Howard County Biological Monitoring and Assessment

Middle Patuxent - 2007

Howard County, Maryland

Howard County MARYLAND

KCI Technologies, Inc.
October 2007

KCI TECHNOLOGIES

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Acknowledgements

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Fieldwork was primarily conducted by Natalie Brown and Colin Hill of KCI. They were assisted by Karen Kesler from Chesapeake Environmental Management (CEM). Biological sample processing was conducted by Natalie Brown, Colin Hill, and Greg LaShoto of KCI and Karen Kesler of CEM. Taxonomic identification was conducted by Environmental Services and Consulting (ESC). ESC's lab manager is Nicole Martin. Andrea Poling of KCI provided additional support with metric calculations, GIS analysis, and report editing.

Michael Pieper assisted with report editing and review and also performed project management duties with contract management oversight from Peter Mattejat and Kerry Rexroad. Project accountants were Jen Pizarro and Dona Izer.

KCI would like to thank Howard County staff for support and review of the draft report including:

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The appropriate citation for this report is:

N. J. Brown, LaShoto, G. B. and C. R. Hill. 2007. Howard County Biological Monitoring and Assessment, Middle Patuxent – 2007. Prepared by KCI Technologies, Inc., Hunt Valley, MD for Howard County, Department of Public Works. Stormwater Management Division. Columbia, MD. August 2007.

Executive Summary

The Howard County Department of Public Works Stormwater Management Division initiated the Howard County Biological Monitoring and Assessment Program in the spring of 2001. The County initiated the monitoring program to establish a baseline ecological stream condition for all of the County's watersheds. The program involves monitoring the biological health and physical condition of the County's water resources and is designed on a five year rotating basis such that each of the County's 15 watersheds, or primary sampling units (PSU) will be sampled once every five years.

The 2007 sampling effort continued the second round of countywide sampling. The Middle Patuxent River Watersheds (Upper, Middle and Lower) were re-sampled at 30 newly selected sites to fulfill the 2007 sampling requirements. These watersheds were previously sampled and assessed by Tetra Tech, Inc. in 2002 during the first round of the county-wide assessment (Pavlik and Stribling, 2003). Stream monitoring was conducted again in 2007 at 10 sites within each of the three Middle Patuxent PSUs (Upper Middle Patuxent, Middle Middle Patuxent, and Lower Middle Patuxent). The monitoring involved sampling instream water quality, collection and analysis of the biological community (benthic macroinvertebrates) using Maryland Biological Stream Survey (MBSS) protocols, cross-section analysis, particle size distribution, and assessment of the physical habitat using the United States Environmental Protection Agency's (EPA) Rapid Bioassessment Protocols (RBP). The sampling methods used are compatible with those used in the first round (2001-2003) with updates where applicable.

The MBSS benthic metrics, scoring criteria, and individual species tolerance were updated by Maryland Department of Natural Resources (DNR) in 2005 (Southerland et al., 2005). The biological data collected in the first round of sampling of the Middle Patuxent River watershed was analyzed using the old metrics (Stribling et. al 1998), and as such, the results are not directly comparable to the current sampling data. Therefore, all data from the 2002 Middle Patuxent River sampling were recalculated using the updated metrics to allow for direct comparison to the current data. For this report any mention of 2002 BIBI scores refer to these recalculated values.

All data collection occurred between March 1st and May 1st of 2007, as required by the MBSS protocols. Sampling sites were marked in the field using tree tags (when possible) at the midpoint of the reach. The positions of the sites were collected using a GPS unit accurate to within 2 meters.

Biological and physical habitat assessment results for 2007 in the Middle Patuxent watershed indicate a stream system that is moderately impaired. Overall, four of the thirty sites sampled received a biological condition rating of 'Good' and fourteen sites received a rating of 'Fair'. The remaining sites received biological condition ratings of 'Poor' or 'Very Poor' based on BIBI scores.

Overall the entire Middle Patuxent watershed, along with each individual subwatershed, received a 'Partially Supporting' physical habitat assessment rating. Conductivity was elevated at many sites across the watershed with values from 121 to 615 µS/cm. The geomorphic assessment revealed a variable system, with many of the channels in the Upper and Lower watersheds being classified as stable type B or C with areas of incised F and G channels more common in the Middle Middle Patuxent subwatershed. Gravel was the dominant substrate across the entire watershed but many areas with sand deposition were observed. The overall percentage of impervious area in the Middle Patuxent watershed is 12.4 percent. Land use base imperviousness values to sampling sites range from 0.0 percent to 44.0 percent.

Pearson correlation coefficients yielded strong negative correlations between BIBI scores and specific conductance (-0.401, with a significance level of 0.028), and percent impervious (-0.461, with a significance level of 0.010). There were no significant positive or negative correlations between any other parameters evaluated.

Results of the 2007 assessment of the Middle Patuxent watershed indicate generally fair to poor biological conditions, and a slight decrease, though not significant, was observed in the overall BIBI scores from 2002. While physical habitat scores have shown an increase, it is not conclusive whether these results are, in fact, due to improving habitat conditions or simply the result of sampler bias or spatial variability. Results from the Maryland Stream Waders 2002 sampling effort indicated similar biological conditions of mostly 'Fair' and 'Poor' ratings throughout the Middle Patuxent watershed (Boward and Bruckler, 2002).

Overall the Middle Patuxent watershed is predominantly agricultural land use, however increasing residential development is leading to rising levels of impervious surface. Continued monitoring is critical to determining whether these changes in land use will detrimentally impact the health of the watershed and to what extent.

Background and Objectives

The Howard County Biological Monitoring and Assessment Program was initiated in the spring of 2001 by the Howard County Department of Public Works Stormwater Management Division. The program involves monitoring the biological health and physical condition of the County's water resources to detect the status and trends at the stream level, the watershed level and ultimately at the County level.

The County initiated the program to establish a baseline ecological stream condition for all of the County's watersheds. The program is designed on a five year rotating basis such that each of the County's 15 watersheds or primary sampling units (PSU) will be sampled once every five years. In general three PSUs would be sampled each year with 10 sites sampled in each PSU.

The first sampling rotation was completed in only three years (2001 to 2003; Table 1). Requirements of the Patuxent Reservoir Watershed Group were addressed in 2001 with sampling conducted in PSUs 2, 5 and 3. This was in addition to sampling conducted in the Little Patuxent (PSUs 11, 12, and 13) under a Watershed Restoration Action Strategy (WRAS) grant. In 2002, only the Middle Patuxent PSUs were sampled. Additional WRAS funding in 2003 allowed sampling to be completed in the Patapsco River Tributaries (PSUs 1, 4, and 10) in addition to Rocky Gorge, Hammond Branch, and Dorsey Run, which were sampled to supplement the data collected in 2001 for the Little Patuxent.

Upper and Lower Brighton Dams (PSUs 2 and 5, respectively) and Cattail Creek (PSU 3) were all sampled as part of the first year of the second round of sampling in 2005. The Little Patuxent River (PSUs 11, 12, and 13) were sampled in 2006 during the second year of the second round of sampling.

Table 1 – Summary of Bioassessment Progress

Year	Number of Sites	Primary Sampling Unit (code and name)
Round One		
1 (2001)	60	11 – Upper Little Patuxent 12 – Middle Little Patuxent 13 – Lower Little Patuxent 2 – Upper Brighton Dam 5 – Lower Brighton Dam 3 – Cattail Creek
2 (2002)	30	6 – Upper Middle Patuxent 7 – Mid Middle Patuxent 8 – Lower Middle Patuxent
3 (2003)	60	9 – Rocky Gorge Dam 14 – Hammond Branch 15 – Dorsey Run 10 – S Branch Patapsco River Tributaries 1 – Patapsco River L Branch A 4 – Patapsco River L Branch B
Round Two		
5 (2005)	30	2 – Upper Brighton Dam 5 – Lower Brighton Dam 3 – Cattail Creek
6 (2006)	30	11 – Upper Little Patuxent 12 – Middle Little Patuxent 13 – Lower Little Patuxent
7 (2007)	30	6 – Upper Middle Patuxent 7 – Middle Middle Patuxent 8 – Lower Middle Patuxent

The 2007 Middle Patuxent sampling continued the second round of sampling. The Middle Patuxent River Watersheds (Upper, Middle and Lower) were re-sampled at 30 newly selected sites to fulfill the 2007 sampling requirements. These watersheds were previously sampled and assessed by Tetra Tech, Inc. in 2002 during the first round of the county-wide assessment (Pavlik and Stribling, 2003). Assessment methods follow those developed by Maryland Department of Natural Resources' (DNR) Maryland Biological Stream Survey (MBSS) and the Standard Operating Procedures (SOPs) found in the Quality Assurance Project Plan (QAPP) for the Howard County Biological Monitoring and Assessment Program (Howard County, 2001). The sampling methods used in 2007 are compatible with those used in the first round (2001-2003) with updates where applicable.

The second round of sampling will continue in 2008 with the sampling of the South Branch Patapsco River Tributaries (PSU 10), Patapsco River Lower Branch A (PSU 1) and Patapsco River Lower Branch B (PSU 4) subwatersheds and will be completed in 2009 after Rocky Gorge Dam (PSU 9), Hammond Branch (PSU 14), and Dorsey Run (PSU 15) subwatersheds are sampled. Figure 1 illustrates the progress made to date on the county-wide biological monitoring program, and indicates which subwatersheds are scheduled for future sampling in 2008 and 2009.

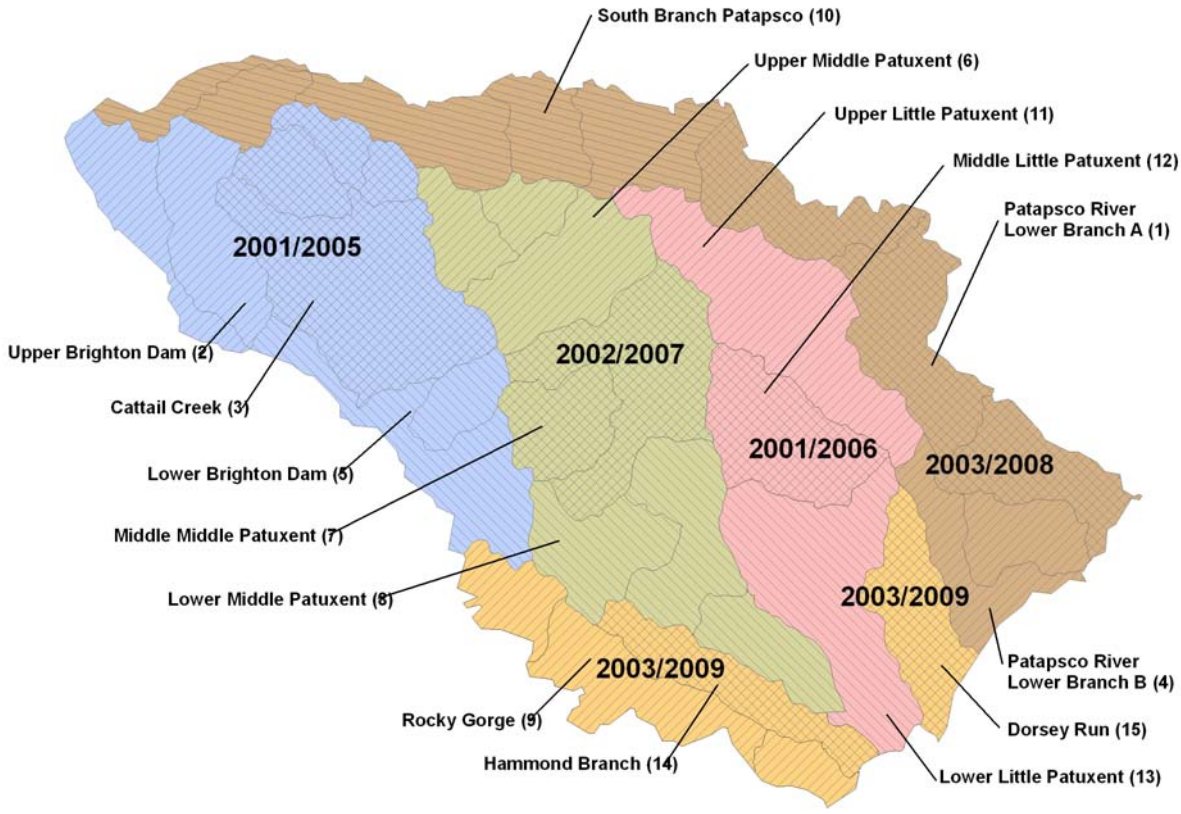

Figure 1 - Howard County Bioassessment

The Middle Patuxent River flows south through Howard County where it joins to the Little Patuxent River which then flows to an eventual confluence with the Patuxent River east of Bowie, Maryland. The Middle Patuxent PSUs are located in the central portion of Howard County and are crossed by several major transportation routes (see Figure 2). Interstate 70 and Maryland Route 40 (Baltimore National Pike) cross the northern portion of the watershed and State Route 97 intersects the

northwestern portion. Maryland State Highway 108 (Clarksville Pike) runs through the central portion of the watershed and Route 29 (Columbia Pike) crosses the southern portion. Maryland State Highway 32 runs north to south through a large portion of the watershed, crossing the main channel in both the Upper and Lower Middle Patuxent PSUs. Interstate 95 spans the Middle Patuxent just north of its confluence with the Little Patuxent River near Savage, Maryland.

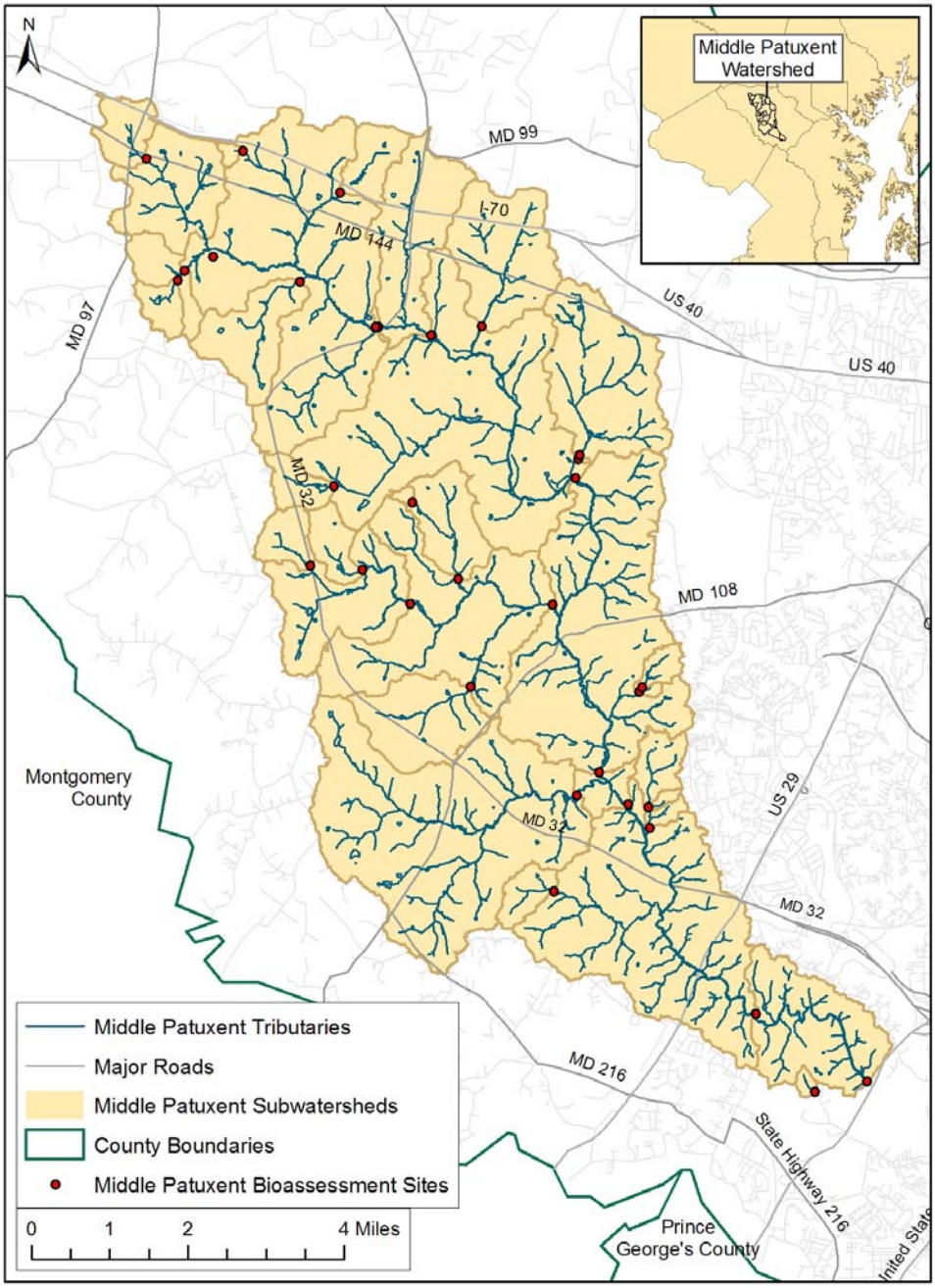

Figure 2 - Location Map, Middle Patuxent River Watershed

1 Methodologies

Stream monitoring was conducted throughout the watershed and involved measuring instream water quality, sampling and assessing the biological community (benthic macroinvertebrates), visually assessing the instream and riparian physical habitat, and performing cross-sectional and substrate particle size measurement and analysis. Monitoring was conducted at 10 sites within each of the three PSUs (Upper Middle Patuxent, Middle Middle Patuxent, and Lower Middle Patuxent). The assessment methods followed the current MBSS protocols and the SOPs described in the County's QAPP. All data collection occurred between March 1st and May 1st of 2007, as required by the MBSS sampling protocols. Monitoring sites were marked in the field using tree tags (when possible) at the midpoint of the reach. The positions of the sites were collected using a GPS unit accurate to within 2 meters. All field data were entered into the Ecological Data Application System (EDAS) Version 3.0 (Tetra Tech 1999). Photographs were taken to document conditions at the time of data collection. A summary of the methods used and the results of the monitoring are documented in this report.

1.1 Selection of Sampling Sites

The sampling design employed a randomized census approach stratified by stream order with a total of 30 sites distributed among the three PSUs. Ten sites were located in each subwatershed. Three additional biological samples were collected as quality assurance/quality control (QA/QC) samples at duplicate sites, one in each of the three subwatersheds.

Biological sampling, habitat assessments and water quality measurements were repeated at the duplicate sites. These sites were selected in the field. Duplicate sampling reaches were the same length as the paired sampling sites (75 meters) were located immediately upstream of their paired sampling sites, had similar habitat characteristics and were not impacted by road crossings or confluences.

To select primary and alternate sampling sites, stream lengths were summed by stream order within each subwatershed. The length of stream by stream order and its percentage of the total length within the subwatershed determined the number of sites selected on that order stream.

The randomized approach was then applied within each subwatershed. The stream layer was divided into 1-meter reaches and each reach was assigned a number. A random number generator was used to select sampling reaches for 2007. Both primary and alternate sites were selected in case the primary site was ephemeral (dry), inaccessible or unsafe to sample. Site codes contain the PSU code and initials of the watershed (**06MP**-1-01-2007), stream order (06MP-**1**-01-2007), a two-digit sequential number (06MP-1-**01**-2007), and the year sampled (06MP-1-01-**2007**). Alternate sites are coded with an "a" after the sequential number.

1.2 Impervious Surface Analysis

The impervious surface acreage and percent was calculated for the drainage area to each site using County GIS data. Drainage areas were first delineated to each sampling site using two-foot contours. Imperviousness was derived based on Maryland Department of Planning (MDP) 2002 land use for Howard County and percent impervious values for each land use. Values for percent impervious by land use were derived from the Natural Resources Conservation Services (NRCS) TR-55 (USDA, 1986). A table with the percent of land use in each subwatershed and the imperviousness percentages applied to each land use is included in Appendix A.

1.3 Water Quality Sampling

To supplement the macroinvertebrate sampling and habitat assessment, instream water quality measurements were performed. Field water quality measurements were collected *in situ* at all sites according to methods in the County QAPP. Each parameter listed in Table 2 was recorded at the bottom, middle and upstream portion of each sampling reach (including field QC sites) and averaged

for a final value. Most *in situ* parameters were measured with a YSI® multiparameter water quality meter. Turbidity was measured with a Hach 2100 Turbidimeter. Water quality meters were regularly inspected, maintained and calibrated to ensure proper usage and accuracy of the readings. Calibration logs were kept by field crew leaders and checked by the project manager regularly.

The Maryland Department of the Environment (MDE) has established acceptable standards for several water quality parameters for each designated Stream Use Classification. These standards are listed in the *Code of Maryland Regulations (COMAR) 26.08.02.01-.03 - Water Quality* (MDE 1994). The drainage areas in the Middle Patuxent River watershed are in *COMAR* in Sub-Basin 02-13-11: Patuxent River Area. It is classified as a Use I-P stream, Water Contact Recreation, Protection of Aquatic Life, and Public Water Supply. Specific designated uses for Use I-P streams include water contact sports, fishing, the growth and propagation of fish, and agricultural, industrial, and public water supply. The acceptable standards for Use I-P streams are listed in Table 2.

Table 2 - Water Quality Sampling and COMAR Standards

Parameter	Units	Acceptable COMAR Standard
pH	standard pH units	6.5 to 8.5
Temperature	degrees Celsius, °C	maximum of 90°F (32°C) or ambient temperature of the surface water, whichever is greater
Dissolved Oxygen (DO)	milligrams per liter, mg/L	may not be less than 5 mg/L at any time
Conductivity	microSiemans per centimeter, µS/cm	no COMAR standard set
Total Dissolved Solids	milligrams per liter, mg/L	no COMAR standard set
Turbidity	Nephelometer Turbidity Units, NTU	maximum of 150 NTUs and maximum monthly average of 50 NTUs

A comparison of these standards to data collected at each station is included in the site summary text in Section 2.1.

1.4 Biological Sampling

Biological monitoring was conducted throughout the Middle Patuxent watershed following methods detailed in the County's QAPP. Biological assessment methods within Howard County are designed to be consistent and comparable with the methods used by Maryland Department of Natural Resources (DNR) in their Maryland Biological Stream Survey (MBSS). The County has adopted the MBSS methodology to be consistent with statewide monitoring programs and programs adopted by other Maryland counties. The methods have been developed locally and are calibrated to Maryland's physiographic regions and stream types. Because MBSS methods dictate that habitat assessments occur during summer sampling, physical habitat for the Middle Patuxent watershed was assessed using the EPA's Rapid Bioassessment Protocol (RBP) (Barbour et. al, 1999) habitat assessment for high-gradient streams. Locations of the bioassessment sites are shown in Figure 3.

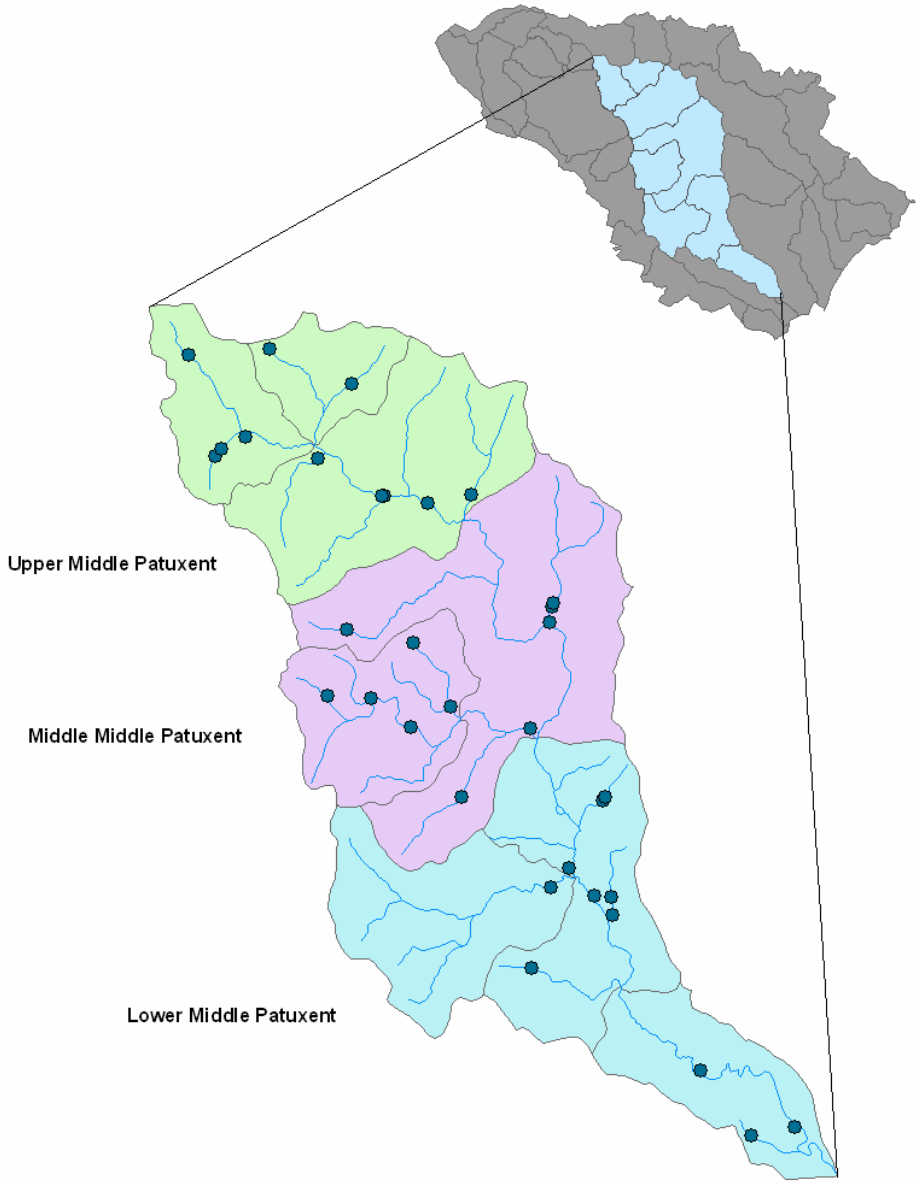

Figure 3 – Middle Patuxent Bioassessment Sampling Locations

1.4.1 Benthic Macroinvertebrate Sampling

Benthic macroinvertebrate collection followed the QAPP which closely mirrors MBSS procedures (Kazyak, 2001). Benthic macroinvertebrate sampling is conducted during the spring season (March 1st to May 1st) along a 75-meter reach. The multi-habitat D-frame net approach was used to sample a range of the most productive habitat types within the reach. In this sampling approach, a total of twenty jabs are distributed among all available habitats within the stream system and combined into one composite sample. Sampled habitats include submerged vegetation, overhanging bank vegetation, leaf packs, mats of organic matter, stream bed substrate, submerged materials (i.e., logs, stumps, snags, dead branches, and other debris) and rocks.

1.4.2 Sample Processing and Laboratory Identification

Benthic macroinvertebrate samples were processed and subsampled according to methods described in the MBSS *Laboratory Methods for Benthic Macroinvertebrate Processing and Taxonomy* (Boward and Friedman, 2000). Subsampling is conducted to standardize the sample size and reduce variation caused by samples of different sizes. In this method the sample is spread evenly across a gridded tray and each grid is picked clean of organisms until a count of 120 is reached. The 120-organism target is used to allow for specimens that are missing parts or are not a late enough instar for proper identification.

The samples were sent to a lab (Environmental Services and Consulting[1]) for identification. Identification of the samples was conducted to the genus level for most organisms. Groups including Oligochaeta and Nematomorpha were identified to the family level while Nematoda was left at phylum. Individuals of early instars or those that were damaged were identified to the lowest possible level, which in most cases was family. Chironomidae was further subsampled depending on the number of individuals in the sample and the numbers in each subfamily or tribe. Most taxa were identified using a stereoscope. Temporary slide mounts were used to identify Oligochaeta to family with a compound scope. Chironomid sorting to subfamily and tribe was also conducted using temporary slide mounts. Permanent slide mounts were then used for final genus level identification. Results were logged on a bench sheet and entered into a spreadsheet for analysis.

For those sites with greater than 120 organisms identified, a post-processing subsampling was conducted using a spreadsheet-based method (Tetra Tech, 2006). This post-processing randomly subsamples the identified organisms to a desired target number for the sample. Each taxon is subsampled based on its original proportion to the entire sample. In this case, the desired sample size selected was 110 individuals. This allows for a final sample size of approximately 110 individuals (±20%) but keeps the total number of individuals below the 120 maximum.

1.4.3 Biological Data Analysis

MBSS has recently updated their method for analyzing benthic macroinvertebrate data. Data was analyzed using methods developed by MBSS as outlined in the *New Biological Indicators to Better Assess the Condition of Maryland Streams* (Southerland et al., 2005). The Benthic Index of Biotic Integrity (BIBI) approach involves statistical analysis using metrics that have a predictable response to water quality and/or habitat impairment. The metrics selected fall into five major groups including taxa richness, taxa composition, tolerance to perturbation, trophic (feeding) classification and taxa habit.

Raw values from each metric are given a score of 1, 3 or 5 based on ranges of values developed for each metric. The results are combined into a scaled BIBI score ranging from 1.0 to 5.0, and a corresponding narrative rating is applied. Three sets of metric calculations have been developed for Maryland streams based on broad physiographic regions. These include the coastal plain, piedmont and combined highlands physiogeographic regions. The Middle Patuxent watershed is located in the piedmont region.

The benthic metrics, scoring criteria, and individual species tolerance were updated by DNR in 2005. The data collected in the first round of sampling of the Middle Patuxent River watershed was analyzed using the old metrics (Stribling et. al 1998), and as such, the results are not directly comparable to the current sampling data. Therefore, all data from the 2002 Middle Patuxent River sampling were recalculated using the updated metrics to allow for direct comparison to the current data (KCI, 2007). For this report, any mention of 2002 BIBI scores refer to these recalculated values.

[1] Address: 101 Professional Park Drive, STE 303, Blacksburg, VA

The following metrics and BIBI scoring were used for data analysis:

Piedmont BIBI Metrics:

Total Number of Taxa – Equals the richness of the community in terms of the total number of genera at the genus level or higher. A large variety of genera typically indicate better overall water quality, habitat diversity and/or suitability, and community health.

Number of EPT Taxa – Equals the richness of genera within the Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies). EPT taxa are generally considered pollution sensitive, thus higher levels of EPT taxa would be indicative of higher water quality.

Number of Ephemeroptera Taxa – Equals the total number Ephemeroptera Taxa in the sample. Ephemeroptera are generally considered pollution sensitive, thus communities dominated by Ephemeroptera usually indicate lower disturbances in water quality.

Percent Intolerant Urban – Equals the percentage of individuals in the sample that are considered intolerant to urbanization (tolerance values 0 – 3). The percent of intolerant urban is expected to decrease with decreasing water quality.

Percent Chironomidae – Equals the percentage of individuals in the sample that are in the Chironomidae family. An increase in the percentage of Chironomidae is generally an indicator of decreasing water quality.

Percent Clingers – Equals the percentage of the total number of individuals who are adapted to attaching to surfaces in stream riffles. Higher percentages of clingers are representative of a decrease in stressors and higher water quality.

Information on trophic or functional feeding group and habit were based heavily on information compiled by DNR and from Merritt and Cummins (1996). Scoring criteria are shown below in Table 3. The raw metric value ranges are given with the corresponding score of 1, 3 or 5. Table 4 gives the BIBI ranges and ratings.

Table 3 – Biological Condition Scoring for Piedmont Benthic Macroinvertebrates

Metric	Score		
	5	3	1
Total Number of Taxa	≥25	15 – 24	<15
Number of EPT Taxa	≥11	5 – 10	<5
Number of Ephemeroptera Taxa	≥4	2 – 3	<2
Percent Intolerant Urban	≥51	12 – 50	<12
Percent Chironomidae	≤4.6	4.7 – 63	>63
Percent Clingers	≥74	31 – 73	<31

Table 4 – BIBI Scoring and Rating

BIBI Score	Narrative Rating
4.0 – 5.0	Good
3.0 – 3.9	Fair
2.0 – 2.9	Poor
1.0 – 1.9	Very Poor

1.5 Physical Habitat Assessment

Each biological monitoring site is characterized based on physical characteristics and various habitat parameters following the Environmental Protection Agency's Rapid Bioassessment Protocol (RBP) habitat assessment for high gradient streams (Barbour *et. al*, 1999). The habitat assessment consists of visually assessing ten biologically significant habitat parameters that evaluate a stream's ability to support an acceptable level of biological health. Each parameter is given a numerical score from 0-20 and a categorical rating of optimal, suboptimal, marginal or poor. Overall habitat quality typically increases as the total score for each site increases. The parameters assessed for high gradient streams are listed in Table 5.

Table 5 – RBP Habitat Parameters - High Gradient Streams

High Gradient Stream Parameters	
Epifaunal substrate/available cover	Channel alteration
Embeddedness	Frequency of riffles/bends
Velocity/depth regime	Bank stability
Sediment deposition	Vegetative protection
Channel flow status	Riparian Vegetative Zone Width

The above parameters for each site (including QC sites) were summed to obtain a total habitat score. A percent comparability was then calculated based on the highest attainable score (200). The percent of reference score, or percent comparability score, is then used to place each site into corresponding narrative rating categories as shown in Table 6.

Table 6 – RBP Habitat Score and Ratings

Percent of Reference	Narrative Rating
>90.0	Comparable to Reference
75.1 – 89.9	Supporting
60.1 – 75.0	Partially Supporting
<60.0	Non-supporting

1.6 Geomorphic Analysis

The goal of the physical monitoring was to create a geomorphic characterization of the stream channels in the watershed. Assessment techniques include the cross-sectional survey, substrate particle size analysis and measurement of channel slope. Additionally, a Rosgen Level I characterization (Rosgen, 1996) was completed for each stream reach based on field-collected data. Table 7 includes general descriptions for each channel type classification.

Table 7 – Rosgen Level I Channel Type Description

Channel Type	General Description (from Rosgen, 1996)
Aa+	Very steep, deeply entrenched, debris transport, torrent streams.
A	Steep, entrenched, confined, cascading, step/pool streams. High energy/debris transport associated with depositional soils. Very stable if bedrock or boulder dominated channel.
B	Moderately entrenched, moderate gradient, riffle dominated channel with infrequently spaced pools. Moderate width/depth ratio. Narrow, gently sloping valleys. Very stable plan and profile. Stable banks.
C	Low gradient, meandering, slightly entrenched, point-bar, riffle/pool, alluvial channels with broad, well-defined floodplains.
D	Braided channel with longitudinal and transverse bars. Very wide channel with eroding banks. Active lateral adjustment, high bedload and bank erosion.
DA	Anastomosing (multiple channels) narrow and deep with extensive, well-vegetated floodplains and associated wetlands. Very gentle relief with highly variable sinuosities and width/depth ratios. Very stable streambanks.
E	Low gradient, Highly sinuous, riffle/pool stream with low width/depth ratio and little deposition. Very efficient and stable. High meander/width ratio.
F	Entrenched, meandering riffle/pool channel on low gradients with high width/depth ratio and high bank erosion rates.
G	Entrenched "gully" step/pool and low width/depth ratio on moderate gradients. Narrow valleys. Unstable, with grade control problems and high bank erosion rates.

1.6.1 Cross Section Analysis

Cross-sections were surveyed at each monitoring station to develop a channel characterization and measurement of cross-sectional area and discharge. Methods followed the Howard County SOP. Each of the 30 cross-sections was located on a representative cross-over reach and was surveyed with a laser level and stadia rod.

The cross-sections include survey of the floodplain and all pertinent channel features including:

- Top of bank
- Bankfull elevation
- Edge of water
- Limits of point and instream depositional features
- Thalweg
- Floodprone elevation

Sinuosity was calculated based on the length of the field-surveyed profile and the straight-line distance between the top and bottom of each profile. The floodprone width is estimated at an elevation two times the bankfull depth.

Additional survey points were taken at the upstream, midpoint and downstream end of the sampling reach to obtain the slope through the reach so that estimates of discharge could be derived. Survey points for slope calculations were taken at the tops of riffles.

The stream cross-section, bed and bank material data and profile information (including slope) were analyzed using the Ohio Department of Natural Resources Reference Reach Spreadsheet Version 4.2L (ODNR). The following values and ratios were calculated:

Sinuosity	Entrenchment ratio	Bankfull cross-section area
Slope	Bankfull height	Velocity
Floodprone width	Bankfull width	Discharge
Width / depth ratio	Mean depth	Shear stress

1.6.2 Particle Size Analysis

The channel bed and bank materials were characterized at each cross-section using pebble count analysis. A single pebble count, modified from the technique developed by Wolman (1954), was conducted in each reach to determine the composition of channel materials and the median particle size for each site. The pebble count procedure was adapted from *Stream Channel Reference Sites: An Illustrated Guide to Field Technique* (Harrelson et al, 1994). The pebble count was conducted at 10 transects across the entire assessment reach. Transects were positioned based on the proportion of riffles/pools/runs in the assessment reach as estimated by visual inspection. The count was conducted within the entire bankfull channel. The pebble counts provide roughness values necessary for calculations of velocity and discharge.

2 Results

2.1 PSU Summaries

A total of 30 sites were visited in the Middle Patuxent watershed, ten within the each of the Lower Middle Patuxent, Middle Middle Patuxent, and Upper Middle Patuxent subwatersheds. Additionally, one biological QA/QC sample was collected in each subwatershed at stations where upstream habitat was considered similar. The summary results of the habitat assessment, biological assessment, land use, and Rosgen characterization (Rosgen, 1998) are divided among the three subwatersheds and presented in detail in this section. A map of each subwatershed displaying the results of the RBP habitat assessment and BIBI is also presented. Full data results are located in Appendices A through F.

2.1.1 Upper Middle Patuxent

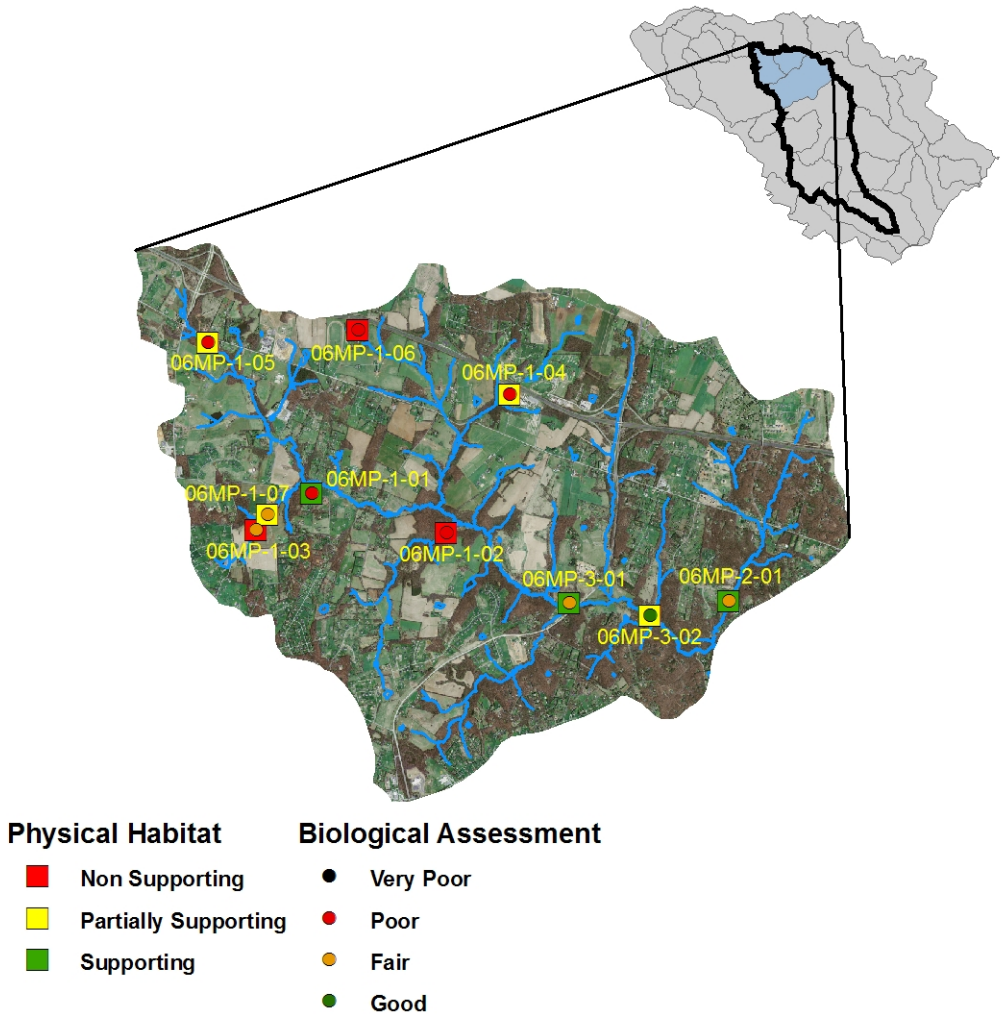

Figure 4 – Upper Middle Patuxent Sampling Results

Seven of the ten sampling sites in 2007 in the Upper Middle Patuxent were on first order streams, one a second order, and two were on third order streams. The field QC sample was collected at site 06MP-3-01. The subwatershed had an average BIBI score of 3.0 and a 'Fair' condition rating, with scores ranging from 2.0 to 4.0. The average RBP habitat assessment comparability score was 71.0, or 'Partially Supporting', with scores ranging from 55.5 percent ('Non-supporting') to 79.5 percent ('Supporting'). The highest habitat comparability score (79.5) in the entire Middle Patuxent watershed was found in this subwatershed. Channels were generally classified as Rosgen type B or C with predominantly gravel/sand substrate. A summary of the results for the Upper Middle Patuxent subwatershed is found in Table 8.

Table 8 - Upper Middle Patuxent Summary

Site ID	Drainage Area (ac)	Impervious Surface Percent	Stream Order	BIBI Score	BIBI Narrative Rating	Habitat Comparability Score	Habitat Narrative Rating	Rosgen Channel Type
06MP-1-01-2007	1357	4.7	1	2.7	Poor	78.5	Supporting	C5
06MP-1-02-2007	750	10.7	1	2.7	Poor	57.0	Non-supporting	B4c
06MP-1-03-2007	205	13.8	1	3.0	Fair	57.0	Non-supporting	B5c
06MP-1-04-2007	350	7.5	1	2.3	Poor	62.0	Partially Supporting	B4c
06MP-1-05-2007	344	8.2	1	2.7	Poor	71.5	Partially Supporting	C4
06MP-1-06-2007	40	42.1	1	2.0	Poor	55.5	Non-supporting	E5
06MP-1-07-2007	536	10.7	1	3.7	Fair	75.0	Partially Supporting	E4
06MP-2-01-2007	1254	13.1	2	3.7	Fair	75.5	Supporting	B4c
06MP-3-01-2007*	7231	7.4	3	3.3	Fair	79.5	Supporting	C4
06MP-3-02-2007	8484	7.7	3	4.0	Good	74.5	Partially Supporting	C5
Minimum	40	4.7	1	2.0	Poor	55.5	Non-supporting	NA
Maximum	8484	42.1	3	4.0	Good	79.5	Supporting	NA
Mean	2055	12.6	NA	3.0	Fair	71.0	Partially Supporting	NA
Standard Deviation	3101	10.7	NA	0.7	NA	9.62	NA	NA

*QC sampling was conducted at this site

Upper Middle Patuxent Site Descriptions:

06MP-1-01-2007
Located just downstream of the culvert running under Rover Mill, this reach was classified as a C5 channel type with a predominantly sand substrate. Imperviousness within the 1357-acre drainage area was calculated to be 4.7 percent, the lowest in the entire subwatershed. Agricultural land uses make up over 60 percent of the drainage area to the sampling site, with 22.5 percent classified as forested. There were 40 taxa in the benthic macroinvertebrate sample, more than at any other site; 7 taxa were EPT but only 8 percent of the individuals were intolerant to urban stressors. Individuals of the Chironomidae family (midges) made up 64 percent of the sample. Although there were numerous taxa present, the high level of Chironomids and low proportion of intolerant individuals led to an overall BIBI score of 2.7 for this site, resulting in a biological rating of 'Poor'. Habitat was rated as

'Supporting', receiving a score of 78.5. The banks were considered to be moderately stable. Water quality results indicated no parameters that exceeded acceptable COMAR standards.

06MP-1-02-2007
Site 06MP-1-02-2007 is located in a large forested area surrounded by farmland. Low density residential and agriculture make up the majority of the land use in the 750-acre drainage area. Percent impervious surface to the sampling site is 10.7. This stream was classified as a B4c channel type with gravel substrate. Water quality measurements indicated no parameters outside COMAR allowable limits. There were 30 benthic macroinvertebrate taxa found at this site. Nearly a quarter of the individuals were considered intolerant to urban land uses. Only 15 percent were classified as clingers, and 65 percent were Chironomids. Based on the BIBI score of 2.7, this site was given a 'Poor' biological condition rating. The habitat assessment resulted in a comparability score of 57, with a rating of 'Non-supporting'. The resulting habitat score is likely due to the lack of suitable epifaunal substrate and woody debris, poor bank stability and vegetative protection, and overall poor habitat quality.

06MP-1-03-2007
This site lies on a B5c channel dominated by sandy substrate. The stream is located in a small forested buffer surrounded by agricultural land use. Over half of the 205-acre drainage area is classified as low-density residential. This accounts for most of the 14 percent of impervious surface present in the drainage area to the sampling site. The remaining land use is agricultural. The habitat assessment resulted in a score of 57 with a rating of 'Non-supporting' indicating habitat that should be less than suitable for supporting a healthy benthic community. All water quality parameters were within COMAR limits for Use I-P streams, although the dissolved oxygen was lower than most other sites in the subwatershed. This site also had the highest turbidity seen in this subwatershed. Ten EPT taxa were present, four of which were Ephemeroptera, out of a total of 34 taxa identified in the benthic macroinvertebrate sample. Intolerant individuals comprised 12 percent of the sample and 24 percent were classified as clingers, resulting in a BIBI score of 3.0 and a 'Fair' classification. Of the 104 individuals in the subsample, no more than eight belonged to any one taxa, indicating a relatively stable and proportionally distributed benthic assemblage.

06MP-1-04-2007
The upstream end of this sampling reach lies just below the culvert under Route 32 and flows through the Howard County Fair Grounds. This site was classified as a B4c channel type and is dominated by gravel substrate. The left bank is steep and made up of primarily hard pan clay at the downstream end of the reach. Water quality results indicated this site had the highest temperature among all sites sampled in the Middle Patuxent watershed. The predominant land use in the 350-acre drainage area is agricultural followed closely by open urban land. Overall, the drainage area has 7.5 percent of impervious surface, which is below the average for the Upper Middle Patuxent sites. The habitat assessment indicated a 'Partially Supporting' habitat with a score of 62. Habitat scores were low for bank stability and riparian zone width along both banks. The majority of the immediate buffer is a mowed park area within the fair grounds. Only one percent of the benthic macroinvertebrate sample, a single *Stenacron* (mayfly; Tolerance Value [TV] = 2) specimen, was intolerant to urbanization. Four EPT taxa were present at this site, two of which were Ephemeroptera. Clingers comprised 58 percent of this sample, nearly half of which were *Cheumatopsyche* (TV =6.5), the dominant taxa in the subsample. Overall, the site received a BIBI scored of 2.3, which classified the biological condition as 'Poor'.

06MP-1-05-2007
Impervious surface draining to this site (8.2 percent) is slightly above the subwatershed average. This is a result of the 32.8 percent of low density residential land use in the 344-acre drainage area.

Construction of a housing development was observed in close proximity to this sampling reach, with a construction vehicle access road crossing the stream just below the site. The drainage area is predominantly forest (46.8 percent) land cover, although 20.5 percent is agricultural land use. The new housing project was not accounted for in the imperviousness delineation as it is not yet complete. The channel type was classified as a Rosgen C with gravel as the most abundant substrate. All water quality parameters were within acceptable ranges. Habitat scored 71.5 and was rated as 'Partially Supporting'. However, the BIBI received a 'Poor' classification with a score of 2.7. There were 30 taxa present in the sample, but only five were EPT taxa, two of which represented Ephemeroptera, and individuals of the family Chironomidae comprised a significant proportion (67 percent) of the sample. Individuals intolerant to urban stressors comprised 24 percent of the sample.

