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**Water Quality Analysis of Eutrophication
for the Wills Creek Basin
in Allegany and Garrett Counties, Maryland**

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List of Abbreviations

BIBI	Benthic Index of Biotic Integrity
BSID	Biological Stressor Identification
CWA	Clean Water Act
DNR	Department of Natural Resources
DO	Dissolved Oxygen
EPA	United States Environmental Protection Agency
FIBI	Fish Index of Biotic Integrity
MBSS	Maryland Biological Stream Survey
MDE	Maryland Department of the Environment
MDP	Maryland Department of Planning
mg/l	Milligrams Per Liter
NPDES	National Pollution Discharge Elimination System
RESAC	Regional Earth Science Applications Center
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
TSI	Trophic State Index
WQA	Water Quality Analysis
WQLS	Water Quality Limited Segment
µg/l	Micrograms Per Liter

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EXECUTIVE SUMMARY

Section 303(d) of the federal Clean Water Act (CWA) and the U.S. Environmental Protection Agency's (EPA) implementing regulations direct each state to identify and list waters, known as water quality limited segments (WQLSs), in which current required controls of a specified substance are inadequate to achieve water quality standards. For each WQLS listed in the *Integrated Report of Surface Water Quality in Maryland (Integrated Report)* (MDE 2008a), the State is to either establish a Total Maximum Daily Load (TMDL) of the specified substance that the waterbody can receive without violating water quality standards, or demonstrate that water quality standards are being met (CFR 2009).

The Wills Creek watershed (basin code 02141003) (2008 *Integrated Report* Assessment Unit ID: MD-02141003) was identified in Maryland's 2008 *Integrated Report* as impaired by cyanide (1996 listing), nutrients (1996 listing), sediment (1996 listing), pH (1998, 2002, 2004 and 2006 listings), fecal bacteria (2002 listing), and impacts to biological communities (2002 listing) (MDE 2008a). The listing for cyanide and the 1998 and 2004 pH listings have been addressed by Water Quality Analyses (WQAs) completed in 2005 and 2006, respectively, showing no impairment. The listings for sediment and fecal bacteria have been addressed via TMDLs completed in 2006, and the 2002 and 2006 pH listings were addressed via TMDLs completed in 2008. The 1996 nutrients listing was refined in the 2008 *Integrated Report* by identifying phosphorus as the specific impairing substance. Consequently, for the purpose of this report, the terms nutrients and phosphorus will be used interchangeably. The listings for impacts to biological communities will be addressed separately at a future date.

A data solicitation for information pertaining to pollutants, including nutrients, in the Wills Creek basin was conducted by Maryland Department of the Environment (MDE) in September 2005, and all readily available data from the past five years have been considered. Currently, Maryland's water quality standards do not contain specific numeric criteria for nutrients. Nutrients typically do not have a direct impact on aquatic life; rather, they mediate impacts through excessive algal growth leading to low dissolved oxygen. Therefore, the evaluation of potentially eutrophic conditions due to nutrient over-enrichment will be based on whether nutrient-related parameters (i.e., dissolved oxygen levels and chlorophyll *a* concentrations) are found to impair designated uses in the Wills Creek watershed (in this case, protection of aquatic life and wildlife, fishing, and swimming).

Recently, MDE developed a biological stressor identification (BSID) methodology to identify the most probable cause(s) of the existing biological impairments in Maryland 8-digit watersheds based on the suite of available physical, chemical, and land use data (MDE 2009a). The BSID analysis for the Wills Creek watershed indicates inorganic pollutants and flow/sediment stressors are associated with impacts to biological communities; these findings will be addressed separately. The BSID analysis did not identify any nutrient stressors present and/or nutrient stressors showing a significant association with degraded biological conditions (MDE 2009b). The results of the BSID study, combined with the analysis of recent water quality data presented in this report, indicate that the Wills Creek watershed is not being impaired by nutrients.

This analysis supports the conclusion that a TMDL for nutrients is not necessary to achieve water quality standards in the Wills Creek watershed. Although the waters of the Wills Creek

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watershed do not display signs of eutrophication, the State reserves the right to require future controls in the watershed if evidence suggests that nutrients from the basin are contributing to downstream water quality problems. For instance, reductions may be required by the forthcoming Chesapeake Bay TMDL, which is currently under development and scheduled to be completed by EPA at the end of 2010.

Barring the receipt of contradictory data, this report will be used to support a revision of the nutrients (i.e., phosphorus) listing for the Wills Creek watershed, from Category 5 (“waterbody is impaired, does not attain the water quality standard, and a TMDL is required”) to Category 2 (“waterbodies meeting some [in this case nutrients-related] water quality standards, but with insufficient data to assess all impairments”) when MDE proposes the revision of the *Integrated Report*.

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1.0 INTRODUCTION

Section 303(d) of the federal Clean Water Act (CWA) and the U.S. Environmental Protection Agency's (EPA) implementing regulations direct each state to identify and list waters, known as water quality limited segments (WQLSs), in which current required controls of a specified substance are inadequate to achieve water quality standards. For each WQLS listed in the *Integrated Report of Surface Water Quality in Maryland (Integrated Report)* (MDE 2008a), the State is to either establish a Total Maximum Daily Load (TMDL) of the specified substance that the waterbody can receive without violating water quality standards, or demonstrate that water quality standards are being met (CFR 2009).

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

The Wills Creek watershed (basin code 02141003) (2008 *Integrated Report* Assessment Unit ID: MD-02141003) was identified in Maryland's 2008 *Integrated Report* as impaired by cyanide (1996 listing), nutrients (1996 listing), sediment (1996 listing), pH (1998, 2002, 2004 and 2006 listings), fecal bacteria (2002 listing), and impacts to biological communities (2002 listing) (MDE 2008a). The listing for cyanide and the 1998 and 2004 pH listings have been addressed by Water Quality Analyses (WQAs) completed in 2005 and 2006, respectively, showing no impairment. The listings for sediment and fecal bacteria have been addressed via TMDLs completed in 2006, and the 2002 and 2006 pH listings were addressed via TMDLs completed in 2008. The 1996 nutrients listing was refined in the 2008 *Integrated Report* by identifying phosphorus as the specific impairing substance. Consequently, for the purpose of this report, the terms nutrients and phosphorus will be used interchangeably. The listings for impacts to biological communities will be addressed separately at a future date.

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

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2.0 GENERAL SETTING

Location

Wills Creek is located in Allegany County and flows south from its headwaters in Pennsylvania to its confluence with the North Branch Potomac River at Cumberland, MD (see Figures 1 and 2). Jennings Run and Braddock Run are the two main tributaries to Wills Creek, draining western Allegany County and a small portion of northeastern Garrett County. The drainage area of Wills Creek totals 160,500 acres, with 38,500 acres in Maryland and 122,000 acres in Pennsylvania. Additionally, there are no “high quality”, or Tier II, stream segments (Benthic Index of Biotic Integrity (BIB)/Fish Index of Biotic Integrity (FIBI) aquatic health scores > 4 (scale 1 – 5)) located within the watershed requiring the implementation of Maryland’s antidegradation policy. Lastly, the total population in the Wills Creek watershed is approximately 33,000 (US Census Bureau 2000).

Geology/Soils

The Wills Creek watershed is situated within the Appalachian Plateau and the Ridge and Valley Province of western Maryland. The surficial geology of the western portion of the Ridge and Valley Province is characterized by strongly folded and faulted sedimentary rock, producing a rugged surface terrain. The surficial geology of the Appalachian Plateau Province is characterized by gently folded shale, siltstone, and sandstone. Folding has produced elongated arches across the region, which exposes Devonian rock at the surface. Coal-bearing strata are preserved in the intervening synclinal basins of these folds. Consequently, this region in western Allegany County has been a productive source for coal mining. The topography in the watershed is often steep and deeply carved by winding streams, with elevations ranging up to 3,360 feet (MGS 2009).

The Wills Creek watershed is comprised of several different soil series including the Dekalb, Ernest, and Hazleton series. The Dekalb soil series consists of moderately deep, well-drained, loamy soils that developed in material weathered in place from sandstone and some conglomerate and shale bedrock. These nearly level to very steep soils are normally found in stony, mountainous regions. Dekalb soils have rapid permeability and internal drainage. The Hazleton soil series consists of deep, well-drained, loamy soils. These soils developed in materials weathered in place from sandstone and shale bedrock. These nearly level to moderately steep soils occur on the top and upper and middle side slopes of hills and mountains. Hazleton soils have moderately rapid permeability and rapid internal drainage. The Ernest soil series consists of deep, moderately well-drained, loamy soils. These nearly level to moderately steep soils formed in materials that accumulated at the base of the steeper slopes. Ernest soils have moderately slow permeability and a moderate available moisture capacity (USDA 1974, 1977).

Land Use

The 2002 Maryland Department of Planning (MDP) land use/land cover data and the Regional Earth Science Application Center (RESAC) land use/land cover data show that the Wills Creek watershed (MDP data applied for the Maryland watershed characterization and RESAC for the Pennsylvania watershed characterization) is comprised primarily of forest (see Figure 3). The

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land use distribution for the entire watershed (i.e., Maryland and Pennsylvania portions) is approximately 82% forest; 10% agricultural; 5% urban; and 3% pasture (MDP 2002; RESAC 2000). The land use distribution for the Maryland portion of the watershed is 75% forest; 17% urban; 5% agricultural; and 4% pasture (MDP 2002).

Point Sources

There are a total of two municipal and industrial process water point source facilities with permits to discharge in the Wills Creek watershed. Of these two facilities, neither is regulated by a National Pollution Discharge Elimination System (NPDES) permit for the discharge of nutrients.

