# TMDLS FOR PHOSPHORUS, COPPER, AND ZINC FOR THE POTEAU RIVER NEAR WALDRON, AR

## (Reach 11110105-031L)

**FINAL**
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# TMDLS FOR PHOSPHORUS, COPPER AND ZINC FOR THE POTEAU RIVER NEAR WALDRON, AR (Reach 11110105-031L)

Prepared for

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# EXECUTIVE SUMMARY

Section 303(d) of the Federal Clean Water Act requires states to identify waterbodies that are not meeting water quality standards and to develop total maximum daily pollutant loads for those waterbodies. A total maximum daily load (TMDL) is the amount of a pollutant that a waterbody can assimilate without exceeding the established water quality standard for that pollutant. Through a TMDL, pollutant loads can be allocated to point sources and nonpoint sources discharging to the waterbody.

This report presents TMDLs for total phosphorus, copper, and zinc for the Poteau River near Waldron in western Arkansas (reach 11110105-031L). The watershed for this reach of the Poteau River is located within the Arkansas River Valley ecoregion and is over 95% forest and pasture. The drainage area upstream of the impaired reach (11110105-031L) is 43.9 square miles. The Poteau River flows into Oklahoma approximately 22 miles downstream of the impaired reach.

This stream reach was cited as not supporting its designated use of aquatic life according to the final 2002 Arkansas 303(d) list and the draft 2004 Arkansas 303(d) list . Based on the 303(d) listing and a 1994 study by the Arkansas Department of Environmental Quality (ADEQ), the suspected sources of impairment include a municipal point source (the City of Waldron wastewater treatment plant (WWTP)) and an industrial point source (Tyson Foods at Waldron). The 1994 study by ADEQ showed that these two facilities appear to have a noticeable impact on water quality in the Poteau River.

Historical monitoring data for phosphorus, copper, and zinc have been collected by ADEQ in the Poteau River upstream of the two point sources (ARK0054) and downstream of the two point sources (ARK0055). These data were summarized and plotted. In general, concentrations of phosphorus, copper, and zinc tended to be higher at the downstream station.

Numeric water quality criteria for copper and zinc were calculated using the equations in Arkansas Regulation No. 2 with the default hardness for the Arkansas River Valley ecoregion. Arkansas has no numeric instream criterion for phosphorus. Previous versions of Arkansas Regulation No. 2 included a guideline of 0.1 mg/L for total phosphorus in streams. Although this

guideline was never a criterion, it was still considered to be a reasonable benchmark for evaluating phosphorus levels in streams for the protection of aquatic life; therefore, it was used as the target concentration, or endpoint, for the phosphorus TMDL.

The copper and zinc wasteload allocations (WLAs) were developed for 7Q10 flow conditions due to potential toxicity from these parameters and ADEQ's permitting policies for toxic substances. The copper and zinc load allocations (LAs) were developed for average annual flow conditions in order to quantify the nonpoint source component of the TMDL. The phosphorus TMDL was developed for average annual conditions because aquatic life impairments typically occur as a result of long term exposure to elevated nutrient concentrations rather than short term increases in nutrient concentrations. All three TMDLs were developed using a simple mass balance approach assuming conservative mixing.

The margin of safety (MOS) for the copper and zinc TMDLs was implicit based on conservative assumptions. An explicit MOS of 10% was used for the phosphorus TMDL.

Point source reductions for copper will be required for both facilities because averages of recent effluent concentrations reported on discharge monitoring reports (DMRs) are greater than the allowable effluent concentrations. Both facilities had individual months with average effluent concentrations of zinc that exceeded the allowable concentration, but the average effluent concentrations over 7–12 months at both facilities are already less than the allowable concentration. Point source reductions for phosphorus will be required for both facilities because averages of recent effluent concentrations reported on DMRs are greater than the allowable effluent concentrations.

No nonpoint source reductions of copper and zinc are required for these TMDLs because the existing upstream concentrations of dissolved copper and dissolved zinc are less than the chronic water quality criteria. A nonpoint source reduction of 35% is needed for phosphorus.

The components of these TMDLs are summarized in Table ES.1.

Table ES.1. Summary of TMDLs for Poteau River reach 11110105-031L.

| | Allowable loads (lbs/day) of: | | |
|---|---|---|---|
| | **Total Phosphorus** | **Dissolved Copper** | **Dissolved Zinc** |
| WLA for point sources | 22.73 | 0.061 | 0.566 |
| LA for nonpoint sources | 20.23 | 0.818 | 2.34 |
| MOS | 4.77 | implicit | implicit |
| TMDL | 47.73 | 0.879 | 2.91 |

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# 1.0 INTRODUCTION

This report presents total maximum daily loads (TMDLs) for total phosphorus, copper, and zinc for the Poteau River near Waldron in western Arkansas. This stream reach was cited as not supporting its designated use of aquatic life according to the final 2002 Arkansas 303(d) list (EPA 2003) and the draft 2004 Arkansas 303(d) list (Arkansas Department of Environmental Quality (ADEQ) 2005). The sources of contamination and causes of impairment from the draft 2004 303(d) list are shown in Table 1.1. The TMDLs in this report address impairments due to total phosphorus, copper, and zinc, but not other causes of impairment (siltation/turbidity and nitrate). The TMDLs in this report were developed in accordance with Section 303(d) of the Federal Clean Water Act and the Environmental Protection Agency's (EPA's) regulations in 40 CFR 130.7.

The purpose of a TMDL is to determine the pollutant loading that a waterbody can assimilate without exceeding the water quality standard for that pollutant and to establish the load reduction that is necessary to meet the standard in a waterbody. The TMDL is the sum of the wasteload allocation (WLA), the load allocation (LA), and a margin of safety (MOS). The WLA is the load allocated to point sources of the pollutant of concern. The LA is the load allocated to nonpoint sources, including natural background. The MOS is a percentage of the TMDL that takes into account any lack of knowledge concerning the relationship between pollutant loadings and water quality.

Table 1.1. 303(d) listing for the stream reach in this task order (ADEQ 2005).

| Stream Name and Reach No. | Impaired Use | Sources | Causes | Category | Priority |
|---|---|---|---|---|---|
| Poteau River 11110105-031L | Aquatic life | Surface erosion, industrial point source, municipal point source | Siltation / turbidity, nitrate, total phosphorus | 5A | Medium |
| | Aquatic life | Industrial point source, municipal point source | Copper, zinc | 5C | Medium |

# 2.0 BACKGROUND INFORMATION

## 2.1 General Information

The study area for the TMDLs in this report is part of the Poteau River watershed near Waldron in western Arkansas (see Figure A.1 located in Appendix A). The Poteau River drains in a generally westerly direction and flows into Oklahoma about 22 miles downstream of the impaired reach (ADEQ 1994). The impaired portion of the Poteau River starts at the confluence of the Poteau River and East Fork Poteau River and extends approximately 7 miles downstream to the confluence with Jones Creek.

The Poteau River watershed is in the Arkansas River Valley ecoregion. The Poteau River watershed is also part of ADEQ Planning Segment 3I and US Geological Survey (USGS) Hydrologic Unit 11110105. The drainage area of the Poteau River is 43.9 square miles at the upstream end of the impaired reach and 73.5 square miles immediately upstream of its confluence with Jones Creek (USGS 1970).

## 2.2 Land Use

Land use data for the study area were obtained from the GEOSTOR database, which is maintained by the Center for Advanced Spatial Technology (CAST) at the University of Arkansas in Fayetteville. These data were based on satellite imagery from 1999. The spatial distribution of these land uses is shown on Figure A.2 (located in Appendix A) and land use percentages are shown in Table 2.1. These data indicate that approximately 55% of the study area is comprised of forest and approximately 41% is pasture. The larger areas of forest land use are generally remote from the streams in the study area, based on a review of the land use map. The areas of pasture land use generally extends to the banks of the streams. This would cause the practices on the pasture land use to have a greater effect on the instream water quality than the practices on the forest land use.

Table 2.1. Land use percentages for the study area.

| Land use | Percentage of study area |
|---|---|
| Forest | 54.8% |
| Pasture | 41.1% |
| Urban | 3.2% |
| Water | 0.9% |
| Total | 100.0% |

## 2.3 Stream Flow

The USGS has published daily stream flow data for the Poteau River near Cauthron, AR (gage No. 07247000), which is downstream of the study area (see Figure A.1). The period of record for this station is from 1940 through 2004. Since September 1974, flow from approximately half of the upstream drainage area has been regulated by a series of floodwater detention reservoirs. For water years 1975 through 2004, the long term average flow for this gage is 244 cfs, resulting in a average flow per unit area of 1.20 cfs per square mile based on the drainage area of 203 square miles at the gage (USGS 2005).

The published 7Q10 flow for the Poteau River near Cauthron, AR is 0.02 cfs (USGS 1992). This 7Q10 flow includes contributions from the two point sources in Waldron as well as any leakage from Hinkle Lake Dam on Jones Creek. Based on these flow contributions and the difference in drainage areas (203 square miles at the USGS gage and 43.9 square miles upstream of the study area), a 7Q10 flow of zero was assumed for the study area.

## 2.4 Water Quality Standards

### 2.4.1 Designated Uses

Water quality standards for the Poteau River are given in Arkansas Regulation No. 2 (APCEC 2004a). The designated uses for this reach of the Poteau River include primary and secondary contact recreation; domestic, industrial, and agricultural water supply; and perennial fishery (where the drainage area is at least 10 square miles).

### 2.4.2 Metals

Section 2.508 of Regulation No. 2 provides both a narrative criterion and numeric criteria that apply to toxic substances including copper and zinc. The general narrative criterion is: "Toxic substances shall not be present in receiving waters, after mixing, in such quantities as to be toxic to human, animal, plant or aquatic life or to interfere with the normal propagation, growth and survival of the indigenous aquatic biota." Numeric criteria for dissolved copper and dissolved zinc include both acute and chronic criteria expressed as a function of hardness. Based on data from ADEQ monitoring station ARK0055, average hardness in the Poteau River downstream of Waldron is approximately 35 mg/L (ADEQ 2002). ADEQ's Continuing Planning Process (CPP) (ADEQ 2000) specifies that numeric criteria for metals such as copper and zinc should be calculated using the default hardness for each ecoregion (25 mg/L for the Arkansas River Valley ecoregion). Using the default hardness value, the acute and chronic criteria for dissolved copper and dissolved zinc in the Arkansas River Valley Ecoregion are calculated as shown in Table 2.2.

The acute criteria are based on toxicity resulting from short-term exposure to high concentrations, whereas chronic criteria are based on toxicity resulting from long-term exposure to lower concentrations. Since this report focuses on critical conditions over the long term, the chronic criteria were used to calculate the TMDLs for copper and zinc.

Table 2.2. Copper and zinc criteria for the Arkansas River Valley ecoregion.

| Parameter | Acute Criterion (µg/L) | | Chronic Criterion (µg/L) | |
|---|---|---|---|---|
| | Equation | Criteria | Equation | Criteria |
| Dissolved Copper | $0.960e^{[0.9422*\ln(\text{hardness})]-1.464}$ | 4.6 | $0.960e^{[0.8545*\ln(\text{hardness})]-1.465}$ | 3.5 |
| Dissolved Zinc | $0.978e^{[0.8473*\ln(\text{hardness})]+0.8604}$ | 35.4 | $0.986e^{[0.8473*\ln(\text{hardness})]+0.7614}$ | 32.3 |

### 2.4.3 Phosphorus

Arkansas Regulation No. 2 includes the following narrative criteria concerning phosphorus (APCEC 2004a):

> "Materials stimulating algal growth shall not be present in concentrations sufficient to cause objectionable algal densities or other nuisance aquatic vegetation or otherwise impair any designated use of the waterbody. Impairment of a waterbody from excess nutrients are dependent on the natural waterbody characteristics such as stream flow, residence time, stream slope, substrate type, canopy, riparian vegetation, primary use of waterbody, season of the year and ecoregion water chemistry. Because nutrient water column concentrations do not always correlate directly with stream impairments, impairments will be assessed by a combination of factors such as water clarity, periphyton or phytoplankton production, dissolved oxygen values, dissolved oxygen saturation, diurnal dissolved oxygen fluctuations, pH values, aquatic-life community structure and possibly others. However, when excess nutrients result in an impairment, based upon Department assessment methodology, by any established, numeric water quality standard, the waterbody will be determined to be impaired by nutrients."

Although Arkansas Regulation No. 2 does not include an instream water quality criterion for phosphorus, it specifies the following requirements for point sources discharging into impaired waterbodies:

> "All point source discharges into the watershed of waters officially listed on Arkansas' impaired waterbody list (303d) with phosphorus as the major cause shall have monthly average discharge permit limits no greater than those listed below. Additionally, waters in nutrient surplus watersheds as determined by Act 1061 of 2003 Regular Session of the Arkansas 84th General Assembly and subsequently designated nutrient surplus watersheds may be included under this Reg. if point source discharges are shown to provide a significant phosphorus contribution to waters within the listed nutrient surplus watersheds.

| Facility Design Flow | Total Phosphorus discharge limit |
|---|---|
| 15 MGD or more | Case by case |
| 3 to <15 MGD | 1.0 mg/L |
| 1 to <3 MGD | 2.0 mg/L |
| 0.5 to <1.0 MGD | 5.0 mg/L |
| <0.5 MGD | Case by case |

> "For discharges from point sources which are greater than 15 MGD, reduction of phosphorus below 1 mg/L may be required based on the magnitude of the phosphorus load (mass) and the type of downstream waterbodies (e.g., reservoirs, Extraordinary Resource Waters). Additionally, any discharge limits listed above may be further reduced if it is determined that these values are causing impairments to special waters such as domestic water supplies, lakes or reservoirs or Extraordinary Resource Waters."

### 2.4.4 Antidegradation

As specified in EPA's regulations at 40 CFR 130.7(b)(2), applicable water quality standards include antidegradation requirements. Arkansas' antidegradation policy is listed in Sections 2.201 through 2.204 of Regulation No. 2. These sections impose the following requirements:

- Existing instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected.
- Water quality that exceeds standards shall be maintained and protected unless allowing lower water quality is necessary to accommodate important economic or social development, although water quality must still be adequate to fully protect existing uses.
- For outstanding state or national resource waters, those uses and water quality for which the outstanding waterbody was designated shall be protected.
- For potential water quality impairments associated with a thermal discharge, the antidegradation policy and implementing method shall be consistent with Section 316 of the Clean Water Act.

## 2.5 Nonpoint Sources

As indicated in Table 1.1, the 303(d) list did not specifically mention nonpoint sources as a primary cause of impairment for phosphorus, copper, or zinc. Previous studies have attributed nonpoint sources of pollution in the watershed to runoff from agricultural activities, particularly cattle and poultry farming (ADEQ 1994).

## 2.6 Point Sources

Based on a previous study of the Poteau River (ADEQ 1994), there are two facilities in the study area with point source discharges that are permitted through the National Pollutant

Discharge Elimination System (NDPES). Design flows and relevant permit limits for these two facilities are presented in Table 2.3 and locations of these facilities are shown on Figure A.3. The NPDES permits for both facilities were renewed in 2004. Relevant effluent data reported by each facility on Discharge Monitoring Reports (DMRs) were downloaded from the Permit Compliance System (PCS) web site (EPA 2005) and are summarized in Table 2.4.

Table 2.3. Design flows and permit limits for point source discharges.

| NPDES Number | Facility Name | Design Flow (MGD) | Parameter | Monthly Average Permit Limits |
|---|---|---|---|---|
| AR0038482 | Tyson Foods Inc. Waldron Facility | 1.25 | Total Phosphorus | 2 mg/L* |
| | | | Copper | Report only |
| | | | Zinc | Report only |
| AR0035769 | City of Waldron Wastewater Treatment Plant (WWTP) | 0.85 | Total Phosphorus | Report only |
| | | | Copper | Report only |
| | | | Zinc | Report only |

* Not effective until December 1, 2007 (end of 3 year compliance period).

Table 2.4. Summary of DMR data for point source discharges.

| Facility Name and NPDES No. | Period of Record | Parameter* | Statistics on monthly average values | | | |
|---|---|---|---|---|---|---|
| | | | No. of Values | Minimum | Maximum | Average |
| Tyson Foods Inc. Waldron Facility (AR0038482) | Dec. 2004 - Jul. 2005 | TP conc. (mg/L) | 7 | 0.52 | 6.96 | 2.53 |
| | | Cu conc. (µg/L) | 7 | 6.0 | 75 | 17 |
| | | Zn conc. (µg/L) | 7 | 6.0 | 100 | 62 |
| | | TP load (lbs/day) | 8 | 5.3 | 71.0 | 29.7 |
| | | Cu load (lbs/day) | 7 | 0.02 | 0.62 | 0.14 |
| | | Zn load (lbs/day) | 7 | 0.05 | 0.90 | 0.51 |
| City of Waldron WWTP (AR0035769) | Aug. 2004 - Jul. 2005 | TP conc. (mg/L) | 12 | 0.16 | 2.99 | 1.18 |
| | | Cu conc. (µg/L) | 12 | 1.5 | 245 | 39 |
| | | Zn conc. (µg/L) | 12 | 5.0 | 184 | 61 |
| | | TP load (lbs/day) | 12 | 1.0 | 15.2 | 5.6 |
| | | Cu load (lbs/day) | 12 | 0.01 | 1.08 | 0.19 |
| | | Zn load (lbs/day) | 12 | 0.03 | 0.90 | 0.30 |

* TP = total phosphorus, Cu = total copper, and Zn = total zinc. Although the water quality standards for metals are expressed as dissolved concentrations, NPDES permittees are required to measure and report total concentrations.

## 2.7 Previous Studies

In 1994, ADEQ conducted a water quality investigation of the Poteau River near Waldron (ADEQ 1994). This investigation included collection of field data to characterize water chemistry, periphyton, macroinvertebrates, and fish communities upstream and downstream of point source discharges from the City of Waldron WWTP and the Tyson Waldron facility. The investigation revealed high nutrient concentrations in the effluent of both facilities and in the Poteau River downstream of the discharges. In particular, the Tyson discharge contained a high ortho-phosphate concentration and the City of Waldron discharge contained a high nitrate concentration. The study also revealed that the City of Waldron discharge contained dissolved copper and zinc concentrations that significantly exceeded the water quality criteria. The discharge from the Tyson facility contained zinc concentrations that slightly exceeded the water quality criteria. As a result, dissolved copper and zinc concentrations in the Poteau River downstream of the discharges slightly exceeded the water quality criteria.

# 3.0 EXISTING WATER QUALITY CONDITIONS

## 3.1 General Description of Data

Nutrient and metals data have been collected by ADEQ at approximately monthly intervals at two locations on the Poteau River within the study area. As shown on Figure A.3 (located in Appendix A), ADEQ Station ARK0054 is located upstream of the two point source discharges (Tyson Foods and City of Waldron WWTP) and ADEQ Station ARK0055 is located downstream of the two point source discharges. Data from these stations were obtained from the ADEQ web site. Time series plots of the data are shown on Figures B.1 – B.6 (located in Appendix B) and summary statistics are presented in Table 3.1. Comparing the data for these two stations, concentrations of total phosphorus, dissolved copper, and dissolved zinc tend to be higher at the downstream station (ARK0055).

