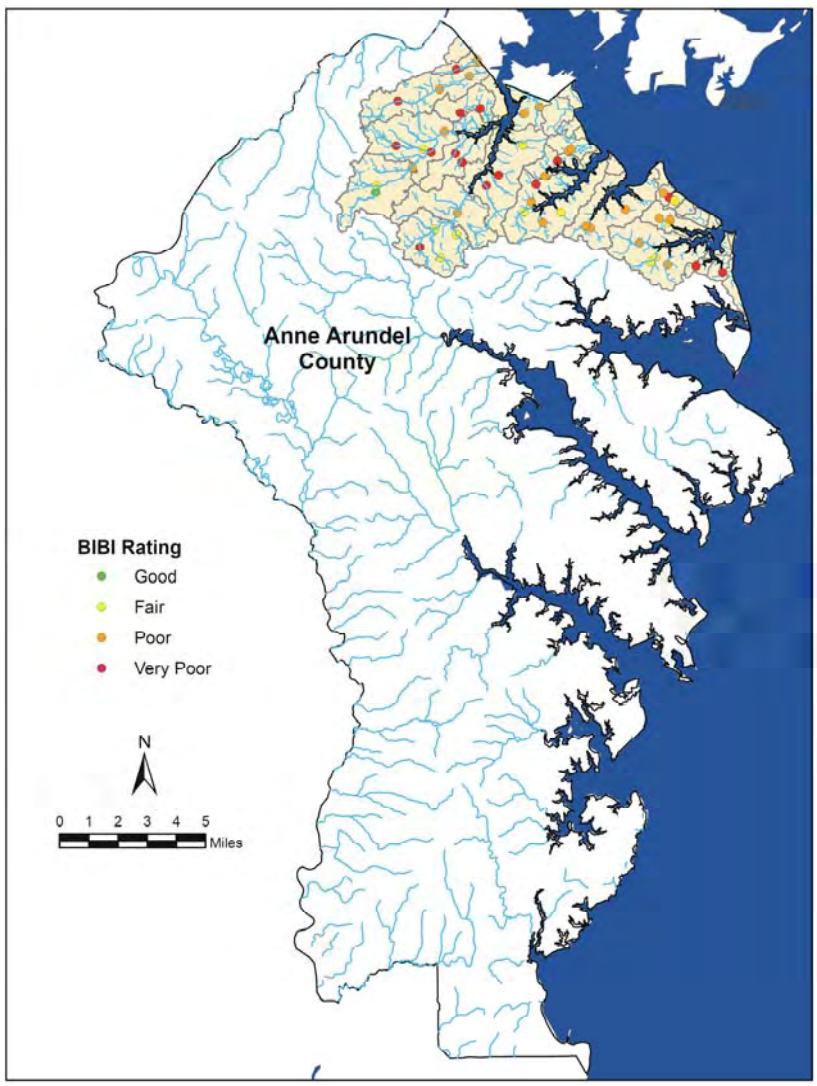
Anne Arundel County, Maryland
Department of Public Works
Watershed, Ecosystem, and Restoration Services Division

Targeted Biological Assessment of Streams in Patapsco Tidal and Bodkin Creek Watersheds, Anne Arundel County, Maryland: 2009



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Targeted Biological Assessment of Streams in Patapsco Tidal and Bodkin Creek Watersheds, Anne Arundel County, Maryland: 2009

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1. INTRODUCTION

Anne Arundel County is required to conduct a systematic assessment of water quality within all County watersheds under its National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit issued by the Maryland Department of the Environment (MDE). The County contracted Versar, Inc., in 2009 to conduct a targeted assessment of the biological communities and physical habitats for non-tidal streams in the Patapsco Tidal and Bodkin Creek watersheds. The project included water quality assessment, benthic macroinvertebrate collection and assessment, and physical habitat assessments at fifty targeted sites pre-selected by Anne Arundel County. The Targeted Biological Assessment of Streams in Patapsco Tidal and Bodkin Creek Watersheds fulfills part of the County's requirements under its NPDES MS4 permit.

The Watershed Assessment and Planning Program is part of the Watershed, Ecosystem, and Restoration Services Division within the Anne Arundel County Department of Public Works. This program developed and maintains the County's Watershed Management Tool (WMT). The WMT is a comprehensive watershed database of GIS layers and field data. It includes different models to assess a watershed in terms of water quality, biological condition, habitat condition, and land use. Data collected in this study will be incorporated into the WMT, coupled with other watershed data, and compiled as part of future assessment efforts to complete a comprehensive watershed assessment.

The Patapsco Tidal and Bodkin Creek watersheds, located at the northern edge of Anne Arundel County (Figure 1-1), contain 36,101 acres and approximately 127 stream miles. The watersheds were subdivided into subwatersheds (Figure 1-2) by the County's Watershed Assessment and Planning Program for targeted site selection. These watersheds are within MDE 8-digit watersheds 02130902 (Bodkin Creek), 02130903 (Baltimore Harbor), and a small part of 02131001 (West Chesapeake Bay). They fall within Maryland's Patapsco/Back River tributary area (Figure 1-3).

Biological data collected in this project will also support the ongoing countywide Aquatic Biological Monitoring Program. Begun in 2004, the primary goals of this program are to assess the status of the biological stream resources of Anne Arundel County and to establish a baseline for comparing future assessments, to assess the status and trends of the biological stream resources, and to relate them to specific programmatic activities. The Biological Monitoring Program is modeled after the state's Maryland Biological Stream Survey (MBSS), and uses field and analysis methods directly comparable to the MBSS. Using a rotating basin design, a subset of watersheds are sampled each year, resulting in all watersheds within the County being sampled over a 5-year period. The Patapsco Tidal and Bodkin Creek study assessed streams within three primary sampling units (PSUs) defined by the countywide monitoring and assessment strategy (PSUs 4 Sawmill Creek, 5 Marley Creek, and 6 Bodkin Creek).

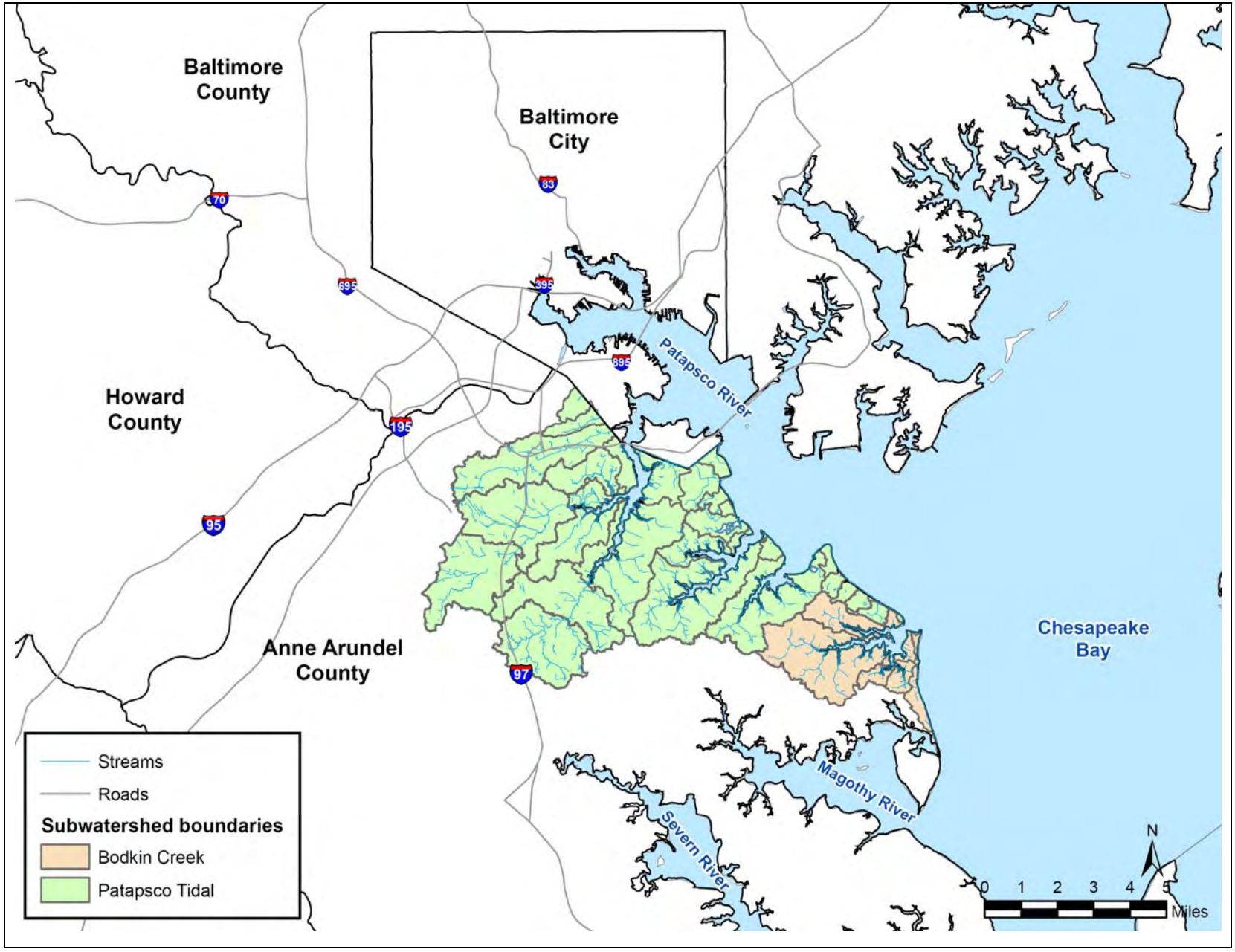

Figure 1-1. Location of Patapsco Tidal / Bodkin Creek watersheds in Anne Arundel County, Maryland

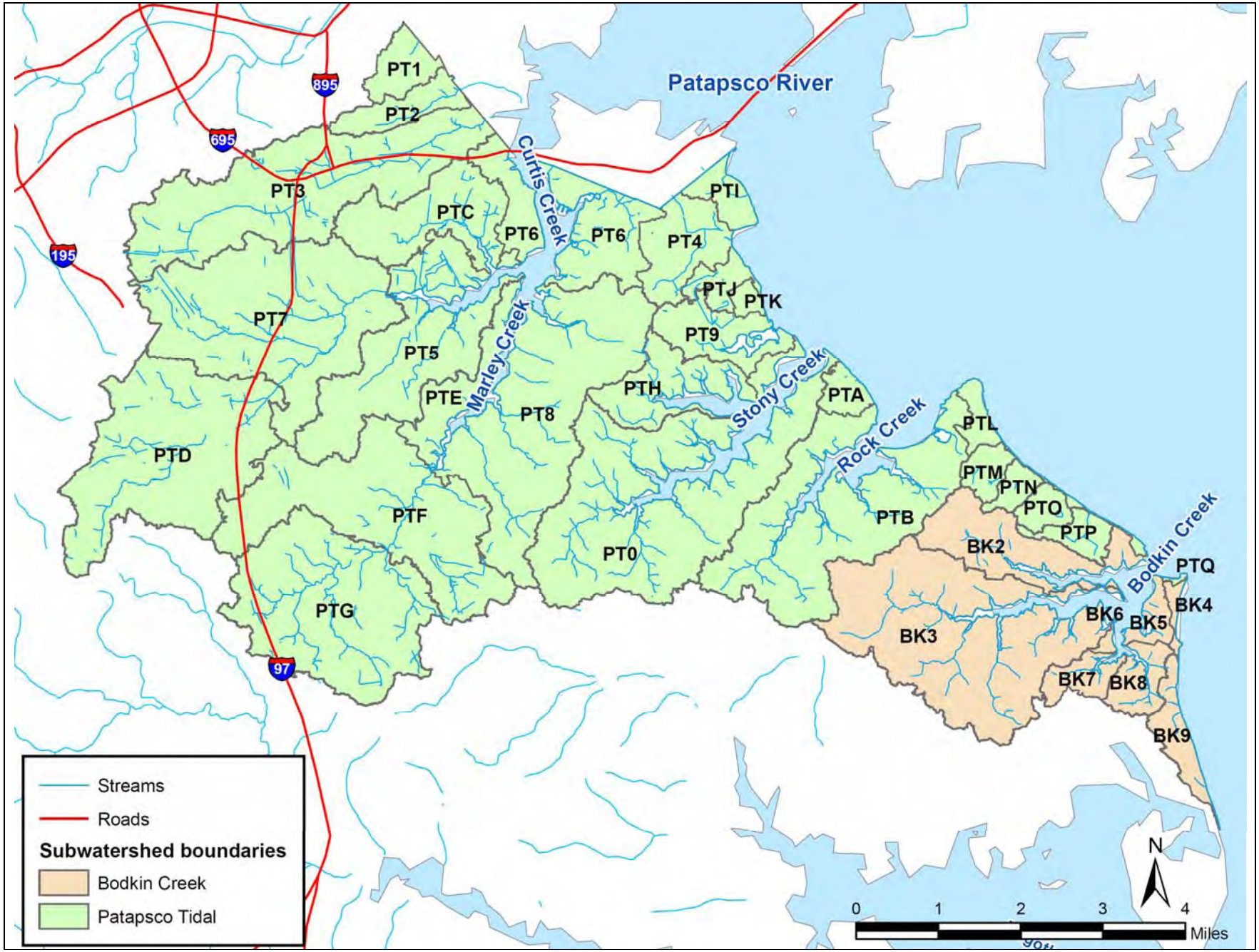

Figure 1-2. Subwatersheds of Patapsco Tidal / Bodkin Creek watersheds

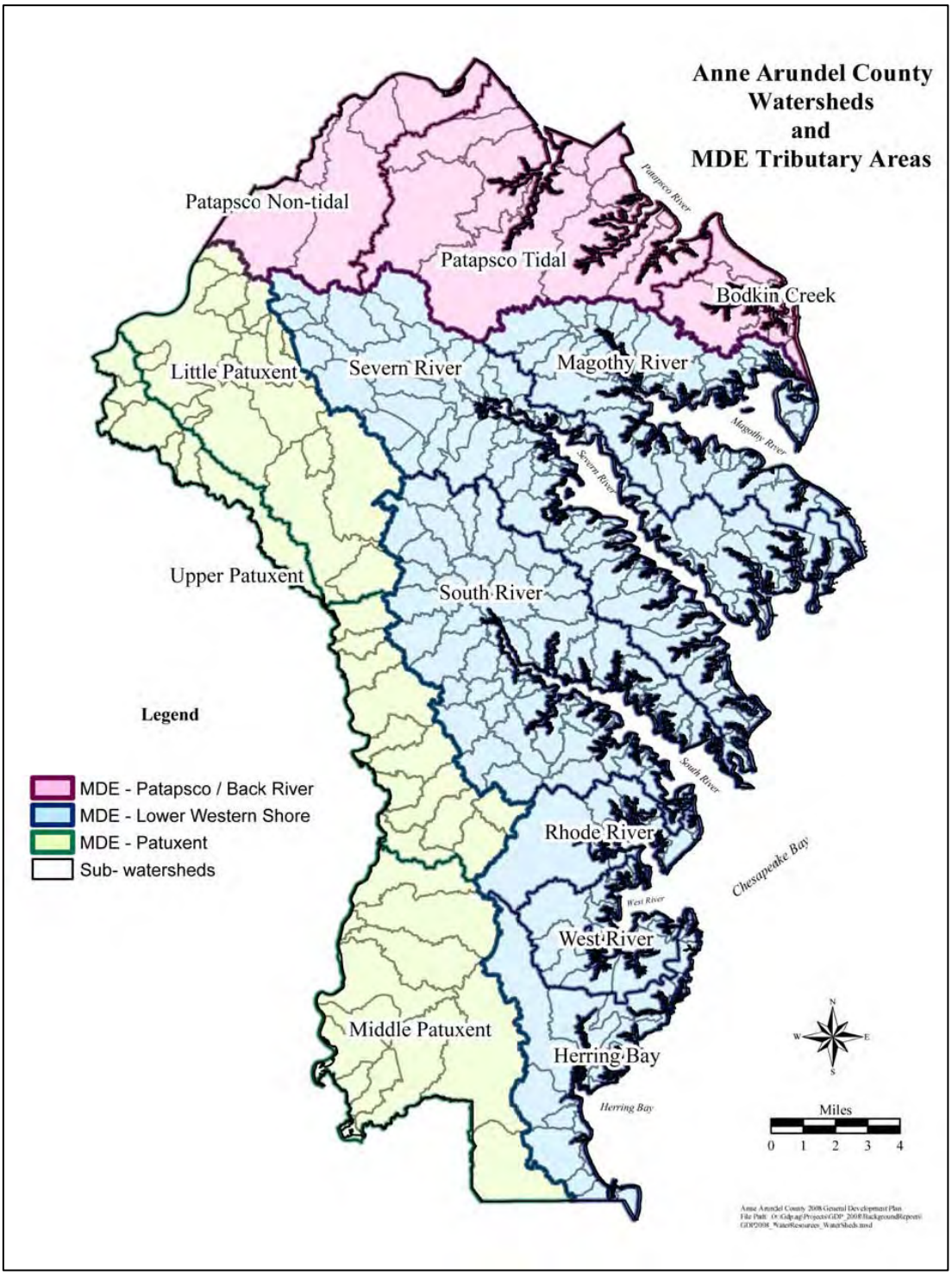

Figure 1-3. Anne Arundel County watersheds and MDE Tributary Areas (from Anne Arundel County 2009)

2. METHODS

2.1 SITE SELECTION, PROPERTY OWNER NOTIFICATION, AND CATCHMENT ANALYSIS

Site locations were pre-selected using a GIS by DPW's Watershed Assessment and Planning Program staff. At least one site was placed in each subwatershed, typically at the downstream end of the subwatershed. Larger subwatersheds were allocated two or more sites, distributed geographically to provide a good characterization of the stream network.

Sites were assigned alphanumeric site names of the following format: BK8-901-T-2009, with the first three characters indicating the subwatershed code (starting with BK for Bodkin, PT for Patapsco Tidal), followed by a three-digit site code, T for targeted site, and 2009 for the year.

Five duplicate sites were assigned site identification numbers that allow for quick reference to their partner site. Each of the duplicate sites has a "D" as its fourth digit (i.e., BK3-D07-T-2009). The remainder of the site identification number matches its partner site, i.e., site BK3-D07-T-2009 is the duplicate of site BK3-907-T-2009.

Field crews used maps with aerial photos and property parcel boundaries to determine which landowners they would need to visit, while in the field, to obtain permission. Landowners were presented with a letter from the county explaining the survey and its purpose and requesting permission for field crews to access stream sites. Seven of the original site locations were determined to be unsampleable for various reasons (unable to obtain permission from landowner, mapped non-tidal stream channels determined nonexistent through field reconnaissance, or other factors). Therefore, these seven sites were relocated to alternative locations. The replacement site locations were determined in consultation with Anne Arundel County's Watershed Assessment and Planning Program staff. When possible, replacement sites were within the same stream subwatershed as the original. When no non-tidal reaches were found in the same vicinity or all streams in a subwatershed were on the same inaccessible property, sites were replaced with new sites in a different subwatershed.

Anne Arundel County staff calculated catchment drainage area for each site, utilizing Arc Hydro to first create a terrain model for the Patapsco Tidal and Bodkin Creek watersheds. The terrain model utilizes the LIDAR derived Digital Evolution Model (DEM) with 1-meter resolution coverage from 2004. Subsurface structures such as stormdrains and culverts are burned into the DEM to enhance drainage area delineation accuracy. Based on this information, Arc Hydro formulates the following grids and layers which are utilized in automating the drainage area delineation to any point of investigation within the watershed: flow direction, flow accumulation, stream, catchment, and adjoint catchments.

The resulting drainage areas were overlain with Anne Arundel County impervious surface and 2007 land use data to characterize the land upstream of individual sampled sites.

2.2 FIELD AND LABORATORY DATA COLLECTION

2.2.1 Water Quality Sampling Methods

Field *in situ* water quality sampling was conducted at each monitoring site, including the duplicate sites, according to methods prescribed in the County Sampling and Analysis Plan (SAP) (Tetra Tech 2007). Water quality meters were regularly inspected, maintained, and calibrated to ensure proper usage and accuracy of the readings. Field crews followed methods as detailed in Versar's Standard Operating Procedure for Calibration of Suite Field Water Quality Monitoring Equipment (Sondes). Calibration logs were kept and regularly checked by the Field Manager. A properly calibrated, multi-parameter water quality monitoring sonde (In-situ Troll 9500, YSI 600XL, or YSI 6800) was used. Parameters measured included temperature, dissolved oxygen, conductivity, and pH.

2.2.2 Biological Sampling Methods

Benthic monitoring was conducted during the MBSS spring index period (March 1 – May 1) and employed the stream sampling methods specified in the County's SAP (Tetra Tech 2007), which closely follows the MBSS protocols (DNR 2007). At each 75-m sample site, benthic macroinvertebrates were collected using a D-net to collect organisms from a combination of habitats that support the most diverse macroinvertebrate community within a sample segment as per MBSS protocols. At each site, 20 "jabs" of the net were distributed among available habitats, including submerged vegetation, overhanging bank vegetation, leaf packs, organic mats, stream bed substrate, submerged woody debris, and rocks. The 20 jabs were composited into a single macroinvertebrate sample per site, which were preserved in the field for laboratory identification.

Benthic sample collection was completed between April 2 and April 30, 2009. Fifty-five benthic samples were collected, including samples from 50 targeted sites and QC samples (field duplicates) collected just upstream of five randomly selected targeted sites.

2.2.3 Biological Sample Subsampling and Laboratory Identification

In the lab, benthic samples were subsampled and sorted, and oligochaetes and chironomids were permanent slide-mounted to allow identification to genus level (family level for oligochaetes) according to the County's SAP (Tetra Tech 2007) and accompanying Standard Operating Procedures (SOPs). Only qualified sorters, those with a history of sorting freshwater samples using MBSS methods, were employed. As a quality control check, 10% of every technician's samples were resorted by a Quality Control Officer (with over 20 years experience in sample sorting procedures) to ensure that samples were thoroughly picked.

Benthic identifications were performed by Senior Taxonomist Mr. Mike Winnell of Freshwater Benthic Services. As per the County protocol, 100- to 120-organism subsamples were identified to genus level or as specified in the RFP. Results were recorded on a bench sheet. In addition, five samples (10% of the original 50) were randomly selected for re-identification by an independent taxonomist (Versar's in-house macroinvertebrate taxonomist).

2.2.4 Physical Habitat Assessment

Physical habitat was assessed at each site and at the five duplicate sites using U.S. Environmental Protection Agency (EPA) Rapid Bioassessment Protocols (RBP) for low-gradient streams (Barbour et al. 1999) and MBSS Stream Habitat Assessment methods (Paul et al. 2002). These procedures, although similar, each provide information that will be useful to the County in assessing habitat quality and ensuring comparability with other programs' data. Since biological potential is limited by the quality of the stream's physical habitat, an assessment of physical habitat is an important component of any biological stream survey. Habitat assessments took place concurrently with benthic macroinvertebrate sampling, from April 2 to April 30, 2009.

2.2.4.1 RBP Methods

EPA's RBP Habitat Assessment procedure is a well-established method for evaluating the structure and function of the physical habitat in a stream and its surrounding riparian area. The RBP protocol consists of ten parameters appropriate for the evaluation of stream habitat (Table 2-1).

Table 2-1. Parameters assessed in the U.S. EPA's Rapid Bioassessment Protocol (RBP) Habitat Assessment procedure for low-gradient streams

Parameter	Rating Scale
1. Epifaunal Substrate/Available Cover	0 to 20
2. Pool Substrate Characterization	0 to 20
3. Pool Variability	0 to 20
4. Sediment Deposition	0 to 20
5. Channel Flow Status	0 to 20
6. Channel Alteration	0 to 20
7. Channel Sinuosity	0 to 20
8. Bank Stability (each bank is scored separately)	0 to 10 left bank, 0 to 10 right bank
9. Vegetative Protection (each bank is scored separately)	0 to 10 left bank, 0 to 10 right bank
10. Riparian Vegetative Zone Width (each bank is scored separately)	0 to 10 left bank, 0 to 10 right bank

The habitat assessment process involves rating each of the parameters on a 0 – 20 scale within four categories:

- Poor: 0-5
- Marginal: 6-10
- Suboptimal: 11-15
- Optimal: 16-20

Scores increase as habitat quality increases. To ensure consistency in the evaluation procedure, descriptions of the physical parameters and relative criteria are included on the rating form.

2.2.4.2 PHI Methods

MBSS stream habitat assessment methods (Paul et al. 2002) were used to assess the physical habitat at each site and at the five duplicate sites using the Coastal Plain Physical Habitat Index (PHI). In developing the PHI, MBSS identified six parameters that have the most discriminatory power for Coastal Plain streams. These parameters were evaluated on a 0 to 20 scale at each sampling site and used to calculate the PHI (Table 2-2).

Table 2-2. Parameters assessed in MBSS's habitat assessment procedure (Physical Habitat Index, or PHI) for Coastal Plain streams

Parameter	Rating Scale
1. Remoteness	0 to 20
2. Shading	0 to 20
3. Epibenthic Substrate	0 to 20
4. Instream Habitat	0 to 20
5. Woody Debris and Rootwads	0 to 20
6. Bank Stability	0 to 20

Digital photographs of each site were taken to record observed conditions.

2.3 DATA ENTRY AND DATA ANALYSIS METHODS

2.3.1 Water Quality Sampling Data

Water quality data were entered into a MS Access database that included custom data entry screens that mimicked field data sheets to minimize data entry errors. Database quality assurance protocols were followed including automatic range checks and data manager review.

Double-entry ensured that any transcription errors were detected and corrected prior to data analysis. Data were backed up at regular intervals.

The Maryland Department of the Environment (MDE) establishes water quality standards for each designated Stream Use Classification. Of the water quality parameters measured in this study, acceptable standards for Use I Streams have been established for pH, DO, and temperature (Table 2-3).

Table 2-3. Water Quality criteria as established by Maryland Department of the Environment (MDE) for Use I streams

Parameter	Criterion
pH	Must be between 6.5 and 8.5 pH units
DO	May not be less than 5 mg/l at any time
temperature	Cannot exceed 90 °F (32 °C) or ambient temperature of the surface water, whichever is greater.

We compared *in situ* values measured at stream sites in this study with these standards to determine whether any sites exceeded the acceptable limits.

2.3.2 Biological Sampling Data

Benthic macroinvertebrate taxonomic identifications and counts recorded on bench sheets were entered into an Excel spreadsheet. Final data were imported to a MS Access database.

Benthic macroinvertebrate data were analyzed using the Coastal Plain version of the MBSS Benthic Index of Biotic Integrity (BIBI) (Southerland et al. 2007). Metrics included in this IBI are detailed in Table 2-4.

Table 2-4. Metrics included in the MBSS Coastal Plain Benthic Index of Biotic Integrity (BIBI) and description

Metric	Description
Total Number of Taxa	Measures the overall variety of the macroinvertebrate assemblage
Number of EPT Taxa	Number of taxa in the insect orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies)
Number of Ephemeroptera Taxa	Number of mayfly taxa
Percent Intolerant Urban	Percent of sample considered intolerant to urbanization (tolerance values 0-3)
Percent Ephemeroptera	Percent mayfly nymphs
Number Scraper Taxa	Number of taxa that scrape food from substrate
Percent Climbers	Percent of sample that primarily lives on stem type surfaces

MBSS attributes for each identified taxa, including functional feeding group, habitat preference, and tolerance values, were used in a SAS program to compute BIBI metrics. For a small number of taxa identified in this survey, MBSS attributes were not available. In these instances, attributes were assigned by Versar's senior taxonomist through literature searches. For each BIBI metric at each site, raw values were assigned a score of 1, 3, or 5 based on ranges of values developed for each metric (Table 2-5).

Table 2-5. Scoring Criteria for metrics in the MBSS Coastal Plain Benthic Index of Biotic Integrity (BIBI)

Metric	Score		
	5	**3**	**1**
Total Number of Taxa	≥ 22	14 - 21	< 14
Number of EPT Taxa	≥ 5	2 - 4	< 2
Number of Ephemeroptera Taxa	≥ 2.0	1 - 1	< 1
Percent Intolerant Urban	≥ 28	10 - 27	< 10.0
Percent Ephemeroptera	≥ 11	0.8 – 10.9	< 0.8
Number Scraper Taxa	≥ 2	1 - 1	< 1
Percent Climbers	≥ 8.0	0.9 – 7.9	< 0.9

Scores for each metric were averaged to give a scaled BIBI score ranging from 1.0 to 5.0 and a corresponding narrative rating (Table 2-6).

Table 2-6. BIBI scoring and Narrative Rating

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

2.3.3 Physical Habitat Assessment Data

Using the same methods described for water quality data (Section 2.3.1), physical habitat data were entered into a MS Access database that included custom data entry screens that mimicked field data sheets to minimize data entry errors. Database quality assurance protocols were followed including automatic range checks and data manager review. Double-entry ensured that any transcription errors were detected and corrected prior to data analysis. Data were backed up at regular intervals.

2.3.3.1 RBP Data

Scores for each of the ten individual parameters in the RBP Habitat Assessment (Table 2-1) were added together to give a total score for each site (200 points maximum). The total score was then assigned to one of four categories (Table 2-7) based on its percent comparability to reference conditions. Since pristine reference conditions do not currently exist in Anne Arundel County, the categories used in this assessment were based on reference conditions obtained from nearby Prince George's County streams and watersheds (Stribling et al. 1999).

Table 2-7. RBP Habitat Assessment score and ratings.

Score	Percent Comparability	Narrative Rating
≥ 151	≥ 75.5	Comparable to Reference
126 – 150	63.0 – 75.0	Supporting
97 – 125	48.5 – 62.5	Partially Supporting
≤ 96	≤ 48.0	Non-supporting

2.3.3.2 PHI Data Entry and Analysis Methods

The MBSS PHI for Coastal Plain streams was calculated using numerical ratings of six habitat parameters evaluated on a 0 to 20 scale (Table 2-2). Some parameters were drainage area dependent, and were scaled accordingly using drainage areas calculated using GIS (Section 2.1). Each raw parameter score was then transposed to a 0 to 100 scale. The average of these scores was calculated to give the final PHI score. Final scores were assigned narrative ratings based on MBSS designations (Table 2-8).

Table 2-8. Coastal Plain PHI scoring and narrative ratings

PHI Score	Narrative Rating
81.0 – 100	Minimally Degraded
66.0 – 80.9	Partially Degraded
51.0 – 65.9	Degraded
0.0 – 50.9	Severely Degraded

2.3.4 Quality Assurance/Quality Control

Benthic taxonomy results, benthic field duplicate results, and habitat field duplicate results were analyzed to assess Quality Assurance/Quality Control (QA/QC). For details on methods used, see Appendix B.

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3. RESULTS

Overall findings are summarized in this section, while site-specific summaries of stream assessment data are provided in Appendix A. QA/QC results are provided in Appendix B.

3.1 SITE LOCATIONS, DRAINAGE AREAS, AND LAND USE

Site are mapped in Figure 3-1 and listed by subwatershed in Table 3-1. Catchment area data are listed for each site. Site catchments range in area from 10.5 to 5317.20 acres. Data characterizing land uses and impervious surface area in each site catchment are included in the site summaries in Appendix A.

Residential, commercial and various industrial and transportation uses are well-represented in the watershed. As expected, given the density of urban/suburban development in the watersheds, impervious surface in site catchments was extensive, ranging from 2.5 to 67.2% of catchment area (mean 26.7%). The majority of sites (26) had more than 25% impervious surface, a threshold at which severe stream degradation is often observed. Another 17 sites had between 10 and 25% impervious surface, a level commonly associated with moderate stream degradation. Only 7 sites had catchments with less than 10% impervious surface.

3.2 MONITORING AND ASSESSMENT RESULTS

3.2.1 Water Quality Results

Water chemistry data are summarized in Table 3-2.

At the 50 sites, *in situ* water temperatures ranged from a low of 10.3 °C to a high of 19.2 °C. These temperatures were acceptable according to MDE criteria. Dissolved oxygen levels were all above acceptable limits, and ranged from 6.8 mg/l to 11.7 mg/l. pH values ranged from a low of 6.1 to a high of 8.68, with nine sites having pH values below the COMAR water quality standard of 6.5 and one site having a pH value above the COMAR standard of 8.5. Eleven sites had pH values greater than 8.0, but not above the COMAR water quality standard. Finally, conductivity values ranged from a low of 0.083 mS/cm to a high of 0.857 mS/cm. MDE does not have any water quality standards for conductivity, but values above 0.500 mS/cm could generally be considered elevated (EPA 1997). Six sites had conductivity values above 0.500 mS/cm. These single-point-in-time measures only provide limited information on the parameters measured and provide no data to evaluate nutrient loads or other potential water chemistry problems.

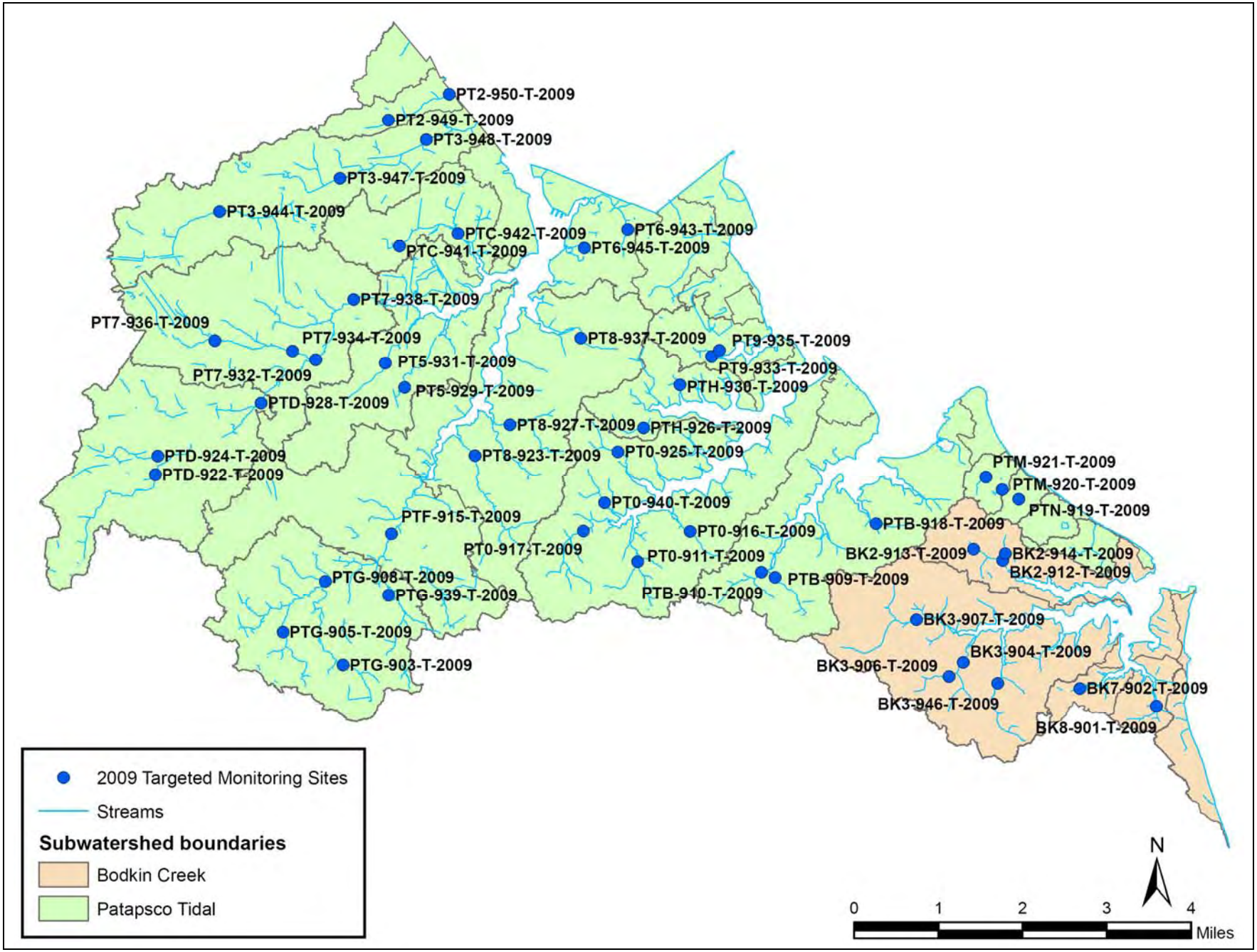

Figure 3-1. 50 targeted sites sampled in Patapsco Tidal and Bodkin Creek watersheds, Anne Arundel County, 2009

Table 3-1. Site names, subwatersheds, and catchment areas for 50 targeted sites and 5 QC sites sampled in Patapsco Tidal and Bodkin Creek watersheds, Anne Arundel County, 2009.

Site	Subwatershed	Catchment Area (acres)
BK2-912-T-2009	Back Creek	381.50
BK2-913-T-2009	Back Creek	274.66
BK2-914-T-2009	Back Creek	54.85
BK3-904-T-2009	Main Creek	584.73
BK3-906-T-2009	Main Creek	253.58
BK3-907-T-2009	Main Creek	748.72
BK3-946-T-2009	Main Creek	269.19
BK7-902-T-2009	Wharf Creek	84.41
BK8-901-T-2009	Locust Cove	96.48
PT0-911-T-2009	Stony Creek	269.73
PT0-916-T-2009	Stony Creek	187.71
PT0-917-T-2009	Stony Creek	554.26
PT0-925-T-2009	Stony Creek	129.96
PT0-940-T-2009	Stony Creek	150.27
PT2-949-T-2009	Cabin Branch 2	144.68
PT2-950-T-2009	Cabin Branch 2	342.47
PT3-944-T-2009	Cabin Branch	786.41
PT3-947-T-2009	Cabin Branch	1808.57
PT3-948-T-2009	Cabin Branch	2421.90
PT5-929-T-2009	Furnace Creek	126.52
PT5-931-T-2009	Furnace Creek	611.94
PT6-943-T-2009	Curtis Creek	174.18
PT6-945-T-2009	Curtis Creek	13.83
PT7-932-T-2009	Sawmill Creek 1	4206.01
PT7-934-T-2009	Sawmill Creek 1	880.52
PT7-936-T-2009	Sawmill Creek 1	566.97
PT7-938-T-2009	Sawmill Creek 1	5317.20
PT8-923-T-2009	Marley Creek 1	624.98
PT8-927-T-2009	Marley Creek 1	264.23
PT8-937-T-2009	Marley Creek 1	304.69
PT9-933-T-2009	Cox Creek	170.91
PT9-935-T-2009	Cox Creek	131.76
PTB-909-T-2009	Rock Creek	319.38
PTB-910-T-2009	Rock Creek	303.19
PTB-918-T-2009	Rock Creek	114.44
PTC-941-T-2009	Back Creek	346.78
PTC-942-T-2009	Back Creek	824.65
PTD-922-T-2009	Sawmill Creek 2	1082.06
PTD-924-T-2009	Sawmill Creek 2	247.75
PTD-928-T-2009	Sawmill Creek 2	2637.77
PTF-915-T-2009	Marley Creek 3	2638.60
PTG-903-T-2009	Marley Creek 4	167.96
PTG-905-T-2009	Marley Creek 4	293.40

Table 3-1. (Continued)

Site	Subwatershed	Catchment Area (acres)
PTG-908-T-2009	Marley Creek 4	1554.46
PTG-939-T-2009	Marley Creek 4	340.87
PTH-926-T-2009	Nabbs Creek	154.94
PTH-930-T-2009	Nabbs Creek	119.01
PTM-920-T-2009	Hines Bog Pond	48.43
PTM-921-T-2009	Hines Bog Pond	45.31
PTN-919-T-2009	Hines Bog	10.50
Duplicate Sites for QC		
BK3-D07-T-2009	Main Creek	748.72
PT0-D17-T-2009	Stony Creek	554.26
PT3-D47-T-2009	Cabin Branch	1808.57
PTF-D15-T-2009	Marley Creek 3	2638.60
PTG-D39-T-2009	Marley Creek 4	340.87

Table 3-2. *In-situ* water quality results for 50 targeted sites sampled in Patapsco Tidal and Bodkin Creek watersheds, Anne Arundel County, 2009. Dark-shaded cells represent values that were outside acceptable COMAR water quality standards (i.e. pH values less than 6.5 or pH values greater than 8.5). Light-shaded cells represent values that are considered elevated (i.e. pH values greater than 8.0, conductivity values greater than 0.500 mS/cm).

