Friends of the Teton River

2015 Water Quality Monitoring Program Report: Upper Teton River Watershed

Water quality monitoring remains a critical tool for maintaining and protecting our valuable water resources.

Program Introduction

Water quality in Teton Valley is an area of strong concern to residents, visitors, natural resource experts, and governmental agencies. Although the rapid rate of growth and development in the Valley has slowed in the past several years, significant concerns remain about the effect of changing land use practices on water quality. Adverse changes in the upper Teton River have been observed over the last several decades, including increased siltation, hydrologic alteration, elevated levels of nitrates, elevated levels of bacteria, and a sharp decline in the native Yellowstone cutthroat trout population.

The upper Teton River runs from its headwaters on the western side of the Teton Range in Teton County, Wyoming, through Teton Valley to Highway 33 in Teton County, Idaho. In 1998, the United States Environmental Protection Agency (EPA) designated the upper Teton River (from the headwaters to Highway 33) and many of its tributaries as impaired under Section 303 (d) of the federal Clean Water Act (CWA). EPA listed excessive nutrients, temperature increases, flow alterations, and sedimentation as the causes of impairment. In response to these listings, Friends of the Teton River (FTR) designed and implemented a water quality monitoring program for the upper Teton River watershed in 2001.

Initially, Idaho Department of Environmental Quality (IDEQ) funded the water quality monitoring program as it collected data from twelve (12) monitoring sites located throughout Teton County, Idaho, and Teton County, Wyoming, at four (4) times per year (see Figure 1 depicting the location of all monitoring sites). In 2005, the Wyoming Teton Conservation District (TCD) also contributed support to the program by providing funding for data collection on the Wyoming tributary sites located in Teton County, Wyoming. The funding originally allocated by IDEQ to the program in Teton County, Idaho, was discontinued due to budgetary cuts within the state in 2009. Since 2009, FTR has solicited private funding to continue the monitoring program in Teton County, Idaho, on a reduced schedule. The reduced schedule provides for data collection from eleven (11) monitoring sites located throughout Teton, County, Idaho, and Teton County, Wyoming, at two (2) times per year. FTR summarizes the data collected by its water quality monitoring program annually and provides its findings to IDEQ, TCD, and the general public upon request.

This report contains a summary of FTR's water quality monitoring program and provides a basic analysis of data collected by the program since its inception in 2001. This report also provides information relevant to the goals of the program, sampling protocols, data analysis, and recommendations for the program's future.

Program Goals

The goals of FTR's water quality monitoring program include: continuing to develop a long-term water quality database for the upper Teton watershed, analyzing and interpreting the results of collected data, and identifying the source(s) of water quality problems. The program's goals also include designing, implementing, and monitoring the progress of remediation efforts. The program additionally incorporates the following measurable objectives:

(1) Produce a set of water quality data for the upper Teton River on an annual basis;
(2) Continue to identify seasonal, long-term or other trends in water quality;
(3) Continue to identify potential sources of water pollution;
(4) Identify sources and remediation strategies for impaired water quality;
(5) Work with IDEQ, TCD and other agencies to manage water quality issues;
(6) Alert and educate the public about water quality issues; and
(7) Provide the public with an accurate assessment of surface water quality.

Sampling Program Summary

FTR's water quality monitoring program currently includes eleven (11) sampling sites (see Figure 1 depicting the location of all monitoring sites. Please note that TR-2 is no longer a sampling site). The eleven (11) sampling sites were strategically selected to represent the widest range of hydrologic conditions in Teton Valley as well as potential areas of water quality concern. The sampling sites can be divided into three hydrologic categories. These sites include:

(1) three main stem Teton River sites (TR-1, TR-3, TR-4);
(2) five valley-floor tributaries or "spring creeks" (Woods Creek (WOODS), Six Springs (SIX), Fish Creek (FISH), lower Fox Creek (FOX-1) and Warm Creek (WARM)); and
(3) three headwater-tributary background sites, located on the east side of Teton Valley draining the west slope of the Teton Mountains on United States Forest Service land (including Darby Creek (DAR), Teton Creek (TC-2), and upper Fox Creek (FOX-2)).

Table 1 lists the sampling sites by stream and indicates the impairment status of each stream, as required by section 303(d) of the CWA. FTR selected the monitoring sites with the assistance of IDEQ, TCD, US Forest Service, the Idaho Department of Fish and Game, and the Teton Regional Land Trust.

In 2015, FTR continued the program with limited change from previous years with respect to the sampling sites, the measured laboratory parameters, and the measured field parameters. Due to the constraints imposed by limited funding, the 2015 program collected data from the sampling sites on only two occasions, July and October.

At each sampling site, samples were collected and laboratory analyzed for total non-filterable residue (TSS), total dissolved solids (TDS), nitrogen-nitrate/nitrite, ammonia, total phosphorus, and *E. coli* bacteria. In 2015, the laboratory also tested Woods Creek samples for ortho-phosphorus. The samples included one blank sample and one duplicate sample collected for quality assurance/quality control (QA/QC) purposes. The QA/QC sites for 2015 are labeled as TR-2 and FOX-3, respectively. FTR also measured field parameters for dissolved oxygen, specific conductance, pH, temperature and turbidity at each site.

FTR staff review all of the field and analytical data generated by each sampling event to ensure that all necessary observations, measurements, and analytical results have been properly measured and recorded. Furthermore, IDEQ peer reviews the results for accuracy and completeness. FTR stores the completed field and analytical data on field data sheets and in spreadsheets. FTR data is available to the general public upon request. Intermountain Analytical Services-EnviroChem (IAS-EnviroChem) in Pocatello, Idaho, analyzes all laboratory samples collected by FTR. Table 2 provides a list of IAS-EnviroChem laboratory parameters, analytical methods, preservation and holding times. Table 3 contains a list of field measurements, equipment, and calibration methods.

Evaluation of Results

FTR annually prepares graphs depicting concentration and date-of-sampling for selected parameters in order to analyze trends. Particular attention is devoted to pollutants of concern in Woods Creek, such as nitrates, nitrites, *E. coli* bacteria, and total phosphate and ammonia. The following is a discussion of the water quality monitoring program results for 2015.

Nitrate + Nitrite

Please refer to the attached concentration vs. date of sampling plots (Figures 1N – 11N) for nitrate and nitrite (NO_2 + NO_3). 2015 nitrogen levels are generally comparable to those of the past several years. The discussion of each individual sample contains detailed nitrogen information.

EPA established recommended nutrient criteria for rivers and streams throughout the various regions of the United States based upon established recommended reference conditions. In southeast Idaho and western Wyoming, the applicable nutrient criteria for nitrates and nitrites is 0.04 mg/L, with reported values ranging from 0.01 mg/L to 7.95 mg/L.[1] Nitrogen levels at all of our sampling sites are above EPA's recommended limit.

The lower segment of the Teton River, from Highway 33 to Bitch Creek, is currently listed as nutrient impaired pursuant to section 303(d) of the CWA. In this segment, the Teton River Subbasin Assessment and Total Maximum Daily Load issued by IDEQ in 2003 prohibits target concentrations of dissolved nitrogen (NO_2 + NO_3 - N) in excess of 0.3 mg/L.[2] Despite the prohibitions imposed by the Teton River Subbasin Assessment and Total Maximum Daily Load, the upper segments of the Teton River (the headwaters to Trail Creek and Trail Creek to Highway 33) are not currently listed as nutrient impaired under section 303(d) of the CWA.

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[1] This portion of Idaho and Wyoming are included in level III ecoregion 17; The Upper Teton River Basin is located in EPA's Ecoregion II, which is also known as the Western Forested Mountains region. The ecoregion criteria for the Western Forested Mountains region offers suggested standards for Total Phosphorus, Total Nitrogen, Chlorophyll a, and Turbidity for rivers and streams in the region. The Ambient Water Quality Criteria Recommendations for the Western Forested Mountains region can be reviewed at: http://water.epa.gov/scitech/swguidance/standards/criteria/nutrients/upload/2007_09_27_criteria_nutrient_ecoregions_rivers_rivers_2.pdf.

[2] *See*, http://www.IDEQ.idaho.gov/media/452220-teton_river_entire.pdf, p. 78.

Significantly, nitrogen concentrations in the upper segment of the Teton River often exceed those found downstream in the lower segments. In 2012, IDEQ conducted an intensive water quality assessment that collected water quality data from sampling sites TR-1, TR-3, and TR-4 on a monthly basis. Table 4 depicts the data collected by IDEQ in 2012. Although the data collected by IDEQ in 2012 exhibited elevated nitrogen levels consistent with FTR's data, IDEQ ultimately determined that the upper segments of the Teton River did not warrant listing pursuant to section 303(d) of the CWA. From FTR's perspective, the current water quality criteria in Idaho for nutrients significantly limited IDEQ's ability to conclude that the upper segments of the Teton River are not impaired.

The most noticeable abnormality in the nitrogen data collected by FTR throughout the course of this program is a significant break reflecting a decrease ($\geq$ -0.5 mg/L) in the nitrogen concentrations at most sites, with the exception of SIX and WOODS) between 2004 and 2005. The reason(s) for the 2005 decrease in nitrogen concentrations is unknown. Previously, FTR hypothesized that lower nitrogen concentrations could be related to higher streamflows, resulting in the dilution of nitrogen concentrations. A decrease in nitrogen levels could also reflect changes in land use throughout the upper Teton River Subbasin.

Teton River sites:
Nitrogen trends in the main stem of the Teton River continue to show a gradual decrease in the downstream direction (TR-1>TR-3>TR-4). Typically, nitrogen concentrations increase in a downstream direction as the number of point and nonpoint sources also increases in this direction. In the Teton River, however, this is an inverse relationship. In 2015, total nitrogen levels for the sampling events at TR-1 averaged 1.27 mg/L, while the mean total nitrogen levels were 0.99 mg/L and 0.85 mg/L at TR-3 and TR-4, respectively.