Table 3.1. Summary of historical data for ADEQ Stations ARK0054 and ARK0055.

| Station ID | Parameter* | Period of Record | No. of values | Min. | Max. | Avg. | No. of values above chron. crit. | % of values above chron. crit. |
|---|---|---|---|---|---|---|---|---|
| ARK0054 | Cu, µg/L | 1/03/95 - 9/21/04 | 38 | <0.5 | 6.3 | 1.78 | 2 | 5% |
| | Zn, µg/L | 1/03/95 - 9/21/04 | 37 | <1.0 | 13.3 | 5.08 | 0 | 0% |
| | TP, mg/L | 9/11/90 - 9/06/05 | 137 | <0.02 | 12.1 | 0.30 | -- | -- |
| ARK0055 | Cu, µg/L | 1/03/95 - 10/04/05 | 55 | <0.5 | 17.4 | 4.63 | 31 | 56% |
| | Zn, µg/L | 1/03/95 - 10/04/05 | 53 | 1.8 | 81.3 | 27.0 | 18 | 34% |
| | TP, mg/L | 9/11/90 - 10/04/05 | 173 | <0.02 | 25.76 | 3.65 | -- | -- |

* TP = total phosphorus, Cu = dissolved copper, and Zn = dissolved zinc.

This stream was assessed as not supporting aquatic life because more than 10% of the measured copper and zinc values exceeded the criteria at Station ARK0055. As shown in Table 3.1, 56% of the copper values and 34% of the zinc values exceeded the chronic criteria at ARK0055.

## 3.2 Seasonal Patterns

The numeric criteria for copper and zinc do not vary seasonally, nor does the narrative criteria for phosphorus. Seasonal variations in existing water quality may provide additional insight into the causes of water quality impairment. Seasonal plots of the data for total phosphorus, dissolved copper, and dissolved zinc are shown on Figures C.1 – C.6 (located in Appendix C). These plots do show slight seasonal variability, but this variability may be attributed to seasonal variations in stream flow.

## 3.3 Relationships with Flow

Plots of total phosphorus, dissolved copper, and dissolved zinc versus stream flow were developed to examine potential correlations (Figures D.1 – D.6 in Appendix D). The flow data used for these plots was from USGS gage number 07247000 (Poteau River near Cauthron, AR). These plots show that the highest concentrations for these parameters generally occurred at low flow conditions.

# 4.0 TMDL DEVELOPMENT FOR COPPER AND ZINC

## 4.1 Critical Conditions and Seasonality

EPA's regulations at 40 CFR 130.7 require the determination of TMDLs to take into account critical conditions for stream flow, loading, and water quality parameters. Also, both Section 303(d) of the Clean Water Act and regulations at 40 CFR 130.7 require TMDLs to consider seasonal variations for meeting water quality standards.

Allowable loadings of copper and zinc should be calculated using a critical flow that is protective for toxic substances because high concentrations of copper or zinc could cause harm to aquatic life within a short period of time. ADEQ uses the 7Q10 flow when they conduct screening calculations involving metals and when they calculate water quality based permit limits for metals; these procedures are documented in the Arkansas CPP (ADEQ 2000). The 7Q10 flow was used for the copper and zinc TMDLs in this report.

These metals TMDLs were developed on an annual basis rather than for individual seasons because the numeric criteria for copper and zinc do not vary seasonally and the point source discharges do not have seasonal permit limits for copper or zinc.

## 4.2 Establishing the Water Quality Targets

As mentioned in Section 2.4, Arkansas has both acute and chronic criteria for dissolved copper and dissolved zinc. Since this report focuses on critical conditions over the long term, the chronic criteria were used to calculate the TMDLs. The chronic criteria are 3.5 μg/L for dissolved copper and 32.3 μg/L for dissolved zinc.

## 4.3 Wasteload Allocation

A WLA was developed for the two point sources discussed in Section 2.6. With a 7Q10 flow of zero, the Poteau River provides no dilution for the point source discharges during critical low flow conditions. The facilities must discharge effluent that meets the instream standard at the point of discharge. Under this scenario, the allowable load for each point source was calculated by multiplying the chronic water quality criterion by the respective design flow for that point

source. The permit limits that would be consistent with this scenario would be monthly average limits that are equal to the chronic water quality criteria (after converting them from dissolved concentrations to total concentrations since ADEQ specifies permit limits for metals as total concentrations). Table 4.1 shows the allowable effluent concentrations and loads as both dissolved and total values.

Table 4.1. Allowable point source concentrations and loads for copper and zinc.

| Parameter | Facility and permit number | Flow rate (MGD) | Dissolved metals | | Permit limits* (total metals) | |
|---|---|---|---|---|---|---|
| | | | Conc. (µg/L) | Load (lbs/day) | Conc. (µg/L) | Load (lbs/day) |
| Copper | City of Waldron WWTP (AR0035769) | 0.85 | 3.5 | 0.025 | 9.2 | 0.065 |
| | Tyson Foods - Waldron (AR0038482) | 1.25 | 3.5 | 0.036 | 9.2 | 0.096 |
| | Total allowable loads | -- | -- | 0.061 | -- | 0.161 |
| Zinc | City of Waldron WWTP (AR0035769) | 0.85 | 32.3 | 0.229 | 85.5 | 0.606 |
| | Tyson Foods - Waldron (AR0038482) | 1.25 | 32.3 | 0.337 | 85.5 | 0.891 |
| | Total allowable loads | -- | -- | 0.566 | -- | 1.497 |

*Monthly average permit limits were calculated using a spreadsheet from ADEQ that includes a conversion between dissolved and total concentrations as well as a factor to estimate monthly average limits that correspond with certain confidence limits for maintaining water quality standards in the receiving stream.

Based on averages of recent effluent concentrations of total copper shown in Table 2.4 (17 µg/L for Tyson and 39 µg/L for the City of Waldron), both point source discharges will need to reduce their effluent concentrations to comply with the copper TMDL. For zinc, both facilities had individual months with average effluent concentrations that exceeded the allowable concentration of total zinc (85.5 µg/L), but the average effluent concentrations of total zinc over 7 –12 months at both facilities (62 µg/L for Tyson and 61 µg/L for the City of Waldron) are already less than the allowable concentration.

## 4.4 Load Allocations

During critical low flow conditions (i.e. 7Q10 conditions), the flow upstream of the point source discharges is estimated to be zero (See Section 2.3). It is also assumed that nonpoint source inflow to the Poteau River downstream of the point sources is negligible under 7Q10 conditions. In order to characterize the nonpoint source contribution to the TMDL, the annual average flow was used with the average concentration of the upstream monitoring data to determine the LA. As shown in Table 3.1, the average concentrations of dissolved copper and dissolved zinc at the upstream monitoring station were 1.78 μg/L and 5.08 μg/L, respectively. Using the appropriate conversion factors and the annual average flow (55.1 MGD; see Section 5.3), the LAs for copper and zinc were 0.818 lbs/day and 2.34 lbs/day, respectively.

No nonpoint source reductions of copper and zinc are required for these TMDLs because the existing upstream concentrations of dissolved copper and dissolved zinc are less than the chronic water quality criteria.

## 4.5 Margin of Safety

Both Section 303(d) of the Clean Water Act and regulations at 40 CFR 130.7 require TMDLs to include a MOS to account for lack of knowledge concerning the relationship between pollutant loadings and water quality. The MOS may be expressed explicitly as unallocated assimilative capacity or implicitly through conservative assumptions used in establishing the TMDL. An implicit MOS was incorporated though conservative assumptions for these metals TMDLs. One conservative assumption was that both point sources would be simultaneously discharging at design capacity during dry weather conditions. Another conservative assumption was the use of a default ecoregion hardness (25 mg/L) that was less than the average measured ambient hardness in the Poteau River (35 mg/L).

## 4.6 TMDLs

Each of these metals TMDLs was equal to the WLA (the sum of the individual permit loads) plus the LA plus the MOS (zero because it was defined as implicit). The TMDLs are summarized in Table 4.2.

Table 4.2. Summary of copper and zinc TMDLs for Poteau River.

| | Allowable loads (lbs/day) of: | |
|---|---|---|
| | **Dissolved Copper** | **Dissolved Zinc** |
| WLA for point sources | 0.061 | 0.566 |
| LA for nonpoint sources | 0.818 | 2.34 |
| MOS | implicit | implicit |
| TMDL | 0.879 | 2.91 |

## 4.7 Future Growth

Compliance with these copper and zinc TMDLs is based on keeping concentrations in the stream below the target concentrations rather than keeping the loads in the stream below certain amounts. Under critical low flow conditions, the flow in the stream consists entirely of effluent from point sources, so that point sources are required to meet the instream criterion at their discharge location (i.e. at the "end of the pipe"). As long as point source discharges or other inflows to the stream have concentrations of copper and zinc that do not exceed the chronic water quality criteria, then the effluent flow rates could increase, which would increase the allowable loading. Future growth for existing or new point sources discharging to the Poteau River is not limited by these TMDLs as long as the effluent concentrations of copper and zinc do not exceed the chronic water quality criteria.

# 5.0 TMDL DEVELOPMENT FOR PHOSPHORUS

## 5.1 Critical Conditions and Seasonality

EPA's regulations at 40 CFR 130.7 require the determination of TMDLs to take into account critical conditions for stream flow, loading, and water quality parameters. Also, both Section 303(d) of the Clean Water Act and regulations at 40 CFR 130.7 require TMDLs to consider seasonal variations for meeting water quality standards. Aquatic life impairments typically occur as a result of long term exposure to elevated nutrient concentrations rather than short-term increases in nutrient concentrations. This phosphorus TMDL was developed for average annual conditions. The most obvious result of nutrients is algal blooms. When the algae die, the resultant biological oxygen demand consumes oxygen, which adversely affects aquatic life. The effect occurs within a short time but the build-up of nutrients and the conditions to start the algal bloom may occur over an extended time.

## 5.2 Establishing the Water Quality Target

As mentioned in Section 2.4, Arkansas has no numeric instream criterion for phosphorus for the protection of aquatic life in streams. At the time when this reach of the Poteau River was first added to the 303(d) list for phosphorus, Arkansas Regulation No. 2 contained a numeric guideline for total phosphorus of 0.1 mg/L for streams. Although the current version of Regulation No. 2 no longer includes that guideline, it is still considered a reasonable benchmark for evaluating phosphorus levels in streams for the protection of aquatic life. The total phosphorus concentration of 0.1 mg/L was used as the target concentration, or numeric endpoint, for this phosphorus TMDL.

## 5.3 TMDL

The first step in developing the components of the phosphorus TMDL was to calculate the assimilative capacity for the segment. The assimilative capacity for the segment was calculated by simply multiplying the target phosphorus concentration (0.1 mg/L) by the total flow in the stream for the segment (the average annual ambient flow from the watershed plus the

design flow of both point source discharges) and the appropriate conversion factor. The average annual ambient flow for the segment was estimated as the average annual flow per unit area for the USGS gage on the Poteau River (1.20 cfs per square mile) times the drainage area of the segment (73.5 square miles) minus the historical average contribution of point source discharges to the USGS measured flows (1.88 MGD). This resulted in average annual flow rate of 88.2 cfs, or 55.1 MGD. Including the combined design flows from the point source discharges (2.1 MGD), the total average annual flow for the segment is 57.2 MGD. The TMDL was set equal to the assimilative capacity, which was calculated to be 47.73 lbs/day of total phosphorus.

## 5.4 Margin of Safety

The next step was to account for the MOS. Both Section 303(d) of the Clean Water Act and regulations at 40 CFR 130.7 require TMDLs to include a MOS to account for lack of knowledge concerning the relationship between pollutant loadings and water quality. The MOS may be expressed explicitly as unallocated assimilative capacity or implicitly through conservative assumptions used in establishing the TMDL. Ten percent of the assimilative capacity (i.e., 4.77 lbs/day) was set aside as an explicit MOS for this phosphorus TMDL. In addition to the explicit MOS, this TMDL also includes an unquantified implicit MOS due to the calculation of loads assuming that both point sources are simultaneously discharging at design capacity.

## 5.5 Wasteload Allocation

After subtracting the MOS from the TMDL, a WLA was calculated for the two point sources in the study area. Initially, an effluent phosphorus concentration of 2 mg/L was assumed for both point sources because that is the permit limit that will become effective for the Tyson facility in December 2007. The load for each point source was calculated as the design flow multiplied by 2 mg/L of total phosphorus and the appropriate conversion factor. When calculated with an effluent concentration of 2 mg/L, the WLA for both facilities consumed such a large portion of the total assimilative capacity that the remaining allowable load for nonpoint sources was unreasonably small. The allowable effluent concentrations were then reduced to 1.5 mg/L

for Tyson and 1.0 mg/L for the City of Waldron and the load calculations were repeated. This yielded allowable loads of 15.64 lbs/day for Tyson and 7.09 lbs/day for the City of Waldron. These loads did not exceed the available loading and were considered acceptable. The allowable effluent concentrations and loads are shown in Table 5.1.

Table 5.1. Allowable point source concentrations and loads for total phosphorus.

| | Flow rate (MGD) | Concentration (mg/L) | Load (lbs/day) |
|---|---|---|---|
| Tyson Foods Facility (AR0038482) | 1.25 | 1.5 | 15.64 |
| City of Waldron WWTP (AR0035769) | 0.85 | 1.0 | 7.09 |
| Total WLA | -- | -- | 22.73 |

Based on averages of recent effluent phosphorus concentrations shown in Table 2.4 (2.53 mg/L for Tyson and 1.18 mg/L for the City of Waldron), both point source discharges will need to reduce their effluent concentrations of phosphorus to comply with this TMDL.

## 5.6 Load Allocation

The LA for nonpoint source loading upstream of the point source discharges was calculated as the remaining available load after the MOS and WLA were subtracted from the TMDL. The LA was calculated to be 20.23 lbs/day.

Table 5.2. Summary of total phosphorus TMDL for Poteau River.

| | Allowable Loads (lbs/day) |
|---|---|
| WLA for point sources | 22.73 |
| LA for nonpoint sources | 20.23 |
| MOS (10%) | 4.77 |
| TMDL | 47.73 |

In order to calculate a percent reduction that would be needed for nonpoint source loads, the existing nonpoint source load was calculated as the median concentration of total phosphorus at ADEQ Station ARK0054 (0.065 mg/L) times the average annual flow for the segment

(57.2 MGD) and the appropriate conversion factor. This yielded an existing load of 31.0 lbs/day. To reduce this existing nonpoint source load to 20.23 lbs/day would require a 35% reduction.

## 5.7 Future Growth

Compliance with the phosphorus TMDL is based on keeping concentrations in the stream below the target concentration rather than keeping the load in the stream below a certain amount. The assimilative capacity of the stream will increase as the amount of flow in the stream increases. Increases in flow will allow for increased phosphorus loadings to the Poteau River. Future growth for existing or new point sources discharging to the Poteau River is not limited by this TMDL as long as the combined effect of the multiple point sources do not cause instream concentrations of phosphorus to exceed the target concentration of 0.1 mg/L.

# 6.0 MONITORING AND IMPLEMENTATION

In accordance with Section 106 of the federal Clean Water Act and under its own authority, ADEQ has established a comprehensive program for monitoring the quality of the State's surface waters. ADEQ collects surface water samples at various locations, utilizing appropriate sampling methods and procedures for ensuring the quality of the data collected. The objectives of the surface water monitoring program are to determine the quality of the state's surface waters, to develop a long-term data base for long term trend analysis, and to monitor the effectiveness of pollution controls. The data obtained through the surface water monitoring program is used to develop the state's biennial 305(b) report (*Water Quality Inventory*) and the 303(d) list of impaired waters, which is published as the 2002 Arkansas Integrated Water Quality Monitoring and Assessment Report (ADEQ 2002).

Point source reductions for this TMDL will be implemented through the NPDES permitting program, which is administered in Arkansas by ADEQ.

# 7.0 PUBLIC PARTICIPATION

When EPA establishes a TMDL, federal regulations require EPA to publicly notice and seek comment concerning the TMDL. Pursuant to a May 2000 consent decree, this TMDL was prepared under contract to EPA. After development of the draft version of this TMDL, EPA prepared a notice seeking comments, information, and data from the general public and affected public. Comments were submitted during the public comment period and this TMDL has been revised accordingly. Responses to these comments are included in Appendix E. EPA has transmitted the revised TMDL to ADEQ for implementation and for incorporation into ADEQ's current water quality management plan.

# 8.0 REFERENCES

ADEQ. 1994. Water Quality Survey of the Tyson Foods and City of Waldron Wastewater Treatment Facilities Effluent on the Poteau River. Report No. WQ94-11-1. Prepared by Water Division, Arkansas Department of Environmental Quality (formerly Arkansas Department of Pollution Control and Ecology). November 1994.

ADEQ. 2000. State of Arkansas Continuing Planning Process. Update and Revisions January 2000. Prepared by Water Division, Arkansas Department of Environmental Quality.

ADEQ. 2002. 2002 Arkansas Integrated Water Quality Monitoring and Assessment Report. Prepared by Arkansas Department of Environmental Quality, Water Division, Prepared pursuant to Sections 305(b) and 303(d) of the Federal Water Pollution Control Act. Downloaded from www.adeq.state.ar.us/water/branch_planning/pdfs/305(b)_030307.pdf

ADEQ. 2005. Arkansas' 2004 List of Impaired Waterbodies. February 2005. Downloaded from www.adeq.state.ar.us/water/branch_planning/pdfs/303d_list_public_notice.pdf

APCEC. 2004a. Regulation No. 2. Regulation Establishing Water Quality Standards for Surface Waters of the State of Arkansas. Adopted by the Arkansas Pollution Control and Ecology Commission on April 23, 2004.

APCEC. 2004b. Regulation No. 6, Regulations for State Administration of the National Pollutant Discharge Elimination System (NPDES). Adopted by the Arkansas Pollution Control and Ecology Commission on March 26, 2004.

EPA. 2003. Decision Document for the Approval of Arkansas' 2002 303(d) List. Downloaded from www.epa.gov/earth1r6/6wq/ecopro/artmdl/ar_2002_final_decision.pdf

EPA. 2005. Data downloaded from EPA Permit Compliance System (PCS) web site (www.epa.gov/enviro/html/pcs/adhoc.html).

USGS. 1970. Drainage Areas of Streams in Arkansas, Arkansas River Basin. Open-File Report, Prepared by J.N. Sullivan and J.E. Terry, US Geological Survey, Little Rock, AR.

USGS. 2005. Water Resources Data Arkansas Water Year 2004. Water-Data Report AR-04-1. Prepared by T.H. Brossett, T.P. Schrader, and D.A. Evans, U.S. Geological Survey, Little Rock, AR. January 2005.

