Howard County Biological Monitoring and Assessment

Patapsco River Watersheds - 2008

Howard County, Maryland

Howard County MARYLAND

KCI Technologies, Inc.
October 2008

KCI TECHNOLOGIES

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October 2008 – Final Report

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Prepared for:

Department of Public Works
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Howard County MARYLAND

Prepared by:

KCI Technologies, Inc.
10 North Park Drive
Hunt Valley, Maryland 21030
KCI Job Order No. 01054139.18

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The principal authors for the Patapsco River Watershed Report are Colin Hill and Megan Killian of KCI Technologies.

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Brenda Belensky, Natural Resource Manager

Lindsay Leiterman, Environmental Planner

Angela Morales, Environmental Planner

Susan Overstreet, Environmental Planning Supervisor

Howard Saltzman, Chief Stormwater Management Division

For more information on this report or Howard County's Watershed Management efforts contact:

Howard Saltzman, Chief Stormwater Management Division

or

Angela Morales, Environmental Planner

Stormwater Management Division
Howard County Department of Public Works
6751 Columbia Gateway Drive
Columbia, Maryland 21046
410-313-6416

Or visit us on the web at http://www.co.ho.md.us/DPW/watershed_management.htm

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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 2008 sampling effort continued the second round of countywide sampling. The Patapsco River Watersheds (South Branch, Lower North Branch A, and Lower North Branch B) were re-sampled at 30 newly selected sites to fulfill the 2008 sampling requirements. These watersheds were previously sampled and assessed by Tetra Tech, Inc. in 2003 during the first round of the county-wide assessment (Pavlik and Stribling, 2005). Stream monitoring was conducted again in 2008 at 10 sites within each of the three Patapsco PSUs (South Branch, Lower Branch A, and Lower Branch B). 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 Patapsco 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 2003 sampling effort were recalculated using the updated metrics to allow for direct comparison to the current data. For this report any mention of 2003 BIBI scores refer to these recalculated values.

All data collection occurred between March 1st and May 1st of 2008, 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 2008 indicate a watershed that is impaired. Only two out of thirty benthic macroinvertebrate samples received a rating of 'Good' and four received a 'Fair' rating. The remaining sites (80 percent) were rated as either 'Poor' or 'Very Poor.'

Overall the entire Patapsco watershed received a 'Non- Supporting' physical habitat assessment rating. Conductivity was elevated at many sites across the watershed with values ranging from 105 to 709 µS/cm. The geomorphic assessment reveals a variable system. Using the Rosgen classification system for natural rivers (Rosgen, 1996), many of the channels sampled throughout the watershed were classified as stable type B, C, or E. However a good portion of the sampling reaches were classified as unstable, incised F channels. Gravel was the dominant substrate across the entire watershed but many areas with sand deposition were observed. The average percentage of impervious area in the Patapsco watershed is 16.5 percent. Land use based imperviousness for the areas draining to the sampling sites range from zero (0) percent to 39 percent.

Pearson correlations between the BIBI scores and three parameters (RBP score, percent imperviousness, and specific conductivity) all showed significant relationships. There was a strong positive correlation with RBP habitat comparability scores (correlation of 0.577 with a significance level of 0.001), suggesting that BIBI scores (and consequently biological condition) increase with improved habitat conditions. The percentage of imperviousness in the area draining to each sampling site indicates a negative relationship (correlation of -0.462 with a significance level of 0.010) to BIBI

scores, implying biological condition decreases with increased watershed imperviousness. Specific conductivity and BIBI scores also showed a strong negative correlation (correlation of -0.552 with a significance level of 0.002). These results support the notion that overall water quality and biological health are likely being affected by the amount of development in the watershed.

A strong correlation was observed between impervious percent and specific conductivity (correlation of -0.662 with a significance level of <0.001), suggesting that increased conductivity is due in large part to urban runoff. In addition, a negative correlation was found between RBP scores and specific conductance (-0.397, with a significance level of 0.030), inferring that urban runoff (a source of high conductivity) may also be impacting the habitat, through more intense discharges and higher peak flows. Results of the 2008 assessment of the Patapsco watershed indicate generally poor biological conditions, and a slight decrease, though not significant, was observed in the overall BIBI scores from 2003. While physical habitat scores also resulted in a slight decrease, there was no significant difference between sampling years.

Overall the Patapsco watershed is predominantly agricultural land use and forested land cover, however increasing residential and commercial 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 more importantly, 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 sites (PSUs 6, 7 and 8) 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.

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 – Middle 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
8 (2008)	30	10 – S Branch Patapsco River Tributaries 1 – Patapsco River L Branch A 4 – Patapsco River L Branch B

Upper and Lower Brighton Dam (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 subwatersheds (PSUs 11, 12, and 13) were sampled in 2006 during year two of the second round of sampling. In 2007, the Middle Patuxent subwatersheds (PSUs 6, 7, and 8) were sampled once again.

The 2008 Patapsco River sampling continued the second round of sampling. The Patapsco River Watersheds (South Branch, Lower Branch A, and Lower Branch B) were re-sampled at 30 newly selected sites to fulfill the 2008 sampling requirements. These watersheds were previously sampled and assessed by Tetra Tech, Inc. in 2003 during the first round of the county-wide assessment (Pavlik and Stribling, 2005). 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 2008 are compatible with those used in the first round (2001-2003) with updates where applicable.

The second round of sampling 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 2009.

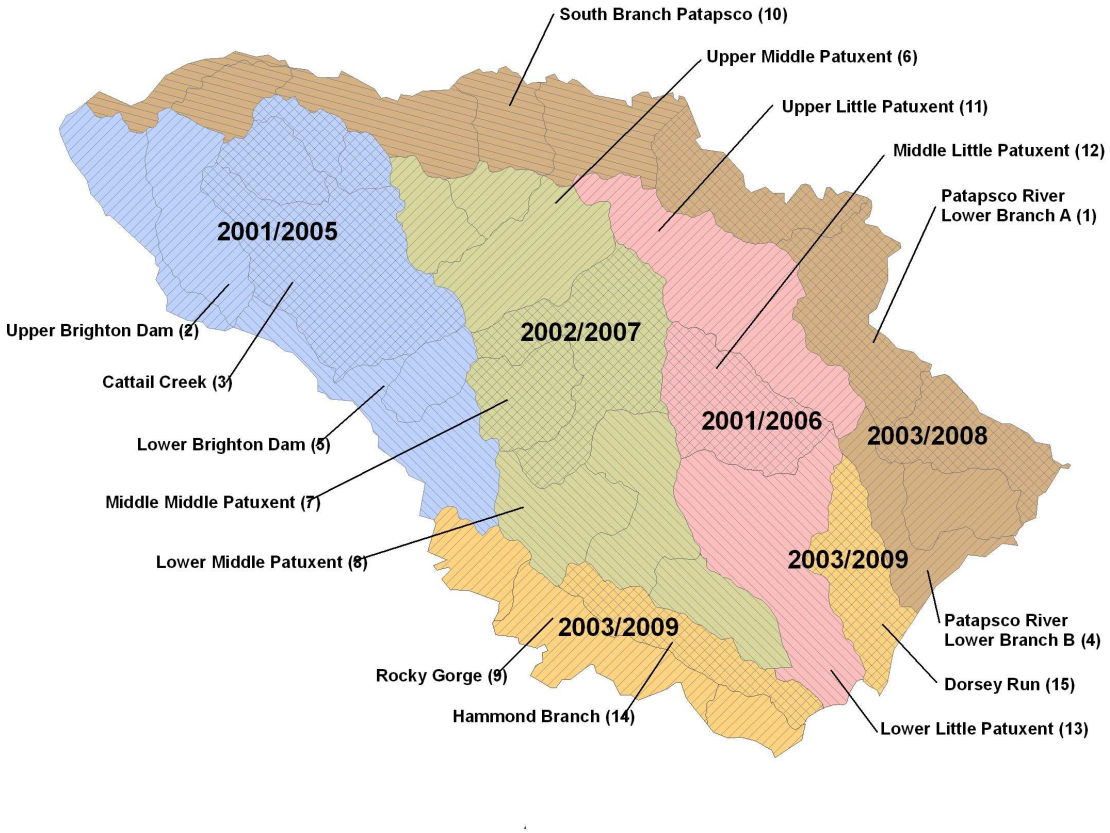

Figure 1 - Howard County Bioassessment

The Patapsco River flows southeast along the upper boundary of Howard County before it becomes a large tidal inlet of the Chesapeake Bay at Baltimore Harbor. The Patapsco PSUs are located along the upper most portion of Howard County and are crossed by several major transportation routes (see Figure 2).

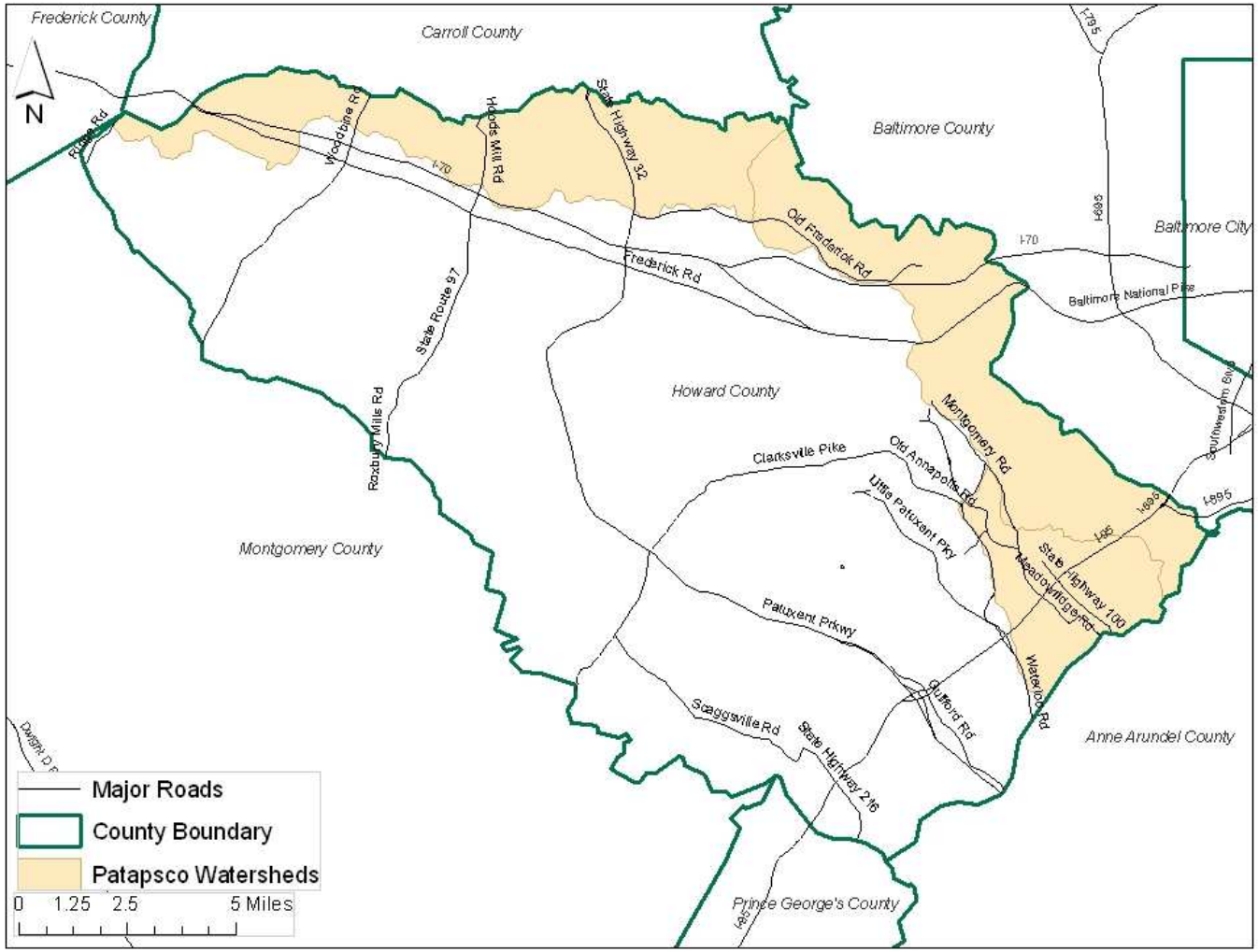

Figure 2 - Location Map, Patapsco River Watershed

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 (South Branch, Lower Branch A, and Lower Branch B). The assessment methods followed the current MBSS protocols (DNR, 2007) and the SOPs described in the County's QAPP (DPW, 2001). All data collection occurred between March 1st and May 1st of 2008, 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 position of each site was 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 2008. 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 (**01PA**-1-01-2008), stream order (01PA-**1**-01-2008), a two-digit sequential number (01PA -1-**01**-2008), and the year sampled (01PA-1-01-**2008**). 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. Since the Patapsco River lies on the boundary of several counties, additional GIS data from Baltimore, Carroll, Frederick, and Anne Arundel Counties were also used to delineate drainage areas and calculate imperviousness based on 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 using a YSI® 6920 series multiprobe 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) 26.08.02.03-03 - Water Quality* (MDE, 1994). The drainage areas in the Patapsco River watershed are in *COMAR* in Sub-Basin 02-13-09: Patapsco River Area. It is classified as a Use I-P water body, Water Contact Recreation, Protection of Aquatic Life, and Public Water Supply, except for the Henryton Road tributary to the South Branch which is classified as a Use III water body, Nontidal Cold Waters, and the mainstem South Branch Patapsco River, which is classified as a Use IV water body, Recreational Trout Waters. 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, III and IV streams are listed in Table 2. A comparison of these standards to data collected at each station is included in the site summary text in Section 2.1.

Table 2 - Water Quality Sampling and COMAR Standards, Use I-P, III, and IV Waters

Parameter	Units	Acceptable COMAR Standard
pH	standard pH units	6.5 to 8.5
Temperature	degrees Celsius, °C	maximum of 90°F (32°C) [68°F (20°C) for Use III waters; 75°F (23.9°C) for Use IV waters] 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

1.4 Biological Sampling

Biological monitoring was conducted throughout the Patapsco watershed following methods detailed in the County's QAPP (DPW, 2001). 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 the Summer Index Period while sampling fish communities, which the County does not support, physical habitat condition for the Patapsco watershed was assessed using the EPA's Rapid Bioassessment Protocol (RBP) (Barbour et. al, 1999) habitat assessment for high-gradient streams. Certain MBSS habitat parameters, namely percent shading, require full leaf out to accurately assess, which is often mis-represented during the Spring Index Period when leaves typically have not yet opened. However, it should be noted that MBSS physical habitat data is collected to supplement RBP

data, and potentially for use in future investigations or comparisons. Locations of the bioassessment sites are shown in Figure 3.

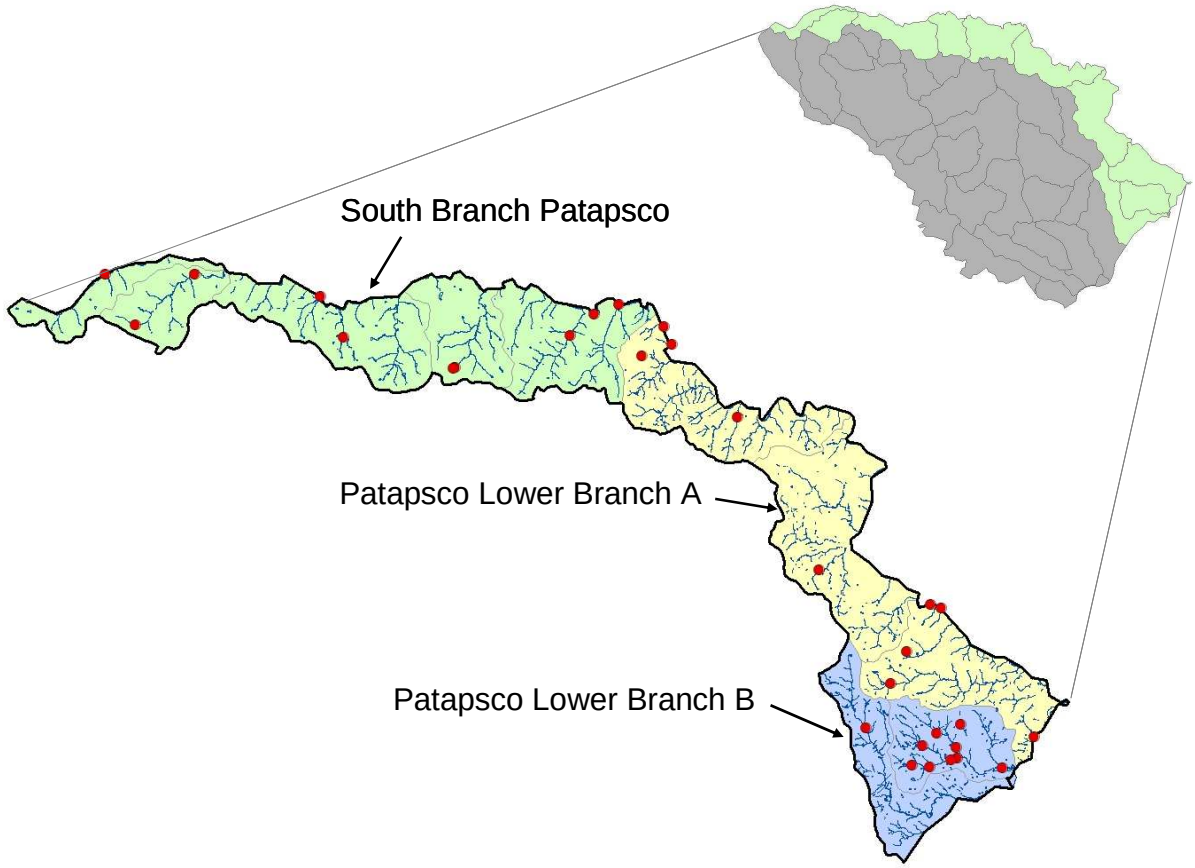

Figure 3 – Patapsco Bioassessment Sampling Locations

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 updated in 2005 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 Patapsco watershed is located predominantly 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 Patapsco 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 2003 Patapsco 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 2003 BIBI scores refer to these recalculated values.

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

Piedmont BIBI Metrics:

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.

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

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.

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 II characterization (Rosgen, 1996) was completed for each stream reach based on field-collected data. Table 7 includes general descriptions for each channel type classification based on the Rosgen classification system for natural rivers (Rosgen, 1996).

Table 7 – Rosgen Level II 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 cross section 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 typically taken at the top of riffle features.

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 (Mecklenburg, 2004). 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 Patapsco River watershed, ten within each of the South Branch, Lower Branch A, and Lower Branch B 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, 1996) 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 displayed in Appendices A through F.

2.1.1 South Branch Patapsco

In 2008, five of the ten sampling sites in the South Branch Patapsco were on first order streams, two on second order streams, and three were on fourth order streams. The field QC sample was collected at site 10PT-2-01. The subwatershed had an average BIBI score of 2.73 and a ‘Poor’ condition rating, with scores ranging from 1.33 to 4.00. The average RBP habitat assessment comparability score 59.6, or ‘Non-Supporting’, with scores ranging from 41.0 percent (‘Non-supporting’) to 72.0 percent (‘Partially Supporting’). Channels were generally classified as Rosgen type B, C, or F types with predominantly gravel/sand substrate. A summary of the results for the South Branch Patapsco subwatershed is found in Table 8.

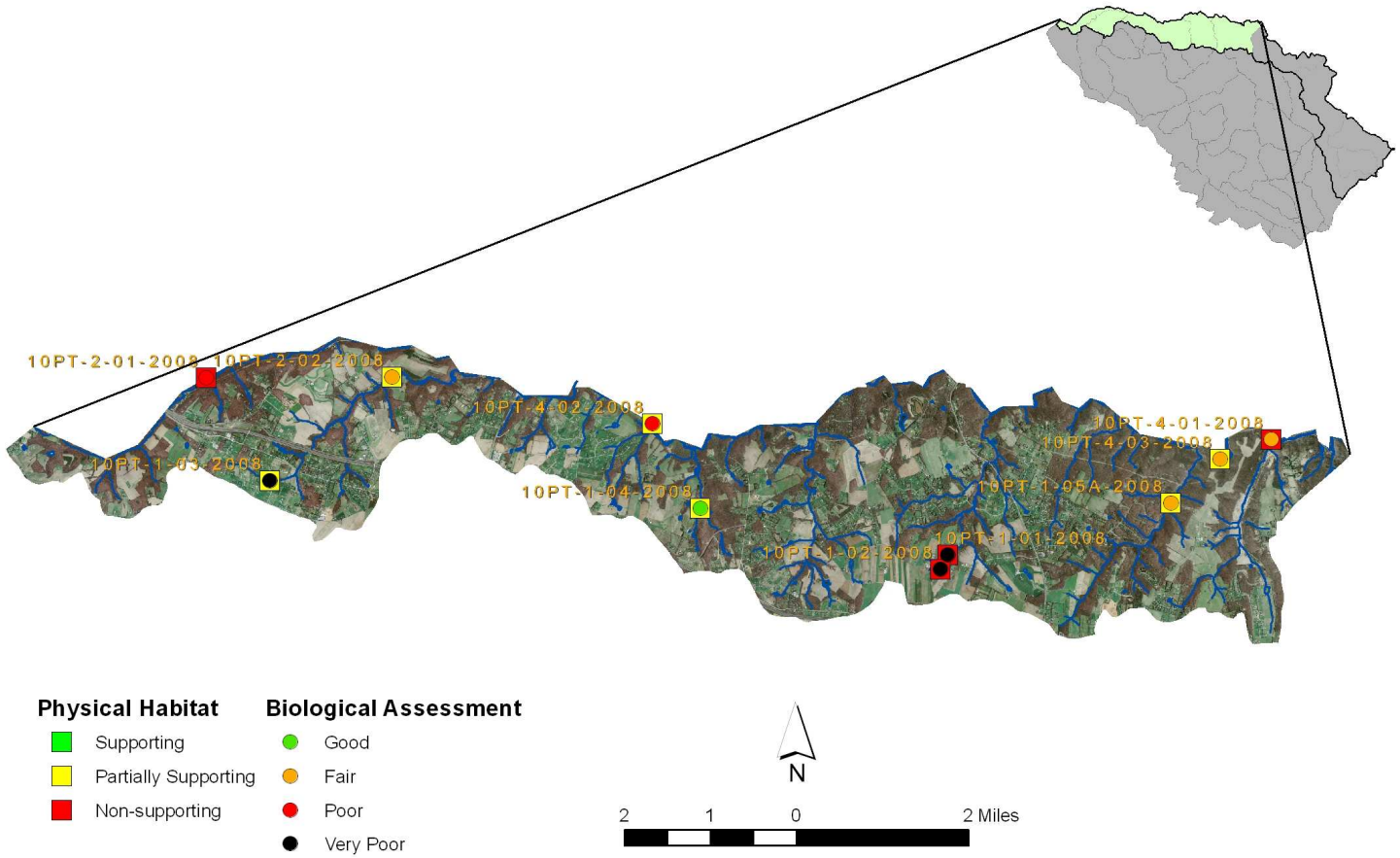

Figure 4 – South Branch Patapsco Sampling Results

Table 8 - South Branch Patapsco Summary

Site ID	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Drainage Area (ac)	Impervious Surface Percent	BIBI Score	BIBI Narrative Rating	Habitat Comparability Score	Habitat Narrative Rating	Rosgen Channel Type
01PA-1-01-2008	39.230680	-76.769881	30.7	0.2	2.00	Poor	60.0	Non-supporting	F4b
01PA-1-02-2008	39.259257	-76.809146	191.3	25.3	2.00	Poor	57.0	Non-supporting	F4
01PA-1-03-2008	39.312585	-76.845846	334.9	21.3	1.33	Very Poor	63.5	Partially Supporting	C4
01PA-1-04-2008*	39.334151	-76.888861	94.7	10.7	4.33	Good	78.0	Supporting	F4
01PA-1-05-2008	39.219505	-76.777249	372.4	32.4	1.67	Very Poor	63.5	Partially Supporting	E4
01PA-3-01-2008	39.200892	-76.712441	12100.6	23.7	1.33	Very Poor	56.5	Non-supporting	C5
01PA-4-01-2008	39.344268	-76.878896	164079.9	9.0	2.33	Poor	65.5	Partially Supporting	F4
01PA-4-02-2008	39.338102	-76.875021	164292.5	9.0	1.67	Very Poor	63.5	Partially Supporting	F4
01PA-4-03-2008	39.247127	-76.758897	193623.4	10.1	2.67	Poor	77.5	Supporting	B3c
01PA-4-04-2008	39.246026	-76.754254	193846.7	10.1	2.67	Poor	71.5	Partially Supporting	B3a
Minimum	--	--	30.7	0.2	1.33	Very Poor	56.5	Non-supporting	--
Maximum	--	--	193846.7	32.4	4.33	Good	78.0	Supporting	--
Mean	--	--	72896.7	15.2	2.20	Poor	65.7	Partially Supporting	--
Standard Deviation	--	--	91886.5	9.9	0.89	--	7.7	--	--

*QC sampling was conducted at this site

South Branch Patapsco Site Descriptions:

10PT-1-01-2008
This site is located on a small, E5 headwaters stream draining pasture land. A strong manure odor was noted at this location, however, it did not appear that livestock had access to the stream, but the odor may have been coming from a large farm pond just adjacent to the stream. Agricultural land use makes up 100 percent of the drainage area, therefore imperviousness was calculated to be 0 percent. There were a total of 20 taxa in the benthic macroinvertebrate sample. While there was only one EPT taxon, individuals intolerant to urban stressors accounted for 29 percent of the sample, and 15 percent were classified as clingers. Individuals of the Chironomidae family (midges) made up 72 percent of the sample. Although there were numerous taxa present, the high level of Chironomids and complete lack of Ephemeroptera taxa contributed to an overall BIBI score of 1.7 for this site, resulting in a biological rating of 'Very Poor'. Habitat was rated as 'Non-supporting', receiving a score of 46.5. The banks were considered to be moderately stable, but benthic substrate was poor and lacking. Water quality results indicated no parameters that exceeded acceptable COMAR standards.

10PT-1-02-2008
Located immediately upstream of site 10PT-1-01, this site was the uppermost headwaters of the channel, and as such it was very small and shallow, covered with dead grass and brush, and unsampleable for the upper half of the reach. This reach was classified as a B5 channel type with a predominantly sand and silt substrate. At 0.4 acres, this site has the smallest drainage area in the entire Patapsco watershed. Like site 1-01, the drainage area is 100 percent agricultural land use, resulting in 0 percent impervious surface. This stream was classified as a B5 channel type with a mostly sand substrate. Water quality measurements indicated no parameters outside COMAR allowable limits, but the site had the highest turbidity values in this subwatershed, which may have been due to recent rains and possible disturbance of the channel upstream prior to sampling. There were 19 benthic macroinvertebrate taxa found at this site. Nearly a quarter of the individuals were considered intolerant to urban land uses and 12 percent were classified as clingers. However, 81 percent of the sample consisted of Chironomids, the highest percentage for all samples in the subwatershed. Based on the BIBI score of 1.7, this site was given a 'Very Poor' biological condition rating. The habitat assessment resulted in a comparability score of 41.0, with a rating of 'Non-supporting'. The resulting habitat score is due to the lack of suitable epifaunal substrate and woody debris, low channel flow, lack of velocity/depth diversity, high embeddedness, and overall poor habitat quality.

10PT-1-03-2008
This site lies on a B5c channel dominated by sandy substrate. The stream is located in a narrow forested buffer surrounded by pasture and residential land use, but the site had to be shifted downstream approximately 200 feet due to a fenced-in horse pasture and lack of access. Nearly half of the 161-acre drainage area is classified as agricultural, with 38 percent as low-density residential which accounts for most of the 9.5 percent of impervious surface present in the drainage area. The habitat assessment resulted in a score of 61 with a rating of 'Partially Supporting' due to marginal epifaunal substrate, and velocity/depth diversity as well as fairly low channel flow. All water quality parameters were within COMAR limits for Use I-P streams. With 14 taxa, this station had one of the lowest taxa counts (tied with station 4-02). Four EPT taxa were present, one of which was Ephemeroptera. At five percent, this site had the lowest percentage of clingers in this subwatershed. Intolerant individuals comprised 20 percent of the sample and Chironomids accounted for 71 percent of the sample, resulting in a BIBI score of 1.3 and a 'Very Poor' classification, the lowest score in this subwatershed.

10PT-1-04-2008
This site was classified as a F4b channel type and has a predominantly gravel substrate. Water quality results indicated that this site was within acceptable limits for all parameters, although pH (8.34) was near the upper acceptable limit. The predominant land use in the 126-acre drainage area is agricultural followed by forested land. Overall, the drainage area has 0.3 percent of impervious surface, which is well below the average for the South Branch subwatershed. The habitat assessment indicated a 'Partially Supporting' habitat with a score of 61.5. Habitat scores were low for bank stability, embeddedness, and sediment deposition. This station received the highest BIBI rating of 'Good' with a score of 4.0. There were 32 benthic macroinvertebrate taxa found in this sample, one of the highest taxa counts throughout the South Branch (tied with station 10PT-4-01-2008). This site also had the highest percent of intolerant urban individuals at 72 percent and the highest number of EPT taxa (12), three of which were Ephemeroptera. Clingers accounted for 54 percent of this sample. At 23 percent, this station had the lowest percentage of individuals in the Chironomidae family.

10PT-1-05A-2008
Located just off of Henryton Road, within the outskirts of Patapsco Valley State Park, this alternate site was chosen because the landowner at the primary site denied the field crew access to his property. The drainage area is predominantly forest (35.8 percent) land cover, although the remaining land use is almost equally divided between agricultural (33.2 percent) and low density residential (31.1 percent). Impervious surface draining to this site (7.8 percent) is slightly below the subwatershed average. The channel type was classified as an incised F4 with gravel as the most abundant substrate. PH (8.45) was near the upper acceptable COMAR limit, however water quality parameters were within acceptable ranges. Physical habitat scored 72 and was rated as 'Partially Supporting', the highest received in the South Branch subwatershed. There were 28 taxa present in this sample, and a significant portion (51 percent) of the sample was comprised of individuals intolerant to urban stressors. Seven taxa were EPT (including three Ephemeroptera taxa) with the intolerant mayfly *Ephemerella* (tolerance value [TV] = 2.3) accounting for almost a third of the sample. This station had one of the highest percentages of clingers at 55 percent. There were 37 individuals in the Chironomidae family. Overall, the site received a BIBI score of 3.7, which classified the biological condition as 'Fair'.

10PT-2-01-2008
This sampling reach is located on the South Branch Patapsco mainstem along the Carroll County and Howard County line. Although the predominant surrounding land use is forested (26 percent), low density residential, medium density residential, high density residential, and commercial and industrial land uses account for nearly 54 percent of the drainage area. The total impervious land use for the drainage area is 28.6 percent, the highest in the South Branch subwatershed. This site is classified as an incised F4 channel with gravel as the dominate substrate. All water quality parameters were within acceptable ranges, however, conductivity was the highest in this subwatershed. Habitat was rated as 'Non-supporting' with a habitat score of 58, primarily due to low scores for bank stability, embeddedness, and sediment deposition. The overall BIBI score was 2.7, resulting in a 'Poor' biological rating. This site had 24 total taxa present and received a low score for percentage of intolerant urban (2.5 percent). Six EPT taxa were present but no sensitive Ephemeroptera taxa. Clingers accounted for 43 percent of the sample. Members of the Chironomidae family comprised a large proportion of the sample (53 percent), with one taxon *Orthocladius* (TV = 9.2) representing 37 percent of the entire sample. A quality control sample was completed just upstream of this sampling reach and received the same BIBI score of 2.7.

10PT-2-02-2008
This sampling reach is located just off of Blooms Lane and is classified as a C4 channel type dominated by a gravel substrate. This site received a habitat assessment score of 66.5 and is classified as 'Partially Supporting'. Most water quality parameters were within COMAR limits, however, pH

(8.53) was just slightly above the upper allowable limit of 8.5 for Use I-P streams. Other sites within the subwatershed had alkaline pH measurements, which may be a result of the underlying geology in the area, such as the presence of limestone bedrock. Land use in the 1909-acre drainage area is primarily agricultural (53.8 percent) and low density residential (29.3 percent), with the majority of the remainder as forested land cover (14.8 percent). The overall imperviousness based on land use is eight percent. This site had a very high percentage of urban intolerant individuals (46.6 percent) and the second lowest percent of Chironomids (32 percent) in the South Branch watershed. Of the 28 taxa present, eight belonged to EPT and three of those were Ephemeroptera taxa. Clingers comprised half of the subsample. This site was classified as 'Fair', with a score of 3.33.

10PT-4-01-2008
This site is located on a fourth-order segment of the South Branch Patapsco River, just upstream of Marroittsville Road. Habitat at this site was rated as 'Non-supporting', receiving a habitat assessment score of 56, which is slightly below the subwatershed average. Dominant land uses in the approximately 41,366-acre drainage include agriculture (43.0 percent), forested (28.2 percent), and low-density residential (23.6 percent), with an overall imperviousness of 8.8 percent. The reach was classified as an F5 channel type with a predominantly sandy substrate. Only one water quality parameter, pH (8.51) narrowly exceeded COMAR limits. As mentioned previously, several sites in the Patapsco watershed had alkaline pH values, suggesting that the high pH is likely due to the underlying geology. Benthic macroinvertebrate sampling resulted in a score of 3.7, indicating 'Fair' biological conditions. This site had 32 total taxa, one of the highest in the South Branch (tied with station 1-04). Of the 32 taxa in the subsample, six were EPT taxa, four of which were Ephemeroptera. Individuals intolerant to urban stressors accounted for 13 percent and clingers 43 percent of this sample. However, midges comprised 43 percent of the sample and individuals from the Tubificidae family comprised 25 percent of the sample.

10PT-4-02-2008
Site 4-02 has a 22,775-acre drainage area and is predominantly agricultural land use (43.2), with the majority of the remainder comprised of low-density residential (25.6 percent) and forest (25.7 percent). The imperviousness to the site is 9.7 percent, just below the subwatershed average of 10.2 percent. There is a wide riparian buffer zone on both sides of the sampling reach. This site was classified as a C4b stream channel type dominated by gravel substrate. Physical habitat received a comparability score of 66 with a narrative rating of 'Partially Supporting'. However, bank stability and vegetative protection were considered poor to marginal. All water quality parameters were within acceptable limits, although pH (8.45) was near the upper acceptable limit. This site received a rating of 'Poor' with a BIBI score of 2.00. There were 14 total taxa, four of which were EPT taxa but none from the order Ephemeroptera. This station had a relatively high percentage of individuals intolerant to urban stressors (38 percent) and a high percentage of clingers (55 percent). However, 45 percent of the sample was made up of individuals in the Chironomidae family, which was dominated by the pollution tolerant taxon *Orthocladius* (TV = 9.2).

10PT-4-03-2008
This site is located on a fourth-order reach of the South Branch Patapsco River within the Patapsco Valley State Park. The sampling reach is located within a heavily forested area with moderately unstable banks and a fair amount of sediment deposition occurring on several sand/gravel bars. The predominant surrounding land use is agricultural (43.1 percent) followed by forested (28 percent) and low density residential (23.7 percent), which account for 8.9 percent imperviousness in the 41,158 acre drainage area. This site was classified as a stream channel type of B4c with a mix of sand, gravel, and cobble substrates. Bank stability was considered to be marginal to sub-optimal with high sediment deposition. The overall habitat comparability score was 67.5, in the 'Partially Supporting' classification. For the biological condition, this site received a rating of 'Fair' with a BIBI score of

3.33. This subsample had 30 taxa present, six of which were EPT taxa. There were also two Ephemeroptera taxa present. Individuals in the Chironomidae family accounted for 57 percent of the sample, and 15 percent of the sample was comprised of individuals intolerant to urban stressors.

2.1.2 Patapsco Lower Branch A

Five of the ten sites sampled in 2008 within the Patapsco Lower Branch A PSU were on first order streams, one a third order, and four were on fourth order streams. The field QC sample was collected immediately upstream of site 01PA-1-04. Habitat assessment comparability scores ranged from 56.5 percent, with a classification of 'Non-supporting' to 78.0 percent and a classification of 'Supporting'. The mean habitat comparability score was 65.7 with a rating of 'Partially Supporting'. The highest habitat comparability score in the entire Patapsco watershed was found in this subwatershed. BIBI scores ranged from a low of 1.33, or 'Very Poor' to 4.33, or 'Good'. The mean BIBI score was 2.20, with an average biological condition rating of 'Poor'. A summary of the results for the Patapsco Lower Branch A subwatershed is found in Table 9.

Patapsco Lower Branch A Site Descriptions:

01PA-1-01-2008
Located behind Bonnie Branch Middle School, this reach begins just downstream of the culvert below the ball fields. Two fairly major head cuts were present just below the rip rap armoring in the channel, indicating significant down cutting and erosion. The reach was classified as a F4b channel type exhibiting incision and down cutting. The dominate substrate was a mix of sand and gravel. This site had the smallest drainage area (30.7 acres) in the subwatershed. Based on Howard County land use data from 2002, the drainage area is 98.5% forested and has only 0.2 percent impervious area. However, more recent aerial photography from 2006 indicates that a large portion of the drainage area has been developed into institutional and low density residential land uses. No water quality values fall outside the acceptable COMAR limits. The BIBI score was 2.00, with a biological rating of 'Poor.' While there was a high number of taxa (32), five of which were EPT, only a single Ephemeroptera taxa was present. Additionally, chironomids (midges) accounted for 70 percent of the sample with *Hydrobaenus* (TV = 7.2) and *Orthocladius* (TV = 9.2) dominating the subsample. At only 12 percent of the sample, the percentage of clingers was one of the lowest observed in this subwatershed

01PA-1-02-2008
At this site, the majority of the surrounding land use in the 191-acre drainage area is medium density residential (41.3 percent) and low density residential (24.2 percent), with only 14.7 percent forested land cover. The overall impervious drainage is just over 25 percent, one of the highest in the subwatershed. The BIBI score for this site was 2.00, which rated the biological condition as 'Poor.' Overall, 28 taxa were identified from the subsample, with five representing EPT, but with no Ephemeroptera taxa. Only 5 percent of the individuals were classified as individuals intolerant to urban stressors. Chironomids accounted for 76 percent of the subsample with *Orthocladius* (TV = 9.2) making up the majority of the count (48 individuals). Most water quality parameters were within COMAR limits, however, pH (8.51) was just slightly above the upper allowable limit of 8.5 for Use I-P streams. Several other sites within the subwatershed had alkaline pH measurements above 8.0, which may be due to the underlying geology. Conductivity was also high (505 µS/cm), which is common in drainages with high imperviousness. The predominant substrate was gravel and the reach was classified as an F4 channel.

