

**WALKER LAKE
SNYDER COUNTY**

**WATER QUALITY STANDARDS REVIEW
UAA-LAKE REDESIGNATION EVALUATION**

**Walker Lake
Stream Code: 17889
Drainage List M**

**WATER QUALITY MONITORING AND ASSESSMENT SECTION (APF)
DIVISION OF WATER QUALITY ASSESSMENT AND STANDARDS
BUREAU OF WATER SUPPLY AND WASTEWATER MANAGEMENT
DEPARTMENT OF ENVIRONMENTAL PROTECTION**

JANUARY 2005

INTRODUCTION

The Department is initiating a correction to the aquatic life use designation in the water quality standards for Walker Lake, Snyder County. It currently has a Trout Stocking (TSF) designation reflecting the condition of its source water. In most cases within Chapter 93, lakes have been classified according to the aquatic life use of their associated streams. As a result, many lakes in Pennsylvania are misclassified. Most lakes cannot and have not achieved their protected use because of natural conditions.

The water impounded within a lake, when warmed by solar radiation, often becomes too warm to support cold water fish species. Also, most Pennsylvania lakes undergo a period of stratification during summer. In early summer, solar radiation warms the surface waters more rapidly than the bottom waters, causing the upper layer to become less dense. This results in thermal stratification where the density gradient between the top and bottom layers prevents mixing of the waters. The epilimnion (surface layer) is made up of uniformly warm, circulating water and floats upon the cold and relatively undisturbed hypolimnion (bottom layer). During the period of thermal stratification, the waters of the hypolimnion are isolated from the atmosphere and cannot be replenished with oxygen. Algae and other organic debris from the epilimnion settle and decompose in the hypolimnion resulting in an increase in biochemical oxygen demand (BCOD) in the bottom waters. In many water bodies, the rate of dissolved oxygen (DO) depletion in the hypolimnion can cause anoxic conditions ($DO = 0$ mg/l), incapable of supporting an aquatic community. The thermal stratifications and accompanying DO responses discussed above are naturally occurring phenomena - common to cold water or warm water lakes in temperate climates. Due to stratification and anoxic conditions in the hypolimnion, many lakes cannot support cold water fish species during the summer but can support healthy warm water fish species and therefore should be reclassified.

BACKGROUND

Walker Lake is owned by the Pennsylvania Fish and Boat Commission (PFBC) and is located in Adams Township, Snyder County. Walker Lake is located on the North Branch Middle Creek (stream code 17889), which is a tributary to Middle Creek within the Susquehanna River basin (drainage list M) (Figure 1). North Branch Middle Creek was impounded in 1970 creating the 239 surface acre lake, which drains a 19 mi² watershed consisting primarily of forested (57%) and agricultural (39%) areas. Walker Lake has a maximum depth of 32 feet with a mean depth of 13.8 feet with an overall volume of 3317 acre-feet of water. There is one permitted single residence, small volume sewage discharge, issued in 1977, upstream of Walker Lake.

WATER QUALITY

Walker Lake typically stratifies during the summer with the thermocline forming between 2 and 4 meters in depth. Once stratification occurs, the DO in the hypolimnion often drops to levels not supportive of a healthy aquatic community (<2 mg/l). Conditions of stratification and an anoxic hypolimnion were evident in early studies of the lake. Further, lake water temperatures often

exceed levels that can support survival of cold water fish species during summer months (Figures 2-4). Water chemistry parameters are consistent with lakes that are in the eutrophic state, which is typical for warm water lakes (Tables 1-3). Physical lake data for temperature and DO reveal conditions that are not supportive of trout stocking.

AQUATIC BIOTA

Walker Lake has a resident self-supporting warm water fish community. Over the history of the lake there have been a total of 21 species captured (Table 4). Examination of catches from trap nets and electrofishing surveys indicated a healthy naturally reproducing population of warmwater species. Natural reproduction is evident upon review of length frequency data (Table 5). Warmwater species such as largemouth bass, pumpkinseed, bluegill, crappie, yellow bullheads, brown bullheads, and yellow perch have length frequency data showing fish lengths are represented in small and large sizes, which is indicative of natural reproduction consisting of multiple year classes. Walker Lake has never supported cold water fish species and has always been managed by the PFBC as a warm water fishery by relying on natural reproduction and supplemental stocking of predatory warmwater fish such as northern pike (Table 6). The PFBC has never stocked trout in Walker Lake.

