

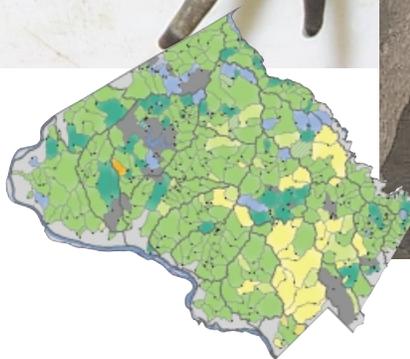
Countywide Stream Protection Strategy

2003 Update

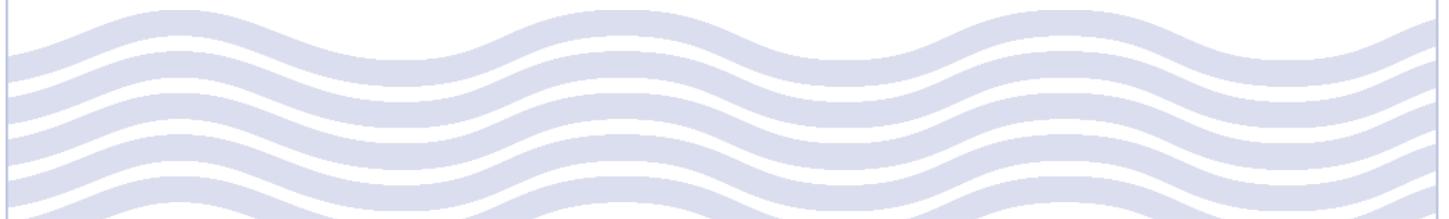
This update of the Countywide Stream Protection Strategy provides information on the current status of county stream conditions based on the first five year watershed monitoring cycle completed in 2000.



STREAM QUALITY CONDITIONS
1994-2000



CURRENT HABITAT STATUS
1994-2000



Countywide Stream Protection Strategy

2003 Update

Updates: Each year DEP monitors different watersheds as part of the baseline monitoring program. Our stream data is continually updated as new information becomes available. For the latest information please go to updates.askdep.com.

Department of Environmental Protection
Montgomery County, Maryland

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From the County Executive

This 2003 Countywide Stream Protection Strategy (CSPS) report is a testament to the County's commitment to improving environmental quality on an on-going basis.



This is not a report that is produced with much fanfare and then sits on a shelf. The CSPS evaluation is an active, vibrant, process that is continually updated to give us the most current assessment of the county's water quality. And, it is a critical decision-making tool that allows us to target our resources to the projects that are most effective in improving stream quality.

In 1998, Montgomery County made a commitment to assess the condition of about 1,500 miles of streams through an innovative method that evaluates not only water quality, but the diversity and quality of biological life and stream habitat. Now, five years later, our comprehensive approach, conducted with the cooperation of many agencies and volunteers, has provided the County with data to establish and assess watershed management priorities.

I invite all the citizens and businesses in Montgomery County to use this CSPS report to learn more about environmental conditions and to become more actively involved with programs and opportunities which protect and restore the quality of our shared environment.

Douglas M. Duncan
Montgomery County Executive

From the DEP Director

The Department of Environmental Protection is pleased to release this update to Montgomery County's 1998 Countywide Stream Protection Strategy (CSPS). The following document reflects the first in a much-anticipated series of updates to DEP strategic plans. The initial success of the CSPS as a technical report and management tool was responsible for shaping the County's subsequent development of a Countywide Forest Preservation Strategy (October 2000), Groundwater Protection Strategy (October 2001) and Air Quality Strategy (November 2003). The CSPS and these other management strategies are receiving recognition nationally as models for other communities to follow. DEP is proud of its role as a leader in developing meaningful strategies which serve to effectively direct future efforts in support of our mission to protect and restore our natural resources.

James A. Caldwell
Director, Department of Environmental Protection

I. Executive Summary

Background

In February 1998, the Montgomery County Department of Environmental Protection (DEP) completed an assessment of biological, chemical, and habitat conditions covering most of the streams within county boundaries. The resulting *Countywide Stream Protection Strategy (CSPS)*

These results show that 62 percent of monitored county streams are rated as being in good to excellent condition, with 38 percent in fair or poor condition. The report also updates original CSPS findings on the quality of stream habitat, including separate ratings on the stability of the stream channels. Some limited data on trends

and aquatic life. Some river systems are still adjusting to impacts of “legacy sediments” introduced from past centuries when watersheds were first converted from primarily forested to agricultural uses. Over the past 50 years or so, the county’s population growth and development gradually shifted many primarily agricultural watersheds into urban and suburban communities. Uncontrolled or inadequately controlled stormwater runoff accompanying these latest watershed changes has significantly altered natural stream flows and increased erosion, impacting stream habitat and resident biological communities. Inadequate management of construction sites contributed a few localized sediment “hot spots.” There are also isolated instances where other pollutant sources, such as pesticide spills, were a primary cause of biological impairment. In 1999 the county experienced severe drought conditions which markedly reduced stream flows, particularly during the summer when rainfall and groundwater reached historically low levels that cut off replenishment of many stream systems. Upper headwaters of many small streams became segmented or dried up entirely, which severely impacted some resident aquatic life and limited DEP’s ability to carry out planned monitoring activities.

TABLE 1A. 1994-2000 County Stream Conditions

Stream Condition	Stream Miles	Percent of Streams Monitored
Excellent	84	7
Good	694	55
Fair	362	28
Poor	131	10
Total Monitored	1272	100
Waters Not Monitored	226 (see Table 5A)	
Total	1498	

evaluated stream conditions based upon aquatic life and stream channel habitat indicators in addition to typically applied stream chemistry measurements. This report updates the CSPS to replace preliminary data used in the original evaluation for some county streams. It provides a comprehensive picture of stream conditions observed between 1994 and 2000. Further, it documents the progress the County is making in addressing watershed management priorities originally identified in the CSPS.

Resource conditions in county streams

Citizen understanding and interest in stream quality is enhanced when results focus on the living organisms found in their neighborhood streams. The CSPS uses familiar terms to discuss the presence, absence, and diversity of fish and aquatic insect populations in a given stream, and the quality of the supporting stream habitat, such as adequacy of riffles, pools, stream side tree cover, and vegetated buffers. Across the county, 60 species of fish and about 420 types of aquatic insects were found. While many streams supported diverse and vibrant aquatic communities, others have impaired habitat conditions which support fewer species at reduced populations. Table 1A updates information on countywide stream conditions, based upon final results from biological monitoring conducted during 1994-2000.

observed in county streams is also presented, based upon a statistical evaluation of results from those stations that have been sampled at least twice. trends.askdep.com

Compliance with water quality standards

Although the extent and diversity of biological life and habitat conditions vary widely, nearly all county streams meet Maryland water quality standards and criteria for dissolved oxygen, temperature, and pH (COMAR 26.08.02.03-3), as they have historically. However, limited samples of *nutrient concentrations* [G](#) show county streams exceed levels needed to reach voluntary nutrient reduction targets established to address Chesapeake Bay management needs. As in most places nationally, bacterial standards are also violated in county streams, which reflects contamination from a diverse variety of natural and man-made sources, including wild mammal and bird populations, pets, leaks or overflows from aging sewer lines, and septic tank overflows. Most violations occur following runoff from storm events. DEP continues to focus its efforts toward improving control of those sources considered most manageable.

Primary causes of biological impacts

Stream erosion and sedimentation remain the dominant impacts on county stream habitat con-

Nature of impaired subwatersheds

The most severely impaired streams are generally found in the older, “down-county” areas. Development at urban and suburban densities occurred here years before stormwater controls were required to help mitigate impacts of accompanying increases in peak stormwater runoff flows and associated pollutant concentrations. Outmoded land development practices at the time regularly enclosed small headwater streams and springs with stormdrain pipes and filled in, rather than preserved, natural wetlands. Biological impairment was also found in some predominately agricultural subwatersheds, suggesting a need for voluntary implementation of additional agricultural *best management practices (BMPs)* [G](#).

Relationships of impacts to impervious areas

The severity of stream habitat degradation and biological impairment seen in county streams can be generally related to the extent that forests, natural vegetation, and underlying topsoil has been graded away and replaced with hard or highly

I. Executive Summary, continued

compacted urban land surfaces such as roads, parking areas, buildings and surrounding lawn areas. These relatively impervious surfaces inhibit the natural *infiltration*  of rainfall, causing significant increases in stormwater runoff and corresponding reductions in the natural replenishment of groundwater. Increased stormwater flows and reduced groundwater replenishment both adversely affect natural stream *hydrology*  and stream habitat. DEP has begun to further analyze these relationships by comparing observed stream quality to drainage area information on land use, impervious area, lawn areas, tree canopy, and protected stream buffer areas. This report further discusses some of these analyses.

Effectiveness of stormwater controls

In general, modern and well-maintained on-site stormwater controls appear to have positive effects in mitigating, but certainly not eliminating, the impacts of increased stormwater runoff from developed land surfaces. However, scientific data currently available on the actual effectiveness of various types of urban BMPs is surprisingly limited. DEP is assembling more complete information to compare stream conditions in small watersheds protected by modern stormwater controls to conditions found in other watersheds that have similar levels of development, but lack modern stormwater controls. The County is also pursuing pilot projects to integrate more on-site Low

Impact Development (LID) design principles and technologies, such as rain gardens and rain barrels, into the mix of stormwater controls used to reduce stormwater impacts.

Mitigating new development impacts

The original CSPA provided an improved level of information on county stream conditions and management priorities which regulatory agencies employ as land use master plans are updated and subdivision, site design, stormwater management, and sediment control requirements are determined through permitting processes. The inspection, enforcement, and maintenance of construction site sediment controls have improved, but further progress appears needed. Stormwater controls have seen improved design standards and use new technology applications, including green roofs and bioretention, to reduce the generation of runoff requiring management. Increased application of innovative stormwater control measures will be needed to continue progress in reducing new development and redevelopment impacts on streams. Regulatory agencies should also seek ways to further reduce natural vegetation and topsoil losses and increases in impervious or compacted land surfaces that result from current land development standards for subdivisions, roads and sidewalks, utilities, parking lots, and individual buildings.

Watershed restoration priorities and progress

The original CSPA designated priority watersheds and identified watershed management categories and related management tools to guide interagency watershed restoration initiatives. DEP and partner agencies continue to use this information to help target available resources for watershed restoration. Interagency efforts are aggressively pursuing proactive watershed restoration projects to mitigate impacts of previously uncontrolled runoff and restore stream habitat to support more diverse biological communities and natural stream settings. There has been substantial progress in completing watershed assessments and designing and constructing projects that help restore conditions in degraded urban watersheds. This includes: completion of watershed feasibility planning assessments for the Upper Paint Branch, Northwest Branch, Rock Creek, Cabin John Creek and the Hawlings River; construction of new stormwater controls to manage runoff from over three square miles of previously developed area; and restoration of habitat and erosion for over twelve miles of degraded streams.

Additional information on previous CSPA findings, watershed management categories, priority watersheds, and methods the County uses to evaluate stream conditions can be found in the original CSPA document.  cspa.askdep.com

Next steps

County agencies continue to work collaboratively on a variety of activities to sustain progress in implementing the CSPA. Goals and action items describing these activities are presented in this update. A few key planned activities include:

- * Complete watershed studies now underway for the Lower Paint Branch and Watts Branch watersheds; initiate new watershed studies for the Great Seneca and Muddy Branch watersheds; design and construct new stormwater controls to manage another three square miles of developed area; and restore another 14 miles of degraded streams.
- * Seek increased funding to expand street sweeping/vacuuming to improve pollutant source reduction from highly trafficked areas. Implement a pilot project to install and test the effectiveness of runoff filtration devices established in stormdrain inlets in central business district areas.
- * Review current zoning, subdivision, building code and road code requirements to explore opportunities for implementing improved standards more consistent with water resource protection objectives to reduce generation of runoff and increase rainfall *infiltration*  for groundwater replenishment.
- * Improve interagency efforts to address issues of encroachment on stream buffers, invasive species and excessive *deer browse*  problems, and dumping of trash and yard wastes all of which impact stream systems.
- * Seek state legislation for a user charge/fee on nitrogen-based, urban lawn, and garden fertilizers to discourage excess use. Use collected revenues to fund outreach efforts to help reduce nutrient inputs to waterways.
- * Complete monitoring to develop an *index of biological integrity*  for nesting birds and amphibians to help augment information developed for the County's next environmental assessment report.

II. Summary of Principal CSPS Findings, Uses, Accomplishments

Discussion of principal findings

The current update has examined results of CSPS monitoring data in conjunction with information on watershed land use, impervious areas, and other natural resource information available through the County's geographical information system. The monitoring data collected since 1998 contains complete datasets on fish, aquatic insect, and/or habitat conditions to replace most of the "preliminary data" classifications assigned to some subwatersheds in the original 1998 CSPS report. The only areas in the county without a stream condition rating are those without a perennial stream draining them, or areas too deep for crews to wade safely, enabling sampling of all pertinent parameters. The next complete CSPS update will be based upon results of data collected through DEP's current five-year watershed monitoring cycle, which ends in 2005. In the interim, DEP will periodically post stream monitoring data and related factsheets to disseminate more recent findings on its website. reports.askdep.com

The watershed management categories and priority subwatershed designations assigned in the original CSPS have been left unchanged inasmuch as overall relationships between stream condition and land use patterns have not changed sufficiently since 1998 to warrant extensive adjustments. The need for substantive change to watershed management categories or priority subwatersheds will be reviewed as part of the next CSPS update.

Ratings of stream conditions in most county watersheds (Figure 4B) did not change substantially from those derived in the original CSPS. Older, established urban areas generally have the poorest water quality and continue to reflect the impacts of outmoded practices that piped stream headwaters and/or lacked adequate stormwater management controls. Conversely, watersheds located in the more northern and western areas have a "good" or "excellent" stream condition rating. This apparently reflects a number of factors, including generally lower development densities and/or improved stormwater controls and stream buffers accompanying new developments, and the use of low or minimum till farming practices in the County's Agricultural Reserve.

Although there are no *nutrient concentration* standards that presently regulate county streams, limited monitoring data suggests relatively high nutrient levels in some of them. Slow moving bod-

ies of water, such as the Patuxent reservoirs, have elevated nutrient levels. Delivery of nutrients downstream also remains a concern for the protection of the Chesapeake Bay. Bacterial contamination also continues to be a ubiquitous problem, both in county streams and nationally. Many wildlife sources of this contamination cannot be easily, if ever, managed. However, greater emphasis on inspection and repair of sanitary sewer infrastructure, enforcement of treated wastewater discharge permit requirement, and improving owner awareness of pet waste impacts are more manageable aspects of nutrient and bacterial sources which need to be better addressed.