Site	Temperature (°C)	Dissolved Oxygen (mg/L)	pH	Conductivity (mS/cm)
BK2-912-T-2009	11.3	8.4	7.05	0.155
BK2-913-T-2009	11.8	8.4	6.30	0.191
BK2-914-T-2009	13.1	7.4	7.34	0.222
BK3-904-T-2009	11.2	8.1	6.33	0.115
BK3-906-T-2009	14.9	7.9	6.56	0.162
BK3-907-T-2009	11.0	10.2	8.13	0.236
BK3-946-T-2009	16.1	6.8	6.62	0.289
BK7-902-T-2009	11.5	9.83	6.35	0.105
BK8-901-T-2009	11.0	8.7	6.88	0.121
PT0-911-T-2009	11.5	10	7.15	0.554
PT0-916-T-2009	11.7	8.7	8.01	0.205
PT0-917-T-2009	11.3	11.0	8.30	0.198
PT0-925-T-2009	14.4	10.5	7.73	0.083
PT0-940-T-2009	13.6	7.0	6.98	0.857
PT2-949-T-2009	10.6	9.1	6.93	0.513
PT2-950-T-2009	13.8	8.5	7.02	0.164
PT3-944-T-2009	17.2	8.3	6.13	0.285
PT3-947-T-2009	11.9	11.7	7.98	0.339
PT3-948-T-2009	11.4	10.7	7.02	0.652
PT5-929-T-2009	11.9	11.3	7.32	0.540
PT5-931-T-2009	18.4	11.6	7.04	0.497

Table 3-2. (Continued)

Site	Temperature (°C)	Dissolved Oxygen (mg/L)	pH	Conductivity (mS/cm)
PT6-943-T-2009	10.9	8.0	7.91	0.183
PT6-945-T-2009	14.7	9.5	8.14	0.219
PT7-932-T-2009	16.5	10.3	6.80	0.281
PT7-934-T-2009	14.5	10.1	7.03	0.189
PT7-936-T-2009	14.4	9.5	7.91	0.169
PT7-938-T-2009	16.2	11.2	7.21	0.199
PT8-923-T-2009	13.8	9.2	6.85	0.260
PT8-927-T-2009	10.9	11.2	8.01	0.170
PT8-937-T-2009	15.0	8.0	6.33	0.122
PT9-933-T-2009	11.8	8.0	7.10	0.302
PT9-935-T-2009	12.7	9.0	7.20	0.567
PTB-909-T-2009	16.2	7.6	6.24	0.225
PTB-910-T-2009	15.7	8.1	6.31	0.265
PTB-918-T-2009	15.1	8.4	8.07	0.134
PTC-941-T-2009	12.1	10.9	8.68	0.086
PTC-942-T-2009	14.0	8.4	6.98	0.402
PTD-922-T-2009	11.2	10.7	8.37	0.157
PTD-924-T-2009	12.8	10.8	8.07	0.233
PTD-928-T-2009	15.2	10.4	7.96	0.208
PTF-915-T-2009	12.2	10.7	8.10	0.225
PTG-903-T-2009	11.1	10.3	8.40	0.105
PTG-905-T-2009	11.5	11.2	8.49	0.103
PTG-908-T-2009	15.3	9.6	7.84	0.214
PTG-939-T-2009	19.2	8.6	7.06	0.181
PTH-926-T-2009	11.7	10.4	7.81	0.126
PTH-930-T-2009	15.5	11.1	6.93	0.426
PTM-920-T-2009	12.9	9.0	6.10	0.168
PTM-921-T-2009	11.7	9.0	6.22	0.222
PTN-919-T-2009	10.3	9.2	7.41	0.146

3.2.2 Biological Monitoring Results

BIBI scores ranged from a low of 1.29 (narrative rating of Very Poor) at site PT5-931-T-2009 on Furnace Creek to a high of 4.14 (Good) at site PTD-922-T-2009 on Sawmill Creek (Figure 3-2, Table 3-3). The average BIBI score from the 50 targeted sites in the study was 2.43 (Poor), with standard deviation of 0.72.

Overall, the greatest number of sites (21 out of the 50 targeted sites) were rated Poor according to the BIBI score. Another 16 sites were rated Very Poor, while 12 were rated Fair. Only one was rated Good.

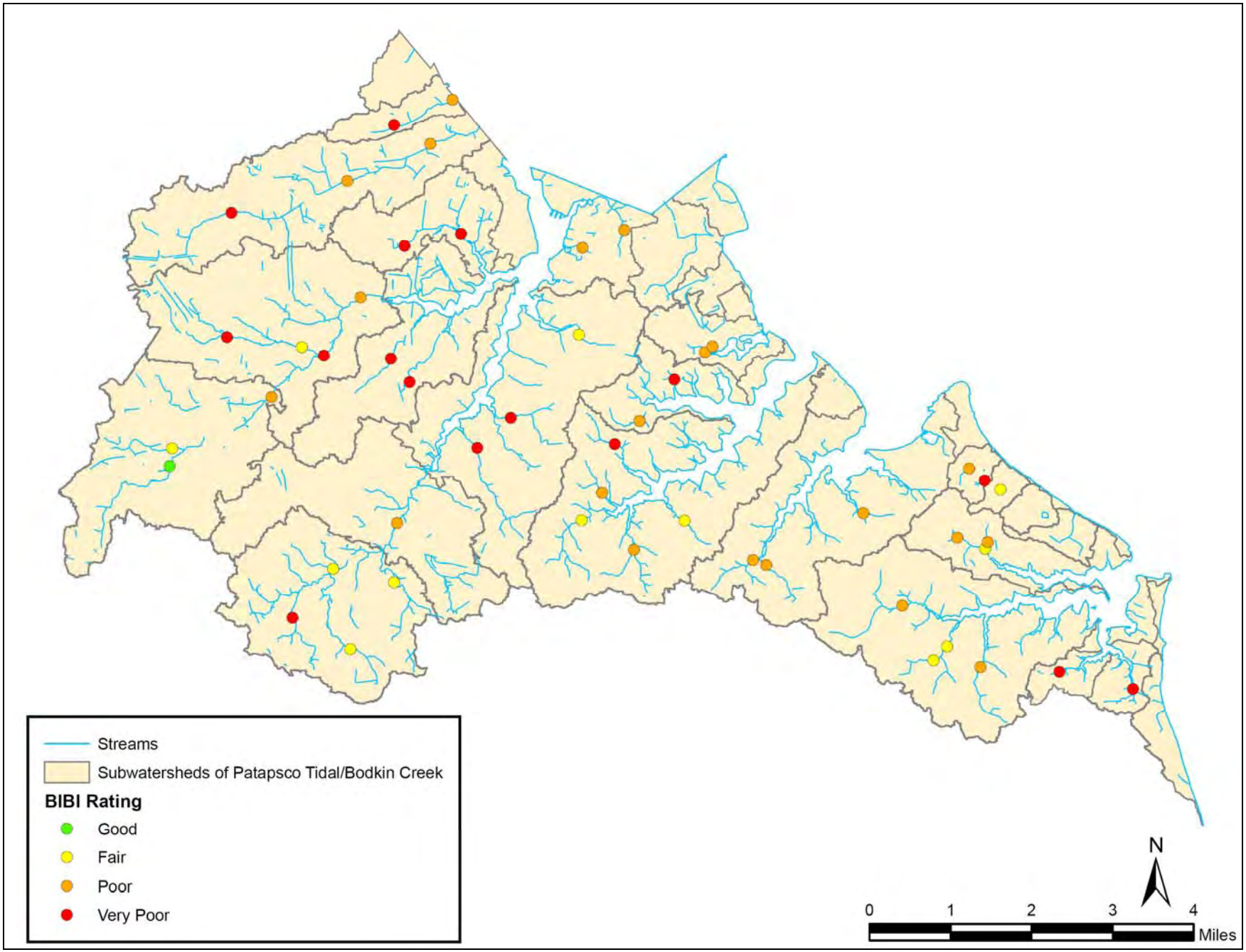

Figure 3-2. Benthic macroinvertebrate results (BIBI ratings) for 50 targeted sites sampled in Patapsco Tidal and Bodkin Creek watersheds, Anne Arundel County, 2009

Table 3-3. Benthic Index of Biotic Integrity (BIBI) Score and Narrative Ratings for 50 targeted sites and 5 QC sites sampled in Patapsco Tidal and Bodkin Creek watersheds, Anne Arundel County, 2009.

Site	BIBI Score	BIBI Narrative Rating
BK2-912-T-2009	3.29	Fair
BK2-913-T-2009	2.43	Poor
BK2-914-T-2009	2.43	Poor
BK3-904-T-2009	3.57	Fair
BK3-906-T-2009	3.29	Fair
BK3-907-T-2009	2.71	Poor
BK3-946-T-2009	2.43	Poor
BK7-902-T-2009	1.86	Very Poor
BK8-901-T-2009	1.86	Very Poor
PT0-911-T-2009	2.43	Poor
PT0-916-T-2009	3.57	Fair
PT0-917-T-2009	3.00	Fair
PT0-925-T-2009	1.86	Very Poor
PT0-940-T-2009	2.14	Poor
PT2-949-T-2009	1.57	Very Poor
PT2-950-T-2009	2.71	Poor
PT3-944-T-2009	1.86	Very Poor
PT3-947-T-2009	2.14	Poor
PT3-948-T-2009	2.43	Poor
PT5-929-T-2009	1.57	Very Poor
PT5-931-T-2009	1.29	Very Poor
PT6-943-T-2009	2.14	Poor
PT7-932-T-2009	1.29	Very Poor
PT6-945-T-2009	2.71	Poor
PT7-934-T-2009	3.00	Fair
PT7-936-T-2009	1.86	Very Poor
PT7-938-T-2009	2.43	Poor
PT8-923-T-2009	1.57	Very Poor
PT8-927-T-2009	1.86	Very Poor
PT8-937-T-2009	3.57	Fair
PT9-933-T-2009	2.71	Poor
PT9-935-T-2009	2.71	Poor
PTB-909-T-2009	2.14	Poor
PTB-910-T-2009	2.43	Poor
PTB-918-T-2009	2.14	Poor
PTC-941-T-2009	1.57	Very Poor
PTC-942-T-2009	1.86	Very Poor
PTD-922-T-2009	4.14	Good
PTD-924-T-2009	3.57	Fair
PTD-928-T-2009	2.43	Poor
PTF-915-T-2009	2.14	Poor
PTG-903-T-2009	3.86	Fair
PTG-905-T-2009	1.57	Very Poor

Table 3-3. (Continued)

Site	BIBI Score	BIBI Narrative Rating
PTG-908-T-2009	3.57	Fair
PTG-939-T-2009	3.00	Fair
PTH-926-T-2009	2.14	Poor
PTH-930-T-2009	1.57	Very Poor
PTM-920-T-2009	1.57	Very Poor
PTM-921-T-2009	2.71	Poor
PTN-919-T-2009	3.00	Fair
Duplicate Sites for QC		
BK3-D07-T-2009	2.71	Poor
PT0-D17-T-2009	3.57	Fair
PT3-D47-T-2009	2.43	Poor
PTF-D15-T-2009	3.00	Fair
PTG-D39-T-2009	3.29	Fair

Distributions of individual BIBI metric values were examined (Figure 3-3 (a through g)). While an approximately normal distribution was present for the Number of Taxa metric (Figure 3-3 (a), other BIBI metrics' distributions tended to be skewed toward lower values (Figure 3-3 (b through g)).

3.2.3 Physical Habitat Assessment Results

RBP Habitat Assessment total scores at the targeted sites ranged from a low score of 104 (52% of reference) to a high score of 169 out of 200 (84.5% of reference; Figure 3-4, Table 3-4). Three of the 50 targeted sites (6%) had total RBP scores above 151 and rated Comparable to Reference. Half of the targeted sites (25 sites) had total RBP scores between 126 and 150, and rated as Supporting. The remainder of the targeted sites (22 sites, or 44%) rated as Partially Supporting. No sites were rated Non-Supporting.

Individual RBP habitat parameters provide additional information about site conditions. Distributions of selected RBP habitat assessment metric scores are presented in Figure 3-5 (a through f). A surprising number of sites were rated high for riparian vegetated protection scores. Both the Riparian Vegetative Zone Width and Bank Vegetative Protection parameters had a high number of sites in the Optimal range (scoring at least 16 out of 20 points), with nearly all scores in the Optimal to Suboptimal categories (scoring 11 or more). In fact, 35 sites received top ratings (Optimal) for Riparian Vegetative Zone Width, and 28 were scored this high for Bank Vegetative Protection.

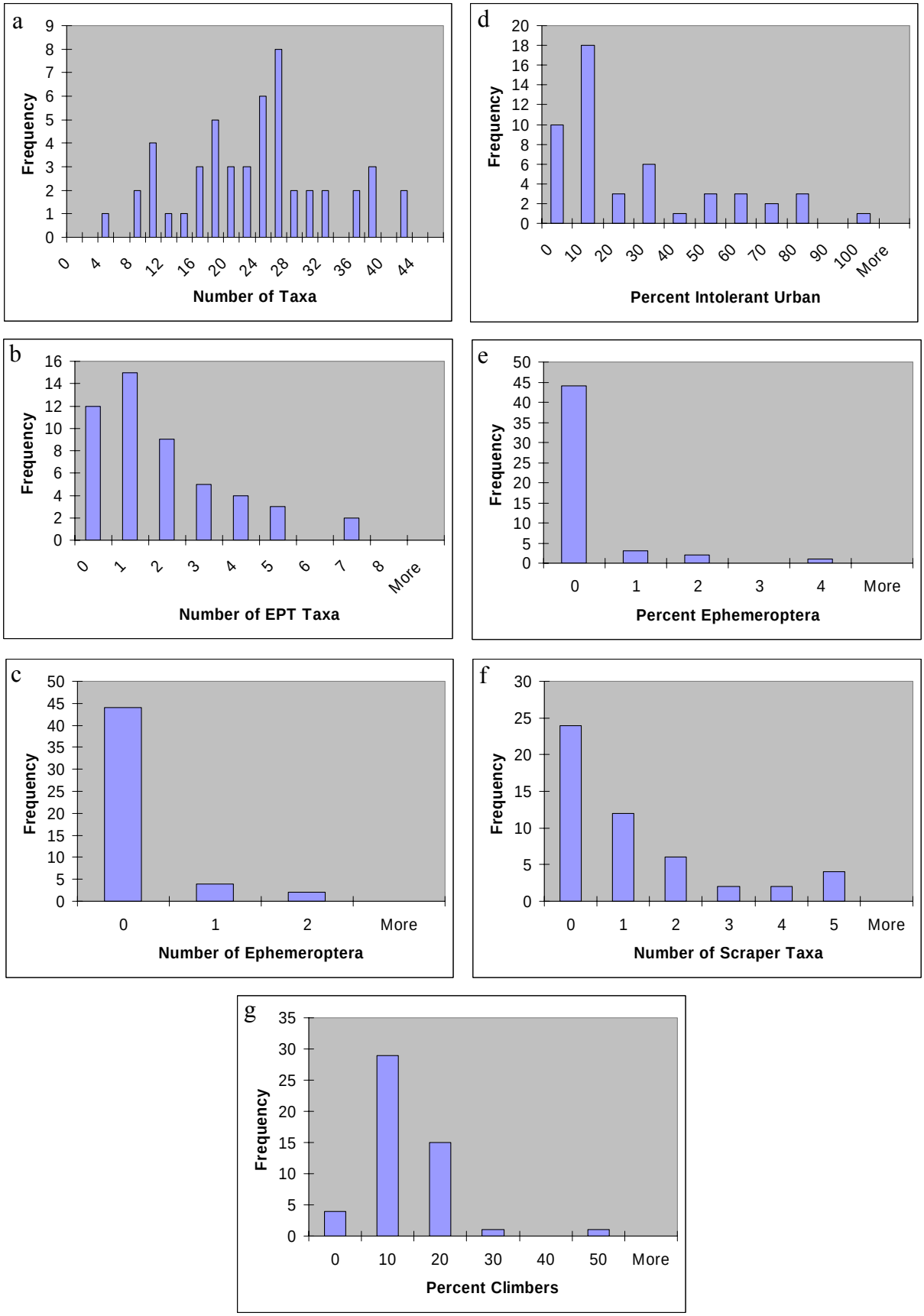

Figure 3-3 (a –g). Histograms depicting distributions of individual BIBI metric values for 50 targeted sites sampled in Patapsco Tidal and Bodkin Creek watersheds, Anne Arundel County, MD, 2009.

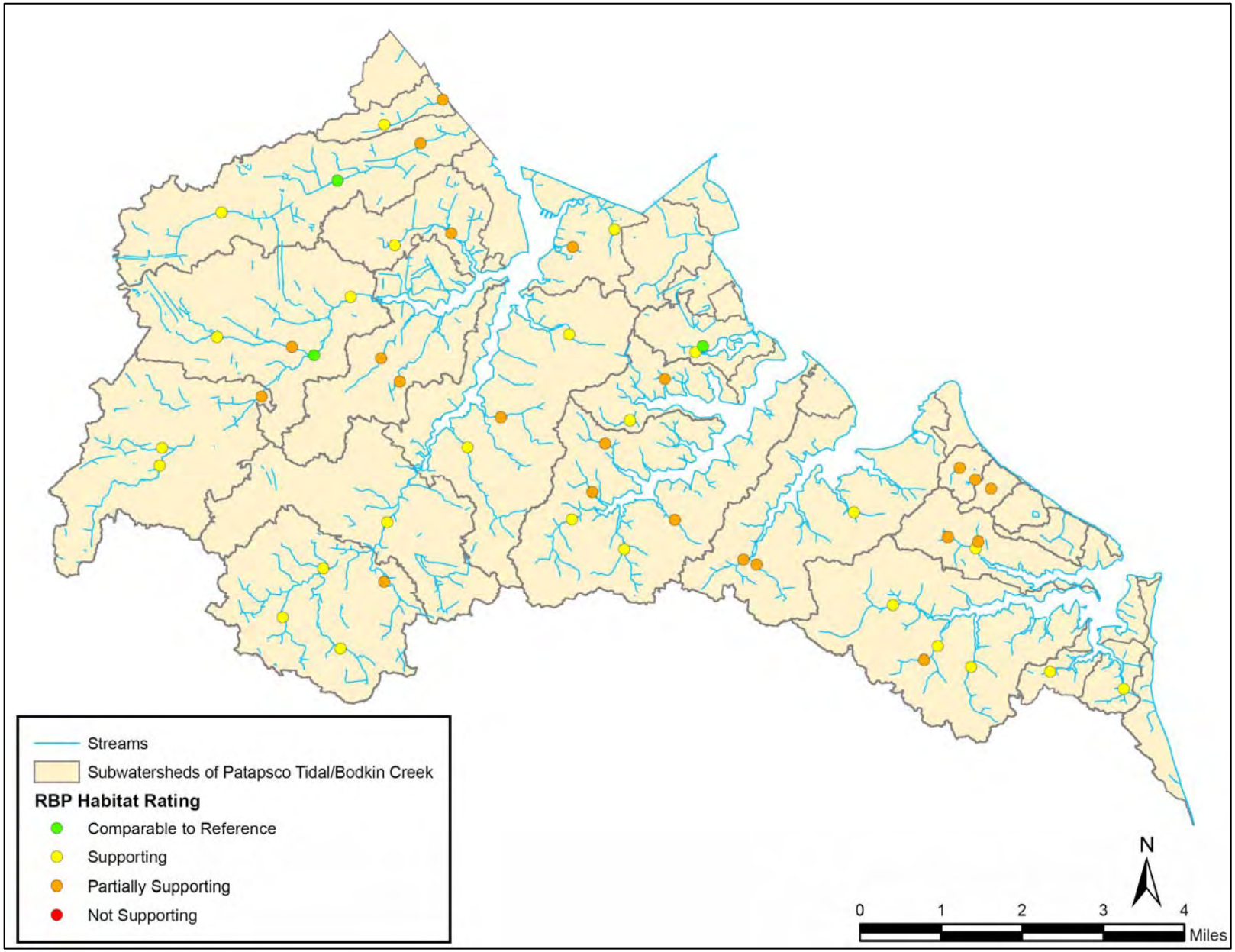

Figure 3-4. RBP Habitat Assessment results for 50 targeted sites sampled in Patapsco Tidal and Bodkin Creek watersheds, Anne Arundel County, 2009

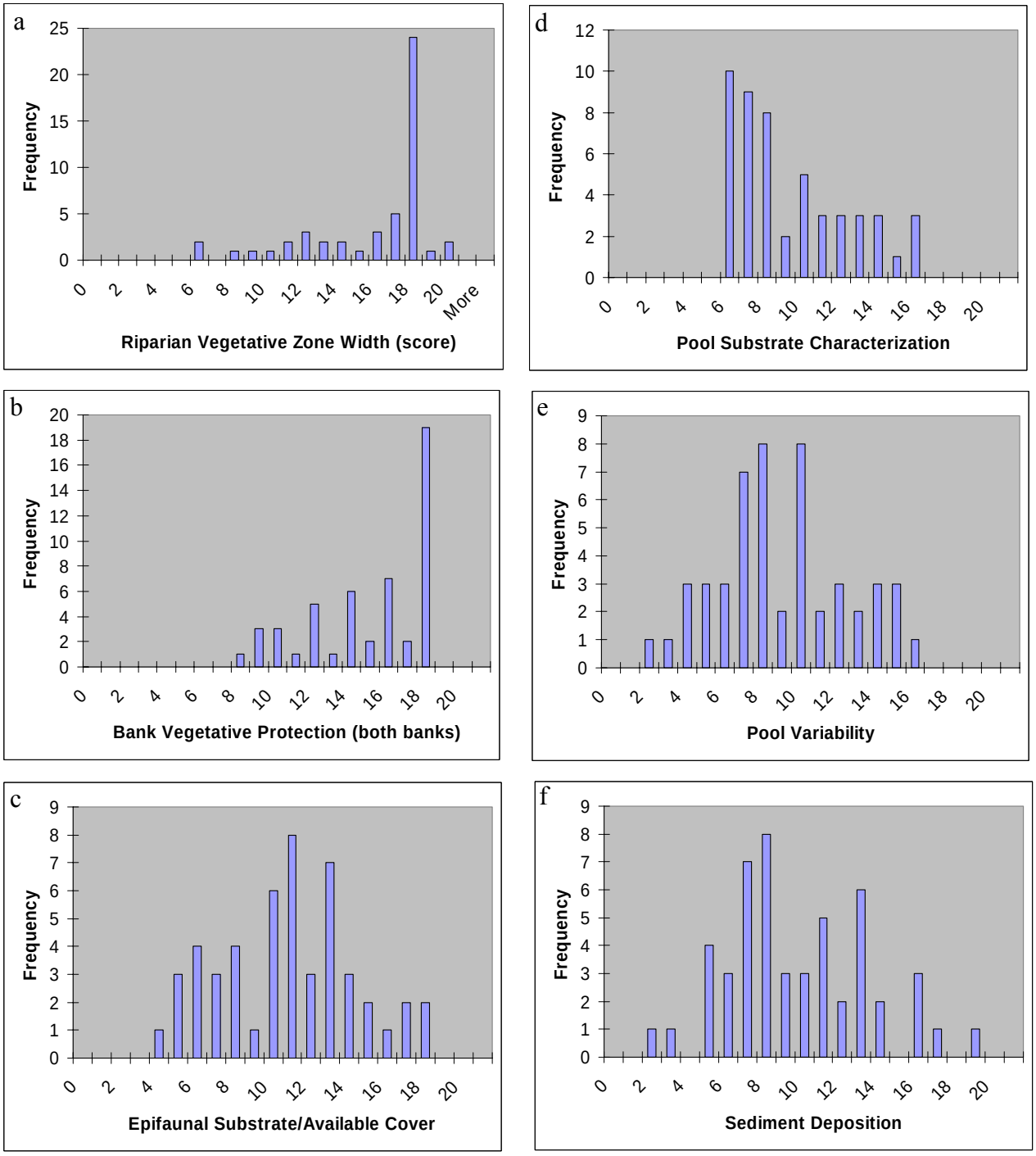

Figure 3-5 (a – f). Histograms depicting distributions of selected RBP habitat assessment metric scores for 50 targeted sites sampled in sampled in Patapsco Tidal and Bodkin Creek watersheds, Anne Arundel County, MD, 2009.

Table 3-4. RBP and PHI Scores and associated ratings for 50 targeted sites and 5 QC sites sampled in Patapsco Tidal and Bodkin Creek watersheds, Anne Arundel County, 2009.

Site	Total RBP Score	Percent of Reference	RBP Classification	PHI Score	PHI Narrative Rating
BK2-912-T-2009	143	71.5	Supporting	77.15	Partially Degraded
BK2-913-T-2009	121	60.5	Partially Supporting	70.43	Partially Degraded
BK2-914-T-2009	114	57	Partially Supporting	74.85	Partially Degraded
BK3-904-T-2009	144	72	Supporting	74.77	Partially Degraded
BK3-906-T-2009	124	62	Partially Supporting	82.82	Minimally Degraded
BK3-907-T-2009	148	74	Supporting	81.49	Minimally Degraded
BK3-946-T-2009	131	65.5	Supporting	79.99	Partially Degraded
BK7-902-T-2009	126	63	Supporting	71.82	Partially Degraded
BK8-901-T-2009	146	73	Supporting	88.77	Minimally Degraded
PT0-911-T-2009	127	63.5	Supporting	68.14	Partially Degraded
PT0-916-T-2009	116	58	Partially Supporting	61.69	Degraded
PT0-917-T-2009	127	63.5	Supporting	65.81	Degraded
PT0-925-T-2009	120	60	Partially Supporting	74.24	Partially Degraded
PT0-940-T-2009	107	53.5	Partially Supporting	82.81	Minimally Degraded
PT2-949-T-2009	146	73	Supporting	79.42	Partially Degraded
PT2-950-T-2009	121	60.5	Partially Supporting	74.66	Partially Degraded
PT3-944-T-2009	127	63.5	Supporting	66.39	Partially Degraded
PT3-947-T-2009	152	76	Comparable to Reference	71.02	Partially Degraded
PT3-948-T-2009	105	52.5	Partially Supporting	57.10	Degraded
PT5-929-T-2009	104	52	Partially Supporting	70.02	Partially Degraded
PT5-931-T-2009	113	56.5	Partially Supporting	60.52	Degraded
PT6-943-T-2009	130	65	Supporting	70.74	Partially Degraded
PT6-945-T-2009	117	58.5	Partially Supporting	84.14	Minimally Degraded
PT7-932-T-2009	169	84.5	Comparable to Reference	61.08	Degraded
PT7-934-T-2009	117	58.5	Partially Supporting	64.94	Degraded
PT7-936-T-2009	135	67.5	Supporting	76.66	Partially Degraded
PT7-938-T-2009	143	71.5	Supporting	70.61	Partially Degraded
PT8-923-T-2009	135	67.5	Supporting	78.94	Partially Degraded
PT8-927-T-2009	117	58.5	Partially Supporting	55.44	Degraded
PT8-937-T-2009	150	75	Supporting	75.76	Partially Degraded
PT9-933-T-2009	137	68.5	Supporting	80.90	Partially Degraded
PT9-935-T-2009	152	76	Comparable to Reference	87.04	Minimally Degraded
PTB-909-T-2009	105	52.5	Partially Supporting	79.24	Partially Degraded
PTB-910-T-2009	121	60.5	Partially Supporting	77.27	Partially Degraded
PTB-918-T-2009	133	66.5	Supporting	90.61	Minimally Degraded
PTC-941-T-2009	126	63	Supporting	68.14	Partially Degraded
PTC-942-T-2009	116	58	Partially Supporting	61.39	Degraded
PTD-922-T-2009	131	65.5	Supporting	79.31	Partially Degraded
PTD-924-T-2009	129	64.5	Supporting	76.35	Partially Degraded
PTD-928-T-2009	117	58.5	Partially Supporting	58.31	Degraded
PTF-915-T-2009	139	69.5	Supporting	57.72	Degraded
PTG-903-T-2009	126	63	Supporting	75.15	Partially Degraded
PTG-905-T-2009	143	71.5	Supporting	76.35	Partially Degraded
PTG-908-T-2009	137	68.5	Supporting	64.34	Degraded
PTG-939-T-2009	118	59	Partially Supporting	70.01	Partially Degraded
PTH-926-T-2009	142	71	Supporting	81.88	Minimally Degraded

Table 3-4. (Continued)

Site	Total RBP Score	Percent of Reference	RBP Classification	PHI Score	PHI Narrative Rating
PTH-930-T-2009	112	56	Partially Supporting	57.17	Degraded
PTM-920-T-2009	108	54	Partially Supporting	79.07	Partially Degraded
PTM-921-T-2009	118	59	Partially Supporting	76.78	Partially Degraded
PTN-919-T-2009	117	58.5	Partially Supporting	85.25	Minimally Degraded
Duplicate Sites for QC					
BK3-D07-T-2009	139	69.5	Supporting	85.16	Minimally Degraded
PT0-D17-T-2009	122	61	Partially Supporting	66.52	Partially Degraded
PT3-D47-T-2009	134	67	Supporting	68.79	Partially Degraded
PTF-D15-T-2009	118	59	Partially Supporting	55.21	Degraded
PTG-D39-T-2009	104	52	Partially Supporting	68.20	Partially Degraded

In contrast, lower scores were generally more common for in-channel conditions, particularly for parameters characterizing substrate quality and the diversity of available pool habitat. For example, only a few sites were rated as Optimal for Epifaunal Substrate / Available Cover (5 sites), Pool Substrate Characterization (3), Pool Variability (1), and Sediment Deposition (5). Pool Substrate Characterization was predominated by Marginal scores, while other parameters exhibited more normal distributions of values.

PHI scores at the targeted sites ranged from a low score of 55.4 (Degraded) to a high score of 90.6 (Minimally Degraded) out of a maximum possible score of 100 (Figure 3-6, Table 3-4). Nine of the targeted sites (18%) had PHI scores greater than or equal to 81, and a narrative rating of Minimally Degraded, the best possible rating. Twelve of the targeted sites (24%) had narrative ratings of Degraded. The majority of the targeted sites (29 sites, 58%) fell in the Partially Degraded category. No sites were rated Severely Degraded, the worst possible rating.

3.2.4 Quality Assurance and Quality Control

QA/QC measures were calculated and compared to quantitative measurement quality objectives (MQOs) when available. No QA/QC problems were identified. For detailed results, see Appendix B.

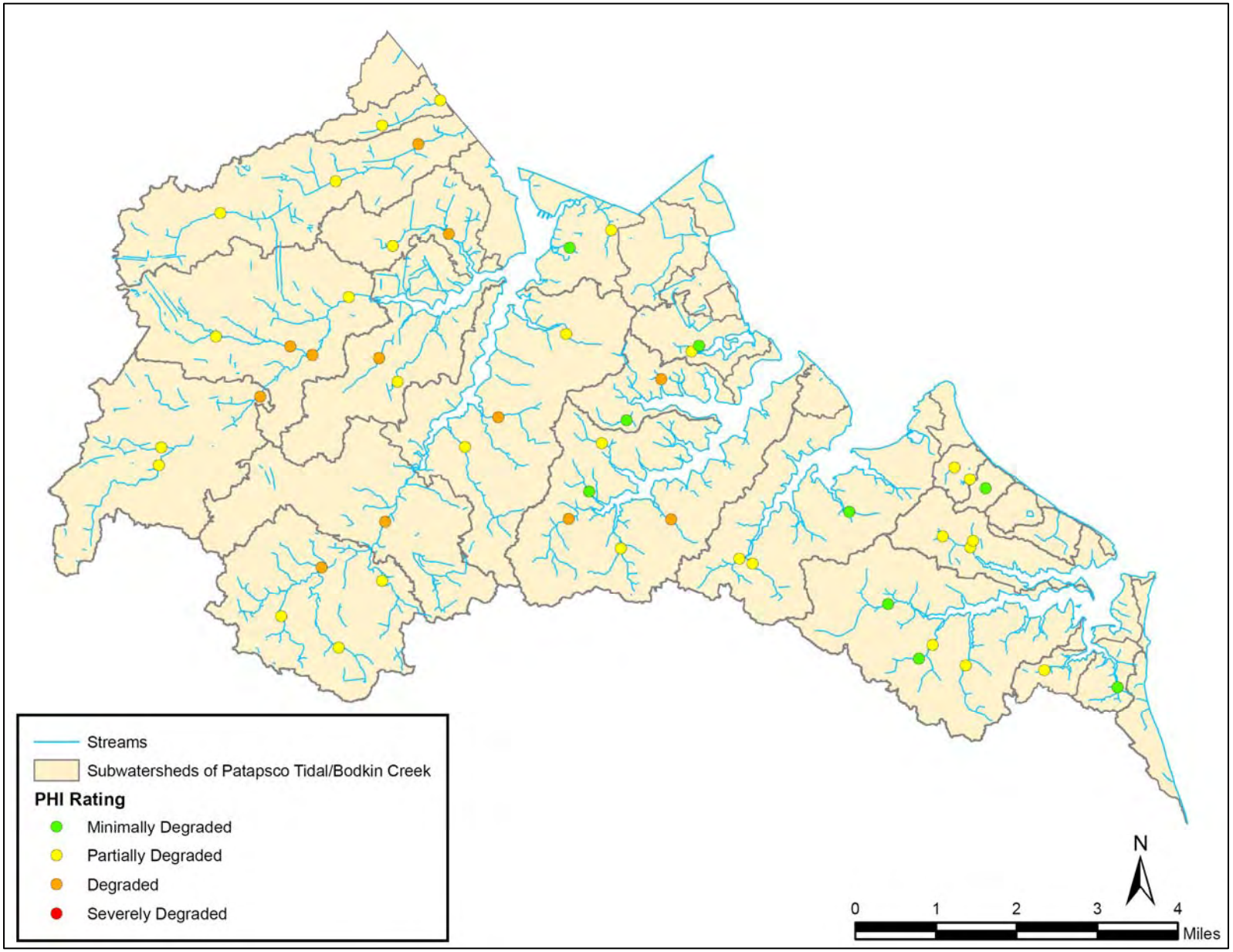

Figure 3-6. PHI habitat assessment results for 50 targeted sites sampled in Patapsco Tidal and Bodkin Creek watersheds, Anne Arundel County, 2009

4. DISCUSSION

The 2009 biological monitoring and assessment of streams in Patapsco Tidal and Bodkin Creek watersheds provided extensive information on the biological and physical conditions present as well as land uses. In this section, we examine the findings of this stream assessment, to interpret those results and contribute to a better understanding of the current status of Anne Arundel County streams.

4.1 LAND USE

Residential, commercial, and various industrial and transportation uses are well-represented in the Patapsco Tidal and Bodkin Creek watersheds. In much of the area, there is a predominance of older residential development, much of which pre-dates requirements for stormwater management. Many of the headwater streams in Patapsco Tidal watershed are surrounded by dense residential, industrial, and commercial development. Within the Patapsco Tidal watershed are Marley Station Mall, several other shopping plazas, the Brandon Shores power plant, a CSX railyard, and portions of BWI airport. Bodkin Creek watershed has generally more wooded cover and less dense residential development, and its area includes the Compass Pointe Golf Course. Some large forested areas are present, for example a large area between Marley and Stoney Creeks within the Patapsco Tidal watershed, as well as some moderate forested riparian buffer, as noted at many of the sampled sites.

As expected, given the density of urban/suburban development in the area, impervious surface in site catchments was extensive, ranging from 2 to 67% of catchment area. The majority of sites (26) had more than 25% impervious surface, a threshold at which severe stream degradation is often observed. Another 17 sites had between 10 and 25% impervious surface, a level commonly associated with moderate stream degradation. Only seven sites had catchments with less than 10% impervious surface. The percentage of wooded land, by catchment, ranged from 2% to 87%.

4.2 WATER CHEMISTRY

At the majority of sites, water chemistry data did not exceed COMAR state water quality standards. However, low pH values (less than 6.5) were observed at nine sites and high pH (greater than 8.5) at one site. In addition, elevated pH values (greater than 8.0, but below maximum water quality standards) were observed at another 11 sites. Interestingly, there were also a few sites with high conductivity (six sites with conductivity greater than 0.500 mS/cm), which may be indicative of pollutant inputs. These single-point-in-time measures only provide limited information on the parameters measured and provide no data to evaluate nutrient loads or inputs of oil and grease, hydrocarbons, or other pollutants often found in urban waterways. However, they do serve as indicators of potential problems that could merit further investigation.

4.3 BIOLOGICAL CONDITION

Overall, BIBI results indicated that benthic macroinvertebrate communities have been degraded to a great degree in many areas across the Patapsco Tidal and Bodkin Creek watersheds. The overwhelming majority of sites sampled were rated either Poor or Very Poor. Of the 50 sites, only 12 were rated Fair and one site Good, the two categories representing sites comparable to reference conditions. These results are constant with prior assessment work performed by the county in both the Patapsco Tidal (Victoria, unpublished data; Stribling et al. 2008) and Bodkin Creek (Stribling et al. 2008) watersheds.

This is not unexpected, given the extent and long history of urban and suburban land uses in Patapsco Tidal and Bodkin Creek watersheds. Many of the sites rated as Fair and Good were in catchments of residential land with some wooded area. However, a predominance of wooded land did not guarantee high benthic scores: eight sites with more than 50% woods in their catchments (one MBSS criterion for a "Sentinel Site" (DNR 2005)) still fell within the Poor to Very Poor biological condition categories.

