Howard County Biological Monitoring and Assessment

Little Patuxent - 2006

Howard County, Maryland

Howard County MARYLAND

KCI Technologies, Inc.
December 2006

KCI TECHNOLOGIES

Howard County Biological Monitoring and Assessment
Little Patuxent River – 2006

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CONTENTS

FIGURES

TABLES

APPENDICES

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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 2006 sampling continued the second round of sampling. The Little Patuxent River Watersheds (Upper, Middle and Lower) were resampled at 30 new sites to fulfill the 2006 sampling requirements. Maryland Department of Natural Resources (DNR) Watershed Restoration Division first sampled these areas in 2001. Stream monitoring was conducted again in 2006 at 10 sites in each of the three PSUs (Upper Little Patuxent, Mid Little Patuxent, and Lower Little Patuxent). The monitoring involved sampling instream water quality, collection and analysis of the biological community (benthic macroinvertebrates) using Maryland Biological Stream Survey (MBSS) methodologies, 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 DNR in 2005 (Southerland et al., 2005). The data collected in the first round of sampling of the Little Patuxent River watershed in 2001 was analyzed using the earlier metrics (Stribling et. al 1998) and as such was not directly comparable to the current sampling data for samples collected in 2006. All data from the 2001 Little Patuxent River sampling was recalculated using the updated metrics to allow for direct comparison to the current data. For this report any mention of 2001 BIBI scores refer to these recalculated values.

Monitoring took place between March 1st and May 1st of 2006. Monitoring sites were marked in the field using tree tags (when possible) at the midpoint of the reach. The positions of the sites were collected using a GPS with sub-meter accuracy.

Biological and physical habitat assessment results in the Little Patuxent watershed indicate streams that are impaired. In 2006 only one of the thirty benthic macroinvertebrate sites sampled received a narrative rating of 'Good' and only four sites received a rating of 'Fair'. The remaining sites all received BIBI ratings of 'Poor' or 'Very Poor'.

Sampling Year	Little Patuxent Subwatershed	Number of sites sampled	Minimum BIBI	Maximum BIBI	Mean BIBI	Narrative Rating	Standard Deviation
2001	Upper	11	1.0	4.0	2.5	Poor	0.888
	Middle	10	1.0	3.0	1.6	Very Poor	0.796
	Lower	9	1.0	2.7	1.6	Very Poor	0.654
	Entire Watershed	30	1.0	4.0	1.9	Very Poor	0.867
2006	Upper	10	1.3	2.7	1.9	Very Poor	0.542
	Middle	10	1.0	4.0	2.5	Poor	1.117
	Lower	10	1.0	3.3	1.9	Very Poor	0.723
	Entire Watershed	30	1.0	4.0	2.1	Poor	0.833

The data collected in 2006 indicate that conditions are similar to those reported in 2001. In 2006, the Lower Little Patuxent PSU had an overall average BIBI of 1.9, with a rating of 'Very Poor'. This represents an increase in the overall score for the Lower Little Patuxent, increasing from a 2001 score of 1.6, with the narrative rating of 'Very Poor'. There was also improvement in the mean score for the Middle Little Patuxent increasing to a 2.5, a 'Poor' rating in 2006 from a score of 1.6, or a 'Very Poor'

rating in 2001. However, the 2006 score is favorably affected by four of the ten sampling sites being located in the least developed portion of the watershed. The Upper Little Patuxent watershed was the only subwatershed for which there was a decrease in the mean BIBI from a 2.5 in 2001 to a 1.9 in 2006 with ratings of 'Poor' and 'Very Poor', respectively. Increases in the Middle and Lower Little Patuxent subwatersheds contributed to an increase in the overall Little Patuxent watershed score and rating from a 1.9, or 'Very Poor' in 2001 to a 2.1 or 'Poor' in 2006. Although the narrative rating has improved from 2001 to 2006, the change in scores is not considered statistically significant.

Sampling Year	Little Patuxent Subwatershed	Number of sites sampled	Minimum RBP	Maximum RBP	Mean RBP	Narrative Rating	Standard Deviation
2001	Upper	11	41	147	108	Non Supporting	28.16
	Middle	10	57	138	94	Non Supporting	26.59
	Lower	9	69	130	93	Non Supporting	21.10
	Entire Watershed	30	41	147	98	Non Supporting	25.82
2006	Upper	10	112	171	148	Partially Supporting	9.77
	Middle	10	103	171	72	Partially Supporting	23.96
	Lower	10	124	178	149	Partially Supporting	18.52
	Entire Watershed	30	103	178	123	Partially Supporting	10.00

Overall, the mean RBP habitat assessment for each subwatershed increased from a 'Non-Supporting' rating to a 'Partially Supporting' rating, resulting in the entire Little Patuxent watershed RPB mean rating also increasing from a 'Non Supporting' to a 'Partially Supporting' stream system.

In the 2006 results, there was a disparity between the habitat ratings and the biological indicators. The 2000 MBSS study also indicated 'Good' mean habitat but only 'Fair' to 'Poor' biological results. The study identified relatively high levels of nitrogen, phosphorus, and chloride, constituents that are not sampled in the County-wide program. However, conductivity was measured at each sampling site in 2006 and this can be used as an indirect measure of chloride.

The Little Patuxent watershed is highly suburbanized with high percentages of residential development and generally high levels of impervious surface. The data from the last 10 years reflect this with an overall degradation of the biological community most likely attributable to moderate disruption in the habitat quality and impacts to water quality.

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). 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. Only the Middle Patuxent PSUs were sampled in 2002. 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.

The 2006 Little Patuxent sampling continued the second round of sampling. The Little Patuxent River Watersheds (Upper, Middle and Lower) were resampled at 30 new sites to fulfill the 2006 sampling requirements. These areas were first sampled by DNR's Watershed Restoration Division in 2001. Assessment methods follow those developed by DNR's 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 2006 are compatible with those used in the first round (2001-2003) with updates where applicable.

Table 1 – Summary of Bioassessment Progress

Year	Number of Sites	Primary Sampling Unit (code and name)
Round One		
1, 2001	60	11 – Upper Little Patuxent 12 – Middle Little Patuxent 13 – Lower Little Patuxent 2 – Upper Brighton Dam 5 – Lower Brighton Dam 3 – Cattail Creek
2, 2002	30	6 – Upper Middle Patuxent 7 – Mid Middle Patuxent 8 – Lower Middle Patuxent
3, 2003	60	9 – Rocky Gorge Dam 14 – Hammond Branch

		15 – Dorsey Run
		10 – S Branch Patapsco River Tributaries
		1 – Patapsco River L Branch A
		4 – Patapsco River L Branch B
Round Two		
5, 2005	30	2 – Upper Brighton Dam
		5 – Lower Brighton Dam
		3 – Cattail Creek
6, 2006	30	11 – Upper Little Patuxent
		12 – Middle Little Patuxent
		13 – Lower Little Patuxent

Table 1 above and Figure 1 below illustrate the progress made to date on the county-wide biological monitoring program.

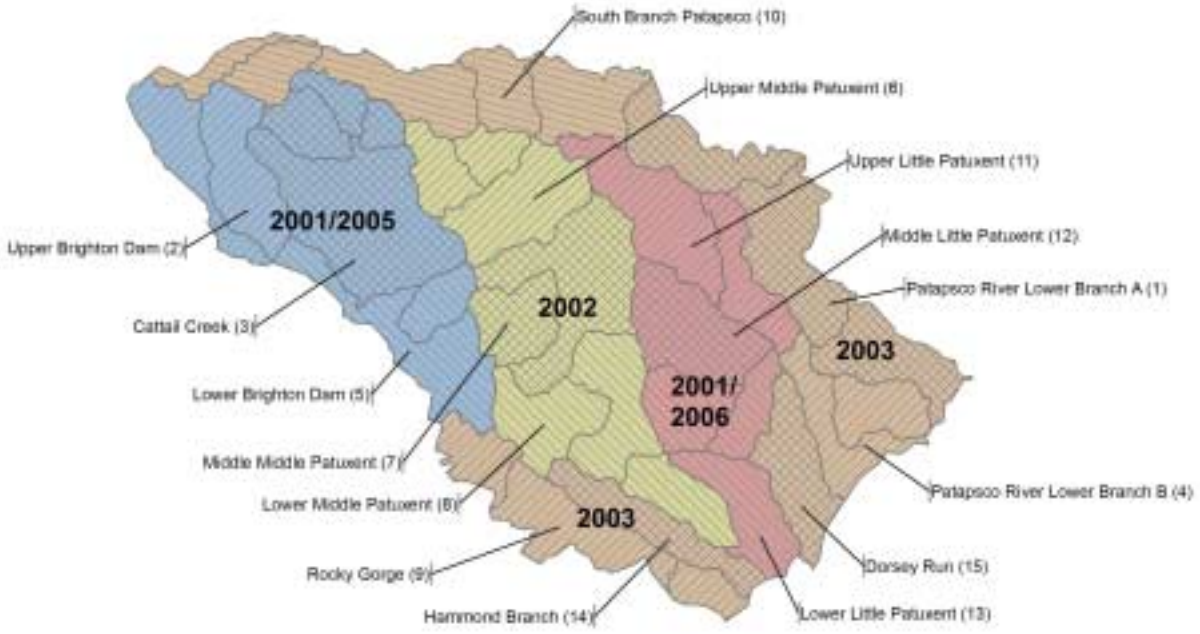

Figure 1 - Howard County Bioassessment

The Little Patuxent River flows south through Howard and Anne Arundel Counties to an eventual confluence with the Patuxent River just west of Crofton, Maryland. The Little Patuxent PSUs are located in the eastern portion of Howard County and are crossed by several major transportation routes (see Figure 2). Interstate 70 and Route 40 are in the northern portion of the watershed. Routes 100, 108 and 29 are in the central portion of the watershed and Routes 1 and 32 and I-95 are in the southern portion.

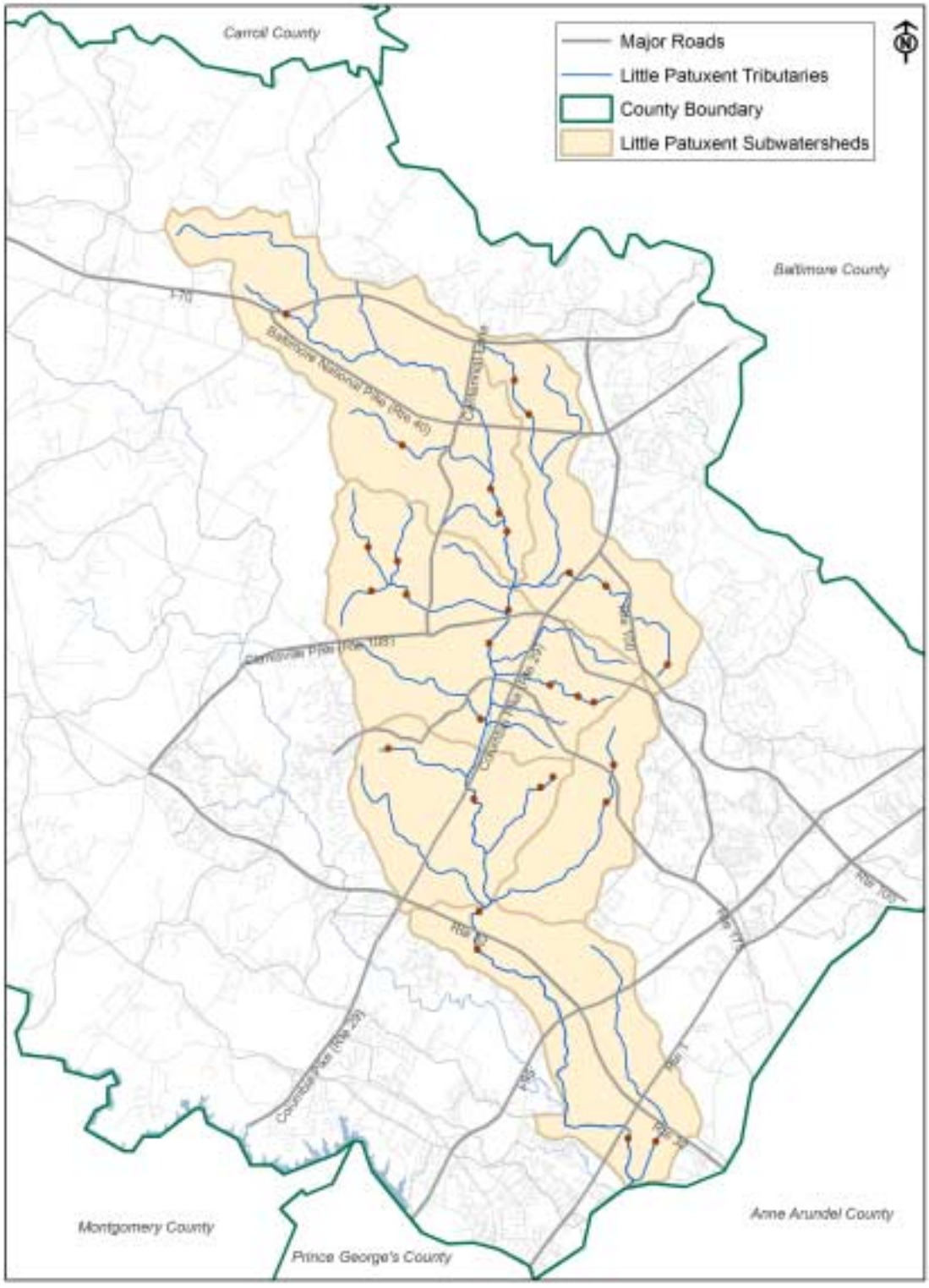

Figure 2 - Location Map, Little Patuxent River Watershed

1 Methodologies

The monitoring was conducted throughout the watershed and involved sampling instream water quality, collecting and analyzing the biological community (benthic macroinvertebrates), cross section analysis, and assessing the physical habitat.

Stream monitoring was conducted at 10 sites in each of the three PSUs (Upper Little Patuxent, Mid Little Patuxent, and Lower Little Patuxent). The assessment methods followed the current MBSS protocols and the SOPs described in the County's QAPP. Monitoring took place between March 1st and May 1st of 2006. Monitoring sites were marked in the field using tree tags (when possible) at the midpoint of the reach. The positions of the sites were collected using a GPS with sub-meter accuracy. All field data was entered into the Ecological Data Application System (EDAS). Photographs were taken to document all fieldwork and conditions. A summary of these methodologies 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 QA/QC samples, one in each of the three subwatersheds.

Biological sampling, habitat assessments and water quality were conducted at the duplicate sites. Duplicate sites were field-selected immediately upstream of sampling sites that had similar habitat characteristics to the original sampling site and were not impacted by road crossings or confluences. The process used during round one monitoring was to select the duplicate sites randomly with no field verification. This approach, however, was ineffective due to duplicate sites that varied in habitat composition and types of stressors from their comparison sampling site.

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 2006. 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 (**11LP**-1-01-2006), stream order (11LP-**1**-01-2006), a two-digit sequential number (11LP-1-**01**-2006), and the year sampled (11LP-1-01-**2006**). Alternate sites are coded with an "a" after the sequential number.

1.2 Impervious Surface Analysis

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

1.3 Water Quality Sampling

To supplement the macroinvertebrate sampling and habitat assessment, water quality sampling was performed. Field water quality measurements were collected in-situ at all monitoring stations according to methods in the County QAPP. Each parameter listed in Table 2 was recorded at the

bottom, middle and upstream portion of each sampling reach (including field QC sites) and averaged for a final value. Most in-situ parameters were measured with a HydroLab MiniSonde® probe and Surveyor® 4 data storage device. Turbidity was measured with a Hach 2100 Turbidimeter. Water quality equipment was regularly inspected, maintained and calibrated to ensure proper usage and accuracy of the readings. Calibration logs were kept by field crew leaders and checked by the project manager regularly.

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

Table 2 - Water Quality Sampling and COMAR Standards

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

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

1.4 Biological Sampling

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

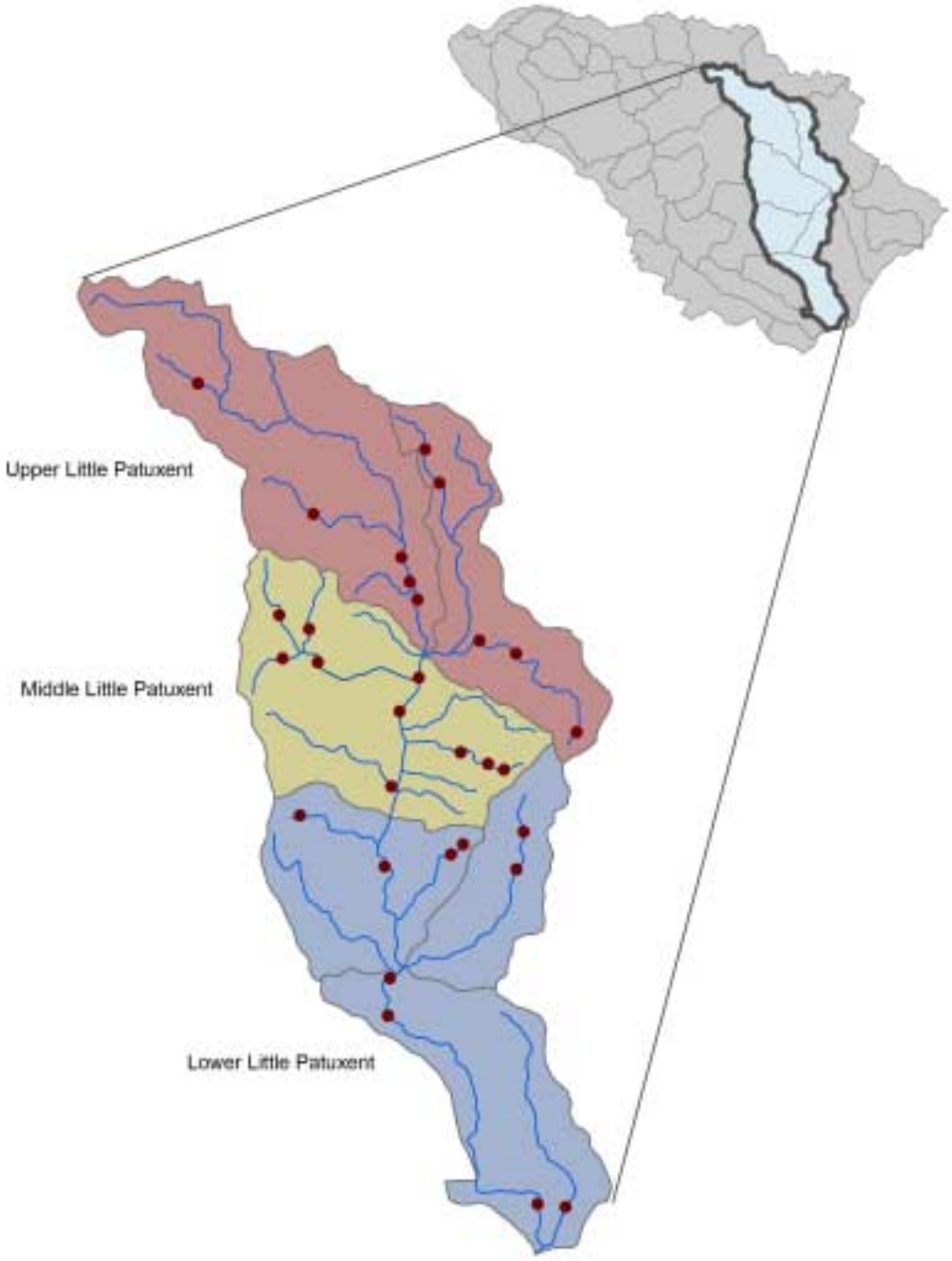

Figure 3 – Little Patuxent Bioassessment Sampling Locations

1.4.1 Benthic Macroinvertebrate Sampling

Benthic macroinvertebrate collection followed the QAPP which closely mirrors MBSS procedures (Kazyak, 2001). Benthic macroinvertebrate sampling is conducted during the spring season (March 1st to May 1st) along a 75-meter reach. The multi-habitat D-frame net approach was used to sample a range of the most productive habitat types within the reach. In this sampling approach, a total of twenty jabs

are distributed among all available habitats within the stream system and combined into one composite sample. Sampled habitats include submerged vegetation, overhanging bank vegetation, leaf packs, mats of organic matter, stream bed substrate, submerged materials (i.e., logs, stumps, snags, dead branches, and other debris) and rocks.

1.4.2 Sample Processing and Laboratory Identification

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

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

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

1.4.3 Biological Data Analysis

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

The benthic metrics, scoring criteria, and individual species tolerance were updated by DNR in 2005. The data collected in the first round of sampling of the Little Patuxent River watershed was analyzed using the old metrics (Stribling et. al 1998) and as such was not directly comparable to the current sampling data. All data from the 2001 Little Patuxent River sampling was recalculated using the updated metrics to allow for direct comparison to the current data. These results are included in Appendix C. For this report any mention of 2001 BIBI scores refer to these recalculated values.

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

Piedmont BIBI Metrics:

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

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

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

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

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

Percent Clingers Taxa – 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 Taxa	≥51	12 – 50	<12
Percent Chironomidae Taxa	≤4.6	4.7 – 63	>63
Percent Clingers Taxa	≥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

The 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 a review of ten biologically significant habitat parameters that assess 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 are as follows.

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 with a total score of 200 possible. A percent comparability was then calculated based on this highest attainable score. The total score is then placed in one of four 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 survey of channel cross-sections, particle size analysis and channel slope. Additionally, a Rosgen Level I characterization (Rosgen, 1998) was completed for each stream reach based on field-collected data.

1.6.1 Cross Section Analysis

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

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

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

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

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

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

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

1.6.2 Particle Size Analysis

The channel bed and bank materials were characterized at each cross-section using pebble count analysis. One modified Wolman pebble count (Wolman, 1954) was conducted in each reach to determine the composition of channel materials and median particle size. 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 are 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 Little Patuxent watershed, ten within the Lower Little Patuxent, ten within the Middle Little Patuxent, and ten within the Upper Little Patuxent subwatersheds. Additionally, one biological QA/QC sample was collected in each subwatershed at stations where upstream habitat was considered similar. The summary results of the habitat assessment, biological assessment, land use, and Rosgen characterization (Rosgen, 1998) are divided among the three subwatersheds and presented in detail in this section. A map of each subwatershed displaying the results of the RBP habitat assessment and BIBI is also presented. Full data results are located in the appendices.

2.1.1 Upper Little Patuxent

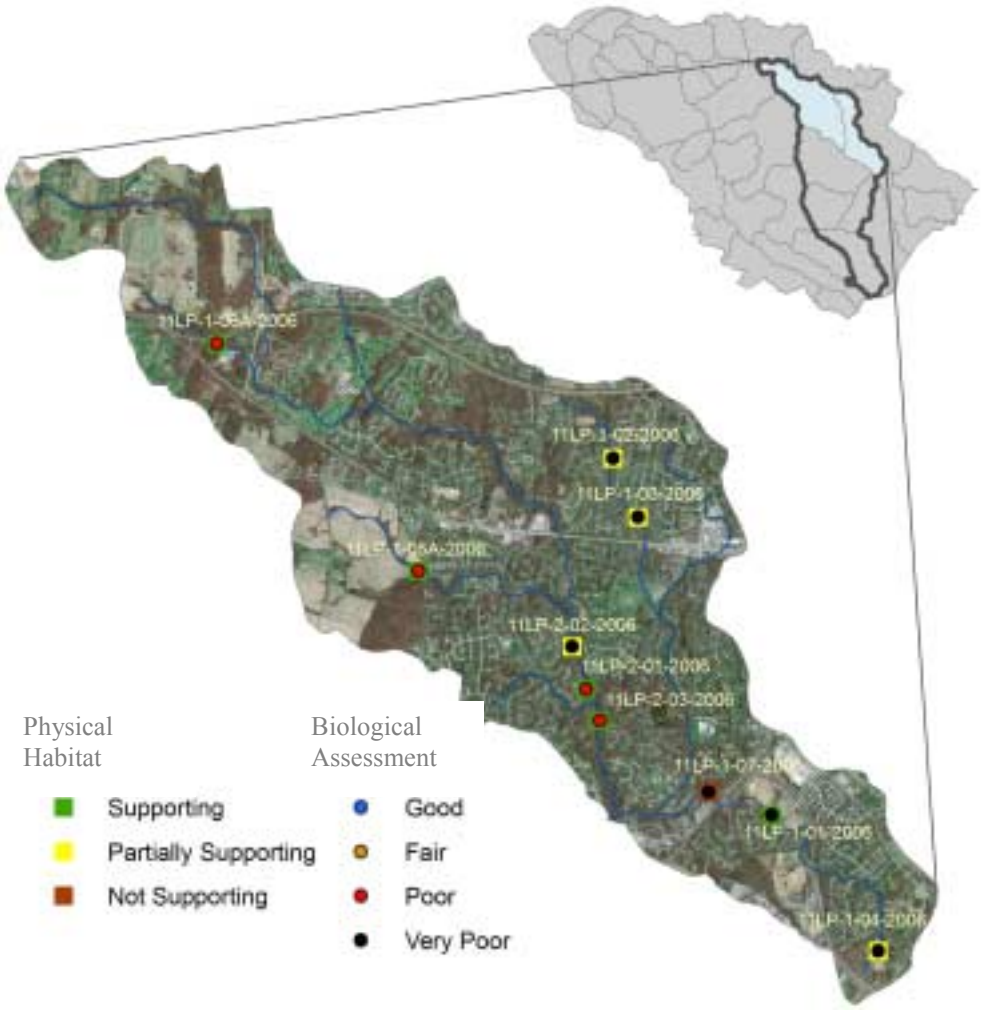

Figure 4 - Upper Little Patuxent Sampling Results

The average BIBI score from the 2001 sampling in this subwatershed was 2.5, or 'Poor'. The average habitat score for the 2001 sampling event was rated as 'Not Supporting'.

Seven of the ten sampling sites in 2006 in the Upper Little Patuxent were on first order streams and three were on second order streams. The field QC sample was collected at site 11LP-1-05A. The

subwatershed had an average BIBI rating of 1.9 or 'Very Poor' with scores ranging from 1.3 to 2.7. The average habitat assessment score was 73.8, or 'Partially Supporting', with scores ranging from 56 percent, or 'Not Supporting' to 85.5 percent, or 'Supporting'. Channels were generally classified as Rosgen type C with predominantly gravel substrate. A summary of the results for the Little Patuxent subwatershed is found in Table 7.

Table 7 - Upper Little Patuxent Summary

Site ID	Drainage Area (ac)	Impervious Surface Percent	Stream Order	BIBI Score	BIBI Narrative Rating	Habitat Score	Habitat Narrative Rating	Rosgen Channel Type
11LP-1-01-2006	1098	27.6	1	1.3	Very Poor	77.0	Supporting	F4c
11LP-1-02-2006	209	22.5	1	1.7	Very Poor	64.0	Partially Supporting	C5c
11LP-1-03-2006	381	27.0	1	1.7	Very Poor	69.0	Partially Supporting	B4c
11LP-1-04-2006	106	26.7	1	1.3	Very Poor	73.0	Supporting	C4
11LP-1-05A-2006*	465	4.3	1	2.0	Poor	84.0	Supporting	C4
11LP-1-06A-2006	512	20.7	1	2.7	Poor	84.5	Supporting	C4
11LP-1-07-2006	1496	25.8	1	1.7	Very Poor	56.0	Not Supporting	C4
11LP-2-01-2006	6514	18.7	2	2.7	Poor	85.5	Supporting	C4/5
11LP-2-02-2006	6382	18.5	2	1.3	Very Poor	69.0	Partially Supporting	C4
11LP-2-03-2006	6932	19.5	2	2.3	Poor	76.0	Supporting	C5
Minimum	106	4.3	1	1.3	Very Poor	56.0	Not Supporting	NA
Maximum	6932	27.6	2	2.7	Poor	85.5	Supporting	NA
Mean	2409	21.3	NA	1.9	Very Poor	73.8	Partially Supporting	NA
Standard Deviation	2930	6.9	NA	0.5	NA	9.60	NA	NA

*QC sampling was conducted at this site

Upper Little Patuxent Site Descriptions:

11LP-1-01-2006
Located near the intersection of US29 and Rt.100 in Meadowbrook Park, this reach was classified as an F channel type with a predominantly gravel substrate. Imperviousness within the 1098-acre drainage area was calculated to be 28 percent. Residential land uses make up over 60 percent of the drainage area to the sampling site, with 38 percent classified as medium- and high-density residential. There were only 14 taxa in the benthic macroinvertebrate sample, none of which were EPT taxa. Individuals of the Chironomidae family (midges) made up 95 percent of the sample. These factors led to an overall BIBI score of 1.3 for this site, with a rating of 'Very Poor'. Habitat, however, was rated as 'Supporting'. Water quality results indicated a pH of 8.7, which is above the allowable maximum as defined by COMAR for Use I-P streams. Water quality sampling also indicated high conductivity and total dissolved solids for this site. These water quality parameters may be contributing to the poor BIBI rating.

11LP-1-02-2006
Site 11LP-1-02-2006 is located less than 100 meters from Michaels Way where the stream flows through a predominantly residential area. Medium density residential land use makes up more than half of the land use in the 209-acre drainage area. Percent impervious surface to the sampling site is 22.5. This stream was classified as a C channel type with sandy substrate. Water quality indicated no parameters outside COMAR allowable limits for its use. However, conductivity and total dissolved solids were high. This site received the highest possible score for total number of taxa but the lowest possible score for all other BIBI metrics. There were no EPT taxa present in the sample, and only one percent of the sample was considered intolerant to urban land uses. Eighty-four percent of the individuals in the sample were chironomids. The habitat assessment resulted in a score of 64, or a

rating of 'Partially Supporting'. The poor habitat quality and lack of suitable epifaunal substrate and woody debris likely resulted in the low BIBI score of 1.7 with a 'Very Poor' rating.

11LP-1-03-2006
This site lies on a B channel dominated by gravel substrate. The stream is located in a residential area and crosses Brookemeade Drive through a 60-foot culvert. The culvert was excluded from sampling, and the total reach length was increased by 60 feet. Sixty-four percent of the drainage area is classified as medium-density residential. This accounts for most of the 27 percent of impervious surface present in the drainage area to the sampling site. The habitat assessment resulted in a score of 69 with a rating of 'Partially Supporting' indicating habitat that should be somewhat suitable for benthic communities. All water quality parameters were within COMAR limits for Use I-P streams, although the dissolved oxygen was lower than most other sites in the subwatershed. As with the above two sites in the Lower Little Patuxent, conductivity and total dissolved solids were elevated. There were no Ephemeroptera taxa present in the benthic macroinvertebrate sample. Additionally, intolerant urban taxa comprised only two percent of the sample. Based on BIBI scoring the site was classified as 'Very Poor,' with a score of 1.7.

11LP-1-04-2006
This upstream end of this sampling reach lies just below a ponded area above a culvert under Horseshoe Road. This site was classified as a C channel type and is dominated by gravel substrate. The right bank is steep and eroding along the upstream portion of the sampling reach. Water quality results indicated this site had the highest temperature, total dissolved solids and conductivity among all sites sampled in the Little Patuxent watershed. Turbidity is also the second highest found in the watershed. The predominant land use in the drainage area is forest followed closely by low-density residential and institutional. Overall, the drainage area has 26.7 percent of impervious surface, which is close to average for the Upper Little Patuxent sites. The habitat assessment indicated a 'Partially Supporting' habitat. Habitat scores were low for bank stability and riparian zone width along the right bank. The landowner adjacent to the stream has recently planted *Viburnum* along the right bank to slow erosion. The poor water quality and impaired habitat may be affecting the benthic macroinvertebrate scores at this site. With the exception of the 'Total Number of Taxa' metric, which received a score of '3', all metrics received the lowest possible score. Overall, the site scored a 1.3 for the BIBI leading to a 'Very Poor' rating.

11LP-1-05A-2006
Site 11LP-1-05A-2006 has the lowest percent impervious surface in the Upper Little Patuxent subwatershed at 4.3 percent. The site is located at one edge of the Carroll Farm property. With the exception of low- and medium-density residential areas adjacent to Frederick Road, the entire drainage area lies within the Carroll Farm property. The land use is predominantly agricultural with a small amount of residential encroaching on the stream as it flows southeast. It is a C channel type with gravel as the most abundant substrate. All water quality parameters were within acceptable ranges. Habitat scored well, receiving an 84, rated as 'Supporting'. However, the BIBI received a 'Poor' classification with a score of 2.0. There were a high number of taxa in the sample. However, there were no Ephemeroptera taxa, only two EPT taxa, and individuals of the Chironomidae family dominated the sample. The field QC sample collected at this site gave similar benthic results.

11LP-1-06A-2006
This sampling reach is located just downstream of a culvert under I-70. Although the stream is classified as a first-order based on the NHD layer, field crews noted a confluence approximately 25 meters upstream. The surrounding land use is predominantly forest, making up 42 percent of the drainage area to the sampling site. An additional 26 percent is low-density residential. Portions of the Howard County Landfill lie within the drainage area to this site. The total impervious land use for the

drainage area is 20.7 percent, just below the Upper Little Patuxent average of 21.3 percent. Typical of many Upper Little Patuxent sites, this site is also classified as a C channel with gravel as the dominate substrate. All water quality parameters were within acceptable ranges. Turbidity was lower than any other site within the Upper Little Patuxent subwatershed. Habitat was rated as 'Supporting' with a habitat score of 84.5. The overall BIBI score was 2.7, or 'Poor', the highest score attained in the Upper Little Patuxent subwatershed. This site received a high score for total number of taxa and had a high percent of clingers. However, the low number of Ephemeroptera taxa and the high number of Chironomidae in the sample lowered the overall rating.

11LP-1-07-2006
This sampling reach lies adjacent to Columbia Road. It is a C channel type dominated by a sandy substrate with unstable banks. The unstable substrate and lack of woody debris was considered less than optimal for epifaunal colonization. This site received the lowest habitat assessment score among all the Upper Little Patuxent sites, classified as 'Not Supporting'. This site also had the second highest conductivity and total dissolved solids among all sites in the Little Patuxent watershed. Land use is primarily residential making up 56 percent of the drainage area. Agricultural land use and forest make up another 35 percent. The overall imperviousness based on land use is 26 percent. This site had the highest percent intolerant urban taxa and the highest percent of Chironomidae taxa in the entire Little Patuxent watershed. The site was dominated by the chironomid *Micropsectra* (64 individuals in the sample) with a tolerance value of 2.1. The absence of EPT and Ephemeroptera taxa led to the low overall BIBI score of 1.7, with a rating of 'Very Poor'.

11LP-2-01-2006
Habitat at this site was rated as 'Supporting', receiving the highest habitat assessment score in the Upper Little Patuxent subwatershed, an 85.5. Dominant land uses in the approximately 6500-acre drainage area are medium-density residential (25 percent), forest (24 percent), and agriculture (19 percent) with an overall imperviousness of 19 percent. The sampling reach is surrounded by forest and has abundant high quality epifaunal habitat. The substrate provides a good mix of silt, sand, and gravel, and was classified as a C4/5 channel type. With the exception of slightly elevated conductivity and total dissolved solids, results of the instream water quality sampling do not indicate any parameters out of the ordinary. Benthic macroinvertebrate sampling resulted in a score of 2.7, or 'Poor'. This was the highest score attained in the Upper Little Patuxent subwatershed. The high number of Chironomidae present in the sample and the low percentage of taxa intolerant to urban land uses lowered scores.

11LP-2-02-2006
Located just off of Yellowstone Road and upstream of 11LP-2-01, site 11LP-2-02 has a wide riparian zone buffering the sample reach from the residential communities surrounding the stream. Rosgen characteristics, land use and percent impervious are similar to the previous site. Habitat received a score of 69 with a narrative rating of 'Partially Supporting'. Bank stability was considered poor to marginal with an embedded substrate and active deposition of sand. This site had the highest pH recorded at any site in the Little Patuxent watershed, 8.9. This is above the acceptable COMAR limit of 8.5. All other water quality parameters were within acceptable limits. Metric scores for benthic macroinvertebrate sampling were all low. The only metric receiving a score higher than '1' was the 'Total Number of Taxa' metric, which received a '3'. There was only one EPT taxa in the sample and 82 percent of the sample was made up of individuals of the Chironomidae family. The overall BIBI score was 1.3, with a 'Very Poor' rating, the lowest score in the Upper Little Patuxent subwatershed.

11LP-2-03-2006
Site 11LP-2-03-2006 is located downstream of site 11LP-2-01 and has similar land use, percent impervious and water quality. Rosgen characteristics were also similar but with a more sandy

substrate. Bank stability was considered to be marginal to sub-optimal with high sediment deposition. The overall habitat assessment score was 76, at the low end of the 'Supporting' classification. Field crews noted the presence of attached brown algae for 60 percent of the reach length. For the benthic macroinvertebrate sample the total number of taxa was high, but individuals of the Chironomidae family dominated the site, and there was a low percentage of taxa intolerant to urban land uses. The overall BIBI score was 2.3 or 'Poor'.

2.1.2 Middle Little Patuxent

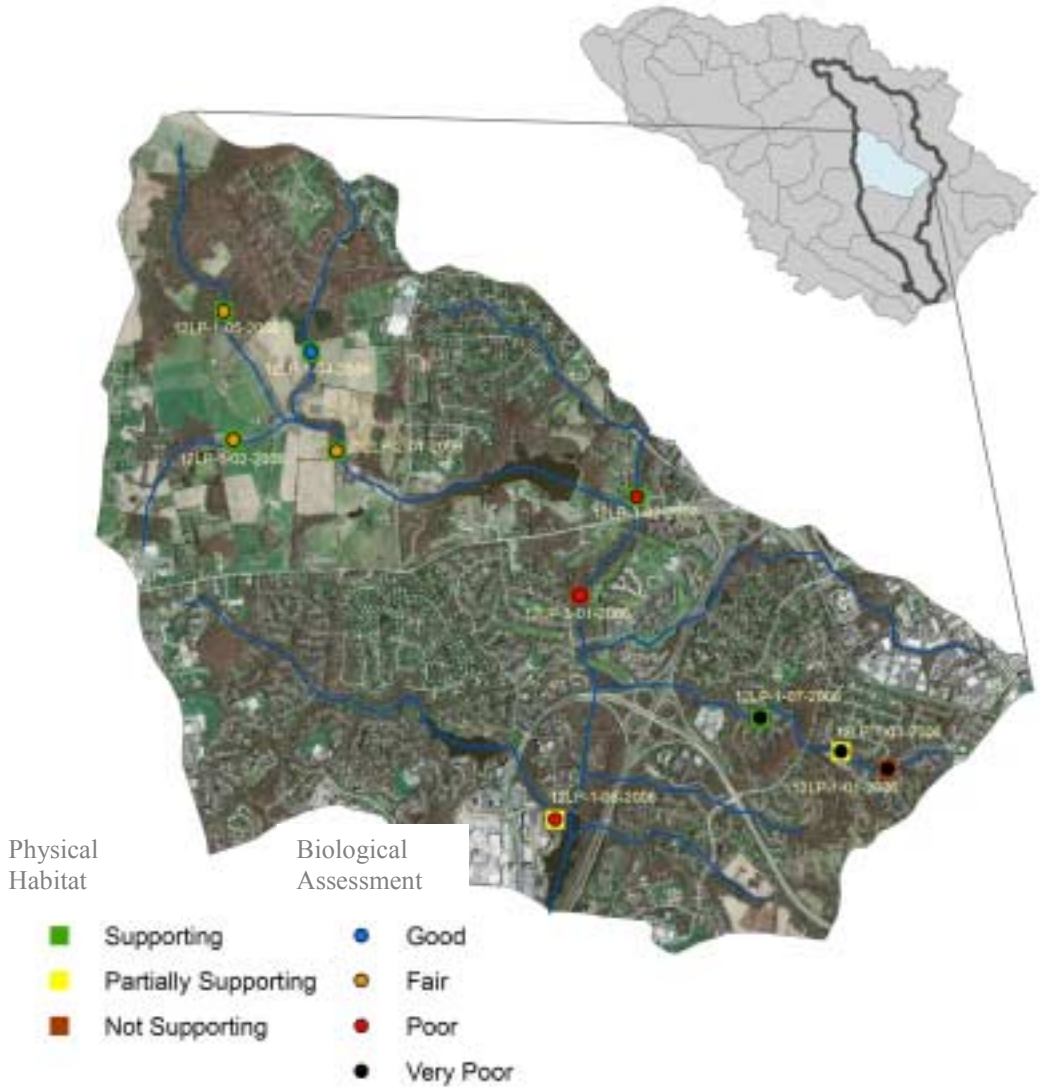

Figure 5 - Middle Little Patuxent Sampling Results

The 2001 mean BIBI score for the Middle Little Patuxent was low - 1.7, or 'Very Poor', with an average habitat rating of 'Not Supporting'.

In 2006, seven of the ten sampling sites in the Middle Little Patuxent subwatershed were on first-order streams, one was on a second-order stream and two were on a third-order stream. The field QC sample was collected at site 12LP-1-05. Habitat assessment scores in the Middle Little Patuxent subwatershed ranged from 51.5 percent, with a classification of 'Not Supporting' to 89.5 percent, or 'Supporting'. BIBI scores ranged from a low of 1.0, or 'Very Poor' to 4.0, or 'Good'. The mean BIBI rating was 2.5, with a rating of 'Poor'. The mean for the habitat assessments was 72.5 with a rating of 'Partially Supporting'. A summary of the results for the Middle Little Patuxent subwatershed is in Table 8.

The 2006 statistics are affected by four sampling sites located in the western portion of the subwatershed on property that is primarily cropland and forest. The Middle Little Patuxent subwatershed contained the site with the highest BIBI score in the Little Patuxent watershed, both the

highest and lowest rated habitat assessment sites in the Little Patuxent watershed and two of three sites with the lowest possible BIBI score.

Sites located in the western portion of this subwatershed (sites 12LP-1-05, 12LP-1-04, 12LP-1-02 and 12LP-2-01) were on the Clark and Carroll farm properties. Channels were classified primarily as type C4 with one F5 channel. Habitat for these sites was rated as 'Supporting' and the benthic macroinvertebrate sampling indicated benthic communities in the 'Fair' to 'Good' range. This was the only cluster in the entire Little Patuxent watershed where both habitat and benthic communities were considered healthy. Site 12LP-1-04 was the only site sampled in 2006 that received a 'Good' BIBI rating. Only one other site in the watershed (13LP-3-02, located in the Lower Middle Patuxent) received a BIBI rating greater than 'Poor', although many sites were rated as having sufficient habitat to support a benthic community.

Sites in the eastern portion of the subwatershed (12LP-1-01, 12LP-1-03, and 12LP-1-07) were located on the same stream. The channel was classified as G4/F4 and had BIBI scores in the 'Very Poor' range. Two of these sites received the lowest possible BIBI score of '1', with the third site receiving only a slightly higher score of '1.3'. Habitat scores were lowest at the upstream end of the stream and increased downstream with a rating of 'Supporting' at the most downstream site (12LP-1-07). Field-sampled water quality parameters were within acceptable ranges as defined by COMAR for a Use I-P streams. Conductivity and total dissolved solids levels were high at the most upstream site with levels decreasing downstream. Land use in the area is primarily medium-density residential with some forest.

