5-alt REPORT FOR VALLEY BRANCH and BUZZARD CREEK SUBWATERSHEDS IN THE RED RIVER WATERSHED (05130206)

AN ALTERNATIVE RESTORATION APPROACH UNDER THE LONG-TERM VISION FOR TMDLs

Tennessee Department of Environment and Conservation
Division of Water Resources

Submitted June 11, 2018

I. Background.

EPA's Vision for the 303(d) program enhances overall efficiency of this Clean Water Act (CWA) program. In particular, it encourages focusing attention on priority waters and acknowledges that states have flexibility in using available tools beyond Total Maximum Daily Loads (TMDLs) to attain water quality restoration and protection. In Integrated Reporting Guidance issued in 2016, EPA acknowledges that the most effective method for achieving water quality standards for some water quality impaired segments may be through controls developed and implemented in advance of TMDL development. Alternatives approaches designated in the Integrated Report as sub-category 5-alt—in advance of a TMDL—recognize that some actions are more effective than TMDL reports in reaching the goal of re-attaining support status for impaired waters. If an alternative restoration approach does not show progress in attaining water quality standards, the impaired segment will be reprioritized for TMDL development.

Tennessee has identified HUC-12s with both nutrient-impaired streams and source water protection areas in its priority framework. Tennessee has committed to using the watershed approach in meeting the goals of the Vision. In keeping with our watershed approach schedule, Tennessee considered Group 4 watersheds for alternative plans in FY-2017 and FY-2018. This report addresses Valley Branch Subwatershed 051302060701 and Buzzard Creek Subwatershed 051302060702 in the Red River Watershed (05130206), which have both a source water protection area and nutrient-impaired streams within its boundary.

Figure 1. The Red River Watershed is Located in Both Tennessee and Kentucky.

HUC	HUC NAME	NUTRIENT-IMPAIRED STREAMS
05130206	Red River	
0513020607	Elk Fork-Red River	
051302060701	Valley Branch-Spring Creek	Spring Creek
051302060702	Buzzard Creek-Red River	Red River

Table 1. HUC Numbers and Names of Impaired Streams in this Report. *HUC, Hydrologic Unit Code.*

II. Nutrient-Impaired Waterbodies to be Addressed.

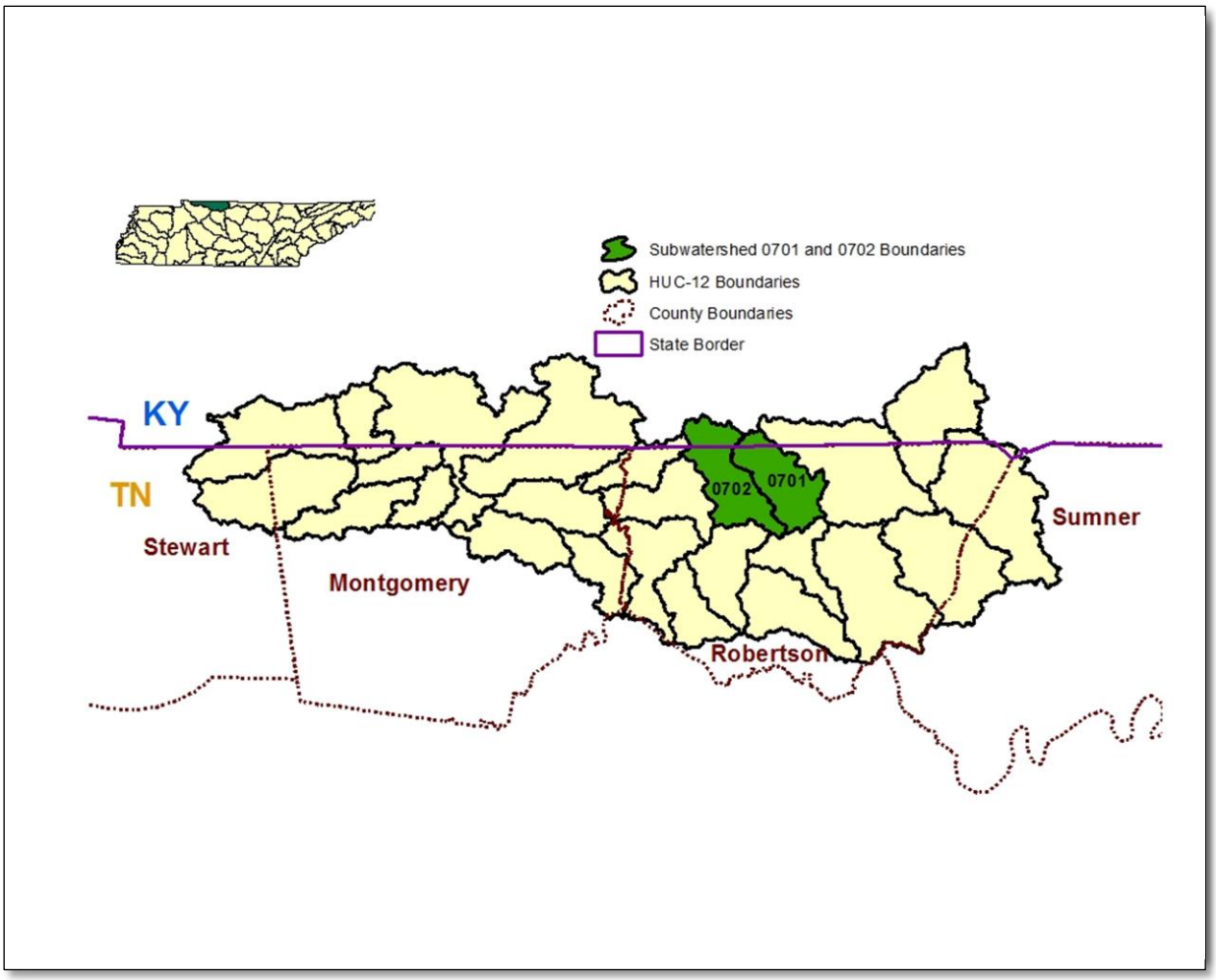

Figure 2. Location of HUC-12 Subwatersheds 051302060701 and 051302060701 in the Red River Watershed. *Subwatershed 0701 is Valley Branch and 0702 is Buzzard Creek.*

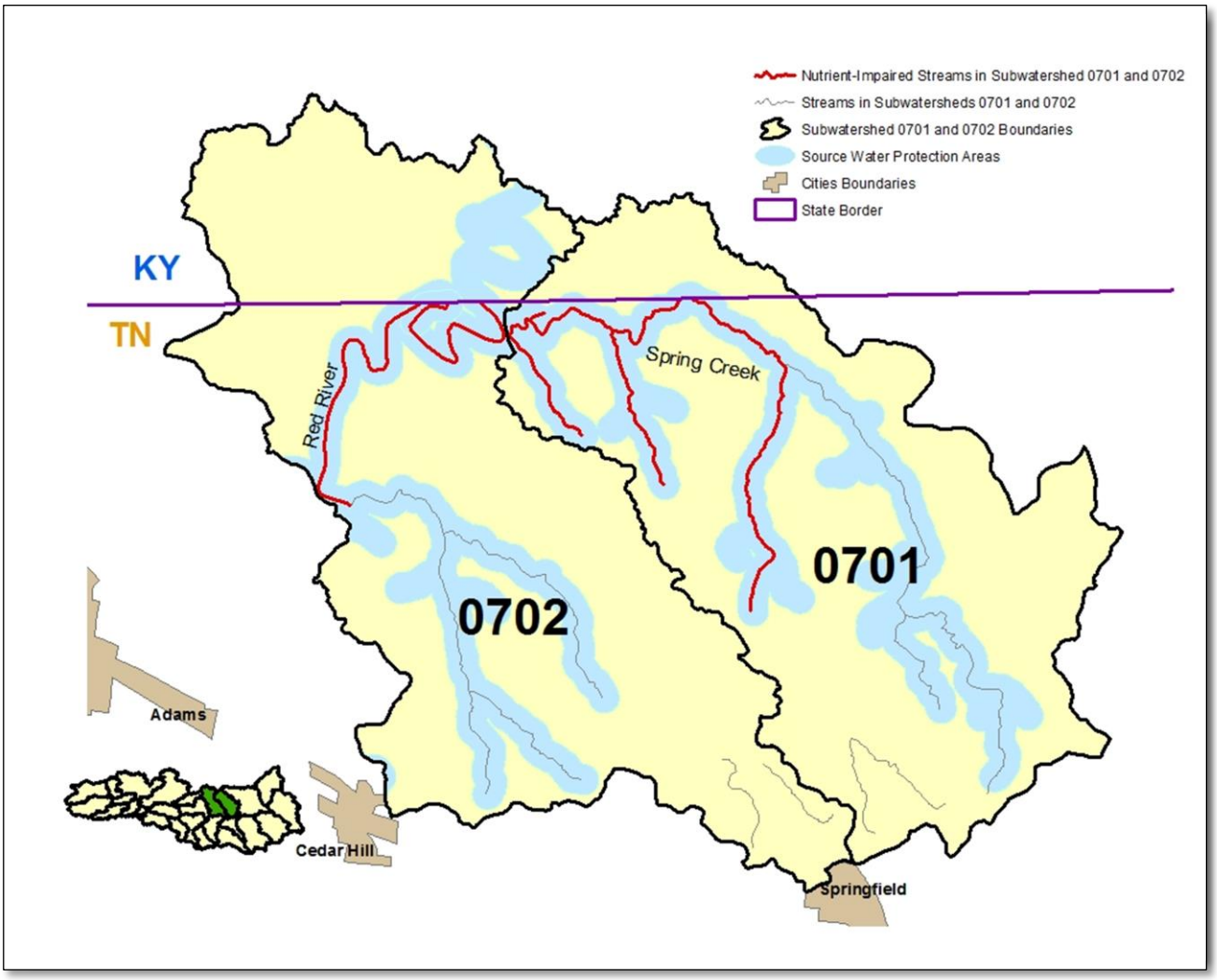

Figure 3. Illustration of Nutrient-Impaired Streams and Source Water Protection Areas in HUC-12 Subwatersheds 051302060701 and 051302060702. *Drinking water sources for Adams, Cedar Hill, and Springfield are in subwatersheds 0701 and 0702. Subwatershed 0701 is Valley Branch and 0702 is Buzzard Creek.*

SEGMENT NUMBER	NAME	COUNTY	MILES	CAUSES/TMDL PRIORITY)	SOURCES
TN05130206002_4000	Red River	Robertson	4.5	**Nitrates (L)**	Nonirrigated crop production
TN05130206002_5000	Red River	Robertson	3.3	Alteration to streamside or littoral vegetation (L) Physical substrate habitat alterations (L) **Nitrates (M)**	Nonirrigated crop production Pasture grazing
TN05130206002_0300	Spring Creek	Robertson	12.25	**Nitrate + Nitrite (L)** Loss of biological integrity due to siltation (L) Eschericia coli (H)	Pasture Grazing

Table 2. Water Quality Descriptions of Red River and Spring Creek in Subwatersheds 0701 and 0702 from Tennessee's 303(d) List as of 04/01/2018. *L, Low; M, Medium. Table 2 is the complete listing of causes of impairment for Red River and Spring Creek in subwatersheds 0701 and 0702. This 5-alt report only addresses Nitrate+Nitrite and Nitrate causes of impairment.*

III. Action Plan that Addresses Nonpoint Sources.

Tennessee is using a nonpoint source approach for addressing nutrients in the Valley Branch and Buzzard Creek Subwatersheds (there are no point sources).