4.4 HABITAT ASSESSMENT

Habitat conditions, assessed using EPA RBP and MBSS PHI methods, were generally indicative of moderate to more pronounced degradation. According to RBP scores, half of the habitat sites (25) were rated Supporting (the second highest category) and most others (22) Partially Supporting (third category of four). PHI results were similar: 29 sites were rated as Partially Degraded (the second highest category) and 12 were Degraded (third category of four). These results are consistent with previous habitat assessments performed by the county in both the Patapsco Tidal (Victoria, unpublished data; Stribling et al. 2008) and Bodkin Creek (Stribling et al. 2008) watersheds.

Few sites received top ratings. The best conditions rated as Minimally Degraded by PHI (9 sites) were generally found in smaller streams and were more common in Bodkin Creek (Figures 3-4 and 4-1). While fewer sites were sampled in Bodkin Creek, the overall distribution of PHI scores in Bodkin Creek fell in the higher categories of Partially Degraded and Minimally Degraded, with no sites rating Degraded (Figure 4-1). Two of the three sites rated as Comparable to Reference by RBP score were found along mainstem creeks.

Scores for RBP and PHI were not necessarily consistent with one another, because the two indicators incorporate different parameters associated with stream habitat (Figure 4-2). At 27 of the 50 sites (54%), sites received a comparable rating between the PHI and RBP habitat assessments (for example, when a site rated in the highest category of Minimally Degraded by the PHI were also rated Comparable to Reference by the RBP). However, almost half of the time (46% of sites) the ratings between the two assessment procedures differed in their relative assessment by category. For instance, site PT7-932-T-2009 received the best RBP

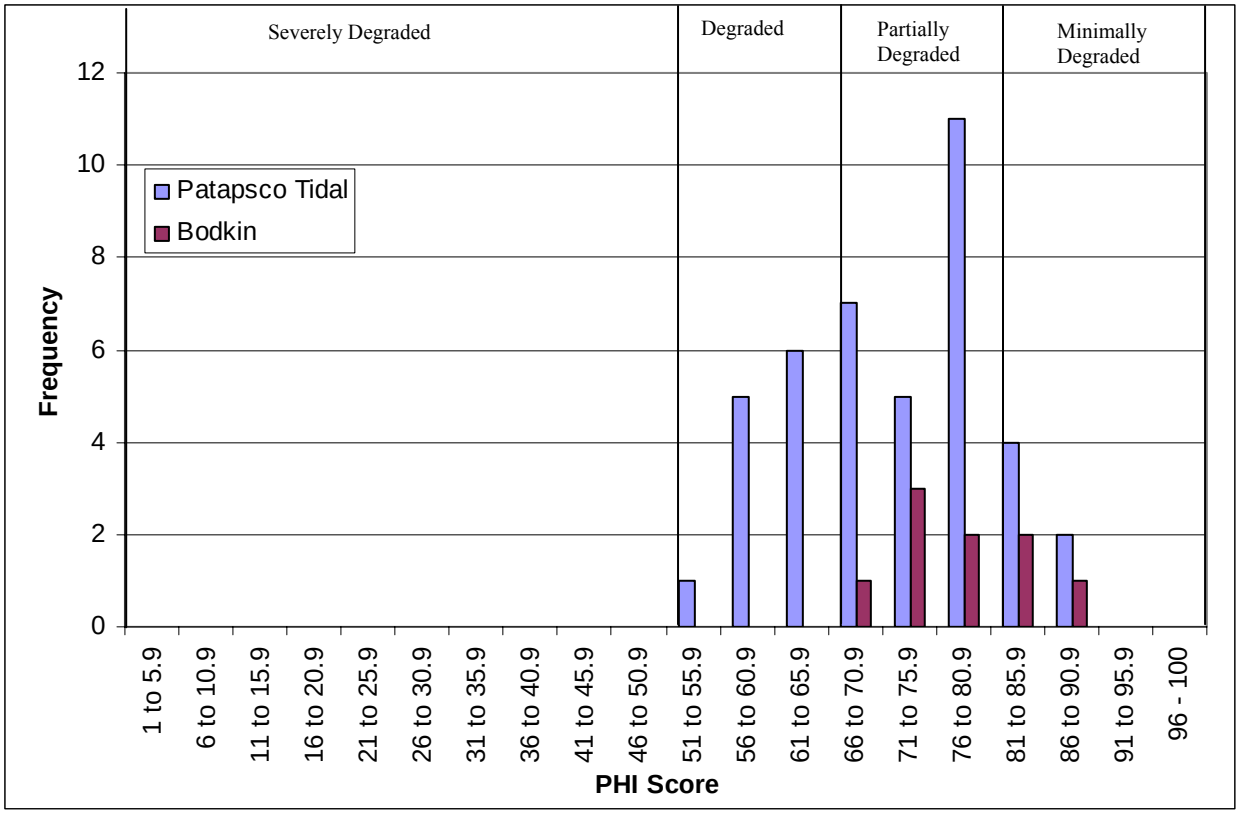

Figure 4-1. Distribution of PHI scores for 50 targeted sites sampled in Patapsco Tidal (41 sites) and Bodkin Creek (9 sites) watersheds, Anne Arundel County, MD, 2009

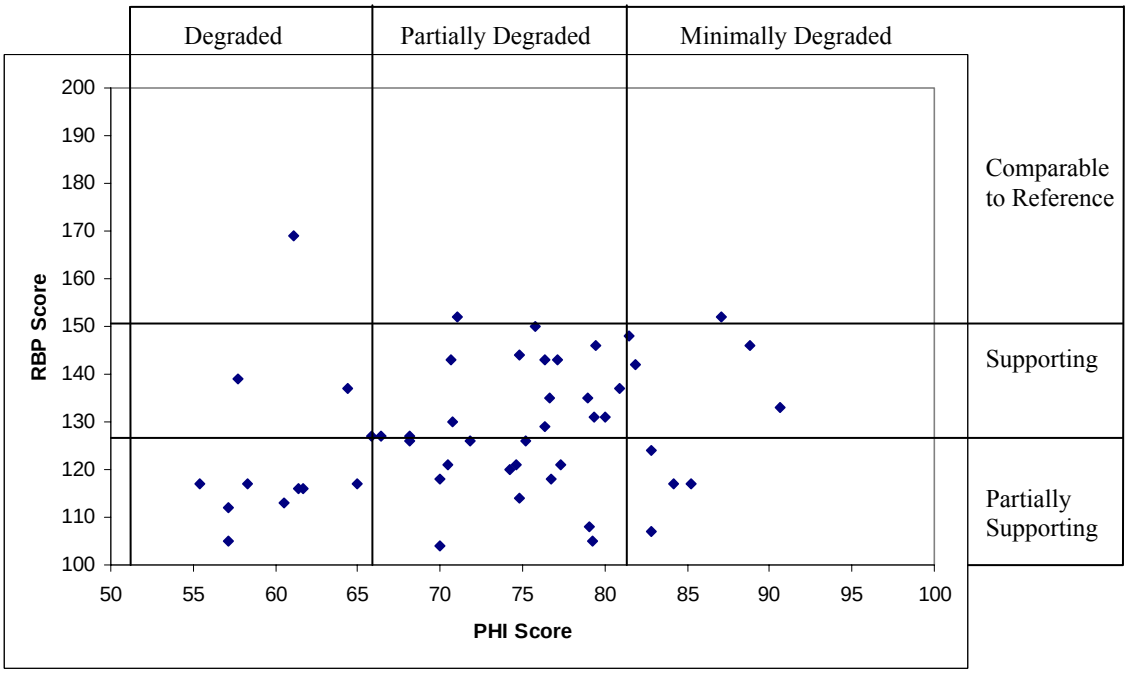

Figure 4-2. Comparison of PHI and RBP Habitat Assessment scores for 50 targeted sites sampled in Patapsco Tidal and Bodkin Creek watersheds, Anne Arundel County, Maryland, 2009.

narrative rating (Comparable to Reference) but was rated in the third of four categories (Degraded) by the PHI. The differences between ratings did not appear to follow any particular pattern, i.e., the PHI narrative rating was not always lower than the RBP narrative rating as the above example indicated. At four sites, the PHI narrative rating was the best possible rating of Minimally Degraded, while the RBP narrative rating was only Partially Supporting.

There was evidence that some streams are experiencing the typical effects of urban runoff and altered hydrology, which are characteristic of watersheds with older development and inadequate stormwater management. The bank erosion, sediment deposition, and low quality epifaunal substrate observed at some sites are signs of habitat degradation. Notably, nearly one-third of the streams surveyed (16) had at least one bank in marginal or poor condition, suggesting that altered flow regime (flashiness) is a potential problem. In urbanized watersheds, natural streamflow patterns can be disrupted, resulting in frequent high flow events that scour streambanks and can alter channel morphology (Leopold 1968, CWP 2005).

However, no sites were rated in the most severely degraded category for either habitat index. The fact that no sites rated as this poor suggests that the streams in Patapsco Tidal and Bodkin Creek watersheds have not reached the point of severe degradation commonly observed in more densely urbanized areas of the Baltimore/Washington Metropolitan region. The riparian forest buffer present at many sites may be affording a degree of protection for stream habitat. It is also possible that the low gradient, characteristic of these Coastal Plain streams, has prevented more severe erosion, which often occurs in watersheds with similar land uses in the Piedmont.

Both watersheds have a large proportion of older development, with about 65-70% of existing development already built by the end of the 1970s (Stribling et al. 2008). However, greater degradation (as evidenced by 12 sites with PHI scores in the Degraded range) was noted in Patapsco Tidal watershed, where commercial/industrial land uses are more prevalent, compared with Bodkin Creek watershed, where development is primarily residential and lower in impervious cover. Impervious surface cover at the nine Bodkin Creek sites ranged from 5.6 to 28.2%, with all but one site less than 20% impervious. In contrast, impervious surface at most of the Patapsco Tidal sites exceeded 20%, with a high of 67.2%.

4.5 INTEGRATED ASSESSMENT

A summary map depicting BIBI, PHI, and highlights of water chemistry results is shown in Figure 4-3.

Neither the RBP Habitat Assessment score nor the PHI exhibited a strong relationship to BIBI scores (Figures 4-4 and 4-5, Tables 4-1 and 4-2). The lack of correlation between BIBI scores and the habitat indicators (either RBP or PHI) suggest that other factors such as water quality or flow regime may be having a greater effect on benthic macroinvertebrates. Tables 4-1 and 4-2 show a pattern suggesting water quality impairment depressing biological integrity, regardless of habitat method used. In particular, some sites (shown in bold in Tables 4-1 and

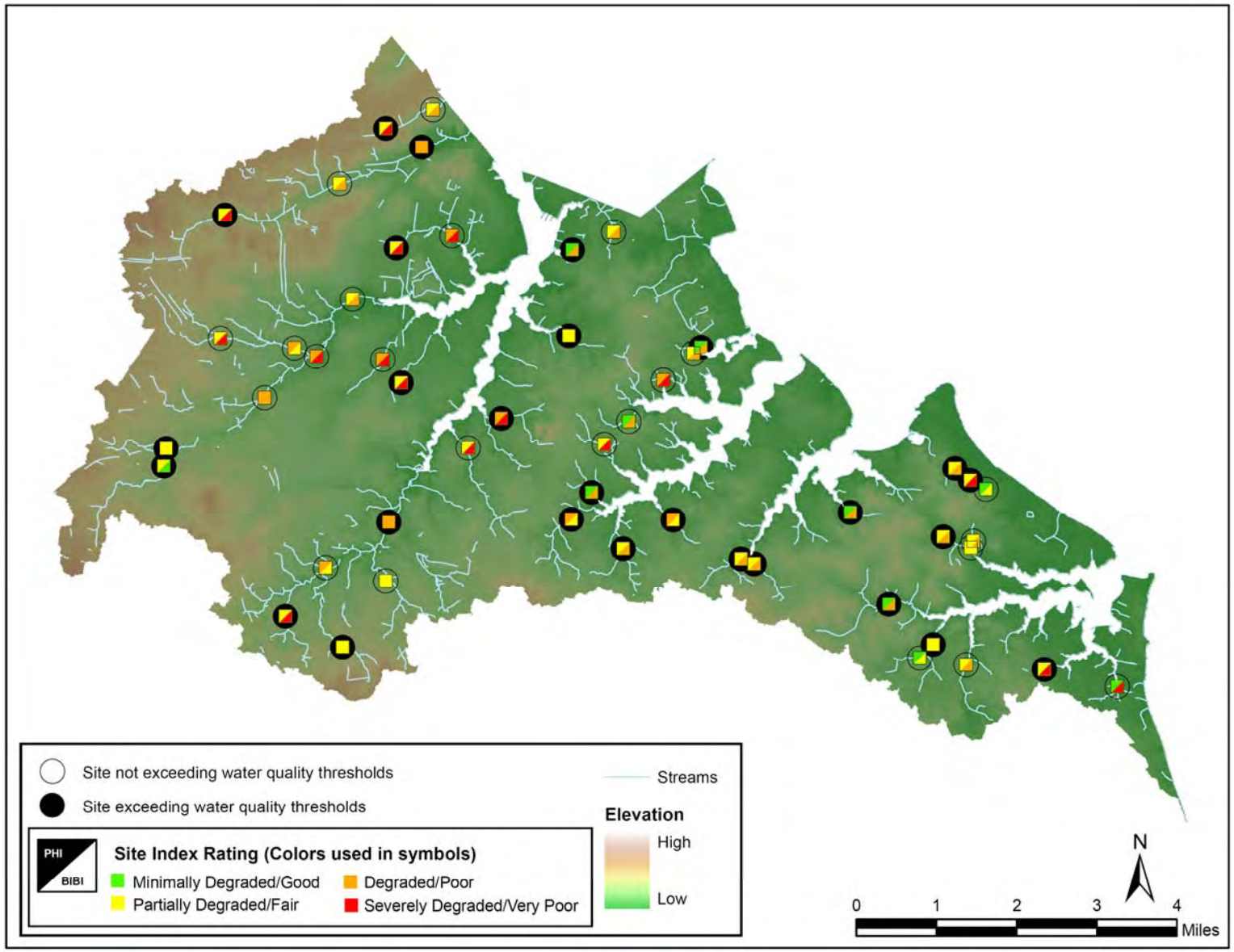

Figure 4-3. Benthic macroinvertebrate (BIBI ratings) and habitat assessment results (PHI ratings) for 50 targeted sites sampled in Patapsco Tidal and Bodkin Creek watersheds, Anne Arundel County, 2009. Sites with pH < 6.5 or > 8.0 or conductivity > 0.500 mS/cm are highlighted as exceeding water quality thresholds.

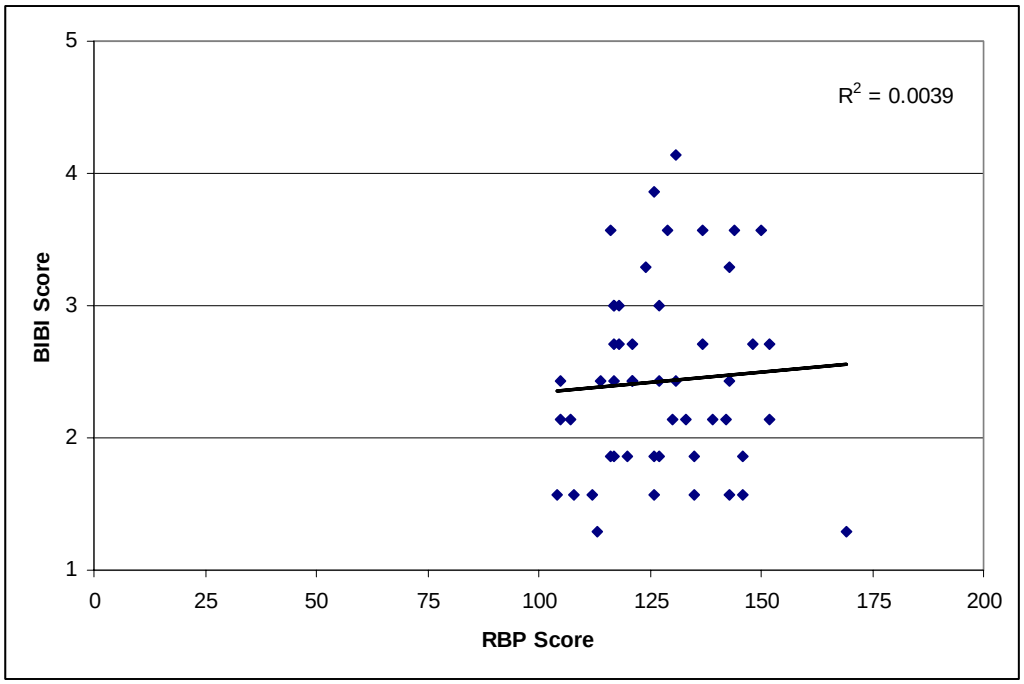

Figure 4-4. Relationship of RBP habitat assessment score to BIBI score for 50 targeted sites sampled in Patapsco Tidal and Bodkin Creek watersheds, Anne Arundel County, Maryland, 2009. Regression coefficient is also presented.

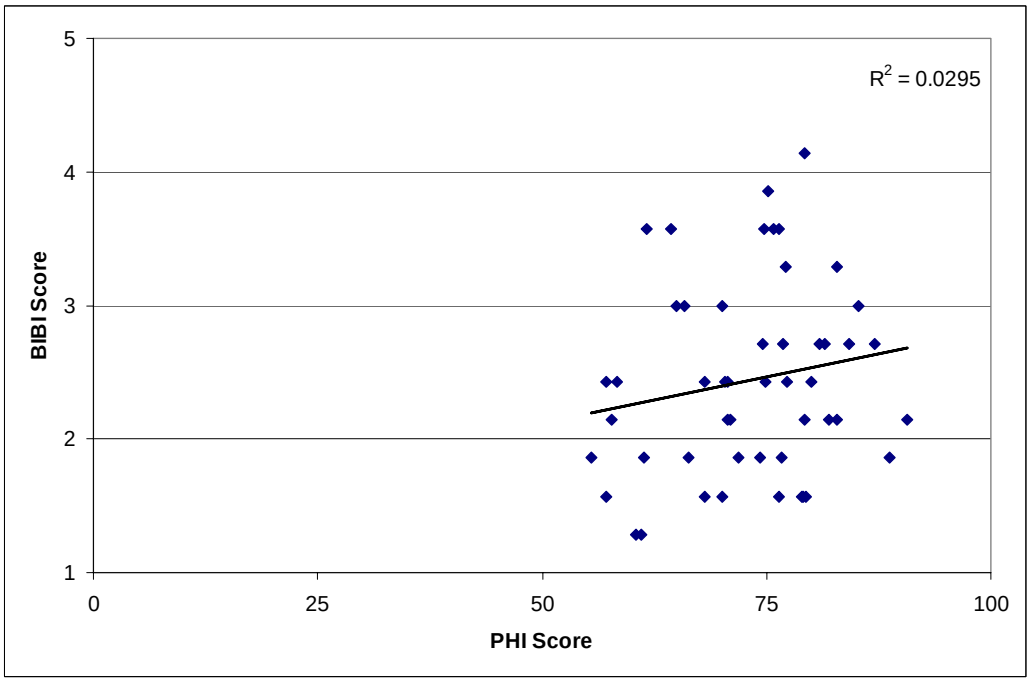

Figure 4-5. Relationship of PHI habitat assessment score to BIBI score for 50 targeted sites sampled in Patapsco Tidal and Bodkin Creek watersheds, Anne Arundel County, Maryland, 2009. Regression coefficient is also presented

Table 4-1. Comparison of sample site BIBI ratings to RBP Habitat ratings at 50 targeted stream sites sampled in Patapsco Tidal and Bodkin Creek watersheds, Anne Arundel County, Maryland, 2009. Cells shaded in green contain 3-digit abbreviations for stream sites where the biological community was less impaired than habitat scores would predict (i.e., the 3-digit "922" is an abbreviation for site PTD-922-T-2009). Yellow cells contain stream sites where the biological community matched available habitat condition. Cells shaded pink contain sites where the biological community was more impaired than the habitat scores would predict. Sites in bold type had biological conditions that differed by at least two categories from the corresponding habitat condition class.

RBP Habitat Rating	**BIBI Narrative Rating**			
	Good	**Fair**	**Poor**	**Very Poor**
Comparable			**935, 947**	**932**
Supporting	922	903, 904, 908, 912, 917, 924, 937	907, 946, 911, 943, 938, 933, 918, 915, 926	**901, 902, 905, 923, 936, 941, 944, 949**
Partially Supporting		906, 916, 919, 934, 939	909, 910, 913, 914, 921, 928, 940, 945, 948,950	920, 925, 927, 929, 930, 931, 942
Non-Supporting				

Table 4-2. Comparison of sample site BIBI ratings to PHI Habitat ratings at 50 targeted stream sites sampled in Patapsco Tidal and Bodkin Creek watersheds, Anne Arundel County, Maryland, 2009. Cells shaded in green contain 3-digit abbreviations for stream sites where the biological community was less impaired than habitat scores would predict (i.e., the 3-digit "922" is an abbreviation for site PTD-922-T-2009). Yellow cells contain stream sites where the biological community matched available habitat condition. Cells shaded pink contain sites where the biological community was more impaired than the habitat scores would predict. Sites in bold type had biological conditions that differed by at least two categories from the corresponding habitat condition class.

PHI Habitat Rating	**BIBI Narrative Rating**			
	Good	**Fair**	**Poor**	**Very Poor**
Minimally Degraded		906, 919	**907, 918, 926, 935, 940, 945**	**901**
Partially Degraded	922	903, 904, 912, 924, 937, 939	909, 910, 911, 913, 914, 921, 933, 938, 943, 946, 947, 950	**902, 905, 920, 923, 925, 929, 936, 941, 944, 949**
Degraded		908, 916, 917, 934	915, 928, 948	927, 930, 931, 932, 942,
Severely Degraded				

4-2) showed a departure of two or more biological condition classes from that expected for the available habitat as measured in both assessment methods. These sites would be good candidates for further investigation of water quality problems or upstream conditions that may be affecting stream quality. Water quality results showed that 27 sites were in fact characterized by low (or high) pH or high conductivity (Tables 4-3 and 4-4), in many cases associated with low BIBI scores. Other sites with low biological integrity, not linked to low-scoring habitat, may also be affected by water quality, but by factors not measured in this assessment. Further investigations may be warranted to identify the sources of these biological impairments.

Anne Arundel County plans to conduct further habitat and geomorphic assessments in streams throughout the Patapsco Tidal and Bodkin Creek watersheds as part of its ongoing watershed assessment program, to provide information for developing stormwater retrofit and stream restoration measures. Field reconnaissance of upstream conditions will likely provide more evidence for factors influencing stream integrity. Supplementing these studies with further water quality investigations may provide a clearer picture of the stressors affecting streams in these two watersheds. As the County looks to improve upon existing stormwater management in these watersheds, solutions that provide for treatment of water quality as well as quantity should be considered.

Table 4-3. Water quality exceedances by site. Colors correspond with the comparison between RBP and BIBI categories, as depicted in Table 4-1. Sites shaded green had a biological community less impaired than habitat scores would predict. Sites shaded yellow had a biological community with condition matching available habitat condition. Sites shaded pink had a biological community more impaired than the habitat scores would predict. Sites in bold type had biological conditions that differed by at least two categories from the corresponding habitat condition class.

Site	low pH (< 6.5)	high pH (> 8.0)	High Conductivity (> 0.500 mS/cm)	pH and Conductivity Normal
BK3-906-T-2009				X
PT7-934-T-2009				X
PTG-939-T-2009				X
PTN-919-T-2009				X
PT0-916-T-2009		X		
PTD-922-T-2009		X		
BK2-912-T-2009				X
BK2-914-T-2009				X
PT2-950-T-2009				X
PTD-928-T-2009				X
PTG-908-T-2009				X
PT0-917-T-2009		X		
PT6-945-T-2009		X		
PTD-924-T-2009		X		
PTG-903-T-2009		X		
BK2-913-T-2009	X			
BK3-904-T-2009	X			
PT8-937-T-2009	X			
PTB-909-T-2009	X			
PTB-910-T-2009	X			
PTM-921-T-2009	X			
PT0-940-T-2009			X	
PT3-948-T-2009			X	
BK8-901-T-2009				**X**
PT3-947-T-2009				**X**
PT7-932-T-2009				**X**
PT7-936-T-2009				**X**
PT8-923-T-2009				**X**
BK3-946-T-2009				X

Table 4-3. (Continued)

Site	low pH (< 6.5)	high pH (> 8.0)	High Conductivity (> 0.500 mS/cm)	pH and Conductivity Normal
PT0-925-T-2009				X
PT5-931-T-2009				X
PT6-943-T-2009				X
PT7-938-T-2009				X
PT9-933-T-2009				X
PTC-942-T-2009				X
PTH-926-T-2009				X
PTH-930-T-2009				X
PTC-941-T-2009		**X**		
PTG-905-T-2009		**X**		
BK3-907-T-2009		X		
PT8-927-T-2009		X		
PTB-918-T-2009		X		
PTF-915-T-2009		X		
BK7-902-T-2009	**X**			
PT3-944-T-2009	**X**			
PTM-920-T-2009	X			
PT2-949-T-2009			**X**	
PT9-935-T-2009			**X**	
PT0-911-T-2009			X	
PT5-929-T-2009			X	

Table 4-4. Water quality exceedances by site. Colors correspond with the comparison between PHI and BIBI categories, as depicted in Table 4-2. Sites shaded green had a biological community less impaired than habitat scores would predict. Sites shaded yellow had a biological community with condition matching available habitat condition. Sites shaded pink had a biological community more impaired than the habitat scores would predict. Sites in bold type had biological conditions that differed by at least two categories from the corresponding habitat condition class.

Site	low pH (< 6.5)	high pH (> 8.0)	High Conductivity (> 0.500 mS/cm)	pH and Conductivity Normal
PT7-934-T-2009				X
PTG-908-T-2009				X
PT0-916-T-2009		X		
PT0-917-T-2009		X		
PTD-922-T-2009		X		
BK2-912-T-2009				X
PTD-928-T-2009				X
PTG-939-T-2009				X
PTD-924-T-2009		X		
PTF-915-T-2009		X		
PTG-903-T-2009		X		
BK3-904-T-2009	X			
PT8-937-T-2009	X			
PT3-948-T-2009			X	
BK8-901-T-2009				**X**
PT0-925-T-2009				**X**
PT7-936-T-2009				**X**
PT8-923-T-2009				**X**
PTH-926-T-2009				**X**
BK2-914-T-2009				X
BK3-906-T-2009				X
BK3-946-T-2009				X
PT2-950-T-2009				X
PT3-947-T-2009				X
PT5-931-T-2009				X
PT6-943-T-2009				X
PT7-932-T-2009				X
PT7-938-T-2009				X
PT9-933-T-2009				X

Table 4-4. (Continued)

Site	low pH (< 6.5)	high pH (> 8.0)	High Conductivity (> 0.500 mS/cm)	pH and Conductivity Normal
PTC-942-T-2009				X
PTH-930-T-2009				X
PTN-919-T-2009				X
BK3-907-T-2009		**X**		
PT6-945-T-2009		**X**		
PTB-918-T-2009		**X**		
PTC-941-T-2009		**X**		
PTG-905-T-2009		**X**		
PT8-927-T-2009		X		
BK7-902-T-2009	**X**			
PT3-944-T-2009	**X**			
PTM-920-T-2009	**X**			
BK2-913-T-2009	X			
PTB-909-T-2009	X			
PTB-910-T-2009	X			
PTM-921-T-2009	X			
PT0-940-T-2009			**X**	
PT2-949-T-2009			**X**	
PT5-929-T-2009			**X**	
PT9-935-T-2009			**X**	
PT0-911-T-2009			X	

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APPENDIX A

INDIVIDUAL SITE DATA SUMMARIES

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Site ID BK2-912-T-2009

Sampling Date 4/20/2009

ADC Map # 10, C-7

Watershed = Bodkin Creek

Subwatershed = Back Creek

Location = Near Oak Road

Upstream from Mid-Point

Downstream from Mid-Point

This site is located in the Bodkin Creek watershed in Back Creek. The site is located in the back corner of the last property on the right hand side of Oak Road. Forty-eight percent of the catchment draining to this site is residential, 38% is wooded, and 13.6% is impervious. There is a shaded canopy and the riparian vegetative zone width and the vegetative protection rated as Optimal on both sides of the stream. The substrate at this site is 90% sand with 10% silt. This site rated Partially Degraded for PHI and Supporting for RBP. Its biological condition rated Fair, as no Ephemeroptera nor any scraper taxa were found, thus limiting its BIBI score (BIBI score of 3.29).

Results Biological Condition : Fair

Habitat Rating : RBP : Supporting MPHI : Partially Degraded

Stream Subsystem = Perennial Stream Origin = Mixture of Origins Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	30
Runs	20
Pools	50

Some Potential Sources of Local Watershed NPS Pollution

Moderate Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation 0

Road Culvert Present ? No

Left Buffer Breaks Present ? No

Right Buffer Breaks Present ? No

Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	90
Boulder	0	Gravel	0	Silt	10
				Clay	0

Water Chemistry	Temperature (C)	11.3	Conductivity (mS/cm)	0.155	pH	7.05	DO (ppm)	8.4

Site ID BK2-912-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	37	5
EPT Taxa	7	5
% Intolerant to Urban	41.60	5
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	0	1
% Climbers	16.00	5

BIBI Score: 3.29 Rating: Fair

Taxa List

Taxa	Count
Anchytarsus	3
Caecidotea	13
Ceratopogon	4
Chaetocladius	1
Corynoneura	3
Dicranota	1
Diplectrona	5
Diplocladius	6
Dolophilodes	1
Enchytraeidae	1
Gammarus	16
Girardia	2
Gymnometriocnemus	1
Heteroplectron	1
Hydatophylax	1
Leuctra	4
Mallochohelea	1
Meropelopia	2
Micropsectra	17
Nais	6
Nigronia	2
Paramerina	1
Parametriocnemus	4
Paraphaenocladius	1
Paratendipes	1
Pisidium	1
Polycentropus	2
Pseudorthocladius	1
Pycnopsyche	3
Synurella	2
Tanytarsus	3
Thienemanniella	1
Thienemannimyia group	3
Tipula	1
Torrenticola	1
Tvetenia	5
Zavrelimyia	4
Total Count	125

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	381.50
Remoteness	87.05
Percent Shading	99.94
Epifaunal Substrate	46.53
Instream Habitat	58.70
Instream Woody Debris	100.00
Bank Stability	70.71
PHI Score	77.15

PHI Narrative Rating: Partially Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	14
Pool Substrate Characterization	12
Pool Variability	10
Sediment Deposition	7
Channel Flow Status	19
Channel Alteration	19
Channel Sinuosity	18
Bank Stability - Left Bank	4
Right Bank	4
Vegetative Protection - Left Bank	9
Right Bank	9
Riparian Vegetative Zone Width - Left Bank	9
Right Bank	9
RBP Score	143

RBP Narrative Rating: Supporting

Land Use Analysis

Impervious Area (acres) 51.81 % Impervious 13.58

Land Use	Acres	% Area
Residential	184.13	48.26
Commercial	8.28	2.17
Transportation	9.98	2.62
Woods	144.10	37.77
Open Space	33.52	8.79
Water	1.49	0.39

Site ID BK2-913-T-2009
Sampling Date 4/20/2009
ADC Map # 10, B-9

Watershed = Bodkin Creek
Subwatershed = Back Creek
Location = Poplar Ridge Park, behind baseball fields

Upstream from Mid-Point

Downstream from Mid-Point

This site is located in the Bodkin Creek watershed in Back Creek. The site is in Poplar Ridge Park, after the last baseball field. In this catchment, the majority of the landuse is residential (54%), but just less than 34% is wooded. There is 15% impervious surface in the surrounding catchment. Poor bank stability was noted along both banks, and high levels of erosion were present in the surrounding watershed, resulting in slightly turbid water clarity in the stream. The field crew observed an ATV course alongside the stream, which may be adding to erosion and bank stability problems. In situ pH measured at this site was 6.30, slightly below the state water quality standard of 6.5. This site rated in the second best category (Partially Degraded) for PHI but in the lower category of Partially Supporting for RBP. The substrate was entirely silt and sand, and epifaunal substrate was marginal, while embeddedness was high. The benthic community at this location included no Ephemeroptera nor any scraper taxa, and only 3 EPT taxa. Benthic conditions rated Poor with a BIBI score of 2.43.

Results Biological Condition : Poor
Habitat Rating : RBP : Partially Supporting MPHI : Partially Degraded

Stream Subsystem = Perennial Stream Origin = Mixture of Origins Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	20
Runs	30
Pools	50

Some Potential Sources of Local Watershed NPS Pollution
Heavy Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation 0

Road Culvert Present ? No
Left Buffer Breaks Present ? Yes
Right Buffer Breaks Present ? No
Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	95
Boulder	0	Gravel	0	Silt	5
				Clay	0

Water Chemistry	Temperature (C)	11.8	Conductivity (mS/cm)	0.191	pH	6.3	DO (ppm)	8.4

Site ID BK2-913-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	23	5
EPT Taxa	3	3
% Intolerant to Urban	20.56	3
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	0	1
% Climbers	5.61	3

BIBI Score: 2.43 Rating: Poor

Taxa List

Taxa	Count
Bezzia	2
Caecidotea	5
Calopteryx	1
Corynoneura	13
Culicoides	1
Dicranota	1
Diplectrona	1
Diplocladius	12
Gammarus	30
Heteroplectron	1
Leuctra	1
Micropsectra	3
Nais	3
Orthocladiinae	1
Parametriocnemus	5
Pisidium	3
Polypedilum	2
Prodiamesa	1
Rheocricotopus	2
Sphaeriidae	4
Synurella	10
Thienemannimyia group	2
Tvetenia	3
Total Count	107

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	274.66
Remoteness	51.66
Percent Shading	99.94
Epifaunal Substrate	48.68
Instream Habitat	78.70
Instream Woody Debris	93.64
Bank Stability	50.00
PHI Score	70.43

PHI Narrative Rating: Partially Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	10
Pool Substrate Characterization	7
Pool Variability	9
Sediment Deposition	6
Channel Flow Status	19
Channel Alteration	19
Channel Sinuosity	19
Bank Stability - Left Bank	2
Right Bank	2
Vegetative Protection - Left Bank	6
Right Bank	6
Riparian Vegetative Zone Width - Left Bank	8
Right Bank	8
RBP Score	121

RBP Narrative Rating: Partially Supporting

Land Use Analysis

Impervious Area (acres) 41.22 % Impervious 15.01

Land Use	Acres	% Area
Residential	149.02	54.26
Commercial	4.25	1.55
Transportation	8.10	2.95
Woods	92.19	33.57
Open Space	19.61	7.14
Water	1.49	0.54

Site ID BK2-914-T-2009

Sampling Date 4/29/2009

ADC Map # 10, C-9

Watershed = Bodkin Creek

Subwatershed = Back Creek

Location = Bayside Beach Road

Upstream from Mid-Point

Downstream from Mid-Point

Site BK2-914-T-2009 is located off of Bayside Beach Road, in the Back Creek subwatershed of the Bodkin Creek watershed. Only about 5.6% of the catchment surrounding this site contains impervious surface, with open space dominating the catchment, contributing 61% of catchment area. Residential landuse, along with a very small amount of transportation-related landuse are also present. Despite almost 60% of the macroinvertebrates obtained in the benthic sample being considered intolerant to urban conditions, this site had only one EPT taxa and no scraper taxa present, and only a few climbers. With a BIBI score of 2.43, it rated Poor. Epifaunal substrate and pool substrate were received low ratings, and pool variability was poor with no deep pools present. Field staff noted some trash in and near the site. Streambanks were stable along both sides of the stream and no bank erosion was present. In addition, the riparian buffer was good. Habitat at this site rated Partially Degraded under the PHI (score of 74.9), and Partially Supporting under the RBP (score of 114).

Results Biological Condition : Poor

Habitat Rating : RBP : Partially Supporting MPHI : Partially Degraded

Stream Subsystem = Perennial Stream Origin = Spring-fed Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	40
Runs	45
Pools	15

No Evidence of Local Watershed NPS Pollution

None Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation: 0

Road Culvert Present ? No

Left Buffer Breaks Present ? No

Right Buffer Breaks Present ? No

Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	60
Boulder	0	Gravel	0	Silt	40
				Clay	0

Water Chemistry	Temperature (C)	13.1	Conductivity (mS/cm)	0.222	pH	7.34	DO (ppm)	7.4

Site ID BK2-914-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	23	5
EPT Taxa	1	1
% Intolerant to Urban	59.29	5
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	0	1
% Climbers	2.65	3

BIBI Score: 2.43 Rating: Poor

Taxa List

Taxa	Count
Aulodrilus	2
Caecidotea	11
Cordulidae	1
Culicidae	1
Culicoides	2
Dasyhelea	4
Diplocladius	2
Enochrus	1
Larsia	1
Limnodrilus	5
Meropelopia	3
Naididae (Tubificinae)	5
Natarsia	1
Paratendipes	2
Phryganeidae	1
Polypedilum	2
Sphaeriidae	7
Spirosperma	1
Synurella	55
Tanytarsus	1
Thienemannimyia group	1
Turbellaria	1
Zavrelimyia	3
Total Count	113

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	54.85
Remoteness	31.22
Percent Shading	100.00
Epifaunal Substrate	53.36
Instream Habitat	67.45
Instream Woody Debris	97.08
Bank Stability	100.00
PHI Score	74.85

PHI Narrative Rating: Partially Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	4
Pool Substrate Characterization	6
Pool Variability	4
Sediment Deposition	6
Channel Flow Status	16
Channel Alteration	18
Channel Sinuosity	6
Bank Stability - Left Bank	9
Right Bank	9
Vegetative Protection - Left Bank	9
Right Bank	9
Riparian Vegetative Zone Width - Left Bank	9
Right Bank	9
RBP Score	114

RBP Narrative Rating: Partially Supporting

Land Use Analysis

Impervious Area (acres) 3.08 % Impervious 5.62

Land Use	Acres	% Area
Residential	19.85	36.19
Transportation	1.46	2.66
Woods	33.54	61.15

Site ID BK3-904-T-2009
Sampling Date 4/20/2009
ADC Map # 10, A-10

Watershed = Bodkin Creek
Subwatershed = Main Creek
Location = Loreen Drive at Silver Run Drive

Upstream from Mid-Point

Downstream from Mid-Point

This site is located at Loreen Drive at Silver Run Drive in the Bodkin Creek watershed in the Main Creek subwatershed. The area surrounding the stream was very marshy and organic deposits and skunk cabbage were present in large quantities. Streambanks were mainly stable and vegetative protection and riparian widths were good. Fifty-nine percent of the catchment draining to this site has residential landuse, while 33% is wooded. Impervious surfaces make up 17.4% of the catchment acreage. In situ pH was 6.33 at this site, notable since it was slightly below the state water quality standard of 6.5. This site had Partially Degraded habitat conditions according to the PHI and rated Supporting under the RBP. This site tied with two other sites in having the largest number of benthic taxa collected during sampling – 42. Benthic metric scores were high for this large number of taxa as well as for a healthy number of scraper taxa. The biological condition at this site was Fair with a BIBI score of 3.57.

