# Water Quality Analysis of Eutrophication for the Potomac River Montgomery County Watershed, Montgomery and Frederick Counties, Maryland

## FINAL

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Submitted to:

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1650 Arch Street
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September 2011

EPA Submittal Date: Sept. 28, 2011
EPA Concurrence Date: May 18, 2012

# Table of Contents

## List of Figures



## List of Tables

## List of Abbreviations

| | |
|---|---|
| BSID | Biological Stressor Identification |
| COMAR | Code of Maryland Regulations |
| CWA | Clean Water Act |
| DNR | Department of Natural Resources |
| DO | Dissolved Oxygen |
| EPA | United States Environmental Protection Agency |
| EPT | Ephemeroptera, Plecoptera, and Trichoptera |
| MBSS | Maryland Biological Stream Survey |
| MDE | Maryland Department of the Environment |
| MDP | Maryland Department of Planning |
| MGS | Maryland Geological Survey |
| mg/l | Milligrams Per Liter |
| NPDES | National Pollution Discharge Elimination System |
| TMDL | Total Maximum Daily Load |
| TN | Total Nitrogen |
| TP | Total Phosphorus |
| WQA | Water Quality Analysis |
| WQLS | Water Quality Limited Segment |

## EXECUTIVE SUMMARY

Section 303(d) of the federal Clean Water Act (CWA) and the U.S. Environmental Protection Agency's (EPA) implementing regulations direct each state to identify and list waters, known as water quality limited segments (WQLSs), in which current required controls of a specified substance are inadequate to achieve water quality standards. This list of impaired waters is commonly referred to as the 303(d) List. For each WQLS listed on the *Integrated Report of Surface Water Quality in Maryland* (Integrated Report), the State is to either establish a Total Maximum Daily Load (TMDL) of the specified substance that the waterbody can receive without violating water quality standards, or demonstrate via a Water Quality Analysis (WQA) that water quality standards are being met (CFR 2010). In 2002, the State began listing biological impairments on the Integrated Report. Maryland Department of the Environment (MDE) has developed a biological assessment methodology to support the determination of proper category placement for 8-digit watershed listings.

The Potomac River Montgomery County watershed (basin code 02140202), located primarily in Montgomery County, was identified on the 2008 Integrated Report under Category 5 as impaired by nutrients and sediments—non-tidal 8-digit watershed (1996 listings); impacts to biological communities—1$^{st}$ through 4$^{th}$ order streams (2006 listing); and toxics: polychlorinated biphenyls (PCBs) in fish tissues—non-tidal 8-digit watershed (2008 listing) (MDE 2008a). The 2008 Integrated Report specified that the designated use impaired by nutrients and sediment is Aquatic Life and Wildlife. The 1996 suspended sediment listing was refined in the 2008 Integrated Report to a listing for total suspended solids. Similarly, the 1996 nutrients listing was refined in the 2008 Integrated Report, and phosphorus was identified as the specific impairing substance. Consequently, for the purpose of this report the terms "nutrients" and "phosphorus" will be used interchangeably. The listings for sediments, impacts to biological communities, and PCBs in fish tissues will be addressed separately at a future date.

A data solicitation for information pertaining to pollutants, including nutrients, in the Potomac River Montgomery County watershed was conducted by MDE in 2009, and all readily available data from the period of 2000 through 2008 have been considered. Currently, there are no specific numeric criteria for nutrients in Maryland's water quality standards. Nutrients typically do not have a direct impact on aquatic life; rather, they mediate impacts through excessive algal growth leading to low dissolved oxygen, poor habitat, or shifts in the trophic relations in aquatic communities. Recently, MDE developed a biological stressor identification (BSID) methodology to identify the most probable cause(s) of the existing biological impairments in 1$^{st}$ through 4$^{th}$ order streams in Maryland 8-digit watersheds based on the suite of available physical, chemical, and land use data (MDE 2009a). The BSID analysis for the Potomac River Montgomery County watershed identifies sediment, instream habitat, and water chemistry (e.g., high chlorides, sulfates, conductivity) as potential biological stressors. The BSID identified neither nitrogen nor phosphorus as potential biological stressors. Therefore, because the BSID determined that biological impairments in 1$^{st}$ through 4$^{th}$ order streams in the Potomac River Montgomery County watershed are not associated with nutrients, it is concluded that excess eutrophication is not a cause of the biological impairments in the watershed.

An analysis of the Department of Natural Resources (DNR) CORE/TREND biological monitoring data confirms that the Potomac River Montgomery County is supporting its aquatic life use. Analyses of observed dissolved oxygen (DO) in the Potomac River mainstem show no violation of the DO criterion. Therefore, it is concluded that nutrients in general and phosphorus in particular are not impairing designated uses in the Potomac River Montgomery County mainstem.

The results of the BSID study, combined with the analysis of dissolved oxygen monitoring data presented in this report, indicate that the Potomac River Montgomery County watershed is not being impaired by nutrients. This WQA supports the conclusion that a TMDL for nutrients is not necessary to achieve water quality standards in the Potomac River Montgomery County. Although the waters of the Potomac River Montgomery County do not display signs of eutrophication, the State reserves the right to require future controls if evidence suggests that nutrients from the watershed are contributing to downstream water quality problems. For instance, reductions will be required to meet allocations assigned to the Potomac Tidal Fresh Bay Water Quality Segment by the Chesapeake Bay TMDL, established by EPA on December 29, 2010.

Barring the receipt of contradictory data, this report will be used to support a revision of the phosphorus listing for the Potomac River Montgomery County watershed, from Category 5 ("waterbody is impaired, does not attain the water quality standard, and a TMDL is required") to Category 2 ("waterbodies meeting some [in this case nutrients-related] water quality standards, but with insufficient data to assess all impairments") when MDE proposes the revision of the Integrated Report. The listings for sediments, impacts to biological communities, and PCBs in fish tissue will be addressed separately at a future date.

# 1.0 INTRODUCTION

Section 303(d) of the federal Clean Water Act (CWA) and the U.S. Environmental Protection Agency's (EPA) implementing regulations direct each state to identify and list waters, known as water quality limited segments (WQLSs), in which current required controls of a specified substance are inadequate to achieve water quality standards. This list of impaired waters is commonly referred to as the 303(d) List. For each WQLS, the State is required to either establish a Total Maximum Daily Load (TMDL) of the specified substance that the waterbody can receive without violating water quality standards, or demonstrate that water quality standards are being met (CFR 2010).

A segment identified as a WQLS may not require the development and implementation of a TMDL if more recent information invalidates previous findings. The most common scenarios that would eliminate the need for a TMDL are: 1) analysis of more recent data indicating that the impairment no longer exists (i.e., water quality standards are being met); 2) results of a more recent and updated water quality modeling which demonstrates that the segment is attaining standards; 3) refinements to water quality standards or to the interpretation of those standards accompanied by analysis demonstrating that the standards are being met; or 4) identification and correction of errors made in the initial listing.

The Potomac River Montgomery County watershed (basin code 02140202), located primarily in Montgomery County was identified on the 2008 Integrated Report under Category 5 as impaired by nutrients and sediments—non-tidal 8-digit watershed (1996 listings); impacts to biological communities—1$^{st}$ through 4$^{th}$ order streams (2006 listing); and toxics: polychlorinated biphenyls (PCBs) in fish tissues—non-tidal 8-digit watershed (2008 listing (MDE 2008a). The 2008 Integrated Report specified that the designated use impaired by nutrients and sediment is Aquatic Life and Wildlife. The 1996 suspended sediment listing was refined in the 2008 Integrated Report to a listing for total suspended solids. Similarly, the 1996 nutrients listing was refined in the 2008 Integrated Report, and phosphorus was identified as the specific impairing substance. Consequently, for the purpose of this report the terms "nutrients" and "phosphorus" will be used interchangeably. The listings for sediments, impacts to biological communities, and PCBs in fish tissues will be addressed separately at a future date.

The Maryland Surface Water Use Designation in the Code of Maryland Regulations (COMAR) for the waters of the Potomac River Montgomery County is Use I-P (Water Contact Recreation, Protection of Aquatic Life, and Public Water Supply) (COMAR 2010a,b,c).

This report provides an analysis of recent data that supports the removal of the nutrients (phosphorus) listing for the Potomac River Montgomery County watershed when MDE proposes the revision of the State's Integrated Report. The remainder of this report lays out the general setting of the Potomac River Montgomery County watershed area, presents a discussion of the water quality characteristics in the basin in terms of the existing water quality standards relating to nutrients, and presents an analysis of the available nutrient data. This analysis supports the conclusion that the waters of the Potomac River Montgomery County watershed do not display signs of eutrophication or nutrient over-enrichment.

## 2.0 GENERAL SETTING

### Location

The Potomac River Montgomery County watershed, which is located predominately in Montgomery County, MD, covers 89,617 acres. Small portions also extend into Frederick County, MD (448 acres) and Washington, DC (1,369 acres). The watershed contains the mainstem of the Potomac River within Montgomery County and all tributaries except Seneca Creek and Cabin John Creek. The watershed encompasses numerous sub-watersheds, including Little Monocacy River, Broad Run, Horsepen Branch, Muddy Branch, Watts Branch, Rock Run, and Little Falls Branch (Figure 1). Several highly developed areas occur in the watershed including parts of Gaithersburg, Rockville, Bethesda, and Chevy Chase.

### Geology/Soils

The Potomac River Montgomery County watershed lies within the Piedmont Plateau Physiographic Province, an open rolling terrain with low knobs and ridges, broad-bottom valleys, and abundant, often steeply incised streams. Areas immediately adjacent to the Potomac River mainstem occupy a well-defined floodplain. The Piedmont Plateau Province can be further subdivided into a smaller western Lowland Section and a larger eastern Upland Section (MGS 2008a,b).

Most of the Potomac River Montgomery County watershed is located in the Upland Section where differential weathering produced distinctive ridges, hills, barrens, and valleys (MGS 2008). This area is underlain by meta-sedimentary rocks of late Precambrian origin including schist, gneiss, and thins beds and lenses of quartzite and marble (MGS 2008a,b).

A small portion of the watershed lies within the Mesozoic Lowland Section. This area is characterized by a relatively flat to gently rolling topography. Here an outcrop of sandstones, siltstones, shales, and various conglomerates of Triassic age weathered into distinctive red soils (MGS 2008a,b).

Soils in the western part of the Potomac River Montgomery County watershed belong to the Glenning-Gaila-Occoquan series, whereas in the eastern part they belong primarily to the Penn-Brentsville-Readington series and some small portion to the Urban land – Wheaton –Glenelg association (USDA 1995). All three soil associations are loamy and occur on broad ridge tops and side slopes.

Glenning-Gaila-Occoquan soils occur in uplands. These well drained, deep to very deep soils are well suited for cultivated crops, pasture, or hay production (USDA 1995). Penn-Brentsville-Readington soils are moderately well drained to well drained and tend to be moderately deep to deep. Soils in this series are suitable for woodland and pasture. Both the Glenning-Gaila-Occoquan and Penn-Brentsville-Readington soil units are somewhat limited for urban development because onsite sewage disposal is affected by restricted permeability, depth to bedrock, and sometimes slope (USDA 1995).

Of the three major soil associations in the Potomac River Montgomery County watershed, the soils in the Urban land – Wheaton –Glenelg unit are the best suited for urban development-the major limitation is restricted permeability. These soils are well drained and deep (USDA 1995).

## Land Use

The western portion of the Potomac River Montgomery County watershed is largely rural with ample farmland, pastures, forests, and smaller urban centers. The eastern portion is highly urbanized, with both old and newly developed neighborhoods interspersed by pockets of commercial centers and research facilities. Based on the Chesapeake Bay Program's Phase 5.2 Watershed Model, urban land occupies approximately 42% of the watershed (7% impervious surfaces), with 38% of the watershed forested, and 20% agricultural (USEPA 2008). Figure 2 provides a land use map of the watershed.

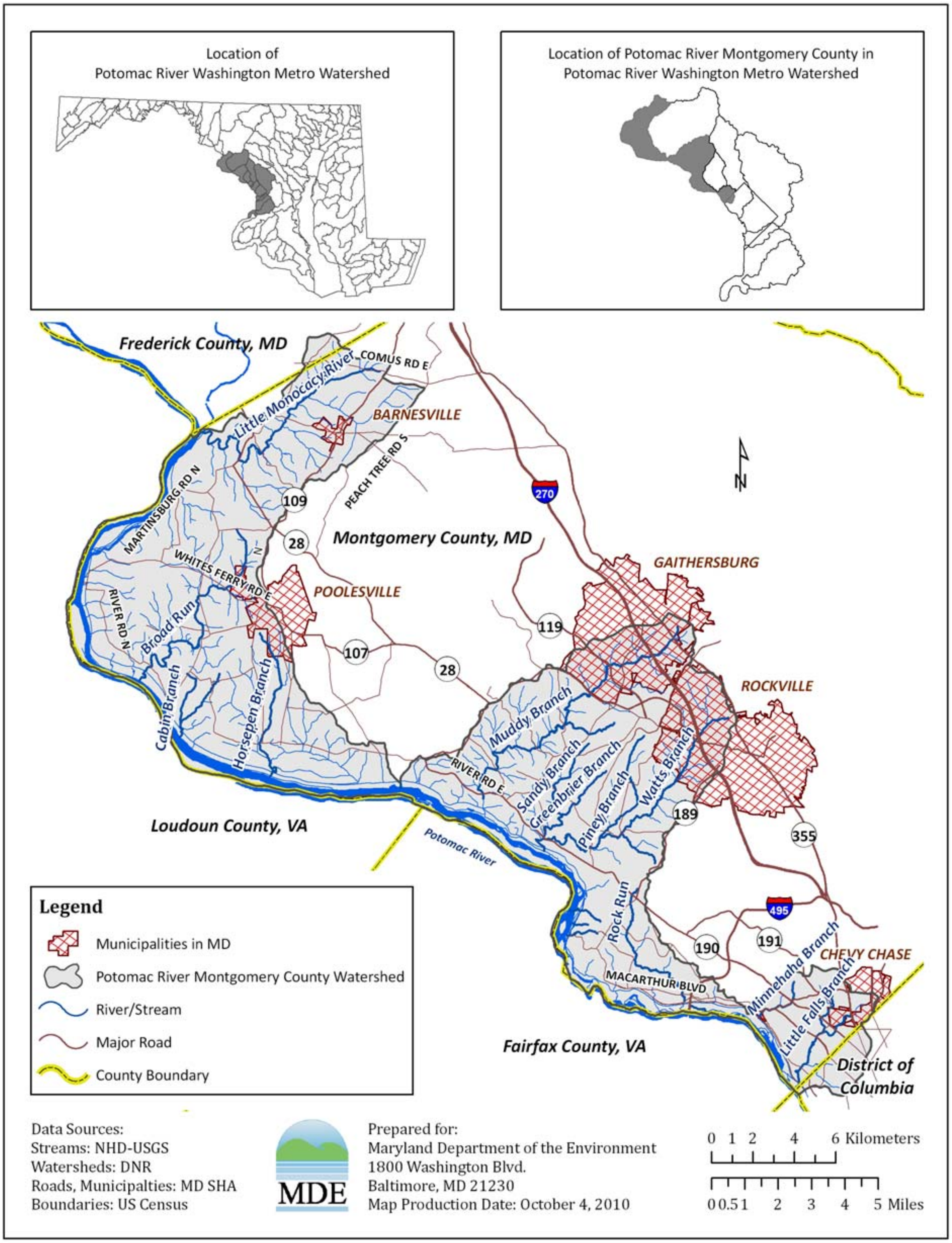
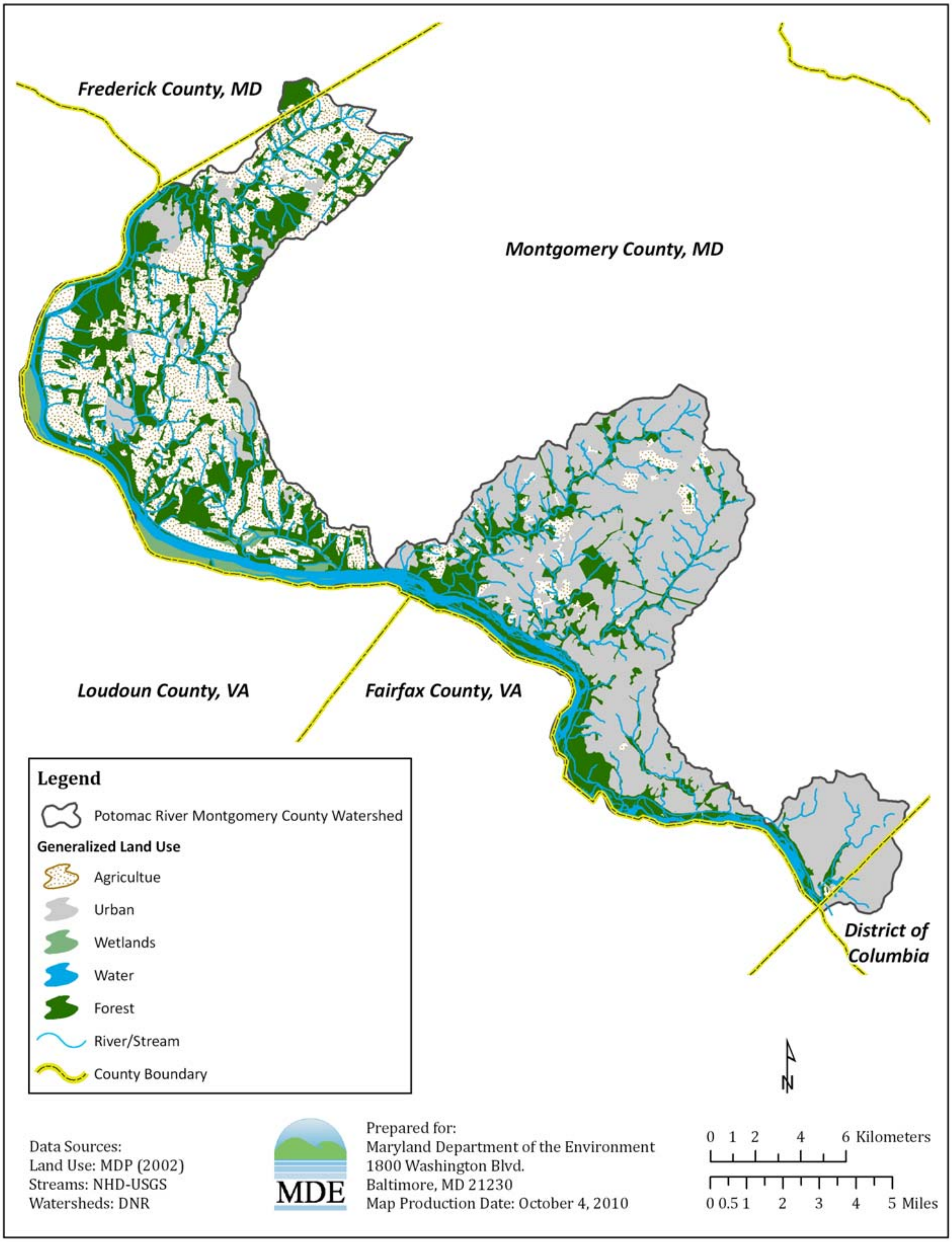

