Magothy River Watershed

Targeted Biological Monitoring and Assessment

2007

Anne Arundel County, Maryland

Prepared for and in collaboration with Anne Arundel County

Department of Public Works
Watershed and Ecosystem Services Division
Watershed Management Program

ANNE ARUNDEL COUNTY
MARYLAND

DPW

KCI Technologies, Inc.
August 2007

KCI TECHNOLOGIES

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1 Background and Objectives

Anne Arundel County, in an effort to improve its water quality and streams, initiated systematic and comprehensive watershed assessments and action plans for restoration and protection across the County. The Magothy River watershed targeted biological assessment and monitoring fulfills part of the County's water quality assessment requirements under their National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit issued by the Maryland Department of the Environment and also assists the County in preparing TMDL implementation plans.

Anne Arundel County contracted KCI to conduct a targeted assessment of the biological community and physical habitat in the Magothy River watershed during the Spring of 2007. The targeted assessment focuses on water quality, sampling and analysis of the benthic macroinvertebrate community, and assessment of instream and riparian physical habitat conditions.

The data collected and reported herein will be primarily utilized in the County's Watershed Management Tool (WMT), which is developed and maintained by the Department of Public Works, Watershed and Ecosystem Services Division, Watershed Management Program. Within the WMT, relationships between biological condition, water quality and landuse are developed to support watershed and landuse planning and restoration efforts.

The biological data will also be beneficial for the ongoing County-wide Biological Monitoring and Assessment Program to further develop status, trends and problem identification for the portions of the County sampled. The Magothy River watershed (MDE 8-digit watershed 02131001) encompasses 22,641 acres and contains approximately 67 miles of perennial, non-tidal streams. It should be noted, however, that the Watershed Management Program has currently updated the watershed and subwatershed boundaries to account for the year 2007 earth data and current storm infrastructure. The watershed covers two primary sampling units (PSUs) defined by the County-wide monitoring and assessment strategy, the Upper Magothy (PSU-07) and the Lower Magothy (PSU-08). The Upper Magothy PSU was most recently assessed by the County in 2006 and the Lower Magothy PSU was completed in 2007. A full watershed comprehensive study is anticipated for completion by 2009.

The Magothy River watershed was subdivided into 27 sub-basins by the County's Watershed Management Program for targeted site selection. Within these sub-basins, 27 targeted sites were selected, at which water quality sampling, benthic macroinvertebrate collection / assessment, and physical habitat assessment were completed between April 17 and April 26, 2007.

The Magothy River watershed is part of Maryland's Lower Western Shore tributary basin. The Lower Western basin drains approximately 270 square miles of land, including portions of Anne Arundel and Calvert Counties along the Western Shore of the Chesapeake Bay. Other large water bodies comprising the basin include the Severn, South, West, and Rhode Rivers. The current study area is located in the northern most portion of the basin, within the Coastal Plain physiographic province. Figure 1 – Vicinity Map shows the general location of the watershed as well as drainage areas to each sampling point. It should be noted, that the MD DNR boundaries do not match exactly with the Anne Arundel County Watershed Boundaries.

2 Methods

The monitoring program includes chemical, physical and biological assessment conducted throughout the watershed. The sampling methods used are compatible with the Sampling and Analysis Plan for Anne Arundel County Biological Monitoring (SAP) (Tetra Tech, 2005) and the Quality Assurance Project Plan (QAPP) for Anne Arundel County Biological Monitoring and Assessment Program (Tetra Tech, 2004). All data was entered into an Ecological Data Application System (EDAS) database. A summary of these methods and the results of the 2007 monitoring are documented in this report.

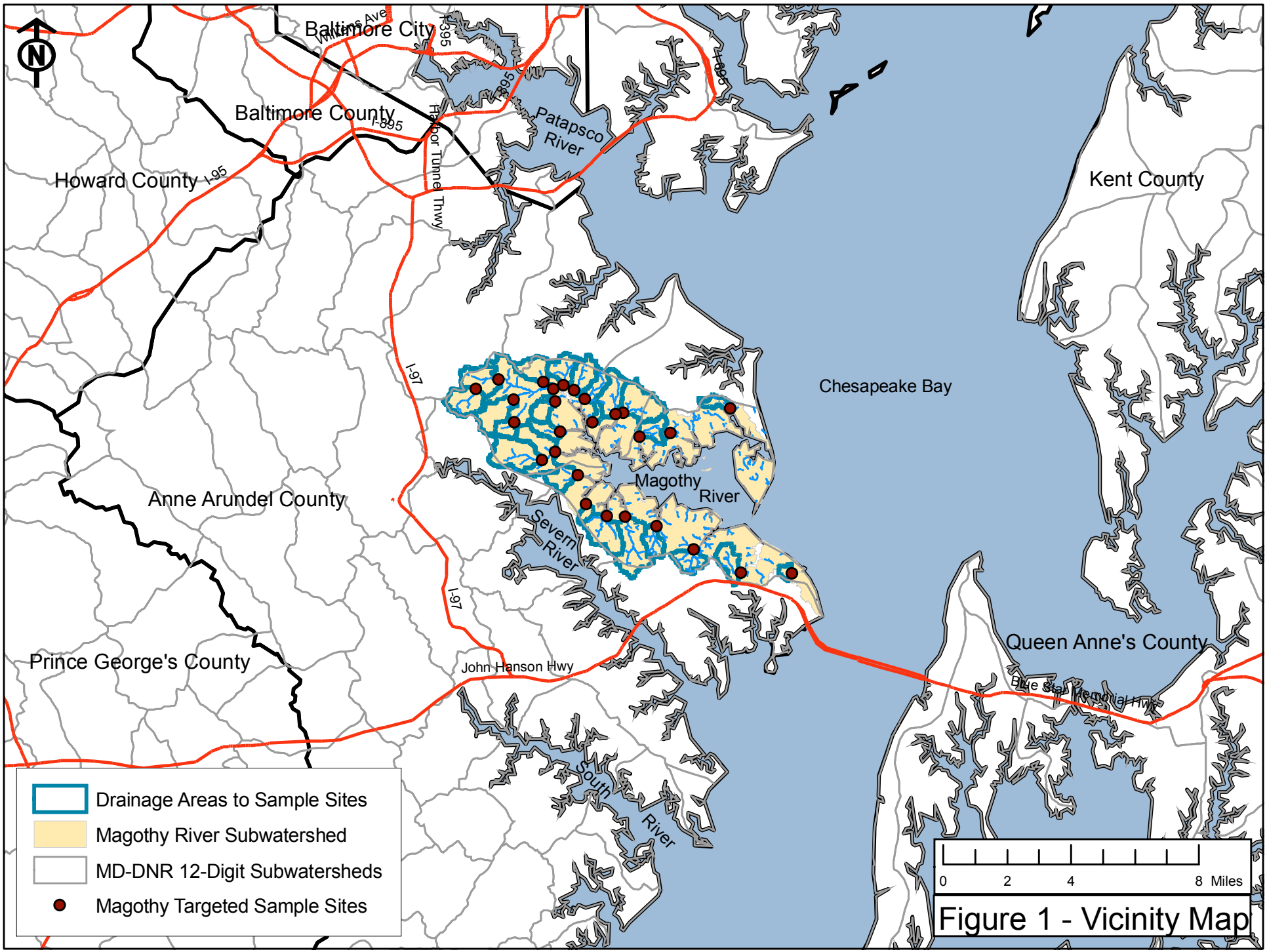


Figure 1 - Vicinity Map

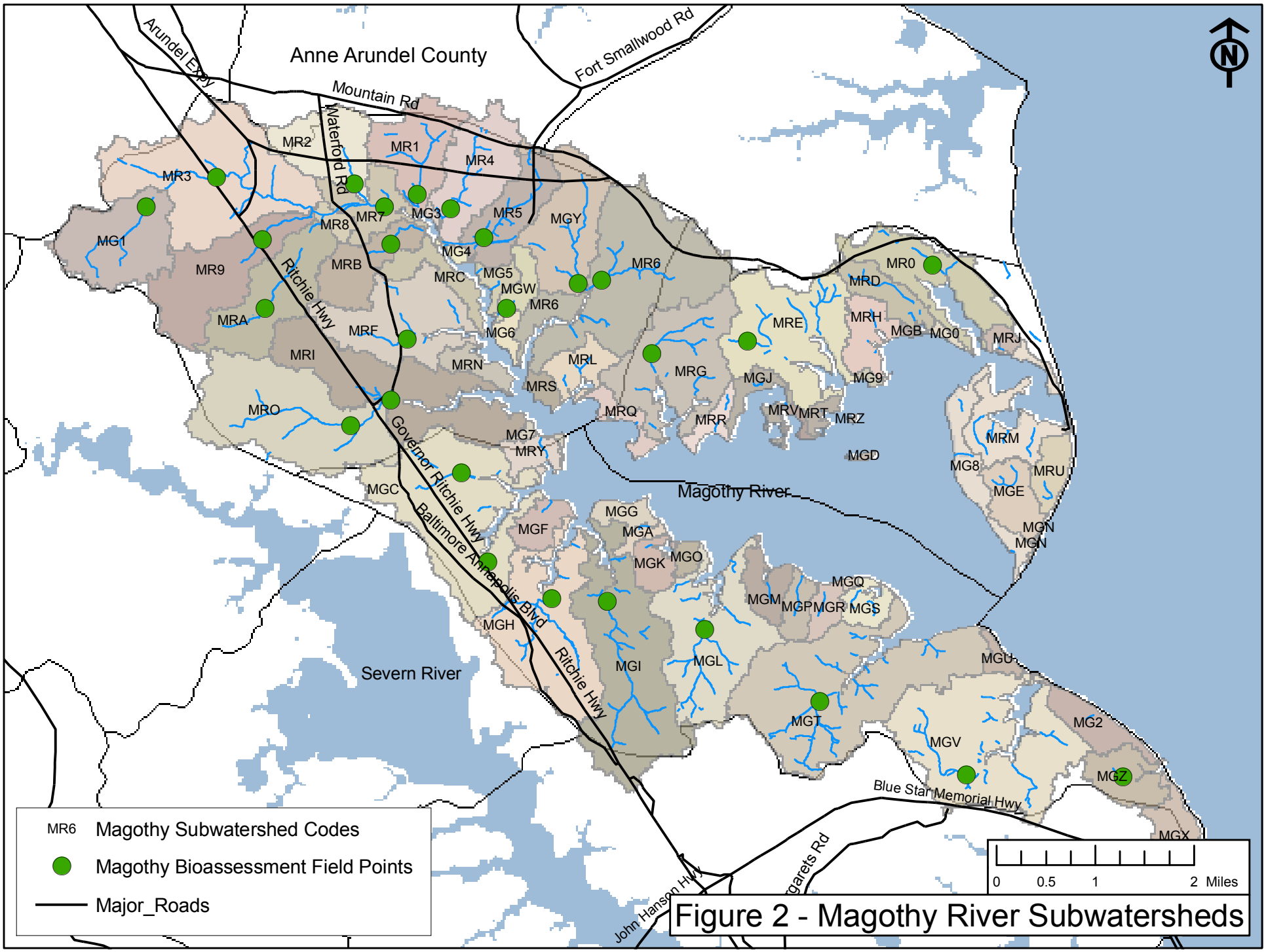
Biological assessment methods within Anne Arundel County are designed to be consistent and comparable with the methods used by Maryland Department of Natural Resources (DNR) in their Maryland Biological Stream Survey (MBSS). All field crew leaders received recent training in MBSS protocols prior to the sampling. The County has adopted the MBSS methodology to be consistent with statewide monitoring programs and programs adopted by other Maryland counties. The methods have been developed locally and are calibrated specifically to Maryland's physiographic regions and stream types. MBSS physical habitat assessment parameters were collected for the Magothy watershed. Physical habitat was also assessed using the EPA's Rapid Bioassessment Protocol (RBP) (Barbour et al., 1999) habitat assessment for low-gradient streams.

2.1 Selection of Sampling Sites

The sampling design employed a targeted approach with a total of 27 sites distributed throughout the study area on each of the major stream reaches, covering 26 non-tidal subwatersheds, as shown in Figure 2. A complete list of targeted sites along with the corresponding subwatershed name and code is displayed in Table 1. The primary goal was to establish adequate spatial coverage of the watershed. Additionally, data from the County-wide random sampling program was used in the site selection process. The Magothy watershed was sampled for the County-wide program in 2006 and 2007. The targeted sites were generally selected in the downstream reaches of the Magothy's tributaries and placed to fill gaps not covered by the County-wide assessment.

Table 1 – Sampling Sites and Corresponding Subwatersheds

Site ID	Subwatershed Name	Code
MAGO-01-2007	Cornfield Creek	MR0
MAGO-02-2007	Gray's Creek	MRE
MAGO-03-2007	Blackhole Creek	MRG
MAGO-04-2007	Cockey Creek	MR6
MAGO-05-2007	Nannys Branch	MGY
MAGO-06-2007	Indian Village Branch	MGW
MAGO-07-2007	Beechwood Branch	MR5
MAGO-08-2007	Brookfield Branch	MR4
MAGO-09-2007	Bailys Branch	MR1
MAGO-10-2007	Magothy Branch	MR7
MAGO-11-2007	Muddy Run	MR2
MAGO-12-2007	Magothy Branch 1	MR3
MAGO-13-2007	Magothy Branch 2	MG1
MAGO-14-2007	Kinder Branch	MR9
MAGO-15-2007	Rouses Branch	MRA
MAGO-16-2007	Nannys Creek	MRB
MAGO-17-2007	Old Man Creek	MRF
MAGO-18-2007	Cattail Creek 1	MRI
MAGO-19-2007	Cattail Creek 2	MRO
MAGO-20-2007	Cypress Creek	MGC
MAGO-21-2007	Cypress Creek	MGC
MAGO-22-2007	Dividing Creek	MGH
MAGO-23-2007	Mill Creek	MGI
MAGO-24-2007	Forked Creek	MGL
MAGO-25-2007	Deep Creek	MGT
MAGO-26-2007	Little Magothy River	MGV
MAGO-27-2007	Podickery Creek	MGZ


Anne Arundel County
Arundel Expy
Mountain Rd
Fort Smallwood Rd
Waterford Rd
Ritchie Hwy
Governor Ritchie Hwy
Baltimore Annapolis Blvd
Ritchie Hwy
Magothy River
Severn River
Blue Star Memorial Hwy
John Hanson Hwy
MR0
MR1
MR2
MR3
MR4
MR5
MR6
MR7
MR8
MR9
MRA
MRB
MRC
MRD
MRE
MRF
MRG
MRH
MRI
MRJ
MRL
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MG9
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MGD
MGE
MGF
MGG
MGH
MGI
MGJ
MGK
MGL
MGM
MGN
MGO
MGP
MGQ
MGR
MGS
MGT
MGU
MGV
MGW
MGX
MGY
MGZ
MR6 Magothy Subwatershed Codes
Magothy Bioassessment Field Points
Major_Roads
0 0.5 1 2 Miles
Figure 2 - Magothy River Subwatersheds

If the stream channel at the selected site was found to be unfit for sampling during the field visit, the site was moved to another sampleable reach either on the same stream, or in an adjacent sub-basin, pending approval by the Project Manager and the County. Conditions that would make a site unsampleable include predominant wetland or dry channel conditions, unsafe conditions, and lack of access due to property ownership issues. Several of the initially selected sites were shifted due to the lack of a defined stream channel and tidal influence. However, all subwatersheds targeted for sampling were able to be sampled.

Field crews used GPS and field maps with ortho-photography overlaid with the sites, streams and drainage areas to navigate to the selected sites. The sites include a 75-meter reach. The position of the reach mid-point was collected with GPS, and the upstream and downstream ends were marked with tree tags. The tags were marked with the site name (i.e. MAGO-01-2007) and either 0 m or 75 m to denote the downstream or upstream end, respectively.

Duplicate biological samples, water quality measurements and physical habitat assessments were collected at three sites as Quality Assurance/Quality Control (QA/QC) samples. These samples were collected immediately upstream of selected sites in an area where the habitat was very similar to the original sampling site based on visual inspection. The duplicate sites were selected in the field by the field crew at the time of the assessment. This method, as opposed to selecting the sites randomly or by desktop analysis, ensures that the stream type and habitat are similar, that no significant inputs of stormwater or confluences occur in the reach, and that the site is sampleable. The duplicate sites are described further in the Quality Assurance and Quality Control section of the document (Appendix C).

2.2 Impervious Surface/GIS Analysis

Upon arrival at sampling locations, latitude and longitude coordinates were recorded using a Thales hand-held GPS unit at the midpoint of each reach to create a point layer showing sampling locations accurate to within one to two meters. These sampling points were then snapped to the stream layer on the Digital Elevation Model (DEM) for the watershed using the ArcHydro toolset to delineate drainage areas to each sampling location. The DEM was generated by the Watershed Management Program based on the 2004 DNR DEM coverage. Before drainage areas were delineated, the DEM was modified with inclusion of County and State Highway Administration stormdrain layers, and streams in areas with low relief. The DEM was reconditioned utilizing terrain preprocessing functionality within the ArcHydro extension toolset.

The impervious surface acreage and percent was calculated for the drainage area to each site using a raster dataset of impervious land cover from 2004, maintained by the DPW, Bureau of Engineering, Watershed Management Program[1]. The GIS data used represents the area of all impervious surfaces (roads, buildings, and parking lots) clipped to the watershed boundaries and then summed for each of the drainage areas. The results include all of the impervious surfaces and do not distinguish between connected versus disconnected surfaces.

The planimetric stream layer was used for locating sampling points and determining stream order. It should be noted, however, that the current planimetric stream layer used for stream ordering has limitations and, consequently, is programmed for update through upcoming Magothy Watershed Study. Stream order, based on the planimetric stream layer, was not used in habitat assessment or BIBI calculations, but was included to demonstrate approximate stream size.

Point and polygon GIS files were generated for the targeted Magothy Bioassessment and include summary data for the landscape, biological, habitat and water quality assessments. Metadata for each file is included with entity attribute descriptions.

[1] Data custodian: Mary Searing, PWSEAR00@aacounty.org

2.3 Water Quality Sampling

To supplement the macroinvertebrate sampling and habitat assessments, water quality sampling was performed. Field water quality was measured at all monitoring sites, including the duplicate sites, according to methods in the County QAPP. Measurements were collected *in situ* from three locations within each sampling reach (upstream end, mid-point, and downstream end) and results were averaged to minimize variability and better represent water quality conditions throughout the entire sampling reach. Most in-situ parameters (i.e., temperature, pH, conductivity, total dissolved solids, and dissolved oxygen) were measured with a YSI 6920 series multiprobe, and turbidity was measured with a Hach 2100 Turbidimeter.

Water quality equipment was regularly inspected, maintained and calibrated to ensure proper usage and accuracy of the readings. Calibration logs were kept by field crew leaders and checked by the project manager regularly. Field tested parameters include those listed below.

- pH (standard pH units)
- Temperature (degrees Celsius, °C)
- Dissolved oxygen (milligrams per liter, mg/L)
- Conductivity (microSiemans per cm, µS/cm)
- Total dissolved solids (mg/L)
- Turbidity (NTU)

2.4 Physical Habitat Assessment

Each biological monitoring site was characterized based on visual observation of physical characteristics and various habitat parameters, including QC sites. Both the EPA's Rapid Bioassessment Protocol (RBP) habitat assessment for low gradient streams (Barbour et al., 1999) and the Maryland Biological Stream Survey's (MBSS) Physical Habitat Index (PHI; Paul et al., 2002) were used to assess the physical habitat at each site. Both assessment techniques rely on subjective scoring of selected habitat parameters. To reduce individual sampler bias, both assessments were completed as a team with discussion and agreement of the scoring for each parameter. In addition to the visual assessments, photographs were taken from three locations within the sampling reach (downstreamr end, mid-point, and upstream end) facing both upstream and downstream, for a total of six (6) photographs per site. Representative photographs for each site are included in Appendix D.

The RBP habitat assessment consists of a review of ten biologically significant habitat parameters that assess a stream's ability to support an acceptable level of biological health. Each parameter is given a numerical score from 0-20 and a categorical rating of optimal, suboptimal, marginal or poor. Overall habitat quality typically increases as the total score for each site increases. The RBP parameters assessed are listed in Table 2

Table 2 – RBP Low Gradient Habitat Parameters

Low Gradient Stream Parameters	
Epifaunal substrate/available cover	Channel alteration
Pool substrate characterization	Channel sinuosity
Pool variability	Bank stability
Sediment deposition	Vegetative protection
Channel flow status	Riparian Vegetative Zone Width

The RBP habitat parameters for each reach are summed with a total possible score of 200. The total score is then placed into one of four categories (Table 3) based on their percent comparability to reference conditions. Since adequate reference condition scores do not currently exist for Anne Arundel County, the categories used in this report are based on reference conditions obtained from Prince George's County streams and watersheds (Stribling et al., 1999).