# APPENDIX A

**Maps**

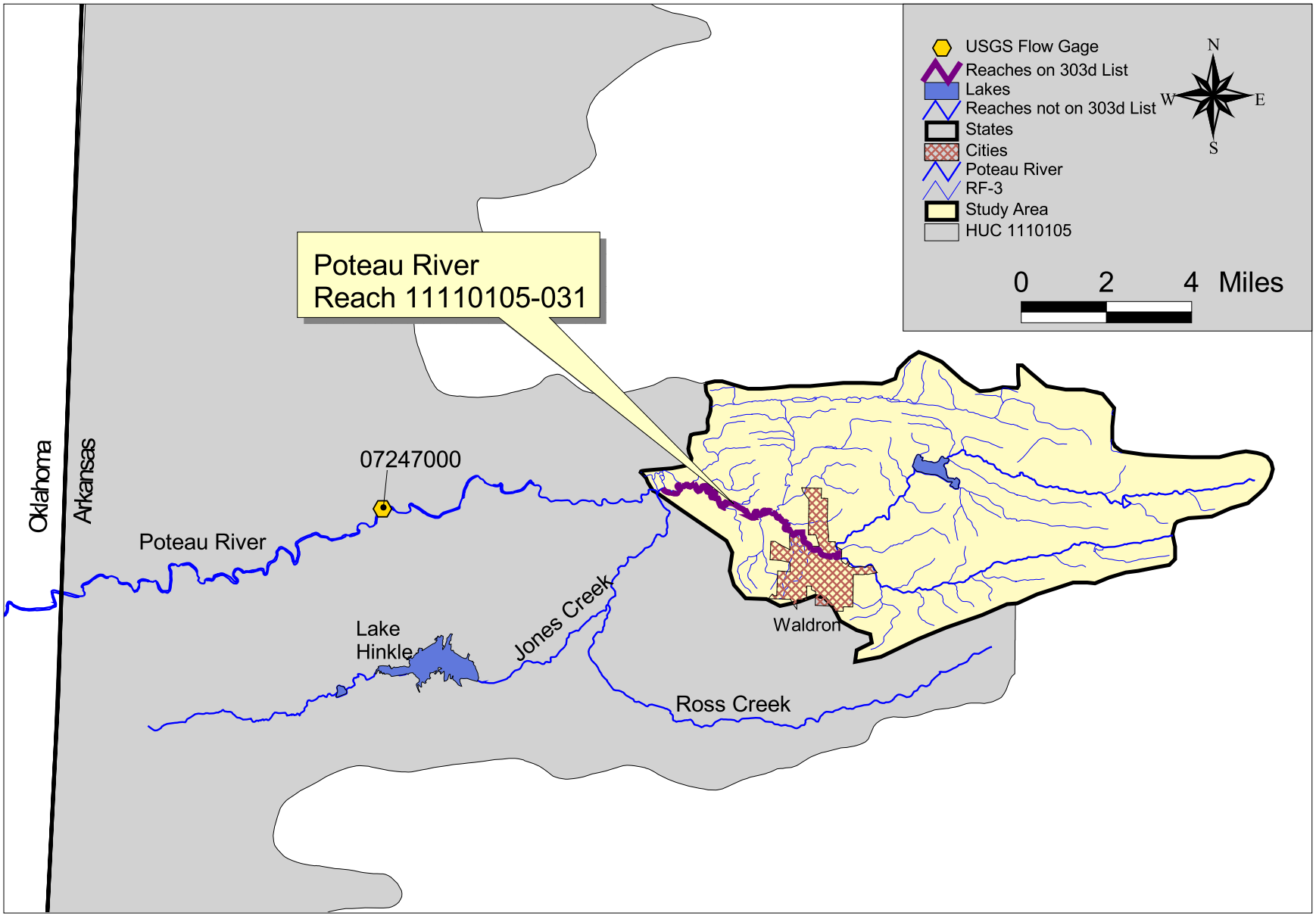



Figure A.1. Map of the study area.

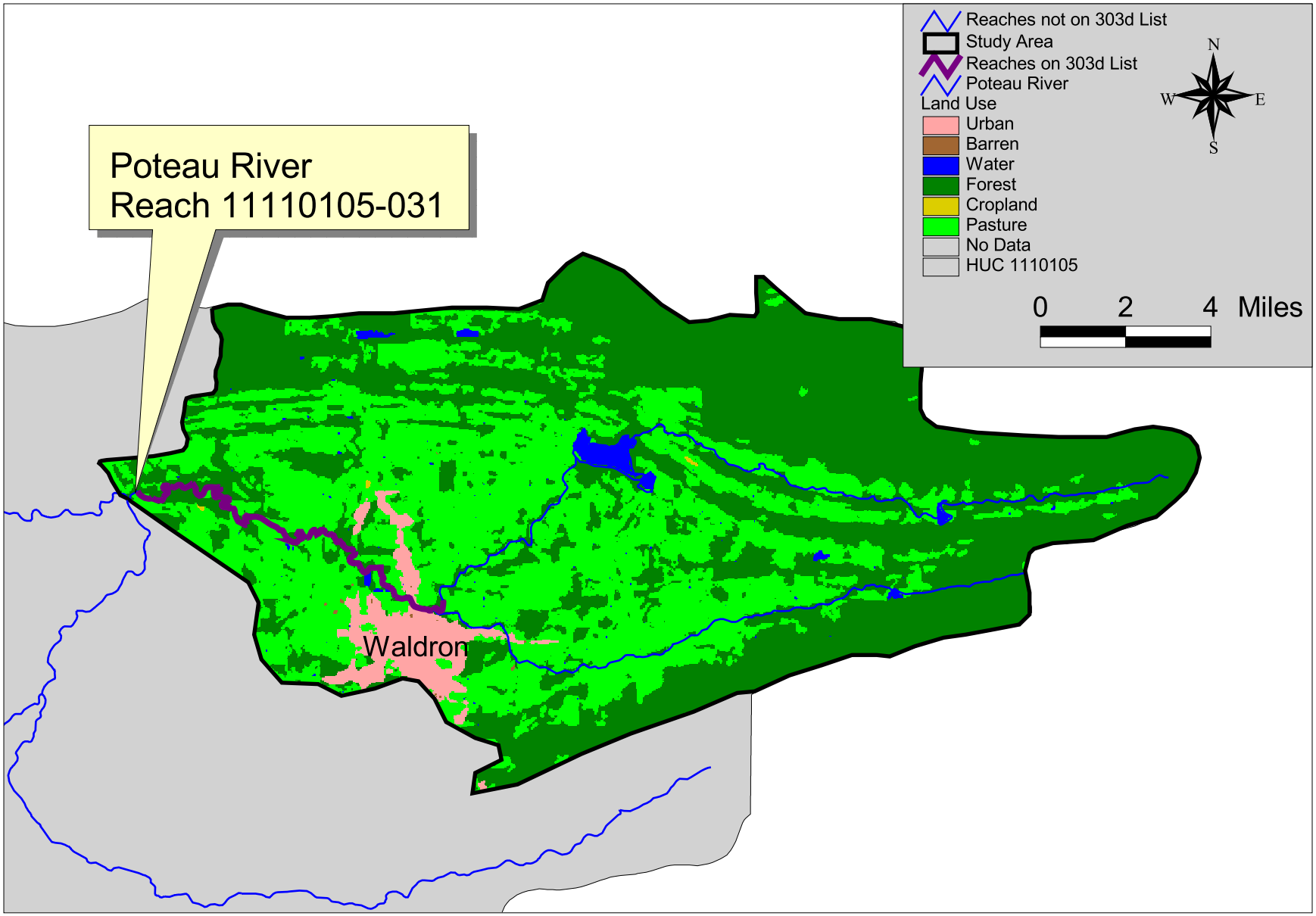



Figure A.2. Land use map.

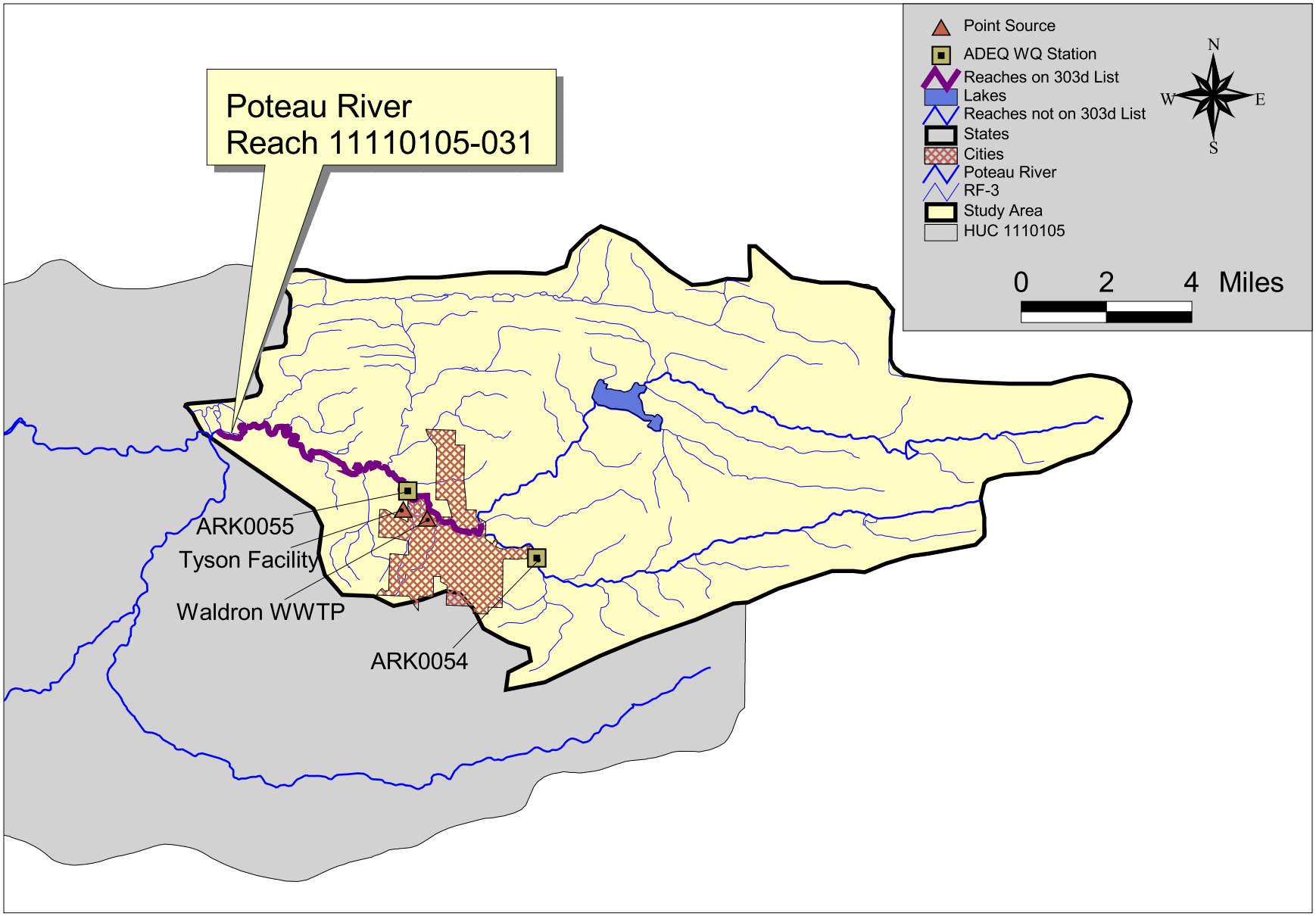



Figure A.3. Map of point source locations and water quality stations.

