Executive Summary

Baltimore County Department of Environmental Protection and Resource Management

Back River Watershed Water Quality Management Plan

In association with
Biohabitats Inc

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EXECUTIVE SUMMARY

INTRODUCTION

This study recommends a watershed water quality management plan for the Back River Watershed located in the southeastern portion of Baltimore County. The study report presents the results of the Back River Water Quality Management Plan study conducted for the Baltimore County Department of Environmental Protection and Resource Management (DEPRM). The report summarizes the work performed, findings, and recommendations for watershed protection measures in the Back River Watershed.

Back River is located in urban and suburban portions of southeastern Baltimore County and includes the northeastern quadrant of Baltimore City. *Figure ES-1* presents a location map of the Back River Watershed. This management plan focuses on structural and nonstructural control measures to minimize the effects of existing and future urban development on water quality within tributaries of Back River, the estuary and the Chesapeake Bay.

BACKGROUND AND STUDY PURPOSE

Stormwater runoff from urbanized areas carries many pollutants, including nutrients, oil and grease, heavy metals and organic pollutants such as residues from pesticides. The 1987 Clean Water Act Amendments required EPA to issue rules for permitting stormwater discharges. Under these rules, urban areas must obtain a permit and develop programs to control discharge of pollutants in stormwater to the "maximum extent practicable."

Stormwater runoff pollution is usually referred to as "nonpoint source pollution" or "nonpoint pollution" because it enters streams at thousands of different places at intermittent times during and after rainfall. Nonpoint source pollution is a major threat to water quality in the Back River watershed. Urban nonpoint pollution is directly related to the amount of imperviousness associated with each land use category within the drainage area. Impervious surfaces such as roads, rooftops, parking lots, and driveways are major sources of nonpoint pollution.

Stormwater "flow" is also a water quality concern in urban watersheds like Back River. Urban development increases the frequency and magnitude of the stormwater flows which must be conveyed by natural stream channels. As a result, urban stormwater runoff can degrade stream channels by causing erosion, cave-ins and excessive sediment deposition. EPA stormwater permitting guidelines have recently recognized that stormwater flow may be as significant a water quality problem as urban stormwater pollution. In an August 1996 guidance memorandum "Interim Permitting Approach for Water Quality-Based Effluent Limitations in Stormwater Permits," the EPA Assistant Administrator for the Office of Water states that:

> Uses may be impacted by both water quality and water quantity. Depending on site-specific considerations, some of the water quality impacts of stormwater discharges may be more related to the physical effects (e.g., stream bank erosion, streambed scouring, extreme temperature variations, sediment smothering) than the type and amount of pollutants present in the discharge.