Results Biological Condition : Fair
Habitat Rating : RBP : Supporting MPHI : Partially Degraded

Stream Subsystem = Perennial Stream Origin = Mixture of Origins Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	80
Runs	10
Pools	10

No Evidence of Local Watershed NPS Pollution
None Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation 0

Road Culvert Present ? No
Left Buffer Breaks Present ? No
Right Buffer Breaks Present ? No
Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	80
Boulder	0	Gravel	0	Silt	20
				Clay	0

Water Chemistry	Temperature (C)	11.2	Conductivity (mS/cm)	0.115	pH	6.33	DO (ppm)	8.1

Site ID BK3-904-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	42	5
EPT Taxa	4	3
% Intolerant to Urban	27.27	3
# Ephemeroptera	1	3
% Ephemeroptera	0.91	3
# Scraper	3	5
% Climbers	6.36	3

BIBI Score: 3.57 Rating: Fair

Taxa List

Taxa	Count
Ablabesmyia	1
Anchytarsus	1
Apsectrotanypus	4
Bezzia	6
Caecidotea	7
Calopteryx	1
Ceratopogon	2
Ceratopogonidae	1
Clinotanypus	2
Cordulegaster	1
Cryptochironomus	2
Culicoides	2
Enchytraeidae	2
Enochrus	1
Eurylophella	1
Forcipomyia	1
Heterotrissocladius	4
Lepidostoma	1
Limnodrilus	2
Meropelopia	2
Micropsectra	1
Molanna	1
Naididae (Tubificinae)	19
Nais	2
Parametriocnemus	1
Paraphaenocladius	1
Pericoma/Telmatoscopus	1
Phaenopsectra	1
Polycentropus	1
Polypedilum	2
Pseudolimnophila	3
Pseudorthocladius	1
Sialis	1
Sphaeriidae	2
Stenelmis	2
Stictochironomus	2
Synurella	9
Tanytarsus	2
Thienemannimyia group	11
Trissopelopia	1
Turbellaria	1
Zavrelimyia	1
Total Count	110

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	584.73
Remoteness	59.13
Percent Shading	91.34
Epifaunal Substrate	43.75
Instream Habitat	70.97
Instream Woody Debris	93.96
Bank Stability	89.45
PHI Score	74.77

PHI Narrative Rating: Partially Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	15
Pool Substrate Characterization	8
Pool Variability	8
Sediment Deposition	9
Channel Flow Status	18
Channel Alteration	19
Channel Sinuosity	16
Bank Stability - Left Bank	9
Right Bank	9
Vegetative Protection - Left Bank	7
Right Bank	9
Riparian Vegetative Zone Width - Left Bank	8
Right Bank	9
RBP Score	144

RBP Narrative Rating: Supporting

Land Use Analysis

Impervious Area (acres) 102.00 % Impervious 17.44

Land Use	Acres	% Area
Residential	345.74	59.13
Commercial	8.92	1.53
Transportation	16.79	2.87
Airport	5.23	0.90
Pasture/Hay	5.45	0.93
Woods	190.18	32.52
Open Space	12.42	2.12

Site ID BK3-906-T-2009

Sampling Date 4/29/2009

ADC Map # 10, A-10

Watershed = Bodkin Creek

Subwatershed = Main Creek

Location = Loreen Drive, between Joanne Court and Overview Drive

Upstream from Mid-Point

Downstream from Mid-Point

This site is located in the Bodkin Creek watershed in Main Creek. The site is off of Loreen Drive and can be accessed through an empty lot between Joanne Court and Overview Drive. The majority of the landuse near this stream is residential (53%), with almost 40% wooded. This site had Minimally Degraded habitat conditions according to the PHI and Partially Supporting habitat conditions according to the RBP assessment (total score of 124). Epifaunal substrate and available cover rated at the low end of suboptimal here, with substrate comprised entirely of sand and silt. The canopy was partially shaded, and some bank erosion was noted by the field crew. Seventy percent of benthic macroinvertebrates collected at this site were considered intolerant to urban conditions and the biological community rated Fair with a BIBI score of 3.29.

Results Biological Condition : Fair

Habitat Rating : RBP : Partially Supporting MPHI : Minimally Degraded

Stream Subsystem = Perennial Stream Origin = Spring-fed Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	40
Runs	20
Pools	40

No Evidence of Local Watershed NPS Pollution

None Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation 0

Road Culvert Present ? No

Left Buffer Breaks Present ? No

Right Buffer Breaks Present ? No

Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	80
Boulder	0	Gravel	0	Silt	20
				Clay	0

Water Chemistry	Temperature (C)	14.9	Conductivity (mS/cm)	0.162	pH	6.56	DO (ppm)	7.9

Site ID BK3-906-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	26	5
EPT Taxa	5	5
% Intolerant to Urban	70.49	5
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	1	3
% Climbers	4.92	3

BIBI Score: 3.29 Rating: Fair

Taxa List

Taxa	Count
Ablabesmyia	1
Bittacomorpha	1
Caecidotea	38
Ceratopogon	2
Chaetocladius	1
Clinotanypus	1
Corynoneura	1
Culicoides	3
Dicranota	2
Diplectrona	1
Heteroplectron	1
Lepidostoma	5
Leuctra	2
Lype	1
Meropelopia	4
Naididae (Tubificinae)	1
Nais	5
Parametriocnemus	6
Phaenopsectra	1
Polypedilum	1
Pseudolimnophila	2
Rheocricotopus	4
Simulium	2
Sphaeriidae	1
Synurella	33
Thienemannimyia group	2
Total Count	122

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	253.58
Remoteness	65.72
Percent Shading	99.94
Epifaunal Substrate	84.05
Instream Habitat	85.07
Instream Woody Debris	70.88
Bank Stability	91.29
PHI Score	82.82

PHI Narrative Rating: Minimally Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	11
Pool Substrate Characterization	6
Pool Variability	6
Sediment Deposition	7
Channel Flow Status	15
Channel Alteration	18
Channel Sinuosity	11
Bank Stability - Left Bank	7
Right Bank	7
Vegetative Protection - Left Bank	9
Right Bank	9
Riparian Vegetative Zone Width - Left Bank	9
Right Bank	9
RBP Score	124

RBP Narrative Rating: Partially Supporting

Land Use Analysis

Impervious Area (acres) 33.02 % Impervious 13.02

Land Use	Acres	% Area
Residential	134.44	53.02
Commercial	0.97	0.38
Transportation	6.26	2.47
Airport	5.23	2.06
Pasture/Hay	5.45	2.15
Woods	101.18	39.90
Open Space	0.04	0.02

Site ID BK3-907-T-2009
Sampling Date 4/22/2009
ADC Map # 9, K-7

Watershed = Bodkin Creek
Subwatershed = Main Creek
Location = Old Nike Missile Site Road, at golf course

Upstream from Mid-Point

Downstream from Mid-Point

This site is located in the Bodkin Creek watershed in the Main Creek subwatershed. It is off of Old Nike Missile Road near a golf course. Nearby landuse is 40% wooded and 35% residential, with 12% of surfaces considered impervious. The substrate at this site was mainly made up of sand and gravel with some silt. It had a shaded canopy, optimal epifaunal substrate and available cover, and low levels of embeddedness. Despite a Minimally Degraded rating for habitat conditions under the PHI and a Supporting rating under the RBP, this site had a Poor biological community, with a BIBI score of 2.71. The benthic community included no Ephemeroptera nor any scraper taxa, and only two EPT taxa. Bank stability at this site received only a marginal rating.

Results Biological Condition : Poor
Habitat Rating : RBP : Supporting MPHI : Minimally Degraded

Stream Subsystem = Perennial Stream Origin = Spring-fed Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	50
Runs	25
Pools	25

No Evidence of Local Watershed NPS Pollution
Moderate Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation: 0

Road Culvert Present ? No
Left Buffer Breaks Present ? No
Right Buffer Breaks Present ? No
Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	50
Boulder	0	Gravel	35	Silt	15
				Clay	0

Water Chemistry	Temperature (C)	11	Conductivity (mS/cm)	0.236	pH	8.13	DO (ppm)	10.2

Site ID BK3-907-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	32	5
EPT Taxa	2	3
% Intolerant to Urban	30.43	5
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	0	1
% Climbers	7.83	3

BIBI Score: 2.71 Rating: Poor

Taxa List

Taxa	Count
Ablabesmyia	5
Apsectrotanypus	1
Caecidotea	11
Ceratopogon	4
Ceratopogonidae	1
Clinotanypus	1
Cordulegaster	1
Culicoides	2
Diplocladius	1
Enchytraeidae	2
Heterotrissocladius	2
Hexatoma	1
Hydrobius	1
Natarsia	4
Nigronia	2
Parametriocnemus	3
Paraphaenocladius	4
Paratendipes	15
Phaenopsectra	1
Pisidium	2
Polycentropus	6
Polypedilum	4
Pseudorthocladius	1
Ptilostomis	1
Rheocricotopus	5
Sialis	2
Simulium	10
Sphaeriidae	8
Synurella	6
Tanytarsus	3
Thienemannimyia group	4
Zavrelimyia	1
Total Count	115

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	748.72
Remoteness	87.05
Percent Shading	100.00
Epifaunal Substrate	94.43
Instream Habitat	100.00
Instream Woody Debris	52.70
Bank Stability	54.77
PHI Score	81.49

PHI Narrative Rating: Minimally Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	17
Pool Substrate Characterization	14
Pool Variability	12
Sediment Deposition	13
Channel Flow Status	18
Channel Alteration	18
Channel Sinuosity	14
Bank Stability - Left Bank	3
Right Bank	3
Vegetative Protection - Left Bank	9
Right Bank	9
Riparian Vegetative Zone Width - Left Bank	9
Right Bank	9
RBP Score	148

RBP Narrative Rating: Supporting

Land Use Analysis

Impervious Area (acres) 91.22 % Impervious 12.18

Land Use	Acres	% Area
Residential	265.26	35.43
Commercial	35.06	4.68
Transportation	6.16	0.82
Airport	3.16	0.42
Pasture/Hay	4.32	0.58
Woods	303.55	40.54
Open Space	127.51	17.03
Water	3.72	0.50

Site ID BK3-D07-T-2009
Sampling Date 4/22/2009
ADC Map # 9, K-7

Watershed = Bodkin Creek
Subwatershed = Main Creek
Location = Old Nike Missile Site Road, at golf course

Upstream from Mid-Point

Downstream from Mid-Point

This is a replicate sample for site BK3-907-T-2009

Results Biological Condition : Poor
Habitat Rating : RBP : Supporting MPHI : Minimally Degraded

Stream Subsystem = Perennial Stream Origin = Spring-fed Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	40
Runs	30
Pools	30

No Evidence of Local Watershed NPS Pollution
None Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation 0

Road Culvert Present ? No
Left Buffer Breaks Present ? No
Right Buffer Breaks Present ? No
Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	70
Boulder	0	Gravel	0	Silt	20
				Clay	10

Water Chemistry	Temperature (C)	19.3	Conductivity (mS/cm)	0.441	pH	5.72	DO (ppm)	6.2

Site ID BK3-D07-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	30	5
EPT Taxa	1	1
% Intolerant to Urban	45.13	5
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	1	3
% Climbers	4.42	3

BIBI Score: 2.71 Rating: Poor

Taxa List

Taxa	Count
Caecidotea	35
Ceratopogon	3
Chaetocladius	1
Corduliidae	1
Corynoneura	1
Crambidae	1
Diplocladius	3
Girardia	1
Heterotrissocladius	1
Hydrobaenus	1
Limnophyes	1
Micropsectra	1
Naididae (Tubificinae)	1
Nais	7
Natarsia	4
Paraphaenocladius	2
Paratendipes	2
Phaenopsectra	1
Phagocata	1
Pisidium	10
Polycentropus	1
Polypedilum	3
Pseudolimnophila	2
Rheocricotopus	8
Simulium	4
Synurella	7
Thienemannimyia group	7
Tipula	1
Tribelos	1
Zavrelimyia	1
Total Count	113

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	748.72
Remoteness	87.05
Percent Shading	99.94
Epifaunal Substrate	82.81
Instream Habitat	100.00
Instream Woody Debris	70.45
Bank Stability	70.71
PHI Score	85.16

PHI Narrative Rating: Minimally Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	16
Pool Substrate Characterization	8
Pool Variability	9
Sediment Deposition	7
Channel Flow Status	17
Channel Alteration	19
Channel Sinuosity	15
Bank Stability - Left Bank	6
Right Bank	6
Vegetative Protection - Left Bank	9
Right Bank	9
Riparian Vegetative Zone Width - Left Bank	9
Right Bank	9
RBP Score	139

RBP Narrative Rating: Supporting

Land Use Analysis

Impervious Area (acres) 91.22 % Impervious 12.18

Land Use	Acres	% Area
Residential	265.26	35.43
Commercial	35.06	4.68
Transportation	6.16	0.82
Airport	3.16	0.42
Pasture/Hay	4.32	0.58
Woods	303.55	40.54
Open Space	127.51	17.03
Water	3.72	0.50

Site ID BK3-946-T-2009

Sampling Date 4/29/2009

ADC Map # 10, C-1

Watershed = Bodkin Creek

Subwatershed = Main Creek

Location = Ipswich Court

Upstream from Mid-Point

Downstream from Mid-Point

This site is located in the Bodkin Creek watershed in Main Creek. It is off of Ipswich Court behind the middle house on the left side of the cul-de-sac. Landuse near this site is dominated by residential (49%) and wooded areas (32%). This site had a shaded canopy, but its channel flow rated at the low end of suboptimal. With a PHI score of 79.99, this site rated Partially Degraded for habitat and similarly rated Supporting under the RBP (RBP score of 131, 65.5% of Reference). Biological conditions at this site rated Poor, as the BIBI score was 2.43. Neither Ephemeroptera nor any scraper taxa were present in the biological community, thus limiting its score.

Results Biological Condition : Poor

Habitat Rating : RBP : Supporting MPHI : Partially Degraded

Stream Subsystem = Perennial Stream Origin = Spring-fed Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	20
Runs	20
Pools	60

No Evidence of Local Watershed NPS Pollution

None Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation: 0

Road Culvert Present ? No

Left Buffer Breaks Present ? No

Right Buffer Breaks Present ? No

Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	75
Boulder	0	Gravel	0	Silt	25
				Clay	0

Water Chemistry	Temperature (C)	16.1	Conductivity (mS/cm)	0.289	pH	6.62	DO (ppm)	6.8

Site ID BK3-946-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	31	5
EPT Taxa	1	1
% Intolerant to Urban	60.18	5
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	0	1
% Climbers	5.31	3

BIBI Score: 2.43 Rating: Poor

Taxa List

Taxa	Count
Ablabesmyia	3
Apsectrotanypus	5
Aulodrilus	1
Bezzia	4
Boyeria	1
Caecidotea	60
Ceratopogon	3
Clinotanypus	4
Corynoneura	1
Crambidae	1
Cryptochironomus	1
Culicoides	1
Eclipidrilus	2
Limnophyes	3
Micropsectra	1
Naididae (Tubificinae)	1
Nigronia	1
Odontomesa	1
Parametriocnemus	2
Phylocentropus	1
Pisidium	1
Pristina	2
Pseudolimnophila	1
Pseudorthocladius	1
Simulium	2
Stempellinella	1
Synurella	2
Tanytarsus	2
Thienemannimyia group	1
Tribelos	1
Zavrelimyia	2
Total Count	113

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	269.19
Remoteness	42.78
Percent Shading	91.34
Epifaunal Substrate	89.47
Instream Habitat	95.55
Instream Woody Debris	76.12
Bank Stability	84.66
PHI Score	79.99

PHI Narrative Rating: Partially Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	14
Pool Substrate Characterization	9
Pool Variability	7
Sediment Deposition	7
Channel Flow Status	11
Channel Alteration	18
Channel Sinuosity	13
Bank Stability - Left Bank	8
Right Bank	8
Vegetative Protection - Left Bank	9
Right Bank	9
Riparian Vegetative Zone Width - Left Bank	9
Right Bank	9
RBP Score	131

RBP Narrative Rating: Supporting

Land Use Analysis

Impervious Area (acres) 34.09 % Impervious 12.67

Land Use	Acres	% Area
Residential	131.21	48.74
Commercial	5.48	2.03
Transportation	9.51	3.53
Woods	87.11	32.36
Open Space	3.79	1.41
Wetland	14.29	5.31
Water	17.80	6.61

Site ID BK7-902-T-2009
Sampling Date 4/20/2009
ADC Map # 10, E-11

Watershed = Bodkin Creek
Subwatershed = Wharf Creek
Location = Ventner Drive at Bodkin Elementary School

Upstream from Mid-Point

Downstream from Mid-Point

This site is in Wharf Creek in the Bodkin Creek watershed. The site is located at Bodkin Elementary School at Ventner Drive. Landuse near this site was 41% commercial, 24% wooded, and 23% open space. Impervious surfaces made up 28.3% of the catchment. Moderate levels of trash were present at the time of sampling. Stream substrate was completely sand, and embeddedness was high. Consequently, epifaunal substrate and available cover received a marginal rating. In situ pH was measured as 6.35, slightly below the state water quality standard of 6.5. Habitat rating scores were moderate, resulting in a PHI rating of Partially Degraded and an RBP habitat rating of Supporting. However, the benthic community is Very Poor, with a BIBI score of 1.86. The benthic community consisted of only 1 EPT taxa and only 8% of the macroinvertebrates obtained in the sample are considered intolerant to urban conditions.

Results Biological Condition : Very Poor
Habitat Rating : RBP : Supporting MPHI : Partially Degraded

Stream Subsystem = Perennial Stream Origin = Mixture of Origins Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	70
Runs	20
Pools	10

Some Potential Sources of Local Watershed NPS Pollution
Moderate Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation: 0

Road Culvert Present ? No
Left Buffer Breaks Present ? No
Right Buffer Breaks Present ? No
Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	100
Boulder	0	Gravel	0	Silt	0
				Clay	0

Water Chemistry	Temperature (C)	11.5	Conductivity (mS/cm)	0.105	pH	6.35	DO (ppm)	9.83

Site ID BK7-902-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	21	3
EPT Taxa	1	1
% Intolerant to Urban	8.74	1
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	0	1
% Climbers	15.53	5

BIBI Score: 1.86 Rating: Very Poor

Taxa List

Taxa	Count
Bezzia	2
Chaetocladius	6
Cryptochironomus	1
Culicoides	1
Enchytraeidae	3
Ironoquia	1
Limnodrilus	3
Limnophyes	1
Lumbricidae	1
Naididae (Tubificinae)	2
Neoporus	1
Orthocladiinae	2
Paraphaenocladius	27
Phaenopsectra	17
Polypedilum	16
Prostoma	1
Pseudorthocladius	4
Rheocricotopus	2
Stygobromus	1
Synurella	9
Zavrelimyia	2
Total Count	103

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	84.41
Remoteness	15.79
Percent Shading	91.34
Epifaunal Substrate	56.36
Instream Habitat	90.78
Instream Woody Debris	86.29
Bank Stability	90.37
PHI Score	71.82

PHI Narrative Rating: Partially Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	8
Pool Substrate Characterization	6
Pool Variability	10
Sediment Deposition	8
Channel Flow Status	19
Channel Alteration	19
Channel Sinuosity	15
Bank Stability - Left Bank	5
Right Bank	5
Vegetative Protection - Left Bank	8
Right Bank	8
Riparian Vegetative Zone Width - Left Bank	6
Right Bank	9
RBP Score	126

RBP Narrative Rating: Supporting

Land Use Analysis

Impervious Area (acres) 23.85 % Impervious 28.25

Land Use	Acres	% Area
Residential	10.04	11.90
Commercial	34.35	40.69
Transportation	0.02	0.02
Woods	20.45	24.22
Open Space	19.56	23.17

Site ID BK8-901-T-2009
Sampling Date 4/20/2009
ADC Map # 10, H-1

Watershed = Bodkin Creek
Subwatershed = Locust Cove
Location = Downs Memorial Park

Upstream from Mid-Point

Downstream from Mid-Point

This site is located near Downs Memorial Park in Locust Cove in the Bodkin Creek watershed. The majority of the landuse near this site (73%) is wooded area, and 10.9% of the catchment is classified as impervious. The stream substrate is made up mainly of sand with some silt, and the stream canopy is shaded. This site received optimal ratings for bank stability, vegetative protection, and riparian zone width on both sides of the stream, and no bank erosion was noted by the field crew. Total RBP habitat score at this site was 146 (Supporting). Very little trash was present and no buffer breaks were observed. The PHI score was 88.7, the second highest score of all sites sampled during this survey. However, the macroinvertebrate community obtained at this site had no climber, no scraper, and no Ephemeroptera taxa, and only one EPT taxa. Thus, its benthic condition was rated as Very Poor, with a BIBI score of 1.86.

Results Biological Condition : Very Poor
Habitat Rating : RBP : Supporting MPHI : Minimally Degraded

Stream Subsystem = Perennial Stream Origin = Mixture of Origins Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	20
Runs	40
Pools	40

No Evidence of Local Watershed NPS Pollution
None Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation: 0

Road Culvert Present ? No
Left Buffer Breaks Present ? No
Right Buffer Breaks Present ? No
Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	80
Boulder	0	Gravel	0	Silt	20
				Clay	0

Water Chemistry	Temperature (C)	11	Conductivity (mS/cm)	0.121	pH	6.88	DO (ppm)	8.7

Site ID BK8-901-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	18	3
EPT Taxa	1	1
% Intolerant to Urban	76.92	5
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	0	1
% Climbers	0.00	1

BIBI Score: 1.86 Rating: Very Poor

Taxa List

Taxa	Count
Caecidotea	74
Chrysops	5
Culicoides	6
Cymbiodyta	1
Diplocladius	1
Erioptera	1
Girardia	1
Hexatoma	3
Limnodrilus	2
Mallochohelea	1
Naididae (Tubificinae)	3
Paranais	1
Rheocricotopus	5
Shipsa	1
Sphaeriidae	3
Spirosperma	1
Synurella	7
Zavrelimyia	1
Total Count	117

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	96.48
Remoteness	42.78
Percent Shading	99.94
Epifaunal Substrate	90.35
Instream Habitat	100.00
Instream Woody Debris	99.57
Bank Stability	100.00
PHI Score	88.77

PHI Narrative Rating: Minimally Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	13
Pool Substrate Characterization	9
Pool Variability	8
Sediment Deposition	8
Channel Flow Status	20
Channel Alteration	19
Channel Sinuosity	15
Bank Stability - Left Bank	9
Right Bank	9
Vegetative Protection - Left Bank	9
Right Bank	9
Riparian Vegetative Zone Width - Left Bank	9
Right Bank	9
RBP Score	146

RBP Narrative Rating: Supporting

Land Use Analysis

Impervious Area (acres) 10.53 % Impervious 10.91

Land Use	Acres	% Area
Residential	7.83	8.12
Commercial	2.26	2.34
Transportation	7.60	7.88
Woods	70.62	73.20
Open Space	8.17	8.46

Site ID PT0-911-T-2009
Sampling Date 4/22/2009
ADC Map # 9, A-7

Watershed = Patapsco Tidal
Subwatershed = Stony Creek
Location = West end of 20th Street

Upstream from Mid-Point

Downstream from Mid-Point

This site is located at the west end of 20th Street in an open area in Stony Creek in the Patapsco Tidal watershed. Landuse near the site is 54% residential, 18.8% wooded, and 15.5% commercial. These landuses result in an impervious surface percentage of 37.4% of total catchment area. Field crew members noted an anaerobic odor present at the site on the day of sampling as well as high levels of trash. Stream substrate contained mostly sand with some silt and some clay present. Embeddedness was high. The canopy was partly shaded, and some emergent and some submerged aquatic vegetation were present. While bank stability, vegetative protection, and riparian vegetative zone width rated well in the RBP habitat assessment, this site received lower scores for epifaunal substrate, sediment deposition, pool substrate, and pool variability. Overall, the total RBP habitat score was 127, Supporting. The total PHI score was 68.1, Partially Degraded. Only 4.6% of the benthic taxa types found at this site were considered intolerant to urban conditions, but the presence of some EPT, some scraper, and some climber taxa resulted in a BIBI score of 2.43, Poor.

Results Biological Condition : Poor
Habitat Rating : RBP : Supporting MPHI : Partially Degraded

Stream Subsystem = Perennial Stream Origin = Spring-fed Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	10
Runs	60
Pools	30

No Evidence of Local Watershed NPS Pollution
Moderate Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation 10

Road Culvert Present ? No
Left Buffer Breaks Present ? No
Right Buffer Breaks Present ? No
Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	90
Boulder	0	Gravel	0	Silt	5
				Clay	5

Water Chemistry	Temperature (C)	11.5	Conductivity (mS/cm)	0.554	pH	7.15	DO (ppm)	10

Site ID PT0-911-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	23	5
EPT Taxa	2	3
% Intolerant to Urban	4.59	1
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	1	3
% Climbers	1.83	3

BIBI Score: 2.43 Rating: Poor

Taxa List

Taxa	Count
Argia	1
Aulodrilus	1
Bezzia	1
Caecidotea	2
Corynoneura	9
Diplectrona	1
Gammarus	58
Gomphus	1
Naididae (Tubificinae)	6
Nais	1
Paratanytarsus	1
Paratendipes	4
Pisidium	2
Polycentropus	1
Polypedilum	2
Prodiamesa	3
Rheotanytarsus	1
Sphaeriidae	2
Stenelmis	4
Thienemannimyia group	1
Tipula	1
Tribelos	5
Zavrelimyia	1
Total Count	109

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	269.73
Remoteness	59.13
Percent Shading	58.94
Epifaunal Substrate	42.98
Instream Habitat	51.15
Instream Woody Debris	100.00
Bank Stability	96.61
PHI Score	68.14

PHI Narrative Rating: Partially Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	7
Pool Substrate Characterization	8
Pool Variability	7
Sediment Deposition	6
Channel Flow Status	15
Channel Alteration	19
Channel Sinuosity	15
Bank Stability - Left Bank	8
Right Bank	8
Vegetative Protection - Left Bank	9
Right Bank	9
Riparian Vegetative Zone Width - Left Bank	8
Right Bank	8
RBP Score	127

RBP Narrative Rating: Supporting

Land Use Analysis

Impervious Area (acres) 100.91 % Impervious 37.41

Land Use	Acres	% Area
Residential	145.03	53.77
Commercial	41.78	15.49
Transportation	12.88	4.78
Woods	50.82	18.84
Open Space	19.22	7.12

Site ID PT0-916-T-2009
Sampling Date 4/22/2009
ADC Map # 9, B-6

Watershed = Patapsco Tidal
Subwatershed = Stony Creek
Location = Duvall Highway, south of Grace Avenue

Upstream from Mid-Point

Downstream from Mid-Point

This site is located off of Duvall Highway, south of Grace Avenue. Eighty percent of the landuse near this stream in Stony Creek in the Patapsco Tidal watershed is residential. The catchment has 35.4% impervious surfaces. Epifaunal substrate at this site is lacking in quality, but levels of embeddedness are lower at this site than they are at the majority of other sites sampled in this assessment. The stream is braided, with a partially shaded canopy. Its location only steps from the road could be to blame for the extreme levels of trash observed at the site. A road culvert is present at the site, and narrow riparian vegetative zones with buffer breaks as well as channelization in the form of gabion baskets hamper the habitat quality here. The overall PHI score was 61.7, Degraded. The overall RBP habitat score was 116 (58% comparable to reference conditions), with a narrative rating of Partially Supporting. Despite these rather poor habitat conditions, the benthic community at this site received a BIBI score of 3.57 (Fair), due to the presence of EPT, scraper, and climber taxa.

Results Biological Condition : Fair
Habitat Rating : RBP : Partially Supporting MPHI : Degraded

Stream Subsystem = Perennial Stream Origin = Spring-fed Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	10
Runs	30
Pools	60

Some Potential Sources of Local Watershed NPS Pollution
Moderate Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation 10

Road Culvert Present ? Yes
Left Buffer Breaks Present ? Yes
Right Buffer Breaks Present ? Yes
Evidence of Channel Straightening or Dredging ? Yes

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	50
Boulder	0	Gravel	30	Silt	20
				Clay	0

Water Chemistry	Temperature (C)	11.7	Conductivity (mS/cm)	0.205	pH	8.01	DO (ppm)	8.7

Site ID PT0-916-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	23	5
EPT Taxa	5	5
% Intolerant to Urban	56.76	5
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	2	5
% Climbers	2.70	3

BIBI Score: 3.57 Rating: Fair

Taxa List

Taxa	Count
Apsectrotanypus	1
Aulodrilus	3
Bezzia	1
Chaetocladius	2
Culicoides	2
Diplectrona	8
Eclipidrilus	1
Enchytraeidae	1
Hydrobaenus	1
Lepidostoma	2
Leuctra	1
Meropelopia	1
Molophilus	1
Nais	15
Oulimnius	3
Paratendipes	2
Prodiamesa	9
Ptilostomis	1
Rheocricotopus	1
Smittia	4
Synurella	47
Tanypodinae	2
Wormaldia	2
Total Count	111

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	187.71
Remoteness	3.31
Percent Shading	58.94
Epifaunal Substrate	45.35
Instream Habitat	65.95
Instream Woody Debris	100.00
Bank Stability	96.61
PHI Score	61.69

PHI Narrative Rating: Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	8
Pool Substrate Characterization	11
Pool Variability	8
Sediment Deposition	13
Channel Flow Status	14
Channel Alteration	8
Channel Sinuosity	15
Bank Stability - Left Bank	8
Right Bank	8
Vegetative Protection - Left Bank	8
Right Bank	7
Riparian Vegetative Zone Width - Left Bank	3
Right Bank	5
RBP Score	116

RBP Narrative Rating: Partially Supporting

Land Use Analysis

Impervious Area (acres) 66.47 % Impervious 35.41

Land Use	Acres	% Area
Residential	150.69	80.28
Commercial	0.44	0.23
Transportation	5.11	2.72
Woods	28.68	15.28
Open Space	2.79	1.49

Site ID PT0-917-T-2009

Sampling Date 4/22/2009

ADC Map # 8, J-6

Watershed = Patapsco Tidal

Subwatershed = Stony Creek

Location = Solley Road, between Jackson Lane and Shady Brook Road

Upstream from Mid-Point

Downstream from Mid-Point

This site is in the Stony Creek subwatershed of the Patapsco Tidal watershed. It is located off of Solley Road between Jackson Lane and Shady Brook Road. The landuse upstream of this site is dominated by residential (53%) and wooded (almost 38%), and 20% of the catchment is considered impervious. Stream banks were moderately unstable to unstable, and erosion was obvious. Stream substrate was made up mainly of sand and gravel with some silt, and moderate levels of deposition were present. The overall PHI score was 65.8 (Degraded), while the overall RBP habitat score was 127 (Supporting). A moderate amount of trash was noted at the site. The benthic community consisted of only one EPT taxa, and no Ephemeroptera. Scrapers and climbers were present in healthy numbers, resulting in a BIBI score of 3.00, Fair.

Results Biological Condition : Fair

Habitat Rating : RBP : Supporting MPHI : Degraded

Stream Subsystem = Perennial Stream Origin = Spring-fed Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	20
Runs	20
Pools	60

No Evidence of Local Watershed NPS Pollution

Moderate Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation: 0

Road Culvert Present ? No

Left Buffer Breaks Present ? No

Right Buffer Breaks Present ? No

Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	60
Boulder	0	Gravel	30	Silt	10
				Clay	0

Water Chemistry	Temperature (C)	11.3	Conductivity (mS/cm)	0.198	pH	8.3	DO (ppm)	11

Site ID PT0-917-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	29	5
EPT Taxa	1	1
% Intolerant to Urban	16.67	3
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	5	5
% Climbers	18.18	5

BIBI Score: 3.00 Rating: Fair

Taxa List

Taxa	Count
Ancyronyx	1
Aulodrilus	1
Brillia	1
Calopteryx	1
Diplocladius	1
Eclipidrilus	1
Enchytraeidae	1
Gammarus	3
Helichus	3
Hydrobaenus	1
Hydrobius	1
Ironoquia	1
Microvelia	1
Nais	7
Orthocladius	2
Parakiefferiella	1
Paraphaenocladius	1
Physa	1
Pisidium	5
Polypedilum	7
Potthastia	1
Pseudorthocladius	3
Slavina	5
Stenelmis	1
Synurella	9
Tanytarsus	2
Thienemanniella	1
Tipula	1
Tvetenia	2
Total Count	66

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	554.26
Remoteness	39.70
Percent Shading	91.34
Epifaunal Substrate	44.10
Instream Habitat	77.07
Instream Woody Debris	67.94
Bank Stability	74.72
PHI Score	65.81

PHI Narrative Rating: Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	13
Pool Substrate Characterization	7
Pool Variability	10
Sediment Deposition	8
Channel Flow Status	13
Channel Alteration	18
Channel Sinuosity	16
Bank Stability - Left Bank	4
Right Bank	2
Vegetative Protection - Left Bank	9
Right Bank	9
Riparian Vegetative Zone Width - Left Bank	9
Right Bank	9
RBP Score	127

RBP Narrative Rating: Supporting

Land Use Analysis

Impervious Area (acres) 111.35 % Impervious 20.09

Land Use	Acres	% Area
Residential	296.01	53.41
Commercial	15.17	2.74
Transportation	21.16	3.82
Woods	208.89	37.69
Open Space	13.04	2.35

Site ID PT0-D17-T-2009
Sampling Date 4/22/2009
ADC Map # 8, J-6

Watershed = Patapsco Tidal
Subwatershed = Stony Creek
Location = Solley Road, between Jackson Lane and Shady Brook Road

Upstream from Mid-Point

Downstream from Mid-Point

This is a replicate sample for site PT0-917-T-2009

Results Biological Condition : Fair
Habitat Rating : RBP : Partially Supporting MPHI : Partially Degraded

Stream Subsystem = Perennial Stream Origin = Spring-fed Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	50
Runs	30
Pools	20

No Evidence of Local Watershed NPS Pollution
Moderate Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation: 0

Road Culvert Present ? No
Left Buffer Breaks Present ? No
Right Buffer Breaks Present ? No
Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	80
Boulder	0	Gravel	0	Silt	20
				Clay	0

Water Chemistry	Temperature (C)	21	Conductivity (mS/cm)	0.312	pH	6.57	DO (ppm)	8.1

Site ID PT0-D17-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	36	5
EPT Taxa	5	5
% Intolerant to Urban	26.72	3
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	6	5
% Climbers	8.62	5

BIBI Score: 3.57 Rating: Fair

Taxa List

Taxa	Count
Amphinemura	1
Ancyronyx	2
Aulodrilus	2
Boyeria	1
Calopteryx	1
Ceratopogon	4
Chaetocladius	1
Cordulegaster	1
Cricotopus	1
Diplectrona	1
Diplocladius	3
Dolophilodes	6
Eukiefferiella	1
Gammarus	3
Helichus	2
Lype	1
Micropsectra	2
Naididae (Tubificinae)	5
Nais	8
Neoporus	1
Orthocladius	13
Oulimnius	7
Parachaetocladius	2
Parametriocnemus	2
Physa	2
Pisidium	2
Polypedilum	4
Rheotanytarsus	1
Slavina	5
Stenelmis	1
Stenochironomus	3
Synurella	9
Taeniopteryx	2
Thienemanniella	1
Tipula	2
Tvetenia	13
Total Count	116

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	554.26
Remoteness	59.13
Percent Shading	91.34
Epifaunal Substrate	44.10
Instream Habitat	71.52
Instream Woody Debris	73.86
Bank Stability	59.16
PHI Score	66.52

PHI Narrative Rating: Partially Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	13
Pool Substrate Characterization	7
Pool Variability	9
Sediment Deposition	6
Channel Flow Status	10
Channel Alteration	18
Channel Sinuosity	16
Bank Stability - Left Bank	4
Right Bank	3
Vegetative Protection - Left Bank	9
Right Bank	9
Riparian Vegetative Zone Width - Left Bank	9
Right Bank	9
RBP Score	122

RBP Narrative Rating: Partially Supporting

Land Use Analysis

Impervious Area (acres) 111.35 % Impervious 20.09

Land Use	Acres	% Area
Residential	296.01	53.41
Commercial	15.17	2.74
Transportation	21.16	3.82
Woods	208.89	37.69
Open Space	13.04	2.35

Site ID PT0-925-T-2009
Sampling Date 4/23/2009
ADC Map # 8, K-3

Watershed = Patapsco Tidal
Subwatershed = Stony Creek
Location = Nabbs Creek Road, below Stoney Creek Park

Upstream from Mid-Point

Downstream from Mid-Point

This site is located off of Nabbs Creek Road, south of the bend below Stony Creek Park. It is in Stony Creek, in the Patapsco Tidal watershed. The majority of the landuse upstream of this site is wooded (86.6%), and therefore the catchment has the lowest percentage of impervious surfaces in the study (2.5%). The aesthetic quality of the stream was very good, as very little trash was present. Very few riffles were present in the stream, and those that were present were not of high quality. Thus, substrate for benthos was lacking. Despite all of the wooded area nearby, bank stability and vegetative protection along the banks was marginal, as was sediment deposition in the channel. The stream was not very sinuous, but channelization was not noted. This is not abnormal for coastal plain streams. This site rated Partially Degraded under the PHI (score of 74.2), and Partially Supporting under the RBP habitat assessment (score of 120). Its benthic community received a BIBI rating of Very Poor (score of 1.86). The benthic community did not have a lot of diversity at this site, as only ten types of taxa were collected. However, the community at this site had the highest percentage of benthos intolerant to urban conditions (91%).