In rural areas of Tennessee, excess nutrients in streams are due to several agricultural practices (mostly poor pasture management and livestock access to the stream) and failing septic systems. Pasture management has been known to improve water quality for some time. In the USDA publication "Nutrient Management in Pastures and Haylands," authors Wood, *et al*. argue for the judicious use of nutrients in managing the nation's pastures and haylands.

The 319 program (administered by the Tennessee Department of Agriculture) has been working with the Soil Conservation District of Robertson County and the Natural Resources Conservation Service to assist landowners who wish to install BMPs in Red River Subwatersheds 051302060701 and 051302060702. Practices installed by stakeholders in subwatersheds 051302060701 and 051302060702 were all NRCS-approved practices designed to reduce sediment and nutrients. The work on the ground was organized and led by the Roberston County Soil Conservation District after consultation with stakeholders through four community (stakeholder) meetings. More information about the Soil Conservation District's role in this project is at http://robertsonscd.wordpress.com/.

The majority of land located in subwatersheds 0701 and 0702 is agricultural with unrestricted pasture grazing in/around streams as confirmed by Soil Conservation District technicians and NRCS staff upon inspection. In addition, NRCS asked TDEC for a consult on septic system integrity. A visit with Tennessee's Ground Water Protection program (part of Division of Water Resources) in Robertson County confirmed needs for septic repair, installation, sewage hookups and maintenance in this area. Subsequent newspaper advertisements were posted to recruit homeowners with failing septic systems.

BMPs. Best Management Practices (BMPs) implemented in the restoration plan that are effective in reducing nutrients include:

- Stream crossings (2,800 square feet)
- Fencing (19,814 linear feet)
- Riparian buffer installations (15 acres)
- Alternative watering facilities (15 units)
- Alternative water supply; Well (750 feet)
- Alternative water supply: Pipeline (8,000 feet)
- Septic repair and replacement (10 units)
- Septic maintenance (100 units)

In addition, the following activities took place in the Valley Branch Restoration Project:

- Land owner conservation plans for pasture grazing
- Needs assessment for septic management through cooperation of TDEC and TDA
- Community outreach events
- Annual advertising, workshops, meetings, and local media
- Site visits with land owners

Details are provided in the Valley Branch Restoration Project Work Plan and in the 319 FY-16 annual report:
https://www.tn.gov/content/dam/tn/agriculture/documents/landwaterstewardship/Annual%20Report%20319%20NPS.pdf.

BMP Name	Quantity	Cost/Unit	75% cost share	25% applicant participation	Total Estimate
Stream crossing	2800 sq ft	5.23/sq.ft.	10983.00	3,661	14,644.00
Fence	19,814 ft	2.01/ft	29869.61	9956.54	39,826.14
Riparian Buffers	15 ac	1041.88	11721.15	3907.05	15,628.20
Watering Facilities	15	2198.00 ea	24727.50	8242.50	32,970.00
Well	750 ft	18.15/ft	10209.38	3403.12	13,612.50
Pipeline	8000’	2.24/LF	13440.00	4480.00	17,920.00
Septic Repair, replacement	10	4200 ea	31500.00	10500.00	42,000.00
Septic maintenance	100	250 ea	18750.00	6250.00	25,000.00
TOTAL			**151,200.64**	**50,400.21**	**$201,600.84**

Table 3. BMP Practices Installed in Subwatersheds 0701 and 0702 in Red River Watershed.

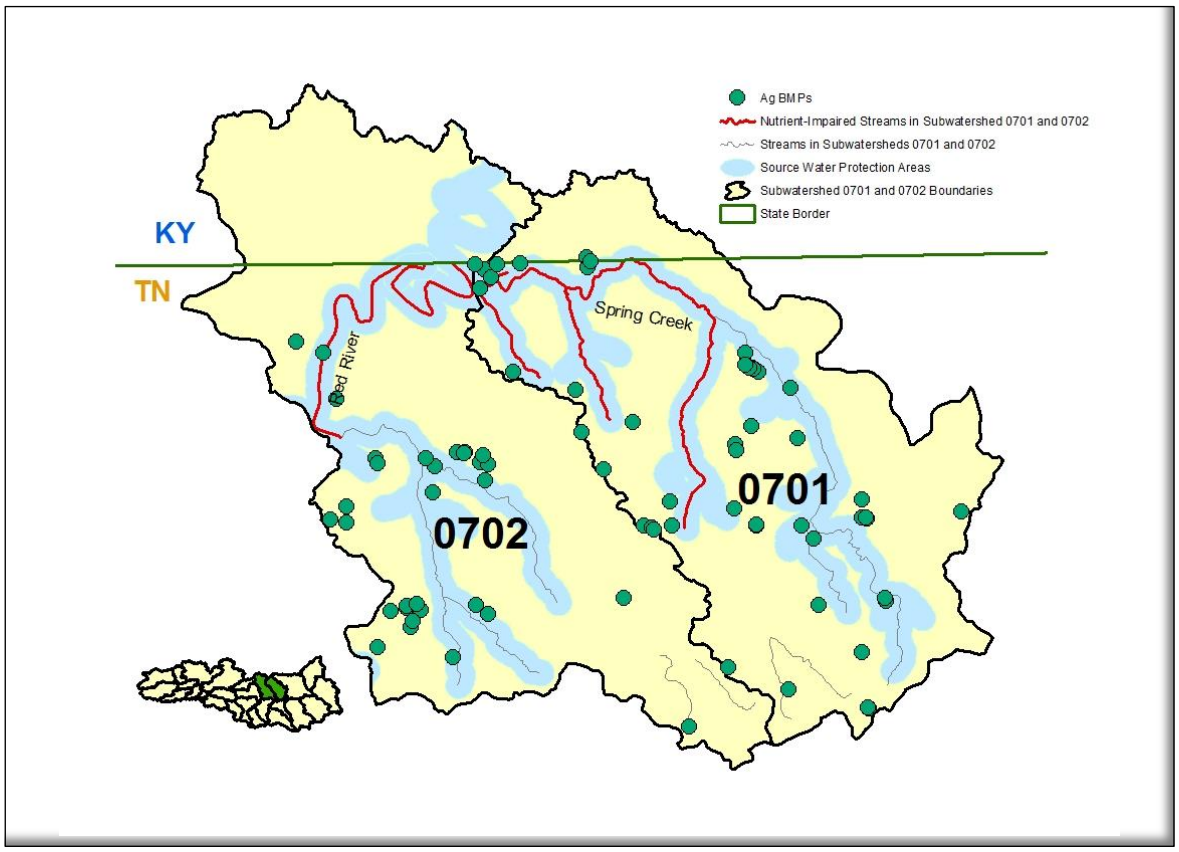

Figure 4. BMPs Installed in Valley Branch and Buzzard Creek Subwatersheds with Tennessee Department of Agriculture Funds from 2003 to 2014. *There are 96 BMPs installed using 319 or state (Agricultural Resource Conservation) funds. NRCS has installed at least an additional 38 practices in these subwatersheds between 2008 and 2017. Subwatershed 0701 is Valley Branch and 0702 is Buzzard Creek.*

The Tennessee Department of Agriculture has run EPA's STEP-L spreadsheet tool for BMPs implemented as part of 319 and Agricultural Resource Conservation Funds in Subwatersheds 0701 and 0702.

0701			**0702**		
Nitrogen	Phosphorus	Sediment	Nitrogen	Phosphorus	Sediment
13,582	1,438	404	32,757	10,038	5,940

Table 4. Nitrogen, Phosphorus, and Sediment Reductions due to BMPs Calculated using EPA STEP-L Program. *Numbers for nitrogen and phosphorus are in pounds per year; numbers for sediment are tons per year. Additional reductions due to NRCS-implemented BMPs are not shown.*

IV. Nonpoint Source Funding Opportunities and Commitment of Partners.

Project funding was a combination of EPA 319 funds ($175,000) and state Agriculture Resources Conservation Funds ($117,567) for a total of $292,567.

The Robertson County Soil Conservation District administered the funds for the restoration projects. Partners included NRCS and TDEC/DWR (ground water protection).

PARTNER	ACTIVITY
Robertson County SCS	Project administration for restoration projects
NRCS-Springfield Office	Technical support (BMPs, site evaluations, engineering assistance)
TDEC/DWR ground water staff	Landowner outreach, septic system permitting and design
TDEC/DWR assessment staff	Additional post-BMP stream assessments

Table 5. Partners and Their Roles in the Restoration Project. *SCS, Soil Conservation Service; NRCS, Natural Resources Conservation Service; TDEC, Tennessee Department of Environment and Conservation; DWR, Division of Water Resources; BMP, Best Management Practice.*

Community outreach and commitments were obtained at four stakeholder meetings throughout the subwatersheds over a two-year period.