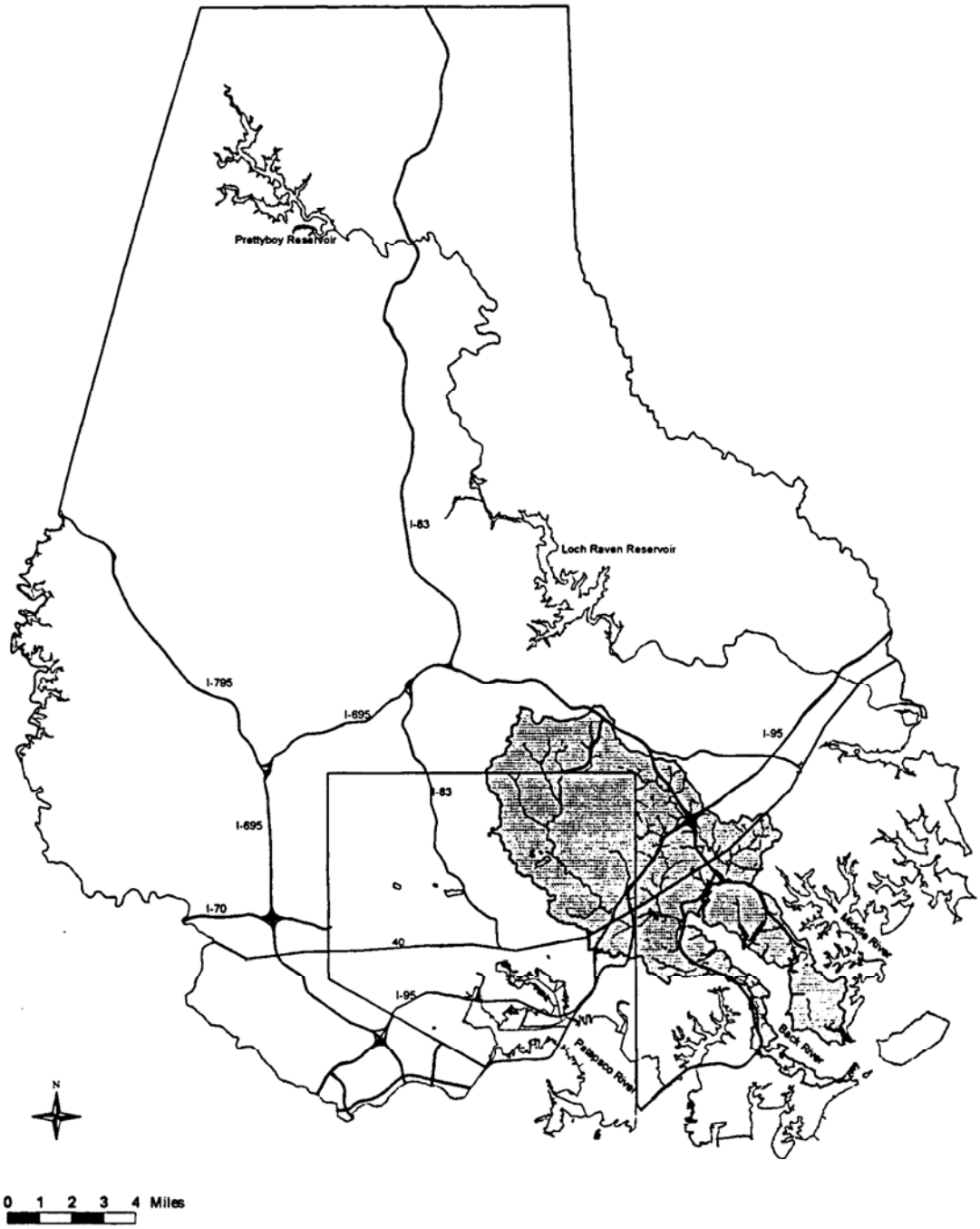

Figure 1-1
Baltimore County, Maryland
Back River Watershed
Regional Location Map

CDM
environmental services

A significant problem in the Back River watershed is streambank instability and excessive streambank erosion due to increased runoff from urban areas. Streambank instability problems are pervasive throughout the watershed, particularly in the more intensely urbanized northwestern areas characterized by steeper slopes. The field work conducted as part of the watershed study identified many areas with channel erosion, failure of erosion protection measures, debris dams, fish migration barriers, and poor aquatic habitat. Stream channel degradation due to urban stormwater flows can be addressed by stream channel restoration projects and stormwater detention facilities to reduce peak flows.

Increased loadings of nonpoint pollutants such as sediment, nutrients and heavy metals resulting from the highly urbanized conditions in the watershed are also clearly a concern. However, due to the flashy nature of urban runoff and the relatively short hydraulic residence times in the tributary subwatersheds, nonpoint pollution loads will primarily impact downstream tidal receiving waters (e.g., Back River estuary and the Chesapeake Bay) rather than the tributary stream system. During storm events, nonpoint pollution loadings are rapidly transported downstream to tidal receiving waters (typically in 12 hours or less) and are thus less likely to result in ambient water quality problems along the nontidal streams that are the focus of this watershed plan. Stormwater pollution loadings in Back River watershed can be managed by requiring structural best management practices (BMPs) for all new development and by pursuing a program to convert stormwater ponds to provide control pollution facilities and to retrofit existing development with BMPs.

Although urban nonpoint pollution represents the major water quality concern within the watershed, the Back River wastewater treatment plant (WWTP) discharges significantly greater nutrient loads to Back River estuary and Chesapeake Bay. This is due in part to the fact that the Back River WWTP serves areas outside the Back River watershed and to the much higher nutrient concentrations in typical municipal point source discharges.

Tables ES-1 and ES-2 summarize projected annual loadings of phosphorus and nitrogen for point and nonpoint sources under different land use conditions and water quality management alternatives. These tables provide a watershed-wide context for evaluating water quality management options.

STUDY ELEMENTS

The elements of the study included:

- Analysis of watershed characteristics, including existing land coverage, and estimation of impervious surface percentages.
- Screening level stream field assessment throughout the watershed and detailed stream investigations at 30 cross sections to provide a framework for future stream restoration
- Computer water quality modeling to estimate nonpoint pollution loadings and stream erosion potential for existing and future land coverage scenarios.
- Identification and analysis of alternative watershed protection measures.
- Analysis of alternative management costs, and recommendation of a watershed management plan.