# APPENDIX B

**Time Series Plots of Water Quality Data**

**Figure B.1. Time Series Plot of Total Phosphorus Concentrations at Station ARK0054**

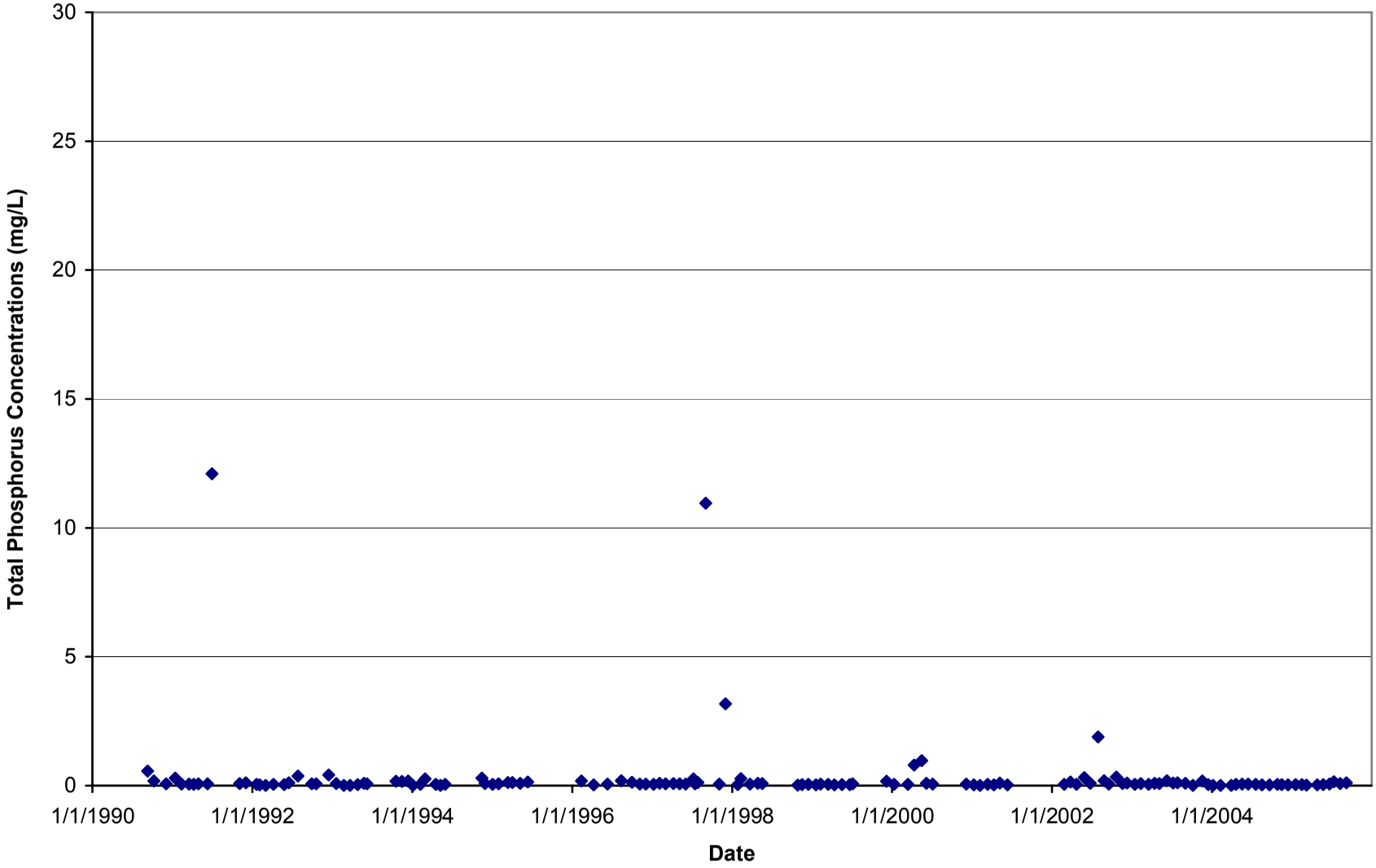


**Figure B.2. Time Series Plot of Total Phosphorus Concentrations at Station ARK0055**

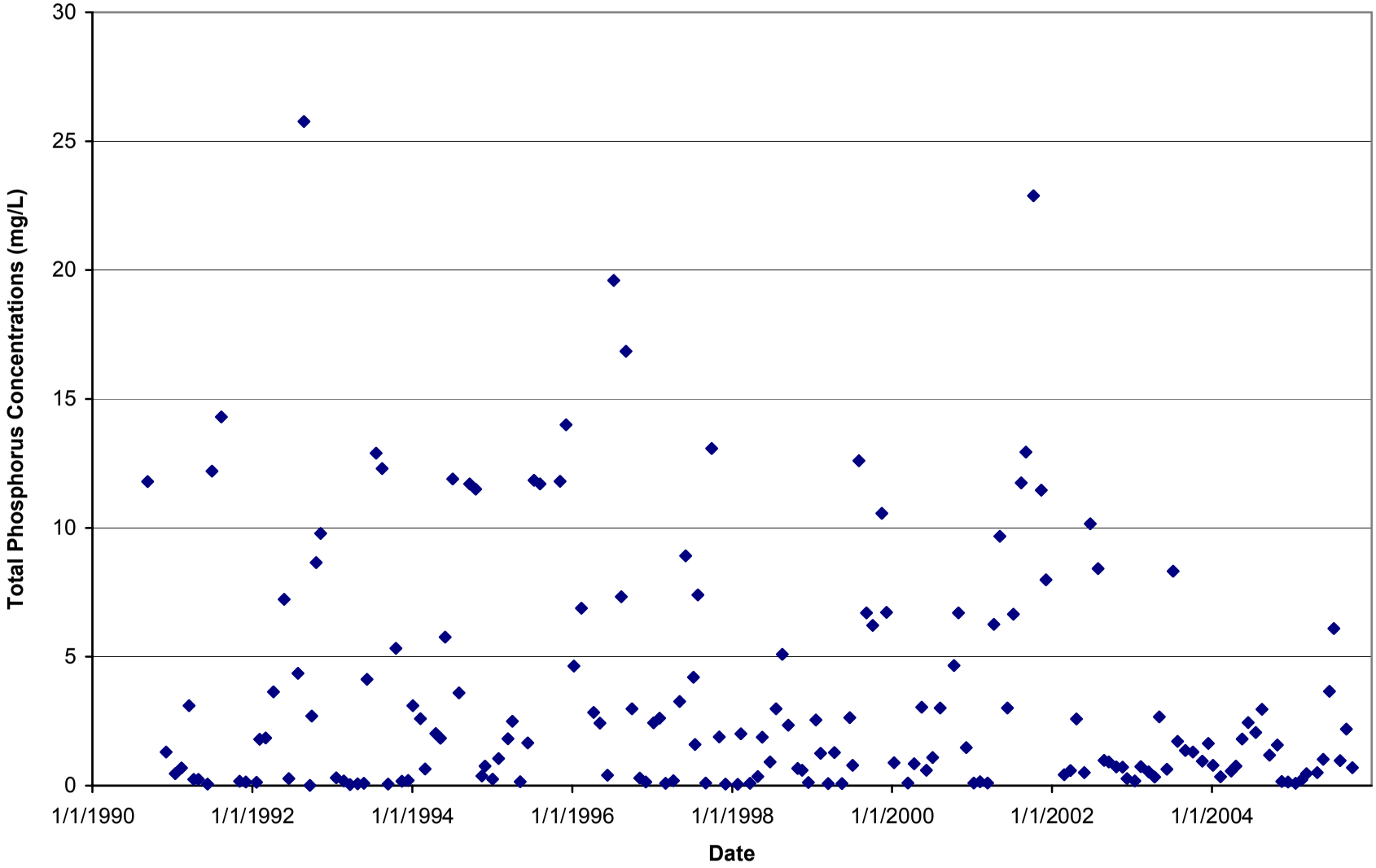


**Figure B.3. Time Series Plot of Dissolved Copper Concentrations at Station ARK0054**

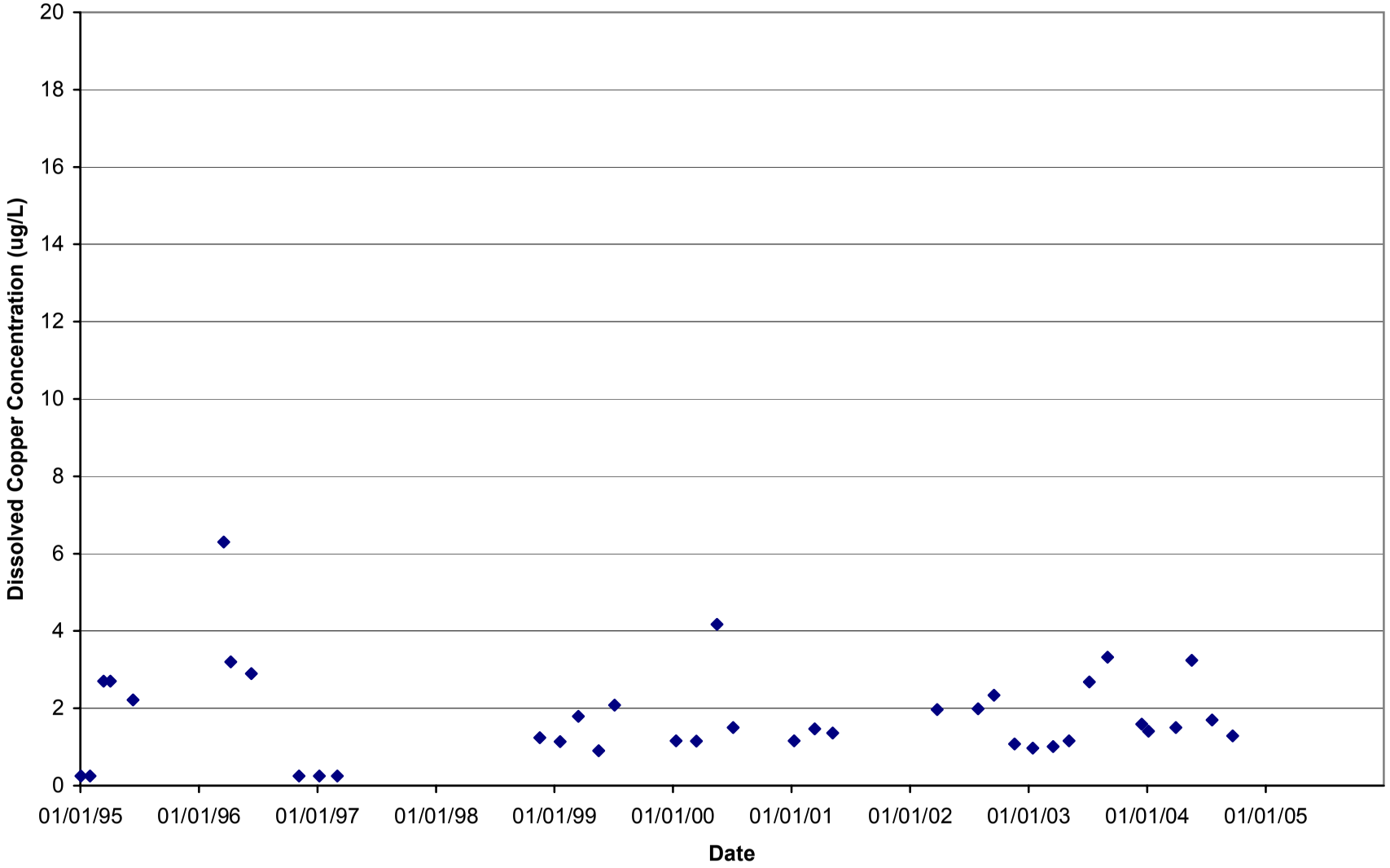


**Figure B.4. Time Series Plot of Dissolved Copper Concentrations at Station ARK0055**

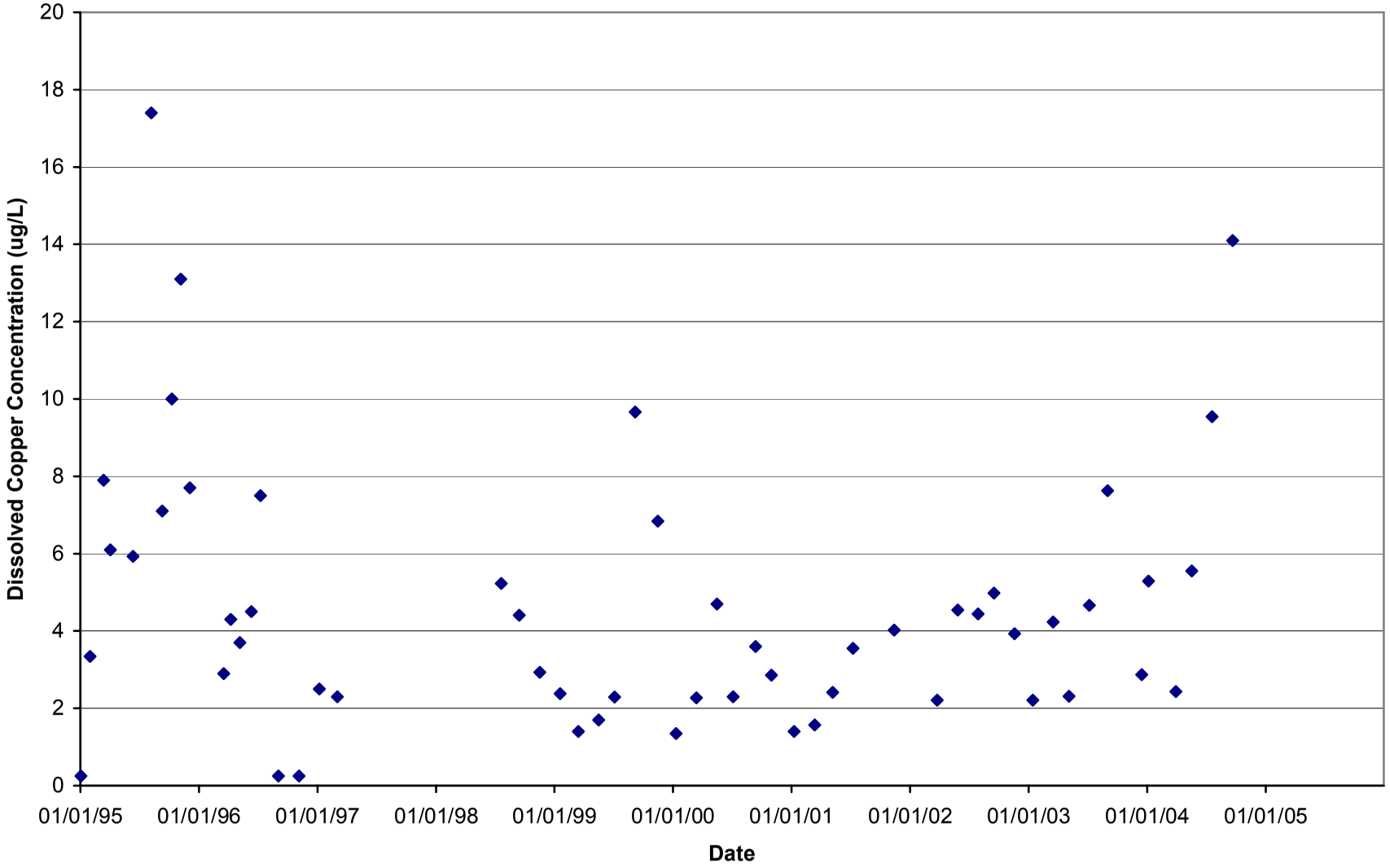


**Figure B.5. Time Series Plot ot Dissolved Zinc Concentrations at Station ARK0054**

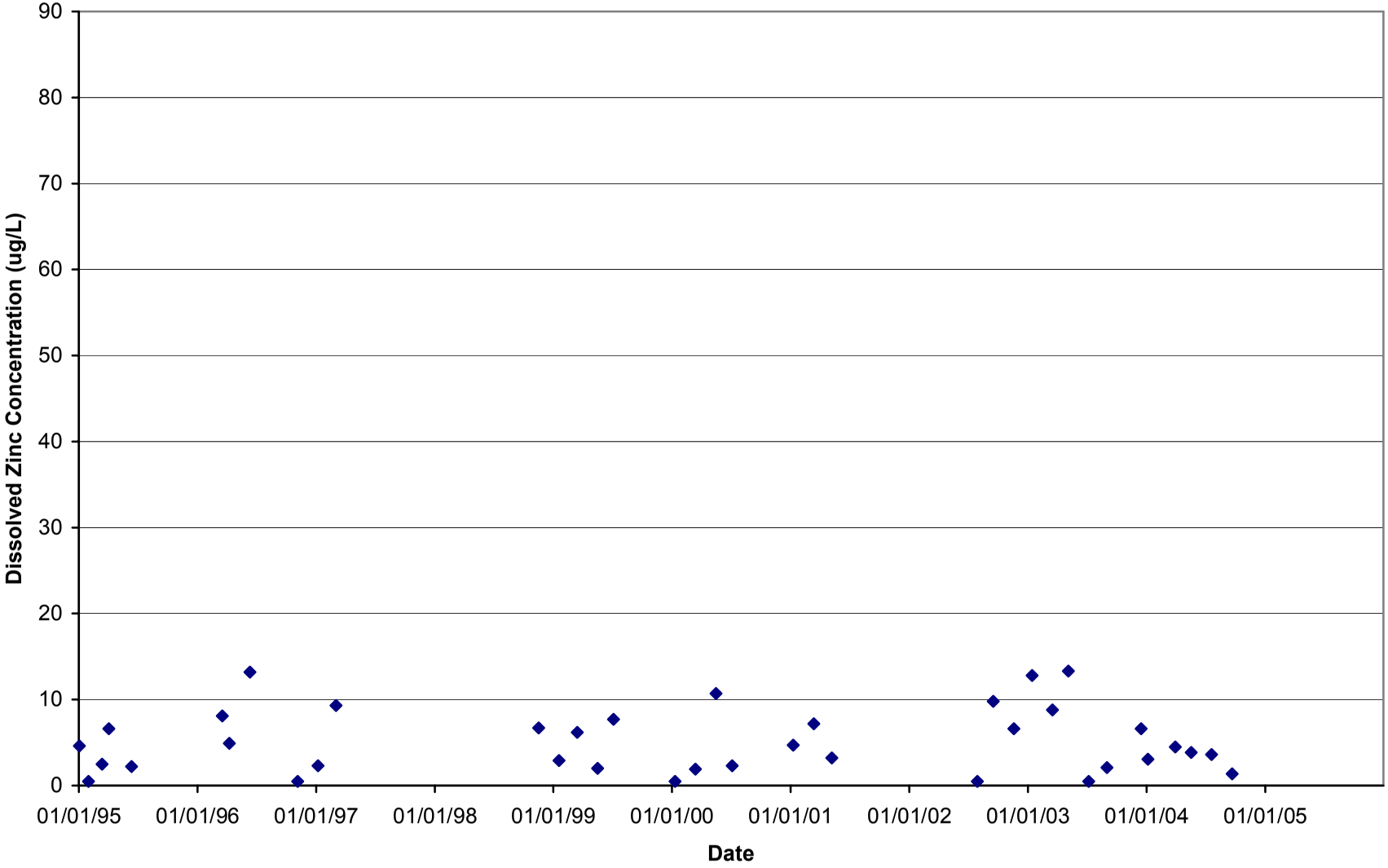
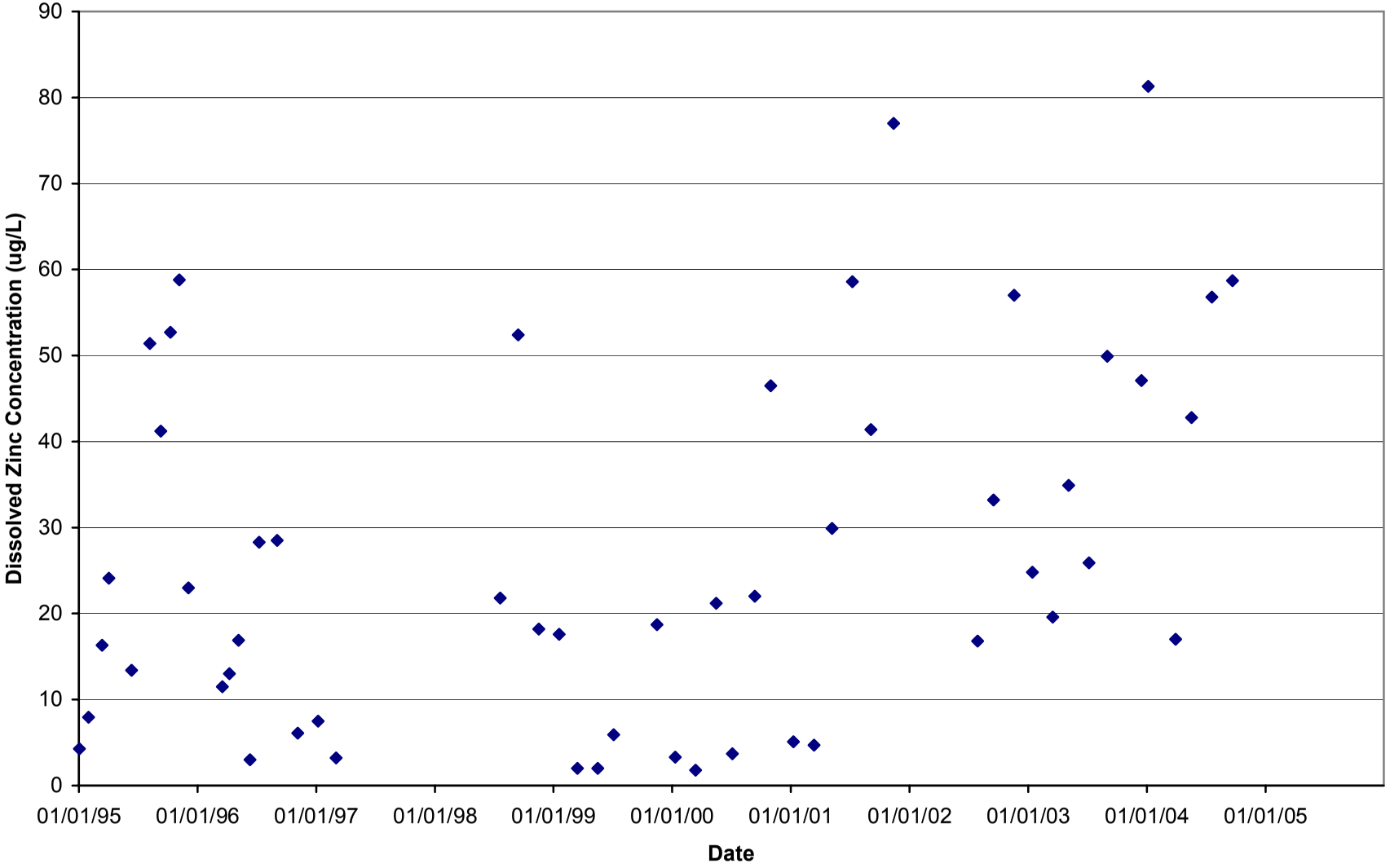