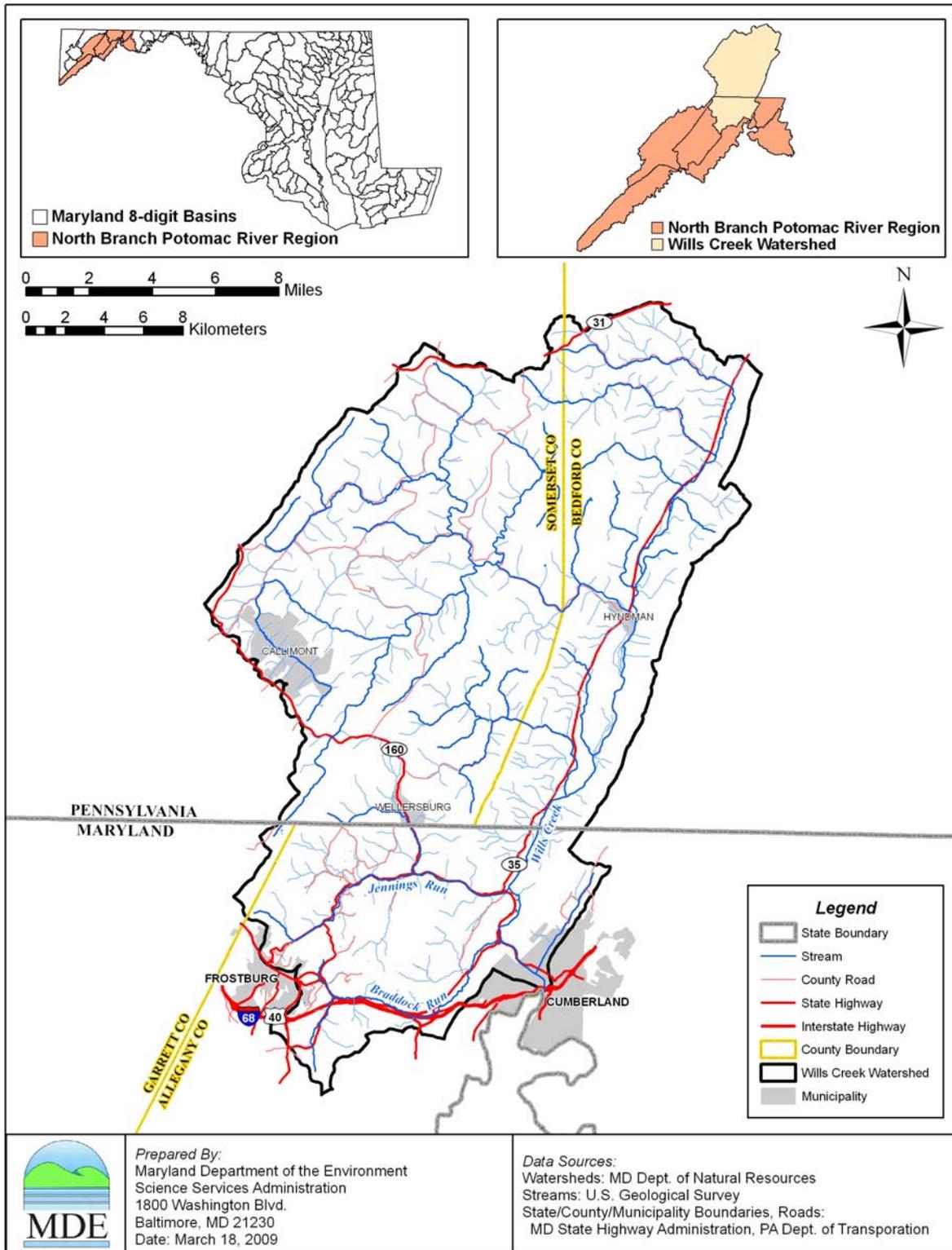


Figure 1: Location Map of the Wills Creek Watershed

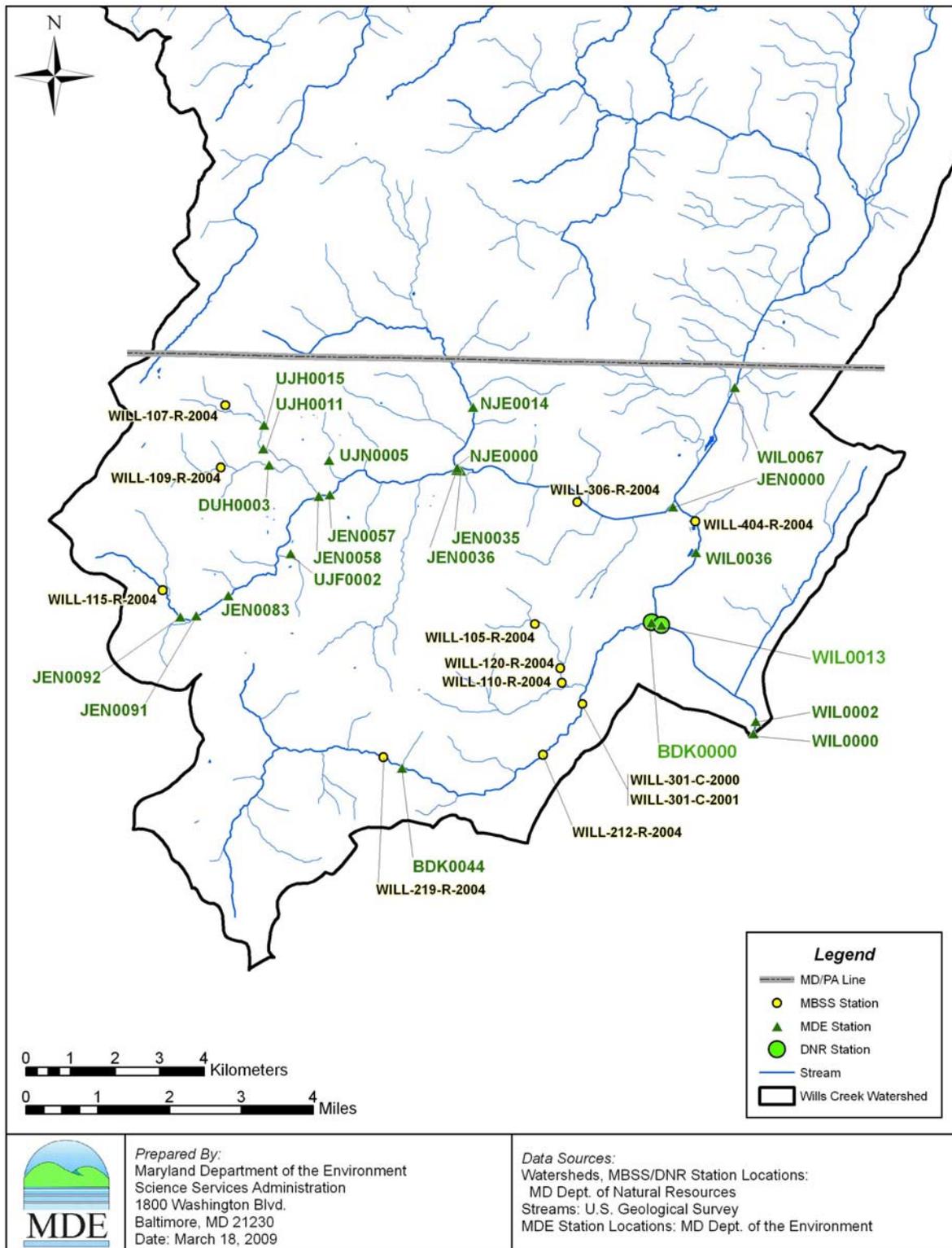


Figure 2: Monitoring Stations in the Wills Creek Watershed

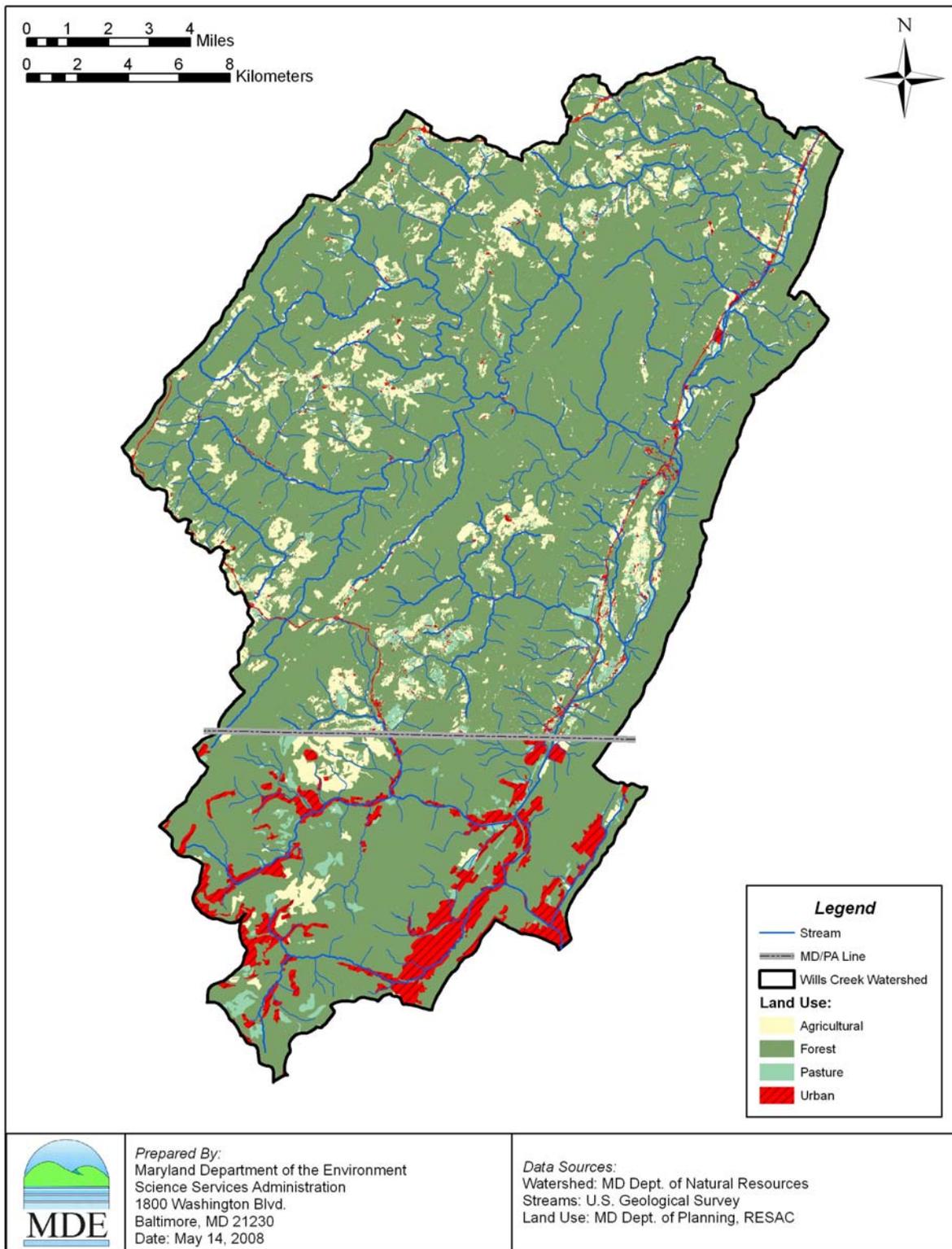


Figure 3: Land Use of the Wills Creek Watershed

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3.0 WATER QUALITY CHARACTERIZATION

The Maryland Surface Water Use Designation for the Wills Creek mainstem is Use IV-P (Recreational Trout Waters and Public Water Supply). The tributaries of Wills Creek are designated as Use III-P (Nontidal Cold Water and Public Water Supply) (COMAR 2009a,b).

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

Currently, there are no specific numeric criteria for nutrients in Maryland's water quality standards. Therefore, the evaluation of potentially eutrophic conditions due to nutrient over-enrichment will be based on whether nutrient-related parameters (i.e., dissolved oxygen levels and chlorophyll *a* concentrations) are found to impair designated uses in the Wills Creek watershed. The dissolved oxygen (DO) concentration to protect Use IV-P waters "may not be less than 5 milligrams per liter (mg/l) at any time" and to protect Use III-P waters "may not be less than 5 milligrams/liter at any time, with a minimum daily average of not less than 6 milligrams/liter" (COMAR 2009c,d). The water quality data presented in this section will show that DO concentrations in Wills Creek and its tributaries meet these criteria, and that Maryland's narrative criteria for chlorophyll *a* are also met.