Table ES-1

Total Point and Nonpoint Source Loads for the Back River Watershed: Total-P

Subwatershed	Area (ac)	Average Annual Total-P Load (lb/yr)				
		Existing	Future - Uncontrolled	Future - Alt. 1	Future - Alt. 2	Future - Alt. 3
Surface Runoff Loads (1,2,3)						
Stemmers Run - City	101	10	10	10	10	10
Stemmers Run - County	3,619	1,560	2,450	1,900	1,650	1,410
Brien Run	1,637	880	1,460	1,090	980	890
Northeast Creek	1,611	660	1,410	930	800	700
Herring Run - County	4,429	2,510	3,230	2,820	2,470	2,110
Herring Run - City	8,061	4,870	4,870	4,870	4,870	4,870
Chinquapin Run - County	379	220	210	210	200	170
Chinquapin Run - City	1,298	820	820	820	820	820
Moores Run - County	525	310	440	350	330	290
Moores Creek - City	2,670	1,440	1,440	1,440	1,440	1,440
Redhouse Run - County	2,400	1,130	1,270	1,140	1,070	1,270
Redhouse Run - City	108	60	60	60	60	60
Bread and Cheese Creek	1,174	620	980	780	700	630
Greenhill Cove	225	80	200	130	110	100
Lynch Point Cove	95	50	50	30	30	20
Back River Direct (South)	2,402	1,050	2,050	1,430	1,240	1,150
Duck Creek	599	300	330	290	290	240
Deep Creek	999	590	740	640	630	550
Muddy Gut	686	190	240	190	180	160
Longs Creek	1,114	80	50	50	50	50
Back River Direct (North)	1,514	390	420	340	340	300
Total Runoff Load	35,646	17,820	22,730	19,520	18,270	17,240
Baltimore County	23,408	10,620	15,530	12,320	11,070	10,040
Baltimore City	12,238	7,200	7,200	7,200	7,200	7,200
Total Baseflow Load (4,5)		3,710	3,710	3,710	3,710	3,710
Baltimore County		2,320	2,320	2,320	2,320	2,320
Baltimore City		1,390	1,390	1,390	1,390	1,390
Back River WWTP (6,7)		273,970	73,060	73,060	73,060	73,060
Total Load		295,500	99,500	96,290	95,040	94,010
Percent of Total Load						
Runoff		6%	23%	20%	19%	18%
Baseflow		1%	4%	4%	4%	4%
Back River WWTP		93%	73%	76%	77%	78%

NOTES:

1. Surface runoff loads are based on SWMM results for 1990 BWI meteorological conditions.
2. Existing runoff loads assume 1990 land cover (MDE).
3. Future runoff loads assume buildout based on County zoning, whereas City land use is assumed to be the same as 1990 land cover.
4. Baseflow loads assume a flow of 0.3 to 0.4 cfs/sq mi, based on measured streamflows at USGS gages on Stemmers Run, Brien Run and Herring Run.
5. Baseflow loads assume a total-P concentration of 0.09 mg/l, based on Baltimore County dry weather monitoring data.
6. Existing Back River WWTP loads reflect conditions before 1988, when the plant was upgraded. The assumed conditions include a discharge of 60 mgd, and a total-P concentration of 1.5 mg/l. (Bethlehem Steel used 120 mgd of Back River effluent for cooling water.)
7. Future Back River WWTP loads reflect permit conditions. The assumed conditions include a discharge of 120 mgd, and a total-P concentration of 0.2 mg/l. (Bethlehem Steel uses 60 mgd of Back River effluent for cooling water.)