Table 8 - Middle Little Patuxent Summary

Site ID	Drainage Area (ac)	Impervious Surface Percent	Stream Order	BIBI Score	BIBI Narrative Rating	Habitat Score	Habitat Narrative Rating	Rosgen Channel Type
12LP-1-01-2006	67	37.8	1	1.0	Very Poor	53.0	Not Supporting	G4
12LP-1-02-2006	324	7.4	1	3.7	Fair	76.0	Supporting	C4
12LP-1-03-2006	210	31.1	1	1.0	Very Poor	68.5	Partially Supporting	F4c
12LP-1-04-2006	338	23.6	1	4.0	Good	89.5	Supporting	C4
12LP-1-05-2006*	327	1.9	1	3.3	Fair	76.5	Supporting	F5c
12LP-1-06-2006	1240	41.7	1	2.0	Poor	68.0	Partially Supporting	F5
12LP-1-07-2006	404	29.7	1	1.3	Very Poor	80.5	Supporting	G4c
12LP-2-01-2006	1423	7.9	2	3.3	Fair	85.5	Supporting	C4c
12LP-3-01-2006	13619	21.3	3	2.7	Poor	51.5	Not Supporting	F4/5c
12LP-3-02-2006	11163	23.7	3	2.3	Poor	75.5	Supporting	F5
Minimum	67	1.9	1	1.0	Very Poor	51.5	Not Supporting	NA
Maximum	13619	41.7	3	4.0	Good	89.5	Supporting	NA
Mean	2912	22.6	NA	2.5	Poor	72.5	Partially Supporting	NA
Standard Deviation	5049	13.3	NA	1.1	NA	12.5	NA	NA

*QC sampling was conducted at this site

Middle Little Patuxent Site Descriptions:

12LP-1-01-2006
This sampling site has a high percentage of impervious area (38 percent). The land use within the drainage area is primarily medium-density residential (60 percent) followed by low-density residential (21 percent). Additionally, the drainage area is small when compared to many of the other sampling sites in the Little Patuxent watershed – only 67 acres. The reach was classified as a G4 channel type with unstable banks. It was very rocky with bedrock and large pieces of concrete/gabion in the channel. There were few pools and the riffles were shallow. The site also lacked sufficient woody

debris/rootwads for optimal colonization. The riparian zone was narrow with few trees and mowing up to the edge of the left bank for the entire reach length. Field crews also noted considerable slumping along the left bank. The habitat score for this site was 53, rated as 'Not Supporting', second to lowest in the Little Patuxent watershed. Conductivity and total dissolved solids were the highest seen in the Middle Little Patuxent subwatershed. The pH was also high, 8.1, but this value does not fall outside the acceptable COMAR limits. It scored the lowest possible score for the BIBI of 1.0, with a rating of 'Very Poor'. A score of 1.0 is the lowest possible BIBI score, receiving the lowest individual score for each parameter measured. Chironomids made up 96 percent of the benthic macroinvertebrate sample, with 61 individuals in the tolerant *Orthocladius* genus. There were no EPT taxa and only one percent of individuals in the sample were considered intolerant to urban land uses.

12LP-1-02-2006
This sampling reach is on the Clark Farm property. The area in which the sample reach was located had recently been fenced off to protect the stream and the riparian buffer zone had been planted with trees and is recovering. The majority of the surrounding land use is agricultural, over 64 percent, resulting in a low impervious surface percentage of 7.4. The habitat assessment score and BIBI score show good correlation. The habitat was rated as 'Supporting' with a score of 76, and the benthic sample received a 'Fair' rating with a score of 3.7. This BIBI score is the second highest in the entire Little Patuxent watershed. All water quality parameters were within acceptable ranges. Gravel and sand made up the majority of the substrate type with gravel slightly dominating. This reach was classified as a C4 channel type.

12LP-1-03-2006
Site 12LP-1-03-2006 is just downstream of 12LP-1-01. It was classified as an F channel with gravel as the dominant substrate. Nearly 70 percent of the land use surrounding the sample site is medium-density residential resulting in a higher than average impervious surface of 31 percent. Habitat was rated as 'Partially Supporting' with a score of 68.5. Bank stability was considered marginal to suboptimal with an insufficient buffer zone. Water quality parameters were within acceptable ranges with a slightly elevated conductivity and total dissolved solids. As with 12LP-1-01, the benthic macroinvertebrate sample received a BIBI score of 1.0, the lowest score possible and was rated as 'Very Poor'. The benthic sample was very similar to 12LP-1-01, with only 12 taxa present in the sample and 97 percent of the taxa made up of individuals of the Chironomidae family – 68 individuals in the tolerant *Orthocladius* genus. There were no Ephemeroptera taxa present in this sample nor were there any taxa considered tolerant to urban land uses.

12LP-1-04-2006
The land use within the drainage area to this site is 48 percent low-density residential and 20 percent forest. The sampling location is on the Clark Farm property and is well-buffered by forest, but the upstream area leading to the site is a residential community. This results in an impervious surface to the sampling site of 24 percent, slightly higher than the Middle Little Patuxent watershed average. It had the highest attained habitat assessment and BIBI scores in the watershed, 89.5 ('Supporting') and 4.0 ('Good') respectively. This is the only site that received a BIBI rating of 'Good' in the entire Little Patuxent watershed. It is a C channel type with gravel making up 80 percent of the substrate.

12LP-1-05-2006
Site 12LP1-05-2006 is classified as an F channel dominated by sand substrate, though gravel is fairly abundant. This site is remote and surrounded entirely by forest. Land use to the sampling site is 63 percent forest and 30 percent agriculture. The drainage area has only 1.9 percent of impervious area, the lowest of any site in the Little Patuxent watershed. Habitat is abundant and the habitat assessment resulted in a habitat assessment score of 76.5 with a rating of 'Supporting'. This correlated well with the BIBI, which received a rating of 'Fair' and a score of 3.3. Water quality parameters were all within

acceptable ranges although the pH was slightly higher than other sites in the subwatershed. Total dissolved solids and conductivity were lower at this site than at any other site in the Little Patuxent watershed. The field QC sample collected at this site gave similar BIBI results.

12LP-1-06-2006
Located just upstream of Lake Kittamaqundi, site 12LP-1-06-2006 is classified as an F channel type with a gravel substrate and a good mix of deep and shallow pools. The banks are unstable and eroding for over half the reach length. Over 50 percent of the surrounding land use is medium- and high-density residential. The drainage area to this site had the highest percentage of high-density residential (27 percent) in the Little Patuxent watershed, which greatly contributed to the highest impervious surface percentage (41.7 percent) in the entire watershed. The habitat assessment resulted in a score of 68, or 'Partially Supporting', with marginal to poor scores received for bank stability and a low score for the riparian zone along the right bank. The benthic macroinvertebrate sample received a score of 2.0, or 'Poor'. The sample lacked Ephemeroptera taxa and had only one percent of individuals intolerant to urban land uses. Conductivity and total dissolved solids were elevated but all other parameters were within acceptable ranges.

12LP-1-07-2006
This site is located downstream of sites 12LP-1-03 and 12LP-1-01. Despite having suitable habitat and receiving a habitat assessment score of 80.5 with a rating of 'Supporting', site 12LP-1-07-2006 scored a BIBI of 1.3 and was classified as 'Very Poor'. There were only 16 taxa present in the sample, only one of which was an Ephemeroptera. Eighty-three percent of the individuals in the sample were in the Chironomidae family. The land use in the drainage area is 65.5 percent medium-density residential, followed by 24 percent forest. There is only a 10 – 15 meter buffer separating the stream from the many developments surrounding it. Though gravel is the dominant substrate there are large amounts of sand deposits and sporadic areas of bedrock. Bank stability at this site was considered poor and the stream is fairly entrenched in some areas. This stream is classified as G channel type. All water quality parameters were within acceptable ranges.

12LP-2-01-2006
This sampling reach provided a variety of substrate, with a good mix of cobble and gravel. There was also a good mix of quality riffles and pools, but woody debris was not prevalent. The habitat score at this site was 85.5 with a rating of 'Supporting'. The site is located just downstream of a private bridge overpass. Imperviousness in the drainage area is only 7.9 percent, with the majority of land use (46 percent) being agricultural. All water quality parameters were within acceptable ranges. Turbidity was higher than other sites, but this could be attributed to rain showers over the 48 hours prior to sampling. Though gravel is the dominant substrate, there were a large number of boulders present within the sample reach. This sample had the highest number of EPT taxa of all sites sampled in the Little Patuxent watershed. The benthic macroinvertebrate sample received a BIBI score of 3.3 with a rating of 'Fair'.

12LP-3-01-2006
Located in a golf course, the stream flows through the very west end of the course and has a narrow forested buffer before flowing through the mowed fairways and greens. Sand and gravel make up the majority of the substrate present and the reach is classified as an F4/5 channel type. Imperviousness in the drainage area is 21.3 percent, just below the subwatershed average of 22.6 percent. The epifaunal substrate was rated as marginal with high embeddedness and low velocity/depth diversity and few riffles. The right bank lacked sufficient vegetative protection and was rated as moderately unstable. The overall habitat score was 51.50, or a 'Not Supporting' rating. This was the lowest habitat rating in the Little Patuxent watershed. The benthic macroinvertebrate sample received a rating of 'Poor' with a

score of 2.7. It had a high total number of taxa, but a low percentage of individuals intolerant to urban land uses, and a low percentage of clingers.

12LP-3-02-2006

Site 12LP-3-02-2006 is located less than 50 meters from Woodland Road. This reach was classified as an F channel. It is a sandy substrate with a narrow forested buffer along one bank. The opposite bank is mowed to the edge. It received a habitat assessment score of 75.50, at the low end of the 'Supporting' category. The right bank riparian zone received a marginal rating and the right bank stability and vegetative protection were rated as suboptimal. Also, suitable substrate and woody debris were not available in good quality or quality for full colonization. Land use immediately adjacent to the stream appears to be an open space that is periodically cleared. Land use in the drainage area is similar to the previous site with a majority being medium-density residential and 23.7 percent of impervious surface overall. Dissolved oxygen was 3.88 at the time of sampling – below the acceptable COMAR limit of 5.0 mg/l. Benthic macroinvertebrate sampling revealed a community with a high total number of taxa. The sample was dominated by Chironomidae (81 percent) and had a low percentage of individuals intolerant to urban land uses. The overall BIBI score was 2.3 with a rating of 'Poor'.

2.1.3 Lower Little Patuxent

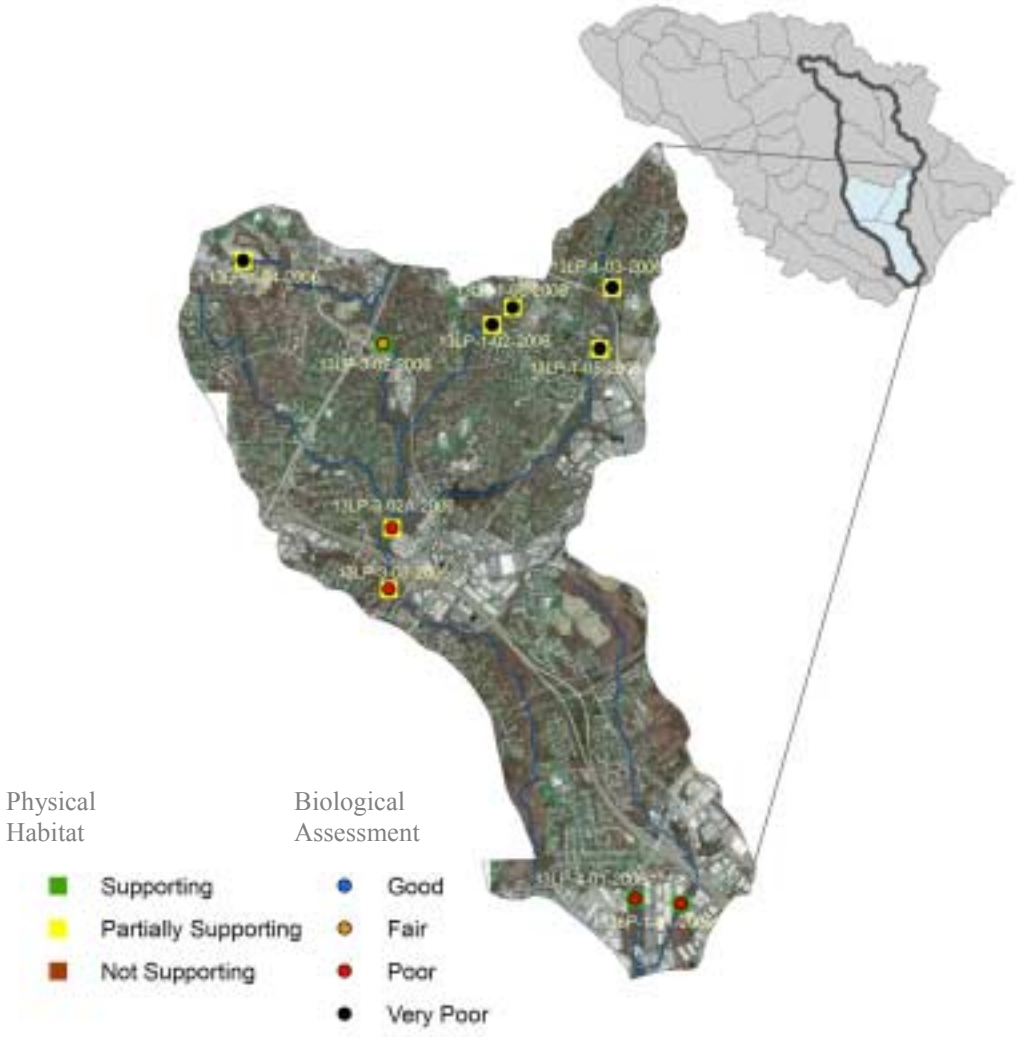

Figure 6 - Lower Little Patuxent Sampling Results

The 2001 mean BIBI score for the Lower Little Patuxent was low - 1.6, or 'Very Poor', with an average habitat score of 38.6 and a rating of 'Not Supporting'.

Six of the ten sites sampled in 2006 in the Lower Little Patuxent subwatershed were located on first-order streams, three were on second-order streams and one site was on a 4-order stream (13LP-4-01). This was the only site sampled on a fourth-order stream in the Little Patuxent watershed. The drainage area to this site includes most of the Little Patuxent subwatershed and the entire Middle Patuxent subwatershed, which is delineated as a separate PSU. The field QC sample was collected at site 13LP-1-01. Most stream reaches were classified as C channels with a sand or gravel substrate. Two of the sites on the mainstem of the Little Patuxent were classified as incising F channels with a predominantly sand substrate. A summary of the results for the Lower Little Patuxent subwatershed is in Table 9.

All sites within the Lower Little Patuxent subwatershed were rated as either 'Partially Supporting' or 'Supporting' based on the RBP habitat assessment scores. The lowest habitat assessment score was 63 percent and the highest was 89 percent, falling just below the 'Comparable to Reference' classification. The mean habitat score of 72.8 resulted in 'Partially Supporting' rating.

BIBI ratings ranged from a low of 1.0, or 'Very Poor' to a high of 3.3, or 'Fair'. This resulted in a mean BIBI score of 1.9 with a rating of 'Very Poor'. This is an increase from the 2001 average BIBI score in the Lower Little Patuxent subwatershed which was 1.6 or 'Very Poor'.

Table 9 - Lower Little Patuxent Summary

Site ID	Drainage Area (ac)	Impervious Surface Percent	Stream Order	BIBI Score	BIBI Narrative Rating	Habitat Score	Habitat Narrative Rating	Rosgen Channel Type
13LP-1-01-2006*	1767	27.9	1	2.0	Poor	89.0	Supporting	C4c
13LP-1-02-2006	96	29.8	1	1.3	Very Poor	72.0	Partially Supporting	C4c
13LP-1-03-2006	518	32.1	1	1.3	Very Poor	71.5	Partially Supporting	F5/4c
13LP-1-04-2006	26	41.2	1	1.3	Very Poor	68.0	Partially Supporting	C4b
13LP-1-05-2006	831	34.8	1	1.7	Very Poor	72.5	Partially Supporting	C5c
13LP-1-06-2006	31	26.8	1	1.0	Very Poor	63.0	Partially Supporting	C5/G5
13LP-3-02-2006	18365	26.0	2	3.3	Fair	79.0	Supporting	C4
13LP-3-02A-2006	23595	28.5	2	2.7	Poor	62.0	Partially Supporting	F5c
13LP-3-03-2006	24023	28.5	2	2.3	Poor	69.5	Partially Supporting	F5
13LP-4-01-2006	62943	19.2	4	2.0	Poor	81.0	Supporting	C3/4
Minimum	26	19.2	1	1.0	Very Poor	62.0	Partially Supporting	NA
Maximum	62943	41.2	4	3.3	Fair	89.0	Supporting	NA
Mean	13220	29.5	NA	1.9	Very Poor	72.8	Partially Supporting	NA
Standard Deviation	20247	5.8	NA	0.7	NA	8.3	NA	NA

*QC sampling was conducted at this site

Lower Little Patuxent Site Descriptions:

13LP-1-01-2006
This site was classified as a C channel with gravel as the dominant substrate. The RBP habitat assessment rated the site as 'Supporting' with a score of 89.0. There was a good mix of cobble and gravel substrate and good quality riffles. However, the site lacked woody debris. Immediately adjacent to the sampling reach is a forested buffer, but large commercial/industrial areas lie outside this buffer. The dominant land use in the drainage area is forest (42 percent). However, residential and commercial and industrial combined make up 48 percent leading to an imperviousness of 28 percent. There is a large storm drain located upstream of the QC reach which was flowing at the time of sampling even though there had been no rain for 24 hours. Water quality indicates no parameters out of the acceptable ranges, but elevated conductivity and total dissolved solids. The BIBI score was 2.0, or 'Poor' which is lower than expected for the available habitat. The sample had only one EPT taxon, no Ephemeroptera taxa, and no taxa intolerant to urban land uses. Results were similar for the field QC sample collected here.

13LP-1-02-2006
This site is located next to paved walking trail and just upstream from a footbridge. The channel was classified as type C with a gravel substrate. The overall habitat was rated as 'Partially Supporting' with a score of 72. At the time of sampling there was little flow in the channel and little velocity/depth diversity. Land use in the drainage area to the site is predominantly medium-density residential (71 percent). Total impervious surface area is 30 percent. The site received a BIBI score of 1.3, with a rating of 'Very Poor'. The sample was dominated by Chironomidae taxa (92 percent), of which 69 individuals were the pollution tolerant *Orthocladius.* There were no Ephemeroptera taxa, and only three percent of individuals were intolerant to urban land uses. Water quality parameters were all within acceptable ranges.

13LP-1-03-2006
This reach lies between two large apartment complexes buffered by a narrow strip of forest. The majority of the land use is medium density residential (58 percent). The imperviousness in the drainage area (32 percent) is higher than average for the subwatershed. The channel appeared to be overwidened with steep banks along much of the reach. It was dominated by gravel and sand substrate and classified as an F5/4. The RBP habitat assessment indicates low bank stability, sediment deposition and low flow. The overall rating was 71.5, or 'Partially Supporting'. The benthic macroinvertebrate sample also received low scores. The overall BIBI score was 1.3, or 'Very Poor'. This site received the lowest score possible for all BIBI parameters except for number of taxa, for which it scored a 3. Water quality results do not indicate any parameters outside the acceptable ranges and nothing that would adversely affect the BIBI scores.

13LP-1-04-2006
This reach is located between a footbridge and a paved footpath on the Howard Community College campus. It is a C channel dominated by gravel with areas of sand deposition. Land use in the drainage area is 80 percent institutional (primarily the College) and as such is 41 percent impervious – the second highest in the Little Patuxent watershed. The habitat assessment rating was 'Partially Supporting' due primarily to poor bank stability, a narrow riparian zone, and lack of sufficient vegetative protection. The overall habitat score was 68. The benthic macroinvertebrate sample was in the 'Very Poor' BIBI range. The sample had a low number of taxa, only one EPT taxa and no Ephemeroptera. All parameters scored a '1' with the exception of number of taxa, which received a score of '3'. Water quality results again fell within acceptable COMAR ranges, however, conductivity and total dissolved solids were high.

13LP-1-05-2006
This sampling reach flows parallel to a paved walking trail with a narrow strip of forested buffer. There is a large amount of clay in the banks and sand deposits in the channel. The dominant substrate is sand though gravel is also present. It is classified as a C channel type. Residential land uses make up most of the drainage area with over 43 percent of the land use classified as medium-density residential followed by 20.7 percent of high-density residential. This makes the total imperviousness 34.8 percent, which is higher than the subwatershed average of 29.8 percent. The habitat rating for this site was 72.5 with a rating of 'Partially Supporting'. The low rating was primarily due to poor bank stability and sand deposition. Field crews also noted high amounts of trash in the channel. The benthic sample was rated as 'Very Poor' with a score of 1.7. Only one metric received a score higher than '1'- the 'total number of taxa' metric received a score of '5'. Water quality parameters were all within acceptable ranges.

13LP-1-06-2006
Site 13LP-1-06-2006 is located near Afternoon Lane and flows through residential lawns. Buffer is very narrow to absent for the entire reach length. Bank stability was rated as moderately unstable with poor to marginal ratings for riparian zone width and poor vegetative protection along the left bank. The channel is very narrow with a sandy substrate and is classified as a C/G. At the time of sampling there was little flow in the channel and very little suitable habitat. This site received a habitat score of 63, 'Partially Supporting', the second lowest score of the Lower Little Patuxent sites. The majority of the land use in the drainage area to the sampling site is medium-density residential, which makes up 61 percent. Imperviousness based on land use is calculated to be 27 percent. This site received the lowest possible BIBI score, a 1.0 with a narrative rating of 'Poor'. All metrics received the lowest possible score (a score of 1). Instream water quality sampling indicates no parameters that would adversely affect the benthic scores.

13LP-3-02-2006
This sampling reach is located next to the Brokenland Parkway exit of Route 29. Imperviousness in the drainage area to this site is calculated as 26 percent. There is a mix of all land uses within the drainage area, but the largest percentage is medium- and low-density residential. With gravel as the dominant substrate present this reach was classified as a C channel. The habitat assessment and BIBI scores show agreement receiving a 79 ('Supporting') and 3.3 ('Fair'), respectively. The only metric receiving a score of '1' was the 'percent intolerant urban' metric. The site had a large amount of woody debris and was surrounded by a forested buffer. Water quality parameters were all within acceptable ranges.

13LP-3-02A-2006
A wide forested buffer surrounds site 13LP-3-02A-2006 with areas outside the buffer primarily in residential and commercial use. Overall land use in the drainage area is similar to the previous site, with a total of 28.5 percent of impervious area. Due to poor bank stability and little vegetative protection this site received a habitat score of 62, the lowest score in the Lower Little Patuxent subwatershed, with a rating of 'Partially Supporting'. A BIBI score of 2.7 was achieved with a rating of 'Poor' due to low numbers of EPT taxa and high numbers of Chironomidae. Water quality results show all parameters within acceptable ranges although conductivity and total dissolved solids were elevated. Dominant substrate was silt/clay and sand, not ideal for suitable habitat or colonization, which may have affected the benthic community. This reach was classified as an F channel.

13LP-3-03-2006
Located downstream of Rte. 32, site 13LP-3-03-2006 is surrounded by a wide forested buffer with a footbridge passing over the middle of the sample reach. It is classified as an F channel with gravel as the dominant substrate and sporadic large boulders scattered throughout the reach. This site received a 'Partially Supporting' rating with a habitat score of 69.5. The BIBI score of 2.3, rated as 'Poor', correlates with these results. The majority of the land use in the drainage area is medium-density residential, with an impervious surface percent of 28.5, just above the subwatershed average. Water quality parameters all fall within acceptable ranges again with elevated levels for conductivity and dissolved solids.

13LP-4-01-2006
With the largest drainage area of all the sites, 13LP-4-01-2006 is classified as a C channel type with cobble as the most abundant substrate. The drainage area is approximately 63,000 acres and includes most of the Little Patuxent watershed and the entire Middle Patuxent watershed PSU. The 19.2 percent impervious surface is just below the Lower Little Patuxent subwatershed average and is divided fairly equally between developed and undeveloped land uses. This site received an overall habitat score of 81 and was rated as 'Supporting'. Despite the good quality of available habitat and normal instream water quality, the BIBI scored a 2.0, and was rated as 'Poor'. One factor that may be affecting the benthic community is the private road for the sewer facility that runs parallel to the stream with a small 15-foot scrub/shrub buffer. High runoff from this road may affect the water chemistry and therefore may be adversely affecting the biological community.

3 Discussion and Comparison

3.1 Little Patuxent River Watershed Summary

3.1.1 2001

Results from 2001 suggested that overall the Little Patuxent watershed was in poor condition. Both habitat and BIBI received the lowest narrative ratings possible. Each subwatershed had at least one site that received the lowest possible BIBI score of 1.0. Overall, the Middle and Lower Little Patuxent subwatersheds were rated as 'Very Poor'. All three subwatersheds received an RBP habitat assessment rating of 'Non Supporting' with the lowest score received being a 20.5 percent. The mean RBP habitat assessment score is a 46.2 percent, a low score even within the 'Non Supporting' narrative rating range.

3.1.2 2006

Bioassessment

Biological and physical habitat assessment results for 2006 in the Little Patuxent watershed indicate a stream system that is moderately impaired. Only one of the thirty benthic macroinvertebrate samples received a rating of 'Good' and only four received a 'Fair' rating. The remaining sites were all rated as 'Poor' or 'Very Poor'. Site 12LP-1-04 was the only site within the Little Patuxent watershed that received a BIBI rating of 'Good'. Sites 12LP-1-02, 12LP-1-05, and 12LP-2-01 all received a 'Fair' rating. All four of these sites were located on the Clark and Carroll Farms (see Figure 5). Without this particular random clustering of sites, the average benthic macroinvertebrate scores would likely have been much lower.

Overall the entire Little Patuxent Watershed, along with each individual subwatershed, received a 'Partially Supporting' physical habitat assessment rating. The mean RBP habitat assessment score for the Little Patuxent watershed was 73.0 percent. The mean habitat scores for all the subwatersheds were in a narrow range with only 1.4 percent separating the lowest mean score from the highest. Habitat assessments revealed many areas with erosion along the banks and buffer encroachment by lawns. Field crews rated many of the sites as providing adequate habitat available for benthic colonization; however, the benthic macroinvertebrate sampling did not agree with this assessment, with most sites receiving BIBI ratings of 'Poor' or 'Very Poor'. Only two of the sites had pH values outside the allowable COMAR range and one had a low dissolved oxygen. These field-measured water quality values alone do not explain the poor benthic community.

Water Quality

Conductivity was elevated at many sites across the watershed with values ranging from 152 to 798 µS/cm. An analysis of these values indicates that there was also a negative correlation between the BIBI score and the specific conductance (-0.497 with a significance level of 0.01). Within this range of values, only three sites located on the Carroll and Clark farm properties had values less than 200 µS/cm. The average value in the Upper Little Patuxent was 464 µS/cm, in the Middle Little Patuxent, 322 µS/cm and in the Lower Little Patuxent, 417 µS/cm. These are values traditionally seen during storm events, and may indicate an elevated background level of pollutants.

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

emissions. A site-by-site breakdown of field-measured water quality parameters is included in Appendix B.

Geomorphology

The geomorphic assessment reveals a variable system. Many of the channels were classified as stable type C with areas of incised F and G channels. Gravel was the dominant substrate in the watershed with many areas of sandy deposition. Field crews noted that many sites exhibited characteristics of Coastal Plain streams rather than Piedmont streams.

Imperviousness

The overall percentage of impervious area in the Little Patuxent watershed is 24.4 percent. Impervious values range from a low of 1.9 percent to a high of 41.7 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. A Pearson correlation between the BIBI scores and the percentage of imperviousness to each sampling site does indicate a negative relationship (correlation of -0.571 with a significance level of 0.01) between the impervious area in the watershed and the BIBI scores. Overall water quality is likely being affected by the amount of development in the watershed.

Results Correlations

The Pearson correlation coefficient measures the linear association between to variables. Values of the coefficient range from -1 to 1. Negative values indicate a negative relationship between the two values, while positive values indicate a positive relationship. The absolute value of the number indicates the strength of the association, with larger absolute values indicating stronger associations between the two variables. The interpretation of a correlation is somewhat arbitrary, especially as values move away from +/- 1. The results in Table 10 should be interpreted carefully, as the correlation results are not considered conclusively strong. The scatterplot matrix in Figure 7 provides a visual display of the data correlated and the best fit line associated with the correlation.

A fairly strong positive correlation (0.604) in the 2006 data was found between specific conductance and percent impervious with high statistical significance. Percent impervious and BIBI scores also showed a slight negative correlation with high statistical significance. Other correlations between habitat scores, BIBI scores and percent impervious showed weaker correlations.

Table 10 - Pearson Correlations

		Habitat Assessment	Percent Impervious	Specific Conductance
BIBI n=30	Correlation	0.429	-0.571	-0.497
	Significance	0.018	0.001	0.005
Habitat Assessment n=30	Correlation		-0.402	-0.419
	Significance		0.028	0.021
Percent Impervious n=30	Correlation			0.604
	Significance			0.000

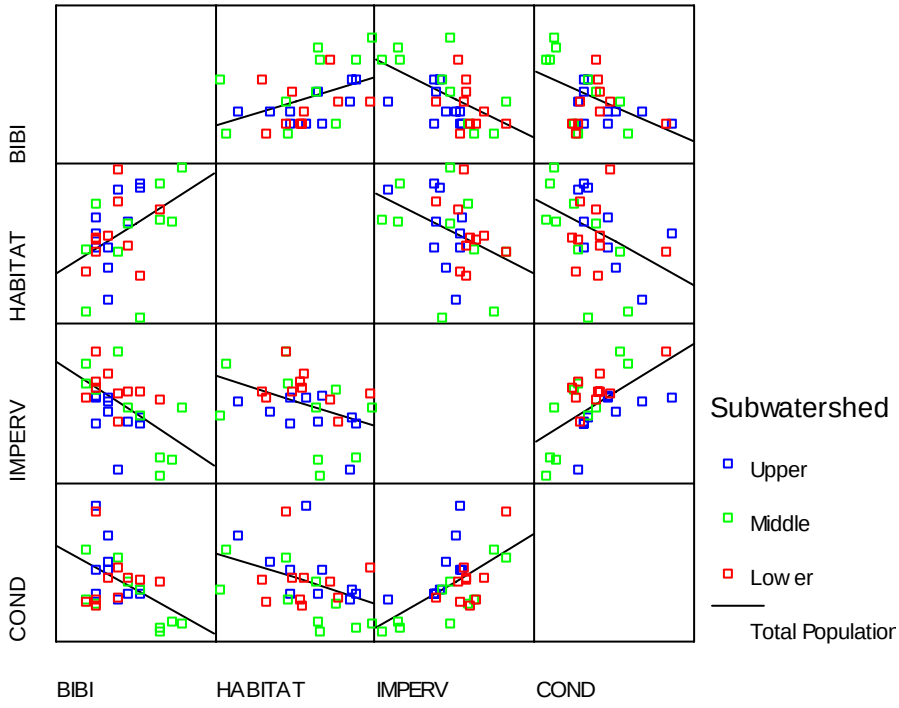

Figure 7 - Scatterplot Matrix for several 2006 Data Parameters (BIBI, Habitat Assessment, Percent Impervious Cover and Specific Conductivity), best fit line represents the total 2006 sample population.

3.1.3 Comparison of 2001 and 2006 Bioassessment data

BIBI

The data collected in 2006 indicate that conditions are similar to those reported in 2001. Table 11 and Figure 8 summarize the results for 2001 and 2006 BIBI data. In 2006, the Lower Little Patuxent PSU had an overall average BIBI of 1.9, with a rating of 'Very Poor'. This represents an increase in the overall score for the Lower Little Patuxent, increasing from a 1.6. This did not change the narrative rating. There was also improvement seen in the mean score for the Middle Little Patuxent increasing to a 2.5, a 'Poor' rating, in 2006, from a score of 1.6, a 'Very Poor' rating, in 2001. However, the 2006 Middle Little Patuxent score is favorably affected by the four sites on the Clark and Carroll farms. The Upper Little Patuxent watershed was the only subwatershed for which there was a decrease in the mean BIBI score and rating, a 2.5 in 2001 ('Poor') to a 1.9 in 2006 ('Very Poor'). Increases in the Lower Little Patuxent and Middle Little Patuxent contributed to an increase in the overall score and rating for the entire Little Patuxent watershed. The overall mean BIBI score changed from a 'Very Poor' rating (1.9) in 2001 to a 'Poor' rating (2.1) in 2006. This change in overall group means is not considered a statistically significant difference.

Table 11 - Comparison of 2001 and 2006 BIBI Data

Sampling Year	Little Patuxent Subwatershed	Number of sites sampled	Min. BIBI	Max. BIBI	Median BIBI	Mean BIBI	Narrative Rating	Standard Deviation
2001	Upper	11	1.0	4.0	2.3	2.5	Poor	0.887
	Middle	10	1.0	3.0	1.3	1.6	Very Poor	0.793
	Lower	9	1.0	2.7	1.3	1.6	Very Poor	0.654
	Entire Watershed	30	1.0	4.0	1.7	1.9	Very Poor	0.867
2006	Upper	10	1.3	2.7	1.7	1.9	Very Poor	0.526
	Middle	10	1.0	4.0	2.5	2.5	Poor	1.113
	Lower	10	1.0	3.3	1.8	1.9	Very Poor	0.721
	Entire Watershed	30	1.0	4.0	2.0	2.1	Poor	0.843

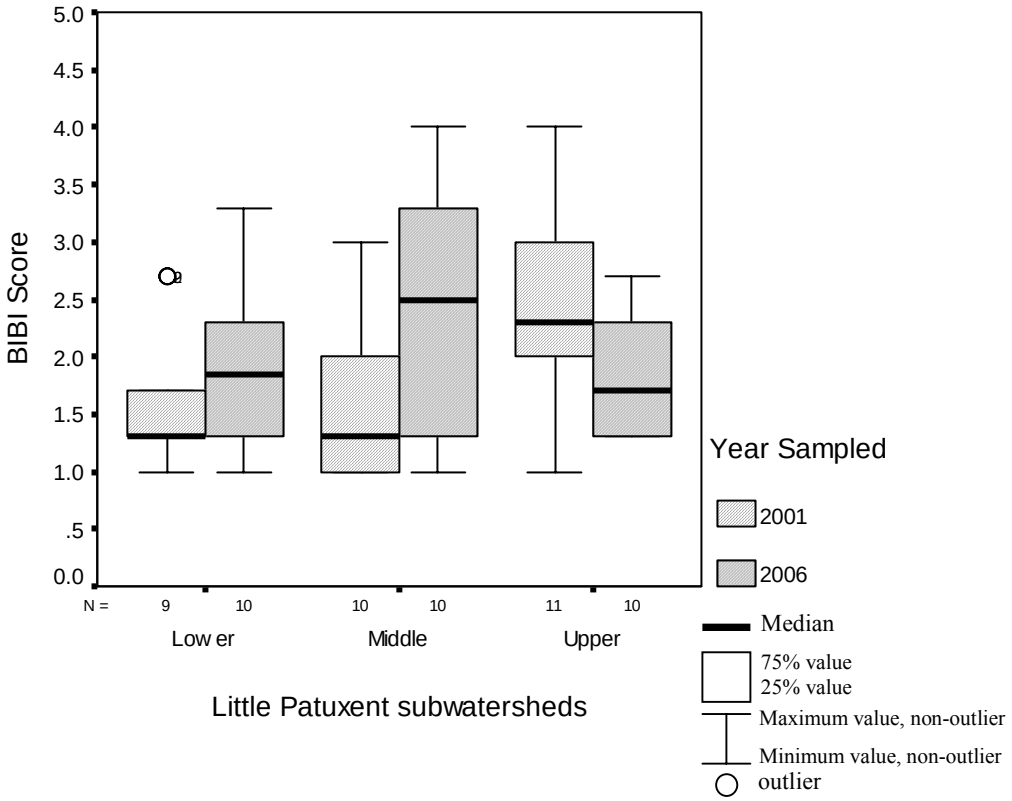

Figure 8 - Comparison of 2001 and 2006 BIBI scores in the Little Patuxent River subwatersheds

RBP Physical Habitat Assessment

Overall, the mean RBP habitat assessment for each subwatershed increased from a 'Non-Supporting' rating to a 'Partially Supporting' rating, resulting in the entire Little Patuxent watershed RBP habitat assessment mean rating increasing from a 'Non Supporting' to 'Partially Supporting'. In order to make a direct comparison between the 2001 and 2006 RBP physical habitat assessment results, data collected in 2001 using WDR sheets instead of RBP habitat assessment field data sheets were excluded from the overall calculated results. A summary of 2001 and 2006 RBP physical habitat assessment data is in Table 12.

Table 12 - Comparison of 2001 and 2006 RBP Physical Habitat Assessment Data

Sampling Year	Little Patuxent Subwatershed	Number of sites sampled (RBP)	Min. RBP	Max. RBP	Median RBP	Mean RBP	Narrative Rating	Standard Deviation
2001	Upper	10	20.5	73.5	59.0	50.0	Non Supporting	21.451
	Middle	10	28.5	69.0	47.0	48.1	Non Supporting	11.980
	Lower	6	37.0	65.0	46.3	38.6	Non Supporting	25.451
	Entire Watershed	26	20.5	69.0	49.5	46.2	Non Supporting	19.899
2006	Upper	10	56.0	85.5	74.5	73.8	Partially Supporting	9.605
	Middle	10	51.5	89.5	75.8	72.5	Partially Supporting	12.547
	Lower	10	62.0	89.0	71.8	72.8	Partially Supporting	8.281
	Entire Watershed	30	51.5	89.5	73.0	73.0	Partially Supporting	10.000

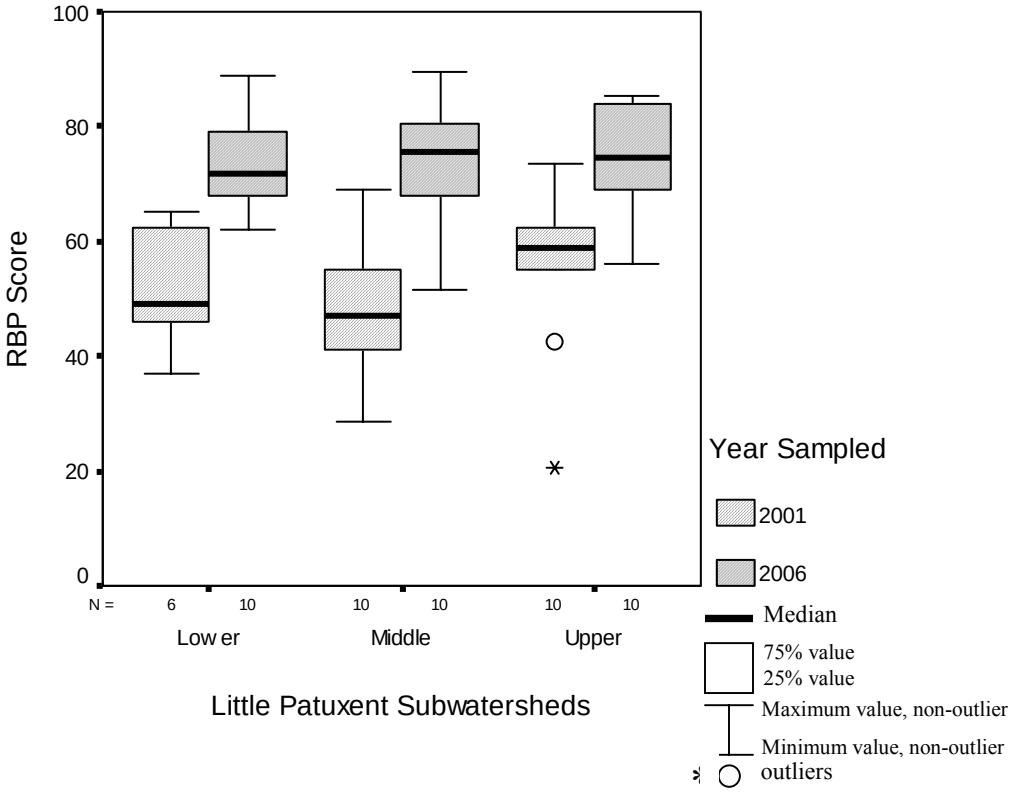

Figure 9 - Comparison of 2001 and 2006 RBP Physical Habitat Assessment scores in the Little Patuxent River subwatersheds

The RBP habitat assessment is a subjective rating of habitat at the sampling site. The assessment is generally completed with input from all field crew members to reduce the subjectivity as much as possible. However, it is possible for two different teams to give different ratings to the same sampling site. Additionally the locations of the sampling sites can have a large effect on overall rating. Differences between the 2001 and 2006 RBP habitat data, therefore, should not be used as compelling evidence that there has been improvement in habitat quality between 2001 and 2006.

4 Conclusion and Recommendations

Watershed Condition

Results of the 2006 assessment of the Little Patuxent watershed indicate generally poor quality and little change in the overall health of the watershed from the County's 2001 conditions, and from earlier studies. The DNR's MBSS results from 1994-1997 indicate overall poor biological quality in the Little Patuxent watershed (Millard, et. al. 2001). Fish sampling at three sites resulted in two 'Poor' ratings and one 'Fair' rating while BIBI scores were rated 'Poor' at four out of five sites.

MBSS sampling was conducted again in 2000 in the Little Patuxent (both Howard County and Anne Arundel portions were combined) and the scores resulted in a mean 'Fair' rating for fish and a 'Poor' rating for benthic macroinvertebrates (Roth et. al. 2001). As in the 2006 results, there was a disparity between the habitat ratings and the biological indicators. The 2000 MBSS study indicated 'Good' mean habitat but only 'Fair' to 'Poor' biological results. The study identified relatively high levels of nitrogen, phosphorus, and chloride, constituents that are not sampled in the County-wide program; however the conductivity measure can be used as an indirect measure of chloride.

A portion of the Middle Little Patuxent was also sampled in 2006 as part of the *Centennial and Wilde Lakes Watersheds Discharge Characterization, Stream Monitoring and Watershed Assessment, Baseline Conditions, Year One – 2006* (KCI, 2006). The results for BIBI and habitat were similar in comparison to the 2006 County-wide results. In the County-wide sampling, the area draining to Centennial Lake exhibited good habitat quality and 'Fair' to 'Good' BIBI. Likewise the Centennial and Wilde Lake study resulted in six 'Fair' and four 'Good' BIBI ratings and generally high quality instream and riparian habitat conditions.

Overall the Little Patuxent Watershed is highly suburbanized with high percentages of residential development and generally high levels of impervious surface. The data from the last 10 years reflect this with an overall degradation of the biological community most likely attributable to moderate disruption in the habitat quality and impacts to water quality.

