Clear Creek / Standley Lake Watershed Agreement

2014 Annual Report

October 1, 2015

Clear Creek Watershed Annual Report – 2014

October 1, 2015

Submitted to the Water Quality Control Commission by:

Black Hawk/Central City Sanitation District
Central Clear Creek Sanitation District
Church Ditch Water Authority
City of Arvada
City of Black Hawk
City of Golden
City of Idaho Springs
City of Northglenn
City of Thornton
City of Westminster
Clear Creek County
Clear Creek Skiing Corporation
Clear Creek Watershed Foundation
Climax Molybdenum Company/Henderson Operations
Colorado Department of Transportation
Farmers' High Line Canal and Reservoir Company
Farmers' Reservoir and Irrigation Company
Molson Coors Brewing Company
Gilpin County
Jefferson County
St. Mary's Glacier Water and Sanitation District
Town of Empire
Town of Georgetown
Town of Silver Plume
Upper Clear Creek Watershed Association

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List of Acronyms and Abbreviations

AS - Autosampler

BHCCSD – Black Hawk/Central City Sanitation District

BMP – Best Management Practice

BNR – Biological Nutrient Removal

CC26 – Clear Creek Sampling Station: Clear Creek at Lawson Gage

CC40 – Clear Creek Sampling Station: Clear Creek near the junction of US-6 and I-70

CC60 – Clear Creek Sampling Station: Clear Creek at Church Ditch Headgate

CCAS26 – Clear Creek Autosampler Station: Clear Creek at Lawson Gage

CCAS59 – Clear Creek Autosampler Station: Clear Creek 2 Miles West of Highway 58/US6 in Golden

CCWF – Clear Creek Watershed Foundation

CDOT – Colorado Department of Transportation

CDPHE – Colorado Department of Public Health and Environment

CERCLA -- Comprehensive Environmental Response, Compensation, and Liability Act (Superfund)

Church – Church Ditch

Croke – Croke Canal

CY –Cubic Yard

DEA – Drug Enforcement Administration

DO – Dissolved Oxygen

EPA – U.S. Environmental Protection Agency

ESD – Equivalent Spherical Diameter

EWM – Eurasian Watermilfoil

FHL – Farmers' High Line Canal

FRICO – Farmers' Reservoir and Irrigation Company

IGA - Intergovernmental Agreement

I-70 – U.S. Interstate 70

KDPL – Kinnear Ditch Pipeline

MGD – Millions of Gallons per Day

MS4 – Municipal Separate Storm Sewer System

N/A – Not Available

ORP – Oxidation/Reduction Potential

OWTS – Onsite Wastewater Treatment System

RTRM – Relative Thermal Resistance to Mixing

SL10 – Standley Lake sampling location near WTP intake

SLC – Standley Lake Cities (Northglenn, Thornton, and Westminster)

SLWQIGA – Standley Lake Water Quality Intergovernmental Agreement

SOP – Standard Operating Procedure

TIN – Total Inorganic Nitrogen

TN – Total Nitrogen

TMDL – Total Maximum Daily Load

TP – Total Phosphorus

TSS – Total Suspended Solids

UCC – Upper Clear Creek

UCCWA – Upper Clear Creek Watershed Association

USGS – United States Geological Survey

UV – Ultraviolet

VWC – Volume Weighted Concentration

WTP – Water Treatment Plant

WQCC – Water Quality Control Commission

WWTF – Wastewater Treatment Facility

Executive Summary

ES-1. Introduction

Standley Lake is an off-channel, municipal and agricultural reservoir located in Jefferson County. This 43,000 acre-foot reservoir is a direct-use drinking water supply for over 250,000 consumers in the downstream cities of Northglenn, Westminster, and Thornton. The reservoir also provides water to farms located in Adams and Weld counties, as well as recreational opportunities. The Standley Lake watershed consists of 400 square miles of the upper Clear Creek watershed (the Upper Basin), small direct drainage areas to delivery canals (the Canal Zone), and the lake's relatively small direct watershed. Figure ES-1 shows Standley Lake, the Upper Basin, and the Canal Zone.

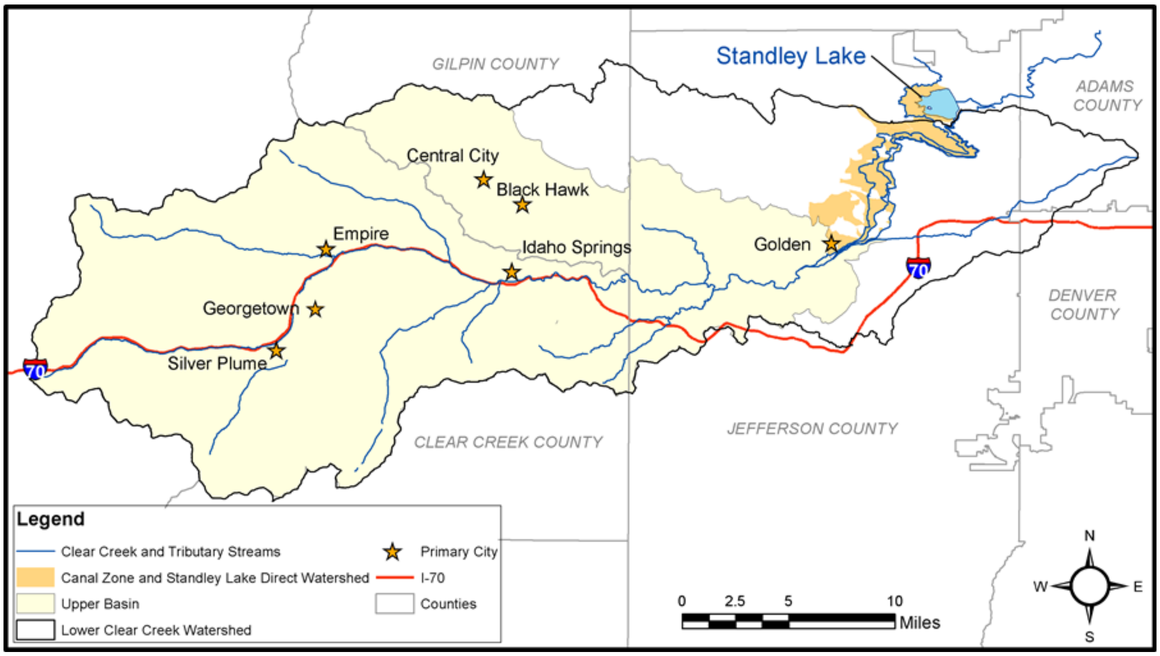

Figure ES-1. Standley Lake and Its Watershed

Water quality in the Upper Basin is affected by a variety of sources. The region contains nine wastewater treatment facilities (WWTFs) which serve the local population and resorts. Additionally, the Upper Basin contains operating and abandoned mines and receives water from trans-basin diversions. Water quality in the Upper Basin may also be impacted by nonpoint sources of pollution, including numerous onsite wastewater treatment systems (septic systems, OWTS), application of roadway deicers and traction sands, and residential and commercial stormwater runoff.

In 1993, the Clear Creek/Standley Lake Watershed Agreement (1993 Agreement) was signed to address certain water-quality issues and concerns within the Clear Creek watershed. The focus of the 1993 Agreement is water quality as it affects Standley Lake. In accordance with the annual reporting obligations set forth in the 1993 Agreement, in this report an overview is presented of monitoring, management, accomplishments and other activities protective of water quality. This information is supported by a summary of observed 2014 water quality in: WWTF effluent, Clear

Creek, the Canal Zone, and Standley Lake. This data is evaluated in the context of the previous five years of record.

ES-2. 2014 Monitoring Activities

Flow measurements and water-quality samples are collected in Standley Lake and at numerous stations throughout the watershed to monitor the concentrations and loading of nutrients, select metals, and other key constituents.

Upper Basin and Canal Zone monitoring for water quality includes grab sampling and the use of autosamplers. The monitoring program has a strong emphasis on the collection of composite samples instead of grab samples. In comparison to grab samples, the 24-hour composite ambient samples collected by autosamplers provide a better representation of average water quality on the date of sampling. In addition to collecting 24-hour ambient samples, the autosamplers are also used to collect event-triggered samples. Events samples are typically storm events. However, they also include first-flush samples collected in the Canal Zone during the initiation of water delivery to Standley Lake. Table ES-1 summarizes sample counts in 2014 by sample type and sub-region of the watershed.

Standley Lake is monitored throughout the year when ice is off the lake. Daily lake profiles are taken, and bi-monthly grab samples are also collected at three depths (at the surface, in the photic zone, and in the hypolimnion). Table ES-1 provides a summary of water-quality sampling in Standley Lake in 2014.

Table ES-1. Summary of 2014 Water-Quality Sample Collection

Sub-Region	Type of Sample	Number of Locations	Total Number of Samples Collected
Upper Basin	Grab Samples	16	45
	Ambient Auto-Samples	4	44
	Storm-triggered Auto-Samples	3	7
Canal Zone	Grab Samples	7	52
	Ambient Auto-Samples	1	12
	Storm-triggered Auto-samples	4	6
	First Flush Auto-Samples	4	6
Standley Lake	Grab Samples	1 (3 depths)	63
	Vertical Profiles	1	Four Times Daily When Ice-Free, Every Meter

ES-3. 2014 Activities and Accomplishments

Efforts to manage, enhance, and protect water quality throughout the Clear Creek watershed and in Standley Lake continued in 2014. These activities were completed by a variety of groups and entities. The following groups of activities are described:

- Canal Maintenance;
- Wastewater Treatment Facilities;
- Illicit Discharges and Emergency Response;
- Nonpoint Source Control, Stormwater Management, and Remediation
- Public Education, Outreach, and Partnerships;
- Planning Activities; and
- Other Activities.

This section provides highlights of this work in 2014. This is not a complete list, and additional important activities and details are presented in the main report.

Canal Maintenance

- Routine operations protect the water quality of Standley Lake by diverting the first flush away from Standley Lake. Additionally, diversions are stopped, as appropriate, in response to occurrences reported through the emergency call-down system.
- Routine maintenance of the canals also protects the water quality of Standley by placing the removed spoils from capacity maintenance below the canals' banks and grading slopes to drain away from the canals.
- Continued efforts to repair damage from the September 2013 flooding event continued in 2014.

Wastewater Treatment Facilities

- WWTFs continued to sample for, and report, nutrient concentrations in effluent to comply with the requirements of the Colorado Department of Public Health and Environment (CDPHE) Regulation 85 (issued in 2012).
- The City of Idaho Springs began planning to switch to ultraviolet (UV) disinfection. This will provide for greater operational safety relative to the current gaseous chlorine and sulfur dioxide system.
- Georgetown completed a study of alternatives for the disposal of facility-generated biosolids.

Illicit Discharges and Emergency Response

- The City of Golden responded to 36 reports of illicit discharges or potential discharges to the storm sewer system in 2014. This resulted in nine written warnings and 19 verbal warnings being issued.

- The City of Arvada issued 26 written Notices of Violation, resulting in seven responsible parties being required to pay for cleanup as part of its Illicit Discharge Detection and Elimination Program.
- The Clear Creek Office of Emergency Management continued to maintain and update the Code Red Emergency Call-Down System to promptly and effectively notify downstream users of Clear Creek water of any potential contamination from an upstream source.
- The Croke Canal Shutdown Standard Operating Procedure was adopted in 2014. The SOP provides guidance on when to consider closing canal headgates on Clear Creek, or to turn out water before it enters Standley Lake in the case when a spill occurs in one of the ditches.

Nonpoint Source Control, Stormwater Management and Remediation

- The City of Golden administered 31 stormwater-quality construction permits and conducted 673 erosion and sediment control inspections. These inspections resulted in 256 written and 119 verbal notifications. Two permits were withheld, and at one site performance security for corrections was used.
- The Stormwater Maintenance Program of the City of Golden performed 245 inspections resulting in 242 letters sent to land owners requesting maintenance. In addition, the City's Stormwater Division inspects and cleans municipal inlets twice per year. Lastly, the Tucker Gulch Channel Construction project was completed, creating a sediment trap to reduce loadings to Clear Creek.
- The City of Arvada completed 1,644 erosion and sediment control inspections on 177 active construction sites. These inspections resulted in 230 Warnings and 13 Notices of Violation. Further, 13 builders were subject to additional enforcement. As a consequence, they must now demonstrate compliance prior to receiving building permits.
- The Stormwater Program of the City of Arvada inspected all 173 permanent BMPs in 2014.
- The Standley Lake Cities installed automatic sampling equipment and infrastructure at the reconstructed headgate of the Farmers' Highline Canal.
- Clear Creek County issued seven permits for floodplain development and 11 permits for stormwater BMPs as part of its efforts to control the release of sediment to Clear Creek.
- The Colorado Department of Transportation (CDOT) continued with a number of projects in the watershed. These include: the I-70 Twin Tunnels, the Peak Period Shoulder Lane, the US-6 Acceleration Lane, and the Clear Creek Tributaries Sediment Control and Metal Removal projects. All include improvements to sediment control and the minimization of impacts to Clear Creek.
- The Clear Creek County Environmental Health Department issued 23 on-site wastewater treatment system (OWTS) permits in 2014 and continued monitoring existing systems for failure.
- The Clear Creek Watershed Foundation (CCWF) completed three site remediation projects in 2014. These include: the North Empire Stream Corridor Restoration, the North Fork Clear Creek Sediment Removal and Remediation, and the Wooded Grove Remediation. In

addition, the CCWF partnered with CDOT on the Clear Creek Tributaries Sediment Control and Metal Removal Project.

Public Education, Outreach, and Partnerships

- The Clear Creek Watershed Foundation organized and hosted the sixth annual Clear Creek Watershed Festival in September 2014. Approximately 600 people attended the event held in central Idaho Springs, which included more than 30 environmental education booths.
- Staff from the City of Golden Stormwater Program distributed educational materials and attended/hosted public events.
- In addition, Golden held another successful Public Works Academy in 2014. This 20-hour program educates citizens about the range of facilities and activities of the Public Works department.
- The City of Arvada hosted water-quality education booths at five festivals in Colorado in 2014.
- Staff from the City of Arvada's Stormwater Program provides education on an on-going basis for contractors, city personnel, citizens and students.
- The City of Golden continued funding for the Rooney Road Recycling Center, which provides critical recycling and disposal services of household hazardous waste and electronics.
- The Clear Creek County Transfer Station sponsored three Household Hazardous Waste Collection events providing services to 238 people. The collected waste filled more than 50 drums representing a significant increase over 2013. The Transfer Station also diverted 1,287 tons of solid waste, sent 237 tons of recyclable materials for reuse, collected 552 CY of slash and handled 2,400 gallons of motor oil.
- The Drug Enforcement Administration (DEA) sponsored two National Pharmaceutical Take-Back Days in 2014. The City of Arvada collected 2,165 pounds of medications and the Standley Lake Cities collected 2,937 pounds. In addition, the City of Golden Police Department held a prescription drug collection in 2014.

Planning Activities

- In 2014, the Westminster Parks and Open Space Department started the process of updating the Standley Lake Park Master Plan. The updated Master Plan is being developed recognizing that the primary purpose of the reservoir is to provide a protected water source to the Standley Lake Cities.
- The SLC are participating in a study titled "Wildfire Impacts on Drinking Water Treatment Process Performance: Development of Evaluation Protocols and Management Practices." This study is being conducted through the Water Research Foundation Tailored Collaboration Program.
- In 2014, UCCWA completed a long-overdue revision of its Watershed Plan. Financial support for this process was provided by Molson Coors. The plan serves an important function in monitoring and tracking needs identified along Clear Creek.

Other Activities

- The Clear Creek Watershed Foundation began work on the Fishing-is-Fun Clear Creek Access project in August 2014. This project is designed to improve access to Clear Creek for fishing and other forms of recreation at eleven access points along the creek between Silver Plume and Tunnel 5 on U.S. Highway 6.
- The Climax Molybdenum Company has completed a project to bypass the flow of Woods Creek from under two tailings impoundments. The replacement system allows mostly open channel flow and improves long-term stability and safety.
- The monitoring and management of aquatic invasive species in Standley Lake continued. The densities of Eurasian Watermilfoil have remained low, with levels in 2014 consistent with the decrease in densities observed since 2006. In 2014, City of Westminster personnel completed the plant monitoring survey.
- Monitoring for invasive zebra and quagga mussels continues. Sampling tows, substrate samplers, and shoreline surveys from 2014 show that Standley Lake continues to be free of zebra and quagga mussels.

ES-4. 2014 Observed Flow and Water Quality

To assess 2014 conditions in Clear Creek and Standley Lake, flow and water-quality records were reviewed and compared to the previous five years of record (2009-2013). For Clear Creek and the canals, the water-quality analyses focused on total suspended solids (TSS), total nitrogen (TN), and total phosphorus (TP). In addition, chlorophyll *a*, Secchi depth, and dissolved oxygen were assessed in Standley Lake. In the Upper Clear Creek Basin, data analyses focused on results from two locations: the upstream location at Lawson (stations CCAS26/CC26), and near the downstream end of the Upper Basin at stations CCAS59/CC60, located near the canal diversion points to Standley Lake. Water-quality analyses of Standley Lake focused on results from sampling location SL10, near the deepest part of the lake. Highlights of findings from these analyses are presented below.

2014 Discharge

Annual hydrographs for the key Upper Basin locations (CC26 and CC60) exhibited fairly typical patterns in 2014 (Figure ES-2). These patterns can be described as rising in early April and steeply increasing mid-May, coinciding with snowmelt runoff. Peak annual flow rates occurred in early June. The falling limb of the snowmelt hydrograph extended through the summer punctuated by occasional increases in streamflow associated with precipitation events. The total annual flow volume through Clear Creek in 2014 was above average compared to the previous five years (2009 through 2013). Compared to the available longer-term record from 1947 through-2013, flows in Clear Creek were 26% above average.

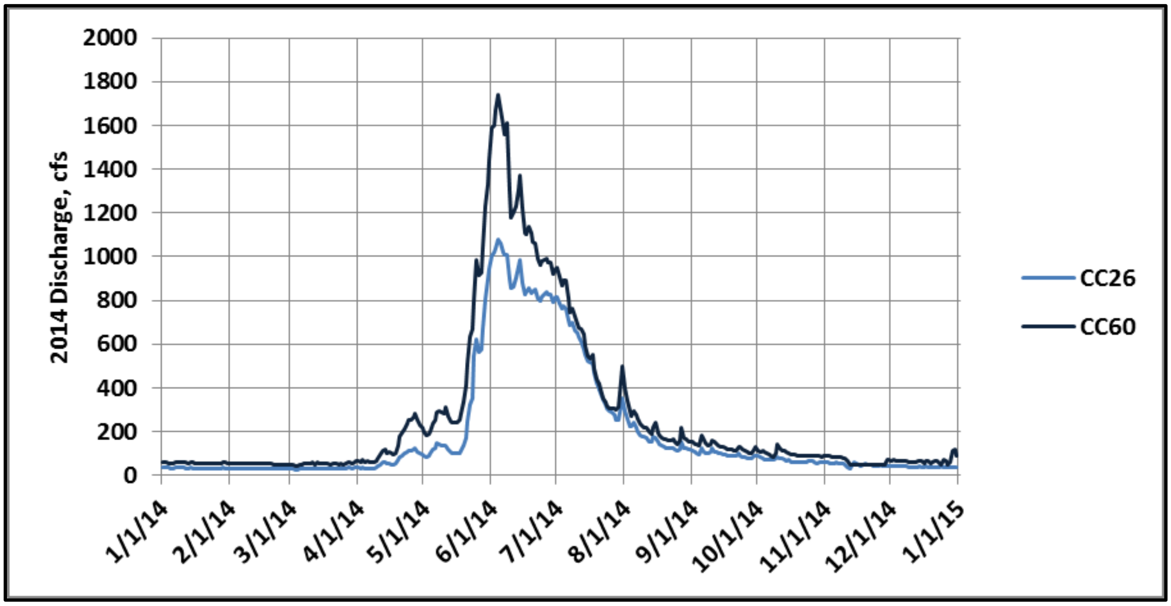

Figure ES-2. 2014 Clear Creek Hydrographs (CC26, CC60)

WWTF Effluent Concentrations

The WWTFs in the Clear Creek watershed continued efforts in 2014 to reduce nutrient discharges. In 2012, the Water Quality Control Commission (WQCC) adopted Regulation 85, the Nutrients Management Control Regulation, which establishes numeric standards for nutrient concentrations in WWTF effluent. WWTFs with a design capacity of less than or equal to 1.0 MGD or WWTFs owned by a disadvantaged community are not required to meet the discharge limits set in the regulation. Of the nine WWTFs in the watershed, only Black Hawk/Central City (with a design hydraulic capacity of 2.0 MGD) is subject to Regulation 85. This regulation also requires all WWTFs to sample and report effluent nutrient concentrations. For minor dischargers (less than 1 MGD), sampling is required at minimum once every two months. For major WWTF dischargers (greater than 1 MGD), monthly sampling is the required minimum frequency. With the exception of Black Hawk/Central City, all of the WWTFs in the watershed are classified as minor dischargers. Sampling under Regulation 85 began in April of 2013.

A summary of 2014 TP and TN effluent data from the 7 WWTFs sampled in the watershed is presented in Table ES-2. This summary only includes facilities subject the sampling requirements of Regulation 85 (this excludes the Eisenhower Tunnel and Henderson Mine WWTFs).

Table ES-2. Summary of Total Phosphorus and Total Nitrogen Concentrations in Wastewater Treatment Facility Effluent in 2014 (Grab Samples)

	Total Phosphorus (mg/L)			Total Nitrogen (mg/L)		
WWTF	Min	Max	Average	Min	Max	Average
Loveland Ski Area	0.16	4.47	1.238	9.4	103	32.42
Georgetown	0.09	1.4	0.581	2.6	7.7	4.87
Empire	0.16	11.17	2.55	15.2	43.2	29.6
Central Clear Creek	1.04	2.7	1.95	20.1	39.8	30.4
St. Mary's	0.43	1.78	1.04	3.2	17.3	11.0
Idaho Springs	0.14	0.62	0.335	1.2	12.6	4.133
Black Hawk / Central City	0.06	0.34	0.13	3.4	8.74	5.2925

Total Suspended Solids and Nutrients in Clear Creek

Concentrations and loads of TSS, TP, and TN in 2014 in the Upper Basin of Clear Creek were generally comparable to ranges observed for 2009-2013 for non-event samples.

Concentrations of TSS were higher in the lower part of the basin as opposed to the upper portion (Figure ES-3). This is consistent with observations from previous years and reflects expected land use loading patterns. Downstream (CC60) peak 2014 TSS concentrations during the snowmelt runoff are at the upper extent of, but similar to, values observed over the previous five years. Peak TSS concentrations at CC26 were higher than the peak concentrations observed in previous years. TSS loads in 2014 were comparable to past years at CC59/60 and higher than past years at CC26.

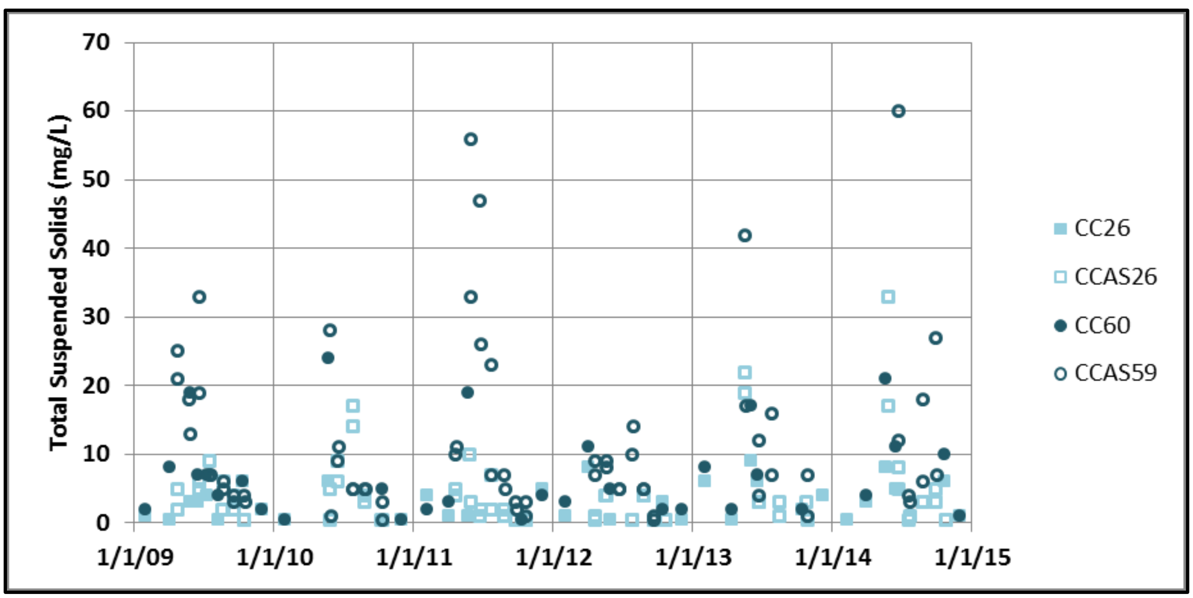

Figure ES-3. Total Suspended Solids Concentrations (Non-Event) in the Upper Basin, 2009-2014

Temporal patterns in TP concentrations track those for TSS, showing three distinct periods: peak concentrations during snowmelt, decreasing concentrations during the summer, and low concentrations during fall and winter (Figure ES-4). This pattern is consistent with the tendency for phosphorus to adsorb to suspended sediments. Results from 2014 typically fall within observed ranges from the previous five years. TP loading in 2014 was comparable to loads in 2011, a year with similar flow volumes.

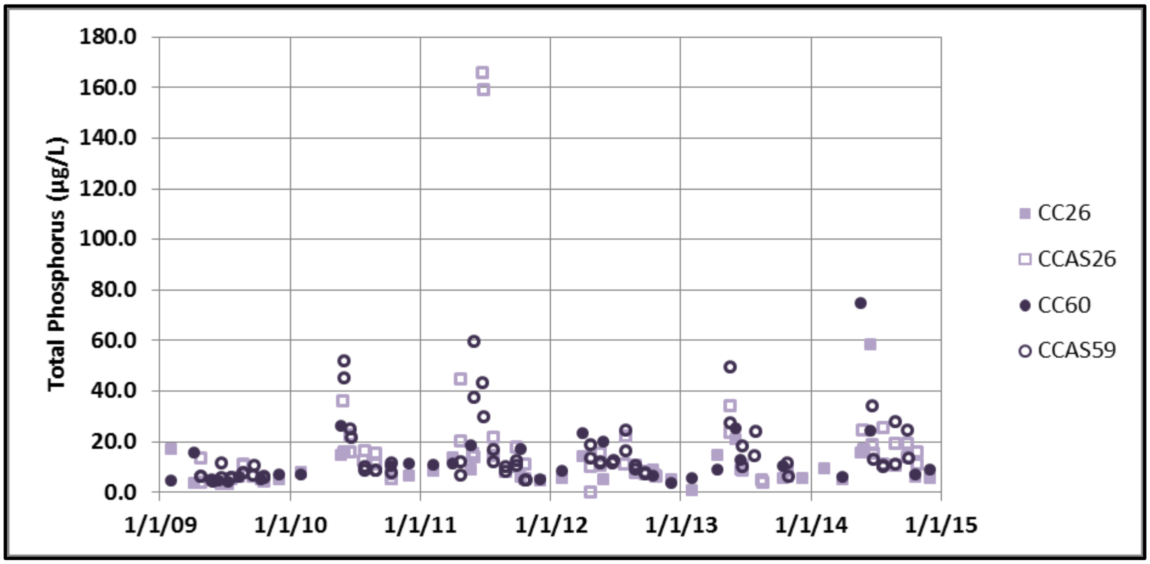

Figure ES-4. Total Phosphorus Concentrations (Non-Event) in the Upper Basin, 2009-2014

TN concentrations follow a seasonal pattern inverse to TSS and TP, with lower concentrations during the summer months, and higher concentrations during the winter and early spring (Figure ES-5). This indicates that the mechanisms of nitrogen loading are different. These non-storm-event results for TN from 2014 all fall within observed ranges from the previous five years. TN Loadings at CC26 are consistent with the average for the previous five years. In contrast, the loadings at CC59/60 are greater than the average of the previous five years.

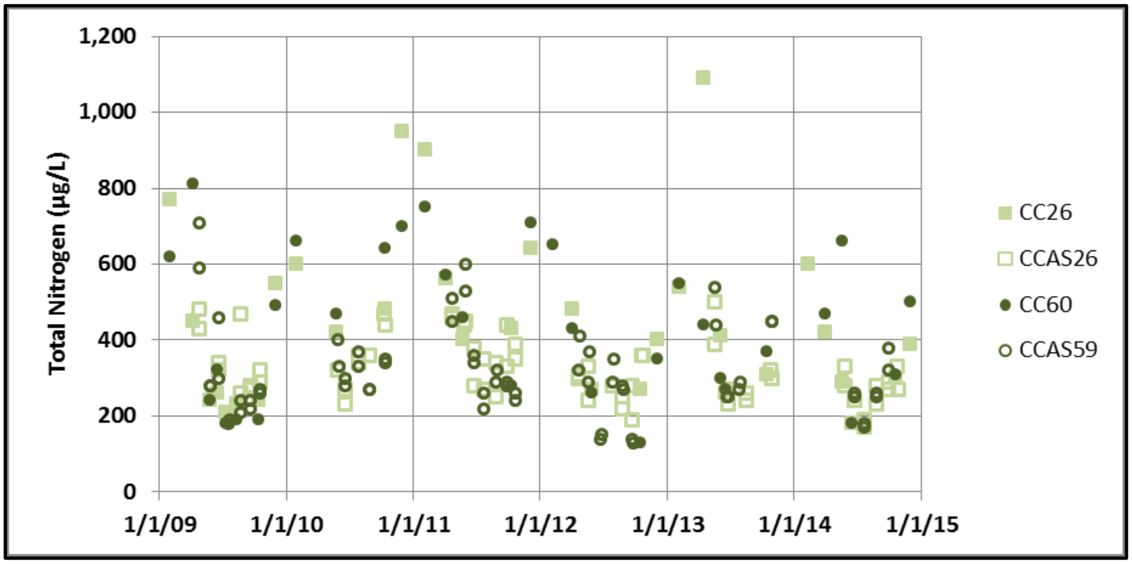

Figure ES-5. Total Nitrogen Concentrations (Non-Event) in the Upper Basin, 2009-2014

Inflow and Loading into Standley Lake

The total volumes of inflow to and outflow from Standley Lake in 2014 were very close to the 2009-2013 average. Figure ES-6 presents total annual inflow and outflow volumes for 2009-2014 as well as 2009-2013 averages.

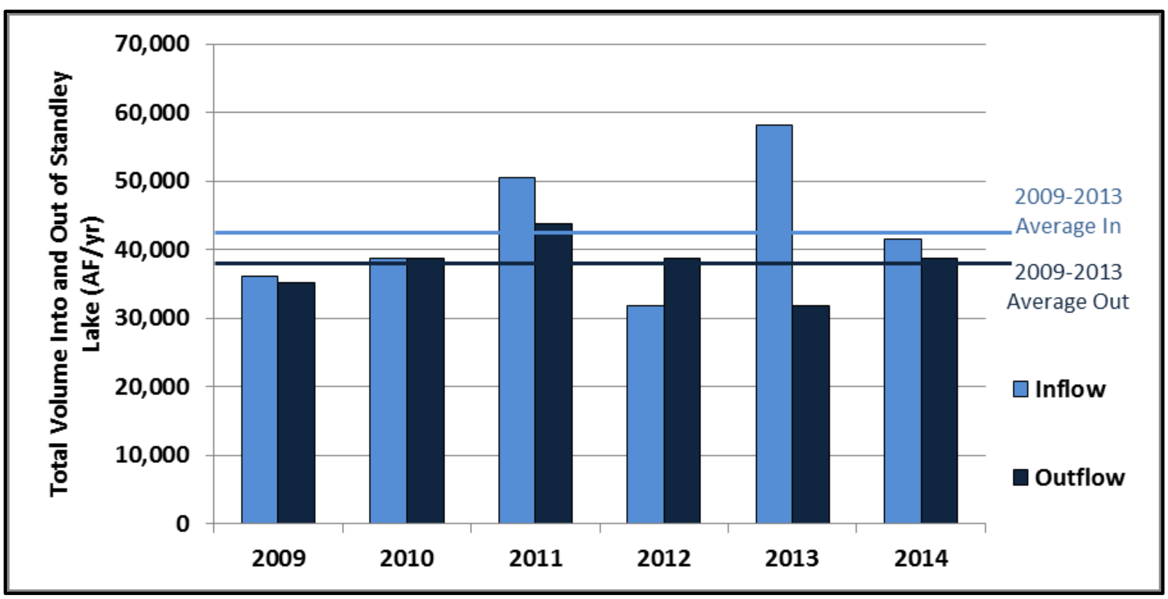

Figure ES-6. Total Annual Inflow and Outflow for Standley Lake, 2009-2014

Standley Lake daily contents in 2014 are presented along with 2009-2013 contents data in Figure ES-7. Following the flood of September 2013, the contents of Standley Lake started much higher than in past years. The lake was filled by May, and Standley Lake water levels ended 2014 at a level consistent with the high levels observed at the end of 2013.

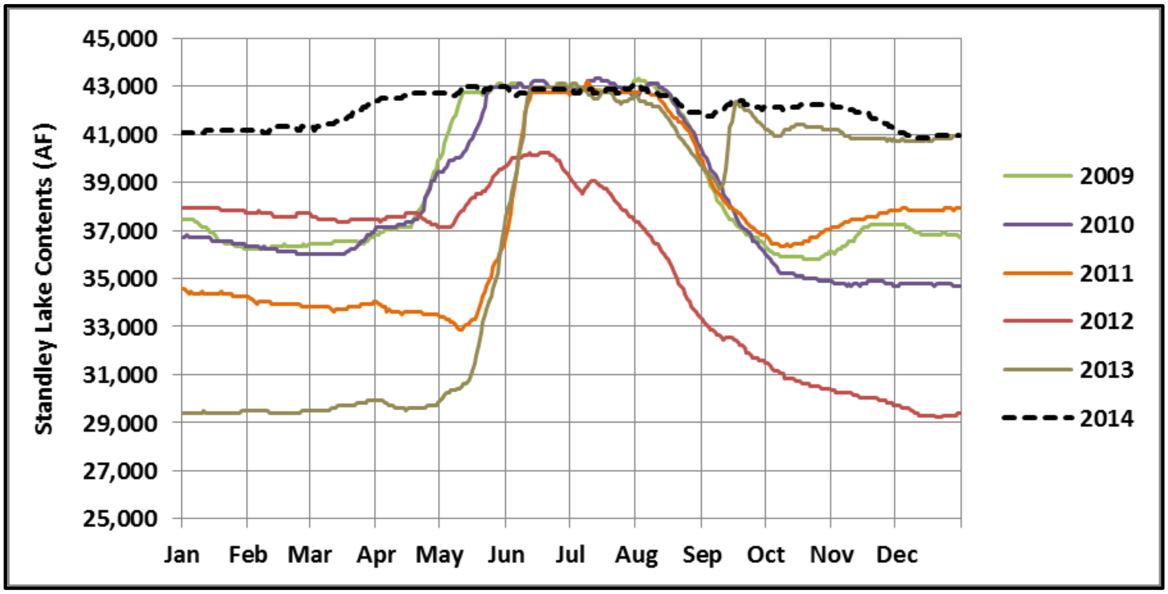

Figure ES-7. Standley Lake Contents, 2009-2014

Total phosphorus loading estimates into and out of Standley Lake based on all ambient (non-storm-event) samples are displayed in Figure ES-8. Total phosphorus loading into Standley Lake was 23% above the 2009-2013 average. The volume-weighted TP concentration of the 2014 inflow was 32% above the 2009-2013 average.

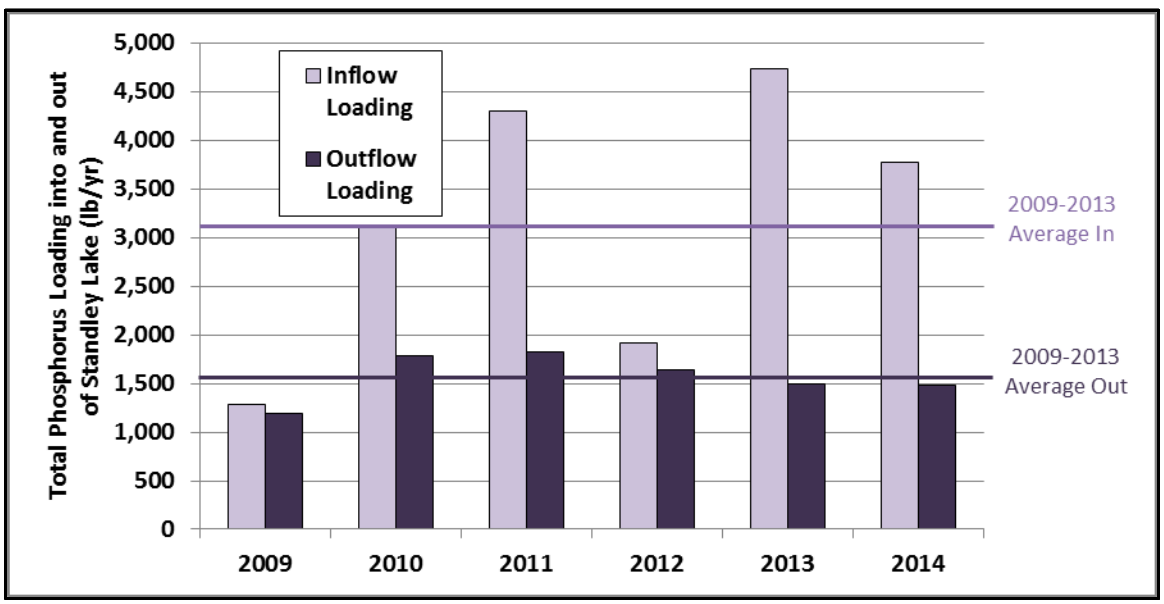

Figure ES-8. Total Phosphorus Loading into and out of Standley Lake, 2009-2014

Total nitrogen loading (based on all non-storm-event samples) into and out of Standley Lake for 2009-2014 is presented in Figure ES-9. Total nitrogen loading was 7% lower than the 2009-2013 average. The 2014 volume-weighted TN concentration into Standley Lake was 3% lower than the 2009-2013 average.

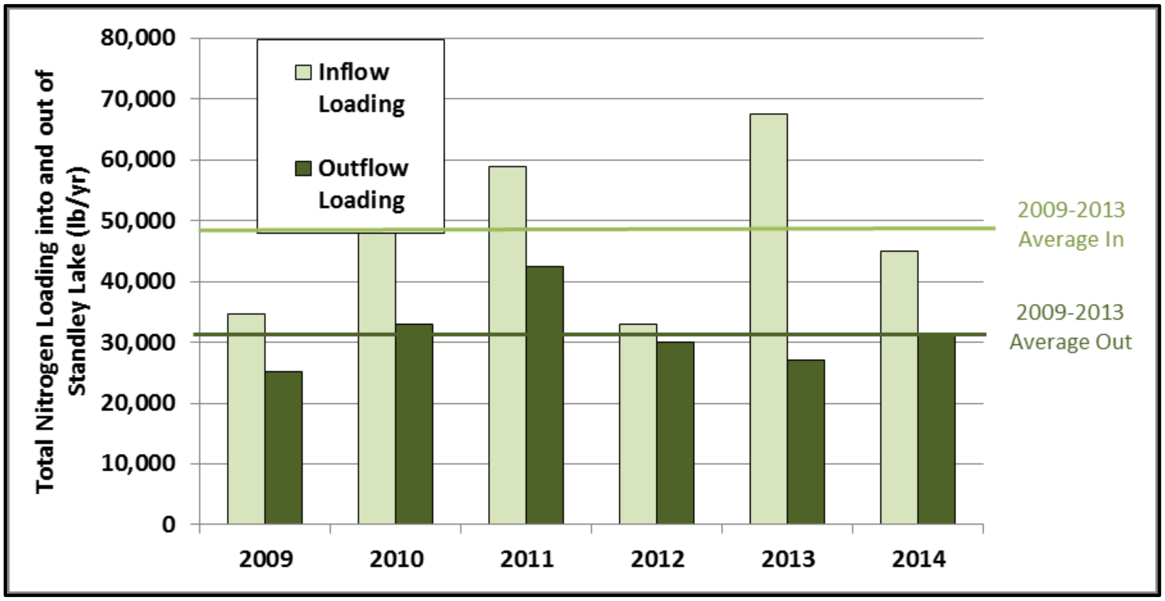

Figure ES-9. Total Nitrogen Loading into and out of Standley Lake, 2009-2014

In 2014, four storm events were sampled on Farmers' High Line Canal (FHL). Incorporation of the observed storm events yields a 9% increase in the estimated 2014 TN loading to Standley Lake from FHL and a 33% increase in TP loading. These results demonstrate that loading from storm events can be a significant fraction of the total annual load to Standley Lake.

Water Quality in Standley Lake

Water quality in Standley Lake was good throughout the year. In July 2014, the reservoir was very strongly stratified. This strong stratification resulted in a late turnover and a longer period of hypoxia (< 2 mg/L dissolved oxygen) in the hypolimnion—100 days. This period was longer than the 2009-2013 average of 95 days (Figure ES-10).

Nutrient concentrations at the top and bottom of Standley Lake also followed typical seasonal patterns and concentrations ranges. As shown in Figure ES-11 and ES-12, TN and TP concentrations at the bottom of the reservoir increased, as usual, during the period of stratification and hypoxia in the hypolimnion, due to internal loading from sediments. Overall, the average TP concentration in 2014 was 23% lower in the hypolimnion than the respective 2009-2013 average and 9% lower in the photic zone. Average TN concentrations in 2014 were 28% higher in the hypolimnion and 43% higher in the photic zone, as compared to the averages from 2009-2013.

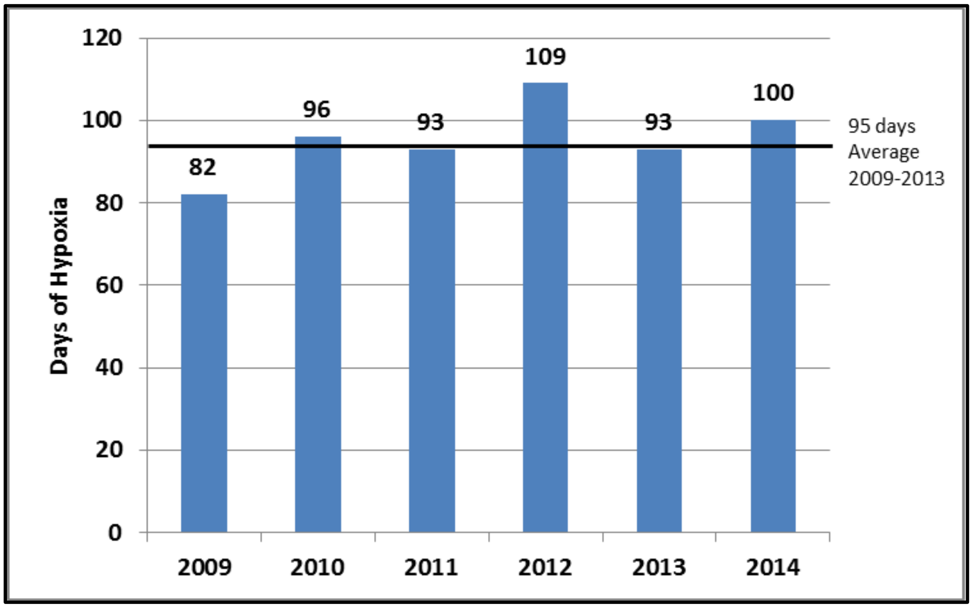

Figure ES-10. Days of Hypoxia (DO < 2.0 mg/L), 2009-2014

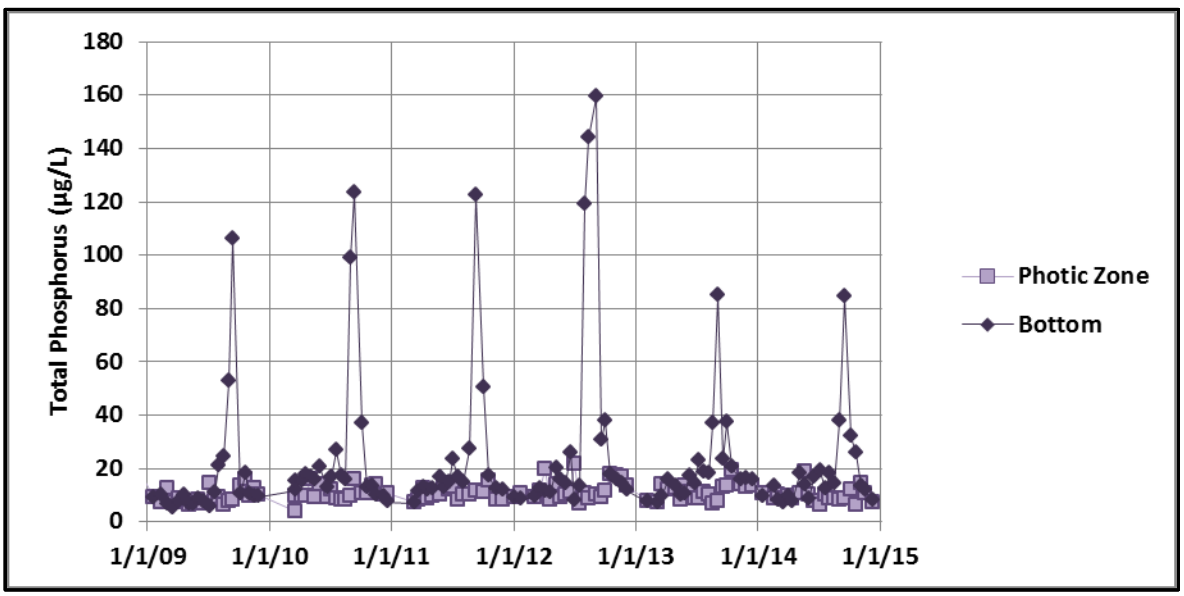

Figure ES-11. Total Phosphorus Concentrations in the Photic Zone and Bottom of Standley Lake, 2009-2014 (Site SL10)

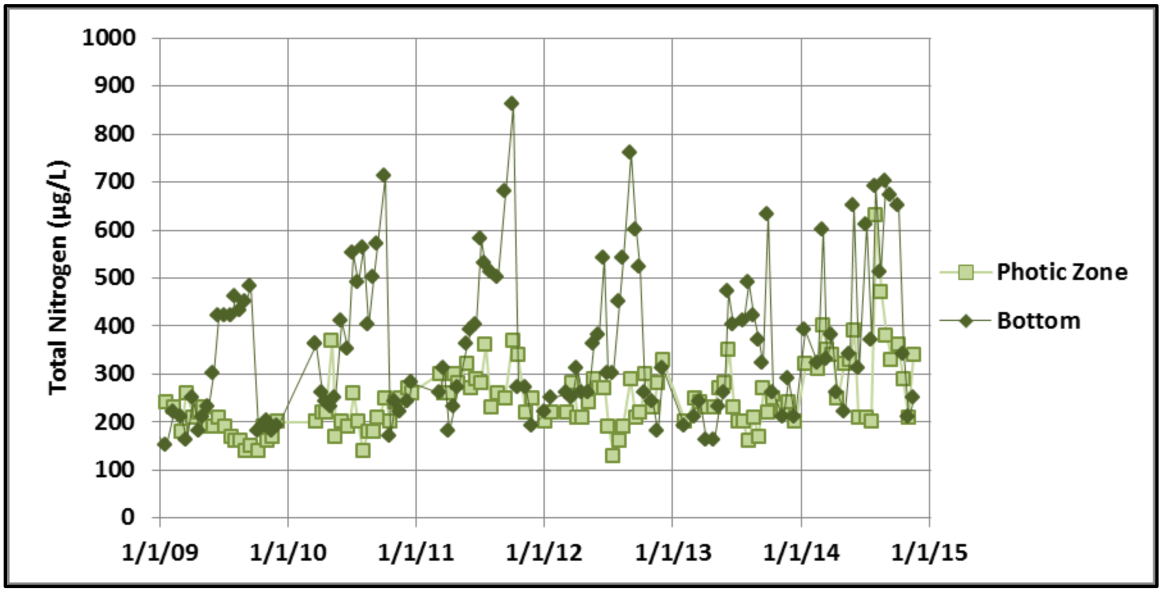

Figure ES-12. Total Nitrogen Concentrations in the Photic Zone and Bottom of Standley Lake, 2009-2014 (Site SL10)

As seen in previous years, chlorophyll *a* concentrations in Standley Lake in 2014 were low during summer months, with the peak concentration of 6.0 µg/L observed in December, and a secondary spring peak of 5.8 µg/L observed in April. The site-specific March through November chlorophyll *a* standard of 4 µg/L was once again met in 2014 with an average value of 2.7 µg/L. The standard is met when four out of the five recent years have a March-though-November average below 4.0 µg/L. For the five-year period 2010-2014, each year had a March-November average concentration below 4.0 µg/L. Of the last ten years, only one year (2007, at 4.8 µg/L) had a March-November average concentration above 4.0 µg/L.

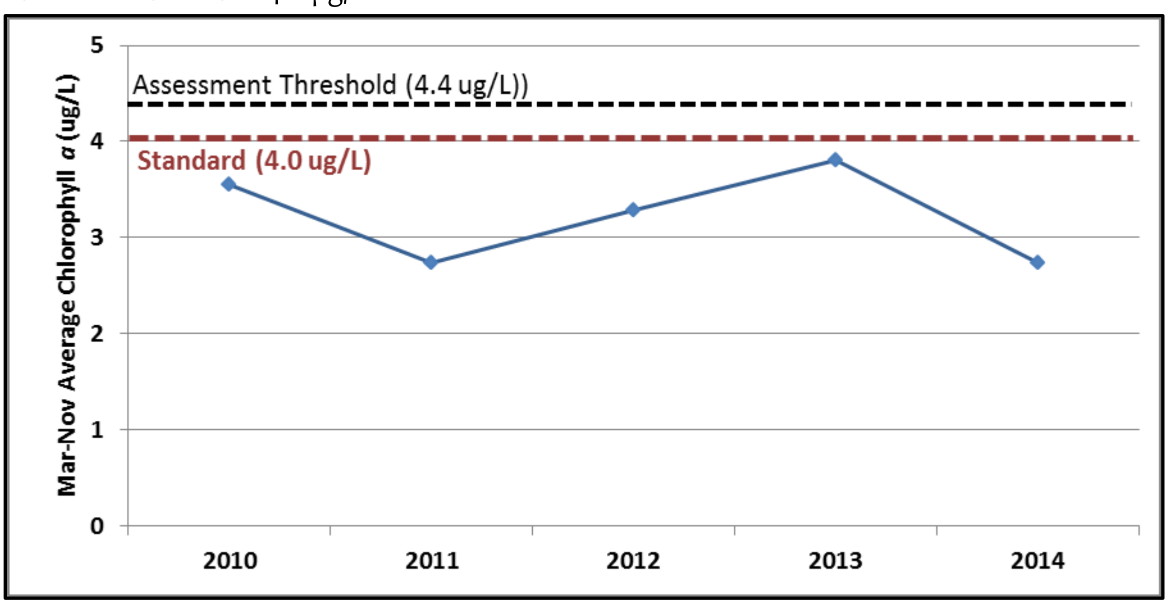

Figure ES-13. Observed Average Chlorophyll *a* Concentrations (Mar-Nov) Compared with the Standard and the Assessment Threshold, 2010-2014 (Site SL10)

I. Introduction

A. Purpose and Scope of Report

In 1993, the Clear Creek/Standley Lake Watershed Agreement (1993 Agreement) was signed by a contingent of governmental agencies and private corporations to address water-quality issues and concerns within the Clear Creek watershed – specifically as they affect the water quality of Standley Lake. This annual report provides a review of 2014 water-quality efforts in the Clear Creek watershed, according to the annual reporting obligations set forth in the 1993 Agreement. Water-quality data for 2014 are also presented and compared to the previous five years of data (2009-2013).

Looking West over Standley Lake (Photo Credit: Eric Scott)

B. Organization of the Report

Following this introductory section, this report is organized as follows:

- **Section II. Description of Standley Lake, Its Watershed, and Routine Monitoring** – An overview of the reservoir and its watershed, including maps and monitoring practices.
- **Section III. Activities and Accomplishments in 2014** – A summary of 2014 activities related to water-quality management and improvement in the Clear Creek Basin, canals, and Standley Lake.
- **Section IV. Upper Basin Water Flows and Quality** – A presentation of data collected from key locations in the Upper Basin, with a focus on nutrient concentrations and annual loading of total nitrogen, total phosphorus, and total suspended solids.
- **Section V. Standley Lake Flows, Contents, and Loading –** A summary of 2014 inflow to Standley Lake, outflow from the lake, and lake storage. This section also includes an analysis

of nutrient loading into and out of the lake, with consideration of total nitrogen and total phosphorus loads from each canal.

- **Section VI. Standley Lake Water Quality** - An analysis of lake water quality with a focus on total nitrogen, total phosphorus, chlorophyll *a,* dissolved oxygen, and clarity.
- **Section VII. Conclusions** – A summary of findings from the report.

In addition, four appendices are included in this report to provide additional background and detailed information:

- Appendix A. Clear Creek / Standley Lake Watershed Agreement;
- Appendix B. Upper Clear Creek / Standley Lake Watershed Water Quality Monitoring Program;
- Appendix C. Clear Creek, Canal, and Standley Lake Water-Quality Monitoring Data for 2014; and
- Appendix D. 2014 Regulation 85 Water-Quality Monitoring Data.

