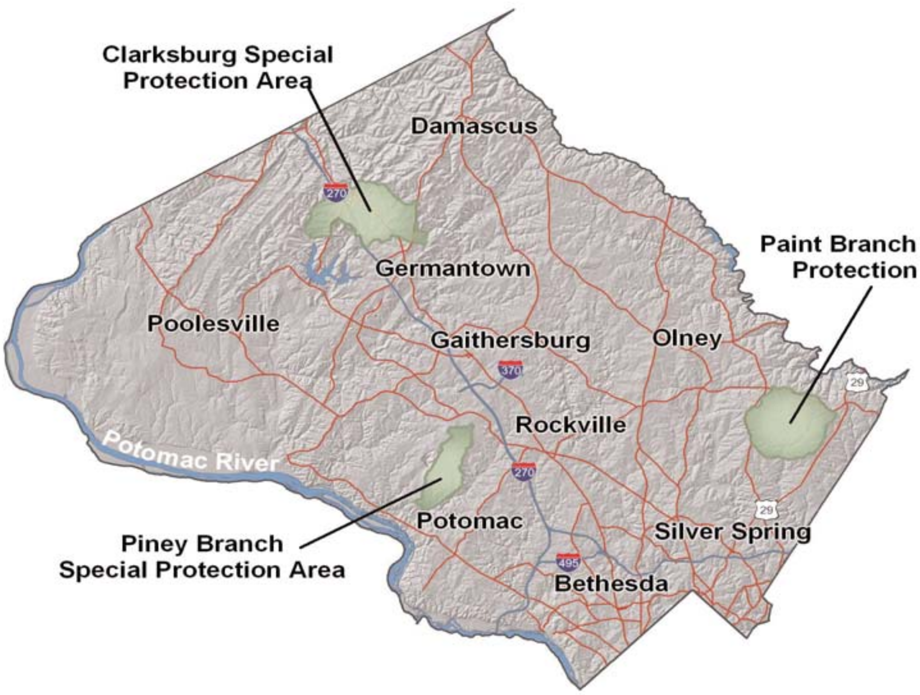
Special Protection Area Program Annual Report 2003



PREPARED BY THE MONTGOMERY COUNTY DEPARTMENT OF ENVIRONMENTAL PROTECTION IN COOPERATION WITH THE DEPARTMENT OF PERMITTING SERVICES AND THE MARYLAND-NATIONAL CAPITAL PARK & PLANNING COMMISSION

SPECIAL PROTECTION AREA PROGRAM
ANNUAL REPORT FOR 2003

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1.0 Executive Summary

Purpose of the Report: The Special Protection Area (SPA) Program was established by Montgomery County Code Chapter 19, Article V (Water Quality Review-Special Protection Areas, Section 19-67). This Section of the County Code was implemented by Executive Regulation 29-95, "Water Quality Review for Development in Designated Special Protection Areas". The regulations require an Annual Report be prepared. The report summarizes and analyzes available monitoring results of stream and best management practices (BMP) collected within SPA's. The report is to be submitted to the County Executive and County Council with a copy to the Planning Board. This is the ninth report on the program. The first report covered the period 1994 through 1995. This report covers stream monitoring results from 2003 and status of development updated through April, 2004.

Existing SPA's: The County Council has designated four areas within Montgomery County as Special Protection Areas (Figure 1). The designated areas are: the Clarksburg Master Plan SPA, the Upper Paint Branch Watershed SPA, the Piney Branch Watershed SPA and the Upper Rock Creek SPA. Upper Rock Creek was designated as an SPA on February 24, 2004 with the adoption of the Upper Rock Creek Master Plan. These areas have high quality stream systems where development is planned that could threaten the stream condition. These are areas in need of protection measures that go beyond current minimum standards for construction site sediment and erosion controls and stormwater management facilities. These protection measures are necessary to ensure that the stream systems are protected to the greatest extent possible from the impact of master planned development activities and supporting infrastructure.

Program Accomplishments: Monitoring results continue to produce a broad range of trend data that will help assess how effective careful water quality review, performance goal setting, improved site planning and intensive best management practices (BMP) are in mitigating development impacts in SPA’s. Although the current program seems to be working well overall, data from the Piney Branch and Clarksburg SPA monitoring sites have shown some temperature and sedimentation impacts accompanying new development. While the sediment pulses during construction may be transitory and short term, the temperature impacts related to runoff from heated road surfaces, rooftops, etc., may not be. Effectiveness in mitigating impacts cannot be fully judged until more development projects have been completed and their long-term effects on streams evaluated. Currently, the program is continuing to generate a comprehensive set of information on baseline conditions in the SPAs. Good information is also being generated on the effects of construction and the efficacy of BMPs produced under SPA guidelines. In the meantime, practices and procedures continue to be refined and improved in order to enhance the overall effectiveness of the program.

SPA Development Review Process: The SPA program requires the Montgomery County Department of Permitting Services (DPS), the Department of Environmental Protection (DEP) and the Maryland-National Capital Park and Planning Commission (M-NCPPC) to work closely with project developers from the outset of the regulatory review process to minimize impacts to SPA stream conditions. SPA permitting requirements guide the development of related concept plans for site imperviousness, site layout, environmental buffers, forest conservation, sediment control and stormwater management. Applicant monitoring requirements for best management practices (BMPs) are also defined through this process. A pre-application meeting presents the project developer with the critical natural resource parameters that need to be maintained in order to protect existing high quality stream conditions. Protection of these natural resource parameters is guided by performance goals developed for each development project. Successful incorporation of the performance goals into the site design process requires innovation and close coordination between the project's design team and environmental, regulatory and planning agencies.

Status of the Stream Monitoring Program: DEP has been monitoring stream conditions in three of the four existing SPA's since 1995. During 2003, stream monitoring was completed at fifty (50) stations, twenty seven (27) in the Clarksburg SPA, thirteen (13) in the Upper Paint Branch SPA, and ten (10) in the Piney Branch SPA. The purpose of stream monitoring is to track stream health over time as development proceeds. Changes in the structure and function of biological communities (fish and benthic macroinvertebrates) are assessed and compared to alterations of physical habitat, water quality and changing land-use in the watersheds. Biological communities living in streams are a reflection of the cumulative impacts (pollutants, sedimentation, temperature, habitat alterations, etc.) on the streams water quality. Specific causes of impairment are pointed out in this report only where possible. DEP commenced monitoring in the Upper Rock Creek SPA in the spring of 2004. Given the limited resources available, the addition of new monitoring requirements for this SPA will require some reduction in sampling activity in the other SPA's.

Paint Branch Biological Community: In general, monitoring results from 2003 indicate that the biological health of Paint Branch is similar to previous years. However, there are signs of some biological impairment from both natural and man-made causes. The brown trout population continued, in 2003, to reflect the extremely stressful stream conditions that existed during the drought of 2002. Based on continued monitoring by MD DNR Fisheries and DEP**,** numbers of brown trout are at the lowest point since monitoring began in 1994. It is expected with improved weather and stream flow conditions along with completed restoration projects that the numbers of brown trout will rebound in the next few years. Monitoring data from 2003 also show some impairment to the benthic macroinvertebrate community in the Right Fork. It is suspected the impairment, which began in 1999 and persists to the present, is related to ongoing construction activity within this sub-watershed. Construction activity either has occurred or is still ongoing on thirty six percent of the land within the Right Fork drainage area. Further monitoring will establish whether impacts persist after the projects have been completed.

Piney Branch Biological Community: The benthic macroinvertebrate community in Piney Branch exhibits a high degree of variability from year to year. Monitoring results from 2003 show a sharp drop in community health, which was most profound in the headwater area of Piney Branch. The fish community has remained relatively stable over the same period of 1995 – 2003. DEP suspects that variability observed in the benthic macroinvertebrate community is related to water quality and a combination of other problems observed in Piney Branch including: 1) extremely low stream flow during 1999 and 2002, 2) low dissolved oxygen levels, 3) heavy algal growth and 4) sediment from construction projects washing into the stream. Increased nutrient concentrations associated with sediment can stimulate excessive algal growth on the stream bottom. When overabundant, algae and associated microbes can drain oxygen from the water and affect macroinvertebrate and fish communities. Low dissolved oxygen levels have been observed in Piney Branch along with thick coatings of algae. DEP has sampled the stream and elevated nutrient levels have not been observed. The cause of the algae growth has not been identified. Another potential problem impacting the benthic macroinvertebrates in the stream is the private application of mosquito larvicide for mosquito control at the Willows of Potomac residential community in ponds that drain to Piney Branch and in the stream itself. Pending future monitoring results, a cooperative study with the Maryland Department of Agriculture may be warranted.

Clarksburg SPA Biological Community: Results of biological monitoring in 2003 indicate some impairment at most locations throughout the Clarksburg SPA. Because land development activity is confined to isolated locations in the Little Seneca watershed, this impairment is believed to be related mostly to residual effects from the drought of 2002. However, the stream receiving runoff from construction activity on the new Clarksburg Town Center shows biological impairment beyond that observed anywhere else in the Clarksburg SPA. DEP attributes the additional impairment to a water main break on the Town Center construction site in April 2003 and to the ongoing fine sediment deposition. DEP has been working closely with DPS to improve sediment control on all development projects in the Clarksburg SPA. Actions taken thus far to improve sediment control in the Clarksburg SPA include the requirement that, in some cases, developers hire a third party sediment inspector to oversee activities related to sediment control and to make sure all sediment control practices are in place and functioning at all times.

Status of BMP Monitoring Plans:

Best management practices (BMPs) are steps taken to minimize the impact a project has on the environment. BMPs can include structures such as sediment ponds, design elements such as minimized imperviousness and even management practices such as limiting fertilizer applications. SPA development projects are required to monitor their BMPs to evaluate effectiveness. Developers usually contract with consulting firms to do this work. BMP monitoring is intended to complement the county's separate stream monitoring program. Currently a total of one hundred nine (109) development projects are under review, have been approved under SPA regulations or are under construction in the SPAs. A summary of all 109 projects is presented in Table 1. Sixty-five (65) of these projects are not required to monitor BMPs, because they are small projects or pre-date SPA regulations. As allowable under the regulations, some projects in Clarksburg and Piney Branch are also exempted from SPA requirements because of low imperviousness (< 8 %) proposed for the site.

Table 1. SPA Development Projects

	Projects in pre-application or plan review phase		Projects with approved BMP monitoring plans		Projects with approved plans not required to monitor BMP's	
	# of projects	Acreage	# of projects	Acreage	# of projects	Acreage
Clarksburg	3	593.2	18	2086	10	237.9
Paint Br.	2	21	9	271	33	252.5
Piney Br.	2	11.5	10	343	22	653.4
TOTAL	**7**	**625.7**	**37**	**2700**	**65**	**1143.8**

Of the thirty-seven (37) projects required to do BMP monitoring, thirty-three (33) have begun collecting monitoring data. The other four (4) projects are either not going to begin construction in the near future or they are not required to do pre-construction monitoring because of the type of data being collected. Table 2 provides a summary of where all thirty-seven (37) projects are, and their stage of BMP monitoring.

Table 2. Status of Monitoring for Projects with Approved BMP Monitoring Plans

Project Status	Clarksburg	Paint Branch	Piney Branch	Total
BMP Monitoring Required But Not Yet Begun	2	0	2	**4**
Pre-Construction Monitoring Underway	3	0	0	**3**
Construction Monitoring Underway	10	4	3	**17**
Post Construction Monitoring Underway	3	5	5	**13**
TOTAL	**18**	**9**	**10**	**37**

Now that fifteen (15) projects have completed construction, SPA BMP monitoring has enough data to enable scientific evaluation. The drought of 2002 has complicated interpretation of results by impacting stream conditions overall and lowering groundwater levels. In two areas SPA development has increased the stress on streams and diminished water quality as measured by benthic IBI scores. This impact is most noticeable in the Clarksburg Town Center tributary where very intensive development is taking place.

Monitored groundwater levels appear to have generally been impacted more by climatic variability than development. Stream temperatures also appear to have been more impacted by weather trends than development impacts.

In two small streams in Clarksburg SPA, we have identified short duration spikes in stream temperatures associated with storm runoff from SPA development. These spikes last for only a few hours at a time and seem to be associated with discharges from construction site sediment control ponds. Stream cross sections have generally been stable indicating little stream bank erosion resulting from SPA development.

The increased size of SPA sediment control structures now being required appears to have significant benefits as these structures work very effectively for most storms. The SPA program does not monitor non SPA sites, but DPS suspects that SPA sediment control structures are performing better than structures on non SPA sites. However, sediment control efforts are less effective during larger, more intense, storms which can overwhelm sediment traps and eliminate their effectiveness. BMP monitoring has also found the ability of traps to control sediment during larger storms diminishes with the age of the structure. Use of larger ponds and increased maintenance could improve pond effectiveness. Some failures have also been seen where accidents or lack of adherence to project requirements have caused the release of large amounts of sediment. Fortunately, aggressive DPS enforcement actions have limited damage to streams and minimized additional sediment discharges. Future monitoring will provide more information on long term effects and post-construction impacts.

Regarding performance of stormwater management BMPs, it is too early to reach conclusions. Post-construction BMP monitoring has occurred for only a brief period. Post-construction monitoring at several projects has been done long enough to make preliminary conclusions on how well sites met performance goals. A review of analytical results thus far for some specific projects is presented in this report.

Supplemental Habitat Restoration and Stormwater Retrofit Measures: DEP is pursuing separate capital project initiatives in the Upper Paint Branch and the Piney Branch SPA's to improve the management of runoff from previously developed areas and mitigate habitat damage that had occurred before the SPA program was established. These projects are intended to supplement improvements in watershed management achieved through the SPA permit process. In the Upper Paint Branch watershed, DEP, the M-NCPPC and other agencies have worked closely to inventory some 75 potential stream habitat restoration, wetlands creation, and stormwater retrofit project opportunities. Some of these are capital projects. Others involve small habitat restoration and wetlands and tree plantings that can be partially implemented by volunteers. DEP has actively involved the public in reviewing these projects. Presently, 9 projects have been completed and 6 more are under design. One project that had previously been in the design phase has been put on hold because of difficulties with land acquisition. In the Piney Branch SPA, DEP has inventoried a limited number of proactive capital project opportunities for small wetlands creation, habitat restoration and stormwater retrofit projects located on the site of the Life Sciences Center in the uppermost portion of the watershed. DEP is also pursuing a Watts Branch watershed study that may include improvements in Piney Branch.

Next Steps:

SPA regulations specify that a BMP monitoring program is to be implemented as part of a preliminary and final water quality plan. The BMP monitoring program has two main objectives: 1) determine if performance goals for a specific development project have been achieved or not and ,2) determine if BMP designs being required are working adequately or in need of improvement. The BMP monitoring program is central to the SPA Program in that it provides essential information to determine the effectiveness of site design and BMP designs in meeting performance goals and in protecting existing high quality stream conditions. Some sites are not required to do BMP monitoring because of their small size.

DEP has attempted to address problems encountered with quality of monitoring data by providing careful review and comment on consultant reports submitted to DEP. Although problems with analysis and reporting of results still exist, some progress has been made in rectifying these. Additionally, the BMP monitoring work group has been re-convened to revise and in some cases write new BMP monitoring protocols. The new and improved protocols will provide better guidance and consistency on how BMP monitoring is to be done and on how results are to be reported. The work group will also consider concentrating BMP monitoring more in the Clarksburg SPA to improve data quality for analytical purposes. It would also improve data collection efficiency and reduce costs.

The Clarksburg Master Plan establishes four staging mechanisms for implementation of the master plan. Because of the high level of development planned, staging mechanisms were established, in part, to: 1) guide the timing and sequence of development, 2) coordinate completion of public infrastructure and 3) use stream and BMP monitoring results from areas in stages I – III to help guide decisions on development density in the stage IV area (much of the Clarksburg SPA west of I-270 draining to Ten Mile Creek). One of the defined triggering mechanisms for the analysis of stage IV occurs when 2,000 building permits have been issued for housing units in the Newcut Road and Town Center sub-areas of Clarksburg. As of July 2004, approximately 1,300 building permits have been issued. Given the current rapid rate of development in Clarksburg, the 2,000 trigger will likely be reached by early 2005. The master plan calls for a review of all BMP and stream data in the next SPA annual report following the issuance of 2,000 building permits. DEP is anticipating this and plans to include a comprehensive review of all data collected through the SPA program in next year's annual report.

Other Observations: Some other informal observations by DEP, DPS and M-NCPPC staffs indicate some preliminary benefits of the SPA program:

- Expanded stream buffers, as required in SPA's, do provide additional protection to the stream eco-system and exclusion of development from expanded buffers has generally been achieved. However, site design constraints, particularly in Clarksburg, have made it difficult to provide this additional protection in every case. In some instances, a greater degree of protection to the receiving stream could have possibly been achieved if sediment and erosion control devices could have been temporarily placed within a stream buffer rather than at more upland areas. Recently, M-NCPPC has allowed temporary sediment and erosion control within stream buffers provided the facility is removed and reforested. M-NCPPC cannot permit clearing of mature forest in stream buffers because it contradicts the Forest Conservation Law and in many cases makes the development noncompliant with the law. DPS is proactive in identifying SWM space requirements. However, in many cases, site design constraints prevent siting of adequate SWM controls outside of buffer areas DEP and DPS will continue to work closely with the MNCPPC to seek greater flexibility in the temporary or permanent use of some stream buffer areas to improve overall stream protection.

- The Traville project, located in the headwater area of Piney Branch, presents a challenge in the effort to achieve a successful combination of development and water quality/environmental protection. In addition to the standard SPA elements required to enhance environmental protection, the site design includes such things as taller buildings, internal garages, and structured parking to reduce the impervious cover and provide more open space.

- In several approved project proposals, M-NCPPC is requiring applicants to reforest (as required by M-NCPPC's Guidelines) earlier than what normally occurs in the development process resulting in a more rapid establishment of the buffer benefits cited earlier.

- Minimizing impervious surfaces has become an important design objective in development projects, especially in the Upper Paint Branch and Upper Rock Creek SPA's, where specific imperviousness caps are required as part of an overlay zone.

- Progress has been made in addressing unauthorized encroachments on stream buffers located on parkland or conservation easements that affect water quality in some portions of Paint Branch. Actions taken by M-NCPPC to halt encroachment into these areas continue to be effective. Stream buffers, which had been kept cleared by adjacent property owners, are now left to grow and provide shading and food to the stream eco-system.

- Stream temperature studies conducted in the Paint Branch SPA indicate that in areas where curb and gutter are used to convey stormwater runoff, the receiving stream experiences higher temperature spikes during short intense summer thunderstorms than do areas using open section roadways (SPA annual report 2002).

2.0 Synopsis of the Special Protection Area Program

The Montgomery County Council established the Special Protection Area (SPA) program in 1994. The program was intended to minimize impacts to designated high quality or unusually sensitive streams that would be threatened by proposed land uses without special protection measures coordinated with land use controls. Originally the County Council had designated three regions as Special Protection Areas: 1) Clarksburg Master Plan SPA, 2) Upper Paint Branch Watershed SPA and 3) the Piney Branch Watershed SPA (Figure 1). On February 24, 2004 County Council designated a fourth SPA as part of the Upper Rock Creek Master Plan. The Upper Rock Creek Special Protection Area includes the Upper Rock Creek watershed within the Upper Rock Creek Planning Area north of Muncaster Mill Road. This area is generally bounded by Woodfield Road on the west, Route 108 on the north, Bowie Mill Road and the North Branch Rock Creek on the east and Muncaster Mill Road on the south.

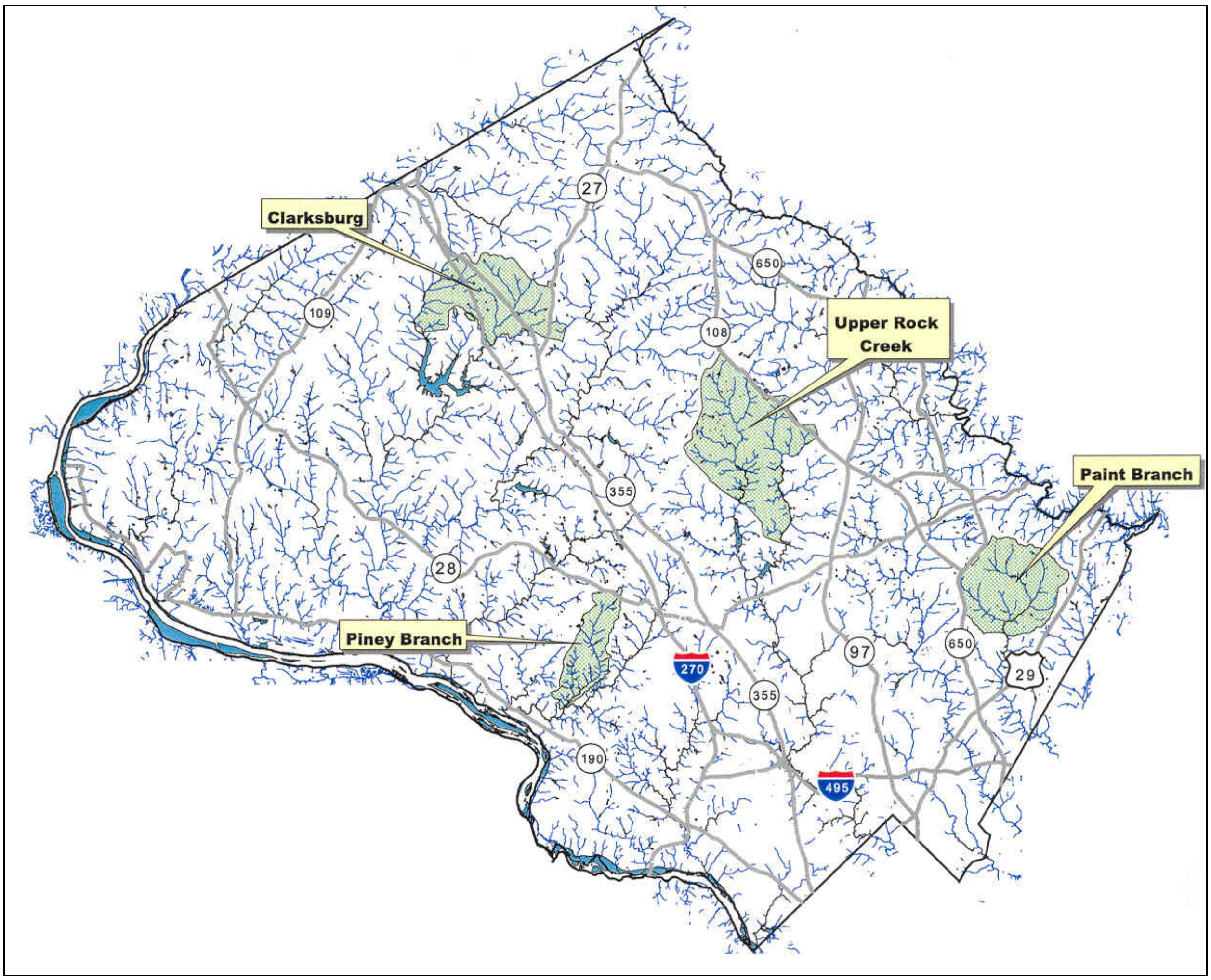

Figure 1 Special Protection Area Locator Map

There are special requirements for developing land in a SPA. Applicants proposing land development projects in both the private and public sectors are required to work closely with county environmental agencies throughout the development process. Particularly significant is the requirement that developers consult with the county early in the process of generating a development plan. This approach seeks to ensure that protection of critical natural resources is incorporated into site design before significant time and financial resources are invested in proposing any particular development scheme.

The SPA program also requires a monitoring component to document stream conditions, stormwater management best management practice (BMP) effectiveness and allow environmental quality goals to be set and performance evaluated for development projects.

Readers desiring more detailed information on the fundamentals of the SPA program should look to Appendix 1 of this document, "Explanation of the Special Protection Area Program."

3.0 Implementation of the SPA Program

3.1 Review of Process to Date

The SPA program requires that water quality concerns be identified and addressed early in the planning process. When protection of identified critical natural resources is not considered in the early stages of preparing a development plan, opportunities for protection are not fully achieved and resources may not be fully protected. Consequently, an integral component of the program is the requirement that developers meet with county environmental and planning staff before significant resources have been invested in planning the development of a site. This allows identification of sensitive areas that must be protected. Guidance on what should be included in a water quality plan for development of the particular site is also provided early in the process. Ideally, the goals and objectives presented in these early meetings are incorporated into the development site design plans.

At some SPA sites however, the complexity and intensity of conflicting development activities makes water quality goals difficult to achieve. In areas of intense master planned land uses, there is a tendency by those involved in the planning process to focus on advance site planning without considering stormwater management needs and inherent siting conflicts. When these needs are not considered concurrently with other interests, opportunities to provide adequate water quality protection may be lost. Advance site planning makes subsequent achievement of a constructive balance between development and water quality a daunting challenge. DEP and DPS will continue to work closely with the M-NCPPC to input environmental protection considerations earlier into the land development planning process.

3.2 Public Involvement in the SPA Program

As part of the SPA regulations, provisions are included that allow the public to participate in the process of planning development. The Department of Permitting Services (DPS) provides written public notice in the M-NCPPC Planning Board Agenda that preliminary water quality plans for a project have been submitted for review and approval. Public information meetings may be requested in writing within fifteen days of the notice being issued. At these meetings members of the public or interested organizations are briefed on submitted plans and can contribute comments if desired. The public can also become involved when water quality plans are reviewed and acted on by the Planning Board in conjunction with review and action on preliminary plans, site plans, mandatory referrals, development plans and certain types of zoning cases.

The Montgomery County Council enacted legislation on October 3, 2000 to help ensure that purchasers of property in an SPA are aware of the program and its implications. The intent of the legislation is to promote awareness and comprehension of the goals and objectives of the SPA program, and of the effect the program may have on the use of a particular property for sale within an SPA. Council Bill 24-00 requires certain disclosures be made to all buyers of real property located in the special protection areas. A brochure explaining SPA requirements is now distributed with materials issued at settlement for all real property sales contracts.

Buyers seeking further information are directed to the web sites of the three agencies responsible for SPA implementation for answers to the most often asked questions. These sites include telephone numbers to call for additional information. Buyers also are directed to check their particular record plat and other land records and regulatory approval conditions to determine the existence of any regulatory restrictions such as conservation easements on their property.

3.3 Status of SPA Conservation Plans

Conservation plans for three SPA's are available (Clarksburg, Paint Branch and Piney Branch). A conservation plan for Upper Rock Creek will be developed as additional monitoring data becomes available. These conservation plans detail findings from several years of monitoring in the SPA's and identify critical natural resources that need to be protected if a high quality stream ecosystem is to be maintained. Performance goals for the protection of critical natural resources are established for each SPA. The conservation plans are intended to provide guidance for County plan reviewers and developers in setting performance goals for individual projects as required in the water quality plan. These conservation plans are 'living documents' intended to present the best available data on critical natural resource parameters. As new cost effective and proven technology becomes available to better describe these natural resource parameters, the conservation plans will be updated as needed.

The conservation plans can be downloaded from the Montgomery County Department of Environmental Protection's web site, http://www.askdep.com. On the DEP homepage, click on Special Protection Areas listed under Programs. Previous SPA Annual Reports can be downloaded here as well.

3.4 Status of BMP Monitoring

BMP monitoring has been required on a total of thirty-seven (37) projects in three SPA's. Three (3) of these projects are currently submitting pre-construction baseline monitoring data, seventeen (17) are currently in the construction phase and thirteen (13) projects have been completed. A summary of all required BMP monitoring to date is provided in Table 2.

Eleven (11) of the completed projects continue to submit BMP monitoring data. Nine (9) of the completed projects have submitted enough post-construction data to permit evaluation of BMP and site design performance. Five of these projects are located in the Piney Branch, one in Paint Branch and three are in Clarksburg. BMP monitoring is discussed in section 5 of this report.

3.4.1 Anticipated Effects of BMP's

Best management practices are intended to minimize development impacts on streams. While the ideal goal is for development to cause no impact to SPA streams, realistically some impacts will occur. Impacts are most likely to be seen while construction activities are underway. After construction is completed, it is anticipated that carefully planned BMP's will allow streams to gradually recover from temporary construction impacts not fully controllable through construction site sediment controls. It is believed that this recovery will require several years to take place. For this reason, water quality plans for SPA development projects usually require three to five years of BMP monitoring after construction of a project has been completed. Until more data is available, the degree to which stream systems will be able to regain preconstruction conditions after development is uncertain. Hopefully, SPA streams will be able to fully recover from any decline in conditions that might occur during construction. However, when other land use goals take precedence over water quality goals in the development of a site, the prospect of complete stream recovery becomes less clear. This is because stormwater controls cannot fully mitigate impacts on stream water quality or hydrology caused by significant reductions in watershed forest cover and increases in developed land in urban or suburban uses.

3.4.2 Outlook for Future

A number of SPA development projects have been completed and some post-construction monitoring data has been submitted. Cavanaugh, Peters, Shady Grove Rd., Boverman and Bruck projects in Piney Branch, and Fairland Community Center, Briarcliff Manor and Safeway in the Paint Branch SPA have turned in some post-construction data. Although datasets from these completed projects are small, preliminary conclusions can be made. We anticipate that more projects will be completed in 2004 and begin turning in post-construction data. Running Brook, the detention center, and Gateway 270 have been completed in Clarksburg. As consultants begin to submit data covering multiple years, BMP monitoring reports will evaluate post-construction conditions, overall development impacts, and effectiveness of the different types of BMP's. Information continues to come in on the effectiveness of sediment control during construction. Over time, BMP monitoring efforts will begin to provide a better understanding of how well the SPA program and associated BMP requirements are doing in minimizing development impacts. The degree to which impacted streams are able to recover from development activities and the time required for recovery will also be better understood. Ultimately, the intent of the SPA program is to offset changes to stream hydrology and quality caused by watershed development, mimicking pre-development hydrology and maintaining environmental quality to the extent feasible. In the next several years DEP will be better able to gage the success of the program in that regard.

3.4.3 BMP Monitoring Methods and Procedures

To insure consistency and accuracy of monitoring techniques, DEP and DPS established the BMP Monitoring Work Group. This group, which consists of water quality professionals from the public sector and private industry, has established protocols for most types of monitoring being used to determine the effectiveness of BMP's. This document, *Montgomery County Department of Environmental Protection Best Management Practice Monitoring Protocols* (June

1998) is available on the web at: http://www.askdep.com. The BMP monitoring workgroup will meet periodically to review effectiveness of the BMP monitoring protocols. The group will reconvene during 2004 to address the following issues: 1) Lack of consistent water chemistry monitoring protocols, 2) data analysis requirements, 3) data submission requirements.

3.5 Status of Stream Monitoring Program

In the fall of 1994, DEP began SPA baseline stream monitoring in Little Seneca Creek and Ten Mile Creek within the Clarksburg Master Plan SPA. In the spring of 1995, in anticipation of SPA designation, DEP initiated further SPA baseline stream monitoring in the Upper Paint Branch and Piney Branch Special Protection Areas. Presently, DEP has fifty nine (59) fixed monitoring stations throughout the four SPA's, twenty seven (27) in Clarksburg, fourteen (14) in Upper Paint Branch, ten (10) in Piney Branch and eight (8) in the Upper Rock Creek SPA. Due to limited staff, DEP can not monitor all fifty nine (59) stations each year. Fifty (50) stations were monitored during 2003.

Monitoring at most stations consists of biological sampling (benthic macroinvertebrates and fish), stream habitat assessment, stream channel measurements, and physiochemical water quality data (dissolved oxygen, temperature, pH, and conductivity). Due to small stream size at several monitoring stations, biological sampling includes only the benthic macroinvertebrate monitoring. Limited field staff and variable field and weather conditions prevent sampling all fifty nine (59) stations each year. Sampling was completed at fifty (50) stations during 2003.

3.5.1 Stream Monitoring Methods and Procedures

The Department of Environmental Protection established a Biological Monitoring Work (BMW) Group consisting of local and state environmental agency personnel, consultants, environmental organizations and citizens. One of the BMW Group's initial functions was to peer review and evaluate County stream monitoring protocols developed by DEP (Van Ness et all, 1997). These stream monitoring protocols are used for all County stream monitoring efforts, including SPA baseline monitoring.

Biological monitoring (fish and benthic macroinvertebrates) is the principal means by which stream condition is tracked over time as development proceeds in the SPA's. Monitoring results from each year are used to calculate an Index of Biological Integrity or IBI (see glossary for definition). Reported in this document are all IBI scores from various locations within each SPA.

Measurements of stream habitat, water temperature and channel morphology assess the quality and stability of stream habitat. Long-term monitoring of these parameters will allow DEP to determine if changes to channel morphology are a result of natural variability or development induced stressors. Understanding where changes in channel morphology have led to degraded stream channels will also help in terms of knowing where stream restoration is needed.

4.0 Status of Individual Special Protection Areas

4.1 Clarksburg Master Plan Special Protection Area

The Clarksburg Area Master Plan, adopted in June of 1994, approved the creation of the first SPA. Based on the environmental analysis for the Clarksburg Master Plan, and guidance provided from the Maryland Department of the Environment and Maryland Department of Natural Resources, portions of Little Seneca Creek, Ten Mile Creek, Wildcat Branch, and Cabin Branch were included in the SPA (Figure 2) in order "to assure that identified sensitive environmental resources were protected to the greatest extent possible from development activities" (Approved and Adopted Clarksburg Master Plan, June 1994, page 206). "Achieving this rather delicate and imprecise balance was recognized to be a difficult goal but one which must be achieved if Clarksburg's outstanding environmental setting is to be preserved" (Approved and Adopted Clarksburg Master Plan, June 1994, page 18).

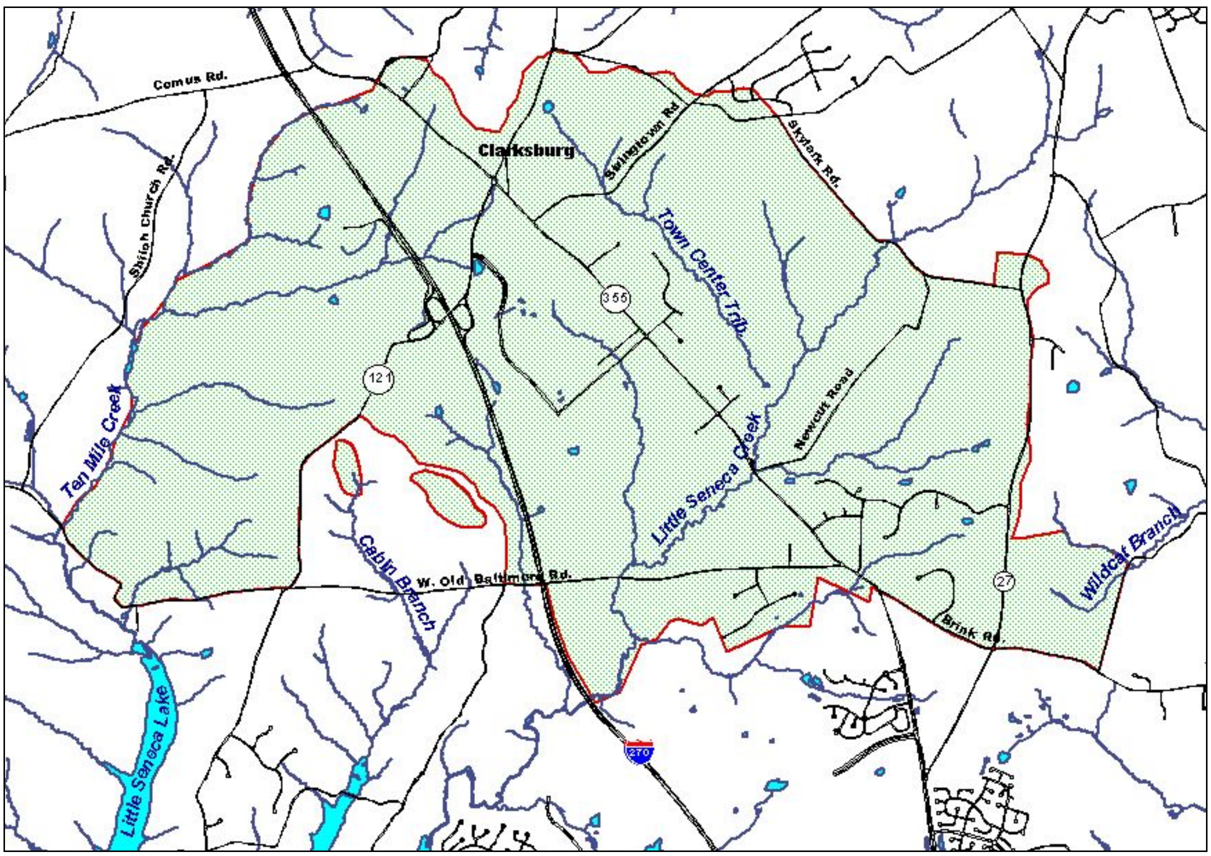

Figure 2 Clarksburg Special Protection Area - shaded in green

The Little Seneca portion of the SPA encompasses approximately 6100 acres of land. These headwaters of Little Seneca Creek are designated by the state of Maryland as a Use IV-P stream (i.e. protection of put-and-take trout and public water supply). Table 3 below lists the state standards for Use IV-P streams.

The Ten Mile Creek subwatershed encompasses approximately 3600 acres. The SPA includes all land in the subwatershed east of the Ten Mile Creek mainstem and north of West Old Baltimore

Road. Ten Mile Creek is designated by the state of Maryland as a Use I-P stream (i.e. protection of water contact recreation, aquatic life and drinking water supply). Table 3 below lists the state standards for Use I-P streams. Historically, Ten Mile Creek was one of the last streams in Montgomery County to support Brook trout, a highly sensitive species requiring clean and cold water to survive.

Only two small portions of the Cabin Branch (Use I-P) subwatershed are included in the SPA. These areas were identified by the Clarksburg Area Master Plan as being outside projected 100' wide stream buffers and having a higher potential for groundwater contamination than the surrounding areas.

The inclusion of a small portion of the Wildcat Branch subwatershed is due to the potential for adverse impacts to the stream from anticipated development along Brink Road and the construction of the Mid-County Highway. The Wildcat Branch portion of the SPA consists of any tributaries in the Clarksburg planning area that receive stormwater runoff from the Brink Road area and the future Mid-County Highway extension. The Wildcat Branch is designated by the state of Maryland as a Use III –P stream (protection of naturally reproducing trout populations and drinking water supply). State standards for all freshwater use designations are listed in Table 3. A viable self supporting brown trout population is found in Wildcat Branch.

Table 3 Maryland Water Quality Standards For Freshwater Use Classes (COMAR 1993 parts 26.08.02.01– 03)

Parameter	**Use I-P**	**Use III-P**	**Use IV-P**
Maximum Total Fecal Coliforms (log mean per 100 mL)	200	200	200
Minimum Dissolved Oxygen (mg/L)	5	5	5
Minimum Daily Average Dissolved Oxygen (mg/L)	N/A	6	N/A
Maximum Temperature (Degrees Fahrenheit)	90^{o} or ambient (whichever is greater)	68^{o} or ambient (whichever is greater)	75^{o} or ambient (whichever is greater)
pH	6.5 to 8.5	6.5 to 8.5	6.5 to 8.5
Maximum Turbidity (NTU)	150	150	150
Maxumum Monthly Average Turbidity (NTU)	50	50	50
Total Residual Chlorine	N/A	No Chlorine Permissible	N/A

4.1.1 Clarksburg SPA Stage IV

The Clarksburg Master Plan (approved and adopted in 1994) included a staging plan for development in Clarksburg. The last stage, Stage 4, covers the areas within the Ten Mile Creek sub-watershed. Release of development in Stage 4 is triggered by (among other things): baseline monitoring of Little Seneca Creek and Ten Mile Creek for a minimum of three years and an evaluation of BMP's and other mitigation techniques used on the Town Center and Newcut Road developments.

The master plan indicates that a comprehensive review of all SPA monitoring data should be part of the first SPA Annual Report following the release of 2,000 building permits for housing units in the Newcut Road and Town Center sub-areas. Overall, 7,260 housing units are planned for this portion of the Clarksburg SPA. Although 2,000 permits have not yet been issued, land clearing has occurred at a scale that would accommodate more then 2,000. As of July 2004 approximately 1,300 permits have been issued. Considering the rapid rate of development it is probable that the 2,000th building permit will be issued in calendar year 2004, and almost certainly in calendar year 2005. This means that the review would need to be done in spring of 2005 or 2006.

In the normal development process, there can be significant time lags between the issuance of building permits, the completion of fully stabilized building sites, and the completion of adequate post-construction monitoring. Because of these time lags, it is recognized that DEP's regular monitoring cycle, immediately following the 2,000th building permit benchmark, would not initially capture the true effectiveness of the related water quality BMPs. Water quality control facilities may not be fully functional until all the properties within their catchment area are developed. Depending on the schedule and layout of the permitted structures, DEP may not have much in the way of functioning BMPs in Clarksburg to evaluate. A significant number of those 2,000 permitted structures may not be completed, and most developments will not have been stabilized and the sediment control structures converted to stormwater management. Little true post-construction monitoring data will be available from the Clarksburg SPA. Unusual weather conditions could further confound the review of data.

4.1.2 Extension of Water and Sewer Service and Increased Density of Development

The 1994 Clarksburg Master Plan recommends the majority of the Clarksburg SPA for community water and sewer service. The Clarksburg area started the initial expansion of community water and sewer service recommended in the master plan, primarily in the Town Center District located between Clarksburg and Stringtown Roads northeast of Route 355. The County Council in 2001 approved an amendment to the Water and Sewer Plan which grants approval for community water and sewer service throughout much of the Development Stages 2 and 3 areas (Future Sewer Service Areas A1 and A) east of I-270; the accompanying map reflects these approvals.

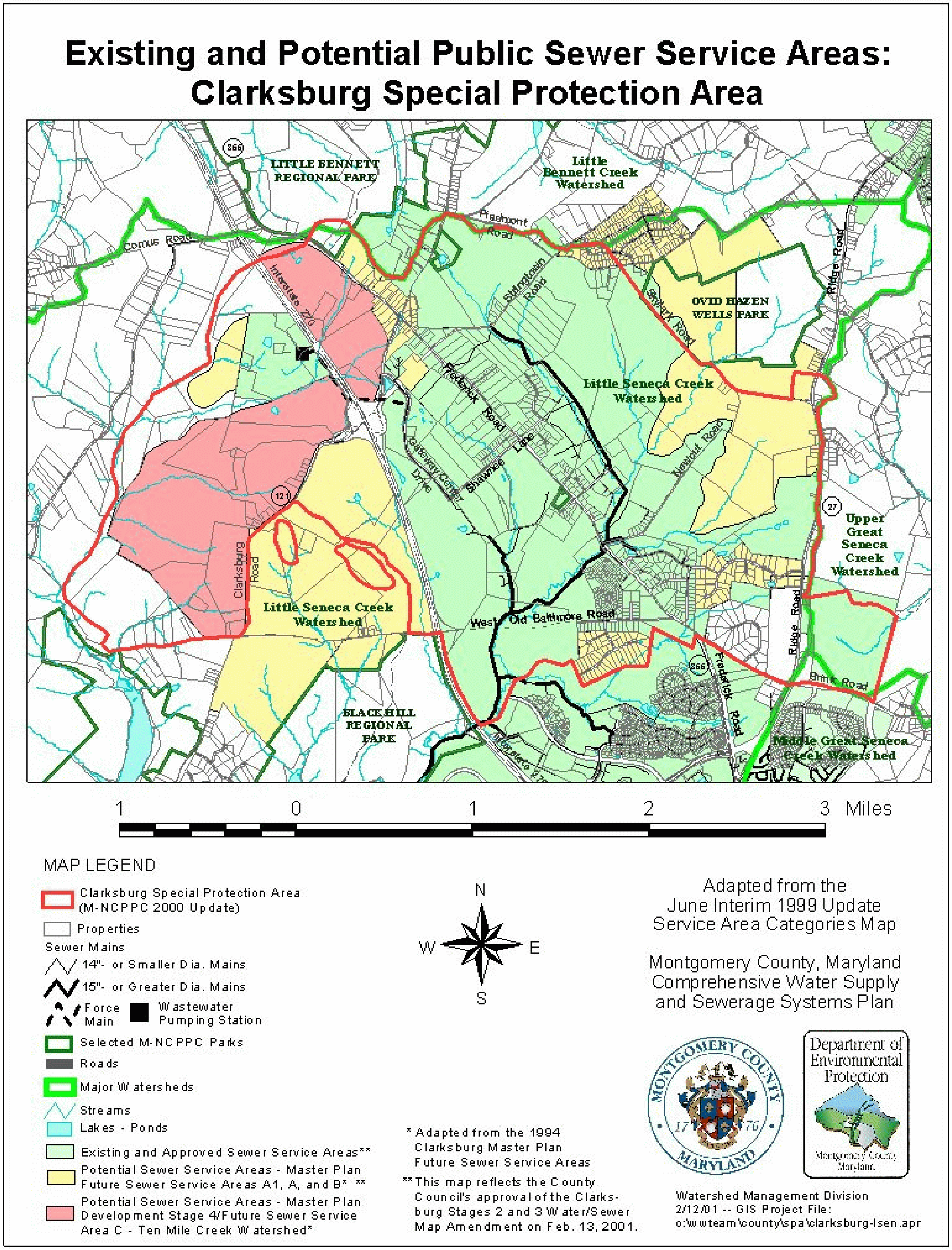

Figure 3. Clarksburg SPA Sewer Service Areas

Only one major area of Development Stage 3 remains as a potential sewer service area - that is the entire area west of I-270, primarily in the Cabin Branch subwatershed (Future Sewer Service Area C, as shown on Figure 3). Community sewer approval of this area will require inclusion in the WSSC capital improvements program (CIP) of the capital sewerage system projects (trunk mains, pumping stations, and force mains) needed to provide sewer service. The location chosen by WSSC and their consultants for the sewer alignment will likely have severe impacts to the Upper Little Seneca South subwatershed during the construction process. It will be aligned along a steep slope in the stream buffer of the tributary that parallels I-270 on the west side.