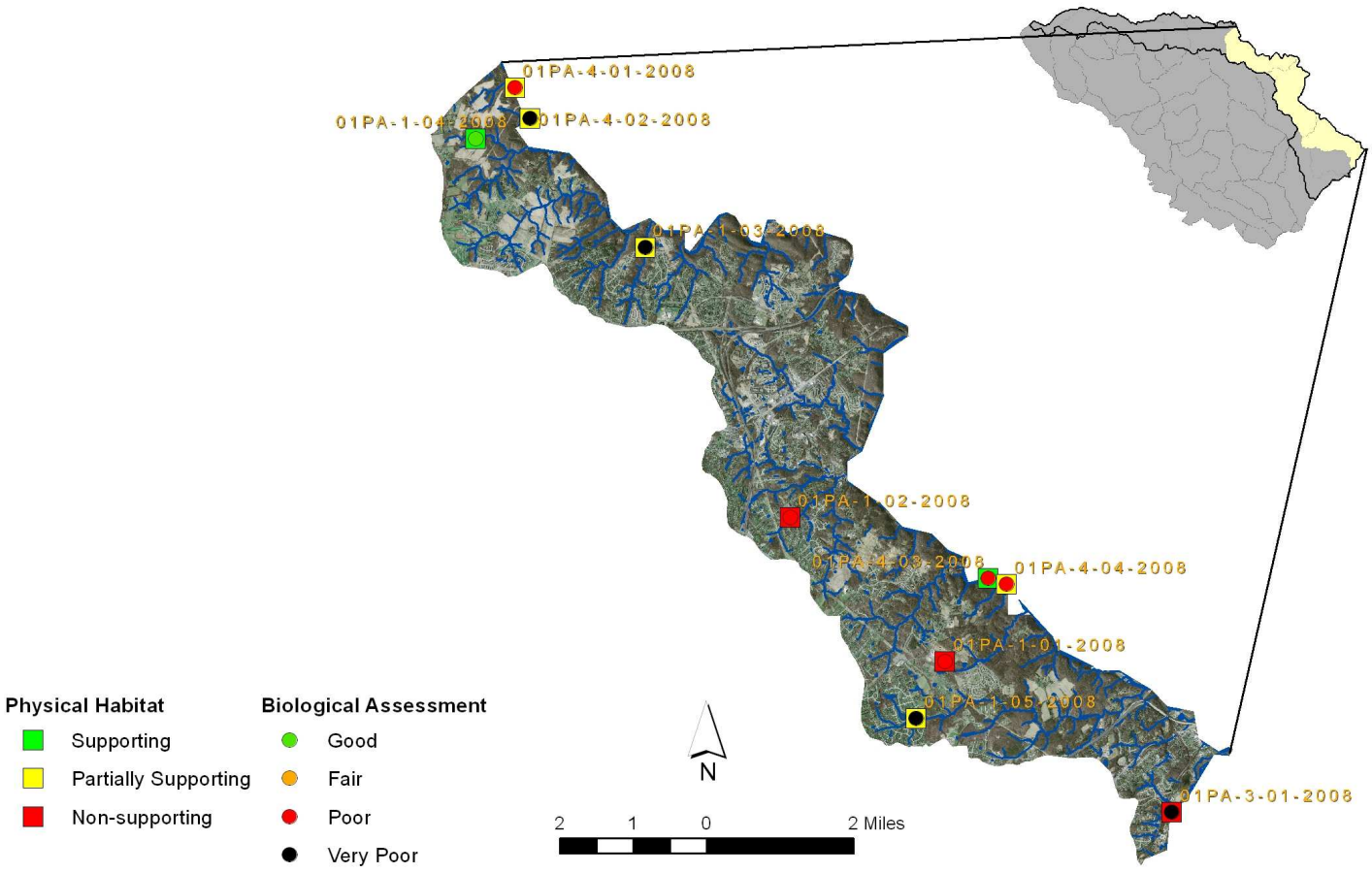

Figure 5 - Patapsco Lower Branch A Sampling Results

Table 9 - Patapsco Lower Branch A Summary

Site ID	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Drainage Area (ac)	Impervious Surface Percent	BIBI Score	BIBI Narrative Rating	Habitat Comparability Score	Habitat Narrative Rating	Rosgen Channel Type
01PA-1-01-2008	39.230680	-76.769881	30.7	0.2	2.00	Poor	60.0	Non-supporting	F4b
01PA-1-02-2008	39.259257	-76.809146	191.3	25.3	2.00	Poor	57.0	Non-supporting	F4
01PA-1-03-2008	39.312585	-76.845846	334.9	21.3	1.33	Very Poor	63.5	Partially Supporting	C4
01PA-1-04-2008*	39.334151	-76.888861	94.7	10.7	4.33	Good	78.0	Supporting	F4
01PA-1-05-2008	39.219505	-76.777249	372.4	32.4	1.67	Very Poor	63.5	Partially Supporting	E4
01PA-3-01-2008	39.200892	-76.712441	12100.6	23.7	1.33	Very Poor	56.5	Non-supporting	C5
01PA-4-01-2008	39.344268	-76.878896	164079.9	9.0	2.33	Poor	65.5	Partially Supporting	F4
01PA-4-02-2008	39.338102	-76.875021	164292.5	9.0	1.67	Very Poor	63.5	Partially Supporting	F4
01PA-4-03-2008	39.247127	-76.758897	193623.4	10.1	2.67	Poor	77.5	Supporting	B3c
01PA-4-04-2008	39.246026	-76.754254	193846.7	10.1	2.67	Poor	71.5	Partially Supporting	B3a
Minimum	--	--	30.7	0.2	1.33	Very Poor	56.5	Non-supporting	--
Maximum	--	--	193846.7	32.4	4.33	Good	78.0	Supporting	--
Mean	--	--	72896.7	15.2	2.20	Poor	65.7	Partially Supporting	--
Standard Deviation	--	--	91886.5	9.9	0.89	--	7.7	--	--

*QC sampling was conducted at this site

01PA-1-03-2008
This site received one of the lowest BIBI scores (1.33; tied with station 3-01-2008) in the subwatershed, which resulted in a 'Very Poor' biological condition rating. Although 21 taxa were present, no Ephemeroptera were represented, and only four EPT taxa were found. This station had the highest percentage of chironomids at 86 percent with *Orthocladius* (TV = 9.2) accounting for over half of the subsample. Only seven percent of the sample was classified as urban intolerant. The sampling reach is classified as a C4 channel with gravel as the predominant substrate. Nearly half (46.7 percent) of the land use in the 335-acres draining to the site is medium density residential land use, with an additional 12.2 percent as low density residential, resulting in a high imperviousness of 21.3 percent. Habitat was rated as 'Partially Supporting' with a comparability score of 63.5. There were several areas exhibiting severe bank erosion, and sediment deposition also scored low. Water quality parameters were within acceptable ranges.

01PA-1-04-2008
This site was located in a well-forested area on the Sisters of Bon Secours property. The land use within the 95-acre drainage area is predominantly forested (39.5 percent) followed by agricultural (27.3 percent) and low density residential (23.8 percent). The percentage of impervious surface in the drainage area is 10.7 percent, which is below the subwatershed average of 15.2 percent. The sampling reach is classified as an F4 channel type with a predominantly gravel substrate. Physical habitat was rated above the subwatershed average as 'Supporting' with a comparability score of 78.0. The biological condition was rated 'Good', receiving the highest BIBI score (4.33) in the entire Patapsco watershed. This is the only site in the Lower Branch subwatershed to receive a 'Good' biological rating. Of 27 total taxa present, eleven were EPT, four of which belonged to the order Ephemeroptera. Sixty-two percent of the subsample was comprised of urban intolerant individuals, the highest percentage of all stations. Clingers represented 47 percent of the subsample. Dominant taxa include the intolerant stonefly *Amphinemura* (TV = 3.0) and intolerant mayfly *Ephemerella* (TV = 2.3). This site also had one of the lowest percentages of chironomids (20 percent) present. A high pH (8.67) was measured, but this is likely due to naturally high alkalinity as opposed to human disturbance.

01PA-1-05-2008
Located adjacent to Sunnyfield Court, this reach is classified as an E4 channel dominated by gravel substrate. The predominant surrounding land use in the 372-acre drainage area is medium density residential (68.3 percent) followed by low density residential (25.3 percent), which results in 32.4 percent imperviousness, the highest of any site in the subwatershed. The habitat assessment resulted in a comparability score of 63.5 and a rating of 'Partially Supporting.' There was a notable presence of attached algae in the stream channel. The BIBI score for this site was 1.67, which was rated as 'Very Poor'. This site had 21 taxa, five of which were EPT, including one Ephemeroptera taxa. Only two percent of the subsample was comprised of individuals intolerant to urban stressors. A high percentage of individuals in the Chironomidae family (78 percent) were present at this site with *Orthocladius* (TV = 9.2) accounting for 42 percent of the subsample. Water quality parameters were all within acceptable ranges, however, conductivity was rather high at 436 µS/cm.

01PA-3-01-2008
Located on the Deep Run mainstem just off Race Road, this site is classified as a C5 channel with a sandy substrate. The banks are moderately unstable and eroding and there is substantial sediment deposition in the channel. Although 42 percent of the drainage area is forested, commercial and industrial (14.7 percent), combined residential (26.9 percent) and institutional (2.5 percent) make up a larger portion of the area. As a result, the 12,101-acre drainage area has a high percentage (23.7 percent) of impervious surface. The habitat assessment resulted in a comparability score of 56.5, or 'Non-supporting', with marginal to poor scores received for embeddedness, sediment deposition, and

bank stability. Not surprisingly, the biological condition rating was rated 'Very Poor' with a BIBI score of 1.33 (tied with station 1-03 as the lowest score). The sample had a low number of total taxa (18) with only one EPT taxa. There were no Ephemeroptera taxa present in the subsample. Chironomids comprised 83 percent of the total sample (the second highest percent of all sites), led by two tolerant midges *Orthocladius* (TV = 9.2) and *Hydrobaenus* (TV = 7.2), which together account for over 60 percent of the sample. Only fourteen percent of the sample was comprised of clingers. Water quality parameters were all within acceptable ranges, however, conductivity was the highest in the subwatershed at 579 µS/cm.

01PA-4-01-2008
Approximately one mile upstream of Woodstock Road, this site is located on a fourth-order reach of the Patapsco River. Nearly forty percent of the 164,080-acre drainage area is agricultural and 30.4 percent is forested. Another 27 percent is a combination of residential, commercial/industrial, and institutional, yielding 9.0 percent imperviousness, which is below the subwatershed average. Physical habitat was given a comparability score of 65.5 with a rating of 'Partially Supporting.' The biological condition was rated as 'Poor'(BIBI = 2.33). There were 31 taxa present in the sample (the second highest taxa count in this subwatershed), but only three EPT taxa. Two of the three EPT taxa belong to the order Ephemeroptera. Individuals from the Chironomidae family accounted for 62 percent of the sample, with *Orthocladius* as the dominant taxon. Only three percent of the individuals in the sample were rated as being intolerant to urban stressors, and 23 percent were clingers. Banks were only moderately stable 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.

01PA-4-02-2008
This site is located on the Patapsco River mainstem, approximately one-half mile upstream of Woodstock Road (downstream of site 4-01). The habitat comparability score at this site was 63.5 with a rating of 'Partially Supporting.' The reach consisted of run/pool feature type with mostly uniform velocity. Imperviousness in the 164,243-acre drainage area is only 9.0 percent, with the majority of land use being agricultural (39.5 percent) and forest (30.5 percent). All water quality parameters were measured within acceptable ranges. Gravel is the predominant substrate and the reach was classified as an F4 channel. This sample contained 22 taxa, with five EPT and only one Ephemeroptera taxa. Additionally, only two percent of the sample was intolerant to urban stress. Seventy-six percent of the sample was comprised of chironomids, and *Orthocladius* was the dominant taxa, accounting for 56 percent of the subsample. The benthic macroinvertebrate sample received a BIBI score of 1.67, resulting in a biological condition rating of 'Very Poor.'

01PA-4-03-2008
Located approximately 200 meters downstream of Bloedes Dam on the Patapsco River, this fourth-order reach is surrounded by Patapsco Valley State Park. The substrate is comprised of a mix of primarily cobbles and boulders, and the reach is classified as a B3c channel. The drainage area to this site is 193,623 acres and is comprised primarily of agricultural (35.8 percent) and forested (32.4 percent) land. Imperviousness in the drainage area is 10.1 percent, below the subwatershed average of 15.2 percent. The habitat comparability score at this site was 77.5 with a rating of 'Supporting'. However, rootwads and woody debris were lacking. The biological condition was rated 'Poor' with a BIBI score of 2.67. There were 26 total taxa (26), two of which were Ephemeropterans. This site had a low percentage of urban intolerant individuals (five percent), but a relatively high percentage of clingers (24 percent). Chironomids comprised 54 percent of the sample. Water quality parameters were all within acceptable ranges. It is possible that the altered flow regime due to the adjacent dam may be having an adverse effect on the biota.

01PA-4-04-2008
This site is located approximately 250 meters downstream of site 4-03 on the Patapsco River mainstem. The reach is classified as a B3a channel with a cobble-dominated substrate. It received a habitat comparability score of 71.5, which is 'Partially Supporting.' Riffles were abundant throughout the reach, although mostly embedded with fine sediments. Also, woody debris and rootwads were not available in quantities optimal for full colonization. Land use in the 193,847-acre drainage area is similar to most other sites sampled on the Patapsco River, predominantly agricultural (35.8 percent) followed by forested (32.4 percent), and with an overall imperviousness of 10.1 percent. Water quality parameters were all within acceptable ranges, with exception to pH, which was slightly acidic at 6.26. The benthic macroinvertebrate community had 20 taxa, with five EPT and two Ephemeroptera taxa. This site had the highest percentage of clingers in the subwatershed (47 percent). The sample had relatively few chironomids (35 percent) and also few intolerant urban individuals (three percent). The overall BIBI score was 2.67, resulting in a biological condition rating of 'Poor'.

2.1.3 Patapsco Lower Branch B

Seven of the ten sites sampled in the Lower Patapsco subwatershed in 2008 were located on first-order streams, and the remaining three sites were on second-order streams. This was the only subwatershed in the Patapsco watershed with no sampling sites on third- or fourth-order streams. The field QC sample was collected at site 04PB-1-05. Most stream reaches were classified as C or F channels with a sand or gravel substrate. A summary of the results for the Patapsco Lower Branch B PSU is in Table 10.

All but one site within the Patapsco Lower Branch B PSU were rated as 'Non-Supporting' based on the RBP habitat assessment comparability scores. Site 04PB-1-03A-2008 received a rating of 'Partially Supporting'. The mean habitat comparability score of 51.8 for the subwatershed resulted in a 'Non-Supporting' rating. It should also be noted that half of the sites (five) had considerable lengths of channel that were either piped into culverts or were channelized under bridges.

All of the streams sampled in the Patapsco Lower Branch B subwatershed received biological condition ratings of 'Very Poor'; the lowest subwatershed rating in the Patapsco watershed. BIBI scores ranged from a low of 1.00 o 1.67, which resulted in a mean BIBI score of 1.37 and a biological condition rating of 'Very Poor' for the subwatershed.

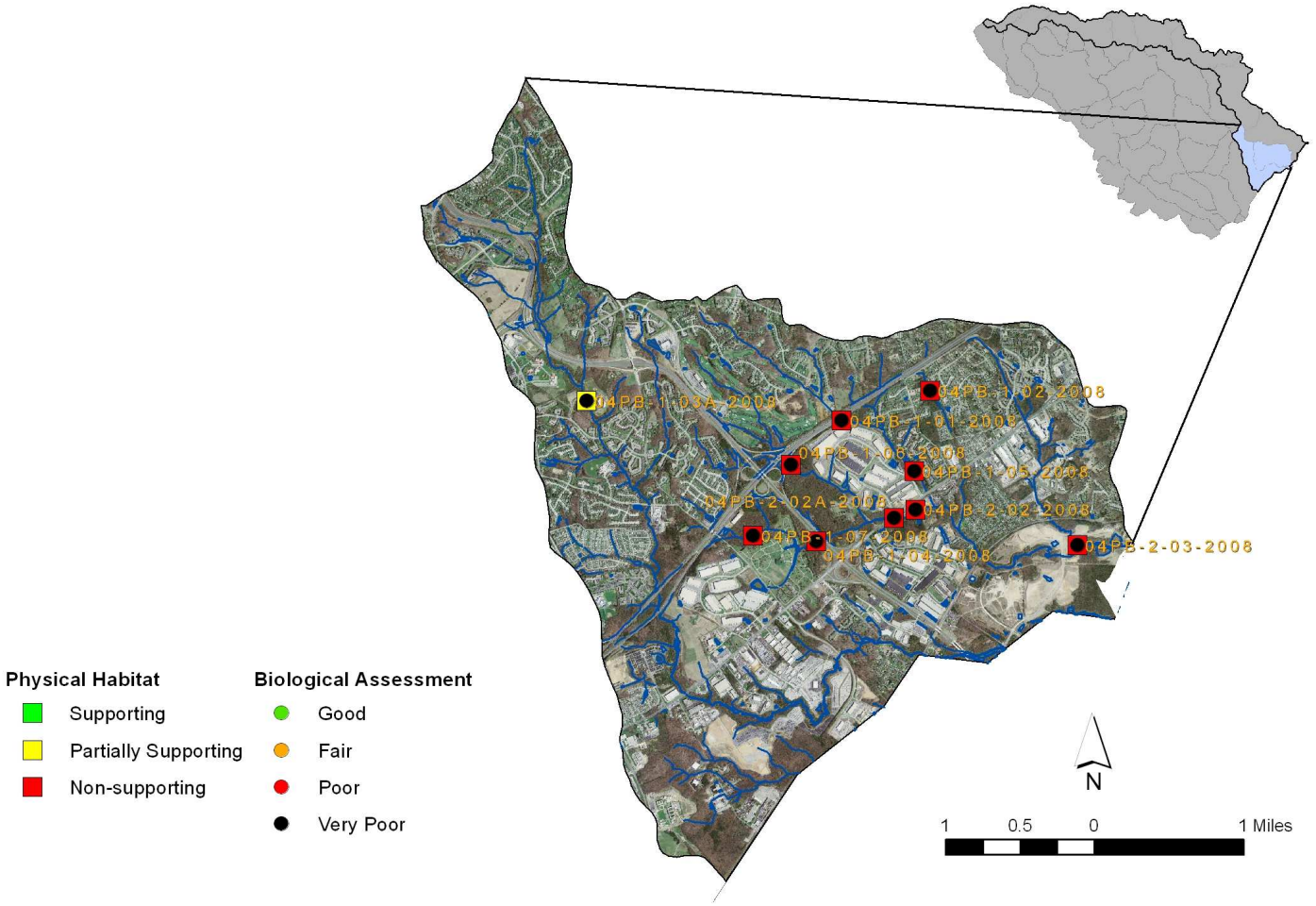

Figure 6 - Patapsco Lower Branch B Sampling Results

Table 10 - Patapsco Lower Branch B Summary

Site ID	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Drainage Area (ac)	Impervious Surface Percent	BIBI Score	BIBI Narrative Rating	Habitat Comparability Score	Habitat Narrative Rating	Rosgen Channel Type
04PB-1-01-2008	39.202373	-76.756504	309.4	21.9	1.00	Very Poor	34.0	Non-supporting	F4
04PB-1-02-2008	39.205220	-76.745481	75.7	24.6	1.00	Very Poor	44.5	Non-supporting	C5
04PB-1-03A-2008	39.204325	-76.788393	919.0	24.4	1.67	Very Poor	61.5	Partially Supporting	B4
04PB-1-04-2008	39.190590	-76.759764	600.5	28.5	1.67	Very Poor	48.0	Non-supporting	F4
04PB-1-05-2008*	39.197397	-76.747471	583.7	18.0	1.67	Very Poor	58.0	Non-supporting	B4c
04PB-1-06-2008	39.198045	-76.762915	302.1	11.8	1.33	Very Poor	49.5	Non-supporting	C4b
04PB-1-07-2008	39.191156	-76.767616	148.4	21.5	1.33	Very Poor	59.0	Non-supporting	C4
04PB-2-02-2008	39.193684	-76.747314	1266.9	20.1	1.33	Very Poor	56.5	Non-supporting	F4
04PB-2-02A-2008	39.192830	-76.749986	1210.8	20.2	1.33	Very Poor	49.5	Non-supporting	F4
04PB-2-03-2008	39.190156	-76.727094	629.7	39.0	1.33	Very Poor	57.5	Non-supporting	F4
Minimum	--	--	75.7	11.8	1.00	Very Poor	34.0	Non-supporting	--
Maximum	--	--	1266.9	39.0	1.67	Very Poor	61.5	Partially Supporting	--
Mean	--	--	604.6	23.0	1.37	Very Poor	51.8	Non-supporting	--
Standard Deviation	--	--	418.0	7.1	0.25	--	8.4	--	--

*QC sampling was conducted at this site

Patapsco Lower Branch B Site Descriptions:

04PB-1-01-2008
This site was located just below Interstate 95 and adjacent to the Troy Hill Corporate Center, off Troy Hill Drive. The stream was classified as an F4 channel with gravel as the dominant substrate. The dominant land use in the drainage area is medium-density residential (30.9 percent) followed by low density residential (23.0 percent) resulting in an impervious percentage of 21.9, higher than the Patapsco watershed average of 16.6. The RBP habitat assessment resulted in a percent comparability score of 34.0 and a rating of 'Non-supporting', the lowest in this subwatershed. It should also be noted that the upper 35 meters of the reach was in a piped culvert below I-95, which was large enough to be sampleable but had only concrete bottom and no sampleable habitat. Consequently, poor ratings were given for a number of habitat characteristics including epifaunal substrate, sediment deposition, and bank stability. Channel alteration also scored in the low range of the marginal category due to the pipe culvert. This station had the lowest BIBI score of 1.00, classified as 'Very Poor' (tied with station 1-02). This site received the lowest score possible for each BIBI parameter with only 14 total taxa. There were no Ephemeroptera taxa, and only two percent of individuals were considered intolerant to urban land stressors. The sample was dominated by chironomids, making up 90 percent of the sample. Individuals from the genus *Hydrobaenus*, a tolerant midge (TV = 7.2), accounted for more than half of the subsample. Water quality parameters were all within acceptable ranges, with exception to pH, which was alkaline at 8.53.

04PB-1-02-2008

This site was located just behind the cul-de-sac at the end of Potomac Hunt Court. The sampling reach runs adjacent to a sewer line clearing and has a storm water management pond draining into the lower end of the reach. There was also evidence of channel stabilization using rip-rap near the downstream end of the reach, which provided the only riffle habitat. The channel was classified as a Rosgen type C5 with a sand and gravel substrate. Land use in the 76-acre drainage area is predominantly medium density residential (62.7 percent), with an overall imperviousness of 24.6 percent. The overall habitat was rated as 'Non-supporting' with a comparability score of 44.5 percent. There was a general lack of stable epifaunal substrate available for colonization, and sedimentation and embeddedness issues. The degraded habitat likely led to the site receiving one of the lowest BIBI scores in the subwatershed (tied with station 04PB-1-01-2008) of only 1.00, with a rating of 'Very Poor'. This site received the lowest score possible for each BIBI parameter and only eight taxa were present in this sample, the lowest observed in any site in the Patapsco watershed. The sample was dominated by individuals of the Chironomidae family (96 percent). The most common taxa were the pollution tolerant *Hydrobaenus* (TV = 7.2) and *Orthocladius* (TV = 9.2) with 36 and 58 individuals, respectively. Additionally, there were no individuals in the sample intolerant to urban stressors, suggesting degradation by urban stressors. Water quality parameters were all within acceptable ranges, however conductivity (709 µS/cm) was much higher than normal background levels for the piedmont and above the subwatershed average (583 µS/cm). This suggests that large amounts of road runoff may be impacting the stream.

04PB-1-03A-2008
Located adjacent to Bellows Springs Elementary School, this alternate site was chosen due to access issues at the primary site. The upstream end of the sampling reach continues under the bridge on the school's main entry road. The majority of the land use in the 919-acre drainage area to this sampling point is medium density residential (32 percent), with another 29.5 percent comprised of low and high density residential, commercial and industrial, and institutional land uses. This results in 24.4 percent impervious surface area for the drainage area. The sampling reach is a B4 channel type with a gravel substrate; however, a large bedrock outcrop provides grade control and prevents further down cutting. Severe erosion and entrenchment were observed at the downstream end of the reach below the bedrock

cascade. The habitat assessment indicated moderately unstable banks and poor vegetative protection along the left bank (facing downstream), and epifaunal substrate was only marginal. The overall habitat comparability score was 61.5 percent, with a rating of 'Partially Supporting', the only rating above 'Non-supporting' in the subwatershed. The biological condition was rated 'Very Poor', with a BIBI score of 1.67. Only two parameters, number of taxa (21) and percent clingers (35.9) received scores greater than the minimum of one point. Water quality parameters were all within acceptable ranges, however conductivity (686 µS/cm) was elevated from background levels typical of the piedmont.

04PB-1-04-2008
This reach is located partially under Maryland Route 100 and drains Meadowridge Memorial Park. The lower 35 meters of the sampling reach were contained within a concrete box culvert and was not sampled due to lack of habitat. The stream is a gravel-dominated F4 channel with areas of sand deposition. Land use in the 601-acre drainage area is 37 percent forested, however commercial and industrial account for 21.3 percent and medium and high density residential combined account for 21.2 percent, leading to a total of 28.5 percent of impervious surface. The habitat was rated as 'Non-supporting' with a comparability score of 48.0 percent. As predicted by the habitat score, the biological condition was in the 'Very Poor' range with a BIBI score of 1.67. The sample had 16 taxa, but only one EPT taxon, the caddisfly *Chimarra*. The sample was dominated by pollution tolerant worms (Order: Haplotaxida). Less than one percent of the individuals in the sample were urban intolerant, suggesting that the presence of urban stressors is impacting biota. Water quality results again fell within acceptable COMAR ranges, although conductivity was still above 500 µS/cm.

04PB-1-05-2008
This sampling reach is located in a narrow, wooded valley between Troy Hill Road and Ducketts Lane. A storm drain from the adjacent town home community parking lot empties into the sampling reach, and a small head cut is forming where the stormwater flows over land and into the stream channel. The stream is classified as a B4c channel type dominated by a gravel substrate. Imperviousness to the sampling site is 18.03 percent, which is below the subwatershed average of 23 percent. Residential land uses make up nearly half of the 584-acre drainage area with over 29.7 percent classified as medium-density residential, and another 15.5 percent as low-density residential. The habitat comparability score for this site was 58.0 percent, with a rating of 'Non-supporting.' The banks were moderately unstable and vegetative protection was less than optimal. The benthic sample was rated as 'Very Poor' with a BIBI score of 1.67. Only two metrics received a score higher than one - the 'total number of taxa' metric received a score of three and Ephemeroptera taxa also received a score of three. Less than one percent of the individuals were intolerant to urban stressors. Eighty-four percent of the sample was chironomids, with the most common taxa being *Orthocladius* (56 specimens). The QC sample collected just upstream of this site was also rated 'Very Poor,' but received a slightly lower BIBI score of 1.33, due to one fewer Ephemeroptera taxon in the subsample. Water quality parameters were all within acceptable ranges.

04PB-1-06-2008
This site is located below the I-95 and Route 100 interchange, just a short distance downstream of the Timbers at Troy Golf Course. The majority of the land use in this 302-acre drainage area is open urban land (61.5 percent), which is primarily golf course, followed by forest (21.5 percent), resulting in a subwatershed low imperviousness of 11.9 percent. The upper 45 feet of the sampling reach is piped into a large concrete culvert that extends under I-95, and was not sampled due to a lack of habitat. Consequently, physical habitat was rated as 'Non-supporting' based on the comparability score of 49.5. The channel is classified as a C4b channel, with a gravel dominated substrate, however cobble and small boulder sized rip-rap had been placed in throughout the stream channel. This site received a BIBI score of 1.33 with a narrative rating of 'Very Poor.' This site had 18 total taxa, none

of which were Ephemeroptera. There was a large proportion of chironomids (85 percent), but much fewer clingers (10.2 percent) in the sample. Instream water quality sampling indicates all parameters within acceptable ranges, although conductivity was elevated (539 µS/cm) and an orange flocculant and attached algae were observed throughout the reach.

04PB-1-07-2008
Located adjacent to Meadowridge Memorial Park, this first-order sampling reach had an abundance of fine sediment deposition, which appears to have been the result of a debris jam backing up flow at a downstream culvert but has since been cleared out, returning flow to normal. Another large woody debris jam is present in the middle of the reach, which alters flow and is collecting sediment and fine particulate organic matter. Imperviousness in the drainage area to this site (21.5 percent) is well above the Patapsco watershed average. Within the 148-acre drainage area, the predominant land use is forested (52.1 percent), however low density residential (29.9 percent) and high density residential (14.1 percent) add a substantial amount of impervious surface. This reach is classified as a C4 channel with a gravel-dominated substrate. The habitat assessment and biological condition show agreement, with the site receiving a 'Non-supporting' habitat rating and a 'Very Poor' biological condition (BIBI = 1.33). This site received the lowest possible score (1) for each metric, except total taxa where it received a moderate score (3). Chironomids dominated the sample (85 percent) and Ephemeroptera taxa were absent. All water quality parameters were within acceptable ranges.

04PB-2-02-2008
This sampling reach runs parallel to Maryland Route 1 just north of the Rt.100 interchange. The stream has been channelized for a considerable length and rip-rap bouldering is evident along the left bank, while a paved path has been built along the right bank, reducing the width of the riparian buffer. Of the 1,267-acres draining to this site, 20.1 percent is impervious. There are a variety of land uses in the drainage area, though the predominant land use is forest (37.6 percent), followed by open urban land (24 percent), which includes Meadowridge Memorial Park and Timbers at Troy Golf Course, and 27.2 percent developed land uses including residential, commercial and industrial, and institutional. Due to heavy channelization, poor riparian buffer width, and little vegetative protection, this site received a habitat comparability score of 56.5, and a rating of 'Non-supporting.' As predicted by the habitat condition, the biological condition was rated 'Very Poor' with a BIBI score of 1.33. This site also received a score of '1' in each metric category, with exception to total taxa. Eighty-five percent of the sample were chironomids, and *Orthocladius* was the dominant taxa comprising nearly half of the subsample. Individuals intolerant to urban stressors comprised less than two percent of the sample. Water quality results show all parameters within acceptable COMAR limits, but with elevated conductivity (609 µS/cm). The dominant substrate was gravel and the reach was classified as a F4 channel.

04PB-2-02A-2008
Located a few hundred feet upstream of site 2-02, this alternate site was sampled due to denied landowner access to sites 2-01 and 2-01A. The upper 95 feet of the sampling reach is contained within a broad, concrete box culvert below Route 1. Additionally, much of the lower portion of the reach is also channelized with boulder rip-rap and earthen berms. Land use and imperviousness (20.2 percent) is nearly identical to site 2-02, and the drainage area is only slightly smaller at 1,211 acres. The reach is classified as an F4 channel with gravel as the dominant substrate. This site received a 'Non-supporting' habitat rating with a comparability score of 49.5, much of which is due to the large portion of the reach being channelized into a culvert. The BIBI score of 1.33, rated as 'Very Poor', as a result of receiving the lowest possible score (1) for each metric category, with exception to total taxa. Like site 2-02, the tolerant midge *Orthocladius* was the dominant taxa comprising nearly half of the subsample. There was also a complete lack of Ephemeroptera as well as individuals intolerant to urban stressors, suggesting that urban stressors are frequently impacting the biota. Although water quality

parameters were all within acceptable ranges, conductivity (636 µS/cm) was elevated from background levels.

04PB-2-03-2008
This site is located approximately 100 meters downstream of Hi Tech Road, just before the confluence with Deep Run. The reach is classified as an F4 channel type and exhibits noticeable over widening and entrenchment. There is also heavy deposition of sand and gravel on mid channel and point bars. The drainage area is approximately 630 acres and has the highest percent imperviousness (39 percent) within the entire Patapsco watershed. This is largely a result of heavy development in the form of commercial and industrial (23.6 percent), high-, medium-, and low-density residential (11.8, 24.1, and 10.8 percent, respectively) and institutional (3.7 percent) land uses. This site received an overall habitat comparability score of 57.5 and was rated as 'Non-supporting' due in part to high percentages of embeddedness and sediment deposition as well as poor bank stability and channel flow. Consequently, the biological condition was rated as 'Very Poor,' with a BIBI scored of 1.33. Chironomids dominated the subsample, comprising over 82 percent, and once again a single pollution tolerant midge (*Orthocladius)* accounted for more than half of the subsample. Intolerant individuals and Ephemeroptera taxa were absent, indicating a high probability that urban stressors are responsible for the impaired biota. However, water quality results did not indicate any exceeded COMAR limits.

3 Discussion and Comparison

3.1 Patapsco River Watershed Summary

3.1.1 2003 Assessment Results

Results from the 2003 watershed assessment indicated that the Patapsco watershed was in a 'Poor' overall biological condition; only one subwatershed – Lower Branch A - had a site that received a biological condition rating of 'Good', and each of the PSUs were individually rated as 'Poor'. Biological condition ratings and BIBI scores from 2003 are displayed in Table 12.

All three PSUs received an average RBP physical habitat quality rating of 'Partially Supporting' with the lowest score received being a 68. The mean RBP habitat comparability score was 61.5 percent. Physical habitat scores and narrative ratings from 2003 are displayed in Table 13.

3.1.2 2008 Assessment Results

Bioassessment

Biological and physical habitat assessment results for 2008 in the Patapsco watershed indicate a stream system that is impaired. Only two of the thirty benthic macroinvertebrate samples received a rating of 'Good' and four received a 'Fair' rating. The remaining sites (80 percent) were rated as either 'Poor' or 'Very Poor.' Sites 10PT-1-04 and 01PA-1-04 were the only ones to receive a biological condition rating of 'Good.' No sites received a 'Good' or 'Fair' biological condition rating in the Patapsco Lower Branch B subwatershed.

Overall, the entire Patapsco watershed received a 'Non-supporting' physical habitat assessment rating. The mean RBP habitat comparability score for the Patapsco watershed was 59 percent. Only one watershed, Lower Branch A, received a "Partially Supporting" physical habitat rating. However, the mean percent comparability score for South Branch (59.6 percent), was less than one percentage point below the lower threshold (60.1) for the "Partially Supporting" habitat rating. Habitat assessments revealed many areas with erosion along the banks and areas of high deposition. There was a strong positive correlation (significance level of 0.01) between the RBP habitat comparability score and the BIBI score. All but one site (01PA-4-04) 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 throughout the watershed with values from 105 to 709 µS/cm. An analysis of these values indicates that there was also a strong negative correlation between the BIBI score and specific conductance. Within this range of values, only one site in the entire watershed (10PT-1-03) had a value less than 200 µS/cm. The average value in the South Branch was 267 µS/cm, in the Lower Branch A, 362 µS/cm and in the Lower Branch B, 583 µS/cm. These are values typically measured in road runoff 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 de-icing 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 sampled throughout the watershed were classified as stable type B, C, or E, however a good portion were classified as unstable, incised F channels. Gravel was the dominant substrate across the entire watershed but many areas with sand deposition were observed.

Imperviousness

The average percentage of impervious area in the Patapsco watershed is 16.5 percent. Land use based imperviousness for the areas draining to the sampling sites range from zero (0) percent to 39 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 variables 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.

Pearson correlations between the BIBI scores and three parameters (RBP score, percent imperviousness, and specific conductivity) all showed significant relationships. There was a strong positive correlation with RBP habitat comparability scores (correlation of 0.577 with a significance level of 0.001), suggesting that BIBI scores (and consequently biological condition) increase with improved habitat conditions. The percentage of imperviousness to each sampling site indicates a

negative relationship (correlation of -0.462 with a significance level of 0.010) to BIBI scores, implying biological condition decreases with increased watershed imperviousness. Specific conductivity and BIBI scores also showed a strong negative correlation (correlation of -0.552 with a significance level of 0.002). These results support the notion that overall water quality and biological health are likely being affected by the amount of development in the watershed.

A strong correlation was observed between impervious percent and specific conductivity (correlation of 0.662 with a significance level of <0.001), suggesting that increased conductivity is due in large part to urban runoff. In addition, a negative correlation was found between RBP scores and specific conductance (-0.397, with a significance level of 0.030), inferring that urban runoff (a source of high conductivity) may also be impacting the habitat, through more intense discharges and higher peak flows.

Table 11 - Pearson Correlations

		Habitat Assessment	Percent Impervious	Specific Conductance
BIBI n=30	Correlation	0.557	-0.462	-0.552
	Significance	0.001	0.010	0.002
Habitat Assessment n=30	Correlation		-0.215	-0.397
	Significance		0.254	0.030
Percent Impervious n=30	Correlation			0.662
	Significance			<0.001

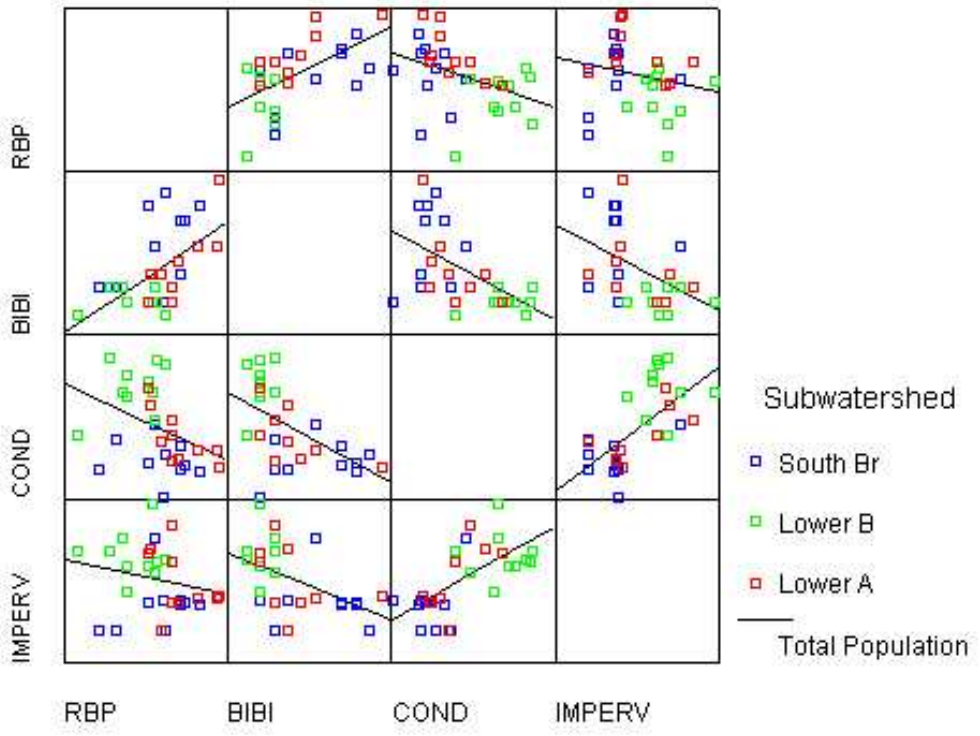

Figure 7 - Scatterplot Matrix for several 2008 Data Parameters (BIBI, Habitat Assessment, Percent Impervious Cover and Specific Conductivity), best fit line represents the total 2008 sample population.

3.1.3 Comparison of 2003 and 2008 Bioassessment data

BIBI

Although recorded BIBI scores declined slightly between 2003 (BIBI = 2.39 ± 1.10) and 2008 (BIBI = 2.10 ± 0.95), the difference between the two sample means was not significant (t-test, t = 1.088, p = 0.281). The overall mean biological condition for the Patapsco watershed remained 'Poor.' Table 12 and Figure 8 summarize the results for 2003 and 2008 BIBI data.

In the South Branch subwatershed, the average BIBI score (2.73) remained consistent between 2003 and 2008. Results from the Lower Branch A subwatershed, were also virtually unchanged, with an average BIBI score of 2.23 in 2003 compared to 2.20 in 2008. This minor change did not affect the narrative rating of 'Poor' and was not statistically significant (t = 0.064, p = 0.950). The biggest shift was observed in the Lower Branch B subwatershed, where the average BIBI score decreased from 2.20 and a rating of 'Poor' in 2003 to 1.37 and a 'Very Poor' rating in 2008. However, t-test results indicate that the difference was not significant (t = 2.056, p = 0.055).

Table 12 - Comparison of 2003 and 2008 BIBI Data

Sampling Year	Patapsco Subwatershed	Number of sites sampled	Min. BIBI	Max. BIBI	Median BIBI	Mean BIBI	Narrative Rating	Standard Deviation
2003	South Branch	10	2.00	3.67	2.67	2.73	Poor	0.54
	Lower Branch A	10	0.00	4.33	2.50	2.23	Poor	1.36
	Lower Branch B	10	0.00	3.33	2.67	2.20	Poor	1.26
	Entire Watershed	*30*	*0.00*	*4.33*	*2.67*	*2.39*	*Poor*	*1.10*
2008	South Branch	10	1.33	4.00	3.00	2.73	Poor	0.99
	Lower Branch A	10	1.33	4.33	2.00	2.20	Poor	0.89
	Lower Branch B	10	1.00	1.67	1.33	1.37	Very Poor	0.25
	Entire Watershed	*30*	*1.00*	*4.33*	*1.67*	*2.10*	*Poor*	*0.95*

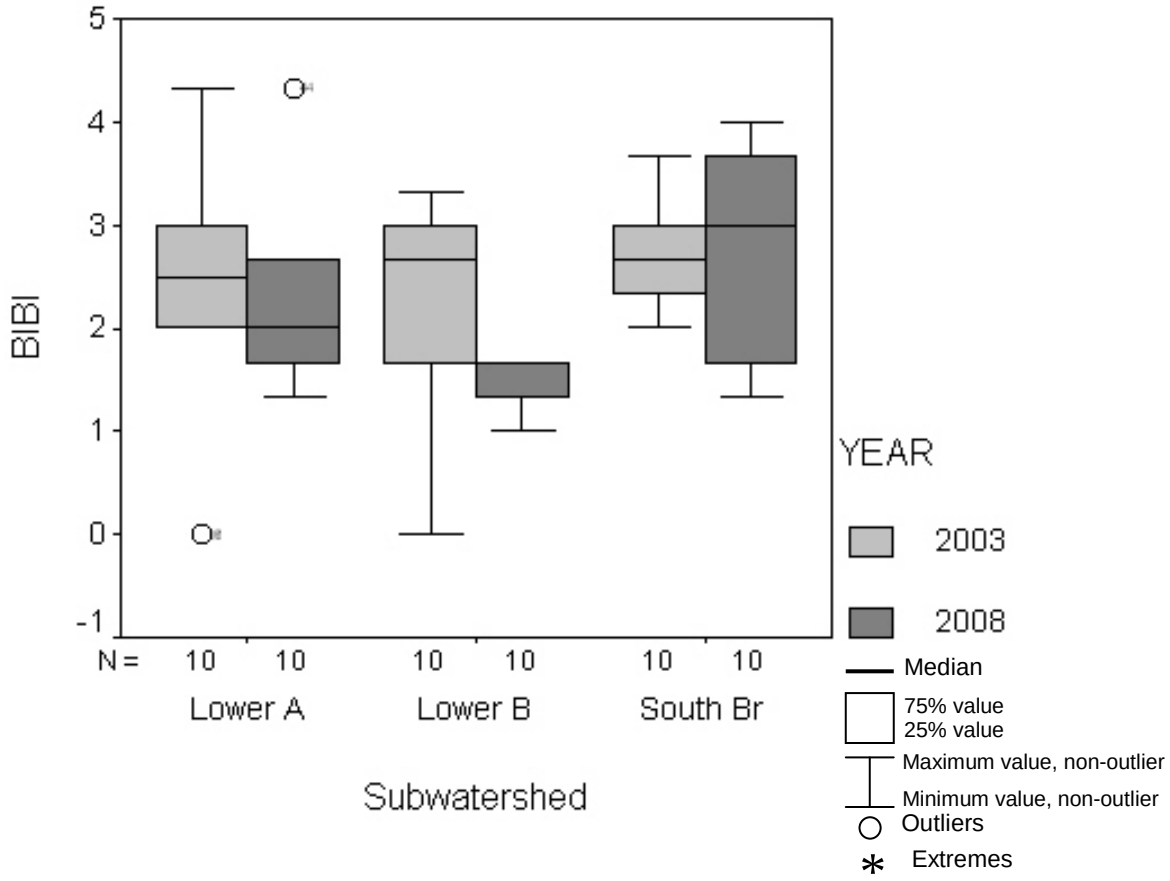

Figure 8 - Comparison of 2003 and 2008 BIBI scores in the Patapsco River subwatersheds

RBP Physical Habitat Assessment

Overall, RBP physical habitat conditions for two subwatersheds (South Branch and Lower Branch B) decreased from a 'Partially Supporting' rating to a 'Non-supporting' rating, resulting in the mean RBP physical habitat condition for the entire Patapsco watershed decreasing from a 'Partially Supporting' rating to a 'Non-supporting' rating. However, the slight change in habitat condition is not statistically significant ($t = 0.960$, $p = 0.341$). The largest shift occurred in the Lower Branch B subwatershed, which may be due to the presence of culverts/bridge overpasses at half of the sampling locations reducing habitat scores. A summary of 2003 and 2008 RBP physical habitat assessment data can be found in Table 13 and a box plot comparing RBP scores over this time period is shown in Figure 9.