In addition to the DO and chlorophyll *a* data analysis, the results of a new biological stressor identification (BSID) analysis demonstrate that any biological impairment in the watershed is not caused by nutrient enrichment. Instead, the analysis suggests that the degradation to biological communities in the Wills Creek watershed is strongly associated with the urban land use of the watershed, which results in altered hydrology and elevated levels of sulfate, chlorides, and (electrical) conductivity (MDE 2009b).

A data solicitation was conducted in 2005. All readily available water quality data from the past five years have been considered for this analysis. Water quality data from MDE surveys conducted from November 1999 through March 2004, and March 2005 through October 2005, were used. Maryland Department of Natural Resources (DNR) data used in the analysis were from January 1998 through June 2007. Data from Maryland Biological Stream Survey (MBSS) sampling conducted in 2000, 2001, and 2004 were also used. Table 1 lists the water quality monitoring stations in the Wills Creek watershed with their geographical coordinates. Figures 4 through 7 provide graphical representation of the collected data for the parameters discussed below.

Table 1: Water Quality Stations in the Wills Creek Watershed Monitored During 1998-2007

Station ID	Agency/Program	Latitude (Decimal-Degrees)	Longitude (Decimal-Degrees)
BDK0000	MDE	39.6705	-78.7919
BDK0044	MDE	39.6400	-78.8562
DUH0003	MDE	39.7008	-78.8925
JEN0000	MDE	39.6937	-78.7806
JEN0035	MDE	39.7004	-78.8423
JEN0036	MDE	39.7005	-78.8436
JEN0057	MDE	39.6951	-78.8766
JEN0058	MDE	39.6947	-78.8795
JEN0083	MDE	39.6742	-78.9026
JEN0091	MDE	39.6699	-78.9108
JEN0092	MDE	39.6696	-78.9150
NJE0000	MDE	39.7009	-78.8435
NJE0014	MDE	39.7133	-78.8396
UJF0002	MDE	39.6829	-78.8865
UJH0011	MDE	39.7040	-78.8942
UJH0015	MDE	39.7089	-78.8941
UJN0005	MDE	39.7020	-78.8769
WIL0000	MDE	39.6484	-78.7646
WIL0002	MDE	39.6509	-78.7641
WIL0013	MDE	39.6699	-78.7893
WIL0036	MDE	39.6848	-78.7806
WIL0067	MDE	39.7184	-78.7712
BDK0000	DNR/CORE	39.6701	-78.7906
WIL0013	DNR/CORE	39.6615	-78.7800
WILL-105-R-2004	DNR/MBSS	39.6696	-78.8223
WILL-107-R-2004	DNR/MBSS	39.7126	-78.9043
WILL-109-R-2004	DNR/MBSS	39.7000	-78.9051
WILL-110-R-2004	DNR/MBSS	39.6578	-78.8150
WILL-115-R-2004	DNR/MBSS	39.6749	-78.9197
WILL-120-R-2004	DNR/MBSS	39.6608	-78.8154
WILL-212-R-2004	DNR/MBSS	39.6432	-78.8196
WILL-219-R-2004	DNR/MBSS	39.6421	-78.8611
WILL-301-C-2000	DNR/MBSS	39.6536	-78.8094
WILL-301-C-2001	DNR/MBSS	39.6536	-78.8094
WILL-306-R-2004	DNR/MBSS	39.6944	-78.8118
WILL-404-R-2004	DNR/MBSS	39.6910	-78.7809

3.1 Dissolved Oxygen

DNR samples were taken in the Wills Creek watershed from January 1998 through June 2007. MDE samples were taken from November 1999 through March 2004, and March 2005 through October 2005, and MBSS samples were taken during spring and summer in 2000, 2001, and 2004. Samples taken during the growing season (May through October) show DO concentrations ranging from 6.5 to 12.9 mg/l, with all values above both the Use IV and Use III-P criterion of 5 mg/l and 6 mg/l, respectively. The growing season DO data are presented graphically in Figure 4, and all MDE, DNR, and MBSS DO data are presented in tabular form in Appendix A. Given the overwhelming level of attainment indicated by the total data used in the analysis, MDE considers that the water quality standard for DO is being met in the Wills Creek watershed.

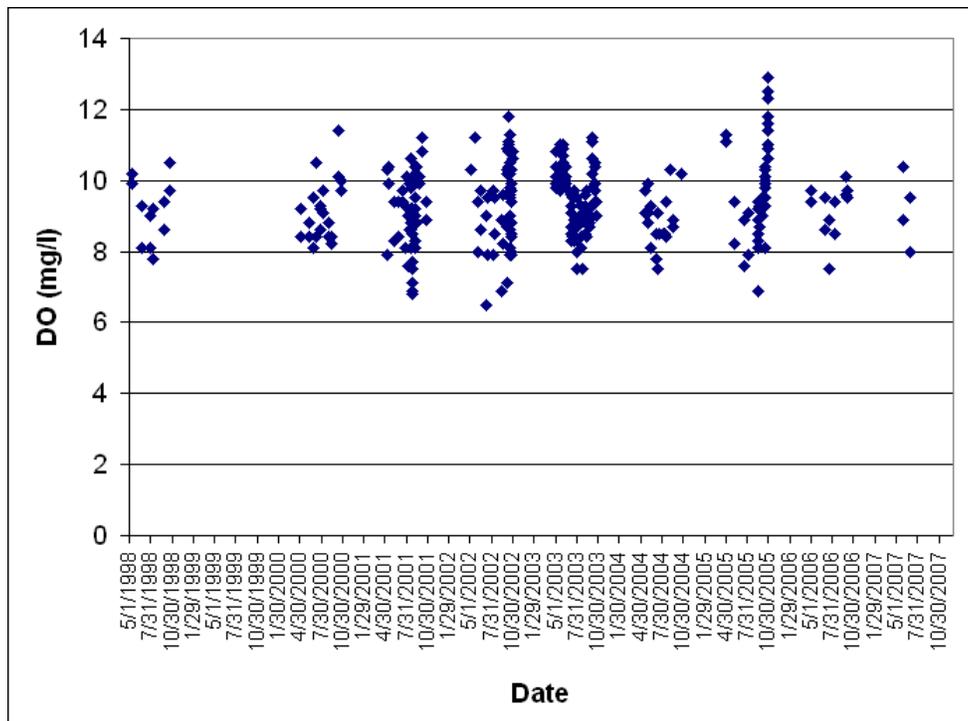


Figure 4: Wills Creek Watershed Dissolved Oxygen Data for Growing Season Periods May 1998 through October 2007

3.2 Chlorophyll *a*

Currently, Maryland water quality standards do not specify numeric criteria for chlorophyll *a*. However pollution of waters of the State by any material in amounts sufficient to create a nuisance or interfere with designated uses is prohibited (COMAR 2009e). Elevated chlorophyll *a* concentrations, a measure of algal growth, may indicate poor water quality that cannot support a waterbody’s designated uses and may constitute a nuisance condition. Nuisance levels of algae can interfere with uses related to recreational activities such as fishing, boating, and aesthetic appreciation. High chlorophyll *a* levels can also present taste, odor, and treatment problems in water supply systems.

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Narrative water quality criteria are an important component of the State's water quality standards, but are difficult to incorporate into quantitative water quality or TMDL analyses. In the case of free-flowing non-tidal waters, there is an insufficient understanding of the relationship between chlorophyll *a* concentrations and the waterbody's designated use impairment. However, the Code of Maryland Regulations includes narrative criteria for acceptable chlorophyll *a* levels in tidal waters. Maryland's numeric interpretation of these criteria for application in estuarine waters, as described in previously approved nutrient TMDLs, is as follows:

The chlorophyll *a* concentration goal used by the State in estuarine TMDL analyses is based on guidelines set forth by Thomann and Mueller (1987) and by the EPA Technical Guidance Manual for Developing Total Maximum Daily Loads, Book 2, Part 1 (1997). The chlorophyll *a* narrative criterion states: "Chlorophyll *a* - Concentrations of chlorophyll *a* in free-floating microscopic aquatic plants (algae) shall not exceed levels that result in ecologically undesirable consequences that would render tidal waters unsuitable for designated uses" (COMAR 2009f). The Thomann and Mueller guidelines acknowledge that "Undesirable levels of phytoplankton [chlorophyll *a*] vary considerably depending on water body." MDE has determined, per Thomann and Mueller, that it is acceptable to maintain chlorophyll *a* concentrations below a maximum of 100 micrograms per liter ($\mu\text{g/L}$), and to target, with some flexibility depending on waterbody characteristics, a 30-day rolling average of approximately 50 $\mu\text{g/L}$ (with some flexibility depending on waterbody characteristics) (MDE 2006).

Maryland has also developed guidelines for application of the narrative criteria in drinking water reservoirs. The guidelines, adapted from previously approved TMDLs, are as follows:

The chlorophyll *a* endpoints selected for public water supply reservoirs are (a) a ninetieth-percentile instantaneous concentration not to exceed 30 $\mu\text{g/l}$ in the surface layers, and (b) a 30-day moving average concentration not to exceed 10 $\mu\text{g/l}$ in the surface layers. The concentration of 10 $\mu\text{g/l}$ corresponds to a score of approximately 53 on the Carlson's Trophic State Index (TSI). This is at the boundary of mesotrophic and eutrophic conditions, which is an appropriate trophic state at which to manage these reservoirs. Mean chlorophyll *a* concentrations exceeding 10 $\mu\text{g/l}$ are associated with peaks exceeding 30 $\mu\text{g/l}$, which in turn are associated with a shift to blue-green assemblages, which present taste, odor and treatment problems (Walker 1984). Achieving these chlorophyll *a* endpoints should thus safeguard such reservoirs from nuisance algal blooms (MDE 2008b).

Using the chlorophyll *a* targets for tidal waters and public water supply reservoirs described above as screening values for non-tidal waters, the following data analysis reflects an absence of excessive algal growth in the Wills Creek watershed, as indicated by low chlorophyll *a* concentrations in comparison with those values.

MDE monitoring data in the Wills Creek watershed show growing season (May through October) averages, by station, between 0.3 and 2.8 $\mu\text{g/l}$. These samples show observed

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chlorophyll *a* concentrations ranging from 0.1 to 21.2 µg/l, with only two out of 143 samples greater than 10 µg/l. These monitoring data values suggest that chlorophyll *a* concentrations are not causing any nuisance in the Wills Creek watershed or interfering with its designated uses.

The growing season chlorophyll *a* data are presented graphically in Figure 5, and all MDE chlorophyll *a* data are presented in tabular form in Appendix A.