MEETING	DATE	LOCATION
1	02/21/2014	Orlinda
2	02/23/2014	Adams
3	11/14/2014	Cedar Hill
4	02/04/2015	Barren Plains

Table 6. Stakeholder Meetings Schedule.

These meetings were helpful in understanding stakeholders' attitudes toward conservation practices and outcomes and working with them through appropriate messengers to offer financial and technical assistance as well as sustaining engagement with the agricultural community following completion of the project.

Informational flyers were sent to stakeholders:

- 70 informational flyers were sent to stakeholders on 04/15/2014
- 70 informational flyers were sent to additional stakeholders on 06/05/2015

Twenty-one stakeholders signed up to participate in restoration projects.

V. Date When Water Quality Standards are Expected to be Achieved.

The Valley Branch Project was extended until July, 2017, so many BMPs are still newly installed. According to our watershed approach schedule, additional monitoring is scheduled to occur in 2018. However, assessments conducted in 2015 already show improvement in the subwatersheds. TDEC monitoring data show an improvement in biology (after septic repair and replacement had been put in place). The relevant passage from the 2017 Assessment for Spring Creek is: “Stream appears to have improved biologically, but since numbers are borderline, and nutrient and pathogen concentrations are still elevated, we would like to see this stream pass again.” Therefore, we expect Spring Creek to meet water quality standards for nutrients after the next water quality assessment in 2019. There is no indication that the Red River biological community has changed (TDEC has one benthic sampling site in the main stem Red River), possibly because not enough time has elapsed since the BMPs were installed. When the biological community at this site improves, the stream will be considered for delisiting.

VI. Effectiveness Monitoring.

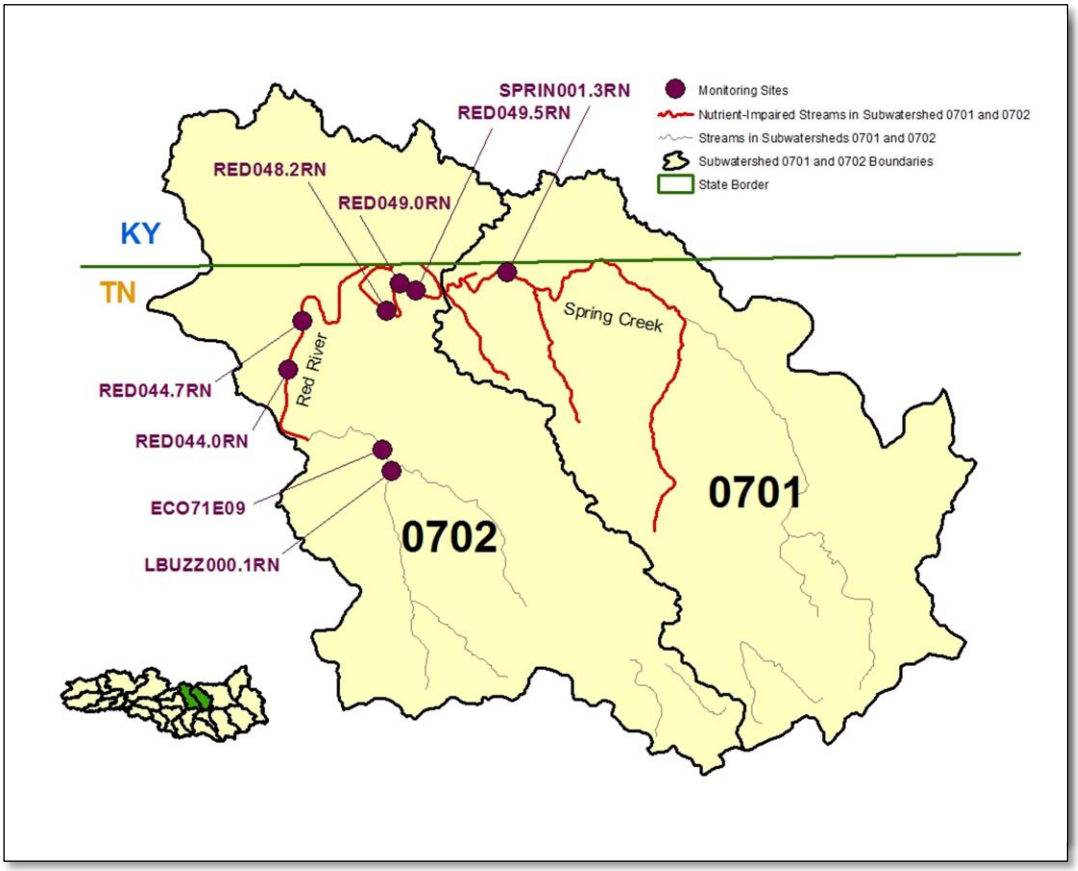

Figure 5. Illustration of Monitoring Sites in Subwatersheds 051302060701 and 051302060702. *Subwatershed 0701 is Valley Branch and 0702 is Buzzard Creek.*

Of the eight monitoring sites in the watershed, six are on the nutrient-impaired segments in subwatersheds 0701 and 0702:

MONITORING SITE	LOCATION	COUNTY
SPRIN001.3RN	Spring Creek @ RM 1.3	Robertson
RED049.5RN	Red River @ RM 49.5	Robertson
RED049.0RN	Red River @ RM 49.0	Robertson
RED048.2RN	Red River @ RM 48.2	Robertson
RED044.7RN	Red River @ RM 44.7	Robertson
RED044.0RN	Red River @ RM 44.0	Robertson

Table 7. Monitoring Sites on Nutrient-Impaired Waters in Subwatersheds 0701 and 0702. RM, River Mile.

Two sites are located on streams not impaired by nutrients:

MONITORING SITE	LOCATION	COUNTY
ECO71E09	Buzzard Creek @ RM 1.3	Robertson
LBUZZ000.1RN	Little Buzzard Creek @ RM 0.1	Robertson

Table 8. Additional Monitoring Sites in Subwatershed 0702. RM, River Mile.

Nitrogen

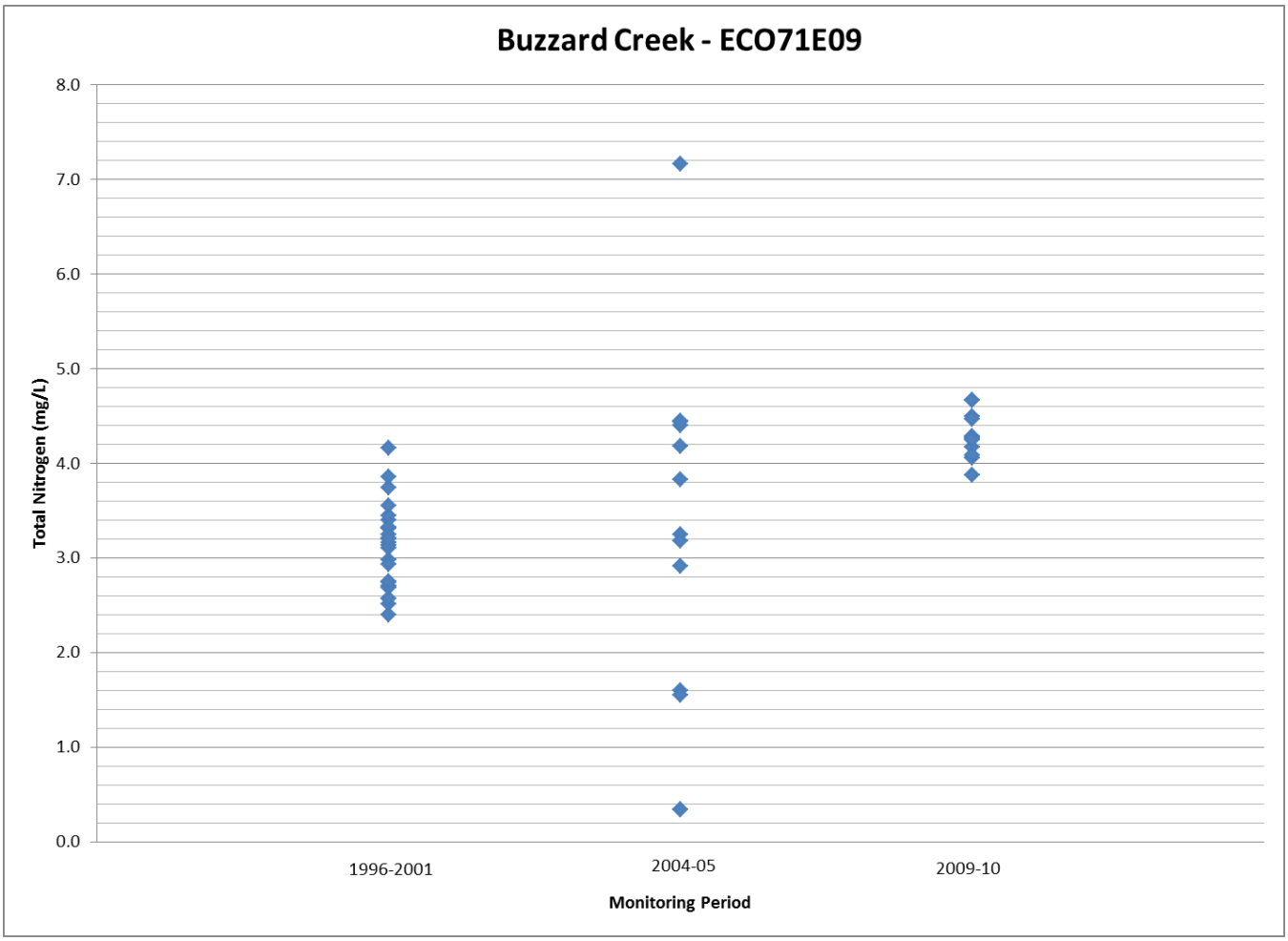

Figure 6. Total Nitrogen Data from ECO71E09 (Buzzard Creek) Monitoring Site.