CSPS uses and accomplishments

Montgomery County agencies apply the findings and priorities identified in the CSPS to focus watershed protection efforts in a variety of ways. The M-NCPPC uses these findings in considering environmental protection needs and impacts as it prepares and updates the County's land use master plans and, as it carries out development review and regulatory processes required for new subdivisions. M-NCPPC has also used CSPS findings and priorities to help identify land acquisition priorities under the Legacy Open Space Program and the Park Acquisition Program. CSPS results are considered by the Department of Permitting Services (DPS) in developing requirements for sediment control and stormwater management in the permitting process that regulates land development.

DEP uses CSPS monitoring results to support compliance with watershed assessment, project implementation, reporting, and enforcement requirements specified in the County's municipal National Pollution Discharge Elimination System (NPDES) stormwater discharge permit. Results are also applied to help assess and set project priorities for fulfilling voluntary regional commitments under the Anacostia Watershed Restoration Agreement, the Patuxent Reservoirs Watershed Agreement, and the Chesapeake Bay 2000 Agreement. DEP uses CSPS findings and priority subwatershed designations as it develops watershed studies and selects, designs, and constructs projects to improve runoff management and restore damaged streams in previously developed watersheds. The analytical approach used in the CSPS to characterize stream conditions and set management priorities contributes to DEP's suc-

cess in securing cost-share grant funding for watershed restoration projects. DEP also applies CSPS results to help target its public outreach and water quality enforcement programs to focus on streams having the greatest protection needs. priorities.askdep.com

The CSPS has served as a stimulus for the County's subsequent development of a *Countywide Forest Preservation Strategy* (October 2000), *Groundwater Protection Strategy* (October 2001), and an *Air Quality Strategy* (November 2003). Actions being pursued to implement goals and action items identified in each of these strategies provide complementary cross-over environmental benefits that contribute both to air and water quality protection. All three of the adopted strategies received *Achievement Awards* from the National Association of Counties (1999, 2000, and 2001 respectively). In August 2002, the CSPS and the associated biological monitoring program and partnerships formed with other local and state agencies and volunteers also received recognition from the U.S. EPA as a national model for other communities to follow (U.S. EPA, 2002).

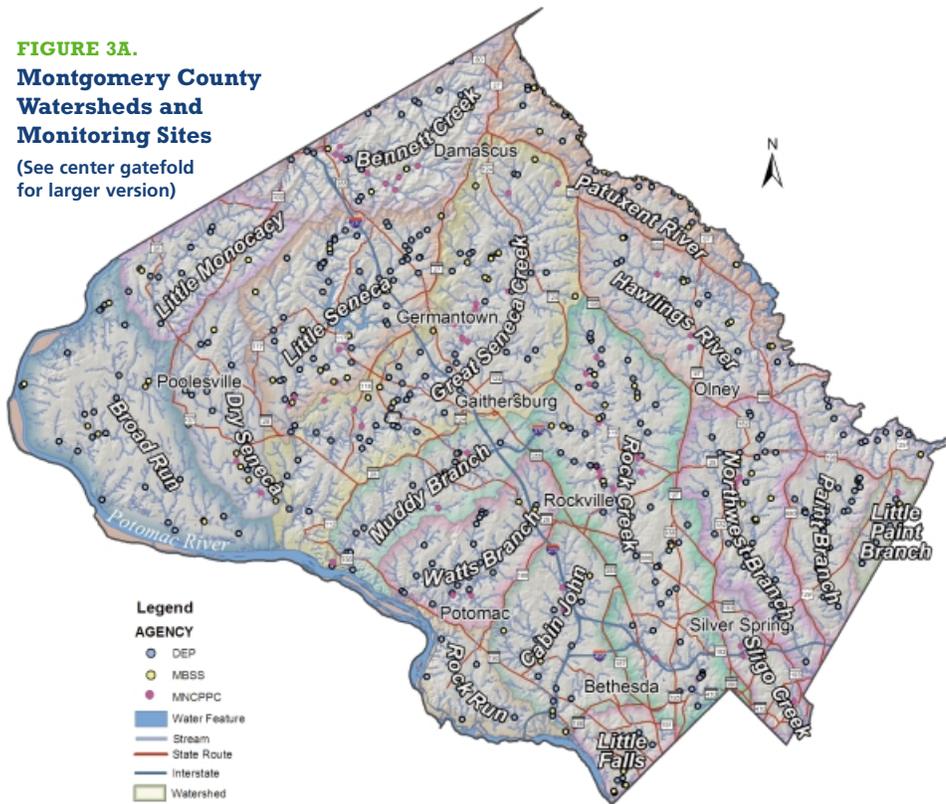
Collaboration on Monitoring Data Collection and Data Sharing

The County relies heavily on sustaining monitoring partnerships with public agencies and volunteer groups to promote efficient data sharing and analysis of water quality conditions in county streams. Key partners in this effort are the M-NCPPC and the Maryland Department of Natural Resources (DNR), including its Maryland Biological Stream Survey (MBSS). Monitoring by volunteers also provides important sources of supplemental information to the existing knowledge of local streams. DEP values the substantial contributions of its partners in supporting a cooperative approach to stream monitoring and protection.



III. Purpose & Methods For Rating Streams

FIGURE 3A.
Montgomery County
Watersheds and
Monitoring Sites
 (See center gatefold
 for larger version)



applying the IBI as the scientific basis to compare and rank conditions found in any county stream against Reference Conditions.

DEP conducts biological monitoring at approximately four hundred baseline monitoring stations, providing full coverage to all of the principal streams in the county and many tributary stream headwaters (Figure 3A). Data collection is a true community effort. Sources of biological data used in determining stream condition throughout Montgomery County include DEP, Maryland-National Capital Park and Planning Commission, State of Maryland (Department of Natural Resources-Maryland Biological Stream Survey (MBSS) [🔗](#)), and a number of citizen volunteer groups.

IBI Measures and Usage

IBI's describe the biological community through the use of measures of community structure and function that respond, in a predictable way, to increased impairment from habitat or pollutant stressors. For example, as stream conditions degrade from pollution or habitat impairment, the number of species and/or the biological diversity of species inhabiting the stream will decrease and be reflected in a lowered IBI score.

Separate measures are applied to produce IBI's for both the fish and aquatic insect (benthic macroinvertebrate) communities (Table 3A). IBI

Biological Monitoring

DEP monitors fish and aquatic insects as a tool to assess and track the health of all county streams over time. DEP observes the changes that occur to the structure and function of the in-stream aquatic communities to assess how cumulative impacts of habitat change and pollution are affecting the stream. Biological monitoring results can be compared to stream habitat assessments to determine if the habitat condition is impairing the biological community, or if chemical pollutants and/or other factors are the causes.

Montgomery County's streams are primarily found in the piedmont region, located west of the Atlantic coastal plain and east of the Appalachian Mountains. Piedmont streams typically have moderate slopes and rock or bedrock bottoms. Following EPA guidelines, DEP developed "Reference Conditions [🔗](#)" to represent biological communities found in the county's highest quality,

least impaired piedmont streams. This was accomplished by analyzing the composition of fish and aquatic insect communities collected at some forty reference stream sites, developing an *Index of Biological Integrity (IBI)* [🔗](#) from this data, and

TABLE 3A. Measurements used in the fish and benthic macroinvertebrate IBI's

Fish IBI

- Total number of species
- Total number of riffle benthic insectivores
- Total number of minnow species
- Total number of intolerant species
- Proportion of tolerant individuals
- Proportion of individuals as omnivore/generalist
- Proportion of individuals as pioneering species
- Total number of individuals (excluding tolerant)
- Proportion of individuals with disease/anomalies

Benthic macroinvertebrate IBI

- Total number of taxa
- Biotic index
- Ratio of scrapers/scrapers + filtering collectors
- Proportion of hydropsyche + cheumatopsyche/total EPT individuals
- Proportion of dominant taxa
- Total number of EPT taxa
- Proportion of total EPT individuals
- Proportion of shredders



Fish sampling crew



Aquatic insect sampling

scores are then assigned, for fish and for aquatic insects. To arrive at one rating for a stream, the IBI scores for fish and for aquatic insects are averaged and assigned a narrative condition rating of “excellent, good, fair, or poor.” These narrative ratings are derived from IBI scores representing the county’s highest quality reference streams. For example, a stream rating of excellent means that organisms inhabiting a stream closely compare with those found in the top 50 percent of reference streams.

Stream Habitat

The quality of stream habitat is important in understanding probable causes of impaired biological condition. A visual assessment of stream habitat is performed when biological monitoring is undertaken.

Ten habitat quality measures developed by the EPA are used in the visual habitat assessment: *instream cover*, *epifaunal substrate*, *embeddedness*, *channel alteration*, *sediment deposition*, *riffle frequency*, *channel flow status*, *bank vegetative protection*, *bank stability*, and *riparian vegetative zone* [G](#). Each parameter is visually scored following written guidelines provided on the habitat assessment field form. All parameters are combined for an overall habitat rating (Barbour and Stribling, 1994 [T](#)).

Good stream habitat

Streams with good habitat have all the conditions necessary to support a healthy biological community including: 1) tree canopy to shade the stream and provide food in the form of leaf detritus for aquatic insects; 2) in-stream cover such as rocks, logs and undercut banks that provide protection for fish and aquatic insects; 3) little or no fine

sediment covering the stream bottom; 4) gravel and cobble-sized stones with open spaces under and around them to harbor aquatic insects and aid in fish reproduction; 5) consistent patterns of shallow, fast areas or riffles and slow, deep areas, such as pools, throughout the stream’s length; and 6) stable stream banks, well covered with a variety of vegetation which helps protect against excess stream channel erosion.

Poor stream habitat

Most streams with poor habitat are characterized by having: 1) an over accumulation of fine sediment in the stream channel that smothers the riffles and fills in the pools; 2) steep, erosion prone and unstable stream banks lacking vegetative cover, that; 3) erode and deposit into the stream channel, smothering much of the stream habitat; and 4) severely undercut stream banks, which topple shade trees, leading to rising stream temperatures, and reducing the availability of tree leaves as important food sources to the benthic aquatic community.

Causes of poor habitat conditions

The primary cause of poor stream habitat in this county is altered stream *hydrology* [G](#). Increases in stormwater runoff associated with watershed development have accelerated channel erosion, habitat loss, and sedimentation damages in county streams. These impacts started with the clearing of land more than three hundred years ago for timber and agricultural purposes. Stream channels continue to adjust to alterations in stream hydrology as watershed development has gradually shifted from agricultural to residential and commercial uses to accommodate the county’s population growth.

Hard surfaces, impervious to water, such as

roads, parking lots, and rooftops, cover an increasing proportion of the landscape. Additions in impervious surfaces and highly compacted lawn surfaces increase the volume of water that rapidly runs off into streams during storms. Less rainfall can naturally infiltrate into soils, which may lower the water table, reduce well yields, and limit replenishment of stream flows during dry weather periods. Before the mid-1980’s, increases in impervious areas were not accompanied by stormwater controls to help mitigate the erosive effects of runoff. The combined effects of increased flooding, accelerated channel erosion, and reduced groundwater replenishment of stream flows can often devastate natural stream channel habitat and its ability to support a diverse biological community.

Sediment is the most important pollutant in Maryland. It has been estimated that up to seventy five percent of sediment deposits from developed urban and suburban areas are from accelerated stream channel erosion, rather than erosion from upland soils, as was traditionally thought. Eroded stream channel sediments may also carry attached *nutrient loadings* [G](#) to impact local and downstream waters. Severe channel erosion can also expose and potentially damage sanitary sewers and other utility lines which can lead to catastrophic pollution and require extensive, costly repairs.

Other threatening impacts to stream habitat include trash, non-native invasive plants, encroachments on county parkland and conservation easements, and deer browsing of woody vegetation. Aquatic species and birds can ingest or become entangled in foreign substances found in garbage-strewn stream environments, endangering their health. If trash accumulations are not prevented and removed, neighbors may

III. Purpose and Methods, continued



A good stream habitat contains features such as a tree canopy, gravel and cobble-size stones, and stable stream banks.



Poor stream habitats have very steep banks which lack vegetative cover, which are vulnerable to erosion during high flow events.

begin to view this as a normal waterway condition and add to the abuse.

Some non-native plant species, accidentally introduced from other remote regions, are free of natural plant competition, insects, and diseases which would otherwise keep them in balance. Prolific seed production and rapid growth of invasive plants such as multiflora rose, porcelain berry, and thistle is gradually out-competing and overtaking desirable native species in some stream buffer areas. www.mncppc.org

Unauthorized encroachment upon publicly-owned parkland and conservation easements, usually by adjacent private property owners, is an illegal activity that can significantly damage streams and protective stream buffers. Encroachments can include mowing of protected stream buffer areas, removal of trees and shrubs which help to stabilize and shade streams, and the dumping of yard trim into the stream itself.

Another habitat problem affecting *riparian buffers* is excessive *deer browse* of vegetation such as saplings, shrubs, and low tree branches. Deer populations, unchecked by natural predation, will commonly eat newly sprouted trees, frequently killing them before they have a chance to sufficiently regenerate and sustain protective tree cover in riparian stream buffers and upland forests.

Identifying causes of impaired aquatic communities

Stream habitat quality largely determines the quality of the biological community, with good habitat supporting a healthy biological community, while poor stream habitat likely to support a

poor biological community. When a poor biological community is found in a stream with good to excellent habitat, other factors must be impacting the biological community. These conditions can include altered stormwater and baseflows, *sediment deposition*, elevated water temperatures, and *chemical stressors*. When monitoring reveals inconsistencies between habitat conditions and expected biological communities, DEP conducts follow-up visual investigations and/or stream chemistry monitoring to assess any potential causes of the impairment. DEP is working to improve screening methods to help better identify and isolate non-habitat related stressors to the biological community. The ability to accurately identify stressors and defend the evidence supporting those findings is a critical step in developing strategies that will improve the quality of aquatic resources (Cormier, et al, 2000).

Measuring stream channel stability

Four of the ten collected measures of habitat quality (*embeddedness*, *sediment deposition*, *bank vegetative protection*, and *bank stability*) are used to evaluate stream channel stability. If a stream is deemed unstable based on these parameters, it is considered as a possible candidate project for stream restoration (see Section VII).

Embeddedness is a measure of how much streambed material, such as gravel or cobble, is surrounded by the silt, sand, or mud of the stream bottom. Generally, as rocks become more embedded, the surface area of habitat available to aquatic insects and fish for shelter, spawning,

and egg incubation is decreased.