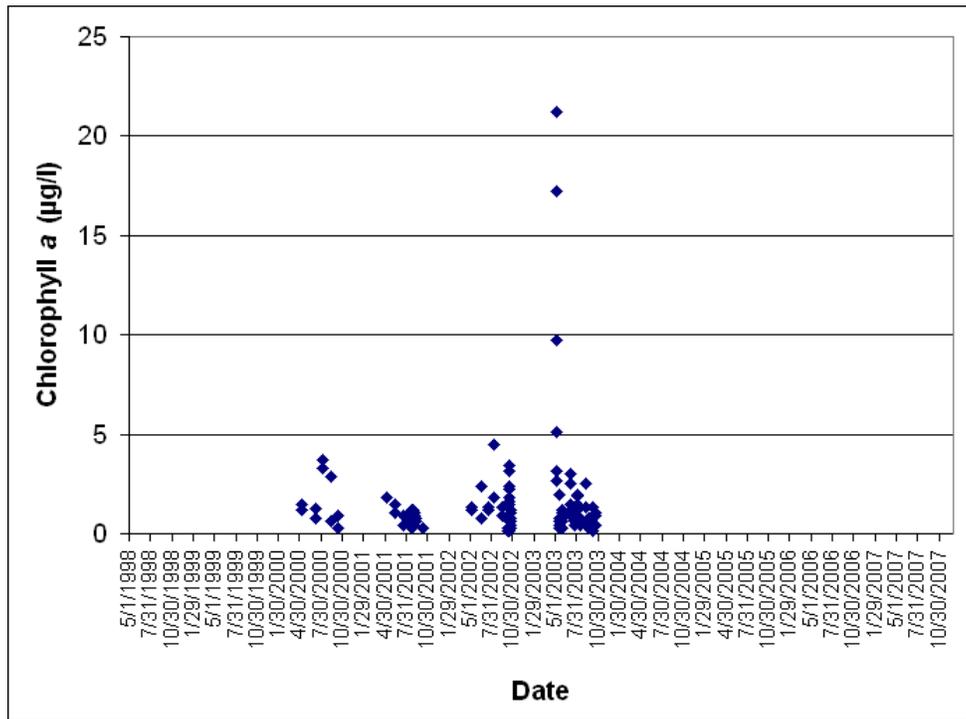


Figure 5: Wills Creek Watershed Chlorophyll *a* Data for Growing Season Periods May 1998 through October 2007

3.3 Nutrients

In the absence of State water quality standards with specific numeric limits for nutrients, evaluation of potentially eutrophic conditions is based on whether nutrient-related parameters (i.e., dissolved oxygen levels and chlorophyll *a* concentrations) are found to impair the designated uses in the Wills Creek watershed (in this case protection of aquatic life and wildlife, fishing, and swimming). Consequently, the nutrients data presented in this section are for informational purposes only.

Total nitrogen (TN) and total phosphorus (TP) data for the Wills Creek watershed have been collected as part of this study and the results are presented here for informational purposes, graphically in Figures 6 and 7 (growing season TN and TP data only (MDE and DNR)), and in tabular form in Appendix A (all MDE, DNR, and MBSS TN and TP data). In general, DNR and MDE data show TN concentrations during the growing season (May through October) ranging from 0.08 to 3.04 mg/l and TP concentrations ranging from 0.002 to 0.44 mg/l.

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In the absence of specific numeric criteria to evaluate the TP and TN monitoring data results, MDE evaluated these results using its BSID methodology, which compared Wills Creek watershed parameters to the results from similar control sites (i.e., watersheds with no biological impairments) and concluded that nutrients are not likely stressors associated with the degraded biological conditions (MDE 2009b). Current DO conditions in the Wills creek watershed further support this conclusion.

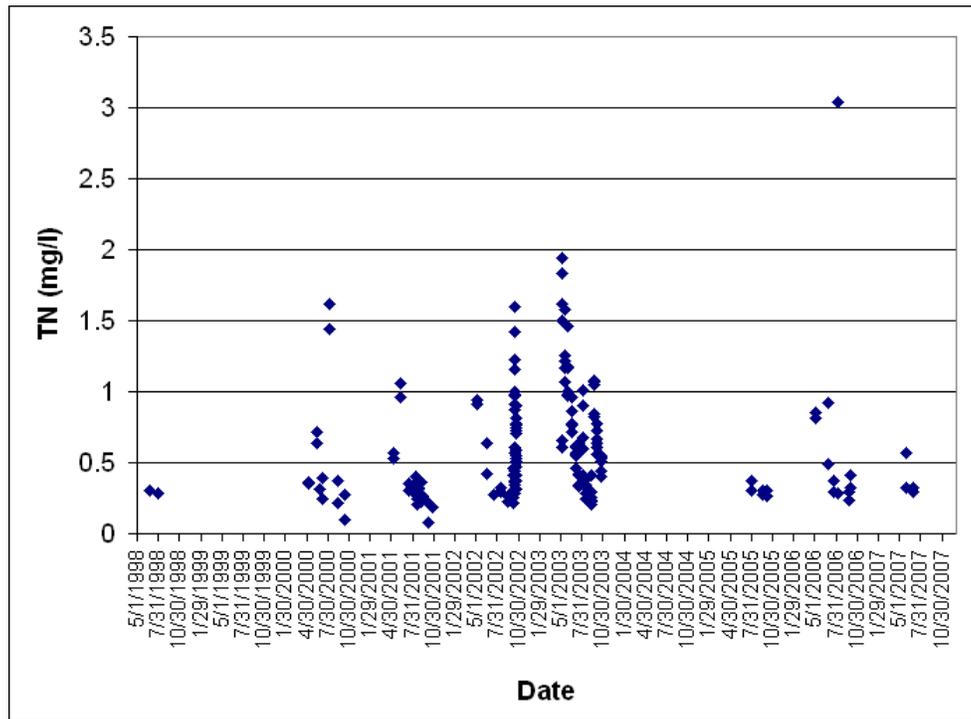


Figure 6: Wills Creek Watershed Total Nitrogen Data for Growing Season Periods May 1998 through October 2007

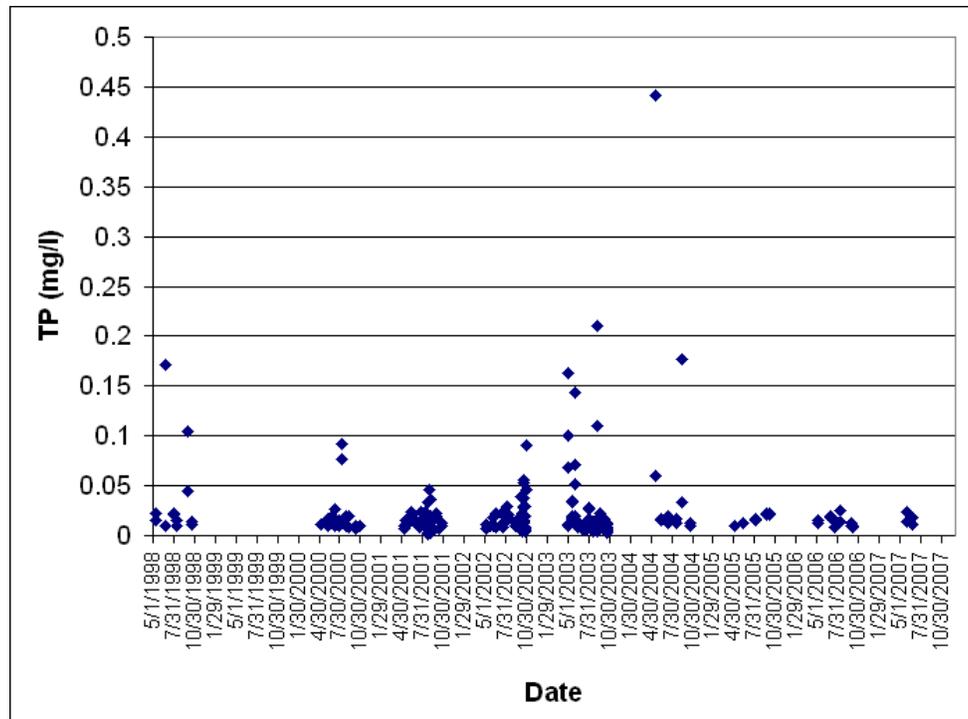


Figure 7: Wills Creek Watershed Total Phosphorus Data for Growing Season Periods May 1998 through October 2007

3.4 Biological Stressor Identification Analysis

In the process of evaluating the existing biological impairments, MDE developed a biological stressor identification methodology (MDE 2009a). The BSID methodology uses data available from the statewide DNR MBSS. These data are presented in Appendix A. The current MDE biological assessment methodology is a three-step process: (1) a data quality review; (2) a systematic vetting of the dataset; and (3) a watershed assessment that presents the results of this assignment in terms of currently used *Integrated Report* listing categories.

The BSID analysis for the Wills Creek watershed did not identify nutrients as potential stressors or indicate any significant association between current nutrient levels and the degraded biological conditions (MDE 2009b). According to this report, nutrients are not causing any impairment to aquatic life or biological communities in the Wills Creek watershed. Rather, the BSID analysis results suggest that biological degradation in the Wills Creek watershed is strongly associated with the urban land use of the watershed, which has resulted in altered hydrology and elevated levels of sulfate, chlorides, and (electrical) conductivity. Furthermore, although only 17% of the Maryland portion of the watershed is urban (see Section 2.0), the watershed areas immediately adjacent to the actual stream system are highly urban. As explained in the BSID report, urbanization of landscapes generates broad and inter-related forms of degradation (i.e., hydrological, morphological, and water chemistry) that can affect stream ecology and biological composition. Scientific literature has established a link between highly urbanized landscapes and degradation in the aquatic health of non-tidal stream ecosystems.

4.0 CONCLUSION

Based on the analysis of data presented in the preceding section of this report indicating that DO and chlorophyll *a* concentrations are meeting water quality criteria and on the results of the Wills Creek watershed BSID analysis, MDE concludes that currently the Wills Creek watershed is not being impaired by nutrients. (The BSID analysis indicates inorganic pollutants and flow/sediment stressors are associated with impacts to biological communities; these findings will be addressed separately.) Barring the receipt of contradictory data, this report will be used to support a revision of the phosphorus listing for the Wills Creek watershed, from Category 5 (“waterbody is impaired, does not attain the water quality standard, and a TMDL is required”) to Category 2 (“waterbodies meeting some [in this case nutrients-related] water quality standards, but with insufficient data to assess all impairments”) (MDE 2008a), when MDE proposes the revision of Maryland’s *Integrated Report*.

Although the waters of the Wills Creek watershed do not display signs of eutrophication, the State reserves the right to require future controls if evidence suggests that nutrients from the basin are contributing to downstream water quality problems. For instance, reductions may be required by the forthcoming Chesapeake Bay TMDL, which is currently under development and scheduled to be completed by the EPA at the end of 2010.