Table ES-2

Total Point and Nonpoint Source Loads for the Back River Watershed: Total-N

Subwatershed	Area (ac)	Average Annual Total-N Load (lb/yr)				
		Existing	Future - Uncontrolled	Future - Alt. 1	Future - Alt. 2	Future - Alt. 3
Surface Runoff Loads (1,2,3)						
Stemmers Run - County	3,619	16,710	23,310	19,640	18,620	17,310
Stemmers Run - City	101	110	110	110	110	110
Brien Run	1,637	9,670	10,900	9,180	8,720	8,370
Northeast Creek	1,611	7,150	10,480	8,240	7,640	7,040
Herring Run - County	4,429	25,970	28,040	25,860	24,580	22,640
Herring Run - City	8,061	46,890	46,800	46,800	46,800	46,800
Chinquapin Run - County	379	2,260	2,070	2,050	2,050	1,930
Chinquapin Run - City	1,298	7,160	7,140	7,140	7,140	7,140
Moores Run - County	525	3,130	3,710	3,240	3,170	3,020
Moores Creek - City	2,670	14,930	14,940	14,940	14,940	14,940
Redhouse Run - County	2,400	11,680	12,970	11,880	11,590	11,030
Redhouse Run - City	108	650	650	650	650	650
Bread and Cheese Creek	1,174	5,910	8,060	7,070	6,620	6,350
Greenhill Cove	225	620	1,640	1,330	1,150	1,100
Lynch Point Cove	95	470	530	370	340	320
Back River Direct (South)	2,402	9,890	15,750	12,300	11,360	11,030
Duck Creek	599	3,140	3,460	3,220	3,150	2,980
Deep Creek	999	5,610	7,390	6,690	6,430	6,170
Muddy Gut	686	1,620	2,220	1,910	1,820	1,690
Longs Creek	1,114	580	310	310	310	310
Back River Direct (North)	1,514	3,830	4,090	3,510	3,440	3,280
Total Runoff Load	35,646	177,980	204,570	186,440	180,630	174,210
Baltimore County	23,408	108,240	134,930	116,800	110,990	104,570
Baltimore City	12,238	69,740	69,640	69,640	69,640	69,640
Total Baseflow Load (4,5)		118,490	118,490	118,490	118,490	118,490
Baltimore County		74,190	74,190	74,190	74,190	74,190
Baltimore City		44,300	44,300	44,300	44,300	44,300
Back River WWTP (6,7)		3,652,920	2,922,340	2,922,340	2,922,340	2,922,340
Total Load		3,949,390	3,245,400	3,227,270	3,221,460	3,215,040
Percent of Total Load						
Runoff		5%	6%	6%	6%	5%
Baseflow		3%	4%	4%	4%	4%
Back River WWTP		92%	90%	91%	91%	91%

NOTES:

1. Surface runoff loads are based on SWMM results for 1990 BWI meteorological conditions.
2. Baseline runoff loads assume 1990 land cover (MDE).
3. Future runoff loads assume buildout based on County zoning, whereas City land use is assumed to be the same as 1990 land cover.
4. Baseflow loads assume a flow of 5.6 in/yr, based on measured streamflows at USGS gages on Stemmers Run, Brien Run and Herring Run.
5. Baseflow loads assume a total-N concentration of 2.88 mg/l, based on Baltimore County dry weather monitoring data.
6. Existing Back River WWTP loads reflect conditions before 1988, when the plant was upgraded. The assumed conditions include a discharge of 60 mgd, and a total-N concentration of 20 mg/l. (Bethlehem Steel used 120 mgd of Back River effluent for cooling water.)
7. Future Back River WWTP loads reflect permit conditions. The assumed conditions include a discharge of 120 mgd, and a total-N concentration of 8 mg/l. (Bethlehem Steel uses 60 mgd of Back River effluent for cooling water.)

- Prioritization of capital projects required to implement the recommended management plan.

WATERSHED CHARACTERISTICS

The Back River Watershed covers a 56 square mile area and includes portions of Baltimore City. At present, about 70 percent of the overall Back River watershed consists of residential, commercial or industrial development. The Baltimore County portions of the watershed are about 63% developed while the Baltimore City portions of the watershed are about 84% developed. Based on 1993 Baltimore County zoning, the percent of development in the watershed will increase to 87 percent under buildout conditions. The composite percent directly connected impervious area (DCIA) is 29.3% for existing land use conditions, and is expected to increase to 33.7% under the future land use scenario *(Table ES-3)*.

Because one third of the watershed is located within Baltimore City, it was necessary to include the City portions of the watershed in the stormwater pollutant loading analyses. However, the portions of the watershed located within the City were analyzed at a lower level of detail. Further, the analyses of watershed management alternatives included only the areas of the watershed that are located within Baltimore County (e.g., conditions within Baltimore City were assumed to remain unchanged under the future alternatives). Additional improvements to water quality may be achievable if Baltimore City is included in the overall planning process and implementation.

WATER QUALITY ANALYSIS

Stormwater monitoring data collected by DEPRM under the Baltimore County National Pollutant Discharge Elimination System (NPDES) stormwater program were supplemented by regional and national studies on urban runoff to develop nonpoint pollutant loading factors for each land use category in the watershed. Coupled with watershed-specific information on rainfall/runoff relationships, point source dischargers, and baseflow characteristics, these data were used to develop a water quality model of the Back River watershed. The model selected to evaluate the watershed was the USEPA Stormwater Management Model (SWMM). SWMM is the primary planning tool used to estimate nonpoint loads and to predict downstream benefits of structural Best Management Practices (BMPs). SWMM was applied to existing and future land use scenarios and management strategies to assess the relative benefits of different alternatives for protecting water quality.

WATERSHED MANAGEMENT STRATEGIES

Management strategies for water quality protection alternatives include "structural" and "nonstructural" best management practices (BMPs). The Back River is currently 70% built-out and much of the existing development is older and predates stormwater management regulations. Therefore, there are only limited opportunities for watershed water quality management using nonstructural BMPs. Effective nonstructural BMPs include controlling land use through local zoning and subdivision regulations that can reduce the pollution generated from future development by controlling the amount and location of impervious surfaces and other pollution generating sources.

