# 2005 WATER QUALITY MONITORING
# F.E. WALTER RESERVOIR
# WHITE HAVEN, PENNSYLVANIA

U.S. Army Corps of Engineers
Philadelphia District
Environmental Resources Branch

January 2006

# 2005 Water Quality Monitoring
## F.E. Walter Reservoir
## White Haven, Pennsylvania

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# 1.0 INTRODUCTION

## 1.1 DESCRIPTION OF F.E. WALTER RESERVOIR

The U.S. Army Corps of Engineers (USACE) manages F.E. Walter Reservoir located in northeastern Pennsylvania within the Delaware River Basin. F.E. Walter Reservoir is an integral part of the Lehigh River Flood Control Program. The authorized purpose of this project is flood control. The reservoir project was authorized for recreation and specifically white water recreation as part of Public Law 100-676, Section 6, dated November 17, 1988. Located about 9 miles southeast of Wilkes-Barre, PA, the reservoir dams a drainage area of 288 square miles. The dam can impound up to 35.8 billion gallons of floodwater. The primary surface water input into the reservoir is the Lehigh River as it flows west between Luzerne and Carbon Counties. Bear Creek, a secondary surface water input, enters the reservoir from the north. Tobyhanna Creek drains an area to the southeast and joins the Lehigh River near the headwaters of the reservoir. The reservoir is approximately 3 miles long and usually about 50 feet deep behind the dam. In an effort to maximize recreational potential in the reservoir and on the Lehigh River downstream, specifically recreational boating and fishing, the normal operating pool of 50 feet was raised 35 feet in late April of 2005. The additional storage was used to augment low flows in the Lehigh River downstream and increase the number of recreational boating releases throughout the summer recreation season.

## 1.2 PURPOSE OF THE MONITORING PROGRAM

Foremost, F.E. Walter Reservoir provides flood control to downstream communities on the Lehigh River. Additionally, the reservoir provides important habitat for fish, waterfowl, and other wildlife, and recreational opportunities through fishing, and boating. Due to the broad range of uses and demands F.E. Walter Reservoir serves, the USACE monitors water quality and other aspects related to reservoir health primarily to ensure public health safety. Water quality monitoring results are compared to state water quality standards and used to diagnose other problems that commonly effect reservoir health such as nutrient enrichment and toxic loadings. This report summarizes the results of water quality monitoring at F.E. Walter Reservoir and its tributaries from 25 May through 20 September 2005. This report also discusses the relevance of the water quality measures to the ecology of the reservoir and makes recommendations toward future water quality monitoring.

## 1.3 ELEMENTS OF THE STUDY

The USACE, Philadelphia District, has been monitoring the water quality of F.E. Walter Reservoir since 1975. Over this time, yearly monitoring program designs have evolved to address new areas of concern such as health aspects of public drinking water, sediment contaminants within the reservoir basin, and a 2002 investigation of a hydrogen sulfide smell near the tail water of the dam. The 2005 monitoring program was similar to those in recent years with additional sampling to monitor water quality changes occurring within the reservoir and downstream as a result of modified operations. The major elements of the monitoring included:

- Monthly water quality and bacteria monitoring from 25 May through 20 September to evaluate compliance with the Pennsylvania state water quality standards;

- Multiple unscheduled profile samples for temperature, dissolved oxygen, chlorophyll, pH and conductivity at the deepest station in the reservoir;

- Meteorological monitoring of air temperature, relative humidity, solar radiation, wind speed and direction every ½ hour at the F. E. Walter Reservoir tower;

- Sediment priority pollutant monitoring of metals and acid/base neutral extractable compounds to evaluate sediment toxicity relative to identified screening concentrations; and

- Automated half-hour temperature recorders at five stations along the Lehigh River below the reservoir and one station upstream of the reservoir pool in Bear Creek.

# 2.0 METHODS

## 2.1 PHYSICAL STRATIFICATION MONITORING

Physical stratification monitoring of the water column of F.E. Walter Reservoir was conducted five times between 24 May and 20 September 2005 at all stations (Table 2-1). Physical stratification parameters included temperature, dissolved oxygen (DO), pH, Chlorophyll and conductivity. Monitoring was conducted at seven fixed stations located throughout the reservoir watershed (Fig. 2-1). Surface water quality was monitored at stations downstream of the reservoir (WA-1) and upstream on Tobyhanna Creek (WA-3), the Lehigh River (WA-4), and Bear Creek (WA-5). Stratification monitoring was conducted within the reservoir at a reservoir tower station (WA-2), Bear Creek arm of the lake (WA-6), and Lehigh River arm of the lake (WA-7) with water quality measured at the surface to the bottom at 5-ft intervals. Stratification monitoring at station WA-2 was conducted a total of 15 times throughout the season from 28 April through 20 September to monitor the changes in water quality as a result of modified operations in 2005. All of the water quality monitoring was conducted with a calibrated YSI 6600 water quality meter.

In this report, water quality data recorded from stratification monitoring were compared to water quality standards mandated by the Pennsylvania Department of Environmental Protection (PADEP Chapter 93). The standard for DO is a minimum concentration of 5 mg/L, and that for pH is an acceptable range from 6 to 9. All of the water quality data collected during physical stratification monitoring is summarized in Appendix A.

## 2.2 WATER COLUMN CHEMISTRY MONITORING

Water column chemistry monitoring was conducted five times at F.E. Walter Reservoir between 24 May and 20 September 2005 (Table 2-1). Water samples were collected at the seven fixed stations throughout the reservoir drainage area (Fig. 2-1). Surface water samples were collected at stations downstream of the reservoir (WA-1) and upstream on Tobyhanna Creek (WA-3), the Lehigh River (WA-4), and Bear Creek (WA-5). Surface, middle, and bottom water samples were collected at the reservoir-body stations WA-2, WA-6, and WA-7. Surface water samples were collected by opening the sample containers approximately 1 foot below the water's surface. Middle and bottom samples were collected with a Van Dorn design water bottle sampler.

Water samples collected from surface, middle, and bottom depths were analyzed for ammonia, nitrite, nitrate, total Kjeldahl nitrogen (TKN), total phosphorus, diss./ortho-phosphate, soluble phosphorus, total dissolved solids (TDS), total suspended solids (TSS), biochemical oxygen demand (BOD), alkalinity, total organic carbon (TOC), total inorganic carbon (TIC), total carbon, and chlorophyll *a*. Table 2-2 summarizes the water quality parameters; laboratory method detection limits, state water quality standards, and allowable and achieved maximum hold times for each.

Table 2-1. F.E. Walter Reservoir water quality schedule for 2005 monitoring

| Date of Sample Collection | Physical Stratification Monitoring (WA-2)*** | Water Column Chemistry Monitoring (All Stations) | Trophic State Determination (WA-2) | Coliform Bacteria Monitoring (All Stations) | Sediment Priority Pollutant Monitoring (WA-2) | Lehigh Temperature Probes** | Drinking Water Monitoring* |
|---|---|---|---|---|---|---|---|
| 28 April | X | | | | | X | |
| 13 May | X | | | | | X | |
| 25 May | X | X | X | X | | X | |
| 09 June | X | | | | | X | |
| 14 June | X | | | | | X | |
| 23 June | X | | | | | X | |
| 28 June | X | X | X | X | | X | |
| 01 July | X | | | | | X | |
| 06 July | X | | | | | X | |
| 14 July | X | | | | | X | |
| 22 July | X | | | | | X | |
| 27 July | X | X | X | X | X | X | |
| 04 August | X | | | | | X | |
| 24 August | X | X | X | X | | X | |
| 20 September | X | X | X | X | | X | |

* Drinking water samples are sampled quarterly by personnel at each reservoir.
** Lehigh River temperature probes continuously monitor river temperatures throughout the sampling period. They are periodically downloaded.
*** Physical stratification monitoring is conducted at all stations during routine monthly sampling.

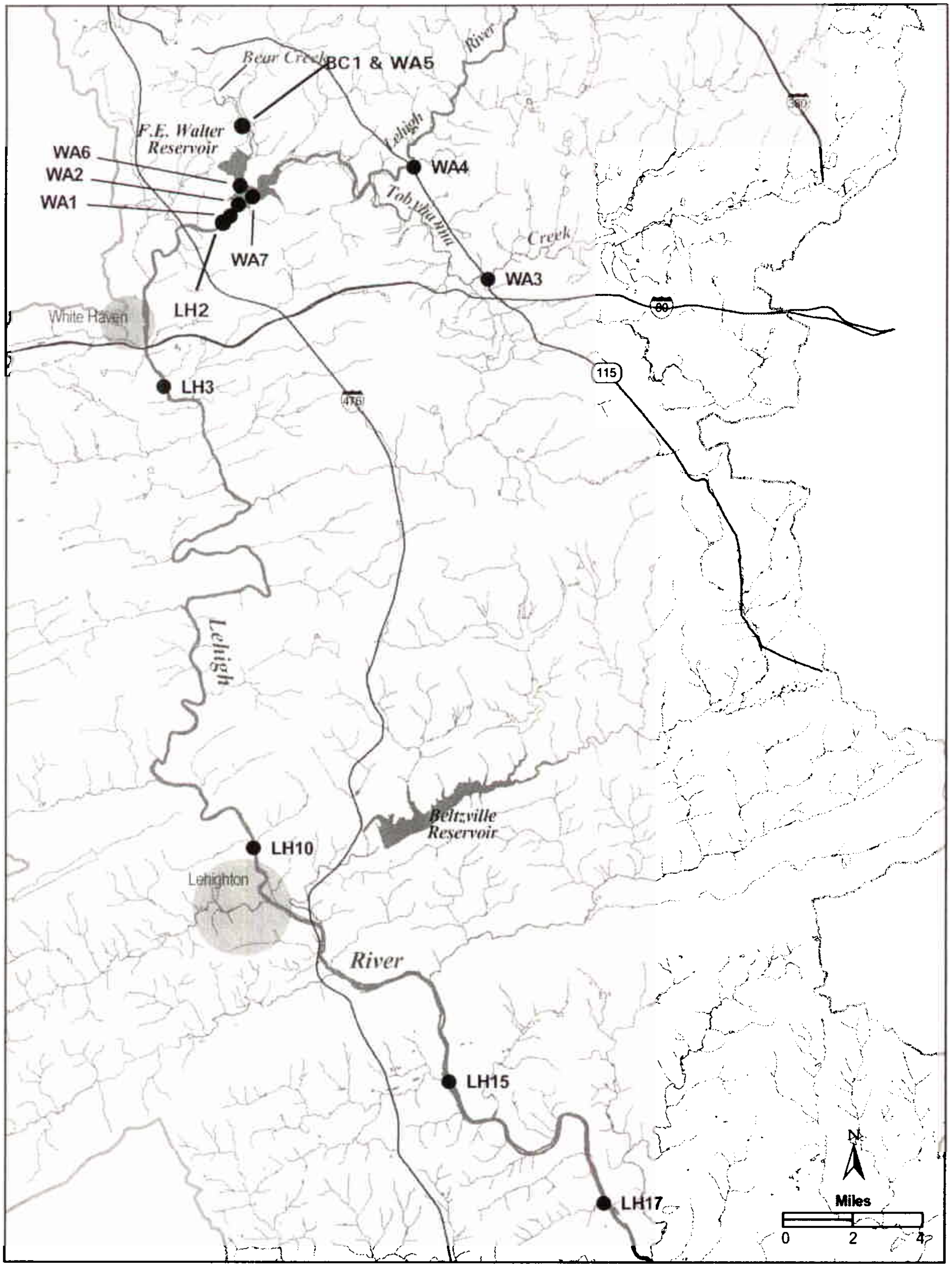


Figure 2-1. Location map for F.E. Walter Reservoir and Lehigh River temperature probe monitoring stations in 2005

Table 2-2. Water quality test methods, detection limits, state regulatory criteria, and sample holding times for water quality parameters monitored at F.E. Walter Reservoir in 2005

| Parameter | EPA Method | Detection Limit | PADEP Surface Water Quality Criteria | Allowable Hold Times (Days) | Maximum Hold Time Achieved (Days) |
|---|---|---|---|---|---|
| Alkalinity | 310.1 | 0.41 mg/L | minimum 20 mg/L $CaCO_3$ | 14 | |
| Biochemical Oxygen Demand (BOD) | 405.1 | 0.8 mg/L | None | 2 | |
| Total Phosphorus | 365.1 | 0.01 mg/L | None | 28 | |
| Diss./Ortho-Phosphate | 365.3 | 0.01mg/L | None | 28 | |
| Soluble Phosphorus | 365.1 | 0.01 mg/L | None | 28 | |
| Total Organic Carbon | 415.1 | 0.5 mg/L | None | 14 | |
| Total Inorganic Carbon | 415.1 | 0.6 mg/L | None | 28 | |
| Total Carbon | 415.1 | 0.6 mg/L | None | 28 | |
| * Chlorophyll *a* | | | None | | |
| Total Kjeldahl Nitrogen | 351.2 | 0.50 mg/L | None | 28 | |
| Ammonia | 350.3 | 0.03 mg/L | Temperature and pH dependent | 28 | |
| Nitrate | 353.2 | 0.04 mg/L | Maximum 10 mg/L (nitrate + nitrite) | 28 | |
| Nitrite | 353.2 | 0.015 mg/L | | 28 | |
| Total Dissolved Solids | 160.1 | 9.7 mg/L | Maximum 500 mg/L | 7 | |
| Total Suspended Solids | 160.2 | 3 mg/L | None | 7 | |

* Chlorophyll *a* samples were recorded using a YSI 6600 with a chlorophyll sensor.

## 2.3 TROPHIC STATE DETERMINATION

The trophic state of F.E. Walter Reservoir was determined by methods outlined by Carlson (1977). In general, this method calculates trophic state indices (TSIs) independently for total phosphorus and chlorophyll *a* concentrations, and secchi disk depth. Surface water measures of total phosphorus and chlorophyll *a* from chemistry monitoring were used independently in determining monthly TSI values. Secchi disk depth was measured only in surface waters in the reservoir-body. Trophic state determinations were made using criteria defined by Carlson (1977) and EPA (1983) and calculated only for Station WA-2 within the reservoir.

## 2.4 RESERVOIR BACTERIA MONITORING

Monitoring for coliform bacteria contaminants was conducted five times between 25 May and 20 September at F.E. Walter Reservoir. Surface water samples were collected in the same manner as for chemical parameter samples, and analyzed for total and fecal coliform bacteria contamination. Table 2-3 presents the test methods, detection limits, PADEP standards, and sample holding times for the bacteria parameters monitored at F.E. Walter Reservoir in 2005. The bacteria analytical method was based on a membrane filtration technique. All of the samples were analyzed within their maximum allowable hold times.

Table 2-3. Water quality test methods, detection limits, PADEP water quality standards, and sample holding times for bacteria parameters monitored at F.E. Walter Reservoir in 2005

| Parameter | Total coliform | Fecal coliform |
|---|---|---|
| Test method | SM 9222B | SM9222D |
| Detection limit | 10 clns/100-mls | 10 clns/100-ml |
| PADEP standard | - | Geometric mean less than 200 clns/100-ml (application of this standard is conservative because swimming is not permitted in the reservoir) |
| Maximum allowable holding time | 30 hours | 30 hours |
| Achieved holding time | < 30 hours | < 30 hours |

Monthly coliform bacteria counts were compared to the PADEP single sample water quality standard for bacteria. The multiple sample standards is defined as a maximum geometric mean of 200 colonies/100-ml based on five samples collected on different days within a 30-day period. Application of this standard is not necessary at F.E. Walter because swimming and other human/water contact recreation is prohibited in the reservoir.

## 2.5 SEDIMENT PRIORITY POLLUTANT MONITORING

Sediment from F.E. Walter Reservoir was monitored for priority pollutant contaminants, Group 2 – metals and acid/base neutral extractables. Sediment was collected on 27 July at station WA-2 with a petite ponar grab-sampler. Sediment from the grab-sampler was emptied into a stainless steel mixing bowl and homogenized with a stainless steel spoon. Sediments were contained in appropriately labeled sample jars and stored on ice until shipment to the analytical laboratory. Table 2-4 summarizes the parameters monitored, method detection limits, sample hold times, and the laboratory methods used in the analyses. Sediment results were compared to New Jersey residential and non-residential cleanup standards. New Jersey standards have been historically used by the Philadelphia District to screen and assess potential sediment contamination.

## 2.6 METEOROLOGICAL MONITORING

Air temperature, relative humidity, solar radiation, wind speed and direction were monitored every ½ hour with a YSI 6200 meteorological station installed and maintained at the F.E. Walter Reservoir discharge tower. Local weather conditions were recorded with these. Due to some equipment failure, data for the entire sampling season was not collected.

## 2.7 LEHIGH WATER QUALITY MONITORING

Ambient water temperature was recorded every ½ hour with Onset Computer Corporation TidbiT™ probes at five stations along the Lehigh River. The station locations were WA1 (just below the F. E. Walter dam outfall), station LH3 (several miles downstream of the dam at Tannery Bridge), LH10 (Lehighton near the Lehighton water intake facility), LH15 (Walnutport), and LH17 (Northampton water treatment plant intake). In addition, a station was placed in Bear Creek upstream of the reservoir.

Table 2-4. Analytical methods, detection limits, and sample hold times for sediment priority pollutant metals and acid/base neutral extractables monitored at F. E. Walter Reservoir in 2005.

| Parameter | EPA Method | Method Detection Limit | Allowable Hold Time (days) | Max. Hold Time Achieved (days) |
|---|---|---|---|---|
| **Conventionals** | | | | |
| Moisture | 160.3 | 0.5 | | 1 |
| **Metals** | | (mg/kg) | | |
| Antimony | 6010B | 2.14 | 180 | 2 |
| Arsenic | 6010B | 1.75 | 180 | 1 |
| Beryllium | 6010B | 0.112 | 180 | 1 |
| Cadmium | 6010B | 0.224 | 180 | 1 |
| Chromium | 6010B | 1.38 | 180 | 1 |
| Copper | 6010B | 0.782 | 180 | 1 |
| Lead | 6010B | 2.03 | 180 | 1 |
| Mercury | 7471A | 0.0068 | 180 | 2 |
| Nickel | 6010B | 0.86 | 180 | 1 |
| Selenium | 6010B | 2.5 | 180 | 2 |
| Silver | 6010B | 0.495 | 180 | 1 |
| Thallium | 6010B | 2.5 | 180 | 1 |
| Zinc | 6010B | 1.2 | 180 | 1 |
| **Acid/Base Neutral Extractables** | | (ug/kg) | | |
| 1,2,4-Trichlorobenzene | 8270C | 89 | 40 | 2 |
| 1,2-Dichlorobenzene | 8270C | 89 | 40 | 2 |
| 1,2-Diphenylhydrazine | 8270C | 89 | 40 | 2 |
| 1,3-Dichlorobenzene | 8270C | 89 | 40 | 2 |
| 1,4-Dichlorobenzene | 8270C | 89 | 40 | 2 |
| 2,4,6-Trichlorophenol | 8270C | 89 | 40 | 2 |
| 2,4-Dichlorophenol | 8270C | 89 | 40 | 2 |
| 2,4-Dimethylphenol | 8270C | 270 | 40 | 2 |
| 2,4-Dinitrophenol | 8270C | 1800 | 40 | 2 |
| 2,4-Dinitrotoluene | 8270C | 180 | 40 | 2 |
| 2,6-Dinitrotoluene | 8270C | 89 | 40 | 2 |
| 2-Chloronaphthalene | 8270C | 89 | 40 | 2 |
| 2-Chlorophenol | 8270C | 89 | 40 | 2 |
| 2-Nitrophenol | 8270C | 89 | 40 | 2 |
| 3,3'-Dichlorobenzidine | 8270C | 270 | 40 | 2 |
| 4,6-Dinitro-2-methylphenol | 8270C | 440 | 40 | 2 |
| 4-Bromophenyl-phenylether | 8270C | 89 | 40 | 2 |
| 4-Chloro-3-methylphenol | 8270C | 180 | 40 | 2 |
| 4-Chlorophenyl-phenylether | 8270C | 89 | 40 | 2 |
| 4-Nitrophenol | 8270C | 440 | 40 | 2 |
| Acenaphthene | 8270C | 89 | 40 | 2 |
| Acenaphthylene | 8270C | 89 | 40 | 2 |
| Anthracene | 8270C | 89 | 40 | 2 |

Table 2-4. (Continued).

| Parameter | EPA Method | Method Detection Limit (ug/kg) | Allowable Hold Time (days) | Max. Hold Time Achieved (days) |
|---|---|---|---|---|
| **Acid/Base Neutral Extractables (Continued)** | | | | |
| Benzidine | 8270C | 1800 | 40 | 2 |
| Benzo(a)anthracene | 8270C | 89 | 40 | 2 |
| Benzo(a)pyrene | 8270C | 89 | 40 | 2 |
| Benzo(b)fluoranthene | 8270C | 89 | 40 | 2 |
| Benzo(g,h,i)perylene | 8270C | 89 | 40 | 2 |
| Benzo(k)fluoranthene | 8270C | 89 | 40 | 2 |
| bis(2-Chloroethoxy)methane | 8270C | 89 | 40 | 2 |
| bis(2-Chloroethyl)ether | 8270C | 89 | 40 | 2 |
| bis(2-Chloroisopropyl)ether | 8270C | 89 | 40 | 2 |
| bis(2-Ethylhexyl)phthalate | 8270C | 180 | 40 | 2 |
| Butylbenzylphthalate | 8270C | 180 | 40 | 2 |
| Chrysene | 8270C | 89 | 40 | 2 |
| Dibenz(a,h)anthracene | 8270C | 89 | 40 | 2 |
| Diethylphthalate | 8270C | 180 | 40 | 2 |
| Dimethylphthalate | 8270C | 180 | 40 | 2 |
| Di-n-butylphthalate | 8270C | 180 | 40 | 2 |
| Di-n-octylphthalate | 8270C | 180 | 40 | 2 |
| Fluoranthene | 8270C | 89 | 40 | 2 |
| Fluorene | 8270C | 89 | 40 | 2 |
| Hexachlorobenzene | 8270C | 89 | 40 | 2 |
| Hexachlorobutadiene | 8270C | 180 | 40 | 2 |
| Hexachlorocyclopentadiene | 8270C | 440 | 40 | 2 |
| Hexachloroethane | 8270C | 89 | 40 | 2 |
| Indeno(1,2,3-cd)pyrene | 8270C | 89 | 40 | 2 |
| Isophorone | 8270C | 89 | 40 | 2 |
| Naphthalene | 8270C | 89 | 40 | 2 |
| Nitrobenzene | 8270C | 89 | 40 | 2 |
| N-Nitrosodimethylamine | 8270C | 180 | 40 | 2 |
| N-Nitroso-di-n-propylamine | 8270C | 89 | 40 | 2 |
| N-Nitrosodiphenylamine | 8270C | 89 | 40 | 2 |
| Pentachlorophenol | 8270C | 440 | 40 | 2 |
| Phenanthrene | 8270C | 89 | 40 | 2 |
| Phenol | 8270C | 89 | 40 | 2 |
| Pyrene | 8270C | 89 | 40 | 2 |

# 3.0 RESULTS AND DISCUSSION

## 3.1 STRATIFICATION MONITORING

The following sections describe temporal and spatial patterns for the water quality parameters of temperature, dissolved oxygen (DO), pH, and conductivity measured throughout the F.E. Walter Reservoir watershed during 2005. Additionally, patterns related to season and depths are described for station WA-2 located in the reservoir. Maximum depths for WA-2 vary between approximately 45 to 95 feet due to operations in 2005 and low rainfall. All of the data collected during the 2005 monitoring period are presented in Appendix A.