PUBLIC RESPONSE AND PARTICIPATION SUMMARY

The Department provided public notice of this aquatic life use evaluation and requested any technical data from the general public through publication in the *Pennsylvania Bulletin* on April 17, 2004. A notice was published in The Daily Item (Sunbury, PA) on May 31, 2000. In addition, Adams and Center Townships and the Snyder County Planning Commission were notified of the redesignation evaluation in letters dated May 29, 2003. No additional information was received in response to the publication of these notices.

RECOMMENDATIONS

A review of available data indicates the existing use for Walker Lake is and has always been WWF. The predominance of warm water conditions and concurrent warm water fisheries found in Walker Lake is the consequence of impounding flowing waters. Such conditions are normal and are expected whenever flowing waters are impounded in areas with temperate climates. These warm water conditions are irremediable since it is not feasible to remove the reservoirs. The historical data indicates that Walker Lake has supported a warm water fish community since it was constructed and has been managed by the PFBC as such.

It is the Department's conclusion that: 1) the designated use of Walker Lake is more restrictive than its existing use; 2) the designated use of TSF cannot be attained by implementing effluent limits required under sections 301(b) and 306 of the Federal Clean Water Act (33 U.S.C.A. §§ 1331(b) and 1316); 3) its current use designation cannot be attained by implementing cost-effective and reasonable best management practices (BMPs) for nonpoint source control; and 4)

the conditions existing in Walker Lake are the result of limnological processes that occur naturally in impoundments and it is not feasible to restore North Branch Middle Creek to its original condition by removing Walker Lake or manage it in a way that would result in the attainment of its designated use.

Based on these findings, the Department recommends that the designated use of Walker Lake be changed from its current TSF designation to WWF. This recommendation is based on the physical characteristics of the water body, dominance of warm water fish species, and the management and stocking of warm water fish by the PFBC. This recommendation will affect approximately 2.2 miles of the North Branch Middle Creek directly limited to Walker Lake, which approximates 239 surface acres. All tributaries to Walker Lake will retain their current CWF designations.

REFERENCES

Department of Environmental Protection. File information.

PA Fish and Boat Commission. File information.

Ulanoski, J. L., R. H. Shertzer, J. L. Barker, and R. L. Hartman. 1981. Trophic classification and characteristics of twenty-six publicly owned Pennsylvania Lakes. Bul. No. 61, Bureau of Water Management, Pennsylvania Department of Environmental Resources. 240 pp.

Figure 1. Walker Lake, Snyder County



TABLE 2.
WALKER LAKE - WATER CHEMISTRY
August 31, 2000
PFBC

Parameter	Alkalinity		Hardness		Specific Conductance		pH	
	mg/l		mg/l		µmhos/cm			
Location	Uplake	Dam	Uplake	Dam	Uplake	Dam	Uplake	Dam
Depth (meter)								
0	47	49	47	50	127	128	8.9	7.7
1	50	49	50	49	-	128	8.8	7.7
3	54	48	-	48	-	-	7.2	8
4.5	-	50	-	-	-	-	-	7.2
7	-	82	-	-	-	-	-	6.8

TABLE 3.
WALKER LAKE - WATER CHEMISTRY
Dam Location
DEP

	Units	7/31/2002 Surface	7/31/2002 Bottom	6/25/2003 Surface	6/25/2003 Bottom
Field Parameters					
pH	pH units	9.12	6.73	8.07	6.75
Diss. O ₂	mg/l	10.12	1.11	11.29	0.08
Temp.	C	27.35	13.74	20.55	11.46
Laboratory Parameters					
pH	pH units	8.8	6.7	7.9	6.9
Chlorophyll A	mg/l	0.059	-	0.0093	-
Carbon, organic-total	mg/l	5.3	5.4	4.6	4.7
Alkalinity	mg/l	46	56	32.6	40.4
Hardness-total	mg/l	55	53	42	45
Susp. Sol.	mg/l	8	12	6	20
NH ₃ -N	mg/l	<0.02	1.17	<0.02	0.72
N-total	mg/l	0.78	0.8	1.31	1.35
P-total	mg/l	0.033	0.071	0.021	0.065
Ca-total	mg/l	15.8	14.7	12.5	13.3
Mg-total	mg/l	3.77	3.95	2.73	2.84
SO ₄	mg/l	11.6	6.6	8.46	8.79
Cu-diss.	µg/l	<4	<4	<4	<4
Cu-total	µg/l	<4	<4	<4	<4
Fe-diss.	µg/l	<20	4430	99	125
Fe-total	µg/l	299	3370	330	1740
Pb-diss.	µg/l	<1	<1	<1	<1
Pb-total	µg/l	<1	<1	<1	<1
Mn-diss.	µg/l	6.9	1188	<2	600
Mn-total	µg/l	29.8	1046	14.1	655
Zn-diss.	µg/l	<5	<5	<5	<5
Zn-total	µg/l	<5	<5	<5	<5
Al-total	µg/l	309	453	197	487
Al-diss.	µg/l	48	32.9	<10	21.6
Specific Conductance	µmhos/cm	136	162	107	124