Results Biological Condition : Very Poor
Habitat Rating : RBP : Partially Supporting MPHI : Partially Degraded

Stream Subsystem = Perennial Stream Origin = Spring-fed Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	10
Runs	70
Pools	20

No Evidence of Local Watershed NPS Pollution
Moderate Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation 15

Road Culvert Present ? No
Left Buffer Breaks Present ? No
Right Buffer Breaks Present ? Yes
Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	65
Boulder	0	Gravel	25	Silt	10
				Clay	0

Water Chemistry	Temperature (C)	14.4	Conductivity (mS/cm)	0.083	pH	7.73	DO (ppm)	10.5

Site ID PT0-925-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	10	1
EPT Taxa	3	3
% Intolerant to Urban	91.23	5
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	0	1
% Climbers	0.88	1

BIBI Score: 1.86 Rating: Very Poor

Taxa List

Taxa	Count
Chaetocladius	1
Enchytraeidae	3
Gammarus	2
Ironoquia	1
Reomyia	2
Shipsa	55
Stegopterna	21
Synurella	26
Tanytarsus	1
Wormaldia	2
Total Count	114

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	129.96
Remoteness	91.57
Percent Shading	49.95
Epifaunal Substrate	53.55
Instream Habitat	69.72
Instream Woody Debris	100.00
Bank Stability	80.63
PHI Score	74.24

PHI Narrative Rating: Partially Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	6
Pool Substrate Characterization	12
Pool Variability	8
Sediment Deposition	7
Channel Flow Status	19
Channel Alteration	19
Channel Sinuosity	11
Bank Stability - Left Bank	5
Right Bank	4
Vegetative Protection - Left Bank	5
Right Bank	4
Riparian Vegetative Zone Width - Left Bank	10
Right Bank	10
RBP Score	120

RBP Narrative Rating: Partially Supporting

Land Use Analysis

Impervious Area (acres) 3.31 % Impervious 2.55

Land Use	Acres	% Area
Residential	9.42	7.25
Commercial	1.80	1.38
Utility	1.91	1.47
Transportation	3.61	2.78
Woods	112.53	86.59
Open Space	0.69	0.53

Site ID PT0-940-T-2009

Sampling Date 4/30/2009

ADC Map # 8, J-5

Watershed = Patapsco Tidal

Subwatershed = Stony Creek

Location = Stone Haven Drive

Upstream from Mid-Point

Downstream from Mid-Point

This highly braided site is in Stony Creek in the Patapsco Tidal watershed. The site can be found behind a double-lot property off of Stone Haven Drive. The catchment surrounding this stream is dominated by wooded and residential landuse, in approximately equal amounts (43% and 44%, respectively). Impervious surfaces account for about 15.5% of the catchment area at this site. The field crew noticed an oily sheen in the stream as well as a significant amount of trash. All in situ water quality, except for conductivity were within the normal range. This site had the highest conductivity of all sites sampled and it is likely indicative of a water quality issue. The substrate at this site was about equally composed of sand and silt, and the site received a Marginal rating for epifaunal substrate and available cover. Submerged and emergent aquatic vegetation were present, along with some algae. Bank stability also rated as Marginal, and moderate amounts of erosion were noted in the local watershed. There were large amounts of both instream and dewatered wood present in this stream. Overall, this site received a total RBP habitat score of 107 (Partially Supporting) and a total PHI score of 82.6 (Minimally Degraded). The benthic community rated Poor, with a total BIBI score of 2.14. This score is a result of the lack of any EPT taxa in the stream, as well as a lack of any individuals that are considered intolerant of urban conditions.

Results Biological Condition : Poor

Habitat Rating : RBP : Partially Supporting MPHI : Minimally Degraded

Stream Subsystem = Perennial Stream Origin = Swamp and Bog Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	5
Runs	75
Pools	20

No Evidence of Local Watershed NPS Pollution

Moderate Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation 15

Road Culvert Present ? No

Left Buffer Breaks Present ? No

Right Buffer Breaks Present ? No

Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	50
Boulder	0	Gravel	0	Silt	50
				Clay	0

Water Chemistry	Temperature (C)	13.6	Conductivity (mS/cm)	0.857	pH	6.98	DO (ppm)	7

Site ID PT0-940-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	12	1
EPT Taxa	0	1
% Intolerant to Urban	0.00	1
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	2	5
% Climbers	47.62	5

BIBI Score: 2.14 Rating: Poor

Taxa List

Taxa	Count
Aedes	2
Aulodrilus	16
Chironomus	1
Ischnura	1
Lumbricidae	1
Lymnaea	2
Naididae (Tubificinae)	18
Physa	47
Pisidium	9
Prostoma	3
Spirosperma	4
Tipula	1
Total Count	105

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	159.46
Remoteness	40.76
Percent Shading	84.56
Epifaunal Substrate	98.69
Instream Habitat	84.27
Instream Woody Debris	100.00
Bank Stability	87.56
PHI Score	82.64

PHI Narrative Rating: Minimally Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	6
Pool Substrate Characterization	6
Pool Variability	6
Sediment Deposition	7
Channel Flow Status	15
Channel Alteration	15
Channel Sinuosity	13
Bank Stability - Left Bank	5
Right Bank	5
Vegetative Protection - Left Bank	8
Right Bank	8
Riparian Vegetative Zone Width - Left Bank	9
Right Bank	4
RBP Score	107

RBP Narrative Rating: Partially Supporting

Land Use Analysis

Impervious Area (acres) 24.80 % Impervious 15.55

Land Use	Acres	% Area
Residential	68.02	42.66
Commercial	0.94	0.59
Industrial	1.11	0.70
Transportation	6.28	3.94
Woods	69.40	43.52
Open Space	13.70	8.59

Site ID PT2-949-T-2009
Sampling Date 4/22/2009
ADC Map # 3, C-6

Watershed = Patapsco Tidal
Subwatershed = Cabin Branch 2
Location = Cedar Hill Cemetary, off of Cedar Hill Lane

Upstream from Mid-Point

Downstream from Mid-Point

This site is located in Cabin Branch Creek 2, in the Patapsco Tidal watershed. The stream site is southeast of the central loop of Cedar Hill Cemetery off of Cedar Hill Lane. Landuse upstream of this site is dominated by residential (57%) and open space (30%), with fairly high levels of impervious surfaces (42% of all surfaces). Embeddedness was low at this site, and epifaunal substrate rated as Suboptimal. The stream was fairly straight, and composed mainly of runs with a few riffles. Its substrate was made up of similar amounts of cobble, gravel, sand, and silt. RBP habitat rated Supporting (73% comparable to reference, total score of 146), while the PHI score was 79.4, or Partially Degraded. Benthos at this site rated Very Poor, with a BIBI score of 1.57. No Ephemeroptera or scraper taxa were present at this site, and none of the macroinvertebrates obtained in the benthic sample were considered intolerant of urban conditions.

Results Biological Condition : Very Poor
Habitat Rating : RBP : Supporting MPHI : Partially Degraded

Stream Subsystem = Perennial Stream Origin = Swamp and Bog Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	45
Runs	50
Pools	5

No Evidence of Local Watershed NPS Pollution
None Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation: 0

Road Culvert Present ? No
Left Buffer Breaks Present ? No
Right Buffer Breaks Present ? No
Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	25	Sand	25
Boulder	0	Gravel	30	Silt	20
				Clay	0

Water Chemistry	Temperature (C)	10.6	Conductivity (mS/cm)	0.513	pH	6.93	DO (ppm)	9.1

Site ID PT2-949-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	20	3
EPT Taxa	1	1
% Intolerant to Urban	0.00	1
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	0	1
% Climbers	5.05	3

BIBI Score: 1.57 Rating: Very Poor

Taxa List

Taxa	Count
Calopteryx	1
Ceratopogonidae	2
Chaetocladius	15
Cheumatopsyche	3
Enchytraeidae	8
Eukiefferiella	1
Limnodrilus	3
Limnophyes	1
Lumbricidae	1
Lumbriculus	1
Naididae (Tubificinae)	19
Nais	2
Orthocladius	26
Phaenopsectra	1
Polypedilum	4
Psectrotanypus	1
Simulium	4
Smittia	3
Tipula	2
Tvetenia	1
Total Count	99

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	144.68
Remoteness	28.28
Percent Shading	73.32
Epifaunal Substrate	100.00
Instream Habitat	90.81
Instream Woody Debris	86.10
Bank Stability	97.98
PHI Score	79.42

PHI Narrative Rating: Partially Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	14
Pool Substrate Characterization	16
Pool Variability	11
Sediment Deposition	13
Channel Flow Status	16
Channel Alteration	18
Channel Sinuosity	8
Bank Stability - Left Bank	8
Right Bank	8
Vegetative Protection - Left Bank	8
Right Bank	8
Riparian Vegetative Zone Width - Left Bank	9
Right Bank	9
RBP Score	146

RBP Narrative Rating: Supporting

Land Use Analysis

Impervious Area (acres) 60.82 % Impervious 42.03

Land Use	Acres	% Area
Residential	82.50	57.02
Commercial	10.23	7.07
Industrial	0.22	0.15
Transportation	5.43	3.75
Woods	3.06	2.11
Open Space	43.25	29.89

Site ID PT2-950-T-2009

Sampling Date 4/22/2009

ADC Map # 3, D-3

Watershed = Patapsco Tidal

Subwatershed = Cabin Branch 2

Location = West of undeveloped portion of Arundel Boulevard

Upstream from Mid-Point

Downstream from Mid-Point

This braided stream site is located to the west of the undeveloped portion of Arundel Boulevard. It is in Cabin Branch Creek 2, part of the Patapsco Tidal watershed. Landuse above this site is 52% residential, with some open space (22%) and wooded areas (19%). While bank erosion at this site was very minimal, the stream is highly embedded and substrate for benthos is marginal. The benthic community at this site rated Poor, with a BIBI score of 2.71. Scrapers and climbers were found in healthy numbers at this site, but no EPT taxa were present in the benthic sample, nor were there many macroinvertebrates intolerant of degraded urban condition. ATV tracks near the site indicate activity that may be contributing to less than optimal habitat conditions. The stream rated Partially Degraded under the PHI (total score of 74.7), and Partially Supporting under the RBP habitat with a total score of 121 (60.5% comparable to reference). Channel substrate was dominated by sand with some silt, and in situ water quality parameters were within the normal range.

Results Biological Condition : Poor

Habitat Rating : RBP : Partially Supporting MPHI : Partially Degraded

Stream Subsystem = Perennial Stream Origin = Swamp and Bog Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	5
Runs	95
Pools	0

No Evidence of Local Watershed NPS Pollution

None Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation 0

Road Culvert Present ? No

Left Buffer Breaks Present ? No

Right Buffer Breaks Present ? No

Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	80
Boulder	0	Gravel	0	Silt	20
				Clay	0

Water Chemistry	Temperature (C)	13.8	Conductivity (mS/cm)	0.164	pH	7.02	DO (ppm)	8.5

Site ID PT2-950-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	25	5
EPT Taxa	0	1
% Intolerant to Urban	1.09	1
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	2	5
% Climbers	11.96	5

BIBI Score: 2.71 Rating: Poor

Taxa List

Taxa	Count
Agabus	1
Aulodrilus	1
Caecidotea	1
Corynoneura	3
Cricotopus	5
Culicidae	1
Diplocladius	1
Enchytraeidae	17
Erioptera	1
Hydrobaenus	1
Hydroporus	1
Ilyodrilus	3
Limnophyes	9
Lumbricidae	8
Lumbriculus	7
Naididae (Tubificinae)	9
Nais	1
Paratanytarsus	2
Physa	6
Polypedilum	5
Psectrotanypus	4
Smittia	1
Thienemanniella	1
Tribelos	1
Turbellaria	2
Total Count	92

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	342.47
Remoteness	71.68
Percent Shading	78.67
Epifaunal Substrate	58.86
Instream Habitat	65.35
Instream Woody Debris	73.39
Bank Stability	100.00
PHI Score	74.66

PHI Narrative Rating: Partially Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	7
Pool Substrate Characterization	8
Pool Variability	7
Sediment Deposition	9
Channel Flow Status	15
Channel Alteration	14
Channel Sinuosity	13
Bank Stability - Left Bank	9
Right Bank	9
Vegetative Protection - Left Bank	6
Right Bank	6
Riparian Vegetative Zone Width - Left Bank	9
Right Bank	9
RBP Score	121

RBP Narrative Rating: Partially Supporting

Land Use Analysis

Impervious Area (acres) 109.85 % Impervious 32.07

Land Use	Acres	% Area
Residential	180.03	52.68
Commercial	13.31	3.90
Industrial	0.22	0.07
Transportation	7.56	2.21
Woods	64.91	18.99
Open Space	75.69	22.15

Site ID PT3-944-T-2009
Sampling Date 4/21/2009
ADC Map # 2, G-9

Watershed = Patapsco Tidal
Subwatershed = Cabin Branch
Location = Meadow Road

Upstream from Mid-Point

Downstream from Mid-Point

This Cabin Branch Creek site in the Patapsco Tidal watershed is located at the southeast corner of Meadow Road. A variety of landuses exist in the catchment surrounding this site, but the most prevalent landuse is residential (approximately 41%). Along with the residential landuse, commercial, industrial, transportation, and utility landuses contribute to the 43% impervious surfaces in this catchment. Open space (16.6%) and wooded landuses (11.3%) are also present. In situ pH measured at this site was 6.13, slightly below the state water quality minimum standard of 6.50. Other water quality parameters were within normal ranges. Very little trash was present at the site. Embeddedness was very high, while bank erosion was minimal. Under the PHI, this site received a score of 66.4 (Partially Degraded). Total RBP habitat score was 127 (Supporting). Despite a fairly moderate habitat, as evaluated under both the PHI and RBP assessments, the benthic community at this site is in Very Poor condition according to the BIBI (BIBI score of 1.86). Only 8 kinds of taxa were found at this site, and no EPT nor pollution-intolerant taxa were found.

Results Biological Condition : Very Poor
Habitat Rating : RBP : Supporting MPHI : Partially Degraded

Stream Subsystem = Perennial Stream Origin = Swamp and Bog Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	20
Runs	80
Pools	0

No Evidence of Local Watershed NPS Pollution
None Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation: 0

Road Culvert Present ? No
Left Buffer Breaks Present ? No
Right Buffer Breaks Present ? No
Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	10	Sand	80
Boulder	0	Gravel	0	Silt	10
				Clay	0

Water Chemistry	Temperature (C)	17.2	Conductivity (mS/cm)	0.285	pH	6.13	DO (ppm)	8.3

Site ID PT3-944-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	8	1
EPT Taxa	0	1
% Intolerant to Urban	0.00	1
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	1	3
% Climbers	16.67	5

BIBI Score: 1.86 Rating: Very Poor

Taxa List

Taxa	Count
Crambidae	1
Culex	1
Enchytraeidae	9
Lumbricidae	6
Lymnaea	3
Phaenopsectra	1
Pseudosmittia	2
Unionicola	1
Total Count	24

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	786.41
Remoteness	24.93
Percent Shading	73.32
Epifaunal Substrate	76.68
Instream Habitat	62.39
Instream Woody Debris	61.02
Bank Stability	100.00
PHI Score	66.39

PHI Narrative Rating: Partially Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	11
Pool Substrate Characterization	13
Pool Variability	8
Sediment Deposition	11
Channel Flow Status	14
Channel Alteration	16
Channel Sinuosity	11
Bank Stability - Left Bank	8
Right Bank	8
Vegetative Protection - Left Bank	5
Right Bank	5
Riparian Vegetative Zone Width - Left Bank	8
Right Bank	9
RBP Score	127

RBP Narrative Rating: Supporting

Land Use Analysis

Impervious Area (acres) 341.41 % Impervious 43.41

Land Use	Acres	% Area
Residential	320.70	40.78
Commercial	58.95	7.50
Industrial	67.63	8.60
Utility	3.81	0.48
Transportation	41.60	5.29
Airport	70.89	9.01
Woods	88.89	11.30
Open Space	130.55	16.60
Water	3.39	0.43

Site ID PT3-947-T-2009
Sampling Date 4/22/2009
ADC Map # 3, A-8

Watershed = Patapsco Tidal
Subwatershed = Cabin Branch
Location = Behind Beltway Crossing Shopping Center

Upstream from Mid-Point

Downstream from Mid-Point

Located in the west corner of the Beltway Crossing Shopping Center, this Cabin Branch Creek site is part of the Patapsco Tidal watershed. There are a wide variety of landuses in the surrounding catchment, including residential (46%), wooded areas (18.5%), and smaller percentages of open space, transportation, commercial, industrial, airport, utility, and water landuses. Thirty-eight percent of the catchment is impervious. All water quality parameters measured at this site fell within normal ranges. Moderate amounts of bank erosion were noted by field staff at this site, with the right bank having the poorest bank stability. A moderate amount of trash was present at the time of sampling. Both epifaunal substrate and pool substrate received optimal ratings. Channel substrate was dominated by gravel (60%) with some cobble and sand (20% of each). The total RBP habitat assessment score at this site was 152, Comparable to Reference, while the PHI rated the site as Partially Degraded, with a score of 71. None of the benthic macroinvertebrates obtained through benthic sampling at this site were considered intolerant to urban conditions, and only 1 EPT taxon was present in the sample. Thus, even with some good substrate for biota, high quality macroinvertebrates are not occupying this site. The overall BIBI score was 2.14, a rating of Poor.

Results Biological Condition : Poor
Habitat Rating : RBP : Comparable to Reference MPHI : Partially Degraded

Stream Subsystem = Perennial Stream Origin = Spring-fed Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	20
Runs	20
Pools	60

No Evidence of Local Watershed NPS Pollution
Moderate Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation 0

Road Culvert Present ? No
Left Buffer Breaks Present ? No
Right Buffer Breaks Present ? No
Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	20	Sand	20
Boulder	0	Gravel	60	Silt	0
				Clay	0

Water Chemistry	Temperature (C)	11.9	Conductivity (mS/cm)	0.339	pH	7.98	DO (ppm)	11.7

Site ID PT3-947-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	15	3
EPT Taxa	1	1
% Intolerant to Urban	0.00	1
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	2	5
% Climbers	5.56	3

BIBI Score: 2.14 Rating: Poor

Taxa List

Taxa	Count
Cheumatopsyche	1
Cricotopus	1
Enchytraeidae	1
Helichus	1
Lepidoptera	1
Liodessus	1
Lymnaea	1
Nais	2
Odontomyia/Hedriodiscus	1
Orthocladius	1
Simulium	2
Smittia	1
Stygobromus	2
Thienemanniella	1
Turbellaria	1
Total Count	18

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	1808.57
Remoteness	31.22
Percent Shading	91.34
Epifaunal Substrate	100.00
Instream Habitat	92.70
Instream Woody Debris	45.67
Bank Stability	65.19
PHI Score	71.02

PHI Narrative Rating: Partially Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	18
Pool Substrate Characterization	16
Pool Variability	15
Sediment Deposition	16
Channel Flow Status	12
Channel Alteration	18
Channel Sinuosity	15
Bank Stability - Left Bank	5
Right Bank	3
Vegetative Protection - Left Bank	8
Right Bank	8
Riparian Vegetative Zone Width - Left Bank	9
Right Bank	9
RBP Score	152

RBP Narrative Rating: Comparable to Reference

Land Use Analysis

Impervious Area (acres) 693.32 % Impervious 38.34

Land Use	Acres	% Area
Residential	838.10	46.34
Commercial	114.13	6.31
Industrial	81.40	4.50
Utility	33.06	1.83
Transportation	143.49	7.93
Airport	70.89	3.92
Woods	334.00	18.47
Open Space	190.11	10.51
Water	3.39	0.19

Site ID PT3-D47-T-2009

Sampling Date 4/22/2009

ADC Map # 3, A-8

Watershed = Patapsco Tidal

Subwatershed = Cabin Branch

Location = Behind Beltway Crossing Shopping Center

Upstream from Mid-Point

Downstream from Mid-Point

This is a replicate sample for site PT3-947-T-2009. Please note that the photos were taken during a return visit in August 2009. At that time, both the original and duplicate stream reaches were dry. Photos attached do not indicate the condition of stream at the time of benthic sampling.

Results Biological Condition : Poor

Habitat Rating : RBP : Supporting MPHI : Partially Degraded

Stream Subsystem = Perennial Stream Origin = Spring-fed Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	25
Runs	50
Pools	25

No Evidence of Local Watershed NPS Pollution

Moderate Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation: 0

Road Culvert Present ? Yes

Left Buffer Breaks Present ? No

Right Buffer Breaks Present ? No

Evidence of Channel Straightening or Dredging ? Yes

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	50	Sand	20
Boulder	0	Gravel	30	Silt	0
				Clay	0

Water Chemistry	Temperature (C)		Conductivity (mS/cm)		pH		DO (ppm)	

Site ID PT3-D47-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	19	3
EPT Taxa	2	3
% Intolerant to Urban	0.00	1
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	1	3
% Climbers	11.27	5

BIBI Score: 2.43 Rating: Poor

Taxa List

Taxa	Count
Ancyronyx	2
Aulodrilus	1
Bezzia	2
Chaetocladius	4
Cheumatopsyche	2
Cricotopus	1
Gammarus	1
Ironoquia	1
Naididae (Tubificinae)	1
Nais	7
Orthocladius	16
Paratendipes	12
Polypedilum	7
Rheotanytarsus	2
Simulium	1
Smittia	1
Tanytarsus	1
Thienemanniella	2
Tvetenia	7
Total Count	71

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	1808.57
Remoteness	12.14
Percent Shading	99.94
Epifaunal Substrate	100.00
Instream Habitat	92.70
Instream Woody Debris	36.80
Bank Stability	71.18
PHI Score	68.79

PHI Narrative Rating: Partially Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	17
Pool Substrate Characterization	15
Pool Variability	15
Sediment Deposition	16
Channel Flow Status	15
Channel Alteration	10
Channel Sinuosity	8
Bank Stability - Left Bank	5
Right Bank	3
Vegetative Protection - Left Bank	8
Right Bank	8
Riparian Vegetative Zone Width - Left Bank	7
Right Bank	7
RBP Score	134

RBP Narrative Rating: Supporting

Land Use Analysis

Impervious Area (acres) 693.32 % Impervious 38.34

Land Use	Acres	% Area
Residential	838.10	46.34
Commercial	114.13	6.31
Industrial	81.40	4.50
Utility	33.06	1.83
Transportation	143.49	7.93
Airport	70.89	3.92
Woods	334.00	18.47
Open Space	190.11	10.51
Water	3.39	0.19

Site ID PT3-948-T-2009

Sampling Date 4/22/2009

ADC Map # 3, D-7

Watershed = Patapsco Tidal

Subwatershed = Cabin Branch

Location = Snow Hill Lane

Upstream from Mid-Point

Downstream from Mid-Point

This braided Cabin Branch Creek site in the Patapsco Tidal watershed can be accessed from the left side of a trail that crosses Snow Hill Lane, and then cutting southeast into the woods. The dominant landuses in the catchment surrounding this site are residential (41%) and wooded (24%), but many other types of landuse are present, including open space, transportation, commercial, industrial, airport, utility, and water landuses. Just over one-third of the catchment area is impervious surface. The field crew noted a large amount of trash present at the time of sampling. Both epifaunal substrate and pool substrate variability received marginal ratings, and sediment deposition was poor. Silt and sand dominated the channel substrate (95% of channel substrate materials when combined). Overall, the total RBP habitat score was 105 (Partially Supporting), one of the lowest scores of all sites in this study. The PHI also rated the stream poorly, with an overall score of 57.1 (Degraded), the second lowest PHI score of all sites in the study. The benthic macroinvertebrate community at the site rated Poor, with a BIBI score of 2.43. Despite a wide variety of taxa obtained through sampling (n=28), no EPT taxa were present, and only six percent of the benthos obtained were considered intolerant to urban conditions.

Results Biological Condition : Poor

Habitat Rating : RBP : Partially Supporting MPHI : Degraded

Stream Subsystem = Perennial Stream Origin = Swamp and Bog Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	15
Runs	80
Pools	5

No Evidence of Local Watershed NPS Pollution

None Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation 0

Road Culvert Present ? No

Left Buffer Breaks Present ? No

Right Buffer Breaks Present ? No

Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	45
Boulder	0	Gravel	5	Silt	50
				Clay	0

Water Chemistry	Temperature (C)	11.4	Conductivity (mS/cm)	0.652	pH	7.02	DO (ppm)	10.7

Site ID PT3-948-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	28	5
EPT Taxa	0	1
% Intolerant to Urban	5.61	1
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	2	5
% Climbers	4.67	3

BIBI Score: 2.43 Rating: Poor

Taxa List

Taxa	Count
Caecidotea	4
Chaetocladius	5
Chironomus	1
Cryptochironomus	7
Dero	1
Enchytraeidae	2
Erioptera	4
Gammarus	39
Hydrobaenus	1
Ischnura	1
Limnophyes	1
Limonia	1
Lumbricidae	1
Mallochohelea	2
Menetus	1
Micropsectra	2
Naididae (Tubificinae)	9
Nais	1
Natarsia	3
Neoporus	1
Orthocladius	6
Phaenopsectra	1
Pisidium	3
Polypedilum	1
Pseudosmittia	1
Smittia	1
Stictochironomus	6
Tipulidae	1
Total Count	107

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	2421.90
Remoteness	42.78
Percent Shading	36.34
Epifaunal Substrate	40.30
Instream Habitat	45.33
Instream Woody Debris	77.87
Bank Stability	100.00
PHI Score	57.10

PHI Narrative Rating: Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	6
Pool Substrate Characterization	6
Pool Variability	6
Sediment Deposition	5
Channel Flow Status	13
Channel Alteration	11
Channel Sinuosity	11
Bank Stability - Left Bank	7
Right Bank	7
Vegetative Protection - Left Bank	8
Right Bank	7
Riparian Vegetative Zone Width - Left Bank	9
Right Bank	9
RBP Score	105

RBP Narrative Rating: Partially Supporting

Land Use Analysis

Impervious Area (acres) 859.19 % Impervious 35.48

Land Use	Acres	% Area
Residential	1000.65	41.32
Commercial	164.68	6.80
Industrial	97.58	4.03
Utility	33.06	1.36
Transportation	214.53	8.86
Airport	70.89	2.93
Woods	584.37	24.13
Open Space	252.76	10.44
Water	3.39	0.14

Site ID PT5-929-T-2009
Sampling Date 4/21/2009
ADC Map # 8, C-1

Watershed = Patapsco Tidal
Subwatershed = Furnace Creek
Location = Furnace Branch Road

Upstream from Mid-Point

Downstream from Mid-Point

Just off of Furnace Branch Road, near the north corner of the school parking lot is site PT5-929-T-2009. This is in Furnace Creek in the Patapsco Tidal watershed. The most prevalent landuse in the catchment of this site is residential (63%), with 13% commercial landuse the next most prevalent. These landuses contribute to the 41% imperviousness of the catchment. In situ water quality parameters measured at this site were within acceptable ranges. Significant amounts of trash were noted by the field crew at the time of sampling. The site was approximately 75% embedded, and instream habitat conditions, including epifaunal substrate and pool substrate, were poor to marginal, with very little pool variability and a great amount of sediment deposition. The total RBP score at this site was the lowest of all scores in the study (104, Partially Supporting, 52% Comparable to Reference). The PHI did not rate this site as harshly (PHI = 70.0, Partially Degraded), but did note poor epifaunal substrate, and a lack of instream habitat, including only one piece of instream wood. These poor habitat conditions contribute to the Very Poor benthic community present in this stream (BIBI = 1.57). No EPT taxa were present, and no taxa were considered to be intolerant of urban conditions.

Results Biological Condition : Very Poor
Habitat Rating : RBP : Partially Supporting MPHI : Partially Degraded

Stream Subsystem = Perennial Stream Origin = Swamp and Bog Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	20
Runs	35
Pools	45

No Evidence of Local Watershed NPS Pollution
None Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation: 0

Road Culvert Present ? No
Left Buffer Breaks Present ? No
Right Buffer Breaks Present ? No
Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	45
Boulder	0	Gravel	10	Silt	45
				Clay	0

Water Chemistry	Temperature (C)	11.9	Conductivity (mS/cm)	0.54	pH	7.32	DO (ppm)	11.3

Site ID PT5-929-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	19	3
EPT Taxa	0	1
% Intolerant to Urban	0.00	1
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	1	3
% Climbers	0.00	1

BIBI Score: 1.57 Rating: Very Poor

Taxa List

Taxa	Count
Chaetocladius	1
Corynoneura	3
Cricotopus	3
Eclipidrilus	3
Enchytraeidae	34
Gammarus	10
Helichus	1
Limnophyes	7
Lumbricidae	4
Naididae (Tubificinae)	1
Nais	24
Orthocladiinae	2
Orthocladius	1
Parakiefferiella	4
Pristina	6
Prodiamesa	1
Sciomyzidae	1
Smittia	2
Turbellaria	2
Total Count	110

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	126.52
Remoteness	38.62
Percent Shading	91.34
Epifaunal Substrate	53.73
Instream Habitat	64.44
Instream Woody Debris	72.83
Bank Stability	99.17
PHI Score	70.02

PHI Narrative Rating: Partially Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	5
Pool Substrate Characterization	6
Pool Variability	4
Sediment Deposition	8
Channel Flow Status	17
Channel Alteration	18
Channel Sinuosity	8
Bank Stability - Left Bank	9
Right Bank	9
Vegetative Protection - Left Bank	7
Right Bank	7
Riparian Vegetative Zone Width - Left Bank	4
Right Bank	2
RBP Score	104

RBP Narrative Rating: Partially Supporting

Land Use Analysis

Impervious Area (acres) 51.34 % Impervious 40.58

Land Use	Acres	% Area
Residential	79.68	62.98
Commercial	16.55	13.08
Transportation	9.04	7.15
Woods	12.14	9.60
Open Space	9.10	7.19

Site ID PT5-931-T-2009
Sampling Date 4/21/2009
ADC Map # 3, B-13

Watershed = Patapsco Tidal
Subwatershed = Furnace Creek
Location = East of Glen Haven Memorial Gardens

Upstream from Mid-Point

Downstream from Mid-Point

This site, located in Furnace Creek in the Patapsco Tidal watershed, has more than 50% impervious catchment area. With 62% residential and 21% commercial landuse, this high percentage of impervious surface is not unusual. This site is just east of the Glen Haven Memorial Gardens. The field crew found in situ water quality parameters to be within acceptable ranges. A minor buffer break (ATV path) was present along the left bank of the stream. Some bank erosion was noted at this site, and approximately 75% of the substrate was embedded. Epifaunal substrate and instream habitat were poor to marginal, and large amounts of trash were found at the site. The PHI rated this site as Degraded, with a score of 60.5, while the RBP habitat assessment was 113, Partially Supporting. A low community diversity was found through benthic sampling (nine taxa), and only one EPT taxon was found. In addition, no benthos considered intolerant to urban conditions were present in the benthic sample. Overall, the BIBI rated this site as Very Poor, with a score of 1.29, the lowest score of all sites sampled in this survey.

Results Biological Condition : Very Poor
Habitat Rating : RBP : Partially Supporting MPHI : Degraded

Stream Subsystem = Perennial Stream Origin = Spring-fed Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	34
Runs	33
Pools	33

No Evidence of Local Watershed NPS Pollution
Moderate Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation: 0

Road Culvert Present ? No
Left Buffer Breaks Present ? Yes
Right Buffer Breaks Present ? No
Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	80
Boulder	0	Gravel	20	Silt	0
				Clay	0

Water Chemistry	Temperature (C)	18.4	Conductivity (mS/cm)	0.497	pH	7.04	DO (ppm)	11.6

Site ID PT5-931-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	9	1
EPT Taxa	1	1
% Intolerant to Urban	0.00	1
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	0	1
% Climbers	2.80	3

BIBI Score: 1.29 Rating: Very Poor

Taxa List

Taxa	Count
Cricotopus	65
Gammarus	3
Hydropsyche	1
Limnodrilus	1
Naididae (Tubificinae)	2
Nais	27
Orthocladius	4
Polypedilum	3
Smittia	1
Total Count	107

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	611.94
Remoteness	31.22
Percent Shading	91.34
Epifaunal Substrate	43.46
Instream Habitat	64.96
Instream Woody Debris	52.03
Bank Stability	80.11
PHI Score	60.52

PHI Narrative Rating: Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	9
Pool Substrate Characterization	6
Pool Variability	7
Sediment Deposition	8
Channel Flow Status	8
Channel Alteration	18
Channel Sinuosity	12
Bank Stability - Left Bank	6
Right Bank	4
Vegetative Protection - Left Bank	9
Right Bank	9
Riparian Vegetative Zone Width - Left Bank	8
Right Bank	9
RBP Score	113

RBP Narrative Rating: Partially Supporting

Land Use Analysis

Impervious Area (acres) 311.21 % Impervious 50.86

Land Use	Acres	% Area
Residential	380.74	62.22
Commercial	131.76	21.53
Transportation	34.89	5.70
Woods	19.36	3.16
Open Space	45.19	7.38

Site ID PT6-943-T-2009

Sampling Date 4/20/2009

ADC Map # 3, K-9

Watershed = Patapsco Tidal

Subwatershed = Curtis Creek

Location = Fort Smallwood Road, behind Jet Blast Companies

Upstream from Mid-Point

Downstream from Mid-Point

This Curtis Creek site is off of Fort Smallwood Road, north of Pillman Road and behind Jet Blast Companies. It is part of the Patapsco Tidal watershed. Wooded areas dominate the landuse of the catchment (57%) with 15% residential and 14% industrial landuses also present. Impervious surfaces account for 23.7% of the catchment area. Sediment fences adjacent to the site were failing at the time of sampling. Channel substrate was composed primarily of sand (80%) with some silt (20%), and most of the sampling reach was long sandy run. Substrate was 100% embedded and the canopy was only 25% shaded. All water quality parameters were within acceptable ranges. The RBP rated this site as Supporting, with a total score of 130. Under the PHI, this site rated Partially Degraded, with a total score of 70.7. No EPT taxa were present in the benthic sample obtained at this site and only 8% of the macroinvertebrates obtained were considered intolerant to urban conditions. Overall, the BIBI rated this site as Poor, with a score of 2.14. Water level was somewhat elevated at time of sampling (it was raining during sampling and had rained within the 24 hours prior to sampling), but site was sampled that day due to limited sampling window.

Results Biological Condition : Poor

Habitat Rating : RBP : Supporting MPHI : Partially Degraded

Stream Subsystem = Perennial Stream Origin = Swamp and Bog Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	5
Runs	95
Pools	0

No Evidence of Local Watershed NPS Pollution

None Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation 5

Road Culvert Present ? No

Left Buffer Breaks Present ? No

Right Buffer Breaks Present ? No

Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	80
Boulder	0	Gravel	0	Silt	20
				Clay	0

Water Chemistry	Temperature (C)	10.9	Conductivity (mS/cm)	0.183	pH	7.91	DO (ppm)	8

Site ID PT6-943-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	29	5
EPT Taxa	0	1
% Intolerant to Urban	8.33	1
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	1	3
% Climbers	4.63	3

BIBI Score: 2.14 Rating: Poor

Taxa List

Taxa	Count
Caecidotea	6
Chaetocladius	11
Copelatus	1
Crambidae	2
Curculionidae	1
Cymbiodyta	1
Dolichopodidae	1
Eclipidrilus	1
Enchytraeidae	3
Erioptera	1
Eukiefferiella	1
Hydrobaenus	2
Limnodrilus	1
Lumbricidae	3
Megascolecidae	1
Molophilus	2
Naididae (Tubificinae)	8
Nais	38
Paraphaenocladius	1
Phaenopsectra	1
Polypedilum	3
Rheocricotopus	9
Rhyacodrilus	1
Silvius	1
Slavina	1
Somatochlora	1
Sphaeriidae	3
Synurella	2
Tipulidae	1
Total Count	108

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	174.18
Remoteness	38.62
Percent Shading	26.57
Epifaunal Substrate	74.88
Instream Habitat	94.46
Instream Woody Debris	89.92
Bank Stability	100.00
PHI Score	70.74

PHI Narrative Rating: Partially Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	12
Pool Substrate Characterization	10
Pool Variability	10
Sediment Deposition	13
Channel Flow Status	14
Channel Alteration	13
Channel Sinuosity	11
Bank Stability - Left Bank	8
Right Bank	8
Vegetative Protection - Left Bank	9
Right Bank	9
Riparian Vegetative Zone Width - Left Bank	5
Right Bank	8
RBP Score	130

RBP Narrative Rating: Supporting

Land Use Analysis

Impervious Area (acres) 41.20 % Impervious 23.65

Land Use	Acres	% Area
Residential	26.93	15.46
Commercial	9.49	5.45
Industrial	24.34	13.98
Transportation	7.71	4.43
Woods	99.52	57.14
Open Space	6.18	3.55

Site ID PT6-945-T-2009

Sampling Date 4/29/2009

ADC Map # 3,J-10

Watershed = Patapsco Tidal

Subwatershed = Curtis Creek

Location = Behind Madison Warehouse property, off of Carbide Road

Upstream from Mid-Point

Downstream from Mid-Point

This Patapsco Tidal site is located in the Curtis Creek subwatershed, in the southwest corner of the Madison Warehouse property, just off of Carbide Road. The dominant landuse near this site is wooded (65%), with some industrial and some transportation landuse. There is no residential landuse in the surrounding catchment. Twenty-two percent of the catchment area is impervious. Channel substrate was 75% sand and 25% silt. Instream habitat, epifaunal substrate, and pool substrate variability rated in the poor to marginal range and sediment deposition levels were also marginal. Channel flow status was also marginal, due to sediment deposition. This site received a Partially Supporting rating under the RBP habitat assessment (score of 117), and a Minimally Degraded rating under the PHI. A large variety of macroinvertebrate taxa were obtained through benthic sampling (n=26), with only two EPT taxa present in the sample. The overall BIBI score was 2.71, Poor.

Results Biological Condition : Poor

Habitat Rating : RBP : Partially Supporting MPHI : Minimally Degraded

Stream Subsystem = Perennial Stream Origin = Spring-fed Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	70
Runs	25
Pools	5

No Evidence of Local Watershed NPS Pollution

Moderate Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation: 0

Road Culvert Present ? No

Left Buffer Breaks Present ? No

Right Buffer Breaks Present ? No

Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	75
Boulder	0	Gravel	0	Silt	25
				Clay	0

Water Chemistry	Temperature (C)	14.7	Conductivity (mS/cm)	0.219	pH	8.14	DO (ppm)	9.5

Site ID PT6-945-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	26	5
EPT Taxa	2	3
% Intolerant to Urban	13.48	3
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	1	3
% Climbers	2.25	3

BIBI Score: 2.71 Rating: Poor

Taxa List

Taxa	Count
Agabus	1
Caecidotea	3
Chironomini	2
Chironomus	4
Cordulegaster	1
Crambidae	2
Culicoides	1
Diplocladius	13
Eclipidrilus	1
Enchytraeidae	5
Erioptera	4
Gammarus	1
Heterotrissocladius	6
Hydrobaenus	2
Ironoquia	1
Limnophyes	1
Lirceus	9
Meropelopia	1
Naididae (Tubificinae)	8
Pisidium	1
Pristina	6
Prostoma	1
Pseudorthocladius	1
Shipsa	2
Sphaeriidae	10
Tipula	2
Total Count	89

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	13.83
Remoteness	42.78
Percent Shading	100.00
Epifaunal Substrate	68.14
Instream Habitat	98.19
Instream Woody Debris	100.00
Bank Stability	95.75
PHI Score	84.14

PHI Narrative Rating: Minimally Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	6
Pool Substrate Characterization	8
Pool Variability	5
Sediment Deposition	10
Channel Flow Status	10
Channel Alteration	18
Channel Sinuosity	8
Bank Stability - Left Bank	7
Right Bank	9
Vegetative Protection - Left Bank	9
Right Bank	9
Riparian Vegetative Zone Width - Left Bank	9
Right Bank	9
RBP Score	117

RBP Narrative Rating: Partially Supporting

Land Use Analysis

Impervious Area (acres) 3.09 % Impervious 22.37

Land Use	Acres	% Area
Industrial	2.92	21.13
Transportation	1.99	14.40
Woods	8.92	64.46

Site ID PT7-932-T-2009
Sampling Date 4/17/2009
ADC Map # 2, K-13

Watershed = Patapsco Tidal
Subwatershed = Sawmill Creek 1
Location = Virginia Avenue and Maple Lane

Upstream from Mid-Point

Downstream from Mid-Point

A wide variety of landuses are present in the catchment surrounding this site, which is located in Sawmill Creek 1 in the Patapsco Tidal watershed. The site can be accessed at the intersection of Virginia Avenue and Maple Lane. No one landuse is particularly dominant, but wooded areas, open space, and residential landuse all contribute between 22 and 27%. Airport land is nearly 10% of the catchment area, and smaller amounts of transportation and industrial lands are present as well. Just under 30% of the catchment is made up of impervious surface. All in situ water quality parameters fell within acceptable limits according to Maryland water quality standards. Streambanks at this site were not eroded, and instream habitat was good. Channel substrate was a mix of sand and silt, and 85% of the reach length was made up of runs, with the remaining 15% riffles This site received the highest RBP habitat assessment score of all sites included in the study (169, Comparable to Reference). However, under the PHI, this site was rated Degraded with a score of 61.1. One factor negatively affecting the PHI was the paltry 5% canopy shading present at the site. The benthic community at this site was not very diverse (only 9 kinds of taxa were found in the benthic sample), and no EPT nor scraper taxa were included in the sample. In addition none of the benthic macroinvertebrates were considered intolerant of urban conditions. Thus, the BIBI rating for this site was Very Poor, with a score of 1.29.