Table 13 - Comparison of 2003 and 2008 RBP Physical Habitat Assessment Data

Sampling Year	Patapsco Subwatershed	Number of sites Assessed	Min. RBP Score	Max. RBP Score	Median RBP Score	Mean RBP Score	Narrative Rating	Standard Deviation
2003	South Branch	10	95	154	123	124	Partially Supporting	16.8
	Lower Branch A	10	78	156	131	124	Partially Supporting	23.7
	Lower Branch B	10	68	143	127	122	Partially Supporting	22.1
	Entire Watershed	*30*	*68*	*156*	*126*	*123*	*Partially Supporting*	*20.4*
2008	South Branch	10	82	144	123	119	Non-Supporting	19.2
	Lower Branch A	10	113	156	127	131	Partially Supporting	15.4
	Lower Branch B	10	68	123	106	104	Non-Supporting	16.8
	Entire Watershed	*30*	*68*	*156*	*119*	*118*	*Non-Supporting*	*20.3*

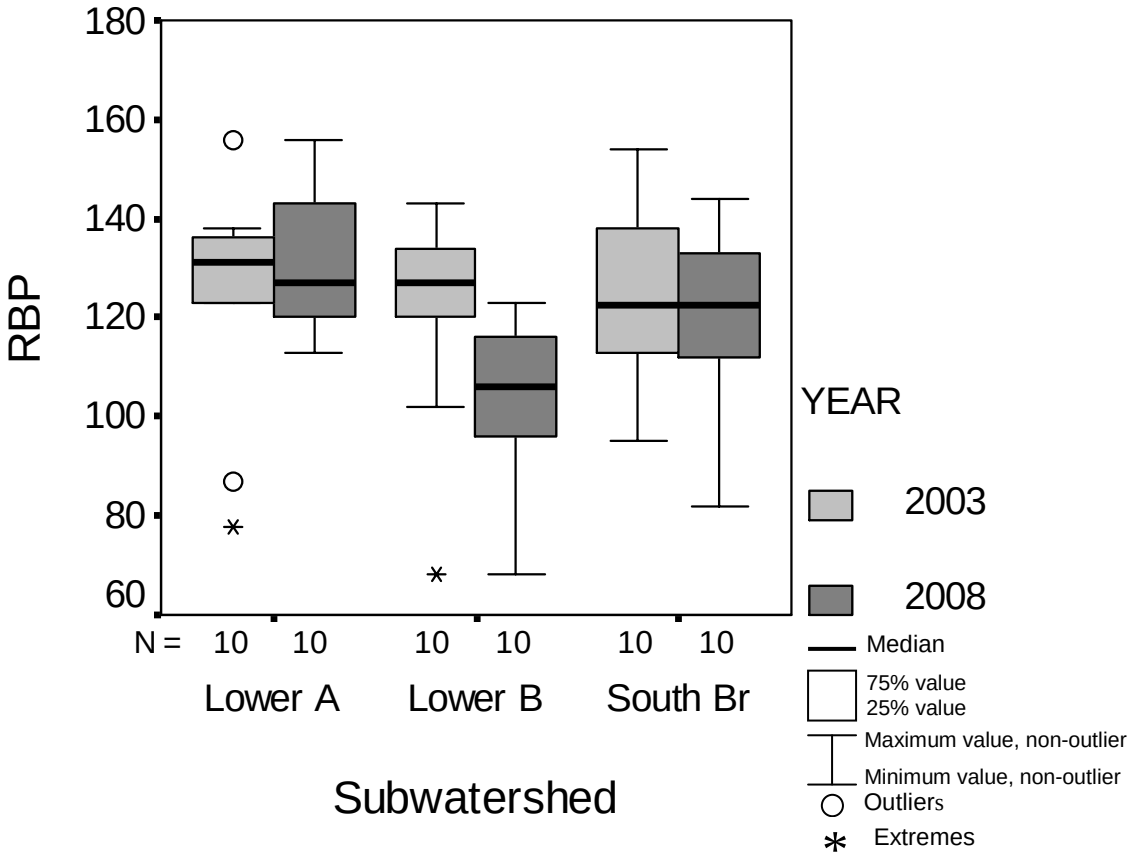

Figure 9 - Comparison of 2003 and 2008 RBP Physical Habitat Assessment scores in the Patapsco River subwatersheds.

4 Conclusion and Recommendations

Watershed Condition

Results of the 2008 assessment of the Patapsco watershed indicate generally poor biological conditions, and a slight decrease, though not significant, was observed in the overall BIBI scores from 2003. While physical habitat scores resulted in a slight decrease, there was no significant difference between years. These results are similar to those obtained by MBSS during Round Two (2000-2004) of statewide sampling (Kazyak et al., 2005).

Overall the Patapsco watershed is predominantly agricultural land use and forested land cover, however increasing residential and commercial 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 more importantly, to what extent.

Additional Water Quality Sampling

The 'Supporting' and 'Partially Supporting' habitat conditions identified were not always substantiated by a healthy benthic community. This can be an indication of degraded water quality conditions. Although very few of the water quality parameters measured (pH only) were outside of the acceptable COMAR standards, additional sampling is recommended, especially on those streams rated as 'Poor' or 'Very Poor' for biological condition, in order to determine whether there are other chemical stressors affecting the biota.

In 2008, 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 Patapsco should also be conducted to determine the presence of 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, with the most recent field sampling protocols having been updated in 2007. While no changes have occurred to the benthic macroinvertebrate collection methods implemented herein, additional surveys have been added to the data collection efforts (i.e., seasonal pool search in the Spring), which may be of interest to the County. Howard County should continue to update their methods in the future to stay current with the latest MBSS sampling 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 and Community Outreach

In 2003, a Stream Corridor Assessment (SCA) was completed for the South Branch and Lower North Branch A of the Patapsco River corridor in Howard County (MDNR, 2003). The report identified 800 potential environmental problems such as inadequate forested stream buffers, erosion, and channel alterations. An SCA was also completed for the Lower North Branch B and the main stem in 2005. In addition, a Watershed Restoration Action Strategy (WRAS) for the Lower Patapsco River was completed in 2006 (DPZ, 2006) which is intended to be a work plan to restore and protect water quality and habitat, and address the needs for environmental outreach and education within the watershed. A similar watershed management for the South Branch Patapsco subwatershed would also be beneficial in the future. The current 2008 data could be incorporated into the monitoring plans for any restoration or preservation projects deemed necessary for the Patapsco 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 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.

Howard County Department of Planning and Zoning (DPZ). 2006. Lower Patapsco River Watershed Restoration Action Strategy (WRAS). Howard County, Maryland. Department of Planning and Zoning, Division of Environmental and Community Planning. Columbia, MD.

Howard County Department of Public Works (DPW). 2001. Quality Assurance Project Plan (QAPP). Howard County, Maryland. Department of Public Works, Stormwater Management Division. Columbia, MD.

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. 2008. 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 2008.

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

Kazyak, P.F., Brindley, A., and M.T. Southerland. 2005. Maryland Biological Stream Survey 2000-2004 Voulme 8: County Results. DNR-12-0305-0107. 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.

Maryland Department of Natural Resources (DNR). 2003. Patapsco River Stream Corridor Assessment Survey in Howard County. Prepared by Watershed Assessment and Targeting Division, Watershed Services Unit, Maryland DNR, Annapolis, MD for Howard County Department of Public Works Bureau of Environmental Services, Stormwater Management Division, NPDES Watershed Management Programs. Columbia, MD. December 2003.

Maryland Department of Natural Resources (DNR). 2007. Maryland Biological Stream Survey Sampling Manual: Field Protocols. CBWP-MANTA-EA-07-01. Published by the Maryland Department of Natural Resources, Annapolis, MD. Publication # 12-2162007-190.

Mecklenburg, Dan. 2004. The Reference Reach Spreadsheet. Version 4.1 L. Ohio Department of Natural Resources.

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. 2005. *Biological Assessment of the Patapsco River Tributary Watersheds, 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

USDA, 1986.

Site ID	Drainage Area (Acres)[1]	LDR	MDR	HDR	CI	INST	EXT	OUL	AGR	FOR	OW	WET	BG	% Impervious[2]
Patapsco River L Branch A														
01PA-1-01	30.67	0.77%							0.73%	98.50%				0.19
01PA-1-02	191.29	24.19%	41.32%		0.44%	4.03%		10.65%	4.69%	14.68%				25.31
01PA-1-03	334.91	12.22%	46.67%						2.81%	37.29%			1.01%	21.30
01PA-1-04	94.75	23.84%				9.38%			27.26%	39.51%				10.65
01PA-1-05	372.37	25.34%	68.34%	0.12%					0.56%	5.64%				32.38
01PA-3-01	12100.62	9.92%	11.45%	5.49%	14.71%	2.50%		4.12%	8.81%	42.14%	0.05%		0.80%	23.74
01PA-4-01	164079.91	20.08%	3.17%	0.48%	2.20%	1.05%	0.16%	0.44%	39.56%	30.41%	2.25%	0.06%	0.14%	9.04
01PA-4-02	164292.49	20.05%	3.17%	0.48%	2.20%	1.05%	0.16%	0.44%	39.53%	30.48%	2.24%	0.06%	0.14%	9.03
01PA-4-03	193623.39	19.36%	5.02%	0.96%	2.31%	1.16%	0.13%	0.78%	35.79%	32.35%	1.90%	0.05%	0.16%	10.07
01PA-4-04	193846.73	19.34%	5.02%	0.96%	2.31%	1.16%	0.13%	0.78%	35.77%	32.41%	1.90%	0.05%	0.16%	10.06
Patapsco River L Branch B														
04PB-1-01	309.39	23.05%	30.90%			4.02%		21.75%	11.02%	9.26%				21.91
04PB-1-02	75.72	3.12%	62.69%						2.49%	31.70%				24.60
04PB-1-03A	918.95	17.98%	31.96%	5.17%	2.42%	3.97%		3.41%	30.72%	4.37%				24.41
04PB-1-04	600.53	0.94%	12.71%	8.46%	21.34%	0.44%		18.57%	0.24%	37.31%				28.50
04PB-1-05	583.71	15.45%	29.70%	0.75%	0.07%	2.13%		11.53%	9.10%	31.26%				18.03
04PB-1-06	302.08	0.26%	10.17%	1.16%	0.47%			61.52%	4.92%	21.50%				11.85
04PB-1-07	148.44	3.82%	29.86%	14.13%	0.05%			0.04%		52.09%				21.53
04PB-2-02	1266.91	0.51%	8.45%	4.29%	13.11%	1.36%		23.97%	8.75%	37.58%			1.99%	20.12
04PB-2-02A	1210.85	0.53%	8.84%	4.48%	12.60%	1.42%		25.08%	9.02%	35.94%			2.09%	20.16
04PB-2-03	629.65	10.83%	24.11%	11.79%	23.62%	3.67%			4.15%	21.84%				38.96
S Branch Patapsco River Tribs														
10PT-1-01	46.83								100.00%					0.00
10PT-1-02	0.38								100.00%					0.00
10PT-1-03	160.59	37.88%							42.41%	12.91%		6.81%		9.47
10PT-1-04	126.11	1.30%							63.46%	35.23%				0.33
10PT-1-05A	1205.98	31.08%							33.16%	35.75%				7.77
10PT-2-01	2317.10	22.56%	9.02%	4.24%	17.65%	3.08%		2.59%	14.89%	25.97%				28.56
10PT-2-02	1908.62	29.30%		0.10%	0.28%	0.61%		0.51%	53.84%	14.78%		0.58%		7.99
10PT-4-01	41366.19	23.57%	1.94%	0.50%	1.80%	0.52%		0.20%	43.02%	28.23%	0.06%	0.11%	0.04%	8.81
10PT-4-02	22775.10	25.59%	1.58%	0.58%	2.29%	0.55%		0.20%	43.18%	25.70%	0.11%	0.14%	0.07%	9.67
10PT-4-03	41157.62	23.69%	1.95%	0.50%	1.81%	0.52%		0.20%	43.12%	27.98%	0.07%	0.11%	0.04%	8.85
Patapsco Watershed Average														**16.55**

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)
EXT: Extractive (17)

OUL: Open Urban Land (18)
AGR: Agriculture (21, 22, 23, 25, 241, 242)
FOR: Forest (41 - 44)
OW: Open Water (50)
WET: Wetlands (60)
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

Patapsco River Watershed
Biological Monitoring and Assessment
Summary Water Quality Data

Howard County
2008

Site ID	Collection Date	pH	Water Temperature *℃*	Dissolved Oxygen *mg/l*	Turbidity *NTU*	Conductivity *µS/cm*	Total Dissolved Solid *mg/l*
Patapsco River L Branch A							
01PA-1-01-2008	3/26/2008	7.78	11.92	10.48	3.2	350	228
01PA-1-02-2008	3/25/2008	8.51	10.50	7.89	4.4	505	328
01PA-1-03-2008	3/24/2008	8.23	9.02	13.03	0.9	373	242
01PA-1-04-2008	3/25/2008	8.67	3.34	13.12	1.1	233	151
01PA-1-05-2008	3/26/2008	8.16	11.00	14.84	1.2	436	284
01PA-3-01-2008	4/3/2008	7.30	9.43	11.27	3.7	579	376
01PA-4-01-2008	4/3/2008	7.83	8.87	14.50	1.3	268	174
01PA-4-02-2008	4/3/2008	7.00	8.62	14.14	1.4	261	169
01PA-4-03-2008	3/27/2008	7.46	8.98	13.06	1.5	310	201
01PA-4-04-2008	3/27/2008	6.26	9.03	12.18	1.3	307	200
Patapsco River L Branch B							
04PB-1-01-2008	3/31/2008	8.53	7.17	13.60	2.5	377	242
04PB-1-02-2008	3/31/2008	7.69	7.58	9.77	3.2	709	460
04PB-1-03A-2008	3/27/2008	7.65	9.92	13.86	1.5	686	446
04PB-1-04-2008	4/7/2008	7.61	10.32	11.08	7.1	561	365
04PB-1-05-2008	4/1/2008	7.58	9.43	10.79	0.9	441	287
04PB-1-06-2008	3/31/2008	7.83	8.16	15.45	3.0	539	350
04PB-1-07-2008	4/7/2008	7.66	9.56	13.29	3.6	705	458
04PB-2-02-2008	4/1/2008	7.92	12.95	14.35	2.7	609	396
04PB-2-02A-2008	4/1/2008	7.99	15.15	14.03	2.4	636	413
04PB-2-03-2008	4/7/2008	7.52	8.75	11.36	2.6	562	366
S Branch Patapsco River Tribs							
10PT-1-01-2008	3/20/2008	7.11	8.64	11.85	3.8	352	229
10PT-1-02-2008	3/20/2008	7.14	9.55	12.14	23.6	226	147
10PT-1-03-2008	3/20/2008	7.69	10.13	12.21	5.7	105	68
10PT-1-04-2008	3/21/2008	8.34	10.63	11.13	1.3	289	188
10PT-1-05A-2008	3/24/2008	8.45	3.57	14.15	0.7	220	143
10-PT-2-01-2008	3/21/2008	7.98	4.95	14.10	1.5	421	273
10PT-2-02-2008	3/21/2008	8.53	8.24	13.36	1.0	330	214
10PT-4-01-2008	3/25/2008	8.51	7.12	7.39	1.8	253	164
10PT-4-02-2008	3/26/2008	8.45	6.71	13.17	1.3	224	146
10PT-4-03-2008	3/24/2008	8.44	6.87	117.50	2.7	248	162

Appendix C: Benthic Macroinvertebrate Data

Raw Data								Scaled Metrics							
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
Patapsco River L Branch A													**Patapsco River L Branch A Average:**	**2.20**	**Poor**
01PA-1-01-2008	3/26/08	32	5	1	2.5	69.7	11.8	5	3	1	1	1	1	2.00	Poor
01PA-1-02-2008	3/25/08	28	5	0	5.2	75.7	20.0	5	3	1	1	1	1	2.00	Poor
01PA-1-03-2008	3/24/08	21	4	0	6.8	86.3	12.0	3	1	1	1	1	1	1.33	Very Poor
01PA-1-04-2008	3/25/08	27	11	4	61.9	20.4	46.9	5	5	5	5	3	3	4.33	Good
01PA-1-04-2008QC	3/25/08	19	7	3	78.7	11.1	50.0	3	3	3	5	3	3	3.33	Fair
01PA-1-05-2008	3/26/08	21	5	1	1.8	78.0	22.0	3	3	1	1	1	1	1.67	Very Poor
01PA-3-01-2008	4/3/08	18	1	0	0.0	82.8	13.8	3	1	1	1	1	1	1.33	Very Poor
01PA-4-01-2008	4/3/08	33	4	2	3.9	62.1	24.3	5	1	3	1	3	1	2.33	Poor
01PA-4-02-2008	4/3/08	22	5	1	2.9	75.7	19.4	3	3	1	1	1	1	1.67	Very Poor
01PA-4-03-2008	3/27/08	26	5	2	4.8	53.8	24.0	5	3	3	1	3	1	2.67	Poor
01PA-4-04-2008	3/27/08	20	5	2	3.4	35.3	47.1	3	3	3	1	3	3	2.67	Poor
Patapsco River L Branch B													**Patapsco River L Branch B Average:**	**1.37**	**Very Poor**
04PB-1-01-2008	3/31/08	14	3	0	1.7	89.7	7.8	1	1	1	1	1	1	1.00	Very Poor
04PB-1-02-2008	3/31/08	8	0	0	0.0	96.3	0.0	1	1	1	1	1	1	1.00	Very Poor
04PB-03A-2008	3/27/08	21	2	0	0.0	66.7	35.9	3	1	1	1	1	3	1.67	Very Poor
04PB-1-04-2008	4/7/08	16	1	0	0.9	46.8	22.9	3	1	1	1	3	1	1.67	Very Poor
04PB-1-05-2008	4/1/08	18	4	2	0.9	84.3	10.2	3	1	3	1	1	1	1.67	Very Poor
04PB-1-05-2008QC	4/1/08	21	4	1	2.6	78.9	19.3	3	1	1	1	1	1	1.33	Very Poor
04PB-1-06-2008	3/31/08	18	2	0	0.8	84.7	10.2	3	1	1	1	1	1	1.33	Very Poor
04PB-1-07-2008	4/7/08	20	1	0	2.5	84.9	13.4	3	1	1	1	1	1	1.33	Very Poor
04PB-2-02-2008	4/1/08	19	3	0	1.8	84.8	13.4	3	1	1	1	1	1	1.33	Very Poor
04PB-2-02A-2008	4/1/08	16	2	0	0.0	87.8	9.6	3	1	1	1	1	1	1.33	Very Poor
04PB-2-03-2008	4/7/08	17	3	0	0.0	82.3	20.4	3	1	1	1	1	1	1.33	Very Poor
S Branch Patapsco River Tribs													**S Branch Patapsco River Tribs Average:**	**2.73**	**Poor**
10PT-1-01-2008	3/20/08	20	1	0	28.6	72.3	15.2	3	1	1	3	1	1	1.67	Very Poor
10PT-1-02-2008	3/20/08	19	1	0	20.4	81.4	12.4	3	1	1	3	1	1	1.67	Very Poor
10PT-1-03-2008	3/20/08	14	4	1	19.8	71.2	4.5	1	1	1	3	1	1	1.33	Very Poor
10PT-1-04-2008	3/21/08	33	12	3	72.1	23.1	53.8	5	5	3	5	3	3	4.00	Good
10PT-1-05a-2008	3/24/08	28	7	3	51.4	34.6	55.1	5	3	3	5	3	3	3.67	Fair
10-PT-2-01-2008	3/21/08	24	6	0	2.5	53.3	42.5	5	3	1	1	3	3	2.67	Poor
10-PT-2-01-2008QC	3/21/08	24	8	2	12.6	63.1	27.9	5	3	3	3	1	1	2.67	Poor
10PT-2-02-2008	3/21/08	28	8	3	46.6	32.0	49.5	5	3	3	3	3	3	3.33	Fair
10PT-4-01-2008	3/25/08	32	6	4	12.9	43.0	43.0	5	3	5	3	3	3	3.67	Fair
10PT-4-02-2008	3/26/08	14	4	0	33.7	44.9	55.1	1	1	1	3	3	3	2.00	Poor
10PT-4-03-2008	3/24/08	30	6	2	15.3	56.8	41.5	5	3	3	3	3	3	3.33	Fair

2008
Benthic Macroinvertebrate Data

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Ceratopogonidae	Dasyhelea	Dasyhelea	I	1	Collector	sp	3.6
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	1	Collector	sp	8.5
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona	I	1	Filterer	cn	2.7
Insecta	Diptera	Chironomidae	Diplocladius	Diplocladius	I	2	Collector	sp	5.9
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia	I	1	Scraper	cn	5.7
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	39	Scraper	sp	7.2
Insecta	Coleoptera	Hydrophilidae	Hydrobius	Hydrobius	I	1	Collector	cb	4.1
Insecta	Coleoptera	Dytiscidae	Ilybius	Ilybius	I	1	Predator	sw	5.4
Insecta	Diptera	Limoniidae	Limnophila	Limnophila	I	1	Predator	bu	4.8
Clitellata	Lumbriculada	Lumbriculidae	not identified	Lumbriculidae	U	1	Collector	bu	6.6
Insecta	Hemiptera	Veliidae	Microvelia	Microvelia	I	3	Predator	skater	6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	2	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	22	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	1	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paraphaenocladius	Paraphaenocladius	I	9	Collector	sp	4
Insecta	Diptera	Chironomidae	Phaenopsectra	Phaenopsectra	I	1	Collector	cn	8.7
Bivalvia	Veneroida	Pisidiidae	not identified	Pisidiidae	U	1	Filterer	bu	5.5
Enopla	Hoplonemertea	Tetrastemmatidae	Prostoma	Prostoma	U	1	Predator	na	7.3
Insecta	Trichoptera	Phryganeidae	Ptilostomis	Ptilostomis	I	1	Shredder	cb	4.3
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	I	3	Collector	sp	6.2
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	1	Filterer	cn	5.7
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	A	1	Scraper	cn	7.1
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	1	Scraper	cn	7.1
Insecta	Diptera	Tipulidae	Tipula	Tipula	I	1	Shredder	bu	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	1	Collector	cn	8.4

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary 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 idicates information for the particular taxa was not available.

Patapsco River Watershed - Biological Monitoring and Assessment
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Benthic Macroinvertebrate Data

01PA-1-02-2008

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	Trichoptera	Hydropsychidae	Ceratopsyche	Ceratopsyche	I	1	Filterer	cn	5
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	2	Filterer	cn	6.5
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	5	Filterer	cn	4.4
Insecta	Diptera	Empididae	Clinocera	Clinocera	I	2	Predator	cn	7.4
Hexapoda	Collembola	not identified	not identified	Collembola	A	1	Collector	sp	6
Insecta	Diptera	Chironomidae	Conchapelopia	Conchapelopia	I	1	Predator	sp	6.1
Insecta	Diptera	Ceratopogonidae	Dasyhelea	Dasyhelea	I	1	Collector	sp	3.6
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	1	Collector	sp	8.5
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona	I	3	Filterer	cn	2.7
Insecta	Diptera	Dixidae	not identified	Dixidae	I	1	Collector	sw	5.8
Insecta	Coleoptera	Psephenidae	Ectopria	Ectopria	I	1	Scraper	cn	2.2
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	1	Collector	bu	9.1
Gastropoda	Basommatophora	Lymnaeidae	Fossaria	Fossaria	U	1	Scraper	cb	6.9
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	11	Scraper	sp	7.2
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	1	Collector	cb	2.1
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	7	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	48	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	2	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	P	1	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paraphaenocladius	Paraphaenocladius	I	2	Collector	sp	4
Insecta	Diptera	Chironomidae	Phaenopsectra	Phaenopsectra	I	2	Collector	cn	8.7
Gastropoda	Basommatophora	Physidae	Physa	Physa	U	1	Scraper	cb	7
Insecta	Coleoptera	Psephenidae	Psephenus	Psephenus	I	2	Scraper	cn	4.4
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	1	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	2	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	6	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	4	Collector	cn	8.4
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 Primary 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 idicates information for the particular taxa was not available.

Patapsco River Watershed - Biological Monitoring and Assessment
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Benthic Macroinvertebrate Data

01PA-1-03-2008

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Crustacea	Decapoda	Cambaridae	not identified	Cambarinae	U	1	Shredder	sp	2.8
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	3	Filterer	cn	6.5
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	1	Filterer	cn	4.4
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	10	Collector	sp	4.1
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	5	Collector	sp	8.5
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona	I	3	Filterer	cn	2.7
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	5	Scraper	sp	7.2
Insecta	Trichoptera	Limnephilidae	Ironoquia	Ironoquia	I	1	Shredder	sp	4.9
Insecta	Coleoptera	Elmidae	Optioservus	Optioservus	I	1	Scraper	cn	5.4
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	1	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	60	Collector	sp	9.2
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius	A	2	Scraper	cn	2.7
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	5	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Phaenopsectra	Phaenopsectra	I	1	Collector	cn	8.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	1	Shredder	cb	6.3
Insecta	Diptera	Simuliidae	Prosimulium	Prosimulium	I	2	Filterer	cn	2.4
Enopla	Hoplonemertea	Tetrastemmatidae	Prostoma	Prostoma	U	1	Predator	na	7.3
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	1	Filterer	cn	7.2
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	10	Collector	sp	8.2
Insecta	Diptera	Chironomidae	Thienemanniella	Thienemanniella	P	1	Collector	sp	5.1
Insecta	Diptera	Tipulidae	Tipula	Tipula	I	1	Shredder	bu	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 Primary 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 idicates information for the particular taxa was not available.

Patapsco River Watershed - Biological Monitoring and Assessment
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Benthic Macroinvertebrate Data

01PA-1-04-2008

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Ephemeroptera	Ameletidae	Ameletus	Ameletus	I	2	Collector	sw	2.6
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura	I	29	Shredder	sp	3
Insecta	Plecoptera	Perlidae	Beloneuria	Beloneuria	I	1	Predator	cn	2.5
Insecta	Diptera	Empididae	Chelifera	Chelifera	I	4	Predator	sp	7.1
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	1	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	4	Collector	sp	4.1
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona	I	2	Filterer	cn	2.7
Insecta	Diptera	Dixidae	Dixa	Dixa	I	1	Predator	sw	5.8
Insecta	Ephemeroptera	Ephemerellidae	Ephemerella	Ephemerella	I	28	Collector	cn	2.3
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	I	3	Collector	sp	6.1
Insecta	Ephemeroptera	Ephemerellidae	Eurylophella	Eurylophella	I	1	Scraper	cn	4.5
Insecta	Odonata	Gomphidae	not identified	Gomphidae	I	1	Predator	bu	2.2
Insecta	Trichoptera	Limnephilidae	Ironoquia	Ironoquia	I	1	Shredder	sp	4.9
Insecta	Plecoptera	Leuctridae	Leuctra	Leuctra	I	1	Shredder	cn	0.4
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	1	Collector	cb	2.1
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	P	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	4	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paraphaenocladius	Paraphaenocladius	I	1	Collector	sp	4
Bivalvia	Veneroida	Pisidiidae	Pisidium	Pisidium	U	1	Filterer	bu	5.7
Insecta	Plecoptera	not identified	not identified	Plecoptera	I	1	Predator	na	2.4
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	2	Shredder	cb	6.3
Insecta	Diptera	Simuliidae	Prosimulium	Prosimulium	I	2	Filterer	cn	2.4
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	3	Filterer	cn	7.2
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	Rhyacophila	I	2	Predator	cn	2.1
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	11	Filterer	cn	5.7
Insecta	Diptera	Chironomidae	Stempellinella	Stempellinella	I	1	Collector	cb	4.2
Insecta	Ephemeroptera	Heptageniidae	Stenonema	Stenonema	I	1	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	2	Filterer	cb	4.9
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 Primary 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 idicates information for the particular taxa was not available.

Patapsco River Watershed - Biological Monitoring and Assessment
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Benthic Macroinvertebrate Data

01PA-1-04-2008QC

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Ephemeroptera	Ameletidae	Ameletus	Ameletus	I	6	Collector	sw	2.6
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura	I	28	Shredder	sp	3
Insecta	Coleoptera	Ptilodactylidae	Anchytarsus	Anchytarsus	I	2	Shredder	cn	3.1
Insecta	Diptera	Empididae	Chelifera	Chelifera	I	3	Predator	sp	7.1
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona	I	1	Filterer	cn	2.7
Insecta	Ephemeroptera	Heptageniidae	Epeorus	Epeorus	I	1	Scraper	cn	1.7
Insecta	Ephemeroptera	Ephemerellidae	Ephemerella	Ephemerella	I	33	Collector	cn	2.3
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	I	6	Collector	sp	6.1
Gastropoda	Basommatophor	Lymnaeidae	Fossaria	Fossaria	U	1	Scraper	cb	6.9
Insecta	Odonata	Gomphidae	Gomphus	Gomphus	I	1	Predator	bu	2.2
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	2	Collector	cb	2.1
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	2	Collector	sp	4.6
Insecta	Diptera	Simuliidae	Prosimulium	Prosimulium	I	9	Filterer	cn	2.4
Insecta	Diptera	Tipulidae	Pseudolimnophila	Pseudolimnophila	I	2	Predator	bu	2.8
Insecta	Trichoptera	Limnephilidae	Pycnopsyche	Pycnopsyche	I	1	Shredder	sp	3.1
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	Rhyacophila	I	2	Predator	cn	2.1
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	6	Filterer	cn	5.7
Insecta	Diptera	Chironomidae	not identified	Tanypodinae	I	1	Predator	sp	7.5
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	1	Filterer	cb	4.9

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary 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 idicates information for the particular taxa was not available.

Patapsco River Watershed - Biological Monitoring and Assessment
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Benthic Macroinvertebrate Data

01PA-1-05-2008

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	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	1	Filterer	cn	6.5
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	13	Filterer	cn	4.4
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	6	Collector	sp	8.5
Insecta	Diptera	Chironomidae	Dicrotendipes	Dicrotendipes	I	1	Collector	bu	9
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona	I	1	Filterer	cn	2.7
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia	A	1	Scraper	cn	5.7
Insecta	Ephemeroptera	Ephemerellidae	Eurylophella	Eurylophella	I	2	Scraper	cn	4.5
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	7	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	1	Filterer	cn	7.5
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	P	6	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	46	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	1	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	1	Shredder	cb	6.3
Insecta	Diptera	Chironomidae	Potthastia	Potthastia	I	1	Omnivore	sp	0
Insecta	Coleoptera	Psephenidae	Psephenus	Psephenus	I	1	Scraper	cn	4.4
Insecta	Diptera	Chironomidae	Smittia	Smittia	I	1	Collector	lentic	6.6
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	3	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	2	Collector	sp	8.2
Insecta	Diptera	Chironomidae	not identified	Tanypodinae	I	1	Predator	sp	7.5
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	7	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	3	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	1	Collector	cn	8.4

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary 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 idicates information for the particular taxa was not available.

Patapsco River Watershed - Biological Monitoring and Assessment
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Benthic Macroinvertebrate Data

01PA-3-01-2008

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Ablabesmyia	Ablabesmyia	I	2	Predator	sp	8.1
Insecta	Coleoptera	Elmidae	Ancyronyx	Ancyronyx	I	1	Scraper	cn	7.8
Insecta	Diptera	Chironomidae	Chaetocladius	Chaetocladius	I	5	Collector	sp	7
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	2	Filterer	cn	6.5
Bivalvia	Veneroida	Corbiculidae	Corbicula	Corbicula	U	3	Filterer	bu	6
Insecta	Diptera	Chironomidae	Dicrotendipes	Dicrotendipes	I	3	Collector	bu	9
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia	I	2	Scraper	cn	5.7
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	39	Scraper	sp	7.2
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	2	Collector	bu	10
not identified	not identified	not identified	not identified	Nematomorpha	U	1	Parasite	bu	na
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	31	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Paratendipes	Paratendipes	I	5	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	Chironomidae	Rheocricotopus	Rheocricotopus	I	4	Collector	sp	6.2
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	1	Filterer	cn	7.2
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	2	Filterer	cb	4.9
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	9	Collector	cn	8.4

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary 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 idicates information for the particular taxa was not available.

Patapsco River Watershed - Biological Monitoring and Assessment
2008
Benthic Macroinvertebrate Data

01PA-4-01-2008

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	Trichoptera	Hydropsychidae	Ceratopsyche	Ceratopsyche	I	1	Filterer	cn	5
Insecta	Diptera	Empididae	Clinocera	Clinocera	I	7	Predator	cn	7.4
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	1	Collector	sp	4.1
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	U	2	Collector	sp	6.7
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	1	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	3	Collector	sp	8.5
Insecta	Diptera	Dixidae	Dixella	Dixella	I	1	Predator	sw	5.8
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia	I	4	Scraper	cn	5.7
Gastropoda	Neotaenioglossa	Pleuroceridae	Elimia	Elimia	U	4	Collector	-	update
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	2	Collector	bu	9.1
Insecta	Ephemeroptera	Ephemerellidae	Ephemerella	Ephemerella	I	1	Collector	cn	2.3
Gastropoda	Basommatophora	Lymnaeidae	Fossaria	Fossaria	U	1	Scraper	cb	6.9
Crustacea	Amphipoda	Gammaridae	Gammarus	Gammarus	U	5	Shredder	sp	6.7
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	4	Scraper	sp	7.2
Insecta	Ephemeroptera	Heptageniidae	Maccaffertium	Maccaffertium	I	1	Scraper	cn	2.6
Insecta	Odonata	Corduliidae	Macromia	Macromia	I	1	Predator	sp	3
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	13	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	24	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parachaetocladius	Parachaetocladius	I	1	Collector	sp	3.3
Insecta	Diptera	Chironomidae	Paraphaenocladius	Paraphaenocladius	I	1	Collector	sp	4
Insecta	Diptera	Chironomidae	Paratendipes	Paratendipes	I	2	Collector	bu	6.6
Insecta	Trichoptera	Polycentropodidae	Polycentropus	Polycentropus	I	1	Filterer	cn	1.1
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	P	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
Crustacea	Amphipoda	Crangonyctidae	Stygobromus	Stygobromus	I	1	Collector	sp	6.5
Insecta	Diptera	Chironomidae	Sublettea	Sublettea	I	1	Collector	-	10
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	3	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemanniella	Thienemanniella	I	3	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	1	Predator	sp	6.7
Insecta	Diptera	Tipulidae	Tipula	Tipula	I	1	Shredder	bu	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	5	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 Primary 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 idicates information for the particular taxa was not available.

Patapsco River Watershed - Biological Monitoring and Assessment
2008
Benthic Macroinvertebrate Data

01PA-4-02-2008

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Coleoptera	Elmidae	Ancyronyx	Ancyronyx	I	1	Scraper	cn	7.8
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	3	Filterer	cn	6.5
Insecta	Diptera	Empididae	Clinocera	Clinocera	I	1	Predator	cn	7.4
Bivalvia	Veneroida	Corbiculidae	Corbicula	Corbicula	U	3	Filterer	bu	6
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	4	Shredder	cn	9.6
Gastropoda	Neotaenioglossa	Pleuroceridae	Elimia	Elimia	U	2	Collector	-	update
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	I	1	Collector	sp	6.1
Crustacea	Amphipoda	Gammaridae	Gammarus	Gammarus	U	6	Shredder	sp	6.7
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	4	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	1	Filterer	cn	7.5
Insecta	Trichoptera	Hydropsychidae	not identified	Hydropsychidae	P	1	Filterer	cn	5.7
Insecta	Ephemeroptera	Heptageniidae	Maccaffertium	Maccaffertium	I	1	Scraper	cn	2.6
Insecta	Coleoptera	Elmidae	Microcylloepus	Microcylloepus	I	1	Collector	cn	4.8
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	2	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	15	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	43	Collector	sp	9.2
Insecta	Plecoptera	Perlidae	not identified	Perlidae	I	1	Predator	cn	2.2
Insecta	Trichoptera	Polycentropodidae	Polycentropus	Polycentropus	I	1	Filterer	cn	1.1
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	2	Filterer	cn	7.2
Insecta	Diptera	Chironomidae	Stempellinella	Stempellinella	I	1	Collector	cb	4.2
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	3	Filterer	cb	4.9
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	3	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 Primary 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 idicates information for the particular taxa was not available.

Patapsco River Watershed - Biological Monitoring and Assessment
2008
Benthic Macroinvertebrate Data

01PA-4-03-2008

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Coleoptera	Elmidae	Ancyronyx	Ancyronyx	I	1	Scraper	cn	7.8
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	3	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	not identified	Chironomidae	P	1	Collector	na	6.6
Bivalvia	Veneroida	Corbiculidae	Corbicula	Corbicula	U	2	Filterer	bu	6
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	1	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	8	Collector	sp	8.5
Insecta	Diptera	Chironomidae	not identified	Diamesinae	I	1	Collector	cn	7.1
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona	I	1	Filterer	cn	2.7
Insecta	Ephemeroptera	Ephemerellidae	Ephemerella	Ephemerella	I	2	Collector	cn	2.3
Crustacea	Amphipoda	Gammaridae	Gammarus	Gammarus	U	21	Shredder	sp	6.7
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	8	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	1	Filterer	cn	7.5
Insecta	Ephemeroptera	Isonychiidae	Isonychia	Isonychia	I	1	Filterer	sw	2.5
Insecta	Odonata	Corduliidae	Macromia	Macromia	I	1	Predator	sp	3
Insecta	Coleoptera	Dryopidae	Macronychus	Macronychus	I	1	Scraper	cn	6.8
Insecta	Coleoptera	Elmidae	Microcylloepus	Microcylloepus	I	1	Collector	cn	4.8
Insecta	Coleoptera	Elmidae	Optioservus	Optioservus	I	1	Scraper	cn	5.4
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	20	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	8	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	1	Collector	sp	4.6
Insecta	Coleoptera	Psephenidae	Psephenus	Psephenus	I	7	Scraper	cn	4.4
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	P	1	Collector	sp	6.2
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	I	1	Collector	sp	6.2
Insecta	Diptera	Simuliidae	not identified	Simuliidae	P	1	Filterer	cn	3.2
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	2	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	1	Collector	sp	8.2
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	1	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemanniella	Thienemanniella	I	2	Collector	sp	5.1
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	2	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	P	1	Collector	sp	5.1
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 Primary 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 idicates information for the particular taxa was not available.

Patapsco River Watershed - Biological Monitoring and Assessment
2008
Benthic Macroinvertebrate Data

01PA-4-04-2008

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Trichoptera	Hydropsychidae	Ceratopsyche	Ceratopsyche	I	2	Filterer	cn	5
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	18	Filterer	cn	6.5
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	15	Filterer	cn	4.4
Insecta	Diptera	Chironomidae	not identified	Chironomidae	I	1	Collector	na	6.6
Bivalvia	Veneroida	Corbiculidae	Corbicula	Corbicula	U	4	Filterer	bu	6
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	P	2	Collector	sp	8.5
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	11	Collector	sp	8.5
Insecta	Ephemeroptera	Heptageniidae	Epeorus	Epeorus	I	1	Scraper	cn	1.7
Insecta	Ephemeroptera	Ephemerellidae	Ephemerella	Ephemerella	I	2	Collector	cn	2.3
Crustacea	Amphipoda	Gammaridae	Gammarus	Gammarus	I	13	Shredder	sp	6.7
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	1	Collector	bu	10
Insecta	Coleoptera	Dryopidae	Macronychus	Macronychus	I	1	Scraper	cn	6.8
Insecta	Coleoptera	Elmidae	Microcylloepus	Microcylloepus	I	10	Collector	cn	4.8
Insecta	Coleoptera	Elmidae	Optioservus	Optioservus	I	2	Scraper	cn	5.4
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	20	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
Gastropoda	Basommatophora	Physidae	Physa	Physa	I	1	Scraper	cb	7
Turbellaria	Tricladida	Planariidae	Planaria	Planaria	I	2	Predator	sp	8.4
Insecta	Coleoptera	Psephenidae	Psephenus	Psephenus	I	2	Scraper	cn	4.4
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	2	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	1	Collector	sp	8.2
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	I	2	Collector	sp	5.1

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary 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 idicates information for the particular taxa was not available.

Patapsco River Watershed - Biological Monitoring and Assessment
2008
Benthic Macroinvertebrate Data

04PB-1-01-2008

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	Empididae	Clinocera	Clinocera	I	3	Predator	cn	7.4
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	7	Collector	sp	8.5
Gastropoda	Basommatophor	Lymnaeidae	Fossaria	Fossaria	U	1	Scraper	cb	6.9
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	66	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	2	Filterer	cn	7.5
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	1	Collector	bu	10
Insecta	Plecoptera	Nemouridae	not identified	Nemouridae	I	1	Shredder	sp	2.9
Insecta	Coleoptera	Elmidae	Optioservus	Optioservus	I	2	Scraper	cn	5.4
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	13	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	1	Collector	sp	9.2
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius	I	1	Scraper	cn	2.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	1	Shredder	cb	6.3
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	13	Collector	sp	8.2
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	P	2	Collector	sp	8.2
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	1	Predator	sp	6.7

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary 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 idicates information for the particular taxa was not available.

