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TOTAL MAXIMUM DAILY LOAD FOR TOTAL PHOSPHORUS FOR TOWN BRANCH NEAR BENTONVILLE, ARKANSAS (REACH 11070208-901)

JULY 15, 2010

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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 loads (TMDLs) for those waterbodies. A TMDL is the amount of a pollutant that a waterbody can assimilate without exceeding established water quality standards (either narrative and/or numeric) for that pollutant.

This report presents a TMDL for total phosphorus for Town Branch (Reach 11070208-901) near Bentonville in northwest Arkansas. Town Branch is a headwater stream with a watershed of only 6.9 square miles at its mouth. Water from Town Branch flows into McKisic Creek, and then into Little Sugar Creek, which flows into the Elk River in Missouri. The Town Branch watershed is in the Ozark Highlands ecoregion and is approximately 44% forest, 30% urban, and 23% pasture/grass. Most of the watershed is within the Bentonville city limits.

Approximately two-thirds of the Town Branch watershed is within an “urbanized area” based on population density. The storm runoff from within the urbanized area is regulated by the Arkansas Department of Environmental Quality (ADEQ) Phase II National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit. The current Phase II MS4 permit does not set numeric limits for quality of storm runoff in Bentonville. Instead, where a TMDL has established an individual wasteload allocation (WLA) for the urbanized area, the permittee is required to incorporate the WLA as a measureable goal. To ensure conformance with an individual WLA in a TMDL, the ADEQ Phase II MS4 permit requires permittees to monitor NPDES stormwater outfalls to identify sources of the pollutant of concern within the urbanized area, and to implement best management practices (BMPs) to minimize pollutants in storm runoff.

In addition to the MS4 Phase II area, six facilities in the Town Branch watershed are covered under the ADEQ Industrial Stormwater General Permit (No. ARR000000). Because of the nature of their discharges, it is not expected that these facilities contribute phosphorus above background concentrations, and therefore no WLA was provided. These facilities are:

- Bentonville Castings Company (ARR00A350),
- Kraft Foods, Inc. Bentonville (ARR00A477),
- Midcontinent Concrete of Arkansas (ARR00B150),
- ProCon, Inc. South Walton Professional Plaza (ARR10C552),
- Wal-Mart Sign Shop and Layout Center (ARR000422), and
- Wal-Mart Fashion Distribution Center #6008 (ARR000245).

The only point source discharge with an individual NPDES permit in the Town Branch watershed is the City of Bentonville wastewater treatment plant (WWTP) (Permit No. AR0022403). The current permit for this facility indicates that it has a design flow of 4.0 million gallons per day (MGD). The 30-day average monthly effluent flow for July 2007 through December 2009 was 5.24 MGD. This WWTP has had a monthly average permit limit of 1.0 mg/L for total phosphorus in effect since January 2007. The 30-day monthly average effluent flows from the Bentonville WWTP for July 2007 through December 2009 ranged from 3.88 MGD to 7.12 MGD. For this same period, the 7-day average effluent flows ranged from 4.71 MGD to 11.15 MGD. The City of Bentonville 2009 Budget Report states that plans are underway to divert flow from the Bentonville WWTP to the future Northwest Arkansas Conservation Authority (NACA) facility.

Town Branch was included in the 2008 final 303(d) list for not supporting its designated use of aquatic life due to high concentrations of total phosphorus. The Arkansas water quality standards currently have no numeric criteria for total phosphorus, but narrative criteria are specified for nutrients (including phosphorus). A review of total phosphorus concentrations in the City of Bentonville WWTP effluent and in Town Branch downstream of the WWTP show that concentrations have dropped dramatically over the last 5 to 10 years. However, there are no recent biological data to determine whether these decreases in phosphorus concentrations have resulted in a change in the biological condition of Town Branch.

This TMDL for Town Branch was calculated as a conservative mass balance for total phosphorus. The total allowable loading in the stream was calculated as the mean annual flow in the stream multiplied by a target concentration of total phosphorus. There were insufficient data to accurately quantify any losses of phosphorus along the stream due to uptake by algae or

settling of particulate matter. Given the scientific literature available on phosphorus concentrations in streams in northwest Arkansas and in the Ozark Highlands ecoregion, along with published guidance, EPA has determined that a total phosphorus concentration of 0.1 mg/L is the highest target scientifically supportable in order to meet the stream's designated use.

An implicit margin of safety (MOS) was established for this TMDL using conservative assumptions, which included neglecting losses of phosphorus along the length of the stream and the consideration of certain data in the development of the target concentration.

The WLA for the City of Bentonville WWTP was calculated as the design flow (4.0 MGD) multiplied by the instream target concentration (0.10 mg/L). The allowable load for storm runoff from the Town Branch watershed was calculated as the remaining allowable load after subtracting the MOS (which is zero because it is implicit) and the WWTP WLA from the TMDL. This allowable load for storm runoff was then divided between two components. One component was the allowable load for storm runoff inside the urbanized area, which was expressed as a WLA because it is regulated by the City of Bentonville's MS4 permit. The other component was a load allocation (LA) for runoff outside the urbanized area. The allowable load for runoff from the entire watershed was divided between these two components based on drainage area. The corresponding concentrations for these allowable loads were then back-calculated as the load divided by the average flow rate. The average flow rate for each area was estimated as the drainage area multiplied by the average annual flow per square mile for the US Geological Survey (USGS) gage on Flint Creek near Springtown, Arkansas (the nearest flow gage on a small stream with a long period of record).

EPA understands that additional phosphorus removal treatment at the existing Bentonville WWTP may be needed to meet the required WLA. The TMDL is also required to assign a WLA to the MS4, which discharges to Town Branch. To reduce phosphorus in stormwater from urban areas, the MS4 will need to implement a combination of source control actions, public education programs, targeted reduction programs, and a monitoring program for evaluating progress towards attaining the MS4 WLA target.

EPA recommends that the City of Bentonville and ADEQ work closely to develop interim limits, performance-based limits, and/or compliance schedules that may be necessary for the City of Bentonville WWTP to meet the WLA.

The components of the Town Branch TMDL are summarized in Table ES.1.

Table ES.1. Town Branch total phosphorus TMDL.

	Allowable Load (lbs/day)	**Corresponding Average Concentration (mg/L)**
WLA for City of Bentonville WWTP (AR0022403)	3.34	0.10
WLA for MS4 runoff (ARR040000)	2.65	0.10
LA for other runoff	1.25	0.10
MOS	implicit	--
TMDL	7.24	--

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1.0 INTRODUCTION

This report presents a total maximum daily load (TMDL) for total phosphorus for Town Branch (Reach 11070208-901) near Bentonville in northwest Arkansas. This stream reach was included on the 2008 final 303(d) list for Arkansas (US Environmental Protection Agency [EPA] 2008a) as impaired due to high concentrations of total phosphorus. The Arkansas Department of Environmental Quality (ADEQ) included this reach on the 1992 through 2002 303(d) lists for nutrients. In 2004, ADEQ kept Town Branch on the 303(d) list but clarified the pollutant by changing it to total phosphorus instead of nutrients. In 2006, ADEQ took Town Branch off of the draft 303(d) list and assessed it as Category 4b, which is for waterbodies that are impaired but do not need a TMDL because they are expected to meet standards through the implementation of alternative pathways. EPA did not approve ADEQ's removal of Town Branch from the 303(d) list and consequently added Town Branch to the final 303(d) lists for 2006 and 2008 (EPA 2008b). In May 2010, ADEQ submitted a letter and justification to EPA requesting that Town Branch be placed in Category 4b, rather than on the 303(d) list. In June 2010, EPA notified ADEQ that the information submitted was insufficient to exclude Town Branch from the 303(d) list and a TMDL is required for total phosphorus.

Information from the 2008 final 303(d) list is shown in Table 1.1. The TMDL in this report was developed in accordance with Section 303(d) of the Federal Clean Water Act and EPA regulations found at Title 40 Code of Federal Regulations (CFR) Part 130.7.

The purpose of a TMDL is to determine the pollutant loading that a waterbody can assimilate without exceeding the water quality standards for the pollutant of concern 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. Information for Town Branch from the 2008 final 303(d) list.

Reach No.	Stream Name	Planning Segment	Pollutant	Category	Priority
11070208-901	Town Branch	3J	Total Phosphorus	5a	High

2.0 BACKGROUND INFORMATION

2.1 General Information

The study area for this report is the watershed for Town Branch near Bentonville in northwest Arkansas (see Figure A.1 in Appendix A). The Town Branch watershed is in the Ozark Highlands ecoregion and in ADEQ Planning Segment 3J. Town Branch is a headwater stream with a drainage area of only 6.9 square miles at its confluence with McKisic Creek. McKisic Creek flows into Little Sugar Creek, which flows into the Elk River in Missouri.

Most of the Town Branch watershed is within the Bentonville city limits. In recent years, Bentonville and the surrounding area have experienced significant population growth. Bentonville grew from a population of 19,730 in 2000 (US Census Bureau 2000) to 28,621 in 2006 (US Census Bureau 2006).

2.2 Land Use / Land Cover

Land use data for the Town Branch watershed were obtained from the GEOSTOR database, which is maintained by the Center for Advanced Spatial Technology (CAST) at the University of Arkansas (CAST 2005). These data were based on satellite imagery from 2004. The spatial distribution of the land use data is shown on Figure A.2 (located in Appendix A) and land use percentages are shown in Table 2.1. These data indicate that the primary land uses in the Town Branch watershed are forest, urban (Bentonville), and pasture/grass. The City of Bentonville geographical information system for mapping indicates that the pasture/grass area, located along Town Branch, is mostly designated as a park.

2.3 Description of Hydrology

Average precipitation for the Town Branch watershed is about 43 inches per year (US Geological Survey [USGS] 1984). Stream flow in Town Branch was characterized using USGS flow data from Flint Creek at Springtown because there are no USGS flow gages on Town Branch. Information for the Flint Creek gage is summarized in Table 2.2.

Table 2.1. Land use percentages for the study area.

Category	Percentage of study area
Urban	30.5%
Barren	2.9%
Water	0.0%
Forest	43.6%
Cropland	0.0%
Fallow	0.0%
Pasture/grass	23.0%
TOTAL	100.0%

Table 2.2. Information for USGS stream flow gaging station (USGS 2009).

Gage name:	Flint Creek at Springtown, AR
Gage number:	07195800
Descriptive location:	State Highway 12, about 14 miles southwest of Bentonville
Period of record:	July 1961 – present
Drainage area:	14.2 square miles
Mean flow:	15.0 cfs
Mean flow per unit area:	1.05 cfs per square mile

Town Branch is considered to be a "losing stream" based on ADEQ's observations of flow in the stream going completely underground for several hundred yards near the confluence with McKisic Creek (ADEQ 1997a).

2.4 Water Quality Standards

Water quality standards for Arkansas waterbodies are listed by ecoregion in Regulation No. 2 (Arkansas Pollution Control and Ecology Commission [APCEC] 2007a).

2.4.1 Designated Uses

Designated uses for Town Branch include secondary contact recreation; public, industrial, and agricultural water supply; and perennial Ozark Highlands fishery (downstream of the City of Bentonville wastewater treatment plant [WWTP]). Primary contact recreation is not a

designated use because the drainage area is less than 10 square miles. The designated use of Town Branch below the WWTP, as identified in ADEQ's water quality standards, is a perennial Ozark Highlands fishery. This designated use applies to streams with a watershed area of 10 square miles or larger where the discharge equals or exceeds 1 cubic foot per second (cfs).

2.4.2 Arkansas Nutrient Criteria

For nutrients, the Arkansas water quality standards have narrative criteria but not a numeric criterion. The narrative criteria for nutrients in Arkansas are as follows:

> 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.

2.4.3 Missouri Nutrient Criteria

Because water from Town Branch eventually flows into Little Sugar Creek and the Elk River in Missouri, water quality standards in Missouri are relevant to this TMDL. Currently the Missouri water quality standards do not include a numeric instream criterion for phosphorus for Little Sugar Creek or the Elk River in Missouri. In TMDLs that have been approved by EPA, the Missouri Department of Natural Resources (MDNR) has used total phosphorus target concentrations of 0.06 mg/L for the Elk River near the Missouri-Oklahoma state line (MDNR 2004a) and 0.075 mg/L for the James River near Table Rock Lake (MDNR 2001, MDNR 2004b).

2.5 Point Sources

Part of the Town Branch watershed is included in the Fayetteville-Springdale "urbanized area" (EPA 2002a). Storm runoff from areas that are within both the Bentonville city limits and the Fayetteville-Springdale urbanized area (see Figure A.3 in Appendix A) is regulated by the ADEQ's Municipal Separate Storm Sewer System (MS4) Phase II permit (National Pollutant Discharge Elimination System [NPDES] Permit No. ARR040009). Although this storm runoff originates from widespread areas, it is classified as a point source for this TMDL because it is covered under the MS4 permit. The current Phase II MS4 permit does not set numeric limits for quality of storm runoff in Bentonville. Instead, where a TMDL has established an individual WLA for the urbanized area, the permit requires the permittee to incorporate the WLA as a measureable goal. To ensure conformance with individual WLAs in TMDLs, the ADEQ Phase II MS4 permit requires permittees with urbanized areas covered by the permit to monitor NPDES stormwater outfalls to identify sources of the pollutant of concern within the urbanized area, and to implement best management practices (BMPs) to minimize pollutants in storm runoff.

Based on information from the EPA Enforcement & Compliance History Online (ECHO) web site (EPA 2009) and the Arkansas 2008 Integrated Report (ADEQ 2008), the only point source with an individual discharge permit in the Town Branch watershed is the City of Bentonville WWTP. The current NPDES permit for the WWTP became effective March 1, 2009, and will expire on February 28, 2014 (ADEQ 2009). Selected permit information for the City of Bentonville WWTP is summarized in Table 2.3 and the location of the facility is shown on Figures A.1 and A.3.

Table 2.3. Information for current discharge permit for City of Bentonville WWTP.

NPDES Number	Facility Name	Design Flow (MGD)	Parameter	Permit Limits (mg/L)
AR0022403	City of Bentonville WWTP	4.0 [(a)]	BOD_5	10 (30-day avg.), 15 (7-day avg.)
			TSS	15 (30-day avg.), 23 (7-day avg.)
			Total Phosphorus [(b)]	1.0 (30-day avg.), 1.5 (7-day avg.)

Notes: (a). See discussion of design flow in paragraph below.
(b). Total phosphorus limits became effective starting January 1, 2007.

The design flow for the WWTP, as specified in the current permit, is 4.0 MGD. The most recent permit renewal application (City of Bentonville 2008) included engineering calculations to demonstrate that the WWTP has sufficient hydraulic capacity and treatment capacity for a design flow of 5.0 MGD, but the application itself specified a design flow of 4.0 MGD (item 17 in Section A of Form 1, and item A.6 in Form 2A). The treatment process is described in the current permit as bar screen, grit and scum removal, aeration basins, anoxic basins, final clarifiers, ultraviolet disinfection, and post aeration. According to information included with the application, two anoxic basin cells were converted to anaerobic selectors in 2005 to promote biological phosphorus removal along with the addition of liquid alum to cause phosphorus to precipitate and settle out in the final clarifiers.

The City of Bentonville WWTP is required to monitor and report effluent flows and phosphorus concentrations (as well as other parameters). The 30-day average and 7-day average values for effluent flow and phosphorus for the WWTP are tabulated in Table B.1 in Appendix B. During the period of March 1998 through November 2005, the average effluent concentration of total phosphorus ranged from 2.0 mg/L to 12.2 mg/L, with an average of 5.9 mg/L. For the period ranging from July 2007 through December 2009, the 30-day average effluent concentration of total phosphorus ranged from 0.1 mg/L to 0.7 mg/L, and the 7-day average effluent concentration of total phosphorus ranged from 0.2 mg/L to 1.1 mg/L. EPA commends the City of Bentonville for this significant reduction in effluent phosphorus concentrations.

The City of Bentonville WWTP's 30-day average effluent flow for July 2007 through December 2009 ranged from 3.88 MGD to 7.12 MGD. For this same period, the 7-day average effluent flow ranged from 4.71 MGD to 11.15 MGD. Since January 1998, the effluent flows have increased, but both the concentrations and loads of total phosphorus have decreased, especially after the facility's 1 mg/L total phosphorus limit went into effect January 1, 2007 (see Figures B.1 through B.4 in Appendix B). The City of Bentonville 2009 Budget Report states that plans are underway to divert flow from the City of Bentonville WWTP to the future Northwest Arkansas Conservation Authority (NACA) facility.

In addition to the MS4 Phase II area, six facilities in the Town Branch watershed are covered under the ADEQ Industrial Stormwater General Permit (No. ARR000000). Because of the nature of their discharges (industrial stormwater), it is not expected that these facilities contribute phosphorus above background concentrations, and therefore no WLA was provided. These facilities are:

- Bentonville Castings Company (ARR00A350),
- Kraft Foods, Inc. Bentonville (ARR00A477),
- Midcontinent Concrete of Arkansas (ARR00B150),
- ProCon, Inc. South Walton Professional Plaza (ARR10C552),
- Wal-Mart Sign Shop and Layout Center (ARR000422), and
- Wal-Mart Fashion Distribution Center #6008 (ARR000245).

2.6 Nonpoint Sources

No nonpoint sources of total phosphorus were identified for Town Branch in the 2004 Arkansas 303(d) list (ADEQ 2005) or in subsequent 303(d) lists. Almost one-third of the Town Branch watershed (2.2 square miles) is outside the Fayetteville-Springdale urbanized area. Runoff from land outside the urbanized area is considered a nonpoint source.

2.7 Previous Studies

ADEQ conducted an intensive field study on Town Branch, McKisic Creek, and Little Sugar Creek in August 1996 (ADEQ 1997a). The report for this field study included a discussion of two earlier field studies in 1978 and 1980. The 1978 field study covered the Illinois River basin and the Little Sugar Creek basin in Arkansas. The 1978 study concluded that “Little Sugar Creek was being impacted by elevated nutrients, resulting in increased algae and a slightly impacted macroinvertebrate community at the state line station.” The 1980 study focused specifically on Town Branch and included field data collected from July 8 through 10, 1980. The 1980 study concluded that Town Branch was being “severely impacted from the [WWTP], resulting in low dissolved oxygen concentrations, excessive algae and very high BOD [biochemical oxygen demand] and nutrients.”

The 1996 ADEQ field study included water quality sampling and in situ measurements at five locations along Town Branch, as well as collection of macroinvertebrates and fish near the ARK56 long-term monitoring station. The results and conclusions from the 1996 field study are discussed in Section 3.3.

3.0 WATER QUALITY DATA

3.1 General Description of Long-Term Monitoring Data

Total phosphorus data have been collected by ADEQ at approximately monthly intervals at one site within the Town Branch watershed. The location of this sampling site is shown on Figures A.1 and A.3 (located in Appendix A). These total phosphorus data for this site prior to 2006 were obtained from ADEQ personnel. Data from 2006 forward were obtained from EPA's Storage and Retrieval (STORET) database. The individual data for the combined period of record are listed in Table C.1 (in Appendix C) and the data are summarized in Table 3.1. The data for this sampling station are stored in the ADEQ and STORET databases with "ARK0056" as the station name, but the station is referred to by its common descriptor of "ARK56" throughout this report. Although ADEQ's station description does not include the name "Town Branch," the latitude and longitude for the sampling station confirm that it is actually located on Town Branch as shown on Figures A.1 and A.3.

Table 3.1. Summary of ADEQ data for total phosphorus in Town Branch.

Station ID	Station Description	Period of Record	Count	Minimum (mg/L)	Median (mg/L)	Average (mg/L)	Maximum (mg/L)
ARK56	Little Sugar Creek tributary below Bentonville, Arkansas	Sept. 1990 – Jun. 2009	206	0.12	3.24	3.16	7.26*

*Note: The highest value was 12.8 mg/L and is likely an outlier; the second highest value was 7.26 mg/L.

3.2 Trends and Patterns in Long-Term Monitoring Data

A long-term plot of the total phosphorus data for the ARK56 station is shown on Figure C.1 (located in Appendix C). This plot shows a decreasing trend in the data from 1990 to 2007, and an abrupt drop in 2007, with the much lower total phosphorus concentrations continuing into 2009. These same data are also displayed in a box and whisker plot for each year (Figure C.2); this plot clearly shows the same decreasing trend.

The reductions in total phosphorus concentrations at the ARK56 station appear to have contributed to reductions in total phosphorus concentrations in Little Sugar Creek downstream of Town Branch. Figure C.3 is a box and whisker plot of total phosphorus concentrations in Little

Sugar Creek near Caverna, Missouri (station ARK0001; located approximately 0.3 mile downstream of the Arkansas-Missouri state line). The total phosphorus concentrations at this station dropped noticeably from 2006 to 2009.

A seasonal plot of the ARK56 data is shown on Figure C.4. This plot shows elevated values of total phosphorus occurring during all seasons.

A plot of total phosphorus at ARK56 versus stream flow was also developed to examine any correlation between concentration and flow (Figure C.5). Relatively lower concentrations occurred during a wide range of flow conditions, while the highest concentrations occurred during low flows.

3.3 ADEQ 1996 Intensive Field Study

As mentioned in Section 2.7, ADEQ conducted an intensive field study of Town Branch, McKisic Creek, and Little Sugar Creek during August 1996 (ADEQ 1997a). The data collected along Town Branch during this survey included water quality sampling and in situ measurements at five locations, as well as collection of macroinvertebrates and fish near the ARK56 long-term monitoring station. The total phosphorus concentrations during this field survey were 0.105 mg/L upstream of the City of Bentonville WWTP, 12.0 mg/L in the WWTP effluent, and 10.0 mg/L to 5.6 mg/L downstream of the WWTP (decreasing in the downstream direction). The in situ data showed “wide fluctuations in oxygen saturation values, resulting from photosynthetic and respiratory activities of algae and periphyton.” ADEQ conducted a rapid bioassessment (RBA) based on the macroinvertebrate collection; the RBA indicated that Town Branch was “slightly impaired” downstream of the WWTP. The fish collection in Town Branch downstream of the WWTP showed a smaller percentage of species that are sensitive to pollution and less diversity of fish species than the reference site on Little Sugar Creek upstream of Town Branch.

3.4 Data Gaps

The ADEQ intensive field study described in Section 3.3 was conducted over 10 years ago. Phosphorus concentrations in the City of Bentonville effluent and in Town Branch have dropped dramatically since that time, and it is possible that the biological condition of Town

Branch has improved as a result. A new intensive field study could be implemented to assess Town Branch's biological health. The result of such a study, if completed over the next few years, could be used to inform future decisions as to whether to revise the TMDL upwards or downwards prior to implementation.

4.0 TMDL DEVELOPMENT

4.1 Seasonality and Critical Conditions

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. An impairment due to high nutrient concentrations over time can result in nuisance levels of algae as well as shifts in the populations of macroinvertebrates and fish (e.g., smaller numbers of sensitive species and greater numbers of pollution-tolerant species, less diversity due to fewer species being supported). These changes in the stream biology (particularly the changes in macroinvertebrates and fish) typically do not occur in a response to brief durations of high nutrient concentrations. Therefore, this phosphorus TMDL was developed for average annual conditions.

4.2 Water Quality Target

The Arkansas water quality standards do not include a numeric criterion for phosphorus, but they do include narrative criteria for nutrients as discussed in Section 2.4. Because a TMDL is a quantitative analysis, it is necessary to establish a numeric target in order to develop a TMDL based on narrative criteria. As noted earlier, there are no recent biological data in Town Branch to determine if the biological condition has improved as a result of the phosphorus reductions. A new intensive field study could be implemented to assess Town Branch's biological health. The result of such a study, if completed over the next few years, could be used to inform future decisions as to whether to revise the TMDL upwards or downwards prior to implementation. In the absence of such data, EPA has selected a target based on published guidance as well as biological and water quality data from Town Branch and other streams in the Ozark Highlands ecoregion.

4.2.1 Selection of Target

For this TMDL, EPA has selected a value of 0.10 mg/L as the numeric target for instream concentrations of total phosphorus in Town Branch. EPA determined that the instream target of 0.10 mg/L total phosphorus is the highest target scientifically supportable in order to meet the stream's designated use. The data and studies used in the selection of a target include:

- The approved TMDL for the James River basin (tributary to Table Rock Lake);
- Field data from a 2003-2004 special study of the Illinois River and Kings River basins;
- ADEQ's 1996 intensive field study of Town Branch, McKisic Creek, and Little Sugar Creek; and
- Other supporting studies conducted throughout the Ozark Highlands ecoregion.

4.2.2 James River TMDL

A target concentration of 0.075 mg/L total phosphorus was used in the TMDL for the James River basin (MDNR 2001, MDNR 2004b). This target was based on information from published literature along with biological and water quality data collected in the James River basin (which is in the Ozark Highlands ecoregion). Included in Appendix D is a four-page excerpt of the James River TMDL report documenting the development of this target concentration. The summary of the data analysis for this target is shown in Table D.1 (also in Appendix D). The geometric means and confidence intervals shown in Table D.1 indicate that total phosphorus concentrations below about 0.08 mg/L were associated with streams ranging from unimpaired to impaired, but total phosphorus concentrations above about 0.08 mg/L would be expected to result in impairment.

4.2.3 Special Study of Illinois River and Kings River Basins

A special study of the Illinois River and Kings River basins was conducted during 2003 and 2004 by personnel from Parsons, Inc. and the University of Arkansas (Parsons/UA 2004). Physical, chemical, and biological data were collected at 16 locations, including locations upstream and downstream of point source discharges. All of the sampling locations were in the

Ozark Highlands ecoregion. Each site was visited three times, and eleven different physical, chemical, and biological indicators were evaluated at each site. Based on the number of indicators whose results were not characteristic of streams supporting the aquatic life designated use, each site was classified as "unimpacted," "slightly impacted," "impacted," or "severely impacted." These data are shown in Appendix E. The average phosphorus concentration for all sites on stream reaches that were not cited on the 2004 final 303(d) list as impaired for the pollutant phosphorus was approximately 0.095 mg/L. Conversely, the average phosphorus concentration for all sites on stream reaches that were classified as impaired on the 2004 final 303(d) list due to phosphorus was approximately 0.758 mg/L.

4.2.4 ADEQ 1996 Intensive Field Study of Town Branch

An intensive field study of Town Branch, McKisic Creek, and Little Sugar Creek was conducted by ADEQ during August 1996 (ADEQ 1997a). Chemical and biological data were collected at 14 locations, including locations upstream and downstream of the City of Bentonville WWTP. All of the sampling locations were in the Ozark Highlands ecoregion. Each site was visited twice, and chemical and biological indicators were evaluated. The report indicated that phosphorus and nitrate provided ample nutrients to generate wide fluctuations in oxygen saturation. In addition, the report also indicates that the biological conditions in Town Branch downstream of the WWTP were slightly impaired, citing that increases in the primary feeders are attributed to an increase in algae. The report indicates that the background phosphorus concentration in Town Branch (located approximately 200 yards upstream of the Bentonville WWTP) was 0.105 mg/L.

4.2.5 Other Supporting Studies in the Ozark Highlands Ecoregion

Following are summaries of data from additional studies conducted between 1983 and 2000 on phosphorus concentrations in waters within the Ozark Highlands Ecoregion. Arkansas Department of Pollution Control and Ecology's (ADPCE) *Physical, Chemical and Biological Characteristics of Least-Disturbed Reference Streams in Arkansas' Ecoregions* (ADPCE 1987) includes sampling results for six reference stream reaches in the Ozark

Highlands ecoregion. Based on eleven sampling events, the study yielded a mean phosphorus concentration of 0.05 mg/L, with a range of 0.01 mg/L to 0.15 mg/L. In this same study, Spavinaw Creek and Flint Creek were among the six reference stream reaches sampled. Based on the data only from Spavinaw Creek and Flint Creek, the mean phosphorus concentration for three sampling events was 0.08 mg/L, with a range of 0.01 mg/L to 0.15 mg/L.

In addition, historical water quality data for Flint Creek collected by ADEQ (water quality stations ARK 04A and ARK0004A) were analyzed using EPA's Technical Guidance Manual for Developing Nutrient Criteria for Rivers and Streams (EPA 2000a) to determine the 75th percentile phosphorus concentrations. In this data evaluation, EPA chose to use the 75th percentile as the reference condition because reference streams are already acknowledged to be in an approximate ideal state for a particular class of streams. For Flint Creek, the 75th percentile of the historical data was 0.064 mg/L (n=104). The mean for this data set is 0.06 mg/L and the median is 0.05 mg/L.

Additionally, in 2000 EPA published *Ambient Water Quality Criteria Recommendations: Information Supporting the Development of State and Tribal Nutrient Criteria, Rivers and Streams in Nutrient Ecoregion XI* (EPA 2000b). Fourteen aggregate ecoregions were established across the US based on land use, topography, soils, etc. Aggregate Ecoregion 11 is a broad-scale ecoregion made up of eight Level III subecoregions spanning numerous states, including portions of Arkansas. For the Aggregate Ecoregion XI, data from 1,591 streams yielded a 25th percentile total phosphorus concentration of 0.01 mg/L. Also, data from the same study, for 175 streams within subecoregion 39 (which includes portions of northwest Arkansas), yielded a 25th percentile total phosphorus concentration of 0.006625 mg/L. The national recommended total phosphorus concentration in streams and rivers in this broad-scale ecoregion is 0.01 mg/L (EPA 2000b).

Another data set that was evaluated was a combination of data from several studies in which data were collected in Osage Creek upstream of the City of Rogers WWTP and Spring Creek upstream of the City of Springdale WWTP. Both of these sites are: 1) not impacted by point source discharges, 2) in relatively urban areas, and 3) in the Ozark Highlands ecoregion. Ten values of total phosphorus were compiled for each of these two sites from sampling

conducted during 1995 and 1996 (ADEQ 1997b) and in 2003 (Parsons/UA 2004). These data are listed in Appendix F. The averages of the values for Osage Creek (0.082 mg/L) and Spring Creek (0.094 mg/L) were averaged to yield an estimated total phosphorus concentration of 0.088 mg/L (rounded off to 0.09 mg/L). This value can be considered as representative of phosphorus concentrations in non-impaired streams with urban watersheds in the Ozark Highlands ecoregion.