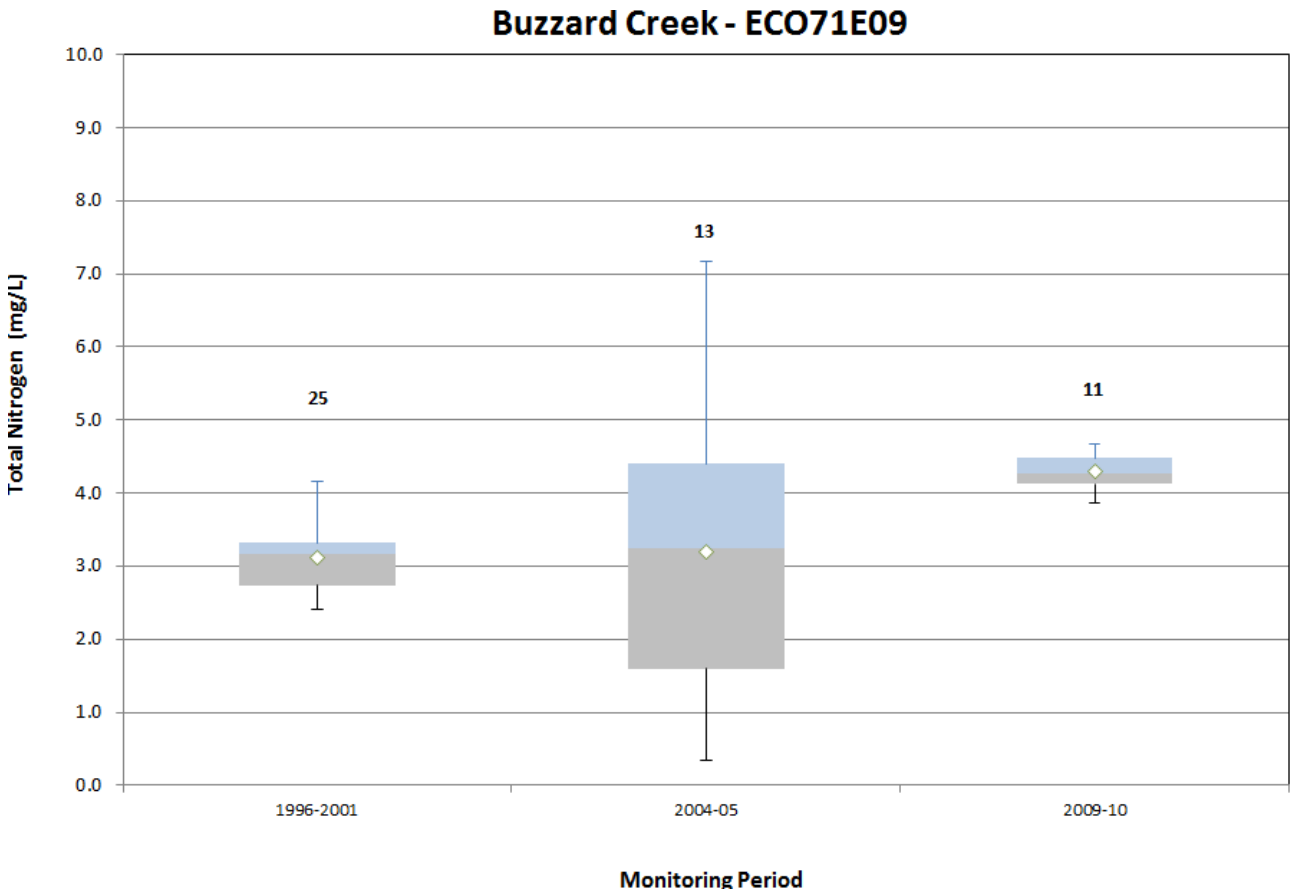

Figure 7. Comparison of Total Nitrogen at ECO71E09 Monitoring Site (Buzzard Creek) 1996-2001 through 2009-2010 monitoring seasons. *Numbers indicate number of samples in the analysis (n).*

Figures 6 and 7 illustrate that there were no reductions in instream nitrogen concentrations in station ECO71E09 (Buzzard Creek) from 1996-2001 to 2009-2010 sampling seasons.

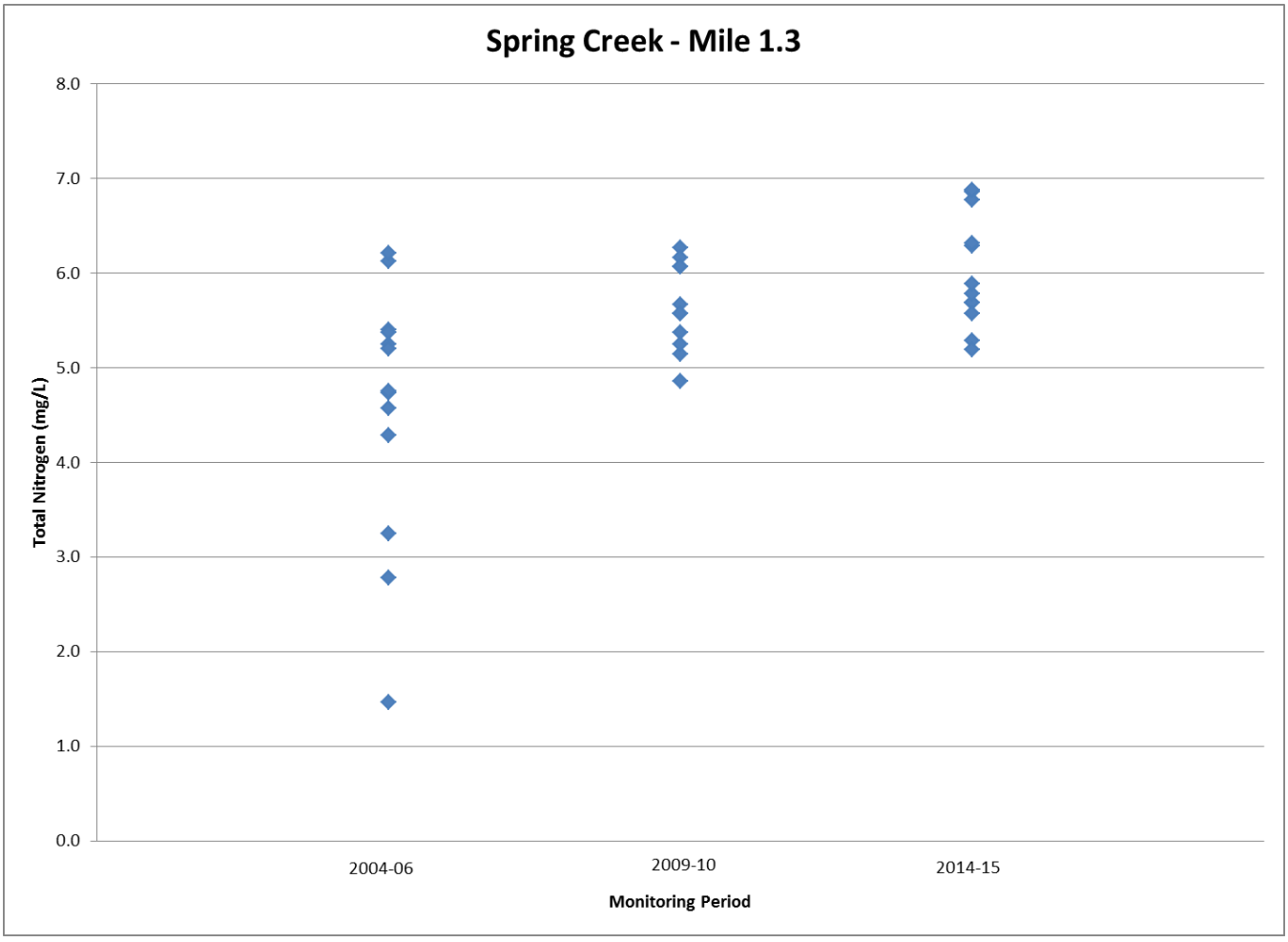

Figure 8. Total Nitrogen Data from Spring Creek@ RM 1.3 Monitoring Site. *RM, River Mile.*