**Figure B.6. Time Series Plot of Dissolved Zinc Concentrations at Station ARK0055**



# APPENDIX C

**Seasonal Plots of Water Quality Data**

**Figure C.1. Seasonal Plot of Total Phosphorus Concentrations at Station ARK0054**

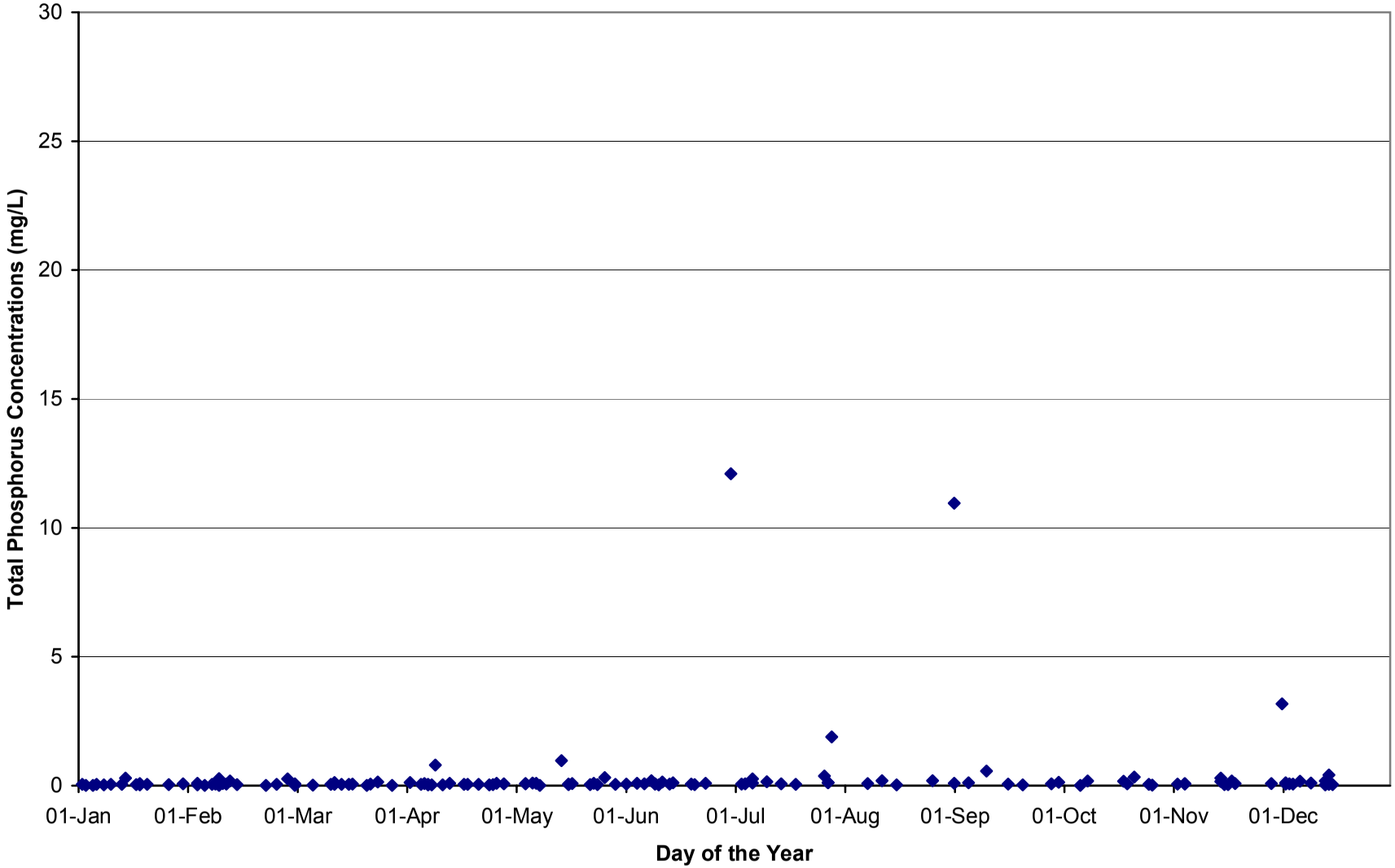


**Figure C.2. Seasonal Plot of Total Phosphorus Concentrations at Station ARK0055**

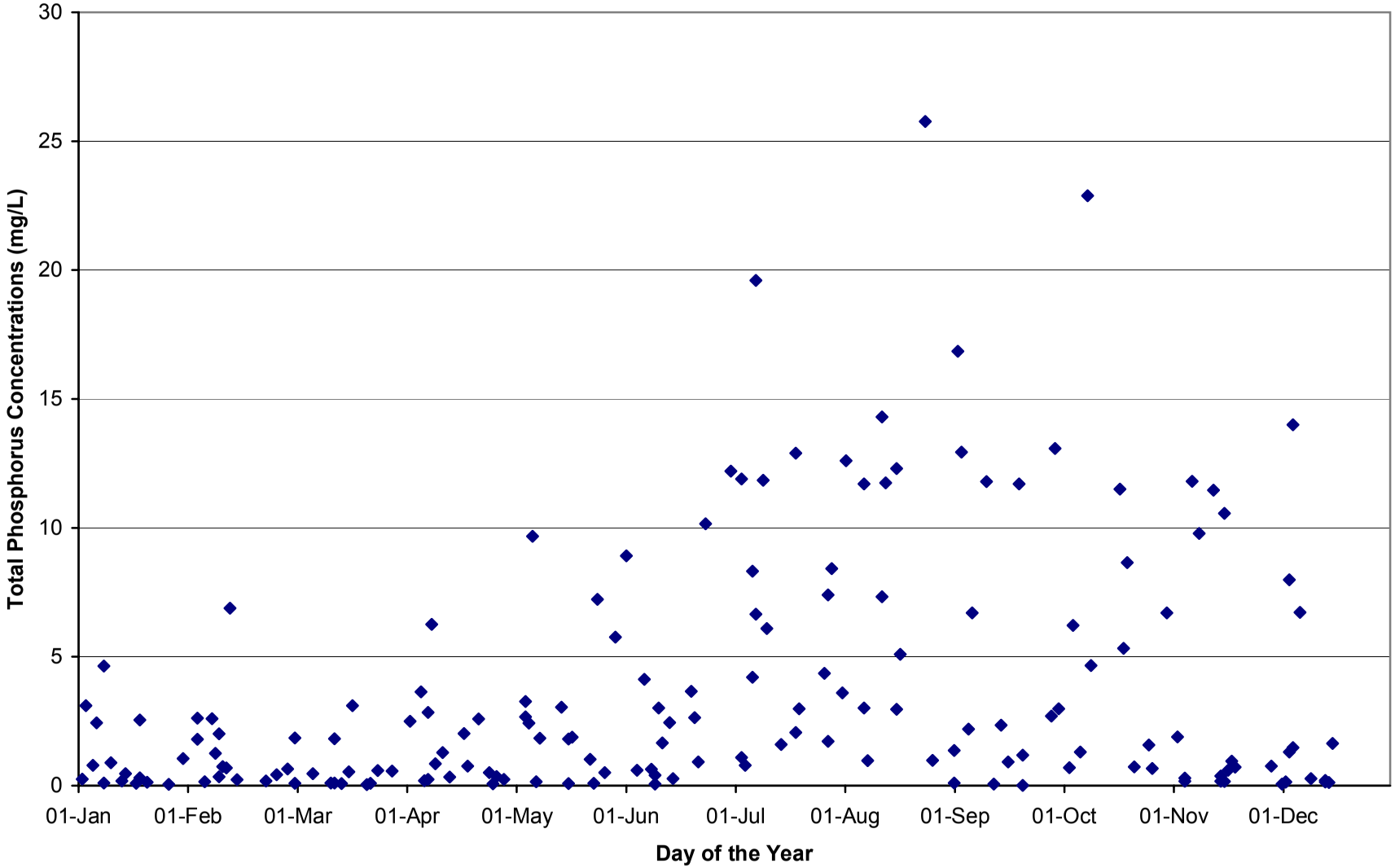


**Figure C.3. Seasonal Plot of Dissolved Copper Concentrations at Station ARK0054**

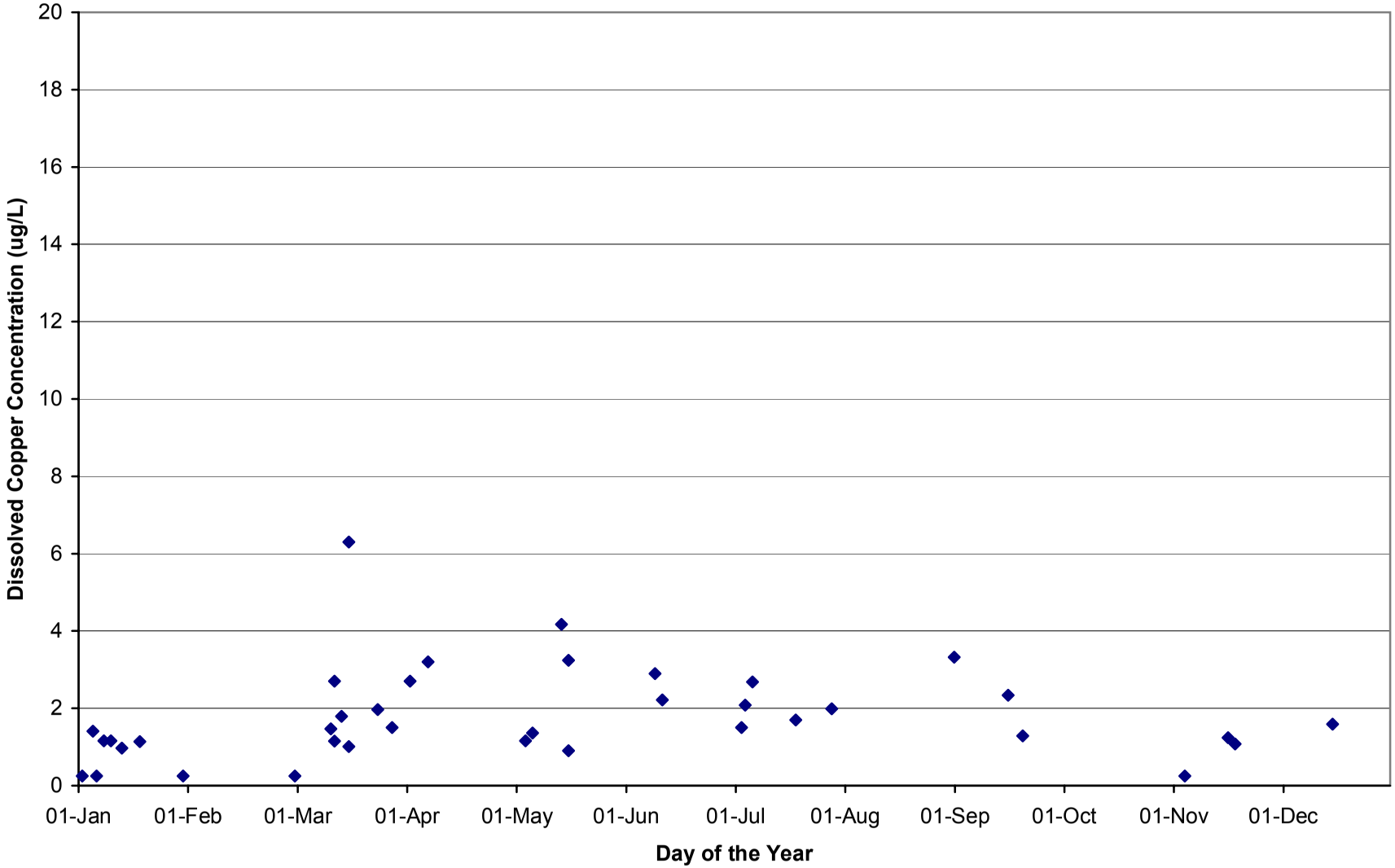


**Figure C.4. Seasonal Plot of Dissolved Copper Concentrations at Station ARK0055**

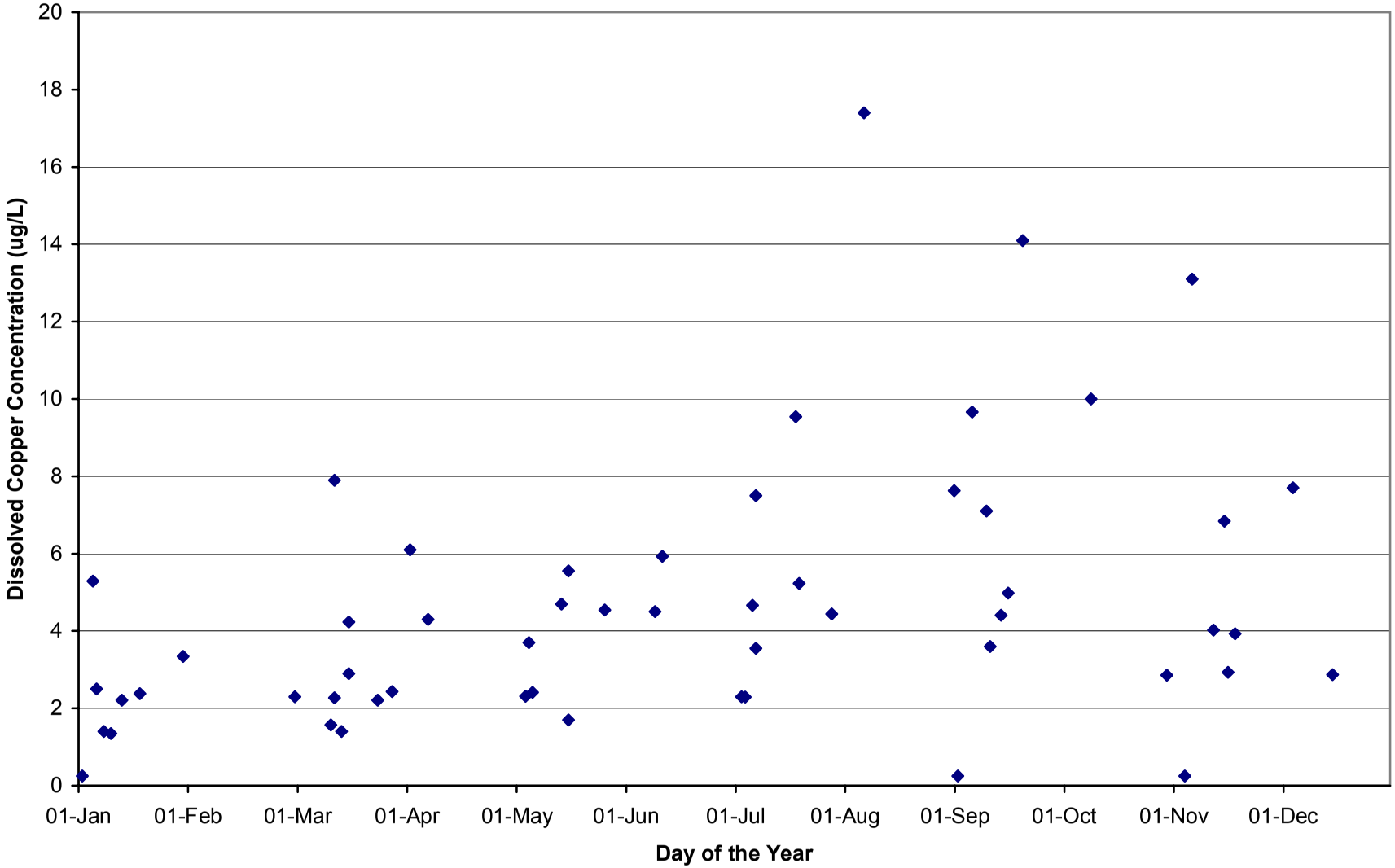


**Figure C.5. Seasonal Plot of Dissolved Zinc Concentrations at Station ARK0054**

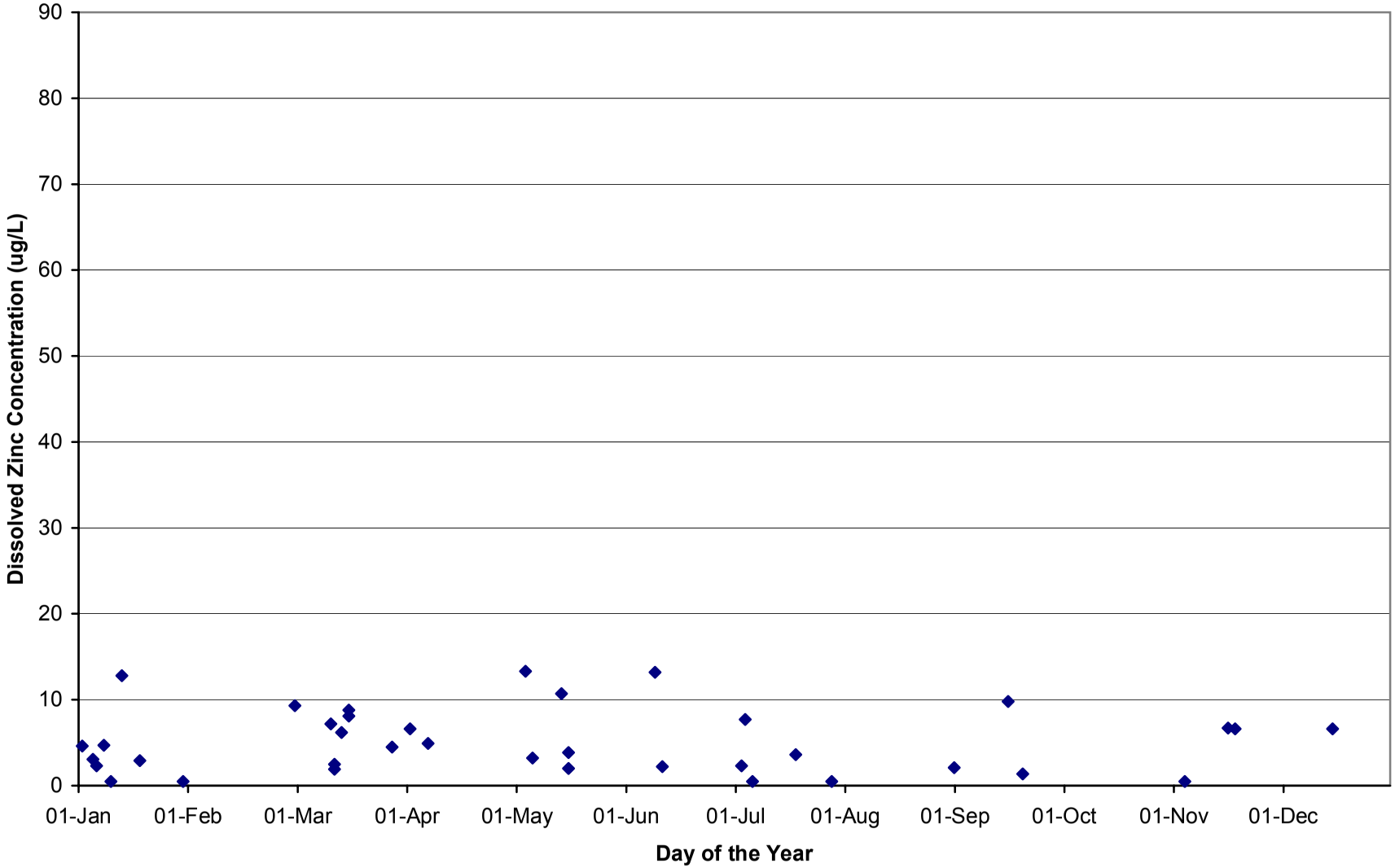
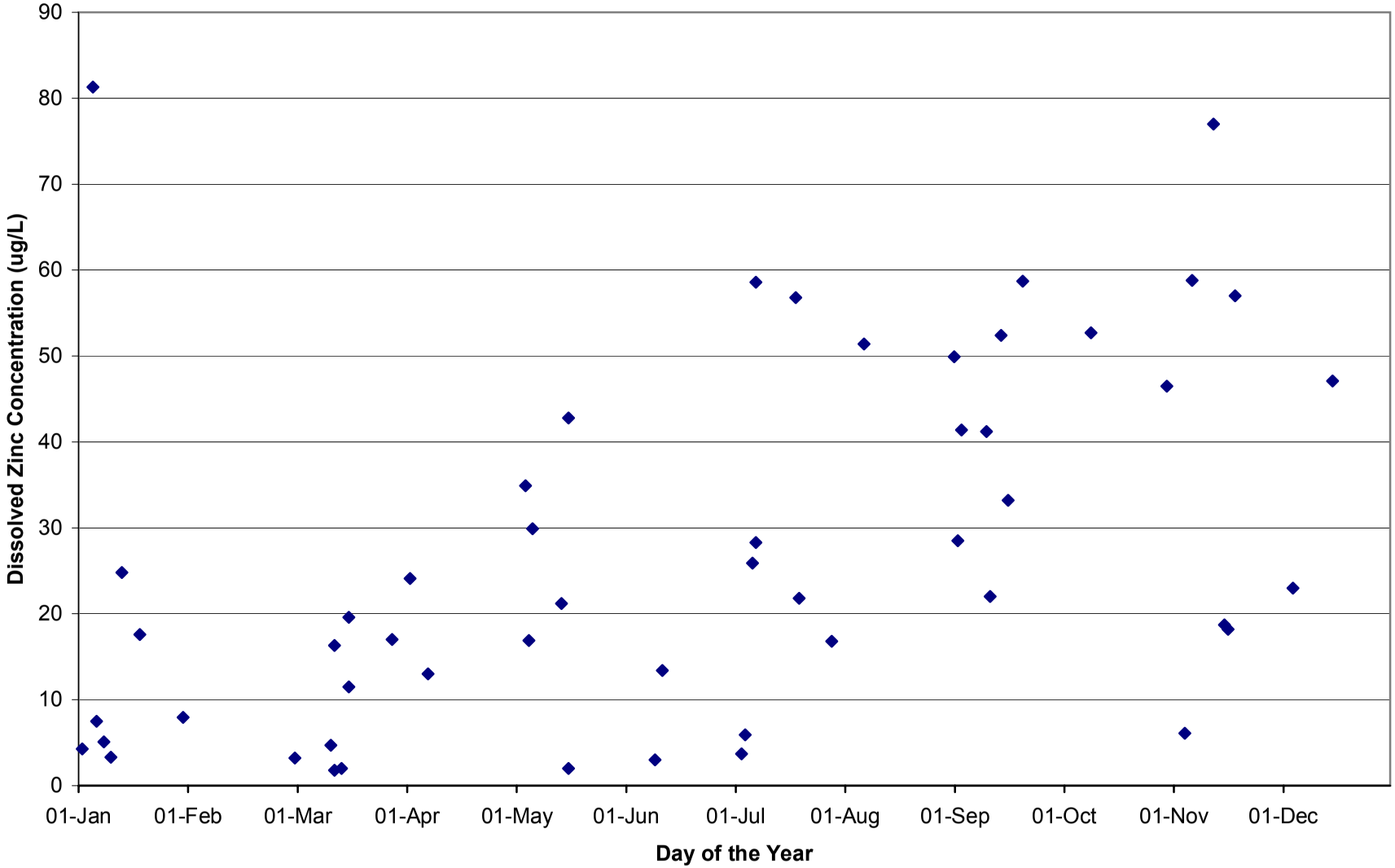