Another potential sewer service area within the SPA is Development Stage 4 (Future Sewer Service Area C) in the Ten Mile Creek subwatershed (shown in red on Figure 3). Master plan staging triggers link development needing community water and sewer service in Stage 4 in part to the results of water quality monitoring for the earlier development stages. These requirements reflect the concern in the Clarksburg Master Plan for, "... the environmentally fragile nature of the streams in this area ..." The master plan requires DEP to conduct baseline monitoring in the Little Seneca Creek and Ten Mile Creek watersheds for at least three years. Baseline assessment in these watersheds began in 1994. The master plan also requires ongoing monitoring by DEP as development proceeds in the Newcut Road and Town Center (Stage 3) neighborhoods to evaluate the water quality best management practices (BMPs) for that development. DEP is to provide its evaluation of these BMPs in the Annual Report on the Water Quality Review Process that follows immediately after the release of 2,000 building permits in the Newcut Road and Town Center neighborhoods. This allows for significant development to get under way east of I-270 to reinforce the Clarksburg town concept. More than 2000 dwelling units will be included in this total because DPS issues a single permit for all the multifamily structures on a property even though individual building permits are required for each single family home and townhouse. For the purpose of tallying 2000 building permits, an apartment complex and a single family home each count as a single building permit.

The County Council will then assess the results of DEP's evaluation, along with considering capital infrastructure needs for the Stage 4 area, and voluntary water quality protection measures taken by local property owners. Following the assessment, the approved and adopted Clarksburg Master Plan (June 1994), stipulates that the County Council can choose from among the following actions:

- Proceed with Stage 4 development by granting Water and Sewer Plan amendments allowing community water and sewer service.

- Proceed with Stage 4 development, as above, but with additional measures, such as more stringent water quality requirements and further development staging, to protect the watershed.

- Defer action on development in Stage 4, pending further study or consideration, by deferring the Water and Sewer Plan amendments needed for community water and sewer service.
- Consider other land use options for the watershed, which may or may not require community water and sewer service.

4.1.3 Status of Development in the Clarksburg Master Plan SPA as of April, 2004

The Clarksburg SPA has experienced the most development activity of the three SPAs by far. This area has undergone numerous changes in the last year, with several large sites under construction. Some of the more notable sites that are under construction include Clarksburg Town Center Phase I and II (269 acres), Greenway Village Phase I and II (164 acres, 210 acres pending approval), Clarksburg Village Phase I and II (333 acres approved, 417 acres pending approval), Martens Property Phase I and II (103 acres), Highlands of Clarksburg (56 acres), Rocky Hill Middle School (25 acres) and Linthicum East (126 acres). Several other developments are nearing the end of the development review process and will likely be under construction before the end of this year. Additionally, there are several other significant sites (Comsat Property 226 acres, Woodcrest 47 acres-18 acres in the SPA and Cabin Branch 535 acres-243 acres in the SPA) that are currently in varying phases of the development review process and are aggressively pursuing development plan approvals.

As can be seen by the sheer number of acres of proposed development listed above (about 2000 acres), which include only the larger development sites, there will be an enormous increase in density and impervious area in the watershed. This, along with the potential sedimentation impacts associated with construction, will greatly challenge the ability to sustain existing stream conditions in this watershed. Adding to this challenge are master plan’s direction to increase densities by requiring several sites, including Clarksburg Village, Martens Property and Gateway Commons, to absorb Transferred Development Rights (TDRs) into the subdivisions. These density increases that allow county goals of increased available housing and the protection of agricultural resources to be achieved will also add impervious area and reduce available area for buffers and redundant stormwater management facilities in Clarksburg. Table 4 lists development projects that are active in the Clarksburg SPA. The table covers the time period from 1995 to April 2004. Table 4 is intended to provide the reader with a general idea of the locations, types, intensity, and stage of review of land development projects. As shown in the table, construction is currently underway on several projects and nearing completion on several others in the watershed. Baseline and construction (temporary) BMP monitoring is currently being performed on several sites as noted in section 4.1.3. As these sites are finalized, monitoring of the permanent stormwater management BMPs will begin.

Table 4 Clarksburg SPA Development Projects (1995 to April 2004)

PROJECT NAME	SPA LOCATION	DEVELOPMENT SIZE /TYPE	STATUS
All Souls Catholic Cemetery – Germantown	Wildcat Branch	166 acres - RDT	Phase I under construction. Plans for Phase II are under review.
Cabin Branch	Little Seneca Creek	535 acres, MXPD, RMX-1/RDT	Preliminary water quality plan approved.
Catawba Manor	Clarksburg, Little Seneca Subwatershed	10.9 acres (4.5 in SPA) RMX-2,R-200	Site under construction
Cellular Phone Antenna Site Ferguson Farm	Clarksburg, Little Seneca Creek Subwatershed	0.6 acres - RDT Communication tower and access drive	Exempt from water quality plan requirements. Stormwater management provided. Construction complete
Clark Meadow, Phase I	Clarksburg, Little Seneca Subwatershed	37 acres, R-200	Subdivision plan approved before SPA designation. Construction complete. As-built approved.
Clark Meadow, Phase II	Clarksburg, Little Seneca Subwatershed.	1.0 acre, R-200.	Site under construction.
Clarksburg Detention Facility (Seneca Correctional Facility)	Clarksburg, Ten Mile Creek Subwatershed	34 acres	Construction complete. As-built under review.
Clarksburg Bus and Maintenance Depot	Clarksburg, Little Seneca Creek	9.28 acres	Water quality inventory approved. Sediment control permit issued.
Clarksburg Greenway Trail	Little Seneca Creek	3.5 acres, parkland	Preliminary/Final water quality plan approved.
Clarksburg High School	Clarksburg, Little Seneca Creek	50+ acres	Preliminary/Final water quality plan approved.

TABLE 4 (Continued)

PROJECT NAME	SPA LOCATION	DEVELOPMENT SIZE, TYPE	STATUS
Highlands of Clarksburg (Clarksburg Gateway)	Clarksburg, Little Seneca Creek	56.4 acres, RMX-2 and R-200	Final water quality plan approved. Under construction.
Clarksburg Heights	Clarksburg, Little Seneca Subwatershed	54 acres, R-200	Subdivision plan approved prior to SPA designation. Construction complete.
Clarksburg Ridge (Funt Property)	Clarksburg, Little Seneca Creek	24 acres, Residential	Under construction.
Clarksburg Town Center -	Clarksburg, Little Seneca Subwatershed	269 acres, RMX-2, RDT	Phases I, IA, IB and II are under construction. Commercial revision under review.
Clarksburg Village (Newcut Village)	Clarksburg, Little Seneca Creek	730 acres, mixed use, TDR receiving area.	Final water quality plan approved. Phase I under construction.
Egan Property (C.N. Sherwood Property)	Clarksburg, Ten Mile Creek Subwatershed	101.6 acres, R-200, Commercial Picnic / Catering Facility	Phase I under construction. Phase II under review.
Gateway Commons	Clarksburg, Little Seneca Creek	56 acres, R-200 TDR-7	Final water quality plan approved. Sediment control plan under review
Gateway 270 (Phase I)	Clarksburg, Little Seneca Creek	24.5 acres, I-3, 3 lots	Construction complete. As-built approved.
Gateway 270 (Lot 7)	Clarksburg, Little Seneca Creek	4.9 acres, I-3	Construction complete. As-built under review.
Gateway 270 West (Phase II)	Clarksburg, Little Seneca Creek	35.5 acres, I-3, 6 lots	Construction complete. As-built approved.
Greenway Village (DiMaio Property)	Clarksburg, Little Seneca Creek	374 acres, PD (Planned Development)	Final water quality plan submitted for Phases I and II. Under construction. Phases 3, 4 and 5 under review.

Table 4. (Continued)

PROJECT NAME	SPA LOCATION	DEVELOPMENT SIZE, TYPE	STATUS
Greenridge Baptist Church	Clarksburg, Little Seneca Creek	8.2 acres	Pre-application meeting completed. Project on hold.
Clarksburg Gateway (now part of Highlands of Clarksburg)	Clarksburg, Little Seneca Subwatershed	16 acres, RMX-2 (high density)	Under construction.
Kingsley Wilderness School	Clarksburg, Little Seneca Creek	5.5acres, Montgomery County Site 30	Under construction.
Linthicum Property East (Phase I)	Clarksburg, Little Seneca Creek	126 acres, R-200	Final water quality plan under review. Sediment control plans under review.
Martens Property	Clarksburg, Little Seneca Creek	103.1 acres, R-200 TDR-4.	Phase I under construction. Phase II sediment control under review.
Nanna Property (Phase I)	Clarksburg, Little Seneca Creek Subwatershed	4 acres, R-200	Construction complete.
Nanna Property (Phase II)	Clarksburg, Little Seneca Creek	12.1acres, R-200C, 24 lots proposed	Under construction.
Parkside	Clarksburg, Little Seneca Creek	10.9 acres, R-200 RMX-2	Under construction.
Rocky Hill Middle School (New)	Clarksburg, Little Seneca Creek	23+ acres, School	Under construction.
Running Brook Acres	Clarksburg, Little Seneca Creek	11.7 acres, R-200, 24 lots proposed (cluster)	Construction nearing completion.
Verizon Clarksburg	Little Seneca Creek	2.4 acres, R-200	Water quality inventory approved.
Stringtown Road	Little Seneca Creek and Ten Mile Creek	17 acres, Roadway	Preliminary/Final water quality plan approved.

4.1.4 Summary of Stream Monitoring in the Clarksburg SPA

Stream monitoring in Clarksburg SPA began in 1994 and is done on an annual basis at most of the twenty seven (27) stations shown in Figure 4. During 2003, biological monitoring was completed at all twenty seven stations and water temperature loggers were deployed at eight (8) stations.

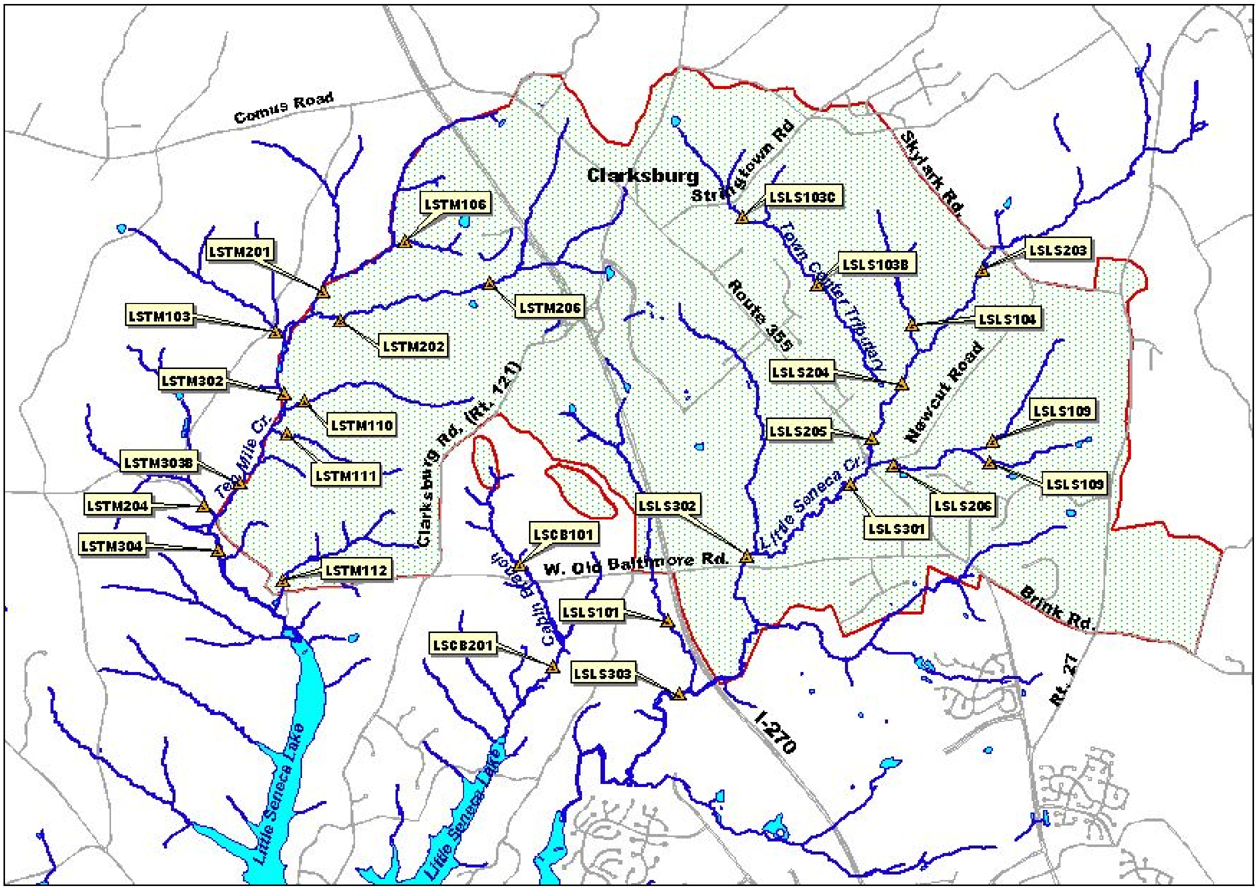

Figure 4 Clarksburg Special Protection Area - stream monitoring station locations

Interpretation of biological monitoring results from 2003 is confounded by the fact that there are at least two causes of impairment to the stream between 2002 and 2003: 1) the region is coming out of a record drought and the streams biological community continues to reflect these stressful conditions, 2) construction activity and associated land disturbance has rapidly increased over a continuously expanding area. Determining whether the source of impairment is from natural or man-made causes is accomplished through the use of control stations. Because of minimal land disturbance in the Ten Mile Creek and Cabin Branch watersheds, results from monitoring stations in these two streams are used as controls. Impairment to the streams biological community at control stations is the result, primarily, of natural causes such as the drought of 2002.

Biological monitoring results from 2003 show impairment to the benthic macroinvertebrate community in the Town Center Tributary beyond that observed in either Ten Mile Creek or Cabin Branch. The additional impairment is believed to be caused by construction activities and associated land disturbance. A separate section of this report is devoted to analysis of monitoring results from the Town Center tributary. Because land development is occurring so rapidly in this sub-watershed it provides one of the first opportunities to assess how successful the SPA program is at protecting stream resources during construction phases of land development. A final assessment of program success can not be made until construction is complete, sediment control is converted to water quality / stormwater management BMP's and these BMP's have had several years to function as designed.

Construction activity during 2003 occurred in the following areas in the Clarksburg SPA (see Figure 5 for locations): 1) Clarksburg Town Center; 2) Greenway Village, Phase I (Skylark Rd. on north side of Little Seneca Cr.); 3) Highlands of Clarksburg; 4) Clarksburg Village, phase I (southeast corner of Stringtown and Peidmont Roads); 5) All Souls Cemetery; 6) Running Brook Acres; 7) Timbercreek; 8) Martens property, phase I; 9) Clarksburg Middle School; 10) Clarksburg Ridge; 11) Catawba Manor; 12) Parkside. The Clarksburg Detention Center (13) was completed in April 2003.

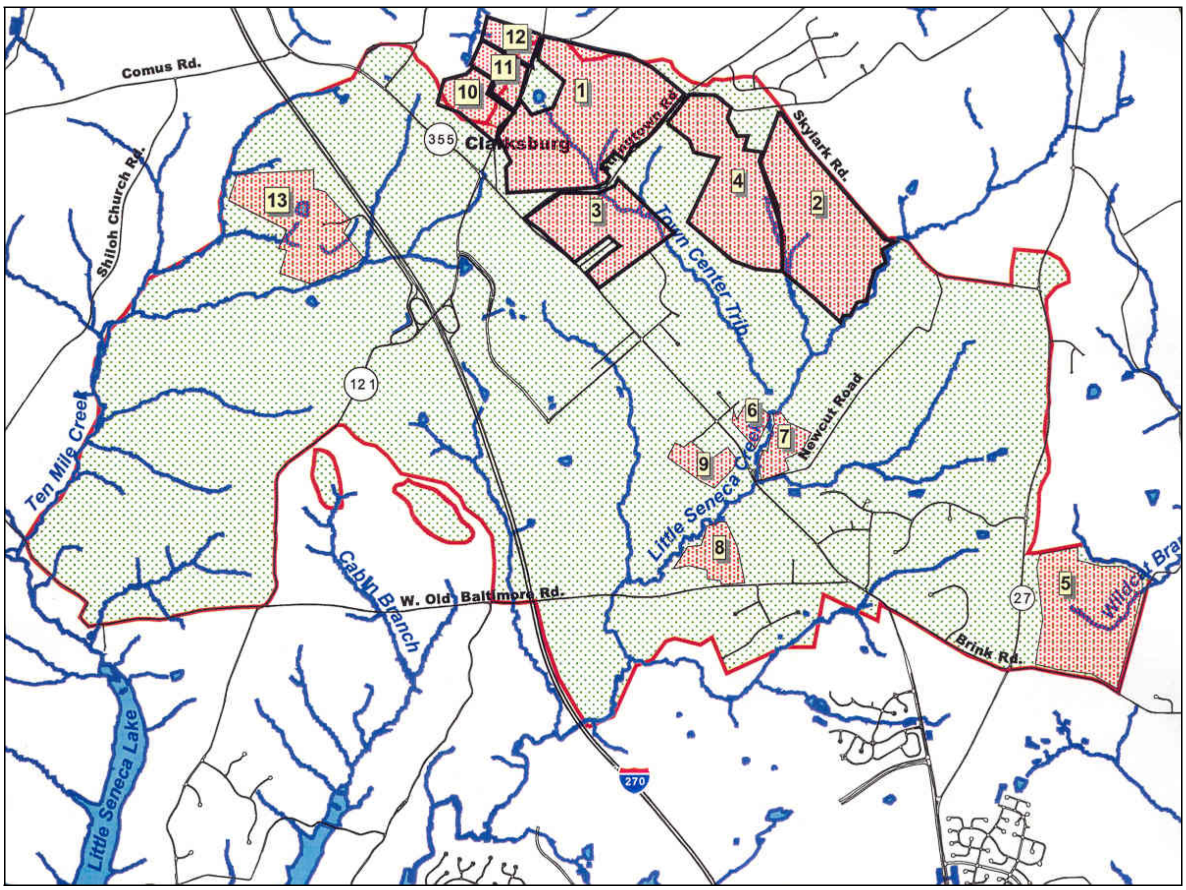

Figure 5 Development projects currently under construction or just recently completed are shaded in red.

Construction on the Greenway Village, Highlands of Clarksburg, Clarksburg Village, Clarksburg Ridge, Catawba Manor and Parkside projects did not begin until mid or late in the year of 2003 and would not have influenced stream condition during the spring when benthic macroinvertebrates are sampled.

A cooperative monitoring effort between the US EPA, US Geological Survey, USFWS, University of Maryland Baltimore, M-NCPPC and DEP continued during 2003 to study changes in stream geomorphology, flow and biology as development proceeds.

4.1.4.a Biological Monitoring Results

Generally, fish monitoring results from 2003 indicate little change in community health from previous years. IBI scores from Little Seneca Creek are within the range of scores from previous years at most monitoring stations (Figure 6). Exceptions include LSLS101 (located along a small un-named tributary that flows parallel to I-270) and LSLS204 (located on the mainstem of Little Seneca Creek upstream of Rt. 355), where IBI scores were lower but still remained in the "good" range. Lower IBI scores at these stations are due, primarily, to an increase in the proportion of pollution tolerant fish species (e.g. Blacknose dace). This kind of minor change in the fish community is often a part of the natural variation observed from year to year and could be related to the 2002 drought. It is presumed that this change in community composition will be temporary as the fish community upstream at LSLS203 and downstream at LSLS205 remained consistent with prior years.

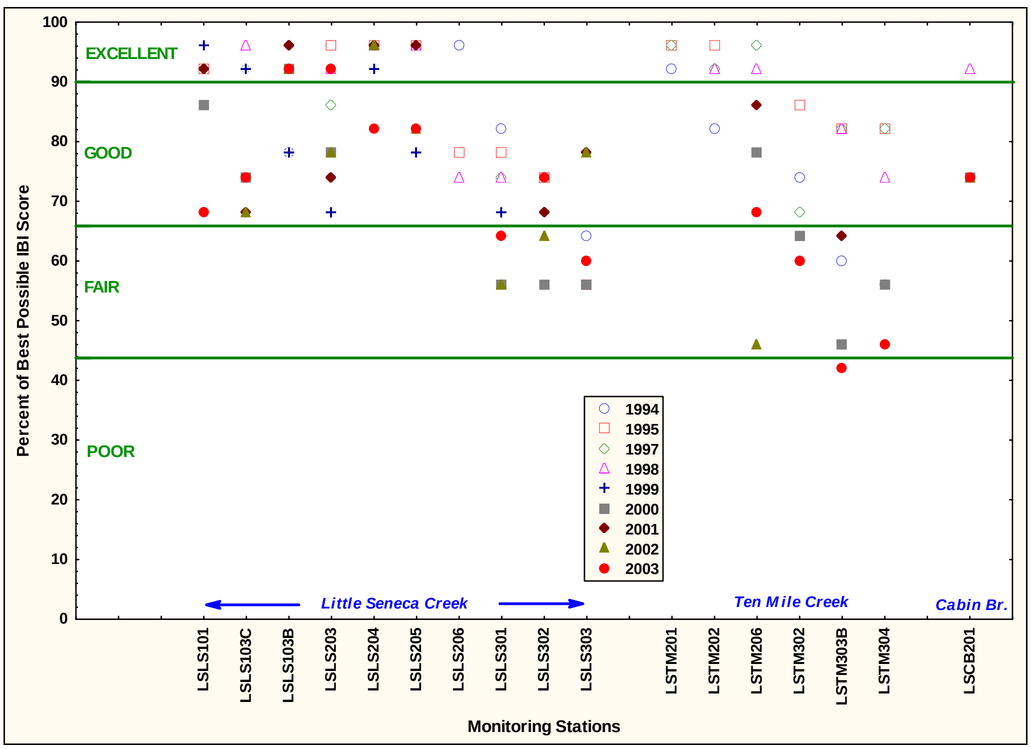

Figure 6 Fish monitoring results from the Clarksburg SPA.

In Ten Mile Creek and Cabin Branch, three of the four stations sampled in 2003 also received fish IBI scores equal to or lower then any year previous (Figure 6). Because there has been minimal land disturbance in these watersheds, low IBI scores here are believed to be related to natural variation and the drought of 2002. Much of the Ten Mile Creek mainstem went completely dry during the summer of 2002. All fish species observed in Ten Mile Creek prior to the drought were observed in 2003 demonstrating the resiliency of the fish community and the ability to quickly re-colonize a stream in the absence of additional man-made impact.

Benthic macroinvertebrate monitoring results from 2003 show many monitoring stations in both Little Seneca and Ten Mile Creeks scored lower than any previous year (Figure 7). This again is largely a reflection of the extremely stressful conditions caused by the drought of 2002. Stressful drought conditions in area streams peaked during the summer months of 2002 and therefore are not fully reflected in benthic macroinvertebrate samples collected during the spring of 2002.

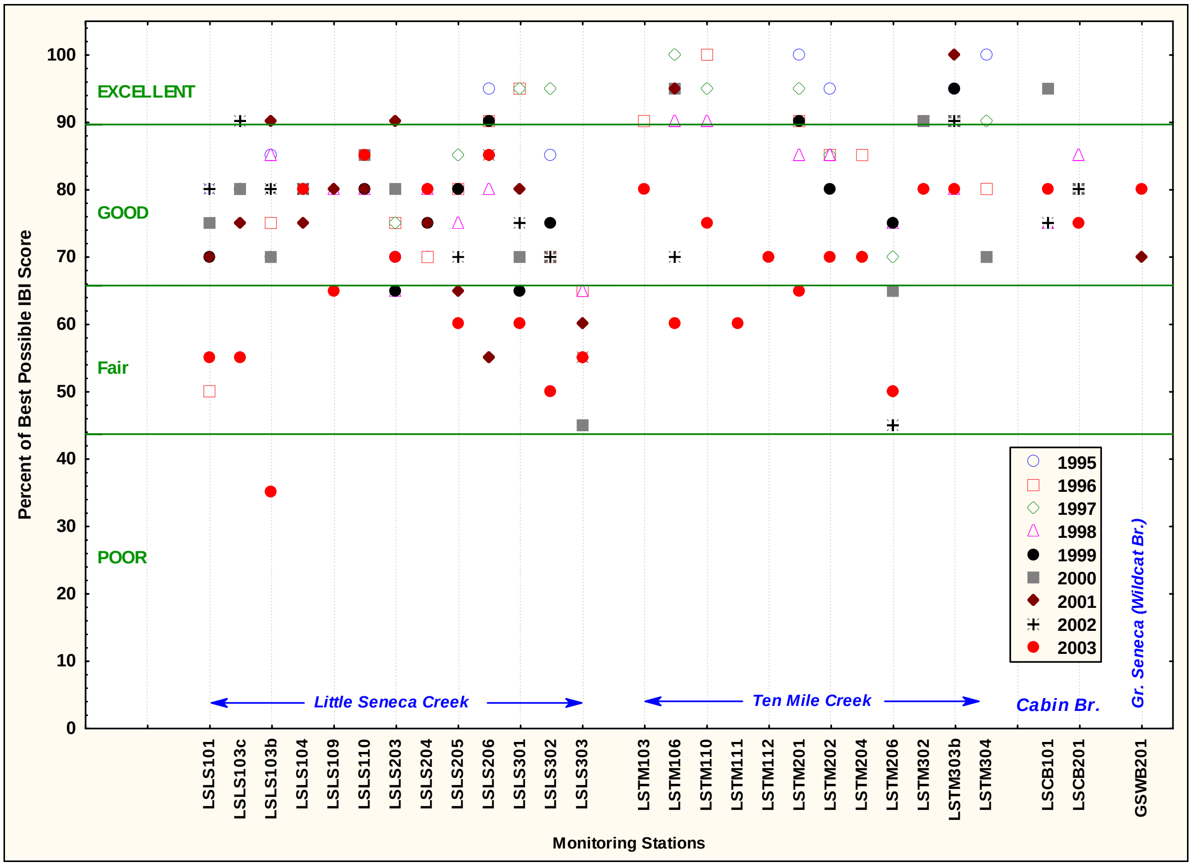

Figure 7 Benthic macroinvertebrate monitoring results from Clarksburg SPA.

Twenty one (21) of the twenty six (26) stations monitored during 2003 received lower IBI scores then the historic mean at each station (Figure 8). The degree of negative change was greatest in the Town Center Tributary (discussed further in the Clarksburg Town Center section below). Other areas where negative change was high include LSLS101 and LSLS301.

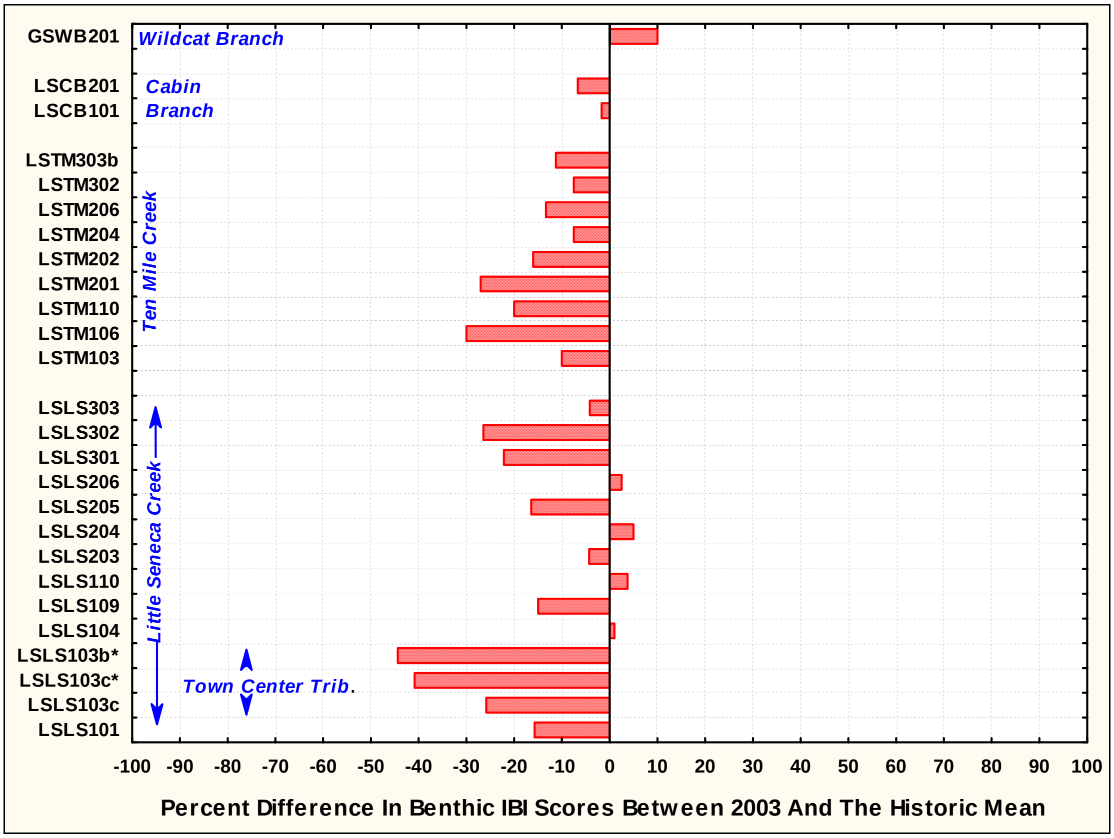

Figure 8 Departure of 2003 benthic macroinvertebrate IBI scores from the historic mean (1995 - 2002). Results from monitoring stations with asterisks are from samples collected after a water main break on the Clarksburg Town Center construction site.

Monitoring stations most impacted by construction activities in the spring 2003 are LSLS103c, LSLS103b and LSTM106. Departure from the historic mean (1995 – 2002, 7 years of natural variability) is greatest at these three stations. The level of impairment beyond that observed at other stations is presumably related to construction and associated land disturbance activity within the drainage area to these three stations.

Clarksburg Town Center Tributary

The Town Center Tributary originates at the Kings Pond along Clarksburg Road between Burnt Hill Road and Rt. 355. The Town Center Tributary watershed extends north of Clarksburg Road to include three new development projects currently under construction (shown in Figure 5 as 10, 11 and 12). From Kings Pond this small stream flows south past additional heavy construction activity on the new Clarksburg Town Center and the Highlands of Clarksburg development, located at the intersection of Rt. 355 and Stringtown Road. With so much active construction underway, this tributary provides an opportunity to evaluate all development related impacts on the stream condition and the effectiveness of sediment control practices in keeping fine sediments on site and out of the stream. Although the first sediment trap was installed on the Town Center (phase I) in August of 1999, the more significant earth moving operations did not begin until the summer of 2001.

DEP has two fixed monitoring stations along the Town Center Tributary; 1) LSLS103C, located just downstream of Stringtown Road; and 2) LSLS103B, located in the lower portion of the tributary (Figure 4). Results from these two stations are used to track stream conditions as development proceeds in the Clarksburg town center area.

There was a water main break at the Town Center on April 14, 2003 that resulted in a large volume of chlorinated water flowing down the Town Center Tributary. DEP had collected a benthic macroinvertebrate sample at LSLS103C prior to the break on 4/7/03. An additional sample was taken after the break to determine if the incident caused any detectable harm. Results do show an impact as IBI score dropped by fifteen percent from fair to poor (Figure **9**). Downstream, at LSLS103B no sample was collected before the water main break so 2003 results reflect all impacts (water main break, construction activities and the 2002 drought).

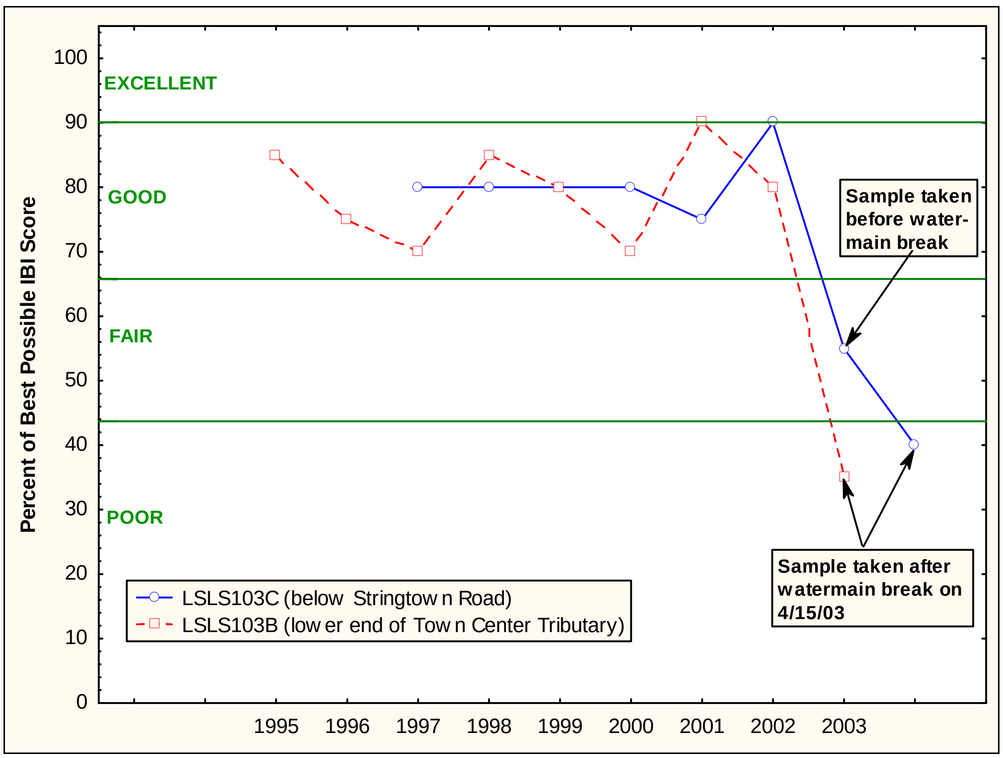

Figure 9 Benthic macroinvertebrate IBI scores from the Town Center Tributary

Historically, results of benthic macroinvertebrate monitoring indicate a healthy, stable community in the Town Center Tributary between 1995 and 2002. Between the spring of 2002 and 2003 the community experienced considerable impact. At LSLS103C the number of taxa that make up the benthic macroinvertebrate community (taxa richness) went from 18 (average from six years, 1997-2002) to 11 in 2003. The taxa that were absent in samples from 2003 are largely the more sensitive mayflies (Ephemeroptera), stoneflies (Plecoptera) and caddisflies (Trichoptera). At LSLS103C the proportion of the overall community that these three families represent (% EPT) went from an average of 64% (1997-2002) to 39% in 2003.

The fish community has not shown any degradation between 2002 and 2003. Fish IBI scores actually went up slightly at LSLS103C and were unchanged at LSLS103B. Numbers of the more sensitive species (e.g. Potomac sculpin and Blue ridge sculpin) were slightly lower in 2003 then 2002 but not enough to affect IBI scores.

Additionally, DEP has observed increased amounts of fine sediment on the steam bottom in the Town Center Tributary (Figures 10 – 13) beginning in 2001. Sediment control measures are in place and inspected routinely. However, considering the large area of land disturbance on the Town Center and surrounding properties, keeping fine sediments out of the stream is difficult and has not been achieved so far. Sediment input to the Town Center Tributary during 2001 was found to originate from a stream stabilization project being constructed in the stream channel and not from the development site. However, since then, the source of sediment is from development activities. Muddy water is routinely observed running out of the three development projects on the north side of Clarksburg Road and into Kings Pond and ultimately to the stream. Stormwater runoff and associated sediment from much of the construction area was well managed for many of the smaller storm events. However, it's during the larger storm events when most of the sediment enters the stream.

Figure 10 1999

Figure 11 2001

Figure 12 2002

Figure 13 2003

BMP monitoring data has shown increased concentrations of sediment leaving sediment traps during larger storm events. This is because the sediment traps can only hold so much water, when storage capacity is reached muddy water flows freely out the riser structure to the stream.

The increased sediment in the stream has facilitated higher rates of algae growth (figure 13) which also has an influence on water quality. The concentration of dissolved oxygen will fluctuate more widely between day and night as a result of greater algal growth. Greater fluctuation in DO can result in very stressful conditions if concentrations drop low enough during night time hours. This may have contributed to the degradation of the benthic macroinvertebrate community in the Town Center Tributary.

Several factors have contributed to the degradation of the benthic macroinvertbrate community in the Town Center Tributary in one year including: 1) a water main break, 2) drought conditions throughout the summer of 2002, 3) increased fine sediment coating the stream bottom, and 4) higher rates of algea growth possibly causing stressful water quality conditions. If development practices do not change and sediment control does not improve, deposition of sediment on the stream bottom is expected to continue for the next several years until much of the watershed is built out and the ground stabilized. It is hoped that the sediment impact on the streams biological community will be temporary. Once the construction site is completed and the ground stabilized, the rate of new sediment input to the stream will diminish. After a period of time depending on weather conditions, the sediment in the stream may flush out. It is not until this point in time that a true assessment of the SPA program and protection of stream resources can be made. Program assessment will be based, primarily, on how the streams biological community compares to baseline condition established during 1995 – 2002.

4.1.4.b Habitat Monitoring

Rapid habitat assessments completed along with biological monitoring are visual based assessments where stream habitat is broken out into10 parameters. The scores for each parameter are summed and the total score is used to assign a narrative habitat condition of optimal, sub-optimal, marginal, or poor. Rapid habitat assessments are helpful in determining if stream habitat condition is playing a role in biological health.

Results of all rapid habitat assessments completed from 1994 to 2003 are presented in Figure 14. Over the nine year period, most monitoring stations have remained in the optimal/suboptimal range. Exceptions include stations LSLS103C (Town Center Trib. below Stringtown Rd.), LSLS205 (Little Seneca Creek just upstream of Rt. 355), LSLS206 (tributary near intersection of Rt. 355 and Newcut Rd.) and LSLS302 (Little Seneca Creek just upstream of Old Baltimore Rd.). Stream habitat at most of these stations is impaired by a lack of riparian vegetation, i.e. forested flood plain. At station LSLS103C stream habitat has been impacted by sediment entering the stream.

Habitat scores from 2003 are generally within the range of previous years except at two stations (LSLS104 and LSTM106) where scores are lower. No one habitat parameter accounts for these lower scores but rather several parameters scored low. The record drought was the cause of reduced wetted area in the stream channel. The effects were greater in the smaller headwater areas of the watershed where streams were reduced to a trickle of water flowing between pools or were completely dry. Because observable changes in channel morphology are generally slow, quantitative monitoring has been scaled back in frequency. We did very little quantitative monitoring in Clarksburg SPA in 2003.

DEP established long term geomorphic monitoring stations in the Clarksburg SPA to assess changes in stream channel dimension. These stations will be surveyed every year and changes in stream channel morphology will be presented in future reports.

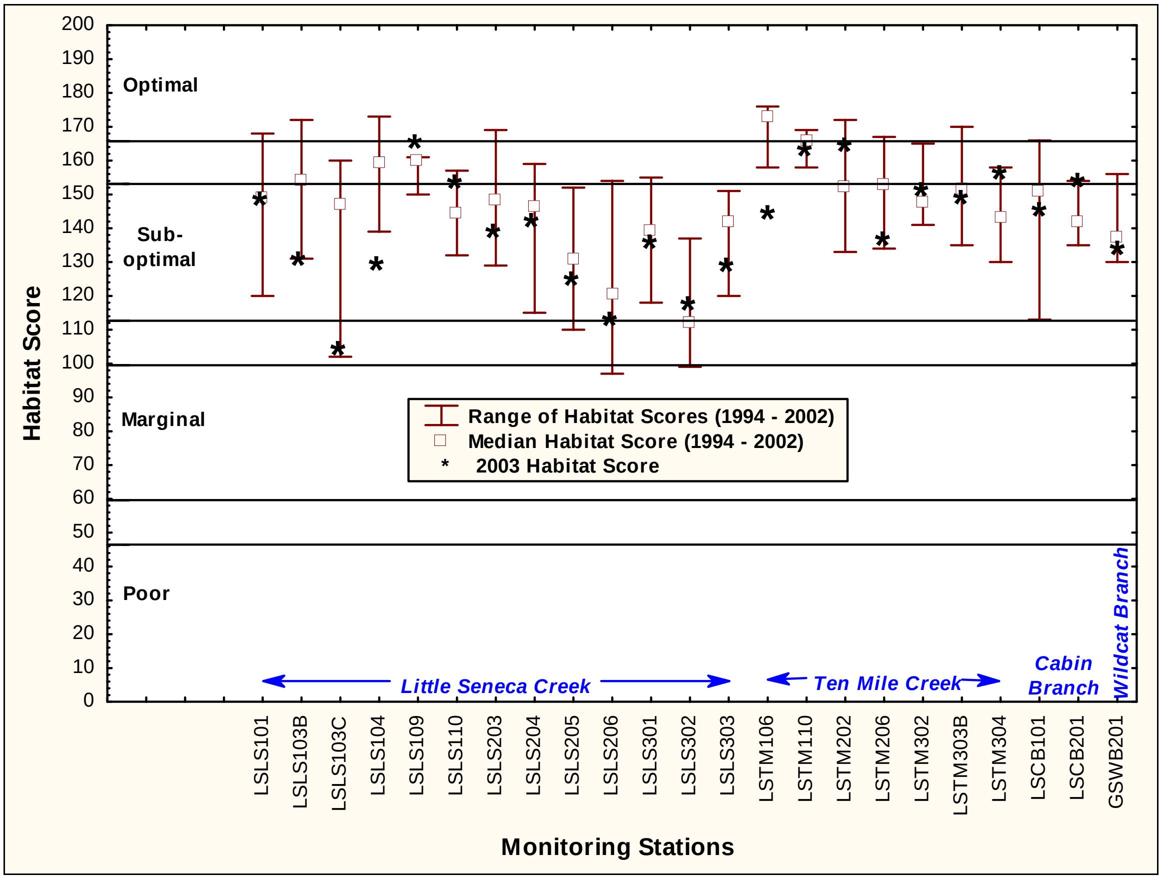

Figure 14 Rapid Habitat Scores From Clarksburg SPA

4.1.4.c Stream Temperature Monitoring

Clarksburg Town Center Tributary

Continuously recording temperature loggers were deployed at LSLS103C and LSLS103B during the summer of 2003. Results, presented in Figure 15, show water temperature remained below the 75^0F criteria for Use IV streams at both locations. However, several sudden spikes in temperature were very close. All temperature spikes correspond with short intense rain events. Sediment ponds on the Town Center construction project are the likely source of these temperature spikes. If enough water runs off the site into a sediment pond, water elevation in the pond reaches the weir crest on the riser and essentially free flows out of the pond. Depending on the length of the storm this can send a short pulse of warm pond water downstream.

Temperature spikes were more pronounced at LSLS103C because this station is closer to the sediment ponds. Further downstream at LSLS103B the spikes were ‘dampened’ by additional cool water input from several small tributaries.

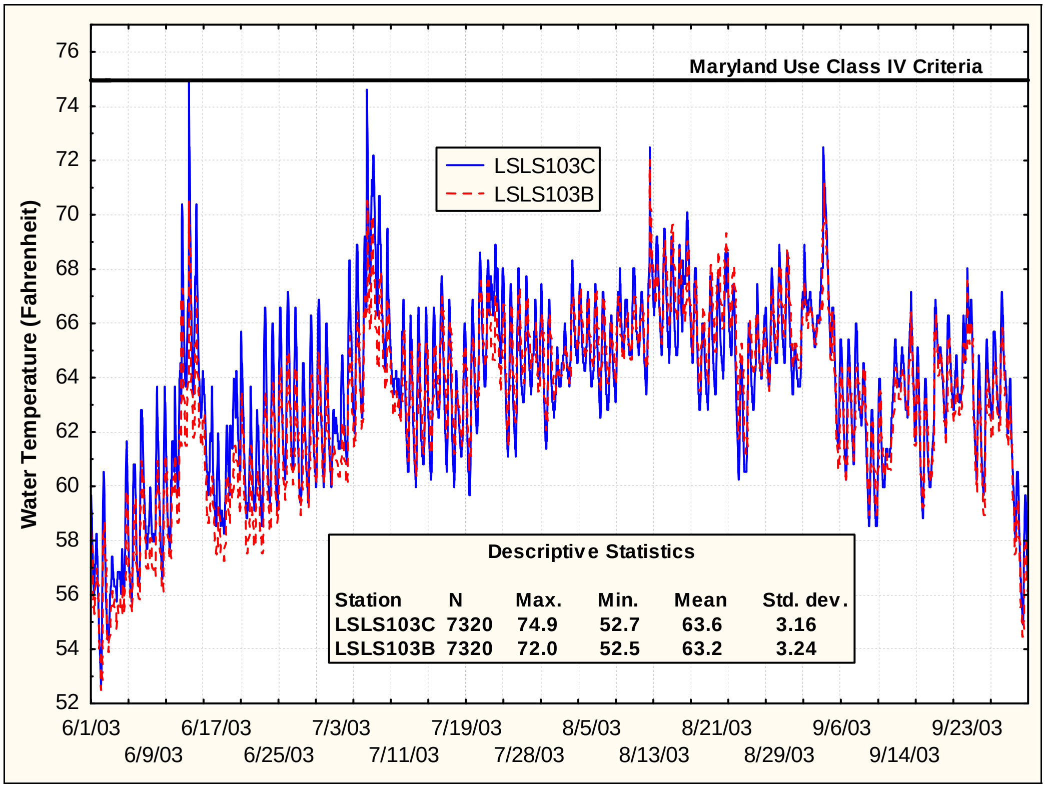

Figure 15 Water temperature data from the Town Center Tributary

Results from 2003 are summarized in Table 5 along with all previous years from LSLS103C. Water temperature data from 1997 and 1998 were collected before construction activity began at the Town Center and are used to establish baseline stream water temperature conditions. The first sediment control pond was constructed on the Town Center property in August of 1999. Data collected between 2000 and 2003 represent the during-construction period. There does appear to be some thermal impact from the new sediment control ponds, particularly regarding maximum water temperatures. Maximum stream temperature is greater during all years that sediment ponds were present. It should be noted that while this is an undesirable impact, sediment ponds function very well at trapping and retaining sediment on-site. Without them, large amounts of sediment would enter the stream.

Table 5 Summary of continuous water temperature data from station LSLS103C (study period for each year is June 1 – Sept. 30). Shaded portion of the table represents during-construction years and the unshaded portion, are pre-construction years.