USGS recently published an article with both biological and water quality data collected for 30 wadeable streams in the Ozark Highlands ecoregion (USGS 2010). In this study, biotic indices and metrics were calculated using field data for algae, macroinvertebrates, and fish. These biotic indices and metrics were compared to nutrient concentrations measured at the same sites. The study stated that "biotic metric scores were inversely related to nutrients and were generally highest when TN [total nitrogen] and TP [total phosphorus] concentrations were less than about 0.40 mg/L and about 0.018 mg/L (respectively), but were generally lowest when concentrations were higher." In other words, the streams with the best biological conditions tended to have total phosphorus concentrations less than about 0.018 mg/L.

4.2.6 Summary of Evidence Supporting Target

The data and information discussed above concerning the selection of a target phosphorus concentration for Town Branch can be summarized as follows:

- Information from the James River TMDL shows that average concentrations above the 0.075 to 0.08 mg/L range may cause impairments.
- Data from the Illinois River and Kings River basins showed non-impaired streams with average concentrations of 0.095 mg/L.
- Data from ADEQ's 1996 intensive field survey of Town Branch, McKisic Creek, and Little Sugar Creek indicate that the background total phosphorus is 0.105 mg/L. The report also indicates that the biological conditions in Town Branch were slightly impaired due to excess nutrients.
- A USGS 2010 publication with data from 30 streams in the Ozark Highlands ecoregion indicates that streams with the best biological conditions tended to have total phosphorus concentrations less than about 0.018 mg/L.

- Data for the upstream portions of Osage Creek and Spring Creek yielded an average concentration of about 0.09 mg/L for non-impaired urban streams.
- The EPA "Gold Book" suggests 0.10 mg/L as a "desirable goal for the prevention of plant nuisances in streams or other flowing waters not discharging directly to lakes or impoundments."

Considering all these data and information together, EPA believes that the value of 0.10 mg/L is the highest target scientifically supportable to meet Town Branch's designated use.

Because this target (0.10 mg/L) was justified by comparing it with average (not maximum) concentrations from other stream systems, it is appropriate to apply this target to Town Branch on an average basis. It is expected that the aquatic life designated use would still be supported if instream concentrations above this target occur for short durations on an occasional basis (e.g., during storms), as long as typical instream concentrations do not exceed the target.

4.3 Components of TMDL for Town Branch

4.3.1 TMDL

The total phosphorus TMDL for Town Branch was calculated as a mass budget for a conservative substance. Along the length of Town Branch, algae attached to rocks will take up some phosphorus for growth, and some phosphorus may be adsorbed to soil particles and settle out. However, most of these phosphorus "losses" are assumed to be temporary because storm flows in the stream will likely scour much of the attached algae (periphyton) and recently settled sediment. There are not sufficient data to quantify these processes in Town Branch. The simple mass budget is the best approach for this TMDL in the absence of data to accurately characterize the fate and transport of phosphorus.

The total allowable load of total phosphorus in Town Branch was computed as the estimated average annual flow for Town Branch (ambient + point source) multiplied by the target total phosphorus concentration (0.10 mg/L). Ambient flows for Town Branch were estimated using data from the USGS Flint Creek flow gage (07195800). The estimate of ambient average annual flow at the mouth of Town Branch was calculated by multiplying the Flint Creek

gage mean annual flow per unit area (1.05 cfs per square mile, from Table 2.2) by the Town Branch drainage area (6.9 square miles). The average annual flow for Town Branch was calculated as the sum of the average annual ambient flow (7.25 cfs, or 4.68 MGD), and the Bentonville WWTP design flow (4.0 MGD). This resulted in the following calculation for the TMDL:

$$\begin{aligned} \text{TMDL (lbs/day)} &= \text{Total flow (MGD)} \times \text{Target concentration (mg/L)} \times 8.345 \\ &= (4.68\ \text{MGD} + 4.0\ \text{MGD}) \times 0.10\ \text{mg/L} \times 8.345 \\ &= 7.24\ \text{lbs/day} \end{aligned}$$

4.3.2 Margin of Safety

Both Section 303(d) of the Clean Water Act and regulations at 40 CFR 130.7 require TMDLs to include an 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. For this TMDL, an implicit MOS was established from conservative assumptions. One conservative assumption was neglecting losses of phosphorus along the length of the stream. Although most of the phosphorus loss is temporary, some of the phosphorus is assumed to be lost permanently without being transported downstream.

4.3.3 WLA for City of Bentonville WWTP

The allowable phosphorus load for the City of Bentonville WWTP was calculated so that the discharge will not cause or contribute to a violation of water quality standards downstream of the discharge (as required by federal regulations). If runoff from the Town Branch watershed was known to have concentrations of total phosphorus that are consistently less than the target concentration, then the runoff could be treated as dilution for the WWTP effluent. However, sufficient data are not available to know what the phosphorus concentrations are in runoff from the Town Branch watershed. The only way to provide assurance that the WWTP discharge will not cause the average instream concentration to exceed the target concentration in Town Branch is for the average effluent concentration to be no greater than the target concentration (i.e., the instream target must be met at the “end of the pipe”). Therefore, the WLA for the WWTP was

calculated as the instream target concentration multiplied by the design flow, as follows (Table 4.1):

WWTP WLA (lbs/day) = Design flow (MGD) × Instream target (mg/L) × 8.345
= 4.0 MGD × 0.10 mg/L × 8.345
= 3.34 lbs/day

Although the design flow specified in the NPDES permit for the WWTP is 4.0 MGD, the reported monthly average discharge for the facility has been consistently greater than 4.0 MGD since December 2007 (see Figure B.1 in Appendix B).

EPA understands that additional phosphorus removal treatment at the existing Bentonville WWTP may be needed to meet the required WLA. EPA recommends that the City of Bentonville and ADEQ work closely to develop a phased approach including interim limits, performance-based limits, and/or compliance schedules that may be necessary for the Bentonville WWTP to meet the WLA.

4.3.4 WLA for MS4 Runoff and LA for Other Runoff

The allowable loads for total phosphorus in runoff from the Town Branch watershed were expressed as two components. A WLA was developed for runoff from areas that are within both the Bentonville city limits and the Fayetteville-Springdale urbanized area because that runoff is regulated through the City of Bentonville's MS4 permit (see Section 2.5). An LA was developed for runoff from other areas within the Town Branch watershed (outside the urbanized area) because that runoff is not regulated by an MS4 permit.

The sum of the WLA for MS4 runoff and the LA for runoff from other areas was computed as the remaining allowable load after subtracting the MOS (which is zero because it is implicit) and the WLA for the WWTP. This is shown in the following calculation:

WLA for MS4 + LA for Other Runoff = TMDL – MOS – WLA for WWTP
= 7.24 – 0 (implicit MOS) – 3.34
= 3.90 lbs/day

The result of the calculation above (3.90 lbs/day) was divided between the WLA for MS4 runoff and the LA for other runoff based on drainage area. The MS4 WLA is the allowable load for runoff from 4.7 square miles, while the LA is the allowable load for runoff from 2.2 square miles. Therefore the MS4 WLA and the LA were calculated as follows (Table 4.1):

MS4 WLA (lbs/day) = Total runoff load × 4.7 sq. mi / (4.7 sq. mi. + 2.2 sq. mi.)
= 3.90 lbs/day × 0.68
= 2.65 lbs/day

LA (lbs/day) = Total runoff load × 2.2 sq. mi / (4.7 sq. mi. + 2.2 sq. mi.)
= 3.90 lbs/day × 0.32
= 1.25 lbs/day

The allowable concentration associated with each of these runoff loads was calculated as the allowable load divided by the average annual runoff for the area corresponding to that load (and a conversion factor). The average annual runoff was estimated as the mean annual flow per square mile for Flint Creek (1.05 cfs per square mile, from Table 2.2) multiplied by the appropriate drainage area (4.7 square miles for the MS4 WLA and 2.2 square miles for the LA). These calculations yielded an allowable concentration of 0.10 mg/L for both the MS4 runoff and the runoff from other areas.

The allowable loads and corresponding average concentrations for the Town Branch TMDL are shown in Table 4.1.

To reduce phosphorus in stormwater from the urbanized area, the MS4 will need to implement a combination of source control actions, public education programs, targeted reduction programs, and a monitoring program for evaluating progress towards attaining the MS4 WLA target.

Table 4.1. Town Branch total phosphorus TMDL.

	Allowable Load (lbs/day)	**Corresponding Average Concentration (mg/L)**
WLA for City of Bentonville WWTP (AR0022403)	3.34	0.10
WLA for MS4 runoff* (ARR040000)	2.65	0.10
LA for other runoff	1.25	0.10
MOS	implicit	--
TMDL	7.24	--

*Note: Within 6 months from the approval of this TMDL, the WLA for the City of Bentonville MS4 must be incorporated in Bentonville's Stormwater Management Program (SWMP).

4.4 Future Growth

Compliance with this TMDL is based on keeping total phosphorus concentrations and loadings in Town Branch below the target concentration and loading capacity on an average basis. Based on the existing information, no load was set aside for future growth. If future loads are needed for this watershed, these future loads would have to ensure that both the load and concentration targets will not be exceeded.

5.0 MONITORING AND IMPLEMENTATION

5.1 ADEQ Routine Monitoring

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 database 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 are issued as a single document titled *Arkansas Integrated Water Quality Monitoring and Assessment Report*.

5.2 Future Monitoring

EPA recognizes the importance of current information regarding the linkage between the biological conditions in Town Branch and the ambient water quality conditions. The most recent biological data for Town Branch demonstrating a relationship between instream phosphorus concentrations and the biology of the stream were collected in August 1996 (ADEQ 1997a). EPA encourages the collection of additional data (both biological and instream water quality) to assess the waterbody's biological health. The result of such a data collection effort, if completed over the next few years, could be used to inform future decisions as to whether to revise the TMDL upwards or downwards prior to implementation. Useful additional data might include, among other things: 1) water quality nutrient measurements, 2) 72-hour diurnal instream measurements, 3) habitat and geomorphology assessment, 4) periphyton assessment, 5) fish collections, and 6) benthic macro-invertebrate collections. These data could also be utilized to assess designated uses.

5.3 Stormwater Permitting Requirements and BMP Approach

The NPDES permitting program for stormwater discharges was established under the Clean Water Act as the result of a 1987 amendment. The Clean Water Act specifies the level of control to be incorporated into the NPDES stormwater permitting program depending on the source (industrial versus municipal stormwater). These programs contain specific requirements for the regulated communities/facilities to establish a comprehensive stormwater management program (SWMP) or stormwater pollution prevention plan (SWPPP) to implement any requirements of the TMDL allocation (in accordance with 40 CFR Part 130).

5.4 Specific SWMP/SWPPP Requirements

As noted in Section 4.3.4 of this TMDL report, stormwater runoff from the MS4 Phase II urbanized area may contribute nutrients loads to Town Branch. Based on the current NPDES permit regulations found at 40 CFR 122.44(d)(1)(vii)(B), NPDES permit conditions must be consistent with the assumptions and requirements of an available WLA. Therefore, the NPDES permit and SWMP for this urbanized area must be consistent with the WLA in this TMDL. Currently, the Arkansas Small MS4 General Permit (ARR040000), which was reissued in July 2009, states that if a TMDL provides an individual WLA for an urbanized area, the permittee for that urbanized area is required to incorporate the WLA as a measureable goal in the SWMP (Section 1.3.4 of Permit) and implement best management practices to meet the WLA prescribed in the TMDL (40 CFR 122.44(k)(2)&(3)).

To ensure that the municipality complies with the WLA in the TMDL, Section 3.4.5 of the Arkansas Small MS4 General permit provides a framework necessary for the regulated municipality to review and update its SWMP. As specified in Section 3.4.5 of the existing Small MS4 General permit, specific requirements and timeframes are to be implemented for nutrients impaired waters. These requirements and timeframes include:

- Within 1 year of the date of permit issuance, identify potential significant sources of the pollutant of concern entering your MS4.
- Within 2 years of the date of permit issuance, develop (or modify an existing program as necessary) and implement a public education program to reduce the

discharge of the pollutant of concern in municipal stormwater contributed by residential and commercial use of fertilizers.

- Within 2 years of the date of permit issuance, develop (or modify an existing program as necessary) and implement a program to reduce the discharge of the pollutant of concern in municipal stormwater contributed by fertilizer use at municipal operations (e.g., parks, roadways, municipal facilities).
- Within 2 years of the date of permit issuance, develop (or modify an existing program as necessary) and implement a program to reduce the discharge of the pollutant of concern in municipal stormwater contributed by municipal and private golf courses within your jurisdiction.
- Within 3 years of the date of permit issuance, develop (or modify an existing program as necessary) and implement a program to reduce the discharge of the pollutant of concern in municipal stormwater contributed by any other significant source identified in the source identification evaluation.
- Include in your annual reports progress on program implementation and reducing the nutrient pollutant of concern and updates to measurable goals for nutrient reduction program elements.

5.4.1 Monitoring Requirements

In addition to revising the existing SWMP, as specified in Section 3.5 of the existing Small MS4 General permit, the municipality must monitor outfalls (specifically quarterly grab samples) to determine if the existing stormwater controls are adequate to meet the MS4's WLA. The monitoring requirements, as specified in Section 3.5 of ADEQ's Small MS4 NPDES permit, include:

- The permittee shall prepare and submit to ADEQ and EPA a nutrient monitoring plan. The plan shall include:
  - A detailed description of the goals, monitoring, and sampling and analytical methods; and
  - A list and map of the selected outfall(s) within the TMDL watershed that will be sampled that are representative of the nutrient sources in the watershed.

EPA expects that, within 6 months of the establishment of the TMDL, the municipality will provide ADEQ with copies of a revised SWMP, incorporating the WLA target and the

proposed nutrient monitoring plan to assess progress toward achieving the WLA. In addition, EPA expects that the municipality will commence sampling 6 months after submittal of the revised SWMP.

5.4.2 Annual Reporting

The permittee shall include a TMDL implementation report as part of their annual report. The TMDL implementation report shall include the status and actions taken by the permittee to implement the Nutrient Reduction Plan and monitoring program. The TMDL implementation report shall: 1) document relevant actions taken by the permittee that affect MS4 stormwater discharges, 2) report the results of monitoring activities, and 3) document the progress toward achieving the WLA that was included in the revised SWMP. This TMDL implementation report also shall identify the status of any applicable TMDL implementation schedule milestones.

6.0 PUBLIC PARTICIPATION

When EPA establishes a TMDL, federal regulations require EPA to publish a public notice and seek comment concerning the TMDL. Pursuant to a May 2000 consent decree, this TMDL for Town Branch is required. EPA noticed for public comment the TMDL and requested the public provide information and data concerning the draft version of this TMDL. The public comment period was announced in the Federal Register (Volume 75, Number 74) on April 19, 2010, and it extended through May 19, 2010. The draft version of this report (dated April 2010) was available to the public on the EPA Region 6 web site throughout the public comment period.

Comments were submitted during the public comment period by ADEQ, Mitchell Williams Law representing NACA, and the City of Bentonville. The original comments are shown in Appendix G, and EPA's responses are shown in Appendix H. EPA has made several revisions to the TMDL proposed on April 19, 2010, primarily adding more detail to several sections in response to the public comments. EPA will transmit this TMDL to ADEQ for implementation and for incorporation into ADEQ's current water quality management plan.

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APPENDIX A

Maps

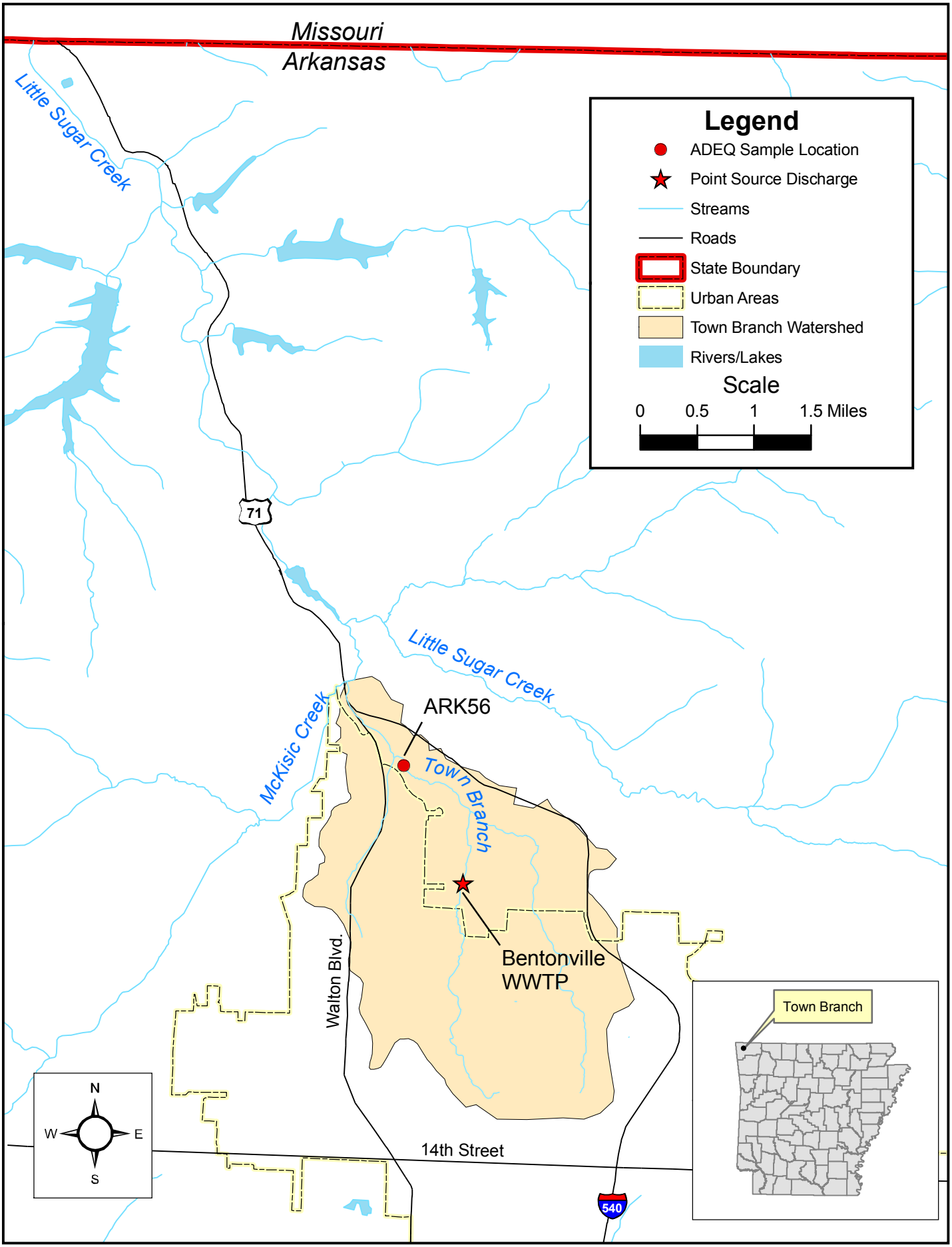

Figure A.1. Watershed Map for Town Branch Lake

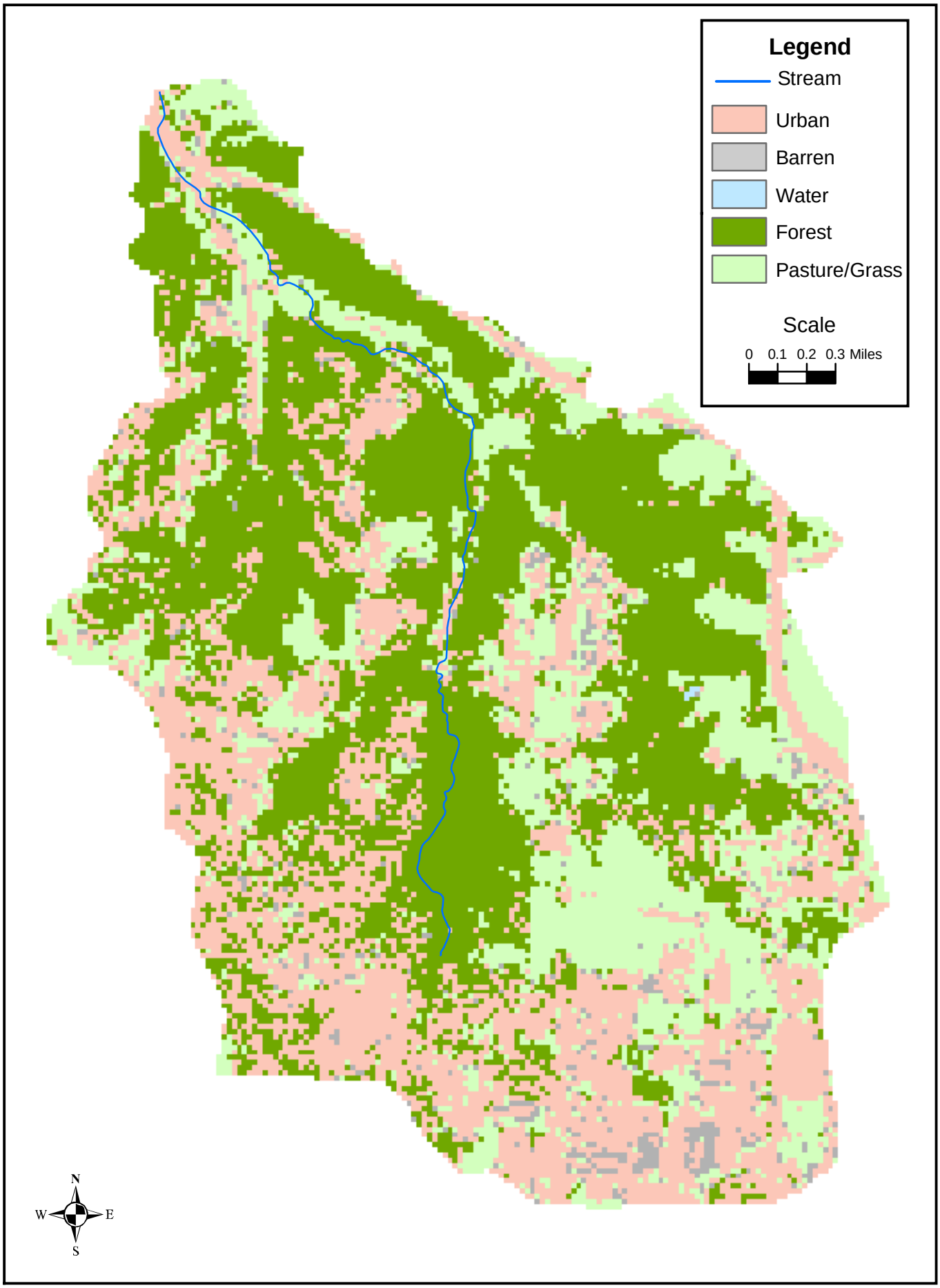

Figure A.2. Land Use Map for Town Branch

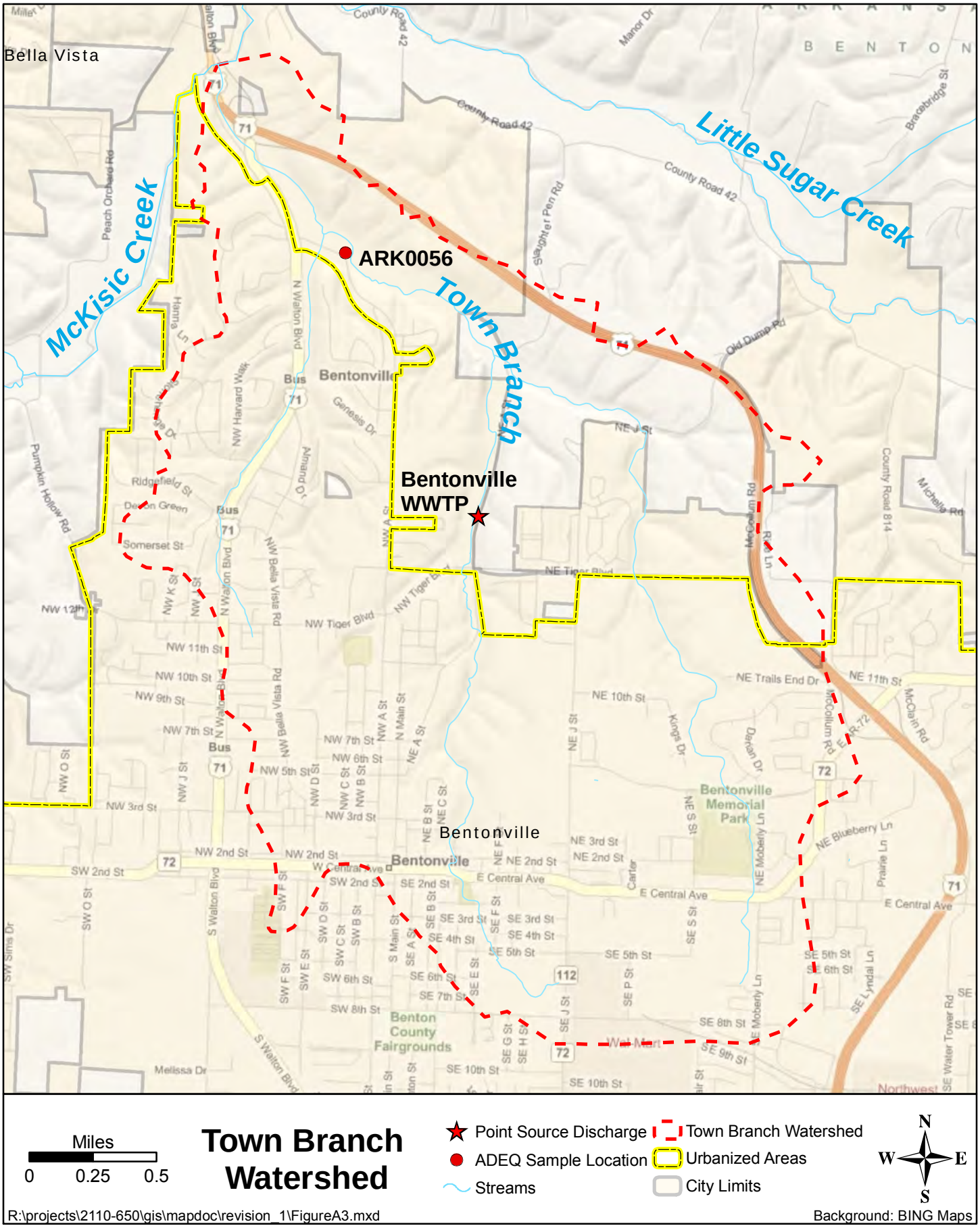

Figure A.3. Map of watershed boundary, city limits, and urbanized area.

APPENDIX B

Effluent Data for City of Bentonville WWTP

Table B.1. Effluent data for City of Bentonville WWTP (AR0022403).