### 3.1.1 Temperature

Temperature of the tributary surface waters of the F.E. Walter Reservoir watershed generally followed a similar pattern throughout the monitoring period. Temperatures increased throughout the summer and peaked in late June at approximately 22.5 °C, and decreased thereafter through September (Fig. 3-1). Temperatures in surface waters of the reservoir-body (station WA-2, -6, and -7) were generally warmer than in tributaries (stations WA-3, -4, and -5) and downstream of the dam (WA-1). In-lake reservoir surface temperatures peaked in late June at approximately 28 °C. Downstream release surface temperatures peaked in late July at approximately 24 °C.

The water column of F.E. Walter Reservoir was moderately stratified during 2005 (Fig. 3-2). Due to operational changes in 2005, specifically the raising of the base pool level and recreational release operations, the temperature stratification within the reservoir was likely disrupted on various occasions during the season. Prior to the early seasonal recreational releases and subsequent pool lowering, the reservoir was exhibiting characteristics' of a well established stratified column. In addition, the majority of releases are made from the bottom flood gates of the tower with limited mixing from a bypass system approximately 50 feet above the reservoir bottom. As a result, lower and typically cooler bottom waters are withdrawn first, likely causing a disruption in stratification and depletion of colder water. The extent and maintenance of temperature stratification as it relates to operating at a higher pool level could not be confidently established. The 2005 sampling does provide a low inflow scenario due to the low rainfall in the watershed.

### 3.1.2 Dissolved Oxygen

In 2005, dissolved oxygen (DO) in the tributary surface waters of F.E. Walter Reservoir decreased slightly from May through July and then rose through September. Generally, DO concentrations in surface waters of the reservoir-body (station WA-2, -6, and -7) were slightly lower than in tributaries (stations WA-3, -4, and -5) and downstream of the dam (WA-1).

The water column of F.E. Walter Reservoir was moderately stratified with respect to DO during most of the sampling season (Fig. 3-4). During late May, early April, and late September the water column was relatively uniform with concentrations remaining fairly stable throughout the water column. The rest of the sampling season has shown a trend of decreasing DO concentrations at greater depths in the water column.

The health of aquatic ecosystems can be impaired by low DO concentrations in the water column. Hypoxia, or conditions of DO concentrations less than 2 mg/L, is generally accepted as the threshold at which the most severe effects on biota occur. In 2005, the lower water column of F.E. Walter Reservoir experienced hypoxia or near hypoxic conditions when pool levels were sampled at their greatest depths (Fig. 3-4). In general, DO concentrations were at their lowest when pool levels were at their highest. Sampling conducted on June 1st showed near anoxic (0 mg/L) conditions in the deepest portion of the reservoir (station WA-2). Release water is re-aerated as it passes through the conduit system of the reservoir. As a result, release DO concentrations ranged from 7.67 mg/L to 12.6 mg/L throughout the season downstream in the Lehigh River.

### 3.1.3 pH

Measures of pH in tributary surface waters of F.E. Walter Reservoir generally followed a similar pattern during 2005; however, slight differences were apparent between reservoir body, upstream, and downstream waters (Figs. 3-5). Stations located in the reservoir body (WA-2, -6, and -7) steadily increased throughout the sampling season. Measures of pH downstream of the reservoir (WA-1) and the upstream stations (WA-3, -4, and –5) decreased to their lowest levels in June and increased thereafter.

On most monitoring dates in 2005, measures of pH were relatively uniform throughout the water column (Fig. 3-6). In most cases, higher pH levels were seen at or near the surface waters. Likely, this is a result of increased algal productivity. Measures of pH in the water column of F.E. Walter Reservoir were routinely not in compliance with PADEP water quality standards. The water quality standard for pH is a range of acceptable measures between 6 and 9. Station WA-2 was below standard on 28 April, 06 July, 24 August, and 20 September through October. Stations WA-6 was below standard on 24 August and 20 September. Additionally, station WA-7 was below the standard on 28 June, 24 August, and 20 September (Appendix A).

### 3.1.4 Conductivity

For the most part, conductivity among the surface waters of F.E. Walter Reservoir followed a fairly consistent increasing pattern during 2005 (Fig. 3-7). Conductivity was routinely higher upstream of the reservoir at station WA-5. In most months, conductivity measures were generally uniform throughout the water column, but showed a slight increasing trend deeper in the water column (Fig. 3-8). Conductivity patterns in the water column at station WA-2 were at their lowest during 28 April and 13 May and at their highest levels on 24 August.

## 3.2 WATER COLUMN CHEMISTRY MONITORING

Table 3-2 provides a summary of water column chemistry sampling for all stations and dates sampled at F.E. Walter Reservoir in 2005. The following sections describe the temporal, spatial, and depth related patterns for these water quality measures.

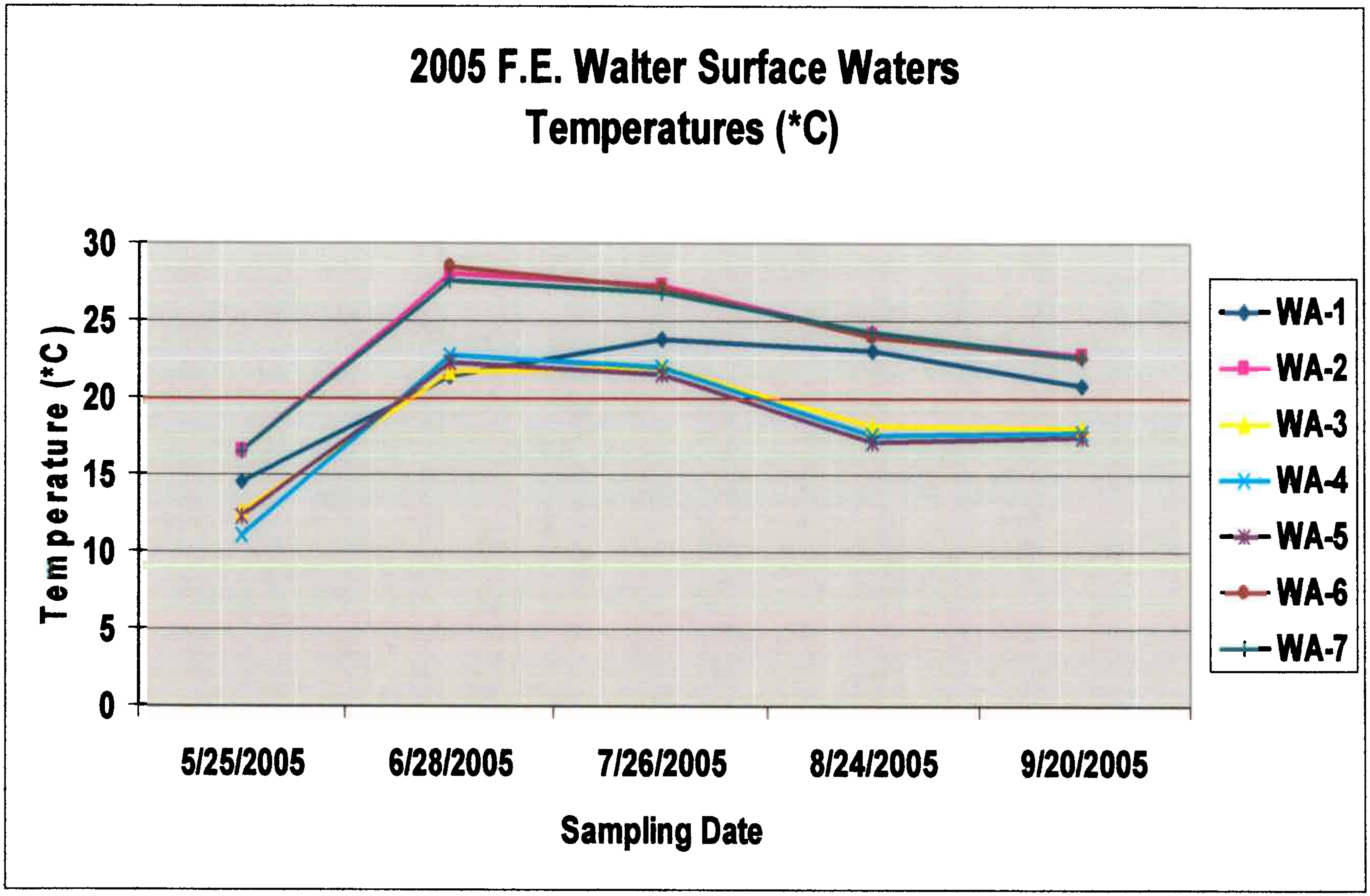


**Figure 3-1.** Temperature measured in surface waters of F.E. Walter Reservoir during 2005. See Appendix A for a summary of the plotted values.

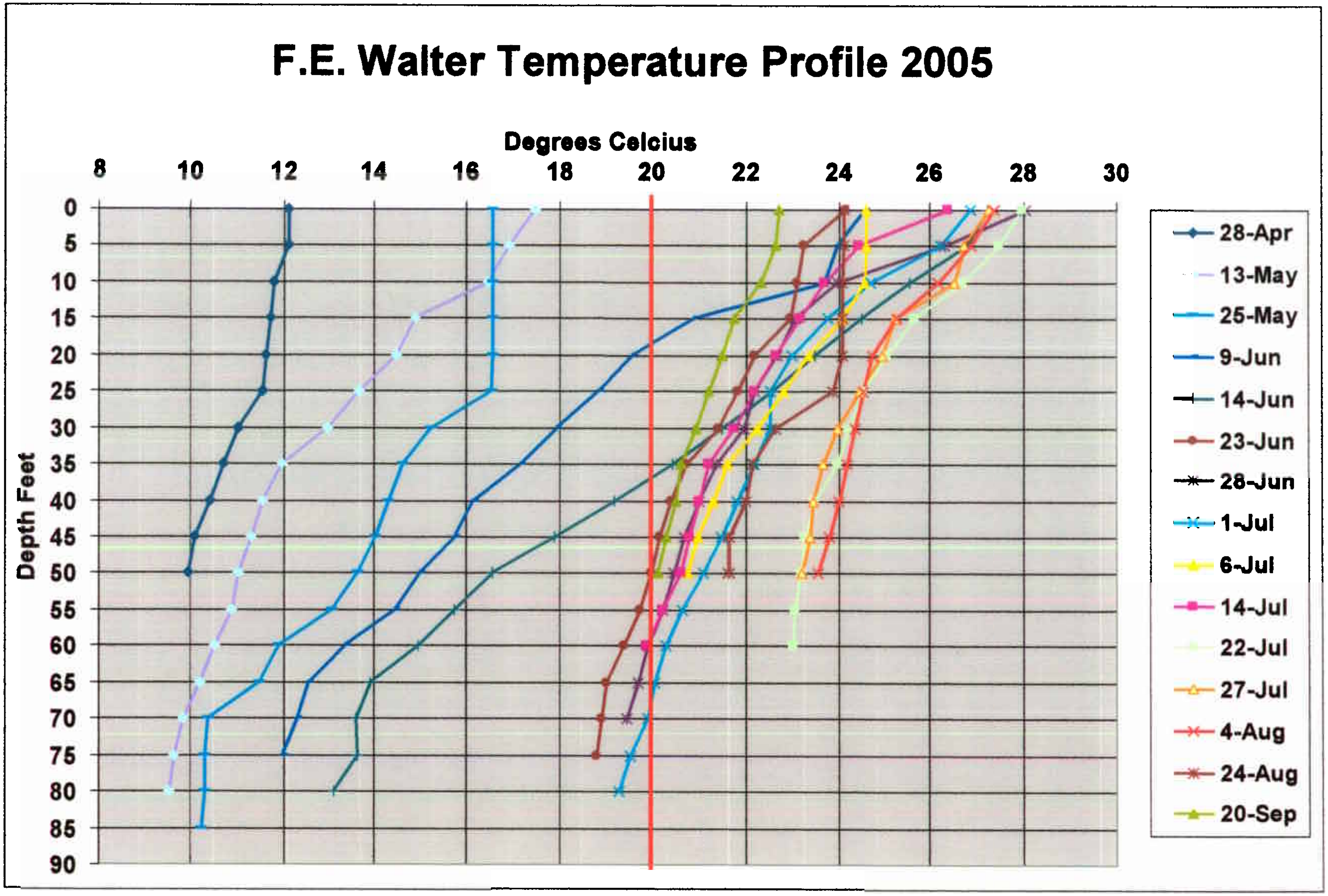


**Figure 3-2.** Stratification of temperature measured in the water column of F. E. Walter Reservoir at station WA-2 during 2005. See Appendix A for a summary of the plotted values.

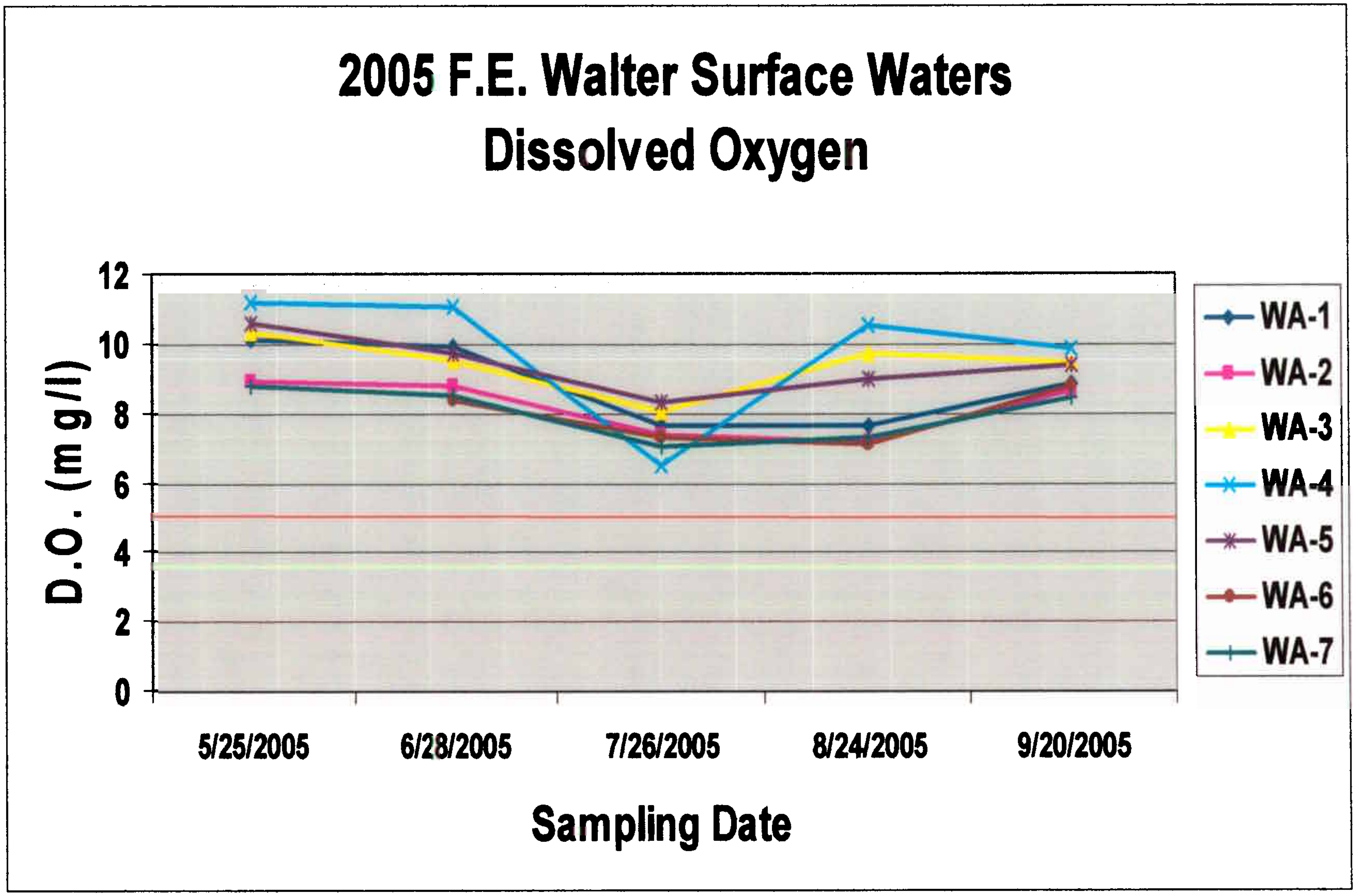


**Figure 3-3.** Dissolved oxygen measured in surface waters of F. E. Walter Reservoir during 2005. See Appendix A for a summary of the plotted values

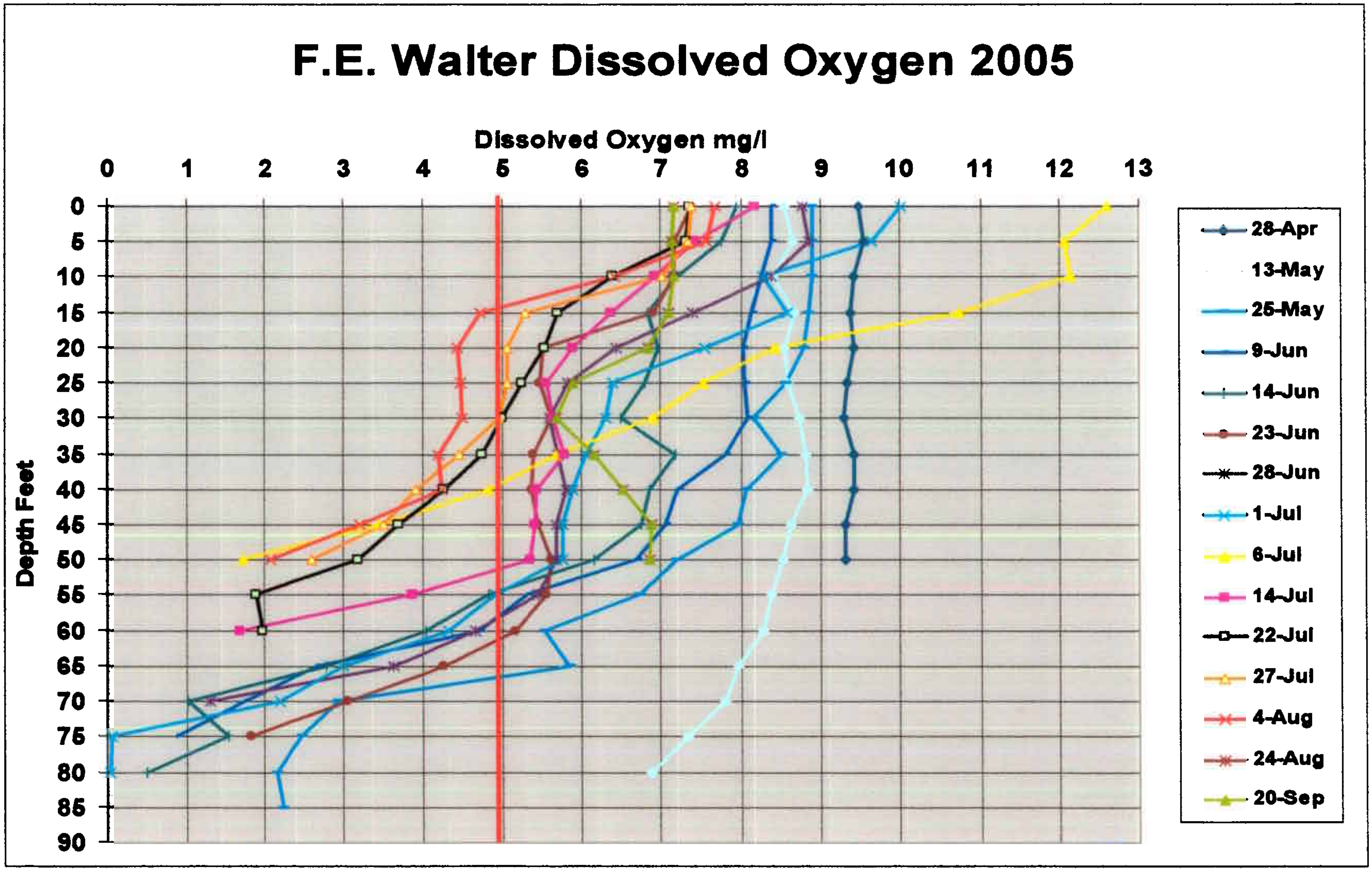


Figure 3-4. Dissolved oxygen measured in the water column of F.E. Walter Reservoir at station WA-2 during 2005. The PADEP water quality standard for DO is a minimum concentration of 5 mg/L. See Appendix A for a summary of the plotted values

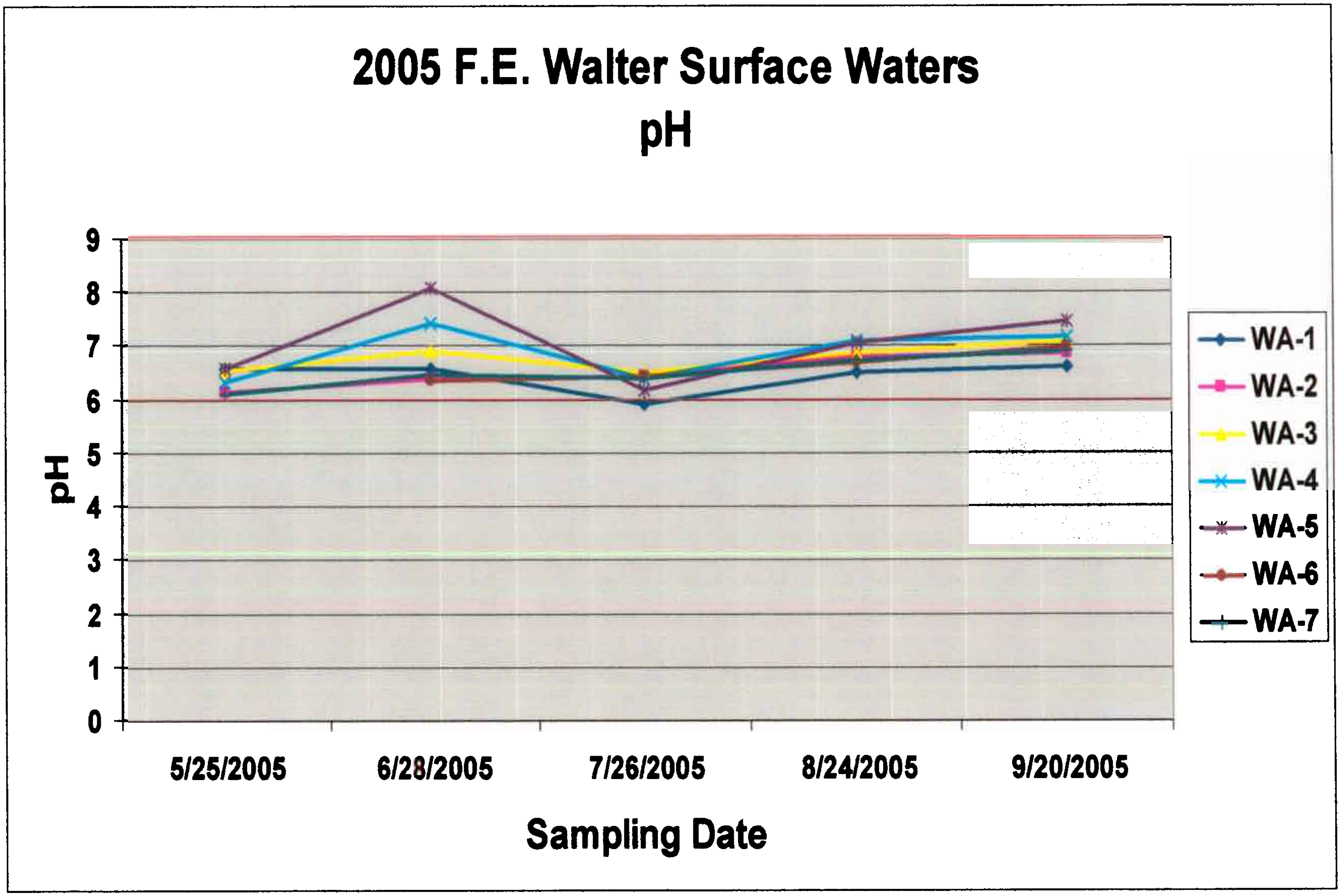


**Figure 3-5.** Measures of pH in surface waters of F.E. Walter Reservoir during 2005. The PADEP water quality standard for pH is an acceptable range from 6 to 9. See Appendix A for a summary of the plotted values.