II. Description of Standley Lake, Its Watershed, and Routine Monitoring

In this section, a broad description of Standley Lake and its watershed is provided. The watershed is comprised of the Upper Basin, which is a portion of the larger Clear Creek watershed, and the Canal Zone, which refers to the lands draining directly to the lake itself or the canals feeding the lake. Routine monitoring activities for each area are also summarized.

A. Standley Lake

Standley Lake is an off-channel, municipal and agricultural reservoir located in Jefferson County, Colorado (Figure 1). This 43,000 acre-foot reservoir is a direct-use drinking water supply for over 250,000 consumers in the downstream cities of Northglenn, Westminster, and Thornton. In addition, the reservoir supports recreational activities and provides water to farms located in Adams and Weld counties. It is owned and operated by the Farmers' Reservoir and Irrigation Company (FRICO).

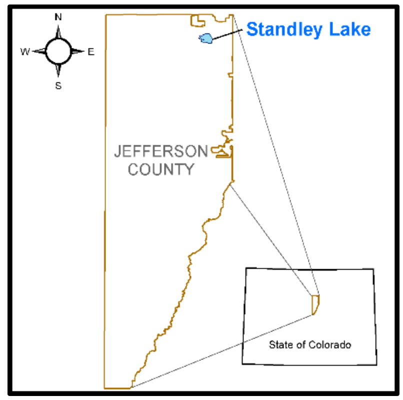

Figure 1. Location of Standley Lake

Through the Standley Lake Monitoring Program, the lake is frequently monitored throughout the year during ice-free conditions. The lake is sampled at multiple locations, but for this report, the focus is on results from the deepest sampling location, SL10 (Figure 2). This location is approximately 0.25 miles south of the municipal supply intakes. Routine monitoring practices for Standley Lake are described in detail in the Upper Clear Creek/Standley Lake Watershed Water Quality Monitoring Program (Appendix B). Lake monitoring efforts are summarized below:

Windsurfing at Standley Lake (Photo Credit: City of Westminster, 2014 Standley Lake Master Plan)

- **Daily Profiles –**Standley Lake water quality is measured four times daily using an automated profiler (Figure 3). Measurements are taken every meter, from the surface to within 2 meters of the bottom. The profiler is equipped with a multi-probe sonde and provides readings of water temperature, dissolved oxygen, pH, conductivity, turbidity, oxidation reduction potential (ORP), and chlorophyll *a* concentrations.

- **Surface and Bottom Sampling** – Grab samples are collected in the lake at three depths: the surface, in the photic zone (at two times the measured Secchi depth), and one meter from the bottom. Sampling occurs twice each month if the lake is not frozen. A wide range of constituents are measured, including nutrients, metals, algae, suspended solids, and numerous field parameters.

- **Zooplankton Tows** – Zooplankton tows are conducted during each lake sampling event.
- **Invasive Species Monitoring** – Monitoring for Eurasian watermilfoil and zebra and quagga mussels is conducted during each lake sampling event.

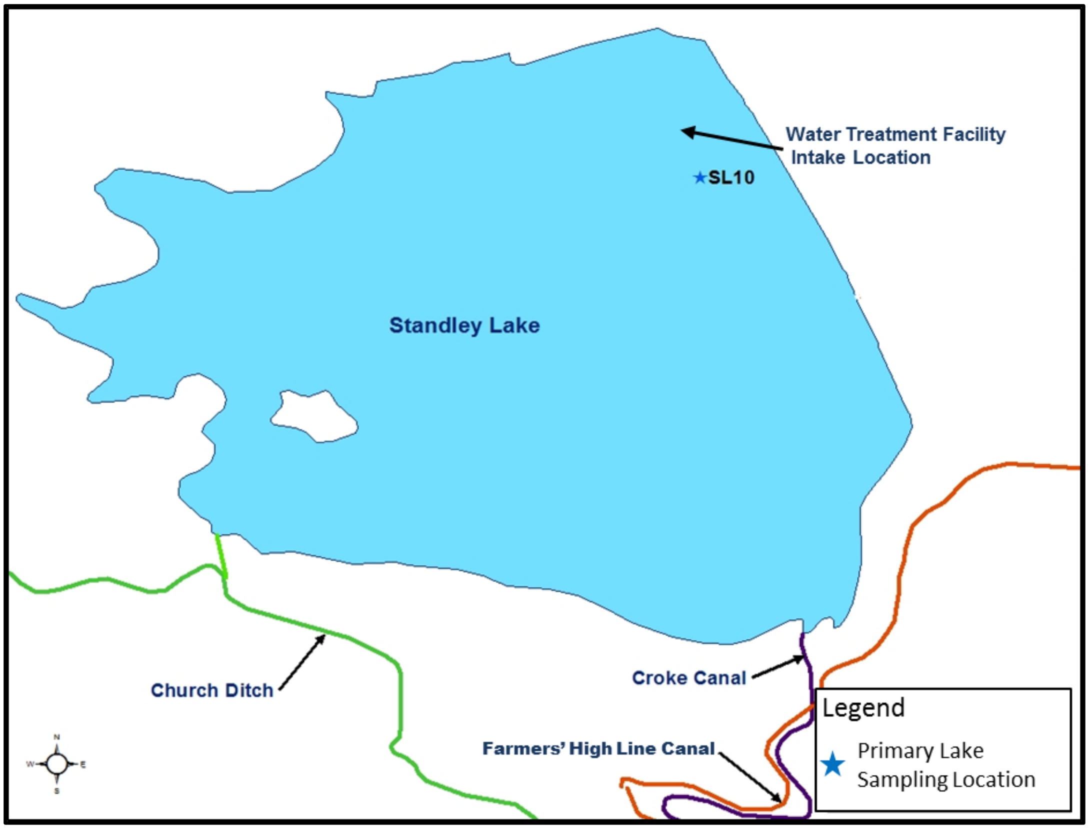

Figure 2. Standley Lake and Sampling Location SL10

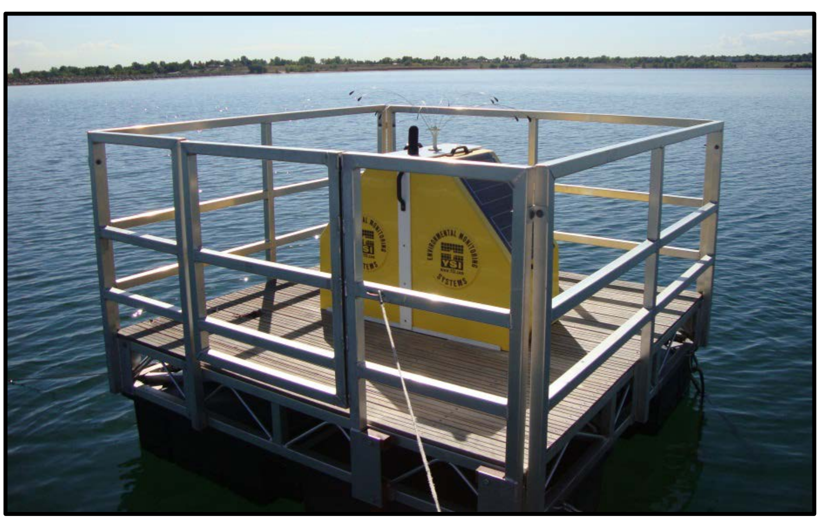

Figure 3. Water-Quality Profiler at SL10

B. Description of the Watershed

The Clear Creek watershed is located west of Denver, Colorado, with its headwaters in the mountains at the Continental Divide (Figure 4). The watershed covers an area of 575 square miles; beginning at an elevation of about 14,000 feet and descending to approximately 5,000 feet at the confluence with the South Platte River in north Denver. In addition to supplying drinking water to 350,000 residents in the watershed, Clear Creek provides water for various recreational, agricultural, and industrial purposes.

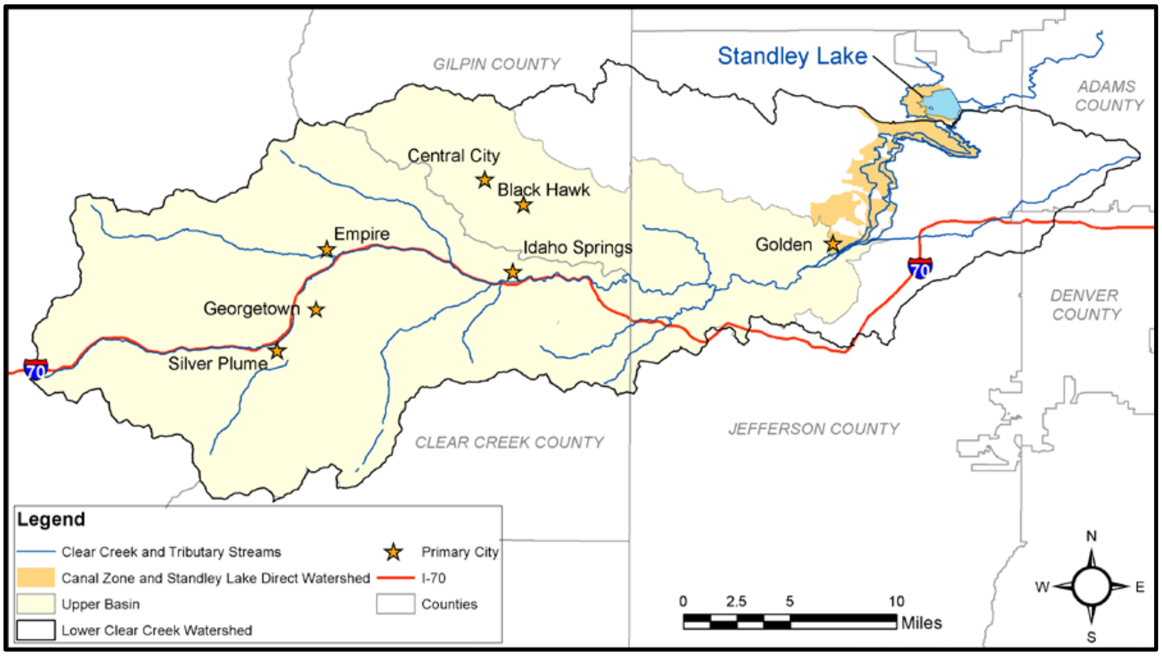

Figure 4. The Standley Lake watershed, Upper Basin, Canal Zone and Direct Watershed

The Standley Lake watershed includes the Upper Basin of the Clear Creek watershed, the canals used to transport water from Clear Creek to the lake and their drainage areas (the Canal Zone), and a direct lake watershed. The following subsections describe the Upper Basin and the Canal Zone.

1. Upper Basin

The Upper Basin region of the Clear Creek watershed (Figure 4) comprises nearly 400 square miles upstream of the Croke Canal headgate. This region includes the upper portion of Clear Creek and its various tributaries -- the most prominent of these being the West Fork of Clear Creek, Leavenworth Creek, the South Fork of Clear Creek, Fall River, Chicago Creek, the North Fork of Clear Creek, Beaver Brook, Soda Creek, and Elk Creek. Numerous cities and towns are scattered throughout this mountainous area including Idaho Springs, Black Hawk, Central City, Empire, Georgetown, and Silver Plume. Additionally, U.S. Interstate 70 (I-70) runs through the watershed. This highly-utilized transportation corridor averages approximately 40,000 vehicles per day near Idaho Springs (CDOT, 2015.

Water quality in the Upper Basin is affected by a variety of sources. The region contains nine wastewater treatment facilities (WWTFs) which serve the local population and resorts (Figure 5). Additionally, the Upper Basin contains operating and abandoned mines and receives water from trans-basin diversions. Water quality in the Upper Basin may also be impacted by nonpoint sources of pollution, including numerous onsite wastewater treatment systems (septic systems, OWTS), application of roadway deicers and traction sands, and residential and commercial stormwater runoff.

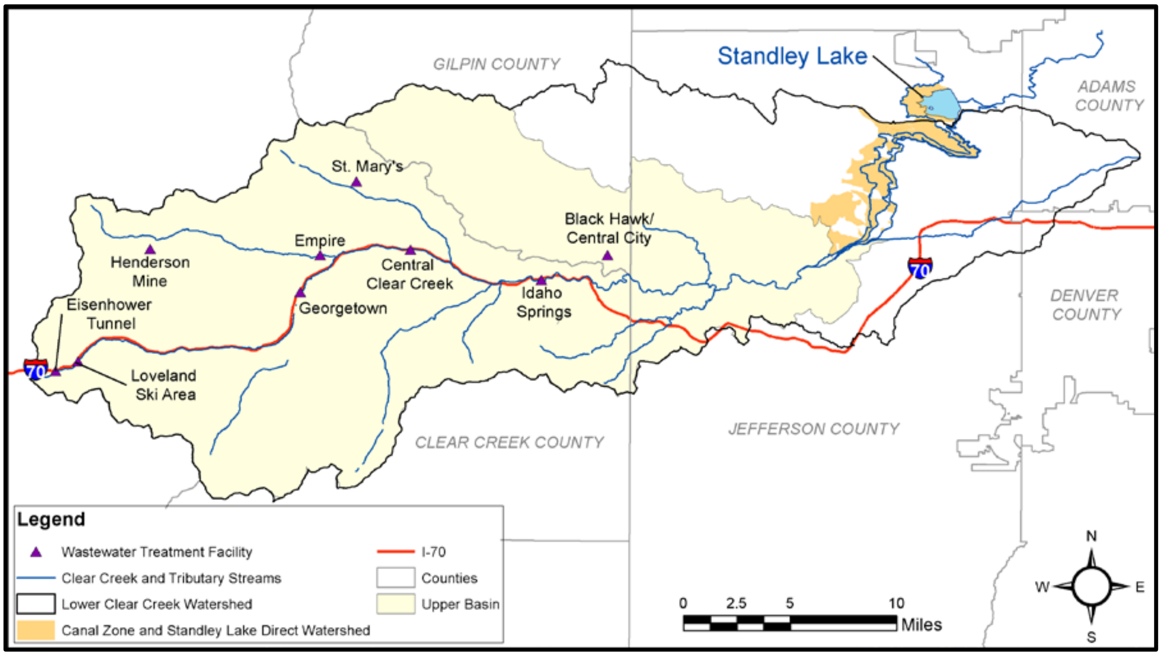

Figure 5. Wastewater Treatment Facilities in the Upper Basin

Flow measurements and water-quality samples are collected at numerous stations throughout the watershed to monitor the concentrations of nutrients, select metals, and other key constituents (Figure 6).

Upper Basin monitoring activities have been designed to evaluate the relative contributions of various nutrient sources, effectiveness of best management practices (BMPs), WWTF operational changes, and nutrient reductions from WWTF upgrades. The monitoring program has a strong emphasis on the collection of composite samples instead of grab sampling. The composite samples are collected by autosamplers; relative to grab samples, they provide a more complete picture of water quality over the course of the sampling date. These composite samples are of two types: ambient and event. Ambient samples are collected on a periodic basis and consist of two consecutive 24-hour composites, providing a 48-hour snapshot of water quality. Event samples are storm-triggered and are located at certain locations. Routine monitoring for the Upper Basin is described in detail in Appendix B.

The analyses described in the Upper Basin portion of this report are based on data from two key sampling areas (circled on Figure 6), based on their location and higher frequency of sampling (Table 1). For this report, three important constituents are analyzed: total phosphorus (TP), total nitrogen (TN), and total suspended solids (TSS).

Table 1. Key Watershed Locations in the Upper Basin

General Area	Purpose	Station Name and Location	Station Type
Clear Creek main stem, downstream of the confluence with the West Fork, at the location of USGS* Lawson flow gage	Characterize water quality in the upper portion of the Upper Basin	CC26 – Clear Creek at Lawson Gage	Grab Sample Station
		CCAS26 -- Clear Creek at Lawson Gage	24-Hr Composite Autosampler
Clear Creek main stem, near the canal headgates, near Golden	Characterize water quality near the Clear Creek canal diversions to Standley Lake	CC60 – Clear Creek at Church Ditch Headgate	Grab Sample Station
		CCAS59 – Clear Creek 2 miles west of Highway 58/US6	24-Hr Composite Autosampler

*United States Geological Survey (USGS)

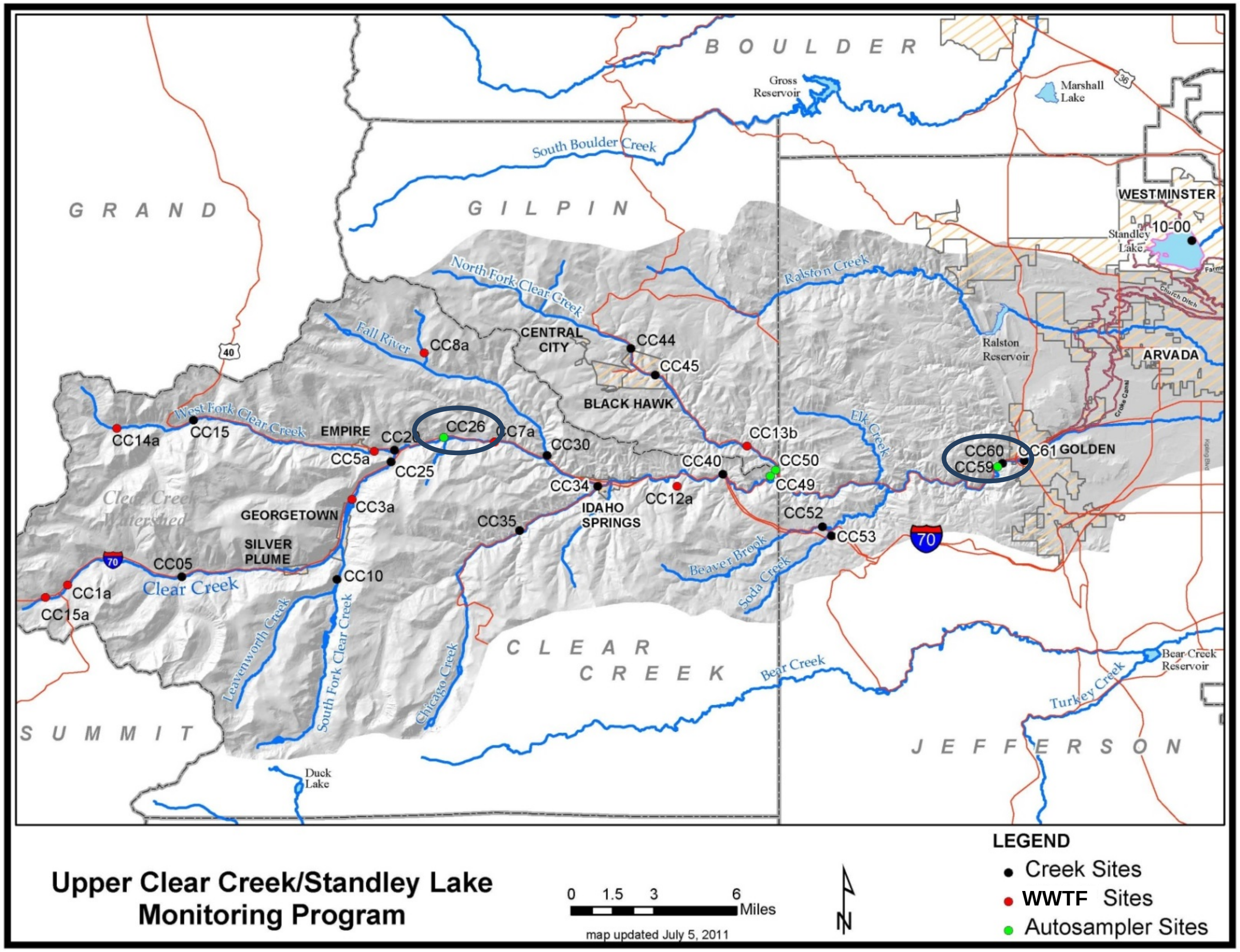

Figure 6. Upper Clear Creek Sampling Stations **(Key locations for this report are circled)**

2. Canal Zone

The Canal Zone contains the canals (and drainage areas) that divert water from Clear Creek into Standley Lake: Church Ditch (Church), Farmers' High Line Canal (FHL), and the Croke Canal (Croke) (Figure 7). In addition to these three Clear Creek canals, the Kinnear Ditch Pipeline (KDPL) also contributes water to Standley Lake sourced from the Coal Creek, South Boulder Creek, and Fraser River basins. The canals are open and largely unlined ditches that are slow-flowing (low gradient). The canals are subject to nonpoint-source loading from adjacent horse and cattle operations, agricultural operations, and residential properties (some with OWTSs). Since the 1990s, a significant percentage (~80%) of the direct runoff into the Clear Creek canals has been hydrologically disconnected from the canals to protect Standley Lake water quality.

To provide information for evaluation of the nutrient loadings from nonpoint sources in the Canal Zone, the three Clear Creek canals are sampled at the headgates, where water is diverted, and at the inlets into the lake. The KDPL is sampled near the inlet into the lake. Figure 7 shows the inlet monitoring location for each canal (CCT4, CCT11, CCT27, and CCT22d). Routine monitoring for the Canal Zone is described in detail in Appendix B.

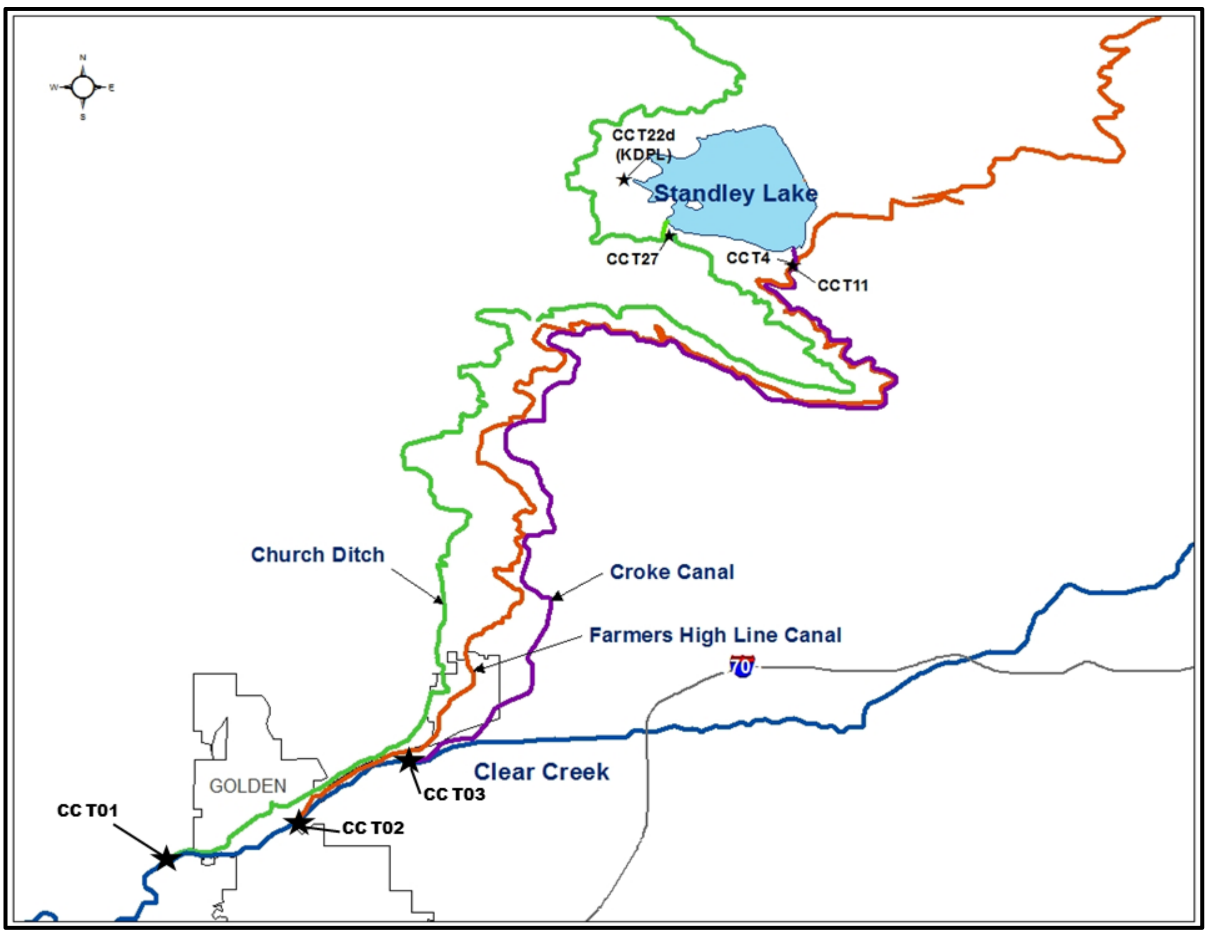

Figure 7. The Three Canals that Divert Water from Clear Creek to Standley Lake and Sampling Stations at the Lake Inflow Locations (including KDPL)

III. Activities and Accomplishments

Efforts to manage, enhance, and protect water quality throughout the Clear Creek watershed and in Standley Lake continued in 2014. These activities were completed by a variety of groups and entities. This section provides highlights of these activities in 2014. The following groups of activities are described:

- Monitoring;
- Canal Maintenance;
- Wastewater Treatment Facilities;
- Illicit Discharges and Emergency Response;
- Nonpoint Source Control, Stormwater Management, and Remediation;
- Public Education, Outreach, and Partnerships;
- Planning Activities; and
- Other Activities.

A. Monitoring Activities

The Upper Clear Creek/Standley Lake Watershed Water Quality Monitoring Program provides the framework for routine collection of flow measurements and water-quality samples throughout the Upper Basin, the Canal Zone, and in Standley Lake. Sample collection for 2014 is summarized in Table 2. Samples were analyzed for a number of constituents, as described in the monitoring plan (Appendix B). Some of the resources used for flow and water-quality monitoring are listed in Table 3.

New measurement devices were also installed in 2014. The September 2013 floods demonstrated a gap in rainfall data for the Clear Creek watershed. To address this, a rain gauge was installed at the headgate of the Farmers' Highline Canal in Golden. In addition, a new autosampler was installed at this same location.

Water-Quality Monitoring on Standley Lake (Photo Credit: Eric Scott)

Table 2. Summary of 2014 Water-Quality Sample Collection

Sub-Region	Type of Sample	Number of Locations	Total Number of Samples Collected
Upper Basin	Grab Samples	16	45
	Ambient Auto-Samples	4	44
	Storm-triggered Auto-Samples	3	7
Canal Zone	Grab Samples	7	52
	Ambient Auto-Samples	1	12
	Storm-triggered Auto-samples	4	6
	First Flush Auto-Samples	4	6
Standley Lake	Grab Samples	1 (3 depths)	63
	Vertical Profiles	1	Four Times Daily When Ice-Free, Every Meter

Table 3. Summary of 2014 Monitoring Costs

Entity	Activity Funded	2014 Amount
City of Golden	Water Quality Sampling and Analysis	~$10,000
	Support USGS gage on the West Fork	$10,630
UCCWA*	Support gage at CC40	N/A
Clear Creek County*	Support gages: 1) on Leavenworth Creek, 2) at Berthoud Falls on west Clear Creek, 3) on Fall River	N/A
Standley Lake Cities	Various Gage Support / Water-Quality Sampling and Analysis	$200,000+

*Upper Clear Creek Watershed Association (UCCWA). Financial support for UCCWA and Clear Creek County from Freeport-McMoRan (through Henderson Mine operations)

B. Canal Maintenance

As described in the 2013 Annual Report (Hydros, 2014), a significant amount of effort was devoted to addressing damage from the September 2013 flood. Some of these efforts continued into 2014. The ditch companies worked diligently to repair damaged sections of all canals. The City of Arvada provided significant support to the restoration and improvement of flood-impacted waterways. Included in this support was assistance with repairing and replacing diversion control structures and erosion control structures along the Church Ditch, FHL Canal, and the Croke Canal. FRICO conducted a significant cleaning project at the headgate on Coal Creek. This headgate had been covered with sediment since the September 2013 flood. All 11 repairs on the Church Ditch were completed in July 2015, at a total cost of more than $830,000.

Farmers' High Line Canal (Photo Credit: Eric Scott)

C. Wastewater Treatment Facilities

Nine wastewater treatment facilities are located in the Upper Basin (Figure 5). The following sub-sections provide a brief discussion of key activities at the three largest WWTFs in the basin. Effluent nutrient concentrations over time for each of the WWTFs are presented later in this section.

1. Idaho Springs WWTF

The City of Idaho Springs WWTF is currently in the design phase to switch to ultraviolet (UV) disinfection. This will provide for greater operational safety relative to the current gaseous chlorine and sulfur dioxide system. Reconstruction of the Highway 103 Bridge over I-70 in Idaho Springs was unexpectedly delayed by the discovery of groundwater with elevated levels of metals. This groundwater was successfully treated at the Idaho Springs WWTF, with no impacts observed on effluent quality. Annual averages for nutrient monitoring in 2014 were: ammonia 1.02 mg/L, nitrate 1.15 mg/L, and total phosphorus 0.36 mg/L.

2. Georgetown WWTF

As expected following the expansion and upgrade in 2011, the Georgetown WWTF continued to operate well during 2014. A study evaluating alternatives for the disposal of biosolids generated at this WWTF was completed in 2014.

3. Black Hawk/Central City Sanitation District WWTF

The Black Hawk/Central City Sanitation District (BHCCSD / District) continues to achieve excellent nutrient removal at their WWTF. The District's WWTF employs enhanced biological nutrient removal (BNR) treatment plus tertiary filtration with mechanical disk filters. Following filtration, an additional chemical coagulation/flocculation process is used to further reduce soluble reactive phosphorus. Nitrogen concentrations are controlled by nitrification/denitrification reactions in the BNR process. The final treatment step prior to discharge is UV-disinfection.

The treatment methods continue to result in very low levels of nutrients in the effluent. The BHCCSD WWTF is required to meet Regulation 85 values[1], its effluent concentrations of TP and total inorganic nitrogen (TIN, Table 4) are significantly lower than applicable limits (<40%).

Table 4. BHCCSD WWTF 2014 Effluent Concentrations Compared to Regulation 85 Limitations

	Total Phosphorus (mg/L)		Total Inorganic Nitrogen (mg/L)	
Percentile	BHCCSD WWTF	Reg 85 Value	BHCCSD WWTF	Reg 85 Value
50th	0.15	1.0	4.25	15
95th	0.77	2.5	7.82	20

The WWTF has experienced a slight decrease in average daily flow volumes in recent years. Daily effluent flow rates averaged 0.416, 0.406, and 0.392 million gallons per day (MGD) for 2012, 2013, and 2014 respectively.

BHCCSD monitors and calculates seasonal TP and TIN loadings to North Clear Creek pursuant to a 2000 intergovernmental agreement (IGA) among Central City, Black Hawk, Gilpin County and the District. Actual total phosphorus and total inorganic nitrogen loadings compared to the loading goals specified in a 2000 Water Court Stipulation are displayed in Figure 8 and Figure 9. BHCCSD was not party to the Stipulation, but agreed under the IGA to use its best efforts to operate and maintain the WWTF, which was designed to meet these loading goals. The loading goals are based on an average effluent TP concentration of 0.3 mg/L and an average effluent TIN concentration of 10 mg/L. As demonstrated by Figure 8 and Figure 9, BHCCSD continues to successfully operate the plant. These operations remove nutrients to very low levels as part of an ongoing effort to protect water quality in Clear Creek.

[1] While actual flows are less than 1.0 MGD, the design capacity of the plant is 2.0 MGD. Regulation 85 is further described in the following section.

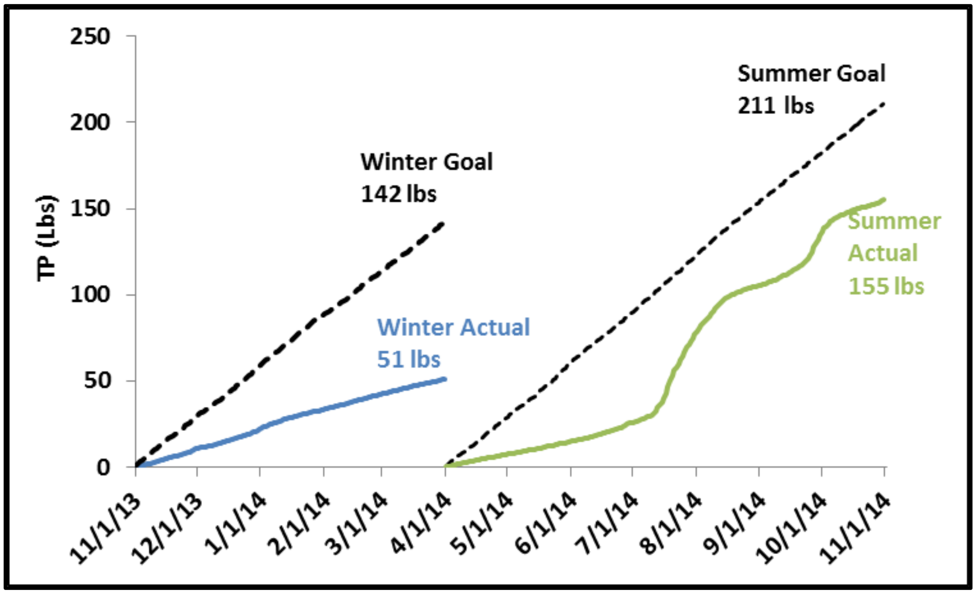

Figure 8. Seasonal TP Loadings to the North Fork of Clear Creek from BHCCSD WWTF

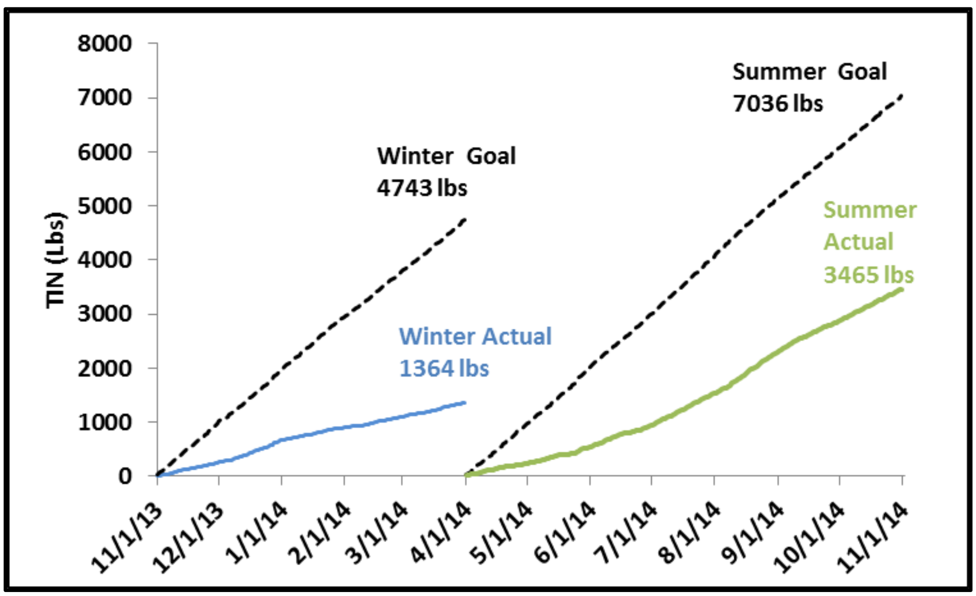

Figure 9. Seasonal TIN Loadings to the North Fork of Clear Creek from BHCCSD WWTF

4. Observed WWTF Effluent Concentrations

In 2012, the Water Quality Control Commission (WQCC) adopted Regulation 85, the Nutrients Management Control Regulation, which establishes numeric standards for nutrient concentrations in WWTF effluent (Table 5). WWTFs with a design capacity of less than or equal to 1.0 MGD or WWTFs owned by a disadvantaged community are not required to meet the discharge limits set in the regulation. Of the nine WWTFs in the watershed, only Black Hawk/Central City (with a design hydraulic capacity of 2.0 MGD) is subject to Regulation 85.

Table 5. Regulation 85 Limitations, existing facilities, for TP and TIN

Constituent	Units	Median (50th Percentile)	95th Percentile
Total Phosphorus	mg/L as P	1.0	2.5
Total Inorganic Nitrogen	mg/L as N	15	20

The WQCC through Regulation 85 also requires all WWTFs to sample and report effluent nutrient concentrations. For minor dischargers (less than 1 MGD), sampling is required at minimum once every two months. For major WWTF dischargers (greater than 1 MGD), monthly sampling is the required minimum frequency. All of the WWTFs in the watershed, except BHCCSD, are classified as minor dischargers. Sampling under Regulation 85 began in April of 2013. Prior to this, periodic effluent sampling for nutrients was conducted as part of the Upper Clear Creek (UCC) Monitoring Program. However, nutrient analysis of samples from the WWTFs was discontinued with the implementation of Regulation 85. Data from the UCC Monitoring Program and data collected to meet Regulation 85 requirements represent end-of-pipe concentrations and are generated by different laboratories, in some cases using different methods.

TP and TN concentrations measured for each WWTF in 2009-2014 are presented in Figure 10 through Figure 15. These figures show observations from both the UCC Monitoring Program (through early 2013) and Regulation 85 sampling (2013 to present). Note that the sampling frequency varied by WWTF and over the course of the year. Data collected as part of the UCC Monitoring Program are depicted with filled data points, and data collected as part of Regulation 85 are depicted with hollow data points. For context, the average daily flow for each plant in 2014 is provided on each figure.

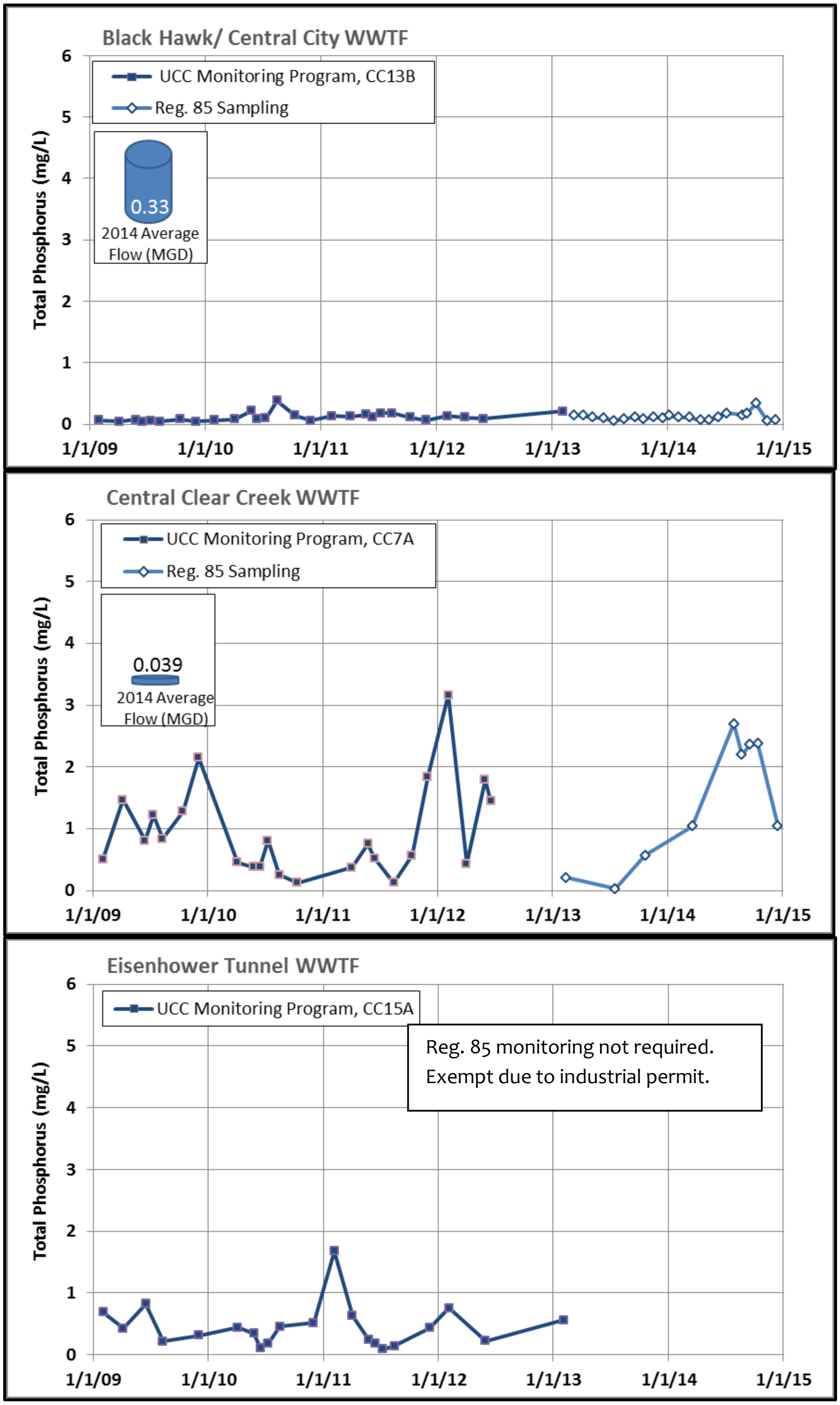

Figure 10. Effluent TP Concentrations (2009-2014) for Black Hawk/Central City, Central Clear Creek, and Eisenhower Tunnel WWTFs

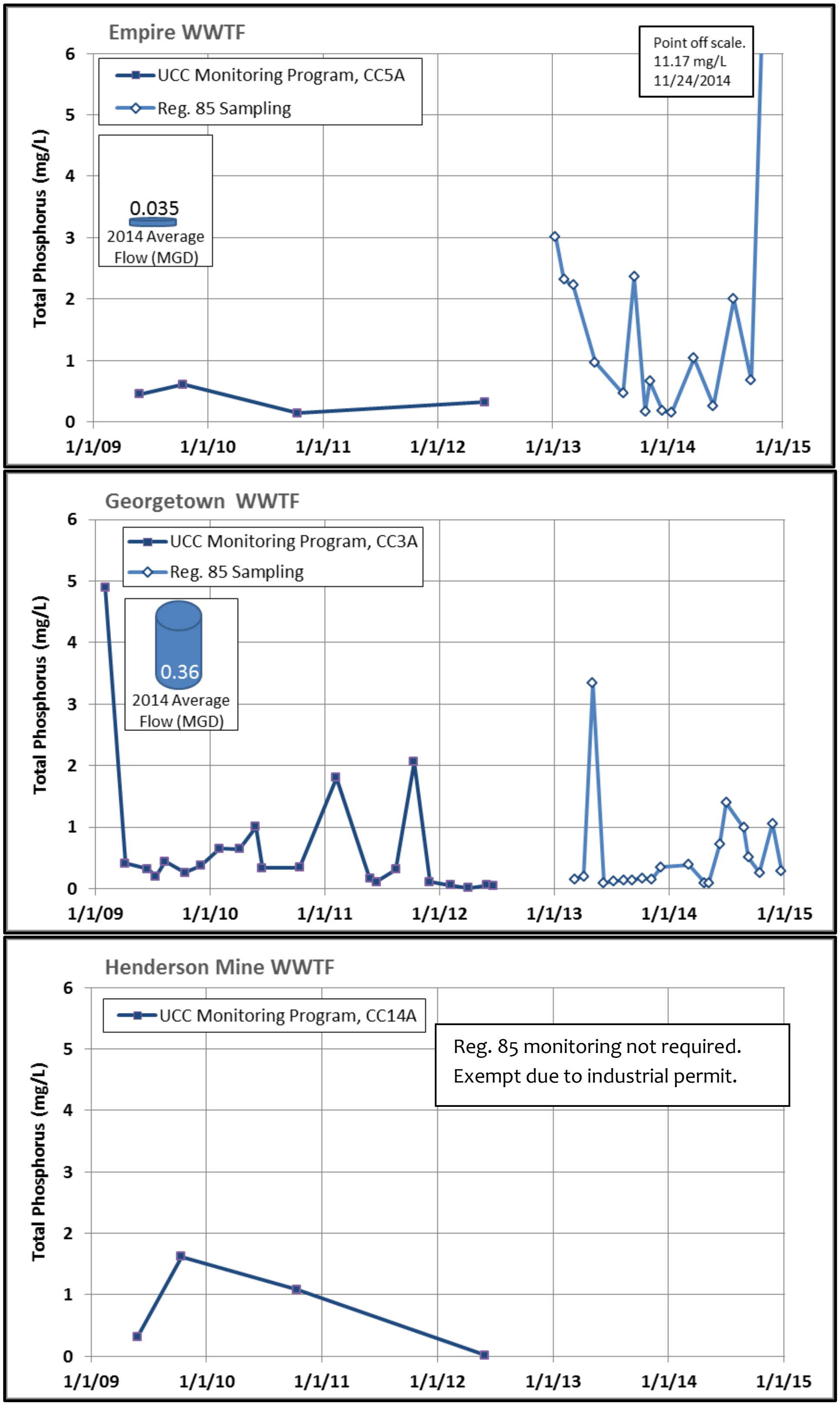

Figure 11. Effluent TP Concentrations (2009-2014) for Empire, Georgetown, and Henderson Mine WWTFs

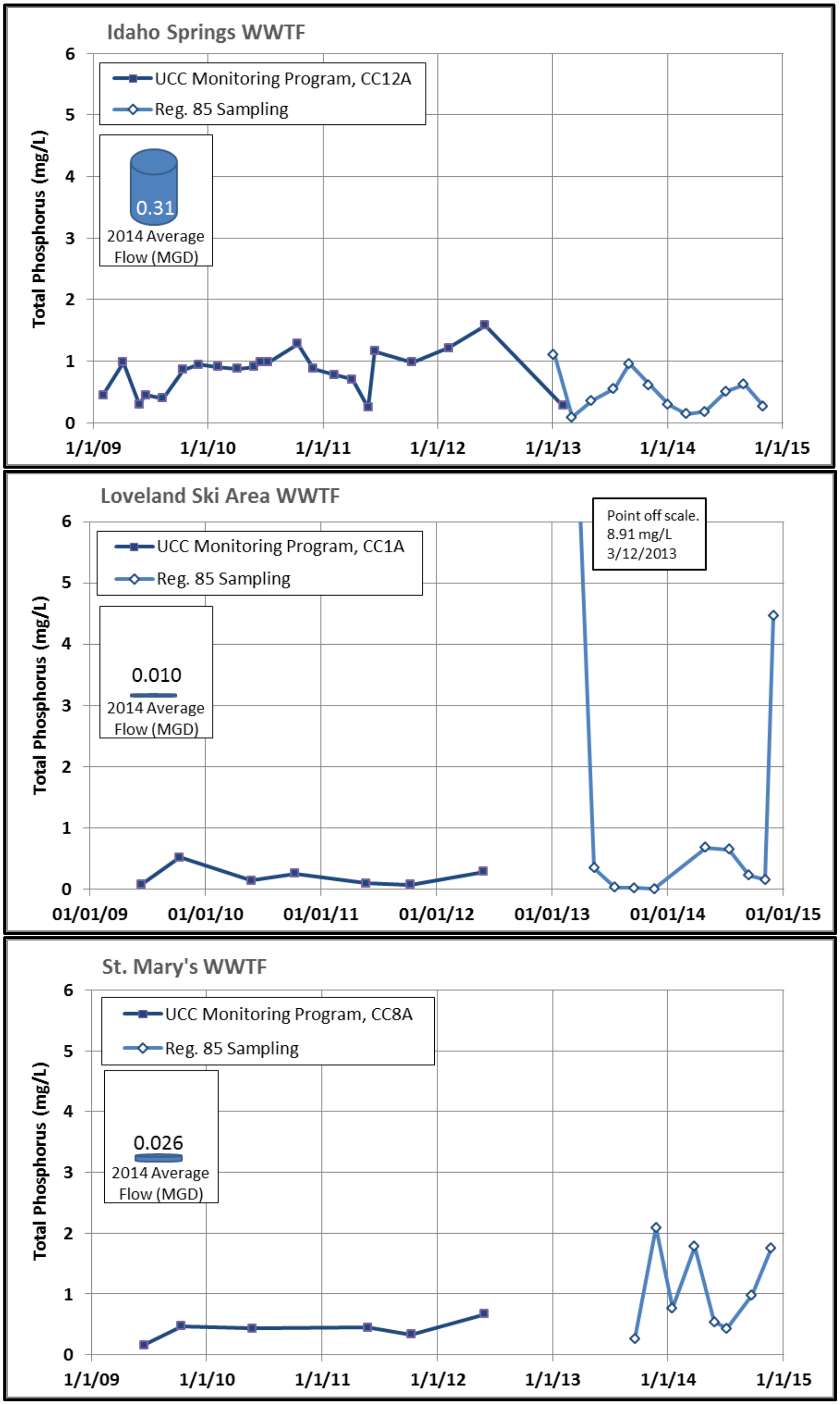

Figure 12. Effluent TP Concentrations (2009-2014) for Idaho Springs, Loveland Ski Area, and St. Mary's WWTFs

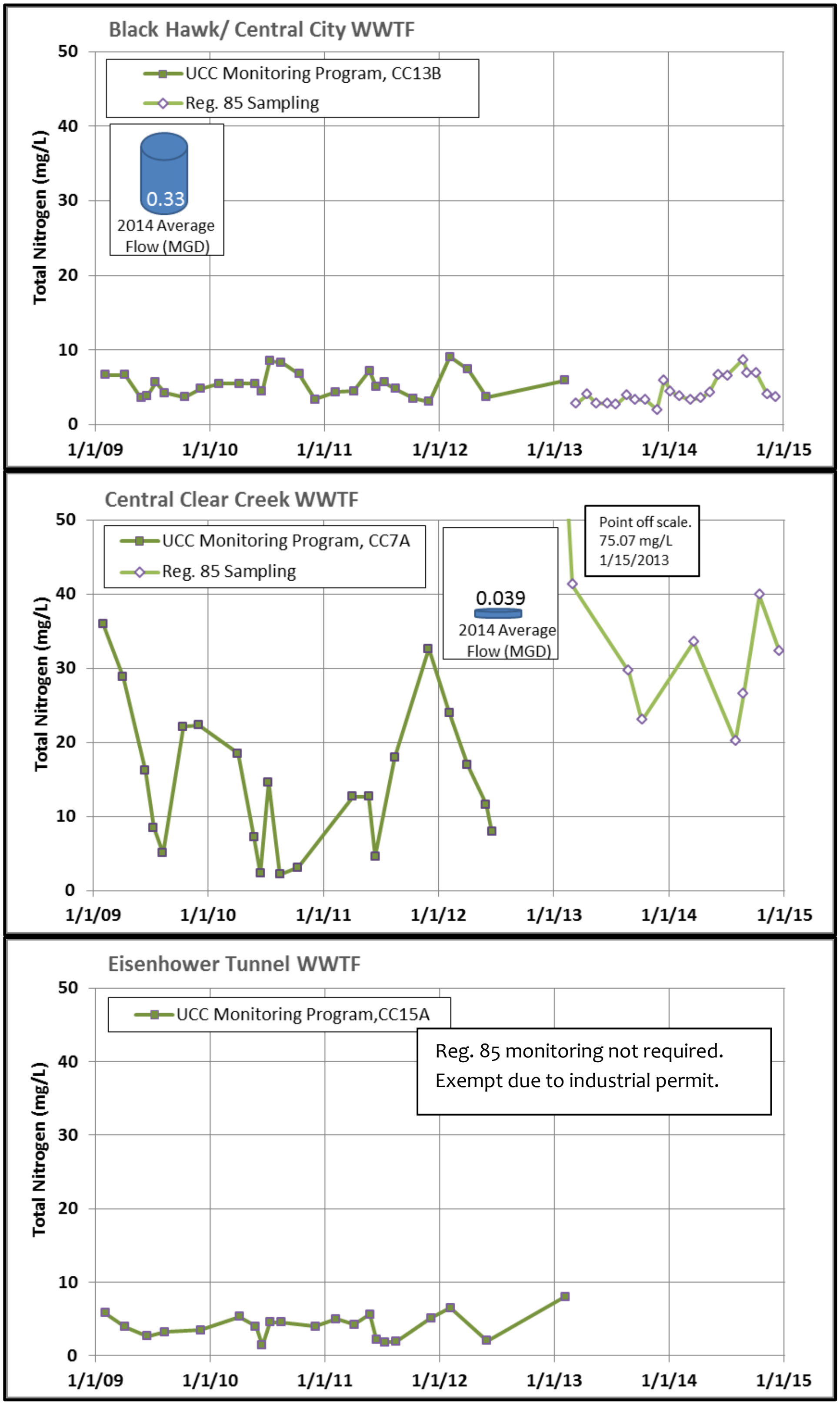

Figure 13. Effluent TN Concentrations (2009-2014) for Black Hawk/Central City, Central Clear Creek, and Eisenhower Tunnel WWTFs

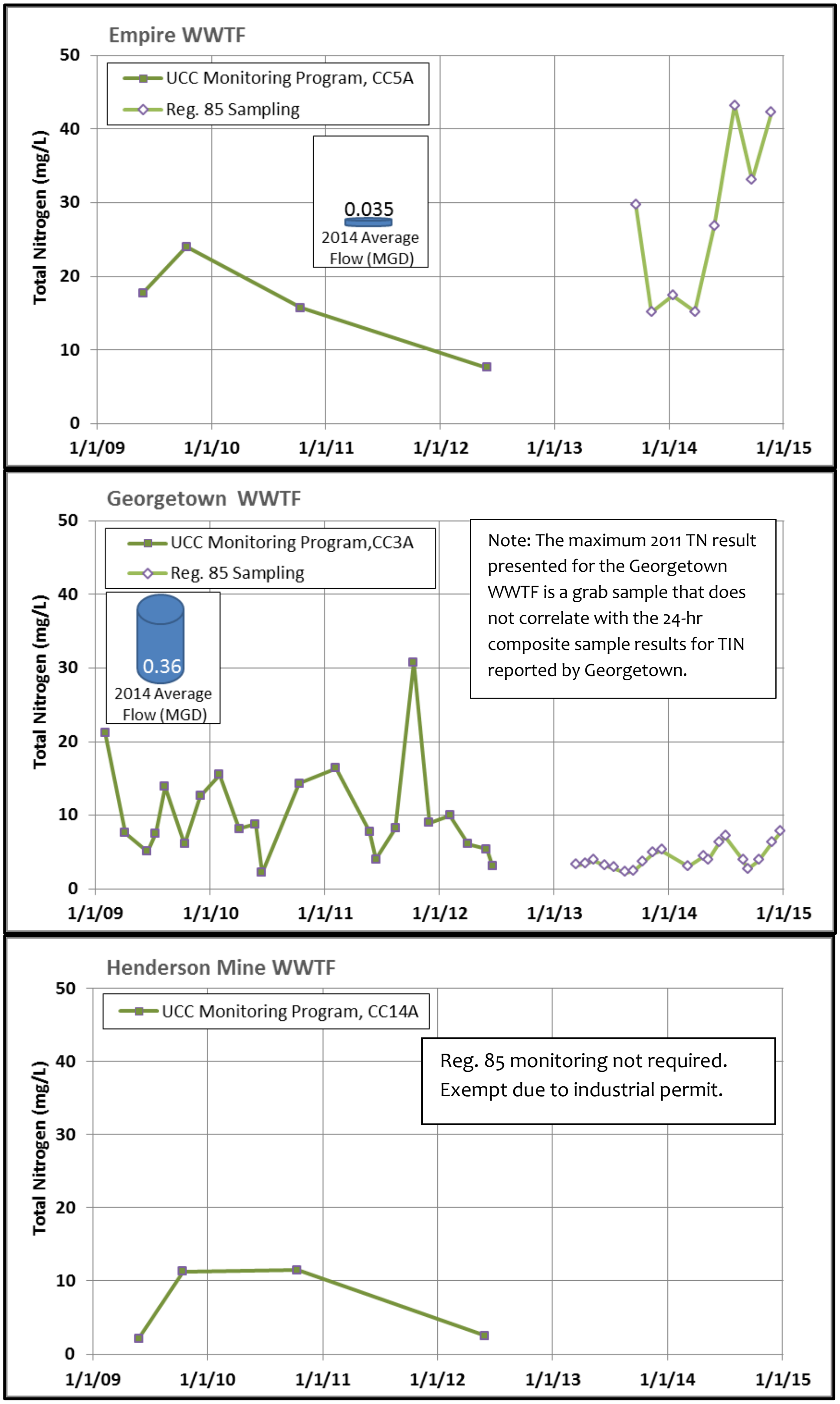

Figure 14. Effluent TN Concentrations (2009-2014) for Empire, Georgetown, and Henderson Mine WWTFs

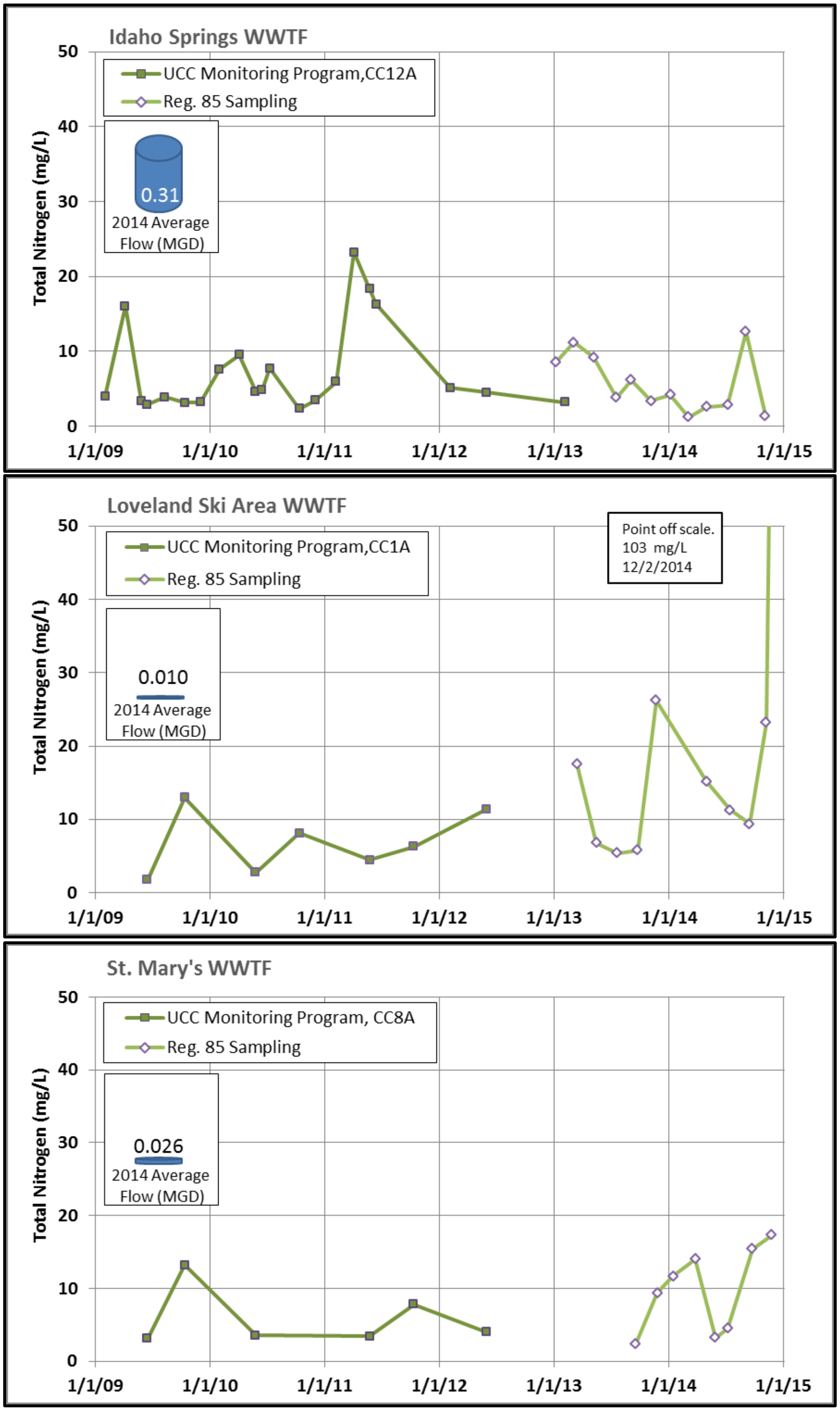

Figure 15. Effluent TN Concentrations (2009-2014) for Idaho Springs, Loveland Ski Area, and St. Mary's WWTFs

D. Illicit Discharges and Emergency Response

Timely response to unexpected upstream releases and limiting illicit discharges are key to controlling the effects of these types of incidents on in-stream and reservoir water quality. Programs to address these issues continue to improve and be effective.