Table 3 – RBP Habitat 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

Source: Stribling et al., 1999

The PHI incorporates the results of a series of habitat parameters selected for Coastal Plain, Piedmont and Highlands regions. While all parameters are rated during the field assessment, the Coastal Plain parameters are used to develop the PHI score. In developing the PHI, MBSS identified six parameters that have the most discriminatory power for the coastal plain streams. These parameters are used in calculating the PHI (see Table 4). Several of the parameters have been found to be drainage area dependent and are scaled accordingly. The drainage area to each point was calculated using GIS with County digital elevation model (DEM) topography as described in Section 2.2.

Table 4 – PHI Coastal Plain Parameters

Coastal Plain Stream Parameters	
Remoteness	Instream Habitat
Shading	Woody Debris and Rootwads
Epibenthic Substrate	Bank Stability

Each habitat parameter is given a value from 0-20. A prepared score and scaled score (0-100) are then calculated. The average of these scores yields the final PHI score. The final scores are then ranked according to the ranges shown in Table 5 and assigned corresponding narrative ratings, which allows for a score that can be compared to habitat assessments done statewide.

Table 5 – PHI Score and Ratings

PHI Score	Narrative Rating
81.0 – 100.0	Minimally Degraded
66.0 – 80.9	Partially Degraded
51.0 – 65.9	Degraded
0.0 – 50.9	Severely Degraded

2.5 Benthic Macroinvertebrate Sampling

Biological assessment using benthic macroinvertebrate sampling and analysis was completed at all sites including QC sites. Benthic macroinvertebrate collection follows the QAPP which closely mirrors MBSS procedures (Kazyak, 2001). The monitoring sites consist of a 75-meter sampling reach, and benthic macroinvertebrate sampling is conducted during the spring index period (March 1st to May 1st). The sampling methods utilize systematic field collections of the benthic macroinvertebrate community. The multi-habitat D-frame net approach is used to sample a range of the most productive habitat types present within the reach. In this sampling approach, a total of twenty jabs are distributed among all available productive habitats within the stream system and combined into a single composite sample. Potential habitats include submerged vegetation, overhanging bank vegetation, leaf packs, stream bed substrate (i.e., cobbles, gravel, sand), and submerged organic matter (i.e., logs, stumps, snags, dead branches, and other debris).

2.5.1 Sample Processing and Laboratory Identification

Benthic macroinvertebrate samples were processed and subsampled according to the County QAPP and methods described in the MBSS *Laboratory Methods for Benthic Macroinvertebrate Processing*

and Taxonomy (Boward and Friedman, 2000). Subsampling is conducted to standardize the sample size and reduce variation caused by samples of different size. In this method, the sample is spread evenly across a gridded tray (100 total grids), and each grid is picked clean of organisms until a minimum count of 120 is reached. The 120 organism target is used to allow for specimens that are missing parts or are not mature enough for proper identification. For those sites with a final count of greater than 120 organisms, a post-processing subsampling procedure was conducted using an Excel spreadsheet application (Tetra Tech, 2006). This post-processing application is designed to randomly subsample all identified organisms within a given sample to a desired target number. Each taxon is subsampled based on its original proportion to the entire sample. In this case, the desired sample size selected was 110 individuals. This allows for a final sample size of approximately 110 individuals (±20percent) but keeps the total number of individuals below the 120 maximum.

Identification of the subsampled specimens is conducted by Environmental Services and Consulting, LLC[2]. Taxa are identified to the genus level for most organisms. Groups including Oligochaeta and Nematomorpha are identified to the family level while Nematoda is left at phylum. Individuals of early instars or those that may be damaged are identified to the lowest possible level, which could be phylum or order, but in most cases would be family. Chironomidae can be further subsampled depending on the number of individuals in the sample and the numbers in each subfamily or tribe. Most taxa are identified using a stereoscope. Temporary slide mounts are used to identify Oligochaeta to family with a compound scope. Chironomid sorting to subfamily and tribe is also conducted using temporary slide mounts. Permanent slide mounts are then used for final genus level identification. Results are logged on a bench sheet and entered into a spreadsheet for analysis.

2.5.2 Biological Data Analysis

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

Raw values from each metric are given a score of 1, 3 or 5 based on ranges of values developed for each metric. The results are combined into a scaled BIBI score ranging from 1.0 to 5.0 and a corresponding narrative rating is assigned. Three sets of metric calculations have been developed for Maryland streams based on broad physiographic regions. These include the coastal plain, piedmont and combined highlands regions, divided by the Fall Line. The current study area is located within the coastal plain region. The following metrics and BIBI scoring were used for the analysis.

2.5.2.1 Coastal Plain BIBI Metrics (Modified from Table 2-3 in Southerland et al., 2005)

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

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

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

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

Percent Intolerant Urban – Percentage of sample considered intolerant to urbanization. Equals the percentage of individuals in the sample with a tolerance value of 0-3. As impairment increases the percent of intolerant taxa decreases.

Percent Ephemeroptera – Equals the percent of Ephemeroptera individuals in the sample. Ephemeroptera are generally considered pollution sensitive, thus communities dominated by Ephemeroptera usually indicate lower disturbances in water quality.

Number Scraper Taxa – Equals the number of scraper taxa in the sample, those taxa that scrape food from the substrate. As the levels of stressors or pollution rise there is an expected decrease in the numbers of Scraper taxa.

Percent Climbers – Equals the percentage of the total number of individuals who are adapted to living on stem type surfaces. Higher percentages of climbers typically represent a decrease in stressors and overall better water quality.

Information on trophic or functional feeding group and habit were based heavily on information compiled by DNR and from Merritt and Cummins (1996). Scoring criteria are shown below in Table 6. The raw metric value ranges are given with the corresponding score of 1, 3 or 5. Table 7 includes the BIBI scoring ranges and related narrative ratings.

Table 6 - Biological Condition Scoring for the Coastal Plain Benthic Macroinvertebrates

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	<1.0
Percent Intolerant Urban Taxa	≥28	10-27	<10.0
Percent Ephemeroptera Taxa	≥11	0.8-10.9	<0.8
Number Scraper Taxa	≥2	1-1	<1.0
Percent Climber Taxa	≥8.0	0.9-7.9	<0.9

Table 7 – BIBI Scoring and Rating

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

3 Results

Biological monitoring was conducted between April 17 and April 26, 2007. A total of 27 sites were visited. Additionally, three biological duplicate QC samples were collected in each subwatershed at stations where upstream habitat was considered similar. Presented below are the summary results for

each assessment site. Maps of the Magothy watershed displaying the bioassessment results can be found in Figure 3 and Appendix B. For full bioassessment data and results, refer to Appendix A.

3.1 Impervious Surface Analysis

The sampled sites are listed below in Table 8 with general information and the results of the impervious surface calculation. Stream order (Strahler) is based on the County's planimetric stream layer. Drainage areas ranged from 37.27 acres at site 2, to 3511.93 acres at site 10, the most downstream site on the major northwestern tributary of the Magothy River. The average area for the study is 553.94 acres. Imperviousness ranged from 0.83 percent, at site 27, to 42.89 percent, at site 20. The average impervious percent for the study is 19.49.

Table 8 - Site Characteristics/Imperviousness

Site	Date Sampled	Stream Order	Drainage Area (acres)	Impervious Area (acres)	Impervious Percent
MAGO-01-2007	4/17/2007	1	167.44	33.01	19.71
MAGO-02-2007	4/17/2007	1	37.27	0.94	2.52
MAGO-03-2007	4/17/2007	3	314.99	7.71	2.45
MAGO-04-2007	4/17/2007	3	733.70	78.98	10.76
MAGO-05-2007	4/17/2007	2	544.58	120.61	22.15
MAGO-06-2007	4/18/2007	1	90.79	20.93	23.05
MAGO-07-2007	4/18/2007	2	264.42	40.43	15.29
MAGO-08-2007	4/18/2007	2	420.16	106.06	25.24
MAGO-09-2007	4/18/2007	2	382.83	104.92	27.41
MAGO-10-2007*	4/18/2007	3	3511.93	569.84	16.23
MAGO-11-2007	4/19/2007	1	387.03	71.20	18.40
MAGO-12-2007	4/19/2007	1	1046.76	186.85	17.85
MAGO-13-2007	4/19/2007	1	522.11	81.92	15.69
MAGO-14-2007	4/19/2007	1	522.79	72.41	13.85
MAGO-15-2007	4/23/2007	1	202.57	41.83	20.65
MAGO-16-2007*	4/23/2007	1	243.81	28.92	11.86
MAGO-17-2007	4/23/2007	2	230.91	37.97	16.44
MAGO-18-2007	4/24/2007	3	1463.47	321.29	21.95
MAGO-19-2007	4/24/2007	2	788.38	176.72	22.42
MAGO-20-2007	4/24/2007	1	324.66	139.23	42.89
MAGO-21-2007	4/26/2007	1	116.71	32.09	27.49
MAGO-22-2007	4/24/2007	3	641.18	160.32	25.00
MAGO-23-2007*	4/25/2007	3	882.38	237.73	26.94
MAGO-24-2007	4/25/2007	3	300.28	71.18	23.70
MAGO-25-2007	4/25/2007	3	349.70	92.04	26.32
MAGO-26-2007	4/26/2007	2	373.52	108.43	29.03
MAGO-27-2007	4/26/2007	1	91.89	0.77	0.83

*QC sampling was conducted at these sites

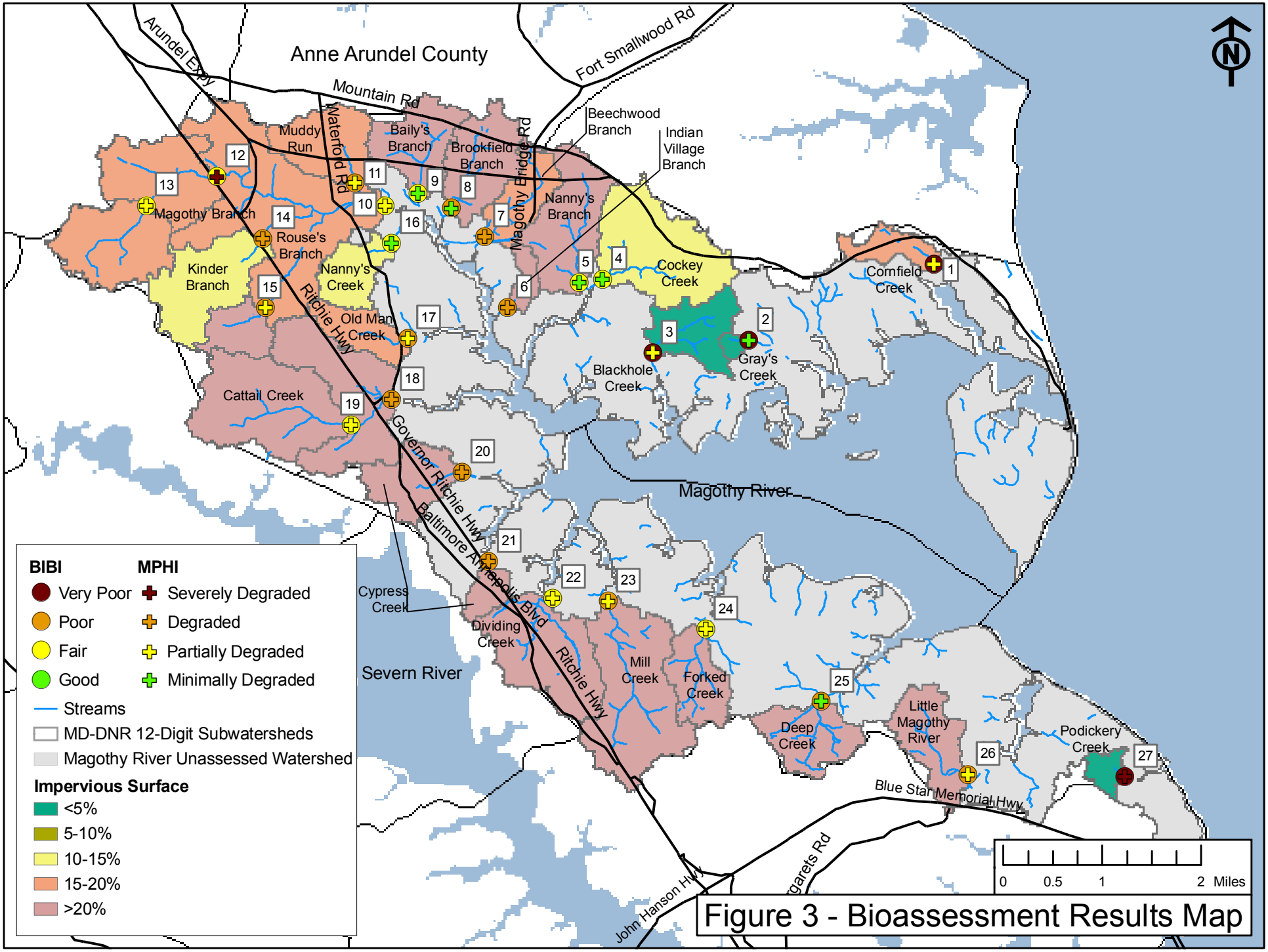

Figure 3 - Bioassessment Results Map

3.2 Water Quality

Instream water quality sampling was conducted in conjunction with macroinvertebrate sampling and occurred between April 17 and April 26, 2007. Table 9 presents the results of the instream water quality sampling. It should be noted that problems were encountered with the DO probe on three separate occasions: April 24th, 25th, and 26th, and therefore data may have been compromised. On April 24th, the DO membrane became damaged and had to be replaced in the field. It was later discovered that the KCl solution in the field kit, which was used to repair the probe, was past its expiration date and consequently may not have been performing as intended. For two sites on the final day of sampling the probe failed altogether and no data was recorded. Samples prior to April 24th were collected with a fully operable probe with functional KCl solution.

The Maryland Department of the Environment (MDE) has established acceptable standards for several of the sampled parameters for each designated Stream Use Classification. Currently, there are no standards available for conductivity or TSS. Acceptable standards are listed in the *Code of Maryland Regulations (COMAR) 26.08.02.01-.03 - Water Quality*. The Magothy River watershed is listed in *COMAR* in Sub-Basin 02-13-10: West Chesapeake Area. It is classified as a Use I stream, Water Contact Recreation, and Protection of Aquatic Life. Specific designated uses for Use I streams include water contact sports, fishing, the growth and propagation of fish, and agricultural, and industrial water supply. The acceptable standards for Use I streams are as follows:

- pH - 6.5 to 8.5
- DO - may not be less than 5 mg/l at any time
- Turbidity - maximum of 150 Nephelometer Turbidity Units (NTU's) and maximum monthly average of 50 NTU
- Temperature - maximum of 90°F (32°C) or ambient temperature of the surface water, whichever is greater

Overall, the water quality fell within COMAR limits for a Use I stream and are typical of a coastal plain stream. The shaded cells represent values that were outside acceptable COMAR limits. There were six sites with pH values below the acceptable limit of 6.5 and five with a dissolved oxygen reading below the acceptable level of 5.0 mg/l.

Table 9 - Instream Water Quality Results

Site	pH	Temperature (°C)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	Conductivity (µS/cm)	Total Dissolved Solids (mg/L)
MAGO-01-2007	6.44	8.14	11.16	16.60	365	238
MAGO-02-2007	4.21	7.99	9.60	1.97	80	52
MAGO-03-2007	3.85	8.05	10.89	1.38	95	62
MAGO-04-2007	6.05	10.50	10.79	4.00	179	116
MAGO-05-2007	6.38	10.83	10.80	5.42	214	139
MAGO-06-2007	6.36	8.69	11.86	20.23	316	205
MAGO-07-2007	6.63	8.30	9.75	10.40	338	219
MAGO-08-2007	6.91	8.80	11.48	5.17	259	169
MAGO-09-2007	6.89	10.27	11.63	3.65	368	239
MAGO-10-2007	7.19	9.48	11.75	11.87	173	113
*MAGO-10-2007-QC	6.98	9.72	11.70	12.50	174	113
MAGO-11-2007	6.87	10.7	11.09	4.46	191	125
MAGO-12-2007	7.00	10.41	11.75	3.91	211	137
MAGO-13-2007	7.09	10.73	11.64	5.74	173	119
MAGO-14-2007	6.71	11.5	11.61	8.18	182	119
MAGO-15-2007	7.29	15.00	4.62[1]	2.64	292	190
MAGO-16-2007	7.16	15.68	3.36[1]	12.32	292	190
*MAGO-16-2007-QC	7.19	17.57	3.32[1]	18.70	308	207
MAGO-17-2007	7.18	19.31	5.74[1]	1.79	234	152
MAGO-18-2007	7.12	21.27	10.82	5.17	285	185
MAGO-19-2007	7.09	22.44	8.03	10.20	184	120
MAGO-20-2007	7.22	16.18	3.08[1]	5.67	462	300
MAGO-21-2007	6.90	15.49	#	12.47	599	389
MAGO-22-2007	7.64	15.21	4.08[1]	16.77	393	256
MAGO-23-2007	7.41	15.43	10.59	11.17	251	163
*MAGO-23-2007-QC	7.18	15.29	9.33	9.99	253	165
MAGO-24-2007	7.35	15.19	10.07	7.62	127	83
MAGO-25-2007	6.94	15.67	9.58	5.30	180	117
MAGO-26-2007	7.36	13.30	7.42[1]	7.26	230	149
MAGO-27-2007	6.97	13.73	#	8.57	102	66
Study Mean	6.75	12.90	9.33	7.78	250.9	163
Standard Deviation	0.83	4.01	2.98	5.13	112.7	73

*QC sampling was conducted at these sites, excluded from mean and SD.

Dissolved Oxygen probe malfunctioned, no data recorded

[1] Questionable DO values, possibly due to malfunctioning probe

3.3 Physical Habitat Assessment

The results of the RBP and PHI habitat assessments are presented in Table 10. The percent comparability to reference scores ranged from 45.5 percent at site 06 to a high of 83.5 percent at site 08. Overall, six sites (22 percent) were classified as 'Comparable to Reference.' Thirteen sites (48 percent) were rated as 'Supporting' and seven (26 percent) were rated as 'Partially Supporting.' Only one site (4 percent) received a 'Non-Supporting' rating.

The lowest PHI score of 47.34 was recorded at site 12 while the highest score, 91.05 was recorded at site 8. Two sites, 12 and 27 rated as 'Severely Degraded', the lowest classification, and seven sites were rated as 'Degraded.' Six sites received the highest classification of 'Minimally Degraded', and the remaining 12 sites were rated as 'Partially Degraded.'

Table 10 – Habitat Assessment Results

Site	Total RBP	Percent Reference	RBP Classification	PHI Score	PHI Narrative Rating
MAGO-01-2007	136	68.0	Supporting	77.01	Partially Degraded
MAGO-02-2007	145	72.5	Supporting	83.47	Minimally Degraded
MAGO-03-2007	145	72.5	Supporting	78.79	Partially Degraded
MAGO-04-2007	160	80.0	Comparable to Reference	88.61	Minimally Degraded
MAGO-05-2007	156	78.0	Comparable to Reference	89.27	Minimally Degraded
MAGO-06-2007	91	45.5	Not Supporting	58.05	Degraded
MAGO-07-2007	131	65.5	Supporting	60.76	Degraded
MAGO-08-2007	167	83.5	Comparable to Reference	91.05	Minimally Degraded
MAGO-09-2007	156	78.0	Comparable to Reference	87.42	Minimally Degraded
MAGO-10-2007	155	77.5	Comparable to Reference	76.95	Partially Degraded
*MAGO-10-2007-QC	156	78.0	Comparable to Reference	77.32	Partially Degraded
MAGO-11-2007	128	64.0	Supporting	71.85	Partially Degraded
MAGO-12-2007	110	55.0	Partially Supporting	47.34	Severely Degraded
MAGO-13-2007	147	73.5	Supporting	72.69	Partially Degraded
MAGO-14-2007	128	64.0	Supporting	65.83	Degraded
MAGO-15-2007	111	55.5	Partially Supporting	66.91	Partially Degraded
MAGO-16-2007	147	73.5	Supporting	80.99	Partially Degraded
*MAGO-16-2007-QC	145	72.5	Supporting	78.71	Partially Degraded
MAGO-17-2007	124	62.0	Partially Supporting	76.63	Partially Degraded
MAGO-18-2007	138	69.0	Supporting	55.96	Degraded
MAGO-19-2007	122	61.0	Partially Supporting	66.14	Partially Degraded
MAGO-20-2007	98	49.0	Partially Supporting	54.99	Degraded
MAGO-21-2007	98	49.0	Partially Supporting	61.07	Degraded
MAGO-22-2007	141	70.5	Supporting	71.81	Partially Degraded
MAGO-23-2007	139	69.5	Supporting	68.89	Partially Degraded
*MAGO-23-2007-QC	154	77.0	Comparable to Reference	73.90	Partially Degraded
MAGO-24-2007	139	69.5	Supporting	65.94	Degraded
MAGO-25-2007	151	75.5	Comparable to Reference	84.33	Minimally Degraded
MAGO-26-2007	141	70.5	Supporting	78.15	Partially Degraded
MAGO-27-2007	97	48.5	Partially Supporting	50.07	Severely Degraded
Study Mean	133.4	66.7	Supporting	72.03	Partially Degraded
Standard Deviation	20.98	10.3	--	11.73	--

*QC sampling was conducted at these sites, excluded from mean and SD.