Nonstructural BMPs include density restrictions, locational restrictions, prohibition or restriction of highly impervious land uses, land acquisition, and buffer zones. Within Back River Watershed, there is a total of about 2,400 acres of Resource Conservation (RC-20) zoning to control

Table ES-3
Summary of Directly Impervious Area Coverage by Subwatershed

Subwatershed Area	Drainage Area (acres)	% Impervious Surface in Watershed	
		Existing	Future
Stemmers Run	3,720	22.9	33.1
Brien Run	1,637	29.7	45.0
Northeast Creek	1,611	28.5	43.0
Herring Run	12,490	35.0	36.4
Chinquapin Run	1,676	34.0	33.4*
Moores Run	3,195	30.1	32.3
Redhouse Run	2,508	23.4	26.5
Bread and Cheese Creek	1,174	31.9	43.6
Greenhill Cove	225	38.7	39.5
Lynch Point Cove	95	34.1	26.3*
Back River (North Side)	2,402	32.7	41.3
Duck Creek	599	32.8	29.5*
Deep Creek	999	35.1	42.4
Muddy Gut	686	11.0	16.8
Longs Creek	1,114	3.2	1.2*
Back River (North Side)	1,514	14.2	13.4*
WATERSHED TOTAL	35,645	29.3	33.7

*Minor reductions in DCIA are due to zoning classifications that do not account for existing development

impervious surfaces and stormwater runoff within the Chesapeake Bay critical areas near the mouth of the Back River estuary. The Baltimore County forest buffer zone requirements and forest conservation ordinance were additional nonstructural controls evaluated in the watershed.
In the Back River Watershed, implementation of structural BMPs is the only feasible approach to achieve water quality control because of the high levels of existing and future imperviousness. Structural BMPs are constructed downstream from urbanized areas and are typically designed to control the volume and discharge rate of runoff and to reduce the amount of pollutants discharged. Detention basins were identified as the most practical and cost effective BMP. This area includes part of the County's recent Eastern Revitalization area under the Community Conservation initiative. As redevelopment occurs, there will be opportunities for encouraging bioretention and other infiltration practices. All structural BMPs require a capital investment for construction. In addition, a long-term commitment of funding and other resources is necessary for proper operation and maintenance to sustain effective performance levels of structural controls.

EVALUATION OF WATERSHED MANAGEMENT OPTIONS

Alternative watershed protection scenarios, based on both non-structural and structural controls, were evaluated in determining a recommended watershed management plan. Three alternatives, summarized in *Table ES-4* were developed for each of the following components of the watershed management plan:

- Nonstructural/Source Control Programs
- Urban Retrofit Structural BMP Facilities
- New Development Structural BMP Facilities
- Stream Restoration Projects

The alternatives were devised in recognition that impacts of urbanization in Back River are severe and that restoration of this watershed will be extremely costly. Therefore, the three alternatives which were formulated reflect increasing levels of capital improvement (CIP) funding.

Alternative 1 is the lowest cost option and reflects benefits derived from existing ordinances and stormwater/watershed management programs. Under Alternative 1, only minimal additional expenditures would be incurred by Baltimore County to address water quality problems in Back River watershed.

Alternative 2 reflects an improved level of service and is intended to comply with the EPA NPDES Stormwater Regulations which require that municipal stormwater/watershed programs control nonpoint pollution discharges to the "maximum extent practicable" (MEP). To date, neither EPA nor MDE have defined this performance standard, thereby permitting local governments like Baltimore County to exercise considerable latitude in devising local approaches that are both feasible and affordable. This alternative assumes an ongoing stream restoration program resulting in 2 or 3 restoration projects every 5 years contingent on CIP funding.

Alternative 3 is intended to demonstrate the extent of water quality improvements that could be achieved in Back River watershed with unlimited financial resources. It also includes a more extensive stream restoration program resulting in 3 to 5 restoration projects every 5 years

Table ES-4
Alternate Water Quality Management Strategies for Back River Watershed