TR-1 is located upstream of the point at which major Teton River tributaries emerging from the Teton Mountain range join the main stem of the Teton River, and it evidences the greatest total nitrogen concentration of all the Teton River sampling sites. FTR hypothesizes that agricultural operations located upstream of TR-1, including a dairy farm and a horse farm, could be contributing to the elevated nitrogen levels found at TR-1. Although there is no proof that these upstream agricultural operations are the direct source of elevated nitrogen levels in the upper Teton River, IDEQ acknowledges that nutrient impairment is often caused by agricultural operations, particularly in the Teton River Subbasin.

Valley tributaries:
The valley tributaries tend to yield varied nitrogen concentrations, and the tributary with the highest concentration is typically Six Springs. In 2015, total nitrogen levels for the sampling events at Six Springs averaged 4.2 mg/L, which is consistent with data that typically averages more than 3 mg/L and often more than 4 mg/L at the site. The second highest nitrogen concentrations on the valley floor occur at the FOX-1 site, with annual averages in the 1.75-2.10 mg/L range. The 2015 average total nitrogen concentration at FOX-1 was 1.83 mg/L, which is consistent with nitrogen levels occurring in recent years.

The elevated areas adjacent to Six Springs include a portion of the Darby Creek alluvial fan, which encompasses a significant percentage of fertilized agricultural land. To date, the catchment area for this site has seen relatively little subdivision development, which indicates that the elevated nitrogen concentrations could be related to the area's agricultural land use practices. FTR has no way of determining the extent or location of the impact that these land use practices might have on the Six Springs area. Furthermore, FTR is unable to conduct the water quality testing necessary to understand the impact of these consistently elevated nitrogen levels on the watershed without additional funding.

The second highest average concentration of total nitrogen among the study sites typically occurs at the FOX-1 site. Unlike Six Springs, the trend line at FOX-1 has been essentially flat since 2005, when concentrations dropped by at least 0.5 mg/L from events in 2005. This could be due to decreased agricultural land use practices in the catchment area up-gradient of the FOX-1 site. The overall trend line has remained relatively flat since 2005, remaining in the range of 1.8-2.2 mg/L. In 2012, nitrogen testing demonstrated a significant drop in nitrogen levels, with readings of 1.55 mg/L and 1.79 mg/L. Nitrogen testing in 2013 revealed newly elevated nitrogen levels, with readings of 1.57 and 2.34 mg/L in July and October, respectively. Furthermore, in 2013, the second highest average concentration of total nitrogen among the study sites actually occurred at Woods Creek, demonstrating nitrogen levels of 1.9 and 2.52 mg/L in July and October, respectively. This variation in data is unknown and more data is necessary to determine if this is the start of a new trend or an isolated event.

Nitrogen levels in Woods Creek were also similar to previous years in 2015, with readings of 1.46 and 1.38 mg/L at the July and October sampling events, respectively. The Woods Creek site is stationed immediately downstream of the municipal wastewater treatment facility in Driggs, and the site remains a tributary of concern for all quality parameters due to its location.

Nitrogen levels in Fish Creek were similarly low in 2015, with readings of 0.44 and 0.54 mg/L at the July and October sampling events, respectively. Nitrogen levels in Fish Creek have not risen above the 1.0 mg/L mark since 2004. Until 2013, Fish Creek had shown the most significant drop in nitrogen concentrations of the valley tributaries, with readings less than 1.0 mg/L between 2005 and 2012. The Fish Creek site typically has the second lowest concentration of nitrogen among the valley locations, which is likely attributable to a smaller catchment area and less impact from agricultural land use practices than at the Six Springs site. Immediately upstream of the Fish Creek site is a portion of the Darby Creek alluvial fan that is largely undeveloped and unfertilized, and the area consists primarily of dry grazing lands covered by sagebrush.

Nitrogen levels in Warm Creek have remained consistently low, less than or equal to 0.3 mg/L dating back to events in 2008. The 2015 nitrogen data indicated similar nitrogen levels, with readings of <0.5 and 0.4 mg/L at the July and October sampling events, respectively. A series of springs flows through the valley forming Warm Creek, and the Warm Creek site is located just downstream of the golf course and resort community in Victor, Idaho.

Mountain tributaries:
The mountain tributary sites generally show the lowest average nitrogen concentrations for a group of sites, with each event averaging readings less than or equal to 0.5 mg/L since 2008. In 2005, these levels showed the same -0.5 mg/L decline in total nitrogen concentrations as some of

the valley sites. Nitrogen levels for these sites remained near or below the 0.5 mg/L mark in 2015. Although these tributaries flow from the mountains to the valley in a parallel pattern, the valley's vast topographical features create distinct and unique characteristics in each mountain tributary. Water quality data remains congruent among the mountain tributary sites, which could be attributable to similar conditions created by seasonal snowmelt in the mountain areas. The consistently low nitrogen concentrations at the mountain tributary sites indicates that the source of nitrogen contributing to elevated concentrations in the Teton River and valley sites likely originates on the valley floor.

The anthropogenic variables affecting nitrogen concentrations include residential development and the impact from septic systems and fertilizers as well as increasing changes in agricultural land use practices. Although trends indicate that residential and agricultural development in Teton Valley has slowed in recent years, the relative magnitude of impact on the Teton River Subbasin remains unknown. Water quality monitoring, particularly nitrogen monitoring, is crucial in light of the recent and rapid variables impacting the area.

Phosphate and Ammonia

Both phosphate and ammonia are rarely above detection limits at any of the monitoring sites, with the exception of the Woods Creek site. Elevated phosphate and ammonia readings at Woods Creek are likely attributable to the municipal wastewater treatment facility in Driggs located approximately 1.5 miles upstream of the site.

Total phosphate is usually in the detectable range at the Woods Creek site. Past sampling has revealed that total phosphate concentrations in Teton Valley streams usually reach the annual peak in the spring (especially in April), with a secondary but lower peak in the fall. Peak spring concentrations could be explained by mobilization of phosphates due to early snowmelt occurring in April on the valley floor. The fall season increases due to seasonally lower flows, which typically result in a higher concentration of phosphates. Total phosphate levels in 2015 were less than 0.05 mg/L for all sites, except Woods Creek. Woods Creek demonstrated levels of 0.79 mg/L and 0.24 mg/L during 2015, respectively.

The EPA has a total phosphorus recommendation of 0.01 mg/L for the Western Forested Mountain Region, and the upper Teton River is a part of this region. The Teton River Subbasin is currently phosphorus limited, but a relatively minor increase in phosphorus could lead to greater eutrophication in the watershed. FTR will pay particular attention to phosphorus levels as residential development in Teton Valley resumes.

Like phosphate levels, ammonia levels detected in Woods Creek have not been directly linked to the municipal wastewater treatment facility in Driggs. However, ammonia has not been detected elsewhere in the watershed, with the exception of occasional low concentrations in the Teton River (TR-3) downstream of the Woods Creek confluence. In 2015, Woods Creek measured ammonia levels of 0.37 mg/L and less than 0.05 mg/L in October.

The Teton Regional Water Reclamation Facility, utilizing a multi-stage biological process that leads to a total consumption of solids and the elimination of waste sludge, discharges directly into Woods Creek. FTR will continue to monitor ammonia and phosphate levels at the Woods

Creek site, especially with respect to the discharges from the Teton Regional Water Reclamation Facility.

***E. coli* Bacteria**

Sites in the valley, Spring Creek, and the Teton River have at least occasionally produced elevated counts of *E. coli* bacteria throughout the monitoring program's twelve year history. Primary and Secondary Contact Recreation Standards used by the state of Idaho for *E. coli* are 406 and 576 cfu/100 mls, respectively, for instantaneous measurements.[3] In 2015, the only sites that had instantaneous readings over *E. coli* contact standards were TR-1 at 686.7 (October); TR-3 at 547.5 (October); and Woods at 547.5 (October).

The background or mountain tributary sites are usually below detection limits for *E. coli* but show occasional detectable spikes, with the highest being a count of 252 cfu/100 mls in FOX-2 in August of 2004. Darby Creek and Teton Creek *E. coli* levels have never been recorded above 100 cfu/100mls. In general, *E. coli* concentrations display some seasonality at all the sites, with the highest concentrations tending to occur in mid to late summer, though elevated concentrations are occasionally seen at other times of the year, even in late fall/winter. *E. coli* growth rates tend to increase as water temperature increases; however, the bacteria can also persist within the range of colder temperatures found in Teton Valley streams.

Woods Creek:

In previous years *E. coli* bacteria has commonly been measured at levels well above Idaho's Recreational Contact Standards in Woods Creek. From 2001-2004, and 2007-2009, *E. coli* bacteria in Woods Creek exceeded recreational standards during some point in the year; in 2005 and 2006 Woods Creek concentrations remained below recreational standards, or <366 cfu/100 mls. In 2009, *E. coli* concentrations were the highest recorded (>2419.2 MPN/100 mls) during the July sampling event. *E. coli* levels then remained relatively low until 2011, when August readings were well above the Recreation Contact Standards at 980 MPN/100mls in August; however, readings greatly decreased to 96 MPN/100mls during the month of October. In October 2012 readings were again above the Recreational Contact Standards at 687 MPN/100 mls; however July levels were relatively low (167 MPN/100 mls). 2013 readings were also well above and nearly double the Recreational Contact Standards at 1119 and 1553 MPN/100 mls in July and October. 2014 readings returned to normal levels with Woods Creek reading at 579.4 MPN/100 mls (July) and then down to 72.3 MPN/100 mls (October), a trend that continued into the 2015 monitoring year.

FTR's *E. coli* source tracking project on Woods Creek in 2005 showed that while numerous species, including humans and sewage from the wastewater treatment plant, contribute bacteria to the stream, the majority of the bacteria are associated with waterfowl and undifferentiated bird species. Fluctuation in *E. coli* levels could be indicative of changing habitat use and migration patterns among those bird species. It is the experience of FTR that spikes in *E. coli* levels at these particular sites can be due to a variety of point source polluters, including human activities that discharge effluents, wildlife concentrations including the aforementioned waterfowl and bird species, or stock.