Location of
Potomac River Washington Metro Watershed
Location of Potomac River Montgomery County in
Potomac River Washington Metro Watershed
Frederick County, MD
Little Monocacy River
COMUS RD E
BARNESVILLE
PEACH TREE RD S
MARTINSBURG RD N
109
28
Montgomery County, MD
270
WHITES FERRY RD E
POOLESVILLE
GAITHERSBURG
RIVER RD N
Broad Run
119
107
28
ROCKVILLE
Cabin Branch
Horsepen Branch
Muddy Branch
Sandy Branch
Greenbrier Branch
Piney Branch
Watts Branch
RIVER RD E
189
355
Loudoun County, VA
Potomac River
Rock Run
495
190
191
Minnehaha Branch
CHEVY CHASE
MACARTHUR BLVD
Little Falls Branch
Fairfax County, VA
District of Columbia
Legend
Municipalities in MD
Potomac River Montgomery County Watershed
River/Stream
Major Road
County Boundary
Data Sources:
Streams: NHD-USGS
Watersheds: DNR
Roads, Municipalties: MD SHA
Boundaries: US Census
MDE
Prepared for:
Maryland Department of the Environment
1800 Washington Blvd.
Baltimore, MD 21230
Map Production Date: October 4, 2010
0 1 2 4 6 Kilometers
0 0.5 1 2 3 4 5 Miles

**Figure 1. Location Map of the Potomac River Montgomery County Watershed**



Frederick County, MD
Montgomery County, MD
Loudoun County, VA
Fairfax County, VA
District of Columbia
Legend
Potomac River Montgomery County Watershed
Generalized Land Use
Agricultue
Urban
Wetlands
Water
Forest
River/Stream
County Boundary
N
Data Sources:
Land Use: MDP (2002)
Streams: NHD-USGS
Watersheds: DNR
MDE
Prepared for:
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1800 Washington Blvd.
Baltimore, MD 21230
Map Production Date: October 4, 2010
0 1 2 4 6 Kilometers
0 0.5 1 2 3 4 5 Miles

**Figure 2. Land Use Map of the Potomac River Montgomery County Watershed**

## Point Sources

According to the national Pollutant Discharge Elimination System (NPDES) data, there are 15 point source facilities with permits regulating their discharges in the Potomac River Montgomery County watershed. Of these, four municipal facilities have NPDES permits regulating the discharge of nutrients (Table 1).

**Table 1: Point Source Facilities in the Potomac River Montgomery County Watershed**

| Facility | NPDES Number | MDE Number | Latitude (dec degree) | Longitude (dec degree) |
|---|---|---|---|---|
| KUNZANG ODSAL PALYUL CHANGCHUB CHOLING | MD0067539 | 00DP3163 | 39.0850 | -77.3972 |
| BRETTON WOODS RECREATION CENTER | MD0064777 | 03DP2754 | 39.0703 | -77.3306 |
| NIH ANIMAL CENTER | MD0020931 | 04DP2529 | 39.1250 | -77.4825 |
| LEESBURG WATER POLLUTION CONTROL FACILITY | VA0066184 | | 39.1150 | -77.5042 |

## 3.0 WATER QUALITY CHARACTERIZATION

The Maryland Surface Water Use Designation in the Code of Maryland Regulations (COMAR) for the waters of the Potomac River Montgomery County is Use I-P (Water Contact Recreation, Protection of Aquatic Life, and Public Water Supply) (COMAR 2010a,b,c).

A water quality standard is the combination of a designated use for a particular body of water and the water quality criteria designed to protect that use. Designated uses include support of aquatic life, primary or secondary contact recreation, drinking water supply, and shellfish propagation and harvest. Water quality criteria consist of narrative statements and numeric values designed to protect the designated uses. The criteria developed to protect the designated use may differ and are dependent on the specific designated use(s) of a waterbody.

The 2008 Integrated Report specified that the designated use impaired by nutrients is the Aquatic Life Use. Currently, there are no specific numeric criteria for nutrients in Maryland's water quality standards for the protection of aquatic life in free-flowing non-tidal waters. MDE has developed a biological stressor identification (BSID) analysis to identify potential stressor of aquatic life, including nutrients, in 1$^{st}$ through 4$^{th}$ order streams assessed by the Maryland Biological Stream Survey (MBSS). The impact of eutrophication on smaller-order streams in the watershed will be evaluated on the basis of the BSID analysis, which provides necessary and sufficient conditions for determining whether phosphorus is a potential stressor of the biological community in smaller-order streams.

Low levels of dissolved oxygen are sometimes associated with the decay of excess primary production and therefore nutrient over-enrichment. The dissolved oxygen (DO) concentration to protect Use I-P waters "may not be less than 5 milligrams per liter (mg/l) at any time" (COMAR 2010d). The water quality analysis must demonstrate that either the water quality standards for dissolved oxygen are met or that nutrients are not the cause of the violation of the standards.

A data solicitation was conducted by MDE in 2009, and all readily available water quality data from the time period of 2000 through 2008 were considered for this analysis. DNR collected water quality data from three stations on the Potomac River Montgomery County mainstem for its CORE/TREND network between January 2000 and December 2008 and from 31 stations located on tributaries for its MBSS program in the spring and summer of 2002 through 2004. MDE also sampled at the three CORE/TREND stations between October 2000 and September 2002 and at seven stations sited in tributaries in 2008.

### 3.1 Potomac River Montgomery County Watershed Monitoring Stations

A total of 41water quality monitoring stations were used to characterize the Potomac River Montgomery County watershed. The locations of the water quality monitoring stations are shown in Figure 3, and their geographical coordinates are listed in Table 1. Figures 4 through 7 provide graphical representation of the collected data for the parameters discussed below.

Forty-three biological/physical habitat monitoring stations from Rounds 1 and 2 of the MBSS program were used to characterize the Potomac River Montgomery County watershed in Maryland's 2008 Integrated Report as well as for the BSID analysis (Round 2 only). Biological data were also collected at three stations for the DNR CORE/TREND network on the mainstem Potomac River Montgomery County (see Figure 3 and Table 2).

The potential impact of eutrophication on water quality is best measured during the growing season, May through October. Water quality data for the mainstem Potomac River and smaller-order streams will be analyzed separately.

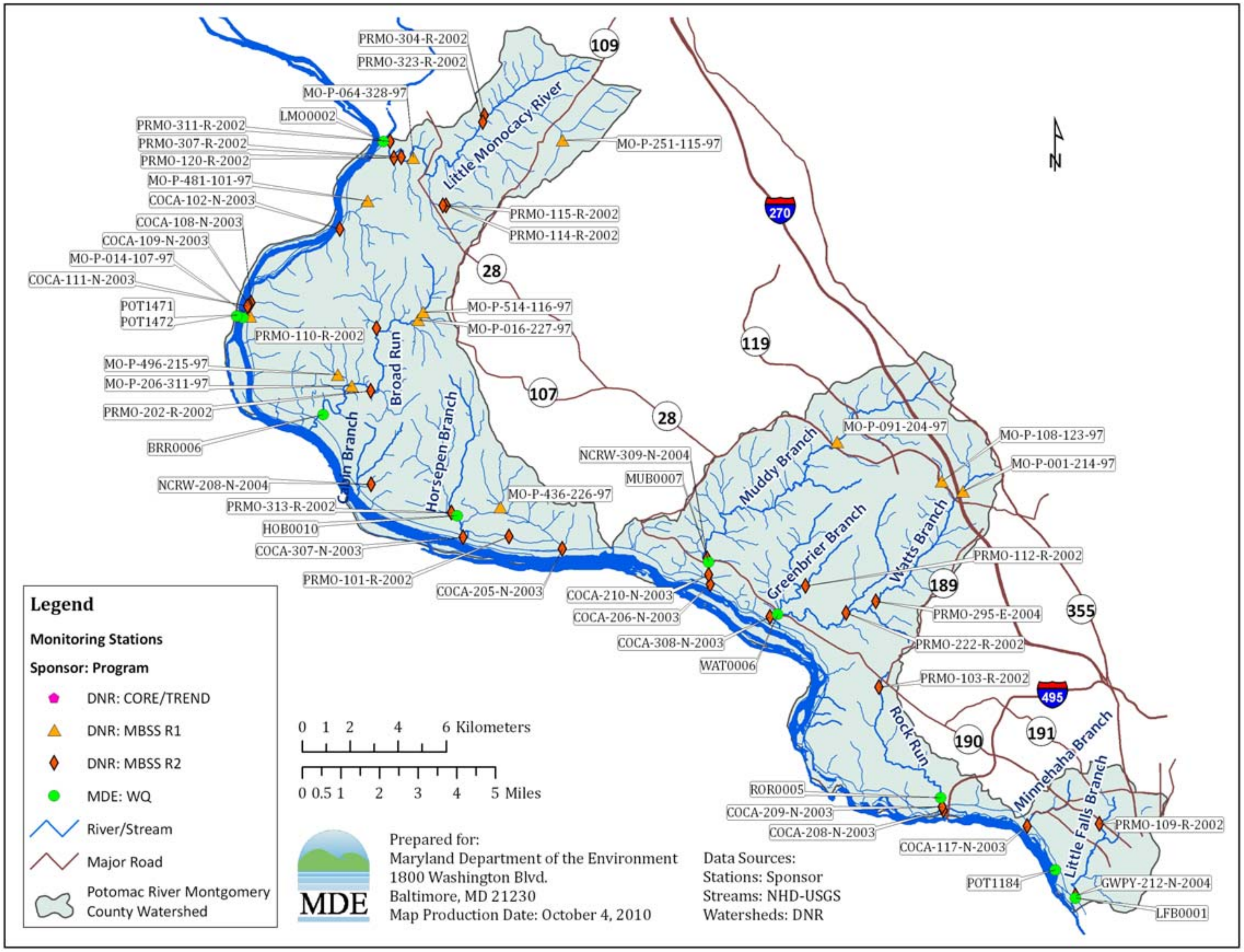
Legend
Monitoring Stations
Sponsor: Program
DNR: CORE/TREND
DNR: MBSS R1
DNR: MBSS R2
MDE: WQ
River/Stream
Major Road
Potomac River Montgomery County Watershed
0 1 2 4 6 Kilometers
0 0.5 1 2 3 4 5 Miles
Prepared for:
Maryland Department of the Environment
1800 Washington Blvd.
Baltimore, MD 21230
Map Production Date: October 4, 2010
Data Sources:
Stations: Sponsor
Streams: NHD-USGS
Watersheds: DNR
MDE
Little Monocacy River
Broad Run
Horsepen Branch
Cabin Branch
Muddy Branch
Greenbrier Branch
Watts Branch
Rock Run
Minnehaha Branch
Little Falls Branch
PRMO-304-R-2002
PRMO-323-R-2002
MO-P-064-328-97
LMO0002
PRMO-311-R-2002
PRMO-307-R-2002
PRMO-120-R-2002
MO-P-481-101-97
COCA-102-N-2003
COCA-108-N-2003
COCA-109-N-2003
MO-P-014-107-97
COCA-111-N-2003
POT1471
POT1472
PRMO-110-R-2002
MO-P-496-215-97
MO-P-206-311-97
PRMO-202-R-2002
BRR0006
NCRW-208-N-2004
PRMO-313-R-2002
HOB0010
COCA-307-N-2003
PRMO-101-R-2002
COCA-205-N-2003
MO-P-251-115-97
PRMO-115-R-2002
PRMO-114-R-2002
MO-P-514-116-97
MO-P-016-227-97
MO-P-436-226-97
NCRW-309-N-2004
MUB0007
COCA-210-N-2003
COCA-206-N-2003
COCA-308-N-2003
WAT0006
MO-P-091-204-97
MO-P-108-123-97
MO-P-001-214-97
PRMO-112-R-2002
PRMO-295-E-2004
PRMO-222-R-2002
PRMO-103-R-2002
ROR0005
COCA-209-N-2003
COCA-208-N-2003
COCA-117-N-2003
PRMO-109-R-2002
POT1184
GWPY-212-N-2004
LFB0001
109
270
28
119
107
189
355
495
190
191
N

**Figure 3. Water Quality Stations in Potomac River Montgomery County Watershed Monitored During 2000-2009**

**Table 2: Water Quality Stations in the Potomac River Montgomery County Watershed Monitored During 2000-2008**

| Station Number | Sponsor | Site Type | Location | Latitude (dec. deg) | Longitude (dec. deg) |
|---|---|---|---|---|---|
| POT1184 | DNR | CORE/TREND | Potomac River | 38.948166 | -77.127205 |
| POT1471 | DNR | CORE/TREND | Potomac River | 39.154550 | -77.521380 |
| POT1472 | DNR | CORE/TREND | Potomac River | 39.155384 | -77.522210 |
| MO-P-001-214-97 | DNR | MBSS Round 1 | Watts Branch | 39.090202 | -77.172147 |
| MO-P-014-107-97 | DNR | MBSS Round 1 | Potomac River UT6 | 39.154903 | -77.516223 |
| MO-P-016-227-97 | DNR | MBSS Round 1 | Broad Run UT1 | 39.153827 | -77.435143 |
| MO-P-064-328-97 | DNR | MBSS Round 1 | Little Monocacy River | 39.214815 | -77.437913 |
| MO-P-091-204-97 | DNR | MBSS Round 1 | Muddy Branch | 39.108597 | -77.232983 |
| MO-P-108-123-97 | DNR | MBSS Round 1 | Watts Branch UT1 | 39.093948 | -77.182392 |
| MO-P-206-311-97 | DNR | MBSS Round 1 | Broad Run | 39.128897 | -77.467122 |
| MO-P-251-115-97 | DNR | MBSS Round 1 | Little Monocacy River UT1 | 39.221523 | -77.365907 |
| MO-P-436-226-97 | DNR | MBSS Round 1 | Horsepen Branch UT2 UT1 | 39.083595 | -77.395120 |
| MO-P-481-101-97 | DNR | MBSS Round 1 | Potomac River UT7 | 39.198428 | -77.459830 |
| MO-P-496-215-97 | DNR | MBSS Round 1 | Broad Run UT2 UT1 | 39.133172 | -77.473733 |
| MO-P-514-116-97 | DNR | MBSS Round 1 | Broad Run UT1 | 39.156757 | -77.432763 |
| COCA-102-N-2003 | DNR | MBSS Round 2 | Potomac River UT19 | 39.187775 | -77.473292 |
| COCA-108-N-2003 | DNR | MBSS Round 2 | Potomac River UT20 | 39.159897 | -77.515942 |
| COCA-109-N-2003 | DNR | MBSS Round 2 | Potomac River UT20 | 39.158927 | -77.516793 |
| COCA-111-N-2003 | DNR | MBSS Round 2 | Potomac River UT20 | 39.158539 | -77.517485 |
| COCA-117-N-2003 | DNR | MBSS Round 2 | Minnehaha Branch | 38.964452 | -77.141014 |
| COCA-205-N-2003 | DNR | MBSS Round 2 | Horsepen Branch UT2 | 39.068100 | -77.365255 |
| COCA-206-N-2003 | DNR | MBSS Round 2 | Muddy Branch | 39.054901 | -77.294014 |
| COCA-208-N-2003 | DNR | MBSS Round 2 | Rock Run | 38.970305 | -77.181366 |
| COCA-209-N-2003 | DNR | MBSS Round 2 | Rock Run | 38.971695 | -77.181955 |
| COCA-210-N-2003 | DNR | MBSS Round 2 | Muddy Branch | 39.058638 | -77.294776 |
| COCA-307-N-2003 | DNR | MBSS Round 2 | Horsepen Branch | 39.072327 | -77.413086 |
| COCA-308-N-2003 | DNR | MBSS Round 2 | Watts Branch | 39.042897 | -77.265091 |
| GWPY-212-N-2004 | DNR | MBSS Round 2 | Little Falls Branch | 38.938331 | -77.117778 |
| NCRW-208-N-2004 | DNR | MBSS Round 2 | Cabin Branch UT1 | 39.091942 | -77.457496 |
| NCRW-309-N-2004 | DNR | MBSS Round 2 | Muddy Branch | 39.064718 | -77.295551 |
| PRMO-101-R-2002 | DNR | MBSS Round 2 | Horsepen Branch UT1 | 39.072644 | -77.390952 |
| PRMO-103-R-2002 | DNR | MBSS Round 2 | Rock Run | 39.016557 | -77.212476 |
| PRMO-109-R-2002 | DNR | MBSS Round 2 | Willett Branch | 38.965375 | -77.106310 |
| PRMO-110-R-2002 | DNR | MBSS Round 2 | Broad Run | 39.150634 | -77.455215 |
| PRMO-112-R-2002 | DNR | MBSS Round 2 | Greenbriar Branch | 39.054407 | -77.247902 |
| PRMO-114-R-2002 | DNR | MBSS Round 2 | Little Monocacy River UT2 | 39.196887 | -77.422092 |
| PRMO-115-R-2002 | DNR | MBSS Round 2 | Little Monocacy River UT2 | 39.196817 | -77.423510 |
| PRMO-120-R-2002 | DNR | MBSS Round 2 | Little Monocacy River UT3 | 39.214530 | -77.447216 |
| PRMO-202-R-2002 | DNR | MBSS Round 2 | Broad Run | 39.127021 | -77.457967 |
| PRMO-222-R-2002 | DNR | MBSS Round 2 | Watts Branch | 39.044301 | -77.228412 |
| PRMO-295-E-2004 | DNR | MBSS Round 2 | Watts Branch | 39.048706 | -77.214123 |
| PRMO-304-R-2002 | DNR | MBSS Round 2 | Little Monocacy River | 39.230676 | -77.403739 |
| PRMO-307-R-2002 | DNR | MBSS Round 2 | Little Monocacy River | 39.214876 | -77.443800 |

