EAST BRANCH CODORUS CREEK

(including Lake Redman & Lake Williams)

YORK COUNTY

WATER QUALITY STANDARDS REVIEW

STREAM REDESIGNATION EVALUATION

Segment: Mainstem
Stream Code: 08097
Drainage List O

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

JUNE 2002

INTRODUCTION

The York Water Company ("York Water") submitted a petition to the Environmental Quality Board (EQB) on April 16, 2002 requesting redesignation of a portion of the East Branch Codorus Creek basin from its present Cold Water Fishes (CWF) designation to Warm Water Fishes (WWF). This portion of the basin includes Lakes Williams and Redman—reservoirs owned and maintained by York Water. The stream section proposed for change to WWF is defined in the petition as that portion of the East Branch Codorus Creek mainstem from the inlet ("tail waters") of Lake Redman (the upper lake), downstream to the mouth.

The petitioner believes that the present CWF designated use is in error and contends that the subject portion of the East Branch Codorus supports a warm water fishery. To support their position, York Water submitted substantial documentation and historical data. The present Chapter 93 designations for the East Branch Codorus Creek basin are shown in Figure 1 and the upstream and downstream mainstem limits of the petitioned area are shown in Figure 2.

BACKGROUND

Lake Williams and Lake Redman. Lake Williams was constructed in 1912. The reservoir presently has a surface area of 220 acres and approximate average and maximum depths of 13 and 36 feet, respectively. The lake's retention time is approximately 37 days. Lake Redman's earthen dam was constructed in 1966. Its normal surface area is designed to be 290 acres with an average depth of 17 feet and maximum depth of approximately 40 feet. Lake Redman's retention time is estimated to be 62 days.

Water Quality Criteria. In 1967, a report from the Department of Health's Sanitary Water Board (the former water quality regulatory agency in Pennsylvania) recommending water quality criteria and designated uses specifically included the East Branch Codorus Creek (noted as "East Branch to the South Branch Codorus Creek"). The recommendation for the entire basin was to add the "Cold Water Fishes" protected use (defined as the "maintenance and propagation of the family salmonidae and fish food organisms").

The Sanitary Water Board approved the CWF designation for the East Branch Codorus in January 1968. That designation appears in the Rules and Regulations of the Sanitary Water Board in the Susquehanna River listing noted as "Amended December 20, 1968". A formal rulemaking proposal was published in the PA Bulletin (March 4, 1978) that revised Pennsylvania's water quality standards into the current Chapter 93 format .The proposed changes to the East Branch Codorus Creek basin's designation were eventually adopted as final rulemaking in the September 8, 1979 PA Bulletin.

GENERAL WATERSHED DESCRIPTION

The East Branch Codorus Creek is a tributary to the South Branch Codorus Creek (Codorus Creek/Susquehanna River drainage). The petitioned area of the East Branch Codorus is located in Springfield and York Townships, York County (Figure 2). The watershed surrounding the study area is dominated by gentle, frequent rolling topography of low relief. Open fields zoned for agriculture use or low-to-moderate density residential uses characterize the surrounding landscape. Some nonpoint source impacts from agriculture have been documented on Inner's Creek, which flows into the upper reaches of Lake Redman. Higher density residential uses are concentrated in Leader Heights, the Borough of Jacobus, and several housing developments. Two point source discharges exists in the basin but they do not discharge to the segment of E. Branch Codorus Creek being considered in this report. Windy Brae Mobile Home Park and Exit 2 Land Venture produce low volume, excellent quality treated sewage effluents discharged to the upper reaches of E. Branch Codorus Creek, upstream from both lakes. Forested areas are represented primarily by small, localized wood lots and the conservation-zoned slopes in the county parkland associated with Lakes Redman and Williams.

A significant portion of the land in the petitioned area is licensed by the York County Department of Parks & Recreation from York Water and managed for public recreation. This includes boating and fishing rights to Lake Williams and Lake Redman. The area managed by York County includes William H. Kain and Richard M. Nixon County Parks (1,832 acres), Lake Williams (220 acres), and Lake Redman (290 acres).