[3] IDAPA 58.01.02.101.01a

Teton River Sites:
Recreational Contact Standards for *E. coli* have also been exceeded in the Teton River, at all sites, and most frequently at TR-1. In 2015, readings at TR-1 and TR-3 indicated levels above Recreational Contact Standards for *E. coli*, with levels in October at TR-1 reading 686.7 and TR-3 reading at 547.5.

<u>Conductivity</u>
Overall, conductivity has shown a general increase at all sites since 2008, by approximately 50-100 uS/cm. In 2007, FTR acquired a more accurate instrument to measure conductivity, and this overall increase could be attributed to that. In 2012, data reports a deviation from this trend with decreased conductivity readings at all of the sites, ranging from a -50 to -150 uS/cm change. In 2013, however, conductivity readings in Teton Creek rose to their highest level since 2006 at 415 uS/cm. Conductivity readings in FOX-1 and Six Springs increased to 419 and 415 uS/cm in October of 2013. Conductivity levels in 2014 returned to normal levels, with all sampling sites reading less than 400 uS/cm. This trend continued into 2015 with all sampling sites holding at less than 400 uS/cm.

<u>pH</u>
2015 measurements are slightly elevated as compared with past years, averaging in the 6-8 pH range. Warm springs reflected the most acidic site, with pH of 10.87 recorded during the October event.

Overall, pH measurements suggest a general trend toward increased acidity since 2001. Between 2001 and 2006 many of the tributaries averaged a pH value of 8-8.5. Since 2006 many tributary pH values have slowly evidenced increased acidity (i.e. – July readings at 6.74 pH in FOX-1; October readings at 6.9 pH in Fish Creek; and October readings at 6.35 pH in Six Springs).

Typically, sites tend to be more acidic in the spring when snowmelt is the primary water contributor and more basic in the autumn when there is more groundwater input. It also follows that Teton River sites tend to be more basic than the mountain tributary sites, as the impact from snowmelt is greatest at river sites. FTR continues to be interested in the possibility of a snow quality monitoring program to look at indicators of pollutants that enter the snowpack through the atmosphere. A snow quality monitoring program would additionally provide insight into pH trends.

<u>Temperature</u>
Temperatures recorded in 2015 were in line with long-term averages among all of the sites. General trout lethal limits are less than 25°C. For adult trout, signs of stress set in at approximately 22°C. Main stem Teton River locations are well within the recommended limits for maintaining healthy trout populations. Warm Creek and Fish Creek had the highest temperatures in 2015 and Warm Creek nearly reached the lethal trout limit at approximately 17.2 °C in July. The FOX-1 site, which is TMDL listed for temperature, reached a maximum temperature of 11.8°C in July.

Based on recommendations from FTR's Science Review Committee,[4] which meets annually, FTR would like to develop a more robust, basin-wide, temperature monitoring network to study how temperature influences the distribution and movements of Yellowstone cutthroat trout and non-native trout; to identify temporal trends that could be caused by climate change; and to study the effects of changes to water supply and management. Federal and State fisheries managers would like to determine if temperature influences emigration of 0 and 1 age Yellowstone cutthroat trout in the tributaries; if temperature influences the success of non-native trout; and if temperature plays a role in migration of native and non-native trout and hence influences hybridization and competition. Temperature may also help us to monitor how changes in water management and land uses may influence groundwater versus surface water inputs. The data will help FTR determine and understand why some streams appear to be better suited to rainbows; monitor water quality and climate change; determine the effects of flow restoration; and to study why Six Springs is a stronghold for Yellowstone cutthroat trout spawning while other spring creeks do not seem to support Yellowstone cutthroat trout spawning.

Distribution of Data

FTR intermittently publishes water quality data and information in our bi-annual newsletter, and the complete data set is posted on the FTR website, www.tetonwater.org. Results are also periodically provided to: the Teton County Commissioners; the Cities of Driggs, Tetonia, and Victor; the Idaho Department of Environmental Quality; the Teton Soil Conservation District in Idaho; the Teton Conservation District in Wyoming; the Idaho District 7 Health Department; and the local Natural Resources Conservation Service office. Additionally, FTR provides program data to appropriate landowners, and we alert the local newspapers (Teton Valley News and Valley Citizen) of any potential public health concerns related to water quality.

Recommendations for Program Changes

FTR recommends that relevant stakeholders within the Teton River watershed coordinate efforts to develop and implement a more robust water quality monitoring program for the Teton River Subbasin. The unique features of the Subbasin demand a monitoring program that collects and assesses a comprehensive water quality data set, the collection of which is tailored to identify and help address water quality questions relevant specifically to the Teton River and its tributaries.

A more robust monitoring program for the Subbasin would seek to understand, preserve and protect the unique geological, biological, and ecological characteristics of the Subbasin, thereby ensuring that the region's water quality does not negatively impact those ecosystem services upon which the region's economy is based. A more robust monitoring program would also provide particular attention to species of interest, like the native Yellowstone cutthroat trout, and issues of concern, like nutrient impairment. Further, a more robust monitoring program would provide the data necessary to support sound impairment designations, TMDL development,

[4] This committee was established to make recommendations to prioritize research and restoration in the upper Teton Watershed, starting in 2004. They are currently working to implement a 10-year restoration and monitoring strategy (2010-2020) under a Model Watershed grant from the Bonneville Environmental Foundation (BEF). The group is currently made up of fisheries biologists from the Idaho Department of Fish and Game, Wyoming Game and Fish, and the US Forest Service; Bob Gresswell and Robert al-Chokhachy from the Northern Rocky Mountain Science Center, Mike Young of the Rocky Mountain Research Station, Dr. Rob VanKirk of the Henry's Fork Foundation/Humboldt State University, Robert Warren of BEF, and FTR staff.

permitting for point sources, and measurable baselines against which to measure progress. Finally, a more robust program would be specifically designed to monitor pollutants and issues of concern for the region, such as groundwater connectivity, surface water connectivity, impacts from septic systems and residential development, and impacts to native fish. The recommendations discussed above, however, will require the concerted and committed effort of various individuals, agencies, and NGO's in the region, and a significant, reliable funding source.

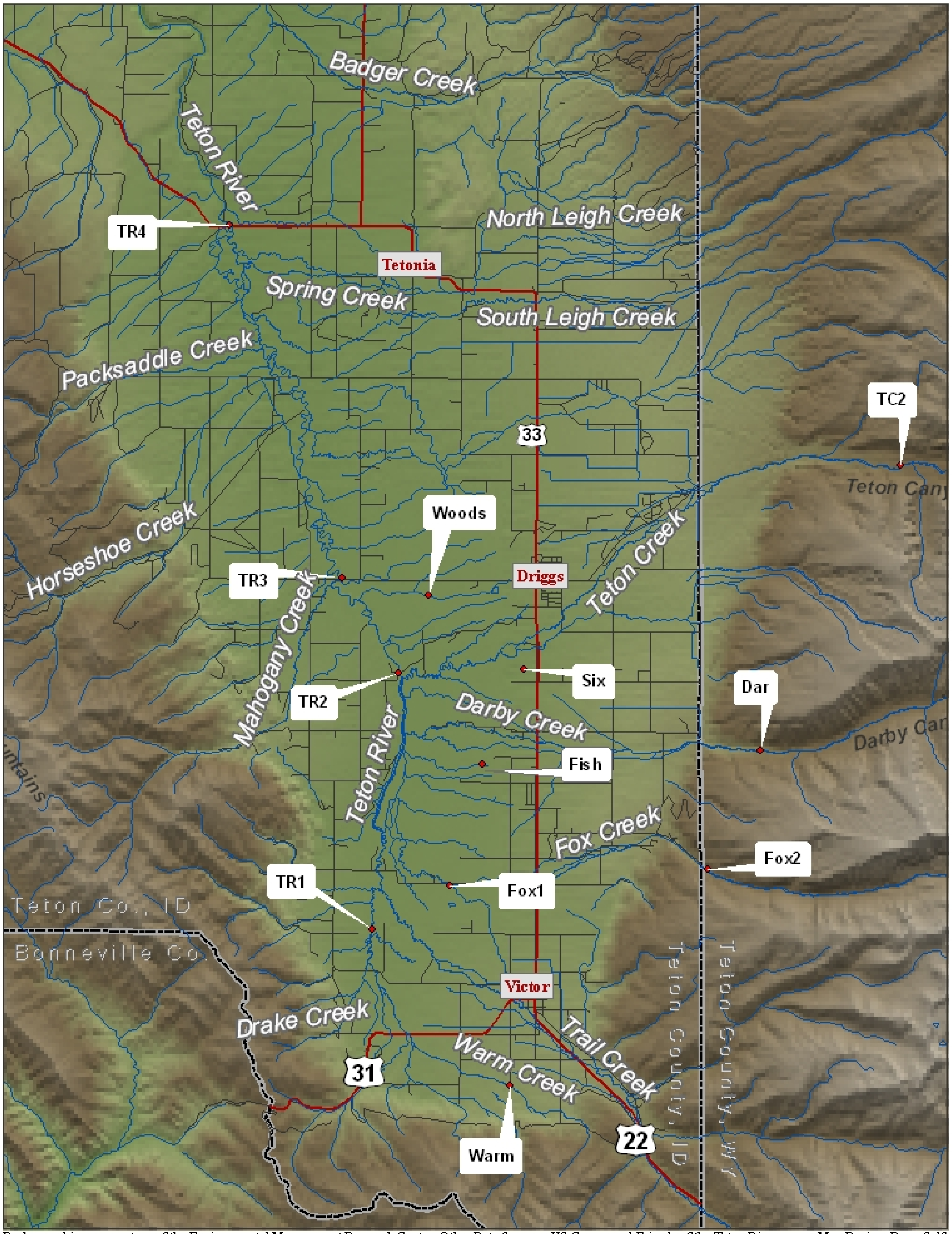
Related Program Activities
In spring 2012, FTR provided a free Well Testing Day to private well owners in Teton Valley. With assistance from the Teton High School Environmental Science class and a grant from the Idaho Department of Environmental Quality, FTR tested nitrate levels in wells around the valley. The results were immediate, confidential, and disclosed to the well owners at the time of the testing. Additionally, during the summer of 2013, FTR worked with a local plumber to provide free nitrate testing to his clients. Data from all tests were recorded by FTR (with property owner names and exact addresses kept confidential) and are being used to monitor basin-wide groundwater nitrate trends.