TABLE 4.
WALKER LAKE - FISH - Species Occurrence
PFBC

Scientific name	Common name	pre-1981	1996	2000	2003
<i>Esox lucius</i>	Northern pike	X	X	X	X
<i>E. masquinongy</i>	Muskellunge	X	-	-	-
<i>E. niger</i>	Chain pickerel	X	X	X	X
<i>Cyprinus carpio</i>	Common carp	-	X	X	X
<i>Notemigonus crysoleucas</i>	Golden shiner	-	X	X	X
<i>Semotilus corporalis</i>	Fallfish	X	-	-	-
<i>Cyprinella spiloptera</i>	Spotfin shiner	-	X	X	-
<i>Catostomus commersoni</i>	White sucker	X	X	X	X
<i>Ictalurus punctatus</i>	Channel Catfish	-	-	-	X
<i>Ameiurus natalis</i>	Yellow bullhead	X	X	X	X
<i>A. nebulosus</i>	Brown bullhead	X	X	X	X
<i>Salmo trutta</i>	Brown trout	X	-	-	-
<i>Ambloplites rupestras</i>	Rock bass	X	-	-	-
<i>Pomoxis nigromaculatus</i>	Black crappie	-	X	X	X
<i>P. annularis</i>	White crappie	-	-	X	X
<i>Micropterus salmoides</i>	Largemouth bass	X	-	X	X
<i>Lepomis auritus</i>	Redbreast sunfish	X	-	-	-
<i>L. gibbosus</i>	Pumpkinseed	X	X	X	X
<i>L. macrochirus</i>	Bluegill	-	X	X	X
<i>Sander vitreus</i>	Walleye	X	X	X	X
<i>Perca flavescens</i>	Yellow perch	X	X	X	X
	Total Species:	14	13	15	15

TABLE 6.
WALKER LAKE - FISH STOCKING HISTORY
PFBC

Year	Species	Lifestage	Number Stocked
2004	Northern Pike	Fingerling	1670
2003	Northern Pike	Fingerling	1670
2002	Northern Pike	Fingerling	1670
2001	Northern Pike	Fingerling	1670
2000	Northern Pike	Fingerling	1670
1999	Northern Pike	Fingerling	1670
1996	Walleye	Phase 1	23000
1995	Northern Pike	Fingerling	2250
1995	Walleye	Fingerling	359
1994	Walleye	Fry	478000
1994	Walleye	Phase 1	47800
1993	Northern Pike	Fingerling	700
1993	Walleye	Fry	478000
1993	Walleye	Phase 1	47800
1992	Walleye	Phase 1	14400
1992	Walleye	Phase 2	470
1991	Walleye	Phase 1	9600
1990	Walleye	Phase 1	7200
1990	Walleye	Phase 2	2080
1989	Northern Pike	Fingerling	1200
1988	Northern Pike	Fingerling	6000
1988	Walleye	Phase 1	12000
1987	Northern Pike	Fingerling	1900
1986	Largemouth Bass	Fingerling	5050
1986	Walleye	Phase 1	12000
1985	Largemouth Bass	Fingerling	24000
1985	Northern Pike	Fingerling	1200
1984	Largemouth Bass	Adult	100
1984	Largemouth Bass	Fingerling	30250
1984	Northern Pike	Fingerling	1200
1983	Walleye	Phase 1	12000
1981	Northern Pike	Fingerling	1200
1981	Walleye	Phase 1	12000
1979	Walleye	Phase 1	7250
1977	Walleye	Fingerling	7200
1976	Northern Pike	Fingerling	1000
1975	Tiger Muskellunge	Fingerling	670
1975	Walleye	Fingerling	9000
1974	Muskellunge	Fingerling	1500

FIGURE 4.
WALKER LAKE - WATER CHEMISTRY
Temperature, Dissolved Oxygen pH and Specific Conductance Profiles
July 31, 2002

DEP

Vertical lines depict parameter criteria.