| Station Number | Sponsor | Site Type | Location | Latitude (dec. deg) | Longitude (dec. deg) |
|---|---|---|---|---|---|
| PRMO-311-R-2002 | DNR | MBSS Round 2 | Little Monocacy River | 39.220888 | -77.449120 |
| PRMO-313-R-2002 | DNR | MBSS Round 2 | Horsepen Branch | 39.081529 | -77.418792 |
| PRMO-323-R-2002 | DNR | MBSS Round 2 | Little Monocacy River | 39.228250 | -77.404564 |
| BRR0006 | MDE | Water Quality | Broad Run | 39.118133 | -77.480750 |
| HOB0010 | MDE | Water Quality | Horsepen Branch | 39.080383 | -77.416000 |
| LFB0001 | MDE | Water Quality | Little Falls Branch | 38.937433 | -77.117833 |
| LMO0002 | MDE | Water Quality | Little Monocacy River | 39.220833 | -77.452317 |
| MUB0007 | MDE | Water Quality | Muddy Branch | 39.063383 | -77.294650 |
| ROR0005 | MDE | Water Quality | Rock Run | 38.975067 | -77.182617 |
| WAT0006 | MDE | Water Quality | Watts Branch | 39.043850 | -77.261283 |
| POT1184 | MDE | Water Quality | Potomac River at Little Falls | 38.948000 | -77.127500 |
| POT1471 | MDE | Water Quality | Potomac River at Whites Ferry MD side | 39.154450 | -77.519750 |
| POT1472 | MDE | Water Quality | Potomac River at Whites Ferry VA side | 39.154983 | -77.522783 |

UT = Unnamed Tributary

### 3.2 Biological Stressor Identification Analysis

In the process of evaluating the existing biological impairments in 1st through 4th order streams, MDE developed a biological stressor identification (BSID) methodology (MDE 2009a). The BSID methodology uses data available from the statewide DNR MBSS. Data used in the development of the BSID report for the Potomac River Montgomery County are presented in Appendix A.

The current MDE biological assessment methodology is a three-step process: (1) a data quality review, (2) a systematic vetting of the dataset, and (3) a watershed assessment that presents the results of this assignment in terms of currently used Integrated Report listing categories.

The BSID analysis for the Potomac River Montgomery County watershed did not identify nutrients as potential stressors or indicate any significant association between current nutrient levels and the degraded biological conditions (MDE 2009b). According to this report, nutrients are not associated with any impairment to aquatic life or biological communities in the Montgomery County watershed.

The BSID analysis did not implicate low DO concentrations as a potential stressor, which agrees with the data analysis in Section 3.3. Low DO concentrations are therefore not associated with biological impairments in the smaller order streams in the Potomac River Montgomery County watershed.

The BSID analysis for the Potomac River Montgomery County watershed found that 92% of stream miles with poor to very poor biological conditions are impacted by sediment, instream habitat, and water chemistry (e.g., high chlorides, sulfates, conductivity). The analysis further suggests that 79% of stream miles with poor to very poor biological conditions are influenced by various types of urban land uses and a low percentage of forest cover, which in turn lead to altered hydrology, elevated levels of inorganic pollutants from impervious surface runoff, and increased sedimentation (MDE 2009b).

### 3.3 Dissolved Oxygen

MDE collected 38 samples during the growing season from tributaries to the Potomac River Montgomery County during 2008, with concentrations ranging from 5.7 to 10.7 mg/l and an average of 8.2 mg/l. The MBSS program also collected field DO samples in tributaries during the summers of 2002 - 2004. The concentrations range from 3.3 to 9.9 mg/l with an average concentration of 7.7 mg/l. Only one sample falls below the 5 mg/l criterion. Given that only one of a total of 68 samples is below 5 mg/l, MDE deems that the water quality standard for DO is being met in the 1$^{st}$ through 4$^{th}$ order streams in the Potomac River Montgomery County watershed.

DNR collected samples for its CORE/TREND program in the mainstem Potomac River Montgomery County from January 2000 through December 2008, and MDE collected samples in the mainstem from October 2000 through September 2002. Samples taken during the growing season (May through October) show DO concentrations ranging from 4.7 to 12.3 mg/l. Given that only one of 196 samples has a DO concentration below the Use I criterion of 5 mg/l, MDE considers that the water quality standard for DO is being met in the mainstem Potomac River Montgomery County.

The DO data are presented graphically in Figure 4 and in tabular form in Appendix A.

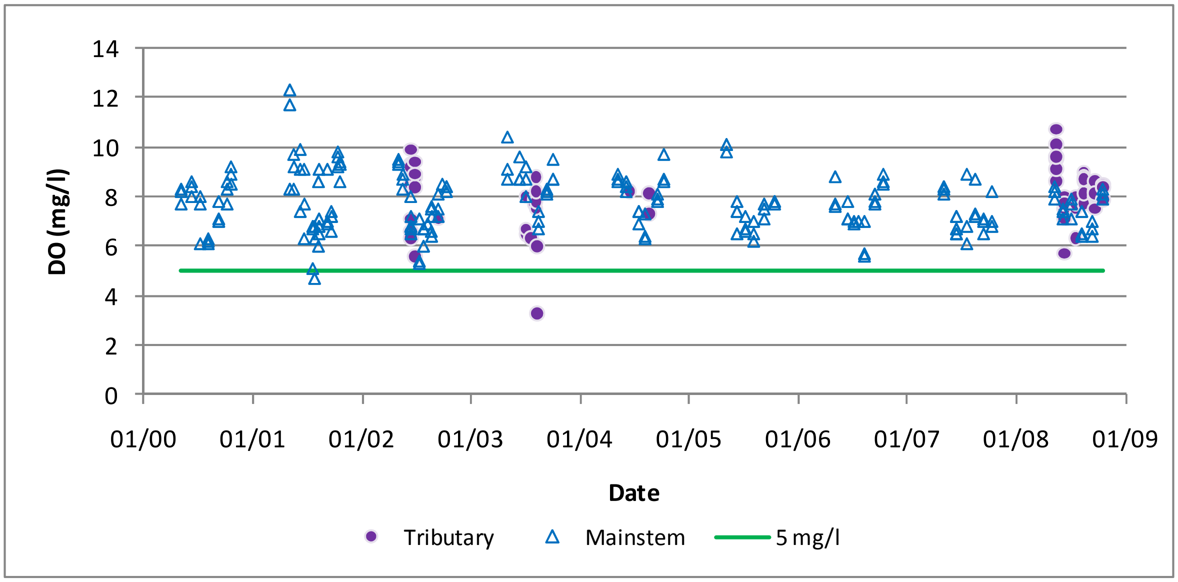


**Figure 4: Potomac River Montgomery County Dissolved Oxygen Data for Growing Season Periods May 2000 through October 2008**

### 3.4 Nutrients

In the absence of State water quality standards with specific numeric limits for nutrients for the protection of aquatic life in non-tidal free-flowing waters, evaluation of potentially eutrophic conditions is based on the BSID analysis and analysis of dissolved oxygen levels. Consequently, the nutrients data presented in this section are for informational purposes only.

Total nitrogen (TN) and total phosphorus (TP) data for the Potomac River Montgomery County watershed have been analyzed as part of this study. The results are presented here graphically in Figures 6 and 7, and in tabular form in Appendix A.

In the mainstem, DNR and MDE data show TN concentrations during the growing season (May through October) ranging from 0.31 to 2.59 mg/l and TP concentrations ranging from 0.02 to 0.34 mg/l. MDE also sampled several tributaries during the 2008 growing season. These data show TN concentrations ranging from 0.7 mg/l to 5.8 mg/l and TP concentrations ranging from 0.01 to 5.72 mg/l. Over 92% of the samples have TN values less than 2.85 mg/l and TP values less than 0.70 mg/l.

Nitrogen and phosphorus are essential nutrients for algae growth. If one nutrient is available in great abundance relative to the other, then the nutrient that is less available limits the amount of plant matter that can be produced; this is known as the "limiting nutrient." The amount of the abundant nutrient does not matter because both nutrients are needed for algae growth. In general, a Nitrogen:Phosphorus (TN:TP) ratio in the range of 5:1 to 10:1 by mass is associated with plant growth being limited by neither phosphorus nor nitrogen. If the TN:TP ratio is greater than 10:1, phosphorus tends to be limiting; if the TN:TP ratio is less than 5:1, nitrogen tends to be limiting (Chiandani et al. 1974).

Both MDE and DNR sampled nutrients in the mainstem Potomac River Montgomery County. Across the two surveys, the average TN:TP ratio is 25.8 and the median 21.8. 95% of the samples have TN:TP ratios greater than ten, and none less than five. The observed data suggest that the mainstem is phosphorus limited.

87% of the samples taken in the lower-order streams during the 2008 growing season have TN:TP ratios greater than ten, and 13% have ratios below five. The average ratio is 55.9 and the median 46.1. This implies that the smaller-order streams in the Potomac River Montgomery County watershed are also phosphorus limited.

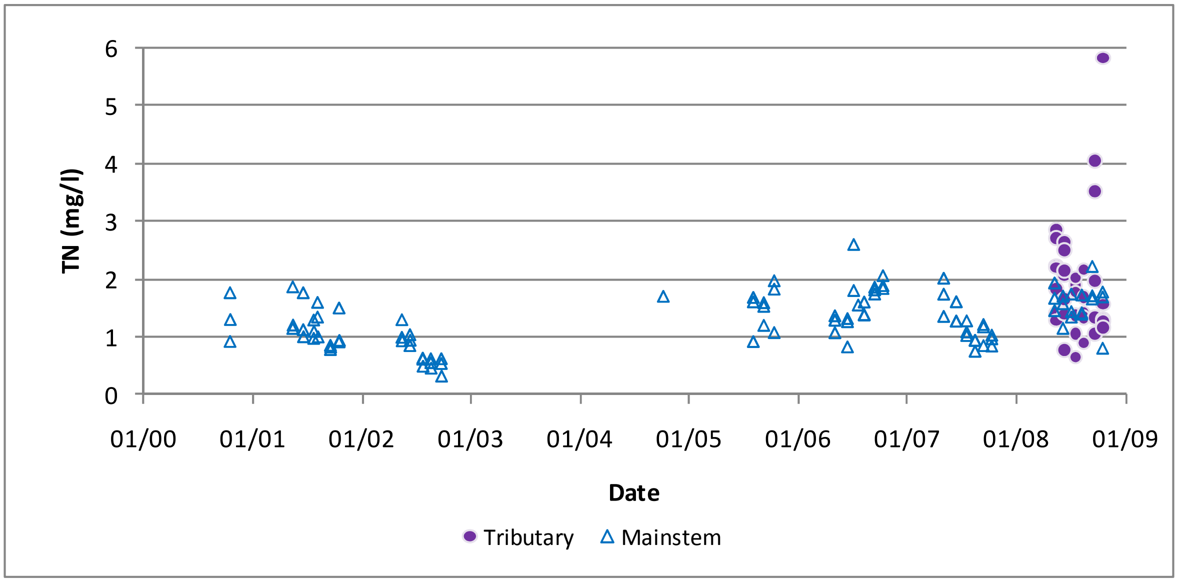


**Figure 5: Potomac River Montgomery County Total Nitrogen for Growing Season Periods May 2000 through October 2008**

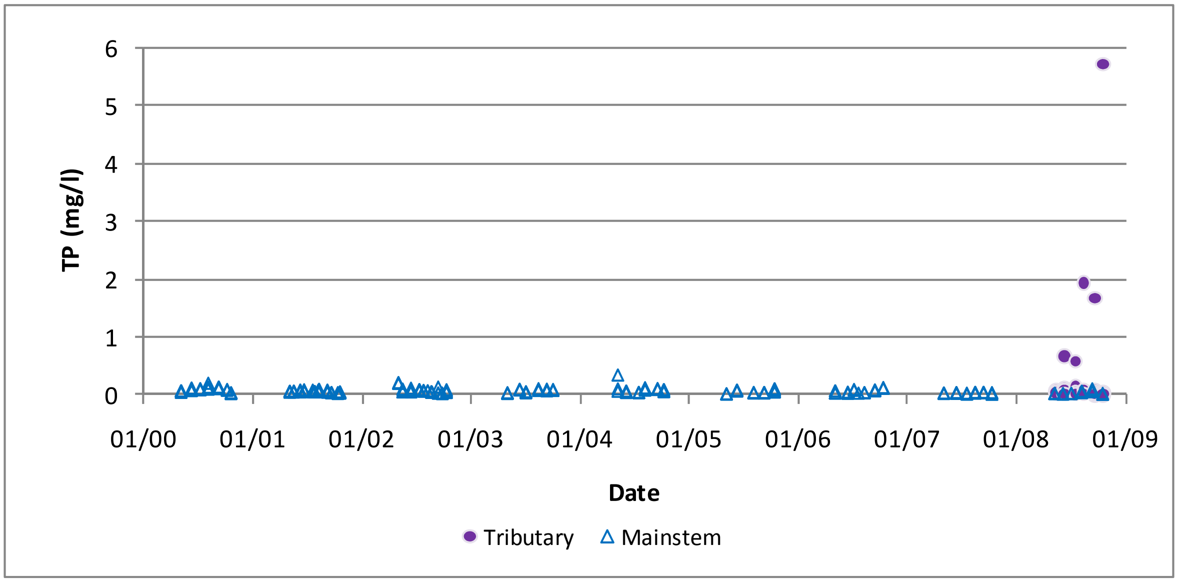


**Figure 6: Potomac River Montgomery County Total Phosphorus Data for Growing Season Periods May 2000 through October 2008**

### 3.5 Potomac River Core/Trend Monitoring Stations

Additional biological data for the Potomac River Montgomery County were obtained from the DNR CORE/TREND program. The program collected benthic macroinvertebrate data between 1976 and 2006. The data were used to calculate four benthic community measures: total number of taxa, Shannon-Weiner diversity index, modified Hilsenhoff biotic index, and percent Ephemeroptera, Plecoptera, and Trichoptera (EPT). DNR has extensive monitoring data for four stations on the mainstem of the Potomac River Montgomery County through the CORE/TREND program. These stations have between 21 and 23 years of benthic macroinvertebrate data (DNR 2009). A summary of the results for the two stations is presented in Table 3.

