

FINAL REPORT

**WATERSHED ASSESSMENT OF
BALLENGER CREEK
FREDERICK COUNTY, MARYLAND**

Prepared for

Frederick County
Division of Public Works
Office of Development Review
118 North Market Street
Frederick, Maryland 21701-5422

Prepared by

Nancy Roth
Morris Perot
Emily Rzemien

Versar, Inc.
9200 Rumsey Road
Columbia, Maryland 21045

January 2001

EXECUTIVE SUMMARY

Ballenger Creek was selected as the second watershed to be assessed under Frederick County's National Pollution Discharge Elimination System (NPDES) stormwater permit (Permit Number MD0068357) because of extensive recent and future development in the watershed, given its close proximity to the City of Frederick. The focus of this watershed assessment was to assess conditions in the watershed, identify water quality problems and opportunities to improve water quality, and develop a water quality plan. The assessment involved a stream characterization survey, collection of visual inspection data from the surrounding watershed, and use of a variety of ancillary data sources. Methods previously utilized in the County's Lower Bush Creek watershed assessment were also employed in this study.

Description of the Watershed

The Ballenger Creek watershed is approximately 14,955 acres (23.4 square miles) in size. It is a fourth order stream that has been designated by Maryland Department of Environment (MDE) as Class III Natural Trout waters. Ballenger Creek drains eastward into the Monocacy River, a National Scenic River. Ballenger Creek watershed lies within the Western Division of the Piedmont Physiographic Province, a region characterized by gently rolling terrain and slow-flowing streams. The eastern third of the watershed is underlain by a limestone formation known as the Frederick Valley, in which karst terrain features are evident. In general, land use in the north-central portion of the watershed, bordering the City of Frederick, consists largely of residential subdivisions, while the area east of U.S. Route 270 is largely commercial/industrial and includes a limestone quarry. The western half of the watershed contains a mix of agricultural uses as well as low density residential properties. Scattered, large forested tracts remain within the watershed, often in areas of steeper slopes along the Catoclin front. Vegetation and landcover in the Ballenger Creek watershed consist of agricultural land, forested areas (deciduous and coniferous), oldfield (transitional vegetation), wetlands, and developed areas (residential, commercial and industrial). Wetlands in the watershed are generally very linear and are associated with Ballenger Creek and its tributaries.

Environmental Assessment of Existing Conditions

Six long-term monitoring stations were established on the mainstem of Ballenger Creek. Field activities involved testing water quality parameters, quantifying physical habitat, conducting a qualitative habitat assessment, and sampling benthic macroinvertebrates and fish. Spring and fall field surveys during 2000 indicate that the stream supports a variety of fish and invertebrate biota, including several sportfish species. Analysis of habitat condition, benthic Index of Biotic Integrity (IBI), and fish IBI scores show that most ratings fall within the second highest category for each index (i.e., good or sub-optimal). Additional stream data from Maryland Biological Stream Survey supplemented the County's field data collection efforts and showed that conditions in Ballenger Creek's headwater streams and upper reaches generally ranged from poor to fair. Given the long history of human habitation and agricultural land use in the region,

streams are far from pristine; however, much of Ballenger Creek and its tributaries appear to be in moderately good condition at present. Wildlife surveys indicated good biodiversity of birds and mammals, particularly in the watershed's vegetated areas.

A visual inspection was conducted to characterize the types and locations of watershed stressors likely to impact water quality. Stressors observed in Ballenger Creek fell into several categories, including hydrologic alterations, agriculture, new construction, industrial/commercial land use, maintenance at some stormwater management (SWM) facilities, and karst features.

The central portion of the Ballenger Creek watershed is currently served by public water and sewer, while rural portions of the watershed are served by residential wells and septic systems. The Ballenger Creek Growth Area is served by the County public water system. Public sewer service is provided by the County's Ballenger Creek Wastewater Treatment Plant (WWTP). Approximately half of the watershed falls within the County's 20-year planned water and sewer service areas.

An inventory of pollution sources was conducted to identify potential chemical stressors. The County's stormwater database reported a total of 114 SWM facilities within the watershed. According to MDE and U.S. Environmental Protection Agency (USEPA) databases, 18 facilities in the watershed have NPDES discharge permits. An on-line review of USEPA's Toxic Releases Inventory and Comprehensive Environmental Response, Compensation, and Liability Information System databases revealed no significant threats likely to adversely affect watershed conditions.

Land use and population projections were made to characterize and predict future environmental conditions, particularly in relation to stream water quality and stormwater management. Residential land use is expected to expand from its current 16 percent to about 36 percent in 2020, while agricultural uses are projected to decrease from its current 59 percent to about 30 percent. An estimated 17,761 people resided in the watershed in 2000, and by 2020, the watershed's population is expected to exceed 30,000. Employment trends demonstrate substantial commercial and industrial growth in the watershed, with approximately 21,020 persons employed in the watershed in 2000, a number projected to reach more than 37,000 by 2020.