Sediment deposition measures changes to the stream bottom resulting from sediment accumulations. While some deposition is natural, large-scale movement of sediment, accelerated by excessive erosion, can bury rocky stream bottoms used as habitat by aquatic insects and as spawning areas by fish. High levels of sediment deposition and movement create an unstable and continually changing environment unsuitable for many organisms.

Stream bank vegetation estimates the percentage of the stream bank covered by native roots, trees, shrubs or other vegetation. The root systems of plants growing on stream banks help hold soil in place, thereby reducing the amount of erosion likely to occur. The overhanging vegetation serves as cover in the stream and helps cool the water temperature. Stream banks, well covered with natural plant growth provide far better habitat for aquatic species than banks lacking vegetation or stabilized with concrete embankments.

Stream bank stability measures the extent of or potential for excessive stream bank erosion. Steep banks are more likely to collapse and suffer from erosion than gently sloping banks and are generally more unstable. Signs of erosion include crumbling, unvegetated banks, exposed tree roots, and exposed soil. (Barbour and Stribling, 1994)

Water chemistry

Readings of pH, dissolved oxygen (DO), conductivity, and temperature are taken at monitoring stations as a regular part of the stream monitoring program. These physical properties of water

help in understanding the water quality of a stream at the time it is monitored.

pH is a measure of the acidity or alkalinity of water on a scale of 0-14. Lower pH readings are more acidic while higher readings are more alkaline. Rainfall is naturally slightly acidic with a pH of around five and one half due primarily to the interaction with carbon dioxide in the atmosphere. As rainfall flows over or infiltrates the land surface, county soils and geology buffer the acidity to the extent that in-stream concentrations of pH are typically between seven and seven and one half. Ninety-two percent of all pH readings taken in county streams during 1994 to 2000 were within Maryland water quality standards (COMAR 26.08.02.03-3 (T)) (Figure 3B).

Fish and aquatic insects require DO in water to breathe through their gills. Dissolved oxygen requirements vary between species. Some species, such as rainbow trout, blue ridge sculpin, stonefly, and mayfly, require higher concentrations of DO, while others, such as common carp, white sucker, worms, and crayfish, can tolerate lower DO. It is generally recognized that DO concentrations less than 5 mg/l (milligrams per liter) are stressful to aquatic life. Maryland's water quality standard for DO is set at 5 mg/l (COMAR 26.08.02.03-3 (T)).

Most of the DO readings taken in county streams range between eight and eleven mg/l. Ninety eight percent of readings were above the Maryland water quality criterion of five mg/l. (Figure 3C) (COMAR 26.08.02.03-3 (T)). However, monitored DO levels in some streams occasionally fell below five mg/l. The majority of these readings occurred during hot summer days when stream flow was also very low.

Summer water temperatures for most streams in

the county average 75 degrees Fahrenheit (F). The physical properties of cool water are able to sustain higher levels of DO than warm water. Many resident species have tolerances to DO conditions that can only be supported by relatively cool water (75 degrees F or less). Some of the higher quality streams may stay at or below 68 degrees F throughout the summer. Cold water species, such as brown trout, require these average cooler temperatures and the higher DO levels they can sustain to survive.

Nutrients and water quality

Nutrients are substances necessary for life. The most common nutrients are nitrogen (N) and phosphorus (P), used for building cells and for energy. These two elements are the N and P listed on bags of plant fertilizers commonly used for lawns and landscaping. The most widespread source of nutrients in Maryland streams is excess fertilizer from farm fields and lawns (USEPA, 1999 (T)). Sanitary sewer overflows and septic tank discharges from urban and suburban sources can also be intermittent and regular sources of excessive nutrients. N and P discharges in treated wastewater effluent represent a regulated, but important source of *nutrient loading* (G) inputs to streams.

In a diverse and high quality aquatic community, there is a balance between the amount of nutrients entering the water and the amount that is easily taken up by that community. When there are excess nutrients, eutrophication may occur, especially in slow moving waters. *Eutrophication* (G) is a condition in an aquatic ecosystem where high *nutrient concentrations* (G) stimulate blooms of algae, creating conditions that may interfere with the health and diversity of the overall biological community (MAIA, 2003 (T)). Eutrophic conditions

typically occur during the warmer months of the year and can result in wide swings in the daily pattern of dissolved oxygen. Currently, there are no established water quality standards in Maryland for nutrients to protect aquatic resources, but there is a drinking water standard of 10 mg/l to protect human health.

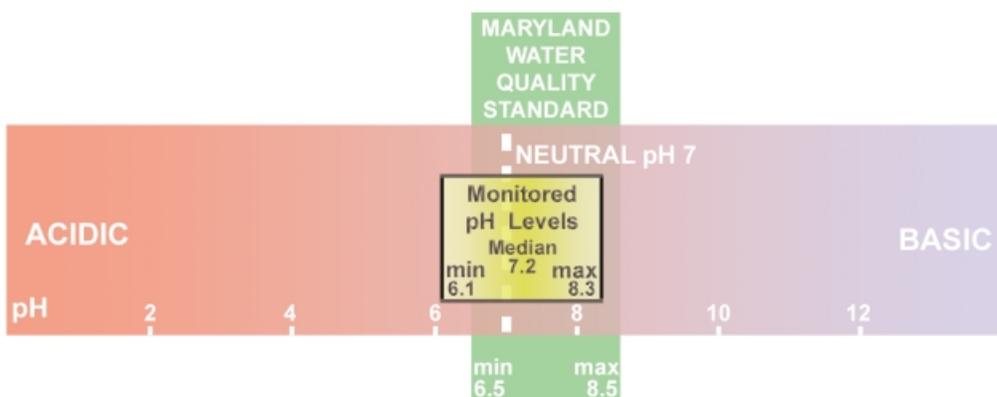
Nutrient monitoring results

As part of its statewide stream sampling program, the MBSS monitors for nitrate-nitrogen (NO₃—the principal component of the N in plant fertilizers) (Kazyak, 2001 (T)). Based on 1994-1997 sampling, the MBSS reported an average of 2.38 mg/l NO₃ in the county, which gave it a ranking of eleventh among the twenty three jurisdictions in the state (MD DNR, 2001 (T)).

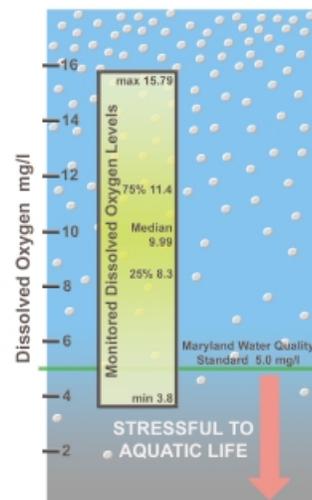
The MBSS monitored a number of stations in county streams for nitrate from 1994-97. DEP continued nitrate sampling at a select subset of stations during the spring of 1998 and 1999. The geographic distribution of MBSS and DEP nitrate sampling stations across the county is shown in Figure 3D. Table 3B summarizes results of this monitoring.

When compared to the MBSS data results, the smaller range in minimum and maximum nitrate concentrations shown in DEP's data may be reflective of DEP's shorter, two-year monitoring period. Over the four years of MBSS sampling, a broader range of values could be expected. The geographic distribution of MBSS stations was less representative of the county's developed watersheds than the DEP dataset.

No stations monitored in the county from 1994-1999 showed NO₃ values above the 10 mg/l drinking water standard. However, all indicate nitrate concentrations greater than the one mg/l



(LEFT) FIGURE 3B. 92% of 1,455 pH readings taken in Montgomery County streams during the period of 1994-2002, are within the Maryland water quality standards.



(RIGHT) FIGURE 3C. 98% of 1,463 dissolved oxygen readings taken in Montgomery County during the period of 1994-2000 are above the Maryland water quality standard of 5.0 mg/l

III. Purpose and Methods, continued

above which the MBSS suggests as representing unnaturally elevated levels of NO_3 (Boward et al, 1999). Interestingly, all but one of the lowest and highest observations in all three sets of monitoring data came from the Seneca Creek watershed. This seems to reflect the wide range of agricultural and developed lands in various parts of this watershed. The least developed agricultural lands generally showed higher *nutrient loads* than the more developed areas. Three wastewater treatment plants in the watershed (Damascus, Seneca, Poolesville) also contribute some nutrient loadings as allowed in their state-regulated effluent discharge permits. The town of Poolesville's discharge is of particular concern because the plant is presently operating in excess of its permitted flow capacity. Treatment plant upgrades are now planned to correct this problem.

The color coding in Figure 3D shows an increase in concentration as colors change from the blue symbols to green, yellow, and red. Consistently, lower values (blue and green markers) occurred in the more developed parts of the county, in the southern and eastern sections, while the highest values (greater than 3 mg/l, shown with a red marker) occurred in the western, more rural and agricultural sections of the county. This pattern has significant implications for targeting watershed management strategies for nutrients.

Although some rural county watersheds do show elevated *nutrient concentrations*, this does not necessarily have serious impacts on the local in-stream biological communities. This is because the relatively fast-flowing nature of most county streams can transport dissolved nutrients downstream quickly before harmful concentrations can occur. However, these elevated concentrations do contribute to *nutrient loading* problems that now impact the Potomac River, Patuxent Reservoirs, and the Chesapeake Bay.

Bacterial contaminants

As in most urbanized areas across the country, data from various sources indicate that Montgomery County's streams regularly exceed the *fecal coliform* bacterial indicators used in Maryland water quality standards, especially following rainfall events. Extensive technical debate continues about the appropriateness of the fecal coliform bacterial test as a useful measure of bacterial contamination. This reflects both the ubiquitous nature of sources involved, particularly in runoff-borne nonpoint sources, and uncertainties about whether some of these sources represent significant threats to public health.

FIGURE 3D.
Concentrations of Nitrate from Nutrient Monitoring Stations

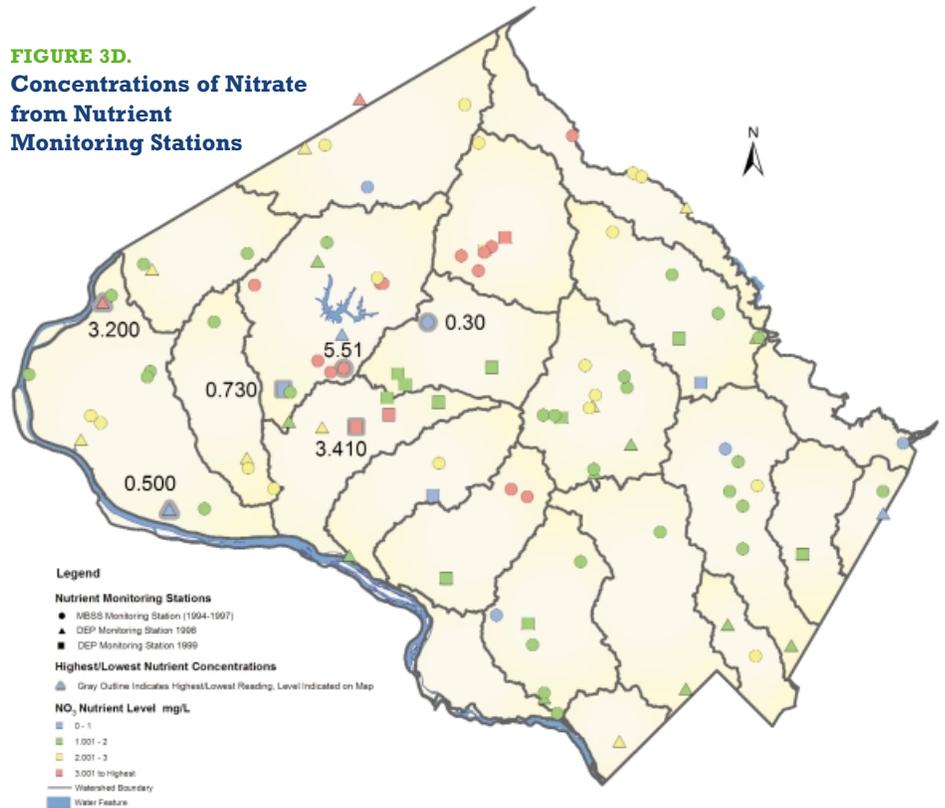


TABLE 3B. Nitrate (NO_3) nutrient concentrations in mg/l from 1994-1999

Program and Year	# of Stations	Average (mg/l NO_3)	Minimum to Maximum (mg/l NO_3)
MBSS 1994-1997	91	2.38	0.191 to 5.514
DEP 1998	32	1.94	0.050 to 3.2
DEP 1999	17	1.69	0.730 to 3.41

MBSS = Maryland Biological Stream Survey

DEP = Montgomery County Department of Environmental Protection

Recent scientific studies indicate diverse sources of bacterial contaminants to county streams, including many from natural wildlife and bird populations, where control options appear limited. Another more manageable source is pet waste, particularly from developed watersheds. Point sources of obvious public health concern are fecal human waste, usually discharged from overloaded or leaking sewer lines, inadequately treated wastewater discharges, or malfunctioning septic systems. Historically, these sources have been of relatively low incidence in the county and usually are quickly rectified when found. DEP continues to work closely with state and local agencies to define the most appropriate steps and priorities for addressing manageable sources of bacterial contamination.

Other types of impacts

Other stressors that affect streams, the most severe of which are often found in urban areas of our county, include heavy metals from brake linings and thermometers, road salt, and pesticides. One example, in the 2000 summer, involved the illegal dumping of substantial amounts of bleach into the Turkey Branch of Rock Creek, which killed the majority of the fish in the tributary.

Additional stressors to the aquatic community are periodic sewage spills and leaks. There are generally more reports of sewage overflows and leaks in the older down-county areas, where aging sanitary sewer lines, servicing higher development densities, have greater maintenance needs. Smaller sewer lines are also affected by invasive tree roots and grease blockages.

IV. Stream Conditions: Current Status

Information on the current status of county stream conditions is based upon results from DEP's first completed monitoring cycle covering all county watersheds (1994-2000).

Average stream conditions by stream miles

Sixty-two percent of the monitored stream miles in the county are rated as "excellent" or "good" while 38 percent of the total stream miles are rated "fair" or "poor" (Table 4A). The 112 miles shown as not sampled include areas that are either too deep to monitor or involve streams that are intermittent or too small to be sampled. In addition, 114 miles of the Potomac River, Patuxent River, large lakes, and the C&O Canal are monitored by other agencies, such as Maryland Department of Natural Resources (MD-DNR), Washington Suburban Sanitary Commission (WSSC), and Maryland National Park and Planning Commission (M-NCPPC). DEP does not routinely sample these systems because of their size, depth, boat access requirements, and because these are already monitored for a wide variety of chemical parameters.

