Chemical Data Analysis
Ambient Station / Unnamed Tributary to Winters Run
Harford County, Maryland

Prepared for

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1. INTRODUCTION

Harford County Department of Public Works (DPW) has collected water quality data from baseflow and stormflow samples from two stations (001 and 002) on an unnamed tributary to Winters Run in Bel Air, Maryland during the years 1998 through 2009. The lower station 001 (downstream station) is located just upstream of Tollgate Road near an existing pumping station, and the upper station 002 (upstream station) is located just downstream from Brentwood Park Drive at the outfall of a storm water management facility. The sample locations are presented on Figure 1. Baseflow samples were collected monthly and stormflow samples were collected during storm events. Continuous temperature, pH, velocity, level calculated flow was recorded at the outfall station during monthly baseflow sampling and stormflow events. A summary of the water quality data recorded during each sampling event and chemical results of the samples collected in 2009 is presented in Appendix A.

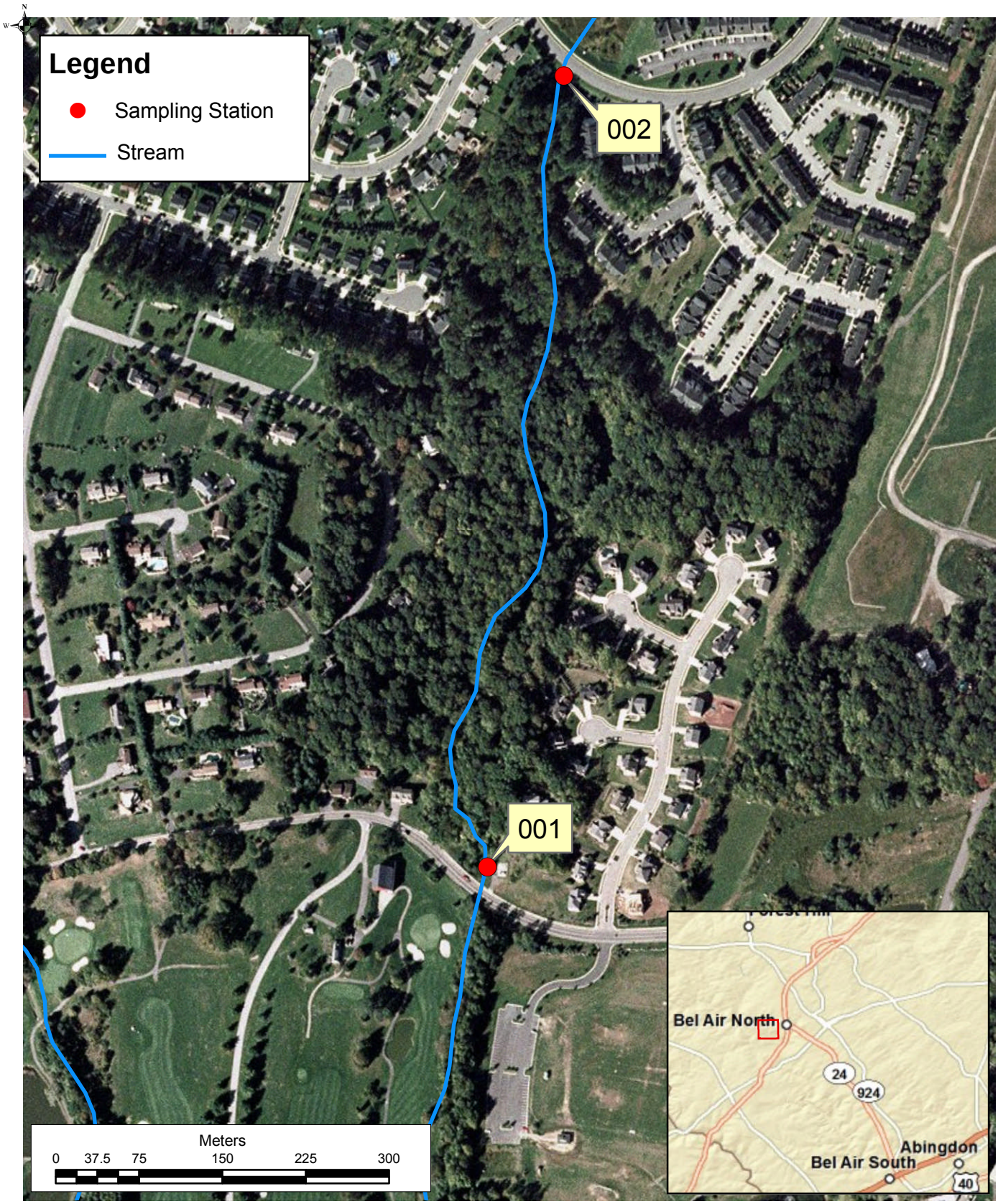
2. METHODS AND DATA COLLECTION

EA Engineering, Science and Technology, Inc. (EA) conducted comparisons and statistical trend analyses for the baseflow and stormflow samples collected from 1998-2009 for the following water quality parameters.

- 5 Day Biological Oxygen Demand (BOD5)
- Total Suspended Solids (TSS)
- Nitrate plus Nitrite (NO23)
- Total Kjeldahl Nitrogen (TKN)
- Total Phosphorus (TP)
- Total Copper (Cu)
- Total Lead (Pb)
- Total Zinc (Zn)
- Total Petroleum Hydrocarbons (TPH)
- *Escherichia coli* (*E. coli*)

Monitoring data consisting of precipitation, stream flow, and water quality was used to conduct the following analyses:

1. Calculation of storm event mean concentrations (EMCs)
2. Estimation of annual constituent loading
3. Comparison of EMCs to Maryland Department of the Environment (MDE) ambient water quality criteria
4. Comparison of EMCs to Maryland National Pollutant Discharge Elimination System (NPDES) and National Urban Runoff Program (NURP) EMCs
5. Correlation between water quality data and benthic data
6. Spatial comparisons and temporal trend analysis of EMCs
7. Comparison of pollutant loads per acre to other local watersheds



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Harford County, Maryland

Figure 1. Location of Sampling Stations

2 November 2009

2.1 Land Use

The existing land use codes, land use categories and land use acreage for each station is presented in Table 1. The total drainage area for station 002 is 79.02 acres and the drainage area for station 001 is 169.09 acres (Figure 2).

Table 1. Land Use Code, Land Use Category and Land Use Acreage

Station[a]	Land Use Code	Land Use Category	Land Use	Land Use Acreage
002	12	Residential	Medium Density Residential	49.56
002	13	Residential	High Density Residential	15.27
002	18	Urban	Open Urban	14.19
001	11	Residential	Low Density Residential	35.11
001	12	Residential	Medium Density Residential	56.44
001	13	Residential	High Density Residential	36.96

[a] Station 002 is designated as the outfall and station 001 is designated as the instream.

2.2 Estimation of Runoff Coefficients

The runoff coefficient for the downstream station 001 was determined to be 0.31 empirically by a regression analysis between measured flow data and precipitation.

The runoff coefficient (Rv_i) is directly related to imperviousness and land use. The runoff coefficients for station 002 were estimated based on the impervious area within each zoning category. The land use code, impervious cover and calculated runoff coefficients for station 002 are listed in Table 2. Information regarding each zoning category was obtained from the County. The runoff coefficient for each zoning category was estimated using Equation 3 on page 5-16 of the "*Guidance Manual for the Preparation of Part 2 of the NPDES Permit Applications for Discharges from Municipal Separate Storm Sewer Systems*", 1992.

The following equation was used to estimate average runoff coefficients for percent imperviousness. Using this method, the runoff coefficient for 002 was estimated to be 0.29.

Equation 3

$$Rv_i = 0.05 + 0.009*I$$

Where: Rv_i = Runoff coefficient
I = Fraction of impervious area

Table 2. Land Use Code, Impervious Cover and Runoff Coefficient Station 002

Land Use Code	Land Use	Impervious Cover (%)	Runoff Coefficient (Rv_i)
11	Low Density Residential	14.3	0.1787
12	Medium Density Residential	27.8	0.3002
13	High Density Residential	40.9	0.4181
18	Open Urban	8.6	0.1274

2.3 Precipitation

A rain gauge is located at the 001 instream station and the rainfall measurements are recorded by the SIGMA. During periods where the SIGMA was not recording data, precipitation data from the USGS rain gage in Winters Run Basin at Fallston, MD http://waterdata.usgs.gov/md/nwis/uv?cb_00045=on&format=html&period=1&site_no=393126076244301 was substituted. The daily rainfall totals for 2009 are presented in Table 3. The total rainfall measured for the year 2009 was 50 inches. The highest rainfall total of 6.49 inches was measured in the month September. The monthly rainfall totals for 1998-2008 are presented in Appendix A.

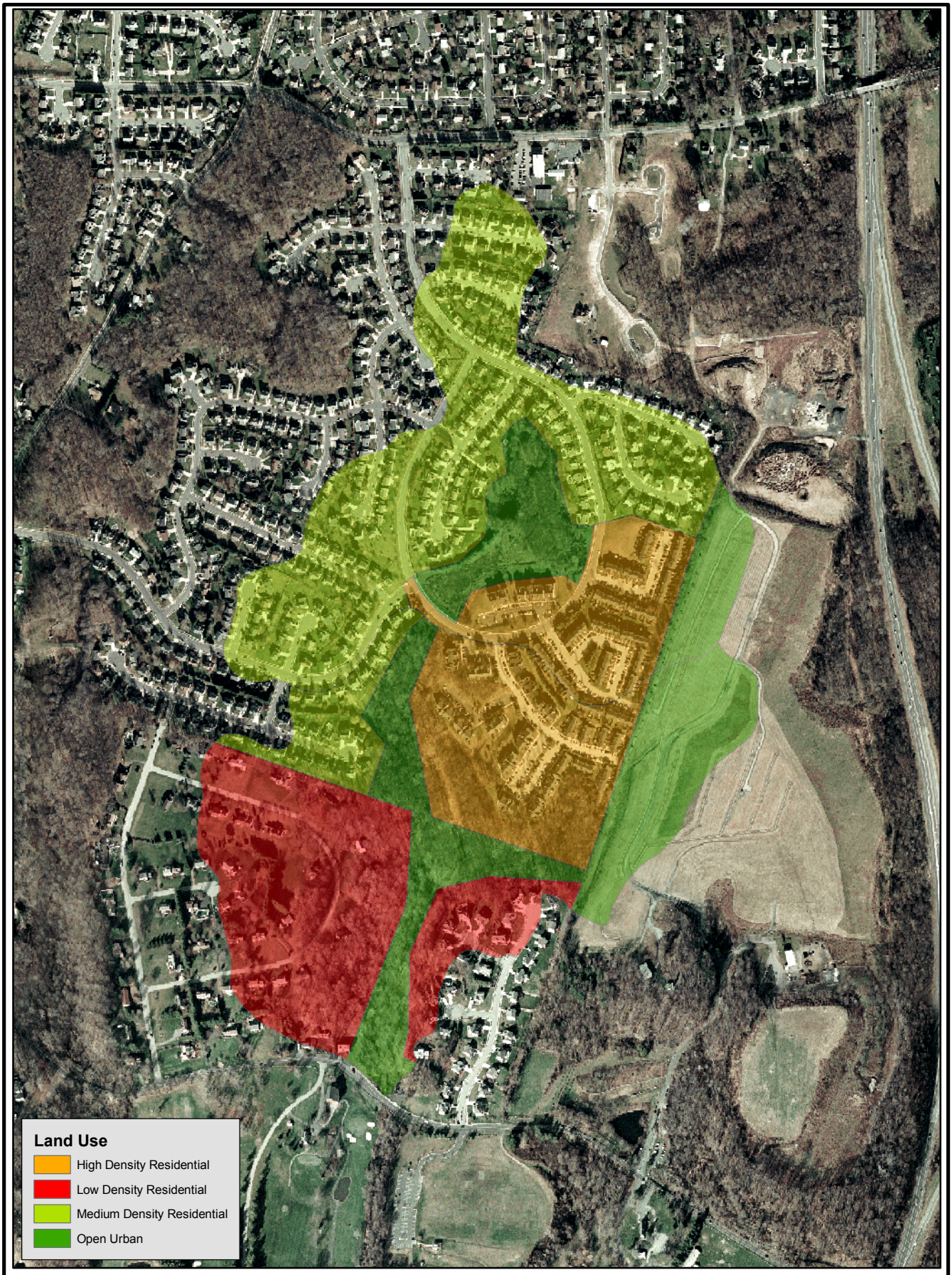

Figure 2 - Ambient Station Drainage Area

0 200 400 800 Feet

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Harford County, Maryland

27 October 2008

Table 3. 2009 Daily Rainfall Totals (inches)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.00	0.12	0.13	0.04	0.25	0.00	0.71	0.00	0.00	0.00	0.27	0.00
2	0.00	0.00	0.00	0.06	0.06	0.00	0.00	1.04	0.00	0.02	0.01	0.84
3	0.00	0.08	0.00	1.98	0.63	0.68	0.00	0.00	0.00	0.00	0.00	0.68
4	0.00	0.01	0.29	0.00	0.99	0.46	0.00	0.01	0.00	0.00	0.00	0.00
5	0.02	0.00	0.00	0.00	0.38	0.83	0.00	0.00	0.00	0.00	0.03	0.07
6	0.04	0.00	0.00	0.13	0.30	0.00	0.00	0.07	0.00	0.01	0.00	0.04
7	1.02	0.00	0.00	0.00	1.04	0.00	0.00	0.00	0.00	0.02	0.00	0.21
8	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18
9	0.00	0.00	0.00	0.00	0.04	0.82	0.00	0.03	0.01	0.07	0.00	1.79
10	0.06	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.01	0.04	0.00	0.00
11	0.08	0.07	0.00	0.41	0.01	0.01	0.00	0.11	4.00	0.00	0.44	0.00
12	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.24	0.00	0.00	0.39	0.00
13	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.75
14	0.00	0.02	0.03	0.37	0.27	0.01	0.00	0.00	0.00	0.00	0.06	0.00
15	0.00	0.00	0.14	0.69	0.00	0.03	0.00	0.00	0.00	0.16	0.00	0.00
16	0.00	0.00	0.10	0.00	0.04	0.00	0.00	0.00	0.13	0.00	0.00	0.00
17	0.00	0.00	0.04	0.00	0.15	0.18	0.09	0.00	0.11	0.34	0.00	0.00
18	0.00	0.22	0.01	0.00	0.00	0.83	0.00	0.50	0.00	0.14	0.00	0.00
19	0.00	0.01	0.12	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.47	0.00
20	0.08	0.00	0.00	1.38	0.00	0.76	0.00	0.00	0.00	0.00	0.28	0.00
21	0.00	0.00	0.00	0.40	0.00	0.00	0.00	0.91	0.00	0.00	0.00	0.09
22	0.00	0.04	0.00	0.04	0.00	0.00	0.00	0.93	0.00	0.00	0.00	0.06
23	0.00	0.00	0.00	0.00	0.00	0.00	0.32	0.00	0.43	0.17	0.20	0.03
24	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.07	0.85	0.84	0.02
25	0.00	0.00	0.00	0.00	0.12	0.00	0.17	0.00	0.05	0.00	0.23	0.02
26	0.00	0.00	0.43	0.00	0.46	0.00	1.14	0.00	0.77	0.00	0.00	0.00
27	0.00	0.06	0.03	0.00	0.02	0.00	0.01	0.00	0.66	0.99	0.04	0.00
28	0.07	0.00	0.42	0.00	0.13	0.00	0.08	1.89	0.25	1.16	0.00	0.00
29	0.32	-----	0.21	0.07	0.42	0.00	0.09	0.02	0.00	0.00	0.00	0.00
30	0.19	-----	0.00	0.00	0.01	1.46	0.00	0.00	0.00	0.02	0.20	0.00
31	0.02	-----	0.00	-----	0.06	-----	0.72	0.00	-----	0.07	-----	0.00
	1.91	0.63	1.95	5.72	5.38	6.31	3.46	5.76	6.49	4.06	3.84	4.78

Note: Missing precipitation data from the rain gauge located at the outfall station was retrieved from the USGS rain gauge Winters Run Basin at Fallston, MD.

Annual Rainfall = 50 inches

2.4 Event Mean Concentration

The continuous flow data and water quality data were used to estimate an event mean concentration (EMC) for each parameter during each baseflow and stormflow event in the year 2009 at stations 002 and 001. The EMCs were based on storm water samples collected during the rising limb, the peak, and the falling limb of the storm. Water quality data was evaluated using three substitution methods for results below the detection limit (DL): (1) zero, (2) one-half of the DL, and (3) the DL. The EMC for each parameter was estimated using the formula below:

$$EMC = \frac{\sum C_i \times V_i}{\sum V_i}$$

$$V_i = \sum_{t-I/2}^{t+I/2} Q_t \Delta t$$

where:

- EMC = event mean concentration
- C_i = concentration of the ith sample in the storm
- V_i = storm flow volume associated with the ith sample in the storm
- Q_t = the volume flow rate at time t
- Δt = the interval between flow measurements (typically 5-minutes for site 001)
- I = the time interval between consecutive samples

2.5 Pollutant Loads

The method used to determine the pollutant loading for each station is based on the Simple Method (Schueler, 1987). The Simple Method is given by the following equation:

$$L_i = 1/12*P*Pj*Rv_i*C_i*A_i*U$$

Where:

- L_i = Annual pollutant load (lbs/outfall/yr)
- P = Annual precipitation (in/yr)
- Pj = Proportion storms where runoff occurs
- Rv_i = Weighted Runoff coefficient for the area served by the outfall
- C_i = Event Mean Concentration of pollutant (mg/L) or (MPN/100 mL)
- A_i = Catchment area (acres)
- 1/12 = Conversion factor
- U = Unit conversion factor: U = 2.72 for chemical constituents in mg/L;
- U = 12,334,818 for bacteria in MPN/100 mL.

The parameter Pj was determined by calculating the proportion of storms that produced runoff for the period between 1998 through 2006. The Pj value used to calculate the pollutant loads for the data was found to be 0.95.

The continuous streamflow and water-quality data from the upstream location were used to estimate the loads. Annual and seasonal pollutant loads were calculated based on data using zero for concentrations less than the detection limit (DL) (nd=0), and half of the DL for concentrations less than the DL (nd=1/2DL). Loading rates and yields were also determined.

3. RESULTS AND DATA ANALYSIS

3.1 Event Mean Concentrations and Pollutant Loads

The annual EMCs for the baseflow and stormflow sampling events from each station are graphed in Figures 3 through 6. The estimated EMCs of each parameter during each baseflow and stormflow event in the year 2009 at stations 002 and 001 are presented in Tables B-1 through B-4 located in Appendix B. Monthly EMCs for the year 2009 are presented in Tables B-5 and B-6. The estimated pollutant loads are presented in Tables B-7 through B-10 located in Appendix B.

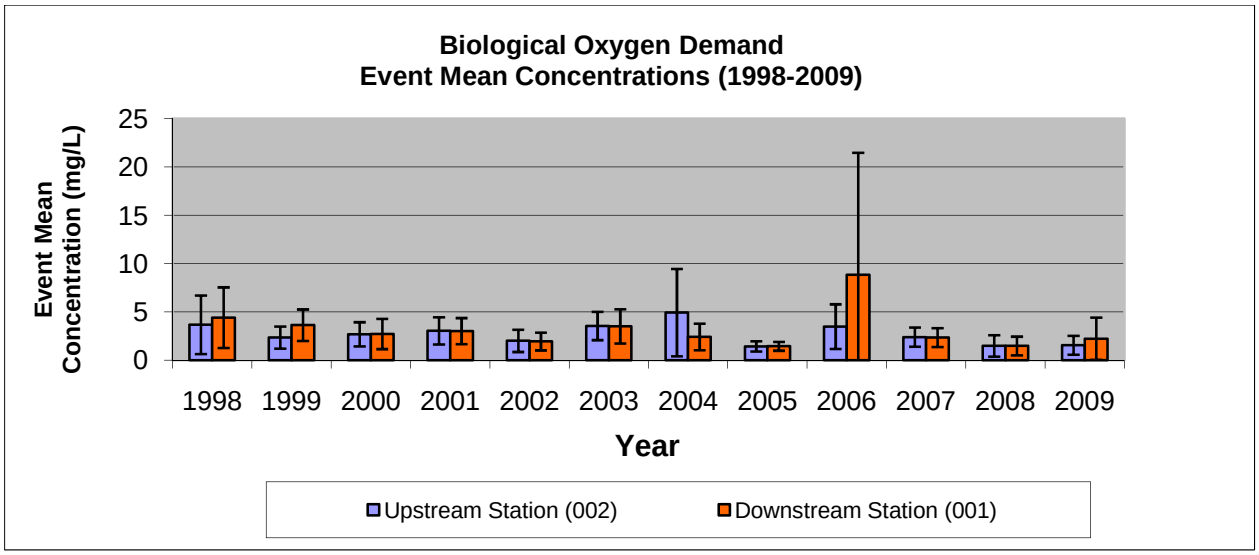
3.2 Comparison of Water Quality Data to Ambient Water Quality Criteria

The EMCs of copper, lead, and zinc baseflow and stormflow samples for stations 002 and 001 were compared to the Maryland Department of the Environment (MDE) acute and chronic freshwater water quality criteria for ambient surface waters listed in Table 4. The data for the year 2009 is presented in Figure 7 and the comprehensive data for the years 1998-2009 is presented in Figures 8 through 11. The EMCs compared were calculated using one half of the detection limit (DL) for concentrations less than the DL. The comprehensive data indicate that during stormflow conditions the estimated EMCs of total cooper concentrations are higher than the MDE acute and chronic ambient surface water quality criteria. During baseflow and stormflow conditions, lead EMCs are observed above the MDE chronic criteria. This is due to the amount of non-detected lead concentrations and the detection limit being measured above the criterion. Concentrations of *E. coli* frequently exceed the criterion of the single sample maximum of 298 cfu/mL and the average EMC at both stations 001 and 002 exceeded the steady-state criterion of 126 cfu/100mL for moderate full body contact recreation (MDE, 2003).

Table 4. Maryland Freshwater Water Quality Criteria for Ambient Surface Waters (mg/L)

Parameter Name	Acute Criteria	Chronic Criteria
Total Copper	0.013	0.009
Total Lead	0.065	0.0025
Total Zinc	0.12	0.12
E. coli (MDE, 2003)	298 cfu/100 mL	126 cfu/100 mL

Code of Maryland Regulations, 26.08.02, Water Quality. Maryland Department of the Environment, Baltimore, Maryland



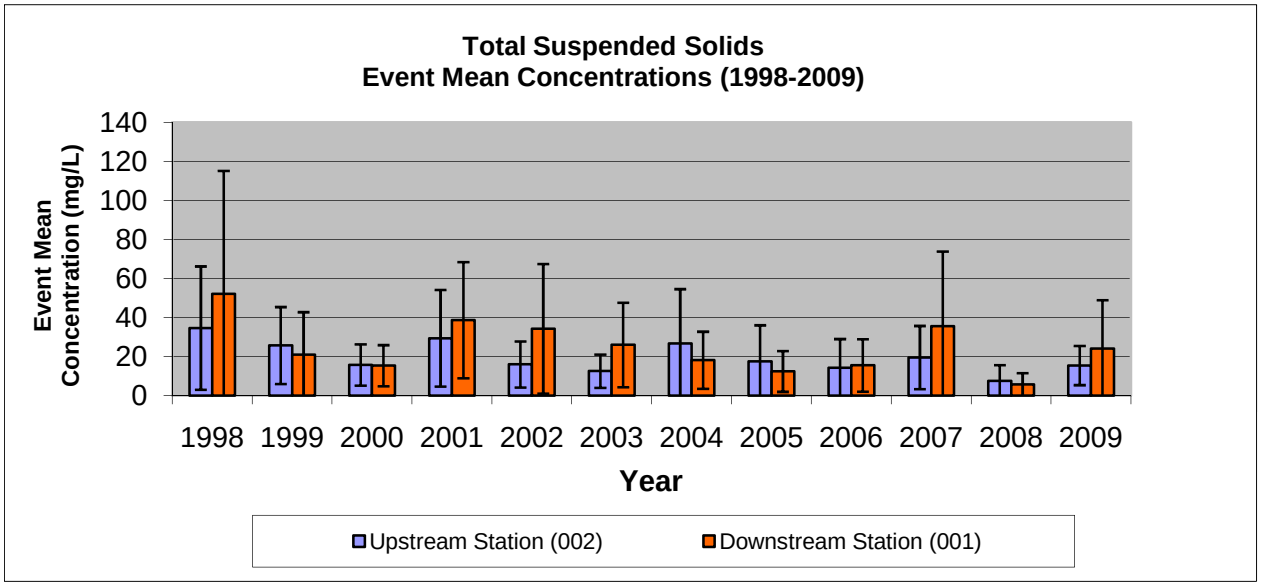
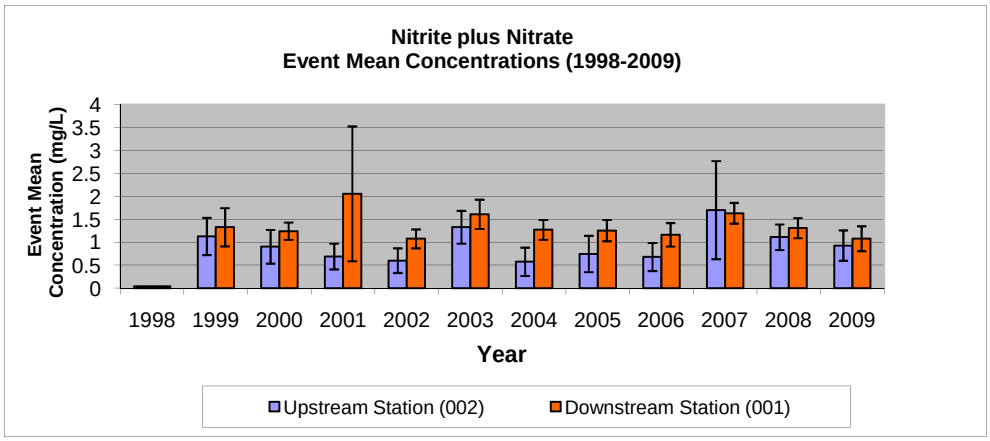
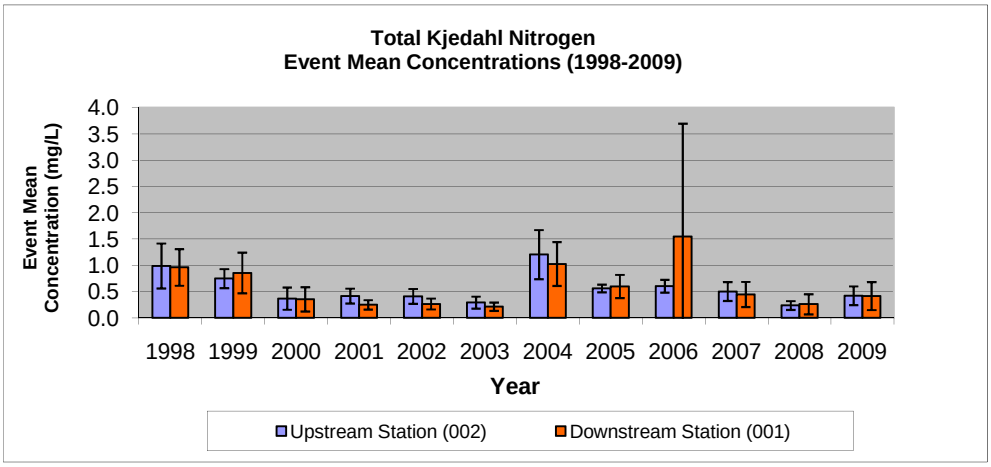


Figure 3. 1998 - 2009 Event Mean Concentrations (EMCs) of biological oxygen demand (BOD5) and total suspended solids (TSS) baseflow and stormflow data. The upstream station (outfall) is a tributary to Winters Run at Brentwood Park Drive, and the downstream station (instream) is a tributary to Winters Run at Tollgate Road. The EMCs were calculated based on analysis results of discrete samples collected from baseflow and stormflow sampling events between April 1998 and December 2009. Data presented is one half of the detection limit (DL) for concentrations less than the DL. The error bars represent the 95% confidence intervals.





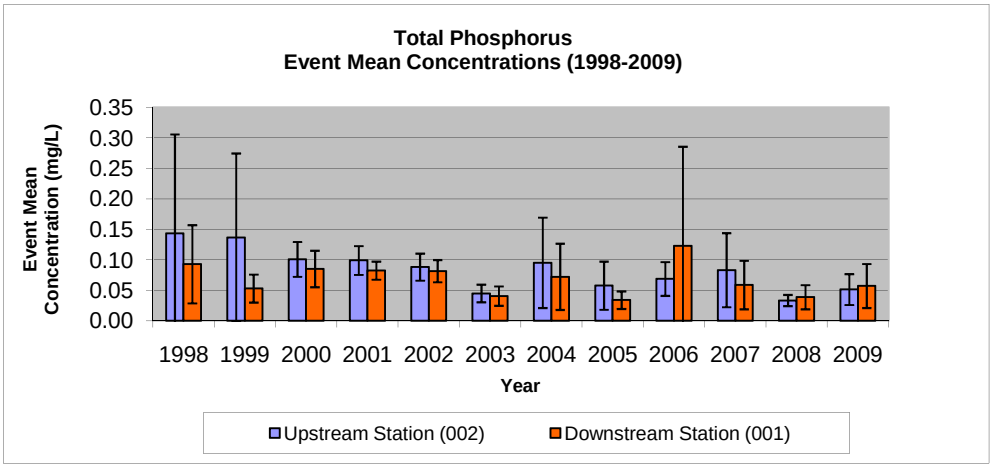
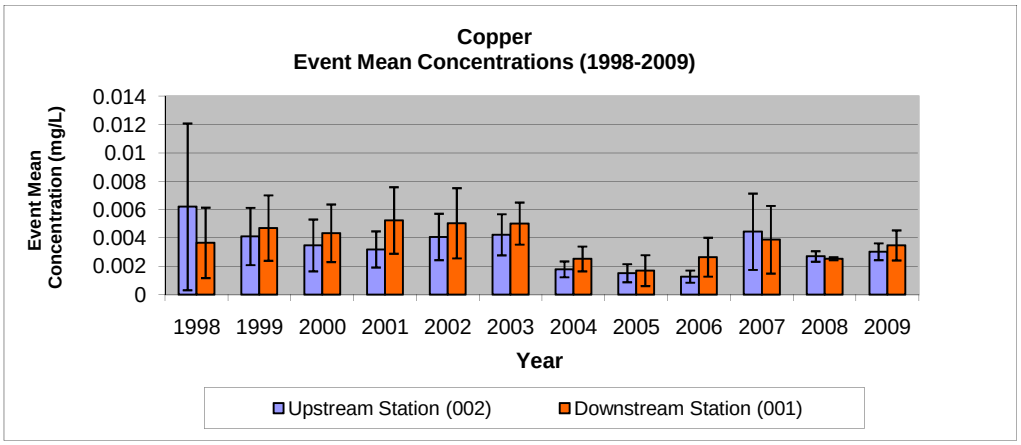
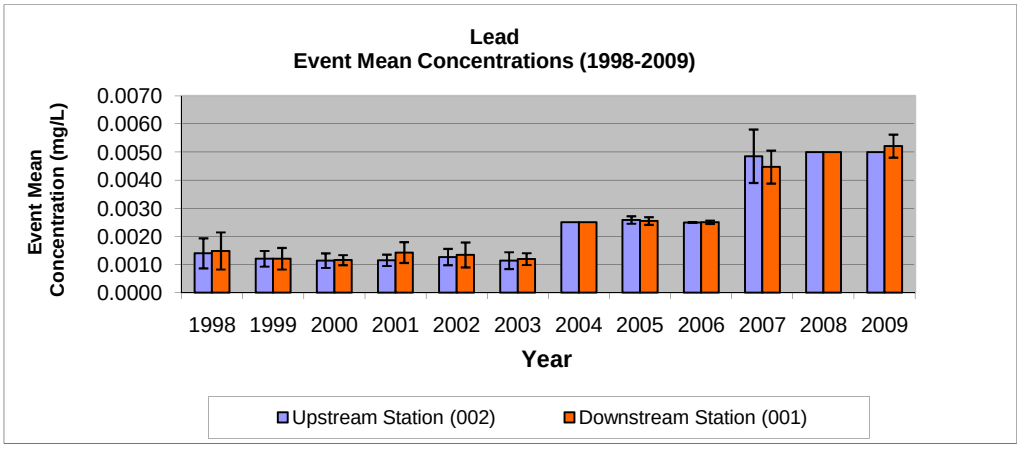


Figure 4. 1998 - 2009 Event Mean Concentrations (EMCs) of nitrite plus nitrate (NO2NO3), total kjeldahl nitrogen (TKN) and total phosphorus baseflow and stormflow data. The upstream station (outfall) is a tributary to Winters Run at Brentwood Park Drive, and the downstream station (instream) is a tributary to Winters Run at Tollgate Road. The EMCs were calculated based on analysis results of discrete samples collected from baseflow and stormflow sampling events between April 1998 and December 2009. Data presented is one half of the detection limit (DL) for concentrations less than the DL. The error bars represent the 95% confidence intervals.