**Table 3: Potomac River Montgomery County CORE/TREND Data**

| Site Number | Current Water Quality Status | Trend Since 1970's |
|---|---|---|
| POT1183 | FAIR/GOOD | NO CHANGE |
| POT1471 | GOOD | IMPROVEMENT |

Generally, a CORE/TREND assessment of "GOOD" or better indicates that the waterbody is supporting its aquatic life use. Station POT1183, at Little Falls below the dam, achieved only FAIR/GOOD status, indicating a borderline water quality condition. POT1183 is the only station on the mainstem Potomac River below the confluence of the North and South Branches assessed as less than "GOOD." Appendix B provides an analysis which compares the benthic community metrics for all CORE/TREND stations in the mainstem Potomac River. For the period 2000-2008, the individual benthic community metrics for POT1183 are not significantly different from the other mainstem Potomac River stations, whose status is assessed as "GOOD" or better. Based on this comparative analysis of benthic community metrics in the mainstem Potomac River, the benthic macroinvertebrate data collected under the CORE/TREND program supports the conclusion that the mainstem Potomac River in Montgomery County is supporting its Aquatic Life Designated Use.

## 4.0 CONCLUSION

The BSID analysis of the Potomac River Montgomery County watershed does not identify phosphorus or nitrogen as a potential stressor of aquatic life in the watershed. Excess eutrophication is therefore not a cause of the biological impairments in the 1$^{st}$ through 4$^{th}$ order streams in the watershed. In addition, the BSID analysis does not associate low DO with biological impairments in the watershed. An analysis of available DO data from the 1$^{st}$ through 4$^{th}$ order streams in Potomac River Montgomery County watershed shows that only one of 68 DO samples collected from smaller-order streams in the watershed has a concentration below 5 mg/l. Therefore, the DO criteria are also met in the smaller-order streams draining to the mainstem Potomac River Montgomery County.

An analysis of benthic monitoring data from DNR's CORE/TREND program indicates that the Aquatic Life Designated Use is met in the mainstem Potomac River in Montgomery County. An analysis of available DO concentrations from the mainstem Potomac River also shows that the DO criterion is being met. Therefore, it is unlikely that nutrients are interfering with aquatic life use in the mainstem Potomac River Montgomery County.

MDE therefore concludes that currently the Potomac River Montgomery County Aquatic Life Use is not being impaired by nutrients. Barring the receipt of contradictory data, this report will be used to support a revision of the phosphorus listing for the Potomac River Montgomery County watershed, from Category 5 ("waterbody is impaired, does not attain the water quality standard, and a TMDL is required") to Category 2 ("waterbodies meeting some [in this case nutrients-related] water quality standards, but with insufficient data to assess all impairments"), when MDE proposes the revision of Maryland's Integrated Report.

Although the waters of the Potomac River Montgomery County do not display signs of eutrophication, the State reserves the right to require future controls if evidence suggests that nutrients from the basin are contributing to downstream water quality problems. For instance, reductions will be required to meet allocations assigned to the Potomac Tidal Fresh Bay Water Quality Segment by the Chesapeake Bay TMDL, established by EPA on December 29, 2010.

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## Appendix A – Tabular Water Quality Data

### Table A-1: DNR CORE/TREND Water Quality Data

| Station | Sampling Date | DO (mg/l) | TN (mg/l) | TP (mg/l) |
|---|---|---|---|---|
| POT1184 | 01/21/98 | 13.3 | | 0.059 |
| POT1184 | 02/04/98 | 11.9 | | 0.079 |
| POT1184 | 03/04/98 | 11.2 | | 0.051 |
| POT1184 | 04/01/98 | 8.5 | | 0.036 |
| POT1184 | 05/13/98 | 9.3 | | 0.102 |
| POT1184 | 06/10/98 | 8.0 | | 0.045 |
| POT1184 | 07/15/98 | 6.9 | | 0.043 |
| POT1184 | 08/12/98 | 6.1 | | 0.056 |
| POT1184 | 09/09/98 | 7.5 | | 0.079 |
| POT1184 | 10/07/98 | 8.3 | | 0.045 |
| POT1184 | 11/12/98 | 10.6 | | 0.041 |
| POT1184 | 12/10/98 | 9.7 | | 0.018 |
| POT1184 | 03/11/99 | 12.0 | | 0.043 |
| POT1184 | 04/07/99 | 8.4 | | 0.049 |
| POT1184 | 05/05/99 | 7.6 | | 0.063 |
| POT1184 | 06/02/99 | 6.0 | | 0.111 |
| POT1184 | 07/14/99 | 6.3 | | 0.142 |
| POT1184 | 08/11/99 | 7.6 | | 0.093 |
| POT1184 | 09/15/99 | 7.2 | | 0.081 |
| POT1184 | 10/13/99 | 9.2 | | 0.158 |
| POT1184 | 11/09/99 | 10.3 | | 0.036 |
| POT1184 | 12/01/99 | 12.0 | | 0.052 |
| POT1184 | 01/12/00 | 11.8 | | 0.031 |
| POT1184 | 02/09/00 | 13.8 | | 0.032 |
| POT1184 | 03/08/00 | 10.5 | | 0.052 |
| POT1184 | 04/05/00 | 9.3 | | 0.144 |
| POT1184 | 05/03/00 | 7.7 | | 0.078 |
| POT1184 | 06/07/00 | 8.4 | | 0.125 |
| POT1184 | 07/06/00 | 6.1 | | 0.096 |
| POT1184 | 08/02/00 | 6.1 | | 0.108 |
| POT1184 | 09/06/00 | 7.8 | | 0.115 |
| POT1184 | 10/04/00 | 7.7 | | 0.093 |
| POT1184 | 11/01/00 | 9.5 | | 0.048 |
| POT1184 | 01/03/01 | 14.2 | | 0.051 |
| POT1184 | 02/07/01 | 12.4 | | 0.052 |
| POT1184 | 03/14/01 | 11.0 | | 0.041 |
| POT1184 | 04/11/01 | 9.5 | | 0.070 |
| POT1184 | 05/02/01 | 8.3 | | 0.057 |
| POT1184 | 06/06/01 | 7.4 | | 0.062 |
| POT1184 | 07/18/01 | 6.7 | | 0.067 |
| POT1184 | 08/08/01 | 6.8 | | 0.070 |

| Station | Sampling Date | DO (mg/l) | TN (mg/l) | TP (mg/l) |
|---|---|---|---|---|
| POT1184 | 09/05/01 | 6.9 | | 0.068 |
| POT1184 | 10/10/01 | 9.2 | | 0.047 |
| POT1184 | 11/07/01 | 10.1 | | 0.031 |
| POT1184 | 12/05/01 | 10.4 | | 0.025 |
| POT1184 | 01/02/02 | 14.0 | | 0.028 |
| POT1184 | 02/06/02 | 12.6 | | 0.037 |
| POT1184 | 03/06/02 | 11.9 | | 0.023 |
| POT1184 | 04/03/02 | 9.2 | | 0.061 |
| POT1184 | 05/01/02 | 9.5 | | 0.217 |
| POT1184 | 06/12/02 | 6.8 | | 0.070 |
| POT1184 | 07/10/02 | 7.1 | | 0.078 |
| POT1184 | 08/07/02 | 6.9 | | 0.080 |
| POT1184 | 09/11/02 | 7.5 | | 0.142 |
| POT1184 | 10/09/02 | 8.4 | | 0.052 |
| POT1184 | 11/06/02 | 10.7 | | 0.099 |
| POT1184 | 12/04/02 | 14.0 | | 0.043 |
| POT1184 | 01/08/03 | 13.2 | | 0.058 |
| POT1184 | 02/05/03 | 13.4 | | 0.029 |
| POT1184 | 03/05/03 | 12.6 | | 0.048 |
| POT1184 | 04/02/03 | 10.4 | | 0.054 |
| POT1184 | 05/01/03 | 10.4 | | 0.046 |
| POT1184 | 06/11/03 | 9.6 | | 0.105 |
| POT1184 | 07/02/03 | 8.0 | | 0.046 |
| POT1184 | 08/13/03 | 7.4 | | 0.086 |
| POT1184 | 09/10/03 | 8.3 | | 0.079 |
| POT1184 | 10/01/03 | 9.5 | | 0.102 |
| POT1184 | 11/12/03 | 10.6 | | 0.050 |
| POT1184 | 12/10/03 | 12.2 | | 0.046 |
| POT1184 | 01/07/04 | 12.3 | | 0.030 |
| POT1184 | 02/11/04 | 12.8 | | 0.131 |
| POT1184 | 03/10/04 | 12.0 | | 0.032 |
| POT1184 | 04/07/04 | 11.5 | | 0.036 |
| POT1184 | 05/05/04 | 8.6 | | 0.343 |
| POT1184 | 06/02/04 | 8.6 | | 0.076 |
| POT1184 | 07/14/04 | 7.4 | | 0.049 |
| POT1184 | 08/04/04 | 7.3 | | 0.091 |
| POT1184 | 09/15/04 | 7.8 | | 0.117 |
| POT1184 | 10/06/04 | 9.7 | | 0.065 |
| POT1184 | 11/03/04 | 9.0 | | 0.026 |
| POT1184 | 12/01/04 | 10.2 | | 0.172 |
| POT1184 | 01/05/05 | 11.5 | | 0.040 |
| POT1184 | 02/09/05 | 11.7 | | 0.024 |
| POT1184 | 03/09/05 | 11.8 | | 0.026 |
| POT1184 | 04/13/05 | 10.5 | | 0.045 |
| POT1184 | 05/04/05 | 9.8 | | 0.030 |

| Station | Sampling Date | DO (mg/l) | TN (mg/l) | TP (mg/l) |
|---|---|---|---|---|
| POT1184 | 06/08/05 | 6.5 | | 0.087 |
| POT1184 | 07/06/05 | 6.7 | | |
| POT1184 | 08/03/05 | 7.0 | 1.60 | 0.051 |
| POT1184 | 09/07/05 | 7.1 | 1.52 | 0.052 |
| POT1184 | 10/12/05 | 7.8 | 1.82 | 0.087 |
| POT1184 | 11/09/05 | 8.6 | 1.37 | 0.035 |
| POT1184 | 12/07/05 | 13.3 | 2.46 | 0.089 |
| POT1184 | 01/04/06 | 12.7 | 2.57 | 0.140 |
| POT1184 | 02/01/06 | 13.4 | 1.96 | 0.034 |
| POT1184 | 03/01/06 | 9.9 | 1.63 | 0.015 |
| POT1184 | 04/12/06 | 8.9 | 1.44 | 0.024 |
| POT1184 | 05/03/06 | 8.8 | 1.28 | 0.079 |
| POT1184 | 06/14/06 | 7.8 | 1.26 | 0.057 |
| POT1184 | 07/20/06 | 7.0 | 1.54 | 0.039 |
| POT1184 | 08/09/06 | 7.0 | 1.38 | 0.046 |
| POT1184 | 09/13/06 | 7.8 | 1.81 | 0.081 |
| POT1184 | 10/11/06 | 8.6 | 2.05 | 0.134 |
| POT1184 | 11/08/06 | 9.4 | 1.30 | 0.159 |
| POT1184 | 12/06/06 | 13.3 | 1.99 | 0.024 |
| POT1184 | 01/03/07 | 12.2 | 2.13 | 0.063 |
| POT1184 | 02/07/07 | 13.2 | 2.06 | 0.013 |
| POT1184 | 03/07/07 | 14.6 | 2.13 | 0.086 |
| POT1184 | 04/04/07 | 9.5 | 1.95 | 0.040 |
| POT1184 | 05/02/07 | 8.1 | 1.73 | 0.035 |
| POT1184 | 06/13/07 | 7.2 | 1.27 | 0.037 |
| POT1184 | 07/18/07 | 6.80 | 1.08 | 0.03 |
| POT1184 | 08/15/07 | 7.30 | 0.93 | 0.04 |
| POT1184 | 09/12/07 | 7.10 | 0.84 | 0.05 |
| POT1184 | 10/10/07 | 8.20 | 0.83 | 0.02 |
| POT1184 | 11/01/07 | 8.90 | 1.29 | 0.04 |
| POT1184 | 12/05/07 | 12.40 | 1.09 | 0.02 |
| POT1184 | 01/09/08 | 11.80 | 1.85 | 0.03 |
| POT1184 | 02/06/08 | 12.30 | 1.92 | 0.05 |
| POT1184 | 03/12/08 | | 2.62 | 0.21 |
| POT1184 | 04/09/08 | 10.30 | 1.48 | 0.02 |
| POT1184 | 05/07/08 | 8.20 | 1.93 | 0.03 |
| POT1184 | 06/04/08 | 7.10 | 1.70 | 0.03 |
| POT1184 | 07/02/08 | 7.10 | 1.33 | 0.03 |
| POT1184 | 08/06/08 | 6.40 | 1.41 | 0.06 |
| POT1184 | 09/10/08 | 7.00 | 1.65 | 0.08 |
| POT1184 | 10/15/08 | 8.30 | 1.68 | 0.02 |
| POT1184 | 11/12/08 | 10.40 | 1.03 | 0.01 |
| POT1184 | 12/10/08 | 11.60 | 1.36 | 0.01 |
| POT1471 | 01/21/98 | 12.0 | | 0.047 |
| POT1471 | 02/04/98 | 12.2 | | 0.046 |

| Station | Sampling Date | DO (mg/l) | TN (mg/l) | TP (mg/l) |
|---|---|---|---|---|
| POT1471 | 03/04/98 | 11.1 | | 0.059 |
| POT1471 | 04/01/98 | 8.4 | | 0.032 |
| POT1471 | 05/13/98 | 9.5 | | 0.084 |
| POT1471 | 06/10/98 | 8.0 | | 0.059 |
| POT1471 | 07/15/98 | 7.1 | | 0.058 |
| POT1471 | 08/12/98 | 6.0 | | 0.315 |
| POT1471 | 09/09/98 | 7.3 | | 0.125 |
| POT1471 | 10/07/98 | 8.2 | | 0.085 |
| POT1471 | 11/12/98 | 10.7 | | 0.050 |
| POT1471 | 12/10/98 | 10.4 | | 0.037 |
| POT1471 | 01/06/99 | 13.1 | | 0.207 |
| POT1471 | 03/10/99 | 12.8 | | 0.026 |
| POT1471 | 04/07/99 | 9.0 | | 0.055 |
| POT1471 | 05/05/99 | 8.8 | | 0.049 |
| POT1471 | 06/02/99 | 6.7 | | 0.089 |
| POT1471 | 07/14/99 | 10.2 | | 0.111 |
| POT1471 | 08/11/99 | 9.0 | | 0.087 |
| POT1471 | 09/15/99 | 5.9 | | 0.120 |
| POT1471 | 10/13/99 | 8.3 | | 0.185 |
| POT1471 | 11/09/99 | 10.2 | | 0.059 |
| POT1471 | 12/01/99 | 11.9 | | 0.070 |
| POT1471 | 01/12/00 | 10.6 | | 0.157 |
| POT1471 | 02/09/00 | 13.0 | | 0.060 |
| POT1471 | 03/08/00 | 10.0 | | 0.051 |
| POT1471 | 04/05/00 | 9.3 | | 0.033 |
| POT1471 | 05/03/00 | 8.3 | | 0.053 |
| POT1471 | 06/07/00 | 8.0 | | 0.113 |
| POT1471 | 07/06/00 | 7.7 | | 0.098 |
| POT1471 | 08/02/00 | 6.2 | | 0.205 |
| POT1471 | 09/06/00 | 7.1 | | 0.140 |
| POT1471 | 10/04/00 | 8.3 | | 0.088 |
| POT1471 | 11/01/00 | 10.0 | | 0.050 |
| POT1471 | 12/06/00 | 13.4 | | 0.028 |
| POT1471 | 01/03/01 | 11.9 | | 0.066 |
| POT1471 | 02/07/01 | 11.8 | | 0.081 |
| POT1471 | 03/14/01 | 11.2 | | 0.077 |
| POT1471 | 04/11/01 | 8.6 | | 0.096 |
| POT1471 | 05/02/01 | 11.7 | | 0.071 |
| POT1471 | 06/06/01 | 9.1 | | 0.092 |
| POT1471 | 07/18/01 | 5.1 | | 0.064 |
| POT1471 | 08/08/01 | 7.1 | | 0.065 |
| POT1471 | 09/05/01 | 7.0 | | 0.056 |
| POT1471 | 10/10/01 | 9.6 | | 0.045 |
| POT1471 | 11/07/01 | 9.9 | | 0.044 |
| POT1471 | 12/05/01 | 9.8 | | 0.054 |

