Water Quality Analysis of Eutrophication of the Casselman River, Garrett County, Maryland

Final

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BOD	Biochemical Oxygen Demand
Chl_*a*	Active Chlorophyll
DO	Dissolved Oxygen

EXECUTIVE SUMMARY

Section 303(d) of the federal Clean Water Act (the Act) directs States 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, 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 provide justification for removal from the 303(d) list.

The Casselman River was identified on the State's 1996 list of WQLSs as impaired by nutrients, among other substances. This report provides an analysis of recent monitoring data, which shows that the dissolved oxygen criterion and designated uses associated with nutrients are being met in the Casselman River. This analysis supports the conclusion that a TMDL for nutrients is not necessary to achieve water quality standards in this case. Barring any contradictory future data, this report will be used as supporting material when MDE proposes the revision of Maryland's 2002 303(d) list for public review. Although the waters of the Casselman River do not display signs of eutrophication, the State reserves the right to require future controls in the Casselman watershed if evidence suggests nutrients from the basin are contributing to downstream water quality problems.

1.0 INTRODUCTION

The Clean Water Act (CWA) Section 303(d) directs each State to develop a list of impaired waters, called the 303(d) list. The Casselman River was first identified on the 1996 303(d) list, submitted to EPA by the Maryland Department of the Environment (MDE). Among other substances still under examination, the Casselman River was listed as being impaired by nutrients. This report provides more recent information that supports the removal of the nutrients' listing for the Casselman River when the 303(d) list is revised in 2002.

In addition to the successful implementation of a TMDL, there are at least four scenarios by which a previously listed waterbody can be removed from the 303 (d) list. Waters may be removed from the list based on 1) more recent data indicating that the impairment no longer exists; 2) more recent and updated water quality modeling which demonstrates that the segment is now attaining standards; 3) refinements to water quality standards, or the interpretation of those standards, which result in standards being met; or 4) correction to errors made in the initial listing. The first scenario most closely applies to the present case, with the qualification that the initial listing for nutrients was suspect due to the lack of data.

The remainder of this report lays out the general setting of the waterbody within the Casselman watershed, presents a discussion of the water quality characterization process, and provides conclusions with regard to the characterization. The data establish that the Casselman River is achieving water quality standards.

2.0 GENERAL SETTING

The Casselman River is located in Garrett County, Maryland, just west of the Eastern Continental Divide. The Casselman River flows north, and lies within the Monongahela River watershed, a part of the Ohio drainage basin. The river is approximately 20 miles in length from the headwaters in the North Branch to the Maryland/Pennsylvania line. The Casselman River

watershed has an area of approximately 66 miles^2 or 42,375 acres (Figure 1). The predominant land use in the watershed is forest (44.8 miles^2 or 68%), with mixed agricultural (18.7 miles^2 or 28%), and urban (2.6 miles^2 or 4%), (Figure 2).

The Casselman basin is formed by the Berlin Syncline. Weather resistant sandstone exposed on the peaks bordering the watershed is responsible for the topographic height of the valley. Numerous coal seams of varying quality and quantity remain in the Casselman Valley. Coal mining began in the middle 1800s as local deep mines started to provide coal to power a steam-driven sawmill. Production peaked during World War I and World War II. After World War II, strip mining replaced deep mining and has continued to a much lesser extent than in surrounding coal basins. Currently, there are no active mines in the basin, and many inactive mines have been reclaimed.

The Casselman originates from wetlands along the southern watershed boundary. A North Branch (to the west) and a South Branch (to the east) flow northward nearly parallel to each other and join mid-basin to form the Casselman proper. Route 495, which transects the basin, roughly divides the North and South Branch drainage areas. The South Branch Casselman is a small stream with few significant tributaries. The South Branch drainage area is predominantly forested. The Savage River State Forest represents a large portion of area on the eastern slope of the basin. Significant agricultural use occurs only in pockets, including areas surrounding the towns of Jennings and Bittenger and land adjacent to Route 495. Agricultural use near Bittenger is mostly row crop and hay production, whereas cow pasture is the dominant form of agriculture around Jennings and along Route 495 (Figure 1).

The North Branch is more sluggish than its sister branch, as it flows through a wider, less steep valley. The North Branch drainage area includes the south west quarter of the Casselman watershed, as well as the entire southern boundary. The valley in the southern portion of the drainage contains many wetlands due to its low topography. Land in the area is generally undeveloped, containing sparse residences and occasional fields of hay or row crops. Recreational use is important, as the basin contains portions of the Savage River State Forest and the Pleasant Valley Recreational Center.