Patapsco River Watershed - Biological Monitoring and Assessment
2008
Benthic Macroinvertebrate Data

04PB-1-02-2008

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	1	Collector	sp	8.5
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	1	Collector	bu	9.1
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	I	4	Collector	sp	6.1
Gastropoda	Basommatophor	Lymnaeidae	Fossaria	Fossaria	U	2	Scraper	cb	6.9
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	36	Scraper	sp	7.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	1	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	58	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	5	Collector	sp	4.6
Bivalvia	Veneroida	Pisidiidae	Pisidium	Pisidium	U	1	Filterer	bu	5.7

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary 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 idicates information for the particular taxa was not available.

Patapsco River Watershed - Biological Monitoring and Assessment
2008
Benthic Macroinvertebrate Data

04PB-1-03A-2008

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	Odonata	Coenagrionidae	Argia	Argia	I	1	Predator	cn	9.3
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx	I	1	Predator	cb	8.3
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	6	Filterer	cn	6.5
Insecta	Diptera	Empididae	Clinocera	Clinocera	I	4	Predator	cn	7.4
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	1	Collector	sp	4.1
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	10	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	2	Filterer	cn	4.9
Insecta	Coleoptera	Elmidae	Optioservus	Optioservus	I	1	Scraper	cn	5.4
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	35	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	18	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	3	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	1	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Phaenopsectra	Phaenopsectra	I	1	Collector	cn	8.7
Insecta	Coleoptera	Psephenidae	Psephenus	Psephenus	I	2	Scraper	cn	4.4
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	P	1	Filterer	cn	7.2
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	A	1	Scraper	cn	7.1
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	13	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	3	Collector	sp	8.2
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	1	Filterer	cb	4.9
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	8	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 Primary 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 idicates information for the particular taxa was not available.

Patapsco River Watershed - Biological Monitoring and Assessment
2008
Benthic Macroinvertebrate Data

04PB-1-04-2008

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Chaetocladius	Chaetocladius	I	1	Collector	sp	7
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	1	Filterer	cn	4.4
Bivalvia	Veneroida	Corbiculidae	Corbicula	Corbicula	U	1	Filterer	bu	6
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	U	10	Collector	sp	6.7
Insecta	Diptera	Chironomidae	Dicrotendipes	Dicrotendipes	I	1	Collector	bu	9
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	3	Collector	bu	9.1
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	1	Scraper	sp	7.2
Clitellata	Haplotaxida	Naididae	not identified	Naididae	U	2	Collector	bu	9.1
Clitellata	Haplotaxida	Naididae	not identified	Naididae	U	15	Collector	bu	9.1
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	31	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	3	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	1	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	7	Shredder	cb	6.3
Insecta	Diptera	Simuliidae	Prosimulium	Prosimulium	I	1	Filterer	cn	2.4
Enopla	Hoplonemertea	Tetrastemmatidae	Prostoma	Prostoma	U	2	Predator	na	7.3
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	9	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	P	5	Filterer	cb	4.9
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	14	Collector	cn	8.4

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary 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 idicates information for the particular taxa was not available.

Patapsco River Watershed - Biological Monitoring and Assessment
2008
Benthic Macroinvertebrate Data

04PB-1-05-2008

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	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	1	Filterer	cn	4.4
Insecta	Diptera	Empididae	Clinocera	Clinocera	I	6	Predator	cn	7.4
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	3	Collector	sp	4.1
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	1	Collector	sp	8.5
Gastropoda	Basommatophor	Ancylidae	Ferrissia	Ferrissia	U	1	Scraper	cb	7
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	9	Scraper	sp	7.2
Insecta	Ephemeroptera	Heptageniidae	Maccaffertium	Maccaffertium	I	2	na	na	na
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	1	Collector	cb	2.1
Clitellata	Haplotaxida	Naididae	not identified	Naididae	U	4	Collector	bu	9.1
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	11	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	56	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	1	Shredder	cb	6.3
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	1	Filterer	cn	7.2
Insecta	Diptera	Chironomidae	Stempellina	Stempellina	I	1	Collector	cb	6.6
Insecta	Ephemeroptera	Heptageniidae	Stenonema	Stenonema	I	2	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	5	Collector	sp	8.2
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	1	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	1	Predator	sp	6.7

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary 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 idicates information for the particular taxa was not available.

Patapsco River Watershed - Biological Monitoring and Assessment
2008
Benthic Macroinvertebrate Data

04PB-1-05-2008QC

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	Empididae	Clinocera	Clinocera	I	4	Predator	cn	7.4
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	2	Collector	sp	4.1
Insecta	Diptera	Ceratopogonidae	Dasyhelea	Dasyhelea	I	1	Collector	sp	3.6
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	P	1	Collector	sp	8.5
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	1	Collector	sp	8.5
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	1	Collector	bu	9.1
Gastropoda	Basommatophora	Ancylidae	Ferrissia	Ferrissia	U	1	Scraper	cb	7
Gastropoda	Basommatophora	Lymnaeidae	Fossaria	Fossaria	U	2	Scraper	cb	6.9
Insecta	Trichoptera	Glossosomatidae	Glossosoma	Glossosoma	I	1	Scraper	cn	0
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	10	Scraper	sp	7.2
Insecta	Plecoptera	Nemouridae	not identified	Nemouridae	I	1	Shredder	sp	2.9
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	2	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	12	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	48	Collector	sp	9.2
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius	I	1	Scraper	cn	2.7
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	3	Filterer	cn	7.2
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	P	1	Filterer	cn	7.2
Insecta	Ephemeroptera	Heptageniidae	Stenonema	Stenonema	I	1	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	Sublettea	Sublettea	I	1	Collector	-	10
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	3	Collector	sp	8.2
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	3	Collector	sp	8.2
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	2	Filterer	cb	4.9
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	5	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 Primary 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 idicates information for the particular taxa was not available.

Patapsco River Watershed - Biological Monitoring and Assessment
2008
Benthic Macroinvertebrate Data

04PB-1-06-2008

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	Philopotamidae	Chimarra	Chimarra	I	3	Filterer	cn	4.4
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	Diamesa	Diamesa	I	5	Collector	sp	8.5
Insecta	Diptera	Tipulidae	Gonomyia	Gonomyia	I	1	No Data	bu	4.8
Insecta	Coleoptera	Dryopidae	Helichus	Helichus	A	1	Scraper	cn	6.4
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	35	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	not identified	Hydropsychidae	P	1	Filterer	cn	5.7
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	1	Collector	bu	10
Clitellata	Haplotaxida	Naididae	not identified	Naididae	U	1	Collector	bu	9.1
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	35	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	1	Collector	sp	9.2
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius	I	1	Scraper	cn	2.7
Insecta	Diptera	Chironomidae	Parachaetocladius	Parachaetocladius	I	5	Collector	sp	3.3
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	1	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	15	Shredder	cb	6.3
Enopla	Hoplonemertea	Tetrastemmatidae	Prostoma	Prostoma	U	2	Predator	na	7.3
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	3	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	3	Collector	sp	8.2

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary 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 idicates information for the particular taxa was not available.

Patapsco River Watershed - Biological Monitoring and Assessment
2008
Benthic Macroinvertebrate Data

04PB-1-07-2008

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Odonata	Aeshnidae	Anax	Anax	I	1	Predator	cb	6.2
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	1	Filterer	cn	4.4
Insecta	Diptera	Chironomidae	not identified	Chironomini	P	1	Collector	bu	5.9
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	4	Collector	sp	8.5
Gastropoda	Basommatophor	Lymnaeidae	Fossaria	Fossaria	U	3	Scraper	cb	6.9
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	20	Scraper	sp	7.2
Insecta	Odonata	Libellulidae	not identified	Libellulidae	I	1	Predator	na	9
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	3	Collector	cb	2.1
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	5	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	24	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	9	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratendipes	Paratendipes	I	5	Collector	bu	6.6
Insecta	Diptera	Chironomidae	Phaenopsectra	Phaenopsectra	I	5	Collector	cn	8.7
Gastropoda	Basommatophor	Physidae	Physa	Physa	U	3	Scraper	cb	7
Bivalvia	Veneroida	Pisidiidae	Pisidium	Pisidium	U	1	Filterer	bu	5.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	15	Shredder	cb	6.3
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	1	Filterer	cn	7.2
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	P	1	Filterer	cn	7.2
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	5	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	1	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	P	1	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	1	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	3	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Zavrelimyia	Zavrelimyia	I	5	Predator	sp	5.3

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary 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 idicates information for the particular taxa was not available.

Patapsco River Watershed - Biological Monitoring and Assessment
2008
Benthic Macroinvertebrate Data

04PB-2-02-2008

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx	I	1	Predator	cb	8.3
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	6	Filterer	cn	6.5
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	3	Filterer	cn	4.4
Insecta	Diptera	Chironomidae	not identified	Chironomini	I	1	Collector	bu	5.9
Insecta	Plecoptera	Chloroperlidae	not identified	Chloroperlidae	I	1	Predator	cn	1.6
Insecta	Diptera	Empididae	Clinocera	Clinocera	I	1	Predator	cn	7.4
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	9	Collector	sp	4.1
Insecta	Diptera	Ceratopogonidae	Dasyhelea	Dasyhelea	I	1	Collector	sp	3.6
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	5	Scraper	sp	7.2
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	1	Collector	cb	2.1
Insecta	Coleoptera	Elmidae	Optioservus	Optioservus	A	1	Scraper	cn	5.4
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	48	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	13	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	10	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	P	1	Collector	sp	7.7
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	1	Filterer	cn	7.2
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	2	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	1	Predator	sp	6.7
Insecta	Diptera	Tipulidae	Tipula	Tipula	I	1	Shredder	bu	6.7
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 Primary 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 idicates information for the particular taxa was not available.

Patapsco River Watershed - Biological Monitoring and Assessment
2008
Benthic Macroinvertebrate Data

04PB-2-02A-2008

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	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	2	Filterer	cn	4.4
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	U	1	Collector	sp	6.7
Insecta	Diptera	Chironomidae	Dicrotendipes	Dicrotendipes	I	3	Collector	bu	9
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	20	Scraper	sp	7.2
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	1	Collector	bu	10
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	17	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	35	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	P	1	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	5	Collector	sp	7.7
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	P	1	Collector	sp	7.7
Gastropoda	Basommatophor	Physidae	Physa	Physa	U	1	Scraper	cb	7
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	I	5	Collector	sp	6.2
Insecta	Diptera	Chironomidae	Smittia	Smittia	I	5	Collector	lentic	6.6
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	3	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	4	Collector	sp	8.2
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	5	Filterer	cb	4.9
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	I	5	Collector	cn	8.4

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary 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 idicates information for the particular taxa was not available.

Patapsco River Watershed - Biological Monitoring and Assessment
2008
Benthic Macroinvertebrate Data

04PB-2-03-2008

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx	I	2	Predator	cb	8.3
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	3	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	8	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	12	Collector	sp	8.5
Insecta	Coleoptera	Dryopidae	Helichus	Helichus	A	1	Scraper	cn	6.4
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	2	Filterer	cn	7.5
Insecta	Trichoptera	Hydroptilidae	Hydroptila	Hydroptila	I	1	Scraper	cn	6
Insecta	Lepidoptera	not identified	not identified	Lepidoptera	I	1	Shredder	na	6.7
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	P	1	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	58	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	8	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Phaenopsectra	Phaenopsectra	I	1	Collector	cn	8.7
Gastropoda	Basommatophor	Physidae	Physa	Physa	U	1	Scraper	cb	7
Enopla	Hoplonemertea	Tetrastemmatidae	Prostoma	Prostoma	U	3	Predator	na	7.3
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	1	Filterer	cn	7.2
Insecta	Diptera	Chironomidae	Sublettea	Sublettea	I	1	Collector	-	10
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	1	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	2	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	6	Collector	cn	8.4

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary 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 idicates information for the particular taxa was not available.

Patapsco River Watershed - Biological Monitoring and Assessment
2008
Benthic Macroinvertebrate Data

10PT-1-01-2008

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Ceratopogonidae	Ceratopogon	Ceratopogon	I	1	Predator	sp	2.7
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae	I	7	Predator	sp	3.6
Insecta	Diptera	Ceratopogonidae	Culicoides	Culicoides	I	2	Predator	bu	5.9
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	1	Collector	sp	8.5
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona	I	11	Filterer	cn	2.7
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	1	Collector	bu	9.1
Insecta	Diptera	Chironomidae	Heterotrissocladius	Heterotrissocladius	I	8	Collector	sp	2
Insecta	Diptera	Tipulidae	Heterosternuta	Hexatoma	I	2	Predator	bu	1.5
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	13	Scraper	sp	7.2
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	9	Collector	cb	2.1
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	3	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	6	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	3	Shredder	cb	6.3
Insecta	Diptera	Chironomidae	Prodiamesa	Prodiamesa	I	3	Collector	bu	6.6
Insecta	Diptera	Tipulidae	Pseudolimnophila	Pseudolimnophila	I	1	Predator	bu	2.8
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	2	Filterer	cn	5.7
Insecta	Diptera	Chironomidae	Stictochironomus	Stictochironomus	I	3	Omnivore	bu	9.2
Insecta	Diptera	Chironomidae	not identified	Tanypodinae	P	1	Predator	sp	7.5
Insecta	Diptera	Chironomidae	Thienemanniella	Thienemanniella	I	9	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	21	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	4	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Zavrelimyia	Zavrelimyia	P	1	Predator	sp	5.3

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary 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 idicates information for the particular taxa was not available.

Patapsco River Watershed - Biological Monitoring and Assessment
2008
Benthic Macroinvertebrate Data

10PT-1-02-2008

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Apsectrotanypus	Apsectrotanypus	I	6	Predator	bu	6.6
Insecta	Diptera	Ceratopogonidae	Ceratopogon	Ceratopogon	I	2	Predator	sp	2.7
Insecta	Diptera	Ceratopogonidae	Culicoides	Culicoides	I	3	Predator	bu	5.9
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona	I	3	Filterer	cn	2.7
Insecta	Diptera	Chironomidae	Diplocladius	Diplocladius	I	10	Collector	sp	5.9
Insecta	Diptera	Chironomidae	Heterotrissocladius	Heterotrissocladius	I	1	Collector	sp	2
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	6	Scraper	sp	7.2
Insecta	Diptera	Chironomidae	Metriocnemus	Metriocnemus	I	3	Omnivore	-	6.6
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	P	1	Collector	cb	2.1
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	16	Collector	cb	2.1
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	8	Collector	bu	7.6
Insecta	Diptera	Chironomidae	Paracladopelma	Paracladopelma	I	1	Collector	sp	6.6
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	9	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paraphaenocladius	Paraphaenocladius	I	12	Collector	sp	4
Bivalvia	Veneroida	Pisidiidae	Pisidium	Pisidium	U	2	Filterer	bu	5.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	1	Shredder	cb	6.3
Insecta	Diptera	Chironomidae	Prodiamesa	Prodiamesa	P	1	Collector	bu	6.6
Insecta	Diptera	Chironomidae	Prodiamesa	Prodiamesa	I	2	Collector	bu	6.6
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	1	Filterer	cn	5.7
Insecta	Diptera	Chironomidae	Stictochironomus	Stictochironomus	I	1	Omnivore	bu	9.2
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	14	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	10	Collector	cn	8.4

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary 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 idicates information for the particular taxa was not available.

Patapsco River Watershed - Biological Monitoring and Assessment
2008
Benthic Macroinvertebrate Data

10PT-1-03-2008

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Plecoptera	Capniidae	Allocapnia	Allocapnia	I	2	Shredder	cn	4.2
Insecta	Ephemeroptera	Ameletidae	Ameletus	Ameletus	I	1	Collector	sw	2.6
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura	I	19	Shredder	sp	3
Insecta	Diptera	Chironomidae	Chaetocladius	Chaetocladius	I	8	Collector	sp	7
Insecta	Diptera	Chironomidae	Diplocladius	Diplocladius	I	6	Collector	sp	5.9
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	2	Collector	bu	9.1
Insecta	Diptera	Tipulidae	Heterosternuta	Hexatoma	I	1	Predator	bu	1.5
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	26	Scraper	sp	7.2
Insecta	Diptera	Chironomidae	Larsia	Larsia	I	1	Predator	sp	8.5
Insecta	Coleoptera	Dytiscidae	Liodessus	Liodessus	I	2	Predator	sw	5.4
Clitellata	Lumbriculada	Lumbriculidae	not identified	Lumbriculidae	U	2	Collector	bu	6.6
Insecta	Trichoptera	Polycentropodidae	Polycentropus	Polycentropus	I	1	Filterer	cn	1.1
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	2	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	I	38	Collector	sp	5.1

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary 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 idicates information for the particular taxa was not available.

Patapsco River Watershed - Biological Monitoring and Assessment 10PT-1-04-2008
2008
Benthic Macroinvertebrate Data

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Ephemeroptera	Baetidae	Acerpenna	Acerpenna	I	9	Collector	sw	2.6
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura	I	9	Shredder	sp	3
Insecta	Diptera	Tipulidae	Antocha	Antocha	I	1	Collector	cn	8
Insecta	Plecoptera	Perlidae	Beloneuria	Beloneuria	I	1	Predator	cn	2.5
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae	I	2	Predator	sp	3.6
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	1	Filterer	cn	4.4
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona	I	6	Filterer	cn	2.7
Insecta	Diptera	Dixidae	Dixa	Dixa	I	1	Predator	sw	5.8
Insecta	Plecoptera	Perlidae	Eccoptura	Eccoptura	I	1	Predator	cn	0.6
Insecta	Coleoptera	Psephenidae	Ectopria	Ectopria	I	1	Scraper	cn	2.2
Insecta	Ephemeroptera	Ephemerellidae	Ephemerella	Ephemerella	I	9	Collector	cn	2.3
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	I	1	Collector	sp	6.1
Insecta	Odonata	Gomphidae	not identified	Gomphidae	I	1	Predator	bu	2.2
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	1	Scraper	sp	7.2
Insecta	Ephemeroptera	Leptophlebiidae	not identified	Leptophlebiidae	I	1	Collector	sw	1.7
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	3	Collector	cb	2.1
Insecta	Coleoptera	Elmidae	Optioservus	Optioservus	I	2	Scraper	cn	5.4
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	4	Collector	sp	9.2
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius	A	11	Scraper	cn	2.7
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius	I	6	Scraper	cn	2.7
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	4	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paraphaenocladius	Paraphaenocladius	I	1	Collector	sp	4
Insecta	Plecoptera	Perlodidae	not identified	Perlodidae	I	2	Predator	cn	2.2
Insecta	Plecoptera	not identified	not identified	Plecoptera	I	1	Predator	na	2.4
Insecta	Trichoptera	Polycentropodidae	Polycentropus	Polycentropus	I	1	Filterer	cn	1.1
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	1	Shredder	cb	6.3
Insecta	Diptera	Simuliidae	Prosimulium	Prosimulium	I	8	Filterer	cn	2.4
Insecta	Diptera	Simuliidae	Prosimulium	Prosimulium	P	1	Filterer	cn	2.4
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	Rhyacophila	I	1	Predator	cn	2.1
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	1	Filterer	cn	5.7
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	2	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	4	Predator	sp	6.7
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	I	1	Collector	sp	5.1
Insecta	Trichoptera	Uenoidae	Uenoidae	Uenoidae	I	3	Scraper	cn	2.7

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary 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 idicates information for the particular taxa was not available.

Patapsco River Watershed - Biological Monitoring and Assessment
2008
Benthic Macroinvertebrate Data

10PT-1-05A-2008

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Ephemeroptera	Ameletidae	Ameletus	Ameletus	I	1	Collector	sw	2.6
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura	I	8	Shredder	sp	3
Insecta	Coleoptera	Carabidae	not identified	Carabidae	I	1	Predator	cn	update
Insecta	Diptera	Empididae	Chelifera	Chelifera	I	3	Predator	sp	7.1
Insecta	Diptera	Chironomidae	not identified	Chironominae	P	1	Collector	na	6.6
Insecta	Diptera	Empididae	Clinocera	Clinocera	I	4	Predator	cn	7.4
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	4	Collector	sp	4.1
Insecta	Trichoptera	Polycentropodidae	Cyrnellus	Cyrnellus	I	1	Filterer	cn	0.2
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona	I	2	Filterer	cn	2.7
Insecta	Ephemeroptera	Ephemerellidae	Ephemerella	Ephemerella	I	33	Collector	cn	2.3
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	I	1	Collector	sp	6.1
Insecta	Ephemeroptera	Ephemerellidae	Eurylophella	Eurylophella	I	4	Scraper	cn	4.5
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	1	Scraper	sp	7.2
Insecta	Diptera	Chironomidae	Larsia	Larsia	I	1	Predator	sp	8.5
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	10	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	Paraphaenocladius	Paraphaenocladius	I	1	Collector	sp	4
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	4	Shredder	cb	6.3
Insecta	Diptera	Simuliidae	Prosimulium	Prosimulium	I	7	Filterer	cn	2.4
Insecta	Trichoptera	Limnephilidae	Pycnopsyche	Pycnopsyche	I	1	Shredder	sp	3.1
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	2	Filterer	cn	7.2
Insecta	Diptera	Chironomidae	Stempellinella	Stempellinella	I	2	Collector	cb	4.2
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	1	Collector	sp	8.2
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	1	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	1	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	I	1	Collector	sp	5.1

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Patapsco River Watershed - Biological Monitoring and Assessment
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Benthic Macroinvertebrate Data

10PT-2-01-2008

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Brillia	Brillia	I	3	Shredder	bu	7.4
Insecta	Trichoptera	Hydropsychidae	Ceratopsyche	Ceratopsyche	I	1	Filterer	cn	5
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	16	Filterer	cn	6.5
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	24	Filterer	cn	4.4
Insecta	Diptera	Chironomidae	not identified	Chironomidae	P	1	Collector	na	6.6
Insecta	Diptera	Ceratopogonidae	Dasyhelea	Dasyhelea	I	3	Collector	sp	3.6
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona	I	1	Filterer	cn	2.7
Insecta	Coleoptera	Dryopidae	Helichus	Helichus	A	1	Scraper	cn	6.4
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	3	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	2	Filterer	cn	7.5
Insecta	Diptera	Tipulidae	Limonia	Limonia	I	1	Shredder	bu	4.8
Clitellata	Haplotaxida	Naididae	not identified	Naididae	U	2	Collector	bu	9.1
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	41	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	3	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	P	1	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	2	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paraphaenocladius	Paraphaenocladius	I	1	Collector	sp	4
Insecta	Diptera	Chironomidae	Phaenopsectra	Phaenopsectra	I	1	Collector	cn	8.7
Insecta	Trichoptera	Polycentropodidae	Polycentropus	Polycentropus	I	2	Filterer	cn	1.1
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	2	Shredder	cb	6.3
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	Stilocladius	Stilocladius	I	1	Collector	sp	6.6
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	3	Collector	sp	8.2
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	1	Filterer	cb	4.9
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	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 Primary 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 idicates information for the particular taxa was not available.

Patapsco River Watershed - Biological Monitoring and Assessment
2008
Benthic Macroinvertebrate Data

10PT-2-01-2008QC

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Ephemeroptera	Ameletidae	Ameletus	Ameletus	I	4	Collector	sw	2.6
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura	I	1	Shredder	sp	3
Insecta	Ephemeroptera	Baetidae	Centroptilum	Centroptilum	I	2	Collector	sw	2.3
Insecta	Trichoptera	Hydropsychidae	Ceratopsyche	Ceratopsyche	I	1	Filterer	cn	5
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	6	Filterer	cn	6.5
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	7	Filterer	cn	4.4
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	3	Collector	sp	4.1
Insecta	Diptera	Ceratopogonidae	Dasyhelea	Dasyhelea	I	1	Collector	sp	3.6
Insecta	Diptera	Empididae	Hemerodromia	Hemerodromia	I	1	Predator	sp	7.9
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	8	Scraper	sp	7.2
Insecta	Trichoptera	Psychomyiidae	Lype	Lype	I	3	Scraper	cn	4.7
Insecta	Megaloptera	Corydalidae	Nigronia	Nigronia	I	1	Predator	cn	1.4
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	2	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	44	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	I	3	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	P	1	Collector	sp	4.6
Gastropoda	Basommatophor	Physidae	Physa	Physa	U	1	Scraper	cb	7
Insecta	Trichoptera	Polycentropodidae	Polycentropus	Polycentropus	I	2	Filterer	cn	1.1
Insecta	Diptera	Simuliidae	Prosimulium	Prosimulium	I	2	Filterer	cn	2.4
Insecta	Diptera	Chironomidae	Stenochironomus	Stenochironomus	I	1	Shredder	bu	7.9
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia	I	4	Collector	sp	8.2
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	1	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	2	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	6	Collector	cn	8.4

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary 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 idicates information for the particular taxa was not available.

Patapsco River Watershed - Biological Monitoring and Assessment
2008
Benthic Macroinvertebrate Data

10PT-2-02-2008

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Ephemeroptera	Baetidae	Acerpenna	Acerpenna	I	2	Collector	sw	2.6
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura	I	18	Shredder	sp	3
Insecta	Diptera	Tipulidae	Antocha	Antocha	I	2	Collector	cn	8
Insecta	Trichoptera	Hydropsychidae	Ceratopsyche	Ceratopsyche	I	5	Filterer	cn	5
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	P	1	Collector	na	6.6
Insecta	Diptera	Empididae	Clinocera	Clinocera	I	3	Predator	cn	7.4
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	1	Collector	sp	4.1
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	1	Collector	bu	9.1
Insecta	Ephemeroptera	Ephemerellidae	Ephemerella	Ephemerella	I	22	Collector	cn	2.3
Insecta	Ephemeroptera	Ephemerellidae	Eurylophella	Eurylophella	I	1	Scraper	cn	4.5
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes	I	1	Filterer	cn	4.9
Insecta	Diptera	Chironomidae	Nanocladius	Nanocladius	I	1	Collector	sp	7.6
Insecta	Megaloptera	Corydalidae	Nigronia	Nigronia	I	1	Predator	cn	1.4
Insecta	Coleoptera	Elmidae	Optioservus	Optioservus	I	1	Scraper	cn	5.4
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	16	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	1	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	1	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paraphaenocladius	Paraphaenocladius	I	1	Collector	sp	4
Insecta	Plecoptera	Perlodidae	not identified	Perlodidae	I	1	Predator	cn	2.2
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	2	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	Chironomidae	Stempellinella	Stempellinella	I	1	Collector	cb	4.2
Insecta	Diptera	Chironomidae	Sublettea	Sublettea	I	1	Collector	-	10
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	1	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemanniella	Thienemanniella	I	1	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	I	2	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Zavrelimyia	Zavrelimyia	I	1	Predator	sp	5.3

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Patapsco River Watershed - Biological Monitoring and Assessment 10PT-4-01-2008
2008
Benthic Macroinvertebrate Data

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	Ephemeroptera	Ameletidae	Ameletus	Ameletus	I	2	Collector	sw	2.6
Insecta	Odonata	Coenagrionidae	Argia	Argia	I	1	Predator	cn	9.3
Crustacea	Decapoda	Cambaridae	not identified	Cambarinae	U	1	Shredder	sp	2.8
Insecta	Ephemeroptera	Baetidae	Centroptilum	Centroptilum	I	2	Collector	sw	2.3
Insecta	Diptera	Empididae	Clinocera	Clinocera	I	1	Predator	cn	7.4
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	U	2	Collector	sp	6.7
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	2	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	not identified	Diamesinae	I	1	Collector	cn	7.1
Insecta	Diptera	Chironomidae	Dicrotendipes	Dicrotendipes	I	1	Collector	bu	9
Insecta	Diptera	Dixidae	Dixella	Dixella	I	3	Predator	sw	5.8
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	4	Collector	bu	9.1
Insecta	Coleoptera	Dryopidae	Helichus	Helichus	A	1	Scraper	cn	6.4
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	12	Scraper	sp	7.2
Insecta	Ephemeroptera	Leptophlebiidae	not identified	Leptophlebiidae	I	1	Collector	sw	1.7
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	3	Collector	bu	10
Insecta	Trichoptera	Psychomyiidae	Lype	Lype	I	1	Scraper	cn	4.7
Insecta	Ephemeroptera	Heptageniidae	Maccaffertium	Maccaffertium	I	1	na	na	na
Insecta	Megaloptera	Corydalidae	Nigronia	Nigronia	I	1	Predator	cn	1.4
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	3	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	5	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Paraphaenocladius	Paraphaenocladius	I	1	Collector	sp	4
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	1	Collector	sp	7.7
Insecta	Diptera	Chironomidae	Phaenopsectra	Phaenopsectra	I	1	Collector	cn	8.7
Bivalvia	Veneroida	Pisidiidae	Pisidium	Pisidium	I	1	Filterer	bu	5.7
Insecta	Trichoptera	Polycentropodidae	Polycentropus	Polycentropus	I	5	Filterer	cn	1.1
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	2	Shredder	cb	6.3
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	3	Filterer	cn	7.2
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	1	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemanniella	Thienemanniella	I	1	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	1	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	23	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Zavrelimyia	Zavrelimyia	I	4	Predator	sp	5.3

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary 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 idicates information for the particular taxa was not available.

Patapsco River Watershed - Biological Monitoring and Assessment
2008
Benthic Macroinvertebrate Data

10PT-4-02-2008

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Brillia	Brillia	I	1	Shredder	bu	7.4
Insecta	Trichoptera	Hydropsychidae	Ceratopsyche	Ceratopsyche	I	3	Filterer	cn	5
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	13	Filterer	cn	6.5
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	2	Filterer	cn	4.4
Insecta	Diptera	Empididae	Clinocera	Clinocera	I	1	Predator	cn	7.4
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	1	Shredder	cn	9.6
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	1	Filterer	cn	7.5
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	34	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	1	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	1	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	1	Shredder	cb	6.3
Insecta	Diptera	Simuliidae	Prosimulium	Prosimulium	I	33	Filterer	cn	2.4
Enopla	Hoplonemertea	Tetrastemmatidae	Prostoma	Prostoma	U	1	Predator	na	7.3
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	I	1	Collector	sp	6.2
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	P	1	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	I	3	Collector	sp	5.1

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary 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 idicates information for the particular taxa was not available.

Patapsco River Watershed - Biological Monitoring and Assessment
2008
Benthic Macroinvertebrate Data

10PT-4-03-2008

Subphylum/ Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Coleoptera	Elmidae	Ancyronyx	Ancyronyx	I	1	Scraper	cn	7.8
Insecta	Diptera	Tipulidae	Antocha	Antocha	I	1	Collector	cn	8
Insecta	Trichoptera	Hydropsychidae	Ceratopsyche	Ceratopsyche	I	3	Filterer	cn	5
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	15	Filterer	cn	6.5
Insecta	Diptera	Empididae	Clinocera	Clinocera	I	3	Predator	cn	7.4
Bivalvia	Veneroida	Corbiculidae	Corbicula	Corbicula	U	3	Filterer	bu	6
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	2	Collector	sp	4.1
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	U	1	Collector	sp	6.7
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	1	Shredder	cn	9.6
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	I	1	Collector	sp	8.5
Insecta	Ephemeroptera	Ephemerellidae	Ephemerella	Ephemerella	I	3	Collector	cn	2.3
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	I	2	Collector	sp	6.1
Insecta	Ephemeroptera	Heptageniidae	Maccaffertium	Maccaffertium	I	1	na	na	na
Insecta	Coleoptera	Dryopidae	Macronychus	Macronychus	I	3	Scraper	cn	6.8
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	3	Collector	cb	2.1
Insecta	Coleoptera	Elmidae	Optioservus	Optioservus	I	1	Scraper	cn	5.4
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	6	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	34	Collector	sp	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	2	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	2	Collector	sp	7.7
Insecta	Trichoptera	Polycentropodidae	Polycentropus	Polycentropus	I	1	Filterer	cn	1.1
Insecta	Diptera	Simuliidae	Prosimulium	Prosimulium	I	11	Filterer	cn	2.4
Insecta	Trichoptera	Psychomyiidae	not identified	Psychomyiidae	I	1	Collector	cn	4.9
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	2	Filterer	cn	7.2
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	1	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Sublettea	Sublettea	I	1	Collector	-	10
Insecta	Diptera	Chironomidae	not identified	Tanytarsini	P	1	Filterer	na	3.5
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	2	Filterer	cb	4.9
Insecta	Diptera	Chironomidae	Thienemanniella	Thienemanniella	I	6	Collector	sp	5.1
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	2	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	I	2	Collector	sp	5.1

1 Life Stage, I - Immature, P- Pupa, A - Adult; 2 Functional Feeding Group; 3 Primary 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 idicates information for the particular taxa was not available.

Appendix D: Habitat Assessment Data

Site ID	DATE	CA	CFS	ESC	E	FR	SD	VD	BSL	BSR	VPL	VPR	RZL	RZR	Total	Percent	Narrative Rating
Patapsco River L Branch A PSU															**131**	**66**	**Partially Supporting**
01PA-1-01-2008	3/26/2008	10	15	6	12	10	13	11	7	7	5	5	9	10	120	60.0	Non-supporting
01PA-1-02-2008	3/25/2008	10	11	10	12	13	10	13	6	6	6	5	8	4	114	57.0	Non-supporting
01PA-1-03-2008	3/24/2008	20	10	12	12	16	10	15	2	4	3	5	10	8	127	63.5	Partially Supporting
01PA-1-04-2008	3/25/2008	20	15	13	14	17	15	12	8	8	7	7	10	10	156	78.0	Supporting
01PA-1-04-2008 QC	3/25/2008	20	14	14	14	18	14	11	7	5	7	6	10	10	150	75.0	Partially Supporting
01PA-1-05-2008	3/26/2008	15	11	11	14	16	11	14	4	6	5	5	9	6	127	63.5	Partially Supporting
01PA-3-01-2008	4/3/2008	16	14	9	6	10	6	13	4	4	6	5	10	10	113	56.5	Non-supporting
01PA-4-01-2008	4/3/2008	19	18	12	6	12	13	12	6	4	5	4	10	10	131	65.5	Partially Supporting
01PA-4-02-2008	4/3/2008	19	16	12	10	9	10	12	4	5	5	5	10	10	127	63.5	Partially Supporting
01PA-4-03-2008	3/27/2008	15	18	13	12	16	14	17	9	9	9	9	7	7	155	77.5	Supporting
01PA-4-04-2008	3/27/2008	11	18	13	7	15	11	18	9	9	9	9	5	9	143	71.5	Partially Supporting
Patapsco River L Branch B PSU															**104**	**52**	**Non-supporting**
04PB-03A-2008	3/27/2008	12	14	10	14	14	10	14	3	6	4	6	8	8	123	61.5	Partially Supporting
04PB-1-01-2008	3/31/2008	7	10	4	8	8	5	10	1	1	3	3	5	3	68	34.0	Non-supporting
04PB-1-02-2008	3/31/2008	12	14	5	9	9	8	10	3	3	5	3	3	5	89	44.5	Non-supporting
04PB-1-04-2008	4/7/2008	6	13	8	10	12	8	14	5	6	2	2	5	5	96	48.0	Non-supporting
04PB-1-05-2008	4/1/2008	15	10	12	12	16	9	13	3	3	4	4	6	9	116	58.0	Non-supporting
04PB-1-05-2008 QC	4/1/2008	15	11	12	13	17	12	15	4	4	4	4	7	9	127	63.5	Partially Supporting
04PB-1-06-2008	3/31/2008	8	8	5	12	14	6	10	5	7	4	4	8	8	99	49.5	Non-supporting
04PB-1-07-2008	4/7/2008	15	10	10	10	14	5	14	6	6	5	5	10	8	118	59.0	Non-supporting
04PB-2-02-2008	4/1/2008	6	14	12	13	16	9	15	7	7	4	4	4	2	113	56.5	Non-supporting
04PB-2-02A-2008	4/1/2008	4	13	8	10	11	8	13	8	8	5	5	3	3	99	49.5	Non-supporting
04PB-2-03-2008	4/7/2008	16	11	9	10	16	8	13	4	2	6	4	7	9	115	57.5	Non-supporting
S Branch Patapsco River Tribs PSU															**119**	**60**	**Non-supporting**
10PT-1-01-2008	3/20/2008	16	14	5	5	9	8	9	5	5	4	4	6	3	93	46.5	Non-supporting
10PT-1-02-2008	3/20/2008	16	5	2	5	5	8	7	6	6	5	5	8	4	82	41.0	Non-supporting
10PT-1-03-2008	3/20/2008	15	12	9	13	13	13	10	6	6	6	6	5	8	122	61.0	Partially Supporting
10PT-1-04-2008	3/21/2008	18	11	10	9	16	10	10	4	5	5	6	9	10	123	61.5	Partially Supporting
10PT-1-05A-2008	3/24/2008	19	14	14	14	17	11	15	5	5	6	5	9	10	144	72.0	Partially Supporting
10PT-2-01-2008	3/21/2008	15	13	12	8	16	9	16	3	3	4	4	3	10	116	58.0	Non-supporting
10PT-2-01-2008 QC	3/21/2008	15	13	12	9	17	10	15	4	3	5	4	5	10	122	61.0	Partially Supporting
10PT-2-02-2008	3/21/2008	15	15	12	9	16	14	15	5	5	5	5	8	9	133	66.5	Partially Supporting
10PT-4-01-2008	3/25/2008	18	18	9	10	5	9	7	6	2	6	4	10	8	112	56.0	Non-supporting
10PT-4-02-2008	3/26/2008	16	15	16	14	15	10	17	2	2	3	2	10	10	132	66.0	Partially Supporting
10PT-4-03-2008	3/24/2008	20	15	14	9	17	10	16	3	3	4	4	10	10	135	67.5	Partially Supporting
Overall Watershed															**118**	**59**	**Non-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

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 dominant particle size	Channel Type
Patapsco River L Branch A													
01PA-1-01-2008	0.3	6.0	2.1	17.4	7.8	1.3	2.40	164	1.50	9.40	Gravel	46	F4b
01PA-1-02-2008	0.9	15.4	13.5	17.5	19.6	1.3	1.30	250	1.10	46.00	Gravel	47	F4
01PA-1-03-2008	1.6	18.6	28.9	12.0	54.0	2.9	1.80	104	2.37	9.40	Gravel	52	C4
01PA-1-04-2008	0.5	10.4	5.1	21.1	13.4	1.3	1.90	201	1.22	12.00	Gravel	59	F4
01PA-1-05-2008	1.4	16.5	22.5	12.1	150.0	9.1	1.20	163	1.51	30.00	Gravel	62	E4
01PA-3-01-2008	2.7	47.8	129.5	17.6	400.0	8.4	0.01	238	1.03	0.24	Gravel	41	C5
01PA-4-01-2008	4.2	106.4	449.3	25.2	132.5	1.2	0.04	240	1.03	9.20	Gravel	49	F4
01PA-4-02-2008	4.3	93.5	398.7	21.9	114.8	1.2	0.12	240	1.03	15.00	Gravel	48	F4
01PA-4-03-2008	3.6	97.8	356.8	26.8	220.5	2.3	0.46	240	1.03	170.00	Cobble	41	B3c
01PA-4-04-2008	3.2	132.9	420.6	42.0	200.0	1.5	0.43	240	1.03	110.00	Cobble	35	B3a
Patapsco River L Branch B													
04PB-03A-2008	0.9	13.5	11.8	15.4	16.0	1.2	1.70	246	1.03	6.90	Gravel	22	F4
04PB-1-01-2008	0.5	12.6	6.8	23.1	60.0	4.8	1.60	246	1.05	0.19	Sand	53	C5
04PB-1-02-2008	1.5	19.1	29.4	12.4	28.2	1.5	2.60	246	1.04	12.00	Gravel	51	B4
04PB-1-04-2008	1.5	22.6	33.9	15.1	27.3	1.2	0.79	246	1.03	11.00	Gravel	42	F4
04PB-1-05-2008	1.8	20.9	38.6	11.3	42.2	2.0	1.80	246	1.29	21.00	Gravel	61	B4c
04PB-1-06-2008	1.3	16.9	21.6	13.2	63.0	3.7	2.50	246	1.05	14.00	Gravel	38	C4b
04PB-1-07-2008	0.8	13.8	10.7	17.9	32.2	2.3	1.60	246	1.11	2.80	Gravel	44	C4
04PB-2-02-2008	1.6	26.9	44.0	16.5	35.5	1.3	0.86	246	1.00	24.00	Gravel	62	F4
04PB-2-02A-2008	1.6	29.1	47.7	17.8	33.8	1.2	0.73	246	1.23	12.00	Gravel	51	F4
04PB-2-03-2008	1.6	23.4	38.2	14.3	29.7	1.3	0.44	246	1.04	12.00	Gravel	60	F4
S Branch Patapsco River Tribs													
10PT-1-01-2008	0.8	6.3	5.0	8.0	22.5	3.5	1.30	234	1.05	0.09	Silt/Clay	42	E5
10PT-1-02-2008	0.8	6.7	5.1	8.8	11.2	1.7	2.20	208	1.18	0.08	Sand	48	B5
10PT-1-03-2008	0.6	9.7	5.7	16.7	17.6	1.8	1.70	213	1.15	0.06	Gravel	56	F4b
10PT-1-04-2008	0.6	9.6	6.1	15.1	12.6	1.3	2.20	216	1.14	11.00	Gravel	47	F4
10PT-1-05A-2008	1.0	20.2	19.9	20.4	24.6	1.2	0.82	218	1.13	12.00	Gravel	78	F4
10-PT-2-01-2008	2.0	29.6	60.0	14.6	42.8	1.4	0.47	219	1.12	19.00	Gravel	64	C4
10PT-2-02-2008	1.6	18.5	29.8	11.4	150.0	8.1	0.38	222	1.11	20.00	Sand	44	F5
10PT-4-01-2008	3.4	70.6	241.0	20.7	82.3	1.2	0.04	230	1.07	0.43	Gravel	60	C4b
10PT-4-02-2008	3.2	67.5	215.5	21.1	800.0	11.9	2.30	238	1.03	17.00	Gravel	52	B4c