FTR is currently working to implement a Drinking Water Source Water Protection Plan for the Teton Basin. FTR has involved Teton County through their Comprehensive Planning Process, as well as the Cities of Victor, Driggs, and Tetonia. Through this process, FTR will help develop best management practices, community education, and other practices that will guard Teton Valley's drinking water sources from contamination. With a Source Water Protection Plan in place, the Teton Basin will be eligible for additional funding to implement the plan, including grants and loans from IDEQ, the EPA, the USDA, and others.

Need for Program Continuation
FTR emphasizes the importance of maintaining a robust and long-term water quality monitoring program in Teton Valley. A more complete data set is increasingly valuable, not only as a guide to FTR programming but also as a consideration for local land use planners and municipal decision-makers. Rapid growth rates, increased residential development, and changing land use practices significantly impact Teton Valley's water quality. <u>Water quality monitoring thus remains a critical tool for maintaining and protecting our valuable water resources.</u>

As the State of Idaho decreased funding for water quality monitoring programming in recent years, FTR accordingly reduced the size of its water quality monitoring programming in Teton Valley. In order to continue a basic surface water quality monitoring program, FTR reduced the number of sampling rounds and cut costs. To date, alternative funding sources for basic but essential water quality monitoring programs remains scarce. Despite these challenges, FTR continues to keep its water quality monitoring program a fundamental part of our organizational agenda. Furthermore, FTR encourages water quality agencies and decision-makers to make water quality monitoring a priority, particularly in areas with valuable water resources such as Teton Valley.

Figure 1 – Water Quality Test Sites



Background image courtesy of the Environmental Management Research Center. Other Data Sources: US Census and Friends of the Teton River. Map Design: Doug Self

Figure 2 – Stream Temperature Logger Locator Map

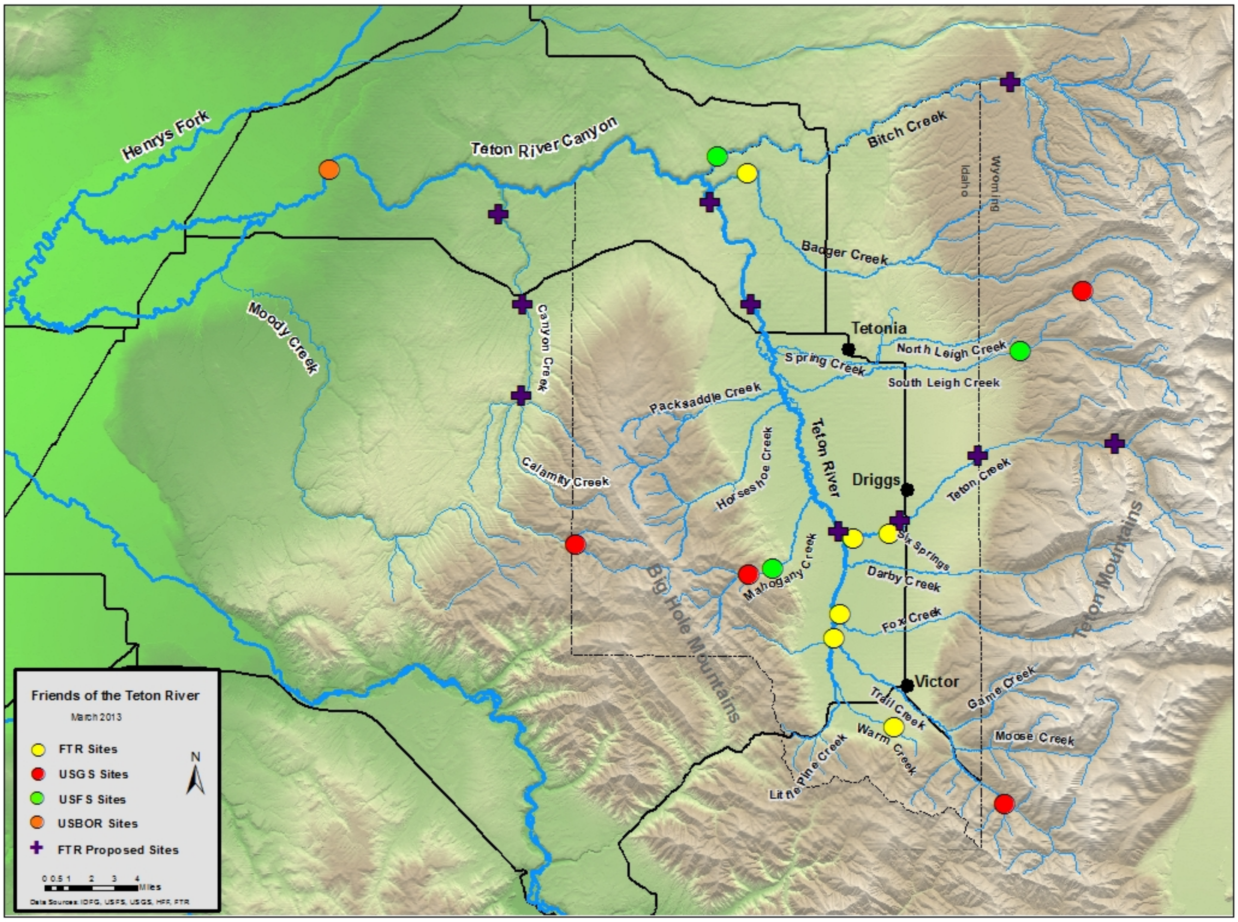


Table 1 - Monitoring Sites, 303(d) Listing Status and Pollutant Parameters

Monitoring Station	Subwatershed Name and 303(d) Listing Status	Pollutant Parameters Listed
TR1	Teton River (Headwaters to Trail Creek) (303(d) listed)	Habitat Alteration
TR3	Teton River (Bates) (303(d) listed)	Sediment Habitat Alteration
TR4	Teton River (Highway 33) (303(d) listed)	Sediment Habitat Alteration
Warm	Warm Creek	
Fox1	Lower Fox Creek (303(d) listed)	Sediment Temperature Flow Alteration
Fish	Fish Creek	
Six	Six Springs	
Dar	Darby Creek above Wyoming Line	
Woods	Woods Creek	Possible listing for *E. coli* pending
Fox2	Fox Creek above Wyoming Line	
TC2	Teton Creek above Wyoming Line	

Table 2 - FTR Laboratory Analyzed Water Quality Parameters

Analytical Parameter	**Sample Size**	**Preservation**	**Holding Time**	***Method***
Non-Filterable Residue (TSS)	200 ml	Cool 4°C	7 Days	EPA 160.2
Volatile Residue (TVS)	200 ml	Cool 4°C	7 Days	EPA 160.4
Nitrogen-nitrate/nitrite	50 ml	Cool 4 °C H_2SO_4 pH<2	28 Days	EPA 300
Ammonia	150 ml	Cool 4 °C H_2SO_4 pH<2	28 Days	EPA 350.3
Total Phosphorus	100 ml	Cool 4 °C, H_2SO_4 pH<2	28 Days	EPA 365.4
Ortho Phosphorus	100 ml	Filtered, Cool 4°C	24 Hours	EPA 365.2
E. Coli	100 ml	Cool 4 °C, H2S04 pH <2	8 Hours	EPA 1103.1

Table 3 - FTR Sampling Field Measurements

Parameters	**Instrument**	**Calibration**
Dissolved Oxygen	YSI Model 550 A	Ambient air calibration
Temperature	YSI Model 550 A	Centigrade thermometer
Turbidity	Hach Model 2100P	Formazin Solutions and/or Gelex Standards
Conductance	Hach Pocket Pal Conductivity Tester	Factory Calibrated
pH	Oakton Model 300	Standard buffer (7,10) bracketing for linearity
Stream Flow	Marsh-McBirney Flo-Mate 2000 Flow Meter	Factory Calibrated, zeroed weekly

Table 4 – 2012 IDEQ Teton River Water Quality Data

Location	Date	TKN (mg/L)	NO2+NO3 (mg/L)	TP (mg/L)	Chlorphyll-a (ug/L)	Pheophytin-a (ug/L)
TR-1	3/25/2012	0.71	<0.010	0.059		
TR-2	3/25/2012	0.79	1.4	0.099		
TR-3	3/25/2012	0.77	0.54	0.095		
TR-4	3/25/2012	0.63	0.38	0.068		
TR-1	4/26/2012	0.33	0.33	0.1		
TR-2	4/26/2012	0.32	2.7	0.048		
TR-3	4/26/2012	0.8	0.58	0.094		
TR-4	4/26/2012	0.29	0.41	0.06		
TR-1	5/31/2012	0.31	1.0	0.043		
TR-2	5/31/2012	0.21	0.53	0.021		
TR-3	5/31/2012	0.31	0.87	0.036		
TR-4	5/31/2012	0.34	0.25	0.024		
TR-1	6/28/2012	0.36	1.3	0.034		
TR-2	6/28/2012	0.35	0.48	0.021		
TR-3	6/28/2012	0.37	0.6	0.027		
TR-4	6/28/2012	0.44	0.23	0.028		
TR-1	7/5/2012	0.32	1.3	0.022	2.0	1.2
TR-2	7/5/2012	0.45	0.61	0.018	1.6	1.1
TR-3	7/5/2012	0.52	0.96	0.032	2.0	5.6
TR-4	7/5/2012	0.42	0.24	0.026	1.5	1.3
TR-1	7/12/2012	0.32	1.2	0.018	0.41	<0.32
TR-2	7/12/2012	0.35	0.83	0.014	0.83	<0.32
TR-3	7/12/2012	0.37	1.0	0.025	10	8.1
TR-4	7/12/2012	0.3	0.28	0.019	1.1	<0.32
TR-1	7/19/2012	0.37	1.1	0.014	0.93	0.65
TR-2	7/19/2012	0.36	0.56	0.011	0.79	<0.32
TR-3	7/19/2012	0.44	0.94	0.021	1.4	1.4
TR-4	7/19/2012	0.35	0.4	0.018	0.81	1.3
TR-1	7/26/2012	0.4	1.1	0.014	1.2	<0.32
TR-2	7/26/2012	0.34	0.59	0.011	0.66	0.45
TR-3	7/26/2012	0.39	0.98	0.016	1.6	2.4
TR-4	7/26/2012	0.29	0.59	0.015	2.3	1.7