3.4 Benthic Macroinvertebrates

The BIBI scores and ratings for each site are presented in Table 11. Overall, there were four sites (15 percent) rated as 'Very Poor,' and no primary sites rated as 'Good.' Ten sites were rated as 'Fair' (37 percent) and thirteen were 'Poor' (48 percent).

Table 11 – BIBI Summary

Site	BIBI Score	Narrative Rating
MAGO-01-2007	1.6	Very Poor
MAGO-02-2007	1.6	Very Poor
MAGO-03-2007	1.6	Very Poor
MAGO-04-2007	3.9	Fair
MAGO-05-2007	3.3	Fair
MAGO-06-2007	2.1	Poor
MAGO-07-2007	2.4	Poor
MAGO-08-2007	2.7	Poor
MAGO-09-2007	3.9	Fair
MAGO-10-2007	3.6	Fair
*MAGO-10-2007-QC	4.1	Good
MAGO-11-2007	2.7	Poor
MAGO-12-2007	3.6	Fair
MAGO-13-2007	3.9	Fair
MAGO-14-2007	2.1	Poor
MAGO-15-2007	2.1	Poor
MAGO-16-2007	3.6	Fair
*MAGO-16-2007-QC	3.0	Fair
MAGO-17-2007	2.7	Poor
MAGO-18-2007	2.1	Poor
MAGO-19-2007	3.9	Fair
MAGO-20-2007	2.1	Poor
MAGO-21-2007	2.7	Poor
MAGO-22-2007	3.0	Fair
MAGO-23-2007	2.1	Poor
*MAGO-23-2007-QC	2.4	Poor
MAGO-24-2007	3.3	Fair
MAGO-25-2007	2.7	Poor
MAGO-26-2007	2.7	Poor
MAGO-27-2007	1.9	Very Poor
Study Mean	2.78	Poor
Standard Deviation	0.78	-

*QC sampling was conducted at these sites, excluded from mean and SD.

An analysis of the percent abundance and percent occurrence was completed and the results of the top 30 taxa are shown in Tables 12 and 13, respectively. *Caecidotea*, an isopod, was the most commonly collected genus making up over 9 percent of the total collected individuals. Of the top 30 taxa by percent abundance, 13 were in the family Chironomidae (midges).

Table 12 – Percent Abundance (by top 30 taxa)

Final Identification	Order	Family	Functional Feeding Group	Habit[1]	Tolerance Value	Total Number of Individuals	Percent of collected individuals
Caecidotea	Isopoda	Asellidae	Collector	sp	2.6	277	9.33
Rheocricotopus	Diptera	Chironomidae	Collector	sp	6.2	157	5.29
Polypedilum	Diptera	Chironomidae	Shredder	cb, cn	6.3	154	5.19
Tubificidae	Haplotaxida	Tubificidae	Collector	cn	8.4	120	4.04
Simulium	Diptera	Simuliidae	Filterer	cn	5.7	102	3.44
Crangonyx	Amphipoda	Crangonyctidae	Collector	sp	6.7	99	3.34
Pseudorthocladius	Diptera	Chironomidae	Collector	sp	6	98	3.30
Thienemannimyia	Diptera	Chironomidae	Predator	sp	6.7	91	3.07
Cheumatopsyche	Trichoptera	Hydropsychidae	Filterer	cn	6.5	85	2.86
Enchytraeidae	Haplotaxida	Enchytraeidae	Collector	bu	9.1	85	2.86
Orthocladiinae (tribe)	Diptera	Chironomidae	Collector	bu, sp	7.6	78	2.63
Valvata	Heterostropha	Valvatidae	Scraper	na	9	78	2.63
Gammarus	Amphipoda	Gammaridae	Shredder	sp	6.7	70	2.36
Orthocladius	Diptera	Chironomidae	Collector	sp, bu	9.2	66	2.22
Physa	Basommatophora	Physidae	Scraper	cb	7	64	2.16
Crangonyctidae	Amphipoda	Crangonyctidae	Collector	sp	6.5	60	2.02
Micropsectra	Diptera	Chironomidae	Collector	cb, sp	2.1	57	1.92
Stenelmis	Coleoptera	Elmidae	Scraper	cn	7.1	56	1.89
Hydrobaenus	Diptera	Chironomidae	Scraper	sp	7.2	46	1.55
Parametriocnemus	Diptera	Chironomidae	Collector	sp	4.6	45	1.52
Ceratopogonidae	Diptera	Ceratopogonidae	Predator	sp, bu	3.6	43	1.45
Calopteryx	Odonata	Calopterygidae	Predator	cb	8.3	42	1.42
Rheotanytarsus	Diptera	Chironomidae	Filterer	cn	7.2	41	1.38
Lumbricina (suborder)	Haplotaxida	not identified	Collector	bu	10	39	1.31
Pisidium	Veneroida	Pisidiidae	Filterer	bu	5.7	37	1.25
Polycentropus	Trichoptera	Polycentropodidae	Filterer	cn	1.1	33	1.11
Diplocladius	Diptera	Chironomidae	Collector	sp	5.9	28	0.94
Macronychus	Coleoptera	Dryopidae	Scraper	cn	6.8	28	0.94
Eukiefferiella	Diptera	Chironomidae	Collector	sp	6.1	26	0.88
Potthastia	Diptera	Chironomidae	Omnivore	sp	0	25	0.84

1 – Habit abbreviations: bu – burrower, cn – clinger, cb – climber, sp – sprawler, dv – diver, sk – skater.
QC sites were excluded from calculations.

The tolerant chironomids, *Polypedilum* and Orthocladiinae (tribe) were found at 20 (74.1 percent) and 18 (66.7 percent) of the sampling sites, respectively. An intolerant isopod, *Caecidotea* (Tolerance value = 2.6), was found at 17 of the 27 sites (63.0 percent). Other intolerant taxa in the top 30 include the midge, *Micropsectra* (Tol. val. = 2.1), the caddisfly, *Polycentropus* (Tol. val. = 1.1), and the midge, *Potthastia* (Tol. val. = 0). By percent occurrence, chironomids (midges) make up nearly half (14) of the top 30 taxa.

Table 13 – Percent Occurrence (by top 30 taxa)

Final Identification	Order	Family	Functional Feeding Group	Habit[1]	Tolerance Value	Number of sites with this taxa	Percent of sites with this taxa
Polypedilum	Diptera	Chironomidae	Shredder	cb, cn	6.3	20	74.1
Orthocladiinae (tribe)	Diptera	Chironomidae	Collector	bu, sp	7.6	18	66.7
Caecidotea	Isopoda	Asellidae	Collector	sp	2.6	17	63.0
Calopteryx	Odonata	Calopterygidae	Predator	cb	8.3	16	59.3
Thienemannimyia	Diptera	Chironomidae	Predator	sp	6.7	16	59.3
Tubificidae	Haplotaxida	Tubificidae	Collector	cn	8.4	16	59.3
Simulium	Diptera	Simuliidae	Filterer	cn	5.7	15	55.6
Crangonyx	Amphipoda	Crangonyctidae	Collector	sp	6.7	14	51.9
Orthocladius	Diptera	Chironomidae	Collector	sp, bu	9.2	14	51.9
Ceratopogonidae	Diptera	Ceratopogonidae	Predator	sp, bu	3.6	13	48.1
Enchytraeidae	Haplotaxida	Enchytraeidae	Collector	bu	9.1	12	44.4
Hydrobaenus	Diptera	Chironomidae	Scraper	sp	7.2	12	44.4
Lumbricina (suborder)	Haplotaxida	not identified	Collector	bu	10	12	44.4
Cheumatopsyche	Trichoptera	Hydropsychidae	Filterer	cn	6.5	11	40.7
Eukiefferiella	Diptera	Chironomidae	Collector	sp	6.1	11	40.7
Micropsectra	Diptera	Chironomidae	Collector	cb, sp	2.1	11	40.7
Stenelmis	Coleoptera	Elmidae	Scraper	cn	7.1	11	40.7
Lepidoptera	Lepidoptera	not identified	Shredder	na	6.7	10	37.0
Parametriocnemus	Diptera	Chironomidae	Collector	sp	4.6	10	37.0
Rheocricotopus	Diptera	Chironomidae	Collector	sp	6.2	10	37.0
Diplocladius	Diptera	Chironomidae	Collector	sp	5.9	9	33.3
Physa	Basommatophora	Physidae	Scraper	cb	7	9	33.3
Polycentropus	Trichoptera	Polycentropodidae	Filterer	cn	1.1	9	33.3
Chironomini	Diptera	Chironomidae	Collector	bu	5.9	8	29.6
Cricotopus	Diptera	Chironomidae	Shredder	cn, bu	9.6	8	29.6
Gammarus	Amphipoda	Gammaridae	Shredder	sp	6.7	8	29.6
Pisidium	Veneroida	Pisidiidae	Filterer	bu	5.7	8	29.6
Pseudorthocladius	Diptera	Chironomidae	Collector	sp	6	8	29.6
Rheotanytarsus	Diptera	Chironomidae	Filterer	cn	7.2	8	29.6
Tipula	Diptera	Tipulidae	Shredder	bu	6.7	8	29.63

1 – Habit abbreviations: bu – burrower, cn – clinger, cb – climber, sp – sprawler, dv – diver, sk – skater.
QC sites were excluded from calculations.

As shown in Tables 12 and 13, members of the family Chironomidae were dominant throughout the watershed. In general, the relative abundance of chironomids increases with increased perturbation. Table 14 lists all sites sampled and the percentage of identified individuals that were in the Chironomidae family. Site 25 contained the highest percentage of chironomids (87 percent) followed by sites 03 (70 percent) and 11 (69 percent). The lowest percentage was found at site 21, with only 3 individuals (3 percent).

Table 14 – Chironomidae Analysis

Site	Total Chironomidae per site	Total number of individuals per site	Percent Chironomidae
MAGO-01-2007	42	119	35
MAGO-02-2007	42	116	36
MAGO-03-2007	81	116	70
MAGO-04-2007	35	112	31
MAGO-05-2007	68	118	58
MAGO-06-2007	65	109	60
MAGO-07-2007	15	109	14
MAGO-08-2007	53	116	46
MAGO-09-2007	47	102	46
MAGO-10-2007	54	109	50
MAGO-10-2007-QC	36	121	30
MAGO-11-2007	74	108	69
MAGO-12-2007	44	106	42
MAGO-13-2007	67	106	63
MAGO-14-2007	32	105	30
MAGO-15-2007	42	118	36
MAGO-16-2007	31	105	30
MAGO-16-2007-QC	37	117	32
MAGO-17-2007	43	102	42
MAGO-18-2007	10	112	9
MAGO-19-2007	47	107	44
MAGO-20-2007	18	108	17
MAGO-21-2007	3	114	3
MAGO-22-2007	25	120	21
MAGO-23-2007	51	89	57
MAGO-23-2007-QC	22	86	26
MAGO-24-2007	38	115	33
MAGO-25-2007	90	104	87
MAGO-26-2007	32	111	29
MAGO-27-2007	22	112	20

4 Site Conditions

The Magothy watershed study area is made up of multiple small tributaries with average drainage areas of approximately 500 acres. The study area can be effectively divided into a northern portion and southern portion, with Cattail Creek being the lower extent of the northern section and Cypress Creek being the upper extent of the southern section, as is the case with the County-wide Biological Monitoring Program. Table 15 contains consolidated assessment results for each site to allow for easier comparisons of site specific conditions. Biological potential is limited by the quality of the physical habitat, which forms the template upon which biological communities develop (Southwood 1977). To examine the biological condition in comparison to the site's biological potential as defined by the habitat ratings (both RBP and PHI), a matrix was developed by plotting each station by biological rating on one axis and habitat rating on the other in order to determine whether they exceed, match, or fall short of their expected biological potential. The biological potential matrix for both RBP and PHI habitat ratings is shown in Table 16. The following section contains brief descriptions of the site-specific results and conditions.

Table 15 – Consolidated Assessment Results

Site	Subwatershed Code	Drainage Area (acres)	Impervious Percent	BIBI Score	RBP Score	RBP Percent Reference	PHI Score
MAGO-01-2007	MR0	167.44	19.71	1.6	136	68	77.01
MAGO-02-2007	MRE	37.27	2.52	1.6	145	72.5	83.47
MAGO-03-2007	MRG	314.99	2.45	1.6	145	72.5	78.79
MAGO-04-2007	MR6	733.7	10.76	3.9	160	80	88.61
MAGO-05-2007	MGY	544.58	22.15	3.3	156	78	89.27
MAGO-06-2007	MGW	90.79	23.05	2.1	91	45.5	58.05
MAGO-07-2007	MR5	264.42	15.29	2.4	131	65.5	60.76
MAGO-08-2007	MR4	420.16	25.24	2.7	167	83.5	91.05
MAGO-09-2007	MR1	382.83	27.41	3.9	156	78	87.42
MAGO-10-2007	MR7	3511.93	16.23	3.6	155	77.5	76.95
MAGO-11-2007	MR2	387.03	18.4	2.7	128	64	71.85
MAGO-12-2007	MR3	1046.76	17.85	3.6	110	55	47.34
MAGO-13-2007	MG1	522.11	15.69	3.9	147	73.5	72.69
MAGO-14-2007	MR9	522.79	13.85	2.1	128	64	65.83
MAGO-15-2007	MRA	202.57	20.65	2.1	111	55.5	66.91
MAGO-16-2007	MRB	243.81	11.86	3.6	147	73.5	80.99
MAGO-17-2007	MRF	230.91	16.44	2.7	124	62	76.63
MAGO-18-2007	MRI	1463.47	21.95	2.1	138	69	55.96
MAGO-19-2007	MRO	788.38	22.42	3.9	122	61	66.14
MAGO-20-2007	MGC	324.66	42.89	2.1	98	49	54.99
MAGO-21-2007	MGC	116.71	27.49	2.7	98	49	61.07
MAGO-22-2007	MGH	641.18	25	3	141	70.5	71.81
MAGO-23-2007	MGI	882.38	26.94	2.1	139	69.5	68.89
MAGO-24-2007	MGL	300.28	23.7	3.3	139	69.5	65.94
MAGO-25-2007	MGT	349.7	26.32	2.7	151	75.5	84.33
MAGO-26-2007	MGV	373.52	29.03	2.7	141	70.5	78.15
MAGO-27-2007	MGZ	91.89	0.83	1.9	97	48.5	50.07

Table 16 – Station Biological Potential Matrix

EPA RBP HABITAT RATING	BIOLOGICAL RATING				MBSS PHI HABITAT RATING	BIOLOGICAL RATING			
	GOOD	FAIR	POOR	VERY POOR		GOOD	FAIR	POOR	VERY POOR
Comparable		04; 05; 09; 10	08; 25		Minimally Degraded		04; 05; 09;	08; 25	2
Supporting		13; 16; 22; 24	07; 11; 14; 18; 23; 26	01; 02; 03	Partially Degraded		10; 13; 16; 19; 22;	11; 15; 17; 23; 26	01; 03
Partially Supporting		12; 19	15; 17; 20; 21	27	Degraded		24	06; 07; 14; 18; 20; 21	
Non-Supporting			6		Severely Degraded		12		27

Green indicates stations where the biological community exceeded the habitat potential
Orange indicates stations where the biological community reached habitat potential
Pink indicates stations where the biological community did not reach the habitat potential

01 Cornfield Creek (Subwatershed MR0)

Site 01 is located along a segment of Cornfield Creek situated in a residential neighborhood and has a drainage area of 167 acres. The drainage area has a high percentage of imperviousness (19.7 percent), primarily due to residential and commercial land uses. The site received a 'Supporting' RBP habitat rating and the PHI habitat received a similar 'Partially Degraded' rating. The biological condition was rated 'Very Poor' with a BIBI score of 1.6. Water quality, including a low pH (6.44), is likely a more limiting factor to the biota than is habitat quality. The low pH was likely attributed to an abundance of leaf and organic matter decomposing in the swampy wetlands draining into the stream. Conductivity (365 uS/cm) and total dissolved solids (238 mg/L) were also above average for the watershed, suggesting excessive urban runoff may be impacting the biota.

02 Gray's Creek (Subwatershed MRE)

This site is located along a small, shallow first-order segment of Gray's Creek, which lacked the necessary drainage area and depth to provide good instream habitat for fish. The channel was not well defined and had very little flow, most of which was likely the result of recent heavy rains. Much of the water in the channel was present as standing pools with an abundance of leaf matter. The decomposing leaf matter is likely contributing to the low pH (4.21). The drainage area is mostly forested (only 2.5 percent imperviousness), and both RBP and PHI habitat received 'Supporting' and 'Minimally Degraded' ratings, respectively. However, the biological condition was rated 'Very Poor' (BIBI = 1.6). The benthic community was dominated by midges and aquatic worms, with an overall diversity of 19 total taxa. Based on the small drainage area (37.3 acres), lack of defined channel features, and limited flow, it is likely that this is an intermittent tributary with seasonal flow.

03 Black Hole Creek (Subwatershed MRG)

Located on a third-order segment of the Blackhole Creek mainstem, this site has a mostly forested drainage with minimal impervious cover (2.4 percent) and an area of 315 acres. This site was rated

'Partially Degraded,' for the PHI, and the RBP rating was similar and in the 'Supporting' category. The BIBI score was a very low 1.6, placing the biological condition in the 'Very Poor' category. The benthic community was dominated by midges, which comprised 70 percent of the sample. *Pseudorthocladius*, a fairly tolerant midge (Tol. val. = 6) was the most abundant taxon. There was an abundance of leaves, pine needles, and woody debris in the channel, some of which appeared to have been dumped into the channel by nearby residences. The decomposing pine needles and leaves and the Blackhole Creek Bog located upstream complex, which is naturally acidic, could explain the very low pH (3.85), which, consequently may be inhibiting the biological community

04, 05 Cockey Creek and Nannys Branch (Subwatersheds MR6 and MGY)

Sites 04 and 05 are located on Cockey Creek and Nannys Branch, respectively. Site 04 had significantly less impervious drainage (10.8 percent) and had a larger drainage area (734 acres) than site 05 (22.1 percent, 545 acres); both received RBP habitat ratings of 'Comparable to Reference' and PHI ratings of 'Minimally Degraded.' Both sites also received biological condition ratings of 'Fair', with site 04 having a slightly higher BIBI score (3.9) than site 05 (3.3). Both sites had good numbers of taxa present, but site 04 scored slightly higher due to the presence of Ephemeroptera and a greater percentage of individuals intolerant to urban stressors (52 percent versus 19 percent). These sites had ample riparian buffers, stable banks, and were well shaded.

06 Indian Village Branch (Subwatershed MGW)

Site 06 is located in the middle of a residential yard and had virtually no riparian buffer due to the landowner mowing to the edge of the stream banks. There was an abundance of rip-rap placed in the channel and along the lower banks along much of the reach. There was also a very large pile of refuse and tires dumped in the channel just upstream of the site. This was a relatively small drainage area (90.8 acres), with high imperviousness (23.1 percent). Habitat assessment results were 'Non-Supporting' (RBP) and 'Degraded' (PHI) primarily due to the lack of adequate instream habitat, riparian buffers, pools, and low flow diversity. The benthic community had very low taxa diversity (14 total) and was dominated by midges (*Polypedilum* and *Chironomus*) and aquatic worms (Enchytraeidae and Tubificidae*)*, resulting in a BIBI score of 2.1 and a 'Poor' rating.

07 Beechwood Branch (Subwatershed MR5)

Site 07 has a drainage area of 264 acres, 15.29 percent of which is impervious and is located just upstream of Magothy Bridge Road on the mainstem of Beechwood Branch. The stream was a shallow, sandy bottom channel and contained a large amount of refuse. The site is rated as 'Degraded' by the PHI primarily due to its proximity to the road, lack of epibenthic substrate and instream habitat, and poor shading. For RBP habitat, however, it was rated as 'Supporting' since it had high scores for bank stability, vegetative protection, and riparian buffers. Along with site 06 it had the lowest number of taxa (14) in the entire Magothy watershed and received a BIBI score of 2.4, resulting in a 'Poor' biological rating. Dominant taxa include the intolerant isopod *Caecidotea* (Tol. val. = 2.6) and the clam Pisidiidae (Tol. val. = 5.5). No Ephemeroptera or EPT taxa were present and only one scraper taxa was found.