1. Illicit Discharges

The **City of Golden** responded to 36 reports of illicit discharges or potential discharges to the storm sewer system in 2014. This resulted in nine written warnings and 19 verbal warnings being issued. The **Illicit Discharge Detection and Elimination Program of the City of Arvada** issued 26 written Notices of Violation, resulting in seven responsible parties being required to pay for cleanup. In addition, Arvada conducted 493 dry-weather screenings of outfalls. These outfall inspections identify and eliminate potential sources of illicit discharges. Further, these screenings evaluate the condition of outfalls and identify those in need of repair. Outfalls found to be in need of repair are listed on a maintenance schedule.

2. Emergency Response

In order to promptly and effectively notify downstream users of Clear Creek water of any potential contamination from an upstream source, Clear Creek County uses the ***Code Red Emergency Call-Down System***. The Clear Creek Office of Emergency Management continues to maintain and update the database for the call lists. The system applies to incidents/spills into Clear Creek and tributaries leading into Clear Creek that occur in Clear Creek County. In 2014, Clear Creek Dispatch and the City of Golden Dispatch Center launched 9 calls for incidents within its jurisdiction that impacted Clear Creek. In addition, three of these events warranted follow-up notifications.

Incident with Potential to Activate Call-Down System (Photo Credit: Mary Fabisiak)

Related to the call-down system is the finalization of the ***Croke Canal Shutdown Standard Operating Procedure*** (SOP), which was adopted in 2014. This represents a milestone in a multi-year process involving water resources and water-quality staff of the Standley Lake Cities (SLC). The SOP provides guidance on when to consider closing canal headgates on Clear Creek or to turn out water before it enters Standley Lake when a spill occurs in one of the ditches. The SOP takes the following factors into account for purposes of decision making:

- Type of contaminant;

- Amount of contaminant;
- Flow in Clear Creek;
- Proximity to the headgate;
- Travel time and mile marker location; and
- Likelihood of Standley Lake filling.

E. Nonpoint Source Control, Stormwater Management, and Remediation

Additional efforts to reduce pollutant and nutrient loading to Clear Creek in 2014 are discussed in this section. The sources in the previous two sections, WWTFs and illicit discharges, are types of point sources. The sources in this section are primarily non-point sources, including stormwater and erosion. It also includes OWTS monitoring, and site remediation. The following subsections provide selected highlights of such activities.

1. Erosion and Sediment Control

City of Golden: The City of Golden operates under a Municipal Separate Storm Sewer System (MS4) permit and is designated a Qualifying Local Program by the Water Quality Control Division. Under this permit and designation, the City has ensured that erosion and sediment controls are implemented on construction sites. In 2014, the City of Golden administered 31 stormwater-quality construction permits and conducted 673 erosion and sediment control inspections. These inspections resulted in 256 written and 119 verbal notifications. Two permits were withheld, and at one site performance security for corrections was used.

The ***Stormwater Maintenance Program of the City of Golden*** performs yearly inspections on all private systems requiring routine cleaning and maintenance. In 2014, 245 inspections were conducted resulting in 242 letters sent to land owners requesting maintenance. In addition, the City's Stormwater Division inspects and cleans municipal inlets twice per year. This aggressive schedule helps increase the efficiency of system operation and improves the quality of stormwater released to the creek. Stormwater conveyance system improvements have included sumped manholes and sediment traps. The sumped manholes allow for the settling of solids in stormwater. These sumps are cleaned twice per year, removing an average of 1 cubic yard per cleaning. In 2014, sediment traps removed and captured 42 cubic yards of debris that would have otherwise been released to Clear Creek.

Tucker Gulch, in the area of 7th Place and HWY 58, has been a maintenance issue for the City of Golden for years. The channel was fairly steep just upstream of the 7th Place bridge but flat directly beneath it. This caused sediment to settle out beneath the bridge where it is difficult to remove. The ***Tucker Gulch Channel Construction Project***, conducted in cooperation with Urban Drainage and Flood Control District in 2014, flattened out an area just upstream of the bridge and provided a large sediment trap. The design allows sediment to settle in the flatter area upstream of the bridge where it can be easily removed. The end result should be a more maintainable and cleaner stream.

City of Arvada: The City of Arvada's most concentrated efforts for the protection of water quality in the Clear Creek basin continues to focus on compliance with the City's MS4 permit. The control of erosion on active construction sites and the inspection of post-construction permanent BMPs are two key components of the ***MS4 program***.

Erosion and sediment control on active construction sites is a significant component of the MS4 Program. In 2014, 1,644 erosion and sediment control inspections were conducted on 177 active construction sites. These inspections resulted in 230 Warnings and 13 Notices of Violation. Further, 13 builders were subject to additional enforcement. As a consequence, they must now demonstrate compliance prior to receiving building permits.

A second key component of Arvada's stormwater program is inspection and enforcement of permanent BMPs for stormwater. These BMPs include detention and retention ponds, swales, and underground proprietary devices. In 2014, 12 new permanent BMPs were added to the 161 BMPs previously implemented since the program began. The City inspected all 173 permanent BMPs in 2014. Inspections are followed by corresponding reports that identify noncompliant issues needing to be addressed. Such reports are sent to owners of the stormwater conveyance.

Canal Zone Monitoring: Development projects located along on the Clear Creek canals were monitored in 2014. This monitoring ensures that drainage is not routed into the canals and that proper water-quality BMPs are utilized. The Farmers' Highline canal headgate was redone in 2013. In February and March of 2014 sampling equipment was installed at the reconstructed headgate by the Standley Lake Cities. This included an *in-situ* sonde, data logger, an autosampler and supporting infrastructure. This equipment will allow the continued monitoring of canal water quality and evaluation of non-point source inputs in the Canal Zone.

Green Autosampler Box at the reconstructed Farmers Highline Canal headgate. (Photo Credit: Chip Billerbeck)

Clear Creek County: As part of the County's efforts to control the releases of sediment to Clear Creek, permits are required for BMPs and floodplain development. The purpose of these permits is to monitor performance and ensure environmental and public safety. In 2014, the County issued seven permits for floodplain development. In addition, 11 permits were issued for BMPs.

Colorado Department of Transportation: The Colorado Department of Transportation (CDOT) continues to have a number of projects, ongoing and planned, in the Clear Creek Watershed. A major focus of these projects is the control of erosion and the capture of sediments produced during construction and during highway maintenance activities.


Inside the West-bound Twin Tunnel Bore (Photo Credit: CDOT)

CDOT continued implementation of the ***I-70 Twin Tunnels Project***, including widening of the westbound bore and adding a third eastbound lane along I-70, between Idaho Springs and Floyd Hill. The project added sediment basins through this four mile stretch, which runs along the main stem of Clear Creek. This project was visited by both CDPHE and the United States Environmental Protection Agency (EPA), who inspected the construction-related erosion and sediment controls. Both agencies gave CDOT and the contractor high marks. This project will be completed in 2015, along with stream improvements to re-create a more natural channel and floodplain near the Twin Tunnels.

Progress was made by CDOT in 2014 for the ***Peak Period Shoulder Lane Project***. Design was completed and construction began in the project area – located along eastbound I-70 between Empire Junction and Idaho Springs. This project involves adding minimal pavement in order to have a managed express lane during specific, peak traffic times. At other times, this lane will serve as a left shoulder. The project includes permanent sediment control facilities (BMPs) that significantly improve existing conditions. While the paved area will increase by 3%, new BMPs (curb, basins) will increase capture volume by more than 20%. In addition, highly-mineralized material near the east end of Idaho Springs will be capped in order to decrease metals impacts to Clear Creek. Construction activities began in 2014 and will continue in 2015.

The design phase of the ***US 6 Acceleration Lane Project*** continued in 2014. This project will create a formal chain-down station at the eastbound on-ramp from US 6 to I-70. At approximately 10,800 feet elevation, this area is near the headwaters of Clear Creek. The original concept—to carry an extra lane all the way to Herman Gulch—was changed because of potential environmental impacts. The lane has been shortened significantly. However, water quality BMPs are included in the ramp and chain station areas, where sand usage is very high. In addition, habitat improvements for Boreal toads (a Colorado-listed endangered species) are being designed as part of this project.

Clear Creek Tributaries Sediment Control and Metal Removal Project: This project was a cooperative effort between the Clear Creek Watershed Foundation (CCWF) and CDOT. The primary goal of this project was to significantly reduce the loading of particulate metals and particulate phosphate to Clear Creek. These include the Total Maximum Daily Load (TMDL) target metals: cadmium, copper, and zinc. It consisted of the construction of two sediment basins designed to capture metal-laden sediments. The detention basins were designed to facilitate CDOT's maintenance operations and to allow the captured sediment to be removed entirely from the drainage area. Removed sediments are to be contained in CDPHE's Church Placer Mine Waste Repository. CDOT paid for the design of these basins. The basins are located at Hoosac Gulch and an unnamed tributary just east of Dumont. The Hoosac location involved creation of a new basin and replacing an existing, eroding rundown channel with a pipe, as well as capping a mill tailings area. The Dumont location had a small catchment basin, but the new one is more than twice the size. Both basins serve to capture materials containing high concentration of metals, but not highway runoff. Design, clearances, and much of the construction were completed in 2014. Final construction was completed in February 2015.

Rough Grade of the Hoosac Gulch Sediment Removal Basin and Inlet Box (Photo Credit: CCWF)

2. Pollution Prevention

Pollution prevention is an ongoing component of the City of Arvada's stormwater protection efforts. All City of Arvada facilities with runoff control plans are inspected twice annually. The training focus is two-fold: 1) preventing and mitigating any potential contamination sources from City facilities, and 2) spill response procedures specific to work in the field. Arvada's spill response hotline is answered after-hours by personnel at the water treatment plant, who then dispatch those on call to the spill.

3. Onsite Wastewater Treatment Systems

The Clear Creek County Environmental Health Department issued 23 OWTS permits in 2014 and continued monitoring existing systems for failure. Two new types of OWTS permits are required in Clear Creek County. A Use Permit is required to be obtained upon transfer of a property, which ensures that the system is functioning properly. A total of 38 Use Permits were issued in 2014. The second type of permit is an Operating Permit. This type of permit is required for an OWTS that provides higher level treatment and ensures that associated mechanical and electrical equipment is operating properly. A total of 29 Operating Permits were issued in 2014.

4. Site Remediation

The Clear Creek Watershed Foundation conducted three projects in 2014 for the remediation of mine waste materials.

North Empire Stream Corridor Restoration: This restoration was completed in the fall of 2014 and occurred on a tributary of Lion Creek, which flows into the West Fork of Clear Creek at the Town of

Empire. It consisted of the excavation and consolidation of both an 18,000 cubic yard (CY) mine waste pile and accumulated sediment from the active channel of North Empire Creek. The materials were consolidated into an on-site repository and capped with inert fill material from on-site. The cap was amended with compost and fertilizer. In addition, run-on/run-off controls were constructed to prevent the re-mobilization of consolidated mine waste. This project has resulted in significant reductions in toxic metal concentrations and an increase in pH of 3 units. The bulk of the funding was provided through a Supplemental Environmental Project administered by CDPHE and funded by Molson Coors. The Colorado Division of Reclamation Mining and Safety also made a generous cash contribution. The total cost of this project, including project match, was $536,000.

North Empire Stream Corridor Restoration. Ore bin of the Conqueror mine atop an 18,250 CY waste pile within North Empire Creek (Left). Final grade in Upper North Empire Creek after removal of the Conqueror mine waste pile (Right). (Photo Credit: CCWF)

<u>North Fork Clear Creek Sediment Removal and Remediation:</u> This project is located in Gilpin County along the west side of State Highway 119, approximately 1 mile north of the confluence of North Clear Creek and Clear Creek. During the floods of September 2013, sediment was released from the spill containment system for a crusher fines repository located in the headwaters area of an unnamed tributary to the North Fork of Clear Creek. The floodwaters caused significant erosion of a crusher fines pile, which was carried down toward the North Fork of Clear Creek. A debris fan

North Fork of Clear Creek Sediment Removal. Sediment Fan after the September 2013 flood (Left). Same location following the remediation and removal (Right). (Photo Credit: CCWF)

comprised of this residual mining material was deposited at the mouth of the affected unnamed tributary. The volume of this deposit was approximately 3,250 CY. This project involved the complete removal of the sediment from the debris fan and placement in a redesigned and flood-proofed repository. The Town of Black Hawk hauled some of the excavated materials to use for structural fill on its municipal projects. Albert Frei & Sons hauled and disposed of the remainder. This project also consisted of re-grading and re-vegetating the affected area. The cost of this project was $41,415, excluding haulage and disposal costs.

Wooded Grove Remediation Project: This project is located on an unnamed tributary of Trail Creek, which is a tributary of Clear Creek. This project was a mine waste clean-up effort on former Bureau of Land Management land, which was transferred to Clear Creek County under Federal Statute. CCWF received authorization from EPA, under its Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, also known as Superfund) Administrative Action Memorandum, to conduct *in-situ* capping of the more highly mineralized mine waste material on the Wooded Grove property.

F. Public Education, Outreach, and Partnerships

Outreach activities, primarily through festivals, seminars, and public meetings, are a key component of educating the public about the protection of water quality. The appropriate disposal of household hazardous waste and pharmaceuticals allows the public to actively participate in the protection of the watershed.

1. General Public Education and Outreach

Clear Creek Watershed Foundation: The CCWF organized and hosted the sixth annual ***Clear Creek Watershed Festival*** on September 20, 2014. Approximately 600 people attended. This growing, popular event is held at Courtney Riley Cooper Park located along the banks of Clear Creek in central Idaho Springs. The festival is designed for educators, students, and families to visit dozens of watershed passport stations. Clear Creek County and the Standley Lake Cities each sponsored one of the over 30 environmental education booths.

City of Golden: Golden's Stormwater Program continues its public education campaign by distributing educational materials and attending or hosting public events. Events in 2014 included the ***Water-Wise Seminar*** and ***Greener Golden***. At these events, Golden distributes Garden-in-a-box kits to encourage the planting of water-conserving landscapes. In addition, Golden held another successful ***Public Works Academy*** in 2014. This 20-hour program educates citizens about the range of facilities and activities of the Public Works department. In 2014, this program was attended by 10 individuals.

City of Arvada: The City of Arvada provides education for contractors, city personnel, citizens, and students on an on-going basis. This education and outreach is a major component of the City's Stormwater Program. This ensures that the public is aware that city storm drains flow directly to waterways and certain activities can contaminate those waterways. Arvada provides the public with various resources to increase their awareness, such as adopt-a-street or trail programs, storm drain marking, household hazardous chemical disposal and recycling, brochures, and demonstrations that are focused on preventing stormwater pollution. In 2014, the City also hosted booths at five festivals where staff spoke one-on-one to attendees about issues concerning water quality.

Stormwater Education, Arvada Harvest Festival
(Photo Credit: Kevin Tohill, City of Arvada)

2. Recycling and Disposal of Household Chemicals and Hazardous Waste

City of Golden: In 2014, the City of Golden contributed $7,903 to the Rooney Road Recycling Center. The City actively participates as a member of the Board of Managers for the Rooney Road Recycling Center Authority. This facility provides critical recycling and disposal services of household hazardous waste and electronics and annually serves more than 3,000 Jefferson County residents. This facility has been successful in diverting large quantities of hazardous waste, for example in 2012 over 380,000 pounds of household hazardous waste were handled by the facility (RRC, 2015). The City has also been an active founding member of the Rooney Road Recycling Center Foundation. The foundation was created to help secure additional funding for the Rooney Road Recycling Center

Authority to further grow the number of residents served by the recycling facility. Residents of the City of Arvada are also able to use the Rooney Road Recycling Center.

Clear Creek County: The Clear Creek County Transfer Station sponsored three single-day household hazardous waste collection events providing disposal services to 238 people. The materials collected filled more than 50 drums, representing a significant increase over 2013. These events were free to Clear Creek County residents. Funding for these events was provided by the generous contributions of local fire departments, Henderson Mine, Upper Clear Creek Watershed Association, the Clear Creek Local Emergency Planning Commission and Alpine Disposal. In 2014, the Transfer Station collected and transferred 1,287 tons of solid waste to an appropriate disposal site and sent 237 tons of recyclable materials for reuse. In addition 552 CY of slash from forestry projects and 2,400 gallons of motor oil were handled. The appropriate disposal or processing of these materials resulted in the diversion of all these materials from the watershed.

3. Pharmaceutical Disposal

Two National Pharmaceutical Take-Back Days were sponsored by the Drug Enforcement Agency (DEA) in 2014. These nationwide events provided an opportunity for the public to surrender unwanted pharmaceuticals for disposal. The events provide a safe way to dispose of unwanted medications; preventing their illicit use and diverting them from entering the water supply. In 2014, the City of Arvada collected 2,165 pounds of medications from 743 drop-offs. The Standley Lake Cities collected a total of 2,937 pounds, which is an increase of more than 1,000 pounds from the previous year. In addition, the City of Golden Police Department held a prescription drug collection in 2014.

G. Planning Activities

Water-quality management planning activities for Clear Creek conducted in 2014 are described briefly in the following subsections.

1. Standley Lake Park Master Plan

In 2014, the Westminster Parks and Open Space Department started the process of updating the Standley Lake Park Master Plan. The first Master Plan was adopted in 1996 and subsequently the first phases of improvements, specifically camping and boating amenities were developed. Since that time, recreation at Standley Lake has been limited primarily to local boat owners, anglers, trail users, and vehicle-based camping. The update will revitalize the lake as a more notable regional recreation destination. The updated Master Plan is being developed recognizing that the primary purpose of the reservoir is to provide a protected water source to the Standley Lake Cities.

The Plan divides the lake and its surrounding land into 5 distinct areas (Figure 16). Plans include connecting trails all the way around the lake as well as a variety of recreational options for the Lake View, South Shore, and North Shore areas.

Since development on or around the lake has the potential to alter water quality, the Standley Lake Water Quality IGA Committee (SLWQIGA Committee) is closely following and helping to guide development of the plan. The plan will be finalized in late 2015.

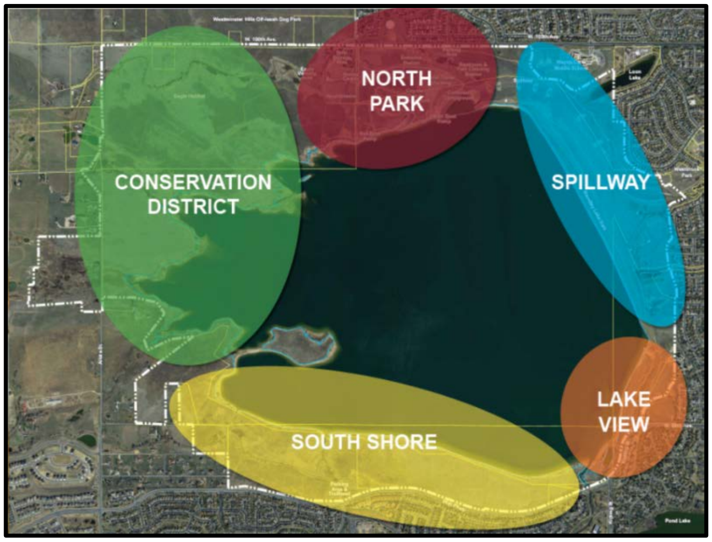

Figure 16. Sub-Areas Identified in the Standley Lake Park Master Plan

2. Wildfire Impacts to Water Supply Study

The SLC are participating in a study titled "Wildfire Impacts on Drinking Water Treatment Process Performance: Development of Evaluation Protocols and Management Practices." This study is being conducted through the Water Research Foundation Tailored Collaboration Program. The frequency, intensity, and duration of Western wildfires have increased in recent decades. This trend is expected to continue, with possible exacerbation due to drying from climate change and the continuing Mountain Pine beetle outbreak. Forested watersheds commonly serve as high quality drinking water sources. As drinking water providers, the SLC are concerned about the potential impacts of a wildfire in the Clear Creek watershed. These impacts include changes in water quality and availability, as well as the treatability, and associated costs, of impacted source water. The tailored collaboration project will develop a lab-based burn procedure to simulate the effects of wildfire on water quality and treatability. The project will also investigate, through a series of case studies, the implications of a wildfire for full-scale operation and design.

In addition to the SLC, the participating utilities include Denver Water, San Francisco Public Utilities, New York City Department of Environmental Protection, Truckee Meadows Water Authority, and the Metropolitan Water District of Southern California. The SLC have donated $30,000 in co-funding of the $267,053 total project budget. The study is slated to be completed in 2016.

3. Clear Creek Watershed Plan Revisions

In 2014, UCCWA completed a long-overdue revision of its Watershed Plan. Financial support for this process was provided by Molson Coors. The plan serves an important function in monitoring and tracking needs identified along Clear Creek.

H. Other Activities

1. Fishing is Fun Access Project

The Clear Creek Watershed Foundation began work on the Fishing-is-Fun Clear Creek Access project in August 2014. This project is designed to improve access to Clear Creek for fishing and other forms of recreation at eleven access points along the creek between Silver Plume and Tunnel 5 on U.S. Highway 6. The project was completed in March 2015 for a total cost of $133,000.

2. City of Golden Water Supply Line

The floods of 2013 and subsequent ice flows in December 2013 disrupted and displaced the main raw water supply line for the City of Golden. In February 2014, two sections of the supply line were removed so the eroded supporting soils could be repaired and improved. The two pipe line sections were replaced and installed in an improved manner to better withstand flooding and erosion. Backfill of the pipeline trench was accomplished using soils that were removed from the Tucker Gulch flooding in September 2013. This work was done in an environmentally sensitive area with no damage to the watershed, resident endangered species, or habitat.

3. URAD Mine - Woods Creek Channel Improvement Project

The URAD Mine, owned by Climax Molybdenum Company (Climax), is an inactive and reclaimed mine located in the Woods Creek drainage near the presently active Henderson Mine. Historically, pipelines carried the flow from Woods Creek under tailings impoundments at the mine. In an effort to improve long-term stability and safety, the decision was made to close the diversion pipelines and construct a new bypass system. The current project, initiated in 2012, provides a replacement system which allows mostly open-channel flow from the Upper Reservoir to the Lower Reservoir. In 2012, Climax constructed a surface channel bypassing the lower URAD tailings impoundment, and in 2014 Climax grouted the pipeline that formerly carried flow under the lower tailings impoundment. In 2014, Climax also completed a surface channel bypassing the upper URAD tailings impoundment, upstream of the treatment plant discharge location. Climax plans to grout the pipeline that formerly carried flow under the upper URAD tailings impoundment in 2015.

Upper URAD Channel after Construction. (Photo Credit: Freeport-McMoRan)

4. North Fork Heavy Metals and Water Rights Issue

The record of decision for Operable Unit 4 of the Central City/Cleark Creek Superfund site was revised to require construction of a CDPHE/EPA water treatment facility to remove heavy metals from the North Fork of Clear Creek. This construction has been postponed due to a potential conflict with local water rights. CDPHE, the Division of Reclamation and Mining Safety, CDOT, the Colorado Water Conservation Board, Colorado Parks and Wildlife, Gilpin County, the City of Blackhawk, and other agencies have begun negotiations to resolve the potential conflict. Construction of this plant is anticipated to begin in 2015.

5. Aquatic Invasive Species Management

Eurasian Watermilfoil - Eurasian watermilfoil (EWM; *Myriophyllum spicatum L)* is a non-native, aquatic, noxious weed that grows rapidly at depths of up to 35 feet. EWM can grow into dense mats that severely interfere with recreation and can provide a substrate for blue-green algae growth. Blue-green algae blooms can ultimately cause taste and odor events in drinking water supplies. EWM was first observed in Standley Lake in 1998 and positively identified in 2000. In 2012, it was confirmed that the Eurasian watermilfoil hybridized with a native Colorado species, Northern watermilfoil (*Myriophillum sibiricum*). The hybrid species is more robust and grows even faster than the Eurasian watermilfoil. EWM weevils, an herbivorous insect specialized to EWM, have been stocked on the west side of the lake on five occasions since 2002. When an adequate weevil population is sustained, the weevils may be able to control the spread of the milfoil. Annual surveys of weevil populations have found that populations of weevils have been declining since 2006. In 2013, no weevils were found during the annual survey. A substantial decrease in milfoil densities was observed over the course of the weevil stocking program.

Standley Lake Plant Survey. (Photo Credit: Eric Scott)

The milfoil monitoring program underwent a major shift in 2014. Previous surveys (2002-2013) were performed by EnviroScience. These surveys were focused on EMW weevils and used divers to observe the existing weed beds and to collect samples. The survey in 2014 was intended to be more comprehensive to better understand additional variables that have contributed to the decline of milfoil in the reservoir.

The 2014 survey was performed in August 2014 by City of Westminster personnel. Each of the ten sample sites (Figure 17) was surveyed using an electronic depth finder to identify the densest part of the weed bed. A one-square meter sample was collected at this location using a 1-meter wide rake. The vegetation samples were then returned to the lab for identification and enumeration. A dissecting scope (40x magnification) was used to examine samples containing milfoil. This examination was intended to evaluate insect populations, insect damage to plants, and disease.

Standley Lake experienced an overall decrease in milfoil density from 2006 to 2013, from 450 stems/m^2 to 43 stems/m^2. In 2014, average milfoil densities were 15 stems/m^2 (Figure 18). Given the change in sampling methodologies (diver pre-2014, rake in 2014), it is uncertain that this represents an additional decrease in milfoil densities. However, the 2014 average density is consistent with the lower densities typically observed post-2009. Weevil stocking has played a significant role in this decrease. However, other factors likely contributing to the decrease include reservoir drawdown, competition from other aquatic vegetation and predation from other insects.

Competition from other aquatic vegetation for the limited pool of available nutrients, minerals, and light provides an additional control on milfoil populations. Figure 19 provides a comparison of the abundance, expressed as a percentage of the total plant population, of milfoil at each sample site. Of the sites dominated by milfoils, sites S2, S4 and S9 were dominated by hybrid milfoil and S6 and S8 by Eurasian milfoil. The population dynamics of predator (herbivore insects) and prey (milfoil) are typically complex. However, in 2014 many of the sites dominated by milfoil also had large herbivore populations, e.g. S2, S6 and S8 (Figure 20).

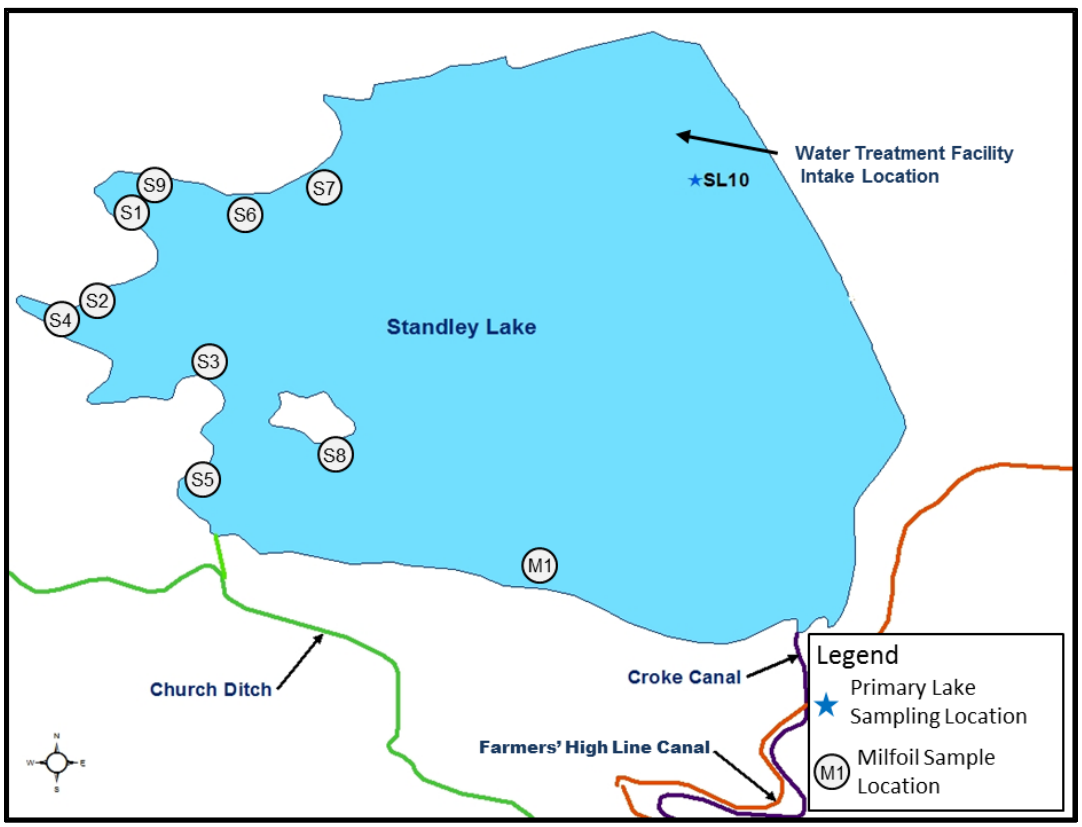

Figure 17. Milfoil Sample Locations

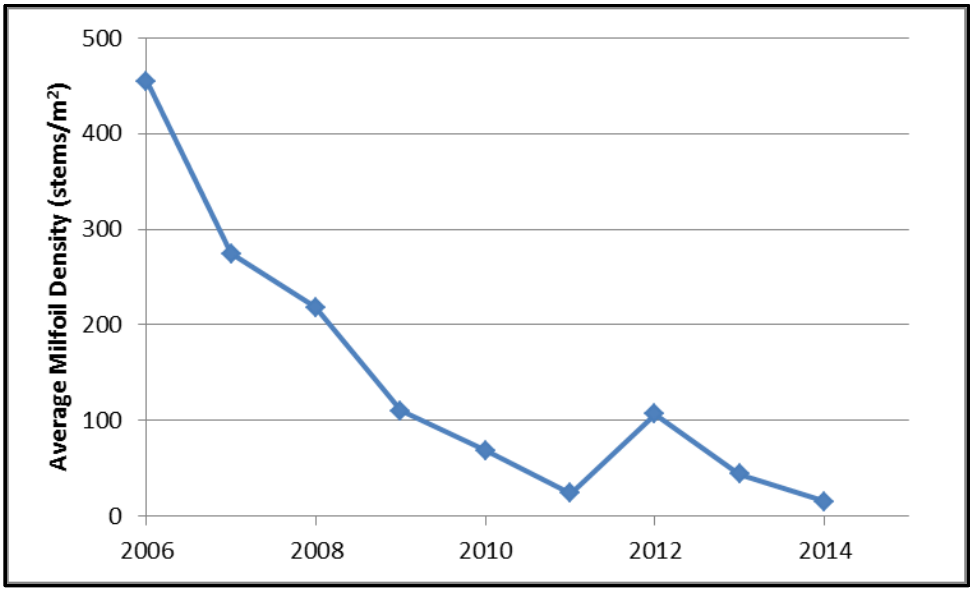

Figure 18. Average Milfoil Densities in Standley Lake (2006-2014) {Enviroscience, 2013}

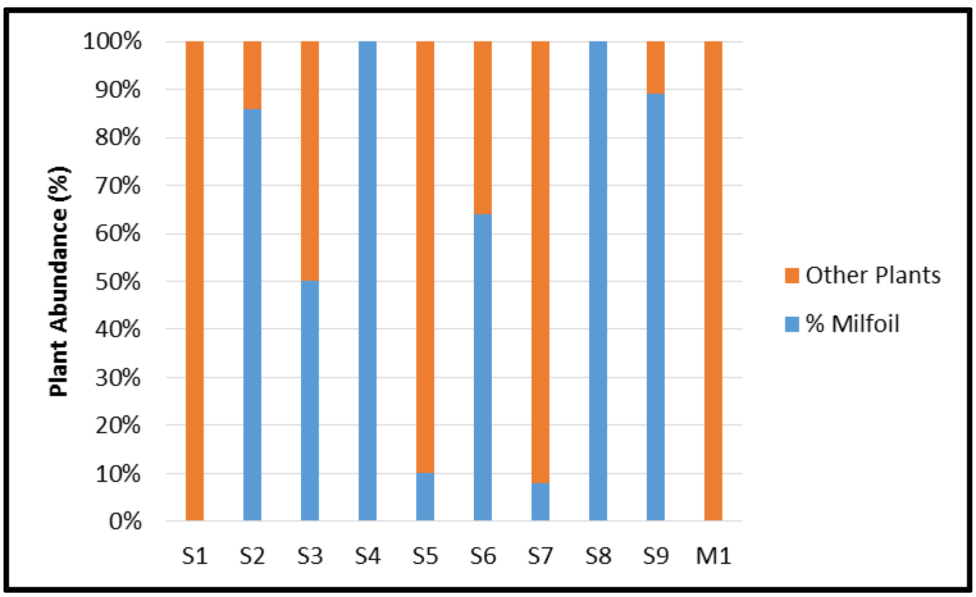

Figure 19. Milfoil Abundance in Standley Lake in 2014

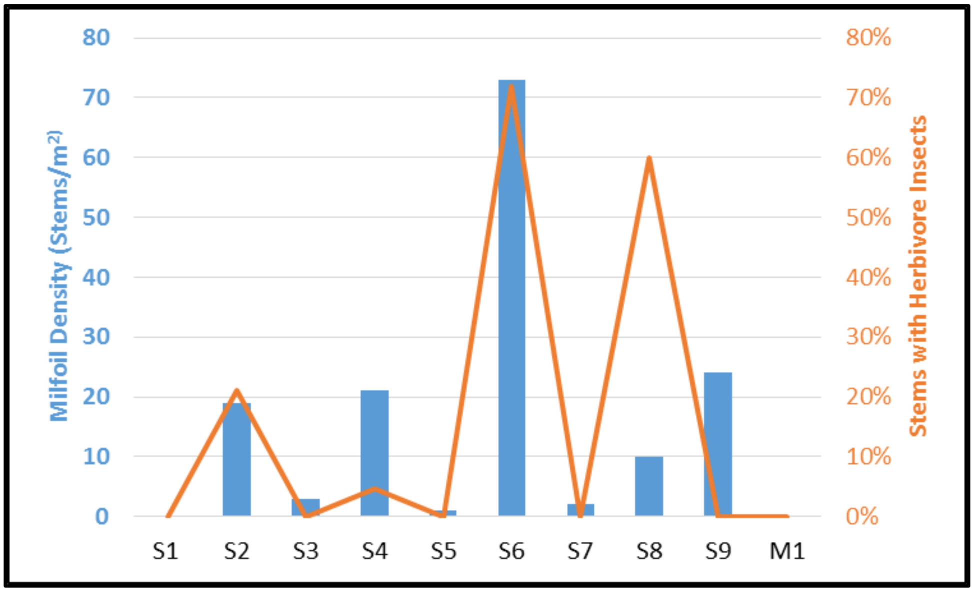

Figure 20. Milfoil Density and Herbivore Population in Standley Lake (2014)

Zebra and Quagga Mussels - Zebra and quagga mussels are non-native, aquatic invasive species that can be introduced to new water bodies by the unintentional transfer of organisms from an infested water body via boats or fishing bait. Aquatic mussels cause serious damage to the ecosystem and result in costly control procedures for drinking water treatment facilities. Both zebra and quagga veligers (zebra or quagga mussel larvae) were discovered in a few of Colorado's lakes in 2008. Prevention of aquatic mussel infestation is key to protecting Standley Lake. An intensive boat inspection and decontamination program was initiated in 2008 to protect the lake from new invasive species. Additionally, no live aquatic baits are allowed at Standley Lake.

Standley Lake is monitored for aquatic mussels every two weeks using the zooplankton tow procedure. The tows are performed at the lake inlets, SL-10, and the boat ramp/outlet area. Several invasive species have a planktonic life stage, and sampling with the plankton nets can provide early warning of infestation. In addition, substrate samplers, constructed and monitored by Colorado Parks and Wildlife, are placed throughout the lake. Substrate samplers are made up of a float, rope, plastic plates, and an anchor weight. A plate is located at every 10 feet of depth from the surface to the bottom of the lake at various locations. The plates and ropes are checked periodically for aquatic mussel growth. A plate or rope that feels like sand paper will be scraped and examined under the microscope for veligers. Shoreline surveys are performed when the water level is at the lowest for the year. A shoreline survey consists of walking the shoreline in teams looking for adult mussels attached to any hard substrate.

Sampling tows, substrate samplers, and shoreline surveys from 2014 show that Standley Lake continues to be free of zebra and quagga mussels.

IV. Upper Basin Flows and Water Quality

The previous section highlighted activities and accomplishments of various entities to manage, enhance, and protect water quality. This section describes an analysis of 2014 water-quality data in the Upper Basin. Constituents described include discharge (flow), total suspended solids, total phosphorus, and total nitrogen. The analysis is based on grab sample data collected at sampling locations CC26 (Clear Creek at Lawson Gage) and CC60 (Clear Creek at Church Ditch Headgate), combined with data from proximal ambient autosamplers, CCAS26 (Clear Creek at Lawson Gage) and CCAS59 (Clear Creek 2 miles west of Highway 58/US-6). Locations CC26 and CCAS26 (jointly referred to as simply CC26 in this report) are located on the main stem of Clear Creek (Figure 6) and provide information on water quality in the upper portion of the Upper Basin. CC60 and CCAS59 (jointly referred to as CC59/60) are located on the main stem of Clear Creek near the headgates of the canals to Standley Lake (Figure 6) and provide data at the bottom of the Upper Basin near Golden.

Clear Creek Upstream of the Confluence with the North Fork. (Photo Credit: Eric Scott)

A. Discharge

Annual hydrographs for the key Upper Basin locations (CC26 and CC60) exhibited fairly typical patterns in 2014 (Figure 21). These patterns can be described as rising in early April and steeply increasing mid-May, coinciding with snowmelt runoff. Peak annual flow rates occurred in early June. The falling limb of the snowmelt hydrograph extended through the summer punctuated by occasional increases in stream flow associated with precipitation events.

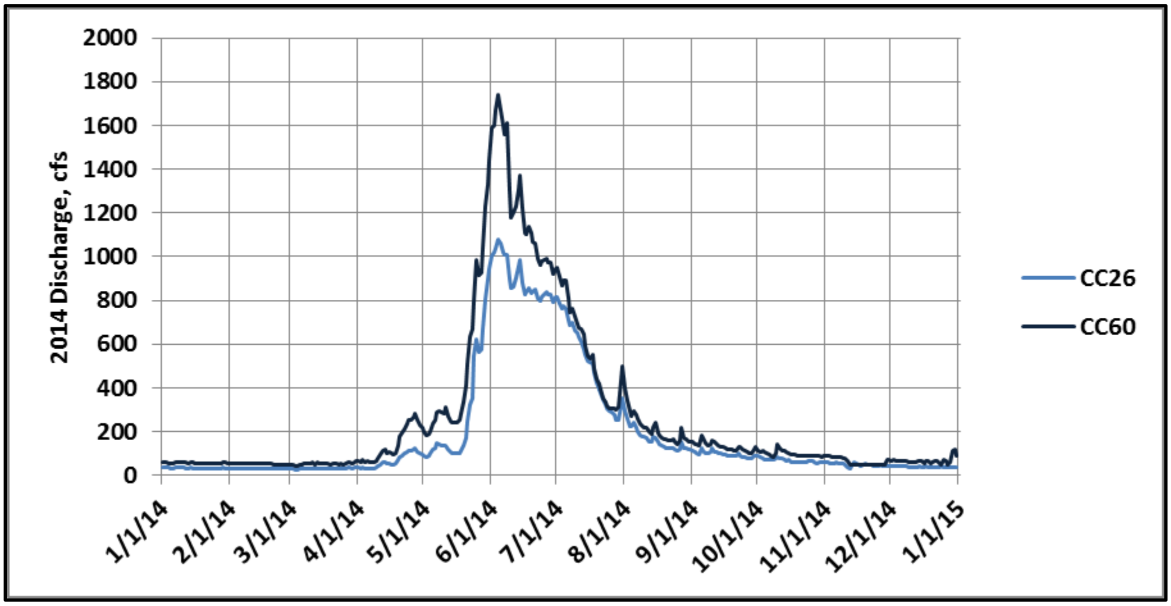

Figure 21. 2014 Clear Creek Hydrographs (CC26, CC60)

The total annual flow volume through Clear Creek in 2014 was above average compared to the previous five years (2009 through 2013). Compared to the longer-term record (1947-2013), flows in Clear Creek were 26% above average. Total annual flow volumes (in acre-feet per year) for 2009-2014 are displayed in Figure 22, which also includes the 2009-2013 average flow volume at each location for reference.

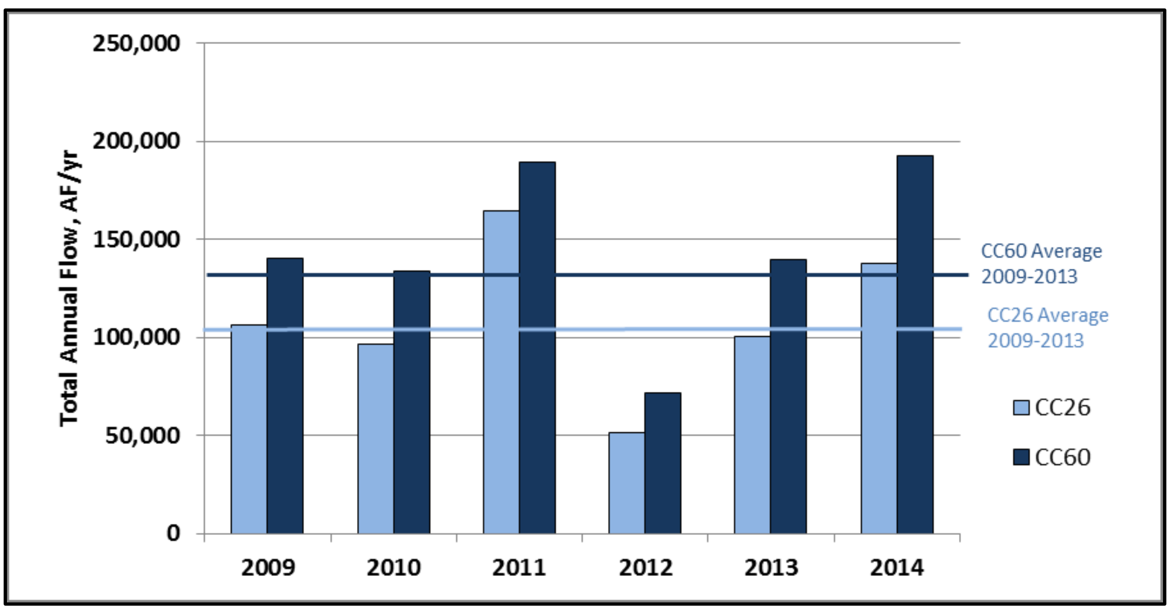

Figure 22. Total Annual Flow in Clear Creek at CC26 and CC60, 2009-2014

The total annual flow volumes for 2014 were comparable to those observed in 2011; however, the timing of flows was different. This is apparent in Figure 23, which shows hydrographs from CC60 for

2009-2014. The 2014 hydrograph, though above-average in volume, was a return to a more typical pattern after two atypical years; the extremely low flow year of 2012 and the flood year of 2013. Late winter baseflows, from January through mid-April, were elevated relative to previous years. This is likely the result of increased groundwater inflow to the creek following the September 2013 rainfall event. These flows, however, contribute a small fraction of the total annual discharge.

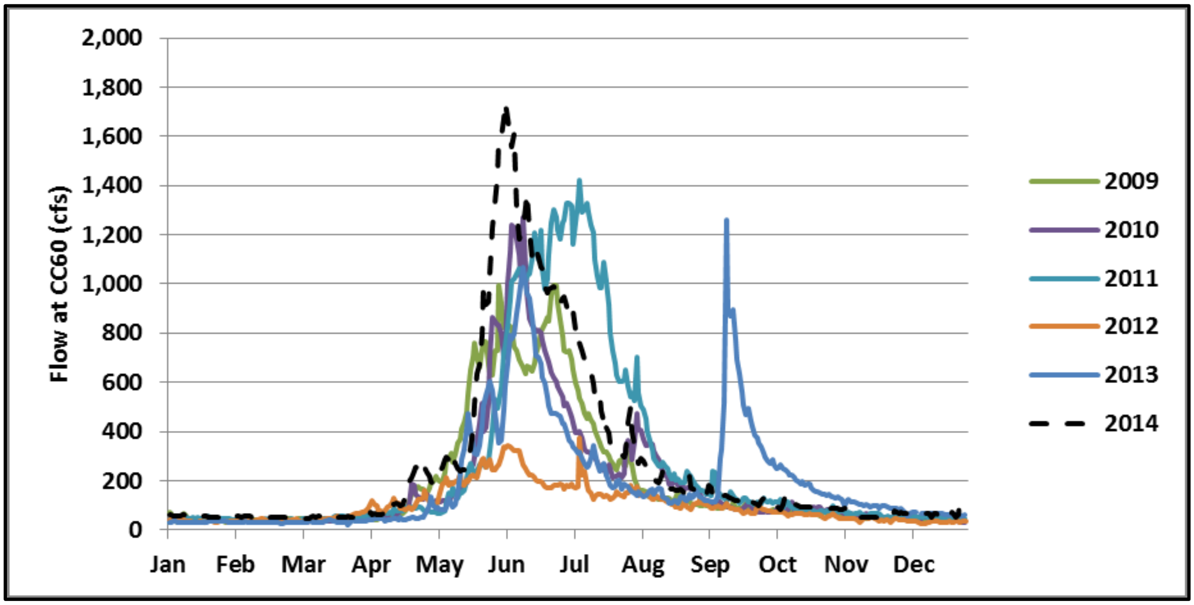

Figure 23. Annual Clear Creek Hydrographs for 2009-2014 (CC60)

B. Total Suspended Solids

Total suspended solids concentrations from CC59/60 and CC26 in 2014 are displayed in Figure 24. Concentrations were higher in the lower part of the basin as opposed to the upper portion. This is consistent with observations from previous years and reflects expected land use loading patterns. The highest TSS concentration (60 mg/L) was measured at CCAS59 on 6/23/14. This was the first sample date following the peak flow in early June. The maximum observed TSS (33 mg/L) for the upper portion of the basin (CC26) was observed during the rising limb, approximately one week before peak runoff. Subsequent to the snowmelt runoff period, the maximum TSS concentration at CC26 occurred after a significant precipitation event. Nearly 1.5 inches of rain was measured in Georgetown in the three days preceding the peak TSS. Note that the actual timing of peak TSS concentrations at CC59/60 may have been more similar to that of CC26 than the data indicate, since samples were not collected at CC59/60 on the same date as the observed peak TSS at CC26.