The Casselman proper is a slow moving, meandering river with areas of wide shallow riffles. The North and South Branches contribute nearly equal flows to the Casselman proper. Land use north of the confluence between the North and South branches reflects a larger population than the southern portion of the basin. While the basin as a whole is mostly forested, the wide valley bottom north of the confluence contains significant cow pasture, intermixed with occasional row crops and hay fields. The Town of Grantsville consists of 100+ residences and dozens of small businesses arranged linearly across the basin along the National Pike (Route 40). The majority of the town rests on the western slope of the basin (Figure 1).

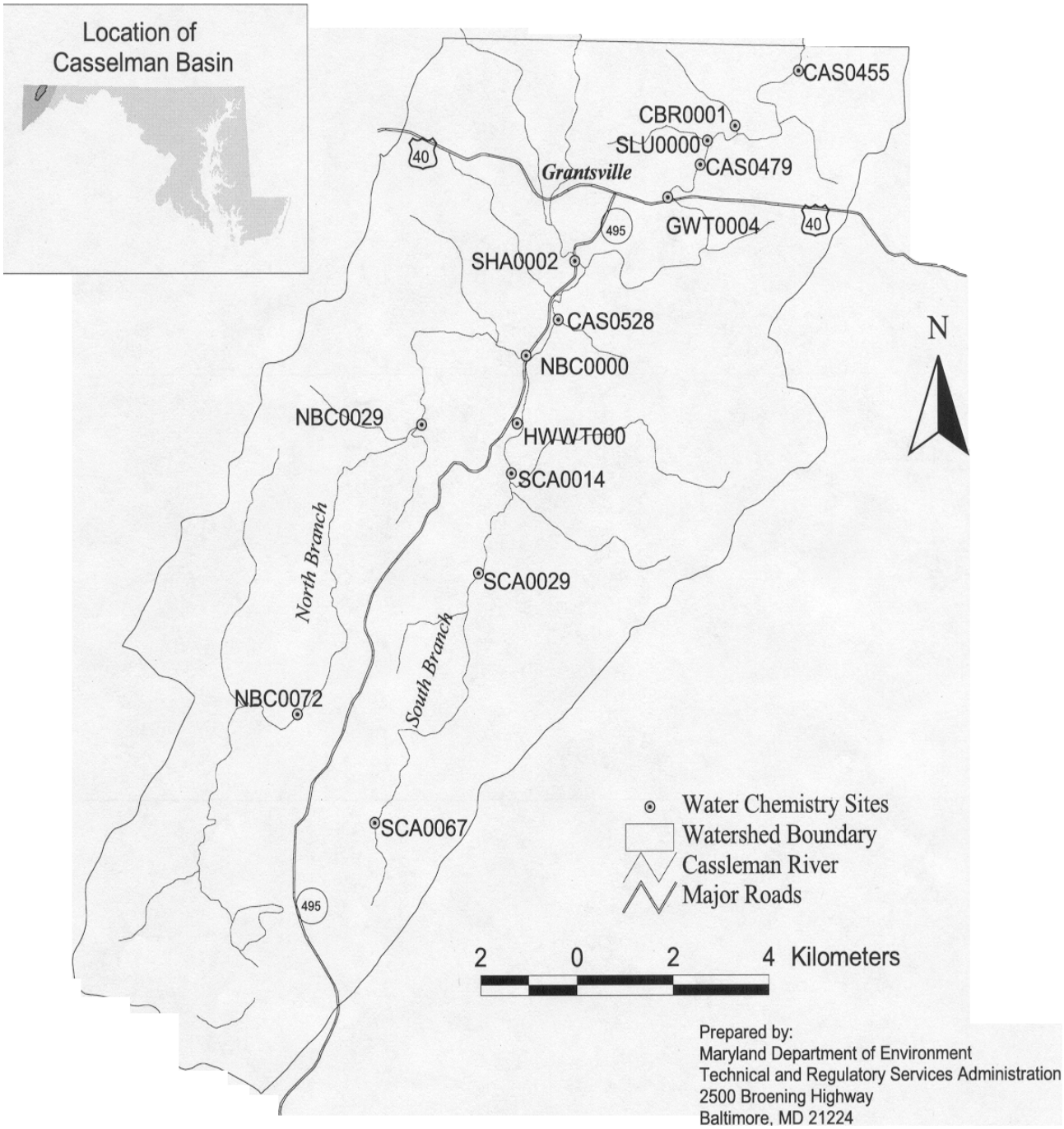


Figure 1: Casselman River Location Map and Monitoring Stations

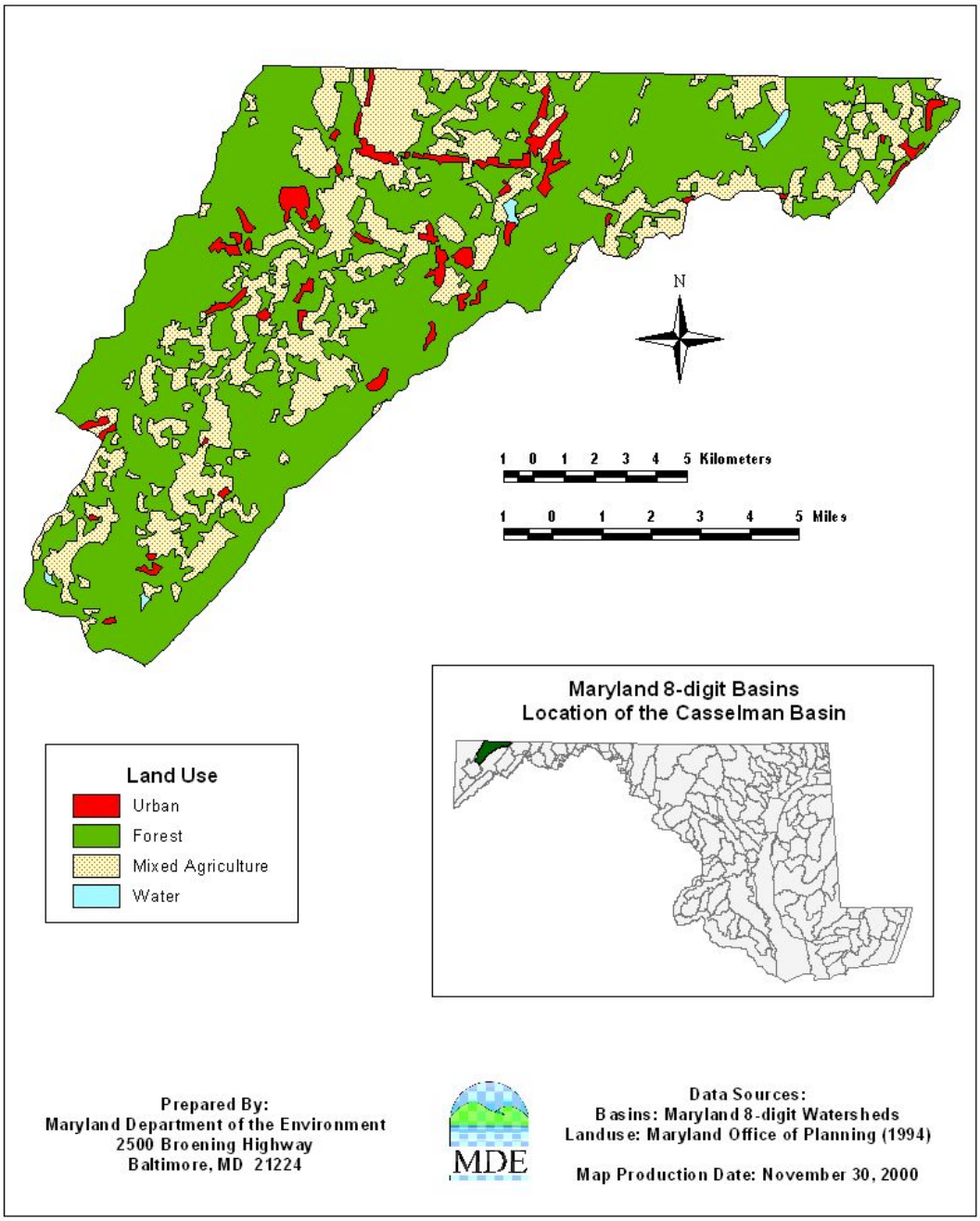


Figure 2: Land Use Map of the Casselman River Watershed

3.0 WATER QUALITY CHARACTERIZATION

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 activities such as swimming, drinking water supply, and shellfish propagation and harvest. Water quality criteria consist of narrative statements and numeric values designed to protect the designated uses. Criteria may differ among waters with different designated uses.