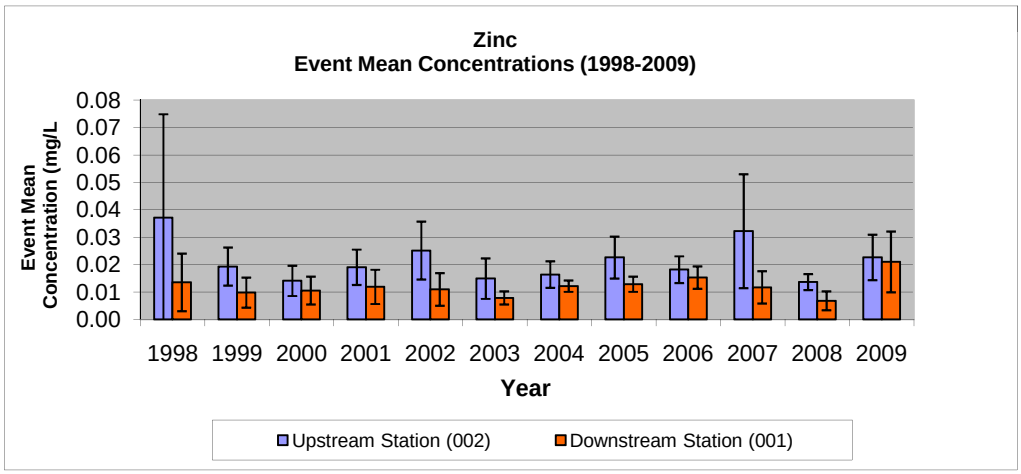
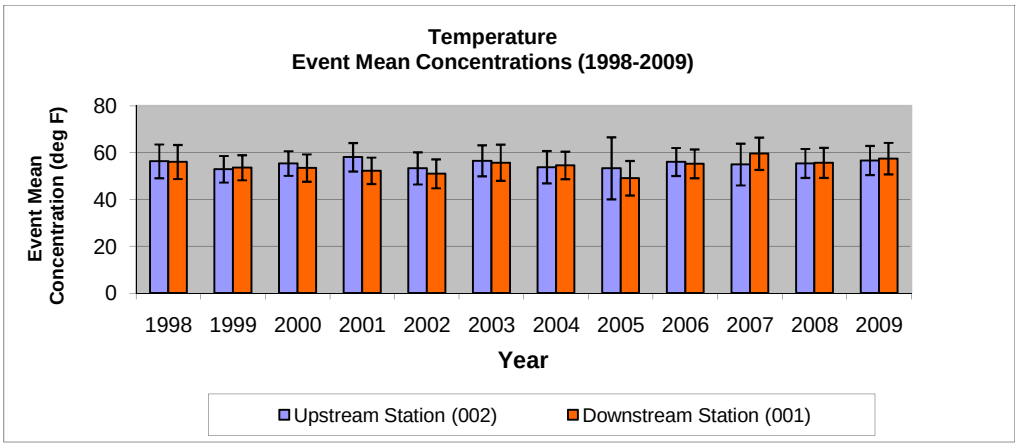
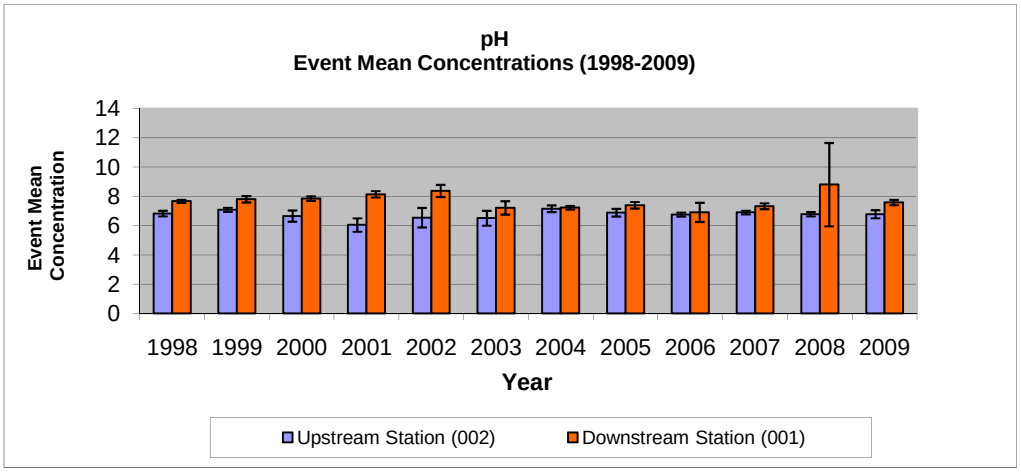


Figure 5. 1998 - 2009 Event Mean Concentrations (EMCs) of copper (Cu), lead (Pb) and zinc (Zn) baseflow and stormflow data. The upstream station (outfall) is a tributary to Winters Run at Brentwood Park Drive, and the downstream station (instream) is a tributary to Winters Run at Tollgate Road. The EMCs were calculated based on analysis results of discrete samples collected from baseflow and stormflow sampling events between April 1998 and December 2009. Data presented is one half of the detection limit (DL) for concentrations less than the DL. The error bars represent the 95% confidence intervals.





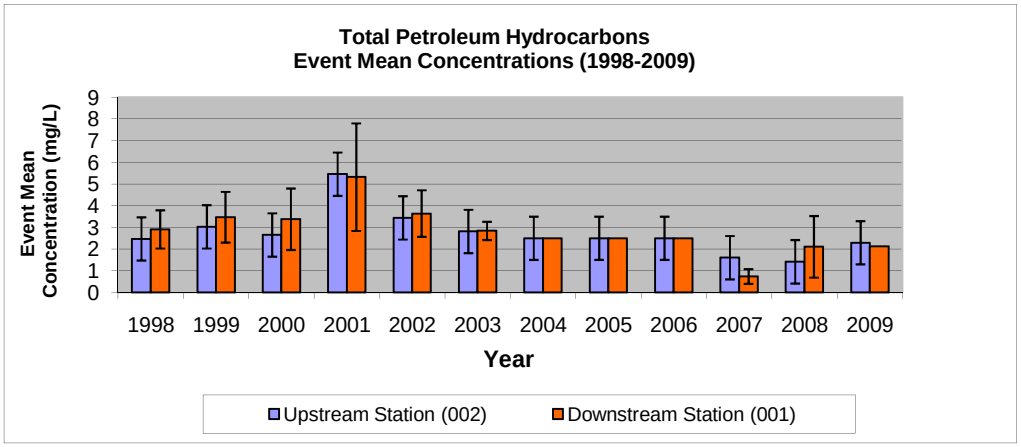
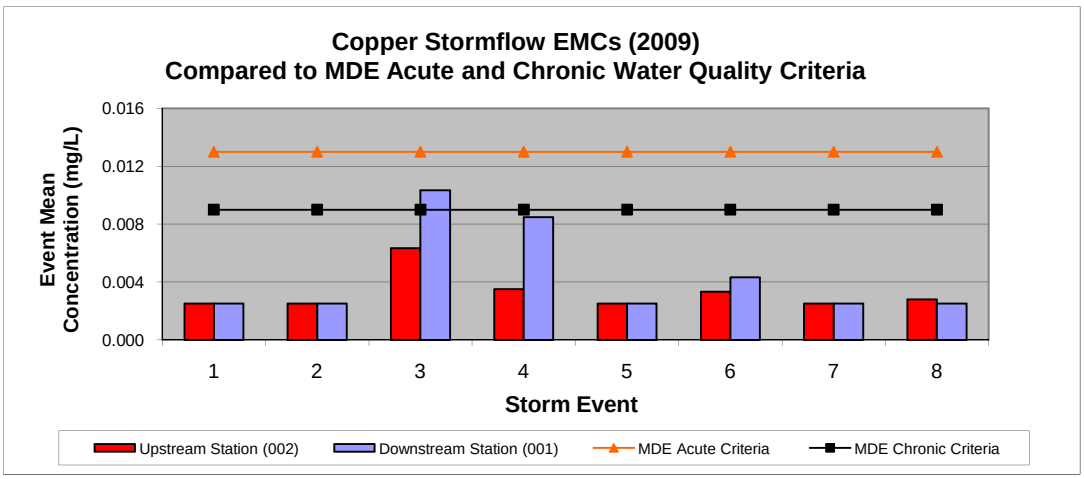
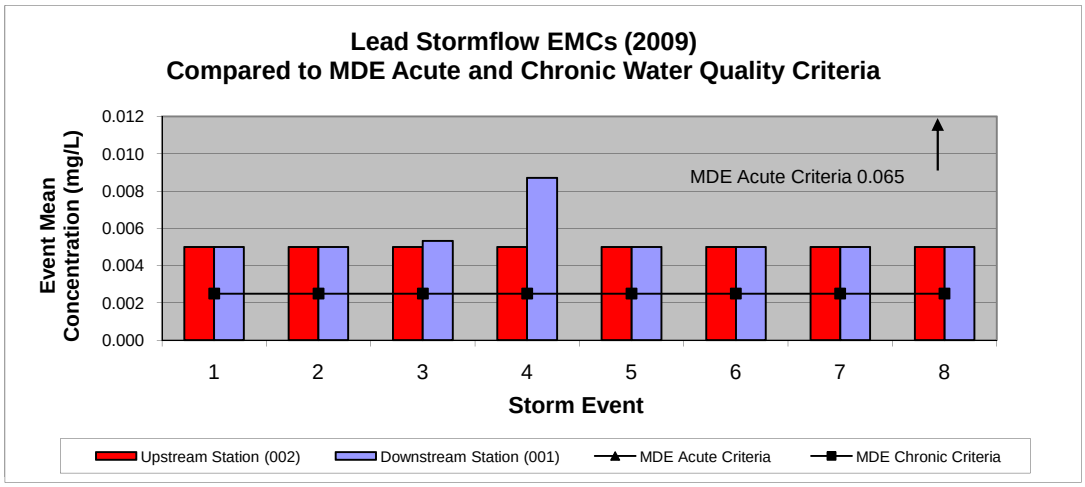


Figure 6. 1998 - 2009 Event Mean Concentrations (EMCs) of temperature, pH and total petroleum hydrocarbons (TPH) baseflow and stormflow data. The upstream station (outfall) is a tributary to Winters Run at Brentwood Park Drive, and the downstream station (instream) is a tributary to Winters Run at Tollgate Road. The EMCs were calculated based on analysis results of discrete samples collected from baseflow and stormflow sampling events between April 1998 and December 2009. The error bars represent the 95% confidence intervals.





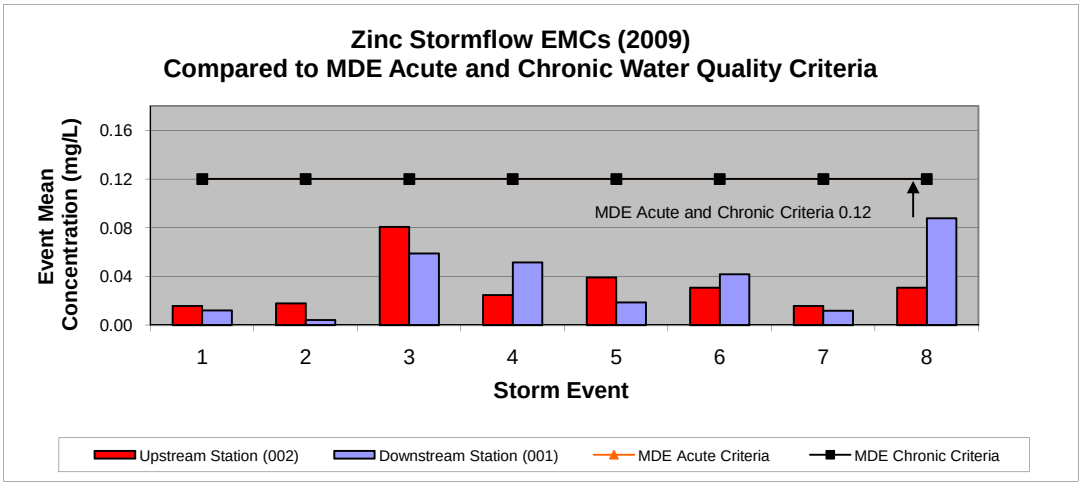
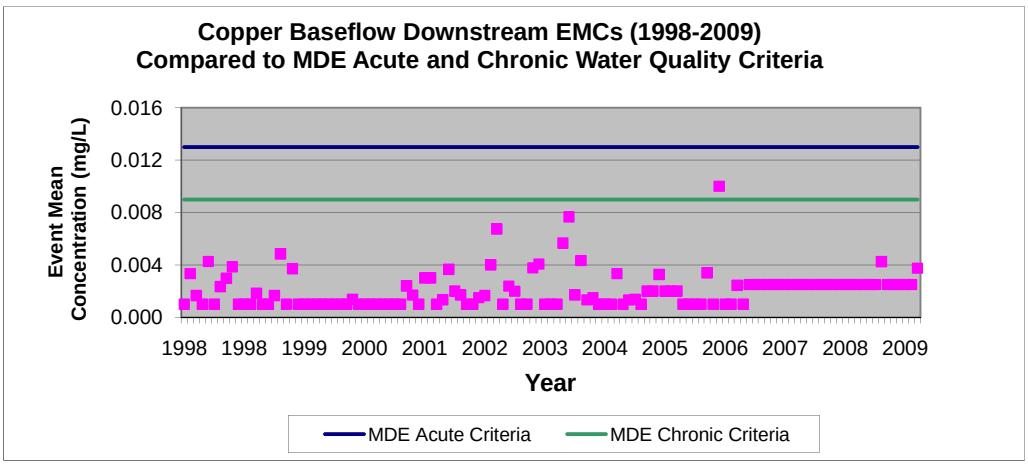
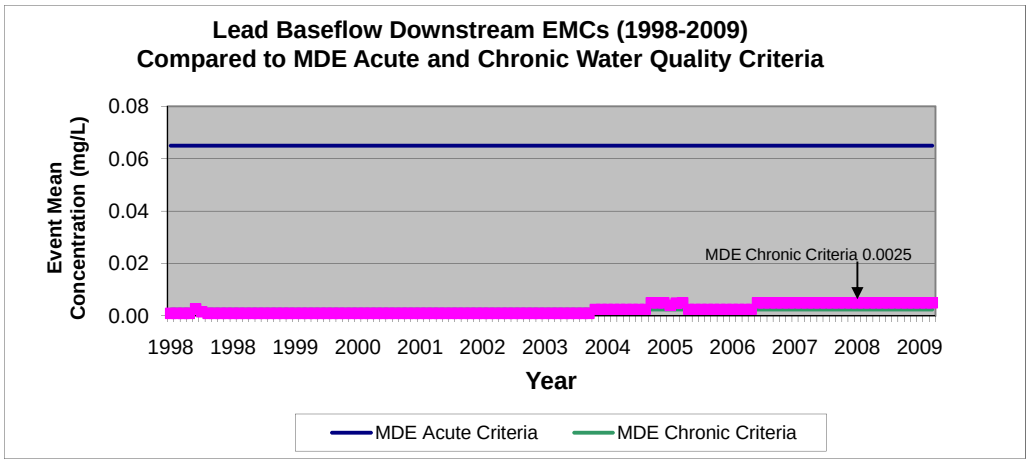


Figure 7. 2009 Event Mean Concentrations (EMCs) of copper (Cu) , lead (Pb) and zinc (Zn) stormflow data from the upstream (outfall) and downstream station (instream) compared against the Maryland Department of the Environment (MDE) acute and chronic freshwater water quality criteria for ambient surface waters. Data presented is on half of the detection limit (DL) for concentrations less than the DL.





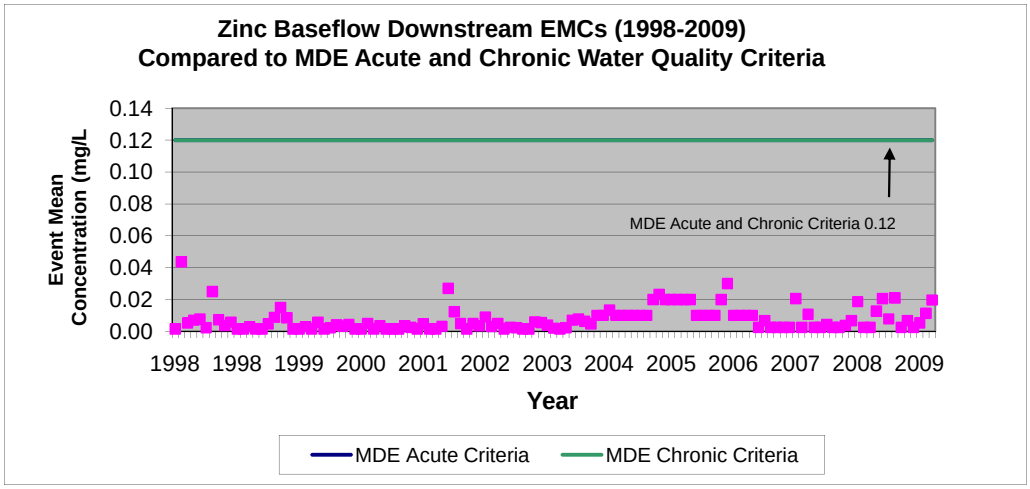
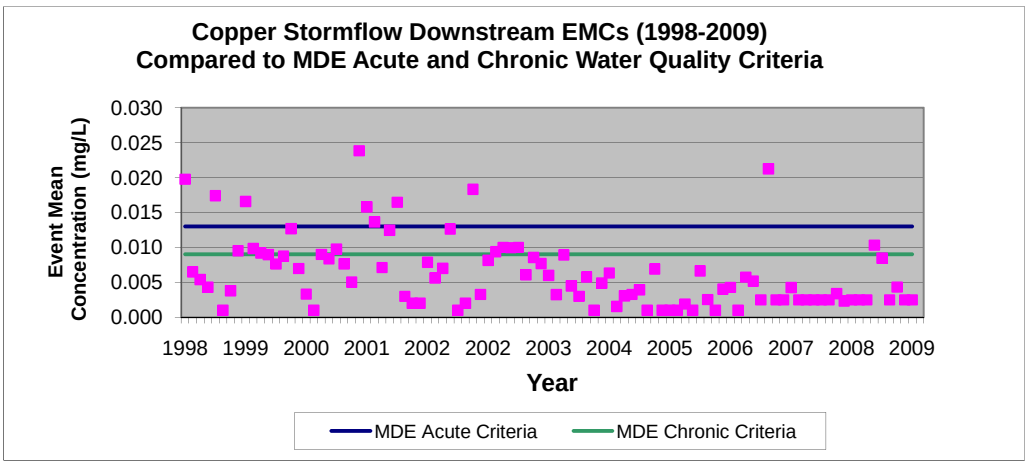
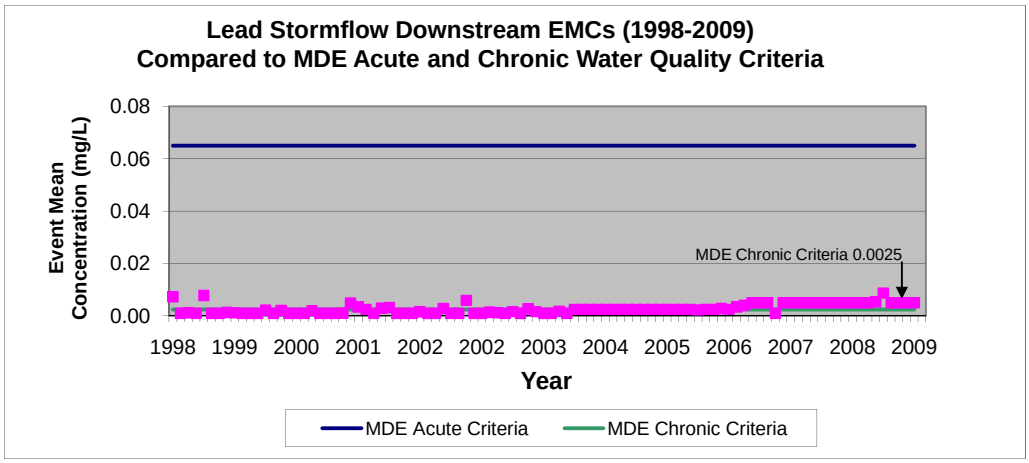


Figure 8. 1998 - 2009 Event Mean Concentrations (EMCs) of copper (Cu) , lead (Pb) and zinc (Zn) baseflow data from the downstream station (instream) compared against the Maryland Department of the Environment (MDE) acute and chronic freshwater water quality criteria for ambient surface waters. Data presented is on half of the detection limit (DL) for concentrations less than the DL.





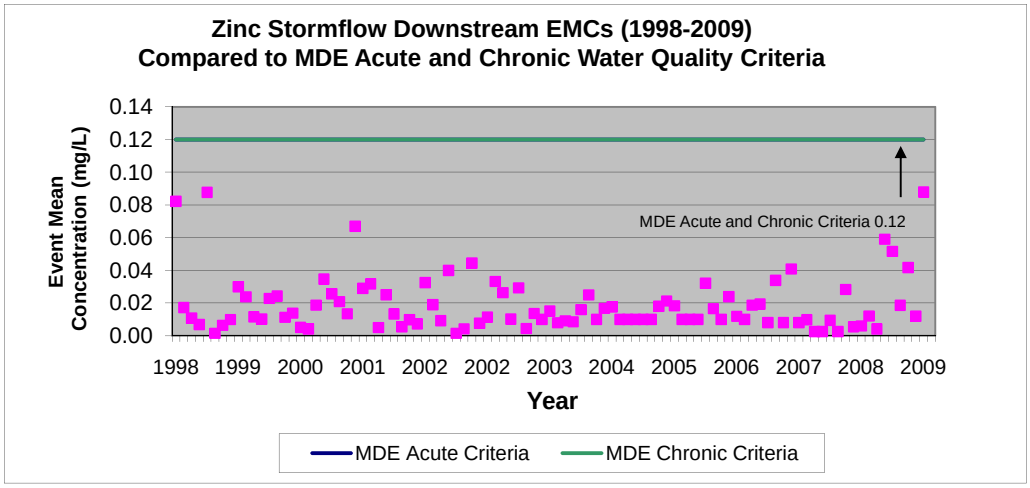
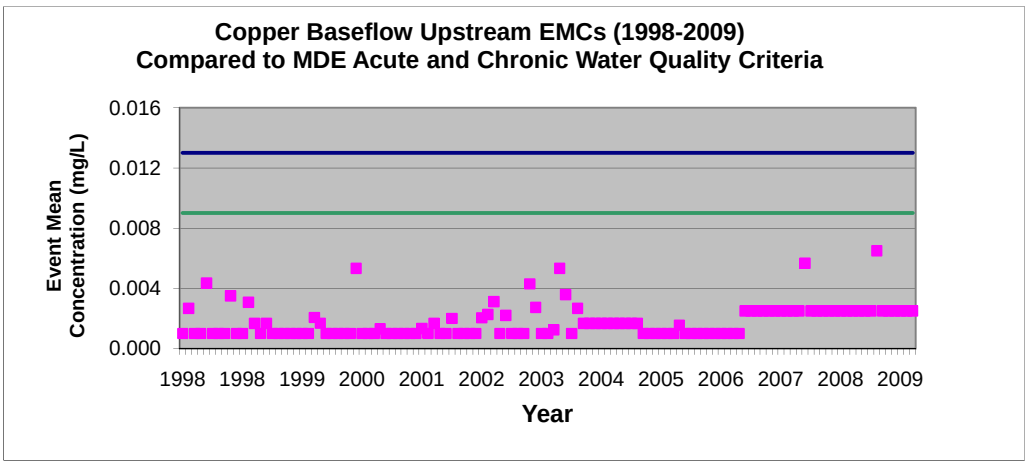
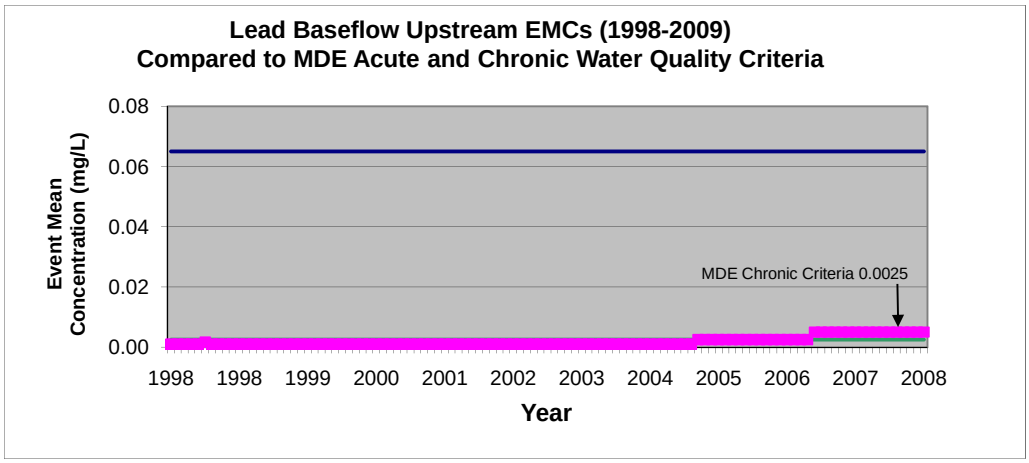


Figure 9. 1998 - 2009 Event Mean Concentrations (EMCs) of copper (Cu) , lead (Pb) and zinc (Zn) stormflow data from the downstream station (instream) compared against the Maryland Department of the Environment (MDE) acute and chronic freshwater water quality criteria for ambient surface waters. Data presented is on half of the detection limit (DL) for concentrations less than the DL.





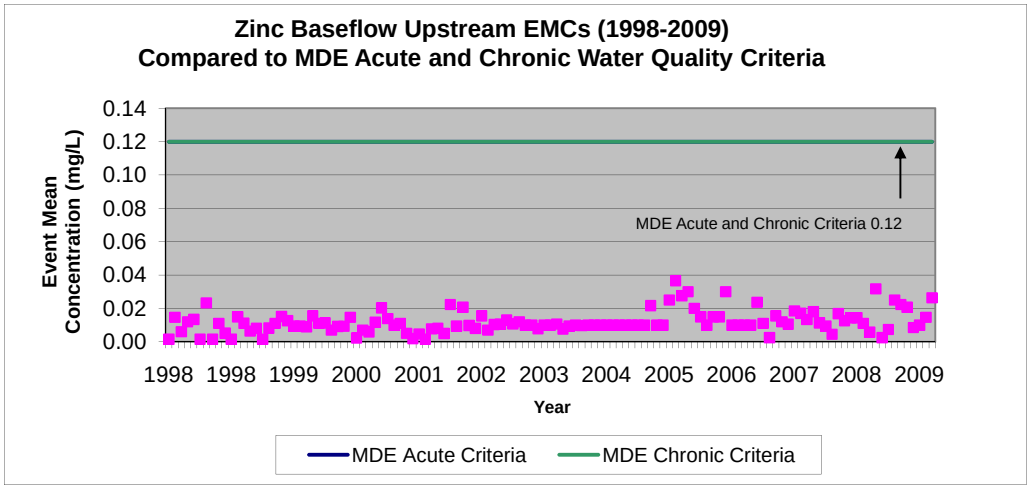
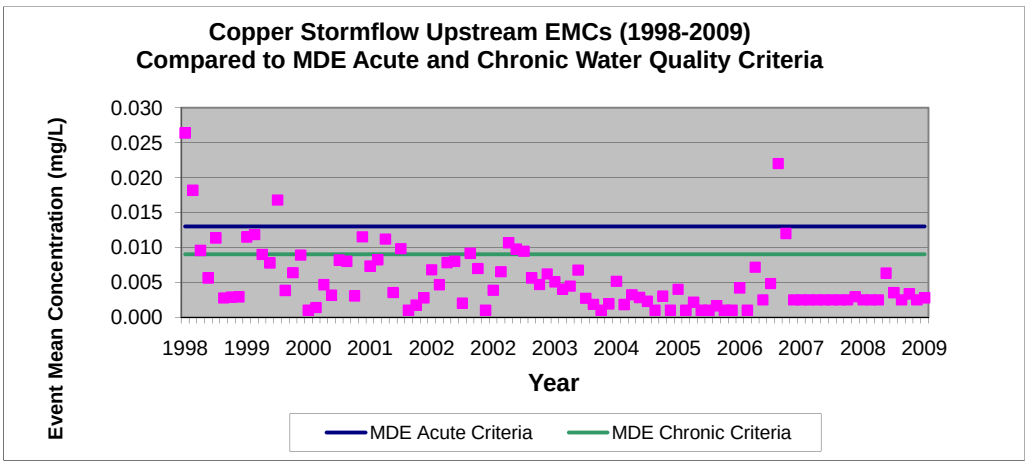
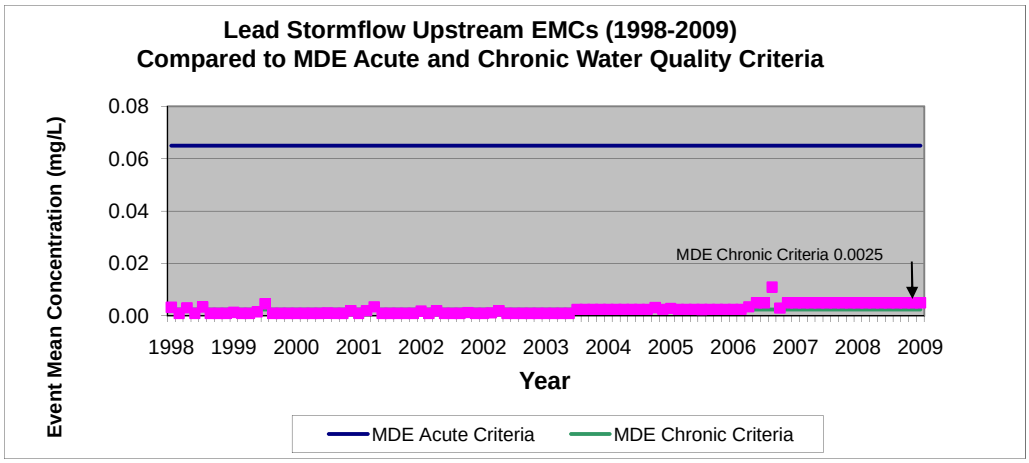


Figure 10. 1998 - 2009 Event Mean Concentrations (EMCs) of copper (Cu) , lead (Pb) and zinc (Zn) baseflow data from the upstream station (outfall) compared against the Maryland Department of the Environment (MDE) acute and chronic freshwater water quality criteria for ambient surface waters. Data presented is on half of the detection limit (DL) for concentrations less than the DL.