Additional Water Quality Sampling

The relatively healthy habitat identified over the last 10 years was not always substantiated by a healthy benthic community. This can be an indication of poor water chemistry. In 2006, total dissolved solid levels were high across most of the watershed. A more in-depth analysis should be performed to determine the types and potential sources of pollutants.

Additional water quality sampling including parameters not measured in the most recent round of sampling should also be conducted on those streams rated as 'Poor' or 'Very Poor' to determine whether there are other stressors affecting the sites.

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. County wet weather monitoring results for the Little Patuxent should be incorporated to define additional water quality stressors.

Comparability with Statewide Methods

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

Beginning with the 2006 Spring Index Period the MBSS began using new metrics for the calculation of the BIBI. In addition, many of the tolerance values were updated. Data collected and analyzed under the old metrics (Stribling et. al. 1998) from 2001 were recalculated as part of the 2006 data

analysis to ensure comparability. Data from 2002-2005 should be recalculated using the new metrics for the best comparison of results.

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 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 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

A Watershed Restoration Action Strategy (WRAS) was completed for the Little Patuxent Watershed in 2002 by the Howard County DPW (Howard County, 2002). The report and the associated supporting documents identified water quality, living resource and land use issues throughout the watershed and defined restoration and preservation goals and opportunities. Subsequent restoration plans included the Centennial and Wilde Lake Watershed Restoration Plan (CWP, 2005) and the associated baseline conditions assessment which with additional sampling in upcoming years will identify changes in watershed condition as restoration activities are implemented (KCI, 2006).

The data and results of the 2006 Little Patuxent monitoring reinforce the findings, goals and objectives of the recent watershed studies and provide further support for their restoration and protection goals. The 2006 data should be incorporated into the monitoring plans for the Centennial and Wilde Lakes restoration activities and any other restoration or preservation projects for the Little Patuxent Watershed.

5 References

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

Boward, D. and 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). 2005. Centennial and Wilde Lake Watershed Restoration Plan. Prepared for Howard County Stormwater Management Division by the Center for Watershed Protection.

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.

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. 2006. Centennial and Wilde Lakes Watersheds Discharge Characterization, Stream Monitoring and Watershed Assessment, Baseline Conditions, Year One – 2006 Prepared by KCI Technologies, Inc. for the Howard County Department of Public Works Stormwater Management Division. Columbia, MD.

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

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

Maryland Department of Natural Resources. 2001. Little Patuxent River Watershed Characterization. Prepared in partnership with Howard County in support of Howard County's Watershed Restoration Action Strategy for the Little Patuxent River Watershed.

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

Millard C.J., Kazyak P.F. and A.P. Prochaska. 2001. Howard County, Results of the 1994-1997 Maryland Biological Stream Survey: County-Level Assessments. CBWP-MANTA-EA-01-20. Maryland Department of Natural Resources, Monitoring and Non-Tidal Assessment Division. Annapolis, MD.

Pavlik, K.L. and Stribling. 2001. Biological Assessment of the Little Patuxent River, Cattail Creek and Brighton Dam Watersheds, Howard County, Maryland. Prepared by Tetra Tech, Inc. Owings Mills, MD for Howard County, Department of Public Works. Stormwater Management Division. Columbia, MD.

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.

Roth, N.E., Southerland M.T., Mercurio, G and J.H. Volstad. 2001. Maryland Biological Stream Survey 2000-2004, Volume I: Ecological Assessment of Watersheds Sampled in 2000. CBWP-MANTA-EA-01-5. Maryland Department of Natural Resources, Monitoring and Non-Tidal Assessment Division. Annapolis, MD.

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. 2006. Random Subsample Routine. Developed by Eric W. Leppo.

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

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

Appendix A: Land Use and Imperviousness

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

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

Site ID	Drainage Area (Acres)[1]	LDR	MDR	HDR	CI	INST	OUL	AGR	FOR	OW	BG	% Impervious[2]
Upper Little Patuxent												
11LP-1-01-2006	1098.28	25.2%	32.6%	5.1%	4.9%	3.4%		17.3%	11.4%		0.2%	27.6
11LP-1-02-2006	209.12	6.6%	54.8%					12.5%	26.0%			22.5
11LP-1-03-2006	380.53	11.5%	63.4%					6.9%	18.2%			27.0
11LP-1-04-2006	106.47	27.4%	0.4%	8.4%	1.2%	26.4%		3.8%	32.3%			26.7
11LP-1-05A-2006	464.89	7.0%	5.1%				5.2%	80.2%	2.5%			4.3
11LP-1-06A-2006	512.29	26.1%						3.5%	42.1%		28.3%	20.7
11LP-1-07-2006	1495.90	23.3%	29.2%	3.7%	6.3%	2.5%		21.0%	13.8%		0.1%	25.8
11LP-2-01-2006	6513.80	11.9%	25.0%	0.3%	2.2%	0.6%	12.0%	18.8%	24.3%		5.0%	18.7
11LP-2-02-2006	6381.94	12.1%	24.0%	0.3%	2.3%	0.6%	12.2%	19.2%	24.2%		5.1%	18.5
11LP-2-03-2006	6931.58	12.4%	27.9%	0.3%	2.1%	0.6%	11.4%	17.6%	23.1%		4.7%	19.5
Middle Little Patuxent												
12LP-1-01-2006	66.86	21.3%	60.1%	2.5%		16.0%						37.8
12LP-1-02-2006	324.03	27.9%				0.8%		64.1%	7.2%			7.4
12LP-1-03-2006	209.61	6.8%	69.3%	0.8%		5.1%			18.0%			31.1
12LP-1-04-2006	338.07	47.8%	10.5%			15.2%	0.6%	6.2%	19.7%			23.6
12LP-1-05-2006	327.46	7.6%						29.5%	62.9%			1.9
12LP-1-06-2006	1239.64	18.9%	27.5%	26.7%	5.7%	7.4%	5.1%	4.4%	2.4%	1.9%		41.7
12LP-1-07-2006	403.84	3.5%	65.5%	0.9%	1.2%	4.5%			24.3%			29.7
12LP-2-01-2006	1423.18	20.0%	2.5%			3.8%	0.1%	45.8%	27.8%			7.9
12LP-3-01-2006	13619.08	16.7%	27.7%	1.7%	3.2%	2.0%	5.8%	19.1%	21.0%	0.4%	2.4%	21.3
12LP-3-02-2006	11162.97	15.8%	32.4%	1.7%	3.9%	1.6%	7.1%	15.1%	19.5%		2.9%	23.7
Lower Little Patuxent												
13LP-1-01-2006	1766.63	7.9%	13.9%	9.5%	16.6%	3.8%		6.2%	42.2%			27.9
13LP-1-02-2006	95.72	0.7%	70.5%			2.2%	16.3%	3.6%	6.8%			29.8
13LP-1-03-2006	518.11	4.3%	58.1%	11.7%	0.6%	1.3%	1.4%	1.4%	21.1%			32.1
13LP-1-04-2006	25.59				1.1%	80.4%			18.5%			41.2
13LP-1-05-2006	831.18	3.1%	43.4%	20.7%	2.7%	2.4%	4.9%	0.9%	21.9%			34.8
13LP-1-06-2006	31.21	2.2%	61.3%				26.9%	9.7%				26.8
13LP-3-02-2006	18364.83	15.0%	27.2%	5.7%	6.5%	2.8%	4.9%	15.0%	20.6%	0.6%	1.8%	26.0
13LP-3-02A-2006	23594.57	13.8%	29.8%	6.5%	8.3%	3.1%	4.6%	11.7%	20.1%	0.6%	1.4%	28.5
13LP-3-03-2006	24023.43	13.6%	29.7%	6.4%	8.5%	3.1%	4.5%	11.6%	20.5%	0.6%	1.4%	28.5
13LP-4-01-2006	62943.46	21.8%	15.0%	3.8%	4.8%	2.4%	2.5%	24.1%	24.8%	0.3%	0.6%	19.2

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

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

Appendix B: Water Quality Data

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

Howard County
2006

Site ID	Date	pH	Water Temperature *°C*	Dissolved Oxygen *mg/l*	Turbidity *NTU*	Conductivity *µS/cm*	Total Dissolved Solid *mg/l*
Upper Little Patuxent							
11LP-1-01-2006	4/21/2006	8.68	14.3	14.58	2.29	467.05	299.25
11LP-1-02-2006	4/20/2006	7.02	13.2	11.05	1.90	506.73	324.47
11LP-1-03-2006	4/20/2006	6.59	10.9	8.74	1.31	473.53	303.37
11LP-1-04-2006	4/26/2006	7.68	17.9	11.00	7.04	798.50	519.00
11LP-1-05A-2006	4/20/2006	7.63	15.1	13.21	1.69	319.10	204.23
11LP-1-06A-2006	4/21/2006	6.94	12.5	9.38	0.80	373.17	239.10
11LP-1-07-2006	4/21/2006	6.98	13.8	8.67	1.52	645.00	412.65
11LP-2-01-2006	4/19/2006	7.26	13.1	10.36	3.56	351.33	225.40
11LP-2-02-2006	4/19/2006	8.90	17.0	12.28	2.70	351.47	224.80
11LP-2-03-2006	4/19/2006	7.46	12.8	10.33	2.66	349.87	223.93
Middle Little Patuxent							
12LP-1-01-2006	4/24/2006	8.10	15.6	9.85	0.82	571.00	371.00
12LP-1-02-2006	4/25/2006	8.16	13.4	11.44	5.61	204.67	133.00
12LP-1-03-2006	4/24/2006	8.20	14.9	10.19	1.09	319.67	208.00
12LP-1-04-2006	4/25/2006	8.33	16.2	11.13	3.75	194.67	126.33
12LP-1-05-2006	4/26/2006	8.42	10.3	11.11	6.44	151.50	98.50
12LP-1-06-2006	4/18/2006	7.17	13.4	9.43	2.69	533.16	341.20
12LP-1-07-2006	4/24/2006	8.21	13.7	9.82	2.33	293.33	190.33
12LP-2-01-2006	4/25/2006	8.33	11.2	10.48	10.60	179.33	116.33
12LP-3-01-2006	4/28/2006	8.36	15.0	12.59	4.75	367.50	239.00
12LP-3-02-2006	5/1/2006	8.34	14.3	3.88	3.07	405.00	263.00
Lower Little Patuxent							
13LP-1-01-2006	4/27/2006	8.11	12.4	11.42	2.55	480.00	311.50
13LP-1-02-2006	4/18/2006	7.44	12.3	12.66	0.75	284.10	181.70
13LP-1-03-2006	4/27/2006	8.00	12.7	10.62	2.39	318.00	206.50
13LP-1-04-2006	4/26/2006	7.31	12.4	10.81	3.89	763.50	496.50
13LP-1-05-2006	4/27/2006	8.23	10.6	10.35	1.81	429.50	279.00
13LP-1-06-2006	4/18/2006	7.20	14.1	11.32	2.41	311.17	199.30
13LP-3-02-2006	5/1/2006	8.15	13.7	12.34	3.77	412.00	269.00
13LP-3-02A-2006	5/1/2006	8.15	12.8	11.31	4.17	419.50	272.00
13LP-3-03-2006	5/1/2006	8.06	12.4	10.70	3.39	427.00	277.00
13LP-4-01-2006	4/28/2006	8.39	13.5	11.74	1.86	325.50	211.50

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
Upper Little Patuxent													**Upper Little Patuxent Average:**	**1.9**	**Very Poor**
11LP-1-01-2006	4/21/2006	14	0	0	45	95.0	8	1	1	1	3	1	1	1.3	Very Poor
11LP-1-02-2006	4/20/2006	25	0	0	1	83.6	15	5	1	1	1	1	1	1.7	Very Poor
11LP-1-03-2006	4/20/2006	22	3	0	2	79.3	50	3	1	1	1	1	3	1.7	Very Poor
11LP-1-04-2006	4/26/2006	22	3	0	11	88.1	18	3	1	1	1	1	1	1.3	Very Poor
11LP-1-05A-2006	4/20/2006	30	2	0	11	80.6	33	5	1	1	1	1	3	2.0	Poor
11LP-1-05A-2006 QC	4/20/2006	28	2	0	15	86.0	33	5	1	1	3	1	3	2.3	Poor
11LP-1-06A-2006	4/21/2006	27	7	1	24	64.9	67	5	3	1	3	1	3	2.7	Poor
11LP-1-07-2006	4/21/2006	12	0	0	68	97.9	3	1	1	1	5	1	1	1.7	Very Poor
11LP-2-01-2006	4/19/2006	27	5	2	7	72.3	45	5	3	3	1	1	3	2.7	Poor
11LP-2-02-2006	4/19/2006	21	1	1	4	81.6	12	3	1	1	1	1	1	1.3	Very Poor
11LP-2-03-2006	4/19/2006	29	4	3	8	71.0	37	5	1	3	1	1	3	2.3	Poor
Middle Little Patuxent													**Middle Little Patuxent Average:**	**2.5**	**Poor**
12LP-1-01-2006	4/24/2006	12	0	0	1	96.3	4	1	1	1	1	1	1	1.0	Very Poor
12LP-1-02-2006	4/25/2006	31	8	5	21	62.5	36	5	3	5	3	3	3	3.7	Fair
12LP-1-03-2006	4/24/2006	12	2	0	0	96.7	7	1	1	1	1	1	1	1.0	Very Poor
12LP-1-04-2006	4/25/2006	25	9	4	50	38.9	74	5	3	5	3	3	5	4.0	Good
12LP-1-05-2006	4/26/2006	25	9	3	34	51.0	61	5	3	3	3	3	3	3.3	Fair
12LP-1-05-2006 QC	4/26/2006	26	8	3	49	37.0	66	5	3	3	3	3	3	3.3	Fair
12LP-1-06-2006	4/18/2006	24	2	0	1	51.8	36	3	1	1	1	3	3	2.0	Poor
12LP-1-07-2006	4/24/2006	16	2	1	5	82.9	22	3	1	1	1	1	1	1.3	Very Poor
12LP-2-01-2006	4/25/2006	24	10	4	18	56.0	59	3	3	5	3	3	3	3.3	Fair
12LP-3-01-2006	4/28/2006	35	5	2	4	57.5	29	5	3	3	1	3	1	2.7	Poor
12LP-3-02-2006	5/1/2006	27	3	2	5	81.2	50	5	1	3	1	1	3	2.3	Poor
Lower Little Patuxent													**Lower Little Patuxent Average:**	**1.9**	**Very Poor**
13LP-1-01-2006	4/27/2006	20	1	0	0	54.6	44	3	1	1	1	3	3	2.0	Poor
13LP-1-01-2006 QC	4/27/2006	13	2	0	0	8.0	79	1	1	1	1	3	5	2.0	Poor
13LP-1-02-2006	4/18/2006	15	3	0	3	91.9	11	3	1	1	1	1	1	1.3	Very Poor
13LP-1-03-2006	4/27/2006	24	3	1	5	76.8	14	3	1	1	1	1	1	1.3	Very Poor
13LP-1-04-2006	4/26/2006	15	1	0	2	72.7	7	3	1	1	1	1	1	1.3	Very Poor
13LP-1-05-2006	4/27/2006	25	3	1	6	75.6	14	5	1	1	1	1	1	1.7	Very Poor
13LP-1-06-2006	4/18/2006	7	2	1	0	93.7	4	1	1	1	1	1	1	1.0	Very Poor
13LP-3-02-2006	5/1/2006	28	6	4	5	44.8	34	5	3	5	1	3	3	3.3	Fair
13LP-3-02A-2006	5/1/2006	25	4	3	13	64.0	45	5	1	3	3	1	3	2.7	Poor
13LP-3-03-2006	5/1/2006	33	4	2	4	70.2	41	5	1	3	1	1	3	2.3	Poor
13LP-4-01-2006	4/28/2006	29	4	1	6	28.4	18	5	1	1	1	3	1	2.0	Poor

11LP-1-01

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Odonata	Coenagrionidae	Argia	Argia		1	Predator	cn, cb, sp	9.3
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx		1	Predator	cb	8.3
Insecta	Diptera	Chironomidae	not identified	Chironomini		2	Collector	bu	6
Insecta	Diptera	Chironomidae	Chironomus	Chironomus		2	Collector	bu	4.6
Insecta	Diptera	Chironomidae	Cladotanytarsus	Cladotanytarsus		1	Filterer	-	6.6
Insecta	Diptera	Chironomidae	Cryptochironomus	Cryptochironomus		1	Predator	sp, bu	7.6
Insecta	Diptera	Empididae	Hemerodromia	Hemerodromia		1	Predator	sp, bu	7.9
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus		6	Scraper	sp	7.2
Insecta	Diptera	Chironomidae	Limnophyes	Limnophyes		1	Collector	sp	8.6
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	P	7	Collector	cb, sp	2.1
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra		38	Collector	cb, sp	2.1
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	P	1	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius		21	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus		2	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum		5	Shredder	cb, cn	6.3
Insecta	Diptera	Simuliidae	Simulium	Simulium		2	Filterer	cn	5.7
Insecta	Diptera	Chironomidae	Thienemanniella	Thienemanniella		1	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia		8	Collector	sp	5.1

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

11LP-1-02

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Ablabesmyia	Ablabesmyia		2	Predator	sp	8.1
Insecta	Diptera	Chironomidae	Brillia	Brillia		1	Shredder	bu, sp	7.4
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx		1	Predator	cb	8.3
Insecta	Diptera	Chironomidae	Conchapelopia	Conchapelopia		2	Predator	sp	6.1
Insecta	Diptera	Chironomidae	Cryptochironomus	Cryptochironomus		2	Predator	sp, bu	7.6
Gastropoda	Neotaenioglossa	Pleuroceridae	Elimia	Elimia		1	Scraper	cb	10
Insecta	Diptera	Tipulidae	Erioptera	Erioptera		2	Collector	bu	4.8
Gastropoda	Basommatophora	Lymnaeidae	Fossaria	Fossaria		1	Scraper	cb	6.9
Insecta	Diptera	Chironomidae	Heterotrissocladius	Heterotrissocladius		1	Collector	sp, bu	2
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus		7	Scraper	sp	7.2
Insecta	Coleoptera	Hydrophilidae	Hydrobius	Hydrobius		1	Collector	cb, cn, sp	4.1
Insecta	Lepidoptera	not identified	not identified	Lepidoptera		1	Shredder	na	6.7
Insecta	Coleoptera	Dryopidae	Macronychus	Macronychus		1	Scraper	cn	6.8
Insecta	Diptera	Stratiomyidae	Odontomyia	Odontomyia		1	Collector	sp	na
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius		6	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	1	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus		5	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratendipes	Paratendipes		30	Collector	bu	6.6
Gastropoda	Basommatophora	Physidae	Physa	Physa		1	Scraper	cb	7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum		3	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Saetheria	Saetheria		13	Collector	bu	6.6
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia		3	Collector	sp	8.2
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus		3	Filterer	cb, cn	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia		6	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae		8	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia		7	Collector	sp	5.1

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

11LP-1-03

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Tipulidae	Antocha	Antocha		3	Collector	cn	8
Insecta	Odonata	Coenagrionidae	Argia	Argia		1	Predator	cn, cb, sp	9.3
Insecta	Diptera	Chironomidae	Brillia	Brillia		1	Shredder	bu, sp	7.4
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx		3	Predator	cb	8.3
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche		3	Filterer	cn	6.5
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra		2	Filterer	cn	4.4
Insecta	Diptera	Chironomidae	Diamesa	Diamesa		2	Collector	sp	8.5
Insecta	Diptera	Chironomidae	not identified	Diamesinae		3	Collector	cn, bu	7.1
Insecta	Diptera	Tipulidae	Dicranota	Dicranota		1	Predator	sp, bu	1.1
Gastropoda	Neotaenioglossa	Pleuroceridae	Elimia	Elimia		1	Scraper	cb	10
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus		1	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche		1	Filterer	cn	7.5
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius		13	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	P	1	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus		2	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratendipes	Paratendipes		14	Collector	bu	6.6
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum		35	Shredder	cb, cn	6.3
Insecta	Diptera	Ceratopogonidae	Probezzia	Probezzia		1	Predator	bu	3
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis		6	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Stenochironomus	Stenochironomus		1	Shredder	bu	7.9
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus		1	Filterer	cb, cn	4.9
Insecta	Diptera	Chironomidae	Thienemanniella	Thienemanniella		2	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia		7	Predator	sp	6.7
Insecta	Diptera	Tipulidae	not identified	Tipulidae	P	1	Predator	bu, sp	4.8
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia		5	Collector	sp	5.1

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

11LP-1-04

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Stratiomyidae	Allognosta	Allognosta		1	Collector	sp, bu	na
Insecta	Odonata	Coenagrionidae	Argia	Argia		1	Predator	cn, cb, sp	9.3
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche		1	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	Chironomus	Chironomus		1	Collector	bu	4.6
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus		7	Shredder	cn, bu	9.6
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona		1	Filterer	cn	2.7
Insecta	Diptera	Chironomidae	Diplocladius	Diplocladius		1	Collector	sp	5.9
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella		1	Collector	sp	6.1
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus		7	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche		2	Filterer	cn	7.5
Insecta	Diptera	Chironomidae	Limnophyes	Limnophyes	P	1	Collector	sp	8.6
Clitellata	Lumbriculada	Lumbriculidae	not identified	Lumbriculidae		1	Collector	bu	6.6
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	P	1	Collector	cb, sp	2.1
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra		10	Collector	cb, sp	2.1
Clitellata	Haplotaxida	Naididae	not identified	Naididae		1	Collector	bu	9.1
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius		11	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus		49	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum		3	Shredder	cb, cn	6.3
Insecta	Diptera	Simuliidae	Simulium	Simulium		2	Filterer	cn	5.7
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia		1	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae		3	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia		2	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Zavrelimyia	Zavrelimyia		1	Predator	sp	5.3

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

Little Patuxent Watershed
Biological Monitoring and Assessment
Benthic Macroinvertebrate Data

Howard County
2006

11LP-1-05A

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Ablabesmyia	Ablabesmyia		2	Predator	sp	8.1
Insecta	Odonata	Aeshnidae	Aeshna	Aeshna		1	Predator	cb	3
Insecta	Diptera	Tipulidae	Antocha	Antocha		1	Collector	cn	8
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx		2	Predator	cb	8.3
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche		3	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	not identified	Chironomidae	P	2	Collector	na	6.6
Insecta	Diptera	Chironomidae	Conchapelopia	Conchapelopia		3	Predator	sp	6.1
Insecta	Diptera	Chironomidae	Conchapelopia	Conchapelopia		1	Predator	sp	6.1
Insecta	Diptera	Chironomidae	Dicrotendipes	Dicrotendipes		2	Collector	bu	9
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus		2	Scraper	sp	7.2
Insecta	Coleoptera	Hydrophilidae	Hydrobius	Hydrobius		1	Collector	cb, cn, sp	4.1
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche		2	Filterer	cn	7.5
Arachnida	Acariformes	Hydrobatidae	not identified	Hygrobatidae		1	na	na	na
Insecta	Lepidoptera	not identified	not identified	Lepidoptera		1	Shredder	na	6.7
Clitellata	Lumbriculada	Lumbriculidae	not identified	Lumbriculidae		1	Collector	bu	6.6
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra		5	Collector	cb, sp	2.1
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes		1	Filterer	cn	4.9
Insecta	Megaloptera	Corydalidae	Nigronia	Nigronia		2	Predator	cn, cb	1.4
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae		3	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius		9	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus		5	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratendipes	Paratendipes		3	Collector	bu	6.6
Insecta	Diptera	Chironomidae	Phaenopsectra	Phaenopsectra		1	Collector	cn	8.7
Gastropoda	Basommatophora	Physidae	Physa	Physa		1	Scraper	cb	7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	P	1	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum		14	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Potthastia	Potthastia		3	Omnivore	sp	0
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	P	1	Filterer	cn	7.2
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis		1	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus		4	Filterer	cb, cn	4.9
Insecta	Diptera	Chironomidae	Thienemanniella	Thienemanniella		2	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia		19	Predator	sp	6.7
Insecta	Diptera	Tipulidae	Tipula	Tipula		1	Shredder	bu	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae		2	Collector	cn	8.4

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

11LP-1-05A QC

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Ablabesmyia	Ablabesmyia		3	Predator	sp	8.1
Insecta	Odonata	Coenagrionidae	Argia	Argia		3	Predator	cn, cb, sp	9.3
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx		1	Predator	cb	8.3
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche		2	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	not identified	Chironomini	P	1	Collector	bu	6
Insecta	Diptera	Chironomidae	Conchapelopia	Conchapelopia	P	1	Predator	sp	6.1
Insecta	Diptera	Chironomidae	Cryptochironomus	Cryptochironomus		1	Predator	sp, bu	7.6
Insecta	Diptera	Chironomidae	Dicrotendipes	Dicrotendipes		5	Collector	bu	9
Insecta	Diptera	Empididae	Hemerodromia	Hemerodromia		1	Predator	sp, bu	7.9
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus		7	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche		1	Filterer	cn	7.5
Insecta	Diptera	Chironomidae	Limnophyes	Limnophyes		1	Collector	sp	8.6
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra		8	Collector	cb, sp	2.1
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes		3	Filterer	cn	4.9
Insecta	Megaloptera	Corydalidae	Nigronia	Nigronia		3	Predator	cn, cb	1.4
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae		2	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius		7	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus		4	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratendipes	Paratendipes		7	Collector	bu	6.6
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum		13	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Potthastia	Potthastia		1	Omnivore	sp	0
Insecta	Diptera	Chironomidae	Potthastia	Potthastia		4	Omnivore	sp	0
Insecta	Diptera	Simuliidae	Simulium	Simulium		1	Filterer	cn	5.7
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis		1	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Synorthocladius	Synorthocladius		1	Collector	na	6.6
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus		5	Filterer	cb, cn	4.9
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	P	1	Filterer	cb, cn	4.9
Insecta	Diptera	Chironomidae	Thienemanniella	Thienemanniella		1	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Thienemanniella	Thienemanniella	P	1	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia		13	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae		2	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Zavrelimyia	Zavrelimyia		2	Predator	sp	5.3

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

11LP-1-06A

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura		14	Shredder	sp, cn	3
Insecta	Diptera	Tipulidae	Antocha	Antocha		3	Collector	cn	8
Insecta	Trichoptera	Hydropsychidae	Ceratopsyche	Ceratopsyche		1	Filterer	cn	5
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche		1	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus		2	Shredder	cn, bu	9.6
Insecta	Diptera	Chironomidae	Diamesa	Diamesa		2	Collector	sp	8.5
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona		2	Filterer	cn	2.7
Insecta	Trichoptera	Philopotamidae	Dolophilodes	Dolophilodes		1	Collector	cn	1.7
Insecta	Ephemeroptera	Ephemerellidae	Ephemerella	Ephemerella		6	Collector	cn, sw	2.3
Insecta	Diptera	Empididae	Hemerodromia	Hemerodromia		1	Predator	sp, bu	7.9
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche		6	Filterer	cn	7.5
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra		1	Collector	cb, sp	2.1
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes		1	Filterer	cn	4.9
Insecta	Megaloptera	Corydalidae	Nigronia	Nigronia		1	Predator	cn, cb	1.4
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae		1	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius		6	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus		8	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratendipes	Paratendipes		2	Collector	bu	6.6
Insecta	Trichoptera	Philopotamidae	not identified	Philopotamidae	P	1	Filterer	cn	2.6
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum		33	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Potthastia	Potthastia		1	Omnivore	sp	0
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus		1	Collector	sp	6.2
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus		1	Filterer	cn	7.2
Insecta	Diptera	Simuliidae	Simulium	Simulium		1	Filterer	cn	5.7
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis		1	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Sympotthastia	Sympotthastia		2	Collector	sp	8.2
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus		1	Filterer	cb, cn	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia		10	Predator	sp	6.7
Insecta	Diptera	Tipulidae	not identified	Tipulidae	P	1	Predator	bu, sp	4.8
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia		2	Collector	sp	5.1

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11LP-1-07

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae		1	Predator	sp, bu	3.6
Insecta	Diptera	Chironomidae	not identified	Chironomidae		1	Collector	na	6.6
Insecta	Diptera	Chironomidae	Chironomus	Chironomus		1	Collector	bu	4.6
Insecta	Diptera	Chironomidae	Conchapelopia	Conchapelopia		1	Predator	sp	6.1
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus		4	Scraper	sp	7.2
Insecta	Diptera	Chironomidae	Limnophyes	Limnophyes		3	Collector	sp	8.6
Clitellata	Lumbriculada	Lumbriculidae	not identified	Lumbriculidae		1	Collector	bu	6.6
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra		60	Collector	cb, sp	2.1
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	P	4	Collector	cb, sp	2.1
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius		12	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum		3	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Procladius	Procladius	P	1	Predator	sp	1.2
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia		1	Predator	sp	6.7
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia		4	Collector	sp	5.1

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11LP-2-01

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Ablabesmyia	Ablabesmyia		6	Predator	sp	8.1
Insecta	Diptera	Tipulidae	Antocha	Antocha		1	Collector	cn	8
Insecta	Odonata	Aeshnidae	Boyeria	Boyeria		2	Predator	cb, sp	6.3
Insecta	Diptera	Chironomidae	Brillia	Brillia		5	Shredder	bu, sp	7.4
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx		2	Predator	cb	8.3
Insecta	Trichoptera	Hydropsychidae	Ceratopsyche	Ceratopsyche		1	Filterer	cn	5
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche		18	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	not identified	Chironomidae		1	Collector	na	6.6
Insecta	Diptera	Chironomidae	Diamesa	Diamesa		1	Collector	sp	8.5
Insecta	Diptera	Chironomidae	Dicrotendipes	Dicrotendipes		2	Collector	bu	9
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus		3	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	not identified	Hydropsychidae	P	1	Filterer	cn	5.7
Insecta	Coleoptera	Dytiscidae	Hygrotus	Hygrotus		1	Predator	sw, dv	5.4
Insecta	Ephemeroptera	Isonychiidae	Isonychia	Isonychia		1	Filterer	sw, cn	2.5
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra		4	Collector	cb, sp	2.1
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes		1	Filterer	cn	4.9
Insecta	Megaloptera	Corydalidae	Nigronia	Nigronia		1	Predator	cn, cb	1.4
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius		10	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Parakiefferiella	Parakiefferiella		1	Collector	sp	2.1
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus		4	Collector	sp	4.6
Insecta	Trichoptera	Philopotamidae	not identified	Philopotamidae	P	1	Filterer	cn	2.6
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	P	1	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum		20	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus		5	Collector	sp	6.2
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus		1	Filterer	cn	7.2
Insecta	Diptera	Simuliidae	Simulium	Simulium		1	Filterer	cn	5.7
Insecta	Ephemeroptera	Heptageniidae	Stenonema	Stenonema		1	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus		1	Filterer	cb, cn	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia		11	Predator	sp	6.7
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia		4	Collector	sp	5.1

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11LP-2-02

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Ablabesmyia	Ablabesmyia		25	Predator	sp	8.1
Insecta	Diptera	Chironomidae	Brillia	Brillia		1	Shredder	bu, sp	7.4
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx		1	Predator	cb	8.3
Insecta	Diptera	Chironomidae	not identified	Chironomini		1	Collector	bu	6
Insecta	Diptera	Chironomidae	Cladotanytarsus	Cladotanytarsus		1	Filterer	-	6.6
Insecta	Diptera	Chironomidae	Conchapelopia	Conchapelopia	P	3	Predator	sp	6.1
Insecta	Diptera	Chironomidae	Conchapelopia	Conchapelopia		4	Predator	sp	6.1
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx		11	Collector	sp	6.7
Insecta	Diptera	Chironomidae	Cryptotendipes	Cryptotendipes		2	Collector	sp	6.6
Insecta	Diptera	Chironomidae	Dicrotendipes	Dicrotendipes		3	Collector	bu	9
Insecta	Odonata	Gomphidae	not identified	Gomphidae		1	Predator	bu	2.2
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus		2	Scraper	sp	7.2
Clitellata	Haplotaxida	Naididae	not identified	Naididae		1	Collector	bu	9.1
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae		1	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius		1	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus		1	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratendipes	Paratendipes		10	Collector	bu	6.6
Gastropoda	Basommatophora	Physidae	Physa	Physa		3	Scraper	cb	7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum		9	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Potthastia	Potthastia		1	Omnivore	sp	0
Insecta	Ephemeroptera	Heptageniidae	Stenonema	Stenonema		2	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	not identified	Tanypodinae		1	Predator	sp, sw	7.5
Insecta	Diptera	Chironomidae	not identified	Tanytarsini		2	Filterer	na	3.5
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	P	1	Filterer	cb, cn	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia		13	Predator	sp	6.7
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia		2	Collector	sp	5.1

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11LP-2-03

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Ablabesmyia	Ablabesmyia		9	Predator	sp	8.1
Insecta	Odonata	Aeshnidae	Boyeria	Boyeria		2	Predator	cb, sp	6.3
Insecta	Diptera	Chironomidae	Brillia	Brillia		3	Shredder	bu, sp	7.4
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx		7	Predator	cb	8.3
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche		5	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	Conchapelopia	Conchapelopia		1	Predator	sp	6.1
Insecta	Diptera	Chironomidae	Conchapelopia	Conchapelopia	P	2	Predator	sp	6.1
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura		1	Collector	sp	4.1
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx		2	Collector	sp	6.7
Insecta	Ephemeroptera	Ephemerellidae	Ephemerella	Ephemerella		1	Collector	cn, sw	2.3
Insecta	Diptera	Empididae	Hemerodromia	Hemerodromia		1	Predator	sp, bu	7.9
Insecta	Trichoptera	Hydropsychidae	not identified	Hydropsychidae	P	2	Filterer	cn	5.7
Insecta	Ephemeroptera	Isonychiidae	Isonychia	Isonychia		1	Filterer	sw, cn	2.5
Insecta	Lepidoptera	not identified	not identified	Lepidoptera		1	Shredder	na	6.7
Insecta	Diptera	Chironomidae	Limnophyes	Limnophyes		1	Collector	sp	8.6
Gastropoda	Basommatophora	Lymnaeidae	not identified	Lymnaeidae		1	Scraper	cb	6.9
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra		6	Collector	cb, sp	2.1
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	P	1	Collector	cb, sp	2.1
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius		2	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus		4	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratendipes	Paratendipes		11	Collector	bu	6.6
Insecta	Diptera	Chironomidae	Phaenopsectra	Phaenopsectra		1	Collector	cn	8.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum		18	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus		2	Filterer	cn	7.2
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	P	1	Filterer	cn	7.2
Insecta	Diptera	Simuliidae	Simulium	Simulium		1	Filterer	cn	5.7
Insecta	Coleoptera	Hydrophilidae	Sperchopsis	Sperchopsis		1	Collector	cn	4.1
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis		1	Scraper	cn	7.1
Insecta	Ephemeroptera	Heptageniidae	Stenonema	Stenonema		3	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus		1	Filterer	cb, cn	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia		4	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae		2	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia		8	Collector	sp	5.1

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

Little Patuxent Watershed
Biological Monitoring and Assessment
Benthic Macroinvertebrate Data

Howard County
2006

12LP-1-01

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus		3	Shredder	cn, bu	9.6
Insecta	Coleoptera	Dytiscidae	not identified	Dytiscidae		1	Predator	sw, dv	5.4
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae		1	Collector	bu	9.1
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus		14	Scraper	sp	7.2
Insecta	Lepidoptera	not identified	not identified	Lepidoptera		1	Shredder	na	6.7
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra		1	Collector	cb, sp	2.1
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	1	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius		60	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus		15	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Psectrocladius	Psectrocladius		1	Shredder	sp, bu	6.6
Insecta	Diptera	Chironomidae	Smittia	Smittia		7	Collector	lentic	6.6
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae		1	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Zavrelimyia	Zavrelimyia		2	Predator	sp	5.3

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

Little Patuxent Watershed
Biological Monitoring and Assessment
Benthic Macroinvertebrate Data

Howard County
2006

12LP-1-02

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Ablabesmyia	Ablabesmyia		2	Predator	sp	8.1
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura		1	Shredder	sp, cn	3
Insecta	Odonata	Aeshnidae	Boyeria	Boyeria		2	Predator	cb, sp	6.3
Insecta	Diptera	Chironomidae	Brillia	Brillia		2	Shredder	bu, sp	7.4
Insecta	Diptera	Chironomidae	not identified	Chironomidae		1	Collector	na	6.6
Insecta	Ephemeroptera	Baetidae	Cloeon	Cloeon		1	Collector	sw, cn	2.3
Insecta	Diptera	Chironomidae	Conchapelopia	Conchapelopia	P	1	Predator	sp	6.1
Insecta	Diptera	Chironomidae	Cryptochironomus	Cryptochironomus		1	Predator	sp, bu	7.6
Insecta	Diptera	Chironomidae	Diamesa	Diamesa		1	Collector	sp	8.5
Insecta	Diptera	Chironomidae	Dicrotendipes	Dicrotendipes		2	Collector	bu	9
Insecta	Plecoptera	Perlidae	Eccoptura	Eccoptura		2	Predator	cn	0.6
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae		1	Collector	bu	9.1
Insecta	Ephemeroptera	Ephemerellidae	Ephemerella	Ephemerella		7	Collector	cn, sw	2.3
Insecta	Ephemeroptera	Ephemerellidae	Eurylophella	Eurylophella		10	Scraper	cn, sp	4.5
Insecta	Trichoptera	Lepidostomatidae	Lepidostoma	Lepidostoma		1	Shredder	cb, sp, cn	0
Insecta	Ephemeroptera	Leptophlebiidae	not identified	Leptophlebiidae		1	Collector	sw, cn	1.7
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra		6	Collector	cb, sp	2.1
Insecta	Megaloptera	Corydalidae	Nigronia	Nigronia		1	Predator	cn, cb	1.4
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae		4	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius		20	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus		5	Collector	sp	4.6
Insecta	Plecoptera	Perlidae	not identified	Perlidae		1	Predator	cn	2.2
Gastropoda	Basommatophora	Physidae	Physa	Physa		3	Scraper	cb	7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum		3	Shredder	cb, cn	6.3
Insecta	Megaloptera	Sialidae	Sialis	Sialis		1	Predator	bu, cb, cn	1.9
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	A	1	Scraper	cn	7.1
Insecta	Ephemeroptera	Heptageniidae	Stenonema	Stenonema		4	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	not identified	Tanypodinae	P	3	Predator	sp, sw	7.5
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus		2	Filterer	cb, cn	4.9
Insecta	Diptera	Chironomidae	Telopelopia	Telopelopia		2	Predator	na	7.5
Insecta	Diptera	Chironomidae	Thienemanniella	Thienemanniella		7	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia		2	Predator	sp	6.7
Insecta	Diptera	Tipulidae	Tipula	Tipula		1	Shredder	bu	6.7
Insecta	Diptera	Chironomidae	Trissopelopia	Trissopelopia	P	1	Predator	sp	4.1
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae		1	Collector	cn	8.4

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

12LP-1-03

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Coleoptera	Carabidae	not identified	Carabidae		1	Predator	cn	na
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche		1	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus		9	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche		1	Filterer	cn	7.5
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae		1	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	3	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius		65	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus		31	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus		1	Collector	sp	7.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum		4	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Smittia	Smittia		2	Collector	lentic	6.6
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae		1	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia		1	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Zavrelimyia	Zavrelimyia		1	Predator	sp	5.3

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

12LP-1-04

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Ablabesmyia	Ablabesmyia		1	Predator	sp	8.1
Insecta	Coleoptera	Ptilodactylidae	Anchytarsus	Anchytarsus		3	Shredder	cn	3.1
Insecta	Ephemeroptera	Baetidae	Baetis	Baetis		8	Collector	sw, cb, cn	3.9
Insecta	Diptera	Chironomidae	Conchapelopia	Conchapelopia		1	Predator	sp	6.1
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona		1	Filterer	cn	2.7
Insecta	Trichoptera	Philopotamidae	Dolophilodes	Dolophilodes		1	Collector	cn	1.7
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia		1	Scraper	cn, cb	5.7
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia	A	1	Scraper	cn, cb	5.7
Insecta	Plecoptera	Perlidae	Eccoptura	Eccoptura		1	Predator	cn	0.6
Insecta	Ephemeroptera	Ephemerellidae	Ephemerella	Ephemerella		2	Collector	cn, sw	2.3
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella		1	Collector	sp	6.1
Insecta	Ephemeroptera	Ephemerellidae	Eurylophella	Eurylophella		6	Scraper	cn, sp	4.5
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche		1	Filterer	cn	7.5
Insecta	Ephemeroptera	Leptophlebiidae	not identified	Leptophlebiidae		28	Collector	sw, cn	1.7
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra		9	Collector	cb, sp	2.1
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes		1	Filterer	cn	4.9
Insecta	Coleoptera	Elmidae	Optioservus	Optioservus		3	Scraper	cn	5.4
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae		1	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus		2	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum		12	Shredder	cb, cn	6.3
Insecta	Trichoptera	Rhyacophilidae	Rhyacophila	Rhyacophila		1	Predator	cn	2.1
Insecta	Diptera	Simuliidae	Simulium	Simulium		2	Filterer	cn	5.7
Insecta	Diptera	Chironomidae	Smittia	Smittia		1	Collector	lentic	6.6
Insecta	Diptera	Chironomidae	Stempellinella	Stempellinella		1	Collector	cb, sp, cn	4.2
Insecta	Ephemeroptera	Heptageniidae	Stenonema	Stenonema		6	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus		1	Filterer	cb, cn	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia		8	Predator	sp	6.7
Insecta	Diptera	Tipulidae	not identified	Tipulidae	P	1	Predator	bu, sp	4.8
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia		3	Collector	sp	5.1

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

12LP-1-05

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Ablabesmyia	Ablabesmyia		1	Predator	sp	8.1
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura		2	Shredder	sp, cn	3
Insecta	Coleoptera	Ptilodactylidae	Anchytarsus	Anchytarsus		3	Shredder	cn	3.1
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx		2	Predator	cb	8.3
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche		2	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	not identified	Chironomini		1	Collector	bu	6
Insecta	Diptera	Chironomidae	Conchapelopia	Conchapelopia	P	2	Predator	sp	6.1
Insecta	Diptera	Tipulidae	Dicranota	Dicranota		3	Predator	sp, bu	1.1
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona		1	Filterer	cn	2.7
Insecta	Trichoptera	Philopotamidae	Dolophilodes	Dolophilodes		1	Collector	cn	1.7
Insecta	Ephemeroptera	Ephemerellidae	Ephemerella	Ephemerella		18	Collector	cn, sw	2.3
Insecta	Ephemeroptera	Ephemerellidae	Eurylophella	Eurylophella		8	Scraper	cn, sp	4.5
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus		3	Scraper	sp	7.2
Insecta	Trichoptera	Limnephilidae	Ironoquia	Ironoquia		1	Shredder	sp	4.9
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra		6	Collector	cb, sp	2.1
Clitellata	Haplotaxida	Naididae	not identified	Naididae		2	Collector	bu	9.1
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius		4	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus		2	Collector	sp	4.6
Insecta	Plecoptera	Perlidae	not identified	Perlidae		1	Predator	cn	2.2
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum		12	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus		1	Filterer	cn	7.2
Insecta	Diptera	Chironomidae	Saetheria	Saetheria		3	Collector	bu	6.6
Insecta	Ephemeroptera	Heptageniidae	Stenonema	Stenonema		6	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	not identified	Tanypodinae		1	Predator	sp, sw	7.5
Insecta	Diptera	Chironomidae	not identified	Tanypodinae		1	Predator	sp, sw	7.5
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus		7	Filterer	cb, cn	4.9
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	P	1	Filterer	cb, cn	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia		8	Predator	sp	6.7
Insecta	Diptera	Tipulidae	Tipula	Tipula		1	Shredder	bu	6.7