Year	Number of Observations	Maximum (Fahrenheit)	Mean (Fahrenheit)	Standard Deviation	Percent of Time 75^0 F Criteria Was Exceeded	Mean Air Temp. (F) *
1997	7320	71.7	61.7	3.69	0 %	72.9
1998	3196	71.7	64.1	3.36	0 %	74.0
2000	7320	74.1	64.9	3.88	0 %	70.6
2001	7320	73.1	63.1	3.96	0 %	72.3
2002	6660	72.8	64.8	3.43	0 %	76.0
2003	7320	74.9	63.6	3.16	0 %	72.3

* Air temperature data from Damascus, MD

Tributary 104

Tributary 104 is a small stream that flows parallel with the Town Center Tributary to the east. It originates near the intersection of Piedmont and Skylark Rd. and flows south between two large development tracts (Greenway Village and Clarksburg Village). Because of the high intensity development that has already begun construction in this small sub-watershed, it was selected by the county to monitor the effectiveness of Maryland's new stormwater regulations. This monitoring will include biology, geomorphology surveys of the stream channel, stream flow and some water quality.

A temperature logger was placed in the lower portion of this tributary at LSLS104. Results show water temperature remained below the Use Class IV criteria of 75^0 F throughout the summer of 2003. However, like results from the Town Center tributary there are several brief temperature spikes that occurred. Comparing results from 2003 with 1998 makes it apparent that these temperature spikes are a new phenomenon (Figure 16). Sediment ponds on construction phases I and II of the Greenway Village are the likely source of temperature spikes.

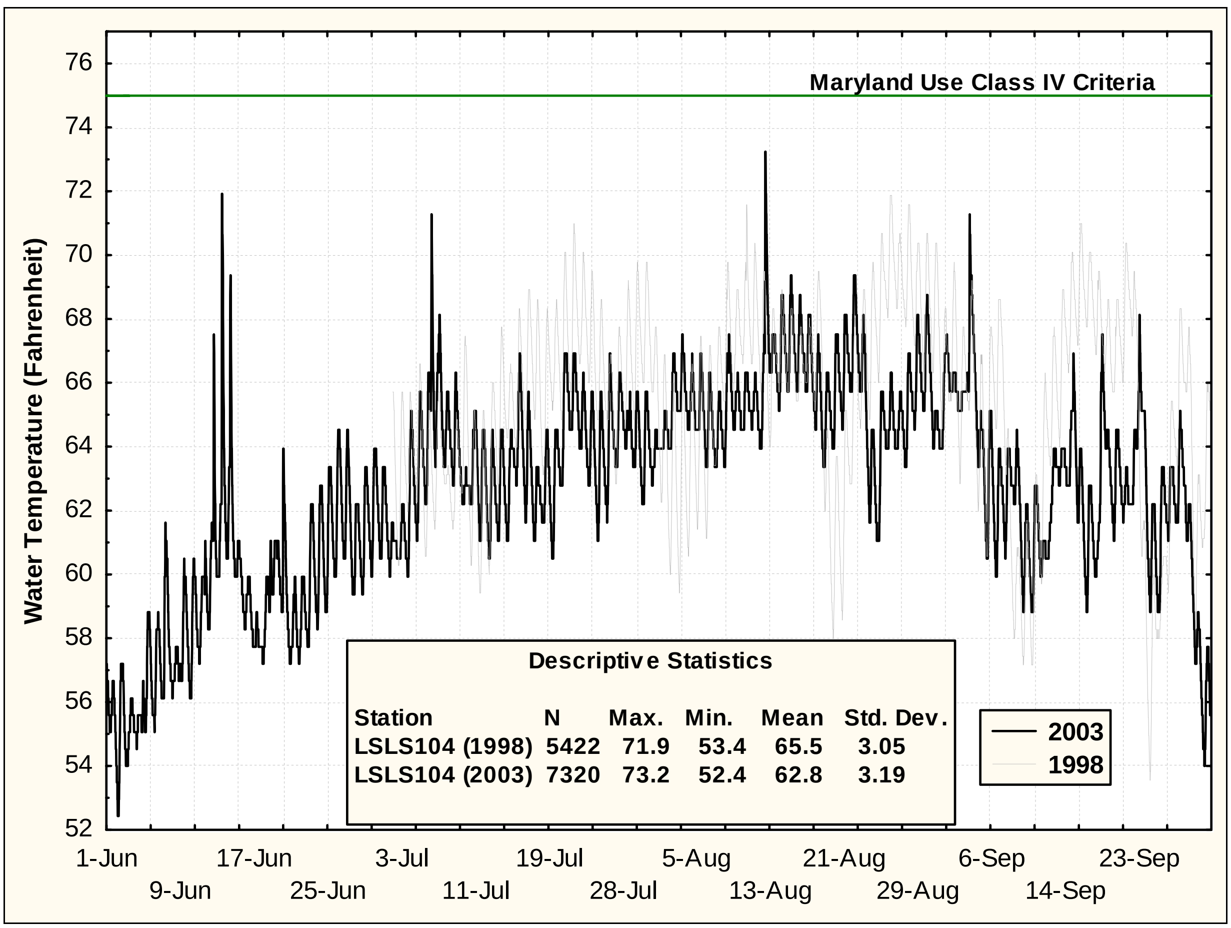

Figure 16 Stream temperature data from monitoring station LSLS104

I-270 Tributary

The I-270 tributary originates in the Gateway 270 Industrial Park, flows under and then parallel with I-270 to the west. Monitoring station LSLS101 is located downstream of West Old Baltimore road. Results from a temperature logger placed at LSLS101 show stream temperature remained below the Use Class IV criteria of 75^0 F throughout the summer of 2003 (Figure 17).

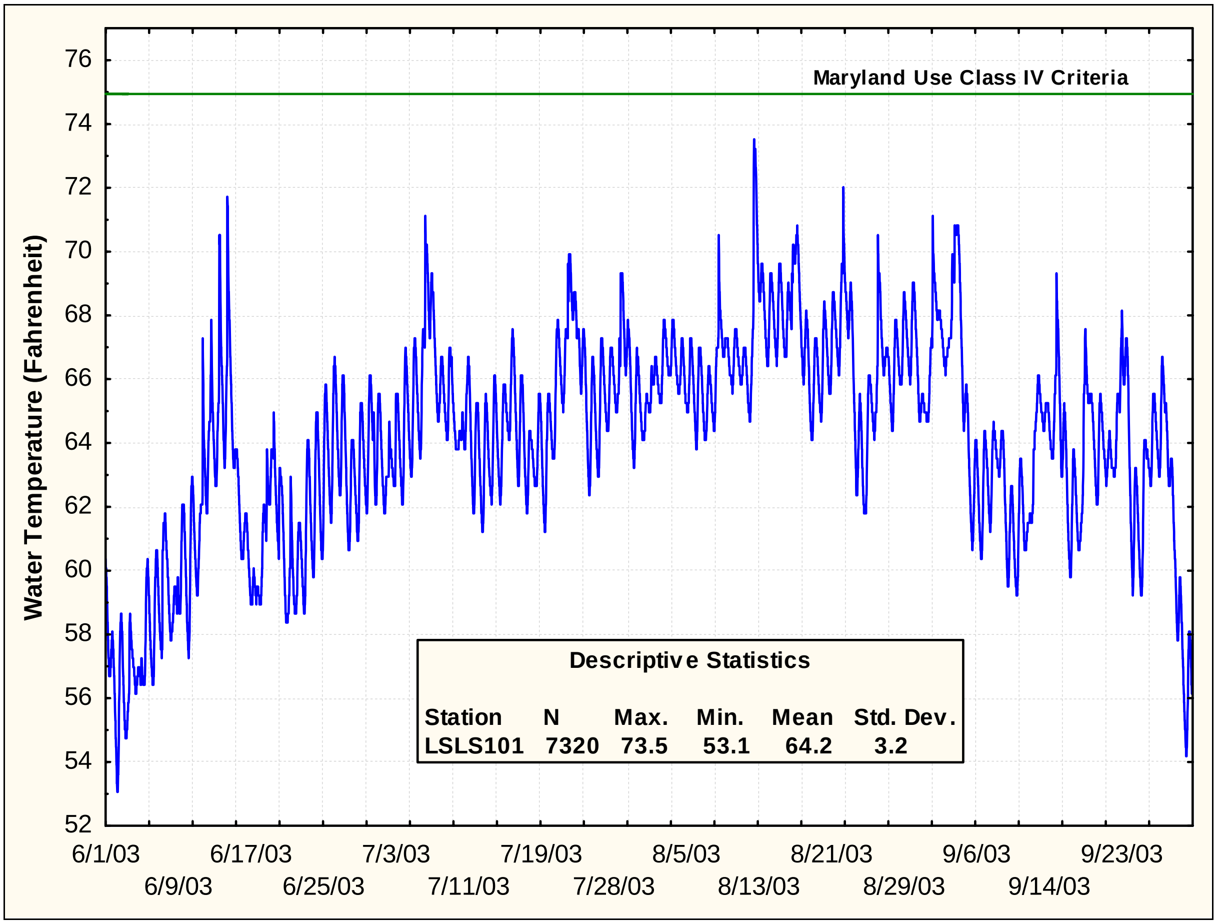

Figure 17 Stream temperature data from LSLS101

Cabin Branch

Data from a temperature logger placed in Cabin Branch at LSCB201 during the summer of 1998 show water temperature generally remaining below the Maryland Use Class III criteria of 68^0 F. During the summer of 2003 water temperature again was generally below the Use Class III criteria (Figure 18). Although this stream is designated by Maryland as Use Class I, water temperature is clearly well below Class I criteria of 90^0 F. Maintaining these low water temperatures is very important in preserving the biological health of Cabin Branch and is a performance goal on the Cabin Branch Neighborhood development.

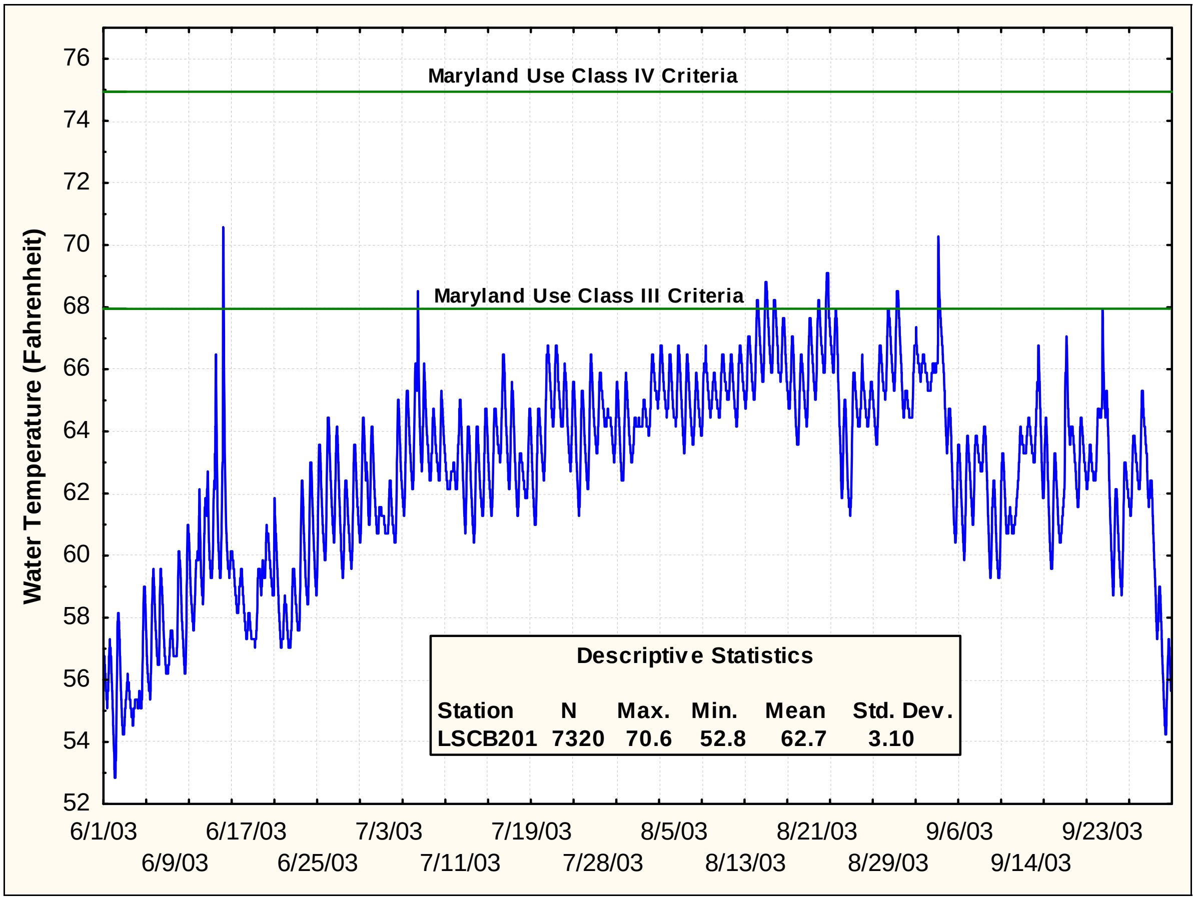

Figure 18 2002 Temperature Data from Cabin Branch – LSCB201

Interestingly, temperature spikes occur on some of the same dates that they appear in Town Center Tributary and LSLS104. The spikes in Cabin Branch were not as high or as numerous as these other two areas. The source in Cabin Branch may have been late afternoon storm runoff from the heated surface of West Old Baltimore Road.

Ten Mile Creek

Temperature loggers were deployed at two locations in the Ten Mile Creek watershed during 2003. One at station LSTM303B, located just upstream of West Old Baltimore Rd., and the other at a new monitoring station, LSTM112, located on a small tributary that flows under West Old Baltimore Road near the intersection with Ten Mile Creek Road.

Results from LSTM303B show stream temperature remained below the Maryland Use Class IV criteria throughout the summer of 2003 (Figure 19). Mean water temperature was higher then any other area in the Clarksburg SPA. This is likely due to differences in stream channel characteristics between Ten Mile Creek and Little Seneca Creek. In Ten Mile Creek the stream channel tends to be wide and shallow. This allows the stream to warm up more as there is greater exposure to warm ambient air temperatures.

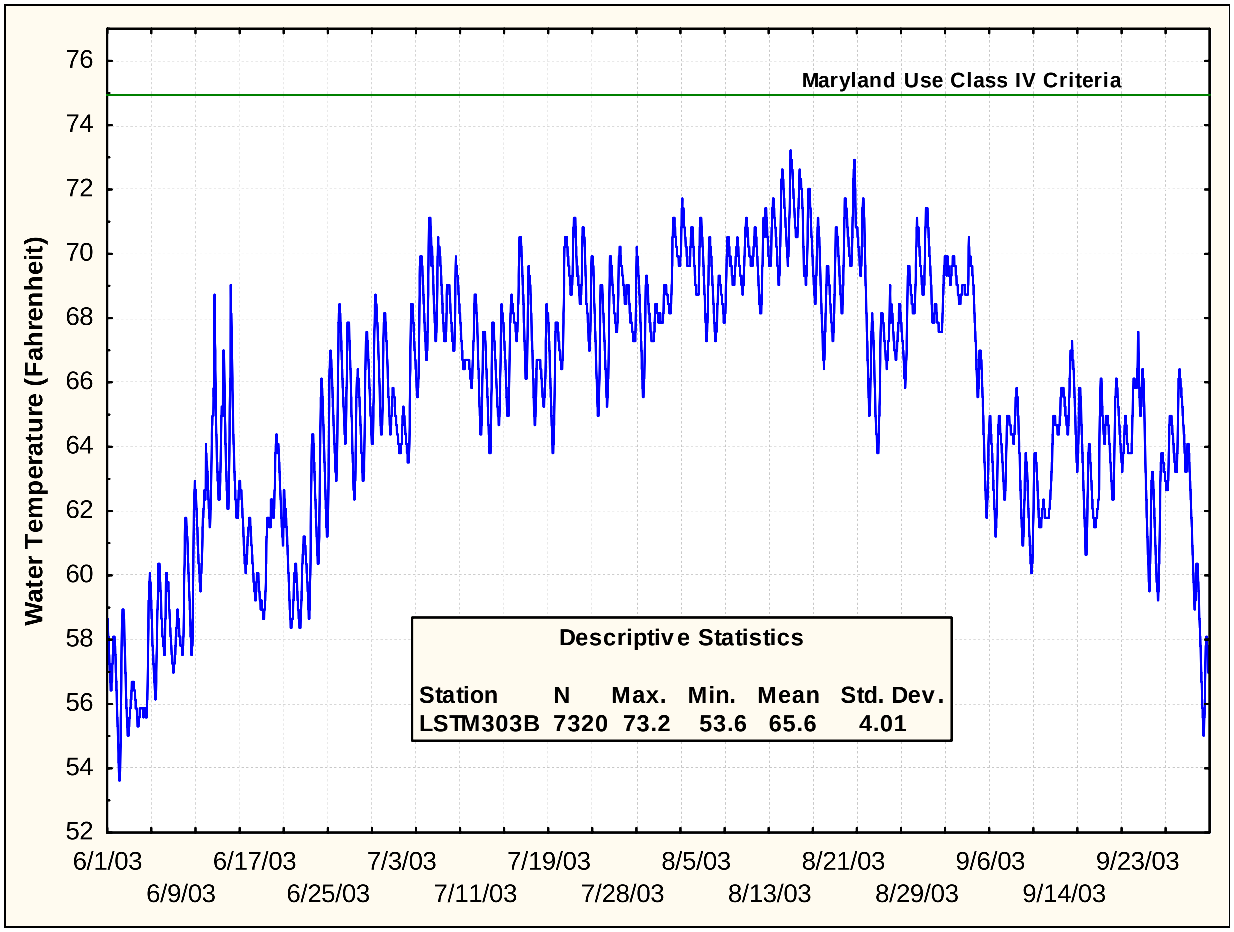

Figure 19 Stream temperature data from Ten Mile Creek - mainstem

Results from LSTM112 show water temperature was cooler then most other areas in the Clarksburg SPA (Figure 20). 2003 is the first year data was collected from this fairly large tributary to Ten Mile Creek. Benthic Macroinvertebrate sampling revealed good biological condition. Monitoring results from 2003 help establish baseline conditions before this small subwatershed develops in the future.

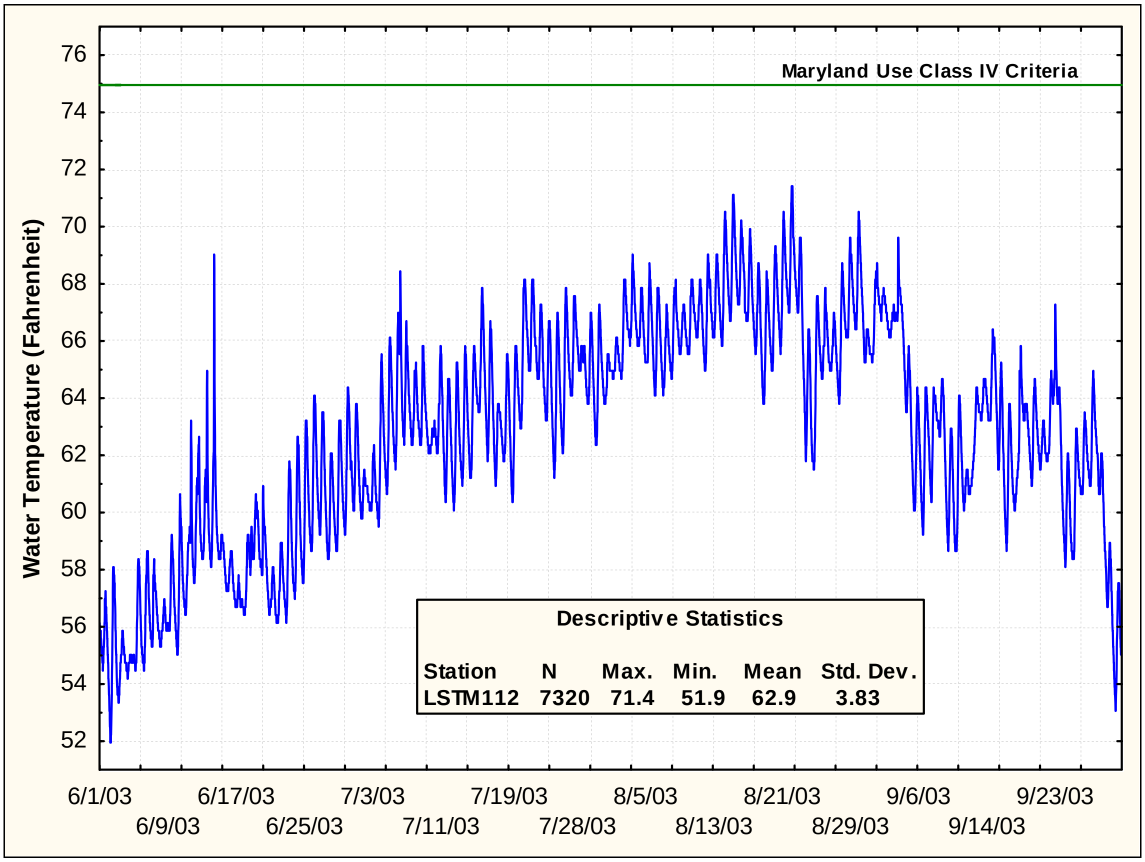

Figure 20 Stream temperature data from Ten Mile Creek – tributary

4.1.4.d Development Impact Study

A cooperative study to evaluate the impacts of development and BMPs, and the usefulness of LIDAR (LIght Detection And Ranging) as a monitoring tool for quickly collecting large amounts of very accurate data on surface elevations, was initiated during 2002. Participating federal and local agencies include the U.S. Geological Survey, EPA, USFWS, M-NCPPC, Montgomery County DEP and the University of Maryland.

One goal of the project is to evaluate the degree to which LIDAR can be used to monitor changes in stream channels and other environmental features. It is uncertain how well this technology will work in this new application. If LIDAR is accurate enough, there are many possible ways that the data could be used. Topographic maps showing stream channel shapes, locations of erosion, sediment deposition and vegetation coverage are among the numerous potential mapping products that might result. From that data additional products could possibly emerge including calculations of the amounts of sediment deposited in stream channels, and eroded from them. LIDAR may have a big impact on our ability to document stream channel characteristics. It is currently only practical to accurately survey very small sections of stream channel at widely spaced sample sites while LIDAR might be able to produce accurate images of entire watersheds. We hope that LIDAR will allow us to gain a much clearer idea of how stream channels are behaving over time and reacting to development impacts although it is uncertain how well this experimental application will work.

LIDAR data was collected over the area delineated in Figure 21 which includes most of the Clarksburg SPA. The area to the north, Sopers Branch - a tributary to Little Bennett Creek, was included as a positive control (ie, minimal land disturbance).

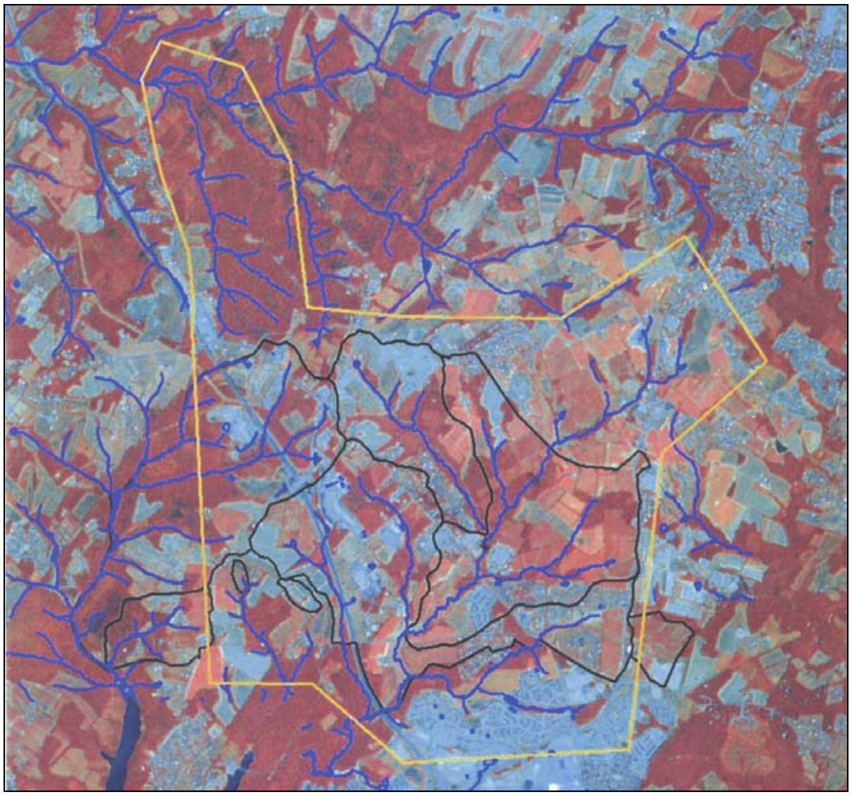

Figure 21 Area from which LIDAR data was collected in Dec. 2002, includes all of Little Seneca Creek watershed (upstream of I 270), a portion of Little Bennett Creek water shed (Sopers Branch) to the north and a portion of Ten Mile Creek to the west.

To complement the LIDAR data, the USGS and DEP have cooperated to install five flow gages in Clarksburg SPA tributaries. The USGS and DEP are to cooperatively operate these gages. This collaboration will give DEP access to the expertise of the USGS in collecting and analyzing information on stream flow. It will also provide DEP access to additional technological capabilities, including real-time data dissemination, which we have not had in the past.

4.2 Upper Paint Branch Special Protection Area

4.2.1 SPA Designation History for the Upper Paint Branch SPA

The Paint Branch watershed, upstream of I-495, is designated as a Use III naturally reproducing trout stream. Long term biological and habitat monitoring results indicate that certain portions of the watershed experienced considerable stress from prior land development activities. To help better protect this watershed and its unique urban cold water natural resource, the County Council designated the Upper Paint Branch watershed (above Fairland Road) a Special Protection Area on July 11, 1995. Complementing this designation, as part of an environmental overlay zone, is a requirement for a ten percent impervious area cap on all new development in the SPA portion of the watershed (originally recommended by the 1981 Eastern Montgomery County Master Plan). The ten percent limit only applies to new development. Additions to existing homes are exempt. Upper Paint Branch and Upper Rock Creek are the only SPA's which have specific limits on site imperviousness for land development.

The SPA requirements, criteria, and guidelines are applied to all proposed land-disturbing activities. Unlike the other SPA's, there are no exemptions from SPA provisions related to plan review because of a proposed project's small size or land use. However, if an applicant requests a waiver, and a hardship condition is determined, the Planning Board or DPS, as applicable, may waive any or all of the SPA requirements, criteria, and guidelines for a project as a part of the water quality plan review and approval. Although not exempted from all SPA requirements, some projects are not required to conduct BMP monitoring if their small size or distance from a stream makes monitoring impractical.

To provide additional environmental protection, the County Council approved an environmental overlay zone for the Upper Paint Branch SPA in July, 1997. The overlay zone establishes the ten percent site cap on the allowable imperviousness area for new development projects, prohibits certain land uses, requires special land management practices for certain special exceptions, and establishes very limited provisions for grandfathering, exempting, and waiving specific, existing uses from the site imperviousness cap.

M–NCPPC, through the purchase of large land areas, has allocated a significant amount of capital investment in the Upper Paint Branch SPA. Additional land has been acquired through dedication as part of subdivision plans for new land development projects. Large forested parklands are functioning well as stream buffer areas to protect stream habitat and water quality in the Good Hope sub-watershed.

DEP is also pursuing capital project initiatives in the Upper Paint Branch SPA to improve the management of runoff from previously developed areas and mitigate areas of habitat damage caused by development impacts that occurred before the SPA program was established. These projects are intended to supplement improvements in watershed management achieved through the SPA permit process. DEP, with M-NCPPC and other agencies, have worked closely to inventory 75 potential stream habitat restoration, wetlands creation, and stormwater retrofit project opportunities. Some of these are capital projects. Others involve small habitat restoration, wetlands creation and tree planting that can be partially implemented by volunteers. As of August 2003, a total of nine watershed restoration projects have been completed in the

Paint Branch SPA. Eight projects are in the Good Hope subwatershed and one is in the Gum Springs subwatershed. Another six projects are under design, one in the Good Hope subwatershed, three in the Gum Springs subwatershed, one in the Right Fork subwatershed and one in the Left Fork subwatershed. One project in the Right Fork, previously under design, has been placed on hold due to property acquisition issues.

Additionally, downstream of the Special Protection Area, 2.25 miles of stream restoration has been completed on the Paint Branch mainstem between Fairland Road and Route 29. Stream restoration along this stretch of Paint Branch included: bank stabilization, tree planting, lunkers and woody debris placement (for fish habitat), grade control and channel relocation to protect an historical site. Restoration is expected to significantly improve habitat support for brown trout and other species. One year after project completion, field evaluations of this restoration work were completed in July of 2003 and indicate that much of this restoration has held up well and is functioning as designed. Field evaluations will be made in years three and five after project completion as well. DEP has also initiated a new watershed study, primarily for the Lower Paint Branch, which will also include some further evaluation on additional projects to increase stormwater control within the SPA.

4.2.2 Description of the Watershed Within the Upper Paint Branch SPA

Paint Branch is recognized as a unique County resource due to its ability to support a naturally reproducing trout population in a suburban setting. The Upper Paint Branch SPA encompasses the entire watershed above Fairland Road (Figure 22). For management purposes the watershed is divided into five (5) subwatersheds; the Left Fork, the Right Fork, Gum Springs tributary, Good Hope tributary, and the Paint Branch mainstem.

Numerous studies have generally found that the Good Hope tributary is the primary trout spawning and nursery area for the Paint Branch system. This tributary consistently produces the highest percentage of young-of-year trout within the entire Paint Branch watershed. Gum Springs and the Right Fork subwatersheds supply water of excellent quality and also provide trout spawning habitat. Similarly, the Left Fork provides high water quality and acceptable habitat for trout, but is not consistently used as a spawning and nursery area. Each of these subwatersheds is important in maintaining the water quality, in-stream habitat and overall ecological health within the Paint Branch mainstem.

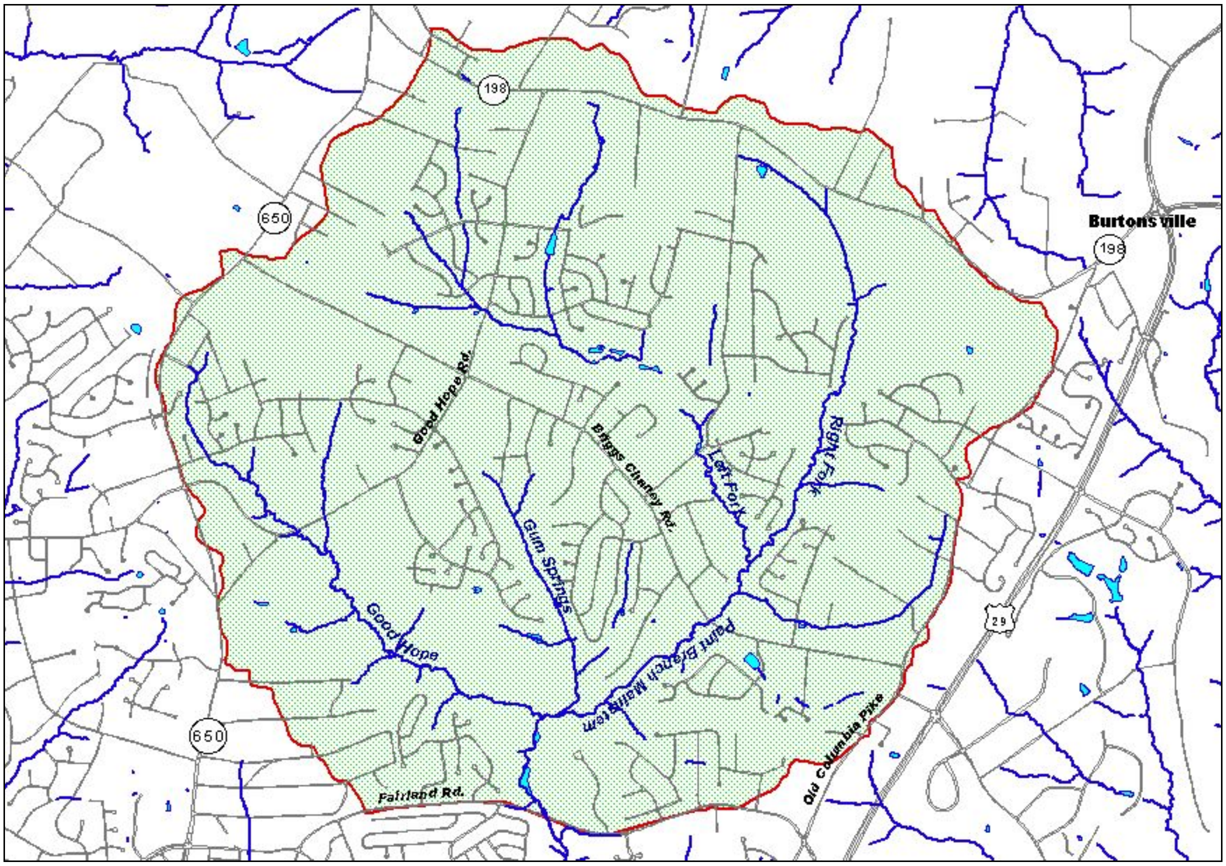

Figure 22 Paint Branch Special Protection Area

4.2.3 Status of Development in the Upper Paint Branch SPA as of April 2004

There are many land development projects that have been approved under the requirements of the SPA Law in the Upper Paint Branch that have been for small (1 to 5 acre) residential subdivisions. However, since there are no exemptions for smaller subdivisions in this SPA, each development must fully comply with the SPA regulations. This trend has been generally consistent since the SPA was implemented. There have also been larger subdivisions and projects (residential, commercial, institutional) which have been approved and are in various stages of the land development process**:** Hunt Property-Lions Den (78.7 acres, under construction), Briarcliff Manor West (58.15 acres, substantially complete) and Hunt Property-Miles Tract (48.2 acres, under construction) Cloverly Safeway, Snider's Estates**,** that are being closely monitored to determine their effect on the watershed. Many, but not all, of these subdivisions are located within the drainage area for the Right Fork of the Upper Paint Branch watershed.

Again this year, many of the building permits that have been issued were for individual houses on existing recorded lots. Development of lots that were recorded before October 31, 1994 are not subject to the SPA regulations. These developments however, are reviewed for conformance to the ten percent imperviousness cap that is mandated by the environmental overlay zone and encompasses the entire SPA portion of the Paint Branch watershed. To comply with the overlay zone requirements, DPS requires proof that each application for a building permit that is not required to get Planning Board approval will not exceed the impervious cap. Of all the lots that were not subject to SPA regulations but that were reviewed by DPS for conformance with the impervious cap, only one single-family lot was granted a waiver due to hardship.

The ten percent site imperviousness cap is also an important part of development projects that require Planning Board approval. Imperviousness limits set as part of a Planning Board approval of a project are enforced through a written agreement between the Board and the applicant**,** followed by detailed review of site grading plans, building permit applications, and as-built plans. In 2003**,** of the projects that have obtained Planning Board approval (and Planning Board and DPS approval of the water quality plans), there were no impervious cap waivers granted. For information on projects that were previously granted waivers of the 10 percent impervious cap by the Planning Board, please see the previous annual reports that are available on line at http://www.askdep.com

Development projects that have been approved by the Planning Board incorporate forest preservation, aforestation/reforestation areas and protection of environmental buffers. Environmental buffer areas are wider on land development projects within the SPA, compared to outside the SPA. Non-forested buffers are required to be planted in forest as part of the land development project, even if the plantings exceed the minimum required under the County Forest Conservation Law.

Some of these projects involve the dedication of parkland to provide additional protection for environmentally sensitive areas. These new areas of parkland dedication are consistent with the park recommendations of the Cloverly Master Plan, Fairland Master Plan, and the 1995 Limited Amendment to the 1981 Eastern Montgomery County Master Plan. Almost 400 acres of land have been added to the M-NCPPC Upper Paint Branch park system as conservation or stream valley parks since the creation of the SPA. Currently, over 35 acres of conservation easements are in place on private land within the SPA.

Table 6. Upper Paint Branch SPA Development Projects (1995 to April 2004)

PROJECT NAME	SPA LOCATION	DEVELOPMENT SIZE, TYPE	STATUS
Allnutt/Peach Orchard Estates	Right Fork Tributary	141 acres, 130 lots, RE-1 cluster option adjoining 2 subdivisions were concurrently reviewed. Includes parkland dedication.	Preliminary and final water quality plans approved. Project construction started; however, site is now owned by SHA due to its location in an alternative ICC route.
Bailey Thompson Property	Left Fork Tributary	9.8 acres, RE-1 cluster option, proposed 5 lots includes parkland dedication and acquisition.	Construction nearing completion.
Briarcliff Manor West (Baldi Property)	Right Fork Tributary	58.15 acres, 56 lots proposed	As-built plans approved.
Briarcliff Meadows North	Left Fork Tributary	RE-1 cluster, 11.6 acres.	Preliminary/final water quality plan under review.
Briarcliff Meadows South	Left Fork Tributary	RE-1 cluster, 9.4 acres.	Preliminary/final water quality plan under review.
Briggs Chaney Road/Old Columbia Pike Intersection improvements	Right Fork Tributary	1 acre	Preliminary and final water quality plans approved. Sediment control approved. Under construction.
Calvin Williams Subdivision	Good Hope Tributary	1 lot	No plan of subdivision. Sediment control permit issued. Overlay zone requirements conditionally waived due to long driveway created by flag lot. Onsite stormwater management to be provided.
Camp Property	Good Hope Tributary	5.7 acres, RE-2C, 2 lots.	Preliminary/Final water quality plan approved. Under construction.
Carlton Subdivision (Rose Property)	Right Fork Tributary	2.9 acres, R-200	Preliminary/Final water quality plan approved.

Table 6. (continued)

PROJECT NAME	SPA LOCATION	DEVELOPMENT SIZE, TYPE	STATUS
Cedar Ridge Community Church (Spencer Farm)	Right Fork Tributary	12.3 acres, Proposed church	Construction complete. As-built under review.
Cloverly Safeway	Good Hope Tributary	2.6 acres, C-1 Renovation	Construction complete.
Cloverly Town Center	Good Hope Tributary	3.13 acres, C-1 (0.57 acres in SPA)	Under construction.
Colesville Heights	Left Fork Tributary	0.5 acres, RE-1, 1 lot	Preliminary and final water quality plans approved. Sediment control permit issued.
Davila Residence, Ethel Lee Pell property	Left Fork Tributary	2.0 acres, RE-1 1 lot	No plan of subdivision. Meets overlay zone requirements. Construction complete.
Drayton Farms (Parr's Ridge)	Left Fork Tributary	63.5 acres, RE-1 cluster option	Construction complete. As-built approved.
Fairland Acres	Upper Paint Branch Mainstem	3.7 acres,R-200	Construction complete.
Fairland – County Community Center	Right Fork Tributary	9.8 acres	Construction complete.
Fairland Gardens	Right Fork Tributary	1.0 acre, one lot.	Preliminary / final water quality plans approved.
Fairland Gardens	Right Fork Tributary	5.9 acres, R-200, 5 lots previously approved, with 3 new lots proposed)	Construction is substantially complete. Awaiting as-built.
Fairland Gardens Pond Retrofit	Right Fork Tributary	1.6 acres	Sediment control permit pending.
Fairland Heights	Right Fork Tributary	0.56 acres, R-200	Preliminary/final water quality plan approved.
Fairland, Freedman's addition	Upper Paint Branch, Mainstem	1 lot	No plan of subdivision. Sediment control permit issued. Overlay zone requirements met.
Franklin Property-Miles Tract	Right Fork Tributary	1.75 acres, R-200, 2 Lots.	Preliminary/final water quality plan approved.

Table 6. (continued)

PROJECT NAME	SPA LOCATION	DEVELOPMENT SIZE, TYPE	STATUS
Good Hope Community Center	Good Hope Tributary	0.2 acres, spray park (modification to existing community center)	Preliminary / final water quality plans approved. Construction complete.
Good Hope Estates	Left Fork Tributary	3.9 acres, RE-1 3 lots	One lot complete, second new lot has not yet started construction.
Good Hope Union United Methodist Church	Good Hope Tributary	7.7 acres, new church	Construction complete. As-built approved. Currently building a small addition.
Great Hope Homes	Good Hope Tributary	11.5 acre, new community center	Construction complete.
Gum Springs Stream Restoration	Gum Springs Tributary	1.0 acres	Sediment control permit pending.
Han Property	Right Fork Tributary	4.9 acres, R-200	Preliminary / final water quality plans approved. Under construction.
Harding Subdivision	Upper Paint Branch, Mainstem	2.6 acres, R-200	Preliminary/Final water quality plans approved.
Hardings Subdivision – Parcel 135	Upper Paint Branch Mainstem	1.0 acres, R-200	Preliminary / final water quality plans approved.
Harding's Subdivision, Lot 16	Upper Paint Branch, Mainstem	0.7 acre	Not a plan of subdivision. Sediment control permit issued. Overlay zone requirements waived with conditions due to lot setback requirements in an established neighborhood.
Hunt Property - Lions Den	Right Fork Tributary	78.7 acres, RE-1	Preliminary/ final water quality plans approved. Under Construction.
Hunt Property - Miles Tract	Right Fork Tributary	48.2 acres, PD-2	Preliminary/final water quality plan approved. Under construction.
Kaplan Property	Right Fork Tributary	2.17 acres, R-200, 2 lots	Preliminary and final water quality plans approved

Table 6. (continued)

PROJECT NAME	SPA LOCATION	DEVELOPMENT SIZE, TYPE	STATUS
LaRoe Property	Left Fork Tributary	14.4 acres, RE-1 (9.4 acres in SPA)	Preliminary water quality plan withdrawn. Property sold to SHA due to ICC alternative.
Lord Subdivision	Right Fork Tributary	1.16 acres, R-200, 3 lots proposed	Preliminary / final water quality plans approved.
Old Columbia Pike Pedestrian Improvements	Upper Paint Branch mainstem	0.75 acres, DPWT Roadway / Sidewalk improvements	Revised preliminary / final water quality plans approved.
Sines Property	Left Fork Tributary	2.5 acres, RE-1, 2 lots	Preliminary / final water quality plans approved. Under constuction.
Snowdens Manor, Enlarged P572	Good Hope Tributary	1.0 acre	No plan of subdivision. Sediment control permit issued. Overlay zone requirements met.
Spencerville Post Office	Right Fork Tributary	3.9 acres, RE-1 Proposed U.S. Post Office	Preliminary and final water quality plans approved. Construction completed.
Thompson Road Sidewalk	Left Fork Tributary	0.5 acres	Preliminary / final water quality plans approved. Construction completed.
Tofigh Property	Mainstem	1.8 acres, R-200	Preliminary / final water quality plans approved.
Snider’s Estates	Left Fork Tributary	8.1 acres, RE-1	Preliminary / final water quality plans approved. Under construction.

4.2.4 Summary of Stream Monitoring in the Paint Branch SPA

Stream monitoring in Paint Branch began in 1994 and has been done annually since. Presently there are fourteen fixed monitoring stations from which biological (fish and benthic macroinvertebrate), habitat, and water quality data are collected (Figure 23). During 2003 stream monitoring was conducted at thirteen monitoring stations. Benthic macroinvertebrate sampling was completed at all thirteen stations and fish were sampled from eight stations.

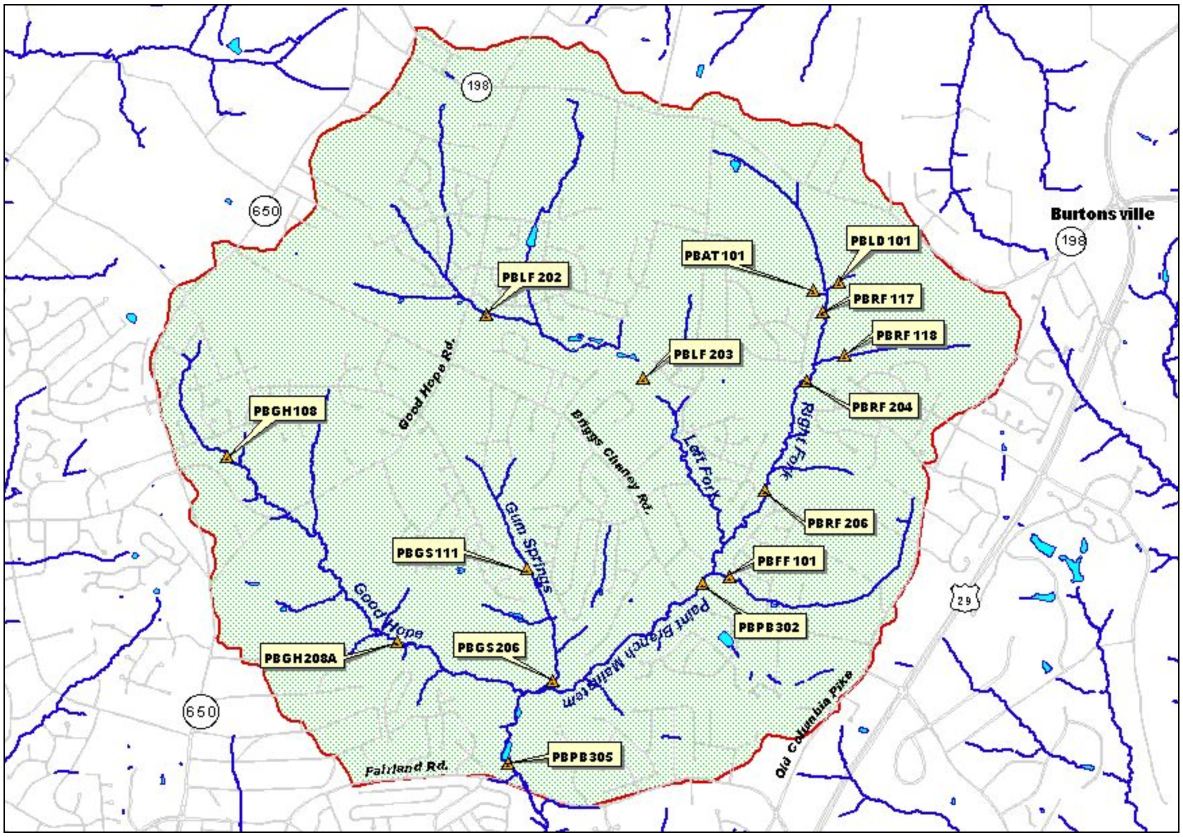

Figure 23 Paint Branch Special Protection Area - stream monitoring station locations

Quantitative habitat assessments were completed at ten monitoring stations during 2003. Stream channel cross section surveys were first done in 1997. Surveys completed in 2003 provide a seven year record of stream channel stability from various locations throughout Paint Branch.