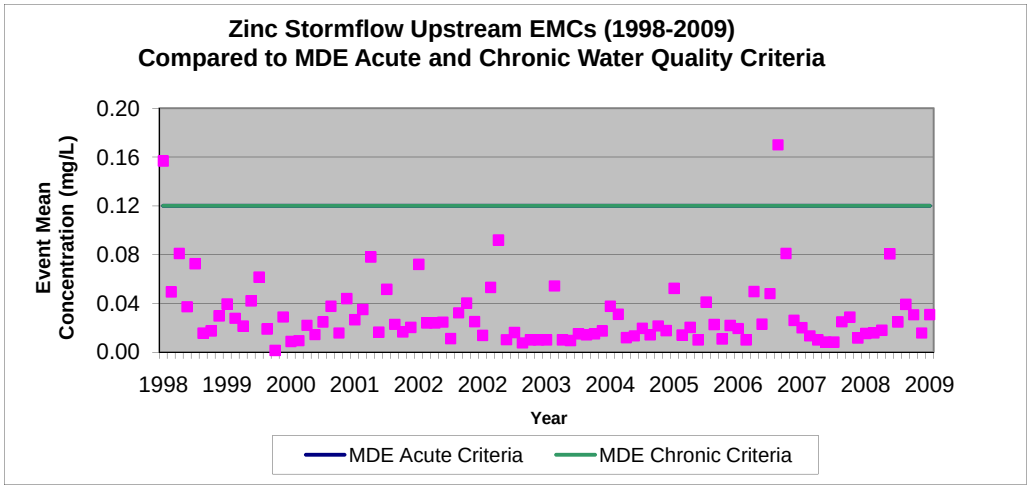


Figure 11. 1998 - 2009 Event Mean Concentrations (EMCs) of copper (Cu) , lead (Pb) and zinc (Zn) stormflow data from the upstream station (outfall) compared against the Maryland Department of the Environment (MDE) acute and chronic freshwater water quality criteria for ambient surface waters. Data presented is on half of the detection limit (DL) for concentrations less than the DL.

3.3 Comparison of EMCs with Maryland National Pollutant Discharge Elimination System (NPDES) and Nationwide Urban Runoff Program (NURP)

Average yearly EMCs for stations 002 and 001 were compared to EMCs from Maryland's NPDES stormwater monitoring program and NURP (EPA, 1983). The average yearly EMCs were calculated from data using zero for concentrations less than the detection limit (DL). The NPDES EMC information was derived from the Maryland's NPDES Municipal Stormwater Monitoring, Maryland Department of the Environment (MDE), Water Management Administration, 1997 (Table 7, pg. 16). The 2009 data is presented in Table 5 and the comprehensive data from 1998-2009 is presented in Table B-11 located in Appendix B. As in previous years, nitrate plus nitrite EMCs have been observed at concentrations slightly higher that the Maryland NPDES and NURP EMCs at station 001.

Table 5. Comparison of 2009 Event Mean Concentrations (EMCs) with Maryland NPDES EMCs and NURP Residential EMCs

Parameter	Average Yearly EMC (mg/L)	Maryland NPDES EMCs (mg/L)	NURP Residential EMCs (mg/L)
Upstream Station (Outfall)			
Biological Oxygen Demand	1.16	14.26	11
Total Suspended Solids	15.25	55.08	140
Nitrate plus Nitrite	0.92	0.97	0.96
Total Kjeldahl Nitrogen	0.39	1.75	2.35
Total Phosphorus	0.03	0.37	0.47
Total Petroleum Hydrocarbons	1.90	--	--
Total Copper	0.0009	0.0141	0.05
Total Lead	0.0000	0.0057	0.18
Total Zinc	0.0225	0.0893	0.18
E. coli (MPN/mL)	856	--	--
Downstream Station (Instream)			
Biological Oxygen Demand	1.85	14.26	11
Total Suspended Solids	23.79	55.08	140
Nitrate plus Nitrite	**1.08**	**0.97**	**0.96**
Total Kjeldahl Nitrogen	0.37	1.75	2.35
Total Phosphorus	0.04	0.37	0.47
Total Petroleum Hydrocarbons	1.70	--	--
Total Copper	0.0013	0.0141	0.05
Total Lead	0.0004	0.0057	0.18
Total Zinc	0.0204	0.0893	0.18
E. coli (MPN/mL)	655	--	--

Note: Bold values represent exceedences.
[a]Total lead was not detected.

3.4 Correlation between Water Quality Constituents and the Benthic Community

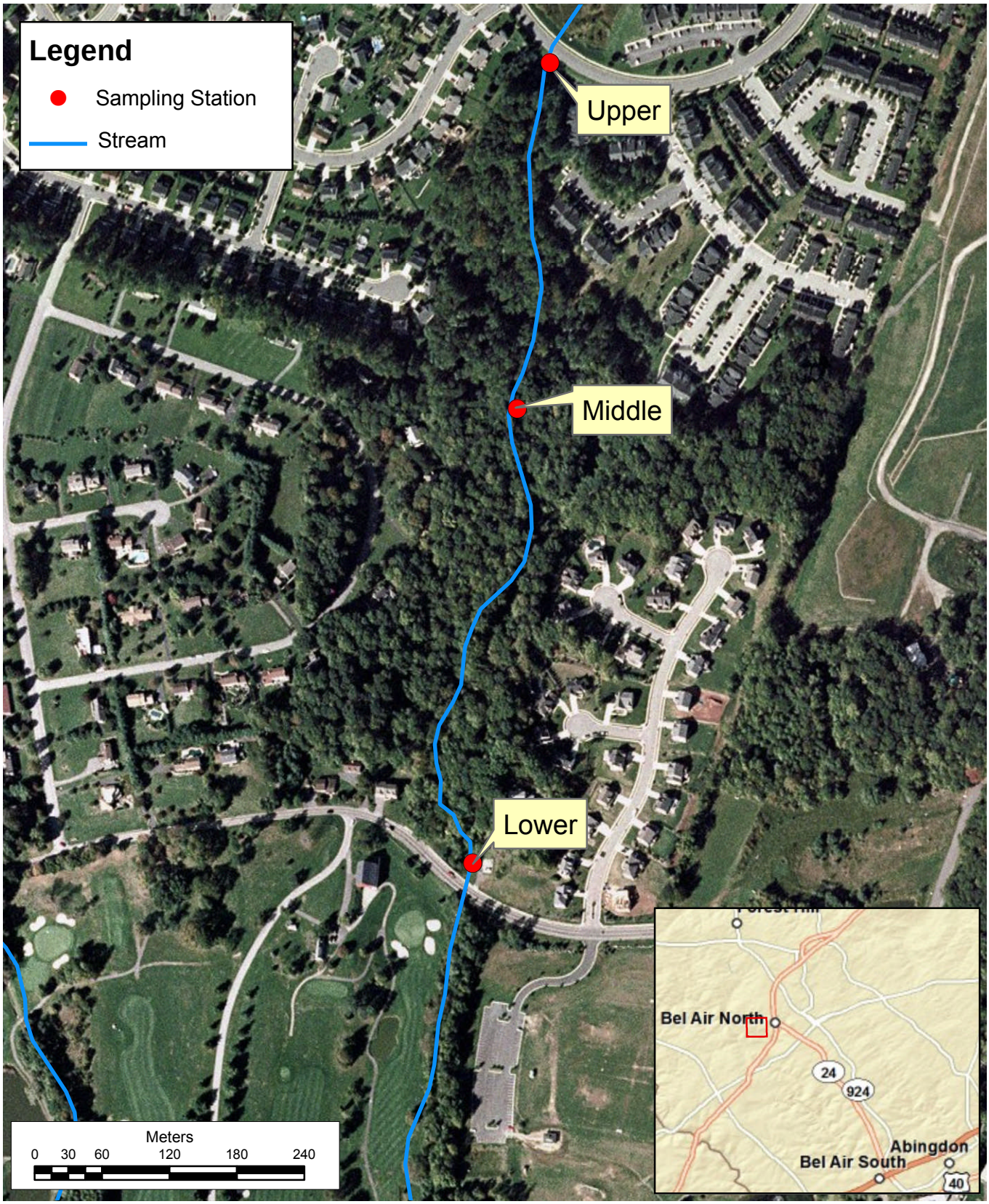
Since 1998, Harford County DPW has been monitoring the benthic condition of the unnamed tributary at three stations presented in Figure 12. The association between water quality and the condition of the benthic community was investigated by computing Pearson product-moment correlations coefficients between the water quality parameters, and values of the Maryland Benthic Index of Biotic Integrity (B-IBI) and Hilsenhoff Biotic Index (HBI). The B-IBI and HBI scores were obtained from EA (2009), and were paired with mean water quality data by year and season.

The results of the Pearson product-moment correlation coefficient's between water quality and benthic condition are presented in Table 6. None of the correlation coefficients exceeded the critical value at the 95% significance level, which is not surprising since benthic communities tend to reflect average water quality conditions.

Table 6. Pearson Product-Moment Correlation Coefficients between Water Quality Parameters and Benthic Condition Metrics

Parameter	Station	B-IBI	HBI
BOD5	001	-0.23	0.30
	002	-0.07	-0.02
Cu	001	0.26	-0.45
	002	-0.07	-0.24
E. coli	001	-0.78	-0.26
	002	-0.04	0.45
Nitrate+Nitrite	001	0.31	-0.15
	002	-0.33	-0.04
Pb	001	0.20	-0.25
	002	0.07	-0.12
Temperature	001	0.14	0.21
	002	0.04	0.14
TKN	001	-0.16	0.27
	002	0.16	-0.03
TN	001	0.11	0.08
	002	0.23	-0.29
TP	001	0.18	-0.18
	002	0.23	0.07
TPH	001	0.22	-0.24
	002	0.11	-0.07
TSS	001	-0.02	-0.10
	002	-0.08	-0.09
Zn	001	-0.23	0.30
	002	-0.07	-0.02

Note: None of the correlation coefficients exceed the critical value at the 95% significance level.



EA Engineering, Science, and Technology, Inc.

Harford County
Benthic Monitoring

Harford County, Maryland

N
W E
S

Figure 12.
Location of Benthic Monitoring Stations

2 November 2009

3.5 Comparisons between Station Locations and Trend Analysis

A variance component model was used to conduct spatial and temporal trend analysis of EMCs. The variance component model included fixed effect terms for the two sampling stations 002 and 001, seasonal cyclicality, and temporal trend. The model also included random effect terms attributed to sample year and residual sampling error. The variance component model is given by the following:

$$\mathrm{EMC} = \mathrm{B}_0 + \mathrm{B}_{\mathrm{YEAR}} \times \mathrm{YEAR} + \mathrm{B}_{\mathrm{SEASON}} + \mathrm{B}_{\mathrm{SITE}} + \mathrm{N}_{(0,\sigma_{\mathrm{YEAR}})} + \mathrm{N}_{(0,\sigma_{\mathrm{RESIDUAL}})}$$

where

$\mathrm{EMC} =$ event mean concentration

$\mathrm{YEAR} =$ calendar year of EMC

$\mathrm{B}_0 =$ model intercept

$\mathrm{B}_{\mathrm{YEAR}} =$ temporal trend

$$\mathrm{B}_{\mathrm{SEASON}} = \text{season effect} \begin{cases} \mathrm{B}_{\mathrm{WINTER}} & \text{if season} = \text{winter} \\ \mathrm{B}_{\mathrm{SPRING}} & \text{if season} = \text{spring} \\ \mathrm{B}_{\mathrm{SUMMER}} & \text{if season} = \text{summer} \\ \mathrm{B}_{\mathrm{FALL}} & \text{if season} = \text{fall} \end{cases}$$

$$\mathrm{B}_{\mathrm{SEASON}} = \text{season effect} \begin{cases} \mathrm{B}_{001} & \text{if site} = 001 \\ \mathrm{B}_{002} & \text{if site} = 002 \end{cases}$$

$\mathrm{N}_{(0,\sigma_{\mathrm{year}})} =$ random year effect, distributed normally with mean of 0 and variance of σ^2_{year}

$\mathrm{N}_{(0,\sigma_{\mathrm{residual}})} =$ residual error, distributed normally with mean of 0 and variance of $\sigma^2_{\mathrm{residual}}$

Once the model coefficients have been determined, the trend line was computed by zeroing the random effect components $\mathrm{N}_{(0,\sigma_{\mathrm{year}})}$ and $\mathrm{N}_{(0,\sigma_{\mathrm{residual}})}$. Significant trends were identified at the 95% significance level.

The results of the trend analysis are presented in Appendix C. The EMCs of biological oxygen demand, total suspended solids, total phosphorus, total copper, and total zinc that have declined since 1998 continue to stabilize at relatively low concentrations. Water quality EMCs tended to be higher in the spring/summer months, than in winter months. This is likely a combination of higher residential activities during spring/summer and due to the spring snow melt releasing material sequestered during the winter months. The summer peak in total phosphorus may be attributed to the relatively heavy use of fertilizers and frequent lawn mowing that result in grass clippings entering the stream during periods of runoff.

Between monitoring locations, station 002 had higher concentrations of total phosphorus and zinc. A likely source of the phosphorus is from grass clippings left in the grass buffer strips along Brentwood Park Drive. The most likely source of zinc is leachate from the

culvert. The relatively high concentrations of nitrate+nitrite at the downstream station 001 are indicative of the use of fertilizers containing inorganic nitrogen that, being completely soluble and highly mobile, is conveyed to the stream by stormwater runoff.

3.6 Comparison of Pollutant Loads with available NPS Data

To further assess the effects of nutrient pollutant loads, the annual loading yields (lbs/acre/yr) for total kjeldahl nitrogen (TKN); nitrate plus nitrite (NO_2NO_3) and total phosphorus were compared to nitrogen and phosphorus loading rates (lbs/acre) for selected watersheds in Maryland (Aberdeen Proving Ground, Bynum Run and Lower Winters Run). The information was downloaded from the website: http://www.dnr.state.md.us/bay/czm/nps/. The watershed restoration indicators show that a reduction in nutrient loading for nitrogen and total phosphorus is necessary in Bynum Run and Lower Winters Run. The Watershed profiles for Aberdeen Proving Ground, Bynum Run and Lower Winters Run are in Appendix D. The results of the watershed comparisons are presented in Figures 13 and 14.

4. SUMMARY AND CONCLUSION

Harford County Department of Public Works (DPW) has collected water quality data from baseflow and stormflow samples collected from two stations (001 and 002) on an unnamed tributary to Winters Run in Bel Air, Maryland during the years 1998 through 2009.

This report summarizes surface water quality data collected by Harford County Department of Public Works (DPW) from an unnamed stream to Winters Run in Harford County, Maryland in calendar year 2009. The water quality monitoring data was used to calculate event mean concentrations (EMCs) and seasonal and annual pollutant loads at the outfall and instream station.

The total suspended solids EMCs were some among the lowest on record since chemical monitoring began in 1998. This is most likely a result of random variation in the characteristics of the sampled storm events (e.g., total rainfall, rainfall intensity, duration of rainfall, and antecedent dry days), rather than any systematic watershed effects. Additionally, the biological oxygen demand, total phosphorus, total copper, and total zinc EMCs continue on a downward trend.

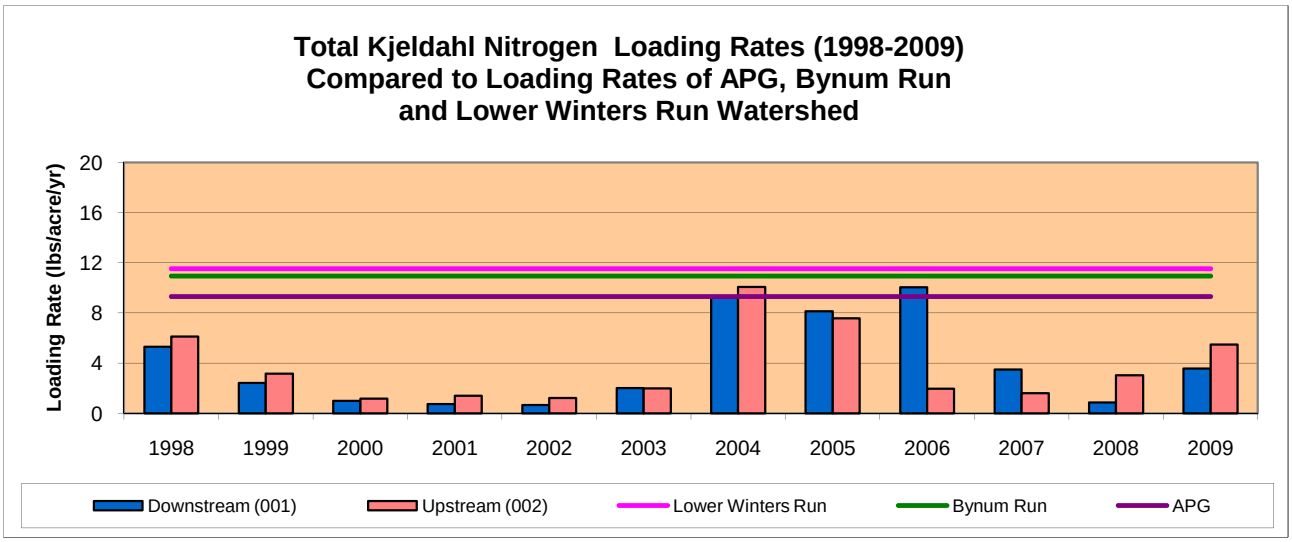
The average EMCs of the copper, lead and zinc were compared to the MDE acute and chronic ambient surface water criteria. Copper concentrations measured during the stormflow events have been above the acute and chronic criteria. Lead concentrations are not detected and zinc concentrations remain below the criterion.

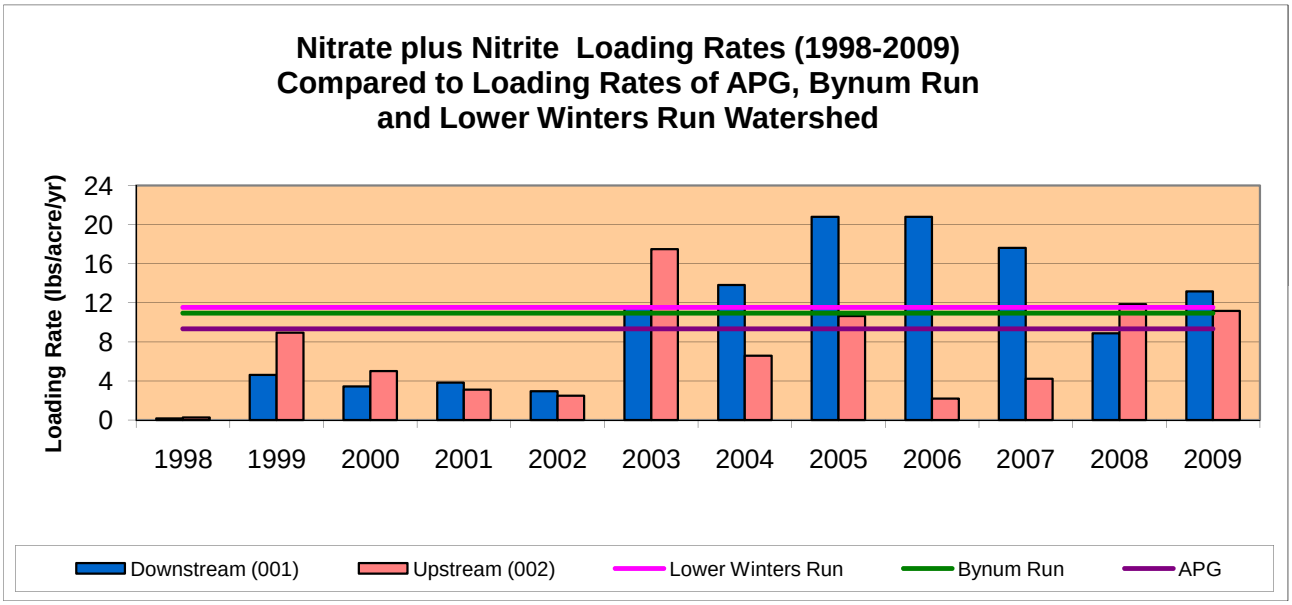
The chemical monitoring data were compared to the average EMCs from Maryland's NPDES stormwater monitoring program and NURP. Nitrate plus nitrite EMCs remain slightly above the NPDES and NURP concentrations. All other parameters compared

were measured at lower concentrations. Seasonal trends exist in TPH and total phosphorous during spring and summer months, respectively.

Water quality data collected by the County and EA indicated that concentrations of fecal bacteria became elevated during storm events, and were approximately 10 times higher in the summer months than during the winter months. As a result, a bacterial source tracking (BST) study was conducted from November 2007 through December 2008 to determine the cause(s) of the elevated fecal bacteria. The results of the BST study showed that wildlife was the largest contributor of fecal bacteria comprising on average 43%, the human source was the second largest contributor at 30%, followed by 18% pet, and 9% livestock (EA, 2009). This BST study showed a relatively high concentration of fecal bacteria with approximately 30% attributed to human fecal pollution within the watershed, such as sanitary sewer leaks or failing septic systems (EA, 2009).

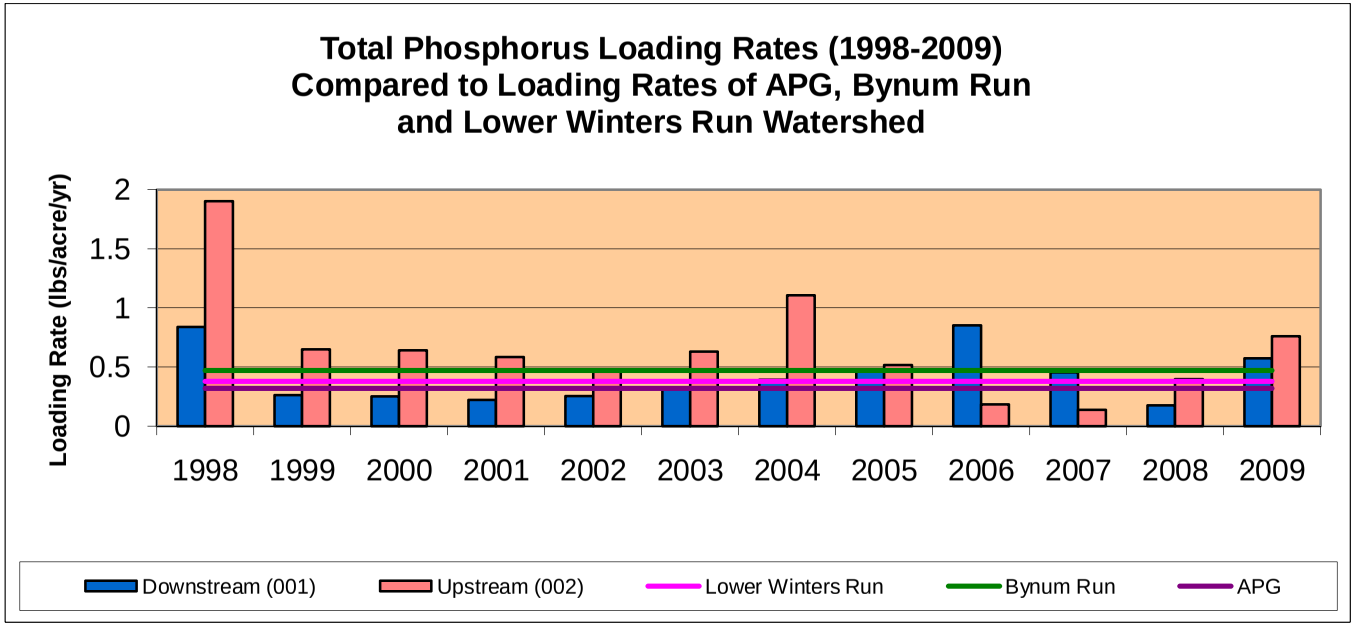
Figure 13. Comparison of Total Kjeldahl Nitrogen and Nitrate + Nitrite Data to Non-Point Source (NPS) Data





Total kjeldahl nitrogen and nitrate plus nitrite loading rates (lbs/acre/yr) of the upstream (outfall) and downstream (instream) station are compared to total nitrogen loading rates (lbs/acre) of the Aberdeen Proving Ground (APG), Bynum Run and Lower Winters Run Watershed. The calculated loading rates were derived using one half of the detection limit (DL) for concentrations less than the DL. The information was dowloaded from the website: http://www.dnr.state.md.us/bay/czm/nps/.

Figure 14. Comparison of Total Phosphorus Data to Non-Point Source (NPS) Data



Total phosphorus loading rates (lbs/acre/yr) of the upstream (outfall) and downstream (instream) station are compared to phosphorus loading rates (lbs/acre) of the Aberdeen Proving Ground (APG), Bynum Run and Lower Winters Run Watershed. The calculated loading rates were derived using one half of the detection limit (DL) for concentrations less than the DL. The information was dowloaded from the website: http://www.dnr.state.md.us/bay/czm/nps/.