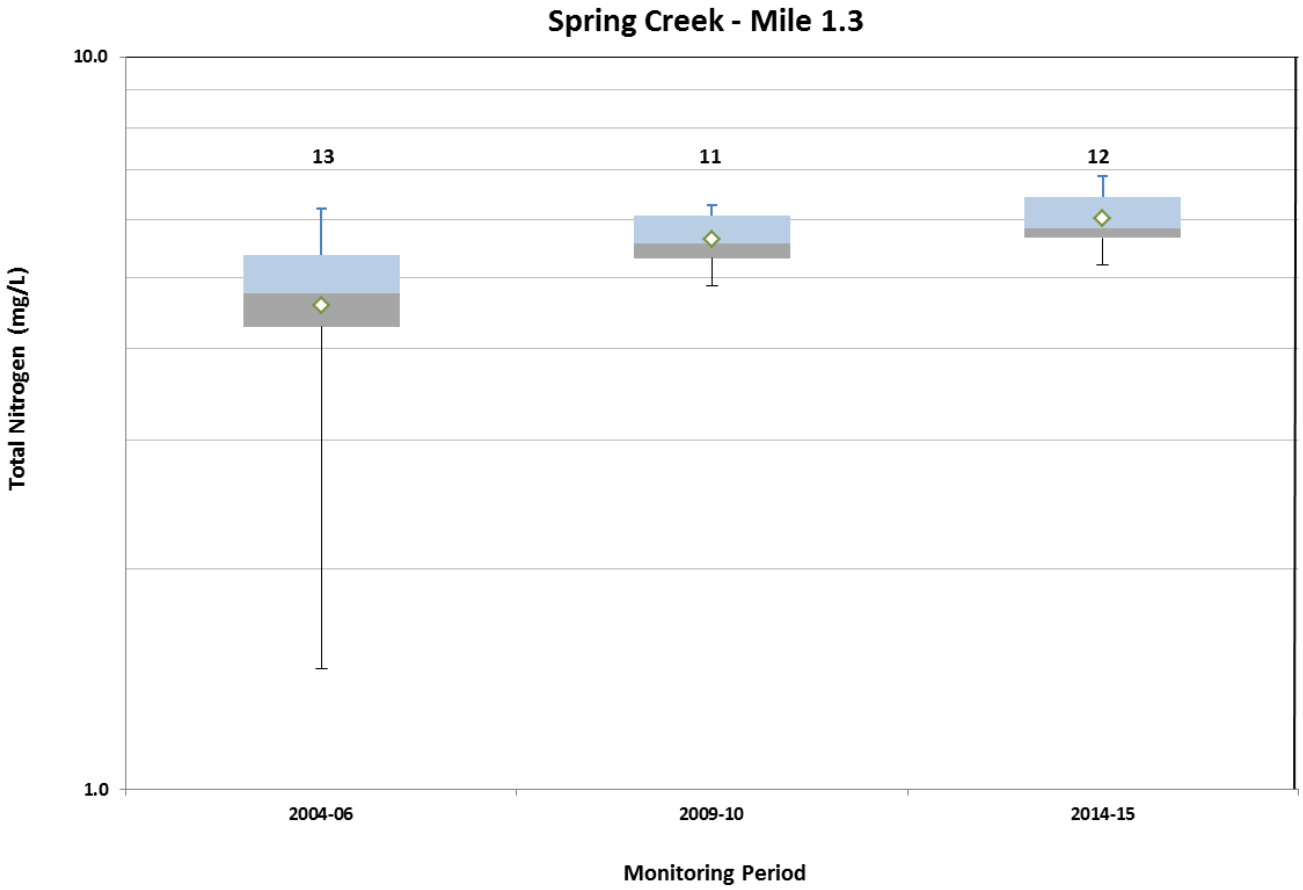

Figure 9. Comparison of Total Nitrogen at Spring Creek @ RM 1.3 Monitoring Site (Spring Creek) 2004-2006 through 2014-2015 monitoring seasons. *Numbers indicate number of samples in the analysis (n).*

Figures 8 and 9 illustrate that there were no reductions in instream nitrogen concentrations from 2004-2006 to 2014-2015 sampling seasons at Spring Creek at river mile 1.3. The pattern over the years was similar to the ecoregion site shown in Figures 6 and 7.

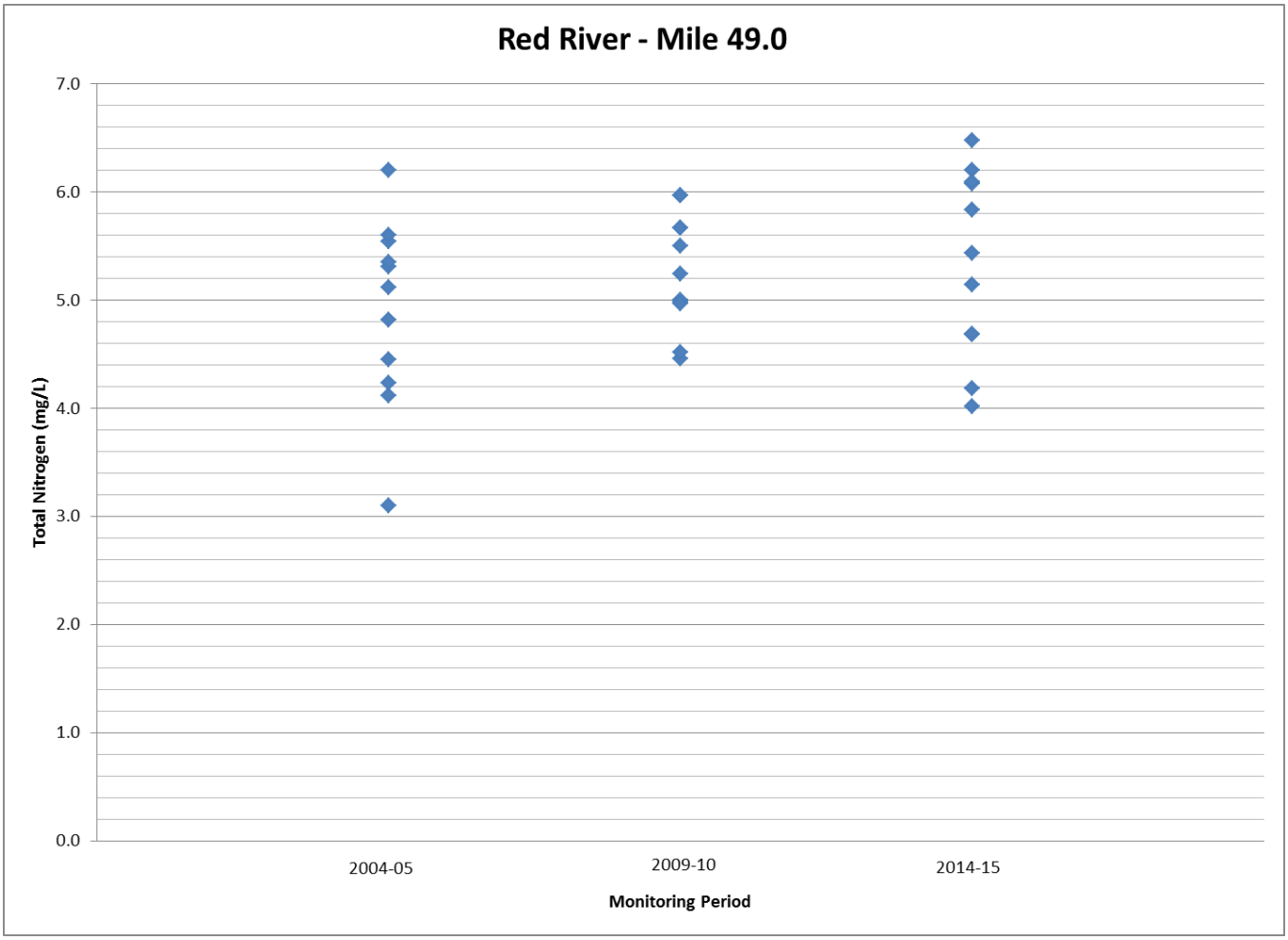

Figure 10. Total Nitrogen Data from Red River @RM 49.0 Monitoring Site. *RM, River Mile.*

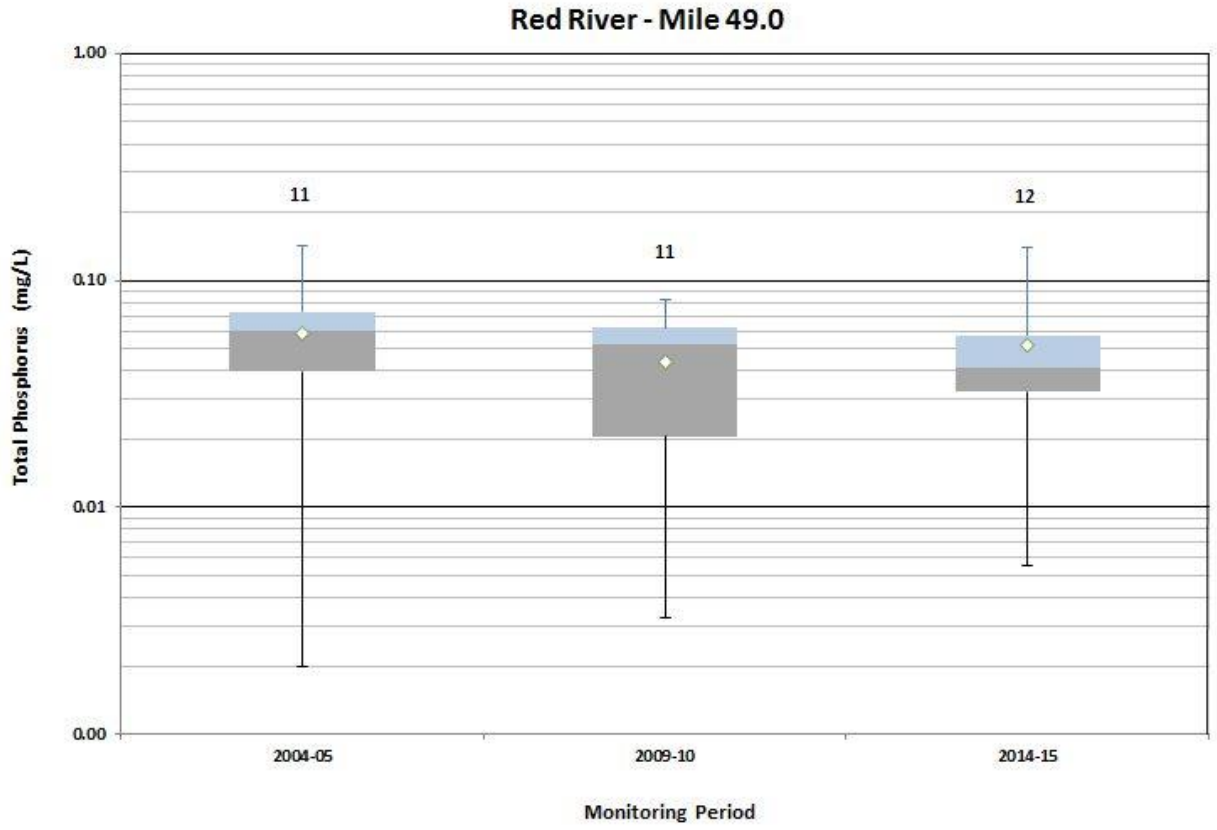

Figure 11. Comparison of Total Phosphorus at Red River @ RM 49.0 Monitoring Site 2004-2006 through 2014-2015 monitoring seasons. *Numbers indicate number of samples in the analysis (n).*

Figures 10 and 11 illustrate that there were no reductions in instream nitrogen concentrations from 2004-2005 to 2014-2015 sampling seasons at Red River at river mile 49.0. The pattern over the years was similar to the ecoregion site shown in Figures 6 and 7.