Results Biological Condition : Very Poor
Habitat Rating : RBP : Comparable to Reference MPHI : Degraded

Stream Subsystem = Perennial Stream Origin = Swamp and Bog Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	15
Runs	85
Pools	0

No Evidence of Local Watershed NPS Pollution
None Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation 20

Road Culvert Present ? No
Left Buffer Breaks Present ? No
Right Buffer Breaks Present ? No
Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	50
Boulder	0	Gravel	0	Silt	50
				Clay	0

Water Chemistry	Temperature (C)	16.5	Conductivity (mS/cm)	0.281	pH	6.8	DO (ppm)	10.3

Site ID PT7-932-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	9	1
EPT Taxa	0	1
% Intolerant to Urban	0.00	1
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	0	1
% Climbers	1.79	3

BIBI Score: 1.29 Rating: Very Poor

Taxa List

Taxa	Count
Aulodrilus	8
Gammarus	37
Limnodrilus	5
Naididae (Tubificinae)	46
Nais	10
Polypedilum	2
Slavina	1
Sphaeriidae	2
Tvetenia	1
Total Count	112

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	4206.01
Remoteness	31.22
Percent Shading	0.00
Epifaunal Substrate	77.37
Instream Habitat	95.16
Instream Woody Debris	62.74
Bank Stability	100.00
PHI Score	61.08

PHI Narrative Rating: Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	13
Pool Substrate Characterization	15
Pool Variability	14
Sediment Deposition	19
Channel Flow Status	18
Channel Alteration	19
Channel Sinuosity	13
Bank Stability - Left Bank	10
Right Bank	10
Vegetative Protection - Left Bank	9
Right Bank	9
Riparian Vegetative Zone Width - Left Bank	10
Right Bank	10
RBP Score	169

RBP Narrative Rating: Comparable to Reference

Land Use Analysis

Impervious Area (acres) 1261.28 % Impervious 29.99

Land Use	Acres	% Area
Residential	990.92	23.56
Commercial	175.06	4.16
Industrial	271.50	6.46
Utility	21.16	0.50
Transportation	227.12	5.40
Airport	402.25	9.56
Row Crops	5.26	0.13
Woods	1146.70	27.26
Open Space	959.14	22.80
Water	6.88	0.16

Site ID PT7-934-T-2009

Sampling Date 4/17/2009

ADC Map # 2, J-13

Watershed = Patapsco Tidal

Subwatershed = Sawmill Creek 1

Location = Longwood Avenue, between Hopkins Street and Idlewood Street

Upstream from Mid-Point

Downstream from Mid-Point

This site is located in Sawmill Creek 1 in the Patapsco Tidal watershed. It is on the south side of Longwood Avenue, between Hopkins and Idlewood Streets. Thirty-two percent of the landuse surrounding this site is related to the BWI airport, and 51% of the catchment acreage is impervious. In situ water quality parameters were all within acceptable ranges. Despite its close proximity to the BWI airport, the benthic macroinvertebrate community at this site scored in the Fair range, with a BIBI of 3.00. Twenty-two different taxa were found, including three EPT taxa and two scrapers. However, only 2% of the sample consisted of macroinvertebrates considered intolerant of urban conditions. According to the landowner, the county had done dredging work there approximately ten years ago and installed chainlink fence and chicken wire throughout the site. An old metal fence is embedded into the streambed along almost the entire length of reach, which made benthic sampling somewhat difficult. Streambanks along both sides of the stream had minimal levels of erosion and only 25% of the canopy was shaded. Epifaunal substrate and pool substrate variability were rated in the lower end of Suboptimal, and sediment deposition was marginal. Along the left bank of the stream, the riparian zone was rated Poor. The total RBP score was 117 (Partially Supporting) while the PHI rating was Degraded (score of 64.9).

Results Biological Condition : Fair

Habitat Rating : RBP : Partially Supporting MPHI : Degraded

Stream Subsystem = Perennial Stream Origin = Mixture of Origins Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	95
Runs	0
Pools	5

No Evidence of Local Watershed NPS Pollution

None Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation 0

Road Culvert Present ? No

Left Buffer Breaks Present ? No

Right Buffer Breaks Present ? No

Evidence of Channel Straightening or Dredging ? Yes

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	90
Boulder	0	Gravel	10	Silt	0
				Clay	0

Water Chemistry	Temperature (C)	14.5	Conductivity (mS/cm)	0.189	pH	7.03	DO (ppm)	10.1

Site ID PT7-934-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	22	5
EPT Taxa	3	3
% Intolerant to Urban	1.96	1
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	2	5
% Climbers	10.78	5

BIBI Score: 3.00 Rating: Fair

Taxa List

Taxa	Count
Amphinemura	1
Aulodrilus	2
Brillia	3
Cheumatopsyche	1
Cricotopus	2
Cryptochironomus	2
Enchytraeidae	4
Eukiefferiella	23
Gammarus	32
Limnodrilus	5
Lymnaea	1
Macronychus	1
Naididae (Tubificinae)	5
Natarsia	1
Orthocladius	3
Paratendipes	1
Polypedilum	9
Prostoma	1
Rhyacophila	1
Stenochironomus	2
Tanytarsus	1
Tipulidae	1
Total Count	102

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	880.52
Remoteness	36.34
Percent Shading	26.57
Epifaunal Substrate	75.94
Instream Habitat	77.88
Instream Woody Debris	77.49
Bank Stability	95.40
PHI Score	64.94

PHI Narrative Rating: Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	11
Pool Substrate Characterization	11
Pool Variability	10
Sediment Deposition	8
Channel Flow Status	18
Channel Alteration	15
Channel Sinuosity	7
Bank Stability - Left Bank	8
Right Bank	8
Vegetative Protection - Left Bank	6
Right Bank	6
Riparian Vegetative Zone Width - Left Bank	1
Right Bank	8
RBP Score	117

RBP Narrative Rating: Partially Supporting

Land Use Analysis

Impervious Area (acres) 445.83 % Impervious 50.63

Land Use	Acres	% Area
Residential	132.85	15.09
Commercial	30.06	3.41
Industrial	96.59	10.97
Transportation	28.97	3.29
Airport	284.28	32.29
Woods	74.07	8.41
Open Space	232.25	26.38
Water	1.44	0.16

Site ID PT7-936-T-2009
Sampling Date 4/21/2009
ADC Map # 2, G-13

Watershed = Patapsco Tidal
Subwatershed = Sawmill Creek 1
Location = Aviation Boulevard

Upstream from Mid-Point

Downstream from Mid-Point

Near the BWI Airport, this site is located on the east side of Aviation Boulevard where the stream crosses the road. It is in Sawmill Creek 1, in the Patapsco Tidal watershed. Fifty percent of the landuse surrounding this site is related to the BWI airport, and 52% of the catchment acreage is impervious. The close proximity of this site to BWI Airport likely influences the quality of the benthic macroinvertebrate community and the habitat at this site. The benthic community received a BIBI score of 1.86 (Very Poor), as the sample lacked any EPT or scraper taxa and no taxa were considered intolerant to urban conditions. While the water had a distinct reddish/orangish color, all water quality parameters measured by the field crew were within acceptable limits according to state water quality standards. Field crew members noted a moderate amount of trash present at the site. Streambanks had some erosion along both sides of the stream, and bank stability was rated marginal along the left bank. Epifaunal substrate and instream habitat were in the optimal to suboptimal range. Embeddedness was 45% and the canopy was 85% shaded. The total RBP score was 135 (Supporting) while the PHI rating was Partially Degraded (score of 76.7).

Results Biological Condition : Very Poor
Habitat Rating : RBP : Supporting MPHI : Partially Degraded

Stream Subsystem = Perennial Stream Origin = Spring-fed Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	40
Runs	35
Pools	25

No Evidence of Local Watershed NPS Pollution
Moderate Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation: 30

Road Culvert Present ? No
Left Buffer Breaks Present ? No
Right Buffer Breaks Present ? No
Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	20	Sand	30
Boulder	5	Gravel	45	Silt	0
				Clay	0

Water Chemistry	Temperature (C)	14.4	Conductivity (mS/cm)	0.169	pH	7.91	DO (ppm)	9.5

Site ID PT7-936-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	15	3
EPT Taxa	0	1
% Intolerant to Urban	0.00	1
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	0	1
% Climbers	11.71	5

BIBI Score: 1.86 Rating: Very Poor

Taxa List

Taxa	Count
Aulodrilus	4
Conchapelopia	3
Corbicula	1
Cricotopus	1
Enchytraeidae	1
Naididae (Tubificinae)	22
Nais	43
Nanocladius	1
Orthocladius	2
Polypedilum	11
Pristina	12
Rheotanytarsus	1
Slavina	5
Sphaeridae	2
Tanytarsus	2
Total Count	111

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	566.97
Remoteness	38.62
Percent Shading	84.56
Epifaunal Substrate	100.00
Instream Habitat	100.00
Instream Woody Debris	58.81
Bank Stability	78.00
PHI Score	76.66

PHI Narrative Rating: Partially Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	16
Pool Substrate Characterization	10
Pool Variability	12
Sediment Deposition	13
Channel Flow Status	13
Channel Alteration	18
Channel Sinuosity	13
Bank Stability - Left Bank	4
Right Bank	6
Vegetative Protection - Left Bank	8
Right Bank	8
Riparian Vegetative Zone Width - Left Bank	9
Right Bank	5
RBP Score	135

RBP Narrative Rating: Supporting

Land Use Analysis

Impervious Area (acres) 293.30 % Impervious 51.73

Land Use	Acres	% Area
Residential	12.98	2.29
Commercial	15.08	2.66
Industrial	13.79	2.43
Transportation	11.72	2.07
Airport	284.28	50.14
Woods	36.72	6.48
Open Space	190.95	33.68
Water	1.44	0.25

Site ID PT7-938-T-2009

Sampling Date 4/21/2009

ADC Map # 3, A-12

Watershed = Patapsco Tidal

Subwatershed = Sawmill Creek 1

Location = Behind GMC Trucks property on Crain Highway

Upstream from Mid-Point

Downstream from Mid-Point

This site is located behind the GMC Trucks property off of Crain Highway. It is in Sawmill Creek 1 in the Patapsco Tidal watershed. Residential landuse makes up the greatest percentage of landuse in the catchment at 31%, while wooded and open space landuse account for 24 and 19%, respectively. Impervious surface makes up 32.3% of the catchment area. Epifaunal substrate and instream habitat were rated in the suboptimal range at this site, and embeddedness was 50%. The field crew noted a moderate amount of trash nearby, and the left bank lacked adequate vegetative protection along with a narrow riparian vegetative zone. Moderate levels of erosion were noted in the local watershed. Overall, the site received a narrative rating of Partially Degraded under the PHI (score of 70.6) and rated Supporting under the RBP (score of 143, 71.5 % comparable to reference). While a good diversity of taxa were found through benthic macroinvertebrate sampling (n=26), no EPT taxa were present in the sample and only 7.5% of the macroinvertebrates were considered intolerant of urban conditions. A healthy number of scrapers were present, along with some climbers, resulting in a Poor classification by the BIBI (score of 2.43). Some SAV was present.

Results Biological Condition : Poor

Habitat Rating : RBP : Supporting MPHI : Partially Degraded

Stream Subsystem = Perennial Stream Origin = Spring-fed Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	45
Runs	45
Pools	10

No Evidence of Local Watershed NPS Pollution

Moderate Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation 25

Road Culvert Present ? No

Left Buffer Breaks Present ? No

Right Buffer Breaks Present ? No

Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	50
Boulder	0	Gravel	50	Silt	0
				Clay	0

Water Chemistry	Temperature (C)	16.2	Conductivity (mS/cm)	0.199	pH	7.21	DO (ppm)	11.2

Site ID PT7-938-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	26	5
EPT Taxa	0	1
% Intolerant to Urban	7.55	1
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	4	5
% Climbers	2.83	3

BIBI Score: 2.43 Rating: Poor

Taxa List

Taxa	Count
Ancyronyx	1
Argia	1
Boyeria	1
Caecidotea	1
Calopteryx	2
Chaetocladius	4
Chaetogaster	1
Corynoneura	2
Cricotopus	10
Gammarus	20
Hyalella	1
Lumbricidae	1
Macronychus	2
Microvelia	1
Naididae (Tubificinae)	3
Nais	31
Orthocladius	1
Oulimnius	7
Paracladopelma	1
Paralauterborniella	1
Saetheria	1
Slavina	1
Stenelmis	1
Stygobromus	1
Stylaria	1
Tvetenia	9
Total Count	106

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	5317.20
Remoteness	31.22
Percent Shading	73.32
Epifaunal Substrate	93.28
Instream Habitat	87.21
Instream Woody Debris	48.26
Bank Stability	90.37
PHI Score	70.61

PHI Narrative Rating: Partially Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	18
Pool Substrate Characterization	16
Pool Variability	14
Sediment Deposition	14
Channel Flow Status	16
Channel Alteration	18
Channel Sinuosity	8
Bank Stability - Left Bank	8
Right Bank	8
Vegetative Protection - Left Bank	3
Right Bank	8
Riparian Vegetative Zone Width - Left Bank	3
Right Bank	9
RBP Score	143

RBP Narrative Rating: Supporting

Land Use Analysis

Impervious Area (acres) 1720.22 % Impervious 32.35

Land Use	Acres	% Area
Residential	1657.80	31.18
Commercial	284.87	5.36
Industrial	326.33	6.14
Utility	30.22	0.57
Transportation	297.71	5.60
Airport	402.25	7.57
Row Crops	5.26	0.10
Woods	1279.92	24.07
Open Space	1024.72	19.27
Water	8.11	0.15

Site ID PT8-923-T-2009
Sampling Date 4/21/2009
ADC Map # 8, F-4

Watershed = Patapsco Tidal
Subwatershed = Marley Creek 1
Location = Marley Neck Boulevard, north of Merct Drive

Upstream from Mid-Point

Downstream from Mid-Point

Residential landuse is the most prevalent landuse in the catchment of site PT8-923-T-2009, accounting for 58% of the catchment area. This site is located in Marley Creek 1, in the Patapsco Tidal watershed. Other landuses present include wooded (24%), commercial (7%), and transportation-related (6%). This site is located on the south side of Marley Neck Boulevard, just north of Merct Drive. Channel substrate consisted of 80% sand and 20% silt, and the stream was 100% embedded. The field crew noted moderate to heavy amounts of trash and some bank erosion. This site had suboptimal epifaunal substrate, while instream habitat, pool substrate, and pool variability rated marginal. Impervious surfaces account for just under 31% of the catchment area. The total RBP Habitat score was 135 (Supporting), while the PHI score of 78.9 rated the site as Partially Degraded. The benthic community at the site showed signs of degradation, with an overall BIBI score of 1.57 (Very Poor). Benthic macroinvertebrate sampling targeted rootwads and woody debris, which accounted for about half of the benthic habitat present at the site. No sensitive EPT taxa were obtained in the benthic sample, nor were there any scrapers. In addition, less than 5% of the macroinvertebrates present in the benthic sample were considered intolerant of urban conditions.

Results Biological Condition : Very Poor
Habitat Rating : RBP : Supporting MPHI : Partially Degraded

Stream Subsystem = Perennial Stream Origin = Swamp and Bog Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	15
Runs	85
Pools	0

No Evidence of Local Watershed NPS Pollution
None Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation 0

Road Culvert Present ? No
Left Buffer Breaks Present ? No
Right Buffer Breaks Present ? No
Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	80
Boulder	0	Gravel	0	Silt	20
				Clay	0

Water Chemistry	Temperature (C)	13.8	Conductivity (mS/cm)	0.26	pH	6.85	DO (ppm)	9.2

Site ID PT8-923-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	18	3
EPT Taxa	0	1
% Intolerant to Urban	4.35	1
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	0	1
% Climbers	4.35	3

BIBI Score: 1.57 Rating: Very Poor

Taxa List

Taxa	Count
Caecidotea	4
Calopteryx	2
Chaetocladius	13
Cricotopus	1
Cryptochironomus	1
Enchytraeidae	4
Erioptera	1
Limnodrilus	3
Lumbricidae	1
Naididae (Tubificinae)	6
Nais	68
Orthocladiinae	1
Polypedilum	3
Rheocricotopus	3
Simulium	1
Smittia	1
Stenochironomus	1
Synurella	1
Total Count	115

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	624.98
Remoteness	38.62
Percent Shading	78.67
Epifaunal Substrate	89.80
Instream Habitat	70.29
Instream Woody Debris	100.00
Bank Stability	96.27
PHI Score	78.94

PHI Narrative Rating: Partially Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	13
Pool Substrate Characterization	10
Pool Variability	9
Sediment Deposition	12
Channel Flow Status	14
Channel Alteration	16
Channel Sinuosity	15
Bank Stability - Left Bank	7
Right Bank	7
Vegetative Protection - Left Bank	7
Right Bank	7
Riparian Vegetative Zone Width - Left Bank	9
Right Bank	9
RBP Score	135

RBP Narrative Rating: Supporting

Land Use Analysis

Impervious Area (acres) 191.13 % Impervious 30.58

Land Use	Acres	% Area
Residential	364.76	58.36
Commercial	43.60	6.98
Industrial	3.05	0.49
Utility	9.07	1.45
Transportation	40.13	6.42
Woods	153.17	24.51
Open Space	11.20	1.79

Site ID PT8-927-T-2009

Sampling Date 4/22/2009

ADC Map # 8, G-2,3

Watershed = Patapsco Tidal

Subwatershed = Marley Creek 1

Location = Marley Neck Road

Upstream from Mid-Point

Downstream from Mid-Point

This site in Marley Creek 1 in the Patapsco Tidal watershed had one of the lowest amounts of impervious surface in its catchment of all sites included in this study (4.6%). Much of the landuse surrounding this site is wooded (73%) or open space (16%), and only small amounts of utility (6%), water (2%), and transportation landuses (1.7%) are present. The site is located off of Marley Neck Road, north of a train and automobile junkyard. This junkyard is located just outside the 50-meter riparian area along the right bank of the stream. The proximity of the site just next to the road, along with the nearness of the junkyard resulted in the lowest ratings possible for remoteness and aesthetics (trash). Despite the low amounts of impervious surface, this site is plagued by terrible bank erosion. The field crew rated the entire 75-meter stretch as having extreme bank erosion along the left bank and moderate bank erosion along the right bank. Overall habitat scores were low at this site, with the RBP habitat assessing the site as Partially Supporting (score of 117), and the PHI rating the site as Degraded (score of 55.4, the lowest PHI score in the study). The benthic community also rated as Very Poor, with a BIBI score of 1.86. Community diversity was lacking, as only 7 taxa were present in the benthic sample.

Results Biological Condition : Very Poor

Habitat Rating : RBP : Partially Supporting MPHI : Degraded

Stream Subsystem = Perennial Stream Origin = Spring-fed Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	60
Runs	20
Pools	20

No Evidence of Local Watershed NPS Pollution

Moderate Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation: 0

Road Culvert Present ? No

Left Buffer Breaks Present ? No

Right Buffer Breaks Present ? No

Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	35
Boulder	0	Gravel	55	Silt	10
				Clay	0

Water Chemistry	Temperature (C)	10.9	Conductivity (mS/cm)	0.17	pH	8.01	DO (ppm)	11.2

Site ID PT8-927-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	7	1
EPT Taxa	2	3
% Intolerant to Urban	4.00	1
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	0	1
% Climbers	8.00	5

BIBI Score: 1.86 Rating: Very Poor

Taxa List

Taxa	Count
Aeshna	1
Chaetocladius	19
Ironoquia	1
Lepidostoma	1
Orthocladius	1
Simulium	1
Tipula	1
Total Count	25

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	264.23
Remoteness	3.31
Percent Shading	84.56
Epifaunal Substrate	54.74
Instream Habitat	90.20
Instream Woody Debris	64.49
Bank Stability	35.36
PHI Score	55.44

PHI Narrative Rating: Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	10
Pool Substrate Characterization	10
Pool Variability	5
Sediment Deposition	14
Channel Flow Status	15
Channel Alteration	17
Channel Sinuosity	11
Bank Stability - Left Bank	2
Right Bank	1
Vegetative Protection - Left Bank	8
Right Bank	6
Riparian Vegetative Zone Width - Left Bank	9
Right Bank	9
RBP Score	117

RBP Narrative Rating: Partially Supporting

Land Use Analysis

Impervious Area (acres) 12.12 % Impervious 4.59

Land Use	Acres	% Area
Residential	0.45	0.17
Commercial	0.14	0.05
Industrial	0.22	0.08
Utility	16.89	6.39
Transportation	4.58	1.73
Woods	193.86	73.37
Open Space	43.16	16.33
Water	4.93	1.87

Site ID PT8-937-T-2009
Sampling Date 4/21/2009
ADC Map # 8, G-4

Watershed = Patapsco Tidal
Subwatershed = Marley Creek 1
Location = Marley Neck Road at Tanyard Cove Road

Upstream from Mid-Point

Downstream from Mid-Point

This Marley Creek 1 site in the Patapsco Tidal watershed is located on a farm off of Marley Neck Road at Tanyard Cove Road. This stream had stable banks with very little erosion present. No trash was observed at the site by field staff. Much of the length of the stream sampled consisted of long sandy run, with few riffles or pools. Epifaunal substrate and pool substrate were both rated toward the lower end of suboptimal, with most of the channel substrate composed of sand (80%) and some silt (20%). Overall, this site rated as Supporting under the RBP (score of 150, 75% comparable to reference), and as Partially Degraded under the PHI (score of 75.8). The benthic community present at this site received one of the higher BIBI scores of all sites included in this study (BIBI = 3.57, Fair), and had a high amount of diversity (35 taxa present, including 5 EPT taxa). In situ pH levels at this site were 6.33, slightly below the minimum state water quality standard of 6.5.

Results Biological Condition : Fair
Habitat Rating : RBP : Supporting MPHI : Partially Degraded

Stream Subsystem = Perennial Stream Origin = Swamp and Bog Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	20
Runs	75
Pools	5

No Evidence of Local Watershed NPS Pollution
None Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation 0

Road Culvert Present ? No
Left Buffer Breaks Present ? No
Right Buffer Breaks Present ? No
Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	80
Boulder	0	Gravel	0	Silt	20
				Clay	0

Water Chemistry	Temperature (C)	15	Conductivity (mS/cm)	0.122	pH	6.33	DO (ppm)	8

Site ID PT8-937-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	35	5
EPT Taxa	5	5
% Intolerant to Urban	50.00	5
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	1	3
% Climbers	18.03	5

BIBI Score: 3.57 Rating: Fair

Taxa List

Taxa	Count
Apsectrotanypus	1
Caecidotea	1
Chaetocladius	1
Corynoneura	1
Culicoides	1
Diplectrona	3
Heterotrissocladius	1
Leuctra	17
Limnophyes	2
Lype	2
Mallochohelea	1
Meropelopia	9
Micropsectra	17
Nais	2
Natarsia	1
Nigronia	4
Orthocladiinae	1
Paracladopelma	1
Parametriocnemus	6
Phaenopsectra	1
Pisidium	3
Polycentropus	6
Polypedilum	1
Pseudolimnophila	2
Ptychoptera	2
Pycnopsyche	1
Rheocricotopus	2
Sialis	2
Simulium	5
Synurella	8
Tanytarsus	4
Thienemannimyia group	9
Tipula	1
Tribelos	2
Zavrelimyia	1
Total Count	122

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	304.69
Remoteness	31.22
Percent Shading	73.32
Epifaunal Substrate	82.86
Instream Habitat	77.64
Instream Woody Debris	89.50
Bank Stability	100.00
PHI Score	75.76

PHI Narrative Rating: Partially Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	11
Pool Substrate Characterization	13
Pool Variability	10
Sediment Deposition	16
Channel Flow Status	18
Channel Alteration	18
Channel Sinuosity	12
Bank Stability - Left Bank	9
Right Bank	9
Vegetative Protection - Left Bank	9
Right Bank	9
Riparian Vegetative Zone Width - Left Bank	7
Right Bank	9
RBP Score	150

RBP Narrative Rating: Supporting

Land Use Analysis

Impervious Area (acres) 11.87 % Impervious 3.90

Land Use	Acres	% Area
Residential	12.58	4.13
Commercial	8.25	2.71
Industrial	0.02	0.01
Transportation	5.37	1.76
Woods	264.37	86.77
Open Space	14.10	4.63

Site ID PT9-933-T-2009
Sampling Date 4/20/2009
ADC Map # 4, C-13

Watershed = Patapsco Tidal
Subwatershed = Cox Creek
Location = Fort Smallwood Drive, north of Chestnut Cover Drive

Upstream from Mid-Point

Downstream from Mid-Point

Located in the Cox Creek subwatershed of the Patapsco Tidal watershed, this site can be accessed off of Fort Smallwood Drive, north of Chestnut Cove Drive. More than half of the landuse near this site is industrial, with woods (17%) and open space (15%) the next most-prevalent landuses. The surrounding catchment is nearly 47% impervious. The site is located in close proximity to the road, and a moderate amount of trash was present at the time of sampling. A storm drain along the left bank of the stream was present and served as a minor buffer break. Channel substrate was highly embedded and instream habitat, epifaunal substrate, and pool substrate rated in the marginal to suboptimal range. Stream banks were stable with no erosion, while the riparian vegetative width rated at the low end of suboptimal. Under the RBP Habitat Assessment, this site rated Supporting with a total score of 137 (68.5% comparable to reference conditions). Under the PHI, this site received a score of 80.9 (Partially Degraded). A good biological community diversity was present at this site (n=26 taxa), but only one EPT taxa was present and 99% of the benthic sample consisted of macroinvertebrates tolerant of urban conditions. A healthy amount of scraper taxa and climbers were present in the benthic sample, resulting in an overall BIBI score of 2.71, a rating of Poor. Sampling was conducted when water level was slightly elevated (rainy conditions) because of limited sampling window.

Results Biological Condition : Poor
Habitat Rating : RBP : Supporting MPHI : Partially Degraded

Stream Subsystem = Perennial Stream Origin = Mixture of Origins Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	20
Runs	80
Pools	0

No Evidence of Local Watershed NPS Pollution
Moderate Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation 0

Road Culvert Present ? No
Left Buffer Breaks Present ? Yes
Right Buffer Breaks Present ? No
Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	60
Boulder	0	Gravel	0	Silt	40
				Clay	0

Water Chemistry	Temperature (C)	11.8	Conductivity (mS/cm)	0.302	pH	7.1	DO (ppm)	8

Site ID PT9-933-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	26	5
EPT Taxa	1	1
% Intolerant to Urban	1.11	1
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	4	5
% Climbers	18.89	5

BIBI Score: 2.71 Rating: Poor

Taxa List

Taxa	Count
Aulodrilus	4
Calopteryx	1
Chaetocladius	14
Cheumatopsyche	2
Cricotopus	13
Cryptochironomus	2
Culicoides	1
Dubiraphia	2
Enchytraeidae	2
Gammarus	11
Limnophyes	4
Lymnaea	1
Megascolecidae	1
Menetus	1
Meropelopia	1
Micropsectra	1
Naididae (Tubificinae)	4
Orimarga	1
Orthocladius	2
Paratanytarsus	1
Polypedilum	13
Slavina	1
Smittia	2
Stenelmis	1
Stenochironomus	3
Tvetenia	1
Total Count	90

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	170.91
Remoteness	24.93
Percent Shading	78.67
Epifaunal Substrate	98.24
Instream Habitat	83.56
Instream Woody Debris	100.00
Bank Stability	100.00
PHI Score	80.90

PHI Narrative Rating: Partially Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	13
Pool Substrate Characterization	14
Pool Variability	7
Sediment Deposition	11
Channel Flow Status	18
Channel Alteration	16
Channel Sinuosity	14
Bank Stability - Left Bank	9
Right Bank	9
Vegetative Protection - Left Bank	7
Right Bank	7
Riparian Vegetative Zone Width - Left Bank	6
Right Bank	6
RBP Score	137

RBP Narrative Rating: Supporting

Land Use Analysis

Impervious Area (acres) 79.70 % Impervious 46.63

Land Use	Acres	% Area
Residential	1.08	0.63
Commercial	4.94	2.89
Industrial	92.13	53.90
Utility	5.79	3.39
Transportation	8.46	4.95
Woods	29.87	17.48
Open Space	26.33	15.41
Water	2.32	1.36

Site ID PT9-935-T-2009
Sampling Date 4/20/2009
ADC Map # 4, C-13

Watershed = Patapsco Tidal
Subwatershed = Cox Creek
Location = Wagner Station Road, southwest side treatment plant.

Upstream from Mid-Point

Downstream from Mid-Point

Wooded and industrial landuses each account for approximately one-third of the landuse surrounding site PT9-935-T-2009. No residential landuse is present, and 29% of the catchment of this Cox Creek subwatershed site is impervious. This site is located along the southwestern side of the Cox Creek wastewater treatment plant, just off of Wagner Station Road in the Patapsco Tidal watershed. Some trash was present at the site, as well as an odor of sewage likely resulting from the nearby treatment plant. Benthic community diversity was good, with 36 different taxa present in the benthic sample obtained here. A healthy number of climbers were present, but only two EPT taxa and one scraper taxa were present, resulting in a BIBI score of 2.71, Poor. Habitat conditions assessed under the RBP mainly rated in the suboptimal range, with stable banks with little to no erosion noted. The total RBP habitat score was 152, Comparable to Reference. The PHI also rated habitat conditions well, with a total score of 87, Minimally Degraded.

Results Biological Condition : Poor
Habitat Rating : RBP : Comparable to Reference MPHI : Minimally Degraded

Stream Subsystem = Perennial Stream Origin = Mixture of Origins Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	50
Runs	50
Pools	0

No Evidence of Local Watershed NPS Pollution
None Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation 0

Road Culvert Present ? No
Left Buffer Breaks Present ? No
Right Buffer Breaks Present ? No
Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	75
Boulder	0	Gravel	0	Silt	25
				Clay	0

Water Chemistry	Temperature (C)	12.7	Conductivity (mS/cm)	0.567	pH	7.2	DO (ppm)	9

Site ID PT9-935-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	36	5
EPT Taxa	2	3
% Intolerant to Urban	8.26	1
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	1	3
% Climbers	9.17	5

BIBI Score: 2.71 Rating: Poor

Taxa List

Taxa	Count
Aulodrilus	4
Caecidotea	1
Chironomus	1
Cryptochironomus	3
Culicoides	1
Diplectrona	1
Diplocladius	1
Dolichopodidae	4
Gammarus	37
Gonomyia	1
Gymnometriocnemus	1
Haliplus	1
Hemerodromia	1
Hesperocorixa	1
Hydropsyche	1
Limnodrilus	1
Limnophyes	1
Lumbricidae	6
Meropelopia	1
Molophilus	1
Naididae (Tubificinae)	4
Nais	2
Neumania	1
Orthocladius	2
Paracladopelma	2
Paraphaenocladius	2
Paratendipes	1
Polypedilum	8
Prodiamesa	2
Pseudorthocladius	3
Rheotanytarsus	1
Stenelmis	2
Stenochironomus	1
Synurella	7
Tanytarsus	1
Zavrelimyia	1
Total Count	109

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	131.76
Remoteness	51.66
Percent Shading	73.32
Epifaunal Substrate	99.94
Instream Habitat	97.32
Instream Woody Debris	100.00
Bank Stability	100.00
PHI Score	87.04

PHI Narrative Rating: Minimally Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	13
Pool Substrate Characterization	12
Pool Variability	13
Sediment Deposition	16
Channel Flow Status	16
Channel Alteration	15
Channel Sinuosity	15
Bank Stability - Left Bank	9
Right Bank	9
Vegetative Protection - Left Bank	8
Right Bank	9
Riparian Vegetative Zone Width - Left Bank	10
Right Bank	7
RBP Score	152

RBP Narrative Rating: Comparable to Reference

Land Use Analysis

Impervious Area (acres) 37.68 % Impervious 28.60

Land Use	Acres	% Area
Commercial	3.17	2.41
Industrial	43.38	32.92
Utility	5.10	3.87
Transportation	8.43	6.40
Woods	44.45	33.73
Open Space	21.03	15.96
Water	6.20	4.70

Site ID PTB-909-T-2009
Sampling Date 4/21/2009
ADC Map # 9, E-7

Watershed = Patapsco Tidal
Subwatershed = Rock Creek
Location = Tower Bridge Drive and Robin Air Court

Upstream from Mid-Point

Downstream from Mid-Point

This site in the Rock Creek subwatershed of the Patapsco Tidal watershed is surrounded by residential landuse in 64% of its catchment. Wooded landuse accounts for 20% of the catchment, and some commercial (8%) and some transportation-related landuse (4%) is also present. Approximately 30% of the catchment draining to this site is impervious surface. This site is located near the intersection of Tower Bridge Drive and Robin Air Court. A sewage line runs along the stream on the right bank and serves as a severe break in the buffer. Sewage odors were strong and field staff thought that sewage could possibly be draining into the stream. In situ pH was 6.24, slightly below the minimum state water quality standard of 6.5. The biological community at this site rated Poor under the BIBI, with a total score of 2.14. Only one pollution-sensitive EPT taxa was present in the benthic sample, and only one scraper taxa. Seventy-five percent of the benthic macroinvertebrates found at this site were considered tolerant of urban conditions. Severe bank erosion was present along some stretches of both streambanks. Epifaunal substrate rated Marginal, and channel substrate consisted mainly of sand (90%) with some silt, and was almost completely embedded. Deposition was severe with sand 30 to 50 cm deep in some places. These less than ideal habitat conditions resulted in a Partially Degraded rating under the PHI and a Partially Supporting rating under the RBP.

Results Biological Condition : Poor
Habitat Rating : RBP : Partially Supporting MPHI : Partially Degraded

Stream Subsystem = Perennial Stream Origin = Mixture of Origins Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	30
Runs	40
Pools	30

Some Potential Sources of Local Watershed NPS Pollution
Moderate Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation: 0

Road Culvert Present ? No
Left Buffer Breaks Present ? No
Right Buffer Breaks Present ? Yes
Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	90
Boulder	0	Gravel	5	Silt	5
				Clay	0

Water Chemistry	Temperature (C)	16.2	Conductivity (mS/cm)	0.225	pH	6.24	DO (ppm)	7.6

Site ID PTB-909-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	20	3
EPT Taxa	1	1
% Intolerant to Urban	23.77	3
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	1	3
% Climbers	5.74	3

BIBI Score: 2.14 Rating: Poor

Taxa List

Taxa	Count
Caecidotea	14
Calopteryx	5
Chaetocladius	4
Corduliidae	2
Corynoneura	18
Eclipidrilus	6
Enchytraeidae	1
Helichus	2
Limnephilidae	2
Limnophyes	1
Naididae (Tubificinae)	3
Nais	38
Pristina	1
Prostoma	1
Rheocricotopus	2
Simulium	1
Synurella	13
Thienemanniella	5
Tipula	1
Zavrelimyia	2
Total Count	122

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	319.38
Remoteness	91.57
Percent Shading	99.94
Epifaunal Substrate	36.07
Instream Habitat	77.16
Instream Woody Debris	100.00
Bank Stability	70.71
PHI Score	79.24

PHI Narrative Rating: Partially Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	8
Pool Substrate Characterization	6
Pool Variability	7
Sediment Deposition	2
Channel Flow Status	11
Channel Alteration	18
Channel Sinuosity	15
Bank Stability - Left Bank	5
Right Bank	3
Vegetative Protection - Left Bank	7
Right Bank	6
Riparian Vegetative Zone Width - Left Bank	8
Right Bank	9
RBP Score	105

RBP Narrative Rating: Partially Supporting

Land Use Analysis

Impervious Area (acres) 95.43 % Impervious 29.88

Land Use	Acres	% Area
Residential	205.26	64.27
Commercial	25.75	8.06
Industrial	3.09	0.97
Transportation	12.38	3.88
Woods	64.25	20.12
Open Space	8.66	2.71

Site ID PTB-910-T-2009
Sampling Date 4/21/2009
ADC Map # 9, D-7

Watershed = Patapsco Tidal
Subwatershed = Rock Creek
Location = Edwin Raynor Boulevard, north of Countryside Drive

Upstream from Mid-Point

Downstream from Mid-Point

This site is located along the east side of Edwin Raynor Boulevard, north of Countryside Drive. It is in the Rock Creek subwatershed of the Patapsco Tidal watershed. Eighty-three percent of the landuse surrounding this site is residential with some open space present (9.8%). Impervious surface accounts for just under 40% of the catchment area. From the benthic macroinvertebrate sample obtained here, biological community diversity was high, with 24 different taxa present, including three EPT taxa. No scrapers were present, however, and the overall BIBI score was 2.43, Poor. Severe bank erosion affected some stretches of both streambanks, and large amounts of litter were noted by field staff. A large amount of sand was present at this site, both in the form of channel substrate and deposition that affected channel flow status and filled pools. In general, habitat conditions were somewhat degraded, as reflected by a PHI rating of Partially Degraded (score of 77.3) and a RBP rating of Partially Supporting (score of 121). A slightly low pH level was detected at this site, with in situ pH at 6.31, just below the state's minimum water quality standard of 6.5.