**Figure C.6. Seasonal Plot of Dissolved Zinc Concentrations at Station ARK0055**



# APPENDIX D

**Concentration vs. Flow Plots**

**Figure D.1. Plot of Total Phosphorus at Station ARK0054 versus Stream Flow**

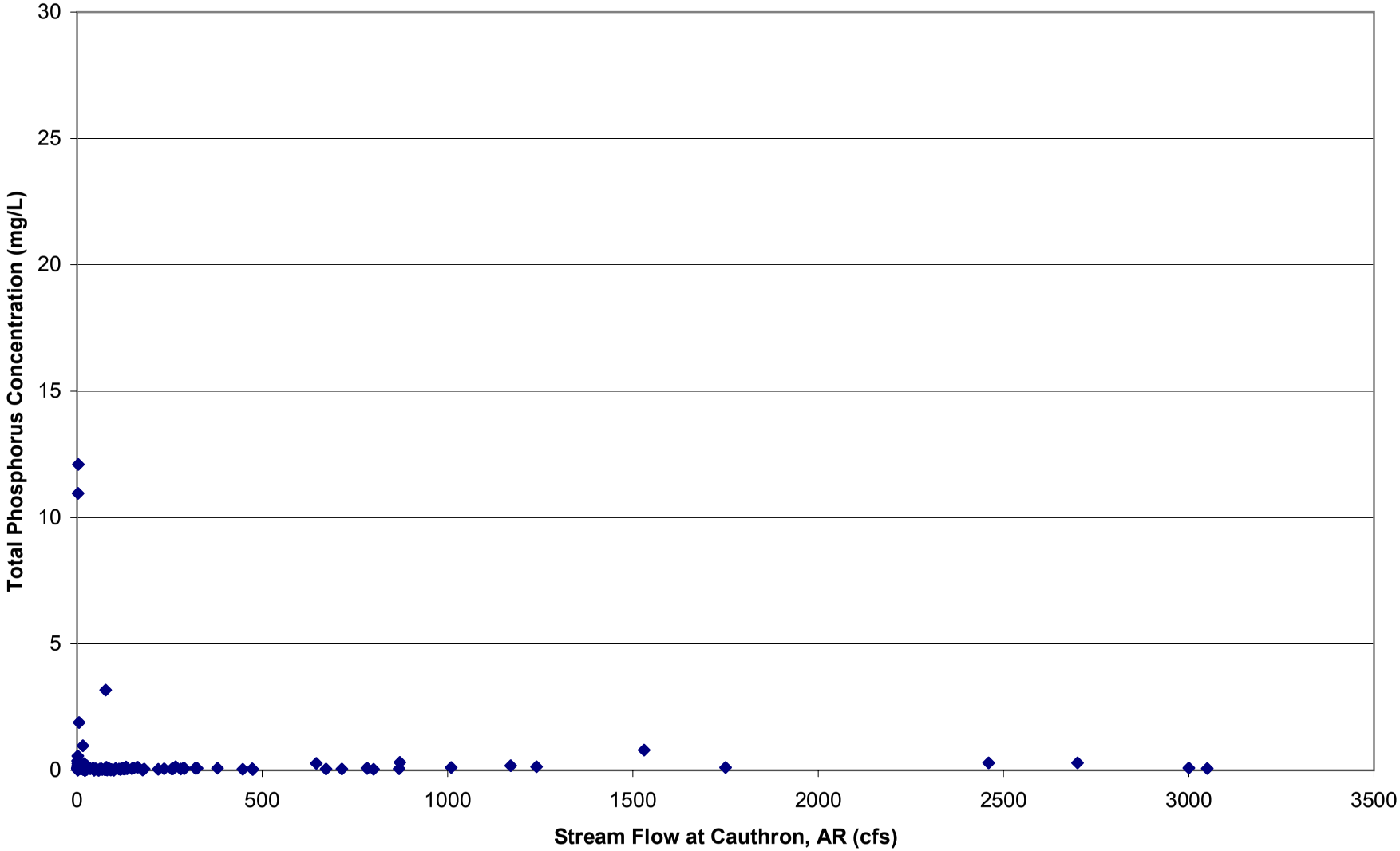


**Figure D.2. Plot of Total Phosphorus at Station ARK0055 versus Stream Flow**

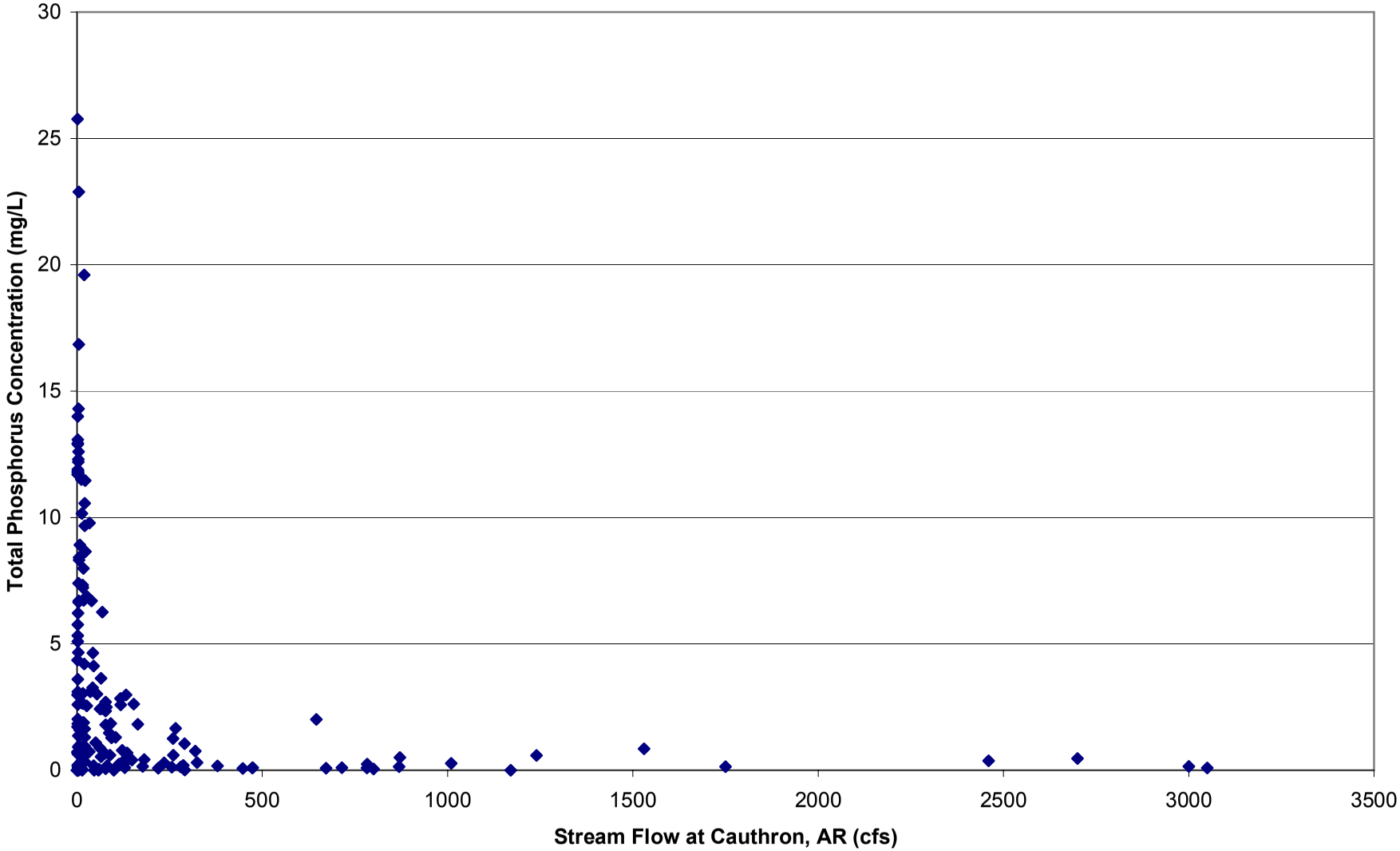


**Figure D.3. Plot of Dissolved Copper at Station ARK0054 versus Stream Flow**

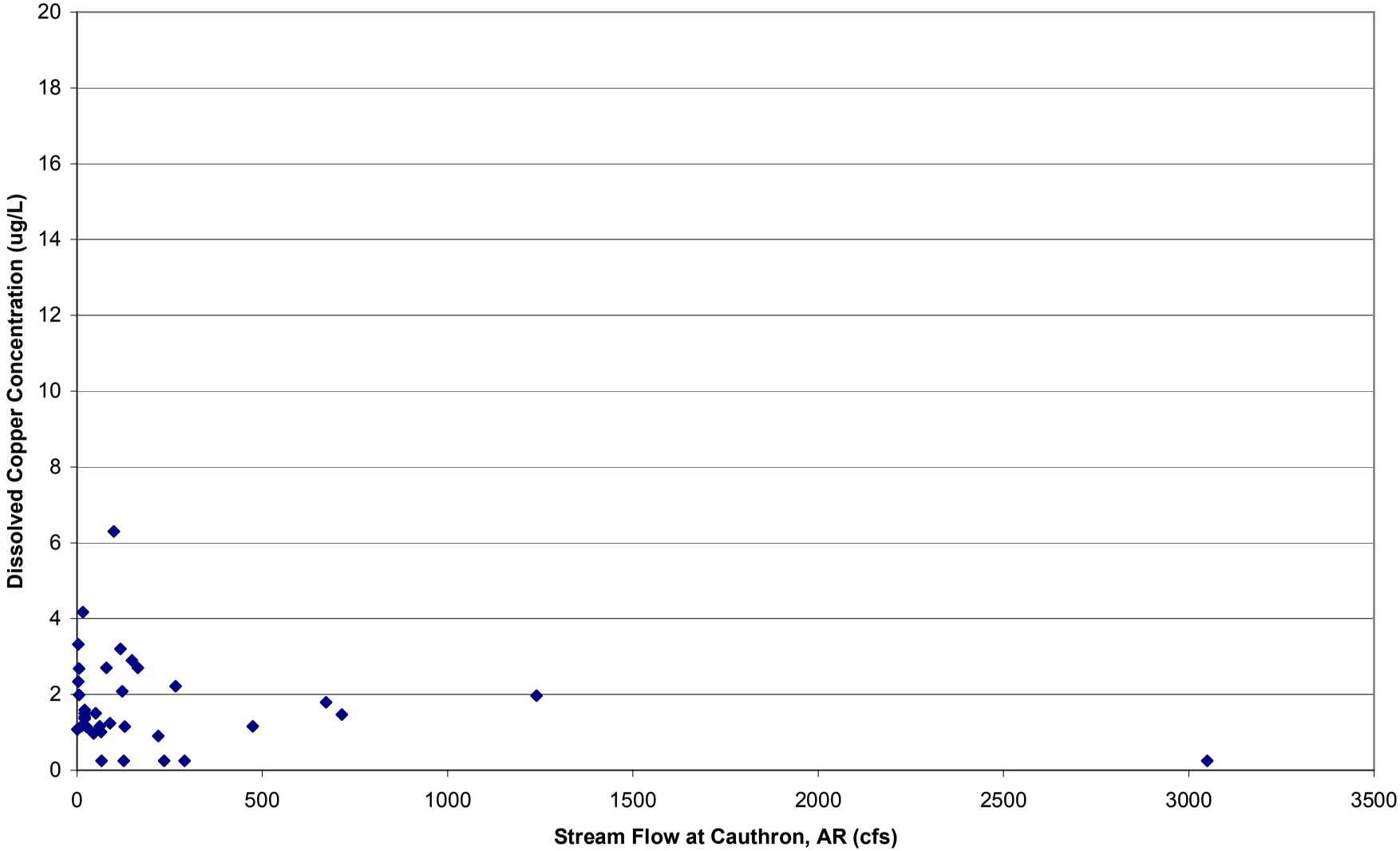


**Figure D.4. Plot of Dissolved Copper at Station ARK0055 versus Stream Flow**

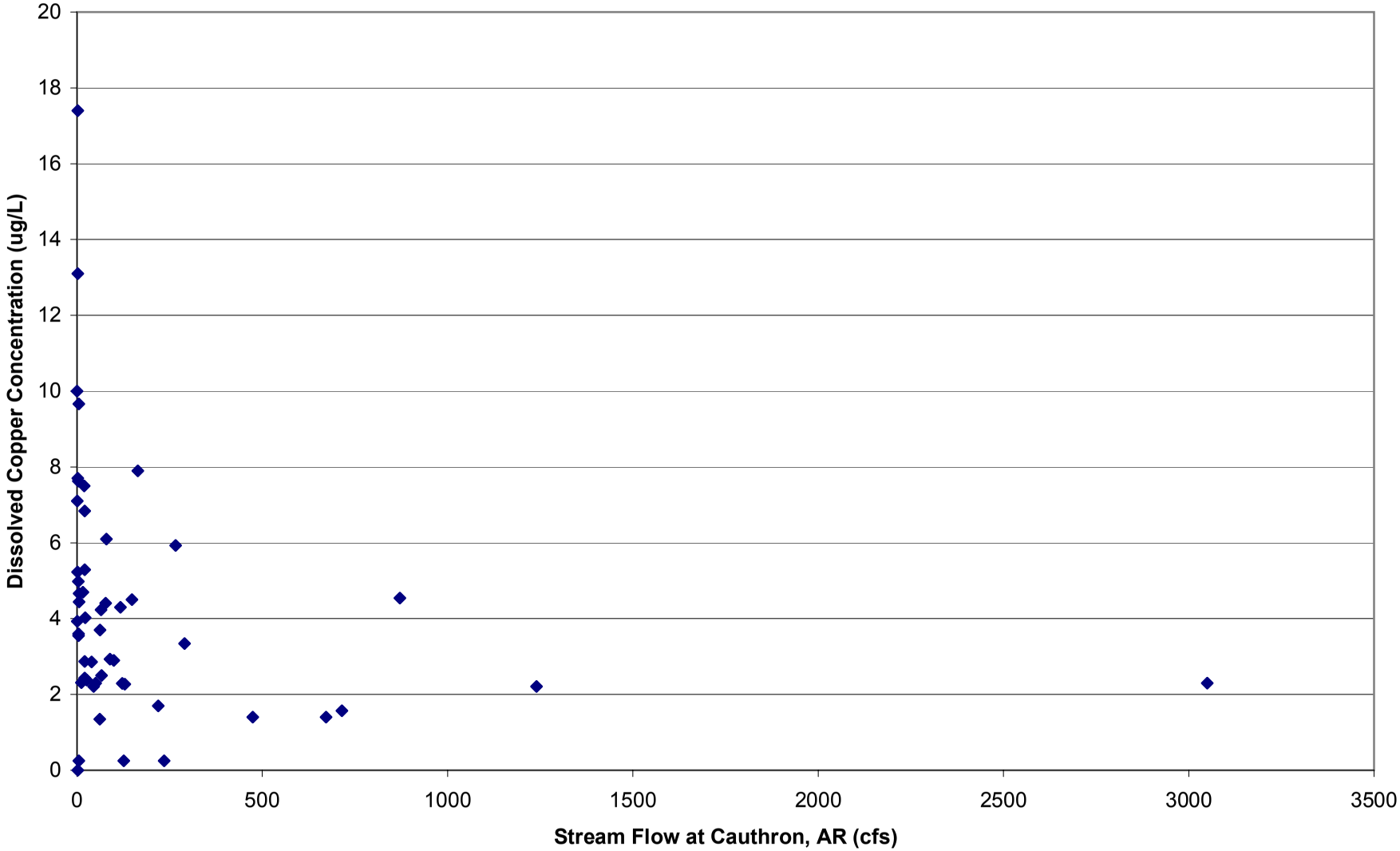


**Figure D.5. Plot of Dissolved Zinc at Station ARK0054 versus Stream Flow**

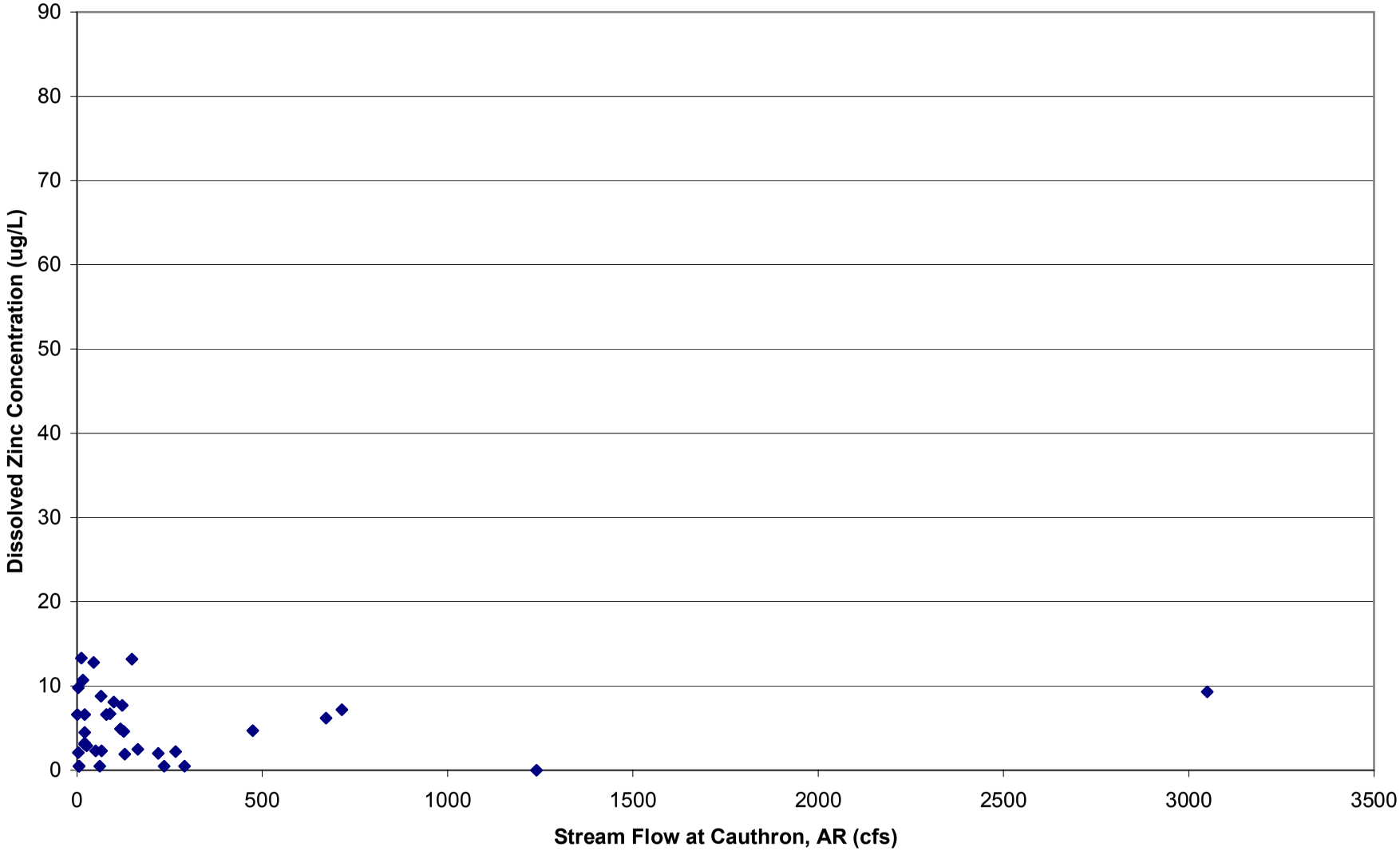
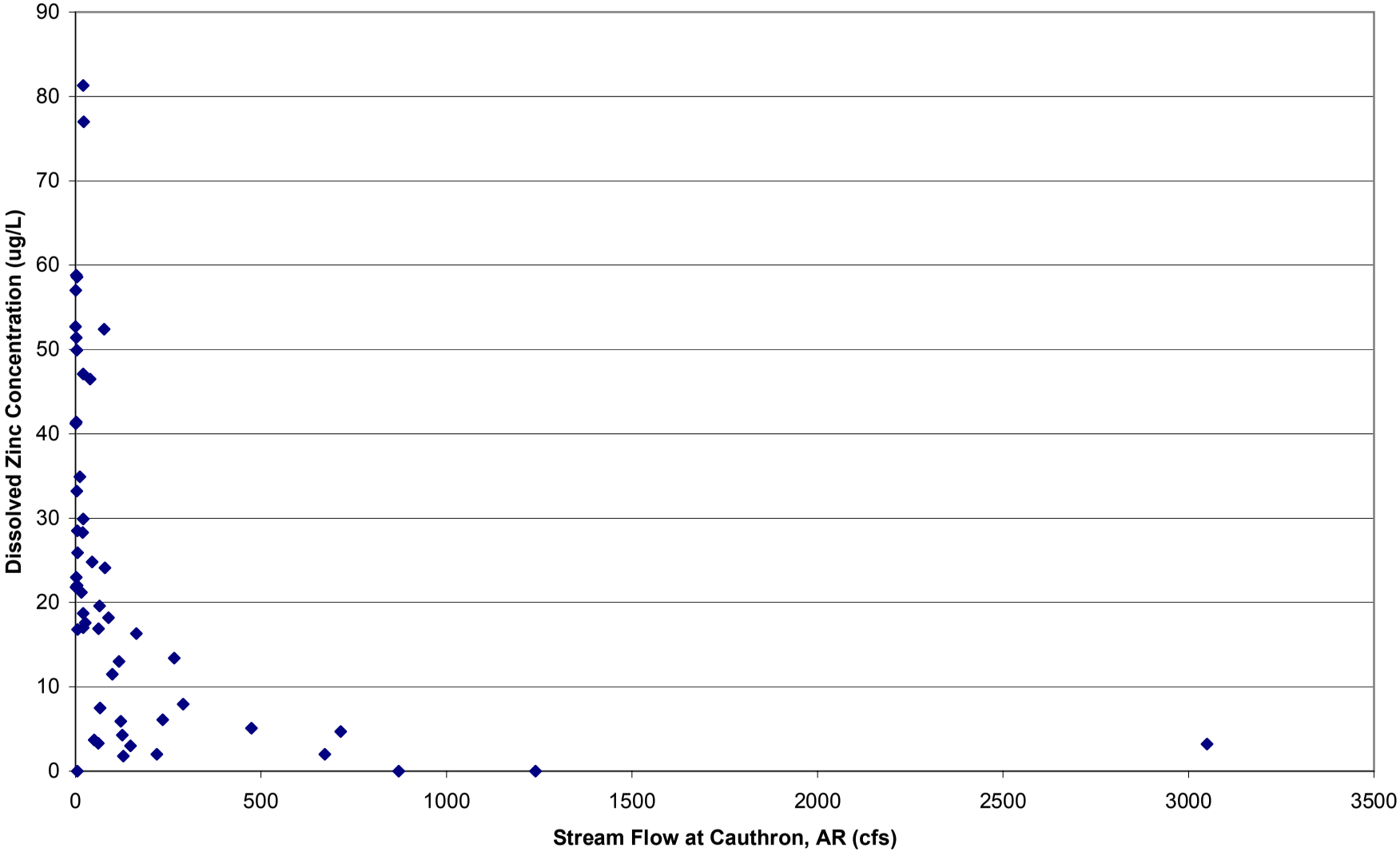


**Figure D.6. Plot of Dissolved Zinc at Station ARK0055 versus Stream Flow**



# APPENDIX E

**Public Comments and Responses**

PUBLIC COMMENTS AND RESPONSES

TMDLs FOR PHOSPHORUS, COPPER, AND ZINC
FOR THE POTEAU RIVER NEAR WALDRON, AR

January 10, 2006

Comments that were received by EPA during the public comment period are shown below with EPA responses inserted in a different font.

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COMMENTS FROM TYSON FOODS, INC.:

The Arkansas Department of Environmental Quality (ADEQ) recently published proposed changes to the Impaired Waterbodies List (303d list) on February 20, 2005. Since that time, the Arkansas information has been forwarded to EPA. Currently, EPA Region 6 has prepared 43 TMDLs and the calculations for these TMDLs for waters listed in the state of Arkansas under section 303(d) of the Clean Water Act (CWA). EPA is allowing comments on the 43 proposed TMDLs until December 12, 2005.

Tyson Foods (Tyson) is respectfully submitting this letter to offer comments regarding one of the streams included on the proposed 303(d) list. This stream is the Poteau River which is located near a Tyson process facility in Waldron, AR. The Poteau River is listed as a Category 5A for Total Phosphorus and Nitrates and a 5C for Copper and Zinc. Tyson provides comments on each of these pollutants as follows:

The determination of aquatic life impairment in the Poteau River, below the Waldron point source dischargers, was made using data from a 1994 study completed by the Arkansas Department of Pollution Control and Ecology (ADPC&E). Since that time Tyson Foods has significantly upgraded their treatment facilities. This data is too old to be representative of current conditions in the Poteau River. It is therefore unreasonable to assume the same level of "impairment" exists in the Poteau River as existed then. Follow up macroinvertebrate collections have been completed by ADEQ in the Poteau River below the discharges (October 1, 2002). It does not appear that results from these collections were considered in the TMDL. The subsequent collections in the river were made at different locations than the 1994 collections; and no upstream reference stations were sampled. The TMDL process should not proceed until a determination can be made that the Poteau River has current aquatic life impairment. Loading restrictions for phosphorus, such as required by this TMDL, should not be imposed on the City of Waldron or Tyson Foods if they are not currently necessary.

Response: The determination of impairment for this reach of the Poteau River was originally made by ADEQ a number of years ago. Even with the additional macroinvertebrate collections, ADEQ apparently still considers this stream to be impaired because they included it in

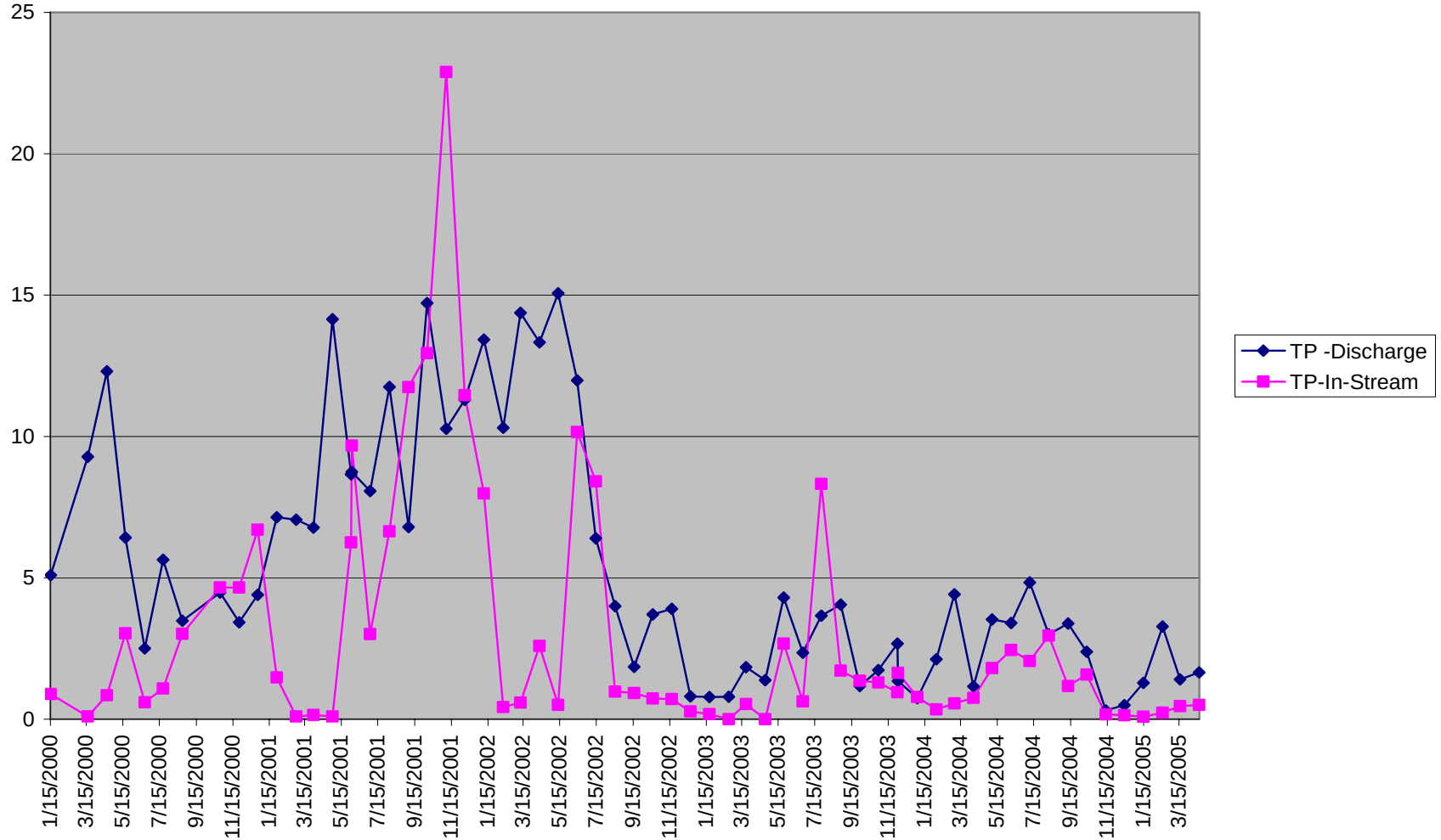
category 5a (for phosphorus and nitrate) on the 2004 draft 303(d) list. The additional macroinvertebrate data were not mentioned in the TMDL report because EPA was unaware that the data existed and was never informed by ADEQ that the data existed. The additional macroinvertebrate data are relevant for determining impairment, which is the focus of the 303(d) list. The focus of this TMDL report is to calculate allowable loadings, which are not directly affected by the macroinvertebrate data. If a more appropriate numeric endpoint is developed in the future, this TMDL can be revised at that time.