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APPENDIX A
WATER QUALITY AND RAINFALL DATA

Table A-1. Water Quality Data Station 002 (Outfall) Baseflow

Date	BOD5 (mg/L)	TSS (mg/L)	NO23 (mg/L)	TKN (mg/L)	TP (mg/L)	Cu (mg/L)	Pb (mg/L)	Zn (mg/L)	TPH (mg/L)	Temp (deg F)	pH	E. coli (MPN/100mL)	Depth (in)	Velocity (ft/s)	Discharge (cfs)
1/26/09 11:10 AM	-999	-999	2.12	-999	-999	-999	-999	0.005	5.8	35.96	7.05	30	1	0.93	0.077
1/26/09 11:40 AM	-999	-999	2.54	-999	-999	-999	-999	0.006	9.2	35.96	7.07	22	1	1.13	0.077
1/26/09 12:10 PM	-999	-999	2.18	-999	-999	-999	-999	0.006	7.6	35.96	7.03	14	1	1.01	0.077
2/19/09 11:00 AM	-999	-999	1.08	-999	-999	-999	-999	0.018	-999	38.4	6.94	11	0.801	1.24	0.05
2/19/09 11:30 AM	-999	-999	0.98	-999	-999	-999	-999	0.015	-999	38.4	6.89	13	1.711	1.65	0.24
2/19/09 12:00 PM	-999	-999	1.02	-999	-999	-999	-999	0.061	-999	38.5	6.89	4	1.669	1.29	0.23
3/30/09 11:15 AM	-999	-999	1.26	0.38	-999	-999	-999	-999	-999	47.3	6.94	4	1.2	1.41	0.11
3/30/09 11:45 AM	-999	-999	1.19	0.39	-999	-999	-999	0.008	-999	47.4	7.03	7	1.2	1.36	0.11
3/30/09 12:15 PM	-999	-999	1.32	0.24	-999	0.005	-999	-999	-999	47.4	6.96	7	1.2	1.43	0.11
4/28/09 10:55 AM	-999	-999	0.28	-999	-999	-999	-999	0.009	-999	63.9	6.94	50	1.375	1.26	0.15
4/28/09 11:25 AM	-999	-999	0.37	-999	-999	-999	-999	0.006	-999	64.2	6.98	50	2.191	1.26	0.41
4/28/09 11:55 AM	-999	-999	0.51	-999	-999	-999	-999	0.007	-999	65.3	6.96	50	2.106	1.33	0.38
5/21/09 9:50 AM	-999	-999	0.31	0.25	-999	0.007	-999	0.035	-999	56.3	7.07	80	1.375	1.29	0.15
5/21/09 10:20 AM	-999	-999	0.56	-999	-999	0.006	-999	0.011	6.2	56.8	7.09	240	1.375	1.13	0.15
5/21/09 10:50 AM	-999	-999	0.47	0.32	-999	0.006	-999	0.029	17	57.9	7.09	80	1.375	1.21	0.15
6/25/09 10:30 AM	-999	8	-999	0.37	-999	-999	-999	0.02	-999	68.4	6.94	500	1.375	1.21	0.15
6/25/09 11:00 AM	-999	8	-999	0.32	-999	-999	-999	0.033	-999	69	6.96	900	1.25	1.31	0.12
6/25/09 11:30 AM	-999	16	-999	0.43	-999	-999	-999	0.014	-999	69.8	6.98	500	1.25	1.48	0.12
7/28/09 11:15 AM	2	10	-999	0.56	-999	-999	-999	0.019	11.8	72.8	6.69	1600	1.342	1.6	0.12
7/28/09 11:45 AM	2	9	-999	0.63	-999	-999	-999	0.02	12.6	72.6	6.73	1600	1.427	1.63	0.12
7/28/09 12:15 PM	2	10	-999	0.67	-999	-999	-999	0.023	7.5	72.7	6.71	1600	1.25	1.43	0.12
8/20/09 11:20 AM	-999	17	0.52	0.47	-999	-999	-999	0.008	-999	72.7	6.69	1600	1.25	1.11	0.12
8/20/09 11:50 AM	-999	19	-999	0.46	-999	-999	-999	0.009	-999	72.3	6.73	1600	1.25	1.12	0.12
8/20/09 12:20 PM	-999	19	-999	0.44	-999	-999	-999	0.008	6	72.5	6.71	1600	1.25	0.89	0.12
9/24/09 10:50 AM	-999	-999	0.17	0.23	-999	-999	-999	0.011	-999	69.7	6.71	1600	1.75	1.82	0.26
9/24/09 11:20 AM	-999	5	0.16	0.25	-999	-999	-999	0.009	-999	69.7	6.73	1600	1.75	1.73	0.26
9/24/09 11:50 AM	-999	-999	0.25	0.26	-999	-999	-999	0.01	-999	69.9	6.73	1600	1.75	1.74	0.26
11/19/09 11:00 AM	-999	-999	0.64	-999	-999	-999	-999	0.017	-999	53.2	7	110	1.5	0.84	0.18
11/19/09 11:30 AM	-999	-999	0.62	0.22	-999	-999	-999	0.013	-999	53.2	7.05	900	1.5	0.79	0.18
11/19/09 12:00 PM	-999	-999	0.45	-999	-999	-999	-999	0.014	-999	53.4	7.05	240	1.5	0.82	0.18
12/17/09 9:50 AM	-999	-999	2.21	-999	-999	-999	-999	0.03	-999	36.3	6.72	13	2	1.58	0.34
12/17/09 10:20 AM	-999	-999	2.25	-999	-999	-999	-999	0.022	-999	36.4	6.92	14	2	1.74	0.34
12/17/09 10:50 AM	-999	-999	2.18	-999	-999	-999	-999	0.027	-999	36.5	6.98	30	2	1.89	0.34

-999 represents non-deteted concentrations
EQ = Equipment Failure
NC = Not Collected
NA = Not Analyzed

Table A-2. Water Quality Data Station 002 (Outfall) Stormflow

Date	BOD5 (mg/L)	TSS (mg/L)	NO23 (mg/L)	TKN (mg/L)	TP (mg/L)	Cu (mg/L)	Pb (mg/L)	Zn (mg/L)	TPH (mg/L)	Temp (deg F)	pH	E. coli (MPN/100mL)	Depth (in)	Velocity (ft/s)	Discharge (cfs)
4/6/09 11:42 AM	-999	8	0.43	0.44	-999	-999	-999	0.028	-999	56.8	4.78	80	1	1.96	0.08
4/6/09 1:20 PM	-999	29	0.79	0.48	-999	-999	-999	0.016	-999	55.4	4.38	240	2.4	2.07	0.08
4/6/09 4:05 PM	-999	-999	1.16	0.51	-999	-999	-999	0.011	-999	61.8	4.54	240	1.5	2.01	0.08
6/17/09 1:56 PM	-999	15	1.47	0.4	-999	-999	-999	0.023	-999	64.992	7.05	1600	1.375	1.32	0.152
6/17/09 8:44 PM	-999	-999	0.47	0.33	-999	-999	-999	0.008	-999	64.578	6.98	1600	2.511	1.318	0.55
6/17/09 10:56 PM	-999	-999	0.56	0.41	-999	-999	-999	0.007	-999	64.371	6.96	1600	2.213	1.334	0.421
6/30/09 2:20 PM	10	118	1.22	2.64	0.51	0.005	-999	0.171	5.9	78.9	6.44	1600	1.9	3.89	0.3
6/30/09 2:52 PM	12	67	1.77	1.55	0.14	0.01	-999	0.042	-999	74.42	6.65	1600	1.85	3.96	0.28
6/30/09 5:02 PM	2	11	0.76	0.68	-999	0.004	-999	0.029	-999	73.59	6.77	1600	1.25	1.85	0.12
9/11/09 2:00 AM	-999	25	0.65	0.22	-999	-999	-999	0.023	-999	64.682	6.86	80	1.29	0.23	0.13
9/11/09 4:18 AM	7	107	2.15	1.21	0.16	0.005	-999	0.038	-999	63.544	6.81	1600	1.6	2.829	0.211
9/11/09 7:06 AM	-999	10	0.67	0.5	-999	-999	-999	0.015	9.8	62.717	6.83	1600	1.392	3.121	0.15
10/15/09 11:34 AM	11	102	1.49	1.26	0.31	-999	-999	0.074	-999	51.891	6.85	1600	1.75	2.058	0.255
10/15/09 2:42 PM	-999	12	0.54	0.4	-999	-999	-999	0.026	-999	51.942	6.9	1600	1.817	2.015	0.277
10/15/09 4:42 PM	-999	4	1	-999	-999	-999	-999	0.01	-999	51.582	6.96	1600	1.75	1.494	0.255
11/19/09 5:30 PM	2	10	0.76	0.44	-999	-999	-999	0.024	-999	54.8	6.96	240	2.657	1.825	0.621
11/19/09 6:12 PM	7	118	0.85	1.34	0.16	0.005	-999	0.042	-999	56.112	6.88	1600	6.897	4.113	4.529
11/19/09 8:02 PM	4	32	0.46	0.64	0.06	-999	-999	0.026	-999	56.524	6.85	1600	3.915	2.03	1.405
11/23/09 3:03 PM	-999	-999	NA	-999	-999	-999	-999	0.008	-999	47.4	6.99	130	1.5	1.38	0.18
11/24/09 12:59 AM	-999	8	NA	-999	-999	-999	-999	0.014	-999	49.2	7.03	1600	1.5	2.17	0.18
11/24/09 8:18 AM	2	12	NA	0.53	0.05	-999	-999	0.021	-999	49.8	6.94	900	1.5	2.27	0.18
11/24/09 11:04 AM	2	9	NA	0.66	0.05	-999	-999	0.028	-999	50.9	7	1600	1.5	2.63	0.18
12/8/09 11:50 PM	-999	4	1.76	-999	0.1	-999	-999	0.022	-999	39.7	6.98	1600	2.2	EQ	2.42
12/9/09 8:09 AM	-999	37	0.91	0.69	0.14	-999	-999	0.093	-999	40.3	6.89	1600	6.8	EQ	4.35
12/9/09 10:57 AM	-999	35	0.86	0.72	0.12	0.005	-999	0.089	-999	40.9	6.83	1600	6	EQ	4.64

-999 represents non-deteted concentrations
EQ = Equipment Failure
NA = Not Analyzed
NC = Not Collected

Table A-3. Water Quality Data Station 001 (Instream) Baseflow

Date	BOD5 (mg/L)	TSS (mg/L)	NO23 (mg/L)	TKN (mg/L)	TP (mg/L)	Cu (mg/L)	Pb (mg/L)	Zn (mg/L)	TPH (mg/L)	Temp (deg F)	pH	E. coli (MPN/100mL)	Depth (in)	Velocity (ft/s)	Discharge (cfs)
1/26/09 9:55 AM	-999	-999	1.74	-999	-999	-999	-999	-999	-999	40.82	7.41	2	1.172	EQ	0.15
1/26/09 10:25 AM	-999	-999	1.86	-999	-999	-999	-999	-999	6.5	40.82	7.43	4	1.299	EQ	0.19
1/26/09 10:55 AM	-999	-999	1.85	-999	-999	-999	-999	-999	-999	40.82	6.97	8	1.273	EQ	0.18
2/19/09 9:30 AM	-999	-999	1.03	-999	-999	-999	-999	0.016	-999	41.18	7.97	300	2.172	1.83	0.57
2/19/09 10:00 AM	-999	-999	1.08	-999	-999	-999	-999	0.008	-999	39.56	8.01	170	1.854	1.78	0.41
2/19/09 10:30 AM	-999	-999	1.02	-999	-999	-999	-999	0.014	-999	40.82	8.01	300	1.846	1.45	0.41
3/30/09 9:45 AM	-999	-999	1.29	0.34	-999	-999	-999	-999	-999	EQ	EQ	50	2.157	0.2	0.57
3/30/09 10:15 AM	-999	-999	1.34	0.3	-999	-999	-999	0.041	-999	EQ	EQ	50	2.018	0.2	0.49
3/30/09 10:45 AM	-999	-999	1.3	0.32	-999	-999	-999	0.018	-999	EQ	EQ	240	1.676	0.2	0.33
4/28/09 9:35 AM	-999	-999	0.85	-999	-999	-999	-999	-999	-999	63.32	7.54	70	2.118	EQ	0.54
4/28/09 10:05 AM	-999	-999	0.89	-999	-999	-999	-999	0.013	17.4	63.86	7.63	11	1.9712	EQ	0.466
4/28/09 10:35 AM	-999	-999	0.79	-999	-999	-999	-999	0.008	11	67.46	7.69	7	1.7664	EQ	0.368
5/21/09 8:30 AM	-999	-999	1.2	-999	-999	0.006	-999	0.039	-999	EQ	EQ	17	1.885	EQ	0.42
5/21/09 9:00 AM	-999	-999	1.21	-999	-999	0.006	-999	0.018	-999	EQ	EQ	30	2.069	EQ	0.52
5/21/09 9:30 AM	-999	-999	1.23	-999	-999	-999	-999	0.006	-999	EQ	EQ	80	2.179	EQ	0.58
6/25/09 9:00 AM	-999	5	0.19	0.27	-999	-999	-999	-999	-999	68.9	7.68	240	2.557	EQ	0.82
6/25/09 9:30 AM	-999	5	-999	-999	-999	-999	-999	-999	-999	68.72	7.8	80	2.485	EQ	0.77
6/25/09 10:00 AM	-999	-999	-999	-999	-999	-999	-999	-999	-999	68.72	7.85	50	EQ	EQ	EQ
7/28/09 9:45 AM	-999	-999	-999	0.24	-999	-999	-999	0.011	8.5	71.78	7.65	900	2.794	1.32	0.99
7/28/09 10:15 AM	-999	-999	-999	0.25	-999	-999	-999	-999	9.9	72.14	7.69	900	2.473	1.28	0.76
7/28/09 10:45 AM	-999	-999	0.18	0.33	-999	-999	-999	-999	10.6	74.12	7.7	900	2.429	1.36	0.73
8/20/09 9:50 AM	-999	6	1.38	-999	-999	-999	-999	-999	-999	73.04	7.72	500	2.343	0.72	0.68
8/20/09 10:20 AM	-999	-999	1.38	0.33	-999	-999	-999	-999	-999	73.58	7.7	220	2.384	0.92	0.7
8/20/09 10:50 AM	-999	-999	1.41	-999	-999	-999	-999	-999	-999	73.76	7.72	300	2.29	0.85	0.64
9/24/09 9:15 AM	-999	-999	0.73	-999	-999	-999	-999	-999	-999	68.36	7.83	1600	2.649	1.29	0.88
9/24/09 9:45 AM	-999	-999	0.92	-999	-999	-999	-999	0.008	-999	69.62	7.76	900	2.486	2.62	0.77
9/24/09 10:15 AM	-999	-999	1.13	-999	-999	-999	-999	-999	-999	69.62	7.8	1600	2.758	2.27	0.96
11/19/09 9:30 AM	-999	-999	0.76	-999	-999	-999	-999	0.008	-999	52.88	8.13	2	3.004	1.62	1.15
11/19/09 10:00 AM	-999	-999	0.88	-999	-999	-999	-999	0.015	-999	53.78	8.08	4	2.306	1.83	0.65
11/19/09 10:30 AM	-999	-999	0.82	-999	-999	-999	-999	0.011	-999	54.32	8.13	-999	2.496	2.09	0.77
12/17/09 8:25 AM	3	-999	2.37	-999	-999	0.005	-999	0.019	-999	38.66	7.37	30	2.719	2.73	0.93
12/17/09 8:55 AM	2	-999	2.45	-999	-999	-999	-999	0.011	-999	37.4	7.46	23	2.271	2.67	0.63
12/17/09 9:25 AM	-999	-999	2.17	-999	-999	-999	-999	0.029	-999	37.76	7.5	17	2.689	2.54	0.91

-999 represents non-deteted concentrations
EQ = Equipment Failure
NC = Not Collected
NA = Not Analyzed

Table A-4. Water Quality Data Station 001 (Instream) Stormflow

Date	BOD5 (mg/L)	TSS (mg/L)	NO23 (mg/L)	TKN (mg/L)	TP (mg/L)	Cu (mg/L)	Pb (mg/L)	Zn (mg/L)	TPH (mg/L)	Temp (deg F)	pH	E. coli (MPN/100mL)	Depth (in)	Velocity (ft/s)	Discharge (cfs)
4/6/09 11:57 AM	-999	5	1.2	-999	-999	-999	-999	0.018	-999	EQ	EQ	50	2.687	EQ	0.93
4/6/09 1:34 PM	-999	22	1.09	0.37	-999	-999	-999	0.011	-999	EQ	EQ	500	3.66	EQ	1.42
4/6/09 4:22 PM	-999	-999	1.08	0.36	-999	-999	-999	0.012	-999	EQ	EQ	500	3.44	EQ	0.88
6/17/09 2:10 PM	3	5	0.32	0.44	-999	-999	-999	0.005	-999	62.6	7.84	500	1.798	1.28	0.383
6/17/09 8:55 PM	-999	6	0.76	-999	-999	-999	-999	-999	-999	62.4	7.9	900	2.086	1.34	0.527
6/17/09 11:10 PM	-999	5	-999	-999	-999	-999	-999	-999	-999	62.2	7.86	900	1.876	1.29	0.419
6/30/09 2:30 PM	40	173	1.66	3.09	0.36	0.013	-999	0.065	-999	75.9	7.27	1600	5.34	1.96	3.93
6/30/09 3:05 PM	17	293	1.39	2.87	0.47	0.012	0.006	0.093	-999	72.9	7.43	1600	6.14	2.86	5.47
6/30/09 5:20 PM	4	18	1.24	0.9	0.05	0.006	-999	0.019	-999	73.4	7.57	1600	3.38	2.32	1.48
9/11/09 2:20 AM	-999	11	1.6	0.21	-999	-999	-999	0.014	-999	62.1	8.07	220	1.913	0.76	0.437
9/11/09 4:30 AM	8	375	0.91	2.89	0.46	0.017	0.014	0.101	12.9	61.3	7.29	1600	6.45	3.61	5.849
9/11/09 7:20 AM	-999	30	0.76	0.41	0.07	-999	-999	0.017	8.4	61.1	7.67	1600	5.898	3.05	4.843
10/15/09 11:40 AM	4	28	1.14	0.47	0.09	-999	-999	0.019	-999	49.6	7.96	300	2.095	2.28	0.532
10/15/09 3:00 PM	2	30	2.02	0.52	0.05	-999	-999	0.022	-999	49.6	7.84	1600	4.543	3.64	2.784
10/15/09 5:05 PM	-999	11	0.67	-999	-999	-999	-999	0.008	-999	49.5	7.88	900	3.495	3	1.592
11/19/09 5:40 PM	4	77	1.39	1.05	0.16	0.008	-999	0.077	-999	55.9	7.49	1600	2.694	1.87	0.912
11/19/09 6:30 PM	8	52	0.82	0.88	0.09	-999	-999	0.031	-999	56.1	7.82	1600	6.718	3.47	6.166
11/19/09 8:20 PM	3	15	0.49	0.5	-999	-999	-999	0.017	-999	58.8	7.95	1600	6.057	0.9	5.122
11/23/09 3:30 PM	-999	-999	NA	-999	-999	-999	-999	0.006	-999	50.5	7.41	23	2.11	2.52	0.54
11/24/09 1:20 AM	-999	-999	NA	-999	-999	-999	-999	0.015	-999	49.8	6.02	1600	2.83	2.837	1.01
11/24/09 8:25 AM	2	22	NA	0.54	0.05	-999	-999	0.018	-999	49.8	7.11	1600	6.53	6.532	6
11/24/09 11:30 AM	-999	8	NA	0.49	-999	-999	-999	0.013	-999	51.1	7.12	900	5.71	5.717	4.53
12/9/09 12:15 AM	-999	4	1.27	-999	-999	-999	-999	0.119	-999	41	7.02	1600	3.03	EQ	2.31
12/9/09 8:20 AM	-999	32	1.24	0.58	0.09	-999	-999	0.081	-999	43	6.66	1600	11.18	EQ	3.43
12/9/09 11:05 AM	-999	22	1.32	0.42	0.07	-999	-999	0.064	-999	45.1	6.76	1600	9.26	EQ	4.06

-999 represents non-deteted concentrations
EQ = Equipment Failure
NA = Not Analyzed
NC = Not Collected

Table A-5. 1998 - 2008 Monthly Rainfall Totals (inches)
Harford County: Trib to Winters Run at Tollgate Road

Month	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1	---	4.88	---	2.85	1.78	2.24	0.9	4.03	3.72	1.84	1.43	1.91
2	---	2.83	1.59	2.4	0.16	1.64	3.2	0.9	1.8	1.16	4.58	0.63
3	---	3.75	2.52	5.5	2.89	4.6	2.62	5.31	0.18	3.88	2.96	1.95
4	0.32	2.62	3.22	1.81	2.21	1.87	5.31	4.64	3.63	4.63	3.21	5.72
5	6.67	1.52	2.74	4.24	2.73	0.83	2.98	2.41	2.6	1.27	5.01	5.38
6	2.25	2.42	1.91	3.41	3.17	3.38	4.46	3.66	20.08	2.76	1.99	6.31
7	2.94	2.02	5.77	0	2.1	3.61	7.17	5.68	4.75	2.88	5.09	3.46
8	5.12	5.74	3.06	3.46	2.63	5.9	2.42	1.25	2.76	3.48	1.94	5.76
9	1.97	12.84	3.61	4.4	4.46	9.28	6.32	0.35	7.94	0.95	6.87	6.49
10	2.82	4.14	0.27	0.92	3.74	6.94	2.6	13.26	5.75	7.20	2.21	4.06
11	1.33	2.74	2.38	1.49	0.25	3.44	5.33	2.41	5.61	1.92	2.68	3.84
12	0.96	3.4	2.91	1.57	5.25	---	3.3	2.14	1.88	5.29	4.01	4.78
Total Rainfall (inches)	24.38	48.9	29.98	32.05	31.37	43.73	46.61	46.04	60.7	37.26	41.98	50.29

Note:

Missing precipitation data due to equipment failure from the rain gauge located at the outfall station was retrieved from the USGS rain gauge Winters Run Basin at Fallston, MD.

--- represents missing data

APPENDIX B
EVENT MEAN CONCENTRATION TABLES

Table B-1. 2009 Baseflow Event Mean Concentrations (EMCs)
Station 002

Date	BOD5	TSS	NO23	TKN	TP	Cu	Pb	Zn	TPH	Temp*	pH**	E. coli***
1/26/2009	0.00	0.00	2.28	0.00	0.00	0.000	0.000	0.006	7.5	35.96	7.05	22
2/19/2009	0.00	0.00	1.03	0.00	0.00	0.000	0.000	0.032	0.0	38.45	6.91	9
3/30/2009	0.00	0.00	1.26	0.38	0.00	0.000	0.000	0.000	0.0	47.35	6.98	6
4/28/2009	0.00	0.00	0.39	0.00	0.00	0.000	0.000	0.007	0.0	64.47	6.96	50
5/21/2009	0.00	0.00	0.45	0.19	0.00	0.007	0.000	0.025	7.7	57.00	7.08	160
6/25/2009	0.00	12.00	0.00	0.37	0.00	0.000	0.000	0.022	0.0	69.07	6.96	700
7/28/2009	2.00	9.67	0.00	0.62	0.00	0.000	0.000	0.021	10.6	72.70	6.71	1,600
8/20/2009	0.00	18.00	0.26	0.46	0.00	0.000	0.000	0.009	3.0	72.61	7.05	1,600
9/24/2009	0.00	2.50	0.19	0.25	0.00	0.000	0.000	0.010	0.0	69.80	6.72	1,600
11/19/2009	0.00	0.00	0.57	0.07	0.00	0.000	0.000	0.015	0.0	53.30	7.03	414
12/17/2009	0.00	0.00	2.21	0.00	0.00	0.000	0.000	0.026	0.0	36.4	6.87	19

Baseflow EMCs (mg/L) were calculated from data using zero for concentrations less than the detection limit (DL).

Date	BOD5	TSS	NO23	TKN	TP	Cu	Pb	Zn	TPH	Temp*	pH**	E. coli***
1/26/2009	0.50	0.50	2.28	0.10	0.03	0.003	0.005	0.006	7.53	35.96	7.05	22
2/19/2009	0.50	0.50	1.03	0.10	0.03	0.003	0.005	0.03	0.50	38.45	6.91	9
3/30/2009	0.50	0.50	1.26	0.38	0.03	0.003	0.005	0.00	0.50	47.35	6.98	6
4/28/2009	0.50	0.50	0.39	0.10	0.03	0.003	0.005	0.01	0.50	64.47	6.96	50
5/21/2009	0.50	0.50	0.45	0.22	0.03	0.007	0.005	0.03	7.90	57.00	7.08	160
6/25/2009	0.50	12.00	0.08	0.37	0.03	0.003	0.005	0.02	0.50	69.07	6.96	700
7/28/2009	2.00	9.67	0.08	0.62	0.03	0.003	0.005	0.02	10.59	72.70	6.71	1,600
8/20/2009	0.50	18.00	0.30	0.46	0.03	0.003	0.005	0.009	3.25	72.61	7.05	1,600
9/24/2009	0.50	2.75	0.19	0.25	0.03	0.003	0.005	0.010	0.50	69.80	6.72	1,600
11/19/2009	0.50	0.50	0.57	0.14	0.03	0.003	0.005	0.015	0.50	53.30	7.03	414
12/17/2009	0.50	0.50	2.21	0.10	0.03	0.003	0.005	0.026	0.50	36.40	6.87	19

Baseflow EMCs (mg/L) were calculated from data using half of the detection limit (DL) for concentrations less than the DL.

Date	BOD5	TSS	NO23	TKN	TP	Cu	Pb	Zn	TPH	Temp*	pH**	E. coli***
1/26/2009	1.00	1.00	2.28	0.20	0.05	0.005	0.010	0.006	7.5	35.96	7.05	22
2/19/2009	1.00	1.00	1.03	0.20	0.05	0.005	0.010	0.032	1.0	38.45	6.91	9
3/30/2009	1.00	1.00	1.26	0.38	0.05	0.005	0.010	0.005	1.0	47.35	6.98	6
4/28/2009	1.00	1.00	0.39	0.20	0.05	0.005	0.010	0.007	1.0	64.47	6.96	50
5/21/2009	1.00	1.00	0.45	0.26	0.05	0.007	0.010	0.025	8.1	57.00	7.08	160
6/25/2009	1.00	12.00	0.15	0.37	0.05	0.005	0.010	0.022	1.0	69.07	6.96	700
7/28/2009	2.00	9.67	0.15	0.62	0.05	0.005	0.010	0.021	10.6	72.70	6.71	1600
8/20/2009	1.00	18.00	0.34	0.46	0.05	0.005	0.010	0.009	3.5	72.61	7.05	1600
9/24/2009	1.00	3.00	0.19	0.25	0.05	0.005	0.010	0.010	1.0	69.80	6.72	1600
11/19/2009	1.00	1.00	0.57	0.21	0.05	0.005	0.010	0.015	1.0	53.30	7.03	414
12/17/2009	1.00	1.00	2.21	0.20	0.05	0.005	0.010	0.026	1.0	36.40	6.87	19

Baseflow EMCs (mg/L) were calculated from data using the detection limit (DL) for concentrations less than the DL.

* deg F
** no units
*** MPN/100mL
NA = Not Analyzed
NC = Not Collected

Table B-2. 2009 Stormflow Event Mean Concentrations (EMCs)
Station 002

Date	BOD5	TSS	NO23	TKN	TP	Cu	Pb	Zn	TPH	Temp*	pH**	E. coli***
4/6/2009	0.00	12.34	0.89	0.49	0.00	0.000	0.000	0.016	0.0	58.5	4.49	212
6/17/2009	0.00	10.01	1.15	0.39	0.00	0.000	0.000	0.018	0.0	64.8	7.03	1,600
6/30/2009	8.00	65.33	1.25	1.62	0.22	0.006	0.000	0.081	2.0	75.6	6.62	1,600
9/11/2009	2.84	50.24	1.27	0.77	0.07	0.002	0.000	0.025	5.3	63.2	6.83	1,516
10/15/2009	3.94	42.26	0.99	0.61	0.11	0.000	0.000	0.039	0.0	51.8	6.90	1,600
11/19/2009	4.33	53.33	0.69	0.81	0.07	0.002	0.000	0.031	0.0	55.8	6.90	1,147
11/23/2009	0.87	6.05	NA	0.25	0.02	0.000	0.000	0.016	0.0	48.9	6.98	817
12/8/2009	0.00	8.05	1.64	0.09	0.10	0.001	0.000	0.031	0.0	40.8	6.84	1,600

Stormflow EMCs (mg/L) were calculated from data using zero for concentrations less than the detection limit (DL).

Date	BOD5	TSS	NO23	TKN	TP	Cu	Pb	Zn	TPH	Temp*	pH**	E. coli***
4/6/2009	0.50	12.56	0.89	0.49	0.03	0.003	0.005	0.016	0.5	58.5	4.49	212
6/17/2009	0.50	10.17	1.15	0.39	0.03	0.003	0.005	0.018	0.5	64.8	7.03	1,600
6/30/2009	8.00	65.33	1.25	1.62	0.23	0.006	0.005	0.081	2.3	75.6	6.62	1,600
9/11/2009	3.14	50.24	1.27	0.77	0.08	0.004	0.005	0.025	5.5	63.2	6.83	1,516
10/15/2009	4.26	42.26	0.99	0.63	0.13	0.003	0.005	0.039	0.5	51.8	6.90	1,600
11/19/2009	4.33	53.33	0.69	0.81	0.08	0.003	0.005	0.031	0.5	55.8	6.90	1,147
11/23/2009	1.15	6.25	NA	0.31	0.04	0.003	0.005	0.016	0.5	48.9	6.98	817
12/8/2009	0.50	8.05	1.64	0.18	0.10	0.003	0.005	0.031	0.5	40.8	6.84	1,600

Stormflow EMCs (mg/L) were calculated from data using half of the detection limit (DL) for concentrations less than the DL.

Date	BOD5	TSS	NO23	TKN	TP	Cu	Pb	Zn	TPH	Temp*	pH**	E. coli***
4/6/2009	1.00	12.79	0.89	0.49	0.05	0.005	0.010	0.016	1.0	58.5	4.49	212
6/17/2009	1.00	10.34	1.15	0.39	0.05	0.005	0.010	0.018	1.0	64.8	7.03	1,600
6/30/2009	8.00	65.33	1.25	1.62	0.23	0.006	0.010	0.081	2.6	75.6	6.62	1,600
9/11/2009	3.44	50.24	1.27	0.77	0.09	0.005	0.010	0.025	5.7	63.2	6.83	1,516
10/15/2009	4.58	42.26	0.99	0.66	0.14	0.005	0.010	0.039	1.0	51.8	6.90	1,600
11/19/2009	4.33	53.33	0.69	0.81	0.09	0.005	0.010	0.031	1.0	55.8	6.90	1,147
11/23/2009	1.44	6.45	NA	0.36	0.05	0.005	0.010	0.016	1.0	48.9	6.98	817
12/8/2009	1.00	8.05	1.64	0.27	0.10	0.005	0.010	0.031	1.0	40.8	6.84	1,600

Stormflow EMCs (mg/L) were calculated from data using the detection limit (DL) for concentrations less than the DL.

* deg F
** no units
*** MPN/100mL
NA = Not Analyzed
NC = Not Collected

Table B-3. 2009 Baseflow Event Mean Concentrations (EMCs)
Station 001

Date	BOD5	TSS	NO23	TKN	TP	Cu	Pb	Zn	TPH	Temp*	pH**	E. coli***
1/26/2009	0.00	0.00	1.82	0.00	0.00	0.000	0.000	0.000	3.3	40.8	7.27	5
2/19/2009	0.00	0.00	1.04	0.00	0.00	0.000	0.000	0.013	0.0	40.5	7.99	235
3/30/2009	0.00	0.00	1.31	0.32	0.00	0.000	0.000	0.020	0.0	NC	NC	145
4/28/2009	0.00	0.00	0.84	0.00	0.00	0.000	0.000	0.007	9.5	64.9	7.62	29
5/21/2009	0.00	0.00	1.21	0.00	0.00	0.003	0.000	0.021	0.0	NC	NC	42
6/25/2009	0.00	2.50	0.10	0.14	0.00	0.000	0.000	0.000	0.0	68.8	7.78	123
7/28/2009	0.00	0.00	0.09	0.27	0.00	0.000	0.000	0.006	9.7	72.7	7.68	900
8/20/2009	0.00	3.00	1.40	0.17	0.00	0.000	0.000	0.000	0.0	73.3	7.37	340
9/24/2009	0.00	0.00	0.93	0.00	0.00	0.000	0.000	0.004	0.0	68.99	7.80	1,250
11/19/2009	0.00	0.00	0.82	0.00	0.00	0.000	0.000	0.011	0.0	53.66	8.11	2
12/17/2009	1.67	0.00	2.33	0.00	0.00	0.003	0.000	0.020	0.0	37.94	7.44	23

Baseflow EMCs (mg/L) were calculated from data using zero for concentrations less than the detection limit (DL).

Date	BOD5	TSS	NO23	TKN	TP	Cu	Pb	Zn	TPH	Temp*	pH**	E. coli***
1/26/2009	0.50	0.50	1.82	0.10	0.03	0.003	0.005	0.003	3.5	40.8	7.27	5
2/19/2009	0.50	0.50	1.04	0.10	0.03	0.003	0.005	0.013	0.5	40.5	7.99	235
3/30/2009	0.50	0.50	1.31	0.32	0.03	0.003	0.005	0.021	0.5	NC	NC	145
4/28/2009	0.50	0.50	0.84	0.10	0.03	0.003	0.005	0.008	9.6	64.9	7.62	29
5/21/2009	0.50	0.50	1.21	0.10	0.03	0.004	0.005	0.021	0.5	NC	NC	42
6/25/2009	0.50	2.75	0.13	0.19	0.03	0.003	0.005	0.003	0.5	68.8	7.78	123
7/28/2009	0.50	0.50	0.13	0.27	0.03	0.003	0.005	0.007	9.7	72.7	7.68	900
8/20/2009	0.50	3.25	1.40	0.22	0.03	0.003	0.005	0.003	0.5	73.3	7.37	340
9/24/2009	0.50	0.50	0.93	0.10	0.03	0.003	0.005	0.005	0.5	68.99	7.80	1,250
11/19/2009	0.50	0.50	0.82	0.10	0.03	0.003	0.005	0.011	0.5	53.66	8.11	2
12/17/2009	1.83	0.50	2.33	0.10	0.03	0.004	0.005	0.020	0.5	37.94	7.44	23

Baseflow EMCs (mg/L) were calculated from data using half of the detection limit (DL) for concentrations less than the DL.