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12LP-1-05 QC

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Ablabesmyia	Ablabesmyia		2	Predator	sp	8.1
Insecta	Plecoptera	Nemouridae	Amphinemura	Amphinemura		6	Shredder	sp, cn	3
Insecta	Coleoptera	Ptilodactylidae	Anchytarsus	Anchytarsus		13	Shredder	cn	3.1
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx		2	Predator	cb	8.3
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche		2	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	Cryptochironomus	Cryptochironomus		1	Predator	sp, bu	7.6
Insecta	Diptera	Tipulidae	Dicranota	Dicranota		5	Predator	sp, bu	1.1
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona		3	Filterer	cn	2.7
Insecta	Ephemeroptera	Ephemerellidae	Ephemerella	Ephemerella		17	Collector	cn, sw	2.3
Insecta	Ephemeroptera	Ephemerellidae	Eurylophella	Eurylophella		4	Scraper	cn, sp	4.5
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche		2	Filterer	cn	7.5
Insecta	Trichoptera	Limnephilidae	Ironoquia	Ironoquia		1	Shredder	sp	4.9
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra		3	Collector	cb, sp	2.1
Insecta	Coleoptera	Dryopidae	Oulimnius	Oulimnius		1	Scraper	cn	2.7
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus		3	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	P	1	Collector	sp	7.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum		4	Shredder	cb, cn	6.3
Insecta	Diptera	Tipulidae	Pseudolimnophila	Pseudolimnophila		1	Predator	bu	2.8
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus		2	Filterer	cn	7.2
Insecta	Diptera	Chironomidae	Saetheria	Saetheria		1	Collector	bu	6.6
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	A	1	Scraper	cn	7.1
Insecta	Ephemeroptera	Heptageniidae	Stenonema	Stenonema		5	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	not identified	Tanypodinae		1	Predator	sp, sw	7.5
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus		6	Filterer	cb, cn	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia		8	Predator	sp	6.7
Insecta	Diptera	Chironomidae	Trissopelopia	Trissopelopia	P	4	Predator	sp	4.1
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia		1	Collector	sp	5.1

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12LP-1-06

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Odonata	Coenagrionidae	Argia	Argia		2	Predator	cn, cb, sp	9.3
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche		3	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	not identified	Chironomini		1	Collector	bu	6
Insecta	Diptera	Chironomidae	not identified	Chironomini	P	3	Collector	bu	6
Insecta	Diptera	Chironomidae	Chironomus	Chironomus		5	Collector	bu	4.6
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx		1	Collector	sp	6.7
Insecta	Diptera	Chironomidae	Diamesa	Diamesa		3	Collector	sp	8.5
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	P	2	Collector	sp	8.5
Insecta	Diptera	Chironomidae	Dicrotendipes	Dicrotendipes		2	Collector	bu	9
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia	A	1	Scraper	cn, cb	5.7
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia		1	Scraper	cn, cb	5.7
Insecta	Odonata	Coenagrionidae	Enallagma	Enallagma		2	Predator	cb	9
Insecta	Diptera	Chironomidae	Glyptotendipes	Glyptotendipes		5	Filterer	bu, cn	6.6
Clitellata	Lumbriculada	Lumbriculidae	not identified	Lumbriculidae		2	Collector	bu	6.6
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra		1	Collector	cb, sp	2.1
Clitellata	Haplotaxida	Naididae	not identified	Naididae		28	Collector	bu	9.1
Insecta	Trichoptera	Leptoceridae	Oecetis	Oecetis		1	Predator	cn, sp, cb	4.7
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius		9	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	1	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus		1	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus		1	Collector	sp	7.7
Gastropoda	Basommatophora	Physidae	Physa	Physa		2	Scraper	cb	7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum		17	Shredder	cb, cn	6.3
Enopla	Hoplonemertea	Tetrastemmatidae	Prostoma	Prostoma		1	Predator	na	7.3
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis		4	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Thienemanniella	Thienemanniella		1	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia		2	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae		7	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia		4	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	P	1	Collector	sp	5.1

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

12LP-1-07

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Ephemeroptera	Baetidae	not identified	Baetidae		1	Collector	sw, cn	2.3
Insecta	Ephemeroptera	Baetidae	Baetis	Baetis		1	Collector	sw, cb, cn	3.9
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx		2	Predator	cb	8.3
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche		2	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	Dicrotendipes	Dicrotendipes		1	Collector	bu	9
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus		5	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	not identified	Hydropsychidae		12	Filterer	cn	5.7
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra		3	Collector	cb, sp	2.1
Clitellata	Haplotaxida	Naididae	not identified	Naididae		1	Collector	bu	9.1
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius		24	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus		43	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratendipes	Paratendipes		1	Collector	bu	6.6
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum		8	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Smittia	Smittia		2	Collector	lentic	6.6
Insecta	Diptera	Chironomidae	Thienemanniella	Thienemanniella		1	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia		1	Predator	sp	6.7
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia		2	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Zavrelimyia	Zavrelimyia		1	Predator	sp	5.3

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

12LP-2-01

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Coleoptera	Ptilodactylidae	Anchytarsus	Anchytarsus		4	Shredder	cn	3.1
Insecta	Diptera	Tipulidae	Antocha	Antocha		1	Collector	cn	8
Insecta	Ephemeroptera	Baetidae	not identified	Baetidae		3	Collector	sw, cn	2.3
Insecta	Ephemeroptera	Baetidae	Baetis	Baetis		1	Collector	sw, cb, cn	3.9
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche		6	Filterer	cn	6.5
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra		1	Filterer	cn	4.4
Insecta	Diptera	Chironomidae	not identified	Chironomini		1	Collector	bu	6
Insecta	Diptera	Chironomidae	Cladotanytarsus	Cladotanytarsus		1	Filterer	-	6.6
Insecta	Ephemeroptera	Ephemerellidae	Ephemerella	Ephemerella		4	Collector	cn, sw	2.3
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella		1	Collector	sp	6.1
Insecta	Ephemeroptera	Ephemerellidae	Eurylophella	Eurylophella		1	Scraper	cn, sp	4.5
Insecta	Trichoptera	Glossosomatidae	Glossosoma	Glossosoma		1	Scraper	cn	0
Insecta	Diptera	Tipulidae	Hexatoma	Hexatoma		1	Predator	bu, sp	1.5
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche		1	Filterer	cn	7.5
Insecta	Trichoptera	Limnephilidae	Ironoquia	Ironoquia		2	Shredder	sp	4.9
Insecta	Coleoptera	Elmidae	Optioservus	Optioservus		1	Scraper	cn	5.4
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius		5	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus		15	Collector	sp	4.6
Insecta	Plecoptera	Perlidae	Perlesta	Perlesta		1	Predator	cn	1.6
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	P	2	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum		21	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Potthastia	Potthastia		3	Omnivore	sp	0
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis		1	Scraper	cn	7.1
Insecta	Ephemeroptera	Heptageniidae	Stenonema	Stenonema		10	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia		6	Predator	sp	6.7
Insecta	Diptera	Tipulidae	not identified	Tipulidae	P	4	Predator	bu, sp	4.8
Insecta	Trichoptera	not identified	not identified	Trichoptera	P	1	na	na	4.6
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia		1	Collector	sp	5.1

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

12LP-3-01

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Ablabesmyia	Ablabesmyia		1	Predator	sp	8.1
Insecta	Odonata	Coenagrionidae	Argia	Argia		2	Predator	cn, cb, sp	9.3
Insecta	Odonata	Aeshnidae	Boyeria	Boyeria		1	Predator	cb, sp	6.3
Insecta	Diptera	Chironomidae	Brillia	Brillia		2	Shredder	bu, sp	7.4
Crustacea	Isopoda	Asellidae	Caecidotea	Caecidotea		1	Collector	sp	2.6
Insecta	Ephemeroptera	Caenidae	Caenis	Caenis		1	Collector	sp	2.1
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx		1	Predator	cb	8.3
Insecta	Trichoptera	Polycentropodidae	Cernotina	Cernotina		1	Predator	cn	6
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche		1	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	not identified	Chironomini	P	1	Collector	bu	6
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx		19	Collector	sp	6.7
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus		7	Shredder	cn, bu	9.6
Insecta	Coleoptera	Curculionidae	not identified	Curculionidae	A	1	Shredder	cn	na
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia		1	Scraper	cn, cb	5.7
Insecta	Odonata	Coenagrionidae	Enallagma	Enallagma		3	Predator	cb	9
Clitellata	Arhynchobdellida	Erpobdellidae	not identified	Erpobdellidae		1	Predator	sp	10
Insecta	Odonata	Gomphidae	Gomphus	Gomphus		1	Predator	bu	2.2
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus		1	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche		1	Filterer	cn	7.5
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra		2	Collector	cb, sp	2.1
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes		3	Filterer	cn	4.9
Insecta	Diptera	Muscidae	not identified	Muscidae		1	Predator	sp	7
Clitellata	Haplotaxida	Naididae	not identified	Naididae		6	Collector	bu	9.1
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae		1	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	3	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius		13	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	P	1	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus		3	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus		9	Collector	sp	7.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum		1	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	P	1	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus		7	Filterer	cn	7.2
Insecta	Diptera	Simuliidae	Simulium	Simulium		1	Filterer	cn	5.7
Insecta	Diptera	Chironomidae	Stenochironomus	Stenochironomus		1	Shredder	bu	7.9
Insecta	Ephemeroptera	Heptageniidae	Stenonema	Stenonema		3	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus		1	Filterer	cb, cn	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia		4	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae		2	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	P	1	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia		1	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Xestochironomus	Xestochironomus		1	Collector	na	6.6

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Little Patuxent Watershed
Biological Monitoring and Assessment
Benthic Macroinvertebrate Data

Howard County
2006

12LP-3-02

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Ephemeroptera	Baetidae	Baetis	Baetis		1	Collector	sw, cb, cn	3.9
Insecta	Odonata	Aeshnidae	Boyeria	Boyeria		1	Predator	cb, sp	6.3
Insecta	Diptera	Chironomidae	Brillia	Brillia		2	Shredder	bu, sp	7.4
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx		1	Predator	cb	8.3
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche		3	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	Cladotanytarsus	Cladotanytarsus		2	Filterer	-	6.6
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx		2	Collector	sp	6.7
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	P	2	Shredder	cn, bu	9.6
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus		9	Shredder	cn, bu	9.6
Insecta	Diptera	Chironomidae	Dicrotendipes	Dicrotendipes		1	Collector	bu	9
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia		2	Scraper	cn, cb	5.7
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus		1	Scraper	sp	7.2
Insecta	Coleoptera	Dryopidae	Macronychus	Macronychus		1	Scraper	cn	6.8
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra		2	Collector	cb, sp	2.1
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra		2	Collector	cb, sp	2.1
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes		6	Filterer	cn	4.9
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae		1	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius		2	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus		5	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus		10	Collector	sp	7.7
Gastropoda	Basommatophora	Physidae	Physa	Physa		1	Scraper	cb	7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum		3	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus		6	Collector	sp	6.2
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus		16	Filterer	cn	7.2
Insecta	Diptera	Simuliidae	Simulium	Simulium		3	Filterer	cn	5.7
Insecta	Ephemeroptera	Heptageniidae	Stenonema	Stenonema		2	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus		1	Filterer	cb, cn	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia		3	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae		2	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia		8	Collector	sp	5.1

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13LP-1-01

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Odonata	Aeshnidae	Boyeria	Boyeria		1	Predator	cb, sp	6.3
Insecta	Diptera	Chironomidae	Brillia	Brillia		1	Shredder	bu, sp	7.4
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche		2	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	Chironomus	Chironomus		1	Collector	bu	4.6
Insecta	Odonata	Coenagrionidae	not identified	Coenagrionidae		2	Predator	cb	9
Insecta	Diptera	Chironomidae	Conchapelopia	Conchapelopia	P	3	Predator	sp	6.1
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus		1	Shredder	cn, bu	9.6
Insecta	Diptera	Chironomidae	Dicrotendipes	Dicrotendipes		3	Collector	bu	9
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia		2	Scraper	cn, cb	5.7
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus		1	Scraper	sp	7.2
Insecta	Coleoptera	Dytiscidae	Hydroporus	Hydroporus		1	Predator	sw, cb	4.6
Insecta	Odonata	Coenagrionidae	Ischnura	Ischnura		1	Predator	cb	9
Clitellata	Lumbriculada	Lumbriculidae	not identified	Lumbriculidae		9	Collector	bu	6.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	2	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius		8	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	P	2	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus		22	Collector	sp	4.6
Gastropoda	Basommatophora	Physidae	Physa	Physa		1	Scraper	cb	7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum		10	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia		1	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae		33	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	P	1	Collector	sp	5.1

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13LP-1-01 QC

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Odonata	Coenagrionidae	Argia	Argia		1	Predator	cn, cb, sp	9.3
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx		3	Predator	cb	8.3
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche		1	Filterer	cn	6.5
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche		1	Filterer	cn	7.5
Clitellata	Lumbriculada	Lumbriculidae	not identified	Lumbriculidae		12	Collector	bu	6.6
Clitellata	Haplotaxida	Naididae	not identified	Naididae		1	Collector	bu	9.1
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius		4	Collector	sp, bu	9.2
Gastropoda	Basommatophora	Physidae	Physa	Physa		1	Scraper	cb	7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum		3	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia		1	Predator	sp	6.7
Insecta	Diptera	Tipulidae	Tipula	Tipula		1	Shredder	bu	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae		83	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia		1	Collector	sp	5.1

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13LP-1-02

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx		1	Predator	cb	8.3
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche		3	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	Chironomus	Chironomus		1	Collector	bu	4.6
Insecta	Diptera	Chironomidae	Conchapelopia	Conchapelopia	P	1	Predator	sp	6.1
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona		2	Filterer	cn	2.7
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus		15	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche		2	Filterer	cn	7.5
Insecta	Diptera	Chironomidae	Limnophyes	Limnophyes		1	Collector	sp	8.6
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra		1	Collector	cb, sp	2.1
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae		1	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	3	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius		66	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus		7	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum		4	Shredder	cb, cn	6.3
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis		1	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia		1	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Zavrelimyia	Zavrelimyia		1	Predator	sp	5.3

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Howard County
2006

13LP-1-03

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Ephemeroptera	Baetidae	not identified	Baetidae		2	Collector	sw, cn	2.3
Insecta	Diptera	Chironomidae	Brillia	Brillia		5	Shredder	bu, sp	7.4
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx		6	Predator	cb	8.3
Crustacea	Decapoda	Cambaridae	not identified	Cambarinae		1	Shredder	sp	2.8
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche		2	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	Chironomus	Chironomus		3	Collector	bu	4.6
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus		2	Shredder	cn, bu	9.6
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona		1	Filterer	cn	2.7
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae		1	Collector	bu	9.1
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus		4	Scraper	sp	7.2
Clitellata	Lumbriculada	Lumbriculidae	not identified	Lumbriculidae		1	Collector	bu	6.6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae		2	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	7	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius		32	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	P	1	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus		4	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum		1	Shredder	cb, cn	6.3
Insecta	Diptera	Tipulidae	Pseudolimnophila	Pseudolimnophila		1	Predator	bu	2.8
Insecta	Diptera	Chironomidae	Smittia	Smittia		1	Collector	lentic	6.6
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis		5	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Stenochironomus	Stenochironomus		1	Shredder	bu	7.9
Crustacea	Amphipoda	Crangonyctidae	Stygobromus	Stygobromus		1	Collector	sp	6.5
Insecta	Diptera	Chironomidae	not identified	Tanypodinae	P	1	Predator	sp, sw	7.5
Insecta	Diptera	Chironomidae	Thienemanniella	Thienemanniella		1	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia		7	Predator	sp	6.7
Insecta	Diptera	Tipulidae	Tipula	Tipula		1	Shredder	bu	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae		1	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Zavrelimyia	Zavrelimyia		4	Predator	sp	5.3

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

13LP-1-04

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Coleoptera	Dytiscidae	Agabus	Agabus		9	Predator	sw, dv	5.4
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus		1	Shredder	cn, bu	9.6
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona		2	Filterer	cn	2.7
Insecta	Diptera	Empididae	Hemerodromia	Hemerodromia		1	Predator	sp, bu	7.9
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus		6	Scraper	sp	7.2
Insecta	Coleoptera	Dytiscidae	Hydroporus	Hydroporus		8	Predator	sw, cb	4.6
Insecta	Diptera	Chironomidae	Limnophyes	Limnophyes		2	Collector	sp	8.6
Insecta	Coleoptera	Dytiscidae	Lioporeus	Lioporeus	A	2	Predator	sw, dv	5.4
Clitellata	Lumbriculada	Lumbriculidae	not identified	Lumbriculidae		3	Collector	bu	6.6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae		2	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius		25	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus		28	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Smittia	Smittia		2	Collector	lentic	6.6
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae		5	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia		2	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Zavrelimyia	Zavrelimyia		12	Predator	sp	5.3

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

Little Patuxent Watershed
Biological Monitoring and Assessment
Benthic Macroinvertebrate Data

Howard County
2006

13LP-1-05

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Ephemeroptera	Baetidae	Baetis	Baetis		3	Collector	sw, cb, cn	3.9
Insecta	Diptera	Chironomidae	Brillia	Brillia		1	Shredder	bu, sp	7.4
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx		1	Predator	cb	8.3
Crustacea	Decapoda	Cambaridae	not identified	Cambarinae		1	Shredder	sp	2.8
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae		2	Predator	sp, bu	3.6
Insecta	Diptera	Chironomidae	Conchapelopia	Conchapelopia		1	Predator	sp	6.1
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona		1	Filterer	cn	2.7
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae		2	Collector	bu	9.1
Insecta	Diptera	Tipulidae	Erioptera	Erioptera		1	Collector	bu	4.8
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus		2	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche		2	Filterer	cn	7.5
Clitellata	Lumbriculada	Lumbriculidae	not identified	Lumbriculidae		4	Collector	bu	6.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	3	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius		46	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus		21	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum		3	Shredder	cb, cn	6.3
Insecta	Coleoptera	Dytiscidae	Rhantus	Rhantus		1	Predator	sw	5.4
Insecta	Hemiptera	Corixidae	Sigara	Sigara	A	1	Piercer	sw, cb	5.6
Insecta	Diptera	Simuliidae	Simulium	Simulium		1	Filterer	cn	5.7
Insecta	Diptera	Chironomidae	not identified	Tanypodinae		1	Predator	sp, sw	7.5
Insecta	Diptera	Chironomidae	Telopelopia	Telopelopia		1	Predator	na	7.5
Insecta	Diptera	Chironomidae	Thienemanniella	Thienemanniella		1	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia		2	Predator	sp	6.7
Insecta	Diptera	Tipulidae	Tipula	Tipula		2	Shredder	bu	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae		7	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia		2	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Zavrelimyia	Zavrelimyia		6	Predator	sp	5.3

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

13LP-1-06

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche		3	Filterer	cn	6.5
Hexapoda	Collembola	not identified	not identified	Collembola	A	1	Collector	sp, sk	6
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus		11	Scraper	sp	7.2
Insecta	Coleoptera	Dytiscidae	Lioporeus	Lioporeus	A	1	Predator	sw, dv	5.4
Clitellata	Lumbriculada	Lumbriculidae	not identified	Lumbriculidae		1	Collector	bu	6.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	5	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius		88	Collector	sp, bu	9.2
Insecta	Ephemeroptera	Heptageniidae	Stenonema	Stenonema		1	Scraper	cn	4.6

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

13LP-3-02

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Ephemeroptera	Baetidae	Baetis	Baetis		1	Collector	sw, cb, cn	3.9
Insecta	Diptera	Chironomidae	Brillia	Brillia		3	Shredder	bu, sp	7.4
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx		2	Predator	cb	8.3
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche		2	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	not identified	Chironomini	P	1	Collector	bu	6
Insecta	Diptera	Chironomidae	not identified	Chironomini		1	Collector	bu	6
Insecta	Diptera	Chironomidae	Chironomus	Chironomus		1	Collector	bu	4.6
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx		7	Collector	sp	6.7
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus		8	Shredder	cn, bu	9.6
Insecta	Diptera	Chironomidae	Diamesa	Diamesa	P	1	Collector	sp	8.5
Insecta	Diptera	Chironomidae	Dicrotendipes	Dicrotendipes		1	Collector	bu	9
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae		1	Collector	bu	9.1
Insecta	Ephemeroptera	Ephemerellidae	Eurylophella	Eurylophella		2	Scraper	cn, sp	4.5
Insecta	Diptera	Tipulidae	Hexatoma	Hexatoma		2	Predator	bu, sp	1.5
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche		1	Filterer	cn	7.5
Insecta	Odonata	Coenagrionidae	Ischnura	Ischnura		1	Predator	cb	9
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra		1	Collector	cb, sp	2.1
Clitellata	Haplotaxida	Naididae	not identified	Naididae		28	Collector	bu	9.1
Insecta	Diptera	Chironomidae	Nanocladius	Nanocladius		1	Collector	sp	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius		3	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus		5	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus		5	Collector	sp	7.7
Insecta	Ephemeroptera	Baetidae	Plauditus	Plauditus		1	Collector	sw, cn	2.3
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum		3	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus		2	Collector	sp	6.2
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus		6	Filterer	cn	7.2
Insecta	Ephemeroptera	Heptageniidae	Stenonema	Stenonema		1	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus		2	Filterer	cb, cn	4.9
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae		9	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia		3	Collector	sp	5.1

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

Little Patuxent Watershed
Biological Monitoring and Assessment
Benthic Macroinvertebrate Data

Howard County
2006

13LP-3-02A

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Coleoptera	Elmidae	Ancyronyx	Ancyronyx	A	3	Scraper	cn, sp	7.8
Insecta	Ephemeroptera	Baetidae	Baetis	Baetis		8	Collector	sw, cb, cn	3.9
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche		1	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	Chironomus	Chironomus		2	Collector	bu	4.6
Insecta	Diptera	Chironomidae	Cladotanytarsus	Cladotanytarsus		6	Filterer	-	6.6
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx		6	Collector	sp	6.7
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus		15	Shredder	cn, bu	9.6
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia		1	Scraper	cn, cb	5.7
Insecta	Diptera	Tipulidae	Hexatoma	Hexatoma		1	Predator	bu, sp	1.5
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus		1	Scraper	sp	7.2
Clitellata	Lumbriculada	Lumbriculidae	not identified	Lumbriculidae		2	Collector	bu	6.6
Clitellata	Haplotaxida	Naididae	not identified	Naididae		4	Collector	bu	9.1
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	P	6	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae		2	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius		25	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus		3	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus		1	Collector	sp	7.7
Insecta	Ephemeroptera	Baetidae	Plauditus	Plauditus		5	Collector	sw, cn	2.3
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum		5	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus		1	Filterer	cn	7.2
Insecta	Diptera	Simuliidae	Simulium	Simulium		2	Filterer	cn	5.7
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	A	2	Scraper	cn	7.1
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis		1	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Stenochironomus	Stenochironomus		1	Shredder	bu	7.9
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus		3	Filterer	cb, cn	4.9
Insecta	Ephemeroptera	Ephemerellidae	Timpanoga	Timpanoga		1	Collector	sp	2.6
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae		4	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia		2	Collector	sp	5.1

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13LP-3-03

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Coleoptera	Elmidae	Ancyronyx	Ancyronyx		1	Scraper	cn, sp	7.8
Insecta	Diptera	Chironomidae	Brillia	Brillia		2	Shredder	bu, sp	7.4
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx		2	Predator	cb	8.3
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche		1	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	Chironomus	Chironomus		1	Collector	bu	4.6
Insecta	Diptera	Chironomidae	Cladotanytarsus	Cladotanytarsus		4	Filterer	-	6.6
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx		7	Collector	sp	6.7
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus		15	Shredder	cn, bu	9.6
Insecta	Diptera	Chironomidae	Dicrotendipes	Dicrotendipes		3	Collector	bu	9
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae		1	Collector	bu	9.1
Insecta	Ephemeroptera	Ephemerellidae	Eurylophella	Eurylophella		1	Scraper	cn, sp	4.5
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus		1	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	not identified	Hydropsychidae	P	2	Filterer	cn	5.7
Insecta	Diptera	Chironomidae	Limnophyes	Limnophyes		1	Collector	sp	8.6
Insecta	Coleoptera	Dryopidae	Macronychus	Macronychus		3	Scraper	cn	6.8
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra		1	Collector	cb, sp	2.1
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes		2	Filterer	cn	4.9
Clitellata	Haplotaxida	Naididae	not identified	Naididae		5	Collector	bu	9.1
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae		1	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	2	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius		7	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	P	3	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus		7	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paraphaenocladius	Paraphaenocladius		1	Collector	sp	4
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus		3	Collector	sp	7.7
Insecta	Diptera	Chironomidae	Paratendipes	Paratendipes		1	Collector	bu	6.6
Insecta	Ephemeroptera	Baetidae	Plauditus	Plauditus		1	Collector	sw, cn	2.3
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	P	1	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum		1	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Potthastia	Potthastia		2	Omnivore	sp	0
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus		2	Collector	sp	6.2
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus		3	Filterer	cn	7.2
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	A	1	Scraper	cn	7.1
Insecta	Plecoptera	Taeniopterygidae	Taeniopteryx	Taeniopteryx		1	Shredder	sp, cn	4.8
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	P	2	Filterer	cb, cn	4.9
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus		3	Filterer	cb, cn	4.9
Insecta	Diptera	Chironomidae	Thienemanniella	Thienemanniella		1	Collector	sp	5.1
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae		5	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia		3	Collector	sp	5.1

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

Little Patuxent Watershed
Biological Monitoring and Assessment
Benthic Macroinvertebrate Data

Howard County
2006

13LP-4-01

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Ablabesmyia	Ablabesmyia		1	Predator	sp	8.1
Insecta	Odonata	Coenagrionidae	Argia	Argia		1	Predator	cn, cb, sp	9.3
Insecta	Trichoptera	Leptoceridae	Ceraclea	Ceraclea		1	Collector	sp, cb	4.1
Insecta	Diptera	Chironomidae	Chironomus	Chironomus		1	Collector	bu	4.6
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx		49	Collector	sp	6.7
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus		2	Shredder	cn, bu	9.6
Insecta	Odonata	Gomphidae	not identified	Gomphidae		1	Predator	bu	2.2
Insecta	Coleoptera	Dytiscidae	Hydroporus	Hydroporus		1	Predator	sw, cb	4.6
Insecta	Trichoptera	Hydropsychidae	not identified	Hydropsychidae	P	1	Filterer	cn	5.7
Clitellata	Lumbriculada	Lumbriculidae	not identified	Lumbriculidae		1	Collector	bu	6.6
Insecta	Odonata	Corduliidae	Macromia	Macromia		1	Predator	sp	3
Insecta	Coleoptera	Dryopidae	Macronychus	Macronychus		2	Scraper	cn	6.8
Insecta	Diptera	Chironomidae	Microtendipes	Microtendipes		1	Filterer	cn	4.9
Clitellata	Haplotaxida	Naididae	not identified	Naididae		1	Collector	bu	9.1
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius		9	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Parakiefferiella	Parakiefferiella	P	2	Collector	sp	2.1
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus		1	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus		3	Collector	sp	7.7
Insecta	Plecoptera	Perlidae	Perlesta	Perlesta		1	Predator	cn	1.6
Insecta	Diptera	Chironomidae	Phaenopsectra	Phaenopsectra		1	Collector	cn	8.7
Turbellaria	Tricladida	Planariidae	Planaria	Planaria		2	Predator	sp	8.4
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum		3	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Procladius	Procladius		1	Predator	sp	1.2
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis		1	Scraper	cn	7.1
Insecta	Ephemeroptera	Heptageniidae	Stenonema	Stenonema		2	Scraper	cn	4.6
Insecta	Diptera	Tanyderidae	not identified	Tanyderidae		1	Collector	-	na
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia		1	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae		2	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia		1	Collector	sp	5.1

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

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
Upper Little Patuxent													**Upper Little Patuxent Average:**		**148**	**74**	**Partially Supporting**
11LP-1-01-2006	4/21/2006	17	17	17	14	19	12	15	3	4	8	8	10	10	154	77.0	Supporting
11LP-1-02-2006	4/20/2006	20	10	11	7	18	3	13	5	2	10	10	9	10	128	64.0	Partially Supporting
11LP-1-03-2006	4/20/2006	8	19	17	19	18	19	15	9	5	3	2	3	1	138	69.0	Partially Supporting
11LP-1-04-2006	4/26/2006	14	15	15	18	18	16	10	7	4	9	7	9	4	146	73.0	Partially Supporting
11LP-1-05A-2006	4/20/2006	20	18	18	17	17	13	15	5	5	10	10	10	10	168	84.0	Supporting
11LP-1-05A-2006 QC	4/20/2006	20	18	18	18	18	13	15	5	6	10	10	10	10	171	85.5	Supporting
11LP-1-06A-2006	4/21/2006	20	16	18	19	20	18	14	2	5	10	10	7	10	169	84.5	Supporting
11LP-1-07-2006	4/21/2006	17	8	11	8	5	4	12	5	7	10	9	10	6	112	56.0	Not Supporting
11LP-2-01-2006	4/19/2006	20	19	19	16	15	16	17	7	6	10	7	10	9	171	85.5	Supporting
11LP-2-02-2006	4/19/2006	20	20	17	6	11	8	15	2	4	7	8	10	10	138	69.0	Partially Supporting
11LP-2-03-2006	4/19/2006	20	17	16	12	19	3	16	4	7	10	8	10	10	152	76.0	Supporting
Middle Little Patuxent													**Middle Little Patuxent Average:**		**145**	**72**	**Partially Supporting**
12LP-1-01-2006	4/24/2006	17	8	11	16	5	14	9	2	4	3	8	2	7	106	53.0	Not Supporting
12LP-1-02-2006	4/25/2006	20	19	13	11	18	11	14	9	9	7	7	7	7	152	76.0	Supporting
12LP-1-03-2006	4/24/2006	17	9	18	14	17	13	12	5	8	5	6	7	6	137	68.5	Partially Supporting
12LP-1-04-2006	4/25/2006	20	18	19	18	18	17	11	10	10	9	9	10	10	179	89.5	Supporting
12LP-1-05-2006	4/26/2006	20	14	17	10	20	5	11	8	8	10	10	10	10	153	76.5	Supporting
12LP-1-05-2006 QC	4/26/2006	20	15	17	10	20	6	12	7	7	10	10	10	10	154	77.0	Supporting
12LP-1-06-2006	4/18/2006	17	14	14	12	16	11	16	2	3	10	8	10	3	136	68.0	Partially Supporting
12LP-1-07-2006	4/24/2006	20	16	18	19	20	15	15	3	5	8	8	7	7	161	80.5	Supporting
12LP-2-01-2006	4/25/2006	15	18	15	19	19	16	14	8	7	10	10	10	10	171	85.5	Supporting
12LP-3-01-2006	4/28/2006	15	12	6	5	6	10	10	9	6	9	3	6	6	103	51.5	Not Supporting
12LP-3-02-2006	5/1/2006	20	18	18	9	10	18	15	9	6	9	6	10	3	151	75.5	Supporting
Lower Little Patuxent													**Lower Little Patuxent Average:**		**149**	**74**	**Partially Supporting**
13LP-1-01-2006	4/27/2006	19	18	15	18	18	19	13	9	9	10	10	10	10	178	89.0	Supporting
13LP-1-01-2006 QC	4/27/2006	19	19	15	17	18	17	15	9	9	10	10	10	10	178	89.0	Supporting
13LP-1-02-2006	4/18/2006	16	10	15	16	18	12	9	6	5	9	10	8	10	144	72.0	Partially Supporting
13LP-1-03-2006	4/27/2006	20	7	17	18	18	7	14	4	4	10	10	7	7	143	71.5	Partially Supporting
13LP-1-04-2006	4/26/2006	13	17	14	19	17	19	10	5	5	5	5	4	3	136	68.0	Partially Supporting
13LP-1-05-2006	4/27/2006	20	11	15	14	18	7	14	5	2	10	10	10	9	145	72.5	Partially Supporting
13LP-1-06-2006	4/18/2006	15	16	12	16	17	16	9	5	7	1	7	2	3	126	63.0	Partially Supporting
13LP-3-02-2006	5/1/2006	20	16	15	9	14	16	16	8	8	9	9	8	10	158	79.0	Supporting
13LP-3-02A-2006	5/1/2006	20	15	12	13	14	10	10	7	2	5	1	5	10	124	62.0	Partially Supporting
13LP-3-03-2006	5/1/2006	13	15	16	9	17	11	18	6	4	7	7	8	8	139	69.5	Partially Supporting
13LP-4-01-2006	4/28/2006	11	19	19	18	20	18	17	9	4	9	5	10	3	162	81.0	Supporting

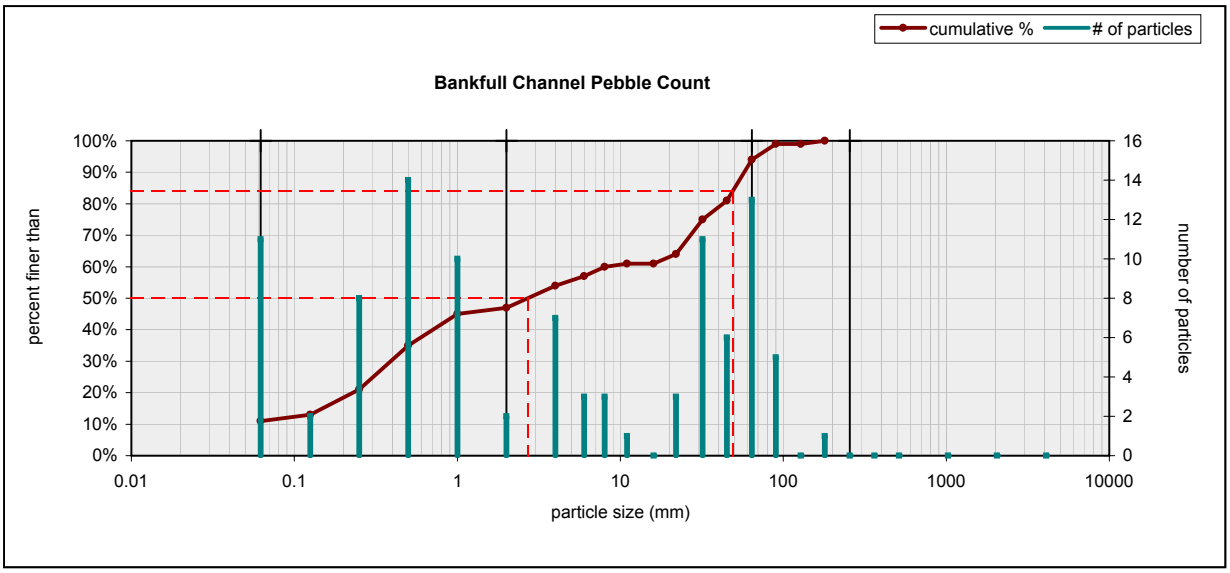
CA - Channel alteration	VPL - Vegetative Protection (left	VPR - Vegetative Protection (right)
CFS - Channel Flow Status	SD - Sediment /deposition	RZL - Riparian Zone (left)
ESC - Epifaunal substrate / available cover	VD - Velocity /depth	RZR - Riparian Zone (right)
E - Embeddeddness	BSL - Bank Stability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

Classification Scoring and Narrative Rating	
≥90%	Comparable to Reference
75.1-89.9%	Supporting
60.1-75.0%	Partially Supporting
≤60%	Not 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 dominat particle size	Channel Type
Upper Little Patuxent													
11LP-1-01-2006	1.0	13.6	14.1	13.0	17.0	1.3	0.57	210	1.17	2.70	Gravel	47	F4c
11LP-1-02-2006	0.8	10.2	8.2	12.7	20.8	2.0	0.31	160	1.54	0.59	Sand	56	C5c
11LP-1-03-2006	0.9	7.6	6.8	8.5	14.1	1.9	1.90	215	1.14	6.00	Gravel	48	B4c
11LP-1-04-2006	0.9	12.4	11.7	13.3	65.0	5.2	1.20	200	1.23	8.00	Gravel	61	C4
11LP-1-05A-2006	1.3	15.0	19.0	11.8	26.4	1.8	0.43	209	1.18	7.40	Gravel	60	C4
11LP-1-06A-2006	1.5	16.7	24.3	11.5	65.0	3.9	1.00	188	1.31	38.00	Gravel	51	C4
11LP-1-07-2006	1.2	10.8	13.3	8.8	25.0	2.3	0.74	175	1.41	1.40	Sand	54	C4
11LP-2-01-2006	2.1	34.9	71.9	16.9	100.0	2.9	0.22	195	1.26	0.94	Gravel	35	C4/5
11LP-2-02-2006	2.3	29.5	67.4	12.9	100.0	3.4	0.76	230	1.07	6.00	Gravel	48	C4
11LP-2-03-2006	1.3	26.0	34.9	19.3	100.0	3.9	0.30	195	1.26	0.55	Sand	53	C5
Middle Little Patuxent													
12LP-1-01-2006	1.0	11.1	10.8	11.4	19.3	1.7	2.30	228	1.08	23.00	Gravel	59	G4
12LP-1-02-2006	0.8	12.1	10.0	14.6	100.0	8.3	0.81	208	1.18	2.20	Gravel	52	C4
12LP-1-03-2006	1.1	18.9	20.7	17.3	23.3	1.2	0.65	234	1.05	8.50	Gravel	65	F4c
12LP-1-04-2006	0.8	11.1	9.1	13.6	26.2	2.4	1.10	227	1.08	16.00	Gravel	80	C4
12LP-1-05-2006	0.7	8.8	6.0	12.8	10.2	1.2	0.62	210	1.17	1.10	Sand	50	F5c
12LP-1-06-2006	1.0	27.5	26.5	28.4	32.2	1.2	0.78	213	1.15	18.00	Gravel	55	F5
12LP-1-07-2006	1.4	15.8	21.5	11.7	18.3	1.2	0.13	234	1.05	4.40	Gravel	54	G4c
12LP-2-01-2006	1.4	19.0	25.8	14.0	25.8	1.4	0.68	153	1.61	9.10	Gravel	62	C4c
12LP-3-01-2006	2.7	37.3	100.0	13.9	42.9	1.2	0.38	196	1.26	0.81	Gravel	34	F4/5c
12LP-3-02-2006	2.3	33.3	77.5	14.3	49.4	1.5	0.18	246	1.00	0.36	Sand	53	F5
Lower Little Patuxent													
13LP-1-01-2006	1.4	16.5	23.4	11.7	24.2	1.5	0.42	236	1.04	47.00	Gravel	56	C4c
13LP-1-02-2006	0.9	12.0	11.2	12.9	15.4	1.3	0.94	222	1.11	17.00	Gravel	53	C4c
13LP-1-03-2006	0.9	25.6	22.4	29.2	34.2	1.3	0.42	148	1.66	1.80	Sand	45	F5/4c
13LP-1-04-2006	0.8	4.1	3.3	5.1	52.0	12.8	3.10	214	1.15	8.00	Gravel	44	C4b
13LP-1-05-2006	1.2	23.5	28.1	19.7	37.4	1.6	0.62	179	1.37	1.10	Sand	46	C5c
13LP-1-06-2006	1.2	3.4	4.2	2.7	40.0	11.9	1.50	186	1.32	0.79	Sand	57	C5/G5
13LP-3-02-2006	2.9	40.8	116.8	14.3	160.0	3.9	0.17	246	1.00	6.30	Gravel	38	C4
13LP-3-02A-2006	2.4	47.8	117.1	19.5	54.0	1.1	0.21	142	1.73	0.23	Sand	39	F5c
13LP-3-03-2006	2.0	50.1	97.9	25.6	56.5	1.1	0.52	246	1.00	5.20	Gravel	54	F5
13LP-4-01-2006	3.8	83.8	321.5	21.8	105.6	1.3	0.72	246	1.00	66.00	Cobble	38	C3/4

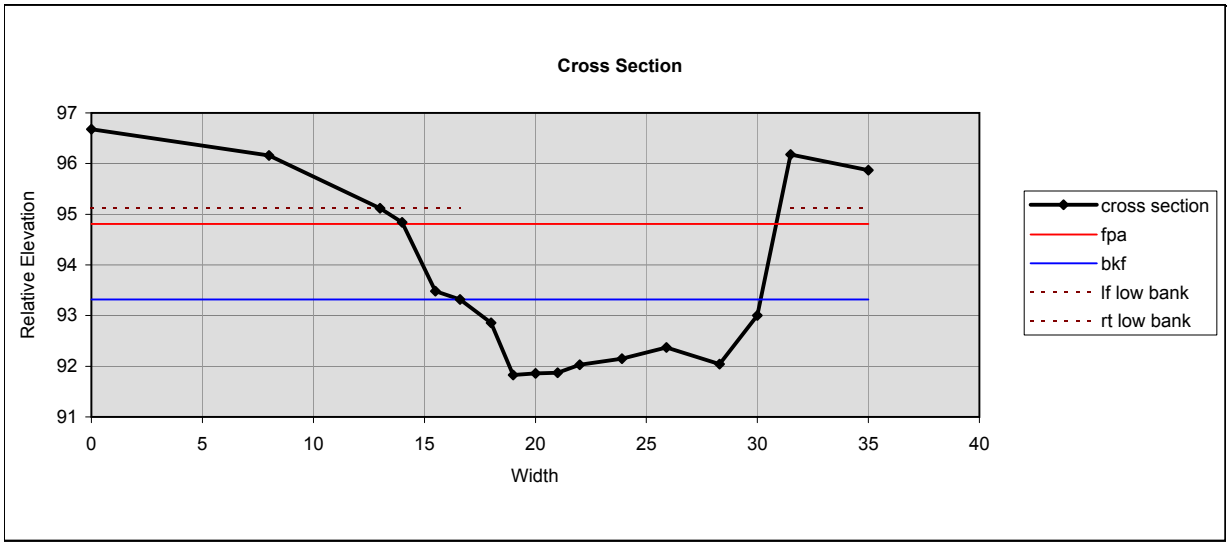
11LP-1-01-2006



Size (mm)	
D16	0.16
D35	0.5
D50	2.7
D65	23
D84	49
D95	69

Size Distribution	
mean	2.8
dispersion	17.5
skewness	0.0

Type	
silt/clay	11%
sand	36%
gravel	47%
cobble	6%
boulder	0%
bedrock	0%



Bankfull Dimensions	
14.1	x-section area (ft.sq.)
13.6	width (ft)
1.0	mean depth (ft)
1.5	max depth (ft)
14.6	wetted perimeter (ft)
1.0	hydraulic radius (ft)
13.0	width-depth ratio