Results Biological Condition : Poor
Habitat Rating : RBP : Partially Supporting MPHI : Partially Degraded

Stream Subsystem = Perennial Stream Origin = Mixture of Origins Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	30
Runs	40
Pools	30

Obvious Sources of Local Watershed NPS Pollution
Moderate Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation: 0

Road Culvert Present ? No
Left Buffer Breaks Present ? No
Right Buffer Breaks Present ? No
Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	85
Boulder	0	Gravel	10	Silt	5
				Clay	0

Water Chemistry	Temperature (C)	15.7	Conductivity (mS/cm)	0.265	pH	6.31	DO (ppm)	8.1

Site ID PTB-910-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	24	5
EPT Taxa	3	3
% Intolerant to Urban	22.41	3
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	0	1
% Climbers	6.90	3

BIBI Score: 2.43 Rating: Poor

Taxa List

Taxa	Count
Calopteryx	6
Ceratopogonidae	1
Chaetocladius	16
Chaetogaster	1
Cheumatopsyche	1
Corynoneura	7
Dolophilodes	4
Eclipidrilus	1
Enchytraeidae	2
Ironoquia	1
Lumbricidae	1
Lumbriculus	3
Naididae (Tubificinae)	3
Nais	31
Orthocladius	1
Parametriocnemus	1
Polypedilum	2
Pristina	1
Prodiamesa	1
Simulium	3
Slavina	1
Somatochlora	1
Synurella	21
Zavrelimyia	6
Total Count	116

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	303.19
Remoteness	42.78
Percent Shading	99.94
Epifaunal Substrate	82.89
Instream Habitat	83.24
Instream Woody Debris	100.00
Bank Stability	54.77
PHI Score	77.27

PHI Narrative Rating: Partially Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	11
Pool Substrate Characterization	6
Pool Variability	16
Sediment Deposition	8
Channel Flow Status	11
Channel Alteration	18
Channel Sinuosity	7
Bank Stability - Left Bank	4
Right Bank	4
Vegetative Protection - Left Bank	9
Right Bank	9
Riparian Vegetative Zone Width - Left Bank	9
Right Bank	9
RBP Score	121

RBP Narrative Rating: Partially Supporting

Land Use Analysis

Impervious Area (acres) 119.36 % Impervious 39.37

Land Use	Acres	% Area
Residential	253.54	83.62
Commercial	7.96	2.62
Transportation	10.76	3.55
Woods	29.66	9.78
Open Space	1.28	0.42

Site ID PTB-918-T-2009
Sampling Date 4/29/2009
ADC Map # 9, J-6

Watershed = Patapsco Tidal
Subwatershed = Rock Creek
Location = Tar Cove Park, north of golf course

Upstream from Mid-Point

Downstream from Mid-Point

Wooded landuse is dominant around site PTB-918-T-2009, contributing to 60% of the catchment area. Some residential (23%) and some open space (12%) landuses are also present, and overall imperviousness levels are only about 9%. This site is located in Tar Cove Park, north of Compass Point Golf Course. This is part of the Rock Creek subwatershed of the Patapsco Tidal watershed. Overall, the benthic macroinvertebrate community at this site indicates a stream in Poor condition, with a BIBI score of 2.14. The site scored well for the percent of the benthic sample considered intolerant of urban conditions (67%), but moderate community diversity and few EPT and no scraper taxa, as well as few climbers contributed to the Poor rating. Habitat at this site rated Minimally Degraded under the PHI with the highest total PHI score of all sites included in this study (90.6). Bank stability was good with no erosion present and a healthy riparian buffer width. Only small amounts of trash were noted. Epifaunal substrate and pool substrate were in the suboptimal to marginal ranges, and the overall RBP habitat score was 133, Supporting.

Results Biological Condition : Poor
Habitat Rating : RBP : Supporting MPHI : Minimally Degraded

Stream Subsystem = Perennial Stream Origin = Spring-fed Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	20
Runs	20
Pools	60

No Evidence of Local Watershed NPS Pollution
None Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation 0

Road Culvert Present ? No
Left Buffer Breaks Present ? No
Right Buffer Breaks Present ? No
Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	75
Boulder	0	Gravel	0	Silt	25
				Clay	0

Water Chemistry	Temperature (C)	15.1	Conductivity (mS/cm)	0.134	pH	8.07	DO (ppm)	8.4

Site ID PTB-918-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	18	3
EPT Taxa	1	1
% Intolerant to Urban	67.29	5
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	0	1
% Climbers	2.80	3

BIBI Score: 2.14 Rating: Poor

Taxa List

Taxa	Count
Caecidotea	37
Corynoneura	7
Dicranota	1
Diplocladius	3
Ephydridae	1
Ironoquia	1
Limnodrilus	2
Limnophyes	2
Nais	4
Natarsia	2
Paratendipes	2
Polypedilum	1
Rheocricotopus	2
Simulium	2
Sphaeriidae	1
Synurella	34
Tanytarsus	2
Zavrelimyia	3
Total Count	107

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	114.44
Remoteness	65.72
Percent Shading	99.94
Epifaunal Substrate	89.24
Instream Habitat	100.00
Instream Woody Debris	88.76
Bank Stability	100.00
PHI Score	90.61

PHI Narrative Rating: Minimally Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	13
Pool Substrate Characterization	7
Pool Variability	8
Sediment Deposition	7
Channel Flow Status	15
Channel Alteration	18
Channel Sinuosity	11
Bank Stability - Left Bank	9
Right Bank	9
Vegetative Protection - Left Bank	9
Right Bank	9
Riparian Vegetative Zone Width - Left Bank	9
Right Bank	9
RBP Score	133

RBP Narrative Rating: Supporting

Land Use Analysis

Impervious Area (acres) 10.86 % Impervious 9.49

Land Use	Acres	% Area
Residential	26.51	23.16
Commercial	1.11	0.97
Transportation	3.97	3.47
Woods	68.60	59.95
Open Space	14.25	12.45

Site ID PTC-941-T-2009
Sampling Date 4/20/2009
ADC Map # 3, B-10

Watershed = Patapsco Tidal
Subwatershed = Back Creek
Location = Chesapeake Center Drive at Glen Burnie Mall

Upstream from Mid-Point

Downstream from Mid-Point

The catchment surrounding this site had the greatest percentage of impervious surface (65%) of any site in this study. More than half of the landuse here is commercial, with another 32% residential, and 6.7% transportation-related. Only 6.8% of the surrounding landuse is wooded. This site is part of the Back Creek subwatershed in the Patapsco Tidal watershed. It is located off of Chesapeake Center Drive at the Centre at Glen Burnie shopping center, and it was littered with large amounts of trash when the field crew visited. In addition, in situ pH values at this site were 8.68, a bit above the state's maximum water quality standard of 8.5. The benthic community at this site scored among the lowest of all sites included in this survey (BIBI score of 1.57, Very Poor), which was not surprising, given the prevalence of impervious cover and the site's proximity to a large retail area. There were very few macroinvertebrates living in this stream, and only 4 taxa were present in the benthic sample, none of which were EPT taxa nor any taxa considered intolerant of urban conditions. Some bank erosion affected portions of both banks, and the riparian buffer zone width rated at the low end of suboptimal. Instream habitat, epifaunal substrate, and pool substrate showed signs of degradation, and the site rated as Partially Degraded under the PHI with a score of 68.1. Under the RBP, this site rated Supporting with a total score of 126.

Results Biological Condition : Very Poor
Habitat Rating : RBP : Supporting MPHI : Partially Degraded

Stream Subsystem = Perennial Stream Origin = Spring-fed Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	25
Runs	50
Pools	25

No Evidence of Local Watershed NPS Pollution
None Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation: 0

Road Culvert Present ? No
Left Buffer Breaks Present ? No
Right Buffer Breaks Present ? No
Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	50
Boulder	0	Gravel	10	Silt	40
				Clay	0

Water Chemistry	Temperature (C)	12.1	Conductivity (mS/cm)	0.086	pH	8.68	DO (ppm)	10.9

Site ID PTC-941-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	4	1
EPT Taxa	0	1
% Intolerant to Urban	0.00	1
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	0	1
% Climbers	25.00	5

BIBI Score: 1.57 Rating: Very Poor

Taxa List

Taxa	Count
Enchytraeidae	6
Limnodrilus	4
Naididae (Tubificinae)	5
Polypedilum	5
Total Count	20

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	346.78
Remoteness	33.89
Percent Shading	78.67
Epifaunal Substrate	47.16
Instream Habitat	81.87
Instream Woody Debris	73.25
Bank Stability	93.99
PHI Score	68.14

PHI Narrative Rating: Partially Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	10
Pool Substrate Characterization	8
Pool Variability	15
Sediment Deposition	13
Channel Flow Status	17
Channel Alteration	17
Channel Sinuosity	8
Bank Stability - Left Bank	7
Right Bank	7
Vegetative Protection - Left Bank	6
Right Bank	6
Riparian Vegetative Zone Width - Left Bank	6
Right Bank	6
RBP Score	126

RBP Narrative Rating: Supporting

Land Use Analysis

Impervious Area (acres) 226.04 % Impervious 65.18

Land Use	Acres	% Area
Residential	110.99	32.01
Commercial	183.58	52.94
Transportation	23.17	6.68
Woods	23.53	6.78
Open Space	5.51	1.59

Site ID PTC-942-T-2009

Sampling Date 4/22/2009

ADC Map # 3, E-10

Watershed = Patapsco Tidal

Subwatershed = Back Creek

Location = McLean Way, at the Bay Meadow Industrial Park

Upstream from Mid-Point

Downstream from Mid-Point

This Patapsco Tidal watershed site is located in the Back Creek subwatershed off McLean Way, at the Bay Meadow Industrial Park. Commercial landuse is the most prevalent in the surrounding catchment (36%), but a mixture of other landuses also contribute, including residential (21%), wooded (15%), and open space, industrial, and transportation (each approximately 9% of catchment area). This results in a fairly high amount of impervious surface (52% of the surrounding catchment). Likely a result of degradation associated with this urbanized area, the benthic community at this site received an overall rating of Very Poor, with a BIBI score of 1.86. Benthos exhibited a moderate community diversity, with EPT and scraper taxa lacking, and only one macroinvertebrate considered intolerant of urban conditions. The sampled reach contained no riffles, and very little instream wood, thus benthic habitat was lacking. Bank erosion affected both streambanks, and sand dominated the substrate material. Some SAV was present at the site. Under the PHI, habitat rated Degraded with a score of 61.4. Under the RBP, habitat rated Partially Supporting (score of 116).

Results Biological Condition : Very Poor

Habitat Rating : RBP : Partially Supporting MPHI : Degraded

Stream Subsystem = Perennial Stream Origin = Swamp and Bog Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	0
Runs	80
Pools	20

No Evidence of Local Watershed NPS Pollution

None Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation 3

Road Culvert Present ? No

Left Buffer Breaks Present ? No

Right Buffer Breaks Present ? No

Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	100
Boulder	0	Gravel	0	Silt	0
				Clay	0

Water Chemistry	Temperature (C)	14	Conductivity (mS/cm)	0.402	pH	6.98	DO (ppm)	8.4

Site ID PTC-942-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	21	3
EPT Taxa	0	1
% Intolerant to Urban	1.02	1
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	0	1
% Climbers	10.20	5

BIBI Score: 1.86 Rating: Very Poor

Taxa List

Taxa	Count
Caecidotea	1
Chaetocladius	5
Chironomus	7
Crambidae	1
Cryptochironomus	2
Culicoides	1
Dicrotendipes	4
Eclipidrilus	2
Enchytraeidae	7
Gammarus	15
Limnodrilus	9
Lumbriculus	2
Naididae (Tubificinae)	21
Nais	3
Orthocladius	2
Peltodytes	1
Pisidium	2
Polypedilum	8
Sciomyzidae	1
Sphaeriidae	3
Unionicola	1
Total Count	98

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	824.65
Remoteness	46.55
Percent Shading	49.95
Epifaunal Substrate	70.56
Instream Habitat	56.35
Instream Woody Debris	54.57
Bank Stability	90.37
PHI Score	61.39

PHI Narrative Rating: Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	10
Pool Substrate Characterization	8
Pool Variability	14
Sediment Deposition	11
Channel Flow Status	17
Channel Alteration	11
Channel Sinuosity	11
Bank Stability - Left Bank	6
Right Bank	4
Vegetative Protection - Left Bank	5
Right Bank	5
Riparian Vegetative Zone Width - Left Bank	6
Right Bank	8
RBP Score	116

RBP Narrative Rating: Partially Supporting

Land Use Analysis

Impervious Area (acres) 429.40 % Impervious 52.07

Land Use	Acres	% Area
Residential	174.82	21.20
Commercial	300.17	36.40
Industrial	73.17	8.87
Transportation	73.31	8.89
Woods	126.99	15.40
Open Space	74.27	9.01
Water	1.91	0.23

Site ID PTD-922-T-2009
Sampling Date 4/21/2009
ADC Map # 7, E-4

Watershed = Patapsco Tidal
Subwatershed = Sawmill Creek 2
Location = Queenstown Park

Upstream from Mid-Point

Downstream from Mid-Point

This site is located at Queenstown Park, and is part of the Sawmill Creek 2 subwatershed leading to the Patapsco Tidal watershed. The most prevalent landuses surrounding this site are residential and wooded, each accounting for approximately 37% of the surrounding catchment area, and approximately 17% of the catchment is impervious. The benthic community at this site scored the highest out of all sites in this study, with a total BIBI score of 4.14. A healthy, diverse community, with healthy numbers of EPT and scraper taxa, and a good proportion of climbers contributed to this Good rating. A minimal amount of bank erosion was present along both banks, and very little trash was noted by the field crew. However, deep pools were missing and sediment deposition and pool substrate each rated Marginal. Overall, the habitat at this site rated Partially Degraded according to the PHI (score of 79.3) and Supporting according to the RBP (score of 131).

Results Biological Condition : Good
Habitat Rating : RBP : Supporting MPHI : Partially Degraded

Stream Subsystem = Perennial Stream Origin = Spring-fed Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	60
Runs	30
Pools	10

No Evidence of Local Watershed NPS Pollution
None Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation: 0

Road Culvert Present ? No
Left Buffer Breaks Present ? No
Right Buffer Breaks Present ? No
Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	75
Boulder	0	Gravel	20	Silt	5
				Clay	0

Water Chemistry	Temperature (C)	11.2	Conductivity (mS/cm)	0.157	pH	8.37	DO (ppm)	10.7

Site ID PTD-922-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	37	5
EPT Taxa	4	3
% Intolerant to Urban	29.20	5
# Ephemeroptera	2	3
% Ephemeroptera	1.77	3
# Scraper	5	5
% Climbers	14.16	5

BIBI Score: 4.14 Rating: Good

Taxa List

Taxa	Count
Acerpenna	2
Aedes	1
Amphinemura	1
Aulodrilus	3
Caecidotea	7
Ceratopogon	3
Corduliidae	1
Corynoneura	3
Cryptochironomus	1
Dicranota	2
Dubiraphia	1
Eclipidrilus	1
Enchytraeidae	2
Hyalella	1
Hydrobaenus	1
Hydrobius	2
Ironoquia	12
Kloosia	2
Limnodrilus	1
Lumbriculus	1
Lype	1
Microvelia	1
Naididae (Tubificinae)	2
Nais	14
Orthocladius	1
Paracladopelma	2
Physa	1
Pisidium	7
Polypedilum	12
Pseudorthocladius	1
Ptychopteridae	1
Simulium	1
Smittia	1
Stenelmis	1
Synurella	17
Tanytarsus	1
Tipula	1
Total Count	113

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	1082.06
Remoteness	62.52
Percent Shading	99.94
Epifaunal Substrate	74.60
Instream Habitat	92.41
Instream Woody Debris	51.49
Bank Stability	94.87
PHI Score	79.31

PHI Narrative Rating: Partially Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	11
Pool Substrate Characterization	8
Pool Variability	8
Sediment Deposition	10
Channel Flow Status	17
Channel Alteration	18
Channel Sinuosity	9
Bank Stability - Left Bank	9
Right Bank	9
Vegetative Protection - Left Bank	7
Right Bank	7
Riparian Vegetative Zone Width - Left Bank	9
Right Bank	9
RBP Score	131

RBP Narrative Rating: Supporting

Land Use Analysis

Impervious Area (acres) 191.38 % Impervious 17.69

Land Use	Acres	% Area
Residential	404.54	37.39
Commercial	41.34	3.82
Industrial	40.39	3.73
Utility	2.44	0.23
Transportation	46.47	4.29
Row Crops	5.26	0.49
Woods	397.79	36.76
Open Space	140.79	13.01
Water	3.03	0.28

Site ID PTD-924-T-2009
Sampling Date 4/21/2009
ADC Map # 7, E-3

Watershed = Patapsco Tidal
Subwatershed = Sawmill Creek 2
Location = Friendship Park

Upstream from Mid-Point

Downstream from Mid-Point

This Friendship Park site is part of the Sawmill Creek 2 subwatershed in the Patapsco Tidal watershed. Industrial landuse contributes to 31% of the catchment area, followed by wooded and open space, which each account for approximately 25%. The overall catchment impervious percentage is 38%. Benthic macroinvertebrates sampled at this site indicate a fairly healthy stream, with an overall BIBI score of 3.57 (Fair). There was good community diversity, with moderate amounts of EPT taxa present, but overall very few macroinvertebrates considered intolerant of urban conditions. A minimal amount of bank erosion was present along both streambanks, while moderate amounts of sediment deposition affected substrate. Instream wood was completely absent and only one piece of dewatered wood was present in the reach. Habitat was rated Partially Degraded (76.3) under the PHI and Supporting (129) under the RBP.

Results Biological Condition : Fair
Habitat Rating : RBP : Supporting MPHI : Partially Degraded

Stream Subsystem = Perennial Stream Origin = Spring-fed Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	25
Runs	50
Pools	25

No Evidence of Local Watershed NPS Pollution
None Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation 0

Road Culvert Present ? No
Left Buffer Breaks Present ? No
Right Buffer Breaks Present ? No
Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	60
Boulder	0	Gravel	40	Silt	0
				Clay	0

Water Chemistry	Temperature (C)	12.8	Conductivity (mS/cm)	0.233	pH	8.07	DO (ppm)	10.8

Site ID PTD-924-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	38	5
EPT Taxa	4	3
% Intolerant to Urban	6.92	1
# Ephemeroptera	4	5
% Ephemeroptera	3.08	3
# Scraper	5	5
% Climbers	2.31	3

BIBI Score: 3.57 Rating: Fair

Taxa List

Taxa	Count
Ablabesmyia	1
Aulodrilus	3
Bezzia	5
Caenis	3
Calopteryx	1
Chaetogaster	9
Conchapelopia	1
Corbicula	31
Corynoneura	1
Cryptochironomus	1
Culicoides	1
Diplocladius	8
Eurylophella	1
Girardia	1
Gomphus	1
Gymnometriocnemus	3
Hyalella	3
Krenosmittia	1
Larsia	2
Lymnaea	1
Macronychus	1
Microvelia	1
Nais	6
Neoporus	1
Orthocladius	3
Oulimnius	1
Parametriocnemus	4
Paratanytarsus	1
Peltodytes	1
Polycentropus	1
Pristina	11
Probezzia	1
Procladius	1
Slavina	3
Stenelmis	11
Thienemanniella	1
Triaenodes	1
Turbellaria	3
Total Count	130

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	247.74
Remoteness	37.50
Percent Shading	91.34
Epifaunal Substrate	84.20
Instream Habitat	90.86
Instream Woody Debris	59.31
Bank Stability	94.87
PHI Score	76.35

PHI Narrative Rating: Partially Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	12
Pool Substrate Characterization	7
Pool Variability	7
Sediment Deposition	11
Channel Flow Status	16
Channel Alteration	18
Channel Sinuosity	10
Bank Stability - Left Bank	9
Right Bank	9
Vegetative Protection - Left Bank	6
Right Bank	6
Riparian Vegetative Zone Width - Left Bank	9
Right Bank	9
RBP Score	129

RBP Narrative Rating: Supporting

Land Use Analysis

Impervious Area (acres) 94.70 % Impervious 38.22

Land Use	Acres	% Area
Residential	12.30	4.96
Commercial	1.59	0.64
Industrial	77.78	31.39
Transportation	16.89	6.82
Airport	14.17	5.72
Woods	63.77	25.74
Open Space	59.74	24.12
Water	1.51	0.61

Site ID PTD-928-T-2009
Sampling Date 4/21/2009
ADC Map # 7, H-2

Watershed = Patapsco Tidal
Subwatershed = Sawmill Creek 2
Location = Between Sawmill Creek Park and Glenview Avenue

Upstream from Mid-Point

Downstream from Mid-Point

Landuse around this site is mainly a mixture of wooded (35%), residential (24%), and open space (22%), but a variety of other landuses are present in small amounts, resulting in 21% impervious surface in the catchment. This site is between Sawmill Creek Park and Glenview Avenue, in the Sawmill Creek 2 subwatershed of the Patapsco Tidal drainage. Beaver activity was obvious at this site, and a landowner expressed concern to the field crew about possible damage caused by beavers. Mowed lawn adjacent to the stream resulted in a partially open canopy (only 45% shading) and a poor riparian vegetative zone width, particularly along the right bank. Embeddedness was low and some SAV was present. Habitat rated Degraded under the PHI with a score of 58.3 and Partially Supporting under the RBP with a score of 117 (58.5% comparable to reference). The benthic community at this site was diverse, with 26 different taxa found in the benthic sample. Some EPT taxa were present, but no scrapers, and only a few macroinvertebrates intolerant of urban conditions. Overall, the BIBI score was 2.43 (Poor).

Results Biological Condition : Poor
Habitat Rating : RBP : Partially Supporting MPHI : Degraded

Stream Subsystem = Perennial Stream Origin = Spring-fed Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	30
Runs	40
Pools	30

No Evidence of Local Watershed NPS Pollution
None Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation 25

Road Culvert Present ? No
Left Buffer Breaks Present ? No
Right Buffer Breaks Present ? No
Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	60
Boulder	0	Gravel	20	Silt	20
				Clay	0

Water Chemistry	Temperature (C)	15.2	Conductivity (mS/cm)	0.208	pH	7.96	DO (ppm)	10.4

Site ID PTD-928-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	26	5
EPT Taxa	4	3
% Intolerant to Urban	3.81	1
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	0	1
% Climbers	12.38	5

BIBI Score: 2.43 Rating: Poor

Taxa List

Taxa	Count
Aulodrilus	3
Caecidotea	2
Chimarra	1
Crangonyx	2
Cryptochironomus	1
Diplectrona	1
Enchytraeidae	3
Gammarus	52
Ironoquia	2
Isotomidae	1
Lebertia	1
Lepidostoma	1
Mallochohelea	1
Naididae (Tubificinae)	8
Nais	1
Orthocladiinae	1
Orthocladius	1
Paraphaenocladius	1
Pericoma/Telmatoscopus	1
Polypedilum	10
Pristina	1
Simulium	2
Smittia	1
Sphaeriidae	3
Tanytarsus	2
Thienemanniimyia group	2
Total Count	105

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	2637.77
Remoteness	37.50
Percent Shading	45.47
Epifaunal Substrate	28.13
Instream Habitat	94.39
Instream Woody Debris	44.36
Bank Stability	100.00
PHI Score	58.31

PHI Narrative Rating: Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	8
Pool Substrate Characterization	7
Pool Variability	10
Sediment Deposition	10
Channel Flow Status	17
Channel Alteration	18
Channel Sinuosity	10
Bank Stability - Left Bank	9
Right Bank	9
Vegetative Protection - Left Bank	5
Right Bank	3
Riparian Vegetative Zone Width - Left Bank	9
Right Bank	2
RBP Score	117

RBP Narrative Rating: Partially Supporting

Land Use Analysis

Impervious Area (acres) 556.45 % Impervious 21.10

Land Use	Acres	% Area
Residential	639.55	24.25
Commercial	80.81	3.06
Industrial	127.72	4.84
Utility	14.47	0.55
Transportation	163.56	6.20
Airport	92.34	3.50
Row Crops	5.26	0.20
Woods	922.18	34.96
Open Space	586.44	22.23
Water	5.44	0.21

Site ID PTF-915-T-2009
Sampling Date 4/23/2009
ADC Map # 8, C-6

Watershed = Patapsco Tidal
Subwatershed = Marley Creek 3
Location = Marley Station Mall

Upstream from Mid-Point

Downstream from Mid-Point

This site can be accessed from the Marley Station Mall, in the northwest corner of the parking lot. It is part of the Marley Creek 3 subwatershed in the Patapsco Tidal watershed. Most of the landuse in the surrounding area is residential (55%) and wooded (18%), and the shopping center and other commercial areas contribute to about 11% of the catchment area. This results in 36% impervious surface in the surrounding catchment. Benthic community diversity was somewhat diminished at this site, and no macroinvertebrates considered intolerant to urban conditions and no scraper taxa were obtained through benthic sampling. The site received a BIBI score of 2.14 (Poor). Field crew members noted large amounts of trash present at the time of sampling. Channel substrate was dominated by silt (60%) with some sand and gravel, and sediment deposition rated Marginal. Thus epifaunal substrate, pool substrate, and instream habitat conditions were all less than ideal. Habitat overall was rated Degraded under the PHI (57.7) and Supporting under the RBP habitat assessment procedure (score of 139).

Results Biological Condition : Poor
Habitat Rating : RBP : Supporting MPHI : Degraded

Stream Subsystem = Perennial Stream Origin = Spring-fed Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	5
Runs	15
Pools	80

No Evidence of Local Watershed NPS Pollution
None Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation 5

Road Culvert Present ? No
Left Buffer Breaks Present ? No
Right Buffer Breaks Present ? No
Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	20
Boulder	0	Gravel	20	Silt	60
				Clay	0

Water Chemistry	Temperature (C)	12.2	Conductivity (mS/cm)	0.225	pH	8.1	DO (ppm)	10.7

Site ID PTF-915-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	16	3
EPT Taxa	2	3
% Intolerant to Urban	0.00	1
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	0	1
% Climbers	14.16	5

BIBI Score: 2.14 Rating: Poor

Taxa List

Taxa	Count
Argia	1
Brillia	1
Cheumatopsyche	34
Cladotanytarsus	5
Corynoneura	6
Cricotopus	2
Enallagma	1
Hydropsyche	22
Limnodrilus	1
Naididae (Tubificinae)	3
Nais	2
Polypedilum	15
Pristina	1
Rheotanytarsus	1
Stenochironomus	16
Tvetenia	2
Total Count	113

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	2638.60
Remoteness	37.50
Percent Shading	63.55
Epifaunal Substrate	33.94
Instream Habitat	61.10
Instream Woody Debris	50.27
Bank Stability	100.00
PHI Score	57.72

PHI Narrative Rating: Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	11
Pool Substrate Characterization	11
Pool Variability	12
Sediment Deposition	7
Channel Flow Status	18
Channel Alteration	18
Channel Sinuosity	10
Bank Stability - Left Bank	8
Right Bank	9
Vegetative Protection - Left Bank	9
Right Bank	8
Riparian Vegetative Zone Width - Left Bank	9
Right Bank	9
RBP Score	139

RBP Narrative Rating: Supporting

Land Use Analysis

Impervious Area (acres) 941.23 % Impervious 35.67

Land Use	Acres	% Area
Residential	1446.50	54.82
Commercial	291.42	11.04
Industrial	14.18	0.54
Utility	17.99	0.68
Transportation	178.66	6.77
Pasture/Hay	2.96	0.11
Row Crops	52.57	1.99
Woods	490.81	18.60
Open Space	139.88	5.30
Water	3.63	0.14

Site ID PTF-D15-T-2009
Sampling Date 4/23/2009
ADC Map # 8, B-6

Watershed = Patapsco Tidal
Subwatershed = Marley Creek 3
Location = Marley Station Mall

Upstream from Mid-Point

Downstream from Mid-Point

This is a replicate sample for site PTF-915-T-2009

Results Biological Condition : Fair
Habitat Rating : RBP : Partially Supporting MPHI : Degraded

Stream Subsystem = Perennial Stream Origin = Spring-fed Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	15
Runs	25
Pools	60

No Evidence of Local Watershed NPS Pollution
Moderate Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation 10

Road Culvert Present ? No
Left Buffer Breaks Present ? No
Right Buffer Breaks Present ? No
Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	70
Boulder	0	Gravel	5	Silt	25
				Clay	0

Water Chemistry	Temperature (C)	22.9	Conductivity (mS/cm)	0.287	pH	6.82	DO (ppm)	6.9

Site ID PTF-D15-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	35	5
EPT Taxa	1	1
% Intolerant to Urban	15.25	3
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	4	5
% Climbers	27.12	5

BIBI Score: 3.00 Rating: Fair

Taxa List

Taxa	Count
Ablabesmyia	1
Ancyronyx	7
Argia	1
Atrichopogon	1
Aulodrilus	1
Chironomus	1
Cladopelma	3
Cladotanytarsus	3
Conchapelopia	1
Cricotopus	10
Cryptochironomus	5
Diplocladius	1
Dubiraphia	1
Enchytraeidae	1
Lepidoptera	1
Limnodrilus	1
Macronychus	2
Naididae (Tubificinae)	5
Nais	2
Nanocladius	1
Orthocladius	2
Parakiefferiella	6
Paratendipes	3
Phaenopsectra	3
Polypedilum	32
Probezzia	12
Pseudorthocladius	1
Smittia	1
Sphaeriidae	1
Stenelmis	1
Stenochironomus	1
Thienemanniella	1
Thienemannimyia group	1
Triaenodes	1
Tribelos	3
Total Count	118

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	2638.60
Remoteness	28.28
Percent Shading	68.32
Epifaunal Substrate	51.36
Instream Habitat	55.55
Instream Woody Debris	50.27
Bank Stability	77.46
PHI Score	55.21

PHI Narrative Rating: Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	10
Pool Substrate Characterization	11
Pool Variability	10
Sediment Deposition	5
Channel Flow Status	11
Channel Alteration	18
Channel Sinuosity	6
Bank Stability - Left Bank	8
Right Bank	8
Vegetative Protection - Left Bank	5
Right Bank	8
Riparian Vegetative Zone Width - Left Bank	9
Right Bank	9
RBP Score	118

RBP Narrative Rating: Partially Supporting

Land Use Analysis

Impervious Area (acres) 941.23 % Impervious 35.67

Land Use	Acres	% Area
Residential	1446.50	54.82
Commercial	291.42	11.04
Industrial	14.18	0.54
Utility	17.99	0.68
Transportation	178.66	6.77
Pasture/Hay	2.96	0.11
Row Crops	52.57	1.99
Woods	490.81	18.60
Open Space	139.88	5.30
Water	3.63	0.14

Site ID PTG-903-T-2009

Sampling Date 4/20/2009

ADC Map # 8, C-10

Watershed = Patapsco Tidal

Subwatershed = Marley Creek 4

Location = Williamstowne Drive, between Mali Court and Williamstowne Court

Upstream from Mid-Point

Downstream from Mid-Point

This Marley Creek 4 site is located in the Patapsco Tidal watershed, off of Williamstowne Drive, between Mali Court and Williamstowne Court. At this site, residential landuse dominates the surrounding catchment, contributing to 87% of the catchment area. Twenty-nine percent of the catchment consists of impervious surfaces. Riparian buffer was lacking on the right side of the stream, likely resulting in unstable, erosive banks. In fact, a landowner near this site expressed concern that the erosion is so great that the stream might erode into his property. Moderate amounts of trash were present, along with some SAV. With some cobble in the channel substrate and a good proportion of riffles throughout the reach, epifaunal substrate rated Suboptimal, as did pool substrate. Overall, the RBP rated habitat at this site as Supporting, with a score of 126, while the PHI rated it as Partially Degraded with a score of 75.2. With an overall BIBI score of 3.86, this site rated Fair according to the benthic macroinvertebrate community obtained here. There were 7 different EPT taxa in the benthic sample, the most EPT taxa found at any site in this study. Community diversity was good, and approximately 25% of the macroinvertebrates in the sample were considered intolerant of urban conditions.

Results Biological Condition : Fair

Habitat Rating : RBP : Supporting MPHI : Partially Degraded

Stream Subsystem = Perennial Stream Origin = Spring-fed Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	50
Runs	40
Pools	10

No Evidence of Local Watershed NPS Pollution

Moderate Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation: 5

Road Culvert Present ? No

Left Buffer Breaks Present ? No

Right Buffer Breaks Present ? No

Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	15	Sand	0
Boulder	0	Gravel	0	Silt	60
				Clay	25

Water Chemistry	Temperature (C)	11.1	Conductivity (mS/cm)	0.105	pH	8.4	DO (ppm)	10.3

Site ID PTG-903-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	23	5
EPT Taxa	7	5
% Intolerant to Urban	23.58	3
# Ephemeroptera	2	5
% Ephemeroptera	1.89	3
# Scraper	1	3
% Climbers	0.94	3

BIBI Score: 3.86 Rating: Fair

Taxa List

Taxa	Count
Acentrella	1
Amphinemura	1
Antocha	1
Chaetocladius	37
Cheumatopsyche	1
Diplocladius	2
Enchytraeidae	1
Ephemerella	1
Eukiefferiella	3
Hydrobaenus	2
Ironoquia	1
Lebertia	1
Lumbricidae	2
Naididae (Tubificinae)	6
Nais	7
Orthocladius	9
Polypedilum	1
Pseudosmittia	1
Shipsa	1
Simulium	1
Stactobiella	1
Stygobromus	3
Synurella	22
Total Count	106

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	167.96
Remoteness	24.93
Percent Shading	78.67
Epifaunal Substrate	92.55
Instream Habitat	100.00
Instream Woody Debris	69.62
Bank Stability	85.15
PHI Score	75.15

PHI Narrative Rating: Partially Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	15
Pool Substrate Characterization	14
Pool Variability	13
Sediment Deposition	8
Channel Flow Status	18
Channel Alteration	16
Channel Sinuosity	14
Bank Stability - Left Bank	6
Right Bank	3
Vegetative Protection - Left Bank	6
Right Bank	3
Riparian Vegetative Zone Width - Left Bank	9
Right Bank	1
RBP Score	126

RBP Narrative Rating: Supporting

Land Use Analysis

Impervious Area (acres) 49.33 % Impervious 29.37

Land Use	Acres	% Area
Residential	146.40	87.16
Transportation	6.96	4.15
Woods	12.09	7.20
Open Space	2.51	1.49

Site ID PTG-905-T-2009
Sampling Date 4/20/2009
ADC Map # 7, J-9

Watershed = Patapsco Tidal
Subwatershed = Marley Creek 4
Location = Between Nolberry Drive and Phirne Drive

Upstream from Mid-Point

Downstream from Mid-Point

A variety of landuses contribute to the catchment area here, including residential (29%), commercial (23%), and wooded (18%). In addition, row crop landuse is present in the surrounding catchment, contributing 9.5% of total area – the largest proportion of row crop landuse of sites included in this survey. Impervious surfaces occupy 39% of the surrounding catchment. This site is located in open space between Nolberry Drive and Phirne Drive, and is part of the Marley Creek 4 subwatershed of the Patapsco Tidal watershed. The stream is located very close to the road and the field crew noted large amounts of trash present. The benthic community at this site revealed less than ideal conditions, as only one EPT taxa and only one scraper taxa were present in the benthic sample, and no climbers were found. In addition, less than 2% of the macroinvertebrates sampled were considered intolerant of urban conditions. Overall, the BIBI rated this site as Very Poor, with a score of 1.57. Some erosion was present along both banks, and the stream exhibited some channelization in the vicinity of a 5-meter wide and 18-meter long culvert. Under the PHI, habitat at this site scored 76.4 (Partially Degraded), and under the RBP, it scored 143 (Supporting).

Results Biological Condition : Very Poor
Habitat Rating : RBP : Supporting MPHI : Partially Degraded

Stream Subsystem = Perennial Stream Origin = Spring-fed Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	60
Runs	30
Pools	10

No Evidence of Local Watershed NPS Pollution
None Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation: 0

Road Culvert Present ? Yes
Left Buffer Breaks Present ? No
Right Buffer Breaks Present ? No
Evidence of Channel Straightening or Dredging ? Yes

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	50
Boulder	0	Gravel	35	Silt	15
				Clay	0

Water Chemistry	Temperature (C)	11.5	Conductivity (mS/cm)	0.103	pH	8.49	DO (ppm)	11.2

Site ID PTG-905-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	17	3
EPT Taxa	1	1
% Intolerant to Urban	1.92	1
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	1	3
% Climbers	0.00	1

BIBI Score: 1.57 Rating: Very Poor

Taxa List

Taxa	Count
Amphinemura	1
Culicoides	1
Enchytraeidae	15
Hydrobaenus	1
Isotomidae	2
Lebertia	1
Lumbricidae	2
Lumbriculus	3
Megascolecidae	2
Naididae (Tubificinae)	1
Nais	7
Orthocladius	1
Prostoma	1
Pseudorthocladius	5
Pseudosmittia	2
Smittia	2
Sphaeriidae	5
Total Count	52

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	293.40
Remoteness	3.31
Percent Shading	91.34
Epifaunal Substrate	100.00
Instream Habitat	100.00
Instream Woody Debris	72.18
Bank Stability	91.29
PHI Score	76.35

PHI Narrative Rating: Partially Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	17
Pool Substrate Characterization	13
Pool Variability	11
Sediment Deposition	17
Channel Flow Status	17
Channel Alteration	12
Channel Sinuosity	9
Bank Stability - Left Bank	7
Right Bank	8
Vegetative Protection - Left Bank	6
Right Bank	8
Riparian Vegetative Zone Width - Left Bank	9
Right Bank	9
RBP Score	143

RBP Narrative Rating: Supporting

Land Use Analysis

Impervious Area (acres) 113.36 % Impervious 38.64

Land Use	Acres	% Area
Residential	83.63	28.51
Commercial	69.94	23.84
Industrial	10.28	3.50
Utility	1.99	0.68
Transportation	20.62	7.03
Row Crops	27.82	9.48
Woods	51.52	17.56
Open Space	23.97	8.17
Water	3.63	1.24

Site ID PTG-908-T-2009
Sampling Date 4/23/2009
ADC Map # 7, K-7

Watershed = Patapsco Tidal
Subwatershed = Marley Creek 4
Location = Elvaton Road

Upstream from Mid-Point

Downstream from Mid-Point

This site is part of the Marley Creek 4 subwatershed in the Patapsco Tidal watershed. Residential landuse is the most prevalent here, contributing 55% of catchment area. Wooded and commercial landuse contribute 15% and 12%, respectively, and the overall imperviousness is 37%. This site had the greatest benthic community diversity of all sites in the study, with 42 different taxa present. Only 8% of the macroinvertebrates were considered intolerant of urban conditions, and the site rated Fair overall (BIBI score of 3.57). Some erosion was present along both banks, and lots of deposition was present throughout the channel. Channel substrate and deposition both consisted of large amounts of sand. The site was located very close to road, and field staff noted moderate amounts of trash present, along with some algae. Overall the PHI rated habitat at this site as Degraded (score of 64.3), and the RBP rated habitat as Supporting (score of 137).