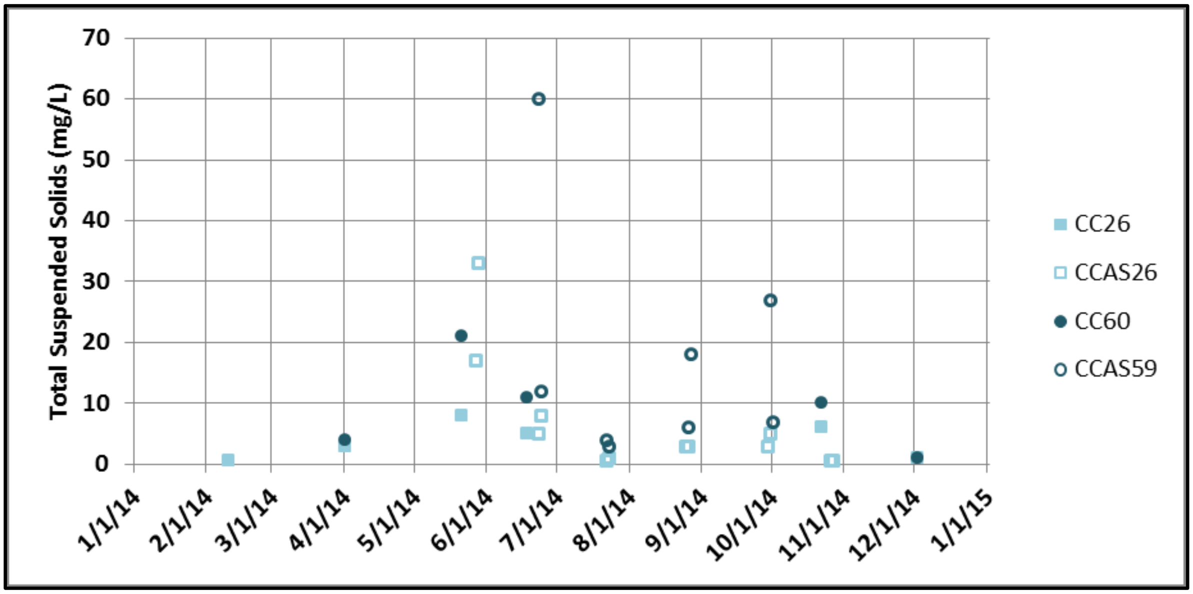

Figure 24. Total Suspended Solids Concentrations (Non-Event) in the Upper Basin, 2014

Non-storm-event TSS sample results in the Upper Basin over the last six years are presented in Figure 25. A pattern of higher concentrations at the lower location (CC59/60) is apparent. The peak 2014 TSS concentrations during the snowmelt runoff are at the upper extent of, but similar to, values observed over the previous five years. As noted above, this figure includes ambient grab and autosampler results and therefore does not reflect TSS during storm events. Peak TSS concentrations at CC26 were higher than the peak concentrations observed in previous years.

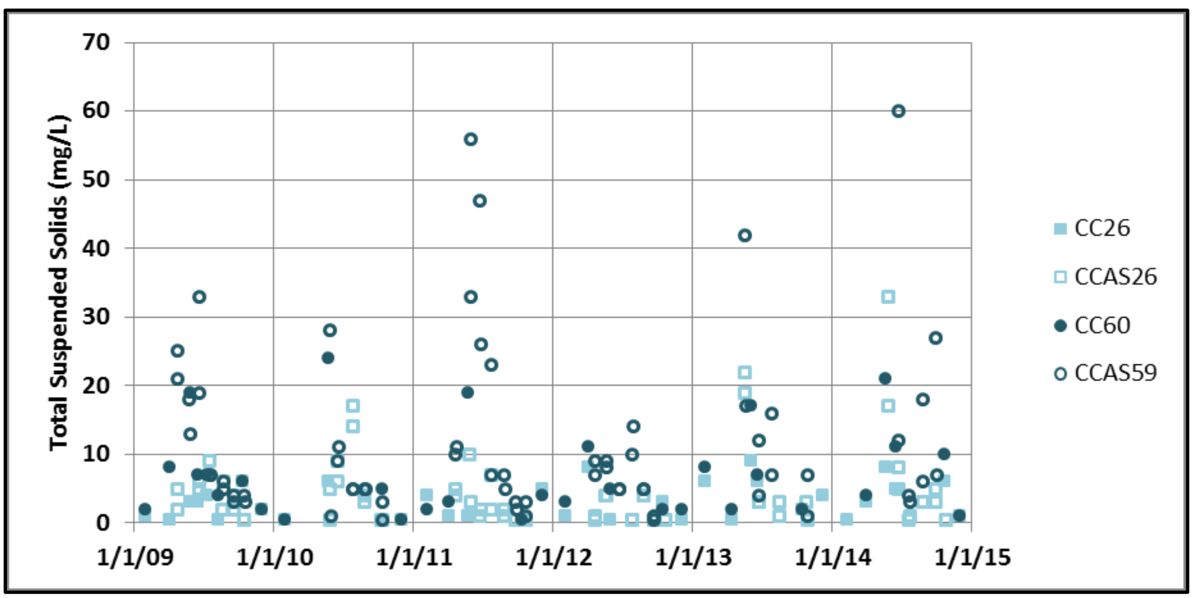

Figure 25. Total Suspended Solids Concentrations (Non-Event) in the Upper Basin, 2009-2014

Average monthly TSS concentrations in the lower portion of the basin in 2014 are compared to the average and range of previous years (2009-2013) in Table 6. TSS values in 2014 typically fall within or near ranges observed from previous years. July and October are exceptions, both falling outside previous ranges; however, the magnitude of the difference is relatively small.

Table 6. Monthly Average Total Suspended Solids Concentrations (Non-Event) in the Upper Basin at CC59/60

Month	2014 TSS Concentrations (mg/L)	2009-2013 Average and Range of TSS (mg/L)	% Difference -- 2014 Versus 2009-2013 Average
February	N/A	3.1 (0.5-8)	N/A
April	4.0*	10.7 (2-25)	-63%
May	21.0*	21.5 (5-56)	-2%
June	27.7	15.7 (1-47)	+76%
July	3.5	9.8 (5.0-23)	-64%
October	8.5	2.9 (0.5-7)	+191%

* "Average" based on only one observed value.

Loads are calculated using daily flows and concentration data, from samples collected as part of the Upper Clear Creek/Standley Lake Watershed Water Quality Monitoring Program. Annual loads are then calculated as the sum of individual daily loads. Non-storm-event TSS loading at CC26 and CC59/60 was calculated for 2014 and compared to estimates from 2009-2013 (Figure 26). At CC59/60, loads in 2014 were comparable to loads in past years. At CC26, loads in 2014 were higher than in past years.

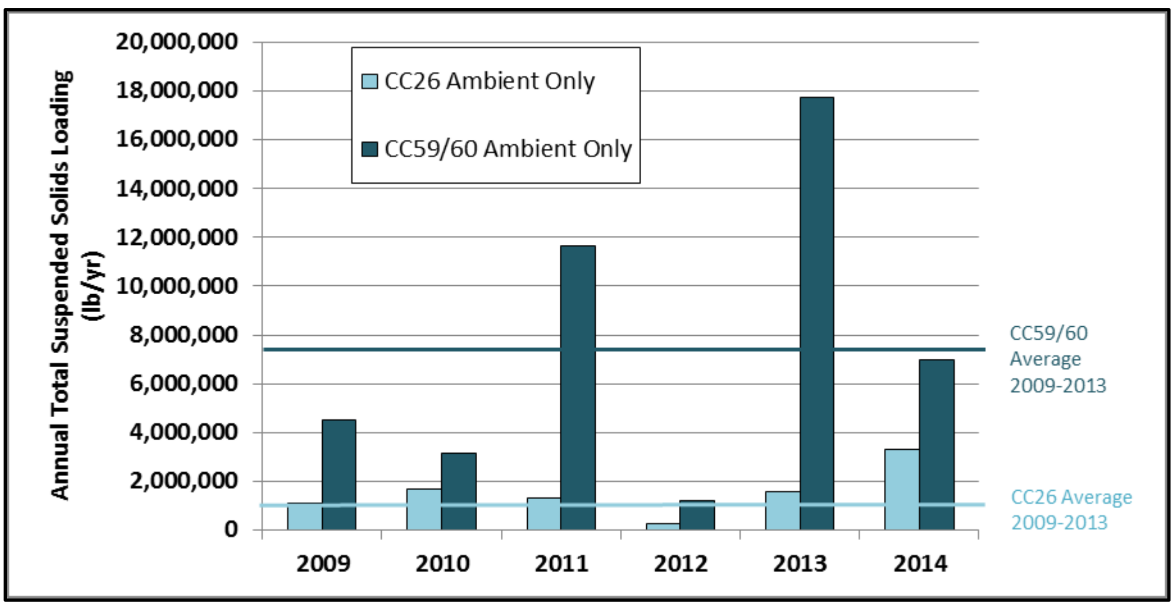

Figure 26. Total Suspended Solids Loading Estimates in the Upper Basin, 2009-2014

Volume-weighted concentrations were computed at the two key locations for the past six years (Figure 27). They were calculated by summing the annual load and dividing by the annual flow volume. Volume-weighted concentrations at CC26 are greater than previous years; and those at CC59/60 are comparable to previous years. This pattern is similar to that observed for TSS loadings.

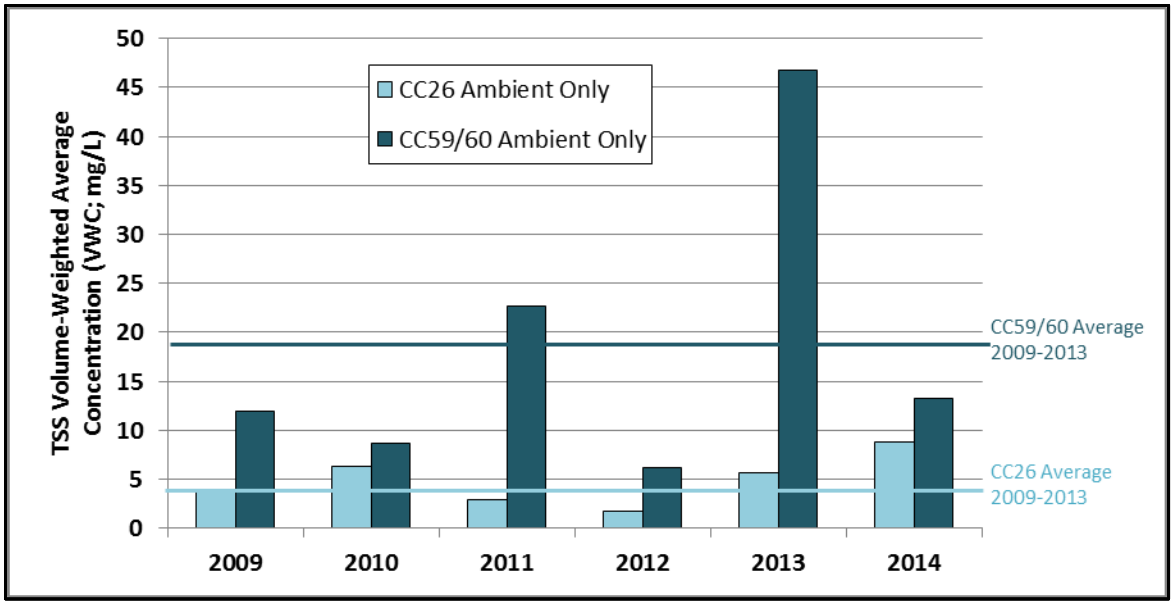

Figure 27. Total Suspended Solids Volume-Weighted Concentration Estimates in the Upper Basin, 2009-2014

C. Total Phosphorus

Total phosphorus concentrations from grab samples and ambient autosamplers in 2014 in the Upper Basin are displayed in Figure 28. As observed in previous years, TP concentrations generally increase at both locations during snowmelt runoff. Temporal patterns in total phosphorus concentrations track those for TSS, showing three distinct periods: peak concentrations during snowmelt, decreasing concentrations during the summer, and low concentrations during fall and winter. This is to be expected given the tendency for phosphorus to adsorb to suspended sediments. The maximum measured concentration of 74.7 µg/L occurred on 5/21/14 at CC60 during the rising limb of the hydrograph.

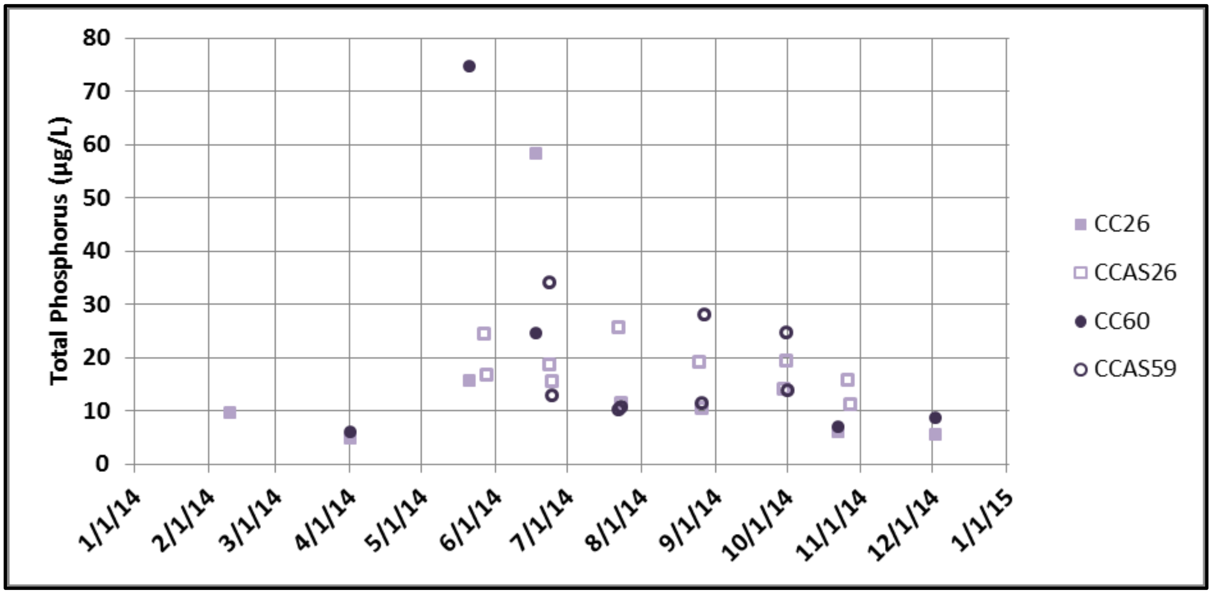

Figure 28. Total Phosphorus Concentrations (Non-Event) in the Upper Basin, 2014

Non-storm-event triggered TP sample results in the Upper Basin for 2009-2014 are presented in Figure 29. The pattern and range of concentrations in 2014 ambient samples is generally similar to that observed in recent years. As noted above, this figure presents ambient grab and autosampler results and therefore does not reflect storm events.

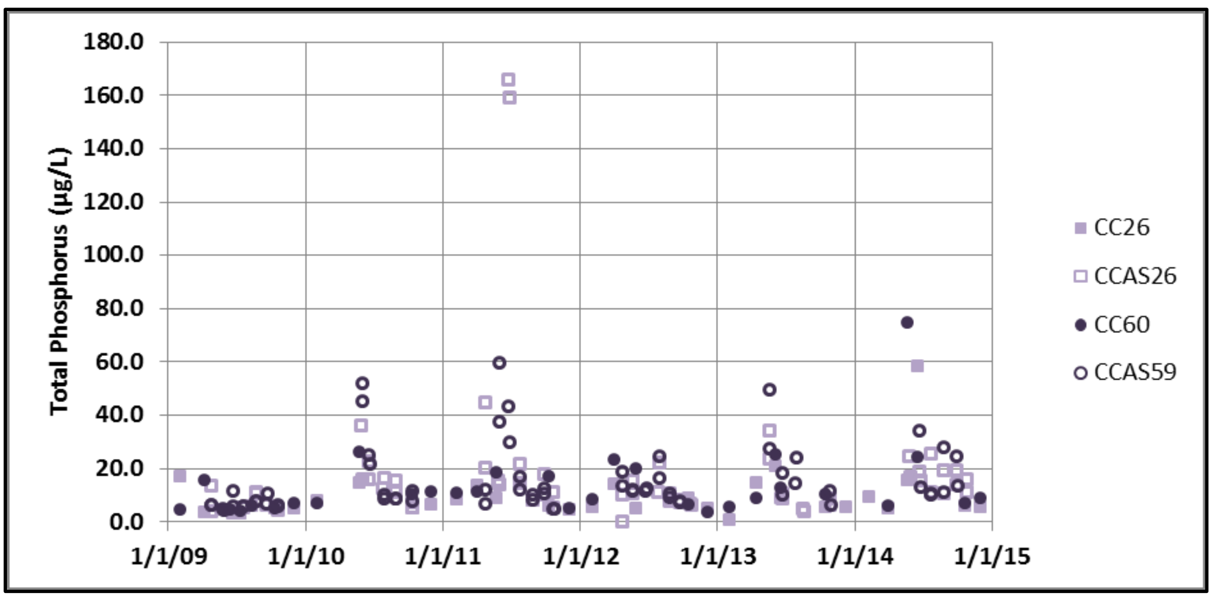

Figure 29. Total Phosphorus Concentrations (Non-Event) in the Upper Basin, 2009-2014

Monthly average TP concentrations for 2014 and for the 2009-2013 average and range are shown in Table 7. Results from 2014 typically fall within observed ranges from the previous five years. May is an exception with the 2014 TP value of 74.7 µg /L, exceeding the 2009-2013 range. This value however, is based on a single measurement and not an average.

Table 7. Monthly Average Total Phosphorus Concentrations (Non-Event) in the Upper Basin at CC59/60

Month	2014 Average TP (µg/L)	2009-2013 Average and Range of TP (µg/L)	% Difference -- 2014 Versus 2009-2013 Average
February	N/A	7.2 (4.6-10.8)	N/A
April	5.9*	12.2 (6.3-23.2)	-52%
May	74.7*	23.6 (4.3-59.5)	+317%
June	23.8	21.5 (4.5-52)	+11%
July	10.6	13.1 (4-24.5)	-19%
October	10.4	8.2 (4.8-17.1)	26%

*"Average" based on only one observed value

Non-storm-event TP loading at CC26 and CC59/60 was calculated for 2014 and compared to estimates from 2009-2013 (Figure 30). TP loading in 2014 was comparable to loads in 2011, a year with similar flow volumes.

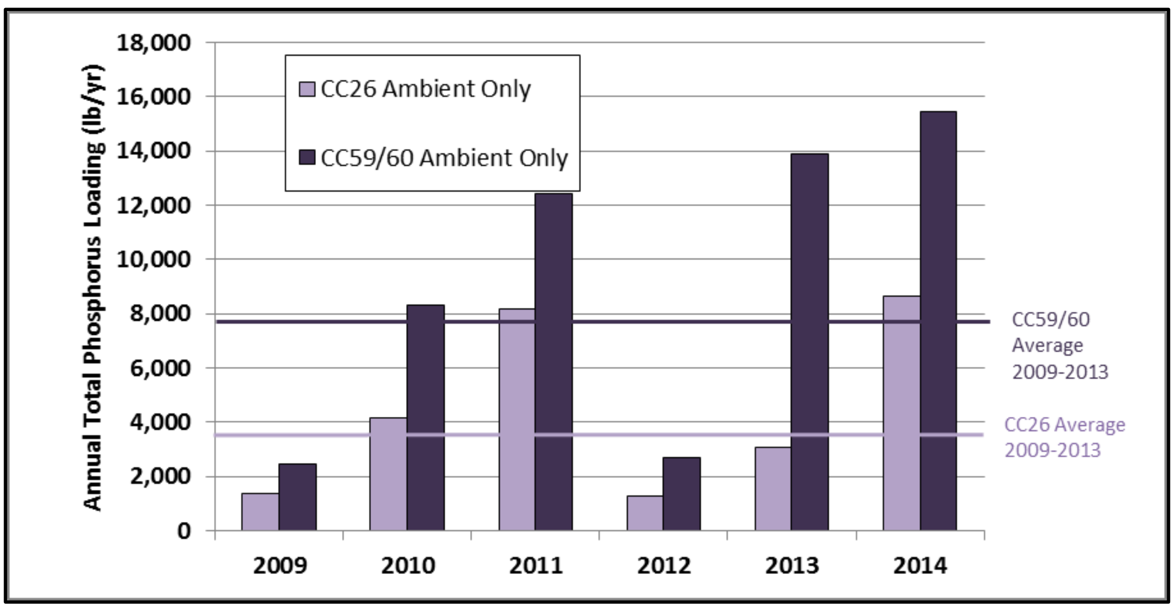

Figure 30. Annual Total Phosphorus Loading Estimates in the Upper Basin, 2009-2014

Volume-weighted concentrations (annual load divided by annual volume) of TP at CC26 and CC59/60 are presented in Figure 31 for 2009-2014. In 2014, volume-weighted concentrations at both CC26 and CC59/60 were greater than the average of the previous 5 years.

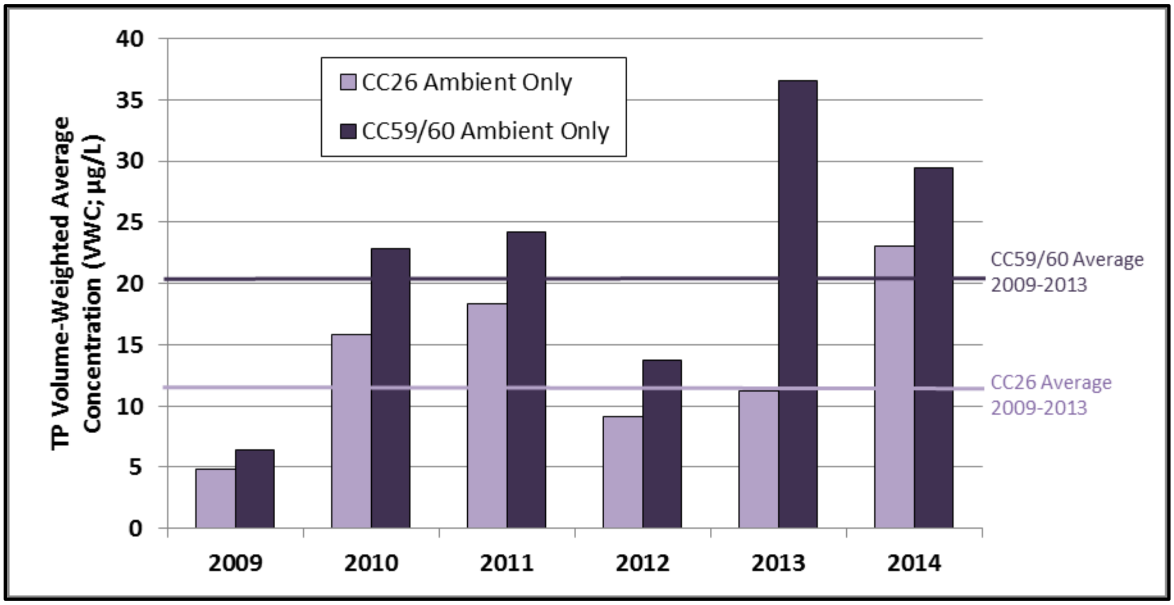

Figure 31. Volume-Weighted Total Phosphorus Concentration Estimates in the Upper Basin, 2009-2014

D. Total Nitrogen

Figure 32 presents ambient total nitrogen concentrations observed in the Upper Basin for 2014 based on grab samples and 24-hour composite autosampler data. Data from both stations follow the same general seasonal pattern, with lower concentrations during the summer months, and higher concentrations during the winter and early spring. This pattern is inverse to the pattern for TSS and total phosphorus; indicating that the mechanisms of nitrogen loading are different. The maximum non-storm-event concentration was observed at CC26 on 2/10/14 during a period of winter low flows. In contrast, the maximum concentration at CC60 was observed on 5/21/14, coincident with the peak TSS and TP concentrations.

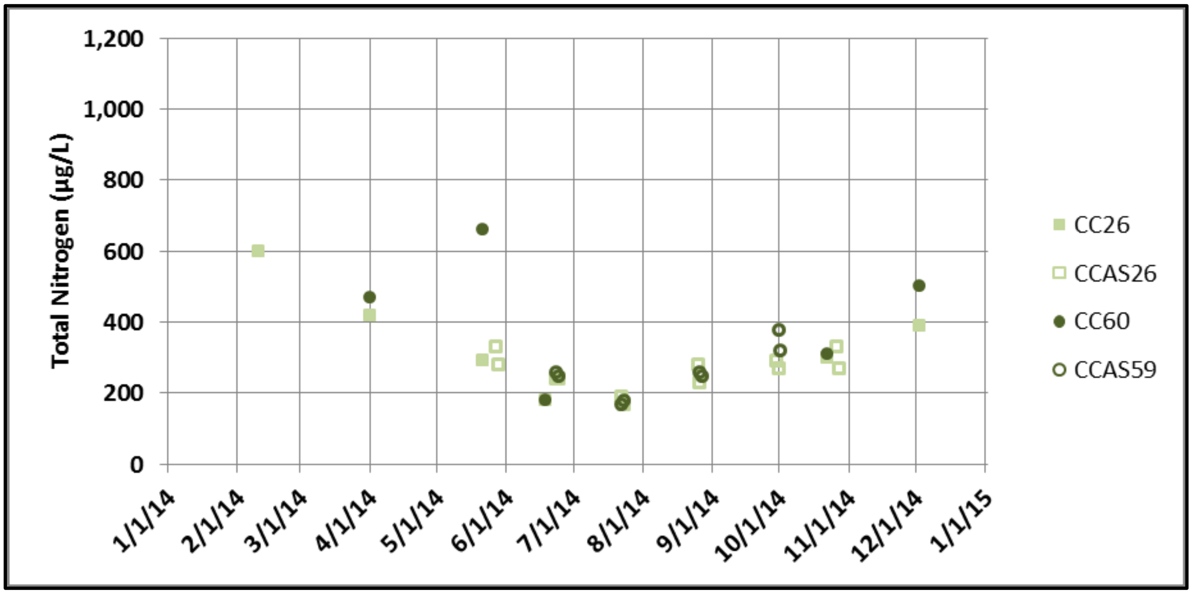

Figure 32. Total Nitrogen Concentrations (Non-Event) in the Upper Basin, 2014

The temporal pattern for 2014 ambient TN concentration data is consistent with previous years (lower in summer and higher in winter), as shown in Figure 33.

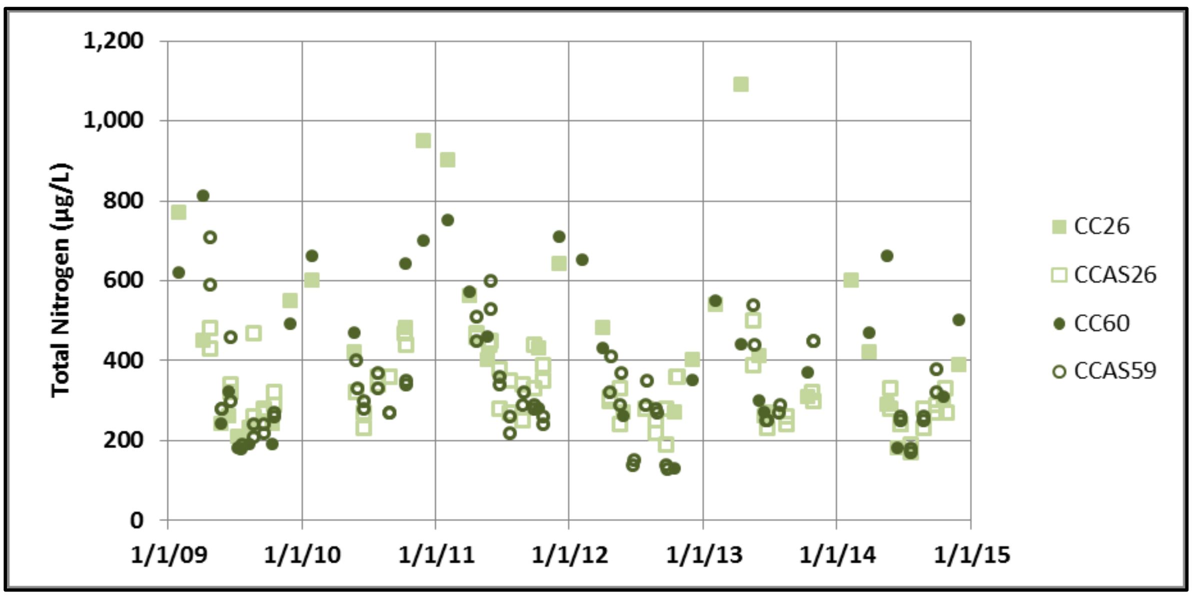

Figure 33. Total Nitrogen Concentrations (Non-Event) in the Upper Basin, 2009-2014

A comparison of monthly average TN concentrations at CC59/60 for 2014 and the 2009-2013 average is provided in Table 8. These non-storm-event results for TN from 2014 all fall within observed ranges from the previous five years. As with TP and TSS, the month of May is an exception with May 2014 TN concentrations exceeding the range from 2009-2013.

Table 8. Monthly Average Total Nitrogen Concentrations (Non-Event) in the Upper Basin at CC59/60

Month	2014 TN (µg/L)	2009-2013 Average and Range of TN (µg/L)	% Difference -- 2014 Versus 2009-2013 Average
February	N/A	646 (550-750)	N/A
April	470*	524 (320-810)	-10%
May	660*	386 (240-600)	+71%
June	230	305 (140-530)	-25%
July	175	266 (180-370)	-34%
October	315	325 (130-640)	-3%

*Average based on one observed value

Non-storm-event TN loading at CC26 and CC59/60 were calculated for 2014 and compared to estimates from 2009-2013 (Figure 34). Loadings at CC26 are consistent with the average for the previous five years. In contrast, the loadings at CC59/60 are greater than the average of the previous five years.

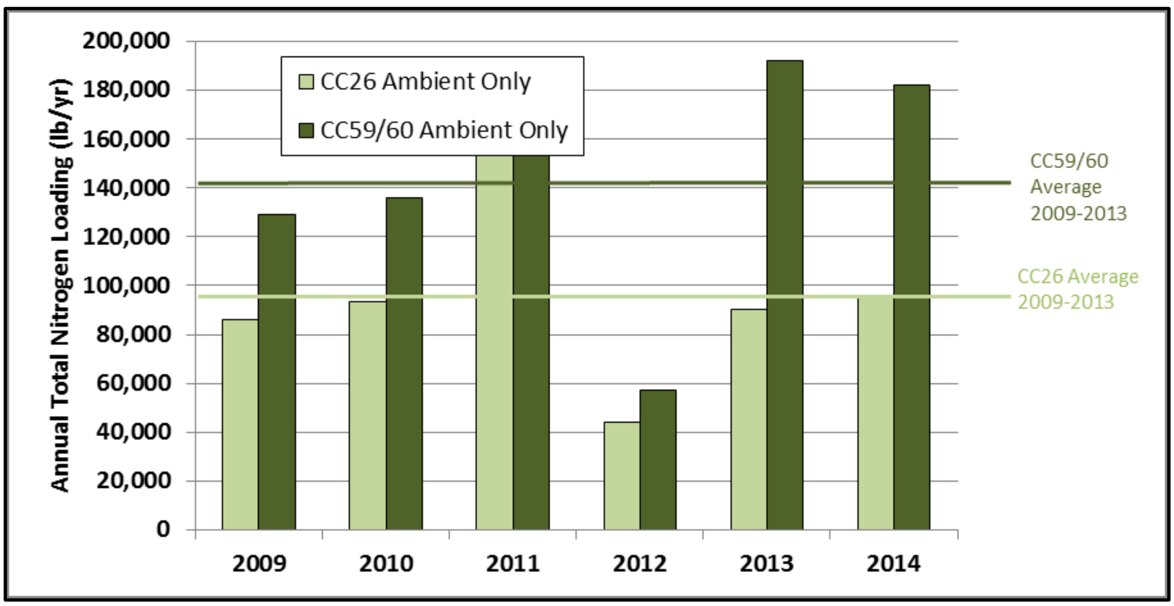

Figure 34. Total Nitrogen Loading Estimates in the Upper Basin, 2009-2014

Volume-weighted concentrations (annual load divided by annual volume) of TN at CC26 and CC59/60 are presented in Figure 35 for 2009-2014. The volume weighted concentrations for CC59/60 are consistent with the average of the previous five years. This consistency in volume-weighted concentrations at CC59/60 demonstrates that the increase in flows heavily influences the increase in loads. In contrast, at CC26 volume-weighted concentrations are lower than the previous five years, possibly the result of dilution by larger flows.

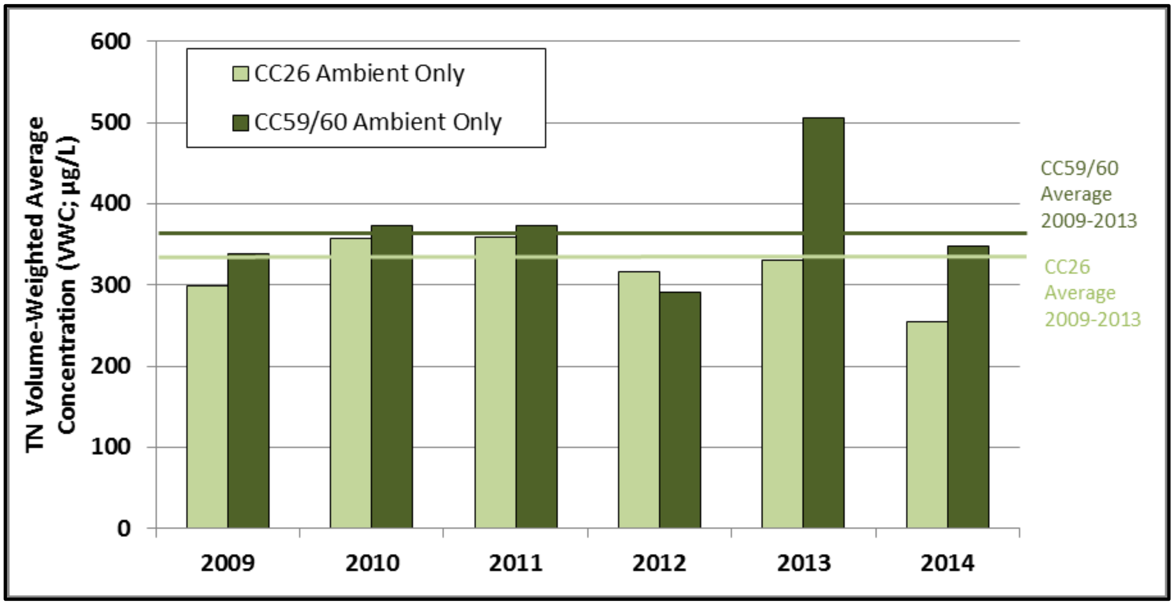

Figure 35. Volume-Weighted Total Nitrogen Concentration Estimates in the Upper Basin, 2009-2014

E. Effects of Storm Events on Loading

The loading calculation results described earlier in this section include grab samples and ambient autosampler data. These types of samples, which are taken at regular intervals, are not intended to capture the water-quality response to storm events. It is widely recognized, however, that even relatively small precipitation events can result in substantial changes to water quality. As such, since 2006 event-triggered sampling has been conducted and this was continued in 2014 at station CCAS59.

In 2014, four event-triggered samples were collected at CCAS59 between mid-July and mid-August. Incorporating these event samples into the annual loading calculations yields increases of 3% for TN, 24% for TP, and 28% for TSS (Table 9 and Figure 36). The effects are even more apparent in the monthly loading for the months in which the events occurred (Table 9). The greatest relative increase in loading for storm events is for TSS and TP; with TN showing a much smaller difference. This is expected due to the impact of precipitation events on TSS (and associated sorbed phosphorus) concentrations. These general findings about the significance of storm events in annual loads are consistent with the results reported in previous reports. Note that storm-event concentrations were assumed to represent concentrations for the full day of the composite sample, though runoff events can cover longer or shorter periods.

Table 9. Effect of Storm Events on Annual and Monthly Loading at CC59/60

Time Period	Increase in TN Loading with Storm Events	Increase in TP Loading with Storm Events	Increase in TSS Loading with Storm Events
2014 (Annual Load)	3%	24%	28%
July 2014 (Monthly Load)	23%	222%	207%
August 2014 (Monthly Load)	16%	263%	258%

The storm-event samples provide valuable snapshots of the water-quality response to storm events in the Clear Creek basin. Nonetheless, it is important to remember that they do not comprise all the storm events of 2014. As such, estimates of loading including these events estimate a fraction of the additional annual loading attributable to storm events.

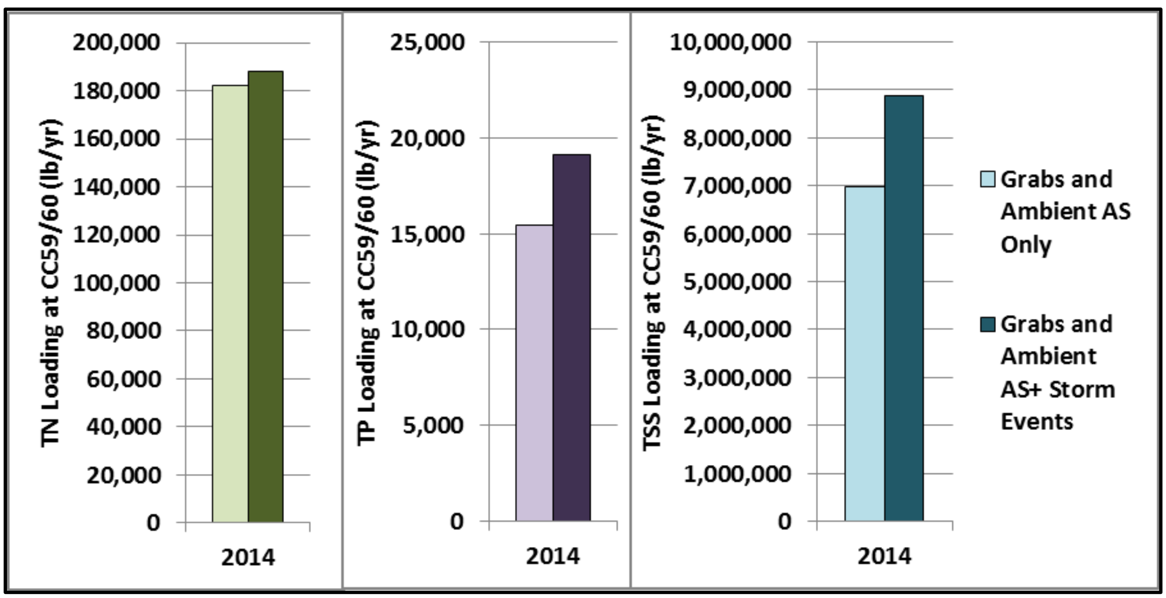

Figure 36. Total Nitrogen, Total Phosphorus, and Total Suspended Solids Loading in 2014, With and Without Storm Events

V. Standley Lake Flows, Contents, and Loadings

The Upper Basin is the source for the vast majority of water entering Standley Lake and is described in the previous section. This section provides a discussion of the quantity and the quality of the inflows and outflows to Standley Lake.

A. Flows and Contents

Water enters Standley Lake via four conveyances (Figure 7): the Church Ditch, the Croke Canal, Farmers' High Line Canal (FHL), and the Kinnear Ditch Pipeline (KDPL). Inflows for 2014 from each of these sources are shown in Figure 37. The Croke Canal has the most senior rights in the Clear Creek Basin during the non-irrigation season (November – March). During 2014, as is typical, the Croke Canal provided the only inflow to Standley Lake during the non-irrigation season. During the irrigation season (April to October), the FHL Canal was the dominant source of inflows. The Church Ditch and the KPDL delivered water later in the irrigation season.

View across Standley Lake. (Photo Credit: Eric Scott)

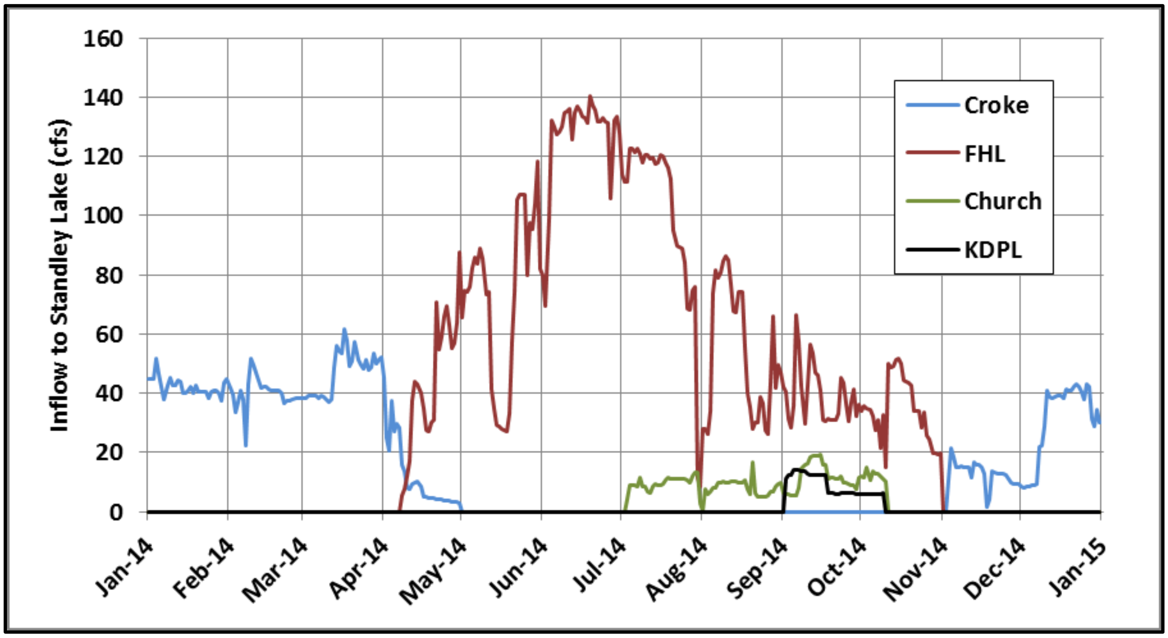

Figure 37. Inflow to Standley Lake, 2014

Annual inflow volume from each source is shown in Figure 38 for 2009 through 2014. The FHL and Croke Canals are the dominant sources of water to Standley Lake, providing, respectively, 67% and 26.5% of total inflows. Church and KDPL are much smaller sources, combining to provide 6.5% of total inflows.

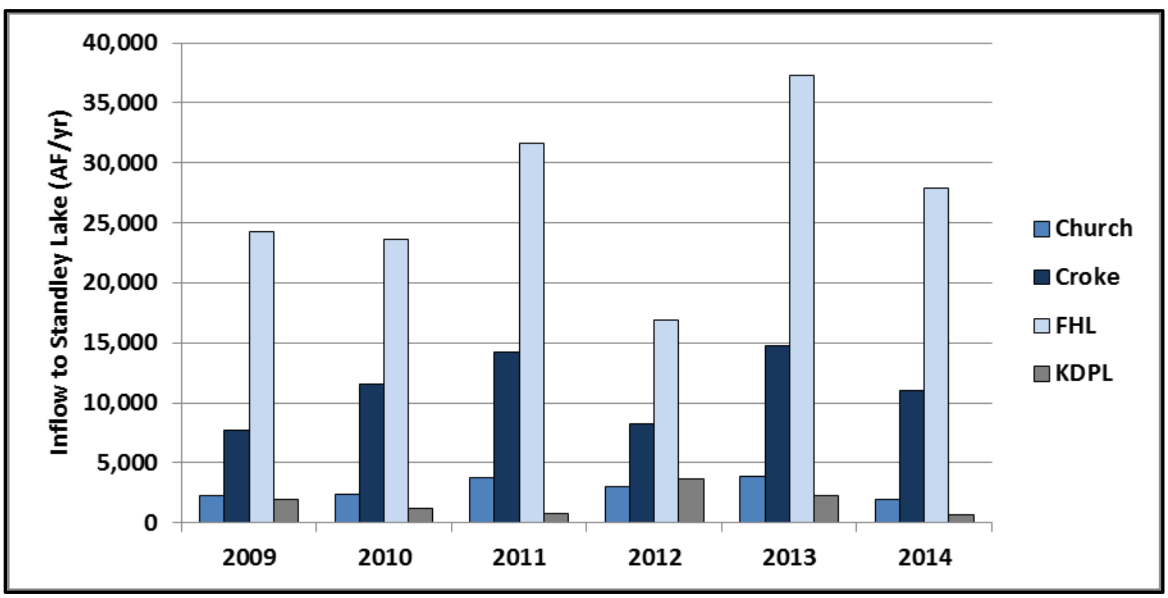

Figure 38. Annual Inflow to Standley Lake by Source, 2009-2014

Outflow from the lake in 2014 is presented in Figure 39. The largest outflows occurred during the irrigation season. The total measured annual inflow (all four sources combined) and outflow volumes for these years are presented in Figure 40. Even though it was a wet year, total inflows and outflows were close to the averages for 2009-2013; inflow volume was 4% lower than the previous 5-year average and outflow was 3% higher.

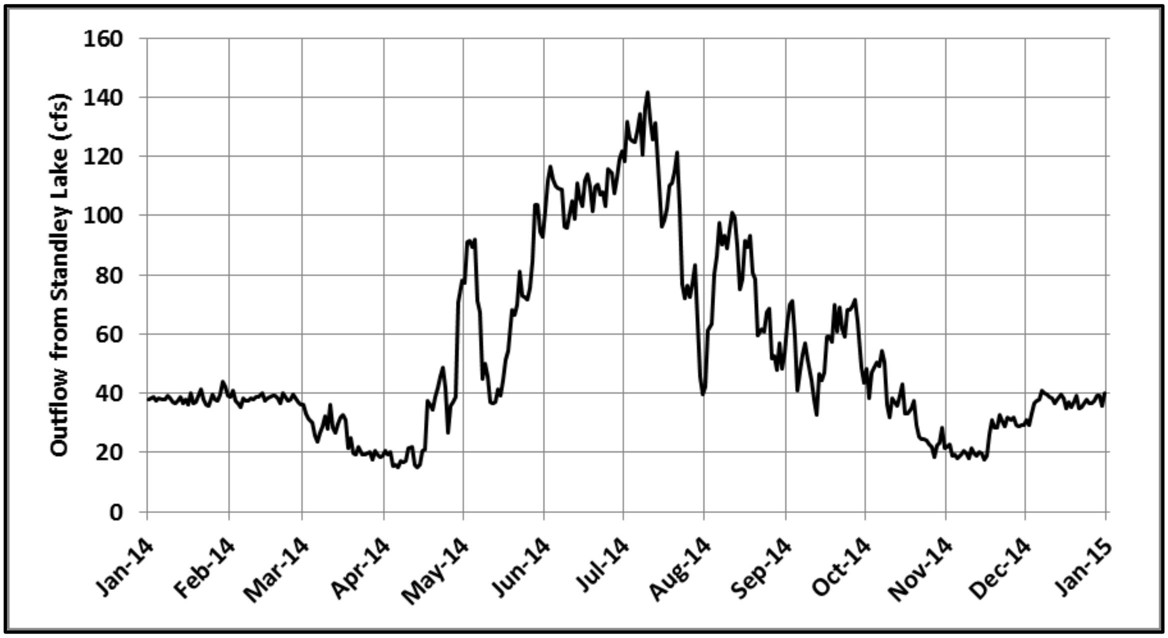

Figure 39. Outflow from Standley Lake, 2014

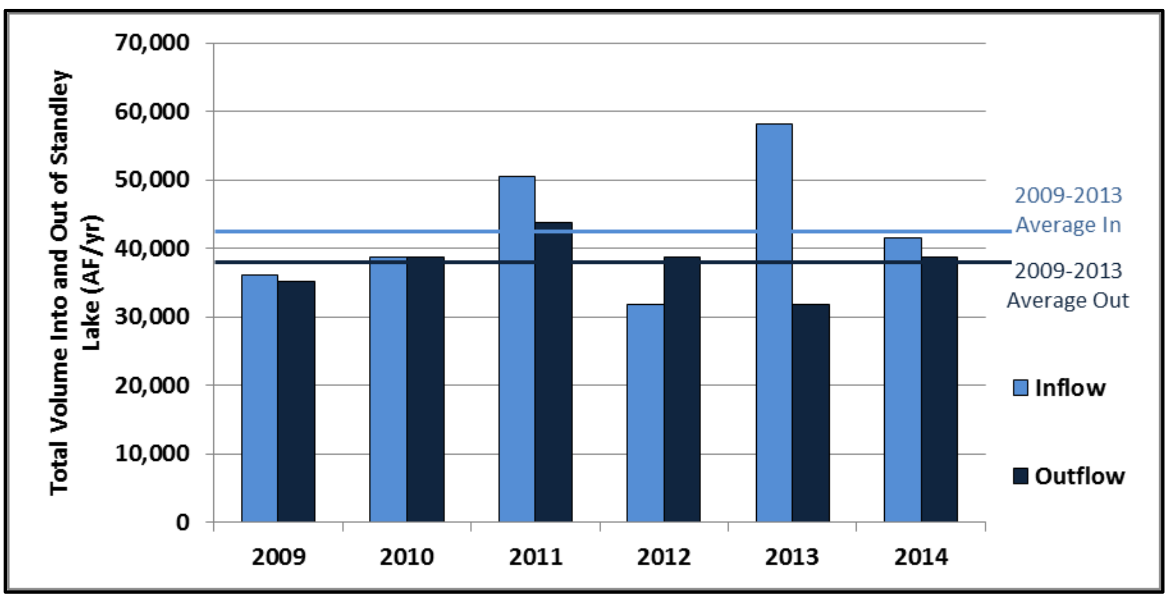

Figure 40. Total Measured Annual Standley Lake Inflow and Outflow, 2009-2014

Daily contents for Standley Lake over the past six years are displayed in Figure 41. Contents were calculated using gage-height measurements and elevation-area-volume relationships for the lake.

Lake contents started out unusually high following the September 2013 floods. These high lake contents continued throughout 2014, maintaining for much of the year levels higher than those seen in previous years. Average lake contents were 13% higher in 2014 relative to the average of the previous five years.

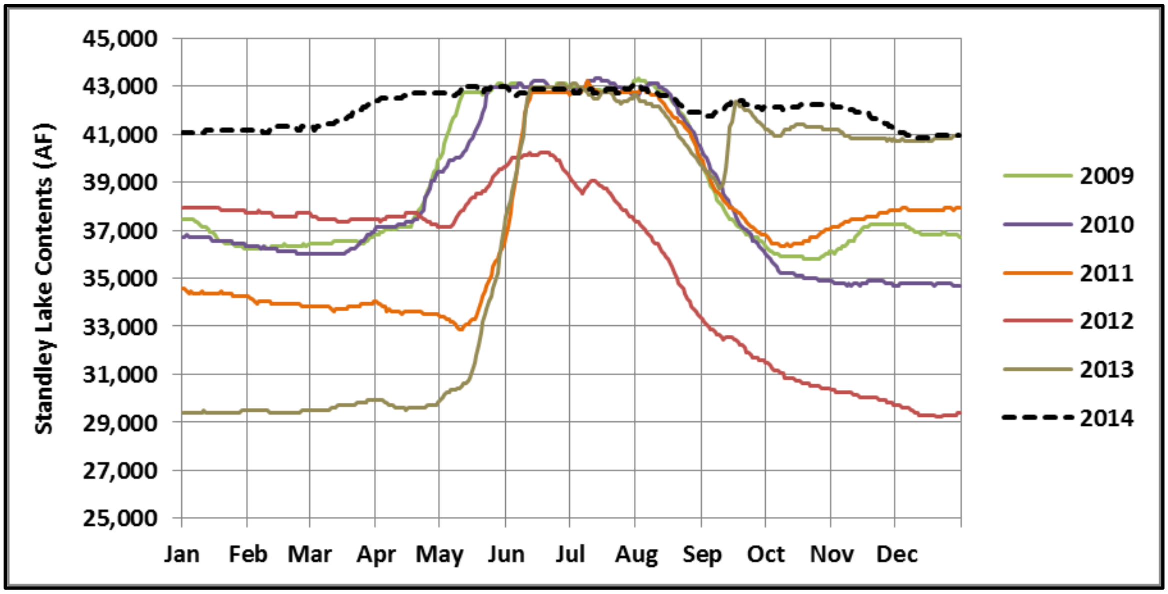

Figure 41. Standley Lake Contents, 2009-2014

B. Loading Into and Out of Standley Lake

Estimates of nutrient loading into and out of the lake are described in this sub-section. Loads are calculated using daily flows and concentration data, from samples collected as part of the Upper Clear Creek/Standley Lake Watershed Water Quality Monitoring Program. The sampling data for inflows includes ambient grab samples and 24-hour ambient autosampler (AS) data. In addition, first-flush samples were collected for FHL and Croke at the beginning of deliveries for the year. To compute the loads, a mid-point step function was used to fill daily concentrations between the available sample data. An autosampler on the FHL Canal was used to collect storm-event samples in 2014. These samples provide an indication of the effects of storm events on loading to the reservoir.

1. Total Phosphorus

Total phosphorus loading into Standley Lake is presented by source for 2009-2014 in Figure 42. As noted above, the loading estimates include data from ambient grab and ambient autosampler samples and autosampler results from first-flush. The data include one pair (two back-to-back 24-hour autosampler runs) of first-flush samples each for Croke and a single first-flush sample for FHL. No first-flush type samples were collected for KDPL or Church Ditch. The canals which contributed the greatest volumes of water to Standley Lake, the Croke and FHL Canals (Figure 38), delivered the largest TP loads (Figure 42). This pattern is consistent with that seen in previous years. First flush samples have only a minimal effect on annual loading values, inclusion of the first flush samples changed annual loading values for TN and TP by less than 1% in all cases in 2014.