08 Brookfield Branch (Subwatershed MR4)

Site 08 has a drainage area of over 420 acres and an imperviousness of 25.2 percent due to residential developments, portions of Rte 100 and Mountain Road and their associated commercial land use. The site is located in a mostly wetland area, with a narrow (less than 1 meter), fairly deep (70 cm) channel dominated by sandy substrate. The overall habitat rating is 91.0 in the 'Minimally Degraded' PHI category and 83.5 in the 'Comparable to Reference' RBP category. The BIBI score was 2.7 in the 'Poor' range, which is below what would be expected based on the habitat scores. While the benthic sample had a high number of overall taxa and a good number of scraper taxa, the lack of Ephemeroptera and low percentage of individuals intolerant to urbanization indicate an impaired

biological community. Possible water quality issues may be causing biological impairment, especially following storm flows given the high imperviousness of the drainage area. It should also be noted that a large (approximate 2 foot diameter) corrugated plastic pipe ran parallel to the channel along the entire length of the floodplain, possibly acting as a replacement storm sewer line. It is possible that the pipe may be leaking into the stream channel causing impairment.

09 Bailys Branch (Subwatershed MR1)

Site 09 is located in a steep valley in relatively mature forest, however the 383 acre drainage area has a high degree of imperviousness (27.4 percent) due to residential landuse and portions of Rte 100 and Mountain Road and associated commercial land use. The habitat rating was 'Minimally Degraded' matching fairly well with the rating from RBP of 'Comparable to Reference.' The BIBI score was 3.9, in the 'Fair' category and just below the rating of 'Good,' which ranges from 4.0 to 5.0. The channel had a broad riparian buffer and good undercut bank habitat. The banks in the reach were stable, with only minor signs of erosion. Five EPT taxa were present in the sample of 29 overall taxa, however, none were Ephemeroptera.

10, 12, 13 Magothy Branch (Subwatersheds MR7, MR3, and MG1)

Sites 10, 12, and 13 are all located along the Magothy Branch mainstem. These sites all received 'Fair' biological ratings. The most downstream site (10) has the largest drainage area (3512 acres) of sites in the Magothy watershed study and a below average percent imperviousness (16.2 percent). The site received habitat ratings of 'Comparable to Reference' (RBP) and 'Partially Degraded' (PHI), with the PHI rating slightly lower for remoteness, due to the proximity to a nearby road, and reduced woody debris. Site 12 has a drainage area of 1047 acres and an imperviousness of 17.85 percent. Located just downstream of Ritchie Highway this site had more degraded habitat conditions, resulting in ratings of 'Partially Supporting' (RBP) and 'Severely Degraded' (PHI). Most of the channel was eroding due to an active headcut. The substrate was primarily hard-pan clay. Proximity to the highway and a lack of stable habitat for biota were also responsible for the low habitat ratings. The low habitat rating and moderate biological rating, suggests that there may be some nutrient enrichment occurring at this location, which would explain the higher than expected BIBI scores. Site 13, the most upstream site on the mainstem with a drainage area of 577 acres, is located in a residential neighborhood and has a moderately impervious drainage area (15.7 percent), most of which is attributed to residential land use. The stream is a braided, sandy bottom channel with a sufficient amount of woody debris and rootmats. Physical habitat was rated 'Supporting' (RBP) and 'Partially Degraded' (PHI). Low scores were given for remoteness and percent shading, but sinuosity, channel flow, and bank stability all scored well.

11, 14, and 15 Magothy Branch Tributaries (Muddy Run MR2, Kinder Branch MR9, and Rouses Branch MRA)

Site 11 is located just upstream of a farm pond impoundment on Muddy Run and has a drainage area of 387 acres, 18.4 percent of which is impervious. There was excessive sedimentation observed in the channel, which is likely exacerbated by the alterations in flow and transport patterns resulting from the instream impoundment. As expected, this site was rated 'Poor' (BIBI = 2.7) for biological condition. Of 24 total taxa found, only one EPT taxa was present, and greater than two-thirds of the individuals (69 percent) were Chironomidae taxa. The site received ratings of 'Partially Degraded' (PHI) and 'Supporting' (RBP) for habitat. Sites 14 and 15 also had 'Poor' biological ratings, with identical BIBI scores of 2.1. Both sites also had low total taxa counts of 17 and 15, respectively. Site 14 had a slightly better RBP habitat rating ('Supporting' vs. 'Partially Supporting), while site 15 received a slightly better PHI rating ('Partially Degraded' vs. 'Degraded'). Percent imperviousness was greater at site 15 (20.7 percent) than at site 14 (13.9 percent).

16 Nannys Creek (Subwatershed NRB)

Site 16 is located in a wooded valley surrounded by wetlands, adjacent to a residential neighborhood. The drainage area is fairly small at 244 acres, and it has an impervious cover of 11.9 percent, which is well below the average in the watershed. The habitat was rated as 'Partially Degraded' (PHI) and 'Supporting' (RBP), with very little bank erosion. The biology was rated 'Fair' with a BIBI score of 3.6. This site had 31 total taxa present, five EPT taxa and five scraper taxa.

17 Old Man Creek (Subwatershed MRF)

This site is located on the mainstem of Old Man Creek, a short distance downstream of Baltimore Annapolis Boulevard. Much of the drainage area is comprised of residential land use, and subsequently, impervious cover accounts for 16.4 percent of the 231 acre drainage. The overall habitat rating is 76.6 in the 'Partially Degraded' PHI category and 62.0 in the 'Partially Supporting' RBP category. The biological condition was rated 'Poor' with a BIBI score of 2.7. The dominant taxa found were *Simulium,* a black fly, (Tol. val.= 5.7), and *Corynoneura*, a midge, (Tol. val.= 4.1). The complete lack of Ephemeroptera and low percentage of individuals intolerant to urbanization signify an impaired biological community.

18, 19 Cattail Creek (Subwatersheds MRI and MRO)

Sites 18 and 19 are both located along the Cattail Creek mainstem in highly impervious drainages of 22.0 and 22.4 percent, respectively. Site 18, located downstream of site 19, has the second largest drainage area in the Magothy watershed at 1463 acres. This stream flows through a large wetland and had a very mucky, organic substrate. Some beaver activity was observed around the stream. This site was rated 'Degraded' for the PHI, but had a slightly better RBP rating of 'Supporting.' The BIBI score was low (2.1), placing the biological condition in the 'Poor' category. The benthic community was dominated by *Valvata*, a pollution tolerant snail (Tol. val. = 9). Site 19, which has a drainage area of 788 acres, had a BIBI score of 3.9, resulting in a 'Fair' biological condition rating. The dominant taxon at this site was *Micropsectra*, an intolerant midge (Tol. val. = 2.1). In addition, there was a high number of scraper taxa (7) as well as a high percentage of climbers present (40.2 percent). Physical habitat was rated 'Partially Supporting' (RBP) and 'Partially Degraded' (PHI).

20, 21 Cypress Creek (Subwatershed MGC)

Sites 20 and 21 are located on the north fork and south fork of Cypress Creek, respectively. Site 20 has a drainage area of 325 acres and has the highest imperviousness (42.9 percent) within the entire watershed due in large part to the presence of Severna Park Market Place, Park Plaza, and Loehmanns Plaza upstream. As expected, the biological condition was rated 'Poor' with a BIBI score of 2.1. The benthic community was dominated by pollution tolerant worm taxa including Tubificidae (Tol. val.= 8.1), Enchytraeidae (Tol. val.= 9.1), and Lumbricina (Tol. val.=10). Only one percent of the sample was comprised of urban intolerant individuals, suggesting that urban stressors are largely responsible for the biological impairment at this site. Both sites were rated as 'Degraded' (PHI) and 'Partially Supporting' (RBP), however, site 20 had more severely eroded banks and an excessive amount of refuse in the channel. Although it had slightly less impervious at 27.5 percent, site 21, which has a drainage area of 117 acres, also had a 'Poor' biological condition (BIBI = 2.7). In contrast to site 20, the dominant taxon was *Caecidotea* (Tol. val.= 2.6), a fairly intolerant isopod. However, total taxa was low compared with the rest of the watershed, and EPT taxa were absent from the sample altogether.

22 Dividing Creek (Subwatershed MGH)

Site 22, located on the Dividing Creek mainstem and has a drainage area of 641 acres, has an impervious drainage of 25 percent, due in large part to Anne Arundel Community College and a large stretch of Ritchie Highway. Physical habitat was rated 'Partially Degraded,' for the PHI in part due to the adjacent roadway and an incomplete riparian buffer. The RBP rating was similar and in the

'Supporting' category. An active headcut was observed in the channel indicating active downcutting and erosion. A clay substrate dominates a large portion of the reach. The biological condition was rated 'Fair' with a BIBI score of 3.0, which is just above the upper threshold of 2.9 for the 'Poor' category. *Physa*, a tolerant snail (Tol. val.= 7) was the dominant taxon present. Metrics for total taxa, number of scrapers, and percent climbers all scored well, however, a low intolerant to urban percentage and a complete lack of Ephemeroptera taxa kept the sample from achieving a higher BIBI score.

23 Mill Creek (Subwatershed MGI)

Also located downstream of Anne Arundel Community College and a large stretch of Ritchie Highway, site 23 has an 882 acre drainage area with a high percentage of impervious surface (26.9 percent). The site was located along a segment of Mill Creek with prominent beaver activity, and a beaver dam was observed just upstream of the sampling reach. The sampling reach was uncharacteristically deep and slow flowing, suggesting that there may have been a beaver dam further downstream. Habitat assessment results were 'Supporting' (RBP) and 'Partially Degraded' (PHI). Biological condition, however, was rated 'Poor' (BIBI = 2.1), due to the absence of both EPT taxa (including Ephemeroptera) and scraper taxa, as well a low percentage of individuals intolerant to urban stressors (4 percent). It is possible that the depressed biological score can be partially attributed to hydrologic alterations caused by beaver activity, although to a lesser extent than stressors related to elevated imperviousness.

24 Forked Creek (Subwatershed MGL)

Site 24 is located along a section of Forked Creek that meanders through a broad, swampy wetland and has a very mucky, organic matter dominated substrate. Due to a large proportion of residential land use in the 300 acre drainage area, imperviousness is 23.7 percent. Physical habitat was rated as 'Degraded' by the PHI in large part due to its lack of shading and remoteness. For RBP habitat, however, it was rated as 'Supporting' since it received high scores for bank stability, vegetative protection, and riparian buffers in addition to channel features (i.e., flow, sinuosity, and alteration). The BIBI score was 3.3, placing the biological condition in the 'Fair' category. The benthic community was dominated by *Caecidotea* (Tol. val.= 2.6), a fairly intolerant isopod, resulting in the maximum score for the percent intolerant to urban metric. High scores were also received for total taxa and number of scraper metrics, however, the absence of *Ephemeroptera* kept the BIBI score at the lower end of the 'Fair' category.

25 Deep Creek (Subwatershed MGT)

Site 25 is located within a broad wetland valley on a braided segment of Deep Creek. Much of the 350 acre drainage area is comprised of residential land uses, and impervious cover accounts for 26.3 percent of the drainage area. The site received a BIBI score of 2.7, resulting in a 'Poor' condition rating. The benthic results indicate that 87 percent of the individuals were Chironomidae taxa (midges). Additionally, only one EPT taxon was present, the percentage of intolerant individuals was very low (6 percent), and Ephemeroptera taxa were absent. The overall habitat rating is 84.3 in the 'Minimally Degraded' PHI category and 75.5 in the 'Comparable to Reference' RBP category, suggesting that habitat is not the limiting factor affecting the biota. It is likely that water quality, primarily during storm flows, may be responsible for the observed biological impairment at this location.

26 Little Magothy River (MGV)

The imperviousness at site 26 was the second highest in the watershed at 29 percent of the 374 acre drainage area, which is due in large part to Broadneck High School and Cape Saint Claire Elementary School in addition to high density residential land use. This site was located adjacent to a residential home, and it was observed that the landowner had been filling in the floodplain with mulch and

attempting to stabilize the streambank with timbers and cinderblock. The physical habitat was rated 'Partially Degraded' (PHI) and 'Supporting' (RBP) due to the abundance of woody debris, high shading, and stable, well-vegetated banks. The biological condition, however, was rated 'Poor' with a BIBI score of 2.7. Total taxa was relatively low (15) for the site, Ephemeroptera were absent, and only one EPT taxa was present. Since the biological community did not reflect the potential provided by the habitat, it is likely that water quality impairment may be the limiting stressor at this site, given the highly impervious drainage area.

27 Podickery Creek (Subwatershed MGZ)

Located immediately downstream of Tydings Road and Sandy Point State Park, site 27 had the lowest percentage of impervious area of all sites in the watershed at 0.8 percent. While predominantly forested, the drainage area is relatively small (91.9 acres), and a wetland upstream of the road appeared to limit the flow out of the culvert and into the sampling reach. The stream was very narrow and shallow and lacks the necessary drainage area and depth to provide good instream habitat for fish and suitable substrate to support a healthy benthic macroinvertebrate community. Physical habitat was rated 'Severely Degraded' (PHI) due to the lack of fish and epifaunal habitat, poor shading, and the proximity to the road. Habitat was rated slightly higher for RBP as 'Partially Supporting', but the score was at the lowest end of that range and only one point above the 'Non-Supporting' category. There were also some signs of channel alteration (i.e., gabion baskets) and stabilization, and the lack of sinuosity suggests that there may have been some past channel straightening. As anticipated, the biological community was rated 'Very Poor' (BIBI = 1.9), due to low total taxa (15), no EPT or Ephemeroptera Taxa, and a small percentage of climbers (0.8 percent).

5 Conclusion

While the targeted study design does not support assessment results at the overall watershed scale, general statements about the Magothy study area can be made based on site-specific results. Of the 27 sites assessed, 63 percent had impaired biological conditions and no sites were rated 'Good'. The biological results indicate a mean BIBI score of 2.73, which would be in the 'Poor' category. Four sites were rated as 'Very Poor' and most received either 'Poor' (thirteen sites) or 'Fair' (ten sites) biological ratings. Chironomidae taxa dominated many of the samples and made up three of the top five taxa by percent occurrence. While some chironomid taxa are intolerant to stressors, the relevant abundance of chironomids tends to increase in urbanized drainages. Other prevalent taxa included *Caecidotea,* an intolerant isopod (as defined by Bressler at al. 2004 and accepted by MBSS), and *Calopteryx*, a stressor tolerant damselfly. Although *Caecidotea* is defined by MBSS as intolerant based on its revised tolerance value for Maryland (Tol. val. = 2.6), several other sources have assigned higher tolerance ratings indicative of greater pollution tolerance (i.e., Hilsenhoff, 1987 [Tol. val. = 8]; Barbour et al., 1999 [Tol. val. = 6] Davies and Jackson, 2006[Biological Condition Gradient = 5, i.e. tolerant], Carlisle et al., 2007 [highly tolerant to nutrients and ions and to a lesser extent fine substrates]). Additionally, *Caecidotea* has been found to be tolerant to sedimentation and able to withstand high flow effects (Meidel 2005), which are both common stressors in urbanized watersheds. A broad lack of taxa in the sensitive orders – Ephemeroptera, Plecoptera, and Trichoptera – is further indication that urban stressors are broadly affecting the biological integrity of these streams.

Habitat scores for the RBP and PHI assessments were well correlated (r squared = 0.68), and both indicate varying habitat conditions throughout the watershed. The majority of sites assessed were rated as "Supporting" by the RBP (48 percent) or "Partially Degraded" by the PHI (46 percent). Twenty-six percent of the sites were rated as 'Partially Supporting' (RBP) or 'Degraded' (PHI), while 22 percent were rated 'Comparable to Reference' (RBP) or 'Minimally Degraded'(PHI). Only a small proportion of sites were rated as either 'Non-Supporting'(four percent) or 'Severely Degraded'(seven percent).

Impervious surface coverage was relatively high throughout the study area with an average imperviousness of 19.5 percent. Only three drainage areas had imperviousness below 10 percent,

while eight sites had impervious drainages of 25 percent or greater. Water quality parameters were primarily within the required levels, however, a few sites had very low pH values. These low values are likely due to tannic conditions caused by decomposing organic matter and from naturally occurring acidic bog conditions.

The responses observed in the Magothy Watershed are fairly consistent with those predicted by the Impervious Cover Model (Scheuler 1994), which concludes that most stream quality indicators (in this case benthic macroinvertebrates) decline when watershed impervious cover exceeds 10%, with severe degradation expected beyond 25% impervious cover. By and large, urban stressors appear to be the primary cause of biological impairment observed throughout the watershed. Urban stressors likely occurring in the Magothy Watershed include altered hydrologic regimes, increased sedimentation, degraded instream habitat, degraded riparian habitat, and possibly increased nutrients and toxics from runoff.

6 References

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Appendix A: Benthic Macroinvertebrate Data

Magothy Watershed - Biological Monitoring and Assessment
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Benthic Macroinvertebrate Data

MAGO-01-2007

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Ablabesmyia	Ablabesmyia	I	1	Predator	sp	8.1
Insecta	Diptera	Chironomidae	Alotanypus	Alotanypus	I	2	na	na	6.6
Bivalvia	not identified	not identified	not identified	Bivalvia	U	1	Filterer	na	5.5
Crustacea	Isopoda	Asellidae	Caecidotea	Caecidotea	U	26	Collector	sp	2.6
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae	I	1	Predator	sp, bu	3.6
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae	P	1	Predator	sp, bu	3.6
Insecta	Diptera	Chironomidae	not identified	Chironomini	P	1	Collector	bu	5.9
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	U	37	Collector	sp	6.7
Insecta	Diptera	Chironomidae	Diplocladius	Diplocladius	I	3	Collector	sp	5.9
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	2	Collector	bu	9.1
Arachnida	Acariformes	Hydrachnidae	not identified	Hydrachnidae	I	2	na	na	na
Insecta	Diptera	Chironomidae	Paraphaenocladius	Paraphaenocladius	I	17	Collector	sp	4
Insecta	Diptera	Chironomidae	Paratendipes	Paratendipes	I	1	Collector	bu	6.6
Insecta	Diptera	Chironomidae	Phaenopsectra	Phaenopsectra	I	1	Collector	cn	8.7
Insecta	Trichoptera	Polycentropodidae	Polycentropus	Polycentropus	I	1	Filterer	cn	1.1
Insecta	Diptera	Chironomidae	Psectrocladius	Psectrocladius	I	1	Shredder	sp, bu	6.6
Insecta	Diptera	Chironomidae	Pseudorthocladius	Pseudorthocladius	I	2	Collector	sp	6
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	1	Filterer	cn	5.7
Insecta	Diptera	Syrphidae	not identified	Syrphidae	I	1	Collector	na	na
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	5	Predator	sp	6.7
Insecta	Diptera	Tipulidae	Tipula	Tipula	I	3	Shredder	bu	6.7
Insecta	Diptera	Tipulidae	not identified	Tipulidae	I	1	Predator	bu, sp	4.8
Insecta	Diptera	Chironomidae	Tribelos	Tribelos	I	8	Collector	bu	7

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

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Benthic Macroinvertebrate Data

MAGO-02-2007

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Culicidae	Aedes	Aedes	I	7	Filterer	sw	8
Insecta	Diptera	Chironomidae	Cantopelopia	Cantopelopia	I	1	Predator	sp	6.6
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae	I	12	Predator	sp, bu	3.6
Hexapoda	Collembola	not identified	not identified	Collembola	U	1	Collector	sp, sk	6
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	3	Collector	sp	4.1
Insecta	Diptera	Ceratopogonidae	Culicoides	Culicoides	I	2	Predator	bu	5.9
Insecta	Coleoptera	Dytiscidae	not identified	Dytiscidae	I	2	Predator	sw, dv	5.4
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	14	Collector	bu	9.1
Insecta	Coleoptera	Dytiscidae	Hydaticus	Hydaticus	I	2	Predator	sw	5.4
Insecta	Coleoptera	Hydrophilidae	not identified	Hydrophilidae	I	1	Collector	sw, dv	4.1
Insecta	Lepidoptera	not identified	not identified	Lepidoptera	I	5	Shredder	na	6.7
Insecta	Diptera	Chironomidae	Limnophyes	Limnophyes	I	3	Collector	sp	8.6
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	13	Collector	bu	10
Insecta	Diptera	Tipulidae	Molophilus	Molophilus	I	6	Shredder	bu	4.8
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	3	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	3	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Pseudorthocladius	Pseudorthocladius	I	10	Collector	sp	6
Insecta	Coleoptera	Staphylinidae	not identified	Staphylinidae	A	1	Predator	cn, cb, bu	5
Insecta	Diptera	Chironomidae	not identified	Tanypodinae	P	4	Predator	sp, sw	7.5
Insecta	Coleoptera	Dytiscidae	Thermonectus	Thermonectus	A	1	Predator	sw, dv	5.4
Insecta	Diptera	Tipulidae	Tipula	Tipula	I	5	Shredder	bu	6.7
Insecta	Diptera	Tipulidae	Tipula	Tipula	P	2	Shredder	bu	6.7
Insecta	Diptera	Chironomidae	Zavrelimyia	Zavrelimyia	I	15	Predator	sp	5.3