Temperature loggers were deployed during the summer of 2003 in four areas, 1) upper Good Hope – upstream and downstream of the Piping Rock Road SWM pond 2) lower Good Hope 3) Right Fork and 4) Paint Branch mainstem at Fairland Road.

4.2.4.a Biological Monitoring Results

Results of fish sampling during 2003 show little change in overall community integrity. In other words, most fish species found during the first year of DEP's monitoring (1994) continue to thrive in Paint Branch. The exception is brown trout. 2003 results show brown trout continued to decline in number. In 1994 a total of 73 adult and 96 young-of-year brown trout were counted in samples from ten monitoring stations. In 2003, five adult and zero young-of-year brown trout were counted in samples from eight monitoring stations (Table 7).

Table 7 Brown Trout Data From Paint Branch SPA

Station		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
PBRF117 *(Right Fork)*	No. of Adult trout	1	N/S	0	2	6	N/S	0	0	0	0
	No. of YOY trout	0	N/S	2	9	5	N/S	0	2	0	0
PBRF204 *(Right Fork)*	No. of Adult trout	5	N/S	2	3	8	2	0	0	2	0
	No. of YOY trout	5	N/S	2	7	4	1	0	0	0	0
PBRF206 *(Right Fork)*	No. of Adult trout	N/S	N/S	N/S	N/S	2	N/S	0	0	N/S	N/S
	No. of YOY trout	N/S	N/S	N/S	N/S	3	N/S	0	0	N/S	N/S
PBLF202 *(Left Fork)*	No. of Adult trout	0	N/S	0	0	N/S	0	0	0	N/S	0
	No. of YOY trout	0	N/S	0	0	N/S	0	0	0	N/S	0
PBLF203 *(Left Fork)*	No. of Adult trout	2	N/S	0	0	N/S	0	0	0	N/S	0
	No. of YOY trout	0	N/S	1	0	N/S	0	0	0	N/S	0
PBGS111 *(GumSprings)*	No. of Adult trout	7	N/S	0	0	2	1	1	0	2	N/S
	No. of YOY trout	41	N/S	0	1	0	0	0	8	0	N/S
PBGS206 *(GumSprings)*	No. of Adult trout	10	2	4	0	2	N/S	0	0	1	1
	No. of YOY trout	21	0	0	2	1	N/S	0	21	1	0
PBGH108 *(Good Hope)*	No. of Adult trout	2	2	1	0	N/S	0	0	N/S	N/S	N/S
	No. of YOY trout	2	0	2	25	N/S	0	1	N/S	N/S	N/S
PBGH208A *(Good Hope)*	No. of Adult trout	25	17	16	15	10	14	3	6	3	3
	No. of YOY trout	21	0	0	18	10	18	8	12	7	0
PBPB302 *(Mainstem)*	No. of Adult trout	2	N/S	1	2	6	1	1	N/S	N/S	0
	No. of YOY trout	0	N/S	0	16	1	3	0	N/S	N/S	0
PBPB305 *(Mainstem)*	No. of Adult trout	19	8	0	3	N/S	N/S	2	0	N/S	1
	No. of YOY trout	6	0	0	5	N/S	N/S	0	8	N/S	0
TOTALS	No. of Adult trout	**73**	**29**	**24**	**25**	**36**	**18**	**7**	**6**	**8**	**5**
	No. of YOY trout	**96**	**0**	**7**	**83**	**24**	**22**	**9**	**51**	**8**	**0**

(N/S = Not Sampled) (YOY = Young-of-Year)

DEP attributes this decline primarily to severe drought conditions and associated impacts to the stream including reduced stream flow and habitat availability, elevated water temperature and low dissolved oxygen content. Drought conditions occurred during the summer of 1999 and the spring/summer of 2002. Numbers of brown trout dropped off in 2000 reflecting stressful stream conditions during 1999. Monitoring results from 2001 showed higher numbers of young-of-year trout reflecting improved stream flow conditions during 2000. During the spring and summer of 2002 severe drought conditions returned. A nearby groundwater well operated by the USGS since the 1940's indicated groundwater levels reached record lows during the summer of 2002. The drought of 2002 had greater impacts on groundwater then the 1999 drought. Impacts to the stream were at least as bad in 2002 as 1999 and probably worse. Monitoring results from 2003 reflect these stressful conditions as the number of brown trout reached new lows. Preliminary results from 2004 show that improved flow conditions during 2003 have helped in the recovery of brown trout as higher numbers have been observed.

The rest of the fish community also exhibited some response to drought conditions, mostly by reduced numbers of individuals. However, the diversity of the community (number of species, i.e. taxa richness) remained intact which is why IBI scores from 2003 are similar to previous years (Figure 24).

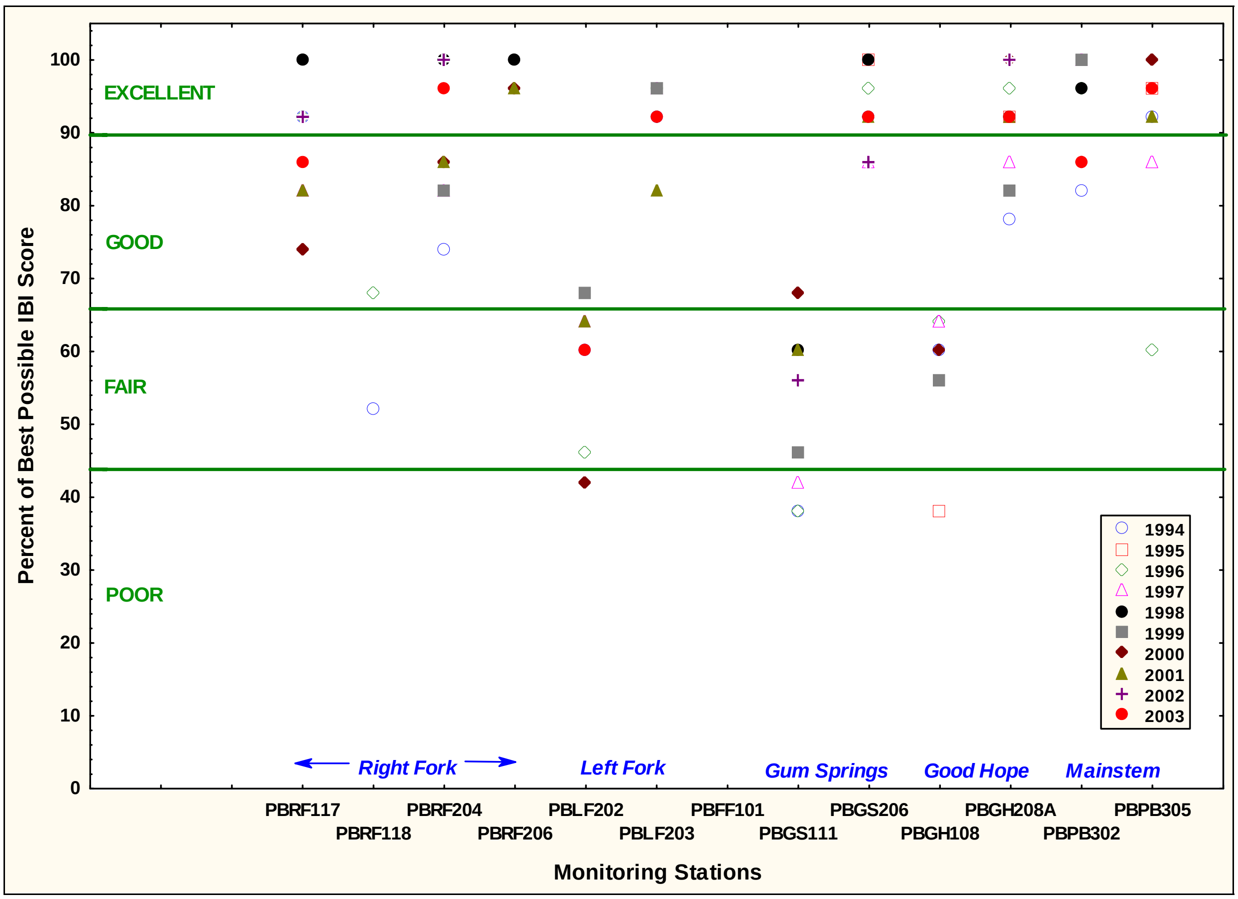

Figure 24 Fish Monitoring Results

Looking at fish IBI scores plotted over time shows how little the overall health of the fish community has changed during the period of 1994-2003 (Figure 25). Community health (as measured by IBI score) at three monitoring stations located in headwater areas of tributaries is not as good as the rest of Paint Branch simply because of the small stream size and habitat constraints in these areas.

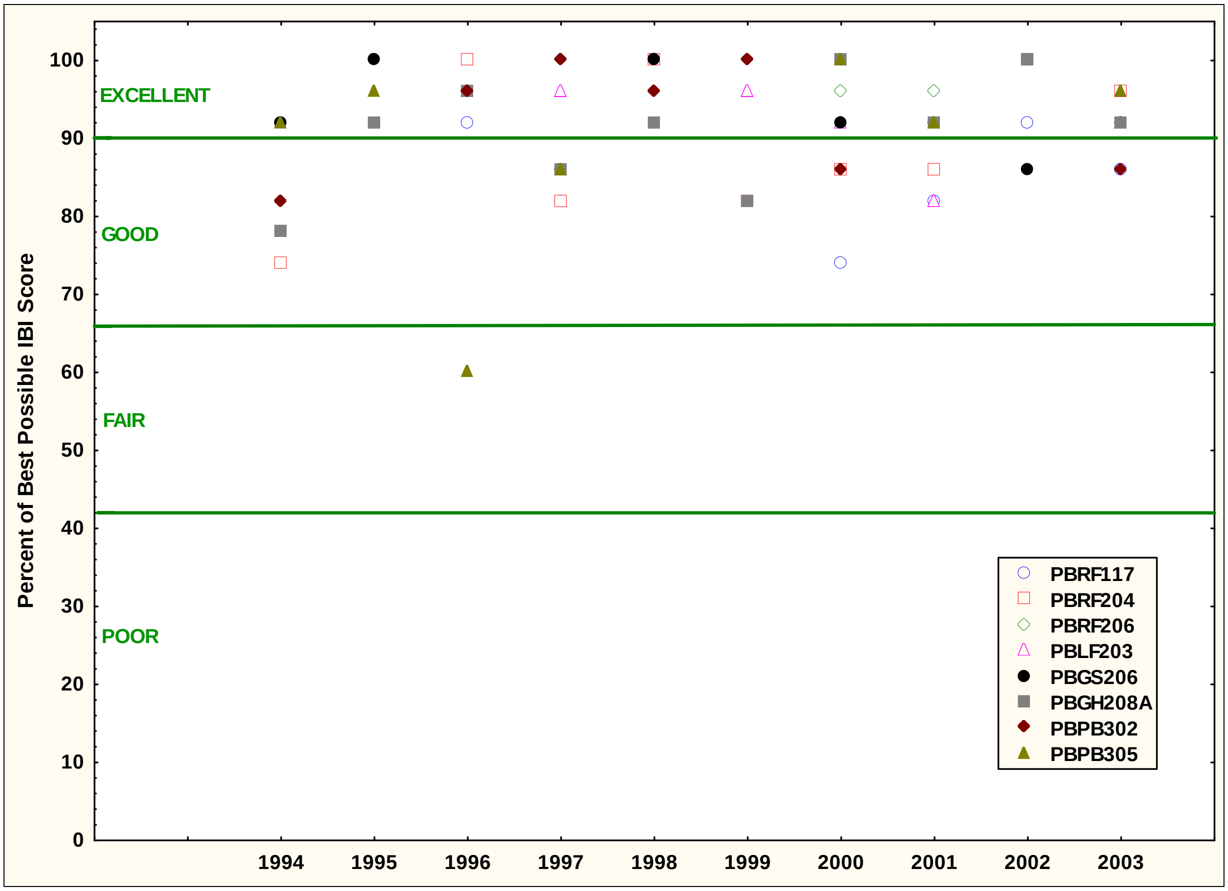

Figure 25 Time series plot of fish IBI scores - excluding monitoring stations located in the headwater areas of tributaries, ie. PBLF202, PBGS111 and PBGH108

Results of benthic macroinvertebrate sampling indicate that some impact to the community occurred between 2002 and 2003 at several monitoring stations. Although 2003 IBI scores were within the range of scores from previous years, many stations were near the lower end of that range (Figure 26) and one station (PBRF204) was lower then any other year. Results from this station, located in the Right Fork, are discussed further in the Right Fork section below. Lower than normal benthic IBI scores from 2003 throughout most of the Paint Branch SPA are likely a reflection of stressful drought conditions that occurred during 1999 and 2002.

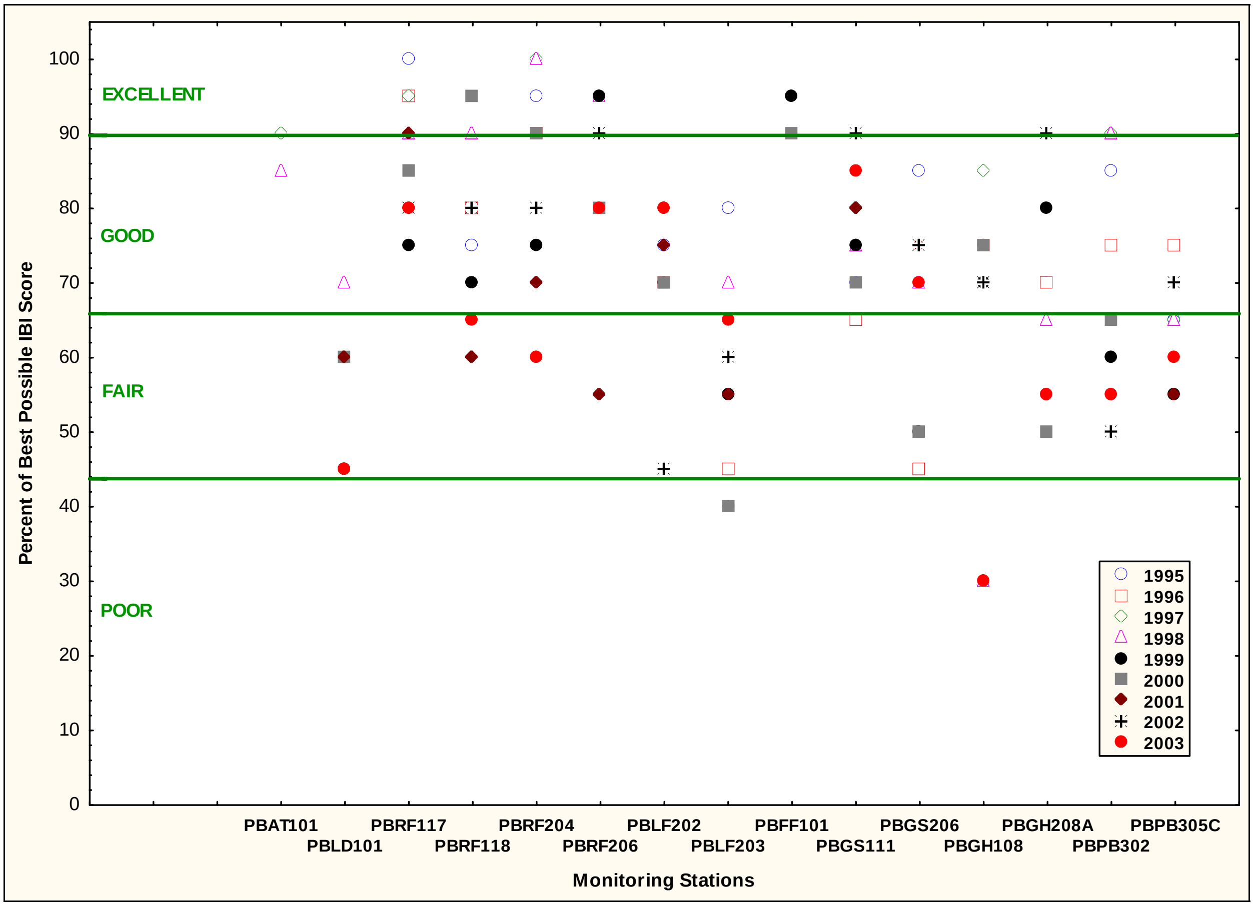

Figure 26 Benthic Macroinvertebrate Monitoring Results - All BIBI Scores

In the upper portion of the Good Hope tributary at station PBGH108 the benthic macroinvertebrate community experienced considerable impairment between 2002 and 2003. IBI score dropped 57 % from a good rating to poor in one year. This kind of abrupt decline in community health occurred before at this station in 1998 and has occurred elsewhere in the Paint Branch SPA. In each case community health recovered to previous condition on the following year. There are many possible causes of such short term, local impairment to the benthic macroinvertebrate community including: 1) someone pouring or spraying pesticides, insecticides or some other toxic substance in or near the stream or 2) some sort of local disturbance to the stream bottom from people or animals walking through the same area of stream from which the sample was collected. Construction of a new SWM pond upstream of PBGH108 at Piping Rock Road was completed in 2001. Concerns were expressed that this new pond may create a thermal impact to Good Hope. Results from temperature loggers deployed upstream and downstream of the new SWM pond during 2003 show no thermal impact, eliminating this as a possible cause of impairment to the benthic macroinvertebrate community in Good Hope. At this point the cause is unknown. This kind of short term variability is to be expected and will be reported. However, it is the long term degradation resulting in a permanent impaired condition that is of most concern.

The cause(s) of impairment in the upper portions of Good Hope may have also impacted the benthic macroinvertebrate community downstream at PBGH208A where the 2003 IBI score was considerably lower then the historic average (Figure 27). DEP will continue to monitor the biological health of the Good Hope in 2004 to determine if the impairment persists.

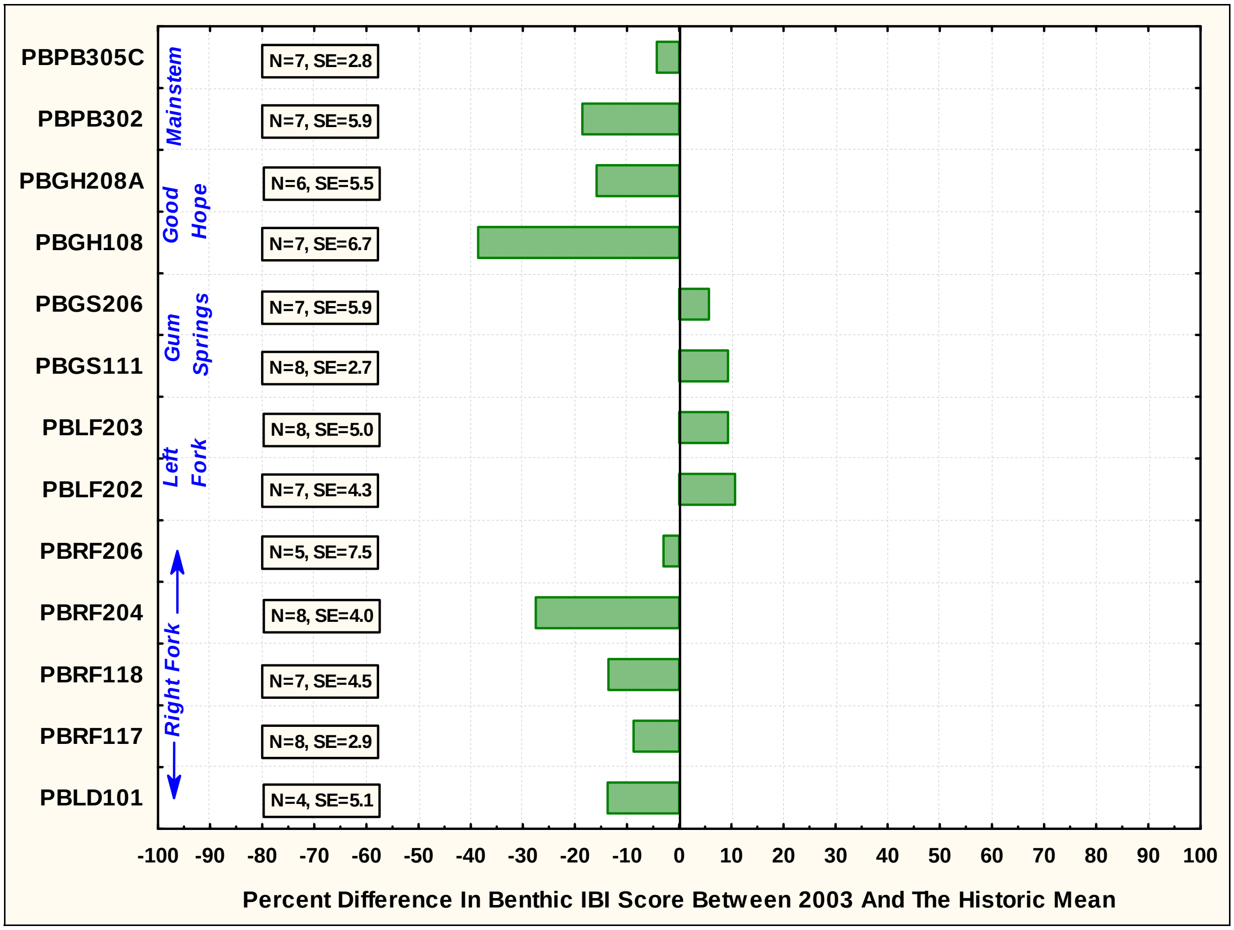

Figure 27 Departure of 2003 benthic IBI scores from the historic mean at each monitoring station. Bars extending into the negative portion of the graph indicate that benthic IBI Scores from 2003 are lower then the historic (1995 – 2002) average. The number of samples (N) and the standard error (SE) of the mean are also given.

Other areas in the Paint Branch SPA where benthic IBI scores from 2003 were considerably lower then the historic average are the Right Fork (discussed below) and PBPB302 located just upstream of Briggs Chaney crossing over the Paint Branch mainstem. Causes for impairment here may be related to stream habitat issues. Several large trees have fallen into the stream causing a debris jam which in turn traps bedload sediment resulting in a build up of sediment. The fallen tree and resulting debris jam has also destabilized the stream banks causing the stream channel to widen. These sudden changes in habitat condition may explain the lower benthic IBI scores at PBPB302.

Right Fork

Most of the land development in the Paint Branch SPA has occurred in the Right Fork sub-watershed. To date there are five development projects in the Right Fork (Table 8). Two projects are completed, two are still under construction and one was halted. All five of these development projects cover 36% of the total drainage area in the Right Fork sub-watershed.

Table 8 Development projects in the Right Fork Sub-watershed

Project	Acres	Date Construction Began	Date Construction Was Completed
Peach/Orchard Allnut *	141	May, 1997	
Fairland Comm. Center	10	June, 1999	March, 2002
Briarcliff Manor (West)	58	August, 1999	May, 2003
Hunt/Lions Den	79	January, 2002	currently under construction
Hunt – Miles Tract	48	April, 2003	currently under construction
TOTAL	**336**		
RIGHT FORK TOTAL	**941**		

* **purchased by the Maryland State Highway Administration as an ICC alternative**

Monitoring at three Right Fork stations (PBRF117, PBRF118 and PBRF204) began in 1995. Stations PBLD101 and PBRF206 were added in 1998 to provide results from points closer to development projects (Figure 28).

As reported in previous SPA annual reports biological monitoring results from the Right Fork sub-watershed suggest a decline in benthic macroinvertebrate community health has occurred. The decline is observed only in the benthic macroinvertebrate community and not the fish. Monitoring results from 2003 support this observation as IBI scores were lower than the historic mean at all five monitoring stations in the Right Fork (Figure 27).

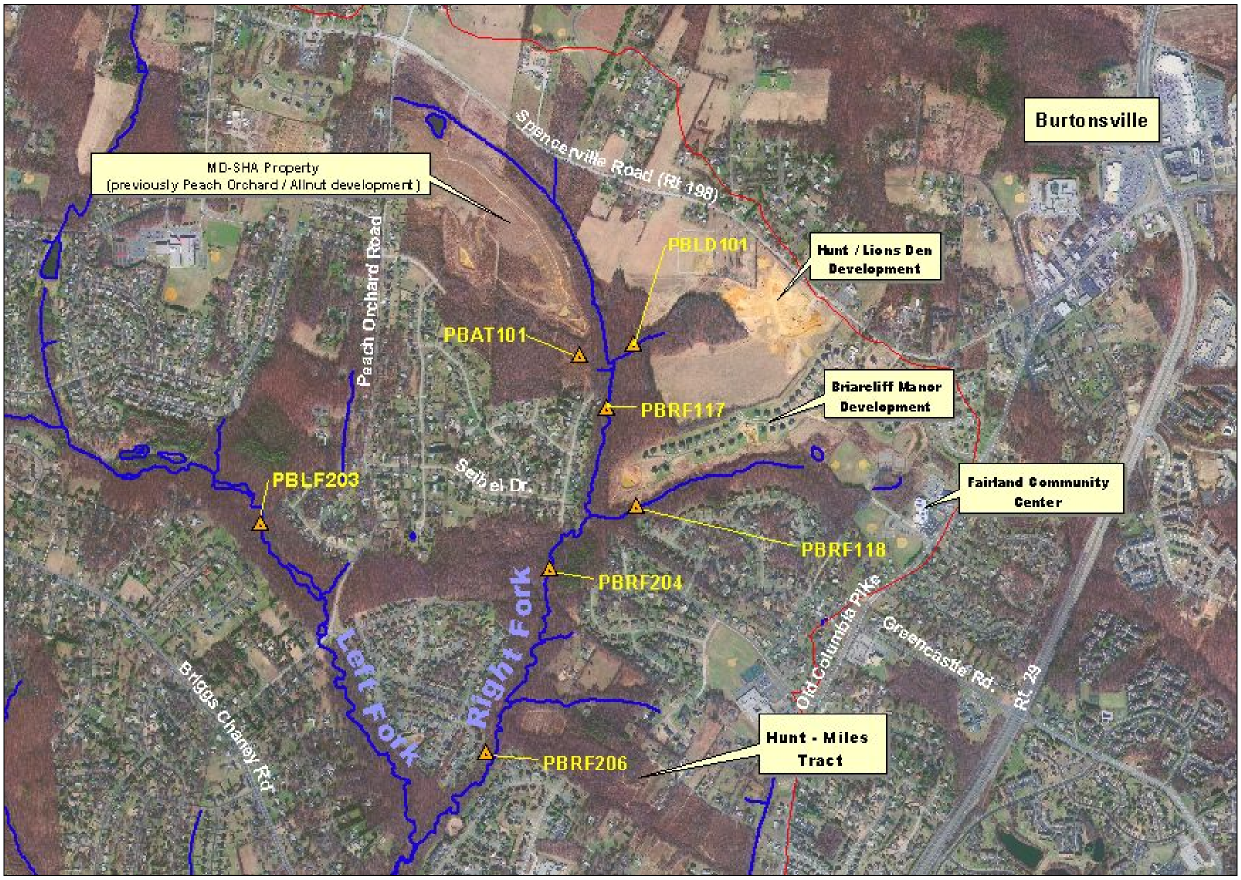

Figure 28 Right Fork of Paint Branch (photo taken Dec. 2002)

Results of benthic macroinvertebrate sampling from three Right Fork stations with a longer monitoring history indicate a slight decline in community health beginning in 1999 (
Figure 29). Since 1999 results have been variable as the community responds to the presence and absence of stressors in this small stream. Stressors include: stream flow, water quality (ie. water temperature, dissolved oxygen concentration) and sediment washed into the stream channel. Prior to 1999 the benthic IBI scores did vary from year to year but remained in the good / excellent range. Stressors, prior to 1999, consisted of normal annual variation in stream flow and water temperature. The drought, which extended from 1999 to 2002, caused unusually stressful conditions in all streams and certainly contributed to variable biological conditions found in the Right Fork. However, the added impacts from construction activities combine with natural stressors to increase impacts to the streams biological community.

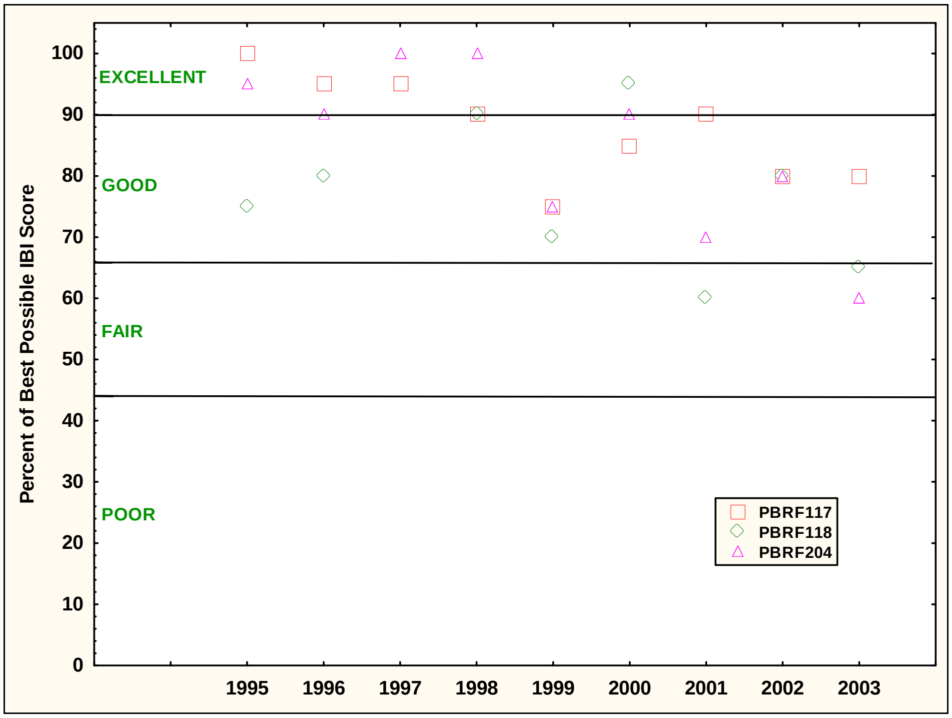

Figure 29 Time series plot of benthic macroinvertebrate monitoring results from the Right Fork

The Peach Orchard/Alnutt development project, located in the headwater area of the Right Fork was the first of several land disturbances to occur in this sub-watershed. Construction activities began at the site in May of 1997. Construction was stopped in 1998 because Maryland – DOT purchased the site to hold as an alternative ICC alignment. The sediment control ponds remain on the site and are inspected/maintained by Maryland Department of the Environment. While no sedimentation in the stream has been observed downstream of the MD-DOT property, turbid water has been observed leaving the site after larger storm events. There are also extensive ATV trails on the site that are subject to erosion and some bank erosion has been observed where drainage from the site enters the right fork of Paint Branch. The sediment ponds on the site could also be a source of thermal impacts. Additionally, in the winter of 2002-3 the site was used to store snow cleared from area roads. DEP, in a memo to MD-SHA, expressed concern that a large amount of top soil was present in the piles of snow and that this posed a threat to Paint Branch as snow melt could carry sediment, road salt and other roadway pollutants to the stream. SHA responded by installing silt fence around the site and leveling out the piles of snow and top soil.

Four other development projects have since begun construction in the Right Fork. Fine sediments washed off from construction sites have been observed in the Right Fork. There appears to also have been an increase in algae growth that may be related to the fine sediment (Figures 30 and 31). Sediment washing off the land often carries with it nutrients, particularly from areas previously under agricultural use, which supply nourishment for algae growth in the receiving stream. The sediment and algae fill in the spaces under and around the stones on the stream bottom restricting biological colonization in this important stream habitat.

Figure 30 Sediment and Algae in Right Fork

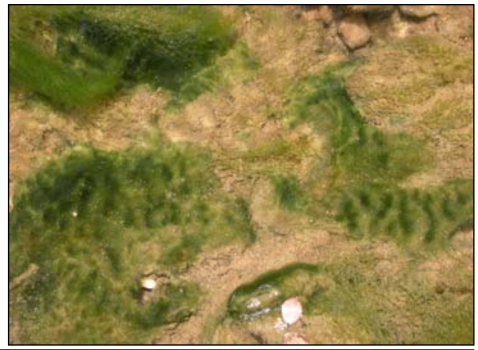

Figure 31 Algae growth in Right Fork

The extent to which changes in the benthic community are a reflection of drought or development impact is hard to say with certainty. What is certain is that impacts from development projects, thus far, are construction related and have more to do with increased sediment input to the stream. The increased level of sediment control required in SPA's may have reduced the amount of sediment getting into streams but has not completely eliminated it. Construction related impacts, although significant, are temporary. Sediment that enters the stream from construction sites will move through the stream channel network. A true assessment of how well the SPA program, along with zoning laws, protect the Right Fork can not be made until several years after construction is complete and stormwater management has had time to function as designed. At that point in time, program assessment will depend on how the streams biological health compares to baseline conditions established between 1995 and 1998.

4.2.4.b Habitat Monitoring

Rapid Habitat Assessment

Rapid habitat assessments are completed along with biological monitoring. A visual assessment of ten different parameters or habitat features in the stream, they provide information about habitat quality in the stream and provide a means for qualitatively tracking habitat quality over time. Some of the habitat parameters that are assessed include stream bank vegetative cover, amount of sediment deposited in the stream, amount and quality of cover in the stream for fish, salamanders, aquatic insects, etc. (e.g. logs, rocks, root mats, undercut areas along the bank) and amount of shading provided by trees and shrubs on the stream bank. All habitat parameters are summed for an overall habitat score. Results of all habitat assessments completed in Paint Branch are summarized in (Figure 32). Median habitat scores are in the sub-optimal range at all monitoring stations. This means that overall stream habitat conditions in the Upper Paint Branch are adequate to support a diverse and healthy biological community. This also means that there are problems with stream habitat that have been documented. Stream bank stability, sediment deposition and forest cover along stream corridors are the main problems identified (SPA Annual Reports for 2001 and 2002).

Results of habitat assessments completed in 2003 show scores at most stations are within the range of scores from previous years. Three monitoring stations scored below this range. They are PBLD101 and PBRF118 in the Right Fork and PBLF203 in the Left Fork.

Monitoring station PBLD101 is located on a small tributary of the Right Fork that receives runoff from the Hunt/Lions Den property (Figure 28). Habitat parameters responsible for the lower habitat score are embeddedness and sediment deposition. The increased sediment likely came from construction activities on the Hunt/Lions Den property which began in January of 2002. DEP learned that the sediment inspector with DPS was working with the developer during the fall of 2002 to rectify a problem with a forebay to one of the sediment traps. This could have been the source of sediment observed at PBLD101 in March of 2003. Sediment in this tributary likely has had or will have an impact on stream habitat at monitoring stations downstream in the Right Fork.

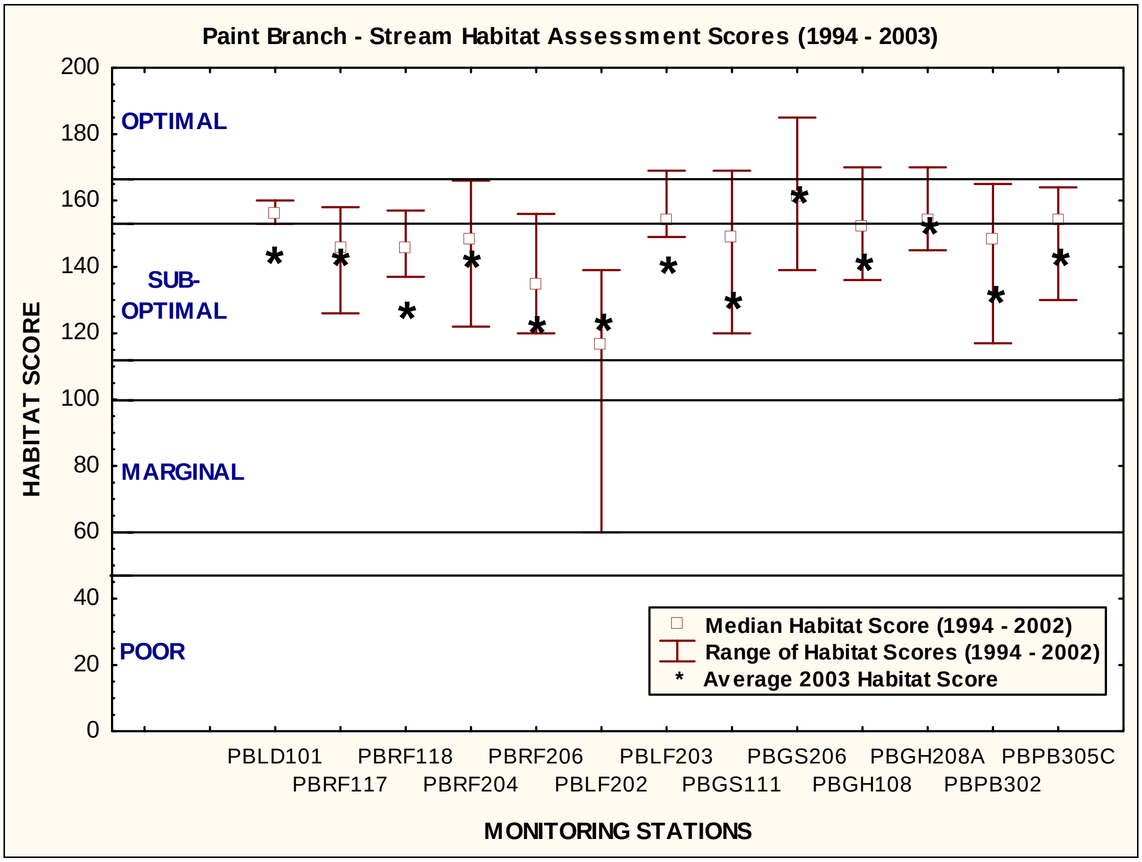

Figure 32 Results Of All Rapid Habitat Assessments Completed In Paint Branch

Monitoring station PBRF118 is also located on a tributary to the Right Fork called Greencastle Tributary. Habitat parameters responsible for lower habitat score here during 2003 are alteration to the stream channel and loss of vegetation on stream banks and in the riparian zone. The cause of these impacts to stream habitat is a new sewer line crossing to bring service to the Briarcliff Manor development. Briarcliff Manor is a new residential development which is located immediately adjacent the Greencastle Tributary to the north (Figure 28). Trees have been planted in the area of the crossing and throughout the length of the development that runs parallel to Greencastle Tributary. As these trees grow the forest buffer will widen improving stream habitat.

The other monitoring station with low habitat scores in 2003 is PBLF203 located on the Left Fork just downstream of Maydale Nature Center. Habitat parameters responsible for low scores are stream bank stability and stream bank vegetative cover. Because of the lack of any substantial land cover changes within the Left Fork watershed in recent years it appears likely that high flow events during 2003 are the cause of these impacts. Most of the development in the Left Fork predates stormwater management laws and has no stormwater control.

Quantitative Stream Habitat Monitoring

Quantitative habitat monitoring was completed at ten monitoring stations in Paint Branch during 2003. This monitoring included surveying stream channel cross sections and pebble counts. Stream channel cross section surveys provide information on channel stability. Pebble counts provide information on stream bottom composition. Monitoring completed in 2003 provides a seven year record on channel stability and stream bottom composition. It should be noted that cross section surveys are somewhat limited in that they represent only a very small portion of the stream length. The stream channel may be degrading in one area while fifty meters downstream it is aggrading. Multiple cross section surveys from throughout the watershed more accurately describe changes with the stream channel.

Stream Channel Cross Sections

Results of stream channel surveys indicate that channel degradation between 1997 and 2003 was greatest at stations PBRF206 in the Right Fork, PBGH208A in the Good Hope and PBLF203 in the Left Fork tributary (Table 9). These stations are all located near the lower end of tributaries and therefore reflect cumulative impact from most of the drainage area within these sub-watersheds. These results follow patterns of stormwater management in the watershed. Most of the development in the Right Fork, Good Hope and Left Fork subwatersheds predate stormwater management laws and has no stormwater management. Half of the development in the Gum Springs subwatershed has stormwater management. This shows the importance of stormwater management in protecting stream channels from erosion and thus protecting stream habitat. DEP has installed several new stormwater management facilities and is currently designing additional facilities to provide stromwater management in areas of the Paint Branch SPA where none existed before. It is hoped that these facilities will slow or stop stream channel degradation in tributaries that are key to maintaining a healthy biological community in Paint Branch.

Results also show that the stream channel is aggrading at two stations located along the mainstem of Paint Branch. This suggests that material removed from the Right Fork, Left Fork and Good Hope tributaries is depositing in the mainstem of Paint Branch.

Table 9. Results of stream channel cross section surveys. Positive change in stream channel area indicates channel enlargement (degradation), while negative change indicates reduction in channel area (aggradation).

Station	1997 Stream Channel Area (sq. ft.)	2003 Stream Channel Area (sq. ft.)	Change In Stream Channel Area (2003 – 1997)	% Change in Channel Area
PBRF117 *(Right Fork)*	77.4 ft^2	75.2 ft^2	-2.2 ft^2	-3%
PBRF204 *(Right Fork)*	74.2 ft^2	75.8 ft^2	+1.6 ft^2	+2%
PBRF206 *(Right Fork)*	76.1 ft^2	81.6 ft^2	+5.5 ft^2	+7%
Average Change In Stream Channel Area From 3 Right Fork Stations			**+1.6 ft^2**	
PBGS111 *(Gum Springs)*	50.0 ft^2	45.3 ft^2	-4.7 ft^2	-9%
PBGS206 *(Gum Springs)*	59.8 ft^2	57.3 ft^2	-2.5 ft^2	-4%
Average Change In Stream Channel Area From 2 Gum Springs Stations			**-3.6 ft^2**	
PBGH108 *(Good Hope)*	47.8 ft^2	47.7 ft^2	-0.1 ft^2	0%
PBGH208A *(Good Hope)*	40.1 ft^2	45.0 ft^2	+4.9 ft^2	+12%
Average Change In Stream Channel Area From 2 Good Hope Stations			**+2.4 ft^2**	
PBPB302 *(Mainstem)*	141.8 ft^2	140.5 ft^2	-1.3 ft^2	-1%
PBPB305C *(Mainstem)*	219.4 ft^2	219.2 ft^2	-0.2 ft^2	0%
Average Change In Stream Channel Area From 2 Mainstem Stations			**-0.7 ft^2**	
PBLF203 *(Left Fork)*	81.0 ft^2	84.5 ft^2	+3.5 ft^2	+4%
Average Change In Stream Channel Area From All 10 Stations			**+ 0.4 Ft^2**	

Cross section surveys of the stream channel at PBGS111, located in the Gum Springs tributary, show a lot of channel movement indicating that the stream channel in this area is very unstable. The lack of forest buffer along this portion of Gum Springs is likely contributing to instability of the stream channel.

Plots of all stream channel cross section surveys completed thus far are presented in figures 33 thru 42. Stream channel area can not be calculated from data collected prior to 1997 because of differences in field methods.