Date	Flow (MGD)		Total Phosphorus Concentration (mg/L)		Estimated Phos. Load *
	30-day avg	7-day avg	30-day avg	7-day avg	(lbs/day)
1/31/98	4.256	8.519			
2/28/98	3.317	5.290			
3/31/98	4.450	7.983	3.7	5.0	137
4/30/98	2.738	4.043	8.8	10.0	201
5/31/98	2.813	6.255	7.8	11.3	183
6/30/98	2.491	3.039	8.7	11.0	181
7/31/98	2.475	3.032	12.2	13.0	252
8/31/98	2.482	3.288	9.0	10.0	186
9/30/98	2.460	6.090	10.0	10.0	205
10/31/98	2.727	5.521	9.0	9.0	205
11/30/98	2.778	4.612	7.0	8.0	162
12/31/98	2.765	3.513	6.0	6.0	138
1/31/99	2.814	4.308	7.0	7.0	164
2/28/99	3.304	6.604	7.0	8.0	193
3/31/99	4.196	7.620	6.0	7.0	210
4/30/99	3.830	5.943	6.0	7.0	192
5/31/99	4.291	6.971	5.0	5.0	179
6/30/99	4.561	7.228	5.0	6.0	190
7/31/99	3.410	7.597	6.0	6.0	171
8/31/99	2.540	3.241	8.0	8.0	170
9/30/99	2.509	3.508	8.0	7.0	168
10/31/99	2.416	2.993	9.0	10.0	181
11/30/99	2.501	3.834	8.0	8.0	167
12/31/99	3.031	5.272	9.0	10.0	228
1/31/00	2.671	5.348	7.0	6.0	156
2/29/00	2.659	3.369	10.0	9.0	222
3/31/00	3.217	6.021	9.0	9.0	242
4/30/00	2.829	4.140	10.0	11.0	236
5/31/00	3.608	5.758	10.0	10.0	301
6/30/00	5.402	12.236	7.0	8.0	316
7/31/00	3.228	6.669	7.0	8.0	189
8/31/00	2.508	3.114	5.0	5.0	105
9/30/00	2.609	5.151	9.0	9.0	196
10/31/00	2.391	3.311	10.0	10.0	200
11/30/00	3.171	4.927	8.0	10.0	212
12/31/00	2.804	4.528	8.0	8.0	187
1/31/01	3.342	5.757	6.0	8.0	167
2/28/01	4.736	9.190	3.0	3.0	119
3/31/01	3.222	4.157	7.0	6.0	188
4/30/01	2.672	3.517	5.0	5.0	111
5/31/01	3.366	6.627	5.0	6.0	140
6/30/01	2.900	4.265	7.0	6.0	169
7/31/01	2.782	5.138	6.0	7.0	139
8/31/01	2.671	3.321	8.0	7.0	178
9/30/01	2.791	4.994	5.0	6.0	116
10/31/01	3.328	6.605	6.0	6.0	167
11/30/01	2.972	4.984	6.0	6.0	149
12/31/01	4.231	9.870	4.0	5.0	141
1/31/02	3.226	6.665	4.0	5.0	108

Date	Flow (MGD)		Total Phosphorus Concentration (mg/L)		Estimated Phos. Load *
	30-day avg	7-day avg	30-day avg	7-day avg	(lbs/day)
2/28/02	4.067	5.832	6.0	5.0	204
3/31/02	4.057	6.266	6.0	6.0	203
4/30/02	4.157	8.733	7.0	8.0	243
5/31/02	5.007	8.299	7.0	8.0	292
6/30/02	3.570	5.500	8.0	7.0	238
7/31/02	3.412	5.835	8.0	8.0	228
8/31/02	3.047	4.961	4.0	5.0	102
9/30/02	2.925	3.605	5.0	5.0	122
10/31/02	2.796	3.989	7.0	8.0	163
11/30/02	2.616	2.951	6.0	6.0	131
12/31/02	3.409	5.510	4.0	4.0	114
1/31/03	2.852	4.102	4.0	4.0	95
2/28/03	3.524	5.209	3.0	5.0	88
3/31/03	3.592	5.208	4.0	7.0	120
4/30/03	3.019	4.087	8.0	11.0	202
5/31/03	4.424	6.651	5.0	7.0	185
6/30/03	3.534	7.490	5.0	7.0	147
7/31/03	3.142	5.598	7.0	8.0	184
8/31/03	2.950	4.861	6.0	8.0	148
9/30/03	3.289	5.997	5.0	7.0	137
10/31/03	3.069	4.584	4.0	5.0	102
11/30/03	3.671	5.992	4.0	7.0	123
12/31/03	3.514	5.509	3.0	4.0	88
1/31/04	3.984	7.117	3.0	5.0	100
2/29/04	3.491	4.531	3.0	5.0	87
3/31/04	4.454	7.628	5.0	9.0	186
4/30/04	4.897	10.736	2.0	5.0	82
5/31/04	4.376	9.708	5.0	6.0	183
6/30/04	3.457	4.518	4.0	7.0	115
7/31/04	5.024	9.272	2.0	3.0	84
8/31/04	3.662	6.494	2.0	3.0	61
9/30/04	3.151	4.311	5.0	5.0	131
10/31/04	3.681	6.063	6.0	9.0	184
11/30/04	5.405	9.908	3.0	4.0	135
12/31/04	4.627	9.110	2.0	3.0	77
1/31/05	6.049	11.802	2.0	2.0	101
2/28/05	3.491	4.531	3.0	5.0	87
3/31/05	4.499	5.563	3.0	3.0	113
4/30/05	5.086	7.775	3.0	6.0	127
5/31/05	4.099	7.023	7.0	11.0	239
6/30/05	4.149	7.224	4.0	6.0	138
7/31/05	3.786	5.464	7.0	8.0	221
8/31/05	3.915	5.623	5.0	7.0	163
9/30/05	3.779	5.276	6.0	6.0	189
10/31/05	3.561	4.853	4.0	5.0	119
11/30/05	3.548	4.385	3.0	5.0	89
12/31/05	3.383	4.059	0.4	1.0	11
1/31/06	3.537	4.842	0.6	1.1	18
2/28/06	3.418	4.190	1.7	2.3	48
3/31/06	3.980	5.982	1.1	3.5	37
4/30/06	4.229	7.029	2.5	6.3	88

Date	Flow (MGD)		Total Phosphorus Concentration (mg/L)		Estimated Phos. Load *
	30-day avg	7-day avg	30-day avg	7-day avg	(lbs/day)
5/31/06	4.890	7.039	4.2	4.8	171
6/30/06	4.076	5.093	6.3	8.5	214
7/31/06	3.859	5.141	2.4	4.0	77
8/31/06	3.995	5.957	3.0	5.6	100
9/30/06	4.239	7.092	1.4	3.8	50
10/31/06	3.744	6.077	0.5	0.6	16
11/30/06	4.008	9.642	0.6	0.8	20
12/31/06	4.691	7.896	0.6	1.2	23
1/31/07	5.665	8.652	0.4	0.8	19
2/28/07	4.996	8.355	0.3	0.4	13
3/31/07	4.174	4.899	1.3	1.8	45
4/30/07	4.507	7.027	1.5	3.5	56
5/31/07	4.650	7.375	0.9	1.4	35
6/30/07	4.695	6.801	0.6	1.4	24
7/31/07	4.850	7.498	0.2	0.3	8
8/31/07	4.200	7.144	0.4	0.2	14
9/30/07	5.448	9.874	0.7	1.1	32
10/31/07	5.048	7.096	0.4	0.5	17
11/30/07	3.883	4.922	0.6	1.0	19
12/31/07	4.926	7.555	0.4	0.6	16
1/31/08	4.414	6.342	0.3	0.6	11
2/29/08	5.926	10.359	0.2	0.2	10
3/31/08	6.357	11.154	0.3	0.4	16
4/30/08	6.998	10.439	0.3	0.4	18
5/31/08	5.793	7.714	0.4	0.7	19
6/30/08	5.527	7.210	0.6	0.7	28
7/31/08	5.871	8.202	0.5	0.6	24
8/31/08	4.944	8.986	0.3	0.4	12
9/30/08	6.073	9.967	0.6	0.6	30
10/31/08	4.526	5.108	0.4	0.5	15
11/30/08	4.497	5.324	0.4	0.5	15
12/31/08	4.594	5.955	0.3	0.5	12
1/31/09	4.486	5.841	0.2	0.4	7
2/28/09	5.898	8.215	0.1	0.2	5
3/31/09	5.478	8.394	0.5	0.8	23
4/30/09	6.784	9.391	0.4	0.7	23
5/31/09	7.121	10.570	0.3	0.5	18
6/30/09	5.416	7.119	0.5	0.7	23
7/31/09	4.567	6.871	0.5	0.6	19
8/31/09	4.271	5.467	0.7	0.9	25
9/30/09	4.536	5.930	0.6	0.7	23
10/31/09	5.878	10.859	0.4	0.6	20
11/30/09	4.824	6.629	0.3	0.3	12
12/31/09	4.132	4.708	0.4	0.5	14

* Loads were not available for most DMRs, so they were calculated as follows:
Estimated Load (lbs/day) = 30-day avg flow (MGD) × 30-day avg conc (mg/L) × 8.345

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Figure B.1. Monthly average effluent flow for City of Bentonville WWTP

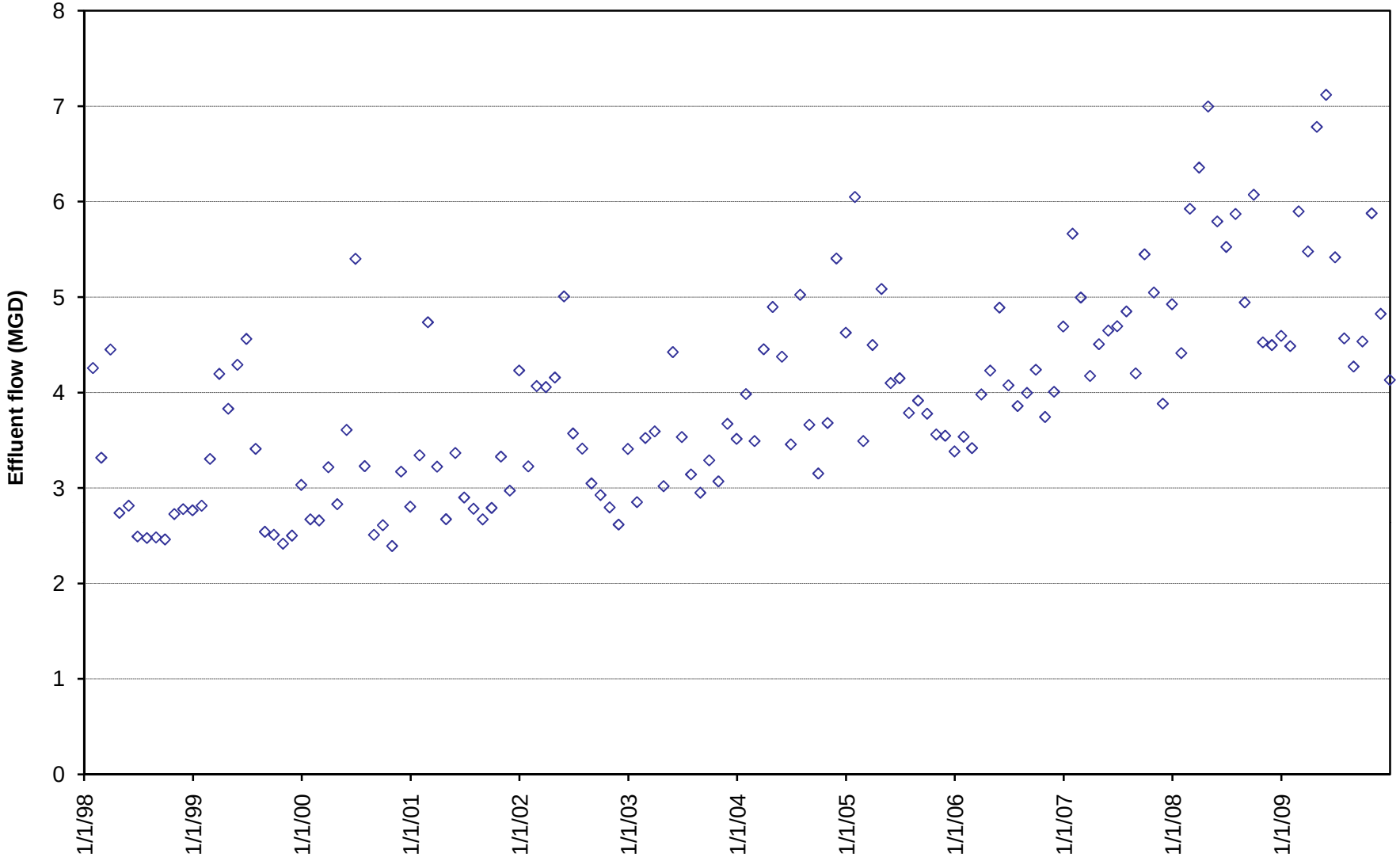


Figure B.2. Monthly average total phosphorus concentrations for City of Bentonville WWTP

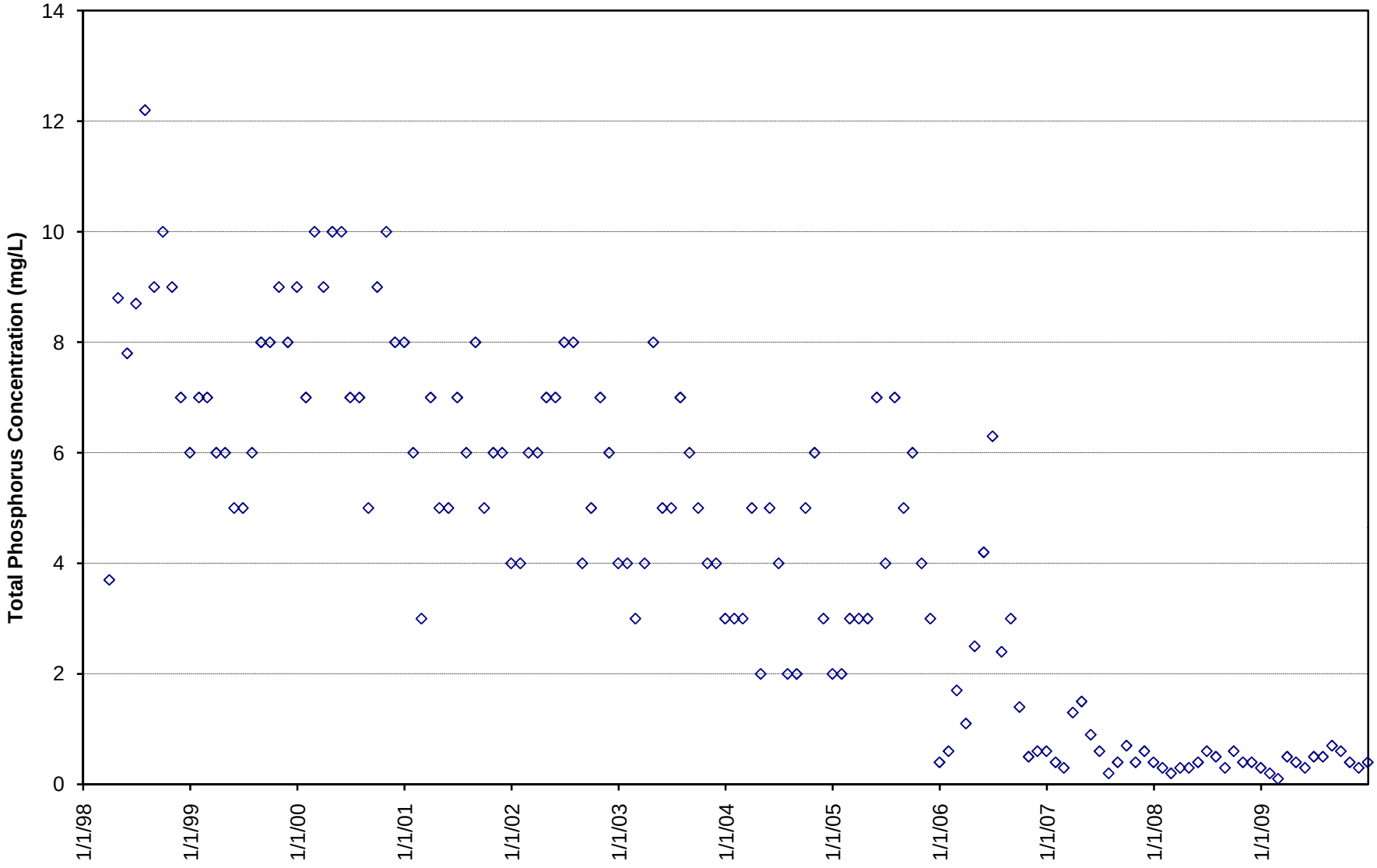


Figure B.3. Total Phosphorus Concentrations by Year for City of Bentonville WWTP Effluent

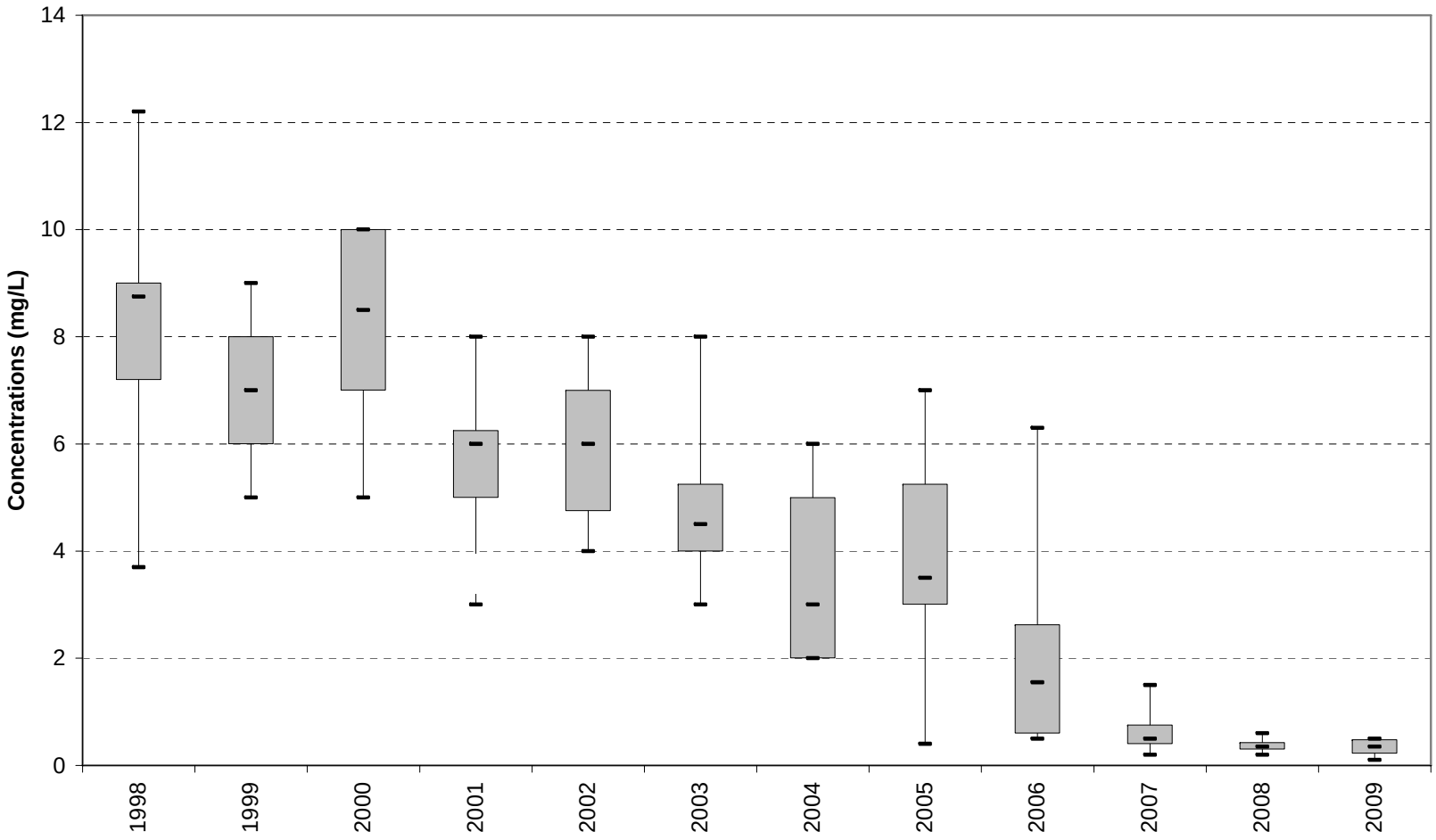
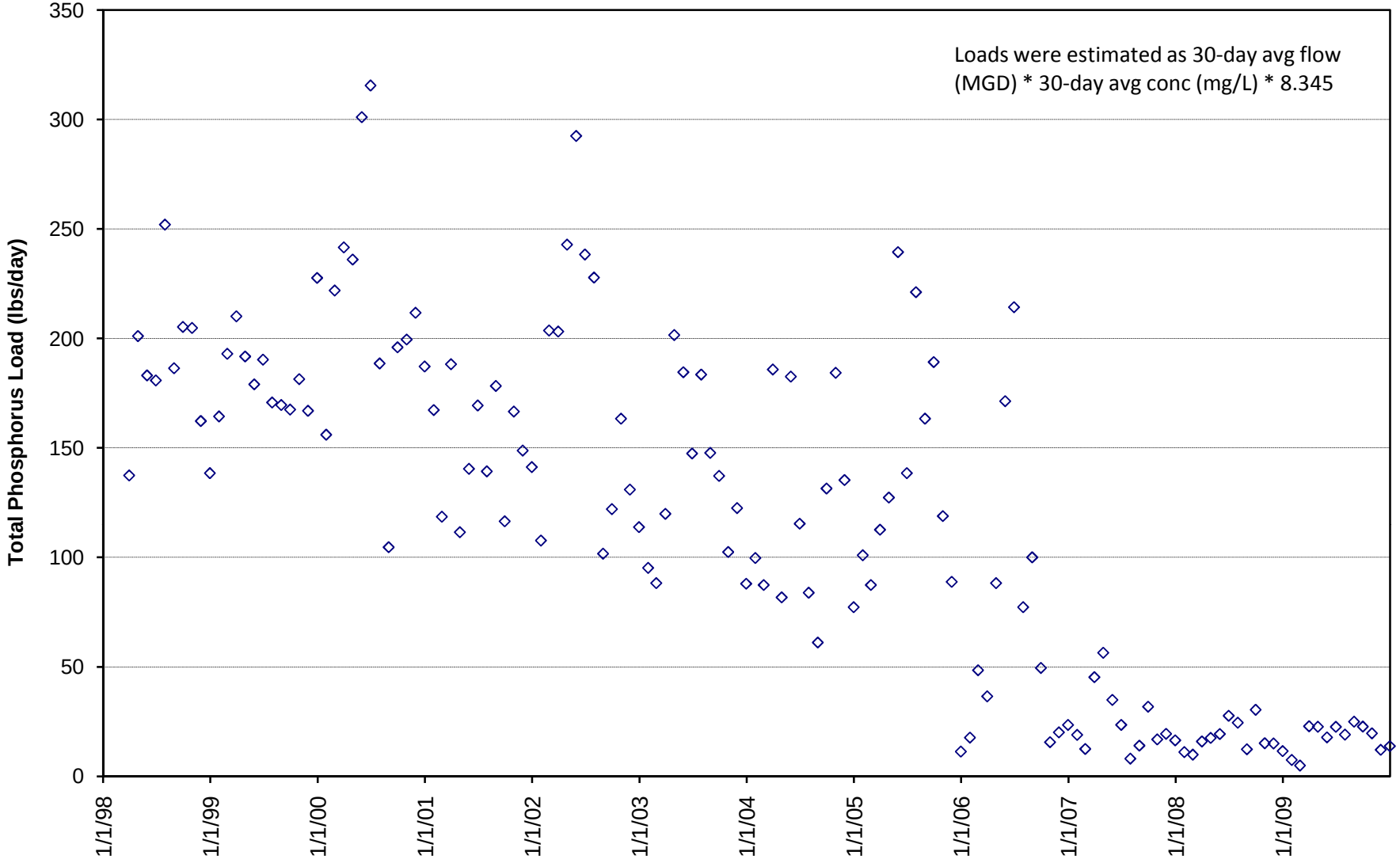


Figure B.4. Monthly average total phosphorus loads for City of Bentonville WWTP



APPENDIX C

Phosphorus Data for Town Branch and Little Sugar Creek

Table C.1. ADEQ Total Phosphorus Data for Town Branch (ARK56)
and Estimated Flow at Mouth of Town Branch *

Date Collected	Total Phosphorus mg/L	Estimated Flow in Town Branch (cfs)
9/25/1990	6.250	2.8
10/23/1990	6.100	2.6
11/19/1990	6.000	3.6
12/18/1990	5.700	10.2
1/29/1991	4.050	8.3
2/26/1991		4.4
3/26/1991		5.3
4/23/1991	3.050	8.7
5/07/1991	3.420	7.3
6/25/1991		1.8
7/23/1991	6.050	2.3
8/27/1991		1.8
9/24/1991		3.3
10/22/1991		1.9
12/30/1991	1.360	10.7
1/28/1992	12.800	3.2
2/18/1992	3.500	9.7
3/17/1992	7.200	3.2
4/21/1992	2.610	19.4
5/26/1992	5.260	3.1
6/22/1992	3.980	4.4
7/21/1992	4.570	2.3
8/18/1992	5.020	1.6
9/15/1992	5.820	0.8
10/13/1992	5.640	5.3
11/03/1992	4.710	11.2
12/08/1992	5.260	4.9
1/12/1993	0.339	11.7
2/23/1993	1.910	19.9
3/09/1993	3.370	7.8
4/20/1993	1.890	14.1
5/11/1993		38.9
6/15/1993	3.720	11.7
7/06/1993	3.600	16.5
8/03/1993	4.800	3.8
8/30/1993	5.600	1.5
10/05/1993	4.040	4.1
11/09/1993	4.440	2.3
12/14/1993	2.960	11.2
1/11/1994	6.000	5.3
2/15/1994	5.350	4.7
3/15/1994	2.080	29.2
4/05/1994	2.560	16.5
5/10/1994	4.120	8.3
6/07/1994	5.920	5.3
7/12/1994	6.050	3.9

Date Collected	Total Phosphorus mg/L	Estimated Flow in Town Branch (cfs)
8/09/1994	6.240	3.0
9/20/1994	6.560	2.8
10/11/1994	6.240	3.8
11/08/1994	4.440	14.1
12/06/1994	5.120	4.2
1/10/1995		3.6
2/27/1995	2.400	1.7
3/14/1995	2.660	3.8
4/11/1995	2.120	13.6
5/09/1995	1.270	48.1
6/27/1995	4.000	7.8
8/01/1995	5.760	4.6
8/29/1995		2.8
9/25/1995		3.5
10/24/1995	6.270	3.7
11/14/1995	6.330	3.9
1/09/1996	5.288	3.3
1/23/1996	3.272	7.3
2/26/1996	5.264	3.7
3/19/1996		3.5
4/23/1996		13.1
5/14/1996	3.820	19.4
6/04/1996	5.060	6.3
7/02/1996	6.683	2.5
8/20/1996	5.900	1.8
9/10/1996	7.260	1.7
10/22/1996	4.150	4.2
11/12/1996	2.670	11.7
12/03/1996	1.454	23.8
1/27/1997	4.000	4.6
2/11/1997	4.070	5.3
3/04/1997	2.300	13.6
4/08/1997	3.190	6.3
5/06/1997	4.160	4.1
6/17/1997		15.1
7/08/1997	5.000	2.9
8/05/1997	5.240	2.1
9/09/1997	4.800	2.5
10/07/1997	5.440	2.5
11/04/1997	4.744	3.1
12/01/1997	4.164	8.7
1/06/1998	0.723	87.0
2/03/1998	2.996	5.8
3/03/1998	2.338	6.3
3/31/1998	1.807	12.1
5/05/1998	3.949	4.9
6/02/1998	3.998	5.8
6/30/1998	5.190	3.1
8/04/1998	5.690	2.4

Date Collected	Total Phosphorus mg/L	Estimated Flow in Town Branch (cfs)
10/13/1998	5.210	2.7
11/03/1998	4.920	4.5
12/01/1998	3.883	4.7
1/12/1999	5.045	3.6
2/08/1999	1.956	23.3
3/08/1999	4.158	10.2
4/19/1999	3.788	5.8
5/03/1999	3.968	7.3
6/07/1999	4.840	5.3
7/12/1999	3.682	9.7
8/09/1999	4.315	6.8
9/13/1999	3.950	7.8
10/12/1999		3.6
11/22/1999	4.933	4.2
12/07/1999	5.340	6.8
1/04/2000	2.534	14.6
2/08/2000		3.5
3/07/2000	5.011	9.2
4/18/2000		2.8
5/16/2000	4.564	4.3
6/13/2000	5.736	3.2
7/18/2000	4.862	4.1
8/08/2000	3.987	3.6
9/12/2000		4.0
10/10/2000	5.749	3.3
11/07/2000	4.546	9.7
12/05/2000	4.950	4.7
1/23/2001	4.437	4.2
2/27/2001	1.469	19.4
3/27/2001	3.030	4.8
4/24/2001	2.498	4.9
5/29/2001	2.980	4.1
6/26/2001	3.840	3.6
7/24/2001	3.912	2.3
8/28/2001	5.019	2.2
9/25/2001	3.516	2.8
10/16/2001	3.073	4.4
11/19/2001	2.013	4.9
12/18/2001	1.130	35.5
1/22/2002	2.408	4.6
2/19/2002	3.214	7.3
3/12/2002	2.650	7.3
4/09/2002	3.702	27.2
5/14/2002	0.823	8.7
6/11/2002	3.207	4.8
7/23/2002	3.712	3.9
8/20/2002	3.491	3.0
9/24/2002	3.990	2.6
10/22/2002	4.090	3.0

Date Collected	Total Phosphorus mg/L	Estimated Flow in Town Branch (cfs)
12/10/2002	2.140	3.2
1/14/2003	3.310	2.2
2/11/2003	2.540	2.2
3/04/2003	4.160	5.8
4/08/2003	0.563	3.0
5/13/2003	2.220	12.6
6/10/2003	4.100	2.9
7/29/2003	1.960	1.9
9/02/2003	2.130	5.3
10/07/2003	3.720	2.0
11/18/2003	1.640	19.0
12/02/2003	2.790	9.7
1/06/2004	1.540	5.3
2/10/2004	0.732	4.7
3/16/2004	1.030	6.3
4/20/2004	0.900	3.4
5/18/2004	2.190	9.7
6/15/2004	3.280	3.0
7/20/2004	1.630	2.9
8/10/2004	1.640	3.2
8/31/2004	2.440	1.1
10/05/2004	5.100	0.7
11/02/2004	1.490	40.3
12/07/2004	0.510	25.3
1/11/2005	0.611	35.0
2/01/2005	0.116	8.3
3/01/2005	0.973	5.3
4/12/2005	0.769	6.3
5/10/2005	5.350	3.8
5/10/2005	0.349	3.8
6/06/2005	3.320	2.2
7/12/2005	3.390	2.1
8/09/2005	2.500	2.4
9/06/2005	3.730	2.0
10/11/2005	2.310	1.8
11/08/2005	2.420	2.2
12/06/2005	1.590	1.5
1/10/2006	0.803	2.2
2/07/2006	1.030	1.5
2/28/2006	2.460	0.7
4/04/2006	0.836	1.1
5/09/2006	0.964	11.2
6/13/2006	5.740	2.6
7/11/2006	3.080	4.2
8/08/2006	2.000	0.2
9/05/2006	2.540	1.9
10/03/2006	1.250	1.6
11/14/2006	0.916	5.3
12/05/2006	0.506	8.3

Date Collected	Total Phosphorus mg/L	Estimated Flow in Town Branch (cfs)
1/02/2007	0.723	13.6
2/13/2007	0.341	13.6
3/20/2007	0.860	2.0
4/10/2007	1.020	1.8
5/22/2007	0.739	1.7
6/26/2007	0.667	1.7
7/24/2007	0.588	2.1
8/07/2007	0.639	1.7
9/18/2007	0.594	0.0
10/02/2007	0.565	11.2
11/06/2007	0.660	1.1
12/11/2007	0.316	9.2
1/08/2008	0.422	19.9
2/04/2008	0.368	1.9
3/18/2008	0.683	275.5
4/08/2008	0.229	32.6
5/13/2008	0.365	4.9
6/24/2008	0.638	5.3
7/08/2008	0.506	3.0
8/19/2008	0.604	3.6
9/23/2008	0.736	5.8
10/28/2008	0.564	2.8
11/18/2008	0.585	2.9
12/02/2008	0.589	2.7
1/13/2009	0.379	2.8
2/10/2009	0.305	4.2
3/10/2009	0.429	3.2
4/14/2009	0.245	21.4
5/12/2009	0.323	18.5
6/09/2009	0.618	3.8

* Estimated flow in Town Branch = USGS measured flow in Flint Creek at Springtown × (6.9 sq.mi. ÷ 14.2 sq.mi.)