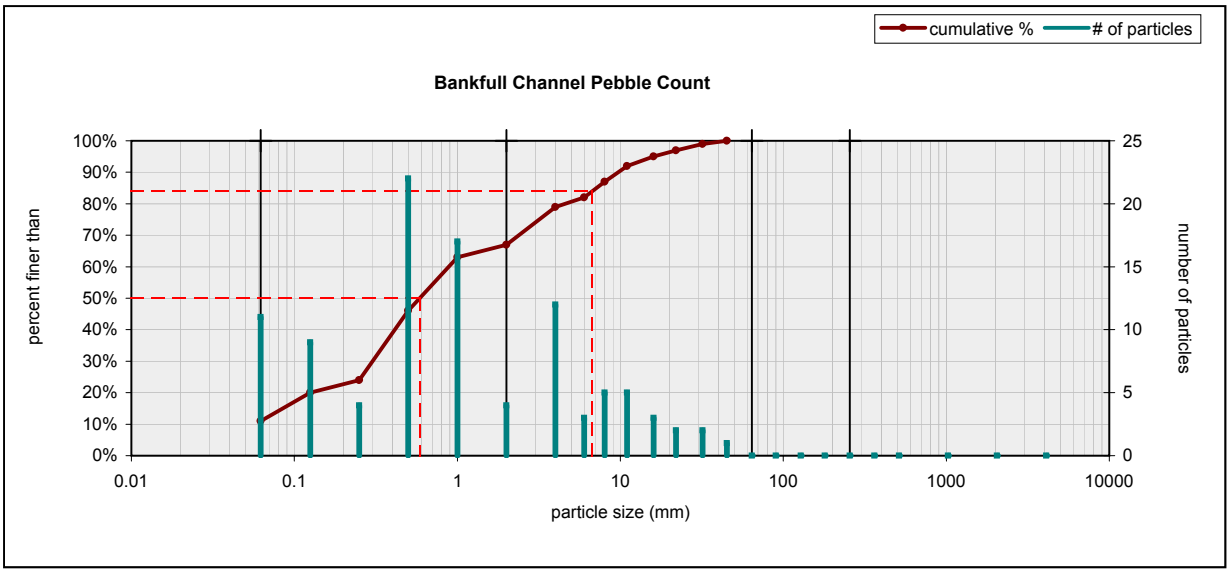
Flood Dimensions	
17.0	Width flood prone area (ft)
1.3	entrenchment ratio
3.3	low bank height (ft)
2.2	low bank height ratio

Flow Resistance	
0.034	Manning's roughness

Bankfull Flow	
3.2	velocity (ft/s)
45.9	discharge rate (cfs)
0.57	channel slope (%)

Sinuosity	Channel Type
1.17	F4c

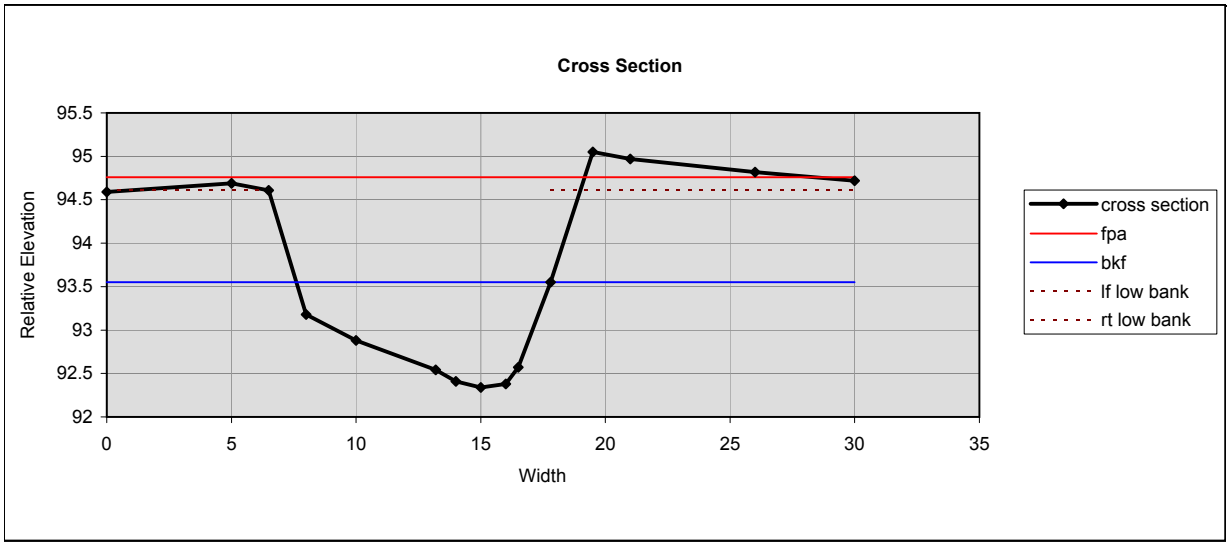
11LP-1-02-2006



Size (mm)	
D16	0.092
D35	0.35
D50	0.59
D65	1.4
D84	6.7
D95	16

Size Distribution	
mean	0.8
dispersion	8.9
skewness	0.1

Type	
silt/clay	11%
sand	56%
gravel	33%
cobble	0%
boulder	0%
bedrock	0%



Bankfull Dimensions	
8.2	x-section area (ft.sq.)
10.2	width (ft)
0.8	mean depth (ft)
1.2	max depth (ft)
10.8	wetted perimeter (ft)
0.8	hydraulic radius (ft)
12.7	width-depth ratio

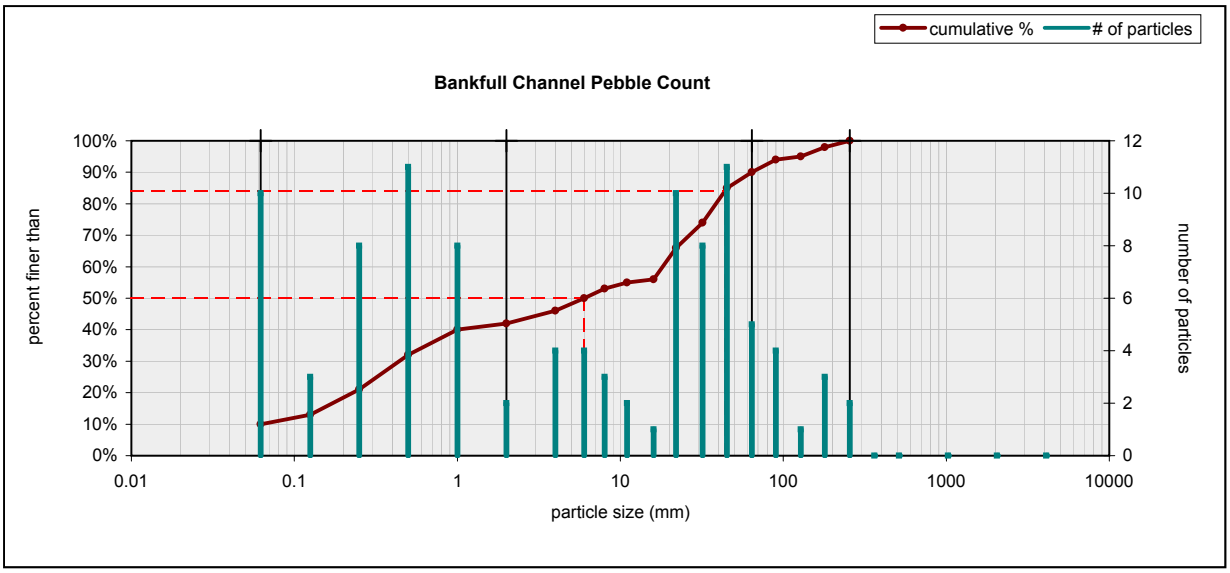
Flood Dimensions	
20.8	Width flood prone area (ft)
2.0	entrenchment ratio
2.3	low bank height (ft)
1.9	low bank height ratio

Flow Resistance	
0.021	Manning's roughness

Bankfull Flow	
3.3	velocity (ft/s)
27.4	discharge rate (cfs)
0.31	channel slope (%)

Sinuosity	Channel Type
1.54	C5c

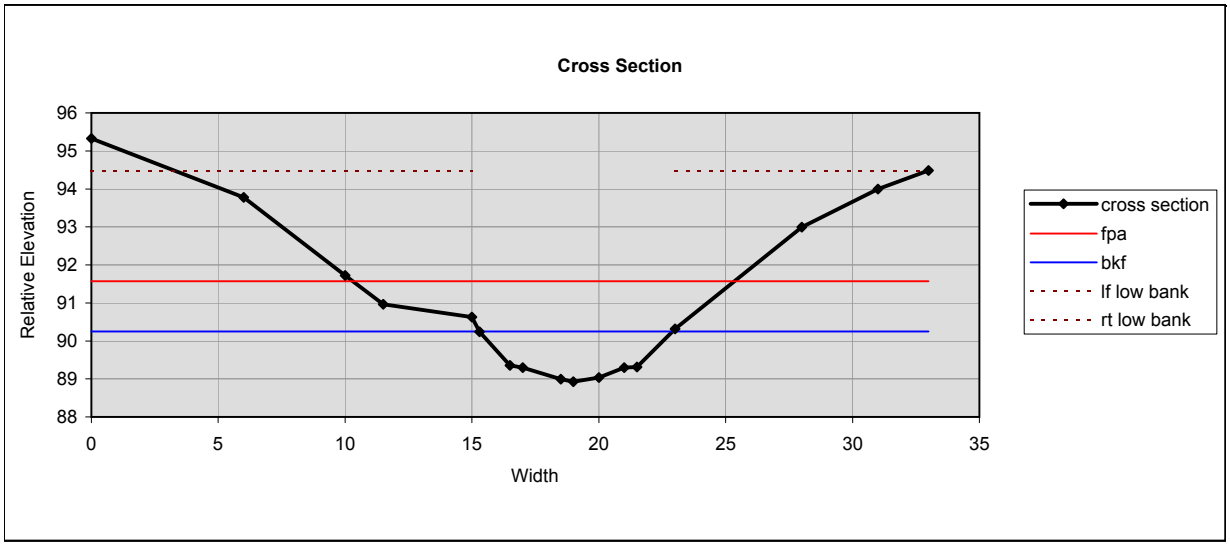
11LP-1-03-2006



Size (mm)	
D16	0.16
D35	0.65
D50	6
D65	21
D84	44
D95	130

Size Distribution	
mean	2.7
dispersion	22.4
skewness	-0.2

Type	
silt/clay	10%
sand	32%
gravel	48%
cobble	10%
boulder	0%
bedrock	0%



Bankfull Dimensions	
6.8	x-section area (ft.sq.)
7.6	width (ft)
0.9	mean depth (ft)
1.3	max depth (ft)
8.3	wetted perimeter (ft)
0.8	hydraulic radius (ft)
8.5	width-depth ratio

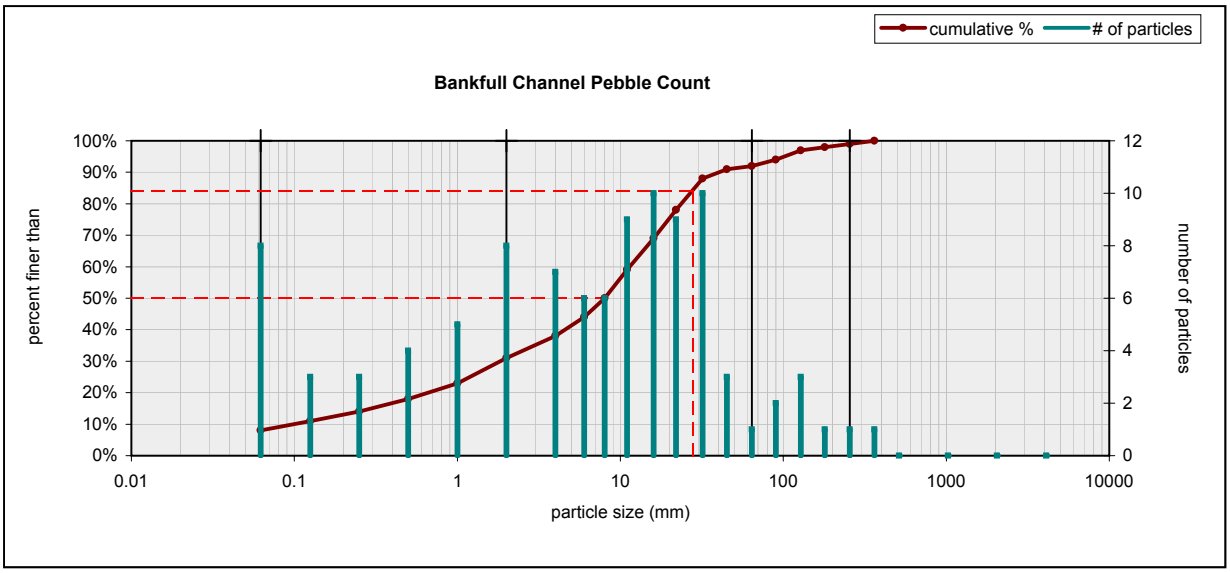
Flood Dimensions	
14.1	Width flood prone area (ft)
1.9	entrenchment ratio
5.6	low bank height (ft)
4.2	low bank height ratio

Flow Resistance	
0.033	Manning's roughness

Bankfull Flow	
5.4	velocity (ft/s)
36.5	discharge rate (cfs)
1.90	channel slope (%)

Sinuosity	Channel Type
1.14	B4c

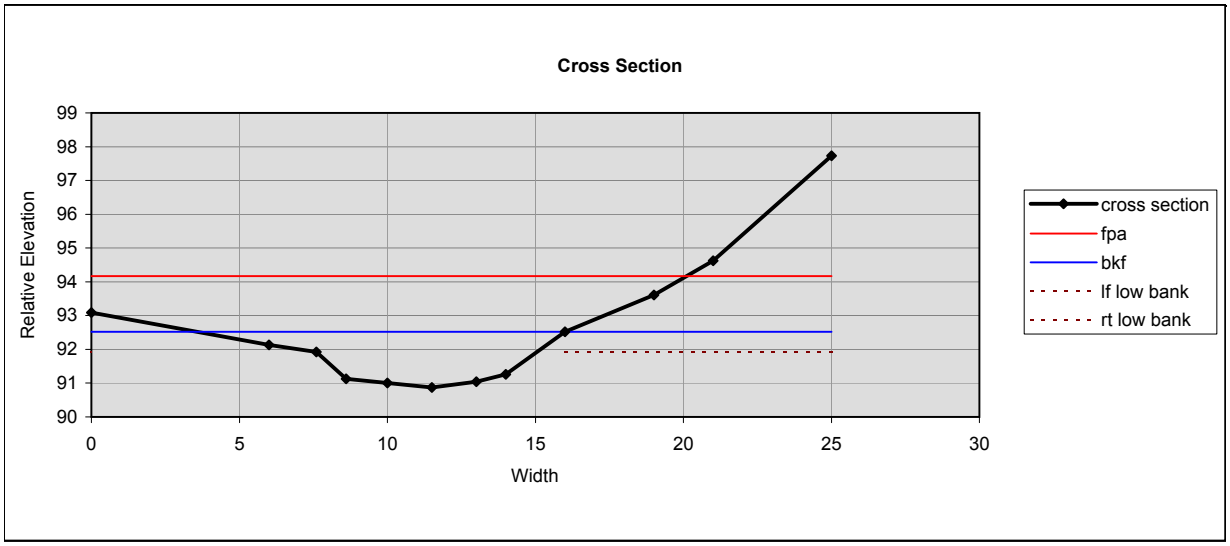
11LP-1-04-2006



Size (mm)	
D16	0.35
D35	3
D50	8
D65	14
D84	28
D95	100

Size Distribution	
mean	3.1
dispersion	13.2
skewness	-0.3

Type	
silt/clay	8%
sand	23%
gravel	61%
cobble	7%
boulder	1%
bedrock	0%



Bankfull Dimensions	
11.7	x-section area (ft.sq.)
12.4	width (ft)
0.9	mean depth (ft)
1.6	max depth (ft)
13.2	wetted perimeter (ft)
0.9	hydraulic radius (ft)
13.3	width-depth ratio

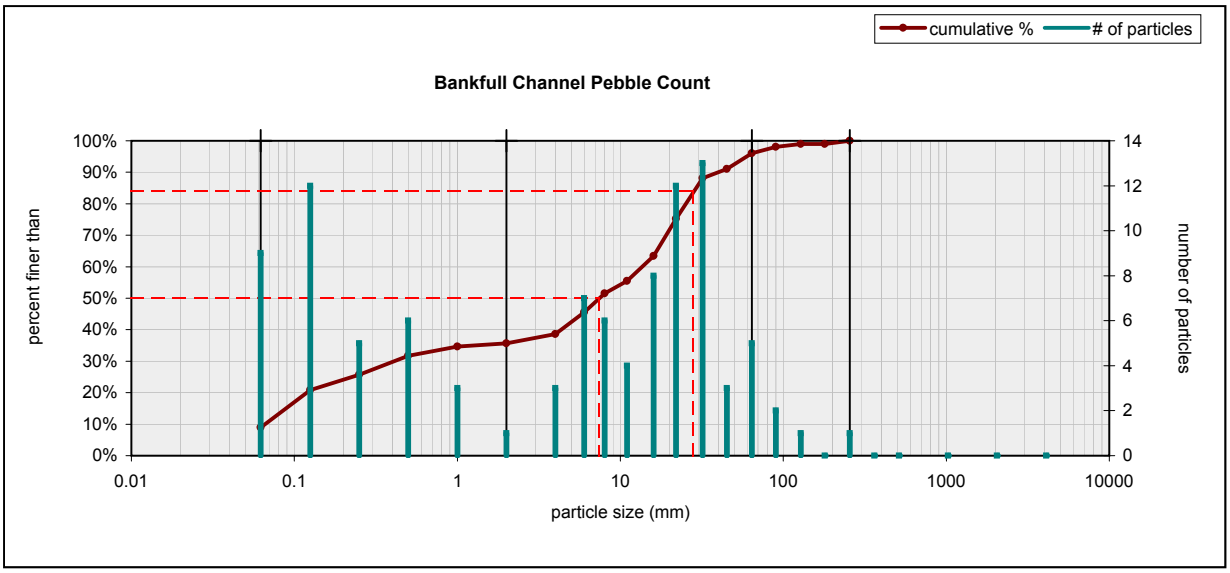
Flood Dimensions	
65.0	Width flood prone area (ft)
5.2	entrenchment ratio
1.1	low bank height (ft)
0.6	low bank height ratio

Flow Resistance	
0.028	Manning's roughness

Bankfull Flow	
5.3	velocity (ft/s)
61.5	discharge rate (cfs)
1.20	channel slope (%)

Sinuosity	Channel Type
1.23	C4

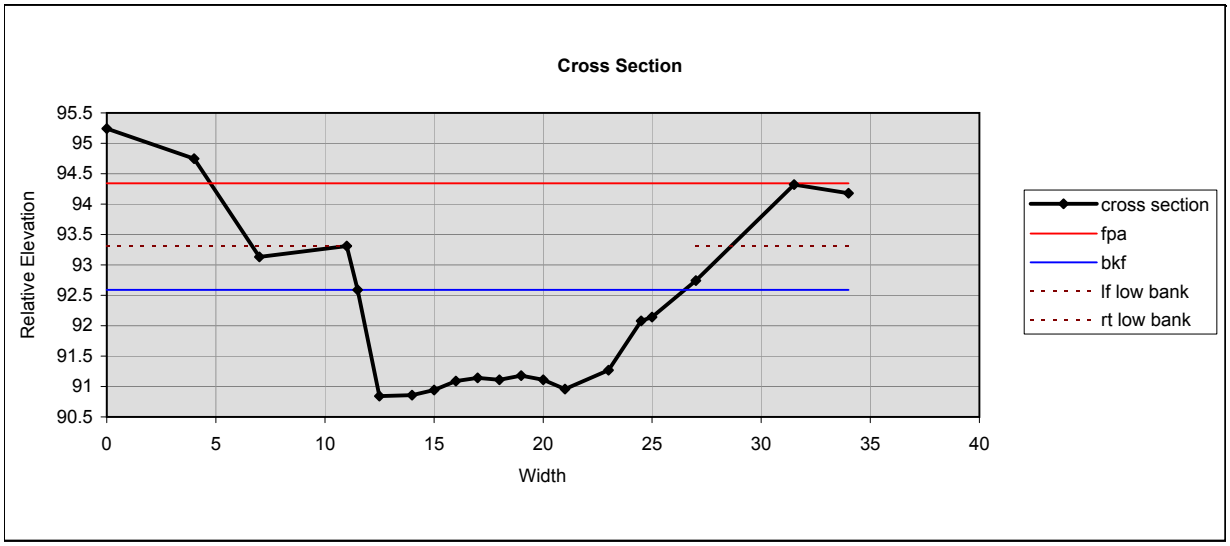
11LP-1-05A-2006



Size (mm)	
D16	0.094
D35	1.3
D50	7.4
D65	17
D84	28
D95	59

Size Distribution	
mean	1.6
dispersion	41.3
skewness	-0.4

Type	
silt/clay	9%
sand	27%
gravel	60%
cobble	4%
boulder	0%
bedrock	0%



Bankfull Dimensions	
19.0	x-section area (ft.sq.)
15.0	width (ft)
1.3	mean depth (ft)
1.8	max depth (ft)
16.3	wetted perimeter (ft)
1.2	hydraulic radius (ft)
11.8	width-depth ratio

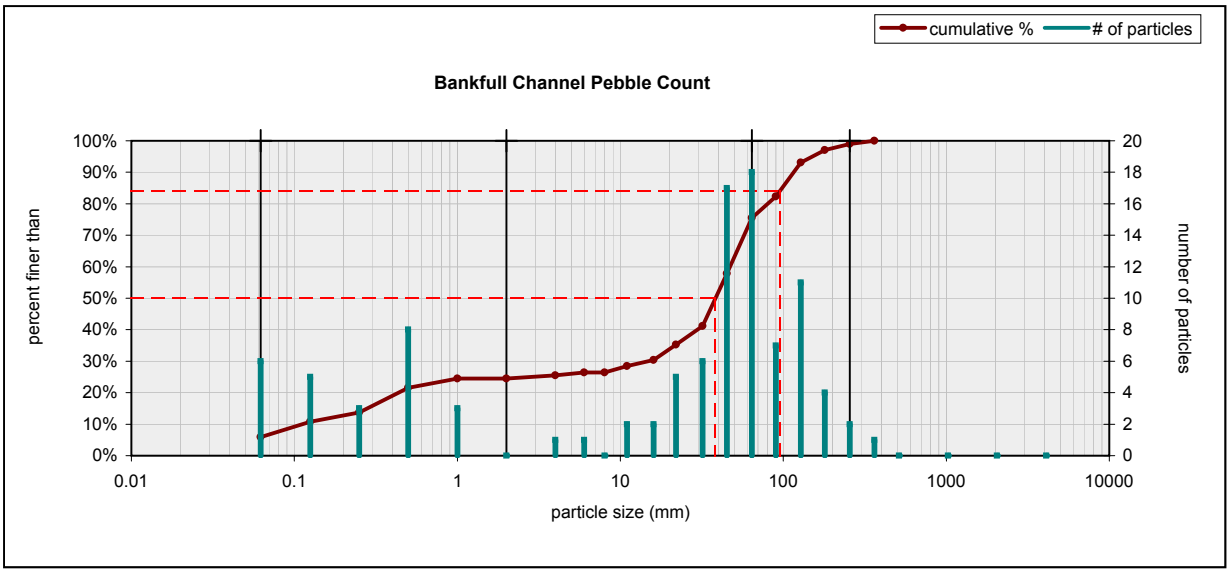
Flood Dimensions	
26.4	Width flood prone area (ft)
1.8	entrenchment ratio
2.5	low bank height (ft)
1.4	low bank height ratio

Flow Resistance	
0.028	Manning's roughness

Bankfull Flow	
3.8	velocity (ft/s)
72.9	discharge rate (cfs)
0.43	channel slope (%)

Sinuosity	Channel Type
1.18	C4

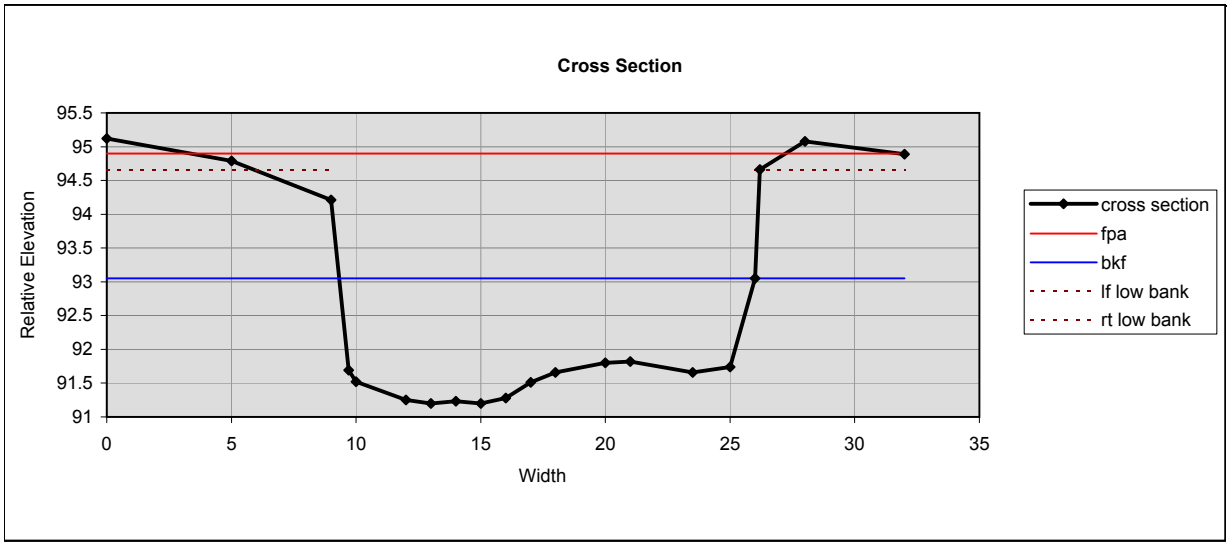
11LP-1-06A-2006



Size (mm)	
D16	0.31
D35	22
D50	38
D65	52
D84	95
D95	150

Size Distribution	
mean	5.4
dispersion	62.5
skewness	-0.5

Type	
silt/clay	6%
sand	19%
gravel	51%
cobble	24%
boulder	1%
bedrock	0%



Bankfull Dimensions	
24.3	x-section area (ft.sq.)
16.7	width (ft)
1.5	mean depth (ft)
1.8	max depth (ft)
18.5	wetted perimeter (ft)
1.3	hydraulic radius (ft)
11.5	width-depth ratio

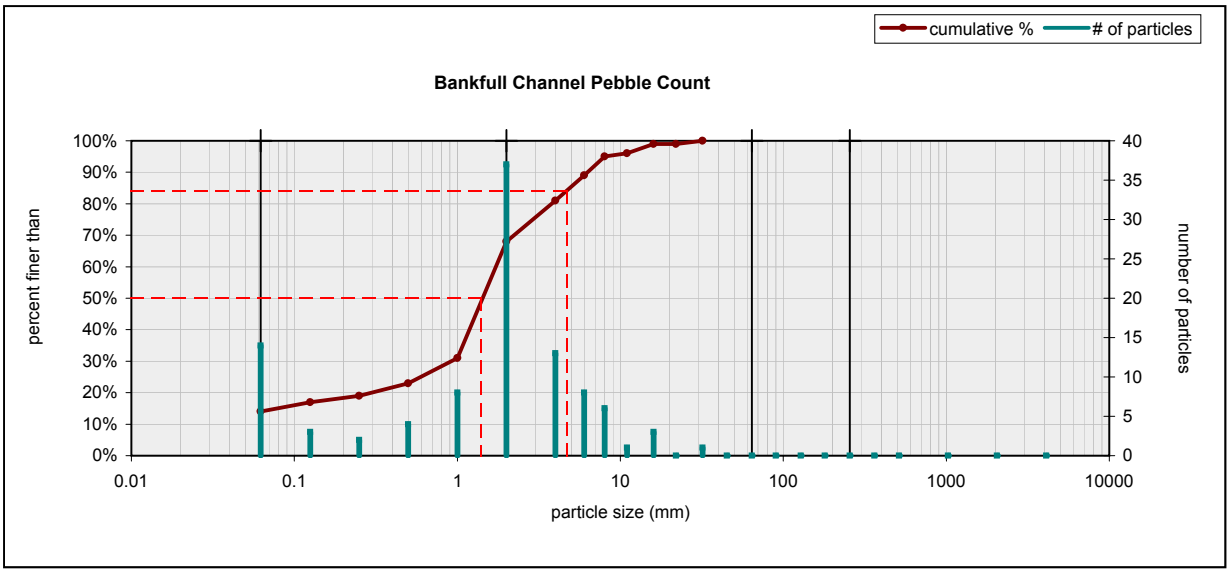
Flood Dimensions	
65.0	Width flood prone area (ft)
3.9	entrenchment ratio
3.5	low bank height (ft)
1.9	low bank height ratio

Flow Resistance	
0.041	Manning's roughness

Bankfull Flow	
4.4	velocity (ft/s)
106.5	discharge rate (cfs)
1.00	channel slope (%)

Sinuosity	Channel Type
1.31	C4

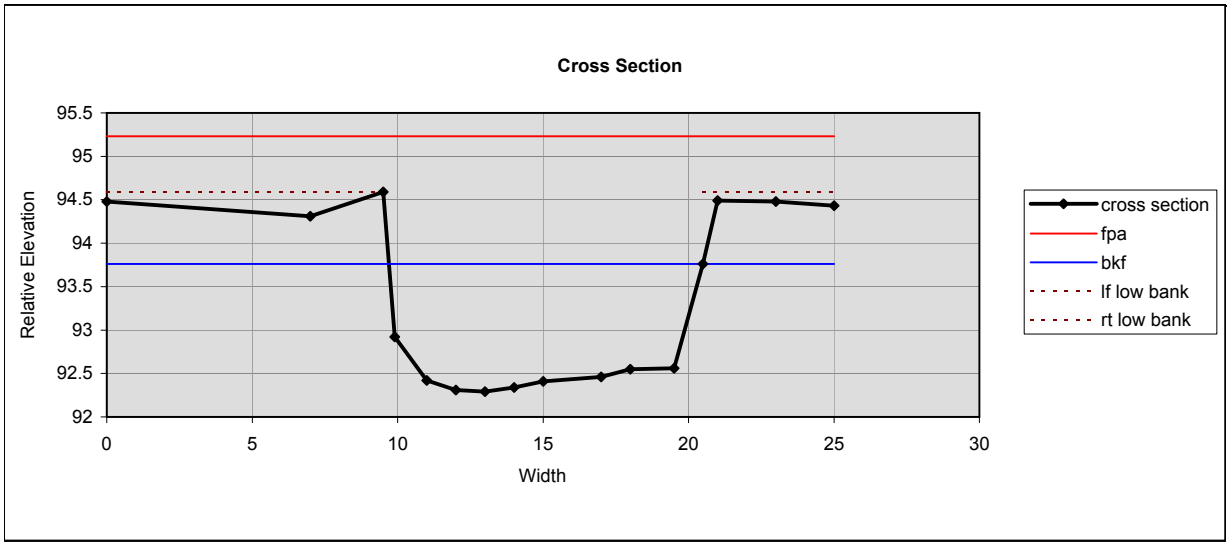
11LP-1-07-2006



Size (mm)	
D16	0.099
D35	1.1
D50	1.4
D65	1.9
D84	4.7
D95	8

Size Distribution	
mean	0.7
dispersion	8.7
skewness	-0.2

Type	
silt/clay	14%
sand	54%
gravel	32%
cobble	0%
boulder	0%
bedrock	0%



Bankfull Dimensions	
13.3	x-section area (ft.sq.)
10.8	width (ft)
1.2	mean depth (ft)
1.5	max depth (ft)
12.1	wetted perimeter (ft)
1.1	hydraulic radius (ft)
8.8	width-depth ratio

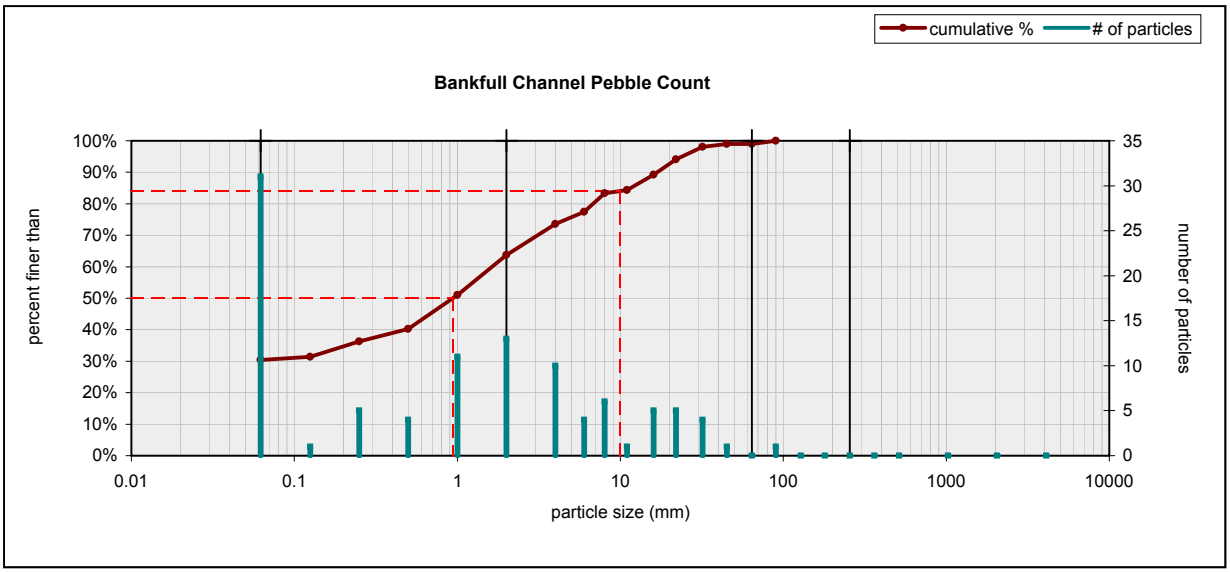
Flood Dimensions	
25.0	Width flood prone area (ft)
2.3	entrenchment ratio
2.3	low bank height (ft)
1.6	low bank height ratio

Flow Resistance	
0.019	Manning's roughness

Bankfull Flow	
7.0	velocity (ft/s)
93.2	discharge rate (cfs)
0.74	channel slope (%)

Sinuosity	Channel Type
1.41	C4

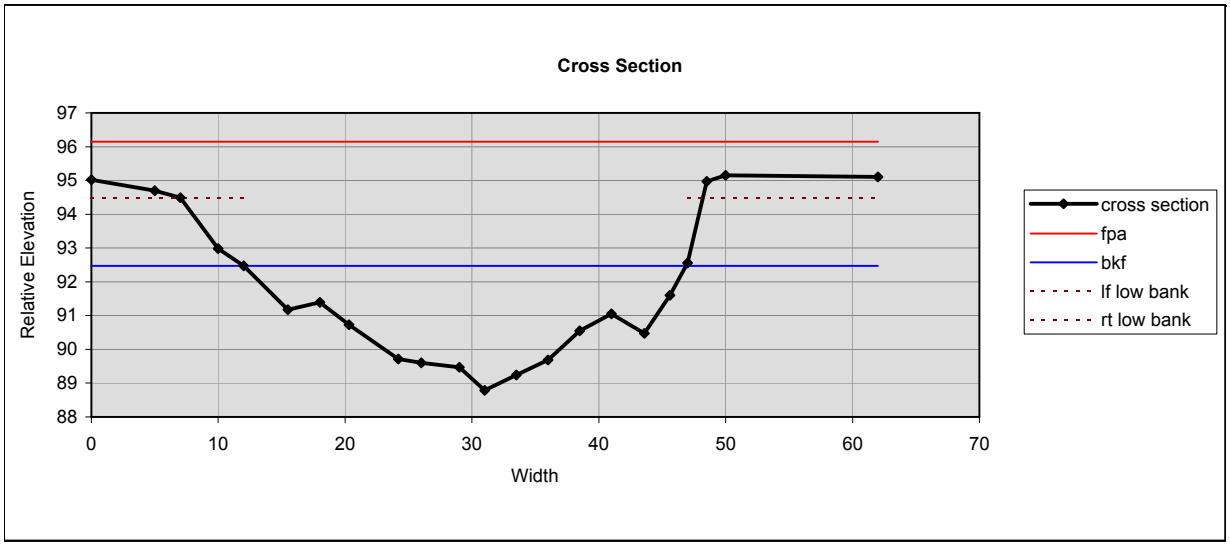
11LP-2-01-2006



Size (mm)	
D16	0.062
D35	0.21
D50	0.94
D65	2.2
D84	9.9
D95	24

Size Distribution	
mean	0.8
dispersion	12.8
skewness	-0.1

Type	
silt/clay	30%
sand	33%
gravel	35%
cobble	1%
boulder	0%
bedrock	0%



Bankfull Dimensions	
71.9	x-section area (ft.sq.)
34.9	width (ft)
2.1	mean depth (ft)
3.7	max depth (ft)
36.4	wetted perimeter (ft)
2.0	hydraulic radius (ft)
16.9	width-depth ratio

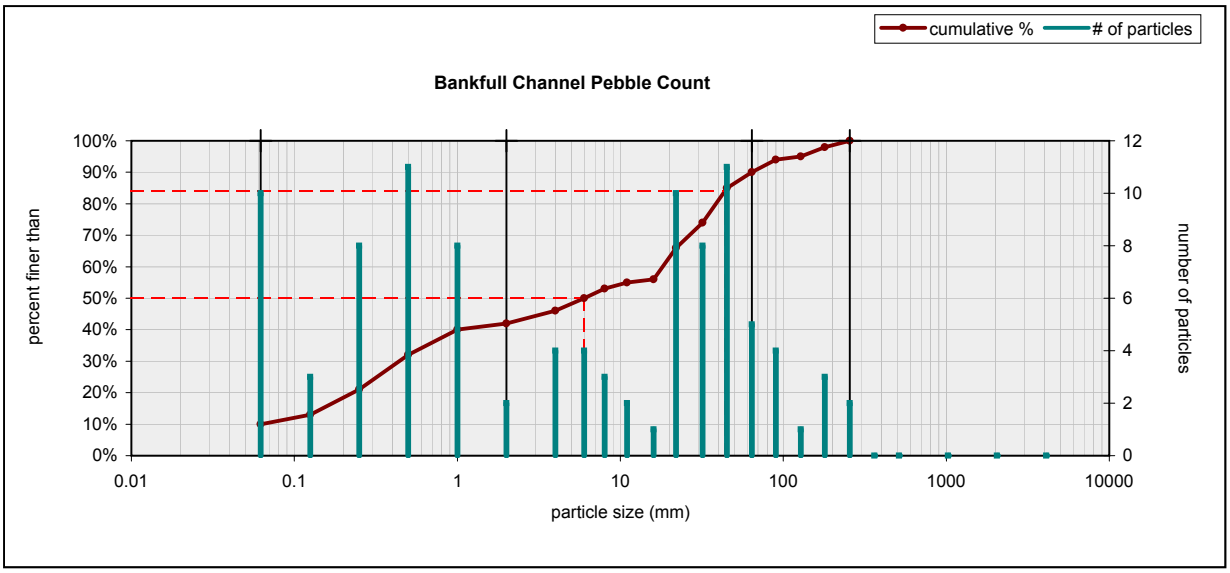
Flood Dimensions	
100.0	Width flood prone area (ft)
2.9	entrenchment ratio
5.7	low bank height (ft)
1.5	low bank height ratio

Flow Resistance	
0.022	Manning's roughness

Bankfull Flow	
5.1	velocity (ft/s)
366.6	discharge rate (cfs)
0.22	channel slope (%)

Sinuosity	Channel Type
1.26	C4/5

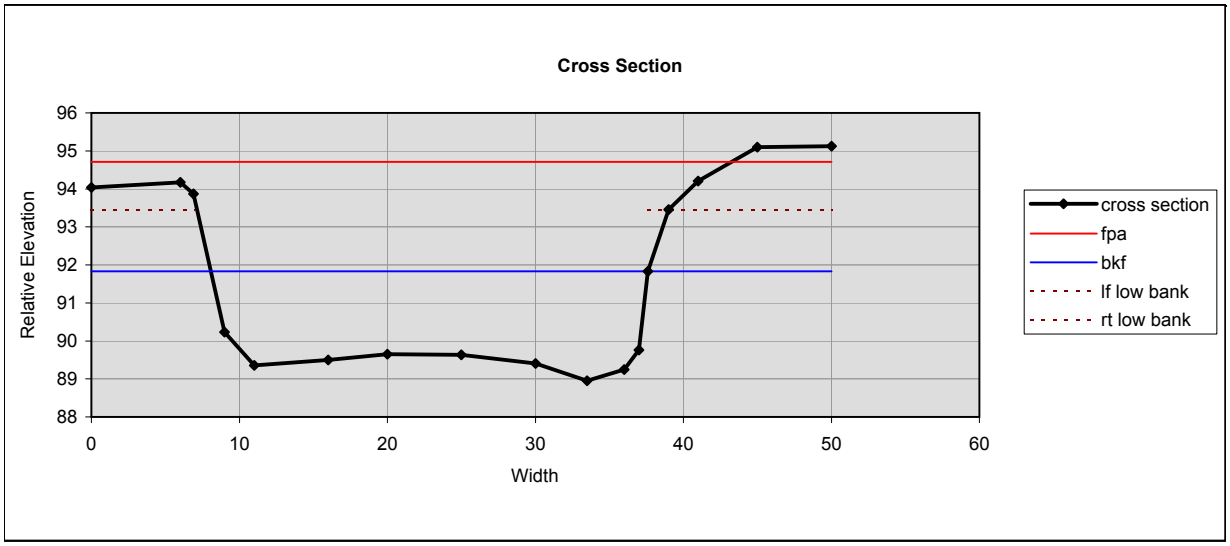
11LP-2-02-2006



Size (mm)	
D16	0.16
D35	0.65
D50	6
D65	21
D84	44
D95	130

Size Distribution	
mean	2.7
dispersion	22.4
skewness	-0.2

Type	
silt/clay	10%
sand	32%
gravel	48%
cobble	10%
boulder	0%
bedrock	0%



Bankfull Dimensions	
67.4	x-section area (ft.sq.)
29.5	width (ft)
2.3	mean depth (ft)
2.9	max depth (ft)
32.4	wetted perimeter (ft)
2.1	hydraulic radius (ft)
12.9	width-depth ratio