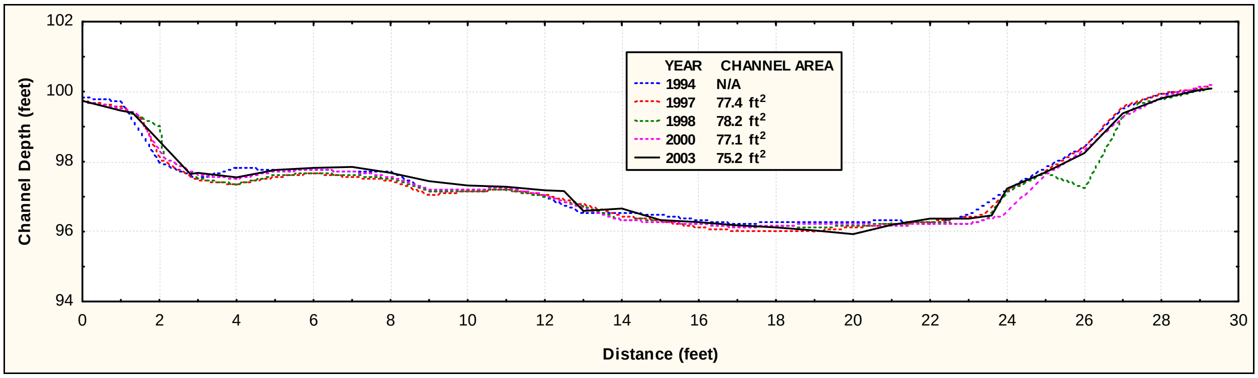

Figure 33 Stream channel cross section surveys from PBRF117, located in the Right Fork

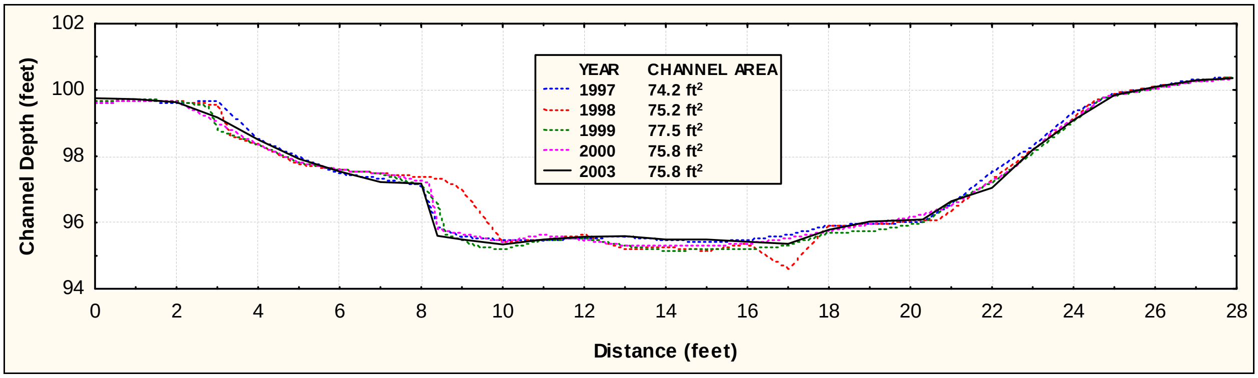

Figure 34 Stream channel cross section surveys from PBRF204, located on the Right Fork

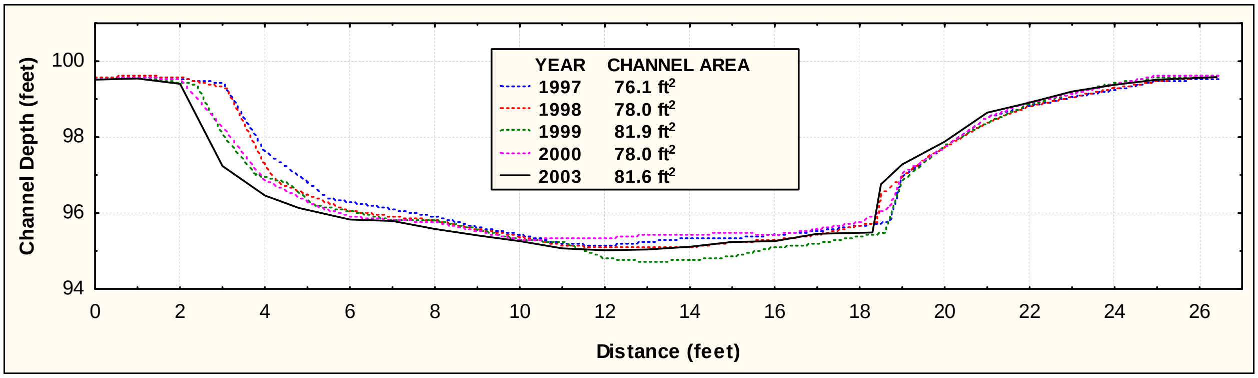

Figure 35 Stream channel cross sections surveys from PBRF206, located in the Right Fork

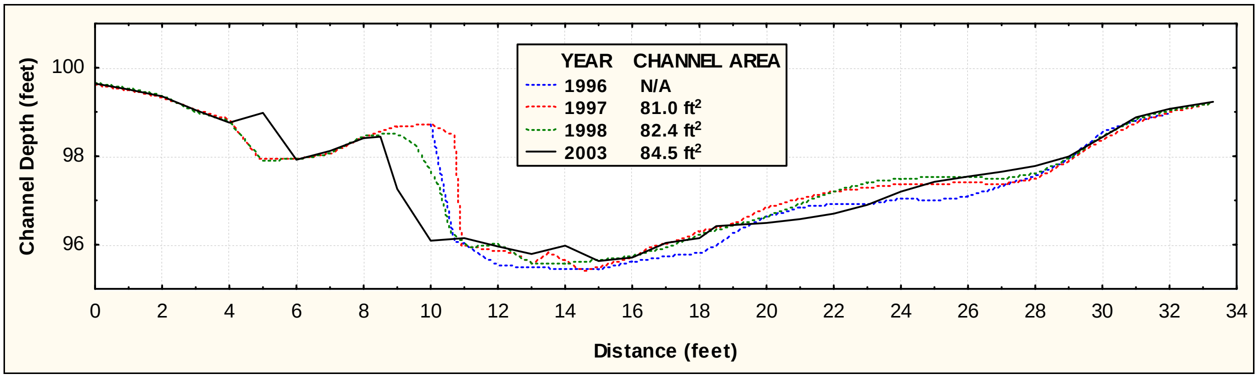

Figure 36 Stream channel cross section surveys from PBLF203, located in the Left Fork

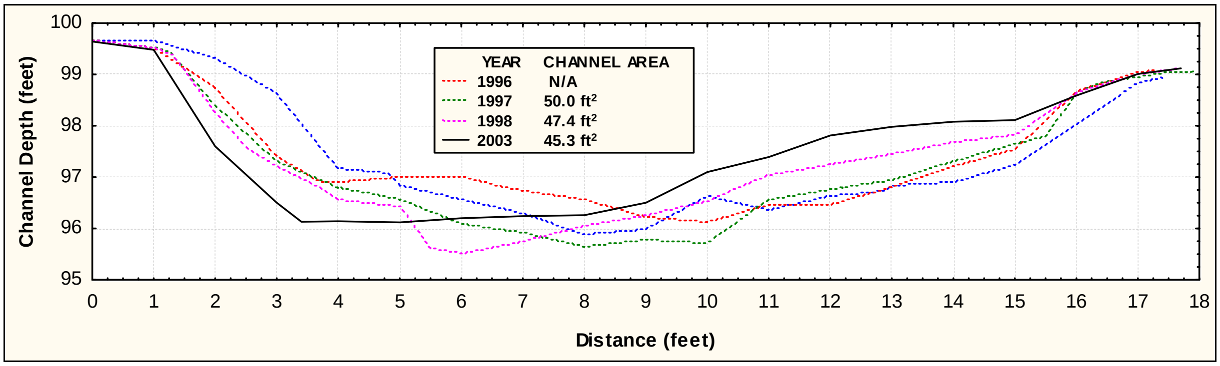

Figure 37 Stream channel cross section surveys from PBGS111, located in Gum Springs

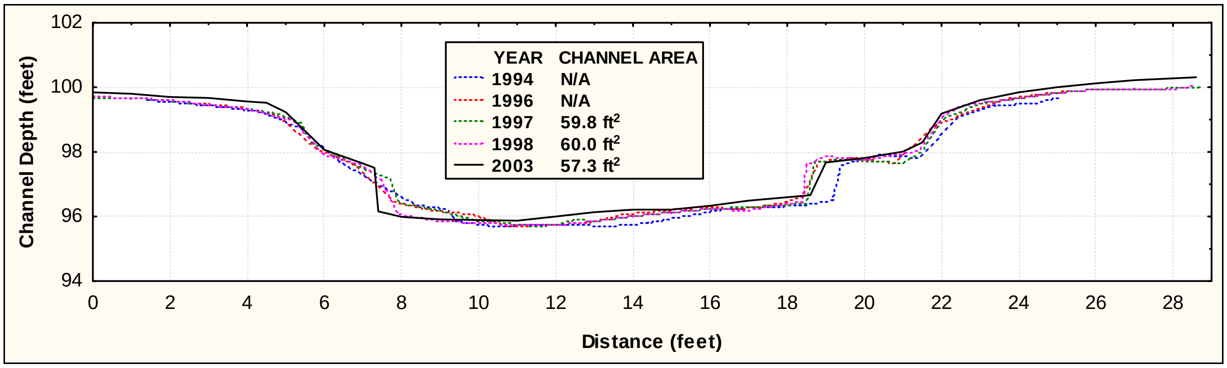

Figure 38 Stream channel cross section surveys from PBGS206, located in Gum Springs

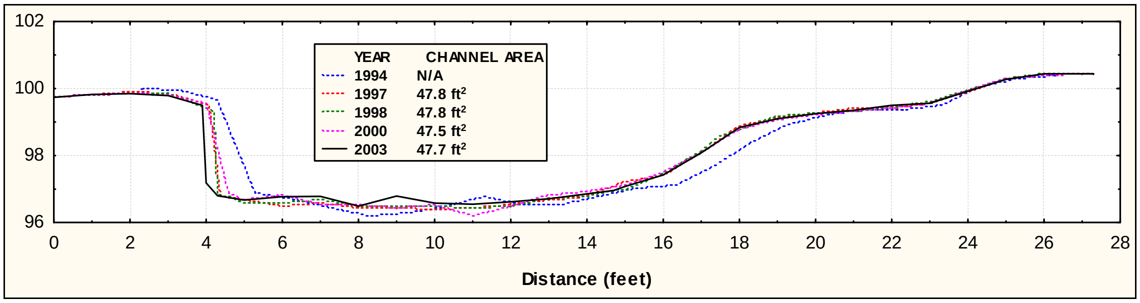

Figure 39 Stream channel cross section surveys from PBGH108, located in Good Hope

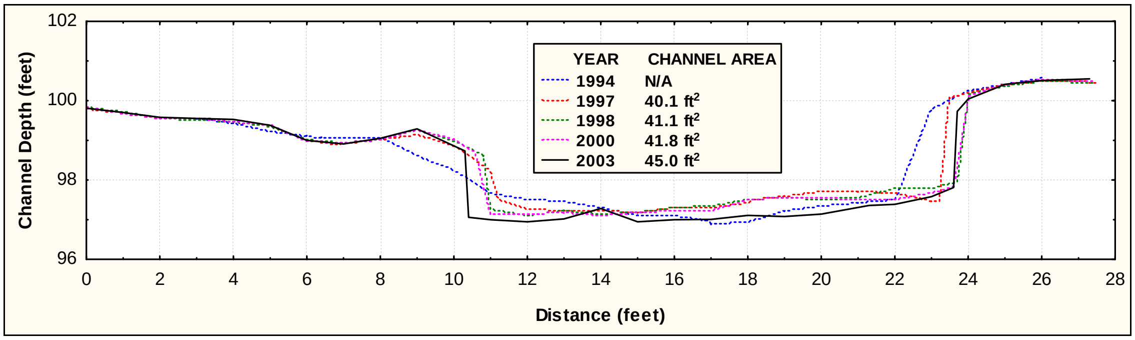

Figure 40 Stream channel cross section surveys from PBGH208A, located in Good Hope

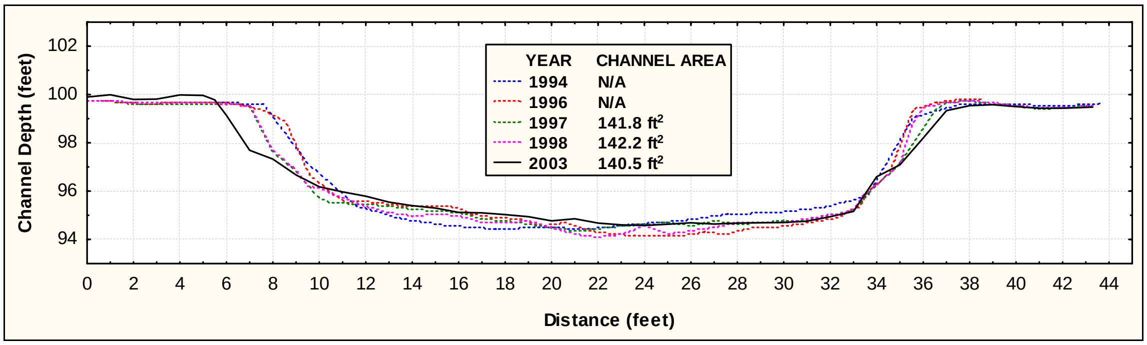

Figure 41 Stream channel cross section surveys from PBPB302, located in the mainstem

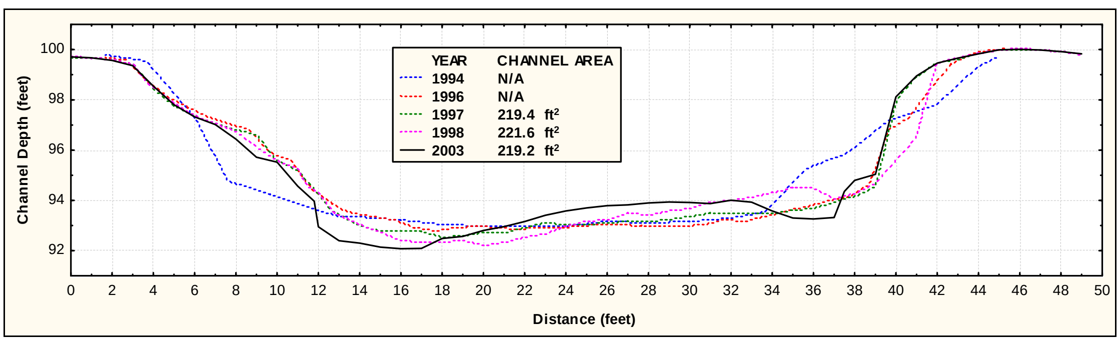

Figure 42 Stream channel cross section surveys from PBPB305C, located in the mainstem

Pebble Counts

Pebble counts were completed in 2003 along with cross section surveys. This monitoring provides information on composition of the stream substrate (gravel and cobble material on the stream bottom) that provides habitat to the streams biological community. The procedure DEP follows assesses stream substrate only in the riffle portions of the stream. Changes in substrate composition usually are a result of changes in the stream hydrology. For example, increased discharge in a stream results in smaller particles being flushed out leaving larger particles behind. Pebble counts determine whether or not such a shift in stream bed composition has occurred. Increased input of fine sediments from land disturbance activities can also cause a shift to higher proportions of smaller size class material.

Results from 2003 indicate very little change in substrate composition has occurred over the past seven years. For those monitoring stations that did exhibit change, the shift was towards larger sediment size. For example, at station PBGH208A located on Good Hope the median sediment size sampled or the D-50, shifted from 30 mm (coarse gravel) in 1997 to 54 mm (very coarse gravel) in 2003 (Figure 43). This represents a very minor shift. Most monitoring stations, such as PBGH108 located in upper Good Hope, showed no change (Figure 44).

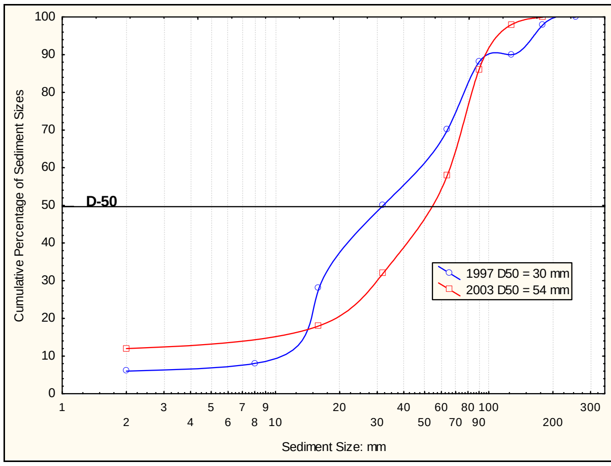

Figure 43 Pebble count results from PBGH208A

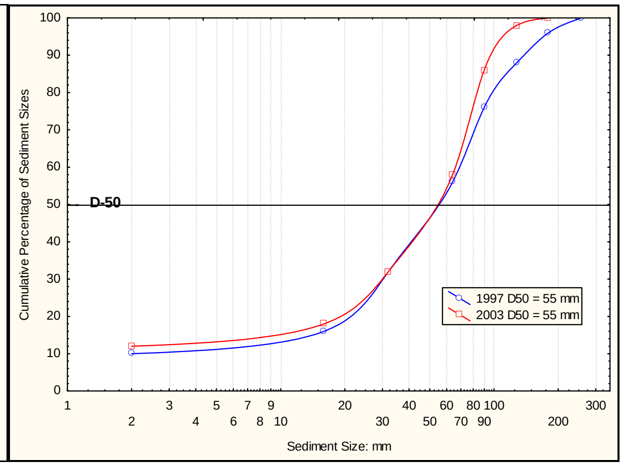

Figure 44 Pebble count results from PBGH108

4.2.4.c Stream Temperature Monitoring

Continuous water temperature loggers were deployed at seven locations in Paint Branch during the summer of 2003. Two loggers were placed in the vicinity of the new Piping Rock Road stormwater management pond, one upstream and one downstream, to determine if thermal impact from the pond exists and if so to what extent. Two loggers were placed in the Right Fork, two in the Left Fork, two in the Good Hope and one in the mainstem of Paint Branch at Fairland Road.

Air temperature during the summer of 2003 was near the historic average of 72.1^0 F (June 1 – September 30 from Dulles National Airport). This is considerably cooler then the previous summer (2002) when average air temperature was 74.2^0 F or 2.1^0 F warmer then the historic average. Accordingly, water temperature during the summer of 2003 was generally cooler than 2002 throughout Paint Branch. Water temperature exceeded the Maryland Use III criteria of 68^0F, 41.8% of the time, on average, during the summer 2002 (June 1 – September 30) and only 17.1% during the summer of 2003 (Table 10).

Table 10 Percent of temperature readings from Paint Br. above 68 Degrees

	PBPB305C	PBRF204	PBRF117	PBGH108	All Sites
2002	45.9%	45.3%	37.7%	38.3%	41.8%
2003	25.3%	11.7%	6.8%	24.5%	17.1%

Piping Rock Road SWM Pond

Figure 45 Piping Rock trash rack

The Piping Rock Road stormwater management pond, installed by DEP with CIP funds in 2001, controls storm flow for all storms up to the 1-year event (2.6 inches of rain in 24 hours). This facility is located in the upper Good Hope subwatershed and provides stormwater management for 166 acres where none had previously existed. The primary function of this facility is to reduce peak storm flows, which slows the rate of stream channel erosion downstream. As the stream rises during a storm, water flows into the pond and is released at a slower rate over a 12 hour period. The inlet structure to the pond is protected by a trash rack that needs to be cleared frequently in order for the pond to function as designed (Figure 45).

The pond has two small permanent pools located near the inlet and outlet (Figure 46 and Figure 47). The area in between is vegetated with various wetland plants. Because of the small permanent wet pools there were concerns that they may cause thermal problems in the Good Hope as warm water from these pools is flushed out during storm events.

Figure 46 Piping Rock pond from outlet

Figure 47 Piping Rock pond from inlet

During the summer of 2003 temperature loggers were placed immediately upstream and downstream of the Piping Rock Road storm water management pond to determine if the pond is a thermal impact to the Good Hope tributary. Results from the temperature loggers indicate that there is no thermal impact on Good Hope from this pond. Average water temperature is cooler downstream of the pond and maximum temperature is considerably cooler downstream (Figure 48).

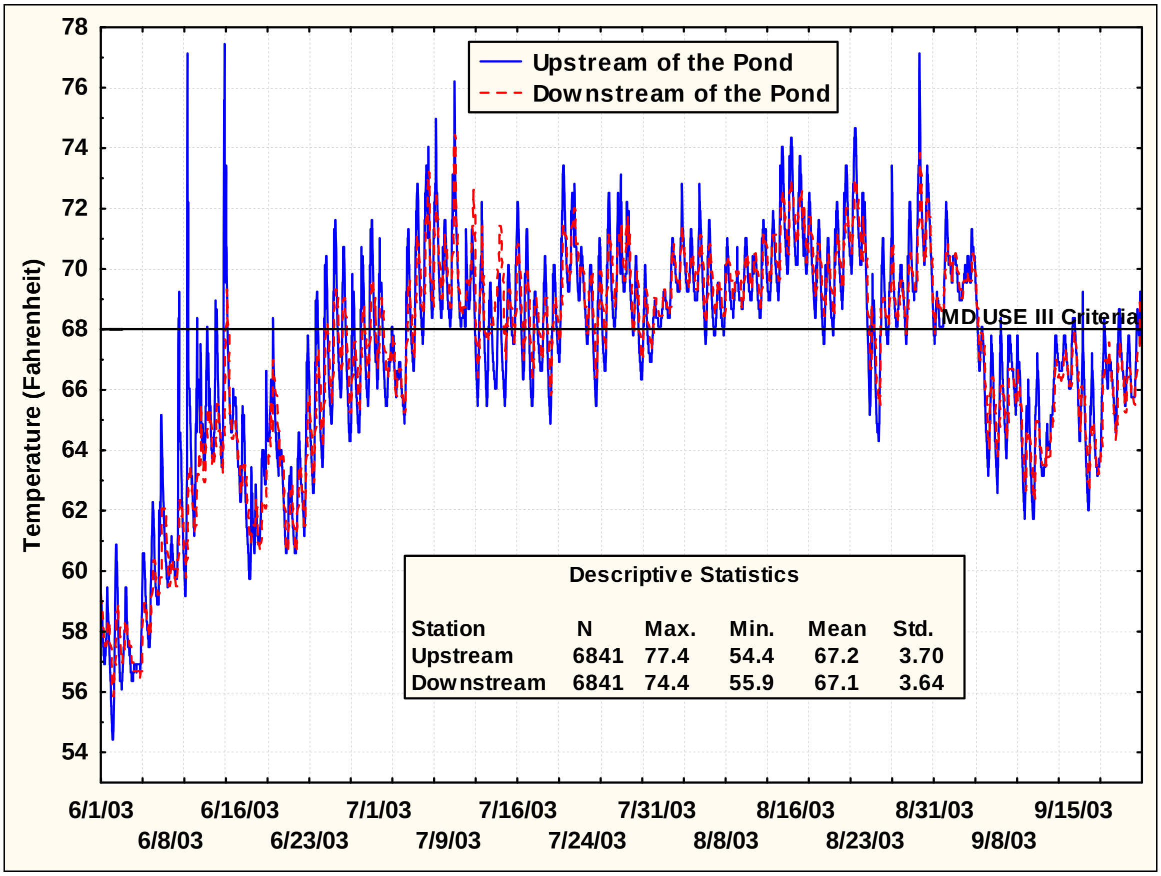

Figure 48 Stream temperature data from Good Hope, upstream and downstream of piping rock SWM pond

Two temperature loggers were placed in the Good Hope tributary during the summer of 2003. One at PBGH108 located in the upper portion of the tributary approximately one quarter of a mile downstream of Piping Rock Road and one at PBGH208A located in lower Good Hope. Results are interesting in that they show warmer stream temperature at upstream station PBGH108 (Figure 49). Going further upstream, above the Piping Rock SWM pond, water temperature was warmer yet. Typically, streams are cooler in the head water areas and warm as they flow downstream. A possible cause for the anomalous results from Good Hope tributary is the lack of wooded buffer upstream of Piping Rock Road. High rates of groundwater input to the stream between PBGH108 and PBGH208A also contribute to cooler water temperature in lower Good Hope. During the summer of 2004 DEP will place loggers in Good Hope upstream of Piping Rock Road to isolate where water temperature in the stream is warming.

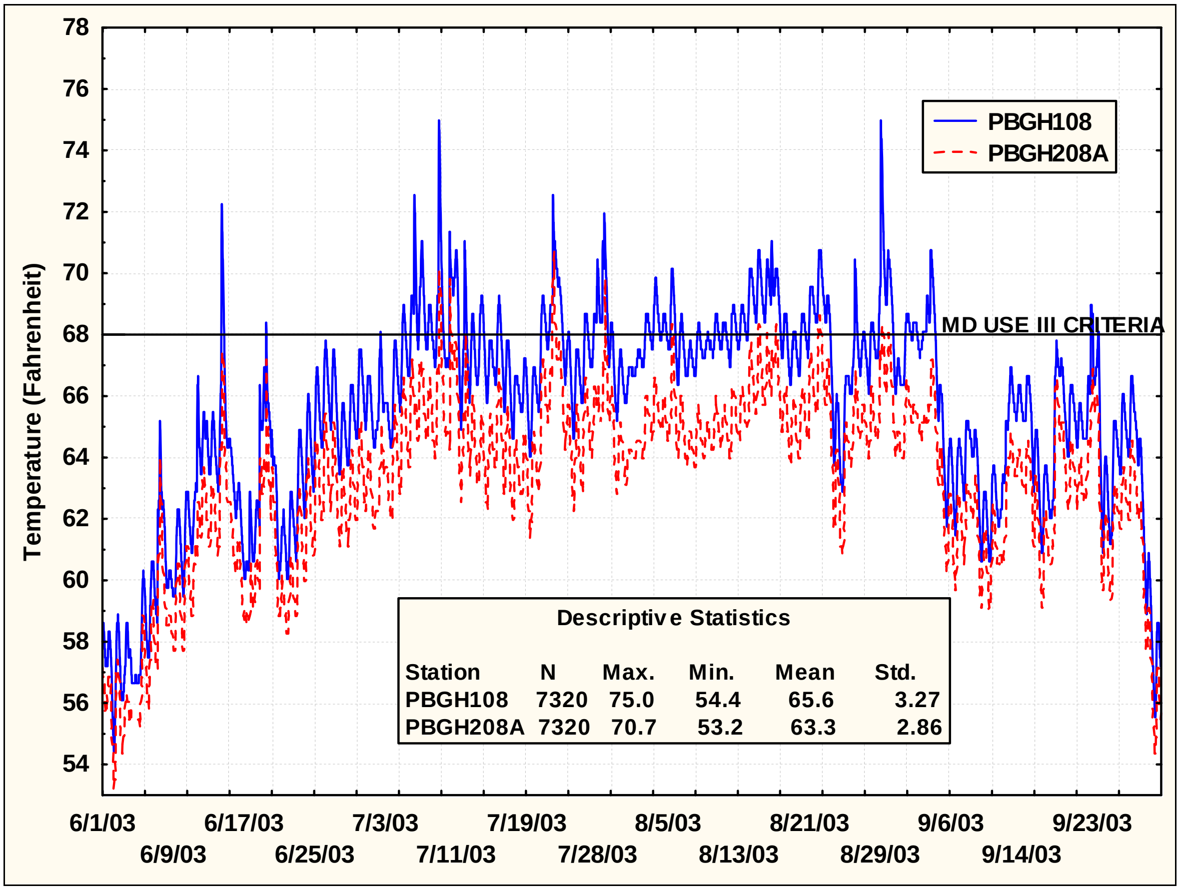

Figure 49 Stream temperature data from Good Hope tributary

Right Fork

Temperature loggers were deployed in the Right Fork at two locations, PBRF117 and PBRF204. Results presented in Figure 50 show water temperatures exceeded the Maryland Use III criteria of 68^0 F for only brief periods during the summer of 2003. Water temperature was considerably cooler in 2003 then 2002 reflecting the cooler air temperature and higher stream flow conditions during 2003.

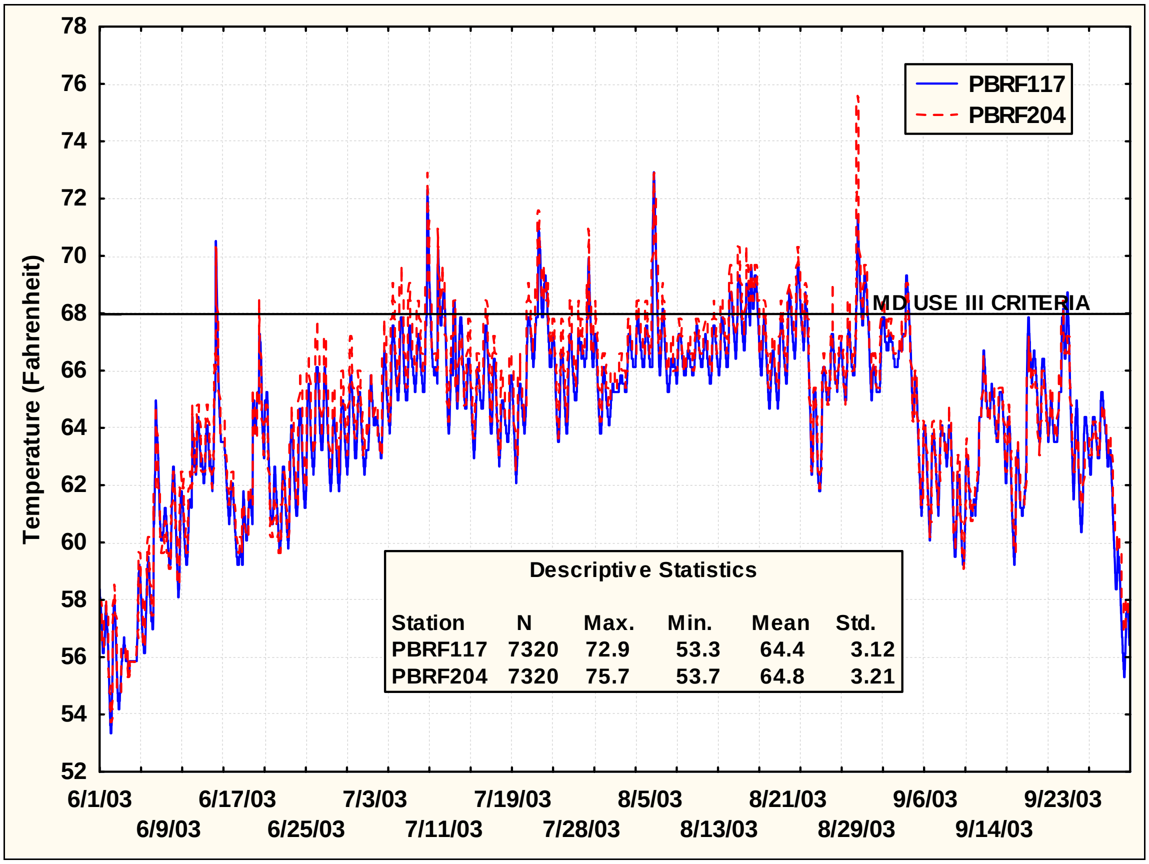

Figure 50 Stream water temperature data from the Right Fork

Sediment control traps on the Hunt/Lions Den construction site discharge into Right Fork between the two monitoring stations PBRF117 and PBRF204. Comparing results from these two locations shows little difference in average water temperature. Maximum water temperature was higher at the downstream station PBRF204 on most days. This is likely due to a normal temperature regime where water warms as it flows downstream. Results from these two monitoring stations in 1998, before construction on the Hunt/Lions Den property began, also show that water temperature was warmer on most days at PBRF204.

There was a spike that occurred on 8/29 at 6:00 pm where temperature shot up to 75.5^0 F. A similar occurrence was observed in the upper Good Hope tributary at the same time. The cause of this spike is likely a late day thunderstorm resulting in a pulse of warm water runoff from heated surfaces such as rooftops and roadways in the vicinity of Timberlake Drive.

Paint Branch Mainstem

One temperature logger was deployed in the Paint Branch mainstem during the summer of 2003 just upstream of Fairland Road at PBPB305C. Results are consistent with other areas of Paint Branch in that they show water temperature was cooler in 2003 then 2002. The period of time that stream temperature exceeded the Maryland Use III criteria (68^0 F) is much less during 2003 (Table 10).

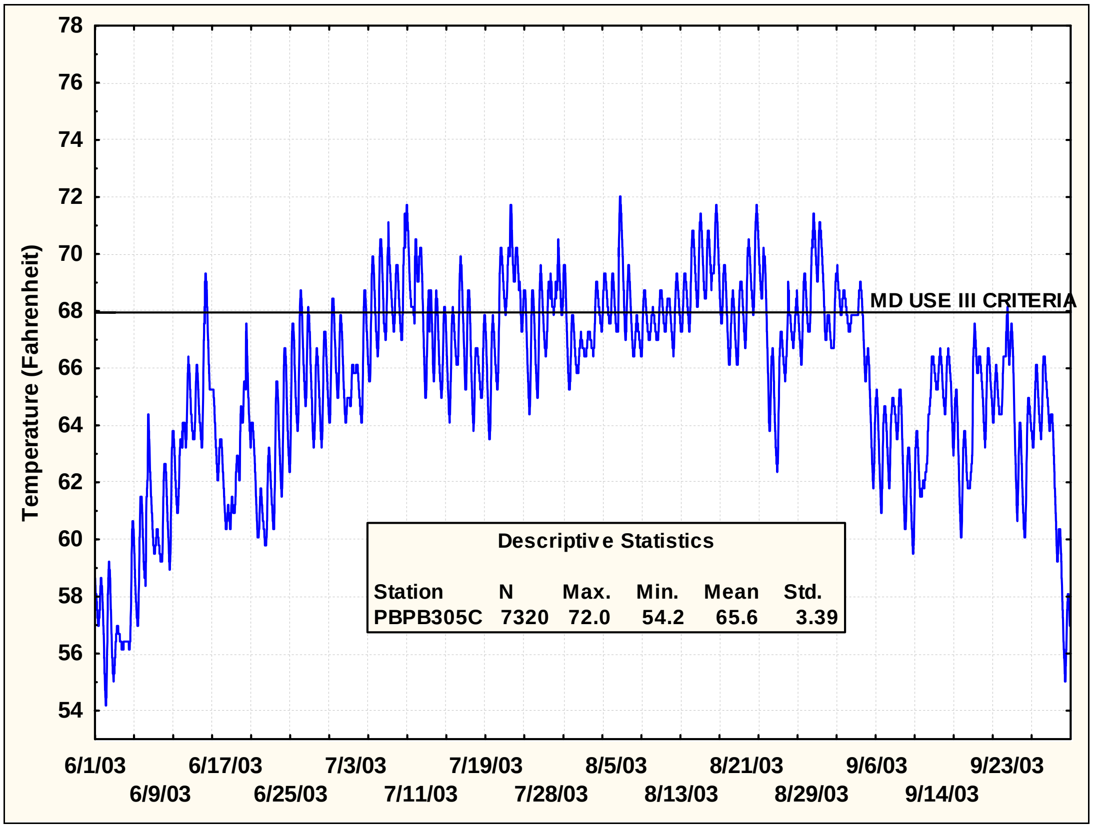

Figure 51 Stream temperature data from Paint Branch mainstem - upstream of Fairland Road

This station, along with the rest of the Paint Branch mainstem, provides habitat for the larger adult trout. It is important, therefore, that water temperature remain below 68^0 (F). As water temperature rises the dissolved oxygen content in the water decreases. Trout require cool, well oxygenated water. When these conditions are not met their food intake drops off. They become sluggish and are at a greater risk of predation. This is may be why numbers of adult brown trout have dropped off in recent years. During the drought of 1999 and 2002 water temperature and DO conditions were extremely stressful to the trout and many were likely consumed by birds of prey, raccoons, etc.

Water temperature was closer to the historic norm during 2003. It is hoped that several more years of normal stream flow and water temperature will allow the brown trout population to recover.

4.3 Piney Branch Special Protection Area

4.3.1 Description of the Piney Branch SPA Watershed

The Piney Branch watershed was designated as an SPA because of the intensive development planned for the area and the existing high water quality found in the watershed. SPA designation was done by County Council resolution on October 24, 1995. The Piney Branch watershed, a subwatershed of Watts Branch, is located in south-central Montgomery County just west of the city of Rockville. Piney Branch originates just to the north of Shady Grove Rd. and east of Travilah Road. From its headwaters, Piney Branch flows to the south entering Watts Branch just south of Glen Road (Figure 52). The SPA includes all 2400 acres of the Piney Branch watershed.

Prior to 1990, the Piney Branch watershed consisted of a mix of agricultural land uses and large lot (1-2 acre) single family homes with some commercial and office development. In early 1993, residential construction began in the headwaters area of Piney Branch on the Willows of Potomac and Piney Glen Village, two large residential subdivisions. No SPA requirements were placed on these projects as they predated the SPA designation. In mid 1994, construction began in the Piney Branch stream valley on a sanitary sewer line from the Watts Branch up to the headwaters of Piney Branch.

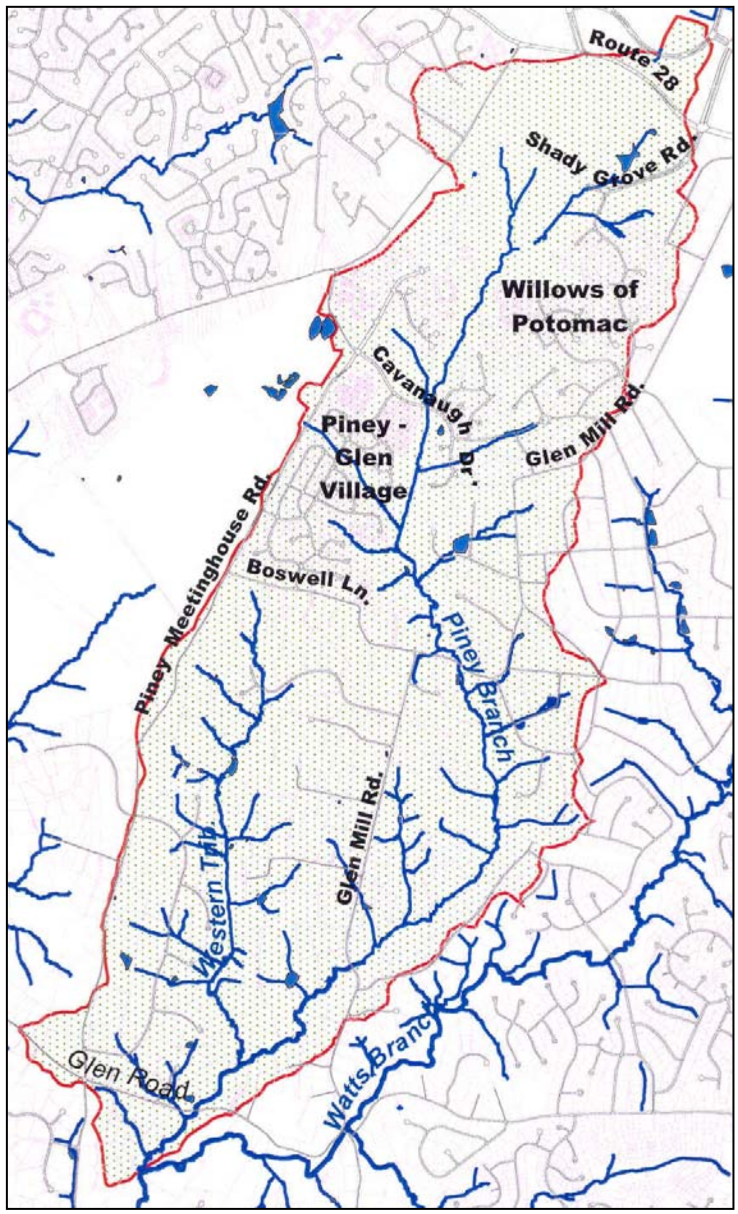

Figure 52 Piney Branch Special Protection Area - shaded in green

4.3.2 Status of Development in Piney Branch SPA as of April 2004

Twenty-one final water quality plans have been approved for this SPA (Table 11). There are several other projects in various stages of the planning and development process. Also, a significant amount of development had been approved prior to SPA designation. There is potential for adverse change to Piney Branch due to the cumulative impacts of these projects. This is being mitigated on projects currently under construction by strict adherence to approval standards and by innovative stormwater management techniques. All new development will have to adhere to more stringent SPA requirements.

Although the Piney Branch watershed has experienced an increase in development activity over the last couple of years, the majority of the proposed development is for large residential single family lots (0.5 acres to 2+ acres). One notable exception is the proposed Traville site. This site is 192 acres of proposed mixed-use development within the headwaters of the Piney Branch. The site is made up of six separate site plans (and six interconnected Final Water Quality Plans), with all the site plans currently in some phase of construction. It is expected that with this amount of construction activity that there may be some initial water quality impacts, however, by using the oversized and redundant sediment trapping devices that were required, these impacts should be kept to a minimum.

The planned Traville development includes a retail center, apartment buildings for elderly living, various multi-family dwelling units, a research and development campus for Human Genome Sciences and additional research and development areas for future development. This project will present a considerable challenge in maintaining water quality after construction is complete due to the inherently high percentage of impervious area that accompanies this type of development. The developers of Traville had originally agreed to limit the overall site imperviousness area to 35%, however that number was subsequently reduced to about 33%. This percentage may still appear to be somewhat high, but it is a significant reduction in imperviousness than what would normally be seen in this type of development. This reduction in imperviousness along with the redundant water quality BMPs (treating the first 1 inch of runoff from the impervious areas), expanded stream buffers and quantity control for the 1-year storm, will afford the best opportunity to mitigate the potential impacts of this development. It will be quite interesting to monitor the extensive and complex web of the interconnected BMPs on this site. However, it could be some time (one to two years) before the BMPs are converted from temporary sediment control to permanent stormwater management at which time post development monitoring will begin.

As a separate initiative, DEP is also investigating other opportunities for improving existing stormwater management controls in the watershed through the Montgomery County Stormwater Management Capital Improvement Program (CIP). DEP has completed a study of the drainage area on the University of Maryland Shady Grove campus. This study investigated possible improvements to the existing SWM pond and stream valley upstream of the pond. These improvements consist of combinations of wetland enhancements, reforestation, and bank stabilization. Results of the study are now being reviewed by DEP. DEP has also met with the property owner, who has agreed, in principle, to participate in improvements on the property.

DEP has also worked cooperatively with the M-NCPPC to evaluate stream conditions and erosion problem areas throughout the Watts Branch watershed including Piney Branch. Over the next few years DEP will be identifying other potential stormwater retrofit and stream restoration projects within Watts Branch that may include additional projects to help protect Piney Branch.

Table 11. Piney Branch SPA Development Projects (1995 to April 2004)

PROJECT NAME	SPA LOCATION	DEVELOPMENT SIZE, TYPE	STATUS
Avon Glen	Piney Branch - middle reach	39.6 acres, RE-1, 28 lots and sewer pumping station	Subdivision approval predated SPA designation. Construction complete.
Boverman Property	Piney Branch - Lower reach	13.8 acres, RE-1	Construction complete. As-built approved.
Bruck Property	Piney Branch - Lower Reach	16 acres, RE-1	Construction complete.
Burton Glen	Piney Branch-Lower reach	3.3 acres, 3lots	Water quality inventory approved.
Carb 2	Piney Branch headwaters	1.7 acres, R&D	Preliminary and final water quality plan approved.
Cavanaugh Property	Piney Branch – middle reach	18.1 acres, RE-1 Cluster, 18 lots	Construction complete. As-built approved.
Charles Duvall Farm	Piney Branch	0.5 acres, R-200 1 lot	Exempt from SPA Water Quality Plan Requirements.
Glen Mill Knolls	Piney Branch-Lower reach	4.13 acres, RE-1, 1 lot	Water quality inventory approved.
Grupenfoff Residence	Piney Branch	2 acres, 1 lot	Exempt from SPA Water Quality Requirements.
Hoffman Property	Piney Branch	10.26 acres, RE-1, 1 lot	Preliminary and final water quality plan approved. Under construction.
Horizon Hills	Piney Branch-Lower reach	4.0 acres, RE-2	Water quality inventory approved. Under construction.
Hunting Hill Woods	Headwaters	1.6 acres, R-200, 3 lots	Water quality inventory approved. Under construction.
Lakewood Glen	Piney Branch	5.2 acres, RE-1 5 lots proposed	Exempt from water quality plan requirements.

Table 11 (continued)

PROJECT NAME	SPA LOCATION	DEVELOPMENT SIZE, TYPE	STATUS
Lankler Property (Highgate)	Piney Branch-Lower reach	60.3 acres, RE-2	Water quality inventory approved. Under construction.
New Life Christian Fellowship Church	Piney Branch – Headwater area	1.2 acres, Proposed church	Pre-application meeting complete. On hold.
North Glen Hills	Piney Branch- middle reach	2.26 acres, RE-1, 2 lots.	Preliminary and final water quality plan approved. Construction complete.
Otsuka America Pharmaceutical, Inc.	Piney Branch – Headwaters	4.7 acres, R&D	Preliminary/final water quality plans approved. Construction complete.
Peters Property	Piney Branch- Lower reach	RE-1, Cluster Option	Construction complete. As-built approved.
Piney Glen Village	Piney Branch – Middle reach	188 acres, Mixed residential	This project predates SPA requirements. Construction substantially complete.
Piney Meetinghouse Road and Travillah Road Improvements	Piney Branch- Middle reach	Road Improvements	Preliminary/final water quality plans approved. Sediment control permit issued.
Piney Meetinghouse Road Site - Fling Property	Piney Branch – Middle reach	6.4 acres, RE-2, proposed mulching/ landscape operation	Preliminary/final water quality plans approved. Pending special exception.
Potomac Glen South	Piney Branch	15.3 acres, RE-1, 8 lots proposed	Exempt from water quality plan requirements due to low imperviousness. Construction complete.
Potomac Preserve (Fling Property)	Piney Branch	28.5 acres, RE-2, 11 lots.	Water quality inventory approved. Sediment control plan under review.
Shady Grove Adventist Hospital Addition	Piney Branch – Headwaters	4.8 acres	Preliminary/final water quality plans approved.

Table 11 (continued)

PROJECT NAME	SPA LOCATION	DEVELOPMENT SIZE, TYPE	STATUS
Shady Grove Life Sciences Center – Life Technologies Inc.	Piney Branch – Headwaters	18.1 acres – R & D	Preliminary plan approved prior to SPA designation; however, voluntary compliance. Water quality plans approved. Initial construction complete.
Shady Grove Road	Piney Branch – Headwaters	8 acres, Road extension	Construction is complete. Awaiting as-built approvals.
Simmons Property	Piney Branch	2.1 acres, 4 lots, R-200/TDR	Water quality inventory approved.
Snider Property	Piney Branch – Lower Reach	21.9 acres, RE-1C	Construction complete.
Temple Beth Ami	Piney Branch – Headwaters	7.9 acres, R-200 /TDR Church	Preliminary and final water quality plans approved. Construction is complete. Permit closed.
Tenny Property	Piney Branch	2.5 acres, R-200, 5 lots	Exempt from water quality plan requirements.
Travilah Road Project	Piney Branch	9.0 acres, Road improvements	Revised preliminary/final water quality plans under review.
Traville (5 Site Plans) 1) Senior Housing (under construction) 2) Retail Center (under construction) 3) Village Center Streets (under construction) 4) Avalon Bay (under construction) 5) Human Genome Sciences (under construction) 6) Parcels I, J and K	Piney Branch – Headwaters	192 acres, MXN and R&D (there are two additional R&D sites that will be developed in the future)	Preliminary water quality plan approved for the entire site. Separate final water quality plans have been approved.
Willow Oaks	Piney Branch-Middle reach	5.5acres, R-200	Preliminary/final water quality plan approved. Under construction.

Table 11 (continued)

PROJECT NAME	SPA LOCATION	DEVELOPMENT SIZE, TYPE	STATUS
Willows of Potomac	Piney Branch – Middle reach	245 acres, mixed residential	Subdivision approvals predate SPA requirements. Construction complete.
Wilson Property	Piney Branch-Lower reach	10.3 acres, RE-2	Pre-application meeting complete.

4.3.3 Summary of Environmental Protection and Innovative Site Design: The Revised Traville Concept for Consolidation of Human Genome Sciences

The Traville project at the headwaters of the Piney Branch continues to provide many challenges in the effort to achieve a successful combination of development and water quality/environmental protection. However, recent changes to the concept for the largest Research and Development (R&D) portion (with Human Genome Sciences as the principal tenant) reflect achievement of many environmental objectives of the Special Protection Area program.

In addition to standard SPA elements such as SWM features in series, protection and enhancement of environmental buffers and the natural resources within them, including full reforestation of all unforested portions of the stream valley buffer, which will be permanently protected through Category I Forest Conservation Easements, the concept proposes use of many site design elements to reduce environmental impacts of the development on Piney Branch, within the framework of master planned land uses and zoning.

These elements include: use of taller buildings, internal garages, and structured parking leading to lower impervious cover; greater open space leading to enhanced opportunities for more gentle, natural appearing, aesthetic multi-use recharge/infiltration/ water quality treatment facilities; flexibility in the location of the edge of grading, resulting in better achievement of environmental and development objectives; and more opportunity for appropriate transitions between natural and developed areas.

4.3.4 Summary of Stream Monitoring in Piney Branch

Stream monitoring began in the Piney Branch SPA during 1995 and has been done annually since. Presently there are ten fixed monitoring stations located throughout the watershed from which biological (benthic macroinvertebrates and fish), water quality and habitat data are collected (Figure 53). During 2003, benthic macroinvertebrates were sampled at all ten monitoring stations and fish were sampled from seven monitoring stations. Two monitoring stations, located in the headwater area of Piney Branch, are too small to sample for fish (<300 acres of drainage area).