TR-1	8/3/2012	0.29	1.1	0.014	1.3	1.0
TR-2	8/3/2012	0.41	0.56	0.012	0.41	0.65
TR-3	8/3/2012	0.46	0.92	0.016	1.5	1.2
TR-4	8/3/2012	0.44	0.69	0.014	0.55	1.3
TR-1	8/10/2012	0.39	1.2	0.018	<0.32	3.6
TR-2	8/10/2012	0.46	0.58	0.016	0.43	2.2
TR-3	8/10/2012	0.47	0.94	0.017	0.82	6.7
TR-4	8/10/2012	0.45	0.73	0.017	1.6	2.1
TR-1	8/16/2012	0.39	1.2	0.018	<0.32	2.2
TR-2	8/16/2012	0.33	0.59	0.012	0.96	0.38
TR-3	8/16/2012	0.43	0.92	0.020	1.8	3.3
TR-4	8/16/2012	0.41	0.7	0.015	2.0	1.2
TR-1	8/23/2012	0.25	1.2	0.019	0.79	0.5
TR-2	8/23/2012	0.54	0.70	0.012	1	<0.32
TR-3	8/23/2012	0.38	0.94	0.022	1.8	1.4
TR-4	8/23/2012	0.41	0.72	0.013		
TR-1	8/30/2012	0.41	1.1	0.022	1.0	0.70
TR-2	8/30/2012	0.46	1	0.014	0.87	0.35
TR-3	8/30/2012	0.38	0.93	0.025	1.6	1.4
TR-4	8/30/2012	0.46	0.41	0.033	2.1	1.2
TR-1	9/6/2012	0.26	1.1	0.018	0.99	<0.32
TR-2	9/6/2012	0.34	0.71	0.011	0.85	0.44
TR-3	9/6/2012	0.4	0.97	0.024	2.3	1.3
TR-4	9/6/2012	0.34	0.74	0.014	1.8	0.92
TR-1	9/13/2012	0.4	1.1	0.015	0.7	<0.32
TR-2	9/13/2012	0.33	0.84	0.0095	0.85	<0.32
TR-3	9/13/2012	0.25	1.0	0.023	1.9	2.1
TR-4	9/13/2012	0.44	0.78	0.010	1.4	1.2
TR-1	9/21/2012	0.25	1.1	0.014		
TR-2	9/21/2012	0.36	0.785	0.0096		
TR-3	9/21/2012	0.5	0.95	0.024		
TR-4	9/21/2012	0.36	0.72	0.011	1.7	1.1

TR-1	9/26/2012	0.21	1.0	0.018		
TR-2	9/26/2012	0.22	0.77	0.012		
TR-3	9/26/2012	0.34	0.94	0.029		
TR-4	9/26/2012	0.23	0.71	0.012		
TR-1	10/4/2012	0.17	1.2	0.13	0.63	0.36
TR-2	10/4/2012	0.16	0.87	0.013	<0.32	2.5
TR-3	10/4/2012	0.26	0.97	0.037	2.0	2.5
TR-4	10/4/2012	0.25	0.71	0.012	1.8	1.6
TR-1	10/11/2012	0.24	1.1	0.013	0.68	<0.32
TR-2	10/11/2012	0.22	0.91	0.011	1.2	<0.32
TR-3	10/11/2012	0.23	1.0	0.021	1.8	1.1
TR-4	10/11/2012	0.24	0.84	0.01	1.0	0.51
TR-1	10/18/2012	0.43	1.2	0.048		
TR-2	10/18/2012	0.27	0.94	0.011	1.1	0.72
TR-3	10/18/2012	0.41	1.0	0.023	2.3	<0.32
TR-4	10/18/2012	0.25	0.75	0.011	1.5	0.87