FILE: R:\PROJECTS\2110-650\TECH\TOWN BRANCH\ARK0056.XLS

Figure C.1. Long term plot of total phosphorus in Town Branch (ARK56)

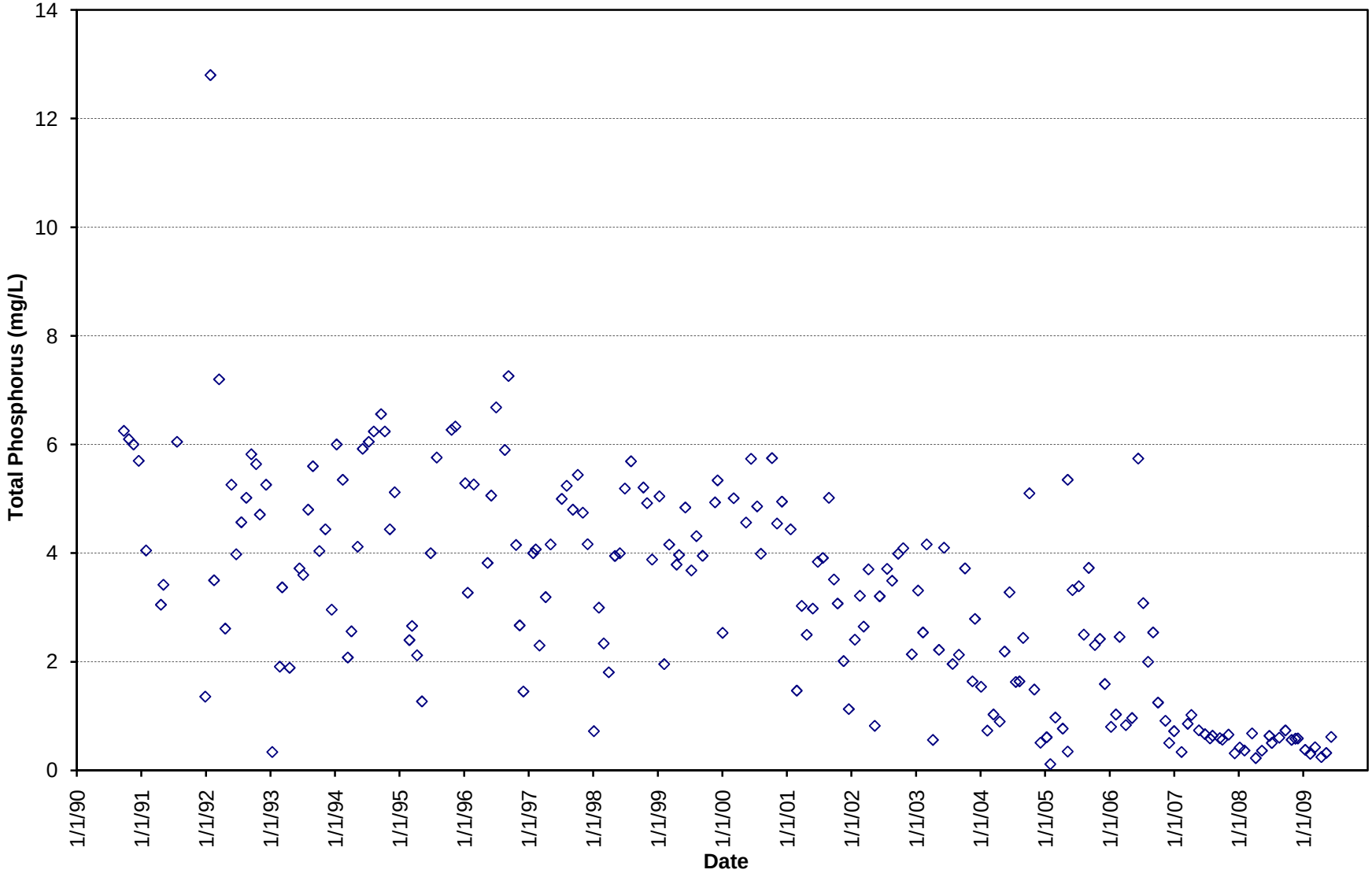


Figure C.2. Total Phosphorus by Year for Town Branch at ARK56

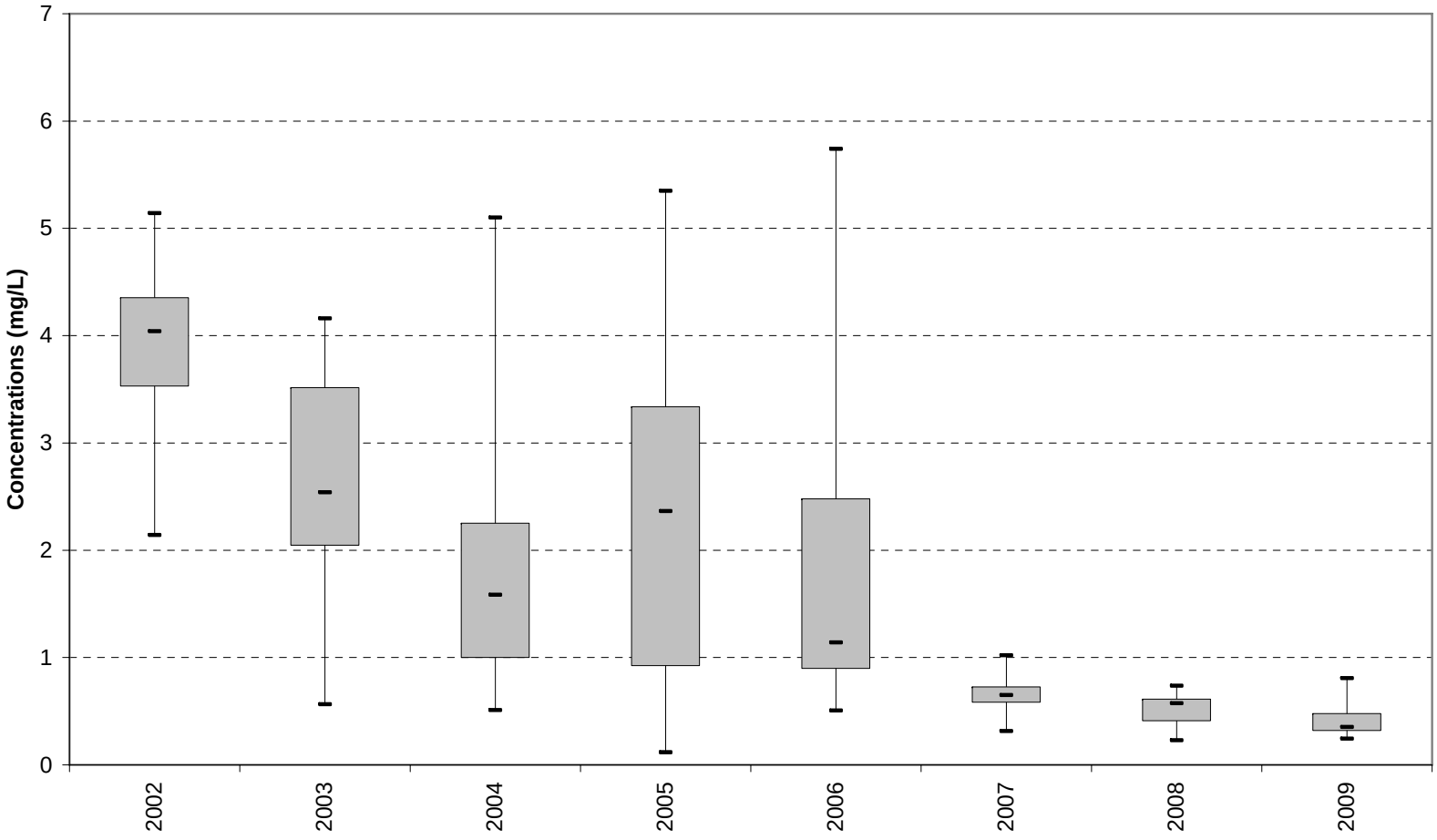


Figure C.3. Total Phosphorus by Year for Little Sugar Creek near Caverna, MO (ARK0001)

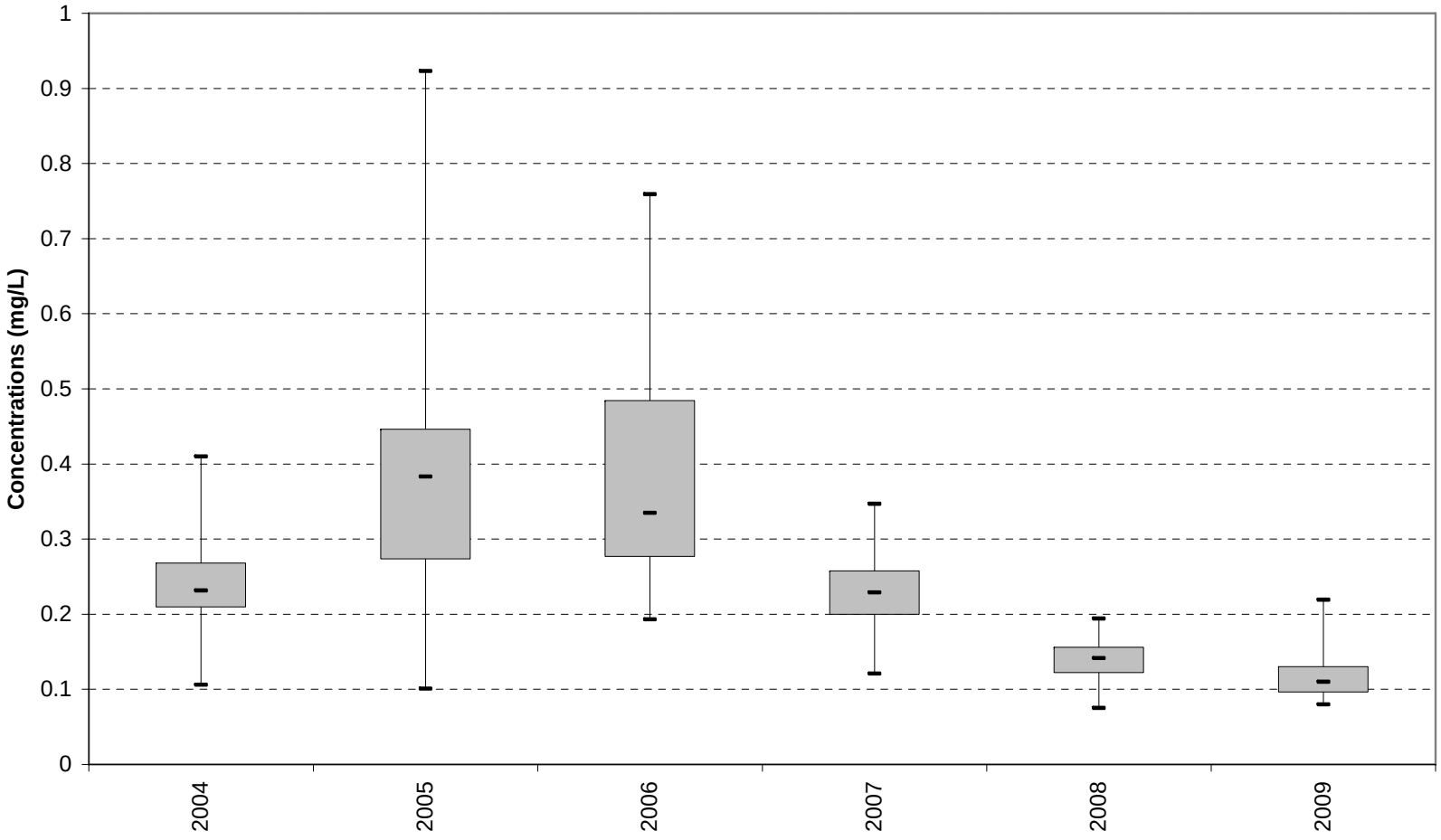


Figure C.4. Seasonal plot of total phosphorus in Town Branch (ARK56)

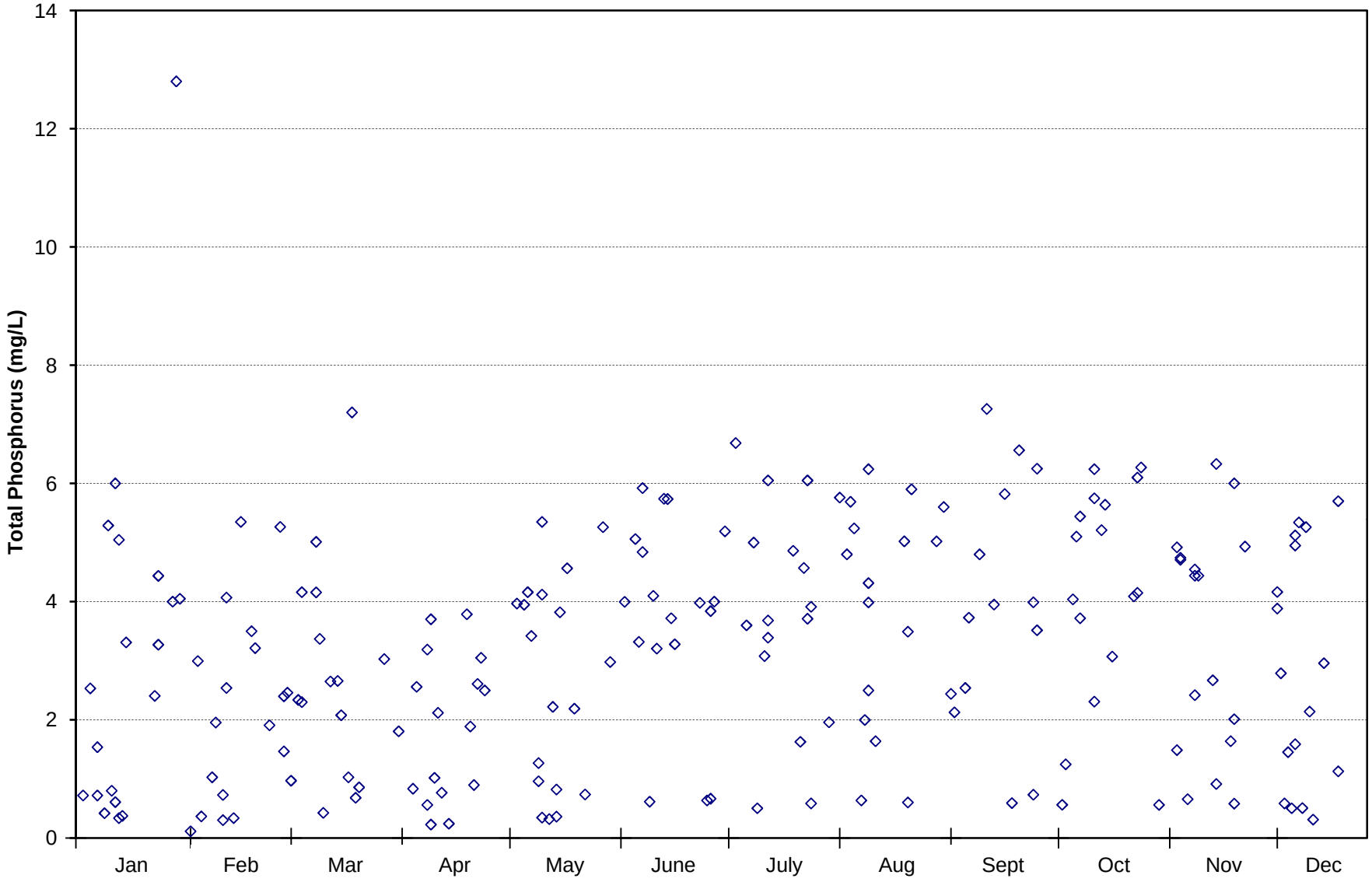
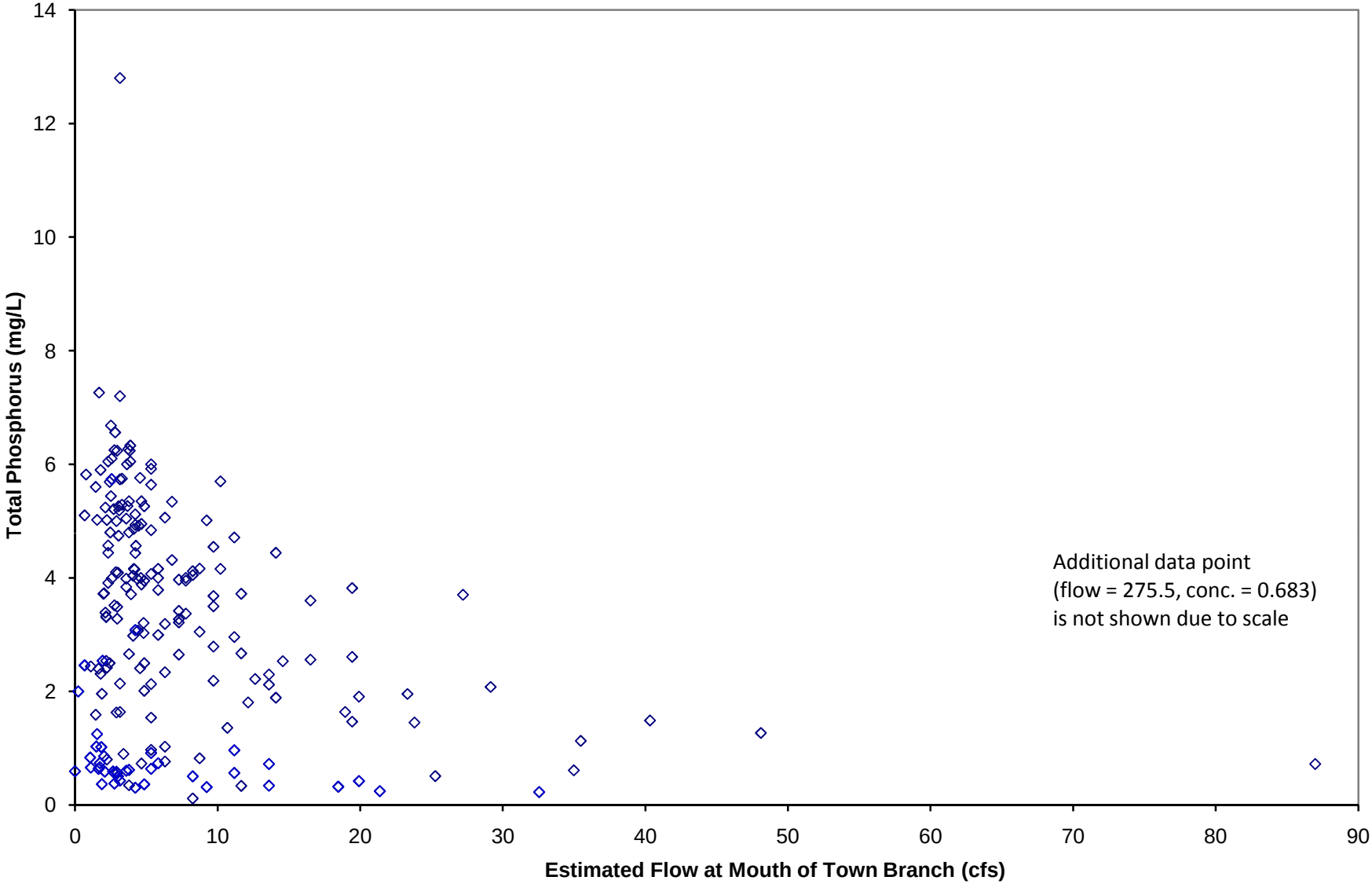


Figure C.5. Total phosphorus in Town Branch (ARK56) vs estimated stream flow



APPENDIX D

Excerpt from James River TMDL Report

2. Calculation of Load Capacity

A. Determination of TMDL Target

The goal of this TMDL is to reduce the frequency of benthic algal blooms in excess of 100 mg/m^2 Chl_a through in-stream nutrient limits on total phosphorus and total nitrogen. Reduction of benthic algae will be the end point used to determine the success of the TMDL implementation plan. Algal biomass increases with additions of usable forms of phosphorus until nitrogen begins to limit the system also (transitional zone). As phosphorus levels continue to rise, nitrogen eventually becomes the limiting nutrient (Leibig's Law of the Minimum). Table 1 summarizes published Nitrogen:Phosphorus ratios for limiting algal response.

Table 1. Published Nitrogen Limiting Thresholds (N:P)

Information Source	N Limiting Threshold	Transition	P Limiting Threshold
Schanz and Juon (1983)	<10:1	10:1 – 20:1	>20:1
Petersen et al (1993)			>20:1
Stockner and Shortreed (1978)			>20:1
Pringle (1987)			>20:1
Grimm and Fisher (1986)	<10:1		
Dodds et al (1998)	<12.6:1		
Borchardt (1996)			>17:1
Lohman (1988) Saline Creek (Miller Co)	<12:1		

For the periods specified, total nitrogen (TN)[18] concentration values were divided by total phosphorus (TP) concentration values to arrive at a mean TN:TP ratio for the sites shown in Figure 1. Studentized range tests, tests to determine the normality of the distribution, revealed nutrient ratios (w/s=5.9, n=553, α=0.05) and total nitrogen (w/s=6.4, n=553, α=0.05) were lognormally distributed.[19] Increased phosphorus inputs since the late 1970s have produced a nitrogen limited situation in many areas of the James River Basin (Table 2). A phosphorus limit near 0.070 mg/L would allow control of algal growth by creating a phosphorus limited situation.

[18] TN = NH3-N + NO2 &NO3-N + Org. N
[19] U.S. Environmental Protection Agency, *Practical Methods for Data Analysis*, EPA/600/R096/084, January 1998

Figure. 2. Map of James River Basin showing relative locations of water quality monitoring sites.

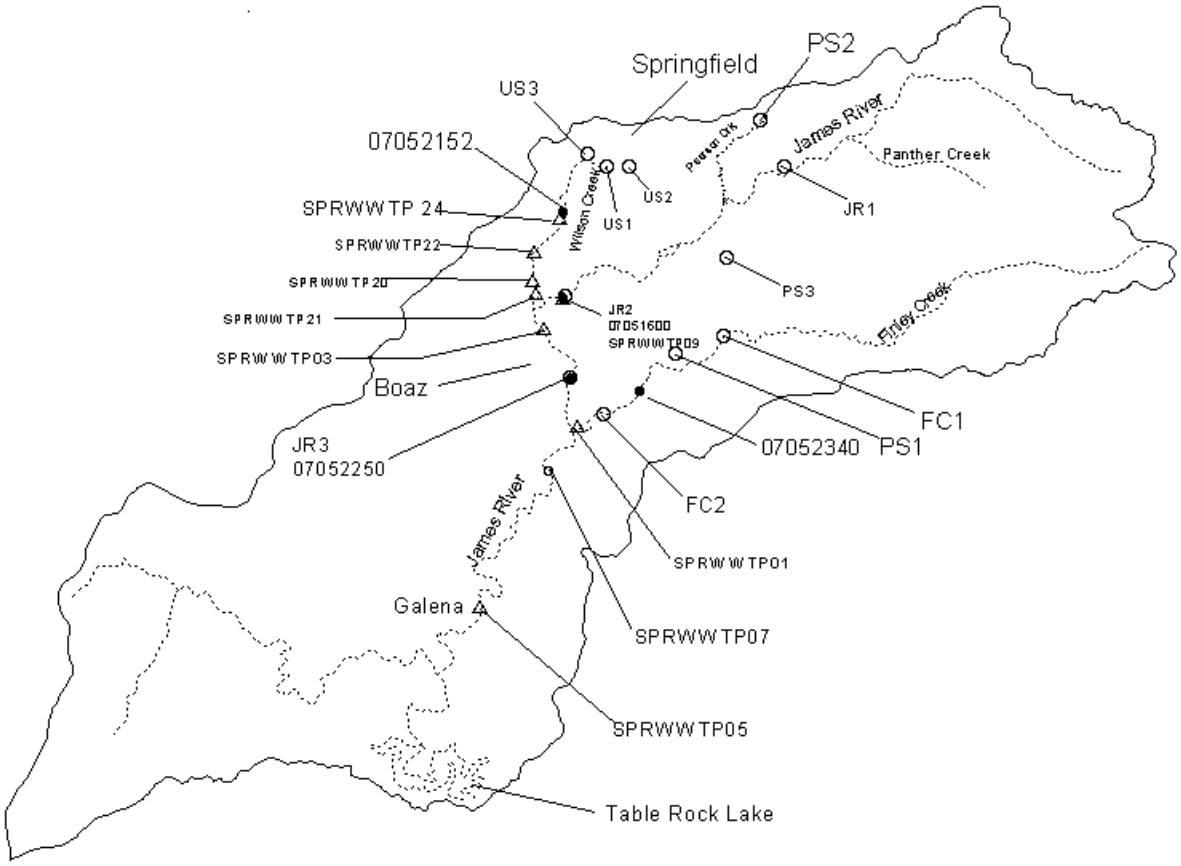


Table 2. Nutrient Limitation Determination for Sites on James River above Galena.

Station ID	Period of Record	Sample Number	TN:TP (Geomean)	Standard Error (log 10 units)	Limiting Nutrient	TP (ug/L) Geomean to achieve 20:1
JR1	1978-1979	27	32.2	0.61	P	N/A
JR2	1978-1979	27	34.1	0.57	P	N/A
JR3	1978-1979	27	31.9	0.44	P	N/A
FC1	1978-1979	27	43.6	0.54	P	N/A
FC2	1978-1979	27	19.8	0.45	P	N/A
US1	1978-1979	33	67	0.73	P	N/A
US2	1978-1979	20	80.5	0.66	P	N/A
US3	1978-1979	20	70.5	0.41	P	N/A
PS1	1978-1979	32	48	0.39	P	N/A
PS2	1978-1979	20	83.3	0.42	P	N/A
PS3	1978-1979	19	60.4	0.4	P	N/A

07052340	1973-1975	24	34.4	0.51	P	N/A
07051600	1967-1977	97	37.2	0.40	P	N/A
07052152	1993-1999	34	3.6	0.14	N	528.0
07052250	1992-1999	39	7.4	0.21	N	165.6
SPRWWTP01	1997-1999	5	4.9	0.16	N	71.4
SPRWWTP03	1992-1999	12	7.8	0.42	N	233.5
SPRWWTP05	1993-1999	10	6.6	0.33	N	126.7
SPRWWTP07	1993-1999	7	5.5	0.22	N	145.2
SPRWWTP09	1993-1999	5	8.6	0.45	N	123.8
SPRWWTP20	1993-1999	8	4.5	0.23	N	322.3
SPRWWTP21	1993-1999	12	3.8	0.20	N	286.5
SPRWWTP22	1993-1999	7	3.6	0.16	N	294
SPRWWTP24	1993-1999	14	3.7	0.17	N	500.2
07052152	1997-1999	16	3.5	0.19	N	384.0
07052250	1997-1999	16	6.9	0.24	N	153.4

Algal and Nutrient Benchmarks

Several studies in past decades have focused on nuisance algal growth, associated nutrient relations, and trophic state. Periphyton chlorophyll$_a$ (Chl$_a$) is the measurement of the amount of photosynthesis occurring in the water. It is used to determine the amount of suspended algae present in a waterbody. A value of 150 milligrams per square meter (mg/m^2) Chl$_a$ is generally agreed upon as a nuisance algal level. Nutrient concentrations that lead to specific algal biomass values, however, are often obscured by interactions from light, disturbance, and grazing (Cattaneo, 1987). See Table 3 for information obtained from literature search.

Table 3. Potential Algal and Nutrient Limits as Suggested by Literature Review.

Variable	Units	Value	Risk/Justification	Source
Mean Benthic Chl$_a$	mg/m^2	>70	Eutrophication	EPA 2000
Sestonic Chl$_a$	µg/L	>30	Eutrophication	EPA 2000
Total Nitrogen	µg/L	>1500	Eutrophication	EPA 2000
Total Phosphorus	µg/L	>75	Eutrophication	EPA 2000
Benthic Chl$_a$	mg/m^2	100-150	Nuisance Growth	EPA 2000
Benthic Chl$_a$	mg/m^2	>50	Decreased Recreational Uses	Nordin (1985)
Benthic Chl$_a$	mg/m^2	>100	Reduced Invertebrate Diversity	Nordin (1985)
Benthic Chl$_a$	mg/m^2	>75	Increased Biomass Recovery following disturbance	Lohman (1992)
PO_4-P	µg/L	0.3-0.6	Saturated Growth Rate of Benthic Diatoms	Bothwell (1988)
PO_4-P	µg/L	20-50	Maximum Benthic Algal Biomass	Borchardt (1996)
Total Phosphorus	µg/L	38-90	Max. Periphytic biomass between 100-200 mg/m^2	Dodds et al (1997)
Total Phosphorus	µg/L	20-39	Prevent Mean Periphytic Biomass of 100 mg/m^2 in Clark Fork River, MT	EPA 2000

Nutrient and Algal Relationships

Based on literature values presented in Table 3, benthic chlorophyll$_a$ measurements collected by Smart [20] were grouped into the impairment classes shown in Table 4. This data indicates that excessive algal biomass occurs at TP values above 106 micrograms per liter (µg/L). A linear predictive relationship between benthic chlorophyll$_a$ and nutrient concentration is not, however, clear or precise based on his 1978-79 data.

Table 4. Periphytic Biomass and Nutrient Relationships Based on Algal Impairment in the James River Basin.

Class	Benthic Chla Range (mg/m^2)	Nutrient	Sample #	Geometric Mean	95% C.I.
Non-Impairing	0-75.9	TP (µg/L)	111	69.6	58 – 84
		TN (µg/L)	111	3240.6	2628 – 3995
Partially Impairing	76-99.9	TP (µg/L)	35	46	33 – 64
		TN (µg/L)	35	2818.4	1864 – 4260
Impaired	100-149.9	TP (µg/L)	31	47.7	35 – 65
		TN (µg/L)	31	4190.5	2887 – 6082
Excessive	150-500	TP (µg/L)	102	105.5	80 – 139
		TN (µg/L)	102	2403.1	1921 – 3005

Determination of Target Load

Algal levels judged to be excessive impair the James River and are caused by nutrient enrichment. Other factors contribute to the accrual and loss of algal biomass. These include light, temperature, hydrologic disturbance and invertebrate grazing. Managing nutrient levels, however, is considered the most feasible option for reducing the standing crop of benthic algae.