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Appendix A – Tabular Water Quality Data

Table A-1: MDE Water Quality Data

Station	Sampling Date	DO (mg/l)	Chlorophyll <i>a</i> (µg/l)	TN (mg/l)	TP (mg/l)
BDK0000	3/8/2001	11.3	1.35	0.90	0.012
BDK0000	3/27/2001	12.6	0.75	2.62	0.012
BDK0000	4/3/2001	11.5	3.14	1.09	0.013
BDK0000	8/22/2001	9.8	1.20	0.29	0.015
BDK0000	8/28/2001	7.7	1.20	0.26	0.016
BDK0000	9/6/2001	10.0			0.020
BDK0000	10/8/2002	10.2	0.15	0.30	0.005
BDK0000	10/15/2002	10.8		0.41	0.004
BDK0000	10/17/2002	9.8	0.30	1.22	0.015
BDK0000	10/21/2002	8.6		0.50	0.008
BDK0000	10/23/2002	8.8		0.41	0.008
BDK0000	11/7/2002	10.8	0.60	1.37	0.011
BDK0000	11/12/2002	10.6	1.35	0.81	0.017
BDK0000	11/13/2002	11.0		1.47	0.017
BDK0000	11/15/2002	10.4			
BDK0000	11/18/2002	10.7	0.15	2.57	0.173
BDK0000	11/20/2002	11.3		1.38	0.007
BDK0000	12/2/2002	12.9		0.63	0.004
BDK0000	12/9/2002	12.9	1.20	0.52	0.007
BDK0000	12/17/2002	12.4		1.39	0.005
BDK0000	1/7/2003	12.5	0.27	1.86	0.047
BDK0000	1/21/2003			0.74	0.006
BDK0000	2/3/2003	12.0		0.45	0.006
BDK0000	3/18/2003	10.5		2.24	0.042
BDK0000	4/1/2003	11.3	2.39	0.77	0.016
BDK0000	4/15/2003	10.6	2.99	1.35	0.065
BDK0000	4/21/2003	10.1	8.67	1.02	0.127
BDK0000	4/28/2003	10.6	1.35	0.47	0.013
BDK0000	5/5/2003	10.4	17.19	1.94	0.163
BDK0000	5/19/2003	10.8	1.94	1.58	0.034
BDK0000	6/2/2003	10.5	1.05	1.46	0.051
BDK0000	6/16/2003	9.9		0.72	0.009
BDK0000	7/7/2003	9.6	1.50	0.46	0.007
BDK0000	7/21/2003	9.7	0.45	0.34	0.007
BDK0000	8/4/2003	9.5	0.75	0.41	0.011
BDK0000	8/18/2003	9.3	0.75	0.33	0.009
BDK0000	9/8/2003	9.3	2.49	0.41	0.110
BDK0000	9/22/2003	9.2	0.60	0.84	0.023
BDK0000	10/7/2003	10.2		0.56	0.017
BDK0000	10/21/2003	9.4	0.45	0.40	0.007
BDK0000	12/8/2003	12.6		0.62	0.010
BDK0000	2/9/2004	12.5		1.26	0.014
BDK0000	2/10/2004	11.6		1.14	0.012
BDK0000	2/12/2004	11.9		1.16	0.010
BDK0000	3/29/2004	10.3	2.69	1.04	0.012
BDK0044	3/8/2001	10.2		0.64	0.034
BDK0044	3/27/2001	12.0		2.41	0.046

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Station	Sampling Date	DO (mg/l)	Chlorophyll <i>a</i> (µg/l)	TN (mg/l)	TP (mg/l)
BDK0044	4/3/2001	12.4		1.03	0.048
BDK0044	8/22/2001	10.6		0.27	0.034
BDK0044	8/28/2001	8.5		0.23	0.046
BDK0044	9/6/2001	10.2		0.22	0.036
BDK0044	10/15/2002	10.3		0.29	0.022
BDK0044	10/17/2002	10.5	0.30	0.87	0.028
BDK0044	10/21/2002	11.3		0.37	0.029
BDK0044	10/23/2002	10.3		0.32	0.030
BDK0044	11/12/2002	11.3		0.69	0.018
BDK0044	11/13/2002	11.5		1.14	0.014
BDK0044	11/15/2002	11.1			
BDK0044	11/18/2002	11.1		1.30	0.030
BDK0044	12/9/2002	12.0		0.38	0.021
BDK0044	12/8/2003	11.0		0.50	0.023
BDK0044	2/9/2004	11.8		0.96	0.016
BDK0044	2/10/2004	11.1		0.87	0.019
BDK0044	2/12/2004	11.0		0.93	0.020
BDK0044	3/29/2004	10.6		0.92	0.019
BDK0044	3/28/2005	11.5			
BDK0044	4/4/2005	10.6			
BDK0044	4/18/2005	10.0			
BDK0044	9/19/2005	9.4			
BDK0044	10/17/2005	10.0			
BDK0044	10/31/2005	10.9			
DUH0003	3/28/2005	11.6			
DUH0003	4/4/2005	11.3			
DUH0003	4/18/2005	10.0			
DUH0003	9/19/2005				
DUH0003	10/17/2005	9.3			
DUH0003	10/31/2005	11.6			
JEN0000	3/8/2001	11.7		1.26	0.012
JEN0000	3/27/2001	13.1	0.15	1.61	0.008
JEN0000	4/3/2001	12.0	0.45	1.42	0.005
JEN0000	8/22/2001	9.0	0.30	0.29	0.002
JEN0000	8/28/2001	7.1	0.60	0.32	0.002
JEN0000	9/6/2001	9.2		0.27	0.004
JEN0000	10/15/2002	11.0	0.15	0.61	0.004
JEN0000	10/17/2002	9.8	1.64	1.60	0.013
JEN0000	10/21/2002	9.0	0.75	0.91	0.006
JEN0000	10/23/2002	8.0		0.72	0.005
JEN0000	11/12/2002	10.9		1.00	0.005
JEN0000	11/13/2002	10.9	0.90	1.45	0.014
JEN0000	11/15/2002	10.8			
JEN0000	11/18/2002	11.5	0.45	1.50	0.008
JEN0000	12/9/2002	13.7		0.96	0.004
JEN0000	12/8/2003	13.7		1.16	0.005
JEN0000	2/9/2004	13.6		1.87	0.010
JEN0000	2/10/2004	12.9		1.78	0.011
JEN0000	2/12/2004	13.4		1.82	0.011
JEN0000	3/29/2004	10.4	1.20	1.64	0.014
JEN0035	10/15/2002	11.0	0.30	0.35	0.004
JEN0035	10/17/2002	9.6	1.79	1.42	0.013

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Station	Sampling Date	DO (mg/l)	Chlorophyll <i>a</i> (µg/l)	TN (mg/l)	TP (mg/l)
JEN0035	10/21/2002	7.9		0.59	0.009
JEN0035	10/23/2002	9.7	0.30	0.77	0.005
JEN0035	11/12/2002	11.2		0.90	0.006
JEN0035	11/13/2002	11.3	0.60	1.40	0.016
JEN0035	11/15/2002	9.6			
JEN0035	11/18/2002	11.5	0.15	1.44	0.010
JEN0035	12/9/2002	14.1		0.91	0.008
JEN0035	12/8/2003	13.6		1.22	0.004
JEN0035	2/9/2004	13.6		1.82	0.010
JEN0035	2/10/2004	13.0		1.83	0.011
JEN0035	2/12/2004	13.1		1.76	0.010
JEN0035	3/29/2004	10.5	1.05	1.72	0.013
JEN0036	3/8/2001	11.4		1.22	0.015
JEN0036	3/27/2001	13.5		1.69	0.008
JEN0036	4/3/2001	12.4		1.46	0.008
JEN0036	8/22/2001	9.2	0.75	0.35	0.003
JEN0036	8/28/2001	7.1	0.45	0.32	0.004
JEN0036	9/6/2001	9.5		0.27	0.003
JEN0036	10/8/2002	10.3	0.30	0.46	0.006
JEN0036	11/7/2002	10.5	0.75	1.47	0.007
JEN0036	11/20/2002	11.7		1.49	0.008
JEN0036	12/2/2002	13.4		0.97	0.005
JEN0036	12/17/2002	12.8		1.87	0.008
JEN0036	1/7/2003	12.7		1.91	0.006
JEN0036	1/21/2003			1.29	0.006
JEN0036	2/3/2003	13.0		1.00	0.006
JEN0036	3/18/2003	10.9		2.01	0.035
JEN0036	4/1/2003	12.2		1.20	0.008
JEN0036	4/15/2003	11.3	0.41	1.29	0.017
JEN0036	4/21/2003	10.8	0.75	0.98	0.020
JEN0036	4/28/2003	10.4	0.60	0.80	0.015
JEN0036	5/5/2003	10.8	5.08	1.62	0.068
JEN0036	5/19/2003	11.0	0.45	1.25	0.016
JEN0036	6/2/2003	10.7	0.60	1.16	0.016
JEN0036	6/16/2003	10.1		0.96	0.012
JEN0036	7/7/2003	9.3	2.54	0.61	0.009
JEN0036	7/21/2003	8.4	0.90	0.57	0.007
JEN0036	8/4/2003	8.7	1.50	0.60	0.010
JEN0036	8/18/2003	8.4	0.75	0.38	0.004
JEN0036	9/8/2003	9.1	1.35	0.29	0.006
JEN0036	9/22/2003	8.9	0.75	1.07	0.014
JEN0036	10/7/2003	11.1		0.77	0.011
JEN0036	10/21/2003	9.7		0.54	0.006
JEN0036	3/28/2005	11.9			
JEN0036	4/4/2005	11.4			
JEN0036	4/18/2005	10.3			
JEN0036	9/19/2005	6.9			
JEN0036	10/17/2005	10.1			
JEN0036	10/31/2005	12.9			
JEN0057	3/28/2005	11.7			
JEN0057	4/4/2005	11.4			
JEN0057	4/18/2005	10.5			

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Station	Sampling Date	DO (mg/l)	Chlorophyll <i>a</i> (µg/l)	TN (mg/l)	TP (mg/l)
JEN0057	9/19/2005	8.9			
JEN0057	10/17/2005	10.1			
JEN0057	10/31/2005	12.5			
JEN0058	3/28/2005	11.6			
JEN0058	4/4/2005	11.7			
JEN0058	4/18/2005	10.6			
JEN0058	9/19/2005	8.5			
JEN0058	10/17/2005	9.9			
JEN0058	10/31/2005	12.3			
JEN0083	3/28/2005	11.3			
JEN0083	4/4/2005	11.4			
JEN0083	4/18/2005	10.2			
JEN0083	9/19/2005	9.2			
JEN0083	10/17/2005	10.4			
JEN0083	10/31/2005	11.4			
JEN0091	10/15/2002	11.1	2.39	0.57	0.019
JEN0091	10/17/2002	9.7	0.30	1.16	0.030
JEN0091	10/21/2002	7.9	1.20	0.71	0.053
JEN0091	10/23/2002	9.9		0.51	0.019
JEN0091	11/12/2002	10.9		0.82	0.097
JEN0091	11/13/2002	11.2	0.30	1.07	0.014
JEN0091	11/15/2002	10.6			
JEN0091	11/18/2002	11.4		1.08	0.012
JEN0091	12/9/2002	12.8		0.69	0.028
JEN0091	12/8/2003	12.2		0.86	0.007
JEN0091	2/9/2004	12.5		1.26	0.012
JEN0091	2/10/2004	12.0		1.24	0.015
JEN0091	2/12/2004	12.0		1.15	0.012
JEN0091	3/29/2004	10.5		1.26	0.015
JEN0092	3/28/2005	11.8			
JEN0092	4/4/2005	11.9			
JEN0092	4/18/2005	10.4			
JEN0092	9/19/2005	8.1			
JEN0092	10/17/2005	10.3			
JEN0092	10/31/2005	11.4			
NJE0000	3/8/2001	11.6	0.30	1.16	0.012
NJE0000	3/27/2001	13.6		1.49	0.005
NJE0000	4/3/2001	12.3		1.39	0.003
NJE0000	8/22/2001	8.8	0.45	0.35	0.006
NJE0000	8/28/2001	7.5	1.05	0.37	0.006
NJE0000	9/6/2001	9.0		0.36	0.008
NJE0014	10/8/2002	7.1	0.30	0.21	0.011
NJE0014	11/7/2002	11.2	0.45	1.28	0.009
NJE0014	11/20/2002	11.6		1.26	0.007
NJE0014	12/2/2002	13.6		0.93	0.002
NJE0014	12/17/2002	12.8		1.67	0.007
NJE0014	1/7/2003	12.8		1.76	0.009
NJE0014	1/21/2003			1.45	0.006
NJE0014	2/3/2003	12.5		1.21	0.006
NJE0014	3/18/2003	10.7		1.57	0.020
NJE0014	4/1/2003	11.8		1.17	0.008
NJE0014	4/15/2003	10.8	1.50	1.22	0.014