Stream channel cross sections were surveyed at eight monitoring stations. As this monitoring was first done in 1997, surveys completed in 2003 provide a seven year record of stream channel stability throughout Piney Branch.

One temperature logger was deployed in Piney Branch during 2003 to compare stream temperature conditions with previous years. The logger was placed at station WBPB101, located on the Western Tributary of Piney Branch.

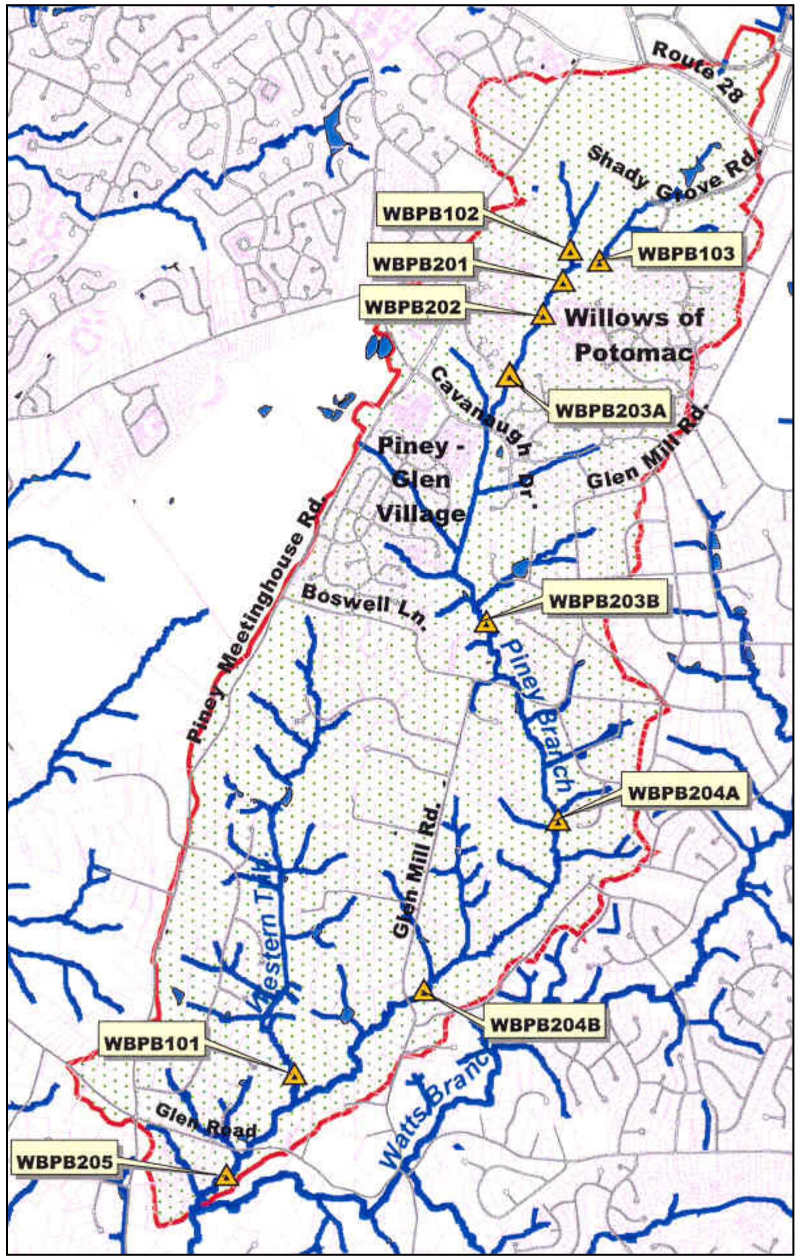

Figure 53 Piney Branch Stream Monitoring Station Locations

4.3.4.a Biological Monitoring

IBI scores from 1995 - 2003 for both fish and benthic macroinvertebrates are presented in Figure 54 and Figure 57. Fish IBI scores from 2003 indicate that fish community health remains similar to previous years. All fish species found during the first year of sampling (1995) were present in 2003. The degree to which these species are represented in the overall fish community varies from year to year (temporal variability) and between monitoring stations (spatial variability). This accounts for the differences in IBI Scores between years and monitoring stations. For example, at station WBPB101, located on the Western Tributary, the number of sculpins (both Potomac and Blue Ridge) dropped off in 2002 while the number of Blacknose dace remained high resulting in a higher proportion of pollution tolerant species and a lower proportion of intolerant, riffle/benthic species. Consequently, the IBI score dropped from good in 2001 to fair in 2002. Sampling results from 2003 show a recovery in the number of sculpins and in IBI score at station WBPB101 (Figure 54). Temporal variability like this is often due to natural causes such as annual variation in stream flow and temperature, extreme events such as floods or drought, predation (either from other fish, birds or animals such as raccoons), etc. In this case extremely low stream flow during the spring and summer of 2002 is the likely cause. Spatial variability is often due to differences in habitat availability between monitoring stations.

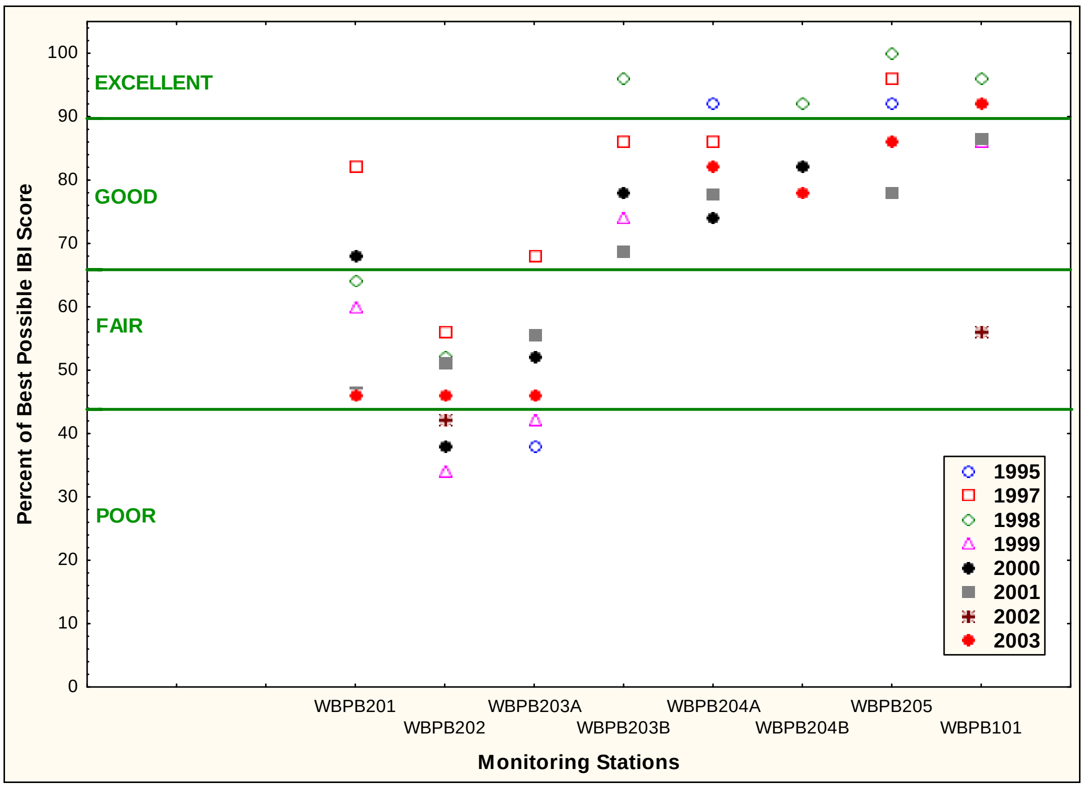

Figure 54 Fish Monitoring Results From Piney Branch

The fact that no fish species have been extirpated from Piney Branch during the course of DEP's monitoring period indicates that water quality and habitat requirements continue to be met. However, there are trends in the data that show the abundance of certain species has declined in a way that may not be due to natural variability. For example, sculpins have declined in abundance throughout the mainstem of Piney Branch (see SPA Annual Report for 2001 and

Figure 55). The average number of sculpins found in samples taken from seven stations along the mainstem went from 93 (16 % of the overall fish community) in 1998 to 15 (7 % of overall fish community) in 2003.

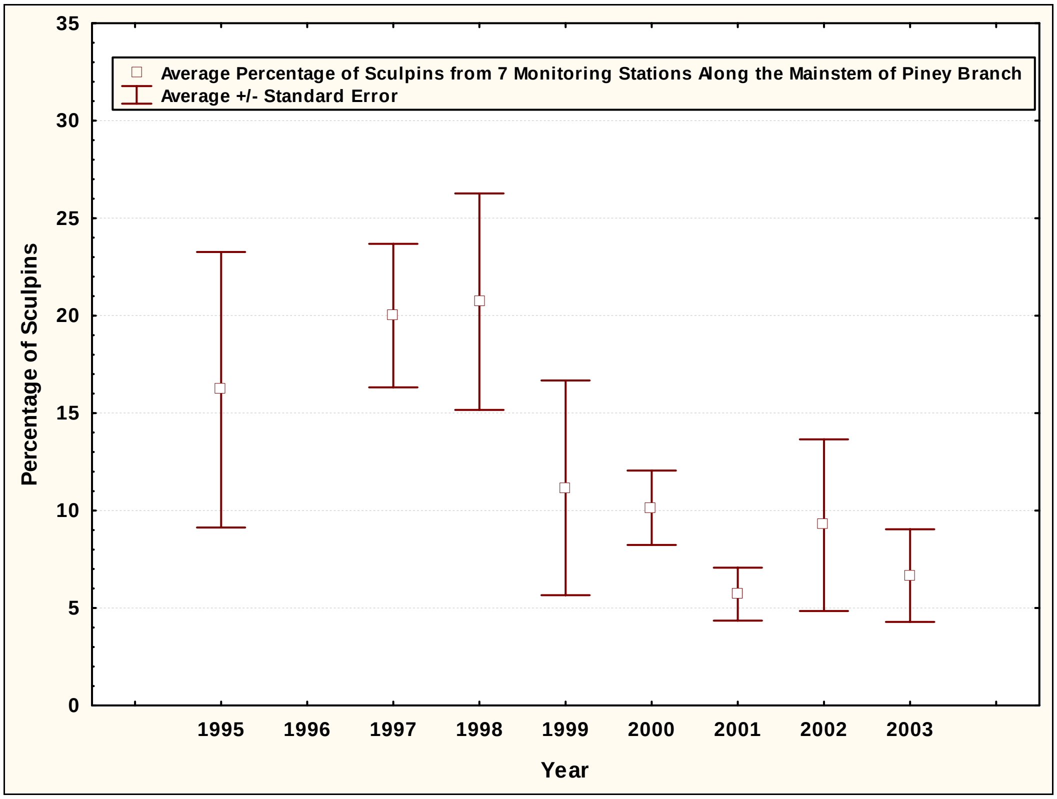

Figure 55 Time series plot showing the average proportion of sculpins in the overall fish commuity from seven Piney Branch mainstem stations

Sculpins are one of the better indicator fish species because of their habitat requirements for spawning. They need clean gravel and cobble sized stones on the stream bottom under which they attach their eggs. The interstitial spaces between and under the stones must remain open to allow oxygenated water to flow past the developing eggs. DEP has noted higher rates of algae growth in the mainstem of Piney Branch beginning in 1999. It is possible that algae growth has impacted sculpin spawning by impeding the flow of water through interstitial spaces and could explain the downward trend of their abundance.

The abundance of sculpins affects the overall fish community health because they are one of the few intolerant fish species found in area streams. Their influence over IBI scores becomes apparent by comparing a plot of IBI scores from seven mainstem stations (Figure 56) with a plot of sculpin abundance shown in Figure 55. As the abundance of sculpins reached their peak in 1997 and 1998 IBI scores also peaked.

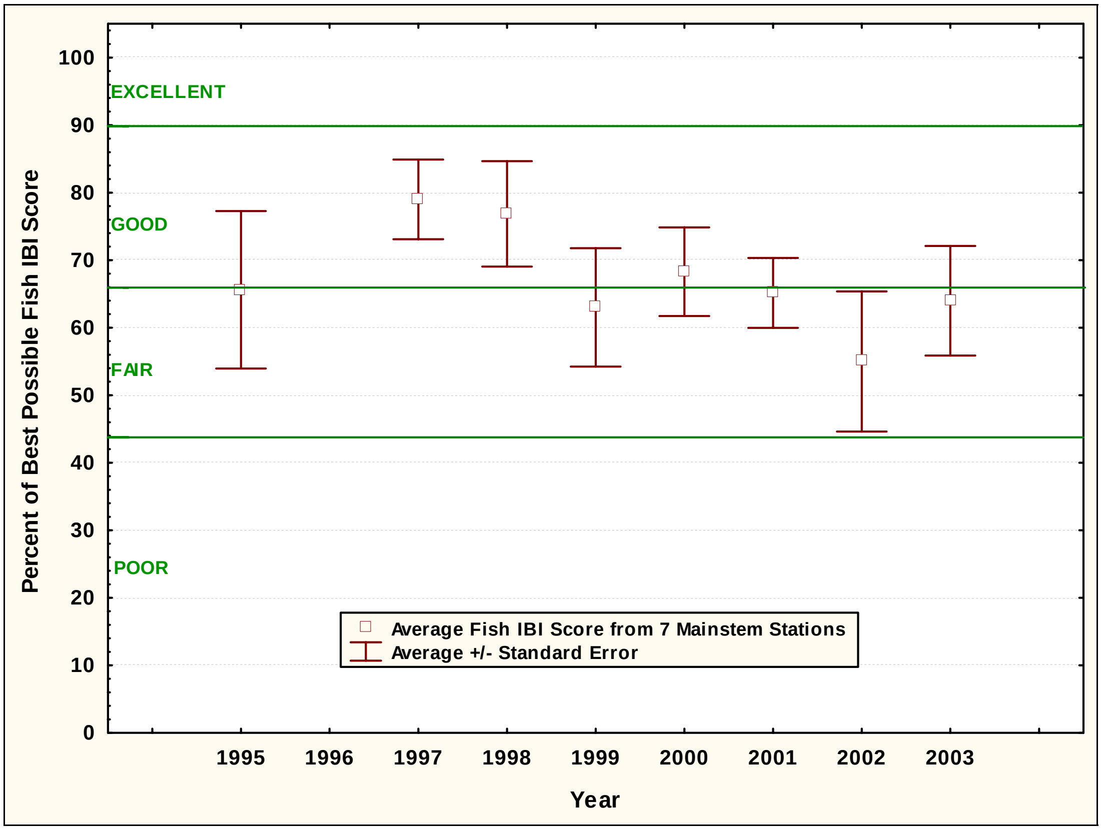

Figure 56 Time series plot of average fish IBI scores from seven stations along Piney Branch mainstem

Benthic macroinvertebrate monitoring results show that community health has remained fairly consistent over the past seven years. IBI scores from most monitoring stations have remained in the fair/poor range (Figure 57 and Figure 58). Results from years 1998 and 2002 show community health was slightly better then other years suggesting that stream conditions were favorable to the benthic community during years prior (1997 and 2001). In general, the health of the benthic macroinvertebrate community has remained in an impaired condition since monitoring began in 1996. The exception is monitoring station WBPB101, located on the Western Tributary, where community health has remained in the good range.

Results from 2003 indicate that the benthic macroinvertebrate community experienced additional impairment between the spring of 2002 and 2003 throughout the mainstem of Piney Branch but not in the Western Tributary. Benthic IBI scores from 2003 indicate poor community health at six of the nine monitoring stations along Piney Branch mainstem. IBI scores were in the fair range at three monitoring stations located in the downstream portion of the mainstem. This suggests that the source of impairment was in the headwater areas of Piney Branch and was dampened somewhat downstream.

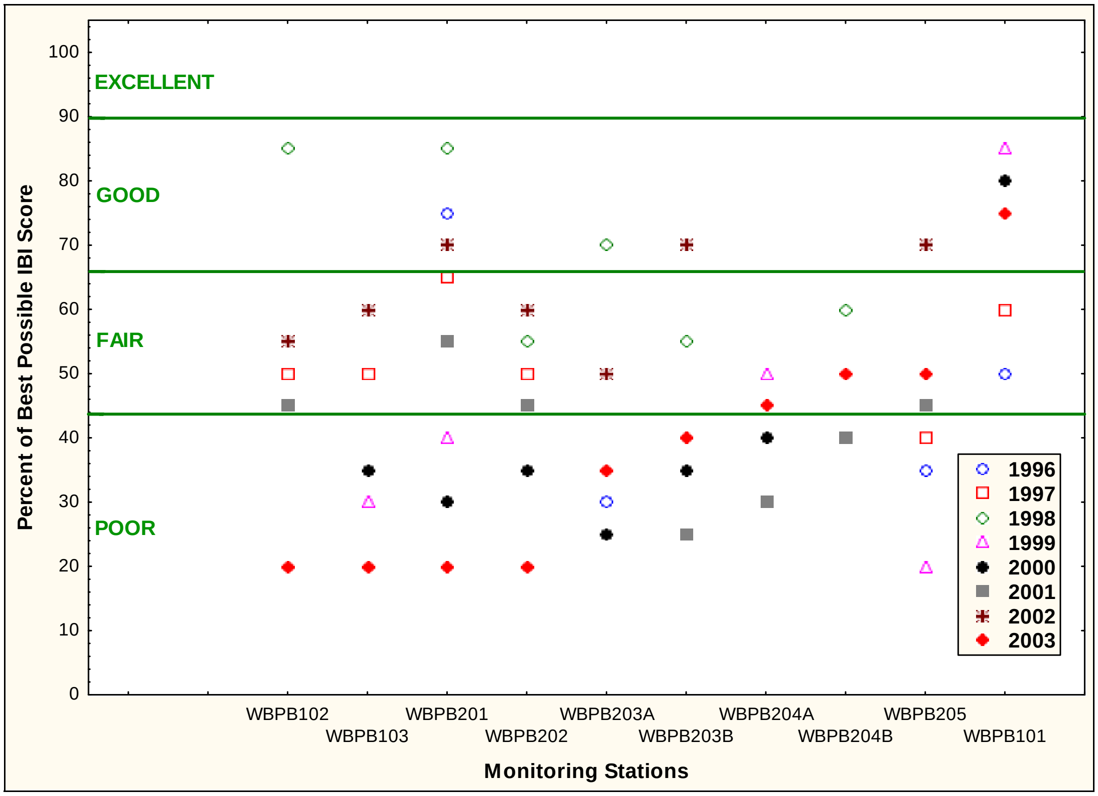

Figure 57 Results of Benthic Macroinvertebrate Monitoring In Piney Branch

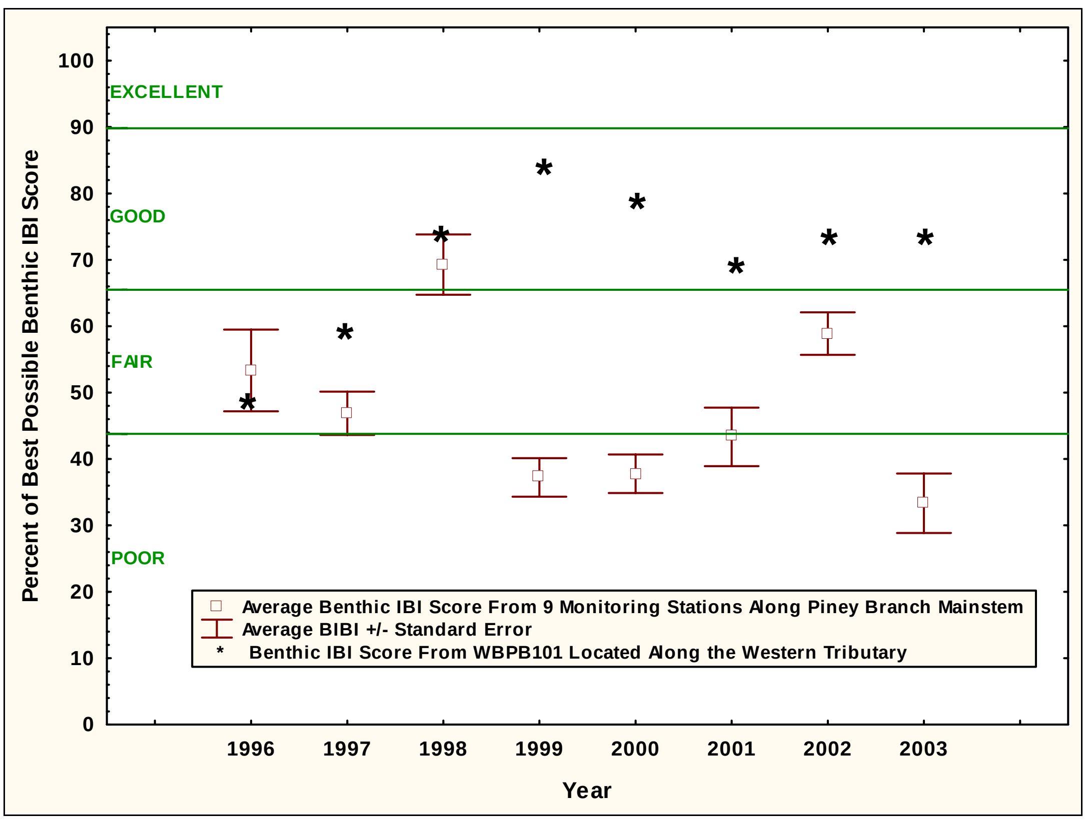

Figure 58 Time Series Plot of Benthic IBI Scores From Monitoring Locations Along Piney Branch Mainstem

Both the total number of individuals (density) and the number of taxa (diversity) dropped off sharply in benthic samples collected from stations throughout the mainstem during 2003. The decline was most profound in the upper portions of Piney Branch between Shady Grove Road and Cavanaugh Drive where the average number of bugs estimated per sample went from 1,652 for the period 1996 – 2002 to 51 in 2003, a 97% decline (Table 12). Reduction in density occurred to a lesser degree in the lower portion of Piney Branch and not at all in the Western Tributary. Results from monitoring stations in other SPA's also show reduced population density in 2003 but not to the extent as upper Piney Branch. This suggests that drought conditions in 2002 impacted population density in all area streams but that drought impacts appear to have been exacerbated in Piney Branch by additional impact(s).

Table 12 Benthic macroinvertebrate population density estimates from three areas of Piney Branch and other SPA's. Estimates were determined by extrapolating the number of individuals subsampled to the whole sample.

	Average number of bugs per sample (estimated) for the period 1996 – 2002	Average number of bugs per sample (estimated) for 2003	Percent change in estimated numbers from the period 1996–2002 to 2003
Upper Piney Br. *(5 monitoring stations between Shady Grove Road – Cavanaugh Road)*	1652	51	-97%
Lower Piney Br. *(4 monitoring stations between Cavanaugh Road – Glenn Mill Road)*	1492	270	-82%
Western Tributary to Piney Br. *(1 monitoring station -WBPB101)*	1913	3460	+81%
Little Seneca Cr. *(Town Center Trib. - LSLS103C)*	3730	530	-86%
Little Seneca Cr. *(Town Center Trib. – LSLS103B)*	1598	323	-80%
Ten Mile Cr. *(LSTM303B)*	2051	1650	-20%
Paint Br. *(Right Fork – PBRF117)*	2215	280	-87%

Because of the low number of individuals (<60 in the sample) and the loss of several pollution sensitive taxa, IBI scores were not calculated on monitoring data from four stations in upper Piney Branch (WBPB102, WBPB103, WBPB201, WBPB202) but rather a default rating of 'poor' was assigned to these stations for 2003 (Figure 57).

Clearly something impacted the benthic macroinvertebrate community in Piney Branch and appears to have originated in the upper portion of the watershed. Although drought is a contributing factor there appear to be other impact(s) that have degraded the benthic community. Possible causes of additional impact include sediment from construction activity on the Traville property or some type of toxic event that impacted the benthic macroinvertebrate community and not the fish.

The Willows of Potomac Home Owners Association (located in the upper Piney Branch) is one of approximately twenty two (22) HOA's throughout Montgomery County participating in the Mosquito Control Program run by the Maryland Department of Agriculture (MDA). Field records from MDA provide information on where, when, the type of mosquito control treatment used and how much was applied at the Willows of Potomac. According to the field records Methoprene was the agent used and was applied in stormwater ponds, outfall areas from ponds, vernal pools adjacent to Piney Branch and in some instances (during the summer of 2002 when only isolated pools were present) directly to the stream itself. Methoprene is a growth inhibitor causing incomplete development of insect larva such that the adult stage is never reached. According to the USEPA (http://www.epa.gov/pesticides/factsheets/larvicides4mosquitos.htm#methoprene) "Methoprene mosquito control products present minimal acute and chronic risk to freshwater fish, freshwater invertebrates and estuarine species". According to the EXTOXNET Pesticide Information Profile (http://ace.orst.edu/info/extoxnet/pips/methopre.htm) "methoprene is slightly to moderately toxic to fish…" and "very highly toxic to some species of freshwater, estuarine, and marine invertebrates". Methoprene "had very little effect, if any, on exposed non-target aquatic organisms including waterflies, damselflies, snails, tadpoles and mosquitofish". Both of these references indicate Methoprene is, at least, minimally toxic to freshwater fish and macroinvertebrates.

DEP is concerned that mosquito larvicide use in upper Piney Branch may have contributed to the reduced numbers observed in the benthic macroinvertebrate community particularly since it was applied directly to the stream. Methoprene degrades rapidly in water which would explain why there was less of an impact in the downstream portions of Piney Branch. Although MDA's field records indicate that a careful process was followed whereby the presence of mosquito larvae was confirmed before applying Methoprene, no in-situ studies have been done to determine the effects of its use in streams.

One monitoring station in upper Piney Branch that is located upstream of the treated area and presumably out of the area influenced by larvicide, also exhibited a sharp decline in benthic macroinvertbrate community density and composition. Therefore, the cause of declining biological conditions could be related to other factors including sediment from the extensive construction projects currently under way in upper Piney Branch. DEP will continue to monitor the biological condition of Piney Branch. If conditions do not improve after construction is complete and larvicide use continues, DEP may seek a cooperative study with MDA to examine its effects on stream ecology.

4.3.4.b Habitat Monitoring

Results of all rapid habitat assessments done in Piney Branch are presented in Figure 59. Median habitat scores from all stations have remained in the sub-optimal range. Meaning that overall condition of stream habitat is adequate to support a diverse biological community. Important habitat features such as woody debris (fallen trees, limbs and logs), undercut banks, root mats, rocky stream bottom and a variety of flow conditions (shallow fast, deep slow, etc) are present within the stream.

Habitat ratings completed at stations WBPB102 and WBPB204B are lower then any previous year. Analysis of individual parameters that make up the overall habitat assessment revealed several parameters explain these lower scores. Both stations scored low for bank stability and bank vegetative cover. At WBPB204B a large beaver dam, present since 2002, flooded the stream banks killing much of the vegetation. The dam was removed during one of the many high flow events that occurred during 2003 leaving high 'raw' banks and no vegetative cover. Low scores at WBPB102 may be related to new construction taking place on the Traville property. A new stormwater outfall empties into Piney Branch just upstream of the monitoring station. Additional storm flow could be the cause of lower habitat ratings. However, surveys of the stream channel cross section indicate little widening or deepening has occurred at WBPB102.

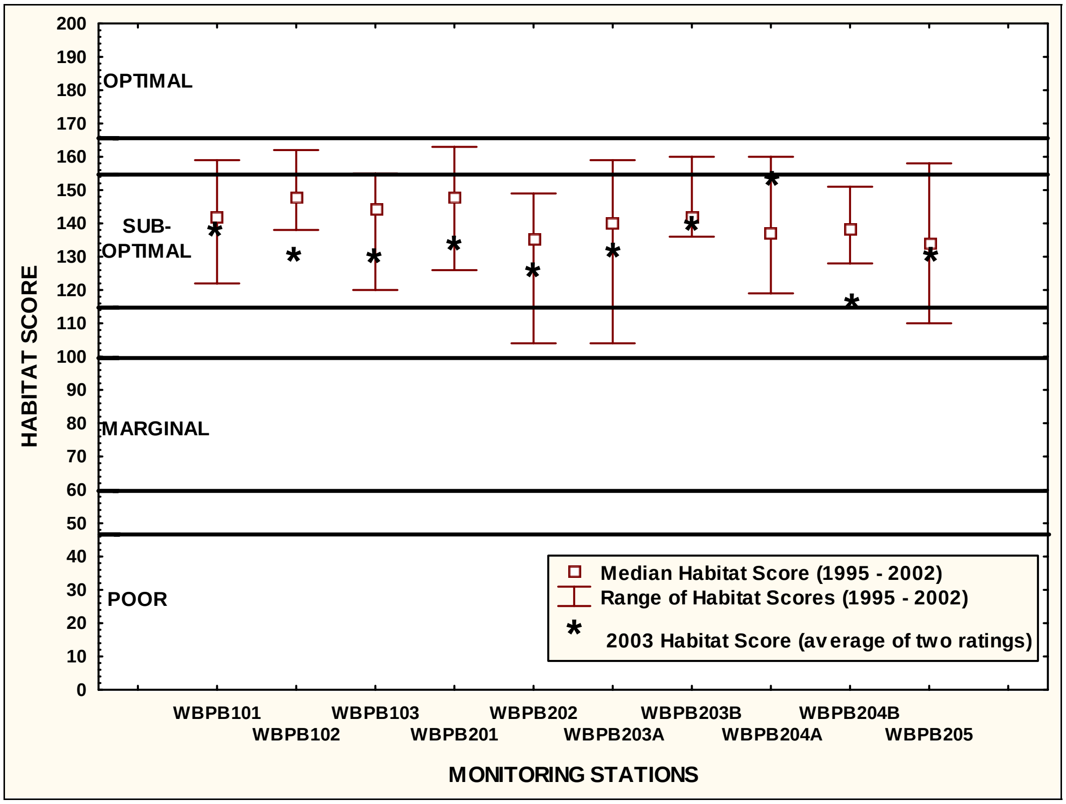

Figure 59 Results of Rapid Habitat Assessments In Piney Branch

Quantitative Habitat – Stream Channel Cross Sections

Stream channel cross sections were surveyed at eight monitoring stations in Piney Branch during 2003. The purpose of surveying stream channels is to determine whether the channel is widening or deepening as development proceeds in the watershed. As impervious surface area increases with the addition of rooftops, roads, parking lots, etc., the volume of stormwater runoff that reaches the stream increases. Higher stream flow leads to accelerated channel erosion, loss of stream habitat and consequently degraded biological communities. Therein lies the purpose of stormwater management, to capture stormwater runoff in structures designed to either infiltrate water into the ground or hold it and release at a slower rate over an extended period of time.

DEP uses stream channel cross section surveys, done over time, as a measure of how well stormwater management is protecting stream channels from degradation. It should be noted that cross sections are somewhat limited in that they provide information from a very small portion of the stream. Stream channels may be degrading (widening or deepening or both) in one stream segment while they are aggrading (sediment deposition) immediately downstream. However, if all cross sections surveyed throughout a streams length are analyzed together one can say with greater confidence whether or not the stream channel is degrading.

Results from all stream channel cross section surveys are presented in Table 13. Average change in stream channel area from cross section surveys done along Piney Branch is only +0.4 ft^2. Cross section surveys done on the Western Tributary (WBPB101) indicate an increase in stream channel area by 1.8 ft^2. The Western Tributary has not received any additional stormwater from new development during the period of study (1997 – 2003). These results indicate that stream channel degradation has been minimal along the mainstem of Piney Branch and that stormwater management on new development has been effective in channel protection.

Table 13 Stream channel area calculated from cross section surveys – positive change indicates channel enlargement (degradation), negative change indicates a reduction in channel area (agradation)

Station	1997 Stream Channel Area – sq. ft.	2003 Stream Channel Area – sq. ft.	Change In Stream Channel Area (1997 – 2003)	% Change in Channel Area (1997-2003)
WBPB101 (Western Trib.)	63.7 ft^2	65.5 ft^2	+1.8 ft^2	+3%
WBPB102 (Piney Br. Mainstem)	40.5 ft^2	38.6 ft^2	**-1.9 ft^2**	**-5%**
WBPB103 (Piney Br. Mainstem)	26.8 ft^2	26.7 ft^2	**-0.1 ft^2**	**0%**
WBPB201 (Piney Br. Mainstem)	72.4 ft^2	74.1 ft^2	**+1.7 ft^2**	**+2%**
WBPB202 (Piney Br. Mainstem)	77.1 ft^2	75.4 ft^2	**-1.7 ft^2**	**-2%**
WBPB204A (Piney Br. Mainstem)	104.1 ft^2	110.0 ft^2	**+5.9 ft^2**	**+6%**
WBPB204B (Piney Br. Mainstem)	112.0 ft^2	107.4 ft^2	**-4.6 ft^2**	**-4%**
WBPB205 (Piney Br. Mainstem)	157.5 ft^2	159.4 ft^2	**+1.9 ft^2**	**+1%**
Average Change In Stream Channel Area At 7 Mainstem Stations			**+ 0.4 ft^2**	

Stream channel surveys from two stations where higher rates of change were observed are plotted in Figure 60 and Figure 61. At station WBPB204A the stream channel appears to have widened while downstream at station WBPB204B the stream channel has aggraded.

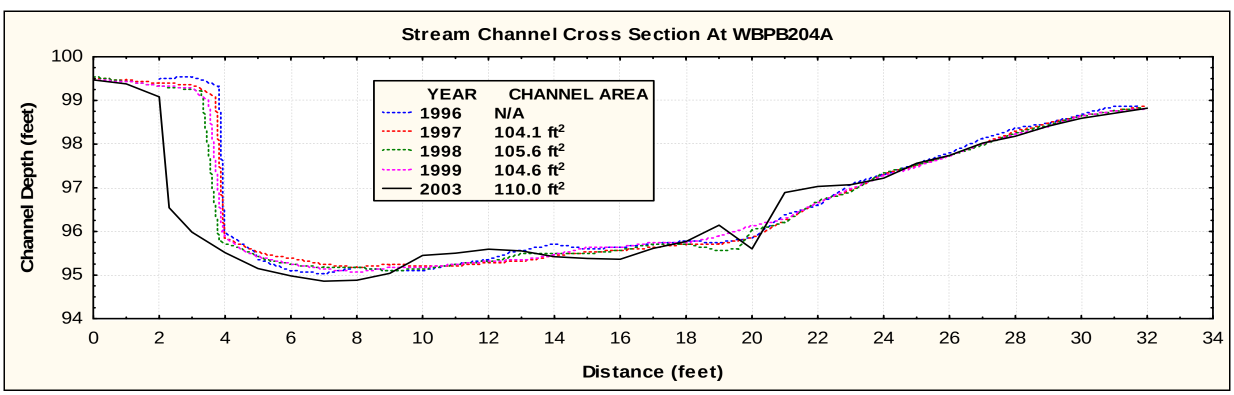

Figure 60 Stream Channel Surveys From WBPB204A

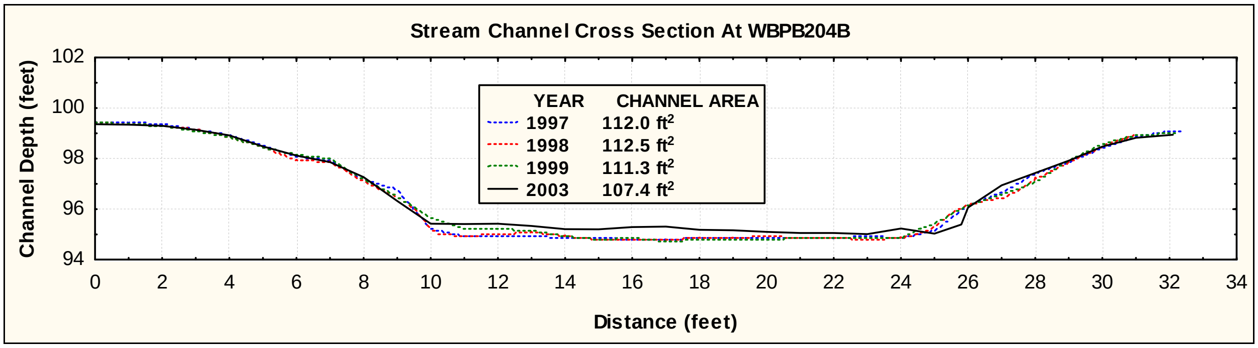

Figure 61 Stream Channel Surveys From WBPB204B

4.3.4.c Temperature Monitoring

A temperature logger was deployed at WBPB101 on the Western Tributary during the summer of 2003. Water temperature data collected in 2002 from the same location is plotted in Figure 62 for comparison. Stream temperature was 2.6^0 F warmer, on average, during the summer of 2002 then 2003. Stream temperature was likely cooler throughout the rest of Piney Branch which, along with better flow conditions, improved overall stream condition giving reason to believe that biological health of Piney Branch should improve in 2004.

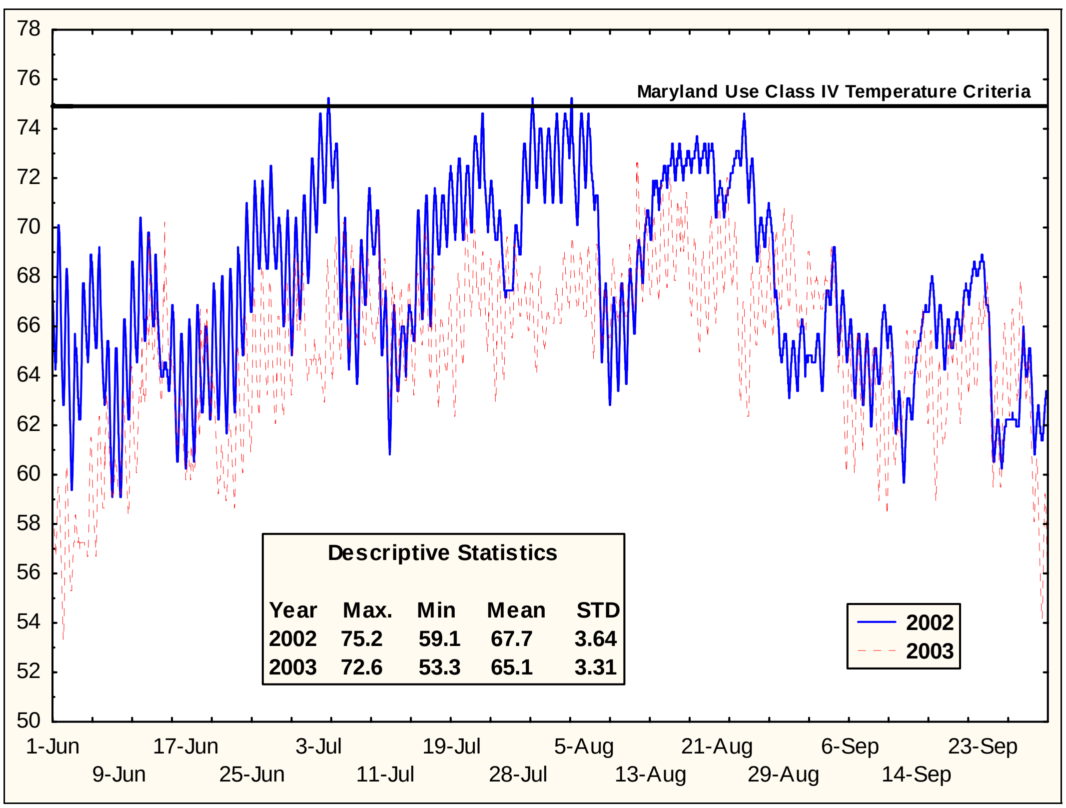

Figure 62 Water Temperature Data From Piney Branch – WBPB101 (Western Trib.)

4.4 Upper Rock Creek Special Protection Area

4.4.1 Description of Upper Rock Creek SPA

On February 24, 2004, the County Council designated a new Special Protection Area when they adopted the Upper Rock Creek Master Plan. The Upper Rock Creek Special Protection Area includes the Upper Rock Creek watershed within the Upper Rock Creek Planning Area north of Muncaster Mill Road (Figure 63). This area is generally bounded by Woodfield Road on the west, Route 108 on the north, Bowie Mill Road and the North Branch Rock Creek on the east and Muncaster Mill Road on the south.

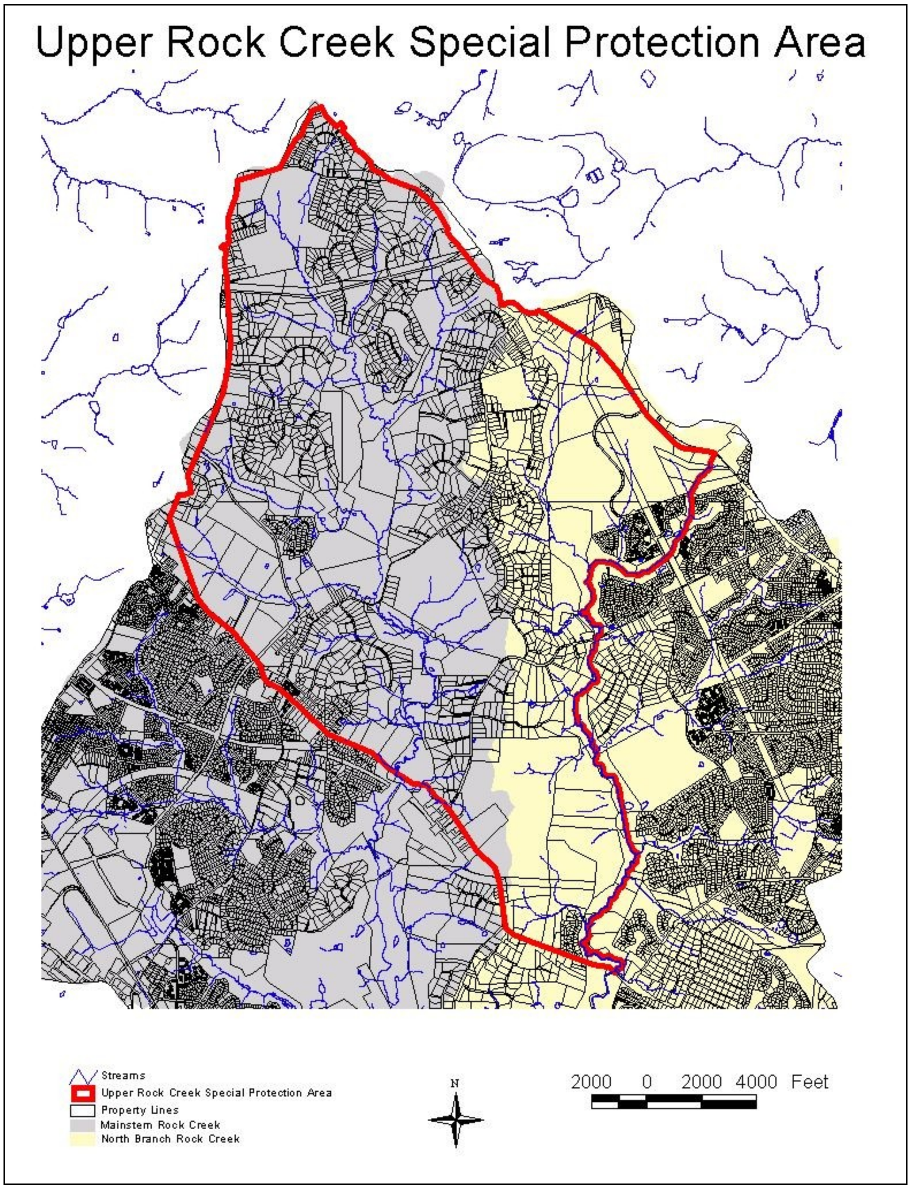

Figure 63 Upper Rock Creek SPA

The Council determined that the existing water resources, including the Use III stream and associated forests and wetlands, are of high quality and unusually sensitive (The Upper Rock

Creek Master Plan and the Upper Rock Creek Environmental Resources Inventory contain additional information describing these resources). While the Master Plan recommends zoning densities that will result in relatively low watershed imperviousness (hard surfaces imperviousness between 9-11.2%), there was still a concern that the proposed land uses have the potential to threaten the resources in the absence of special water quality protection measures that are closely coordinated with land use controls. The master plan uses the Rural Neighborhood Cluster Zone to set aside large areas of contiguous open space in its natural state. Much of this area will be added to the Rock Creek and North Branch Stream Valley Parks at time of subdivision. The new parkland will include almost all environmental buffers on undeveloped property and contiguous forest stands remaining in the watershed. The Plan also removes the exemptions for submission of a water quality plan, requiring all new development to comply with that provision.

In addition, the County Council has adopted that an environmental overlay zone to implement an 8% imperviousness cap on all new development receiving sewer service (with some exceptions noted in the overlay zone). The zone provides that public projects should employ all reasonable techniques to reduce imperiousness to the 8% level, but the cap must not preclude the construction of public projects.

4.4.2 Summary of Stream Monitoring in Upper Rock Creek SPA

Prior to Upper Rock Creek being designated an SPA, DEP had established seventeen (17) fixed monitoring stations (Figure 64) to assess stream condition as part of the Countywide Stream Protection Strategy (CSPS). Biological sampling (fish and benthic macroinvertebrates) was first completed at these stations in 1995. Most were sampled again in 2002 for the CSPS update. Results from this sampling indicate that most streams in the Upper Rock Creek watershed are in good to excellent condition. These seventeen monitoring stations are scheduled to be sampled by DEP once every five years.

Once Upper Rock Creek was designated an SPA, DEP established eight new monitoring stations from which biological sampling (benthic macroinvertebrates only), habitat assessment and water quality readings will be taken. These eight stations are located on small tributaries that drain parcels of land slated for development and will be monitored annually to provide the necessary information to evaluate the level of stream protection.