Based on the information cited, the recommended in-stream total phosphorus level should not exceed 0.075 mg/L and the in-stream total nitrogen level should not exceed 1.5 mg/L (mesotrophic/eutrophic boundary). These levels of nutrient loading will keep the benthic algal biomass between 100-200 mg/m^2 in the James River. Saturation growth rates of benthic algae can occur at levels less than 0.075mg/L (or 75 µg/L) TP. But considering the absence of a precise predictive relationship, the justification of a more stringent limit would be difficult.

Nutrient Target Recommendations

In-stream total phosphorus is not to exceed 0.075 mg/L and total nitrogen is not to exceed 1.5 mg/L for any twenty-four hour period throughout a calendar year. Limits apply to all classified streams and rivers that feed into impaired segments of the James River. Catastrophic events (such as floods, tornadoes, etc.) result in situations that exceed feasible management and the nutrient load recommendations do not apply under those circumstances.

[20] Smart, Miles M., 1980, Stream Watershed Relationships in the Missouri Ozark Plateau Province, PhD Dissertation, University of Missouri-Columbia.

Table D.1. Summary of data analysis for James River TMDL target

Impairment Class	Range of Benthic Algae (mg/m^2 of chlorophyll a)	Total Phosphorus Data		
		Number of Samples	Geometric Mean Concentration (mg/L)	95% Confidence Interval for Geometric Mean Conc. (mg/L)
Not impaired	0 – 75.9	111	0.070	0.058 – 0.084
Partially impaired	76 – 99.9	35	0.046	0.033 – 0.064
Impaired	100 – 149.9	31	0.048	0.035 – 0.065
Excessive	150 – 500	102	0.106	0.080 – 0.139

Note: These data were presented in Table 4 of the James River TMDL (MDNR 2001) and are summarized here.

APPENDIX E

Data from Illinois River and Kings River Basins

PHOSPHORUS DATA AND BIOLOGICAL IMPACTS FOR ILLINOIS
AND KINGS RIVER BASINS (from Parsons/UA 2004 report)
(Table numbers refer to Parsons/UA 2004 report)

Station	Individ. Sample Data (Tables 3.3 and 4.3) Date	Total P (mg/L)	Average Total Phos. (mg/L)	Number of Indicators Impacted (Table E-3)	Reach on 2004 final 303d list for phos?	Description of stream reach
OSG930UP	8/26/2003 9/16/2003 10/7/2003	0.072 0.040 0.066	0.059	3	no	Osage Creek upstream of Rogers WWTP
OSG930DN	8/26/2003 9/16/2003 10/7/2003	0.138 0.112 0.118	0.123	7	YES	Osage Creek downstream of Rogers WWTP
SPG931UP	8/26/2003 9/16/2003 10/7/2003	0.224 0.078 0.070	0.124	7	no	Spring Creek upstream of Springdale WWTP
SPG931DN	8/26/2003 9/16/2003 10/7/2003	2.470 2.160 0.272	1.634	16	YES	Spring Creek downstream of Springdale WWTP
OSG030	8/26/2003 9/16/2003 10/7/2003	1.044 0.534 0.246	0.608	12	YES	Osage Creek below mouth of Spring Creek
MUD027UP	8/26/2003 9/16/2003 10/7/2003	0.148 0.062 0.086	0.099	8	no	Muddy Fork upstream of Prairie Grove WWTP
MUD027DN	8/26/2003 9/16/2003 10/7/2003	0.572 0.416 0.770	0.586	12	YES	Muddy Fork downstream of Prairie Grove WWTP
MUD025	8/26/2003 9/16/2003 10/7/2003	0.100 0.150 0.086	0.112	7	no	Muddy Fork below mouth of Moores Creek
ILL022	8/26/2003 9/16/2003 10/7/2003	0.228 0.184 0.168	0.193	6	no	Illinois River below mouth of Osage Creek
ILL020	8/26/2003 9/16/2003 10/7/2003	0.222 0.164 0.174	0.187	4	no	Illinois River below mouth of Cincinatti Creek (near state line)
SPA048	8/26/2003 9/16/2003 10/7/2003	0.026 0.036 0.026	0.029	1	no	Spavinaw Creek (reference site)
FLT031	8/26/2003 9/16/2003 10/7/2003	0.072 0.072 0.056	0.067	2	no	Flint Creek (reference site)
OSG045UP	8/26/2003 9/16/2003 10/7/2003	0.034 0.040 0.052	0.042	3	no	Osage Creek upstream of Berryville WWTP
OSG045DN	8/26/2003 9/16/2003 10/7/2003	0.474 0.232 1.824	0.843	16	YES	Osage Creek downstream of Berryville WWTP
KIN037	8/26/2003 9/16/2003 10/7/2003	0.174 0.056 0.126	0.119	8	no	Kings River below mouth of Osage Creek
KIN042	8/26/2003 9/16/2003 10/7/2003	0.018 0.032 0.014	0.021	3	no	Kings River in upper reaches (reference site)

APPENDIX F

Data for Upstream Portions of Osage and Spring Creeks

APPENDIX F

Data for Upstream Portions of Osage and Spring Creeks

TOTAL PHOSPHORUS DATA FOR UPSTREAM PORTIONS OF OSAGE AND SPRING CREEKS

Data Source	Station ID	Date	Total Phos. Conc. (mg/L)
ADEQ 1997b	OSG01A	5/23/1995	0.10
ADEQ 1997b	OSG01A	7/11/1995	0.05
ADEQ 1997b	OSG01A	9/18/1995	0.09
ADEQ 1997b	OSG01A	11/14/1995	0.05
ADEQ 1997b	OSG01A	1/16/1996	0.04
ADEQ 1997b	OSG01A	4/16/1996	0.12
ADEQ 1997b	OSG01A	6/1/1996	0.19
Parsons/UA 2004	OSG930UP	8/26/2003	0.072
Parsons/UA 2004	OSG930UP	9/16/2003	0.040
Parsons/UA 2004	OSG930UP	10/7/2003	0.066

Average for Osage Creek u/s of Rogers WWTP = 0.082

Data Source	Station ID	Date	Total Phos. Conc. (mg/L)
ADEQ 1997b	SPG01A	5/23/1995	0.07
ADEQ 1997b	SPG01A	7/11/1995	0.03
ADEQ 1997b	SPG01A	9/18/1995	0.06
ADEQ 1997b	SPG01A	11/14/1995	0.06
ADEQ 1997b	SPG01A	1/16/1996	0.07
ADEQ 1997b	SPG01A	4/16/1996	0.06
ADEQ 1997b	SPG01A	6/1/1996	0.22
Parsons/UA 2004	SPG931UP	8/26/2003	0.224
Parsons/UA 2004	SPG931UP	9/16/2003	0.078
Parsons/UA 2004	SPG931UP	10/7/2003	0.070

Average for Spring Creek u/s of Springdale WWTP = 0.094

REFERENCES:

ADEQ. 1997b. Illinois River Water Quality, Macroinvertebrate, and Fish Community Survey. Published by Arkansas Department of Environmental Quality. Downloaded from ADEQ web site (www.adeq.state.ar.us/water/branch_planning/pdfs/WQ97-03-1.pdf)

Parsons/UA. 2004. Water Quality and Biological Assessment of Selected Segments in the Illinois River Basin and Kings River Basin, Arkansas. Prepared by Parsons, Inc. and University of Arkansas Ecological Engineering Group. November 2004. Downloaded from EPA web site (www.epa.gov/Region6/6wq/ecopro/watershd/monitrng/studies/)

APPENDIX G

Public Comments

ADEQ

A R K A N S A S
Department of Environmental Quality

May 19, 2010

Ms. Diane Smith
Environmental protection Specialist
Water Quality Protection Division
U.S. Environmental Protection Agency Region 6
1445 Ross Ave.
Dallas, Texas 75202-2733

Via Email:smith.diane@epa.gov

Re: TMDL for Total Phosphorus for Town Branch near Bentonville
Stream Reach 11070208-901
Draft April, 2010

Dear Ms. Smith:

The Arkansas Department of Environmental Quality (ADEQ) provides the following comments on the April 2010 Draft TMDL for Town Branch.

I. Overview

The first sentence of the Executive Summary of the April 2010 draft TMDL for Town Branch states, "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 loads (TMDLs) for those waterbodies." As ADEQ has repeatedly stated, Arkansas has no water quality standard for total phosphorus. We have a narrative standard for nutrients. Additionally, no data was provided that indicates the designated uses are not being met in Town Branch. In the absence of either standards or data, EPA has prepared a *third* draft TMDL for Town Branch. This decision directly impacts the City of Bentonville's wastewater treatment plant (WWTP), the only point source discharge to Town Branch. Town Branch is an urban headwater losing stream with a *watershed* size of 6.9 square miles, and most of the watershed is *within Bentonville's city limits.*

ADEQ conducted a study in 1996. This study found Town Branch to be "slightly impaired" for nutrients. At that time, Bentonville was discharging effluent from its wastewater treatment plant with phosphorus levels in the 200#+/day range. By 2009, Bentonville had successfully reduced the total phosphorus in its effluent by an order of magnitude, discharging a daily load of 20#+/day. Despite these drastic reductions in loadings, despite consistent in-stream phosphorus levels of less than 1 mg/L, and in the total absence of any new biological data showing designated use impairments, EPA maintains that Town Branch continues to be impaired for phosphorus and requires a TMDL.

The third draft Town Branch TMDL (which includes both the draft dated March 2010 and the final draft dated April 2010) is developed using the Gold Book, which relies on forty year old data and the Parsons' Report (November, 2004), which used three sampling events in the Illinois River and the Kings River basins over a five month period between August 12, 2003 – December 24, 2003. Also, EPA reaches the decisions in its third draft TMDL by comparing Ozark Highlands Ecoregion reference streams and other streams to Town Branch. Ordinarily these comparisons might be appropriate. However, in this instance, the selected reference streams are not comparable physically, chemically, or biologically to Town Branch. For example, EPA compares the watershed for the James River basin, with 987 square miles, and the watershed of the Arkansas portion of the Illinois River, with 1,500 square miles, to Town Branch, an urban headwater losing stream with a watershed of 6.9 square miles, most of which is in the city limits of Bentonville. These are not reasonable comparisons.

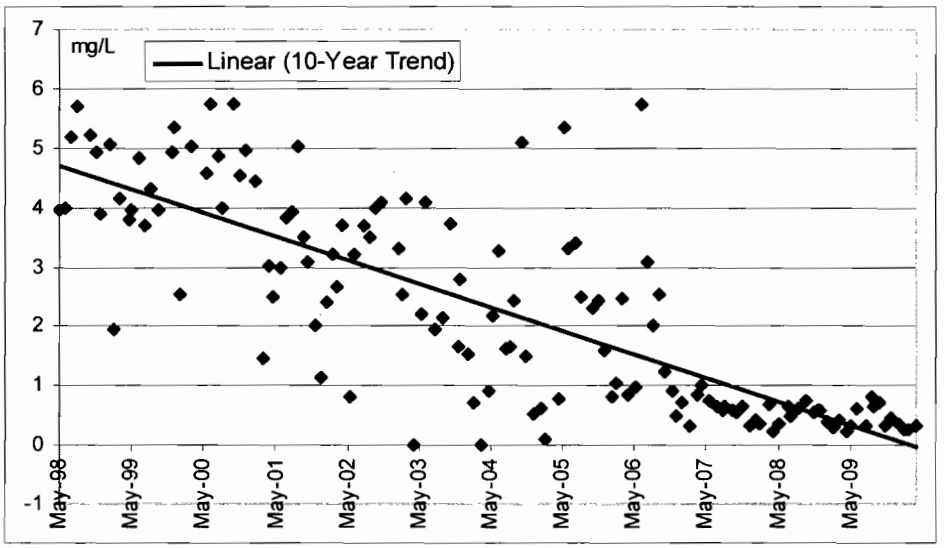
TMDL decisions should be based on sound science. This draft TMDL arrives at a load allocation for the City of Bentonville's WWTP of 3.34 #/day, reduced considerably from the allowable load of 16.69 #/day calculated in the first draft TMDL (2006) or the allowable load of 33.45#/day calculated in the second draft TMDL (2007). These numbers correspond to an effluent phosphorus concentration for Bentonville's WWTP of 0.5 mg/L for the first draft (2006), an effluent phosphorus concentration of 1.0 mg/L for the second draft (2007), and the third draft now proposes an effluent phosphorus concentration of 0.1 mg/L (2010). These wildly varying waste load allocations for a discharge to a stream with a 6.9 mile watershed were developed in the complete absence of any new biological data. The most recent, if not only, biological data from Town Branch, which can serve as the basis for determining an impairment to the aquatic life designated use, is from 1996. That data was collected years before the improvements were made to Bentonville's WWTP and phosphorus loadings reduced by an order of magnitude. Furthermore, that data was used by ADEQ to determine that Town Branch was slightly impaired for nutrients *due to nitrates*, not phosphorus. This draft Town Branch TMDL is not warranted or supported by sound science.

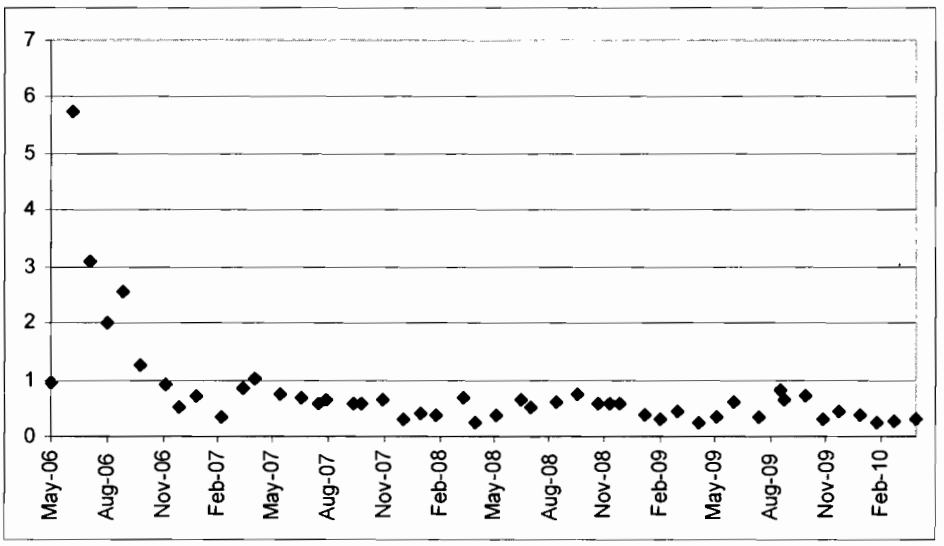
II. Background

- **Town Branch (Stream Reach 11070208-901) near Bentonville, Arkansas, is an *urban headwater losing stream with a watershed size of 6.9 square miles, most of which is within the city limits of Bentonville.* Town Branch is the receiving stream from the City of Bentonville's WWTP. Town Branch flows into McKisic Creek, then to Little Sugar Creek, and then to the Elk River in Missouri. The Elk River Basin is 1,036 square miles.**
- **Town Branch was originally listed by ADEQ for nutrients on the 1998 303(d) list. The constituent of concern was nitrates because Town Branch is a losing stream.**
- **In 2000, The Sierra Club, Federation of Fly Fishers, Crooked Creek Coalition, Arkansas Fly Fishers, and Save our Streams filed suit against EPA in Federal Court because, among other things, EPA failed to disapprove the State of Arkansas's 1998 303(d) list and failed to identify and prioritize all Water Quality Limited Segments, and failed to establish TMDL's for these Water Quality Limited Segments. The parties entered into a Consent Decree to resolve this lawsuit. As part of this Consent Decree, EPA agreed to complete TMDL's on a number of Water Quality Limited Segments, including the streams listed on Arkansas' 1998 303(d) list.**

- **Town Branch was again listed by ADEQ for nutrients on the 2002 303(d) list due to nitrates (Safe Drinking Water Act criteria of 10 mg/L), and ADEQ placed the stream in category 5d on the 2004 303(d) list. Category 5d waters are "waters which need data verification to confirm use impairment (additional sampling, biological assessment) before a TMDL is developed". EPA determined Town Branch was not impaired for nitrates because the drinking water criteria was only exceeded 7% of the time, not the 10% that is required for listing under the Stat's assessment methodology. EPA then determined that Town Branch should be listed for Total Phosphorus; however, no justification for that listing was provided even though a Total Phosphorus water quality standard does not exist in Arkansas and no data was provided to support EPA's determination. Furthermore, EPA determined that placing Town Branch into Category 5d for further monitoring would not be consistent with the Consent Decree TMDL schedule. EPA changed the listing for Town Branch on the 2004 303(d) list from being impaired for Nitrates to Total Phosphorus and placed Town branch in Category 5a. (Category 5a waters are "waters that are truly impaired; a TMDL needs to be developed for the listed parameter").**
- **In 2004, the City of Bentonville's WWTP NPDES permit was renewed to include a Total Phosphorus limit of 1.0 mg/L at a design flow of 4.0 million gallons per day.**
- **Town Branch was listed by ADEQ on the 2006 and 2008 impaired water bodies list in Category 4b based on the 2006 Integrated Report Guidance from EPA. Category 4b are "waters where available data and/or information indicate that a least one designated use is not met or is threatened and/or the antidegradation policy is not supported, but a TMDL is not needed. A TMDL is not needed in these instances because the segment is expected to meet water quality standards through implementation of alternative pathways". EPA did not approve this listing decision.**
- **EPA added Town Branch on the 2006 303(d) list as impaired for Total Phosphorus.**
- **EPA added Town Branch on the 2008 303(d) list as impaired for Total Phosphorus.**
- **As a result of the upgrades to the City of Bentonville's WWTP to meet the 2004 permit limit of 1.0 mg/L for total phosphorus, phosphorus loadings in Town Branch have significantly declined. Permit AR0022403 was renewed in 2009. Based on a review of the water quality data from ADEQ's fixed ambient water quality monitoring station ARK0056, (See Figure 1), ADEQ has determined that all water quality standards are currently being met.**

Figure 1 - Total Phosphorus Trends in Town Branch (ARK0056)





III. Missouri's 2004 TMDL for Elk River

Total Phosphorus effluent limit of 1.0 mg/L for Bentonville WWTP

- **Town Branch flows into McKisic Creek, then into Sugar Creek and then into Elk River. Missouri, like Arkansas, does not have a water quality standard for Total Phosphorus for streams. The Elk River was listed on Missouri's 1998 303(d) list as impaired for nutrients and the major source originally identified was nonpoint source pollution from livestock production. Missouri determined that the City of Bentonville's wastewater treatment plant's Total Phosphorus effluent limit of 1.0 mg/L will result in phosphorus load reductions sufficient to meet the point source waste load allocation under the Elk River TMDL. EPA Region 7 approved Missouri's TMDL for Elk River.**
- **The Missouri Department of Natural Resources completed the TMDL for the Elk River Basin in 2004. This TMDL was approved by EPA in March 2004.**

- **The TMDL for Elk River states the following:**
    - **"The water quality monitoring station on the Elk River at Tiff City has been in operation since 1966...There are a total of 283 records of water quality data that were collected between 1966 and 2002. The reference data set, consisting of information collected between 1966-1984 contains 136 records. The average total phosphorus concentration of the reference data is 0.0638 mg/L...This phosphorus concentration represents the conditions that existed before eutrophication of the river was an issue. The value of 0.06 mg/L is, therefore, the Phase I target for the Elk River TMDL. Progress toward this target will be evaluated by analyzing ambient water from the Elk River at the Tiff City gage station." (Page 12.)**
    - **"In Arkansas, there are four state operating permits that discharge to the Elk River watershed. The average daily total phosphorus loading from these point sources is 268 pounds per day at a design flow of 7.44 ft^3/s. Adding this amount to the daily load from point sources in Missouri, the result equals 630 lb/day at an existing design flow of 12.5 ft^3/s." (City of Bentonville load at that time was 234.143 lb/day total phosphorus of the 268 lb/day contribution from Arkansas. See Table 8.) (Page 17.)**
    - **"Under base-flow conditions at Tiff City, the observed load of 228 lb/day will be used as a reference condition that is believed to reflect the instream and watershed effects. The point source load was combined with the background load to produce the observed load of 228 lb/day. This observed load represents the 95th percentile of all measured loads that occurred within the base-flow range from 0 to 250 ft^3/s...This 95th percentile was selected to compare with the upper bounds of the target value within the same flow range. *To meet the TMDL target load within the 0 to 250 ft^3/s flow range, the existing load should be reduced by 64 percent"* (emphasis added). (Page 18.)**
    - **"Two facilities in the watershed were having nutrient limits added to their permits prior to the development of this TMDL. The planned changes include a total phosphorus effluent limit of 1.0 mg/L monthly average concentration for the Bentonville Arkansas treatment facility and 1.5 mg/L daily maximum for the Tyson Noel Processing Plant in Missouri. Although the Tyson Noel permit has not yet been issued, the compliance schedule contained in a consent decree agreement between the company and the State of Missouri ensures the limits will go into affect in the near future. *These two permit actions will result in reducing the current load of phosphorus from 630 lb/day to 225 lb/day.* Assuming that the contribution from nonpoint sources is not a factor within the base-flow range, *this reduction is equal to the target of 64 percent established for base-flow conditions as measured at the Tiff City gage...."*(emphasis added). (Page 18.)**
    - **"A total phosphorus permit limit of 1.0 mg/L monthly average and 1.5 mg/L daily maximum are essentially equivalent. Consequently, the permit limits being proposed by Arkansas and Missouri will result in equivalent permit limits throughout the basin." (Page 19.)**

- **It is clear in the Elk River TMDL that the State of Missouri contemplated the impact of the reduced phosphorus loadings from the City of Bentonville as a result of the 1.0 mg/L permit limit for Total Phosphorus, and both the State of Missouri and EPA Region 7 were satisfied that this reduction was protective of Missouri's water quality in the Elk River Basin. The reduced loadings from the City of Bentonville as a result of the 1.0 mg/L permit limit for Total Phosphorus is not similarly contemplated by EPA Region 6 in its draft March 2010 Town Branch TMDL.**
- **ADEQ incorporates by reference Missouri Department of Natural Resources, Water Pollution Control Program, Total Maximum Daily Load for the Elk River Basin, completed January 30, 2004 and approved on March 26, 2004.**
- **The Elk River TMDL, approved by EPA Region 7, determined that a total phosphorus effluent limit of 1.0 mg/L monthly average concentration for the Bentonville WWTP would meet the point source waste load allocation for the Elk River. This is the same conclusion reached by EPA in its 2007 draft TMDL for Town Branch. The 2010 draft TMDL reaches a completely different point source waste load allocation from that contained in either EPA's 2007 draft TMDL for Town Branch or the Elk River TMDL approved by EPA in 2004. This difference and the bases for it are not adequately explained or technically justified by EPA in its 2010 TMDL.**

IV. First Draft TMDL for Town Branch (November 2006) Total Phosphorus effluent limit of 0.5 mg/L for Bentonville WWTP

- **In 2006, EPA prepared a TMDL for Total Phosphorus for Town Branch near Bentonville, Arkansas.**
- **This first draft TMDL states as follows:**
    - **"In Arkansas Regulation No. 6, Chapter 4, it is stated that 'No permit for discharge of domestic wastewater into Little Sugar Creek or its tributaries by the City of Bentonville shall authorize more than 1.0 mg/L Total Phosphorus based on a monthly average.'...Because water from Town Branch eventually flows into Little Sugar Creek and the Elk River in Missouri, water quality standards in Missouri are relevant to this TMDL. Currently the Missouri water quality standards do not have a numeric instream criterion for phosphorus for Little Sugar Creek or the Elk River in Missouri. However, a total phosphorus target concentration of 0.06 mg/L was developed for the Elk River basin in Missouri as part of a TMDL that was approved by EPA...." (Page 2-4.)**
    - **"A phosphorus TMDL for the Elk River watershed in southwestern Missouri was completed by MDNR in January 2004 and approved by EPA in March 2004. This TMDL addressed point source and nonpoint source loads of phosphorus from the entire Elk River basin, including the Town Branch watershed and the rest of the Little Sugar Creek watershed in Arkansas and Missouri....The report used historical data to develop a target concentration of 0.06 mg/L of total phosphorus. The TMDL calculations were based on a mass balance for the Elk River at the point where it flows out of Missouri and Oklahoma. The report indicated that a *monthly average permit limit of 1.0 mg/L of total phosphorus would be appropriate for the City of Bentonville WWTP....*"(emphasis added). (Page 2-6.)**

- **"As mentioned in Section 2.4, the Arkansas water quality standards do not include a numeric criterion for phosphorus. A specific target concentration for phosphorus in Town Branch was not developed for this TMDL because only limited data are available for evaluating the relationship between phosphorus concentrations and aquatic life in Town Branch. In lieu of developing a target for Town Branch, this TMDL was based on calculations of allowable loadings at the nearest downstream point where a target had already been established. This downstream point is Little Sugar Creek at the Arkansas-Missouri state line where the target phosphorus concentration of 0.06 mg/L was established in the Elk River TMDL (MDNR 2004). For the Town Branch TMDL, the 0.06 mg/L target was applied to the Little Sugar Creek watershed (upstream of the state line) as a whole, but it was not applied directly to the Town Branch watershed individually." (Page 4-1.)**
- **"The first step in developing this phosphorus TMDL was to calculate the assimilative capacity for Little Sugar Creek at the Arkansas-Missouri state line. The assimilative capacity was calculated by simply multiplying the target phosphorus concentration in the Elk River TMDL (0.06 mg/L) by the total annual flow in the stream at the state line." (Page 4-2.)**
- **"This calculation [wasteload allocation] was initially carried out with an effluent concentration of 1.0 mg/L, but the resulting load for point sources was approximately 93% of the total assimilative capacity at the state line (which would not be acceptable because only 7% of the assimilative capacity could be allocated to nonpoint sources and the explicit MOS). *The WLA for Town Branch was calculated as the design flow for the City of Bentonville WWTP (4.0 MGD) multiplied by the effluent phosphorus concentration of 0.5 mg/L, which yields an allowable load of 16.69 lbs/day.* Based on recent effluent phosphorus loads that were calculated for the City of Bentonville WWTP (118.59 lbs/day; see Section 2.6), the City of Bentonville WWTP will need to reduce its phosphorus load by approximately 86% to comply with this TMDL. (Emphasis added.) (Page 4-3.)**

- **This draft 2006 TMDL for Town Branch provided a waste load allocation for the City of Bentonville by multiplying the WWTP's design flow by one half of the permit limit deemed appropriate in the EPA approved TMDL for Elk River. This draft TMDL determined that a Total Phosphorus effluent limit of 0.5 mg/L was appropriate for Bentonville's WWTP. This draft TMDL was never finalized.**

V. Second Draft Town Branch TMDL(January 2007) Total Phosphorus effluent limit of 1.0 mg/L for Bentonville WWTP

- **The second draft TMDL EPA prepared states as follows:**
  - **"Because water from Town Branch eventually flows into Little Sugar Creek and the Elk River in Missouri, water quality standards in Missouri are relevant to this TMDL.) (Page 2-4.)**
  - **"A phosphorus TMDL for the Elk River watershed...was completed by MDNR in January 2004 and approved by EPA in March 2004. This TMDL addressed point source and nonpoint source loads of phosphorus from the entire Elk River basin, including the Town branch watershed ....This report stated that the Elk River was impaired due to excessive algae growth as a result of nutrient loading from both point and nonpoint sources (including livestock and poultry production). The report used historical data to develop**

a target concentration of 0.06 mg/L of total phosphorus at the Missouri-Oklahoma state line. The TMDL calculations were based on a mass balance for the Elk River at the point where it flows out of Missouri and into Oklahoma. *The report indicated that a monthly average permit limit of 1 mg/L of total phosphorus would be appropriate for the City of Bentonville WWTP* (emphasis added)." (Page 2-6.)

- **"...ADEQ conducted an intensive field study of Town Branch, McKisic Creek, and Little Sugar Creek during August 1996.... The data collected along Town Branch during the survey included water quality sampling and in situ measurements at five locations, as well as collection of macroinvertebrates and fish near the ARK56 long term monitoring station....The in situ data showed 'wide fluctuations in oxygen saturation values, resulting from photosynthetic and respiratory activities of algae and periphyton'. ADEQ conducted a rapid bioassessment (RBA) based on the macroinvertebrate collection; the RBA indicated that Town Branch was 'slightly impaired'. The fish collection in Town Branch showed a smaller percentage of species that are sensitive to pollution and less diversity of fish species than the reference site on Little Sugar Creek upstream of Town Branch. It should be noted that this intensive field study was conducted over 10 years ago. Biological conditions in Town Branch may have improved since 1996 because the effluent phosphorus concentrations from the City of Bentonville WWTP have decreased in recent years...." (Page 3-2.)**
- **"As mentioned in Section 2.4, the Arkansas water quality standards do not include a numeric criterion for phosphorus. A specific target concentration for phosphorus in Town Branch was not developed for this TMDL because only limited data are available for evaluating the relationship between phosphorus concentrations and aquatic life in Town Branch. In lieu of developing a target for Town Branch, this TMDL was based on calculations of allowable loadings at the nearest downstream point where a target load had already been established. This downstream point is the Elk River at the Missouri-Oklahoma state line (where the Elk River flows out of Missouri and into Oklahoma). The target load that was developed for the Elk River at the Missouri-Oklahoma line was based on a target phosphorus concentration of 0.06 mg/L....*The target load for the Town Branch watershed was calculated as a portion of the Elk River target load. The Town Branch target load was calculated as the allowable load for the City of Bentonville WWTP (specified in the Elk River TMDL) plus the allowable load for runoff*....It should be noted that the target phosphorus concentration of 0.06 mg/L that was developed for the Elk River at the Missouri-Oklahoma state line is not being applied directly to the Town Branch watershed. The value of 0.06 mg/L was developed for a stream that is much larger and higher order than Town Branch. The methodology used to develop the 0.06 mg/L target causes it to be specific to the Elk River. The value of 0.06 mg/L is not being proposed here as a phosphorus target or criterion for streams in Arkansas (emphasis added)." (Pages 4-1 – 4-2.)**
- **"*The allowable load for the City of Bentonville WWTP was already specified in the Elk River TMDL report as a weekly average load..., which corresponds to a monthly average load of 33.45 lbs/day. The WLA for the City of Bentonville***

WWTP was set to this value (33.45 lbs/day). This WLA was based on a monthly average permit limit of 1.0 mg/L for total phosphorus." (Page 4-3.)