Watershed Management Practice	Alternative 1 "Existing Ordinances and Programs"	Alternative 2 "Improved Level of Service"	Alternative 3 "Unlimited Resources"
Nonstructural/ Source Control Program	• Chesapeake Bay Critical Areas Requirements • Forest Buffers/Forest Conservation • Public/Information Education Programs • NPDES Illicit Connection Removal Program • Site design initiatives	Alternative 1 plus: • Expanded Storm Drain Inlet Cleaning Program • "Clean Business"/"Clean Neighborhood" Programs	Alternative 2 plus: • Targeted Streambank and Shoreline Land Acquisition program primarily within Chesapeake Bay Critical Area (Assumes purchase of high priority, stream corridor, wetland, waterfront areas, contigent on available CIP funding)
Urban Retrofit/ Conversion of Structural BMP Facilities	• No conversion of existing storm water management facilities	Alternative 1 plus: • In high priority areas, convert selected dry detention SWM facilities with drainage areas >10 acres to operate as extended detention BMPs. • Retrofit 25 percent of existing commercial/industrial land uses not already served by a BMP. (Assumes 10 to 15 urban retrofit/conversion projects every 5 years, contingent on available CIP funding)	Alternative 1 plus: • Convert all suitable dry detention SWM facilities (excluding underground storage) to operate as extended detention BMPs • Retrofit 50 percent of existing residential and commercial/industrial land uses not already served by a BMP. (Contigent on available CIP funding over 20-year period)
New Development Structural BMP Facilities	• Structural BMPs for water quality control for future development only	Alternative 1 plus: • Construct regional BMP ponds at a limited number of promising sites in high priority areas, contingent on projected CIP funding. (Assumes CIP funding for 1-3 regional BMP projects every 5 years)	Alternative 1 plus: • Construct regional detention pond BMPs at most promising sites in each major subwatershed (Assumes 3-5 regional BMP projects every 5 years contigent on CIP funding)
Stream Restoration Projects	• No restoration/limited restoration projects • Removal of debris and log jams along high priority reaches • Outfall stabilization projects • Tree planting/forestation along stream corridors	Alternative 1 plus: • Implement 2 to 3 stream restoration projects every 5 years, contingent on available CIP funding	Alternative 1 plus: • Implement 3 to 5 stream restoration projects every 5 years, contingent on available CIP funding

contingent on CIP funding. This alternative represents the upper end of the range of management options for comparison with the MEP option (Alternative 2).

Table ES-5 summarizes cost estimates for the CIP projects included in Alternatives 2 and 3. Alternative 1 is assumed to require no additional CIP expenditures. The costs presented in *Table ES-5* represent "planning level" estimates. For Alternatives 2 and 3, the stream restoration projects and some of the regional BMPs will achieve stormwater flow control benefits. The BMP retrofits, pond conversions, and regional BMP projects will achieve reductions in stormwater pollution loadings.

Table ES-6 summarizes the effectiveness of the three watershed management alternatives in reducing future nonpoint loadings of total phosphorus (total-P) and total nitrogen (total-N). These pollutants are presented because they are of concern for protecting water quality in the Chesapeake Bay. Compared to uncontrolled future land use conditions, the annual pollution loading reductions projected for the three management alternatives are as follows: Alternative 1 is projected to reduce annual phosphorus loadings by 14% and annual nitrogen loadings by 9%; Alternative 2 is projected to reduce annual phosphorus loadings by 20% and annual nitrogen loadings by 12%; and Alternative 3 is projected to reduce annual phosphorus loadings by 24% and annual nitrogen loadings by 15%.

Stream restoration/stabilization projects were evaluated based on the Level I and Level II field analyses conducted during the study. In the Level I analysis, 108 stream reaches were evaluated, and 30 were selected for more detailed Level II analysis. These 30 reaches and adjoining reaches were evaluated in order to identify and prioritize locations where stream restoration/stabilization would be desirable.

Table ES-7 summarizes the recommended stream restoration/stabilization projects for Back River watershed. The "priority" shown in the table can be used to develop a CIP implementation schedule. The following factors were used to assign the priority ranking (high, medium, low) for stream restoration/stabilization projects:

- Severity of existing erosion problems.
- Adjoining land use. Projects with adjoining residential land use and/or parkland typically received a higher priority than similar projects in industrial/commercial areas. Projects in areas projected for future development were typically flagged for an increased priority when development occurs.
- Availability of upstream detention to reduce peak flows and erosion potential within the stream restoration/stabilization project reaches
- Stream restoration was considered a higher priority than stream stabilization.
- Downstream main stem projects typically received a higher priority than upstream tributary projects.