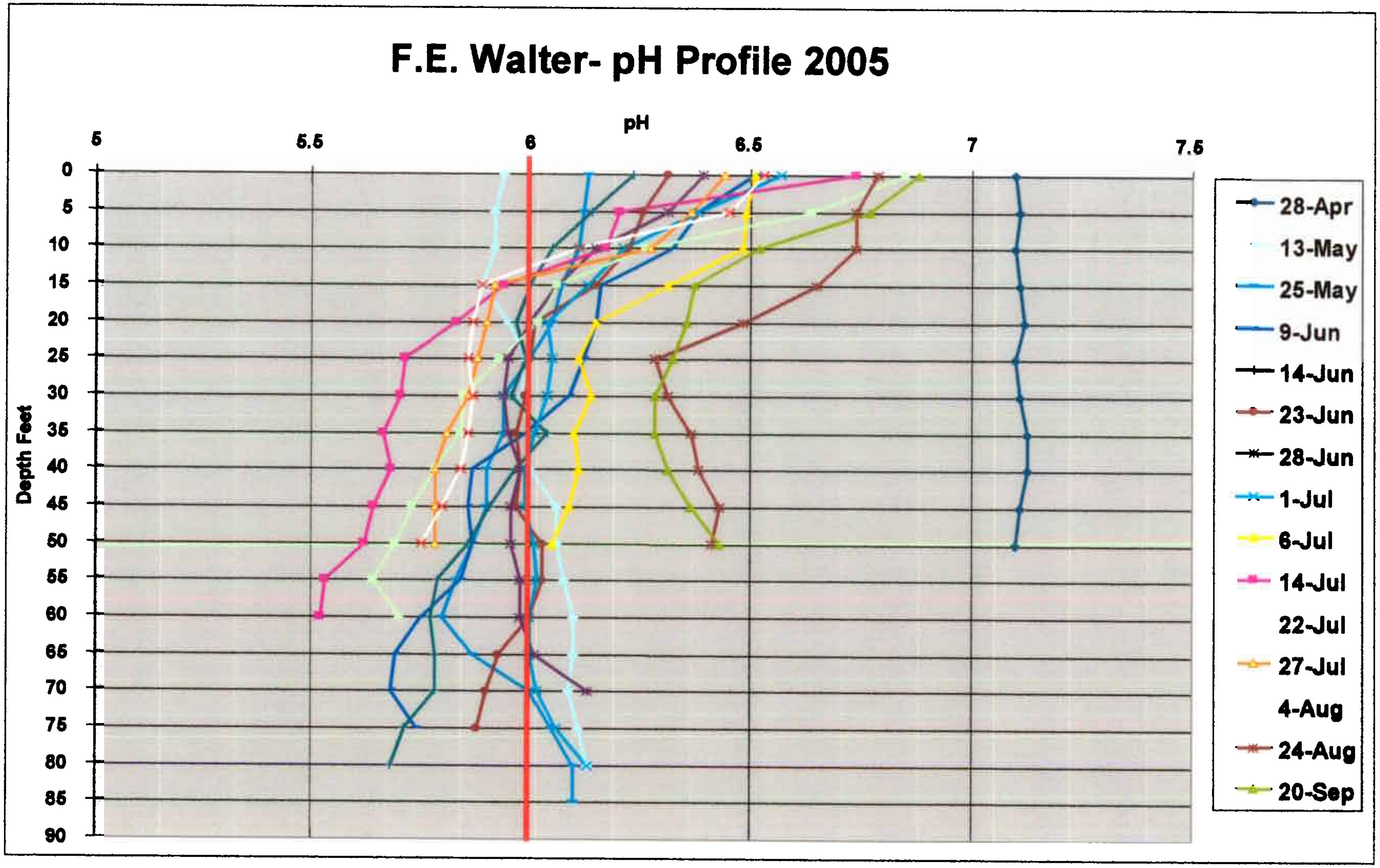


**Figure 3-6.** Stratification of pH measured in the water column of F.E. Walter Reservoir at station WA-2 during 2005. The PADEP water quality standard pH is an acceptable range from 6 to 9. See Appendix A for a summary of the plotted values.

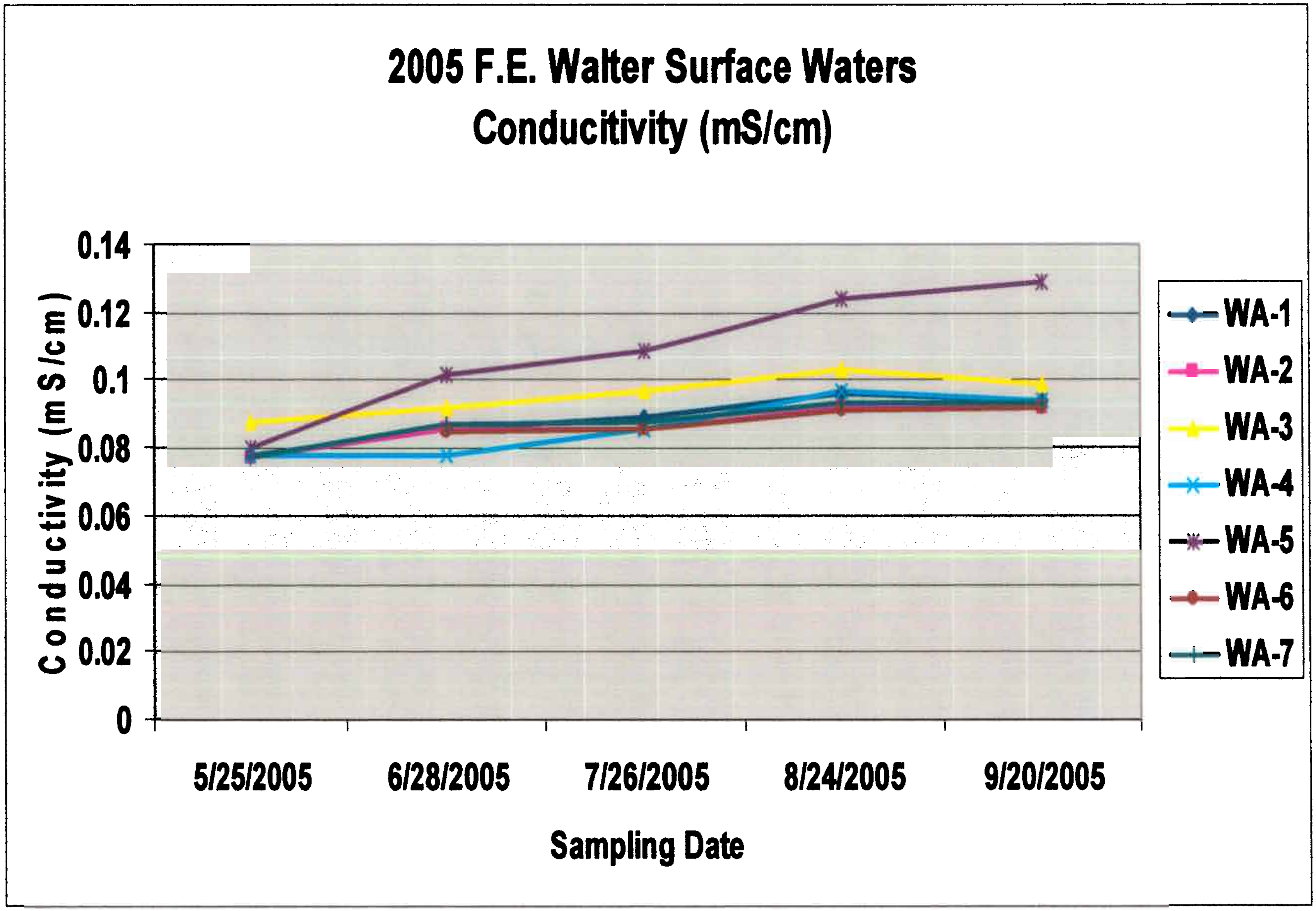


Figure 3-7. Conductivity measured in surface waters of F.E. Walter Reservoir during 2005. See Appendix A for a summary of the plotted values.

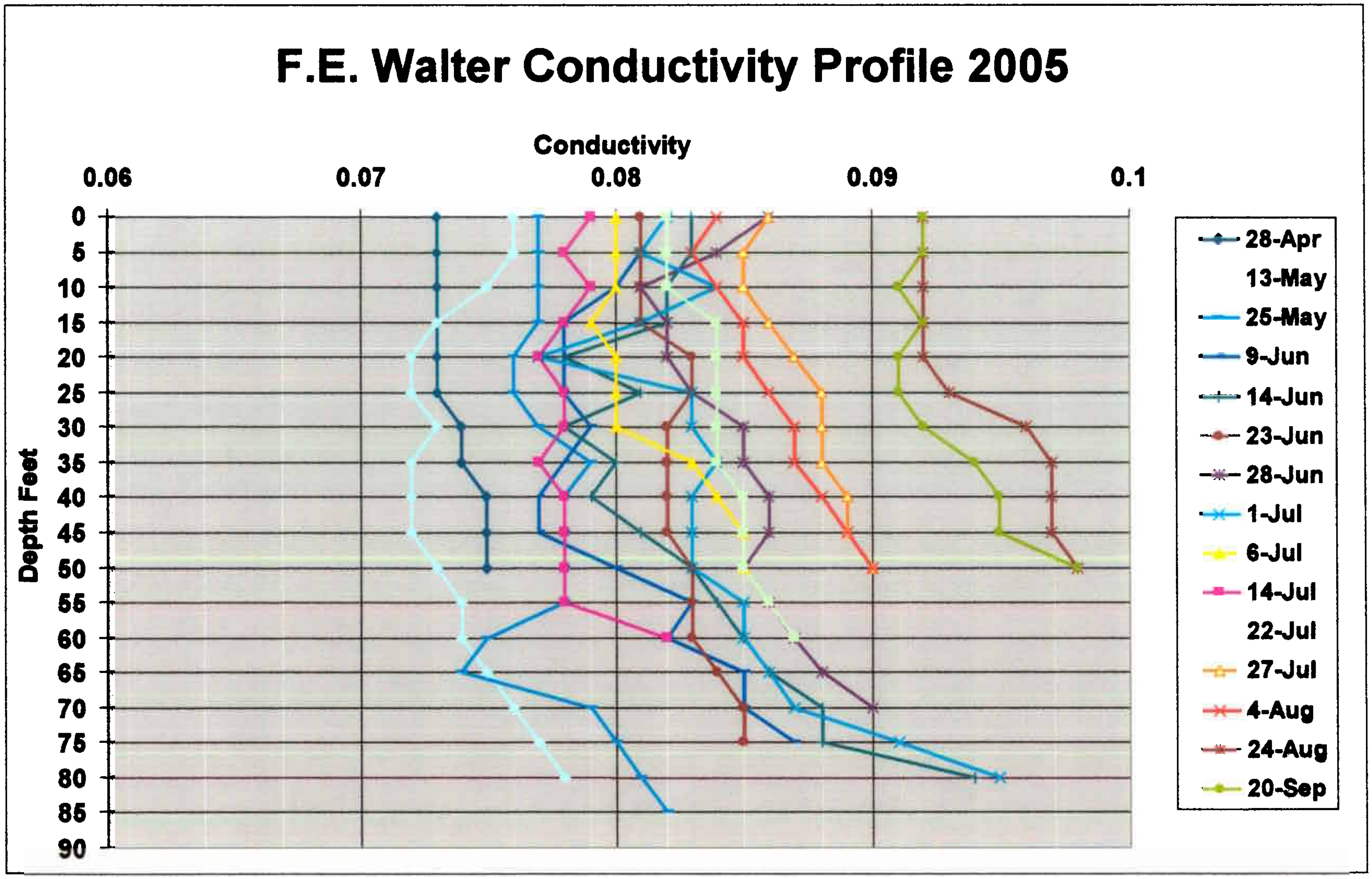


**Figure 3-8.** Stratification of conductivity measured in the water column of F. E. Walter Reservoir at station WA-2 during 2005. See Appendix A for a summary of the plotted values.

TABLE 3-1. Summary of surface, middle, and bottom water quality monitoring data for F.E. Walter Reservoir in 2005

| STATION | DATE | | NH3 | | NO2 | | NO3 | | PO4 | | TKN | TP | TDS | | TSS | | BOD5 | ALK | DISS P | TOC | TIC | TC | CHLA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WA-1S | 25-May | | 0.062 | < | 0.015 | < | 0.040 | < | 0.01 | < | 0.50 | 0.04 | 34 | < | 3.0 | < | 1.8 | 4.5 | 0.02 | 3.2 | 1.3 | 4.6 | 1.0 |
| | 28-Jun | | 0.140 | < | 0.015 | | 0.072 | < | 0.01 | < | 0.50 | | 47 | | 6.8 | < | 1.8 | 5.9 | | 4.2 | 2.3 | 6.5 | 0.0 |
| | 27-Jul | | 0.089 | < | 0.015 | | 0.043 | < | 0.01 | < | 0.50 | 0.05 | 56 | | 14.8 | < | 2.6 | 6.4 | 0.03 | 3.6 | 3.2 | 6.8 | 0.7 |
| | 24-Aug | | 0.056 | < | 0.015 | < | 0.040 | < | 0.01 | < | 0.50 | 0.07 | 49 | | 12.4 | < | 0.75 | 7.4 | 0.03 | 3.6 | 3.6 | 7.2 | 0.6 |
| | 20-Sep | < | 0.030 | < | 0.015 | < | 0.040 | < | 0.01 | < | 0.50 | 0.04 | 59 | | 10.4 | < | 2.5 | 17.3 | 0.01 | 3.4 | 4.2 | 7.5 | 0.3 |
| Mean | | | 0.075 | | 0.015 | | 0.047 | | 0.01 | | 0.50 | 0.05 | 49 | | 9.5 | | 1.9 | 8.3 | 0.023 | 3.6 | 2.9 | 6.5 | 0.5 |
| Maximum | | | 0.140 | | 0.015 | | 0.072 | | 0.01 | | 0.50 | 0.07 | 59 | | 14.8 | | 2.6 | 17.3 | 0.030 | 4.2 | 4.2 | 7.5 | 1.0 |
| Minimum | | | 0.030 | | 0.015 | | 0.040 | | 0.01 | | 0.50 | 0.04 | 34 | | 3.0 | | 0.75 | 4.5 | 0.010 | 3.2 | 1.3 | 4.6 | 0.0 |
| Std. Dev | | | 0.042 | | 0.000 | | 0.014 | | 0.00 | | 0.00 | 0.01 | 9.5 | | 4.7 | | 0.74 | 5.1 | 0.010 | 0.4 | 1.1 | 1.1 | 0.4 |
| No. of D | | | 4 | | 0 | | 2 | | 0 | | 0 | 4 | 5 | | 4 | | 0 | 5 | 4 | 5 | 5 | 5 | 5 |
| WA-2S | 25-May | | 0.039 | < | 0.015 | < | 0.040 | < | 0.01 | < | 0.50 | 0.04 | 29 | < | 3.0 | < | 2.0 | 3.9 | 0.02 | 3.5 | 1.6 | 5.1 | 2.4 |
| | 28-Jun | | 0.057 | < | 0.015 | | 0.066 | < | 0.01 | < | 0.50 | 0.03 | 49 | < | 3.0 | < | 2.0 | 5.2 | 0.02 | 4.3 | 2.1 | 6.4 | 0.9 |
| | 27-Jul | | 0.035 | < | 0.015 | < | 0.040 | < | 0.01 | < | 0.50 | 0.01 | 56 | < | 3.0 | < | 2.6 | 5.9 | 0.04 | 3.6 | 2.6 | 6.2 | 1.2 |
| | 24-Aug | < | 0.030 | < | 0.015 | < | 0.040 | < | 0.01 | < | 0.50 | 0.03 | 41 | < | 3.0 | < | 1.4 | 6.8 | 0.04 | 3.5 | 2.8 | 6.4 | 2.6 |
| | 20-Sep | | 0.079 | < | 0.015 | < | 0.040 | < | 0.01 | < | 0.50 | 0.01 | 58 | < | 3.0 | < | 2.8 | 7.0 | 0.02 | 3.4 | 3.5 | 6.9 | 4.1 |
| Mean | | | 0.048 | | 0.015 | | 0.045 | | 0.01 | | 0.50 | 0.02 | 46 | | 3.0 | | 2.2 | 5.8 | 0.028 | 3.7 | 2.5 | 6.2 | 2.2 |
| Maximum | | | 0.079 | | 0.015 | | 0.066 | | 0.01 | | 0.50 | 0.04 | 58 | | 3.0 | | 2.8 | 7.0 | 0.040 | 4.3 | 3.5 | 6.9 | 4.1 |
| Minimum | | | 0.030 | | 0.015 | | 0.040 | | 0.01 | | 0.50 | 0.01 | 29 | | 3.0 | | 1.4 | 3.9 | 0.020 | 3.4 | 1.6 | 5.1 | 0.9 |
| Std. Dev | | | 0.020 | | 0.000 | | 0.012 | | 0.00 | | 0.00 | 0.01 | 11.7 | | 0.0 | | 0.55 | 1.27 | 0.011 | 0.36 | 0.72 | 0.67 | 1.3 |
| No. of D | | | 4 | | 0 | | 1 | | 0 | | 0 | 5 | 5 | | 0 | | 0 | 5 | 5 | 5 | 5 | 5 | 5 |
| WA-2M | 25-May | | 0.050 | < | 0.015 | < | 0.040 | | 0.018 | < | 0.50 | 0.03 | 40 | < | 3.0 | < | 1.9 | 8.1 | 0.03 | 3.3 | 1.4 | 4.7 | 0.8 |
| | 28-Jun | < | 0.030 | < | 0.015 | | 0.060 | < | 0.01 | < | 0.50 | 0.03 | 46 | < | 3.0 | < | 1.8 | 5.2 | 0.03 | 4.0 | 3.2 | 7.3 | 0.7 |
| | 27-Jul | | 0.047 | < | 0.015 | < | 0.040 | < | 0.01 | < | 0.50 | 0.07 | 55 | | 3.6 | < | 2.4 | 6.3 | 0.04 | 3.7 | 3.4 | 7.1 | 0.6 |
| | 24-Aug | | 0.038 | < | 0.015 | < | 0.040 | | 0.018 | < | 0.50 | 0.04 | 44 | | 4.0 | < | 1.0 | 7.4 | 0.03 | 3.4 | 3.7 | 7.1 | 1.2 |
| | 20-Sep | | 0.041 | < | 0.015 | < | 0.040 | < | 0.01 | < | 0.50 | 0.04 | 58 | | 8.0 | < | 2.1 | 7.7 | 0.02 | 3.5 | 3.7 | 7.2 | 0.7 |
| Mean | | | 0.041 | | 0.015 | | 0.044 | | 0.01 | | 0.50 | 0.04 | 48 | | 4.3 | | 1.8 | 6.9 | 0.030 | 3.6 | 3.1 | 6.7 | 0.8 |
| Maximum | | | 0.050 | | 0.015 | | 0.060 | | 0.02 | | 0.50 | 0.07 | 58 | | 8.0 | | 2.4 | 8.1 | 0.040 | 4.0 | 3.7 | 7.3 | 1.2 |
| Minimum | | | 0.030 | | 0.015 | | 0.040 | | 0.01 | | 0.50 | 0.03 | 40 | | 3.0 | | 1.0 | 5.2 | 0.020 | 3.3 | 1.4 | 4.7 | 0.6 |
| Std. Dev | | | 0.008 | | 0.000 | | 0.009 | | 0.00 | | 0.00 | 0.02 | 7.7 | | 2.1 | | 0.52 | 1.2 | 0.007 | 0.28 | 1.0 | 1.1 | 0.2 |
| No. of D | | | 4 | | 0 | | 1 | | 2 | | 0 | 5 | 5 | | 3 | | 0 | 5 | 5 | 5 | 5 | 5 | 5 |