- **This draft 2007 TMDL for Town Branch provided a waste load allocation for the City of Bentonville's WWTP by using the load specified in the EPA approved Elk River TMDL. The Town Branch target load was calculated as the allowable load for the City of Bentonville WWTP (specified in the Elk River TMDL) plus the allowable load for runoff. This draft 2007 TMDL for Town Branch was never finalized.**

VI. Third Draft Town Branch TMDL(March 2010 and April 2010) Total Phosphorus effluent limit of 0.1 mg/L for Bentonville WWTP

- **Both the March and April 2010 draft TMDLs, state, "The purpose of a TMDL is to determine the pollutant loading that a waterbody can assimilate without exceeding the water quality standards for that pollutant and to establish the load reduction that is necessary to meet the standard in a waterbody." (Page 1-1.) Arkansas does not have a numeric water quality standard for total phosphorus. It has a narrative standard for nutrients. While EPA may accurately state the purpose of a TMDL, what water quality standard in Arkansas does this draft TMDL propose to meet?**
- **The April 2010 draft states, "EPA understands that additional phosphorus removal treatment at the existing Bentonville WWTP may be needed to meet the required WLA. EPA recommends that the City of Bentonville and ADEQ work closely to develop interim limits, performance-based limits, and/or compliance schedules that may be necessary for the Bentonville WWTP to meet the WLA." (Page 4-8.) The problem with these statements is that the waste load allocation is a moving target for EPA. The draft TMDL dated November 2006 contemplated a waste load allocation of 16.69 lbs/day total phosphorus, which corresponds to an effluent concentration of 0.5 mg/L, the draft TMDL dated January 2007 contemplated a waste load allocation of 33.34 lbs/day total phosphorus resulting in an effluent concentration of 1.0 mg/L, while the final draft TMDL dated April 2010 requires a waste load allocation of 3.34 lbs/day total phosphorus, which corresponds to an effluent concentration of 0.1 mg/L. EPA has failed to justify, which, if any of these waste load allocations are appropriate or necessary.**
- **The April 2010 draft states regarding the City of Bentonville's WWTP, "During the period of March 1998 through November 2005, the average effluent concentration of total phosphorus ranged from 2.0 mg/L to 12.2 mg/L, with an average of 5.9 mg/L." (Page 2-5.)**
  The March 2010 draft states, "During the period of March 1998 through December 2005, the average effluent concentration of total phosphorus ranged from 2.4 mg/L to 6.1 mg/L, with an average of 5.9 mg/L." (Page 2-5.)
  The March draft ends in November 2005. The April draft includes one additional month (December 2005), resulting in a markedly different range, while both drafts (March and April 2010) report the same average (5.9 mg/L).
- **Both 2010 drafts recognize improvements in water quality as a result of the improvements to Bentonville's WWTP. "For the last two years of available data (July 2007 through June 2009), the 30-day average effluent concentration of total phosphorus ranged from 0.1 mg/L to 0.7 mg/L. The 7-day average effluent concentration of total phosphorus ranged from 0.2 mg/L to 1.1 mg/L....Since January 1998, the effluent flows have increased, but both the concentrations and**

loads of total phosphorus have decreased, *especially after the facility's 1 mg/L total phosphorus limit went into effect January 1, 2007* (see Figures B.1-B.4 in Appendix B) (emphasis added.)" (Page 2-5.)

- **Both 2010 drafts indicate additional biological data is needed. The drafts state, "The ADEQ intensive field study... was conducted over 10 years ago. Phosphorus concentrations in the City of Bentonville effluent and in Town Branch have dropped dramatically since that time, and it is possible that the biological condition of Town Branch has improved as a result." However, the data's use shifted inexplicably between the March 2010 draft and the April 2010 draft. The March 2010 draft uses terms that are well defined and, as such, is the preferable version. It states, "A new intensive field study would be required to determine whether or not conditions in Town Branch have already improved enough to support the *aquatic life designated use* (emphasis added)." (Pages 3-2 to 3-3.) "Designated uses" and "aquatic life" are well understood and defined terms. The April 2010 draft at first blush appears similar, but is far less precise technically and legally. The April 2010 draft states, "A new intensive field study would be required to determine whether the reduction in phosphorus concentrations *translates into improved biological conditions in the stream* (emphasis added)." (Page 3-3.) "Improved biological conditions" is not a readily defined phrase.**
- **The subtle but important difference in the two 2010 drafts noted above reappears elsewhere. The March 2010 draft again uses defined terms stating, "If recent biological data were available for Town Branch showing a relationship between phosphorus concentrations and *attainment of aquatic life designated use*, EPA could use those data to refine the target phosphorus concentrations for Town Branch (emphasis added)." (Page 4-1.) The April 2010 draft states, "As noted earlier, there is no recent biological data demonstrating the relationship between phosphorus concentrations in Town Branch and the *biological conditions in the stream.* Such data might allow EPA to further refine the target phosphorus concentration for Town Branch (emphasis added)." (Page 4-1.) ADEQ suggests that EPA use terms defined in the water quality standards.**
- **Previous draft Town Branch TMDLs determined a specific target concentration of phosphorus was not developed because, "only limited data are available for evaluating the relationship between phosphorus concentrations and aquatic life in Town Branch". Unlike EPA's prior draft TMDLs, both 2010 drafts state, "For this TMDL, EPA has selected a value of 0.10 mg/L as the numeric target for instream concentrations of total phosphorus in Town Branch. This value is suggested as a 'desirable goal for the prevention of plant nuisances in streams or other flowing waters not discharging directly to lakes or impoundments' in criteria document entitled EPA Quality Criterion for Waters commonly referred as the 'Gold Book' (EPA 1986). EPA believes that the instream target of 0.10 mg/L total phosphorus is reasonable for Town Branch based on a 'weight of evidence' approach using other data and studies in the Ozark Highlands ecoregion. These data and studies include:**

  the approved TMDL for the James River basin (tributary to Table Rock Lake), and
  field data from a special study in the Illinois River and Kings River basins
  ADEQ's 1996 intensive field study of Town Branch, McKisic Creek, and Little Sugar Creek; and

other supporting studies conducted throughout the Ozark Highlands Ecoregion."

(Page 4-2.)

- **Recent biological data is crucial for validating the numeric target; unfortunately, no such data exists. "The Arkansas water quality standards do not include a numeric criterion for phosphorus, but they do include narrative criteria for nutrients.... Because a TMDL is a quantitative analysis, it is necessary to establish a numeric target in order to develop a TMDL based on narrative criteria....[Because there are no recent biological data for Town Branch], EPA has selected a target based on published guidance as well as biological and water quality data from Town Branch and other streams in the Ozark Highlands ecoregion." (April 2010 Draft TMDL, Page 4-1.)**
- **The Gold Book is based on 40-year old studies of total phosphorus impacts on lakes and impoundments. While this may be a "desirable goal for the prevention of plant nuisances in streams or other flowing waters," to apply this numeric target in this case without further biological and water quality data is not scientifically sound, arbitrary, and a decision that is not supported by substantial evidence. If the Gold Book's numeric target is the "desirable goal for the prevention of plant nuisances in streams and flowing waters", then EPA could arbitrarily apply this mandate to any stream in the United States.**
- **Again, it must be pointed out that Town Branch is an urban headwater losing stream with a watershed of 6.9 square miles. The watershed for the James River basin is 987 square miles and the watershed of the Arkansas portion of the Illinois River is 1,500 square miles. These are not reasonable comparisons to Town Branch.**
- **The discrepancies of the Parsons Study on the Illinois River and its tributaries are too numerous to discuss here; however, it should suffice to say this study is of limited value as justification for deriving a numeric target from which a waste load allocation is calculated resulting in a 0.1 mg/L effluent limit for Bentonville's WWTP. This study considered data from three sampling events collected in the same season of the same year. This study was plagued with time constraints, a very limited data set, reference streams assessed as impacted, high flow events, and failed equipment. The conclusion of the Parsons' Report from page 6-3, states, "The loss of sensitive species of macroinvertebrates in this system is cause for concern. The presumed causal factor is loss of in-stream habitat due to sedimentation and geomorphological alteration. Proving causality will require assessing the impact of watershed-level changes and stressors on this system, including measuring sediment loads to the streams, analyzing alterations of hydrologic regimes and associated geomorphologic alteration and assessing land use change impacts on stream ecosystem functions such as primary productivity". At best, this study concludes that more study is needed. Nonetheless, EPA relies on this study, conducted on the Illinois River and its tributaries, to derive a numeric target for an urban headwater losing stream with a 6.9 square mile watershed where phosphorus loadings have been drastically reduced since 2004 (when the study was done) and for which there is no biological data more recent than 1996 showing any impairment of designated uses.**
- **The ADEQ 1996 Study was conducted at a time when the City of Bentonville did not have phosphorus removal as part of its wastewater treatment process. As stated above, the City of Bentonville's NPDES permit for its wastewater treatment plant**

was re-issued with a 1.0 mg/L total phosphorus limit that went into effect in January 2007. Since this time, and as delineated in Appendix B of the 2010 draft TMDLs, the City of Bentonville's effluent total phosphorus concentrations have been significantly reduced.

- **According to the April 2010 draft TMDL, at page, 4-3, other supporting studies in the Ozark Highlands Ecoregion analyzing historical data from reference streams indicate that mean phosphorus concentration values ranged from 0.01 mg/L to 0.15 mg/L. As stated earlier Town Branch is an urban headwater losing stream. These reference stream conditions are not physically, chemically, or biologically equivalent comparisons.**
- **According to the April 2010 draft TMDL, at page 4-4, the "Ambient Water Quality Criteria Recommendations: Information Supporting the Development of State and Tribal Nutrient Criteria, Rivers and Streams in Nutrient Ecoregion XI" considered data from 1,591 streams and determined that based on the 25th percentile, the national recommended total phosphorus concentration in streams and rivers in this broad scale Ecoregion is 0.01 mg/L. It should be pointed out that none of the 1,591 streams evaluated in Ecoregion XI (of which NW Arkansas is located) were streams in Arkansas. Again, there is no evidence that any of these streams are physically, chemically, or biologically equivalent to the small Town Branch watershed.**
- **According to the April 2010 draft TMDL, at page 4-5, the data collected from several studies in Osage Creek above the City of Rogers WWTP and Spring Creek upstream of the City of Springdale WWTP had average phosphorus values of 0.082 mg/L and 0.094 mg/L respectively. These values were rounded to 0.09mg/L and considered to be representative of phosphorus concentrations for non-impaired streams with urban watersheds in the Ozark Highlands Ecoregion. These streams may have urban watersheds, but neither is an urban headwater losing stream with most of its watershed located within a city's limits.**
- **The April 2010 draft TMDL states, "The designated use of Town Branch below the WWTP, as identified in ADEQ's water quality standards, is a perennial Ozark Highlands fishery. This designated use applies to streams with a watershed area of 10 square miles or larger where the discharge equals or exceeds 1 cubic foot per second (cfs)." (Page 2-3.) The Water Quality Standards are the Arkansas Pollution Control and Ecology Commission's Regulation, not ADEQ's and the definition of "Perennial Ozark Highland fishery – all streams with watershed of 10mi^2 and larger and those waters where discharges equal or exceed 1 CFS".**
- **Both 2010 draft TMDLs state, "The allowable phosphorus load for the City of Bentonville WWTP was calculated so that the discharge will not cause or contribute to a violation of water quality standards downstream of the discharge (as required by federal regulations). If runoff from Town Branch watershed was known to have concentrations of total phosphorus that are consistently less than the target concentration, then the runoff could be treated as dilution for the WWTP effluent. However, sufficient data are not available to know what the phosphorus concentrations are in runoff from Town Branch watershed. The only way to provide assurance that the WWTP discharge will not cause the average instream concentration to exceed the target concentration in Town Branch is for the average effluent concentration to be no greater than the target concentration (i.e., the instream target must be met at the "end of the pipe"). Therefore, the WLA for the WWTP was calculated as the instream target concentration multiplied by the design flow as follows:**

WWTP WLA (lbs/day) = Design flow (MGD) x instream target (mg/L) x 8.345
= 4.0 MGD x 0.10 mg/L x 8.345
= 3.34 lbs/day

(Draft March 2010 TMDL at Page 4-5; Draft April 2010 TMDL at Page 4-7.)
This is an order of magnitude lower than the current permit of 33.34lbs/day.

- **The April 2010 draft TMDL concludes, "Considering all of this data and information together, EPA, believes that the value of 0.10 mg/L is a reasonable and conservative target concentration for total phosphorus in Town Branch". (Page 4-5.) EPA's conclusion is based on dated literature and reference stream conditions that are not truly reflective of the physical, chemical, and biological conditions of Town Branch. Further, EPA has failed to show that either the water quality standards (nutrient narrative criteria) or the aquatic life designated use for Town Branch are not being met.**

VII. Conclusion

If this final draft TMDL is implemented, it will require the City of Bentonville to spend millions of dollars upgrading their wastewater treatment plant to meet an arbitrarily set instream total phosphorus concentration target value without any knowledge of the current conditions of the aquatic life uses. It makes no sense to expend scarce resources to address an issue that is not known to be a problem. It is clear that significant reductions in total phosphorus loadings to Town Branch have occurred since the effluent limit of 1.0 mg/L total phosphorus went into effect for the City of Bentonville's WWTP. The pollution controls are in place and fully implemented. Furthermore, monitoring will continue through the submittal of DMRs and the monthly water quality sampling at ADEQ's ambient monitoring station (ARK0056) on Town Branch. In addition, ADEQ has recently established four additional water quality monitoring sites, one above the City of Bentonville's wastewater treatment plant outfall, two sampling sites on tributaries (not impacted by permitted discharges), and one downstream of Bentonville on Little Sugar Creek. ADEQ will work with the City of Bentonville to establish a monitoring program at appropriate storm water outfalls pursuant to the MS 4 permit. Best Management Practices will be developed and implemented to further reduce the impacts from possible sources of nonpoint runoff pursuant to the requirements of Acts 1652, 1653, and 1654 of 2007 and the applicable phosphorus index. Finally, ADEQ has initiated an intensive monitoring program to evaluate the aquatic community of Town Branch. ADEQ will monitor aquatic macroinvertebrates twice per year for two years, and ADEQ will conduct fish surveys during the low flow season.

Placing Town Branch in category 4b of the 303(d) list is a reasonable alternative to repeatedly attempting to fabricate a waste load allocation for the City Of Bentonville's WWTP in the absence of any evidence of designated use or water quality impairments. Category 4b contains "waters where available data and/or information indicate that a least one designated use is not met or is threatened and/or the antidegradation policy is not supported, but a TMDL is not needed. A TMDL is not needed in these instances because the segment is expected to meet water quality standards through implementation of alternative pathways". This option is authorized under Section V. G. 2 of the "Guidance for 2006 Assessment, Listing, and Reporting Requirements Pursuant to Sections 303(d), 305(b) and 314 of the Clean Water Act, July 29, 2005" (2006 IR Guidance)" and has been

ADEQ's preferred approach in previous years. ADEQ incorporates by reference EPA's 2006 IR Guidance in these comments.

ADEQ attempted to list Town Branch on both the 2006 and 2008 303(d) lists as a Category 4b water. The 2006 IR Guidance document answers the question, "Which segments should states include in Category 4b?" (see Page 54) by stating, "EPA regulations recognize that alternative pollution control requirements may obviate the need for a TMDL. Segments are not required to be included on the Section 303(d) list if technology-based effluent limitations required by the Act, more stringent effluent limitations required by state, local, or federal authority, or "[o]ther pollution control requirements (e.g., best management practices) required by local, State, or Federal authority" are stringent enough to implement applicable water quality standards (see 40 CFR 130.7(b)(1)) within a reasonable period of time." This guidance acknowledges that the most effective method of achieving water quality standards for some water quality impaired segments may be through controls developed and implemented without TMDLs (referred to as a "4b alternative"). ADEQ maintains that Town Branch is not impaired because there is no numeric water quality standard for total phosphorus nor is there any data showing that the designated uses are not being met; however, even if one were to assume that Town Branch is impaired for total phosphorus, then, based on the 2006 IR Guidance, it should appropriately be placed in Category 4b and this TMDL is not required.

Sincerely,

Steven L. Drown

Steven L. Drown
Chief, Water Division
ADEQ

cc: Teresa Marks, Director
Ryan Benefield, P.E., Deputy Director

Attachments:
Summary and Recommendations from the TMDL Investigation of Water Quality Impairments to Town Branch, McKisic, and Little Sugar Creeks, Benton County, Arkansas (May 1997);
April 28, 2010 ASIWPCA letter to USEPA regarding Water Quality Standards for Florida's Lakes and Flowing Waters;
ADEQ Comments on March 2010 draft Town Branch TMDL;
Total Maximum Daily Load for Total Phosphorus for Town Branch Near Bentonville, Arkansas (Reach 11070208-901) (Draft March 10, 2010);
Total Maximum Daily Load for Total Phosphorus for Town Branch Near Bentonville, Arkansas (Reach 11070208-901) (Draft January 24, 2007);
Total Maximum Daily Load for Total Phosphorus for Town Branch Near Bentonville, Arkansas (Reach 11020708-901) (Draft November 28, 2006).

May 19, 2010 **Via Electronic Delivery**

Ms. Diane Smith,
Environmental Protection Specialist
Water Quality Protection Division
US Environmental Protection Agency, Region 6
1445 Ross Avenue
Dallas, Texas 75202-2733

RE: City of Bentonville Response to Public Notice
Draft TMDL for Total Phosphorus for Town Branch, Bentonville Arkansas

Dear Ms. Smith:

The purpose of this correspondence is to provide comments regarding the public notice of the Environmental Protection Agency's (EPA) draft Total Maximum Daily Load (TMDL) for total phosphorus for Town Branch in Bentonville, Benton County, Arkansas. The City of Bentonville (City) is notably conscientious about the environment and aggressively pursues ways to protect and improve the pristine natural resources within its control; however, the City adamantly opposes the EPA's proposed TMDL of 0.10 mg/L for phosphorus for Town Branch.

Steve Drown, Water Division Manager, ADEQ issued a letter April 26, 2010 to Miguel Flores, Director, Water Quality Division, EPA Region 6, regarding placement of Town Branch in category 4b as a result of a meeting conducted at the City of Bentonville City Hall with representatives from ADEQ, EPA, City of Bentonville, as well as Congressman Boozman and his aide, and Senator Lincoln's aide attending to discuss the TMDL in question. The City agrees with ADEQ's assessment of Town Branch and fully supports recommendations as outlined in Mr. Drown's letter; however, the City is compelled to make additional comments which follow.

1. The consequences of the proposed TMDL will have devastating affects on the local economy. The proposed TMDL will force the City to install significant improvements at the Wastewater Treatment Facility which will have a considerable, negative financial impact on citizens, commercial enterprise, and industry in Bentonville but will only yield minor environmental impact or improvement. The wastewater treatment plant has produced an average phosphorus discharge of 0.35 mg/L for the past year. Reducing phosphorus to 0.10 mg/L is an insignificant concentration reduction yielding negligible

environmental improvement but will place a considerable financial burden on the ratepayers. Further, the City will be required to institute a new program including purchase, installation, and maintenance of new equipment to meet the stormwater monitoring requirements of the proposed TMDL which will require additional funding not currently included in the City's annual budget. The proposed TMDL will also lead to new ordinances yielding tighter controls of development and activities on private property further straining the general public and local businesses financially. A detailed study of the stream needs to be completed prior to establishing a TMDL for Town Branch so financial obligations can be responsibly coupled with environmental impacts and protection. The EPA is pursuing this TMDL with total disregard to the economic impacts ratepayers will endure.

2. It is the City's opinion that the phosphorus target of 0.10 mg/L was arbitrarily and carelessly selected by EPA and is not based on sound science or supported by current or relevant data. This is supported by the fact that FTN Associates, Ltd. (FTN) repeatedly states in their draft TMDL report prepared in April 2010 that insufficient data exists with regard to phosphorus levels or its affects on the biological conditions of the stream. The latest detailed study of Town Branch, conducted by ADEQ in 1996, is 14 years old and many, significant changes have occurred since that date including more than a tenfold reduction in phosphorus discharge from the City's wastewater treatment plant within the last 10 years. In addition, three separate draft TMDL reports were prepared by FTN yielding three different results. Said reports include conspicuously similar narratives and reference similar data yet demonstrate significantly different results. Results or recommendations would not vary if the suggested TMDLs were based on actual studies and supported by relevant data. It appears the EPA is pursuing a subjective goal with no solid data to support their desired result. The City argues that the stream is not impaired, but there is no current data to support said stance other than the notable decrease in phosphorus discharged from the plant. However, to establish such a strict TMDL without supporting data is reckless and irresponsible.

3. Given the untimely availability of the TMDL draft report (April 2010) relative to the hasty deadline of July 15, 2010 for a final TMDL, no agency can reasonably digest, let alone, responsibly address an issue of this magnitude. This absurd timeframe does not provide adequate time to properly review data, discuss implications, explore alternatives, or constructively collaborate with concerned agencies. Ample time to properly study and prepare an appropriate TMDL that is environmentally sensitive, economically feasible, and scientifically sound is simply not provided. Given the fact that EPA had draft TMDLs started by their consultant FTN in 2006, it is evident that EPA is trying to force their hand to achieve the 0.10 mg/L goal. Supporting data could have easily been gathered and analyzed within the 4 years previous to the actual TMDL published if the EPA were responsible in pursuit of an accurate and defendable target.

4. The EPA would be more responsible to conduct a detailed analysis of Town Branch, including biological conditions, prior to establishing such a strict TMDL. Given the noted decrease in phosphorus discharge from the City's wastewater treatment plant, water quality in Town Branch has undoubtedly improved. If setting a TMDL is the only way EPA feels it can meet the consent decree, starting at discharge limits currently set for the City's wastewater plant followed by a timely detailed study of Town Branch

ultimately establishing a TMDL based on relevant data seems, in the City's opinion, to be the responsible approach. This would also ensure that any financial obligations would be based on sound evidence, not wasted on arbitrary speculation. Other TMDL's established based on consent decrees have been set on pristine bodies of water used for fisheries or bodies of water that show documented impairment or declining water quality. Town Branch is neither a pristine fishery nor does it have declining water quality. Although detailed data does not exist, FTN references improving water quality in their report prepared for this TMDL based on reductions in phosphorus levels in the wastewater treatment plant discharge.

The City hopes the EPA will act responsibly and consider the unjust ramifications the reckless enforcement of the proposed TMDL will have on the citizens of Bentonville. The City is simply asking the EPA to do what is fair and just. Withdraw the proposed TMDL and pursue a detailed study to support reasonable and responsible goals.

Thank you for your consideration of these comments regarding the unprecedented TMDL proposed for Town Branch in Bentonville, Arkansas. Please feel free to contact me if you have any questions or wish to further discuss any comments.

Respectfully,

Mike Bender, PE
Public Works Director

Cc: Honorable Bob McCaslin, Mayor, City of Bentonville
Honorable John Boozman, US Congress
Honorable Blanche Lincoln, US Senate
Teresa Marks, Director, ADEQ
George Spence, City Attorney, City of Bentonville

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May 19, 2010

Via Facsimile (214) 665-7373 and E-Mail Delivery – smith.diane@epa.gov
Ms. Diane Smith
Environmental Protection Specialist
U.S. Environmental Protection Agency Region 6
1445 Ross Avenue
Dallas, TX 75202-2733

Re: Public Comments of Northwest Arkansas Conservation Authority on Draft TMDL for Town Branch in Arkansas

Dear Ms. Smith:

I am writing this letter on behalf of the Northwest Arkansas Conservation Authority ("NACA") to comment on the Draft Total Maximum Daily Load for Town Branch which EPA published on April 19, 2010.

The Northwest Arkansas Conservation Authority ("NACA") is a statutorily authorized public body whose members are incorporated municipalities in Northwest Arkansas. The current members of NACA are Bentonville, Springdale, Rogers, Lowell, Bethel Heights, Cave Springs, Elm Springs, Highfill, Centerton, and Tontitown. NACA's principal goals are to develop and implement cost-effective regional solutions to the challenges of providing environmentally sound wastewater and biosolids infrastructure and watershed management.

NACA has several concerns regarding the Draft TMDL for Town Branch.

1. There Is No Valid Information That Town Branch Is Impaired for Phosphorus.

NACA recognizes that Town Branch appears on the current Arkansas 303(d) list as being impaired for phosphorus. NACA respectfully submits that despite this listing, there is no valid information to support the notion that Town Branch is impaired for phosphorus.

Town Branch has never been listed by the State of Arkansas as impaired for phosphorus. EPA placed Town Branch on the Arkansas 303(d) list as being impaired for phosphorus, over the State's objection, without offering any justification or identifying any valid base of supporting data. In subsequent years, ADEQ proposed including Town Branch in the State's 303(d) list as a category 4b water body, i.e.:

> "waters where available data and/or information indicate that at least one designated use is not met or is threatened and/or the antidegradation policy is not supported, but a TMDL is not needed.

> A TMDL is not needed in these instances because the segment is expected to meet water quality standards through implementation of alternative pathways."

EPA responded by adding Town Branch back to the Arkansas 303(d) list, rather than accepting ADEQ's proposed identification of Town Branch as a category 4b water body.

NACA believes that there was no valid information to support these actions by EPA, that Town Branch was not impaired for phosphorus at the time EPA initially added the stream to the Arkansas 303(d) list as impaired for phosphorus, and that Town Branch is not currently impaired for phosphorus.

Given the lack of information to support EPA's claim of impairment and the State's consistent disagreement with that claim, NACA believes that it is inappropriate to issue a TMDL for Town Branch at this time. Instead, NACA believes that EPA should work cooperatively with ADEQ and the local stakeholders to resolve whether the stream is actually impaired for phosphorus before any TMDL is issued.

2. <u>The Draft TMDL Ignores The Admittedly Dramatic Change in Conditions.</u>

Even if one assumes that there was a valid basis for concluding that Town Branch was impaired for phosphorus when EPA originally added the stream to the Arkansas 303(d) list, it is undisputed that phosphorus loadings have declined dramatically since the date of that listing. The City of Bentonville Waste Water Treatment Plant is the only point source that discharges phosphorus into Town Branch. The Draft TMDL for Town Branch expressly recognizes that the Bentonville WWTP has dramatically reduced the amount of phosphorus in its discharge, and that this reduction in loading has dramatically reduced phosphorus concentrations in the stream:

> "A review of total phosphorus concentrations in the City of Bentonville WWTP effluent and in Town Branch downstream of the WWTP show that concentrations have dropped dramatically over the last 5 to 10 years." Proposed TMDL at p. ii.

Despite this admitted change in relevant conditions, the Draft TMDL proceeds to ignore the change on the ground that there has been no recent biological sampling that would confirm whether the dramatic reductions in phosphorus concentrations have resulted in changes in the "biological conditions" in the stream:

> "[EPA's] review of total phosphorus concentrations . . . show [sic] that concentrations have dropped dramatically over the last 5 to 10 years. <u>However, there are no recent biological data to determine whether these decreases in phosphorus concentrations have resulted in a change in the biological conditions of Town Branch</u>." Id. (Emphasis supplied.). See also Id., at p. 3-2 to 3-3.

NACA respectfully submits that it is arbitrary, capricious, and irrational for EPA to disregard the dramatic changes in phosphorus concentrations in Town Branch. NACA agrees that valid biological data are essential to properly answer the question whether any designated use is impaired; but when it is clear that phosphorus loadings in Town Branch have declined dramatically, the appropriate response is to validly assess the extent of the change in conditions. It is not appropriate to disregard the changes because such measurements have not yet been collected, particularly when EPA listed Town Branch without such data.

3. The Proposed Allocations Are Not Logically Related to Actual Conditions.

The Draft TMDL proposes phosphorus load and wasteload allocations that have no logical connection to actual conditions in Town Branch. Instead, the phosphorus load and wasteload allocations in the Draft TMDL are based on Gold Book values, an aspirational goal that formerly appeared in versions of the Arkansas Water Quality Standards, and observations drawn from other bodies of water that are not at all comparable to Town Branch. NACA believes that it is inappropriate to impose load and wasteload allocations that have no rational cause and effect relationship to actual conditions in the stream in question.

The arbitrary character of the values proposed in the Draft TMDL is particularly apparent when one considers the approved TMDL for the Elk River in Missouri and the prior draft TMDLs that have been prepared for Town Branch. These documents show a 1,500% variation in the load and wasteload allocations deemed appropriate. Such wild swings in load and wasteload allocations, standing alone, raise very serious questions regarding the validity of the judgment involved.

Conclusion.

NACA respectfully submits that EPA should withdraw the Draft TMDL for Town Branch and instead commission a study of actual conditions in the stream.

Respectfully submitted,
MITCHELL, WILLIAMS, SELIG,
GATES & WOODYARD, P.L.L.C.

By
Allan Gates

AG:ce
Enclosure

APPENDIX H

EPA Responses to Public Comments

TMDL FOR TOTAL PHOSPHORUS FOR TOWN BRANCH NEAR BENTONVILLE, ARKANSAS

PUBLIC COMMENTS AND EPA RESPONSES

Proposed April 2010 / Established July 15, 2010

Introduction

The United States Environmental Protection Agency (EPA) Region 6 noticed for public comment a draft total maximum daily load (TMDL) on April 19, 2010. During the public comment period for this TMDL, EPA received comments from the Arkansas Department of Environmental Quality (ADEQ), the Northwest Arkansas Conservation Authority (NACA), and the City of Bentonville.