However, during the 2002 drought, DEP participated in habitat evaluations coordinated by Maryland DNR to re-assess the minimum low flow requirements now established for the Potomac River at Little Falls. This effort included monitoring, mapping, and assessing Potomac River habitat from Seneca Creek to the Little Falls Dam to review the adequacy of present minimum flow requirements which are in place to protect the biological integrity of the Potomac River. Specified minimum allowable Potomac River flow limits at Little Falls, restrict the maximum amount of river flow that can be withdrawn from the Washington Metropolitan Area's water supply intakes located immediately upstream between Seneca Creek and Little Falls.

Stream conditions by major watersheds

The 1998 CSPA presented information on stream conditions found in each of the major county watersheds. For some watersheds, stream ratings were termed "preliminary" because they lacked the complete suite of bio-

logical and habitat data used to evaluate conditions in most watersheds. This CSPA update replaces ratings on stream conditions in watersheds where ratings had been previously based upon preliminary data. Findings on stream conditions reflect results of DEP's completion of its first five-year monitoring cycle, in which all county watersheds were fully monitored at least one time over a five-year period. The update also reflects the results from sampling additional monitoring stations to improve full watershed coverage.

Figure 4A describes average stream conditions found within each of the county's 23 major watersheds. Average watershed condition ratings were based upon combining results of observed stream conditions from the smaller drainage areas to each of approximately 400 monitoring stations countywide (Figure 4B). Examination of the smaller, individual monitoring station drainage areas allows more in-depth examination of the varying conditions found in the county's major watersheds. These results can also be compared to the stream conditions described in the 1998 CSPA. conditions.askdep.com

Following is a summary of average watershed conditions, organized by the major watersheds shown on Figure 4A. Watershed summaries also refer to information on some of the more detailed monitoring results depicted on Figure 4B. The urban watersheds, with moderate to high density land uses, are discussed first, followed by the rural watersheds, which generally contain lower density residential or agricultural land uses. Within these two categories, the individual watershed summaries are presented in alphabetical order.

Urban watersheds

The majority of the major urban watersheds listed below had a "fair" stream condition rating. Down-county urban watersheds (generally represented as those inside of or near to the Capital Beltway and the lower end of the I-270 corridor) were the earliest to change from agricultural to urban/suburban land use because of their proximity to Washington, D.C. These watersheds tend to have higher percentages of impervious area, fewer acres controlled by

stormwater management facilities, and many more miles of piped headwater streams, than county watersheds located to the north and west. These cumulative impacts altered stream base and storm flows, increased in-channel sediment deposition [9](#), increased bank erosion, and lowered stream stability and habitat quality.

Cabin John Creek (Fair) is significantly impacted by suburban development centered around the county's main transportation corridors (CSPA, 1998 [10](#)). The headwaters and middle portion are in fair condition (Figure 4B). Booze Creek and Beltway Branch in the southeast and Snakeden Branch in the northwest remain in poor condition (Figure 4B). Three tributaries to the southwest (Buck Branch, Ken Branch, and the Congressional tributary) still support a healthy fish community and are in good condition (Figure 4B). Today, increased citizen awareness of the watershed had led to the formation of the Friends of Cabin John Creek Watershed. This volunteer citizen group is dedicated to the restoration, preservation and stewardship of the watershed.

Little Falls (Poor) watershed contains one of the county's most urban and altered stream systems. Stream conditions remain poor (Figure 4B), with little biological life or diversity above MacArthur Boulevard. Recently completed stream restoration projects in the areas below Massachusetts Avenue may enable successful reintroduction of some native fish and amphibians once resident in the watershed.

Little Paint Branch (Fair) The upper portions of Little Paint Branch remain in good condition (Figure 4B) and still provide habitat necessary to support healthy communities of fish and aquatic insects. Conditions decline rapidly downstream as many portions of the watershed were developed before requirements for stormwater controls.

Lower Great Seneca (Good) originates in the urban Gaithersburg area with poor and fair conditions, Lower Great Seneca improves to a good condition as it leaves the rapidly expanding urban development areas around Quince Orchard (Figure 4B).

Lower Patuxent River (Fair) watershed consists of the Patuxent mainstem and its tributaries

IV. Stream Conditions: Current Status, continued

below the Hawlings River (CSPS, 1998 [1](#)). Even though much of the land is protected by park land, buffers and master planning, only the upper portion supports good stream conditions (Figure 4B). The lower half has a fair stream condition (Figure 4B).

Lower Rock Creek (Fair) is a heavily urbanized, densely populated watershed that developed many years before there were requirements for managing stormwater runoff resulting from development (CSPS, 1998 [1](#)). While its overall condition is fair (Figure 4A), major portions of the upper watershed draining Rockville, and middle portions in the Kensington and Silver Spring areas are in poor stream condition (Figure 4B). A toxic chemical released into the creek near Connecticut Avenue in 2002 killed thousands of fish throughout the stream as far as the District.

Middle Great Seneca Creek (Fair) drains the urban areas of Gaithersburg, Montgomery Village, and parts of Germantown. Cabin Branch and Whetstone Run to the east of the watershed remain in fair condition. Gunners Branch on the southwest was rated in good condition despite relatively high imperviousness.

Muddy Branch (Fair) Headwaters of Muddy Branch are within Gaithersburg, with much of the middle portion outside of Gaithersburg being developed since 1973 (CSPS, 1998 [1](#)). The very headwaters are in poor stream condition with much of the middle portion of Muddy Branch in fair condition (Figure 4B). Portions of the Dufief Tributary and Quince Orchard Knolls Tributary remain in good condition. The lower third of the Muddy Branch is in good condition with the exception of the Farmlands Tributary which supported a fair condition.

Northwest Branch (Fair) is the largest of the three county contributing watersheds to the regional Anacostia watershed (CSPS, 1998 [1](#)). The upper third of the watershed contains a variety of stream conditions ranging from excellent (Upper Bryant's Nursery) to poor (portions of the Longmeade Tributary and the Left Fork) (Figure 4B). The rest of the watershed largely supports poor to fair stream conditions.

Paint Branch (Good) supports a unique county and regional resource—an urban cold-water fishery and wild brown trout population, surrounded by suburban development and located in close proximity to the nation's capital. The upper reaches (particularly Good Hope and Gum Springs) provide essential spawning/nursery habitat and cold clean water

for young trout. Zoning, land use, and *Special Protection Area* [2](#) requirements in place for the upper watershed, plus continuing stream buffer acquisition and stream restoration efforts are helping to mitigate development impacts on the stream resource. Monitoring results for this update finds that most of the upper portions of the watershed support good stream conditions. Below Randolph Road, stream conditions vary from fair to good (Figure 4B).

Rock Run (Fair) generally provides good habitat owing to forested stream valleys, however, the streams only support a poor to fair biological community (Figure 4B).

Sligo Creek (Poor) watershed has been the focus of intensive watershed restoration activities by the county. In 1990, degraded stream habitat in upper Sligo Creek was only able to support two native fish species. Capital projects were designed and built to restore lost stream habitat and overcome many of the impacts typically encountered in urban streams. Habitat improvements were followed with the reintroduction of eighteen long absent native fish species during the early 1990's, seven of which, monitoring results have shown, remain self-sustaining. This success enabled portions of Upper Sligo Creek to receive a "fair" water quality rating in the original CSPS. However the most sensitive species, blue ridge sculpin, apparently was unable to maintain a viable population after the 1999 drought. Although there is some uncertainty as to the sufficiency of the original stocking of this species, monitoring through 2000 classifies Sligo Creek just slightly falling below fair and into a poor rating. With the extensive habitat restoration and stormwater management controls, DEP is confident that Sligo Creek will again soon support a fair and improving fish community. Recently, a citizen watershed group has been formed; the goal of Friends of Sligo Creek is to see Sligo Creek become the best natural area possible. The successes documented thus far in restoring Sligo Creek are setting the standard for other urban watersheds in and beyond our county (CSPS 1998 [1](#)). The nature and status of continuing restoration and species reintroduction work on Sligo Creek is further described in Section VII.

Watts Branch (Fair) watershed, like many county watersheds, is influenced by the historic development patterns that saw the creation of towns and roads at high points in the landscape (CSPS, 1998 [1](#)). These high points were often at the top of watersheds. Today, Rockville

occupies much of the headwaters of Watts Branch. Piney Branch is a designated Special Protection Area with areas planned for medium to high impervious development. Much of Watts Branch supports a fair stream condition. The upper Piney Branch supports a fair or poor stream condition. The areas with a good stream condition are in portions of the Sandy Branch, West Piney Branch, and lower main stem below Glen Road (Figure 4B). Conditions in the Piney Branch have greatly fluctuated over the last several years, droughts and other natural factors may have cumulatively impacted the watershed along with development related impacts. More time is required to determine whether the Piney Branch can again fully support good stream conditions once the temporary development impacts in the headwaters have ceased and the development sites have been fully stabilized with permanent stormwater infrastructure fully in place.

Rural Watersheds

Average conditions in the county's predominantly rural watersheds, where there is generally more large tracts of forested parkland and agricultural land, had an overall "good" rating. Residential and commercial development is either of low density or has been built with more modern storm water controls, wider accompanying stream buffers, and with less exclusive dependence on piped storm drainage systems to convey storm flows. Impacts from agricultural developments are also seen in these watersheds. However, in general, impacts on habitat conditions are less severe than those seen in the county's older, higher density urban and suburban areas.

Bennett Creek (Good) contains two high quality watersheds (Figure 4A). Bennett Creek is a forested agricultural watershed supporting a healthy and diverse ecosystem. Little Bennett Creek (lower stream system on Figure 4A) is a high quality cold-water stream. Some flow and habitat problems limit the ability of Little Bennett to improve as a coldwater resource (CSPS, 1998 [1](#)). All of Little Bennett supported a good stream condition (Figure 4B). Many of the best streams remaining in the county are found within this watershed and make up a portion of the reference stream reaches used to determine the stream condition of other county streams.

Broad Run (Good) originates west of Poolesville and passes through a section of Montgomery County little changed in over one hundred years (CSPS, 1998 [1](#)). Most of the

COUNTYWIDE STREAM PROTECTION STRATEGY ■ 2003 UPDATE ■ MONTGOMERY COUNTY, MARYLAND

These maps represent the current conditions in Montgomery County streams (CSPS Update 2003). Each area is rated as either "excellent," "good," "fair," or "poor" condition. Ratings are based on comparison to "reference conditions" found in the highest quality, least-impaired streams in and around Montgomery County.

FIGURE 3A. Montgomery County Watersheds and Monitoring Sites

- Legend**
- AGENCY**
- DEP
 - MBSS
 - MNCPPC
- Water Feature
- Stream
 - State Route
 - Interstate
 - Watershed

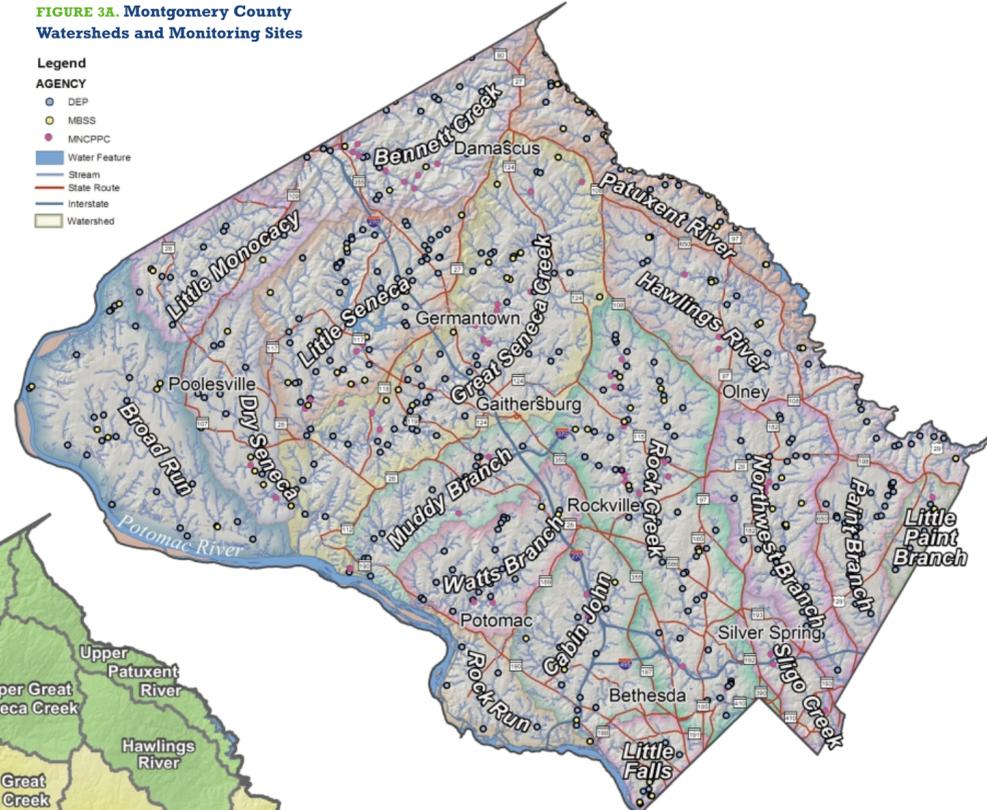


FIGURE 4A. Average Stream Conditions in Major County Watersheds
Based on actual weighted IBI scores/acre for subwatersheds depicted in Figure 4B.