Phosphorus

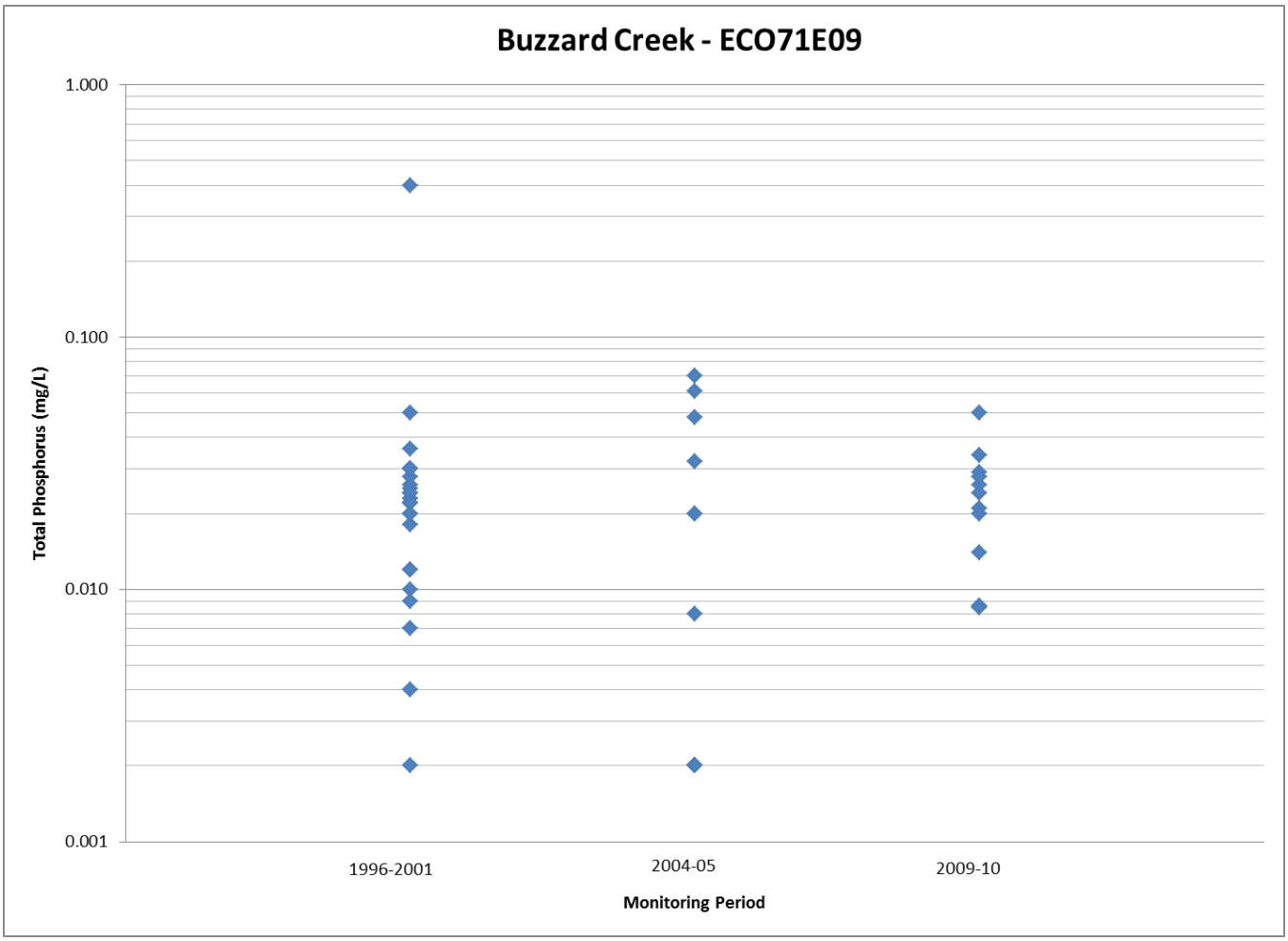

Figure 12. Total Phosphorus Data from ECO71E09 (Buzzard Creek) Monitoring Site.

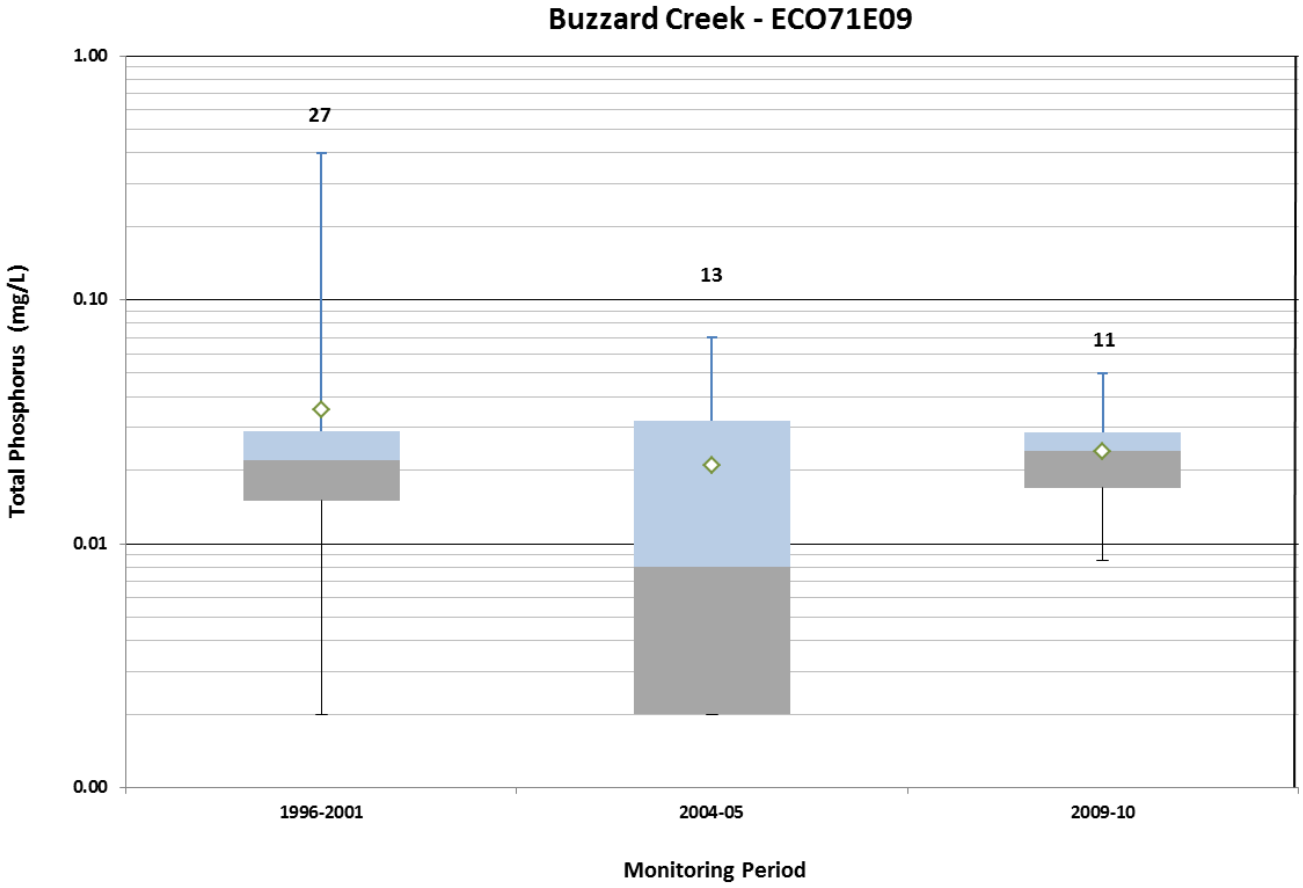

Figure 13. Comparison of Total Phosphorus at ECO71E09 Monitoring Site (Buzzard Creek) 1996-2001 through 2009-2010 monitoring seasons. *Numbers indicate number of samples in the analysis (n).*

Figures 12 and 13 illustrate that there were no reductions in instream phosphorus concentrations in station ECO71E09 (Buzzard Creek) from 1996-2001 to 2009-2010 sampling seasons.