The following entities provided comments and/or attachments during the comment period:

- **Arkansas Department of Environmental Quality (ADEQ)**
  - ADEQ Comment Letter, May 19, 2010, TMDL for Total Phosphorus Town Branch near Bentonville Stream Reach 11070208-901, Draft May 19, 2010
  - ADEQ Comments titled "TMDL for Total Phosphorus Town Branch near Bentonville Stream Reach (11070208-901)," Prepared by FTN Associates, Ltd. for EPA Region VI (Draft March 10, 2010)
  - TMDL Investigation of Water Quality Impairments to Town Branch, McKisic, and Little Sugar Creeks, Benton County, Arkansas (1997)
  - Draft TMDL for Total Phosphorus For Town Branch Near Bentonville, AR (November 2006)
  - Draft TMDL for Total Phosphorus For Town Branch Near Bentonville, AR (January 2007)
  - ASIWPCA Letter, April 28, 2010, Water Quality Standards for the State of Florida's Lakes and Flowing Water, Re: Docket ID No. EPA-HQ-OW-2009-0596
  - Draft TMDL for Total Phosphorus For Town Branch Near Bentonville, AR (Reach 11070208-901) (March 10, 2010)
- **Mitchell Williams (representing Northwest Arkansas Conservation Authority)**
- **City of Bentonville, Arkansas**

EPA Region 6 has received and evaluated all comments and information received prior to finalizing this action. In preparing response to the comments for this TMDL, some of the comments were repetitive and many of the ideas expressed appear to overlap. In the interest of clarity, EPA has attempted to separate the comments into specific issues and provide specific responses.

Comments submitted by Arkansas Department of Environmental Quality (ADEQ):

Comment 1

ADEQ notes that the State of Arkansas does not have a numeric water quality standard for total phosphorus, but rather a narrative nutrient standard. ADEQ argues that no data has been collected on Town Branch indicating the designated uses are not being met. ADEQ's 1996 study indicated that Town Branch was "slightly impaired for nutrients". During this time the wastewater treatment plant (WWTP) was discharging 200 lbs/day of Total Phosphorus (TP), which is now down to 20 lbs/day. Despite the above WWTP decrease in loadings, despite "consistent" instream TP levels of less than 1 mg/L, and in the absence of any new biological data showing designated use impairments, EPA maintains that Town Branch is impaired for TP and requires a total maximum daily load (TMDL).

Response 1

EPA acknowledges that the State of Arkansas does not have numeric water quality standards for nutrients. Section 2.4.2 of the draft TMDL states, "For nutrients, the Arkansas water quality standards have narrative criteria, but not a numeric criterion." However, the development of TMDLs is not dependent on the existence of numeric water quality standards. Both the Clean Water Act and EPA regulations anticipate the development of TMDLs on the basis of narrative water quality standards alone. Section 303(d)(1)(A) of the Clean Water Act requires each state to identify those waters within its boundaries for which effluent limitations "are not stringent enough to implement <u>any</u> water quality standard applicable to such waters" [CWA §303(d)(1)(A)]. Further, in requiring that TMDLs be developed for each water quality limited segment listed in 40 CFR § 130.7(b)(1), subpart (c) of that section specifically states, in pertinent part, that "…TMDLs shall be established at levels necessary to attain and maintain the applicable <u>narrative</u> and numerical WQS…." [40 CFR § 130.7(c)(1), emphasis added].

To develop a TMDL, in the absence of a numeric criterion, it is necessary to have a quantitative measure that can be used to evaluate the relationship between pollutant sources and their impact on water quality (EPA 1999). As suggested in EPA's *Protocol for Developing Nutrient TMDLs*, one method for establishing a total phosphorus target value is through a comparison to reference sites. For the Town Branch TMDL, as discussed in Section 4.2, EPA evaluated several studies that were conducted for waters in the Ozark Highlands ecoregion. Given the scientific literature available on phosphorus concentrations in streams in northwest Arkansas and the Ozark Highlands ecoregion, EPA has concluded that a total phosphorus concentration of 0.1 mg/L is the highest scientifically supportable target in order to meet the stream's designated use. The total phosphorus target of 0.1 mg/L for Town Branch was justified by comparing mean (not maximum) total phosphorus concentrations from other Ozark Highlands stream systems. EPA also updated the TMDL to include a more recent study conducted by the United States Geological Survey on nutrients for waters in the Ozark Highlands ecoregion. In addition, the 0.1 mg/L target is both consistent with ADEQ's previous 1998 water quality

guideline included in Regulation No. 2 and the background phosphorus concentrations in Town Branch found in the ADEQ 1997 water quality survey.

While it is true that the City of Bentonville wastewater treatment plant (WWTP) has decreased its total phosphorus loadings to Town Branch over the past several years and that phosphorus concentrations in Town Branch have dropped over that same period, there are no recent biological data demonstrating that this decrease in phosphorus loading has resulted in the attainment of the designated use. The information currently available to the agency supports the waterbody's impaired status.

Town Branch has been included on the State of Arkansas impaired waters list (Clean Water Act Section 303(d) list) since 1992 due to nutrients. In 2004, the State of Arkansas further clarified phosphorus as the pollutant of concern for the impairment. Although phosphorus concentrations in Town Branch have dropped over the last several years, the segment remains on the impaired list. In addition, Town Branch was included in a May 2000 consent decree that requires EPA to address impaired waters in Arkansas, including Town Branch, by July 15, 2010.

Regarding ADEQ's comments on the 1996 study, EPA notes that ADEQ's 1997 Water Quality Survey of Town Branch (ADEQ 1997)[1] indicates that "large increases in nitrates and phosphorus in Town Branch Creek below the STP [sewage treatment plant] provided ample nutrients to generate wide fluctuations in oxygen saturation values, resulting from photosynthetic and respiration activities of algae and periphyton." The report also indicated that phosphorus concentrations in Town Branch "produced the macrophytic growth in the stream channel."

Regarding ADEQ's comment on the impairment status of Town Branch, please see the Response to Comment 4.

Comment 2

ADEQ states that the TMDL is developed based on the Gold Book (which is over 40 years old), the Parsons Report (with three sampling events in the Illinois River and the Kings River Basin for a 5-month period from August to December of 2003), the Ozark Highlands ecoregion reference streams, and other streams similar to Town Branch within the 2010 TMDL. ADEQ states that comparing the James River Basin (987 square miles) and the Arkansas portion of the Illinois River watershed (1,500 square miles) to the Town Branch watershed is not a reasonable comparison. ADEQ states that these reference streams are not comparable physically, chemically, or biologically to Town Branch. ADEQ indicates that the TMDL used watersheds of differing sizes to compare against Town Branch.

[1] ADEQ comment refers several times to a 1996 study. The samples were collected in 1996; study results were published by ADEQ in May 1997 (Publication WQ-97-05-2)

Response 2

The TMDL utilizes the best information that is currently available. Data from streams in other watersheds were used as part of an evaluation of appropriate targets that included various pieces of information, including the 1986 Gold Book; EPA's *Ambient Water Quality Criteria Recommendations: Information Supporting the Development of State and Tribal Nutrient Criteria, Rivers and Streams in Nutrient Ecoregion XI*; the approved TMDL for the James River; the Parsons/UA study of the Illinois River and Kings River basins; ADEQ's published 1997 intensive field survey of Town Branch; data for Osage Creek and Spring Creek upstream of the Rogers and Springdale WWTPs, respectively; and more recently, the 2010 US Geological Survey report on nutrients in Ozark Highlands streams. The target for the James River TMDL was based on several hundred samples collected at various sites in the James River basin. These sites likely included numerous small streams and other streams of varying sizes. The James River TMDL is an example of using data from multiple streams of different sizes to set a phosphorus target. For the Illinois River basin, the data used to evaluate phosphorus targets for the Town Branch TMDL were from small streams, including Osage Creek and Spring Creek upstream of the WWTPs for Rogers and Springdale, respectively. EPA agrees that some of the Illinois River basin sites have drainage areas larger than Town Branch. However, the various data identified in Section 4.2.1 of the draft 2010 Town Branch TMDL were part of this evaluation of appropriate targets for Town Branch.

Given the scientific literature available on phosphorus concentrations in streams in Northwest Arkansas and the Ozark Highlands ecoregion, EPA has determined that a total phosphorus concentration of 0.1 mg/L is the highest target scientifically supportable in order to meet the stream's designated use.

Comment 3

ADEQ indicates that the TMDL should be based on sound science. The TMDL provides a load to Bentonville of 3.34 lbs/day, which is reduced considerably from the allowable loads of 16.69 lbs/day and 33.45 lbs/day in previously drafted TMDLs. Biological data collected in 1996 for Town Branch were collected years before Bentonville upgraded its WWTP, and phosphorus loadings have been reduced by an order of magnitude. Furthermore, those data were used by ADEQ to determine that Town Branch was slightly impaired for nutrients due to nitrate, not phosphorus. This draft TMDL is not warranted or supported by science.

Response 3

EPA is committed to carrying out its statutory duties based on sound science and has developed the Town Branch TMDL based on the latest and best science available. EPA understands that the 1997 study of Town Branch (ADEQ 1997) was conducted prior to upgrading the City of Bentonville's WWTP to reduce phosphorus discharges. Although the 1997 report was completed prior to this upgrade, the report clearly indicates that phosphorus is one of the pollutants impacting Town Branch, and therefore a TMDL is

warranted. Specifically, the Summary and Conclusion Section (Pages 26 and 27) of the report titled "TMDL Investigation of Water Quality Impairments to Town Branch, McKisik, and Little Sugar Creeks, Benton County, Arkansas" indicates that "large increases in nitrates and phosphorus in Town Branch Creek below the STP provided ample nutrients to generate wide fluctuations in oxygen saturation values, resulting from photosynthetic and respiration activities of algae and periphyton." The report also indicated that phosphorus concentration in Town Branch produced macrophytic growth in the channel. Lastly, the report indicated that the increase in the primary feeders in Town Branch was attributed to an increase in algae and periphytic growth. To address nitrates, the 1997 Town Branch study recommended a nitrate effluent limit for the City of Bentonville of 10 mg/L (Page 27), but only recommended monitoring for phosphorus. The effluent limitation of 10 mg/L for nitrates and a monitoring requirement for total phosphorus were included in Bentonville's National Pollutant Discharge Elimination System (NPDES) permit reissuance in 1998. After completion of the 1997 study, ADEQ continued to carry Town Branch on the 303(d) list for nutrients. In 2004, ADEQ clarified the nutrient listing to be attributed to total phosphorus.

Section 303(d) of the CWA and 40 CFR § 130.7 explicitly recognize the need to proceed with TMDL development despite a lack of complete information. Both the statute and the regulations direct EPA and the states to develop TMDLs with a "margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality." CWA §303(d)(1)(C); 40 CFR § 130.7(c)(1).

Comment 4

ADEQ provides information on the stream's listing, the consent decree, and other items related to determining if the waterbody is impaired. ADEQ states that Town Branch was originally listed by ADEQ for nutrients on the 1998 303(d) list and that Town Branch was included in the 2000 Consent Decree, in which the EPA agrees to complete TMDLs on a number of water quality limited segments, including the streams listed on Arkansas's 1998 303(d) list. In addition, ADEQ contends Town Branch was also listed by ADEQ for nutrients due to nitrates on the 2002 303(d) list; however, ADEQ indicates that EPA changed the listing for Town Branch in 2004 to indicate that the waterbody was impaired for total phosphorus. ADEQ notes that the State placed Town Branch in Category 5d on the 2004 303(d) list. Category 5d waters are "waters which need data verification to confirm use impairment (additional sampling, biological assessment) before a TMDL is developed." ADEQ then states that EPA determined Town Branch was not impaired for nitrates because the drinking water criteria were only exceeded 7% of the time, not the 10% that is required for listing. ADEQ then states that EPA determined that Town Branch should be listed for total phosphorus; however, no justification for that listing was provided even though a total phosphorus water quality standard does not exist and no data were provided to support EPA's determination.

Response 4

Town Branch was first identified as impaired by the State, not EPA. According to EPA records, the State of Arkansas began including Town Branch on its 303(d) list in 1992 as impaired for nutrients (as well as at that time for pathogens). When the Consent Decree was entered in 2000, rivers and streams on Arkansas' 1998 303(d) list were specifically covered and listed in Attachment C to the Decree. Town Branch is included in Attachment C as impaired for nutrients and metals. Subsequently, on its 2004 list, the State (again, not EPA) clarified the pollutant of concern for the impairment as phosphorus. EPA approved ADEQ's decision to include Town Branch on the 2004 §303(d) list with total phosphorus identified as a cause of water quality impairment (EPA 2006).

A typographic error in the hydrologic unit number for Town Branch in ADEQ's 2004 Integrated Report "Table IV-4: Water Quality Limited Waterbodies (Category 5d) – 303(d) List" may lead to some confusion, but the waterbody name, station identifier, length of the segment, reach number, and planning basin confirm that the record refers to Town Branch near Bentonville, and "TP," or total phosphorus, was the cause for inclusion on the §303(d) list (ADEQ 2005). The correct hydrologic unit identifier (HUC 11070208, Reach 901) was included in Table A-131 of the 2004 Integrated Report where total phosphorus was again identified as cause for inclusion on the §303(d) list.

In the State's 2006 Integrated Report submittal, ADEQ identified both nitrates and total phosphorus as causes of water quality impairment for Town Branch; however, instead of listing the segment on the 303(d) list as an impaired waterbody needing a TMDL, ADEQ included Town Branch in category 4b, which is a subcategory of impaired waters for which control measures other than a TMDL are expected to result in attainment of all applicable water quality standards within a reasonable period of time.

EPA regulations recognize that alternative pollution control requirements may obviate the need for a TMDL. Specifically, states are not required to include segments on the §303(d) list if other local, state, or federal pollution control requirements are stringent enough to implement applicable water quality standards (see 40 CFR 130.7(b)(1)) within a reasonable period of time. To simplify communication about waterbody status, EPA's 2008 Integrated Reporting Clarification Memorandum recommends that states describe these segments for which alternatives to TMDLs are sufficient to implement water quality standards as Category 4b waters; whereas, waters to be included on the 303(d) list are described at Category 5 waters. States include waters that are impaired by pollutants on the §303(d) list (Category 5) or Category 4b, depending on whether or not a TMDL is required.

In 2006, ADEQ included Town Branch in Category 4b, but did not submit a sufficient rationale for excluding the waterbody from the §303(d) list, leading to disapproval by EPA. Because EPA's disapproved the State's placement of the impaired waterbody in Category 4b, the water body remained on the final Arkansas 303(d) list with total phosphorus identified as a cause of water quality impairment. For the 2008 303(d) list,

EPA disapproved the omission of Town Branch, and added Town Branch back to ADEQ's §303(d) list for total phosphorus.

On May 4, 2010, ADEQ submitted a letter and justification to EPA requesting that Town Branch again be placed in Category 4b, rather than on the §303(d) list. After careful review of the State's rationale, EPA determined that although nutrient levels in Town Branch have been significantly reduced, the State failed to show that the nutrient controls associated with the City of Bentonville WWTP permit and other control measures will result in attainment of water quality standards over a reasonable period of time. EPA determined that the pollution controls described in the rationale are not consistent with the requirements of 40 CFR 130.7(b)(1) and expectations for Category 4b as discussed in EPA's Integrated Reporting Guidance. By letter dated June 30, 2010, EPA notified the State of its determination that the information submitted by ADEQ was insufficient to exclude Town Branch from the §303(d) list and that the waterbody must remain on the list until a TMDL is completed for total phosphorus.

As discussed above, both Category 5 (the 303(d) list) and Category 4b are for impaired waters. States choose to place impaired waters on the 303(d) list or in Category 4b depending on whether a TMDL is needed, or if another pollution control measure will bring the water into compliance with standards within a reasonable period of time. Between 1992 and 2008, the State assigned Town Branch to either the §303(d) list (category 5) or category 4b based on concerns about nutrient concentrations (clarified as total phosphorus beginning in 2004), thereby acknowledging that excessive nutrient loadings are causing or contributing to water quality impairment. The point source discharge is the only source of excess phosphorus identified in the problem statement and in Integrated Reports previously submitted by ADEQ. The State did not identify other possible point or nonpoint sources of nutrients contributing to water quality impairment, although the 4b rationale describes control measures for other sources.

While ADEQ's comments suggest disagreement between EPA and ADEQ about total phosphorus as a cause of water quality impairment in Town Branch, EPA's records demonstrate that EPA concurred with ADEQ's identification of total phosphorus as a specific cause of water quality impairment in Integrated Reports submitted by ADEQ. Neither ADEQ nor EPA included nitrate on a State of Arkansas 303(d) list.

Because Town Branch remains on the State of Arkansas' Section 303(d) list as impaired for total phosphorus, the Clean Water Act and EPA regulations at 40 CFR Section 130.7 require that a total phosphorus TMDL be developed. Further, as noted by ADEQ in its comments, in accordance with the May 2000 Consent Decree entered in *Sierra Club v. EPA*, a TMDL for Town Branch is required to be completed by July 15, 2010.

It is true that Arkansas has a narrative, not a numeric water quality standard for phosphorus. However, as discussed in Response to Comment 1, the Clean Water Act and EPA regulations require the development of TMDLs for waterbodies identified on the State's 303(d) list as not meeting applicable water quality standards, regardless of whether those standards are numeric or narrative.

Comment 5

In 2004, the City of Bentonville's WWTP NPDES permit was renewed to include a total phosphorus limit of 1 mg/L at a design flow of 4.0 MGD. In 2006 and 2008 ADEQ placed Town Branch in Category 4b of the 303(d) list. Category 4b is for waterbodies with data indicating that at least one use is not met but a TMDL is not needed. EPA declined this listing and added Town Branch to both the 2006 and 2008 303(d) list as impaired for total phosphorus. According to the current permit limit of 1 mg/L, the decline of total phosphorus being discharged from Bentonville due to the City's upgrade of the WWTP, and the total phosphorus declining trend in Town Branch, ADEQ has determined that the standards are currently being met.

Response 5

EPA commends the City of Bentonville for their efforts to reduce phosphorus discharges in their wastewater treatment plant effluent. As discussed in Response to Comment 4, in the State's 2006 Integrated Report submittals, ADEQ did include Town Branch in Category 4b, a subcategory of impaired waters for which control measures other than a TMDL are expected to result in attainment of all applicable water quality standards within a reasonable period of time. By assigning Town Branch to Category 4b based on concerns about phosphorus concentrations, the State has indicated that excessive nutrient loadings are causing or contributing to water quality impairment. There was nothing in the State's listing rationale to demonstrate that water quality standards in Town Branch are currently being met.

It is true that EPA disapproved the State's inclusion of Town Branch in Category 4b. In 2006, the disapproval resulted from the State's failure to submit a sufficient rationale for excluding the waterbody from the §303(d) list. In ADEQ's 2008 submittal, the State omitted Town Branch from the 303(d) list and EPA added Town Branch back to the 303(d) list.

As stated above in Response to Comment 4, on May 4, 2010, ADEQ submitted a letter and justification to EPA requesting that Town Branch again be placed Town Branch in Category 4b, rather than on the §303(d) list. The State's rationale was largely based on the argument that more stringent limits in the City of Bentonville's NPDES permit, along with the decline of total phosphorus being discharged from Bentonville due to the City's upgrade of the WWTP and the total phosphorus declining trend in Town Branch, were sufficient to ensure the attainment of water quality standards in Town Branch. However, because Arkansas does not have a numeric criterion for phosphorus, attainment of the aquatic life designated use cannot be determined solely from a decrease in phosphorus concentrations at the ambient monitoring station. EPA determined that the information submitted by the State failed to show that the nutrient controls associated with the City of Bentonville WWTP permit and other efforts (municipal stormwater permit and certifications for poultry litter haulers and other fertilizer applicators) will result in attainment of water quality standards over a reasonable time period. (See Response to

Comment 4 and EPA's June 30, 2010, letter to ADEQ disapproving the State's inclusion of Town Branch in Category 4b).

Comment 6

ADEQ indicates that Missouri, like Arkansas, does not have a numeric water quality standard for phosphorus. Instead the State of Missouri, like Arkansas, has a narrative water quality standard for nutrients. ADEQ also indicates that the 2004 Elk River TMDL provided the City of Bentonville with a 1 mg/L total phosphorus effluent limit. ADEQ states that the Elk River TMDL provided a total phosphorus target concentration at Tiff City, Missouri, of 0.06 mg/L. ADEQ states that the Elk River TMDL accounted for the City of Bentonville and therefore provided an allocation of 1 mg/L to meet 0.06 mg/L water quality target at Tiff City, Missouri. ADEQ states that the Elk River TMDL determined that a total phosphorus effluent limitation of 1.0 mg/L monthly average concentration for the Bentonville WWTP was protective of Missouri's water quality in the Elk River basin. ADEQ notes that this is the same conclusion reached by EPA's 2007 draft TMDL for Town Branch. The 2010 draft TMDL reaches a completely different point source wasteload allocation in comparison to either EPA's 2007 draft TMDL for Town Branch or the Elk River TMDL approved by EPA in 2004. This difference and the basis for it are not adequately explained or technically justified by EPA in its 2010 TMDL.

Response 6

As discussed above, the Clean Water Act (CWA) and 40 CFR § 130.7 require TMDLs to be established as necessary to attain and maintain both narrative and numeric water quality standards. (See Response to Comment 1.)

While it is true that Missouri's Elk River TMDL set an instream total phosphorus target of 0.06 mg/L for the Elk River at Tiff City, Missouri, no instream targets were set for upstream reaches of the watershed (such as Town Branch). The Elk River TMDL instream total phosphorus target was based on two statistical tests (e.g. Kruskall-Wallace and 2-sample T-test on the log-transformed total phosphorus data [$p < 0.05$]) of total phosphorus concentrations in the Elk River at Tiff City, Missouri. Further, while the Missouri TMDL did assume wasteload allocations for Arkansas point sources in the Arkansas portion of the Elk River watershed, including an allocation of 1mg/L for the City of Bentonville WWTP, these allocations were merely informational assumptions necessary for demonstrating compliance with the instream target at Tiff City, Missouri. The Elk River TMDL does not purport to protect water quality in Town Branch or any other Arkansas waterbody. In fact, the Elk River TMDL clearly acknowledges that Missouri does not have authority to make implementation decisions for the State of Arkansas. Specifically, page 19 of the Elk River TMDL states that "the State of Missouri is only establishing the allocations in Missouri and is not taking action with respect to any allocations, point or nonpoint, in Arkansas" (MDNR 2004a). The informational assumptions included in the Missouri TMDL are irrelevant in determining the instream

total phosphorus target necessary to ensure compliance with water quality standards in Town Branch.

In regard to the 2006 and 2007 preliminary draft TMDLs for Town Branch mentioned in ADEQ's comments, these documents were internal staff working products that were shared with ADEQ staff at the time for discussion purposes only. EPA Region 6 concluded that both documents were incomplete and that the Agency was not comfortable with the conclusions drawn. These preliminary drafts 2006 and 2007 TMDLs were never proposed by EPA as a final action.

Comment 7

ADEQ notes that the draft 2006 TMDL for Town Branch provided a total phosphorus effluent limit of 0.5 mg/L for Bentonville WWTP. ADEQ reiterates that both Arkansas and Missouri lack a numeric criterion for phosphorus. ADEQ cites the 2006 Town Branch TMDL as calculating the assimilative capacity for Little Sugar Creek at the Arkansas-Missouri state line by simply multiplying the target phosphorus concentration in the Elk River TMDL (0.06 mg/L) by the total annual flow in the stream at the state line. ADEQ states that the draft 2006 draft TMDL for Town Branch provided a WLA for the City of Bentonville by multiplying the WWTP's design flow by one-half of the permit limit that was deemed appropriate in the EPA Region 7 approved Elk River TMDL. ADEQ reiterates that this 2006 draft TMDL for Town Branch determined that a total phosphorus limit 0.5 mg/L was appropriate for Bentonville's WWTP. ADEQ notes that this draft 2006 TMDL was never finalized.

Response 7

See the Response to Comment 6 above.

Comment 8

ADEQ points out that the 2007 draft TMDL for Town Branch provided a total phosphorus effluent limit of 1 mg/L for Bentonville WWTP and notes that in the Missouri Elk River TMDL historical data was utilized to develop a target concentration of 0.06 mg/L of total phosphorus at the Missouri-Oklahoma stateline. The calculations for the 2007 draft TMDL for Town Branch were based on a mass balance for the Elk River at the point where it flows out of Missouri and into Oklahoma. Additional assessments and studies are referenced below. A rapid bioassessment (RBA) was conducted and indicated that Town Branch was 'slightly impaired.' This 10-year-old ADEQ intensive field study yielded the following summary (in reference to Town Branch):

- Smaller percentage of species that are sensitive to pollution, and
- Less diversity of fish species than the reference site on Little Sugar Creek upstream of Town Branch.

ADEQ states that a specific total phosphorus target concentration for Town Branch was not developed for the 2007 draft Town Branch TMDL due to limited data. The 2007 draft TMDL was developed using calculations of allowable loads at the nearest downstream point where a target load had already been established (hence the Elk River). Again the 2007 draft TMDL indicates a 1 mg/L of total phosphorus for Town Branch. The 2007 draft TMDL for Town Branch, which was never finalized, provided a WLA for the City of Bentonville by multiplying the WWTP's design flow by 1.0 mg/L, deemed appropriate in the EPA-approved Elk River TMDL.

Response 8

As stated earlier in response to Comment 6 above, the 2006 and 2007 preliminary draft TMDLs for Town Branch were internal staff working products that were shared with ADEQ staff at the time for discussion purposes only. These previous drafts were incomplete and did not include a comprehensive review and evaluation of appropriate target concentrations necessary to protect the designated uses in the receiving waterbody. In addition, please see the response to Comment 6 above.

Comment 9

Both the March and April 2010 draft TMDL reports indicate that the purpose of the TMDL is to determine the pollutant loading that a waterbody can assimilate without exceeding water quality standards for that pollutant. Because ADEQ does not have a numeric water quality criterion for total phosphorus, what water quality standard does the draft TMDL meet?

Response 9

EPA understands that ADEQ does not have a numeric water quality criterion for total phosphorus; however ADEQ does have a narrative water quality criterion for nutrients (APCEC 2007a). The Town Branch TMDL addresses the narrative criterion for nutrients. To develop a TMDL in the absence of a numeric criterion, it is necessary to have a quantitative measure that can be used to evaluate the relationship between pollutant sources and their impact on water quality (EPA 1999). As discussed in "EPA's Protocol for Developing Nutrient TMDLs", recommended methods for developing a target value include comparison to similar but unimpaired waters, and literature values (EPA 1999, p. 4-13). For the Town Branch TMDL, as discussed in Section 4.2, EPA evaluated information and data from various sources, including ADEQ's reference stream data and several studies that were conducted for waters in the Ozark Highlands ecoregion. These sources of information and data included EPA's Ambient Water Quality Criteria Recommendations: Information Supporting the Development of State and Tribal Nutrient Criteria, Rivers and Streams in Nutrient Ecoregion XI; the EPA Gold Book; the approved TMDL for the James River; the Parsons/UA study of the Illinois River and Kings River basins; ADEQ's published 1997 intensive field survey of Town Branch; data for Osage and Spring Creeks upstream of the Rogers and Springdale WWTPs; and more recently, the 2010 US Geological Survey report on nutrients in Ozark Highlands streams. Data

from the above mentioned studies included phosphorus concentrations ranging from 0.006 mg/L to a 0.1 mg/L (see table below).

Evaluated Targets	Reference
0.006 mg/L	Target for Subecoregion 39, which includes portions of northwest Arkansas (EPA 2000b)
0.095 mg/L	Non-impaired streams in the Illinois River / Kings River (Parsons/UA 2004)
0.094 mg/L	1995-96/2003 data for Spring Creek upstream of Springdale WWTP (see Section 4.2.5 of this report)
0.082 mg/L	1995-96/2003 data for Osage Creek upstream of Rogers WWTP (see Section 4.2.5 of this report)
0.064 mg/L	75th percentile of Flint Creek data (see Section 4.2.5 of this report)
0.075 mg/L	Target in James River TMDL (MDNR 2001; MDNR 2004b)
0.05 mg/L	Reference streams in Ozark Highlands Ecoregion (ADPCE 1987)
0.02 mg/L	Threshold for nutrient enrichment in Ozark Highlands streams (USGS 2010)
0.01 mg/L	Target for Aggregate Ecoregion XI (EPA 2000b)
0.10 mg/L	ADEQ Regulation 2 guideline prior to 2004 EPA Gold Book (EPA1986) Town Branch concentration above WWTP (ADEQ 1997)

Although the EPA Gold Book was published in 1986, its recommended target for total phosphorus for rivers and streams is consistent with previous versions of Arkansas Regulation No. 2 which utilized the 0.1 mg/L total phosphorus value as a guideline prior to 2004. Based on this evaluation of data and information, EPA has concluded the value of 0.1 mg/L is the highest scientifically supportable target concentration for total phosphorus in order to meet Town Branch designated uses.

Comment 10

ADEQ notes that EPA has prepared three (3) draft TMDLs for Town Branch with differing wasteload allocations. ADEQ notes that the November 2006 draft TMDL included a WLA of 16.69 lbs/day for the Bentonville WWTP. ADEQ also notes that the January 2007 draft TMDL included a WLA of 33.34 lbs/day for the Bentonville WWTP. Lastly, ADEQ notes that the April 2010 draft TMDL included a WLA of 3.34 lbs/day. EPA failed to justify, which, if any of these WLA is appropriate and/or necessary.

Response 10

Although EPA has prepared various working drafts of the Town Branch TMDL, those drafts were internal working documents that were never finalized (or even proposed) by the agency. The Town Branch TMDL proposed for public comment on April 19, 2010,

establishes and explains the basis for the waste load allocation that EPA has determined is appropriate and necessary for Town Branch. (See also Response to Comment 6).

Comment 11

ADEQ notes that the April 2010 draft TMDL states that, "During the period of March 1998 through November 2005, the City of Bentonville's mean effluent concentration of total phosphorus ranged from 2.0 mg/L to 12.2 mg/L, with an average concentration of 5.9 mg/L." The March 2010 TMDL states that, "During the period of March 1998 through December 2005, the City of Bentonville's mean effluent concentration of total phosphorus ranged from 2.4 mg/L to 6.1 mg/L, with an average concentration of 5.9 mg/L." The April [*sic*] report included one additional month (December 2005), resulting in markedly different ranges, while both reports show the same average total phosphorus concentration.