06MP-1-06-2007
This sampling reach is located just upstream of a culvert under McKendree Road within a small forested area. At 40 acres, this site has the smallest drainage area in the entire Middle Patuxent watershed. The surrounding land use is predominantly institutional, accounting for 83 percent of the drainage area. The remaining drainage area is in agricultural (7.8 percent) and forested (8.9 percent) land use. The total impervious land use for the drainage area is 42.1 percent, the highest in the Upper Middle Patuxent subwatershed. This site is classified as an E channel with sand as the dominate substrate. All water quality parameters were within acceptable ranges. Turbidity was higher than most other sites within this subwatershed. Habitat was rated as 'Non-supporting' with a habitat score of 55.5, the lowest score received in the Upper Middle Patuxent subwatershed. The overall BIBI score was 2.0 and rated 'Poor', the lowest score recorded in the Upper Middle Patuxent subwatershed. This site received an average score for percentage of intolerant urban and had 22 total taxa present. However, no Ephemeroptera taxa and only four EPT taxa were present. Members of the Chironomidae family comprised a large proportion of the sample (59 percent), with one taxon *Parametriocnemus* (TV = 4.5) representing 25 percent of the total sample.

06MP-1-07-2007
This sampling reach lies just downstream of site 06MP-1-03-2007 and is classified as a C channel type dominated by a sandy substrate. This site received a habitat assessment score of 75 and is classified as 'Partially Supporting'. All water quality parameters were within COMAR limits for Use I-P streams. Land use in the 536-acre drainage area is primarily agricultural (46.5 percent) and low density residential (43.0 percent), with the remainder as forested landcover (10.5 percent). The overall imperviousness based on land use is 11 percent. This site had the highest percent of intolerant urban individuals (35 percent) and the second lowest percent of Chironomids (35 percent) in the Upper Middle Patuxent watershed. Of the 30 taxa present, ten belonged to EPT and half of those were Ephemeroptera taxa. Nearly half of the individuals in the sample (49 percent) were classified as clingers. This site was classified as 'Fair', with a score of 3.7. Of the 101 individuals in the subsample, no more than nine belonged to any one taxa, indicating a relatively stable and healthy benthic assemblage.

06MP-2-01-2007
Habitat at this site was rated as 'Supporting', receiving a habitat assessment score of 75.5, which is slightly above the subwatershed average. Dominant land uses in the approximately 1254-acre drainage include low-density residential (48.2 percent) and agriculture (26.2 percent) with an overall imperviousness of 13.1 percent. The sampling reach is surrounded by a small forested buffer and has high quality epifaunal habitat. The substrate provides a good mix of gravel and cobbles, and the reach was classified as a B4c channel type. The lowest turbidity recorded in the subwatershed was measured at this site, and no other water quality parameters exceeded COMAR limits. Benthic macroinvertebrate sampling resulted in a score of 3.7, indicating 'Fair' biological conditions. This site had the second highest percent of individuals intolerant to urban stressors (33 percent) in the

subwatershed as well as a high proportion of clingers (57 percent), due in large part to the dominance of the mayfly *Ephemerella* (TV = 2.3), which made up nearly 28 percent of the sample. There were nine EPT taxa at this site, five of which were Ephemeroptera, out of 32 total taxa. However, midges comprised 40 percent of the sample, which indicate a deviation from a stable, well distributed benthic assemblage.

06MP-3-01-2007
Located just off of State Highway 32, site 06MP-3-01 has a 7231-acre drainage area and is just over 50 percent in agricultural land use, with the majority of the remainder of the area in low-density residential (25 percent) and forest (21 percent). The imperviousness to the site is 7 percent, lower than the Middle Patuxent Watershed average of 12 percent. There is a wide riparian buffer zone on the left side of the sample reach. This site was classified as a C stream channel type dominated by gravel substrate. Habitat received a score of 79.5 with a narrative rating of 'Supporting', the highest received in the Upper Middle Patuxent watershed. However, bank stability was considered poor to marginal. This site had the highest dissolved oxygen recorded at any site in the Upper Middle Patuxent watershed (12.73 mg/L), although it also had one of the highest recorded water temperatures. Nonetheless, all water quality parameters were within acceptable limits. Metrics for benthic macroinvertebrates all received marginal scores of '3', except for total number of taxa, which received a score of '5'. There were 34 total taxa, of which ten were EPT taxa and three were Ephemeroptera. Thirteen percent of the sample was classified as being intolerant to urban stressors and 55 percent of the sample was made up of individuals of the Chironomidae family. The biological condition was rated 'Fair,' with an overall BIBI score of 3.3. A quality control sample was completed just upstream of this sampling reach, and was rated as 'Good' with a score of 4.0. The quality control site had two more EPT taxa (*Ceratopsyche* and *Drunella*) and one more Ephemeroptera taxa (*Drunella*) than the original sampling site, both of which then qualified for a higher categorical rating even though only one specimen from each of *Ceratopsyche* and *Drunella* were found in the sample.

06MP-3-02-2007
Site 06MP-3-02-2007 is on a third-order stream with an 8484-acre drainage area. The sampling site is located within a large forested area with poor bank stability on the right side and large amounts of aggradation occurring on many sand/gravel bars. The predominant surrounding land use is agricultural (49.1 percent) followed by low density residential (25.1 percent) and forested (22.3 percent), which account for 7.7 percent imperviousness of the drainage area. This site was classified as a stream channel type of C5 with a good mix of sand, gravel, and cobble. Bank stability was considered to be marginal to sub-optimal with high sediment deposition. The overall habitat assessment score was 74.5, at the high end of the 'Partially Supporting' classification. For the biological condition, this site received the highest rating of 'Good' (BIBI = 4.0) of all sites in the Upper Middle Patuxent watershed. This site had the highest number of EPT taxa (12), the highest percentage of clinger taxa (65 percent) and lowest percentage of Chironomids (31 percent) in the subwatershed, and the highest number of Ephemeroptera taxa (seven) in the entire Middle Patuxent watershed. Only 13 percent of the sample was comprised of individuals intolerant to urban stressors.

2.1.2 Middle Middle Patuxent

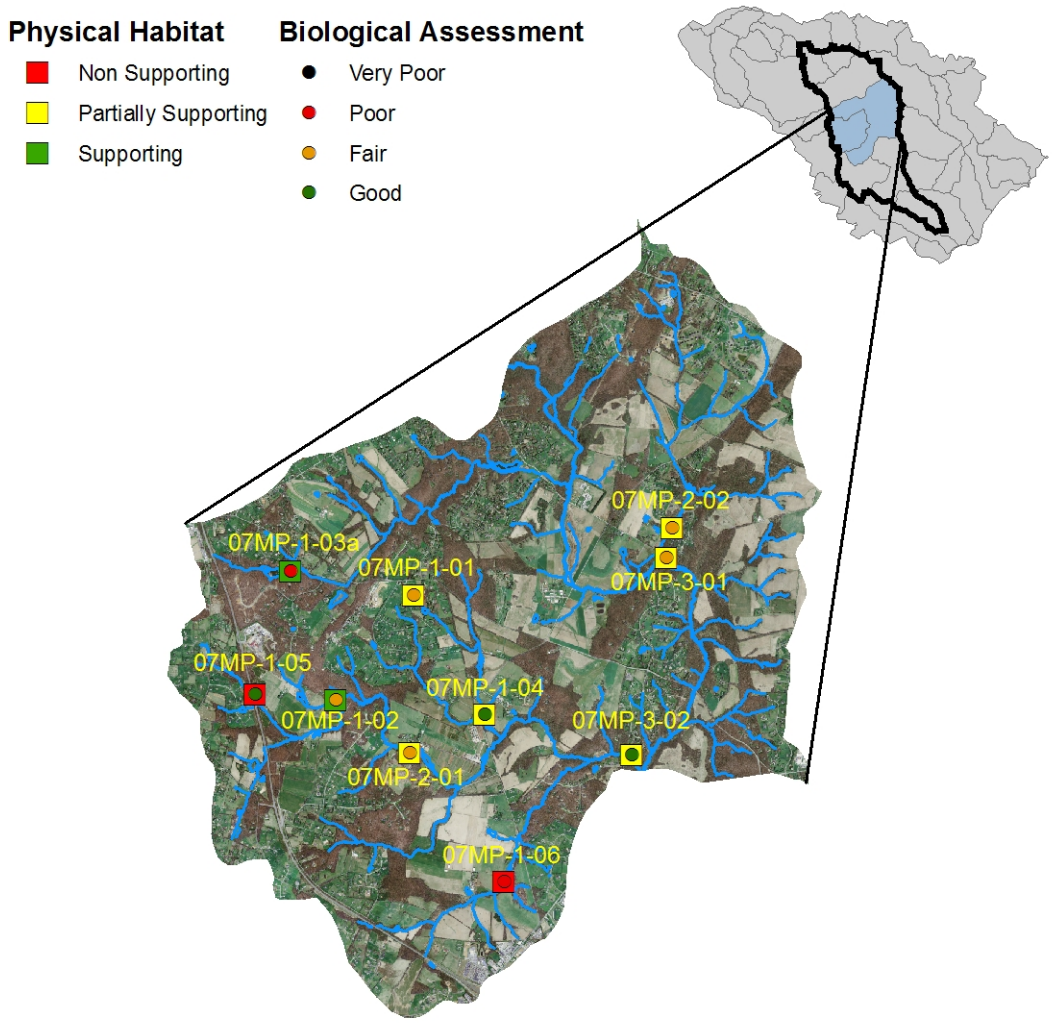

Figure 5 - Middle Middle Patuxent Sampling Results

In 2007, six of the ten sampling sites in the Middle Middle Patuxent subwatershed were on first-order streams, two were on second-order streams and the remaining two were on third-order streams. The field QC sample was collected at site 07MP-2-02. Habitat assessment comparability scores in the Middle Middle Patuxent subwatershed ranged from 49.0 percent, with a classification of 'Non-supporting' to 79.0 percent and a classification of 'Supporting'. BIBI scores ranged from a low of 2.3, or 'Poor' to 4.0, or 'Good'. The mean BIBI score was 3.4, with an average biological condition rating of 'Fair'. The mean habitat comparability score was 69.0 with a rating of 'Partially Supporting'. Although the Upper Middle Patuxent subwatershed had a higher percentage of sites rated as 'Non-supporting' for habitat condition than did the Middle Middle Patuxent, sites 07MP-1-05 and 07MP-1-06 received the two lowest habitat assessment comparability scores in the entire Middle Patuxent watershed. A summary of the results for the Middle Middle Patuxent subwatershed is found in Table 9.

Table 9 - Middle Middle Patuxent Summary

Site ID	Drainage Area (ac)	Impervious Surface Percent	Stream Order	BIBI Score	BIBI Narrative Rating	Habitat Comparability Score	Habitat Narrative Rating	Rosgen Channel Type
07MP-1-01-2007	30	31.9	1	3.7	Fair	66.0	Partially Supporting	G4c
07MP-1-02-2007	289	14.1	1	3.0	Fair	79.0	Supporting	F4
07MP-1-03A-2007	259	12.3	1	2.3	Poor	77.5	Supporting	B4
07MP-1-04-2007	660	7.3	1	4.0	Good	71.5	Partially Supporting	B4
07MP-1-05-2007	278	20.4	1	4.0	Good	51.0	Non-supporting	G4
07MP-1-06-2007	954	8.3	1	2.7	Poor	49.0	Non-supporting	F5
07MP-2-01-2007	1781	13.2	2	3.3	Fair	63.5	Partially Supporting	F4
07MP-2-02-2007*	1667	5.9	2	3.0	Fair	70.5	Partially Supporting	C4
07MP-3-01-2007	16158	9.2	3	3.7	Fair	75.0	Partially Supporting	C4
07MP-3-02-2007	5800	11.1	3	4.0	Good	63.0	Partially Supporting	F4
Minimum	30	5.9	1	2.3	Poor	49.0	Non-supporting	NA
Maximum	16158	31.9	3	4.0	Good	79.0	Supporting	NA
Mean	2788	13.4	NA	3.4	Fair	69	Partially Supporting	NA
Standard Deviation	4995	7.7	NA	0.6	NA	10.3	NA	NA

*QC sampling was conducted at this site

Middle Middle Patuxent Site Descriptions:

07MP-1-01-2007
This sampling site has the highest percentage of impervious area (32 percent) in this subwatershed. The land use within the drainage area is primarily low-density residential (68 percent) followed by institutional (30 percent). Additionally, the drainage area is the smallest when compared to many of the other sampling sites in the Middle Patuxent watershed – only 30 acres. The reach was classified as a G4c channel type with fairly stable banks. The dominate substrate was a good mix of sand and gravel. The riparian zone was made up of few trees and grazing paddocks on each bank for the entire length of the reach. The habitat score for this site was 66, rated as 'Partially Supporting', just below this subwatershed average. No water quality values fall outside the acceptable COMAR limits. The BIBI score was 3.7, with a biological rating of 'Fair'. This site had the highest percentage of urban intolerant individuals (51 percent) and the lowest percentage of chironomids (31 percent) in the Middle Middle Patuxent watershed. *Amphinemura*, an intolerant stonefly (TV = 3), was the dominant taxa found in the subsample. Additionally, there were ten EPT and four Ephemeroptera taxa present, and 35 percent of the specimens identified were classified as clingers.

07MP-1-02-2007
At this site, the majority of the surrounding land use in the 289-acre drainage area is agricultural, over 42 percent, with the remaining portions made up of low density residential (28.6 percent) and forest (20.8 percent). The overall imperviousness to the site is just over 14 percent. The habitat comparability score and BIBI score show good correlation. The habitat was rated as 'Supporting' with a score of 79, the highest rating in the Middle Middle Patuxent subwatershed. The BIBI score for this site was 3.0, which rated as 'Fair'. Overall, 27 taxa were identified from the subsample, with six representing EPT taxa and two Ephemeroptera taxa. Only 24 percent of the individuals were classified as clingers.

Thirty percent of the individuals were urban intolerant, 66 percent of which were *Amphinemura* (stoneflies). All water quality parameters were within acceptable ranges. The predominant substrate was gravel and the reach was classified as an F channel.

07MP-1-03A-2007
This site received the lowest BIBI score (2.3) in the Middle Middle Patuxent watershed, which resulted in a 'Poor' biological condition rating. Although 29 taxa were present, only three represented EPT and one represented Ephemeroptera. Dominant taxa include *Cheumatopsyche*, a moderately tolerant caddisfly (TV = 6.5) and *Sphaerium*, a moderately tolerant clam (TV = 5.5). Only two percent of the sample was classified as urban intolerant, which was represented by two individual midge specimens of the genus *Potthastia* (TV = 0). The sampling reach is classified as a B channel with gravel as the predominant substrate. Over 54 percent of the land use in the 259-acres draining to the site is forested resulting in a below average impervious surface of 12.3 percent. Habitat was rated as 'Supporting' with a comparability score of 77.5. Bank stability was considered suboptimal, but the reach showed signs of severe embeddedness. Water quality parameters were within acceptable ranges with a slightly lower pH than the subwatershed average.

07MP-1-04-2007
The land use within the 660-acre drainage area to this site is predominantly agricultural (50.3 percent) followed by forested (25.1 percent) and low density residential (19.8 percent). The percentage of impervious surface in the drainage area is 7.3 percent, which is below the subwatershed average. The sampling reach is classified as a B4c channel type with a predominantly gravel substrate. Physical habitat was rated just above the subwatershed average as 'Partially Supporting' with a comparability score of 71.5. The biological condition was rated 'Good' with a BIBI score of 4.0. This site is one of only four in the entire Middle Patuxent watershed, to receive a 'Good' biological rating. Of 31 total taxa present, eleven were EPT, four of which belonged to Ephemeroptera. Eighteen percent of the subsample was comprised of urban intolerant individuals.

07MP-1-05-2007
This site flows under State Highway 32 through a 105-foot culvert that was included in the sampling reach. The reach is classified as a G4 channel dominated by sand substrate, though gravel is fairly abundant. The predominant surrounding land use in the 278-acre drainage area is low density residential (66.5 percent), which results in 20.4 percent imperviousness, the second highest of any site in the subwatershed. The habitat assessment resulted in a comparability score of 51.0 and a rating of 'Non-supporting' as the culvert comprised nearly half of the sampling reach and provided poor habitat. However, the BIBI score for this site was 4.0, which was rated as 'Good'. This site had the highest number of Ephemeroptera taxa (six) and the second highest percent intolerant urban (46 percent) in the subwatershed, as well as the highest number of EPT taxa (15) in the entire Middle Patuxent watershed. Clingers comprised 54 percent of the sample; the most of which was *Ephemerella*, an intolerant mayfly (TV = 2.3). Water quality parameters were all within acceptable ranges. While the BIBI scored much higher than expected based on the habitat rating, it is likely that the increased score is a result of nutrient enrichment in the sampling reach especially due to the high percentage of low density residential land use upstream and the tendency for landowners to over-apply lawn fertilizers, increasing the potential for nutrient runoff.

07MP-1-06-2007
Located within a pasture with few trees and virtually no riparian buffer, this site is classified as a F5 channel with a sandy substrate. The banks are unstable and eroding and have very little vegetative protection. Over 66 percent of the surrounding land use is agricultural, and consequently, the 954-acre drainage area had a fairly low percentage (8.3 percent) of impervious surface. The habitat assessment resulted in a comparability score of 49, or 'Non-supporting', with marginal to poor scores received for

bank stability and a low score for epifaunal substrate. Not surprisingly, the benthic macroinvertebrate sample received a BIBI score of 2.7, or 'Poor', one of only two 'Poor' sites in the subwatershed. The sample had a high number of total taxa (35), but relatively low numbers of EPT and Ephemeroptera taxa (five and four, respectively). Chironomids comprised 77 percent of the total sample, led by two tolerant midges *Orthocladius* (TV = 9.2) and *Hydrobaenus* (TV = 7.2), which together account for over 34 percent of the sample. Only twelve percent of the sample was comprised of clingers, the lowest proportion observed in the subwatershed. Temperature and dissolved oxygen were elevated but all parameters were within acceptable ranges.

07MP-2-01-2007
Forty-three percent of the 1782-acre drainage area to this site is low-density residential. Another 33 percent is agricultural and 21 percent forest, giving an overall percent impervious of approximately 13 percent, just over the Middle Patuxent average. The sampling site is located just upstream of a pond discharge pipe and flows parallel to a dirt road. Having suitable habitat and receiving a habitat comparability score of 63.5 with a rating of 'Partially Supporting', the biological condition was rated as 'Fair'(BIBI = 3.3). There were 37 taxa present in the sample (tied for the most in this subwatershed), but only three of these belonged to Ephemeroptera. However, an intolerant mayfly, *Ephemerella* (TV = 2.3) was the dominant taxon, accounting for 26 percent of the sample. Consequently, 36 percent of the individuals in the sample were rated as being intolerant to urban stressors and 45 percent of the sample was clingers. The land use in the drainage area is 43.4 percent low-density residential, followed by 32.6 percent agricultural, and 21.3 percent forest. Though gravel is the predominant substrate, there are large amounts of sand deposits in the channel. Bank stability at this site was considered poor and the stream is fairly entrenched in some areas. This stream is classified as an F4 channel. All water quality parameters were within acceptable ranges.

07MP-2-02-2007
The habitat comparability score at this site was 70.5 with a rating of 'Partially Supporting'. Imperviousness in the 1667-acre drainage area is only 5.9 percent, the lowest in this subwatershed, with the majority of land use being agricultural (48.6 percent) and forest (28.5 percent). All water quality parameters were measured within acceptable ranges. Gravel is the predominant substrate and a large number of depositional bars were observed within the sample reach. This reach was classified as a C4 channel. This sample had a high number of EPT and Ephemeroptera taxa (nine and five, respectively), but only ten percent of the sample was intolerant to urban stress. Sixty-six percent of the sample was comprised of chironomids, and *Orthocladius*, a tolerant midge (TV = 9.2), was the dominant taxa. The benthic macroinvertebrate sample received a BIBI score of 3.0 and a rating of 'Fair'. The field QC sample collected just upstream of this site gave a similar BIBI result, though the QC sample had fewer taxa representing Ephemeroptera and Chironomidae.

07MP-3-01-2007
Located parallel to Caroll Mill Rd., this third-order stream flows through a wide forested buffer before entering residential areas. The substrate is comprised of a mix of sand and gravel, and the reach is classified as a C4 channel. The drainage area to this site is 16,158 acres, the largest in the Middle Patuxent subwatershed, and is made up primarily of agricultural (42 percent), and low-density residential (32 percent) land uses. Imperviousness in the drainage area is 9.2 percent, below the subwatershed average of 13.4 percent. This sampling reach provided a good mix of riffles and pools, as well as a prevalence of woody debris. The habitat comparability score at this site was 75.0 with a rating of 'Partially Supporting'. The left bank lacked sufficient vegetative protection and was rated as moderately unstable. The biological condition was rated 'Fair' with a BIBI score of 3.7. There was a moderate number of total taxa (29), with ten belonging to EPT and four to Ephemeroptera. This site had a relatively low percentage of urban intolerant individuals (14 percent), but the second highest

percentage of clingers (56 percent). The most common taxon found was *Cheumatopsyche,* a moderately intolerant caddisfly (TV = 6.5), which comprised 20 percent of the sample.

07MP-3-02-2007

This site is located within a wide forested buffer and the reach was classified as an F4 channel with a gravel-dominated substrate. It received a habitat comparability score of 63.0, which is 'Partially Supporting'. There were areas of high sediment deposition and the riffles were predominately embedded. Also, suitable substrate and woody debris were not available in quantities optimal for full colonization. Land use in the 5800-acre drainage area is similar to most other sites in this subwatershed, predominantly agricultural (44 percent) followed by low density residential (31 percent), and with an overall imperviousness of 11.1 percent. Water quality parameters were all within acceptable ranges.

The benthic macroinvertebrate community had the highest total number of taxa in the subwatershed (37; tied with site 07MP-2-01-2007), as well as the highest percentage of clingers (60 percent). The sample had relatively few chironomids (36 percent), but also relatively few intolerant urban individuals (15 percent). The overall BIBI score was 4.0, resulting in a biological condition rating of 'Good'.

2.1.3 Lower Middle Patuxent

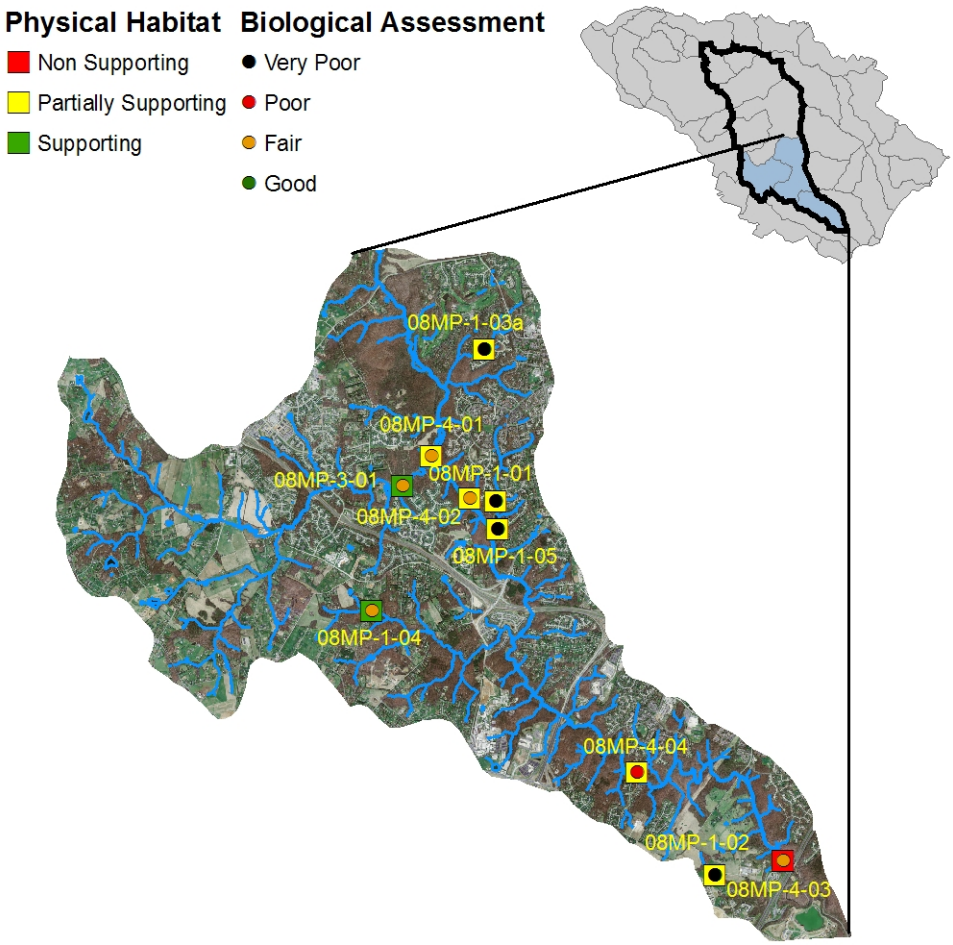

Figure 6 - Lower Middle Patuxent Sampling Results

Five of the ten sites sampled in 2007 in the Lower Middle Patuxent subwatershed were located on first-order streams, one was on a third-order stream and four sites were on a fourth-order stream. This was the only subwatershed in the Middle Patuxent watershed with a sampling site on a fourth-order stream. The drainage area to several of these sites includes the entire Middle and Upper Middle Patuxent subwatersheds, which are delineated as separate PSUs. The field QC sample was collected at site 08MP-1-03A. Most stream reaches were classified as C or B channels with a sand or gravel substrate. A summary of the results for the Lower Middle Patuxent subwatershed is in Table 10.

All but one site within the Lower Middle Patuxent subwatershed were rated as either 'Partially Supporting' or 'Supporting' based on the RBP habitat assessment comparability scores. Site 08MP-4-03-2007 received a rating of 'Non-supporting'. The mean habitat comparability score of 70.0 for the subwatershed resulted in 'Partially Supporting' rating.

BIBI scores ranged from a low of 1.0, or 'Very Poor' to a high of 3.7, or 'Fair'. This resulted in a mean BIBI score for the subwatershed of 2.4 with a rating of 'Poor'.

Four of the five first-order streams sampled in the Lower Middle Patuxent subwatershed received BIBI ratings of 'Poor' or 'Very Poor'; those sites were given the lowest biological assessment scores in the Middle Patuxent watershed.

Table 10 - Lower Middle Patuxent Summary

Site ID	Drainage Area (ac)	Impervious Surface Percent	Stream Order	BIBI Score	BIBI Narrative Rating	Habitat Comparability Score	Habitat Narrative Rating	Rosgen Channel Type
08MP-1-01-2007	35	35.4	1	1.3	Very Poor	70.0	Partially Supporting	E4
08MP-1-02-2007	46	0.0	1	1.3	Very Poor	65.0	Partially Supporting	B4c
08MP-1-03A-2007*	162	44.0	1	1.0	Very Poor	74.0	Partially Supporting	B4
08MP-1-04-2007	243	13.8	1	3.7	Fair	76.0	Supporting	C4
08MP-1-05-2007	403	39.1	1	1.3	Very Poor	69.0	Partially Supporting	C4
08MP-3-01-2007	4493	14.8	3	3.7	Fair	75.5	Supporting	C4
08MP-4-01-2007	26048	10.6	4	3.0	Fair	67.5	Partially Supporting	C5
08MP-4-02-2007	30772	11.2	4	3.0	Fair	68.0	Partially Supporting	C5
08MP-4-03-2007	36527	12.4	4	3.3	Fair	59.5	Non-supporting	C5
08MP-4-04-2007	35146	12.2	4	2.7	Poor	69.0	Partially Supporting	C5/4
Minimum	35	0.0	1	1.0	Very Poor	59.5	Non-supporting	NA
Maximum	36527	44.0	4	3.7	Fair	76.0	Supporting	NA
Mean	13388	19.3	NA	2.4	Poor	70	Partially Supporting	NA
Standard Deviation	16408	14.6	NA	1.1	NA	5.0	NA	NA

*QC sampling was conducted at this site

Lower Middle Patuxent Site Descriptions:

08MP-1-01-2007
This site was classified as an E channel with gravel as the dominant substrate. The dominant land use in the drainage area is medium-density residential (82 percent) resulting in an impervious percentage of 35.4, higher than average for the subwatershed. The RBP habitat assessment resulted in a percent comparability score of 70.0 and a rating of 'Partially Supporting'. There is a forested buffer adjacent to the sampling reach. However, a playground and walking path also run along a portion of the reach, resulting in a lower than optimal riparian zone scores for the habitat assessment. The site also lacked sufficient woody debris and quality substrate for high epifaunal colonization. The BIBI score was 1.3, or 'Very Poor' which is even lower than expected for the available habitat. The sample had four EPT taxa, but no Ephemeroptera taxa, and only three percent of individuals were considered intolerant to urban land stressors. The sample was dominated by chironomids, making up 88 percent of the sample. Fifty-six of these were from the genus *Orthocladius*. Water quality measurements indicated no parameters out of the acceptable ranges.

08MP-1-02-2007
This site is located along Gorman Road on the Gorman Crossing Elementary School property in a small forested area between the school and soccer fields. The total subwatershed area is 46.12 acres. Analysis using the Howard County land use layer showed this subwatershed to be entirely agricultural, giving an imperviousness of zero percent (as shown in Table 10). Recent development observed by field crews, and updated land use delineation using 2005 satellite photographs, results in an actual current imperviousness of 10.8 percent. Under an updated land use delineation, agricultural would make up only 44 percent of the subwatershed area, with 24 percent in forest, 18 percent in institutional use (new schools), and 14 percent in undeveloped open urban land. It should be noted that additional development has likely occurred throughout the Watershed but for which additional land use delineation was not completed. The location of the sampling site so close to the newly developed area and the imperviousness of zero percent, which is very rare, prompted a more in-depth analysis.

The channel was classified as a Rosgen type B with a gravel substrate. The overall habitat was rated as 'Partially Supporting' with a comparability score of 65 percent. At the time of sampling there was little flow in the channel and little velocity/depth diversity. There was also little epifaunal substrate available for colonization. This lack of quality habitat likely led to the site receiving a BIBI score of only 1.3, with a rating of 'Very Poor'. Only one Ephemeroptera taxa (with two individuals) was identified. The sample was dominated by individuals of the Chironomidae family (76 percent). The most common taxa was the pollution tolerant *Hydrobaenus* (TV = 7.2), with 33 individuals. Additionally, only eight percent of individuals in the sample were intolerant to urban stressors. Water quality parameters were all within acceptable ranges.

08MP-1-03A-2007
The majority of the land use in the 162-acre drainage area to this sampling point is high density residential (41 percent), contributing to the 44 percent of total impervious surface area – the highest percentage in the entire Middle Patuxent watershed. The sampling reach lies between two housing developments and is buffered by a wide strip of forest. It is a B channel type with a gravel substrate; however, large boulders dominated in the upstream portion of the reach. The habitat assessment indicated moderate bank stability, and sub-optimal pool quality and velocity/depth diversity. The overall habitat comparability score was 74.0 percent with a rating of 'Partially Supporting'. The benthic macroinvertebrate sample received low scores. This site received the lowest score possible for each BIBI parameter, recording the lowest overall value for total number of taxa (nine), the second highest percent Chironomidae (87 percent), and the third lowest number of EPT taxa (two). This site was one of four sampled that did not have any Ephemeroptera taxa. The overall BIBI score was 1.0, or 'Very Poor'. The field quality control sample taken at this site received the same BIBI score. Water quality results do not indicate any parameters outside the acceptable ranges and nothing that would adversely affect the BIBI scores. Results were similar for the field QC sample collected here.

08MP-1-04-2007
This reach is located at the end of Woodscape Road and lies within a small forested buffer. It is a gravel-dominated C channel with areas of sand deposition. Land use in the 243-acre drainage area is dominated by low density residential (55 percent) leading to a total of 13.8 percent of impervious surface. The habitat was rated as 'Supporting' with a comparability score of 76.0 percent, the highest in this subwatershed. The biological condition was in the 'Fair' BIBI range with a score of 3.7. The sample had a high number of taxa (33), five Ephemeroptera taxa and eleven EPT taxa. There was a low percentage of clingers in the sample which led to the 'Fair' rating. The sample was dominated by chironomids (66 percent of the total sample), with the pollution-tolerant midge, *Eukiefferiella* (TV = 6.1) being the most abundant taxon. The second-most abundant was in the intolerant caddisfly family, Polycentropodidae (TV = 0.2). This site also had the highest percentage of intolerant urban taxa (forty

percent) in the Lower Patuxent watershed. Water quality results again fell within acceptable COMAR ranges.

08MP-1-05-2007
This sampling reach is located just downstream of a stormwater management pond outfall. It is classified as a C channel type dominated by a gravel substrate but with a large amount of cobble also present. Imperviousness to the sampling site is 39.1 percent, the highest in this subwatershed. Residential land uses make up most of the 403-acre drainage area with over 46 percent classified as medium-density residential, and another 28.1 percent of high-density residential. The habitat comparability score for this site was 69.0 percent with a rating of 'Partially Supporting'. This low rating was primarily due to high embeddedness and large amounts of sediment deposition. The benthic sample was rated as 'Very Poor' with a BIBI score of 1.3. Only one metric received a score higher than '1'- the 'total number of taxa' metric received a score of '3'. This site was one of four with no Ephemeroptera taxa, and the only site in the entire Middle Patuxent watershed with zero taxa intolerant to urban stressors. Seventy-seven percent of the sample was chironomids, with the most common taxa being *Polypedium* (31 specimens) and *Orthocladius* (20 specimens). Water quality parameters were all within acceptable ranges.

08MP-3-01-2007
The majority of the land use in this 4493-acre drainage area is agricultural (32 percent) followed closely by low-density residential (28.7 percent), resulting in an overall imperviousness of 14.8 percent. Bank stability was rated as moderately unstable with suboptimal ratings for riparian zone width and vegetative protection along both banks. The channel has a gravel dominated substrate and is classified as a C4 channel. This site received a habitat comparability score of 75.5, or 'Supporting', the second highest score of the Lower Middle Patuxent sites. This site received a BIBI score of 3.7 with a narrative rating of 'Fair'. This site had the highest count of Ephemeroptera taxa found in the Lower Middle Patuxent (five), and tied for the highest count of EPT taxa in the Lower Middle Patuxent (eleven). There was a relatively large proportion of chironomids (49 percent) and clingers (50 percent) in the sample. Instream water quality sampling indicates all parameters within acceptable ranges.

08MP-4-01-2007
This fourth-order sampling reach has a wide forested riparian buffer. Imperviousness in the drainage area to this site (10.6 percent) is well below the subwatershed average. There is a mix of all land uses within the 26,408-acre drainage area, but the largest percentage is agricultural (38.2) and low density residential (29.7). This reach was classified as a C5 channel with a sand-dominated substrate. The habitat assessment and biological condition show agreement, with the site receiving a habitat comparability score of 67.5 ('Partially Supporting') and a BIBI score of 3.0 ('Fair'). This site received a moderate score (3) for each metric. The percentage of clingers was the second highest recorded in the subwatershed at 62 percent, largely because of the 42 specimens of *Simulium* (TV = 5.7), a moderately tolerant clinger. All water quality parameters were within acceptable ranges.

08MP-4-02-2007
This site is located just west of site 08MP-1-01-2007 across Bright Post Road. Overall land use in the 30,772-acre drainage area is similar to site 08MP-4-01-2007, with a total of 11.2 percent of impervious area. Due to poor bank stability and little vegetative protection this site received a habitat comparability score of 68, just below the average score in the subwatershed, and a rating of 'Partially Supporting'. Biological condition was rated 'Fair' with a BIBI score of 3.0. This site also received a score of '3' in each metric category. Fifty-five percent of the sample were clingers and 47 percent were chironomids. Individuals intolerant to urban stressors comprised 16 percent of the sample. Water quality results show all parameters within acceptable ranges. The dominant substrate was sand,

not ideal for suitable habitat or full colonization, which may have affected the benthic community. This reach was classified as a C5 channel.

08MP-4-03-2007

With the largest drainage area of all the sites in the Middle Patuxent Watershed at 36,527 acres, this site is located just upstream of I-95 and is surrounded by a wide forested buffer and channelized at the downstream end and beyond to the bridge overpass. It is classified as a C5 channel with sand as the dominant substrate. This site received a 'Non-supporting' habitat rating with a comparability score of 59.5, the lowest score and rating in the Lower Middle Patuxent subwatershed. The BIBI score of 3.3, rated as 'Fair', was largely driven by the high number of total taxa (29), high number of EPT taxa (nine), and a high percentage of clingers (50 percent). The most abundant clinger taxa were *Simulium,* a moderately tolerant black fly larvae (TV = 5.7) and *Perlesta*, an intolerant stonefly (TV = 1.6) with 17 and 15 specimens, respectively. Similar to the other fourth-order streams, there is a variety of land uses, though the predominant land use is agricultural (33.2 percent) followed closely by low density residential (28.4 percent). Impervious surface (12.4 percent) is well below the subwatershed average. Water quality parameters all fall within acceptable ranges.

08MP-4-04-2007

This site was classified as a C5/4 channel type with an even mix of sand and gravel as the most abundant substrates. The drainage area is approximately 35,147 acres and includes most of the Lower Middle Patuxent watershed and the entire Middle and Upper Patuxent subwatersheds. The 12.2 percent impervious surface is well below the Lower Middle Patuxent subwatershed average and is divided fairly equally between developed and undeveloped land uses, with 34 and 26 percent in agricultural and forest use, respectively, and additional 30 percent in low density residential use. This site received an overall habitat comparability score of 69 and was rated as 'Partially Supporting' due to high percentages of embeddedness and sediment deposition as well as poor bank stability on the right bank. Despite the good quality of available habitat and normal instream water quality, the BIBI scored a 2.7, and was rated as 'Poor'. Although there was a high number of total taxa (33, tied for most in the Lower Middle Patuxent subwatershed), only five EPT taxa and only one Ephemeroptera taxa were present. This site did have the highest percentage of clingers in the entire Middle Patuxent watershed at 69 percent, primarily due to the dominance of *Simulium,* which alone accounted for 43 specimens.

3 Discussion and Comparison

3.1 Middle Patuxent River Watershed Summary

3.1.1 2002 Assessment Results

Results from the 2002 watershed assessment indicated that Middle Patuxent watershed was in a 'Fair' overall biological condition; each subwatershed had at least one site that received a biological condition rating of 'Good', and the Upper, Middle, and Lower Middle Patuxent subwatersheds were all rated as 'Fair'. Biological condition ratings and BIBI scores from 2002 are displayed in Table 12.

All three subwatersheds received an average RBP physical habitat quality rating of 'Non-supporting' with the lowest comparability score received being a 36.5 percent. The mean RBP habitat comparability score was a 54.0 percent; only eight sites were scored above 60 percent and rated 'Partially Supporting'. Physical habitat scores and narrative ratings from 2002 are displayed in Table 13.

3.1.2 2007 Assessment Results

Bioassessment

Biological and physical habitat assessment results for 2007 in the Middle Patuxent watershed indicate a stream system that is moderately impaired. Four of the thirty benthic macroinvertebrate samples received a rating of 'Good' and fourteen received a 'Fair' rating. The remaining sites were all rated as 'Poor' or 'Very Poor'. Sites 06MP-3-02, 07MP-1-04, 07MP-1-05, and 07MP-3-02 received biological condition ratings of 'Good'. Three of these sites were located in the Middle Middle Patuxent subwatershed and one was located in the Upper Middle Patuxent subwatershed. No sites received a 'Good' biological condition rating in the Lower Middle Patuxent subwatershed.

Overall the entire Middle Patuxent watershed, along with each individual subwatershed, received a 'Partially Supporting' physical habitat assessment rating. The mean RBP habitat comparability score for the Middle Patuxent watershed was 68.0 percent. The mean habitat scores for all the subwatersheds were in a narrow range with only 2.0 percent separating the lowest mean score from the highest. Habitat assessments revealed many areas with erosion along the banks and areas of high deposition. Field crews rated many of the sites as providing adequate habitat available for benthic colonization; however, the benthic macroinvertebrate sampling did not always agree with this assessment. There was no significant correlation (0.063 with a significance level of 0.740) between the RBP habitat comparability score and the BIBI score. All of the sites sampled showed pH and dissolved oxygen readings within the allowable COMAR range. These field-measured water quality values alone do not explain the poor benthic community found at some sites.

Conductivity was elevated at many sites across the watershed with values from 121 to 615 µS/cm. An analysis of these values indicates that there was also a negative correlation between the BIBI score and the specific conductance (-0.401 with a significance level of 0.028). Within this range of values, only two sites in the entire watershed (06MP-1-02 and 08MP-1-04) had values less than 200 µS/cm. The average value in the Upper Middle Patuxent was 276 µS/cm, in the Middle Middle Patuxent, 315 µS/cm and in the Lower Middle Patuxent, 310 µS/cm. These are values typically measured during storm events, and may indicate an elevated background level of pollutants.

Specific conductance is related to the type and concentrations of inorganic ions in solution. Natural sources within a watershed can include salt from poorly drained soils, salt from ground water, and erosion from geologic formations of marine origin. Unnatural sources may come from both non-point source runoff from residential and urban areas and point source inputs from effluent waters. Typically, roadway pollutants tend to concentrate along the edge of a road, making them susceptible to runoff to streams from rainfall or snow melt and flow-off from wind or vehicle turbulence. Inorganic salts that

are associated with roadways include deicing salts and atmospheric washout from vehicle emissions. A site-by-site breakdown of field-measured water quality parameters is included in Appendix B.

Geomorphology

The geomorphic assessment reveals a variable system. Many of the channels in the Upper and Lower watersheds were classified as stable type B or C with areas of incised F and G channels more common in the Middle Middle Patuxent watershed. Gravel was the dominant substrate across the entire watershed but many areas with sand deposition were observed.

Imperviousness

The overall percentage of impervious area in the Middle Patuxent watershed is 12.4 percent. Land use imperviousness to sampling sites range from 4.7 percent to of 44.0 percent (see Appendix A for impervious values). The benthic community in a freshwater stream can be affected by impervious cover and associated runoff at values as low as 10 percent (CWP, 2003). A statistical correlation between imperviousness and the BIBI was identified and is discussed in the following section.

Results Correlations

The Pearson correlation coefficient measures the linear association between two variables. Values of the coefficient range from -1 to 1. Negative values indicate an inverse relationship between the two values (i.e., when one variable increases the other decreases), while positive values indicate a positive relationship (i.e., both variable increase). The absolute value of the number indicates the strength of the association, with larger absolute values indicating stronger associations between the two variables. The significance level is a measure of the likelihood that the two variables are related, with smaller values indicating a stronger likelihood of relation. A significance level of 0.05 is typically used as a cutoff for strong correlations. The interpretation of a correlation is somewhat arbitrary, especially as values move away from +/- 1. Table 11 includes correlation and significance values, while the scatterplot matrix in Figure 7 provides a visual display of the data correlated and the best fit line associated with the correlation.

A Pearson correlation between the BIBI scores and the percentage of imperviousness to each sampling site indicates a negative relationship (correlation of -0.461 with a significance level of 0.010) between the impervious area in the watershed and the BIBI scores. Overall water quality is likely being affected by the amount of development in the watershed.

Strong negative correlations in the 2007 data were also found between BIBI scores and specific conductance (-0.401, with a significance level of 0.028). There were no significant positive or negative correlations between any other parameters evaluated.

Table 11 - Pearson Correlations

		Habitat Assessment	Percent Impervious	Specific Conductance
BIBI n=30	Correlation	0.070	-0.461	-0.401
	Significance	0.713	0.010	0.028
Habitat Assessment n=30	Correlation		-0.125	0.041
	Significance		0.512	0.829
Percent Impervious n=30	Correlation			0.142
	Significance			0.453

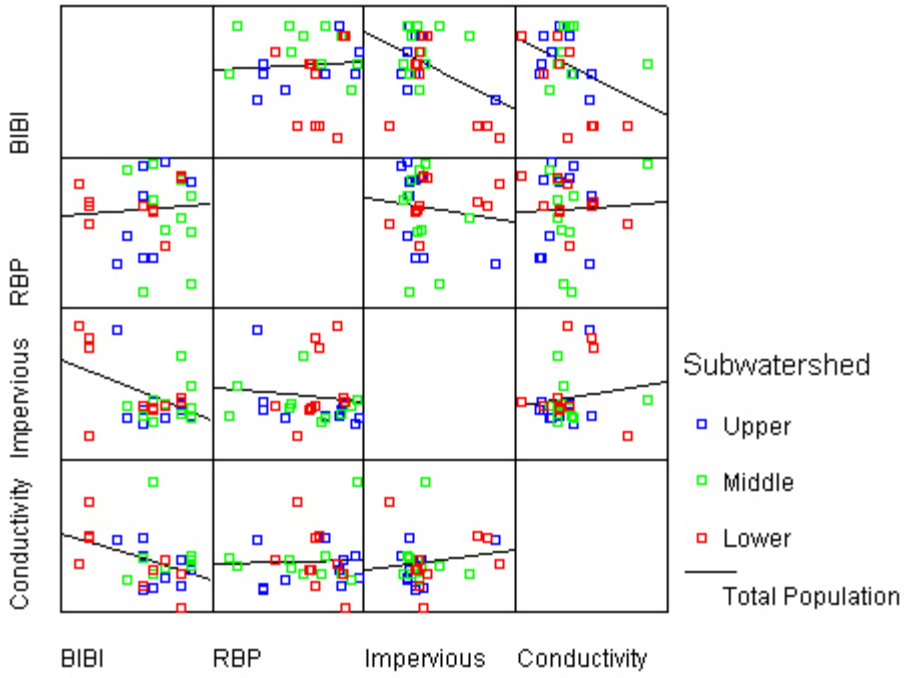

Figure 7 - Scatterplot Matrix for several 2007 Data Parameters (BIBI, Habitat Assessment, Percent Impervious Cover and Specific Conductivity), best fit line represents the total 2007 sample population.

3.1.3 Comparison of 2002 and 2007 Bioassessment data

BIBI

Although recorded BIBI scores declined slightly between 2002 and 2007, the difference between the two sample means was not significant (t-test, t=-1.504, p=0.138). Table 12 and Figure 8 summarize the results for 2002 and 2007 BIBI data.

In 2007, the Lower Middle Patuxent PSU had an overall average BIBI of 2.43, with a rating of 'Poor'. This represents a decrease in the overall score for the Lower Middle Patuxent, decreasing from 3.20, with a rating of 'Fair', however, the difference was not significant (t=-1.841, p=0.084). There was a smaller decline seen in the mean score for the Middle Middle Patuxent, from a score of 3.43 in 2002 to 3.37 in 2007. This change did not affect the narrative rating of 'Fair' and was also not statistically significant (t=-0.264, p=0.795). The Upper Middle Patuxent watershed mean BIBI score declined from 3.04 in 2002 to 3.00 in 2007; resulting in no change in biological condition rating ('Fair') and no statistically significant difference (t=-0.099, p=0.923). However, in 2002 two sites were not sampled in this subwatershed due to dry stream channels, whereas all ten sites were sampled in 2007. By excluding those sites and not replacing them with alternates to maintain a consistent sample size for the subwatershed, it is possible that the 2002 study mean may have been skewed slightly towards a higher BIBI score.

Decreases in mean BIBI scores for each subwatershed contributed to a decrease in the overall score and rating for the entire Middle Patuxent watershed. The overall mean biological condition for the watershed shifted from a 'Fair' rating (BIBI = 3.24; SD = 0.641) in 2002 to a 'Poor' rating (BIBI =

2.93; SD = 0.86) in 2007, but due to variability between sites and a relatively small sample size, there was no statistically significant change observed in BIBI scores between 2002 and 2007.