**TABLE 3-1 Continued**

| STATION | DATE | | NH3 | | NO2 | | NO3 | | PO4 | | TKN | | TP | TDS | | TSS | | BOD5 | ALK | DISS P | TOC | TIC | TC | CHLA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WA-2B | 25-May | | 0.110 | < | 0.015 | < | 0.040 | < | 0.01 | < | 0.50 | | 0.29 | 40 | | 16 | < | 1.5 | 5.0 | 0.04 | 3.7 | 3.2 | 6.9 | 11.6 |
| | 28-Jun | | 0.250 | < | 0.015 | < | 0.200 | < | 0.01 | | 1.2 | | 0.30 | 46 | | 117 | < | 2.8 | 8.0 | 0.04 | 5.4 | 8.8 | 14.2 | 0.1 |
| | 27-Jul | | 0.120 | < | 0.015 | < | 0.040 | < | 0.01 | | 0.73 | | 0.15 | 52 | | 40 | < | 2.8 | 7.2 | 0.03 | 3.9 | 4.1 | 8.0 | 1.8 |
| | 24-Aug | | 0.045 | < | 0.015 | < | 0.040 | < | 0.01 | | 1.5 | | 0.60 | 42 | | 242 | < | 1.5 | 7.9 | 0.02 | 4.6 | 2.5 | 7.0 | 1.7 |
| | 20-Sep | | 0.039 | < | 0.015 | < | 0.040 | < | 0.01 | | 1.0 | | 0.25 | 59 | | 74 | < | 2.8 | 6.1 | 0.01 | 3.9 | 3.9 | 7.8 | 0.7 |
| Mean | | | 0.113 | | 0.015 | | 0.072 | | 0.01 | | 0.99 | | 0.32 | 48 | | 98 | | 2.3 | 6.8 | 0.028 | 4.3 | 4.5 | 8.8 | 3.2 |
| Maximum | | | 0.250 | | 0.015 | | 0.200 | | 0.01 | | 1.50 | | 0.60 | 59 | | 242 | | 2.8 | 8.0 | 0.040 | 5.4 | 8.8 | 14.2 | 11.6 |
| Minimum | | | 0.039 | | 0.015 | | 0.040 | | 0.01 | | 0.50 | | 0.15 | 40 | | 16 | | 1.5 | 5.0 | 0.010 | 3.7 | 2.5 | 6.9 | 0.1 |
| Std. Dev | | | 0.085 | | 0.000 | | 0.072 | | 0.00 | | 0.39 | | 0.17 | 7.7 | | 89 | | 0.71 | 1.3 | 0.013 | 0.70 | 2.5 | 3.1 | 4.8 |
| No. of D | | | 5 | | 0 | | 0 | | 0 | | 4 | | 5 | 5 | | 5 | | 0 | 5 | 5 | 5 | 5 | 5 | 5 |
| WA-3S | 25-May | | 0.030 | < | 0.015 | | 0.079 | < | 0.01 | < | 0.5 | | 0.05 | 41 | | 4.8 | < | 2.0 | 4.8 | 0.02 | 4.0 | 1.3 | 5.3 | 2.4 |
| | 28-Jun | < | 0.030 | < | 0.015 | | 0.140 | < | 0.01 | < | 0.50 | < | 0.01 | 57 | < | 3.0 | < | 2.0 | 6.6 | 0.01 | 3.9 | 2.5 | 6.4 | 0.7 |
| | 27-Jul | | 0.049 | < | 0.015 | | 0.110 | < | 0.01 | < | 0.50 | | 0.03 | 53 | < | 3.0 | < | 2.4 | 8.5 | 0.02 | 4.7 | 3.4 | 8.1 | 1.3 |
| | 24-Aug | < | 0.030 | < | 0.015 | | 0.062 | < | 0.01 | < | 0.5 | | 0.05 | 52 | < | 3.0 | < | 1.3 | 8.7 | 0.04 | 4.2 | 3.1 | 7.3 | 0.5 |
| | 20-Sep | | 0.037 | < | 0.015 | | 0.094 | < | 0.01 | < | 5.0 | | 0.03 | 65 | < | 3.0 | < | 2.3 | 8.3 | 0.02 | 3.7 | 3.3 | 7.0 | 0.4 |
| Mean | | | 0.035 | | 0.015 | | 0.097 | | 0.01 | | 1.4 | | 0.03 | 53 | | 3.4 | | 2.0 | 7.4 | 0.022 | 4.1 | 2.7 | 6.8 | 1.1 |
| Maximum | | | 0.049 | | 0.015 | | 0.140 | | 0.01 | | 5.0 | | 0.05 | 65 | | 4.8 | | 2.4 | 8.7 | 0.040 | 4.7 | 3.4 | 8.1 | 2.4 |
| Minimum | | | 0.030 | | 0.015 | | 0.062 | | 0.01 | | 0.50 | | 0.01 | 41 | | 3.0 | | 1.3 | 4.8 | 0.010 | 3.7 | 1.3 | 5.3 | 2.4 |
| Std. Dev | | | 0.008 | | 0.000 | | 0.030 | | 0.00 | | 2.0 | | 0.02 | 8.8 | | 0.80 | | 0.43 | 1.7 | 0.011 | 0.38 | 0.87 | 1.0 | 0.8 |
| No. of D | | | 3 | | 0 | | 5 | | 0 | | 0 | | 4 | 5 | | 1 | | 0 | 5 | 5 | 5 | 5 | 5 | 5 |
| WA-4S | 25-May | < | 0.030 | < | 0.015 | | 0.095 | < | 0.01 | < | 0.50 | | 0.03 | 34 | < | 3.0 | < | 2.2 | 10.0 | 0.01 | 3.2 | 1.5 | 4.6 | 1.4 |
| | 28-Jun | | 0.034 | < | 0.015 | | 0.051 | < | 0.01 | < | 0.50 | | 0.08 | 43 | < | 3.0 | < | 2.4 | 7.9 | 0.01 | 3.9 | 3 | 6.8 | 1.2 |
| | 27-Jul | | 0.035 | < | 0.015 | < | 0.040 | < | 0.01 | < | 0.50 | | 0.03 | 50 | < | 3.0 | < | 2.6 | 11.6 | 0.02 | 3.0 | 4.3 | 7.4 | 7.4 |
| | 24-Aug | < | 0.030 | < | 0.015 | | 0.041 | < | 0.01 | < | 0.50 | | 0.04 | 48 | < | 3.0 | < | 1.6 | 13.9 | 0.03 | 2.7 | 4.2 | 6.9 | 1.1 |
| | 20-Sep | < | 0.030 | < | 0.015 | < | 0.040 | < | 0.01 | < | 5.0 | | 0.01 | 61 | < | 3.0 | < | 2.5 | 11.4 | 0.02 | 2.3 | 4.2 | 6.5 | 0.6 |
| Mean | | | 0.032 | | 0.015 | | 0.053 | | 0.01 | | 1.4 | | 0.04 | 47 | | 3.0 | | 2.3 | 11.0 | 0.018 | 3.0 | 3.4 | 6.4 | 2.3 |
| Maximum | | | 0.035 | | 0.015 | | 0.095 | | 0.01 | | 5.0 | | 0.08 | 61 | | 3.0 | | 2.6 | 13.9 | 0.030 | 3.9 | 4.3 | 7.4 | 7.4 |
| Minimum | | | 0.030 | | 0.015 | | 0.040 | | 0.01 | | 0.50 | | 0.01 | 34 | | 3.0 | | 1.6 | 7.9 | 0.010 | 2.3 | 1.5 | 4.6 | 0.6 |
| Std. Dev | | | 0.002 | | 0.000 | | 0.024 | | 0.00 | | 2.0 | | 0.03 | 10.1 | | 0.0 | | 0.40 | 2.2 | 0.008 | 0.60 | 1.2 | 1.1 | 2.8 |
| No. of D | | | 2 | | 0 | | 3 | | 0 | | 0 | | 5 | 5 | | 0 | | 0 | 5 | 5 | 5 | 5 | 5 | 5 |

**TABLE 3-1 Continued**

| STATION | DATE | | NH3 | | NO2 | | NO3 | | PO4 | | TKN | | TP | | TDS | | TSS | | BOD5 | | ALK | | DISS P | | TOC | | TIC | | TC | | CHLA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WA-5S | 25-May | | 0.032 | < | 0.015 | < | 0.040 | < | 0.01 | < | 0.50 | | 0.03 | | 32 | < | 3.0 | < | 2.0 | | 0.72 | | 0.02 | | 2.9 | < | 0.6 | | 3.4 | | 1.6 |
| | 28-Jun | < | 0.030 | < | 0.015 | | 0.077 | < | 0.01 | < | 0.50 | | 0.05 | | 54 | < | 3.0 | < | 2.0 | | 1.10 | | 0.01 | | 3.4 | | 0.76 | | 4.1 | | 0.1 |
| | 27-Jul | | 0.034 | < | 0.015 | < | 0.040 | < | 0.01 | < | 0.50 | | 0.03 | | 49 | < | 3.0 | < | 1.4 | | 0.82 | | 0.04 | | 3.0 | | 1.3 | | 4.3 | | 1.0 |
| | 24-Aug | < | 0.030 | < | 0.015 | < | 0.040 | < | 0.01 | < | 0.50 | | 0.05 | | 59 | | 3.2 | < | 1.3 | | 2.90 | | 0.03 | | 2.7 | | 1.8 | | 4.6 | | 0.0 |
| | 20-Sep | < | 0.030 | < | 0.015 | | 0.050 | < | 0.01 | < | 0.50 | | 0.02 | | 74 | < | 3.0 | < | 2.2 | | 1.30 | | 0.02 | | 1.8 | | 1.5 | | 3.3 | | 0.0 |
| Mean | | | 0.031 | | 0.015 | | 0.049 | | 0.01 | | 0.50 | | 0.04 | | 53 | | 3.0 | | 1.8 | | 1.37 | | 0.024 | | 2.8 | | 1.2 | | 3.9 | | 0.5 |
| Maximum | | | 0.034 | | 0.015 | | 0.077 | | 0.01 | | 0.50 | | 0.05 | | 74 | | 3.2 | | 2.2 | | 2.90 | | 0.040 | | 3.4 | | 1.8 | | 4.6 | | 1.6 |
| Minimum | | | 0.030 | | 0.015 | | 0.040 | | 0.01 | | 0.50 | | 0.02 | | 32 | | 3.0 | | 1.3 | | 0.72 | | 0.010 | | 1.8 | | 0.60 | | 3.3 | | 0.0 |
| Std. Dev | | | 0.002 | | 0.000 | | 0.016 | | 0.00 | | 0.00 | | 0.01 | | 15.1 | | 0.09 | | 0.40 | | 0.89 | | 0.011 | | 0.59 | | 0.50 | | 0.57 | | 0.7 |
| No. of D | | | 2 | | 0 | | 2 | | 0 | | 0 | | 5 | | 5 | | 1 | | 0 | | 5 | | 5 | | 5 | | 4 | | 5 | | 5 |
| WA-6S | 25-May | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 28-Jun | | 0.060 | < | 0.015 | | 0.055 | < | 0.01 | < | 0.50 | | 0.03 | | 46 | < | 3.0 | < | 2.3 | | 3.7 | | 0.02 | | 4.4 | | 2.4 | | 6.8 | | 1.1 |
| | 27-Jul | | 0.046 | < | 0.015 | < | 0.040 | < | 0.01 | < | 0.50 | | 0.03 | | 42 | < | 3.0 | < | 1.3 | | 5.9 | | 0.03 | | 3.5 | | 2.7 | | 6.2 | | 1.3 |
| | 24-Aug | < | 0.030 | < | 0.015 | < | 0.040 | < | 0.01 | < | 0.50 | | 0.03 | | 45 | | 3.2 | < | 1.2 | | 6.7 | | 0.01 | | 3.5 | | 2.8 | | 6.3 | | 2.3 |
| | 20-Sep | < | 0.030 | < | 0.015 | < | 0.040 | < | 0.01 | < | 0.50 | | 0.01 | | 53 | < | 3.0 | | 2.9 | | 7.4 | | 0.01 | | 2.9 | | 2.7 | | 5.6 | | 4.1 |
| Mean | | | 0.042 | | 0.015 | | 0.044 | | 0.01 | | 0.50 | | 0.03 | | 46 | | 3.1 | | 1.9 | | 5.9 | | 0.018 | | 3.6 | | 2.7 | | 6.2 | | 2.2 |
| Maximum | | | 0.060 | | 0.015 | | 0.055 | | 0.01 | | 0.50 | | 0.03 | | 53 | | 3.2 | | 2.9 | | 7.4 | | 0.030 | | 4.4 | | 2.8 | | 6.8 | | 4.1 |
| Minimum | | | 0.030 | | 0.015 | | 0.040 | | 0.01 | | 0.50 | | 0.01 | | 42 | | 3.0 | | 1.2 | | 3.7 | | 0.010 | | 2.9 | | 2.4 | | 5.6 | | 1.1 |
| Std. Dev | | | 0.014 | | 0.000 | | 0.007 | | 0.00 | | 0.00 | | 0.01 | | 4.7 | | 0.10 | | 0.82 | | 1.6 | | 0.010 | | 0.6 | | 0.2 | | 0.5 | | 1.4 |
| No. of D | | | 2 | | 0 | | 1 | | 0 | | 0 | | 4 | | 4 | | 1 | | 1 | | 4 | | 4 | | 4 | | 4 | | 4 | | 4 |
| WA-6M | 25-May | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 28-Jun | | 0.061 | < | 0.015 | < | 0.040 | < | 0.01 | < | 0.50 | | 0.04 | | 49 | < | 3.0 | < | 1.6 | | 5.1 | | 0.03 | | 4.1 | | 2.2 | | 6.3 | | 0.7 |
| | 27-Jul | | 0.041 | < | 0.015 | < | 0.040 | < | 0.01 | < | 0.50 | | 0.04 | | 41 | | 3.2 | < | 1.2 | | 5.9 | | 0.02 | | 3.5 | | 3.1 | | 6.6 | | 1.8 |
| | 24-Aug | | 0.033 | < | 0.015 | < | 0.040 | < | 0.01 | < | 0.50 | | 0.06 | | 48 | | 8.4 | < | 1.4 | | 6.6 | | 0.03 | | 3.5 | | 3.1 | | 6.6 | | 3.5 |
| | 20-Sep | < | 0.030 | < | 0.015 | < | 0.040 | < | 0.01 | < | 0.50 | | 0.04 | | 48 | | 4.8 | < | 2.5 | | 7.2 | | 0.02 | | 2.7 | | 3 | | 5.7 | | 11.8 |
| Mean | | | 0.041 | | 0.015 | | 0.040 | | 0.01 | | 0.50 | | 0.05 | | 46 | | 4.9 | | 1.7 | | 6.2 | | 0.025 | | 3.5 | | 2.9 | | 6.3 | | 4.5 |
| Maximum | | | 0.061 | | 0.015 | | 0.040 | | 0.01 | | 0.50 | | 0.06 | | 49 | | 8.4 | | 2.5 | | 7.2 | | 0.030 | | 4.1 | | 3.1 | | 6.6 | | 11.8 |
| Minimum | | | 0.030 | | 0.015 | | 0.040 | | 0.01 | | 0.50 | | 0.04 | | 41 | | 3.0 | | 1.2 | | 5.1 | | 0.020 | | 2.7 | | 2.2 | | 5.7 | | 0.7 |
| Std. Dev | | | 0.014 | | 0.000 | | 0.000 | | 0.00 | | 0.00 | | 0.01 | | 3.5 | | 2.5 | | 0.57 | | 0.91 | | 0.006 | | 0.6 | | 0.4 | | 0.4 | | 5.0 |
| No. of D | | | 3 | | 0 | | 0 | | 0 | | 0 | | 4 | | 4 | | 3 | | 0 | | 4 | | 4 | | 4 | | 4 | | 4 | | 4 |

**TABLE 3-1 Continued**

| STATION | DATE | | NH3 | | NO2 | | NO3 | | PO4 | | TKN | | TP | | TDS | | TSS | | BOD5 | | ALK | | DISS P | | TOC | | TIC | | TC | | CHLA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WA-6B | 25-May | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 28-Jun | | 0.120 | < | 0.015 | | 0.053 | < | 0.01 | < | 0.50 | | 0.12 | | 54 | | 31.6 | < | 1.9 | | 5.8 | | 0.03 | | 4.1 | | 3.3 | | 7.5 | | 0.8 |
| | 27-Jul | | 0.060 | < | 0.015 | < | 0.040 | < | 0.01 | < | 0.50 | | 0.07 | | 39 | | 18.0 | < | 1.2 | | 5.9 | | 0.04 | | 3.4 | | 3.4 | | 6.8 | | 0.9 |
| | 24-Aug | | 0.032 | < | 0.015 | < | 0.040 | < | 0.01 | < | 0.50 | | 0.05 | | 47 | | 10.8 | < | 1.3 | | 7.3 | | 0.03 | | 3.7 | | 2.9 | | 6.6 | | 1.6 |
| | 20-Sep | | 0.048 | < | 0.015 | < | 0.040 | < | 0.01 | < | 0.50 | | 0.09 | | 45 | | 24.0 | < | 2.5 | | 6.6 | | 0.02 | | 2.8 | | 3.2 | | 6.0 | | 0.8 |
| Mean | | | 0.065 | | 0.015 | | 0.043 | | 0.01 | | 0.50 | | 0.08 | | 46 | | 21.1 | | 1.7 | | 6.4 | | 0.030 | | 3.5 | | 3.2 | | 6.7 | | 1.0 |
| Maximum | | | 0.120 | | 0.015 | | 0.053 | | 0.01 | | 0.50 | | 0.12 | | 54 | | 31.6 | | 2.5 | | 7.3 | | 0.040 | | 4.1 | | 3.4 | | 7.5 | | 1.6 |
| Minimum | | | 0.032 | | 0.015 | | 0.040 | | 0.01 | | 0.50 | | 0.05 | | 39 | | 10.8 | | 1.2 | | 5.8 | | 0.020 | | 2.8 | | 2.9 | | 6.0 | | 0.8 |
| Std. Dev | | | 0.038 | | 0.000 | | 0.007 | | 0.00 | | 0.00 | | 0.03 | | 6.4 | | 8.8 | | 0.60 | | 0.70 | | 0.008 | | 0.5 | | 0.2 | | 0.6 | | 0.4 |
| No. of D | | | 4 | | 0 | | 1 | | 0 | | 0 | | 4 | | 4 | | 4 | | 0 | | 4 | | 4 | | 4 | | 4 | | 4 | | 4 |
| WA-7S | 25-May | | 0.030 | < | 0.015 | < | 0.040 | < | 0.01 | < | 0.50 | | 0.02 | | 30 | < | 3.0 | < | 2.0 | | 4.0 | | 0.02 | | 3.4 | | 1.4 | | 4.8 | | 2.5 |
| | 28-Jun | | 0.063 | < | 0.015 | | 0.066 | < | 0.01 | < | 0.50 | | 0.04 | | 61 | | 3.2 | < | 2.0 | | 5.4 | < | 0.01 | | 4.2 | | 2.4 | | 6.6 | | 1.0 |
| | 27-Jul | | 0.042 | < | 0.015 | < | 0.040 | < | 0.01 | < | 0.50 | | 0.03 | | 37 | < | 3.0 | < | 1.5 | | 6.7 | | 0.03 | | 3.7 | | 2.9 | | 6.6 | | 1.0 |
| | 24-Aug | | 0.033 | < | 0.015 | < | 0.040 | < | 0.01 | < | 0.50 | | 0.03 | | 45 | < | 3.0 | < | 1.7 | | 6.9 | | 0.03 | | 3.6 | | 3 | | 6.6 | | 1.5 |
| | 20-Sep | < | 0.030 | < | 0.015 | < | 0.040 | < | 0.01 | < | 0.50 | | 0.05 | | 50 | | 3.6 | | 2.7 | | 7.9 | < | 0.01 | | 2.9 | | 3 | | 6.0 | | 4.8 |
| Mean | | | 0.040 | | 0.015 | | 0.045 | | 0.01 | | 0.50 | | 0.03 | | 44 | | 3.2 | | 2.0 | | 6.2 | | 0.010 | | 3.6 | | 2.5 | | 6.1 | | 2.2 |
| Maximum | | | 0.063 | | 0.015 | | 0.066 | | 0.01 | | 0.50 | | 0.05 | | 61 | | 3.6 | | 2.7 | | 7.9 | | 0.010 | | 4.2 | | 3.0 | | 6.6 | | 4.8 |
| Minimum | | | 0.030 | | 0.015 | | 0.040 | | 0.01 | | 0.50 | | 0.02 | | 30 | | 3.0 | | 1.5 | | 4.0 | | 0.010 | | 2.9 | | 1.4 | | 4.8 | | 1.0 |
| Std. Dev | | | 0.014 | | 0.000 | | 0.012 | | 0.00 | | 0.00 | | 0.01 | | 11.9 | | 0.26 | | 0.5 | | 1.51 | | 0.000 | | 0.5 | | 0.7 | | 0.8 | | 1.6 |
| No. of D | | | 4 | | 0 | | 1 | | 0 | | 0 | | 5 | | 5 | | 2 | | 1 | | 5 | | 3 | | 5 | | 5 | | 5 | | 5 |
| WA-7M | 25-May | | 0.03 | < | 0.015 | < | 0.040 | | 0.012 | < | 0.50 | | 0.02 | | 31 | < | 3.0 | < | 1.8 | | 4.7 | | 0.03 | | 3.4 | | 1.3 | | 4.6 | | 0.9 |
| | 28-Jun | | 0.072 | < | 0.015 | | 0.067 | < | 0.01 | < | 0.50 | | 0.05 | | 47 | < | 3.0 | < | 1.8 | | 5.4 | | 0.01 | | 4.2 | | 2.7 | | 6.9 | | 0.6 |
| | 27-Jul | | 0.042 | < | 0.015 | < | 0.040 | < | 0.01 | < | 0.50 | | 0.06 | | 46 | | 5.2 | < | 1.2 | | 26.9 | | 0.02 | | 3.6 | | 3.3 | | 6.9 | | 1.1 |
| | 24-Aug | | 0.034 | < | 0.015 | < | 0.040 | < | 0.01 | < | 0.50 | | 0.04 | | 46 | < | 3.0 | < | 2.0 | | 7.0 | | 0.23 | | 3.6 | | 3.1 | | 6.7 | | 4.4 |
| | 20-Sep | < | 0.030 | < | 0.015 | < | 0.040 | < | 0.01 | < | 0.50 | | 0.02 | | 46 | | 4.0 | < | 2.8 | | 7.4 | < | 0.01 | | 2.9 | | 3.1 | | 6.0 | | 4.1 |
| Mean | | | 0.042 | | 0.015 | | 0.045 | | 0.01 | | 0.50 | | 0.04 | | 43 | | 3.6 | | 1.9 | | 10.3 | | 0.060 | | 3.5 | | 2.7 | | 6.2 | | 2.2 |
| Maximum | | | 0.072 | | 0.015 | | 0.067 | | 0.01 | | 0.50 | | 0.06 | | 47 | | 5.2 | | 2.8 | | 26.9 | | 0.230 | | 4.2 | | 3.3 | | 6.9 | | 4.4 |
| Minimum | | | 0.030 | | 0.015 | | 0.040 | | 0.01 | | 0.50 | | 0.02 | | 31 | | 3.0 | | 1.2 | | 4.7 | | 0.010 | | 2.9 | | 1.3 | | 4.6 | | 0.6 |
| Std. Dev | | | 0.017 | | 0.000 | | 0.012 | | 0.00 | | 0.00 | | 0.02 | | 6.7 | | 1.0 | | 0.6 | | 9.4 | | 0.095 | | 0.5 | | 0.8 | | 1.0 | | 1.9 |
| No. of D | | | 4 | | 0 | | 1 | | 1 | | 0 | | 5 | | 5 | | 2 | | 0 | | 5 | | 4 | | 5 | | 5 | | 5 | | 5 |