| Station | Sampling Date | DO (mg/l) | TN (mg/l) | TP (mg/l) |
|---|---|---|---|---|
| POT1471 | 01/02/02 | 11.5 | | 0.083 |
| POT1471 | 02/06/02 | 11.7 | | 0.064 |
| POT1471 | 03/06/02 | 11.0 | | 0.073 |
| POT1471 | 04/03/02 | 8.2 | | 0.088 |
| POT1471 | 05/01/02 | 9.3 | | 0.202 |
| POT1471 | 06/12/02 | 6.5 | | 0.062 |
| POT1471 | 07/10/02 | 5.3 | | 0.100 |
| POT1471 | 08/19/02 | 7.5 | | 0.058 |
| POT1471 | 09/11/02 | 8.1 | | 0.044 |
| POT1471 | 10/09/02 | 8.2 | | 0.097 |
| POT1471 | 11/06/02 | 10.4 | | 0.076 |
| POT1471 | 12/04/02 | 13.0 | 2.20 | 0.041 |
| POT1471 | 01/08/03 | 12.6 | | 0.069 |
| POT1471 | 02/05/03 | 12.6 | | 0.071 |
| POT1471 | 03/05/03 | 12.5 | | 0.061 |
| POT1471 | 04/02/03 | 10.7 | | 0.047 |
| POT1471 | 05/01/03 | 8.7 | | 0.035 |
| POT1471 | 06/11/03 | 8.7 | | 0.103 |
| POT1471 | 07/02/03 | 8.7 | | 0.056 |
| POT1471 | 08/13/03 | 7.0 | | 0.098 |
| POT1471 | 09/10/03 | 8.2 | | 0.106 |
| POT1471 | 10/01/03 | 8.7 | | 0.092 |
| POT1471 | 11/12/03 | 10.5 | | 0.025 |
| POT1471 | 12/10/03 | 12.1 | | 0.037 |
| POT1471 | 01/07/04 | 11.8 | | 0.036 |
| POT1471 | 02/11/04 | 13.1 | | 0.138 |
| POT1471 | 03/10/04 | 11.3 | | 0.041 |
| POT1471 | 04/07/04 | 10.7 | | 0.032 |
| POT1471 | 05/05/04 | 8.9 | | 0.071 |
| POT1471 | 06/02/04 | 8.4 | | 0.052 |
| POT1471 | 07/14/04 | 6.9 | | 0.053 |
| POT1471 | 08/04/04 | 6.3 | | 0.130 |
| POT1471 | 09/15/04 | 8.1 | | 0.101 |
| POT1471 | 10/06/04 | 8.7 | 1.70 | 0.072 |
| POT1471 | 11/03/04 | 10.1 | | 0.039 |
| POT1471 | 12/01/04 | 10.9 | | 0.066 |
| POT1471 | 01/05/05 | 10.5 | | 0.046 |
| POT1471 | 02/09/05 | 12.7 | | 0.037 |
| POT1471 | 03/09/05 | 12.4 | | 0.029 |
| POT1471 | 04/13/05 | 9.1 | | 0.045 |
| POT1471 | 05/04/05 | 10.1 | | 0.028 |
| POT1471 | 06/08/05 | 7.8 | | 0.075 |
| POT1471 | 07/06/05 | 6.6 | | |
| POT1471 | 08/03/05 | 6.2 | 1.68 | 0.044 |
| POT1471 | 09/07/05 | 7.5 | 1.59 | 0.048 |

| Station | Sampling Date | DO (mg/l) | TN (mg/l) | TP (mg/l) |
|---|---|---|---|---|
| POT1471 | 10/12/05 | 7.8 | 1.97 | 0.113 |
| POT1471 | 11/09/05 | 8.9 | 2.32 | 0.050 |
| POT1471 | 12/07/05 | 12.3 | 2.61 | 0.047 |
| POT1471 | 01/04/06 | 12.7 | 2.19 | 0.073 |
| POT1471 | 02/01/06 | 11.4 | 2.64 | 0.036 |
| POT1471 | 03/01/06 | 13.4 | 1.72 | 0.014 |
| POT1471 | 04/12/06 | 9.5 | 1.64 | 0.037 |
| POT1471 | 05/03/06 | 7.7 | 1.36 | 0.040 |
| POT1471 | 06/14/06 | 7.1 | 1.31 | 0.047 |
| POT1471 | 07/05/06 | 7.0 | 2.59 | 0.088 |
| POT1471 | 08/09/06 | 5.6 | 1.60 | 0.049 |
| POT1471 | 09/13/06 | 7.7 | 1.86 | 0.081 |
| POT1471 | 10/11/06 | 8.5 | 1.88 | 0.123 |
| POT1471 | 11/08/06 | 9.9 | 2.75 | 0.075 |
| POT1471 | 12/06/06 | 12.1 | 2.29 | 0.028 |
| POT1471 | 01/03/07 | 11.6 | 2.41 | 0.091 |
| POT1471 | 02/07/07 | 14.6 | 3.00 | 0.021 |
| POT1471 | 03/07/07 | 13.7 | 2.26 | 0.060 |
| POT1471 | 04/04/07 | 9.0 | 1.66 | 0.050 |
| POT1471 | 05/02/07 | 8.4 | 2.01 | 0.038 |
| POT1471 | 06/13/07 | 6.5 | 1.60 | 0.045 |
| POT1471 | 07/18/07 | 8.90 | 1.02 | 0.02 |
| POT1471 | 08/15/07 | 8.70 | 0.74 | 0.05 |
| POT1471 | 09/12/07 | 7.00 | 1.21 | 0.05 |
| POT1471 | 10/10/07 | 6.80 | 1.02 | 0.05 |
| POT1471 | 11/01/07 | 9.40 | 1.71 | 0.07 |
| POT1471 | 12/05/07 | 10.60 | 2.49 | 0.06 |
| POT1471 | 01/09/08 | 11.90 | 2.71 | 0.04 |
| POT1471 | 02/06/08 | 11.50 | 2.77 | 0.06 |
| POT1471 | 03/12/08 | 11.20 | 2.56 | 0.07 |
| POT1471 | 04/09/08 | 10.40 | 2.04 | 0.02 |
| POT1471 | 05/07/08 | 8.40 | 1.66 | 0.03 |
| POT1471 | 06/04/08 | 7.50 | 1.57 | 0.02 |
| POT1471 | 07/02/08 | 7.70 | 1.73 | 0.03 |
| POT1471 | 08/06/08 | 6.50 | 1.72 | 0.05 |
| POT1471 | 09/10/08 | 6.40 | 2.21 | 0.11 |
| POT1471 | 10/15/08 | 7.90 | 1.77 | 0.03 |
| POT1471 | 11/12/08 | 9.40 | 1.45 | 0.03 |
| POT1471 | 12/10/08 | 11.60 | 2.74 | 0.02 |
| POT1472 | 01/21/98 | 11.9 | | 0.065 |
| POT1472 | 02/04/98 | 11.9 | | 0.071 |
| POT1472 | 03/04/98 | 11.1 | | 0.044 |
| POT1472 | 04/01/98 | 8.3 | | 0.028 |
| POT1472 | 05/13/98 | 9.4 | | 0.076 |
| POT1472 | 06/10/98 | 8.0 | | 0.043 |

| Station | Sampling Date | DO (mg/l) | TN (mg/l) | TP (mg/l) |
|---|---|---|---|---|
| POT1472 | 07/15/98 | 8.4 | | 0.029 |
| POT1472 | 08/12/98 | 7.4 | | 0.078 |
| POT1472 | 09/09/98 | 8.0 | | 0.126 |
| POT1472 | 10/07/98 | 8.4 | | 0.073 |
| POT1472 | 11/12/98 | 11.6 | | 0.022 |
| POT1472 | 12/09/98 | 9.0 | | 0.010 |
| POT1472 | 02/03/99 | 11.6 | | 0.080 |
| POT1472 | 03/10/99 | 12.7 | | 0.044 |
| POT1472 | 04/07/99 | 9.1 | | 0.065 |
| POT1472 | 05/05/99 | 8.6 | | 0.062 |
| POT1472 | 06/02/99 | 7.2 | | 0.145 |
| POT1472 | 07/14/99 | 6.5 | | 0.127 |
| POT1472 | 08/11/99 | 7.3 | | 0.095 |
| POT1472 | 09/15/99 | 6.8 | | 0.095 |
| POT1472 | 10/13/99 | 8.9 | | 0.097 |
| POT1472 | 11/09/99 | 11.3 | | 0.039 |
| POT1472 | 12/01/99 | 12.7 | | 0.072 |
| POT1472 | 01/12/00 | 12.5 | | 0.046 |
| POT1472 | 02/09/00 | 15.0 | | 0.028 |
| POT1472 | 03/08/00 | 10.6 | | 0.049 |
| POT1472 | 04/05/00 | 9.5 | | 0.039 |
| POT1472 | 05/03/00 | 8.2 | | 0.079 |
| POT1472 | 06/07/00 | 8.6 | | 0.082 |
| POT1472 | 07/06/00 | 8.0 | | 0.116 |
| POT1472 | 08/02/00 | 6.3 | | 0.139 |
| POT1472 | 09/06/00 | 7.0 | | 0.141 |
| POT1472 | 10/04/00 | 8.6 | | 0.102 |
| POT1472 | 11/01/00 | 10.2 | | 0.026 |
| POT1472 | 12/06/00 | 13.5 | | 0.035 |
| POT1472 | 01/03/01 | 13.3 | | 0.030 |
| POT1472 | 02/07/01 | 12.5 | | 0.043 |
| POT1472 | 03/14/01 | 11.2 | | 0.020 |
| POT1472 | 04/11/01 | 8.5 | | 0.094 |
| POT1472 | 05/02/01 | 12.3 | | 0.072 |
| POT1472 | 06/06/01 | 9.9 | | 0.088 |
| POT1472 | 07/18/01 | 6.8 | | 0.090 |
| POT1472 | 08/08/01 | 9.1 | | 0.104 |
| POT1472 | 09/05/01 | 9.1 | | 0.090 |
| POT1472 | 10/10/01 | 9.8 | | 0.036 |
| POT1472 | 11/07/01 | 10.6 | | 0.026 |
| POT1472 | 12/05/01 | 11.2 | | 0.029 |
| POT1472 | 01/02/02 | 14.8 | | 0.050 |
| POT1472 | 02/06/02 | 14.1 | | 0.036 |
| POT1472 | 03/06/02 | 13.8 | | 0.042 |
| POT1472 | 04/03/02 | 8.8 | | 0.098 |

| Station | Sampling Date | DO (mg/l) | TN (mg/l) | TP (mg/l) |
|---|---|---|---|---|
| POT1472 | 05/01/02 | 9.4 | | 0.207 |
| POT1472 | 06/12/02 | 6.7 | | 0.122 |
| POT1472 | 07/10/02 | 5.4 | | 0.094 |
| POT1472 | 08/19/02 | 6.6 | | 0.065 |
| POT1472 | 09/11/02 | 7.2 | | 0.040 |
| POT1472 | 10/09/02 | 8.4 | | 0.075 |
| POT1472 | 11/06/02 | 10.8 | | 0.099 |
| POT1472 | 12/04/02 | 13.7 | | 0.041 |
| POT1472 | 01/08/03 | 12.7 | | 0.059 |
| POT1472 | 02/05/03 | 13.1 | | 0.015 |
| POT1472 | 03/05/03 | 12.0 | | 0.104 |
| POT1472 | 04/02/03 | 11.1 | | 0.058 |
| POT1472 | 05/01/03 | 9.1 | | 0.045 |
| POT1472 | 06/11/03 | 8.7 | | 0.094 |
| POT1472 | 07/02/03 | 9.2 | | 0.064 |
| POT1472 | 08/13/03 | 6.7 | | 0.114 |
| POT1472 | 09/10/03 | 8.1 | | 0.084 |
| POT1472 | 10/01/03 | 8.7 | | 0.086 |
| POT1472 | 11/12/03 | 10.2 | | 0.028 |
| POT1472 | 12/10/03 | 12.1 | 1.34 | 0.047 |
| POT1472 | 01/07/04 | 11.8 | | 0.029 |
| POT1472 | 02/11/04 | 13.5 | | 0.139 |
| POT1472 | 03/10/04 | 10.7 | | 0.031 |
| POT1472 | 04/07/04 | 10.8 | | 0.034 |
| POT1472 | 05/05/04 | 8.7 | | 0.111 |
| POT1472 | 06/02/04 | 8.2 | | 0.068 |
| POT1472 | 07/14/04 | 7.4 | | 0.048 |
| POT1472 | 08/04/04 | 6.4 | | 0.102 |
| POT1472 | 09/15/04 | 7.9 | | 0.112 |
| POT1472 | 10/06/04 | 8.6 | | 0.100 |
| POT1472 | 11/03/04 | 10.1 | | 0.025 |
| POT1472 | 12/01/04 | 10.7 | | 0.078 |
| POT1472 | 01/05/05 | 11.0 | | 0.034 |
| POT1472 | 02/09/05 | 12.7 | | 0.033 |
| POT1472 | 03/09/05 | 12.1 | | 0.024 |
| POT1472 | 04/13/05 | 9.0 | | 0.050 |
| POT1472 | 05/04/05 | 10.1 | | 0.025 |
| POT1472 | 06/08/05 | 7.4 | | 0.091 |
| POT1472 | 07/06/05 | 7.2 | | |
| POT1472 | 08/03/05 | 6.5 | 0.91 | 0.050 |
| POT1472 | 09/07/05 | 7.7 | 1.19 | 0.044 |
| POT1472 | 10/12/05 | 7.7 | 1.07 | 0.060 |
| POT1472 | 11/09/05 | 10.5 | 1.06 | 0.027 |
| POT1472 | 12/07/05 | 12.2 | 1.89 | 0.050 |
| POT1472 | 01/04/06 | 13.1 | 1.88 | 0.061 |

| Station | Sampling Date | DO (mg/l) | TN (mg/l) | TP (mg/l) |
|---|---|---|---|---|
| POT1472 | 02/01/06 | 12.0 | 1.70 | 0.025 |
| POT1472 | 03/01/06 | 13.3 | 1.36 | 0.018 |
| POT1472 | 04/12/06 | 10.1 | 1.08 | 0.027 |
| POT1472 | 05/03/06 | 7.6 | 1.07 | 0.046 |
| POT1472 | 06/14/06 | 7.1 | 0.82 | 0.038 |
| POT1472 | 07/05/06 | 6.9 | 1.80 | 0.101 |
| POT1472 | 08/09/06 | 5.7 | 1.37 | 0.048 |
| POT1472 | 09/13/06 | 8.1 | 1.74 | 0.094 |
| POT1472 | 10/11/06 | 8.9 | 1.83 | 0.123 |
| POT1472 | 11/08/06 | 10.5 | 1.33 | 0.235 |
| POT1472 | 12/06/06 | 12.5 | 1.87 | 0.024 |
| POT1472 | 01/03/07 | 12.1 | 1.47 | 0.016 |
| POT1472 | 03/07/07 | 13.0 | 1.66 | 0.073 |
| POT1472 | 04/04/07 | 8.6 | 1.55 | 0.045 |
| POT1472 | 05/02/07 | 8.3 | 1.35 | 0.043 |
| POT1472 | 06/13/07 | 6.7 | 1.27 | 0.049 |
| POT1472 | 07/18/07 | 6.10 | 1.27 | 0.04 |
| POT1472 | 08/15/07 | 7.20 | 0.93 | 0.05 |
| POT1472 | 09/12/07 | 6.50 | 1.17 | 0.05 |
| POT1472 | 10/10/07 | 7.00 | 0.96 | 0.05 |
| POT1472 | 11/01/07 | 10.00 | 1.07 | 0.05 |
| POT1472 | 12/05/07 | 12.10 | 1.13 | 0.03 |
| POT1472 | 01/09/08 | 12.80 | 1.49 | 0.02 |
| POT1472 | 02/06/08 | 10.80 | 1.21 | 0.03 |
| POT1472 | 03/12/08 | 10.90 | 1.70 | 0.04 |
| POT1472 | 04/09/08 | 10.80 | 1.27 | 0.04 |
| POT1472 | 05/07/08 | 7.90 | 1.45 | 0.04 |
| POT1472 | 06/04/08 | 7.40 | 1.14 | 0.03 |
| POT1472 | 07/02/08 | 7.90 | 1.43 | 0.04 |
| POT1472 | 08/06/08 | 7.40 | 1.39 | 0.07 |
| POT1472 | 09/10/08 | 6.70 | 1.70 | 0.06 |
| POT1472 | 10/15/08 | 8.10 | 0.80 | 0.02 |
| POT1472 | 11/12/08 | 11.30 | 0.69 | 0.01 |
| POT1472 | 12/10/08 | 13.40 | 0.96 | 0.01 |