- Legend**
- Watershed Boundary
 - Rivers and Lakes
- Average Stream Condition**
- Excellent
 - Good
 - Fair
 - Poor

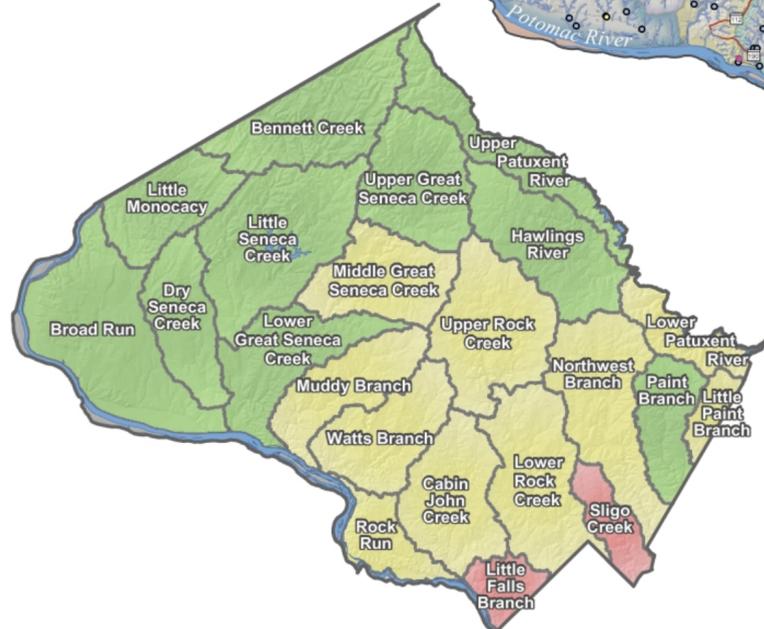
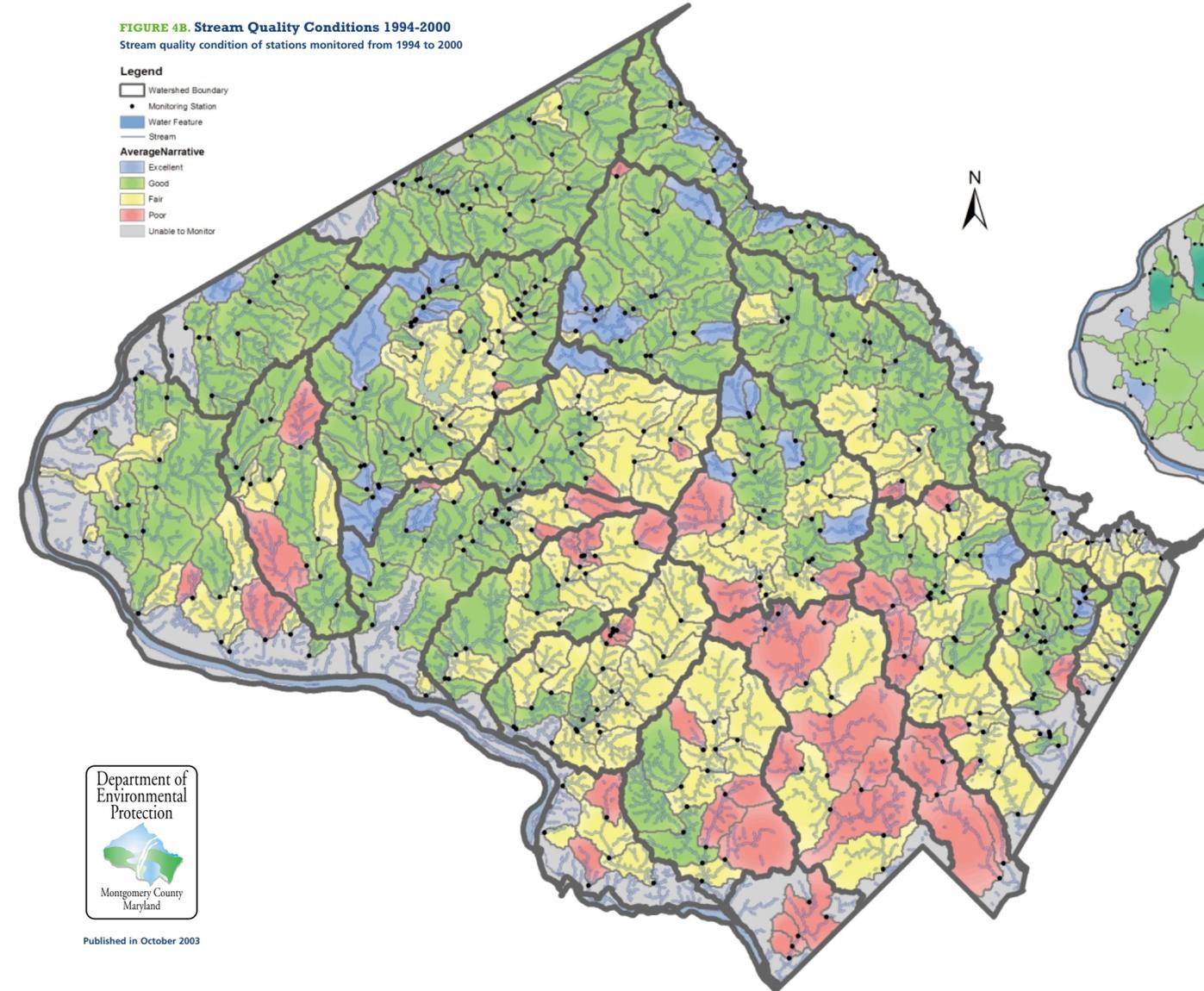


FIGURE 4B. Stream Quality Conditions 1994-2000
Stream quality condition of stations monitored from 1994 to 2000

- Legend**
- Watershed Boundary
 - Monitoring Station
 - Water Feature
 - Stream
- Average Narrative**
- Excellent
 - Good
 - Fair
 - Poor
 - Unable to Monitor



Published in October 2003

FIGURE 5A. Current Habitat Status 1994-2000
Habitat conditions for stations monitored between 1994 and 2000 with the addition of data from 2001 and 2002 where needed.

- Legend**
- Watershed Boundary
 - Habitat Status
 - Monitoring Station
- Habitat Status
- Excellent
 - Excellent/Good
 - Good
 - Good/Fair
 - Fair
 - Fair/Poor
 - Poor
 - 2001 and 2002 data used
 - Not sampled
 - Data not available

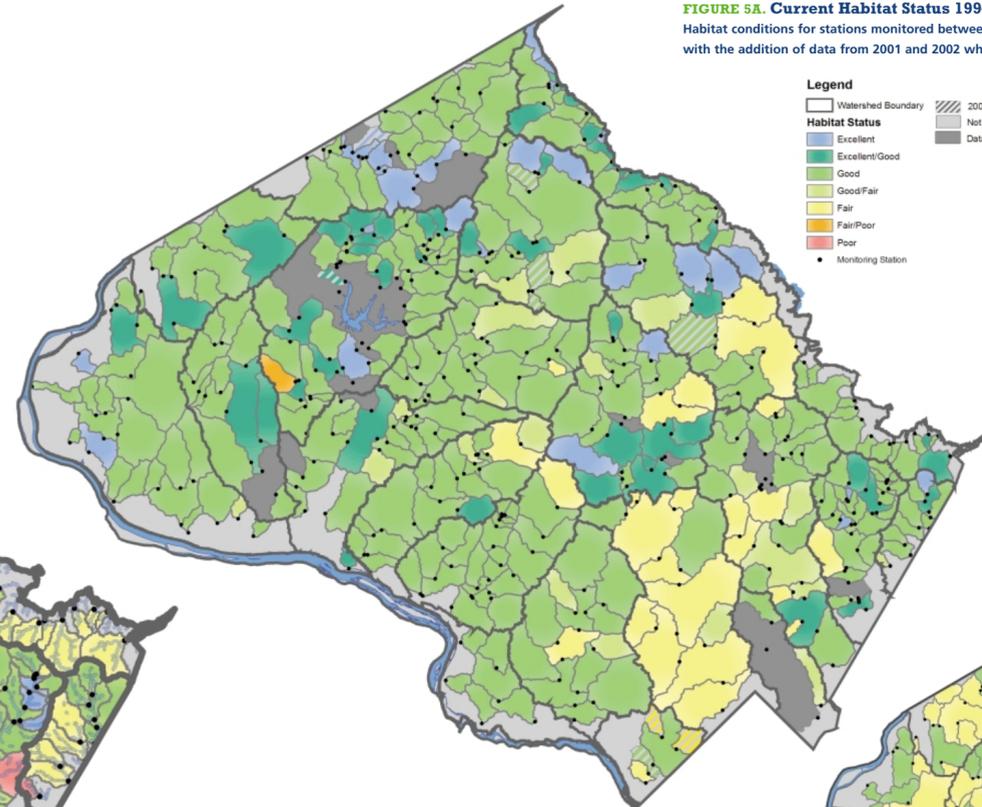


FIGURE 5B. Habitat Stability 1994-2000
Stations that scored fair or poor on at least 1 out of 4 stability parameters are considered unstable.

- Legend**
- Monitoring Station
 - Lakes and Rivers
 - Watershed Boundary
- STATION**
- Stable Habitat
 - Unstable Habitat
 - Not Sampled

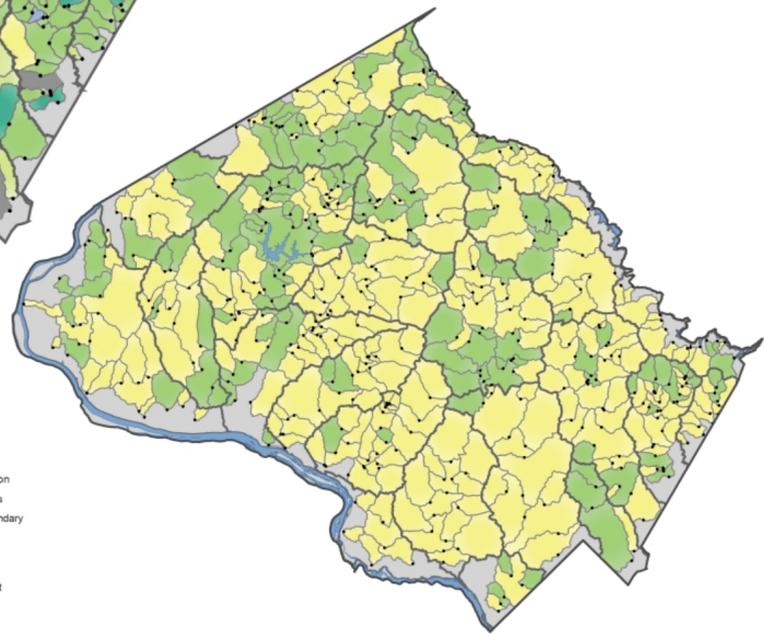


TABLE 4A. Summary of 1994-2000 Findings on County Stream Resource Conditions

Stream Resource Condition	Stream Miles	Stream Miles Monitored (%)	Watershed (acres)	County Acreage Monitored (%)
Excellent	84	7	18,091	6
Good	695	55	143,512	50
Fair	362	28	86,431	30
Poor	131	10	41,580	14
Total Monitored Miles	1,272	100	289,614	100
Intermittent streams or streams too deep to monitor	112			
River/lake/canal systems monitored by other agencies	114			
Total County Stream miles	1,498		291,001	

watershed is in good condition, with only relatively small areas in the northwest supporting fair stream conditions (Figure 4B). Horsepen Branch contains the poor and fair drainage areas south of Dry Seneca Creek (Figure 4B) and enters the Potomac River within the McKee-Beshers Wildlife Management Area (CSPS, 1998 [T](#)). Wetlands in the lower Horsepen Branch have been designated as wetlands of special state concern because of their botanical diversity and value to wildlife (CSPS, 1998 [T](#)). Much of the watershed tends to dry up almost completely in the summer due to the drought sensitive underlying geology and only supports a poor or fair stream condition (Figure 4B). However, the upper portions support good stream conditions (Figure 4B).

Dry Seneca Creek (Good) is a large tributary to Seneca creek, draining Poolesville and portions of Beallsville. Conditions throughout much of the watershed are good, however the stream in the upper portion of the Peach Tree Tributary and the more urbanized Russell Branch are poor. Conditions in other areas of Poolesville and the Darnall Tributary are fair (Figure 4B). Monitoring data collected after 2000 found poor stream conditions below the Poolesville Wastewater Treatment Plant (WWTP) and the more urbanized Russell Branch. DEP's monitoring indicated that overloaded conditions at the Poolesville WWTP were a direct cause of some of the poor water quality and biological conditions observed in the Dry Seneca Creek. DEP has been working closely with Poolesville and the Maryland Department of the Environment (MDE) to ensure that the WWTP and sewer line upgrades are pursued expeditiously to rectify these problems.

Hawlings River (Good) is a major tributary

of the Patuxent and plays an important role in the overall efforts to reduce *nutrient* and *sediment loadings* [G](#) to this river, and in particular, to the Rocky Gorge reservoir, a public drinking water supply (CSPS, 1998 [T](#)). Overall, the Hawlings continues to support a good stream condition. Portions of the Reddy Branch and James Creek, draining the Olney developed area, support either poor or fair stream conditions. The upper reaches of the Gregg Tributary and a small portion of the Hawlings in the northwest are also in fair condition (Figure 4B).

Little Monocacy (Good) is one of the most scenic rural watersheds in the county (CSPS, 1998 [T](#)). It supports habitat and water quality parameters supporting good stream conditions throughout the watershed (Figure 4B). The headwaters draining a portion of Sugarloaf Mountain support excellent stream conditions.

Little Seneca Creek (Good) drains Clarksburg, Germantown, and Boyds before flowing into Great Seneca Creek near Dawsonville (CSPS, 1998 [T](#)). Land use within the watershed is very diverse, ranging from agricultural to urban. Stream conditions within the watershed reflect the diversity of landscapes. Stream conditions range from a small poor drainage area near Lake Churchill to excellent stream conditions in much of the Ten Mile Creek area (Figure 4B). The Little Seneca Creek drainage, above Little Seneca Lake, contains the Clarksburg Special Protection Area. This rapidly changing area will have long lasting effects to the quality of the stream.

Upper Great Seneca Creek (Good) begins in the vicinity of Hawkins Creamery Road and contain the headwaters of the Great Seneca Creek watershed (CSPS, 1998 [T](#)). This watershed supports many areas of excellent to good

stream conditions (Figure 4B). The only area found supporting poor stream conditions is a small headwater drainage area of Magruder Branch (Figure 4B). This area receives stormwater runoff from the highly impervious Damascus commercial area in the vicinity of Bethesda Church Road.

Upper Patuxent River (Good) forms the boundary between Montgomery and Howard County and includes all the land draining to the Patuxent River above the Triadelphia Reservoir (CSPS, 1998 [T](#)). The watershed includes large forested areas along with agricultural cropland, pasture and large lot residential development (CSPS, 1998 [T](#)). Much of this watershed supports good stream conditions as well as many areas supporting excellent stream conditions (Figure 4B). As in Little Bennett, many of the best streams remaining in the county are also found within this watershed. Only one small stream supported fair stream conditions in this watershed (Figure 4B). This stream, called Mt. Carmel Tributary in the 1998 CSPS, parallels Georgia Avenue. Road impacts may be affecting the stream.