**TABLE 3-1 Continued**

| STATION | DATE | | NH3 | | NO2 | | NO3 | | PO4 | | TKN | T P | TDS | TSS | | BOD5 | ALK | DISS P | TOC | TIC | T C | CHLA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| W A - 7 B | 25-May | | 0.140 | < | 0.015 | < | 0.040 | < | 0.01 | | 0.87 | 0.14 | 4 1 | 212 | | 3 . 1 | 6.1 | 0 . 0 2 | 4.9 | 4.2 | 9.0 | 1 . 6 |
| | 28-Jun | | 0.150 | < | 0.015 | | 0.048 | < | 0.01 | | 0.52 | 0.10 | 5 2 | 10.0 | < | 1 . 6 | 7.7 | 0 . 0 4 | 4.1 | 4.7 | 8.8 | 1 . 2 |
| | 27-Jul | | 0.160 | < | 0.015 | < | 0.040 | < | 0.01 | | 0.95 | 0.28 | 4 1 | 61.2 | < | 1 . 6 | 8.5 | 0 . 0 4 | 4.2 | 4.1 | 8.3 | 1 . 4 |
| | 24-Aug | | 0.037 | < | 0.015 | < | 0.040 | < | 0.01 | < | 0.50 | 0.06 | 4 6 | 6.4 | < | 1 . 4 | 7.3 | 0 . 0 9 | 3.7 | 3 | 6.7 | 1 . 6 |
| | 20-Sep | < | 0.030 | < | 0.015 | < | 0.040 | < | 0.01 | < | 0.50 | 0.05 | 5 6 | 10.0 | < | 2 . 4 | 8.8 | 0 . 0 1 | 2.7 | 3.5 | 6.2 | 2 . 4 |
| M e a n | | | 0.103 | | 0.015 | | 0.042 | | 0.01 | | 0.67 | 0.13 | 4 7 | 59.9 | | 2 . 0 | 7.7 | 0.040 | 3.9 | 3.9 | 7.8 | 1 . 6 |
| Maximum | | | 0.160 | | 0.015 | | 0.048 | | 0.01 | | 0.95 | 0.28 | 5 6 | 212 | | 3 . 1 | 8.8 | 0.090 | 4.9 | 4.7 | 9.0 | 2 . 4 |
| Minimum | | | 0.030 | | 0.015 | | 0.040 | | 0.01 | | 0.50 | 0.05 | 4 1 | 6.4 | | 1 . 4 | 6.1 | 0.010 | 2.7 | 3.0 | 6.2 | 1 . 2 |
| Std. Dev | | | 0.064 | | 0.000 | | 0.004 | | 0.00 | | 0.22 | 0.09 | 6.6 | 88.0 | | 0.72 | 1.1 | 0.031 | 0.8 | 0.7 | 1.3 | 0 . 5 |
| No. of D | | | 4 | | 0 | | 1 | | 0 | | 3 | 5 | 5 | 5 | | 1 | 5 | 5 | 5 | 5 | 5 | 5 |

### 3.2.1 Ammonia

Ammonia in the water column of F.E. Walter Reservoir was consistently low throughout the monitoring period. Measures of ammonia did not exceed 0.25 mg/L and ranged to less than the detection limit of 0.03-mg/L. (Table 3-1).

F.E. Walter Reservoir was in compliance with the PADEP water quality standard for ammonia during 2005. The water quality standard of ammonia is dependent on temperature and pH (Table 3-2). Throughout the monitoring period, all measures of ammonia were less than their respective criteria values.

Table 3-2. PADEP ammonia nitrogen criteria (Pennsylvania Code, Title 25 1984). Specific ammonia criteria dependent on temperature and pH.

| PH | 0 °C | 5 °C | 10 °C | 15 °C | 20 °C | 25 °C | 30 °C |
|---|---|---|---|---|---|---|---|
| 6.50 | 25.5 | 25.5 | 25.5 | 17.4 | 12.0 | 8.4 | 5.9 |
| 6.75 | 23.6 | 23.6 | 23.6 | 16.0 | 11.1 | 7.7 | 5.5 |
| 7.00 | 20.6 | 20.6 | 20.6 | 14.0 | 9.7 | 6.8 | 4.8 |
| 7.25 | 16.7 | 16.7 | 16.7 | 11.4 | 7.8 | 5.5 | 3.9 |
| 7.50 | 12.4 | 12.4 | 12.4 | 8.5 | 5.9 | 4.1 | 2.9 |
| 7.75 | 8.5 | 8.5 | 8.5 | 5.8 | 4.0 | 2.8 | 2.0 |
| 8.00 | 5.5 | 5.5 | 5.5 | 5.8 | 4.0 | 2.8 | 2.0 |
| 8.25 | 3.4 | 3.4 | 3.4 | 2.3 | 1.6 | 1.2 | 0.9 |
| 8.50 | 2.0 | 2.0 | 2.0 | 1.4 | 1.0 | 0.7 | 0.6 |
| 8.75 | 1.2 | 1.2 | 1.2 | 0.9 | 0.6 | 0.5 | 0.4 |
| 9.00 | 0.8 | 0.8 | 0.8 | 0.5 | 0.4 | 0.3 | 0.3 |

### 3.2.2 Nitrite and Nitrate

Concentrations of nitrite in the water column of F.E. Walter Reservoir were consistently low during 2005. Concentrations of nitrite measured at all stations and all depths were less than method detection limits (0.015-mg/L) throughout the monitoring period (Table 3-1).

Nitrate was distributed uniformly in the water column of F.E. Walter Reservoir during 2005. At most stations and depths, concentrations ranged from less than the method detection limit (0.04 mg/L) to 0.20 mg/L..

In 2005, F.E. Walter Reservoir was in compliance with the PADEP water quality standard for nitrogen. The water quality standard for nitrogen is a summed concentration of nitrite and nitrate of less than 10-mg/L. Throughout the monitoring period, the summed concentrations for each station were well below this standard with a maximum summed concentration of 0.215 mg/L.

### 3.2.3 Total Kjeldahl Nitrogen

Total Kjeldahl nitrogen (TKN) is a measure of organic nitrogen that includes ammonia. TKN in the water column of F.E. Walter Reservoir was generally low during 2005 (Table 3-1). Concentrations measured at all reservoir stations were below the detection limit of 0.50 mg/L except in bottom water samples of in-lake stations WA-2 and WA-7. The highest concentration measured was 1.5 mg/L on 24 August in the bottom waters of station WA-2.

### 3.2.4 Dissolved Phosphate

Dissolved phosphate in the water column of F.E. Walter Reservoir was consistently low during 2005. Concentrations measured at nearly all stations and depths were below the detection limit of 0.01 mg/L throughout the monitoring period (Table 3-1). The highest concentration of dissolved phosphate (0.018 mg/L) was measured in the middle depth waters of the reservoir at Station WA-2 on 24 August. In freshwater environments, dissolved phosphate is usually a limiting nutrient and is readily taken up by freshwater plants and algae.

### 3.2.5 Dissolved Phosphorus

In 2005, concentrations of dissolved phosphate were generally at or below the detection limit of 0.01 mg/L with most stations and depths ranging from 0.01 mg/L up to 0.04 mg/L throughout the sampling season (Table 3-1). The highest concentration of 0.23 mg/L was recorded on 24 August in the middle depth waters of station WA-7

### 3.2.6 Total Phosphorus

Concentrations of total phosphorus were fairly uniform at all the reservoir surface water stations (Table 3-1). An increase in concentrations was seen as samples were taken from deeper in the water column. The highest concentrations were seen in the reservoir bottom water samples. This may have resulted from phosphorus sediment release during low oxygen conditions. The highest concentration of 0.60 mg/L was seen in the 24 August bottom water sample at station WA-2. EPA guidance for nutrient criteria in lakes and reservoirs suggests a maximum concentration for total phosphorus of 0.01-mg/L (EPA 2000). Lakes and reservoirs exceeding this concentration are more likely to experience algal bloom problems during the growing season. All but five samples taken during the sampling season exceeded the EPA guideline.

### 3.2.7 Total Dissolved Solids

Total dissolved solids (TDS) in the lake and tributary stations of F.E. Walter Reservoir remained relatively constant during 2005. Concentrations at all stations and depths averaged 47-mg/L over the monitoring period while ranging from 29 to 74 mg/L (Table 3-1). Average concentrations were highest at upstream surface tributary stations WA-3 and WA-4 at 53 mg/L and 53 mg/L, respectively. F.E. Walter Reservoir and its tributaries were in compliance with the PADEP water quality standard for total dissolved solids during 2005. The water quality standard is a maximum concentration of 500-mg/L.

### 3.2.8 Total Suspended Solids

Total suspended solids (TSS) in the water column of F.E. Walter Reservoir were consistently low in 2005 with many samples less then the detection limit of 0.3 mg/L. Overall concentrations at all stations and depths ranged from less than the detection limit to an isolated 242 mg/L concentration (Table 3-1). Isolated high levels of suspended solids were detected only in the bottom water samples of in-lake stations. This is likely due to contamination of sediment in the sampling apparatus.

### 3.2.9 Biochemical Oxygen Demand

Measurements of 5-day Biochemical oxygen demand (BOD) in F.E. Walter Reservoir and tributary stations ranged from 0.75 mg/L to 3.1 mg/L (Table 3-1). On 25 May, the bottom water sample at Station WA-7 measured 3.1 mg/L and was the only sample to exceed 3.0 mg/L for the sampling season.

### 3.2.10 Alkalinity

Alkalinity measurements in the waters of F.E. Walter Reservoir were routinely low during 2005. Concentrations measured at all stations and depths averaged 6.9 mg/L throughout the monitoring period (Table 3-1). The greatest concentration of 26.9 mg/L was measured on 27 July in the middle depths of the reservoir at station WA-7. The lowest measurement was 0.72 mg/L, measured on 25 May at upstream station WA-5. Alkalinity is a measure of the acid-neutralizing capacity of water. The PADEP standard is a minimum concentration of 20-mg/L $CaCO_3$ except where natural conditions are less. The natural alkalinity of water is largely dependent on the underlying geology and soils within the surrounding watershed. The low alkalinity measured at F.E. Walter Reservoir probably results from the regional geology, which is primarily sandstone and shale (Van Diver 1990).

### 3.2.11 Total Inorganic and Organic Carbon

Total inorganic carbon (TIC) and total organic carbon (TOC) were measured in the water column and tributaries of F.E. Walter Reservoir (Table 3-1). Concentrations of TIC at all stations and depths ranged from 8.8 mg/L to less than the method detection limit of 0.6 mg/L. Additionally, concentrations of TOC at all stations and depths ranged from 5.4 mg/L to 1.8 mg/L. The highest single measured concentration was in the bottom waters of station WA-2 on 28 June. The highest average concentration of 4.3 mg/L was also in the bottom waters at station WA-2. Total carbon is the sum of TIC and TOC. Total carbon in the waters of F.E. Walter Reservoir at all stations and depths ranged from 3.3 mg/L to 14.2 mg/L. The highest single measured concentration of 14.2 mg/L was in the bottom waters of station WA-2 on 28 June.

### 3.2.12 Chlorophyll *a*

For the most part, chlorophyll *a* was low in the waters of F.E. Walter Reservoir during 2005 (Table 3-1). Concentrations at all stations and depths ranged from 0.0 ug/L to 11.8 ug/L throughout the monitoring season. The highest average concentration of 4.5 ug/L was measured in the bottom waters of station WA-6. The highest single measured concentration of 11.6 ug/L was taken from stations WA-2 and WA-6 on 25 May.

## 3.3 TROPHIC STATE DETERMINATION

Carlson's (1977) trophic state index (TSI) is a method of expressing the extent of eutrophication of a lake, quantitatively. The trophic state analysis calculates separate indices for eutrophication based on measures of total phosphorus, chlorophyll *a*, and secchi disc depth. Index values for each parameter range on the same scale from 0 (least enriched) to 100 (most enriched). The resulting indices can also be compared to qualitative threshold values that correspond to levels of eutrophication. Classification of F.E. Walter Reservoir was based on a single sample each month during the sampling season. It is important to note that variability in measurements not captured between samples and the resulting classification can occur. Figure 3-9 graphically shows this potential variability between samples.

TSIs calculated for measures of Total Phosphorus classified F.E. Walter Reservoir as Oligotrophic in May, July, and September with TSI values of 24.1, 37.4, and 37.4 respectively. TSIs calculated for measures of Total Phosphorus increased in June and August to 49.3 and 53.2 respectively. This would classify the reservoir as eutrophic during these months.

TSIs calculated for measures of secchi disk depth classified F.E. Walter Reservoir as mesotrophic throughout the sampling season with values ranging from 45.7 to 50.

TSIs calculated for measures of chlorophyll *a* classified F.E. Walter Reservoir as mesotrophic in May, August, and September with TSI values of 40, 40.7, and 47.5 respectively. F.E. Walter Reservoir was oligotrophic in June and July with TSI values of 33.2 and 35.8 respectively.

Carlson (1977) warned against averaging TSI values estimated for different parameters, and instead suggested giving priority to chlorophyll a during the summer and to phosphorus in the spring, fall, and winter. With this in mind, and based on the pattern of TSI values for secchi disk depth, chlorophyll a and Total Phosphorus, F.E. Walter Reservoir was oligotrophic/mesotrophic during 2005.

The EPA (1983) also provides criteria for classifying the trophic conditions of lakes of the North Temperate Zone based on concentrations of total phosphorus, chlorophyll *a*, and secchi disk depth (Table 3-3). Taking into account the general agreement between the EPA classifications with that of the TSIs, the trophic condition of F.E. Walter Reservoir was mesotrophic/oligotrophic.

Table 3-3. EPA trophic classification criteria and average monthly measures for F.E. Walter Reservoir in 2005

| Water Quality Variable | Oligo-trophic | Meso-trophic | Eutrophic | 15 May | 10 June | 16 July | 13 August | 24 September |
|---|---|---|---|---|---|---|---|---|
| Total phos. (ppb) | <10 | 10-20 | >20 | 40 | 30 | 10 | 30 | 10 |
| Chlorophyll a (ppb) | <4 | 4-10 | >10 | 2.6 | 1.3 | 1.7 | 2.8 | 5.6 |
| Secchi depth (m) | >4 | 2-4 | <2 | 2.3 | 2.1 | 2.0 | 2.1 | 2.7 |

NM = not measured

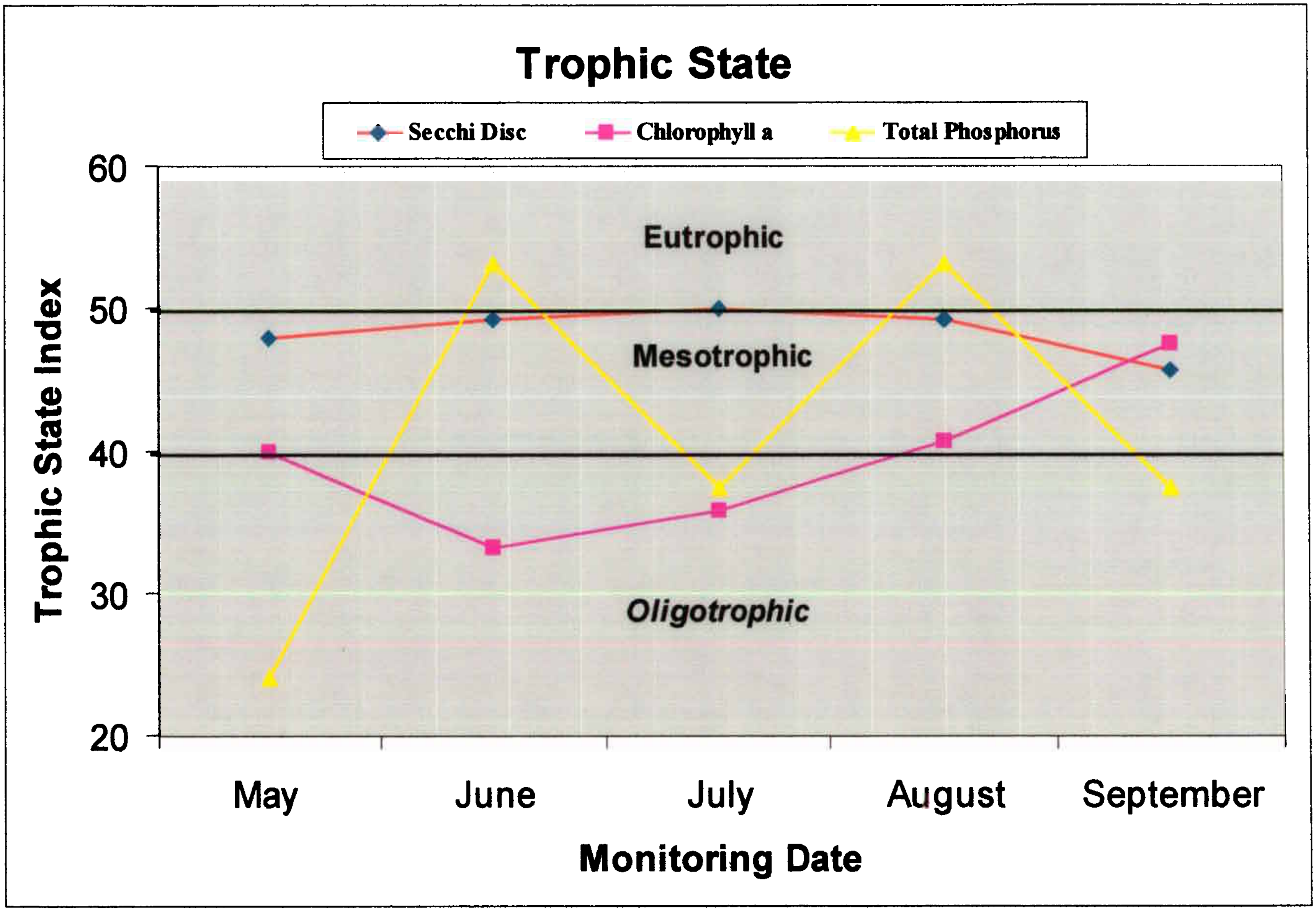


Figure 3-9. Carlson Trophic state indices calculated from secchi disk depth, concentrations of chlorophyll a and Total Phosphorus measured in surface waters of F.E. Walter Reservoir at Station WA-2 during 2005.

## 3.4 RESERVOIR BACTERIA MONITORING

Two forms of coliform bacteria contamination were monitored at F.E. Walter Reservoir during 2005 including total and fecal coliform (Table 3-4). Total coliform includes *Escherica coli* (*E. coli*) and related bacteria that are associated with fecal discharges. Fecal coliform bacteria are a subgroup of the total coliform and are normally associated with waste derived from human and other warm-blooded animals. Total coliform contamination was high at F.E. Walter Reservoir during 2005. Total coliform measures ranged from less then the detection limit of 2 to greater then 2400-clns/100-ml. All of the stations had high coliform counts during the 27 July and 24 August sampling events. Fecal coliform contamination at F.E. Walter Reservoir during 2005 ranged from less than the detection limit of 2 to 220-clns/100-ml throughout the monitoring period.

Coliform bacteria contamination was for the most part low at F.E. Walter Reservoir with respect to PADEP water quality standards throughout the monitoring period. Fecal coliform exceeded 200 colonies/100-ml only at station WA-7 on 27 July. For waters with contact recreation, the water quality standard for bacteria contamination is a geometric mean among fecal coliform samples less than 200 colonies/100-ml. At no point did the geometric means approach the PADEP standard. Water contact recreation is not permitted at F.E. Walter Reservoir.

Table 3-4. Bacteria counts (colonies/100 ml) at F.E. Walter Reservoir surface stations during 2005.

| STATION | DATE | Total Coliform (TC) | Fecal Coliform (FC) |
|---|---|---|---|
| WA-1S | 25-May | 180 | < 2 |
| | 28-Jun | 12 | 8 |
| | 27-Jul | 1700 | 8 |
| | 24-Aug | > 2400 | 4 |
| | 20-Sep | > 2400 | 4 |
| WA-2S | 25-May | 36 | 2 |
| | 28-Jun | 2 | < 2 |
| | 27-Jul | 260 | 2 |
| | 24-Aug | > 2400 | 2 |
| | 20-Sep | 260 | 10 |
| WA-3S | 25-May | 960 | 2 |
| | 28-Jun | 90 | 6 |
| | 27-Jul | > 2400 | 48 |
| | 24-Aug | > 2400 | 4 |
| | 20-Sep | 2400 | 40 |
| WA-4S | 25-May | 1700 | 20 |
| | 28-Jun | >Error | 78 |
| | 27-Jul | 1700 | 54 |
| | 24-Aug | 2400 | 20 |
| | 20-Sep | 2400 | 30 |
| WA-5S | 25-May | 2000 | 14 |
| | 28-Jun | 57 | 32 |
| | 27-Jul | >2400 | 52 |
| | 24-Aug | >2400 | 8 |
| | 20-Sep | 520 | 28 |
| WA-6S | Error | Error | Error |
| | 28-Jun | 4 | <2 |
| | 27-Jul | 290 | 14 |
| | 24-Aug | > 2400 | 2 |
| | 20-Sep | 200 | 30 |
| WA-7S | 25-May | 50 | < 2 |
| | 28-Jun | <2 | < 2 |
| | 27-Jul | 1600 | 220 |
| | 24-Aug | > 2400 | 4 |
| | 20-Sep | 220 | < 2 |

## 3.5 SEDIMENT PRIORITY POLLUTANT MONITORING

Sediment samples were collected at stations WA-2 and analyzed for priority pollutant contaminants, Group 2 – metals and acid/base neutral extractables. Resulting concentrations were compared to New Jersey Soil Cleanup Criteria (NJDEP 1999). The NJDEP criteria are human health based with categories addressing residential and non-residential settings, and impacts to groundwater. For comparison, the most conservative of the three criteria was reported.