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

Magothy Watershed - Biological Monitoring and Assessment
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Benthic Macroinvertebrate Data

MAGO-03-2007

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Bibionidae	not identified	Bibionidae	I	4	na	na	na
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae	I	5	Predator	sp, bu	3.6
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae	P	1	Predator	sp, bu	3.6
Insecta	Diptera	Chironomidae	not identified	Chironomidae	P	1	Collector	na	6.6
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	3	Collector	sp	4.1
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	1	Shredder	cn, bu	9.6
Insecta	Diptera	Chironomidae	Heterotrissocladius	Heterotrissocladius	I	1	Collector	sp, bu	2
Insecta	Diptera	Chironomidae	Limnophyes	Limnophyes	I	1	Collector	sp	8.6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	1	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	Pseudorthocladius	Pseudorthocladius	I	73	Collector	sp	6
Insecta	Megaloptera	Corydalidae	Chauliodes	Chauliodes	I	2	Predator	cn, cb	1.4
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	I	2	Collector	sp	6.7
Crustacea	Amphipoda	Crangonyctidae	Stygobromus	Stygobromus	I	2	Collector	sp	6.5
Insecta	Diptera	Culicidae	Aedes	Aedes	I	1	Filterer	sw	8
Insecta	Coleoptera	Dytiscidae	Laccophilus	Laccophilus	A	2	Predator	sw, dv	5.4
Insecta	Coleoptera	Dytiscidae	Rhantus	Rhantus	I	1	Predator	sw	5.4
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	3	Collector	bu	9.1
Insecta	Plecoptera	Nemouridae	Prostoia	Prostoia	I	2	Shredder	sp, cn	4.5
Insecta	Diptera	not identified	not identified	Diptera	P	1	na	na	6
Insecta	Lepidoptera	not identified	not identified	Lepidoptera	I	1	Shredder	na	6.7
Insecta	Coleoptera	Scirtidae	Elodes	Elodes	I	7	Collector	cb, sp	4
Insecta	Diptera	Tabanidae	Chrysops	Chrysops	I	1	Predator	sp, bu	2.9

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

Magothy Watershed - Biological Monitoring and Assessment
2007
Benthic Macroinvertebrate Data

MAGO-04-2007

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Odonata	Aeshnidae	Boyeria	Boyeria	I	1	Predator	cb, sp	6.3
Insecta	Trichoptera	Calamoceratidae	Heteroplectron	Heteroplectron	I	1	Shredder	sp	3
Insecta	Plecoptera	Capniidae	not identified	Capniidae	I	2	Shredder	sp, cn	3.7
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae	P	1	Predator	sp, bu	3.6
Insecta	Diptera	Chironomidae	Ablabesmyia	Ablabesmyia	I	1	Predator	sp	8.1
Insecta	Diptera	Chironomidae	Apsectrotanypus	Apsectrotanypus	I	1	Predator	bu, sp	6.6
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	2	Shredder	cn, bu	9.6
Insecta	Diptera	Chironomidae	Heterotrissocladius	Heterotrissocladius	I	2	Collector	sp, bu	2
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	1	Collector	cb, sp	2.1
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	1	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	1	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Paracladopelma	Paracladopelma	I	1	Collector	sp	6.6
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	8	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	1	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	1	Filterer	cn	7.2
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	15	Predator	sp	6.7
Insecta	Plecoptera	Chloroperlidae	not identified	Chloroperlidae	I	14	Predator	cn	1.6
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	I	1	Collector	sp	6.7
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	1	Filterer	cn	6.5
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona	I	11	Filterer	cn	2.7
Insecta	Trichoptera	Leptoceridae	Triaenodes	Triaenodes	I	2	Shredder	sw, cb	5
Insecta	Ephemeroptera	Leptophlebiidae	not identified	Leptophlebiidae	I	1	Collector	sw, cn	1.7
Insecta	Lepidoptera	not identified	not identified	Lepidoptera	I	1	Shredder	na	6.7
Insecta	Plecoptera	not identified	not identified	Plecoptera	I	20	Predator	na	2.4
Insecta	Trichoptera	Philopotamidae	Chimarra	Chimarra	I	1	Filterer	cn	4.4
Insecta	Trichoptera	Polycentropodidae	Polycentropus	Polycentropus	I	8	Filterer	cn	1.1
Insecta	Trichoptera	Psychomyiidae	Lype	Lype	I	4	Scraper	cn	4.7
Insecta	Coleoptera	Ptilodactylidae	Anchytarsus	Anchytarsus	I	5	Shredder	cn	3.1
Bivalvia	Veneroida	Sphaeriidae	Musculium	Musculium	I	1	Filterer	-	5.5
Insecta	Diptera	Tipulidae	Polymera	Polymera	I	2	Predator	bu, sp	4.8

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

Magothy Watershed - Biological Monitoring and Assessment
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Benthic Macroinvertebrate Data

MAGO-05-2007

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Ablabesmyia	Ablabesmyia	I	4	Predator	sp	8.1
Insecta	Diptera	Chironomidae	Acricotopus	Acricotopus	I	2	Collector	sp	6.6
Insecta	Coleoptera	Elmidae	Ancyronyx	Ancyronyx	I	1	Scraper	cn, sp	7.8
Crustacea	Isopoda	Asellidae	Caecidotea	Caecidotea	U	2	Collector	sp	2.6
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx	I	4	Predator	cb	8.3
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae	I	3	Predator	sp, bu	3.6
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona	I	1	Filterer	cn	2.7
Insecta	Coleoptera	Dytiscidae	not identified	Dytiscidae	I	1	Predator	sw, dv	5.4
Insecta	Coleoptera	Dryopidae	Helichus	Helichus	A	3	Scraper	cn	6.4
Insecta	Diptera	Chironomidae	Heterotrissocladius	Heterotrissocladius	I	2	Collector	sp, bu	2
Insecta	Trichoptera	Hydropsychidae	not identified	Hydropsychidae	P	1	Filterer	cn	5.7
Insecta	Trichoptera	Lepidostomatidae	Lepidostoma	Lepidostoma	I	1	Shredder	cb, sp, cn	0
Insecta	Odonata	Libellulidae	not identified	Libellulidae	I	1	Predator	na	9
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	1	Collector	bu	10
Insecta	Trichoptera	Psychomyiidae	Lype	Lype	I	4	Scraper	cn	4.7
Insecta	Diptera	Ceratopogonidae	Mallochohelea	Mallochohelea	I	1	Predator	bu	3.6
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	1	Collector	cb, sp	2.1
Insecta	Diptera	Chironomidae	Natarsia	Natarsia	I	1	Predator	sp	6.6
Insecta	Megaloptera	Corydalidae	Nigronia	Nigronia	I	3	Predator	cn, cb	1.4
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	1	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	Parachaetocladius	Parachaetocladius	I	1	Collector	sp	3.3
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	P	1	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	6	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paraphaenocladius	Paraphaenocladius	I	1	Collector	sp	4
Insecta	Diptera	Chironomidae	Paratendipes	Paratendipes	P	1	Collector	bu	6.6
Insecta	Diptera	Chironomidae	Phaenopsectra	Phaenopsectra	I	1	Collector	cn	8.7
Insecta	Trichoptera	Polycentropodidae	Polycentropus	Polycentropus	I	9	Filterer	cn	1.1
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	6	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Potthastia	Potthastia	I	1	Omnivore	sp	0
Insecta	Diptera	Tipulidae	Pseudolimnophila	Pseudolimnophila	I	1	Predator	bu	2.8
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	15	Filterer	cn	7.2
Insecta	Megaloptera	Sialidae	Sialis	Sialis	I	2	Predator	bu, cb, cn	1.9

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Benthic Macroinvertebrate Data

MAGO-05-2007

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	1	Filterer	cn	5.7
Insecta	Coleoptera	Staphylinidae	not identified	Staphylinidae	A	1	Predator	cn, cb, bu	5
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	4	Scraper	cn	7.1
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	A	4	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	1	Filterer	cb, cn	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	19	Predator	sp	6.7
Insecta	Diptera	Tipulidae	Tipula	Tipula	I	1	Shredder	bu	6.7
Insecta	Diptera	Chironomidae	Zavrelimyia	Zavrelimyia	I	4	Predator	sp	5.3

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Magothy Watershed - Biological Monitoring and Assessment
2007
Benthic Macroinvertebrate Data

MAGO-06-2007

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	not identified	Chironomidae	I	1	Collector	na	6.6
Insecta	Diptera	Chironomidae	Chironomus	Chironomus	I	11	Collector	bu	4.6
Insecta	Diptera	Chironomidae	Chironomus	Chironomus	P	1	Collector	bu	4.6
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	26	Collector	bu	9.1
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	I	3	Collector	sp	6.1
Insecta	Diptera	Chironomidae	Goeldichironomus	Goeldichironomus	I	1	Collector	bu	5.9
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	1	Scraper	sp	7.2
Insecta	Lepidoptera	not identified	not identified	Lepidoptera	I	1	Shredder	na	6.7
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	1	Collector	bu	10
Clitellata	Lumbriculada	Lumbriculidae	not identified	Lumbriculidae	U	1	Collector	bu	6.6
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	45	Shredder	cb, cn	6.3
Enopla	Hoplonemertea	Tetrastemmatidae	Prostoma	Prostoma	U	3	Predator	na	7.3
Insecta	Diptera	Chironomidae	Psectrocladius	Psectrocladius	I	1	Shredder	sp, bu	6.6
Insecta	Diptera	Chironomidae	Smittia	Smittia	I	1	Collector	lentic	6.6
Insecta	Diptera	Tipulidae	Tipula	Tipula	I	1	Shredder	bu	6.7
Insecta	Diptera	Tipulidae	not identified	Tipulidae	P	1	Predator	bu, sp	4.8
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	10	Collector	cn	8.4

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Magothy Watershed - Biological Monitoring and Assessment
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Benthic Macroinvertebrate Data

MAGO-07-2007

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Crustacea	Isopoda	Asellidae	Caecidotea	Caecidotea	I	63	Collector	sp	2.6
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae	I	1	Predator	sp, bu	3.6
Insecta	Diptera	Chironomidae	Chironomus	Chironomus	I	2	Collector	bu	4.6
Insecta	Diptera	Chironomidae	Diplocladius	Diplocladius	I	1	Collector	sp	5.9
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	1	Scraper	sp	7.2
Insecta	Odonata	Coenagrionidae	Ischnura	Ischnura	I	1	Predator	cb	9
Insecta	Diptera	Stratiomyidae	Myxosargus	Myxosargus	I	1	Collector	sp, sw	10
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	1	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Paratendipes	Paratendipes	P	1	Collector	bu	6.6
Bivalvia	Veneroida	Pisidiidae	not identified	Pisidiidae	I	13	Filterer	bu	5.5
Bivalvia	Veneroida	Pisidiidae	Pisidium	Pisidium	I	2	Filterer	bu	5.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	6	Shredder	cb, cn	6.3
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	9	Filterer	cn	5.7
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	3	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	4	Collector	cn	8.4

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Magothy Watershed - Biological Monitoring and Assessment
2007
Benthic Macroinvertebrate Data

MAGO-08-2007

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Odonata	Coenagrionidae	Argia	Argia	I	1	Predator	cn, cb, sp	9.3
Insecta	Odonata	Aeshnidae	Boyeria	Boyeria	I	2	Predator	cb, sp	6.3
Crustacea	Isopoda	Asellidae	Caecidotea	Caecidotea	U	2	Collector	sp	2.6
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx	I	2	Predator	cb	8.3
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	26	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	Chironomus	Chironomus	I	1	Collector	bu	4.6
Insecta	Odonata	Corduliidae	not identified	Corduliinae	I	1	Predator	sp, cb	2
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	I	8	Collector	sp	6.7
Insecta	Coleoptera	Dryopidae	Helichus	Helichus	A	1	Scraper	cn	6.4
Insecta	Diptera	Chironomidae	Heterotrissocladius	Heterotrissocladius	I	1	Collector	sp, bu	2
Insecta	Trichoptera	Limnephilidae	Ironoquia	Ironoquia	I	1	Shredder	sp	4.9
Insecta	Trichoptera	Psychomyiidae	Lype	Lype	I	3	Scraper	cn	4.7
Clitellata	Haplotaxida	Naididae	not identified	Naididae	U	4	Collector	bu	9.1
Insecta	Diptera	Chironomidae	Nanocladius	Nanocladius	I	1	Collector	sp	7.6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	2	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	2	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	7	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	1	Collector	sp	7.7
Insecta	Diptera	Chironomidae	Paratendipes	Paratendipes	I	1	Collector	bu	6.6
Gastropoda	Basommatophor	Physidae	Physa	Physa	U	1	Scraper	cb	7
Bivalvia	Veneroida	Pisidiidae	not identified	Pisidiidae	I	1	Filterer	bu	5.5
Insecta	Trichoptera	Polycentropodidae	Polycentropus	Polycentropus	I	4	Filterer	cn	1.1
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	1	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	I	24	Collector	sp	6.2
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	6	Filterer	cn	7.2
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	2	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	4	Predator	sp	6.7
Insecta	Diptera	Tipulidae	Tipula	Tipula	I	1	Shredder	bu	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	3	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Zavrelimyia	Zavrelimyia	I	2	Predator	sp	5.3

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Magothy Watershed - Biological Monitoring and Assessment
2007
Benthic Macroinvertebrate Data

MAGO-09-2007

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Odonata	Aeshnidae	Boyeria	Boyeria	I	3	Predator	cb, sp	6.3
Insecta	Diptera	Chironomidae	Brillia	Brillia	I	1	Shredder	bu, sp	7.4
Crustacea	Isopoda	Asellidae	Caecidotea	Caecidotea	U	8	Collector	sp	2.6
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx	I	6	Predator	cb	8.3
Insecta	Diptera	Ceratopogonidae	Ceratopogon	Ceratopogon	I	1	Predator	sp, bu	2.7
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	2	Filterer	cn	6.5
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	U	2	Collector	sp	6.7
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	2	Shredder	cn, bu	9.6
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	5	Collector	bu	9.1
Insecta	Diptera	Chironomidae	Georthocladius	Georthocladius	I	1	Collector	sp	7.6
Insecta	Diptera	Empididae	Hemerodromia	Hemerodromia	I	1	Predator	sp, bu	7.9
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	3	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	1	Filterer	cn	7.5
Insecta	Trichoptera	Limnephilidae	Ironoquia	Ironoquia	I	2	Shredder	sp	4.9
Insecta	Lepidoptera	not identified	not identified	Lepidoptera	I	1	Shredder	na	6.7
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	1	Collector	bu	10
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	1	Collector	cb, sp	2.1
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	2	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	4	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Phaenopsectra	Phaenopsectra	I	2	Collector	cn	8.7
Insecta	Trichoptera	Polycentropodidae	Polycentropus	Polycentropus	I	5	Filterer	cn	1.1
Insecta	Diptera	Chironomidae	Potthastia	Potthastia	I	20	Omnivore	sp	0
Insecta	Diptera	Chironomidae	Psectrocladius	Psectrocladius	I	3	Shredder	sp, bu	6.6
Insecta	Trichoptera	Phryganeidae	Ptilostomis	Ptilostomis	I	1	Shredder	cb	4.3
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	2	Filterer	cn	5.7
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	3	Scraper	cn	7.1
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	A	2	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	7	Predator	sp	6.7
Insecta	Diptera	Tipulidae	Tipula	Tipula	I	4	Shredder	bu	6.7
Insecta	Diptera	Tipulidae	not identified	Tipulidae	I	1	Predator	bu, sp	4.8
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	4	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Zavrelimyia	Zavrelimyia	P	1	Predator	sp	5.3

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

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Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Coleoptera	Elmidae	Ancyronyx	Ancyronyx	I	1	Scraper	cn, sp	7.8
Insecta	Diptera	Chironomidae	Brillia	Brillia	I	1	Shredder	bu, sp	7.4
Crustacea	Isopoda	Asellidae	Caecidotea	Caecidotea	U	16	Collector	sp	2.6
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx	I	3	Predator	cb	8.3
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae	I	3	Predator	sp, bu	3.6
Insecta	Diptera	Empididae	Chelifera	Chelifera	I	1	Predator	sp, bu	7.1
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	2	Filterer	cn	6.5
Insecta	Odonata	Cordulegastridae	Cordulegaster	Cordulegaster	I	1	Predator	bu	2.4
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	U	1	Collector	sp	6.7
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	2	Shredder	cn, bu	9.6
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	2	Collector	bu	9.1
Crustacea	Amphipoda	Gammaridae	Gammarus	Gammarus	U	5	Shredder	sp	6.7
Insecta	Coleoptera	Dryopidae	Helichus	Helichus	A	2	Scraper	cn	6.4
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	1	Filterer	cn	7.5
Insecta	Lepidoptera	not identified	not identified	Lepidoptera	I	1	Shredder	na	6.7
Insecta	Coleoptera	Dryopidae	Macronychus	Macronychus	A	1	Scraper	cn	6.8
Insecta	Coleoptera	Dryopidae	Macronychus	Macronychus	I	1	Scraper	cn	6.8
Insecta	Coleoptera	Elmidae	Microcylloepus	Microcylloepus	I	1	Collector	cn, cb, bu	4.8
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	P	5	Collector	cb, sp	2.1
Insecta	Megaloptera	Corydalidae	Nigronia	Nigronia	I	3	Predator	cn, cb	1.4
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	20	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	2	Collector	sp, bu	9.2
Insecta	Coleoptera	Elmidae	Oulimnius	Oulimnius	I	5	Scraper	cn	2.7
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	1	Collector	sp	4.6
Insecta	Plecoptera	not identified	not identified	Plecoptera	I	1	Predator	na	2.4
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	P	1	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	6	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Potthastia	Potthastia	I	3	Omnivore	sp	0
Insecta	Diptera	Chironomidae	Pseudorthocladius	Pseudorthocladius	I	8	Collector	sp	6
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	1	Filterer	cn	5.7
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	A	1	Scraper	cn	7.1
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	1	Scraper	cn	7.1

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Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Stenochironomus	Stenochironomus	I	2	Shredder	bu	7.9
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	1	Filterer	cb, cn	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	2	Predator	sp	6.7
Insecta	Trichoptera	Leptoceridae	Triaenodes	Triaenodes	I	1	Shredder	sw, cb	5

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MAGO-10-2007-QC

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Coleoptera	Elmidae	Ancyronyx	Ancyronyx	A	1	Scraper	cn, sp	7.8
Insecta	Coleoptera	Elmidae	Ancyronyx	Ancyronyx	I	2	Scraper	cn, sp	7.8
Insecta	Odonata	Aeshnidae	Boyeria	Boyeria	I	1	Predator	cb, sp	6.3
Insecta	Diptera	Chironomidae	Brillia	Brillia	I	1	Shredder	bu, sp	7.4
Crustacea	Isopoda	Asellidae	Caecidotea	Caecidotea	U	3	Collector	sp	2.6
Insecta	Ephemeroptera	Caenidae	Caenis	Caenis	I	1	Collector	sp	2.1
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx	I	4	Predator	cb	8.3
Insecta	Diptera	Ceratopogonidae	Ceratopogon	Ceratopogon	I	1	Predator	sp, bu	2.7
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae	I	2	Predator	sp, bu	3.6
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	2	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	Conchapelopia	Conchapelopia	P	2	Predator	sp	6.1
Bivalvia	Veneroida	Corbiculidae	Corbicula	Corbicula	U	1	Filterer	bu	6
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	1	Collector	sp	4.1
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	U	16	Collector	sp	6.7
Insecta	Diptera	Empididae	not identified	Empididae	P	1	Predator	sp, bu	7.5
Insecta	Diptera	Chironomidae	Glyptotendipes	Glyptotendipes	I	1	Filterer	bu, cn	6.6
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	1	Filterer	cn	7.5
Insecta	Plecoptera	Leuctridae	Leuctra	Leuctra	I	1	Shredder	cn	0.4
Insecta	Coleoptera	Dryopidae	Macronychus	Macronychus	I	5	Scraper	cn	6.8
Insecta	Coleoptera	Dryopidae	Macronychus	Macronychus	A	3	Scraper	cn	6.8
Insecta	Coleoptera	Elmidae	Microcylloepus	Microcylloepus	A	1	Collector	cn, cb, bu	4.8
Insecta	Coleoptera	Elmidae	Microcylloepus	Microcylloepus	I	4	Collector	cn, cb, bu	4.8
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	P	1	Collector	cb, sp	2.1
Insecta	Megaloptera	Corydalidae	Nigronia	Nigronia	I	1	Predator	cn, cb	1.4
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	2	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	1	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Parachaetocladius	Parachaetocladius	I	2	Collector	sp	3.3
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	9	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Potthastia	Potthastia	I	2	Omnivore	sp	0
Insecta	Diptera	Chironomidae	Pseudorthocladius	Pseudorthocladius	I	2	Collector	sp	6
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	1	Filterer	cn	7.2
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	20	Filterer	cn	5.7