Maryland's water quality standards presently do not impose a limit on the concentration of nutrients in the water column[1]. Rather, Maryland manages nutrients indirectly by limiting their effect expressed in terms of excess algal growth, and resultant low dissolved oxygen (DO). Because biochemical oxygen demand (BOD) also consumes DO, this potentially confounding factor must be considered in the analysis if low DO is observed.

The Maryland Surface Water Use Designation (COMAR 26.08.02.07) for the Casselman River is Use III-P – *water contact recreation, fishing, protection of aquatic life and wildlife, natural trout waters, and public water supply*. According to the numeric criteria for DO for Use III-P waters, concentrations may not be less than 5.0 mg/l at any time, with a minimum daily average of not less than 6.0 mg/l (COMAR 26.08.02.03-3D(2)) unless resulting from natural conditions (COMAR 26.08.02.03.A(2)). The water quality data presented in this section will show the designated use of this water body is being met as it relates to nutrients.

All readily available water quality data for the last five years were considered for this analysis. Water quality surveys conducted at fourteen (14) stations along the Casselman River from September 1997 until August 1998 were used to conduct the analysis. Table 1 shows the list of stations with their geographical coordinates, descriptive location in the Casselman River and the relevant water quality parameters that were analyzed from the samples. The assessment was coordinated with the Pennsylvania Department of Environmental Protection (McDonnel, 2000).