A total of 14 metals were analyzed in F.E. Walter Reservoir sediments (Table 3-5). Thallium (6.87 mg/L) was the only metal measured at concentrations that exceeded USACE screening levels of 2 mg/L. A total of 57 acid/base neutral extractables were analyzed in F.E. Walter Reservoir sediments (Table 3-5). Five of the compounds were detected in the sediment samples for station WA-2, but none exceeded the New Jersey soil cleanup screening criteria.

Table 3-5. Metal and acid/base neutral extractables (Group 2) concentrations measured in sediments of F.E. Walter Reservoir on 27 July 2005.

| | Station Core Section | WA-2 | (mg/kg) New Jersey Residential SCC | (mg/kg) New Jersey Non-Residential SCC |
|---|---|---|---|---|
| **Metals** | | | | |
| Antimony | mg/kg | 2.14 | 14 | 340 |
| Arsenic | mg/kg | 7.88 | 20 | 20 |
| Beryllium | mg/kg | 1.47 | 2 | 2 |
| Cadmium | mg/kg | 2.6 | 39 | 100 |
| Chromium | mg/kg | 16.5 | 240 [b] 270 [c] | 6100 [b] 20 [c] |
| Copper | mg/kg | 17.8 | 600 | 600 |
| Lead | mg/kg | 46.4 | 400 | 600 |
| Mercury | mg/kg | 0.0765 | 14 | 270 |
| Nickel | mg/kg | 23.4 | 250 | 2,400 |
| Selenium | mg/kg | 2.5 | 63 | 3,100 |
| Silver | mg/kg | 0.495 | 110 | 4,100 |
| Thallium | mg/kg | 3.65 | 2 | 2 |
| Zinc | mg/kg | 256 | 1,500 | 1,500 |
| Iron | mg/kg | 22700 | None | None |

Table 3-5. (Continued)

| | Station Core Section | WA-2 | New Jersey Residential SCC | New Jersey Non-Residential SCC |
|---|---|---|---|---|
| **Acid/Base Neutral Extractables** | | | | |
| 1,2,4-Trichlorobenzene | ug/kg | < 89 | 68,000 | 1,200,000 |
| 1,2-Dichlorobenzene | ug/kg | < 89 | 5,100,000 | 10,000,000 |
| 1,2-Diphenylhydrazine | ug/kg | < 89 | | |
| 1,3-Dichlorobenzene | ug/kg | < 89 | 5,100,000 | 10,000,000 |
| 1,4-Dichlorobenzene | ug/kg | < 89 | 570,000 | 10,000,000 |
| 2,4,6-Trichlorophenol | ug/kg | < 89 | 62,000 | 270,000 |
| 2,4-Dichlorophenol | ug/kg | < 89 | 170,000 | 3,100,000 |
| 2,4-Dimethylphenol | ug/kg | < 270 | 1,100,000 | 10,000,000 |
| 2,4-Dinitrophenol | ug/kg | < 1800 | 110,000 | 2,100,000 |
| 2,4-Dinitrotoluene | ug/kg | < 180 | 1,000 | 4,000 |
| 2,6-Dinitrotoluene | ug/kg | < 89 | | |
| 2-Chloronaphthalene | ug/kg | < 89 | | |
| 2-Chlorophenol | ug/kg | < 89 | 280,000 | 5,200,000 |
| 2-Nitrophenol | ug/kg | < 89 | | |
| 3,3'-Dichlorobenzidine | ug/kg | < 270 | 2,000 | 6,000 |
| 4,6-Dinitro-2-methylphenol | ug/kg | < 440 | | |
| 4-Bromophenyl-phenylether | ug/kg | < 89 | | |
| 4-Chloro-3-methylphenol | ug/kg | < 180 | 10,000,000 | 10,000,000 |
| 4-Chlorophenyl-phenylether | ug/kg | < 89 | | |
| 4-Nitrophenol | ug/kg | < 440 | | |
| Acenaphthene | ug/kg | < 89 | 3,400,000 | 10,000,000 |
| Acenaphthylene | ug/kg | < 89 | | |
| Anthracene | ug/kg | < 89 | 10,000,000 | 10,000,000 |
| Benzidine | ug/kg | < 1800 | | |
| Benzo(a)anthracene | ug/kg | < 89 | 900 | 4,000 |
| **Benzo(a)pyrene** | ug/kg | 100 | 660 | 660 |
| **Benzo(b)fluoranthene** | ug/kg | 120 | 900 | 4,000 |
| Benzo(g,h,I)perylene | ug/kg | < 89 | | |

| Table 3-5. (Continued) | | | | |
|---|---|---|---|---|
| | **Station Core Section** | **WA-2** | **New Jersey Residential SCC** | **New Jersey Non-Residential SCC** |
| Benzo(k)fluoranthene | ug/kg | < 89 | 900 | 4,000 |
| bis(2-Chloroethoxy)methane | ug/kg | < 89 | | |
| bis(2-Chloroethyl)ether | ug/kg | < 89 | 660 | 3,000 |
| bis(2-Chloroisopropyl)ether | ug/kg | < 89 | | |
| bis(2-Ethylhexyl)phthalate | ug/kg | < 360 | 49,000 | 210,000 |
| Butylbenzylphthalate | ug/kg | < 180 | 1,100,000 | 10,000,000 |
| **Chrysene** | ug/kg | 91 | 9,000 | 40,000 |
| Dibenz(a,h)anthracene | ug/kg | < 89 | 660 | 660 |
| Diethylphthalate | ug/kg | < 180 | 10,000,000 | 10,000,000 |
| Dimethylphthalate | ug/kg | < 180 | 10,000,000 | 10,000,000 |
| Di-n-butylphthalate | ug/kg | < 180 | 5,700,000 | 10,000,000 |
| Di-n-octylphthalate | ug/kg | < 180 | 1,100,000 | 10,000,000 |
| **Fluoranthene** | ug/kg | 150 | 2,300,000 | 10,000,000 |
| Fluorene | ug/kg | < 89 | 2,300,000 | 10,000,000 |
| Hexachlorobenzene | ug/kg | < 89 | 660 | 2,000 |
| Hexachlorobutadiene | ug/kg | < 180 | 1,000 | 21,000 |
| Hexachlorocyclopentadiene | ug/kg | < 440 | 400,000 | 7,300,000 |
| Hexachloroethane | ug/kg | < 89 | 6,000 | 100,000 |
| Indeno(1,2,3-cd)pyrene | ug/kg | < 89 | 900 | 4,000 |
| Isophorone | ug/kg | < 89 | 1,100,000 | 1,000,000 |
| Naphthalene | ug/kg | < 89 | 230,000 | 4,200,000 |
| Nitrobenzene | ug/kg | < 89 | 28,000 | 520,000 |
| N-Nitrosodimethylamine | ug/kg | < 180 | | |
| N-Nitroso-di-n-propylamine | ug/kg | < 89 | 660 | 660 |
| N-Nitrosodiphenylamine | ug/kg | < 89 | 140,000 | 600,000 |
| Pentachlorophenol | ug/kg | < 440 | 6,000 | 24,000 |
| Phenanthrene | ug/kg | < 89 | | |
| Phenol | ug/kg | < 89 | 10,000,000 | 10,000,000 |
| **Pyrene** | ug/kg | 150 | 1,[illegible]00,000 | 10,000,000 |

## 3.6 TEMPERATURE PROBE MONITORING

In-situ TidbiT$^{tm}$ temperature probes were deployed at five Lehigh River monitoring stations to continuously record surface water temperatures in ½ hour increments over the sampling period from April through September 2005. Station WA1 (LH-2) was located just downstream of the F. E. Walter dam outfall (Fig. 3-10). Station LH3 was located at Tannery Bridge near White Haven, PA (Fig. 3-11). Station LH10 was located near the Lehighton water intake structure in Lehighton, PA (Fig. 3-12). Station LH-15 was located near the Walnutport USGS gauging station in Walnutport, PA (Fig. 3-13). Station LH-17 was located near the Northampton water intake structure in Northampton, PA. Station LH-17 has not been evaluated as part of this report.

The Commonwealth of Pennsylvania provides water temperature standards that are based on a particular water body's protected use (Pennsylvania Code, Title 25, Chapter 93 2001). Stations LH-2 and LH-3 are classified as a High Quality-Cold Water Fishes (HQ-CWF) by PADEP. Pennsylvania Department of Environmental Protection defines Cold Water Fishes as the *"maintenance and/or propagation of fish species including the family Salmonidae and additional flora and fauna that are indigenous to a coldwater habitat"*. The maximum temperature criterion for this reach of the Lehigh River is 66 degrees Fahrenheit (18.87 degrees Celsius) from 01 July through 30 August. From Mid-June through September of 2005, the temperatures recorded in this section of the river routinely exceeded this criterion (Fig. 3-10 and Fig. 3-11). The maximum temperature recorded during the monitoring period at LH-2 and LH-3 was 24.38 °C and 28.87 °C, respectively.

Stations LH10 and LH15 are classified a Trout Stocking Fishery (TSF). Pennsylvania Department of Environmental Protection defines Trout Stocking as the *"maintenance of stocked trout from February 15 to July 31 and maintenance and propagation of fish species and additional flora and fauna which are indigenous to a warm water habitat"*. The maximum temperature criterion for this reach of the Lehigh River varies during the season from 70 degrees Fahrenheit (21.1 degrees Celsius) from 01 June through 15 June; 72 degrees Fahrenheit (22.2 degrees Celsius) from 16 June through 30 June; 74 degrees Fahrenheit (23.3 degrees Celsius) from 01 July through 31 July; 80 degrees Fahrenheit (26.6 degrees Celsius) from 01 August through 15 August; and 87 degrees Fahrenheit (30.5 degrees Celsius) from 16 August through 30 August. In general, stations LH-10 and LH-15 routinely exceeded the state criterion from mid-June through mid-August of 2005 (Fig. 3-12 and Fig. 3-13). The maximum temperature recorded during the monitoring period at LH-10 and LH-15 was 28.33 °C and 30.92 °C, respectively.

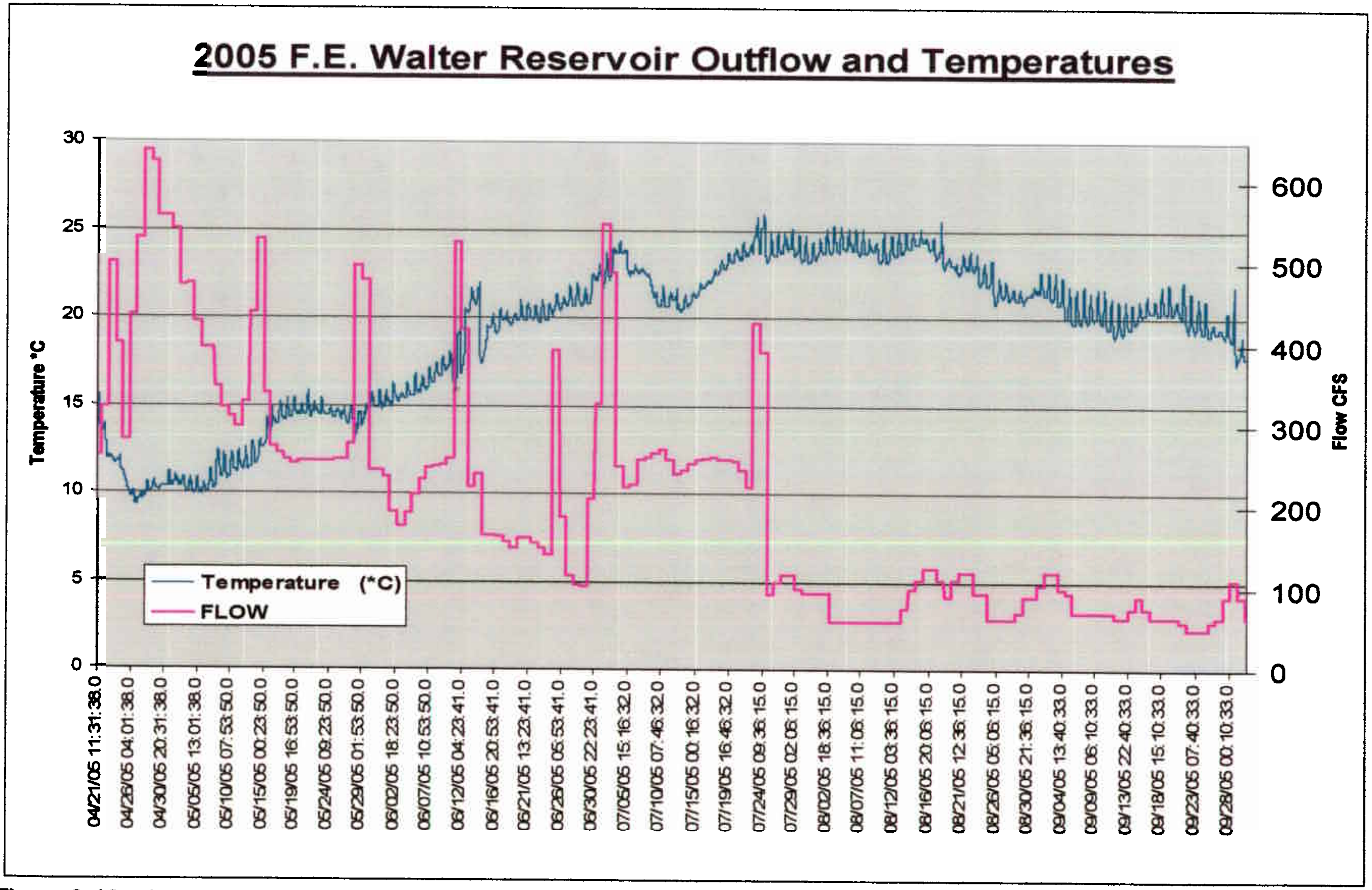


**Figure 3-10.** In-situ temperature measured in surface waters of Lehigh River immediately downstream of F.E. Walter Reservoir and reservoir flow releases during 2005 monitoring.

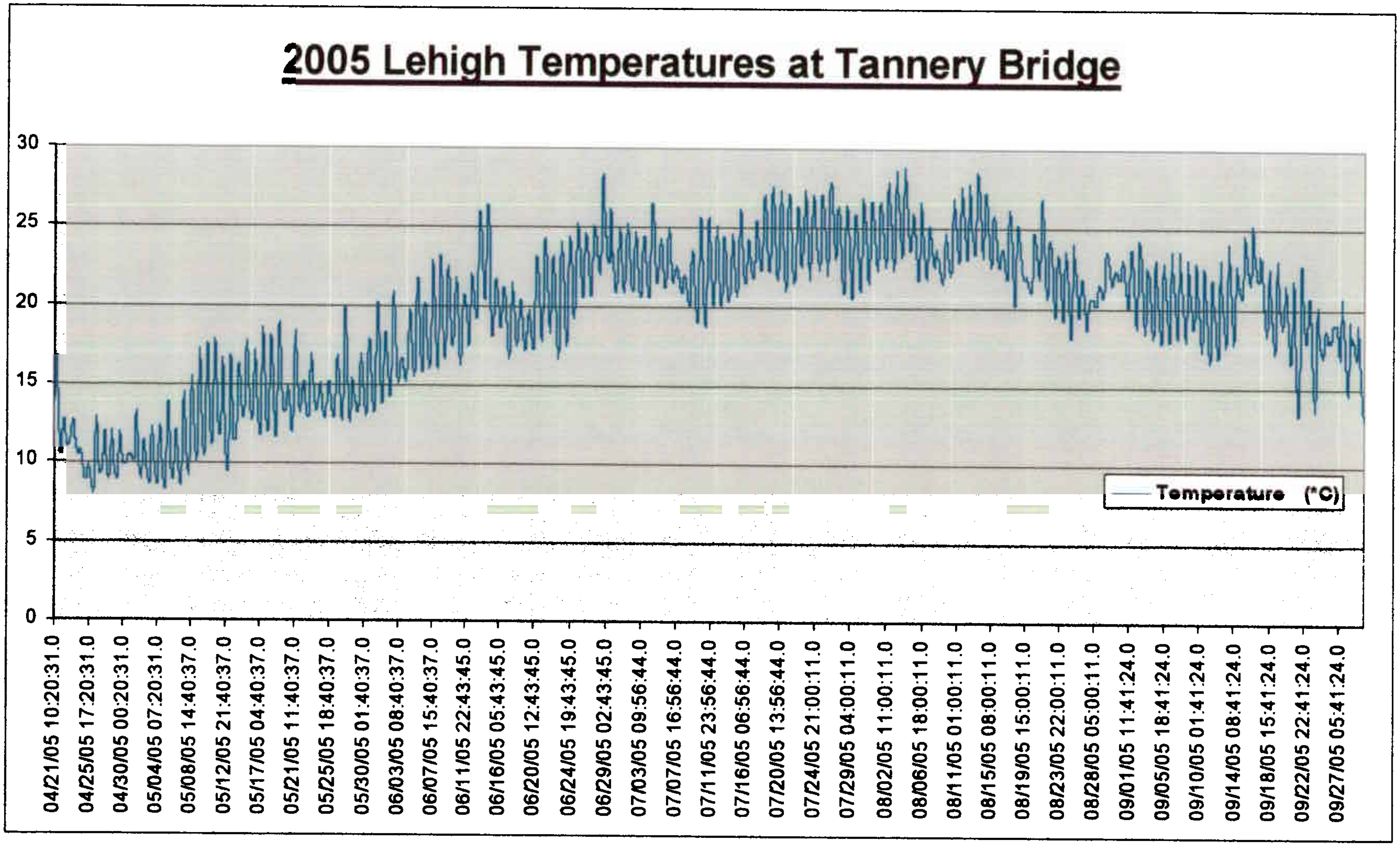


**Figure 3-11.** In-situ temperature measured in surface waters of Lehigh River at Tannery Bridge near White Haven, PA during 2005.