Tyson provides comments concerning Phosphorus as follows:

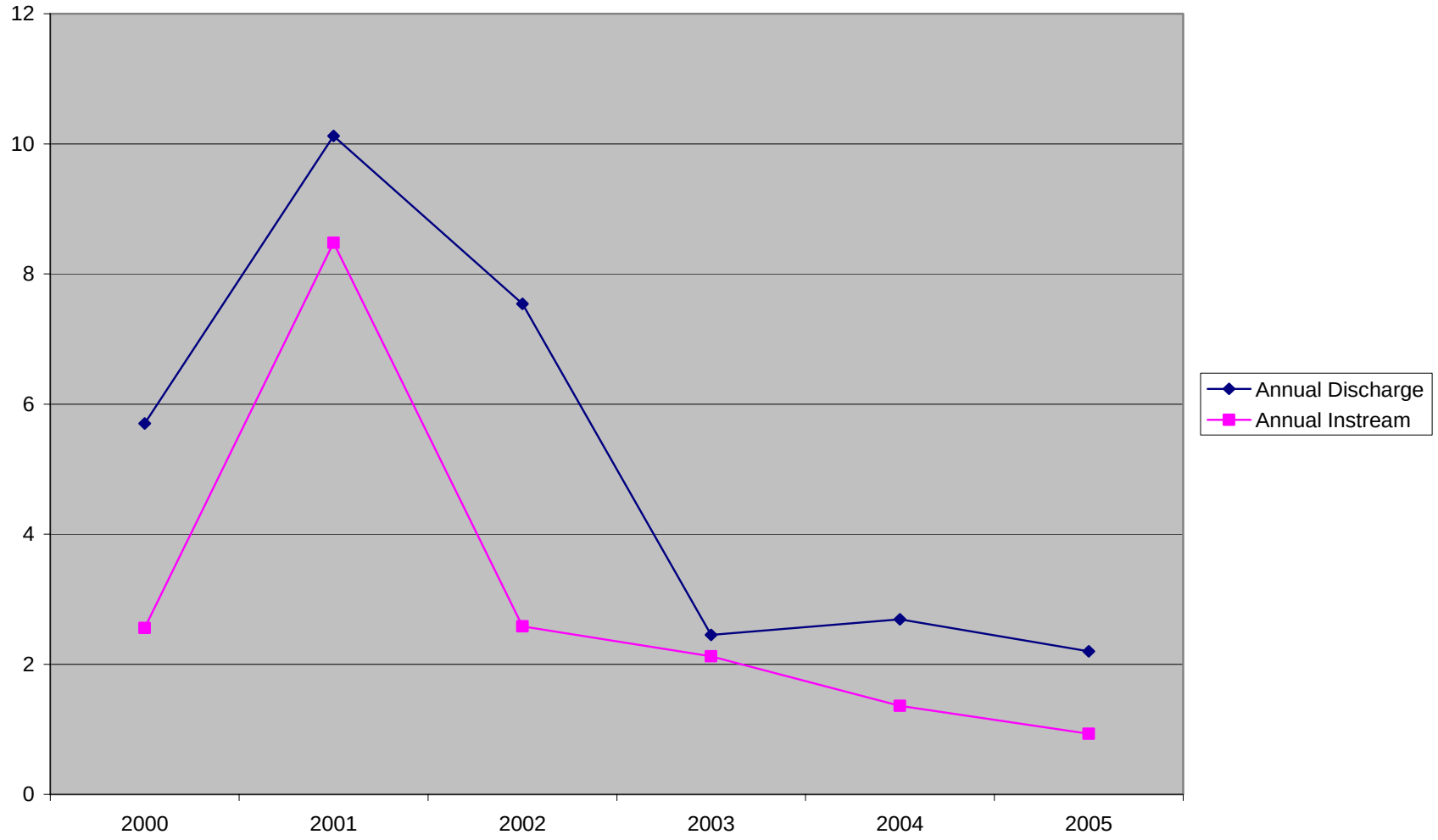
The Tyson-Waldron facility began reducing its phosphorus discharge levels in 2002. Attachments A and B are graphs that compare phosphorus effluent levels and in-stream phosphorus concentrations for the Poteau River. The graphs indicate the voluntary measures that Tyson has implemented have been effective and the phosphorus concentration levels in the stream continue to decline. Based on this data, Tyson requests that the stream continue to be monitored for phosphorus and re-evaluated. This pollutant should be re-classified to 5D to determine if a TMDL is needed.

Response: EPA commends Tyson for reducing its phosphorus discharge levels. ADEQ still considers this stream to be impaired (as mentioned above). TMDLs are required for impaired streams. EPA agrees that the graphs in Tyson's attachments A and B (shown on next two pages of this document) indicate a decrease in effluent and instream phosphorus concentrations over several years. However, the graph in attachment B also shows that the average instream phosphorus concentration during 2005 is still approximately an order of magnitude greater than the target concentration of 0.1 mg/L used in this TMDL. This stream should continue to be considered as impaired until there is sufficient evidence to clearly indicate otherwise.

**Attachment A**



**Attachment B**



The basis for the phosphorus target for the TMDL is not a valid numerical water quality standard, is not scientifically derived implementation of a narrative water quality standard, and is not appropriate endpoint for a TMDL for the Poteau River. The 0.1 mg/L phosphorus target is not supported in the Arkansas standards. As acknowledged in the TMDL the 0.1 mg/L total phosphorus value was removed from the water quality standards. The value has never been a water quality standard but rather was used as a "guideline" for certain waters of the state. The 0.1 mg/L phosphorus target is not technically defensible and certainly is not appropriate for Arkansas River Valley streams such as the Poteau River which are more turbid and can assimilate more phosphorus than streams found in the Mountain and Highland Ecoregions of Arkansas. EPA supports the idea that the 0.1 mg/L target is not appropriate in all Ecoregions in Arkansas (EPA Rationale for making Listing Decisions, Region 6). "In their Rationale for Listing Decisions EPA states that "EPA did not believe that application of the guideline values (i.e., the 0.1 mg/L phosphorus guideline for streams) was an appropriate approach."

The TMDL acknowledges that the 0.1 mg/L phosphorus guideline does not currently exist, but states that "it is still a reasonable benchmark for evaluating phosphorus levels in streams for the protection of aquatic life." This assumption is incorrect as there is no documented relationship between 0.1 mg/L phosphorus and protection of aquatic life that could be applied in the Poteau River situation. This point is further illustrated by the ADEQ in their public response to comments made in the April 9, 2004 Responsiveness Summary to Comments received from the Public Concerning proposed Changes to Regulation No. 2. In this document the ADEQ states that "Based on years of water division field data, the relationship between nutrient concentration and impairment is not necessarily directly correlated for streams. Therefore, at this time we feel numeric criteria are not appropriate." Furthermore, in their amendments to Regulation No. 2 the ADEQ has added language for determining impairments due to nutrients that considers factors such as "water clarity, periphyton or phytoplankton production, dissolved oxygen values, dissolved oxygen saturation, diurnal dissolved oxygen fluctuations, pH values, aquatic life community structure and possibly others." With the exception of the decade old biological assessment, none of the listed determining factors were considered in the development of the TMDL target. Therefore, based on the latest regulations of the ADEQ with input from EPA the target for this TMDL is outdated and technically inappropriate. Without a valid phosphorus target as the basis for the TMDL, the resulting TMDL must also be invalid.