Date	BOD5	TSS	NO23	TKN	TP	Cu	Pb	Zn	TPH	Temp*	pH**	E. coli***
1/26/2009	1.00	1.00	1.82	0.20	0.05	0.005	0.010	0.005	3.8	40.8	7.27	5
2/19/2009	1.00	1.00	1.04	0.20	0.05	0.005	0.010	0.013	1.0	40.5	7.99	235
3/30/2009	1.00	1.00	1.31	0.32	0.05	0.005	0.010	0.021	1.0	NC	NC	145
4/28/2009	1.00	1.00	0.84	0.20	0.05	0.005	0.010	0.009	9.8	64.9	7.62	29
5/21/2009	1.00	1.00	1.21	0.20	0.05	0.006	0.010	0.021	1.0	NC	NC	42
6/25/2009	1.00	3.00	0.17	0.24	0.05	0.005	0.010	0.005	1.0	68.8	7.78	123
7/28/2009	1.00	1.00	0.17	0.27	0.05	0.005	0.010	0.008	9.7	72.7	7.68	900
8/20/2009	1.00	3.50	1.40	0.27	0.05	0.005	0.010	0.005	1.0	73.3	7.37	340
9/24/2009	1.00	1.00	0.93	0.20	0.05	0.005	0.010	0.007	1.0	69.0	7.80	1,250
11/19/2009	1.00	1.00	0.82	0.20	0.05	0.005	0.010	0.011	1.0	53.7	8.11	3
12/17/2009	2.00	1.00	2.33	0.20	0.05	0.005	0.010	0.020	1.0	37.94	7.44	23

Baseflow EMCs (mg/L) were calculated from data using the detection limit (DL) for concentrations less than the DL.

* deg F
** no units
*** MPN/100mL
NA = Not Analyzed
NC = Not Collected

Table B-4. 2009 Stormflow Event Mean Concentrations (EMCs)
Station 001

Date	BOD5	TSS	NO23	TKN	TP	Cu	Pb	Zn	TPH	Temp*	pH**	E. coli***
4/6/2009	0.00	9.66	1.09	0.34	0.00	0.000	0.000	0.012	0.0	NC	NC	465
6/17/2009	2.00	5.26	0.41	0.29	0.00	0.000	0.000	0.003	0.0	62.5	7.86	633
6/30/2009	20.33	161.33	1.43	2.29	0.29	0.010	0.002	0.059	0.0	74.1	7.42	1,600
9/11/2009	3.30	171.58	0.86	1.43	0.23	0.007	0.006	0.052	9.9	61.2	7.53	1,544
10/15/2009	2.32	26.13	1.50	0.42	0.05	0.000	0.000	0.019	0.0	49.6	7.89	1,051
11/19/2009	5.00	48.00	0.90	0.81	0.08	0.003	0.000	0.042	0.0	56.9	7.75	1,600
11/23/2009	0.53	7.36	NA	0.24	0.01	0.000	0.000	0.012	0.0	50.3	7.06	856
12/9/2009	0.00	17.20	1.29	0.29	0.05	0.000	0.000	0.088	0.0	43.2	6.84	1,600

Stormflow EMCs (mg/L) were calculated from data using zero for concentrations less than the detection limit (DL).

Date	BOD5	TSS	NO23	TKN	TP	Cu	Pb	Zn	TPH	Temp*	pH**	E. coli***
4/6/2009	0.50	9.91	1.09	0.34	0.03	0.003	0.005	0.012	0.5	NC	NC	465
6/17/2009	2.17	5.26	0.41	0.33	0.03	0.003	0.005	0.004	0.5	62.5	7.86	633
6/30/2009	20.33	161.33	1.43	2.29	0.29	0.010	0.005	0.059	0.5	74.1	7.42	1,600
9/11/2009	3.59	171.58	0.86	1.43	0.23	0.008	0.009	0.052	9.9	61.2	7.53	1,544
10/15/2009	2.41	26.13	1.50	0.43	0.06	0.003	0.005	0.019	0.5	49.6	7.89	1,051
11/19/2009	5.00	48.00	0.90	0.81	0.09	0.004	0.005	0.042	0.5	56.9	7.75	1,600
11/23/2009	0.90	7.64	NA	0.29	0.03	0.003	0.005	0.012	0.5	50.3	7.06	856
12/9/2009	0.50	17.20	1.29	0.33	0.06	0.003	0.005	0.088	0.5	43.2	6.84	1,600

Stormflow EMCs (mg/L) were calculated from data using half of the detection limit (DL) for concentrations less than the DL.

Date	BOD5	TSS	NO23	TKN	TP	Cu	Pb	Zn	TPH	Temp*	pH**	E. coli***
4/6/2009	1.00	10.16	1.09	0.35	0.05	0.005	0.010	0.012	1.0	NC	NC	465
6/17/2009	2.33	5.26	0.42	0.36	0.05	0.005	0.010	0.005	1.0	62.5	7.86	633
6/30/2009	20.33	161.33	1.43	2.29	0.29	0.010	0.009	0.059	1.0	74.1	7.42	1,600
9/11/2009	3.89	171.58	0.86	1.43	0.23	0.010	0.012	0.052	10.0	61.2	7.53	1,544
10/15/2009	2.49	26.13	1.50	0.45	0.06	0.005	0.010	0.019	1.0	49.6	7.89	1,051
11/19/2009	5.00	48.00	0.90	0.81	0.10	0.006	0.010	0.042	1.0	56.9	7.75	1,600
11/23/2009	1.26	7.91	NA	0.35	0.05	0.005	0.010	0.012	1.0	50.3	7.06	856
12/9/2009	1.00	17.20	1.29	0.37	0.07	0.005	0.010	0.088	1.0	43.2	6.84	1,600

* deg F
** no units
*** MPN/100mL
NA = Not Analyzed
NC = Not Collected

Table B-5. 2009 Monthly Event Mean Concentrations (EMCs)
Station 002

Month	Event Type	BOD5	TSS	NO23	TKN	TP	Cu	Pb	Zn	TPH	Temp*	pH**	E. coli***
1	BASEFLOW	0.00	0.00	2.28	0.00	0.00	0.000	0.000	0.006	7.5	36.0	7.05	22
2	BASEFLOW	0.00	0.00	1.03	0.00	0.00	0.000	0.000	0.032	0.0	38.5	6.91	9
3	BASEFLOW	0.00	0.00	1.26	0.38	0.00	0.000	0.000	0.000	0.0	47.4	6.98	6
4	BASEFLOW	0.00	0.00	0.39	0.00	0.00	0.000	0.000	0.007	0.0	64.5	6.96	50
4	STORM	0.00	12.34	0.89	0.49	0.00	0.000	0.000	0.016	0.0	58.5	4.49	212
5	BASEFLOW	0.00	0.00	0.45	0.19	0.00	0.007	0.000	0.025	7.7	57.0	7.08	160
6	BASEFLOW	0.00	12.00	0.00	0.37	0.00	0.000	0.000	0.022	0.0	69.1	6.96	700
6	STORM	4.00	37.67	1.20	1.00	0.11	0.003	0.000	0.049	1.0	70.2	6.82	1,600
7	BASEFLOW	2.00	9.67	0.00	0.62	0.00	0.000	0.000	0.021	10.6	72.7	6.71	1,600
8	BASEFLOW	0.00	18.00	0.26	0.46	0.00	0.000	0.000	0.009	3.0	72.6	7.05	1,600
9	BASEFLOW	0.00	2.50	0.19	0.25	0.00	0.000	0.000	0.010	0.0	69.8	6.72	1,600
9	STORM	2.84	50.24	1.27	0.77	0.07	0.002	0.000	0.025	5.3	63.2	6.83	1,516
10	STORM	3.94	42.26	0.99	0.61	0.11	0.000	0.000	0.039	0.0	51.8	6.90	1,600
11	BASEFLOW	0.00	0.00	0.57	0.07	0.00	0.000	0.000	0.015	0.0	53.3	7.03	414
11	STORM	2.60	29.69	0.69	0.53	0.05	0.001	0.000	0.023	0.0	52.4	6.94	982
12	BASEFLOW	0.00	0.00	2.21	0.00	0.00	0.000	0.000	0.026	0.0	36.4	6.87	19
12	STORM	0.00	8.05	1.64	0.09	0.10	0.001	0.000	0.031	0.0	40.8	6.84	1,600

Monthly EMCs (mg/L) were calculated from data using zero for concentrations less than the detection limit (DL).

Month	Event Type	BOD5	TSS	NO23	TKN	TP	Cu	Pb	Zn	TPH	Temp*	pH**	E. coli***
1	BASEFLOW	0.50	0.50	2.28	0.10	0.03	0.003	0.005	0.006	7.5	36.0	7.05	22
2	BASEFLOW	0.50	0.50	1.03	0.10	0.03	0.003	0.005	0.032	0.5	38.5	6.91	9
3	BASEFLOW	0.50	0.50	1.26	0.38	0.03	0.003	0.005	0.003	0.5	47.4	6.98	6
4	BASEFLOW	0.50	0.50	0.39	0.10	0.03	0.003	0.005	0.007	0.5	64.5	6.96	50
4	STORM	0.50	12.56	0.89	0.49	0.03	0.003	0.005	0.016	0.5	58.5	4.49	212
5	BASEFLOW	0.50	0.50	0.45	0.22	0.03	0.007	0.005	0.025	7.9	57.0	7.08	160
6	BASEFLOW	0.50	12.00	0.08	0.37	0.03	0.003	0.005	0.022	0.5	69.1	6.96	700
6	STORM	4.25	37.75	1.20	1.00	0.13	0.004	0.005	0.049	1.4	70.2	6.82	1,600
7	BASEFLOW	2.00	9.67	0.08	0.62	0.03	0.003	0.005	0.021	10.6	72.7	6.71	1,600
8	BASEFLOW	0.50	18.00	0.30	0.46	0.03	0.003	0.005	0.009	3.3	72.6	7.05	1,600
9	BASEFLOW	0.50	2.75	0.19	0.25	0.03	0.003	0.005	0.010	0.5	69.8	6.72	1,600
9	STORM	3.14	50.24	1.27	0.77	0.08	0.004	0.005	0.025	5.5	63.2	6.83	1,516
10	STORM	4.26	42.26	0.99	0.63	0.13	0.003	0.005	0.039	0.5	51.8	6.90	1,600
11	BASEFLOW	0.50	0.50	0.57	0.14	0.03	0.003	0.005	0.015	0.5	53.3	7.03	414
11	STORM	2.74	29.79	0.69	0.56	0.06	0.003	0.005	0.023	0.5	52.4	6.94	982
12	BASEFLOW	0.50	0.50	2.21	0.10	0.03	0.003	0.005	0.026	0.5	36.4	6.87	19
12	STORM	0.50	8.05	1.64	0.18	0.10	0.003	0.005	0.031	0.5	40.8	6.84	1,600

Monthly EMCs (mg/L) were calculated from data using half of the detection limit (DL) for concentrations less than the DL.

* deg F
** no units
*** MPN/100mL
EQ = Equipment Failure
NA = Not Analyzed
NC = Not Collected

Table B-6. 2009 Monthly Event Mean Concentrations (EMCs)
Station 001

Month	Event Type	BOD5	TSS	NO23	TKN	TP	Cu	Pb	Zn	TPH	Temp*	pH**	E. coli***
1	BASEFLOW	0.00	0.00	1.82	0.00	0.00	0.000	0.000	0.000	3.3	40.8	7.27	5
2	BASEFLOW	0.00	0.00	1.04	0.00	0.00	0.000	0.000	0.013	0.0	40.5	7.99	235
3	BASEFLOW	0.00	0.00	1.31	0.32	0.00	0.000	0.000	0.020	0.0	NC	NC	145
4	BASEFLOW	0.00	0.00	0.84	0.00	0.00	0.000	0.000	0.007	9.5	64.9	7.62	29
4	STORM	0.00	9.66	1.09	0.34	0.00	0.000	0.000	0.012	0.0	NC	NC	465
5	BASEFLOW	0.00	0.00	1.21	0.00	0.00	0.003	0.000	0.021	0.0	NC	NC	42
6	BASEFLOW	0.00	2.50	0.10	0.14	0.00	0.000	0.000	0.000	0.0	68.8	7.78	123
6	STORM	11.17	83.29	0.92	1.29	0.15	0.005	0.001	0.031	0.0	68.3	7.64	1,117
7	BASEFLOW	0.00	0.00	0.09	0.27	0.00	0.000	0.000	0.006	9.7	72.7	7.68	900
8	BASEFLOW	0.00	3.00	1.40	0.17	0.00	0.000	0.000	0.000	0.0	73.3	7.37	340
9	BASEFLOW	0.00	0.00	0.93	0.00	0.00	0.000	0.000	0.004	0.0	69.0	7.80	1,250
9	STORM	3.30	171.58	0.86	1.43	0.23	0.007	0.006	0.052	9.9	61.2	7.53	1,544
10	STORM	2.32	26.13	1.50	0.42	0.05	0.000	0.000	0.019	0.0	49.6	7.89	1,051
11	BASEFLOW	0.00	0.00	0.82	0.00	0.00	0.000	0.000	0.011	0.0	53.7	8.11	2
11	STORM	2.76	27.68	0.90	0.52	0.05	0.001	0.000	0.027	0.0	53.6	7.41	1,228
12	BASEFLOW	1.67	0.00	2.33	0.00	0.00	0.003	0.000	0.020	0.0	37.9	7.44	23
12	STORM	0.00	17.20	1.29	0.29	0.05	0.000	0.000	0.088	0.0	43.2	6.84	1,600

Monthly EMCs (mg/L) were calculated from data using zero for concentrations less than the detection limit (DL).

Month	Event Type	BOD5	TSS	NO23	TKN	TP	Cu	Pb	Zn	TPH	Temp*	pH**	E. coli***
1	BASEFLOW	0.50	0.50	1.82	0.10	0.03	0.003	0.005	0.003	3.5	40.8	7.27	5
2	BASEFLOW	0.50	0.50	1.04	0.10	0.03	0.003	0.005	0.013	0.5	40.5	7.99	235
3	BASEFLOW	0.50	0.50	1.31	0.32	0.03	0.003	0.005	0.021	0.5	NC	NC	145
4	BASEFLOW	0.50	0.50	0.84	0.10	0.03	0.003	0.005	0.008	9.6	64.9	7.62	29
4	STORM	0.50	9.91	1.09	0.34	0.03	0.003	0.005	0.012	0.5	NC	NC	465
5	BASEFLOW	0.50	0.50	1.21	0.10	0.03	0.004	0.005	0.021	0.5	NC	NC	42
6	BASEFLOW	0.50	2.75	0.13	0.19	0.03	0.003	0.005	0.003	0.5	68.8	7.78	123
6	STORM	11.25	83.29	0.92	1.31	0.16	0.006	0.005	0.032	0.5	68.3	7.64	1,117
7	BASEFLOW	0.50	0.50	0.13	0.27	0.03	0.003	0.005	0.007	9.7	72.7	7.68	900
8	BASEFLOW	0.50	3.25	1.40	0.22	0.03	0.003	0.005	0.003	0.5	73.3	7.37	340
9	BASEFLOW	0.50	0.50	0.93	0.10	0.03	0.003	0.005	0.005	0.5	69.0	7.80	1,250
9	STORM	3.59	171.58	0.86	1.43	0.23	0.008	0.009	0.052	9.9	61.2	7.53	1,544
10	STORM	2.41	26.13	1.50	0.43	0.06	0.003	0.005	0.019	0.5	49.6	7.89	1,051
11	BASEFLOW	0.50	0.50	0.82	0.10	0.03	0.003	0.005	0.011	0.5	53.7	8.11	2
11	STORM	2.95	27.82	0.90	0.55	0.06	0.003	0.005	0.027	0.5	53.6	7.41	1,228
12	BASEFLOW	1.83	0.50	2.33	0.10	0.03	0.004	0.005	0.020	0.5	37.9	7.44	23
12	STORM	0.50	17.20	1.29	0.33	0.06	0.003	0.005	0.088	0.5	43.2	6.84	1,600

Monthly EMCs (mg/L) were calculated from data using half of the detection limit (DL) for concentrations less than the DL.

* deg F
** no units
*** MPN/100mL
NA = Not Analyzed
NC = Not Collected

Table B-7. 1998-2009 Annual Loads and Yields
Station 002

Year	BOD5	TSS	NO23	TKN	TP	Cu	Pb	Zn	TPH	Fecal Coliforms*	E. coli*
1998	2,220	15,977	0.00	620.99	190.05	5.736	0.397	43.329	0.0	ND	ND
1999	743	4,634	338.24	171.54	23.05	2.619	0.000	9.328	0.0	2,078,286	ND
2000	537	2,421	221.76	86.87	24.92	0.721	0.000	3.676	0.0	44,615	ND
2001	328	5,133	118.04	112.72	22.54	0.734	0.000	4.114	548.8	474,581	ND
2002	62	1,885	103.85	87.52	20.16	1.029	0.000	4.538	569.0	1,070,751	ND
2003	1,471	5,461	738.22	141.36	30.00	2.397	0.000	6.070	0.0	2,231,028	ND
2004	2,191	9,496	244.26	532.88	42.91	1.203	0.000	4.915	0.0	3,191,253	ND
2005	0	4,519	814.53	0.00	42.13	0.591	0.000	24.154	0.0	3,581,708	ND
2006	661	2,391	169.98	0.00	14.36	0.000	0.000	4.585	0.0	ND	1,089,624
2007	359	3,363	334.10	104.54	8.37	0.243	0.000	6.045	0.0	ND	827,232
2008	0	6,746	934.20	204.99	26.15	0.000	0.000	11.717	0.0	ND	2,569,089
2009	1,196	17,572	882.87	414.26	44.52	0.192	0.000	22.567	0.0	ND	4,779,317

Annual loads (lbs/yr) were calculated from data using zero for concentrations less than the detection limit DL.

Year	BOD5	TSS	NO23	TKN	TP	Cu	Pb	Zn	TPH	Fecal Coliforms**	E. coli**
1998	28	202	0.00	7.86	2.41	0.073	0.005	0.548	0.0	ND	ND
1999	9	59	4.28	2.17	0.29	0.033	0.000	0.118	0.0	26,301	ND
2000	7	31	2.81	1.10	0.32	0.009	0.000	0.047	0.0	565	ND
2001	4	65	1.49	1.43	0.29	0.009	0.000	0.052	6.9	6,006	ND
2002	1	24	1.31	1.11	0.26	0.013	0.000	0.057	7.2	13,550	ND
2003	19	69	9.34	1.79	0.38	0.030	0.000	0.077	0.0	28,234	ND
2004	28	120	3.09	6.74	0.54	0.015	0.000	0.062	0.0	40,385	ND
2005	0	57	10.31	0.00	0.53	0.007	0.000	0.306	0.0	45,327	ND
2006	8	30	2.15	0.00	0.18	0.000	0.000	0.058	0.0	ND	13,789
2007	5	43	4.23	1.32	0.11	0.003	0.000	0.077	0.0	ND	10,469
2008	0	85	11.82	2.59	0.33	0.000	0.000	0.148	0.0	ND	32,512
2009	15	222	11.17	5.24	0.56	0.002	0.000	0.286	0.0	ND	60,482

Yields (lbs/acre/yr) were calculated from data using zero for concentrations less than the detection limit DL.

Table B-7. 1998-2009 Annual Loads and Yields
Station 002

Year	BOD5	TSS	NO23	TKN	TP	Cu	Pb	Zn	TPH	Fecal Coliforms*	E. coli*
1998	2,309	16,022	11.96	665.83	190.65	5.863	0.639	43.329	747.2	ND	ND
1999	962	4,634	338.24	277.54	23.21	2.712	0.384	9.328	958.9	2,078,286	ND
2000	718	2,605	221.76	98.61	24.92	0.844	0.275	3.676	688.5	44,615	ND
2001	478	5,264	118.04	118.52	22.54	0.877	0.220	4.114	548.8	474,581	ND
2002	259	2,001	104.93	91.38	20.16	1.107	0.228	4.538	569.0	1,070,751	ND
2003	1,678	5,844	738.22	166.88	30.00	2.567	0.607	6.070	1,517.4	2,231,028	ND
2004	2,619	9,993	244.26	797.27	42.91	1.741	2.127	11.785	2,127.1	3,191,253	ND
2005	1,167	5,412	814.53	583.41	42.13	1.547	2.917	26.533	2,917.1	3,581,708	ND
2006	799	2,535	169.98	152.22	14.36	0.304	0.761	5.415	761.1	ND	1,089,624
2007	463	3,539	334.10	126.89	10.85	0.777	1.269	6.096	126.9	ND	827,232
2008	463	6,912	935.29	239.36	31.46	2.317	4.635	11.717	463.5	ND	2,569,089
2009	1,543	17,805	882.87	432.80	60.03	2.510	4.828	22.567	482.8	ND	4,779,317

Annual loads (lbs/yr) were calculated from data using half of the detection limit (DL) for concentrations less than the DL.

Year	BOD5	TSS	NO23	TKN	TP	Cu	Pb	Zn	TPH	Fecal Coliforms**	E. coli**
1998	29	203	0.15	8.43	2.41	0.074	0.008	0.548	9.5	ND	ND
1999	12	59	4.28	3.51	0.29	0.034	0.005	0.118	12.1	26,301	ND
2000	9	33	2.81	1.25	0.32	0.011	0.003	0.047	8.7	565	ND
2001	6	67	1.49	1.50	0.29	0.011	0.003	0.052	6.9	6,006	ND
2002	3	25	1.33	1.16	0.26	0.014	0.003	0.057	7.2	13,550	ND
2003	21	74	9.34	2.11	0.38	0.032	0.008	0.077	19.2	28,234	ND
2004	33	126	3.09	10.09	0.54	0.022	0.027	0.149	26.9	40,385	ND
2005	15	68	10.31	7.38	0.53	0.020	0.037	0.336	36.9	45,327	ND
2006	10	32	2.15	1.93	0.18	0.004	0.010	0.069	9.6	ND	13,789
2007	6	45	4.23	1.61	0.14	0.010	0.016	0.077	1.6	ND	10,469
2008	6	87	11.84	3.03	0.40	0.029	0.059	0.148	5.9	ND	32,512
2009	20	225	11.17	5.48	0.76	0.032	0.061	0.286	6.1	ND	60,482

Yields (lbs/acre/yr) were calculated from data using half of the detection limit (DL) for concentrations less than the DL.

* million MPN/yr
** million MPN/acre/yr
ND = No Data

Table B-8. 1998-2009 Annual Loads and Yields
Station 001

Year	BOD5	TSS	NO23	TKN	TP	Cu	Pb	Zn	TPH	Fecal Coliforms*	E. coli*
1998	4,457	157,356	0.00	908.56	157.47	5.374	0.485	9.802	0.0	ND	ND
1999	1,542	13,822	816.92	0.00	43.97	4.792	0.000	6.886	0.0	3,750,462	ND
2000	631	7,601	661.70	171.48	49.30	3.000	0.000	8.641	0.0	47,735	ND
2001	738	8,405	576.49	105.75	38.46	2.544	0.132	3.932	1,174.8	1,420,871	ND
2002	0	16,360	480.64	86.78	41.54	2.664	0.000	4.394	1,233.2	1,489,946	ND
2003	2,799	24,065	2,034.99	278.45	53.24	6.195	0.205	10.645	0.0	5,133,158	ND
2004	2,043	15,438	2,556.13	709.84	58.62	3.050	0.000	0.000	0.0	4,808,689	ND
2005	1,116	24,505	3,177.14	0.00	74.17	0.000	0.000	7.443	0.0	7,546,516	ND
2006	9,320	53,667	3,943.56	0.00	193.87	7.765	0.000	17.178	0.0	ND	16,095,817
2007	3,214	25,272	2,980.66	379.81	47.29	1.330	0.000	11.823	0.0	ND	6,497,092
2008	0	3,753	1,498.56	71.83	12.67	0.000	0.000	4.643	0.0	ND	3,419,085
2009	2,980	29,844	2,225.07	517.83	70.59	0.000	0.000	46.358	0.0	ND	8,487,339

Annual loads (lbs/yr) were calculated from data using zero for concentrations less than the detection limit DL.

Year	BOD5	TSS	NO23	TKN	TP	Cu	Pb	Zn	TPH	Fecal Coliforms**	E. coli**
1998	26	931	0.00	5.37	0.93	0.032	0.003	0.058	0.0	ND	ND
1999	9	82	4.83	0.00	0.26	0.028	0.000	0.041	0.0	22,180	ND
2000	4	45	3.91	1.01	0.29	0.018	0.000	0.051	0.0	282	ND
2001	4	50	3.41	0.63	0.23	0.015	0.001	0.023	6.9	8,403	ND
2002	0	97	2.84	0.51	0.25	0.016	0.000	0.026	7.3	8,812	ND
2003	17	142	12.03	1.65	0.31	0.037	0.001	0.063	0.0	30,358	ND
2004	12	91	15.12	4.20	0.35	0.018	0.000	0.000	0.0	28,439	ND
2005	7	145	18.79	0.00	0.44	0.000	0.000	0.044	0.0	44,630	ND
2006	55	317	23.32	0.00	1.15	0.046	0.000	0.102	0.0	ND	95,191
2007	19	149	17.63	2.25	0.28	0.008	0.000	0.070	0.0	ND	38,424
2008	0	22	8.86	0.42	0.07	0.000	0.000	0.027	0.0	ND	20,221
2009	18	176	13.16	3.06	0.42	0.000	0.000	0.274	0.0	ND	50,194

Yields (lbs/acre/yr) were calculated from data using zero for concentrations less than the detection limit DL.

Table B-8. 1998-2009 Annual Loads and Yields
Station 001

Year	BOD5	TSS	NO23	TKN	TP	Cu	Pb	Zn	TPH	Fecal Coliforms*	E. coli*
1998	4,553	157,404	26.18	1,004.51	158.43	5.534	0.897	9.991	1,636.1	ND	ND
1999	2,049	13,872	816.92	410.37	44.63	5.199	0.821	6.985	2,051.8	3,750,462	ND
2000	933	7,977	661.70	196.61	49.30	3.251	0.592	8.830	1,480.4	47,735	ND
2001	1,037	8,592	579.83	124.38	38.46	2.668	0.536	4.118	1,174.8	1,420,871	ND
2002	493	16,607	480.64	105.02	41.54	2.781	0.493	4.518	1,233.2	1,489,946	ND
2003	3,345	24,611	2,034.99	338.34	55.97	6.559	1.440	10.645	3,257.8	5,133,158	ND
2004	3,535	16,049	2,556.13	1,363.85	58.62	3.967	4.772	19.087	4,771.7	4,808,689	ND
2005	3,301	26,559	3,177.14	1,282.26	75.60	2.565	6.411	30.225	6,411.3	7,546,516	ND
2006	11,018	55,744	3,943.56	2,038.64	194.08	9.829	10.193	51.435	10,193.2	ND	16,095,817
2007	3,754	25,867	2,980.66	592.19	76.68	5.414	9.277	15.131	927.7	ND	6,497,092
2008	549	4,055	1,498.56	146.45	29.60	2.744	5.488	5.332	548.8	ND	3,419,085
2009	3,497	30,188	2,225.07	603.70	97.16	5.166	10.332	46.932	1,033.2	ND	8,487,339

Annual loads (lbs/yr) were calculated from data using half of the detection limit (DL) for concentrations less than the DL.

Year	BOD5	TSS	NO23	TKN	TP	Cu	Pb	Zn	TPH	Fecal Coliforms**	E. coli**
1998	27	931	0.15	5.94	0.94	0.033	0.005	0.059	9.7	ND	ND
1999	12	82	4.83	2.43	0.26	0.031	0.005	0.041	12.1	22,180	ND
2000	6	47	3.91	1.16	0.29	0.019	0.004	0.052	8.8	282	ND
2001	6	51	3.43	0.74	0.23	0.016	0.003	0.024	6.9	8,403	ND
2002	3	98	2.84	0.62	0.25	0.016	0.003	0.027	7.3	8,812	ND
2003	20	146	12.03	2.00	0.33	0.039	0.009	0.063	19.3	30,358	ND
2004	21	95	15.12	8.07	0.35	0.023	0.028	0.113	28.2	28,439	ND
2005	20	157	18.79	7.58	0.45	0.015	0.038	0.179	37.9	44,630	ND
2006	65	330	23.32	12.06	1.15	0.058	0.060	0.304	60.3	ND	95,191
2007	22	153	17.63	3.50	0.45	0.032	0.055	0.089	5.5	ND	38,424
2008	3	24	8.86	0.87	0.18	0.016	0.032	0.032	3.2	ND	20,221
2009	21	179	13.16	3.57	0.57	0.031	0.061	0.278	6.1	ND	50,194

Yields (lbs/acre/yr) were calculated from data using half of the detection limit (DL) for concentrations less than the DL.