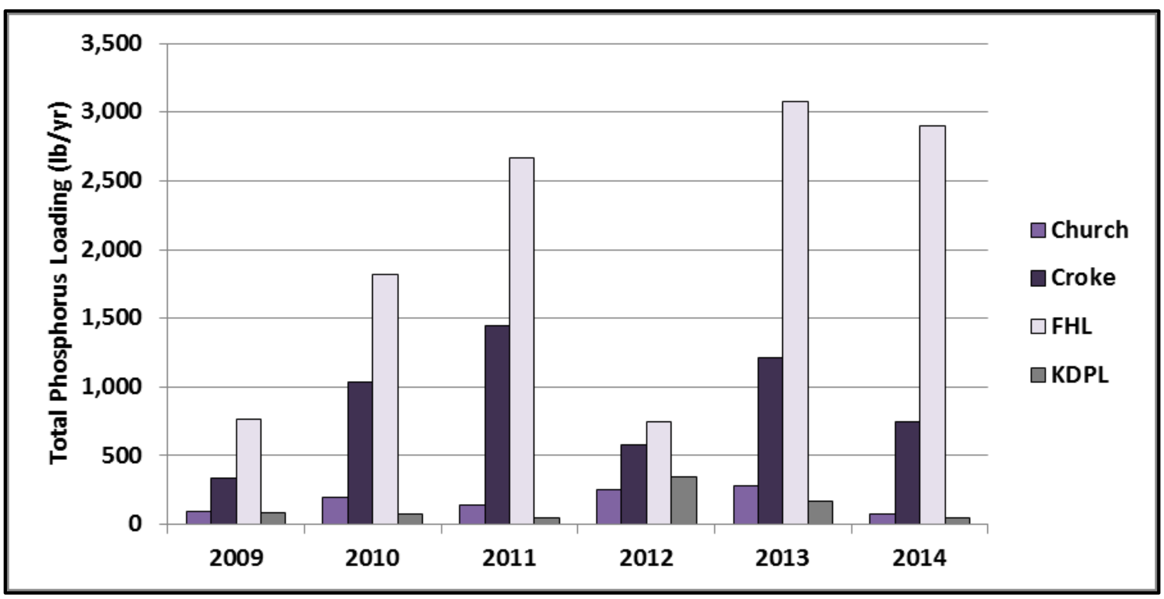

Figure 42. Total Phosphorus Loading into Standley Lake by Source, Using Grab Samples and 24-Hour Ambient Autosampler Data, 2009-2014

Estimated annual TP loadings into and out of Standley Lake for 2009-2014 are shown in Figure 43. Non-storm event loading of total phosphorus in 2014 was 23% higher than the average of the previous five years. As with previous years, loadings of total phosphorus into the lake were greater than outflow, indicating some level of phosphorus retention.

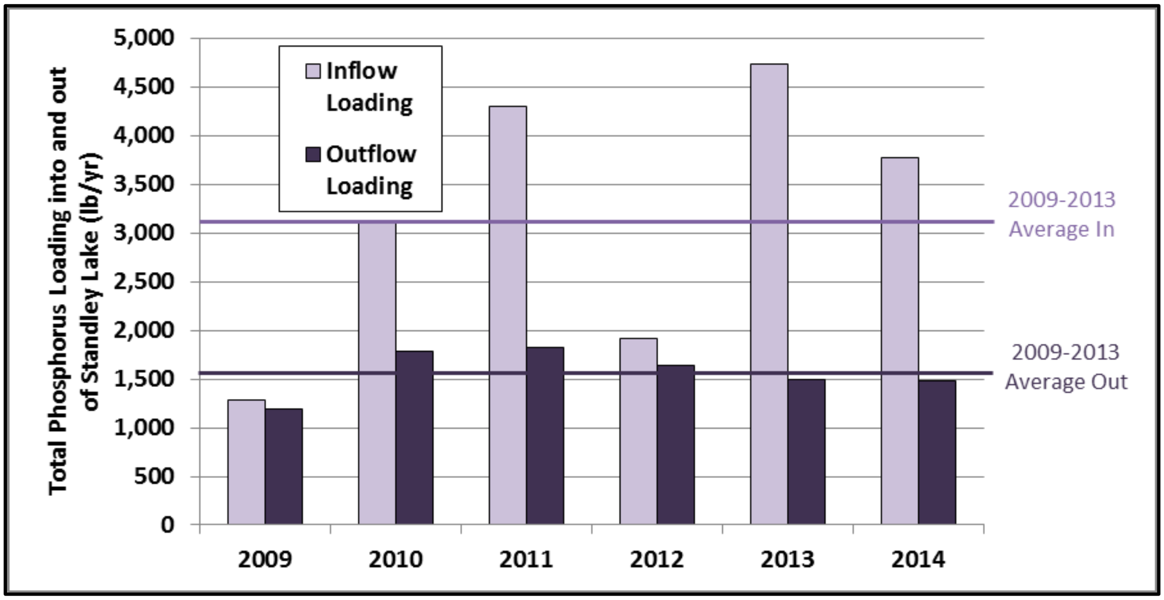

Figure 43. Total Phosphorus Loading into and Out of Standley Lake, 2009-2014

The volume-weighted TP concentrations into Standley Lake are presented in Figure 44 by source. The non-storm-event volume-weighted TP concentrations were variable in the canals in 2014; with FHL having the highest volume-weighted concentration and Church ditch the lowest. The combined average of the canals in 2014 was 32% higher than the 2009-2013 average.

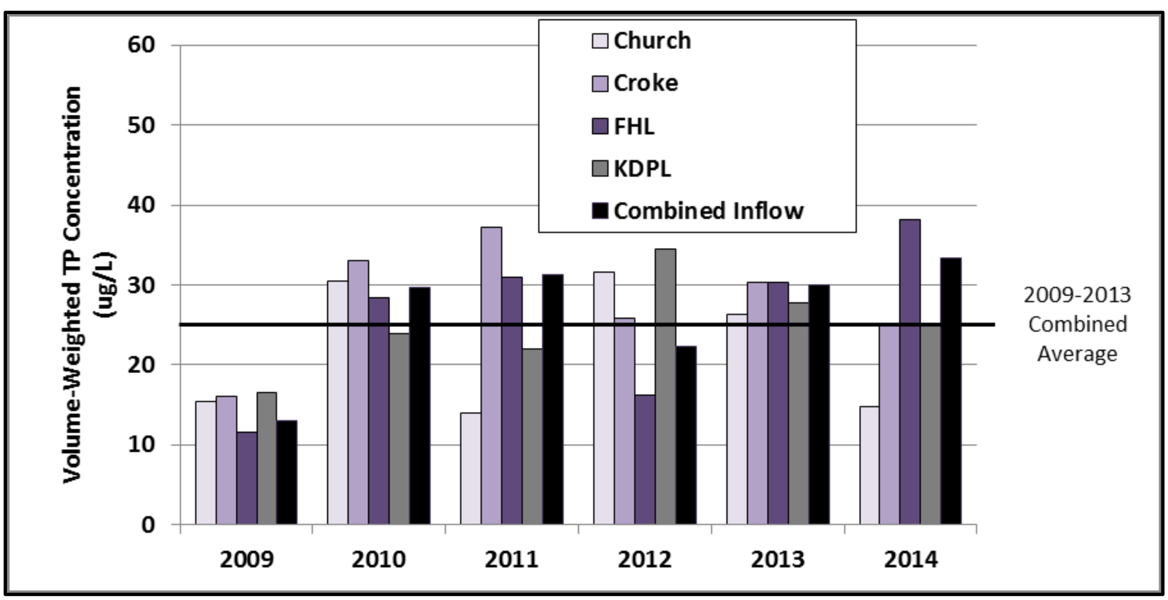

Figure 44. Volume-Weighted Total Phosphorus Concentrations into Standley Lake, 2009-2014

In 2009, a by-pass project was implemented in Church Ditch with the aim of reducing its high nutrient concentrations. The analysis of the success of that project is updated in this annual report. Monthly volume-weighted TP concentrations in Church Ditch for 2005-2015 are provided in Figure 45. The median volume-weighted TP concentrations have decreased by 49% comparing 2005-2008 to 2009-2014. The statistical significance of this decrease was tested using a one-sided, two-sample Kolmogorov-Smirnov test[2]. The test results indicate a greater than 99.9% probability that there has been a decrease in TP concentrations since implementation of the by-pass project, further confirming findings presented in the 2012 annual report. The result is the same even if the two highest values of TP observed in 2008 are excluded.

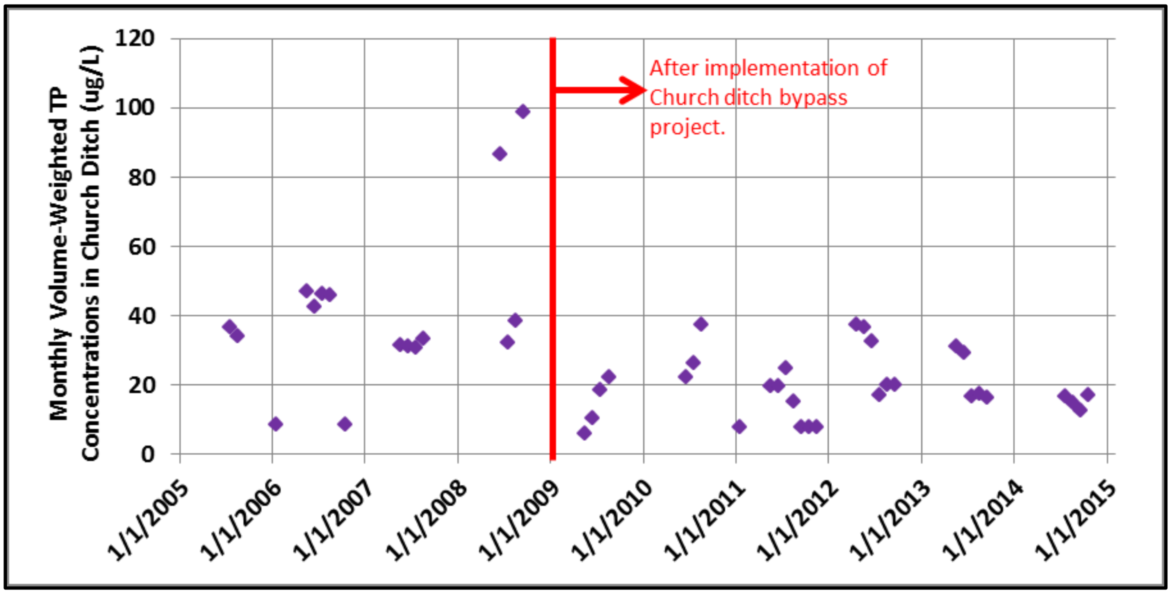

Figure 45. Volume-Weighted Average Total Phosphorus Concentrations in Church Ditch, 2005-2014

2. Total Nitrogen

Total nitrogen loading into Standley Lake, grouped by source and based on data from ambient grab and ambient autosampler samples and autosampler results from first-flush, is displayed in Figure 46. Combined TN loading into and out of the lake is presented in Figure 47. The relative pattern of loading by source in 2014 was consistent with those seen in previous years. The mass of total nitrogen entering Standley Lake in 2014 was 7% lower relative to the previous five years. Outflow of total nitrogen in 2014 was 7% lower than the 2009-2013 average. As with previous years, loading into the lake was higher than outflow from the lake, indicating some level of nitrogen retention.

[2] A one-sided, two-sample Kolmogorov-Smirnov test is a nonparametric statistical test of two datasets that assesses a null hypothesis that one dataset is greater in magnitude than the other dataset.

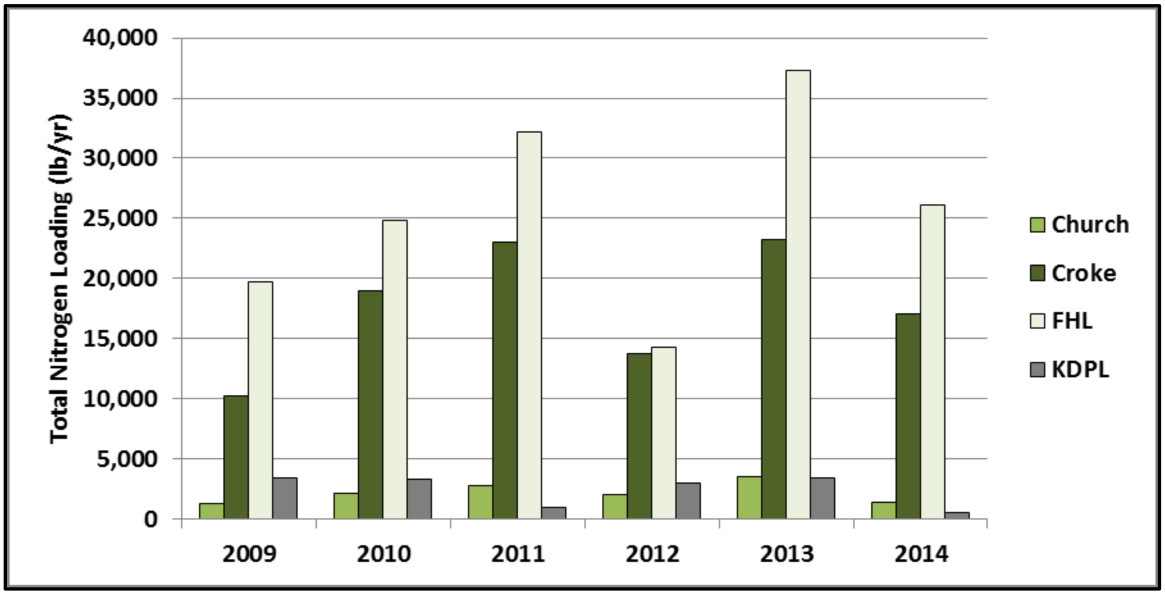

Figure 46. Total Nitrogen Loading into Standley Lake by Source, 2009-2014

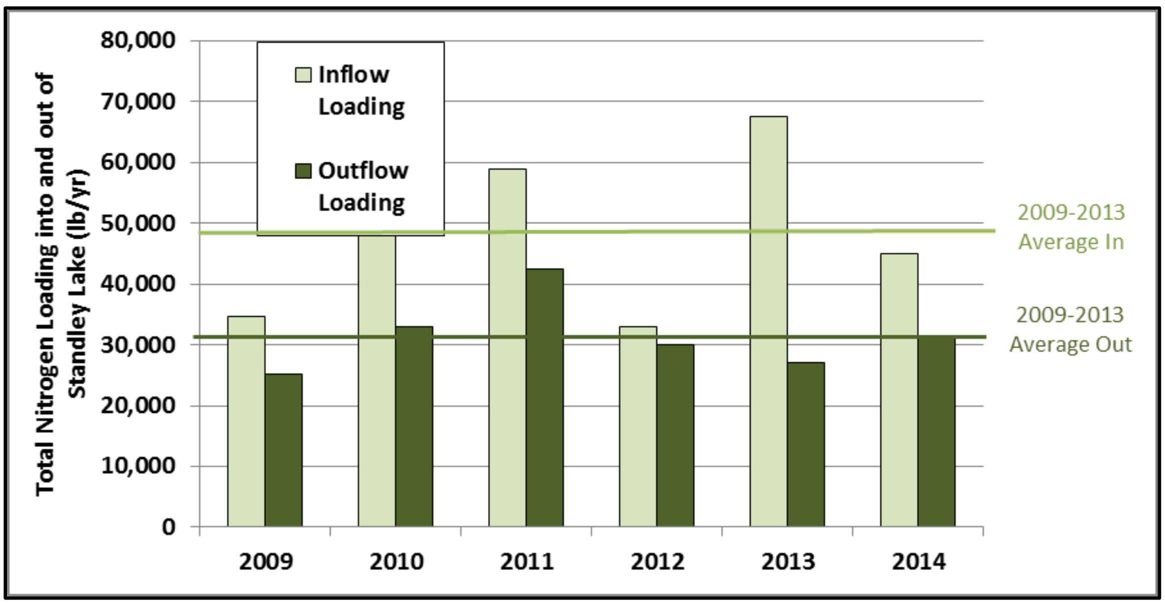

Figure 47. Total Nitrogen Loading into and Out of Standley Lake, 2009-2014

Volume-weighted total nitrogen concentrations into the lake are presented in Figure 48. The combined average from all sources in 2014 was 3% lower than the combined average for 2009-2013.

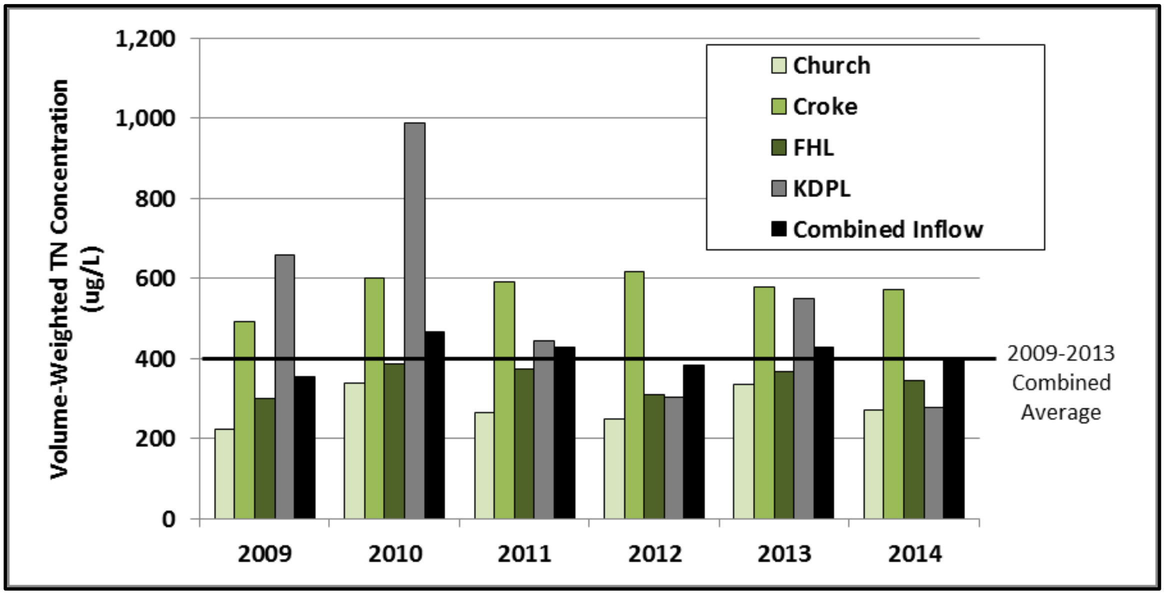

Figure 48. Volume-Weighted Total Nitrogen Concentrations into Standley Lake, 2009-2014

Volume-weighted TN concentrations in Church Ditch for the period 2005-2014 are presented in Figure 49. As seen above with TP concentrations, the volume-weighted TN concentrations in Church Ditch are lower beginning in 2009, coinciding with the implementation of the by-pass project. The median volume-weighted TN concentrations have decreased by 41% comparing 2005-2008 to 2009-2014. The statistical significance of this decrease in TN was tested using a two-sample Kolmogorov-Smirnov test[3]. As seen for TP, the test results indicate a 99.9% probability that there has been a decrease in TN concentrations since implementation of the by-pass project. The result is the same even if the two highest values of TN observed in 2008 are excluded.

[3] A one-sided, two-sample Kolmogorov-Smirnov test is a nonparametric statistical test of two datasets that assesses a null hypothesis that one dataset is greater in magnitude than the other dataset.

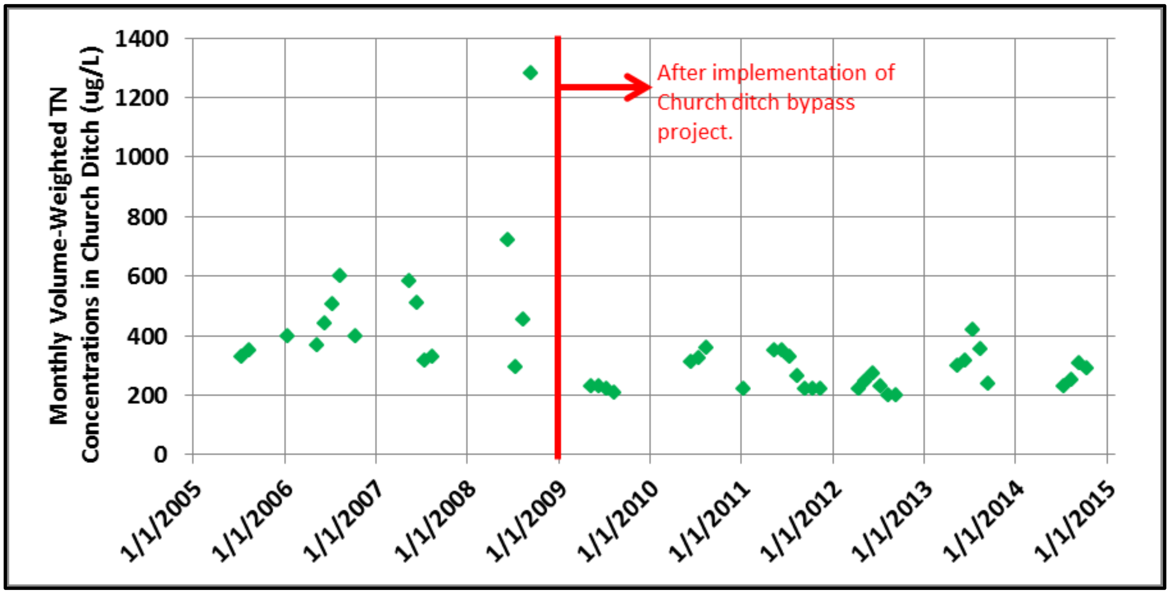

Figure 49. Volume-Weighted Average Total Nitrogen Concentrations in Church Ditch, 2005-2014

3. Effect of Storm Events on Nutrient Loading

The nutrient loads presented above were calculated using grab samples, ambient autosampler data, and autosampler data from first flush. Load estimates that include storm-event-triggered autosampler data are described in this section. An autosampler located on the FHL canal at the inflow location to Standley Lake was used to collected storm event samples in 2014. These samples were collected during July (7/13, 7/28 and 7/29) and August (8/8). Storm event samples were assumed to represent conditions for the full 24-hour period on the sample date.

A comparison of nutrient loading into Standley Lake from FHL in 2014 with and without the sampled storm events is shown in Figure 50. The lighter bars in the figure represent the loading estimated excluding storm-event autosampler data. The darker bars include the events listed above. Consistent with the storm-event loading analysis for the upper watershed, it should be noted that the storm event estimates only represent the sampled storms. Because of this, the loading estimates presented here are lower bound estimates of the actual loading. Incorporation of the observed storm events yields a 9% increase in TN loading from FHL and a 33% increase in TP loading. Total phosphorus loads from storm events are a greater fraction of the annual total than total nitrogen. This pattern is consistent with phosphorus loading being driven by particulate transport. Apparent particulate-driven transport of total phosphorus was also seen in the upper watershed. These results demonstrate that loading from storm events can be a significant fraction of the total annual load to Standley Lake.

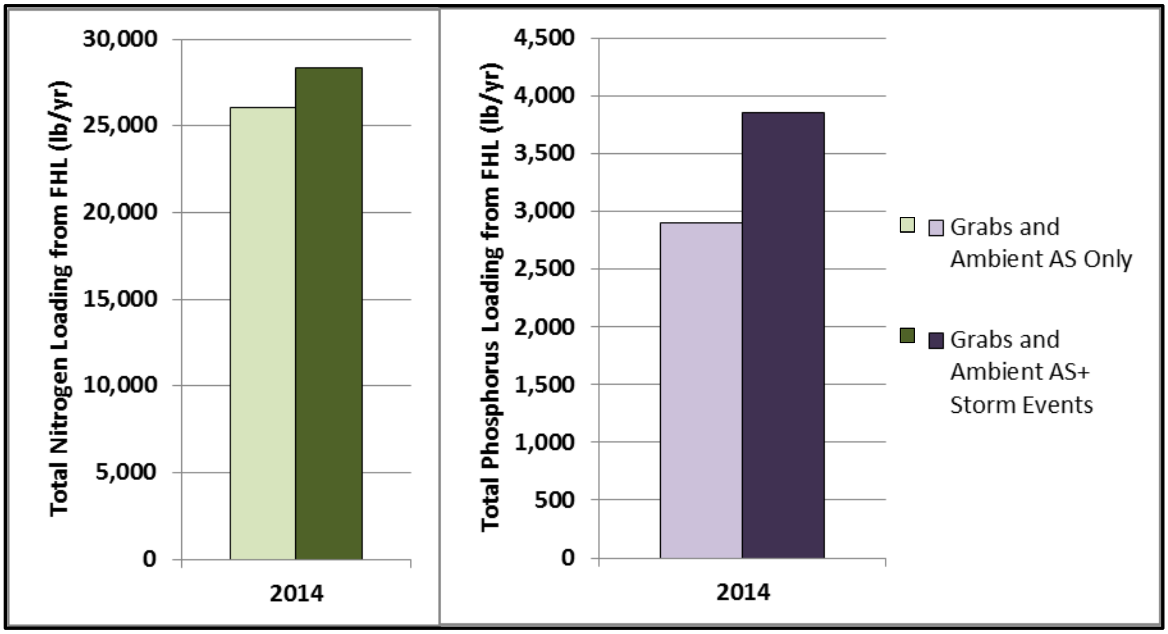

Figure 50. Nutrient Loading to Standley Lake from Farmers' High Line Canal in 2014, With and Without Storm Events

VI. Standley Lake Water Quality

In this section, water-quality responses to the hydrology and nutrient loads are discussed. The data considered here were measured at sampling location SL-10 (Figure 2). This sampling location was selected as it has an extensive sampling history, is directly relevant to water treatment plant operations, and is the location of the automatic lake profiler station. The water-quality indicators discussed here include: dissolved oxygen (DO), TP, TN, chlorophyll *a*, and clarity.

A. Dissolved Oxygen

Dissolved oxygen is a primary water-quality parameter because of its effect on aquatic life and drinking water treatment. Dissolved oxygen at the sediment-water interface (i.e. the bottom of the lake) is of particular relevance. Low DO at this location can result in loading of nutrients and certain metals from the sediment to the water column. These releases can lead to increases in water treatment costs and the potential for taste and odor events in drinking water.

The threshold for hypoxic conditions is 2 mg/L or less of dissolved oxygen. Each year, Standley Lake experiences a period of hypoxic conditions in the hypolimnion. This is common for stratified reservoirs in Colorado. In 2014, DO concentrations started dropping at the bottom in mid-June and hypoxic conditions were well developed by July. The extent of hypoxic conditions in 2014 began to decrease in September and ended, as is typical, during turnover in early October. An isopleth of dissolved oxygen concentrations in Standley Lake for March through November 2014 is provided in Figure 51.

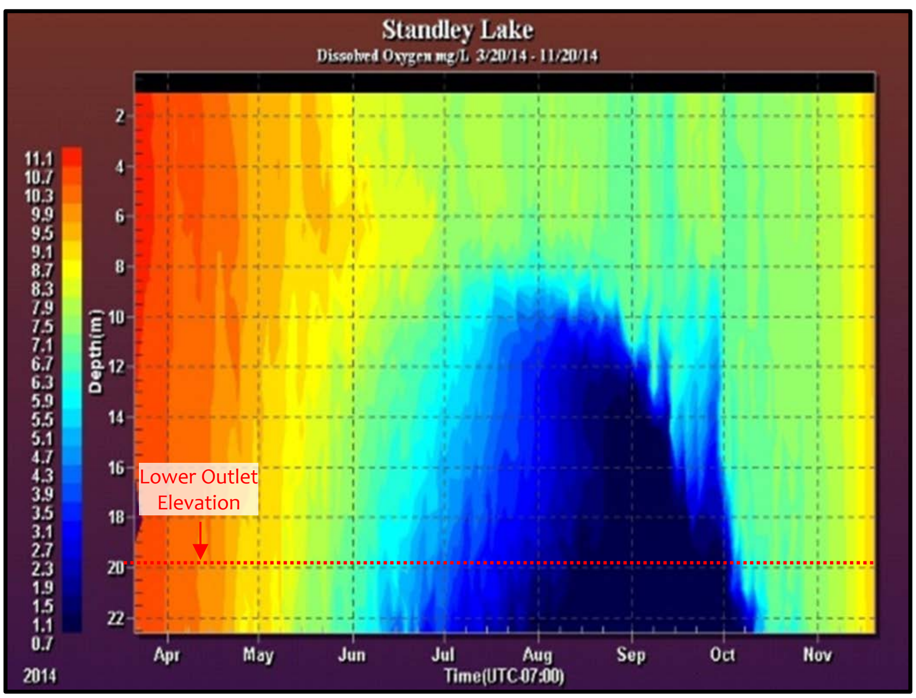

Figure 51. Isopleth of Dissolved Oxygen in Standley Lake, March-November 2014

Dissolved oxygen concentrations measured at the top and bottom of Standley Lake through 2014 are provided in Figure 52. At the surface, DO concentrations are driven by the decrease in oxygen solubility with increasing temperatures. The onset of stratification is observed to occur at the beginning in May, when lake-bottom DO concentrations are observed to diverge from surface concentrations. This divergence increases in magnitude as stratification is maintained and dissolved oxygen is depleted in the isolated hypolimnion. Consistent with the isopleth (Figure 51), the divergence between surface and bottom DO concentrations is rapidly extinguished with turnover in October.

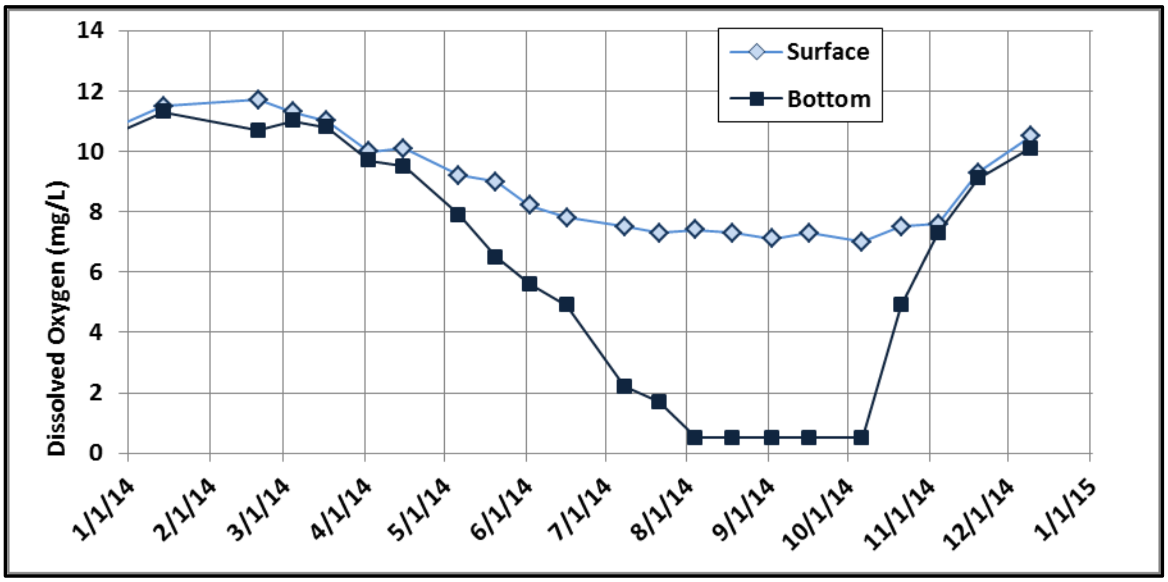

Figure 52. Dissolved Oxygen Concentrations in Standley Lake, 2014

The 2014 seasonal dissolved oxygen patterns closely match those observed in previous years in Standley Lake, as shown in Figure 53.

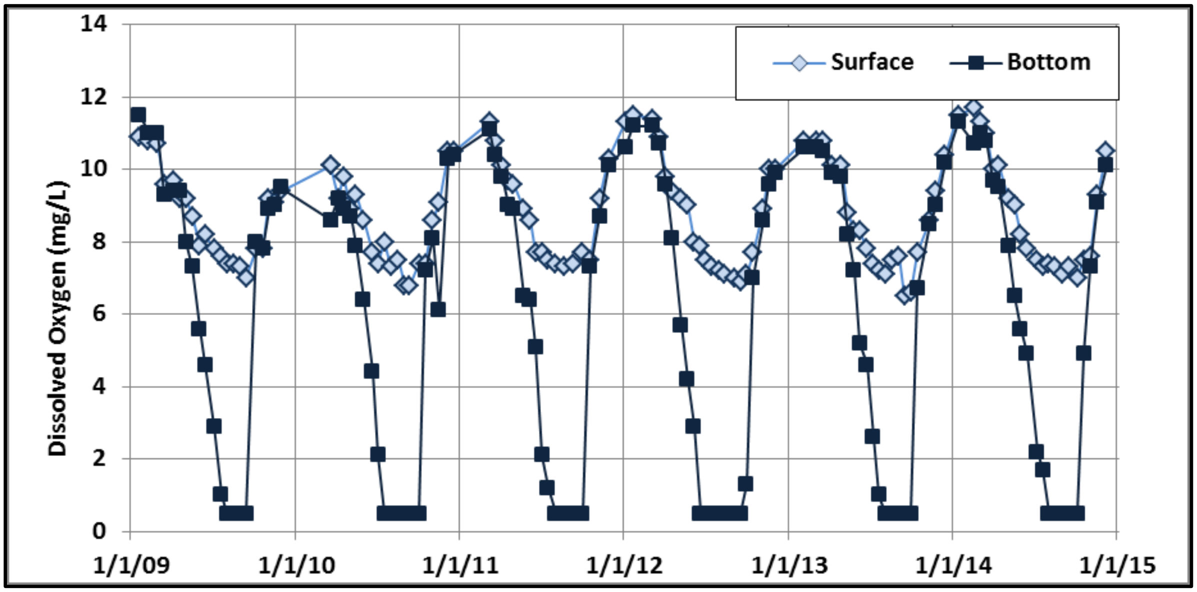

Figure 53. Dissolved Oxygen Concentrations in Standley Lake, 2009-2014

Hypoxia occurs each year in the hypolimnion of Standley Lake, but the start date, end date, and duration varies from year to year. In 2014, the hypoxic period started in early July, which is typical but lasted until turnover on October 12th, which is the latest fall turnover experienced over the last 10 years. The late turnover was likely due, in part, to the reservoir being very strongly stratified in July[4] – much more so than in previous years. Because turnover was later than typical, the period of hypoxia was higher than the 2009-2013 average of 95 days (Figure 54).

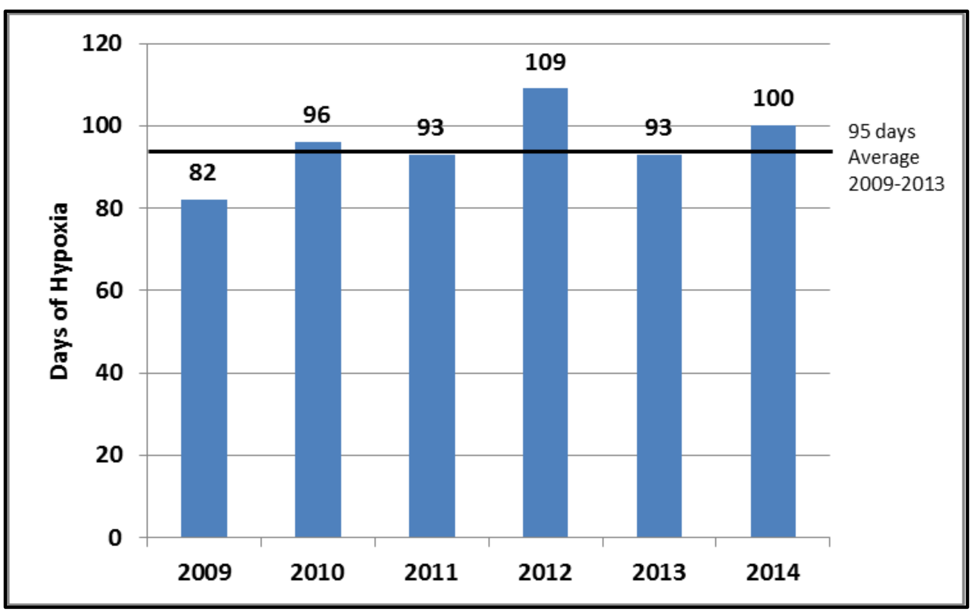

Figure 54. Days of Hypoxia (DO < 2.0 mg/L), 2009-2014

[4] As indicated by a comparison of Relative Thermal Resistance to Mixing (RTRM) for 2005-2014

B. Total Phosphorus

Total phosphorus concentrations observed in Standley Lake are displayed in Figure 55. One measurement is made in the photic zone, defined as twice the Secchi depth, and one at the bottom of Standley Lake. The most pertinent feature of the annual time-series is the spike in phosphorus concentrations in the hypolimnion in late summer/early fall. The maximum concentration of 84.3 µg/L was measured on 9/16/14. This pattern of increasing hypolimnetic TP concentrations in late summer/fall is attributable to sediment releases of nutrients during conditions of hypoxia.

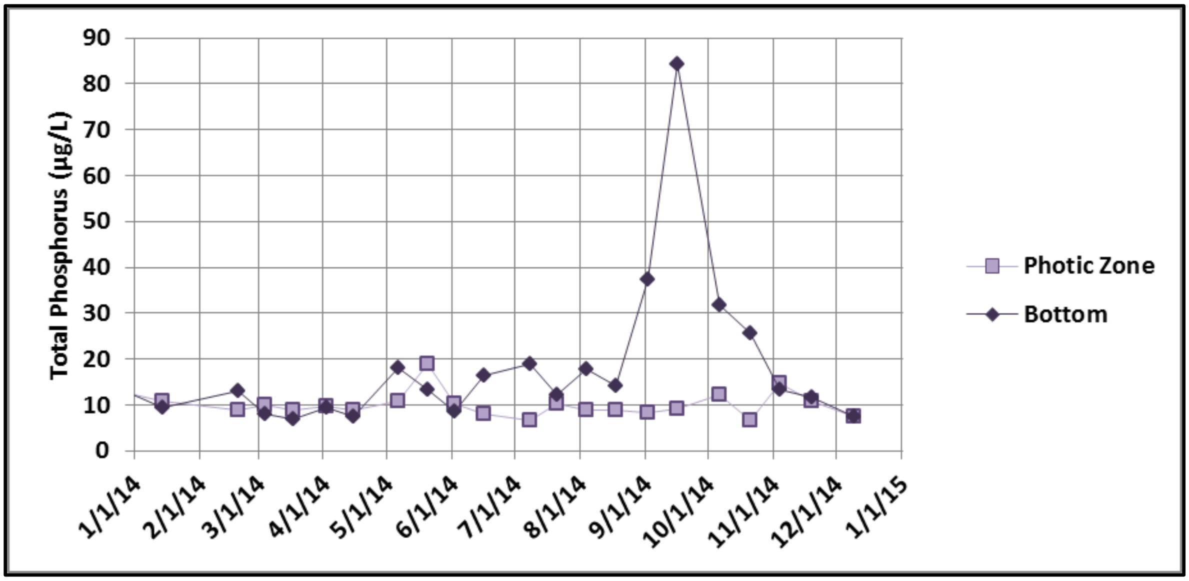

Figure 55. Total Phosphorus Concentrations in Standley Lake, 2014

This observed pattern is typical of previous years, as shown in Figure 56. Relative to the 2009-2013 averages; the average TP concentration in 2014 was 23% lower in the hypolimnion and 9% lower in the photic zone.

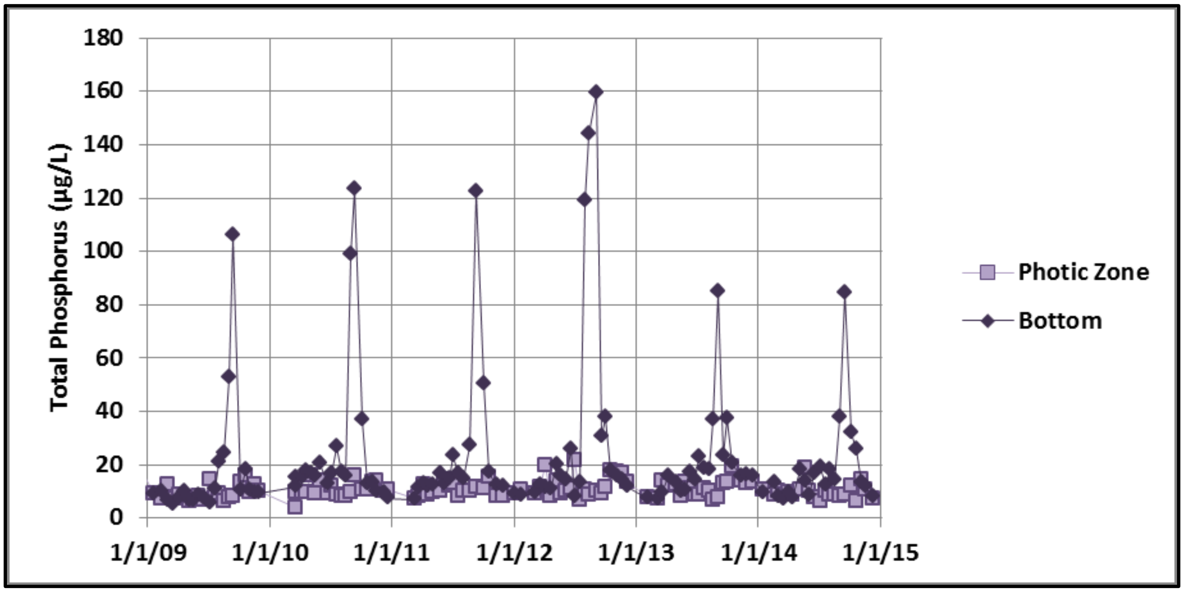

Figure 56. Total Phosphorus Concentrations in Standley Lake, 2009-2014

C. Total Nitrogen

Concentrations of TN observed in Standley Lake in 2014 in the photic zone and hypolimnion are shown in Figure 57. The pattern in the hypolimnion is similar to that seen in other years and is a reflection of external loading during runoff, subsequent nitrification dynamics, and internal loading in late summer. The maximum 2014 concentration observed in the hypolimnion (700 µg/L), was observed on 9/2/14. In past years, concentrations in the photic zone have had smaller fluctuations relative to the hypolimnion. In 2014, this was not the case. The range of total nitrogen concentrations through the year, however, was comparable.

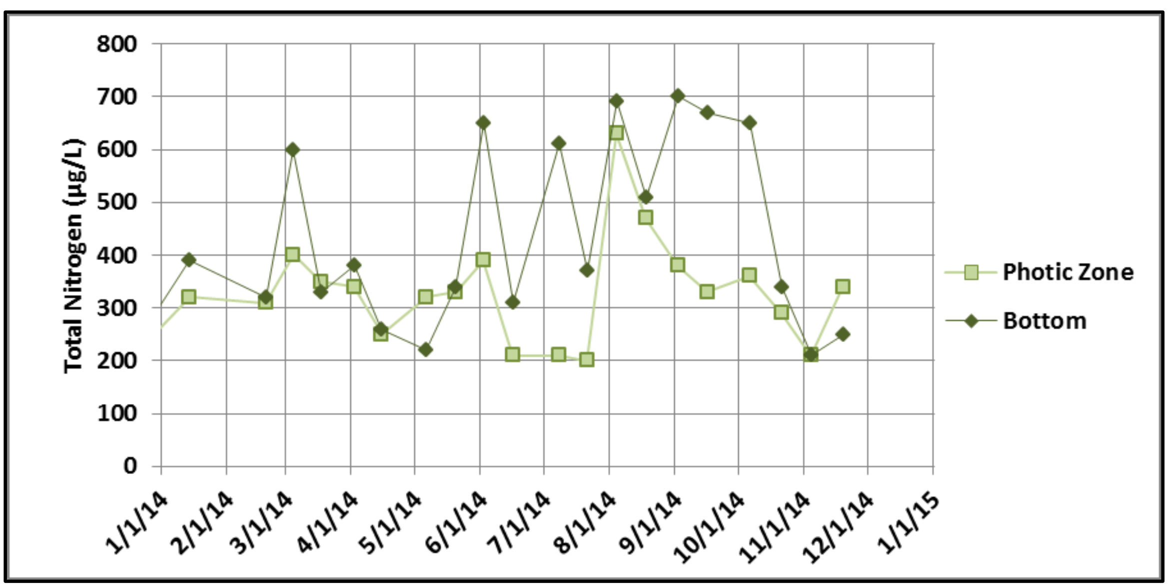

Figure 57. Total Nitrogen Concentrations in Standley Lake, 2014

Concentrations of TN in the lake for 2009-2014 are shown in Figure 58. Overall, TN concentration ranges observed in 2014 at the bottom were similar to previous years. However, bottom TN concentrations were higher for a longer period of time during the summer of 2014, compared to previous years. When compared with the 2009-2013 annual average concentrations, the 2014 average TN concentrations were 28% higher in the hypolimnion and 43% higher in the photic zone.

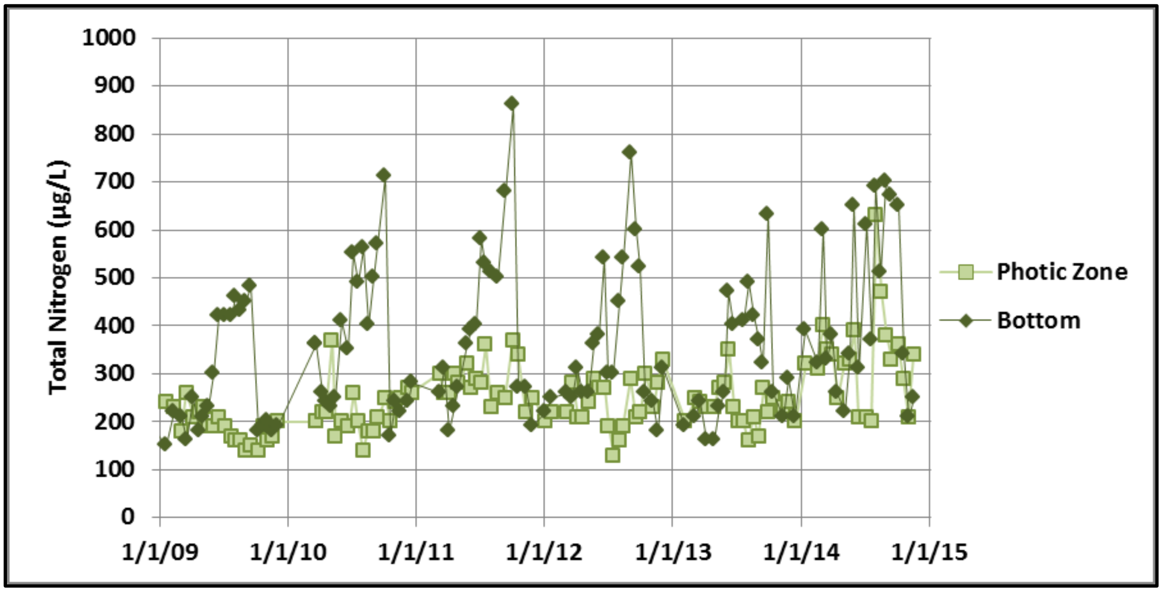

Figure 58. Total Nitrogen Concentrations in Standley Lake, 2009-2014

D. Chlorophyll *a*

The chlorophyll *a* standard of 4.0 µg/L (assessed at 4.4 µg/L) was established in 2009 for Standley Lake. This standard is evaluated on an annual basis using the average of observed data from March through November. Chlorophyll *a* concentrations observed in Standley Lake in 2014 are presented in Figure 59, with March-November observations (the relevant period for assessment of the standard) outlined in green. The maximum concentration measured in 2014 was 6.0 µg/L and occurred on 12/09/14. The timing of this fall peak was later than in recent years (December) and is not included in the average computed for comparison to the standard. In 2014 there was a secondary peak (5.8 µg/L) on 4/15/14.

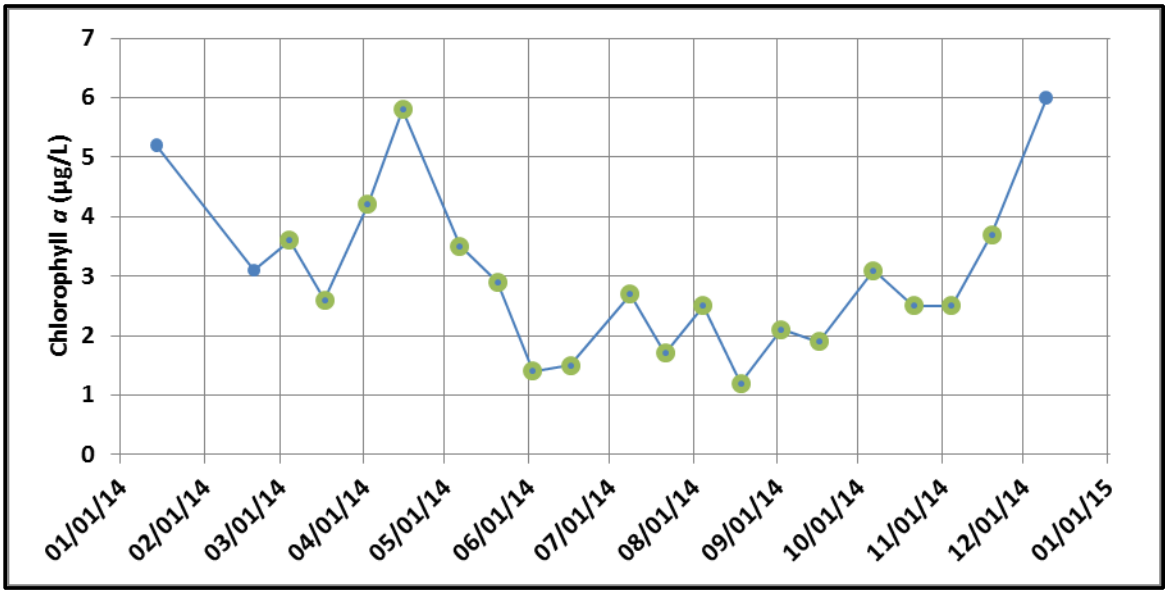

Figure 59. Chlorophyll *a* Concentrations in Standley Lake, 2014 (March-November observations highlighted in green)

Chlorophyll *a* concentrations observed from 2009 through 2014 are shown in Figure 60. Consistent with the previous figure, the green-outlined markers indicate March-November observations used for evaluation of the chlorophyll *a* standard. A seasonal pattern with chlorophyll *a* concentrations peaking after fall turnover is typical for Standley Lake. Peak concentrations in 2014 were lower than the maximum values observed in the previous four years. As in other years, turnover and an increase in concentrations of nutrients in the photic zone led to increasing chlorophyll *a*. The late fall maximum may be related to later-than-normal fall turnover. The secondary spring peak has been observed in previous years, but is typically smaller relative to the fall peak. Increasing temperatures in the spring, combined with well-mixed water column provides conditions amenable to phytoplankton growth.

An isopleth of chlorophyll *a* concentrations in Standley Lake for March-November 2014 at 10-70 is shown in Figure 61. The spring time bloom is apparent. However, only the initial stages of the fall bloom are seen; the peak of this bloom occurred after the profiler had been removed from the lake in the fall. Concentrations of chlorophyll *a* remained low for the June through November period.