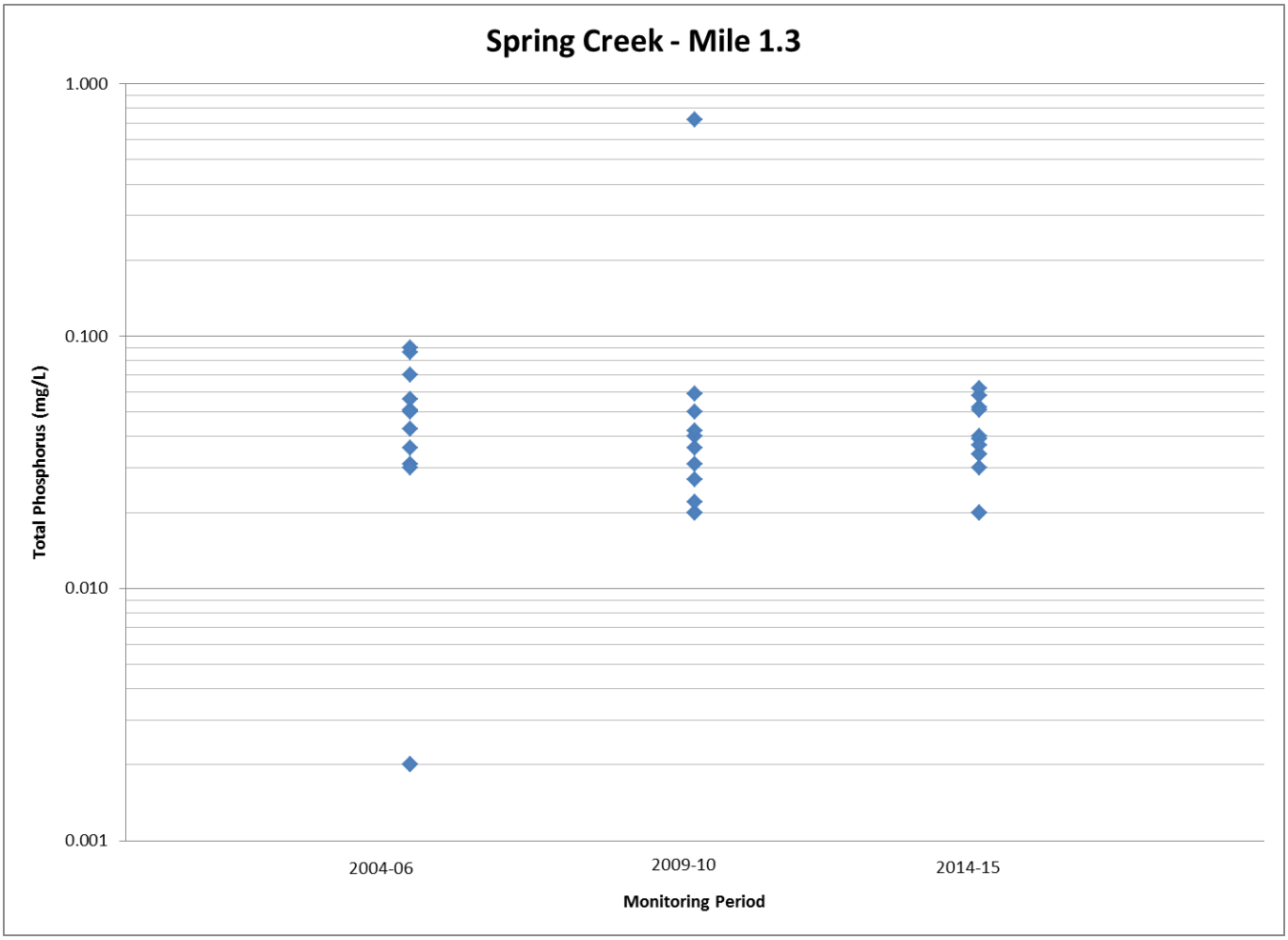

Figure 14. Total Phosphorus Data from Spring Creek at RM 1.3 Monitoring Site. *RM, River Mile.*

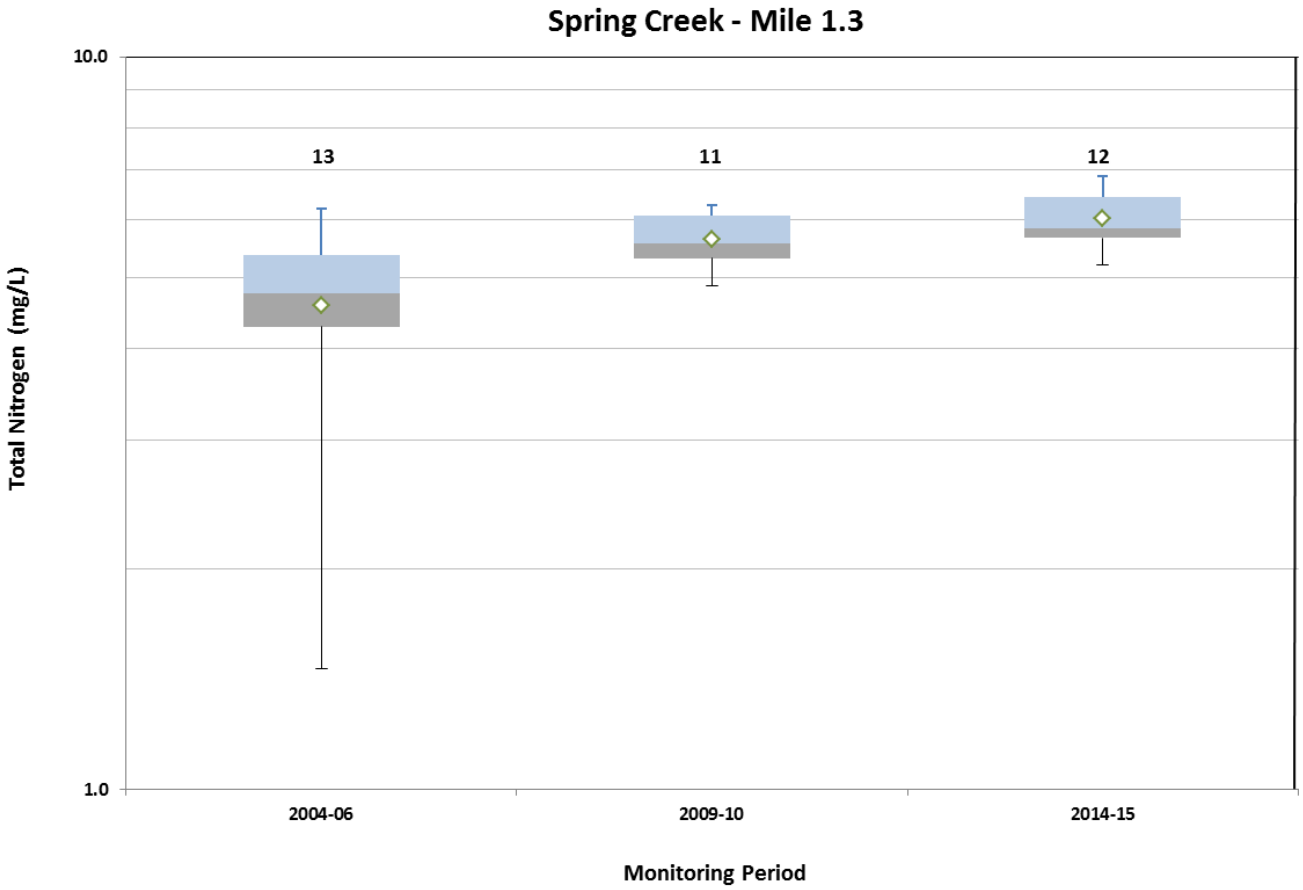

Figure 15. Comparison of Total Phosphorus at Spring Creek @ RM 1.3 Monitoring Site 2004-2006 through 2014-2015 monitoring seasons. *Numbers indicate number of samples in the analysis (n).*

Figures 15 and 16 illustrate that there were no reductions in instream phosphorus concentrations from 2004-2005 to 2014-2015 sampling seasons at Spring Creek at river mile 1.3. The pattern over the years was similar to the ecoregion site shown in Figures 12 and 13.

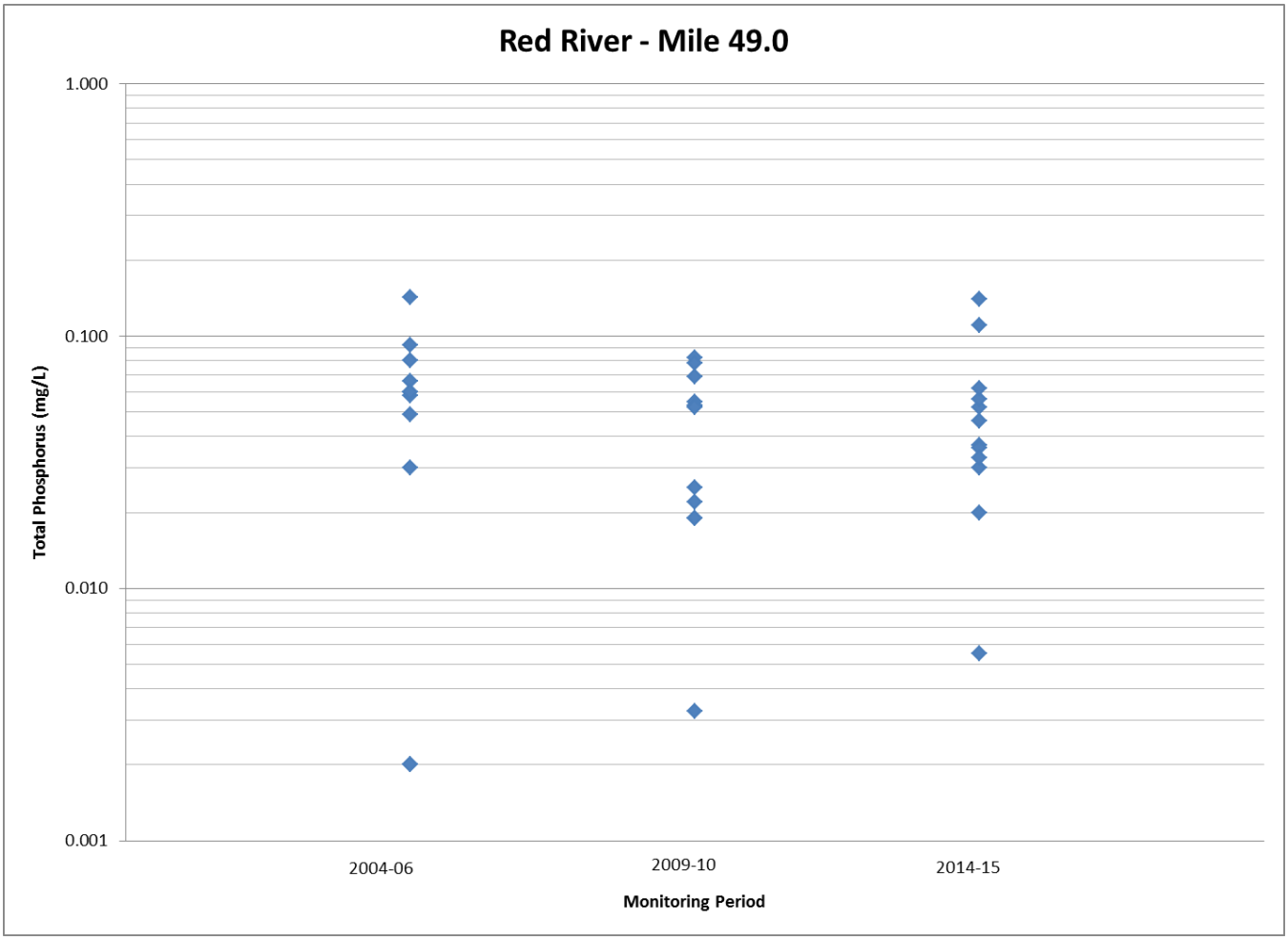

Figure 16. Total Phosphorus Data from Red River at RM 49.0 Monitoring Site. *RM, River Mile.*