Figure 1N

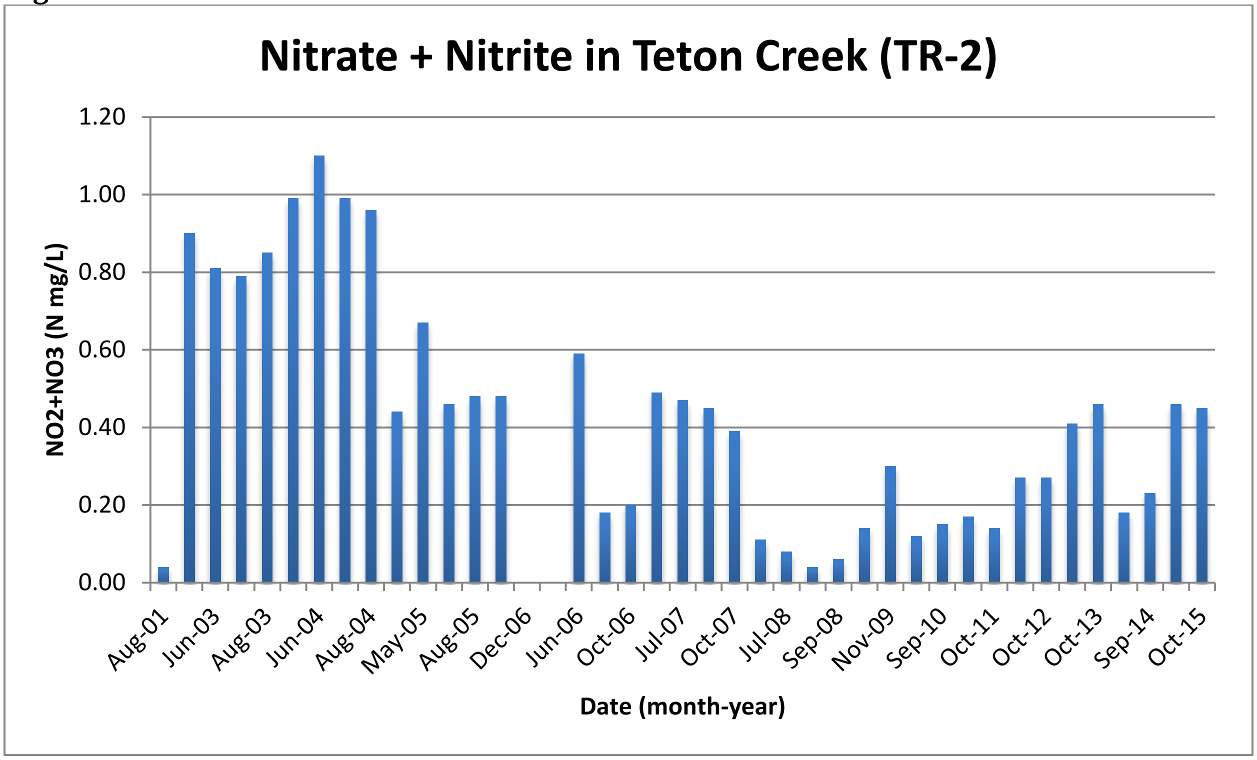


Figure 2N

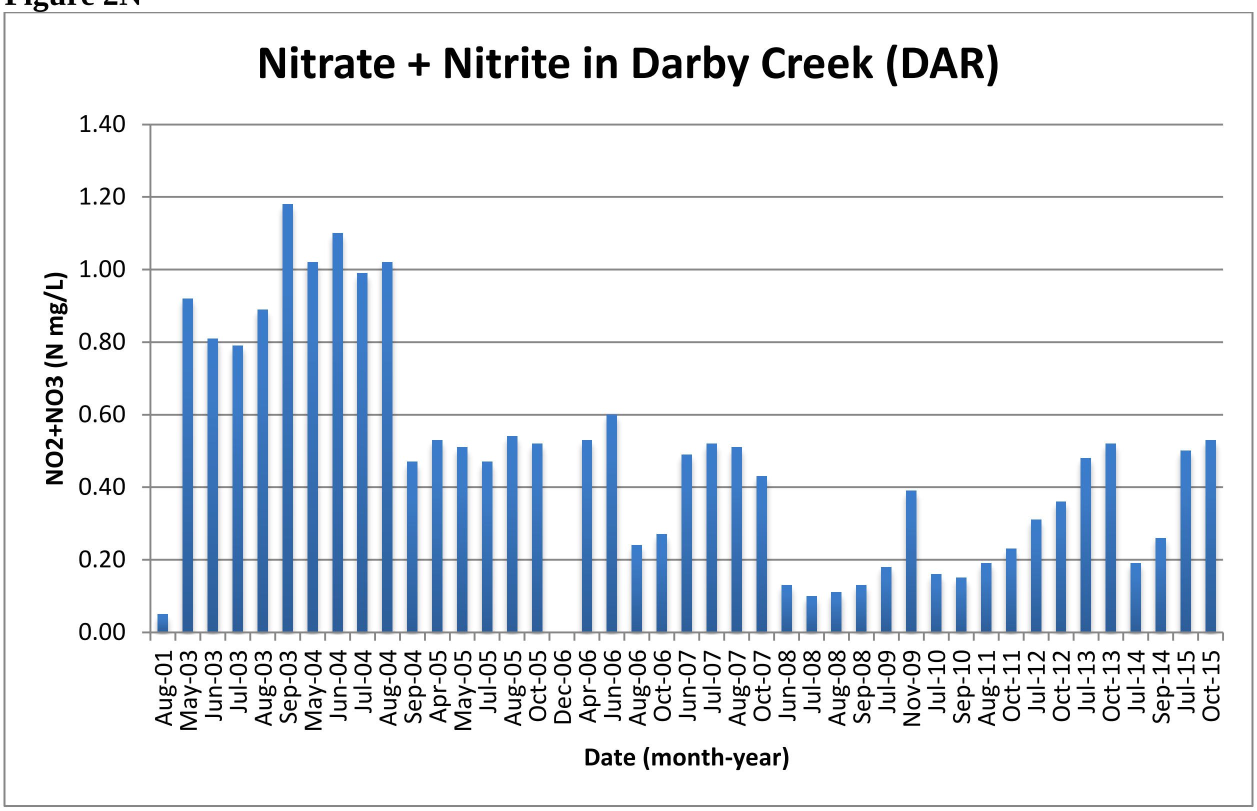


Figure 3N

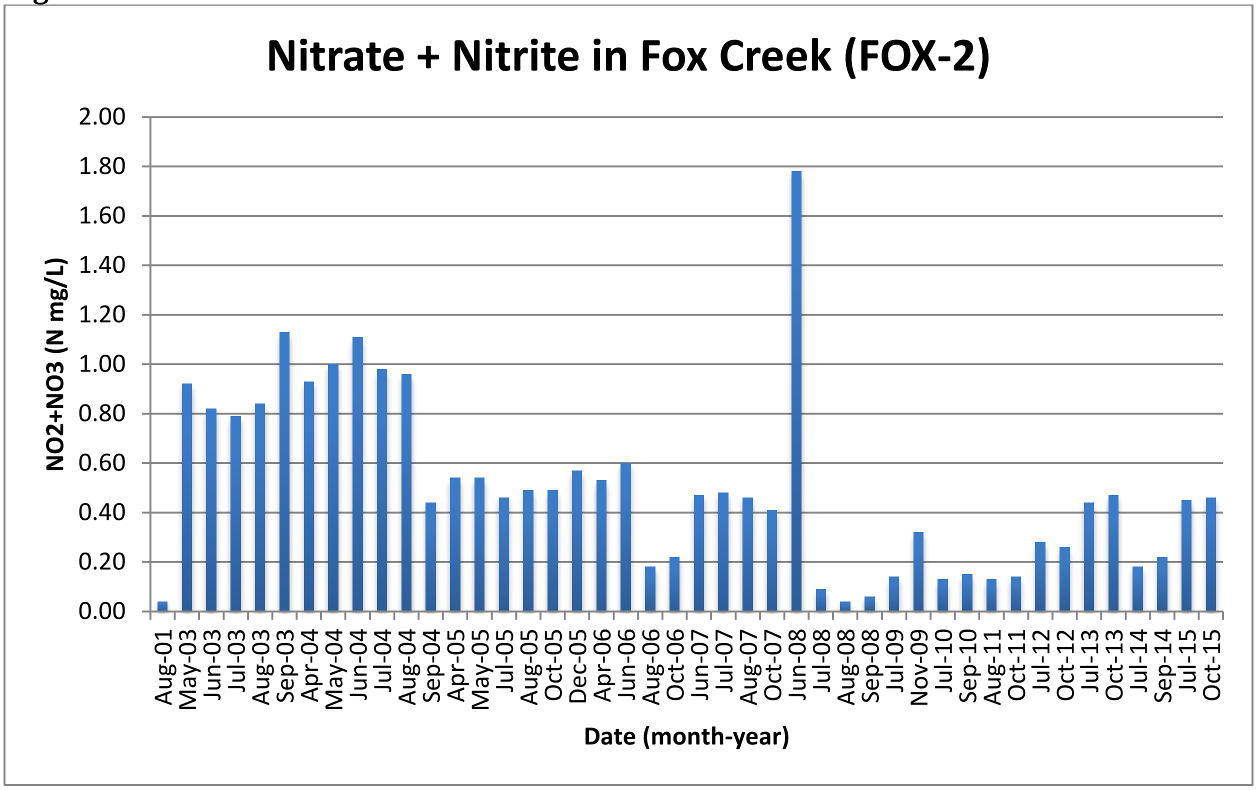


Figure 4N

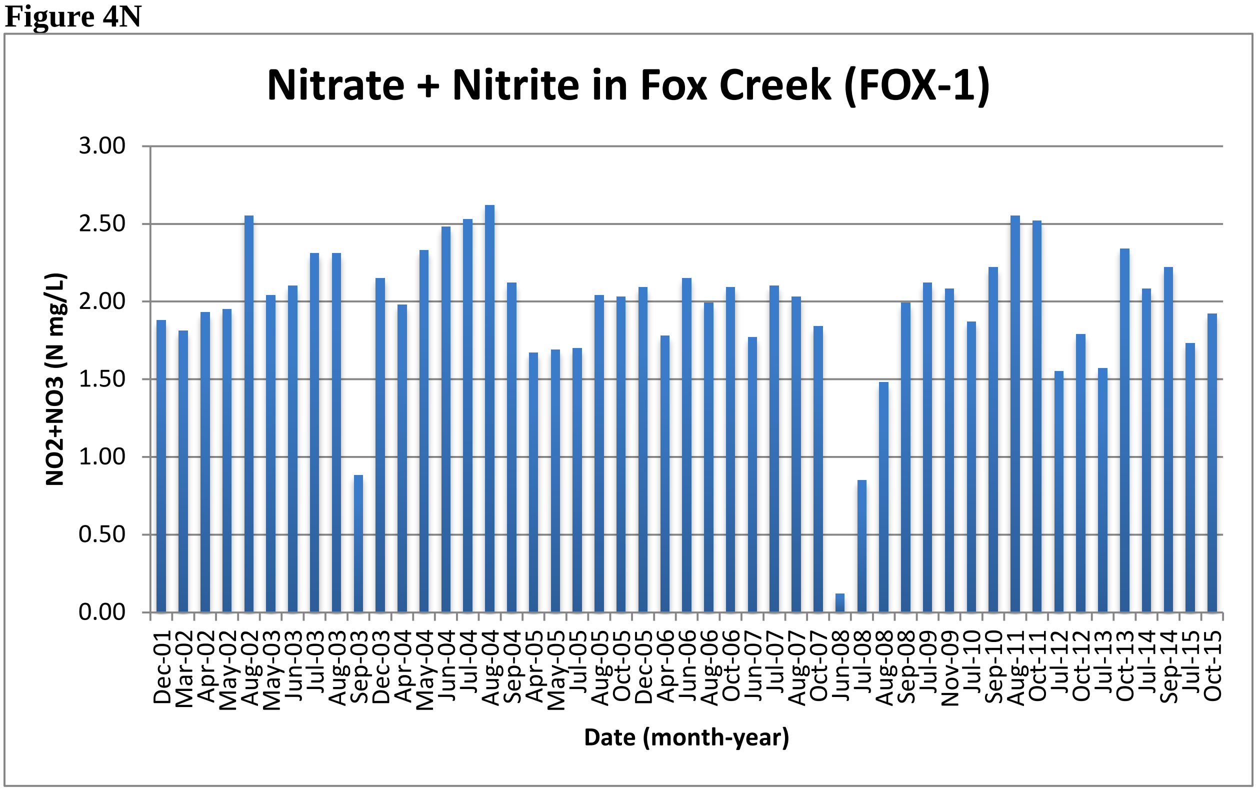


Figure 5N

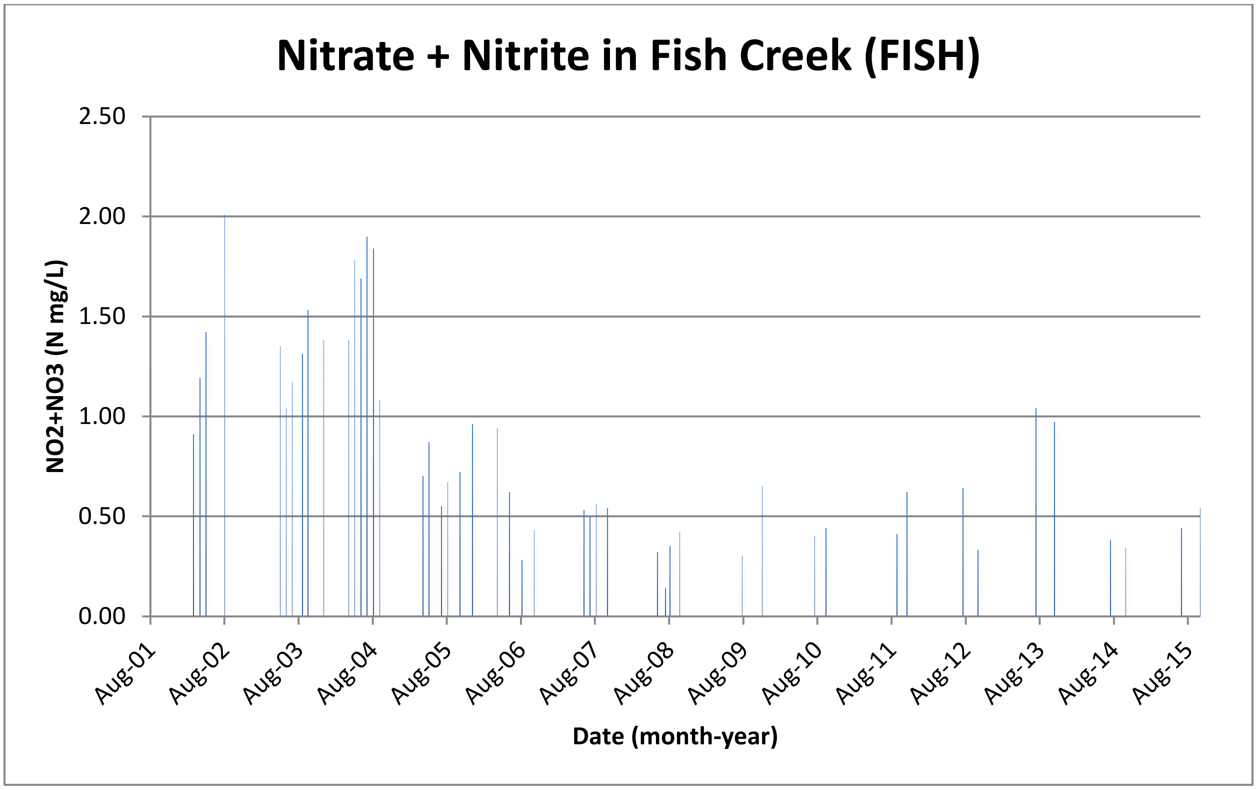


Figure 6N