**Table A-2: MBSS Water Quality Data**

| Station | Sampling Date | DO (mg/l) | TN (mg/l) | TP (mg/l) |
|---|---|---|---|---|
| MO-P-514-116-97 | 07/15/97 | 7.6 | | |
| MO-P-496-215-97 | 06/17/97 | 9.8 | | |
| MO-P-481-101-97 | 06/05/97 | 8 | | |
| MO-P-436-226-97 | 06/05/97 | 6.4 | | |
| MO-P-251-115-97 | 07/02/97 | 7.9 | | |
| MO-P-206-311-97 | 06/17/97 | 7.3 | | |
| MO-P-108-123-97 | 07/15/97 | 6.7 | | |
| MO-P-091-204-97 | 06/04/97 | 8.9 | | |
| MO-P-064-328-97 | 07/07/97 | 8.9 | | |
| MO-P-016-227-97 | 06/19/97 | 8 | | |
| MO-P-014-107-97 | 07/15/97 | 5.5 | | |
| MO-P-001-214-97 | 06/05/97 | 9.3 | | |
| COCA-102-N-2003 | 04/14/03 | | 3.9 | 0.02 |
| COCA-102-N-2003 | 07/22/03 | 6.3 | | |
| COCA-108-N-2003 | 04/14/03 | | 0.4 | 0.02 |
| COCA-108-N-2003 | 07/02/03 | 8 | | |
| COCA-109-N-2003 | 04/14/03 | | 0.4 | 0.03 |
| COCA-109-N-2003 | 07/02/03 | 6.5 | | |
| COCA-111-N-2003 | 04/14/03 | | 0.4 | 0.04 |
| COCA-111-N-2003 | 07/02/03 | 6.7 | | |
| COCA-117-N-2003 | 04/23/03 | | 2.2 | 0.02 |
| COCA-117-N-2003 | 08/06/03 | 7.8 | | |
| COCA-205-N-2003 | 04/14/03 | | 0.3 | 0.08 |
| COCA-205-N-2003 | 08/07/03 | 3.3 | | |
| COCA-206-N-2003 | 04/15/03 | | 1.8 | 0.02 |
| COCA-206-N-2003 | 07/30/03 | 7.9 | | |
| COCA-208-N-2003 | 04/15/03 | | 0.7 | 0.03 |
| COCA-208-N-2003 | 08/06/03 | 8.8 | | |
| COCA-209-N-2003 | 04/15/03 | | 0.7 | 0.04 |
| COCA-209-N-2003 | 08/06/03 | 8.2 | | |
| COCA-210-N-2003 | 04/15/03 | | 1.7 | 0.02 |
| COCA-210-N-2003 | 07/30/03 | 7.7 | | |
| COCA-307-N-2003 | 04/14/03 | | 0.7 | 0.1 |
| COCA-307-N-2003 | 08/07/03 | 6 | | |
| COCA-308-N-2003 | 04/15/03 | | 1.5 | 0.02 |
| COCA-308-N-2003 | 08/05/03 | 7.5 | | |
| GWPY-212-N-2004 | 03/10/04 | | 2.7 | 0.02 |
| GWPY-212-N-2004 | 06/14/04 | 8.2 | | |
| NCRW-208-N-2004 | 04/27/04 | | 1.1 | 0.05 |
| NCRW-208-N-2004 | 08/17/04 | 7.3 | | |
| NCRW-309-N-2004 | 04/27/04 | | 1.6 | 0.03 |
| NCRW-309-N-2004 | 08/17/04 | 8.1 | | |
| PRMO-101-R-2002 | 03/05/02 | | 0.5 | 0.11 |
| PRMO-103-R-2002 | 03/05/02 | | 0.9 | 0.02 |

| Station | Sampling Date | DO (mg/l) | TN (mg/l) | TP (mg/l) |
|---|---|---|---|---|
| PRMO-103-R-2002 | 06/25/02 | 5.6 | | |
| PRMO-109-R-2002 | 03/05/02 | | 3.2 | 0.06 |
| PRMO-109-R-2002 | 06/12/02 | 9.2 | | |
| PRMO-110-R-2002 | 03/04/02 | | 1 | 0.01 |
| PRMO-110-R-2002 | 06/10/02 | 9.3 | | |
| PRMO-112-R-2002 | 03/05/02 | | 0.8 | 0.01 |
| PRMO-112-R-2002 | 06/12/02 | 6.3 | | |
| PRMO-114-R-2002 | 03/04/02 | | 0.7 | 0.01 |
| PRMO-114-R-2002 | 06/12/02 | 8.5 | | |
| PRMO-115-R-2002 | 03/04/02 | | 0.7 | 0.01 |
| PRMO-115-R-2002 | 06/12/02 | 8.5 | | |
| PRMO-120-R-2002 | 03/04/02 | | 1.7 | 0.05 |
| PRMO-120-R-2002 | 06/24/02 | 8.8 | | |
| PRMO-202-R-2002 | 03/04/02 | | 2.2 | 0.03 |
| PRMO-202-R-2002 | 06/24/02 | 9.4 | | |
| PRMO-222-R-2002 | 03/05/02 | | 1.4 | 0.02 |
| PRMO-222-R-2002 | 06/25/02 | 8.9 | | |
| PRMO-295-E-2004 | 09/13/02 | 7.1 | | |
| PRMO-295-E-2004 | 04/22/04 | | 2 | 0.01 |
| PRMO-304-R-2002 | 03/06/02 | | 1.9 | 0.01 |
| PRMO-304-R-2002 | 06/11/02 | 7.1 | | |
| PRMO-307-R-2002 | 03/04/02 | | 2 | 0.02 |
| PRMO-307-R-2002 | 06/24/02 | 8.4 | | |
| PRMO-311-R-2002 | 03/04/02 | | 2 | 0.02 |
| PRMO-311-R-2002 | 06/10/02 | 8.4 | | |
| PRMO-313-R-2002 | 03/04/02 | | 0.8 | 0.04 |
| PRMO-313-R-2002 | 06/11/02 | 6.6 | | |
| PRMO-323-R-2002 | 03/06/02 | | 1.9 | 0.02 |
| PRMO-323-R-2002 | 06/11/02 | 9.9 | | |

**Table A-3: MDE Water Quality Data**

| Station | Sampling Date | DO (mg/l) | TN (mg/l) | TP (mg/l) |
|---|---|---|---|---|
| BRR0006 | 01/24/08 | 16.2 | 3.39 | 0.471 |
| BRR0006 | 02/14/08 | 14.0 | 3.00 | 0.179 |
| BRR0006 | 03/12/08 | 12.0 | 3.87 | 0.181 |
| BRR0006 | 04/16/08 | 13.8 | 1.88 | 0.221 |
| BRR0006 | 05/14/08 | 9.6 | 2.85 | 0.057 |
| BRR0006 | 06/11/08 | 7.1 | 2.64 | 0.670 |
| BRR0006 | 07/16/08 | 7.5 | 1.89 | 0.583 |
| BRR0006 | 08/13/08 | 7.7 | 2.17 | 1.927 |
| BRR0006 | 09/17/08 | 7.5 | 4.04 | 1.667 |
| BRR0006 | 10/16/08 | 8.4 | 5.82 | 5.716 |
| BRR0006 | 11/13/08 | 9.1 | 0.58 | 0.429 |
| BRR0006 | 12/10/08 | 11.3 | 3.88 | 0.539 |
| HOB0010 | 01/24/08 | 13.7 | 2.65 | 0.010 |
| HOB0010 | 02/14/08 | 13.5 | 3.78 | 0.047 |
| HOB0010 | 03/12/08 | 11.3 | 3.66 | 0.026 |
| HOB0010 | 04/16/08 | 12.0 | 1.02 | 0.021 |
| HOB0010 | 05/14/08 | 8.6 | 2.24 | 0.068 |
| HOB0010 | 06/11/08 | 5.7 | 0.78 | 0.059 |
| HOB0010 | 07/16/08 | 6.3 | 0.65 | 0.063 |
| HOB0010 | 12/10/08 | 10.8 | 1.03 | 0.017 |
| LFB0001 | 01/24/08 | 13.4 | 2.61 | 0.122 |
| LFB0001 | 02/14/08 | 13.5 | 2.55 | 0.123 |
| LFB0001 | 03/12/08 | 11.0 | 2.66 | 0.086 |
| LFB0001 | 04/16/08 | 11.8 | 1.96 | 0.095 |
| LFB0001 | 05/14/08 | 9.5 | 2.71 | 0.074 |
| LFB0001 | 06/11/08 | 7.5 | 2.06 | 0.094 |
| LFB0001 | 07/16/08 | 7.5 | 1.76 | 0.136 |
| LFB0001 | 08/13/08 | 9.0 | 1.68 | 0.084 |
| LFB0001 | 09/17/08 | 8.2 | 1.97 | 0.080 |
| LFB0001 | 11/13/08 | 10.1 | 2.06 | 0.640 |
| LFB0001 | 12/10/08 | 10.7 | 2.63 | 0.248 |
| LMO0002 | 01/24/08 | 14.3 | 2.42 | 0.015 |
| LMO0002 | 02/14/08 | 14.4 | 2.45 | 0.050 |
| LMO0002 | 03/12/08 | 12.0 | 2.92 | 0.010 |
| LMO0002 | 04/16/08 | 11.7 | 1.65 | 0.016 |
| LMO0002 | 05/14/08 | 10.1 | 2.20 | 0.048 |
| LMO0002 | 06/11/08 | 8.0 | 2.14 | 0.051 |
| LMO0002 | 07/16/08 | 7.9 | 2.02 | 0.024 |
| LMO0002 | 08/13/08 | 8.6 | 1.33 | 0.018 |
| LMO0002 | 09/17/08 | 8.6 | 1.34 | 0.018 |
| LMO0002 | 10/16/08 | 8.5 | 1.31 | 0.024 |
| LMO0002 | 11/13/08 | 10.7 | 0.91 | 0.027 |
| LMO0002 | 12/10/08 | 11.7 | 2.19 | 0.008 |
| MUB0007 | 01/24/08 | 14.7 | 2.03 | 0.006 |

| Station | Sampling Date | DO (mg/l) | TN (mg/l) | TP (mg/l) |
|---|---|---|---|---|
| MUB0007 | 02/14/08 | 13.9 | 1.68 | 0.037 |
| MUB0007 | 03/12/08 | 12.2 | 1.70 | 0.011 |
| MUB0007 | 04/16/08 | 12.3 | 1.32 | 0.007 |
| MUB0007 | 05/14/08 | 9.1 | 1.40 | 0.030 |
| MUB0007 | 06/11/08 | 7.5 | 1.65 | 0.016 |
| MUB0007 | 07/16/08 | 7.7 | 1.06 | 0.015 |
| MUB0007 | 08/13/08 | 8.1 | 1.40 | 0.013 |
| MUB0007 | 09/17/08 | 8.6 | 1.35 | 0.009 |
| MUB0007 | 10/16/08 | 8.5 | 1.57 | 0.008 |
| MUB0007 | 11/13/08 | 10.5 | 1.45 | 0.021 |
| MUB0007 | 12/10/08 | 12.1 | 2.27 | 0.006 |
| ROR0005 | 01/24/08 | 14.0 | 1.43 | 0.007 |
| ROR0005 | 02/14/08 | 13.4 | 1.58 | 0.054 |
| ROR0005 | 03/12/08 | 11.5 | 1.64 | 0.030 |
| ROR0005 | 04/16/08 | 11.6 | 0.98 | 0.008 |
| ROR0005 | 05/14/08 | 10.7 | 1.29 | 0.042 |
| ROR0005 | 06/11/08 | 8.0 | 1.39 | 0.071 |
| ROR0005 | 07/16/08 | 8.0 | 1.37 | 0.044 |
| ROR0005 | 08/13/08 | 8.8 | 0.90 | 0.017 |
| ROR0005 | 09/17/08 | 8.0 | 1.05 | 0.034 |
| ROR0005 | 10/16/08 | 8.4 | 1.28 | 0.025 |
| ROR0005 | 11/13/08 | 9.7 | 0.90 | 0.035 |
| ROR0005 | 12/10/08 | 11.4 | 1.59 | 0.014 |
| WAT0006 | 01/24/08 | 14.2 | 1.91 | 0.009 |
| WAT0006 | 02/14/08 | 13.7 | 1.96 | 0.031 |
| WAT0006 | 03/12/08 | 12.1 | 2.59 | 0.008 |
| WAT0006 | 04/16/08 | 11.9 | 2.03 | 0.009 |
| WAT0006 | 05/14/08 | 9.6 | 1.82 | 0.031 |
| WAT0006 | 06/11/08 | 7.7 | 2.49 | 0.018 |
| WAT0006 | 07/16/08 | 8.0 | 1.77 | 0.020 |
| WAT0006 | 08/13/08 | 8.7 | 1.33 | 0.018 |
| WAT0006 | 09/17/08 | 8.1 | 3.51 | 0.018 |
| WAT0006 | 10/16/08 | 7.9 | 1.16 | 0.014 |
| WAT0006 | 11/13/08 | 9.6 | 1.25 | 0.027 |
| WAT0006 | 12/10/08 | 11.8 | 2.31 | 0.009 |
| POT1184 | 10/18/00 | 8.5 | 1.29 | 0.042 |
| POT1184 | 11/16/00 | 10.6 | 1.20 | 0.026 |
| POT1184 | 12/06/00 | 12.9 | 1.39 | 0.019 |
| POT1184 | 01/10/01 | 13.8 | 2.11 | 0.044 |
| POT1184 | 02/07/01 | 13.1 | 2.12 | 0.046 |
| POT1184 | 03/21/01 | 11.6 | 1.52 | 0.047 |
| POT1184 | 04/18/01 | 10.1 | 1.98 | 0.127 |
| POT1184 | 05/16/01 | 9.2 | 1.20 | 0.072 |
| POT1184 | 06/20/01 | 7.7 | 1.00 | 0.065 |
| POT1184 | 07/25/01 | 6.3 | 1.09 | 0.065 |

| Station | Sampling Date | DO (mg/l) | TN (mg/l) | TP (mg/l) |
|---|---|---|---|---|
| POT1184 | 08/08/01 | 6.5 | 0.99 | 0.061 |
| POT1184 | 09/19/01 | 7.2 | 0.82 | 0.050 |
| POT1184 | 10/18/01 | 9.3 | 0.93 | 0.052 |
| POT1184 | 11/07/01 | 10.7 | 0.67 | 0.057 |
| POT1184 | 12/19/01 | 10.6 | 0.97 | 0.028 |
| POT1184 | 01/24/02 | 12.4 | 1.43 | 0.040 |
| POT1184 | 02/21/02 | 11.9 | 1.09 | 0.035 |
| POT1184 | 03/21/02 | 10.8 | 0.98 | 0.058 |
| POT1184 | 04/18/02 | 8.0 | 0.98 | 0.077 |
| POT1184 | 05/16/02 | 8.9 | 0.93 | 0.080 |
| POT1184 | 06/12/02 | 7.2 | 0.94 | 0.070 |
| POT1184 | 07/25/02 | 6.7 | 0.49 | 0.073 |
| POT1184 | 08/21/02 | 7.2 | 0.45 | 0.059 |
| POT1184 | 09/25/02 | 8.5 | 0.31 | 0.031 |
| POT1471 | 10/17/00 | 8.9 | 0.91 | 0.031 |
| POT1471 | 11/15/00 | 9.3 | 1.90 | 0.088 |
| POT1471 | 12/05/00 | 12.3 | 1.62 | 0.040 |
| POT1471 | 01/09/01 | 11.5 | 3.40 | 0.111 |
| POT1471 | 02/06/01 | 12.2 | 3.15 | 0.066 |
| POT1471 | 03/20/01 | 10.4 | 2.15 | 0.056 |
| POT1471 | 04/17/01 | 8.6 | 2.30 | 0.135 |
| POT1471 | 05/15/01 | 8.3 | 1.86 | 0.075 |
| POT1471 | 06/19/01 | 6.3 | 1.76 | 0.082 |
| POT1471 | 07/24/01 | 4.7 | 1.29 | 0.062 |
| POT1471 | 08/06/01 | 6.0 | 1.59 | 0.074 |
| POT1471 | 09/18/01 | 6.6 | 0.77 | 0.048 |
| POT1471 | 10/17/01 | 8.6 | 1.49 | 0.063 |
| POT1471 | 11/06/01 | 9.1 | 1.23 | 0.058 |
| POT1471 | 12/18/01 | 9.4 | 1.63 | 0.083 |
| POT1471 | 01/23/02 | 11.8 | 1.83 | 0.054 |
| POT1471 | 02/20/02 | 10.3 | 1.53 | 0.053 |
| POT1471 | 03/20/02 | 9.0 | 2.03 | 0.098 |
| POT1471 | 04/17/02 | 7.0 | 1.20 | 0.091 |
| POT1471 | 05/15/02 | 8.3 | 1.29 | 0.108 |
| POT1471 | 06/11/02 | 6.8 | 1.03 | 0.062 |
| POT1471 | 07/24/02 | 6.0 | 0.63 | 0.077 |
| POT1471 | 08/20/02 | 7.6 | 0.62 | 0.055 |
| POT1471 | 09/24/02 |  | 0.62 | 0.042 |
| POT1472 | 10/17/00 | 9.2 | 1.76 | 0.047 |
| POT1472 | 11/15/00 | 10.3 | 1.01 | 0.069 |
| POT1472 | 12/05/00 | 13.0 | 1.12 | 0.015 |
| POT1472 | 01/09/01 | 13.3 | 1.67 | 0.009 |
| POT1472 | 02/06/01 | 12.6 | 1.66 | 0.038 |
| POT1472 | 03/20/01 | 10.8 | 1.45 | 0.031 |
| POT1472 | 04/17/01 | 8.7 | 1.63 | 0.085 |

| Station | Sampling Date | DO (mg/l) | TN (mg/l) | TP (mg/l) |
|---|---|---|---|---|
| POT1472 | 05/15/01 | 9.7 | 1.14 | 0.060 |
| POT1472 | 06/19/01 | 9.1 | 1.12 | 0.097 |
| POT1472 | 07/24/01 | 6.8 | 0.97 | 0.068 |
| POT1472 | 08/06/01 | 8.6 | 1.34 | 0.092 |
| POT1472 | 09/18/01 | 7.4 | 0.85 | 0.049 |
| POT1472 | 10/17/01 | 9.4 | 0.91 | 0.040 |
| POT1472 | 11/06/01 | 10.5 | 0.56 | 0.048 |
| POT1472 | 12/18/01 | 10.9 | 0.67 | 0.016 |
| POT1472 | 01/23/02 | 13.0 | 1.27 | 0.042 |
| POT1472 | 02/20/02 | 11.8 | 0.80 | 0.044 |
| POT1472 | 03/20/02 | 9.9 | 0.83 | 0.097 |
| POT1472 | 04/17/02 | 7.7 | 1.04 | 0.089 |
| POT1472 | 05/15/02 | 8.7 | 0.99 | 0.062 |
| POT1472 | 06/11/02 | 8.0 | 0.84 | 0.092 |
| POT1472 | 07/24/02 | 6.7 | 0.61 | 0.086 |
| POT1472 | 08/20/02 | 6.4 | 0.55 | 0.052 |
| POT1472 | 09/24/02 | | 0.53 | 0.039 |

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## Appendix B – Analysis of CORE/TREND Benthic Monitoring Results in the Potomac River Montgomery County Watershed Mainstem

The Maryland Department of Natural Resources' (DNR) CORE/TREND program monitors the benthic macroinvertebrate community at 111 fixed locations in Maryland. Monitoring has been performed at some of these sites as far back as the 1970s. The information collected is used to assess water quality status and trends, and is intended to complement water quality monitoring that is also performed under the CORE/TREND program.