* million MPN/yr
** million MPN/acre/yr
ND = No Data

Table B-9. 1998-2009 Seasonal Loads
Station 002

Year	Season	BOD5	TSS	NO23	TKN	TP	Cu	Pb	Zn	TPH	Fecals*	E. coli*
1998	SUMMER	202	1,725	0.00	67.67	18.62	0.581	0.035	2.690	0.4	ND	ND
1998	FALL	218	1,007	0.00	15.39	3.06	0.100	0.030	0.886	0.0	ND	ND
1999	WINTER	0	5,175	65.42	0.00	4.55	0.377	0.000	2.493	0.0	ND	ND
1999	SPRING	47	2,815	10.72	33.51	4.04	0.254	0.073	1.619	0.0	ND	ND
1999	SUMMER	325	1,549	85.80	36.86	10.39	0.398	0.000	3.478	0.0	1,071,481	ND
1999	FALL	119	1,023	54.52	52.80	4.51	0.497	0.000	1.535	60.7	381,916	ND
2000	WINTER	161	836	50.80	53.83	3.95	0.271	0.000	0.806	0.0	ND	ND
2000	SPRING	96	673	23.46	21.01	5.70	0.182	0.000	0.769	0.0	ND	ND
2000	SUMMER	31	259	9.49	12.46	4.60	0.096	0.000	0.559	0.0	ND	ND
2000	FALL	326	626	37.51	25.20	5.01	0.277	0.006	0.839	0.0	ND	ND
2001	WINTER	174	1,361	44.81	57.69	7.14	0.491	0.000	2.311	153.5	ND	ND
2001	SPRING	120	2,165	0.00	36.65	4.82	0.311	0.035	1.231	1,002.6	ND	ND
2001	SUMMER	162	1,315	20.92	18.57	3.84	0.154	0.000	0.878	59.0	ND	ND
2001	FALL	21	51	3.57	2.18	0.69	0.013	0.000	0.124	45.5	28,914	ND
2002	WINTER	0	217	7.83	5.59	1.48	0.109	0.011	0.362	37.2	43,841	ND
2002	SPRING	32	293	8.72	22.06	3.12	0.191	0.000	0.883	68.5	151,740	ND
2002	SUMMER	0	147	4.46	7.83	1.65	0.032	0.000	0.323	41.7	112,548	ND
2002	FALL	79	2,752	58.08	73.33	7.57	0.541	0.018	4.391	207.0	600,483	ND
2003	WINTER	636	8,401	247.42	91.50	18.24	2.163	0.115	10.820	0.0	883,549	ND
2003	SPRING	269	1,125	0.00	47.13	5.11	0.686	0.000	1.166	0.0	526,314	ND
2003	SUMMER	333	2,263	105.67	34.48	4.27	0.514	0.000	0.915	0.0	635,328	ND
2003	FALL	192	763	203.40	36.14	5.53	0.487	0.000	1.040	0.0	630,198	ND
2004	WINTER	83	825	623.73	49.56	7.95	0.534	0.000	6.240	0.0	23,012	ND
2004	SPRING	671	5,454	130.19	639.53	35.89	0.309	0.000	2.096	0.0	1,838,345	ND
2004	SUMMER	7,028	36,314	104.18	545.82	117.89	0.772	0.000	8.740	0.0	1,999,342	ND
2004	FALL	1,005	2,111	257.89	93.02	12.13	0.610	0.000	1.431	0.0	1,106,920	ND
2005	WINTER	0	0	284.77	35.60	2.82	0.000	0.000	1.780	0.0	21,416	ND
2005	SPRING	216	961	168.72	25.52	3.88	0.189	0.088	1.815	0.0	987,267	ND
2005	SUMMER	66	6,219	34.54	14.72	16.11	0.105	0.064	4.935	0.0	53,662	ND
2005	FALL	275	379	497.02	0.00	15.58	0.132	0.000	7.449	0.0	47,603	ND
2006	WINTER	57	0	54.29	0.00	1.36	0.000	0.000	0.679	0.0	ND	461
2006	SPRING	496	3,016	55.28	28.10	11.10	0.000	0.017	1.227	0.0	ND	219,246
2006	SUMMER	153	1,963	21.45	33.12	6.68	0.034	0.000	1.117	0.0	ND	437,738
2006	FALL	225	366	49.27	0.00	3.03	0.061	0.002	0.586	0.0	ND	199,019
2007	WINTER	120	1,267	67.48	17.15	3.15	0.072	0.040	0.943	0.0	ND	111,355
2007	SPRING	44	1,578	16.29	32.89	2.94	0.000	0.000	1.004	0.0	ND	451,688
2007	SUMMER	125	785	108.06	35.72	6.89	0.353	0.115	3.349	0.0	ND	188,250
2007	FALL	165	451	225.73	12.48	0.00	0.000	0.000	1.672	228.3	ND	258,009
2008	WINTER	185	1,147	281.63	17.41	2.37	0.000	0.000	2.035	0.0	ND	37,591
2008	SPRING	671	1,693	284.67	87.73	4.67	0.000	0.000	1.935	162.6	ND	865,796
2008	SUMMER	0	5,404	283.53	92.94	15.13	0.000	0.000	7.244	0.0	ND	1,869,270
2008	FALL	0	185	177.48	45.58	5.79	0.000	0.000	3.332	420.6	ND	620,855
2009	WINTER	0	0	60.01	0.00	0.00	0.000	0.000	0.270	0.0	ND	1,999
2009	SPRING	0	2,292	239.69	103.33	0.00	0.000	0.000	4.846	0.0	ND	1,396,955
2009	SUMMER	552	10,651	264.55	192.41	12.62	0.394	0.000	5.739	1,302.5	ND	2,006,419
2009	FALL	546	5,717	383.19	102.09	20.01	0.068	0.000	9.304	0.0	ND	1,526,172

Seasonal loads (lbs/season) were calculated from data using zero for concentrations less than the detection limit DL.

Table B-9. 1998-2009 Seasonal Loads
Station 002

Year	Season	BOD5	TSS	NO23	TKN	TP	Cu	Pb	Zn	TPH	Fecals*	E. coli*
1998	SUMMER	202	1,725	1.04	74.18	18.62	0.581	0.056	2.690	64.8	ND	ND
1998	FALL	218	1,007	0.44	29.96	3.06	0.105	0.034	0.886	27.3	ND	ND
1999	WINTER	67	5,175	65.42	47.59	4.79	0.377	0.067	2.493	167.3	ND	ND
1999	SPRING	60	2,815	10.72	42.62	4.04	0.254	0.077	1.619	55.8	ND	ND
1999	SUMMER	377	1,570	85.80	110.57	10.39	0.431	0.148	3.478	369.3	1,071,481	ND
1999	FALL	119	1,023	54.52	77.68	4.51	0.497	0.055	1.535	170.8	381,916	ND
2000	WINTER	96	498	30.29	52.91	2.35	0.162	0.025	0.481	63.3	ND	ND
2000	SPRING	110	681	23.46	26.93	5.70	0.202	0.041	0.769	102.1	ND	ND
2000	SUMMER	54	296	10.04	14.69	4.60	0.123	0.039	0.559	96.9	ND	ND
2000	FALL	326	626	37.51	19.40	5.01	0.277	0.037	0.839	84.6	ND	ND
2001	WINTER	177	1,361	44.81	36.21	7.14	0.491	0.061	2.311	153.5	ND	ND
2001	SPRING	140	2,165	1.60	46.62	4.82	0.311	0.060	1.231	1,002.6	ND	ND
2001	SUMMER	168	1,315	21.11	19.93	3.84	0.158	0.024	0.878	59.0	ND	ND
2001	FALL	24	51	3.57	5.01	0.69	0.015	0.007	0.124	45.5	28,914	ND
2002	WINTER	15	219	7.86	8.56	1.48	0.109	0.021	0.362	37.2	43,841	ND
2002	SPRING	51	311	8.72	27.59	3.12	0.191	0.027	0.883	68.5	151,740	ND
2002	SUMMER	17	152	4.83	11.99	1.65	0.041	0.017	0.323	41.7	112,548	ND
2002	FALL	122	2,752	58.08	77.57	7.57	0.541	0.095	4.391	207.0	600,483	ND
2003	WINTER	1,028	11,646	342.99	31.55	25.28	2.998	0.437	14.999	733.7	1,224,841	ND
2003	SPRING	269	1,168	2.90	85.30	5.11	0.686	0.073	1.166	181.4	526,314	ND
2003	SUMMER	334	2,341	106.02	36.87	4.27	0.514	0.092	0.915	228.8	635,328	ND
2003	FALL	241	774	203.40	38.24	5.53	0.497	0.104	1.040	259.9	630,198	ND
2004	WINTER	456	1,133	623.73	115.35	8.66	0.746	1.020	8.262	1,019.8	23,975	ND
2004	SPRING	1,104	5,739	131.63	392.33	35.89	0.737	1.257	6.425	1,256.8	1,838,345	ND
2004	SUMMER	7,229	36,349	106.28	307.46	118.09	1.090	1.080	10.747	1,079.9	1,999,342	ND
2004	FALL	1,254	2,476	257.89	132.74	12.31	0.866	1.089	5.070	1,088.6	1,106,920	ND
2005	WINTER	194	243	284.77	116.50	3.14	0.194	0.485	3.074	485.4	21,416	ND
2005	SPRING	528	1,351	168.72	198.44	5.13	0.501	0.953	4.706	907.1	987,267	ND
2005	SUMMER	212	6,219	34.93	87.74	16.11	0.251	0.403	5.092	391.4	53,662	ND
2005	FALL	556	697	497.02	174.96	15.58	0.434	0.875	8.169	874.8	47,603	ND
2006	WINTER	68	42	54.29	16.97	1.36	0.034	0.085	0.679	84.8	ND	461
2006	SPRING	522	3,070	55.28	59.78	11.10	0.087	0.215	1.758	216.9	ND	219,246
2006	SUMMER	212	1,963	21.45	72.47	6.68	0.120	0.256	1.632	255.9	ND	437,738
2006	FALL	274	402	49.27	33.38	3.03	0.113	0.167	0.974	166.9	ND	199,019
2007	WINTER	141	1,307	67.48	30.81	3.40	0.119	0.148	1.216	136.6	ND	112,799
2007	SPRING	89	1,578	17.41	33.24	2.94	0.062	0.156	1.004	155.7	ND	451,688
2007	SUMMER	163	824	108.21	44.45	7.09	0.392	0.253	3.349	155.1	ND	188,250
2007	FALL	195	516	225.73	34.91	0.37	0.075	0.187	1.822	378.4	ND	258,009
2008	WINTER	254	1,208	281.63	29.45	5.39	0.400	0.800	2.035	80.0	ND	37,591
2008	SPRING	704	1,734	284.67	90.06	7.54	0.578	1.156	1.947	271.1	ND	865,796
2008	SUMMER	155	5,451	284.29	102.39	17.49	0.777	1.553	7.244	155.3	ND	1,869,270
2008	FALL	113	289	177.48	51.88	6.35	0.563	1.126	3.332	491.9	ND	620,855
2009	WINTER	24	24	60.01	4.76	1.19	0.119	0.238	0.270	23.8	ND	1,999
2009	SPRING	127	2,368	239.69	105.60	6.35	0.635	1.270	4.846	127.0	ND	1,396,955
2009	SUMMER	656	10,651	264.55	192.41	17.82	0.914	1.434	5.739	1,370.4	ND	2,006,419
2009	FALL	672	5,773	383.19	120.75	23.80	0.886	1.704	9.304	170.4	ND	1,526,172

Seasonal loads (lbs/season) were calculated from data using half of the detection limit (DL) for concentrations less than the DL.

* million MPN/season
ND = No Data

Table B-10. 1998-2009 Seasonal Loads
Station 001

Year	Season	BOD5	TSS	NO23	TKN	TP	Cu	Pb	Zn	TPH	Fecals*	E. coli*
1998	SUMMER	725	23,058	0.00	101.03	25.29	0.733	0.205	2.775	31.7	ND	ND
1998	FALL	490	713	0.00	30.89	2.21	0.127	0.009	0.240	0.0	ND	ND
1999	WINTER	0	1,474	182.53	0.00	0.00	0.617	0.000	0.988	0.0	ND	ND
1999	SPRING	707	20,944	29.12	106.06	12.14	0.832	0.373	4.189	0.0	ND	ND
1999	SUMMER	711	6,472	288.73	119.87	19.49	2.052	0.046	2.399	0.0	1,322,025	ND
1999	FALL	237	1,987	91.21	0.00	8.26	1.089	0.000	1.367	630.2	756,659	ND
2000	WINTER	334	2,664	107.30	75.92	6.64	0.760	0.142	1.980	0.0	ND	ND
2000	SPRING	363	1,236	132.93	36.54	6.53	0.451	0.000	0.802	336.0	ND	ND
2000	SUMMER	59	1,473	75.36	16.74	11.06	0.677	0.000	1.548	0.0	ND	ND
2000	FALL	790	2,780	48.17	58.53	16.49	0.707	0.000	1.853	0.0	ND	ND
2001	WINTER	375	3,763	110.54	95.78	10.28	1.005	0.025	2.736	328.5	ND	ND
2001	SPRING	272	12,057	429.95	52.34	9.66	1.257	0.232	2.591	1,665.9	ND	ND
2001	SUMMER	245	3,611	92.88	16.92	4.57	0.486	0.060	0.472	126.2	ND	ND
2001	FALL	19	79	13.02	1.48	1.40	0.029	0.000	0.123	102.0	78,383	ND
2002	WINTER	0	2,176	23.14	6.20	2.89	0.237	0.019	0.820	79.6	133,191	ND
2002	SPRING	207	391	78.64	10.89	5.53	0.117	0.000	0.249	146.7	49,578	ND
2002	SUMMER	0	785	32.54	14.73	3.83	0.204	0.000	0.338	89.3	259,049	ND
2002	FALL	243	14,196	114.33	89.12	13.02	1.561	0.151	5.513	415.3	353,643	ND
2003	WINTER	501	29,430	656.82	132.88	27.53	4.521	0.073	8.277	0.0	1,903,078	ND
2003	SPRING	588	12,050	6.62	82.72	10.48	1.553	0.186	4.540	0.0	1,126,226	ND
2003	SUMMER	905	3,351	259.61	68.13	6.47	1.506	0.260	1.958	0.0	1,359,211	ND
2003	FALL	793	3,783	476.06	32.76	13.35	1.086	0.000	1.914	0.0	989,502	ND
2004	WINTER	133	3,427	871.75	0.00	11.67	0.719	0.000	2.544	0.0	428,846	ND
2004	SPRING	882	9,725	687.94	762.92	30.35	1.354	0.000	2.788	0.0	1,305,019	ND
2004	SUMMER	329	12,572	547.96	331.65	45.95	1.009	0.000	1.775	0.0	1,519,492	ND
2004	FALL	1,431	1,453	454.29	0.00	13.09	0.835	0.000	0.000	0.0	844,942	ND
2005	WINTER	0	0	875.94	437.97	3.86	0.000	0.000	2.576	0.0	57,613	ND
2005	SPRING	284	7,413	958.43	0.00	10.33	1.906	0.000	1.893	0.0	2,112,591	ND
2005	SUMMER	312	6,051	365.84	0.00	14.14	0.000	0.227	2.281	0.0	22,059	ND
2005	FALL	226	1,495	1,184.31	0.00	38.91	0.226	0.000	0.000	0.0	13,990	ND
2006	WINTER	652	0	1,141.25	0.00	13.04	0.000	0.000	0.000	0.0	ND	68,977
2006	SPRING	1,167	8,207	390.13	82.27	22.65	0.802	0.123	2.973	0.0	ND	687,801
2006	SUMMER	88	14,756	1,105.89	0.00	56.99	0.905	0.000	11.053	0.0	ND	5,525,651
2006	FALL	4,243	20,156	896.50	0.00	50.53	2.377	0.510	6.018	0.0	ND	2,317,889
2007	WINTER	1,099	21,275	1,742.76	141.76	25.62	1.113	0.915	4.618	0.0	ND	793,665
2007	SPRING	623	8,310	443.55	172.74	16.74	0.675	0.000	3.011	0.0	ND	1,136,133
2007	SUMMER	453	7,407	300.77	47.19	8.46	0.601	0.000	1.231	0.0	ND	459,643
2007	FALL	705	1,057	365.42	79.85	0.00	0.000	0.000	2.044	0.0	ND	1,280,619
2008	WINTER	243	2,252	556.87	19.30	3.22	0.000	0.000	1.462	0.0	ND	146,619
2008	SPRING	811	2,210	369.40	37.96	5.42	0.000	0.000	0.705	285.2	ND	1,076,155
2008	SUMMER	0	565	355.40	28.26	0.00	0.000	0.000	0.179	0.0	ND	1,126,894
2008	FALL	0	0	225.17	58.48	9.79	0.101	0.000	1.640	352.5	ND	776,531
2009	WINTER	0	0	133.51	0.00	0.00	0.000	0.000	1.291	0.0	ND	66,987
2009	SPRING	796	3,842	557.82	133.66	0.00	0.000	0.000	5.810	0.0	ND	1,168,950
2009	SUMMER	1,371	71,286	539.42	624.83	94.76	2.914	2.400	22.206	4,119.5	ND	3,716,737
2009	FALL	896	10,537	1,007.78	172.54	24.92	0.304	0.000	18.429	0.0	ND	2,936,321

Seasonal loads (lbs/season) were calculated from data using zero for concentrations less than the detection limit DL.

Table B-10. 1998-2009 Seasonal Loads
Station 001

Year	Season	BOD5	TSS	NO23	TKN	TP	Cu	Pb	Zn	TPH	Fecals*	E. coli*
1998	SUMMER	725	23,058	2.23	138.14	25.29	0.733	0.233	2.775	165.6	ND	ND
1998	FALL	490	713	0.94	41.61	2.21	0.127	0.028	0.251	58.5	ND	ND
1999	WINTER	143	1,474	182.53	101.84	1.43	0.617	0.143	0.988	358.0	ND	ND
1999	SPRING	707	20,944	29.12	113.05	12.14	0.832	0.373	4.189	119.5	ND	ND
1999	SUMMER	830	6,472	288.73	233.69	19.49	2.103	0.339	2.565	790.3	2,292,795	ND
1999	FALL	237	1,987	91.21	107.22	8.26	1.089	0.118	1.367	794.6	756,659	ND
2000	WINTER	208	1,664	67.01	126.49	4.15	0.474	0.113	1.237	135.4	ND	ND
2000	SPRING	391	1,236	132.93	41.84	6.53	0.451	0.087	0.824	526.5	ND	ND
2000	SUMMER	112	1,473	75.36	22.99	11.06	0.695	0.083	1.548	207.3	ND	ND
2000	FALL	790	2,780	48.17	64.38	16.49	0.707	0.072	1.853	181.0	ND	ND
2001	WINTER	382	3,763	110.54	93.72	10.28	1.005	0.144	2.736	328.5	ND	ND
2001	SPRING	314	12,057	432.28	56.38	9.66	1.257	0.254	2.591	1,665.9	ND	ND
2001	SUMMER	262	3,611	92.88	20.37	4.57	0.494	0.098	0.476	126.2	ND	ND
2001	FALL	26	79	13.02	7.43	1.40	0.029	0.014	0.123	102.0	78,383	ND
2002	WINTER	32	2,176	23.35	13.73	2.89	0.237	0.041	0.820	79.6	133,191	ND
2002	SPRING	240	391	78.64	16.97	5.53	0.117	0.059	0.249	146.7	49,578	ND
2002	SUMMER	36	785	32.54	17.99	3.83	0.204	0.036	0.338	89.3	259,049	ND
2002	FALL	328	14,196	114.33	129.58	13.02	1.561	0.242	5.513	415.3	353,643	ND
2003	WINTER	1,188	40,797	910.53	53.65	38.17	6.267	0.695	11.474	1,570.0	2,638,188	ND
2003	SPRING	588	12,050	12.46	114.39	10.48	1.553	0.258	4.540	388.2	1,126,226	ND
2003	SUMMER	905	3,351	259.61	84.53	6.47	1.506	0.326	1.958	489.6	1,359,211	ND
2003	FALL	793	3,812	476.06	87.69	13.84	1.140	0.217	1.914	542.8	989,502	ND
2004	WINTER	550	3,750	871.75	236.30	12.53	0.965	1.180	5.993	1,180.4	428,846	ND
2004	SPRING	1,111	9,725	687.94	787.12	30.35	1.582	1.261	6.904	1,261.5	1,305,019	ND
2004	SUMMER	683	12,740	547.96	420.49	45.95	1.240	1.084	5.351	1,084.0	1,519,492	ND
2004	FALL	1,701	1,844	454.29	245.21	13.18	1.062	1.225	4.902	1,225.4	844,942	ND
2005	WINTER	515	644	875.94	566.78	5.15	0.515	1.288	6.870	1,288.1	57,613	ND
2005	SPRING	988	8,020	958.43	388.22	13.18	2.412	1.941	8.930	1,941.1	1,059,155	ND
2005	SUMMER	558	6,051	366.27	167.59	14.26	0.335	0.898	4.675	837.9	12,096	ND
2005	FALL	955	2,272	1,184.31	404.98	38.91	0.955	2.025	8.100	2,024.9	15,452	ND
2006	WINTER	978	815	1,141.25	326.07	13.04	0.652	1.630	6.521	1,630.4	ND	68,977
2006	SPRING	1,258	8,350	390.67	220.40	22.94	1.041	0.814	5.425	837.5	ND	687,801
2006	SUMMER	1,328	15,069	1,105.89	638.11	57.06	1.893	3.191	20.131	3,190.6	ND	5,525,651
2006	FALL	4,447	20,696	896.50	438.73	50.53	2.699	2.279	12.633	2,193.7	ND	2,317,889
2007	WINTER	376	2,384	556.87	45.72	9.82	0.821	1.643	2.071	164.3	ND	146,619
2007	SPRING	868	2,276	369.40	53.20	8.23	0.690	1.380	1.307	407.0	ND	1,076,155
2007	SUMMER	130	624	355.40	40.12	6.50	0.650	1.300	0.739	130.0	ND	1,126,894
2007	FALL	117	117	225.17	80.56	12.00	0.583	1.165	1.733	440.1	ND	776,531
2008	WINTER	1,472	335	1,264.40	67.10	16.77	1.677	3.355	4.417	335.5	ND	46,636
2008	SPRING	385	385	1,097.05	143.88	19.27	1.927	3.854	1.927	2,517.8	ND	150,237
2008	SUMMER	462	462	1,380.74	92.46	23.12	2.312	4.623	3.467	462.3	ND	600,742
2008	FALL	357	357	351.43	624.23	77.43	1.787	3.574	7.565	1,268.7	ND	207,363
2009	WINTER	51	51	133.51	10.19	2.55	0.255	0.510	1.291	51.0	ND	66,987
2009	SPRING	935	4,015	557.82	151.35	13.59	1.359	2.717	5.932	271.7	ND	1,168,950
2009	SUMMER	1,593	71,385	539.42	634.75	100.14	4.020	4.612	22.453	4,227.1	ND	3,716,737
2009	FALL	1,087	10,658	1,007.78	210.02	34.29	1.975	3.646	18.429	364.6	ND	2,936,505

Seasonal loads (lbs/season) were calculated from data using half of the detection limit (DL) for concentrations less than the DL.

* million MPN/season
ND = No Data

Table B-11. Comparison of 1998-2008 Event Mean Concentrations (EMCs) with Maryland NPDES EMCs and NURP Residential EMCs

Parameter	Yearly Average EMC (mg/L)	Maryland NPDES (mg/L)	NURP Residential EMCs (mg/L)
1998 Upstream Station (Outfall)			
Biological Oxygen Demand	2.54	14.26	11
Total Suspended Solids	21.14	55.08	140
Nitrate plus Nitrite	NC	0.97	0.96
Total Kjeldahl Nitrogen	0.64	1.75	2.35
Total Phosphorus	0.13	0.37	0.47
Total Petroleum Hydrocarbons	0.002	--	--
Total Phenols	**0.003**	**0.0022**	--
Total Cadmium	NC	0.00004	--
Total Copper	0.004	0.0141	0.05
Total Lead	0.0005	0.0057	0.18
Total Zinc	0.026	0.0893	0.18
1998 Downstream Station (Instream)			
Biological Oxygen Demand	4.22	14.26	11
Total Suspended Solids	**63.63**	**55.08**	140
Nitrate plus Nitrite	NC	0.97	0.96
Total Kjeldahl Nitrogen	0.64	1.75	2.35
Total Phosphorus	0.11	0.37	0.47
Total Petroleum Hydrocarbons	0.076	--	--
Total Phenols	**0.010**	**0.0022**	--
Total Cadmium	NC	0.00004	--
Total Copper	0.003	0.0141	0.05
Total Lead	0.0007	0.0057	0.18
Total Zinc	0.014	0.0893	0.18
1999 Upstream Station (Outfall)			
Biological Oxygen Demand	1.26	14.26	11
Total Suspended Solids	28.13	55.08	140
Nitrate plus Nitrite	**1.31**	**0.97**	**0.96**
Total Kjeldahl Nitrogen	0.41	1.75	2.35
Total Phosphorus	0.14	0.37	0.47
Total Petroleum Hydrocarbons	0.70	--	--
Total Phenols	**0.024**	**0.0022**	--
Total Cadmium	NC	0.00004	--
Total Copper	0.003	0.0141	0.05
Total Lead	0.0003	0.0057	0.18
Total Zinc	0.020	0.0893	0.18
Fecal Coliform (MPN/mL)	899.76	2309.12	--
1999 Downstream Station (Instream)			
Biological Oxygen Demand	3.22	14.26	11
Total Suspended Solids	30.90	55.08	140
Nitrate plus Nitrite	**1.30**	**0.97**	**0.96**
Total Kjeldahl Nitrogen	0.47	1.75	2.35
Total Phosphorus	0.05	0.37	0.47
Total Petroleum Hydrocarbons	1.08	--	--
Total Phenols	**0.015**	**0.0022**	--
Total Cadmium	NC	0.00004	--
Total Copper	0.004	0.0141	0.05
Total Lead	0.0005	0.0057	0.18
Total Zinc	0.011	0.0893	0.18
Fecal Coliform (MPN/mL)	852.08	2309.12	--

Note: Bold values represent exceedences.

Maryland's National Pollutant Discharge Elimination System Municipal Stormwater Monitoring, 1997. Maryland Department of the Environment Water Management Administration.

Table B-11. Comparison of 1998-2008 Event Mean Concentrations (EMCs) with Maryland NPDES EMCs and NURP Residential EMCs

Parameter	Yearly Average EMC (mg/L)	Maryland NPDES (mg/L)	NURP Residential EMCs (mg/L)
2000 Upstream Station (Outfall)			
Biological Oxygen Demand	1.99	14.26	11
Total Suspended Solids	14.94	55.08	140
Nitrate plus Nitrite	0.90	0.97	0.96
Total Kjeldahl Nitrogen	0.31	1.75	2.35
Total Phosphorus	0.10	0.37	0.47
Total Petroleum Hydrocarbons	0.193	--	--
Total Phenols	**0.003**	**0.0022**	--
Total Cadmium	**0.0002**	**0.00004**	--
Total Copper	0.003	0.0141	0.05
Total Lead	0.0002	0.0057	0.18
Total Zinc	0.015	0.0893	0.18
Fecal Coliform (MPN/mL)	222.08	2309.12	--
2000 Downstream Station (Instream)			
Biological Oxygen Demand	1.93	14.26	11
Total Suspended Solids	15.07	55.08	140
Nitrate plus Nitrite	**1.26**	**0.97**	**0.96**
Total Kjeldahl Nitrogen	0.30	1.75	2.35
Total Phosphorus	0.08	0.37	0.47
Total Petroleum Hydrocarbons	0.716	--	--
Total Phenols	NC	0.0022	--
Total Cadmium	NC	0.00004	--
Total Copper	0.004	0.0141	0.05
Total Lead	0.0003	0.0057	0.18
Total Zinc	0.009	0.0893	0.18
Fecal Coliform (MPN/mL)	104.49	2309.12	--
2001 Upstream Station (Outfall)			
Biological Oxygen Demand	2.55	14.26	11
Total Suspended Solids	28.81	55.08	140
Nitrate plus Nitrite	0.66	0.97	0.96
Total Kjeldahl Nitrogen	0.38	1.75	2.35
Total Phosphorus	0.10	0.37	0.47
Total Petroleum Hydrocarbons	5.677	--	--
Total Phenols	**0.026**	**0.0022**	--
Total Cadmium	NC	0.00004	--
Total Copper	0.003	0.0141	0.05
Total Lead	0.0003	0.0057	0.18
Total Zinc	0.020	0.0893	0.18
Fecal Coliform (MPN/mL)	269.90	2309.12	--
2001 Downstream Station (Instream)			
Biological Oxygen Demand	2.23	14.26	11
Total Suspended Solids	39.17	55.08	140
Nitrate plus Nitrite	**1.68**	**0.97**	**0.96**
Total Kjeldahl Nitrogen	0.19	1.75	2.35
Total Phosphorus	0.08	0.37	0.47
Total Petroleum Hydrocarbons	5.809	--	--
Total Phenols	**0.024**	**0.0022**	--
Total Cadmium	0.00002	0.00004	--
Total Copper	0.005	0.0141	0.05
Total Lead	0.0007	0.0057	0.18
Total Zinc	0.012	0.0893	0.18
Fecal Coliform (MPN/mL)	324.52	2309.12	--

Note: Bold values represent exceedences.

Maryland's National Pollutant Discharge Elimination System Municipal Stormwater Monitoring, 1997. Maryland Department of the Environment Water Management Administration.

Table B-11. Comparison of 1998-2008 Event Mean Concentrations (EMCs) with Maryland NPDES EMCs and NURP Residential EMCs

Parameter	Yearly Average EMC (mg/L)	Maryland NPDES (mg/L)	NURP Residential EMCs (mg/L)
2002 Upstream Station (Outfall)			
Biological Oxygen Demand	0.50	14.26	11
Total Suspended Solids	11.97	55.08	140
Nitrate plus Nitrite	0.58	0.97	0.96
Total Kjeldahl Nitrogen	0.38	1.75	2.35
Total Phosphorus	0.08	0.37	0.47
Total Petroleum Hydrocarbons	3.53	--	--
Total Phenols	**0.023**	**0.0022**	--
Total Cadmium	0.000002	0.00004	--
Total Copper	0.003	0.0141	0.05
Total Lead	0.0002	0.0057	0.18
Total Zinc	0.022	0.0893	0.18
Fecal Coliform (MPN/mL)	660.68	2309.12	--
2002 Downstream Station (Instream)			
Biological Oxygen Demand	0.99	14.26	11
Total Suspended Solids	39.07	55.08	140
Nitrate plus Nitrite	**1.08**	**0.97**	**0.96**
Total Kjeldahl Nitrogen	0.21	1.75	2.35
Total Phosphorus	0.08	0.37	0.47
Total Petroleum Hydrocarbons	3.83	--	--
Total Phenols	**0.024**	**0.0022**	--
Total Cadmium	0.00001	0.00004	--
Total Copper	0.005	0.0141	0.05
Total Lead	0.0005	0.0057	0.18
Total Zinc	0.011	0.0893	0.18
Fecal Coliform (MPN/mL)	485.68	2309.12	--
2003 Upstream Station (Outfall)			
Biological Oxygen Demand	3.09	14.26	11
Total Suspended Solids	10.97	55.08	140
Nitrate plus Nitrite	**1.37**	**0.97**	**0.96**
Total Kjeldahl Nitrogen	0.24	1.75	2.35
Total Phosphorus	0.04	0.37	0.47
Total Petroleum Hydrocarbons	0.45	--	--
Total Phenols	**0.011**	**0.0022**	--
Total Cadmium	0.00000	0.00004	--
Total Copper	0.004	0.0141	0.05
Total Lead	0.0001	0.0057	0.18
Total Zinc	0.016	0.0893	0.18
Fecal Coliform (MPN/mL)	586.81	2309.12	--
2003 Downstream Station (Instream)			
Biological Oxygen Demand	3.04	14.26	11
Total Suspended Solids	23.06	55.08	140
Nitrate plus Nitrite	**1.62**	**0.97**	**0.96**
Total Kjeldahl Nitrogen	0.15	1.75	2.35
Total Phosphorus	0.04	0.37	0.47
Total Petroleum Hydrocarbons	0.61	--	--
Total Phenols	**0.001**	**0.0022**	--
Total Cadmium	0.11905	0.00004	--
Total Copper	0.005	0.0141	0.05
Total Lead	0.0003	0.0057	0.18
Total Zinc	0.008	0.0893	0.18
Fecal Coliform (MPN/mL)	594.09	2309.12	--

Note: Bold values represent exceedences.

Maryland's National Pollutant Discharge Elimination System Municipal Stormwater Monitoring, 1997. Maryland Department of the Environment Water Management Administration.