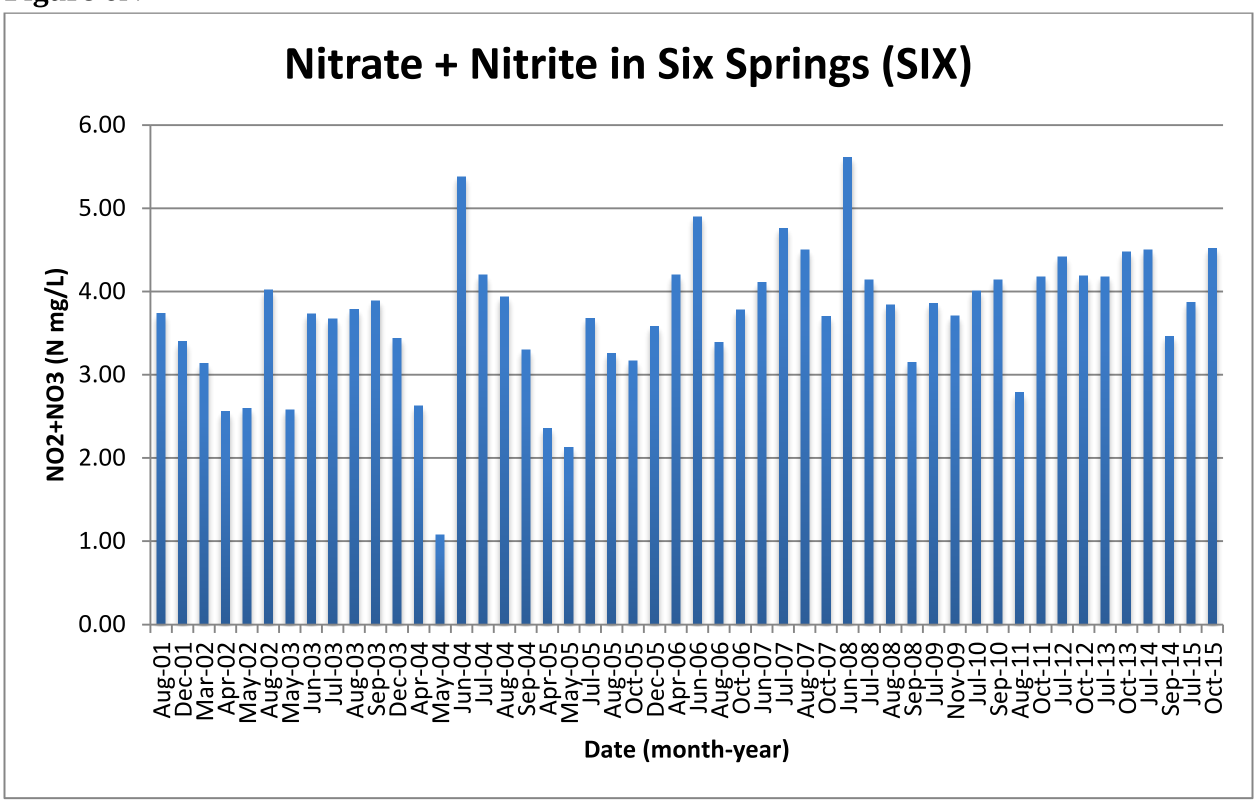


Figure 7N

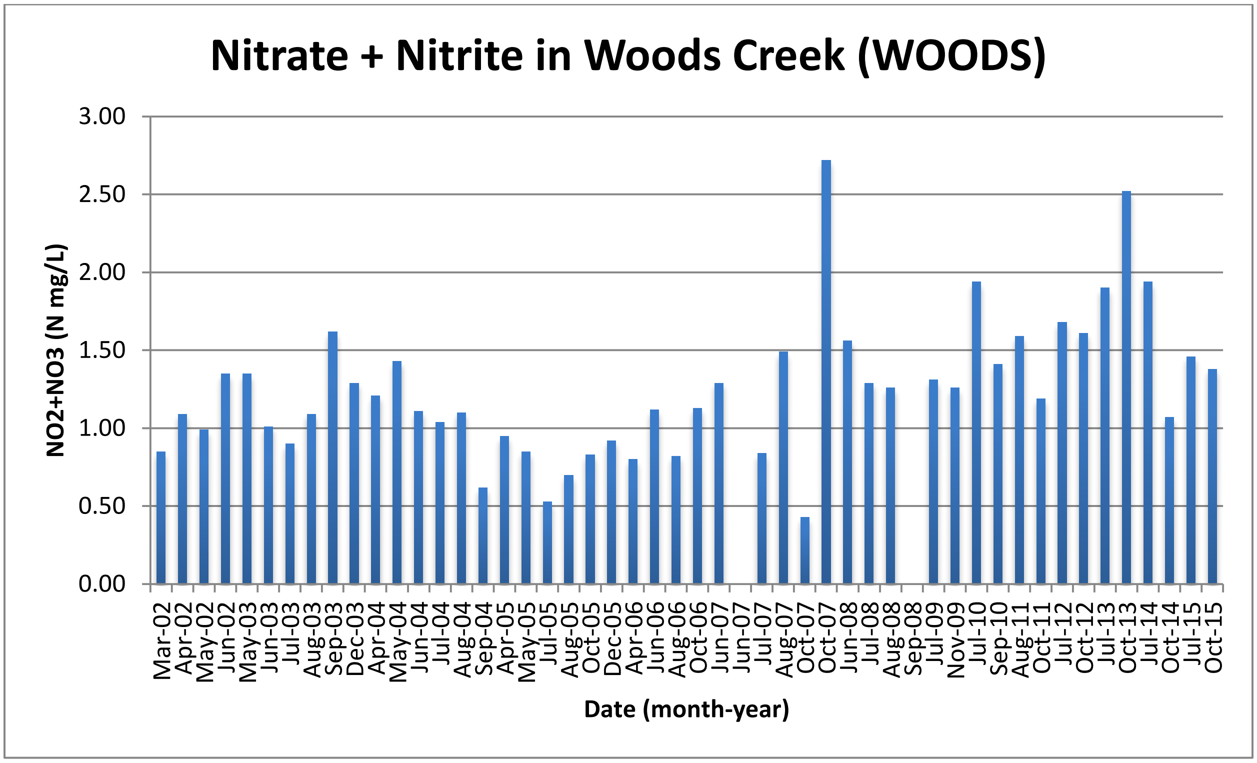


Figure 8N

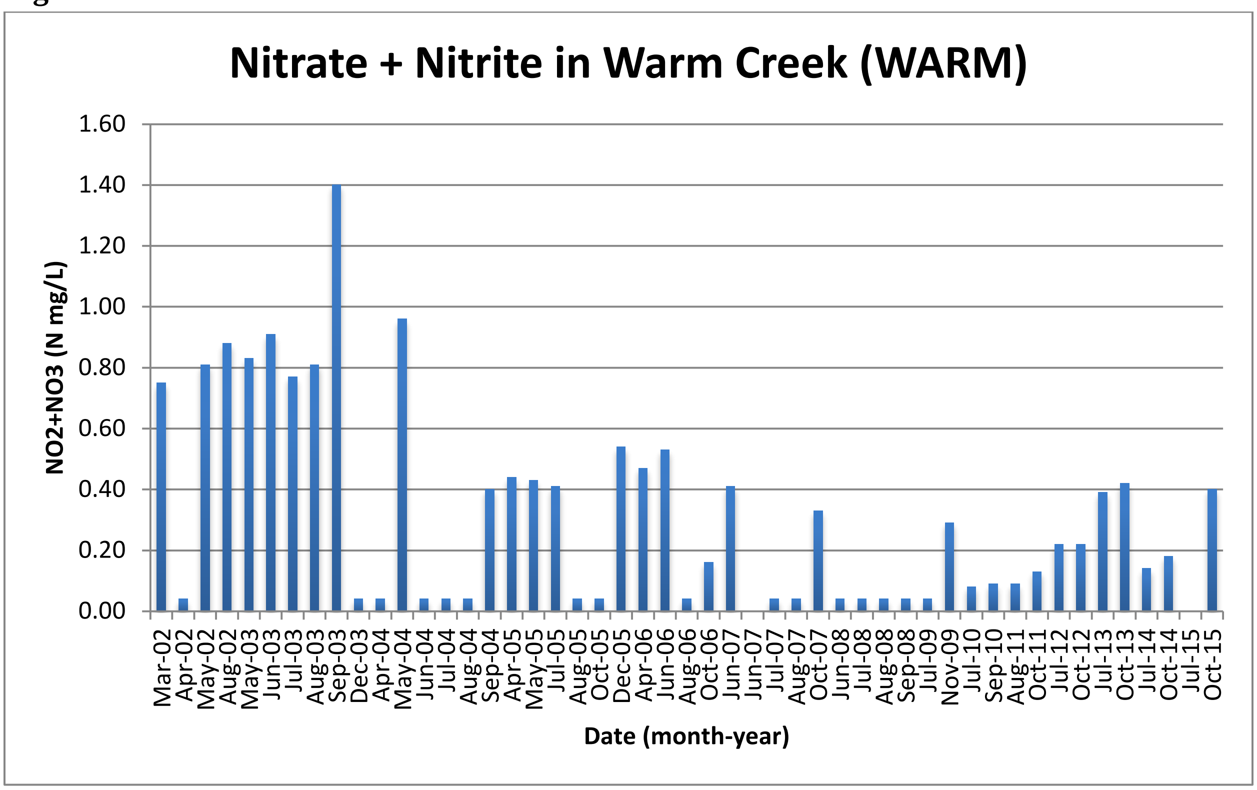


Figure 9N

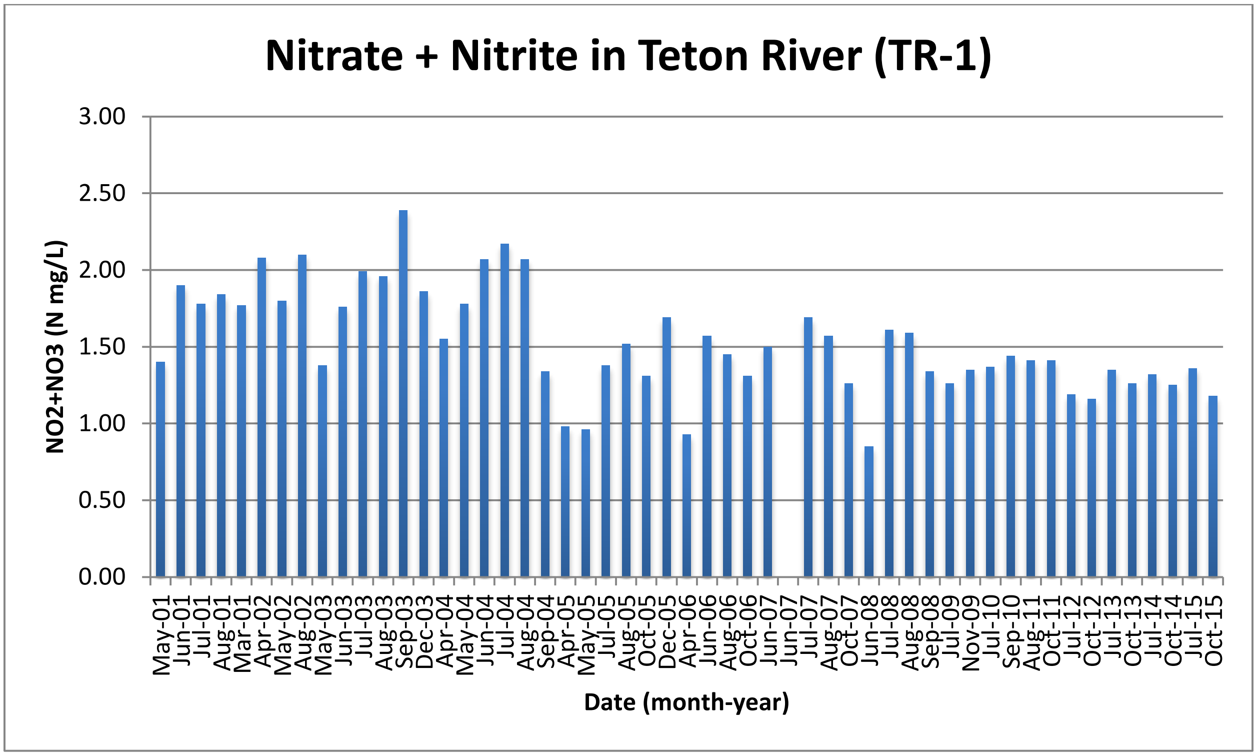


Figure 10N

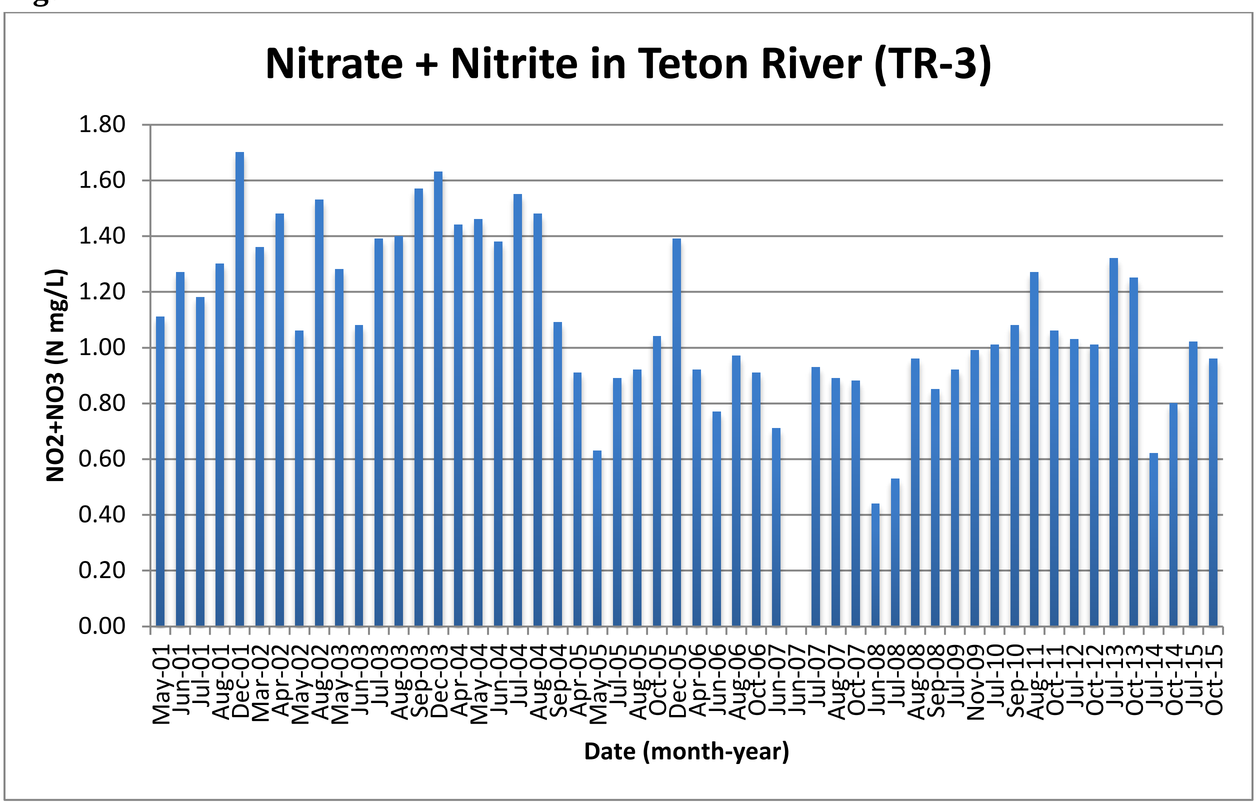
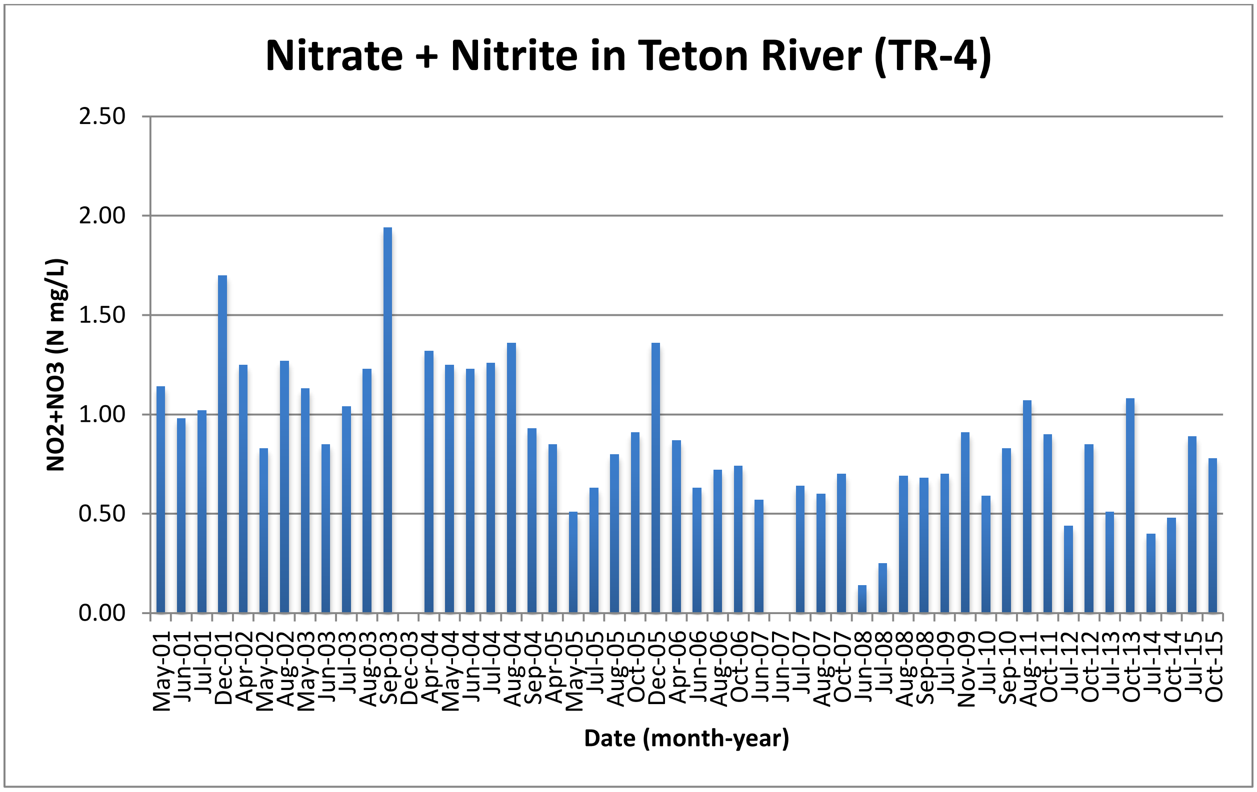


Figure 11N


Nitrate + Nitrite in Teton River (TR-4)
2.50
2.00
1.50
1.00
0.50
0.00
NO2+NO3 (N mg/L)
May-01
Jun-01
Jul-01
Dec-01
Apr-02
May-02
Aug-02
May-03
Jun-03
Jul-03
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Jul-14
Oct-14
Jul-15
Oct-15
Date (month-year)