Response 11

In the March 2010 preliminary draft report, the range of 30-day average effluent phosphorus concentrations for the Bentonville WWTP was incorrect. The Bentonville 30-day average effluent phosphorus concentrations reported in the proposed April 2010 draft report (2.0 mg/L to 12.2 mg/L with a mean concentration of 5.9 mg/L for March 1998 to November 2005) are correct. The individual values for each month are shown in Appendix B of the report. No change is needed to the TMDL.

Comment 12

ADEQ notes that the March 2010 preliminary draft TMDL uses terms that are well defined and, as such, is the preferable version. It states that, "A new intensive field study would be required to determine whether or not conditions in Town Branch have already improved enough to support the *aquatic life designated use* (emphasis added)." "Designated uses" and "aquatic life" are well understood and define terms. The April 2010 draft states, "A new intensive field study would be required to determine whether the reduction in phosphorus concentration *translates into improved biological conditions in the stream* (emphasis added)." "Improved biological conditions" is not a readily defined phrase.

ADEQ also notes that additional text between the March and April 2010 draft report regarding the biological data has changed. Specifically, the March 2010 preliminary draft TMDL uses terms that are well defined and, as such, is the preferable version. The March 2010 preliminary draft TMDL states that, "If recent biological data were available for Town Branch showing a relationship between phosphorus concentrations and *attainment of aquatic life designated use*, EPA could use those data to refine the target phosphorus concentrations for Town Branch (emphasis added)." The April 2010 draft states, "As noted earlier, there is no relationship between total phosphorus concentrations in Town Branch and the *biological conditions in the stream*. Such data might allow EPA to further

refine the target concentration for Town Branch (emphasis added)." Again, ADEQ suggests that EPA use terms defined in the water quality standards.

Response 12

EPA disagrees. EPA has revised the language in Section 5.2 of the Town Branch TMDL to state that, "EPA encourages the collection of additional data (both biological and instream water quality) to assess the waterbody's biological health. The result of such a data collection effort, if completed over the next few years, could be used to inform future decisions as to whether to revise the TMDL upwards or downwards prior to implementation." EPA believes that this change is more appropriate.

Comment 13

ADEQ states that a TMDL is a quantitative analysis and it is necessary to establish a numeric target in order to develop a TMDL based on a narrative criterion. ADEQ states that, "If the Gold Book's numeric target is the desired goal for the prevention of plant nuisances in streams and free flowing waters, then EPA could arbitrarily apply this mandate to any stream in the United States."

Response 13

Although EPA utilized national guidance (i.e., the Gold Book) as part of the basis for the 0.1 mg/L target for total phosphorus, EPA is certainly not proposing to arbitrarily apply this target to all streams across the United States. The target concentration for Town Branch was developed based on an evaluation of appropriate targets with information and data from various sources including data from streams within the Ozark Highlands ecoregion and national guidance (i.e., the EPA Gold Book). This evaluation led EPA to the conclusion that 0.1 mg/L is the highest target scientifically supportable in order to meet the streams designated uses.

The Gold Book, and more recently the EPA recommended Ecoregion Criterion document (EPA 2000b), serve as a guidance that States can use to establish numeric nutrient criterion to protect State waters. The Response to Comment 9 explains how data and information from the Gold Book and other sources were used to establish the total phosphorus target for Town Branch.

Although ADEQ's comments oppose the target concentration developed by EPA, the comments do not propose or provide scientific rationale for a specific alternative target phosphorus concentration for Town Branch to protect the designated use.

Comment 14

The TMDL states that Town Branch is a 6.9 square mile watershed. The James River is 987 square miles, and the Illinois River is 1,500 square miles. These watersheds are not comparable to Town Branch.

Response 14

See Response to Comment 2.

Comment 15

The TMDL uses the Parsons study of the Illinois River watershed and its tributaries in deriving a 0.1 mg/L target for Town Branch. ADEQ states that the Parsons study is plagued with time constraints, a very limited data set, reference streams assessed as impacted, high flow events and failed sampling equipment. ADEQ states that proving causality will require assessing the impact of watershed-level changes and stressors on this system, including measuring sediment loads to the streams, analyzing alterations of hydrologic regimes and associated geomorphological alterations, and lastly assessing landuse change impacts on Town Branch's stream ecosystem.

Response 15

The draft April 2010 Town Branch TMDL cites multiple studies (including ADEQ's 1997 intensive field study on Town Branch, McKisic Creek, and Little Sugar Creek) in setting a reasonable instream target of 0.10 mg/L total phosphorus. The Parsons study of the Illinois River and Kings River watersheds and their tributaries in the Ozark Highlands ecoregion is just one of the several studies cited in Section 4.2. Multiple studies and datasets support an instream concentration of 0.10 mg/L total phosphorus or less.

EPA fully acknowledges that the Parsons study (Parsons/UA 2004) encountered weather related delays in sampling, time constraints, equipment failures, etc.; however, these events are common when conducting field studies. The physical, chemical, and biological data collected during this study was used in a "weight-of-evidence" approach to assess the aquatic life use. As stated in the Parsons Study, "it is recognized that neither a single indictor [physical, chemical or biological] nor a single [sampling] event represent adequate information upon which to base an assessment of aquatic life use status. However, when a suite of indicators suggest aquatic life use impacts more than one time, there is reasonable cause to characterize aquatic life at that site as impacted to some degree." An overall characterization of each site was compiled using the summation of eleven indicators for each site over three sampling events for a total of 33 possible indicators. Indicators were either reported as impacted or not impacted. The number of indicators observed as impacted was summed. The two reference streams in this study were characterized as "unimpacted" because only 1 or 2 of the indicators were observed as "impacted."

ADEQ determined the aquatic life use was impaired by nutrients in Town Branch beginning with the 1992 §303(d) list. The "nutrient" impairment was changed to total phosphorus in 2004 and for subsequent lists and EPA approved the listings, because ADEQ had demonstrated that nutrients were causing or contributing to non-attainment of water quality standards. The applicable regulations do not require that states or EPA prove causality to impose effluent limitations, if there is reasonable potential for a

pollutant to cause or contribute to non-attainment of state water quality standards, including narrative criteria (see 40 CFR § 122.44(d)(1)(i)).

A recent study (USGS 2010) of 30 wadeable Ozark Highlands streams identified 0.015 mg/L total phosphorus as a concentration suspected of distinguishing between reference streams and slightly enriched streams. A two-year study of 26 wadeable streams in the Brazos River basin (Cross Timbers Level III Ecoregion) identified sharp declines in biological integrity (periphyton, macrophytes) and loss of species (algae, macroinvertebrates) in surface waters exceeding 0.02 mg/L total phosphorus. These threshold total phosphorus concentrations fall within the range (0.015 mg/L to 0.025 mg/L) reported in the literature of other similar causal studies, as reported by USGS (2010).

Comment 16

The TMDL indicates that the ADEQ 1996 study was conducted when the City of Bentonville did not have phosphorus removal as part of the wastewater treatment process. The City now has an effluent limit of 1.0 mg/L that went into effect in January 2007. Since that time, the City of Bentonville total phosphorus concentration has been significantly reduced.

Response 16

As stated above in the Responses to Comments 1 and 5, EPA acknowledges that the City of Bentonville wastewater treatment plant (WWTP) has significantly reduced total phosphorus loadings to Town Branch over the past several years. However, no recent biological data are available to establish that the designated uses have been met and the stream is no longer impaired. The information currently available to the agency supports the waterbody's impaired status.

Comment 17

ADEQ indicates that the *Ambient Water Quality Criteria Recommendation: Information Supporting the Development of State and Tribal Nutrient Criterion, River and Streams in Nutrient Ecoregion XI* evaluated data from 1,591 streams in Nutrient Ecoregion XI (in which northwest Arkansas is located). ADEQ notes that none of the 1,591 streams is in Arkansas, and there is no evidence that any of these streams are physically, chemically, or biologically equivalent to Town Branch.

Response 17

The National Nutrient Database (http://www.epa.gov/waterscience/criteria/nutrient/database/) includes data collected from 5,843 distinct stream and river sites within the Central and Forested Uplands (Ecoregion XI). Multiple sites were located on many of the streams and rivers that were included in the database. EPA determined that 447 sites in the database were located

within the Ozark Highlands ecoregion of Arkansas, Kansas, Missouri, and Oklahoma (a subset of these sites [n=187] were located in northwest Arkansas). Ecoregions are delineated based on factors that are primarily responsible for determining water quality conditions and other physical, chemical, and biological characteristics, including land use, land surface form, potential natural vegetation, and soils (Omernik 1987). As such, EPA is confident that the database is representative of stream conditions within the Ozark Highlands ecoregion where Town Branch is located. As mentioned above, these data were only one of several data sets and studies that were used to develop the Town Branch target. No change to the document needed.

Comment 18

ADEQ states that the data used from Osage Creek and Spring Creek above the WWTPs have concentrations of 0.082 mg/L and 0.094 mg/L, respectively. ADEQ contends that these values were rounded and considered to be representative concentrations for non-impaired streams with urban watersheds in the Ozark Highlands ecoregion. ADEQ contends that neither Osage Creek nor Spring Creek is an urban headwater losing stream with most of its watershed located within the city limits.

Response 18

EPA disagrees with ADEQ's assertions. Based on EPA's review of the urbanized area maps (http://www.epa.gov/npdes/pubs/ua_ar_fayetteville_springdale_rds.pdf), EPA has determined that both Osage Creek and Spring Creek are headwater streams originating within the urbanized area. As mentioned above in the Response Comment 2, it is acceptable to use data from a variety of streams to help develop a TMDL target because it is usually not possible to find other streams for which biological data have been collected and which are almost identical to the TMDL stream. No change to the TMDL is needed.

Comment 19

ADEQ states that the water quality standards are the Arkansas Pollution Control and Ecology Commission's regulations and not ADEQ's. In addition, the definition of a Perennial Ozark Highland fishery is that all streams within the watershed of 10 square miles and larger and those waters where discharges equal or exceed 1 cfs.

Response 19

The reference to the water quality standards on page 2-3 of the TMDL has been revised to reflect the fact that the water quality standards are established by the Arkansas Pollution Control and Ecology Commission. EPA recognizes that ADEQ is responsible for developing and implementing the regulation while the Commission has the authority to promulgate the regulation.

Based on EPA's review of the Arkansas Pollution Control and Ecology Commission Regulation No. 2, Town Branch is designated a perennial Ozark Highland fishery. Based

on Regulation 2 (APCEC 2007a), the perennial Ozark Highlands fishery use applies to all streams with watersheds of 10 square miles and larger and those waters where discharges equal or exceed 1 cfs. The City of Bentonville WWTP, which discharges to Town Branch, has an effluent design flow rate which exceeds 1 cfs. As shown in Appendix B of the report, between 1998 and 2006, the 30 day mean effluent flow rate was 3.5 cfs. Between 2007 and 2009, the 30 day mean effluent flow rate was 5.2 cfs.

EPA's interpretation of the applicability of the fishery use is consistent with information provided by ADEQ (2010b) in the 2010 Integrated Report, which identifies Town Branch as not attaining the fishery use. ADEQ's 2010 report states, "The fisheries designated use in Town Branch Creek is currently listed as impaired because of historic excessive nutrient loads being discharged from the local municipal point source." No change is needed to the TMDL.

Comment 20

ADEQ states that the Town Branch TMDL concluded that 0.10 mg/L is a reasonable and conservative target concentration for total phosphorus in Town Branch. ADEQ contends that EPA failed to show that either the water quality standards (narrative nutrient criterion) or the aquatic life designated use for Town Branch are not being met.

Response 20

EPA disagrees with the State’s assertions. Town Branch is listed on the State of Arkansas’ 303(d) list as impaired for phosphorus and the information currently available to the agency supports the water body’s impaired status. See Response to Comment 1.

Comment 21

ADEQ concludes that placing Town Branch in Category 4b is a reasonable alternative to repeatedly attempting to fabricate a wasteload allocation for the City of Bentonville’s WWTP in the absence of any evidence of designated use or water quality impairments.

Response 21

EPA disagrees. After carefully reviewing the rationale submitted by the State to support placing Town Branch in Category 4b, EPA determined that the rationale did not demonstrate that existing water quality controls are sufficient to ensure attainment of all applicable water quality standards within a reasonable period of time as required by 40 CFR § 130.7(b)(1). See Responses to Comments 4 and 5.

Comments from the City of Bentonville, Arkansas ("the City")

Comment 22

The City notes that the TMDL will have a devastating effect on the local economy, will require significant improvements at the Wastewater Treatment Facility and will only yield minor environmental improvement. The WWTP produced an average phosphorus discharge of 0.35 mg/L last year so reducing it to 0.1 mg/L yields negligible environmental improvement but will place a considerable financial burden on the ratepayers. In addition, the City will be required to institute a new program to meet the TMDL stormwater requirements which will require additional funding not currently included in the City's budget. The City of Bentonville recommends that a detailed study of the stream be completed prior to establishing a TMDL for Town Branch so financial obligations can be responsibly coupled with environmental impacts and protection. The City states that the EPA is pursuing this TMDL with total disregard to the economic impacts ratepayers will endure.

Response 22

EPA recognizes that implementing the wasteload allocation prescribed in the Town Branch TMDL may require additional upgrades to the wastewater treatment facility and the agency is sympathetic to the burden this may place on the City's budget. However, as discussed in previous comments, based on its evaluation of available sources of data and information, EPA has determined that a value of 0.1 mg/L is the highest instream target concentration for total phosphorus that is scientifically supportable to ensure compliance with water quality standards in Town Branch. Once that target concentration has been established, EPA must ensure that the WLAs and load allocations add up to, but do not exceed, the assimilative capacity of the water body. Section 303(d) of the Clean Water Act and the implementing regulations found at 40 CFR 130.7 do not allow the agency to use cost considerations as a justification for establishing the TMDL at a level that is not stringent enough to meet water quality standards. Although Clean Water Act Section 303(d) and 40 CFR 130.7 do not provide for the performance of an economic analysis when developing TMDLs to restore an impaired water, EPA is willing to work with ADEQ and the City of Bentonville to design and implement a water quality study to evaluate and assess Town Branch's biological health. The results of such a study could be used to inform future decisions as to whether to revise the TMDL upwards or downwards prior to implementation.

Lastly, EPA is completing a TMDL for Town Branch because Town Branch is currently listed on the State of Arkansas Section 303(d) list for total phosphorus and because the TMDL is required per the May 2000 TMDL consent decree.

Comment 23

The City notes that in its opinion, the phosphorus target of 0.1 mg/L was arbitrarily and carelessly selected by EPA and is not based on sound science or supported by current relevant data. This is support by the fact that FTN Associates, Ltd. (FTN) repeatedly states in its draft TMDL report prepared in April 2010 that insufficient data exists with regard to phosphorus levels or its affects on the biological conditions of the stream. The latest detailed study of Town Branch, conducted by ADEQ in 1996, is 14 years old and many changes have occurred since then including more than a tenfold reduction in phosphorus discharge from the City's wastewater treatment plant within the last 10 years. In addition, three separate draft TMDL reports were prepared by FTN yielding three different results. These draft reports include conspicuously similar narratives and reference similar data yet demonstrate significantly different results. Results or recommendations would not vary if the suggested TMDLs were based on actual studies and supported by relevant data. The City contends that EPA is pursuing a subjective goal with no solid data to support its desired result. The City argues that the stream is not impaired, but acknowledges there is no current data to support its belief other than the notable decrease in phosphorus from the plant. However, the City argues that to establish such a strict TMDL without supporting data is reckless and irresponsible.

Response 23

See Response to Comment 9 concerning how the 0.1 mg/L target was developed. In addition, see Responses to Comments 6 and 10 concerning the previous draft TMDL reports which were never public noticed.

As discussed in Response to Comment 5, attainment of the aquatic life designated use cannot be determined solely from a decrease in phosphorus concentrations at the ambient monitoring station. As discussed in Responses to Comments 1, 4, and 5, although phosphorus concentrations in Town Branch have dropped over the several years, the segment remains on the State's 303(d) list as impaired for phosphorus because no biological data are available to establish that the designated uses have been met and the segment is no longer impaired. The information currently available to the agency supports the waterbody's impaired status.

Comment 24

The City notes that given the untimely availability of the TMDL draft report (April 2010) relative to the hasty deadline of July 15, 2010, for a final TMDL, no agency can reasonably digest, let alone, responsibly address an issue of this magnitude. This absurd timeframe does not provide adequate time to properly review data, discuss implications, explore alternatives, or constructively collaborate with concerned agencies. Ample time to properly study and prepare an appropriate TMDL that is environmentally sensitive, economically feasible, and scientifically sound is simply not provided. Given the fact that EPA had draft TMDLs started by their consultant FTN in 2006, it is evident that EPA is trying to force their hand to achieve a 0.1 mg/L goal. Supporting data could have easily

been gathered and analyzed within the 4 years previous to the actual TMDL published if the EPA were responsible in pursuit of an accurate and defendable target.

Response 24

EPA acknowledges that a significant time gap exists between the 2006 and 2010 draft versions of the Town Branch TMDL. During this time gap, EPA reviewed regional and national literature to determine the highest target scientifically supportable in order to meet the Town Branch's designated use. As a result of this review, EPA public noticed a draft TMDL on April 19, 2010, which establishes and explains the basis for the waste load allocation that EPA has determined is appropriate and necessary for Town Branch. As stated earlier, although EPA prepared various working drafts of the Town Branch TMDL, those drafts were internal working documents that were never finalized, or even proposed by the agency.

Regarding the scientific soundness of the TMDL target, EPA disagrees with the commenter and believes that the TMDL as well as the target are both sound and defensible. Given the scientific literature available on phosphorus concentration in streams in northwest Arkansas and the Ozark Highlands ecoregion, EPA believes that the 0.1 mg/L for total phosphorus is the highest supportable phosphorus target concentration for Town Branch. As stated in Section 5.2 of the April 2010 TMDL, EPA "encourages, as part of TMDL implementation, the collection of additional data (both biological and instream water quality) to help in assessing the waterbody biological health." Section 5.2 of the April 2010 TMDL also states that "this future data could, if appropriate, be used to refine the phosphorus target included in the TMDL." See Reponse to Comment 9 concerning how the 0.1 mg/L target was developed.

Regarding the City's comments on the availability of the TMDL for public comment, EPA regulations require that the public be provided a comment period of no less than 30 days. EPA did not receive any request to extend the comment period past May 19, 2010.

Comment 25

The City notes that EPA would be more responsible to conduct a detailed analysis of Town Branch, including biological conditions, prior to establishing such a strict TMDL. Given the noted decrease in phosphorus discharge from the City's WWTP, water quality in Town Branch has undoubtedly improved. If setting a TMDL is the only way EPA feels it can meet the consent decree, starting at discharge limits currently set for the City's WWTP followed by a timely detailed study of Town Branch ultimately establishing a TMDL based on relevant data seems, in the City's opinion, to be the responsible approach. This would also ensure that any financial obligations would be based on sound evidence. Other TMDLs have been developed for pristine fisheries or waterbodies with documented impairments or declining water quality. Town Branch is neither a pristine fishery nor does it have declining water quality. Although detailed data does not exist,

FTN references improving water quality in their report prepared for this TMDL based on reductions in phosphorus levels in the WWTP discharge.

Response 25

See Response to Comment 22 concerning EPA's obligation to establish this TMDL.

It appears that the commenter is requesting a phased approach TMDL with the initial WLA based on current permit limits for the Bentonville WWTP. The phased approach for TMDLs is presented in the following excerpt from Chapter 3 of "Guidance for Water Quality-Based Decisions: The TMDL Process" (EPA 1991):

"Under the phased approach, the TMDL has LAs and WLAs calculated with margins of safety to meet water quality standards. The allocations are based on estimates which use available data and information, but monitoring for collection of new data is required. The phased approach provides for further pollution reduction without waiting for new data collection and analysis."

As noted in the first sentence of this excerpt, the TMDL must be developed to meet water quality standards (including narrative criteria) based on data and information that are currently available (including published literature and relevant data from other waterbodies). This is what EPA has done for Town Branch. As mentioned in the Response to Comment 22, Section 5.2 of the TMDL report encourages future monitoring.

EPA is not claiming that Town Branch is either a pristine fishery or a waterbody with declining water quality. EPA commends the City of Bentonville for the reduction of phosphorus discharges from their WWTP in the last several years. As discussed in the Response to Comment 5, the improvement in phosphorus levels is not sufficient evidence by itself to determine if the stream is fully supporting the aquatic life designated use.

Comments from the Northwest Arkansas Conservation Authority (NACA)

Comment 26

NACA notes that Town Branch appears on the current Arkansas 303(d) list as being impaired for phosphorus. NACA respectfully submits that despite this listing, there is no valid information to support the notion that Town Branch is impaired for total phosphorus. Town Branch has never been listed by the State of Arkansas as impaired for phosphorus. EPA placed Town Branch on the Arkansas 303(d) list as being impaired for phosphorus, over the State's objection, without offering any justification or identifying any valid base of supporting data. In subsequent years, ADEQ proposed including Town Branch in the State's 303(d) list as a Category 4b waterbody. EPA responded by adding Town Branch back to the Arkansas 303(d) list, rather than accepting ADEQ's proposed identification of Town Branch as a Category 4b waterbody. NACA believes that there was no valid information to support these actions by EPA that Town Branch was not

impaired for phosphorus at the time EPA initially added the stream to the Arkansas 303(d) list as impaired for phosphorus, and the Town Branch is not currently impaired for phosphorus. Given the lack of information to support EPA's claim of impairment and the State's consistent disagreement with that claim, NACA believes that it is inappropriate to issue a TMDL for Town Branch at this time. Instead, NACA believes that EPA should work cooperatively with ADEQ and the local stakeholders to resolve whether the stream is actually impaired for phosphorus before any TMDL is issued.

Response 26

EPA disagrees with the commenter's assertions. Town Branch was identified as impaired by the State, not EPA, and the State has included it as an impaired water body in its Integrated Reports to EPA (either on the 303(d) list or in Category 4b) since 1992. Further, while the comments suggest disagreement between EPA and ADEQ about total phosphorus as a cause of water quality impairment in Town Branch, EPA's records demonstrate that EPA concurred with ADEQ's identification of total phosphorus as a specific cause of water quality impairment in each Integrated Report submitted by the State between 2004 and 2008. See Response to Comment 4 concerning the 303(d) listing history for Town Branch . As discussed in Responses to Comments 1, 4 and 5, although phosphorus concentrations in Town Branch have dropped over the last several years, the segment remains on the State's 303(d) list as impaired for phosphorus because no biological data are available to establish that the designated uses have been met and the segment is no longer impaired. The information currently available to the agency supports the waterbody's impaired status.

See Responses to Comments 4 and 5 regarding the Category 4b determinations for Town Branch.

Comment 27

NACA notes that the Draft TMDL ignores the change in conditions. Aside from the validity of the listing of Town Branch, NACA points out that the total phosphorus loadings have declined since the listings. NACA quotes from the TMDL that, "the TP concentrations in the effluent of the City of Bentonville WWTP and the TP concentration downstream of the WWTP have dropped over the last 5-10 years (page ii)", and agrees that the Bentonville WWTP has dramatically reduced the amount of TP concentrations in its discharge and therefore in the stream. Has this reduction resulted in an improvement in biological conditions in the stream? NACA submits that it is arbitrary, capricious and irrational for EPA to disregard the dramatic changes in TP concentrations in Town Branch. NACA believes that biological data is important and should not be disregarded, but instead used to determine the listing status and water quality improvement within Town Branch.

Response 27

EPA commends the City of Bentonville for the reduction of phosphorus discharges from its WWTP in the last several years. As discussed in Response to Comment 5, the assessment status of Town Branch (with regard to the aquatic life designated use) cannot be changed based solely on the declining trend in phosphorus concentrations. Because there is no numeric criterion for phosphorus in Town Branch, a change in assessment status must be based on biological data that address the narrative criteria for nutrients. As discussed in Responses to Comments 1, 4 and 5, although phosphorus concentrations in Town Branch have dropped over the last 5-10 years, the segment remains on the State's 303(d) list as impaired for phosphorus because no biological data are available to establish that the designated uses have been met and the segment is no longer impaired. The information currently available to the agency supports the waterbody's impaired status.

As stated in Section 5.2 of the April 2010 TMDL, EPA "encourages, as part of TMDL implementation, the collection of additional data (both biological and instream water quality) to help in assessing the waterbody's biological health." Section 5.2 of the April 2010 TMDL also states that "such future data could, if appropriate, be used to refine the phosphorus target included in the TMDL."

Comment 28

NACA notes that the proposed allocations are not logically related to actual conditions. NACA also notes that the draft TMDL proposes phosphorus load and wasteload allocations that have no logical connections to actual conditions in Town Branch. Instead, the phosphorus load and wasteload allocations in the Draft TMDL are based on Gold Book values, an aspirational goal that formerly appeared in versions of the Arkansas Water Quality Standards and studies from other waterbodies that are not comparable to Town Branch. NACA believes that it is inappropriate to impose load and wasteload allocations that have no rational cause and effect relationship to actual conditions in the stream in question.

Response 28

EPA disagrees. See Response to Comment 9 concerning how the 0.1 mg/L target was developed.

Comment 29

NACA notes that arbitrary values were used in this TMDL compared to the Elk River TMDL in Missouri. Prior draft TMDLs prepared for Town Branch demonstrate a 1,500% variation in load and wasteload allocations that were deemed appropriate. NACA notes that such large variations in load demonstrate a lack of validity of the judgment involved. Therefore NACA suggests that this TMDL should be withdrawn.

Response 29

EPA disagrees. See Response to Comment 6 regarding the comparison of this TMDL to the Elk River TMDL. See Responses to Comments 6 and 10 regarding the different wasteload allocations in different preliminary draft versions of the Town Branch TMDL prior to being proposed for public review by EPA. The proposed TMDL is not withdrawn.

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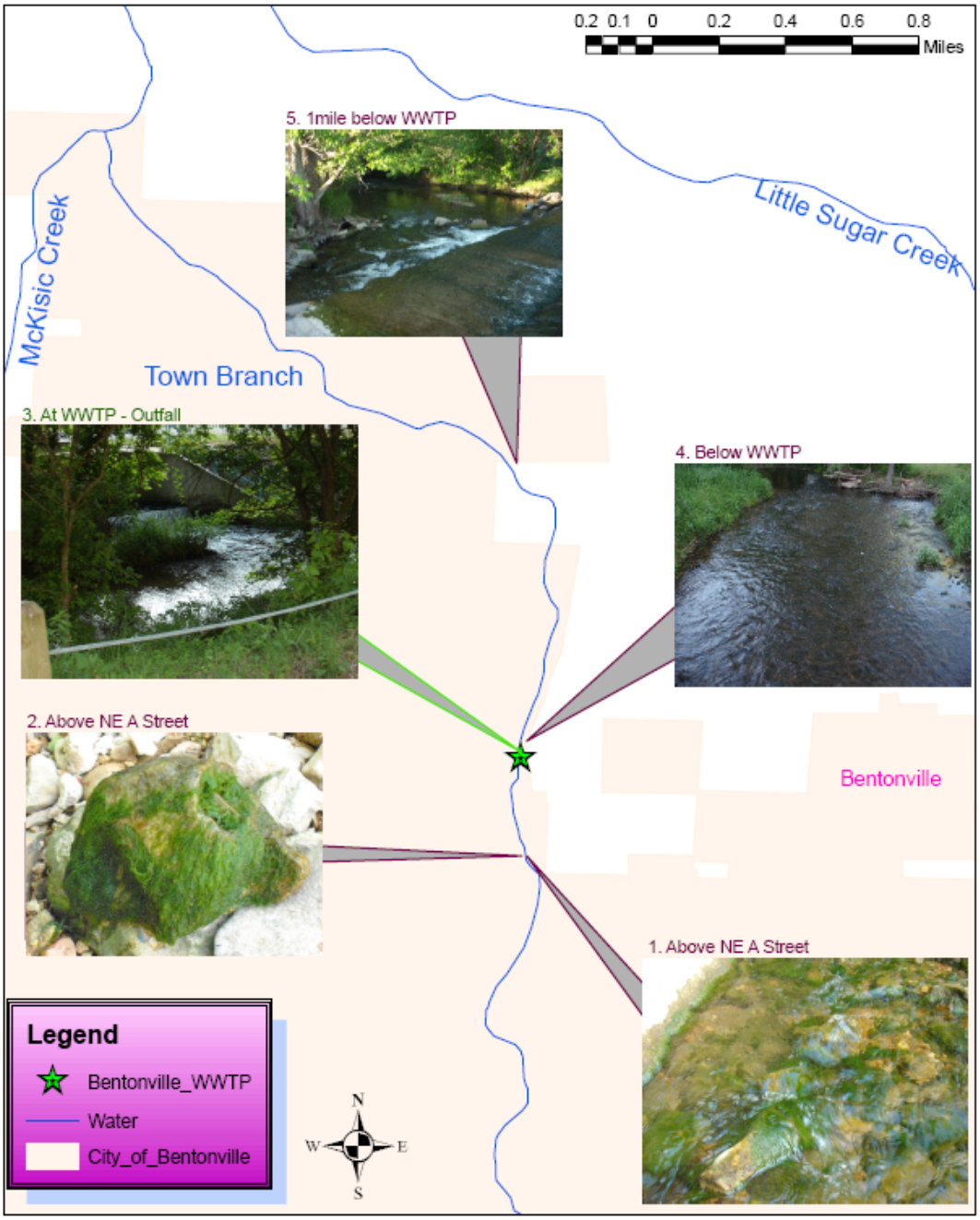
APPENDIX I

Photographs of Town Branch Taken on May 6, 2010

Town Branch Pictures

Map made on June the 29th, 2010
by Sala N. Senkayi



1. Town Branch Picture Above NE A Street.

2. Town Branch Picture Above NE A Street.

3. Town Branch Picture at WWTP - Outfall

4. Town Branch Picture Below WWTP.

5. Town Branch Picture 1 Mile Below WWTP.