Upper Rock Creek (Fair) contains the headwaters of the first major Potomac tributary west of the Anacostia River drainage (CSPS, 1998 [T](#)). Today, homes and businesses have almost entirely replaced farms and fields as the landscape has been changed as a result of planned growth. This watershed supports a wide range of stream conditions ranging from excellent to poor (Figure 4B). Areas with poor stream conditions are adjacent to areas with excellent stream conditions reflecting the changes occurring in this watershed (Figure 4B).

V. Habitat Status

Average habitat conditions by major watersheds

Figure 5A presents habitat ratings for all stations monitored between 1994 and 2000. Table 5A presents this information converting station data to stream miles and watershed acreage. Most of the stream miles monitored (seventy eight percent) had ratings ranging from “excellent” to “good” while fifteen percent of the stream miles rated from “good/fair” to “fair/poor.” No stations scored “poor” (Figure 5A). Ratings for ten of the stations shown on Figure 5A were based on data from 2001 and 2002 due to lack of earlier data.

The majority of the “excellent” and “excellent/good” stations were located in the northern part of the county. Forested areas, publicly-owned parkland, and older residential areas supported “good” stream habitats. Almost all “fair” habitat areas were within the down-county developed part of the county. “Fair” habitat areas were located throughout the Lower Rock Creek watershed: in the Bel Pre

Tributary portions of the Northwest Branch watershed, the North Branch portions of the Upper Rock Creek watershed, Lower Ken Branch of the Cabin John Creek watershed, and the Lower Hawlings River. Only one station, located in Lower Little Seneca Creek, rated “fair/poor.” This small stream was almost dry when monitored in 1998, and consequently received lower than normal habitat scores.

There were no poor scores from the final 1994 to 2000 data. These results can be compared to the habitat assessment results for each watershed in the 1998 CSPS. conditions.askdep.com

Channel stability

In the first CSPS (1998), stream channel stability was assessed using the following four parameters; *embeddedness*, *pool sediment deposition*, *stream bank vegetation*, and *stream bank stability* . The same parameters were re-examined in this update with the results are shown in Figure 5B. If a station scored “fair” or “poor” on at least one of the parameters, stream habi-

tat was considered unstable.

Sixty nine per cent (274) of the stations monitored for habitat from 1994 through 2000 exhibited unstable stream channels. There are many streams in unstable condition and they are distributed across the county. These ratings reflect the continuing impacts of the county’s earlier agricultural development, followed by more severe impacts of urban and suburban development when it lacked adequate stormwater controls.

When stream stability ratings were reviewed within each of the twenty three major watersheds, large areas of Muddy Branch, Watts Branch, Cabin John, Lower Rock Creek, Middle Great Seneca, and the Northwest Branch were rated as unstable; while much of Upper Patuxent, Little Bennett Creek, Little Seneca Creek, and Upper Great Seneca Creek in the northern part of the county rated as stable. Portions of the Upper Rock Creek watershed below Lakes Needwood and Frank are stable, as well as Sligo Creek and the Upper Paint Branch.

TABLE 5A. Summary of County Stream Habitat Conditions (1994-2000)

Habitat Conditions	Stream Miles	Stream Miles Monitored (%)	Acreage	County Acreage Monitored (%)
Excellent	68	5	14,098	5
Excellent/Good	137	11	31,294	11
Good	790	62	180,192	62
Good/Fair	64	5	15,587	5
Fair	124	10	31,165	11
Fair/Poor	3	0.3	619	0.2
Poor	0	0	0	0
Habitat Data Not Available	86	7	18,046	6
Intermittent streams or streams too deep to monitor	112			
River/lake/canal systems	114			
TOTAL	1,498		291,001	

Availability of updated information on stream and habitat conditions and trends since 2000

The County has collected and analyzed available 2001 to 2003 data collected from some 180 monitoring stations since final 1994 to 2000 data results were compiled for this report. Preliminary results are compiled as an analysis of water quality trends seen since 2000 and can be reviewed or down-loaded from DEP’s website. trends.askdep.com Results include maps and tables describing water quality and habitat conditions and trends found at each monitoring station along with general observations of what these data suggest, statistically, about countywide trends in water quality and habitat conditions since 2000. DEP will update preliminary and trends information periodically, as new monitoring data is collected and analyzed.

VI. Imperviousness and Streams

Impervious and highly compacted surfaces covering the landscape affect how much water infiltrates and how much runs off. Recent research (Center for Watershed Protection, 2003 [🔗](#)) has shown that most stream quality indicators will decline when watershed imperviousness exceeds ten percent, with severe impairment occurring when imperviousness exceeds 25 percent. A preliminary regression model developed by DEP, and based solely on available county stream quality and watershed impervious area data, also predicts that average aquatic insect IBIs could decline to the fair category when imperviousness exceeds eight percent. When imperviousness exceeds 21 percent, the model predicts that average aquatic insect IBIs may shift to the poor category (Figure 6A).

Additional research is needed to assess the extent to which the combined effect of modern stormwater controls, stream buffers, and forest reforestation, can help mitigate the effects of increasing imperviousness and compacted soil conditions in urban and suburban watersheds. For example, some studies (ERM 2000, Maxted 1999, CWP 2003 [🔗](#)) suggested a small but positive effect of stormwater control relative to aquatic insect diversity. This positive effect was seen in the five percent to 20 percent imperviousness range, but was not detected beyond 30 percent imperviousness. The Center for Watershed Protection Study (CWP 2003 [🔗](#)) further notes that it would be premature to presume that stormwater management controls are of limited value in maintaining biological diversity in small streams. Most stormwater management control structures studied to date were designed to control certain types of storms but were not specifically designed to protect stream habitat or to optimize prevention of downstream channel erosion. Forest retention and buffers may also provide benefits that have not been well quantified (CWP 2003 [🔗](#)). Few studies have actually followed a small watershed from pre-construction through to the build-out of projects to evaluate the cumulative effects of various combinations of stormwater management controls, supporting stream buffers, trees and other stormwater pollutant controls in mitigating watershed development impacts.

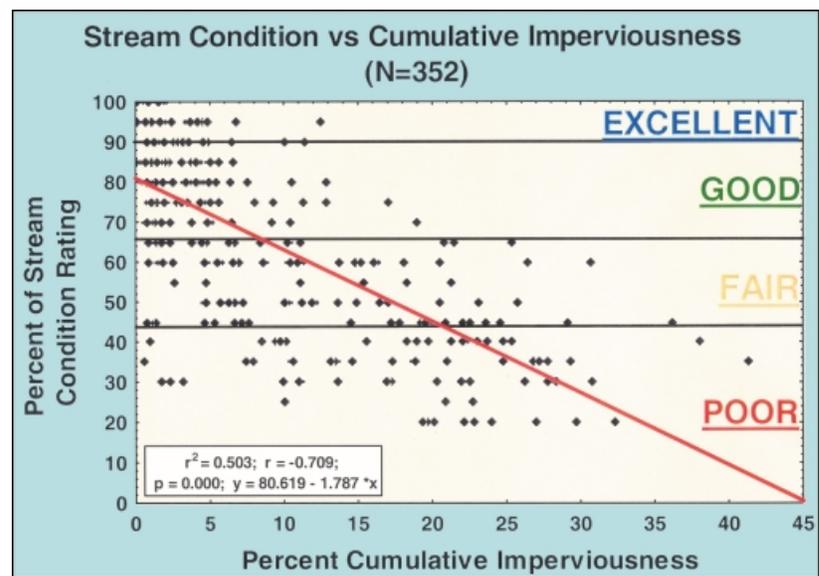
Next steps

DEP's stream monitoring databases are now linked to other County GIS databases on land cover and natural features. This allows analysis of relationships between water quality impacts, potential determining factors such as impervious land cover, compacted lawn surfaces, and piped drainage systems, and the effects of various types

geometry and stream ecology.

DEP is also required to monitor the effectiveness of the new Maryland stormwater design manual in maintaining healthy stream environments. This study design includes a small test watershed in the Clarksburg area that, at authorized master plan development, will have about 30 percent of the land surface in impervious

FIGURE 6A.



of stormwater management controls, stream buffers, and urban tree canopy in helping to mitigate these impacts. In addition, DEP has been monitoring the effectiveness of current stormwater management facilities located in designated Special Protection Areas within the Upper Paint Branch, Piney Branch, and the Clarksburg Master Plan areas of the Little Seneca Creek watershed. As more of this data becomes available, DEP hopes to be able to better quantify how redundant and modern *Best Management Practices* [🔗](#) can help to mitigate the effects of imperviousness on the biological communities in our streams. DEP has also been a research partner with University of Maryland scientists, in developing a predictive model to examine how changes in the landscape alter stream *hydrology* [🔗](#), channel

area. The study includes monitoring comparisons with a control stream in an adjoining watershed that will remain within a relatively undisturbed public park. DEP's monitoring for this work includes stream flow, groundwater levels, channel geometry, water temperature, biological community monitoring, and some water chemistry. Light Detection and Ranging photography (*LIDAR* [🔗](#)) has also been recently flown over the area. DEP hopes to use this technology to help better measure changes in the stream channel conditions and their relationship to development activities in the watershed. Co-investigators in this study include the U.S. EPA, University of Maryland Baltimore County, Montgomery County's Department of Permitting Services, M-NCPPC, and the USGS.

VII. County Watershed Protection and Restoration Programs

Montgomery County employs a variety of comprehensive, interagency programs that address and help mitigate the effects that watershed development and increases in impervious area have on natural stream systems. Since 1927, a comprehensive park acquisition and subdivision

Increasingly effective construction site sediment controls and stormwater runoff control have been in effect since the early 1970's.

Since 1990, Montgomery County's Department of Environmental Protection has been applying the Capital Improvements Program (CIP) to

stream bank slopes and carefully position rocks, logs, and native woody vegetation to stabilize eroding streambanks, recreate or improve habitat for fish, aquatic insects, birds, and other wildlife, and provide shading to help maintain cool stream temperatures.

DEP's general goal for these projects is to "raise the bar" to enable degraded streams to support more diverse and vibrant biological communities. Reduction of stream channel erosion to reduce sedimentation damage to downstream areas is another important objective common to all projects. A few projects are also undertaken primarily to protect vulnerable private properties from excessive stream bank erosion.

Many of the county's stream restoration projects are carried out in stream reaches protected by stream valley parkland and conservation easements reserved by M-NCPPC. M-NCPPC and other agencies are important partners with DEP in designing and building these projects, and in providing easements or cost-share funding to help support them. Other key partners include the Maryland Department of the Environment, Maryland Department of Natural Resources, and the U.S. Army Corps of Engineers.

As Table 7A and Figure 7A indicate, DEP's recently completed watershed feasibility planning studies cover 152 square miles or approximately 30 percent of Montgomery County's developed and developing watershed drainage. Studies covering another 33 square miles are underway. These watershed studies have identified many opportunities for retrofitting stormwater controls and restoring degraded sections of damaged streams. The studies form the basis for watershed actions plans which establish goals and implementation schedules for specific projects, and further identify other activities planned to address watershed protection needs and priorities. Thus far, the County has an inventory of over 380 potential projects which address needs for new runoff controls or to restore damaged sections of stream. New, ongoing watershed studies in the Lower Paint Branch and Watts

TABLE 7A. Summary of Montgomery County DEP Watershed Restoration Projects

Project Type	Completed or Under Construction	Under Final Design
Stormwater Retrofit	2,103 Watershed Acres Protected (15 projects, \$4.62 million)	2,242 Watershed Acres Protected (17 projects, \$6.38 million)
Stream Restoration	11.6 Stream Miles Restored (17 projects, \$4.68 million)	14.7 Stream Miles Restored (37 projects, \$7.50 million)
Watershed Study	152 Square Miles, Upper Paint Branch, Northwest Branch, Rock Creek, Cabin John Creek, Hawlings River (\$1.68 million)	33 Square Miles, Lower Paint Branch, Watts Branch (\$0.50 million)

review program administered by the Maryland-National Capital Park and Planning Commission (M-NCPPC) has purchased parkland or reserved conservation easements to add protective stream buffers for most of the county's watersheds now undergoing development change. These buffer areas help filter pollutants in runoff and provide habitat cover for fish and wildlife. In carrying out its land use master planning and development review responsibilities, the M-NCPPC develops resource inventories and employs strict environmental guidelines that help protect floodplain areas, wetlands, and forest resources important to water quality protection. As new development occurs, the County's Department of Permitting Services (DPS) requires a diverse array of accompanying *stormwater infiltration* and detention controls, along with improved site planning, to help mitigate impacts of impervious area increases that on stream *hydrology*, habitat, and resident aquatic communities. These controls capture and treat runoff to address both the peak flow quantity impacts on streams and reduce pollutants contained in the runoff.

proactively build projects that improve runoff controls and restore degraded streams in developed watersheds. Priorities identified in the original *Countywide Stream Protection Strategy* are used to help target these watershed restoration efforts. Thus far, DEP has focused CIP project implementation primarily in older, urban areas which developed before runoff controls were required and where damages to natural stream habitat have been the greatest.

Table 7A quantifies the extent of Montgomery County's recent efforts to build stormwater retrofit projects and stream restoration projects.

DEP's stormwater retrofit projects are designed to reduce peak runoff flows and pollutant loading impacts on downstream areas from watersheds that lack adequate stormwater controls. Stream restoration projects attempt to adjust the stream channel habitat to accept changes in watershed *hydrology* that accompany watershed development, while retaining a natural sequence of riffles and pools, as needed for the sustenance of more diverse biological communities. During stream restoration, equipment is used to regrade

Branch are adding to this inventory. Presently, over 120 of the projects inventoried thus far have been built, are under construction, or under design. The County continues to be quite successful in securing cost-share grant funding to help support implementation of these projects and leverage the allocated County CIP funds.