Assessment of Water Quality Problems and Identification of Opportunities for Improvement

Problems affecting water quality in Ballenger Creek and its tributaries are predominantly associated with urban and agricultural nonpoint sources. General problem types evident in Ballenger Creek and its tributaries include alterations of natural flow regimes, sediment deposition, and physical habitat degradation. In many cases, problems are minor, particularly where the presence of existing SWM facilities or extensive forest buffer has provided some protection from the impacts of nearby land uses. More severe impacts were apparent at particular

locations, especially in the lower sections of Ballenger Creek where karstic features re-route surface runoff and streamflows underground, create instabilities in existing best management practices (BMPs), and otherwise increase the complexity of SWM issues. Taken individually, many of the activities in the watershed likely have little detrimental effect; however, the cumulative effect of these activities throughout the watershed can be of greater concern.

Water quality problems within Ballenger Creek fall into ten groups centered around the following issues: karst, hydrologic modification, livestock access to stream, cropland runoff, failing septic systems, new construction, future development, industrial/commercial development, existing structures, and stream restoration. Site-specific and/or general programmatic opportunities were identified for each problem that would help improve water quality within the watershed.

Watershed Water Quality Plan

The most promising opportunities that address water quality problems in Ballenger Creek watershed were selected as part of a watershed water quality plan. Further implementation will depend cost, available funding, feasibility, and the likelihood of success in improving or sustaining stream habitat and water quality. Items include general programmatic approaches as well as more site-specific opportunities. Actions will address the primary threats to water quality, including stormwater runoff from existing development, stormwater management issues in karst areas, livestock access to streams, agricultural runoff, and future construction and development. A proposed schedule and preliminary cost estimate was developed for each recommendation.

Programmatic refinements to Frederick County's SWM activities are expected to be particularly important because they address water quality impacts across the County and not just in Ballenger Creek watershed. As such, the following programmatic approaches are recommended:

- ! Formation of a management committee to coordinate SWM efforts between County agencies
- ! Development of a karst ordinance to supplement the County's Stormwater Ordinance
- ! Development of a karst overlay zone to identify areas in which special SWM measures would be required
- ! Development of procedures for managing stormwater issues in coordination with agricultural agencies and neighboring jurisdictions
- ! Continuation of current initiatives to reduce stormwater impacts from roads

- ! Implementation of a combination of program activities to address stormwater management issues in areas where restoration measures or new BMPs are initiated
- ! Utilization of the County's Forest Resource Ordinance to target off-site mitigation plantings in riparian areas to restore forested stream buffers

Site-specific opportunities to improve water quality were identified at several locations in the watershed. These opportunities were classified into two categories: BMPs and stream restoration. A third category contains recommendations for further study, for instances where insufficient information was available to fully assess impacts or develop specific recommendations.

The following actions associated with BMPs are recommended in the Ballenger Creek watershed:

- ! Construction of a structural BMP demonstration project to research karst issues related to stormwater management
- ! Re-inspection of three existing SWM structures to assess potential maintenance needs observed during the watershed assessment

Restoration of destabilized stream channels is a valuable tool that can help return streams to a more natural condition, and thereby prevent additional degradation of water quality, habitat, and biological resources. The following stream restoration actions are recommended:

- ! Restoration of Ballenger Creek at Ballenger Creek Elementary School
- ! Restoration of Ballenger Creek at Ballenger Creek Park
- ! Restoration or enhancement of the riparian buffer from Ballenger Creek Park to the mouth of Ballenger Creek
- ! Feasibility investigation for restoring Ballenger Creek just upstream of New Design Road

Further study is recommended to fully assess water quality impacts associated with the following issues:

- ! Evaluation of surface and groundwater chemistry in the vicinity of existing SWM facilities to assess groundwater impacts in karst areas
- ! Evaluation of potential chemical impacts to water quality from a scrapyard and truck repair facility on Reichs Ford Road

The final recommendation of this plan is to continue watershed monitoring to evaluate the effectiveness of water quality improvements. Specifically, the six Ballenger Creek watershed monitoring stations should be reevaluated every two years, and results documented in a separate study report as well as summarized in the County's NPDES Annual Report. Additionally, supplemental visual inspections and photographic documentation of specific site locations should be conducted at least every two years to monitor effectiveness of management actions. Trends and recommendations from each round of supplemental visual inspections should also be documented in a study report.