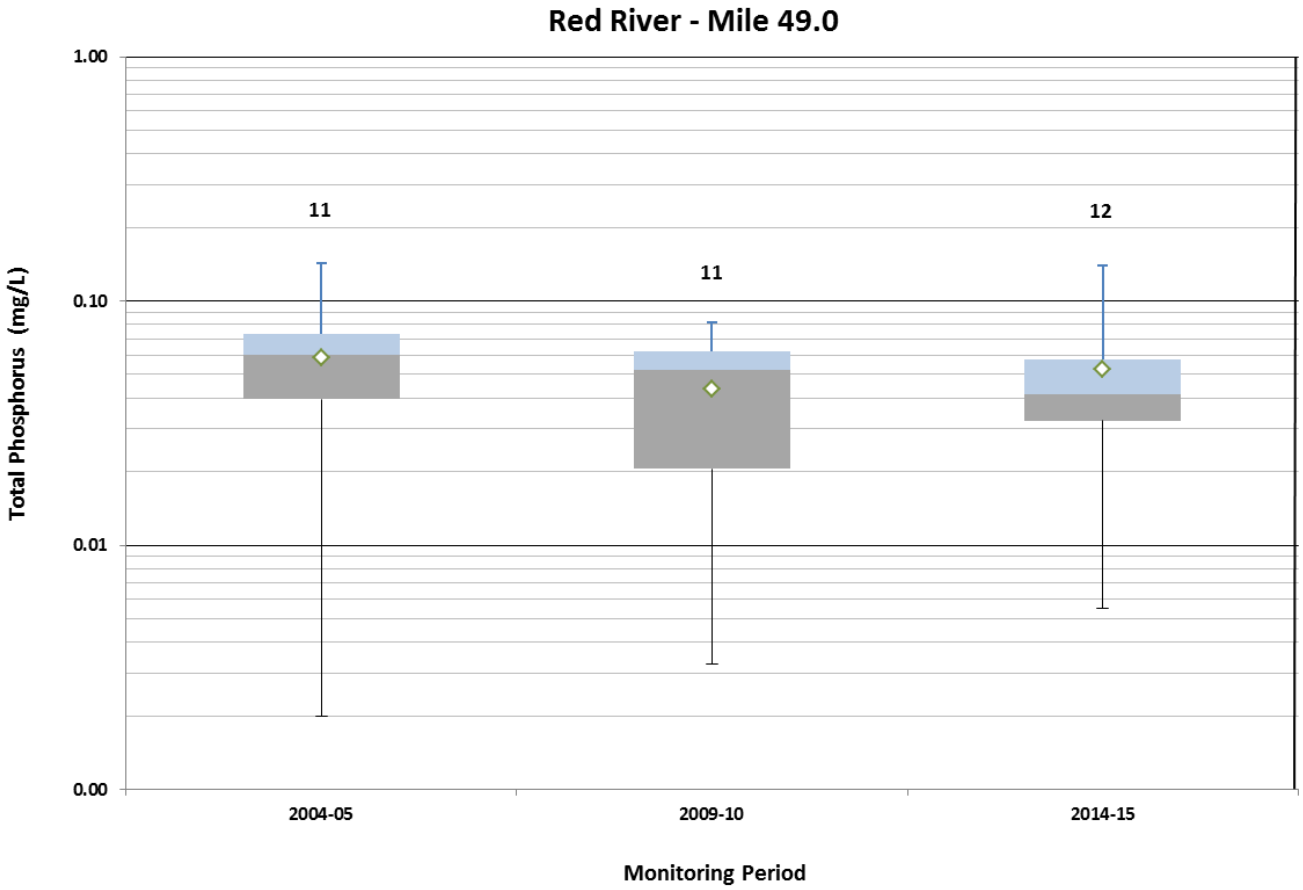

Figure 17. Comparison of Total Phosphorus at Red River @ RM 49.0 Monitoring Site 2004-2006 through 2014-2015 monitoring seasons. *Numbers indicate number of samples in the analysis (n). RM, River Mile.*

Figures 16 and 17 illustrate that there were no reductions in instream phosphorus concentrations from 2004-2005 to 2014-2015 sampling seasons at Red River at river mile 49.0. The pattern over the years was similar to the ecoregion site shown in Figures 12 and 13.

Tennessee's nutrient water quality standards are narrative and have both a chemical (nutrients) and biological (*e.g.*, benthic macroinvertebrates) component. Benthic macroinvertebrate data were collected from two sites (Red River and Spring Creek) before the Spring Creek Plan was fully implemented.

SITE	DATE	TMI	TOTAL TAXA	%EPT-CHEUM	% NUTRIENT TOLERANT	HABITAT SCORE
RED044.0RN	10/14/2010	40	29	51.8	26.1	154
RED044.0RN	11/14/2014					135

Table 9. Benthic Macroinvertebrate Data from Monitoring Site at Red River at River Mile 44.0. *TMI, Tennessee Macroinvertebrate Index; EPT, Ephemeroptera, Plecoptera, Trichoptera; Cheum, Cheumatopsyche.*

SITE	DATE	TMI	TOTAL TAXA	%EPT-CHEUM	% NUTRIENT TOLERANT	HABITAT SCORE
RED049.0RN	8/19/2000					125

Table 10. Benthic Macroinvertebrate Data from Monitoring Site at Red River at River Mile 49.0. *TMI, Tennessee Macroinvertebrate Index; EPT, Ephemeroptera, Plecoptera, Trichoptera; Cheum, Cheumatopsyche.*

SITE	DATE	TMI	TOTAL TAXA	%EPT-CHEUM	% NUTRIENT TOLERANT	HABITAT SCORE
RED049.5RN	10/21/2010					138
RED049.5RN	10/23/2013					122

Table 11. Benthic Macroinvertebrate Data from Monitoring Site at Red River at River Mile 49.5. *TMI, Tennessee Macroinvertebrate Index; EPT, Ephemeroptera, Plecoptera, Trichoptera; Cheum, Cheumatopsyche.*

SITE	DATE	TMI	TOTAL TAXA	%EPT-CHEUM	% NUTRIENT TOLERANT	HABITAT SCORE
SPRIN001.3RN	7/6/2006	32	25	18.3	9.6	123
SPRIN001.3RN	7/16/2015	34	34	15.6	29.7	134

Table 12. Benthic Macroinvertebrate Data from Monitoring Site at Spring Creek at River Mile 1.3. *TMI, Tennessee Macroinvertebrate Index; EPT, Ephemeroptera, Plecoptera, Trichoptera; Cheum, Cheumatopsyche.*

Data Summary for Red River Monitoring Sites:

- Data from Red River are primarily habitat data due to river depth.
- The sole macroinvertebrate data from Red River (RED044.0RN on 10/14/2010) showed a passing Tennessee Macroinvertebrate Index (TMI) score (Passing score is 32). More information about Tennessee's TMI score is in TDEC's Benthic macroinvertebrate SOP at: https://www.tn.gov/content/dam/tn/environment/water/documents/DWR-PAS-P-01-Quality_System_SOP_for_Macroinvertebrate_Stream_Surveys-081117.pdf.

Data Summary for Spring Creek Monitoring Site:

- TMI Score. TMI scores were passing scores for 2006 and 2015 (Passing score is 32).
- Total Taxa. Total Taxa have increased over time indicating an increase in macroinvertebrate diversity.
- %EPT-Cheum. This category is a finer-tuned representation of aquatic health than EPT because it excludes macroinvertebrates that are not clean water organisms (Cheumatopsyche). The data indicate a slight decrease over time.
- % Nutrient Tolerant. The data indicate an increase in nutrient-tolerant organisms over time, indicating a decrease in water quality.
- Habitat Score. The most recent data indicate a passing score for habitat (a passing score for Ecoregion 71e in this season is 130).

It's important to note that these data were collected as the BMPs were being implemented or shortly after some were implemented indicating that more time post-BMP implementation is needed before additional improvement is documented.

VII. Current and Future Activities.

Although the project terminated in July 2017, work continues in Red River subwatersheds 0701 and 0702. TDA has funded three BMP projects since July 2017 (alternative watering facilities).

TDA projects are requested through an RFP every December 1.

NRCS has implemented eighty-four BMPs designed to reduce nutrients directly or indirectly (reduce livestock access) since July 2017. These additional BMPs include:

- Nutrient management
- Nitrification Inhibitors
- Cover Crops
- Alternative watering facilities

NRCS continues to fund projects through EQIP.

VIII. Further Information.

For further information about TMDLs and 5-alt documents in Tennessee, visit the TDEC/DWR web site: https://www.tn.gov/environment/program-areas/wr-water-resources/watershed-stewardship/tennessee-s-total-maximum-daily-load--tmdl--program.html

Technical questions regarding this 5-alt report should be directed to:

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LIST of INITIALS and ACRONYMS USED

303(d). Section 303(d) of the Clean Water Act that addresses impaired waters.

BMP. Best Management Practice.

CWA. Clean water Act.

EPA. Environmental Protection Agency.

FY. Fiscal Year.

HUC. Hydrologic Unit Code.

NRCS. Natural Resources Conservation Service.

RM. River Mile.

TDA. Tennessee Department of Agriculture.

TDEC. Tennessee Department of Environment and Conservation.

TMDL. Total Maximum Daily Load.

TMI. Tennessee macroinvertebrate Index.

REFERENCES CITED

Tennessee Prioritization of TMDLs document under the New Vision
https://www.tn.gov/content/dam/tn/environment/water/documents/wr-ws_tmdl-priority-framework-101415.pdf

TDEC Watershed Approach
https://www.tn.gov/environment/program-areas/wr-water-resources/watershed-stewardship/watershed-management-approach.html.

C. Jerry Nelson (editor). Conservation Outcomes from Pastureland and Hayland Practices: Assessment, Recommendations, and Knowledge Gaps. Chapter 5: Nutrient Management on Pastures and Haylands (Wood, C.W., Moore, P.A., Joern, Brad C., Jackson, R.D., and Cabrera, M.L.). 2012. https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1080496.pdf.