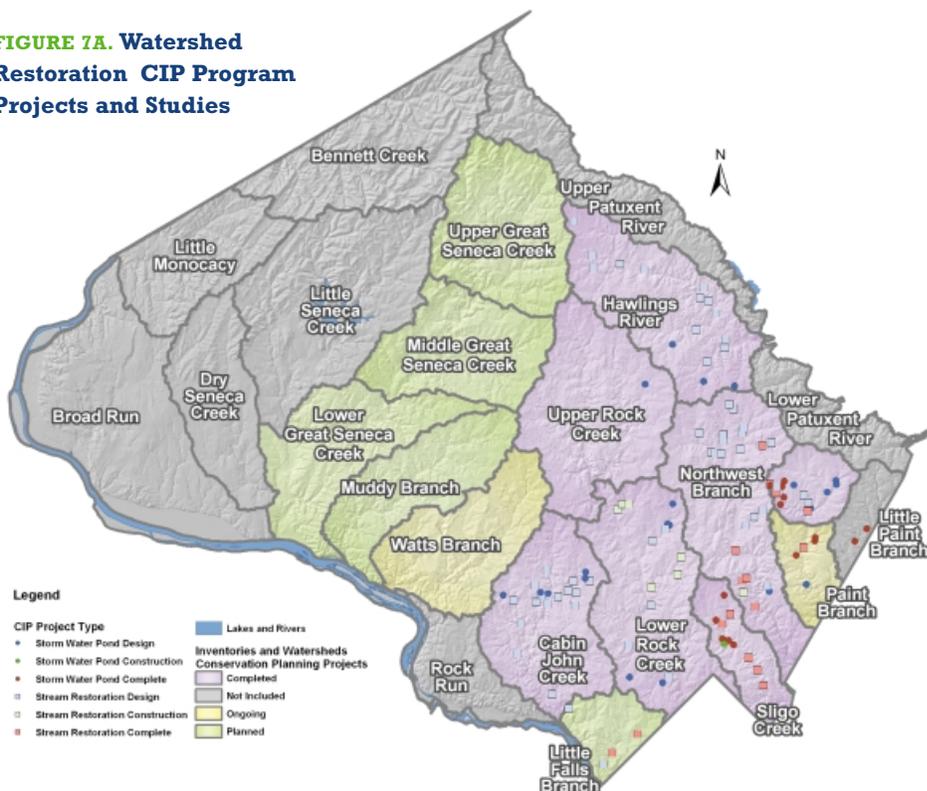
This section includes pictures which show examples of projects constructed thus far. Most of these projects have been carried out with cooperation and support from M-NCPPC, and some have been in partnership with the U.S. Army Corps of Engineers and the Metropolitan Washington Council of Governments. Many projects have also received cost-share grant assistance from the state of Maryland.

To date, DEP has built, or has under final design 32 projects that add or improve stormwater management covering 4,345 acres of developed watershed drainage. Another 54 stream restoration projects have been built or are under final design to restore habitat and reduce channel erosion in 26 miles of stream.

Watersheds where projects have been constructed or are presently under design or construction include Sligo Creek, Northwest Branch, Paint Branch and the Little Paint Branch of the regional Anacostia watershed, Rock Creek, Cabin John Creek, Watts Branch, Little Falls Branch, and the Hawlings River (Figure 7A). Some of the restoration projects also include the implementation of new wetlands at the end of storm drain outfalls, to mitigate water quality impacts and recreate lost habitat for frogs and salamanders.

DEP's work in Sligo Creek represents the most extensive watershed restoration effort undertaken thus far in the county. Since 1990, over one dozen projects were built to add new stormwater runoff controls to 1,359 acres of upper watershed drainage and restore habitat features in five miles of stream. The Sligo Creek watershed posed special challenges, as many of the important headwater tributaries have been piped

FIGURE 7A. Watershed Restoration CIP Program Projects and Studies



and/or eliminated. When restoration began, only two fish species remained in Montgomery County's portion of Sligo Creek. Restoration progressed through at least four separate phases addressing runoff control, stream bank stabilization, and stream and wetlands habitat improvements. A team of biologists worked to reintroduce native species that once lived in the watershed. Today, 11 species (including seven species surviving from the original reintroductions) are known to be present in Sligo Creek. The diversity of the supported aquatic insect communities also improved. The next steps are to continue reintroducing formerly native species, including any lost during the 1999 and 2001 drought when parts of Sligo Creek dried up and became temporarily isolated pools. The species reintroduction plan will include more sensitive

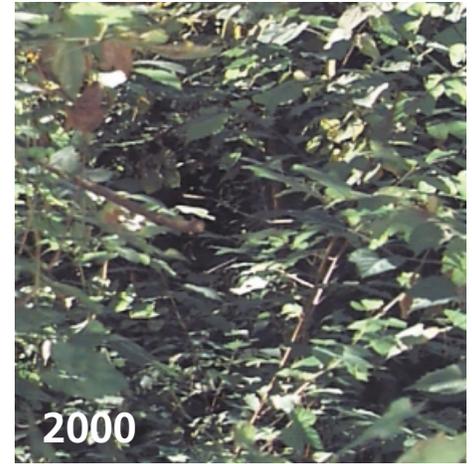
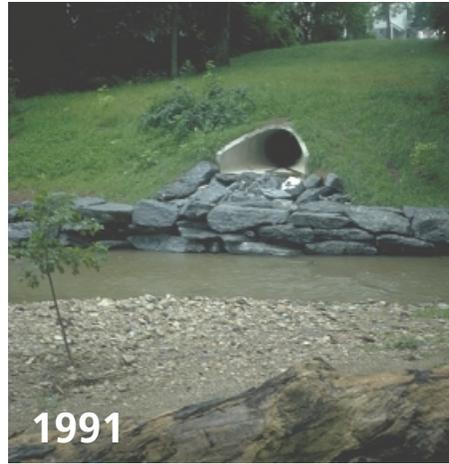
species, with the goal of raising the stream condition of the upper portions of Sligo Creek from "poor" to "fair" by the next CSPS update.

The majority of other watershed restoration projects constructed thus far have been located in the fragile headwater areas of the Upper Paint Branch watershed, where protection of the naturally propagating brown trout population is of primary concern. A number of new stormwater controls and in-stream restoration measures have been built to improve stormwater controls, restore stream habitat, add wetlands features, and address stream temperature concerns. Many more projects are planned. Stream temperature reductions achieved as a result of one project seem to be extending the quality and range of the brown trout habitat in the Upper Gum Springs Tributary. Monitoring is continuing to



Northwest Branch Restoration below Randolph Road, 2002. Before (left), overly widened shallow channel. After (right), habitat restored.

VII. Restoration Programs, continued



Progress in Wheaton Branch Stream Restoration. 1990 (left) devastation, 1991 (center) restoration, 2000 (right) nature's healing (showing vegetative growth seen at site of 1991 improvements).

assess the effectiveness of other individual projects as they are completed, and it will take a number of years to complete this work.

DEP and its watershed partner agencies conduct ongoing outreach programs to help educate and involve the public in the personal stewardship responsibilities critical to the success of long-term watershed protection. Interagency coordination has also improved to better integrate stream protection considerations into road design and to reduce unnecessary mowing of stream buffer areas. To help evaluate the success of stream restoration projects, interagency efforts are also underway to monitor changes in the stream channel *geomorphology* ⁽⁶⁾, habitat, and supported biological communities to evaluate the success of stream restoration efforts. Some of these research efforts involve close associations with the University of Maryland College Park, University of Maryland Baltimore County, the Patuxent Wildlife Research Center, and the U. S. Environmental Protection Agency's Mid-Atlantic Integrated Assessment.

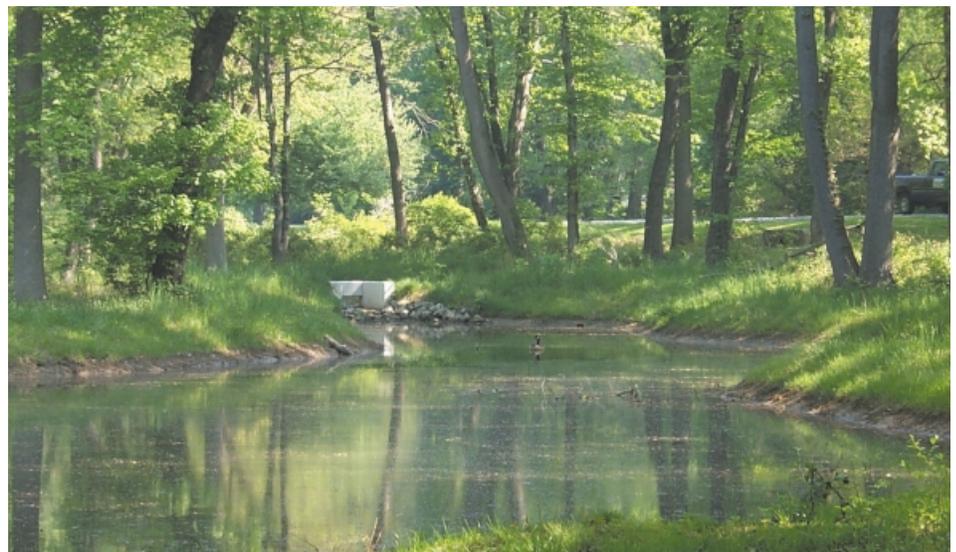
Collectively, interagency activities and projects undertaken in support of the *Countywide Stream Protection Strategy* are significantly improving habitat support for aquatic life and substantially reducing the extent of stream channel erosion that has been stimulated by uncontrolled, or inadequately controlled, stormwater runoff. The increased biological diversity that can be supported through restored stream habitat can also help supplement upland stormwater controls to uptake *nutrient loadings* ⁽⁶⁾. These loadings would otherwise be delivered downstream and further stress conditions in the Potomac and Patuxent Rivers and, ultimately, the Chesapeake Bay.

Many complementary volunteer initiatives have evolved over the years which materially con-

tribute to County agency efforts to protect and restore its watersheds. For example, the Friends of Sligo Creek and the Eyes of Paint Branch have formed as concerned, activist watershed organizations dedicated to raising community interests and involvement in protecting their neighborhood streams. These and other groups, such as the Friends of Cabin John Creek, Temple Shalom in Rock Creek, the Sidwell Friends High School in Muddy Branch, and many other schools have developed valuable website and newsletter information to raise awareness and interest about the natural features of their watersheds, related pollution management issues, and identify opportunities for direct citizen involvement in stream stewardship.

Volunteer watershed organizations help organize and implement stream-side tree plantings to add habitat and shading to streams, remove

invasive plant species which overtake desirable tree and plant species in stream buffers, and stream cleanups to remove unsightly, polluting trash accumulations. Other organizations such as the Audubon Naturalist Society, Chesapeake Bay Trust, the Izaak Walton League of America, and Maryland State Save Our Streams support volunteer stream monitoring and related activities which contribute to watershed protection. DEP is also pursuing exciting new joint public/volunteer opportunities to encourage homeowners to construct small rain gardens, use rain barrels, and disconnect downspouts to storm drains. Property owners undertaking these small projects help increase on-site rainfall *infiltration* ⁽⁶⁾ and groundwater replenishment, conserve water for non-potable uses, and reduce off-site impacts of stormwater runoff. ⁽⁶⁾ [see more watershed protection projects at \[restoration.askdep.com\]\(http://restoration.askdep.com\)](#)



Sligo Creek — New Godwin Drive Constructed Wetland

VIII. Future CSPS Issues, Goals, and Action Items

As available funds and staffing resources allow, future efforts to implement the *Countywide Stream Protection Strategy* will focus upon the following Issues, Goals, and Action Items:

Watershed Restoration:

Issue:

The County will continue its efforts to complete watershed assessments, and to design and construct capital projects aimed at improving runoff controls and restoring habitat conditions in seriously degraded streams. The focus of these projects will continue to be primarily in CSPA priority subwatersheds, where stream erosion and sedimentation are severe and a cause of degraded stream habitat and impaired resident biological communities. For long-term, watershed restoration success, these capital project initiatives must be supported by complementary interagency and volunteer efforts to improve protection of stream buffer areas and address other manageable sources of pollution.

Goal:

Restore county streams damaged by inadequate water management practices of the past, by reestablishing the flow regime, chemistry, physical conditions, and biological diversity of natural stream systems as closely as possible

Action Items:

1. Improve the stream condition of the upper portions of Sligo Creek from "poor" to "fair" by the next CSPA update by reintroducing and successfully sustaining habitat support to more sensitive species of native fish.
2. Restore habitat conditions and abate excessive erosion in 15 miles of county streams by 2008. Monitor restoration projects to track, evaluate, and report upon success of restoration activities. Involve neighborhood citizen and watershed groups to undertake complementary tree plantings, stream cleanups, and outreach efforts that involve the surrounding communities in personal and collective stream stewardship activities critical to the long term success of watershed restoration efforts.
3. Implement stormwater retrofit and stream restoration projects to help manage or remediate impacts of uncontrolled impervious areas. By 2006, implement projects that directly control or address impacts of ten percent of impervious area drainage that has not been previously controlled to the maximum extent practicable.
4. By 2003, complete feasibility planning studies for watershed restoration on the Cabin John watershed; by 2004, on the Watts Branch watershed and the Lower Paint Branch watershed. By 2005, commence a new feasibility planning assessment on the Great Seneca Creek watershed and the Muddy Branch watershed.
5. As resources permit, work closely with Office of Economic Development (OED), the Montgomery Soil Conservation District, and pertinent local, state, federal, and agricultural agencies, to increase stream buffers in the County's Agricultural Reserve through the Conservation Reserve Enhancement Program (CREP). Seek to target the reservation of easements to establish stream buffers in those areas with needs and opportunities to improve stream habitat, temperature, and biological resource conditions.
6. Work closely with citizen groups and M-NCPPC to educate communities about the harm that encroachments cause in publicly-owned stream valley parkland and stream-side conservation easements. Unauthorized mowing, tree removal, and dumping of yard waste all impact the natural integrity and function of these areas. Collaborative efforts against encroachers should be targeted in CSPA priority subwatersheds, in Special Protection Areas, and areas where DEP is engaged in stream restoration efforts.
7. Work closely with WSSC, the Town of Poolesville, and MDE to ensure that effective inspection, maintenance, and management pro-

grams are in place to notify the public and protect county streams from wastewater overflows, leaks, or discharges from existing transmission or wastewater treatment infrastructure. Work with these agencies to assure timely establishment and maintenance of the necessary programs to fully comply with new EPA regulations addressing sanitary sewer overflows.

New Development Controls:

Issue:

Current zoning specifications, regulations, and code requirements often unintentionally and unnecessarily impede implementation of land development more sensitive to water quality and water conservation needs. An updated review of these requirements is needed to find development designs that reduce impervious area and peak runoff impacts, promote stormwater reuse, and enhance replenishment of groundwater for sustaining well yields and stream base flows.

Goal:

Explore opportunities to lessen unintended, adverse environmental impacts of land development on water resources.

Action Items:

1. Work with the M-NCPPC, DPS, and the DPWT to conduct a joint interagency assessment of current zoning, subdivision, building, and road code standards that impede efforts to mitigate the environmental effects of land development. Assemble a Task Force to initiate this effort by early 2004 and develop related recommendations by 2005.
2. Develop, by June 2005, proposed changes to Chapter 19 of the County Code and associated regulations to implement a grading ordinance provision to improve management of lot-to-lot drainage and avoid related nuisance flooding and erosion problems.