WATER QUALITY AND USES

Surface Water

The petitioned area of the East Branch Codorus Creek is currently classified as Cold Water Fishes (CWF). The dominant surface water features associated with the petitioned area are Lake Williams and Lake Redman. York Water manages both impoundments as its primary sources of drinking water. Representative water quality data available for review are presented in Tables 1-4. The data in these tables are from The York Water Company, Pennsylvania Fish & Boat Commission (PFBC), and the Department.

Water Chemistry. Tables 1 & 2 present some water chemistry results from Lake Redman and Lake Williams. No direct comparison to applicable water criteria can be made, however, due to the instantaneous nature of the samples. Despite the limitations of grab samples, observations can be made that are summarized below.

The 2001 concentrations of most metals (Table 1) in Lake Redman with hardness-based criteria (Al, Cu, Ni, Pb, Zn) were very low or below detection limits. Generally, Lake Redman iron and manganese concentrations were also low and well below criteria values.

Limited alkalinity and hardness data indicates that the Lake Redman/Williams system exhibits soft-to-moderate hardness. Water column alkalinity values from Lake Redman in 1970 (Table 2; "MO" = "methyl orange" alkalinity) ranged from 42-64 mg/l. Hardness and alkalinity values in the East Branch Codorus Creek flowing into Lake Redman in 1996 (PFBC 2000) ranged from 46-58 and 19-30 mg/l, respectively. The hardness and alkalinity of Lake Williams' outlet water were 66 and 42 mg/l for the same time period.

Temperature and Dissolved Oxygen. Temperature and dissolved oxygen (DO) are the two most important physical measures of water quality. Tables 1-4 show Lake Redman temperature and DO data ranging from that collected by the PFBC in 1970 to data collected by the Department in 1997. Included in this time frame is a study conducted by York Water (Table 1) that compared temperatures of Lake Redman to Lake Clarke (impounded Susquehanna River). These data points include measurements taken in different seasons of the year.

In temperate climates, lakes with adequate depth will normally stratify into water layers of widely different temperature regimes. A layer of warmer, less dense waters will form on top and is known as the epilimnion. The colder, denser waters settling to the bottom forms the bottom layer called the hypolimnion.

The epilimnion is considered to be the "live zone" because light penetration supports photosynthesis (thus, phytoplankton and macrophyte production). In healthy lakes, the photosynthetic activity also assures the epilimnion is adequately oxygenated to support aquatic biota. The hypolimnion essentially becomes "capped" by the stable, upper epilimnion. It is often too deep for enough light to penetrate for the photosynthetic activity necessary to support the oxygen demands of the resident aquatic organisms. It is common, therefore, for the hypolimnion to become anaerobic (DO = 0 mg/l) and unable to support healthy aquatic communities.

The transition between the epilimnion and hypolimnion is usually characterized by a rapid change in temperature and/or DO. The dashed lines in Table 4 indicate probable epilimnion depths of 3-4 m for Lake Redman (August 1997) where lake parameters begin to change abruptly. Lake Williams did not become thermally stratified on the same date. Less than 2 F° separated the surface and bottom temperatures of Lake Williams, thus not allowing a true thermally stratified epilimnion layer to develop. However, the dashed lines in Table 3 and 4 are drawn at a depth where DO begins to decrease rapidly.

Temperature values measured from Lake Redman and Lake Williams that exceed Chapter 93 CWF criteria are bolded and parenthesized in Tables 1-4. It can be seen from these tables that the temperatures necessary for cold-water fish communities are frequently exceeded at various times of the year. Most of these above-criteria days are during the warmer months. In August '97, all depths of Lake Williams and much of the upper depths of Lake Redman had temperatures that were too warm for cold-water fish survival. Also, lake temperatures measured during abnormally warm spring or fall seasons (Lake Williams - surface waters, April '97; Lake Redman – all depths, late October '97; Tables 3 & 4) were also too warm for cold-water fish. The Temperature Comparison Study data (Table 1) shows excessively warm temperatures in Lake Redman in the middle of November 2001.