1 Maryland does limit the ammonia form of nitrogen from the WWTPs due its toxic affects on some aquatic organisms.

3.1 Nutrients

The total phosphorus (TP) concentrations range from 0.01 – 0.06 mg/l, while the total nitrogen (TN) concentrations range from 0.1 – 1.3 mg/l (Figures 4 and 9). However, a few water quality samples from survey stations near the wastewater treatment plants (WWTPs) show high nutrient concentrations (TN = 53 mg/l and TP = 5.4 mg/l).

Although the localized high concentrations do not lead to eutrophication problems in the Casselman River, nor down stream in Pennsylvania (McDonnel, 2000), the State reserves the right to require future controls in the Casselman basin if future evidence suggests nutrients from the basin are contributing to downstream water quality problems. Tabular data is presented in Appendix A.

3.2 Dissolved Oxygen

Figure 7 presents the dissolved oxygen concentrations sampled during the 1997 and 1998 water quality surveys. None of the concentrations are lower than 8 mg/l and at times reach as high as 15 mg/l. Tabular data is presented in Appendix A.

3.3 Chlorophyll *a*

Chlorophyll *a* data was collected during the algal growing season, March and August 1998 when concentrations are at their peak. Observed concentrations are low and do not reach levels higher than 3 µg/l. This suggests that dissolved oxygen production from chlorophyll *a* photosynthesis will have no significant effect on observed DO values. These data are summarized in Figure 8. Tabular data is presented in Appendix A.

3.4 Biochemical Oxygen Demand (BOD)

Because biochemical oxygen demand (BOD) also consumes DO, this potentially confounding factor must be considered in the analysis if low DO is observed. However, because low DO is not indicated in the Casselman River, BOD does not enter into this analysis.

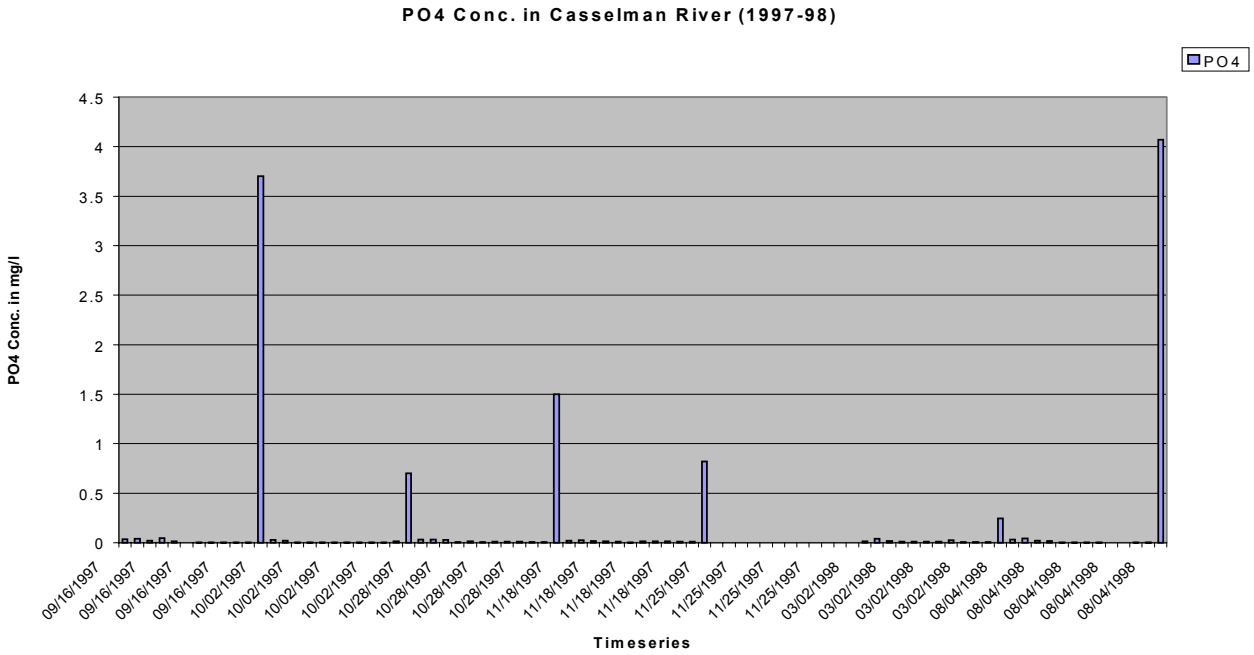
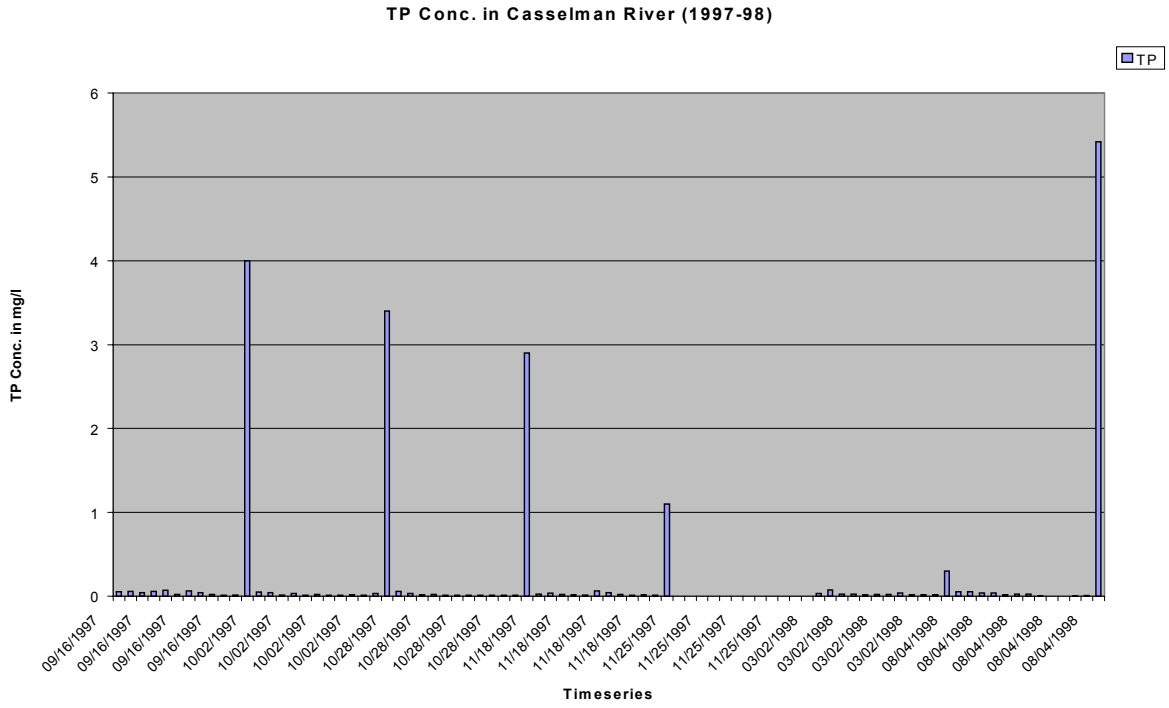