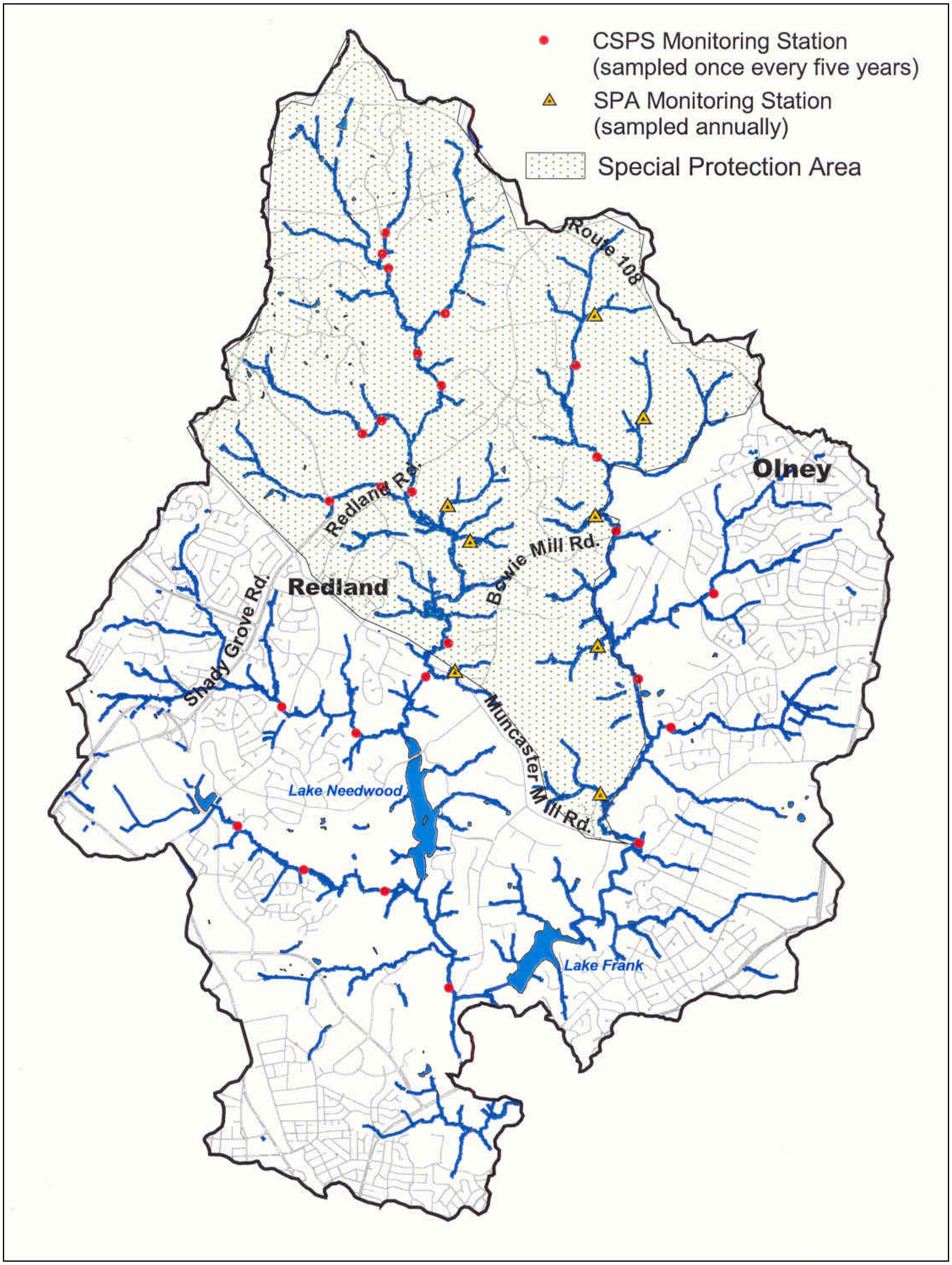

Figure 64 Upper Rock Creek Watershed

5.0 BMP Monitoring

5.1 Introduction

SPA development projects are required to implement linked systems of modern BMP controls designed to enhance effective management of runoff impacts from construction activity and completed development projects on stream quality. In order to evaluate the effectiveness of these efforts, developers must perform BMP monitoring of their sites. BMP monitoring is separate from DEP stream monitoring which focuses on stream biology and habitat in stream systems. Stream monitoring can be used to evaluate the overall impact of development on streams. BMP monitoring by developers focuses on the effectiveness of the BMPs on individual projects in mitigating impacts to water quality. BMP monitoring gives information on particular BMP approaches while stream monitoring gives information on development impacts overall. Montgomery County BMP monitoring protocols are available at the following web address. http://www.montgomerycountymd.gov/content/dep/spa/pdf%20files/bmpprotocols.pdf.

Developers hire consultants to fulfill BMP monitoring requirements that are produced during the planning process. The type of BMP monitoring that is required varies depending on the particulars of the individual project. Up to one year of monitoring may be required before construction begins. Projects may be required to monitor BMPs throughout the construction period and for up to five years after the end of construction. Projects provide regular updates on their monitoring results. Table 18 lists the SPA development projects currently submitting BMP monitoring data and identifies the sort of data they are collecting.

SPA BMP monitoring utilizes a variety approaches depending largely on site design and type of BMP to be monitored. Monitoring can be conducted at a site over a long period of time to allow comparison of pre-construction conditions with post-construction conditions. Annual surveys of channel cross sections are an example of how this approach can be used to evaluate development impacts. Other monitoring may seek to look at spatial differences. Temperature loggers placed in a stream above and below a development outfall would be an example. Comparison of the temperature differences between the two loggers will minimize the impacts of annual weather variation and isolate the impacts of a single development. Other monitoring is very closely targeted to evaluate the impact of a single treatment train or BMP structure. An example would be water samples collected at the inflow and outflow points of a sediment trap. As we accumulate more data, results from multiple projects will be aggregated to produce a body of information on the effectiveness of particular design approaches at different sites. This will allow comparison of design features including differing classes of BMPs. The information will also allow evaluation of the performance of similar types of BMPs under differing land use scenarios. The results will be used by DPS, MNCPPC, developers and consulting firms to improve designs on future projects and guide maintenance efforts. The results should also aid in countywide evaluation for NPDES permit-required assessments and for the cooperative nutrient reduction efforts for the Maryland's Tributary Strategies. Ultimately, SPA BMP data, along with DEP stream monitoring data, will be helpful in evaluating the compatibility of development, using modern storm water controls, with the maintenance of healthy streams.

5.1.1 Sequence of Data Collection

Data collected during the pre-construction period generally provides information on baseline conditions. This data is very useful for comparison with data collected during and after construction. During construction, data is collected on parameters such as sediment control effectiveness, groundwater levels, channel conditions and stream temperature. Post-construction monitoring of water quality BMPs provides additional information. It can be compared to the pre-construction and during-construction data to evaluate impacts of the completed development with stormwater management BMPs in place. Post-construction data allows evaluation of the effectiveness of stormwater management BMPs and the ability of streams to absorb construction impacts and adapt to developed conditions.

Thus far, the phasing of most development activity in SPAs has been such that most collected BMP monitoring data represented pre-construction or during-construction conditions. Considering the length of the planning process and the pre-construction and during-construction periods, it may be many years from the time that monitoring requirements are specified until information on stormwater BMPs is produced in sufficient amounts to allow conclusions to be made about stormwater management BMP effectiveness.

Currently seventeen (17) projects are submitting during-construction monitoring data and thirteen sites have submitted data on post-construction monitoring. Most of the sites now in post-construction are relatively small and are collecting lesser amounts of data. In the past year construction work has begun on some of the larger tracts of land in the SPAs which have proportionately larger monitoring requirements. The data collected so far has permitted a few conclusions to be drawn on the effectiveness of efforts to minimize development impacts in SPAs. Total suspended solids (TSS) data on sediment control efforts have been received from three development projects and some preliminary conclusions are in this report. There is currently a large amount of construction under way in the SPAs. With much more data expected next year, a better evaluation of sediment control BMPs will be available for the next SPA annual report. This report also contains some preliminary data on the effectiveness of water quality BMPs. More data should be coming in next year.

5.2 During-Construction Monitoring

The most useful information received so far from SPA BMP monitoring has been during-construction data because we have received enough information to begin drawing conclusions about BMP effectiveness. SPA sediment control structures are multi-celled and generally 10 - 25% larger than those required in the rest of the county (
Figure **65**). Current state requirements mandate that sediment traps be sized to hold about an inch of rainfall and SPA structures are often oversized to provide additional protection. Rainfall intensity is not a design parameter for sediment control structures. Structures are designed to hold a particular volume of sediment and water. The volume is determined by calculating the disturbed area draining to the structure and multiplying by a selected rainfall amount. Sediment control structures work by detaining stormwater for a period of time so that particles carried in the water can settle out. All particle sizes settle out eventually, but larger sediment particles are more likely to be trapped in the sediment control structure. The smaller the particle, the more likely it is to remain suspended, and pass through the structure.

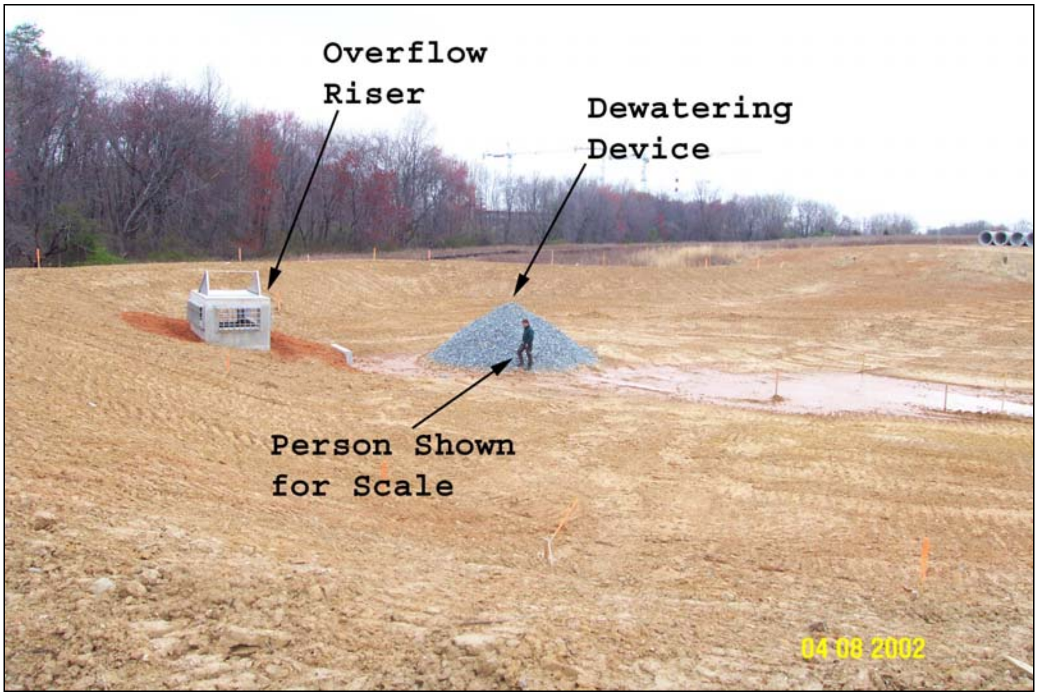

Figure 65 Sediment Control Structure, Traville

The configuration of sediment control structures varies but a typical version has a single forebay and a main cell. Water initially flows into the forebay for settling. From there some water drains through a dewatering device to the main cell of the structure. A dewatering device is generally a mound of two inch gravel covered with a layer of 70 sieve non-woven filter cloth outside of 100 sieve non-woven filter cloth. Soil particles smaller than 100 sieve that could pass through this filter are called clays. A perforated pipe inside the gravel mound drains water from the forebay and carries it to the main cell. The dewatering device acts to filter some of the stormwater and increase sediment removal.

Larger storms can fill the forebay and overflow directly into the main cell bypassing the dewatering device. The main cell is generally much larger than the forebay and also has a dewatering device which moves filtered water from the main cell and releases it to run to the nearest stream. The main cell also has an overflow riser that bypasses the dewatering device during larger storms. When the structure fills with sediment to a pre-determined level, maintenance is required. The structure is drained and the accumulated sediment must be removed and the dewatering devices refurbished before the structure is put back into service. Figure 66 shows a two-celled structure and illustrates the value of redundancy in trapping sediment. The water gets visibly clearer as it moves from right to left through this structure.

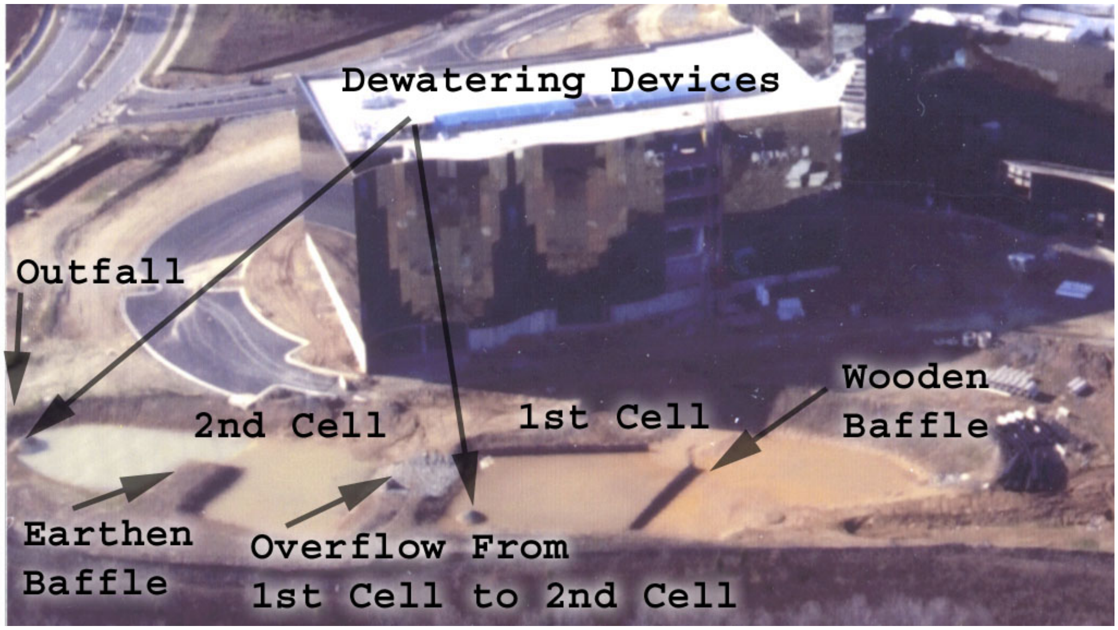

Figure 66 Two Celled Sediment Control Structure (courtesy of Loiderman Soltesz Assoc.)

Monitoring results have been variable reflecting the variability of rainfall amounts, intensities and durations impacting particular development sites. Results indicate that SPA sediment control BMPs perform well during rainfall events of a half inch or less. On average, rainfall events of a half inch are seen roughly monthly in the county. During rainfall events of 1.6 inches or more, sediment control efforts are less effective. The area can be expected to receive several storms of this size annually. On average, the area can be expected to annually have a storm deliver at least 2.5 inches of rain in a 24 hour period. This is called a one year 24 hour storm event.

Monitoring has also shown decreased sediment removal efficiency as structures fill up over the duration of a construction project. Effectiveness of sediment control structures is measured in a number of ways. The amount of total suspended solids (TSS) in the water entering and leaving the structure can be compared to evaluate the efficiency of the structure in removing sediment. For example, monitoring of the Running Brook project found the sediment control structure to be effective in reducing sediment leaving the site for small storms up to about a half inch of rainfall (Figure 67). Overall the structure reduced TSS concentrations a mean of 64% during four of these small storms throughout construction. During a large storm of 1.60 inches midway through construction though, the structure had almost no overall effect. Water entering the BMP had slightly less TSS than the water leaving the BMP. Later in construction the trap apparently partially filled with sediment and a storm of 0.85 inches resuspended accumulated sediment and flushed it out of the structure. Although the 1.60 inch storm may exceed the designed capacity of the structure, 0.85 inches of rain is within the designed capacity of the facility. In that event the water leaving the structure had almost three times the TSS concentration of the water entering the structure.

The project was clearly having an impact on stream conditions during the 0.85 inch storm. Turbidity measured in the receiving stream below the BMP outfall was 41.2 nephelometric turbidity units (NTUs) while above the outfall the stream turbidity was only 1.47 NTUs.

Turbidity is a measure of the clarity of a water sample. Light is shined on the sample and a measurement is made of the amount of light that is reflected at a 90 degree angle. This is compared to a reference sample and is used to arrive at a measurement of the turbidity of the sample in NTUs. This indicates the amount of small solid particles suspended in the water which cause it to appear cloudy. The increased turbidity below the project outfall indicates that the project was releasing small particulates and making the stream cloudier. In both of these larger storms (0.85 and 1.60 inches) the TSS measured between the first and second cells was reduced 52% from the value at the entrance. This supports the idea that the sediment in the second cell was being re-suspended. The consultant suggested that cleaning out the trap may have prevented this result. DPS has verified that the trap was never cleaned out during the construction period.

Table 14 Running Brook Storm Sampling

Running Brook Sediment Trap Stormwater Sampling							
	Monitoring Date	Location					Precipitation (inches)
		TSS (*mg/L*) Station #1	TSS (*mg/L*) Station #2	Percent Reduction Forebay	TSS (*mg/L*) Station #3	Overall Percent Reduction	
Early Construction	March 26, 2002	23	19	17.39%	18	21.74%	0.56
	June 7, 2002	58	21	63.79%	12	79.31%	0.27
Middle Construction	October 11, 2002	100	48	52.00%	104	-4.00%	1.60
	February 4, 2003	520	428	17.69%	226	56.54%	0.40
Late Construction	May 16, 2003	110	53	51.82%	410	-272.73%	0.85
	September 3, 2003	110	8.5	92.27%	8	92.72%	0.31

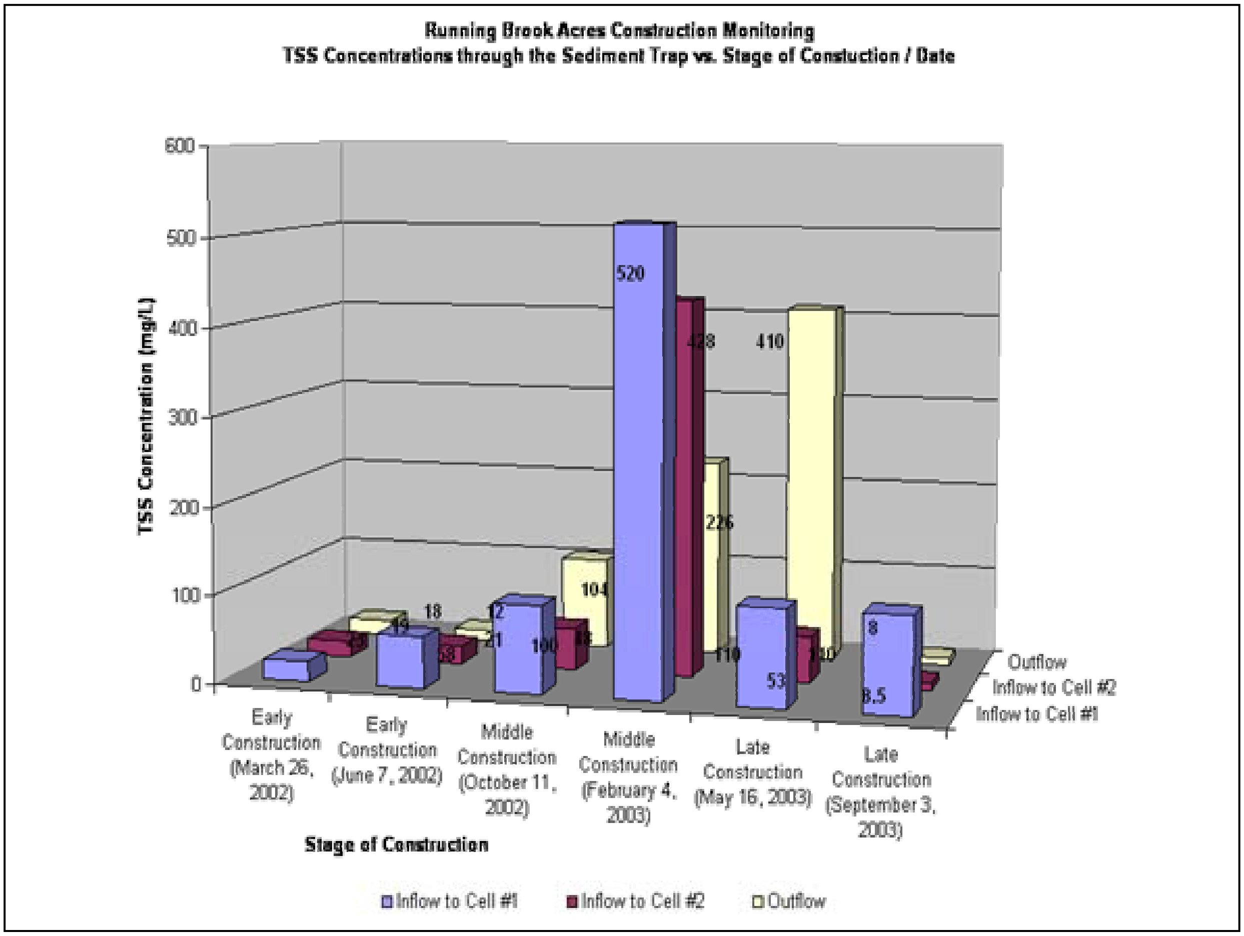

Figure 67 Running Brook Sediment Trap Efficiency

The Martens project in Clarksburg also found storm size to be an important factor in sediment control effectiveness. Much more sediment entered the on-site sediment trap during a 1.72 inch storm on 9/18/03 than during a 0.51 inch storm on 10/27/03 (Table 15). The 1.72 inch storm in September was probably at or above the designed capacity of the structure. Following the large September storm, water in the forebay had a TSS concentration of 340 mg/L. At the outfall on that date the TSS concentration was 440 mg/L indicating that sediment was being re-suspended and the pond was not providing much benefit. Following the small storm in October the TSS concentration entering the facility was a relatively low 86 mg/L which decreased to 35 mg/L at the outfall. This echoes the Running Brook results indicating the effect of storm size on sediment control. Rainfall intensity was not very different for the two storms. The Martens project is still under construction and we expect to get additional results in the coming year.

Table 15 Martens Sediment Control Structure Efficiency

Sample Collection Date	Rainfall (inches)	Rainfall Intensity (in/hr)	TSS Entering (mg/L)	TSS Leaving (mg/L)
9/19/03	1.72	0.11	340	440
10/28/03	0.51	0.08	86	35

The Fairland Farms (formerly Hunt Miles Tract) property in Paint Branch SPA collected data on two small storms on September 3 and 4, 2003 that also indicated good removal rates and little sediment leaving the site (Table 16). There was too little flow at the outfall to collect a sample which means that the structure was not delivering measurable amounts of sediment to the stream. In contrast to the results from Running Brook and Martens, a larger storm on September 23, 2003 also had a good removal rate.

Table 16

Fairland Farms Sediment Control Structure Efficiency

Date	9/3/03	9/4/03	9/23/03
Rainfall	0.12	0.37	2.14
TSS Entering	120	400	356
TSS Leaving	No flow	No flow	80
Removal Rate	~100.0%	~100.0%	77.5%

All of the above data on sediment control BMPs is based on grab samples. Grab samples are collected at a single point in time during a storm. Sometimes several grab samples are collected over time and blended to attempt to produce a more representative sample of conditions. The data seems to be reliable and consistent. However, because it is not collected throughout an entire storm, it may not accurately represent the overall effect of the BMP on all the runoff from the storm. In the coming year we expect to begin receiving data collected by automated samplers throughout entire storms that can be used to more confidently evaluate the effectiveness of BMPs. This data, because it is collected through an entire event, will certainly be representative of the entire storm and not a brief point in time.

5.2.1 Temperature Monitoring Results

Most temperature monitoring results are from projects still under construction and therefore are used to evaluate thermal impact from sediment control ponds. At most projects water temperature loggers are placed in the receiving stream upstream and downstream of outfalls from sediment control ponds. Table 17 lists temperature stream differences upstream and downstream of outfalls from five SPA development projects.

Table 17 2003 Stream Temperature Monitoring Results

Development Project	Mean Temperature Upstream (°F)	Mean Temperature Downstream (°F)	Mean Temperature Difference (°F)	Site Induced Spikes During Storms	Status	Drainage Area (sq. mi.) of receiving stream
Highlands	63.74	62.62	-1.12	No	Under Construction	0.41
Timbercreek	64.40	64.30	-0.10	No	Almost Completed	3.31
Martens	64.12	65.36	1.24	No	Under Construction	4.23
Hunt Lions Den	64.58	64.28	-0.30	No	Under Construction	0.61
Miles	64.74	65.19	0.45	No	Under Construction	1.35
Peters	20.68	20.22	-0.46	No	Completed	1.99

These projects generally outfall to larger streams with an average drainage area of two square miles. The results indicate that these projects are not having large impacts on stream temperatures. The average impact of the five projects was a 0.05°F decrease in stream temperature as the water moved past the sites. None of these projects appeared to increase stream temperatures during storms. Typical of these projects is the Hunt Lions Den project in Paint Branch SPA (Figure 68).

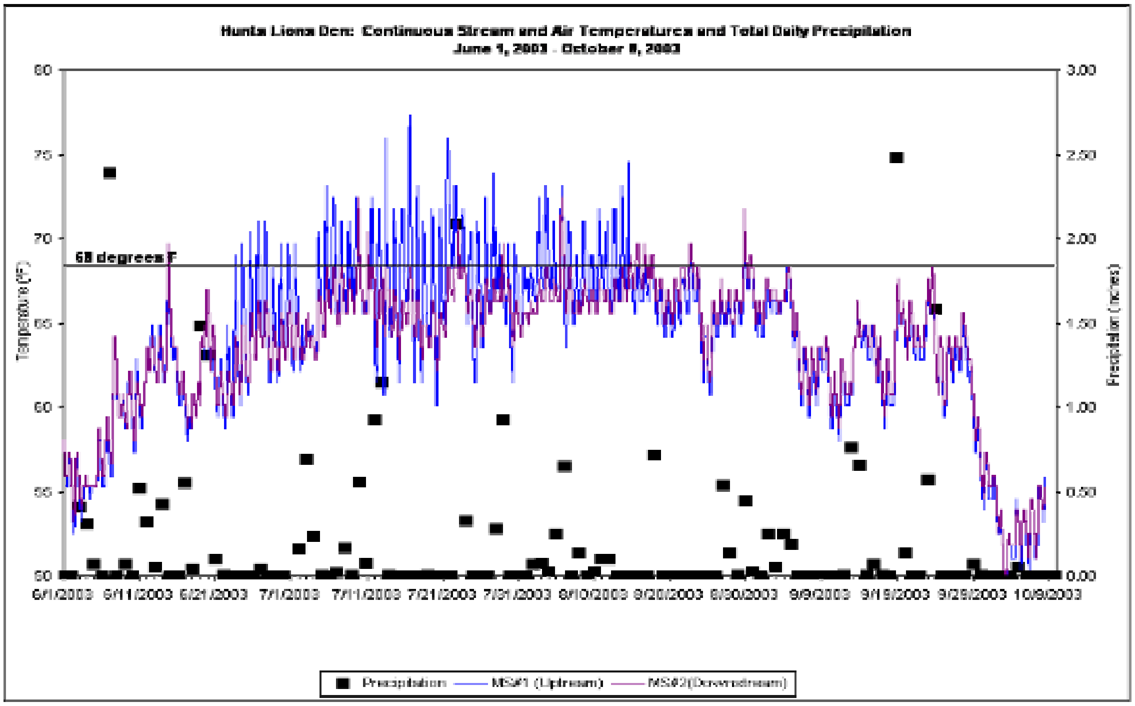

Figure 68 Hunt Lions Den Temperature and Rainfall Data

The data indicate that temperatures above and below the project did not differ greatly during summer of 2003. The average difference between the two loggers was 0.3 degrees Fahrenheit. No temperature spikes were observed here during storm events indicating that the sediment control pond is not delivering bursts of heated water to the stream during storms. These projects are all on streams of moderate size and temperature impacts could be hidden by dilution effects.

Results from the Martens development project show mean water temperature is considerably warmer downstream of the site (Table 17). This is due to the considerable distance between the upstream and downstream monitoring locations and a lack of stream side tree cover to provide shade along this stretch of Little Seneca Creek.

While monitoring data from larger streams has not identified temperature impacts from sediment ponds, data from two projects on smaller headwater streams (drainage area < 0.4 square miles) have identified temperature impacts during construction. Sediment control ponds protect streams from sediment impacts, but they also provide an opportunity for water to become warmed. This water can have temperature impacts on nearby streams if released suddenly during a storm. In very small streams there may not be enough flow above the site to collect upstream/downstream temperature data as on larger streams. A single temperature logger can still identify impacts on these sites in comparison with pre-construction data. Temperature spikes have been seen at DEP stream monitoring station LSLS103c (drainage area = 0.40 sq. mi.) in the stream below Stringtown Road and the Clarksburg Town Center project (Figure 15, in section 4.1.4.c). The temperature spikes were still seen well downstream from the site at LSLS103b (drainage area = 0.90 sq. mi.) although they were dampened somewhat (Figure 15, in section 4.1.4.c).

Temperature spikes were not seen here before construction. Biology in this stream has degraded in the last year and temperature impacts may have played a small role. The decline in stream biology is more likely due to 1) drought impacts, 2) sediment deposition or 3) a release of chlorinated water on 4/14/03 (Section 4.1.4.a). The monitoring of the All Souls Cemetery project also found temperature spikes when examining data from a Wildcat Branch tributary downstream from the project's sediment pond (drainage area = 0.1 sq. mi.). Figure 69 shows temperature spikes associated with storm events throughout the summer. Temperature spikes of this sort were not observed in past years at this sampling point, again indicating the apparent role of the sediment pond in causing warm water discharge impacts.

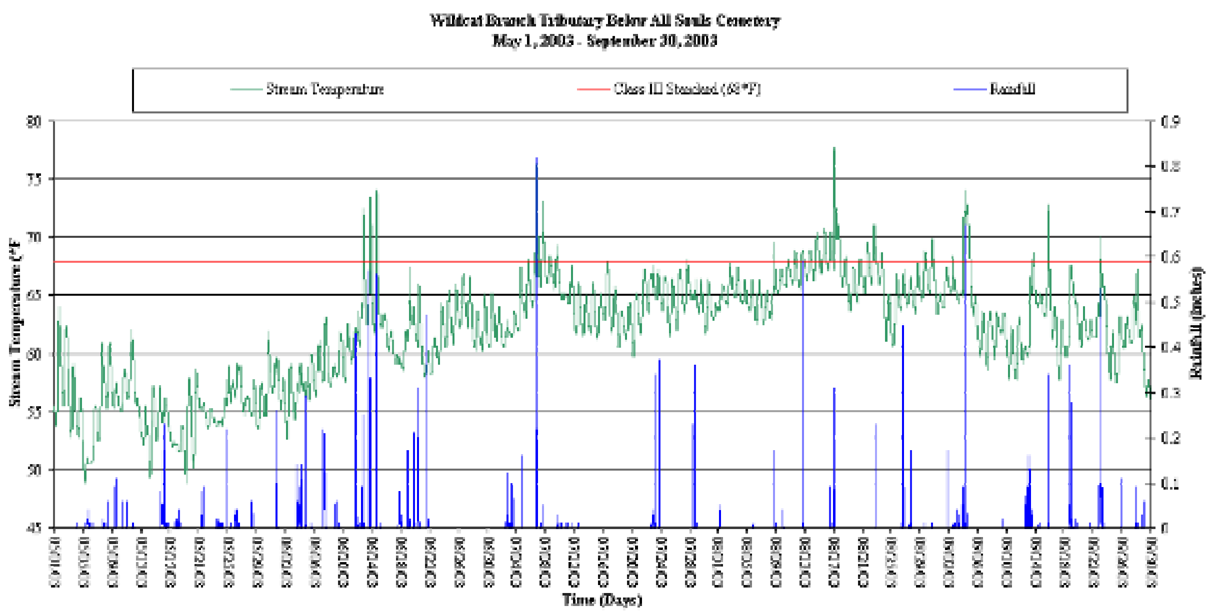

Figure 69 Wildcat Branch Temperature and Rainfall Data

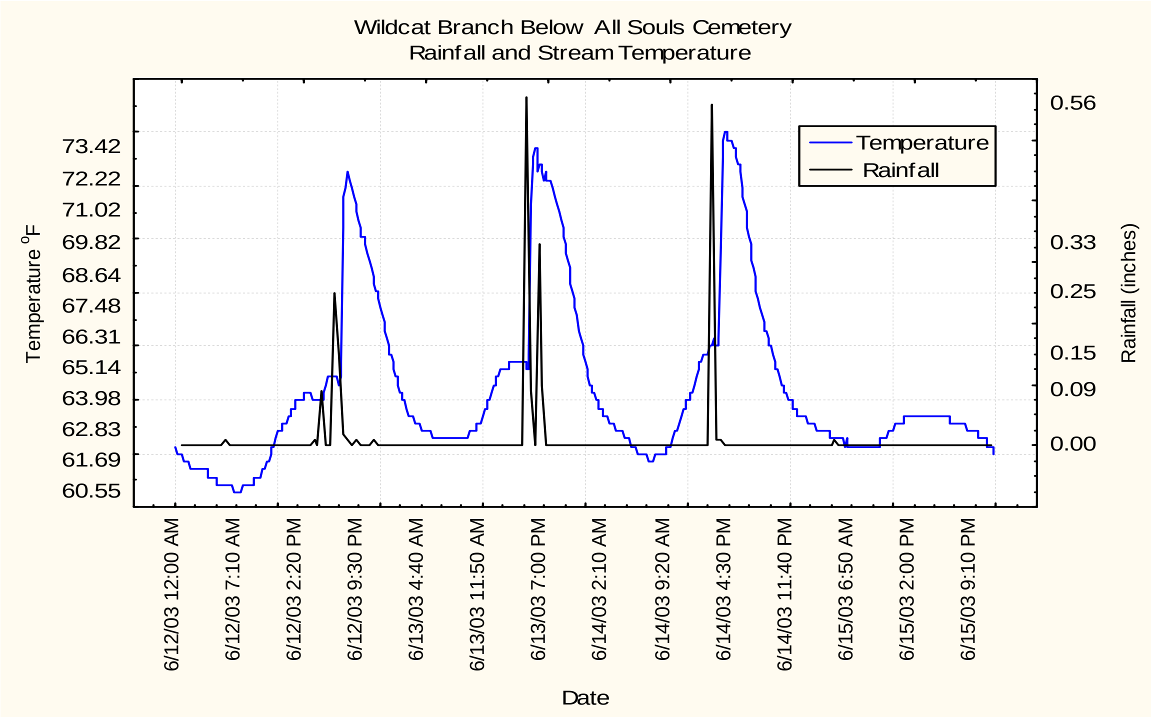

Figure 70 Wildcat Branch Storm Response

Both Wildcat Branch and the Town Center tributary are very small headwater streams where sediment pond discharge makes a major contribution to stream flow. Although there were temperature increases, the maximum temperatures observed were not extreme. The maximum temperature observed in Wildcat Branch was 77.77 degrees Fahrenheit. The maximum temperature observed in the Town Center tributary was 74.9 degrees Fahrenheit. 2003 was fairly cool summer and this may have helped moderate any impacts. The temperature impacts were also episodic and only lasted for a few hours after each storm. A graph of the temperature impacts from three typical storms in Wildcat Branch is shown in Figure 70. Stream temperatures during these events appeared to be elevated for about six to seven hours before returning to normal. Eleven storms caused temperature impacts to the stream during the 2003 monitoring period. Stream biology does not appear to have been adversely affected by these brief increases in stream temperature (Section 4.1.4.a). The perceived positive tradeoff is that the effectiveness of the sediment ponds in removing suspended solids outweighs the minimal temperature impacts observed.

Development and increased imperviousness often has been associated with the delivery of heated water to streams during storms. BMP monitoring has so far not identified any major impacts. As we have only documented temperature impacts from the two projects discussed above that are under construction near small headwater streams, it appears that efforts to minimize temperature impacts have been relatively successful so far. However 2003 was a very cool summer and most BMP temperature monitoring data is on pre-construction and during construction conditions.

5.2.2 Groundwater Monitoring Results

BMP groundwater level data collected so far has generally provided information on pre-construction and during-construction conditions on development projects. Most of this data reflects conditions overall on project sites. 2002 was a record drought year. County-wide groundwater levels were eight feet below normal on average in 2002 and returned to normal in 2003. Groundwater levels were very low in many areas of the SPAs. Generally upland areas were more impacted while wells in floodplain areas showed much less impact. The upland well at the Timbercreek project (Figure 71) was dry for large portions of 2001 through 2003 while the floodplain well maintained a constant level. This provides good information on worst case conditions at the site. Data from the Fairland Community Center project in Paint Branch exhibits a similar pattern (Figure 72). The stream buffer well was much less impacted by the drought than the parking lot well in the upland area.

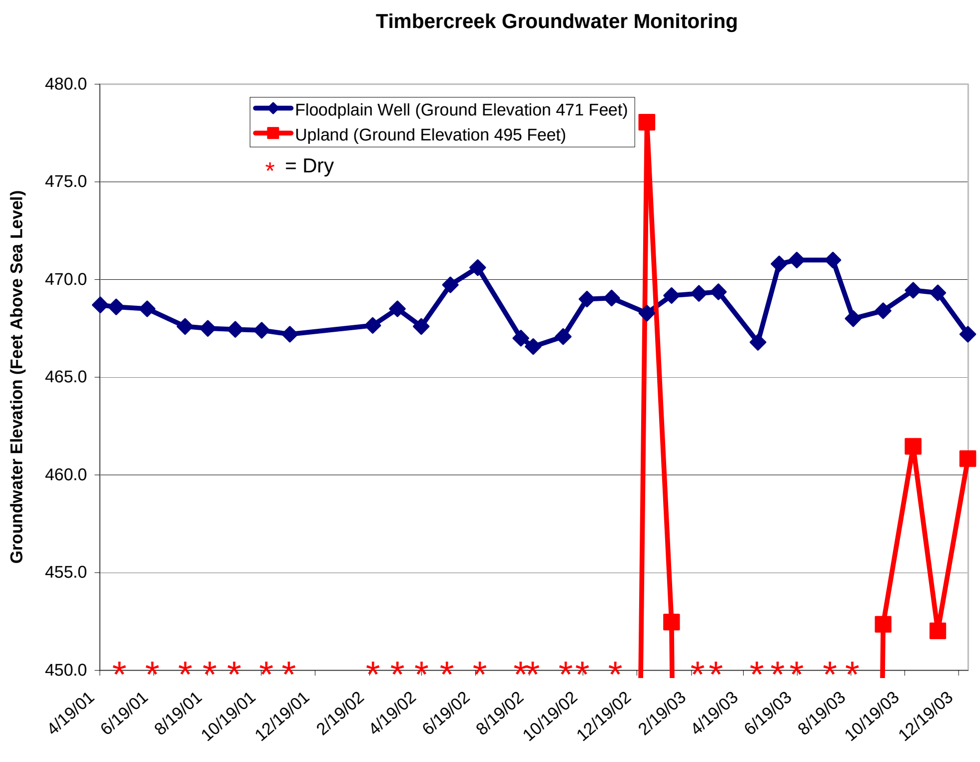

Figure 71 Timbercreek Groundwater Monitoring

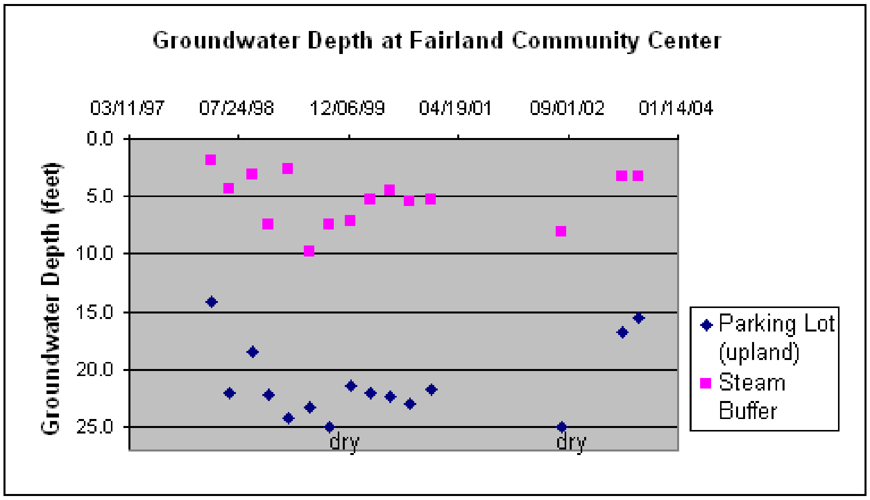

Figure 72 Fairland Groundwater Data

The drought ended in late 2002 and SPA groundwater returned to more normal levels in 2003 as the area received more rainfall. So far, no development impact on overall groundwater levels has been isolated from SPA construction, but the drought of 2002 and large amount of rainfall in 2003 has greatly complicated interpretation of the data. The accumulation of additional data in coming years will help evaluate the impacts of SPA development on overall groundwater levels. We currently have post-construction data from four wells on three properties. Additional data on post-construction conditions will be especially helpful.

DEP is also hoping to get data that sheds light on the effectiveness of individual BMPs at promoting infiltration of groundwater. The Gateway Commons project in Clarksburg SPA has been collecting data using a continuous level logging instrument (Figure 73). Although this is pre-construction data, it clearly shows the impact of individual storms on groundwater. Continuous data of this sort has the potential to help us learn much more about the function of individual infiltration BMPs. Technological advances have made the collection of this sort of data much more practical in recent years. In the past year, the SPA program has been requiring more of this sort of data collection and expects it to be much more useful than quarterly readings. Fluctuations due to individual rainfall events in wells read only quarterly could lead to erroneous conclusions on development impacts. Continuous data should provide much more useful information in that regard.

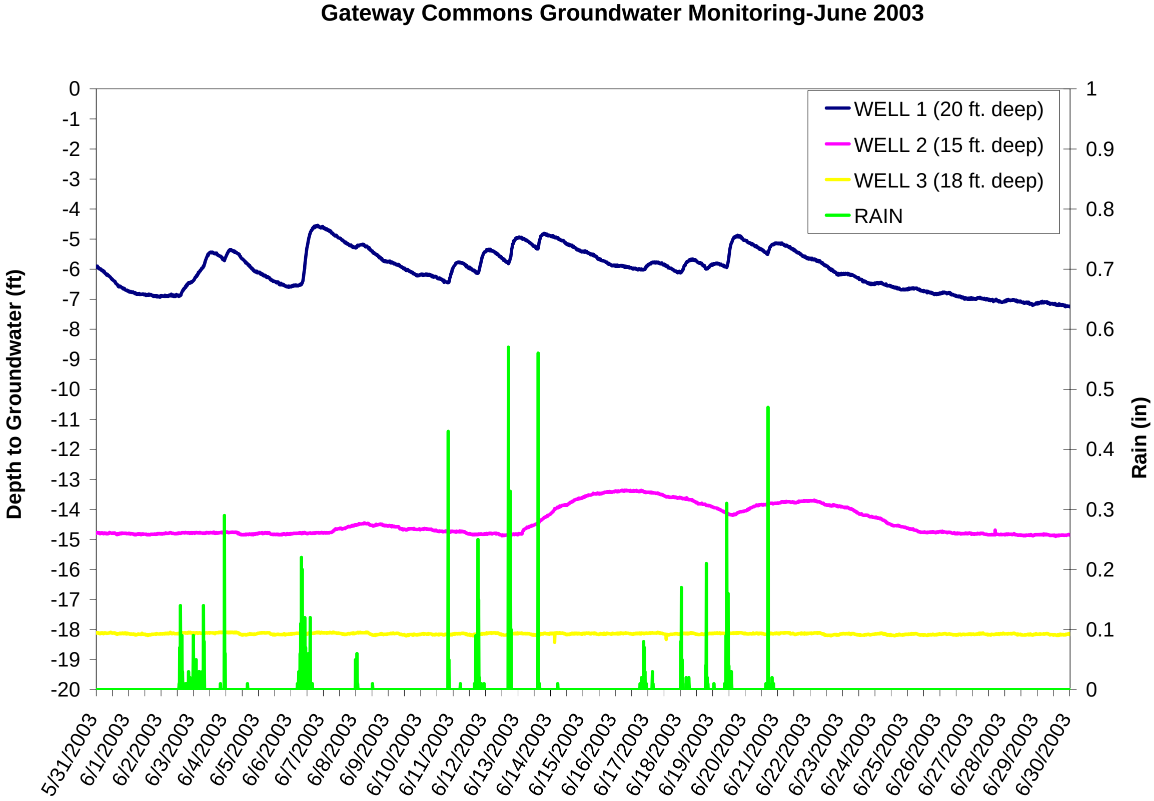

Figure 73 Gateway Commons Continuous Groundwater Data

5.2.3 Cross Section and Embeddedness Monitoring

Cross section and embeddedness data indicate that sediment impacts on SPA streams morphology have generally been small. Cross section data does not indicate major changes in stream channels. Cross sections done in the right fork watershed of Paint Branch at the Briarcliff Manor West project (Figure 74) and the Hunt Lions Den project (Figure 75) are typical. DEP cross section data also indicates that SPA stream channels are generally stable (Sections 4.1.4.b, 4.2.4.b and 4.3.4.b). Embeddedness data is more variable, but tends to indicate that impacts to channel morphology are small and short-term. Data from the Running Brook project in Clarksburg indicate the embeddedness during construction has been comparable to pre-construction conditions (Figure 76).