Table 12 - Comparison of 2002 and 2007 BIBI Data

Sampling Year	Middle Patuxent Subwatershed	Number of sites sampled	Min. BIBI	Max. BIBI	Median BIBI	Mean BIBI	Narrative Rating	Standard Deviation
2002	Upper	8	2.00	4.00	3.17	3.04	Fair	0.677
	Middle	10	2.67	4.33	3.50	3.43	Fair	0.473
	Lower	10	1.33	4.00	3.33	3.20	Fair	0.757
	Entire Watershed	28	1.33	4.33	3.33	3.24	Fair	0.641
2007	Upper	10	2.00	4.00	2.83	3.00	Fair	0.648
	Middle	10	2.33	4.00	3.50	3.37	Fair	0.598
	Lower	10	1.00	3.67	2.83	2.43	Poor	1.066
	Entire Watershed	30	1.00	4.00	3.00	2.93	Poor	0.864

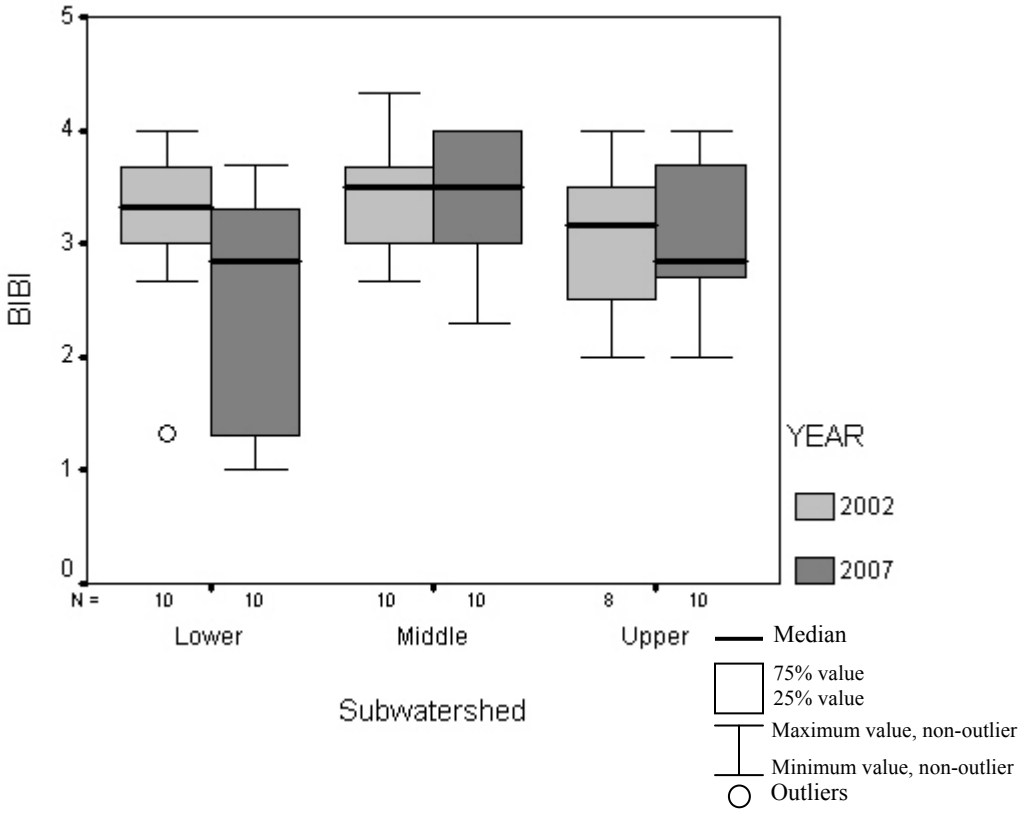

Figure 8 - Comparison of 2002 and 2007 BIBI scores in the Middle Patuxent River subwatersheds

RBP Physical Habitat Assessment

Overall, the mean RBP physical habitat condition for each subwatershed increased from a 'Non-supporting' rating to a 'Partially Supporting' rating, resulting in the entire Middle Patuxent watershed rating increasing from a 'Non-supporting' to 'Partially Supporting'. This relationship is examined in more detail in Figure 9 and in the following paragraph. A summary of 2002 and 2007 RBP physical habitat assessment data can be found in Table 13.

Table 13 - Comparison of 2002 and 2007 RBP Physical Habitat Assessment Data

Sampling Year	Middle Patuxent Subwatershed	Number of sites Assessed	Min. RBP Score	Max. RBP Score	Median RBP Score	Mean RBP Score	Narrative Rating	Standard Deviation
2002	Upper	10	73	134	108	102	Non-supporting	23.47
	Middle	10	82	125	108	106	Non-supporting	13.22
	Lower	10	88	139	118	117	Non-supporting	15.31
	Entire Watershed	30	73	139	112	108	Non-supporting	18.51
2007	Upper	10	111	159	146	137	Partially Supporting	19.24
	Middle	10	98	158	137	133	Partially Supporting	20.64
	Lower	10	119	152	138	139	Partially Supporting	10.01
	Entire Watershed	30	98	159	139	136	Partially Supporting	16.85

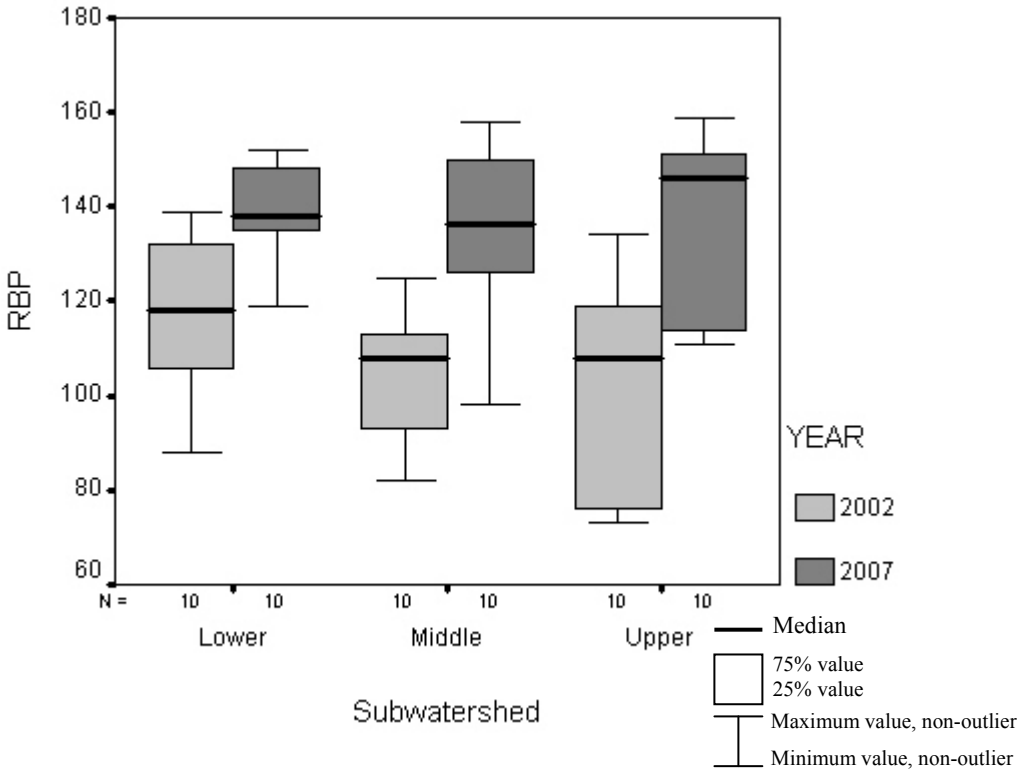

Figure 9 - Comparison of 2002 and 2007 RBP Physical Habitat Assessment scores in the Middle Patuxent River subwatersheds

The RBP habitat assessment is a subjective rating of physical habitat conditions both within the channel and in the surrounding riparian zone of the sampling reach. The assessment is generally completed with input from all field crew members to reduce the subjectivity as much as possible. However, it is possible for two different teams to give different ratings to the same sampling site. Differences between the 2002 and 2007 RBP habitat data for the entire watershed, though statistically significant ($t=6.135$, $p<0.0005$), should not be used as compelling evidence that there has been improvement in habitat quality between 2002 and 2007. This difference may be attributed to the subjective interpretation of physical habitat conditions by the field crews, since different crews sampled the sites in 2002 than in 2007. Additionally, it is possible that the sites sampled in 2007 simply had better physical habitat conditions than those visited in 2002 due to the fact that new sites

within the watershed were randomly selected in 2007. This increase in RBP scores between the first and second rounds of sampling is consistent with other subwatersheds (see Gallardo et al and Poling et al). Without revisiting sites sampled in previous years, it is difficult to tease out possible sources of variability.

4 Conclusion and Recommendations

Watershed Condition

Results of the 2007 assessment of the Middle Patuxent watershed indicate generally fair to poor biological conditions, and a slight decrease, though not significant, was observed in the overall BIBI scores from 2002. While physical habitat scores have shown an increase, it is not conclusive whether these results are, in fact, due to improving habitat conditions or simply the result of sampler bias or spatial variability. Results from the Maryland Stream Waders 2002 sampling effort indicated similar biological conditions of mostly 'Fair' and 'Poor' ratings throughout the Middle Patuxent watershed (Boward and Bruckler, 2002).

Overall the Middle Patuxent watershed is predominantly agricultural land use, however increasing residential development is leading to rising levels of impervious surface. Continued monitoring is critical to determining whether these changes in land use will detrimentally impact the health of the watershed, and to what extent.

Additional Water Quality Sampling

The relatively healthy habitat identified was not always substantiated by a healthy benthic community. This can be an indication of degraded water quality conditions. Although none of the water quality parameters measured were outside of the acceptable COMAR standards, additional sampling is recommended, especially on those streams rated as 'Poor' or 'Very Poor', to determine whether there are other chemical stressors affecting these sites.

In 2007, conductivity levels were the only measured parameter considered high across much of the watershed. However, the limited number of water quality parameters measured during the spring sampling season decreases the ability to identify specific stressors. A more in-depth analysis of water quality should be performed to determine the types and potential sources of pollutants. Supplementary sampling should evaluate additional parameters such as nutrients and metals, which may potentially be of concern.

Because the biological monitoring is conducted generally under baseflow conditions there is the potential for missing pollutants associated with stormwater runoff, specifically in more urbanized portions of the watershed. Wet weather monitoring in the Middle Patuxent should also be conducted to determine additional water quality stressors.

Comparability with Statewide Methods

Howard County adopted the DNR's MBSS methods in 2001. The MBSS program continues to evolve and refine their sampling design, field procedures and data analysis protocols. Howard County should continue to update their methods to stay current with the latest protocols.

Quality Assurance and Quality Control

The QA/QC procedures outlined in the Quality Assurance Project Plan (QAPP) for the Howard County Biological Monitoring and Assessment Program (Howard County, 2001) should be re-evaluated considering the evolution of the metric scoring system and may not be appropriate for incremental data such as that found in the scaled BIBI metrics.

The BIBI scoring system is not continuous. That is, each metric is assigned a value of 1, 3, or 5 and then averaged for a final BIBI score. This means that scores increase incrementally by 0.3 or 0.4. Additionally, the relative percent difference (RPD) between low scores (2.0 and 2.3) will be higher than a comparison of higher scores (4.7 and 5.0). This can lead to a site not meeting the measurement quality objective (MQO) despite the scores being only one scoring increment apart. A relatively minor difference between samples can lead to the MQO not being met.

Watershed Studies

In 2002, a Watershed Restoration Action Strategy (WRAS) was completed for the Little Patuxent Watershed by the Howard County DPW (Howard County, 2002). The report and the associated supporting documents identified water quality, living resource and land use issues throughout the watershed and defined restoration and preservation goals and opportunities. A similar management plan for the Middle Patuxent Watershed would be beneficial to identify strategies for improving and preserving this condition of this watershed, which is another major tributary of the Patuxent River that ultimately drains into the Chesapeake Bay. The current 2007 data could be incorporated into the monitoring plans for any restoration or preservation projects deemed necessary for the Middle Patuxent Watershed.

5 References

Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling. 1999. Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish, Second Edition. EPA 841-B-99-002. U.S. Environmental Protection Agency, Office of Water; Washington D.C.

Boward, D. and R. Bruckman. 2002. Maryland Stream Waders Sample Year 2002 Report. Maryland Department of Natural Resources Monitoring and Non-Tidal Assessment Division. Annapolis, MD. CBWP-MANTA-EA-03-02.

Boward, D. and E. Friedman. 2000. Maryland Biological Stream Survey Laboratory Methods for Benthic Macroinvertebrate Processing and Taxonomy. Maryland Department of Natural Resources Monitoring and Non-Tidal Assessment Division. Annapolis, MD. CBWP-MANTA-EA-00-6.

Center for Watershed Protection (CWP). 2003. Impacts of Impervious Cover on Aquatic Systems. Watershed Protection Research Monograph No. 1. Center for Watershed Protection. Ellicott City, MD. March 2003.

Gallardo, A.C., J.E. Garrish, C.R. Hill, and J.B. Stribling 2006. Biological Assessment of the Cattail Creek and Brighton Dam Watershed, Howard County, Maryland. Prepared by Tetra Tech, Inc., Owings Mills, MD for Howard County, Department of Public Works. Stormwater Management Division. Columbia, MD. January 2006.

Harrelson, C.C, C.L. Rawlins, and J.P. Potyondy. 1994. Stream channel reference sites: An illustrated guide to field technique. Gen. Tech. Rep. RM-245. U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station.

Hill, C.R., J.B. Stribling, and A.C. Gallardo. 2005. *Documentation of Method Performance Characteristics for the Anne Arundel County Biological Monitoring Program*. Prepared by Tetra Tech, Inc., Owings Mills, MD for Anne Arundel County Office of Environmental & Cultural Resources. Annapolis, MD

Howard County. 2001. Quality Assurance Project Plan for Howard County Biological Monitoring and Assessment Program. Prepared for Howard County Department of Public Works Stormwater Management Division by Tetra Tech, Inc.

Howard County. 2002. Little Patuxent River Watershed Restoration Action Strategy. Howard County Department of Public Works, Stormwater Management Division. Columbia, MD.

KCI. 2007 (Draft). Howard County Biological Monitoring and Assessment Calculation of Benthic Index of Biotic Integrity (BIBI) Scoring. Prepared by KCI Technologies, Inc., Hunt Valley, MD for Howard County Department of Public Works Bureau of Environmental Services, Stormwater Management Division, NPDES Watershed Management Programs. Columbia, MD. August 2007.

Kazyak, P.F. 2001 Maryland Biological Stream Survey Sampling Manual. Maryland Department of Natural Resources Monitoring and Non-Tidal Assessment Division. Annapolis, MD.

Maryland Department of the Environment. Code of Maryland Regulations (COMAR). Continuously updated. Code of Maryland Regulations, Title 26- Department of the Environment. 26.08.02.01-Water Quality.

Merritt, R.W. and Cummins, K.W. 1996 An Introduction to the Aquatic Insects of North America, 3rd edition, Kendall / Hunt Publishing Company.

Pavlik, K.L. and J.B. Stribling. 2003. *Biological Assessment of the Middle Patuxent River Watershed, Howard County, Maryland*. Prepared by Tetra Tech, Inc., Owings Mills, MD for Howard County, Department of Public Works. Stormwater Management Division. Columbia, MD.

Poling, A. D., N. J. Brown, and M. J. Pieper. 2006. Howard County Biological Monitoring and Assessment, Little Patuxent . 2006. Prepared by KCI Technologies, Inc., Hunt Valley, MD for Howard County, Department of Public Works. Stormwater Management Division. Columbia, MD. December 2006.

Rosgen, D. L. 1996. Applied River Morphology. Wildland Hydrology. Pagosa Springs, CO.

Rosgen, D. L. 1998. Reference Reach Field Book. Wildland Hydrology. Pagosa Springs, CO.

Southerland, M.T., G.M. Rogers, M.J. Kline, R.P. Morgan, D.M. Boward, P.F. Kazyak, R.J. Klauda, S.A. Stranko. 2005. New Biological Indicators to Better Assess the Condition of Maryland Streams. DNR-12-0305-0100. Maryland Department of Natural Resources, Monitoring and Non-Tidal Assessment Division. Annapolis, MD.

Stribling, J.B., Jessup, B.K. and J.S. White. 1998. Development of a Benthic Index of Biotic Integrity for Maryland Streams. CBWP-EA-98-3. Maryland Department of Natural Resources, Monitoring and Non-Tidal Assessment Division. Annapolis, MD.

Tetra Tech, Inc. 1999. Ecological Data Application System (EDAS). A user's guide. November. For further information, contact Erik Leppo at 410/356-8993.

Tetra Tech, Inc. 2006. Random Subsample Routine. Developed by Eric W. Leppo.

United States Department of Agriculture, Natural Resources Conservation Service. 1986. Urban Hydrology for Small Watersheds. Technical Release 55 (TR55).

Wolman, M.G. 1954. A method of sampling coarse river-bed material. Transactions of American Geophysical Union.

Appendix A: Land Use and Imperviousness

Impervious values per land use type used to calculate imperviousness for each monitoring site's drainage area.

Land Use Code	Description	Imperviousness (%)
11	Low Density Residential	25
12	Medium Density Residential	38
13	High Density Residential	65
14	Commercial	85
15	Industrial	72
16	Institutional	50
17	Extractive	11
18	Open Urban Land	11
21	Cropland	0
22	Pasture	0
23	Orchards	0
24	Feeding Operations	0
25	Row Crops	0
41	Deciduous Forest	0
42	Evergreen Forest	0
43	Mixed Forest	0
44	Brush	0
50	Water	0
60	Wetlands	0
70	Barren Land	50
71	Beaches	0
72	Bare Exposed Rock	100
73	Bare Ground	50
80	Transportation	75
191	Large Lot Agricultural	15
192	Large Lot Forest	15
241	Feeding Operations	10
242	Agricultural Buildings	10

Site ID	Drainage Area (Acres)[1]	LDR	MDR	HDR	CI	INST	OUL	AGR	FOR	OW	BG	% Impervious[2]
Upper Middle Patuxent												
06MP_1_01_2007	1357.94	15.8%				1.5%		60.2%	22.5%			4.7
06MP_1_02_2007	750.58	43.0%						42.5%	14.6%			10.7
06MP_1_03_2007	205.16	55.2%						44.8%				13.8
06MP_1_04_2007	350.19	6.9%			1.2%	3.2%	28.9%	46.1%	13.8%			7.5
06MP_1_05_2007	344.97	32.8%						20.5%	46.8%			8.2
06MP_1_06_2007	40.18					83.4%		7.8%	8.9%			42.1
06MP_1_07_2007	536.33	43.0%						46.5%	10.5%			10.7
06MP_2_01_2007	1253.74	48.2%				0.5%	7.2%	26.2%	17.8%			13.1
06MP_3_01_2007	7231.15	24.5%			0.3%	1.8%	1.6%	50.5%	21.3%			7.4
06MP_3_01_2007_QC	7213.14	24.6%			0.3%	1.8%	1.6%	50.5%	21.3%			7.5
06MP_3_02_2007	8484.48	25.1%			0.4%	1.7%	1.4%	49.1%	22.3%			7.7
Middle Middle Patuxent												
07MP_1_01_2007	30.24	67.8%				29.5%		2.7%				31.9
07MP_1_02_2007	289.12	28.6%			8.2%			42.5%	20.8%			14.1
07MP_1_03a_2007	259.97	26.5%			6.6%			12.7%	54.1%			12.3
07MP_1_04_2007	660.10	19.8%				4.7%		50.3%	25.1%			7.3
07MP_1_05_2007	278.41	66.5%			4.4%			9.1%	19.9%			20.4
07MP_1_06_2007	954.69	14.0%			4.5%	1.9%		66.9%	12.7%			8.3
07MP_2_01_2007	1781.57	43.4%			2.8%			32.6%	21.3%			13.2
07MP_2_02_2007	1667.97	22.3%				0.6%		48.6%	28.5%			5.9
07MP_2_02_2007_QC	1660.33	22.3%				0.6%		48.8%	28.3%			5.9
07MP_3_01_2007	16158.93	31.7%			0.6%	1.3%	1.3%	41.6%	23.4%	0.0%	0.1%	9.2
07MP_3_02_2007	5800.53	31.0%			3.1%	1.4%		44.0%	20.6%			11.1
Lower Middle Patuxent												
08MP_1_01_2007	35.83	17.2%	81.9%						1.0%			35.4
08MP_1_02_2007	46.12							100.0%				0.0
08MP_1_03a_2007	162.39	3.3%	11.9%	40.7%	11.1%	1.4%	16.8%	0.8%	12.3%		1.7%	44.0
08MP_1_03a_2007_QC	132.99	4.0%	11.3%	37.1%	13.6%	1.7%	20.6%	0.9%	10.9%			44.0
08MP_1_04_2007	243.11	55.3%						28.6%	16.2%			13.8
08MP_1_05_2007	403.61	11.3%	46.9%	28.1%	0.1%				12.6%		1.0%	39.1
08MP_3_01_2007	4493.26	28.7%	14.3%	0.3%	1.6%	1.1%		32.4%	21.0%		0.5%	14.8
08MP_4_01_2007	26048.22	29.7%	1.5%	0.9%	1.2%	1.4%	1.7%	38.2%	25.3%	0.0%	0.1%	10.6
08MP_4_02_2007	30772.54	29.3%	3.5%	0.9%	1.3%	1.4%	1.4%	37.0%	25.0%	0.0%	0.1%	11.2
08MP_4_03_2007	36527.64	28.4%	5.2%	1.6%	1.6%	1.8%	1.2%	33.2%	26.9%	0.0%	0.1%	12.4
08MP_4_04_2007	35146.67	29.5%	4.8%	1.1%	1.4%	1.7%	1.2%	33.7%	26.3%	0.0%	0.1%	12.2
Entire Middle Patuxent	**37058.14**	**28.0%**	**5.1%**	**1.6%**	**1.5%**	**1.9%**	**1.2%**	**33.3%**	**27.2%**	**0.1%**	**0.2%**	**12.4%**

LDR: Low Density Residential (11)[3,4]
MDR: Medium Density Residential (12)
HDR: High Density Residential (13)
CI: Commercial & Industrial (14, 15)
INST: Institutional (16)
OUL: Open Urban Land (18)
AGR: Agriculture (21, 22, 23, 25, 241, 242)
FOR: Forest (41 - 44)
OW: Open Water (50)
BG: Bare Ground (73)

1 Drainage areas provided are delineated to each sampling site.
2 See text for discussion of impervious percent.
3 Land use is based on Maryland Department of Planning (MDP) 2002 data.
4 Numbers in parentheses correspond to MDP land use codes.

Appendix B: Water Quality Data

Middle Patuxent River Watershed
Biological Monitoring and Assessment
Summary Water Quality Data

Howard County
2007

Site ID	Date	pH	Water Temperature *°C*	Dissolved Oxygen *mg/l*	Turbidity *NTU*	Conductivity *µS/cm*	Total Dissolved Solid *mg/l*
Middle Patuxent Upper							
06MP-1-01-2007	3/27/2007	7.67	10.0	6.02	2.89	330	214.67
06MP-1-02-2007	3/29/2007	7.15	6.2	12.25	4.96	187	121.00
06MP-1-03-2007	3/27/2007	6.65	13.2	5.73	10.91	200	130.33
06MP-1-04-2007	3/28/2007	6.99	15.3	11.11	6.91	233	151.00
06MP-1-05-2007	3/27/2007	6.72	14.7	12.48	4.84	399	259.33
06MP-1-06-2007	3/28/2007	6.87	11.1	11.74	7.04	389	249.00
06MP-1-07-2007	3/27/2007	7.09	10.8	6.04	5.67	208	135.33
06MP-2-01-2007	3/29/2007	7.22	11.8	11.08	1.68	305	198.33
06MP-3-01-2007	3/28/2007	7.44	14.6	12.73	2.65	238	155.33
06MP-3-02-2007	3/29/2007	6.87	9.0	12.10	2.56	266	173.00
Middle Patuxent Middle							
07MP-1-01-2007	4/2/2007	7.30	12.7	10.62	2.11	259	168.33
07MP-1-02-2007	4/3/2007	7.77	9.5	10.82	1.16	615	400.33
07MP-1-03A-2007	4/3/2007	6.97	16.2	8.45	4.20	229	148.67
07MP-1-04-2007	4/2/2007	7.33	10.2	11.14	3.94	333	222.67
07MP-1-05-2007	4/3/2007	7.62	11.6	10.16	3.81	287	186.67
07MP-1-06-2007	4/2/2007	7.71	18.3	11.62	18.38	321	209.00
07MP-2-01-2007	4/5/2007	7.51	9.9	10.70	5.95	278	181.00
07MP-2-02-2007	4/5/2007	7.60	6.8	10.95	3.73	256	166.00
07MP-3-01-2007	4/5/2007	7.81	9.1	11.92	3.55	263	170.67
07MP-3-02-2007	4/6/2007	7.33	5.7	12.60	4.72	310	201.67
Middle Patuxent Lower							
08MP-1-01-2007	4/6/2007	7.63	7.6	13.94	3.28	406	263.33
08MP-1-02-2007	4/13/2007	7.59	6.9	6.44	10.97	541	352.00
08MP-1-03A-2007	4/11/2007	7.81	4.4	11.63	0.94	299	222.33
08MP-1-04-2007	4/11/2007	7.55	6.3	13.55	2.27	121	78.33
08MP-1-05-2007	4/6/2007	7.58	6.5	13.26	13.17	401	260.33
08MP-3-01-2007	4/9/2007	7.48	5.9	13.12	2.38	261	169.33
08MP-4-01-2007	4/9/2007	7.15	4.4	13.27	2.91	272	177.00
08MP-4-02-2007	4/9/2007	6.98	4.0	10.62	2.47	270	175.33
08MP-4-03-2007	4/13/2007	7.35	8.8	13.98	7.45	311	202.00
08MP-4-04-2007	4/11/2007	7.22	6.8	14.10	2.05	215	182.00

Appendix C: Benthic Macroinvertebrate Data

		Metric Values						Metric Scores							
Site ID	Date	Total Number of Taxa	Number of EPT Taxa	Number of Ephemeroptera Taxa	Percent Intolerant Urban Taxa	Percent Chironomidae Taxa	Percent Clinger Taxa	Total Number of Taxa	Number of EPT Taxa	Number of Ephemeroptera Taxa	Percent Intolerant Urban Taxa	Percent Chironomidae Taxa	Percent Clinger Taxa	BIBI Score	Narrative Rating
Upper Middle Patuxent												**Upper Middle Patuxent Average:**		**3.00**	**Fair**
06-MP-1-01	3/27/2007	40	7	3	8.1	64.0	31.5	5	3	3	1	1	3	2.67	Poor
06-MP-1-02	3/29/2007	30	6	3	24.3	65.4	15.0	5	3	3	3	1	1	2.67	Poor
06-MP-1-03	3/27/2007	34	10	4	11.5	49.0	24.0	5	3	5	1	3	1	3.00	Fair
06-MP-1-04	3/28/2007	24	4	2	1.0	37.9	58.3	3	1	3	1	3	3	2.33	Poor
06-MP-1-05	3/27/2007	30	5	2	24.3	66.7	26.1	5	3	3	3	1	1	2.67	Poor
06-MP-1-06	3/28/2007	22	4	0	20.8	59.4	12.5	3	1	1	3	3	1	2.00	Poor
06-MP-1-07	3/27/2007	30	10	5	34.7	34.7	48.5	5	3	5	3	3	3	3.67	Fair
06-MP-2-01	3/29/2007	32	9	5	33.1	39.8	56.8	5	3	5	3	3	3	3.67	Fair
06-MP-3-01	3/28/2007	34	10	3	12.9	55.4	50.5	5	3	3	3	3	3	3.33	Fair
06-MP-3-01 QC	3/28/2007	34	12	4	24.8	41.6	51.5	5	5	5	3	3	3	4.00	Good
06-MP-3-02	3/29/2007	32	12	7	12.7	30.5	65.3	5	5	5	3	3	3	4.00	Good
Middle Middle Patuxent												**Middle Middle Patuxent Average:**		**3.37**	**Fair**
07-MP-1-01	4/2/2007	29	10	4	50.9	30.9	34.5	5	3	5	3	3	3	3.67	Fair
07-MP-1-02	4/3/2007	27	6	2	30.5	54.3	23.8	5	3	3	3	3	1	3.00	Fair
07-MP-1-03a	4/3/2007	29	3	1	1.9	35.8	41.5	5	1	1	1	3	3	2.33	Poor
07-MP-1-04	4/2/2007	31	11	4	17.8	47.5	42.6	5	5	5	3	3	3	4.00	Good
07-MP-1-05	4/3/2007	33	15	6	46.2	41.5	53.8	5	5	5	3	3	3	4.00	Good
07-MP-1-06	4/2/2007	35	5	4	11.1	76.9	12.0	5	3	5	1	1	1	2.67	Poor
07-MP-2-01	4/5/2007	37	9	3	36.1	44.4	45.4	5	3	3	3	3	3	3.33	Fair
07-MP-2-02	4/5/2007	27	9	5	9.7	65.6	32.3	5	3	5	1	1	3	3.00	Fair
07-MP-2-02 QC	4/5/2007	33	6	3	9.5	61.2	38.8	5	3	3	1	3	3	3.00	Fair
07-MP-3-01	4/5/2007	29	10	4	13.9	40.7	56.5	5	3	5	3	3	3	3.67	Fair
07-MP-3-02	4/6/2007	37	11	4	15.5	36.1	59.8	5	5	5	3	3	3	4.00	Good
Lower Middle Patuxent												**Lower Middle Patuxent Average:**		**2.43**	**Poor**
08-MP-1-01	4/6/2007	18	4	0	3.4	88.1	12.7	3	1	1	1	1	1	1.33	Very Poor
08-MP-1-02	4/13/2007	18	3	1	7.6	75.6	10.1	3	1	1	1	1	1	1.33	Very Poor
08-MP-1-03a	4/11/2007	9	2	0	0.9	87.0	13.0	1	1	1	1	1	1	1.00	Very Poor
08-MP-1-03a QC	4/11/2007	13	1	0	0.9	66.1	20.2	1	1	1	1	1	1	1.00	Very Poor
08-MP-1-04	4/11/2007	33	11	4	39.8	61.1	30.6	5	5	5	3	3	1	3.67	Fair
08-MP-1-05	4/6/2007	21	1	0	0.0	76.8	8.1	3	1	1	1	1	1	1.33	Very Poor
08-MP-3-01	4/9/2007	31	11	5	10.3	48.6	50.5	5	5	5	1	3	3	3.67	Fair
08-MP-4-01	4/9/2007	24	6	2	13.4	33.9	61.6	3	3	3	3	3	3	3.00	Fair
08-MP-4-02	4/9/2007	22	7	3	16.5	42.3	54.6	3	3	3	3	3	3	3.00	Fair
08-MP-4-03	4/13/2007	29	9	2	19.5	44.2	49.6	5	3	3	3	3	3	3.33	Fair
08-MP-4-04	4/13/2007	33	5	1	11.2	31.0	69.0	5	3	1	1	3	3	2.67	Poor

Middle Patuxent Watershed
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Howard County
2007

06-MP-1-01

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Ablabesmyia	Ablabesmyia	I	1	Predator	sp	8.1
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura	I	3	Shredder	sp	3
Insecta	Diptera	Tipulidae	Antocha	Antocha	I	1	Collector	cn	8
Insecta	Diptera	Ceratopogonidae	Bezzia	Bezzia	I	1	Predator	bu	3.3
Insecta	Diptera	Chironomidae	Brillia	Brillia	I	1	Shredder	bu	7.4
Insecta	Diptera	Empididae	Chelifera	Chelifera	I	2	Predator	sp	7.1
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	5	Filterer	cn	6.5
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	1	Filterer	cn	4.4
Insecta	Diptera	Chironomidae	not identified	Chironomidae	I	1	Collector	na	6.6
Insecta	Diptera	Chironomidae	Cladotanytarsus	Cladotanytarsus	I	3	Filterer	-	6.6
Insecta	Diptera	Empididae	Clinocera	Clinocera	I	1	Predator	cn	7.4
Hexapoda	Collembola	not identified	not identified	Collembola	U	1	Collector	sp	6
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	2	Collector	sp	4.1
Insecta	Diptera	Chironomidae	Diplocladius	Diplocladius	I	1	Collector	sp	5.9
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia	I	1	Scraper	cn	5.7
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	1	Collector	bu	9.1
Insecta	Ephemeroptera	Ephemerellidae	Ephemerella	Ephemerella	I	1	Collector	cn	2.3
Insecta	Ephemeroptera	Ephemerellidae	not identified	Ephemerellidae	I	1	Collector	cn	2.6
Insecta	Ephemeroptera	Ephemerellidae	Eurylophella	Eurylophella	I	7	Scraper	cn	4.5
Insecta	Diptera	Empididae	Hemerodromia	Hemerodromia	I	1	Predator	sp	7.9
Insecta	Diptera	Tipulidae	Hexatoma	Hexatoma	I	1	Predator	bu	1.5
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	6	Scraper	sp	7.2
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	1	Collector	bu	10
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes	I	2	Filterer	cn	4.9
Insecta	Megaloptera	Corydalidae	Nigronia	Nigronia	I	2	Predator	cn	1.4
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	2	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	13	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	6	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	3	Collector	sp	7.7
Insecta	Diptera	Chironomidae	Phaenopsectra	Phaenopsectra	I	1	Collector	cn	8.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	4	Shredder	cb	6.3
Insecta	Coleoptera	Elmidae	Promoresia	Promoresia	I	1	Scraper	cn	0
Insecta	Trichoptera	Limnephilidae	Pycnopsyche	Pycnopsyche	I	1	Shredder	sp	3.1
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	I	1	Collector	sp	6.2

06-MP-1-01

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	4	Filterer	cn	7.2
Insecta	Ephemeroptera	Heptageniidae	Stenonema	Stenonema	I	6	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	Stilocladius	Stilocladius	I	2	Collector	sp	6.6
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	1	Collector	sp	8.2
Insecta	Diptera	Chironomidae	not identified	Tanypodinae	I	1	Predator	sp	7.5
Insecta	Diptera	Chironomidae	not identified	Tanytarsini	I	1	Filterer	na	3.5
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	4	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemanniella	Thienemanniella	I	1	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	5	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	1	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	I	5	Collector	sp	5.1

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na indicates information for the particular taxa was not available.

Middle Patuxent Watershed
Biological Monitoring and Assessment
Benthic Macroinvertebrate Data

Howard County
2007

06-MP-1-02

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Ephemeropte	Ameletidae	Ameletus	Ameletus	I	1	Collector	sw	2.6
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura	I	3	Shredder	sp	3
Insecta	Coleoptera	Ptilodactylidae	Anchytarsus	Anchytarsus	I	1	Shredder	cn	3.1
Insecta	Diptera	Ceratopogonidae	Bezzia	Bezzia	I	8	Predator	bu	3.3
Insecta	Diptera	Chironomidae	Brillia	Brillia	I	3	Shredder	bu	7.4
Insecta	Diptera	Tabanidae	Chrysops	Chrysops	I	2	Predator	sp	2.9
Hexapoda	Collembola	not identified	not identified	Collembola	U	1	Collector	sp	6
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	1	Collector	sp	4.1
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona	I	3	Filterer	cn	2.7
Insecta	Coleoptera	Dytiscidae	not identified	Dytiscidae	I	1	Predator	sw	5.4
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	1	Collector	bu	9.1
Insecta	Ephemeropte	Ephemerellidae	Eurylophella	Eurylophella	I	1	Scraper	cn	4.5
Insecta	Diptera	Chironomidae	Heleniella	Heleniella	I	1	Collector	sp	0.9
Insecta	Diptera	Tipulidae	Hexatoma	Hexatoma	I	1	Predator	bu	1.5
Insecta	Lepidoptera	not identified	not identified	Lepidoptera	I	1	Shredder	na	6.7
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	1	Collector	bu	10
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	13	Collector	cb	2.1
Insecta	Trichoptera	Uenoidae	Neophylax	Neophylax	I	2	Scraper	cn	2.7
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	5	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	7	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	18	Shredder	cb	6.3
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	1	Filterer	cn	7.2
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	3	Filterer	cn	5.7
Insecta	Diptera	Chironomidae	Stempellinella	Stempellinella	I	1	Collector	cb	4.2
Insecta	Ephemeropte	Heptageniidae	Stenonema	Stenonema	I	3	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	6	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemanniella	Thienemanniella	I	3	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	2	Predator	sp	6.7
Insecta	Diptera	Tipulidae	Tipula	Tipula	I	2	Shredder	bu	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	2	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	I	8	Collector	sp	5.1

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na indicates information for the particular taxa was not available.

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Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Ephemeroptera	Baetidae	Baetis	Baetis	I	7	Collector	sw	3.9
Insecta	Odonata	Aeshnidae	Boyeria	Boyeria	I	1	Predator	cb	6.3
Insecta	Ephemeroptera	Baetidae	Centroptilum	Centroptilum	I	6	Collector	sw	2.3
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	2	Filterer	cn	6.5
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	1	Filterer	cn	4.4
Insecta	Diptera	Chironomidae	not identified	Chironomidae	I	3	Collector	na	6.6
Insecta	Diptera	Tabanidae	Chrysops	Chrysops	I	2	Predator	sp	2.9
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	7	Collector	sp	4.1
Insecta	Diptera	Ceratopogonidae	Culicoides	Culicoides	I	1	Predator	bu	5.9
Insecta	Diptera	Chironomidae	Diplocladius	Diplocladius	I	1	Collector	sp	5.9
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia	I	6	Scraper	cn	5.7
Insecta	Coleoptera	Dytiscidae	not identified	Dytiscidae	I	1	Predator	sw	5.4
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	I	1	Collector	sp	6.1
Insecta	Ephemeroptera	Ephemerellidae	Eurylophella	Eurylophella	I	1	Scraper	cn	4.5
Insecta	Coleoptera	Dytiscidae	Hydroporus	Hydroporus	A	2	Predator	sw	4.6
Insecta	Trichoptera	Lepidostomatidae	Lepidostoma	Lepidostoma	I	1	Shredder	cb	0
Insecta	Trichoptera	Psychomyiidae	Lype	Lype	I	1	Scraper	cn	4.7
Insecta	Coleoptera	Dryopidae	Macronychus	Macronychus	A	6	Scraper	cn	6.8
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes	P	1	Filterer	cn	4.9
Insecta	Coleoptera	Elmidae	Optioservus	Optioservus	I	1	Scraper	cn	5.4
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	8	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	2	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	1	Collector	sp	7.7
Insecta	Diptera	Chironomidae	Paratendipes	Paratendipes	I	1	Collector	bu	6.6
Insecta	Diptera	Chironomidae	Phaenopsectra	Phaenopsectra	I	2	Collector	cn	8.7
Bivalvia	Veneroida	Pisidiidae	Pisidium	Pisidium	I	7	Filterer	bu	5.7
Insecta	Plecoptera	not identified	not identified	Plecoptera	I	2	Predator	na	2.4
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	5	Shredder	cb	6.3
Insecta	Trichoptera	Odontoceridae	Psilotreta	Psilotreta	I	1	Scraper	sp	0.9
Insecta	Diptera	Chironomidae	Stempellinella	Stempellinella	I	7	Collector	cb	4.2
Insecta	Ephemeroptera	Heptageniidae	Stenonema	Stenonema	I	2	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	not identified	Tanypodinae	P	1	Predator	sp	7.5
Insecta	Diptera	Chironomidae	not identified	Tanypodinae	I	1	Predator	sp	7.5
Insecta	Diptera	Chironomidae	not identified	Tanytarsini	I	1	Filterer	na	3.5

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Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	4	Filterer	cb	4.9
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	2	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Zavrelimyia	Zavrelimyia	I	5	Predator	sp	5.3

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Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Tipulidae	Antocha	Antocha	I	1	Collector	cn	8
Insecta	Diptera	Empididae	Chelifera	Chelifera	I	1	Predator	sp	7.1
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	28	Filterer	cn	6.5
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	7	Filterer	cn	4.4
Insecta	Diptera	Chironomidae	not identified	Chironomidae	I	1	Collector	na	6.6
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	1	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	P	2	Collector	sp	8.5
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	5	Collector	sp	8.5
Insecta	Diptera	Chironomidae	Diplocladius	Diplocladius	I	2	Collector	sp	5.9
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	1	Collector	bu	9.1
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	I	1	Collector	sp	6.1
Insecta	Trichoptera	Hydropsychidae	not identified	Hydropsychidae	P	7	Filterer	cn	5.7
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	1	Collector	bu	10
Gastropoda	Basommatop	Planorbidae	Menetus	Menetus	U	1	Scraper	cb	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	5	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	1	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	1	Collector	sp	7.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	14	Shredder	cb	6.3
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	8	Filterer	cn	5.7
Insecta	Ephemeropte	Heptageniidae	Stenacron	Stenacron	I	1	Collector	cn	2
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	2	Scraper	cn	7.1
Insecta	Ephemeropte	Heptageniidae	Stenonema	Stenonema	I	1	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	Stilocladius	Stilocladius	I	2	Collector	sp	6.6
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	3	Predator	sp	6.7
Insecta	Diptera	Tipulidae	Tipula	Tipula	I	1	Shredder	bu	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	4	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	P	1	Collector	sp	5.1

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Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura	I	2	Shredder	sp	3
Insecta	Coleoptera	Ptilodactylidae	Anchytarsus	Anchytarsus	I	2	Shredder	cn	3.1
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx	I	1	Predator	cb	8.3
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae	I	3	Predator	sp	3.6
Insecta	Diptera	Chironomidae	not identified	Chironomidae	I	4	Collector	na	6.6
Insecta	Diptera	Chironomidae	not identified	Chironomidae	A	1	Collector	na	6.6
Insecta	Diptera	Chironomidae	not identified	Chironomini	I	4	Collector	bu	5.9
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	1	Shredder	cn	9.6
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona	I	1	Filterer	cn	2.7
Insecta	Diptera	not identified	not identified	Diptera	I	3	na	na	6
Insecta	Ephemeroptera	Ephemerellidae	Ephemerella	Ephemerella	I	5	Collector	cn	2.3
Insecta	Ephemeroptera	Ephemerellidae	not identified	Ephemerellidae	I	3	Collector	cn	2.6
Insecta	Ephemeroptera	Ephemerellidae	Eurylophella	Eurylophella	I	1	Scraper	cn	4.5
Insecta	Diptera	Tipulidae	Hexatoma	Hexatoma	I	1	Predator	bu	1.5
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	1	Filterer	cn	7.5
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	6	Collector	cb	2.1
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes	I	3	Filterer	cn	4.9
Insecta	Megaloptera	Corydalidae	Nigronia	Nigronia	I	1	Predator	cn	1.4
Insecta	Coleoptera	Elmidae	Optioservus	Optioservus	I	2	Scraper	cn	5.4
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	10	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	2	Collector	sp	9.2
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius	A	2	Scraper	cn	2.7
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius	I	1	Scraper	cn	2.7
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	3	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	1	Collector	sp	7.7
Insecta	Diptera	Chironomidae	Paratendipes	Paratendipes	I	2	Collector	bu	6.6
Insecta	Plecoptera	not identified	not identified	Plecoptera	I	1	Predator	na	2.4
Insecta	Diptera	Simuliidae	Prosimulium	Prosimulium	I	2	Filterer	cn	2.4
Insecta	Diptera	Tipulidae	Pseudolimnophila	Pseudolimnophila	I	2	Predator	bu	2.8
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	1	Filterer	cn	7.2
Insecta	Diptera	Chironomidae	Stempellinella	Stempellinella	I	1	Collector	cb	4.2
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	2	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Sublettea	Sublettea	I	3	Collector	-	10
Insecta	Diptera	Chironomidae	not identified	Tanypodinae	I	4	Predator	sp	7.5

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Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	not identified	Tanytarsini	I	4	Filterer	na	3.5
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	20	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemanniella	Thienemanniella	P	1	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	2	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	I	1	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	I	1	Collector	sp	5.1

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Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura	I	5	Shredder	sp	3
Insecta	Diptera	Ceratopogonidae	Bezzia	Bezzia	I	9	Predator	bu	3.3
Insecta	Diptera	Chironomidae	not identified	Chironomidae	P	1	Collector	na	6.6
Insecta	Diptera	Chironomidae	not identified	Chironomidae	I	1	Collector	na	6.6
Insecta	Diptera	Tabanidae	Chrysops	Chrysops	I	1	Predator	sp	2.9
Hexapoda	Collembola	not identified	not identified	Collembola	U	1	Collector	sp	6
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	1	Collector	sp	4.1
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona	I	4	Filterer	cn	2.7
Insecta	Diptera	Chironomidae	Diplocladius	Diplocladius	I	9	Collector	sp	5.9
Insecta	Trichoptera	Philopotamidae	Dolophilodes	Dolophilodes	I	1	Filterer	cn	1.7
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	5	Collector	bu	9.1
Insecta	Trichoptera	Limnephilidae	not identified	Limnephilidae	I	1	Shredder	cb	3.1
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	P	2	Collector	cb	2.1
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	6	Collector	cb	2.1
Insecta	Hemiptera	Ochteridae	Ochterus	Ochterus	I	1	Predator	cb	na
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	3	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	25	Collector	sp	4.6
Bivalvia	Veneroida	Pisidiidae	Pisidium	Pisidium	U	2	Filterer	bu	5.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	5	Shredder	cb	6.3
Insecta	Diptera	Tipulidae	Pseudolimnophila	Pseudolimnophila	I	1	Predator	bu	2.8
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	5	Filterer	cn	5.7
Insecta	Diptera	Chironomidae	Thienemanniella	Thienemanniella	I	1	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	2	Predator	sp	6.7
Insecta	Trichoptera	not identified	not identified	Trichoptera	I	1	na	na	4.6
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	2	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	I	1	Collector	sp	5.1

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Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura	I	6	Shredder	sp	3
Insecta	Coleoptera	Ptilodactylidae	Anchytarsus	Anchytarsus	I	5	Shredder	cn	3.1
Insecta	Diptera	Tipulidae	Antocha	Antocha	I	4	Collector	cn	8
Insecta	Diptera	Ceratopogonidae	Bezzia	Bezzia	I	1	Predator	bu	3.3
Insecta	Ephemeropte	Baetidae	Centroptilum	Centroptilum	I	3	Collector	sw	2.3
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	3	Filterer	cn	4.4
Insecta	Diptera	Chironomidae	not identified	Chironomidae	I	2	Collector	na	6.6
Hexapoda	Collembola	not identified	not identified	Collembola	A	1	Collector	sp	6
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	3	Collector	sp	8.5
Insecta	Diptera	Chironomidae	not identified	Diamesinae	I	1	Collector	cn	7.1
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia	A	1	Scraper	cn	5.7
Insecta	Ephemeropte	Ephemerellidae	Ephemerella	Ephemerella	I	8	Collector	cn	2.3
Insecta	Ephemeropte	Ephemerellidae	Eurylophella	Eurylophella	I	1	Scraper	cn	4.5
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	1	Filterer	cn	7.5
Insecta	Ephemeropte	Leptophlebiidae	not identified	Leptophlebiidae	I	9	Collector	sw	1.7
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes	I	1	Filterer	cn	4.9
Insecta	Hemiptera	Veliidae	Microvelia	Microvelia	A	1	Predator	skater	6
Clitellata	Haplotaxida	Naididae	not identified	Naididae	U	1	Collector	bu	9.1
Insecta	Diptera	Chironomidae	Nanocladius	Nanocladius	I	1	Collector	sp	7.6
Insecta	Coleoptera	Elmidae	Optioservus	Optioservus	I	2	Scraper	cn	5.4
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	P	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	2	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	7	Collector	sp	9.2
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius	A	2	Scraper	cn	2.7
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius	I	4	Scraper	cn	2.7
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	1	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	3	Shredder	cb	6.3
Insecta	Trichoptera	Odontoceridae	Psilotreta	Psilotreta	I	1	Scraper	sp	0.9
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	4	Filterer	cn	7.2
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	Rhyacophila	I	2	Predator	cn	2.1
Insecta	Diptera	Chironomidae	Smittia	Smittia	I	1	Collector	lentic	6.6
Insecta	Diptera	Chironomidae	Stempellinella	Stempellinella	I	1	Collector	cb	4.2
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	2	Scraper	cn	7.1
Insecta	Ephemeropte	Heptageniidae	Stenonema	Stenonema	I	8	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	not identified	Tanypodinae	I	2	Predator	sp	7.5
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	5	Predator	sp	6.7

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Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Ablabesmyia	Ablabesmyia	I	1	Predator	sp	8.1
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura	I	3	Shredder	sp	3
Insecta	Odonata	Aeshnidae	Boyeria	Boyeria	I	2	Predator	cb	6.3
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx	I	1	Predator	cb	8.3
Insecta	Ephemeropte	Baetidae	Centroptilum	Centroptilum	I	2	Collector	sw	2.3
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	10	Filterer	cn	6.5
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	3	Filterer	cn	4.4
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	1	Collector	sp	4.1
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	3	Collector	sp	8.5
Insecta	Ephemeropte	Ephemerellidae	Drunella	Drunella	I	1	Scraper	cn	1.9
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia	A	1	Scraper	cn	5.7
Insecta	Ephemeropte	Ephemerellidae	Ephemerella	Ephemerella	I	31	Collector	cn	2.3
Insecta	Ephemeropte	Ephemerellidae	not identified	Ephemerellidae	I	1	Collector	cn	2.6
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	I	4	Collector	sp	6.1
Insecta	Ephemeropte	Ephemerellidae	Eurylophella	Eurylophella	I	7	Scraper	cn	4.5
Insecta	Coleoptera	Dryopidae	Helichus	Helichus	A	3	Scraper	cn	6.4
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	3	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	1	Filterer	cn	7.5
Trematoda	Plagiorchiida	Maseniidae	Masenia	Masenia	I	1	Parasite	na	na
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes	I	3	Filterer	cn	4.9
Clitellata	Haplotaxida	Naididae	not identified	Naididae	U	1	Collector	bu	9.1
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	P	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	2	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	14	Collector	sp	9.2
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius	I	1	Scraper	cn	2.7
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	1	Collector	sp	7.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	1	Shredder	cb	6.3
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	I	1	Collector	sp	6.2
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	3	Filterer	cn	7.2
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	A	1	Scraper	cn	7.1
Insecta	Ephemeropte	Heptageniidae	Stenonema	Stenonema	I	1	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	1	Collector	sp	8.2
Insecta	Diptera	Chironomidae	not identified	Tanytarsini	I	1	Filterer	na	3.5
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	4	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	2	Predator	sp	6.7
Insecta	Diptera	Chironomidae	Zavrelimyia	Zavrelimyia	I	1	Predator	sp	5.3

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na indicates information for the particular taxa was not available.