Results Biological Condition : Fair
Habitat Rating : RBP : Supporting MPHI : Degraded

Stream Subsystem = Perennial Stream Origin = Spring-fed Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	20
Runs	40
Pools	40

No Evidence of Local Watershed NPS Pollution
None Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation 10

Road Culvert Present ? No
Left Buffer Breaks Present ? No
Right Buffer Breaks Present ? No
Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	65
Boulder	0	Gravel	10	Silt	25
				Clay	0

Water Chemistry	Temperature (C)	15.3	Conductivity (mS/cm)	0.214	pH	7.84	DO (ppm)	9.6

Site ID PTG-908-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	42	5
EPT Taxa	3	3
% Intolerant to Urban	8.41	1
# Ephemeroptera	1	3
% Ephemeroptera	0.93	3
# Scraper	5	5
% Climbers	10.28	5

BIBI Score: 3.57 Rating: Fair

Taxa List

Taxa	Count
Ablabesmyia	1
Argia	3
Aulodrilus	1
Brillia	1
Caecidotea	1
Calopteryx	2
Chaetogaster	6
Cheumatopsyche	4
Chironomus	1
Crangonyx	2
Cricotopus	6
Dicrotendipes	1
Dubiraphia	3
Enchytraeidae	2
Eurylophella	1
Gonomyia	1
Macronychus	4
Microvelia	2
Naididae (Tubificinae)	3
Nais	18
Orthocladiinae	1
Orthocladius	10
Parakiefferiella	2
Paraphaenocladius	1
Phaenopsectra	1
Physa	1
Pisidium	2
Polypedilum	7
Ptilostomis	1
Rheocricotopus	1
Simulium	1
Slavina	2
Smittia	1
Somatochlora	2
Sphaeriidae	1
Spirosperma	1
Stenelmis	1
Stenochironomus	1
Synurella	4
Thienemanniella	1
Tipula	1
Tvetenia	1
Total Count	107

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	1554.46
Remoteness	3.31
Percent Shading	91.34
Epifaunal Substrate	72.24
Instream Habitat	83.16
Instream Woody Debris	50.35
Bank Stability	85.64
PHI Score	64.34

PHI Narrative Rating: Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	11
Pool Substrate Characterization	8
Pool Variability	15
Sediment Deposition	5
Channel Flow Status	18
Channel Alteration	18
Channel Sinuosity	10
Bank Stability - Left Bank	8
Right Bank	8
Vegetative Protection - Left Bank	9
Right Bank	9
Riparian Vegetative Zone Width - Left Bank	9
Right Bank	9
RBP Score	137

RBP Narrative Rating: Supporting

Land Use Analysis

Impervious Area (acres) 580.94 % Impervious 37.37

Land Use	Acres	% Area
Residential	857.74	55.18
Commercial	189.90	12.22
Industrial	13.62	0.88
Utility	5.09	0.33
Transportation	104.80	6.74
Row Crops	36.59	2.35
Woods	232.81	14.98
Open Space	110.29	7.09
Water	3.63	0.23

Site ID PTG-939-T-2009
Sampling Date 4/27/2009
ADC Map # 8, B-8

Watershed = Patapsco Tidal
Subwatershed = Marley Creek 4
Location = Cross Creek Drive

Upstream from Mid-Point

Downstream from Mid-Point

More than half of the catchment surrounding site PTG-939-T-2009 consists of residential landuse, with 36% wooded landuse. This results in 19.6% imperviousness in this catchment. The site can be accessed through a wooded lot on the right side of Cross Creek Drive. It is part of the Marley Creek 4 subwatershed in the Patapsco Tidal watershed. The benthic community at this site received a Fair rating with a BIBI score of 3.00. A diverse benthic community was present, with healthy numbers of scrapers, but less than 1% of the macroinvertebrates were considered intolerant of urban conditions. Both epifaunal and pool substrate were less than ideal, as the channel substrate consisted of 60% silt and 40% sand, with large amounts of deposition. Moderate amounts of trash were present at the site, and deep pools were lacking. Habitat rated Partially Degraded under the PHI and Partially Supporting under the RBP (scores of 70 and 118, respectively).

Results Biological Condition : Fair
Habitat Rating : RBP : Partially Supporting MPHI : Partially Degraded

Stream Subsystem = Perennial
Stream Origin = Spring-fed
Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	40
Runs	55
Pools	5

No Evidence of Local Watershed NPS Pollution
None Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation: 0

Road Culvert Present ? No
Left Buffer Breaks Present ? No
Right Buffer Breaks Present ? No
Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	40
Boulder	0	Gravel	0	Silt	60
				Clay	0

Water Chemistry	Temperature (C)	19.2	Conductivity (mS/cm)	0.181	pH	7.06	DO (ppm)	8.6

Site ID PTG-939-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	25	5
EPT Taxa	1	1
% Intolerant to Urban	0.91	1
# Ephemeroptera	1	3
% Ephemeroptera	0.91	3
# Scraper	3	5
% Climbers	3.64	3

BIBI Score: 3.00 Rating: Fair

Taxa List

Taxa	Count
Acentrella	1
Ancyronyx	2
Aulodrilus	5
Chaetocladius	1
Chaetogaster	4
Cricotopus	1
Cryptochironomus	1
Culicoides	1
Diplocladius	1
Eclipidrilus	1
Limnodrilus	1
Macronychus	2
Micropsectra	1
Naididae (Tubificinae)	28
Nais	28
Orthocladius	4
Paratendipes	4
Physa	2
Pisidium	2
Polypedilum	1
Rheotanytarsus	2
Rhyacodrilus	1
Slavina	14
Sphaeriidae	1
Tipula	1
Total Count	110

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	340.87
Remoteness	38.62
Percent Shading	78.67
Epifaunal Substrate	47.27
Instream Habitat	82.04
Instream Woody Debris	73.44
Bank Stability	100.00
PHI Score	70.01

PHI Narrative Rating: Partially Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	5
Pool Substrate Characterization	7
Pool Variability	5
Sediment Deposition	5
Channel Flow Status	16
Channel Alteration	18
Channel Sinuosity	8
Bank Stability - Left Bank	9
Right Bank	9
Vegetative Protection - Left Bank	9
Right Bank	9
Riparian Vegetative Zone Width - Left Bank	9
Right Bank	9
RBP Score	118

RBP Narrative Rating: Partially Supporting

Land Use Analysis

Impervious Area (acres) 66.90 % Impervious 19.62

Land Use	Acres	% Area
Residential	178.74	52.44
Commercial	0.75	0.22
Transportation	12.20	3.58
Pasture/Hay	2.96	0.87
Row Crops	15.97	4.69
Woods	124.15	36.42
Open Space	6.10	1.79

Site ID PTG-D39-T-2009
Sampling Date 4/27/2009
ADC Map # 3, J-10

Watershed = Patapsco Tidal
Subwatershed = Marley Creek 4
Location = Cross Creek Drive

Upstream from Mid-Point

Downstream from Mid-Point

This is a replicate sample for site PTG-939-T-2009

Results Biological Condition : Fair
Habitat Rating : RBP : Partially Supporting MPHI : Partially Degraded

Stream Subsystem = Perennial Stream Origin = Spring-fed Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	50
Runs	40
Pools	10

No Evidence of Local Watershed NPS Pollution
None Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation: 0

Road Culvert Present ? No
Left Buffer Breaks Present ? No
Right Buffer Breaks Present ? No
Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	10
Boulder	0	Gravel	5	Silt	60
				Clay	25

Water Chemistry	Temperature (C)	22.7	Conductivity (mS/cm)	0.201	pH	6.89	DO (ppm)	7.8

Site ID PTG-D39-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	21	3
EPT Taxa	2	3
% Intolerant to Urban	1.85	1
# Ephemeroptera	1	3
% Ephemeroptera	0.93	3
# Scraper	4	5
% Climbers	12.96	5

BIBI Score: 3.29 Rating: Fair

Taxa List

Taxa	Count
Argia	2
Brillia	2
Chaetogaster	8
Cordulidae	1
Eclipidrilus	5
Enchytraeidae	1
Eurylophella	1
Ironoquia	1
Micropsectra	1
Naididae (Tubificinae)	26
Nais	30
Physa	3
Planorbidae	1
Polypedilum	9
Rheotanytarsus	3
Slavina	5
Sminthuridae	1
Stenelmis	2
Stylaria	1
Turbellaria	1
Tvetenia	4
Total Count	108

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	340.87
Remoteness	31.22
Percent Shading	91.34
Epifaunal Substrate	47.27
Instream Habitat	76.49
Instream Woody Debris	64.57
Bank Stability	98.32
PHI Score	68.20

PHI Narrative Rating: Partially Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	5
Pool Substrate Characterization	6
Pool Variability	5
Sediment Deposition	7
Channel Flow Status	9
Channel Alteration	19
Channel Sinuosity	7
Bank Stability - Left Bank	8
Right Bank	8
Vegetative Protection - Left Bank	8
Right Bank	8
Riparian Vegetative Zone Width - Left Bank	5
Right Bank	9
RBP Score	104

RBP Narrative Rating: Partially Supporting

Land Use Analysis

Impervious Area (acres) 66.90 % Impervious 19.62

Land Use	Acres	% Area
Residential	178.74	52.44
Commercial	0.75	0.22
Transportation	12.20	3.58
Pasture/Hay	2.96	0.87
Row Crops	15.97	4.69
Woods	124.15	36.42
Open Space	6.10	1.79

Site ID PTH-926-T-2009

Sampling Date 4/22/2009

ADC Map # 8, A-3

Watershed = Patapsco Tidal

Subwatershed = Nabbs Creek

Location = Nabbs Creek Road, north of Locust Grove Road

Upstream from Mid-Point

Downstream from Mid-Point

This mainly wooded site (80% of total catchment area) has a resulting low level of overall imperviousness in its surrounding catchment (less than 5% impervious). It is located off of Nabbs Creek Road, north of Locust Grove Road, and is part of the Nabbs Creek subwatershed in the Patapsco Tidal watershed. Habitat conditions were good at this site, as it rated Minimally Degraded under the PHI (score of 81.9), and Supporting under the RBP (score of 142, 71% comparable to reference conditions). Riffle substrate was minimal, but large amounts of rootwads/woody debris and overhanging grasses provided substrate for benthos, as did some emergent aquatic vegetation. A dirt road served as a severe buffer break along both sides of the stream, and moderate amounts of trash were present. Despite over 70% of the macroinvertebrates sampled at this site being considered intolerant of degraded urban conditions, a moderate community diversity and a lack of climbers and scrapers resulted in an overall benthic assessment of Poor (BIBI score of 2.14).

Results Biological Condition : Poor

Habitat Rating : RBP : Supporting MPHI : Minimally Degraded

Stream Subsystem = Perennial Stream Origin = Spring-fed Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	10
Runs	50
Pools	40

No Evidence of Local Watershed NPS Pollution

Moderate Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation 5

Road Culvert Present ? No

Left Buffer Breaks Present ? Yes

Right Buffer Breaks Present ? Yes

Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	70
Boulder	0	Gravel	0	Silt	20
				Clay	10

Water Chemistry	Temperature (C)	11.7	Conductivity (mS/cm)	0.126	pH	7.81	DO (ppm)	10.4

Site ID PTH-926-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	18	3
EPT Taxa	2	3
% Intolerant to Urban	70.91	5
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	0	1
% Climbers	0.00	1

BIBI Score: 2.14 Rating: Poor

Taxa List

Taxa	Count
Ceratopogonidae	1
Diplocladius	2
Enchytraeidae	1
Gammarus	1
Ironoquia	5
Libellulidae	4
Lumbricidae	5
Nais	1
Paratendipes	1
Pseudorthocladius	1
Pseudosmittia	1
Rheocricotopus	4
Shipsa	51
Simulium	1
Stygobromus	2
Synurella	27
Tanypodinae	1
Zavrelimyia	1
Total Count	110

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	154.94
Remoteness	91.57
Percent Shading	73.32
Epifaunal Substrate	52.41
Instream Habitat	84.56
Instream Woody Debris	100.00
Bank Stability	89.45
PHI Score	81.88

PHI Narrative Rating: Minimally Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	10
Pool Substrate Characterization	10
Pool Variability	10
Sediment Deposition	12
Channel Flow Status	19
Channel Alteration	19
Channel Sinuosity	14
Bank Stability - Left Bank	7
Right Bank	7
Vegetative Protection - Left Bank	8
Right Bank	8
Riparian Vegetative Zone Width - Left Bank	9
Right Bank	9
RBP Score	142

RBP Narrative Rating: Supporting

Land Use Analysis

Impervious Area (acres) 6.93 % Impervious 4.48

Land Use	Acres	% Area
Residential	13.12	8.47
Commercial	1.54	1.00
Utility	11.14	7.19
Transportation	5.09	3.29
Woods	124.04	80.06

Site ID PTH-930-T-2009
Sampling Date 4/23/2009
ADC Map # 9, B-1

Watershed = Patapsco Tidal
Subwatershed = Nabbs Creek
Location = Arbor Wood Place

Upstream from Mid-Point

Downstream from Mid-Point

At this site, wooded and open space landuses are most prevalent in the surrounding catchment (37% and 30%, respectively), followed by 25% industrial landuse. Resultant imperviousness is 18%. Part of the Nabbs Creek subwatershed of the Patapsco Tidal watershed, this site is located near the southwest corner of Arbor Wood Place. The benthic community sampled at this site had a poor community diversity (n=10 taxa), and low numbers of EPT and scraper taxa, with few climbers. Thus, it rated Very Poor according to the BIBI (score of 1.57). The PHI rated the habitat as Degraded (score of 57.2), while the RBP rated the habitat as Partially Supporting (score of 112). Moderate amounts of bank erosion were affecting the stability of both banks, and significant levels of deposition were present throughout the stream, resulting in poor substrate conditions. Emergent grasses, some SAV, and some algae were present in the stream, and only 30% of the canopy was shaded.

Results Biological Condition : Very Poor
Habitat Rating : RBP : Partially Supporting MPHI : Degraded

Stream Subsystem = Perennial Stream Origin = Spring-fed Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	20
Runs	50
Pools	30

No Evidence of Local Watershed NPS Pollution
Moderate Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation 5

Road Culvert Present ? No
Left Buffer Breaks Present ? No
Right Buffer Breaks Present ? No
Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	65
Boulder	0	Gravel	15	Silt	10
				Clay	10

Water Chemistry	Temperature (C)	15.5	Conductivity (mS/cm)	0.426	pH	6.93	DO (ppm)	11.1

Site ID PTH-930-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	10	1
EPT Taxa	1	1
% Intolerant to Urban	2.80	1
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	1	3
% Climbers	0.93	3

BIBI Score: 1.57 Rating: Very Poor

Taxa List

Taxa	Count
Agabus	7
Chaetocladius	54
Diplocladius	12
Lumbricidae	4
Naididae (Tubificinae)	3
Orthocladius	23
Physa	1
Shipsa	1
Stegopterna	1
Synurella	1
Total Count	107

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	119.01
Remoteness	37.50
Percent Shading	31.57
Epifaunal Substrate	42.50
Instream Habitat	53.97
Instream Woody Debris	100.00
Bank Stability	77.46
PHI Score	57.17

PHI Narrative Rating: Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	7
Pool Substrate Characterization	7
Pool Variability	8
Sediment Deposition	3
Channel Flow Status	17
Channel Alteration	19
Channel Sinuosity	6
Bank Stability - Left Bank	4
Right Bank	4
Vegetative Protection - Left Bank	9
Right Bank	9
Riparian Vegetative Zone Width - Left Bank	9
Right Bank	10
RBP Score	112

RBP Narrative Rating: Partially Supporting

Land Use Analysis

Impervious Area (acres) 21.53 % Impervious 18.09

Land Use	Acres	% Area
Residential	1.41	1.19
Commercial	0.09	0.07
Industrial	29.75	24.99
Utility	6.61	5.56
Transportation	0.94	0.79
Woods	44.37	37.28
Open Space	35.84	30.11

Site ID PTM-920-T-2009
Sampling Date 4/21/2009
ADC Map # 10, B-5

Watershed = Patapsco Tidal
Subwatershed = Hines Bog Pond
Location = Fox Hollow Run

Upstream from Mid-Point

Downstream from Mid-Point

The catchment surrounding this site is made up of residential and wooded landuse (70% and 30% respectively). Approximately 12% of the catchment area is impervious. It is part of the Hines Bog Pond subwatershed in the Patapsco Tidal watershed, and is located off of Fox Hollow Run. During spring sampling, large numbers of juvenile spring peepers were present at this site. The macroinvertebrates in the benthic sample revealed a Very Poor stream, with low community diversity, only 1 EPT taxa, and no scraper taxa (BIBI score of 1.57). Habitat assessments were not quite as harsh, with the RBP rating the stream as Partially Supporting, and the PHI rating the stream as Partially Degraded. Severe bank erosion affected portions of both banks, and the riparian buffer zone along both banks was very narrow. A dirt road served as a severe buffer break along both sides of the stream. Field staff noted moderate amounts of trash present, and deep pools were lacking.

Results Biological Condition : Very Poor
Habitat Rating : RBP : Partially Supporting MPHI : Partially Degraded

Stream Subsystem = Perennial Stream Origin = Mixture of Origins Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	60
Runs	39
Pools	1

Some Potential Sources of Local Watershed NPS Pollution
Moderate Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation: 0

Road Culvert Present ? No
Left Buffer Breaks Present ? Yes
Right Buffer Breaks Present ? Yes
Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	90
Boulder	0	Gravel	10	Silt	0
				Clay	0

Water Chemistry	Temperature (C)	12.9	Conductivity (mS/cm)	0.168	pH	6.1	DO (ppm)	9

Site ID PTM-920-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	13	1
EPT Taxa	1	1
% Intolerant to Urban	11.97	3
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	0	1
% Climbers	5.13	3

BIBI Score: 1.57 Rating: Very Poor

Taxa List

Taxa	Count
Culicoides	1
Ironoquia	2
Limnodrilus	1
Paracladopelma	1
Parametriocnemus	83
Paratendipes	3
Phaenopsectra	1
Polypedilum	5
Pseudorthocladius	1
Rheocricotopus	1
Synurella	14
Tanytarsus	1
Zavrelimyia	3
Total Count	117

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	48.43
Remoteness	42.78
Percent Shading	100.00
Epifaunal Substrate	89.03
Instream Habitat	74.27
Instream Woody Debris	100.00
Bank Stability	68.32
PHI Score	79.07

PHI Narrative Rating: Partially Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	10
Pool Substrate Characterization	7
Pool Variability	3
Sediment Deposition	9
Channel Flow Status	17
Channel Alteration	15
Channel Sinuosity	15
Bank Stability - Left Bank	8
Right Bank	8
Vegetative Protection - Left Bank	5
Right Bank	5
Riparian Vegetative Zone Width - Left Bank	3
Right Bank	3
RBP Score	108

RBP Narrative Rating: Partially Supporting

Land Use Analysis

Impervious Area (acres) 6.02 % Impervious 12.44

Land Use	Acres	% Area
Residential	33.61	69.41
Woods	14.81	30.59

Site ID PTM-921-T-2009
Sampling Date 4/21/2009
ADC Map # 10, B-4

Watershed = Patapsco Tidal
Subwatershed = Hines Bog Pond
Location = Venetian Drive

Upstream from Mid-Point

Downstream from Mid-Point

Residential landuse is the most prevalent at site PTM-921-T-2009, contributing to 67% of the landuse in the surrounding catchment. The rest of the catchment is wooded with a small amount of transportation-related landuse. Overall, impervious surface accounts for 12.3% of the catchment area. The site is located off of Venetian Drive, near a property with a lot of heavy equipment. It is part of the Hines Bog Pond subwatershed in the Patapsco Tidal watershed. Moderate amounts of bank erosion were present along some portions of both streambanks at this site, and a storm drain served as a minor buffer break along the right side of the stream. In addition, the riparian buffer was narrow, particularly along the left side of the stream. Pool variability was poor, and no deep pools were present. However, embeddedness was very low, and very little trash was present at the site. Thus, habitat ratings were somewhat moderate, with an overall RBP score of 118 (Partially Supporting), and an overall PHI score of 76.8 (Partially Degraded). The benthic community at this site was diverse, and 45% of the macroinvertebrates were considered intolerant to urban conditions. However, a moderate number of EPT taxa and climbers, and a lack of scrapers resulted in an overall assessment of Poor, with a BIBI of 2.71.

Results Biological Condition : Poor
Habitat Rating : RBP : Partially Supporting MPHI : Partially Degraded

Stream Subsystem = Perennial Stream Origin = Spring-fed Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	70
Runs	20
Pools	10

Some Potential Sources of Local Watershed NPS Pollution
Moderate Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation: 0

Road Culvert Present ? No
Left Buffer Breaks Present ? No
Right Buffer Breaks Present ? Yes
Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	25	Sand	50
Boulder	0	Gravel	20	Silt	5
				Clay	0

Water Chemistry	Temperature (C)	11.7	Conductivity (mS/cm)	0.222	pH	6.22	DO (ppm)	9

Site ID PTM-921-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	27	5
EPT Taxa	2	3
% Intolerant to Urban	45.45	5
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	0	1
% Climbers	2.73	3

BIBI Score: 2.71 Rating: Poor

Taxa List

Taxa	Count
Aulodrilus	2
Caecidotea	22
Calopteryx	1
Cordulegaster	1
Crambidae	1
Crangonyx	3
Diplocladius	5
Eclipidrilus	1
Hemerodromia	1
Limnodrilus	3
Limnophyes	1
Mallochohelea	1
Meropelopia	2
Naididae (Tubificinae)	14
Nais	1
Paratendipes	2
Pisidium	2
Polycentropus	1
Ptilostomis	1
Rheocricotopus	3
Simulium	2
Smittia	1
Stegopterna	15
Synurella	11
Thienemannimyia group	2
Tipula	2
Zavrelimyia	9
Total Count	110

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	45.31
Remoteness	31.22
Percent Shading	58.94
Epifaunal Substrate	83.65
Instream Habitat	100.00
Instream Woody Debris	93.33
Bank Stability	93.54
PHI Score	76.78

PHI Narrative Rating: Partially Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	12
Pool Substrate Characterization	7
Pool Variability	4
Sediment Deposition	11
Channel Flow Status	18
Channel Alteration	19
Channel Sinuosity	14
Bank Stability - Left Bank	7
Right Bank	6
Vegetative Protection - Left Bank	2
Right Bank	7
Riparian Vegetative Zone Width - Left Bank	2
Right Bank	9
RBP Score	118

RBP Narrative Rating: Partially Supporting

Land Use Analysis

Impervious Area (acres) 5.56 % Impervious 12.28

Land Use	Acres	% Area
Residential	30.36	67.00
Transportation	0.68	1.50
Woods	14.28	31.50

Site ID PTN-919-T-2009

Sampling Date 4/23/2009

ADC Map # 10, D-5

Watershed = Patapsco Tidal

Subwatershed = Hines Bog

Location = Choptank Avenue, south of Hines Pond

Upstream from Mid-Point

Downstream from Mid-Point

Located off of the Choptank Avenue cul-de-sac, south of Hines Pond, this site is part of the Hines Bog subwatershed in the Patapsco Tidal watershed. Less than 6% of the catchment is impervious, as surrounding landuses are wooded (62%) and residential (38%). This site had healthy benthic community diversity, a healthy number of climbers, and more than 50% of the macroinvertebrates sampled were considered intolerant to urban conditions. However, only 2 EPT taxa were present in the sample and no scrapers, so the site rated Fair with a BIBI score of 3.00. Streambanks at this site were stable with no erosion, and a shaded canopy was present, along with only a small amount of trash. However, epifaunal substrate and pool substrate received low ratings, and pool variability was poor with no deep pools present. Channel substrate was composed of 90% sand with some silt, and sediment deposition was extensive. Overall, the RBP rated the habitat here as Partially Supporting (58.5% comparable to reference, with a total score of 117). The PHI rated habitat Minimally Degraded, with an overall score of 85.3.

Results Biological Condition : Fair

Habitat Rating : RBP : Partially Supporting MPHI : Minimally Degraded

Stream Subsystem = Perennial Stream Origin = Swamp and Bog Stream Type = Warmwater

Proportion of the Stream that is :

Riffles	60
Runs	30
Pools	10

No Evidence of Local Watershed NPS Pollution

None Local Watershed Erosion

Proportion of the Stream with Aquatic Vegetation: 0

Road Culvert Present ? No

Left Buffer Breaks Present ? No

Right Buffer Breaks Present ? No

Evidence of Channel Straightening or Dredging ? No

Percent of Inorganic Substrate Components

Bedrock	0	Cobble	0	Sand	90
Boulder	0	Gravel	0	Silt	10
				Clay	0

Water Chemistry	Temperature (C)	10.3	Conductivity (mS/cm)	0.146	pH	7.41	DO (ppm)	9.2

Site ID PTN-919-T-2009

Biological Benthic Condition

Metrics	Value	Scores
Total Taxa	26	5
EPT Taxa	2	3
% Intolerant to Urban	53.90	5
# Ephemeroptera	0	1
% Ephemeroptera	0.00	1
# Scraper	0	1
% Climbers	12.77	5

BIBI Score: 3.00 Rating: Fair

Taxa List

Taxa	Count
Apsectrotanypus	5
Bezzia	1
Brundiniella	2
Caecidotea	7
Calopteryx	2
Clinotanypus	2
Cordulidae	1
Dolophilodes	1
Heterotrissocladius	10
Ilybius	3
Isotomidae	2
Micropsectra	12
Nais	2
Natarsia	1
Orthocladiinae	1
Polycentropus	2
Pseudolimnophila	2
Ptychoptera	13
Rheocricotopus	2
Sialis	1
Synurella	40
Tanypodinae	1
Tanytarsus	3
Thienemannimyia group	14
Zavrelia	1
Zavrelimyia	10
Total Count	141

Physical Habitat

Maryland Biological Stream Survey PHI

Drainage Area (acres)	10.50
Remoteness	51.66
Percent Shading	100.00
Epifaunal Substrate	69.94
Instream Habitat	89.92
Instream Woody Debris	100.00
Bank Stability	100.00
PHI Score	85.25

PHI Narrative Rating: Minimally Degraded

EPA Rapid Bioassessment

Epifaunal Substrate / Available Cover	5
Pool Substrate Characterization	6
Pool Variability	2
Sediment Deposition	5
Channel Flow Status	19
Channel Alteration	18
Channel Sinuosity	8
Bank Stability - Left Bank	9
Right Bank	9
Vegetative Protection - Left Bank	9
Right Bank	9
Riparian Vegetative Zone Width - Left Bank	9
Right Bank	9
RBP Score	117

RBP Narrative Rating: Partially Supporting

Land Use Analysis

Impervious Area (acres) 0.61 % Impervious 5.79

Land Use	Acres	% Area
Residential	4.03	38.42
Woods	6.46	61.58

APPENDIX B

BENTHIC AND HABITAT ASSESSMENT QA/QC

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B.1 BENTHIC TAXONOMY QA/QC

As a QA/QC measure, five of the benthic samples (10% of the original 50) were randomly selected for re-identification by a taxonomist who did not participate in the original identifications. We compared the taxonomic results (including counts and identifications) generated by the primary and QC-taxonomists for each sample.

Percent disagreement in enumeration (PDE) was calculated as

$$PDE = \frac{|n_1 - n_2|}{n_1 + n_2} \cdot 100$$

where n_1 is the number of specimens counted in the sample by the first taxonomist and n_2 is the number of specimens counted by the QC taxonomist.

Percent taxonomic disagreement (PTD) was calculated as

$$PTD = \left[1 - \left(\frac{comp_{pos}}{n}\right)\right] \cdot 100$$

where $comp_{pos}$ is the number of agreements (positive comparisons) and n is the total number of specimens in the larger of the two counts.

The five benthic samples that were randomly selected for re-identification by an independent taxonomist showed good agreement. The percent disagreement in enumeration (PDE) and percent taxonomic disagreement (PTD) were calculated for each sample (Table B-1). Average values for each parameter were also examined, and both the average PDE and average PTD were within an acceptable range, falling well below the measurement quality objectives of a mean PDE less than or equal to 5% and a mean PTD less than or equal to 15% (Tetra Tech 2007). Complete taxa lists and counts for these laboratory QC sites are included in Table B-2.

Table B-1. Benthic identification laboratory QC summary statistics.

Site	PDE	PTD
BK8-901-T-2009	0.86%	1.71%
PT0-911-T-2009	0.46%	5.45%
PT5-931-T-2009	0.00%	1.87%
PT8-927-T-2009	0.00%	0.00%
PTC-942-T-2009	0.00%	6.12%
Average	0.26%	3.03%

Table B-2. Benthic macroinvertebrate identifications from samples at five randomly chosen sites as recorded by the original taxonomist (original) and an independent taxonomist (duplicate).

Site: BK8-901-T-2009		
Benthic Macroinvertebrate – Lowest Practical Level	**Original**	**Duplicate**
Caecidotea	74	72
Chrysops	5	5
Culicoides	6	6
Cymbiodyta	1	1
Diplocladius	1	1
Erioptera	1	1
Girardia	1	1
Hexatoma	3	3
Limnodrilus	2	2
Mallochohelea	1	1
Naididae (Tubificinae)	3	3
Paranais	1	1
Rheocricotopus	5	5
Shipsa	1	1
Sphaeriidae	3	3
Spirosperma	1	1
Synurella	7	7
Zavrelimyia	1	1
Site: PT0-911-T-2009		
Benthic Macroinvertebrate – Lowest Practical Level	**Original**	**Duplicate**
Argia	1	1
Aulodrilus	1	1
Bezzia	1	1
Caecidotea	2	2
Chironomidae	0	1
Chironominae	0	2
Corynoneura	9	8
Diplectrona	1	1
Gammarus	58	59
Gomphus	1	1
Naididae (Tubificinae)	6	6
Nais	1	1
Paratanytarsus	1	1
Paratendipes	4	4
Pisidium	2	4
Polycentropus	1	1
Polypedilum	2	2
Prodiamesa	3	3
Rheotanytarsus	1	1
Sphaeriidae	2	0
Stenelmis	4	4
Thienemannimyia group	1	1

Table B-2. (Continued)

PT0-911-T-2009 (Continued)		
Benthic Macroinvertebrate – Lowest Practical Level	**Original**	**Duplicate**
Tipula	1	1
Tribelos	5	3
Zavrelimyia	1	1
Site: PT5-931-T-2009		
Benthic Macroinvertebrate – Lowest Practical Level	Original	Duplicate
Cricotopus	65	64
Gammarus	3	3
Hydropsyche	1	1
Limnodrilus	1	1
Naididae (Tubificinae)	2	2
Nais	27	27
Orthocladinae	0	2
Orthocladius	4	3
Polypedilum	3	3
Smittia	1	1
Site: PT8-927-T-2009		
Benthic Macroinvertebrate – Lowest Practical Level	**Original**	**Duplicate**
Aeshna	1	1
Chaetocladius	19	19
Ironoquia	1	1
Lepidostoma	1	1
Orthocladius	1	1
Simulium	1	1
Tipula	1	1
Site: PTC-942-T-2009		
Benthic Macroinvertebrate – Lowest Practical Level	**Original**	**Duplicate**
Caecidotea	1	1
Chaetocladius	5	5
Chironomus	7	7
Crambidae	1	1
Cryptochironomus	2	2
Culicoides	1	1
Dicrotendipes	4	4
Eclipidrilus	2	0
Enchytraeidae	7	7
Gammarus	15	15
Limnodrilus	9	8
Lumbriculidae	0	2
Lumbriculus	2	2
Naididae (Tubificinae)	21	22
Nais	3	3
Orthocladius	2	2

Table B-2. (Continued)

PTC-942-T-2009 (Continued)		
Benthic Macroinvertebrate – Lowest Practical Level	**Original**	**Duplicate**
Peltodytes	1	1
Pisidium	2	5
Polypedilum	8	8
Sciomyzidae	1	1
Sphaeriidae	3	0
Unionicola	1	1

B.2 FIELD DUPLICATES QA/QC FOR BIBI SCORES AND INDIVIDUAL METRIC SCORES

Five duplicate sites were sampled for benthic macroinvertebrates in the field just upstream of their partner site following identical procedures. The duplicate sites were assigned site identification numbers that allow for quick reference to their partner site. Each of the duplicate sites has a "D" as its fourth digit (i.e., BK3-D07-T-2009). The remainder of the site identification number matches its partner site, i.e., site BK3-D07-T-2009 is the duplicate of site BK3-907-T-2009. BIBI metrics and scores were calculated for duplicate sites.

For five duplicate field sites, BIBI scores were compared between the targeted site and its duplicate pair. Precision was calculated from the two duplicate samples by relative percent difference (RPD) as

$$RPD = \left(\frac{|A - B|}{A + B} \right) \times 2 \times 100$$

where A and B = the two values. Relative standard deviation (RSD), also known as coefficient of variability (CV) was calculated as

$$RSD = \frac{sd}{\overline{X}} \times 100$$

where sd is the standard deviation and $\overline{X}$ is the mean of the two values.

Mean RPD and RSD values were calculated for all five pairs of duplicate field sites and compared to measurement quality objectives. For this study, measurement quality objectives included a mean RPD and a mean RSD less than or equal to 15% for each parameter (Tetra Tech 2007).

In addition, for the five duplicate field sites, values for individual BIBI metrics were compared between the targeted site and its duplicate pair. Several different measures of precision were calculated, including RPD, root mean square error (RMSE), CV (or RSD), and 90% Confidence Interval (CI). These were compared to measurement quality objectives for certain metrics as available (Table B-3). Because of changes made to the BIBI (Southerland et al. 2007), Anne Arundel County does not yet have available measurement quality objectives for the Number of Ephemeroptera Taxa, Percent Intolerant to Urban, and Percent Climber metrics.

Table B-3. Measurement quality objectives for BIBI metrics (from Tetra Tech 2005)			
Metric	**MQO**		
	Median RPD	**CV**	**90% CI**
Total Number of Taxa	< 30	< 20	± 10
Number of EPT Taxa	< 30	< 20	± 10
Percent Ephemeroptera	< 30	< 20	± 10
Number Scraper Taxa	< 30	< 70	± 10

For four of the five QC samples, field duplicates had BIBI scores in the same rating category as the original samples from corresponding sites (Table B-4). Only one pair differed in rating, as the study site sample had a BIBI score of 2.14 (Poor) and the duplicate sample had a BIBI score of 3.00 (Fair). The relative percent difference and relative standard deviation (RPD and RSD) between each targeted site and its paired duplicate were calculated for each pair. The average RPD was 14.54%, while the average RSD was 10.29%, both below the measurement quality objectives of 15% for each parameter (Tetra Tech 2007).

Table B-4. BIBI scores and narrative ratings for field duplicate QC sites		
Site	**BIBI Score**	**BIBI Narrative Rating**
BK3-907-T-2009	2.71	Poor
BK3-D07-T-2009	2.71	Poor
PT0-917-T-2009	3.00	Fair
PT0-D17-T-2009	3.57	Fair
PT3-947-T-2009	2.14	Poor
PT3-D47-T-2009	2.43	Poor
PTF-915-T-2009	2.14	Poor
PTF-D15-T-2009	3.00	Fair
PTG-939-T-2009	3.00	Fair
PTG-D39-T-2009	3.29	Fair

Additional analysis of field duplicate data was conducted to assess the variability of individual benthic metric values. Among the five pairs, metric values generally showed good consistency (Table B-5). Precision for the five pairs was evaluated using four measures (Table B-6). Two metrics that yielded high RPD and coefficient of variation (CV) tended to be influenced by low values and by a greater difference observed in a single site (e.g., 5 EPT taxa at site PT0-917-T-2009 v. 1 EPT taxa at its duplicate PT0-D17-T-2009), while most site pairs were more consistent (e.g., 2 EPT taxa v. 1 EPT taxa).

Table B-5. Individual metric scores from BIBI for field duplicate QC sites

Site	Number of Taxa	Number of EPT Taxa	Number of Ephem-eroptera Taxa	Percent Intolerant Urban	Percent Ephem-eroptera	Number Scraper Taxa	Percent Climbers
BK3-907-T-2009	32	2	0	30.4	0	0	7.8
BK3-D07-T-2009	30	1	0	45.1	0	1	4.4
PT0-917-T-2009	29	1	0	16.7	0	5	18.2
PT0-D17-T-2009	36	5	0	26.7	0	6	8.6
PT3-947-T-2009	15	1	0	0	0	2	5. 6
PT3-D47-T-2009	19	2	0	0	0	1	11.3
PTF-915-T-2009	16	2	0	0	0	0	14.2
PTF-D15-T-2009	35	1	0	15.3	0	4	27.1
PTG-939-T-2009	25	1	1	0.9	0.9	3	3.6
PTG-D39-T-2009	21	2	1	1.9	0.9	4	13.0

Table B-6. Metric precision represented by median relative percent difference (RPD), root mean square error (RMSE), coefficient of variation (CV), and 90% confidence interval (CI) for 5 sample pairs. Shaded cells indicate values that exceed measurement quality objectives as presented in Tetra Tech (2005). * indicates no measurement quality objectives are currently available for this parameter. n.a. is shown when division by zero precludes estimation of parameter.

Metric	Measures of Precision			
	Median RPD	RMSE	CV	90% CI
Total Number of Taxa	21.57	9.44	36.61	±15.49
Number of EPT Taxa	66.67	2.00	111.11	±3.28
Number of Ephemeroptera Taxa*	n.a.	0.00	0.00	±0.00
Percent Intolerant Urban*	n.a.	10.50	76.62	±17.21
Percent Ephemeroptera	n.a.	0.01	4.10	±0.01
Number Scraper Taxa	66.67	2.00	76.92	±3.28
Percent Climbers*	67.91	8.84	77.69	±14.49

B.3 PHYSICAL HABITAT DUPLICATES QA/QC FOR RBP HABITAT AND PHI SCORES

Habitat was also assessed in the field at five duplicate sites just upstream of their partner site following identical procedures. The duplicate sites were assigned site identification numbers that allow for quick reference to their partner site. Each of the duplicate sites has a "D" as its fourth digit (i.e., BK3-D07-T-2009). The remainder of the site identification number matches its partner site, i.e., site BK3-D07-T-2009 is the duplicate of site BK3-907-T-2009. RBP habitat assessment scores and MPHI scores were calculated for the duplicate sites.

Field duplicate sites received the same RBP narrative rating as their respective targeted site at two of the five sites (Table B-7). In the cases where the duplicate sites' narrative rating did not match their paired target site rating, they different by only one assessment category. For example, duplicate site PT0-D17-T-2009 was rated Partially Supporting (61% of reference) while its paired targeted site PT0-917-T-2009 was rated Supporting (63.5% of reference). When comparing Percent of Reference scores between the targeted sites and their paired duplicate site, differences ranged from a minimum of 2.5% to a maximum of 10.5%.

Table B-7. RBP and PHI Scores and associated ratings for field duplicate QC sites

Site	Total RBP Score	Percent of Reference	RBP Classification	PHI Score	PHI Narrative Rating
BK3-907-T-2009	148	74	Supporting	81.49	Minimally Degraded
BK3-D07-T-2009	139	69.5	Supporting	85.16	Minimally Degraded
PT0-917-T-2009	127	63.5	Supporting	65.81	Degraded
PT0-D17-T-2009	122	61	Partially Supporting	66.52	Partially Degraded
PT3-947-T-2009	152	76	Comparable to Reference	71.02	Partially Degraded
PT3-D47-T-2009	134	67	Supporting	68.79	Partially Degraded
PTF-915-T-2009	139	69.5	Supporting	57.72	Degraded
PTF-D15-T-2009	118	59	Partially Supporting	55.21	Degraded
PTG-939-T-2009	118	59	Partially Supporting	70.01	Partially Degraded
PTG-D39-T-2009	104	52	Partially Supporting	68.20	Partially Degraded

Field duplicate sites received the same PHI narrative rating as their corresponding targeted site at all but one of the five sites (Table B-7). In the one case that did not match, the narrative rating was different by only one assessment category and less than 1 point on the rating scale. Duplicate site PT0-D17-T-2009 received a PHI score of 66.5 (Partially Degraded) while its paired targeted site PT0-917-T-2009 received a PHI score of 65.8 and a narrative rating of Degraded.