Figure 3: Ortho-Phosphate Concentrations in the Casselman River

Figure 4: Total Phosphorus Concentrations in the Casselman River



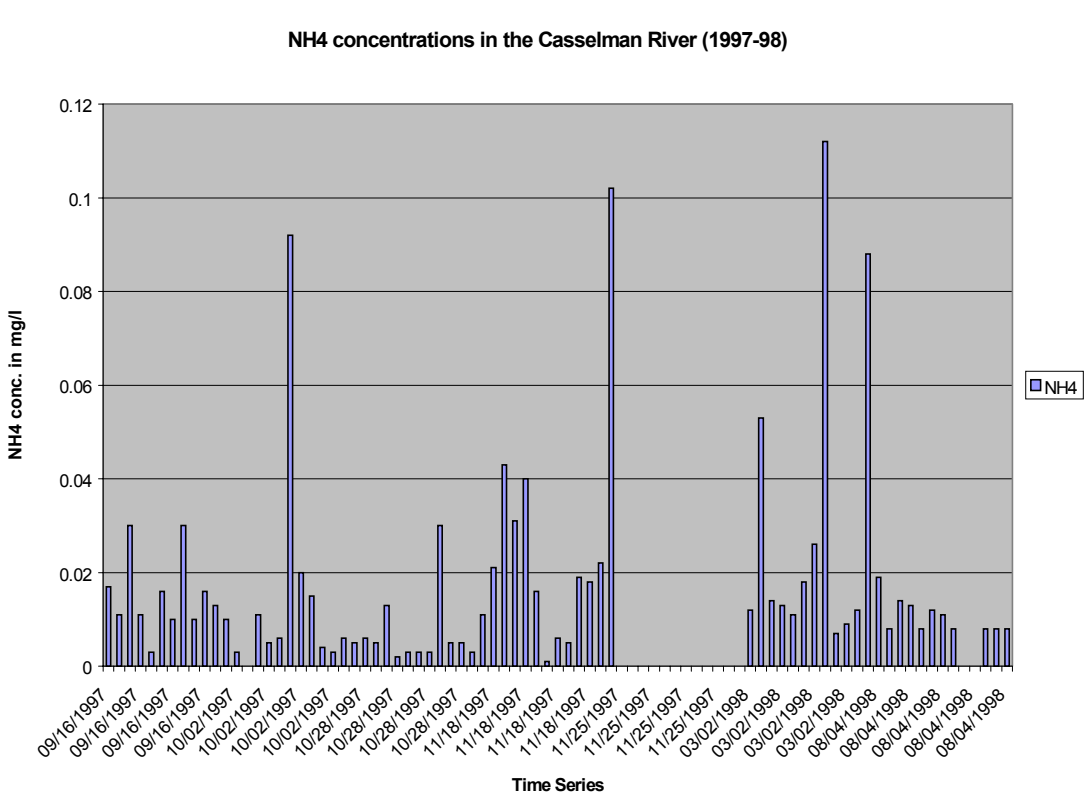
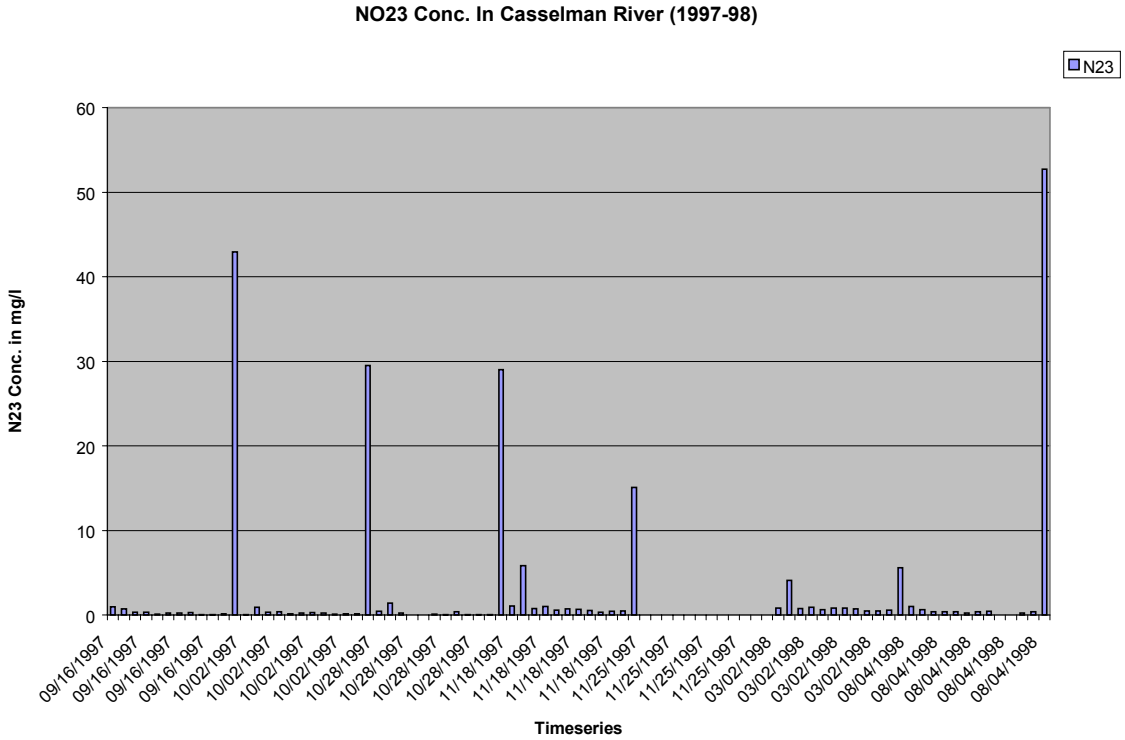