Most of the fixed sites are on the larger rivers and streams draining Maryland's 8-digit watersheds. Although there is some overlap, these larger rivers and streams generally fall outside the domain of the Maryland Biological Stream Survey (MBSS) program, which assesses the integrity fish and macroinvertebrate community in 1$^{st}$ through 4$^{th}$ order streams. In most cases, the CORE/TREND data represent the only biological data available for these larger rivers and streams. Consequently, although it is not formally part of Maryland's assessment methodology, the evaluation of benthic macroinvertebrate data under the CORE/TREND program has played a large role in determining whether aquatic life is supported in larger rivers and streams in TMDLs and WQAs. Generally, a CORE/TREND status assessment of "GOOD" or better indicates that the waterbody is supporting its aquatic life use.

In the Potomac River Montgomery County watershed mainstem, there are two fixed stations at which the CORE/TREND program assesses water quality based on macroinvertebrate sampling: (1) POT1183, at Little Falls below the dam; and (2) POT1471, at White's Ferry. Figure B-1 shows the location of these stations. The CORE/TREND assessed the status of water quality at POT1471 as "GOOD," but rated the water quality status at POT1183 as "FAIR/GOOD," indicating borderline water quality conditions.

POT1183 is the only station on the mainstem Potomac River below the confluence of the North and South Branches assessed as less than "GOOD." Figure B-1 shows the location of the other CORE/TREND stations in the mainstem Potomac River. Table B-1 shows the location, status, and trend of these stations. The goal of this analysis is to compare the assessment of the benthic community at POT1183 with the assessment at other stations in the mainstem Potomac River to evaluate whether aquatic life use is supported in the mainstem Potomac River in Montgomery County.

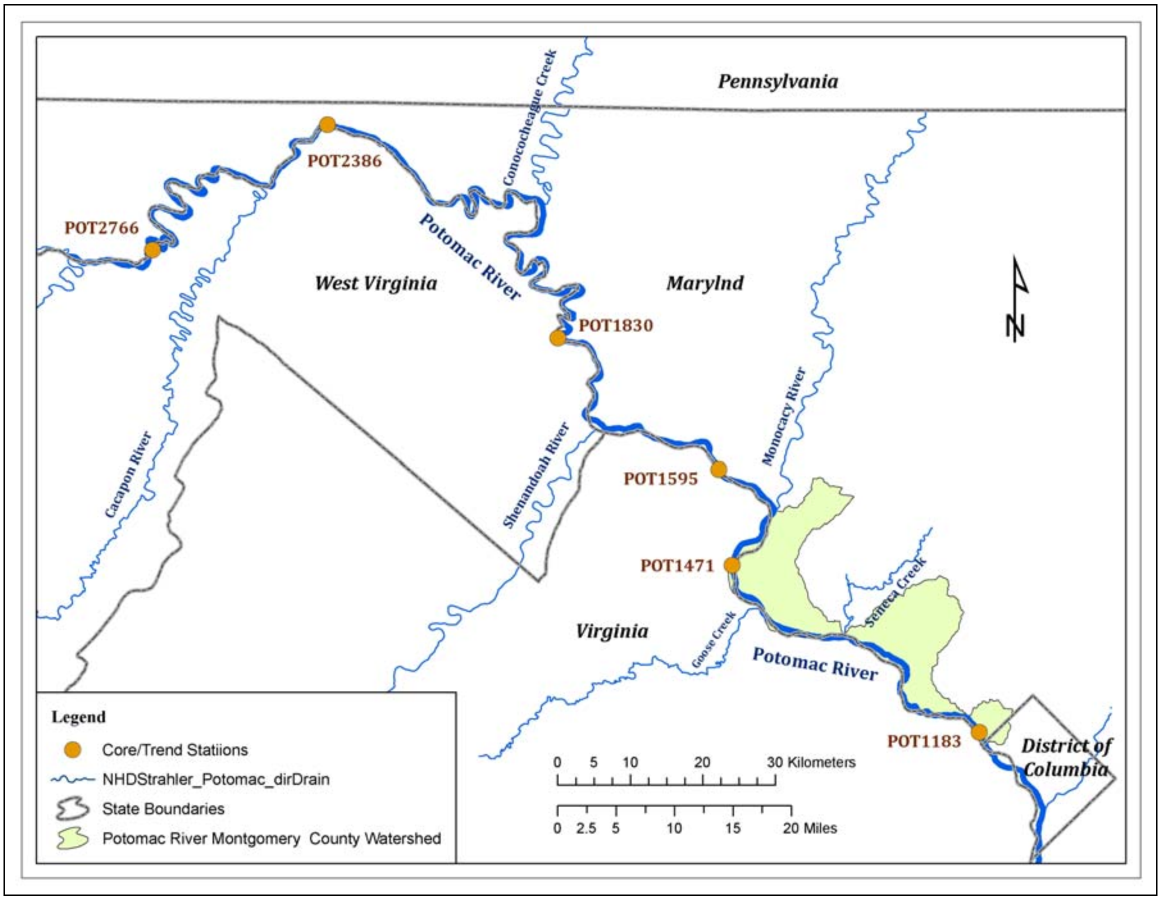


**Figure B-1: CORE/TREND Monitoring Stations in the Mainstem Potomac River**

**Table B-1: CORE/TREND Stations in the Mainstem Potomac River**

| Station | Location | Status | Trend |
|---|---|---|---|
| POT1183 | Little Falls below dam | FAIR/GOOD | NO CHANGE |
| POT1471 | Whites Ferry | GOOD | IMPROVEMENT |
| POT1595 | Point of Rocks | GOOD | NO CHANGE |
| POT1830 | Shepardstown | GOOD | DEGRADATION |
| POT2386 | Hancock | GOOD | IMPROVEMENT |
| POT2766 | Paw Paw | GOOD/VERY GOOD | IMPROVEMENT |

**CORE/TREND Assessment Methodology**

The CORE/TREND assessment is based on four metrics: (1) total number of taxa; (2) Shannon-Wiener diversity index (DI); (3) modified Hilsenhoff biotic index (HBI); and (4) percent Ephemeroptera, Plecoptera, and Tricoptera (%EPT).

Total number of taxa, as the name suggests, is simply the number of taxa identified in the sample. A larger number of taxa indicates a more diverse benthic community and better water quality. Table B-2 shows the range of values for the total number of taxa for each assessment category.

**Table B-2: Assessment Ranges for Total Number of Taxa[1]**

| Assessment | Range |
|---|---|
| Excellent | ≥28 |
| Very Good | 23-28 |
| Good | 18-22 |
| Fair | 12-17 |
| Poor | 6-11 |
| Very Poor | 1-5 |

[1] Source: Friedman, 2010a.

The Shannon-Wiener diversity index (DI) is the measure of relative abundance of taxa or the degree to which the benthic community is dominated by a small number of taxa. Poorer water quality is associated with the greater dominance of a few taxa. Table B-3 shows the range of values of the DI for each assessment category.

**Table B-3: Assessment Ranges for Shannon-Wiener Diversity Index[1]**

| Assessment | Range |
|---|---|
| Excellent | 4-5 |
| Good to Very Good | 3-4 |
| Fair to Good | 2-3 |
| Poor to Fair | 1-2 |
| Very Poor to Poor | 0-1 |

[1] Source: Friedman, 2009.

The Hilsenhoff Biotic Index (HBI) is a measure of the degree to which the taxa present in the benthic community can tolerate organic pollution, such as raw sewage. Individual taxa are classified according to their tolerance, and the overall score is a weighted average of the tolerance of the number of individuals of each taxa. The larger the value of the metric, the greater the overall tolerance of the community to organic pollution, and the greater the likelihood that the community is impacted by poor water quality. Table B-4 shows the range of values of the HBI for each assessment category.

**Table B-4: Assessment Ranges for Hilsenhoff Biotic Index[1]**

| Assessment | Range |
|---|---|
| Excellent | 0-1.75 |
| Very Good | 1.76-2.25 |
| Good | 2.26-2.75 |
| Fair | 2.76-3.5 |
| Poor | 3.51-4.25 |
| Very Poor | 4.26-5 |

[1] Source: Friedman, 2009.

Percent EPT is the percent of individuals belonging to the families Ephemeroptera (mayflies), Plecoptera (stoneflies), and Tricoptera (caddisflies) in the sample. Mayflies, stoneflies, and caddisflies are generally intolerant of pollution or habitat impairment, and therefore their presence is indicative of good water quality. The larger the percentage of individuals from these taxa, the better the water quality. Table B-5 shows the range of values of %EPT for each assessment category.

**Table B-5: Assessment Ranges for Percent Ephemeroptera, Plecoptera, and Tricoptera[1]**

| Assessment | Range |
|---|---|
| Good to Excellent | 75-100% |
| Good | 50-75% |
| Fair | 25-50% |
| Poor | 0-25% |

[1] Source: Friedman, 2010a.

The evaluation of the overall status of a station is not based on a strict formula, but involves professional judgment in two respects (Friedman, 2010b). First, the overall rating is based on the rating of the four metrics, but is not a numerical average of the component metrics. Generally, the overall assessment should be in the assessment range of the metrics. Second, the number of years of data used to assess status is a function of the trend at the station. Only more years will be representative of a station that shows a strong trend in metric scores, while a longer period of record will be more representative of a station without strong trends in the metrics.

**Evaluation of the Benthic Community Metrics for the Mainstem Potomac River**

Table B-6 gives the benthic community metric scores for stations on the mainstem Potomac River between 2000 and 2007, the last year data are available from the CORE/TREND program. Table B-7 gives summary statistics for the metrics from those stations. Figures B-2, B-3, B-4, and B-5 compare the distribution of scores of the total taxa, HBI, DI, and %EPT, respectively, from Potomac River stations from that period. Metrics from POT2386 at Hancock have been omitted from the analysis because data were only collected in two years, 2004 and 2005.

**Table B-6: CORE/TREND Benthic Metrics 2000-2008, Mainstem Potomac River**

| STATION[1] | YEAR | Total Individuals Collected | Benthic Metric | | | |
|---|---|---|---|---|---|---|
| | | | TOTAL TAXA (#) | HBI | Shannon-Wiener DI | EPT (%) |
| POT1183 | 2000 | 2562 | 40 | 3.25 | 2.87 | 55 |
| | 2001 | 828 | 34 | 2.77 | 3.68 | 66 |
| | 2002 | 286 | 15 | 2.45 | 1.73 | 4 |
| | 2003 | 1374 | 42 | 3.13 | 3.5 | 58 |
| | 2004 | 415 | 27 | 2.85 | 3.43 | 73 |
| | 2007 | 559 | 23 | 2.62 | 3.34 | 42 |
| POT1471 | 2000 | 448 | 25 | 2.88 | 3.35 | 47 |
| | 2001 | 865 | 39 | 2.8 | 3.59 | 46 |
| | 2003 | 460 | 29 | 3.18 | 3.32 | 73 |
| | 2004 | 610 | 35 | 2.6 | 3.07 | 50 |
| POT1595 | 2001 | 783 | 37 | 2.94 | 3.61 | 47 |
| | 2002 | 1470 | 32 | 2.51 | 2.44 | 3 |
| | 2003 | 531 | 43 | 2.86 | 4.31 | 50 |
| | 2004 | 511 | 33 | 2.78 | 3.62 | 75 |
| | 2005 | 546 | 22 | 2.58 | 2.93 | 45 |
| | 2006 | 438 | 28 | 2.89 | 3.4 | 40 |
| POT1830 | 2000 | 1538 | 31 | 2.63 | 2.87 | 12 |
| | 2001 | 491 | 36 | 2.9 | 3.66 | 24 |
| | 2003 | 1602 | 42 | 2.65 | 3.17 | 87 |
| | 2004 | 357 | 34 | 2.44 | 3.42 | 87 |
| | 2005 | 378 | 38 | 2.59 | 4.2 | 67 |
| | 2006 | 687 | 35 | 2.77 | 3.84 | 21 |
| POT2766 | 2000 | 231 | 30 | 2.76 | 3.92 | 26 |
| | 2001 | 790 | 52 | 2.79 | 4.14 | 55 |
| | 2002 | 842 | 47 | 2.97 | 4.52 | 66 |
| | 2003 | 618 | 33 | 2.74 | 3.56 | 59 |
| | 2004 | 394 | 35 | 2.6 | 3.95 | 69 |
| | 2005 | 237 | 29 | 2.39 | 3.5 | 73 |
| | 2006 | 512 | 39 | 2.54 | 4.06 | 67 |
| | 2007 | 345 | 28 | 2.29 | 2.88 | 69 |

**Note**: [1] The analysis includes all CORE/TREND stations located on the Potomac River mainstem below the confluence of the North and South Branches. Metrics from the POT2386 station at Hancock, however, are not included in the analysis, since data was only collected at the station during two years, 2004 and 2005.

**Table B-7: Summary Statistics for Benthic Community Metrics, Potomac River CORE/TREND Stations, 2000-2008**

| **HBI** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Station**[1] | **n**[2] | **mean** | **minimum** | **25%** | **50%** | **75%** | **maximum** |
| POT1183 | 6 | 2.85 | 2.45 | 2.6575 | 2.81 | 3.06 | 3.25 |
| POT1471 | 4 | 2.87 | 2.6 | 2.75 | 2.84 | 2.955 | 3.18 |
| POT1595 | 6 | 2.76 | 2.51 | 2.63 | 2.82 | 2.8825 | 2.94 |
| POT1830 | 6 | 2.66 | 2.44 | 2.6 | 2.64 | 2.74 | 2.9 |
| POT2766 | 8 | 2.64 | 2.29 | 2.5025 | 2.67 | 2.7675 | 2.97 |
| **Shannon-Weiner DI** | | | | | | | |
| **Station** | **n** | **mean** | **minimum** | **25%** | **50%** | **75%** | **maximum** |
| POT1183 | 6 | 3.09 | 1.73 | 2.9875 | 3.385 | 3.4825 | 3.68 |
| POT1471 | 4 | 3.33 | 3.07 | 3.2575 | 3.335 | 3.41 | 3.59 |
| POT1595 | 6 | 3.39 | 2.44 | 3.0475 | 3.505 | 3.6175 | 4.31 |
| POT1830 | 6 | 3.53 | 2.87 | 3.2325 | 3.54 | 3.795 | 4.2 |
| POT2766 | 8 | 3.82 | 2.88 | 3.545 | 3.935 | 4.08 | 4.52 |
| **Percent EPT (%)** | | | | | | | |
| **Station** | **n** | **mean** | **minimum** | **25%** | **50%** | **75%** | **maximum** |
| POT1183 | 6 | 49.67 | 4 | 45.25 | 56.5 | 64 | 73 |
| POT1471 | 4 | 54.00 | 46 | 46.75 | 48.5 | 55.75 | 73 |
| POT1595 | 6 | 43.33 | 3 | 41.25 | 46 | 49.25 | 75 |
| POT1830 | 6 | 49.67 | 12 | 21.75 | 45.5 | 82 | 87 |
| POT2766 | 8 | 60.50 | 26 | 58 | 66.5 | 69 | 73 |
| **Total Taxa (#)** | | | | | | | |
| **Station** | **n** | **mean** | **minimum** | **25%** | **50%** | **75%** | **maximum** |
| POT1183 | 6 | 30.17 | 15 | 24 | 30.5 | 38.5 | 42 |
| POT1471 | 4 | 32.00 | 25 | 28 | 32 | 36 | 39 |
| POT1595 | 6 | 32.50 | 22 | 29 | 32.5 | 36 | 43 |
| POT1830 | 6 | 36.00 | 31 | 34.25 | 35.5 | 37.5 | 42 |
| POT2766 | 8 | 36.62 | 28 | 29.75 | 34 | 41 | 52 |

**Note**: [1] The analysis includes all CORE/TREND stations located on the Potomac River mainstem below the confluence of the North and South Branches. Metrics from the POT2386 station at Hancock, however, are not included in the analysis, since data was only collected at the station during two years, 2004 and 2005.
[2] n = number of samples.