Table B-11. Comparison of 1998-2008 Event Mean Concentrations (EMCs) with Maryland NPDES EMCs and NURP Residential EMCs

Parameter	Yearly Average EMC (mg/L)	Maryland NPDES (mg/L)	NURP Residential EMCs (mg/L)
2004 Upstream Station (Outfall)			
Biological Oxygen Demand	4.03	14.26	11
Total Suspended Solids	19.88	55.08	140
Nitrate plus Nitrite	0.44	0.97	0.96
Total Kjeldahl Nitrogen	0.92	1.75	2.35
Total Phosphorus	0.07	0.37	0.47
Total Petroleum Hydrocarbons	0.00	--	--
Total Phenols	**0.034**	**0.0022**	--
Total Cadmium	0.00	0.00004	--
Total Copper	0.002	0.0141	0.05
Total Lead	0.00	0.0057	0.18
Total Zinc	0.010	0.0893	0.18
Fecal Coliform (MPN/mL)	1179.53	2309.12	--
2004 Downstream Station (Instream)			
Biological Oxygen Demand	1.54	14.26	11
Total Suspended Solids	16.04	55.08	140
Nitrate plus Nitrite	**1.07**	**0.97**	**0.96**
Total Kjeldahl Nitrogen	0.72	1.75	2.35
Total Phosphorus	0.05	0.37	0.47
Total Petroleum Hydrocarbons	0.00	--	--
Total Phenols	**0.018**	**0.0022**	--
Total Cadmium	0.00	0.00004	--
Total Copper	0.003	0.0141	0.05
Total Lead	0.00	0.0057	0.18
Total Zinc	0.00	0.0893	0.18
Fecal Coliform (MPN/mL)	844.61	2309.12	--
2005 Upstream Station (Outfall)			
Biological Oxygen Demand	0.55	14.26	11
Total Suspended Solids	16.90	55.08	140
Nitrate plus Nitrite	0.74	0.97	0.96
Total Kjeldahl Nitrogen	0.10	1.75	2.35
Total Phosphorus	0.06	0.37	0.47
Total Petroleum Hydrocarbons	0.00	--	--
Total Copper	0.0007	0.0141	0.05
Total Lead	0.0003	0.0057	0.18
Total Zinc	0.0186	0.0893	0.18
Fecal Coliform (MPN/mL)	365	2,309	--
2005 Downstream Station (Instream)			
Biological Oxygen Demand	0.60	14.26	11
Total Suspended Solids	11.90	55.08	140
Nitrate plus Nitrite	**1.25**	**0.97**	**0.96**
Total Kjeldahl Nitrogen	0.14	1.75	2.35
Total Phosphorus	0.03	0.37	0.47
Total Petroleum Hydrocarbons	0.00	--	--
Total Copper	0.0008	0.0141	0.05
Total Lead	0.0001	0.0057	0.18
Total Zinc	0.0047	0.0893	0.18
Fecal Coliform (MPN/mL)	336	2,309	--

Note: Bold values represent exceedences.

Maryland's National Pollutant Discharge Elimination System Municipal Stormwater Monitoring, 1997. Maryland Department of the Environment Water Management Administration.

Table B-11. Comparison of 1998-2008 Event Mean Concentrations (EMCs) with Maryland NPDES EMCs and NURP Residential EMCs

Parameter	Yearly Average EMC (mg/L)	Maryland NPDES (mg/L)	NURP Residential EMCs (mg/L)
2006 Upstream Station (Outfall)			
Biological Oxygen Demand	2.91	14.26	11
Total Suspended Solids	13.66	55.08	140
Nitrate plus Nitrite	0.68	0.97	0.96
Total Kjeldahl Nitrogen	0.17	1.75	2.35
Total Phosphorus	0.07	0.37	0.47
Total Petroleum Hydrocarbons	0.00	--	--
Total Copper	0.0004	0.0141	0.05
Total Lead	0.0001	0.0057	0.18
Total Zinc	0.0131	0.0893	0.18
E. coli (MPN/mL)	554	--	--
2006 Downstream Station (Instream)			
Biological Oxygen Demand	8.33	14.26	11
Total Suspended Solids	14.91	55.08	140
Nitrate plus Nitrite	**1.16**	**0.97**	**0.96**
Total Kjeldahl Nitrogen	1.10	1.75	2.35
Total Phosphorus	0.12	0.37	0.47
Total Petroleum Hydrocarbons	0.00	--	--
Total Copper	0.0020	0.0141	0.05
Total Lead	0.0002	0.0057	0.18
Total Zinc	0.0082	0.0893	0.18
E. coli (MPN/mL)	537	--	--
2007 Upstream Station (Outfall)			
Biological Oxygen Demand	2.11	14.26	11
Total Suspended Solids	19.25	55.08	140
Nitrate plus Nitrite	**1.69**	**0.97**	**0.96**
Total Kjeldahl Nitrogen	0.42	1.75	2.35
Total Phosphorus	0.07	0.37	0.47
Total Petroleum Hydrocarbons	0.90	--	--
Total Copper	0.0026	0.0141	0.05
Total Lead	0.0009	0.0057	0.18
Total Zinc	0.0309	0.0893	0.18
E. coli (MPN/mL)	785	--	--
2007 Downstream Station (Instream)			
Biological Oxygen Demand	2.03	14.26	11
Total Suspended Solids	35.23	55.08	140
Nitrate plus Nitrite	**1.63**	**0.97**	**0.96**
Total Kjeldahl Nitrogen	0.34	1.75	2.35
Total Phosphorus	0.04	0.37	0.47
Total Petroleum Hydrocarbons	0.00	--	--
Total Copper	0.0019	0.0141	0.05
Total Lead	0.0002	0.0057	0.18
Total Zinc	0.0094	0.0893	0.18
E. coli (MPN/mL)	633	--	--

Note: Bold values represent exceedences.

Maryland's National Pollutant Discharge Elimination System Municipal Stormwater Monitoring, 1997. Maryland Department of the Environment Water Management Administration.

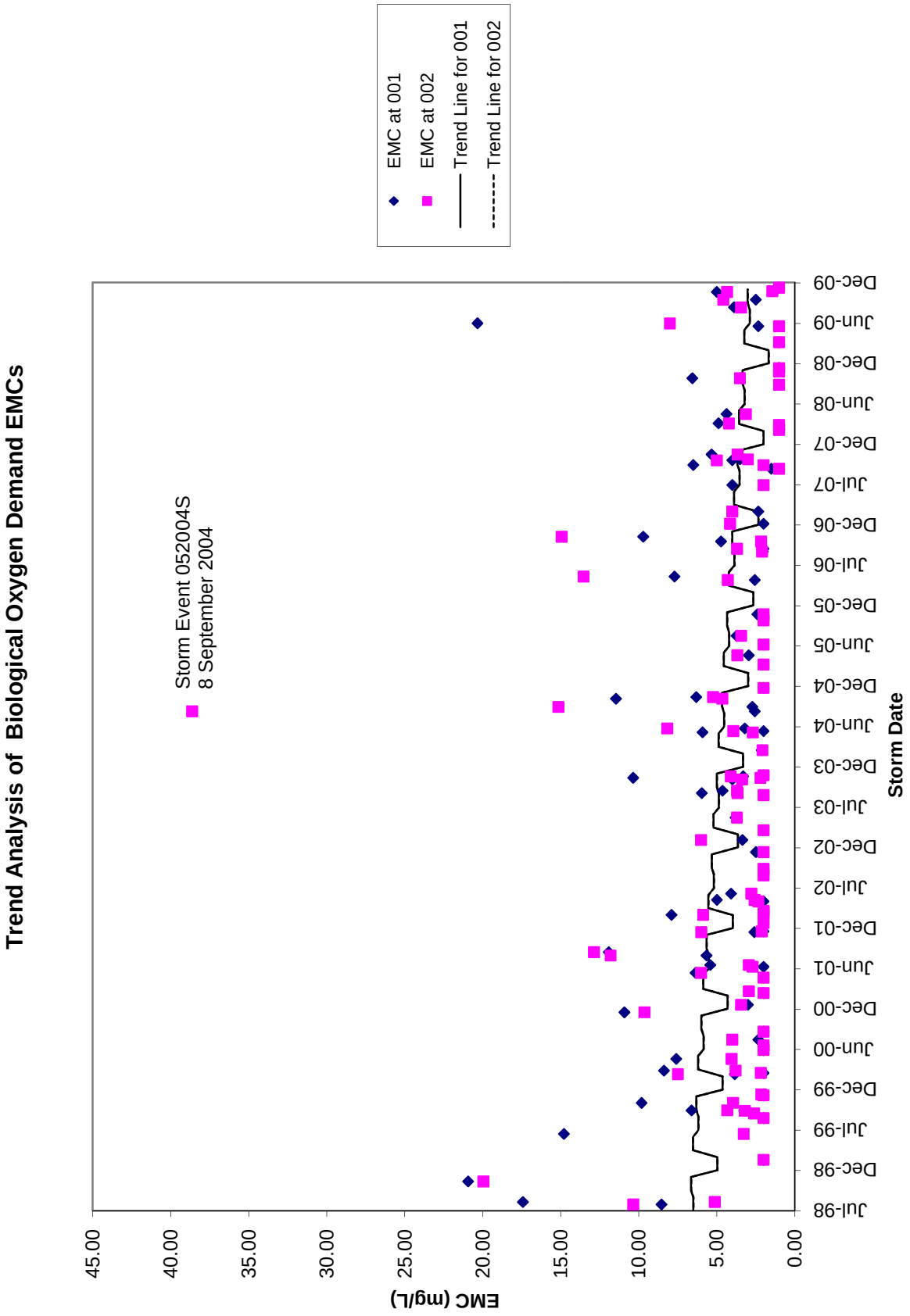
Table B-11. Comparison of 1998-2008 Event Mean Concentrations (EMCs) with Maryland NPDES EMCs and NURP Residential EMCs

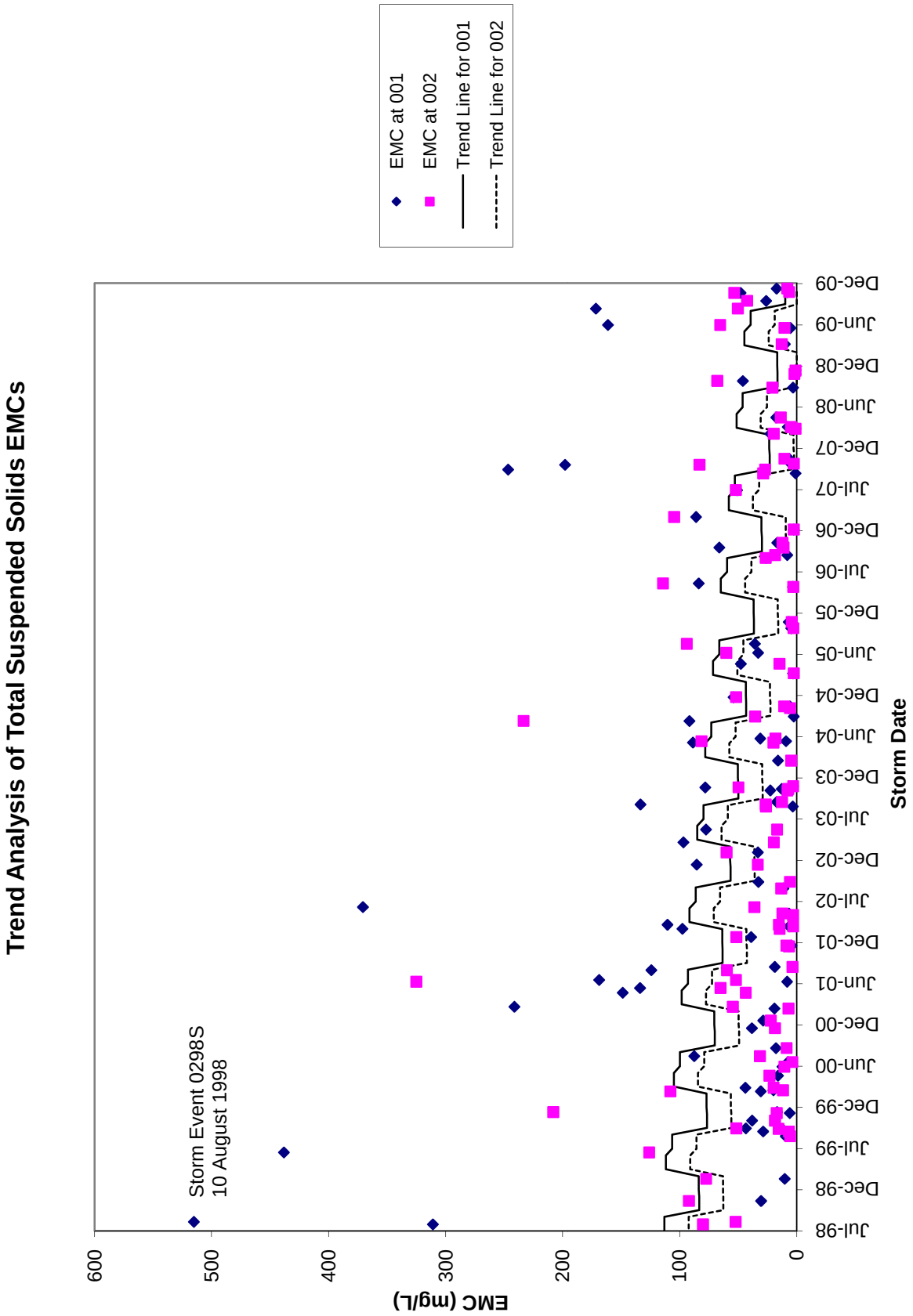
Parameter	Yearly Average EMC (mg/L)	Maryland NPDES (mg/L)	NURP Residential EMCs (mg/L)
2008 Upstream Station (Outfall)			
Biological Oxygen Demand	1.08	14.26	11
Total Suspended Solids	7.12	55.08	140
Nitrate plus Nitrite	**1.11**	**0.97**	**0.96**
Total Kjeldahl Nitrogen	0.18	1.75	2.35
Total Phosphorus	0.02	0.37	0.47
Total Petroleum Hydrocarbons	0.98	--	--
Total Copper	0.0005	0.0141	0.05
Total Lead	0.0000	0.0057	0.18
Total Zinc	0.0136	0.0893	0.18
E. coli (MPN/mL)	427	--	--
2008 Downstream Station (Instream)			
Biological Oxygen Demand	1.08	14.26	11
Total Suspended Solids	5.32	55.08	140
Nitrate plus Nitrite	**1.31**	**0.97**	**0.96**
Total Kjeldahl Nitrogen	0.19	1.75	2.35
Total Phosphorus	0.02	0.37	0.47
Total Petroleum Hydrocarbons	1.70	--	--
Total Copper	0.0001	0.0141	0.05
Total Lead	0.0000	0.0057	0.18
Total Zinc	0.0054	0.0893	0.18
E. coli (MPN/mL)	504	--	--

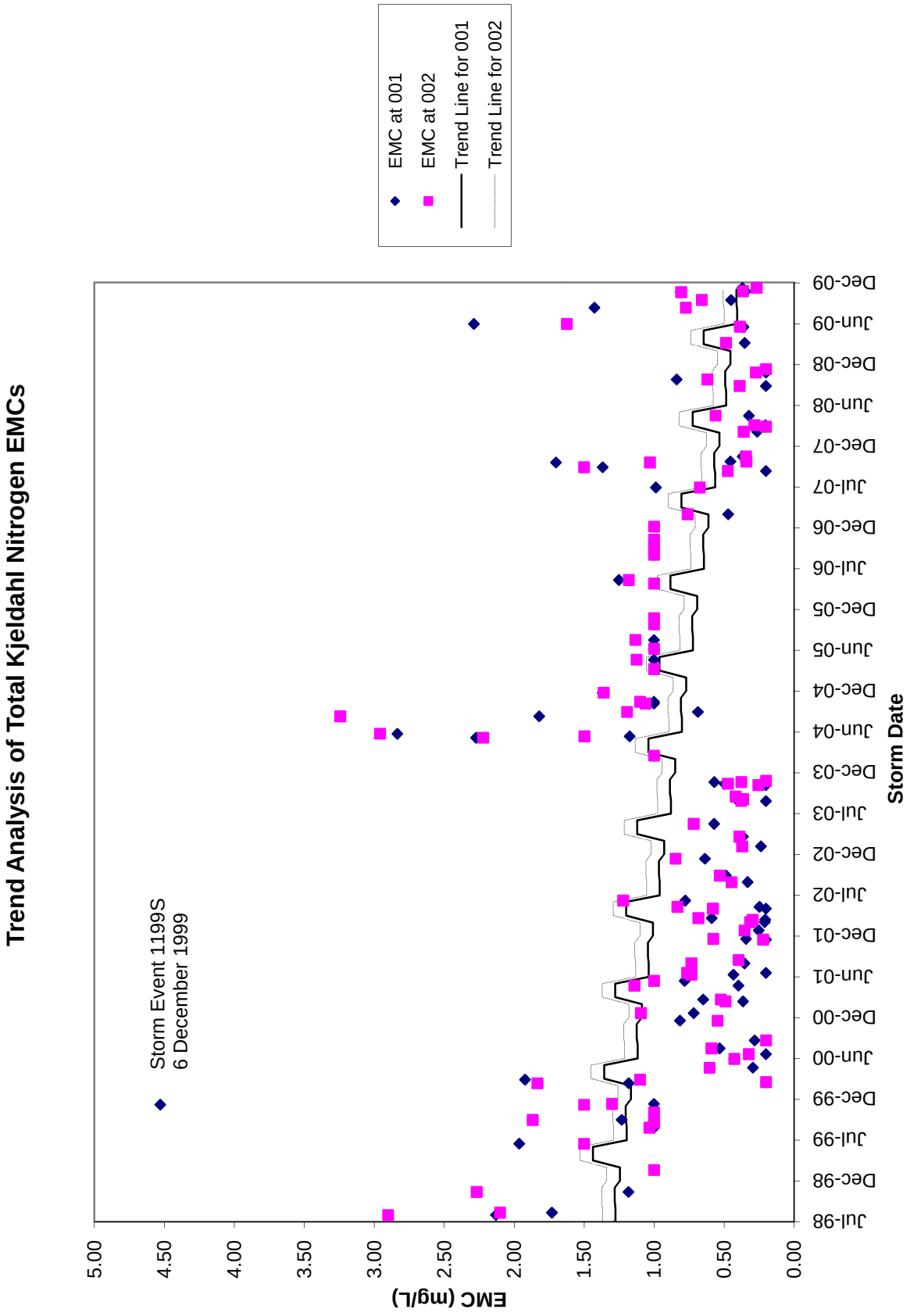
Note: Bold values represent exceedences.

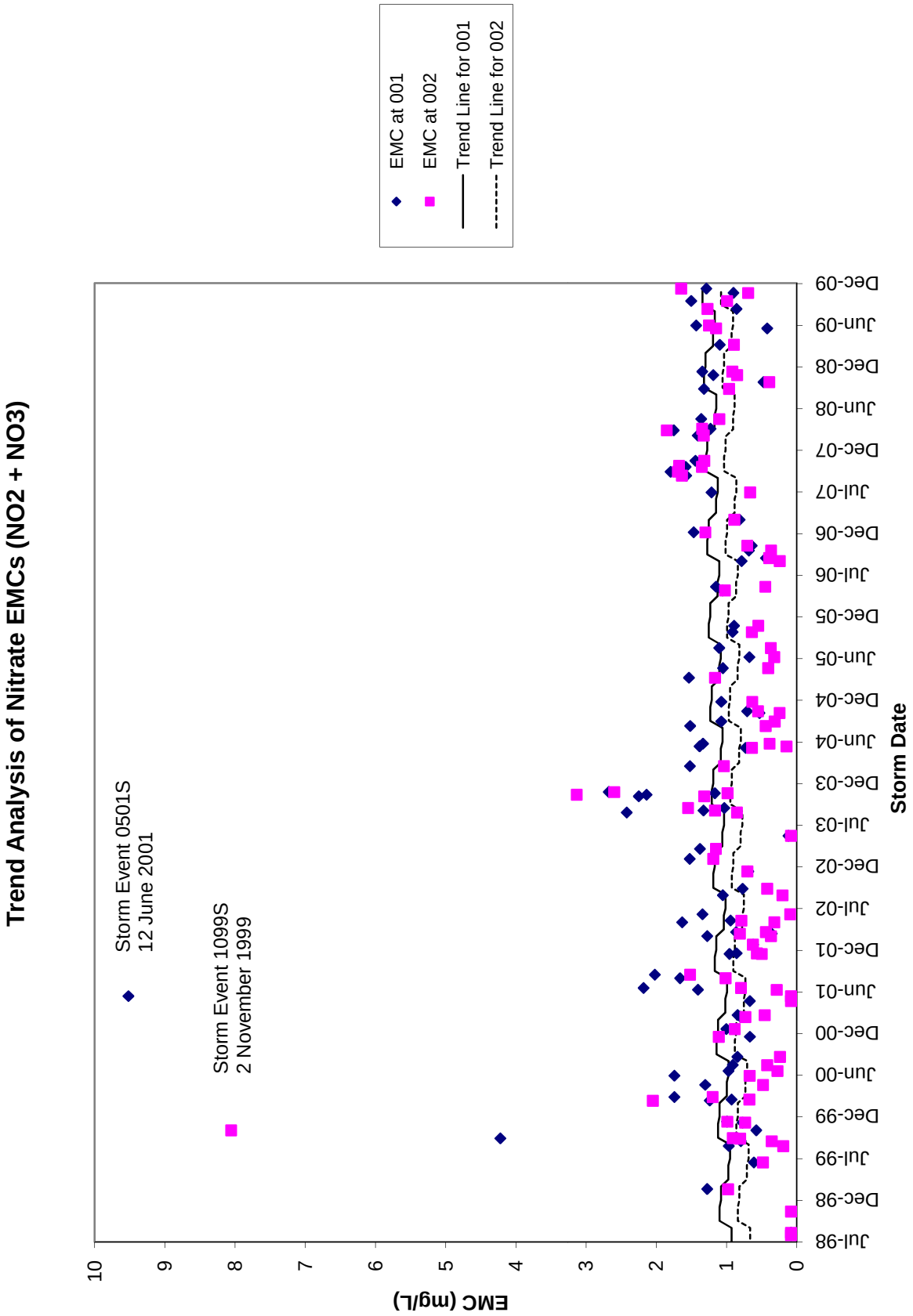
Maryland's National Pollutant Discharge Elimination System Municipal Stormwater Monitoring, 1997. Maryland Department of the Environment Water Management Administration.

APPENDIX C
TREND ANALYSIS GRAPHS


Trend Analysis of Biological Oxygen Demand EMCs
Storm Event 052004S
8 September 2004
EMC at 001
EMC at 002
Trend Line for 001
Trend Line for 002
EMC (mg/L)
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Jul-98
Dec-98
Jul-99
Dec-99
Jun-00
Dec-00
Jun-01
Dec-01
Jul-02
Dec-02
Jul-03
Dec-03
Jun-04
Dec-04
Jun-05
Dec-05
Jul-06
Dec-06
Jul-07
Dec-07
Jun-08
Dec-08
Jun-09
Dec-09
Storm Date


Trend Analysis of Total Suspended Solids EMCs
EMC at 001
EMC at 002
Trend Line for 001
Trend Line for 002
Storm Event 0298S
10 August 1998
EMC (mg/L)
600
500
400
300
200
100
0
Jul-98
Dec-98
Jul-99
Dec-99
Jun-00
Dec-00
Jun-01
Dec-01
Jul-02
Dec-02
Jul-03
Dec-03
Jun-04
Dec-04
Jun-05
Dec-05
Jul-06
Dec-06
Jul-07
Dec-07
Jun-08
Dec-08
Jun-09
Dec-09
Storm Date


Trend Analysis of Total Kjeldahl Nitrogen EMCs
Storm Event 1199S
6 December 1999
EMC at 001
EMC at 002
Trend Line for 001
Trend Line for 002
EMC (mg/L)
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Jul-98
Dec-98
Jul-99
Dec-99
Jun-00
Dec-00
Jun-01
Dec-01
Jul-02
Dec-02
Jul-03
Dec-03
Jun-04
Dec-04
Jun-05
Dec-05
Jul-06
Dec-06
Jul-07
Dec-07
Jun-08
Dec-08
Jun-09
Dec-09
Storm Date


Trend Analysis of Nitrate EMCs (NO2 + NO3)
Storm Event 0501S
12 June 2001
Storm Event 1099S
2 November 1999
EMC at 001
EMC at 002
Trend Line for 001
Trend Line for 002
EMC (mg/L)
0
1
2
3
4
5
6
7
8
9
10
Storm Date
Jul-98
Dec-98
Jul-99
Dec-99
Jun-00
Dec-00
Jun-01
Dec-01
Jul-02
Dec-02
Jul-03
Dec-03
Jun-04
Dec-04
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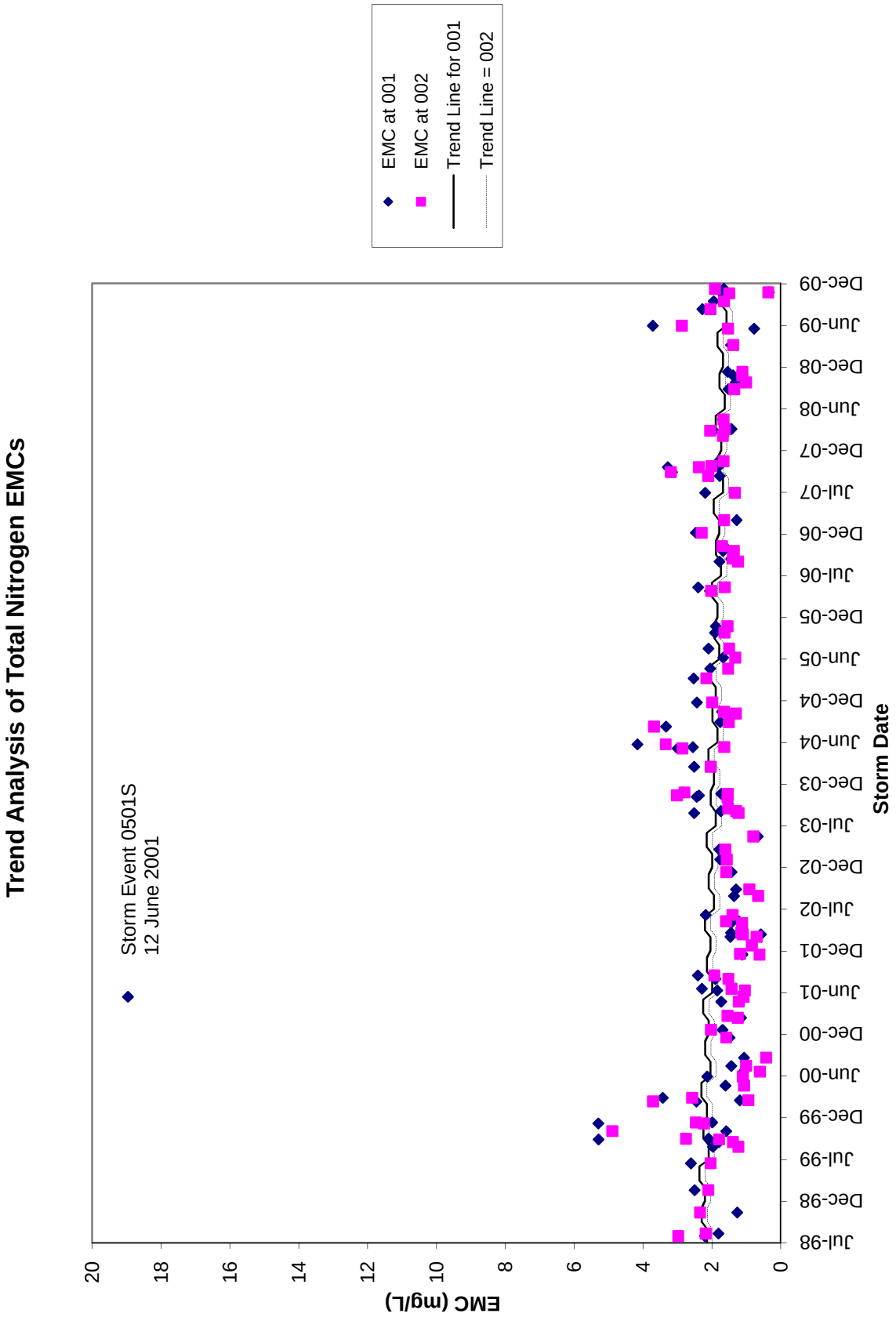
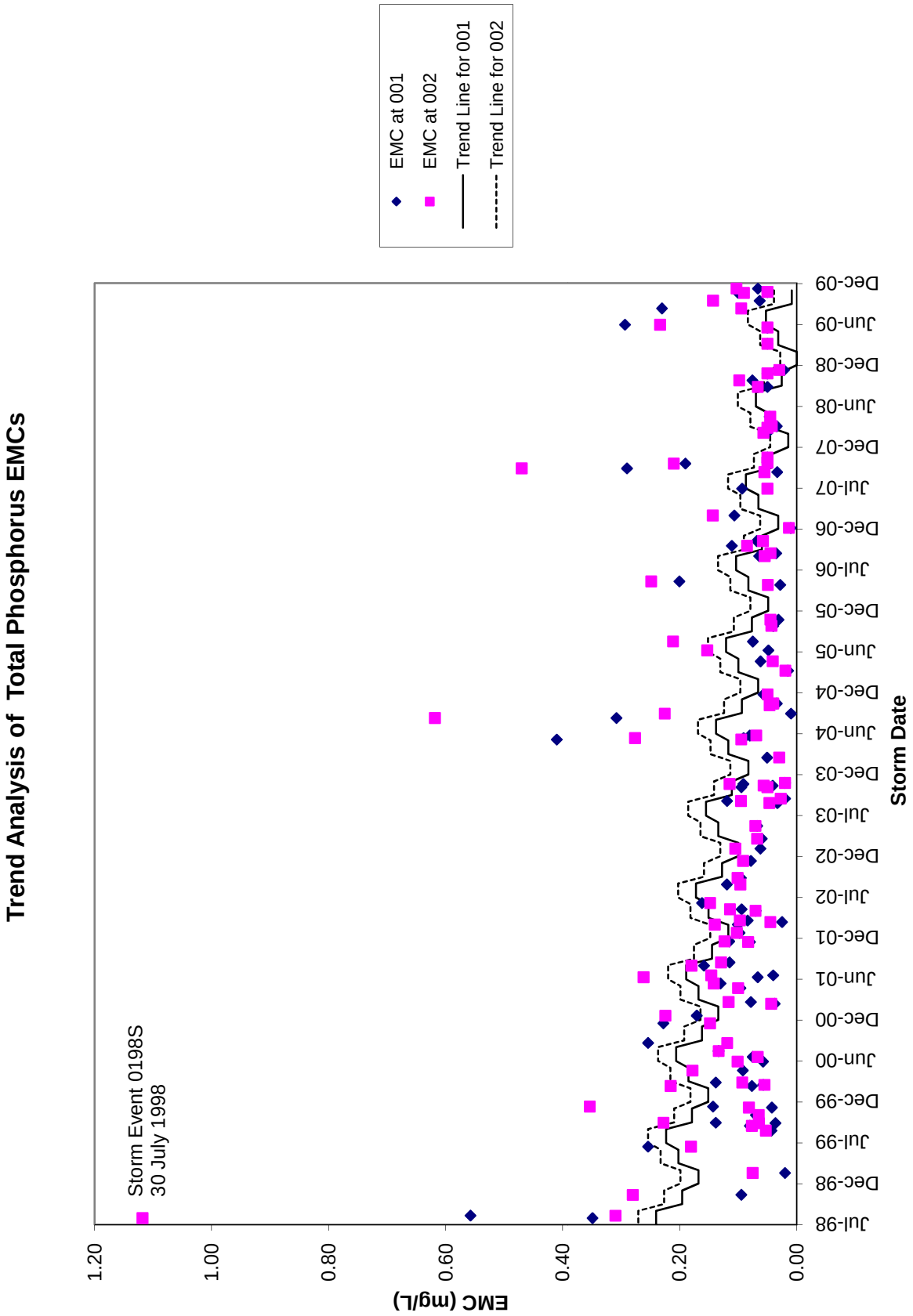
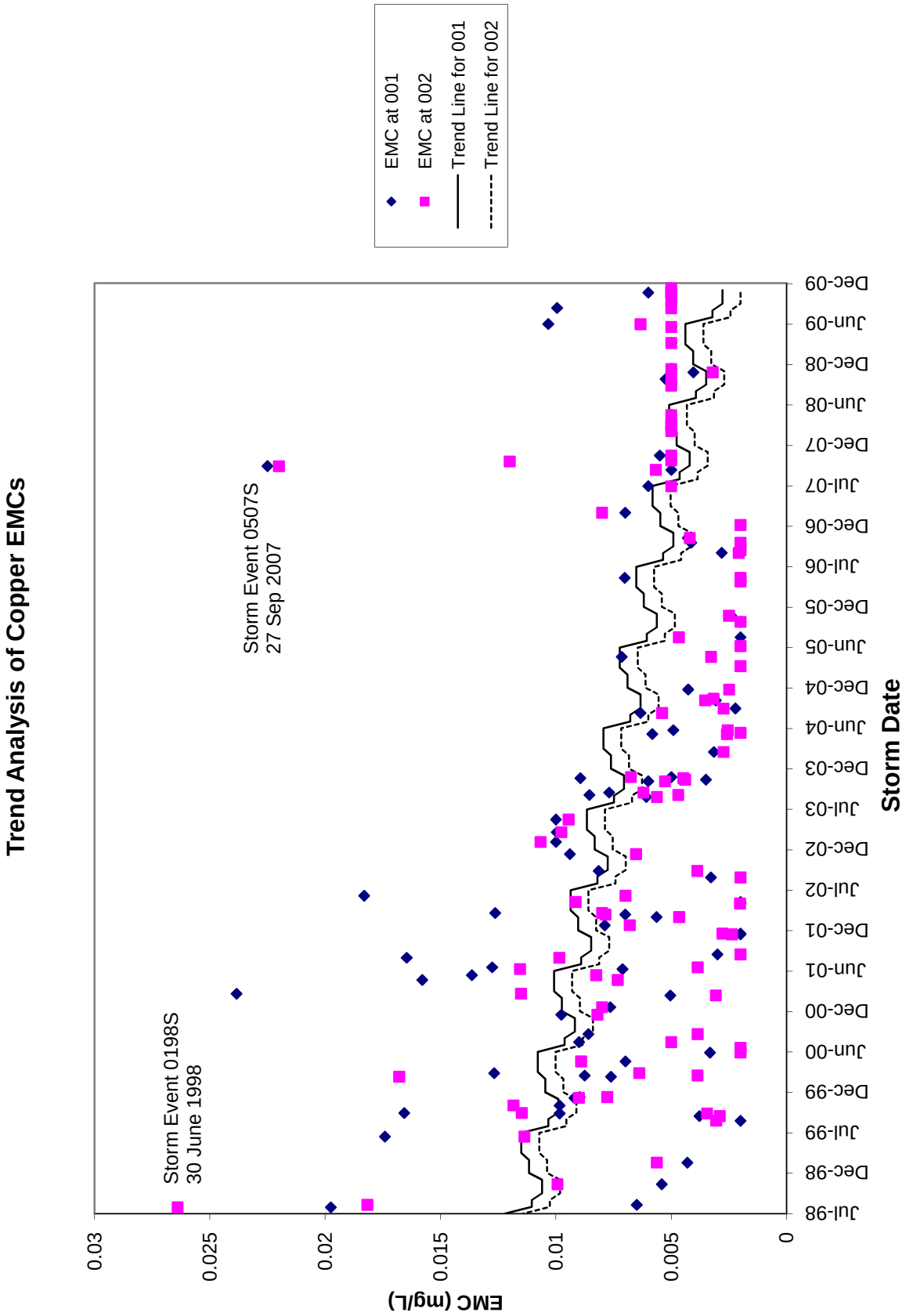
Dec-05
Jul-06
Dec-06
Jul-07
Dec-07
Jun-08
Dec-08
Jun-09
Dec-09