Table ES-5
CIP Costs for Back River Watershed Management Alternatives

Management Alternative	Cost Estimate ($1,000,000)				
	Stream Restoration Projects	BMP Retrofits	Pond Conversions	Regional BMPs	Total
ALTERNATIVE 1	NA[a]	NA[a]	NA[a]	NA[a]	NA[a]
ALTERNATIVE 2					
1. Capital Cost	$5.80	$4.52	$1.01	$2.4	$13.73
2. Annualized Cost[b]	$0.59/yr	$0.64/yr	$0.15/yr	$0.34/yr	$1.72/yr
ALTERNATIVE 3					
1. Capital Cost	$5.80	$24.85	$1.83	$4.0	$36.48
2. Annualized Cost[b]	$0.59/yr	$3.53/yr	$0.26/yr	$0.57/yr	$4.94/yr

[a]Alternative 1 assumes no additional CIP expenditures
[b]Annualized costs include O&M costs and are based on a 20-year planning period and an 8 percent interest rate.

Table ES-6
Summary of Stormwater Pollution Control Benefits
of Back River Watershed Management Alternatives

	Future - Uncontrolled	Future - Alternative 1	Future - Alternative 2	Future - Alternative 3
Average Annual Total-P Load (lb/yr)	22,730	19,600	18,270	17,240
Average Annual Total-N Runoff Load (lb/yr)	204,570	186,790	180,630	174,210
Area Served by Regional BMPs (acres)	NA	0	3,460	3,730
Area Served by Conversion of Dry Detention BMPs (acres)	NA	0	575	840
Area Served by Retrofit BMPs (acres)	NA	0	680	5,968

Table ES-7

Summary of Potential Stream Restoration/Stabilization Projects in Back River Watershed

Stream Restoration/Stabilization Concept Project	Priority	Length of Stream Channel	Total Cost
Herring Run #1	Low/Medium	5,200	$652,000
Herring Run #2	Medium	3,920	$294,000
Herring Run #3	Low	4,740	$174,000
Herring Run #4	High	2,860	$354,500
Redhouse Run #1	Low	13,280	$332,000
Stemmers Run #1	Medium	2,020	$151,500
Stemmers Run #2	High	4,050	N/A
Stemmers Run #3	Low/Medium	2,900	$405,000
Stemmers Run #4	Low	940	$188,000
Stemmers Run #5	Medium/High	2,850	$332,500
Stemmers Run #6	Low/Medium	3,450	$327,500
Stemmers Run #7	High	4,900	$792,500
Brien Run #1	Low/Medium	1,860	$339,500
Brien Run #2	High	1,420	$284,000
Northeast Creek #1	Low/Medium	2,470	$182,250
Back River #1	Low/High	3,200	$537,500
Bread & Cheese Creek #1	Low	4,220	$458,000
	Total High Priority	13,230	$1,431,000
	Total Medium Priority	6,770	$626,500
	Total Low Priority	44,280	$3,747,250
	Total	64,280	$5,804,750
	Annualized Cost		$591,000

NOTES:

1. Stream restoration costs assume $200 per linear foot for restoration from "F" to "C" channel, $175 per linear foot for restoration from "G" to "B" channel, $75 per linear foot for streambank stabilization, and $25 per linear foot for local stabilization, debris removal.
2. Capital Costs include base construction costs including contingencies for design, engineering, permitting, and 2-years of monitoring/maintenance
3. Stream Restoration/Stabilization costs do not include land acquisition costs
4. Capital costs are annualized based on a 20-year period and an 8 percent interest rate.
5. Summary of priority rankings is based on the lower priority listed

- Projects on Use IV (recreational trout waters) streams were assigned a higher priority than projects on Use I streams.

RECOMMENDED WATERSHED MANAGEMENT PLAN

The recommended watershed management plan is based on Alternative 2. The components of the watershed plan include: stream restoration/stabilization; regional detention pond BMPs; detention pond BMP conversions; and BMP retrofits for commercial/ industrial land use. A summary of the watershed management plan is presented below:

Stream Restoration/Stabilization

Table ES-7 presents the recommended plan for potential stream restoration/stabilization projects targeting over 12 miles of impacted streams in the Back River watershed. The projects in the table are prioritized based on criteria discussed above, and costs are summarized by priority level. A total of 17 projects were identified, with an associated capital cost of $5.8 million. The annualized cost over a 20-year period would be $0.59 million per year. Many of these stream restoration/stabilization projects could potentially be included in the County's overall plans for land acquisition for parks and local open space.

Regional BMPs

A network of 17 potential regional detention pond BMP sites *(Table ES-8)*, serving over 3,400 acres, were identified throughout the watershed. Where feasible, the sites were considered to achieve both pollution removal and peak-shaving benefits. The total capital cost for the recommended regional BMP network is $2.4 million, and the annualized capital cost is $0.34 million per year. Regional BMP ponds which achieve peak-shaving benefits and are located upstream of proposed stream restoration/stabilization projects should be assigned the highest priority and should be constructed concurrent with the stream channel project. Before the regional BMPs can be implemented, detailed site analyses should be conducted to confirm the feasibility of the sites.