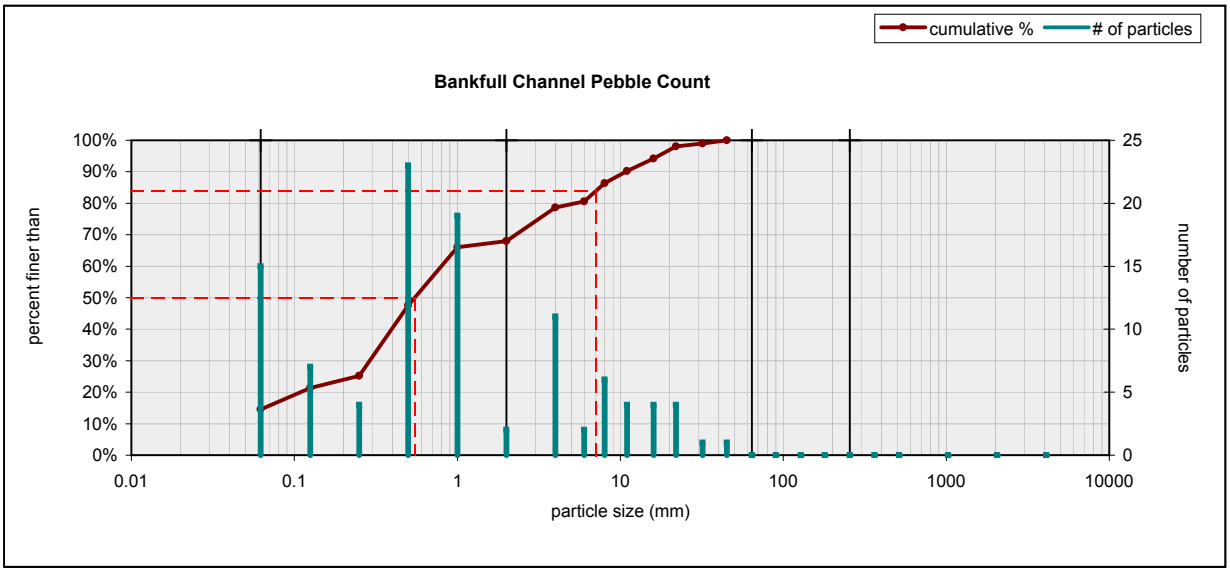
Flood Dimensions	
100.0	Width flood prone area (ft)
3.4	entrenchment ratio
4.5	low bank height (ft)
1.6	low bank height ratio

Flow Resistance	
0.030	Manning's roughness

Bankfull Flow	
7.0	velocity (ft/s)
471.1	discharge rate (cfs)
0.76	channel slope (%)

Sinuosity	Channel Type
1.07	C4

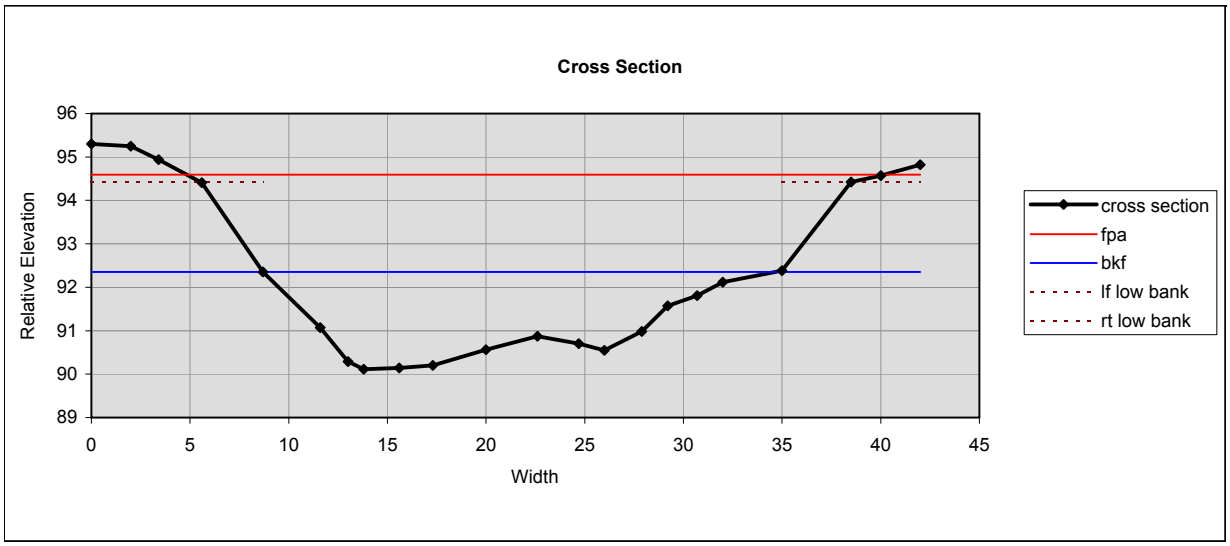
11LP-2-03-2006



Size (mm)	
D16	0.072
D35	0.34
D50	0.55
D65	0.96
D84	7.1
D95	17

Size Distribution	
mean	0.7
dispersion	10.3
skewness	0.1

Type	
silt/clay	15%
sand	53%
gravel	32%
cobble	0%
boulder	0%
bedrock	0%



Bankfull Dimensions	
34.9	x-section area (ft.sq.)
26.0	width (ft)
1.3	mean depth (ft)
2.2	max depth (ft)
26.7	wetted perimeter (ft)
1.3	hydraulic radius (ft)
19.3	width-depth ratio

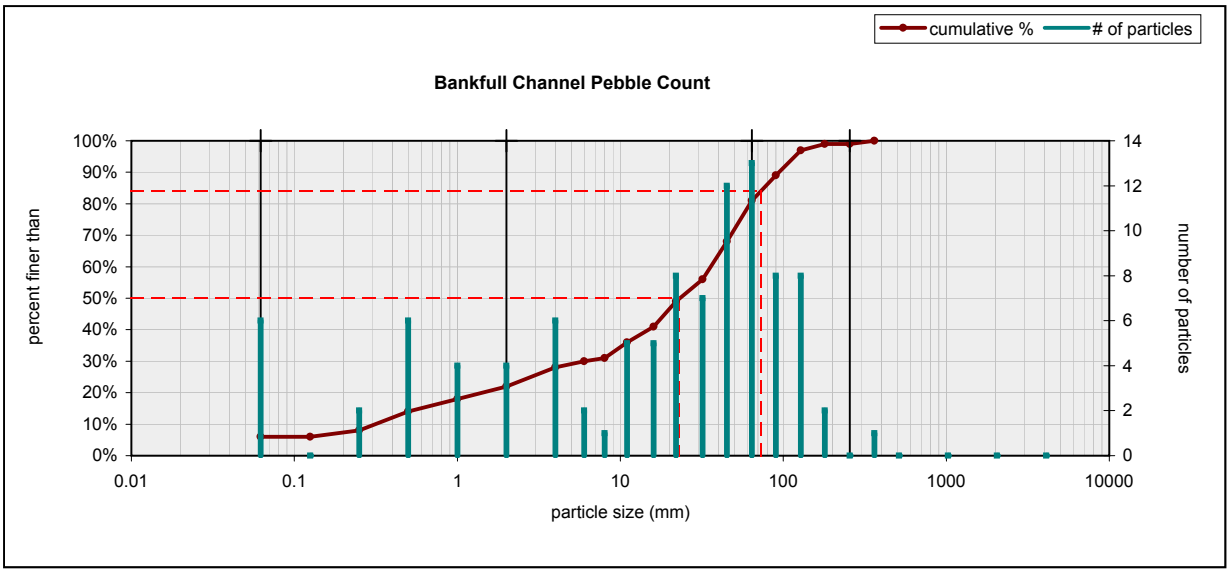
Flood Dimensions	
100.0	Width flood prone area (ft)
3.9	entrenchment ratio
4.3	low bank height (ft)
1.9	low bank height ratio

Flow Resistance	
0.021	Manning's roughness

Bankfull Flow	
4.7	velocity (ft/s)
165.7	discharge rate (cfs)
0.3	channel slope (%)

Sinuosity	Channel Type
1.26	C5

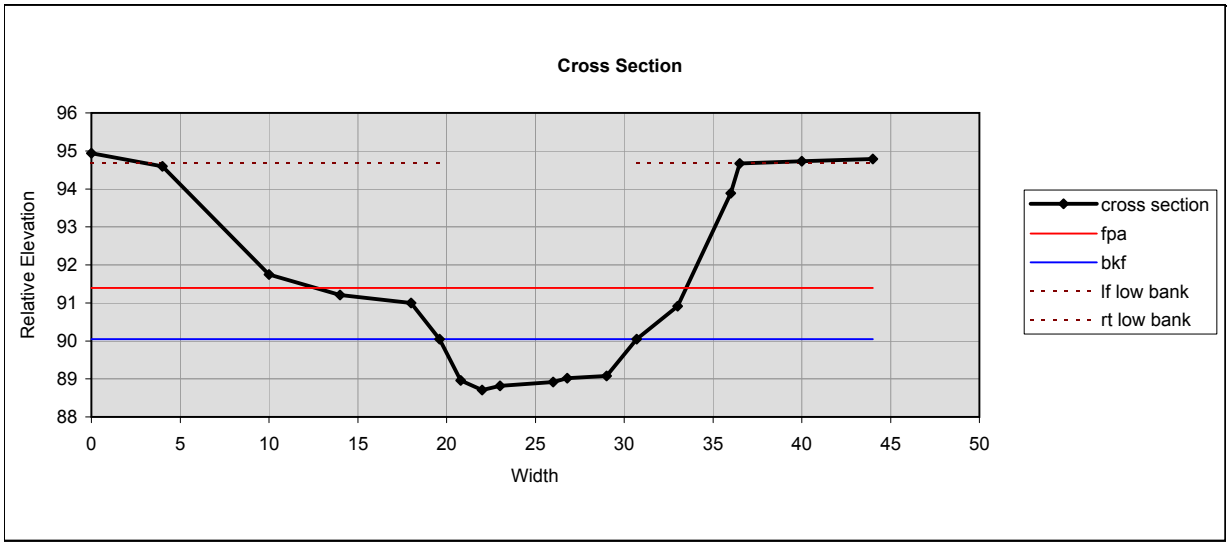
12LP-1-01-2006



Size (mm)	
D16	0.71
D35	10
D50	23
D65	41
D84	73
D95	120

Size Distribution	
mean	7.2
dispersion	17.8
skewness	-0.4

Type	
silt/clay	6%
sand	16%
gravel	59%
cobble	18%
boulder	1%
bedrock	0%



Bankfull Dimensions	
10.8	x-section area (ft.sq.)
11.1	width (ft)
1.0	mean depth (ft)
1.3	max depth (ft)
11.8	wetted perimeter (ft)
0.9	hydraulic radius (ft)
11.4	width-depth ratio

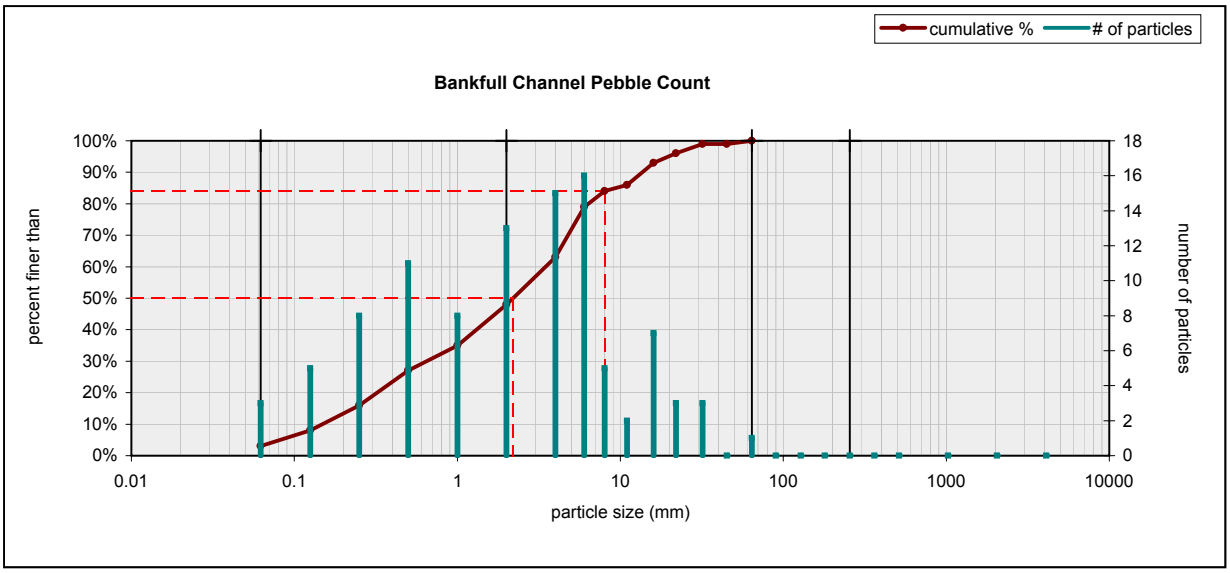
Flood Dimensions	
19.3	Width flood prone area (ft)
1.7	entrenchment ratio
6.0	low bank height (ft)
4.4	low bank height ratio

Flow Resistance	
0.040	Manning's roughness

Bankfull Flow	
5.4	velocity (ft/s)
58.2	discharge rate (cfs)
2.30	channel slope (%)

Sinuosity	Channel Type
1.08	G4

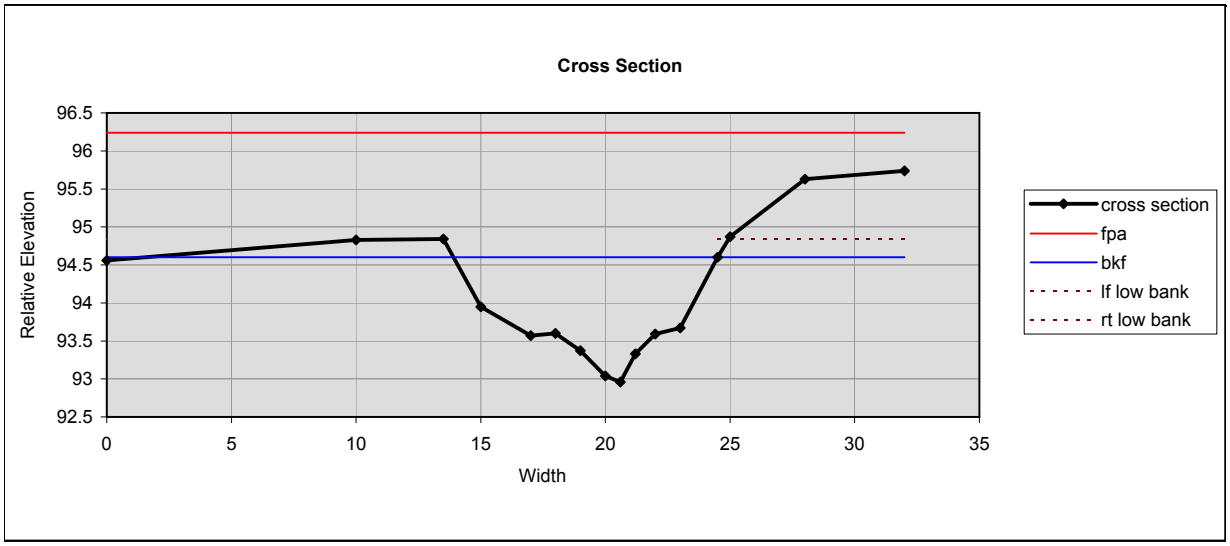
12LP-1-02-2006



Size (mm)	
D16	0.25
D35	1
D50	2.2
D65	4.2
D84	8
D95	20

Size Distribution	
mean	1.4
dispersion	6.2
skewness	-0.2

Type	
silt/clay	3%
sand	45%
gravel	52%
cobble	0%
boulder	0%
bedrock	0%



Bankfull Dimensions	
10.0	x-section area (ft.sq.)
12.1	width (ft)
0.8	mean depth (ft)
1.6	max depth (ft)
12.8	wetted perimeter (ft)
0.8	hydraulic radius (ft)
14.6	width-depth ratio

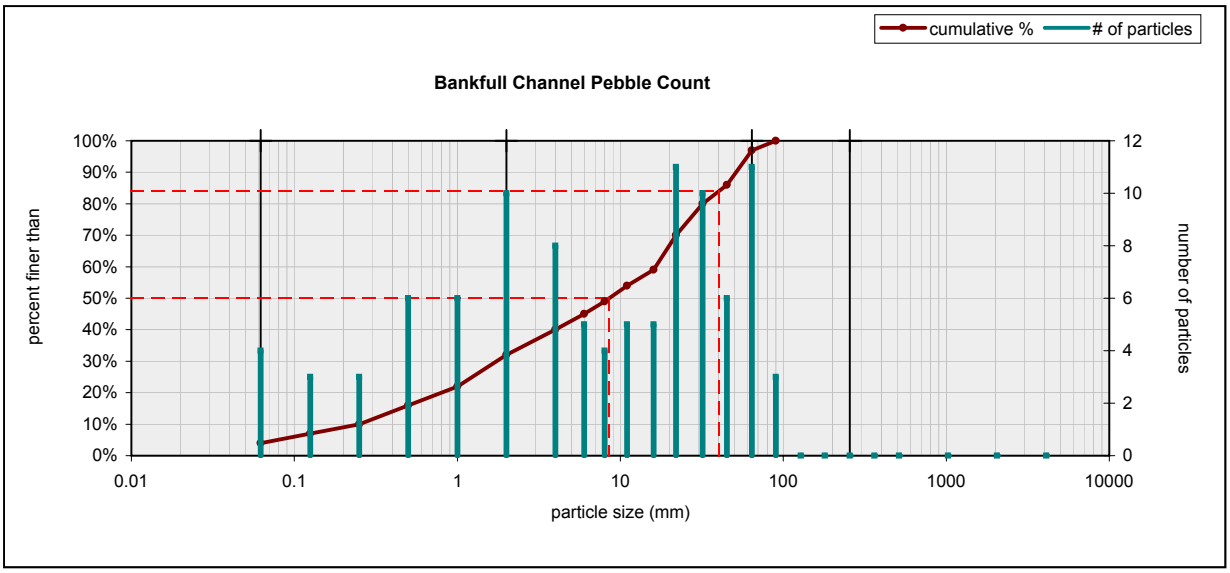
Flood Dimensions	
100.0	Width flood prone area (ft)
8.3	entrenchment ratio
1.9	low bank height (ft)
1.1	low bank height ratio

Flow Resistance	
0.021	Manning's roughness

Bankfull Flow	
5.4	velocity (ft/s)
54.0	discharge rate (cfs)
0.81	channel slope (%)

Sinuosity	Channel Type
1.18	C4

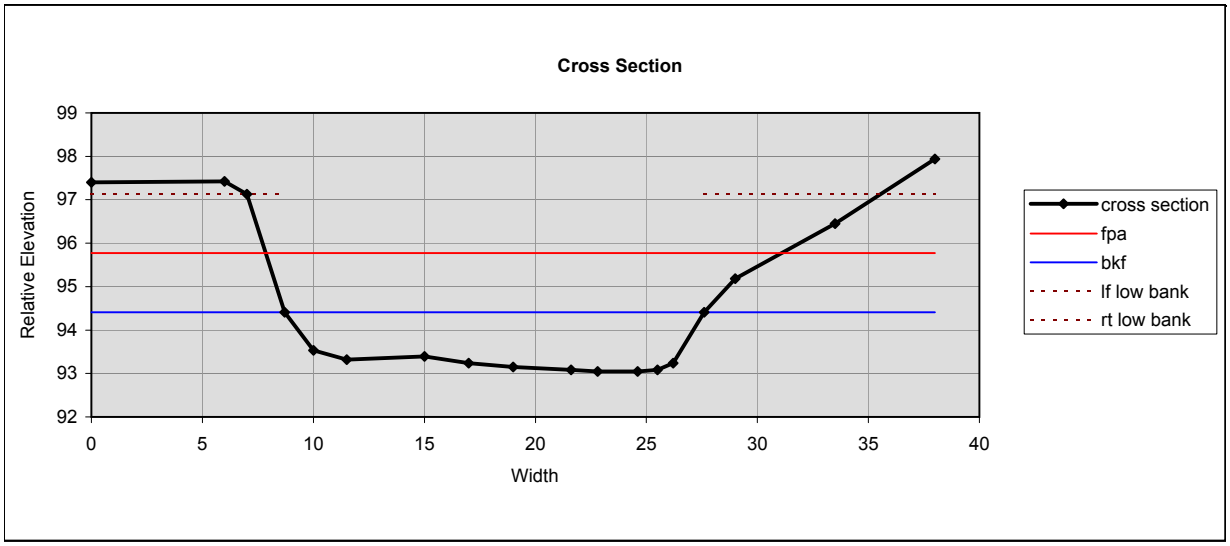
12LP-1-03-2006



Size (mm)	
D16	0.5
D35	2.6
D50	8.5
D65	19
D84	40
D95	60

Size Distribution	
mean	4.5
dispersion	10.9
skewness	-0.2

Type	
silt/clay	4%
sand	28%
gravel	65%
cobble	3%
boulder	0%
bedrock	



Bankfull Dimensions	
20.7	x-section area (ft.sq.)
18.9	width (ft)
1.1	mean depth (ft)
1.4	max depth (ft)
19.6	wetted perimeter (ft)
1.1	hydraulic radius (ft)
17.3	width-depth ratio

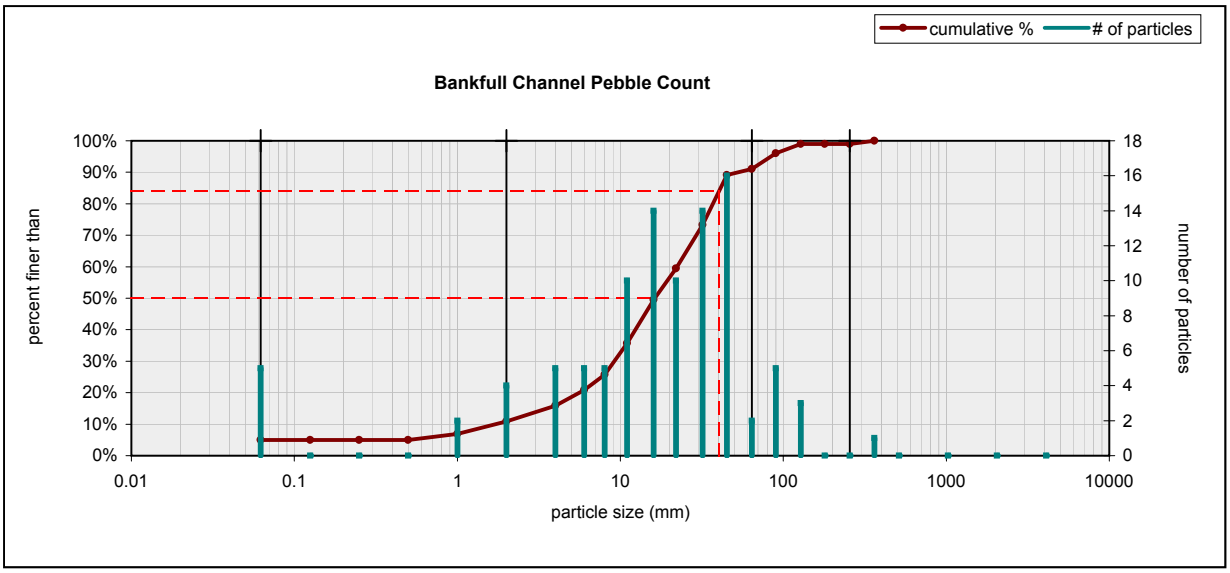
Flood Dimensions	
23.3	Width flood prone area (ft)
1.2	entrenchment ratio
4.1	low bank height (ft)
3.0	low bank height ratio

Flow Resistance	
0.032	Manning's roughness

Bankfull Flow	
3.9	velocity (ft/s)
80.5	discharge rate (cfs)
0.65	channel slope (%)

Sinuosity	Channel Type
1.05	F4c

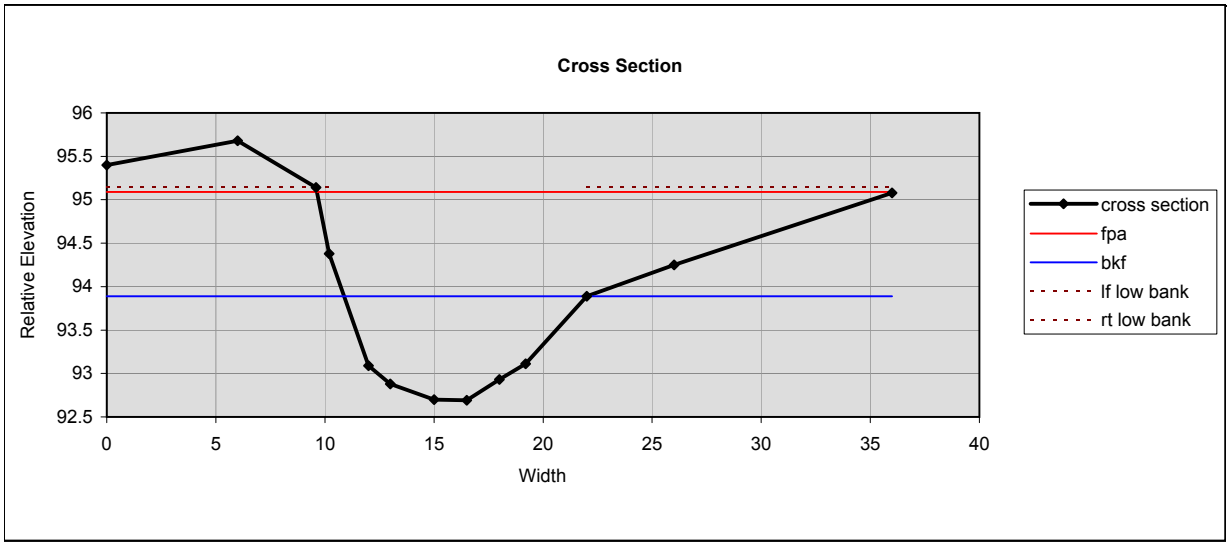
12LP-1-04-2006



Size (mm)	
D16	4.1
D35	11
D50	16
D65	26
D84	40
D95	84

Size Distribution	
mean	12.8
dispersion	3.2
skewness	-0.1

Type	
silt/clay	5%
sand	6%
gravel	80%
cobble	8%
boulder	1%
bedrock	0%



Bankfull Dimensions	
9.1	x-section area (ft.sq.)
11.1	width (ft)
0.8	mean depth (ft)
1.2	max depth (ft)
11.5	wetted perimeter (ft)
0.8	hydraulic radius (ft)
13.6	width-depth ratio

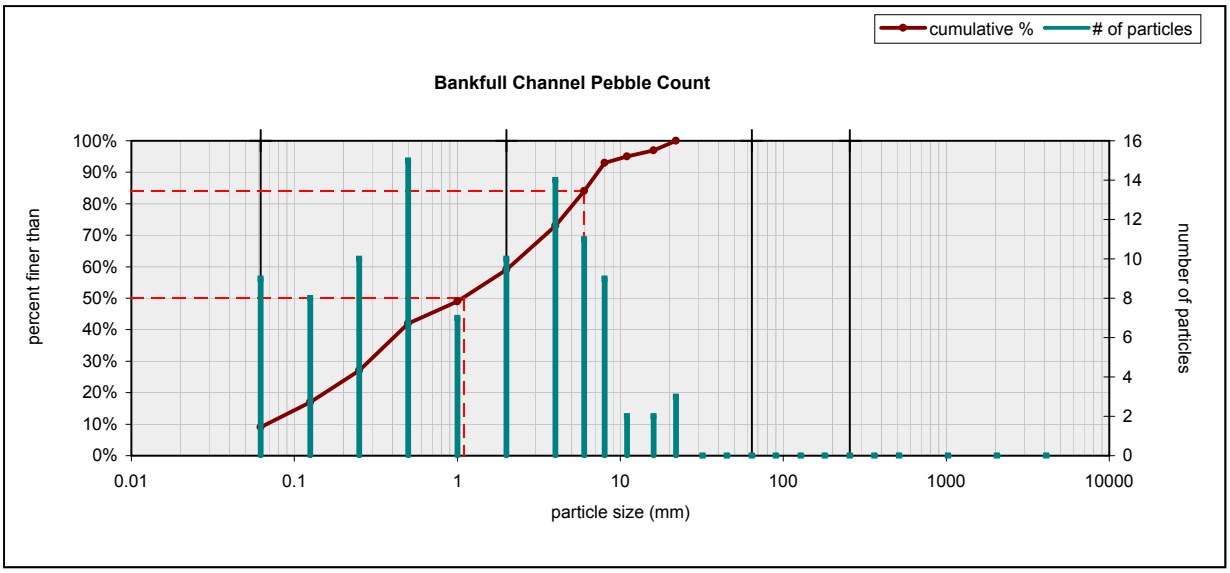
Flood Dimensions	
26.2	Width flood prone area (ft)
2.4	entrenchment ratio
2.5	low bank height (ft)
2.0	low bank height ratio

Flow Resistance	
0.033	Manning's roughness

Bankfull Flow	
4.1	velocity (ft/s)
37.0	discharge rate (cfs)
1.10	channel slope (%)

Sinuosity	Channel Type
1.08	C4

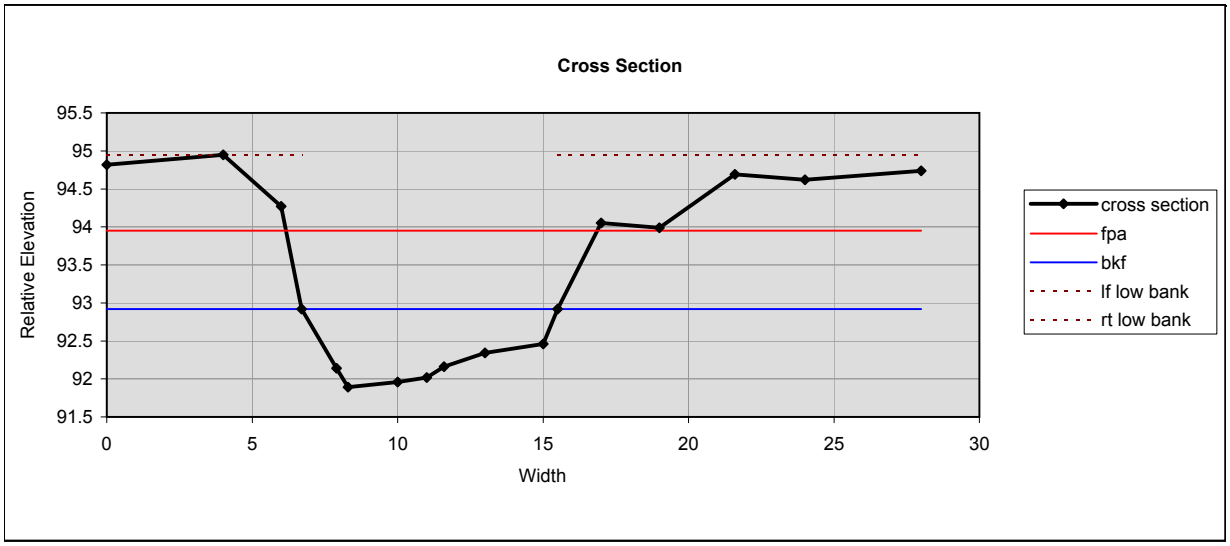
12LP-1-05-2006



Size (mm)	
D16	0.11
D35	0.36
D50	1.1
D65	2.7
D84	6
D95	11

Size Distribution	
mean	0.8
dispersion	7.7
skewness	-0.1

Type	
silt/clay	9%
sand	50%
gravel	41%
cobble	0%
boulder	0%
bedrock	0%



Bankfull Dimensions	
6.0	x-section area (ft.sq.)
8.8	width (ft)
0.7	mean depth (ft)
1.0	max depth (ft)
9.3	wetted perimeter (ft)
0.6	hydraulic radius (ft)
12.8	width-depth ratio

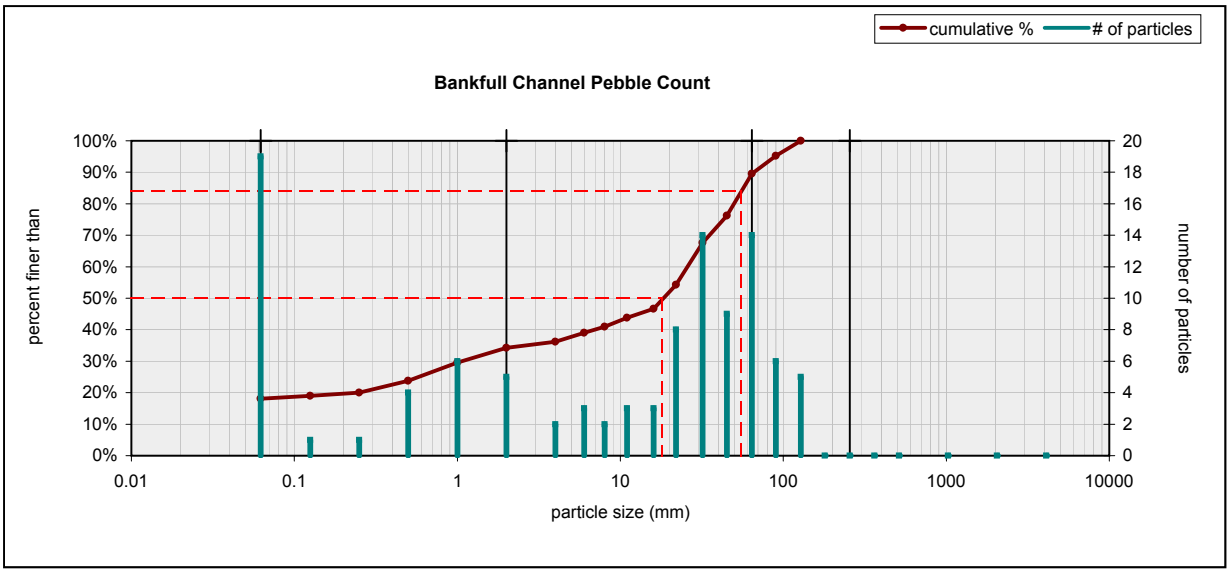
Flood Dimensions	
10.2	Width flood prone area (ft)
1.2	entrenchment ratio
3.1	low bank height (ft)
3.0	low bank height ratio

Flow Resistance	
0.020	Manning's roughness

Bankfull Flow	
4.3	velocity (ft/s)
26.0	discharge rate (cfs)
0.62	channel slope (%)

Sinuosity	Channel Type
1.17	F5c

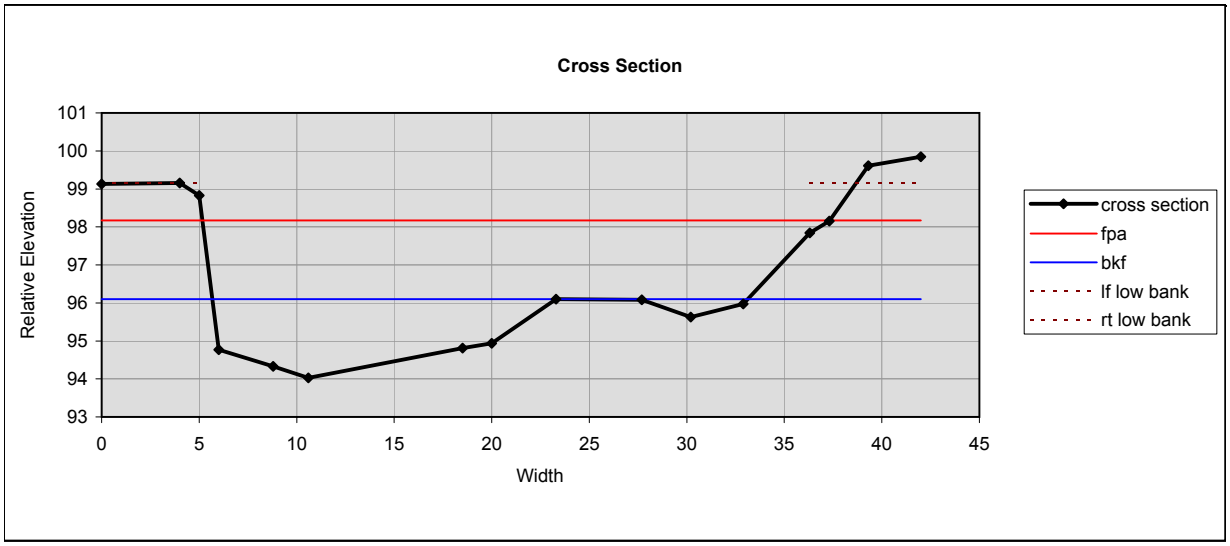
12LP-1-06-2006



Size (mm)	
D16	0.062
D35	2.6
D50	18
D65	30
D84	55
D95	89

Size Distribution	
mean	1.8
dispersion	146.7
skewness	-0.6

Type	
silt/clay	18%
sand	16%
gravel	55%
cobble	10%
boulder	0%
bedrock	0%



Bankfull Dimensions	
26.5	x-section area (ft.sq.)
27.5	width (ft)
1.0	mean depth (ft)
2.1	max depth (ft)
28.9	wetted perimeter (ft)
0.9	hydraulic radius (ft)
28.4	width-depth ratio

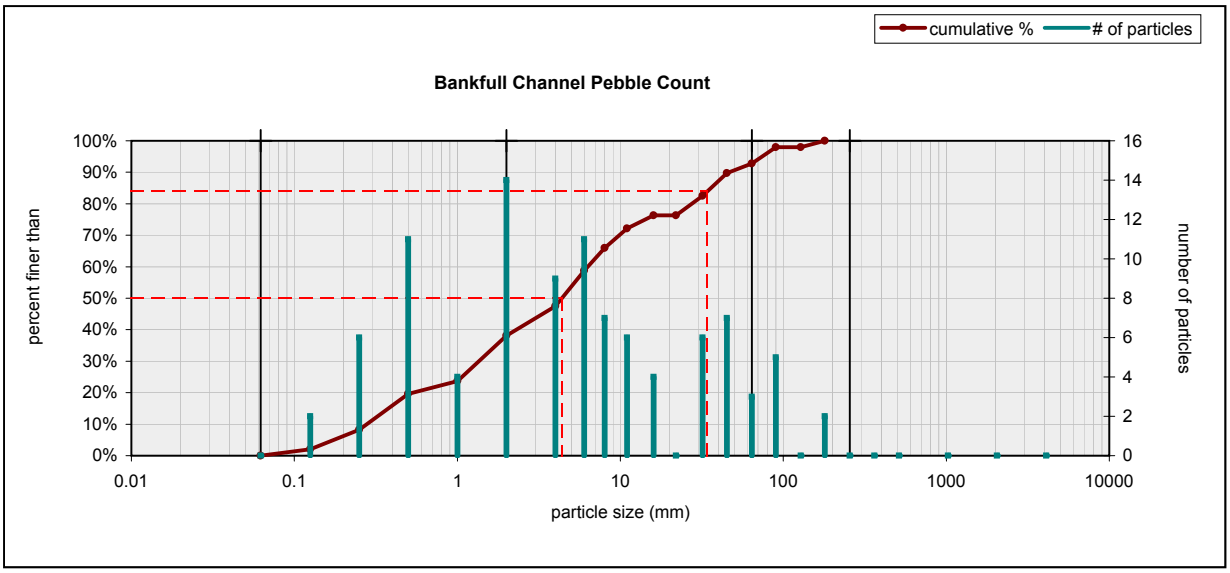
Flood Dimensions	
32.2	Width flood prone area (ft)
1.2	entrenchment ratio
5.1	low bank height (ft)
2.5	low bank height ratio

Flow Resistance	
0.034	Manning's roughness

Bankfull Flow	
3.6	velocity (ft/s)
96.5	discharge rate (cfs)
0.78	channel slope (%)

Sinuosity	Channel Type
1.15	F5

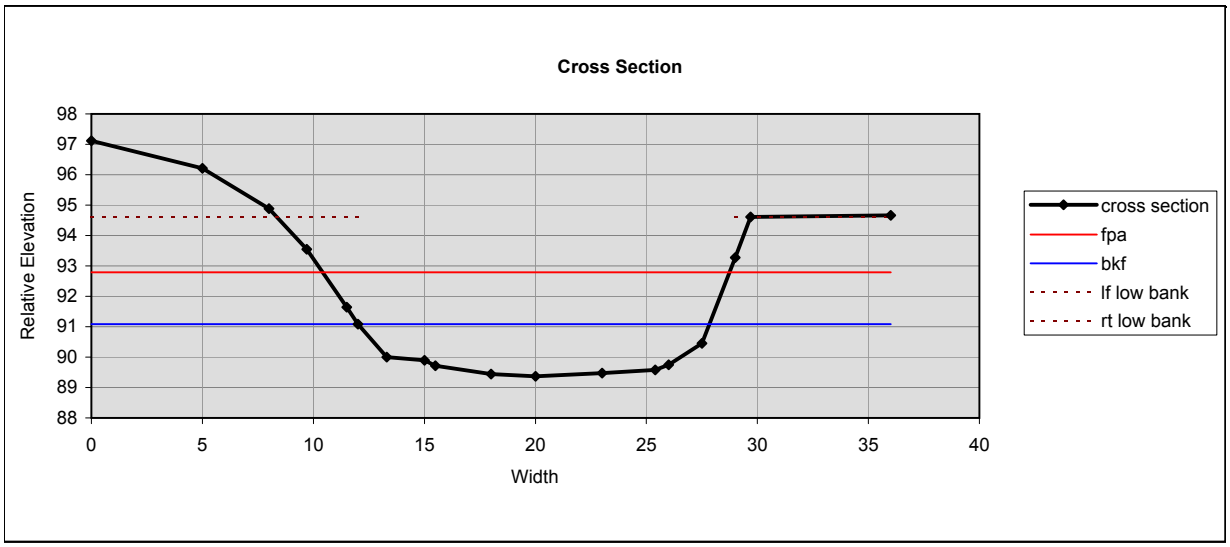
12LP-1-07-2006



Size (mm)	
D16	0.4
D35	1.7
D50	4.4
D65	7.7
D84	34
D95	74

Size Distribution	
mean	3.7
dispersion	9.4
skewness	-0.1

Type	
silt/clay	0%
sand	37%
gravel	54%
cobble	7%
boulder	0%
bedrock	2%



Bankfull Dimensions	
21.5	x-section area (ft.sq.)
15.8	width (ft)
1.4	mean depth (ft)
1.7	max depth (ft)
16.8	wetted perimeter (ft)
1.3	hydraulic radius (ft)
11.7	width-depth ratio