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MAGO-10-2007-QC

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Smittia	Smittia	I	1	Collector	lentic	6.6
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	7	Scraper	cn	7.1
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	A	2	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Stenochironomus	Stenochironomus	I	2	Shredder	bu	7.9
Insecta	Ephemeroptera	Heptageniidae	Stenonema	Stenonema	I	5	Scraper	cn	4.6
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	3	Filterer	cb, cn	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	5	Predator	sp	6.7

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MAGO-11-2007

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Brillia	Brillia	I	2	Shredder	bu, sp	7.4
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx	I	2	Predator	cb	8.3
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae	I	1	Predator	sp, bu	3.6
Insecta	Diptera	Chironomidae	not identified	Chironomini	I	1	Collector	bu	5.9
Insecta	Diptera	Chironomidae	Diplocladius	Diplocladius	I	1	Collector	sp	5.9
Insecta	Coleoptera	Dytiscidae	not identified	Dytiscidae	I	1	Predator	sw, dv	5.4
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	I	7	Collector	sp	6.1
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	27	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	Hydropsyche	Hydropsyche	I	1	Filterer	cn	7.5
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	3	Collector	bu	10
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	P	1	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	Paracladopelma	Paracladopelma	I	2	Collector	sp	6.6
Insecta	Diptera	Chironomidae	Phaenopsectra	Phaenopsectra	I	2	Collector	cn	8.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	9	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	P	1	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Prodiamesa	Prodiamesa	I	1	Collector	bu, sp	6.6
Insecta	Diptera	Chironomidae	Pseudorthocladius	Pseudorthocladius	I	2	Collector	sp	6
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	I	8	Collector	sp	6.2
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	3	Filterer	cn	7.2
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	14	Filterer	cn	5.7
Insecta	Diptera	Chironomidae	Smittia	Smittia	I	1	Collector	lentic	6.6
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	8	Scraper	cn	7.1
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	A	1	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	not identified	Tanypodinae	P	1	Predator	sp, sw	7.5
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	3	Predator	sp	6.7
Insecta	Diptera	Tipulidae	Tipula	Tipula	I	1	Shredder	bu	6.7
Insecta	Diptera	Chironomidae	Tribelos	Tribelos	I	1	Collector	bu	7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	2	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Zavrelimyia	Zavrelimyia	I	1	Predator	sp	5.3

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MAGO-12-2007

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Ephemeroptera	Baetidae	Acerpenna	Acerpenna	I	1	Collector	sw, cn	2.6
Insecta	Coleoptera	Elmidae	Ancyronyx	Ancyronyx	A	2	Scraper	cn, sp	7.8
Insecta	Diptera	Tipulidae	Antocha	Antocha	I	1	Collector	cn	8
Insecta	Ephemeroptera	Baetidae	not identified	Baetidae	I	1	Collector	sw, cn	2.3
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx	I	2	Predator	cb	8.3
Insecta	Trichoptera	Hydropsychidae	Ceratopsyche	Ceratopsyche	I	1	Filterer	cn	5
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	4	Filterer	cn	6.5
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	U	17	Collector	sp	6.7
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	2	Shredder	cn, bu	9.6
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia	I	1	Scraper	cn, cb	5.7
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	I	1	Collector	sp	6.1
Insecta	Coleoptera	Dryopidae	Helichus	Helichus	A	1	Scraper	cn	6.4
Insecta	Diptera	Empididae	Hemerodromia	Hemerodromia	I	1	Predator	sp, bu	7.9
Crustacea	Amphipoda	Hyalellidae	Hyalella	Hyalella	U	2	Shredder	sp	4.2
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	1	Scraper	sp	7.2
Insecta	Trichoptera	Limnephilidae	Ironoquia	Ironoquia	I	2	Shredder	sp	4.9
Insecta	Lepidoptera	not identified	not identified	Lepidoptera	I	1	Shredder	na	6.7
Insecta	Coleoptera	Dryopidae	Macronychus	Macronychus	A	8	Scraper	cn	6.8
Insecta	Coleoptera	Dryopidae	Macronychus	Macronychus	I	3	Scraper	cn	6.8
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	2	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	2	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	8	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	2	Collector	sp	4.6
Bivalvia	Veneroida	Pisidiidae	Pisidium	Pisidium	I	1	Filterer	bu	5.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	21	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Potthastia	Potthastia	I	1	Omnivore	sp	0
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	1	Filterer	cn	5.7
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	12	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	1	Filterer	cb, cn	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	3	Predator	sp	6.7

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MAGO-13-2007

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Ephemeroptera	Baetidae	Acerpenna	Acerpenna	I	2	Collector	sw, cn	2.6
Insecta	Odonata	Aeshnidae	not identified	Aeshnidae	I	1	Predator	cb	6.2
Insecta	Diptera	Chironomidae	Brillia	Brillia	I	1	Shredder	bu, sp	7.4
Crustacea	Decapoda	Cambaridae	not identified	Cambarinae	U	1	Shredder	sp	2.8
Insecta	Ephemeroptera	Baetidae	Centroptilum	Centroptilum	I	2	Collector	sw, cn	2.3
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae	I	1	Predator	sp, bu	3.6
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	6	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	not identified	Chironomini	I	1	Collector	bu	5.9
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	I	1	Collector	sp	6.7
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	I	2	Collector	sp	6.1
Insecta	Coleoptera	Dryopidae	Helichus	Helichus	A	2	Scraper	cn	6.4
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	1	Scraper	sp	7.2
Insecta	Coleoptera	Hydrophilidae	Hydrobius	Hydrobius	I	1	Collector	cb, cn, sp	4.1
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	1	Collector	bu	10
Insecta	Coleoptera	Dryopidae	Macronychus	Macronychus	A	1	Scraper	cn	6.8
Insecta	Coleoptera	Dryopidae	Macronychus	Macronychus	I	6	Scraper	cn	6.8
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	1	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	1	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	7	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	32	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Psectrocladius	Psectrocladius	I	1	Shredder	sp, bu	6.6
Insecta	Diptera	Chironomidae	Pseudorthocladius	Pseudorthocladius	I	1	Collector	sp	6
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	12	Filterer	cn	7.2
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	9	Filterer	cn	5.7
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	2	Scraper	cn	7.1
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	A	1	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	4	Filterer	cb, cn	4.9
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	3	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	2	Collector	cn	8.4

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MAGO-14-2007

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx	I	1	Predator	cb	8.3
Crustacea	Decapoda	Cambaridae	Cambarus	Cambarus	U	1	Collector	sp	0.4
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	22	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	not identified	Chironomini	I	1	Collector	bu	5.9
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	2	Collector	bu	9.1
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	I	1	Collector	sp	6.1
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	1	Scraper	sp	7.2
Insecta	Trichoptera	Hydropsychidae	not identified	Hydropsychidae	P	17	Filterer	cn	5.7
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	3	Collector	bu	10
Clitellata	Haplotaxida	Naididae	not identified	Naididae	U	8	Collector	bu	9.1
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	1	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	2	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	23	Collector	sp, bu	9.2
Bivalvia	Veneroida	Pisidiidae	not identified	Pisidiidae	U	1	Filterer	bu	5.5
Enopla	Hoplonemertea	Tetrastemmatidae	Prostoma	Prostoma	I	1	Predator	na	7.3
Insecta	Diptera	Chironomidae	Psectrocladius	Psectrocladius	I	1	Shredder	sp, bu	6.6
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	7	Filterer	cn	5.7
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	2	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	2	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	8	Collector	cn	8.4

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

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MAGO-15-2007

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Crustacea	Isopoda	Asellidae	Caecidotea	Caecidotea	U	10	Collector	sp	2.6
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae	I	5	Predator	sp, bu	3.6
Hexapoda	Collembola	not identified	not identified	Collembola	A	6	Collector	sp, sk	6
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	I	1	Collector	sp	6.1
Insecta	Coleoptera	Dytiscidae	Hydaticus	Hydaticus	I	1	Predator	sw	5.4
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	3	Scraper	sp	7.2
Insecta	Lepidoptera	not identified	not identified	Lepidoptera	I	1	Shredder	na	6.7
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	28	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	4	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	1	Collector	sp	7.7
Gastropoda	Basommatophor	Physidae	Physa	Physa	U	4	Scraper	cb	7
Bivalvia	Veneroida	Pisidiidae	not identified	Pisidiidae	U	2	Filterer	bu	5.5
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	1	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	I	1	Collector	sp	6.2
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	P	2	Collector	sp	6.2
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	1	Filterer	cb, cn	4.9
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	47	Collector	cn	8.4

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

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Benthic Macroinvertebrate Data

MAGO-16-2007

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Odonata	Aeshnidae	Boyeria	Boyeria	I	1	Predator	cb, sp	6.3
Crustacea	Isopoda	Asellidae	Caecidotea	Caecidotea	U	5	Collector	sp	2.6
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx	I	1	Predator	cb	8.3
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae	I	3	Predator	sp, bu	3.6
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae	P	1	Predator	sp, bu	3.6
Insecta	Diptera	Chironomidae	not identified	Chironomidae	I	1	Collector	na	6.6
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	2	Collector	sp	4.1
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	I	9	Collector	sp	6.7
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona	I	1	Filterer	cn	2.7
Insecta	Coleoptera	Scirtidae	Elodes	Elodes	I	2	Collector	cb, sp	4
Gastropoda	Basommatophor	Lymnaeidae	Fossaria	Fossaria	U	6	Scraper	cb	6.9
Insecta	Diptera	Tipulidae	Hexatoma	Hexatoma	I	1	Predator	bu, sp	1.5
Crustacea	Amphipoda	Hyalellidae	Hyalella	Hyalella	I	1	Shredder	sp	4.2
Insecta	Coleoptera	Hydrophilidae	Hydrobius	Hydrobius	I	1	Collector	cb, cn, sp	4.1
Insecta	Plecoptera	Leuctridae	Leuctra	Leuctra	I	1	Shredder	cn	0.4
Insecta	Trichoptera	Psychomyiidae	Lype	Lype	I	4	Scraper	cn	4.7
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	1	Collector	cb, sp	2.1
Insecta	Hemiptera	Veliidae	Microvelia	Microvelia	I	1	Predator	skater	6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	1	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	4	Collector	sp	4.6
Gastropoda	Basommatophor	Physidae	Physa	Physa	U	12	Scraper	cb	7
Bivalvia	Veneroida	Pisidiidae	not identified	Pisidiidae	U	1	Filterer	bu	5.5
Insecta	Trichoptera	Polycentropodidae	Polycentropus	Polycentropus	I	1	Filterer	cn	1.1
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	4	Shredder	cb, cn	6.3
Insecta	Diptera	Tipulidae	Pseudolimnophila	Pseudolimnophila	I	1	Predator	bu	2.8
Insecta	Diptera	Chironomidae	Pseudorthocladius	Pseudorthocladius	I	1	Collector	sp	6
Insecta	Trichoptera	Odontoceridae	Psilotreta	Psilotreta	I	1	Scraper	sp	0.9
Insecta	Diptera	Ptychopteridae	Ptychoptera	Ptychoptera	I	2	Collector	bu	4
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	I	5	Collector	sp	6.2
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	12	Filterer	cn	5.7
Insecta	Diptera	Simuliidae	Simulium	Simulium	P	1	Filterer	cn	5.7
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	1	Scraper	cn	7.1

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MAGO-16-2007

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	A	1	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	12	Predator	sp	6.7
Insecta	Diptera	Tipulidae	Tipula	Tipula	I	1	Shredder	bu	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	2	Collector	cn	8.4

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

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MAGO-16-2007-QC

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Brillia	Brillia	I	1	Shredder	bu, sp	7.4
Crustacea	Isopoda	Asellidae	Caecidotea	Caecidotea	U	3	Collector	sp	2.6
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx	I	1	Predator	cb	8.3
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae	I	3	Predator	sp, bu	3.6
Insecta	Odonata	Cordulegastridae	Cordulegaster	Cordulegaster	I	2	Predator	bu	2.4
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	3	Collector	sp	4.1
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	U	8	Collector	sp	6.7
Gastropoda	Basommatophora	Lymnaeidae	Fossaria	Fossaria	U	2	Scraper	cb	6.9
Insecta	Coleoptera	Hydrophilidae	not identified	Hydrophilidae	I	1	Collector	sw, dv	4.1
Insecta	Trichoptera	Limnephilidae	Ironoquia	Ironoquia	I	1	Shredder	sp	4.9
Insecta	Trichoptera	Psychomyiidae	Lype	Lype	I	1	Scraper	cn	4.7
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	2	Collector	cb, sp	2.1
Clitellata	Haplotaxida	Naididae	not identified	Naididae	U	1	Collector	bu	9.1
Insecta	Diptera	Chironomidae	Natarsia	Natarsia	I	1	Predator	sp	6.6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	1	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	1	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Paracladopelma	Paracladopelma	I	1	Collector	sp	6.6
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	4	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Phaenopsectra	Phaenopsectra	I	2	Collector	cn	8.7
Gastropoda	Basommatophora	Physidae	Physa	Physa	U	12	Scraper	cb	7
Bivalvia	Veneroida	Pisidiidae	Pisidium	Pisidium	U	5	Filterer	bu	5.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	11	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Potthastia	Potthastia	I	1	Omnivore	sp	0
Insecta	Diptera	Tipulidae	Pseudolimnophila	Pseudolimnophila	I	1	Predator	bu	2.8
Insecta	Coleoptera	Dytiscidae	Rhantus	Rhantus	I	1	Predator	sw	5.4
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	I	4	Collector	sp	6.2
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	32	Filterer	cn	5.7
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	1	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	3	Predator	sp	6.7
Insecta	Diptera	Tipulidae	Tipula	Tipula	I	1	Shredder	bu	6.7
Insecta	Diptera	Tipulidae	not identified	Tipulidae	I	1	Predator	bu, sp	4.8
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	3	Collector	cn	8.4
Insecta	Diptera	Chironomidae	Zavrelimyia	Zavrelimyia	I	2	Predator	sp	5.3

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MAGO-17-2007

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Crustacea	Isopoda	Asellidae	Caecidotea	Caecidotea	I	1	Collector	sp	2.6
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx	I	1	Predator	cb	8.3
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	2	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	not identified	Chironomini	I	1	Collector	bu	5.9
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	11	Collector	sp	4.1
Insecta	Diptera	Chironomidae	Diplocladius	Diplocladius	I	6	Collector	sp	5.9
Insecta	Trichoptera	Philopotamidae	Dolophilodes	Dolophilodes	I	1	Filterer	cn	1.7
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	3	Collector	bu	9.1
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	I	4	Collector	sp	6.1
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	1	Scraper	sp	7.2
Insecta	Trichoptera	Limnephilidae	Ironoquia	Ironoquia	I	1	Shredder	sp	4.9
Clitellata	Haplotaxida	Naididae	not identified	Naididae	U	10	Collector	bu	9.1
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	P	2	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	3	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	P	2	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	I	2	Collector	sp	4.6
Insecta	Diptera	Chironomidae	Paratendipes	Paratendipes	I	1	Collector	bu	6.6
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	1	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	I	2	Collector	sp	6.2
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	35	Filterer	cn	5.7
Bivalvia	Veneroida	Pisidiidae	Sphaerium	Sphaerium	U	1	Collector	bu	5.5
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	A	1	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	Stenochironomus	Stenochironomus	I	2	Shredder	bu	7.9
Insecta	Diptera	Chironomidae	Thienemanniella	Thienemanniella	I	4	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	1	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	3	Collector	cn	8.4

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

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Benthic Macroinvertebrate Data

MAGO-18-2007

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Coleoptera	Elmidae	Ancyronyx	Ancyronyx	A	1	Scraper	cn, sp	7.8
Insecta	Odonata	Coenagrionidae	Argia	Argia	I	2	Predator	cn, cb, sp	9.3
Insecta	Diptera	Ceratopogonidae	Atrichopogon	Atrichopogon	I	1	Predator	sp, cn	3.6
Crustacea	Isopoda	Asellidae	Caecidotea	Caecidotea	U	1	Collector	sp	2.6
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx	I	1	Predator	cb	8.3
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	1	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	Clinotanypus	Clinotanypus	I	1	Predator	bu	6.6
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	U	9	Collector	sp	6.7
Insecta	Coleoptera	Curculionidae	not identified	Curculionidae	U	1	Shredder	cn, cb	4.1
Crustacea	Amphipoda	Hyalellidae	Hyalella	Hyalella	U	6	Shredder	sp	4.2
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	1	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	1	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Paratendipes	Paratendipes	I	4	Collector	bu	6.6
Bivalvia	Veneroida	Pisidiidae	Pisidium	Pisidium	U	1	Filterer	bu	5.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	2	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Tvetenia	Tvetenia	I	1	Collector	sp	5.1
Gastropoda	Heterostropha	Valvatidae	Valvata	Valvata	U	78	Scraper	na	9

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MAGO-19-2007

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Coleoptera	Elmidae	Ancyronyx	Ancyronyx	I	3	Scraper	cn, sp	7.8
Insecta	Odonata	Coenagrionidae	Argia	Argia	I	6	Predator	cn, cb, sp	9.3
Crustacea	Isopoda	Asellidae	Caecidotea	Caecidotea	U	7	Collector	sp	2.6
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx	I	2	Predator	cb	8.3
Insecta	Diptera	Chironomidae	not identified	Chironomini	I	1	Collector	bu	5.9
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia	I	2	Scraper	cn, cb	5.7
Insecta	Coleoptera	Elmidae	Dubiraphia	Dubiraphia	A	2	Scraper	cn, cb	5.7
Insecta	Coleoptera	Dytiscidae	not identified	Dytiscidae	I	1	Predator	sw, dv	5.4
Insecta	Ephemeroptera	Ephemerellidae	Eurylophella	Eurylophella	I	1	Scraper	cn, sp	4.5
Crustacea	Amphipoda	Gammaridae	Gammarus	Gammarus	U	1	Shredder	sp	6.7
Insecta	Coleoptera	Dryopidae	Helichus	Helichus	A	7	Scraper	cn	6.4
Crustacea	Amphipoda	Hyalellidae	Hyalella	Hyalella	U	2	Shredder	sp	4.2
Insecta	Odonata	Libellulidae	not identified	Libellulidae	I	2	Predator	na	9
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	1	Collector	bu	10
Insecta	Coleoptera	Dryopidae	Macronychus	Macronychus	A	1	Scraper	cn	6.8
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	37	Collector	cb, sp	2.1
Insecta	Diptera	Chironomidae	Paratendipes	Paratendipes	I	1	Collector	bu	6.6
Gastropoda	Basommatophor	Physidae	Physa	Physa	U	2	Scraper	cb	7
Bivalvia	Veneroida	Pisidiidae	Pisidium	Pisidium	U	7	Filterer	bu	5.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	2	Shredder	cb, cn	6.3
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	1	Filterer	cn	5.7
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	A	1	Scraper	cn	7.1
Insecta	Coleoptera	Elmidae	Stenelmis	Stenelmis	I	9	Scraper	cn	7.1
Insecta	Diptera	Chironomidae	not identified	Tanytarsini	I	1	Filterer	na	3.5
Insecta	Diptera	Chironomidae	Tribelos	Tribelos	I	5	Collector	bu	7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	I	2	Collector	cn	8.4

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Benthic Macroinvertebrate Data

MAGO-20-2007

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Odonata	Coenagrionidae	Argia	Argia	I	7	Predator	cn, cb, sp	9.3
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx	I	3	Predator	cb	8.3
Insecta	Diptera	Chironomidae	not identified	Chironomini	I	3	Collector	bu	5.9
Insecta	Diptera	Chironomidae	Chironomus	Chironomus	I	1	Collector	bu	4.6
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	U	3	Collector	sp	6.7
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	2	Shredder	cn, bu	9.6
Insecta	Diptera	not identified	not identified	Diptera	I	1	na	na	6
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	18	Collector	bu	9.1
Insecta	Odonata	Libellulidae	Erythemis	Erythemis	I	1	Predator	sp	7
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	I	2	Collector	sp	6.1
Insecta	Odonata	Coenagrionidae	Ischnura	Ischnura	I	3	Predator	cb	9
Insecta	Lepidoptera	not identified	not identified	Lepidoptera	U	4	Shredder	na	6.7
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	9	Collector	bu	10
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	1	Collector	cb, sp	2.1
Clitellata	Arhynchobdellida	Eropdellidae	Mooreobdella	Mooreobdella	U	3	Predator	sp	8
Clitellata	Haplotaxida	Naididae	not identified	Naididae	U	1	Collector	bu	9.1
Gastropoda	Basommatophor	Physidae	Physa	Physa	U	13	Scraper	cb	7
Bivalvia	Veneroida	Pisidiidae	not identified	Pisidiidae	U	1	Filterer	bu	5.5
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	1	Shredder	cb, cn	6.3
Enopla	Hoplonemertea	Tetrastemmatidae	Prostoma	Prostoma	U	5	Predator	na	7.3
Insecta	Diptera	Chironomidae	Smittia	Smittia	I	7	Collector	lentic	6.6
Insecta	Diptera	Chironomidae	Stenochironomus	Stenochironomus	I	1	Shredder	bu	7.9
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	18	Collector	cn	8.4