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Station	Sampling Date	DO (mg/l)	Chlorophyll <i>a</i> (µg/l)	TN (mg/l)	TP (mg/l)
NJE0014	4/21/2003	10.5	2.39	1.04	0.014
NJE0014	4/28/2003	10.6	1.35	0.83	0.011
NJE0014	5/5/2003	10.1	21.23	1.83	0.068
NJE0014	5/19/2003	10.9	0.75	1.25	0.018
NJE0014	6/2/2003	10.4	0.30	1.00	0.015
NJE0014	6/16/2003	9.8		0.86	0.014
NJE0014	7/7/2003	9.1	2.99	0.62	0.007
NJE0014	7/21/2003	8.3	1.05	0.64	0.010
NJE0014	8/4/2003	8.3	1.20	0.68	0.017
NJE0014	8/18/2003	8.1	0.75	0.35	0.009
NJE0014	9/8/2003	8.8	0.60	0.26	0.008
NJE0014	9/22/2003	8.7	0.45	0.82	0.018
NJE0014	10/7/2003	10.6		0.61	0.009
NJE0014	10/21/2003	9.9	1.05	0.44	0.005
UJF0002	3/28/2005	11.9			
UJF0002	4/4/2005	11.8			
UJF0002	4/18/2005	10.4			
UJF0002	9/19/2005	8.3			
UJF0002	10/17/2005	10.1			
UJF0002	10/31/2005	11.8			
UJH0011	3/28/2005	11.5			
UJH0011	4/4/2005	11.4			
UJH0011	4/18/2005	10.0			
UJH0011	9/19/2005	8.5			
UJH0011	10/17/2005	9.8			
UJH0011	10/31/2005	10.9			
UJH0015	3/28/2005	11.5			
UJH0015	4/4/2005	11.5			
UJH0015	4/18/2005	10.4			
UJH0015	9/19/2005				
UJH0015	10/17/2005	9.5			
UJH0015	10/31/2005	11.0			
UJN0005	3/28/2005	11.5			
UJN0005	4/4/2005	10.9			
UJN0005	4/18/2005	9.2			
UJN0005	9/19/2005				
UJN0005	10/17/2005	8.1			
UJN0005	10/31/2005	10.6			
WIL0000	10/8/2002	7.1	1.50	0.41	0.040
WIL0000	10/15/2002	11.8	0.60	0.44	0.008
WIL0000	10/17/2002	9.6	3.44	0.97	0.055
WIL0000	10/21/2002	9.6	0.60	0.76	0.007
WIL0000	10/23/2002	7.9	1.05	0.53	0.007
WIL0000	11/7/2002	11.2	1.35	1.33	0.013
WIL0000	11/12/2002	10.5	1.35	1.03	0.007
WIL0000	11/13/2002	10.1	3.74	1.22	0.026
WIL0000	11/15/2002	10.9			
WIL0000	11/18/2002	11.4	1.35	1.37	0.033
WIL0000	11/20/2002	11.7		1.42	0.013
WIL0000	12/2/2002	13.5	0.75	0.96	0.004
WIL0000	12/9/2002	14.3	1.05	0.91	0.006
WIL0000	12/17/2002	12.0	1.35	1.51	0.011

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Station	Sampling Date	DO (mg/l)	Chlorophyll <i>a</i> (µg/l)	TN (mg/l)	TP (mg/l)
WIL0000	1/7/2003	11.9	0.15	1.65	0.010
WIL0000	1/21/2003			1.24	0.009
WIL0000	2/3/2003	12.0	0.75	1.01	0.006
WIL0000	3/18/2003	10.9	2.62	1.56	0.038
WIL0000	4/1/2003	12.2	1.50	0.93	0.008
WIL0000	4/15/2003	11.2	2.54	1.08	0.022
WIL0000	4/21/2003	10.6	4.24	1.02	0.029
WIL0000	4/28/2003	10.5	1.64	0.65	0.012
WIL0000	5/5/2003	9.8	9.72	1.50	0.101
WIL0000	5/19/2003	10.2	0.45	1.22	0.019
WIL0000	6/2/2003	10.5	1.05	1.18	0.019
WIL0000	6/16/2003	9.8		0.76	0.010
WIL0000	7/7/2003	8.3	0.90	0.57	0.006
WIL0000	7/21/2003	8.9	0.75	0.42	0.006
WIL0000	8/4/2003	8.8	1.92	0.90	0.026
WIL0000	8/18/2003	9.3	0.45	0.39	0.014
WIL0000	9/8/2003	9.6	1.36	0.23	0.016
WIL0000	9/22/2003	9.0	0.30	1.07	0.017
WIL0000	10/7/2003	11.2	1.31	0.72	0.009
WIL0000	10/21/2003	10.4	0.90	0.55	0.005
WIL0000	12/8/2003	13.4		0.97	0.010
WIL0000	2/9/2004	13.5	0.90	1.52	0.015
WIL0000	2/10/2004	13.2		1.55	0.015
WIL0000	2/12/2004	13.3	0.45	1.37	0.013
WIL0000	3/29/2004	10.8	1.79	1.33	0.010
WIL0002	10/11/2000	11.4	0.90	0.27	0.009
WIL0002	11/2/2000	12.2	0.96	0.18	0.010
WIL0002	12/11/2000	12.4	1.20	0.66	0.002
WIL0002	1/17/2001	12.9		0.65	0.019
WIL0002	2/13/2001	13.0	0.75	1.71	0.009
WIL0002	3/8/2001	12.5	0.45	1.03	0.013
WIL0002	3/13/2001	11.0	3.74	1.69	0.039
WIL0002	3/27/2001	13.3	0.75	1.28	0.007
WIL0002	4/3/2001	12.0	1.50	1.28	0.009
WIL0002	4/11/2001	10.4	3.89	1.09	0.025
WIL0002	5/8/2001	10.3	1.79	0.53	0.009
WIL0002	6/12/2001	9.4	1.50	0.96	0.023
WIL0002	7/17/2001	9.7	0.90	0.36	0.008
WIL0002	8/14/2001	9.9	1.05	0.40	0.010
WIL0002	8/22/2001	10.0	1.20	0.24	0.009
WIL0002	8/28/2001	9.2	0.90	0.24	0.008
WIL0002	9/6/2001	10.4	0.90	0.27	0.007
WIL0002	9/11/2001	10.4	0.75	0.25	0.008
WIL0002	10/10/2001	11.2	0.30	0.22	0.007
WIL0002	11/14/2001	12.4	0.60	0.13	0.003
WIL0002	12/11/2001	11.7	1.35	0.25	0.006
WIL0002	1/15/2002	11.8	1.37	1.09	0.014
WIL0002	2/12/2002	12.6	0.45	0.72	0.004
WIL0002	3/12/2002	11.9	0.60	0.82	0.013
WIL0002	4/9/2002	10.6	1.64	0.97	0.010
WIL0002	5/7/2002	10.3	1.35	0.94	0.012
WIL0002	6/18/2002	9.7	2.39	0.64	0.022

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Station	Sampling Date	DO (mg/l)	Chlorophyll <i>a</i> (µg/l)	TN (mg/l)	TP (mg/l)
WIL0002	7/16/2002	9.5	1.20	0.27	0.009
WIL0002	8/13/2002	9.5	4.49	0.32	0.016
WIL0002	9/17/2002	9.6	1.35	0.27	0.012
WIL0002	1/7/2003	13.3			
WIL0002	1/21/2003				
WIL0002	2/3/2003	11.5			
WIL0002	2/11/2003	13.2			
WIL0002	3/10/2003	12.2			
WIL0002	3/17/2003	11.3			
WIL0002	3/17/2003	11.3			
WIL0002	3/25/2003	10.3			
WIL0002	4/1/2003	12.6			
WIL0002	4/21/2003	10.3			
WIL0002	5/19/2003	10.2			
WIL0002	6/2/2003	10.5			
WIL0002	6/16/2003	10.4			
WIL0002	7/7/2003	8.3			
WIL0002	7/21/2003	8.9			
WIL0002	8/4/2003	8.8			
WIL0002	8/18/2003	8.8			
WIL0002	9/8/2003	9.6			
WIL0002	9/22/2003	9.0			
WIL0002	10/7/2003	11.2			
WIL0002	10/21/2003	10.4			
WIL0013	11/10/1999	11.3			
WIL0013	12/6/1999	11.2		0.62	0.006
WIL0013	1/18/2000	12.6		0.76	0.004
WIL0013	2/14/2000	14.3	13.83	1.80	0.426
WIL0013	3/6/2000	10.5		0.96	0.006
WIL0013	4/10/2000	11.6	2.39	0.71	0.006
WIL0013	5/8/2000	9.2	1.50	0.36	0.012
WIL0013	6/12/2000	8.8		0.64	0.017
WIL0013	7/10/2000	8.4	1.25	0.24	0.009
WIL0013	8/7/2000	9.1	3.74	1.62	0.076
WIL0013	9/11/2000	8.2	2.84	0.37	0.020
WIL0013	10/8/2002	8.7	0.15	0.25	0.010
WIL0013	10/15/2002	10.4	0.15	0.37	0.006
WIL0013	10/17/2002	9.6	2.24	0.98	0.028
WIL0013	10/21/2002	10.2	0.30	0.78	0.008
WIL0013	10/23/2002	9.4	0.30	0.55	0.007
WIL0013	11/7/2002	11.2	1.35	1.32	0.013
WIL0013	11/12/2002	10.6	1.05	1.01	0.004
WIL0013	11/13/2002	10.9	2.99	1.23	0.026
WIL0013	11/15/2002	10.8			
WIL0013	11/18/2002	11.1	1.05	1.27	0.014
WIL0013	11/20/2002	11.3		1.42	0.006
WIL0013	12/2/2002	13.2	0.45	1.02	0.003
WIL0013	12/9/2002	13.9	0.45	1.01	0.003
WIL0013	12/17/2002	12.5	1.50	1.55	0.008
WIL0013	1/7/2003	13.3	0.12	1.58	0.010
WIL0013	1/21/2003			1.34	0.010
WIL0013	2/3/2003	12.8	0.45	1.12	0.006