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Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Ablabesmyia	Ablabesmyia	I	1	Predator	sp	8.1
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura	I	2	Shredder	sp	3
Insecta	Diptera	Tipulidae	Antocha	Antocha	I	2	Collector	cn	8
Insecta	Diptera	Ceratopogonidae	Bezzia	Bezzia	I	1	Predator	bu	3.3
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	11	Filterer	cn	6.5
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	2	Filterer	cn	4.4
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	2	Shredder	cn	9.6
Insecta	Diptera	Ceratopogonidae	Culicoides	Culicoides	I	1	Predator	bu	5.9
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia	A	1	Scraper	cn	5.7
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	1	Collector	bu	9.1
Insecta	Ephemeropte	Ephemerellidae	Ephemerella	Ephemerella	I	1	Collector	cn	2.3
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	P	3	Collector	sp	6.1
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	I	5	Collector	sp	6.1
Insecta	Ephemeropte	Ephemerellidae	Eurylophella	Eurylophella	I	6	Scraper	cn	4.5
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	4	Scraper	sp	7.2
Insecta	Trichoptera	Hydroptilidae	Leucotrichia	Leucotrichia	I	1	Scraper	cn	5
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	5	Collector	cb	2.1
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes	P	1	Filterer	cn	4.9
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes	I	8	Filterer	cn	4.9
Clitellata	Haplotaxida	Naididae	not identified	Naididae	U	2	Collector	bu	9.1
Insecta	Coleoptera	Elmidae	Optioservus	Optioservus	I	1	Scraper	cn	5.4
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	P	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	13	Collector	sp	9.2
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius	I	3	Scraper	cn	2.7
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	2	Collector	sp	7.7
Insecta	Plecoptera	Perlidae	not identified	Perlidae	I	1	Predator	cn	2.2
Insecta	Trichoptera	Polycentropodida	Polycentropus	Polycentropus	I	1	Filterer	cn	1.1

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Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	2	Shredder	cb	6.3
Insecta	Trichoptera	Limnephilidae	Pycnopsyche	Pycnopsyche	I	1	Shredder	sp	3.1
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	3	Filterer	cn	7.2
Insecta	Diptera	Simuliidae	not identified	Simuliidae	I	1	Filterer	cn	3.2
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	1	Filterer	cn	5.7
Insecta	Diptera	Chironomidae	Stempellinella	Stempellinella	I	1	Collector	cb	4.2
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	2	Scraper	cn	7.1
Insecta	Ephemeropte	Heptageniidae	Stenonema	Stenonema	I	2	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	2	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	2	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	1	Collector	cn	8.4

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Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura	I	3	Shredder	sp	3
Insecta	Diptera	Chironomidae	Brillia	Brillia	I	1	Shredder	bu	7.4
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx	I	1	Predator	cb	8.3
Insecta	Trichoptera	Hydropsychidae	Ceratopsyche	Ceratopsyche	I	1	Filterer	cn	5
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	15	Filterer	cn	6.5
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	1	Filterer	cn	4.4
Insecta	Diptera	Chironomidae	not identified	Chironomidae	I	1	Collector	na	6.6
Insecta	Diptera	Empididae	Clinocera	Clinocera	I	2	Predator	cn	7.4
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	1	Collector	sp	8.5
Insecta	Ephemeropte	Ephemerellidae	Drunella	Drunella	I	1	Scraper	cn	1.9
Insecta	Ephemeropte	Ephemerellidae	Ephemerella	Ephemerella	I	13	Collector	cn	2.3
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	I	1	Collector	sp	6.1
Insecta	Ephemeropte	Ephemerellidae	Eurylophella	Eurylophella	I	2	Scraper	cn	4.5
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	2	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	1	Filterer	cn	7.5
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes	I	1	Filterer	cn	4.9
Insecta	Plecoptera	Nemouridae	Nemoura	Nemoura	I	2	Shredder	sp	2.9
Insecta	Coleoptera	Elmidae	Optioservus	Optioservus	A	1	Scraper	cn	5.4
Insecta	Coleoptera	Elmidae	Optioservus	Optioservus	I	2	Scraper	cn	5.4
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	P	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	1	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	16	Collector	sp	9.2
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius	I	1	Scraper	cn	2.7
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius	A	1	Scraper	cn	2.7
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	P	2	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	1	Collector	sp	4.6
Insecta	Plecoptera	Perlidae	not identified	Perlidae	I	1	Predator	cn	2.2
Gastropoda	Basommatop	Physidae	Physa	Physa	I	1	Scraper	cb	7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	2	Shredder	cb	6.3
Insecta	Diptera	Simuliidae	Prosimulium	Prosimulium	I	2	Filterer	cn	2.4
Insecta	Trichoptera	Odontoceridae	Psilotreta	Psilotreta	I	1	Scraper	sp	0.9
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	3	Filterer	cn	7.2
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	2	Filterer	cn	5.7
Arachnida	Acariformes	Sperchonidae	not identified	Sperchonidae	U	1	Predator	na	na

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Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Ephemeropte	Heptageniidae	Stenonema	Stenonema	I	2	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	5	Collector	sp	8.2
Insecta	Diptera	Chironomidae	not identified	Tanytarsini	P	1	Filterer	na	3.5
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	1	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	1	Predator	sp	6.7
Insecta	Diptera	Tipulidae	Tipula	Tipula	I	2	Shredder	bu	6.7
Insecta	Diptera	Chironomidae	Zavrelimyia	Zavrelimyia	I	1	Predator	sp	5.3

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Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Coleoptera	Elmidae	Ancyronyx	Ancyronyx	A	1	Scraper	cn	7.8
Insecta	Plecoptera	Perlidae	Acroneuria	Acroneuria	I	2	Predator	cn	2.5
Insecta	Ephemeropte	Ameletidae	Ameletus	Ameletus	I	1	Collector	sw	2.6
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura	I	1	Shredder	sp	3
Insecta	Diptera	Tipulidae	Antocha	Antocha	I	4	Collector	cn	8
Insecta	Ephemeropte	Baetidae	Baetis	Baetis	I	1	Collector	sw	3.9
Insecta	Ephemeropte	Baetidae	Centroptilum	Centroptilum	I	3	Collector	sw	2.3
Insecta	Trichoptera	Hydropsychidae	Ceratopsyche	Ceratopsyche	I	8	Filterer	cn	5
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	32	Filterer	cn	6.5
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	10	Filterer	cn	4.4
Insecta	Diptera	Chironomidae	not identified	Chironomidae	I	1	Collector	na	6.6
Insecta	Diptera	Chironomidae	not identified	Chironominae	I	1	Collector	na	6.6
Insecta	Diptera	Empididae	Clinocera	Clinocera	I	1	Predator	cn	7.4
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	1	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	1	Collector	sp	8.5
Insecta	Ephemeropte	Ephemerellidae	Drunella	Drunella	I	1	Scraper	cn	1.9
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia	A	2	Scraper	cn	5.7
Insecta	Ephemeropte	Ephemerellidae	Ephemerella	Ephemerella	I	2	Collector	cn	2.3
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	I	2	Collector	sp	6.1
Insecta	Ephemeropte	Ephemerellidae	Eurylophella	Eurylophella	I	2	Scraper	cn	4.5
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	3	Scraper	sp	7.2
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	P	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	5	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	11	Collector	sp	9.2
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius	I	4	Scraper	cn	2.7
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	1	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Phaenopsectra	Phaenopsectra	I	1	Collector	cn	8.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	2	Shredder	cb	6.3
Insecta	Diptera	Simuliidae	Prosimulium	Prosimulium	I	1	Filterer	cn	2.4
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	1	Filterer	cn	7.2
Insecta	Diptera	Simuliidae	not identified	Simuliidae	I	1	Filterer	cn	3.2
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	1	Scraper	cn	7.1
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	A	1	Scraper	cn	7.1
Insecta	Ephemeropte	Heptageniidae	Stenonema	Stenonema	I	1	Scraper	cn	4.6

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Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	2	Collector	sp	8.2
Insecta	Diptera	Chironomidae	Synorthocladius	Synorthocladius	I	1	Collector	empty cell	6.6
Insecta	Diptera	Tipulidae	not identified	Tipulidae	P	1	Predator	bu	4.8
Insecta	Trichoptera	not identified	not identified	Trichoptera	P	1	na	na	4.6
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	P	1	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	I	1	Collector	sp	5.1

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Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura	I	21	Shredder	sp	3
Insecta	Coleoptera	Ptilodactylidae	Anchytarsus	Anchytarsus	I	3	Shredder	cn	3.1
Insecta	Diptera	Tipulidae	Antocha	Antocha	I	3	Collector	cn	8
Insecta	Ephemeropte	Baetidae	Baetis	Baetis	I	1	Collector	sw	3.9
Insecta	Diptera	Chironomidae	Brillia	Brillia	I	2	Shredder	bu	7.4
Insecta	Diptera	Chironomidae	not identified	Chironomidae	I	1	Collector	na	6.6
Insecta	Diptera	Tabanidae	Chrysops	Chrysops	I	1	Predator	sp	2.9
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	1	Collector	sp	4.1
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	3	Collector	sp	8.5
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona	I	11	Filterer	cn	2.7
Insecta	Trichoptera	Philopotamidae	Dolophilodes	Dolophilodes	I	1	Filterer	cn	1.7
Insecta	Ephemeropte	Ephemerellidae	Ephemerella	Ephemerella	I	6	Collector	cn	2.3
Insecta	Lepidoptera	not identified	not identified	Lepidoptera	I	1	Shredder	na	6.7
Insecta	Trichoptera	Limnephilidae	not identified	Limnephilidae	I	2	Shredder	cb	3.1
Insecta	Megaloptera	Corydalidae	Nigronia	Nigronia	I	1	Predator	cn	1.4
Insecta	Coleoptera	Elmidae	Optioservus	Optioservus	I	6	Scraper	cn	5.4
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	P	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	4	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parachaetocladius	Parachaetocladius	I	1	Collector	sp	3.3
Insecta	Ephemeropte	Leptophlebiidae	Paraleptophlebia	Paraleptophlebia	I	10	Collector	sw	2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	1	Collector	sp	4.6
Bivalvia	Veneroida	Pisidiidae	not identified	Pisidiidae	I	1	Filterer	bu	5.5
Insecta	Trichoptera	Polycentropodida	not identified	Polycentropodidae	I	2	Filterer	cn	0.2
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	7	Shredder	cb	6.3
Insecta	Diptera	Tipulidae	Pseudolimnophila	Pseudolimnophila	I	1	Predator	bu	2.8
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	Rhyacophila	I	2	Predator	cn	2.1
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	2	Filterer	cn	5.7
Insecta	Ephemeropte	Heptageniidae	Stenonema	Stenonema	I	1	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	1	Collector	sp	8.2
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	9	Predator	sp	6.7
Insecta	Diptera	Chironomidae	Zavrelimyia	Zavrelimyia	I	2	Predator	sp	5.3

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07-MP-1-02

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura	I	21	Shredder	sp	3
Insecta	Coleoptera	Ptilodactylidae	Anchytarsus	Anchytarsus	I	1	Shredder	cn	3.1
Insecta	Odonata	Aeshnidae	Boyeria	Boyeria	I	1	Predator	cb	6.3
Insecta	Diptera	Empididae	Chelifera	Chelifera	I	1	Predator	sp	7.1
Insecta	Diptera	Tabanidae	Chrysops	Chrysops	I	1	Predator	sp	2.9
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	1	Collector	sp	8.5
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona	I	2	Filterer	cn	2.7
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia	A	1	Scraper	cn	5.7
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia	I	2	Scraper	cn	5.7
Insecta	Ephemeropte	Ephemerellidae	Ephemerella	Ephemerella	I	2	Collector	cn	2.3
Insecta	Ephemeropte	Ephemerellidae	Eurylophella	Eurylophella	I	2	Scraper	cn	4.5
Insecta	Diptera	Chironomidae	Heterotrissocladius	Heterotrissocladius	I	1	Collector	sp	2
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	1	Scraper	sp	7.2
Insecta	Trichoptera	Limnephilidae	not identified	Limnephilidae	I	1	Shredder	cb	3.1
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes	P	1	Filterer	cn	4.9
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes	I	3	Filterer	cn	4.9
Insecta	Coleoptera	Elmidae	Optioservus	Optioservus	I	3	Scraper	cn	5.4
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	3	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	8	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	2	Collector	sp	7.7
Insecta	Trichoptera	Philopotamidae	not identified	Philopotamidae	P	1	Filterer	cn	2.6
Gastropoda	Basommatop	Physidae	Physa	Physa	U	1	Scraper	cb	7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	1	Shredder	cb	6.3
Insecta	Diptera	Simuliidae	Prosimulium	Prosimulium	I	4	Filterer	cn	2.4
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	1	Filterer	cn	7.2
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	2	Filterer	cn	5.7
Insecta	Diptera	Chironomidae	Stempellinella	Stempellinella	I	3	Collector	cb	4.2
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	24	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	5	Predator	sp	6.7
Insecta	Trichoptera	not identified	not identified	Trichoptera	I	2	na	na	4.6
Insecta	Diptera	Chironomidae	Zavrelimyia	Zavrelimyia	I	3	Predator	sp	5.3

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na indicates information for the particular taxa was not available.

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07-MP-1-03a

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Empididae	Chelifera	Chelifera	I	1	Predator	sp	7.1
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	25	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	not identified	Chironomidae	I	1	Collector	na	6.6
Insecta	Odonata	Coenagrionidae	not identified	Coenagrionidae	I	1	Predator	cb	9
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	2	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Diplocladius	Diplocladius	I	2	Collector	sp	5.9
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia	I	1	Scraper	cn	5.7
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	3	Collector	bu	9.1
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	I	1	Collector	sp	6.1
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	1	Filterer	cn	7.5
Insecta	Diptera	Chironomidae	Limnophyes	Limnophyes	I	1	Collector	sp	8.6
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	1	Collector	bu	10
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes	I	1	Filterer	cn	4.9
Clitellata	Haplotaxida	Naididae	not identified	Naididae	U	2	Collector	bu	9.1
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	2	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	10	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	2	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	1	Collector	sp	7.7
Insecta	Diptera	Chironomidae	Paratendipes	Paratendipes	I	1	Collector	bu	6.6
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	6	Shredder	cb	6.3
Insecta	Diptera	Chironomidae	Potthastia	Potthastia	I	2	Omnivore	sp	0
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	I	1	Collector	sp	6.2
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	1	Filterer	cn	7.2
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	1	Filterer	cn	5.7
Bivalvia	Veneroida	Pisidiidae	Sphaerium	Sphaerium	U	20	Collector	bu	5.5
Insecta	Ephemeropte	Heptageniidae	Stenonema	Stenonema	I	9	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	1	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	1	Predator	sp	6.7
Insecta	Diptera	Chironomidae	Trissopelopia	Trissopelopia	I	1	Predator	sp	4.1
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	3	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	I	1	Collector	sp	5.1

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07-MP-1-04

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Ephemeropte	Ameletidae	Ameletus	Ameletus	I	1	Collector	sw	2.6
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura	I	6	Shredder	sp	3
Insecta	Coleoptera	Ptilodactylidae	Anchytarsus	Anchytarsus	I	1	Shredder	cn	3.1
Insecta	Diptera	Tipulidae	Antocha	Antocha	I	5	Collector	cn	8
Insecta	Trichoptera	Hydropsychidae	Ceratopsyche	Ceratopsyche	I	4	Filterer	cn	5
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	10	Filterer	cn	6.5
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	1	Filterer	cn	4.4
Insecta	Diptera	Chironomidae	Cladotanytarsus	Cladotanytarsus	I	1	Filterer	-	6.6
Insecta	Diptera	Empididae	Clinocera	Clinocera	I	1	Predator	cn	7.4
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	5	Collector	sp	8.5
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia	I	2	Scraper	cn	5.7
Insecta	Coleoptera	Dytiscidae	not identified	Dytiscidae	I	1	Predator	sw	5.4
Insecta	Coleoptera	Elmidae	not identified	Elmidae	I	1	Collector	cn	4.8
Insecta	Ephemeropte	Ephemerellidae	Ephemerella	Ephemerella	I	7	Collector	cn	2.3
Insecta	Ephemeropte	Ephemerellidae	Eurylophella	Eurylophella	I	1	Scraper	cn	4.5
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	1	Scraper	sp	7.2
Insecta	Trichoptera	Limnephilidae	Ironoquia	Ironoquia	I	1	Shredder	sp	4.9
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes	I	1	Filterer	cn	4.9
Insecta	Trichoptera	Uenoidae	Neophylax	Neophylax	I	1	Scraper	cn	2.7
Insecta	Coleoptera	Elmidae	Optioservus	Optioservus	A	1	Scraper	cn	5.4
Insecta	Coleoptera	Elmidae	Optioservus	Optioservus	I	2	Scraper	cn	5.4
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	P	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	1	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	21	Collector	sp	9.2
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius	A	1	Scraper	cn	2.7
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius	I	2	Scraper	cn	2.7
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	1	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paraphaenocladius	Paraphaenocladius	I	1	Collector	sp	4
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	1	Collector	sp	7.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	1	Shredder	cb	6.3
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	1	Scraper	cn	7.1
Insecta	Ephemeropte	Heptageniidae	Stenonema	Stenonema	I	1	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	3	Collector	sp	8.2
Insecta	Plecoptera	Taeniopterygidae	Taeniopteryx	Taeniopteryx	I	2	Shredder	sp	4.8

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Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	not identified	Tanytarsini	I	1	Filterer	na	3.5
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	5	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	4	Predator	sp	6.7

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07-MP-1-05

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Ephemeropte	Baetidae	Acerpenna	Acerpenna	I	1	Collector	sw	2.6
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura	I	5	Shredder	sp	3
Insecta	Coleoptera	Ptilodactylidae	Anchytarsus	Anchytarsus	I	6	Shredder	cn	3.1
Insecta	Ephemeropte	Baetidae	Baetis	Baetis	I	1	Collector	sw	3.9
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx	I	1	Predator	cb	8.3
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	1	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	not identified	Chironomidae	I	1	Collector	na	6.6
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	1	Collector	sp	4.1
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	1	Collector	sp	8.5
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona	I	1	Filterer	cn	2.7
Insecta	Plecoptera	Perlidae	Eccoptura	Eccoptura	I	1	Predator	cn	0.6
Insecta	Ephemeropte	Ephemerellidae	Ephemerella	Ephemerella	I	21	Collector	cn	2.3
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	I	1	Collector	sp	6.1
Insecta	Ephemeropte	Ephemerellidae	Eurylophella	Eurylophella	I	3	Scraper	cn	4.5
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	1	Filterer	cn	7.5
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	6	Collector	cb	2.1
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes	I	7	Filterer	cn	4.9
Insecta	Trichoptera	Uenoidae	Neophylax	Neophylax	I	1	Scraper	cn	2.7
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	1	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	1	Collector	sp	9.2
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius	A	2	Scraper	cn	2.7
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius	I	2	Scraper	cn	2.7
Insecta	Ephemeropte	Leptophlebiidae	Paraleptophlebia	Paraleptophlebia	I	3	Collector	sw	2
Insecta	Plecoptera	Perlodidae	not identified	Perlodidae	I	3	Predator	cn	2.2
Insecta	Trichoptera	Polycentropodida	not identified	Polycentropodidae	I	1	Filterer	cn	0.2
Insecta	Trichoptera	Polycentropodida	Polycentropus	Polycentropus	I	1	Filterer	cn	1.1
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	7	Shredder	cb	6.3
Insecta	Diptera	Tipulidae	Pseudolimnophila	Pseudolimnophila	I	1	Predator	bu	2.8
Insecta	Trichoptera	Limnephilidae	Pycnopsyche	Pycnopsyche	I	1	Shredder	sp	3.1
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	I	1	Collector	sp	6.2
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	1	Filterer	cn	7.2
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	1	Scraper	cn	7.1
Insecta	Ephemeropte	Heptageniidae	Stenonema	Stenonema	I	3	Scraper	cn	4.6

07-MP-1-05

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	9	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	2	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	1	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Zavrelimyia	Zavrelimyia	I	4	Predator	sp	5.3

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07-MP-1-06

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Coleoptera	Dytiscidae	Agabus	Agabus	I	1	Predator	sw	5.4
Insecta	Ephemeropte	Ameletidae	Ameletus	Ameletus	I	2	Collector	sw	2.6
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura	I	2	Shredder	sp	3
Insecta	Odonata	Coenagrionidae	Argia	Argia	I	1	Predator	cn	9.3
Insecta	Diptera	Chironomidae	Cladotanytarsus	Cladotanytarsus	I	1	Filterer	-	6.6
Insecta	Diptera	Empididae	Clinocera	Clinocera	I	1	Predator	cn	7.4
Hexapoda	Collembola	not identified	not identified	Collembola	A	1	Collector	sp	6
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	1	Collector	sp	4.1
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	2	Collector	sp	8.5
Insecta	Diptera	Chironomidae	Diplocladius	Diplocladius	I	1	Collector	sp	5.9
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia	I	1	Scraper	cn	5.7
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	1	Collector	bu	9.1
Insecta	Ephemeropte	Ephemeridae	Ephemera	Ephemera	I	3	Collector	bu	3
Insecta	Ephemeropte	Ephemerellidae	Ephemerella	Ephemerella	I	3	Collector	cn	2.3
Insecta	Ephemeropte	Ephemerellidae	Eurylophella	Eurylophella	I	1	Scraper	cn	4.5
Insecta	Diptera	Tipulidae	Gonomyia	Gonomyia	I	1	No Data	bu	4.8
Insecta	Coleoptera	Dryopidae	Helichus	Helichus	A	2	Scraper	cn	6.4
Insecta	Hemiptera	Corixidae	Hesperocorixa	Hesperocorixa	A	1	Piercer	sw	5.6
Crustacea	Amphipoda	Hyalellidae	Hyalella	Hyalella	U	2	Shredder	sp	4.2
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	19	Scraper	sp	7.2
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	1	Collector	cb	2.1
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes	I	2	Filterer	cn	4.9
Insecta	Coleoptera	Elmidae	Optioservus	Optioservus	I	1	Scraper	cn	5.4
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	2	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	19	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	3	Collector	sp	7.7
Insecta	Diptera	Chironomidae	Paratendipes	Paratendipes	I	1	Collector	bu	6.6
Insecta	Diptera	Chironomidae	Phaenopsectra	Phaenopsectra	I	1	Collector	cn	8.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	3	Shredder	cb	6.3
Insecta	Diptera	Tipulidae	Pseudolimnophila	Pseudolimnophila	I	2	Predator	bu	2.8
Insecta	Diptera	Chironomidae	Stempellinella	Stempellinella	I	4	Collector	cb	4.2
Insecta	Diptera	Chironomidae	Stictochironomus	Stictochironomus	I	1	Omnivore	bu	9.2
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	5	Collector	sp	8.2

07-MP-1-06

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	13	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	P	2	Predator	sp	6.7
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	8	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	1	Collector	cn	8.4

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07-MP-2-01

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Plecoptera	Perlidae	Acroneuria	Acroneuria	I	1	Predator	cn	2.5
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura	I	2	Shredder	sp	3
Insecta	Diptera	Tipulidae	Antocha	Antocha	I	1	Collector	cn	8
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae	I	1	Predator	sp	3.6
Insecta	Trichoptera	Hydropsychidae	Ceratopsyche	Ceratopsyche	I	1	Filterer	cn	5
Insecta	Diptera	Empididae	Chelifera	Chelifera	I	3	Predator	sp	7.1
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	4	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	Cladotanytarsus	Cladotanytarsus	I	1	Filterer	-	6.6
Bivalvia	Veneroida	Corbiculidae	Corbicula	Corbicula	U	1	Filterer	bu	6
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	1	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	P	4	Collector	sp	8.5
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	2	Collector	sp	8.5
Insecta	Diptera	Chironomidae	Dicrotendipes	Dicrotendipes	I	1	Collector	bu	9
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia	I	3	Scraper	cn	5.7
Insecta	Ephemeropte	Ephemerellidae	Ephemerella	Ephemerella	I	28	Collector	cn	2.3
Insecta	Ephemeropte	Ephemerellidae	not identified	Ephemerellidae	I	1	Collector	cn	2.6
Insecta	Ephemeropte	Ephemerellidae	Eurylophella	Eurylophella	I	1	Scraper	cn	4.5
Insecta	Odonata	Gomphidae	not identified	Gomphidae	I	1	Predator	bu	2.2
Crustacea	Amphipoda	Hyalellidae	Hyalella	Hyalella	I	3	Shredder	sp	4.2
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	1	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	1	Filterer	cn	7.5
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	4	Collector	cb	2.1
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes	I	1	Filterer	cn	4.9
not identified	not identified	not identified	not identified	Nematomorpha	U	1	Parasite	bu	na
Insecta	Coleoptera	Elmidae	Optioservus	Optioservus	I	2	Scraper	cn	5.4
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	P	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	4	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	9	Collector	sp	9.2
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius	I	1	Scraper	cn	2.7
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	1	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	2	Collector	sp	7.7
Insecta	Plecoptera	Perlodidae	not identified	Perlodidae	I	1	Predator	cn	2.2
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	1	Shredder	cb	6.3

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Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	I	1	Collector	sp	6.2
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	1	Filterer	cn	5.7
Insecta	Diptera	Chironomidae	Stempellinella	Stempellinella	I	1	Collector	cb	4.2
Insecta	Ephemeropte	Heptageniidae	Stenonema	Stenonema	I	1	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	P	1	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	9	Filterer	cb	4.9
Insecta	Diptera	Tipulidae	Tipula	Tipula	I	1	Shredder	bu	6.7
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	I	1	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Zavrelimyia	Zavrelimyia	I	1	Predator	sp	5.3

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na indicates information for the particular taxa was not available.

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Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Tipulidae	Antocha	Antocha	I	2	Collector	cn	8
Insecta	Ephemeropte	Baetidae	Baetis	Baetis	I	1	Collector	sw	3.9
Insecta	Trichoptera	Hydropsychidae	Ceratopsyche	Ceratopsyche	I	3	Filterer	cn	5
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	7	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	not identified	Chironomidae	I	2	Collector	na	6.6
Insecta	Diptera	Chironomidae	not identified	Chironomini	I	1	Collector	bu	5.9
Insecta	Diptera	Tabanidae	Chrysops	Chrysops	I	1	Predator	sp	2.9
Insecta	Diptera	Empididae	Clinocera	Clinocera	I	1	Predator	cn	7.4
Insecta	Diptera	Chironomidae	Cryptochironomus	Cryptochironomus	I	1	Predator	sp	7.6
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	3	Collector	sp	8.5
Insecta	Ephemeropte	Ephemerellidae	Drunella	Drunella	I	1	Scraper	cn	1.9
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia	I	1	Scraper	cn	5.7
Insecta	Ephemeropte	Ephemerellidae	Ephemerella	Ephemerella	I	5	Collector	cn	2.3
Insecta	Ephemeropte	Ephemerellidae	Eurylophella	Eurylophella	I	1	Scraper	cn	4.5
Insecta	Diptera	Empididae	Hemerodromia	Hemerodromia	I	1	Predator	sp	7.9
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	4	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	2	Filterer	cn	7.5
Insecta	Trichoptera	Hydropsychidae	not identified	Hydropsychidae	P	1	Filterer	cn	5.7
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes	I	3	Filterer	cn	4.9
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	2	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	21	Collector	sp	9.2
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius	I	1	Scraper	cn	2.7
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	2	Collector	sp	7.7
Insecta	Trichoptera	Polycentropodida	Polycentropus	Polycentropus	I	1	Filterer	cn	1.1
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	2	Shredder	cb	6.3
Insecta	Diptera	Chironomidae	Stempellina	Stempellina	I	1	Collector	cb	6.6
Insecta	Ephemeropte	Heptageniidae	Stenonema	Stenonema	I	1	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	not identified	Tanytarsini	I	1	Filterer	na	3.5
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	14	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	3	Predator	sp	6.7
Insecta	Diptera	Tipulidae	Tipula	Tipula	I	1	Shredder	bu	6.7
Insecta	Diptera	Tipulidae	not identified	Tipulidae	P	1	Predator	bu	4.8
Insecta	Diptera	Chironomidae	Zavrelimyia	Zavrelimyia	I	1	Predator	sp	5.3

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Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura	I	1	Shredder	sp	3
Insecta	Coleoptera	Ptilodactylidae	Anchytarsus	Anchytarsus	I	2	Shredder	cn	3.1
Insecta	Diptera	Tipulidae	Antocha	Antocha	I	1	Collector	cn	8
Insecta	Ephemeropte	Baetidae	Baetis	Baetis	I	2	Collector	sw	3.9
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx	I	2	Predator	cb	8.3
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae	I	1	Predator	sp	3.6
Insecta	Trichoptera	Hydropsychidae	Ceratopsyche	Ceratopsyche	I	1	Filterer	cn	5
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	11	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	Cladotanytarsus	Cladotanytarsus	I	1	Filterer	-	6.6
Insecta	Diptera	Empididae	Clinocera	Clinocera	I	1	Predator	cn	7.4
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	1	Collector	sp	8.5
Insecta	Diptera	Chironomidae	not identified	Diamesinae	I	2	Collector	cn	7.1
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia	I	3	Scraper	cn	5.7
Insecta	Ephemeropte	Ephemerellidae	Ephemerella	Ephemerella	I	5	Collector	cn	2.3
Insecta	Ephemeropte	Ephemerellidae	Eurylophella	Eurylophella	I	3	Scraper	cn	4.5
Insecta	Coleoptera	Dryopidae	Helichus	Helichus	I	1	Scraper	cn	6.4
Insecta	Diptera	Empididae	Hemerodromia	Hemerodromia	I	2	Predator	sp	7.9
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	9	Scraper	sp	7.2
Insecta	Diptera	Chironomidae	Larsia	Larsia	I	2	Predator	sp	8.5
Insecta	Coleoptera	Dryopidae	Macronychus	Macronychus	A	3	Scraper	cn	6.8
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	2	Collector	cb	2.1
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes	I	4	Filterer	cn	4.9
Insecta	Coleoptera	Elmidae	Optioservus	Optioservus	I	1	Scraper	cn	5.4
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	P	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	9	Collector	sp	9.2
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius	A	3	Scraper	cn	2.7
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	1	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	4	Collector	sp	7.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	4	Shredder	cb	6.3
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	2	Filterer	cn	7.2
Insecta	Diptera	Chironomidae	Stempellinella	Stempellinella	I	1	Collector	cb	4.2
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	25	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	2	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	2	Collector	cn	8.4

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Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura	I	3	Shredder	sp	3
Insecta	Diptera	Tipulidae	Antocha	Antocha	I	2	Collector	cn	8
Insecta	Trichoptera	Hydropsychidae	Ceratopsyche	Ceratopsyche	I	4	Filterer	cn	5
Insecta	Diptera	Empididae	Chelifera	Chelifera	I	1	Predator	sp	7.1
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	22	Filterer	cn	6.5
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	1	Filterer	cn	4.4
Insecta	Diptera	Empididae	Clinocera	Clinocera	I	1	Predator	cn	7.4
Insecta	Megaloptera	Corydalidae	Corydalus	Corydalus	I	1	Predator	cn	1.4
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	3	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Dicrotendipes	Dicrotendipes	I	1	Collector	bu	9
Insecta	Ephemeropte	Ephemerellidae	Drunella	Drunella	I	2	Scraper	cn	1.9
Insecta	Ephemeropte	Ephemerellidae	Ephemerella	Ephemerella	I	3	Collector	cn	2.3
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	P	1	Collector	sp	6.1
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	2	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	5	Filterer	cn	7.5
Insecta	Ephemeropte	Isonychiidae	Isonychia	Isonychia	I	2	Filterer	sw	2.5
Insecta	Megaloptera	Corydalidae	Nigronia	Nigronia	I	1	Predator	cn	1.4
Insecta	Coleoptera	Elmidae	Optioservus	Optioservus	I	1	Scraper	cn	5.4
Insecta	Coleoptera	Elmidae	Optioservus	Optioservus	A	1	Scraper	cn	5.4
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	3	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	4	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	12	Collector	sp	9.2
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius	I	1	Scraper	cn	2.7
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	2	Collector	sp	4.6
Insecta	Plecoptera	Perlidae	not identified	Perlidae	I	1	Predator	cn	2.2
Insecta	Plecoptera	not identified	not identified	Plecoptera	I	1	Predator	na	2.4
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	7	Shredder	cb	6.3
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	I	2	Collector	sp	6.2
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	3	Filterer	cn	7.2
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	2	Filterer	cn	5.7
Insecta	Ephemeropte	Heptageniidae	Stenonema	Stenonema	I	7	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	2	Collector	sp	8.2
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	2	Predator	sp	6.7
Insecta	Diptera	Tipulidae	not identified	Tipulidae	P	1	Predator	bu	4.8
Insecta	Trichoptera	not identified	not identified	Trichoptera	I	1	na	na	4.6

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Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura	I	4	Shredder	sp	3
Insecta	Diptera	Tipulidae	Antocha	Antocha	I	4	Collector	cn	8
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx	I	1	Predator	cb	8.3
Insecta	Diptera	Empididae	Chelifera	Chelifera	I	1	Predator	sp	7.1
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	8	Filterer	cn	6.5
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	1	Filterer	cn	4.4
Insecta	Diptera	Chironomidae	not identified	Chironomidae	I	1	Collector	na	6.6
Insecta	Diptera	Empididae	Clinocera	Clinocera	I	3	Predator	cn	7.4
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	3	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Dicrotendipes	Dicrotendipes	I	1	Collector	bu	9
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia	I	1	Scraper	cn	5.7
Insecta	Ephemeropte	Ephemerellidae	Ephemerella	Ephemerella	I	3	Collector	cn	2.3
Insecta	Ephemeropte	Ephemerellidae	not identified	Ephemerellidae	I	1	Collector	cn	2.6
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	I	3	Collector	sp	6.1
Insecta	Ephemeropte	Ephemerellidae	Eurylophella	Eurylophella	I	1	Scraper	cn	4.5
Insecta	Ephemeropte	Heptageniidae	not identified	Heptageniidae	I	1	Scraper	cn	2.6
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	3	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	1	Filterer	cn	7.5
Insecta	Coleoptera	Dryopidae	Macronychus	Macronychus	I	1	Scraper	cn	6.8
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes	I	1	Filterer	cn	4.9
Clitellata	Haplotaxida	Naididae	not identified	Naididae	U	1	Collector	bu	9.1
Insecta	Diptera	Chironomidae	Nanocladius	Nanocladius	I	1	Collector	sp	7.6
Insecta	Trichoptera	Uenoidae	Neophylax	Neophylax	I	1	Scraper	cn	2.7
Insecta	Coleoptera	Elmidae	Optioservus	Optioservus	A	1	Scraper	cn	5.4
Insecta	Coleoptera	Elmidae	Optioservus	Optioservus	I	2	Scraper	cn	5.4
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	3	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	3	Collector	sp	7.7
Insecta	Plecoptera	Perlidae	Perlesta	Perlesta	I	4	Predator	cn	1.6
Insecta	Plecoptera	Perlodidae	not identified	Perlodidae	I	1	Predator	cn	2.2
Insecta	Diptera	Chironomidae	Phaenopsectra	Phaenopsectra	I	1	Collector	cn	8.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	4	Shredder	cb	6.3
Enopla	Hoplonemert	Tetrastemmatidae	Prostoma	Prostoma	I	1	Predator	na	7.3
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	10	Filterer	cn	5.7

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Insecta	Diptera	Chironomidae	Stempellinella	Stempellinella	I	1	Collector	cb	4.2
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	1	Scraper	cn	7.1
Insecta	Ephemeropte	Heptageniidae	Stenonema	Stenonema	I	6	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	6	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	1	Predator	sp	6.7
Insecta	Trichoptera	not identified	not identified	Trichoptera	I	1	na	na	4.6
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	2	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	I	2	Collector	sp	5.1

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Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	2	Filterer	cn	6.5
Insecta	Trichoptera	Hydropsychidae	Ceratopsyche	Ceratopsyche	I	3	Filterer	cn	5
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	1	Filterer	cn	4.4
Insecta	Diptera	Chironomidae	not identified	Chironomidae	I	1	Collector	na	6.6
Insecta	Diptera	Chironomidae	not identified	Chironomini	I	1	Collector	bu	5.9
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	15	Collector	sp	8.5
Insecta	Diptera	Chironomidae	not identified	Diamesinae	I	1	Collector	cn	7.1
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona	I	3	Filterer	cn	2.7
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	1	Collector	bu	9.1
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	12	Scraper	sp	7.2
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	P	3	Collector	bu	7.6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	16	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	37	Collector	sp	9.2
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius	I	1	Scraper	cn	2.7
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	1	Collector	sp	7.7
Insecta	Diptera	Chironomidae	Paratendipes	Paratendipes	I	1	Collector	bu	6.6
Gastropoda	Basommatop	Physidae	Physa	Physa	U	1	Scraper	cb	7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	3	Shredder	cb	6.3
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	2	Filterer	cn	7.2
Insecta	Diptera	Chironomidae	Smittia	Smittia	I	1	Collector	lentic	6.6
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	6	Collector	sp	8.2
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	3	Filterer	cb	4.9
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	2	Collector	cn	8.4

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na indicates information for the particular taxa was not available.

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08-MP-1-02

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Coleoptera	Dytiscidae	Agabus	Agabus	I	4	Predator	sw	5.4
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura	I	4	Shredder	sp	3
Insecta	Ephemeropte	Baetidae	Centroptilum	Centroptilum	I	2	Collector	sw	2.3
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	1	Filterer	cn	6.5
Hexapoda	Collembola	not identified	not identified	Collembola	A	1	Collector	sp	6
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	1	Collector	sp	4.1
Insecta	Diptera	Chironomidae	Cryptochironomus	Cryptochironomus	I	1	Predator	sp	7.6
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	P	10	Collector	sp	8.5
Insecta	Diptera	Chironomidae	Diplocladius	Diplocladius	I	4	Collector	sp	5.9
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	33	Scraper	sp	7.2
Insecta	Coleoptera	Dytiscidae	not identified	Hydroporinae	I	2	Predator	sw	5.4
Insecta	Coleoptera	Dytiscidae	Hydroporus	Hydroporus	A	1	Predator	sw	4.6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	11	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	9	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	P	1	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	15	Collector	sp	4.6
Insecta	Plecoptera	not identified	not identified	Plecoptera	I	3	Predator	na	2.4
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	10	Filterer	cn	5.7
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	3	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	1	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Zavrelimyia	Zavrelimyia	I	1	Predator	sp	5.3

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na indicates information for the particular taxa was not available.

08-MP-1-03a

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	1	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	not identified	Chironomidae	I	1	Collector	na	6.6
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	67	Collector	sp	8.5
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona	I	1	Filterer	cn	2.7
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	P	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	22	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	3	Shredder	cb	6.3
Insecta	Diptera	Chironomidae	Psectrocladius	Psectrocladius	I	1	Shredder	sp	6.6
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	3	Collector	sp	8.2
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	I	13	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	I	1	Collector	sp	5.1

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na indicates information for the particular taxa was not available.

08-MP-1-03a QC

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	2	Filterer	cn	6.5
Hexapoda	Collembola	not identified	not identified	Collembola	A	1	Collector	sp	6
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	P	1	Collector	sp	8.5
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	48	Collector	sp	8.5
Insecta	Diptera	Chironomidae	not identified	Diamesinae	I	1	Collector	cn	7.1
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	I	1	Collector	bu	9.1
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	I	1	Collector	sp	6.1
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	4	Scraper	sp	7.2
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	1	Collector	cb	2.1
Clitellata	Haplotaxida	Naididae	not identified	Naididae	U	13	Collector	bu	9.1
Insecta	Coleoptera	Elmidae	Optioservus	Optioservus	I	1	Scraper	cn	5.4
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	14	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	1	Collector	sp	8.2
Insecta	Diptera	Tipulidae	Tipula	Tipula	I	1	Shredder	bu	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	18	Collector	cn	8.4

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08-MP-1-04

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura	I	2	Shredder	sp	3
Insecta	Coleoptera	Ptilodactylidae	Anchytarsus	Anchytarsus	I	1	Shredder	cn	3.1
Insecta	Ephemeropte	Baetidae	not identified	Baetidae	I	2	Collector	sw	2.3
Insecta	Ephemeropte	Baetidae	Baetis	Baetis	I	2	Collector	sw	3.9
Insecta	Diptera	Chironomidae	Brillia	Brillia	I	1	Shredder	bu	7.4
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	1	Collector	sp	4.1
Insecta	Diptera	Tipulidae	Dicranota	Dicranota	I	1	Predator	sp	1.1
Insecta	Diptera	Chironomidae	Dicrotendipes	Dicrotendipes	I	1	Collector	bu	9
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona	I	1	Filterer	cn	2.7
Insecta	Ephemeropte	Ephemerellidae	Ephemerella	Ephemerella	I	2	Collector	cn	2.3
Insecta	Ephemeropte	Ephemerellidae	not identified	Ephemerellidae	I	1	Collector	cn	2.6
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	P	4	Collector	sp	6.1
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	I	16	Collector	sp	6.1
Insecta	Diptera	Chironomidae	Larsia	Larsia	I	1	Predator	sp	8.5
Insecta	Ephemeropte	Leptophlebiidae	not identified	Leptophlebiidae	I	2	Collector	sw	1.7
Insecta	Plecoptera	Leuctridae	Leuctra	Leuctra	I	2	Shredder	cn	0.4
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	9	Collector	cb	2.1
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes	I	1	Filterer	cn	4.9
Insecta	Trichoptera	Uenoidae	Neophylax	Neophylax	I	1	Scraper	cn	2.7
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	1	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	4	Collector	sp	9.2
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius	A	3	Scraper	cn	2.7
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	2	Collector	sp	4.6
Insecta	Plecoptera	Perlodidae	not identified	Perlodidae	I	1	Predator	cn	2.2
Gastropoda	Basommatop	Physidae	Physa	Physa	U	1	Scraper	cb	7
Insecta	Trichoptera	Polycentropodida	not identified	Polycentropodidae	I	14	Filterer	cn	0.2
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	6	Shredder	cb	6.3
Insecta	Diptera	Tipulidae	Pseudolimnophila	Pseudolimnophila	I	1	Predator	bu	2.8
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	1	Filterer	cn	7.2
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	Rhyacophila	I	1	Predator	cn	2.1
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	2	Filterer	cn	5.7
Insecta	Diptera	Chironomidae	Stempellinella	Stempellinella	I	1	Collector	cb	4.2
Insecta	Ephemeropte	Heptageniidae	Stenonema	Stenonema	I	1	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	not identified	Tanypodinae	I	1	Predator	sp	7.5

08-MP-1-04

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	7	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	8	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	I	1	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	I	1	Collector	sp	5.1

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08-MP-1-05

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae	I	1	Predator	sp	3.6
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	1	Filterer	cn	6.5
Bivalvia	Veneroida	Corbiculidae	Corbicula	Corbicula	U	5	Filterer	bu	6
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	6	Collector	sp	8.5
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	3	Scraper	sp	7.2
Insecta	Odonata	Coenagrionidae	Ischnura	Ischnura	I	1	Predator	cb	9
Clitellata	Haplotaxida	Naididae	not identified	Naididae	U	9	Collector	bu	9.1
Not Identified	not identified	not identified	not identified	Nematoda	U	1	Parasite	na	na
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	P	2	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	3	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	17	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	1	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratendipes	Paratendipes	I	1	Collector	bu	6.6
Insecta	Diptera	Chironomidae	Phaenopsectra	Phaenopsectra	I	1	Collector	cn	8.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	31	Shredder	cb	6.3
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	2	Filterer	cn	7.2
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	1	Filterer	cn	5.7
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	1	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	4	Collector	sp	8.2
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	2	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	3	Predator	sp	6.7
Insecta	Diptera	Tipulidae	Tipula	Tipula	I	1	Shredder	bu	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	2	Collector	cn	8.4

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08-MP-3-01

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Ablabesmyia	Ablabesmyia	I	1	Predator	sp	8.1
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura	I	1	Shredder	sp	3
Insecta	Diptera	Tipulidae	Antocha	Antocha	I	4	Collector	cn	8
Insecta	Ephemeropte	Caenidae	Caenis	Caenis	I	1	Collector	sp	2.1
Insecta	Ephemeropte	Baetidae	Centroptilum	Centroptilum	I	1	Collector	sw	2.3
Insecta	Trichoptera	Hydropsychidae	Ceratopsyche	Ceratopsyche	I	3	Filterer	cn	5
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	14	Filterer	cn	6.5
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	2	Filterer	cn	4.4
Insecta	Diptera	Chironomidae	not identified	Chironomini	P	1	Collector	bu	5.9
Insecta	Diptera	Chironomidae	not identified	Chironomini	I	1	Collector	bu	5.9
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	2	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	2	Collector	sp	8.5
Insecta	Diptera	Chironomidae	Dicrotendipes	Dicrotendipes	I	1	Collector	bu	9
Insecta	Ephemeropte	Ephemerellidae	Ephemerella	Ephemerella	I	1	Collector	cn	2.3
Insecta	Ephemeropte	Ephemerellidae	Eurylophella	Eurylophella	I	2	Scraper	cn	4.5
Insecta	Coleoptera	Dryopidae	Helichus	Helichus	A	1	Scraper	cn	6.4
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	6	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	3	Filterer	cn	7.5
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	1	Collector	cb	2.1
Insecta	Coleoptera	Elmidae	Optioservus	Optioservus	I	1	Scraper	cn	5.4
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	P	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	6	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	20	Collector	sp	9.2
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius	I	4	Scraper	cn	2.7
Insecta	Plecoptera	Perlidae	Perlesta	Perlesta	I	2	Predator	cn	1.6
Insecta	Diptera	Chironomidae	Phaenopsectra	Phaenopsectra	I	1	Collector	cn	8.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	2	Shredder	cb	6.3
Insecta	Diptera	Chironomidae	Psectrocladius	Psectrocladius	I	3	Shredder	sp	6.6
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	2	Filterer	cn	7.2
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	8	Filterer	cn	5.7
Insecta	Ephemeropte	Heptageniidae	Stenonema	Stenonema	I	4	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	2	Predator	sp	6.7
Insecta	Diptera	Tipulidae	Tipula	Tipula	I	1	Shredder	bu	6.7
Insecta	Diptera	Tipulidae	not identified	Tipulidae	P	2	Predator	bu	4.8

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08-MP-4-01

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura	I	4	Shredder	sp	3
Insecta	Coleoptera	Ptilodactylidae	Anchytarsus	Anchytarsus	I	1	Shredder	cn	3.1
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	6	Filterer	cn	6.5
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	1	Filterer	cn	4.4
Insecta	Diptera	Chironomidae	not identified	Chironomini	I	1	Collector	bu	5.9
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia	A	1	Scraper	cn	5.7
Insecta	Ephemeropte	Ephemerellidae	Ephemerella	Ephemerella	I	9	Collector	cn	2.3
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	I	3	Collector	sp	6.1
Insecta	Diptera	Empididae	Hemerodromia	Hemerodromia	I	1	Predator	sp	7.9
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	2	Scraper	sp	7.2
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	1	Collector	bu	10
Insecta	Coleoptera	Dryopidae	Macronychus	Macronychus	A	1	Scraper	cn	6.8
Insecta	Coleoptera	Dryopidae	Macronychus	Macronychus	I	1	Scraper	cn	6.8
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes	I	1	Filterer	cn	4.9
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	8	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	1	Collector	sp	9.2
Insecta	Plecoptera	Perlidae	Perlesta	Perlesta	I	1	Predator	cn	1.6
Insecta	Plecoptera	not identified	not identified	Plecoptera	I	1	Predator	na	2.4
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	11	Shredder	cb	6.3
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	I	2	Collector	sp	6.2
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	P	1	Collector	sp	6.2
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	2	Filterer	cn	7.2
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	42	Filterer	cn	5.7
Insecta	Ephemeropte	Heptageniidae	Stenonema	Stenonema	I	2	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	not identified	Tanytarsini	I	1	Filterer	na	3.5
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	2	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	2	Predator	sp	6.7
Insecta	Diptera	Tipulidae	Tipula	Tipula	I	1	Shredder	bu	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	1	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	P	1	Collector	sp	5.1

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na indicates information for the particular taxa was not available.