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

Magothy Watershed - Biological Monitoring and Assessment
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Benthic Macroinvertebrate Data

MAGO-21-2007

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Crustacea	Isopoda	Asellidae	Caecidotea	Caecidotea	U	52	Collector	sp	2.6
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae	I	1	Predator	sp, bu	3.6
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	U	1	Collector	sp	6.7
Insecta	Coleoptera	Curculionidae	not identified	Curculionidae	A	1	Shredder	cn, cb	4.1
Insecta	Coleoptera	Dytiscidae	not identified	Dytiscidae	I	3	Predator	sw, dv	5.4
Gastropoda	Basommatophor	Lymnaeidae	Fossaria	Fossaria	U	1	Scraper	cb	6.9
Crustacea	Amphipoda	Gammaridae	Gammarus	Gammarus	U	21	Shredder	sp	6.7
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	1	Scraper	sp	7.2
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	4	Collector	bu	10
Clitellata	Lumbriculada	Lumbriculidae	not identified	Lumbriculidae	U	21	Collector	bu	6.6
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	1	Collector	cb, sp	2.1
Insecta	Diptera	Tipulidae	Molophilus	Molophilus	I	1	Shredder	bu	4.8
Gastropoda	Basommatophor	Physidae	Physa	Physa	U	1	Scraper	cb	7
Insecta	Diptera	Chironomidae	Psectrocladius	Psectrocladius	I	1	Shredder	sp, bu	6.6
Insecta	Diptera	Psychodidae	Psychoda	Psychoda	I	1	Collector	bu	4
Bivalvia	Veneroida	Pisidiidae	Sphaerium	Sphaerium	U	1	Collector	bu	5.5
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	2	Collector	cn	8.4

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

Magothy Watershed - Biological Monitoring and Assessment
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Benthic Macroinvertebrate Data

MAGO-22-2007

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Coleoptera	Elmidae	Ancyronyx	Ancyronyx	A	3	Scraper	cn, sp	7.8
Insecta	Coleoptera	Elmidae	Ancyronyx	Ancyronyx	I	2	Scraper	cn, sp	7.8
Insecta	Odonata	Aeshnidae	Boyeria	Boyeria	I	3	Predator	cb, sp	6.3
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx	I	5	Predator	cb	8.3
Insecta	Trichoptera	Hydropsychidae	Ceratopsyche	Ceratopsyche	I	12	Filterer	cn	5
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	18	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	not identified	Chironomidae	I	1	Collector	na	6.6
Hexapoda	Collembola	not identified	not identified	Collembola	A	1	Collector	sp, sk	6
Insecta	Diptera	Chironomidae	Diplocladius	Diplocladius	I	3	Collector	sp	5.9
Insecta	Coleoptera	Scirtidae	Elodes	Elodes	I	1	Collector	cb, sp	4
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	2	Collector	bu	9.1
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	I	2	Collector	sp	6.1
Crustacea	Amphipoda	Gammaridae	Gammarus	Gammarus	U	8	Shredder	sp	6.7
Insecta	Coleoptera	Dryopidae	Helichus	Helichus	A	4	Scraper	cn	6.4
Insecta	Lepidoptera	not identified	not identified	Lepidoptera	I	1	Shredder	na	6.7
Insecta	Megaloptera	Corydalidae	Nigronia	Nigronia	I	1	Predator	cn, cb	1.4
Gastropoda	Basommatophor	Physidae	Physa	Physa	U	28	Scraper	cb	7
Insecta	Trichoptera	Polycentropodidae	Polycentropus	Polycentropus	I	2	Filterer	cn	1.1
Insecta	Diptera	Chironomidae	Psectrocladius	Psectrocladius	I	4	Shredder	sp, bu	6.6
Insecta	Trichoptera	Phryganeidae	Ptilostomis	Ptilostomis	I	1	Shredder	cb	4.3
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	1	Filterer	cn	7.2
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	2	Filterer	cn	5.7
Insecta	Diptera	Chironomidae	Smittia	Smittia	I	1	Collector	lentic	6.6
Insecta	Odonata	Corduliidae	Somatochlora	Somatochlora	I	1	Predator	sp	1
Insecta	Diptera	Chironomidae	Stenochironomus	Stenochironomus	I	7	Shredder	bu	7.9
Insecta	Diptera	Chironomidae	not identified	Tanypodinae	I	1	Predator	sp, sw	7.5
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	5	Predator	sp	6.7

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

Magothy Watershed - Biological Monitoring and Assessment
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Benthic Macroinvertebrate Data

MAGO-23-2007

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Crustacea	Amphipoda	not identified	not identified	Amphipoda	U	1	Collector	sp	6
Insecta	Odonata	Coenagrionidae	Argia	Argia	I	1	Predator	cn, cb, sp	9.3
Insecta	Odonata	Aeshnidae	Boyeria	Boyeria	I	2	Predator	cb, sp	6.3
Crustacea	Isopoda	Asellidae	Caecidotea	Caecidotea	U	1	Collector	sp	2.6
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx	I	4	Predator	cb	8.3
Insecta	Diptera	Chironomidae	Chironomus	Chironomus	I	4	Collector	bu	4.6
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	U	1	Collector	sp	6.7
Insecta	Diptera	Chironomidae	Diplocladius	Diplocladius	I	1	Collector	sp	5.9
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	6	Collector	bu	9.1
Crustacea	Amphipoda	Gammaridae	Gammarus	Gammarus	U	4	Shredder	sp	6.7
Insecta	Odonata	Coenagrionidae	Ischnura	Ischnura	I	1	Predator	cb	9
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	1	Collector	bu	10
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	3	Collector	cb, sp	2.1
Insecta	Diptera	Tipulidae	Molophilus	Molophilus	I	1	Shredder	bu	4.8
Not Identified	not identified	not identified	not identified	Nematoda	U	1	Parasite	na	na
Insecta	Diptera	Chironomidae	Odontomesa	Odontomesa	I	1	Collector	sp	6.6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	2	Collector	bu, sp	7.6
Bivalvia	Veneroida	Pisidiidae	Pisidium	Pisidium	I	5	Filterer	bu	5.7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	2	Shredder	cb, cn	6.3
Enopla	Hoplonemertea	Tetrastemmatidae	Prostoma	Prostoma	U	1	Predator	na	7.3
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	I	31	Collector	sp	6.2
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	P	1	Filterer	cn	7.2
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	1	Filterer	cn	7.2
Insecta	Diptera	Chironomidae	Stenochironomus	Stenochironomus	I	5	Shredder	bu	7.9
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	8	Collector	cn	8.4

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

Magothy Watershed - Biological Monitoring and Assessment
2007
Benthic Macroinvertebrate Data

MAGO-23-2007-QC

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Ablabesmyia	Ablabesmyia	I	2	Predator	sp	8.1
Crustacea	Amphipoda	not identified	not identified	Amphipoda	U	1	Collector	sp	6
Insecta	Odonata	Coenagrionidae	Argia	Argia	I	9	Predator	cn, cb, sp	9.3
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx	I	1	Predator	cb	8.3
Insecta	Diptera	Chironomidae	not identified	Chironomidae	I	1	Collector	na	6.6
Insecta	Diptera	Chironomidae	not identified	Chironomini	I	1	Collector	bu	5.9
Insecta	Diptera	Chironomidae	Chironomus	Chironomus	I	2	Collector	bu	4.6
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	U	11	Collector	sp	6.7
Insecta	Diptera	Ceratopogonidae	Dasyhelea	Dasyhelea	I	1	Collector	sp	3.6
Insecta	Diptera	not identified	not identified	Diptera	P	1	na	na	6
Insecta	Coleoptera	Scirtidae	Elodes	Elodes	I	1	Collector	cb, sp	4
Insecta	Odonata	Coenagrionidae	Enallagma	Enallagma	I	1	Predator	cb	9
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	11	Collector	bu	9.1
Insecta	Coleoptera	Dryopidae	Helichus	Helichus	A	1	Scraper	cn	6.4
Insecta	Odonata	Coenagrionidae	Ischnura	Ischnura	I	1	Predator	cb	9
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	1	Collector	bu	10
Gastropoda	Basommatophor	Planorbidae	Menetus	Menetus	U	1	Scraper	cb	7.6
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	2	Collector	cb, sp	2.1
Insecta	Diptera	Stratiomyidae	Odontomyia	Odontomyia	I	3	Collector	sp	7
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	P	1	Collector	bu, sp	7.6
Gastropoda	Basommatophor	Physidae	Physa	Physa	U	1	Scraper	cb	7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	1	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Prodiamesa	Prodiamesa	I	1	Collector	bu, sp	6.6
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	I	10	Collector	sp	6.2
Insecta	Diptera	Chironomidae	not identified	Tanypodinae	P	1	Predator	sp, sw	7.5
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	19	Collector	cn	8.4

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

Magothy Watershed - Biological Monitoring and Assessment
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Benthic Macroinvertebrate Data

MAGO-24-2007

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Insecta	Diptera	Chironomidae	Brillia	Brillia	I	2	Shredder	bu, sp	7.4
Crustacea	Isopoda	Asellidae	Caecidotea	Caecidotea	U	38	Collector	sp	2.6
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx	I	2	Predator	cb	8.3
Insecta	Diptera	Chironomidae	not identified	Chironomidae	P	1	Collector	na	6.6
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	1	Collector	sp	4.1
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	P	1	Collector	sp	4.1
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	U	7	Collector	sp	6.7
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	1	Shredder	cn, bu	9.6
Insecta	Trichoptera	Hydropsychidae	Diplectrona	Diplectrona	I	2	Filterer	cn	2.7
Insecta	Diptera	Chironomidae	Diplocladius	Diplocladius	I	1	Collector	sp	5.9
Crustacea	Amphipoda	Gammaridae	Gammarus	Gammarus	U	1	Shredder	sp	6.7
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	4	Collector	cb, sp	2.1
Insecta	Trichoptera	Mollanidae	Molanna	Molanna	I	1	Scraper	sp, cn	6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	P	3	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	2	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	2	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	1	Collector	sp, bu	9.2
Gastropoda	Basommatophor	Physidae	Physa	Physa	U	1	Scraper	cb	7
Bivalvia	Veneroida	Pisidiidae	Pisidium	Pisidium	U	19	Filterer	bu	5.7
Insecta	Trichoptera	Polycentropodidae	Polycentropus	Polycentropus	I	1	Filterer	cn	1.1
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	2	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	I	9	Collector	sp	6.2
Insecta	Diptera	Chironomidae	Rheotanytarsus	Rheotanytarsus	I	1	Filterer	cn	7.2
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	1	Filterer	cn	5.7
Insecta	Diptera	Chironomidae	Thienemanniella	Thienemanniella	I	4	Collector	sp	5.1
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	3	Predator	sp	6.7
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	3	Collector	cn	8.4
Turbellaria	not identified	not identified	not identified	Turbellaria	U	1	Predator	sp	4

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Benthic Macroinvertebrate Data

MAGO-25-2007

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Crustacea	Isopoda	Asellidae	Caecidotea	Caecidotea	U	2	Collector	sp	2.6
Insecta	Odonata	Calopterygidae	Calopteryx	Calopteryx	I	3	Predator	cb	8.3
Insecta	Diptera	Chironomidae	Chironomus	Chironomus	I	1	Collector	bu	4.6
Insecta	Diptera	Chironomidae	Corynoneura	Corynoneura	I	1	Collector	sp	4.1
Clitellata	Haplotaxida	Enchytraeidae	not identified	Enchytraeidae	U	2	Collector	bu	9.1
Insecta	Diptera	Tipulidae	Eriopterini	Eriopterini	I	1	na	na	4.8
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	I	1	Collector	sp	6.1
Crustacea	Amphipoda	Gammaridae	Gammarus	Gammarus	U	1	Shredder	sp	6.7
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	5	Scraper	sp	7.2
Clitellata	Haplotaxida	not identified	not identified	Lumbricina	U	1	Collector	bu	10
Insecta	Diptera	Chironomidae	Micropsectra	Micropsectra	I	2	Collector	cb, sp	2.1
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	P	2	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	1	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	1	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	1	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Parachaetocladius	Parachaetocladius	I	3	Collector	sp	3.3
Insecta	Diptera	Chironomidae	Parametriocnemus	Parametriocnemus	P	1	Collector	sp	4.6
Bivalvia	Veneroida	Pisidiidae	Pisidium	Pisidium	U	1	Filterer	bu	5.7
Gastropoda	Basommatophor	Planorbidae	Planorbella	Planorbella	U	1	Scraper	cb	7.6
Insecta	Trichoptera	Polycentropodidae	Polycentropus	Polycentropus	I	2	Filterer	cn	1.1
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	5	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Prodiamesa	Prodiamesa	I	1	Collector	bu, sp	6.6
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	I	61	Collector	sp	6.2
Insecta	Diptera	Chironomidae	Stenochironomus	Stenochironomus	I	1	Shredder	bu	7.9
Insecta	Diptera	Chironomidae	Thienemanniella	Thienemanniella	I	3	Collector	sp	5.1

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Magothy Watershed - Biological Monitoring and Assessment
2007
Benthic Macroinvertebrate Data

MAGO-26-2007

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Crustacea	Amphipoda	not identified	not identified	Amphipoda	U	1	Collector	sp	6
Insecta	Coleoptera	Elmidae	Ancyronyx	Ancyronyx	A	1	Scraper	cn, sp	7.8
Bivalvia	not identified	not identified	not identified	Bivalvia	U	1	Filterer	na	5.5
Crustacea	Isopoda	Asellidae	Caecidotea	Caecidotea	U	37	Collector	sp	2.6
Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	Cheumatopsyche	I	1	Filterer	cn	6.5
Insecta	Diptera	Chironomidae	Cricotopus	Cricotopus	I	1	Shredder	cn, bu	9.6
Insecta	Diptera	Chironomidae	Cryptochironomus	Cryptochironomus	I	1	Predator	sp, bu	7.6
Insecta	Diptera	Chironomidae	Diplocladius	Diplocladius	I	1	Collector	sp	5.9
Insecta	Diptera	Chironomidae	Eukiefferiella	Eukiefferiella	I	2	Collector	sp	6.1
Crustacea	Amphipoda	Gammaridae	Gammarus	Gammarus	U	29	Shredder	sp	6.7
Insecta	Coleoptera	Dryopidae	Macronychus	Macronychus	I	5	Scraper	cn	6.8
Insecta	Coleoptera	Dryopidae	Macronychus	Macronychus	A	2	Scraper	cn	6.8
Insecta	Diptera	Chironomidae	not identified	Orthocladiinae	I	2	Collector	bu, sp	7.6
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	7	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	1	Collector	sp, bu	9.2
Gastropoda	Basommatophor	Physidae	Physa	Physa	U	2	Scraper	cb	7
Insecta	Diptera	Chironomidae	Polypedilum	Polypedilum	I	2	Shredder	cb, cn	6.3
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	I	11	Collector	sp	6.2
Insecta	Diptera	Chironomidae	Thienemannimyia	Thienemannimyia	I	4	Predator	sp	6.7

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Magothy Watershed - Biological Monitoring and Assessment
2007
Benthic Macroinvertebrate Data

MAGO-27-2007

Subphylum/Class	Order	Family	Genus	Final ID	Note[1]	# of Org	FFG[2]	Habit[3]	Tolerance Value[4]
Crustacea	Isopoda	Asellidae	Caecidotea	Caecidotea	U	6	Collector	sp	2.6
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae	P	2	Predator	sp, bu	3.6
Insecta	Diptera	Ceratopogonidae	not identified	Ceratopogonidae	I	1	Predator	sp, bu	3.6
Insecta	Diptera	Chironomidae	not identified	Chironomini	I	2	Collector	bu	5.9
Insecta	Diptera	Tabanidae	Chrysops	Chrysops	I	1	Predator	sp, bu	2.9
Crustacea	Amphipoda	Crangonyctidae	Crangonyx	Crangonyx	U	77	Collector	sp	6.7
Insecta	Diptera	Chironomidae	Diplocladius	Diplocladius	I	11	Collector	sp	5.9
Insecta	Diptera	Chironomidae	Hydrobaenus	Hydrobaenus	I	1	Scraper	sp	7.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	P	1	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Orthocladius	Orthocladius	I	1	Collector	sp, bu	9.2
Insecta	Diptera	Chironomidae	Paratanytarsus	Paratanytarsus	I	1	Collector	sp	7.7
Bivalvia	Veneroida	Pisidiidae	Pisidium	Pisidium	U	1	Filterer	bu	5.7
Insecta	Diptera	Chironomidae	Pseudorthocladius	Pseudorthocladius	I	1	Collector	sp	6
Insecta	Diptera	Chironomidae	Rheocricotopus	Rheocricotopus	I	3	Collector	sp	6.2
Insecta	Diptera	Ceratopogonidae	Serromyia	Serromyia	I	1	Predator	sp, bu	3.6
Insecta	Diptera	Simuliidae	Simulium	Simulium	I	5	Filterer	cn	5.7
Insecta	Diptera	Chironomidae	Tanytarsus	Tanytarsus	I	1	Filterer	cb, cn	4.9
Clitellata	Haplotaxida	Tubificidae	not identified	Tubificidae	U	2	Collector	cn	8.4

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

Appendix B: Bioassessment Results Map

Appendix C: QA/QC Procedures and Results

Appendix C: Quality Assurance/Quality Control Procedures and Results

The monitoring program for the Magothy River includes chemical, physical and biological assessment conducted throughout the watershed. The sampling methods used are compatible with the Sampling and Analysis Plan for Anne Arundel County Biological Monitoring (SAP) (Tetra Tech, 2005) and the Quality Assurance Project Plan (QAPP) for Anne Arundel County Biological Monitoring and Assessment Program (Tetra Tech, 2004). A summary of the Quality Assurance/Quality Control (QA/QC) procedures and results are included in this Appendix.

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

- Precision (consistency) of field sampling and overall site assessments using intra-team site duplication
  - median relative percent difference (mRPD)
  - coefficient of variability (CV)
  - 90% confidence interval (CI)
- Bias of sample sorting and subsampling
  - percent sorting efficiency (PSE)
- Precision of taxonomic identification and enumeration
  - percent taxonomic disagreement (PTD)
  - percent difference in enumeration (PDE)
- Accuracy of data entry
  - number of errors/corrective actions
- Completeness
  - number of valid data points obtained as a proportion of those planned (Sampling and Analysis Plan, 2005).

Data that does not meet performance or acceptable criteria are re-evaluated to correct any problems or investigated further to determine the reason behind the results.

Field Sampling

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

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

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

Replicate (duplicate) samples were taken at ten percent of the overall sites (three sites). These QC samples were collected just upstream of the original sampling location to determine the

consistency and repeatability of the sampling procedures and the intra-team adherence to those protocols. QC sites were field-selected rather than randomly selected to ensure that the QC sites maintained similar habitat conditions to the original site. Duplicate samples included collection and analysis of the benthic macroinvertebrate community, completion of the RBP and the PHI habitat assessments, and measurement of *in situ* water chemistry. Photographs were also taken at duplicate sites. Duplicate samples were collected at sites 10, 16, and 23.

Precision

Performance characteristics calculated for the consistency of field sampling and overall site assessments using intra-team site duplication were:

- Median Relative Percent Difference (mRPD)
- Coefficient of variability (CV)
- 90% Confidence Interval (CI)

Acceptable measurement quality objectives are listed in Table 1. DNR's MBSS protocols were used for the collection and analysis of macroinvertebrate data. In 2005, DNR updated their Benthic Index of Biotic Integrity (BIBI). These new metrics were used to calculate the BIBI presented in this report. The *Documentation of Method Performance Characteristics for the Anne Arundel County Biological Monitoring Program* (Hill et al. 2005) was completed using the original BIBI, and thus, does not include MQOs for all metrics used in the new BIBI. Therefore, provisional MQOs were used for those metrics (i.e., Number of Ephemeroptera Taxa , Percent Intolerant Urban, and Percent Climber) based on previous County approved MQOs (SAP, 2005).

Table 1 – Measurement Quality Objectives (Hill et al. 2005)

Attribute	MQO		
	Median RPD	CV	90% CI
Total Number of Taxa	<30	<20	±10
Number of EPT Taxa	<30	<20	±10
Number of Ephemeroptera Taxa	<30[1]	n/a	n/a
Percent Intolerant Urban	<30[1]	n/a	n/a
Percent Ephemeroptera	<30	<20	±10
Number of Scraper Taxa	<30	<70	±10
Percent Climber	<30[1]	n/a	n/a
B-IBI	<15	<10	±0.5

[1]Values derived from SAP (2005), n/a denotes not available

Results of performance characteristics using individual metric values are presented in Table 2. Results are shown for the sites where a duplicate sample (i.e., sample pair) was collected and analyzed (10, 16, and 23). Table 3 includes metric and BIBI scores and corresponding performance characteristics.