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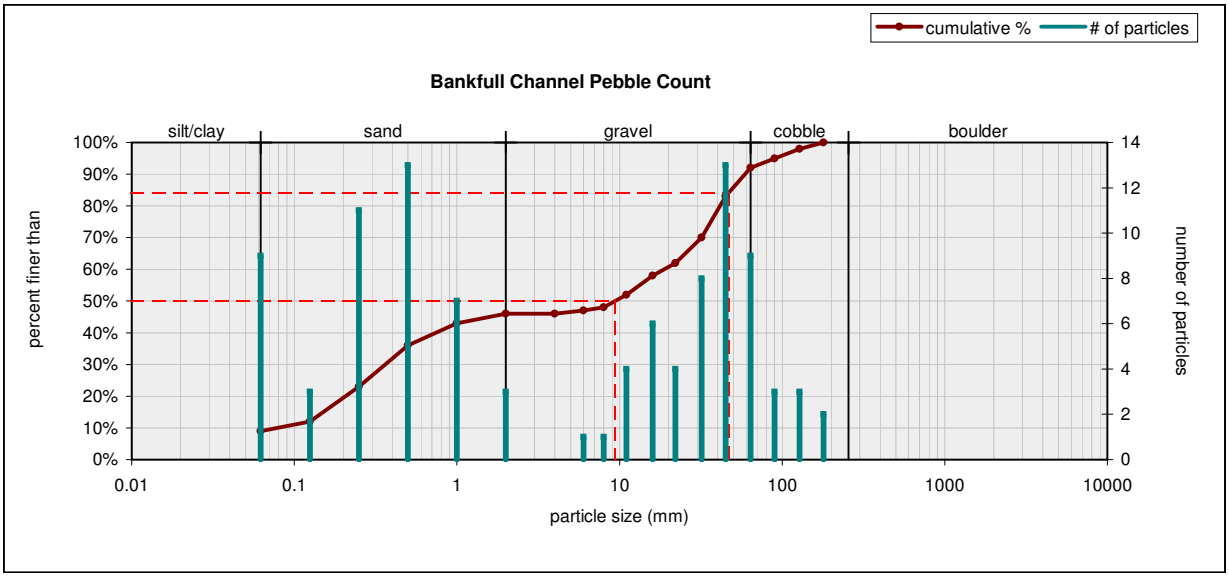
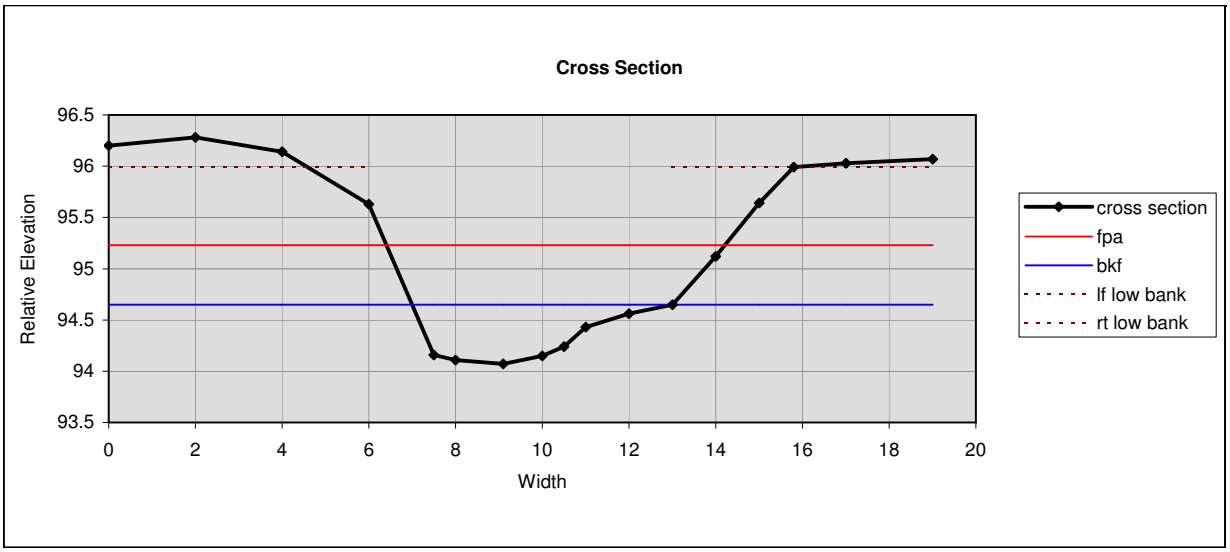


Size (mm)	
D16	0.16
D35	0.47
D50	9.4
D65	25
D84	47
D95	90

Size Distribution	
mean	2.7
dispersion	31.9
skewness	-0.3

Type	
silt/clay	9%
sand	37%
gravel	46%
cobble	8%
boulder	0%
bedrock	0%



Bankfull Dimensions	
2.1	x-section area (ft.sq.)
6.0	width (ft)
0.3	mean depth (ft)
0.6	max depth (ft)
6.3	wetted perimeter (ft)
0.3	hydraulic radius (ft)
17.4	width-depth ratio

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

Flow Resistance	
0.042	Manning's roughness

Bankfull Flow	
2.6	velocity (ft/s)
5.5	discharge rate (cfs)
2.4	channel slope (%)

Sinuosity	Channel Type
1.50	F4b

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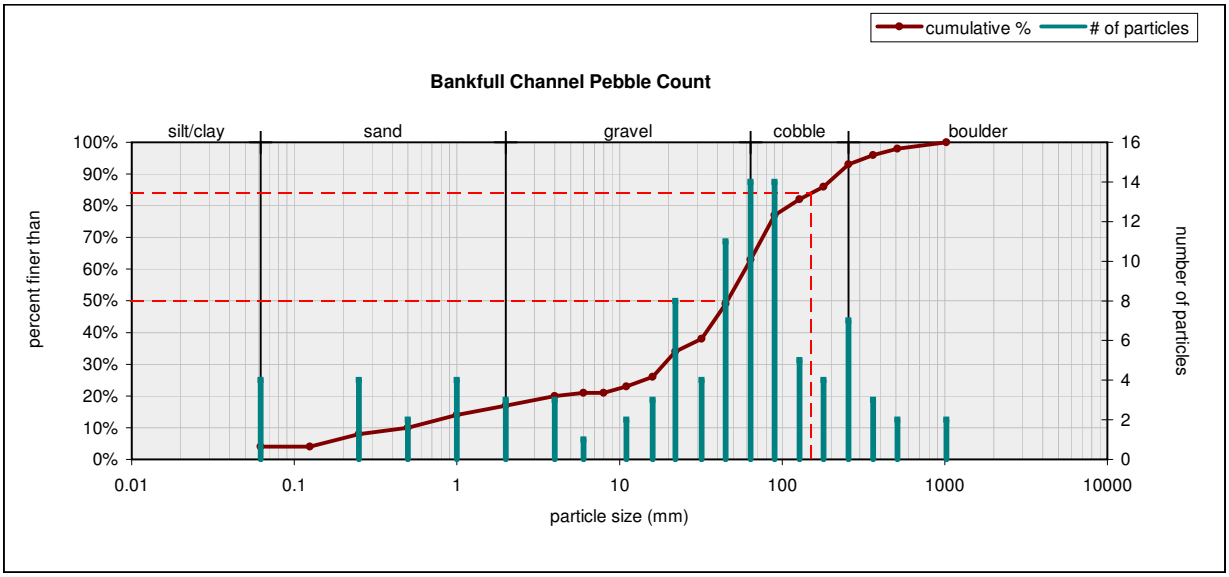
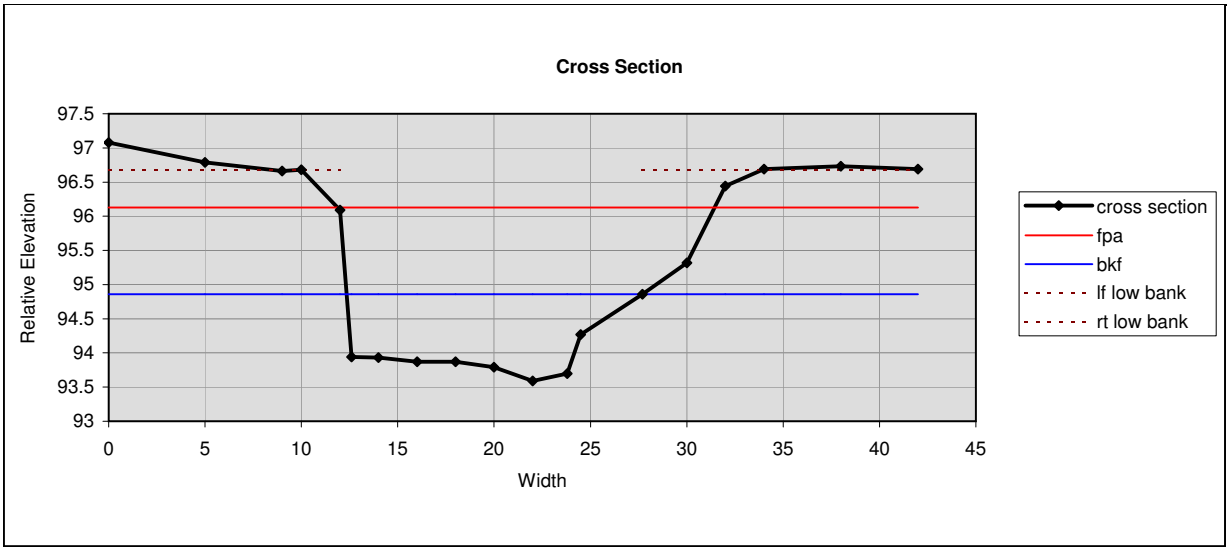


Size (mm)	
D16	1.6
D35	24
D50	46
D65	67
D84	150
D95	320

Size Distribution	
mean	15.5
dispersion	16.0
skewness	-0.3

Type	
silt/clay	4%
sand	13%
gravel	46%
cobble	30%
boulder	7%
bedrock	0%



Bankfull Dimensions	
13.5	x-section area (ft.sq.)
15.4	width (ft)
0.9	mean depth (ft)
1.3	max depth (ft)
16.3	wetted perimeter (ft)
0.8	hydraulic radius (ft)
17.5	width-depth ratio

Flood Dimensions	
19.6	Width flood prone area (ft)
1.3	entrenchment ratio
3.1	low bank height (ft)
2.4	low bank height ratio

Flow Resistance	
0.056	Manning's roughness

Bankfull Flow	
2.6	velocity (ft/s)
35.6	discharge rate (cfs)
1.3	channel slope (%)

Sinuosity	Channel Type
1.10	F4

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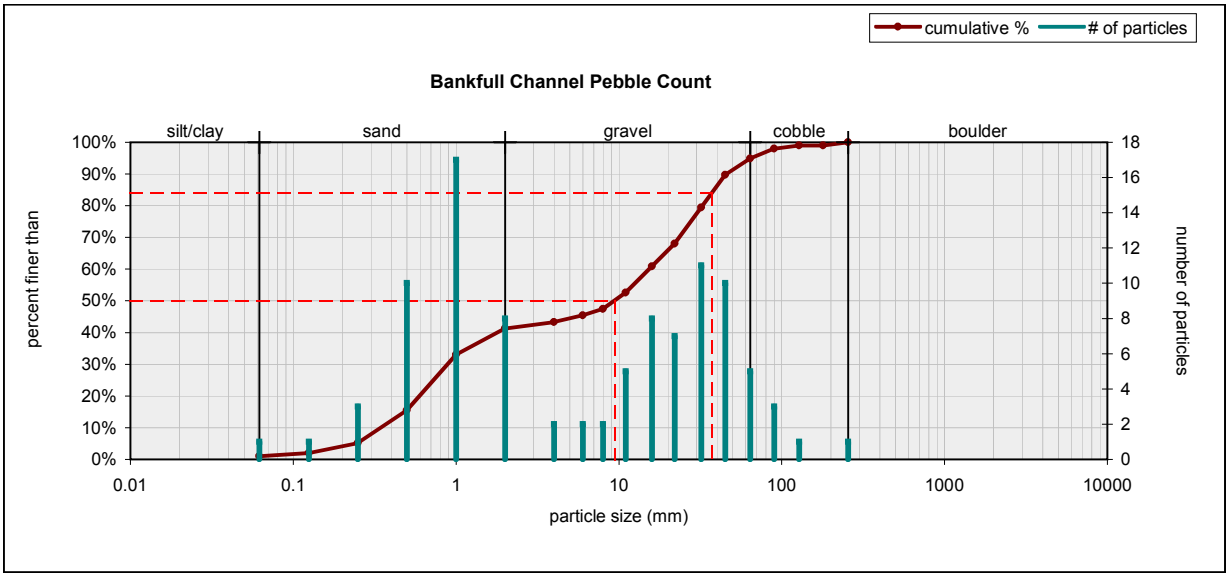
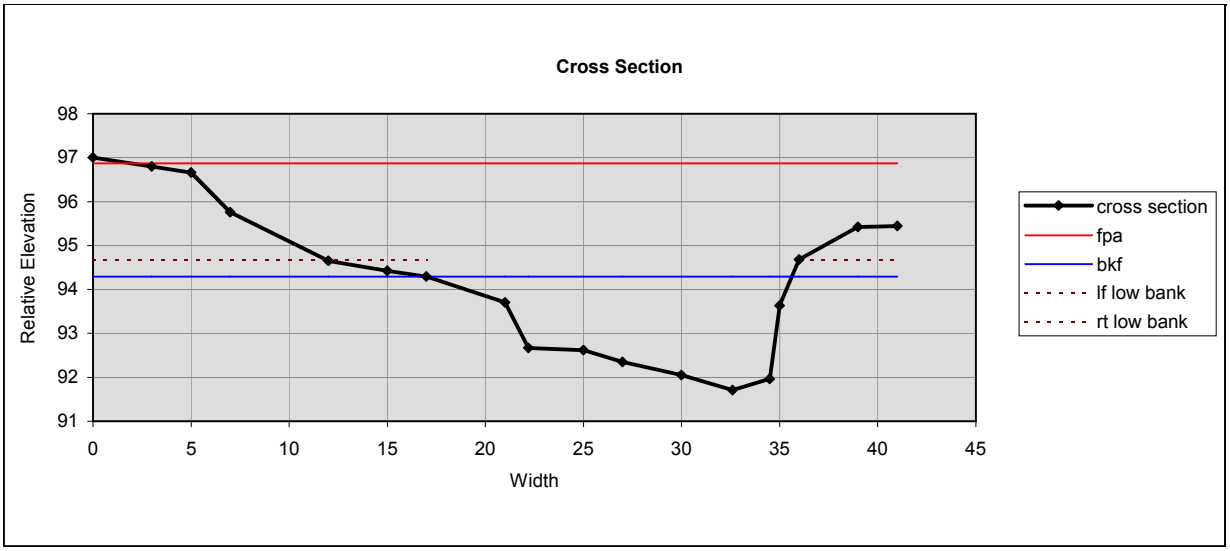


Size (mm)	
D16	0.51
D35	1.2
D50	9.4
D65	19
D84	37
D95	65

Size Distribution	
mean	4.3
dispersion	11.2
skewness	-0.2

Type	
silt/clay	1%
sand	39%
gravel	52%
cobble	5%
boulder	0%
bedrock	0%



Bankfull Dimensions	
28.9	x-section area (ft.sq.)
18.6	width (ft)
1.6	mean depth (ft)
2.6	max depth (ft)
20.7	wetted perimeter (ft)
1.4	hydraulic radius (ft)
12.0	width-depth ratio

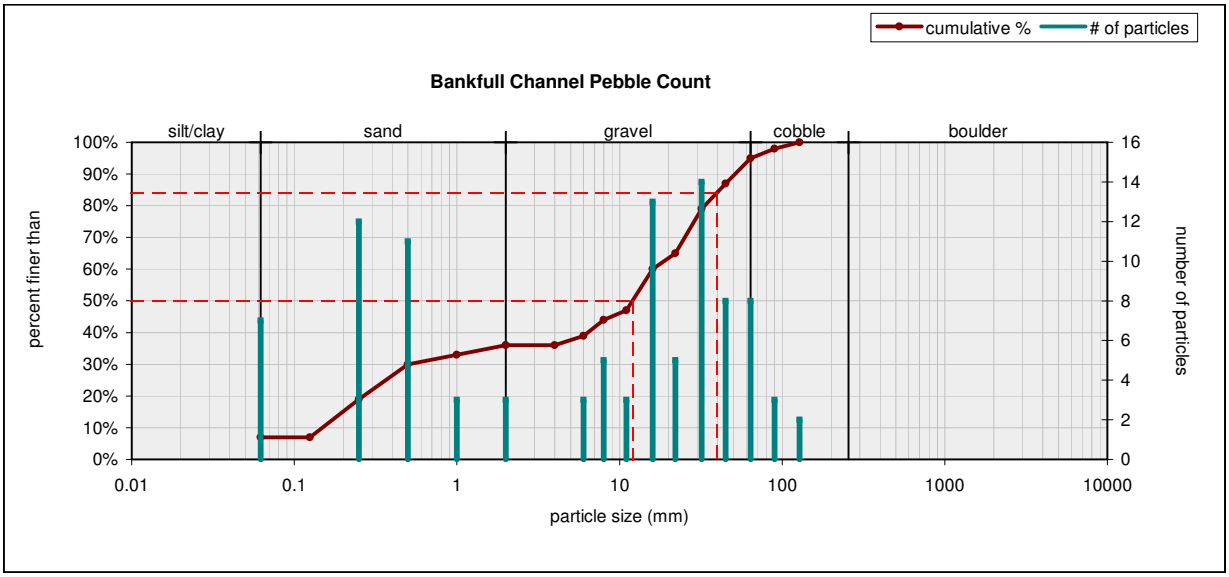
Flood Dimensions	
54.0	Width flood prone area (ft)
2.9	entrenchment ratio
3.0	low bank height (ft)
1.2	low bank height ratio

Flow Resistance	
0.029	Manning's roughness

Bankfull Flow	
8.5	velocity (ft/s)
246.0	discharge rate (cfs)
1.8	channel slope (%)

Sinuosity	Channel Type
2.37	C4

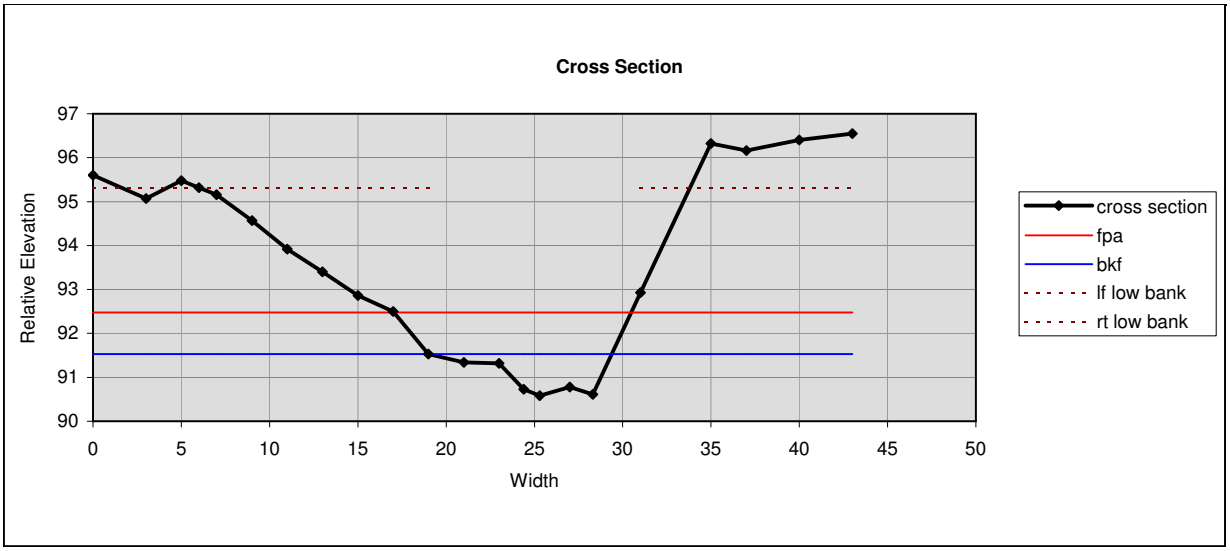
01PA_1_04_2008



Size (mm)	
D16	0.21
D35	1.6
D50	12
D65	22
D84	40
D95	64

Size Distribution	
mean	2.9
dispersion	30.2
skewness	-0.4

Type	
silt/clay	7%
sand	29%
gravel	59%
cobble	5%
boulder	0%
bedrock	0%



Bankfull Dimensions	
5.1	x-section area (ft.sq.)
10.4	width (ft)
0.5	mean depth (ft)
1.0	max depth (ft)
10.9	wetted perimeter (ft)
0.5	hydraulic radius (ft)
21.1	width-depth ratio

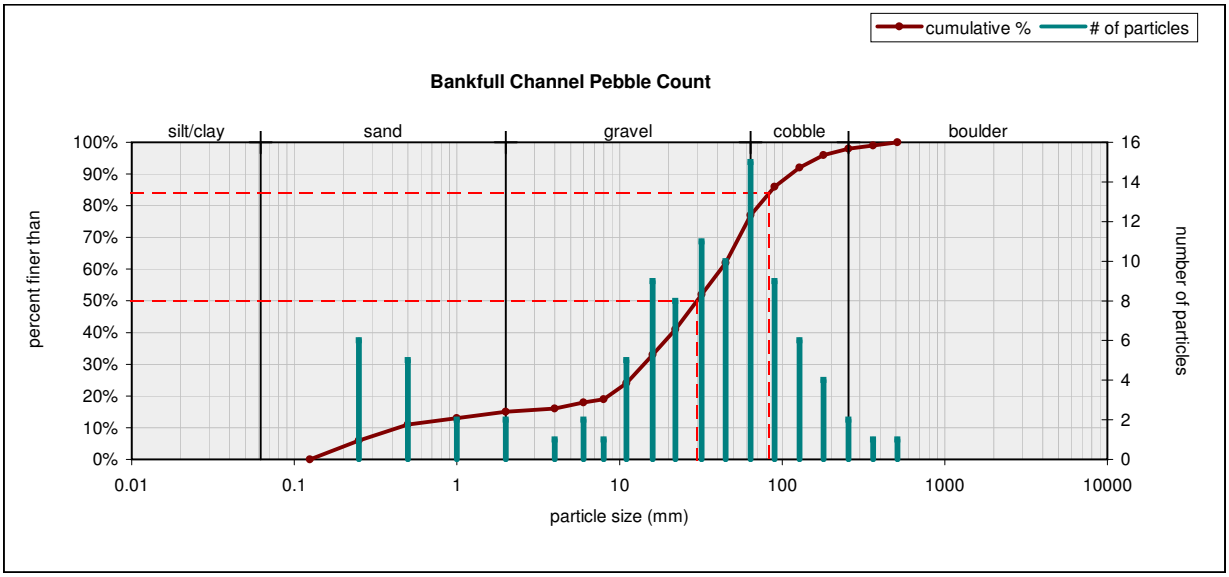
Flood Dimensions	
13.4	Width flood prone area (ft)
1.3	entrenchment ratio
4.7	low bank height (ft)
5.0	low bank height ratio

Flow Resistance	
0.035	Manning's roughness

Bankfull Flow	
3.5	velocity (ft/s)
18.1	discharge rate (cfs)
1.9	channel slope (%)

Sinuosity	Channel Type
1.22	F4

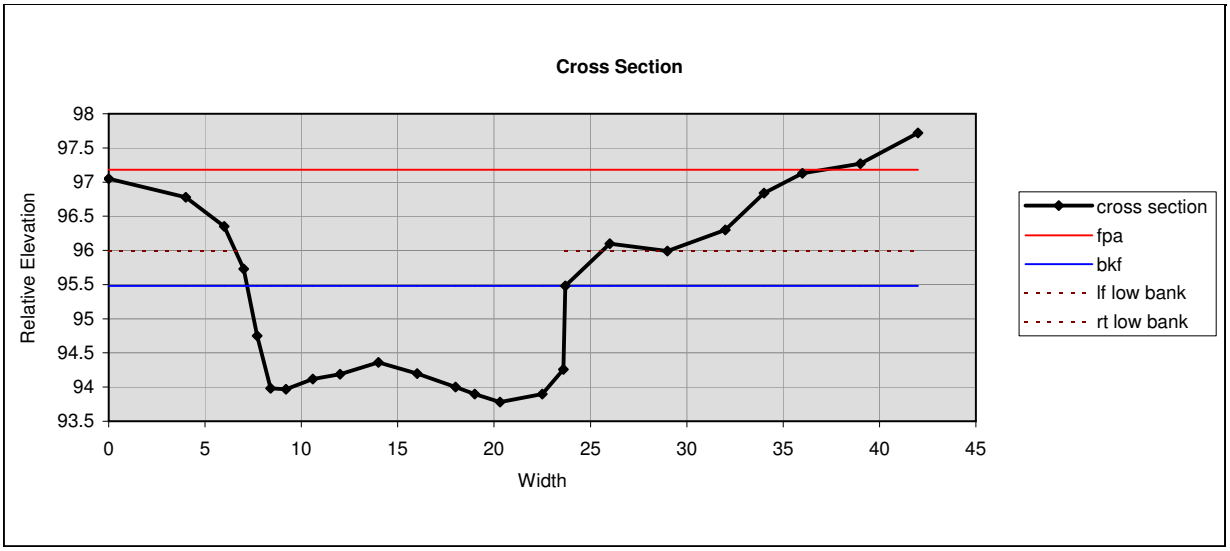
01PA_1_05_2008



Size (mm)	
D16	4
D35	17
D50	30
D65	48
D84	83
D95	170

Size Distribution	
mean	18.2
dispersion	5.1
skewness	-0.2

Type	
silt/clay	0%
sand	15%
gravel	62%
cobble	21%
boulder	2%
bedrock	0%



Bankfull Dimensions	
22.5	x-section area (ft.sq.)
16.5	width (ft)
1.4	mean depth (ft)
1.7	max depth (ft)
18.5	wetted perimeter (ft)
1.2	hydraulic radius (ft)
12.1	width-depth ratio

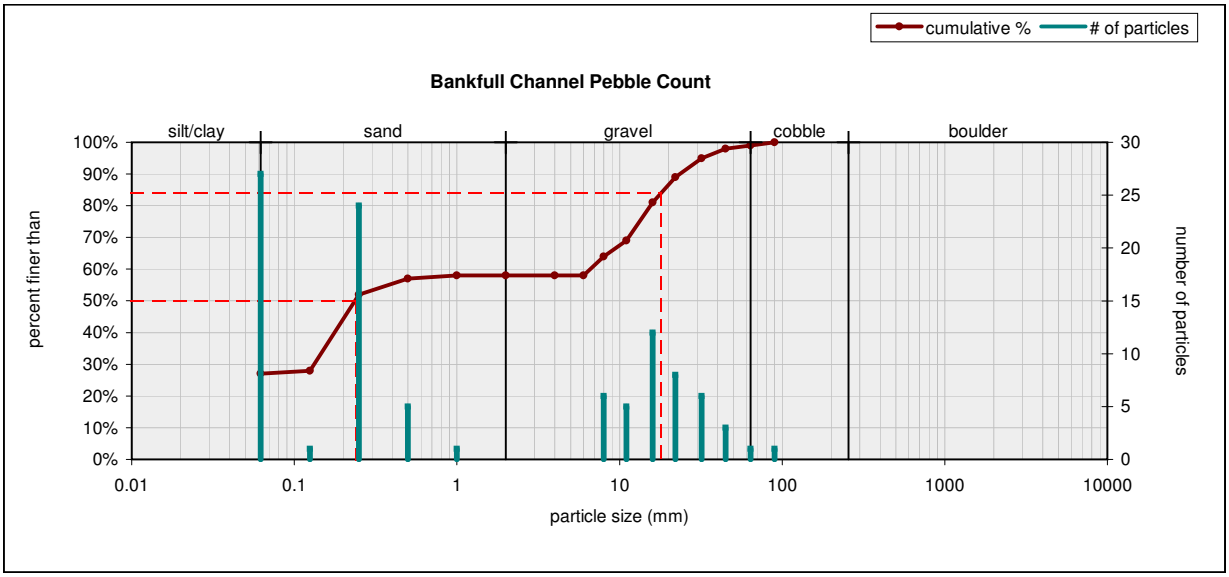
Flood Dimensions	
150.0	Width flood prone area (ft)
9.1	entrenchment ratio
2.2	low bank height (ft)
1.3	low bank height ratio

Flow Resistance	
0.039	Manning's roughness

Bankfull Flow	
4.7	velocity (ft/s)
106.1	discharge rate (cfs)
1.2	channel slope (%)

Sinuosity	Channel Type
1.51	E4

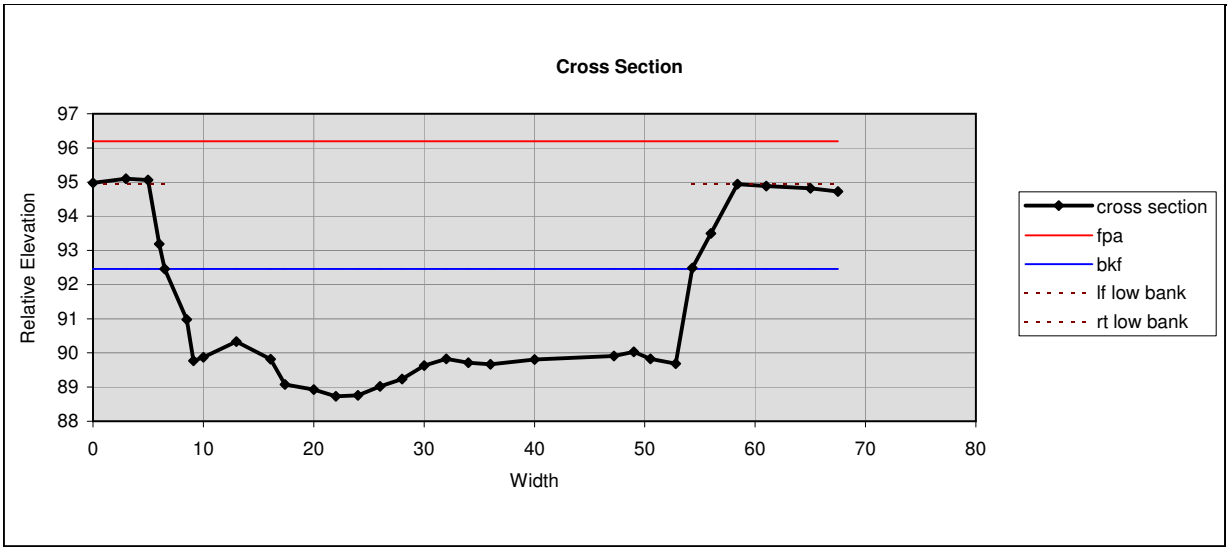
01PA_3_01_2008



Size (mm)	
D16	0.062
D35	0.15
D50	0.24
D65	8.5
D84	18
D95	32

Size Distribution	
mean	1.1
dispersion	39.4
skewness	0.4

Type	
silt/clay	27%
sand	31%
gravel	41%
cobble	1%
boulder	0%
bedrock	0%



Bankfull Dimensions	
129.5	x-section area (ft.sq.)
47.8	width (ft)
2.7	mean depth (ft)
3.7	max depth (ft)
51.1	wetted perimeter (ft)
2.5	hydraulic radius (ft)
17.6	width-depth ratio

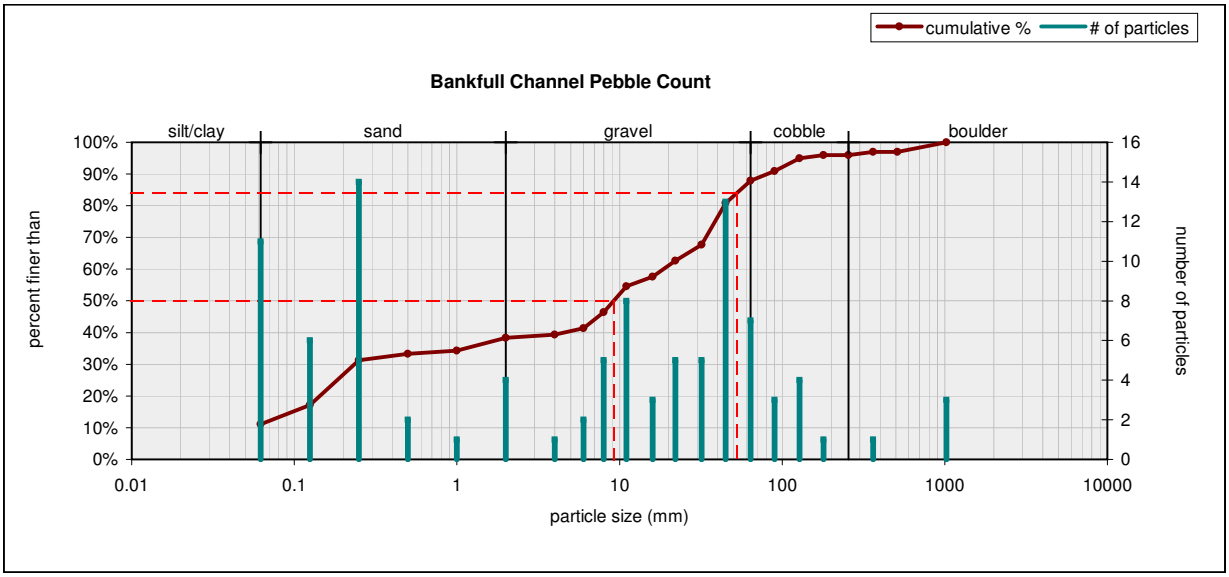
Flood Dimensions	
400.0	Width flood prone area (ft)
8.4	entrenchment ratio
6.2	low bank height (ft)
1.7	low bank height ratio

Flow Resistance	
0.024	Manning's roughness

Bankfull Flow	
1.2	velocity (ft/s)
154.3	discharge rate (cfs)
0.011	channel slope (%)

Sinuosity	Channel Type
1.03	C5

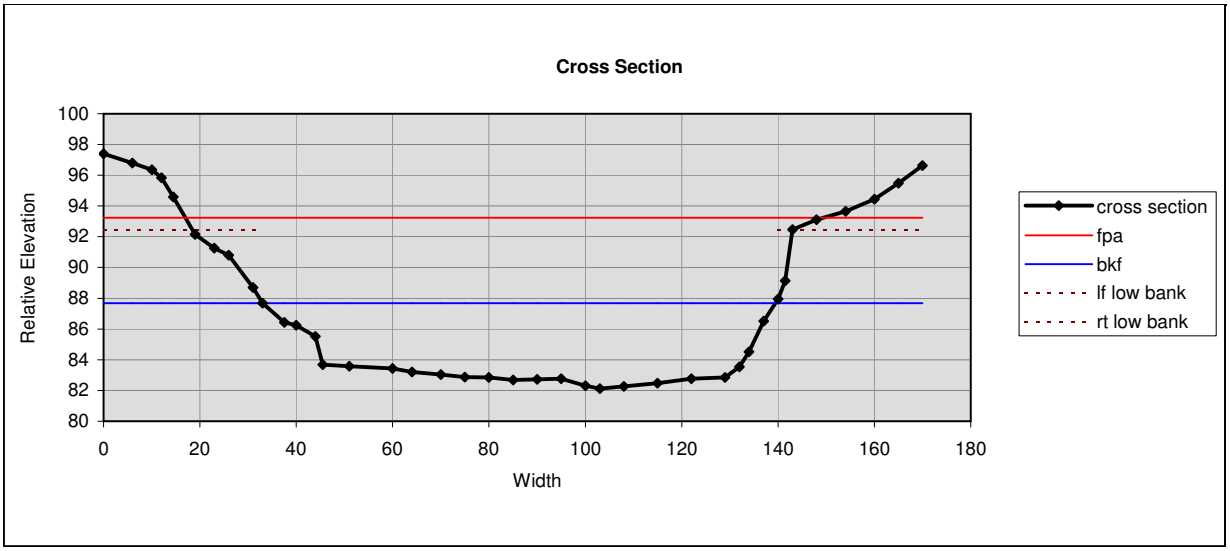
01PA_4_01_2008



Size (mm)	
D16	0.11
D35	1.1
D50	9.2
D65	26
D84	53
D95	130

Size Distribution	
mean	2.4
dispersion	44.7
skewness	-0.4

Type	
silt/clay	11%
sand	27%
gravel	49%
cobble	8%
boulder	4%
bedrock	0%



Bankfull Dimensions	
449.3	x-section area (ft.sq.)
106.4	width (ft)
4.2	mean depth (ft)
5.6	max depth (ft)
108.8	wetted perimeter (ft)
4.1	hydraulic radius (ft)
25.2	width-depth ratio

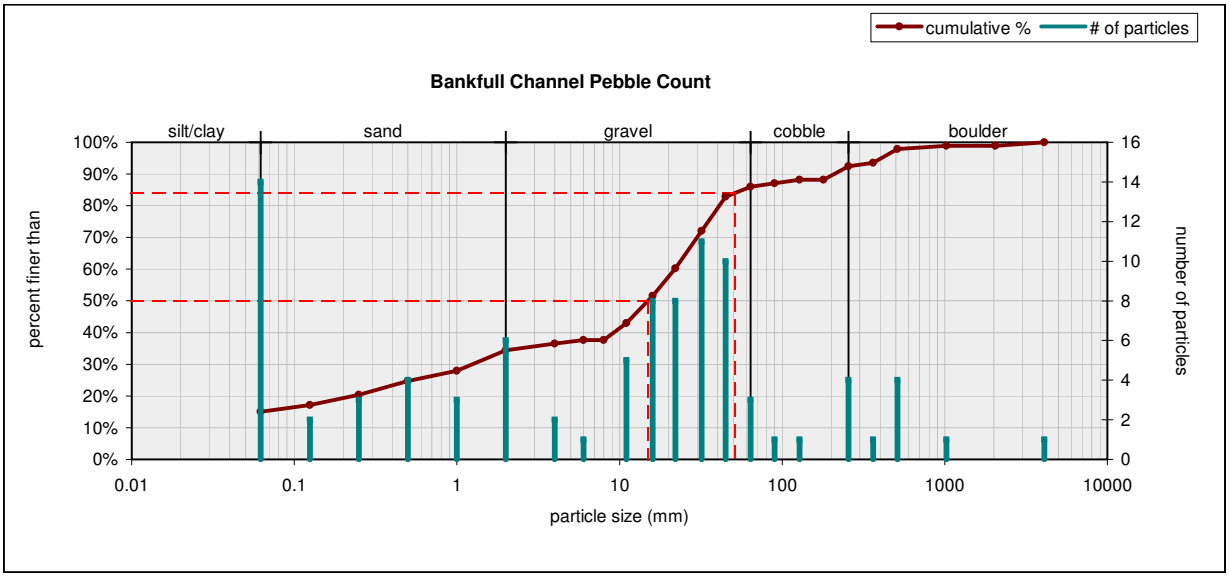
Flood Dimensions	
132.5	Width flood prone area (ft)
1.2	entrenchment ratio
10.4	low bank height (ft)
1.9	low bank height ratio

Flow Resistance	
0.030	Manning's roughness

Bankfull Flow	
2.4	velocity (ft/s)
1068.0	discharge rate (cfs)
0.035	channel slope (%)

Sinuosity	Channel Type
1.03	F4

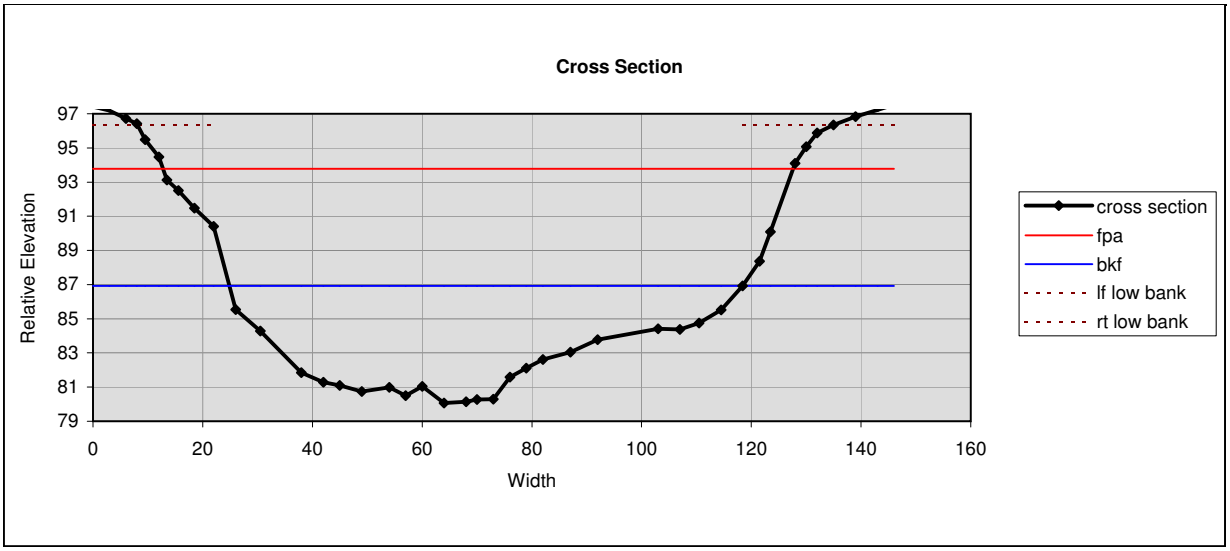
01PA_4_02_2008



Size (mm)	
D16	0.084
D35	2.4
D50	15
D65	26
D84	51
D95	410

Size Distribution	
mean	2.1
dispersion	91.0
skewness	-0.5

Type	
silt/clay	14%
sand	18%
gravel	48%
cobble	6%
boulder	7%
bedrock	0%



Bankfull Dimensions	
398.7	x-section area (ft.sq.)
93.5	width (ft)
4.3	mean depth (ft)
6.9	max depth (ft)
95.8	wetted perimeter (ft)
4.2	hydraulic radius (ft)
21.9	width-depth ratio