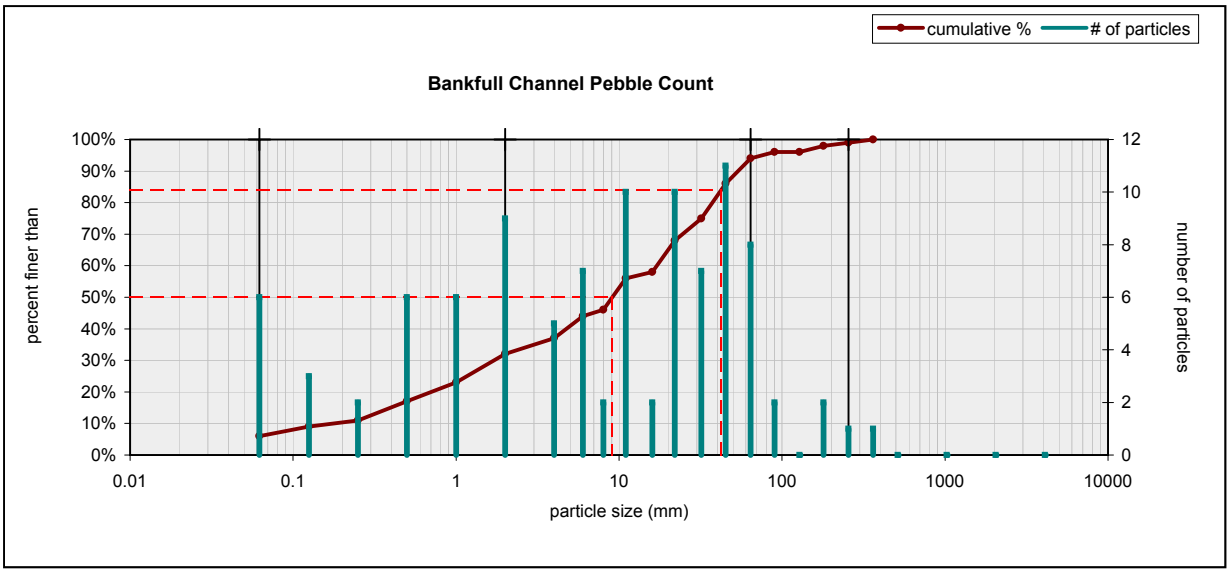
Flood Dimensions	
18.3	Width flood prone area (ft)
1.2	entrenchment ratio
5.2	low bank height (ft)
3.1	low bank height ratio

Flow Resistance	
0.030	Manning's roughness

Bankfull Flow	
6.7	velocity (ft/s)
144.7	discharge rate (cfs)
1.3	channel slope (%)

Sinuosity	Channel Type
1.05	G4c

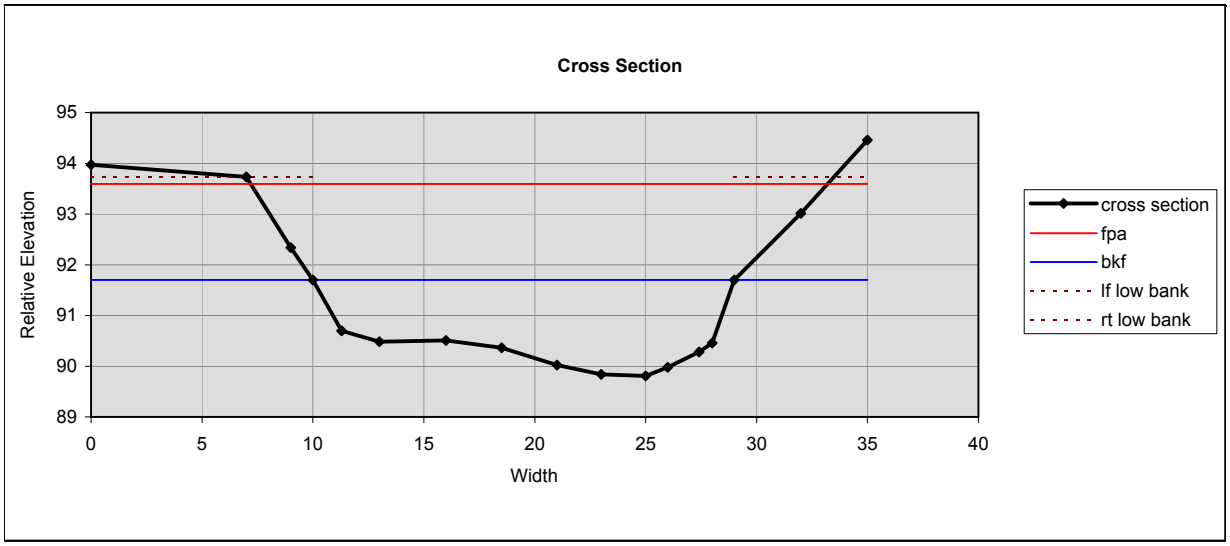
12LP-2-01-2006



Size (mm)	
D16	0.45
D35	3
D50	9.1
D65	20
D84	42
D95	76

Size Distribution	
mean	4.3
dispersion	12.4
skewness	-0.2

Type	
silt/clay	6%
sand	26%
gravel	62%
cobble	5%
boulder	1%
bedrock	0%



Bankfull Dimensions	
25.8	x-section area (ft.sq.)
19.0	width (ft)
1.4	mean depth (ft)
1.9	max depth (ft)
20.1	wetted perimeter (ft)
1.3	hydraulic radius (ft)
14.0	width-depth ratio

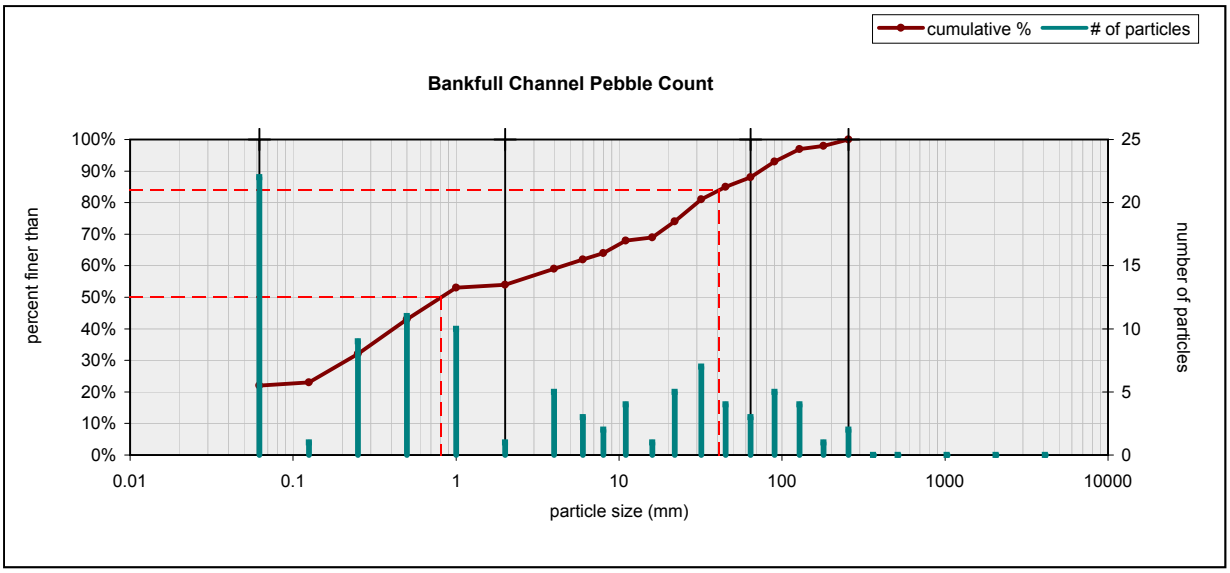
Flood Dimensions	
25.8	Width flood prone area (ft)
1.4	entrenchment ratio
3.9	low bank height (ft)
2.1	low bank height ratio

Flow Resistance	
0.031	Manning's roughness

Bankfull Flow	
4.7	velocity (ft/s)
120.0	discharge rate (cfs)
0.68	channel slope (%)

Sinuosity	Channel Type
1.61	C4c

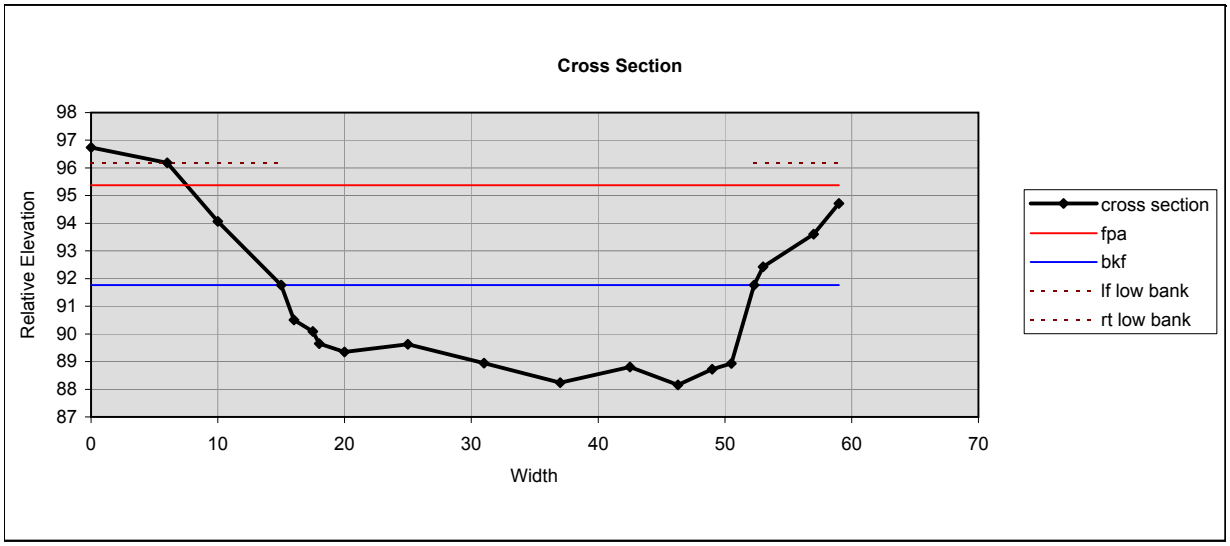
12LP-3-01-2006



Size (mm)	
D16	0.062
D35	0.3
D50	0.81
D65	8.7
D84	41
D95	110

Size Distribution	
mean	1.6
dispersion	31.8
skewness	0.2

Type	
silt/clay	22%
sand	32%
gravel	34%
cobble	12%
boulder	0%
bedrock	0%



Bankfull Dimensions	
100.0	x-section area (ft.sq.)
37.3	width (ft)
2.7	mean depth (ft)
3.6	max depth (ft)
40.0	wetted perimeter (ft)
2.5	hydraulic radius (ft)
13.9	width-depth ratio

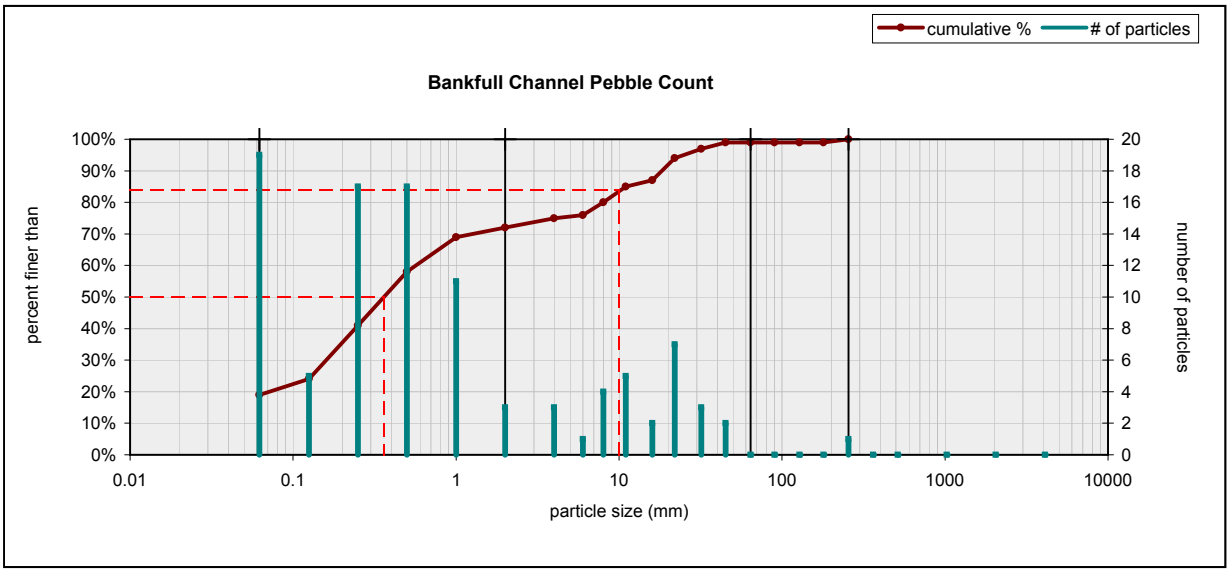
Flood Dimensions	
42.9	Width flood prone area (ft)
1.2	entrenchment ratio
8.0	low bank height (ft)
2.2	low bank height ratio

Flow Resistance	
0.029	Manning's roughness

Bankfull Flow	
5.8	velocity (ft/s)
579.2	discharge rate (cfs)
0.38	channel slope (%)

Sinuosity	Channel Type
1.26	F4/5c

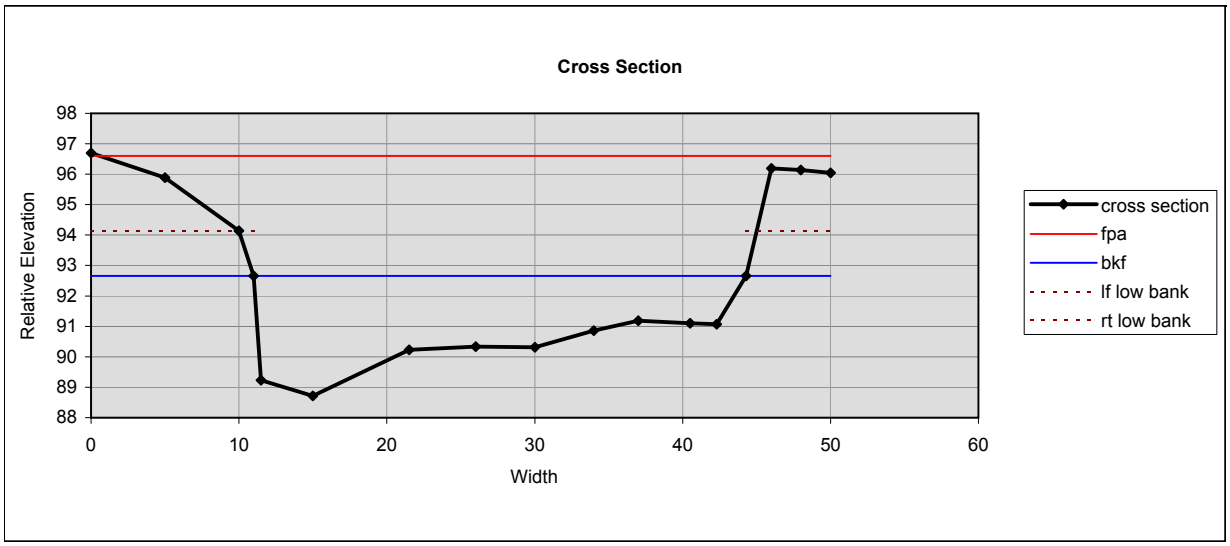
12LP-3-02-2006



Size (mm)	
D16	0.062
D35	0.2
D50	0.36
D65	0.78
D84	10
D95	25

Size Distribution	
mean	0.8
dispersion	16.8
skewness	0.2

Type	
silt/clay	19%
sand	53%
gravel	27%
cobble	1%
boulder	0%
bedrock	0%



Bankfull Dimensions	
77.5	x-section area (ft.sq.)
33.3	width (ft)
2.3	mean depth (ft)
3.9	max depth (ft)
37.1	wetted perimeter (ft)
2.1	hydraulic radius (ft)
14.3	width-depth ratio

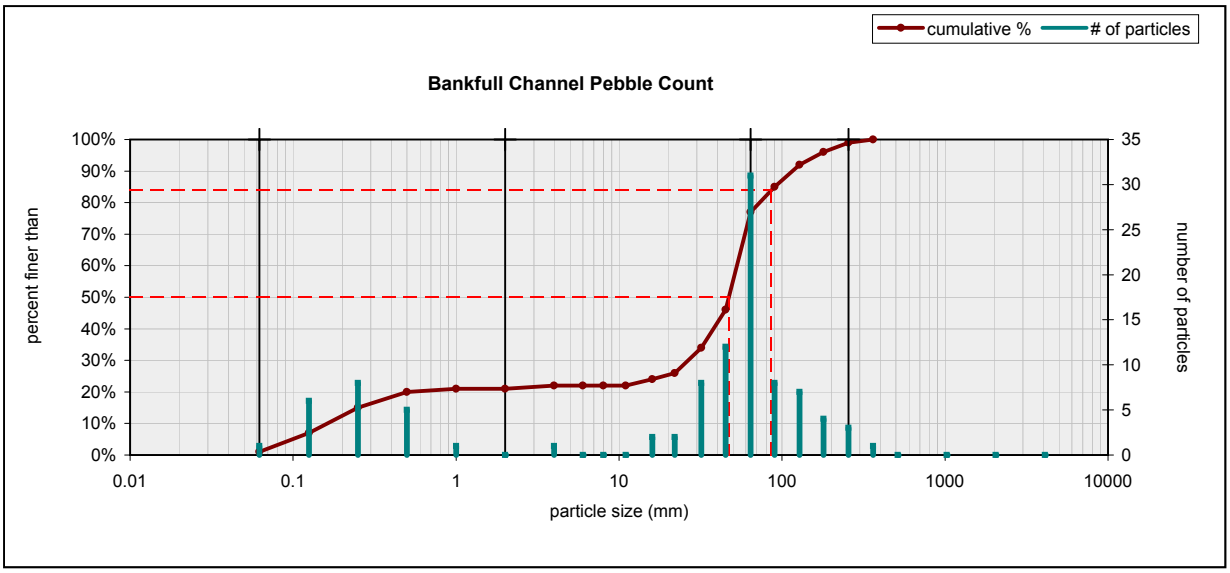
Flood Dimensions	
49.4	Width flood prone area (ft)
1.5	entrenchment ratio
5.4	low bank height (ft)
1.4	low bank height ratio

Flow Resistance	
0.022	Manning's roughness

Bankfull Flow	
4.8	velocity (ft/s)
370.5	discharge rate (cfs)
0.18	channel slope (%)

Sinuosity	Channel Type
1.00	F5

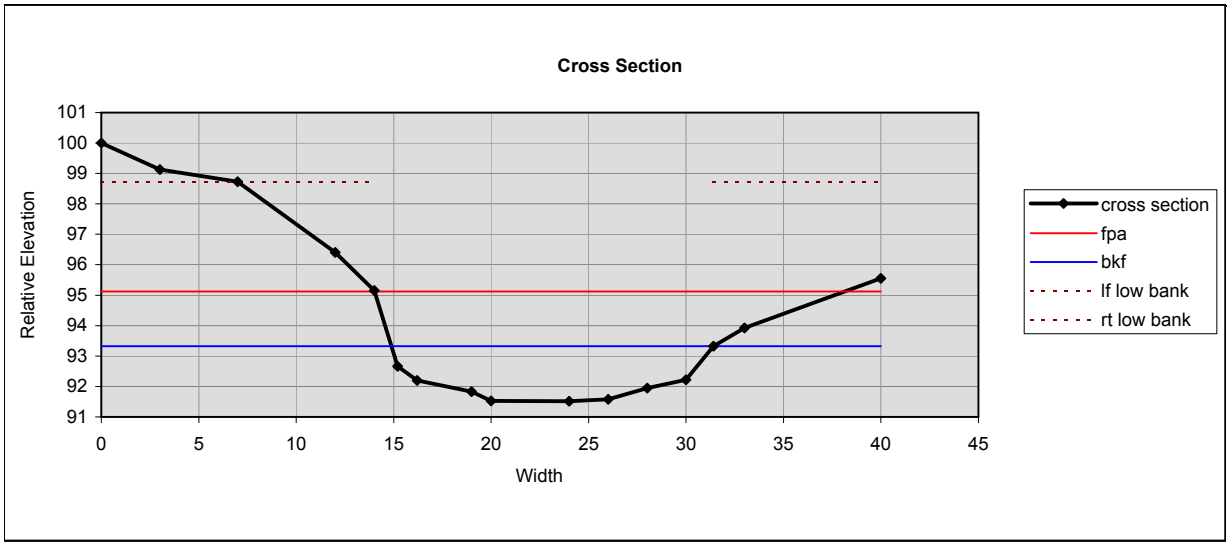
13LP-1-01-2006



Size (mm)	
D16	0.29
D35	33
D50	47
D65	56
D84	86
D95	170

Size Distribution	
mean	5.0
dispersion	81.9
skewness	-0.6

Type	
silt/clay	1%
sand	20%
gravel	56%
cobble	22%
boulder	1%
bedrock	0%



Bankfull Dimensions	
23.4	x-section area (ft.sq.)
16.5	width (ft)
1.4	mean depth (ft)
1.8	max depth (ft)
17.5	wetted perimeter (ft)
1.3	hydraulic radius (ft)
11.7	width-depth ratio

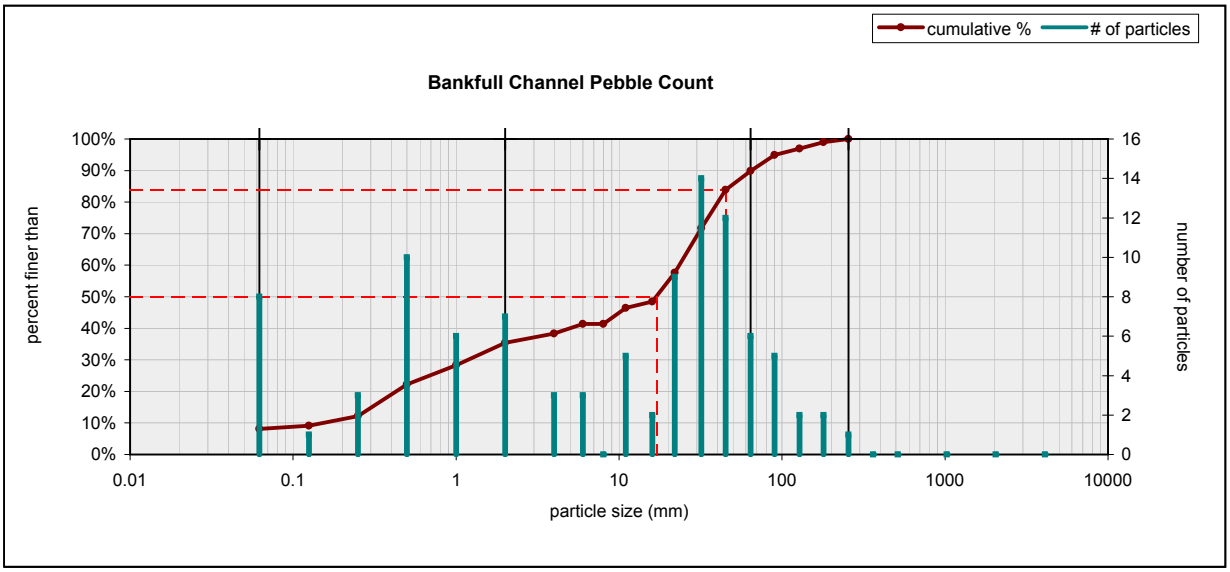
Flood Dimensions	
24.2	Width flood prone area (ft)
1.5	entrenchment ratio
7.2	low bank height (ft)
4.0	low bank height ratio

Flow Resistance	
0.039	Manning's roughness

Bankfull Flow	
3.0	velocity (ft/s)
69.3	discharge rate (cfs)
0.42	channel slope (%)

Sinuosity	Channel Type
1.04	C4c

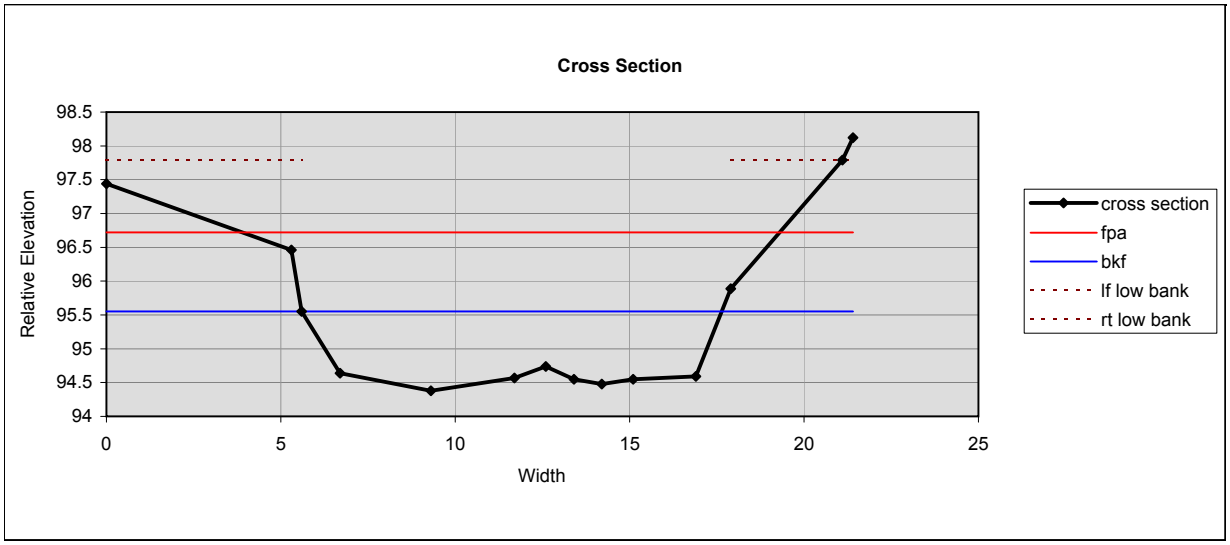
13LP-1-02-2006



Size (mm)	
D16	0.33
D35	1.9
D50	17
D65	27
D84	45
D95	91

Size Distribution	
mean	3.9
dispersion	27.1
skewness	-0.4

Type	
silt/clay	8%
sand	26%
gravel	53%
cobble	10%
boulder	0%
bedrock	3%



Bankfull Dimensions	
11.2	x-section area (ft.sq.)
12.0	width (ft)
0.9	mean depth (ft)
1.2	max depth (ft)
12.9	wetted perimeter (ft)
0.9	hydraulic radius (ft)
12.9	width-depth ratio

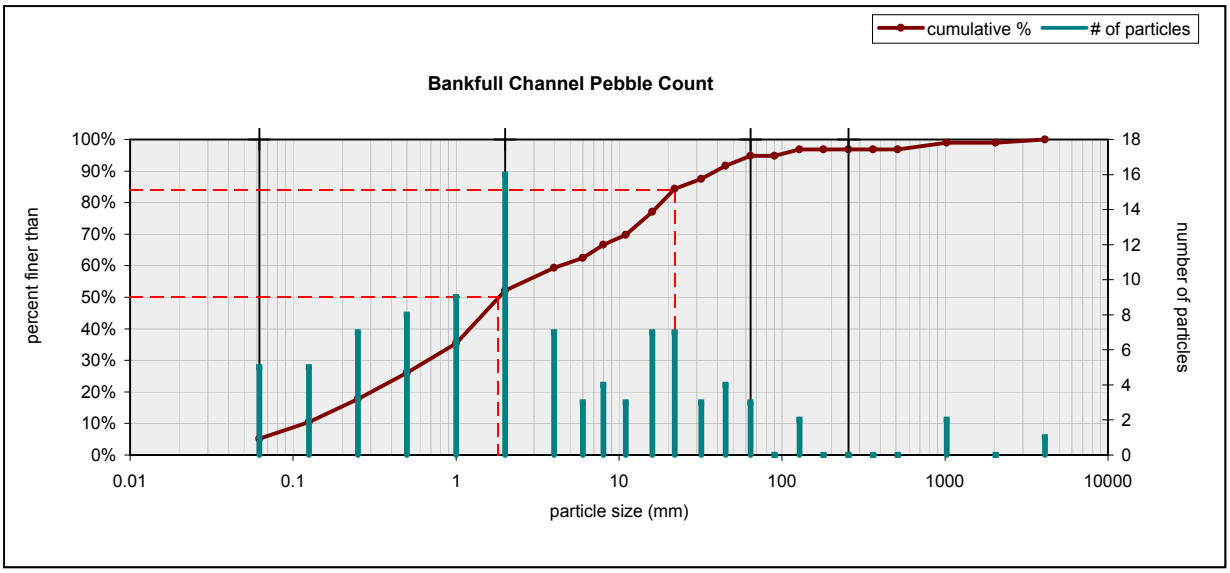
Flood Dimensions	
15.4	Width flood prone area (ft)
1.3	entrenchment ratio
3.4	low bank height (ft)
2.9	low bank height ratio

Flow Resistance	
0.034	Manning's roughness

Bankfull Flow	
3.9	velocity (ft/s)
43.2	discharge rate (cfs)
0.94	channel slope (%)

Sinuosity	Channel Type
1.11	C4c

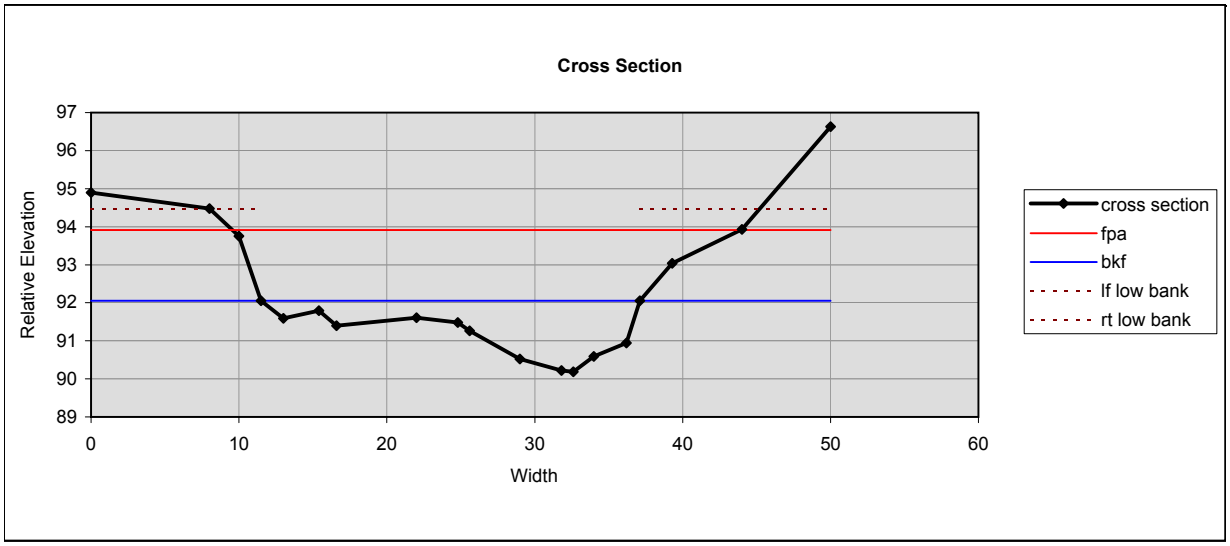
13LP-1-03-2006



Size (mm)	
D16	0.21
D35	0.97
D50	1.8
D65	7.1
D84	22
D95	93

Size Distribution	
mean	2.1
dispersion	10.4
skewness	0.1

Type	
silt/clay	5%
sand	45%
gravel	41%
cobble	2%
boulder	3%
bedrock	4%



Bankfull Dimensions	
22.4	x-section area (ft.sq.)
25.6	width (ft)
0.9	mean depth (ft)
1.9	max depth (ft)
26.5	wetted perimeter (ft)
0.8	hydraulic radius (ft)
29.2	width-depth ratio

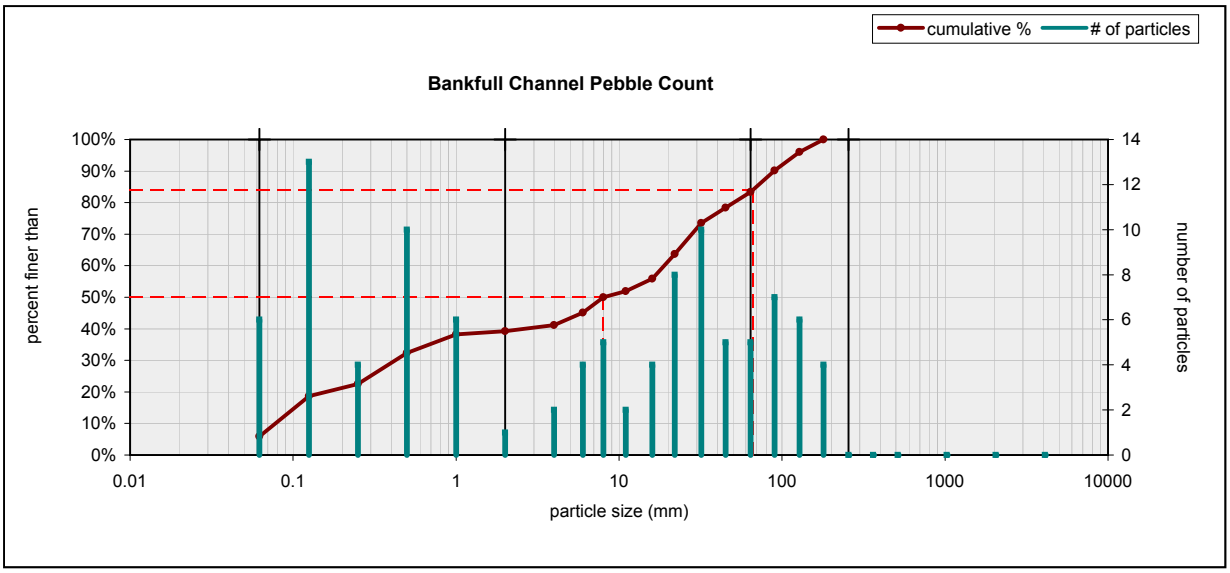
Flood Dimensions	
34.2	Width flood prone area (ft)
1.3	entrenchment ratio
4.3	low bank height (ft)
2.3	low bank height ratio

Flow Resistance	
0.026	Manning's roughness

Bankfull Flow	
3.3	velocity (ft/s)
73.3	discharge rate (cfs)
0.42	channel slope (%)

Sinuosity	Channel Type
1.66	F5/4c

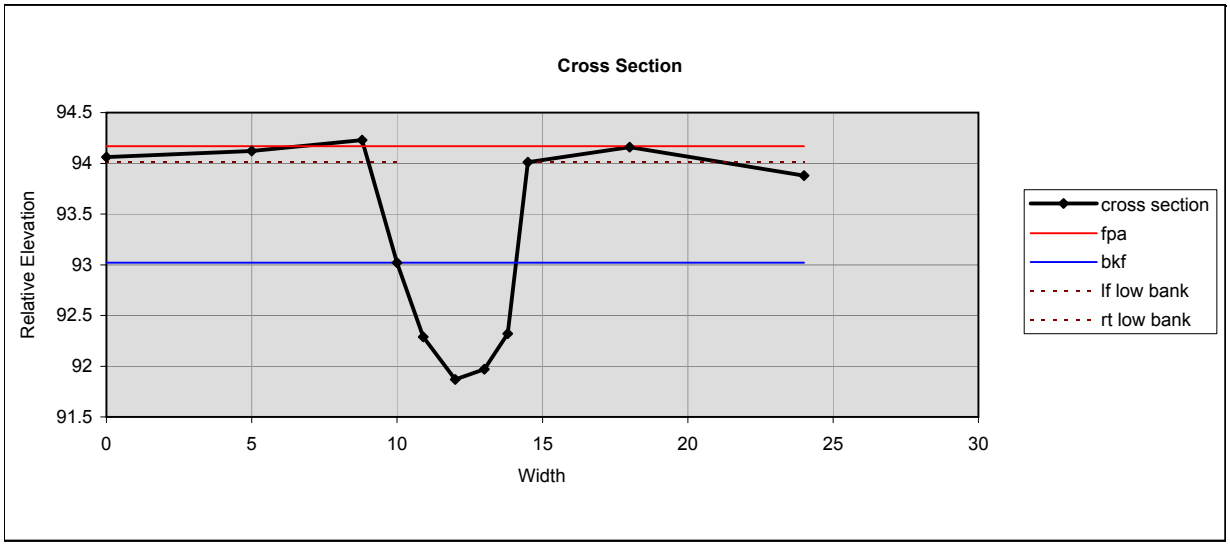
13LP-1-04-2006



Size (mm)	
D16	0.11
D35	0.68
D50	8
D65	23
D84	66
D95	120

Size Distribution	
mean	2.7
dispersion	40.5
skewness	-0.3

Type	
silt/clay	6%
sand	33%
gravel	44%
cobble	17%
boulder	0%
bedrock	0%



Bankfull Dimensions	
3.3	x-section area (ft.sq.)
4.1	width (ft)
0.8	mean depth (ft)
1.1	max depth (ft)
5.0	wetted perimeter (ft)
0.7	hydraulic radius (ft)
5.1	width-depth ratio

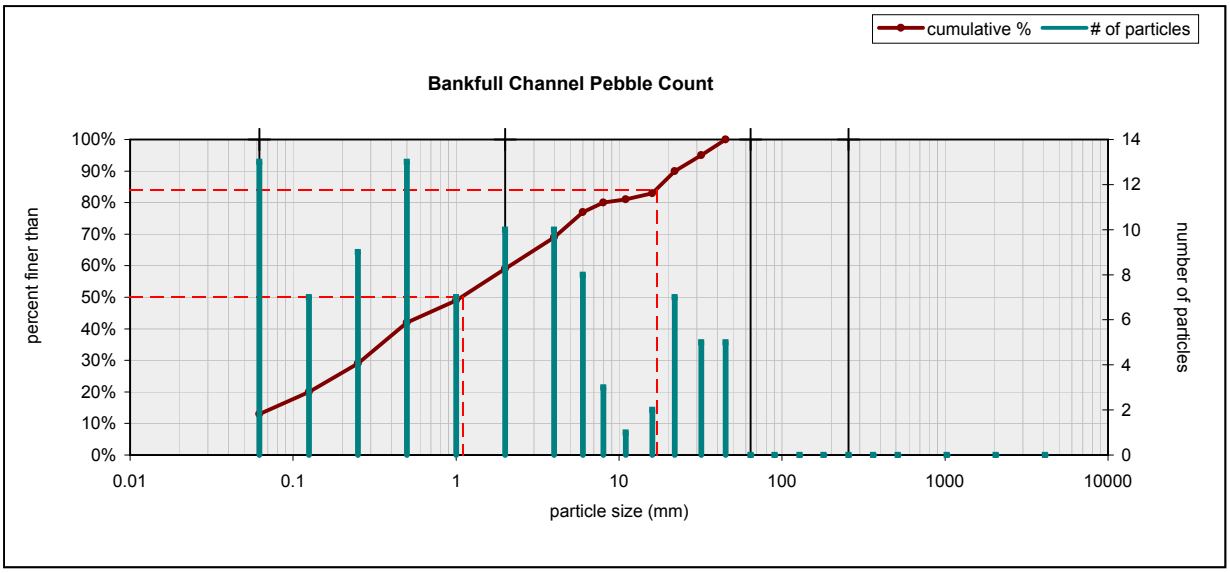
Flood Dimensions	
52.5	Width flood prone area (ft)
12.8	entrenchment ratio
2.1	low bank height (ft)
1.9	low bank height ratio

Flow Resistance	
0.040	Manning's roughness

Bankfull Flow	
4.9	velocity (ft/s)
16.1	discharge rate (cfs)
3.10	channel slope (%)

Sinuosity	Channel Type
1.15	C4b

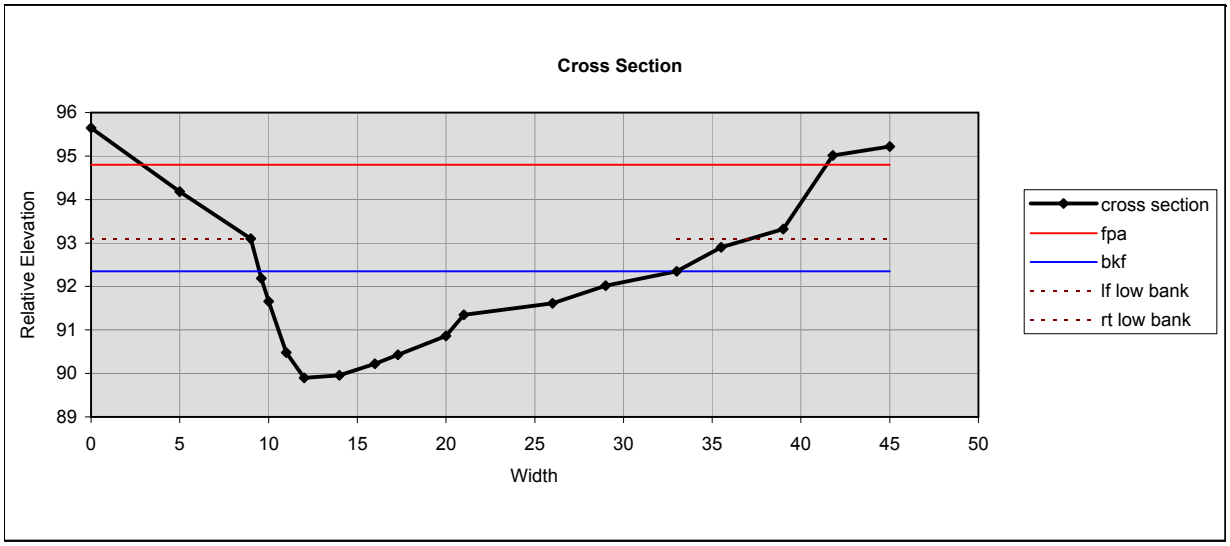
13LP-1-05-2006



Size (mm)	
D16	0.084
D35	0.34
D50	1.1
D65	3
D84	17
D95	32

Size Distribution	
mean	1.2
dispersion	14.3
skewness	0.0

Type	
silt/clay	13%
sand	46%
gravel	41%
cobble	0%
boulder	0%
bedrock	0%



Bankfull Dimensions	
28.1	x-section area (ft.sq.)
23.5	width (ft)
1.2	mean depth (ft)
2.4	max depth (ft)
24.8	wetted perimeter (ft)
1.1	hydraulic radius (ft)
19.7	width-depth ratio