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Station	Sampling Date	DO (mg/l)	Chlorophyll <i>a</i> (µg/l)	TN (mg/l)	TP (mg/l)
WIL0013	3/18/2003	10.1	2.62	1.52	0.033
WIL0013	4/1/2003	12.6	1.50	0.96	0.007
WIL0013	4/15/2003	11.5	3.59	1.03	0.013
WIL0013	4/21/2003	10.4	3.14	0.80	0.011
WIL0013	4/28/2003	10.4	1.64	0.66	0.012
WIL0013	5/5/2003	9.9	2.69	0.66	0.011
WIL0013	5/19/2003	10.8	0.60	1.07	0.016
WIL0013	6/2/2003	11.0	1.20	0.98	0.015
WIL0013	6/16/2003	9.8		0.78	0.010
WIL0013	7/7/2003	8.5	1.20	0.56	0.007
WIL0013	7/21/2003	8.6	0.60	0.42	0.006
WIL0013	8/4/2003	8.0	1.99	1.01	0.028
WIL0013	8/18/2003	9.0	0.45	0.29	0.005
WIL0013	9/8/2003	8.5	0.60	0.21	0.004
WIL0013	9/22/2003	8.8	0.45	1.08	0.015
WIL0013	10/7/2003	10.6	0.45	0.67	0.007
WIL0013	10/21/2003	10.5	0.90	0.53	0.008
WIL0013	12/8/2003	13.5		1.06	0.004
WIL0013	2/9/2004	13.6		1.73	0.017
WIL0013	2/10/2004	13.3		1.53	0.014
WIL0013	2/12/2004	13.4	0.45	1.47	0.012
WIL0013	3/29/2004	10.8	1.64	1.27	0.010
WIL0036	3/8/2001	12.7	0.60	1.05	0.011
WIL0036	3/27/2001	13.6	0.90	1.29	0.006
WIL0036	4/3/2001	11.8	1.50	1.31	0.007
WIL0036	8/22/2001	8.1	0.90	0.26	0.012
WIL0036	8/28/2001	6.8	0.45	0.29	0.011
WIL0036	9/6/2001	8.1	1.05	0.27	0.013
WIL0036	10/15/2002	10.3	0.15	0.36	0.008
WIL0036	10/17/2002	9.5	3.14	1.00	0.038
WIL0036	10/21/2002	8.6	0.45	0.81	0.009
WIL0036	10/23/2002	8.5	0.30	0.55	0.008
WIL0036	11/12/2002	10.6	1.05	1.02	0.005
WIL0036	11/13/2002	10.8	3.29	1.22	0.025
WIL0036	11/15/2002	10.6			
WIL0036	11/18/2002	7.7	1.35	1.29	0.013
WIL0036	12/8/2003	13.7		1.06	0.004
WIL0036	2/9/2004	13.6	0.75	1.61	0.014
WIL0036	2/10/2004	12.6		1.42	0.013
WIL0036	2/12/2004	13.1	0.30	1.42	0.012
WIL0036	3/29/2004	10.4	1.79	1.28	0.011
WIL0067	11/10/1999	10.7			
WIL0067	12/6/1999	11.1		0.56	0.008
WIL0067	1/18/2000	14.6	0.30	0.86	0.003
WIL0067	2/14/2000	12.2	6.28	1.47	0.025
WIL0067	3/6/2000	11.7	0.21	1.07	0.011
WIL0067	4/10/2000	12.6	2.39	0.72	0.007
WIL0067	5/8/2000	8.4	1.20	0.35	0.011
WIL0067	6/12/2000	8.4		0.71	0.010
WIL0067	7/10/2000	10.5	0.75	0.40	0.026
WIL0067	8/7/2000	9.7	3.29	1.44	0.092
WIL0067	9/11/2000	8.4	0.60	0.21	0.009

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Station	Sampling Date	DO (mg/l)	Chlorophyll <i>a</i> (µg/l)	TN (mg/l)	TP (mg/l)
WIL0067	10/11/2000	10.1	0.30	0.10	0.007
WIL0067	11/2/2000	10.7		0.09	0.006
WIL0067	12/11/2000	12.2		0.75	0.009
WIL0067	1/17/2001	12.4		0.78	0.020
WIL0067	2/13/2001	13.3	0.85	1.73	0.014
WIL0067	3/8/2001	13.4	1.20	1.00	0.016
WIL0067	3/13/2001	11.3	6.88	1.48	0.018
WIL0067	3/27/2001	13.7	0.90	1.32	0.006
WIL0067	4/3/2001	12.0	1.50	1.14	0.004
WIL0067	4/11/2001	10.3	4.64	1.17	0.017
WIL0067	5/8/2001	7.9	1.79	0.57	0.007
WIL0067	6/12/2001	8.3	1.05	1.06	0.021
WIL0067	7/17/2001	9.4	0.45	0.31	0.011
WIL0067	8/14/2001	8.6	0.75	0.36	0.014
WIL0067	8/22/2001	8.6	0.75	0.21	0.014
WIL0067	8/28/2001	6.9	0.60	0.25	0.012
WIL0067	9/6/2001	8.3	0.60	0.23	0.014
WIL0067	9/11/2001	8.8	0.60	0.27	0.016
WIL0067	10/10/2001	10.8		0.08	0.008
WIL0067	11/14/2001	11.5	0.14	0.06	0.004
WIL0067	12/11/2001	11.7	0.75	0.15	0.006
WIL0067	1/15/2002	10.7	0.60	1.16	0.009
WIL0067	2/12/2002	12.8	0.75	0.81	0.004
WIL0067	3/12/2002	12.2	1.05	0.92	0.006
WIL0067	4/9/2002	10.6	0.90	0.98	0.009
WIL0067	5/7/2002	10.3	1.20	0.91	0.008
WIL0067	6/18/2002	8.6	0.75	0.42	0.009
WIL0067	7/16/2002	7.9	1.35	0.27	0.012
WIL0067	8/13/2002	8.5	1.79	0.29	0.021
WIL0067	9/17/2002	8.2	0.90	0.22	0.015
WIL0067	10/8/2002	10.9	0.15	0.21	0.010
WIL0067	10/15/2002	10.2	0.30	0.31	0.008
WIL0067	10/17/2002	9.5	1.50	0.92	0.028
WIL0067	10/21/2002	8.1	0.60	0.74	0.010
WIL0067	10/23/2002	8.4	0.30	0.47	0.008
WIL0067	11/7/2002	10.3	0.90	1.17	0.012
WIL0067	11/12/2002	10.5	0.90	0.96	0.007
WIL0067	11/13/2002	10.5	1.79	1.10	0.024
WIL0067	11/15/2002	10.4			
WIL0067	11/18/2002	10.7	0.75	1.20	0.012
WIL0067	11/20/2002	11.4		1.32	0.007
WIL0067	12/2/2002	13.8	0.45	1.02	0.003
WIL0067	12/9/2002	13.4	0.45	1.04	0.006
WIL0067	12/17/2002	13.2	1.62	1.51	0.010
WIL0067	1/7/2003	12.4			0.011
WIL0067	1/21/2003			1.27	0.010
WIL0067	2/3/2003	13.1	0.90	1.15	0.009
WIL0067	3/18/2003	10.8	2.99	1.44	0.031
WIL0067	4/1/2003	13.2	1.64	0.88	0.008
WIL0067	4/15/2003	11.1	1.94	1.07	0.013
WIL0067	4/21/2003	10.4	4.34	0.69	0.011
WIL0067	4/28/2003	10.8	2.84	0.63	0.012

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Station	Sampling Date	DO (mg/l)	Chlorophyll <i>a</i> (µg/l)	TN (mg/l)	TP (mg/l)
WIL0067	5/5/2003	9.9	3.14	0.61	0.010
WIL0067	5/19/2003	10.8	0.30	1.17	0.016
WIL0067	6/2/2003	10.9	0.75	0.98	0.016
WIL0067	6/16/2003	10.0		0.72	0.010
WIL0067	7/7/2003	8.7	1.05	0.55	0.009
WIL0067	7/21/2003	8.7	0.75	0.33	0.009
WIL0067	8/4/2003	7.5	1.50	1.01	0.028
WIL0067	8/18/2003	8.8	0.45	0.25	0.010
WIL0067	9/8/2003	9.1	0.45	0.22	0.008
WIL0067	9/22/2003	8.9	0.30	1.05	0.014
WIL0067	10/7/2003	9.8	0.15	0.64	0.006
WIL0067	10/21/2003	10.4	0.45	0.51	0.003
WIL0067	12/8/2003	13.4		1.04	0.007
WIL0067	2/9/2004	13.5	0.60	1.56	0.013
WIL0067	2/10/2004	13.2	0.30	1.46	0.013
WIL0067	2/12/2004	13.3	0.60	1.46	0.013
WIL0067	3/29/2004	9.5	1.94	1.28	0.008

Table A-2: DNR Water Quality Data

Station	Sampling Date	DO (mg/l)	Chlorophyll <i>a</i> (µg/l)	TN (mg/l)	TP (mg/l)
BDK0000	1/14/1998	12.4			0.029
BDK0000	2/4/1998	11.5			0.020
BDK0000	3/18/1998	11.0		0.83	0.017
BDK0000	4/29/1998	10.9			0.010
BDK0000	5/13/1998	10.2			0.016
BDK0000	6/24/1998	9.3		0.30	0.010
BDK0000	7/29/1998	9.0		0.28	0.021
BDK0000	8/12/1998	9.2			0.010
BDK0000	9/30/1998	9.4			0.104
BDK0000	10/21/1998	10.5			0.011
BDK0000	11/24/1998	10.0			0.020
BDK0000	12/9/1998	11.0			0.058
BDK0000	1/27/1999	12.2			0.010
BDK0000	3/24/1999	11.7			0.017
BDK0000	1/26/2000	12.2			0.025
BDK0000	2/24/2000	11.4			0.010
BDK0000	3/22/2000	11.4			0.021
BDK0000	6/28/2000	9.5		0.31	0.016
BDK0000	7/27/2000	9.2			0.016
BDK0000	8/30/2000	8.8			0.020
BDK0000	10/25/2000	10.0			0.010
BDK0000	11/29/2000	11.8			0.010
BDK0000	12/20/2000	11.7			0.068
BDK0000	1/24/2001	12.0		0.68	0.010
BDK0000	2/7/2001	12.3			0.017
BDK0000	3/28/2001	11.3		1.18	0.016
BDK0000	4/11/2001	9.8			0.028
BDK0000	5/16/2001	10.4			0.015
BDK0000	6/27/2001	9.4			0.015
BDK0000	7/26/2001	9.3			0.023
BDK0000	8/8/2001	9.0			0.023
BDK0000	9/26/2001	10.1			0.022
BDK0000	10/24/2001	9.4		0.19	0.010
BDK0000	11/7/2001	11.0			0.010
BDK0000	12/5/2001	11.0			0.010
BDK0000	1/16/2002	12.5			0.010
BDK0000	2/6/2002	12.8			0.010
BDK0000	3/6/2002	12.7		0.59	0.010
BDK0000	4/17/2002	10.1			0.024
BDK0000	5/22/2002	11.2			0.010
BDK0000	6/5/2002	9.4			0.018
BDK0000	7/10/2002	9.0			0.022
BDK0000	8/7/2002	9.7			0.029
BDK0000	9/11/2002	8.9			0.012
BDK0000	10/30/2002	10.6			0.046
BDK0000	11/20/2002	11.5			0.028
BDK0000	12/4/2002	12.4			0.014
BDK0000	1/7/2003	12.6			0.023
BDK0000	2/5/2003	12.5			0.015
BDK0000	3/5/2003	11.5		1.04	0.013