There has been no substantiated scientific link made between phosphorus levels and aquatic life impairment. This is noted in the TMDL report. In addition, there are several examples of streams in Arkansas that have phosphorus levels above 0.1 mg/L and still maintain all aquatic life uses. Several of these streams are clear running Highland streams which would be expected to be impacted more readily (increased algal growth, etc.) than a more turbid stream given the same phosphorus levels. For example, collections completed in the Illinois River near the Oklahoma State Line and on Osage Creek downstream from phosphorus discharges all were found to have good communities of macroinvertebrates with total phosphorus concentrations exceeding 0.2 mg/L on average (ADPC&E, 1997). Two stations on Osage Creek (OSG03 and OSG04) even exhibited

total phosphorus levels averaging 0.4 mg/L or higher during the study period, yet still contained good macroinvertebrate communities (ADPC&E, 1997).

Response: The phosphorus TMDL in this report is being established to maintain Arkansas' narrative criteria for nutrients. Establishing a TMDL to comply with narrative criteria requires the development of a numeric endpoint. The endpoint for this TMDL is an estimate of the phosphorus that the stream can have and still maintain the aquatic life designated use. The 0.1 mg/L endpoint used in this TMDL was considered by EPA to be a reasonable goal that is not overly stringent. If a more appropriate numeric endpoint is developed in the future, this TMDL can be revised at that time.

EPA agrees with the statements above that aquatic life impairments are usually due to a number of other factors in addition to phosphorus concentrations. The list of factors quoted above is presented in Regulation 2 for the purpose of determining impairment rather than developing TMDLs. The determination of impairment for this stream did rely on several different factors. The TMDL in this report is focused on phosphorus concentration as the endpoint rather than on other indicators of aquatic life impairment (e.g., large diurnal fluctuations of DO and pH, etc.) because the 303(d) listing for this stream cited phosphorus as a cause of impairment. Other indicators of aquatic life impairment are often the result of elevated phosphorus concentrations.

The comments above state that aquatic life is not impaired in some streams that have phosphorus concentrations above 0.1 mg/L, such as Osage Creek in the Illinois River basin. EPA disagrees with this specific example. EPA considers aquatic life to be impaired in Osage Creek in the Illinois River basin, as indicated by EPA's addition of that stream to the Arkansas 2002 Section 303(d) List. EPA believes that the ADEQ 1997 study mentioned in the comments above indicates impairment of aquatic life in Osage Creek based on the combined results for periphyton quantities, macroinvertebrate communities, and fish species (EPA 2003). Another study of the Illinois River basin was conducted by Parsons and the University of Arkansas (UA) in 2003-2004. The Parsons/UA study characterized several sampling stations along Spring Creek and Osage Creek in the Illinois River basin as "severely impacted" and "impacted". The sampling stations in the Parsons/UA

study with the greatest level of impact were the same stations that had the highest phosphorus concentrations. The results of the Parsons/UA study, along with other research and data for streams in this area, demonstrate that elevated phosphorus concentrations definitely contribute to aquatic life impairments.

The 1994 study completed by ADPC&E included macroinvertebrate and fish collections in the spring of 1994 (May 23) and the late summer of 1994 (August 30). The ADPC&E relied mostly on the macroinvertebrate collections in their impairment determination as the fish communities downstream were not noticeably different to those upstream. A closer review of the study data revealed that the spring macroinvertebrate collection was actually found to be only "minimally impaired" and thus in support of the aquatic life use. Only the late summer collection was found to be "substantially impaired" and therefore considered "not supporting" the aquatic life use.

The decision criteria used to assess aquatic life impairment following the 1994 study was the biometric scoring system described in Shackleford, 1988. In this scoring system a total of 7 metrics are calculated and used in a comparison basis between the upstream reference station and the station downstream of a discharger. Each metric earns a score between 1 and 4, dependant on its value calculated from the comparison. The higher scores indicate similar communities and the lower scores dissimilar communities. An average score of $\geq$2.6 indicates minimal to no impairment and indicates support of the aquatic life use. An average score of below 2.6 indicates substantial or excessive impairment and indicates non-support of the aquatic life use.

Further analysis of the 1994 study results reveals that the impairment decision process was not followed in the Poteau River situation. Only 5 of the 7 metrics were used in the biometric scoring system by ADPC&E in their analysis of the summer of 1994 macroinvertebrate data from the Poteau River. When the additional two metrics were properly calculated and added to the biometric scoring system, the summer collection is also found to be supporting the aquatic life use. In light of this information the segment of the Poteau River below the Waldron dischargers should have never been on the 303(d) list for not supporting the aquatic life use. The stream should be removed from the 303(d) list and the TMDL process discontinued. At a minimum, the TMDL for phosphorus should be suspended and metals addressed through normal NPDES permitting processes as warranted.

Response: ADEQ decided to put the phosphorus impairment for Poteau River in category 5a of the 2004 draft 303(d) list. A detailed discussion of the impairment determination was not included in this report because the focus of a TMDL report is to calculate allowable loadings, not determine impairments.

Tyson provides comments concerning Nitrates as follows:

Tyson has not collected a significant amount of data on Nitrates discharged from the Waldron facility. However, Tyson has modified its wastewater treatment system and has implemented denitrification efforts. Tyson believes that processes ongoing at the facility will continue to decrease nitrate levels. Due to a lack of data, Tyson cannot compare with the in-stream Nitrate data to effluent discharge levels. Therefore, Tyson is not able to determine if the Waldron facility is the primary contributor of Total Nitrogen in the stream. Tyson believes that additional data must be collected. Tyson requests that the Designated Category be changed from 5C to 5D to allow time for additional data collection to determine both the source and the level of impact.

Response: These comments are not relevant to the TMDLs in this report because a nitrate TMDL was not developed.

Tyson provides comments concerning Copper and Zinc as follows:

Metals data (for copper and zinc) provided in the TMDL indicate that the levels downstream of the Tyson Foods and the City of Waldron discharges are in excess of water quality standards for the metals. There is no discussion of sampling techniques associated with the metals data so it is not known if clean techniques sampling was used for collection of the data referenced in the TMDL. If clean techniques sampling was not used for collection of this data then it can not be determined if an actual exceedance of the water quality standards actually exists or is an artifact of sampling technique. The metals assessment and the subsequent waste load allocation presented in the TMDL are based on a regulatory flow of 0 cfs and ecoregion default values for hardness and TSS. Although there is no properly presented evidence of any aquatic life impairment, should an exceedance of a water quality standard for a metal exist, the NPDES permitting process is an appropriate forum for development of water quality based limits and the TMDL process is not necessary to address the situation.

Response: The TMDL process is the appropriate, and required forum for addressing this situation. The reason for this is because the metals impairment for this reach of the Poteau River has been on the 303(d) list since at least 1998 and it is included in the consent decree from the Arkansas TMDL lawsuit.

If water quality based permit limits are needed to ensure standards compliance then available site specific data should be used in development of the copper and zinc waste loads (40 CFR 130.7). As noted in the TMDL report site specific data is available for hardness and for TSS (ambient monitoring station ARK0055). The point source discharges listed in the TMDL are already limited by the conservative use of a 0 cfs background flow, which would rarely occur. Metal concentrations for use in the waste load allocations (WLA) calculated using the site specific data for TSS and hardness are provided in the table below.

| | Option | | | |
|---|---|---|---|---|
| **Metal** | **0** | **1** | **2** | **3** |
| | Existing TMDL (µg/L) | Using 15th%tile TSS[1] (µg/L) | Using 15th%tile TSS/median hardness[2] (µg/L) | Using 15th%tile TSS/mean hardness[3] (µg/L) |
| Copper | 9.2 | 10.3 | 13.7 | 14.4 |
| Zinc | 85.5 | 99 | 131 | 138 |

[1]15th %tile TSS is 6 mg/L from ambient monitoring station ARK0055.
[2]median total hardness is 35 mg/L from ambient monitoring station ARK0055.
[3]mean total hardness is 37 mg/L from ambient monitoring station ARK0055.

The use of site specific TSS and hardness data provides for higher waste load allocations for each discharger and in the case of option 4, results in no reasonable potential for water quality standard exceedance for zinc (using DMR data provided in the TMDL report from 2004-2005) by Tyson Foods. Therefore, Tyson Foods limit for zinc, as provided in the TMDL, could be eliminated. Further study of the site specific conditions in the Poteau River, as would be accomplished with development of a water effect ratio, would likely show that copper also has no reasonable potential of causing toxic effects (neither acute nor chronic) in the river downstream of the dischargers. Note that the in-stream hardness under conditions of 0 cfs background flow would be controlled by effluent hardness which should be even higher than that used in the table above, therefore, allowing these recommendations to remain conservative. Again, the appropriate forum for development of water quality based limits for metals is the NPDES permitting process and a TMDL is not necessary to address the apparent exceedance of water quality standards for copper and zinc.

Response: The numeric criteria that were used for the metals TMDLs in this report were calculated using ecoregion default values of TSS and hardness because that is ADEQ's standard protocol as documented in the ADEQ Continuing Planning Process (CPP) document. It is EPA's understanding that one reason why ADEQ uses ecoregion values for hardness is that the hardness of a stream often changes along the length of a stream. ADEQ and EPA have seen situations where hardness is high immediately downstream of a discharge but decreases farther downstream.

Metals data collected using typical routine monitoring protocols has often been found to be substantially higher than that collected using clean techniques. As such, actual in-stream and effluent concentrations of copper and zinc may be significantly lower than those reported. Utilizing these likely higher values as the basis for a TMDL poses an unreasonable level of conservatism on the waste load allocation for each discharger. Since there appears to be no true aquatic life impairment observed in the biota (see bullet

4 above) there is no basis to assume that the metals levels observed are appropriately elevated to cause an in-stream acute or chronic reaction.

Response: The observed data for metals in the Poteau River were not used to calculate the allowable concentrations and loads of metals. The allowable concentrations and loads were calculated using the numeric criteria for the stream and the flow rates (effluent and upstream). EPA agrees that clean sampling techniques are appropriate for evaluating metals concentrations in this stream for assessment purposes.

Assumption of a background flow of 0 cfs is inconsistent with the copper and zinc load allocation (for non-point sources). Non-point source loading of these metals would only occur during times of high flow. The LA for copper and zinc should be eliminated during the critical season (May-October) and the remaining load provided to the dischargers. Seasonal consideration should be given to any TMDL developed for metals as the higher primary season flows would allow for higher point source WLA's while still maintaining the in-stream standard. In the case of the Poteau River increasing the background flow from 0 cfs to just 1 cfs allows the Tyson discharge to pass reasonable potential for both metals, therefore not requiring a limit during at least the primary season (November-April).

Response: As explained in Section 4 of this report, the copper and zinc load allocations for nonpoint sources were based on the average annual flow rather than the 7Q10 flow. However, the load allocations for point sources were based on the annual 7Q10 flow because both point sources currently have year-round limits that do not vary with stream flow rate. Allowable loads of copper and zinc must be calculated to prevent toxicity under critical conditions. Using an average upstream flow rate to calculate allowable point source loads would allow toxicity to occur whenever the upstream flow rate was less than the average value.

The procedures cited in the TMDL report for WLA and LA development were not followed through. In the TMDL Development for Phosphorus Section (Section 5.0) the step-wise procedure for WLA and LA development was explained. In this procedure, the TMDL was set as the in-stream target (0.1 mg/L) times the average annual flow, which resulted in about 48 lb/day. As stated, the second step was subtraction of a 10% margin of safety from the TMDL, and then the remaining load was used to calculate a WLA for the dischargers. It is stated that the WLA was first calculated as a 2.0 mg/L effluent concentration (as per 2007 requirements) and the design flow of the dischargers; but this WLA "…exceeded the available loading (the TMDL minus the MOS)" so an alternative, more conservative effluent concentration was used.

However, if the stepwise procedure described in the report was actually used, the WLA for the dischargers would be 35 lb/day, rather than the 22.7 lb/day provided in the report. This still leaves at least 7.96 lb/day before the TMDL is reached. It appears that in fact the load allocation (LA) was actually derived first, and the remaining loading given to the dischargers. The load allocation is described in the report as "…calculated as the remaining available load after the WLA and the MOS were subtracted from the TMDL." When this error is corrected it provides a new WLA of 35 lbs/day and a LA of 7.96 lbs/day. The additional 12.3 lbs/day gained in the WLA should be appropriately allocated to the dischargers.

Response: The procedure for calculating the phosphorus TMDL components was an iterative process for this waterbody. If allowable phosphorus loads for both dischargers were based on a concentration of 2 mg/L, the allowable nonpoint source load would have been 7.96 lbs/day, which corresponds to a concentration of 0.017 mg/L (using the average annual ambient flow of 55.1 MGD from Section 5.3 of this report). This phosphorus concentration (0.017 mg/L) is not realistic for nonpoint source inflow to the Poteau River and would require a 73% reduction of existing nonpoint sources of phosphorus (based on the existing median concentration of 0.065 mg/L at ARK0054). When this report stated that allowable point source loads were calculated prior to the allowable nonpoint source loads, it did not mean that the point sources were automatically assigned as much load as they wanted. If the point sources want to trade allocations between themselves or with nonpoint sources in the future, that is allowable with a revision of this TMDL. This TMDL report establishes the total maximum loading, but it does not prevent reallocation of loads in the future between individual sources.

Tyson concurs with the additional data confirmation for metals. Tyson will continue to monitor the metals levels being discharged from the Waldron facility as outlined in the NPDES permit. Since the issuance of the NPDES permit, all Copper levels have been below the detection level and the zinc levels have ranged between 0.03 and 0.1mg/l. Tyson had no data to review related to Copper or Zinc in the receiving stream since the NPDES permit was issued.

Tyson is requesting to work with ADEQ and EPA on assessing the water quality impacts associated with discharges from the processing plant mentioned in this letter. In the event that ADEQ determines that the processing plant is contributing to water quality impairments, Tyson would prefer to develop additional voluntary procedures in lieu of developing a TMDL. If you have any questions related to these comments please contact me at (479) 290-7541 or John Couch at (479) 986-1276.

Tyson Foods would like to request a meeting with EPA to further discuss and clarify the points made above. Tyson requests that such a meeting be scheduled prior to the potential adoption of a TMDL for the Poteau River. My contact information is listed below.

Response: After these comments were received, EPA discussed these comments with the author of the letter by telephone on December 14, 2005. EPA will gladly discuss the TMDL with Tyson Foods further and answer any questions concerning the TMDL.

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COMMENTS FROM ARKANSAS DEPARTMENT OF ENVIRONMENT QUALITY:

The Water Division staff has completed its review of the following draft TMDLs: Nitrate and Phosphorus in Rolling Fork; Phosphorus in Osage Creek near Berryville, Ar.; Phosphorus, Copper and Zinc for the Poteau River near Waldron, Ar.

Our comments are as follows:

In each of these studies, the value utilized as the phosphorus removal target is not a numerical water quality standard. In previous versions of Regulation #2, phosphorus was mentioned as a guideline, but was not--and is not--technically defensible due to varied (by ecoregion and individual watershed) responses by aquatic communities to instream nutrient concentrations. As a result, this guideline has since been removed in Arkansas' current water quality standards. TMDL validity must be based on addressing documented violations of existing Arkansas water quality standards and impaired use.

Response: The phosphorus TMDL in this report is being established to maintain Arkansas' narrative criteria for nutrients. Establishing a TMDL to comply with narrative criteria requires the development of a numeric endpoint. The endpoint for this TMDL is an estimate of the phosphorus that the stream can have and still maintain the aquatic life designated use. The 0.1 mg/L endpoint used in this TMDL was considered by EPA to be a reasonable goal that is not overly stringent. If a more appropriate numeric endpoint is developed in the future, this TMDL can be revised at that time.

EPA agrees with the statements above that aquatic life impairments are usually due to a number of other factors in addition to phosphorus concentrations. The list of factors quoted above is presented in Regulation 2 for the purpose of determining impairment rather than developing TMDLs. The determination of impairment for this stream did rely on several different factors. The TMDL in this report is focused

on phosphorus concentration as the endpoint rather than on other indicators of aquatic life impairment (e.g., large diurnal fluctuations of DO and pH, etc.) because the 303(d) listing for this stream cited phosphorus as a cause of impairment. Other indicators of aquatic life impairment are often the result of elevated phosphorus concentrations.

The comments above state that aquatic life is not impaired in some streams that have phosphorus concentrations above 0.1 mg/L, such as Osage Creek in the Illinois River basin. EPA disagrees with this specific example. EPA considers aquatic life to be impaired in Osage Creek in the Illinois River basin, as indicated by EPA's addition of that stream to the Arkansas 2002 Section 303(d) List. EPA believes that the ADEQ 1997 study mentioned in the comments above indicates impairment of aquatic life in Osage Creek based on the combined results for periphyton quantities, macroinvertebrate communities, and fish species (EPA 2003). Another study of the Illinois River basin was conducted by Parsons and the University of Arkansas (UA) in 2003-2004. The Parsons/UA study characterized several sampling stations along Spring Creek and Osage Creek in the Illinois River basin as "severely impacted" and "impacted". The sampling stations in the Parsons/UA study with the greatest level of impact were the same stations that had the highest phosphorus concentrations. The results of the Parsons/UA study, along with other research and data for streams in this area, demonstrate that elevated phosphorus concentrations definitely contribute to aquatic life impairments.

Specific comments include (1) the stream segment below the Tyson discharge to Rolling Fork has had the domestic water supply source designation removed, thereby invalidating the instream TMDL target for nitrate-nitrogen, (2) the current 303d listing for metals in the Poteau River at Waldron is in the 5c category, which indicates questionable data due to QA/QC procedures, and may be resolved due to refinement of sampling techniques, and (3) the Osage Creek TMDL (Berryville) contains numerous errors, erroneous data and inaccurate loading calculations.

Response: Only the second of the three comments above pertains to this report. As mentioned in the responses to comments from Tyson Foods (pages 8-9 of Appendix E), TMDLs for zinc and copper were required because these impairments have been on the 303(d) list since at least 1998 and are included in the consent decree from the Arkansas TMDL lawsuit. Comment 1 above is addressed in the separate document, "TMDLs for Nitrate

and Phosphorus in Rolling Fork." Comment 3 above is addressed in the separate document, "TMDL for Phosphorus in Osage Creek near Berryville, AR."

All three of these point source dischargers have voluntarily agreed to develop/utilize technologies that effectively reduce nutrient loads to the receiving streams. ADEQ commends their willingness to initiate these procedures that will serve to enhance the protection of the instream aquatic communities, and prefers this approach to potential requirements dictated by technically invalid TMDLs.

The Water Division looks forward to continuing our long-standing working relationship with EPA. If you have any questions regarding the above comments, please feel free to contact me.

Response: EPA also commends the point sources for voluntary efforts to reduce nutrient loading to the receiving streams. The allowable point source concentrations developed in this TMDL are similar to permit limits that were already required by Regulation No. 2.