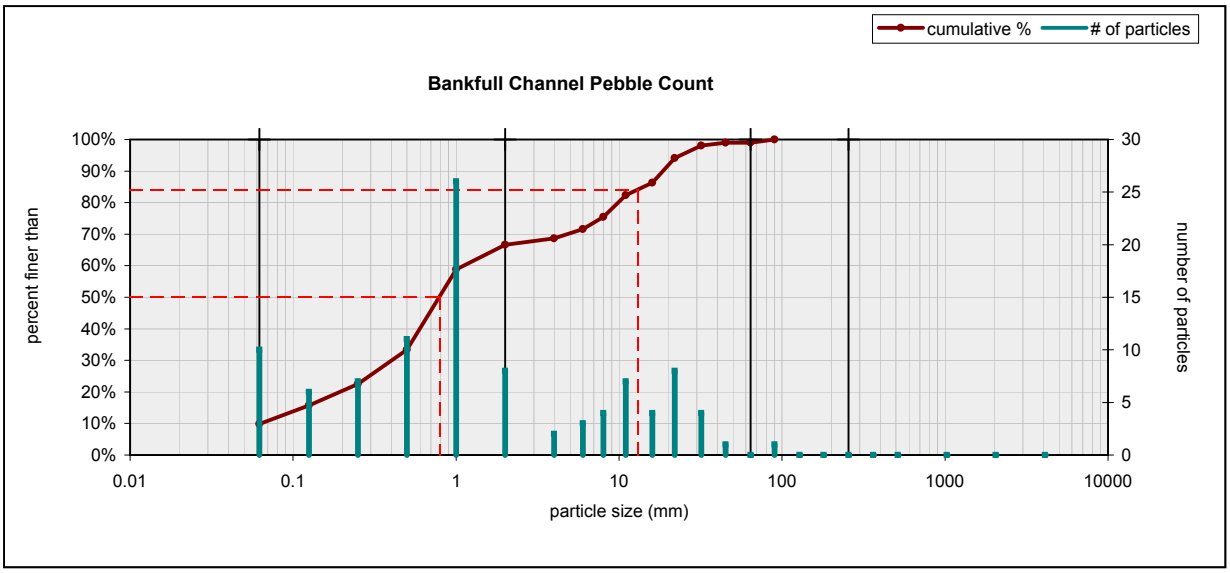
Flood Dimensions	
37.4	Width flood prone area (ft)
1.6	entrenchment ratio
3.2	low bank height (ft)
1.3	low bank height ratio

Flow Resistance	
0.024	Manning's roughness

Bankfull Flow	
5.2	velocity (ft/s)
146.9	discharge rate (cfs)
0.62	channel slope (%)

Sinuosity	Channel Type
1.37	C5c

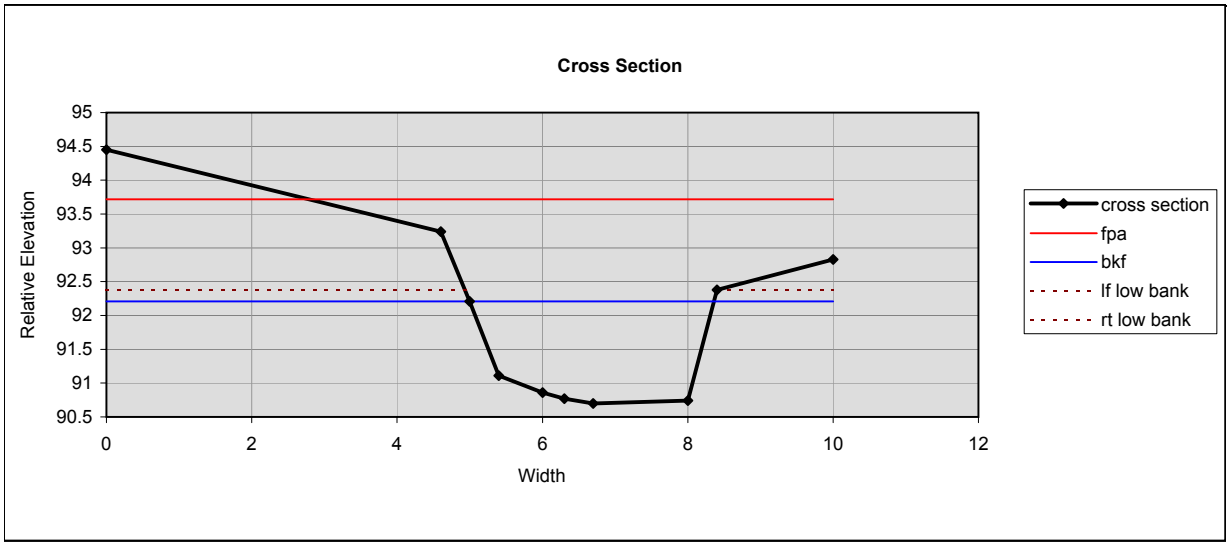
13LP-1-06-2006



Size (mm)	
D16	0.13
D35	0.52
D50	0.79
D65	1.7
D84	13
D95	24

Size Distribution	
mean	1.3
dispersion	11.3
skewness	0.2

Type	
silt/clay	10%
sand	57%
gravel	32%
cobble	1%
boulder	0%
bedrock	0%



Bankfull Dimensions	
4.2	x-section area (ft.sq.)
3.4	width (ft)
1.2	mean depth (ft)
1.5	max depth (ft)
5.4	wetted perimeter (ft)
0.8	hydraulic radius (ft)
2.7	width-depth ratio

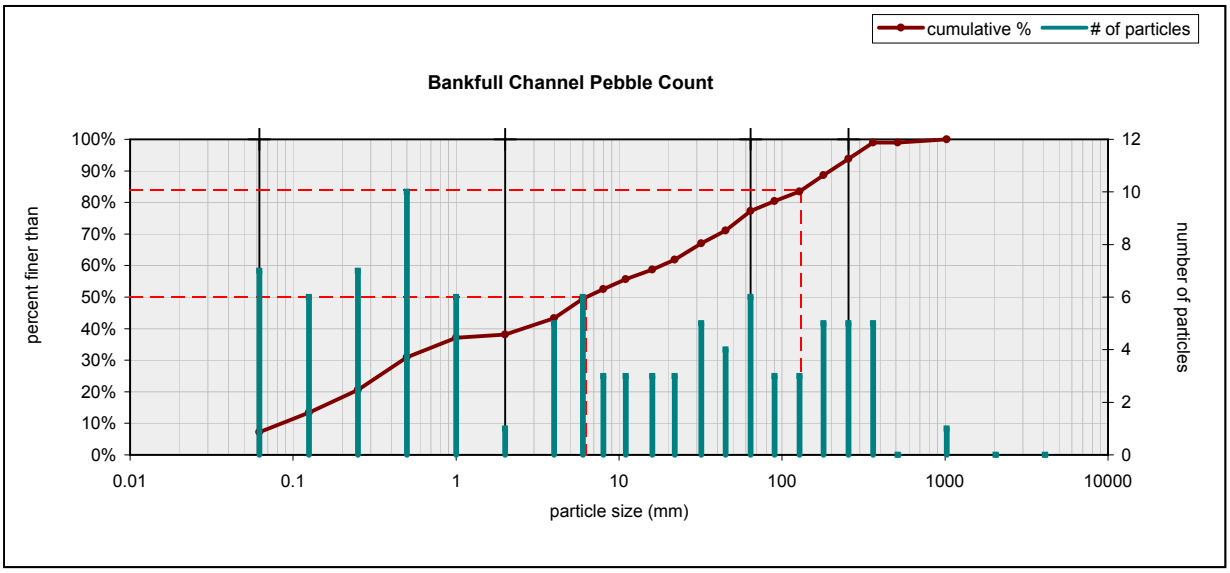
Flood Dimensions	
40.0	Width flood prone area (ft)
11.9	entrenchment ratio
1.7	low bank height (ft)
1.1	low bank height ratio

Flow Resistance	
0.024	Manning's roughness

Bankfull Flow	
6.5	velocity (ft/s)
27.2	discharge rate (cfs)
1.50	channel slope (%)

Sinuosity	Channel Type
1.32	C5/G5

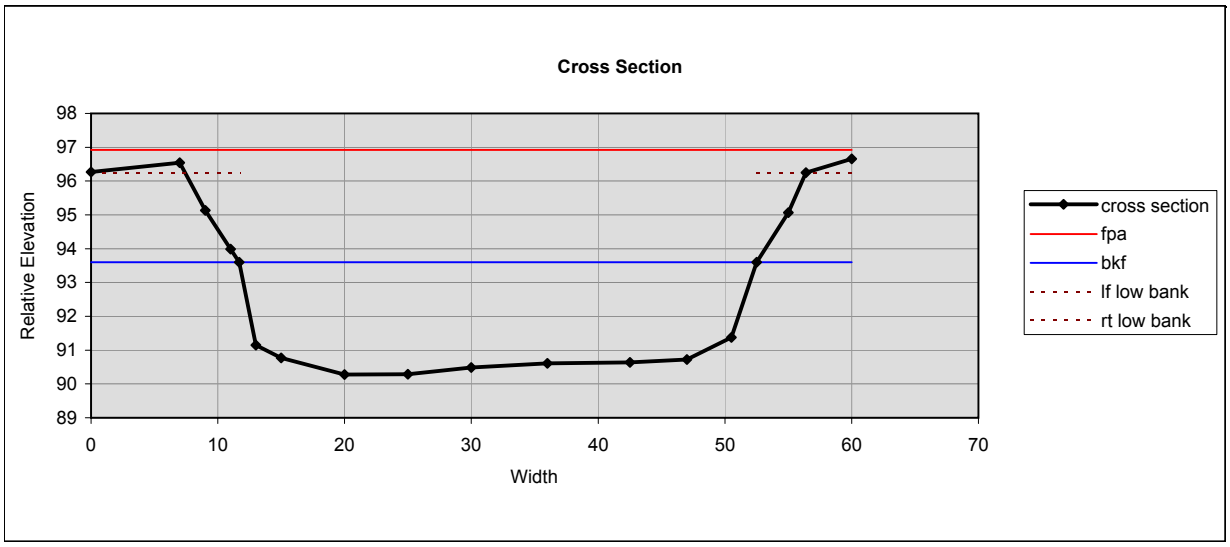
13LP-3-02-2006



Size (mm)	
D16	0.16
D35	0.79
D50	6.3
D65	28
D84	130
D95	280

Size Distribution	
mean	4.6
dispersion	30.0
skewness	-0.1

Type	
silt/clay	7%
sand	30%
gravel	38%
cobble	16%
boulder	6%
bedrock	2%



Bankfull Dimensions	
116.8	x-section area (ft.sq.)
40.8	width (ft)
2.9	mean depth (ft)
3.3	max depth (ft)
43.4	wetted perimeter (ft)
2.7	hydraulic radius (ft)
14.3	width-depth ratio

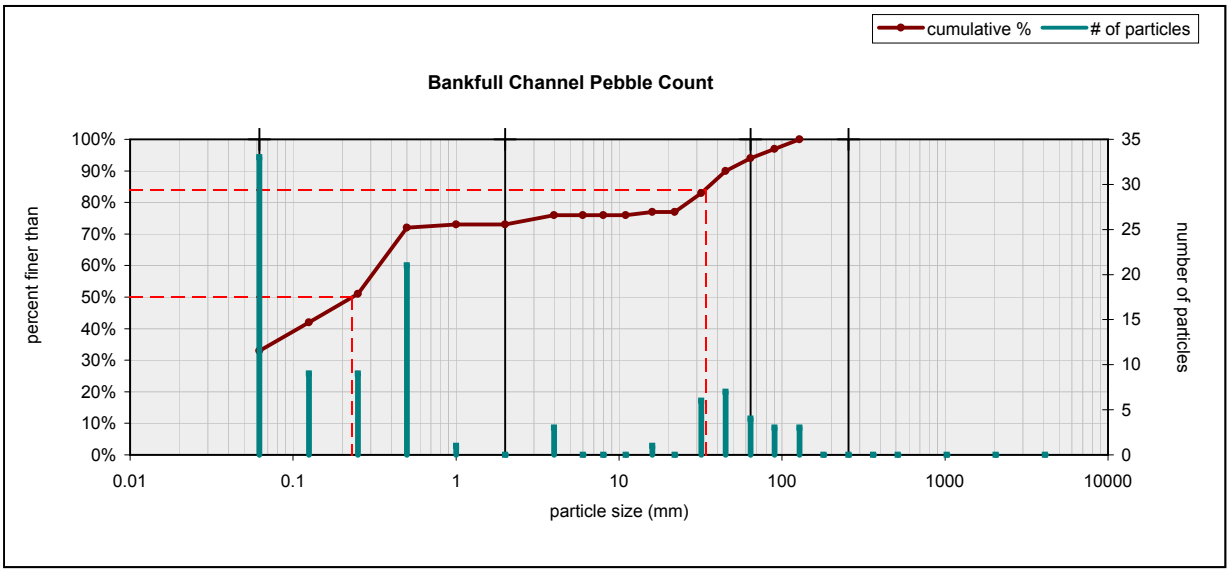
Flood Dimensions	
160.0	Width flood prone area (ft)
3.9	entrenchment ratio
6.0	low bank height (ft)
1.8	low bank height ratio

Flow Resistance	
0.040	Manning's roughness

Bankfull Flow	
2.9	velocity (ft/s)
342.7	discharge rate (cfs)
0.17	channel slope (%)

Sinuosity	Channel Type
1.00	C4

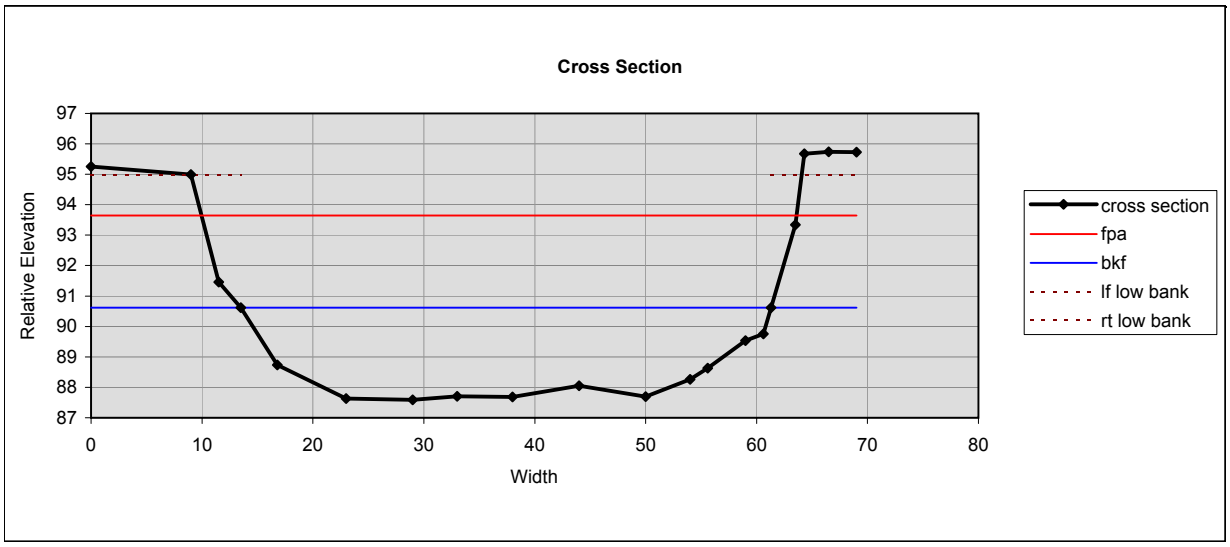
13LP-3-02A-2006



Size (mm)	
D16	0.062
D35	0.072
D50	0.23
D65	0.4
D84	34
D95	72

Size Distribution	
mean	1.5
dispersion	75.8
skewness	0.5

Type	
silt/clay	32%
sand	39%
gravel	20%
cobble	6%
boulder	0%
bedrock	3%



Bankfull Dimensions	
117.1	x-section area (ft.sq.)
47.8	width (ft)
2.4	mean depth (ft)
3.0	max depth (ft)
49.1	wetted perimeter (ft)
2.4	hydraulic radius (ft)
19.5	width-depth ratio

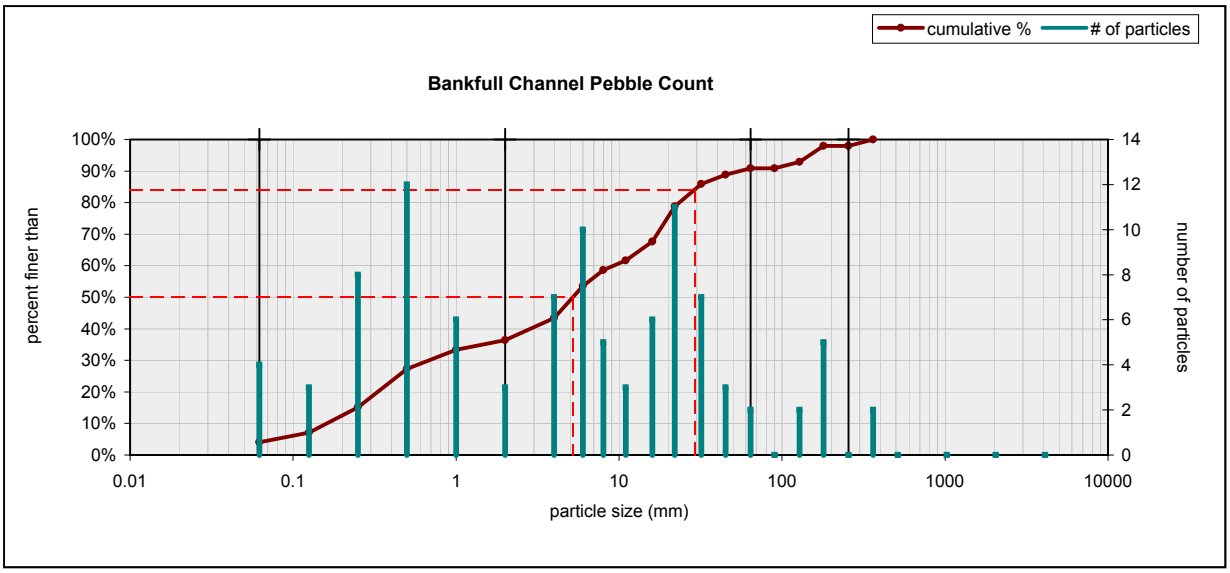
Flood Dimensions	
54.0	Width flood prone area (ft)
1.1	entrenchment ratio
7.4	low bank height (ft)
2.4	low bank height ratio

Flow Resistance	
0.028	Manning's roughness

Bankfull Flow	
4.3	velocity (ft/s)
503.7	discharge rate (cfs)
0.21	channel slope (%)

Sinuosity	Channel Type
1.73	F5c

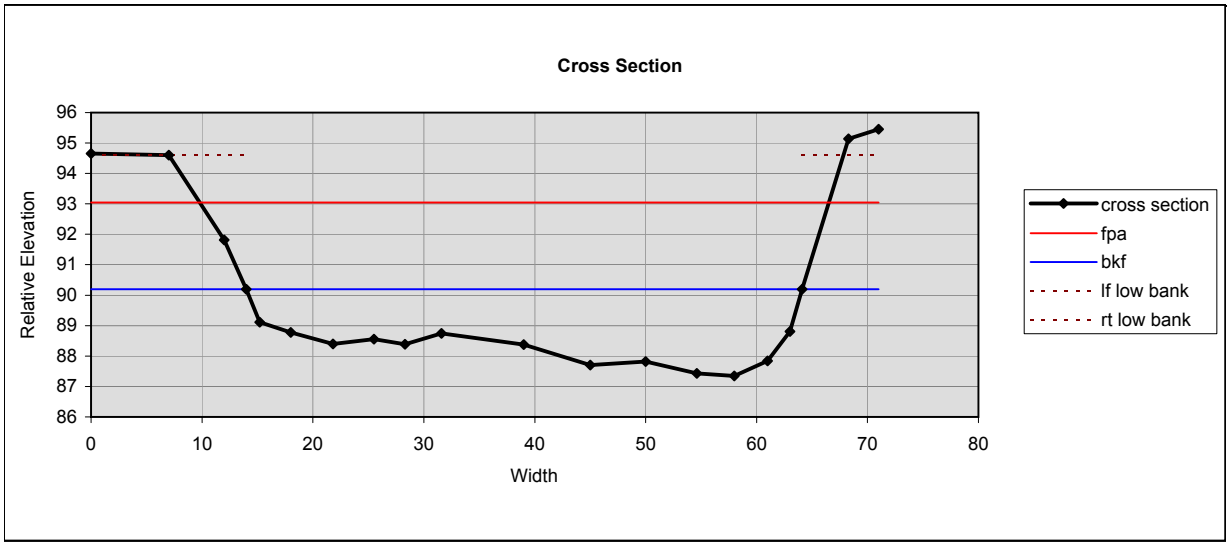
13LP-3-03-2006



Size (mm)	
D16	0.26
D35	1.5
D50	5.2
D65	14
D84	29
D95	150

Size Distribution	
mean	2.7
dispersion	12.8
skewness	-0.2

Type	
silt/clay	4%
sand	32%
gravel	55%
cobble	7%
boulder	2%
bedrock	0%



Bankfull Dimensions	
97.9	x-section area (ft.sq.)
50.1	width (ft)
2.0	mean depth (ft)
2.9	max depth (ft)
51.6	wetted perimeter (ft)
1.9	hydraulic radius (ft)
25.6	width-depth ratio

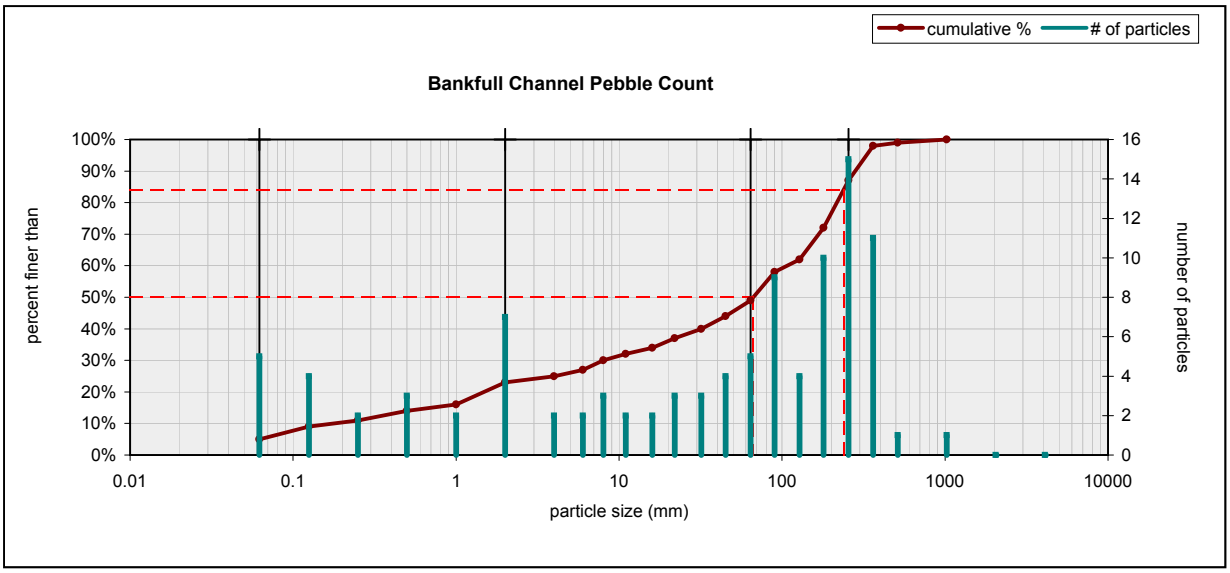
Flood Dimensions	
56.5	Width flood prone area (ft)
1.1	entrenchment ratio
7.3	low bank height (ft)
2.5	low bank height ratio

Flow Resistance	
0.027	Manning's roughness

Bankfull Flow	
6.0	velocity (ft/s)
589.3	discharge rate (cfs)
0.52	channel slope (%)

Sinuosity	Channel Type
1.00	F5

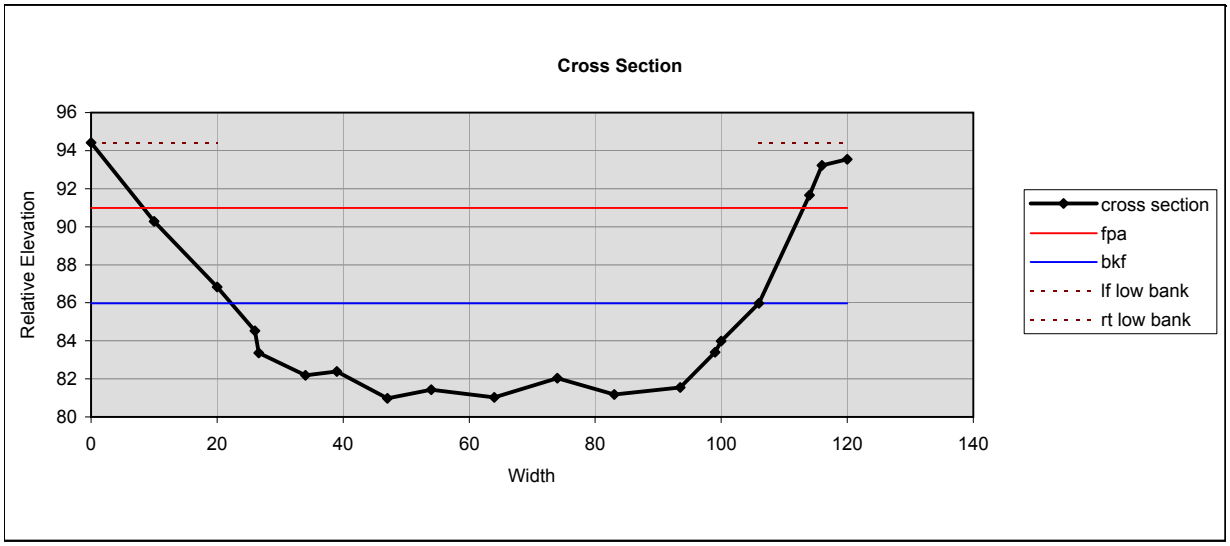
13LP-4-01-2006



Size (mm)	
D16	1
D35	18
D50	66
D65	140
D84	240
D95	330

Size Distribution	
mean	15.5
dispersion	34.8
skewness	-0.4

Type	
silt/clay	5%
sand	18%
gravel	26%
cobble	38%
boulder	13%
bedrock	0%



Bankfull Dimensions	
321.5	x-section area (ft.sq.)
83.8	width (ft)
3.8	mean depth (ft)
5.0	max depth (ft)
85.9	wetted perimeter (ft)
3.7	hydraulic radius (ft)
21.8	width-depth ratio

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

Flow Resistance	
0.047	Manning's roughness

Bankfull Flow	
6.5	velocity (ft/s)
2096.3	discharge rate (cfs)
0.72	channel slope (%)

Sinuosity	Channel Type
1.00	C3/4

Appendix F: Round 2 Site Selection (2007-2009)

The Howard County Biological Monitoring and Assessment 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. Three PSUs would be sampled each year with 10 sites sampled in each.

The first round of sampling began in 2001 and was completed in 2004. The second round began in 2005 and the 2006 sampling continued the second round of sampling. Prior to the Spring 2006 sampling the remainder of the Round 2 sites were selected for years 2007, 2008 and 2009. The original rotation established in 2001 was maintained. The subwatersheds to be sampled and the year are included in the table below.

Site codes for the 2006 – 2009 samples do not follow the original naming convention. Originally sites were numbered sequentially with no defining characteristic in the site name. The new codes contain the PSU code and initials of the watershed (**9RG**-1-01-2008), stream order (9RG-**1**-01-2008), a two-digit sequential number (9RG-1-**01**-2008), and the year sampled (9RG-1-01-**2008**). Alternate sites are coded with an "a" after the sequential number.

Details of the site selection procedure are outlined below.

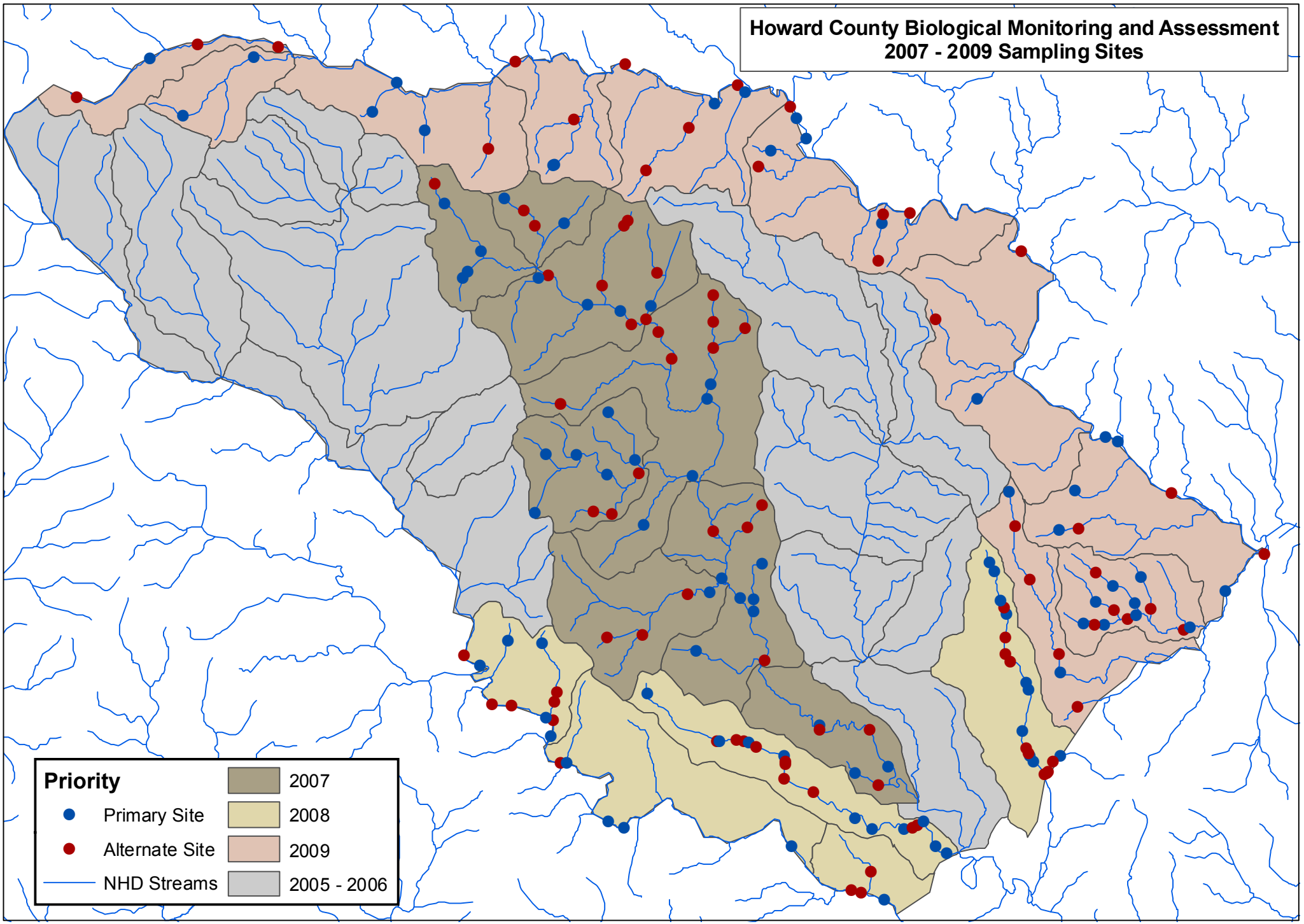
1. Sites were selected for the following PSUs:

Year	Total Number of Stations	Primary Sampling Unit (code and name)
2007	30	6 – Upper Middle Patuxent 7 – Middle Middle Patuxent 8 – Lower Middle Patuxent
2008	30	9 – Rocky Gorge Dam 14 – Hammond Branch 15 – Dorsey Run
2009	30	10 – South Branch Patapsco River Tribs 1 – Patapsco River L Branch A 4 – Patapsco River L Branch B

2. The USEPA's National Hydrography Dataset (NHD) stream layer was used as the base stream layer file. A separate stream layer for each PSU was generated from the NHD.
3. Each stream reach was attributed with a stream order following Strahler stream order convention.
4. Stream lengths calculated and summed for each stream order within each PSU.
5. Points were created along the stream at 1-meter intervals using GIS.
6. Points were removed if they were outside the Howard County boundary.
7. ID numbers were assigned to each point based on PSU and stream order. Ten points were placed in each PSU. An Excel spreadsheet was used to select 20 random numbers within the range of possible values for each stream order in each PSU (10 primary sites and 10 alternate sites). Points were distributed among the PSU based on the proportion of length for each stream order. One alternate was selected for each primary site.
8. If a selected point fell within 50 meters of a lake/pond it was eliminated and a different site was selected.
9. If any of the primary points were within 50 meters of another primary point, one was abandoned and a new random site was selected. Alternate sites were not treated in the same manner.

The following tables include the results of the site selection process. A map showing primary and alternate sites follows the site selection procedure follows.

Stream Order		Length (Meters)	Percent of Total	Number of Sites
2007	*6 - Middle Patuxent Upper*			
	1	23655.11	72.1%	7
	2	4530.59	13.8%	1
	3	4612.34	14.1%	2
	Total	32798.04		
2007	*7 - Middle Patuxent Middle*			
	1	26561.52	59.8%	6
	2	6845.20	15.4%	2
	3	10974.27	24.7%	2
	Total	44381.00		
2007	*8 - Middle Patuxent Lower*			
	1	21426.19	46.5%	4
	2	2791.40	6.1%	1
	3	3385.82	7.3%	1
	4	18476.77	40.1%	4
	Total	46080.18		
2008	*15 - Dorsey Run*			
	1	9447.93	98.1%	10
	2	180.27	1.9%	0
	Total	9628.20		
2008	*14 - Hammond Branch*			
	1	14479.55	100%	10
2008	*9 - Rocky Gorge Dam*			
	1	17781.78	44.0%	4
	2	22633.30	56.0%	6
	Total	40415.07		
2009	*1 - Patapsco River Lower Branch A*			
	1	39501.44	50.4%	5
	2	3921.57	5.0%	1
	3	3942.60	5.0%	1
	4	30942.18	39.5%	4
	Total	78307.78		
2009	*4 - Patapsco River Lower Branch B*			
	1	20972.87	65.9%	7
	2	10850.21	34.1%	3
	Total	31823.07		
2009	*10 - South Branch Patapsco River Tribs*			
	1	36994.02	52.2%	5
	2	12690.19	17.9%	2
	3	969.19	1.4%	0
	4	20250.99	28.6%	3
	Total	70904.40		


Howard County Biological Monitoring and Assessment
2007 - 2009 Sampling Sites
Priority
Primary Site
Alternate Site
NHD Streams
2007
2008
2009
2005 - 2006

Appendix G: Quality Control

The monitoring program for the Little Patuxent River includes chemical, physical and biological assessment 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 included here.

A quality assurance and quality control analysis was completed for the assessment work conducted in the Little Patuxent watershed. This included using measurement quality objectives (MQO) also know as data quality indicators, of precision, accuracy, bias and completeness. Summary statistics include:

- Precision (consistency) of field sampling using intra-team site duplication
  - relative percent difference (RPD)
  - relative standard deviation (RSD)
  - standard deviation
- Accuracy of data entry
  - number of errors/corrective actions
- Bias of sample sorting and subsampling
  - 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 reason behind the results.

Field Sampling

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

Field water quality measurements were collected in-situ at all monitoring sites including the duplicate sites, according to methods in the County QAPP. Most in-situ parameters were measured with a HydroLab MiniSonde® probe and Surveyor® 4 data storage device. Turbidity was measured with a Hach 2100 Turbidimeter. Water quality equipment was regularly inspected, maintained and calibrated to ensure proper usage and accuracy of the readings. Calibration logs were kept by field crew leaders and checked by the project manager regularly.

Sample buckets contained 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 taken at ten percent of the sites (1 site for each PSU, three total for the 2006 sampling year). These QC sites were taken to determine the consistency and accuracy 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. Duplicate samples included water quality sampling, collection and analysis of the benthic macroinvertebrate community and completion of the RBP habitat assessment. Photographs were taken at duplicate sites.

Duplicate sites were monitored at sites 11LP-1-05A-2006, 12LP-1-05-2006 and 13LP-1-01-2006. These sites were selected so that sites with varying drainage areas and impervious surface covers were included. The following table identifies the drainage areas and imperviousness for each site.

QC Site Characteristics

Site	Drainage Area (acres)	Impervious Percent
11LP-1-05A	464.89	4.3
12LP-1-05	327.46	1.9
13LP-1-01	1766.63	27.9

Precision

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

- Relative Percent Difference (RPD) and
- Relative standard deviation (RSD)
- Standard Deviation (SD)

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). 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%		

GPS

All GPS points were collected with GPS capable of submeter accuracy. An analysis of the GPS position data is shown in the table below. Position Dilution of Precision (PDOP) is a measure of the position of the satellites at the time of collection. A better spread of satellites gives better results, which is represented by a lower PDOP value. A PDOP value less than 6 is considered adequate. Multiple positions were recorded at each point and averaged for the location of the final point. All points were differentially corrected using either real-time or post-processed corrections. All points met the required 25m accuracy guideline. A GPS point was collected at all 30 sites, therefore the data meets the 100 percent MQO for completeness.

Measurement Quality Objectives Results – GPS

	MaxPDOP	Positions	Horizontal Precision (meters)	Standard Deviation
Minimum value	2.95	21	0.44	0.0001
Maximum value	5.99	375	0.99	0.0042
Mean value	4.54	72	0.68	0.0011

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. All water quality parameters met the required RPD between the primary site and the QC site. Water quality data for all parameters was collected at all 30 sites, therefore the data meets the >85 percent MQO for completeness

Measurement Quality Objectives Results – Water Quality

	Dissolved Oxygen (mg/l)	pH	Water Temperature (°C)	Conductivity (µS/cm)	MQO met
11LP-1-05A	13.21	7.63	15.1	319.10	
11LP-1-05A QC	13.45	8.10	16.3	320.30	
Absolute Difference	0.24	0.46	1.22	1.20	
RPD	1.80	5.98	7.64	0.38	Met
SD	0.17	0.33	0.85	0.85	
RSD	1.27	4.23	5.40	0.27	
12LP-1-05	11.1	8.42	10.3	151.50	
12LP-1-05 QC	11.42	8.46	10.3	152.00	
Absolute Difference	0.31	0.04	0.02	0.50	
RPD	2.84	0.47	0.00	0.33	Met
SD	0.23	0.03	0.00	0.35	
RSD	2.01	0.34	0.00	0.23	
13LP-1-01	11.42	8.11	12.4	480.00	
13LP-1-01 QC	11.69	7.93	12.9	477.00	
Absolute Difference	0.27	0.18	0.51	3.00	
RPD	2.34	2.24	3.95	0.63	Met
SD	0.19	0.13	0.35	2.12	
RSD	1.65	1.59	2.79	0.44	
Median RPD	2.33	2.90	3.87	0.44	Met

Habitat Assessment

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

Measurement Quality Objectives Results – Habitat Assessment (RBP)

	RBP Total Score	RBP Percent Comparability	Narrative Rating	MQO Met
11LP-1-05A	168	84.0	Supporting	
11LP-1-05A QC	171	85.0	Supporting	
RPD	1.77	1.18		Met
SD	2.12	0.71		
RSD	1.25	0.84		
12LP-1-05	153	76.5	Supporting	
12LP-1-05 QC	154	77.0	Supporting	
RPD	0.65	0.65		Met
SD	0.71	0.35		
RSD	0.46	0.46		
13LP-1-01	178	89.0	Supporting	
13LP-1-01 QC	178	89.0	Supporting	
RPD	0.0	0.0		Met
SD	0.0	0.0		
RSD	0.0	0.0		
Median RPD	0.81	0.61		Met

Biological Assessment

The following two tables include the results of the QC analysis for the Bioassessment metrics and the BIBI score. A number of metrics in all three QC sites fell outside the acceptable range for precision (these are shown in bold). For the most part these are due to metric values that are generally low numbers, such as the number of EPT taxa. This metric, for example, resulted in an RPD of 66.67 for site 1LP-1-05A, yet the actual values only differed by one. For this reason each metric should be investigated carefully.

Measurement Quality Objectives Results – Biological Sampling, Metrics

	Number of Taxa	Number of EPT Taxa	Number of Ephem Taxa	Percent Intolerant Urban	Percent Chironomidae Taxa	Percent Clinger Taxa
11LP-1-05A	30	2	0	11	80.6	33
11LP-1-05A QC	28	2	0	15	86.0	33
RPD	**6.90**	0.00	NA	**30.77**	**6.48**	0.91
SD	1.41	0.00	0.00	2.83	3.82	0.21
RSD	4.88	0.00	NA	21.76	4.58	0.65
12LP-1-05	25	9	3	34	51.0	61
12LP-1-05 QC	26	8	3	49	37.0	66
RPD	3.92	**11.76**	0.00	**36.14**	**31.82**	**7.87**
SD	0.71	0.71	0.00	10.61	9.90	3.54
RSD	2.77	8.32	0.00	25.56	22.50	5.57

13LP-1-01	20	1	0	0	54.6	44
13LP-1-01 QC	13	2	0	0	8.0	79
RPD	**42.42**	**66.67**	NA	NA	**148.88**	**56.91**
SD	4.95	0.71	0.00	0.00	32.95	24.75
RSD	30.00	47.14	NA	NA	105.28	40.24
Median	17.75	26.14	0.00	33.46	62.39	21.59

The BIBI scoring system is not a continuous score. Each metric is assigned a value of 1, 3 or 5, then these values are averaged to yield the final BIBI score. The BIBI scores therefore are incremental. For example the scores increase by 0.3 or 0.4 from 2.0 to 2.3 to 2.7 etc. In addition the RPD between scores of 2.0 and 2.3 will be higher than comparison of scores 4.7 and 5.0.

For these reasons, the BIBI score for Site 11LP-1-05A RPD does not meet the MQO despite the scores only being one scoring increment apart and in the same narrative rating category. Due to the overall BIBI score consisting of scaled incremental metrics, the RPD does not reflect the precision well. BIBI scores for sites 12LP-1-05 and 13LP-1-01 were identical. The BIBI median RPD is 4.65, therefore the overall BIBI calculations meets the MQO and the data is valid.

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, BIBI

	BIBI Score	**Narrative Rating**	**MQO Met**
11LP-1-05A	2.0	Poor	
11LP-1-05A QC	2.3	Poor	
RPD	13.95		Not Met
SD	0.21		
RSD	9.87		
12LP-1-05	3.3	Fair	
12LP-1-05 QC	3.3	Fair	
RPD	0.00		Met
SD	0.00		
RSD	0.00		
13LP-1-01	2.0	Poor	
13LP-1-01 QC	2.0	Poor	
RPD	0.00		Met
SD	0.00		
RSD	0.00		
Median	4.65		Met

Laboratory Sorting and Subsampling

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.

Data Entry/Analysis

Following data entry all EDAS, spreadsheets and data analysis were reviewed by a different environmental scientist and then by a project manager to assure data entry accuracy. Any errors found were corrected before analysis took place. Ten percent of the analyzed metrics were recalculated by hand to verify the computer generated values and formula accuracy.

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