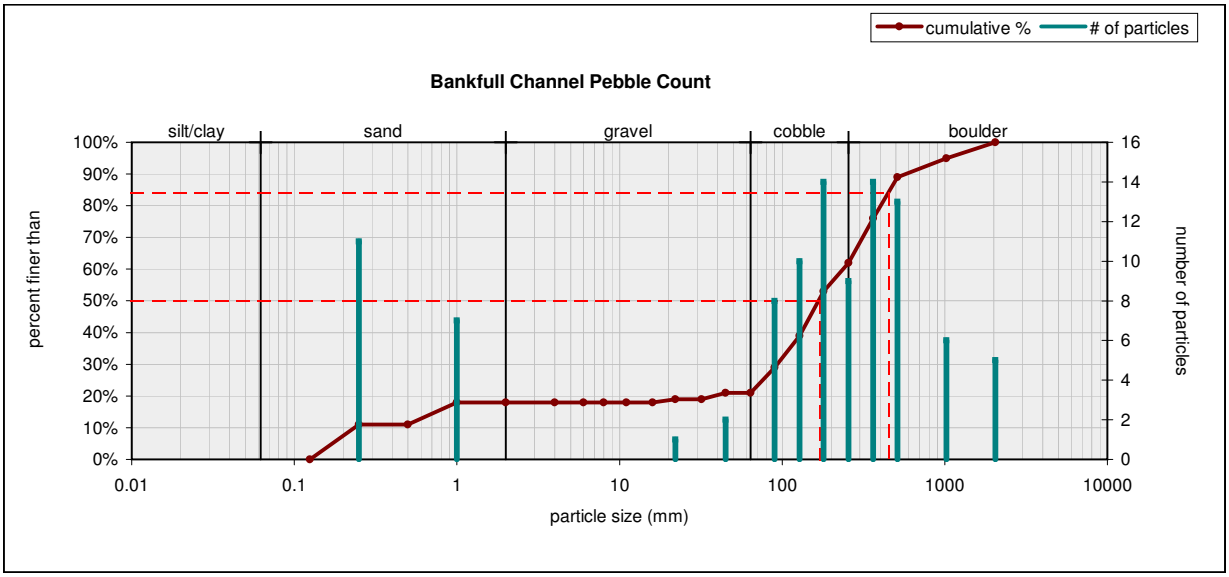
Flood Dimensions	
114.8	Width flood prone area (ft)
1.2	entrenchment ratio
16.3	low bank height (ft)
2.4	low bank height ratio

Flow Resistance	
0.029	Manning's roughness

Bankfull Flow	
4.5	velocity (ft/s)
1805.0	discharge rate (cfs)
0.12	channel slope (%)

Sinuosity	Channel Type
1.03	F4

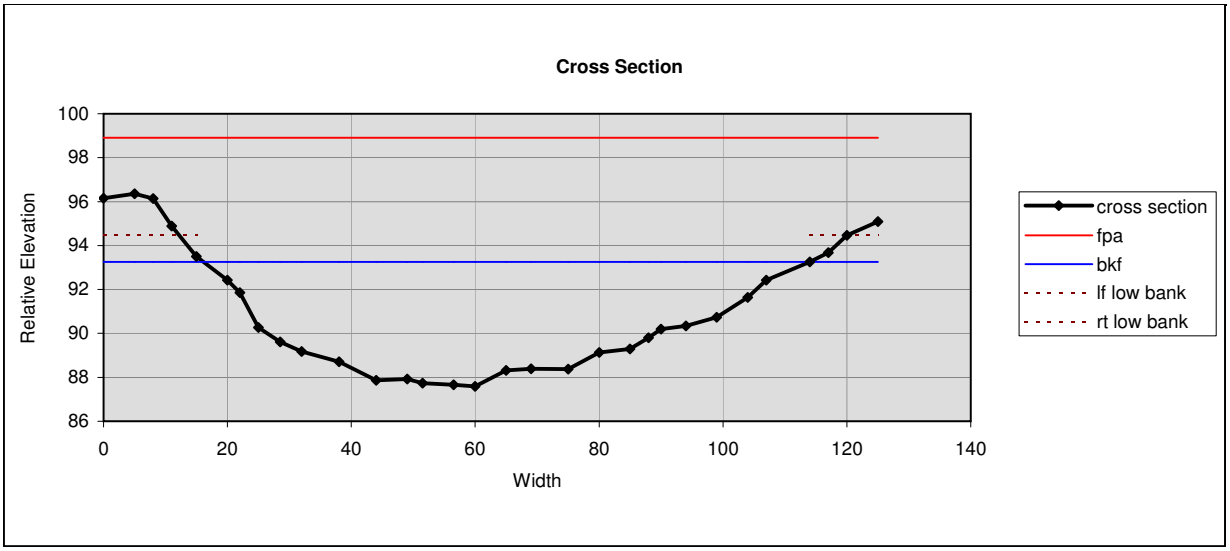
01PA_4_03_2008



Size (mm)	
D16	0.82
D35	110
D50	170
D65	280
D84	450
D95	1000

Size Distribution	
mean	19.2
dispersion	105.0
skewness	-0.6

Type	
silt/clay	0%
sand	18%
gravel	3%
cobble	41%
boulder	38%
bedrock	0%



Bankfull Dimensions	
356.8	x-section area (ft.sq.)
97.8	width (ft)
3.6	mean depth (ft)
5.7	max depth (ft)
99.0	wetted perimeter (ft)
3.6	hydraulic radius (ft)
26.8	width-depth ratio

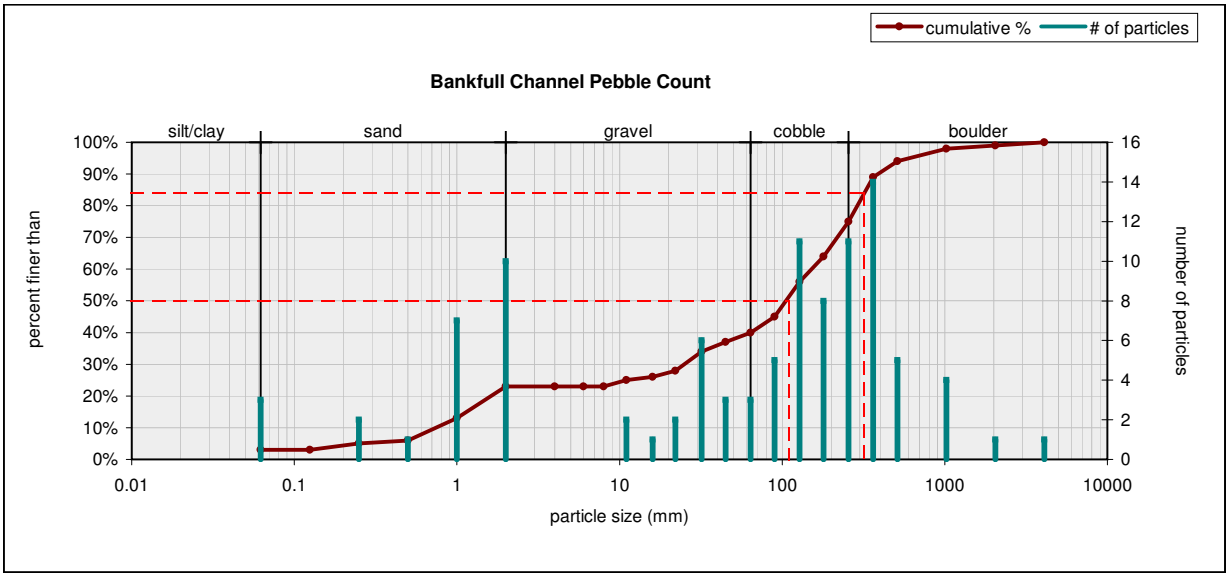
Flood Dimensions	
220.5	Width flood prone area (ft)
2.3	entrenchment ratio
6.9	low bank height (ft)
1.2	low bank height ratio

Flow Resistance	
0.059	Manning's roughness

Bankfull Flow	
4.0	velocity (ft/s)
1423.3	discharge rate (cfs)
0.46	channel slope (%)

Sinuosity	Channel Type
1.03	B3c

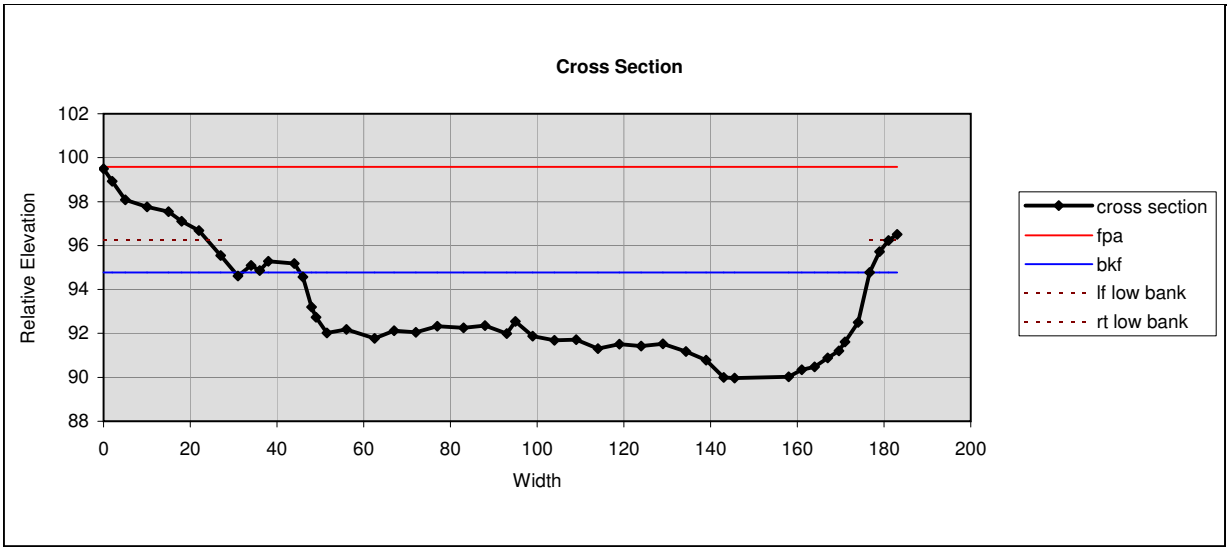
01PA_4_04_2008



Size (mm)	
D16	1.2
D35	36
D50	110
D65	190
D84	320
D95	610

Size Distribution	
mean	19.6
dispersion	47.3
skewness	-0.5

Type	
silt/clay	3%
sand	20%
gravel	17%
cobble	35%
boulder	25%
bedrock	0%



Bankfull Dimensions	
420.6	x-section area (ft.sq.)
132.9	width (ft)
3.2	mean depth (ft)
4.8	max depth (ft)
135.0	wetted perimeter (ft)
3.1	hydraulic radius (ft)
42.0	width-depth ratio

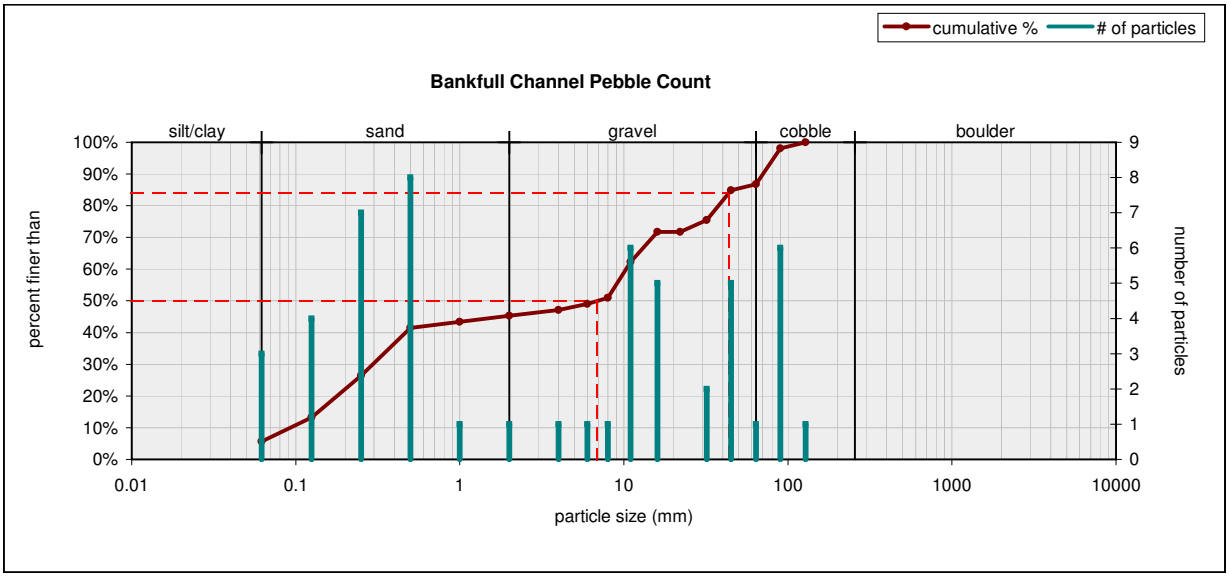
Flood Dimensions	
200.0	Width flood prone area (ft)
1.5	entrenchment ratio
6.3	low bank height (ft)
1.3	low bank height ratio

Flow Resistance	
0.053	Manning's roughness

Bankfull Flow	
3.9	velocity (ft/s)
1639.6	discharge rate (cfs)
0.43	channel slope (%)

Sinuosity	Channel Type
1.03	B3a

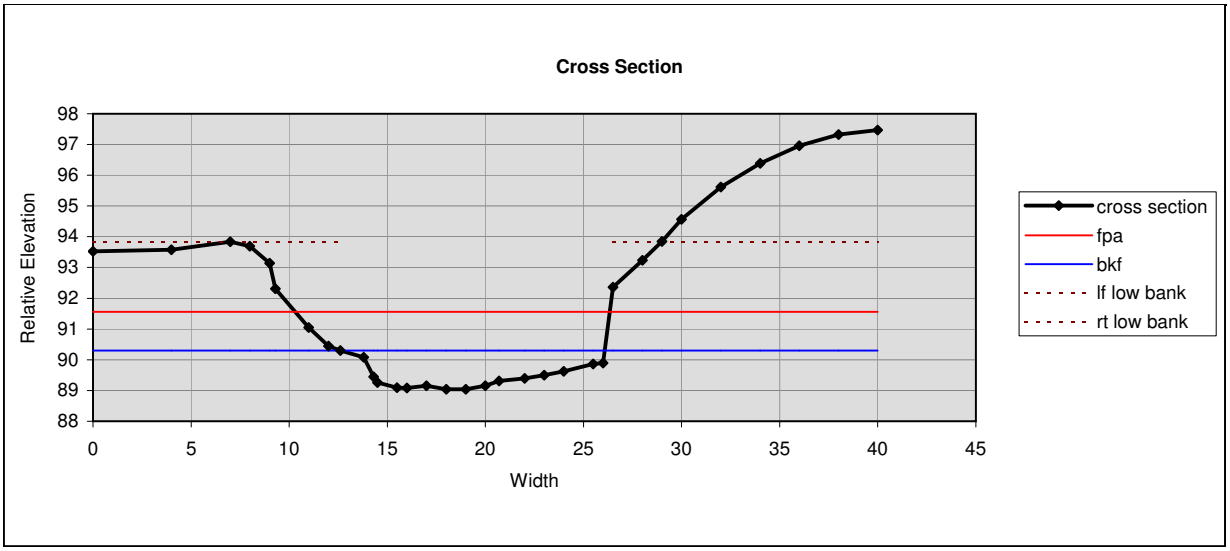
04PB_1_01_2008



Size (mm)	
D16	0.14
D35	0.37
D50	6.9
D65	12
D84	44
D95	82

Size Distribution	
mean	2.5
dispersion	27.8
skewness	-0.3

Type	
silt/clay	3%
sand	21%
gravel	22%
cobble	7%
boulder	0%
bedrock	0%



Bankfull Dimensions	
11.8	x-section area (ft.sq.)
13.5	width (ft)
0.9	mean depth (ft)
1.3	max depth (ft)
14.3	wetted perimeter (ft)
0.8	hydraulic radius (ft)
15.4	width-depth ratio

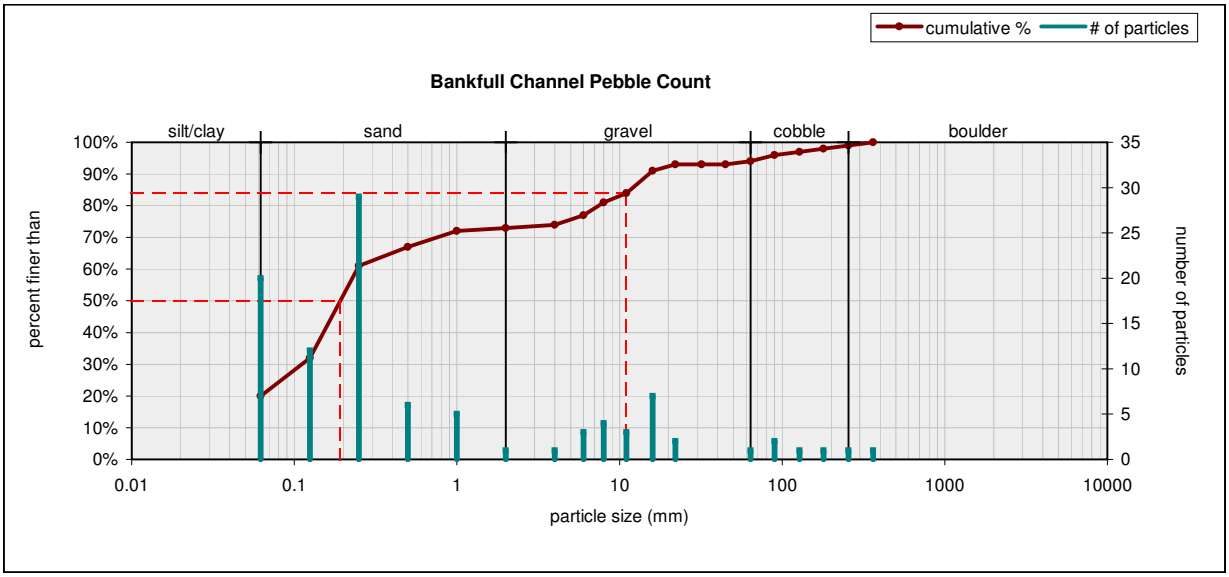
Flood Dimensions	
16.0	Width flood prone area (ft)
1.2	entrenchment ratio
4.8	low bank height (ft)
3.8	low bank height ratio

Flow Resistance	
0.034	Manning's roughness

Bankfull Flow	
9.1	velocity (ft/s)
107.2	discharge rate (cfs)
1.7	channel slope (%)

Sinuosity	Channel Type
1.03	F4

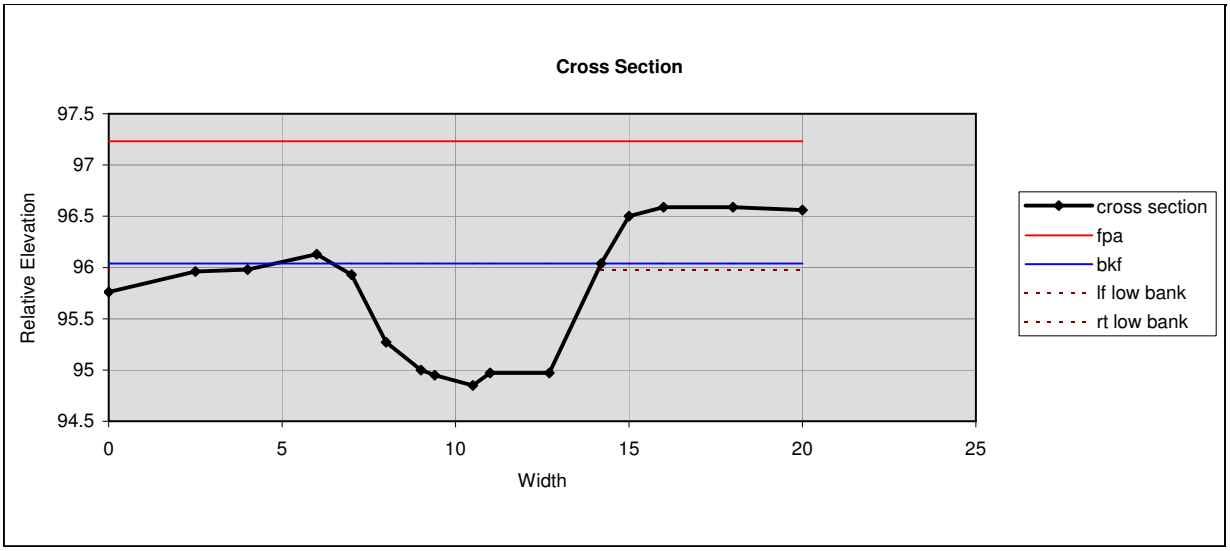
04PB_1_02_2008



Size (mm)	
D16	0.062
D35	0.13
D50	0.19
D65	0.4
D84	11
D95	76

Size Distribution	
mean	0.8
dispersion	30.5
skewness	0.4

Type	
silt/clay	20%
sand	53%
gravel	21%
cobble	5%
boulder	1%
bedrock	0%



Bankfull Dimensions	
6.8	x-section area (ft.sq.)
12.6	width (ft)
0.5	mean depth (ft)
1.2	max depth (ft)
13.2	wetted perimeter (ft)
0.5	hydraulic radius (ft)
23.1	width-depth ratio

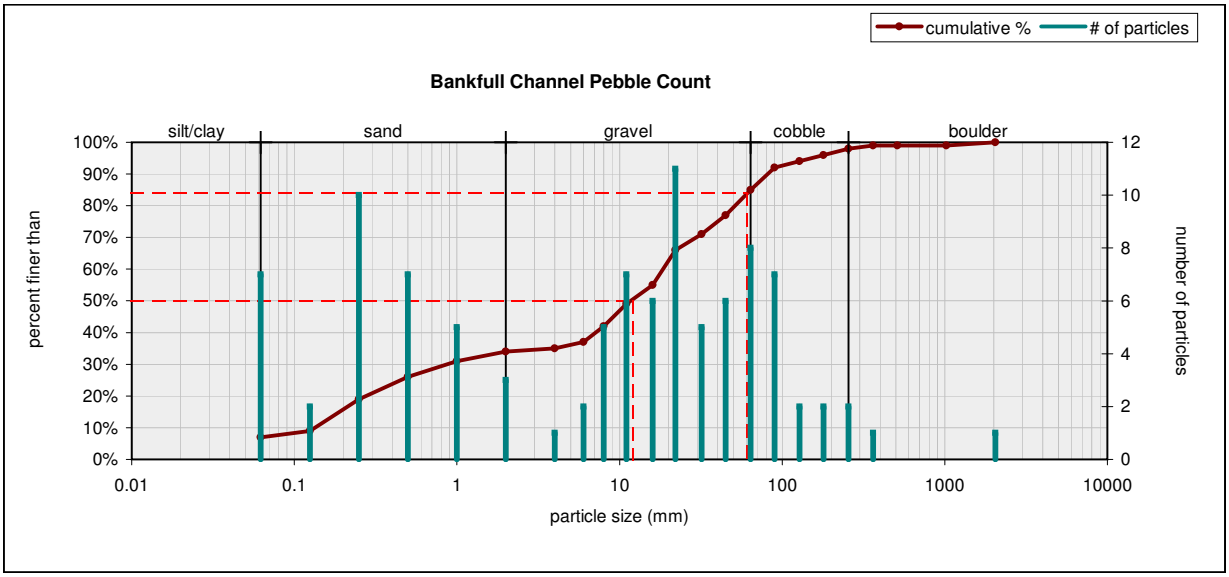
Flood Dimensions	
60.0	Width flood prone area (ft)
4.8	entrenchment ratio
1.1	low bank height (ft)
0.9	low bank height ratio

Flow Resistance	
0.023	Manning's roughness

Bankfull Flow	
5.3	velocity (ft/s)
35.9	discharge rate (cfs)
1.6	channel slope (%)

Sinuosity	Channel Type
1.05	C5

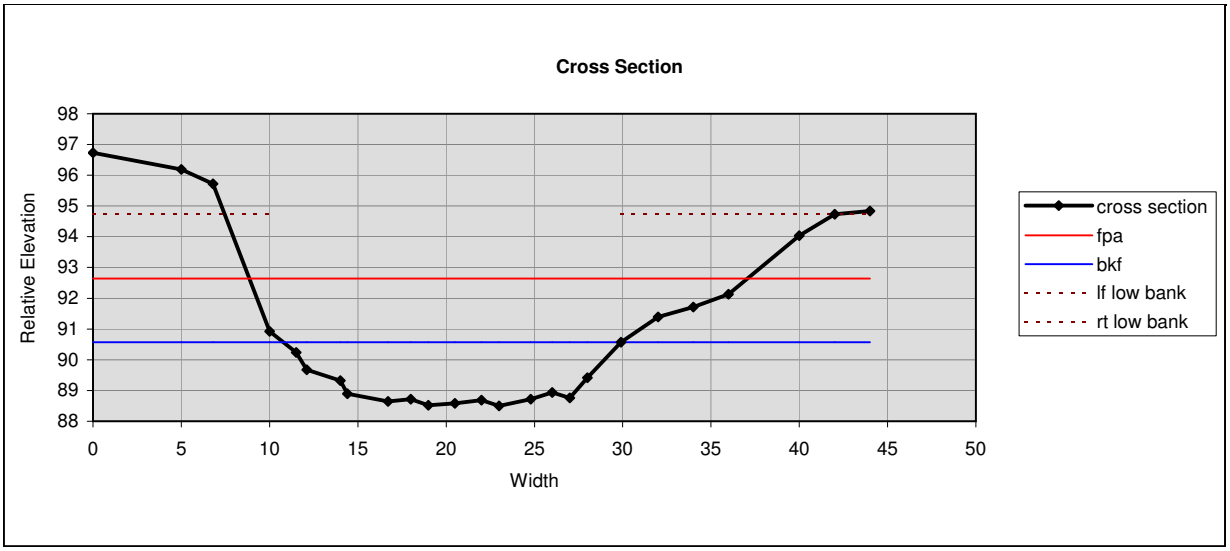
04PB_1_03A_2008



Size (mm)	
D16	0.2
D35	4
D50	12
D65	21
D84	61
D95	150

Size Distribution	
mean	3.5
dispersion	32.5
skewness	-0.3

Type	
silt/clay	7%
sand	27%
gravel	51%
cobble	13%
boulder	2%
bedrock	0%



Bankfull Dimensions	
29.4	x-section area (ft.sq.)
19.1	width (ft)
1.5	mean depth (ft)
2.1	max depth (ft)
20.3	wetted perimeter (ft)
1.5	hydraulic radius (ft)
12.4	width-depth ratio

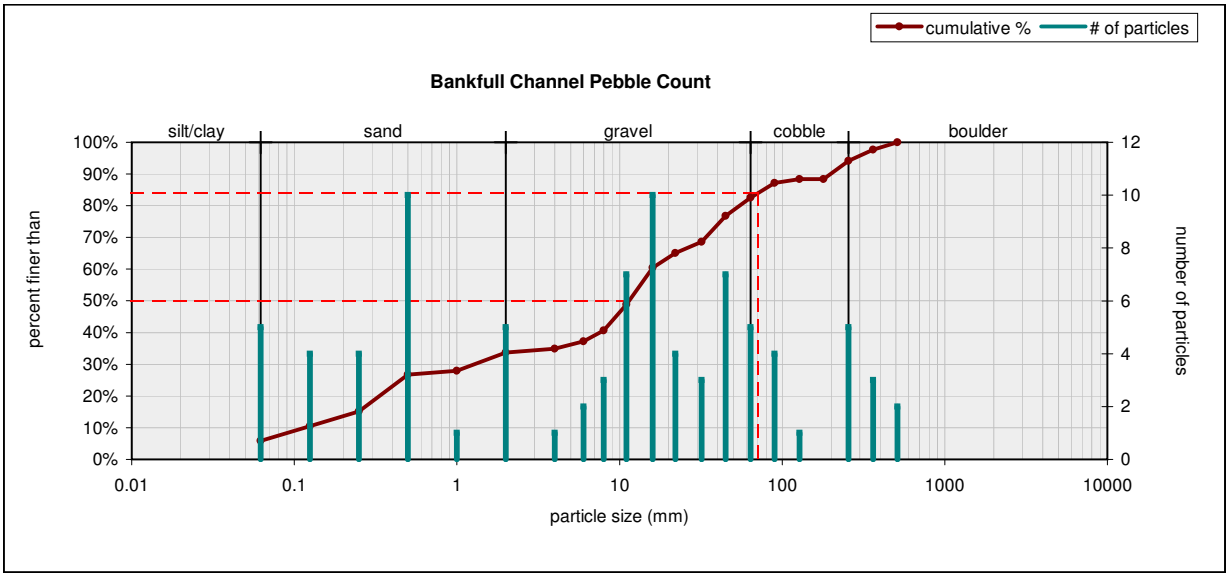
Flood Dimensions	
28.2	Width flood prone area (ft)
1.5	entrenchment ratio
6.2	low bank height (ft)
3.0	low bank height ratio

Flow Resistance	
0.034	Manning's roughness

Bankfull Flow	
8.9	velocity (ft/s)
263.4	discharge rate (cfs)
2.6	channel slope (%)

Sinuosity	Channel Type
1.04	B4

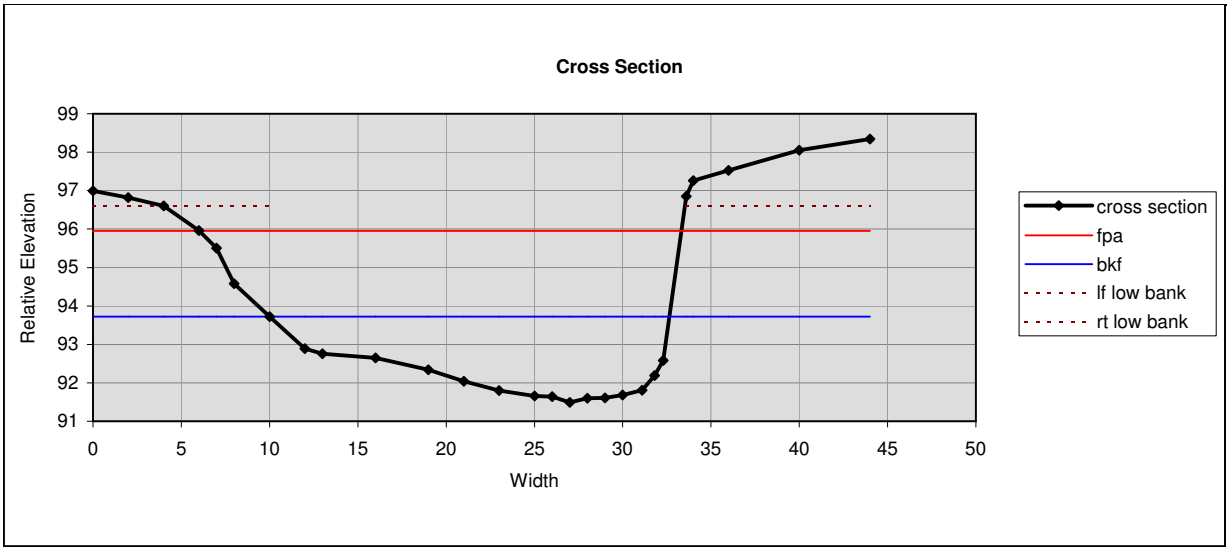
04PB_1_04_2008



Size (mm)	
D16	0.26
D35	4.1
D50	11
D65	22
D84	71
D95	280

Size Distribution	
mean	4.3
dispersion	24.4
skewness	-0.3

Type	
silt/clay	5%
sand	24%
gravel	42%
cobble	10%
boulder	5%
bedrock	0%



Bankfull Dimensions	
33.9	x-section area (ft.sq.)
22.6	width (ft)
1.5	mean depth (ft)
2.2	max depth (ft)
24.0	wetted perimeter (ft)
1.4	hydraulic radius (ft)
15.1	width-depth ratio

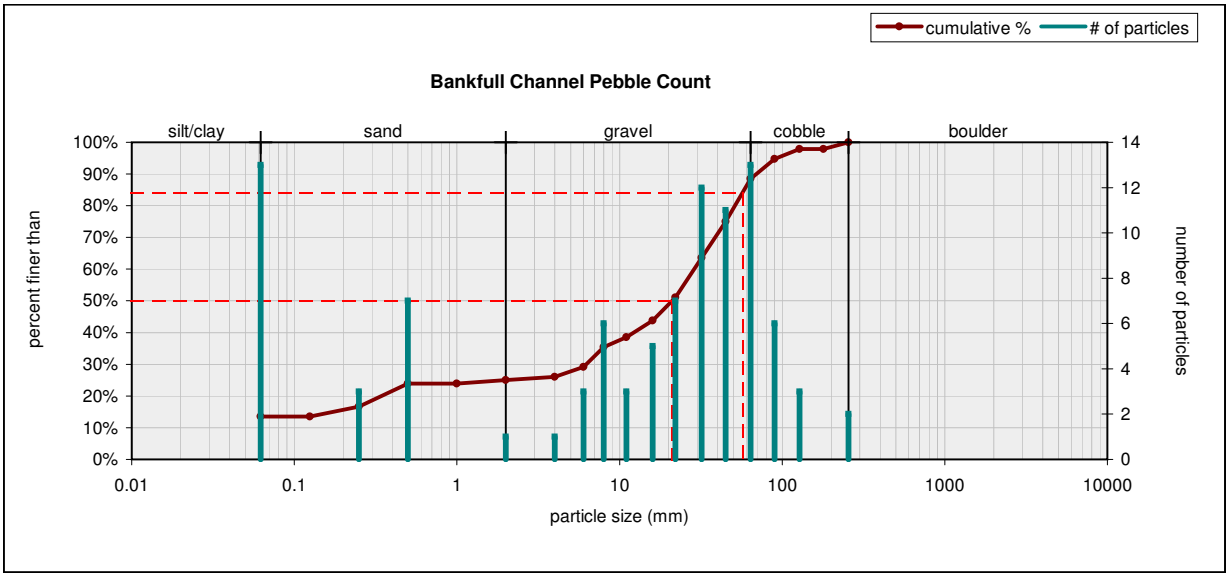
Flood Dimensions	
27.3	Width flood prone area (ft)
1.2	entrenchment ratio
5.1	low bank height (ft)
2.3	low bank height ratio

Flow Resistance	
0.036	Manning's roughness

Bankfull Flow	
4.6	velocity (ft/s)
157.5	discharge rate (cfs)
0.79	channel slope (%)

Sinuosity	Channel Type
1.03	F4

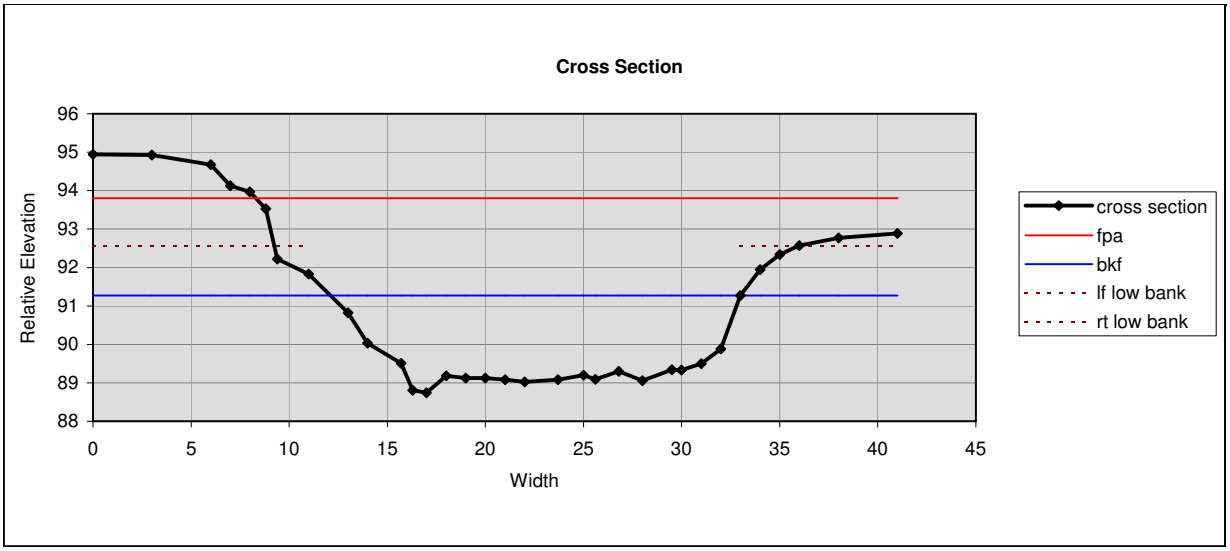
04PA_1_05_2008



Size (mm)	
D16	0.22
D35	7.8
D50	21
D65	33
D84	57
D95	92

Size Distribution	
mean	3.5
dispersion	49.1
skewness	-0.5

Type	
silt/clay	13%
sand	11%
gravel	61%
cobble	11%
boulder	0%
bedrock	0%



Bankfull Dimensions	
38.6	x-section area (ft.sq.)
20.9	width (ft)
1.8	mean depth (ft)
2.5	max depth (ft)
22.7	wetted perimeter (ft)
1.7	hydraulic radius (ft)
11.3	width-depth ratio

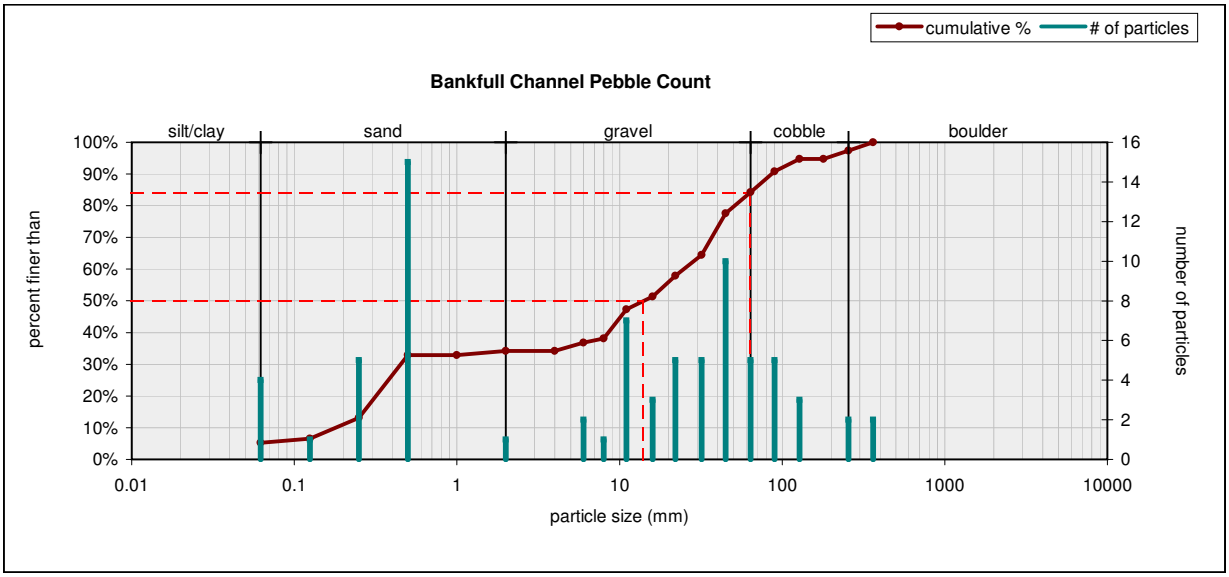
Flood Dimensions	
42.2	Width flood prone area (ft)
2.0	entrenchment ratio
3.8	low bank height (ft)
1.5	low bank height ratio

Flow Resistance	
0.033	Manning's roughness

Bankfull Flow	
8.7	velocity (ft/s)
334.0	discharge rate (cfs)
1.8	channel slope (%)