08-MP-4-02

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Tipulidae	Antocha	Antocha	I	8	Collector	cn	8
Insecta	Ephemeropte	Baetidae	not identified	Baetidae	I	1	Collector	sw	2.3
Insecta	Ephemeropte	Baetidae	Centroptilum	Centroptilum	I	1	Collector	sw	2.3
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	4	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	not identified	Chironomidae	A	1	Collector	na	6.6
Insecta	Diptera	Chironomidae	not identified	Chironomidae	I	2	Collector	na	6.6
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	2	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	3	Collector	sp	8.5
Insecta	Diptera	Chironomidae	Dicrotendipes	Dicrotendipes	I	1	Collector	bu	9
Insecta	Ephemeropte	Ephemerellidae	Ephemerella	Ephemerella	I	7	Collector	cn	2.3
Insecta	Ephemeropte	not identified	not identified	Ephemeroptera	I	1	Collector	na	2.9
Insecta	Diptera	Empididae	Hemerodromia	Hemerodromia	I	1	Predator	sp	7.9
Arachnida	Acariformes	Hydrachnidae	not identified	Hydrachnidae	U	1	na	na	na
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	2	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	6	Filterer	cn	7.5
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	P	1	Collector	cb	2.1
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	1	Collector	cb	2.1
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	4	Collector	bu	7.6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	P	2	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	9	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	5	Collector	sp	9.2
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius	I	1	Scraper	cn	2.7
Insecta	Plecoptera	Perlidae	Perlesta	Perlesta	I	1	Predator	cn	1.6
Insecta	Trichoptera	Polycentropodida	not identified	Polycentropodidae	I	2	Filterer	cn	0.2
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	4	Shredder	cb	6.3
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	17	Filterer	cn	5.7
Insecta	Coleoptera	Staphylinidae	not identified	Staphylinidae	A	1	Predator	cn	5
Insecta	Ephemeropte	Heptageniidae	Stenonema	Stenonema	I	4	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	2	Collector	sp	8.2
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	2	Filterer	cb	4.9

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na indicates information for the particular taxa was not available.

Middle Patuxent Watershed
Biological Monitoring and Assessment
Benthic Macroinvertebrate Data

Howard County
2007

08-MP-4-03

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Tipulidae	Antocha	Antocha	I	1	Collector	cn	8
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	5	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	not identified	Chironomini	I	1	Collector	bu	5.9
Insecta	Diptera	Empididae	Clinocera	Clinocera	I	1	Predator	cn	7.4
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	I	2	Collector	sp	6.7
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	1	Shredder	cn	9.6
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	4	Collector	bu	9.1
Insecta	Diptera	Empididae	Hemerodromia	Hemerodromia	I	2	Predator	sp	7.9
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	3	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	not identified	Hydropsychidae	P	1	Filterer	cn	5.7
Insecta	Ephemeropte	Isonychiidae	Isonychia	Isonychia	I	1	Filterer	sw	2.5
Insecta	Trichoptera	Leptoceridae	not identified	Leptoceridae	I	1	Collector	sp	4.1
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	2	Collector	cb	2.1
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes	I	3	Filterer	cn	4.9
Insecta	Trichoptera	Polycentropodida	Neureclipsis	Neureclipsis	I	1	Filterer	cn	0.2
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	1	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	3	Collector	sp	9.2
Insecta	Plecoptera	Perlidae	Perlesta	Perlesta	I	15	Predator	cn	1.6
Insecta	Trichoptera	Polycentropodida	Polycentropus	Polycentropus	I	2	Filterer	cn	1.1
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	8	Shredder	cb	6.3
Insecta	Plecoptera	Nemouridae	Prostoia	Prostoia	I	1	Shredder	sp	4.5
Insecta	Trichoptera	Limnephilidae	Pycnopsyche	Pycnopsyche	I	1	Shredder	sp	3.1
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	I	1	Collector	sp	6.2
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	2	Filterer	cn	7.2
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	17	Filterer	cn	5.7
Insecta	Ephemeropte	Heptageniidae	Stenonema	Stenonema	I	7	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	Sublettea	Sublettea	I	2	Collector	-	10
Insecta	Diptera	Tabanidae	not identified	Tabanidae	P	1	Predator	sp	2.8
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	9	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemanniella	Thienemanniella	I	3	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	8	Predator	sp	6.7
Insecta	Diptera	Chironomidae	Zavrelimyia	Zavrelimyia	I	2	Predator	sp	5.3

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Middle Patuxent Watershed
Biological Monitoring and Assessment
Benthic Macroinvertebrate Data

Howard County
2007

08-MP-4-04

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura	I	2	Shredder	sp	3
Insecta	Coleoptera	Elmidae	Ancyronyx	Ancyronyx	I	1	Scraper	cn	7.8
Insecta	Trichoptera	Hydropsychidae	Ceratopsyche	Ceratopsyche	I	2	Filterer	cn	5
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	8	Filterer	cn	6.5
Insecta	Diptera	Empididae	Clinocera	Clinocera	I	2	Predator	cn	7.4
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	1	Collector	sp	4.1
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	1	Collector	sp	8.5
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia	A	1	Scraper	cn	5.7
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	I	1	Collector	sp	6.1
Insecta	Coleoptera	Dryopidae	Helichus	Helichus	A	1	Scraper	cn	6.4
Insecta	Trichoptera	Hydropsychidae	not identified	Hydropsychidae	P	1	Filterer	cn	5.7
Insecta	Lepidoptera	not identified	not identified	Lepidoptera	I	2	Shredder	na	6.7
Insecta	Coleoptera	Dryopidae	Macronychus	Macronychus	I	1	Scraper	cn	6.8
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	2	Collector	cb	2.1
Insecta	Coleoptera	Elmidae	Optioservus	Optioservus	I	1	Scraper	cn	5.4
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	P	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	3	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	6	Collector	sp	9.2
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius	I	1	Scraper	cn	2.7
Insecta	Diptera	Chironomidae	Paracladopelma	Paracladopelma	I	2	Collector	sp	6.6
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	1	Collector	sp	7.7
Insecta	Plecoptera	Perlidae	Perlesta	Perlesta	I	7	Predator	cn	1.6
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	4	Shredder	cb	6.3
Insecta	Diptera	Simuliidae	Prosimulium	Prosimulium	I	1	Filterer	cn	2.4
Enopla	Hoplonemert	Tetrastemmatidae	Prostoma	Prostoma	U	1	Predator	na	7.3
Insecta	Diptera	Chironomidae		Rheocricotopus	I	1	Collector	sp	6.2
Insecta	Diptera	Chironomidae		Rheotanytarsus	I	5	Filterer	cn	7.2
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	43	Filterer	cn	5.7
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	1	Scraper	cn	7.1
Insecta	Ephemeropte	Heptageniidae	Stenonema	Stenonema	I	3	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	Sublettea	Sublettea	I	1	Collector	-	10
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	1	Collector	sp	8.2
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	3	Filterer	cb	4.9

08-MP-4-04

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Thienemanniella	Thienemanniella	I	1	Collector	sp	5.1
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	I	1	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	I	1	Collector	sp	5.1

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Habit or form of locomotion, includes bu - burrower, cn - clinger, cb - climber, sk - skater, sp - sprawler; 4 Tolerance Values, based on Hilsenhoff, modified for Maryland; na i

Appendix D: Habitat Assessment Data

Middle Patuxent River Watershed
Biological Monitoring and Assessment
Summary RBP Habitat Assessment Data

Howard County
2007

Site ID	DATE	CA	CFS	ESC	E	FR	SD	VD	BSL	BSR	VPL	VPR	RZL	RZR	Total	Percent	Narrative Rating
Middle Patuxent Upper												**Middle Patuxent Upper:**			**137**	**71**	**Partially Supporting**
06MP-1-01-2007	3/27/2007	15	18	16	14	16	18	18	5	6	7	8	6	10	157	78.5	Supporting
06MP-1-02-2007	3/29/2007	19	13	10	7	16	6	10	3	3	4	4	10	9	114	57.0	Non-supporting
06MP-1-03-2007	3/27/2007	19	14	8	5	10	9	11	8	8	5	5	9	3	114	57.0	Non-supporting
06MP-1-04-2007	3/28/2007	15	12	11	13	17	16	14	4	5	5	6	3	3	124	62.0	Partially Supporting
06MP-1-05-2007	3/27/2007	15	14	14	9	14	14	15	5	5	9	9	10	10	143	71.5	Partially Supporting
06MP-1-06-2007	3/28/2007	19	13	7	4	6	7	9	8	8	5	5	10	10	111	55.5	Non-supporting
06MP-1-07-2007	3/27/2007	20	15	13	16	14	16	12	9	8	7	7	4	9	150	75.0	Partially Supporting
06MP-2-01-2007	3/29/2007	20	15	19	17	17	8	16	4	5	4	6	10	10	151	75.5	Supporting
06MP-3-01-2007	3/28/2007	20	14	18	17	18	11	18	7	4	7	6	10	9	159	79.5	Supporting
06MP-3-01-2007 QC	3/28/2007	20	14	18	17	17	11	18	4	6	5	7	10	9	156	78.0	Supporting
06MP-3-02-2007	3/29/2007	20	16	15	13	16	12	17	7	3	7	3	10	10	149	74.5	Partially Supporting
Middle Patuxent Middle												**Middle Patuxent Middle:**			**133**	**69**	**Partially Supporting**
07MP-1-01-2007	4/2/2007	14	15	11	12	19	15	15	6	6	6	6	2	5	132	66.0	Partially Supporting
07MP-1-02-2007	4/3/2007	20	15	18	14	17	13	15	6	6	7	7	10	10	158	79.0	Supporting
07MP-1-03A-2007	4/3/2007	20	16	15	11	18	12	15	7	7	8	8	9	9	155	77.5	Supporting
07MP-1-04-2007	4/2/2007	14	15	13	12	16	12	15	7	7	7	7	9	9	143	71.5	Partially Supporting
07MP-1-05-2007	4/3/2007	6	13	7	11	13	14	11	6	6	5	5	3	2	102	51.0	Non-supporting
07MP-1-06-2007	4/2/2007	17	14	8	10	15	7	15	2	2	3	3	1	1	98	49.0	Non-supporting
07MP-2-01-2007	4/5/2007	14	13	12	11	15	12	14	7	7	7	7	1	7	127	63.5	Partially Supporting
07MP-2-02-2007	4/5/2007	19	13	17	13	18	9	16	4	4	5	5	8	10	141	70.5	Partially Supporting
07MP-2-02-2007 QC	4/5/2007	19	13	18	13	17	8	16	4	4	5	5	8	10	140	70.0	Partially Supporting
07MP-3-01-2007	4/5/2007	19	15	15	14	16	13	16	5	6	6	7	8	10	150	75.0	Partially Supporting
07MP-3-02-2007	4/6/2007	20	13	15	8	16	9	16	4	2	3	2	9	9	126	63.0	Partially Supporting
Middle Patuxent Lower												**Middle Patuxent Lower:**			**139**	**70**	**Partially Supporting**
08MP-1-01-2007	4/6/2007	14	17	15	14	15	14	13	8	8	7	7	4	4	140	70.0	Partially Supporting
08MP-1-02-2007	4/13/2007	15	14	9	9	16	10	14	6	6	7	7	9	8	130	65.0	Partially Supporting
08MP-1-03A-2007	4/11/2007	20	10	12	16	16	18	11	8	6	6	6	9	10	148	74.0	Partially Supporting
08MP-1-03A-2007 QC	4/11/2007	20	10	13	16	16	18	11	7	7	6	6	9	10	149	74.5	Partially Supporting
08MP-1-04-2007	4/11/2007	20	15	15	18	17	12	15	4	5	6	6	9	10	152	76.0	Supporting
08MP-1-05-2007	4/6/2007	14	14	13	10	16	10	15	7	7	8	8	8	8	138	69.0	Partially Supporting
08MP-3-01-2007	4/9/2007	20	15	12	12	18	10	16	5	7	8	8	10	10	151	75.5	Supporting
08MP-4-01-2007	4/9/2007	20	15	11	14	16	13	15	4	2	5	3	8	9	135	67.5	Partially Supporting
08MP-4-02-2007	4/9/2007	20	15	13	10	17	13	16	4	2	5	3	8	10	136	68.0	Partially Supporting
08MP-4-03-2007	4/13/2007	14	17	8	7	13	10	10	5	5	6	6	8	10	119	59.5	Non-supporting
08MP-4-04-2007	4/11/2007	20	14	13	10	19	8	18	6	2	5	5	8	10	138	69.0	Partially Supporting
												Entire Watershed:			**136**	**68**	**Partially Supporting**

CA - Channel alteration
CFS - Channel Flow Status
ESC - Epifaunal substrate / available cover
E - Embeddeddness
FR - Frequency of riffles
VPL - Vegetative Protection (left)
SD - Sediment /deposition
VD - Velocity /depth
BSL - Bank Stability (left)
BSR - Bank Stability (right)
VPR - Vegetative Protection (right)
RZL - Riparian Zone (left)
RZR - Riparian Zone (right)
Total - Total Score (200 highest possible)
Percent - (Total/200)

Classification Scoring and Narrative Rating	
≥90%	Comparable to Reference
75.1-89.9%	Supporting
60.1-75.0%	Partially Supporting
≤60%	Non-supporting

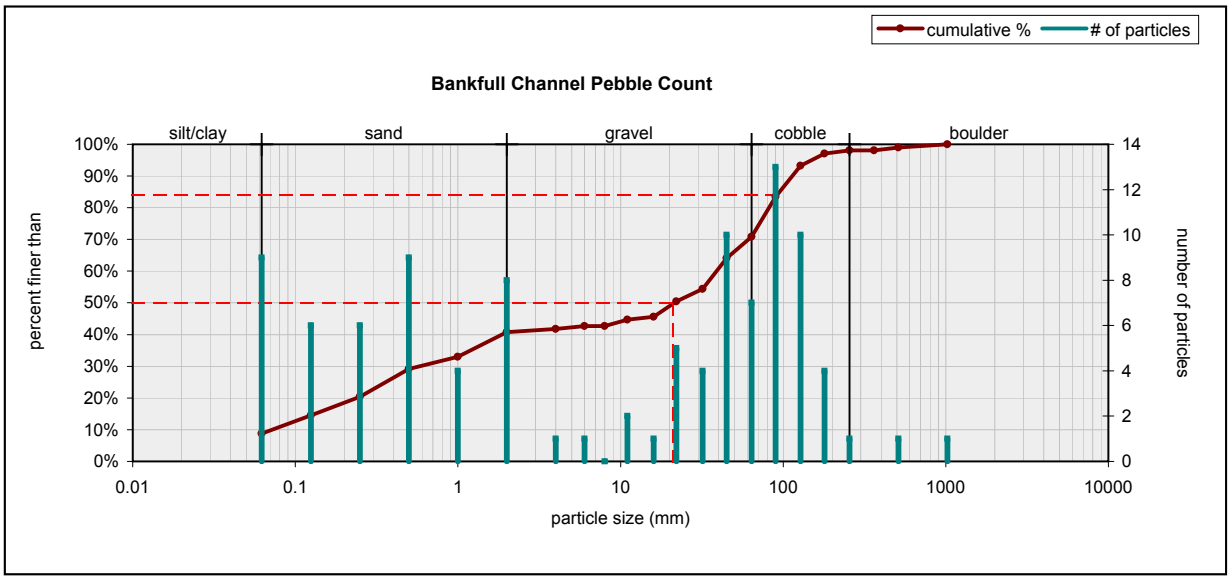
Appendix E: Geomorphologic Data

Middle Patuxent Watershed
Biological Monitoring and Assessment
Summary Geomorphological Data

Howard County
2007

Site ID	Mean depth (dbkf) (ft)	Bankfull width (Wbkf) (ft)	Bankfull cross-sectional area (Abkf) (ft2)	Width/Depth ratio (Wbkf/dbkf)	Width of flood-prone area (Wfpa) (ft)	Entrenchment Ratio (Wfpa/Wbkf)	Slope (water surface, percent)	Valley Length (feet)	Sinuosity (stream length/valley length)	Median particle size, reach (D50) (mm)	Dominant particle size class	Percent dominat particle size	Channel Type
Upper Middle Patuxent													
06MP-1-01-2007	1.6	19.4	30.4	12.4	108.0	5.6	1.40	210	1.17	21.00	Sand	33	C5
06MP-1-02-2007	0.3	9.7	3.0	31.2	18.7	1.9	2.10	185	1.57	8.20	Gravel	56	B4c
06MP-1-03-2007	0.8	4.3	3.5	5.2	8.5	2.0	0.64	196	1.26	0.31	Sand	84	B5c
06MP-1-04-2007	1.3	14.1	18.3	10.9	27.4	1.9	1.40	246	1.00	23.00	Gravel	47	B4c
06MP-1-05-2007	1.6	18.5	29.2	11.7	28.4	1.5	1.30	190	1.29	11.00	Gravel	56	C4
06MP-1-06-2007	0.8	8.3	6.7	10.2	22.4	2.7	1.90	181	1.36	0.11	Sand	74	E5
06MP-1-07-2007	1.3	11.5	15.3	8.7	80.0	6.9	0.77	201	1.22	35.00	Gravel	55	C4
06MP-2-01-2007	1.0	12.6	12.2	12.9	17.5	1.4	1.20	207	1.19	47.00	Gravel	38	B4c
06MP-3-01-2007	2.2	25.8	57.1	11.6	300.0	11.6	0.89	233	1.06	43.00	Gravel	61	C4
06MP-3-02-2007	1.9	70.7	130.9	38.2	350.0	4.9	0.98	223	1.10	2.00	Sand	40	C5
Middle Middle Patuxent													
07MP-1-01-2007	0.9	9.1	7.8	10.7	13.5	1.5	3.00	228	1.08	11.00	Gravel	38	G4c
07MP-1-02-2007	1.0	12.9	12.7	13.1	17.1	1.3	0.96	172	1.43	23.00	Gravel	62	F4
07MP-1-03a-2007	0.7	9.7	6.4	14.8	12.5	1.3	1.90	217	1.13	20.00	Gravel	50	B4
07MP-1-04-2007	1.0	9.3	9.5	9.1	16.6	1.8	0.91	215	1.14	15.00	Gravel	51	B4
07MP-1-05-2007	0.8	7.1	5.6	9.0	7.8	1.1	3.30	204	1.21	9.10	Gravel	40	G4
07MP-1-06-2007	1.5	11.1	16.6	7.4	16.7	1.5	0.33	231	1.06	0.36	Sand	62	F5
07MP-2-01-2007	1.3	28.7	38.6	21.4	35.0	1.2	0.92	185	1.33	34.00	Gravel	53	F4
07MP-2-02-2007	2.0	28.1	56.3	14.0	214.0	7.6	0.57	214	1.15	8.00	Gravel	46	C4
07MP-3-01-2007	2.9	57.6	167.2	19.9	115.0	2.0	0.19	222	1.11	26.00	Gravel	33	C4
07MP-3-02-2007	2.2	28.1	61.5	12.8	40.0	1.4	0.41	215	1.14	15.00	Gravel	52	F4
Lower Middle Patuxent													
08MP-1-01-2007	1.3	13.6	17.2	10.8	36	2.6	1.10	246	1.00	12.00	Gravel	41	E4
08MP-1-02-2007	1.1	10.7	11.7	9.8	17.4	1.6	1.40	190	1.30	12.00	Gravel	61	B4c
08MP-1-03a-2007	1.0	13.5	13.8	13.1	25.0	1.9	3.20	220	1.12	28.00	Gravel	52	B4
08MP-1-04-2007	0.9	12.5	11.1	14.2	172.0	13.7	0.92	172	1.43	22.00	Gravel	52	C4
08MP-1-05-2007	1.4	15.0	20.9	10.8	95.0	6.3	0.97	234	1.05	47.00	Gravel	60	C4
08MP-3-01-2007	2.2	40.0	86.4	18.5	58.0	1.4	0.02	216	1.14	16.00	Gravel	47	C4
08MP-4-01-2007	4.6	66.1	302.2	14.5	225.0	3.4	1.50	225	1.09	1.50	Sand	50	C5
08MP-4-02-2007	3.9	61.7	242.6	15.7	250.0	4.1	0.65	246	1.00	0.50	Sand	74	C5
08MP-4-03-2007	6.6	76.0	498.4	11.6	330.0	4.3	0.12	246	1.00	1.70	Sand	53	C5
08MP-4-04-2007	2.9	84.5	242.3	29.4	114.0	1.3	0.57	196	1.26	16.00	Gravel	41	C5/4

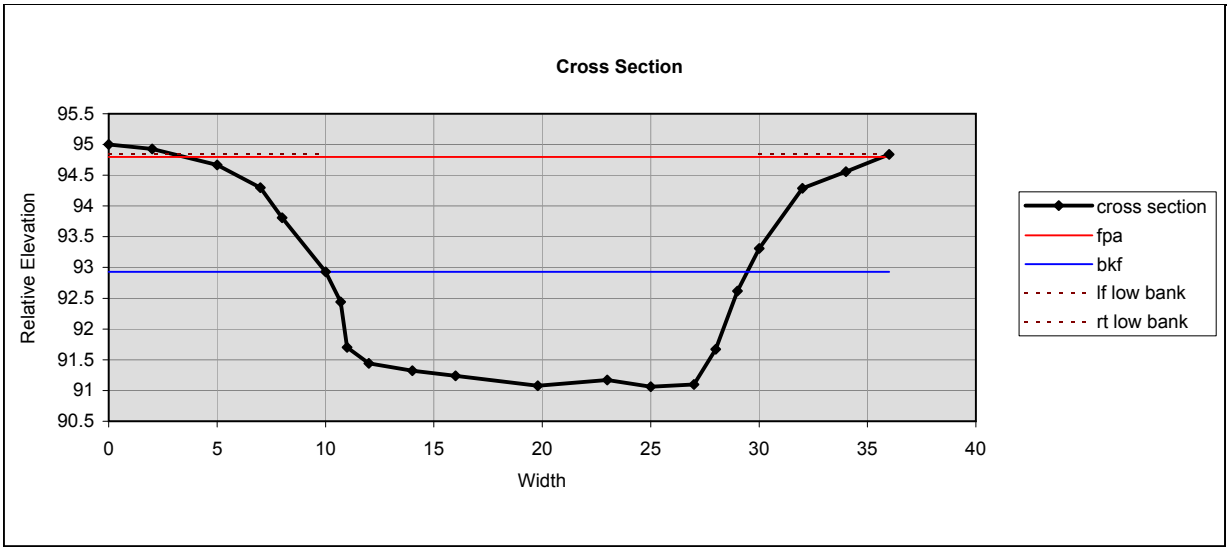
06MP_1_01_2007



Size (mm)	
D16	0.15
D35	1.2
D50	21
D65	47
D84	92
D95	150

Size Distribution	
mean	3.7
dispersion	72.2
skewness	-0.5

Type	
silt/clay	9%
sand	32%
gravel	30%
cobble	27%
boulder	2%
bedrock	0%



Bankfull Dimensions	
30.4	x-section area (ft.sq.)
19.4	width (ft)
1.6	mean depth (ft)
1.9	max depth (ft)
20.8	wetted perimeter (ft)
1.5	hydraulic radius (ft)
12.4	width-depth ratio

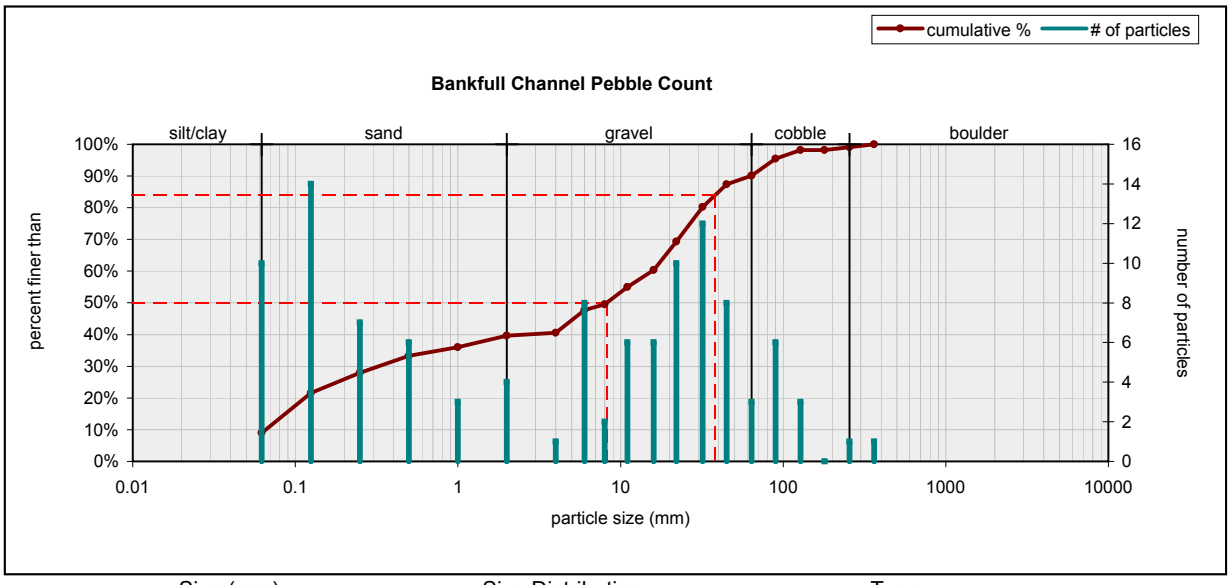
Flood Dimensions	
108.0	Width flood prone area (ft)
5.6	entrenchment ratio
3.8	low bank height (ft)
2.0	low bank height ratio

Flow Resistance	
0.040	Manning's roughness

Bankfull Flow	
5.7	velocity (ft/s)
173.4	discharge rate (cfs)
1.4	channel slope (%)

Sinuosity	Channel Type
1.17	C5

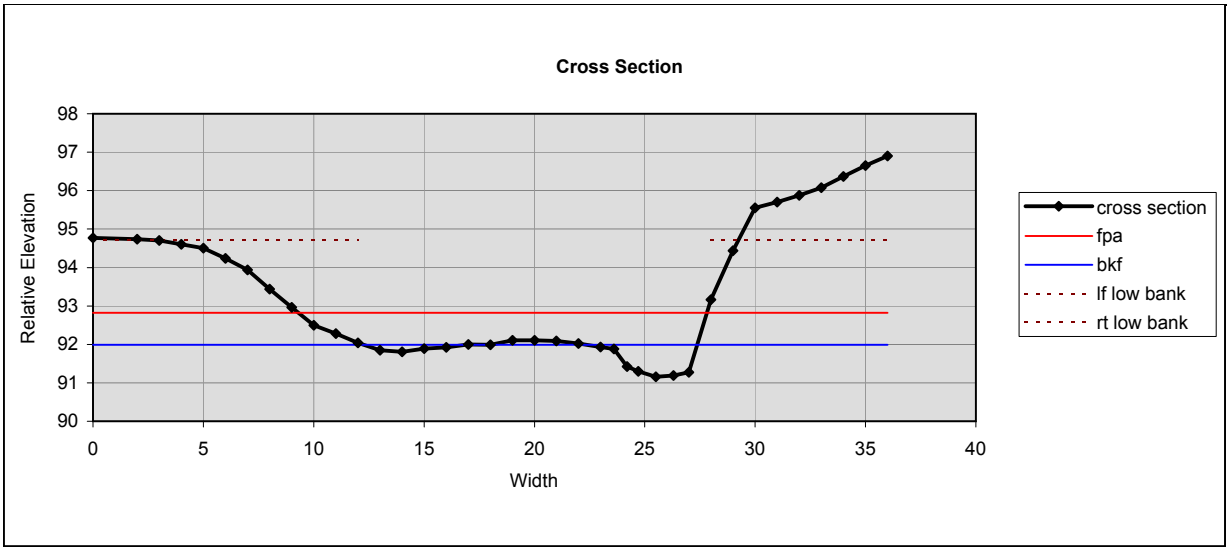
06MP_1_02_2007



Size (mm)	
D16	0.091
D35	0.77
D50	8.2
D65	19
D84	38
D95	87

Size Distribution	
mean	1.9
dispersion	47.4
skewness	-0.4

Type	
silt/clay	9%
sand	31%
gravel	50%
cobble	9%
boulder	1%
bedrock	0%



Bankfull Dimensions	
3.0	x-section area (ft.sq.)
9.7	width (ft)
0.3	mean depth (ft)
0.8	max depth (ft)
10.3	wetted perimeter (ft)
0.3	hydraulic radius (ft)
31.2	width-depth ratio

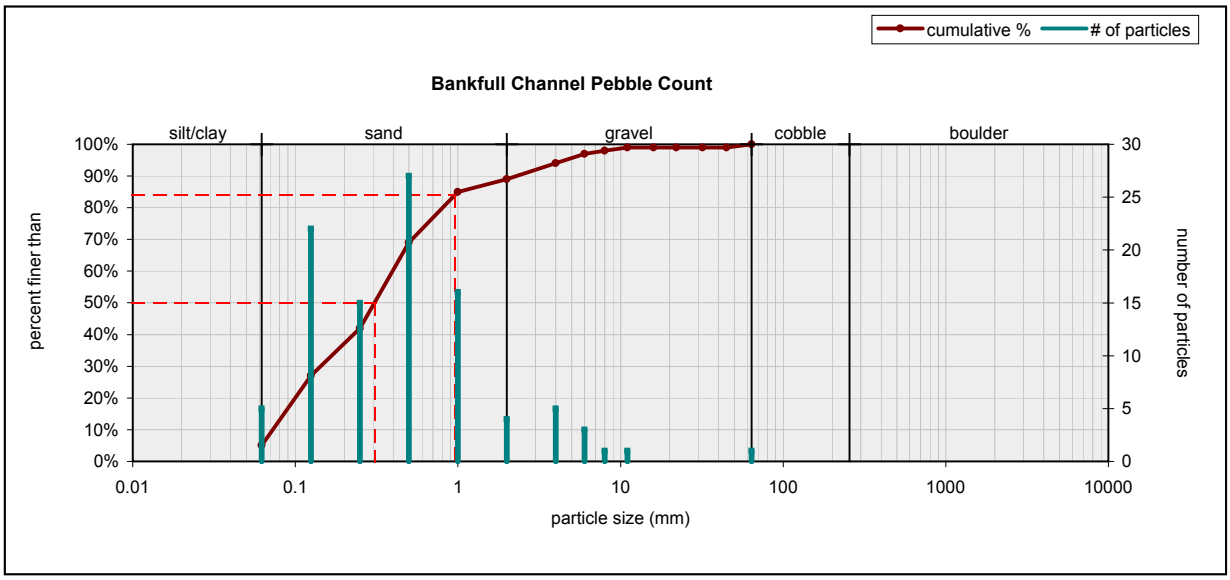
Flood Dimensions	
18.7	Width flood prone area (ft)
1.9	entrenchment ratio
3.5	low bank height (ft)
4.3	low bank height ratio

Flow Resistance	
0.037	Manning's roughness

Bankfull Flow	
2.6	velocity (ft/s)
7.7	discharge rate (cfs)
2.1	channel slope (%)

Sinuosity	Channel Type
1.57	B4c

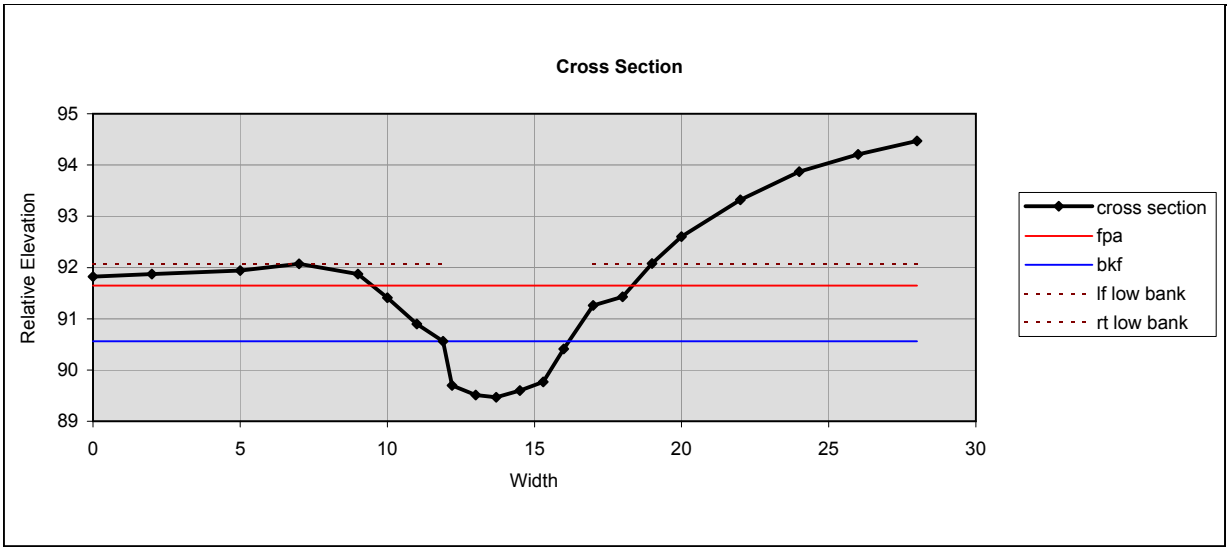
06MP_1_03_2007



Size (mm)	
D16	0.088
D35	0.18
D50	0.31
D65	0.45
D84	0.96
D95	4.6

Size Distribution	
mean	0.3
dispersion	3.3
skewness	0.0

Type	
silt/clay	5%
sand	84%
gravel	11%
cobble	0%
boulder	0%
bedrock	0%



Bankfull Dimensions	
3.5	x-section area (ft.sq.)
4.3	width (ft)
0.8	mean depth (ft)
1.1	max depth (ft)
5.2	wetted perimeter (ft)
0.7	hydraulic radius (ft)
5.2	width-depth ratio

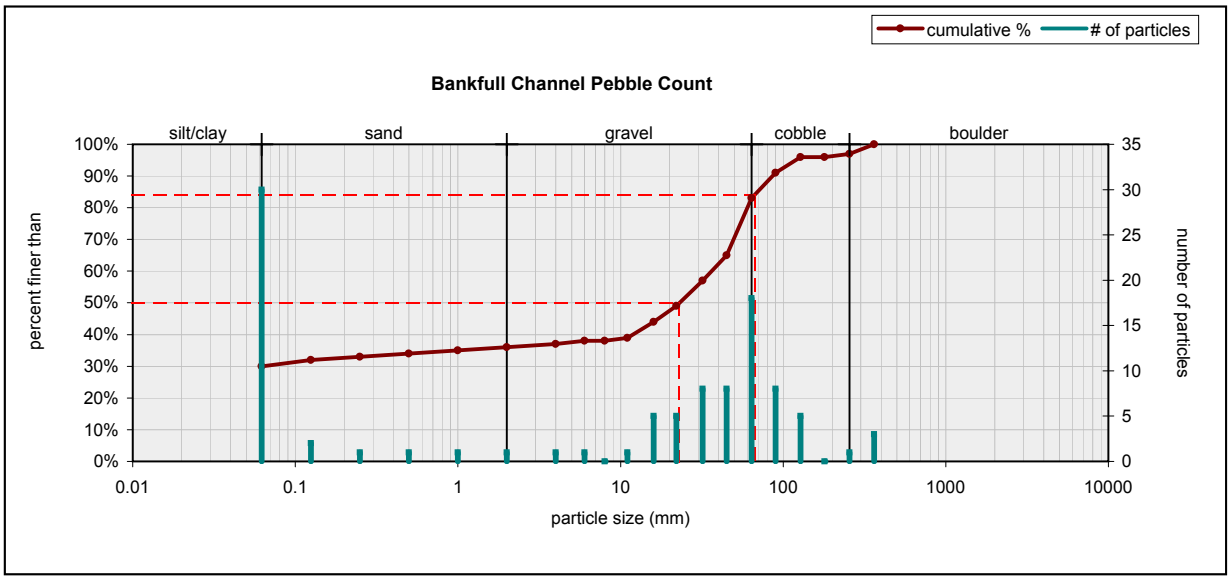
Flood Dimensions	
8.5	Width flood prone area (ft)
2.0	entrenchment ratio
2.6	low bank height (ft)
2.4	low bank height ratio

Flow Resistance	
0.015	Manning's roughness

Bankfull Flow	
6.2	velocity (ft/s)
21.7	discharge rate (cfs)
0.64	channel slope (%)

Sinuosity	Channel Type
1.26	B5c

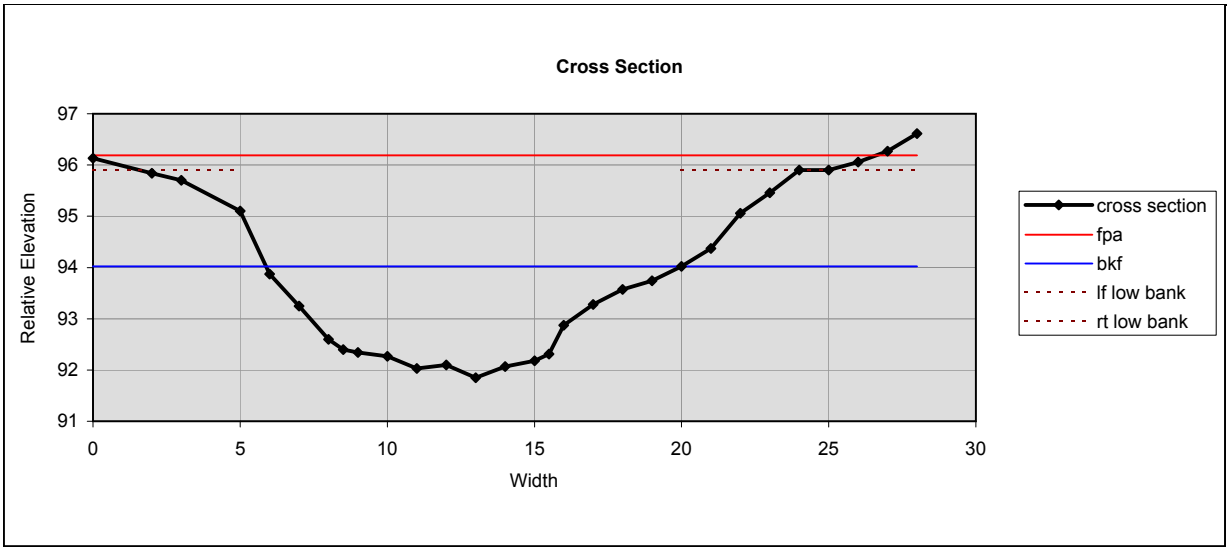
06MP_1_04_2007



Size (mm)	
D16	0.062
D35	1
D50	23
D65	45
D84	67
D95	120

Size Distribution	
mean	2.0
dispersion	186.9
skewness	-0.6

Type	
silt/clay	30%
sand	6%
gravel	47%
cobble	14%
boulder	3%
bedrock	0%



Bankfull Dimensions	
18.3	x-section area (ft.sq.)
14.1	width (ft)
1.3	mean depth (ft)
2.2	max depth (ft)
15.1	wetted perimeter (ft)
1.2	hydraulic radius (ft)
10.9	width-depth ratio

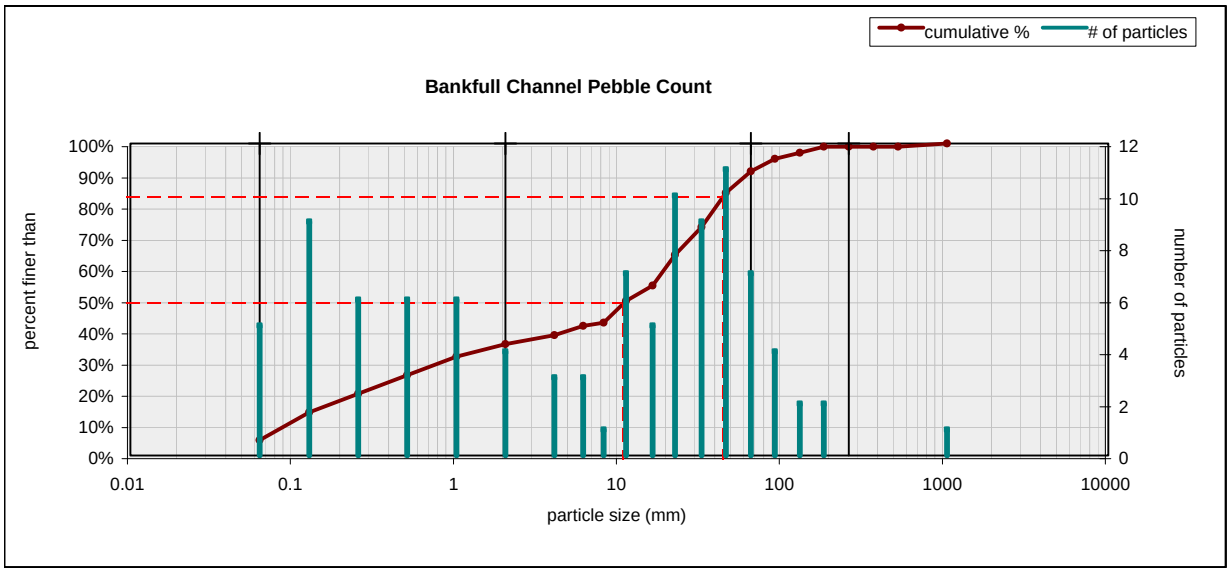
Flood Dimensions	
27.4	Width flood prone area (ft)
1.9	entrenchment ratio
4.1	low bank height (ft)
1.9	low bank height ratio

Flow Resistance	
0.036	Manning's roughness

Bankfull Flow	
5.6	velocity (ft/s)
103.0	discharge rate (cfs)
1.4	channel slope (%)

Sinuosity	Channel Type
1.00	B4c

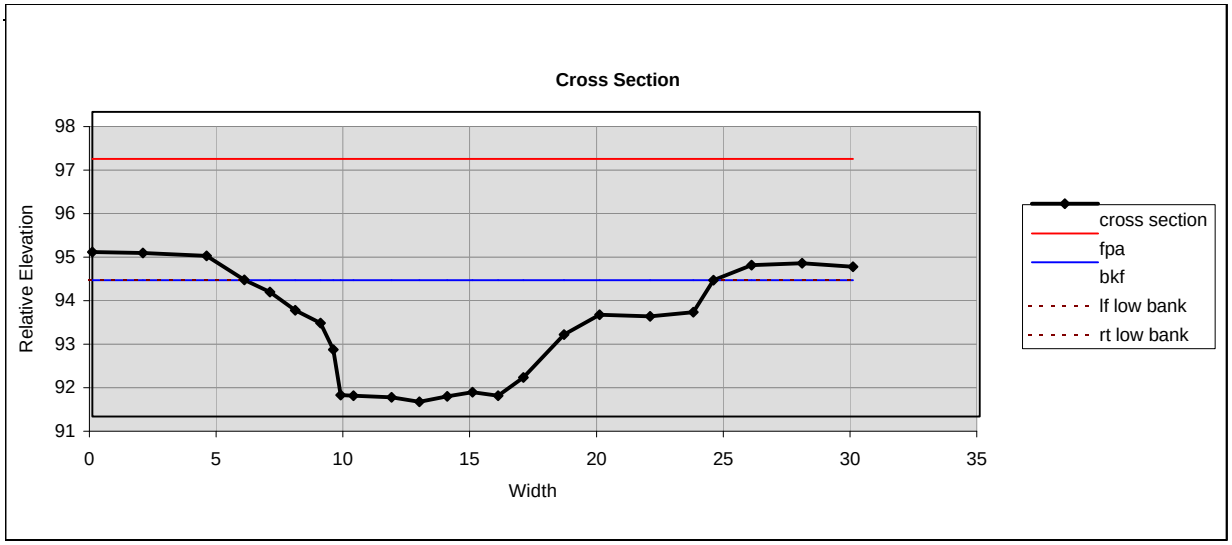
06MP_1_05_2007



Size (mm)	
D16	0.16
D35	1.8
D50	11
D65	23
D84	45
D95	90

Size Distribution	
mean	2.7
dispersion	36.4
skewness	-0.4

Type	
silt/clay	5%
sand	31%
gravel	55%
cobble	8%
boulder	1%
bedrock	0%



Bankfull Dimensions	
29.2	x-section area (ft.sq.)
18.5	width (ft)
1.6	mean depth (ft)
2.8	max depth (ft)
20.4	wetted perimeter (ft)
1.4	hydraulic radius (ft)
11.7	width-depth ratio

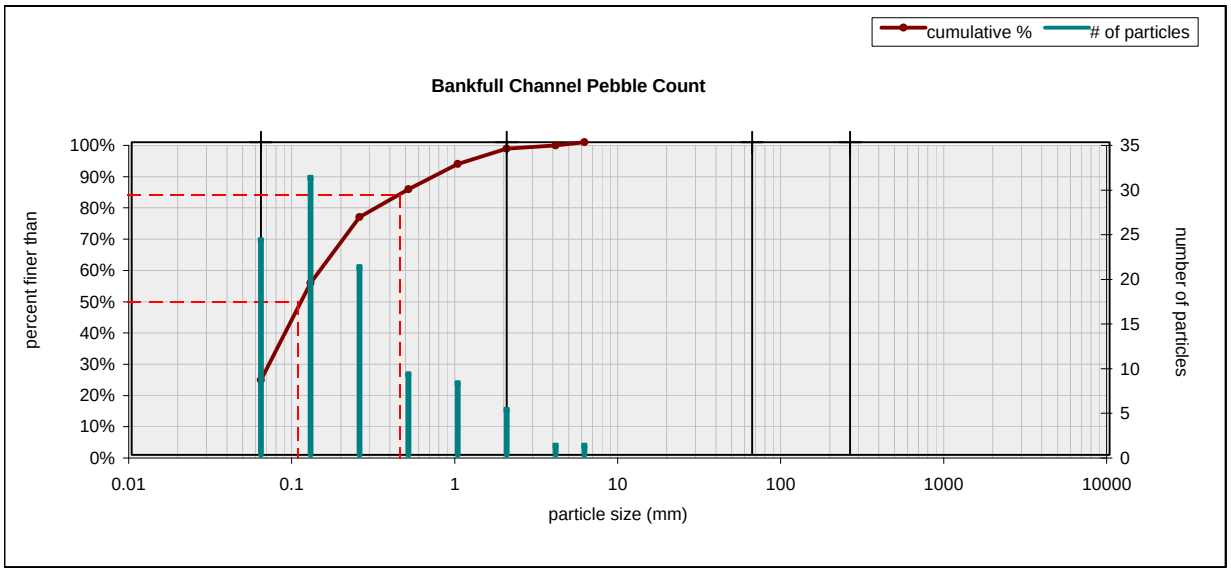
Flood Dimensions	
28.4	Width flood prone area (ft)
1.5	entrenchment ratio
3.1	low bank height (ft)
1.1	low bank height ratio

Flow Resistance	
0.031	Manning's roughness

Bankfull Flow	
7.0	velocity (ft/s)
204.7	discharge rate (cfs)
1.3	channel slope (%)