Detention Pond Conversions

The plan also identifies 19 existing dry detention ponds that may be candidates for conversion to provide water quality control and to potentially provide additional peak-shaving for channel erosion control. These detention pond BMPs serve 575 acres of existing development. The total capital cost for detention pond conversions is $1.0 million. Annual costs over a 20-year period are $0.14 million per year.

Commercial/Industrial Retrofits

The recommended watershed management plan involves retrofitting structural BMPs to existing commercial and industrial areas that were developed before stormwater management requirements. Retrofit BMPs would include construction of additional detention ponds or other treatment devices such as water quality inlets. The goal of the recommended watershed plan is to implement retrofit structural BMPs on 25 percent of the existing commercial and industrial development that is not already served by BMPs. High priority* subbasin areas were identified, that include more than half of the commercial and industrial land use that would require retrofit

* Prioritized by subarea loading (not per acre)

Table ES-8
Regional BMP Sites in Back River Watershed

Subwatershed	Model Subbasin	Regional BMP Site Number	Regional BMP Facility Type	Regional BMP Drainage Area (ac)	Capital Cost	Annual O&M Cost	Annualized Cost
Herring Run	HR126-60	H3	Extended dry detention	450	$155,400	$6,220	$22,050
Herring Run	HR126-65	H2*	Extended dry detention	410	$129,150	$5,170	$18,320
Northeast Creek	NC128-10	S11	Extended dry detention	220	$106,580	$4,260	$15,120
Stemmers Run	SR145-25	S1*	Extended dry detention	440	$93,980	$3,760	$13,330
Herring Run	HR126-70	H1*	Extended dry with peak shaving	410	$278,250	$11,130	$39,470
Northeast Creek	NC128-15	S10*	Extended dry with peak shaving	170	$87,850	$3,510	$12,460
Stemmers Run	SR145-05	S7*	Wet detention with peak shaving	170	$292,780	$11,710	$41,530
Bread and Cheese Creek	BC170-15	B1*	Wet detention with peak shaving	160	$264,950	$10,600	$37,590
Brien Run	OR146-20	S13	Extended dry detention	140	$52,680	$2,110	$7,480
Redhouse Run	RH127-17	H4	Wet detention with peak shaving	140	$215,250	$8,610	$30,530
Stemmers Run	SR145-22	S3*	Extended dry with peak shaving	150	$151,730	$6,070	$21,520
Stemmers Run	SR145-02	S8*	Extended dry detention	130	$52,150	$2,090	$7,400
Northeast Creek	NC128-15	S9*	Wet detention with peak shaving	50	$149,800	$5,990	$21,250
Stemmers Run	SR145-12	S4*	Extended dry with peak shaving	160	$109,380	$4,380	$15,520
Northeast Creek	NC128-02	S12	Extended dry detention	100	$36,930	$1,480	$5,240
Stemmers Run	SR145-05	S6*	Extended dry with peak shaving	90	$95,550	$3,820	$13,550
Stemmers Run	SR145-10	S5*	Wet detention with peak shaving	70	$131,430	$5,260	$18,650
Watershed Total				3,460	$2,403,840	$96,170	$341,010

NOTES:

1. Capital costs include base construction costs, plus 25 percent for contingencies such as engineering, permits, and other conside
2. Regional facility construction costs were estimated based on cost curves developed by the Metropolitan Washington Council of These curves relate base construction cost to volume at the emergency spillway elevation.
3. The MWCOG cost curve values were multiplied by a factor of 1.4 to account for cost increases between 1985 and 1996.
4. The regional facility costs are for facilities designed for water quality and, in some cases, 2-year peak shaving. Facilities were sized to control storms larger than the 2-year event.
5. O&M costs are assumed to be 4 percent of the base construction cost.
6. Costs are annualized based on a 20-year period and an 8 percent interest rate.
7. Capital costs do not include land acquisition costs.
8. Site numbers with an asterisk (*) are located upstream of proposed stream restoration/stabilization projects.

BMPs. The total capital cost for the BMP retrofits is estimated to be $4.5 million, and the annualized cost is about $0.64 million per year.

Other Considerations

The plan also assumes the continued strict adherence to the existing Baltimore County stormwater management regulations. These regulations require construction of structural detention pond BMPs to control stormwater discharges from all new nonresidential developments and medium and high density residential developments. Structural BMPs should be designed to maximize pollutant removal efficiencies and to achieve peak flow reductions in order to minimize downstream streambank erosion.

For all structural BMPs, an effective maintenance program is essential. All regional BMPs and onsite BMPs serving residential areas should be maintained with public funds. Maintenance agreements should be secured for onsite BMPs serving nonresidential development.