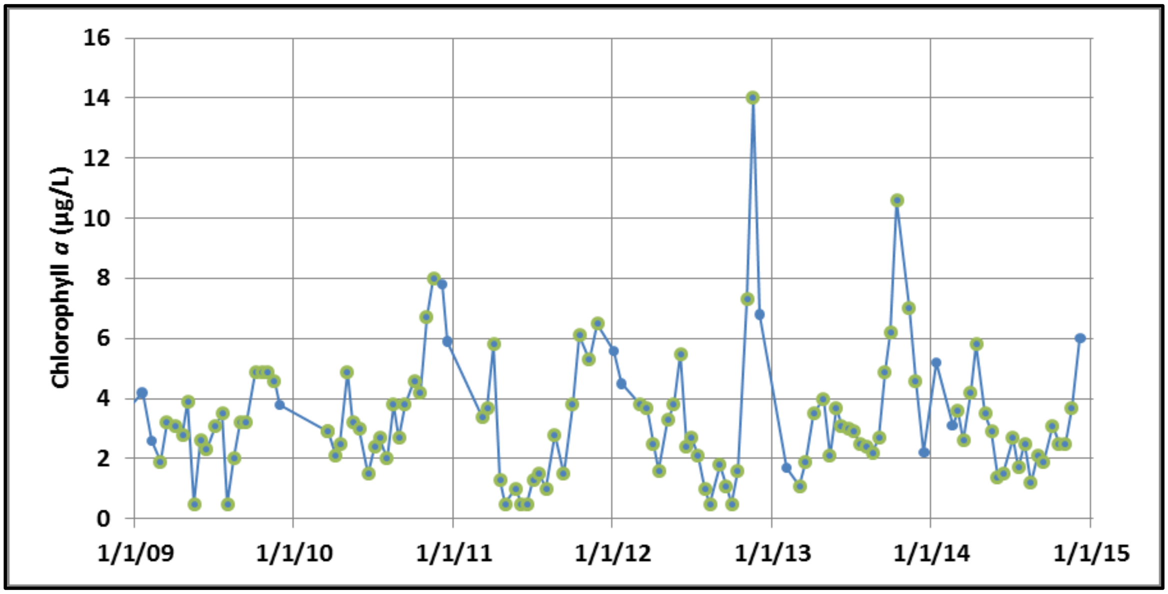

Figure 60. Chlorophyll *a* Concentrations in Standley Lake, 2009-2014 (with March-November observations highlighted)

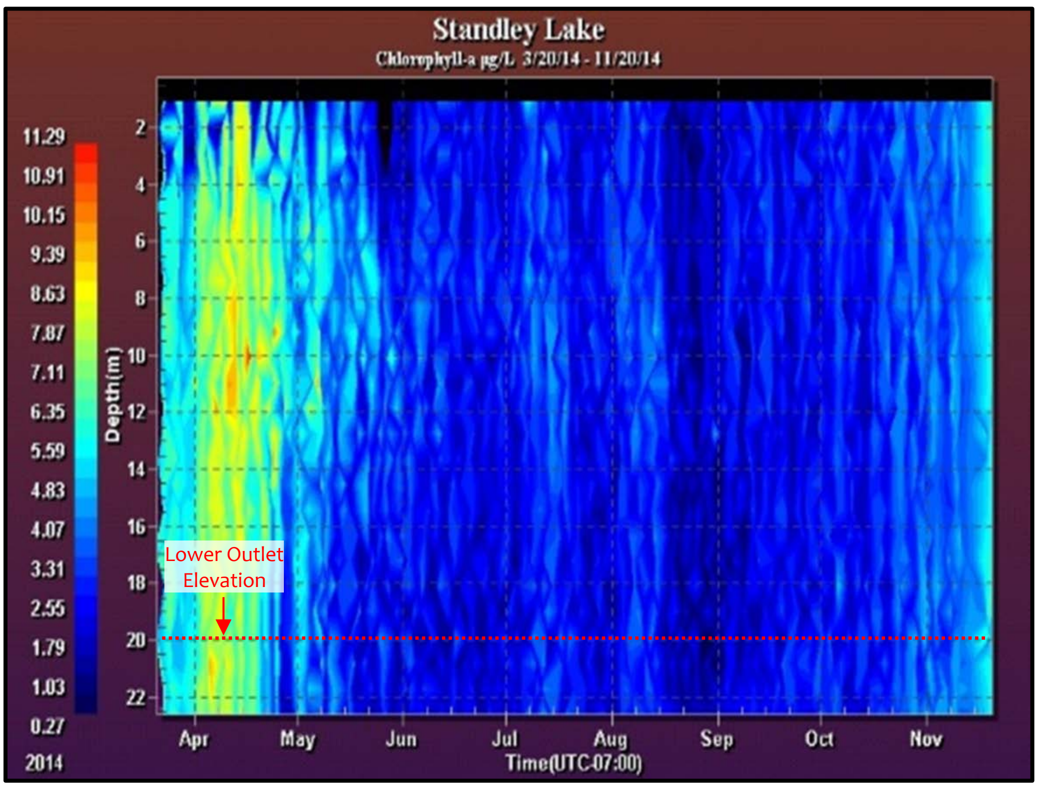

Figure 61. Isopleth of Chlorophyll *a* Concentrations in Standley Lake, March-November 2014

The chlorophyll *a* standard for Standley Lake was met once again in 2014 (Figure 62). In 2014, the average concentration was 2.7 µg/L, calculated as the average of all measurements from the photic zone for the period of March through November. This complies with the 4.0 µg/L standard and is below the assessment threshold. The standard is met when four out of the five most recent years have a March-though-November average below 4.0 µg/L. For the five-year period 2010-2014, each year had March-November average concentrations below 4.0 µg/L. Of the last ten years, only one year (2007 at 4.8 µg/L) had a March-November average concentrations above 4.0 µg/L.

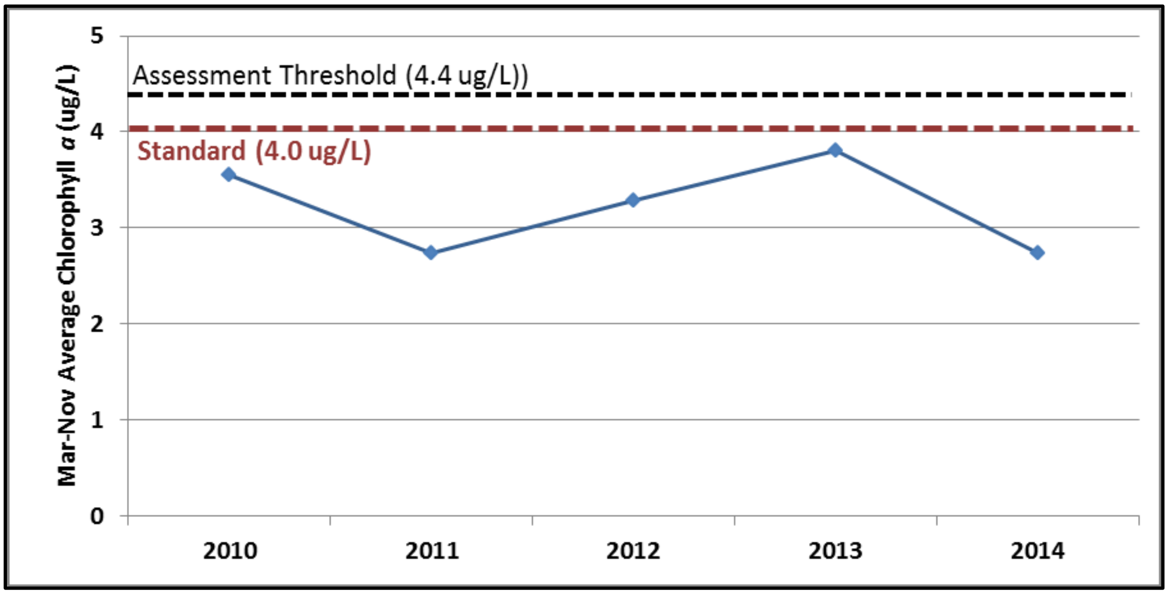

Figure 62. March - November Average Chlorophyll *a* Concentrations for Standard Evaluation, 2010-2014

The seasonal patterns for algal biovolume and observed chlorophyll *a* concentrations in Standley Lake for 2014 are displayed in Figure 63. In 2014, the peaks in chlorophyll *a* concentrations were closely tracked by the peaks in algal biovolume.

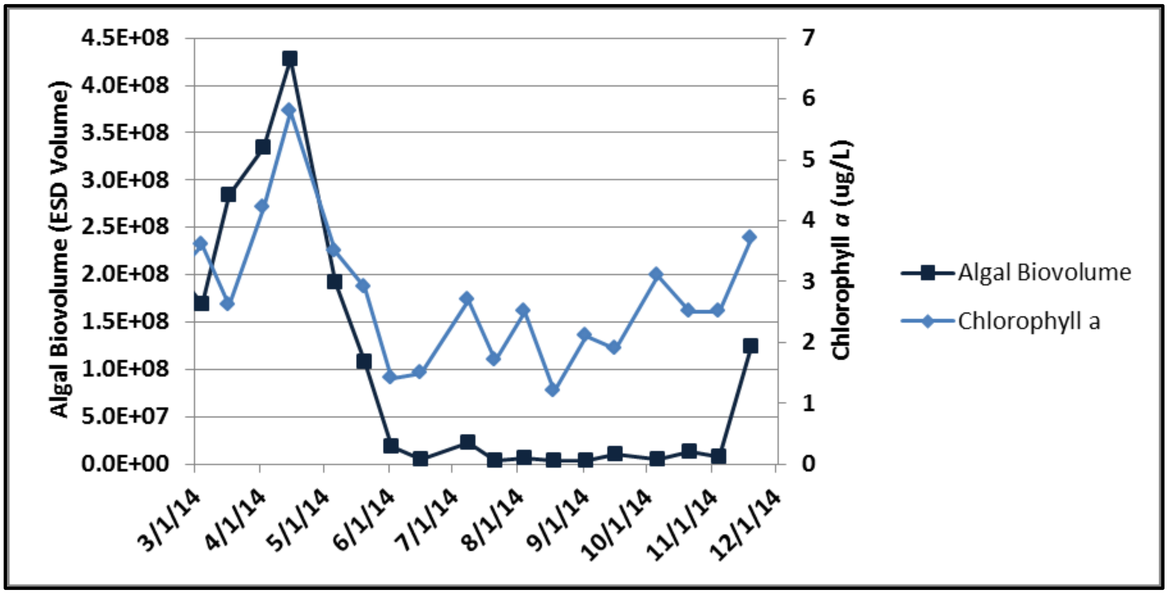

Figure 63. Algal Biovolume and Chlorophyll *a* Concentrations in the Photic Zone of Standley Lake, 2014

E. Secchi Depth

Clarity in Standley Lake is measured using a Secchi disk. When taking this measurement, a black-and-white disk is lowered vertically into the lake until the disk is no longer visible. The resulting depth, the Secchi depth, provides a measure of the scattering and absorption of light in the upper portion of the water column. This includes the effects of algae, non-algal organic particulate matter, inorganic suspended solids, dissolved organic matter, and the water molecules themselves. Secchi-depth measurements for Standley Lake in 2014 are shown in Figure 64. The deepest measure of clarity (6.1 m) occurred on 8/18/14. Throughout the year, clarity is variable, reflecting a combination of effects such as inflowing suspended solids, algal growth, particle settling, and stratification.

Individual Secchi-depth measurements for the past six years are shown in Figure 65. Average annual Secchi depths for the same period can be found in Figure 66. Secchi depths observed in 2014 were in the range of those measured in previous years. The average was the second deepest over the 2009-2014 period.

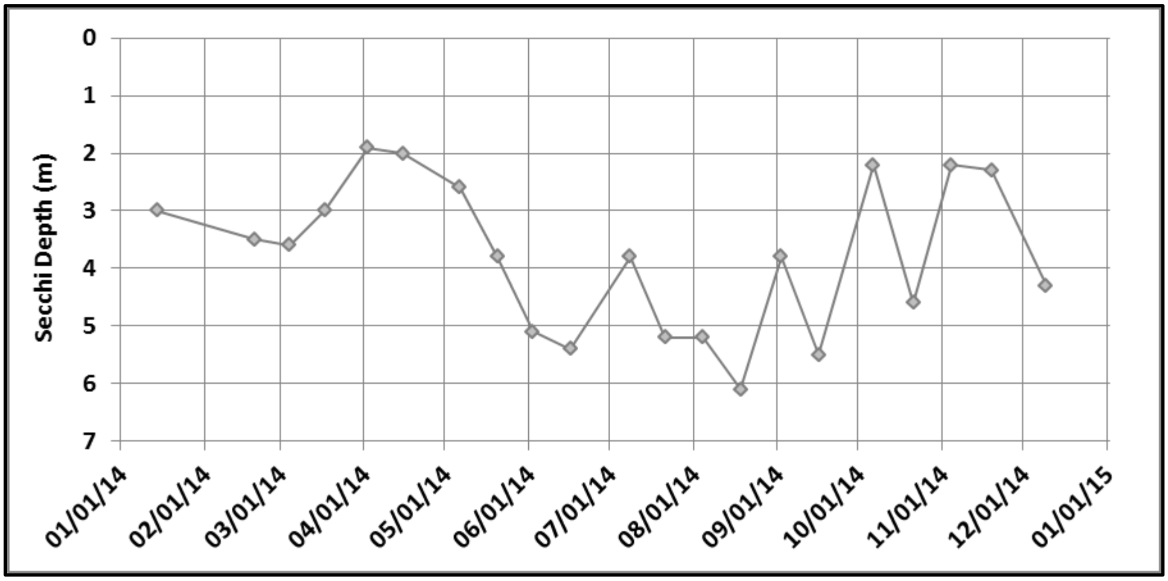

Figure 64. Clarity as Measured by Secchi Depth in Standley Lake, 2014

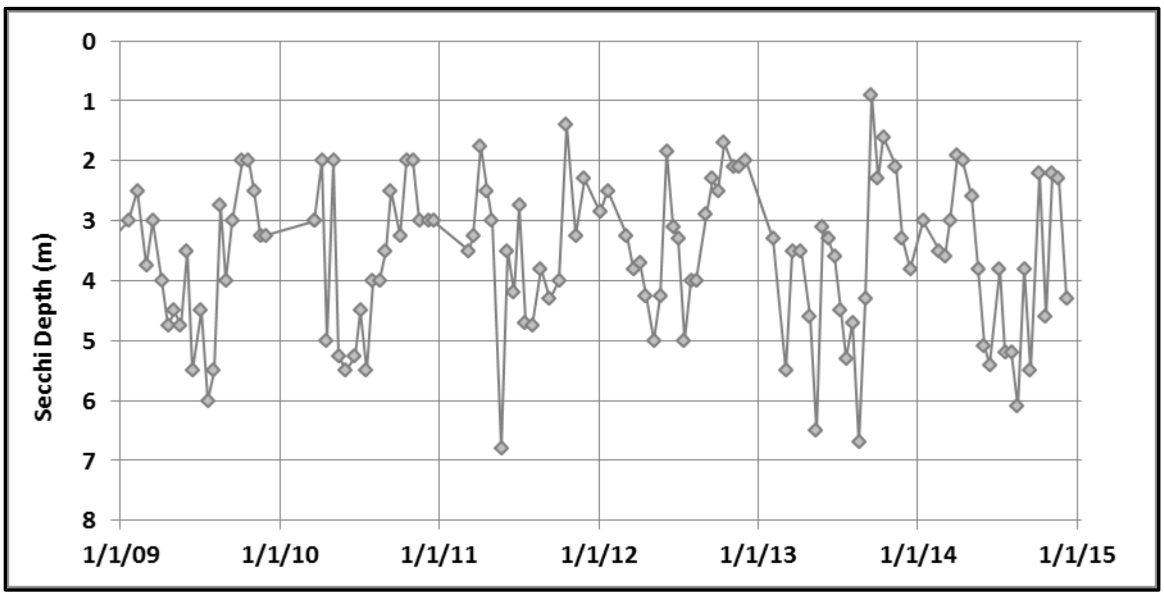

Figure 65. Clarity as Measured by Secchi Depth in Standley Lake, 2009-2014

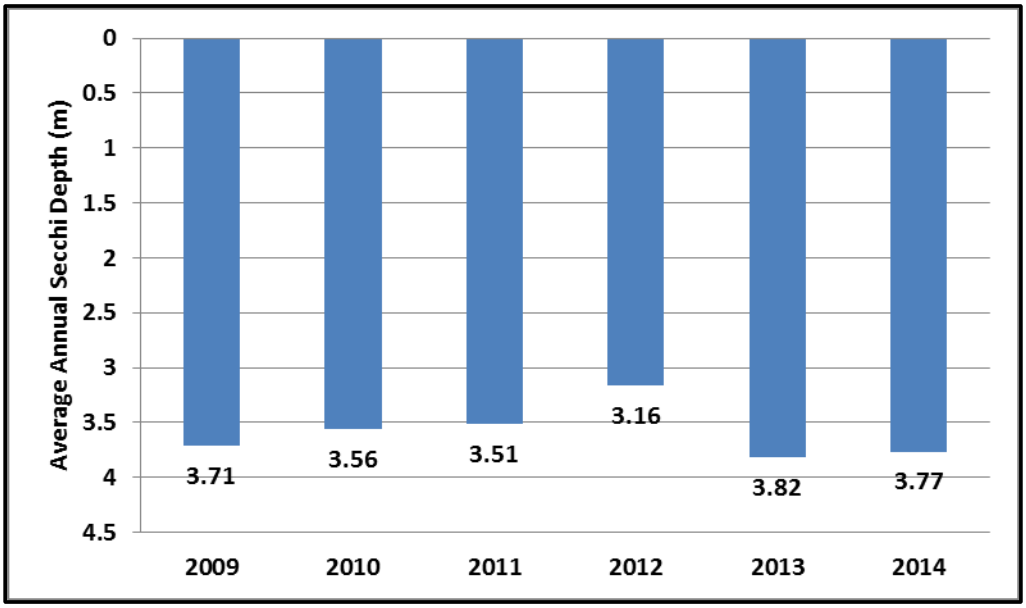

Figure 66. Average Annual Secchi Depth in Standley Lake, 2009-2014

VII. Conclusions

Members of the UCCWA, the Standley Lake Cities, and other parties to the 1993 Agreement continued efforts in 2014 to monitor, preserve, and improve water quality in Clear Creek and Standley Lake. These activities included site remediation, control of sediment and nonpoint sources of pollution, numerous public outreach and educational activities, extensive water-quality monitoring, and advanced planning efforts to support management.

Overall, Upper Basin annual flows in 2014 at both CC60 and CC26 were above average in 2014. The runoff pattern was typical, showing a sharp peak associated with snowmelt. Ambient condition concentrations of TSS, TP, and TN were close to conditions observed during 2009-2013 in the Upper Basin. Loads of TN and TP at CC60, the downstream station, were higher than in past years. This was driven by an increase in flow and for TP, an increase in volume-weighted concentrations.

Annual loads of TN delivered to Standley Lake were near the 2009-2013 average. Loads of TP were 23% higher relative to the 2009-2013 average. This increase was primarily driven by increased loads from the FHL Canal, based on significantly higher TP concentrations at that source and above average flow. Updated statistical analyses show that the Church Ditch by-pass continues to be effective at reducing TN and TP concentrations flowing into Standley Lake.

In 2014, water quality in Standley Lake was very good throughout the year. Water levels in Standley Lake started the year well above average following the September 2013 storm event. Stratification patterns and hypoxic conditions in the hypolimnion were typical in 2014, although fall turnover was later than what is typically observed. The late turnover resulted in a higher than average period of hypoxia. Nutrient concentrations at the top and bottom of the lake were within the normal range although TN concentrations at the bottom were elevated (>600 µg/L) for a longer period of the summer. The site-specific March through November chlorophyll *a* standard of 4.0 µg/L was once again met in 2014 with an average value of 2.7 µg/L. The maximum chlorophyll *a* observation (6 µg/L) occurred outside of the standard assessment period, but was low compared to previous years. The timing of this increase may be related to the late fall turnover. Of the last ten years, only one year (2007 at 4.8 µg/L) has had a March-November average chlorophyll *a* concentration above 4.0 µg/L.

VIII. References

CDOT. 2015. http://dtdapps.coloradodot.info/otis/trafficdata.

Colorado Department of Public Health and Environment (CDPHE). 2012. Nutrients Management Control Regulation. 5 CCR 1002-85 (Regulation 85). Water Quality Control Commission. Adopted June 11, 2012; Effective September 30, 2012.

Enviroscience. 2013. 2013 Milfoil Weevil Survey at Standley Lake, Westminster, Colorado. Enviroscience, Stowe, Ohio.

Hydros Consulting. 2014. Clear Creek Watershed Annual Report—2013. Hydros Consulting, Boulder, Colorado.

RRC. 2015. http://www.rooneyroadrecycling.org/the-3rc-foundation/; accessed 9/17/2015.

Appendix A – Clear Creek/Standley Lake Watershed Agreement

Appendix A

Clear Creek / Standley Lake

Watershed Agreement

AGREEMENT

The undersigned parties hereto agree as follows:

I. Preamble.

This Agreement seeks to address certain water quality issues and concerns within the Clear Creek Basin of Colorado, and specifically, such issues as they affect the water quality of Standley Reservoir, an agricultural and municipal water supply reservoir located in Jefferson County Colorado, which is supplied with water primarily from Clear Creek. For purposes of this Agreement, the Clear Creek Basin is divided into three (3) areas of segments: the Upper Clear Creek Basin ("Upper Basin"), consisting of Clear Creek and its tributaries from its source to and including the headgate of the Croke Canal in Golden, Colorado; the Standley Lake Tributary Basin ("Tributary Basin"), consisting of the lands directly tributary to Standley Lake, the Church Ditch, the Farmers High Line Canal, the Croke Canal, and lands directly tributary to these Canals; and Standley Lake ("Standley Lake"), consisting of the Lake itself.

The parties to this Agreement are governmental agencies and private corporations having land use, water supply, and/or wastewater treatment responsibilities within the Clear Creek Basin. The parties are: (1) UCCBA; (2) City of Golden; (3) City of Arvada; (4) Jefferson County; (5) Jefferson Center Metropolitan District; (6) City of Westminster; (7) City of Northglenn; (8) City of Thornton; (9) City of Idaho Springs; (10) Clear Creek County; (11) Gilpin County; (12) Black Hawk/Central City Sanitation District; (13) Town of Empire; (14) City of Black Hawk; (15) City of Central; (16) Town of Georgetown; (17) Town of Silverplume; (18) Central Clear Creek Sanitation District; (19) Alice/St. Mary's Metropolitan District; (20) Clear Creek Skiing Corporation; (21) Henderson Mine; (22) Coors Brewing Company; (23) Church Ditch Company; (24) Farmers High Line Canal and Reservoir Company; and (25) Farmers Reservoir and Irrigation Company. For purposes of this Agreement, the parties can be divided into four (4) functional groups, as follows: The Upper Basin Entities ("Upper Basin Users" or "UCCBA"), consisting of the members of the Upper Clear Creek Basin Association (generally representing entities with jurisdiction over land use and wastewater treatment activities in the Upper Basin that can affect water quality in the Upper Basin); the Tributary Basin Entities ("Tributary Basin Entities"), consisting of the Cities of Golden, Arvada, and Westminster, and the County of Jefferson and the Jefferson Center Metropolitan District (generally representing entities with jurisdiction over land use activities that can affect water quality in the Tributary Basin); the Standley Lake Cities ("Standley Lake Cities"), consisting of the Cities of Westminster, Northglenn, and Thornton, (representing the municipal water users from Standley Lake); and the three canal companies (the "Canal Companies"), consisting of the Church Ditch Company, the Farmers High Line Canal and Reservoir Company, and the Farmers Reservoir and Irrigation Company (representing the entities that own and operate canals through which water is conveyed to Standley Lake for municipal and agricultural use).

In accordance with the geographical and functional divisions, this Agreement generally sets out rights and obligations with respect to certain water quality matters within the Clear Creek Basin (as above defined) by area or segment and by functional group.

II. Agreement.

1. The parties will submit a joint alternative proposal to the Water Quality Control Commission ("WQCC") in the matter captioned "For Consideration of Revisions to the Water Quality Classifications and Standards, Including Adoption of a Narrative Standard, for Segment 2, Standley Lake, of Big Dry Creek, in the South Platte Basin, and Adoption of a Standley Lake Control Regulation" on or before December 23, 1993. Said alternative proposal shall contain the following points:

a. Request the WQCC to adopt a narrative standard only for Standley Lake at this time, with further consideration of any control regulation or numeric criteria for implementation of the standard at or after the triennial review of the South Platte River to be held in 1997. The narrative standard shall require maintenance of Standley Lake in a mesotrophic state, as measured by a combination of relevant indicators, as recommended by the parties' consultants prior to December 23, 1993.

b. Request language in the Rule and in the Statement of Basis and Purpose for the regulation explaining that during the next triennium ending in 1997 ("triennium") the parties hereto will be conducting additional testing and monitoring, as well as implementing certain best management practices and controls on a voluntary basis, the results of which will be reported to the WQCC on an annual basis, and that point-source discharge permits written during the triennium shall not include any new or more stringent nutrient effluent limitations or wasteload allocations to meet the narrative standard. The proposed language will also refer to the intention of the parties and the Commission that should the narrative standard not be met at the end of the triennium, and substantial progress has not been made in reducing the nutrient loads to Standley Lake, additional measures may be required, including numeric standards or effluent limitations for phosphorous and/or nitrogen in the Upper Basin, and for additional best management controls in Standley Lake to be considered.

2. Should the WQCC fail to approve and adopt the substance of the proposed alternative described in paragraphs 1.a. and 1.b. above, this agreement shall automatically terminate and the parties shall be released from all other obligations and rights hereunder.

3. At or after the triennial review in 1997, the UCCBA and Standley Lake Cities agree that if substantial progress has not been made by the UCCBA in reducing its portion of nutrient loading and in developing controls to maintain appropriate reductions in nutrient loads to Standley Lake sufficient to maintain the narrative standard, they

will jointly petition the Commission to adopt a control regulation for Standley Lake containing the following points:

a. Total Phosphorous effluent limitation of 1.0 mg/l as P as a thirty (30) day average at the Upper Clear Creek Wastewater Treatment Plants, or such other numeric standard(s) or effluent limitations (s) for phosphorous or nitrogen, or in combination, with opportunity for point to point source and nonpoint source to point source trading among the entities that operate the UCCBA treatment plants, as has been determined will be effective in achieving and maintaining the narrative standard for Standley lake. Such numeric standard(s) or effluent limitation(s) shall be implemented over a three year period to allow time for the affected entities to fund, design and construct improvements necessary to meet the standards.

b. In-lake treatment to reduce internal phosphorous loading by 50% from the 1989-90 measured loadings in the 1993 USGS report by Mueller and Ruddy, or such other standards for reduction of internal phosphorous and nitrogen loading as has been determined will be effective in achieving and maintaining the narrative standard for Standley Lake, within three (3) years.

4. The UCCBA, in consultation with the Standley Lake Cities and Tributary Basin Entities will prepare a Best Management Practices Manual by December 31, 1994 for nonpoint sources that will cover disturbed areas of 1 acre or more and use its best efforts to have it approved and adopted for implementation by all jurisdictions within the Upper Basin by July 1, 1995. This Manual will be prepared to deal with the geologic, topographic and weather conditions existing within the Upper Basin to facilitate the reduction of nutrient loading from the various activities of the Upper Basin. This Manual will be coordinated with the Standley Lake Cities and Tributary Basin entities. The plan will include a program for monitoring representative results, to be included in the overall basin monitoring plan. For purposes of development of BMPs, Jeffco will not be considered to be part of the UCCBA.

5. The UCCBA, in consultation with the Standley Lake Cities and the Tributary Basin Entities, will examine the costs and effects of nutrient removal at UCCBA wastewater treatment plants, including operational controls or modifications which would decrease nutrient loads. Recommendations of such review shall be furnished to all the parties hereto by June 30, 1994. The UCCBA will use its best efforts to have its members implement operational modifications which can be implemented without significant capital improvements as quickly as reasonably practical.

6. The Standley Lake Cities, in consultation with the other parties, will develop a Standley Lake Management Plan by December 31, 1994 which will address in-lake nutrient loading and potential nutrient loading from lake activities, water supply operations, recreational activities, and activities in the watershed. The Standley Lake Cities will use their best efforts to implement the Lake Management Plan by

June, 1995. It is understood that the water rights implications of the plan must be considered.

7. The parties will jointly design, implement, and fund in such allocations as they shall agree a monitoring program to evaluate (1) nutrient loadings from point sources; (2) nutrient loadings from non-point sources in the Upper Basin; (3) nutrient loadings from non-point sources in the Tributary Basin; (4) internal Lake loading; and (5) the effect of nutrient reduction measures implemented by the various parties on the trophic status of Standley Lake. The results of the monitoring program will be provided to the Water Quality Control Commission for informational purposes annually. A description of the monitoring program will be included with the Annual Reports.

8. The Tributary Basin Entities and the Standley Lake Cities, in consultation with the other parties, will develop Best Management Practices (BMPs) for each of their jurisdictions by December 31, 1994, and shall use their best efforts to have them adopted as regulations by July, 1995. The BMPs will be designed to remove pollutants to the maximum extent practical considering the costs and benefits of possible measures; provided, however that no retro-fitting of existing construction or development will be required.

9. The Tributary Basin Entities, the Standley Lake Cities and the Canal Companies will develop a Management Plan for the Tributary Basin, addressing stormwater quality and quantity, hazardous substance spills, canal flushing, crossing permits, the Canal Companies' stormwater concerns, and the water rights implications of the above by December, 1994, and use their best efforts to achieve adoption of the portions of the Plan under the control of each entity by July, 1995. If not all affected parties adopt the agreed measures, then the parties that have adopted such measures will determine whether or not to implement the Plan despite such non-adoption by one or more parties.

10. Each functional group (The UCCBA, The Tributary Entities, The Standley Lake Cities, and the Canal Companies) shall provide each other group with semi-annual reports detailing the progress made on the implementation of its responsibilities herein, including development of any BMPs, nutrient reduction programs or controls, or other items required by this agreement, beginning in June, 1994. The parties shall also meet periodically after each report is completed to discuss progress by the parties. It is anticipated that the various functional groups may assign or appoint task groups or committees to address specific tasks or areas of concern (e.g. BMPs; ISDS; Wastewater Plant operational changes; monitoring, etc). If so, then the task groups shall provide the appropriate reports and participate in follow-up meetings.

11. This agreement may be enforced as a contract according to the laws of the State of Colorado; however, this agreement shall not create any right to claim or recover monetary damages for a breach thereof.

12. It is anticipated that other regional agencies with land use and/or water quality responsibilities or impacts within the Clear Creek Basin (as above defined) may join in the parties' monitoring and other efforts pursuant to this Agreement.

13. This Agreement may be executed in counterparts.

Appendix B – Upper Clear Creek/Standley Lake Watershed Water-Quality Monitoring Program

Upper Clear Creek/Standley Lake Watershed

Water Quality Monitoring Plan

Standley Lake

December 2013

TABLE OF CONTENTS

APPENDICES

Abbreviations and Acronyms

BH/CC	Blackhawk/Central City
C	Centigrade
CC	Clear Creek
cfs	cubic feet per second
COC	chain of custody
CWQCC	Colorado Water Quality Control Commission
DI	Deionized Water
DO	Dissolved Oxygen
DRP	Dissolved Reactive Phosphorus (ortho-Phosphate-P)
EPA	U.S. Environmental Protection Agency
FHL	Farmers Highline Canal
FRICO	Farmers Reservoir and Irrigation Company
HCl	Hydrochloric acid
ISDS	Individual Sewage Disposal System
KDPL	Kinnear Ditch Pipe Line
LDMS	Laboratory Data Management System
µg/L	micrograms per liter
µS/cm	microsiemens per centimeter
m	meter
mgd	million gallons per day
mg/L	milligrams per liter
MSCC	Mainstem Clear Creek
mv	millivolt
N	Nitrogen
NFCC	North Fork Clear Creek
NG	City of Northglenn
NPS	Nonpoint Source
NTU	Nephelometric Turbidity Units
ORP	Oxidation Reduction Potential
OWTS	Onsite Wastewater Treatment System
pCi/L	picocuries per liter
P	Phosphorus
QC	Quality Control
SDWA	Safe Drinking Water Act
SFCC	South Fork Clear Creek
SLC	Standley Lake Cities
SLWQIGA	Standley Lake Water Quality Intergovernmental Agreement
SM	Standard Methods for the Examination of Water and Wastewater
TH	City of Thornton
TOC	Total Organic Carbon
TSS	Total Suspended Solids
TVSS	Total Volatile Suspended Solids
UCC	Upper Clear Creek
USGS	United States Geological Survey
Westy	City of Westminster
WFCC	West Fork Clear Creek
WMA	Upper Clear Creek Watershed Management Agreement
WQIGA	Water Quality Intergovernmental Agreement (Standley Lake)
WQS	Colorado Water Quality Standards (Regs #31 and #38)
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

MONITORING PROGRAMS OVERVIEW

Introduction

The quality of the water in Standley Lake has been monitored for more than two decades. Efforts to protect Standley Lake through state water quality regulations culminated in adoption of the numeric chlorophyll *a* standard for the lake in 2009. The Colorado Water Quality Control Commission ("CWQCC") established the chlorophyll *a* standard at 4.0 µg/L with a statistically derived assessment threshold of 4.4 µg/L. The standard is based on the arithmetic average of the individual monthly average chlorophyll *a* data for samples collected during March through November in each year. Exceedance of the standard would occur if the yearly 9-month average of the monthly chlorophyll *a* average results is greater than 4.4 µg/L more frequently than once in five years. In addition, a version of the narrative standard adopted in 1993 was also retained stating that the trophic status of Standley Lake shall be maintained as mesotrophic as measured by a combination of common indicator parameters such as total phosphorus, chlorophyll *a*, secchi depth and dissolved oxygen. The voluntary implementation of best management practices clause included in the 1993 version of the standard was eliminated from the 2009 narrative standard.

The Standley Lake Cities ("SLC") of Northglenn, Thornton and Westminster remain committed to effective and efficient water quality monitoring in the watershed as originally agreed to in the 1993 Watershed Management Agreement. The Standley Lake Water Quality Intergovernmental Agreement ("SLWQIGA" or "WQIGA"), entered into between the SLC, details the provisions for costs sharing related to cooperative efforts regarding water quality issues in the Clear Creek Basin and Standley Lake. The WQIGA monitoring program is subdivided into three inter-related programs for which the SLC provide field sampling, laboratory analyses and data management support: the Upper Clear Creek Monitoring Program, the Tributary Basin Monitoring Program and the Standley Lake Monitoring Program.

The Monitoring Committee was formed to periodically evaluate the monitoring programs and propose appropriate modifications as necessary. The proposals are evaluated by the SLWQIGA committee prior to implementation. Representatives from the SLC, Upper Clear Creek Basin and the Tributary Basin are actively involved in committee activities as appropriate. This document details the specific requirements and responsibilities of the SLC and outlines the commitments of additional entities involved in the Standley Lake watershed monitoring programs.

Standley Lake serves as the sole drinking water source for the cities of Northglenn and Westminster and is one of several drinking water sources for the City of Thornton. The monitoring program is designed to collect samples from a variety of locations in the watershed with varying anthropogenic and natural sources of pollutants. The data is used for trend analysis, modeling and for numerous other applications. Interpretation of the results allows the upstream and downstream communities to work cooperatively to minimize impacts to water quality.

Safety Considerations

The personal safety of the sampling team members is paramount in the decision making process for collection of water quality samples. At no time should personal safety be jeopardized in order to collect a sample. Environmental conditions may change suddenly and are variable throughout the watershed.

The following safety measures should be observed during all sampling activities:

- Sample collection should be performed by a two person team whenever possible.
- Weather conditions at the sampling sites should be evaluated prior to leaving the laboratory.
- Personal flotation devices should be worn if the creek water level is greater than twelve inches deep. Hydrostatically triggered, self-inflating personal flotation devices are recommended for non-lake sampling, as the device will automatically inflate if the sensor is submerged below six inches of water.
- Personal flotation devices are mandatory on Standley Lake. Lake sampling team members should be experienced swimmers.
- Wear waterproof gloves and sock liners, as appropriate.
- Exercise caution on slippery rocks, river banks and boat docks.
- Cell phones must be available during sampling, but be aware that cell phone signals are not reliable in all areas of Clear Creek Canyon.
- First aid kits must be available in all sampling vehicles, including boats. It is recommended that sampling team members be trained in basic first aid techniques.
- Supervisors are notified of the sampling team's itinerary and the expected return time to the lab. Sampling teams will notify supervisors of any delay in the expected return time.

UPPER CLEAR CREEK MONITORING PROGRAM

The Upper Clear Creek ("UCC") Monitoring Program is designed to provide water quality information in order to evaluate nutrient loadings from both point sources (discrete) and non-point sources (dispersed) within the Upper Clear Creek Basin.

The Upper Clear Creek Monitoring Program includes three distinct sub-programs, each designed to obtain water quality data during specified conditions:

- ambient grab samples;
- continuous stream monitoring and the automated collection of 48-hour ambient samples, and
- the automated collection of event samples.

UCC – AMBIENT GRAB SAMPLES

Program Coordination: Thornton
Program Participants: Thornton, Westminster, Arvada, Golden, Upper Basin WWTPs

Grab samples are single, point-in-time samples collected in-stream throughout the Upper Clear Creek Basin. Grab sample locations were selected to correspond with established USGS gage stations and additional sites have been included over the years as the monitoring program has evolved. Refer to the table below for sample site locations. The rationale for selection of the specific sampling sites is included in Appendix A. A map of the watershed is included in Appendix B.

Grab samples are collected five times during the year to correspond with seasonally varying flow conditions in Clear Creek. The *Short Schedule* is collected three times per year (February, April and December) and includes four stream locations. The *Long Schedule* is collected twice per year (May and October) and includes 16 stream locations. Laboratory analytical protocols limit sample collection to Monday through Thursday. Sampling is performed each year on approximately the same schedule. The specific sampling dates for the year are predetermined at the beginning of the year.

Starting in 2013, Wastewater Treatment Plant (WWTP) effluent samples are collected by treatment plant staff and are analyzed for nutrients (nitrogen and phosphorus) by commercial laboratories in accordance with Colorado Regulation 85. Sampling and analysis plans were developed by each WWTP outlining the monitoring locations, frequency and analytical parameters for testing. The analytical data reported by the WWTPs to the Colorado Water Quality Control Division will be included in the watershed annual reports.

WWTP Effluent Sample ID	Sample Location
CC1A	Loveland WWTP
CC3A	Georgetown WWTP
CC5A	Empire WWTP
CC7A	Central Clear Creek WWTP
CC8A	St Mary's WWTP
CC12A	Idaho Springs WWTP
CC13B	Black Hawk/Central City WWTP
CC14A	Henderson Mine WWTP
CC15A	Eisenhower Tunnel WWTP

UCC – AMBIENT GRAB SAMPLES
Locations and Sample Schedule

Clear Creek Sample ID	Flow Gage	Sample Location *	Early Feb	Early Apr	Late May	Mid Oct	Early Dec
CC05	Staff gage	MSCC at Bakerville			X	X	
CC10	Recording gage	SFCC upstream of the lake			X	X	
CC15	Staff gage	WFCC below Berthoud			X	X	
CC20	Recording gage	WFCC below Empire			X	X	
CC25	Recording gage	MSCC above WFCC			X	X	
CC26	Recording gage	MSCC at Lawson Gage	X	X	X	X	X
CC30	Staff gage	Fall River above MSCC			X	X	
CC34	----	MSCC above Chicago Creek			X	X	
CC35	Recording gage	Chicago Creek above Idaho Springs WTP			X	X	
CC40	Recording gage	MSCC below Idaho Springs WWTP (US 6 and I-70))	X	X	X	X	X
CC44	Staff gage	NFCC above BH/CC WTP intake			X	X	
CC45	----	NFCC above original BH/CC WWTP			X	X	
CC50	Recording gage	NFCC at the mouth	X	X	X	X	X
CC52	----	Beaver Brook at the mouth			X	X	
CC53	----	Soda Creek at the mouth			X	X	
CC60	----	MSCC at Church Ditch Headgate	X	X	X	X	X

* MSCC = Mainstem Clear Creek   WFCC = West Fork Clear Creek   WTP = Water Treatment Plant
SFCC = South Fork Clear Creek   NFCC = North Fork Clear Creek   WWTP = Wastewater Treatment Plan

UCC – AMBIENT GRAB SAMPLES
Analytical Parameters for Creek samples – includes parameters for both Short and Long Schedules

Analyte	Analytical Method Reference	Reporting Limit Goal	Responsible Laboratory
Total Nitrogen	SM 4500-NO3 I	0.02 mg/L	Westminster
Nitrate/Nitrite as N	SM 4500-NO3 I	0.01 mg/L	Westminster
Ammonia as N	SM 4500-NH3 H	0.01 mg/L	Westminster
Total Phosphorus	SM 4500-P E	0.0025 mg/L	Northglenn
Ortho-phosphate as P (dissolved) or DRP	SM 4500-P E	0.0025 mg/L	Northglenn
Total Organic Carbon (TOC)	SM 5310 B	0.5 mg/L	Thornton
Total Suspended Solids	SM 2540 D	1 mg/L	Thornton
Temperature	SM 2550 B	1.0 °C	Field Teams/Golden
pH	SM 4500-H+ B	1.0 Std Units	Field Teams/Golden
Conductivity	SM 2510 B	10 µS/cm	Field Teams/Golden
Turbidity	SM 2130 B	1.0 NTU	Field Teams/Golden
Dissolved Oxygen	SM 4500-O G	1.0 mg/L	Field Teams/Golden
Stream Depth	Staff gage reading	0.1 ft	Field Teams

Table Notes:
1) SM refers to the 22nd Edition of Standard Methods for the Examination of Water and Wastewater.
2) Reporting limit goals are matrix dependent and may be increased for complex matrices and may be lower depending on laboratory capability.
3) TOC is analyzed on samples from sites CC05, CC20, CC26, CC35, CC40, CC45, CC50, CC52, CC53, and CC60 during the Long Schedule events. TOC is analyzed on all four creek grab samples during the Short Schedule events.

UCC – AMBIENT GRAB SAMPLES

Flow Monitoring

Various mechanisms are employed throughout the watershed for monitoring the hydrologic conditions at strategic locations. USGS real-time recording gages are installed at CC10, CC20, CC25, CC26, CC35, CC50 and CC61 (Clear Creek at Golden). USGS staff gages are in place at CC05, CC15, CC30 and CC44. The staff gage readings are recorded to the nearest 0.1 foot and may be converted to stream flow using the USGS calibration rating curve established for the location.

The recording gage at CC40 (Clear Creek at US 6 and I-70) is operated and maintained by Clear Creek Consultants on behalf of UCCWA. The SLC provide financial support for the USGS gages at CC05 at Bakerville (staff gage) and CC26 at Lawson (recording gage). The City of Golden provides financial support for the USGS gage on the West Fork of Clear Creek at Empire.

UCC – AMBIENT GRAB SAMPLES

Program Coordination - Short Schedule (Thornton)

Two weeks before the scheduled Clear Creek sampling date:

- Contact Westminster and Northglenn to request adequate supply of sample bottles from each lab.
- Prepare four sample kits as directed below. Each sample bottle kit includes the containers for sampling at one location.

Sample Bottle Kit Prep- Short Schedule

Destination	Quantity	Volume	Bottle Type	Parameter	Laboratory	Additional Documentation
Clear Creek Team – Feb, April and Dec **ONLY** (Collect samples at CC26, CC40, CC50 and CC60)	4	1L	Rectangular plastic	Phosphorus series	Northglenn	Instructions, COCs and one field data sheet
	4	500 mL	Plastic jug	TSS	Thornton	
	4	250 mL	Rectangular plastic	Nitrogen series	Westminster	
	4	40 mL	Glass vial	TOC	Thornton	

Table Notes:
1) Phosphorus series includes total P and dissolved ortho-phosphate-P (also referred to as DRP).
2) Nitrogen series includes total N, ammonia-N and nitrate/nitrite-N.
3) The additional documentation forms are included in Appendix C.

<u>On Clear Creek sampling day (Short Schedule):</u>

- Calibrate turbidity, pH, conductivity, and DO meters in the lab. Ensure all probes and meters are working properly before leaving the lab. Take aliquots of the standards into the field to check instrument calibration if necessary.

- At each sample location, collect samples and analyze for pH, temperature, DO, conductivity, and turbidity. Complete the COC and record all results on the Field Data Sheet (refer to Appendix C).

- The field samples are returned to the Thornton Lab and refrigerated until pickup by Westminster and Northglenn personnel. The samples are relinquished to Westminster (nitrogen) and Northglenn (phosphorus) and the COCs are signed appropriately. The original copies of the COCs are retained by Westminster and Northglenn. Original field data sheets and copies of the COCs are retained by the City of Thornton for permanent archive.

<u>UCC – AMBIENT GRAB SAMPLES</u>

<u>Sampling Locations Directions and Narrative Descriptions - Short Schedule</u>

Sampling Frequency: Feb, April, Dec

POINT	DIRECTIONS AND DESCRIPTION OF LOCATION
CC26	Travel westbound I-70 and exit at Dumont/Downieville. Travel frontage road west towards Lawson. Immediately after the I-70 overpass turn left and park in area just beyond the end of the guardrail. Sample creek at USGS gage and sampling station by bridge. [RECORDING GAGE] **Sample TOC**
CC40	Travel eastbound on I-70 and take US 6 exit. Pull off in parking area just east of the off ramp. (The Tributary at 244 Restaurant is across the road) Sample just below the USGS recording gage. **Sample TOC**
CC50	Travel US 6 eastbound to the intersection of US 6 and CO 119. Turn left up Highway 119 towards Blackhawk/Central City. Approximately 0.2 miles upstream from the intersection is a pullout area on the left with a small red building and cellular antenna pole near a boarded-up tunnel entrance. Sample at the USGS recording gage. [RECORDING GAGE] **Sample TOC**
CC60	Approximately 1 mile west of intersection of Hwy 58 and US 6. Park in the pullout on the south side of highway and walk (or drive) downhill to the Church Ditch diversion structure. Go across the mesh bridge and sample from the main stem of Clear Creek. Do <u>not</u> sample from Church Ditch. **Sample TOC**

Photographs of the sampling locations and GPS coordinates are included in Appendix D.

UCC – AMBIENT GRAB SAMPLES
Program Coordination - Long Schedule (Thornton)

Two weeks before the scheduled Clear Creek sampling date:

- Contact Westminster and Northglenn to request adequate supply of sample bottles from each lab.
- Contact and coordinate the sampling teams. Make sure that there are two samplers available and one set of field meters (turbidity, pH, conductivity and DO) for two Creek Teams. Refer to the Program Participants Contact Information list in Appendix F for sampling personnel who may assist with sampling.
- Prepare sample kits as directed below. Each sample bottle kit includes the containers for sampling at one location.

Prepare sample bottle kits as directed below. Each sample bottle kit contains the prepared sample bottles to collect samples at one location. Prepare 16 bottle kits: 8 kits each for Creek Teams A and B.

Sample Bottle Kit Prep- Long Schedule

Destination	Quantity	Volume	Bottle Type	Parameter	Laboratory	Additional Documentation
Clear Creek Team A (Collects samples at CC25, CC05, CC10, CC26, CC34, CC35, CC52 and CC53)	8	1L	Rectangular plastic	Phosphorus series	Northglenn	One set of: Instructions, COCs and one field data sheet
	8	500 mL	Plastic jug	TSS	Thornton	
	8	250 mL	Rectangular plastic	Nitrogen series	Westminster	
	5	40 mL	Glass vial	TOC	Thornton	
Clear Creek Team B (Collects samples at CC15, CC20, CC30, CC40, CC44, CC45, CC50 and CC60)	8	1L	Rectangular plastic	Phosphorus series	Northglenn	One set of: Instructions, COCs and one field data sheet
	8	500 mL	Plastic jug	TSS	Thornton	
	8	250 mL	Rectangular plastic	Nitrogen series	Westminster	
	5	40 mL	Glass vial	TOC	Thornton	
QC	4	2 L	1:1 HCl rinsed Rectangular plastic	QC spikes and dups for Golden	Golden	QC sampling completed by Team A in May and Team B in October.
	1 (blank)	1 L	Rectangular plastic	Phosphorus series	Northglenn	
	1 (blank)	250 mL	Rectangular plastic	Nitrogen series	Westminster	

Table Notes:
1) Phosphorus series includes total P and dissolved ortho-phosphate-P (also referred to as DRP).
2) Nitrogen series includes total N, ammonia-N and nitrate/nitrite-N.
3) The additional documentation forms are included in Appendix C.

On Clear Creek sampling day (Long Schedule):

- Calibrate turbidity, pH, conductivity, and DO meters in the lab. Ensure all probes and meters are working properly before leaving the lab. Take aliquots of the standards into the field to check instrument calibration if necessary.

- Prepare coolers with ice and sample bottle kits. The Creek Team chosen for QC sampling must also include in the field sample bottle kit: field blank bottles (nitrogen and phosphorus), one field duplicate cubitainer, and at least 4 two-liter bottles for QC samples. Thornton prepares both sample kits for Clear Creek Teams A and B and will provide the extra materials needed for the QC sampling in the appropriate sample kit.

- Meet your sampling team partner at the designated location (usually City of Golden Public Works).

- At each sample location, collect samples and analyze for pH, temperature, DO, conductivity, and turbidity. Complete the COC and record all results on the Field Data Sheet (refer to Appendix C). Samples will be collected at all creek sites for nitrogen series, phosphorus series and TSS. TOC samples are collected only at designated creek sites: CC05, CC20, CC26, CC35, CC40, CC45, CC50, CC52, CC53, and CC60.

- The Clear Creek Team selected for QC sampling will randomly select four creek sites. Collect one sample (2-liter HCl rinsed bottle) at four randomly selected creek sites for preparation of the spike and duplicate nutrient QC samples by Golden Laboratory staff.

- Complete the COC for the QC samples.

- Return to the Golden Lab when sampling is completed. Relinquish the QC samples to the Golden Lab staff.

- Golden Lab staff prepares one duplicate and one spike sample for total nitrogen and total phosphorus from the four QC samples.

- Analyze and complete any missed field parameters as allowable.

- Make two copies of each team's field data sheet: one of each for Golden and one of each for Westminster to use for logging in the samples to the electronic spreadsheet.

- The field samples and prepared QC samples are returned to the Thornton Lab and refrigerated. The samples are relinquished to Westminster (nitrogen) and Northglenn (phosphorus) and the COCs are signed appropriately. The original copies of the COCs are retained by Westminster and Northglenn. Original field data sheets and copies of the COCs are retained by the City of Thornton for permanent archive.

UCC – AMBIENT GRAB SAMPLES
Sampling Locations Directions and Narrative Descriptions - Long Schedule

Clear Creek Team A

Sampling frequency: late May, mid Oct

Sample bottles: Creek sites: One 1 liter rectangular (phosphorus series), one 500 mL (TSS), one 250 mL (nitrogen series) and one 40 mL amber glass vial (TOC) as required.

POINT	DIRECTIONS AND DESCRIPTION OF LOCATION
CC25	Travel west on I-70 approximately 0.8 miles west of mile marker 232. Pull off the highway on the right side immediately beyond the guardrail for the bridge structure. Walk down the hill to the creek. Sample immediately downstream of the box culvert across from the recording gage located downstream. [RECORDING GAGE]
CC05	1-70 westbound to Exit 221 (Bakerville) Exit; go south back over Interstate (left). Park at call box. Take sample upstream of parking area, read gage located downstream. [Read the STAFF GAGE and record on the field data sheet]. **Sample TOC**
CC10	I-70 eastbound to Georgetown. Begin at intersection of 6th and Rose in Georgetown. Go 2.2 miles up Guanella Pass Road (go to the first lake). U-turn by the lake inlet and park on the right side of road. Sample from stream above lake inlet point. [RECORDING GAGE]
CC26	Travel eastbound on I-70 and exit at Lawson. Travel frontage road through Lawson. Immediately before the road curves left under I-70 is a parking area straight ahead through an opening at the end of a guardrail. Sample creek at gage and USGS sampling station by the bridge over the creek. [RECORDING GAGE] **Sample TOC**
CC34	From I-70 (either direction) Exit 240 (Chicago Creek), pull off in the small parking area on the other side of the bridge. Sample the main stem of Clear Creek upstream of Chicago Creek across from the Forest Service Building.
CC35	Continue approx. 3.7 miles on Hwy 103. Pull off on the right shoulder just past the green roofed house that looks like a barn (on the left). Cross road and sample creek at recording gage. [RECORDING GAGE] **Sample TOC**
CC52	Exit I-70 eastbound at Beaver Brook/Floyd Hill (Exit #247). Turn left onto the north frontage road (US Hwy 40). Travel east approximately 2.4 miles. Pull off to the side of road and sample Beaver Brook at this point. **Sample TOC**

CC53 Continue travelling east bound 0.3 miles and cross the second white bridge. Exit immediately on the right to Soda Creek Drive. Park on the right. Sample Soda Creek upstream of the bridge. **Sample TOC**

Photographs of the sampling locations and GPS coordinates are included in Appendix D.

UCC – AMBIENT GRAB SAMPLES
Sampling Locations Directions and Narrative Descriptions - Long Schedule

Clear Creek Team B

Sampling frequency: late May, mid Oct

Sample bottles: Creek sites: One 1 liter rectangular (phosphorus series), one 500 mL (TSS), one 250 mL (nitrogen series) and one 40 mL amber glass vial (TOC) as required.

POINT	DIRECTIONS AND DESCRIPTION OF LOCATION
CC40	Traveling westbound on I-70 take the US 6 exit (#244) at the bottom of Floyd Hill. Turn right at the bottom of the ramp, and pull off to the right in the parking area 150 feet east of the off-ramp. (The Tributary at 244 Restaurant is across the road). Sample below recording gage. [RECORDING/STAFF GAGE] **Sample TOC**
CC30	Drive west on 1-70 to Exit 238 (Fall River Road/St. Mary's Glacier). At the junction of the on/off ramp and Fall River Road is a parking area on the left across from a railing and stairway with USGS equipment. Descend the stairs and sample the creek above the staff gage attached to the bridge. [Read the STAFF GAGE and record on the field data sheet]
CC15	Travel west on I-70 and take US 40 west through Empire. Approximately 6 miles west of Empire there is a large pullout on the creek (left) side of the highway with a large tree in the middle of the pullout. Sample directly below the tree at the creek. Staff gage is along the north bank of stream next to a tree at the stream's edge. [Read the STAFF GAGE and record on the field data sheet]
CC20	Returning back through Empire eastbound, travel along the road/ramp from US 40 towards Westbound I-70. Immediately after turning onto road/ramp, there is a large open space on the right and a Colorado Dept. of Transportation (CDOT) maintenance area on the left. If the gate is open, turn left into the CDOT maintenance yard and sample approx. 150 feet downstream of the bridge at recording gage/staff gage. If the gate is closed, park across the street from the gate and walk into the CDOT maintenance area. [RECORDING/STAFF GAGE] **Sample TOC**
CC44	Return east on I-70 to the Central City Parkway and take the Parkway to Central City. Central Parkway turns into Nevada Street. Nevada Street turns into Spring Street when it crosses over Main Street. Take Spring Street to Gregory Street and turn right. Travel down through Central City into Blackhawk, past Blackhawk's Main Street and turn left on Hwy 119. Travel westbound on 119 approx. 0.9 miles.

There is a small wooden building and parking area on the left side of the road at the Black Hawk water intake. Sample the creek behind the building.

CC45 Turn around and drive east on 119 approx. 1.5 miles and turn right on Mill Street. Take the first left onto Main Street and drive to the east end of the casino and parking garage on the left. At the east end of the building is an alley between the parking garage and a small brown building. Sample the creek at the end of the alley upstream of the old Black Hawk WWTP site. **Sample TOC**

CC50 Continue down Hwy 119 eastbound toward US 6. Approximately 1.4 miles downstream of the new Black Hawk/Central City WWTP and approximately 0.2 miles upstream from the intersection of Hwy 119 and US 6 is a pullout area on the right just past a small red building and cellular antenna pole near a boarded-up tunnel entrance. Sample at the recording gage. [RECORDING GAGE] **Sample TOC**

CC60 Drive east down US 6/Hwy 119. Approximately 0.6 miles east of Tunnel 1 (0.45 miles west of the intersection of Hwy. 58 and US 6) is a pullout/dirt road on the south side of highway. Walk or drive down the hill to the Church Ditch diversion structure. Go across the mesh bridge and sample from the main stem of Clear Creek. Do not sample from Church Ditch. **Sample TOC**

Photographs of the sampling locations and GPS coordinates are included in Appendix D.