Sinuosity	Channel Type
1.29	C4

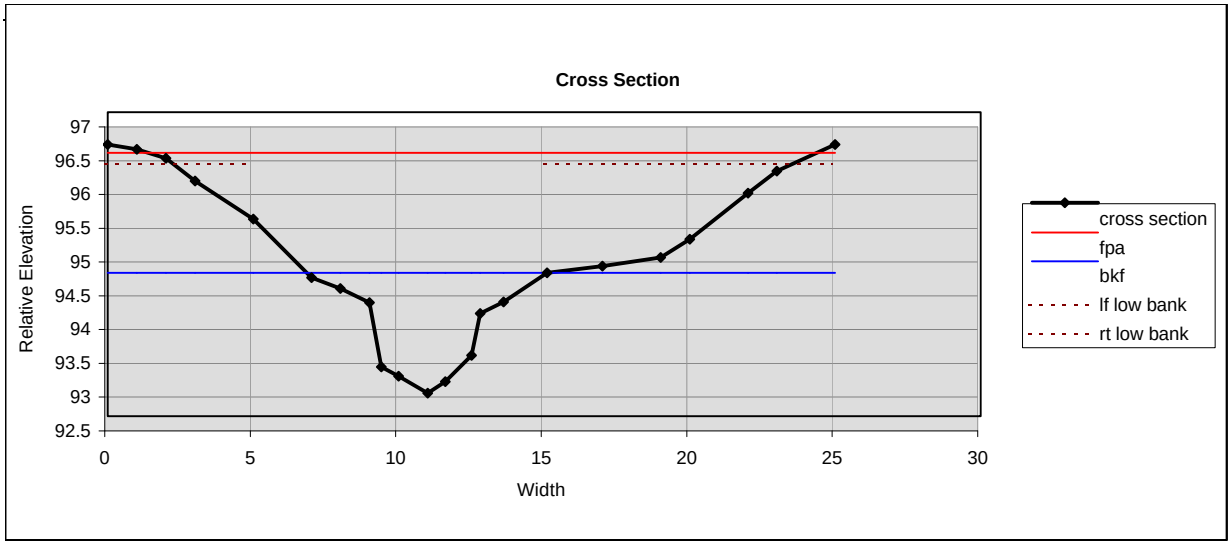
06MP_1_06_2007



Size (mm)	
D16	0.062
D35	0.08
D50	0.11
D65	0.17
D84	0.46
D95	1.3

Size Distribution	
mean	0.2
dispersion	3.0
skewness	0.2

Type	
silt/clay	24%
sand	74%
gravel	2%
cobble	0%
boulder	0%
bedrock	0%



Bankfull Dimensions	
6.7	x-section area (ft.sq.)
8.3	width (ft)
0.8	mean depth (ft)
1.8	max depth (ft)
9.6	wetted perimeter (ft)
0.7	hydraulic radius (ft)
10.2	width-depth ratio

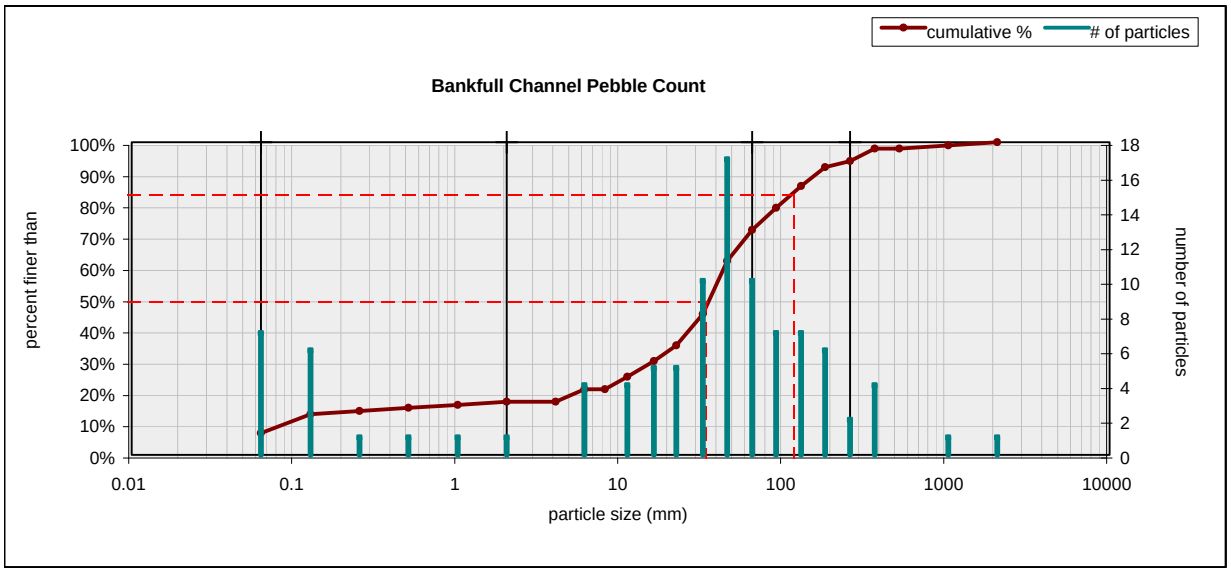
Flood Dimensions	
22.4	Width flood prone area (ft)
2.7	entrenchment ratio
3.6	low bank height (ft)
2.0	low bank height ratio

Flow Resistance	
0.013	Manning's roughness

Bankfull Flow	
12.4	velocity (ft/s)
82.9	discharge rate (cfs)
1.9	channel slope (%)

Sinuosity	Channel Type
1.36	E5

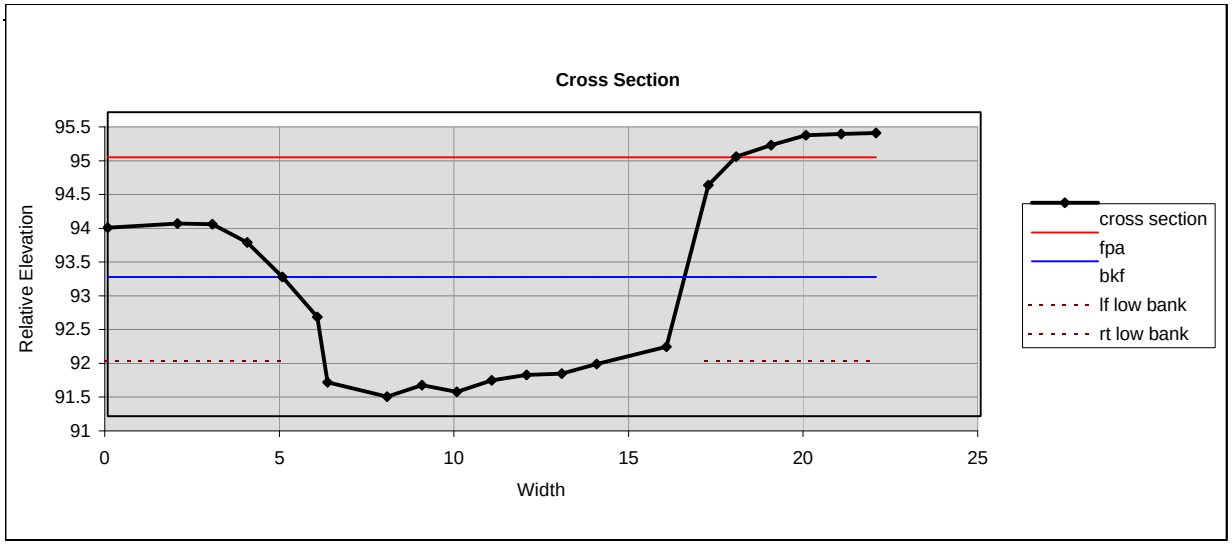
06MP_1_07_2007



Size (mm)	
D16	1
D35	22
D50	35
D65	50
D84	120
D95	280

Size Distribution	
mean	11.0
dispersion	19.2
skewness	-0.3

Type	
silt/clay	7%
sand	10%
gravel	55%
cobble	22%
boulder	6%
bedrock	0%



Bankfull Dimensions	
15.3	x-section area (ft.sq.)
11.5	width (ft)
1.3	mean depth (ft)
1.8	max depth (ft)
13.1	wetted perimeter (ft)
1.2	hydraulic radius (ft)
8.7	width-depth ratio

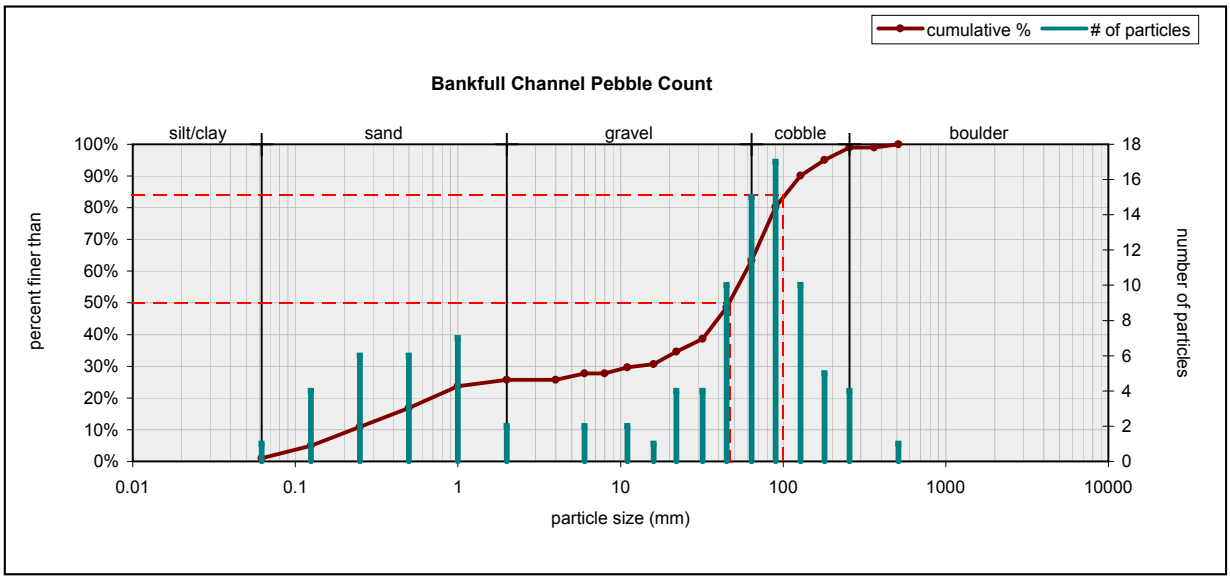
Flood Dimensions	
80.0	Width flood prone area (ft)
6.9	entrenchment ratio
0.7	low bank height (ft)
0.4	low bank height ratio

Flow Resistance	
0.045	Manning's roughness

Bankfull Flow	
3.2	velocity (ft/s)
48.6	discharge rate (cfs)
0.77	channel slope (%)

Sinuosity	Channel Type
1.22	C4

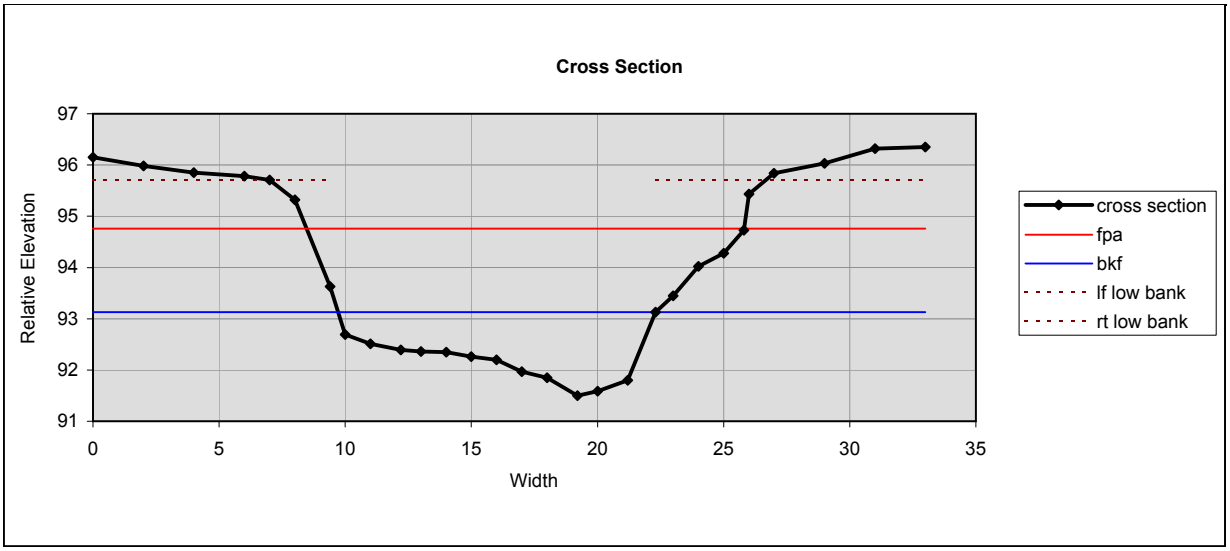
06MP_2_01_2007



Size (mm)	
D16	0.45
D35	23
D50	47
D65	66
D84	100
D95	180

Size Distribution	
mean	6.7
dispersion	53.3
skewness	-0.6

Type	
silt/clay	1%
sand	25%
gravel	38%
cobble	36%
boulder	1%
bedrock	0%



Bankfull Dimensions	
12.2	x-section area (ft.sq.)
12.6	width (ft)
1.0	mean depth (ft)
1.6	max depth (ft)
13.6	wetted perimeter (ft)
0.9	hydraulic radius (ft)
12.9	width-depth ratio

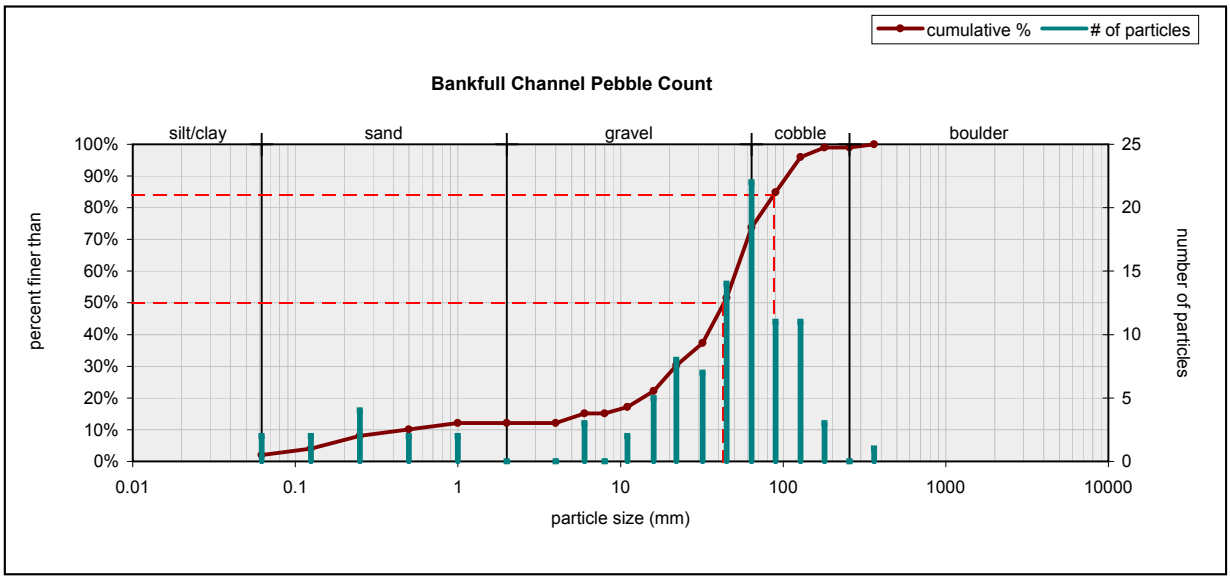
Flood Dimensions	
17.5	Width flood prone area (ft)
1.4	entrenchment ratio
4.2	low bank height (ft)
2.6	low bank height ratio

Flow Resistance	
0.044	Manning's roughness

Bankfull Flow	
3.5	velocity (ft/s)
42.4	discharge rate (cfs)
1.2	channel slope (%)

Sinuosity	Channel Type
1.19	B4c

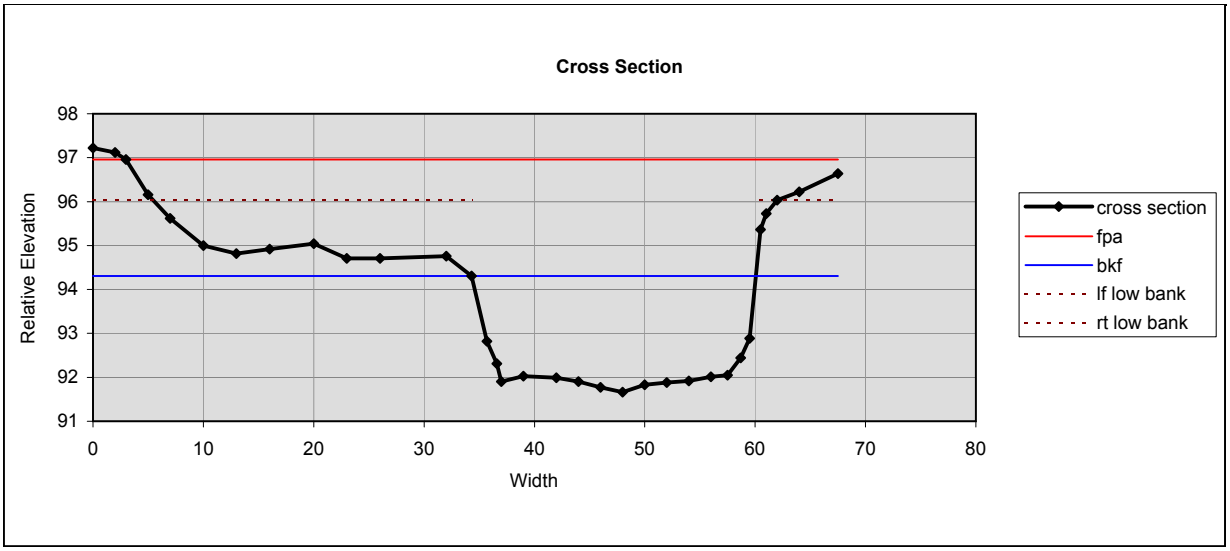
06MP_3_01_2007



Size (mm)	
D16	9.1
D35	28
D50	43
D65	56
D84	88
D95	120

Size Distribution	
mean	28.3
dispersion	3.4
skewness	-0.2

Type	
silt/clay	2%
sand	10%
gravel	61%
cobble	25%
boulder	1%
bedrock	0%



Bankfull Dimensions	
57.1	x-section area (ft.sq.)
25.8	width (ft)
2.2	mean depth (ft)
2.7	max depth (ft)
27.9	wetted perimeter (ft)
2.0	hydraulic radius (ft)
11.6	width-depth ratio

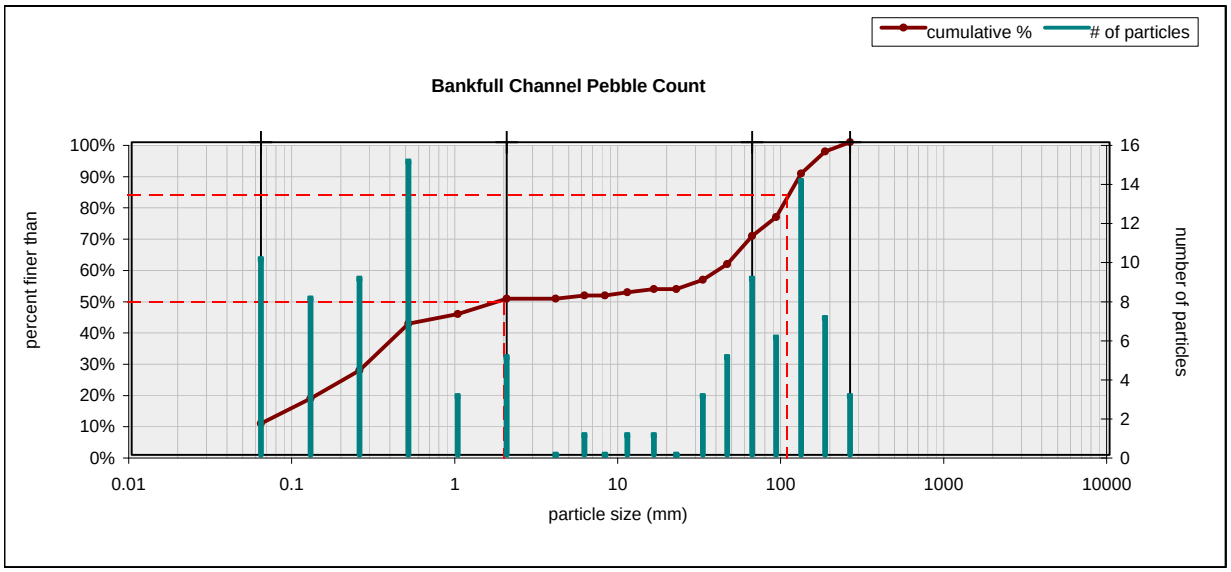
Flood Dimensions	
300.0	Width flood prone area (ft)
11.6	entrenchment ratio
4.4	low bank height (ft)
1.6	low bank height ratio

Flow Resistance	
0.037	Manning's roughness

Bankfull Flow	
6.1	velocity (ft/s)
349.0	discharge rate (cfs)
0.89	channel slope (%)

Sinuosity	Channel Type
1.06	C4

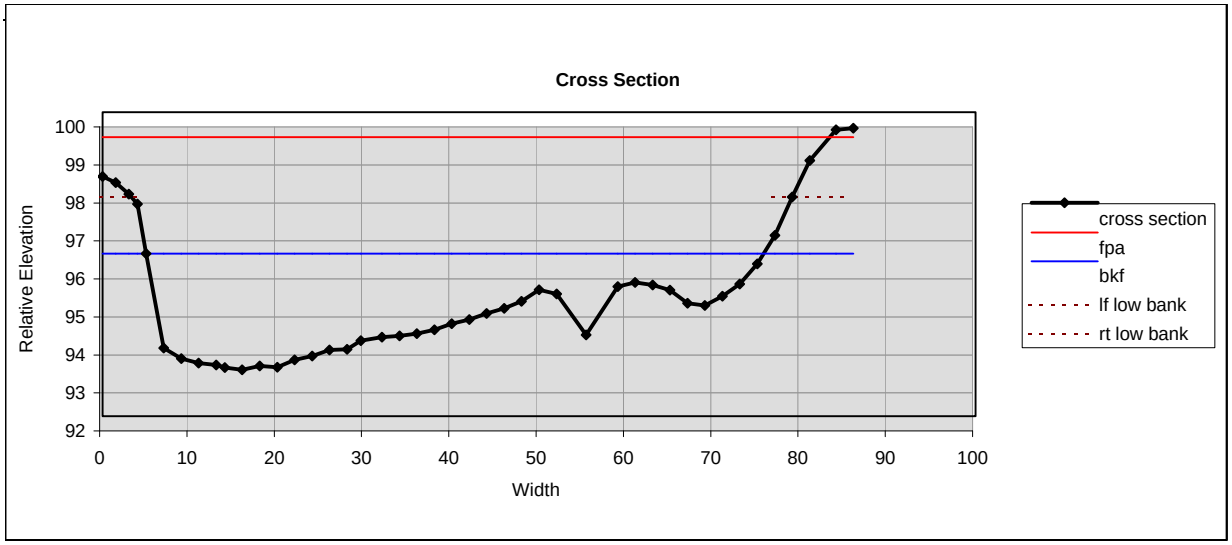
06MP_3_02_2007



Size (mm)	
D16	0.1
D35	0.36
D50	2
D65	53
D84	110
D95	160

Size Distribution	
mean	3.3
dispersion	37.5
skewness	0.1

Type	
silt/clay	10%
sand	40%
gravel	20%
cobble	30%
boulder	0%
bedrock	0%



Bankfull Dimensions	
130.9	x-section area (ft.sq.)
70.7	width (ft)
1.9	mean depth (ft)
3.1	max depth (ft)
72.6	wetted perimeter (ft)
1.8	hydraulic radius (ft)
38.2	width-depth ratio

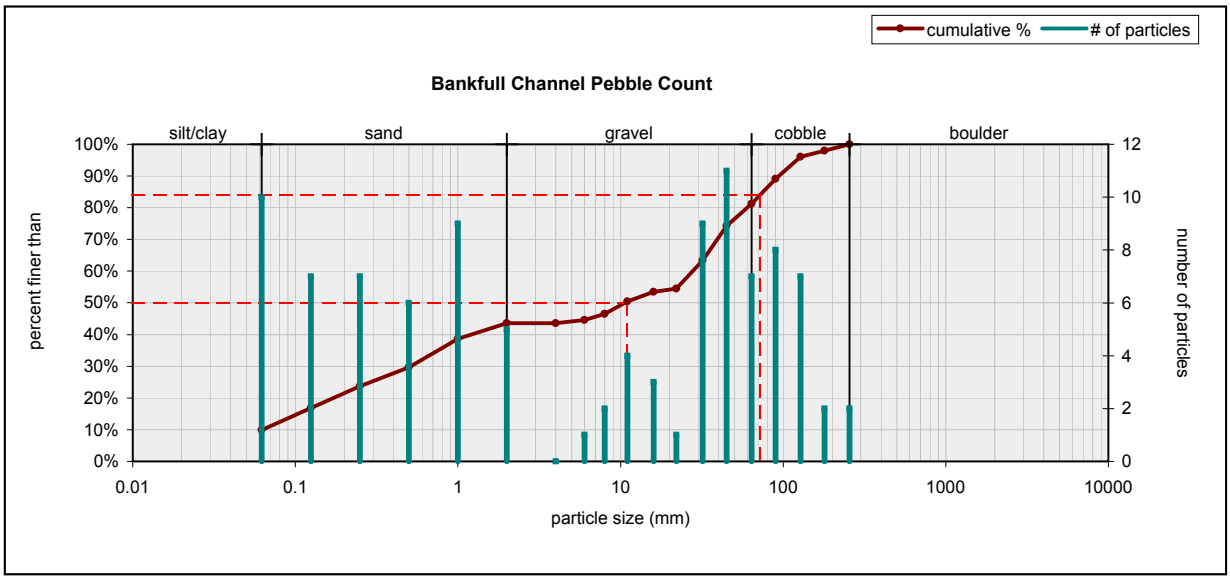
Flood Dimensions	
350.0	Width flood prone area (ft)
4.9	entrenchment ratio
4.9	low bank height (ft)
1.6	low bank height ratio

Flow Resistance	
0.040	Manning's roughness

Bankfull Flow	
5.5	velocity (ft/s)
721.7	discharge rate (cfs)
0.98	channel slope (%)

Sinuosity	Channel Type
1.10	C5

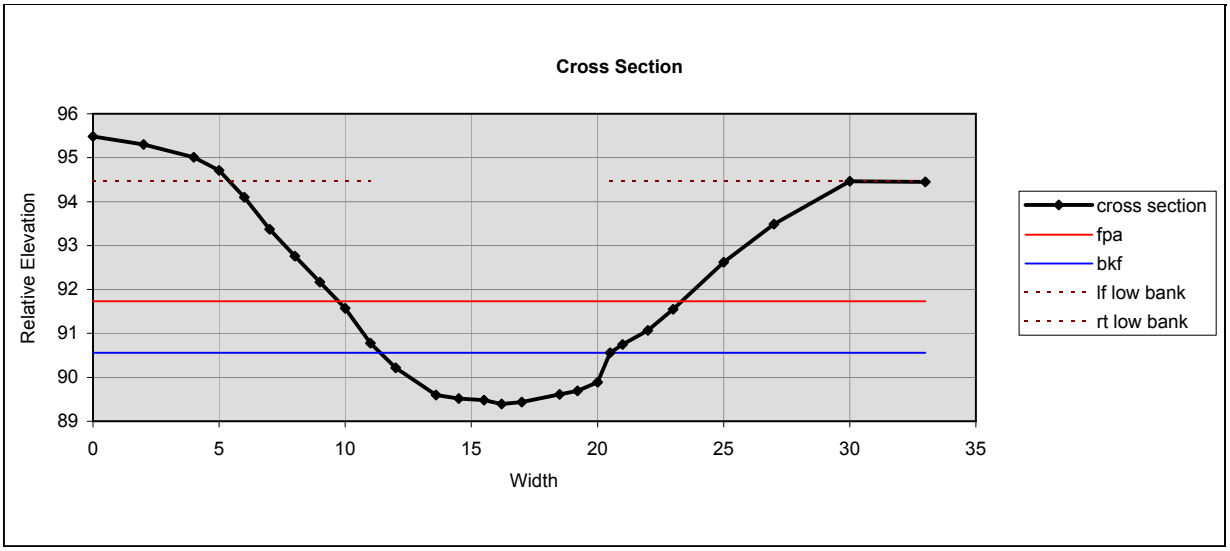
07MP_1_01_2007



Size (mm)	
D16	0.11
D35	0.75
D50	11
D65	34
D84	72
D95	120

Size Distribution	
mean	2.8
dispersion	53.3
skewness	-0.4

Type	
silt/clay	10%
sand	34%
gravel	38%
cobble	19%
boulder	0%
bedrock	0%



Bankfull Dimensions	
7.8	x-section area (ft.sq.)
9.1	width (ft)
0.9	mean depth (ft)
1.2	max depth (ft)
9.7	wetted perimeter (ft)
0.8	hydraulic radius (ft)
10.7	width-depth ratio

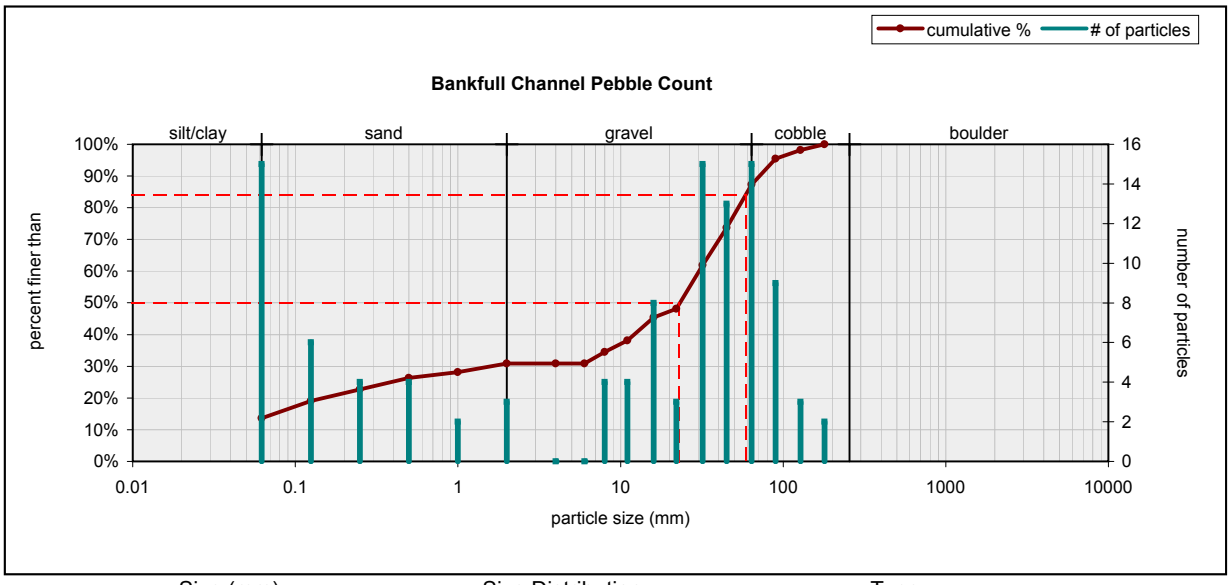
Flood Dimensions	
13.5	Width flood prone area (ft)
1.5	entrenchment ratio
5.1	low bank height (ft)
4.3	low bank height ratio

Flow Resistance	
0.041	Manning's roughness

Bankfull Flow	
5.5	velocity (ft/s)
42.7	discharge rate (cfs)
3	channel slope (%)

Sinuosity	Channel Type
1.08	G4c

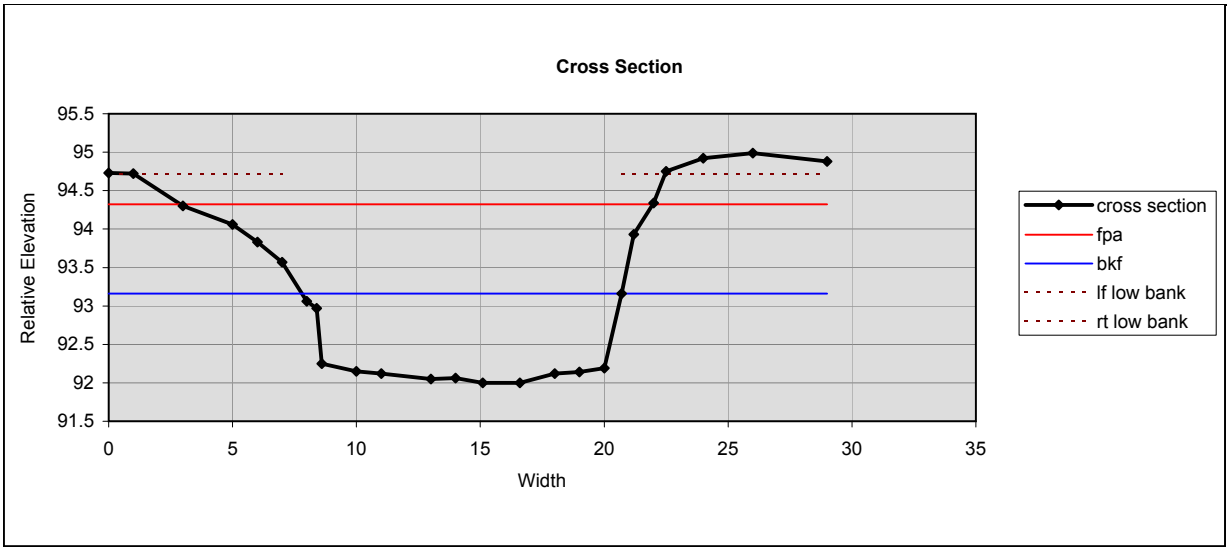
07MP_1_02_2007



Size (mm)	
D16	0.084
D35	8.3
D50	23
D65	35
D84	59
D95	88

Size Distribution	
mean	2.2
dispersion	138.2
skewness	-0.6

Type	
silt/clay	14%
sand	17%
gravel	56%
cobble	13%
boulder	0%
bedrock	0%



Bankfull Dimensions	
12.7	x-section area (ft.sq.)
12.9	width (ft)
1.0	mean depth (ft)
1.2	max depth (ft)
14.0	wetted perimeter (ft)
0.9	hydraulic radius (ft)
13.1	width-depth ratio

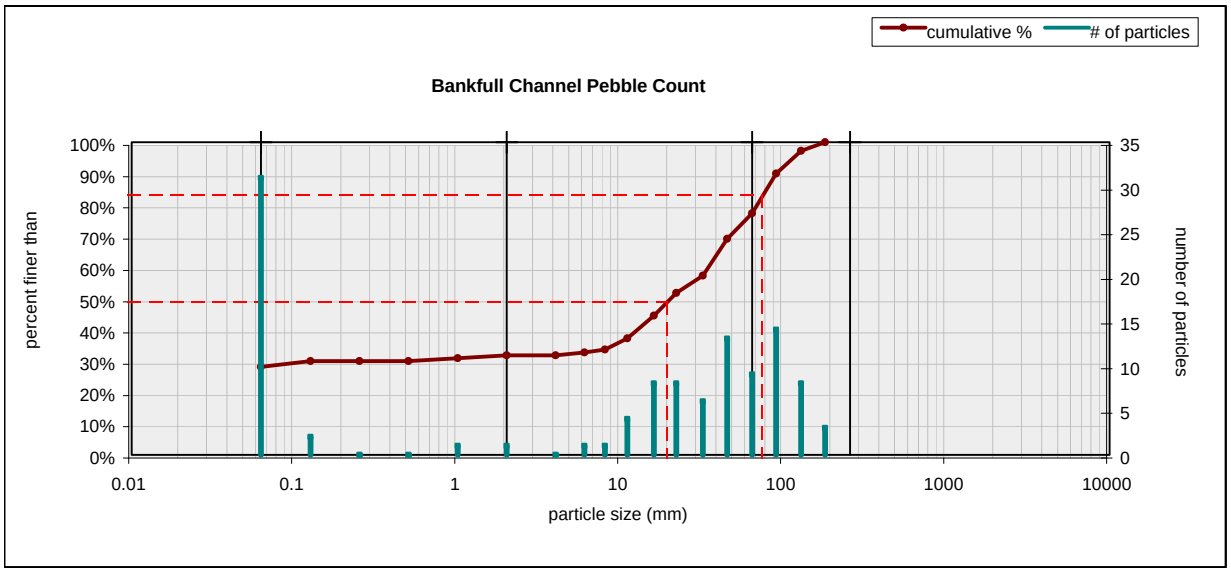
Flood Dimensions	
17.1	Width flood prone area (ft)
1.3	entrenchment ratio
2.7	low bank height (ft)
2.3	low bank height ratio

Flow Resistance	
0.037	Manning's roughness

Bankfull Flow	
3.7	velocity (ft/s)
46.6	discharge rate (cfs)
0.96	channel slope (%)

Sinuosity	Channel Type
1.43	F4

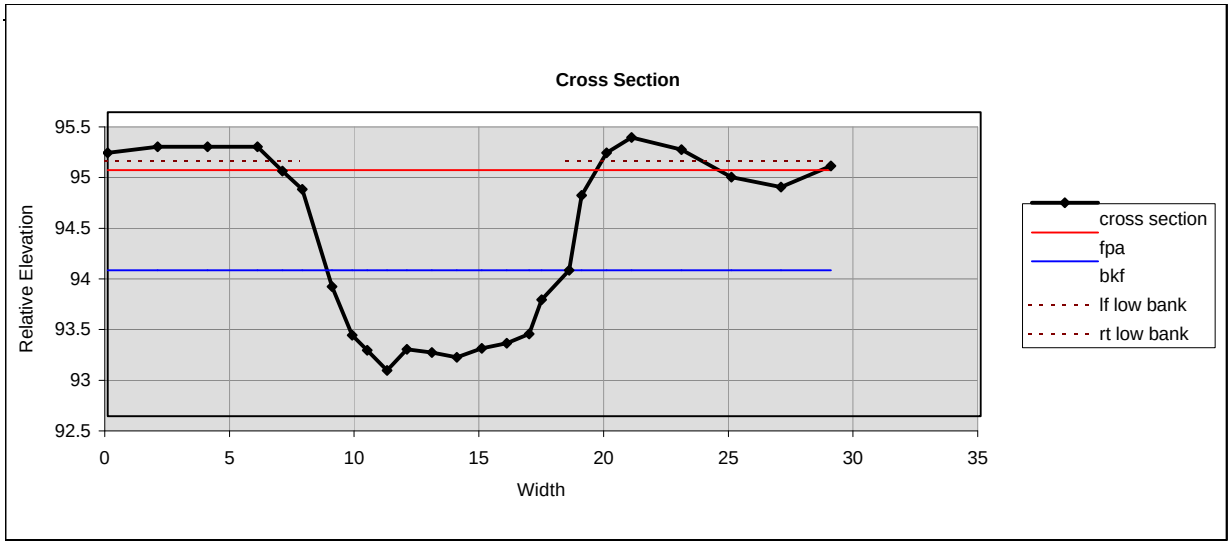
07MP_1_03a_2007



Size (mm)	
D16	0.062
D35	9
D50	20
D65	40
D84	77
D95	110

Size Distribution	
mean	2.2
dispersion	163.2
skewness	-0.5

Type	
silt/clay	28%
sand	4%
gravel	45%
cobble	23%
boulder	0%
bedrock	0%



Bankfull Dimensions	
6.4	x-section area (ft.sq.)
9.7	width (ft)
0.7	mean depth (ft)
1.0	max depth (ft)
10.1	wetted perimeter (ft)
0.6	hydraulic radius (ft)
14.8	width-depth ratio

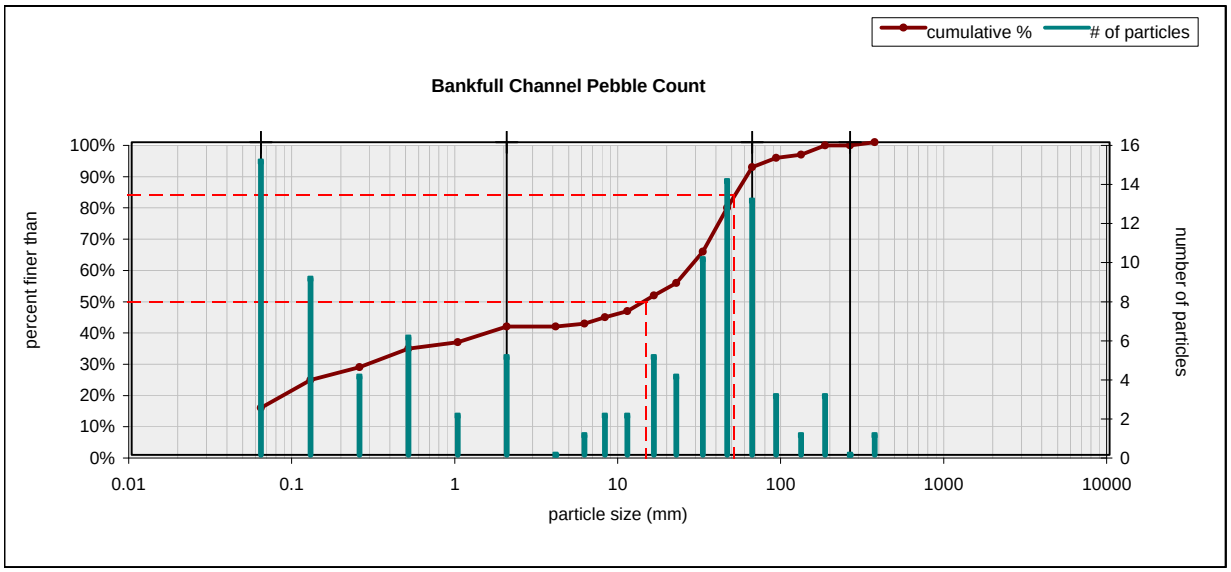
Flood Dimensions	
12.5	Width flood prone area (ft)
1.3	entrenchment ratio
2.2	low bank height (ft)
2.2	low bank height ratio

Flow Resistance	
0.044	Manning's roughness

Bankfull Flow	
3.4	velocity (ft/s)
21.8	discharge rate (cfs)
1.9	channel slope (%)

Sinuosity	Channel Type
1.13	B4

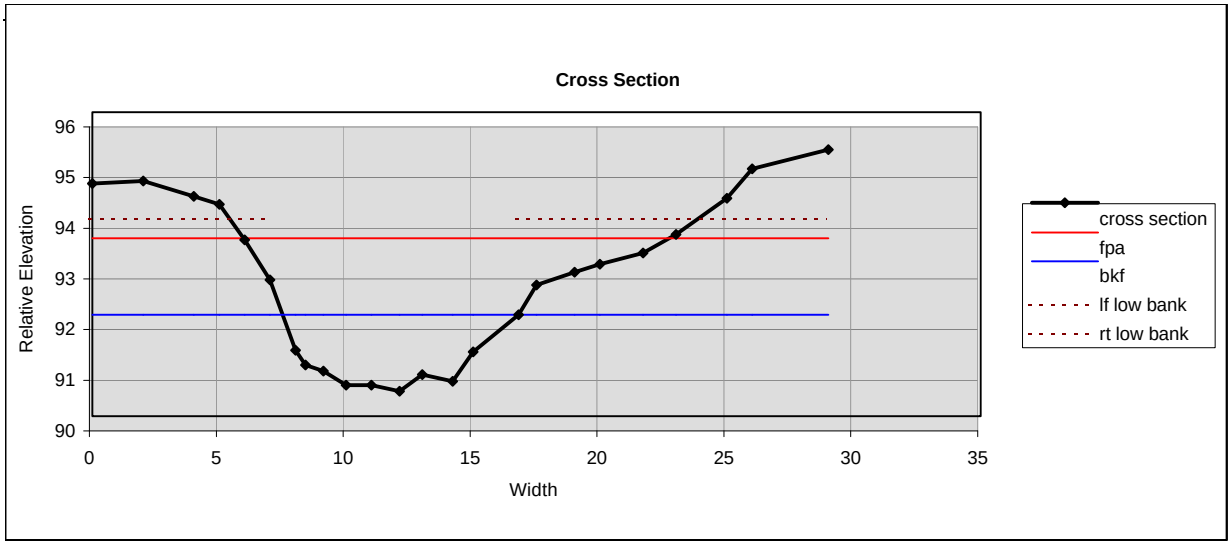
07MP_1_04_2007



Size (mm)	
D16	0.067
D35	0.71
D50	15
D65	32
D84	52
D95	90

Size Distribution	
mean	1.9
dispersion	113.7
skewness	-0.5

Type	
silt/clay	15%
sand	26%
gravel	51%
cobble	7%
boulder	1%
bedrock	0%



Bankfull Dimensions	
9.5	x-section area (ft.sq.)
9.3	width (ft)
1.0	mean depth (ft)
1.5	max depth (ft)
10.2	wetted perimeter (ft)
0.9	hydraulic radius (ft)
9.1	width-depth ratio

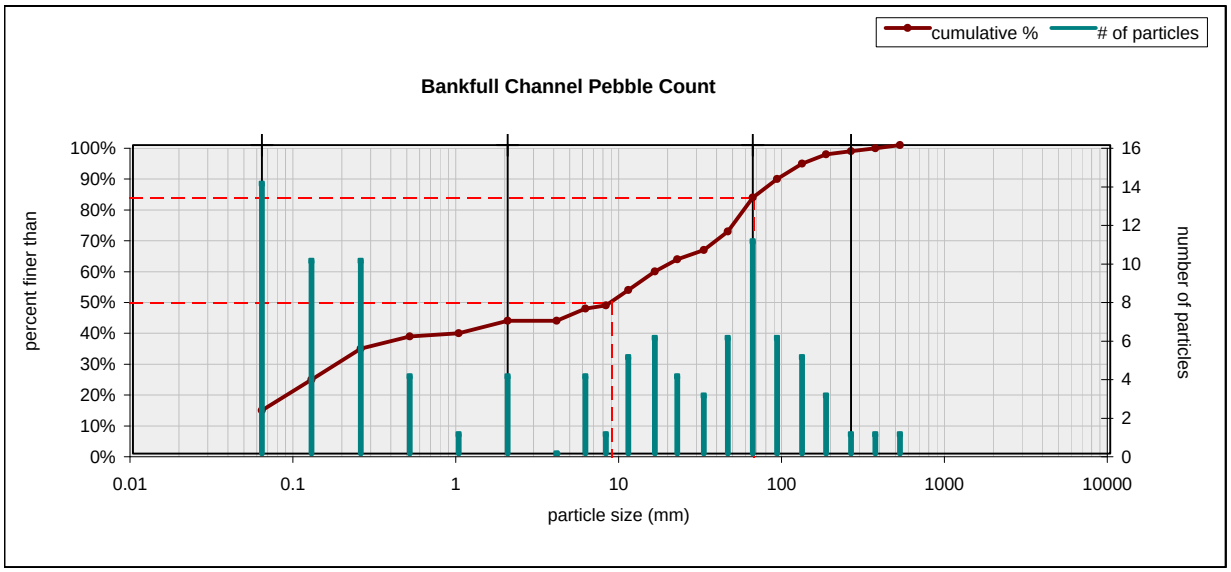
Flood Dimensions	
16.6	Width flood prone area (ft)
1.8	entrenchment ratio
3.7	low bank height (ft)
2.4	low bank height ratio

Flow Resistance	
0.035	Manning's roughness

Bankfull Flow	
3.9	velocity (ft/s)
37.4	discharge rate (cfs)
0.91	channel slope (%)

Sinuosity	Channel Type
1.14	B4

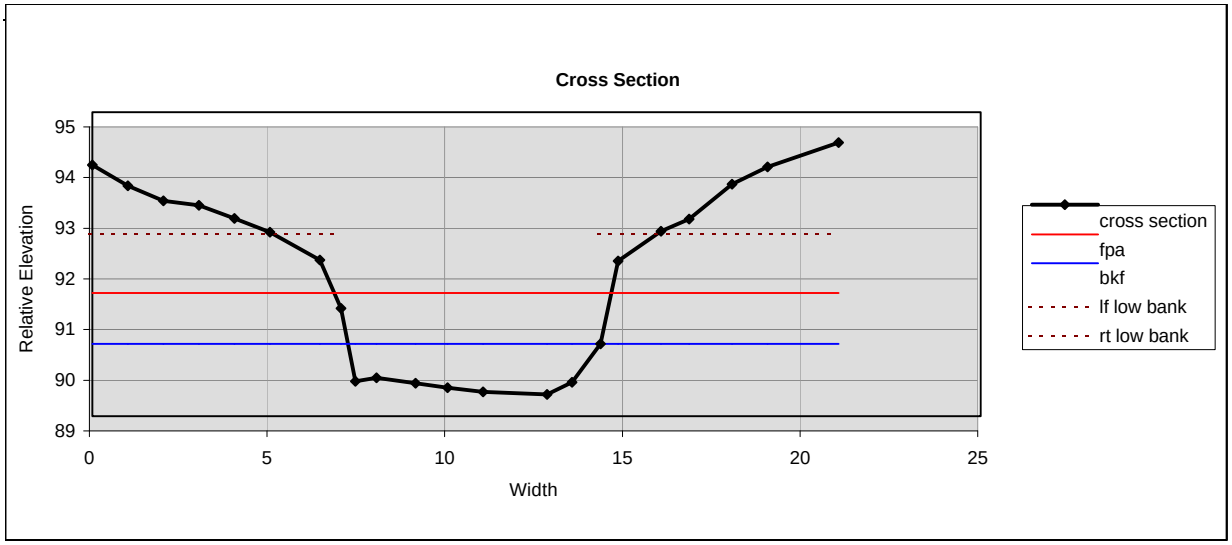
07MP_1_05_2007



Size (mm)	
D16	0.071
D35	0.3
D50	9.1
D65	28
D84	68
D95	140

Size Distribution	
mean	2.2
dispersion	67.8
skewness	-0.4

Type	
silt/clay	14%
sand	29%
gravel	40%
cobble	15%
boulder	2%
bedrock	0%



Bankfull Dimensions	
5.6	x-section area (ft.sq.)
7.1	width (ft)
0.8	mean depth (ft)
1.0	max depth (ft)
8.0	wetted perimeter (ft)
0.7	hydraulic radius (ft)
9.0	width-depth ratio