Figure 5: Ammonia Concentrations in the Casselman River

Figure 6: Nitrite/Nitrate Concentrations in the Casselman River



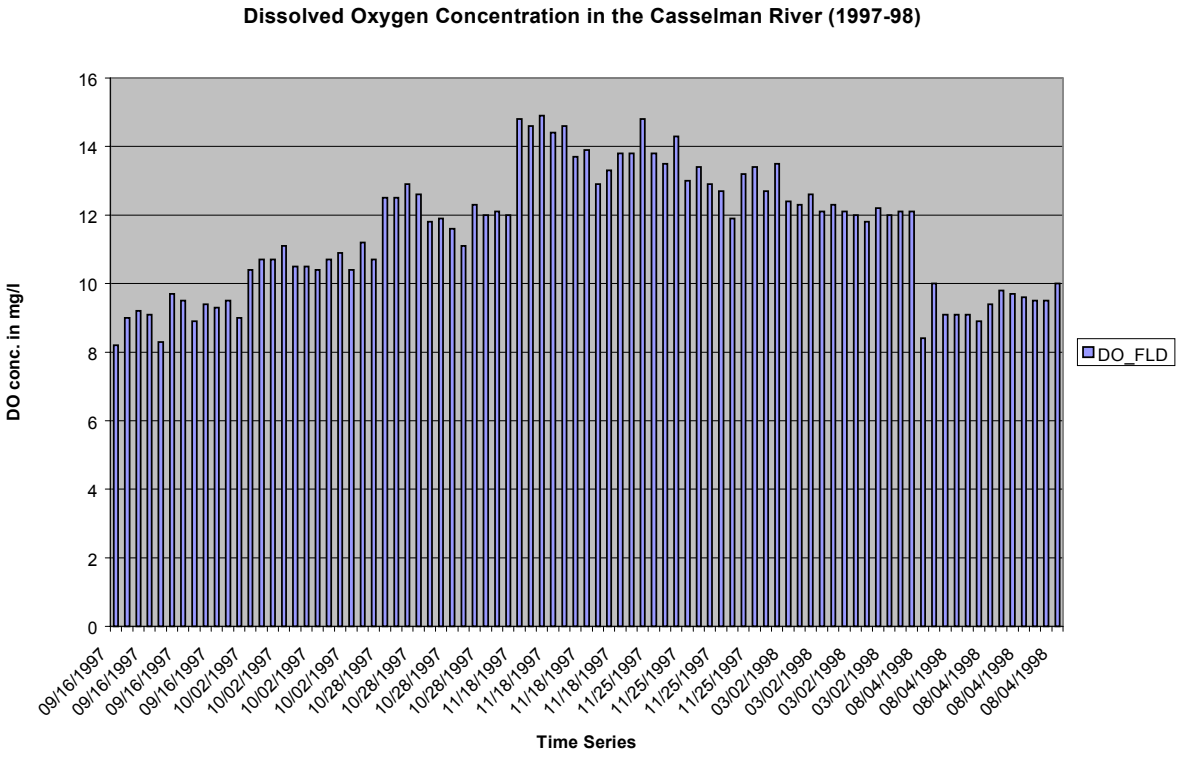


Figure 7: Dissolved Oxygen Concentrations in Casselman River.

Figure 8: Chlorophyll *a* Concentrations in Casselman River

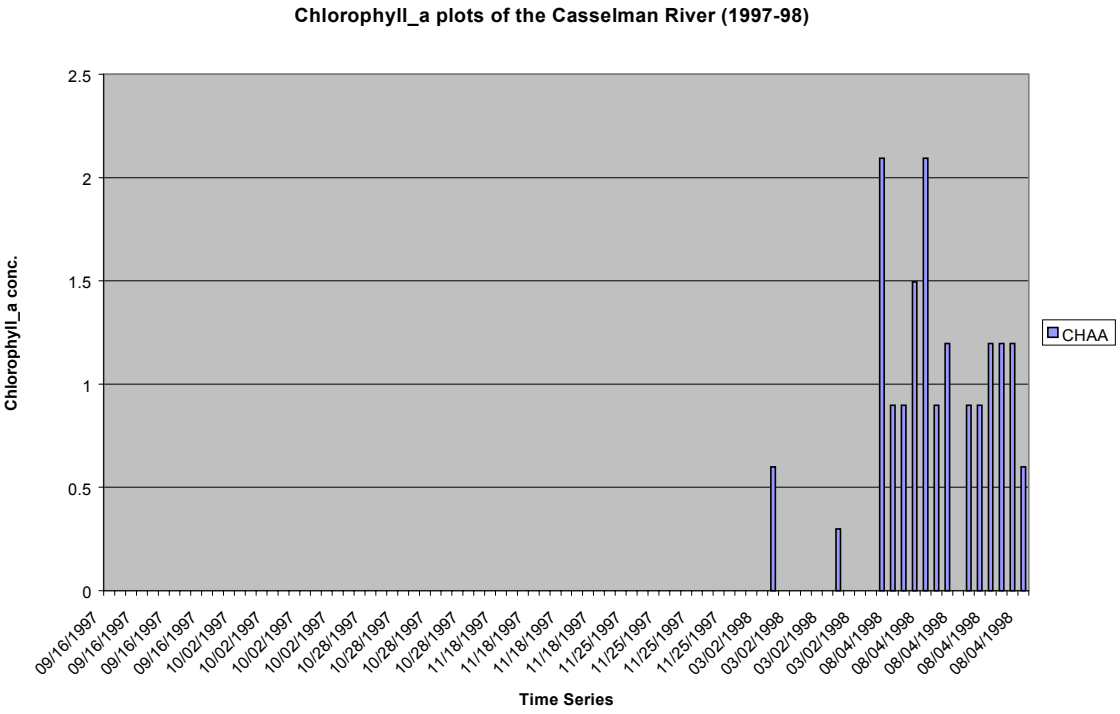


Figure 9: Total Nitrogen Concentrations in Casselman River.