UCC – AMBIENT GRAB SAMPLES

QA/QC Program - Long Schedule Only

Duplicate and spike quality control samples are prepared from creek samples collected during the Clear Creek Long Schedule sampling events for selected nutrients and are analyzed by Westminster (total nitrogen) and Northglenn (total phosphorus). The QC samples are prepared by the City of Golden at their laboratory on the day of sampling. Four creek locations are randomly selected for preparation of the QC samples. One duplicate and one spike are submitted to each laboratory. The analytical procedure for QC preparation is detailed below:

SOP - QC Preparation for Clear Creek Studies

Night before:

- Soak 2 1-Liter Class A volumetric flasks with 1:1 HCl. One flask will be used to make up fresh Nitrate standard and the other will be used for spiking the selected Clear Creek sample (with both nitrate and phosphorus spikes).

The Morning of Sampling Day:

- Remove 5 mg/L Phosphorus standard from fridge to warm to room temperature. This standard is prepared by the City of Northglenn and is stable for 3 months. It is usually in a 125 ml brown glass bottle.
- Remove 100 mg/L Nitrate-N standard from fridge. It is stored in a 125 ml brown Nalgene bottle. This standard is prepared fresh by the City of Golden each time. The method to prepare a 100 mg/L NO3-N standard is in Standard Methods, 21st Ed., page 4-120 and described below.

- **To Prepare Fresh Nitrate-N Standard**
  - Thoroughly rinse out one of the HCl acid soaked 1-Liter flasks to prepare the fresh standard in.
  - Fill flask with 200-300 mL DI water.
  - Weigh out 0.7218 grams of KNO3 and add to flask. (KNO3 is stored in the desiccator).
  - Dilute to 1-Liter volume with DI and mix thoroughly.
  - Discard old standard and refill bottle with fresh standard. Rinse bottle out with fresh standard 2-3 times before filling. Record new prep date on bottle.

- Prepare 4 sample bottles for spike and duplicate samples. Bottles used for spike and duplicate prep are provided by the City of Thornton and are the square plastic 16 ounce “milk type” bottle. They are pre HCl washed and stored in the cabinet above the wastewater sink.

  Two labs receive spike and duplicate samples from this program:
  - Northglenn for low level total phosphorus analysis.
  - Westminster for total nitrogen analysis.

  The bottles are marked with consecutive numbers from month to month, year after year. Refer to the last sample set numbers in the brown Clear Creek Quality Control Log Book (above Vicki's desk) and mark new bottles with the next consecutive number set (##). Mark the 4 bottles with the following information:

  - City of Northglenn - P(##) - Spike for Phosphorus, Date of sampling.
  - City of Northglenn - D(##) - Duplicate for Phosphorus, Date of sampling.

  - City of Westminster - N(##) - Spike for Nitrogen, Date of Sampling.
  - City of Westminster - D(##) - Duplicate for Nitrogen, Date of sampling.

When Samples Arrive in Golden's Lab:

Certain 2 Liter samples from Clear Creek sites will have been randomly selected by the sampling team as "QC" samples.

- Select ONE of these as the QC sample (**spike and duplicate)** and set aside. Record which site was chosen in the QC log book.

This sample will be spiked with both Nitrogen and Phosphorus at concentrations within the analytical ranges of Northglenn's and Westminster's labs.

The "**spiked sample"** will be made in the remaining HCl rinsed volumetric flask and will use up 1 liter from the 2 liter bottle.
The remaining 1 liter volume will be split into the "**duplicate sample**" bottles for both labs.

- **To Prepare Spiked Sample**

  - Rinse out the remaining 1-Liter volumetric flask with DI.
  - Then rinse flask with a small portion of the selected QC Creek sample - 2 times.
  - Refer to the last sampling to determine new spike volumes.

  **Spike amounts for Phosphorus are usually within the 1.75 to 3.0 ml volume range for a total spiked concentration of 0.00875 mg/L to 0.015 mg/L, i.e.,*

  1.75 mL of 5 mg/L phosphorus standard in 1 liter = 0.00875 mg/L concentration spiked

  **Spike amounts for Nitrogen are usually within a 1.5 to 3.0 ml volume range for a total spiked concentration of 0.15 mg/L to 0.3 mg/L, i.e.,*

  1.5 mL of 100 mg/L nitrogen-N standard in 1 liter = 0.15 mg/L concentration spiked

- Mix the Clear Creek sample well and pour approximately 500 mL into pre-rinsed flask.
- Add determined spike volumes of both standards to flask. Mix well.
- Dilute to volume with additional Creek sample finalizing volume with a pipet. (It is too hard to bring it to volume by pouring from the 2 liter container!)
- Mix well and pour into 2 bottles labeled for spike samples (“N” and “P”).

To Prepare Duplicate Sample

- Thoroughly mix remaining Clear Creek sample.
- Pour into 2 bottles labeled for duplicates (“D”).

Record the following information in the brown "Clear Creek QC" book:

1. the time the samples arrived at Golden
2. the new consecutive sample numbers
3. the Clear Creek sample site number that was selected for preparation of the QC samples
4. the volumes spiked for phosphorus and nitrogen

Generate new chain of custody forms for the 4 new samples. One form can be filled out for both Westminster and Northglenn labs. Sampling teams will deliver samples to respective labs. Copies of previous chain of custody forms are in the lower file drawer in drinking water cabinet.

UCC AUTOSAMPLER 48-HOUR AMBIENT SAMPLES

Program Coordination: Westminster and Golden
Field Sampling Teams: Westminster, Thornton, Golden, Arvada

Autosampler sites were selected at strategic locations in the watershed in order to assess diurnal variations in water quality in Clear Creek. The 48-hour ambient composites are collected with programmable automatic sampling devices. Each of the 24 sample bottles represents a two hour time period, resulting from collecting equal volumes of sample in each of two consecutive hours; therefore, 48 hours of samples are collected in 24 bottles. The 24 discrete samples are composited into two 24-hour samples on a time weighted basis (i.e. equal sample volumes are taken from 12 discrete autosampler bottles and combined into a single composite sample). Additional discrete or composite samples may be submitted for analysis based on anomalies noted in field observations for the individual autosampler bottles.

Ambient samples are collected approximately seven times per year on a monthly schedule starting in April and ending in October. The schedule for the ambient sampling is based on clear weather predictions and is staggered at different times during the week, including weekends.

Analytical probes and data logging equipment are active at the autosampler sites year-round to continuously monitor in-stream conditions for temperature and conductivity. From April through October, or as weather conditions permit, additional probes are deployed for pressure (depth), turbidity and pH. YSI multi-probe sondes are deployed at each autosampler location. The sample locations are equipped with data loggers for remote monitoring of water quality conditions in the watershed and to remotely control activation of the autosamplers.

UCC AUTOSAMPLER 48-HOUR AMBIENT SAMPLES
Sample Locations

CC AS 26	Mainstem of CC at USGS Lawson gage
CC AS 49	Mainstem of CC above the confluence of the North Fork
CC AS 50	North Fork of CC above confluence of Mainstem of CC at USGS gage
CC AS 59	Mainstem of CC above Golden and Church Ditch diversions

UCC AUTOSAMPLER 48-HOUR AMBIENT SAMPLES
Flow Monitoring

USGS gages provide the average daily flow associated with each of the two 24-hour composite samples for the ambient autosamplers. Flow data is obtained directly from the gage stations at CC26 and CC50 to correlate with CC AS 26 and CC AS 50, respectively. Flow data from the gage at CC40 is used to correlate to CC AS 49 because there are no significant inflows to or diversions from Clear Creek between CC40 and CC AS 49.

The flow data associated with CC AS 59 is considered to be an estimated flow. The flows diverted to the City of Golden water treatment plant and the Church Ditch will be added to the gage flows recorded at the USGS gage at CC61 (Clear Creek at Golden) to estimate the flow at CC AS 59.

UCC AUTOSAMPLER 48-HOUR AMBIENT SAMPLES

Analytical Parameters

Analyte	Analytical Method Reference	Reporting Limit Goal	Responsible Laboratory
Total Nitrogen	SM 4500-NO3 I	0.02 mg/L	Westminster
Nitrate/Nitrite-N	SM 4500-NO3 I	0.01 mg/L	Westminster
Ammonia-N	SM 4500-NH3 H	0.01 mg/L	Westminster
Total Phosphorus	SM 4500-P E	0.0025 mg/L	Northglenn
Ortho-phosphate-P (dissolved) or DRP	SM 4500-P E	0.0025 mg/L	Northglenn
Total Suspended Solids (TSS)	SM 2540 D	1 mg/L	Thornton
Total Organic Carbon (TOC)	SM 5310 B	0.5 mg/L	Thornton
pH	SM 4500-H+ B	1.0 Std Units	Field Teams
Temperature	SM 2550 B	1.0 °C	Field Teams
Conductivity	SM 2510 B	10 µS/cm	Field Teams
Turbidity	SM 2130 B	1.0 NTU	Field Teams
Total and Dissolved Arsenic	EPA 200.7	0.001 mg/L	Golden
Total and Dissolved Cadmium	EPA 200.7	0.0005 mg/L	Golden
Total and Dissolved Copper	EPA 200.7	0.002 mg/L	Golden
Total and Dissolved Iron	EPA 200.7	0.02 mg/L	Golden
Total and Dissolved Lead	EPA 200.7	0.0005 mg/L	Golden
Total and Dissolved Manganese	EPA 200.7	0.002 mg/L	Golden
Total and Dissolved Molybdenum	EPA 200.7	0.002 mg/L	Golden
Total and Dissolved Zinc	EPA 200.7	0.02 mg/L	Golden

Table Notes:
1) SM refers to the 22nd Edition of Standard Methods for the Examination of Water and Wastewater.
2) Reporting limit goals are matrix dependent and may be increased for complex matrices and may be lower depending on laboratory capability.
3) EPA recommended holding times less than 72 hours may not be met due to the extended sampling routine.
4) Samples collected for nutrients (nitrogen and phosphorus) with a turbidity reading of greater than 100 NTU are analyzed by commercial laboratories that have demonstrated proficiency in analyzing complex matrices for nutrients.

UCC AUTOSAMPLER 48-HOUR AMBIENT SAMPLES
Program Coordination (Westminster and Golden)

Field Equipment

Equipment Installed At Autosampler Locations

- Permanent and tamper-proof enclosure box with lock
- American Sigma 900, 900 Max or other automated sampler
- Power supply – solar panel, rechargeable battery or direct power
- Sample tubing long enough to reach from the autosampler to the streambed. Probes must be contained in protective piping secured in the creek bed
- Dedicated field probes for turbidity, temperature, conductivity and pH
- Depth/velocity flow sensor
- Recording gage at CC26 – Operated and maintained by USGS
- Staff gage at CC50
- Rain gage at CC59
- 24 discrete HCl rinsed autosampler bottles with caps. Bottles must be numbered and inserted in the designated position in autosampler (positions numbered 1 through 24)
- Continuous recording datalogger
- Cellular modem and antenna at CC26, CC50 and CC59

UCC AUTOSAMPLER 48-HOUR AMBIENT SAMPLES
Autosampler Operation

On a monthly basis between April and October, autosamplers are set to collect time-weighted discrete samples for a 48-hour period. The autosamplers are strategically located in order to correlate stream flow with the chemical water quality data collected on the samples. In order to associate the relative impacts of the point and nonpoint pollutant sources located between the sample stations, it is advisable to observe the same "slug" of water at both the upstream and downstream locations. Using the "time of travel" study conducted by USGS in 1999, the downstream autosamplers on Clear Creek are delayed for a predetermined time based on in-stream flow at the Lawson stream gage.

The time of travel estimates tables are included in Appendix E.

Autosampler Setup:

Equipment required:

- 24 discrete HCl rinsed autosampler bottles with caps
- Keys and/or tools to access autosampler enclosure
- Field data collection/station audit sheets

Setup Procedure:

1. Unlock sample enclosure and remove sampler head. Set aside without disturbing or bumping the distributor arm.
2. Load uncapped bottles in the correct positions in the bottom of the sampler.
3. Secure bottles in place with the retaining ring. Store caps in a ziplock bag inside the autosampler until sample collection.
4. Program the sampler according to manufacturer's instructions to collect two 450 mL storm samples per bottle, one sample per pulse.
5. After starting the autosampler, ensure that the distributer arm is positioned above bottle #1.
6. Replace sampler head and lock in place.
7. Record station/equipment information on field sheet.
8. Make sure the autosampler program is ***RUNNING*** before locking the enclosure.
9. The autosampler may be set up ahead of a scheduled start time.

Sample Collection

Additional equipment required:

- Keys and/or tools to access autosampler enclosures
- Large cooler with ice to collect sample bottles
- 24 pre-cleaned, HCl rinsed, discrete sample replacement bottles
- Field data sheets/station audit sheets
- Chain of custody forms
- Laptop with Loggernet software and data cable (9 pin serial cable with SC32B adapter) if retrieving data directly from datalogger
- Two 3-liter or larger Nalgene bottles (clean and rinsed with 1:1 hydrochloric acid) for compositing samples
- 250 mL graduated cylinder (clean and rinsed with 1:1 hydrochloric acid) for compositing samples

- Prepared sample bottles provided by participating Cities for nutrients, solids and metals analyses
    - 1 L square plastic – phosphorus series (Northglenn)
    - 250 mL plastic – nitrogen series (Westminster)
    - 500 mL plastic bottle – TSS (Thornton)
    - 45 mL amber glass vial with septa cap – TOC (Thornton)
    - 250 ml round plastic – total and dissolved metals (Golden - for Clear Creek sites)
- Chain of Custody forms – Refer to Appendix C
- Field Sampling form - Refer to Appendix C

Sample Collection Procedure:

1. Unlock enclosure and remove sampler head.
2. Retrieve date/time information from autosampler if required. To collect sample history on American Sigma samplers, press <Change/ Halt> button, press <time/read> button for 5 seconds. The sample collection time for the first sample will appear. Record data on the field sheet. Press <yes> for next sample time to appear. Continue until all data is recorded.
3. Date and time information for samples is also automatically stored in a data file by the dataloggers at all sites except CC59.
4. Record station/equipment information on field sheet.
5. Make note of any samples with high turbidity determined by visual observance or data obtained from the datalogger.
6. Cap bottles and place in a cooler with ice for transport to Golden lab for compositing.

   Optional compositing of samples in the field is performed by pouring off equal volumes into 3-liter (or larger) pre-cleaned bottles. Refer to the Sample Compositing Procedure Step 1. Save remaining volume of any high turbidity samples to take back to the lab. Discard remaining sample.
7. Clean out autosampler base and reload with a new set of pre-cleaned bottles.
8. Reset the autosampler by pressing the START button (Sigma 900 autosampler). Ensure that the distributor arm is parked over bottle #1 and the display reads “Program Running” before closing the autosampler and placing it back in the enclosure. .
9. Take all samples to the Golden Water Quality Laboratory for compositing, splitting, distribution and wet chemistry analysis of pH, turbidity and conductivity.

UCC AUTOSAMPLER 48-HOUR AMBIENT SAMPLES
Sample Compositing

1. Composite samples in the laboratory if compositing was not performed in field. Shake sample bottles and pour equal volumes of sample from the first 12 bottles into a composite bottle marked "A". Shake sample bottles and pour equal volumes of sample from the remaining 12 bottles into a composite bottle marked "B".
2. Perform turbidity, temperature, pH and conductivity measurements on composited samples. Enter data on the Sampling Form.
3. Use the well mixed composites (A and B) to fill the appropriate bottles for the Northglenn, Thornton, Westminster and Golden labs.
4. If any discrete bottle(s) appears to have an unusually high turbidity and enough sample is available, analyze for turbidity and conductivity. Record on Sampling Form. If there is enough sample, pour the high turbidity discreet samples into separate nutrient and solids bottles for individual analysis.
5. Complete the COCs.
6. Deliver and relinquish to each city their respective samples (Westminster-nitrogen series, Thornton-TSS and TOC, Northglenn-phosphorus series) and sign COCs as appropriate.
7. Original field data sheets and COCs are retained by the Cities of Westminster and Golden for permanent archive.
8. Samples are created in the web-accessible Excel spreadsheet by Westminster for data entry and results archive.

UCC AUTOSAMPLERS – EVENT SAMPLES
Sample Locations

CC AS 49 Event	Mainstem of CC above the confluence of the North Fork
CC AS 50 Event	North Fork of CC above confluence of Mainstem of CC at USGS gage
CC AS 59 Event	Mainstem of CC above Golden and Church Ditch diversions

UCC AUTOSAMPLERS – EVENT SAMPLES
Flow Monitoring

Westminster and Golden will obtain the 15 minute interval flow data from the USGS gage at CC61 (Clear Creek at Golden) to correlate to CC AS 59. The average event flow will be calculated to correspond to the specific time-event composited samples. If the 15 minute interval flow data is not available, the average daily flow will be associated with the event. The average daily flow at UCCWA gage CC40 will be used to correlate with CC AS 49. Flow at CC50 is measured by a USGS gage at that site.

UCC AUTOSAMPLERS – EVENT SAMPLES
Analytical Parameters

Storm event samples are analyzed for the same suite of analytical parameters listed in the previous section for the 48-hour ambient samples. Samples may not be analyzed within the EPA recommended holding time for some parameters based on the random nature of the storm event triggering.

UCC AUTOSAMPLERS – EVENT SAMPLES
Program Coordination (Westminster and Golden)

Field Sampling Teams: Westminster, Thornton, Golden, Arvada

The event autosampler program was initiated in 2006 to assess the pollutant concentrations mobilized during significant snow melt (runoff) or rain events at 48-hour ambient locations CC AS 49, CC AS 50 and CC AS 59. Automated sample collection of stormwater is triggered based on changes in ambient turbidity, conductivity, stage height, or rain gage readings, depending on the autosampler location. The autosamplers are currently set to trigger when the 30 minute running average exceeds a predetermined turbidity level (for example, 100 NTU). The autosampler at CC AS 50 triggers based on a combination of change in stream depth, precipitation and turbidity in order to eliminate triggering autosampler event sampling that might be associated with localized human disturbances in the creek (e.g. sluice mining). Autosamplers trigger independently depending on the localized conditions in the watershed. The autosampler collects discrete samples every 15 minutes until the parameter that triggered the event returns to the ambient condition or until the maximum number of samples is collected. The discrete samples may be analyzed individually or multiple discrete samples may be composited based on the field observations. As necessary, refer to the previous section for instructions on compositing samples from autosamplers. Event sampling can also be started remotely in the event of a spill or other event that might not cause the triggering parameters to be met.

Storm event samples are analyzed for the same suite of analytical parameters listed in the previous section for the 48-hour ambient samples. Samples may not be analyzed within the EPA recommended holding time for some parameters based on the random nature of the storm event triggering.

UCC AUTOSAMPLERS - EVENT SAMPLES

Field Equipment

Storm event sampling utilizes the same equipment listed in the previous section for the 48-hr ambient samples.

Autosampler Operation

Field equipment used for storm event sampling is operated using the same techniques as described in the previous section for 48-hr ambient sampling.

Sample Compositing

Sample compositing is performed similarly to the procedure described in the previous section for 48-hr ambient sampling; however, fewer samples are typically composited based on the severity and duration of a storm event.

TRIBUTARY BASIN MONITORING PROGRAM

The Standley Lake Tributary Basin Monitoring Program is designed to provide water quality information for evaluation of the nutrient loadings from non-point sources in the Standley Lake Tributary Basin. The only point source discharge between CC60 on the main stem of Clear Creek and the canal diversions to Standley Lake is the Coors cooling basin return flow.

Three tributaries (the terms trib and canal are interchangeable) divert Clear Creek water to Standley Lake: the Church Ditch, the Farmers Highline ("FHL") Canal and the Croke Canal. The trib monitoring locations were selected to assess the relative loadings to the canals from areas within unincorporated Jefferson County and the city limits of Golden and Arvada. Denver Water supplies Westminster with a small quantity of water via the Kinnear Ditch Pipeline ("KDPL") which enters Standley Lake after passing through a wetlands area located west of 96th Ave and Alkire Street. The upstream and downstream locations near the wetlands are monitored when there is flow through the pipeline. The Denver Water raw water sources include Gross Reservoir and Coal Creek.

Trib samples are collected year-round on a monthly basis. All tributaries flowing at a rate that allows collection of a representative sample are monitored.

The Church Ditch delivery structure at Standley Lake was relocated in 2008 from the west side of the lake to the south side of the lake in order to avoid the potential for significant stormwater impacts to the lake. The former Church Ditch monitoring location at Standley Lake (T-09) was abandoned in 2009 when the new delivery structure (T-27) became operational.

The raw water pipeline at Semper (T-24) is monitored monthly. The raw water pipeline at NWWTP (T-25) is monitored only when the Semper facility is offline.

TRIB SAMPLES

Locations and Sample Schedule

Sample ID	Sample Location *	Every month of the year when flowing**
T-01	Church Ditch at Headgate on MSCC	X
T-02	FHL at Headgate on MSCC	X
T-03	Croke Canal at Headgate on MSCC	X
T-04	Croke Canal at Standley Lake	X
T-11	FHL at Standley Lake	X
T-22A	Kinnear Ditch Pipeline (KDPL) – at Coal Creek entry point into pipeline	X
T-22D	Kinnear Ditch Pipeline (KDPL) downstream of wetlands	X
T-24	Raw Water Pipeline at Semper	X
T-25	Raw Water Pipeline at NWWTP	X
T-27	Church Ditch delivery structure at SL (est. 2009)	X

*MSCC = Mainstem Clear Creek

** Exceptions noted in paragraph above the table.

TRIB SAMPLES

Analytical Parameters and Analytical Scheme

Analyte	Analytical Method Reference	Reporting Limit Goal	Responsible Laboratory	Monitoring Frequency
Temperature	SM 2550 B	1.0 °C	Field Team	Monthly
pH	SM 4500-H+ B	1.0 Std Units	Field Team	Monthly
Conductivity	SM 2510 B	10 µS/cm	Field Team	Monthly
Turbidity	SM 2130B	1.0 NTU	Field Team	Monthly
Dissolved Oxygen	SM 4500-O G	1.0 mg/L	Field Team	Monthly
Total Phosphorus	SM 4500-P E	0.0025 mg/L	Northglenn	Monthly
Ortho-phosphate as P (dissolved) or DRP	SM 4500-P E	0.0025 mg/L	Northglenn	Monthly
Total Suspended Solids (TSS)	SM 2540 D	1 mg/L	Thornton	Monthly
Total Organic Carbon	SM 5310	0.5 mg/L	Thornton	Monthly
E. coli	SM 9221 D	1 cfu/100mL	Thornton	Monthly
Total and Dissolved Iron	EPA 200.7	0.05 mg/L	Thornton	Monthly
Total and Dissolved Manganese	EPA 200.8	0.002 mg/L	Thornton	Monthly
Total and Dissolved Zinc	EPA 200.8	0.020 mg/L	Thornton	Monthly
Total Nitrogen	SM 4500-NO3 I	0.02 mg/L	Westminster	Monthly
Nitrate/Nitrite as N	SM 4500-NO3 I	0.01 mg/L	Westminster	Monthly
Ammonia as N	SM 4500-NH3 H	0.01 mg/L	Westminster	Monthly
Gross Alpha and Gross Beta	EPA 901.1	0.1 pCi/L	Westminster	Quarterly
Total and Dissolved Arsenic	EPA 200.8	0.001 mg/L	Thornton	Quarterly
Total and Dissolved Barium	EPA 200.8	0.002 mg/L	Thornton	Quarterly
Total and Dissolved Cadmium	EPA 200.8	0.0005 mg/L	Thornton	Quarterly
Total and Dissolved Chromium	EPA 200.8	0.001 mg/L	Thornton	Quarterly
Total and Dissolved Copper	EPA 200.8	0.002 mg/L	Thornton	Quarterly
Total and Dissolved Iron	EPA 200.7	0.05 mg/L	Thornton	Quarterly
Total and Dissolved Lead	EPA 200.8	0.0005 mg/L	Thornton	Quarterly
Total and Dissolved Manganese	EPA 200.8	0.002 mg/L	Thornton	Quarterly
Total and Dissolved Molybdenum	EPA 200.8	0.002 mg/L	Thornton	Quarterly
Total and Dissolved Selenium	EPA 200.8	0.005 mg/L	Thornton	Quarterly
Total and Dissolved Zinc	EPA 200.8	0.020 mg/L	Thornton	Quarterly
Bromide	SM 4110 A	0.1 mg/L	Thornton	Monthly
Chloride	SM 4110 A	5 mg/L	Thornton	Quarterly
Sulfate	SM 4110 A	10 mg/L	Thornton	Quarterly
Total Hardness (as $CaCO_3$)	EPA 130.2	5 mg/L	Thornton	Quarterly

Table Notes:
1) SM refers to the 22nd Edition of Standard Methods for the Examination of Water and Wastewater.
2) Reporting limit goals are matrix dependent and may be increased for complex matrices and may be lower depending on laboratory capability.
3) Quarterly parameters are analyzed in March, June, September and December at all sampled locations.
4) Samples collected for nutrients (nitrogen and phosphorus) with a turbidity reading of greater than 100 NTU are analyzed by commercial laboratories that have demonstrated proficiency in analyzing complex matrices for nutrients.

TRIB SAMPLES

Program Coordination (Northglenn)

Before the scheduled Tributary sampling date:

- Ensure an adequate supply of sample containers is available from Thornton. Westminster's bottles will be picked up at Westminster on sampling day before the start of sampling at T-24.
- Label the Trip blank bottle and fill with laboratory DI water.
- Calibrate the multimeter for conductivity, pH and DO.
- Analyze the Trip Blank for conductivity, pH and DO.
- Pack Trip Blank in cooler to monitor field activities for phosphorus contamination.

Sample Bottle Kit – Tribs Monthly and Quarterly

Quantity	Volume	Bottle Type	Parameter	Laboratory
9	500 mL	Rectangular plastic	Phosphorus series	Northglenn
1 (Trip blank)	500 mL	Rectangular plastic	Phosphorus series	Northglenn
9	500 mL	Plastic	TSS, Total Hardness, Chloride, Sulfate	Thornton
9	40 mL	Glass vial	TOC	Thornton
9	250 mL	Glass	E. coli	Thornton
9	250 mL	Plastic	Total Metals	Thornton
9	125 mL	Plastic	Dissolved Metals	Thornton
9	250 mL	Plastic	Quarterly Total Metals	Thornton
9	125 mL	Plastic	Quarterly Dissolved Metals	Thornton
9	250 mL	Plastic	Nitrogen series, UV-254	Westminster
9	1 L	Plastic	Rads	Westminster

Sample Collection

Equipment required:

- Key to access T-2
- Key to access T-27
- Gate Code for access at T-22A
- Field data book
- Cooler with blue ice or ice
- Trip blank filled with DI
- Sample bottles as detailed above

- Bucket for sample collection
- pH and DO meters and probes
- Ballpoint pen
- Waterproof marker
- Chain of custody forms
- NOTE – Four wheel drive vehicle recommended for sampling due to steep inclines at some locations and potentially rugged or muddy conditions.

Sample collection procedure:

1. Meet with Westminster staff at Semper. Drop off bottles for Westminster staff to collect sample at T-25.
2. Starting with T-24, collect field samples in the order detailed below for each location where water is flowing.
3. Rinse the sample bucket with the field sample water repeatedly at each location before collecting the sample.
4. Collect enough volume of the field sample in the bucket to fill all sample bottles for the location.
5. Fill the appropriate sample bottles from the bucket.
6. Label the sample bottles with location, date and time of collection.
7. Analyze the sample in the field for conductivity, pH, DO and temperature. Record data in the field notebook.
8. Repeat the process at each location.
9. Return to Westminster's Semper WTP to receive T-25 sample from Westminster staff. Sign COC and keep the original copy of the COC.
10. Leave an unsigned copy of the Thornton COC at Westminster so the samples can be logged into the Tribal database by Westminster staff.
11. Complete the COCs and relinquish custody of the samples to Westminster staff. Sign COC and keep a copy of the COC. Leave the original COC with the samples.
12. Return to Northglenn Lab and analyze samples for turbidity on a calibrated meter. Record data in the field notebook.
13. Contact Thornton to pick up collected field samples. Request replenishment of bottles for the next sampling event as needed.
14. Relinquish samples to Thornton and sign COCs. Retain a copy of the COC. Thornton takes possession of the original COC.
15. Northglenn retains a copy of all COCs and field documentation for permanent archive.

TRIB SAMPLES

Sampling Locations Directions and Narrative Descriptions

Tributary sampling occurs generally in an upstream to downstream fashion. Samples are collected at designated locations when water is flowing.

Trib 24
T-24 is located at Westminster's Semper Water Treatment Plant at 8900 Pierce Street. The sample is collected from the RAW water tap in the Operator's Laboratory. Do **NOT** increase the flow at the tap at this location. First tap on the left labeled 24.

Trib 22A
T-22A is the upstream sample point on the Kinnear Ditch pipeline. It is accessed through a gate located at Hwy. 72 and Plainview Rd. A key is required to access the location. The sample point is approximately 0.2 miles from Plainview Rd. Sample is taken at the flume where Coal Creek enters the pipeline.

Trib 1
T-1 is located at the Church Ditch headgate on Clear Creek. This site is accessed via Hwy 6 approximately 0.5 miles west of Hwy 93. There is a diversion from Clear Creek above this location which diverts water from Clear Creek and runs it parallel to the Creek. There are two gates at this location one sends water back into Clear Creek and the other is the Church Ditch headgate. Sample is taken from the bridge just above both gates.

Trib 2
T-2 is located at the Farmers Highline headgate on Clear Creek.
The site is accessed behind the Coors office building at the end of Archer St. Sample is taken from the bridge just inside the gate. Sample the downstream side of the headgate if it is open or on the upstream side if the headgate is closed (Clear Creek side).

Trib 3
T-3 is located at the Croke Canal headgate on Clear Creek.
This site is on Coors property. It is along the frontage road through Coors, on the east side of a small "pond". Sample the downstream side of the headgate if it is open or on the upstream side if the headgate is closed (Clear Creek side).

Trib 22D
T-22D is on the Kinnear Ditch Pipeline between 96th Ave and 88th Ave on Alkire St.
The sample is taken just downstream of the culvert on the east side of Alkire St.

Trib 04 and Trib 11
The Croke Canal (T-04) passes UNDER the Farmers Highline (T-11) in the area just west of 86th and Kipling prior to entering Standley Lake. The Farmers Highline passes OVER the Croke in a concrete structure. Sample the Croke on the south side of the Farmers Highline concrete structure. Sample the Farmers next to the white autosampler housing box.

Trib 25
Located at Westminster's Northwest Water Treatment Plant located at 104th & Wadsworth. The sample is collected by Westminster from the raw water tap on the west wall in the membrane filter gallery. Sample only if T-24 is not running.

Trib 27
Located on the south side of Standley Lake at the Church Ditch delivery structure. This sampling location was activated in 2009.

Photographs of the sampling locations and GPS coordinates are included in Appendix D.

TRIB CONTINUOUS MONITORING

Program Coordination (Westminster)

Field sampling team: Westminster

A YSI multi-parameter sonde and data logging equipment are deployed year-round at the trib location where the Farmers Highline Canal (T-11) crosses over the Croke Canal (T-04), provided there is sufficient flow in one of the canals. A sonde was also installed at the new Church Ditch inlet (T-27) in 2009 and operates under similar conditions. The probes provide continuous in-stream monitoring of pH, ORP, temperature, depth (pressure transducer), conductivity and turbidity. Remote access to the data logger data facilitates monitoring of water quality at these inflow locations to Standley Lake. The FHL/Croke station is also equipped with a tipping-bucket rain gauge.

TRIB CONTINUOUS MONITORING

Sample Locations

CC AS T04	Croke Canal approximately 0.5 mile from Standley Lake inlet
CC AS T11	Farmers Highline Canal approximately 0.5 mile from Standley Lake inlet
CC AS T27	Church Ditch at Standley Lake inlet

Table Note: Historical data from these locations are available as part of the Clear Creek Canal Program that was eliminated in 2008. The sample location identifications associated with the Clear Creek Canal Program have been retained.

TRIB AUTOSAMPLER 48-HOUR AMBIENT SAMPLES

Program Coordination: Westminster
Field Sampling Teams: Westminster

Autosampler sites in the Tributary Basin are located at the canal inlets to Standley Lake. The 48-hour ambient composites are collected with programmable automatic sampling devices as described in the UCC autosampler 48-hr ambient program section of this plan in order to assess any water quality impacts introduced by the canals.

Ambient samples are collected approximately seven times per year on a monthly schedule starting in April and ending in October to coincide with the UCC autosampler 48-hr ambient sample program.

TRIB AUTOSAMPLER 48-HOUR AMBIENT SAMPLES
Sample Locations

CC AS T04	Croke Canal approximately 0.5 mile from Standley Lake inlet
CC AS T11	Farmers Highline Canal approximately 0.5 mile from Standley Lake inlet
CC AS T27	Church Ditch at Standley Lake inlet

TRIB AUTOSAMPLER 48-HOUR AMBIENT SAMPLES
Flow Monitoring

Flow in the canals is tracked by the ditch operators and water accountants.

TRIB AUTOSAMPLER 48-HOUR AMBIENT SAMPLES
Analytical Parameters

Analyte	Analytical Method Reference	Reporting Limit Goal	Responsible Laboratory
Total Nitrogen	SM 4500-NO3 I	0.02 mg/L	Westminster
Nitrate/Nitrite-N	SM 4500-NO3 I	0.01 mg/L	Westminster
Ammonia-N	SM 4500-NH3 H	0.01 mg/L	Westminster
Total Phosphorus	SM 4500-P E	0.0025 mg/L	Northglenn
Ortho-phosphate-P (dissolved) or DRP	SM 4500-P E	0.0025 mg/L	Northglenn
Total Suspended Solids (TSS)	SM 2540 D	1 mg/L	Thornton
Total Organic Carbon (TOC)	SM 5310 B	0.5 mg/L	Thornton
Total and Dissolved Arsenic	EPA 200.8	0.001 mg/L	Thornton
Total and Dissolved Barium	EPA 200.8	0.002 mg/L	Thornton
Total and Dissolved Cadmium	EPA 200.8	0.0005 mg/L	Thornton
Total and Dissolved Chromium	EPA 200.8	0.001 mg/L	Thornton
Total and Dissolved Copper	EPA 200.8	0.002 mg/L	Thornton
Total and Dissolved Iron	EPA 200.7	0.05 mg/L	Thornton
Total and Dissolved Lead	EPA 200.8	0.0005 mg/L	Thornton
Total and Dissolved Manganese	EPA 200.8	0.002 mg/L	Thornton
Total and Dissolved Molybdenum	EPA 200.8	0.002 mg/L	Thornton
Total and Dissolved Selenium	EPA 200.8	0.005 mg/L	Thornton
Total and Dissolved Zinc	EPA 200.8	0.020 mg/L	Thornton
pH	SM 4500-H+ B	1.0 Std Units	Field Teams
Temperature	SM 2550 B	1.0 °C	Field Teams
Conductivity	SM 2510 B	10 µS/cm	Field Teams
Turbidity	SM 2130 B	1.0 NTU	Field Teams

Table Notes:
1) SM refers to the 22nd Edition of Standard Methods for the Examination of Water and Wastewater.
2) Reporting limit goals are matrix dependent and may be increased for complex matrices and may be lower depending on laboratory capability.
3) EPA recommended holding times less than 72 hours may not be met due to the extended sampling routine.
4) Samples collected for nutrients (nitrogen and phosphorus) with a turbidity reading of greater than 100 NTU are analyzed by commercial laboratories that have demonstrated proficiency in analyzing complex matrices for nutrients.

TRIB AUTOSAMPLER 48-HOUR AMBIENT SAMPLES
Program Coordination (Westminster)

Field Equipment

Equipment Installed At Autosampler Locations

- Permanent and tamper-proof enclosure box with lock
- American Sigma 900, 900 Max or other automated sampler
- Power supply – solar panel, rechargeable battery or direct power
- Sample tubing long enough to reach from the autosampler to the streambed. Probes must be contained in protective piping secured in the creek bed
- Dedicated field probes for turbidity, temperature, conductivity and pH
- Depth/velocity flow sensor
- Rain gage at T4/T11
- 24 discrete HCl rinsed autosampler bottles with caps. Bottles must be numbered and inserted in the designated position in autosampler (positions numbered 1 through 24)
- Continuous recording datalogger
- Cellular modem and antenna at T4/T11 and T27

TRIB AUTOSAMPLER 48-HOUR AMBIENT SAMPLES
Autosampler Operation

On a monthly basis between April and October, autosamplers are set to collect time-weighted discrete samples for a 48 hour period. The autosamplers are located at the canal inlets to Standley Lake. In order to associate the relative impacts of the point and nonpoint pollutant sources located between the last autosampler location on Clear Creek (CC AS 59), it is advisable to observe the same "slug" of water at the canal inlets to Standley Lake. The time of travel in the Farmer's Highline canal is calculated from the inflows to the canal at the headgate on Clear Creek.

The time of travel estimates table for the Farmer's Highline Canal is included in Appendix E.

Autosampler Setup:

Equipment required:

- 24 discrete HCl rinsed autosampler bottles with caps
- Keys and/or tools to access autosampler enclosure.
- Field data collection/station audit sheets.

Setup Procedure:

1. Unlock sample enclosure and remove sampler head. Set aside without disturbing or bumping the distributor arm.
2. Load uncapped bottles in the correct positions in the bottom of the sampler.
3. Secure bottles in place with the retaining ring. Store caps in a ziplock bag inside the autosampler until sample collection.
4. Program the sampler according to manufacturer's instructions to collect two 450 ml storm samples per bottle, one sample per pulse.
5. After starting the autosampler, ensure that the distributer arm is positioned above bottle #1.
6. Replace sampler head and lock in place.
7. Record station/equipment information on field sheet.
8. Make sure the autosampler program is ***RUNNING*** before locking the enclosure.
9. The autosampler may be set up ahead of a scheduled start time.

Sample Collection

Additional equipment required:

- Keys and/or tools to access autosampler enclosures
- Large cooler with ice to collect sample bottles
- 24 pre-cleaned, HCl rinsed, discrete sample replacement bottles
- Field data sheets/station audit sheets
- Chain of custody forms
- Laptop with Loggernet software and data cable (9 pin serial cable with SC32B adapter) if retrieving data directly from datalogger
- Two 3-liter Nalgene bottles (clean and rinsed with 1:1 hydrochloric acid) for compositing samples
- 250 mL graduated cylinder (clean and rinsed with 1:1 hydrochloric acid) for compositing samples
- Prepared sample bottles provided by participating Cities for nutrients, solids and metals analyses
    - 1 L square plastic – phosphorus series (Northglenn)
    - 250 mL plastic – nitrogen series (Westminster)
    - 500 mL plastic bottle – TSS (Thornton)
    - 45 mL amber glass vial with septa cap – TOC (Thornton)
    - 500 ml non-preserved metals bottle and 500 ml preserved metals bottle (Thornton)
- Chain of Custody forms – Refer to Appendix C
- Field Sampling form - Refer to Appendix C

Sample Collection Procedure:

1. Unlock enclosure and remove sampler head.
2. Retrieve date/time information from autosampler if required. To collect sample history on American Sigma samplers, press <Change/ Halt> button, press <time/read> button for 5 seconds. The sample collection time for the first sample will appear. Record data on the field sheet. Press <yes> for next sample time to appear. Continue until all data is recorded.
3. Date and time information for samples is also automatically stored in a data file by the dataloggers at all sites except CC59.
4. Record station/equipment information on field sheet.
5. Make note of any samples with high turbidity determined by visual observance or data obtained from the datalogger.
6. Optional compositing of samples in the field is performed by pouring off equal volumes into three-liter (or larger) pre-cleaned bottles. The 24 sample bottles may also be brought back to a laboratory for compositing. Refer to the Sample Compositing Procedure Step 1. Save remaining volume of any high turbidity samples to take back to the lab. Discard remaining sample.
7. Clean out autosampler base and reload with a new set of pre-cleaned bottles.
8. Reset the autosampler by pressing the START button (Sigma 900 autosampler). Ensure that the distributor arm is parked over bottle #1 and the display reads “Program Running” before closing the autosampler and placing it back in the enclosure.
9. Return to the Westminster Water Quality Laboratory for compositing, splitting, distribution and wet chemistry analysis of pH, turbidity and conductivity.

TRIB AUTOSAMPLER 48-HOUR AMBIENT SAMPLES

Sample Compositing

1. Composite samples in the laboratory if compositing was not performed in field. Shake sample bottles and pour equal volumes of sample from the first 12 bottles into a composite bottle marked “A”. Shake sample bottles and pour equal volumes of sample from the remaining 12 bottles into a composite bottle marked “B”.
2. Perform turbidity, temperature, pH and conductivity measurements on composited samples. Enter data on the Sampling Form.
3. Use the well mixed composites (A and B) to fill the appropriate bottles for the Northglenn, Thornton and Westminster labs.
4. If any discreet bottle(s) appears to have an unusually high turbidity and enough sample is available, analyze for turbidity and conductivity. Record on Sampling Form. If there is enough sample, pour the high turbidity discreet samples into separate nutrient and solids bottles for individual analysis.
5. Complete the COCs.
6. Relinquish to each city their respective samples (Westminster-nitrogen series, Thornton-TSS, metals and TOC, Northglenn-phosphorus series) and sign COCs as appropriate.
7. Original field data sheets and COCs are retained by the Cities of Westminster for permanent archive.
8. Samples are created in the web-accessible Excel spreadsheet by Westminster for data entry and results archive.

TRIB AUTOSAMPLER EVENT SAMPLES
Program Coordination (Westminster)

Field Sampling Team: Westminster

The event autosampler program was initiated on the Tributaries in 2009 at CC AS T11 to assess the pollutant concentrations mobilized during significant snow melt (runoff) or rain events at the location closest to Standley Lake. Automated sample collection of stormwater is triggered based on a turbidity reading of 100 NTU. The autosampler may also be activated remotely to begin sampling immediately or programmed to start sampling at a designated time in an attempt to capture the downstream effects of a storm in the upper watershed based on time of travel. The autosampler collects discrete samples every 15 minutes until the ambient condition drops below the trigger level or until the maximum number of samples is collected. The discrete samples may be analyzed individually or multiple discrete samples may be composited based on the field observations.

TRIB AUTOSAMPLERS EVENT MONITORING
Sample Locations

Trib Autosampler Event Samples are only collected at CC AS T11. First flush samples may be collected at all three Trib Autosampler Continuous Monitoring locations.

CC AS T11 Event	Farmers Highline Canal approximately 0.5 mile from Standley Lake inlet

Table Note: Historical data from this location is available as part of the Clear Creek Canal Program which was eliminated in 2008. The sample location identifications associated with the Clear Creek Canal Program have been retained.

TRIB AUTOSAMPLER EVENT SAMPLES
Flow Monitoring

Flow in the canals is tracked by the ditch operators and water accountants. The average daily flow data corresponding with the time-event composited samples will be used for loadings calculations for storm events.

Refer to Appendix E for the time of travel data for the Farmers Highline Canal. Time of travel studies have not been performed from the canal headgates on Clear Creek to Standley Lake for the Croke Canal or the relocated Church Ditch inlet structure.

TRIB AUTOSAMPLER EVENT SAMPLES
Analytical Parameters

Storm event samples are analyzed for the same suite of analytical parameters listed in the previous section for the 48-hour ambient samples. Samples may not be analyzed within the EPA recommended holding time for some parameters based on the random nature of the storm event triggering.

TRIB AUTOSAMPLER EVENT SAMPLES

Field Equipment

Storm event sampling utilizes the same equipment listed in the previous section for the 48-hr ambient samples.

Autosampler Operation

Field equipment used for storm event sampling is operated using the same techniques as described in the previous section for 48-hr ambient sampling.

Sample Compositing

Sample compositing is performed similarly to the procedure described in the previous section for 48-hr ambient sampling; however, fewer samples are typically composited based on the severity and/or duration of a storm event.

STANDLEY LAKE MONITORING PROGRAM

Standley Lake is a storage reservoir that serves as the raw drinking water source for the SLC. Over 250,000 consumers rely on Standley Lake for their drinking water. The Standley Lake ("SL") Monitoring Program is designed to provide water quality information in order to evaluate internal loadings in Standley Lake and the effects of nutrient reduction measures and best management practices on the trophic status of Standley Lake. Regularly spaced and frequent sampling is necessary to provide sufficient data for monitoring trends for the analytes used to evaluate trophic status including dissolved oxygen, chlorophyll and nutrients.

The main water quality monitoring efforts on Standley Lake include:

- Daily top to bottom lake profiles
- Bimonthly grab samples
- Zooplankton tows
- Invasive species monitoring and control

SL – DAILY LAKE PROFILES

Program Coordination (Westminster)

The sampling location in Standley Lake (Site 10-00) is situated near the outlet structure. The lake site was selected based on the lengthy historical record of water quality monitoring data and because the water is drawn from the lake at this location via pipelines to the SLC's water treatment plants. Sampling at varying depths in the lake provides extensive information for use in drinking water treatment process decisions and evaluating water resource management options.

Standley Lake is monitored at Site 10-00 using an automated profiler equipped with a multi-probe sonde four times each day from early spring to late fall for the analytes listed in the following table. The profiler is removed from the lake prior to freezing of the lake surface. Refer to the watershed map in Appendix B for the location of the SL monitoring location. The solar powered unit collects data from the surface of the lake to within five feet off the bottom and every meter in between. The profiler data is accessible via the internet and provides a depth-integrated profile of the lake water quality.

SL – DAILY LAKE PROFILES

Analytical Parameters

Analyte	**Analytical Method Reference**	**Reporting Limit Goal**
Temperature	SM 2560 A	1.0 °C
pH	SM 4500-H+ B	1.0 Std Units
Conductivity	SM 2510 B	10 µS/cm
Turbidity	SM 2130 B	1.0 NTU
Dissolved Oxygen	YSI (optical probe)	1.0 mg/L
Chlorophyll	YSI (electrode)	1.0 µg/L
ORP	SM 2580 A	1.0 mv

Table Notes: 1) SM refers to the 22nd Edition of Standard Methods for the Examination of Water and Wastewater.
2) Reporting limits are matrix dependent and may be increased for complex matrices.

SL – BIMONTHLY GRAB SAMPLES

Program Coordination: Westminster

The same sampling location in Standley Lake (Site 10-00) is used for both the daily lake profiles and the bimonthly grab samples. Sampling at varying depths in the lake provides extensive information for use in drinking water treatment process decisions and evaluating water resource management options. Refer to the watershed map in Appendix B for the location of the SL monitoring location.

SL – BIMONTHLY GRAB SAMPLES

Locations

Grab samples are collected twice each month from March through November, but the sampling may be extended during the winter if the lake is not frozen. The raw water pipeline at Semper (T-24) may be sampled for a subset of the routine analytical parameters when the lake is frozen or when safety of the sampling team is a concern (i.e. high winds, frozen boat dock ramp, etc.).

Sample Identification	**Sample Location**
SL 10-00	SL surface
SL 10-PZ	SL at two times the Secchi depth
SL 10-70	SL at five feet off the bottom. (Approximate depth of 60 ft when lake is full at gage height 96)
SL 69-00	SL surface at the boat dock
T-24	Semper raw water pipeline. T-24 is approximately 10 ft higher than SL 10-70

SL – BIMONTHLY GRAB SAMPLES

Analytical Parameters

Analyte	**Analytical Method Reference**	**Reporting Limit Goal**	**Responsible Laboratory**
Temperature	SM 2550 B	1.0 °C	Field Team
pH	SM 4500-H+ B	1.0 Std Units	Field Team
Conductivity	SM 2510 B	10 µS/cm	Field Team
Turbidity	SM 2130 B	1.0 NTU	Field Team
Dissolved Oxygen	YSI (optical probe)	1.0 mg/L	Field Team
ORP	YSI (electrode)	1 mv	Field Team
Chlorophyll	YSI (electrode)	1.0 µg/L	Field Team
Secchi Depth	Secchi disk	0.1 meter	Field Team
Total Nitrogen	SM 4500-NO3 I	0.02 mg/L	Westminster
Nitrate/Nitrite as N	SM 4500-NO3 I	0.01 mg/L	Westminster
Ammonia as N	SM 4500-NH3 H	0.01 mg/L	Westminster
Gross Alpha and Gross Beta	EPA 900.0	0.1 pCi/L	Westminster
Zooplankton	SM 10900	1 per L	Westminster
Algae	SM 10900	1 per mL	Westminster
Chlorophyll *a*	SM 10200-H	1.0 µg/L	Westminster
UV-254	SM 5910 B	0.001 cm^{-1}	Westminster
Total Phosphorus	SM 4500-P E	0.0025 mg/L	Northglenn
Ortho-phosphate as P (dissolved) or DRP	SM 4500-P E	0.0025 mg/L	Northglenn
Total Organic Carbon	SM 5310 B	0.5 mg/L	Thornton
Total Suspended Solids	SM 2540 D	1 mg/L	Thornton
Total and Dissolved Arsenic	EPA 200.8	0.001 mg/L	Thornton
Total and Dissolved Barium	EPA 200.8	0.002 mg/L	Thornton
Total and Dissolved Cadmium	EPA 200.8	0.0005 mg/L	Thornton
Total and Dissolved Chromium	EPA 200.8	0.001 mg/L	Thornton
Total and Dissolved Copper	EPA 200.8	0.002 mg/L	Thornton
Total and Dissolved Iron	EPA 200.7	0.05 mg/L	Thornton
Total and Dissolved Lead	EPA 200.8	0.0005 mg/L	Thornton
Total and Dissolved Manganese	EPA 200.8	0.002 mg/L	Thornton
Total and Dissolved Molybdenum	EPA 200.8	0.002 mg/L	Thornton
Total and Dissolved Selenium	EPA 200.8	0.005 mg/L	Thornton
Dissolved Silicon	EPA 200.7	0.02 mg/L	Westminster
Total and Dissolved Zinc	EPA 200.8	0.020 mg/L	Thornton
Total Mercury	EPA 245.1	0.0002 mg/L	Thornton
Total Hardness (as $CaCO_3$)	EPA 130.2	5 mg/L	Thornton
E. coli	SM 9221 D	1 cfu/100mL	Thornton
BTEX	EPA 524.2	0.0005 mg/L	Thornton

Table Notes: 1) SM refers to the 22nd Edition of Standard Methods for the Examination of Water and Wastewater.
2) Reporting limit goals are matrix dependent and may be increased for complex matrices and may be lower depending on laboratory capability.

SL – BIMONTHLY GRAB SAMPLES

Analytical Scheme

The analytical scheme for Standley Lake was designed to capture the biological, physical and chemical changes occurring in the lake ecosystem throughout the year. Seasonality plays an important role in lake dynamics and subsequently, on the water treatment processes. The table below details the variable analytical scheme, with the caveat that weather patterns may require modification to the plan. Rads (Gross Alpha and Gross Beta) and metals are collected before and after run-off, and before and after lake turnover, which are both subject to annual fluctuation.