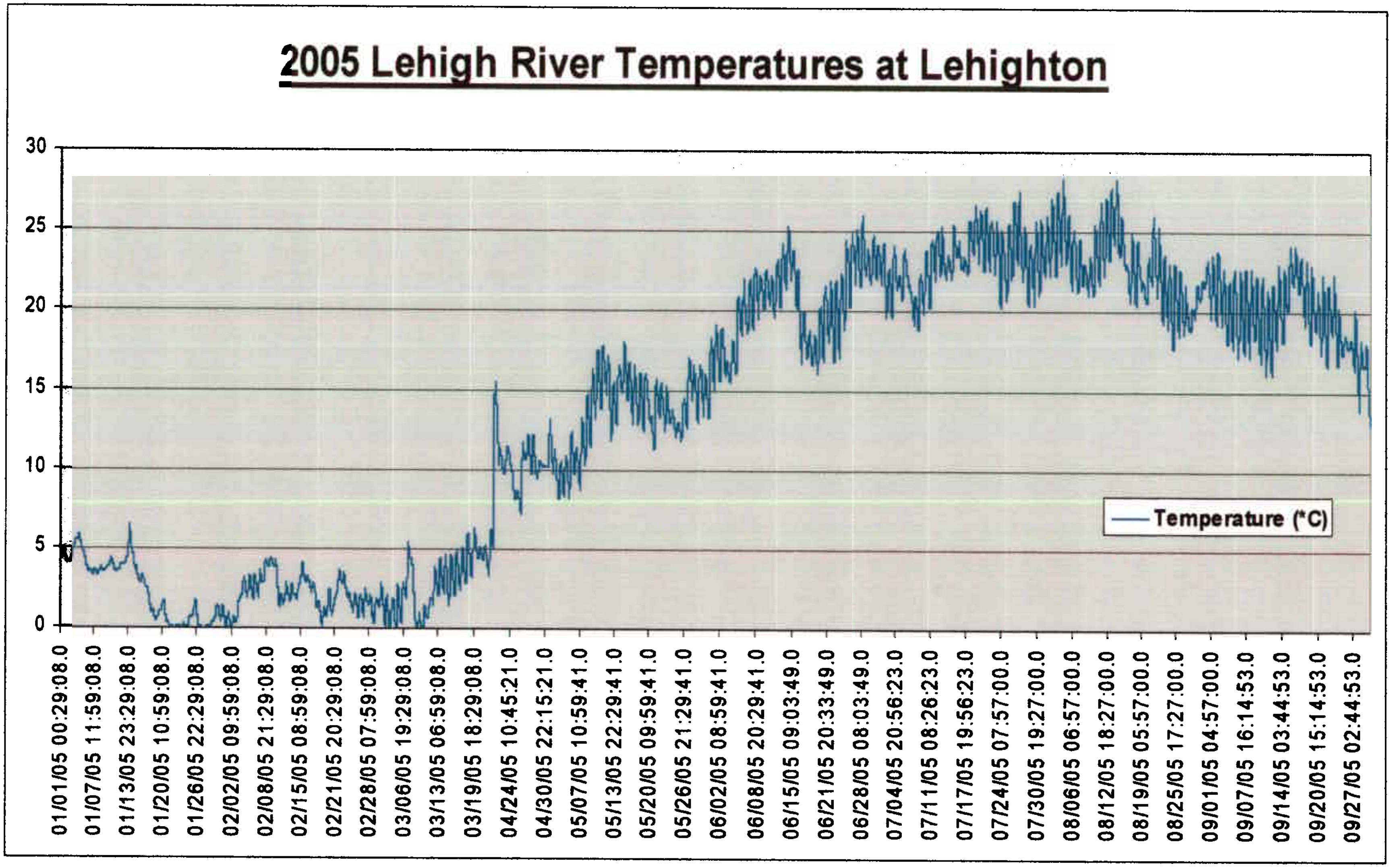


**Figure 3-12.** In-situ temperature measured in surface waters of Lehigh River near Lehighton, PA during 2005.

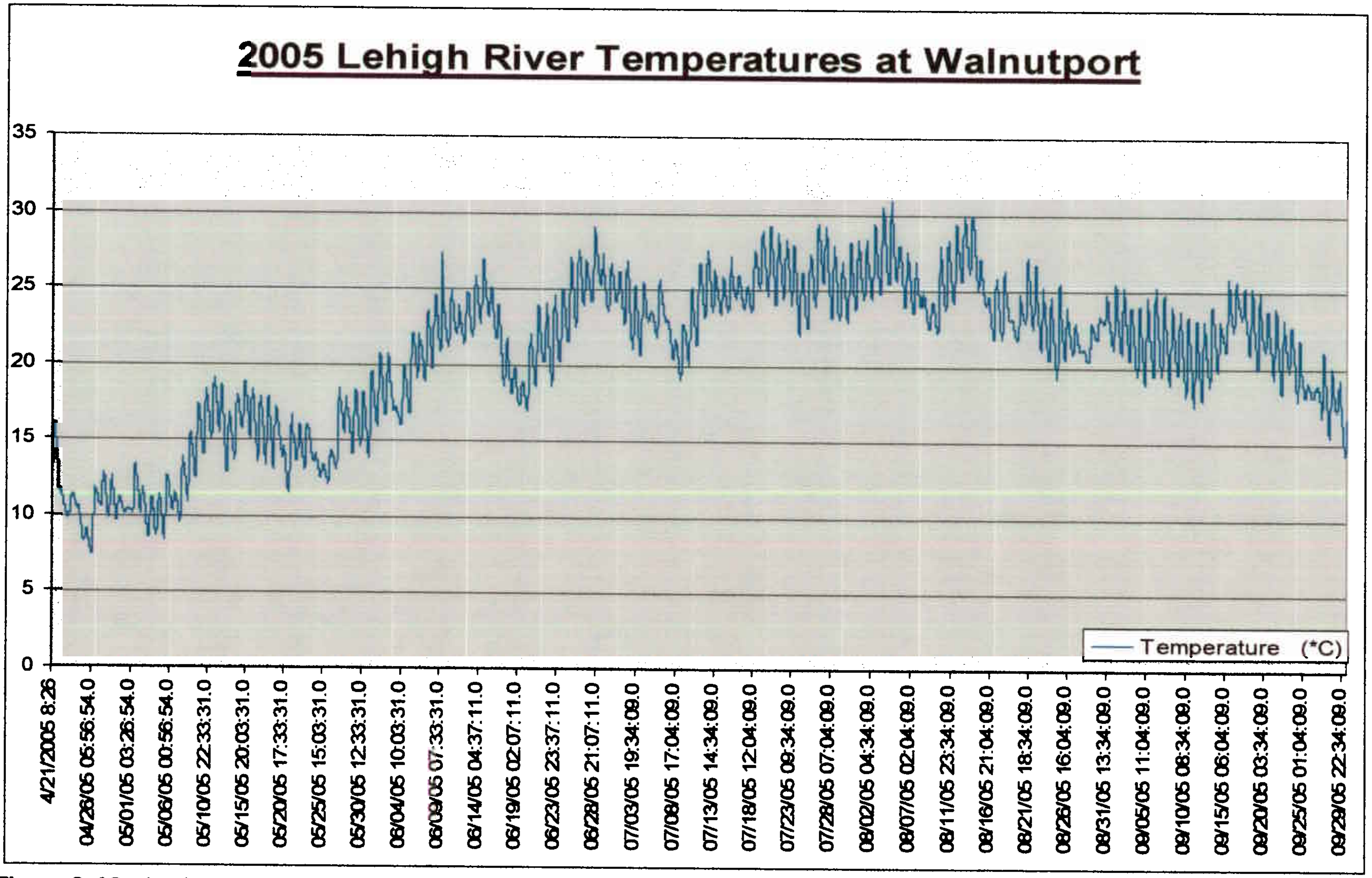


**Figure 3-13.** In-situ temperature measured in surface waters of Lehigh River near Walnutport, PA during 2005.

# 4.0 SUMMARY

The USACE implements a yearly monitoring program at F. E. Walter Reservoir to evaluate potential public health and environmental concerns. In general, the monitoring programs emphasize measuring water quality and sediment contamination. Monitoring results are compared to state and federal criteria to evaluate the condition of F. E. Walter Reservoir. The 2005 monitoring program of F. E. Walter Reservoir comprised five major elements:

- Monthly water quality and bacteria monitoring from 25 May through 20th September to evaluate compliance with the Pennsylvania state water quality standards;
- Multiple unscheduled profile samples for temperature, dissolved oxygen, chlorophyll, pH and conductivity at the deepest station in the reservoir;
- Meteorological monitoring of air temperature, relative humidity, solar radiation, wind speed and direction every ½ hour at the F. E. Walter Reservoir tower;
- Sediment priority pollutant monitoring of metals and acid/base neutral extractable compounds to evaluate sediment toxicity relative to identified screening concentrations; and
- Automated half-hour temperature recorders at five stations along the Lehigh River below the reservoir and one station upstream of the reservoir pool in Bear Creek.

## 4.1 WATER QUALITY MONITORING

Water quality monitoring at F. E. Walter Reservoir was not in compliance with the PADEP standard for dissolved oxygen (DO) during most of the sampling season. The water quality standard for DO is a minimum concentration of 5 mg/L. Measures of pH were also not in compliance throughout the monitoring period with the PADEP water quality standard range, the range is from 6 to 9.

F. E. Walter Reservoir contained variable levels of nutrients during 2005. Many of the measures for total phosphorus were greater than the EPA guideline for reservoirs. Ammonia, nitrate + nitrite, and TDS were in compliance with state water quality standards throughout the reservoir watershed. Alkalinity measures were low in F.E. Walter Reservoir and its tributaries in 2005. The low alkalinity measured at F.E. Walter Reservoir probably results from the regional geology, which is primarily sandstone and shale.

## 4.2 TROPHIC STATE CLASSIFICATION

The trophic status of F.E. Walter Reservoir was defined, independently, by Carlson's trophic state index and EPA criteria. Both classifications were based on concentrations of phosphorus, chlorophyll *a* and secchi disk depths. Carlson's trophic state index classifies the reservoir as mesotrophic/oligotrophic in its trophic condition during 2005. The EPA criterion classifies F.E. Walter Reservoir as highly variable in its trophic condition during 2005 but predominantly oligotrophic/mesotrophic.

## 4.3 COLIFORM BACTERIA MONITORING

Coliform bacteria contamination at F. E. Walter Reservoir was in compliance with the PADEP water quality standard for bacteria contamination during 2005.

## 4.4 SEDIMENT PRIORITY POLLUTANT MONITORING

A total of 13 metals were analyzed in F.E. Walter Reservoir sediments. Three metals were measured at concentrations that exceeded screening levels: beryllium, chromium, and thallium. A total of 57 acid/base neutral extractables were analyzed in F.E. Walter Reservoir sediments. None of these compounds detected in the sediment samples exceeded the screening criteria.

## 4.5 TEMPERATURE PROBE MONITORING

In-situ TidbiT™ temperature probes were deployed at five Lehigh River monitoring stations to continuously record surface water temperatures in ½ hour increments over the sampling period from April through September 2005. The temperature data were examined and compared to PADEP water use criteria for temperature. The maximum temperature recorded during the monitoring period at river stations LH-2 (WA-1) and LH-3 was 24.38 °C and 28.87 °C, respectively. From Mid-June through September of 2005, the temperatures recorded in this section of the river routinely exceeded the state criterion for a High Quality-Cold Water Fishery. In general, river stations LH-10 and LH-15 routinely exceeded the state criterion for a Trout Stocked Fishery from mid-June through mid-August of 2005. The maximum temperature recorded during the monitoring period at LH-10 and LH-15 was 28.33 °C and 30.92 °C, respectively.

# 5.0 REFERENCES

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# APPENDIX A

## STRATIFICATION DATA TABLES

# 2005 Walter Stratification

| Station | Date | Depth | Temp | DO% | DO Conc | pH | Chlorophyll |
|---|---|---|---|---|---|---|---|
| | M/D/Y | Feet | C | | mg/L | | ug/L |
| | 4/28/2005 | 0 | 10.45 | 83.8 | 9.36 | 6.84 | 2.7 |
| WA-1 | 5/13/2005 | 0 | 11.96 | 94.7 | 10.21 | 6.13 | 2.6 |
| Outfall | 5/25/2005 | 0 | 14.48 | 99.3 | 10.12 | 6.56 | 1 |
| | 6/9/2005 | 0 | 17.19 | 102.7 | 9.88 | 6.37 | 9.2 |
| Pre-mix | 6/14/2005 | 0 | 21.56 | 102.1 | 9 | 6.26 | 0.2 |
| Post mix | 6/14/2005 | 0 | 19.55 | 100.2 | 9.19 | 6.24 | 0.1 |
| | 6/23/2005 | 0 | 20.57 | 99.5 | 8.95 | 6.69 | -1.2 |
| | 6/28/2005 | 0 | 21.34 | 112 | 9.92 | 6.59 | -2.5 |
| | 7/1/2005 | 0 | 22.47 | 109.8 | 9.52 | 6.54 | 0.3 |
| | 7/6/2005 | 0 | 22.68 | 140.9 | 12.16 | 6.49 | 0.8 |
| | 7/14/2005 | 0 | 21.27 | 93.8 | 8.32 | 5.8 | 0.5 |
| | 7/22/2005 | 0 | 23.99 | 92.6 | 7.79 | 5.99 | 0.6 |
| | 7/27/2005 | 0 | 23.84 | 90.9 | 7.67 | 5.93 | 0.7 |
| | 8/4/2005 | 0 | 24.22 | 94.3 | 7.9 | 6.11 | 0.2 |
| | 8/24/2005 | 0 | 22.96 | 89.3 | 7.67 | 6.52 | 0.6 |
| | 9/20/2005 | 0 | 20.77 | 98.9 | 8.86 | 6.63 | 0.3 |
| | | | | | | | |
| WA-2 Lake Tower | 4/28/2005 | 0 | 12.12 | 88.4 | 9.5 | 7.1 | 1.7 |
| | | 5 | 12.13 | 88.8 | 9.55 | 7.11 | 1.9 |
| | | 10 | 11.81 | 87.1 | 9.42 | 7.1 | 1.8 |
| | | 15 | 11.72 | 86.5 | 9.38 | 7.11 | 1.4 |
| | | 20 | 11.63 | 86.9 | 9.44 | 7.12 | 0.9 |
| | | 25 | 11.55 | 85.9 | 9.35 | 7.1 | 0.3 |
| | | 30 | 11.03 | 84.5 | 9.31 | 7.11 | 0.3 |
| | | 35 | 10.71 | 85 | 9.43 | 7.13 | 0.8 |
| | | 40 | 10.42 | 84.4 | 9.43 | 7.13 | 0.8 |
| | | 45 | 10.11 | 82.9 | 9.33 | 7.11 | 0.5 |
| | | 50 | 9.98 | 82.6 | 9.32 | 7.1 | 0.6 |
| | | 55 | 9.69 | 81.7 | 9.29 | 7.11 | 0.2 |
| | | 60 | 9.18 | 81.2 | 9.34 | 7.13 | 0.6 |
| | | 65 | 9.23 | 80.5 | 9.25 | 7.11 | 0.7 |
| | | 70 | 8.71 | 77.9 | 9.06 | 7.09 | 0.6 |
| | | 75 | 8.59 | 75.6 | 8.83 | 7.07 | 0.5 |
| | | 80 | 8.59 | 69.2 | 8.08 | 7.02 | 1.1 |
| | | 85 | 8.28 | 62.4 | 7.34 | 6.91 | 1.1 |
| WA-2 Lake Tower | 5/13/2005 | 0 | 17.47 | 89.3 | 8.55 | 5.94 | 2.2 |
| | | 5 | 16.9 | 89.5 | 8.66 | 5.92 | 4.1 |
| | | 10 | 16.46 | 85.9 | 8.4 | 5.92 | 3.2 |
| | | 15 | 14.91 | 85.8 | 8.67 | 5.89 | 1.4 |
| | | 20 | 14.47 | 83.7 | 8.54 | 5.95 | 0.7 |
| | | 25 | 13.67 | 82.9 | 8.6 | 5.99 | 1.1 |
| | | 30 | 12.95 | 82.8 | 8.74 | 5.98 | 1 |
| | | 35 | 11.96 | 81.8 | 8.82 | 6 | 0.5 |
| | | 40 | 11.55 | 81.3 | 8.85 | 6 | 0.4 |
| | | 45 | 11.32 | 78.9 | 8.64 | 6.06 | 0.5 |
| | | 50 | 11.01 | 77.3 | 8.52 | 6.06 | 0.3 |
| | | 55 | 10.88 | 75.7 | 8.37 | 6.08 | 0.1 |
| | | 60 | 10.54 | 74.3 | 8.28 | 6.1 | 0.3 |
| | | 65 | 10.23 | 70.8 | 7.95 | 6.1 | 0.2 |
| | | 70 | 9.86 | 68.8 | 7.79 | 6.09 | 0.1 |
| | | 75 | 9.67 | 64.5 | 7.33 | 6.11 | 0.3 |
| | | 80 | 9.56 | 60.3 | 6.88 | 6.13 | 2.2 |

# 2005 Walter Stratification

| Station | Date | Depth | Temp | DO% | DO Conc | pH | Chlorophyll |
|---|---|---|---|---|---|---|---|
| | M/D/Y | Feet | C | | mg/L | | ug/L |
| WA-2 Lake Tower<br>Secchi 2.3 meters (7' 7") | 5/25/2005 | 0 | 16.56 | 91.3 | 8.9 | 6.13 | 2.4 |
| | | 5 | 16.56 | 91.3 | 8.9 | 6.12 | 2.9 |
| | | 10 | 16.57 | 91.2 | 8.9 | 6.11 | 1.9 |
| | | 15 | 16.55 | 90.9 | 8.87 | 6.07 | 2.8 |
| | | 20 | 16.54 | 90.3 | 8.81 | 6.05 | 2.5 |
| | | 25 | 16.52 | 87.8 | 8.57 | 6 | 2.3 |
| | | 30 | 15.24 | 81.3 | 8.15 | 5.94 | 0.9 |
| | | 35 | 14.62 | 83.6 | 8.5 | 5.94 | 1.2 |
| | | 40 | 14.31 | 78.7 | 8.06 | 5.9 | 0.8 |
| | | 45 | 14.02 | 77.2 | 7.95 | 5.9 | 0.8 |
| | | 50 | 13.64 | 69.4 | 7.21 | 5.87 | 0.5 |
| | | 55 | 13.07 | 64.1 | 6.74 | 5.83 | 0.9 |
| | | 60 | 11.9 | 51.3 | 5.54 | 5.8 | 0.8 |
| | | 65 | 11.47 | 53.6 | 5.85 | 5.87 | 0.4 |
| | | 70 | 10.4 | 26.3 | 2.95 | 6 | 1.3 |
| | | 75 | 10.34 | 22.1 | 2.48 | 6.05 | 9 |
| | | 80 | 10.31 | 19.3 | 2.16 | 6.1 | 7.1 |
| | | 85 | 10.26 | 19.9 | 2.24 | 6.1 | 11.6 |
| WA-2 Lake Tower | 6/9/2005 | 0 | 24.58 | 100.6 | 8.38 | 6.51 | 1.6 |
| | | 5 | 23.97 | 99.5 | 8.38 | 6.38 | 1.7 |
| | | 10 | 23.71 | 97.5 | 8.25 | 6.32 | 1.2 |
| | | 15 | 20.92 | 91.1 | 8.13 | 6.16 | 1.6 |
| | | 20 | 19.58 | 87.6 | 8.03 | 6.15 | 1.9 |
| | | 25 | 18.83 | 86.4 | 8.05 | 6.12 | 1.6 |
| | | 30 | 17.92 | 85.3 | 8.08 | 6.09 | 1.3 |
| | | 35 | 17.15 | 80.9 | 7.79 | 5.99 | 0.6 |
| | | 40 | 16.14 | 73.1 | 7.2 | 5.87 | 0.4 |
| | | 45 | 15.75 | 71.1 | 7.05 | 5.86 | 0.3 |
| | | 50 | 15.01 | 66.5 | 6.7 | 5.87 | 0.5 |
| | | 55 | 14.44 | 52 | 5.31 | 5.84 | 0.2 |
| | | 60 | 13.36 | 45 | 4.7 | 5.75 | 0.8 |
| | | 65 | 12.55 | 25 | 2.66 | 5.69 | 0.5 |
| | | 70 | 12.28 | 16.4 | 1.75 | 5.68 | 0.7 |
| | | 75 | 11.99 | 8.2 | 0.88 | 5.74 | 0.6 |
| WA-2 Lake Tower | 6/14/2005 | 0 | 27.21 | 99.9 | 7.93 | 6.23 | 0.9 |
| | | 5 | 26.79 | 96.8 | 7.74 | 6.14 | 2 |
| | | 10 | 25.55 | 88.2 | 7.21 | 6.05 | 1.6 |
| | | 15 | 24.5 | 82.2 | 6.85 | 6 | 1.8 |
| | | 20 | 23.49 | 82.1 | 6.98 | 5.97 | 1.4 |
| | | 25 | 22.57 | 78.8 | 6.81 | 5.99 | 1.2 |
| | | 30 | 21.53 | 73.9 | 6.52 | 5.96 | 1.1 |
| | | 35 | 20.47 | 79.8 | 7.18 | 6.04 | 0.8 |
| | | 40 | 19.19 | 74.4 | 6.87 | 5.97 | 0.8 |
| | | 45 | 17.89 | 71.3 | 6.76 | 5.91 | 1.1 |
| | | 50 | 16.56 | 63.2 | 6.17 | 5.86 | 0.5 |
| | | 55 | 15.74 | 48.7 | 4.83 | 5.79 | 0.5 |
| | | 60 | 14.98 | 40.1 | 4.04 | 5.77 | 0.4 |
| | | 65 | 13.91 | 27.1 | 2.8 | 5.78 | 0.4 |
| | | 70 | 13.6 | 9.9 | 1.03 | 5.78 | 0.7 |
| | | 75 | 13.62 | 14.8 | 1.53 | 5.71 | 0.5 |
| | | 80 | 13.1 | 4.7 | 0.5 | 5.68 | 2.7 |

## 2005 Walter Stratification

| Station | Date | Depth | Temp | DO% | DO Conc | pH | Chlorophyll |
|---|---|---|---|---|---|---|---|
| | M/D/Y | Feet | C | | mg/L | | ug/L |
| WA-2 Lake Tower | 6/23/2005 | 0 | 24.15 | 88 | 7.38 | 6.31 | 1.3 |
| | | 5 | 23.24 | 84 | 7.17 | 6.25 | 3 |
| | | 10 | 23.1 | 83.7 | 7.17 | 6.22 | 1.8 |
| | | 15 | 22.96 | 80.4 | 6.9 | 6.15 | 1.7 |
| | | 20 | 22.18 | 63.3 | 5.52 | 6.01 | 1 |
| | | 25 | 21.84 | 62.4 | 5.48 | 6 | 0.7 |
| | | 30 | 21.43 | 63.6 | 5.62 | 5.99 | 0.9 |
| | | 35 | 20.75 | 60.2 | 5.39 | 5.97 | 0.5 |
| | | 40 | 20.41 | 59.6 | 5.37 | 5.98 | 0.7 |
| | | 45 | 20.17 | 60.3 | 5.46 | 5.97 | 0.5 |
| | | 50 | 19.99 | 61.8 | 5.62 | 6.03 | 0.5 |
| | | 55 | 19.74 | 60.9 | 5.56 | 6.03 | 0.7 |
| | | 60 | 19.39 | 56.2 | 5.17 | 6 | 0.9 |
| | | 65 | 19.02 | 46.1 | 4.27 | 5.93 | 0.8 |
| | | 70 | 18.9 | 33 | 3.06 | 5.9 | 1.2 |
| | | 75 | 18.81 | 19.7 | 1.83 | 5.88 | 1.8 |
| | | | | | | | |
| WA-2 Lake Tower<br>Secchi 2.1 meters (6' 11") | 6/28/2005 | 0 | 28.02 | 112.1 | 8.77 | 6.39 | 0.9 |
| | | 5 | 26.31 | 109.9 | 8.87 | 6.31 | 1.6 |
| | | 10 | 23.97 | 99.6 | 8.39 | 6.15 | 1.8 |
| | | 15 | 23.08 | 86.4 | 7.4 | 6.06 | 1 |
| | | 20 | 22.67 | 74.6 | 6.44 | 6 | 1 |
| | | 25 | 22.19 | 67.1 | 5.84 | 5.95 | 0.6 |
| | | 30 | 21.96 | 64.1 | 5.6 | 5.94 | 0.4 |
| | | 35 | 21.4 | 64.5 | 5.71 | 5.95 | 0.7 |
| | | 40 | 21.02 | 65.2 | 5.81 | 5.98 | 0.7 |
| | | 45 | 20.71 | 63.6 | 5.7 | 5.96 | 0.4 |
| | | 50 | 20.49 | 63.2 | 5.69 | 5.96 | 0.4 |
| | | 55 | 20.26 | 60.4 | 5.46 | 5.98 | 0.7 |
| | | 60 | 19.95 | 51.2 | 4.66 | 5.98 | -0.1 |
| | | 65 | 19.73 | 39.7 | 3.63 | 6.01 | 0.3 |
| | | 70 | 19.48 | 14.2 | 1.31 | 6.13 | 0.1 |
| | | | | | | | |
| WA-2 Lake Tower | 7/1/2005 | 0 | 26.88 | 125.4 | 10.01 | 6.57 | 1.7 |
| | | 5 | 26.24 | 119.6 | 9.66 | 6.38 | 2.2 |
| | | 10 | 24.72 | 99.6 | 8.27 | 6.21 | 1.8 |
| | | 15 | 23.78 | 101.8 | 8.6 | 6.13 | 0.9 |
| | | 20 | 23 | 87.9 | 7.54 | 6.04 | 1 |
| | | 25 | 22.55 | 74 | 6.41 | 6.05 | 0.7 |
| | | 30 | 22.54 | 73.1 | 6.32 | 6.04 | 0.9 |
| | | 35 | 22.17 | 69.7 | 6.07 | 6.01 | 0.7 |
| | | 40 | 21.85 | 67.4 | 5.91 | 5.99 | 0.5 |
| | | 45 | 21.51 | 65.5 | 5.78 | 5.99 | 0.7 |
| | | 50 | 21.12 | 64.9 | 5.78 | 6.01 | 0.1 |
| | | 55 | 20.66 | 54.8 | 4.91 | 6.02 | 0.3 |
| | | 60 | 20.33 | 48 | 4.33 | 6 | 0.3 |
| | | 65 | 20.06 | 33.2 | 3.01 | 6 | 0.5 |
| | | 70 | 19.94 | 24.2 | 2.2 | 6.02 | 0.4 |
| | | 75 | 19.54 | 0.7 | 0.07 | 6.06 | 1.3 |
| | | 80 | 19.29 | 0.5 | 0.05 | 6.13 | 2.2 |
| | | | | | | | |