Table 2 – Individual Metric Values and Related Measures of Precision. Bold values exceed MQOs.

Site	Total Taxa	EPT Taxa	Ephem Taxa	% Intol Urban	% Ephem	Scraper Taxa	% Climbers
10	32	4	0	31.19	0.00	5	14.68
10-QC	33	5	2	8.26	4.96	4	14.88
16	31	5	0	11.43	0.00	5	26.67
16-QC	31	2	0	7.69	0.00	4	23.93
23	22	0	0	4.49	0.00	0	13.48
23-QC	20	0	0	2.33	0.00	3	10.47
CV	2.51	**35.36**	141.42	62.35	**141.42**	**33.67**	8.08
CI	1.16	1.55	0.77	11.15	1.92	1.93	2.30
mRPD	3.08	22.22	0.00	**63.60**	0.00	22.22	10.81

Table 3 –Metric and Index Scores and Related Measures of Precision. Bold values exceed MQOs.

Site	Total Taxa Score	EPT Taxa Score	Ephem Taxa Score	% Intol Urban Score	% Ephem Score	Scraper Taxa Score	% Climbers Score	BIBI Score
10	5	3	1	5	1	5	5	3.57
10-QC	5	5	5	1	3	5	5	4.14
16	5	5	1	3	1	5	5	3.57
16-QC	5	3	1	1	1	5	5	3.00
23	5	1	1	1	1	1	5	2.14
23-QC	3	1	1	1	1	5	5	2.43
CV	10.10	31.43	**56.57**	70.71	**35.36**	21.76	0	**10.71**
CI	0.77	1.55	1.55	2.32	0.77	1.55	0	**0.55**
mRPD	0.00	**50.00**	0.00	**100.00**	0.00	0.00	0	14.81

Both metric values and metric scores were compared to MQOs to determine exceedances. Only one metric value, Percent Intolerant Urban, exceeded the MQO for mRPD, due to fairly broad differences observed between sample pairs 10 and 16. While a broad difference in the percentage of intolerant individuals was observed for sample pair 10, a closer inspection of the intolerant taxa yielded greater similarity; both samples had seven taxa, only two of which were different. Two metric scores (i.e., Percent Intolerant Urban, and EPT Taxa) also exceeded the MQO for mRPD. Although the EPT Taxa values were very similar for sample pair 10 (4 and 5, respectively), they fell on either side of the scoring threshold (3 and 5, respectively), resulting in a larger difference between scores than actual measurement values. No metrics exceeded MQOs for the 90% CI, however, the BIBI index score did exceed the MQO for CI (0.5) by a very small margin (0.55). Several metric values (EPT Taxa and Percent Ephemeroptera Taxa) and metric/index scores (Number of Ephemeroptera Taxa, Percent Ephemeroptera Taxa, BIBI) exceeded the MQO for CV. Most of this variability can be attributed to the difference in Ephemeroptera taxa and percent abundance between one sample pair (10). Since the new BIBI relies quite heavily on the sensitive taxa Ephemeroptera for three of seven total metrics, small differences in this taxa alone can influence the variability of the entire BIBI. It should also be noted that both of these samples (10 and 10-QC) were subsampled post identification using the random subsampling routine described below, and that greater variability was observed in the sample pair following this procedure. A close examination of the original samples showed greater precision for a number of metrics and scores (Tables 4 and 5). More importantly, the overall BIBI

scores showed considerably less variability and all precision measures for CV and CI fell within acceptable MQO ranges. Therefore, it is likely that a large portion of observed variability in metric scores and values can be attributed to subsampling procedures rather than field sampling procedures.

Table 4 –Individual Metric Values Prior to Subsampling (Sites 10 and 10 QC) and Revised Measures of Precision. Highlighted cells indicate updated values; bold values exceed MQOs.

Site	Total Taxa	EPT Taxa	Ephem Taxa	% Intol Urban	% Ephem	Scraper Taxa	% Climbers
10	34	5	1	30.0	0.77	6	16.9
10-QC	36	5	2	7.69	4.20	4	14.7
16	31	5	0	17.22	0	5	26.7
16-QC	31	2	0	7.69	0	4	23.9
23	22	0	0	4.49	0	0	13.5
23-QC	20	0	0	2.33	0	3	10.5
CV	3.25	**24.96**	47.14	61.11	**97.60**	38.57	10.65
CI	1.55	1.16	0.39	12.06	1.32	2.32	3.09
mRPD	5.71	0.00	0.00	**63.60**	0.00	**40.00**	14.16

Table 5 –Metric and Index Scores Prior to Subsampling (Sites 10 and 10 QC) and Revised Measures of Precision. Highlighted cells indicate updated scores; bold values exceed MQOs.

Site	Total Taxa Score	EPT Taxa Score	Ephem Taxa Score	% Intol Urban Score	% Ephem Score	Scraper Taxa Score	% Climbers Score	BIBI Score
10	5	5	3	5	1	5	5	4.14
10-QC	5	5	5	1	3	5	5	4.14
16	5	5	1	3	1	5	5	3.57
16-QC	5	3	1	1	1	5	5	3.00
23	5	1	1	1	1	1	5	2.14
23-QC	3	1	1	1	1	5	5	2.43
CV	10.10	14.14	23.57	70.71	**35.36**	21.76	0.00	6.24
CI	0.77	0.77	0.77	2.32	0.77	1.55	0.00	0.33
mRPD	0.00	0.00	0.00	**100.00**	0.00	0.00	0.00	12.50

Completeness

One hundred percent of the sampling effort was used at each of the sites samples, resulting in all field sampling data being complete.

Laboratory Sorting and Subsampling

Bias

All sorting was completed by Environmental Services and Consulting, LLC following the MBSS procedures and the QAPP. For these samples 10 percent (three samples) underwent quality

control procedures for sorting. Table 4 shows the results of the sorting quality control checks. All samples passed the stated MQO of >90% for PSE.

Table 4 – Percent Sorting Efficiencies (PSE) Per Sample.

Sample	Organisms Found by Primary Sorter	Organisms Found in QC Check	Total No. of Organisms	Percent Sorting Efficiency
2683-A	161	4	165	97.6
2704-A	162	1	163	99.4
2713-A	138	2	140	98.6

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

Taxonomic Identification and Enumeration

Samples for sites 7, 25, and 27 were randomly selected for QC identification and enumeration by an independent lab. Original identification was completed by Environmental Services and Consulting, LLC[1] (ESC). Re-identification of the randomly selected sites was done by EcoAnalysts, Inc[2]. Each sample was identified to the genus level where possible. Individuals that were not able to be identified to genus level were identified to the lowest possible level, usually family, but in some cases order. For Chironomidae, individuals not identifiable to genus may have been identified to subfamily or tribe level.

Precision

Measures of precision were calculated for the identification consistency between the two randomly selected samples. These include percent difference in enumeration (PDE) and percent taxonomic disagreement (PTD).

The PDE compares the final specimen counts between the two taxonomy labs, whereas PTD compares the number of agreements in final specimen identifications between the two taxonomic labs. To meet required MQOs set by the QAPP, the PDE for each sample must be equal to or less than 5% , and the PTD must be equal to or less than 15%. Results for the taxonomic comparison and resulting values for PDE and PTD are found in Table 4.

The PDE was below the MQO value of 5% for all three samples. PTD was below the MQO value of 15% for samples 07 and 25. For sample 27, however, there was a single discrepancy between laboratories concerning the final identification of an abundant amphipod, which resulted in a considerably elevated PTD of 65.6% that exceeds the MQO. The primary taxonomic laboratory, ESC, identified 151 amphipods as *Crangonyx* (Order: Amphipoda, Family: Crangonyctidae)

[1] Address: 101 Professional Park Drive, STE 303, Blacksburg, VA
[2] Address: 105 East 2nd St.Suite 1, Moscow, ID

while EcoAnalysts identified 143 amphipods as *Gammarus* (Order: Amphipoda, Family: Gammaridae). *Crangonyx* and *Gammarus*, both in Order Amphipoda, are very similar morphologically and have the same habit (sprawler) and tolerance value (6.7). Correcting this single, albeit large, discrepancy would reduce the PTD significantly and would put the sample below the acceptable limit of 15%. To resolve this discrepancy, KCI requested that each laboratory take a second look at the questionable amphipods to verify initial identifications. Upon closer inspection, it was determined by both laboratories that the amphipods in question belonged to a different genus altogether, *Synurella* (Order: Amphipoda, Family: Crangonyctidae), which is commonly referred to as the Coastal Swamp Amphipod. *Synurella* is a much less commonly encountered genus typically found in coastal wetland and swamp habitats, but is very similar morphologically to the more commonly found amphipods *Crangonxy* and *Gammarus*. EcoAnalysts re-identified all 143 individuals as belonging to genus *Synurella,* while ESC identified 35 to the species level as *Synurella chamberlaini*, and the remaining 116 to the family level (Crangonyctidae) due to that the fact that those specimens were either too immature or damaged for positive identification at the genus level. Although, the specimens in question were identified to different hierarchical levels (i.e., Family, Genus, and Species), all were considered to be in agreement. It was ultimately decided that the more conservative final identification by ESC would be used for metric and BIBI score calculations.

Following the corrective actions to resolve the taxonomic discrepancy for sample 27, the PTD was reduced from 65.6% to 1.8%, which is below the acceptable limit of 15%. However, it should be noted that the updated identification resulted in a change in the metric score for percent intolerant to urban from 5.9% to 16.1% and a shift in the overall BIBI score from 1.6 to 1.9, due to *Synurella* having a significantly lower tolerance value (0.4) than either *Crangonyx* (6.7) or *Gammarus* (6.7). Nonetheless, the final biological rating for this site did not change from the original rating of 'very poor' prior to this exercise.

Data Entry

Accuracy

All data entered into EDAS, Excel, or any other program used for site analysis were reviewed and checked for entry error. Table 5 shows the percent error for each data type entered into the database. All errors were corrected and the database was deemed to be 100% accurate. Additionally all metric calculations were checked. Any errors found were corrected.

Table 5 – Percent Error for Database Entries.

Data Type	No. of Entries	No. of Errors	% Error
Water Chemistry	178	5	2.81
Habitat	767	3	0.39
Physical Characteristics	748	3	0.40
Benthic Macroinvertebrates	842	2	0.24

Table 3 - Taxonomic Identification and Enumeration Results

Order	Family	Subfamily	Tribe	EcoAnalysts Sample ID	Site 7 ES&C, LLC	Site 7 EcoAnalysts, Inc.	Site 7 # of agreements	Site 25 ES&C, LLC	Site 25 EcoAnalysts, Inc.	Site 25 # of agreements	Site 27 ES&C, LLC.	Site 27 EcoAnalysts, Inc.	Site 27 # of agreements
Odonata	Calopterygidae			Calopteryx sp.	0	0	0	3	3	3	0	0	0
	Ceratopogonidae			Ceratopogoninae	1	0	0	0	0	0	6	6	6
	Coenagrionidae			Ischnura sp.	1	1	1	0	0	0	0	0	0
Diptera	Chironomidae	Orthocladiinae		Chaetocladius sp.	0	0	0	0	5	0	0	0	0
	Chaoboridae			Chaoboridae	0	0	0	0	0	0	1	0	0
	Chironomidae	Chironominae	Chironomini	Chironomini	0	0	0	0	0	0	3	0	0
	Chironomidae	Chironominae	Chironomini	Chironomus sp.	3	3	3	1	1	1	2	5	5**
	Tabanidae			Chrysops	0	0	0	0	0	0	2	0	2
	Chironomidae	Orthocladiinae		Corynoneura sp.	0	0	0	1	1	1	0	0	0
	Chironomidae	Orthocladiinae		Cricotopus sp.	0	0	0	0	1	0	0	0	0
	Chironomidae	Orthocladiinae		Diplocladius sp.	1	1	1	0	1	0	22	22	22
	Dixidae			Dixidae	0	0	0	0	0	0	0	1	0
	Tipulidae			Erioptera sp.	0	0	0	0	1	0	0	0	0
	Tipulidae			Eriopterini	0	0	0	1	0	1**	0	0	0
	Chironomidae	Orthocladiinae		Eukiefferiella sp.	0	1	0	1	1	1	0	0	0
	Chironomidae	Orthocladiinae		Hydrobaenus sp.	1	0	0	5	0	0	3	3	3
	Chironomidae	Chironominae	Tanytarsini	Micropsectra sp.	0	0	0	2	2	2	1	1	1
	Stratiomyidae	Stratiomyinae	Prosopochrysini	Myxosargus sp.	1	1	1	0	0	0	0	0	0
	Chironomidae	Orthocladiinae		Nanocladius sp.	0	0	0	0	0	0	1	1	1
	Chironomidae	Orthocladiinae		Orthocladiinae	1	0	0	3	1	1	0	0	0
				Orthocladius Complex	0	1	1	0	0	0	0	0	0
	Chironomidae	Orthocladiinae		Orthocladius sp.	1	0	0	2	0	0	3	2	2
	Chironomidae	Orthocladiinae		Parachaetocladius	0	0	0	3	0	0	0	0	0
	Chironomidae	Orthocladiinae		Parametriocnemus sp.	0	0	0	1	2	1	0	0	0
	Chironomidae	Orthocladiinae		Paraphaenocladius sp.	0	1	0	0	0	0	0	0	0
	Chironomidae	Chironominae	Tanytarsini	Paratanytarsus sp.	0	0	0	0	0	0	1	1	1
	Chironomidae	Chironominae	Chironomini	Paratendipes	1	0	0	0	0	0	0	0	0
	Chironomidae	Chironominae	Chironomini	Polypedilum sp.	10	10	10	5	5	5	0	0	0
	Chironomidae	Prodiamesinae		Prodiamesa sp.	0	0	0	1	1	1	0	0	0
	Chironomidae	Orthocladiinae		Psectrocladius	0	0	0	0	0	0	1	0	0
	Chironomidae	Orthocladiinae		Pseudorthocladius sp.	0	0	0	0	2	0	1	1	1
	Chironomidae	Orthocladiinae		Rheocricotopus sp.	0	0	0	61	63	61	3	5	3
	Chironomidae	Chironominae	Tanytarsini	Rheotanytarsus sp.	1	1	1	0	0	0	0	0	0
	Ceratopogonidae			Serromyia	0	0	0	0	0	0	1	0	0
	Simuliidae			Simulium sp.	15	15	15	0	0	0	9	9	9
	Chironomidae	Chironominae	Chironomini	Stenochironomus sp.	0	0	0	1	1	1	0	0	0
	Chironomidae	Chironominae	Tanytarsini	Tanytarsus sp.	0	0	0	0	0	0	1	1	1
	Chironomidae	Orthocladiinae		Thienemanniella sp.	0	0	0	3	3	3	0	0	0
	Chironomidae	Tanypodinae	Pentaneurini	Thienemannimyia gr. sp.	4	4	4	0	0	0	0	0	0
Trichoptera	Polycentropodidae			Polycentropus sp.	0	0	0	2	2	2	0	0	0
	Tabanidae			Tabanidae	0	0	0	0	0	0	0	2	0
Gastropoda	Planorbidae			Helisoma anceps	0	0	0	0	1	1**	0	0	0
	Planorbidae			Planorbella	0	0	0	1	0	0	0	0	0
Bivalvia	Sphaeriidae			Pisidiidae	21	0	0	0	0	0	8	0	0

Order	Family	Subfamily	Tribe	Final ID	Site 7 ES&C, LLC	Site 7 EcoAnalysts, Inc.	Site 7 # of agreements	Site 25 ES&C, LLC	Site 25 EcoAnalysts, Inc.	Site 25 # of agreements	Site 27 ES&C, LLC.	Site 27 EcoAnalysts, Inc.	Site 27 # of agreements
Bivalvia	Pisidiidae			Pisidium sp.	6	25	25	1	1	1	2	10	10
Annelida	Enchytraeidae			Enchytraeidae	1	2	1	2	2	2	0	0	0
				Lumbricina	0	0	0	1	1	1	0	0	0
	Tubificidae			Tubificidae	8	8	8	0	0	0	2	1	1
Isopoda	Asellidae			Caecidotea sp.	88	84	84	2	2	2	9	10	9
	Crangonyctidae			Crangonyctidae	0	0	0	0	0	0	116	0	0
	Crangonyctidae			Synurella	0	0	0	0	0	0	0	143	143**
	Crangonyctidae			Synurella chamberlaini	0	0	0	0	0	0	35	0	0
	Gammaridae			Gammarus sp.	0	0	0	1	1	1	0	0	0
				Total	165	158	155	104	104	92	233	224	220
				PDE			2.17			0.00			1.97
				PTD			1.90			11.54			1.79

* Data are not adjusted for subsampling
** Data are adjusted for SubFamily / Tribe/Species ID's

Appendix D: Site Photographs

Biological Assessment Photos

MAGO_01_02 Facing downstream at the midpoint of reach

MAGO_01_06 Facing upstream at the upstream end of reach

MAGO_02_02 Facing downstream at the midpoint of reach

MAGO_02_06 Facing upstream at the upstream end of reach

Biological Assessment Photos

MAGO_03_01 Facing downstream at the downstream end of reach

MAGO_03_06 Facing upstream at the upstream end of reach

MAGO_04_01 Facing downstream at the downstream end of reach

MAGO_04_06 Facing upstream at the upstream end of reach

Biological Assessment Photos

MAGO_05_01 Facing downstream at the downstream end of reach

MAGO_05_06 Facing upstream at the midpoint of reach

MAGO_06_03 Facing downstream at upstream end of reach

MAGO_06_05 Facing upstream at midpoint of reach

Biological Assessment Photos

MAGO_07_02 Facing downstream at midpoint of reach

MAGO_07_05 Facing upstream at midpoint of reach

MAGO_08_01 Facing downstream at downstream end of reach

MAGO_08_05 Facing upstream at the midpoint of reach

Biological Assessment Photos

MAGO_09_01 Facing downstream at the downstream end of reach

MAGO_09_06 Facing upstream at the upstream end of reach

MAGO_10_03 Facing downstream at the upstream end of reach

MAGO_10_04 Facing upstream at the downstream end of reach

Biological Assessment Photos

MAGO_10dup_04 Facing downstream at the upstream end of reach

MAGO_10dup_06 Facing upstream at the midpoint of reach

MAGO_11_01 Facing downstream at the downstream end of reach

MAGO_11_04 Facing upstream at the downstream end of reach

Biological Assessment Photos

MAGO_12_01 Facing downstream at the downstream end of reach

MAGO_12_07 Facing upstream at the upstream end of reach

MAGO_13_03 Facing downstream at the upstream end of reach

MAGO_13_06 Facing upstream at the upstream end of reach

Biological Assessment Photos

MAGO_14_02 Facing downstream at the midpoint of reach

MAGO_14_05 Facing upstream at the midpoint of reach

MAGO_15_02 Facing downstream at the midpoint of reach

MAGO_15_05 Facing upstream at the midpoint of reach

Biological Assessment Photos

MAGO_16_03 Facing downstream at the midpoint of reach

MAGO_16_02 Facing upstream at the downstream end of reach

MAGO_16dup_03 Facing downstream at the midpoint of reach

MAGO_16dup_05 Facing upstream at the midpoint of reach

Biological Assessment Photos

MAGO_17_03 Facing downstream at the downstream end of reach

MAGO_17_06 Facing upstream at the upstream end of reach

MAGO_18_01 Facing downstream at the downstream end of reach

MAGO_18_05 Facing upstream at the midpoint of reach

Biological Assessment Photos

MAGO_19_02 Facing downstream at the midpoint of reach

MAGO_19_06 Facing upstream at the upstream end of reach

MAGO_20_01 Facing downstream at the downstream end of reach

MAGO_20_08 Facing upstream at the midpoint of reach

Biological Assessment Photos

MAGO_21_01 Facing downstream at the downstream end of reach

MAGO_21_05 Facing upstream at the midpoint of reach

MAGO_22_02 Facing downstream at the midpoint of reach

MAGO_22_03 Facing upstream at the downstream end of reach

Biological Assessment Photos

MAGO_23_02 Facing downstream at the midpoint of reach

MAGO_23_06 Facing upstream at the upstream end of reach

MAGO_23dup_01 Facing downstream at the downstream end of reach

MAGO_23dup_05 Facing upstream at the midpoint of reach

Biological Assessment Photos

MAGO_24_01 Facing downstream at the downstream end of reach

MAGO_24_05 Facing upstream at the midpoint of reach

MAGO_25_02 Facing downstream at the midpoint of reach

MAGO_25_06 Facing upstream at the upstream end of reach

Biological Assessment Photos

MAGO_26_01 Facing downstream at the downstream end of reach

MAGO_26_05 Facing upstream at the midpoint of reach

MAGO_27_02 Facing downstream at the midpoint of reach

MAGO_27_05 Facing upstream at the midpoint of reach

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