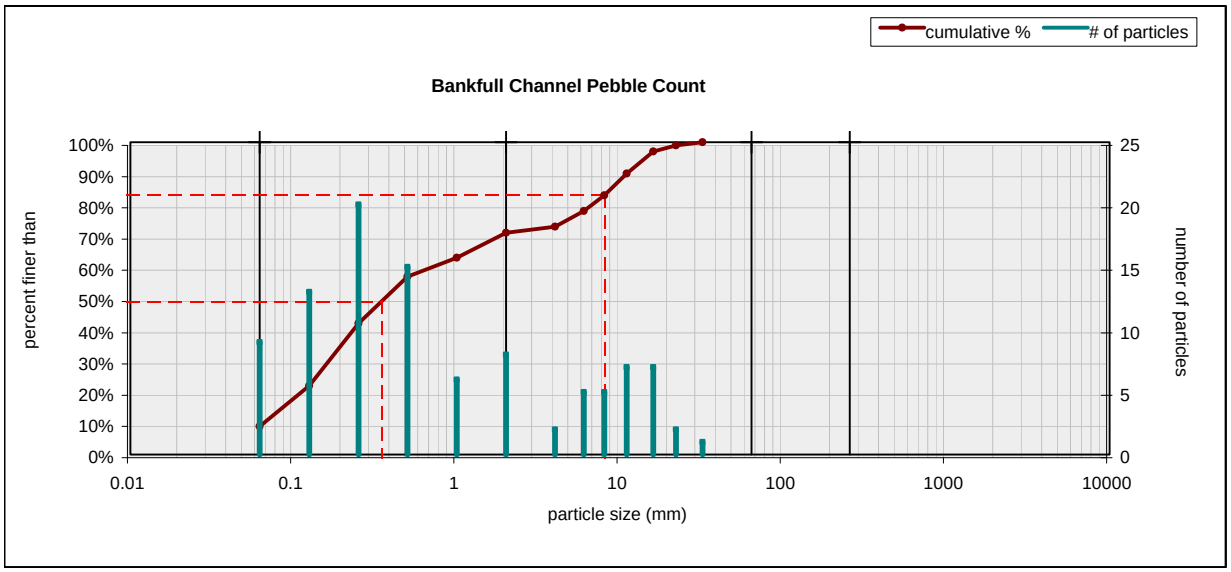
Flood Dimensions	
7.8	Width flood prone area (ft)
1.1	entrenchment ratio
3.5	low bank height (ft)
3.5	low bank height ratio

Flow Resistance	
0.041	Manning's roughness

Bankfull Flow	
5.2	velocity (ft/s)
29.2	discharge rate (cfs)
3.3	channel slope (%)

Sinuosity	Channel Type
1.21	G4

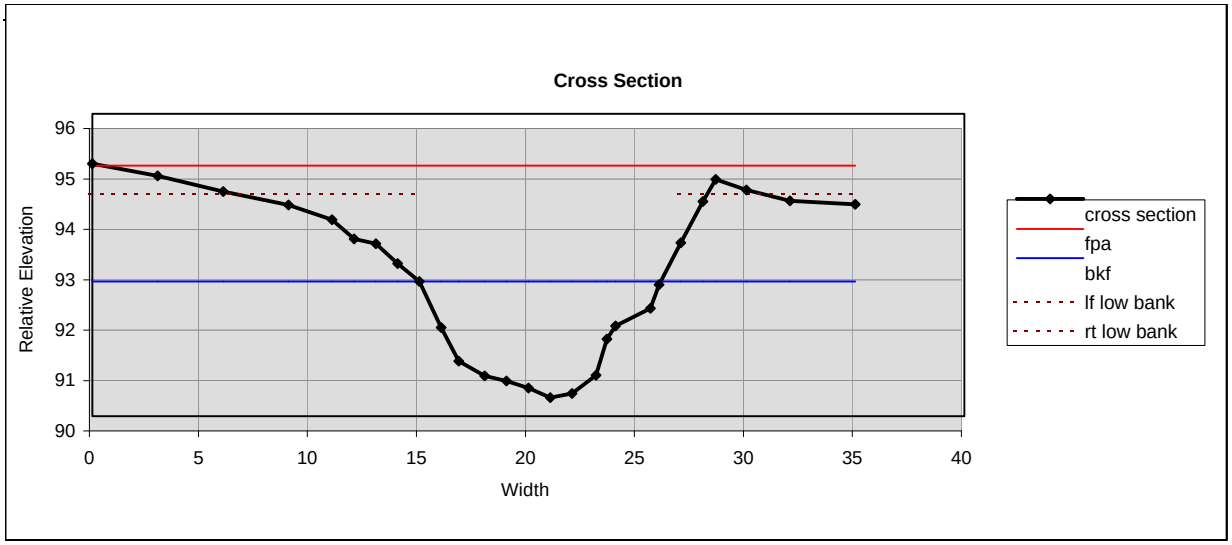
07MP_1_06_2007



Size (mm)	
D16	0.09
D35	0.2
D50	0.36
D65	1.2
D84	8.4
D95	14

Size Distribution	
mean	0.9
dispersion	13.7
skewness	0.3

Type	
silt/clay	9%
sand	62%
gravel	29%
cobble	0%
boulder	0%
bedrock	0%



Bankfull Dimensions	
16.6	x-section area (ft.sq.)
11.1	width (ft)
1.5	mean depth (ft)
2.3	max depth (ft)
12.5	wetted perimeter (ft)
1.3	hydraulic radius (ft)
7.4	width-depth ratio

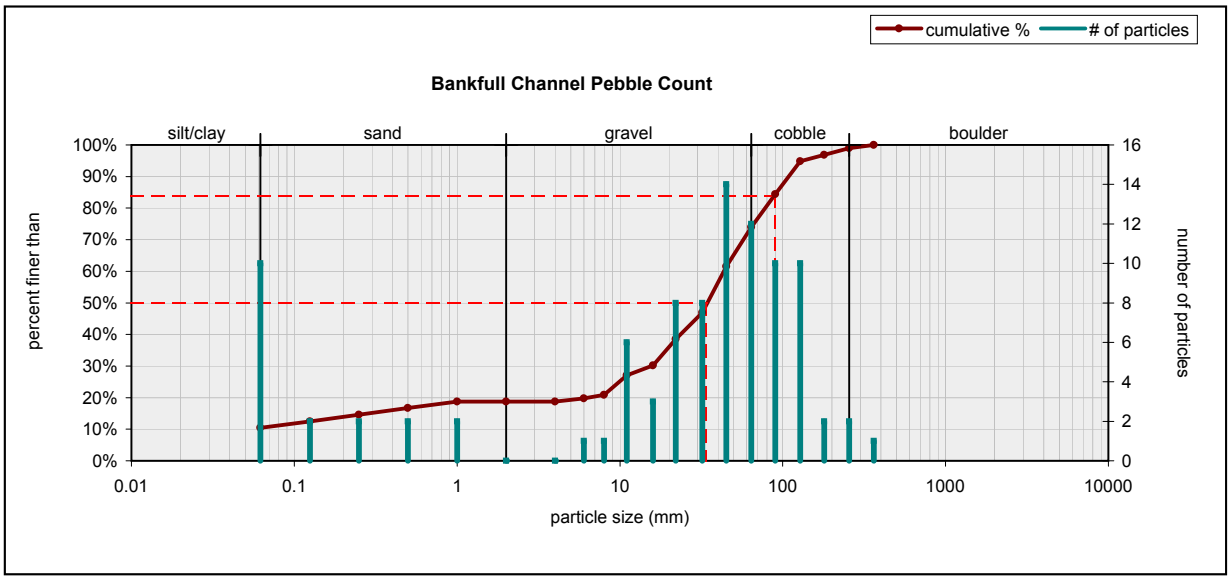
Flood Dimensions	
16.7	Width flood prone area (ft)
1.5	entrenchment ratio
4.3	low bank height (ft)
1.9	low bank height ratio

Flow Resistance	
0.021	Manning's roughness

Bankfull Flow	
4.9	velocity (ft/s)
80.8	discharge rate (cfs)
0.33	channel slope (%)

Sinuosity	Channel Type
1.06	F5

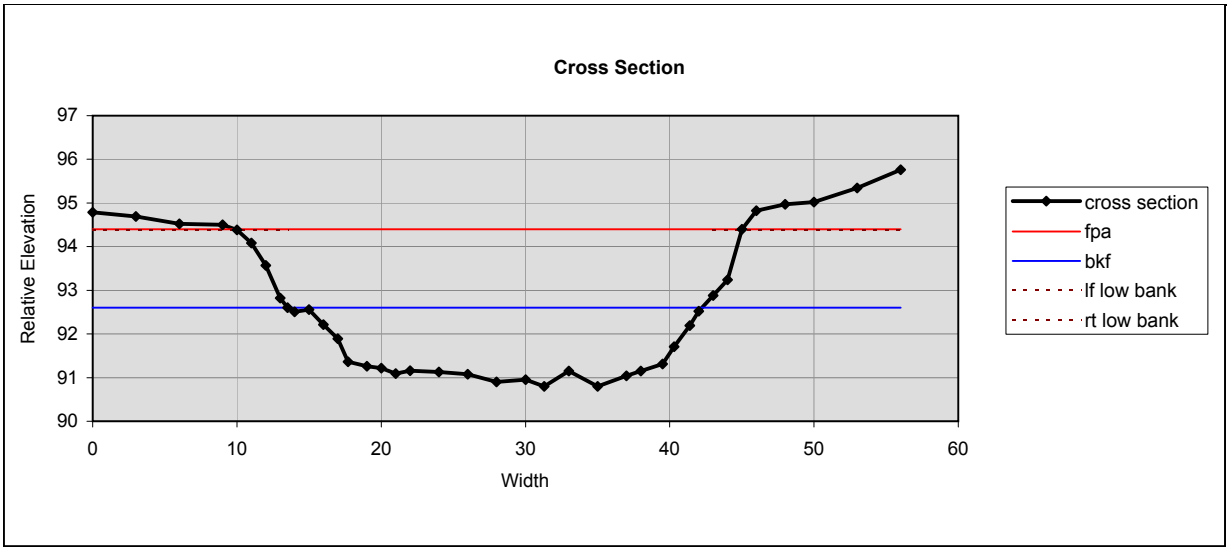
07MP_2_01_2007



Size (mm)	
D16	0.4
D35	19
D50	34
D65	50
D84	89
D95	130

Size Distribution	
mean	6.0
dispersion	43.8
skewness	-0.5

Type	
silt/clay	10%
sand	8%
gravel	53%
cobble	24%
boulder	1%
bedrock	0%



Bankfull Dimensions	
36.9	x-section area (ft.sq.)
28.7	width (ft)
1.3	mean depth (ft)
1.8	max depth (ft)
29.4	wetted perimeter (ft)
1.3	hydraulic radius (ft)
22.4	width-depth ratio

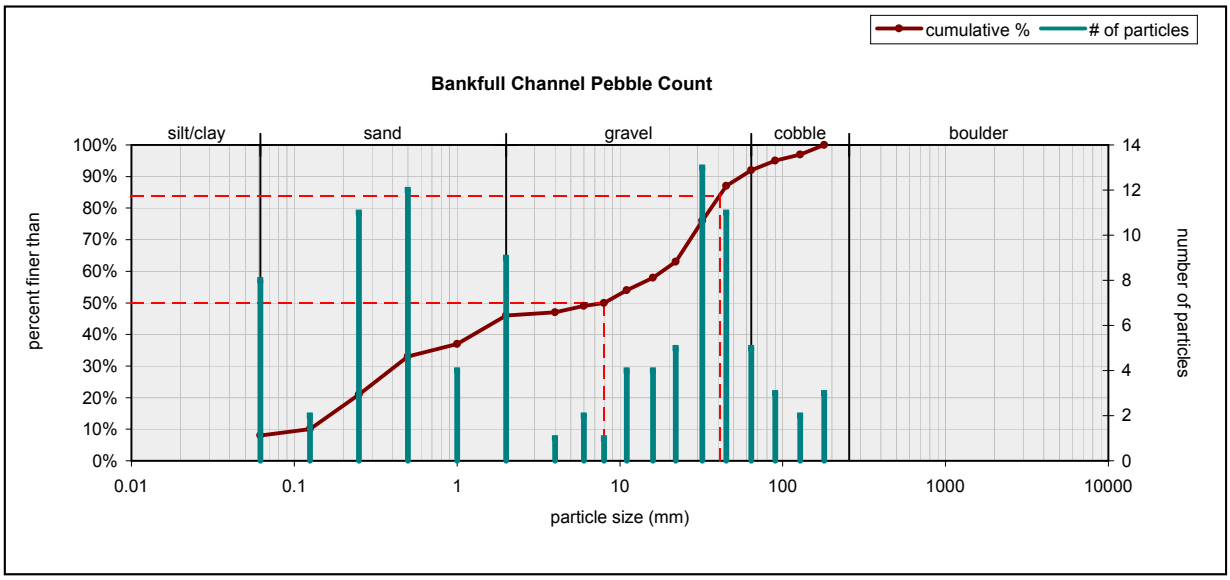
Flood Dimensions	
35.0	Width flood prone area (ft)
1.2	entrenchment ratio
3.6	low bank height (ft)
2.0	low bank height ratio

Flow Resistance	
0.040	Manning's roughness

Bankfull Flow	
4.1	velocity (ft/s)
152.8	discharge rate (cfs)
0.92	channel slope (%)

Sinuosity	Channel Type
1.33	F4

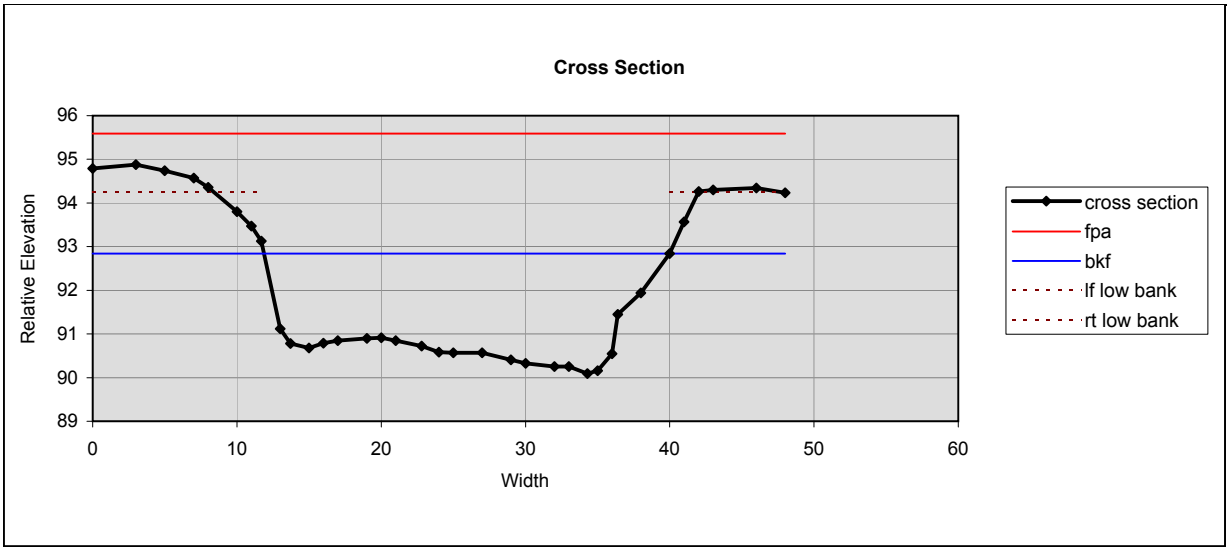
07MP_2_02_2007



Size (mm)	
D16	0.18
D35	0.71
D50	8
D65	23
D84	41
D95	90

Size Distribution	
mean	2.7
dispersion	24.8
skewness	-0.3

Type	
silt/clay	8%
sand	38%
gravel	46%
cobble	8%
boulder	0%
bedrock	0%



Bankfull Dimensions	
56.3	x-section area (ft.sq.)
28.1	width (ft)
2.0	mean depth (ft)
2.8	max depth (ft)
30.1	wetted perimeter (ft)
1.9	hydraulic radius (ft)
14.0	width-depth ratio

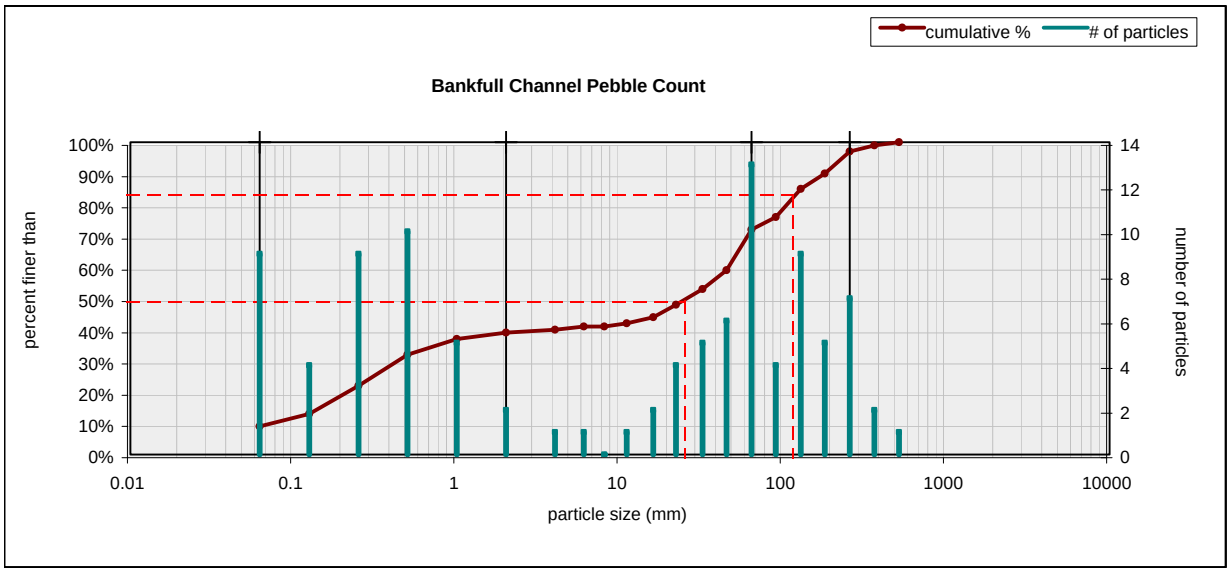
Flood Dimensions	
214.0	Width flood prone area (ft)
7.6	entrenchment ratio
4.2	low bank height (ft)
1.5	low bank height ratio

Flow Resistance	
0.030	Manning's roughness

Bankfull Flow	
5.7	velocity (ft/s)
321.6	discharge rate (cfs)
0.57	channel slope (%)

Sinuosity	Channel Type
1.15	C4

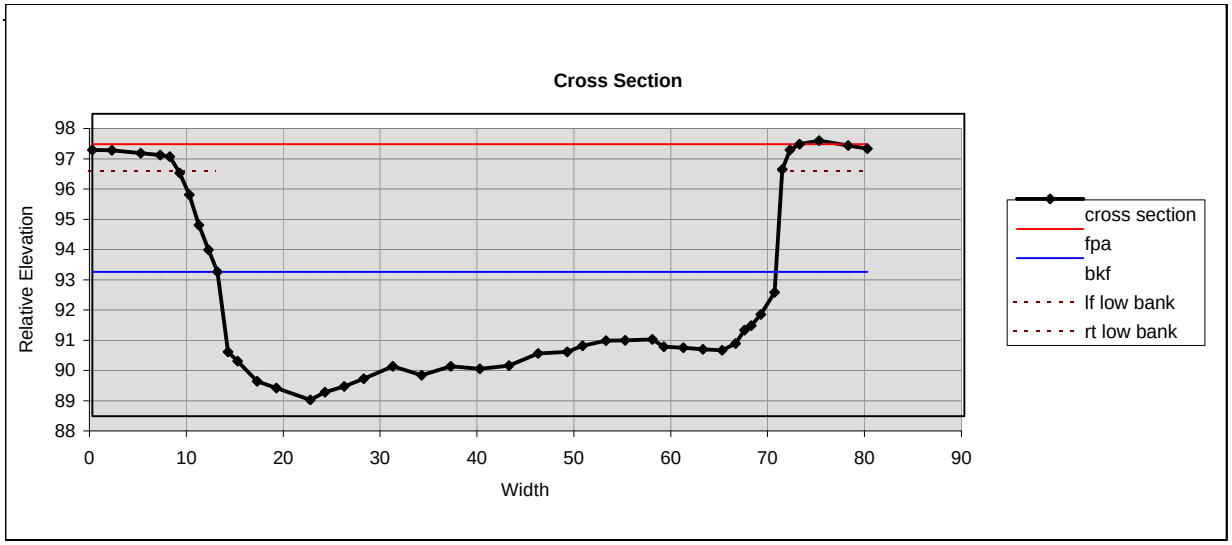
07MP_3_01_2007



Size (mm)	
D16	0.16
D35	0.76
D50	26
D65	53
D84	120
D95	230

Size Distribution	
mean	4.4
dispersion	83.6
skewness	-0.5

Type	
silt/clay	9%
sand	30%
gravel	33%
cobble	25%
boulder	3%
bedrock	0%



Bankfull Dimensions	
167.2	x-section area (ft.sq.)
57.6	width (ft)
2.9	mean depth (ft)
4.2	max depth (ft)
60.7	wetted perimeter (ft)
2.8	hydraulic radius (ft)
19.9	width-depth ratio

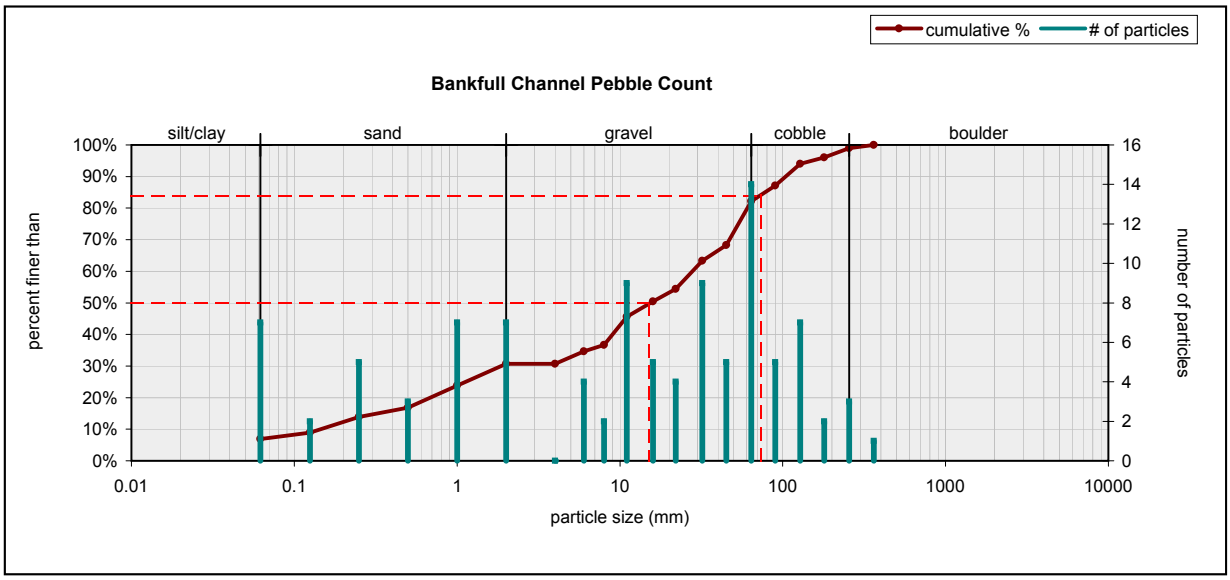
Flood Dimensions	
115.0	Width flood prone area (ft)
2.0	entrenchment ratio
8.0	low bank height (ft)
1.9	low bank height ratio

Flow Resistance	
0.038	Manning's roughness

Bankfull Flow	
3.3	velocity (ft/s)
554.1	discharge rate (cfs)
0.19	channel slope (%)

Sinuosity	Channel Type
1.11	C4

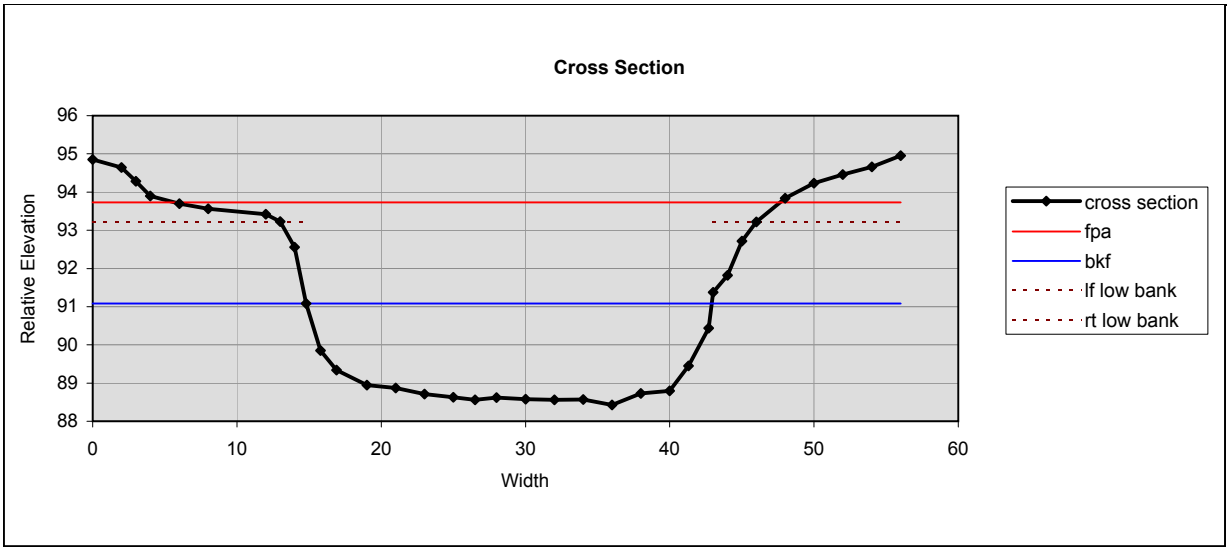
07MP_3_02_2007



Size (mm)	
D16	0.41
D35	6.3
D50	15
D65	36
D84	73
D95	150

Size Distribution	
mean	5.5
dispersion	20.7
skewness	-0.3

Type	
silt/clay	7%
sand	24%
gravel	51%
cobble	17%
boulder	1%
bedrock	0%



Bankfull Dimensions	
61.5	x-section area (ft.sq.)
28.1	width (ft)
2.2	mean depth (ft)
2.6	max depth (ft)
29.8	wetted perimeter (ft)
2.1	hydraulic radius (ft)
12.8	width-depth ratio

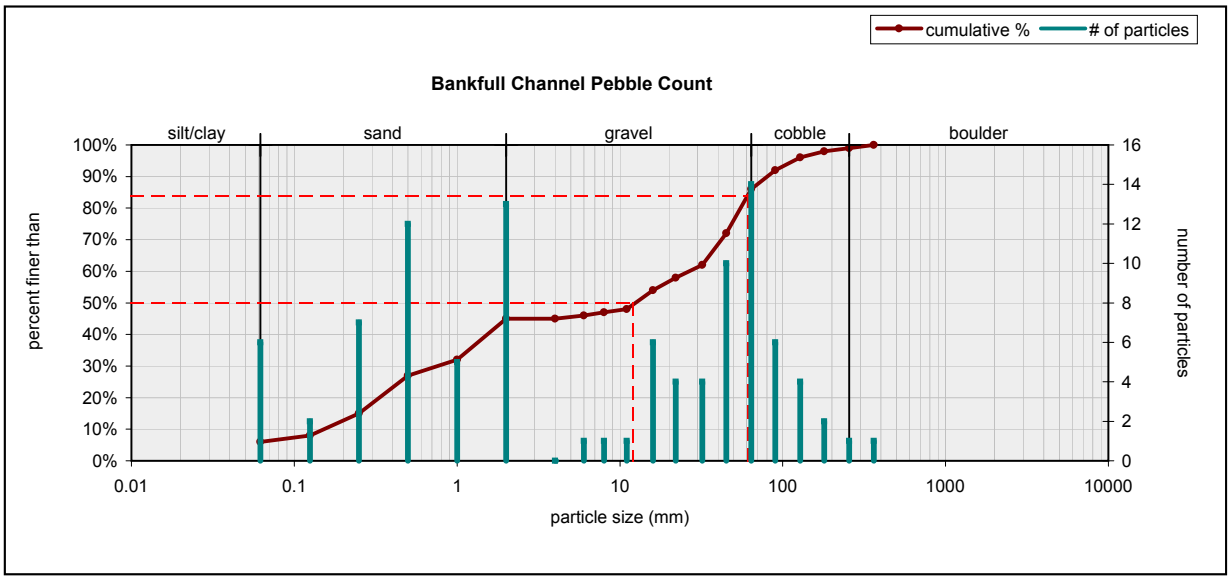
Flood Dimensions	
40.0	Width flood prone area (ft)
1.4	entrenchment ratio
4.8	low bank height (ft)
1.8	low bank height ratio

Flow Resistance	
0.035	Manning's roughness

Bankfull Flow	
4.4	velocity (ft/s)
271.3	discharge rate (cfs)
0.41	channel slope (%)

Sinuosity	Channel Type
1.14	F4

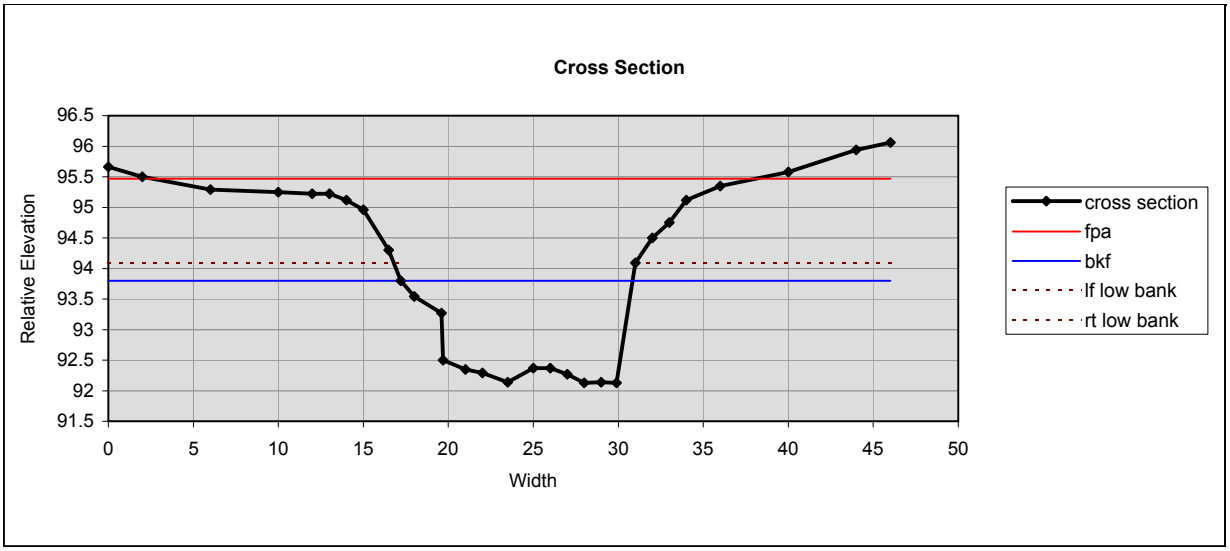
08MP_1_01_2007



Size (mm)	
D16	0.26
D35	1.2
D50	12
D65	35
D84	61
D95	120

Size Distribution	
mean	4.0
dispersion	25.6
skewness	-0.3

Type	
silt/clay	6%
sand	39%
gravel	41%
cobble	13%
boulder	1%
bedrock	0%



Bankfull Dimensions	
17.2	x-section area (ft.sq.)
13.6	width (ft)
1.3	mean depth (ft)
1.7	max depth (ft)
15.4	wetted perimeter (ft)
1.1	hydraulic radius (ft)
10.8	width-depth ratio

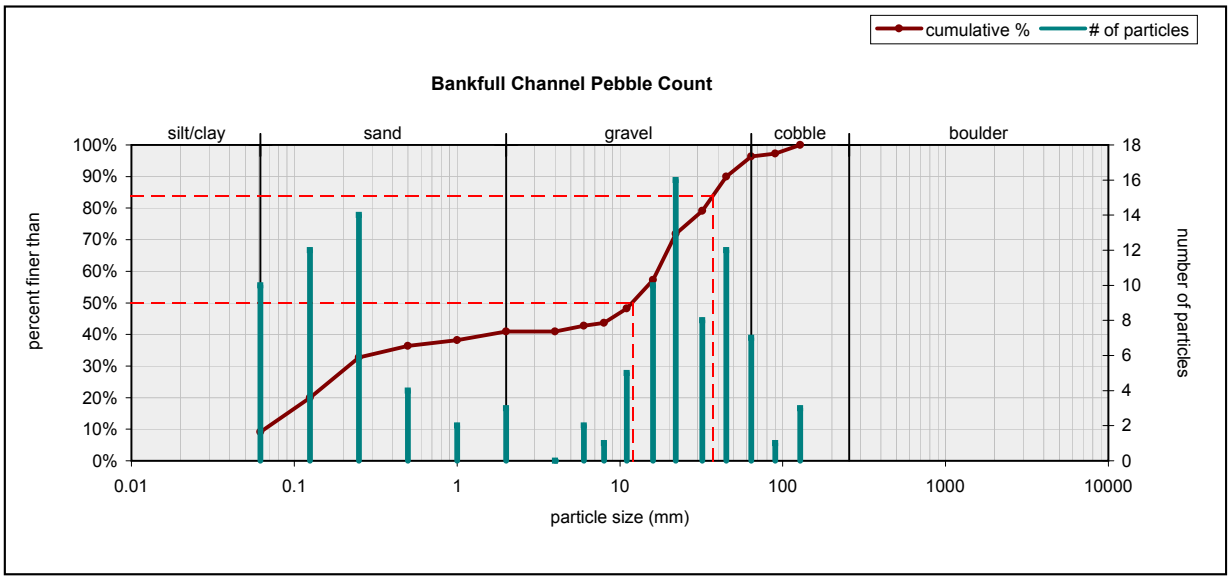
Flood Dimensions	
36.0	Width flood prone area (ft)
2.6	entrenchment ratio
2.0	low bank height (ft)
1.2	low bank height ratio

Flow Resistance	
0.036	Manning's roughness

Bankfull Flow	
4.7	velocity (ft/s)
81.4	discharge rate (cfs)
1.1	channel slope (%)

Sinuosity	Channel Type
1.00	E4

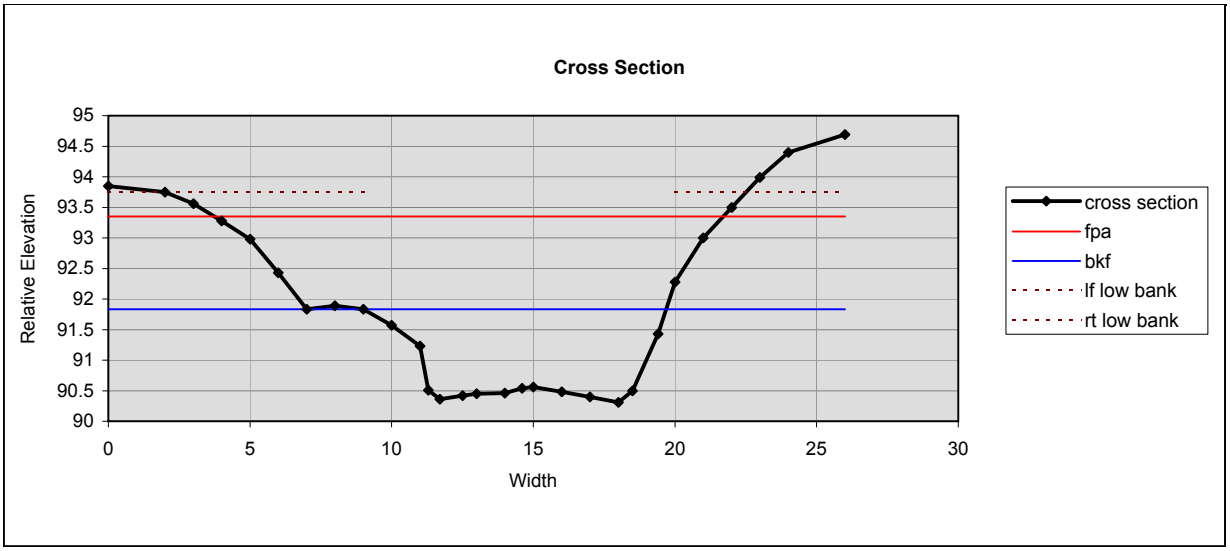
08MP_1_02_2007



Size (mm)	
D16	0.097
D35	0.39
D50	12
D65	19
D84	37
D95	59

Size Distribution	
mean	1.9
dispersion	63.4
skewness	-0.5

Type	
silt/clay	9%
sand	32%
gravel	55%
cobble	4%
boulder	0%
bedrock	0%



Bankfull Dimensions	
11.7	x-section area (ft.sq.)
10.7	width (ft)
1.1	mean depth (ft)
1.5	max depth (ft)
11.9	wetted perimeter (ft)
1.0	hydraulic radius (ft)
9.8	width-depth ratio

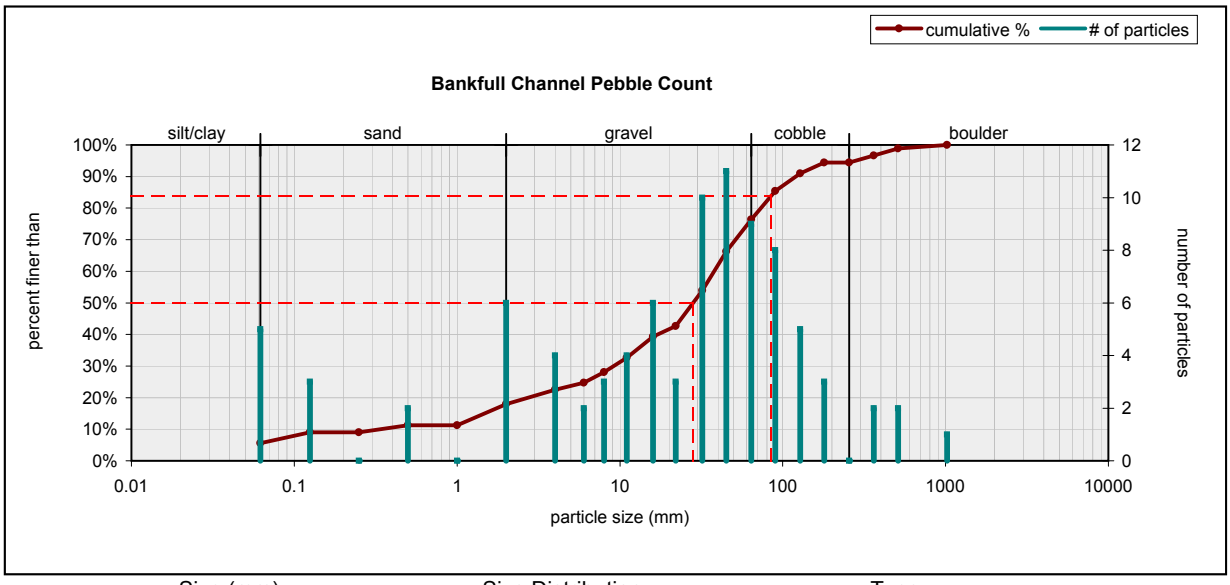
Flood Dimensions	
17.4	Width flood prone area (ft)
1.6	entrenchment ratio
3.4	low bank height (ft)
2.3	low bank height ratio

Flow Resistance	
0.031	Manning's roughness

Bankfull Flow	
5.6	velocity (ft/s)
65.3	discharge rate (cfs)
1.4	channel slope (%)

Sinuosity	Channel Type
1.30	B4c

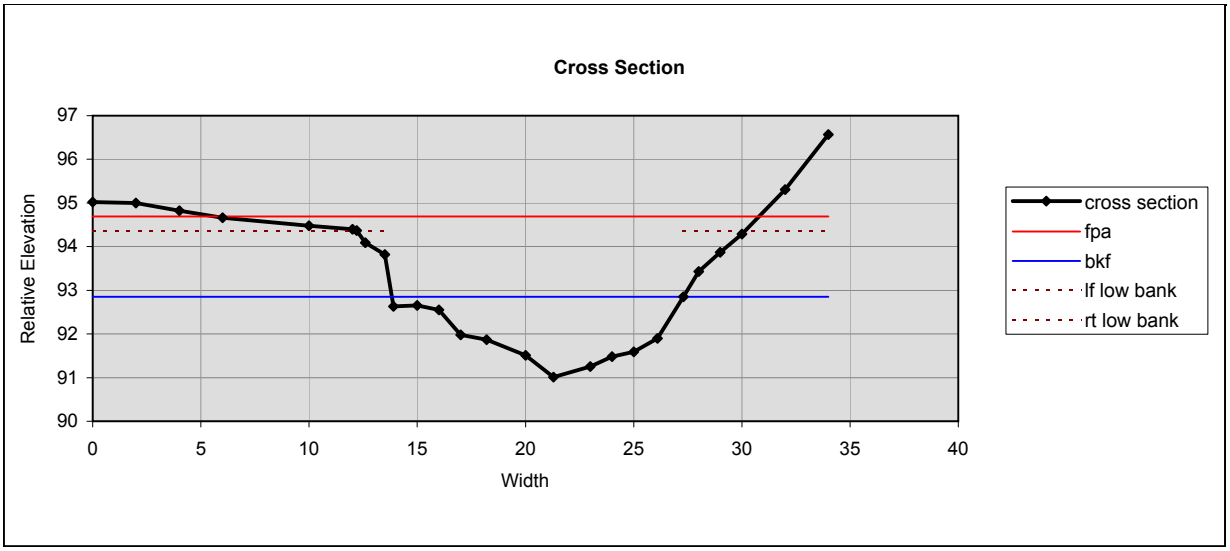
08MP_1_03a_2007



Size (mm)	
D16	1.6
D35	13
D50	28
D65	43
D84	85
D95	280

Size Distribution	
mean	11.7
dispersion	10.3
skewness	-0.3

Type	
silt/clay	5%
sand	11%
gravel	53%
cobble	16%
boulder	5%
bedrock	0%



Bankfull Dimensions	
13.8	x-section area (ft.sq.)
13.5	width (ft)
1.0	mean depth (ft)
1.8	max depth (ft)
14.3	wetted perimeter (ft)
1.0	hydraulic radius (ft)
13.1	width-depth ratio

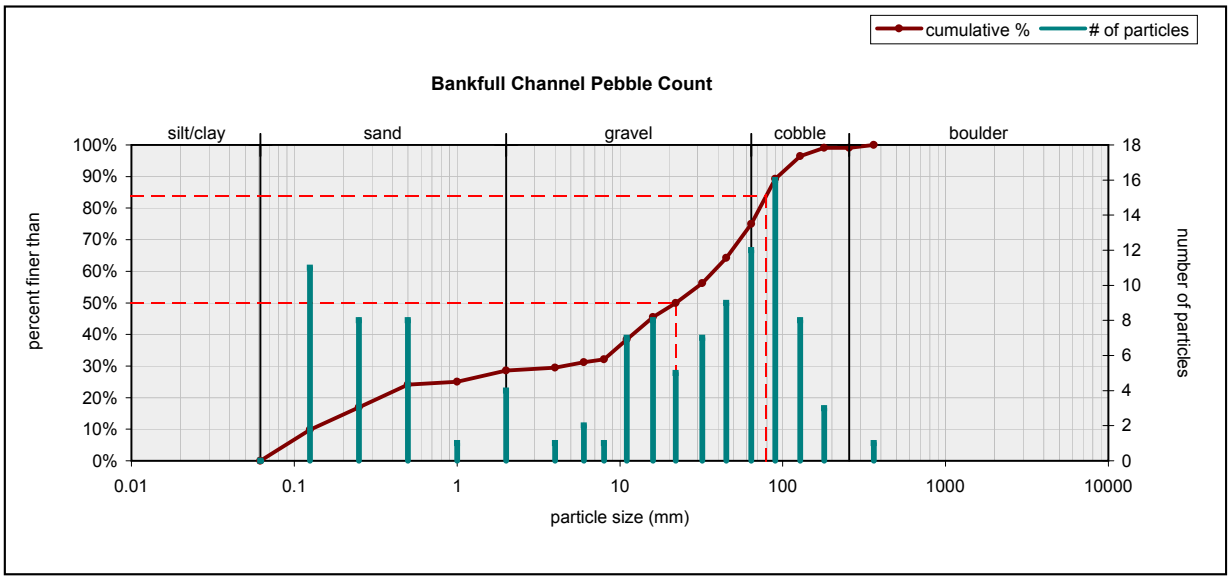
Flood Dimensions	
25.0	Width flood prone area (ft)
1.9	entrenchment ratio
3.4	low bank height (ft)
1.8	low bank height ratio

Flow Resistance	
0.040	Manning's roughness

Bankfull Flow	
6.5	velocity (ft/s)
89.6	discharge rate (cfs)
3.2	channel slope (%)

Sinuosity	Channel Type
1.12	B4

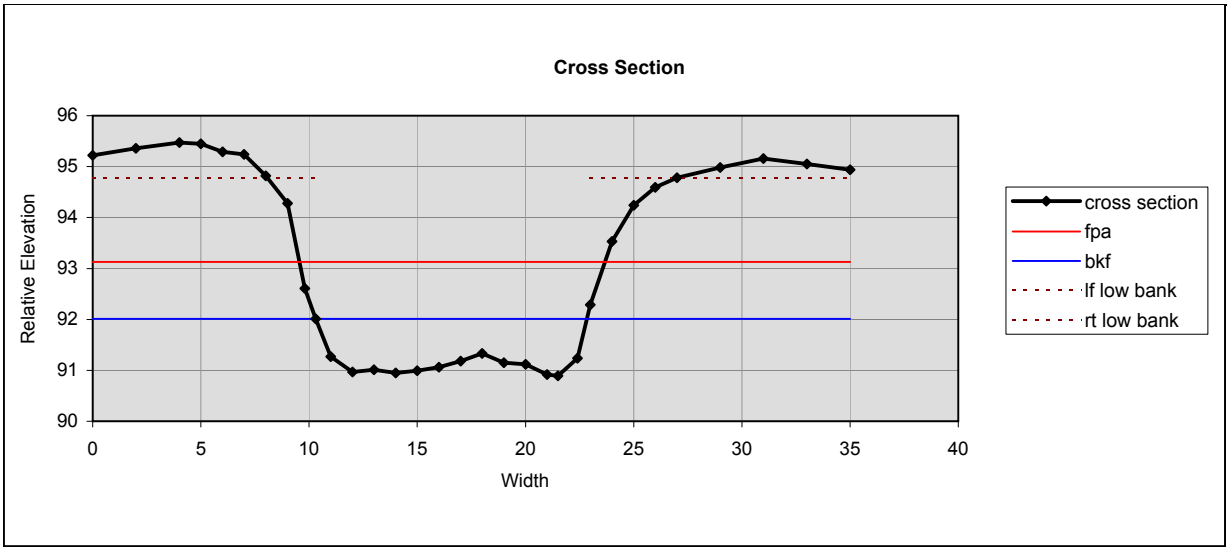
08MP_1_04_2007



Size (mm)	
D16	0.23
D35	9.3
D50	22
D65	46
D84	79
D95	120

Size Distribution	
mean	4.3
dispersion	49.6
skewness	-0.4

Type	
silt/clay	0%
sand	29%
gravel	46%
cobble	24%
boulder	1%
bedrock	0%



Bankfull Dimensions	
11.1	x-section area (ft.sq.)
12.5	width (ft)
0.9	mean depth (ft)
1.1	max depth (ft)
13.5	wetted perimeter (ft)
0.8	hydraulic radius (ft)
14.2	width-depth ratio