VIII. Future CSPA Issues, Goals, and Action Items, continued

Nutrient Management Legislation:

Issue:

The banning of phosphate-based detergents was a highly successful strategy that helped to substantially reduce phosphorus inputs to the Chesapeake Bay and its tributaries. Improving the management of nitrogen continues to be a primary, but somewhat more elusive, nutrient management goal for these watersheds. Much remains to be done to control the effect of wastewater nutrient discharges combined with the effects of nitrogen laden runoff from agricultural land uses, urban and suburban lawns, and air pollutant deposition. The limited success seen thus far reflects the high costs and diminishing returns expected from more stringent wastewater effluent discharges, and the difficulties of effectively controlling diffuse runoff and air deposition sources of nitrogen. Additional steps are needed to proactively address problems of excessive nitrogen inputs, many of which are manageable only through concerted statewide and national initiatives.

Goal:

Reduce nonpoint runoff sources and air deposition sources of nitrogen impacting local streams and the Chesapeake Bay.

Action Items:

1. Consider seeking passage of State legislation to establish a user fee/charge for nitrogen-based suburban lawn and garden fertilizers, to serve as a disincentive for excessive use. Use collected funds to support a grant program for local governments to implement environmental outreach, and fund projects to control nutrient inputs to local waterways.
2. Seek National Association of Counties (NACo) support for national legislation to mandate improved controls on point source air quality discharges from utilities, and to mandate greater use of hybrid vehicles and improved engine air emissions.

Other Pollution Source Controls:

Issue:

New initiatives are needed to reduce impacts on county streams from sediments, abrasives, metals, and nutrients generated from highly trafficked urban and suburban areas. Some of these initiatives also have important cross-media environmental benefits in groundwater replenishment, temperature mitigation, and capture of air pollutants.

Goal:

Target and reduce general runoff pollution loadings from runoff draining intensively developed urban/suburban areas while also providing, in some cases, other important cross-media environmental benefits.

Action Items:

1. Propose a budget initiative to increase the range and frequency of coverage of street sweeping/vacuuming to help reduce concentrated sources of runoff pollution impacting county streams. Target highly trafficked areas with high pollutant generation and solids removal potential, and areas upstream of watershed restoration implementation projects.
2. Propose a budget initiative to implement a pilot project that installs runoff filtration devices at storm drain inlets to remove pollution from high traffic streets. Initially target areas in the Bethesda, Silver Spring, and Wheaton Central Business Districts to test and evaluate the effectiveness of alternative technologies available for this purpose.
3. By 2004, secure grant funds and implement new Low Impact Develop (LID) projects at four County facilities with high public visitation (library, health care center, recreational facility, fire station). Use these pilot installations to demonstrate the capabilities of rain gardens and other bioretention technologies to reduce runoff impacts and infiltrate rainwater to help replenish groundwater.

4. Beginning in 2003, target street tree plantings to priority subwatersheds where the addition of tree canopy may help slow down peak runoff flows, and may mitigate temperature effects of runoff traversing urban surfaces before entering natural stream environments.
5. Seek funding for an outreach effort to encourage more volunteer tree plantings to increase tree canopy in residential yards to help reduce peak stormwater runoff, capture air pollutants, and add shading to help buffer urban/suburban "heat islands." These trees create windbreaks, effect air temperatures, and reduce related energy needs and costs for heating and cooling.

Public Outreach to Increase Volunteer Stewardship in Pollution Reduction and Management:

Issue:

Efforts to educate and stimulate greater involvement of the general public and business community in volunteer stewardship initiatives continue to gain importance in efforts to have environmentally sustainable neighborhoods. DEP has engaged in extensive outreach through its past support of volunteer monitoring, streamside tree planting, and cleanup activities. DEP also disseminates varied information on environmental stewardship roles, and opportunities for citizens and businesses through its comprehensive website, fact sheets, brochures, and cable television programs. New initiatives are needed to more fully harness the power and effectiveness of volunteer citizens, environmental groups, and the business community in helping to address the County's water quality protection goals.

Goal:

Promote and support new outreach initiatives that enhance public awareness and increase citizen participation in environmental stewardship.

Action Items:

1. Target public outreach and enforcement to reduce trash generation and impacts on streams from fast food and other pertinent businesses. Educate streamside residents about the impacts of yard wastes into streams and target priority CSPS subwatersheds to eliminate illegal dumping activities.
2. Seek state legislation to include porcelainberry and kudzu with other invasive species classified as noxious weeds in current state regulations. Beginning in FY05, seek additional resources to increase outreach measures to encourage homeowner plantings of native, rather than exotic and potentially invasive, plant species. Engage volunteers to help remove invasive plants that are damaging their neighborhood streams. Focus this effort on non-park areas not already covered by the M-NCPPC's highly effective "Weed Warriors" program.
3. Continue and expand efforts to secure and implement grants that are applied to educate and support homeowners to voluntarily redirect runoff from impervious surfaces on their properties and to implement rain barrels, rain gardens, and other individual Low Impact Development technologies to encourage on-site reduction of runoff, encourage water conservation, and enhance groundwater replenishment.
4. Beginning in 2004, seek DEP involvement with the existing deer management workgroup to participate in the resolution of deer management issues affecting forest regeneration. Seek ways to increase public understanding about the need to manage excessive deer populations which are severely impairing natural regeneration of county forests and stream side buffer areas.
5. Beginning in 2004, develop and conduct surveys on citizen's attitudes about lawns and landscaping and work closely with local and state agencies to measure and track effectiveness in achieving behavioral changes of residents and businesses in reducing fertilizers, pesticides, and improving their watershed awareness.

Montgomery County Environmental Assessment:

Issue:

The County produced *Environmental Assessment 2000* based upon results in the original CSPS and a wide variety of other water resource, forest, air quality, land use, and energy indicators. Further comprehensive baseline data collection work is needed to track the diversity and abundance of a variety of resident biological communities as measures of the quality and integrity of the county's natural landscapes. The next countywide environmental assessment will attempt to comprehensively describe the health of the total environment (streams, groundwater, wetlands, and terrestrial landscape) using, as in the CSPS, comparisons to defined *reference conditions* ⁹ to quantify observed data results into rating of "excellent, good, fair and poor" for watershed areas inclusive of the streams, wetlands, forests, and fields within them.

Goal:

To develop and implement a comprehensive approach for assessing environmental quality that integrates information on terrestrial, wetland, and stream conditions.

Action Items:

1. Continue cooperative annual surveys with the Patuxent Wildlife Research Center to monitor and map, as another indicator of biodiversity and terrestrial habitat quality, nesting bird populations found in various county field, forest, and urban tree canopy habitats. Develop a Nesting Bird *Index of Biological Integrity* ⁹ by 2005 for use in future County environmental assessments.
2. Augment existing County wetland inventories by surveying and mapping the distribution of vernal pools. Work cooperatively with the M-NCPPC to develop and maintain a vernal pool registration/certification program.
3. Continue cooperative annual surveys with the Patuxent Wildlife Research Center to monitor and map the status of amphibian populations most vulnerable to wetland habitat quality or dependent on vernal pools for survival. Develop an Amphibian *Index of Biological Integrity* ⁹ by 2005 for use in future County environmental assessments.

Watershed Monitoring and Reporting:

Issue:

Continued collaboration is needed with interagency partners, the scientific community, and volunteers to improve understanding of causes of biological impairment, evaluate effectiveness of control measures, and better integrate available agency and volunteer monitoring activities and data.

Goal:

To continue producing an enhanced, accurate, understandable, watershed-based assessment of county stream conditions.

Action Items:

1. Reconvene the Montgomery County Biological Monitoring Workgroup to help develop a *geomorphologic* ⁹ approach to assess and prioritize stream stability; identify better methods to assess sources of biological impairment not found to be habitat related; finalize the County *Indexes of Biological Integrity* ⁹, and improve integration of state and volunteer monitoring activities and data.
2. Continue coordination and collaboration efforts with the Maryland Water Monitoring Council, pertinent Chesapeake Bay Program and Maryland Tributary Strategy committees, and jurisdictions regulated by NPDES municipal stormwater discharge permits. Use these venues to address issues and opportunities of common interest regarding the sharing, interpretation, and equitable tracking of progress on local and regional water quality program commitments.
3. Continue DEP analysis of the effectiveness of stormwater *best management practices (BMPs)* ⁹ in lessening the impacts of watershed imperviousness on stream habitats. Evaluate and attempt to integrate the influences of urban lawns, piped drainage systems, tree cover, and stream buffers to expand understanding of development impacts and improve the effectiveness of management measures that protect streams.

Glossary of Terms

Agricultural storm water best management practices — are policies, practices, procedures or structures implemented to mitigate the adverse environmental effects of stormwater runoff from agricultural areas on surface water quality and groundwater. Agricultural BMPs include strip cropping, terracing, contour stripping, grass waterways, animal waste structures, ponds, minimal tillage, grass and naturally vegetated filter strips, and proper nutrient application measures and rates.

Bank stability — the overall condition of stream banks. Evaluation of stability involves the determination of whether the stream banks are excessively eroded or have that potential. Signs of excessive stream bank erosion include crumbling, undercut, unvegetated banks, exposed tree roots, any extensive areas of exposed soil.

Bank vegetative protection — measures the amount of the stream bank covered by vegetation. The root systems of plants growing on stream banks help hold soil in place, thereby reducing the amount of erosion that is likely to occur.

Best management practices (BMPs) — a practice or combination of practices determined to be the most effective means of preventing or reducing the amount of pollution generated by non-point sources to a level compatible with water quality goals.¹

Biotic integrity — the ability to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that found in relatively undisturbed natural habitats of the region. Biotic integrity is found in aquatic ecosystems in which composition, structure, and function have not been adversely impaired by human activities.

Building restriction lines — lines that restrict where building can occur on a property.

Channel alteration — large man-made scale changes in the shape of a stream channel including straightening, increasing depth, or diverting into concrete channels, often for flood control or irrigation purposes.

Channel flow status — the degree to which a channel is filled with water. Flow status will change as the channel enlarges or as flow decreases as a result of dams and other obstructions, diversions for irrigation, or drought.

Chemical stressors — a chemical entity that can induce an adverse response resulting in biological or ecological impairment.

Deer browse — under normal circumstances white-tailed deer feed mainly on the tender, new growth of trees and shrubs (woody plants), but they are known to sample, or “browse”, on other food types including grasses, fruits, nuts, and mushrooms. When the population of deer in a certain area increases, the main staples of their diet may become short in supply. During this time deer will begin to browse on all edible branches from trees and shrubs, and plants that they would not normally feed on. Excessive deer browse can impede the natural regeneration of desired tree and shrub species that sustain forested stream buffers and upland forests.

Embeddedness — refers to the extent to which stream substrate (gravel, cobble, boulders and snags) is filled and/or covered with silt, sand or mud.²

Epifaunal substrate — the amount of niche space or hard substrates (rocks, snags) available to insects and snails. Numerous types of insect larvae attach themselves to rocks, logs, branches, or other submerged substrates. As with fish, the greater variety and number of available niches or attachment sites, the greater variety of insects in the stream.

Eutrophication — the process by which streams and other water bodies become enriched with dissolved nutrients, resulting in increased growth of algae and other microscopic plants.¹

Fecal Coliform (bacteria) — a group of organisms common to the intestinal tracts of humans and animals. The presence of fecal Coliform bacteria in water is a broad, but often imprecise indicator of pollution and potentially dangerous bacterial contamination.²

Geomorphology — the science that treats the form, structure, and patterns of stream channels and land forms as affected by flowing water.

Hydrology — the science of the origins and processes of water, its properties, phenomena, and distribution as affected by nature and as modified by people.

Index of Biological (Biotic) Integrity (IBI) — a stream assessment tool that evaluates biological integrity based on characteristics of the fish and benthic assemblage at a site.²

Infiltration — the portion of rainfall or surface runoff that moves downward in the subsurface rock and soil.²

Inflow — the flow of water into a pond

Instream cover — includes the relative quantity and variety of natural structures in the stream such as fallen trees, logs, and branches, large rocks, and undercut banks, that are available for feeding, laying eggs, or refugia. A wide variety of submerged structures and rocks in the stream provide fish and aquatic insects with a large number of niches, thus increasing the supported biological diversity.

LIDAR (Light Detection and Ranging) — similar to RADAR; used for measuring heights of features, such as forest canopy height relative to the ground surface, and water depth relative to the water surface.

Non-point sources — contaminants such as sediment, nitrogen and phosphorus, hydrocarbons, heavy metals, and toxins whose sources cannot be pinpointed but rather are washed from the land surface in a diffuse manner by stormwater runoff.²

Nutrient concentration — the amount of nitrogen or phosphorus in a defined volume of water (such as milligrams of nitrogen per liter of water).

Nutrient loadings — the total amount of nitrogen or phosphorus entering the water during a given time, such as “tons of nitrogen per year.” Nutrients may enter the water from runoff, groundwater, or the air in the form of rain or snow or dry deposition.

Reference condition — conditions (i.e. habitat, chemical, biological) that reflect least impaired or best attainable conditions in a given area.²

Riffle frequency — how often a reach of stream is characterized by shallow, fast moving water broken by the presence of rocks and boulders.²

Riparian vegetative zone (riparian buffer) — a transitional area around a stream, lake, or wetland left in a natural vegetated state to protect the waterbody from runoff pollution. Development is often restricted within such zones.²

Sediment deposition — sediment that has accumulated in pools. Large-scale movement of sediment may cause the formation of islands, point bars or shoals, or result in the filling of runs and pools.

Sediment concentration — the amount of sediment in a defined volume of water (such as milligrams of sediment per liter of water).

Sediment loading — the solid material transported by a stream, expressed as the dry weight of all sediment that passes a given point within a specific period of time.

Sediment loads — the total amount of sediment entering the water during a given time, such as “tons of sediment per year.”

Stormdrain outfalls — the point at which a system of channels and pipes designed to carry collected rainwater discharges directly into a stream.¹

Urban storm water best management practices — are policies, practices, procedures or structures implemented to mitigate the adverse environmental effects of uncontrolled stormwater runoff in urban or suburban areas on surface water quality and groundwater resulting from land-use. Emphasis is on controlling the quality and quantity of the runoff.

¹ From the Mountains to the Sea: The State of Maryland's Freshwater Streams. (1999). By D.M. Boward, P.F. Kazyak, S.A. Stranko, M.K. Hurd & T.P. Prochaska. EPA & Maryland DNR.

² Fairfax County Stream Protection Strategy Baseline Study

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DEP Mission Statement:

To protect and enhance the quality of life in our community through conservation, preservation and restoration of our environment guided by principles of science, resource management, sustainability and stewardship.



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