TABLE OF CONTENTS

	Page
EXECUTIVE SUMMARY	iii
1.0 INTRODUCTION	1-1
2.0 METHODS	2-1
2.1 <u>Stream Assessment</u>	2-1
2.2 <u>Geologic Characterization</u>	2-3
2.3 <u>Land Use, Land Cover, and Vegetation Analysis</u>	2-3
2.4 <u>Wildlife and Threatened and Endangered Species</u>	2-3
2.5 <u>Visual Inspection for Potential Watershed Stressors</u>	2-5
2.6 <u>Infrastructure Analysis</u>	2-5
2.7 <u>Inventory of Pollutant Sources</u>	2-5
2.8 <u>Zoning and Population Projections</u>	2-5
2.9 <u>Impervious Surface</u>	2-7
3.0 DESCRIPTION OF THE WATERSHED	3-1
3.1 <u>Geological Setting</u>	3-1
3.1.1 Karstic Terrain	3-5
3.1.2 Topography	3-5
3.1.3 Soils	3-6
3.2 <u>General Land Uses</u>	3-8
3.3 <u>Vegetation and Land Cover</u>	3-9
4.0 ASSESSMENT OF EXISTING CONDITIONS IN BALLENGER CREEK WATERSHED	4-1
4.1 <u>Chemical, Physical, and Biological Assessment of Selected Stream Sites</u>	4-1
4.2 <u>Additional Stream Data from Maryland Biological Stream Survey</u>	4-8
4.3 <u>Wildlife</u>	4-10
4.4 <u>Threatened and Endangered Species</u>	4-11
4.5 <u>Visual Inspection for Watershed Stressors</u>	4-12
4.6 <u>Infrastructure Analysis</u>	4-13
4.6.1 Water and Sewer Service	4-13
4.6.2 Transportation	4-21
4.7 <u>Inventory of Pollution Sources</u>	4-23
4.7.1 Stormwater Management Facilities	4-23
4.7.2 Individual Permitted Discharges	4-26
4.7.3 Nonpoint Pollution from Development	4-28
4.7.4 Nonpoint Pollution from Agriculture	4-29
4.7.5 Potential Sources of Contaminants	4-29

TABLE OF CONTENTS (Cont'd)

	Page
4.8 <u>Zoning and Population Projections</u>	4-30
4.8.1 Existing Land Use	4-30
4.8.2 Existing and Future Population	4-34
4.8.3 Future Land Use	4-35
4.9 <u>Estimates of Impervious Surface in the Watershed</u>	4-37
5.0 ASSESSMENT OF WATER QUALITY PROBLEMS	5-1
5.1 <u>Ranking of Water Quality Problems</u>	5-2
5.2 <u>Opportunities to Improve Water Quality</u>	5-2
6.0 WATERSHED WATER QUALITY PLAN	6-1
6.1 <u>Integration of Watershed Assessment Results</u>	6-1
6.2 <u>Recommended Actions to Improve Water Quality</u>	6-1
6.2.1 Programmatic Opportunities	6-2
6.2.2 Site-Specific Opportunities	6-5
6.3 <u>Monitoring to Evaluate Effectiveness of Water Quality Improvements</u>	6-9
7.0 REFERENCES	7-1
 APPENDICES	
A Species Found Within the Watershed	A-1
B Photographic Log of the Watershed Monitoring Stations	B-1
C Photographic Log for the Visual Inspection	C-1

LIST OF TABLES

Table No.		Page
2-1	Sampling schedule for the watershed monitoring stations	2-1
2-2.	Frederick County and City of Frederick Zoning classes with their assigned land use classes	2-8
2-3	Percent impervious values assigned to land use in Ballenger Creek watershed	2-9
4-1	Summary of field water quality data from Ballenger Creek	4-2
4-2	Summary of qualitative physical data from Ballenger Creek	4-2
4-3	Scoring classes for qualitative habitat assessments in riffle/run prevalent streams	4-3
4-4	Summary of qualitative habitat data from Ballenger Creek	4-4
4-5	Scoring classes for benthic macroinvertebrate indices	4-5
4-6	Summary of benthic macroinvertebrate results from Ballenger Creek	4-6
4-7	Scoring classes for the fish IBI	4-6
4-8	Summary of fish results from Ballenger Creek	4-7
4-9	1995-97 MBSS sites in Ballenger Creek watershed, Frederick County, MD	4-9
4-10	Threatened and endangered plants and animals cited by the Maryland Department of Natural Resources as potentially existing within appropriate habitats in the areas of southern Frederick County	4-11
4-11	Results from the Visual Inspection of Ballenger Creek watershed	4-14
4-12.	Stormwater management facilities in Ballenger Creek watershed	4-24
4-13	NPDES-permitted point source discharges within Ballenger Creek watershed ...	4-27
4-14	Estimated existing land use (2000) in the Ballenger Creek watershed	4-32
4-15	Projected population, number of households, and employment in Ballenger Creek watershed, 1995-2020	4-34
4-16	Estimated future land use (2020) in the Ballenger Creek watershed	4-37
5-1	Assessment of water quality problems in Ballenger Creek watershed	5-4

LIST OF FIGURES

Figure No.		Page
3-1	Physiographic provinces within Frederick County (FCDPZ 1998)	3-2
3-2	Geologic map of Frederick County (Maryland Geologic Survey 1968)	3-3
4-1	Visual inspection for watershed stressors within Ballenger Creek, Summer 2000	4-18
4-2	Major water and sewer infrastructure (existing and planned) within Ballenger Creek watershed	4-19
4-3	Twenty-year planned water and sewer service areas within Ballenger Creek watershed	4-22
4-4	Current (1997) land use within Ballenger Creek watershed	4-31
4-5	Current Frederick County zoning (2000) within Ballenger Creek watershed	4-33
4-6	Current and projected population and employment within Ballenger Creek watershed, 1995-2020	4-34
4-7	Projected future (2020) land use within Ballenger Creek watershed	4-36
4-8	Generalized view of current impervious surface coverage within Ballenger Creek watershed	4-37