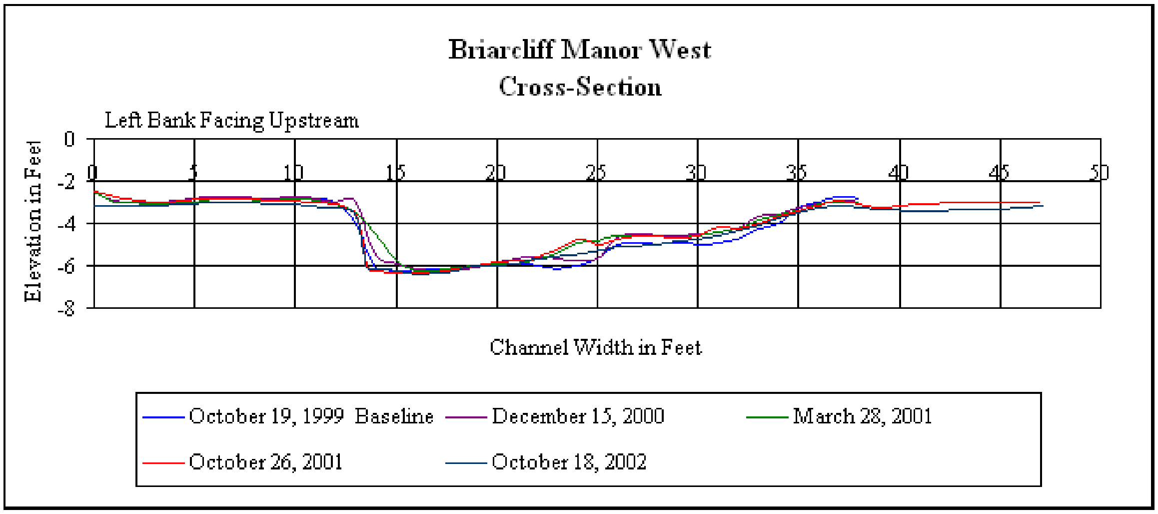

Figure 74 Briarcliff Manor West Cross Section

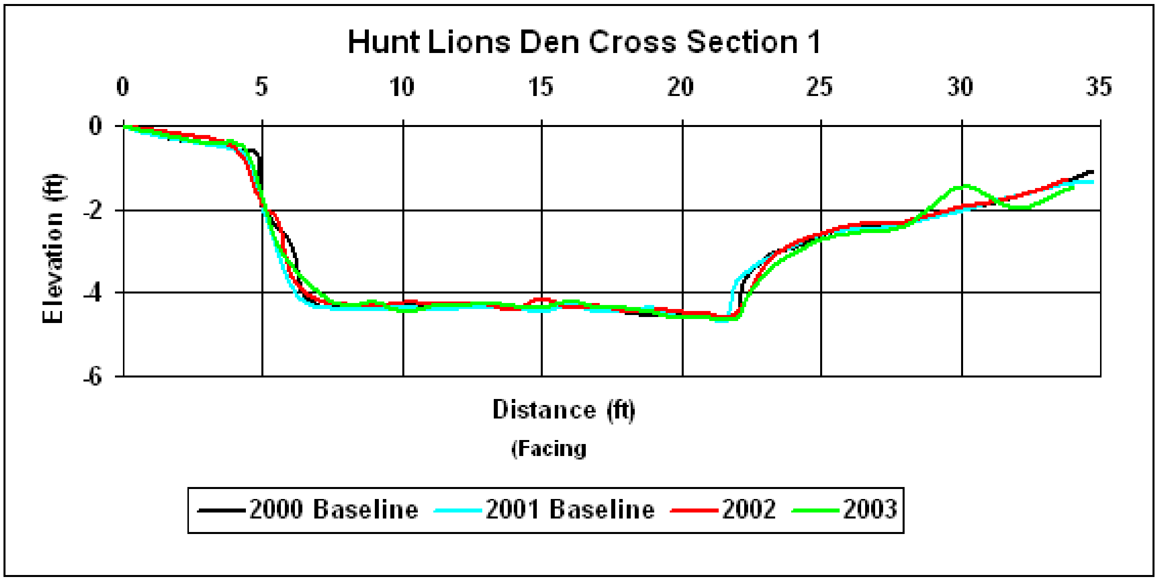

Figure 75 Hunt Lions Den Cross Section

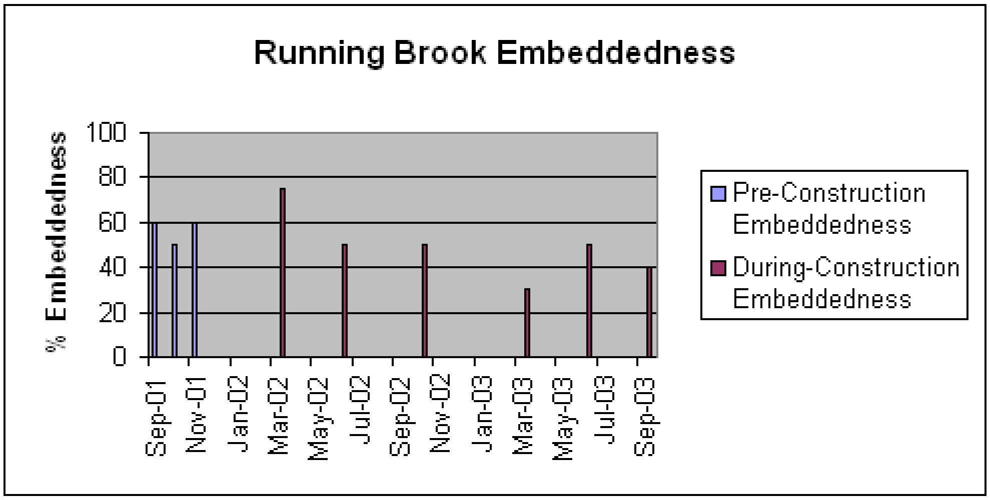

Figure 76 Running Brook Embeddedness

SPA biological monitoring in areas with large amounts of construction under way has shown some impacts to stream biology associated with construction. Paint Branch Right Fork benthic data indicates increased variability in water quality in that area (Section 4.2.4.a). The Hunt Lions Den project and the Forest Ridge project are under way there. Monitoring of the Clarksburg Town Center tributary has also indicated an impact (Section 4.1.4.a). The construction of the Clarksburg Town Center project is definitely a factor. The stream here has been impacted by sediment and chlorinated water. The biology of this tributary has declined drastically, although much of the decline can be attributed to a single release of chlorinated water from a water main break on the Town Center project. Stream monitoring in other areas has generally not been able to identify biological impacts of construction in SPA streams. As the pace of construction in the SPAs picks up DEP will continue to monitor to evaluate whether additional impacts are observed.

5.3 Post-Construction Monitoring

Development frequently results in changes in the flow patterns of nearby streams. Monitoring of stream flow in SPA streams attempts to identify changes over time due to development and increased imperviousness. DEP has been maintaining flow loggers in Paint Branch and Piney Branch and has collected several years of data. This data on current stream response to storms will serve as a baseline for comparison after these SPAs have been developed. A representative hydrograph is plotted in Figure 77. The bulk of the development planned for these two SPAs is now under way. Since water quantity control structures are not installed on development projects until the end of the construction period, current data is not reflective of developed conditions. When development in the area is complete we will be able to evaluate the effectiveness of stormwater quantity control efforts in minimizing impacts to local stream flows. Several developments have been required to begin collecting flow data in Clarksburg SPA in recent years. This data will be used in a similar fashion as that area develops.
DEP has also entered into a cooperative research effort with the USGS, EPA and the University of Maryland to evaluate development impact on Clarksburg area streams (Section 4.1.4.d). Five

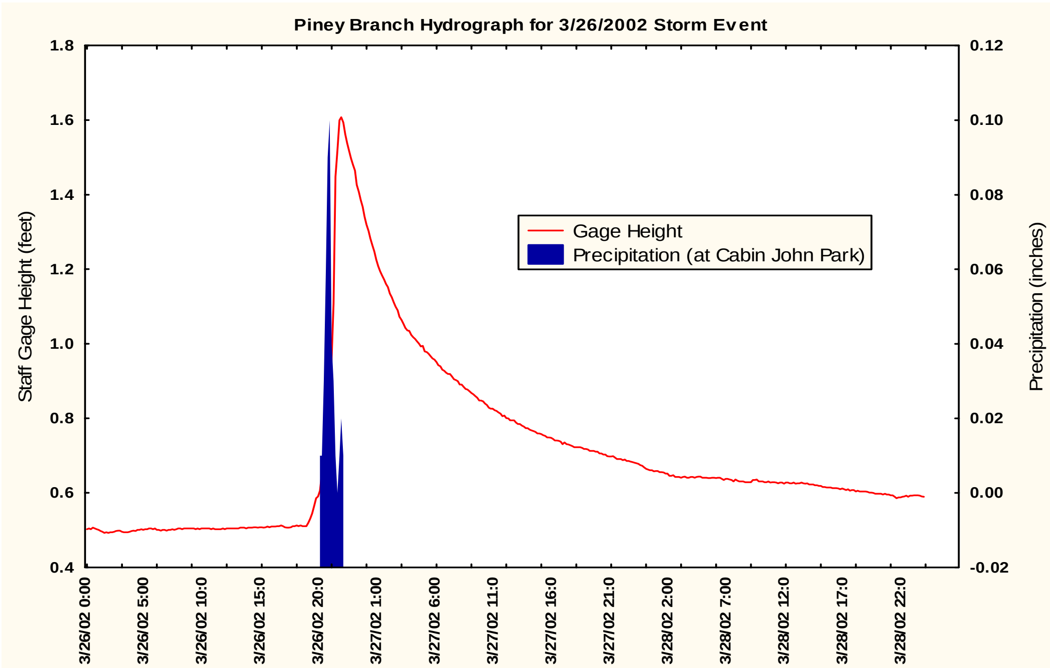

Figure 77 Piney Branch Hydrograph

flow gages have been installed by this group. Detailed flow, water temperature, rainfall, geomorphology, LIDAR and biological information is being collected around each gage. Two of the gages are real-time USGS gages. Data gathered as part of this effort will be used to evaluate development impacts on stream hydrology, morphology and biology. Three of the gage sites are on areas to be developed under new Maryland stormwater management design manual guidelines. One gage is in an already developed watershed and the last is in a "least impaired" minimally developed area. The expertise of the USGS in interpreting the flow data will be extremely helpful in identifying possible development impacts. Changes in stream flow often cause major changes in channel morphology. As discussed in sections 4.1.4.b, 4.2.4.b and 4.3.4.b, channel cross section monitoring has found SPA stream channels to be stable so far. Future monitoring will continue to evaluate development impacts on stream channels.

5.3.1 StormCeptor™ Montoring

Some development projects have been completed which provide a small amount of post-construction data on individual water quality BMPs. We have begun to get data on the water quality BMPs at the Cloverly Safeway in Paint Branch SPA. This commercial site has underground quantity storage, a bioretention facility and a StormCeptor. The monitoring is focusing on the effectiveness of the StormCeptor because of the difficulty in obtaining samples of stormwater entering the other structures. StormCeptors are designed to remove oil/grease and suspended solids from stormwater. A StormCeptor is a large cylindrical chamber divided into upper and lower sections. Dirty water enters the chamber and is forced into the lower chamber where the solids drop out. The lighter oil/grease floats up into the upper chamber and held there. Water is released through an outlet pipe located at mid depth in the structure.

Data was collected on two storms in 2003 and indicated low to moderate levels of metals in the stormwater. Values were generally below the Maryland acute criteria for fresh water. These preliminary results do not indicate that the BMPs were effective in reducing metals concentrations, but the consultant is waiting for additional results before attempting to draw any conclusions. Data has only been collected on two storms so far, and the results appear somewhat anomalous in that values of some parameters seem to increase through the structure. We anticipate that getting data on additional storms in 2004 will shed more light on the function of this BMP.

5.3.2 Sandfilter Monitoring

The Gateway 270 West project in Clarksburg SPA has been monitoring the outfall from their BMPs. They have one year of pre-construction data from 2000 and two years of post-construction data collected during 2002 and 2003. The 24.5 acre I-3 site is a light industrial complex with closed section roads and parking areas. The stormwater is treated by vegetated swales and two sand filters draining 4.5 acres (84% imperviousness) and 5.3 acres (90% imperviousness) respectively. The two sand filters drain independently to a wet pond that provides quantity control and additional quality treatment for the stormwater. The outfall from the wet pond is sampled for nutrients and metals. While monitoring did identify an increase in some parameters following construction, concentrations have subsequently fallen to very low values that are comparable to values obtained during pre-construction (Figure 78). The sand filters were most effective at treating TKN and ortho-phosphate. Only one TKN sample collected on 7/9/02 was above the limit of quantification. No ortho-phosphate samples were above the limit of quantification. This was attributed to the tendency of these substances to bind to soils. The similarity of the results collected during pre-construction and post-construction indicate that the site design and BMPs are sufficient for maintaining the water quality of the runoff from this project. The project will be turning in their third and final year of required post-construction monitoring data in 2004.

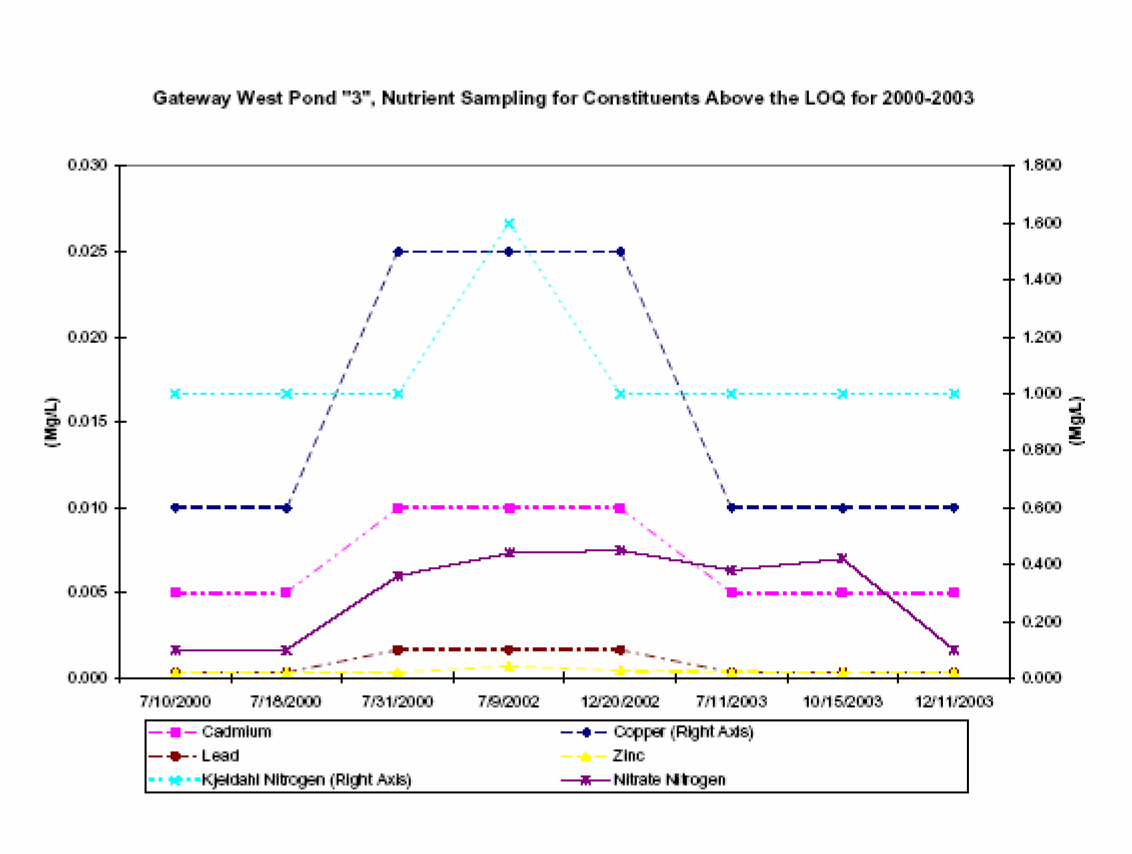

Figure 78 Gateway West Nutrient Data

Table 18 SPA BMP Monitoring

PROJECT NAME & CONSULTANT CONDUCTING THE MONITORING	REQUIRED BMP MONITORING	REQUIRED TIME FRAME FOR BMP MONITORING	DATA SUBMITTED TO DATE
Clarksburg Detention Center / *Chester Engineers* ***(construction completed 4/03)***	**3 groundwater wells** *Ammonia, Total Phosphorus, Total Nitrogen, Specific Conductance, Nitrate, pH, Ortho-Phosphorus* **1 rainfall logger** - *along with the flow logger* **1 flow logger (SWM pond discharge rate***)* **1 continuous temperature logger** **stormwater monitoring** **2 water quality stations to monitor sediment traps (inflow and outflow)**	**pre-development monitoring:** 6 months **during-construction monitoring:** until site is stabilized and sediment control ponds converted to stormwater management ponds **post-construction monitoring:** 3 years during construction monitoring is to include 6 storm events	**groundwater data:** 11/97 - 6/03 **rainfall data:** 1/98 -9/02 **flow data:** 1/98 - 9/02 **temperature data:** 1/98 - 9/02 6 storm events received
Clarksburg Town Center / *Biohabitats* ***(construction began 9/99)***	**1 continuous flow logger** **1 rainfall logger** - along with flow logger **3 continuous temperature logging stations** **4 surface water quality stations:** *VOC, Oil and Grease, Herbicides & Pesticides, NO2, NO3, TN, TP, TSS, Metals, pH, DO, Conductivity*	**pre-development monitoring:** 1 year **during-construction monitoring**: until all infrastructure is installed, site stabilized and 50% of lots developed **post-construction monitoring**: 5 years	**flow and rainfall data:** 4/97 - 3/98, 10/00 - 12/03 **temperature data:** 1997, 2000-2003 **surface water quality:** 5/97, 6/97, 11/02, 4/03
Gateway 270 */ Rodgers Associates* ***Monitoring completed***	**4 continuous temperature loggers**	Three summers following permit approval	**Temperature data:** 7/99-9/99, 6/00-9/00, 6/01-9/01
Gateway 270 lot 7 Rodgers Associates As-built under review	**Photo documentation of bioretention plantings**	**post-construction monitoring**: 3 years	**Photos:** 7/03 – 7/04

Table 18 (continued)

PROJECT NAME & CONSULTANT CONDUCTING THE MONITORING	REQUIRED BMP MONITORING	REQUIRED TIME FRAME FOR BMP MONITORING	DATA SUBMITTED TO DATE
Gateway 270 West / *Rodgers Associates* (c***onstruction complete)***	**water quality monitoring at stormwater pond:** Cadmium, Copper, Lead, Zinc, Kjeldahl Nitrogen, Nitrate Nitrogen, Ammonia Nitrogen, and Ortho-Phosphate	**pre-development monitoring:** 3 storm samples **during-construction monitoring**: none required **post-construction monitoring**: 3 storms per year for three years	**water quality data:** 7/10/00, 7/18/00, 7/31/00, 7/9/02, 12/20/02, 7/03, 10/03, 12/03
All Souls Cemetery / *Macris, Hendricks and Glascock* ***(construction began during fall of 2001)***	**1 Temperature logger** **2 stream channel cross sections**	**pre-development monitoring:** 1 year **during-construction monitoring**: until site is stabilized and sediment control ponds converted to stormwater management **post-construction monitoring:** 3 years	**Temperature:** 2001-2003 **Cross Sections:** 5/01, 7/02, 1/03, 12/03
Running Brook Acres ***(construction began during fall of 2001)***	**Embeddedness** **stormwater monitoring of 1 sediment trap** (TSS inflow and outflow) **Chemical and nutrient monitoring of linked BMP**	**pre-development monitoring:** 3 months **during-construction monitoring:** until site is stabilized and sediment control ponds converted to stormwater management ponds **post-construction monitoring:** 3 years	**Embeddedness:** 9/01-9/03 **TSS Sampling:** 3/02, 7/02, 10/02, 2/03, 5/03, 9/03

Table 18 (continued)

PROJECT NAME & CONSULTANT CONDUCTING THE MONITORING	REQUIRED BMP MONITORING	REQUIRED TIME FRAME FOR BMP MONITORING	DATA SUBMITTED TO DATE
Greenway Village at Clarksburg (previously known as DiMaio Property) / *ESA* *(Construction began during summer of 2003)*	**7 Groundwater wells** **3 Discrete flows** **1 Continuous flow logger** **3 Cross sections** **3 Embeddedness stations** **1 Temperature logger** **Stormwater monitoring of 1 sediment trap** (TSS inflow and outflow) **Water Quality – Storm Sampling Western trib.** (NO2, NO3, TKN, Ortho-P, total P, Cu, Cd, Pb, Zn, TSS)	**pre-development monitoring:** 1 year **during-construction monitoring**: until site is stabilized and sediment control ponds converted to stormwater management ponds **post-construction monitoring:** 5 years	**Cross-sections:** 12/01, 4/03 **Groundwater Wells:** 11/01 – 11/03 **Discrete Flows:** 2/02 – 10/03 **Stream Flow:** 12/01 – 10/03 **Embeddedness:** 12/01 – 10/03 **Stream Temperature:** 6/02 – 9/03 **Water Quality:** 10/11/02, 10/30/02 (not required during construction)
Highlands at Clarksburg / *Macris, Hendricks and Glascock* *(construction began in summer of 2002)*	**2 Temperature loggers** **Stormwater TSS at sediment pond** **Photos of outfall** **Embeddedness** **Water chemistry at one linked BMP - required for post-construction period only** **5 groundwater Wells**	**pre-development monitoring:** 1 year **during-construction monitoring**: until site is stabilized and sediment control ponds converted to stormwater management ponds **post-construction monitoring**: 3 years, 5 years for wells	**Temperatures**: 6/01-9-01, 6/03-9/03 **Wells**: 11/00-11/01 1/03-12/03

Table 18 (continued)

PROJECT NAME & CONSULTANT CONDUCTING THE MONITORING	REQUIRED BMP MONITORING	REQUIRED TIME FRAME FOR BMP MONITORING	DATA SUBMITTED TO DATE
Timbercreek Phases I and II (previously known as Nanna property) / GTA ***(construction began10/01)***	**2 Temperature loggers** **2 Groundwater wells**	**pre-development monitoring:** 1 year **during-construction monitoring**: until site is stabilized and sediment control ponds converted to stormwater management ponds **post-construction monitoring:** 3 years	**Temperatures**: 6/01-9/01, 6/02 – 9/02, 6/03-9/03 **Wells:** 4/01-12/02, 1/03-12/03
Martens Property / GTA (construction began 3/03)	**4 Groundwater wells** **2 Temperature loggers** **TSS sampling in sediment control facility – 4 samples per year** **Water quality sampling to evaluate pollutant removal efficiency of one SWM facility - required for post-construction period only**	**pre-development monitoring: 1 year** **during-construction monitoring: until site is stabilized and sediment control ponds converted to stormwater management ponds** **post-construction monitoring: 3 years**	**Temperature: 6/00 – 9/00, 6/02 – 9/02, 6/03-9/03** **Wells: 3/02 – 12/03** **TSS: 9/03, 10/03**
Linthicum Property (East) AKA Summerfield Crossing/ *Rodgers Consulting, Inc.* (construction has not begun)	**5 Groundwater wells** **5 Temperature loggers** **1 Discrete flow station** (discharge measurements taken at time of well readings) **2 Embeddedness monitoring stations** **2 Nutrient sampling stations in Little Seneca Cr.**	**pre-development monitoring:** 1 year **during-construction monitoring**: until site is stabilized and sediment control ponds converted to stormwater management ponds **post-construction monitoring:** 3 years	**Wells:** 12/3/02, 3/11/03 **Temperature:** pre-construction data to be collected during summer of 2003 **Discrete Flow:** 12/3/02, 3/11/03 **Embeddedness:** 12/3/02, 3/11/03 **Nutrient sampling:** 3/25/03, 5/7/03, 5/13/03

Table 18 (continued)

PROJECT NAME & CONSULTANT CONDUCTING THE MONITORING	REQUIRED BMP MONITORING	REQUIRED TIME FRAME FOR BMP MONITORING	DATA SUBMITTED TO DATE
Clarksburg Village and Greenway Trail ESA (construction began 10/03)	**18 Groundwater wells** **9 Groundwater quality samples** **6 Discrete flows** **2 Continuous flow loggers** **1 Rain gage** **10 Cross sections** **6 Embeddedness stations** **7 Temperature loggers** **Stormwater monitoring of 2 sediment traps** (TSS inflow and outflow) **1 Instream water quality station– baseflow and storm sampling** (NO2, NO3, TKN, Ortho-P, total P, Cu, Cd, Pb, Zn, TSS) **Water quality sampling to evaluate pollutant removal efficiency of three BMPs- required for post-construction period only**	**pre-development monitoring:** 1 year **during-construction monitoring**: until site is stabilized and sediment control ponds converted to stormwater management ponds **post-construction monitoring:** 5 years	**Cross-sections:** 12/01, 4/03 **Groundwater Wells:** 11/01 – 11/03 **Discrete Flows:** 2/02 – 10/03 **Stream Flow:** 12/01 – 10/03 **Embeddedness:** 12/01 – 10/03 **Stream Temperature:** 6/02 – 9/03 **Water Quality:** 10/11/02, 10/30/02 (not required during construction)
Catawba Manor McCarthy and Associates (Construction began 4/03)	**1 Groundwater well** **1 Temperature logger and BOD at sand filter**	**pre-development monitoring:** 1 year – well only **during-construction monitoring**: until site is stabilized and sediment control ponds converted to stormwater management **post-construction monitoring:** 1 year	**1998, 2003**

Table 18 (continued)

PROJECT NAME & CONSULTANT CONDUCTING THE MONITORING	REQUIRED BMP MONITORING	REQUIRED TIME FRAME FOR BMP MONITORING	DATA SUBMITTED THUS FAR
Gateway Commons Biohabitats (Construction has not begun)	**3 Groundwater wells** **3 Cross sections** **1 Continuous flow logger** **Stormwater TSS at sediment pond during construction** **Water quality sampling to evaluate pollutant removal efficiency of one SWM facility - required for post-construction period only**	**pre-development monitoring:** 1 year **during-construction monitoring**: until site is stabilized and sediment control ponds converted to stormwater management **post-construction monitoring:** 3 years	**Wells:** 2/03-2/04 **Cross Sections:** 3/03, 12/03 **Flow:** 2/03 – 2/04
Parkside ESA (construction began in 1/04)	**3 Groundwater wells** **Stormwater TSS at sediment pond during construction** **1 Outfall temperature logger** **Photo documentation of bioretention area**	**pre-development monitoring:** 1 year **during-construction monitoring**: until site is stabilized and sediment control ponds converted to stormwater management **post-construction monitoring:** 3 years	**Wells:** 6/02 – 6/03 (Terminated 5/04 due to site geology and well disturbance.)
Fairland Community Center / *Environmental Quality Resources, Inc.* *(Construction completed)*	**3 continuous temperature loggers** **2 groundwater wells** **photo documentation of bioretention area and annual survey of plant species**	**pre-development monitoring:** 1 year **during-construction monitoring:** until site is stabilized and sediment pond is converted to SWM pond **post-construction monitoring:** 3 years	**temperature data:** 3/98 - 9/98 6/99 - 9/99 6/00 - 9/00 6/01 - 9/01 no data in 2002 - drought **groundwater data:** 3/98 – 10/03

Table 18 (continued)

PROJECT NAME & CONSULTANT CONDUCTING THE MONITORING	REQUIRED BMP MONITORING	REQUIRED TIME FRAME FOR BMP MONITORING	DATA SUBMITTED THUS FAR
Briarcliff Manor West (formerly Baldi Property) / *Environmental Systems Analysis, Inc.* ***(construction began 8/99 and was completed 4/03)***	**1 groundwater observation well** **3 continuous water temperature loggers** **1 continuous air temperature logger** **2 embeddedness stations** **channel cross section** **1 stream flow logger**	**pre-development monitoring :** 1 year **during-construction monitoring:** until site is stabilized with functioning stormwater management facilities **post-construction monitoring:** 1 year	**groundwater data:** 9/98 – 4/03 **temperature data:** 9/98 - 9/02 **embeddedness data:** 9/98 – 4/03 **channel cross section data:** 9/98, 10/99, 4/00, 3/01, 10/01, 10/02 **stream flow data:** 11/98 - 12/99, 1/01-12/01, 5/02-12/02
Cloverly Safeway / *Rodgers Assoc*. *(construction complete)*	**1 continuous water temperature logger** **water quality:** Cadmium, Copper, Lead, Zinc, Hydrocarbons	**Pre_Construction:** 3 storms, Temperature. **During construction:** No monitoring **Post_Construction:** 3 storms per year for 5 years, Temperature.	**temperature data:** 9/98 **water quality data:** 5 storms 9/98-11/99 5/03, 7/03
Hunt Lions Den / *Environmental Systems Analysis, Inc.* *(Construction began 1/02)*	**2 groundwater wells** **2 continuous water temperature loggers** **5 stream channel cross sections** **1 embeddedness station**	**pre-development monitoring:** 1 year **during-construction monitoring:** until site is stabilized and sediment pond is converted to SWM pond **post-construction monitoring:** 3 years	**groundwater data:** 8/00 – 10/03 **temperature data:** 2000 - 2003 **stream channel cross sections:** 9/00, 9/01, 9/02, 10/03 **embeddedness** 2/02-11/01 2002-2003
Parr's Ridge (Formerly Drayton Farms) / *Macris, Hendricks and Glascock* *(construction complete October 2002)*	**1 groundwater well**	**pre-development monitoring:** 1 year **during-construction monitoring:** until site is stabilized and sediment pond is converted to SWM pond **post-construction monitoring:** 3 years	**Groundwater data:** 5/97 – 10/98 (pre-construction) 5/01 – 10/02 (during construction) 5/02 – 10/03 (post-construction)

Table 18 (continued)

PROJECT NAME & CONSULTANT CONDUCTING THE MONITORING	REQUIRED BMP MONITORING	REQUIRED TIME FRAME FOR BMP MONITORING	DATA SUBMITTED THUS FAR
Fairland Gardens *(construction completed during 2000)*	**1 continuous flow logger**	**Logger provided to DEP for long term monitoring of stream flow in the Right Fork of Paint Branch.**	**Flow data:** **4/00 – 12-03**
Snider's Estates *(Construction began 4/03)*	**TSS sampling** – during construction **Nutrient and chemical sampling** – post construction	**pre-development monitoring:** none **during-construction monitoring:** until site is stabilized and sediment pond is converted to SWM pond **post-construction monitoring:** 3 years	**Monitoring Plan Finalized 4/04**
Fairland Farms (Hunt Property – Miles Tract) *(Construction began March 2003)*	**2 temperature loggers** **air temperature gage** **rain gage** **TSS sampling –** during construction **Photo documentation of outfall area** **4 groundwater wells** **3 cross sections** **1 embeddedness station**	**pre-development monitoring:** 1 year **during-construction monitoring:** until site is stabilized and sediment pond is converted to SWM **post-construction monitoring:** 5 years for cross sections, 3 years for all other parameters	**Temps –** 2002-2003 **Rain data –** 6/02-9/03 **Wells –** 7/02 – 12/03 **Cross sections** 6/02 **Embeddedness** 2002-2003 **TSS** 2003 **Photos** 2003
Briggs Chaney Rd./Old Columbia Pike Intersection (Construction to begin during 2004)	**TSS**	**pre-development monitoring:** 2 storm samples **during-construction monitoring:** 3 storm samples **post-construction monitoring:** 1 storm sample	**Storm Samples** - 7/9/03, 7/23/03

Table 18 (continued)

PROJECT NAME & CONSULTANT CONDUCTING THE MONITORING	**REQUIRED BMP MONITORING**	**REQUIRED TIME FRAME FOR BMP MONITORING**	**DATA SUBMITTED THUS FAR**
Shady Grove Road / Loiderman Assoc. ***(construction completed during summer of 2000)***	**4 turbidity stations** **4 embeddedness stations**	**pre-development monitoring:** 1 year **during-development monitoring:** until site is stabilized and sediment control structures converted to water quality **post-development monitoring:** min. 3 years	**turbidity data:** 4/97 - 12/02 **embeddedness data:** 4/97 - 12/02
Traville / Loiderman Assoc. Includes the Human Genome Sciences, Gateway Streets, Senior Housing, Traville Village Center (Beatty), and Avalon Bay projects ***(construction began 1/02)***	**2 continuous temperature loggers** **groundwater monitoring wells** *water level* **1 continuous flow logger** **3 Cross sections** **Surface water storm samples** **embeddedness** **Stormwater samples from sediment ponds** **Infiltration structure percolation rates**	**pre-development monitoring:** 1 year **during-development monitoring:** until site is stabilized and sediment control structures converted to water quality **post-development monitoring:** to be determined at final site plan approval.	**temperature data:** 1997 - 2003 **groundwater data:** 8/97 - 10/97 **flow data:** 8/97 - 10/97 Pre-construction requirements met ***construction began 1/02***
Bruck Property **(*construction complete)***	**2 continuous temperature loggers** **1 embeddedness station**	**pre-development monitoring:** 1 year **during-construction monitoring:** until site is stabilized and sediment control structures converted to water quality	**Temperature data:** 7/98 – 9/03 **embeddedness data:** 6/99, 12/99, 5/00, 9/00, 5/01, 10/01, 5/02, 10/02, 5/03, 10/03
Cavanaugh Property *(construction completed)*	**3 continuous temperature loggers** **2 groundwater wells** **1 embeddedness station**	**pre-development monitoring:** 1 year **during construction monitoring:** until site is stabilized and sediment control structures converted to water quality **post construction monitoring:** 2 years	**temperature data:** 7/98 – 9/98 7/99 – 9/99 6/01 – 9/01 6/02-9/02 **groundwater data:** 3/98 – 5/01 Monitoring terminated by Consultant **embeddedness data:** 8/98 – 9/02

Table 18 (continued)

Boverman Property *(construction completed 5/02)*	**1 continuous temperature logger** **1 embeddedness station** **1 groundwater well:** *nitrate, nitrite, TKN,, total Phosphorus*	**pre-development monitoring:** 1 year **during construction monitoring:** until site is stabilized and sediment control structures converted to water quality **post construction monitoring:** 3 years	**temperature data:** 7/98 – 9/03 **embeddedness data:** 6/99, 12/00, 5/00, 9/00, 5/01, 10/01, 5/02, 10/02, 5/03, 10/03 **groundwater well data:** 6/99, 11/99, 1/00, 9/00, 5/01, 10/01, 5/02, 10/02, 5/03, 10/03
Peters Property *(Construction completed during fall of 2001)*	**2 continuous temperature loggers** **2 embeddedness stations** **1 continuous flow logger** **photo documentation of pond outfall condition**	**pre-development monitoring:** 1 year **during construction monitoring:** until site is stabilized and sediment control structures converted to water quality **post construction monitoring:** 2 years for photo documentation and	**temperature data:** 1999-2003 **embeddedness data:** 10/98 – 11/03 **flow data:** 2/00 – 12/03 **photo documentation:** 10/98 – 11/03
Snider Property *(Construction complete)*	**3 Surface water samples annually** (nitrate, nitrite, TKN, Total P, Ortho P, TSS) **Quarterly photo documentation of pond outfall condition**	**pre-development monitoring**: 3 water samples **during construction monitoring**: until site is stabilized and sediment control structures converted to water quality **post construction monitoring**: 3 years	**Surface water samples:** 8/00 – 10/03 **photo documentation:** 9/00 – 10/03
Willow Oaks *(construction began 1/02)*	**TSS sampling of sediment pond during construction** **One-time pesticide sampling of runoff after mass application of termite repellent.** **Chemical and nutrient sampling of BMP**	**pre-development monitoring**: none **during construction monitoring**: until site is stabilized and sediment control structures converted to water quality **post construction monitoring**: 3 years	**No data submitted to date** **Monitoring in default**

6.0 Evaluation and Recommendations

Streams within Special Protection Areas are not pristine but are among the highest quality in Montgomery County. Ultimately, the goal of the SPA program is to provide the best possible protection to these streams. Monitoring efforts in the Special Protection Areas continue to provide the kind of information needed to comprehensively analyze stream conditions and BMP performance as development proceeds. At the inception of the SPA program in 1994 these streams were impacted from various sources. Piney Branch and Paint Branch watersheds both contained significant amounts of development, some of which pre-date stormwater management laws and requirements. Little Seneca Creek watershed contained large areas of agriculture. Streams in the newest SPA, Upper Rock Creek, are impacted from both development and agriculture.

As development proceeds in the SPAs, biological monitoring results show greater variation between years. One year the biological community may indicate ”good” stream conditions and the next year ”poor” conditions. Degradation of stream condition is often related to natural causes, such as drought, but impacts from construction activity exacerbate the situation and impede recovery. In the Clarksburg SPA, as in other areas of the county, degradation to the biological community was observed as a result of very stressful stream conditions caused by the record drought in 2002. However, in the Town Center Tributary, degradation was greatest and has persisted into 2004. This tributary receives runoff from new development concentrated in and around the new Clarksburg Town Center. Fine sediment on the stream bottom is likely contributing to this problem. DPS is currently working with DEP on the issue. One action being considered is a third party sediment inspector assigned to each development project in Clarksburg to patrol construction areas daily and oversee all activities relating to sediment control. The reviewing agencies should continue discussions on the master plan recommendation for Stage IV in Clarksburg to determine the status of building permits and monitoring, and when the evaluation should be conducted.

Of the four SPA’s, stream condition is most impaired in the Piney Branch SPA. Results of benthic macroinvertebrate monitoring show condition in the ”fair” to ”poor” range during most years since monitoring began in 1995, when the watershed was designated a SPA. Several potential causes of impairment have been identified, including: 1) extremely low stream flow during 1999 and 2002, 2) low dissolved oxygen levels during night time hours in the summer when water temperature is coolest, 3) heavy algal growth, 4) sediment from construction projects washing into the stream and 5) use of methoprene at the Willows of Potomac residential community, for mosquito control, both in ponds that drain to Piney Branch and in the stream itself.

BMP monitoring has found that efforts to minimize impacts during construction have been successful at keeping most of the sediment on site. However, fine sediment continues to deposit in streams coating the stream bottom. On those projects where post-construction monitoring results are available, impact to stream condition has not been identified. DEP is beginning to obtain data on individual BMPs. Most of this data is on sediment control structures at this point. Results indicate that sediment control structures have been very successful at keeping sediment on sites during smaller storms. The larger size of SPA sediment control structures relative to the rest of the county is probably promoting this result. Nonetheless, larger storms tend to overwhelm sediment control structures and reduce or eliminate their efficiency. Increasing the size of sediment control structures further would increase their efficiency during larger events. Data also indicates that the efficiency of structures is reduced over time as sediment accumulates in them. Increased frequency of maintenance may help maintain their efficiency throughout construction. DEP has also received data indicating that sediment ponds are having some slight temperature effects on receiving streams. The impacts observed have been associated with storms and only last for a matter of hours. Stream temperatures do increase for a time but maximum temperatures have remained relatively low. Due to the relatively low maxima and brief duration of these temperature impacts, water quality impacts are presumed to be minimal. DEP stream monitoring data supports this conclusion. The benefits of the structures in controlling sediment far outweigh any temperature impacts observed so far. Data on effectiveness of individual BMPs post-construction has begun to arrive but no conclusions can be drawn at this point. More data will be produced in 2004 and some preliminary conclusions should be possible. An evaluation of the ultimate impacts of large-scale development in SPAs will not be available until watersheds are built out and some time for adjustment has elapsed. Given the long-term staging of this new development, it will be years before that evaluation can be obtained.

All BMP data submitted to DEP will be archived in a database currently being developed. Additionally, all stream monitoring data will be in the same database. The database will be made available to the public.

DEP has reconvened the BMP monitoring workgroup first established in 1995. Originally this group was formed to establish protocols for BMP monitoring. The workgroup is made up of professionals from civil engineering and environmental monitoring firms, development companies, and pertinent government permitting, review and monitoring agencies. The workgroup is being reconvened to review BMP monitoring protocols, discuss problems encountered in following protocols and modify protocols were necessary. The workgroup will also develop a standardized report format for the submittal of BMP monitoring results.

Appendix 1: Explanation of the Special Protection Area Program

App. 1.1 Purpose of Special Protection Areas

Article V of the Montgomery County Code defines Special Protection Areas (SPA's) as geographic areas which may be designated by the County Council where: "...1) existing water resources or other environmental features directly relating to those water resources are of high quality or unusually sensitive; and 2) proposed land uses would threaten the quality or preservation of those resources or features in the absence of special water quality protection measures which are closely coordinated with appropriate land use controls...."

SPA program purposes specified in Article V are to:

> *1) establish coordinated procedures, performance goals, criteria, and requirements for development in SPA's that will mitigate adverse impacts on water resources during and after construction or other land disturbing activities; and,*
>
> *2) provide a focused, coordinated approach for water quality protection and monitoring in SPA's.*

App. 1.2 Designated Special Protection Areas

To date, the County Council has designated four areas within the County as high quality stream systems which are in need of measures beyond current standards to assure that they are protected to the greatest extent possible from the impact of master planned development activities (Figure 1). In chronological order of their designation these SPA's are: the Clarksburg Master Plan SPA; the Upper Paint Branch Watershed SPA; the Piney Branch Watershed SPA; and the Upper Rock Creek SPA. Once Special Protection Areas are designated all subsequently approved plans for development, except for those with a valid record plat recorded prior to October 31, 1994, are required to comply with Executive Regulation 29-95, Water Quality Review for Development in Designated Special Protection Areas.

App. 1.3 Water Quality Plan Review Process

The SPA program requires the Montgomery County agencies and M-NCPPC to work closely with project developers to pro-actively address possible impacts to the existing stream conditions and to guide the development of related concept plans for site layout, environmental buffers, forest conservation, site imperviousness, stormwater management, and sediment control earlier in the regulatory review process. Outside of SPA’s, County and M-NCPPC staffs generally are able to review a project only *after* a plan is formally submitted by an applicant showing a proposed site's conceptual layout and stormwater management designs. This review typically occurs for the preliminary plan of subdivision. (Review of a proposed project’s conformance to environmental protection requirements and guidelines may also occur with a site plan, special exception application, mandatory referral, or zoning application). This sequencing of plan review requires a reactive response by County and M-NCPPC staffs to approve projects in the development review process. This often necessitates major modifications to development plans when County staff or M-NCPPC staff find that environmental protection measures proposed by the applicant are inadequate.

Within SPA's, County and M-NCPPC staffs are now able to convey environmental protection goals, objectives, and concerns to the applicant of a proposed development project *before* the applicant designs the initial site layout concept for the project. The SPA program is designed to put the environmental issues up front in planning for land development within the SPA's. This proactive approach reduces the potential for negative environmental impacts by requiring the County and the M-NCPPC to provide detailed environmental information and guidance on enhanced protection measures to the applicant prior to the concept plan design stage and before the formal development review process begins. Applicants are then able to design projects which take into account current available information on stream conditions, forest conditions, types of soils, site topography, and other environmental features, to address identified environmental constraints, and to incorporate enhanced BMP's before concept plans are submitted.

Under the SPA program, most applications for new development projects in SPA's are required to submit water quality plans which will provide a more comprehensive package of information to the County than is required as part of the more typical (i.e., non-SPA) development review process.

In addition to evaluating the stream conditions, the SPA review process includes site visits, analysis of subwatershed environmental characteristics, investigation of existing environmental problems, avoidance and/or minimization of the long term impacts of the development, and implementation of BMP monitoring plans.

App. 1.4 Public Input

A water quality plan is a document submitted by a permit applicant that demonstrates how a new development project within a SPA proposes to meet certain site-specific, watershed protection goals. It is required for most development projects within SPA's. Typically, permit applicants must prepare both a preliminary and a final water quality plan.

After submission of a preliminary water quality plan, a SPA public information meeting will be held if requested in accordance with Executive Regulation 29-95. At these meetings developers present technical and site design information and methods to the public which show how the water quality plan will meet the performance goals for the SPA as specified in the SPA Conservation Plan. These meetings produce useful dialogue between the public, the County, M-NCPPC, and project developers regarding site design, environmental sensitivity, and BMP selection.

After considering input obtained at an informal public information meeting, the DPS, in coordination with DEP, acts on those aspects of the water quality plan in which the two agencies have lead agency responsibility (see Appendix 1.5 below for summary of lead agency responsibility in water quality plan review).

In addition, the Planning Board holds a public hearing for a water quality plan. as either part of, or in conjunction with a public hearing for the proposed development project itself. The Planning Board is required to review and act on those aspects of the water quality plan in which the M-NCPPC has lead agency responsibility (see also Appendix 1.5 below).

App. 1.5 Agency Review and Approval of Water Quality Plans

The SPA law requires that water quality plans for a project be approved by DPS, in coordination with DEP, and the Planning Board before the project can proceed. Each agency has lead role responsibility for different components of a water quality plan. M-NCPPC has lead agency responsibility for site imperviousness requirements and environmental guidelines, environmental buffers, and forest conservation. Lead agency responsibility for DPS covers stormwater management controls, sediment and erosion controls. DEP has lead agency responsibility for carrying out and reporting results from the SPA stream monitoring program, performance monitoring for best management practices and for preparing SPA conservation plans.

Appendix 2: Glossary of Terms

BMP - Acronym for 'Best Management Practice', refers to either a structure or practice that is designed to either improve water quality or reduce the impact that storm water runoff imparts on the receiving stream. Examples include but are not limited to: 1) storm water retention ponds - purpose is to collect, hold and release storm water runoff at a reduced rate, 2) bioretention areas - an area of densely planted wetland plants that act to uptake nutrients from stormwater runoff, 3) infiltration trench - purpose is to get as much storm water runoff into the ground as possible thus reducing the volume of runoff and recharging groundwater which is important in maintaining baseflow in a nearby stream.

IBI - Acronym for 'Index of Biological Integrity' - the IBI is simply a method of comparing the biological community found in any stream to that found in reference streams. Reference streams are the "least impaired" streams within the Montgomery County region. By measuring how closely a stream compares to the reference condition, a relative assessment can be made of resource condition. The IBI rates the resource condition as excellent, good, fair, or poor. An excellent rating is equivalent or comparable to the reference condition, while a poor rating indicates a condition having little or no similarity to the reference condition. DEP has developed an interim IBI for both fish and benthic macroinvertebrates that is specific to the Montgomery County region.

Benthic Macroinvertebrates - Small creatures that spend at least part of their lives in or on the stream bottom. The name 'benthic macroinvertebrate' derives from the fact that they are bottom dwelling (benthic), large enough to see with the naked eye (macro), and without backbones (invertebrates). Benthic macroinvertebrates include not only insects but also crustaceans (crayfish), oligochaetes (worms) and mollusks (freshwater clams, snails).

Embeddedness - Refers to the extent to which rocks (gravel, cobble or boulders) are covered or sunken into the silt, sand or mud on the stream bottom. This is an important assessment in that many stream inhabitants occupy the spaces in between the rocks on the stream bottom. Thus, as embeddedness increases there are fewer spaces in between the rocks as this space is filled with sediment and therefore fewer stream inhabitants.

Riffle - That portion of a stream where water flows fast and shallow over rocky substrate. This area of a stream is where a majority of the benthic macroinvertebrates live along with several species of fish.

RELATED DOCUMENTS:

- SPA Annual Report, 2002
- SPA Annual Report, 2001
- SPA Annual Report, 2000
- SPA Annual Report, 1999
- SPA Annual Report, 1998
- Clarksburg Conservation Plan
- Piney Branch Conservation Plan
- Upper Paint Branch Conservation Plan

All of the documents cited above are available online in PDF format on our askDEP.com website. In addition, the Department of Environmental Protection maintains an extensive collection of annual, technical, and general reports, public information factsheets, and related publications. Many are available in both PDF and HTML format, and in some cases, print copies of documents are available. Please contact us for more information.

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