The high lake temperatures discussed above are not a recent occurrence. If one compared Lake Redman's 1970 temperatures (Table 2; PFBC 1970) to the current CWF criterion for June 30 (64° F), the CWF criterion was exceeded to a depth of at least 12 feet. It is very likely that the same temperature response seen in Lake Redman in 1970 has also commonly occurred in Lake Williams for most of its history.

In addition to the excessively warm temperatures that are not conducive for cold water fish, many of the corresponding DO values were lower than desired for cold-water fish communities (5 mg/l). DO values were below this criterion in the hypolimnions of Lake Williams (August and October 1997) and Lake Redman (August 1997 only) (Tables 3 & 4).

Thermal stratifications and accompanying DO responses discussed above are naturally occurring phenomena – common to many lakes in temperate climates whether they are cold water or warm water systems. Many true cold water lake systems can experience thermal stratification and still support cold water fish populations because they are deep enough to maintain cooler temperatures and adequate DO concentrations at lower depths. However, Lake Redman and Lake Williams have demonstrated they do not have this capacity. The data presented above indicates these lakes were never capable of long-term maintenance and propagation of cold water fish. Unseasonably warm waters recurring occasionally in the spring and fall are not conducive to the survival of cold water fish species' temperature-critical life stages.

Fish Management. In addition to the management of the reservoirs for water supply and as county parks, Lakes Redman and Williams are also managed by PFBC for public fishing. The PFBC has conducted several fishery management surveys on both lakes since Lake Redman's construction in 1966. These studies include a July 1970 survey of Lake Redman (PFBC 1970) and a series of general inventory (1983-85; PFBC 1997) and conservation regulation evaluation (1986-92; PFBC 1996) surveys of both lakes. Fish species occurrences from these surveys, spanning 22 years, are presented in Table 5. Other PFBC survey efforts in the petitioned area include a

summer 1996 survey of the East Branch Codorus downstream of Lake Williams. These results are also presented in Table 5.

Lake Redman was stocked by the PFBC in 1968 shortly after it was constructed. The 1968 stocking consisted of muskellunge and largemouth bass. Since then, other stocked species have included northern pike, tiger muskellunge, walleye, channel catfish, striped bass, and white/striped bass hybrids.

Lake Williams' fish populations initially originated from expansion of fish populations already present in the drainage basin. Lake Williams' limited access has restricted the potential fishing pressure by anglers. However, the PFBC did begin a stocking program in 1978 with tiger muskellunge. Lake Williams has been stocked with muskellunge, walleye, and channel catfish. In recent years, the fingerling stocking program for these two lakes has been reduced to channel catfish and walleye in Lake Redman, and channel catfish only in Lake Williams.

A total of 37 fish species have been captured from either Lake Redman or Lake Williams by the PFBC during various surveys conducted from 1970 to 1992 (Table 5). This species list consists predominantly of warm water fish – with the exception of a single rainbow trout occurrence in Lake Williams. No explanation, discussion, or comment was made in the PFBC report (1996) other than its entry in the species occurrence table. Rainbow trout have been stocked in the basin, so it is very likely their occurrence represents remnant specimens from stocking efforts or transplants by local fishermen.

The data from these multi-year surveys formed the basis of PFBC's lake management report recommendations for these two lakes (PFBC 1996 & 1997). These reports present very detailed population analyses for selected warm water game fish. These include bluegill, yellow perch, white and black crappie, largemouth and smallmouth bass, walleye, channel catfish, and tiger muskellunge. Additional observations of some of the common forage fish populations were also presented and discussed.

In 1996, the PFBC surveyed four sections (01-03 & 05) of the East Branch Codorus Creek (PFBC 2000). Sections 01-03 are upstream of Lake Redman. Section 05 is the outlet of Lake Williams. The result of PFBC's survey of Section 05 was the documentation of a warm water fishery. The PFBC report (2000) describes Section 05 "as a moderate size warm water stream . . . " with "a fish assemblage typically found in warm water streams". The report states further that the lower East Branch Codorus "supported a diverse warm water fish community" that was affected by migration from Lake Williams upstream and South Branch Codorus Creek downstream.