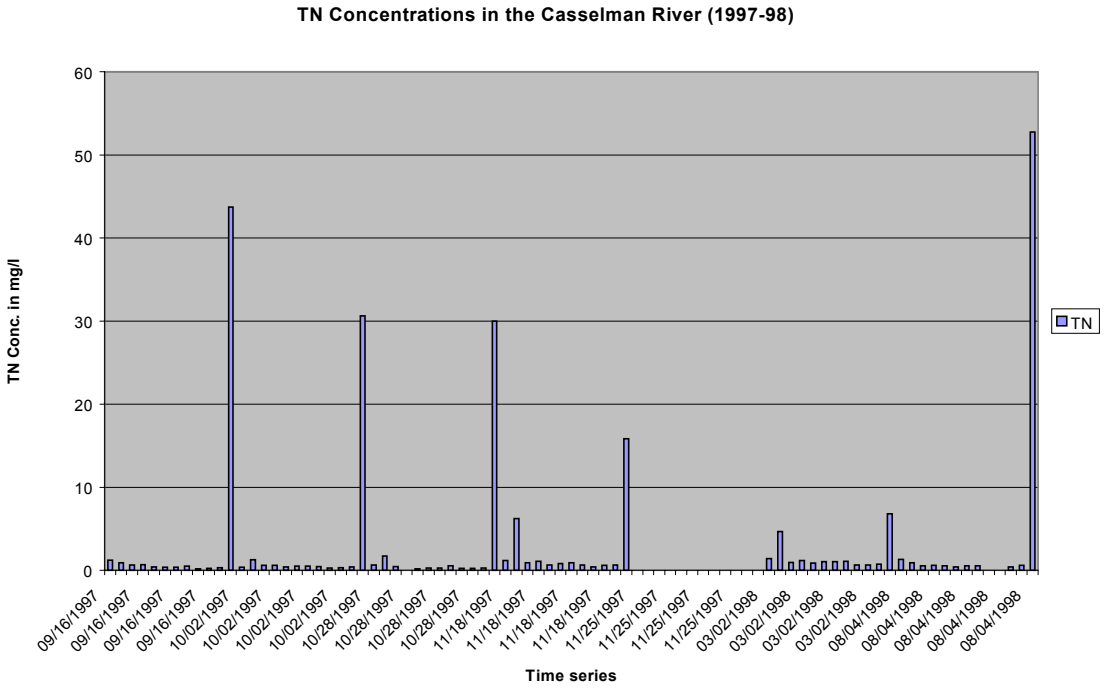


Table 1: Water quality samples collected in 1997-98 at the following stations in the Casselman River.

	Station I.D.	GPS Coordinates	Station Description	BOD	NUT	AMD	BAC
1	CAS0455	39°43.085' 79°06.793'	Casselman at PA line	X	X		
2	CBR0001	39°42.517' 79°07.713'	Crab Run at River Rd	X	X		
3	CAS0479	39°42.119' 79°08.206'	Casselman at River Rd	X	X		X
❑ 4	GWT0004	39°41.786' 79°08.675'	Grantsville WWTP	X	X		X
5	SHA0002	39°41.127' 79°10.016'	Shade Run at Rt495	X	X		X
6	CAS0528	39°40.532' 79°10.243'	Casselman at Maple Grove Rd	X	X		
7	HWWT000	39°39.483' 79°10.812'	Harbison Walker WWTP	X	X		X
8	SCA0014	39°38.978' 79°10.885'	S.Br.Cassel. at Jennings Rd	X	X	X	X
9	SCA0029	39°37.967' 79°11.337'	S.Br.Cassel. at Wilt Rd	X	X		X
10	SCA0067	39°35.435' 79°12.783'	S.Br.Cassel at F.Brenneman Rd	X	X		
11	NBC0000	39°40.164' 79°10.703'	N.Br.Cassel. at Rt495	X	X	X	X
12	NBC0029	39°39.446' 79°12.213'	N.Br.Cassel at Durst Rd	X	X		
13	NBC0072	39°36.502' 79°13.939'	N.Br.Cassel at Legeer Rd	X	X	X	X
14	SLU0000	39°42.365' 79°08.112'	Slaughbaugh Run at River Rd	X	X		X

X Sample analysed for the corresponding variable.

❑ Duplicate samples collected.

- Data obtained from the water quality samples taken at the WWTP have been excluded from the plots.

4.0 CONCLUSION

The data presented above clearly demonstrate that there is no excessive algal growth in the Casselman River, as indicated by low chlorophyll *a*. Similarly, dissolved oxygen concentrations are well within standards. Based on the synoptic survey conducted during 1997-98, water quality data indicate the Casselman River has no eutrophication water quality problems. Barring any contradictory future data, this information provides sufficient justification to revise Maryland's 303(d) list to remove nutrients as an impairing substance in relation to the Casselman River.

5.0 REFERENCES

McDonnel, Lee, Pennsylvania, DEP, Personal Communications, 2000.

Appendix A: Tabular Water Quality Data