## 2005 Walter Stratification

| Station | Date | Depth | Temp | DO% | DO Conc | pH | Chlorophyll |
|---|---|---|---|---|---|---|---|
| | M/D/Y | Feet | C | | mg/L | | ug/L |
| WA-2 Lake Tower | 7/6/2005 | 0 | 24.6 | 151.4 | 12.61 | 6.51 | 3.3 |
| | | 5 | 24.6 | 144.8 | 12.05 | 6.49 | 4 |
| | | 10 | 24.58 | 145.8 | 12.14 | 6.48 | 3.6 |
| | | 15 | 24.08 | 127.6 | 10.73 | 6.31 | 3.6 |
| | | 20 | 23.36 | 98.8 | 8.42 | 6.15 | 1 |
| | | 25 | 22.81 | 87.4 | 7.52 | 6.11 | 1.2 |
| | | 30 | 22.26 | 79.6 | 6.92 | 6.14 | 0.9 |
| | | 35 | 21.62 | 64.6 | 5.69 | 6.1 | 0.4 |
| | | 40 | 21.35 | 54.7 | 4.84 | 6.11 | 0.8 |
| | | 45 | 20.98 | 38.6 | 3.44 | 6.09 | 0.7 |
| | | 50 | 20.79 | 19.3 | 1.73 | 6.05 | 6.5 |
| | | | | | | | |
| WA-2 Lake Tower | 7/14/2005 | 0 | 26.37 | 101.3 | 8.16 | 6.74 | 2 |
| | | 5 | 24.44 | 88.9 | 7.42 | 6.2 | 3.9 |
| | | 10 | 23.69 | 81.9 | 6.94 | 6.17 | 2.3 |
| | | 15 | 23.18 | 74.6 | 6.38 | 5.94 | 2 |
| | | 20 | 22.65 | 68.3 | 5.9 | 5.83 | 1.8 |
| | | 25 | 22.18 | 63.8 | 5.56 | 5.71 | 0.9 |
| | | 30 | 21.77 | 64.2 | 5.64 | 5.7 | 1.2 |
| | | 35 | 21.25 | 65.2 | 5.79 | 5.66 | 0.6 |
| | | 40 | 21.04 | 61 | 5.44 | 5.68 | 0.8 |
| | | 45 | 20.81 | 60.5 | 5.42 | 5.64 | 0.9 |
| | | 50 | 20.64 | 59.7 | 5.36 | 5.62 | 0.7 |
| | | 55 | 20.25 | 42.7 | 3.87 | 5.53 | 1.2 |
| | | 60 | 19.9 | 18.3 | 1.67 | 5.52 | 3.8 |
| | | | | | | | |
| WA-2 Lake Tower | 7/22/2005 | 0 | 27.96 | 93.9 | 7.35 | 6.85 | 1.7 |
| | | 5 | 27.45 | 92.5 | 7.31 | 6.64 | 3.9 |
| | | 10 | 26.7 | 79.9 | 6.4 | 6.26 | 4.2 |
| | | 15 | 25.67 | 70 | 5.71 | 6.06 | 1.4 |
| | | 20 | 25.08 | 67.2 | 5.54 | 6.02 | 1.5 |
| | | 25 | 24.56 | 63.1 | 5.25 | 5.93 | 0.8 |
| | | 30 | 24.21 | 59.5 | 4.99 | 5.85 | 0.6 |
| | | 35 | 23.97 | 56.4 | 4.75 | 5.84 | 0.6 |
| | | 40 | 23.5 | 50.2 | 4.27 | 5.78 | 0.7 |
| | | 45 | 23.28 | 43.4 | 3.7 | 5.73 | 0.6 |
| | | 50 | 23.22 | 37.3 | 3.19 | 5.69 | 0.7 |
| | | 55 | 23.06 | 22.1 | 1.89 | 5.64 | 0.9 |
| | | 60 | 23.04 | 23.2 | 1.98 | 5.7 | 1.8 |
| | | | | | | | |
| WA-2 Lake Tower<br><br>Secchi 2.0 meters (6' '7") | 7/27/2005 | 0 | 27.26 | 93 | 7.38 | 6.44 | 1.2 |
| | | 5 | 26.74 | 91.5 | 7.33 | 6.36 | 2.1 |
| | | 10 | 26.51 | 87.2 | 7.01 | 6.27 | 1.7 |
| | | 15 | 25.26 | 64.3 | 5.29 | 5.92 | 1.4 |
| | | 20 | 24.97 | 61.3 | 5.07 | 5.9 | 1 |
| | | 25 | 24.47 | 60.7 | 5.06 | 5.88 | 0.6 |
| | | 30 | 23.97 | 58.8 | 4.95 | 5.86 | 0.9 |
| | | 35 | 23.68 | 52.6 | 4.46 | 5.81 | 0.6 |
| | | 40 | 23.47 | 45.9 | 3.9 | 5.78 | 1.4 |
| | | 45 | 23.39 | 41.2 | 3.5 | 5.78 | 1 |
| | | 50 | 23.22 | 30.4 | 2.6 | 5.78 | 1.8 |
| | | | | | | | |

## 2005 Walter Stratification

| Station | Date M/D/Y | Depth Feet | Temp C | DO% | DO Conc mg/L | pH | Chlorophyll ug/L |
|---|---|---|---|---|---|---|---|
| WA-2 Lake Tower | 8/4/2005 | 0 | 27.35 | 96.9 | 7.67 | 6.53 | 1.9 |
| | | 5 | 26.85 | 94.8 | 7.57 | 6.45 | 3.1 |
| | | 10 | 26.17 | 79.5 | 6.43 | 6.11 | 2.9 |
| | | 15 | 25.3 | 57.6 | 4.73 | 5.89 | 1.4 |
| | | 20 | 24.75 | 53.4 | 4.43 | 5.87 | 0.4 |
| | | 25 | 24.55 | 53.8 | 4.48 | 5.86 | 0.6 |
| | | 30 | 24.36 | 53.7 | 4.49 | 5.87 | 0.5 |
| | | 35 | 24.19 | 50 | 4.19 | 5.86 | 0.4 |
| | | 40 | 24.02 | 50.5 | 4.25 | 5.84 | 0.7 |
| | | 45 | 23.81 | 38 | 3.21 | 5.8 | 0.7 |
| | | 50 | 23.57 | 24.4 | 2.07 | 5.75 | 1.2 |
| | | | | | | | |
| WA-2 Lake Tower Secchi 2.1 meters (6' 9") | 8/24/2005 | 0 | 24.11 | 85.4 | 7.17 | 6.79 | 2.6 |
| | | 5 | 24.11 | 85.2 | 7.15 | 6.74 | 3 |
| | | 10 | 24.1 | 85.2 | 7.16 | 6.74 | 3.1 |
| | | 15 | 24.1 | 84.4 | 7.09 | 6.65 | 2.9 |
| | | 20 | 24.07 | 81.3 | 6.84 | 6.48 | 3.1 |
| | | 25 | 23.89 | 70 | 5.9 | 6.28 | 1.2 |
| | | 30 | 22.64 | 66 | 5.7 | 6.31 | 1.3 |
| | | 35 | 22.15 | 71 | 6.18 | 6.36 | 1.3 |
| | | 40 | 22.02 | 74.7 | 6.53 | 6.38 | 1.1 |
| | | 45 | 21.66 | 78.2 | 6.88 | 6.43 | 1.5 |
| | | 50 | 21.67 | 78.1 | 6.87 | 6.41 | 1.7 |
| | | | | | | | |
| WA-2 Lake Tower Secchi 2.7 meters (9 feet) | 9/20/2005 | 0 | 22.73 | 100.7 | 8.68 | 6.88 | 4.1 |
| | | 5 | 22.64 | 99.7 | 8.61 | 6.77 | 7.1 |
| | | 10 | 22.32 | 89.1 | 7.74 | 6.52 | 2.1 |
| | | 15 | 21.75 | 79 | 6.94 | 6.37 | 1.2 |
| | | 20 | 21.5 | 76.2 | 6.73 | 6.35 | 2.2 |
| | | 25 | 21.24 | 71.9 | 6.38 | 6.32 | 0.7 |
| | | 30 | 20.94 | 64.4 | 5.74 | 6.28 | 1.2 |
| | | 35 | 20.62 | 59.6 | 5.35 | 6.28 | 0.7 |
| | | 40 | 20.53 | 55.4 | 4.98 | 6.31 | 0.8 |
| | | 45 | 20.31 | 53.7 | 4.85 | 6.36 | 0.6 |
| | | 50 | 20.15 | 50.4 | 4.57 | 6.43 | 0.7 |
| | | | | | | | |
| | | | | | | | |
| WA-3 Tobyhanna Creek Upstream | 4/28/2005 | 0 | 11 | 99.6 | 10.79 | 6.2 | NR |
| | 5/13/2005 | 0 | 11.1 | 104.9 | 11.55 | 5.97 | 3.4 |
| | 5/25/2005 | 0 | 12.55 | 97.2 | 10.35 | 6.54 | 2.4 |
| | 6/14/2005 | 0 | 21.1 | 95.6 | 8.5 | 6.16 | 1.8 |
| | 6/23/2005 | 0 | 15.65 | 122.5 | 12.18 | 6.29 | 0.3 |
| | 6/28/2005 | 0 | 21.69 | 108.5 | 9.55 | 6.89 | 0.7 |
| | 7/6/2005 | 0 | 19.86 | 148.3 | 13.52 | 6.97 | 1.1 |
| | 7/27/2005 | 0 | 21.9 | 91.8 | 8.04 | 6.49 | 1.3 |
| | 8/24/2005 | 0 | 18.24 | 103.5 | 9.75 | 6.86 | 0.5 |
| | 9/20/2005 | 0 | 17.99 | 99.7 | 9.44 | 7.09 | 0.4 |

# 2005 Walter Stratification

| Station | Date | Depth | Temp | DO% | DO Conc | pH | Chlorophyll |
|---|---|---|---|---|---|---|---|
| | M/D/Y | Feet | C | | mg/L | | ug/L |
| WA-4 Lehigh River Upstream | 4/28/2005 | 0 | 12.1 | ER | ER | 7.11 | 1.2 |
| | 5/13/2005 | 0 | 11.01 | 95.6 | 10.54 | 6.14 | 0.7 |
| | 5/25/2005 | 0 | 11.06 | 101.4 | 11.17 | 6.32 | 1.4 |
| | 6/14/2005 | 0 | 22.18 | 94 | 8.19 | 6.33 | 2.7 |
| | 6/23/2005 | 0 | 15.24 | 99.5 | 9.98 | 6.76 | 0.7 |
| | 6/28/2005 | 0 | 22.72 | 128.3 | 11.07 | 7.41 | 1.2 |
| | 7/6/2005 | 0 | 19.31 | 131.2 | 12.09 | 6.81 | 2.2 |
| | 7/27/2005 | 0 | 22.04 | 74.1 | 6.47 | 6.38 | 7.4 |
| | 8/24/2005 | 0 | 17.58 | 110.2 | 10.52 | 7.09 | 1.1 |
| | 9/20/2005 | 0 | 17.8 | 103.7 | 9.86 | 7.17 | 0.6 |
| | | | | | | | |
| | | | | | | | |
| WA-5 Bear Creek Upstream | 4/28/2005 | 0 | 12.32 | 90.2 | 9.65 | 6.68 | -0.6 |
| | 5/13/2005 | 0 | 11.12 | 93.7 | 10.3 | 6.05 | -0.1 |
| | 5/25/2005 | 0 | 12.22 | 98.5 | 10.56 | 6.57 | 1.6 |
| | 6/23/2005 | 0 | 16.75 | 100.4 | 9.75 | 6.45 | -1 |
| | 6/28/2005 | 0 | 22.2 | 111.5 | 9.71 | 8.1 | 0.1 |
| | 7/6/2005 | 0 | 19.83 | 139.6 | 12.73 | 6.4 | 0.2 |
| | 7/27/2005 | 0 | 21.57 | 94.4 | 8.32 | 6.16 | 1 |
| | 8/24/2005 | 0 | 17.1 | 93.1 | 8.98 | 7.05 | -0.2 |
| | 9/20/2005 | 0 | 17.42 | 98.2 | 9.4 | 7.44 | -0.8 |
| | | | | | | | |
| WA-6 Bear Creek Lake Arm | 5/13/2005 | 0 | 17.9 | 90.2 | 8.55 | 5.98 | 4.4 |
| | | 5 | 17.52 | 89.7 | 8.57 | 5.99 | 5.1 |
| | | 10 | 16.6 | 88.3 | 8.61 | 6 | 2.7 |
| | | 15 | 15.45 | 88.1 | 8.8 | 6.04 | 2.1 |
| | | 20 | 14.91 | 84.6 | 8.54 | 6.08 | 1.1 |
| | | 25 | 13.43 | 83.1 | 8.67 | 6.12 | 0.5 |
| | | 30 | 12.56 | 82.9 | 8.82 | 6.14 | 0.6 |
| | | 35 | 11.85 | 82.2 | 8.88 | 6.18 | 0.8 |
| | | 40 | 11.6 | 81.9 | 8.91 | 6.2 | 0.7 |
| | | 45 | 11.3 | 80.5 | 8.81 | 6.22 | 0.4 |
| | | 50 | 11.13 | 78.8 | 8.66 | 6.23 | 0.3 |
| | | 55 | 10.99 | 77.6 | 8.55 | 6.24 | 0.2 |
| | | 60 | 10.8 | 76.7 | 8.5 | 6.21 | 0.3 |
| | | | | | | | |
| WA-6 Bear Creek Lake Arm Secchi 2.5 meters (6' 8") | 6/28/2005 | 0 | 28.41 | 108.3 | 8.41 | 6.36 | 1.1 |
| | | 5 | 26.49 | 108.3 | 8.71 | 6.32 | 1.4 |
| | | 10 | 24.3 | 95.1 | 7.96 | 6.15 | 5 |
| | | 15 | 23.42 | 89 | 7.57 | 6.08 | 1 |
| | | 20 | 22.71 | 69 | 5.95 | 5.98 | 0.8 |
| | | 25 | 22.27 | 67.1 | 5.83 | 6 | 0.7 |
| | | 30 | 21.9 | 64.4 | 5.64 | 5.99 | 0.5 |
| | | 35 | 21.47 | 64.1 | 5.66 | 6 | 0.3 |
| | | 40 | 21.18 | 62.9 | 5.59 | 6.01 | 0.6 |
| | | 45 | 20.88 | 59.5 | 5.31 | 6.05 | 0.3 |
| | | 50 | 20.61 | 54.2 | 4.87 | 6.08 | 0.8 |
| | | | | | | | |
| WA-6 Bear Creek Lake Arm Secchi 2.2 meters (7' 3") | 7/27/2005 | 0 | 27.09 | 91.9 | 7.31 | 6.43 | 1.3 |
| | | 5 | 26.84 | 90 | 7.19 | 6.36 | 2 |
| | | 10 | 26 | 82.9 | 6.73 | 6.18 | 1.8 |
| | | 15 | 25.27 | 72.8 | 5.99 | 5.99 | 1.1 |
| | | 20 | 24.66 | 63.5 | 5.28 | 5.92 | 1 |
| | | 25 | 24.48 | 60.8 | 5.07 | 5.93 | 0.9 |

## 2005 Walter Stratification

| Station | Date M/D/Y | Depth Feet | Temp C | DO% | DO Conc mg/L | pH | Chlorophyll ug/L |
|---|---|---|---|---|---|---|---|
| WA-6 Bear Creek Lake Arm Secchi 2.0 meters (6' 7") | 8/24/2005 | 0 | 23.99 | 84.4 | 7.11 | 6.67 | 2.3 |
| | | 5 | 23.98 | 84 | 7.07 | 6.62 | 3.7 |
| | | 10 | 23.95 | 83.4 | 7.02 | 6.51 | 3.5 |
| | | 15 | 23.86 | 80 | 6.75 | 6.38 | 2.8 |
| | | 20 | 23.16 | 72.8 | 6.23 | 6.24 | 1.4 |
| | | 25 | 22.82 | 67.7 | 5.82 | 6.17 | 1.6 |
| WA-6 Bear Creek Lake Arm Secchi 2.7 meters (9 feet) | 9/20/2005 | 0 | 22.61 | 101.6 | 8.78 | 6.98 | 4.1 |
| | | 5 | 22.61 | 101.3 | 8.75 | 6.88 | 7.2 |
| | | 10 | 22.53 | 99.6 | 8.62 | 6.73 | 11.8 |
| | | 15 | 22.19 | 93.3 | 8.12 | 6.54 | 1.7 |
| | | 20 | 21.54 | 76.3 | 6.73 | 6.39 | 0.2 |
| | | 25 | 21.33 | 73.9 | 6.54 | 6.43 | 0.8 |
| WA-7 Lehigh Lake Arm | 5/13/2005 | 0 | 18.02 | 93.5 | 8.84 | 5.96 | 1.7 |
| | | 5 | 17.55 | 93.8 | 8.96 | 5.98 | 3.8 |
| | | 10 | 16.09 | 92.4 | 9.1 | 6.02 | 3.2 |
| | | 15 | 15.49 | 91.4 | 9.12 | 6.04 | 2 |
| | | 20 | 14.85 | 89.9 | 9.1 | 6.08 | 1.1 |
| | | 25 | 13.79 | 87.2 | 9.03 | 6.14 | 0.6 |
| | | 30 | 12.49 | 85.3 | 9.09 | 6.15 | 0.4 |
| | | 35 | 11.89 | 84 | 9.07 | 6.17 | 0.1 |
| | | 40 | 11.67 | 82.9 | 9 | 6.19 | 0.7 |
| | | 45 | 11.72 | 81.6 | 8.85 | 6.18 | 0.3 |
| | | 50 | 11.15 | 74.5 | 8.19 | 6.2 | 0.1 |
| | | 55 | 10.83 | 65.8 | 7.28 | 6.16 | 0 |
| | | 60 | 10.78 | 66.6 | 7.38 | 6.15 | 0.7 |
| WA-7 Lehigh Lake Arm Secchi 2.5 meters (8' 3") | 5/25/2005 | 0 | 16.48 | 90.2 | 8.81 | 6.11 | 2.5 |
| | | 5 | 16.49 | 90.1 | 8.8 | 6.1 | 2.6 |
| | | 10 | 16.46 | 89.4 | 8.74 | 6.08 | 2.2 |
| | | 15 | 16.46 | 88.6 | 8.66 | 6.06 | 2 |
| | | 20 | 16.38 | 86.8 | 8.5 | 6.05 | 2 |
| | | 25 | 15.43 | 85 | 8.49 | 6.04 | 0.9 |
| | | 30 | 14.91 | 87.2 | 8.81 | 6.06 | 1.3 |
| | | 35 | 14.38 | 87.1 | 8.9 | 6.06 | 1.1 |
| | | 40 | 14.18 | 86.8 | 8.9 | 6.03 | 1.1 |
| | | 45 | 13.84 | 85.8 | 8.87 | 6.01 | 1 |
| | | 50 | 13.64 | 80.6 | 8.37 | 5.97 | 1.1 |
| | | 55 | 13.2 | 48.3 | 5.07 | 5.85 | 1.6 |
| WA-7 Lehigh Lake Arm Secchi 2.45 meters (8' 0") | 6/28/2005 | 0 | 27.52 | 108 | 8.52 | 6.45 | 1 |
| | | 5 | 26.38 | 104.3 | 8.41 | 6.37 | 1.1 |
| | | 10 | 24.78 | 94.5 | 7.84 | 6.24 | 1.1 |
| | | 15 | 23.26 | 79.6 | 6.79 | 6.13 | 0.8 |
| | | 20 | 22.65 | 70 | 6.05 | 6.1 | 0.4 |
| | | 25 | 22.23 | 65.8 | 5.73 | 6.08 | 0.6 |
| | | 30 | 21.77 | 62.6 | 5.5 | 6.08 | 0.5 |
| | | 35 | 21.33 | 61.1 | 5.41 | 6.09 | 0.5 |
| | | 40 | 20.98 | 41.4 | 3.7 | 6.08 | 0.5 |
| | | 45 | 20.81 | 26.5 | 2.37 | 6.11 | 0.5 |
| | | 50 | 20.57 | 12.8 | 1.15 | 6.21 | 1.2 |

**2005 Walter Stratification**

| Station | Date | Depth | Temp | DO% | DO Conc | pH | Chlorophyll |
|---|---|---|---|---|---|---|---|
| | M/D/Y | Feet | C | | mg/L | | ug/L |
| WA-7 Lehigh Lake Arm Secchi 2.35 meters (7' 9") | 7/27/2005 | 0 | 26.77 | 88.2 | 7.06 | 6.41 | 1 |
| | | 5 | 26.55 | 88.6 | 7.12 | 6.34 | 2 |
| | | 10 | 26.02 | 80.5 | 6.53 | 6.22 | 1.1 |
| | | 15 | 25.37 | 83.7 | 6.87 | 6.25 | 0.3 |
| | | 20 | 24.57 | 72.6 | 6.05 | 6.03 | 1.1 |
| | | 25 | 23.55 | 55 | 4.67 | 5.86 | 1.4 |
| WA-7 Lehigh Lake Arm Secchi 2.2 meters | 8/24/2005 | 0 | 24.27 | 87.2 | 7.31 | 6.71 | 1.5 |
| | | 5 | 24.26 | 86.3 | 7.23 | 6.57 | 2.3 |
| | | 10 | 23.92 | 84.2 | 7.09 | 6.49 | 4.4 |
| | | 15 | 23.61 | 82.8 | 7.02 | 6.45 | 2.8 |
| | | 20 | 22.06 | 83.6 | 7.3 | 6.44 | 1.6 |
| WA-7 Lehigh Lake Arm Secchi 2.75 meters (9' 1") | 9/20/2005 | 0 | 22.6 | 98 | 8.47 | 6.9 | 4.8 |
| | | 5 | 22.62 | 97.8 | 8.45 | 6.87 | 4.6 |
| | | 10 | 22.57 | 96.2 | 8.32 | 6.78 | 4.1 |
| | | 15 | 22.38 | 90.5 | 7.86 | 6.67 | 1.6 |
| | | 20 | 19.8 | 89.9 | 8.2 | 6.68 | 2.4 |