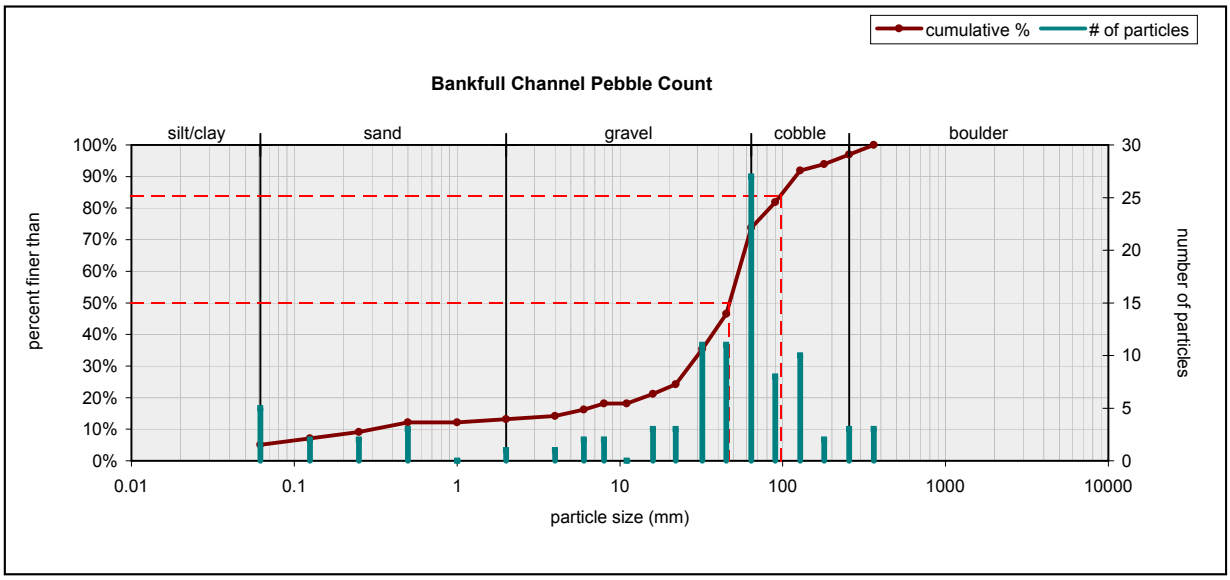
Flood Dimensions	
172.0	Width flood prone area (ft)
13.7	entrenchment ratio
3.9	low bank height (ft)
3.5	low bank height ratio

Flow Resistance	
0.042	Manning's roughness

Bankfull Flow	
3.0	velocity (ft/s)
32.8	discharge rate (cfs)
0.92	channel slope (%)

Sinuosity	Channel Type
1.43	C4

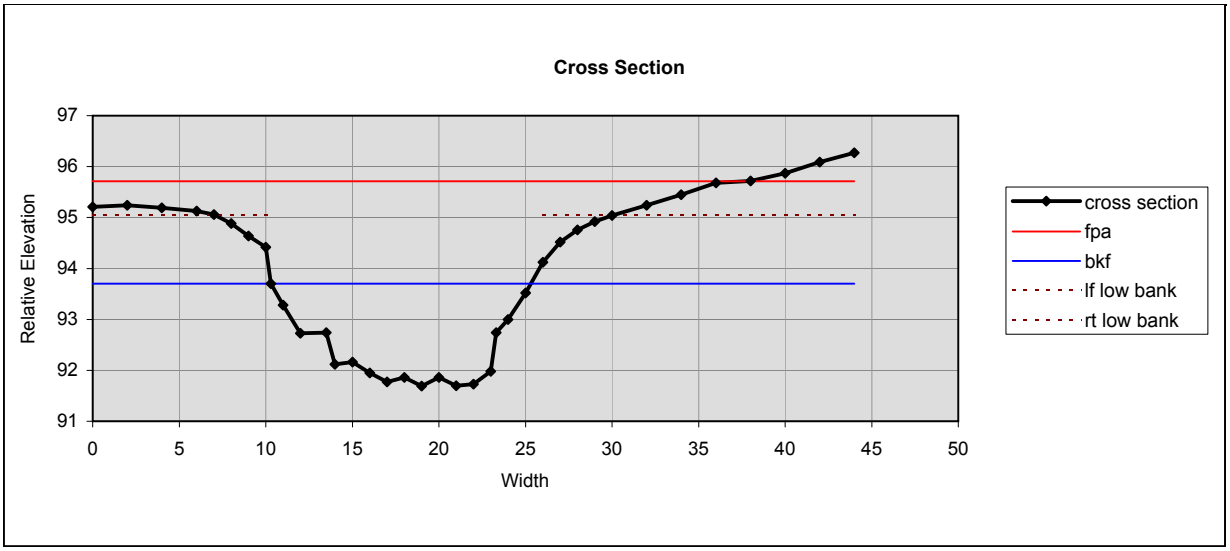
08MP_1_05_2007



Size (mm)	
D16	5.8
D35	32
D50	47
D65	57
D84	97
D95	200

Size Distribution	
mean	23.7
dispersion	5.1
skewness	-0.3

Type	
silt/clay	5%
sand	8%
gravel	61%
cobble	23%
boulder	3%
bedrock	0%



Bankfull Dimensions	
20.9	x-section area (ft.sq.)
15.0	width (ft)
1.4	mean depth (ft)
2.0	max depth (ft)
16.4	wetted perimeter (ft)
1.3	hydraulic radius (ft)
10.8	width-depth ratio

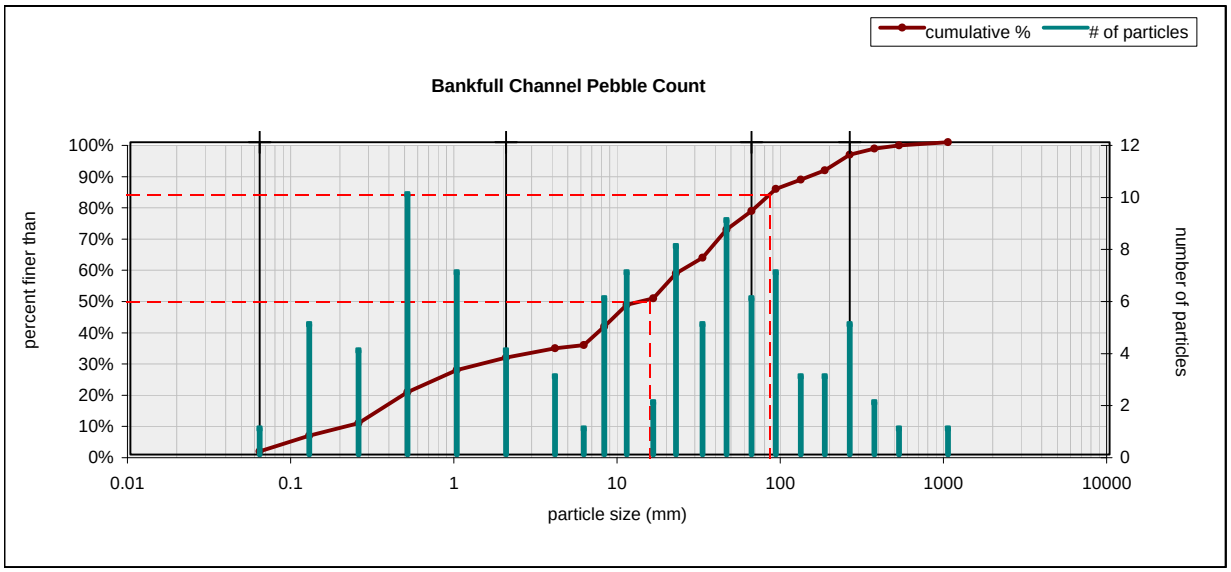
Flood Dimensions	
95.0	Width flood prone area (ft)
6.3	entrenchment ratio
3.4	low bank height (ft)
1.7	low bank height ratio

Flow Resistance	
0.041	Manning's roughness

Bankfull Flow	
4.2	velocity (ft/s)
88.4	discharge rate (cfs)
0.97	channel slope (%)

Sinuosity	Channel Type
1.05	C4

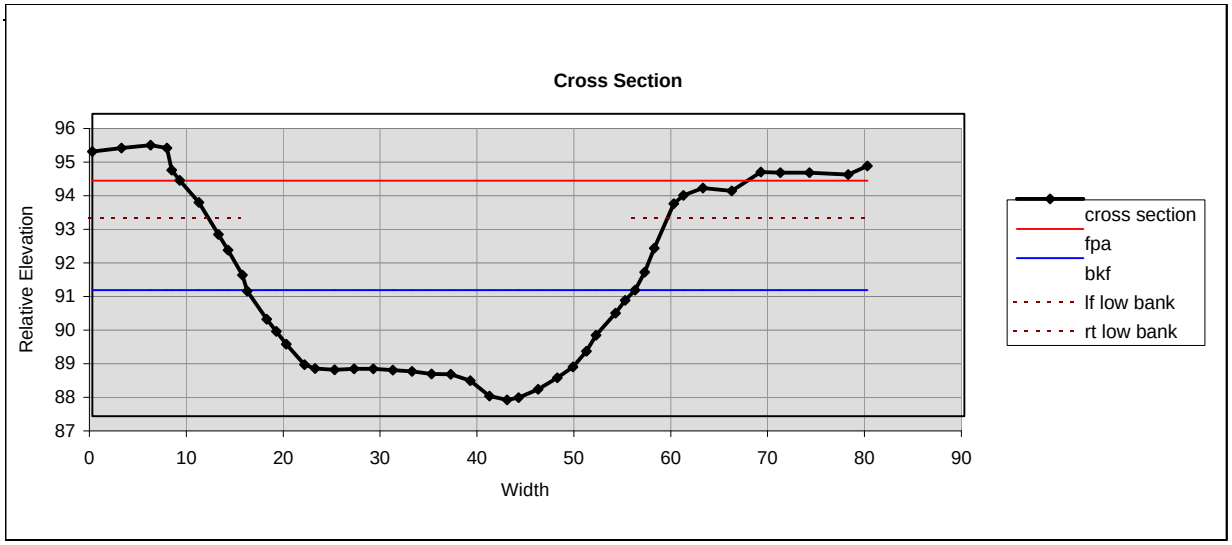
08MP_3_01_2007



Size (mm)	
D16	0.38
D35	6
D50	16
D65	35
D84	86
D95	240

Size Distribution	
mean	5.7
dispersion	23.7
skewness	-0.3

Type	
silt/clay	1%
sand	30%
gravel	47%
cobble	18%
boulder	4%
bedrock	0%



Bankfull Dimensions	
86.4	x-section area (ft.sq.)
40.0	width (ft)
2.2	mean depth (ft)
3.3	max depth (ft)
41.0	wetted perimeter (ft)
2.1	hydraulic radius (ft)
18.5	width-depth ratio

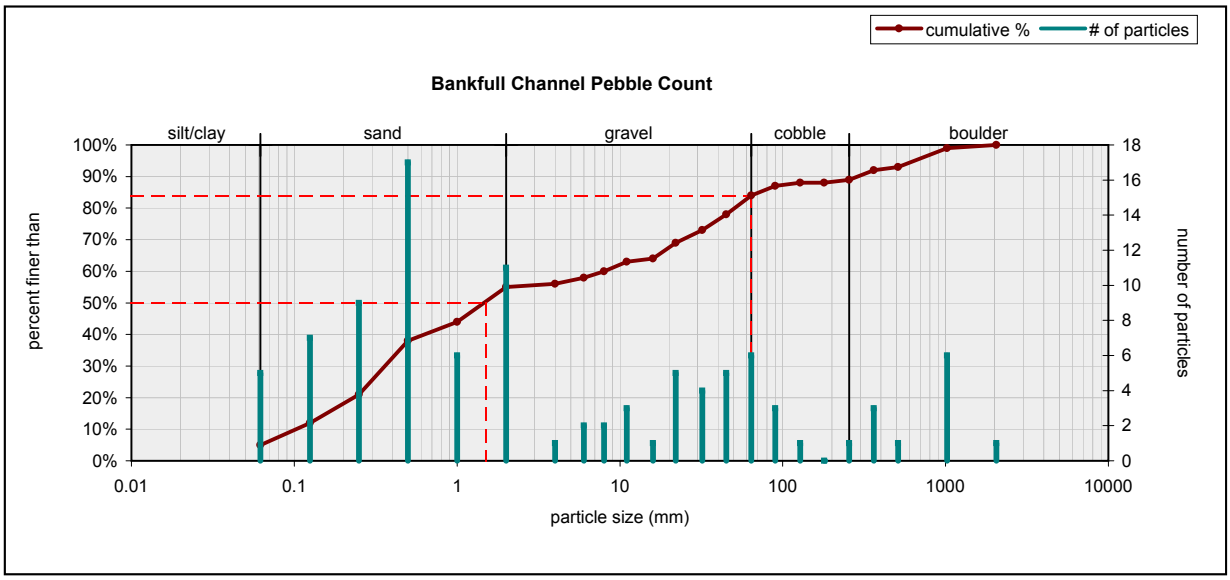
Flood Dimensions	
58.0	Width flood prone area (ft)
1.4	entrenchment ratio
5.8	low bank height (ft)
1.8	low bank height ratio

Flow Resistance	
0.036	Manning's roughness

Bankfull Flow	
1.0	velocity (ft/s)
83.0	discharge rate (cfs)
0.02	channel slope (%)

Sinuosity	Channel Type
1.14	C4

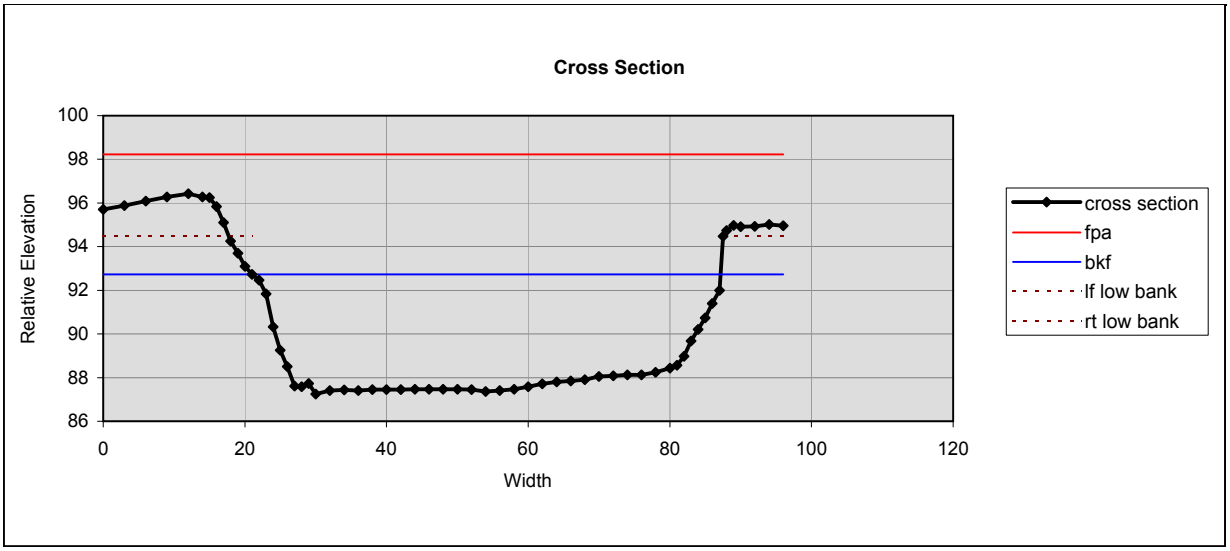
08MP_4_01_2007



Size (mm)	
D16	0.17
D35	0.44
D50	1.5
D65	17
D84	64
D95	650

Size Distribution	
mean	3.3
dispersion	25.7
skewness	0.2

Type	
silt/clay	5%
sand	50%
gravel	29%
cobble	5%
boulder	11%
bedrock	0%



Bankfull Dimensions	
302.2	x-section area (ft.sq.)
66.1	width (ft)
4.6	mean depth (ft)
5.5	max depth (ft)
69.9	wetted perimeter (ft)
4.3	hydraulic radius (ft)
14.5	width-depth ratio

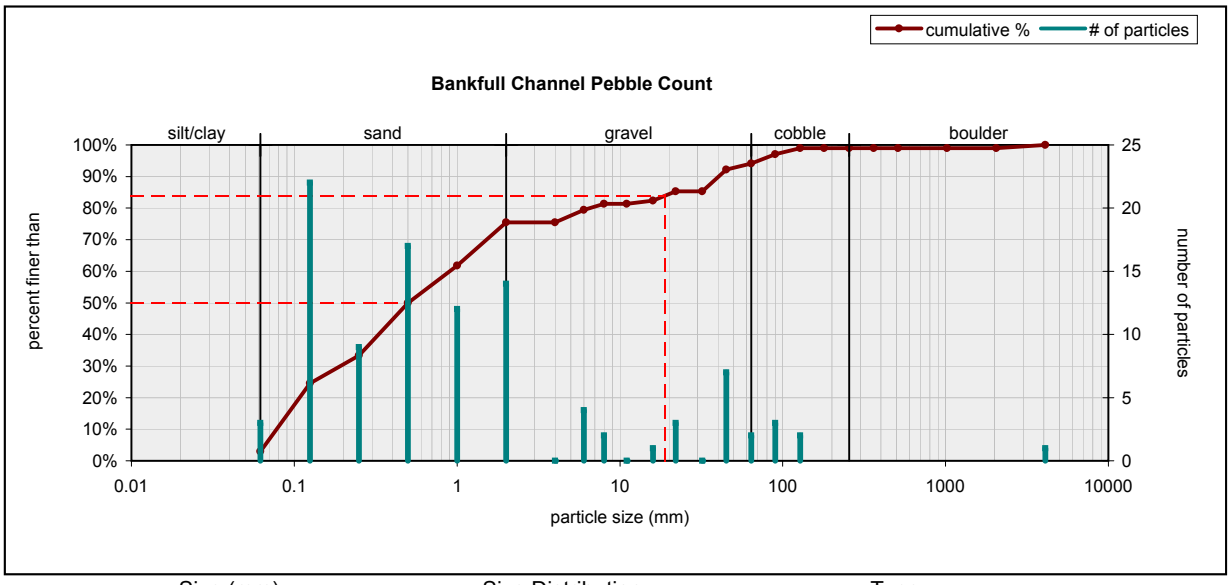
Flood Dimensions	
225.0	Width flood prone area (ft)
3.4	entrenchment ratio
7.2	low bank height (ft)
1.3	low bank height ratio

Flow Resistance	
0.032	Manning's roughness

Bankfull Flow	
15.3	velocity (ft/s)
4634.4	discharge rate (cfs)
1.5	channel slope (%)

Sinuosity	Channel Type
1.09	C5

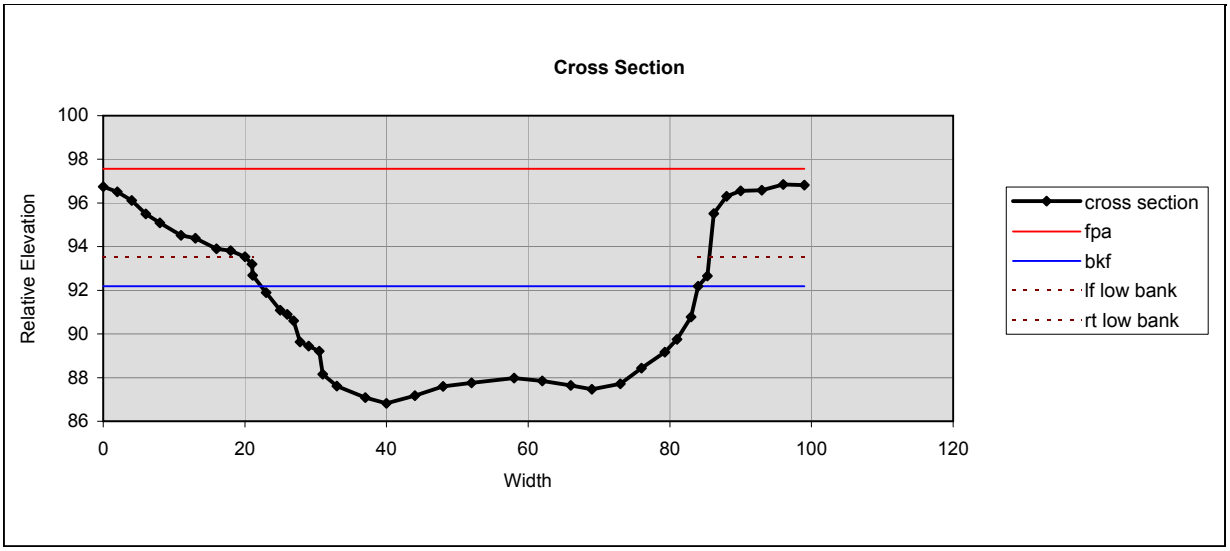
08MP_4_02_2007



Size (mm)	
D16	0.095
D35	0.27
D50	0.5
D65	1.2
D84	19
D95	71

Size Distribution	
mean	1.3
dispersion	21.6
skewness	0.3

Type	
silt/clay	3%
sand	73%
gravel	19%
cobble	5%
boulder	1%
bedrock	0%



Bankfull Dimensions	
242.6	x-section area (ft.sq.)
61.7	width (ft)
3.9	mean depth (ft)
5.4	max depth (ft)
64.6	wetted perimeter (ft)
3.8	hydraulic radius (ft)
15.7	width-depth ratio

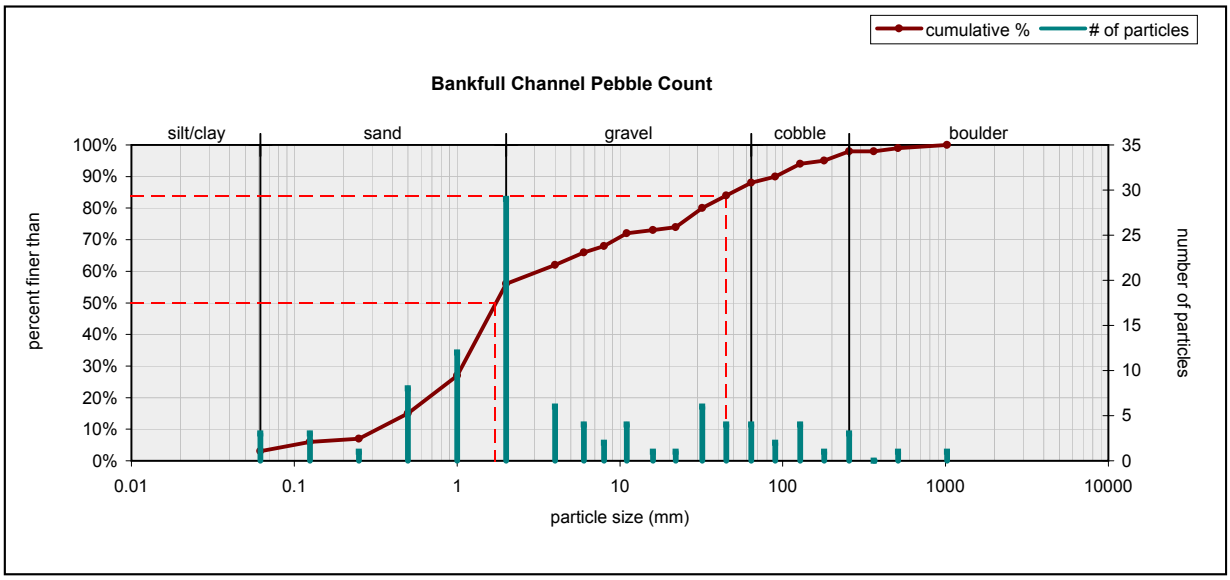
Flood Dimensions	
250.0	Width flood prone area (ft)
4.1	entrenchment ratio
6.7	low bank height (ft)
1.2	low bank height ratio

Flow Resistance	
0.024	Manning's roughness

Bankfull Flow	
11.9	velocity (ft/s)
2881.4	discharge rate (cfs)
0.65	channel slope (%)

Sinuosity	Channel Type
1.00	C5

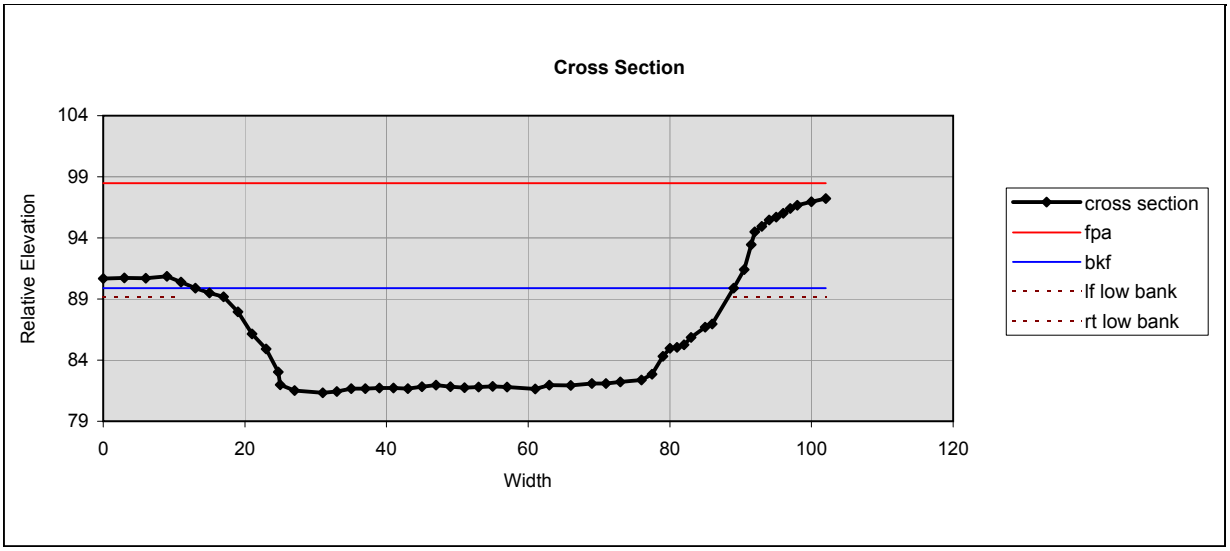
08MP_4_03_2007



Size (mm)	
D16	0.53
D35	1.2
D50	1.7
D65	5.4
D84	45
D95	180

Size Distribution	
mean	4.9
dispersion	14.8
skewness	0.3

Type	
silt/clay	3%
sand	53%
gravel	32%
cobble	10%
boulder	2%
bedrock	0%



Bankfull Dimensions	
498.4	x-section area (ft.sq.)
76.0	width (ft)
6.6	mean depth (ft)
8.6	max depth (ft)
81.7	wetted perimeter (ft)
6.1	hydraulic radius (ft)
11.6	width-depth ratio

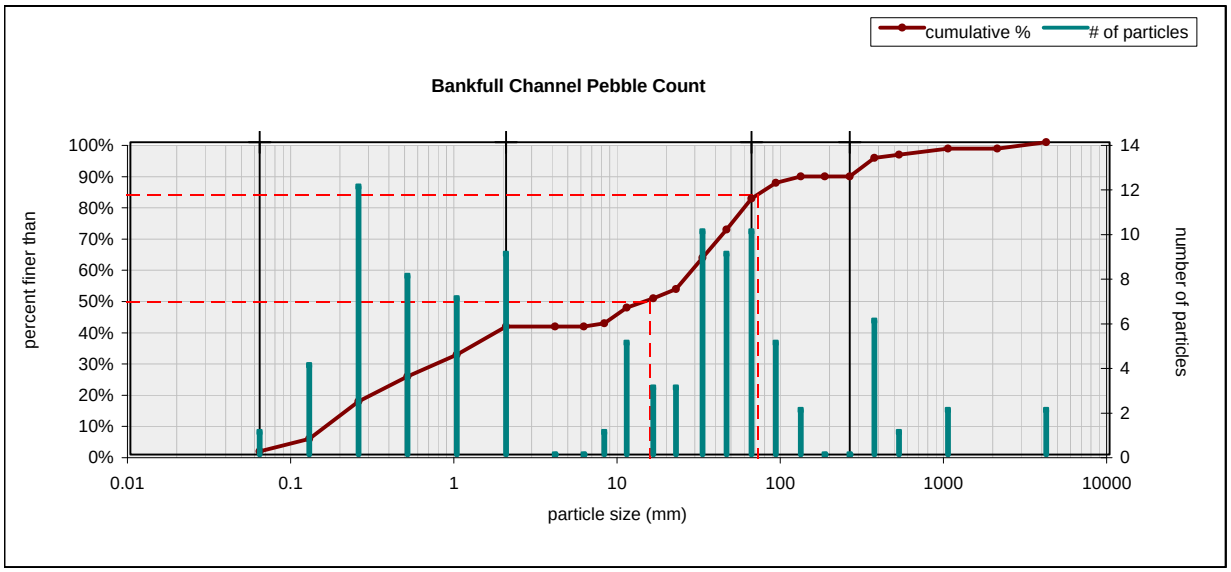
Flood Dimensions	
330.0	Width flood prone area (ft)
4.3	entrenchment ratio
7.9	low bank height (ft)
0.9	low bank height ratio

Flow Resistance	
0.029	Manning's roughness

Bankfull Flow	
6.0	velocity (ft/s)
3006.6	discharge rate (cfs)
0.12	channel slope (%)

Sinuosity	Channel Type
1.00	C5

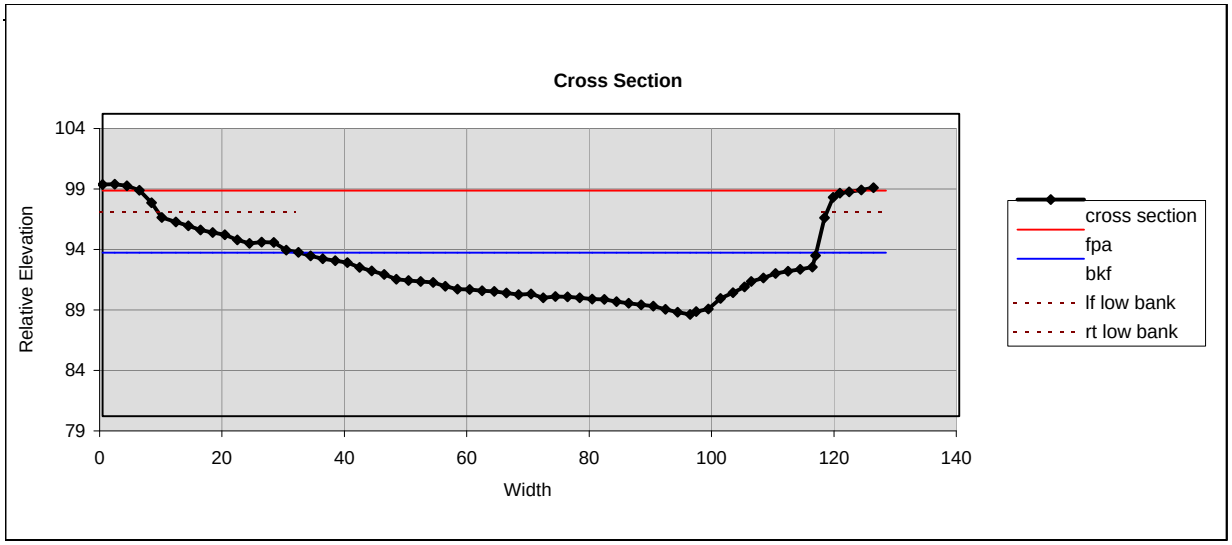
08MP_4_04_2007



Size (mm)	
D16	0.24
D35	1.3
D50	16
D65	35
D84	73
D95	360

Size Distribution	
mean	4.2
dispersion	35.6
skewness	-0.4

Type	
silt/clay	1%
sand	40%
gravel	41%
cobble	7%
boulder	11%
bedrock	0%



Bankfull Dimensions	
242.3	x-section area (ft.sq.)
84.5	width (ft)
2.9	mean depth (ft)
5.1	max depth (ft)
86.0	wetted perimeter (ft)
2.8	hydraulic radius (ft)
29.4	width-depth ratio

Flood Dimensions	
114.0	Width flood prone area (ft)
1.3	entrenchment ratio
9.7	low bank height (ft)
1.9	low bank height ratio

Flow Resistance	
0.033	Manning's roughness

Bankfull Flow	
6.8	velocity (ft/s)
1655.5	discharge rate (cfs)
0.57	channel slope (%)

Sinuosity	Channel Type
1.26	C5/4

Appendix F: Quality Assurance/Quality Control

The biological monitoring program for the Middle Patuxent River watershed includes chemical, physical and biological assessments conducted throughout the selected PSUs. The sampling methods used are compatible with the Design of the Biological Monitoring and Assessment Program for Howard County Maryland (Tetra Tech, 2001) and the Quality Assurance Project Plan (QAPP) for Howard County Department of Public Works (Tetra Tech, 2001). A summary of the Quality Assurance/Quality Control (QA/QC) procedures and results are presented in this Appendix.

A quality assurance and quality control analysis was completed for the assessment work conducted in the Middle Patuxent watershed following the methods described by Hill et al. (2005). This analysis included performance characteristics of precision, accuracy, bias and completeness. Performance measures include:

- Precision (consistency) of field sampling and overall site assessments using intra-team site duplication
  - median relative percent difference (mRPD)
  - coefficient of variability (CV)
  - 90% confidence interval (CI)
- Bias of sample sorting and subsampling
  - percent sorting efficiency (PSE)
- Accuracy of data entry
  - number of errors/corrective actions
- Completeness
  - number of valid data points obtained as a proportion of those planned (QAPP, 2001).

Data that does not meet performance or acceptable criteria are re-evaluated to correct any problems or investigated further to determine the cause of any discrepancies.

Field Sampling

All field crew leaders were recently trained in MBSS Spring Sampling protocols prior to the start of field sampling. All subjective scoring was completed with the input of all team members at the sampling site to reduce individual sampler bias.

Field water quality measurements were collected *in situ* at all monitoring sites including the duplicate sites, according to methods in the County QAPP. All *in situ* parameters were measured with a YSI 6000 series multiprobe and the YSI650 data logging system except turbidity which was measured with a Hach 2100 Turbidimeter. Water quality equipment was regularly inspected, maintained and calibrated to ensure proper usage and accuracy of the readings. Calibration logs were kept by field crew leaders and checked by the project manager regularly.

Sample buckets contained both internal and external labels. All chain-of-custody procedures were followed for transfer of the samples between the field and the identification lab.

Replicate (duplicate) samples were collected at ten percent of the sites (one site for each PSU, three total for the 2007 sampling year). These QC samples were collected to determine the consistency and precision of the sampling procedures and the intra-team adherence to those protocols. QC sites were field-selected rather than randomly selected to ensure that the QC sites maintained similar habitat conditions to the original site. Data collected from duplicate sites included water quality, benthic macroinvertebrate samples, and completion of the RBP habitat assessment. Photographs were also taken at duplicate sites.

Duplicate samples were collected at sites 06MP-3-01-2007, 07MP-2-02-2007 and 08MP-1-03a-2007. These sites represent varying drainage areas and impervious surface covers. The following table identifies the drainage areas and imperviousness for each site.

QC Site Characteristics

Site	Drainage Area (acres)	Impervious Percent
06MP-3-01	7231	7.4
07MP-2-02	1667	5.9
08MP-1-03a	162	44.0

Precision

Measures of precision calculated for the consistency of field sampling using intra-team site duplication were:

- Median relative percent difference (mRPD) and relative percent difference (RPD)
- Coefficient of variability (CV)
- 90% confidence interval (CI)

Acceptable measurement quality objectives (MQO) are listed in the table below. DNR's MBSS protocols were used for the collection and analysis of macroinvertebrate data. In 2005, DNR updated their Benthic Index of Biotic Integrity (BIBI; Southerland et al., 2005). These new metrics were used to calculate the BIBI presented in this report.

Measurement Quality Objectives (QAPP, 2001)

Metric or Index	Precision	Accuracy	Completeness (%)
GPS		± 25m	100
Dissolved Oxygen	RPD ≤ 20%	± 0.2 mg/L	≥ 85
pH	RPD ≤ 20%	± 0.2 units	≥ 85
Temperature	RPD ≤ 20%	± 0.15 ˚C	≥ 85
Conductivity	RPD ≤ 20%	± 1% of value	≥ 85
RBP Physical Habitat Assessment	RPD ≤ 20%	NA	100
Macroinvertebrate taxa			100
Metric Scores	RPD ≤ 5%		
Bioassessment Scores	RPD ≤ 5%		
Sorting Efficiency	SE ≥ 90%		

GPS

All GPS points were collected with a GPS unit capable of accuracy of within 2 meters. Multiple readings were recorded at the reach midpoint and averaged to obtain the location of the final point. All points were differentially corrected using either real-time or post-processed corrections. All points met the required 25m accuracy guideline. A GPS point was collected at all 30 sites, therefore the data meets the 100 percent MQO for completeness.

Water Quality

The following table shows the results of the water quality MQO analysis. The field equipment used, with correct maintenance and calibration, are capable of the required accuracy. Since the true accuracy of field measured water quality is not known with confidence, the measure of precision is used instead. Water quality data for all parameters were collected at all 30 sites,

therefore the data meets the >85 percent MQO for completeness. However, the DO probe calibrated out of range on one occasion, April 5, 2007, leading to questionable data being collected from two sites (07MP-2-02 and 07MP-2-02QC). Readings at these sites likely do not accurately reflect the true conditions of the water quality on this stream and are flagged in the database as such. Not surprisingly, the RPD for this sample pair was elevated (95.15%), and outside the MQO threshold. One other sample pair (08MP-1-03a and 08MP-1-03aQC) had a water quality measurement that exceeded the MQO of ≤20% for conductivity. The calculated RPD for this sample pair was 23.03, just slightly above the stated MQO. Upon closer inspection, it was found that there were several small tributaries feeding into the stream from adjacent wetlands, which likely are responsible for reducing the conductivity at the downstream site. Thus, it is likely that this measurement reflects the variability of in-stream conditions rather than measurement error. All other water quality parameters were within the acceptable ranges for precision.

Measurement Quality Objectives Results – Water Quality. Bold records indicate values exceeding stated MQOs.

	Dissolved Oxygen (mg/l)	pH	Water Temperature (°C)	Total Dissolved Solids (mg/l)	Turbidity (ntu)	Conductivity (µS/cm)
06MP-3-01	12.73	7.44	14.57	0.155	2.65	238
06MP-3-01 QC	13.38	7.41	14.68	0.156	2.89	239
Absolute Difference	0.65	0.03	0.09	0.001	0.24	1
RPD	4.98	0.40	0.75	0.63	8.66	0.42
SD	0.46	0.02	0.08	0.00	0.17	0.00
RSD	3.52	0.29	0.53	0.45	6.13	0.30
07MP-2-02	10.95	7.60	6.82	0.166	3.73	256
07MP-2-02 QC	3.89	7.55	7.75	0.166	3.02	254
Absolute Difference	7.06	0.05	0.93	0	0.71	2
RPD	**95.15**	0.66	12.77	0	21.04	0.78
SD	4.99	0.04	0.66	0	0.50	0.00
RSD	67.28	0.47	9.03	0	14.88	0.55
08MP-1-03a	11.63	7.81	4.40	0.222	0.94	342
08MP-1-03a QC	12.12	7.36	4.52	0.280	1.06	431
Absolute Difference	0.49	0.45	0.12	0.058	0.12	89
RPD	4.13	5.93	2.69	23.11	12.00	**23.03**
SD	0.35	0.32	0.08	0.04	0.08	0.06
RSD	2.92	4.20	1.90	16.34	8.49	16.28
Median RPD	4.98	0.66	2.69	0.63	12.00	0.78

Habitat Assessment

The following table provides the result of the MQO analysis for the habitat assessment. The RPD was <2 percent for all QC sites, therefore, all data meets the MQO of ≤20 percent.

Measurement Quality Objectives Results – Habitat Assessment (RBP)

	RBP Total Score	RBP Percent Comparability	Narrative Rating
06MP-3-01	159	79.5	Supporting
06MP-3-01 QC	156	78.0	Supporting
RPD	1.90	1.90	
SD	2.12	1.06	
RSD	1.35	1.35	
07MP-2-02	141	70.5	Partially Supporting
07MP-2-02 QC	140	70.0	Partially Supporting
RPD	0.71	0.71	
SD	0.71	0.35	
RSD	0.50	0.50	
08MP-1-03a	148	74.0	Partially Supporting
08MP-1-03a QC	149	74.5	Partially Supporting
RPD	0.67	0.67	
SD	0.71	0.35	
RSD	0.48	0.47	
Median RPD	0.71	0.71	

Biological Assessment

The following three tables include the results of the QC analysis for the biological metrics and BIBI scores. A few metric scores did fall outside the acceptable range for precision (these are shown in bold). In each case, the difference was only one scoring class (i.e, 1, 3, or 5), which resulted in a large RPD. In fact, even the smallest incremental difference in metric scores would result in an exceedance of the RPD MQO. Therefore, additional measures of precision were calculated among the combined QC data set to evaluate the significance of the differences in individual metric values and scores, as well as in the overall BIBI score.

Measurement Quality Objectives Results – Biological Sampling, Sample Pair RPD for Metric and IBI Scores

	BIBI	Total Taxa Score	EPT Taxa Score	Ephem Taxa Score	Percent Intolerant Urban Score	Percent Chironomidae Score	Percent Clinger Score
06MP-3-01	3.3	5	3	3	3	3	3
06MP-3-01 QC	4.0	5	5	5	3	3	3
RPD	**19.2**	0	**50**	**50**	0	0	0
07MP-2-02	3.0	5	3	5	1	1	3
07MP-2-02 QC	3.0	5	3	3	1	3	3
RPD	0	0	0	**50**	0	**100**	0
08MP-1-03a	1.0	1	1	1	1	1	1
08MP-1-03a QC	1.0	1	1	1	1	1	1
RPD	0	0	0	0	0	0	0
Median RPD	0	0	0	**50**	0	0	0

The BIBI is not scored on a continuous scale, but rather each metric is scored on an incremental scale (assigned a value of 1, 3 or 5), and these values are averaged to yield the final BIBI score. Since the final BIBI score is an average of six metric scores, the BIBI scores shift by at least 0.3 or 0.4 with a difference in only metric (e.g., 2.0, 2.3, 2.7, 3.0). Additionally, a individual metric value may differ by only one taxa or percent for a sample pair, but if it falls on either side of a scoring threshold (i.e, 1, 3, 5), the resulting difference in metric scores will differ by as much as 50 to 100% for RPD. For these reasons, the BIBI score RPD for sample pair 06MP-3-01 and 06MP-3-01 QC does not meet the MQO despite only minor differences in metric values. For instance, there were only two additional EPT taxa found at site 06MP-3-01 QC, which resulted in a two point difference in metric scores. Similarly, only one additional Ephemeroptera taxa was found at site 06MP-3-01 QC (3 vs. 4), also resulting in a two point difference in metric scores, which together combined to be a difference of 0.7 for the overall BIBI score and a 19.2% RPD.

Due to the overall BIBI score consisting of scaled incremental metrics, the RPD does not reflect the precision well. BIBI scores for sample pairs 07MP-2-02 and 07MP-2-02 QC and 08MP-1-03a and 08MP-1-03a QC were identical, resulting in an RPD of zero. The BIBI median RPD is 0.00, therefore, the overall BIBI calculations meet the MQO. Additional measures of precision (CV, CI, and mRPD) for the combined sample pair results indicate far better precision than does RPD. None of the measures calculated deviated significantly from normal, acceptable levels of precision between duplicate sample pairs observed in similar studies (Hill et. al, 2005; Gallardo et. al, 2006).

All phases of the biological assessment were conducted for every site; therefore the 100 percent completeness MQO is met.

Measurement Quality Objectives Results – Biological Sampling, Combined Precision Measures for Metric Values

	Total Taxa	EPT Taxa	Ephem Taxa	Percent Intolerant Urban	Percent Chironomidae	Percent Clingers
06MP-1-03	34	10	3	13	55	50
06MP-1-03QC	34	12	4	25	42	51
07MP-2-02	27	9	5	10	65.6	32
07MP-2-02QC	33	6	3	9	61.2	39
08MP-1-03a	9	2	0	1	87.0	13
08MP-1-03aQC	13	1	0	1	66.1	20
CV	9.43	21.21	28.28	29.27	14.69	10.06
CI	3.87	2.32	1.16	4.69	15.13	5.67
mRPD	20.00	18.18	28.57	5.36	27.32	18.40

Measurement Quality Objectives Results – Biological Sampling, Combined Precision Measures for Metric and IBI Scores

	Total Taxa	EPT Taxa	Ephem Taxa	Percent Intolerant Urban	Percent Chironomidae	Percent Clingers
06MP-1-03	3.30	5	3	3	3	3
06MP-1-03QC	4.00	5	5	5	3	3
07MP-2-02	3.00	5	3	5	1	1
07MP-2-02QC	3.00	5	3	3	1	3
08MP-1-03a	1.00	1	1	1	1	1
08MP-1-03aQC	1.00	1	1	1	1	1
CV	6.5	0.0	17.7	31.4	0.0	23.6
CI	0.3	0.0	0.8	1.5	0.0	0.8
mRPD	0.0	0.0	0.0	50.0	0.0	0.0

Laboratory Sorting and Subsampling

Each individual sorter had their work checked until a 90% sorting efficiency was consistently achieved. After this level of efficiency was obtained, one out of every 10 randomly selected samples was checked by the laboratory QA officer. During this sampling period, 23 samples were checked in total. Of those 23 samples, the three lab technicians achieved an overall internal sorting efficiency of 85.5 percent.

Subsampling was conducted for those sites with greater than 120 organisms. A post-processing subsampling was conducted using a spreadsheet based method (Tetra Tech, 2006). This post-processing randomly subsamples the identified organisms to a desired target number for the sample. Each taxon is subsampled based on its original proportion to the entire sample. In this case, the desired sample size selected was 110 individuals. This allows for a final sample size of approximately 110 individuals (±20%) but keeps the total number of individuals below the 120 maximum and above 100 organisms.

Laboratory Sorting Results – Percent Sorting Efficiency

Sample ID	Organisms Found by Sorter	Organisms Found in QC Check	Total Organisms Found	Percent Sorting Efficiency
06MP-1-01	141	11	152	92.8
06MP-1-02	154	44	198	77.8
06MP-1-03	129	22	151	85.4
06MP-1-04	156	40	196	79.6
06MP-1-05	139	53	192	72.4
06MP-1-06	138	17	155	89.0
06MP-1-07	210	50	260	80.8
06MP-2-01	127	12	139	91.4
06MP-3-01	126	14	140	90.0
06MP-3-02	134	20	154	87.0
07MP-1-03a	128	40	168	76.2
07MP-1-04	130	47	177	73.4
07MP-1-06	140	33	173	80.9
07MP-2-01	140	11	151	92.7
07MP-2-02	205	15	220	93.2
07MP-2-02 QC	162	28	190	85.3
07MP-3-02	130	5	135	96.3
08MP-1-03A	126	9	135	93.3
08MP-1-03A QC	125	42	167	74.9
08MP-1-04	127	31	158	80.4
08MP-1-05	178	15	193	92.2
08MP-4-02	138	11	149	92.6
08MP-4-04	148	17	165	89.7

Data Entry/Analysis

All data entered into EDAS, Excel, or any other program used for site analysis were reviewed and checked for entry error. A table listing the data entry results is shown below. All errors were corrected and the database was deemed to be 100% accurate. Additionally, ten percent of the analyzed metrics were recalculated by hand to verify the computer generated values and formula accuracy.

Data Entry Results – Percent Error

Data Type	Number of Entries	Number of Incorrect Entries	Percent Error
Water Chemistry	198	5	2.53
Physical Characterization	781	2	0.26
Physical Habitat	711	7	0.98
Cross Section	1014	2	0.20
Pebble Count	489	7	1.43
Benthic Macroinvertebrates	1083	2	0.18

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