Sinuosity	Channel Type
1.29	B4c

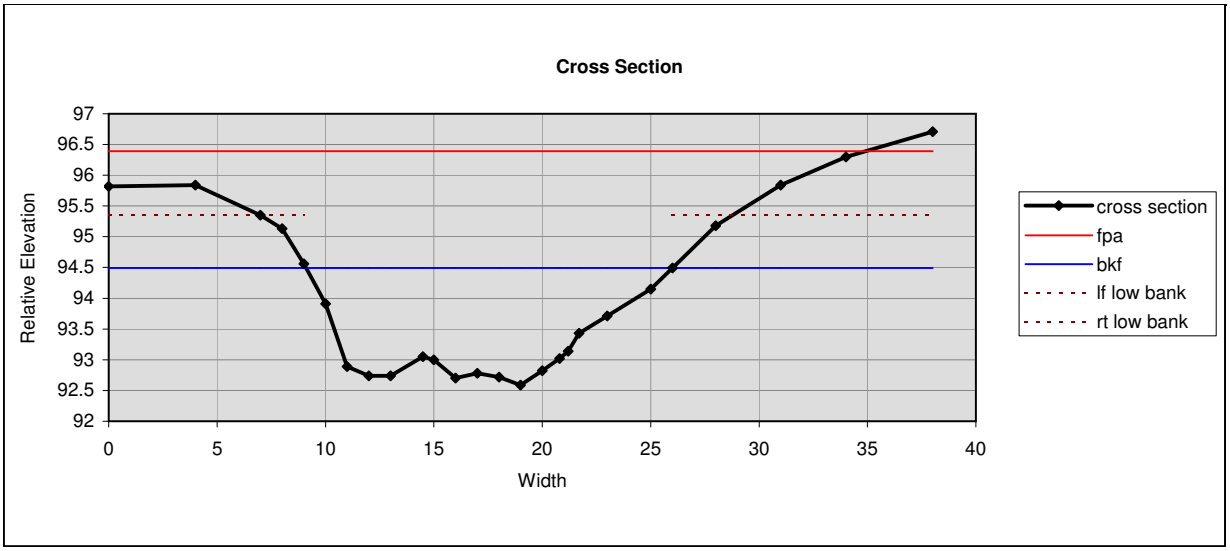
04PB_1_06_2008



Size (mm)	
D16	0.28
D35	4.5
D50	14
D65	32
D84	63
D95	190

Size Distribution	
mean	4.2
dispersion	27.3
skewness	-0.3

Type	
silt/clay	4%
sand	22%
gravel	38%
cobble	10%
boulder	2%
bedrock	0%
	0



Bankfull Dimensions	
21.6	x-section area (ft.sq.)
16.9	width (ft)
1.3	mean depth (ft)
1.9	max depth (ft)
17.9	wetted perimeter (ft)
1.2	hydraulic radius (ft)
13.2	width-depth ratio

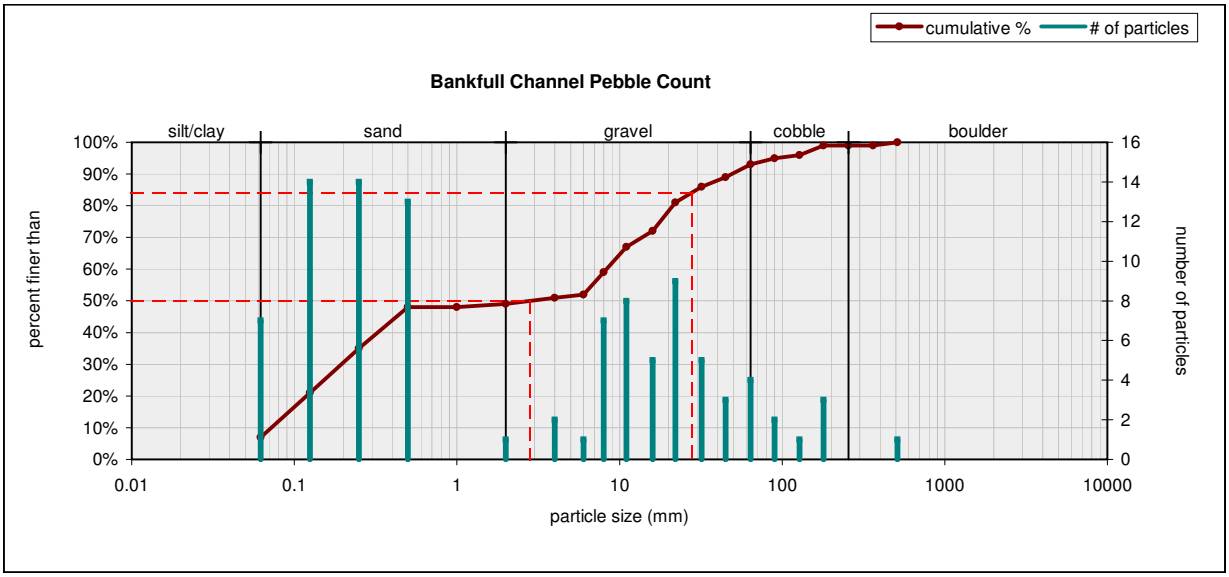
Flood Dimensions	
63.0	Width flood prone area (ft)
3.7	entrenchment ratio
2.8	low bank height (ft)
1.5	low bank height ratio

Flow Resistance	
0.035	Manning's roughness

Bankfull Flow	
7.5	velocity (ft/s)
162.3	discharge rate (cfs)
2.5	channel slope (%)

Sinuosity	Channel Type
1.05	C4b

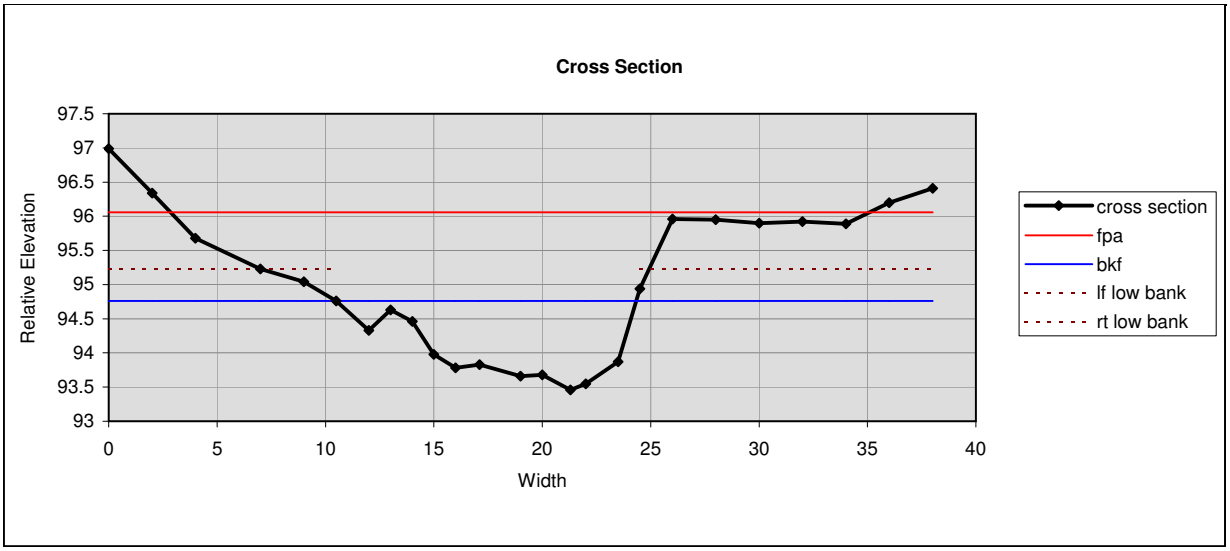
04PB_1_07_2008



Size (mm)	
D16	0.097
D35	0.25
D50	2.8
D65	10
D84	28
D95	90

Size Distribution	
mean	1.6
dispersion	19.4
skewness	-0.1

Type	
silt/clay	7%
sand	42%
gravel	44%
cobble	6%
boulder	1%
bedrock	0%



Bankfull Dimensions	
10.7	x-section area (ft.sq.)
13.8	width (ft)
0.8	mean depth (ft)
1.3	max depth (ft)
14.5	wetted perimeter (ft)
0.7	hydraulic radius (ft)
17.9	width-depth ratio

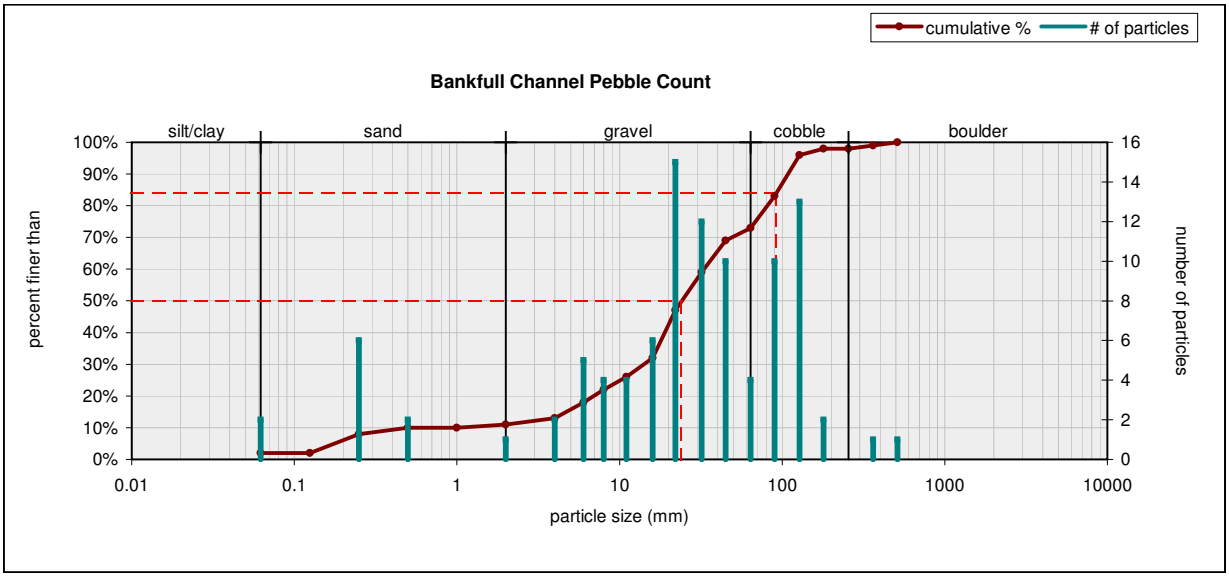
Flood Dimensions	
32.2	Width flood prone area (ft)
2.3	entrenchment ratio
1.8	low bank height (ft)
1.4	low bank height ratio

Flow Resistance	
0.029	Manning's roughness

Bankfull Flow	
5.2	velocity (ft/s)
56.0	discharge rate (cfs)
1.6	channel slope (%)

Sinuosity	Channel Type
1.11	C4

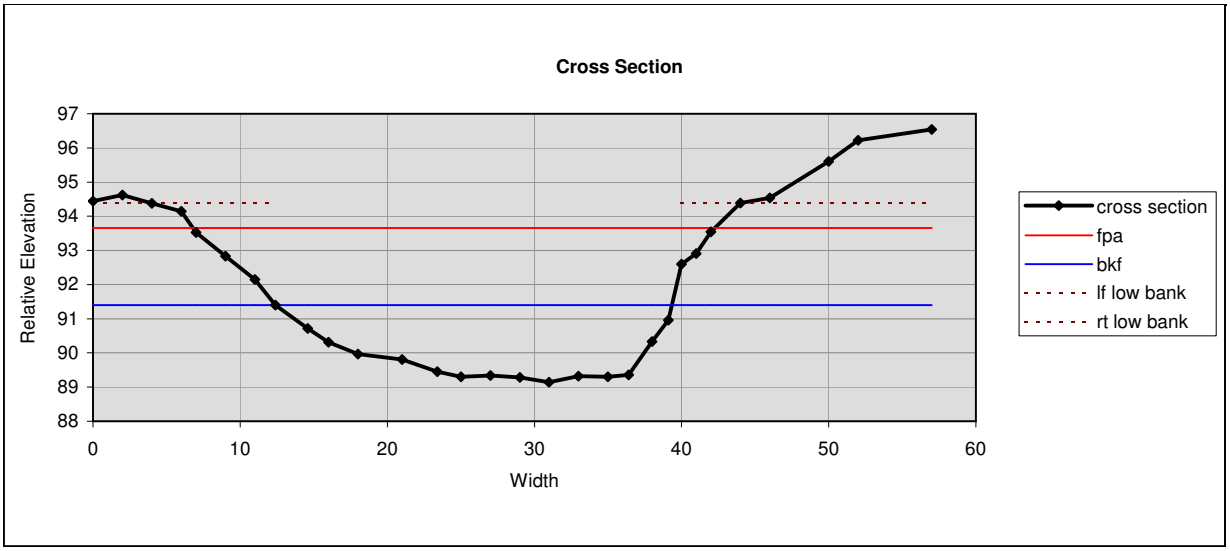
04PA_2_02_2008



Size (mm)	
D16	5.1
D35	17
D50	24
D65	39
D84	92
D95	120

Size Distribution	
mean	21.7
dispersion	4.3
skewness	0.0

Type	
silt/clay	2%
sand	9%
gravel	62%
cobble	25%
boulder	2%
bedrock	0%



Bankfull Dimensions	
44.0	x-section area (ft.sq.)
26.9	width (ft)
1.6	mean depth (ft)
2.3	max depth (ft)
27.9	wetted perimeter (ft)
1.6	hydraulic radius (ft)
16.5	width-depth ratio

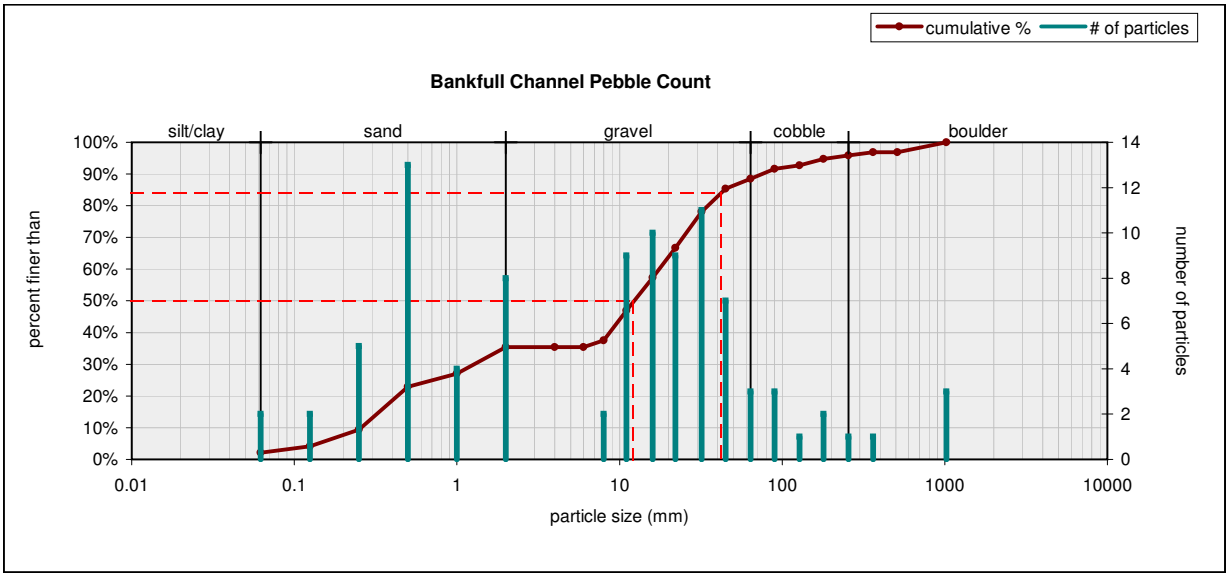
Flood Dimensions	
35.5	Width flood prone area (ft)
1.3	entrenchment ratio
5.2	low bank height (ft)
2.3	low bank height ratio

Flow Resistance	
0.039	Manning's roughness

Bankfull Flow	
4.8	velocity (ft/s)
212.4	discharge rate (cfs)
0.86	channel slope (%)

Sinuosity	Channel Type
1.00	F4

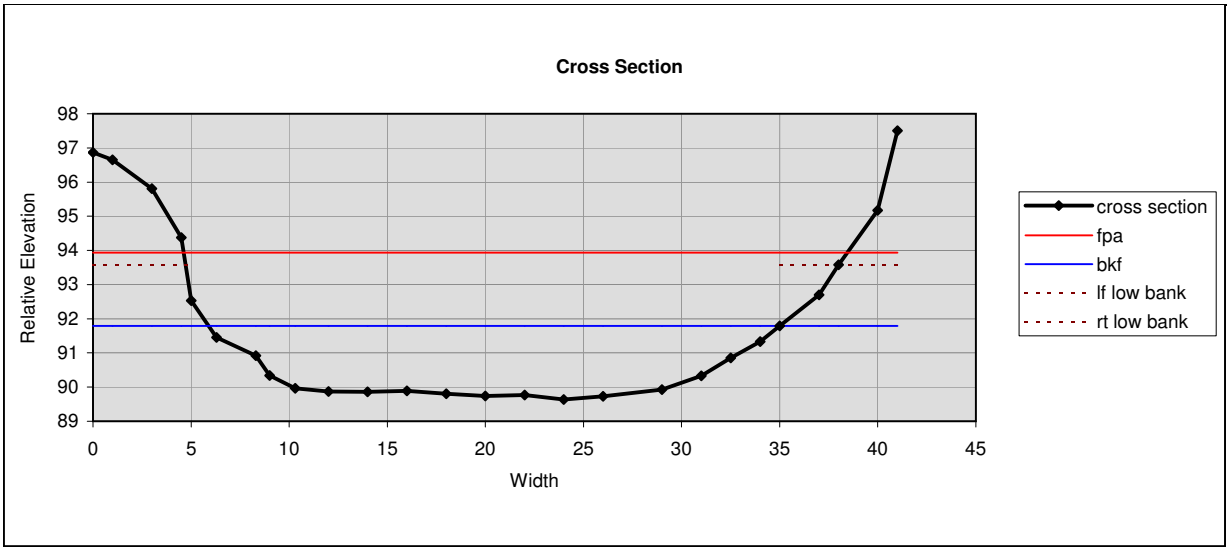
04PB_2_02A_2008



Size (mm)	
D16	0.35
D35	1.9
D50	12
D65	21
D84	42
D95	190

Size Distribution	
mean	3.8
dispersion	18.9
skewness	-0.3

Type	
silt/clay	2%
sand	32%
gravel	51%
cobble	7%
boulder	4%
bedrock	0%



Bankfull Dimensions	
47.7	x-section area (ft.sq.)
29.1	width (ft)
1.6	mean depth (ft)
2.1	max depth (ft)
29.9	wetted perimeter (ft)
1.6	hydraulic radius (ft)
17.8	width-depth ratio

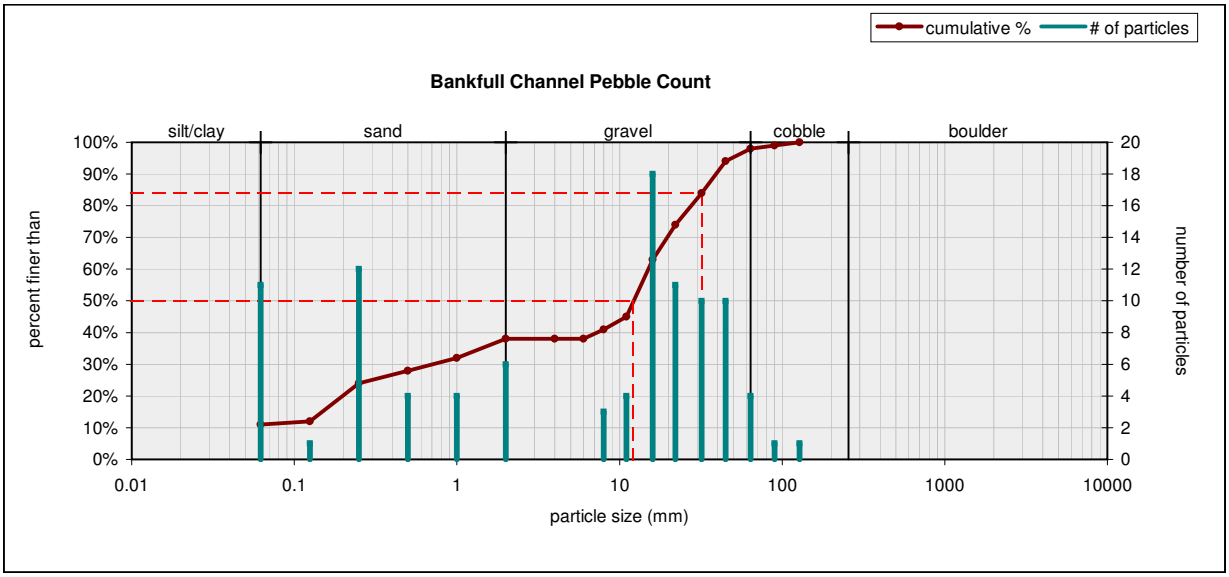
Flood Dimensions	
33.8	Width flood prone area (ft)
1.2	entrenchment ratio
3.9	low bank height (ft)
1.8	low bank height ratio

Flow Resistance	
0.031	Manning's roughness

Bankfull Flow	
5.7	velocity (ft/s)
270.0	discharge rate (cfs)
0.73	channel slope (%)

Sinuosity	Channel Type
1.23	F4

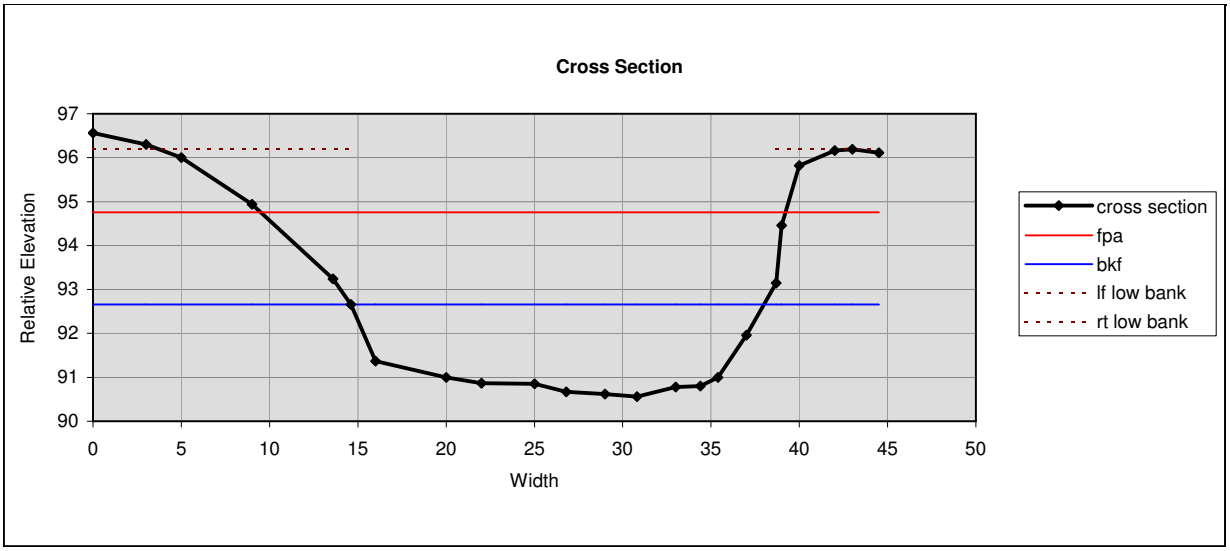
04PB_2_03_2008



Size (mm)	
D16	0.16
D35	1.4
D50	12
D65	17
D84	32
D95	49

Size Distribution	
mean	2.3
dispersion	38.8
skewness	-0.5

Type	
silt/clay	11%
sand	27%
gravel	60%
cobble	2%
boulder	0%
bedrock	0%



Bankfull Dimensions	
38.2	x-section area (ft.sq.)
23.4	width (ft)
1.6	mean depth (ft)
2.1	max depth (ft)
24.5	wetted perimeter (ft)
1.6	hydraulic radius (ft)
14.3	width-depth ratio

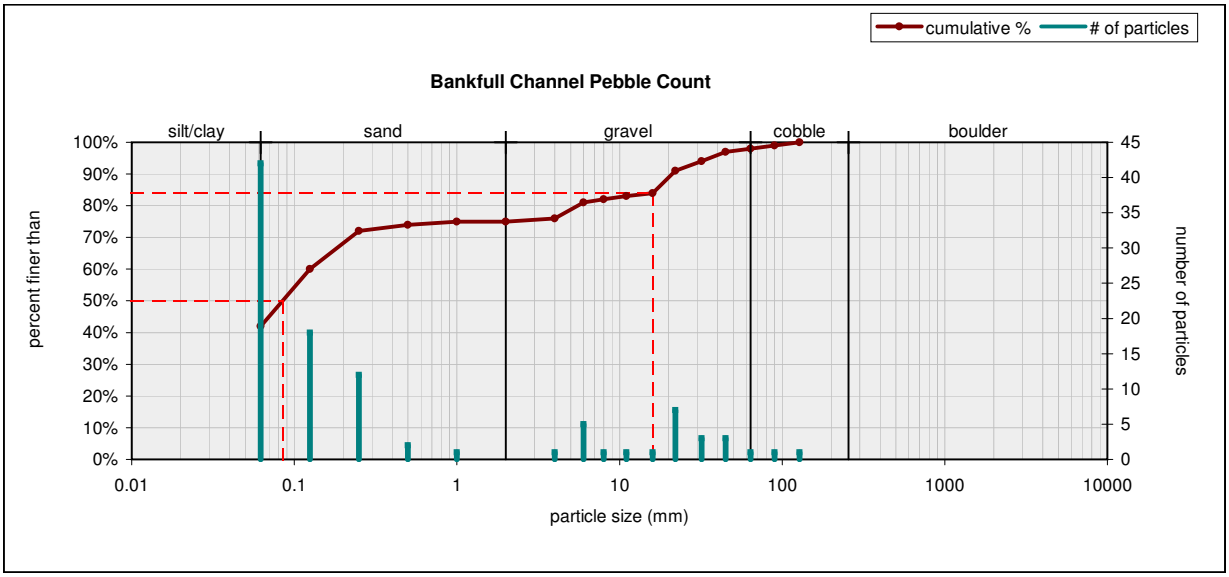
Flood Dimensions	
29.7	Width flood prone area (ft)
1.3	entrenchment ratio
5.6	low bank height (ft)
2.7	low bank height ratio

Flow Resistance	
0.029	Manning's roughness

Bankfull Flow	
4.6	velocity (ft/s)
177.3	discharge rate (cfs)
0.44	channel slope (%)

Sinuosity	Channel Type
1.04	F4

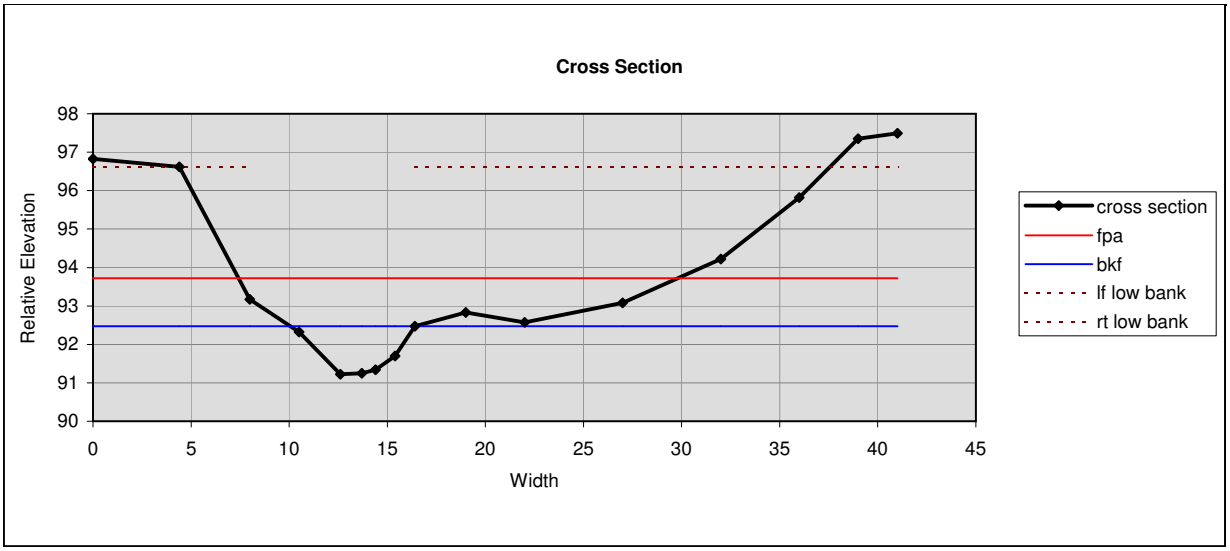
10PT_1_01_2008



Size (mm)	
D16	0.062
D35	0.062
D50	0.085
D65	0.17
D84	16
D95	36

Size Distribution	
mean	1.0
dispersion	94.8
skewness	0.7

Type	
silt/clay	42%
sand	33%
gravel	23%
cobble	2%
boulder	0%
bedrock	0%



Bankfull Dimensions	
5.0	x-section area (ft.sq.)
6.3	width (ft)
0.8	mean depth (ft)
1.3	max depth (ft)
7.0	wetted perimeter (ft)
0.7	hydraulic radius (ft)
8.0	width-depth ratio

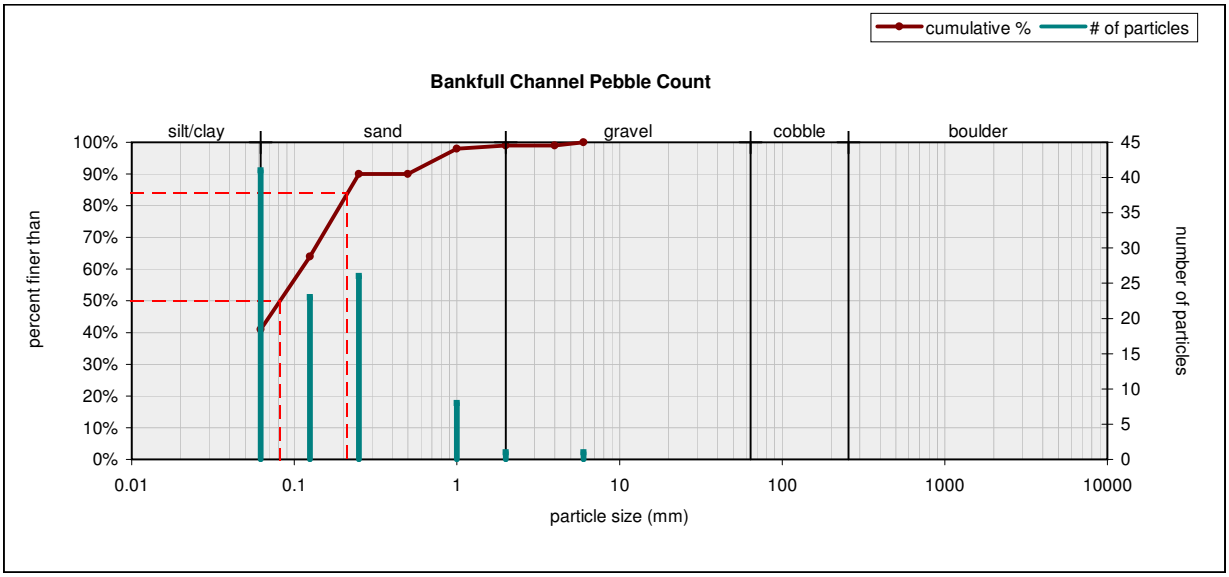
Flood Dimensions	
22.5	Width flood prone area (ft)
3.5	entrenchment ratio
5.4	low bank height (ft)
4.3	low bank height ratio

Flow Resistance	
0.025	Manning's roughness

Bankfull Flow	
8.6	velocity (ft/s)
43.3	discharge rate (cfs)
1.3	channel slope (%)

Sinuosity	Channel Type
1.05	E5

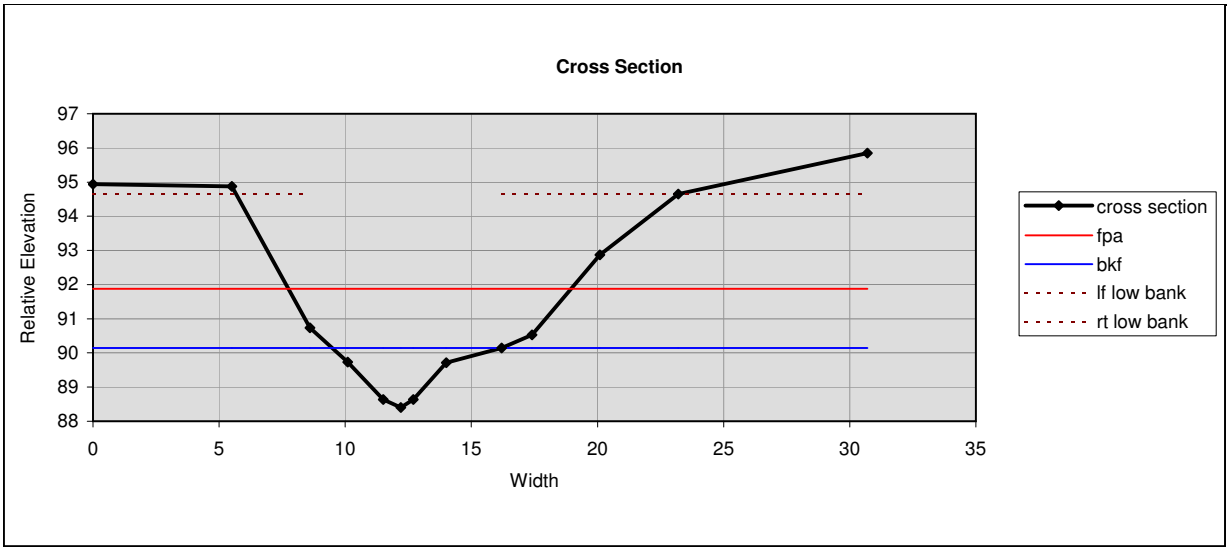
10PT_1_02_2008



Size (mm)	
D16	0.062
D35	0.062
D50	0.082
D65	0.13
D84	0.21
D95	0.77

Size Distribution	
mean	0.1
dispersion	1.9
skewness	0.2

Type	
silt/clay	41%
sand	58%
gravel	1%
cobble	0%
boulder	0%
bedrock	0%



Bankfull Dimensions	
5.1	x-section area (ft.sq.)
6.7	width (ft)
0.8	mean depth (ft)
1.7	max depth (ft)
7.7	wetted perimeter (ft)
0.7	hydraulic radius (ft)
8.8	width-depth ratio

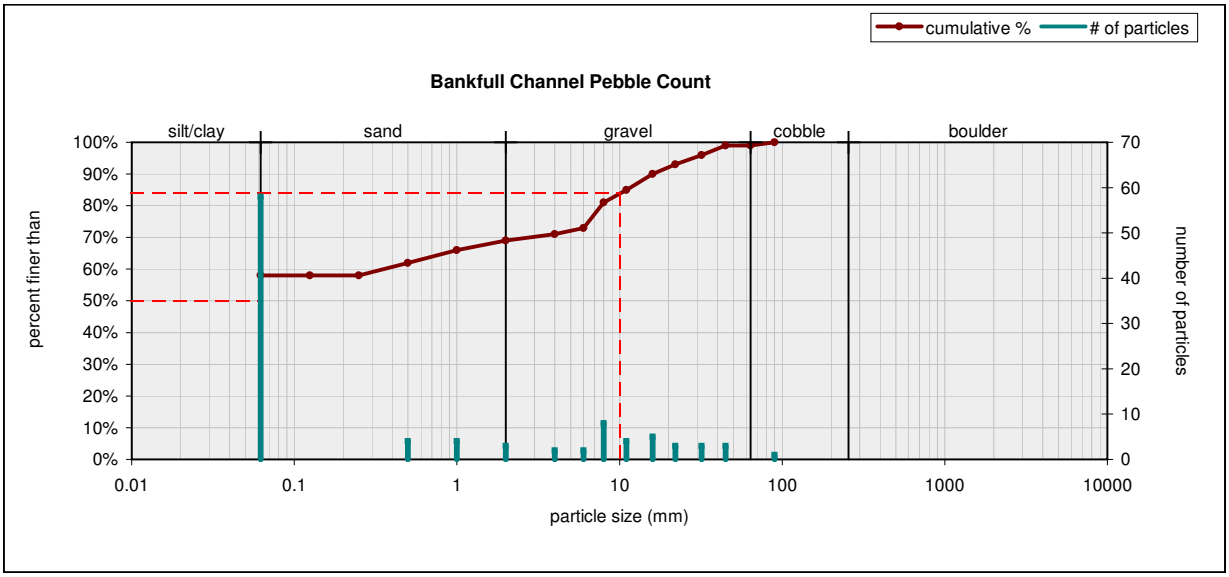
Flood Dimensions	
11.2	Width flood prone area (ft)
1.7	entrenchment ratio
6.3	low bank height (ft)
3.6	low bank height ratio

Flow Resistance	
0.012	Manning's roughness

Bankfull Flow	
14.3	velocity (ft/s)
73.3	discharge rate (cfs)
2.2	channel slope (%)

Sinuosity	Channel Type
1.18	B5

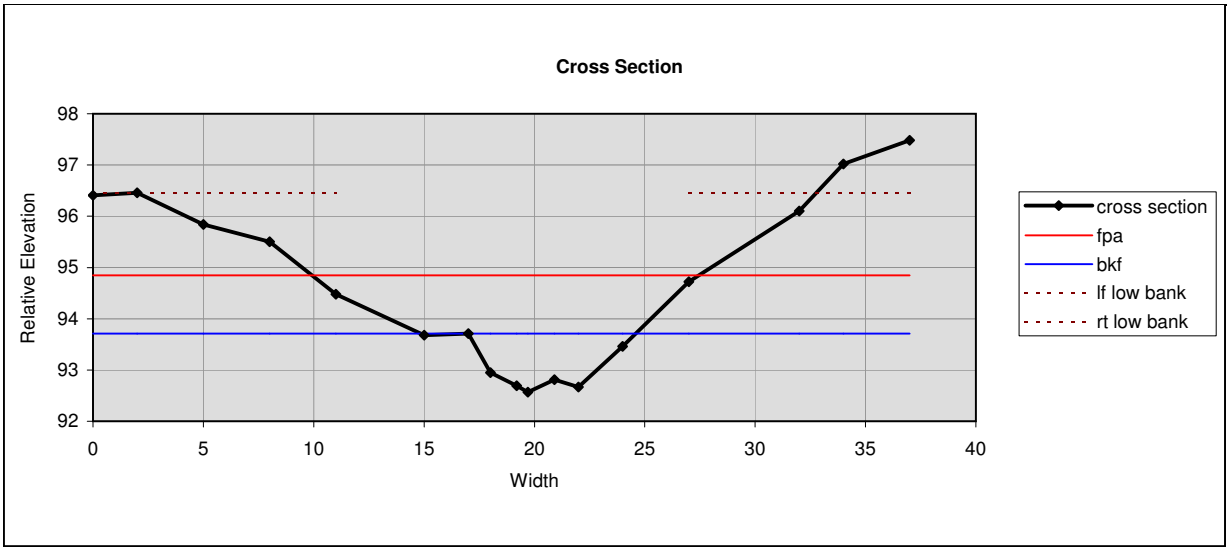
10PT_1_03_2008



Size (mm)	
D16	0.062
D35	0.062
D50	0.062
D65	0.84
D84	10
D95	28

Size Distribution	
mean	0.8
dispersion	81.1
skewness	0.7

Type	
silt/clay	58%
sand	11%
gravel	30%
cobble	1%
boulder	0%
bedrock	0%



Bankfull Dimensions	
5.7	x-section area (ft.sq.)
9.7	width (ft)
0.6	mean depth (ft)
1.1	max depth (ft)
10.3	wetted perimeter (ft)
0.6	hydraulic radius (ft)
16.7	width-depth ratio

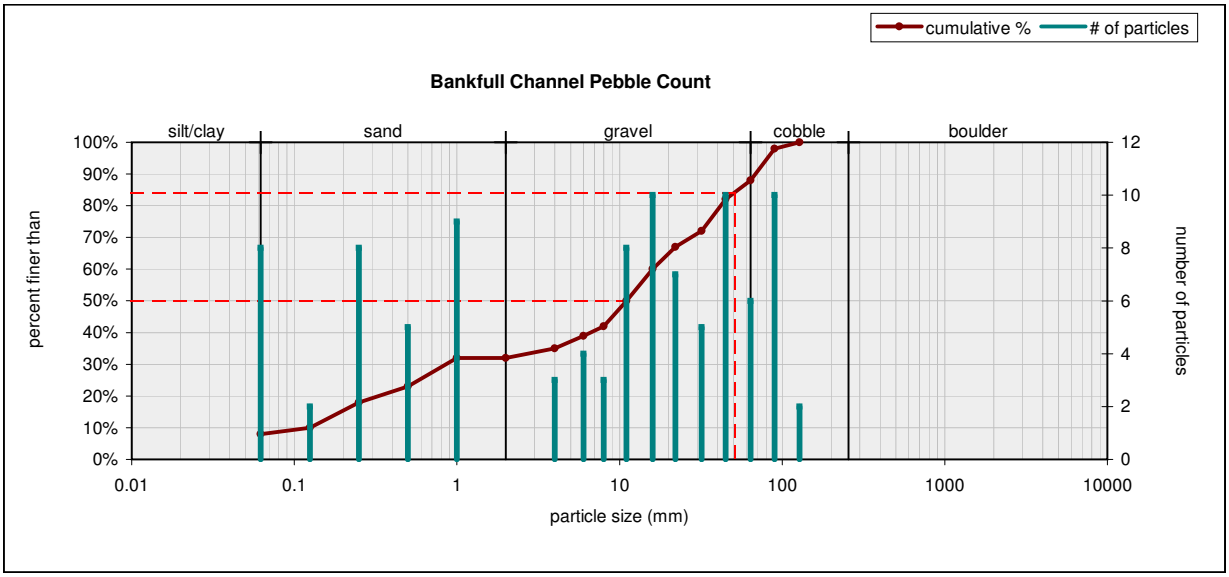
Flood Dimensions	
17.6	Width flood prone area (ft)
1.8	entrenchment ratio
3.9	low bank height (ft)
3.4	low bank height ratio

Flow Resistance	
0.023	Manning's roughness

Bankfull Flow	
5.8	velocity (ft/s)
32.8	discharge rate (cfs)
1.7	channel slope (%)