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Station	Sampling Date	DO (mg/l)	Chlorophyll <i>a</i> (µg/l)	TN (mg/l)	TP (mg/l)
BDK0000	4/16/2003	10.5			0.022
BDK0000	5/21/2003	10.0			0.034
BDK0000	6/4/2003	10.0			0.071
BDK0000	7/16/2003	9.5			0.010
BDK0000	8/27/2003	9.1			0.014
BDK0000	9/10/2003	9.7			0.211
BDK0000	10/22/2003	9.4			0.011
BDK0000	11/5/2003	10.1			0.015
BDK0000	12/10/2003	11.7			0.010
BDK0000	1/7/2004	13.2			0.013
BDK0000	2/11/2004	12.5			0.025
BDK0000	3/10/2004	12.3			0.016
BDK0000	4/21/2004	10.0			0.010
BDK0000	5/19/2004	9.7			0.060
BDK0000	6/16/2004	9.3			0.017
BDK0000	7/14/2004	9.1			0.019
BDK0000	8/18/2004	9.4			0.017
BDK0000	9/15/2004	8.9			0.177
BDK0000	10/20/2004	10.2			0.013
BDK0000	11/17/2004	10.8			0.010
BDK0000	12/15/2004	12.5			0.011
BDK0000	1/19/2005	13.0		0.96	0.010
BDK0000	2/9/2005	10.7			0.010
BDK0000	3/9/2005	12.1			0.034
BDK0000	4/6/2005	11.1			0.016
BDK0000	5/4/2005	11.1			0.010
BDK0000	6/8/2005	9.4			0.013
BDK0000	7/20/2005	8.9			
BDK0000	8/3/2005	9.1		0.30	0.017
BDK0000	9/21/2005	9.3		0.27	0.021
BDK0000	10/5/2005	9.5		0.31	0.022
BDK0000	11/2/2005	10.6		0.53	0.025
BDK0000	12/7/2005	12.9		1.28	0.019
BDK0000	1/24/2006	12.3		2.30	0.027
BDK0000	2/15/2006	12.3		0.81	0.009
BDK0000	3/15/2006	11.6		0.56	0.009
BDK0000	4/12/2006	10.6		0.45	0.021
BDK0000	5/4/2006	9.7		0.86	0.016
BDK0000	6/29/2006	9.5		0.49	0.018
BDK0000	7/20/2006	8.9		0.29	0.016
BDK0000	8/9/2006	9.4		3.04	0.025
BDK0000	9/27/2006	10.1		0.30	0.013
BDK0000	10/4/2006	9.7		0.41	0.009
BDK0000	11/2/2006	10.7		1.12	0.015
BDK0000	12/6/2006	12.6		0.46	0.008
BDK0000	1/18/2007	13.0		0.82	0.012
BDK0000	2/7/2007	13.0		0.47	0.008
BDK0000	3/20/2007	11.7		2.05	0.037
BDK0000	4/4/2007	10.7		0.85	0.035
BDK0000	5/31/2007	10.4		0.32	0.024
BDK0000	6/27/2007	9.5		0.29	0.018
WIL0013	1/14/1998	12.5		1.12	0.018

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Station	Sampling Date	DO (mg/l)	Chlorophyll <i>a</i> (µg/l)	TN (mg/l)	TP (mg/l)
WIL0013	2/4/1998	11.9		0.96	0.019
WIL0013	3/18/1998	11.8		0.94	0.010
WIL0013	4/29/1998	10.5			0.010
WIL0013	5/13/1998	9.9			0.022
WIL0013	6/24/1998	8.1			0.172
WIL0013	7/29/1998	8.1			0.022
WIL0013	8/12/1998	7.8			0.015
WIL0013	9/30/1998	8.6			0.045
WIL0013	10/21/1998	9.7			0.014
WIL0013	11/24/1998	10.4			0.020
WIL0013	12/9/1998	10.7			0.010
WIL0013	1/27/1999	12.4			0.017
WIL0013	2/24/1999	12.3			0.010
WIL0013	3/24/1999	11.9			0.010
WIL0013	1/26/2000	12.1			0.010
WIL0013	2/24/2000	11.4			0.010
WIL0013	3/22/2000	11.7			0.017
WIL0013	6/28/2000	8.1			0.020
WIL0013	7/27/2000	8.6			0.010
WIL0013	8/30/2000	8.4			0.010
WIL0013	10/25/2000	9.7			0.010
WIL0013	11/29/2000	12.4			0.010
WIL0013	12/20/2000	11.8			0.060
WIL0013	1/24/2001	11.9		1.13	0.010
WIL0013	2/7/2001	12.7			0.010
WIL0013	3/28/2001	12.1			0.014
WIL0013	4/11/2001	9.5			0.021
WIL0013	5/16/2001	9.9			0.010
WIL0013	6/27/2001	8.4			0.012
WIL0013	7/26/2001	8.1			0.016
WIL0013	8/8/2001	7.6			0.018
WIL0013	9/26/2001	9.9			0.020
WIL0013	10/24/2001	8.9			0.013
WIL0013	11/7/2001	10.6			0.010
WIL0013	12/5/2001	11.5			0.010
WIL0013	1/16/2002	13.3			0.010
WIL0013	2/6/2002	13.1			0.014
WIL0013	3/6/2002	12.7			0.010
WIL0013	4/17/2002	9.2			0.010
WIL0013	5/22/2002	11.2			0.010
WIL0013	6/5/2002	8.0			0.010
WIL0013	7/10/2002	6.5			0.011
WIL0013	8/7/2002	7.9			0.019
WIL0013	9/11/2002	6.9			0.010
WIL0013	10/30/2002	10.8			0.091
WIL0013	11/20/2002	11.7			0.010
WIL0013	12/4/2002	12.5			0.010
WIL0013	1/7/2003	12.7			0.014
WIL0013	2/5/2003	13.4			
WIL0013	3/5/2003	12.9			0.012
WIL0013	4/16/2003	10.1			0.013
WIL0013	5/21/2003	9.7			0.020

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Station	Sampling Date	DO (mg/l)	Chlorophyll <i>a</i> (µg/l)	TN (mg/l)	TP (mg/l)
WIL0013	6/4/2003	10.1			0.144
WIL0013	7/16/2003	8.4			0.010
WIL0013	8/27/2003	7.5			0.010
WIL0013	9/10/2003	8.4			0.012
WIL0013	10/22/2003	9.0			0.012
WIL0013	11/5/2003	9.9			0.010
WIL0013	12/10/2003	12.6			0.022
WIL0013	1/7/2004	12.4		1.50	0.016
WIL0013	2/11/2004	13.9			0.020
WIL0013	3/10/2004	12.6			0.024
WIL0013	4/21/2004	9.4			0.010
WIL0013	5/19/2004	9.1			0.442
WIL0013	6/16/2004	8.1			0.016
WIL0013	7/14/2004	7.5			0.012
WIL0013	8/18/2004	8.4			0.013
WIL0013	9/15/2004	8.7			0.034
WIL0013	10/20/2004	10.2			0.010
WIL0013	11/17/2004	11.5			0.010
WIL0013	12/15/2004	13.2			0.010
WIL0013	1/19/2005	13.1		1.45	0.011
WIL0013	2/9/2005	12.3			0.032
WIL0013	3/9/2005	12.5		1.61	0.016
WIL0013	4/6/2005	11.0		1.48	0.014
WIL0013	5/4/2005	11.3			0.010
WIL0013	6/8/2005	8.2			0.013
WIL0013	7/20/2005	7.6			
WIL0013	8/3/2005	7.9		0.37	0.016
WIL0013	9/21/2005	8.7		0.31	0.022
WIL0013	10/5/2005	9.0		0.26	0.021
WIL0013	11/2/2005	10.4		0.96	0.028
WIL0013	12/7/2005	13.4		1.52	0.022
WIL0013	1/24/2006	12.7		1.57	0.026
WIL0013	2/15/2006	12.8		1.14	0.016
WIL0013	3/15/2006	11.6		1.15	0.009
WIL0013	4/12/2006	10.7		1.08	0.014
WIL0013	5/4/2006	9.4		0.81	0.013
WIL0013	6/29/2006	8.6		0.93	0.019
WIL0013	7/20/2006	7.5		0.37	0.009
WIL0013	8/9/2006	8.5		0.28	0.015
WIL0013	9/27/2006	9.6		0.23	0.010
WIL0013	10/4/2006	9.5		0.32	0.010
WIL0013	11/2/2006	10.2		0.51	0.010
WIL0013	12/6/2006	12.3		0.87	0.010
WIL0013	1/18/2007	13.1		1.31	0.015
WIL0013	2/7/2007	12.9		1.06	0.008
WIL0013	3/20/2007	12.2		1.50	0.021
WIL0013	4/4/2007	10.8		1.11	0.010
WIL0013	5/31/2007	8.9		0.57	0.014
WIL0013	6/27/2007	8.0		0.32	0.011

Table A-3: MBSS Water Quality Data

Station	Stream	Date	DO (mg/l)	TN (mg/l)	TP (mg/l)
WILL-301-C-2000	Braddock Run	4/11/2000		0.63	0.008
WILL-301-C-2001	Braddock Run	4/6/2001		0.77	0.030
WILL-105-R-2004	Braddock Run UT2 UT1	3/11/2004		2.09	0.014
WILL-109-R-2004	Jennings Run UT1 UT1	3/11/2004		1.81	0.010
WILL-110-R-2004	Braddock Run UT2 UT1	3/11/2004		1.64	0.015
WILL-120-R-2004	Braddock Run UT2 UT1	3/11/2004		1.68	0.014
WILL-219-R-2004	Braddock Run	3/11/2004		1.41	0.018
WILL-115-R-2004	Jennings Run UT2	3/25/2004		2.10	0.015
WILL-306-R-2004	Jennings Run	3/25/2004		1.73	0.013
WILL-107-R-2004	Jennings Run UT1	4/7/2004		0.28	0.006
WILL-212-R-2004	Braddock Run	4/7/2004		0.92	0.010
WILL-404-R-2004	Wills Creek	4/7/2004		1.40	0.013
WILL-301-C-2000	Braddock Run	7/28/2000	9.3		
WILL-301-C-2001	Braddock Run	7/31/2001	10.1		
WILL-105-R-2004	Braddock Run UT2 UT1	6/1/2004	9.1		
WILL-110-R-2004	Braddock Run UT2 UT1	6/1/2004	8.8		
WILL-120-R-2004	Braddock Run UT2 UT1	6/1/2004	9.9		
WILL-107-R-2004	Jennings Run UT1	7/7/2004			
WILL-109-R-2004	Jennings Run UT1 UT1	7/7/2004	7.8		
WILL-219-R-2004	Braddock Run	7/7/2004	8.5		
WILL-115-R-2004	Jennings Run UT2	7/21/2004	8.5		
WILL-212-R-2004	Braddock Run	8/4/2004	8.5		
WILL-306-R-2004	Jennings Run	8/11/2004	8.5		
WILL-404-R-2004	Wills Creek	9/6/2004	10.3		