Trend Analysis of Total Nitrogen EMCs
Storm Event 0501S
12 June 2001
EMC at 001
EMC at 002
Trend Line for 001
Trend Line = 002
EMC (mg/L)
0
2
4
6
8
10
12
14
16
18
20
Storm Date
Jul-98
Dec-98
Jul-99
Dec-99
Jun-00
Dec-00
Jun-01
Dec-01
Jul-02
Dec-02
Jul-03
Dec-03
Jun-04
Dec-04
Jun-05
Dec-05
Jul-06
Dec-06
Jul-07
Dec-07
Jun-08
Dec-08
Jun-09
Dec-09


Trend Analysis of Total Phosphorus EMCs
EMC at 001
EMC at 002
Trend Line for 001
Trend Line for 002
Storm Event 0198S
30 July 1998
EMC (mg/L)
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Jul-98
Dec-98
Jul-99
Dec-99
Jun-00
Dec-00
Jun-01
Dec-01
Jul-02
Dec-02
Jul-03
Dec-03
Jun-04
Dec-04
Jun-05
Dec-05
Jul-06
Dec-06
Jul-07
Dec-07
Jun-08
Dec-08
Jun-09
Dec-09
Storm Date


Trend Analysis of Copper EMCs
EMC at 001
EMC at 002
Trend Line for 001
Trend Line for 002
Storm Event 0198S
30 June 1998
Storm Event 0507S
27 Sep 2007
EMC (mg/L)
0.03
0.025
0.02
0.015
0.01
0.005
0
Jul-98
Dec-98
Jul-99
Dec-99
Jun-00
Dec-00
Jun-01
Dec-01
Jul-02
Dec-02
Jul-03
Dec-03
Jun-04
Dec-04
Jun-05
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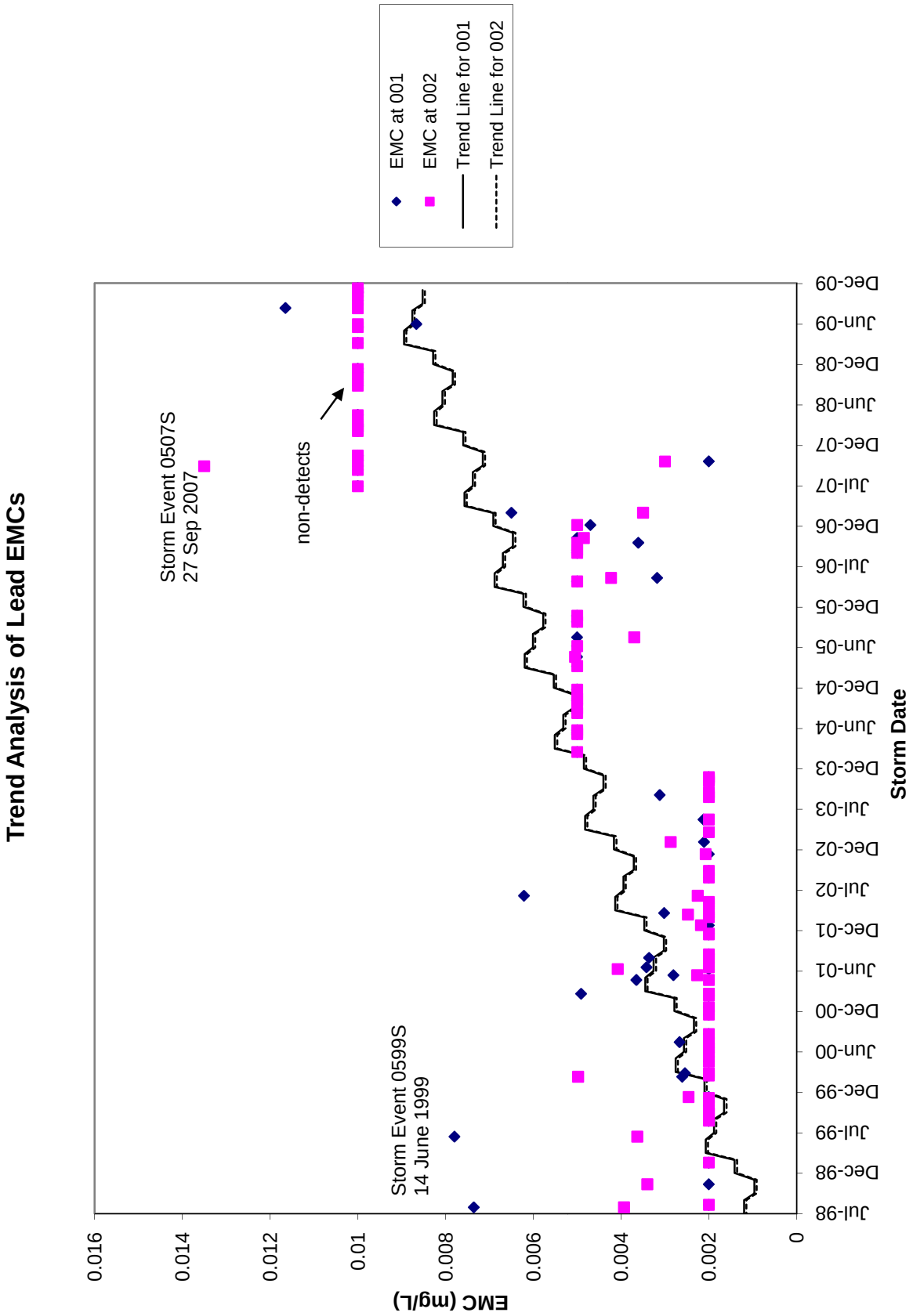
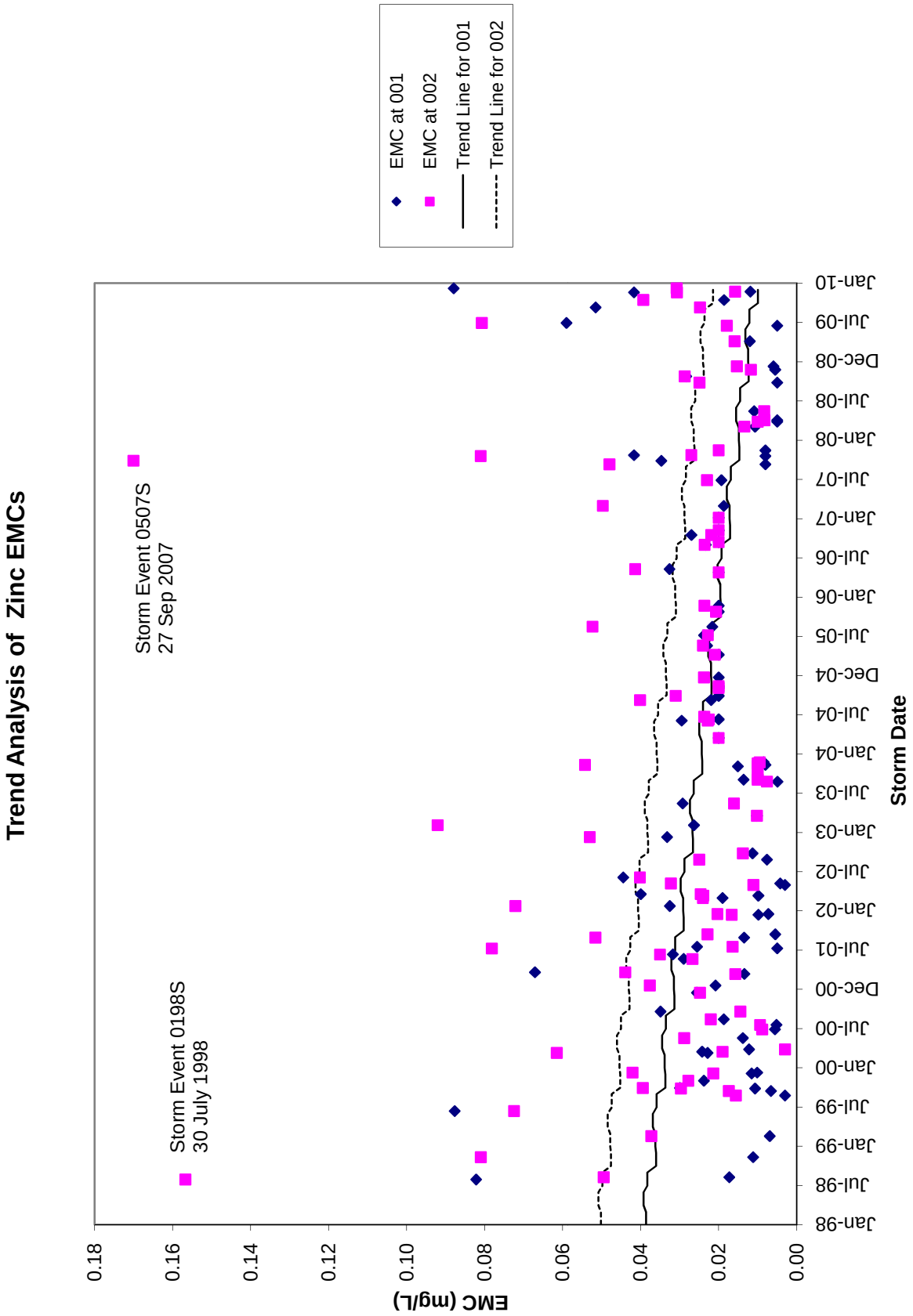
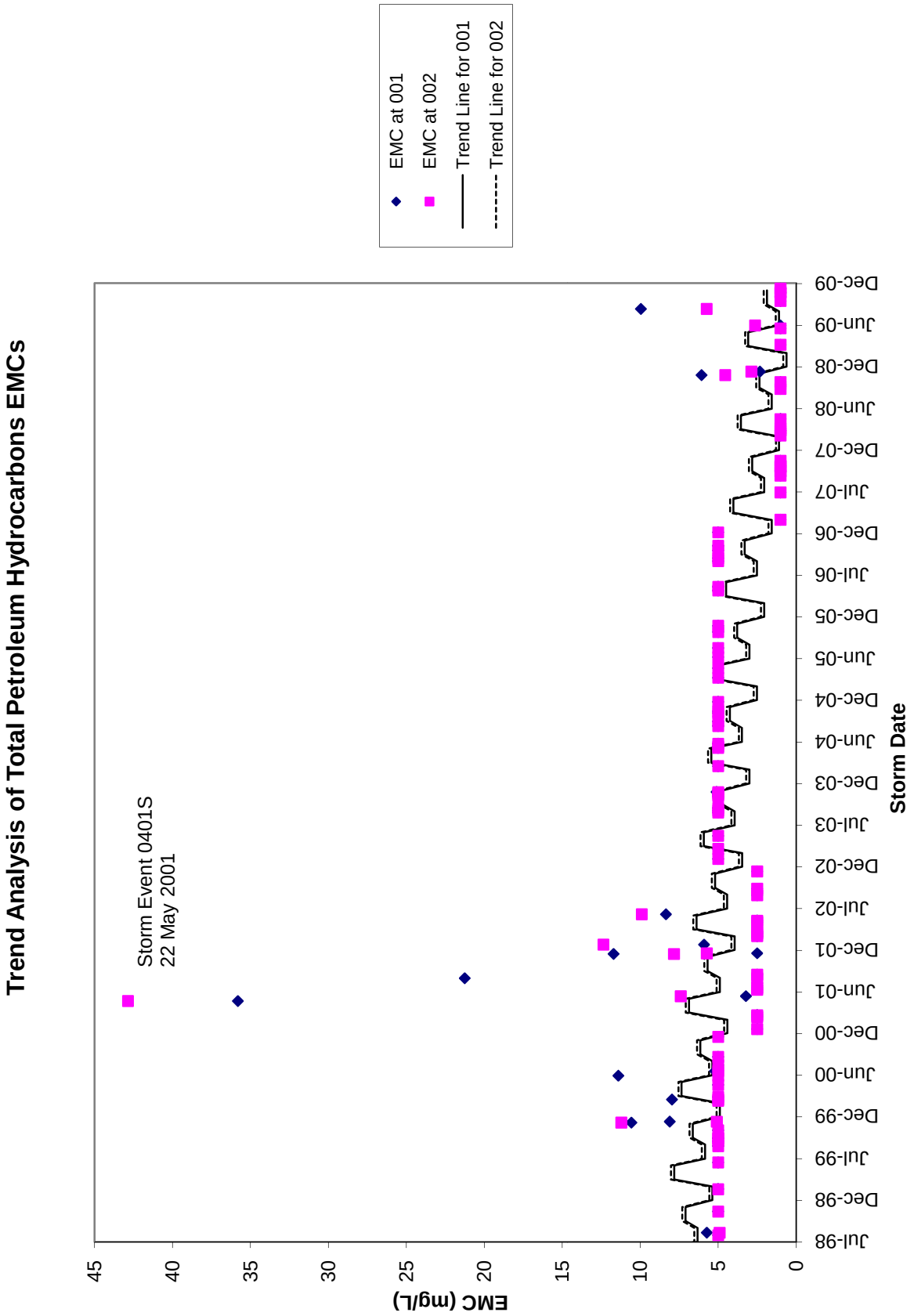
Jul-06
Dec-06
Jul-07
Dec-07
Jun-08
Dec-08
Jun-09
Dec-09
Storm Date


Trend Analysis of Lead EMCs
EMC at 001
EMC at 002
Trend Line for 001
Trend Line for 002
Storm Event 0507S
27 Sep 2007
non-detects
Storm Event 0599S
14 June 1999
EMC (mg/L)
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
Jul-98
Dec-98
Jul-99
Dec-99
Jun-00
Dec-00
Jun-01
Dec-01
Jul-02
Dec-02
Jul-03
Dec-03
Jun-04
Dec-04
Jun-05
Dec-05
Jul-06
Dec-06
Jul-07
Dec-07
Jun-08
Dec-08
Jun-09
Dec-09
Storm Date


Trend Analysis of Zinc EMCs
EMC at 001
EMC at 002
Trend Line for 001
Trend Line for 002
Storm Event 0198S
30 July 1998
Storm Event 0507S
27 Sep 2007
EMC (mg/L)
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
Jan-98
Jul-98
Jan-99
Jul-99
Jan-00
Jul-00
Dec-00
Jul-01
Jan-02
Jul-02
Jan-03
Jul-03
Jan-04
Jul-04
Dec-04
Jul-05
Jan-06
Jul-06
Jan-07
Jul-07
Jan-08
Jul-08
Dec-08
Jul-09
Jan-10
Storm Date


Trend Analysis of Total Petroleum Hydrocarbons EMCs
Storm Event 0401S
22 May 2001
EMC at 001
EMC at 002
Trend Line for 001
Trend Line for 002
EMC (mg/L)
45
40
35
30
25
20
15
10
5
0
Jul-98
Dec-98
Jul-99
Dec-99
Jun-00
Dec-00
Jun-01
Dec-01
Jul-02
Dec-02
Jul-03
Dec-03
Jun-04
Dec-04
Jun-05
Dec-05
Jul-06
Dec-06
Jul-07
Dec-07
Jun-08
Dec-08
Jun-09
Dec-09
Storm Date

APPENDIX D
WATERSHED PROFILES

Maryland's Surf Your Watershed - Watershed Profile

Aberdeen Proving Ground

WATERSHED INFORMATION

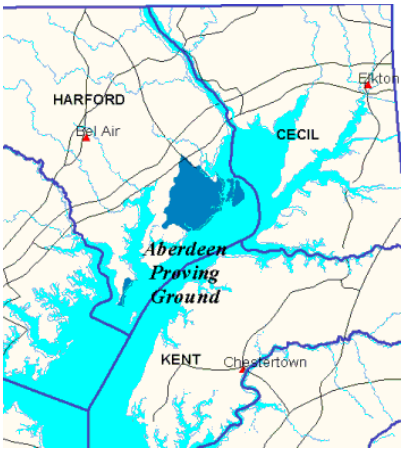
Maryland 8-Digit Watershed Code:	**02130705**
Tributary Basin:	**UPPER WESTERN SHORE**

Population (1990 US Census)

1990 Est. Population Density (Ppl per ac)	**0.87**

1994 Land Use (MdOP Data)

Urban Acres	**8,253**
Agricultural Acres	**224**
Forest Acres	**8,460**
Wetland Acres	**3,042**
Barren Acres	**0**
Total Acres (non-water)	**19,979**



NON-TIDAL WETLAND REGULATORY ACTIONS

Authorizations by Type (since 1991)

Letter of Authorization	**2**
Permit	**1**
Emergency Permit	**0**
Authorization to Proceed	**0**

Wetland Impact Data (since 1991)

Acres of Permanent Loss	**-0.13**
Acres of Permitted Mitigation	**0**
Acres of Programmatic Gains	**0**
Acres of Other Gains	**0**
Net Gain/Loss	**-0.13**

WATERSHED INDICATORS

Restoration Indicators	Indicator Value	Failed Indicator
Water Quality		
Monitored Nutrient Concentrations		
- eutrophication		
- habitat		
Modeled Nitrogen Loading Rate per ac. (lbs.)	**9.32**	
Modeled Phosphorus Loading Rate per ac. (lbs.)	**0.32**	
Aquatic Living Resources		
SAV Abundance		
SAV Habitat		
Tidal Benthic Index of Biotic Integrity		
Tidal Fish Index of Biotic Integrity		
Anadromous Fish Index		
Non-Tidal Benthic Index of Biotic Integrity	**2.57**	
Non-Tidal Fish Index of Biotic Integrity		
Non-Tidal Instream Habitat Index		
Landscape Parameters		
Percent Impervious Surface	**31.5**	Yes
Population Density (people per land acre)	**0.87**	
Historic Wetland Loss (acres)	**258**	
Percent Unforested Stream Buffer	**26**	
Soil Erodibility	**0.01**	
Clean Water Requirements		
303d List	**2**	Yes

Protection Indicators	Indicator Value	Select Indicator
Aquatic Living Resources		
Tidal Fish Index of Biotic Integrity		
Non-Tidal Instream Habitat Index		
Non-Tidal Fish Index of Biotic Integrity		
Imperiled Aquatic Species Indicator	**0**	
Migratory Fish Spawning Area	**4**	Yes
Anadromous Fish Index		
Wetland-Dependent Species	**0.0**	
Trout Spawning Area		
Fish Hatchery Water Supply		
Landscape Parameters		
% Headwater Streams occurring in Interior Forest	**18**	
Percent Watershed Forested	**46**	
Wildland Acres	**0**	
Number of Drinking Water Intakes	**0**	
Wetlands Acres of Special Concern	**0**	

Unified Watershed Assessment Categorization

Priority Category 1 (Does Not Meet Clean Water or Natural Resource Goals)	**No**
Priority Category 2 (Meets Clean Water or Natural Resource Goals)	**No**
Select Category 3 (Need for Special Protection of Natural Resources)	**No**

Documents at DNR

Search for documents related to the Aberdeen Proving Ground watershed that are held at the W.R. Nick Carter III Library & Information Resource Center (IRC) at the Maryland Department of Natural Resources.

Maryland's Surf Your Watershed - Watershed Profile

Bynum Run

WATERSHED INFORMATION

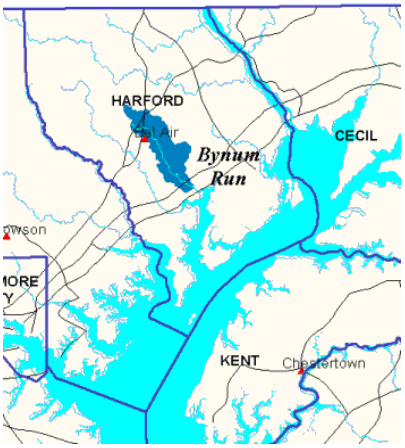
Maryland 8-Digit Watershed Code:	**02130704**
Tributary Basin:	**UPPER WESTERN SHORE**

Population (1990 US Census)

1990 Est. Population Density (Ppl per ac)	**0.81**

1994 Land Use (MdOP Data)

Urban Acres	**6,858**
Agricultural Acres	**5,521**
Forest Acres	**2,011**
Wetland Acres	**0**
Barren Acres	**176**
Total Acres (non-water)	**14,566**



NON-TIDAL WETLAND REGULATORY ACTIONS

Authorizations by Type (since 1991)

Letter of Authorization	**37**
Permit	**31**
Emergency Permit	**0**
Authorization to Proceed	**0**

Wetland Impact Data (since 1991)

Acres of Permanent Loss	**-4.44**
Acres of Permitted Mitigation	**3.17**
Acres of Programmatic Gains	**0**
Acres of Other Gains	**0**
Net Gain/Loss	**-1.27**

WATERSHED INDICATORS

Restoration Indicators	Indicator Value	Failed Indicator
Water Quality		
Monitored Nutrient Concentrations		
- eutrophication		
- habitat		
Modeled Nitrogen Loading Rate per ac. (lbs.)	**10.94**	Yes
Modeled Phosphorus Loading Rate per ac. (lbs.)	**0.47**	
Aquatic Living Resources		
SAV Abundance		
SAV Habitat		
Tidal Benthic Index of Biotic Integrity		
Tidal Fish Index of Biotic Integrity		
Anadromous Fish Index		
Non-Tidal Benthic Index of Biotic Integrity	**4.3**	
Non-Tidal Fish Index of Biotic Integrity	**8.3**	
Non-Tidal Instream Habitat Index	**6.01**	
Landscape Parameters		
Percent Impervious Surface	**21.1**	Yes
Population Density (people per land acre)	**0.81**	
Historic Wetland Loss (acres)	**3,321**	
Percent Unforested Stream Buffer	**70**	Yes
Soil Erodibility	**0.34**	Yes
Clean Water Requirements		
303d List	**2**	Yes

Protection Indicators	Indicator Value	Select Indicator
Aquatic Living Resources		
Tidal Fish Index of Biotic Integrity		
Non-Tidal Instream Habitat Index	**6.01**	
Non-Tidal Fish Index of Biotic Integrity	**8.3**	Yes
Imperiled Aquatic Species Indicator	**0**	
Migratory Fish Spawning Area	**0**	
Anadromous Fish Index		
Wetland-Dependent Species	**0.0**	
Trout Spawning Area	**0.0**	
Fish Hatchery Water Supply		
Landscape Parameters		
% Headwater Streams occurring in Interior Forest	**1**	
Percent Watershed Forested	**33**	
Wildland Acres	**0**	
Number of Drinking Water Intakes	**0**	
Wetlands Acres of Special Concern	**0**	

Unified Watershed Assessment Categorization

Priority Category 1 (Does Not Meet Clean Water or Natural Resource Goals)	**Yes**
Priority Category 2 (Meets Clean Water or Natural Resource Goals)	**No**
Select Category 3 (Need for Special Protection of Natural Resources)	**No**

Documents at DNR

Search for documents related to the Bynum Run watershed that are held at the W.R. Nick Carter III Library & Information Resource Center (IRC) at the Maryland Department of Natural Resources.

Maryland's Surf Your Watershed - Watershed Profile

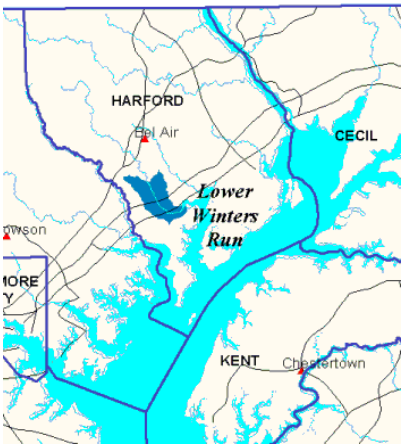
Lower Winters Run

WATERSHED INFORMATION

Maryland 8-Digit Watershed Code:	**02130702**
Tributary Basin:	**UPPER WESTERN SHORE**

Population (1990 US Census)	
1990 Est. Population Density (Ppl per ac)	**0.81**

1994 Land Use (MdOP Data)	
Urban Acres	**3,142**
Agricultural Acres	**1,805**
Forest Acres	**3,311**
Wetland Acres	**144**
Barren Acres	**0**
Total Acres (non-water)	**8,402**



NON-TIDAL WETLAND REGULATORY ACTIONS

Authorizations by Type (since 1991)	
Letter of Authorization	**13**
Permit	**4**
Emergency Permit	**0**
Authorization to Proceed	**1**

Wetland Impact Data (since 1991)	
Acres of Permanent Loss	**-3.41**
Acres of Permitted Mitigation	**8.47**
Acres of Programmatic Gains	**0**
Acres of Other Gains	**0**
Net Gain/Loss	**5.06**

WATERSHED INDICATORS

Restoration Indicators	Indicator Value	Failed Indicator
Water Quality		
Monitored Nutrient Concentrations		
- eutrophication		
- habitat		
Modeled Nitrogen Loading Rate per ac. (lbs.)	**11.54**	Yes
Modeled Phosphorus Loading Rate per ac. (lbs.)	**0.38**	
Aquatic Living Resources		
SAV Abundance		
SAV Habitat		
Tidal Benthic Index of Biotic Integrity		
Tidal Fish Index of Biotic Integrity		
Anadromous Fish Index		
Non-Tidal Benthic Index of Biotic Integrity	**3.71**	
Non-Tidal Fish Index of Biotic Integrity	**8.0**	
Non-Tidal Instream Habitat Index	**6.43**	
Landscape Parameters		
Percent Impervious Surface	**18.3**	Yes
Population Density (people per land acre)	**0.81**	
Historic Wetland Loss (acres)	**3,102**	
Percent Unforested Stream Buffer	**34**	
Soil Erodibility	**0.33**	Yes
Clean Water Requirements		
303d List	**0**	

Protection Indicators	Indicator Value	Select Indicator
Aquatic Living Resources		
Tidal Fish Index of Biotic Integrity		
Non-Tidal Instream Habitat Index	**6.43**	
Non-Tidal Fish Index of Biotic Integrity	**8.0**	
Imperiled Aquatic Species Indicator	**6**	Yes
Migratory Fish Spawning Area	**2**	Yes
Anadromous Fish Index		
Wetland-Dependent Species	**0.0**	
Trout Spawning Area	**0.0**	
Fish Hatchery Water Supply		
Landscape Parameters		
% Headwater Streams occurring in Interior Forest	**8**	
Percent Watershed Forested	**41**	
Wildland Acres	**0**	
Number of Drinking Water Intakes	**1**	Yes
Wetlands Acres of Special Concern	**0**	

Unified Watershed Assessment Categorization	
Priority Category 1 (Does Not Meet Clean Water or Natural Resource Goals)	**No**
Priority Category 2 (Meets Clean Water or Natural Resource Goals)	**No**
Select Category 3 (Need for Special Protection of Natural Resources)	**No**

Documents at DNR

Search for documents related to the Lower Winters Run watershed that are held at the W.R. Nick Carter III Library & Information Resource Center (IRC) at the Maryland Department of Natural Resources.