Sinuosity	Channel Type
1.15	B5c

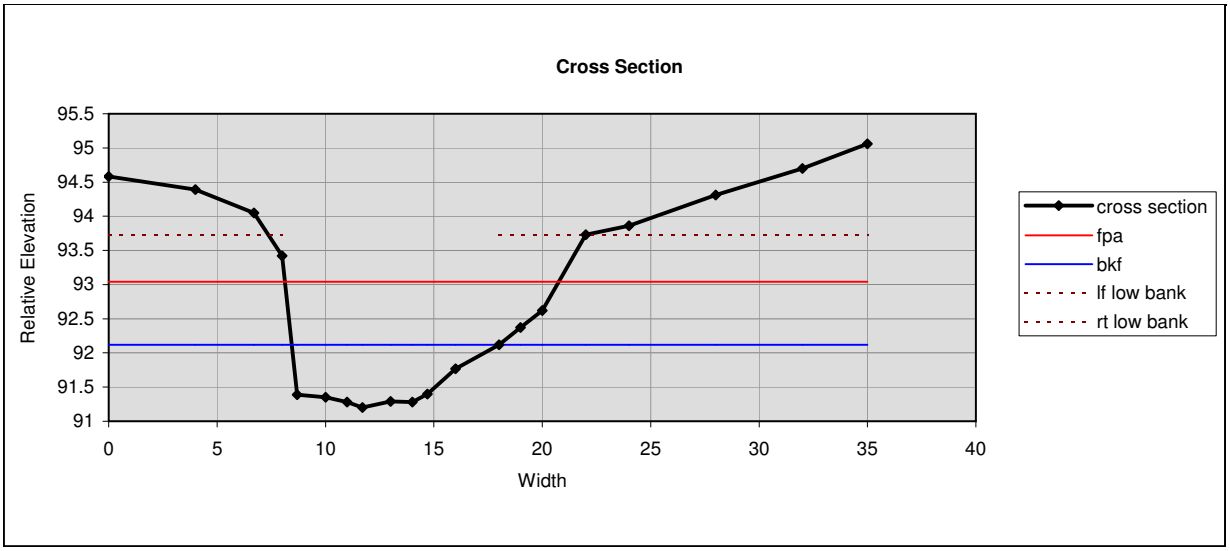
10PT_1_04_2008



Size (mm)	
D16	0.21
D35	4
D50	11
D65	20
D84	51
D95	81

Size Distribution	
mean	3.3
dispersion	28.5
skewness	-0.3

Type	
silt/clay	8%
sand	24%
gravel	56%
cobble	12%
boulder	0%
bedrock	0%



Bankfull Dimensions	
6.1	x-section area (ft.sq.)
9.6	width (ft)
0.6	mean depth (ft)
0.9	max depth (ft)
10.2	wetted perimeter (ft)
0.6	hydraulic radius (ft)
15.1	width-depth ratio

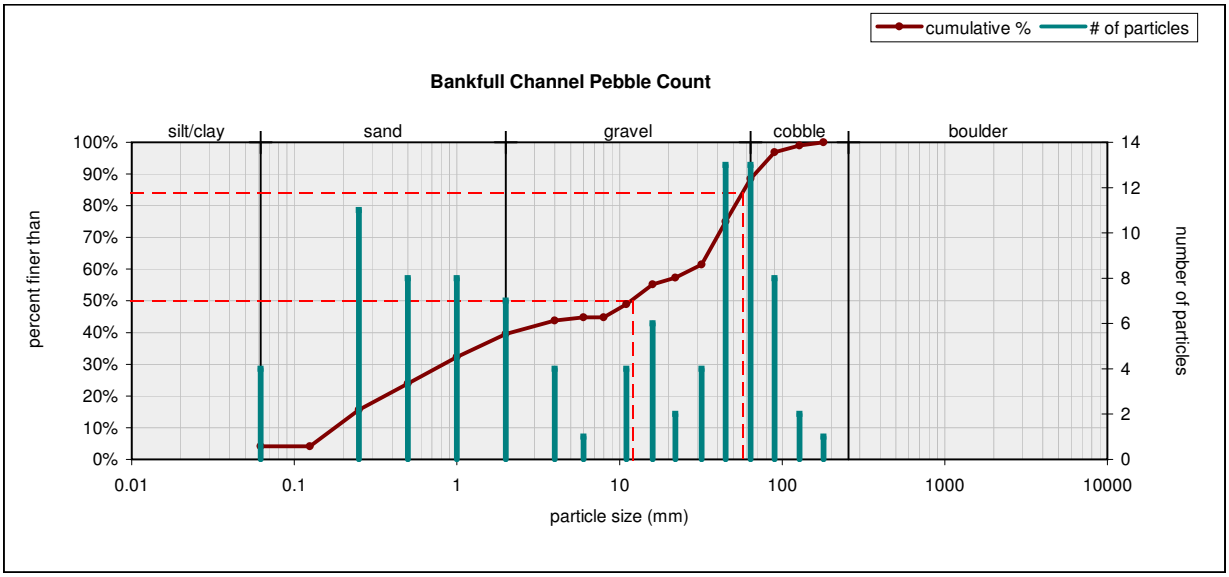
Flood Dimensions	
12.6	Width flood prone area (ft)
1.3	entrenchment ratio
2.5	low bank height (ft)
2.8	low bank height ratio

Flow Resistance	
0.038	Manning's roughness

Bankfull Flow	
4.2	velocity (ft/s)
25.1	discharge rate (cfs)
2.2	channel slope (%)

Sinuosity	Channel Type
1.14	F4b

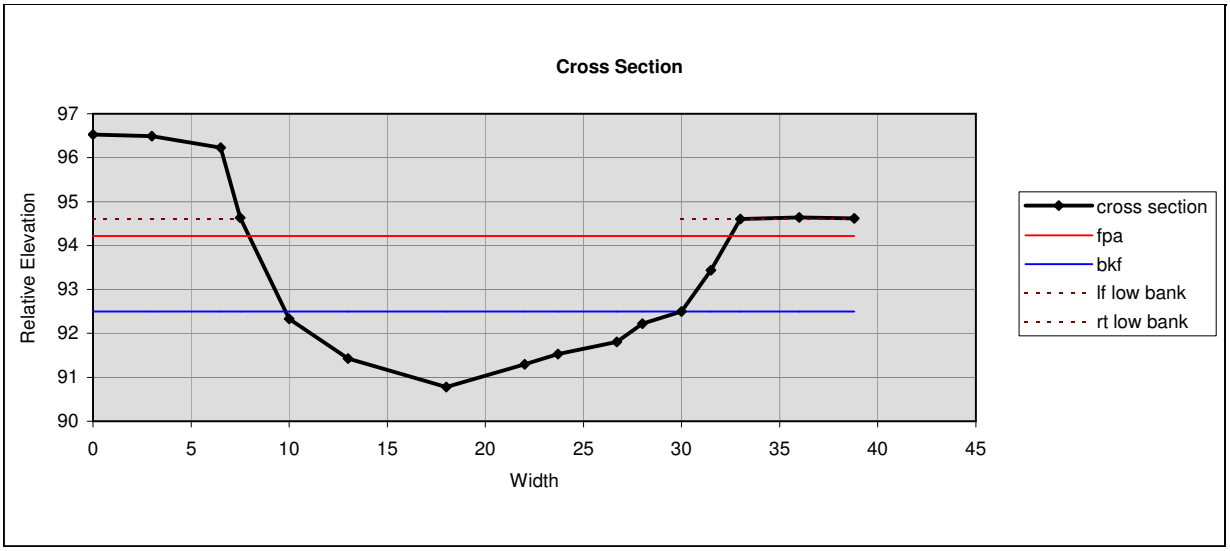
10PT_1_05A_2008



Size (mm)	
D16	0.26
D35	1.3
D50	12
D65	35
D84	57
D95	83

Size Distribution	
mean	3.8
dispersion	25.5
skewness	-0.3

Type	
silt/clay	4%
sand	34%
gravel	47%
cobble	11%
boulder	0%
bedrock	0%



Bankfull Dimensions	
19.9	x-section area (ft.sq.)
20.2	width (ft)
1.0	mean depth (ft)
1.7	max depth (ft)
20.6	wetted perimeter (ft)
1.0	hydraulic radius (ft)
20.4	width-depth ratio

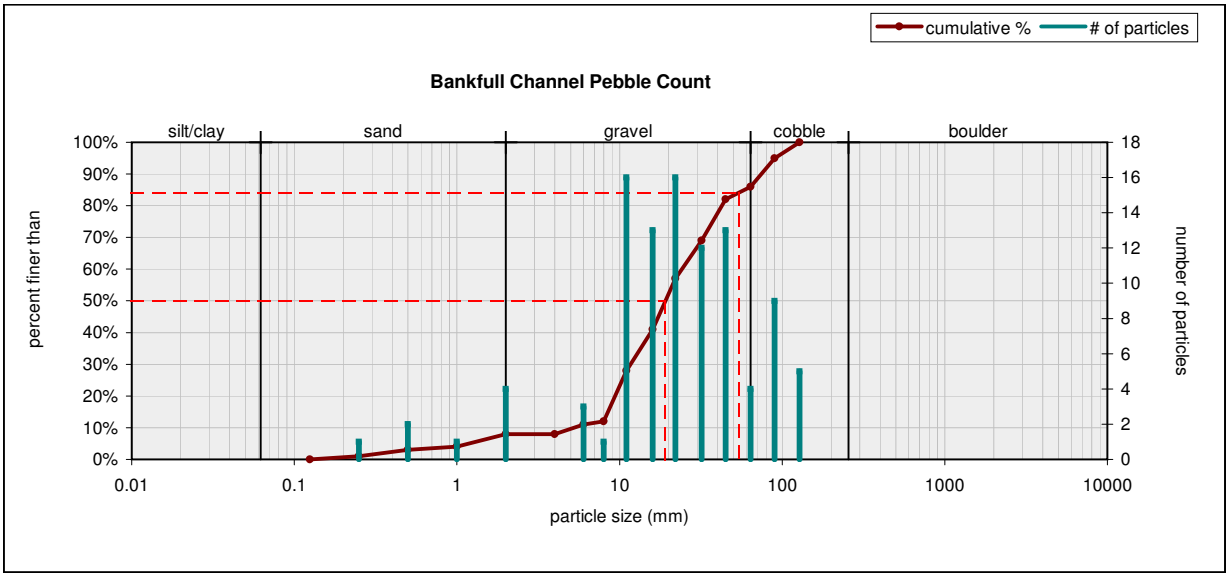
Flood Dimensions	
24.6	Width flood prone area (ft)
1.2	entrenchment ratio
3.8	low bank height (ft)
2.2	low bank height ratio

Flow Resistance	
0.035	Manning's roughness

Bankfull Flow	
3.8	velocity (ft/s)
75.0	discharge rate (cfs)
0.82	channel slope (%)

Sinuosity	Channel Type
1.13	F4

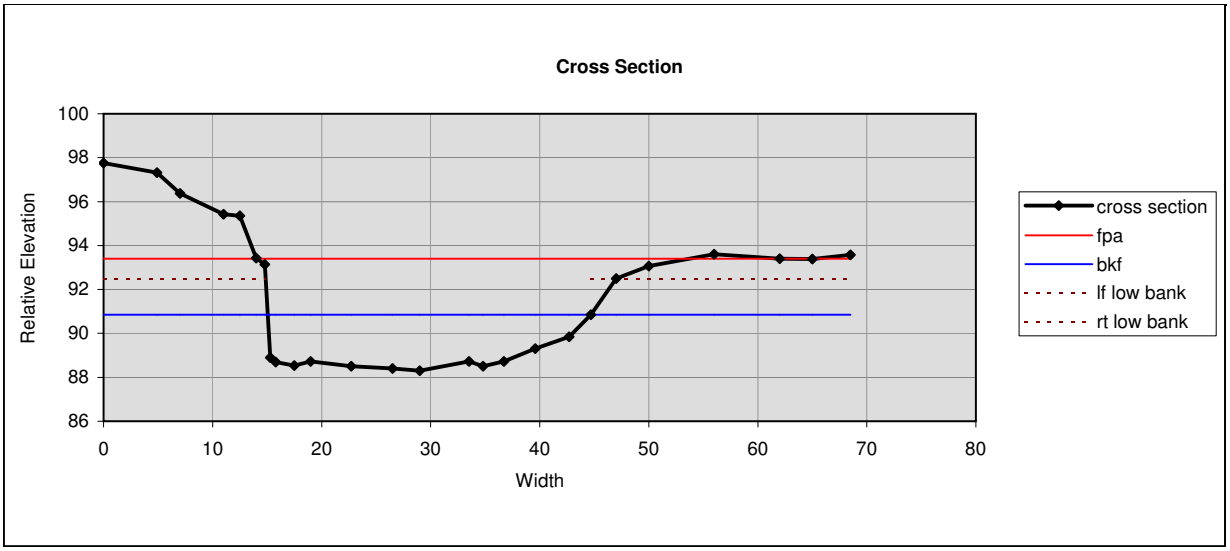
10PT_2_01_2008



Size (mm)	
D16	8.7
D35	13
D50	19
D65	28
D84	54
D95	90

Size Distribution	
mean	21.7
dispersion	2.5
skewness	0.1

Type	
silt/clay	0%
sand	8%
gravel	78%
cobble	14%
boulder	0%
bedrock	0%



Bankfull Dimensions	
60.0	x-section area (ft.sq.)
29.6	width (ft)
2.0	mean depth (ft)
2.6	max depth (ft)
31.8	wetted perimeter (ft)
1.9	hydraulic radius (ft)
14.6	width-depth ratio

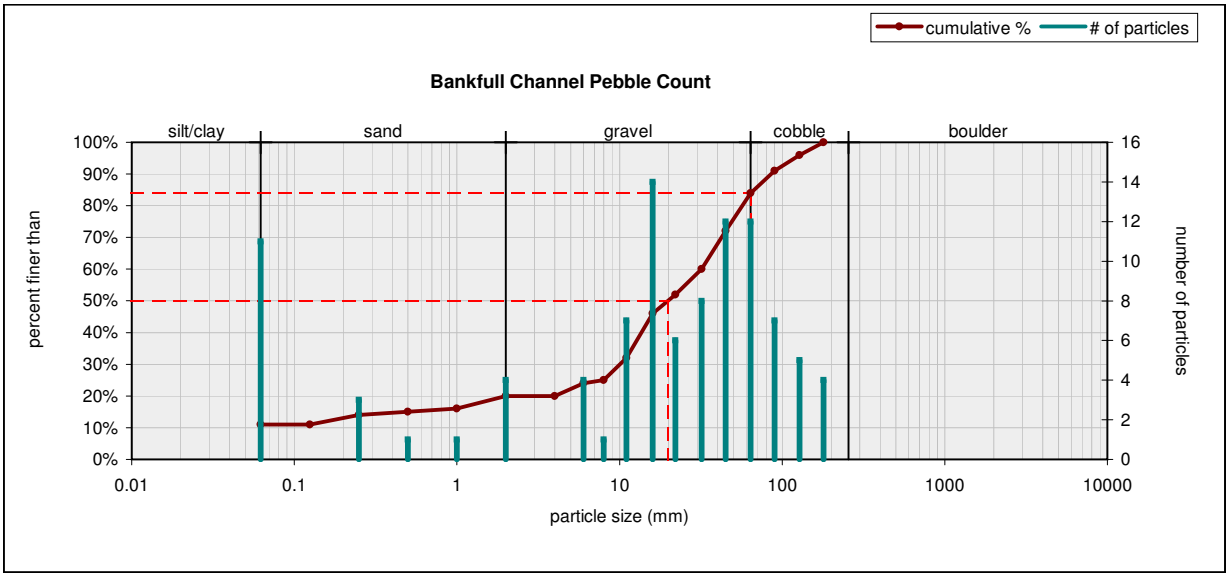
Flood Dimensions	
42.8	Width flood prone area (ft)
1.4	entrenchment ratio
4.2	low bank height (ft)
1.6	low bank height ratio

Flow Resistance	
0.032	Manning's roughness

Bankfull Flow	
4.8	velocity (ft/s)
289.3	discharge rate (cfs)
0.47	channel slope (%)

Sinuosity	Channel Type
1.12	F4

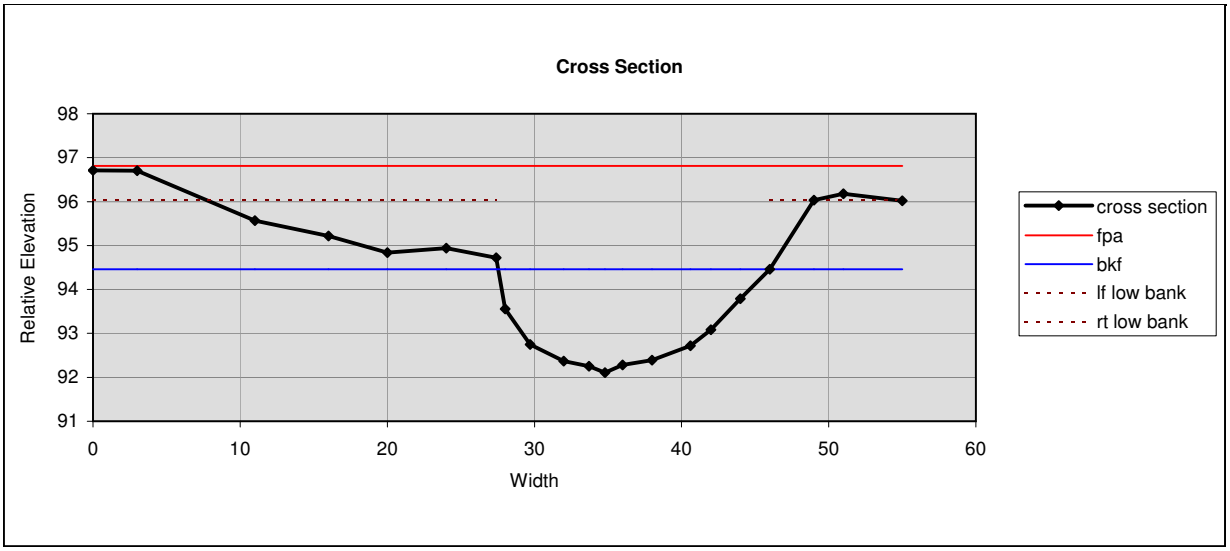
10PT_2_02_2008



Size (mm)	
D16	1
D35	12
D50	20
D65	37
D84	64
D95	120

Size Distribution	
mean	8.0
dispersion	11.6
skewness	-0.3

Type	
silt/clay	11%
sand	9%
gravel	64%
cobble	16%
boulder	0%
bedrock	0%



Bankfull Dimensions	
29.8	x-section area (ft.sq.)
18.5	width (ft)
1.6	mean depth (ft)
2.3	max depth (ft)
19.6	wetted perimeter (ft)
1.5	hydraulic radius (ft)
11.4	width-depth ratio

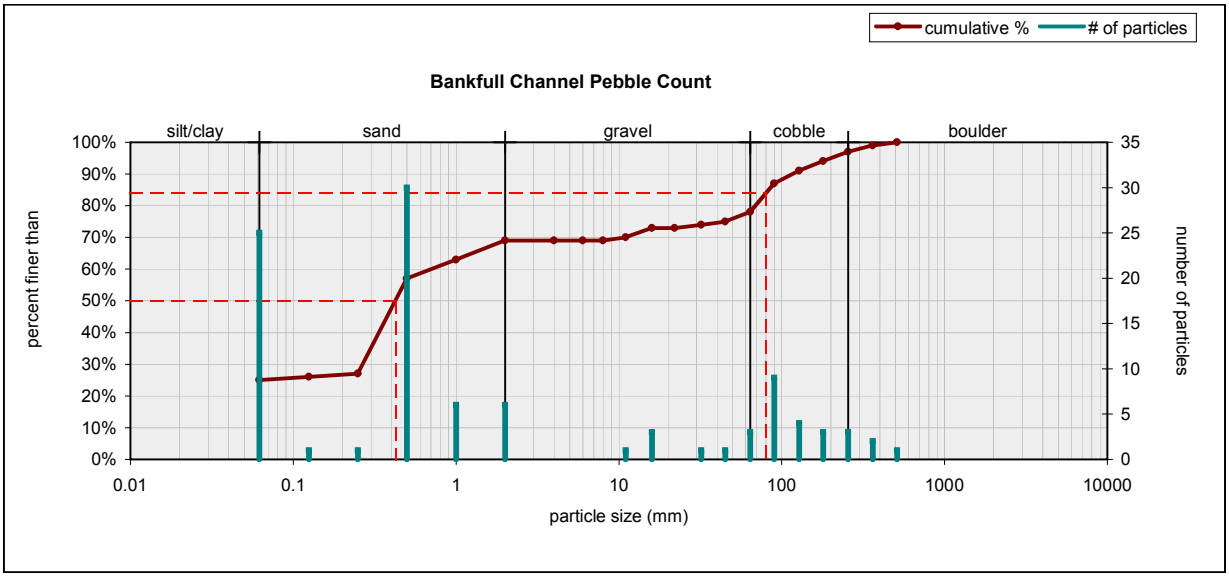
Flood Dimensions	
150.0	Width flood prone area (ft)
8.1	entrenchment ratio
3.9	low bank height (ft)
1.7	low bank height ratio

Flow Resistance	
0.034	Manning's roughness

Bankfull Flow	
3.5	velocity (ft/s)
105.1	discharge rate (cfs)
0.38	channel slope (%)

Sinuosity	Channel Type
1.11	C4

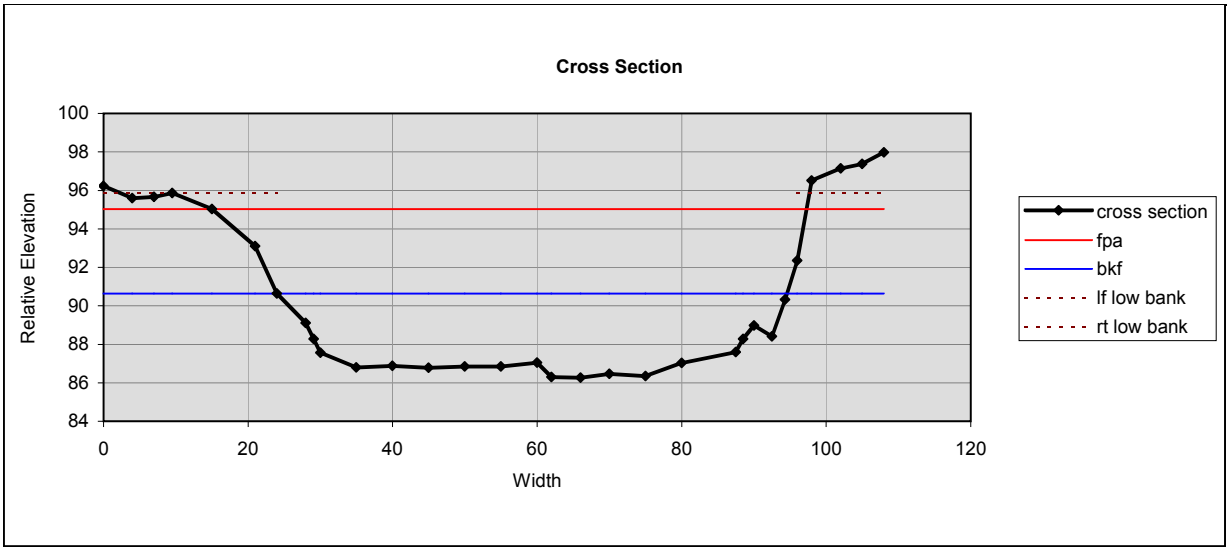
10PT_4_01_2008



Size (mm)	
D16	0.062
D35	0.3
D50	0.43
D65	1.3
D84	80
D95	200

Size Distribution	
mean	2.2
dispersion	96.5
skewness	0.4

Type	
silt/clay	25%
sand	44%
gravel	9%
cobble	19%
boulder	3%
bedrock	0%



Bankfull Dimensions	
241.0	x-section area (ft.sq.)
70.6	width (ft)
3.4	mean depth (ft)
4.4	max depth (ft)
73.1	wetted perimeter (ft)
3.3	hydraulic radius (ft)
20.7	width-depth ratio

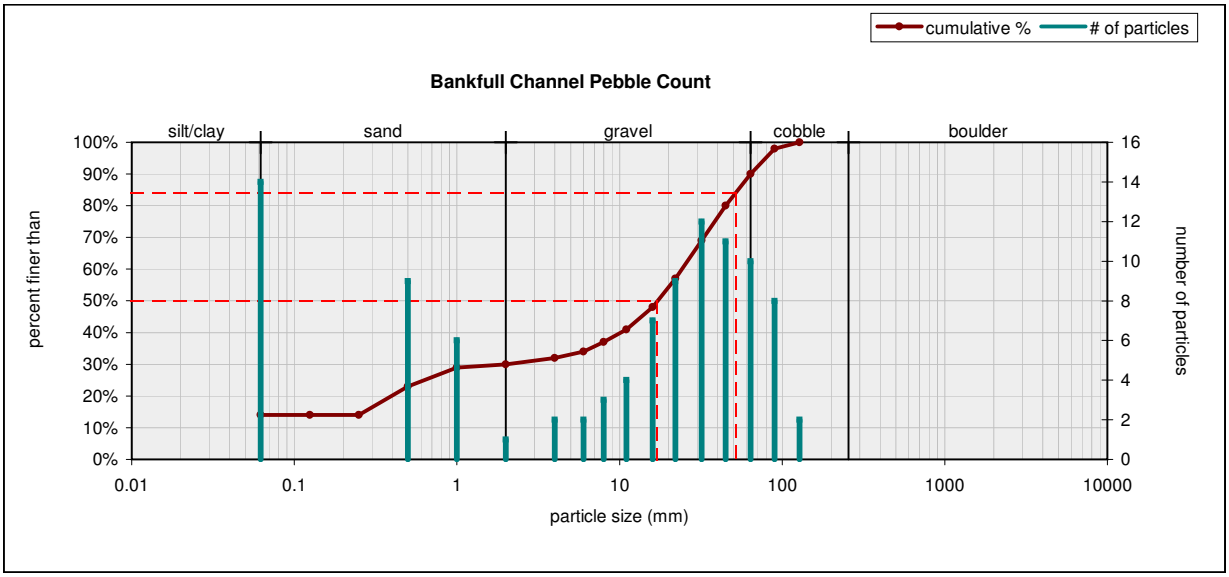
Flood Dimensions	
82.3	Width flood prone area (ft)
1.2	entrenchment ratio
9.6	low bank height (ft)
2.2	low bank height ratio

Flow Resistance	
0.034	Manning's roughness

Bankfull Flow	
1.9	velocity (ft/s)
450.1	discharge rate (cfs)
0.037	channel slope (%)

Sinuosity	Channel Type
1.07	F5

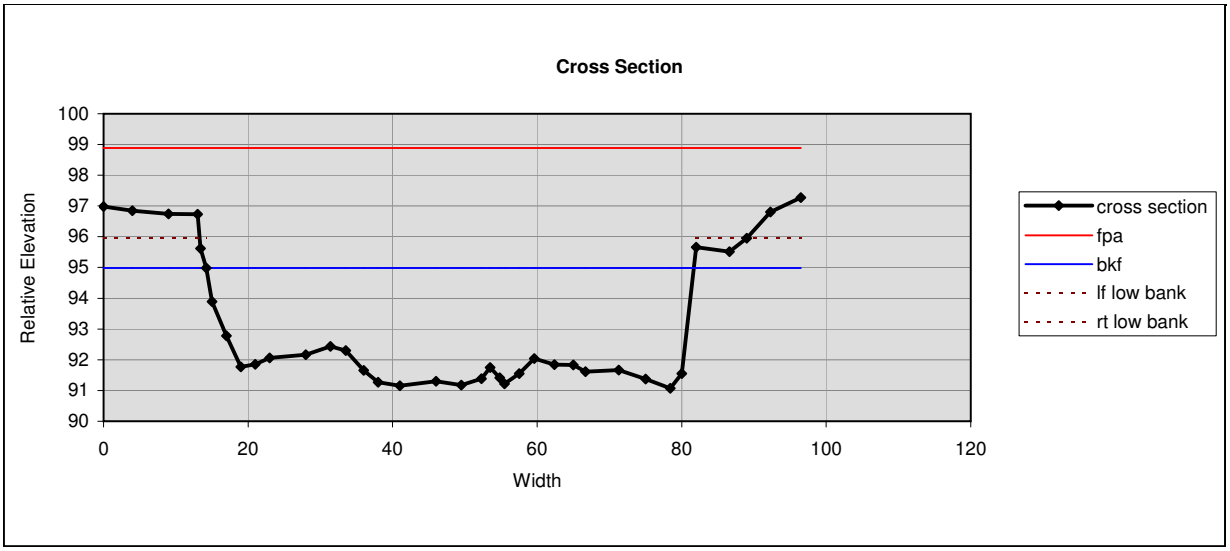
10PT_4_02_2008



Size (mm)	
D16	0.29
D35	6.6
D50	17
D65	28
D84	52
D95	79

Size Distribution	
mean	3.9
dispersion	30.8
skewness	-0.4

Type	
silt/clay	14%
sand	16%
gravel	60%
cobble	10%
boulder	0%
bedrock	0%



Bankfull Dimensions	
215.5	x-section area (ft.sq.)
67.5	width (ft)
3.2	mean depth (ft)
3.9	max depth (ft)
71.2	wetted perimeter (ft)
3.0	hydraulic radius (ft)
21.1	width-depth ratio

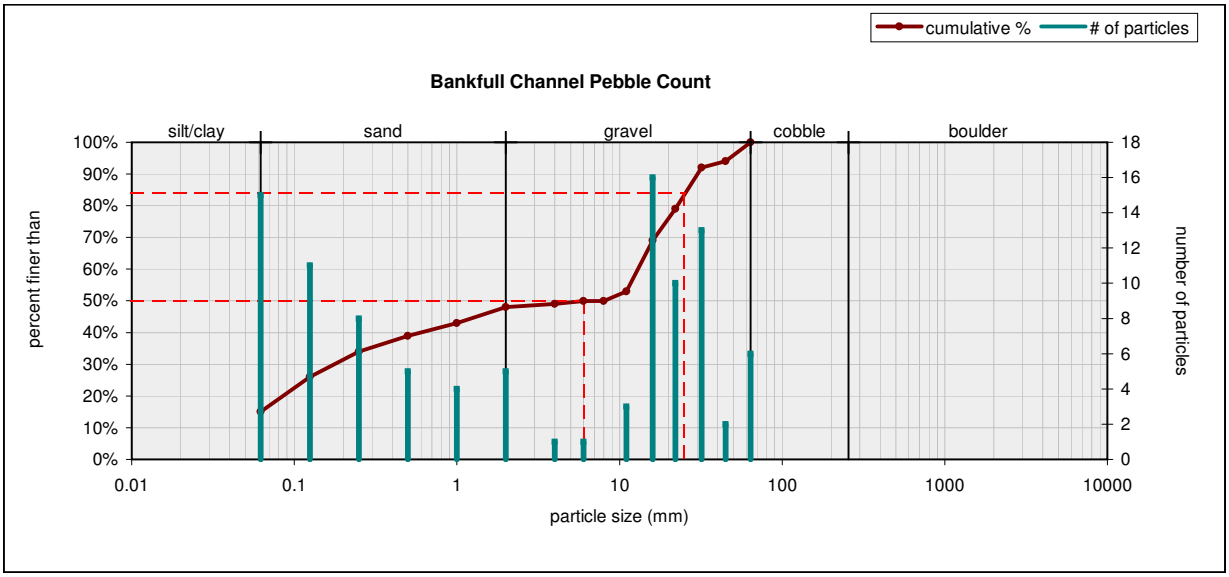
Flood Dimensions	
800.0	Width flood prone area (ft)
11.9	entrenchment ratio
4.9	low bank height (ft)
1.2	low bank height ratio

Flow Resistance	
0.031	Manning's roughness

Bankfull Flow	
15.4	velocity (ft/s)
3309.1	discharge rate (cfs)
2.3	channel slope (%)

Sinuosity	Channel Type
1.03	C4b

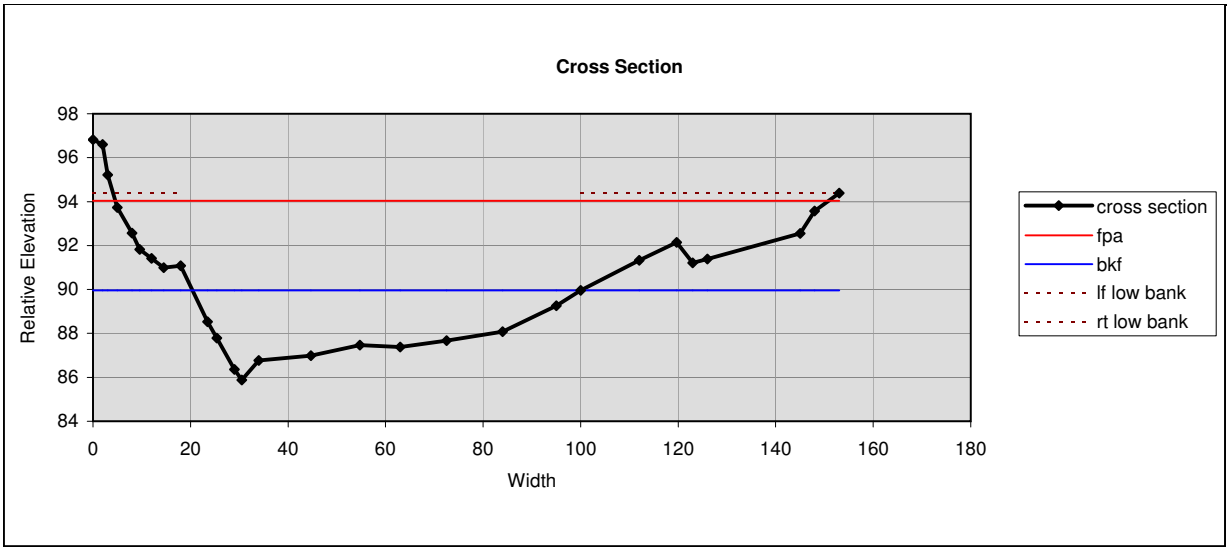
10PT_4_03_2008



Size (mm)	
D16	0.066
D35	0.29
D50	6
D65	15
D84	25
D95	48

Size Distribution	
mean	1.3
dispersion	47.5
skewness	-0.4

Type	
silt/clay	15%
sand	33%
gravel	52%
cobble	0%
boulder	0%
bedrock	0%



Bankfull Dimensions	
178.8	x-section area (ft.sq.)
79.6	width (ft)
2.2	mean depth (ft)
4.1	max depth (ft)
80.6	wetted perimeter (ft)
2.2	hydraulic radius (ft)
35.4	width-depth ratio

Flood Dimensions	
146.3	Width flood prone area (ft)
1.8	entrenchment ratio
8.5	low bank height (ft)
2.1	low bank height ratio

Flow Resistance	
0.026	Manning's roughness

Bankfull Flow	
5.4	velocity (ft/s)
959.3	discharge rate (cfs)
0.3	channel slope (%)

Sinuosity	Channel Type
1.09	B4c

Appendix F: Quality Assurance/Quality Control

The biological monitoring program for the Patapsoc River watersheds 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 Patapsoc River watersheds 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 members 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 using 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 2008 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 01PA-1-04, 04PB-1-05 and 10PT-2-01. 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
01PA-1-04	94.7	10.7
04PB-1-05	583.7	18.0
10PT-2-01	2317.1	28.6

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. Thus, the accuracy requirement of ± 25 meters was met. 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. One sample pair (01PA-1-04

and 01PA-1-04QC) had a water quality measurement that exceeded the MQO of ≤20% for water temperature. The calculated RPD for this sample pair was 34.86, just above the stated MQO. However, given that the temperature at site 01PA-1-04QC was measured approximately two hours later, on clear and sunny day, it is likely that the water simply warmed up during this time and this is not indicative of poor precision. 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)
01PA-1-04-2008	13.12	8.67	3.34	151	1.14	233
01PA-1-04-2008QC	12.26	8.31	4.75	156	0.78	240
Absolute Difference	0.86	0.36	1.41	5.00	0.36	7.00
RPD	6.78	4.24	**34.86**	3.26	37.50	2.96
SD	0.61	0.25	1.00	3.54	0.25	4.95
04PB-1-05-2008	10.79	7.58	9.43	287	0.9	441
04PB-1-05-2008QC	11.2	7.67	10.26	295	1.7	453
Absolute Difference	0.41	0.09	0.83	8.00	0.80	12.00
RPD	3.73	1.18	8.43	2.75	61.54	2.68
SD	0.29	0.06	0.59	5.66	0.57	8.49
10-PT-2-01-2008	14.1	7.98	4.95	273	1.5	421
10-PT-2-01-2008QC	14.81	8.26	5.59	274	1.5	421
Absolute Difference	0.71	0.28	0.64	1.00	0.00	0.00
RPD	4.91	3.45	12.14	0.37	0.00	0.00
SD	0.50	0.20	0.45	0.71	0.00	0.00
Median RPD	4.91	3.45	12.14	2.75	37.50	2.68

Habitat Assessment

The following table provides the result of the MQO analysis for the habitat assessment. The RPD was <10 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
01PA-1-04-2008	156	78	Supporting
01PA-1-04-2008QC	150	75	Partially Supporting
Absolute Difference	6.00	3.00	
RPD	3.92	3.92	
SD	4.24	2.12	
04PB-1-05-2008	116	58	Non-supporting
04PB-1-05-2008QC	127	63.5	Partially Supporting
Absolute Difference	11.00	5.50	
RPD	9.05	9.05	
SD	7.78	3.89	
10-PT-2-01-2008	116	58	Non-supporting
10-PT-2-01-2008QC	122	61	Partially Supporting
Absolute Difference	6.00	3.00	
RPD	5.04	5.04	
SD	4.24	2.12	
Median RPD	5.04	5.04	

Biological Assessment

The following three tables include the results of the QC analysis for the biological metrics and BIBI scores. A few metric scores fell outside the acceptable range for precision (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
01PA-1-04	4.3	5	5	5	5	3	3
01PA-1-04QC	3.3	3	3	3	5	3	3
RPD	**26.11**	**50.00**	**50.00**	**50.00**	0.00	0.00	0.00
04PB-1-05	1.7	3	1	3	1	1	1
04PB-1-05QC	1.3	3	1	1	1	1	1
RPD	**22.67**	0.00	0.00	**100.00**	0.00	0.00	0.00
10PT-2-01	2.7	5	3	1	1	3	3
10PT-2-01QC	2.7	5	3	3	3	1	1
RPD	0.00	0.00	0.00	**100.00**	**100.00**	**100.00**	**100.00**
Median RPD	**22.7**	0.0	0.0	**100.0**	0.0	0.0	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, an 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 Ephemeroptera Taxa score RPD for all sample pairs 01PA-1-04 and 04PB-1-05 do not meet the MQO despite only minor differences in metric values. For instance, there was only one additional Ephemeroptera Taxa found at site 01PA-1-04 and also at site 04PB-1-05, which resulted in a two point difference in metric scores. Similarly, only two additional Ephemeroptera taxa were found at site 10PT-2-01QC, also resulting in a two point difference in metric scores, which together exceeded the RPD and also affected the overall BIBI scores. This one additional taxon resulted in sample pair 04PB-1-05 having a RPD of 22.67, which otherwise would have scored the same.

Due to the overall BIBI score consisting of scaled incremental metrics, the RPD does not reflect the precision well. BIBI scores for sample pair 10PT-2-01 were identical, resulting in an RPD of zero, however the median RPD was much higher, due in large part to minor differences in a few metric values. 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
01PA-1-04	27	11	4	61.9	20.4	46.9
01PA-1-04QC	19	7	3	78.7	11.1	50
04PB-1-05	18	4	2	2.8	84.3	12
04PB-1-05QC	21	4	1	2.6	78.9	19.3
10PT-2-01	24	6	0	2.5	53.3	42.5
10PT-2-01QC	24	8	2	12.6	63.1	27.9
CV	15.5	39.9	70.7	127.7	58.3	47.3
CI	5.6	4.4	2.3	56.2	49.5	25.7
mRPD	15.4	28.6	66.7	23.9	16.8	41.5

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

	Total Taxa	EPT Taxa	Ephem Taxa	Percent Intolerant Urban	Percent Chiro-nomidae	Percent Clingers	BIBI
01PA-1-04	5	5	5	5	3	3	4.3
01PA-1-04QC	3	3	3	5	3	3	3.3
04PB-1-05	3	1	3	1	1	1	1.7
04PB-1-05QC	3	1	1	1	1	1	1.3
10PT-2-01	5	3	1	1	3	3	2.7
10PT-2-01QC	5	3	3	3	1	1	2.7
CV	27.4	56.5	56.5	73.7	54.8	54.8	41.0
CI	1.8	2.5	2.5	3.2	1.8	1.8	1.8
mRPD	0.0	0.0	**100.0**	0.0	0.0	0.0	**22.7**

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, 12 samples were checked in total. Of those 23 samples, the three lab technicians achieved an overall internal sorting efficiency of 77.4 percent. Any organisms recovered during the QC checks were added back to the subsample to be identified.

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
01PA-1-03-2008	165	44	209	78.9
01PA-1-04-2008	136	45	181	75.1
01PA-1-04-2008QC	180	24	204	88.2
01PA-3-01-2008	163	39	202	80.7
10PT-1-01-2008	138	89	227	60.8
10PT-1-02-2008	123	115	238	51.7
10PT-1-03-2008	125	20	145	86.2
10PT-1-04-2008	124	72	196	63.3
10PT-1-05A-2008	143	25	168	85.1
10PT-2-01-2008	120	17	137	87.6
10PT-2-01-2008QC	122	45	167	73.1
10PT-2-02-2008	165	4	169	97.6

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.

KCI Technologies, Inc.
10 North Park Drive
Hunt Valley, Maryland 21030