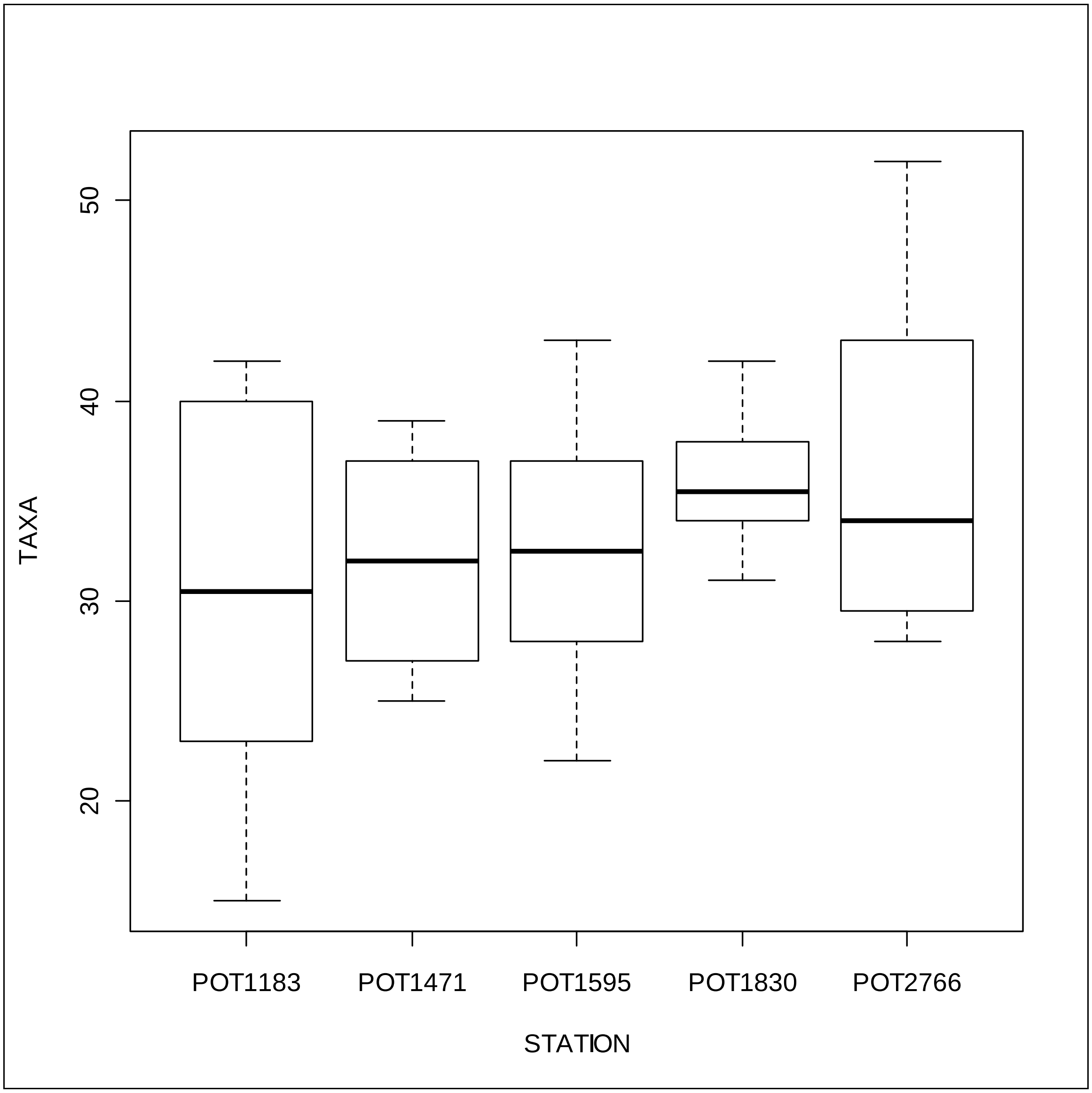


**Figure B-1: Distribution of Number of Taxa, Potomac River CORE/TREND Stations, 2000-2008**

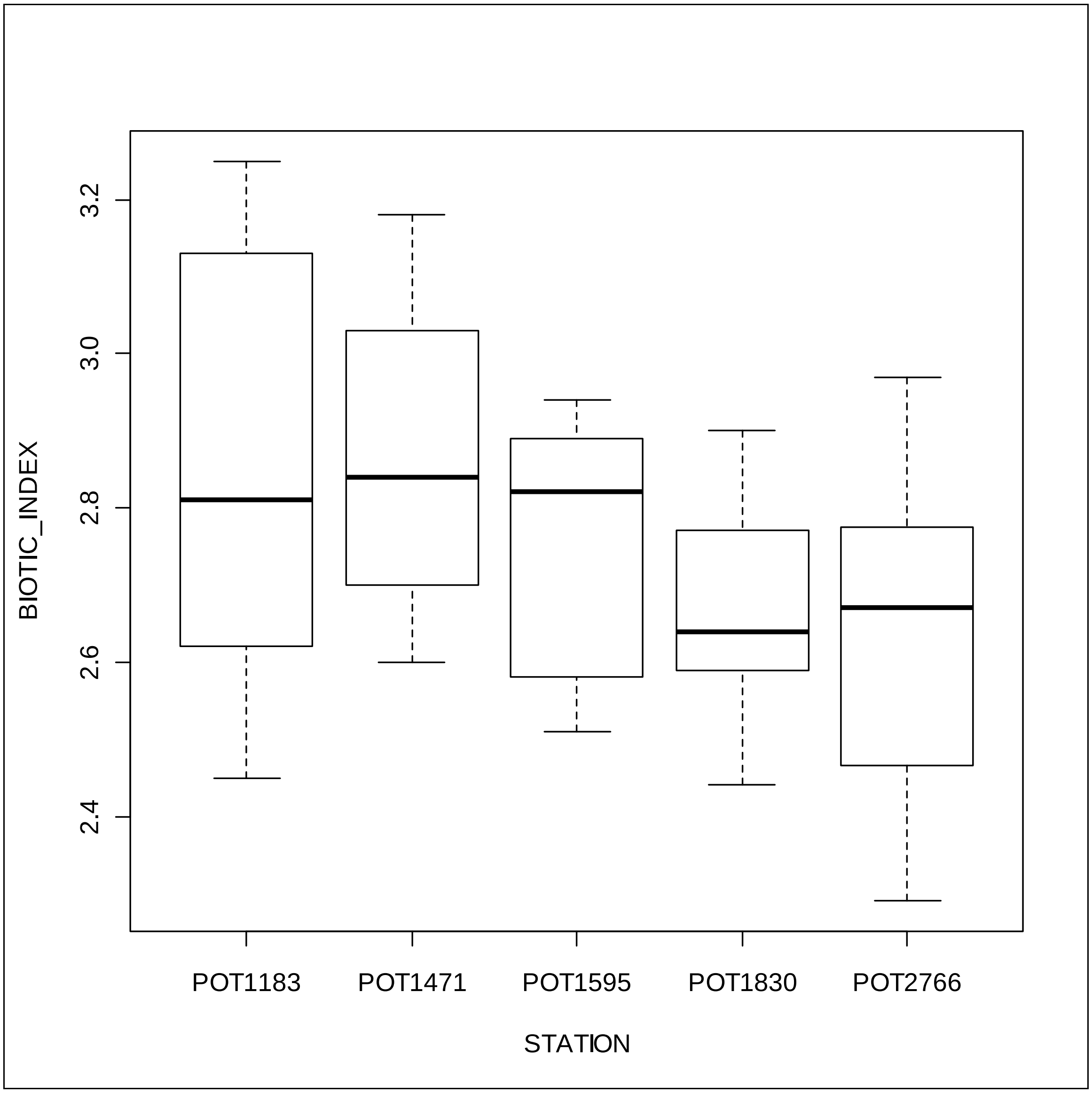


**Figure B-2: Distribution of Hilenshoff Biotic Index, Potomac River CORE/TREND Stations, 2000-2008**

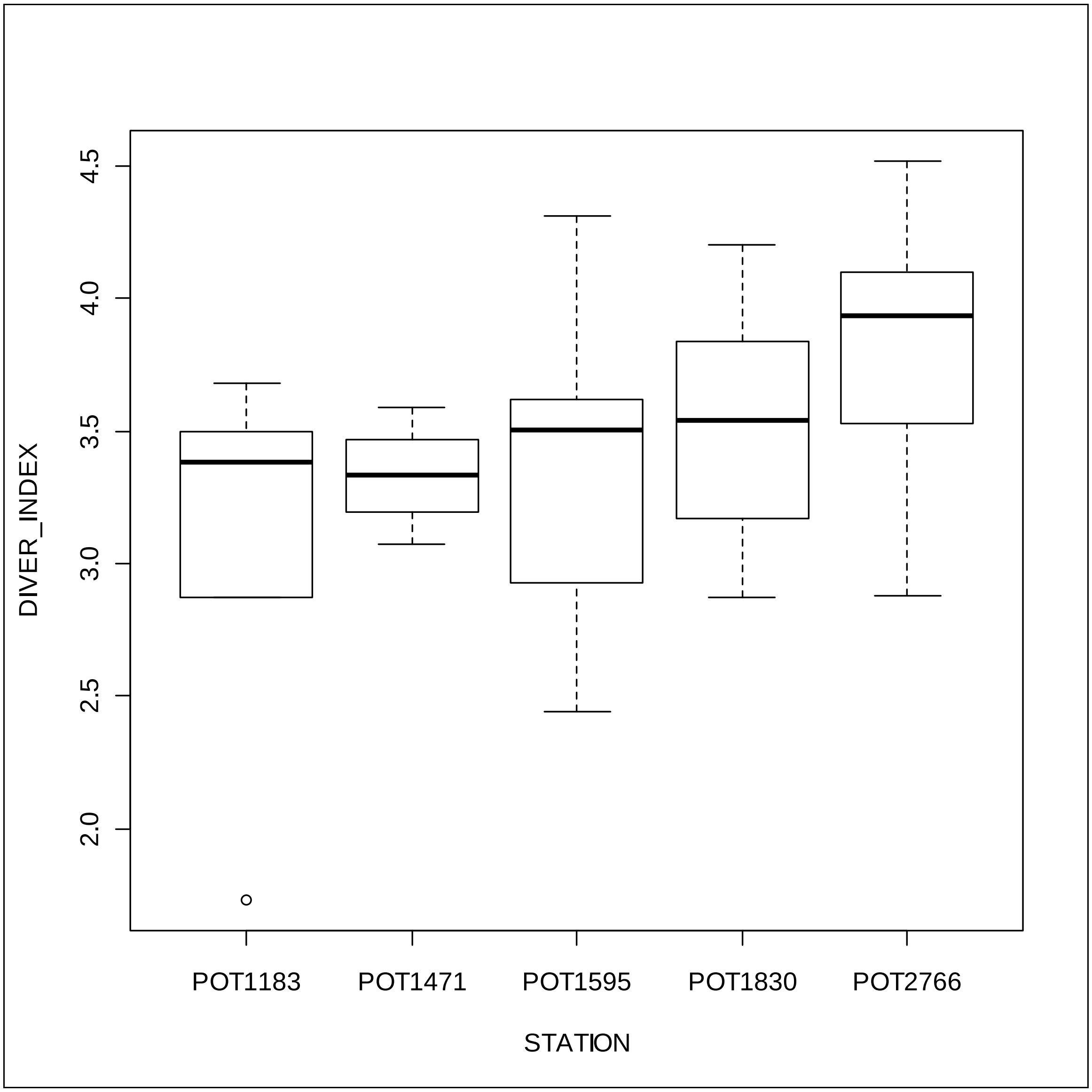


**Figure B-3: Distribution of Shannon-Wiener Index, Potomac River CORE/TREND Stations, 2000-2008**

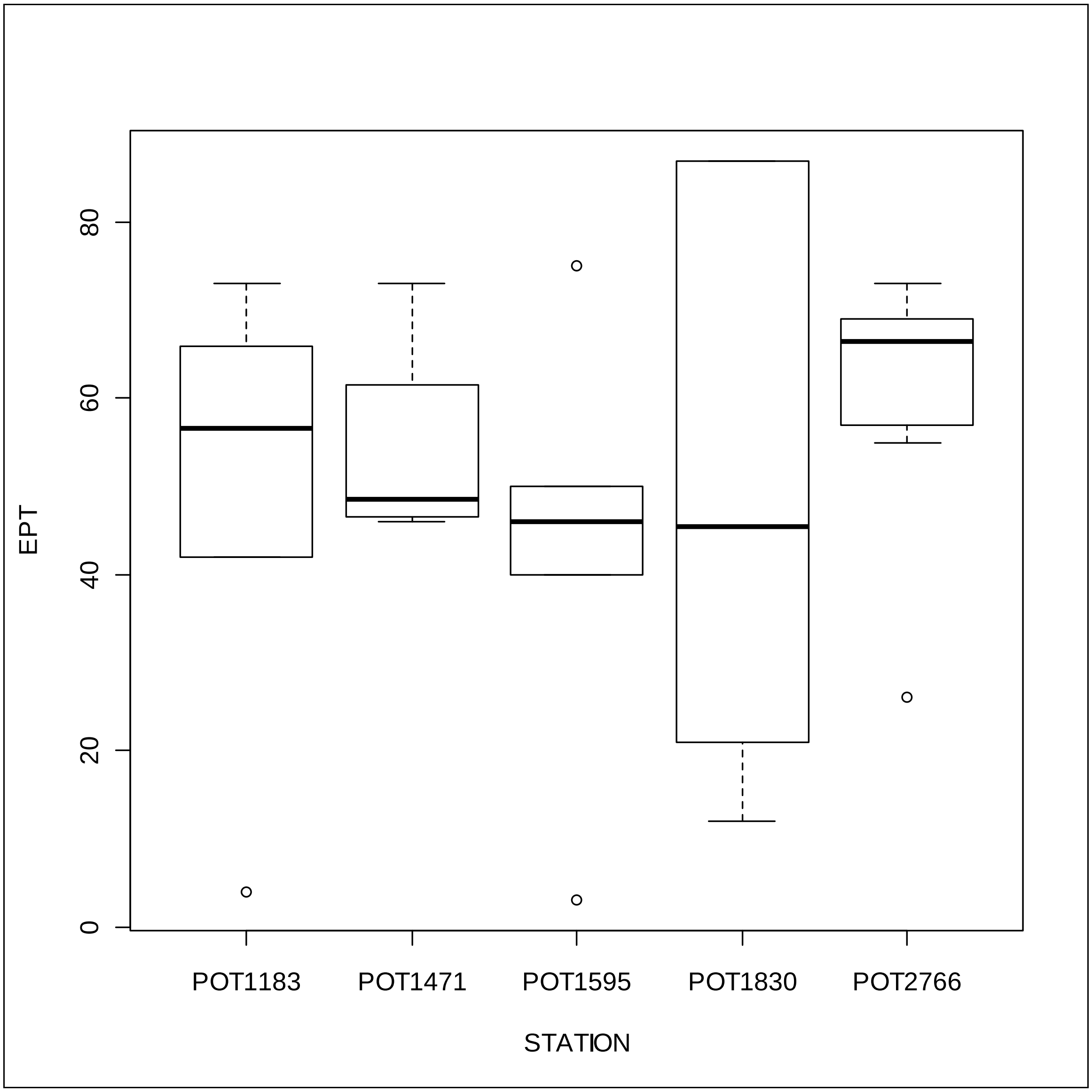


**Figure B-4: Distribution Percent EPT, Potomac River CORE/TREND Stations, 2000-2008**

An examination of Figures B-1 through B-3 seems to suggest that for the total number of taxa, DI, and HBI, the benthic community metric scores indicate a decrease in water quality in the downstream direction. Generally, POT1183 has the worst score among Potomac River stations for each metric, thanks to poor scores on each metric in 2002. However, Krusal-Wallis tests, performed on all of the benthic community metrics, indicate that there is no difference in the distribution of scores in the benthic community metrics among the Potomac River CORE/TREND stations. Table B-8 gives the results of these tests.

**Table B-8: Results of Kruskal-Wallis Tests on Distribution of Benthic Community Indices in CORE/TREND Stations in the Mainstem Potomac River, 2000-2008**

| Metric | Chi-Square | p-value |
|---|---|---|
| Number of Taxa | 2.2712 | 0.686 |
| Biotic Index | 4.0783 | 0.3955 |
| Diversity Index | 5.9219 | 0.2051 |
| Percent EPT | 2.6052 | 0.6259 |

The low scores at POT1183 in 2002 seem to be exceptions to the general trend in the distribution of scores at that station. With the exception of 2002, POT1183 tends to have the best Percent EPT scores of any Potomac River station except POT2766 at Paw Paw. Two-thirds of the samples have Percent EPT scores above 50, which is a greater rate than any other station except POT2766. The metric scores for Total Taxa and DI at POT1183 for 2002 are the only ones below the “Good” range for the period 2000-2007; otherwise, the metric scores from POT1183 are comparable to the other mainstem Potomac River stations. Although two-thirds of the HBI scores at POT1183 are outside the “Good” range, though this is generally true of the Potomac River stations below the confluence with the Shenandoah River.

In summary, since 2000, POT1183 generally has acceptable benthic community metric scores comparable to the other CORE/TREND stations in the mainstem Potomac River. During this period, there is no statistically significant difference in the distribution of metric scores from POT1183 than the other Potomac River stations. If only the benthic monitoring data from this decade are taken into account, water quality at POT1183 is therefore not statistically different from the water quality assessed as “GOOD” at other locations in the mainstem of the Potomac River.

**References**

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