DISCUSSION

Data collected during the Department's 1997 lake surveys indicates that Lake Redman and Lake Williams are eutrophic systems that can frequently experience temperature criteria problems at all depths and low DO concentrations in the hypolimnion. The high temperatures are not restricted to only the typical warmer months. Lake Williams experienced temperatures that were unseasonably high as late as late November. Nor are these elevated temperatures a recent event. Lake Redman began experiencing temperatures that exceeded applicable criteria very soon after it was constructed.

The detailed results, discussion, and recommendations from PFBC's reports (1970, 1996, & 1997) provide documentation of the warm water conditions and the long-term presence of warm water fish communities in Lake Redman, Lake Williams, and the lower East Branch Codorus Creek. This is emphasized by the lack of any viable cold-water game fish populations in Lake Redman and Lake Williams, their current and historical warm water species fingerling stocking program, the documented warm water fish community found in the outlet stream, and PFBC's current and historical management of these water bodies as warm water fisheries.

The predominance of warm water conditions and concurrent warm water fisheries found in the petitioned area are the consequence of impounding the East Branch Codorus by the construction of Lake Redman and Lake Williams. Such conditions are normal and to be expected whenever flowing waters are impounded in areas with temperate climates. These warm water conditions are irretrievable since it is not feasible to remove the reservoirs. They are essential components of York Water's public water supply system.

PUBLIC RESPONSE AND PARTICIPATION SUMMARY

The Department provided public notice of this redesignation evaluation and requested any technical data from the general public through publication in the Pennsylvania Bulletin on June 8, 2002 (32 Pa.B 2814). A similar notice was also published in The York Daily Record and York Dispatch newspapers (York, PA) on June 7, 2002. In addition, York and Springfield Townships and the York County Planning Commission were notified of the redesignation evaluation in a letter dated June 7, 2002. A copy of a draft report was sent out to The York Water Company and York and Springfield Townships on July 23, 2002. The Department received only two comments pursuant to these public notices and the draft report. The York Water Company responded with minor typographical comments and Springfield Township provided no new information but both parties concurred with the Department's recommendations.

CONCLUSIONS AND RECOMMENDATIONS

The Department concludes that the existing use of Lake Redman, Lake Williams, and the lower East Branch Codorus Creek is Warm Water Fishes (WWF). The reasons for

this conclusion are the presence of established warm water fisheries and the absence of cold water fish communities. It is clear from a review of various data and information sources that the petitioned surface waters—Lake Redman, Lake Williams, and lower East Branch Codorus Creek—are warm water systems. The limited historical data from 1970 indicates that the lakes have supported warm water fish communities since they were constructed. While it is unknown how Lake Williams' fishery developed early after its construction, Lake Redman's warm water fishery developed almost from its beginning. The extensive warm water fishery data and PFBC's consistent warm water management strategies all support the petitioner's contention that the petitioned waters are and have been characteristic of WWF waters and should not be designated as CWF.

Pursuant to 25 Pa Code §93.4(b), the Department recommends that the Environmental Quality Board adopt a warm water fishes designation for the mainstem East Branch Codorus Creek from the inlet of Lake Redman to the mouth. It is the Department's opinion that: 1) the designated use of Cold Water Fishes is more restrictive than the existing use; 2) the designated use is minimally affected by point and nonpoint source discharges; and 3) dams, diversions or other types of hydrologic modifications preclude attainment of the cold water fishes use, and it is not feasible to restore the water body to its original condition or to operate the modification in a way that would result in attainment of the designated use.

This recommendation would affect approximately 5.2 miles of the lower East Branch Codorus Creek and includes the approximate 510 surface acres of Lake Redman and Lake Williams.

REFERENCES

Department of Environmental Protection. 1997. Lake Trophic Status Index Survey; Lake Redman & Lake Williams. Central Office File Information.

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