Month	**Lake Sample Location**	**Analytes**														
		Hand Profile	Secchi depth	Rads	E coli	Zooplankton	Nutrients	Metals	Algae	Chlorophyll *a*	TOC	TSS	Total Hardness	BTEX	UV-254	Dissolved Silicon
January 1st week	10-00	X	X	X	X	X										
	10-PZ			X			X	X	X	X	X	X	X		X	X
	10-70	X		X	X		X	X			X	X	X		X	X
	T-24								X						X	
January 3rd week	10-00	X	X			X										
	10-PZ						X		X	X					X	X
	10-70	X					X								X	X
	T-24								X						X	
February 1st week	10-00	X	X		X	X										
	10-PZ						X		X	X	X	X	X		X	X
	10-70	X			X		X				X	X	X		X	X
	T-24								X						X	
February 3rd week	10-00	X	X			X										
	10-PZ						X		X	X					X	X
	10-70	X					X								X	X
	T-24								X						X	
March 1st week	10-00	X	X	X	X	X										
	10-PZ			X			X		X	X	X	X	X		X	X
	10-70	X		X	X		X				X	X	X		X	X
	T-24								X						X	
March 3rd week	10-00	X	X			X										
	10-PZ						X		X	X					X	X
	10-70	X					X								X	X
	T-24								X						X	
April 1st week	10-00	X	X		X	X										
	10-PZ						X		X	X	X	X	X		X	X
	10-70	X			X		X				X	X	X		X	X
	69-00													X		
	T-24								X						X	
April 3rd week	10-00	X	X			X										
	10-PZ						X		X	X					X	X
	10-70	X					X								X	X
	T-24								X						X	

Month	**Lake Sample Location**	**Analytes**														
		Hand Profile	Secchi depth	Rads	E coli	Zooplankton	Nutrients	Metals	Algae	Chlorophyll *a*	TOC	TSS	Total Hardness	BTEX	UV-254	Dissolved Silicon
May 1st week	10-00	X	X		X	X										
	10-PZ						X		X	X	X	X	X		X	X
	10-70	X			X		X				X	X	X		X	X
	T-24								X						X	
May 3rd week	10-00	X	X			X										
	10-PZ						X		X	X					X	X
	10-70	X					X								X	X
	69-00													X		
	T-24								X						X	
June 1st week	10-00	X	X	X	X	X										
	10-PZ			X			X	X	X	X	X	X	X		X	X
	10-70	X		X	X		X	X			X	X	X		X	X
	T-24								X						X	
June 3rd week	10-00	X	X			X										
	10-PZ						X		X	X					X	X
	10-70	X					X								X	X
	69-00													X		
	T-24								X						X	
July 1st week	10-00	X	X		X	X										
	10-PZ						X		X	X	X	X	X		X	X
	10-70	X			X		X				X	X	X		X	X
	T-24								X						X	
July 3rd week	10-00	X	X			X										
	10-PZ						X	**X**	X	X			X		X	X
	10-70	X					X	**X**					X		X	X
	69-00													X		
	T-24								X						X	
August 1st week	10-00	X	X		X	X										
	10-PZ						X		X	X	X	X			X	X
	10-70	X			X		X				X	X			X	X
	T-24								X						X	
August 3rd week	10-00	X	X	X		X										
	10-PZ			X			X	X	X	X			X		X	X
	10-70	X		X			X	X					X		X	X
	69-00													X		
	T-24								X						X	
September 1st week	10-00	X	X		X	X										
	10-PZ						X		X	X	X	X			X	X
	10-70	X			X		X				X	X			X	X
	T-24								X						X	

Month	Lake Sample Location	Analytes														
		Hand Profile	Secchi depth	Rads	E coli	Zooplankton	Nutrients	Metals	Algae	Chlorophyll *a*	TOC	TSS	Total Hardness	BTEX	UV-254	Dissolved Silicon
September	10-00	X	X	X		X										
3rd week	10-PZ			X			X	X	X	X			X		X	X
	10-70	X		X			X	X					X		X	X
	69-00													X		
	T-24								X						X	
October	10-00	X	X		X	X										
1st week	10-PZ						X	**X**	X	X	X	X	X		X	X
	10-70	X			X		X	**X**			X	X	X		X	X
	T-24								X						X	
October	10-00	X	X	X		X										
3rd week	10-PZ			X			X	X	X	X			X		X	X
	10-70	X		X			X	X					X		X	X
	69-00													X		
	T-24								X						X	
November	10-00	X	X		X	X										
1st week	10-PZ						X		X	X	X	X	X		X	X
	10-70	X			X		X				X	X	X		X	X
	T-24								X						X	
November	10-00	X	X			X										
3rd week	10-PZ						X		X	X					X	X
	10-70	X					X								X	X
	T-24								X						X	
December	10-00	X	X	X	X	X										
1st week	10-PZ			X			X		X	X	X	X	X		X	X
	10-70	X		X	X		X				X	X	X		X	X
	T-24								X						X	
December	10-00	X	X			X										
3rd week	10-PZ						X		X	X					X	X
	10-70	X					X								X	X
	T-24								X						X	

Table notes:

1) Hand Profile includes analysis of temperature, pH, conductivity, turbidity, DO, chlorophyll and ORP at the surface of the lake and at the bottom of the lake using the sonde.
2) Rads includes Gross Alpha and Gross Beta.
3) Metals includes the total and dissolved forms of As, Ba, Cd, Cr, Cu, Fe, Pb, Mn, Mo, Se and Zn, dissolved Si and total Hg. **Metals for the 3rd week of July and the 1st week of October consist of ONLY total and dissolved arsenic.**
4) Nutrients include the phosphorus series and the nitrogen series analytes. Phosphorus series includes total P and dissolved ortho-phosphate-P (also referred to as DRP). Nitrogen series includes total N, ammonia-N and nitrate/nitrite-N.
5) Total Hardness is reported as $CaCO_3$.

SL – BIMONTHLY GRAB SAMPLES
Program Coordination (Westminster)

SL Sample bottle kit

The sample containers required for each monitoring event varies depending on the parameters to be analyzed. Westminster will assemble sample bottle kits for each event. The following table details the sample containers for various parameters.

Parameter	Volume	Bottle Type	Laboratory
Phosphorus series	1L	Rectangular plastic	Northglenn
Nitrogen series, UV-254	250 mL	Rectangular plastic	Westminster
Rads	1 L	Plastic	Westminster
Zooplankton	250 mL	Plastic	Westminster
Algae	1 L	Plastic	Westminster
Chlorophyll *a*	1 L	Brown plastic	Westminster
Dissolved Silica	250 mL	Rectangular Plastic	Westminster
Total metals, Total Hg	500 mL	Plastic	Thornton
Dissolved metals	500 mL	Plastic	Thornton
TOC	40 mL	Glass vial	Thornton
TSS, Total Hardness	500 mL	Plastic jug	Thornton
E. coli	250 mL	Glass	Thornton
BTEX	40 mL	Glass vial	Thornton
BTEX trip blank	40 mL	Glass vial	Thornton

Table Notes:
1) A trip blank is required to be prepared when field samples are collected for BTEX. The trip blank is comprised of a pre-cleaned glass vial filled with DI and is used to monitor for volatile organic contamination during transport and lab storage prior to analysis. Analysis of the trip blank is only required when any of the BTEX analytes are detectable in the field samples.
2) Phosphorus series includes total P and dissolved ortho-phosphate-P (also referred to as DRP).
3) Nitrogen series includes total N, ammonia-N and nitrate/nitrite-N.
4) Rads includes: Gross Alpha and Gross Beta
5) BTEX includes: benzene, toluene, ethyl benzene and total xylenes

SL – BIMONTHLY GRAB SAMPLES

Sample Collection

Equipment

Pontoon Boat
Marking Pen – Waterproof
Depth Finder
Secchi Disk
Log book and pen
Van Dorn bottle
Labeled sample bottles (refer to individual monitoring plans)
Churn sample splitter
PZ tube sampler
Ice packs
Coolers
Chain of custody forms
YSI 6600 Sonde - calibrated
YSI 650 Meter and cable
Handheld anemometer/%Relative humidity meter
Cellular phone
GPS unit
Digital camera
Boat Tool Kit
Laptop computer – fully charged with communication cable and "console" application installed
Water pitcher and wide bristle brush for cleaning sonde cage
Jackets, hats, gloves or other protective clothing as appropriate for the weather conditions
First aid kit
Personal flotation devices (one per person)
Survival Suits – yellow (1 hr protection) and orange (1/2 hr protection) -as appropriate
Profiler enclosure key
Boat Anchor(s)
Key for boat ramp during off-season
Zooplankton tow net – 63 µm

Sample collection procedure

At Laboratory

- Prepare and label all required sampling containers.
- Complete basic information on the chain of custody (COC) forms.
- Update the YSI 6600 file names using the format XXMMDDYY, where XX denotes the field sampling program identification (e.g. SL, CC, RC, etc.), MM denotes the month, DD denotes the day and YY denotes the year.
- Notify laboratories about the sampling event and schedule sample pickup.
- Assemble the sampling equipment and load into the truck.
- Calibrate the sonde.

Sampling on Standley Lake

Van Dorn Bottle

- The Van Dorn bottle provides a means of collecting water samples at selected depths below the surface. It is made of an open-ended plastic cylinder that is attached to a rope, and lowered to any desired depth.
- Each end of the cylinder is fitted with a rubber cover. The Van Dorn bottle is attached to the length of rope, marked in 0.1 m increments, with the covers pulled out and attached to the trigger device.
- The depth of the lake is determined using the sonde. The bottle is lowered to a depth one meter above the bottom of the lake.
- A metal weight called a "messenger" is attached to the rope above the bottle. The water sample is taken by dropping a weighted “messenger" down the rope. When the weight hits the triggering device on the upper Van Dorn bottle, the catch releases the rubber end covers. The two covers are pulled together and seal off the ends.
- When the bottle has been closed, it is pulled to the surface.
- Water samples from the Van Dorn bottle are transferred to the appropriate sample containers.
- The Van Dorn sampler has a four liter capacity. If the volume of sample required is greater than the Van Dorn sampler can hold, multiple sample volumes can be collected and combined in the churn. The churn and churn spigot should be rinsed out with new sample water prior to sample collection in order to prevent cross-contamination from prior samples. Once the churn contains enough sample, it is thoroughly mixed and the sample is dispensed into the required sample containers.
- Sample containers are labeled with sample location, date and time of sample collection and the sampler’s initials. The label should indicate any preservative in the sample container.
- Full sample containers are placed in coolers with ice packs until they are returned to the laboratory.

PZ Tube Sampler

- The PZ (photic zone) sampler is used to sample a column of water from the surface of the lake to the depth of the photic zone. Photic zone is defined as twice the secchi depth. The PZ sampler is comprised of a churn sample splitter connected to a polypropylene tube equipped with a quick release connector on one end and a check valve on the other end.
- Measure the secchi depth through the floor port on the pontoon boat. Do not wear sunglasses. Record data in the logbook.
- Hook up the quick release connector end of the tube to the churn.
- The tube is marked in 0.5 meter lengths. Lower the end of the tube with the check valve into the water until it is at the depth of the photic zone.
- Pull the tube up out of the water and hold the end with the check valve upside-down at a height over your head, until the tube drains down to floor level, then quickly drop the check-valve end of the tube back into the water vertically to the depth of the photic zone. The water entering the end of the tube will push the air bubble and prior sample into the churn as the tube is lowered into the water. Use the first collected volume of sample to rinse the tube and churn. Waste the sample back to

the lake. Start collecting the second volume of sample. Repeat this step until sufficient quantity of sample has been collected in the churn. The capacity of the churn is 12 liters.

- Once the churn contains enough sample, it is thoroughly mixed and the sample is dispensed into the required sample containers.
- Sample containers are labeled with sample location, date and time of sample location and the sampler's initials. The label should indicate any preservative in the sample container.
- Sample containers are placed in a cooler with ice packs until they are returned to the laboratory.

Surface Sampling

- Surface sampling is accomplished through the floor port of the pontoon boat. Sample containers are dipped into the water until full to collect samples.
- Sample containers are labeled with sample location, date and time of sample collection and the sampler's initials. The label should indicate any preservative in the sample container.
- Sample containers are placed in a cooler with ice packs until they are returned to the laboratory.

Zooplankton Tows

- Zooplankton samples are collected at SL-10 using a 63 µm tow net.
- A vertical tow sampling methodology involves lowering the tow net to the bottom of the lake and retrieving it at a slow speed of approximately one foot per second up to the surface.
- The zooplankton collected in the net are washed into a 250 mL sample bottle using multiple DI water rinses to ensure all organisms in the net are transferred to the sample container. The final volume in the bottle is not required to be consistent.
- The sample depth is recorded on the sample bottle along with date and location.

SL – AQUATIC INVASIVE SPECIES MANAGEMENT

Eurasian Watermilfoil

Eurasian Watermilfoil ("EWM"), *Myriophyllum spicatum L*, is a non-native, aquatic, noxious weed that grows rapidly and to a depth of 35 feet. EWM grows in dense mats that severely interfere with recreation and has been known to provide a substrate for blue-green algae growth. Blue-green algae blooms can ultimately cause taste and odor events in drinking water supplies. EWM was first observed in Standley Lake in 1998. It was positively identified in 2000. In 2012, it was confirmed that the Eurasian watermilfoil hybridized with a native Colorado species Northern watermilfoil (Myriophillum sibiricum). The hybrid species is more robust and grows even quicker than the Eurasian watermilfoil.

Eurasian milfoil weevils have been stocked in the lake (on the west side) on four occasions from 2004 through 2011. The weevil larva bore into the stem of the milfoil which damages the plant. When an adequate weevil population is sustained, the weevils may be able to control the spread of the milfoil. Annual surveys of weevil populations in the lake are performed by contractors. Standley Lake experienced a steady milfoil density decline from 2006, of 500 stems/m^2 to 26 stems/m^2 in 2011. Unfortunately with the appearance of the hybrid milfoil, the density again increased in 2012 to 106 stems/m^2.

In 2007 the SLC initiated a pilot study on Standley Lake using two solar pond aerators to investigate the theory that continuous aeration will oxidize the sediment and deprive the milfoil of nutrients. Samples were collected and analyzed for nutrients to assess nutrient reduction at the aerator sites compared to other sites in the lake. The solar aerators were removed in the fall of 2009. The results of the study were inconclusive as there was an overall reduction in milfoil growth throughout the lake in 2009.

As lake conditions permit, bathymetric studies are performed on Standley Lake during the early summer for mapping the submerged aquatic vegetation in order to assess milfoil growth and the effectiveness of the remedies.

Zebra and Quagga Mussels

Zebra and quagga mussels are non-native, aquatic invasive species that are introduced to new water bodies by the unintentional transfer of organisms from an infested water body via boats or fishing bait. Aquatic mussels cause serious damage to the ecosystem and result in costly control procedures for drinking water treatment facilities. Both zebra and quagga mussels were discovered in 2008 in a few of Colorado's lakes. Prevention of aquatic mussel infestation is key to protecting Standley Lake. An intensive boat inspection and decontamination program was initiated in 2008 to protect the lake from new invasive species. No live aquatic baits are allowed at Standley Lake.

Standley Lake is monitored for aquatic mussels every two weeks using the zooplankton tow procedure described previously. The tows are performed at the lake inlets, SL-10, and the boat ramp/outlet area. Several invasive species have a planktonic life stage and sampling with the plankton nets will provide early warning of infestation. In addition, substrate samplers, constructed and monitored by Colorado Parks and Wildlife are placed throughout the lake. Substrate samplers are made up of a float, rope, plastic plates and an anchor weight. A plate is located at every 10 feet of depth from the surface to the bottom of the lake at various locations. The plates and ropes are checked periodically for aquatic mussel growth. A plate or rope that feels like sand paper will be scraped and examined under the microscope for veligers (zebra or quagga mussel larvae).

Shoreline surveys are performed when the water level is at the lowest for the year. A shoreline survey consists of walking the shoreline in teams looking for adult mussels attached to any hard substrate.

DATA MANAGEMENT AND REPORTING

The City of Westminster is responsible for management of the data collected in support of the monitoring efforts. A Microsoft Excel spreadsheet is used for archival of monitoring data collected for all programs detailed in this document except the lake profile data. The IGA partners have access to the system via an internet host site which also provides backup protection for the data.

The City of Westminster logs in all samples collected by the various sampling teams. The coordinated sample creation effort reduces interpretation errors and subsequent reporting inconsistencies. Each IGA partner is responsible for analytical results entry for their assigned analyses into the spreadsheet. On a quarterly basis, a peer review team, comprised of at least one representative from each of the SLC, evaluates the data and identifies possible errors or data anomalies. Each city makes corrections to the spreadsheet and submits a final version of the data. The spreadsheet is current to within six months.

Data results from this program, along with other reporting requirements as stated in the Joint Agreement, will be reported to the Colorado Water Quality Control Commission on an annual basis. Only data collected during the normal sampling schedule is included in the annual report. The data is reported in tabular and graphic formats.

Each laboratory must retain all records (i.e. field notebooks and logs, instrument logs, bench sheets, instrument printouts, electronic data files, chain of custody forms, etc.) pertaining to the monitoring programs until the SLC IGA representatives jointly, in writing, authorize disposal of the records.

The periods of record for monitoring data are summarized in the following table:

Program	Period of Record	Available Format
Clear Creek Grabs	1994 – 2001	MS Access/Excel
	2002 – current	MS Excel
Clear Creek Grabs - EPA Metals Data	1994 – current	MS Excel
Clear Creek Autosamplers Ambient	2006 – current	MS Excel
Clear Creek Autosamplers Event	2006 – current	MS Excel
Standley Lake Tributaries – grabs and autosamplers (includes data for the program formerly called Clear Creek Canals)	1988 – 2001	MS Access/Excel
	2002 - current	MS Excel
Standley Lake	1988 – 2001	MS Access/Excel
	2002 - current	MS Excel

Table Notes: The data archive includes phosphorus data from 1999-current, all Thornton data from 2001-current and all Westminster data from 2002-current.

Appendix C – Clear Creek, Canal, and Standley Lake Water-Quality Monitoring Data – 2014

APPENDIX C1 CLEAR CREEK GRAB SAMPLES

APPENDIX C2 TRIBUTARY GRAB SAMPLES

APPENDIX C3 AMBIENT AUTOSAMPLERS

APPENDIX C4 CLEAR CREEK AMBIENT AUTOSAMPLERS—METALS (GOLDEN)

APPENDIX C5 EVENT AUTOSAMPLERS

APPENDIX C6 CLEAR CREEK EVENT AUTOSAMPLERS—METALS (GOLDEN)

APPENDIX C7 STANDLEY LAKE SAMPLES

Clear Creek Grabs

Method				SM2550B	SM4500H+B	SM2510B	SM4500OG	SM2130B	SM5310B	SM2540D	SM4500NH3H	SM4500NO3I	SM4500NO3I	SM4500PE	SM4500PE				
Reporting Limit Goal				1.0	1.0	10	1.0	1	0.5	1	0.01	0.01	0.02	0.0025	0.0025				
figs				3	3	3	3	3	3	3	3	3	3	3	3				
decimals				1	1	0	1	1	1	0	2	2	2	4	4				
Reporting Units				°C	s.u.	µS/cm	mg/L	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L				
Sample Date	Sample Time	Sample Type	Location ID	Temp	pH	Conductivity, Specific	Oxygen, Dissolved	Turbidity	Carbon, Total Organic	Solids, Total Suspended	Nitrogen, Ammonia (Salicylate)	Nitrogen, Nitrate+Nitrite	Nitrogen, Total Nitrogen	Phosphorus, Dissolved (DRP)	Phosphorus, Total	Notes	Conclusion	Field Notes	Lab Notes
02/10/14	10:20	G	CC 26	<1	8.3	319	NT	6.6	1.3	<1	0.02	0.4	0.6	0.0055	0.0095				
NS	NS	G	CC 40													Not sampled. Location frozen			
02/10/14	11:00	G	CC 50	1.4	7.8	655	NT	61.3	1.7	18	0.03	0.47	0.64	0.0034	0.0199				
NS	NS	G	CC 60													Not sampled. Location frozen			
04/01/14	9:55	G	CC 26	3.4	6.7	540	8.9	1	1.1	3	0.01	0.27	0.42	< 0.0025	0.0048				
04/01/14	10:16	G	CC 40	3.6	7.2	349	9.5	<1	1.2	2	< 0.01	0.3	0.46	0.0026	0.0059				
04/01/14	10:25	G	CC 50	4.3	7.1	454	9.5	20	1.9	12	0.02	0.28	0.47	< 0.0025	0.0073				
04/01/14	10:52	G	CC 60	3.7	7.1	368	9.5	3	1.3	4	< 0.01	0.27	0.47	< 0.0025	0.0059				
05/21/14	10:00	G	CC 05	5.8	7.7	635	9.5	5.5	4.8	2	< 0.01	0.11	0.26	0.0027	0.0126				
05/21/14	10:25	G	CC 10	6.5	7.9	352	9.7	1.6		1	< 0.01	0.13	0.24	< 0.0025	0.007				
05/21/14	10:34	G	CC 15	5.3	7.4	333	9	4.9		4	0.04	0.17	0.44	0.0037	0.0115			Staff gage = 4.15 ft	
05/21/14	10:58	G	CC 20	6.1	7.6	222	9.4	13.9	4.2	18	0.01	0.12	0.36	0.0047	0.0283			Staff gage = 5.10 ft	
05/21/14	9:48	G	CC 25	11.1	8.1	813	9.8	3.6		2	< 0.01	0.11	0.29	0.0026	0.0093				
05/21/14	10:52	G	CC 26	9.7	7.6	746	10.8	8.2	3.1	8	< 0.01	0.11	0.29	0.0031	0.0155				
05/21/14	10:00	G	CC 30	5.2	7.8	83	9.7	9.8		13	0.01	0.05	0.44	0.0049	0.0212			Staff gage = 2.0 ft	
05/21/14	11:34	G	CC 34	9.2	7.9	656	11.8	11.6		14	< 0.01	0.1	0.32	0.003	0.0179				
05/21/14	11:21	G	CC 35	7.5	8	242	10.7	12.6	4.5	18	< 0.01	0.05	0.28	0.0058	0.0327				
05/21/14	9:39	G	CC 40	7	7.8	218	9.5	13.2	6.1	29	0.01	0.11	0.57	0.0037	0.0279			Staff gage = 4.80 ft	
05/21/14	11:48	G	CC 44	5.7	7.7	66	9.4	21.6		43	< 0.01	0.03	0.43	0.0074	0.0419				
05/21/14	12:03	G	CC 45	6.6	7.4	108	9.3	26.5	4.2	3	0.01	0.04	0.38	0.0067	0.0589				
05/21/14	12:27	G	CC 50	7.5	7.4	148	9.4	60.2	4.9	99	0.02	0.08	0.6	0.0068	0.0913				
05/21/14	11:57	G	CC 52	11.3	7.7	577	10.9	21.9	4.5	42	< 0.01	0.1	0.37	0.0054	0.041				
05/21/14	11:59	G	CC 53	12	7.9	944	10.7	9.2	4.2	14	< 0.01	0.37	0.66	0.0068	0.0279				
05/21/14	13:24	G	CC 60	10.1	7.6	210	9.3	31.1	4.3	21	0.01	0.12	0.66	0.0042	0.0747				
05/21/14		QC	CCP104												0.0285	Blind QC sample			
05/21/14		QC	CCD104										0.27		0.0177	Blind QC sample			
05/21/14		QC	CCN104										0.56			Blind QC sample			
06/18/14		G	CC 26	8.7	7	365	7.9	2.6	3.2	5	< 0.01	0.11	0.18	0.0359	0.0583				
06/18/14		G	CC 40	8.5	7.2	291	6.2	4	2.3	9	0.01	0.11	0.19	0.0206	0.0336				
06/18/14		G	CC 50	9.6	7.3	395	6.1	3.8	2.9	6	0.01	0.06	0.16	0.012	0.035				
06/18/14		G	CC 60	10.7	7.5	371	7.6	6.5	2.3	11	< 0.01	0.11	0.18	0.0094	0.0244				
10/22/14	9:43	G	CC 05	3.3	8	166	10.6	<1	1.7	6	< 0.01	0.22	0.29	0.0058	0.0074				
10/22/14	10:04	G	CC 10	4.1	8.2	144	11.1	<1		6	< 0.01	0.12	0.17	0.0029	0.0032				
10/22/14	9:55	G	CC 15	3.8	7.5	537	9.4	1.1		9	0.11	0.3	0.48	< 0.0025	0.0034				
10/22/14	10:20	G	CC 20	5.1	7.6	330	9.5	1.6	1.5	4	0.01	0.23	0.34	0.003	0.0098				

Clear Creek Grabs

Method				SM2550B	SM4500H+B	SM2510B	SM4500OG	SM2130B	SM5310B	SM2540D	SM4500NH3H	SM4500NO3I	SM4500NO3I	SM4500PE	SM4500PE				
Reporting Limit Goal				1.0	1.0	10	1.0	1	0.5	1	0.01	0.01	0.02	0.0025	0.0025				
figs				3	3	3	3	3	3	3	3	3	3	3	3				
decimals				1	1	0	1	1	1	0	2	2	2	4	4				
Reporting Units				°C	s.u.	µS/cm	mg/L	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L				
Sample Date	Sample Time	Sample Type	Location ID	Temp	pH	Conductivity, Specific	Oxygen, Dissolved	Turbidity	Carbon, Total Organic	Solids, Total Suspended	Nitrogen, Ammonia (Salicylate)	Nitrogen, Nitrate+Nitrite	Nitrogen, Total Nitrogen	Phosphorus, Dissolved (DRP)	Phosphorus, Total	Notes	Conclusion	Field Notes	Lab Notes
NS	NS	G	CC 25													No access at sample location			
10/22/14	10:22	G	CC 26	5.7	8.1	253	11.2	2.6	1.2	6	0.01	0.19	0.3	0.003	0.006				
10/22/14	10:40	G	CC 30	5	7.7	75	10.1	<1		5	< 0.01	0.08	0.15	0.0025	0.0053				
10/22/14	10:52	G	CC 34	6.7	8	230	10.2	1.1		5	< 0.01	0.17	0.25	<0.0025	0.0055				
10/22/14	10:44	G	CC 35	4.6	8.4	83	10.9	1.2	1.6	1	< 0.01	0.09	0.21	< 0.0025	0.0072				
10/22/14	11:00	G	CC 40	6.4	8	258	9.8	1.1	1.2	10	< 0.01	0.16	0.24	0.0034	0.006				
10/22/14	11:25	G	CC 44	5.2	7.8	120	9.4	<1		4	< 0.01	< 0.01	0.07	< 0.0025	0.0037				
10/22/14	11:40	G	CC 45	7.1	6.9	512	8.8	27.5	1.6	25	0.03	0.03	0.15	0.003	0.0081				
10/22/14	12:00	G	CC 50	9.4	7.6	590	9	40.5	3.6	22	0.03	1.08	1.4	< 0.0025	0.0175				
10/22/14	11:17	G	CC 52	7.8	8	461	9.5	2	2.4	9	< 0.01	0.3	0.42	0.0027	0.0086				
10/22/14	11:20	G	CC 53	8.8	8.4	592	9.5	2.1	2.7	7	< 0.01	0.32	0.48	0.0048	0.0119				
10/22/14	12:30	G	CC 60	8.5	7.9	300	9.6	2.2	1.3	10	< 0.01	0.18	0.31	< 0.0025	0.0069				
10/22/14		QC	CCP105												0.0133	Blind QC sample			
10/22/14		QC	CCD105										0.08		0.0034	Blind QC sample			
10/22/14		QC	CCN105										0.29			Blind QC sample			
12/02/14	9:36	G	CC 26	2.8	9.5	302	14.7	<1	0.8	1	< 0.01	0.31	0.39	0.0025	0.0055				
12/02/14	9:58	G	CC 40	1.4	9.3	312	13	<1	0.8	<1	< 0.01	0.32	0.4	0.0035	0.0096				
12/02/14	10:07	G	CC 50	3	8.9	588	11.5	15.8	1.4	5	< 0.01	0.32	0.47	<0.0025	0.0067				
12/02/14	10:36	G	CC 60	2	9.2	345	11.2	9.9	0.8	1	0.02	0.37	0.5	< 0.0025	0.0086				

Tribs

Method				SM2510B	SM4500OG	SM4500H+B	SM2550B	SM2130B	SM4500PE	SM4500PE	SM4500NH3H	SM4500NO3I	SM4500NO3I	SM7110B	SM7110B	SM7110B	SM7110B	SM5310B	SM2540D
Reporting Limit Goal				10	1.0	1.0	1.0	1	0.0025	0.0025	0.01	0.01	0.02	variable	variable	variable	variable	0.5	1
Max Sig figs				3	3	3	3	3	3	3	3	3	3	2	2	2	2	3	3
Max decimals				0	1	1	1	1	4	4	2	2	2	1	1	1	1	1	0
Reporting Units				µS/cm	mg/L	s.u.	°C	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L	pCi/L	pCi/L	pCi/L	mg/L	mg/L
Sample Date	Sample Time	Sample Type	Location ID	Conductivity, Specific	Oxygen, Dissolved	pH	Temp	Turbidity	Phosphorus, Dissolved (DRP)	Phosphorus, Total	Nitrogen, Ammonia (Salicylate)	Nitrogen, Nitrate+Nitrite	Nitrogen, Total Nitrogen	Gross Alpha	Gross Alpha, Uncertainty	Gross Beta	Gross Beta, Uncertainty	Carbon, Total Organic	Solids, Total Suspended
01/08/14	10:10	G	Trib 01	356	12.8	7.2	1.3	6.9	0.0027	0.0215	< 0.01	0.4	0.53					0.9	15
01/08/14	10:25	G	Trib 02	390	12.2	7.2	1.6	2.1	0.0027	0.0125	NS	NS	NS					1.2	6
01/08/14	10:40	G	Trib 03	407	9.5	7.6	5.9	4.8	0.0039	0.0149	0.01	0.45	0.59					1	10
01/08/14	11:20	G	Trib 04	478	11.3	7.7	4.7	20.6	0.006	0.0311	0.23	0.46	0.88					1.1	38
NS	NS	G	Trib 11																
NS	NS	G	Trib 22a																
NS	NS	G	Trib 22d																
NS	NS	G	Trib 27 (New Church Ditch Inlet)																
02/05/14	9:40	G	Trib 01	417	12.2	7	<1	1.2	0.0031	0.004	0.02	0.44	0.64					0.6	1
NS	NS	G	Trib 02																
02/05/14	10:05	G	Trib 03	457	9.2	7.6	7.2	2.5	0.0055	0.0116	0.03	0.49	0.69					1.3	3
02/05/14	10:40	G	Trib 04	534	11.6	7.6	<1	26.3	0.0082	0.036	0.05	0.47	0.71					0.8	44
NS	NS	G	Trib 11																
NS	NS	G	Trib 22a																
NS	NS	G	Trib 22d																
NS	NS	G	Trib 27 (New Church Ditch Inlet)																
03/05/14	9:20	G	Trib 01	387	12.1	7.6	3.2	2.8	0.0029	0.0066	< 0.01	0.33	0.37	1.8	2.6	0.7	3.4	1.1	4
03/05/14	9:35	G	Trib 02	429	8.8	7.6	11.3	4.4	0.0038	0.0142	0.02	0.38	0.53	2.1	2.4	0.9	3.2	2.3	5
03/05/14	9:45	G	Trib 03	580	9.9	7.7	8	7.7	0.0078	0.0258	0.03	0.46	0.61	2.1	2.7	0	3.5	1.6	6
03/05/14	10:15	G	Trib 04	448	9.7	7.7	8	15.5	0.0076	0.0227	0.04	0.38	0.58	3	3	4.3	3.6	1.4	24
NS	NS	G	Trib 11																
NS	NS	G	Trib 22a																
NS	NS	G	Trib 22d																
NS	NS	G	Trib 27 (New Church Ditch Inlet)																
04/02/14	9:05	G	Trib 01	421	10.9	7.2	4.3	3.8	< 0.0025	0.0011	< 0.01	0.27	0.42					1.8	7
04/02/14	9:15	G	Trib 02	430	7.2	7.6	14.4	5.8	< 0.0025	0.0114	< 0.01	0.3	0.46					1.3	10
04/02/14	9:30	G	Trib 03	463	8.3	7.7	10.2	4.4	< 0.0025	0.013	0.02	0.28	0.47					1.8	9
04/02/14	9:55	G	Trib 04	479	8.5	7.6	7.7	12.7	0.0062	0.0222	0.03	0.27	0.47					2.3	18
NS	NS	G	Trib 11																
NS	NS	G	Trib 22a																
NS	NS	G	Trib 22d																
NS	NS	G	Trib 27 (New Church Ditch Inlet)																
05/07/14	8:50	G	Trib 01	261	10.5	7.4	9	13.3	< 0.0025	0.027	< 0.01	0.13	0.28					2.7	25
05/07/14	9:00	G	Trib 02	275	9.8	7.4	8.4	13.7	0.0032	0.0288	< 0.01	0.14	0.31					2.9	29
05/07/14	9:15	G	Trib 03	271	8.7	7.6	11.8	13.2	0.0031	0.025	< 0.01	0.13	0.27					2.8	20
NS	NS	G	Trib 04																
05/07/14	9:45	G	Trib 11	283	8	7.6	11.8	14.9	0.0026	0.0261	< 0.01	0.12	0.27					2.7	25
NS	NS	G	Trib 22a																
NS	NS	G	Trib 22d																
NS	NS	G	Trib 27 (New Church Ditch Inlet)																
06/04/14	9:15	G	Trib 01	109	11.3	7.5	10.5	44.6	0.0063	0.0514	< 0.01	0.12	0.35	5.6	2.7	2.8	3.6	4.4	18
06/04/14	9:35	G	Trib 02	106	10	7.3	9.8	46.1	0.0061	0.0504	0.01	0.12	0.36	3.3	2.4	2.3	3.1	4.1	26
06/04/14	9:50	G	Trib 03	108	11.6	7.3	8.7	48.6	0.0068	0.0583	< 0.01	0.12	0.38	5	2.7	6.3	3.7	4.3	78
NS	NS	G	Trib 04																
06/04/14	10:20	G	Trib 11	119	8.3	6.9	12.9	48.8	0.0078	0.0818	0.02	0.12	0.6	4.1	2.3	2.2	3.2	4.1	97
NS	NS	G	Trib 22a																
NS	NS	G	Trib 22d																
NS	NS	G	Trib 27 (New Church Ditch Inlet)																
07/02/14	9:15	G	Trib 01	110	7.9	7.3	12.8	2.8	0.004	0.0111	0.01	0.1	0.24					2.2	<1
07/02/14	9:35	G	Trib 02	105	9.7	7.5	13.9	3.4	0.0146	0.0233	< 0.01	0.11	0.22					1.7	2
07/02/14	9:50	G	Trib 03	106	7.7	7.3	14.1	3.4	0.0034	0.0128	< 0.01	0.1	0.24					1.4	4
NS	NS	G	Trib 04																
07/02/14	10:20	G	Trib 11	112	8.6	7.5	15.3	11.2	0.0059	0.0191	< 0.01	0.09	0.26					1.5	22
NS	NS	G	Trib 22a																
NS	NS	G	Trib 22d																

Tribs

Method				SM2510B	SM4500OG	SM4500H+B	SM2550B	SM2130B	SM4500PE	SM4500PE	SM4500NH3H	SM4500NO3I	SM4500NO3I	SM7110B	SM7110B	SM7110B	SM7110B	SM5310B	SM2540D
Reporting Limit Goal				10	1.0	1.0	1.0	1	0.0025	0.0025	0.01	0.01	0.02	variable	variable	variable	variable	0.5	1
Max Sig figs				3	3	3	3	3	3	3	3	3	3	2	2	2	2	3	3
Max decimals				0	1	1	1	1	4	4	2	2	2	1	1	1	1	1	0
Reporting Units				µS/cm	mg/L	s.u.	°C	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	pCi/L	pCi/L	pCi/L	pCi/L	mg/L	mg/L
Sample Date	Sample Time	Sample Type	Location ID	Conductivity, Specific	Oxygen, Dissolved	pH	Temp	Turbidity	Phosphorus, Dissolved (DRP)	Phosphorus, Total	Nitrogen, Ammonia (Salicylate)	Nitrogen, Nitrate+Nitrite	Nitrogen, Total Nitrogen	Gross Alpha	Gross Alpha, Uncertainty	Gross Beta	Gross Beta, Uncertainty	Carbon, Total Organic	Solids, Total Suspended
NS	NS	G	Trib 27 (New Church Ditch Inlet)																
08/13/14	8:45	G	Trib 01	195	10.2	7.1	15.8	2.1	0.0033	0.0116	< 0.01	0.13	0.26					1.9	3
08/13/14	9:00	G	Trib 02	199	9.2	7.2	16.2	2.3	0.003	0.0123	< 0.01	0.15	0.26					1.5	4
08/13/14	9:10	G	Trib 03	222	8.2	7.4	21.5	2.6	0.003	0.0125	< 0.01	0.15	0.3					1.3	3
NS	NS	G	Trib 04																
08/13/14	9:55	G	Trib 11	206	8.8	7.4	18.9	8.2	0.0035	0.0186	< 0.01	0.12	0.25					1.3	13
NS	NS	G	Trib 22a																
NS	NS	G	Trib 22d																
08/13/14	9:45	G	Trib 27 (New Church Ditch Inlet)	203	8.7	8	18.6	7.8	< 0.0025	0.0167	< 0.01	0.08	0.23					1.6	11
09/03/14	9:20	G	Trib 01	227	8.4	6.9	15.3	1.7	< 0.0025	0.0072	< 0.01	0.16	0.31	0	1.5	0	3	1.3	3
09/03/14	9:30	G	Trib 02	237	9.6	7.1	14.9	1.6	0.0032	0.0065	0.01	0.17	0.26	1.7	1.8	0	3.3	1.6	2
09/03/14	9:40	G	Trib 03	264	6.1	7.6	19.4	1.4	0.003	0.0079	0.03	0.18	0.31	2.9	2.3	0	2.9	1.4	2
NS	NS	G	Trib 04																
09/03/14	10:45	G	Trib 11	251	7.5	7.4	17.9	2	< 0.0025	0.0093	< 0.01	0.17	0.28	1.5	2	0	3	1.8	3
NS	NS	G	Trib 22a																
09/03/14	10:30	G	Trib 22d	91	7.8	7.6	18	5.7	0.0174	0.03	0.02	0.05	0.29	2.6	1.8	0.9	3.3	3.8	9
09/03/14	10:15	G	Trib 27 (New Church Ditch Inlet)	246	7.2	7.7	16.8	2.4	< 0.0025	0.0093	0.01	0.07	0.32	1.3	1.9	0	3	1.9	2
10/01/14	9:00	G	Trib 01	251	9.2	6.4	9	2.4	0.0032	0.0087	< 0.01	0.14	0.29					2	<1
10/01/14	9:15	G	Trib 02	263	9.2	6.7	11.3	2.3	< 0.0025	0.0097	< 0.01	0.15	0.27					1.4	1
10/01/14	9:25	G	Trib 03	287	6.6	7.4	14.2	5.5	< 0.0025	0.025	< 0.01	0.16	0.34					1.7	17
NS	NS	G	Trib 04																
10/01/14	11:20	G	Trib 11	264	8	7.3	13.6	8.4	< 0.0025	0.0143	< 0.01	0.17	0.31					1.6	11
NS	NS	G	Trib 22a																
10/01/14	10:05	G	Trib 22d	103	8.1	7.5	12.1	3.5	0.006	0.0179	0.01	0.07	0.26					3.2	5
10/01/14	9:55	G	Trib 27 (New Church Ditch Inlet)	254	7.7	7.5	10.9	8.2	0.0037	0.017	< 0.01	0.12	0.29					1.6	8
11/05/14	9:15	G	Trib 01	311	12.4	6.7	5.6	1.9	< 0.0025	0.0059	< 0.01	0.24	0.34					1.8	4
11/05/14	9:30	G	Trib 02	310	9.7	6.7	9	1.6	< 0.0025	0.005	< 0.01	0.24	0.32					1.8	<1
11/05/14	9:40	G	Trib 03	317	9.9	7.2	9.9	1.5	< 0.0025	0.0055	< 0.01	0.24	0.32					1.6	1
11/05/14	10:20	G	Trib 04	373	9.6	7.6	8.3	5.4	0.0063	0.018	< 0.01	0.11	0.26					2	6
NS	NS	G	Trib 11																
NS	NS	G	Trib 22a																
NS	NS	G	Trib 22d																
NS	NS	G	Trib 27 (New Church Ditch Inlet)																
12/03/14	9:10	G	Trib 01	362	11.1	6.9	2.3	2.5	0.0045	0.0157	0.07	0.36	0.63	2.8	2	0	2.1	0.8	1
12/03/14	9:25	G	Trib 02	380	10.5	7	2.3	2	0.0041	0.0117	0.03	0.38	0.59	1.9	2.2	0	1.9	0.9	1
12/03/14	9:40	G	Trib 03	371	8.4	7.2	7.2	2	0.0027	0.009	0.03	0.37	0.54	1.5	2	1.3	2.1	0.9	1
12/03/14	10:10	G	Trib 04	428	9.8	7.3	2.8	7	0.0045	0.0129	< 0.01	0.3	0.5	1.8	2.3	0	2	1.3	9
NS	NS	G	Trib 11																
NS	NS	G	Trib 22a																
NS	NS	G	Trib 22d																
NS	NS	G	Trib 27 (New Church Ditch Inlet)																

Tribs

Method				SM9221D	EPA200.7	EPA200.7	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA130.2	SM4110A	SM4110A	SM4110A	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8
Reporting Limit Goal				1	0.01	0.01	0.00025	0.00025	0.0025	0.0025	5	5	10	0.1	0.00015	0.00015	0.0001	0.0001	0.001	0.001	0.00010
Max Sig figs				3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Max decimals				0	3	3	5	5	4	4	0	0	0	1	5	5	5	5	4	4	5
Reporting Units				cfu/100mL	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L as CaCO3	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sample Date	Sample Time	Sample Type	Location ID	E. coli,	Iron, Dissolved	Iron, Total	Manganese, Dissolved	Manganese, Total	Zinc, Dissolved	Zinc, Total	Hardness, Total	Chloride	Sulfate	Bromide	Arsenic, Dissolved	Arsenic, Total	Barium, Dissolved	Barium, Total	Beryllium, Dissolved	Beryllium, Total	Cadmium, Dissolved
01/08/14	10:10	G	Trib 01	<1	<0.01	0.561	0.198	0.356	0.197	0.301											
01/08/14	10:25	G	Trib 02	6	<0.01	0.212	0.203	0.213	0.204	0.229											
01/08/14	10:40	G	Trib 03	22	<0.01	0.306	0.199	0.232	0.169	0.217											
01/08/14	11:20	G	Trib 04	49	0.01	0.515	0.12	0.257	0.0824	0.167											
NS	NS	G	Trib 11																		
NS	NS	G	Trib 22a																		
NS	NS	G	Trib 22d																		
NS	NS	G	Trib 27 (New Church Ditch Inlet)																		
02/05/14	9:40	G	Trib 01	2	<0.01	0.116	0.256	0.258	0.215	0.234											
NS	NS	G	Trib 02																		
02/05/14	10:05	G	Trib 03	49	<0.01	0.217	0.218	0.242	0.149	0.187											
02/05/14	10:40	G	Trib 04	14	<0.01	0.655	0.182	0.299	0.0911	0.201											
NS	NS	G	Trib 11																		
NS	NS	G	Trib 22a																		
NS	NS	G	Trib 22d																		
NS	NS	G	Trib 27 (New Church Ditch Inlet)																		
03/05/14	9:20	G	Trib 01	<1	0.011	0.35	0.258	0.28	0.184	0.217	154	34	83	<0.1	<0.00015	0.00022	0.0441	0.0443			0.00069
03/05/14	9:35	G	Trib 02	10	<0.01	0.397	0.205	0.24	0.147	0.199	190	53	83	<0.1	<0.00015	0.00023	0.0428	0.0464			0.00054
03/05/14	9:45	G	Trib 03	48	<0.01	0.428	0.202	0.235	0.133	0.189	164	89	86	<0.1	0.00018	0.00031	0.0446	0.05			0.00053
03/05/14	10:15	G	Trib 04	153	<0.01	0.538	0.146	0.2	0.0624	0.136	156	42	93	<0.1	0.00076	0.00138	0.0484	0.0559			0.00015
NS	NS	G	Trib 11																		
NS	NS	G	Trib 22a																		
NS	NS	G	Trib 22d																		
NS	NS	G	Trib 27 (New Church Ditch Inlet)																		
04/02/14	9:05	G	Trib 01	<1	<0.01	0.46	0.286	0.301	0.177	0.232											
04/02/14	9:15	G	Trib 02	2	<0.01	0.469	0.233	0.273	0.147	0.201											
04/02/14	9:30	G	Trib 03	22	<0.01	0.46	0.202	0.28	0.107	0.175											
04/02/14	9:55	G	Trib 04	9	<0.01	0.495	0.212	0.282	0.0716	0.104											
NS	NS	G	Trib 11																		
NS	NS	G	Trib 22a																		
NS	NS	G	Trib 22d																		
NS	NS	G	Trib 27 (New Church Ditch Inlet)																		
05/07/14	8:50	G	Trib 01	17	0.177	1.09	0.224	0.379	0.161	0.318											
05/07/14	9:00	G	Trib 02	9	0.148	1.1	0.222	0.358	0.148	0.322											
05/07/14	9:15	G	Trib 03	19	0.154	0.956	0.219	0.317	0.148	0.275											
NS	NS	G	Trib 04																		
05/07/14	9:45	G	Trib 11	9	0.141	0.81	0.0593	0.192	0.0959	0.223											
NS	NS	G	Trib 22a																		
NS	NS	G	Trib 22d																		
NS	NS	G	Trib 27 (New Church Ditch Inlet)																		
06/04/14	9:15	G	Trib 01	11	0.134	0.962	0.0697	0.458	0.0751	0.224	48	14	25	<0.1	0.00017	0.00063	0.018	0.0358			0.00033
06/04/14	9:35	G	Trib 02	10	0.124	1.28	0.0702	0.553	0.0754	0.254	80	7	16	<0.1	0.00019	0.0007	0.0184	0.0423			0.00033
06/04/14	9:50	G	Trib 03	15	0.12	0.924	0.0679	0.454	0.072	0.225	52	11	17	<0.1	0.00017	0.00058	0.018	0.0367			0.00033
NS	NS	G	Trib 04																		
06/04/14	10:20	G	Trib 11	150	0.124	1.22	0.0432	0.559	0.0788	0.305	52	8	18	<0.1	0.00024	0.00084	0.0206	0.045			0.0003
NS	NS	G	Trib 22a																		
NS	NS	G	Trib 22d																		
NS	NS	G	Trib 27 (New Church Ditch Inlet)																		
07/02/14	9:15	G	Trib 01	11	NT	NT	NT	NT	NT	NT											
07/02/14	9:35	G	Trib 02	6	NT	NT	NT	NT	NT	NT											
07/02/14	9:50	G	Trib 03	16	NT	NT	NT	NT	NT	NT											
NS	NS	G	Trib 04																		
07/02/14	10:20	G	Trib 11	126	NT	NT	NT	NT	NT	NT											
NS	NS	G	Trib 22a																		
NS	NS	G	Trib 22d																		

Tribs

Method				SM9221D	EPA200.7	EPA200.7	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA130.2	SM4110A	SM4110A	SM4110A	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8
Reporting Limit Goal				1	0.01	0.01	0.00025	0.00025	0.0025	0.0025	5	5	10	0.1	0.00015	0.00015	0.0001	0.0001	0.001	0.001	0.00010
Max Sig figs				3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Max decimals				0	3	3	5	5	4	4	0	0	0	1	5	5	5	5	4	4	5
Reporting Units				cfu/100mL	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L as CaCO3	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sample Date	Sample Time	Sample Type	Location ID	E. coli,	Iron, Dissolved	Iron, Total	Manganese, Dissolved	Manganese, Total	Zinc, Dissolved	Zinc, Total	Hardness, Total	Chloride	Sulfate	Bromide	Arsenic, Dissolved	Arsenic, Total	Barium, Dissolved	Barium, Total	Beryllium, Dissolved	Beryllium, Total	Cadmium, Dissolved
NS	NS	G	Trib 27 (New Church Ditch Inlet)																		
08/13/14	8:45	G	Trib 01	37	0.0219	0.213	0.12	0.139	0.12	0.122											
08/13/14	9:00	G	Trib 02	33	0.0233	0.202	0.114	0.134	0.0837	0.117											
08/13/14	9:10	G	Trib 03	102	0.0227	0.245	0.0999	0.128	0.0647	0.0952											
NS	NS	G	Trib 04																		
08/13/14	9:55	G	Trib 11	192	0.0212	0.34	0.0123	0.0714	0.0311	0.074											
NS	NS	G	Trib 22a																		
NS	NS	G	Trib 22d																		
08/13/14	9:45	G	Trib 27 (New Church Ditch Inlet)	687	0.0292	0.275	0.0167	0.0737	0.02998	0.0587											
09/03/14	9:20	G	Trib 01	12	0.0158	0.188	0.104	0.136	0.0873	0.131	92	8	27	<0.1	<0.00015	<0.00015	0.0302	0.0331			0.00038
09/03/14	9:30	G	Trib 02	16	0.0159	0.171	0.104	0.136	0.0873	0.131	96	8	27	<0.1	<0.00015	<0.00015	0.0302	0.0331			0.00038
09/03/14	9:40	G	Trib 03	308	0.0131	0.163	0.0514	0.119	0.0493	0.0885	108	8	28	<0.1	<0.00015	<0.00015	0.0339	0.0366			0.00024
NS	NS	G	Trib 04																		
09/03/14	10:45	G	Trib 11	166	0.0131	0.169	0.00058	0.0395	0.0224	0.0464	152	8	31	<0.1	<0.00015	<0.00015	0.0333	0.0368			<0.0001
NS	NS	G	Trib 22a																		
09/03/14	10:30	G	Trib 22d	921	0.078	0.274	0.00116	0.0357	0.00388	0.00491	56	NT	NT	NT	<0.00015	<0.00015	0.0185	0.023			<0.0001
09/03/14	10:15	G	Trib 27 (New Church Ditch Inlet)	172	0.0172	0.153	<0.00025	0.0277	0.0212	0.0417	100	8	31	<0.1	<0.00015	<0.00015	0.033	0.0369			<0.0001
10/01/14	9:00	G	Trib 01	11	0.0262	0.291	0.131	0.157	0.103	0.14											
10/01/14	9:15	G	Trib 02	32	0.0233	0.271	0.113	0.14	0.0842	0.126											
10/01/14	9:25	G	Trib 03	488	0.019	0.606	0.0812	0.161	0.0561	0.133											
NS	NS	G	Trib 04																		
10/01/14	11:20	G	Trib 11	261	0.0173	0.542	0.023	0.0645	0.0293	0.0701											
NS	NS	G	Trib 22a																		
10/01/14	10:05	G	Trib 22d	31	0.0758	0.225	0.0299	0.0535	0.0037	0.0037											
10/01/14	9:55	G	Trib 27 (New Church Ditch Inlet)	387	0.0219	0.384	0.0124	0.0457	0.0389	0.0706											
11/05/14	9:15	G	Trib 01	NT	<0.01	0.216	0.194	0.22	0.158	0.206											
11/05/14	9:30	G	Trib 02	36	<0.01	0.202	0.174	0.191	0.146	0.182											
11/05/14	9:40	G	Trib 03	46	<0.01	0.19	0.142	0.172	0.113	0.158											
11/05/14	10:20	G	Trib 04	326	0.01	0.264	0.00264	0.0416	0.0194	0.0397											
NS	NS	G	Trib 11																		
NS	NS	G	Trib 22a																		
NS	NS	G	Trib 22d																		
NS	NS	G	Trib 27 (New Church Ditch Inlet)																		
12/03/14	9:10	G	Trib 01	<1	<0.01	0.27	0.208	0.261	0.167	0.222	126	26	83	<0.1	<0.00015	<0.00015	0.038	0.0432			0.00058
12/03/14	9:25	G	Trib 02	3	<0.01	0.261	0.223	0.252	0.167	0.21	128	25	82	<0.1	<0.00015	<0.00015	0.0423	0.0453			0.00057
12/03/14	9:40	G	Trib 03	15	<0.01	0.226	0.16	0.212	0.125	0.181	128	25	81	<0.1	<0.00015	<0.00015	0.0358	0.0435			0.00043
12/03/14	10:10	G	Trib 04	21	<0.01	0.242	0.0418	0.067	0.0282	0.0615	140	26	86	<0.1	0.00072	0.00125	0.0422	0.052			<0.0001
NS	NS	G	Trib 11																		
NS	NS	G	Trib 22a																		
NS	NS	G	Trib 22d																		
NS	NS	G	Trib 27 (New Church Ditch Inlet)																		

Tribs

Method				EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8
Reporting Limit Goal				0.00010	0.00050	0.00050	0.00025	0.00025	0.00020	0.00020	0.00050	0.00050	0.005	0.005	0.00050	0.00050	0.0005	0.0005
Max Sig figs				3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Max decimals				5	5	5	5	5	5	5	5	5	4	4	5	5	5	5
Reporting Units				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sample Date	Sample Time	Sample Type	Location ID	Cadmium, Total	Chromium, Dissolved	Chromium, Total	Copper, Dissolved	Copper, Total	Lead, Dissolved	Lead, Total	Molybdenum, Dissolved	Molybdenum, Total	Nickel, Dissolved	Nickel, Total	Selenium, Dissolved	Selenium, Total	Silver, Dissolved	Silver, Total
01/08/14	10:10	G	Trib 01															
01/08/14	10:25	G	Trib 02															
01/08/14	10:40	G	Trib 03															
01/08/14	11:20	G	Trib 04															
NS	NS	G	Trib 11															
NS	NS	G	Trib 22a															
NS	NS	G	Trib 22d															
NS	NS	G	Trib 27 (New Church Ditch Inlet)															
02/05/14	9:40	G	Trib 01															
NS	NS	G	Trib 02															
02/05/14	10:05	G	Trib 03															
02/05/14	10:40	G	Trib 04															
NS	NS	G	Trib 11															
NS	NS	G	Trib 22a															
NS	NS	G	Trib 22d															
NS	NS	G	Trib 27 (New Church Ditch Inlet)															
03/05/14	9:20	G	Trib 01	0.00079	<0.0005	<0.0005	0.0046	0.0116	0.00037	0.00076	0.00173	0.00177			<0.00050	<0.00050		
03/05/14	9:35	G	Trib 02	0.00076	<0.0005	<0.0005	0.00503	0.0121	<0.0002	0.00101	0.00187	0.00191			<0.00050	<0.00050		
03/05/14	9:45	G	Trib 03	0.00072	<0.0005	<0.0005	0.00508	0.0117	<0.0002	0.0012	0.00183	0.00191			<0.00050	<0.00050		
03/05/14	10:15	G	Trib 04	0.00048	<0.0005	<0.0005	0.00273	0.0138	0.00021	0.0923	0.0023	0.0023			<0.00050	<0.00050		
NS	NS	G	Trib 11															
NS	NS	G	Trib 22a															
NS	NS	G	Trib 22d															
NS	NS	G	Trib 27 (New Church Ditch Inlet)															
04/02/14	9:05	G	Trib 01															
04/02/14	9:15	G	Trib 02															
04/02/14	9:30	G	Trib 03															
04/02/14	9:55	G	Trib 04															
NS	NS	G	Trib 11															
NS	NS	G	Trib 22a															
NS	NS	G	Trib 22d															
NS	NS	G	Trib 27 (New Church Ditch Inlet)															
05/07/14	8:50	G	Trib 01															
05/07/14	9:00	G	Trib 02															
05/07/14	9:15	G	Trib 03															
NS	NS	G	Trib 04															
05/07/14	9:45	G	Trib 11															
NS	NS	G	Trib 22a															
NS	NS	G	Trib 22d															
NS	NS	G	Trib 27 (New Church Ditch Inlet)															
06/04/14	9:15	G	Trib 01	0.00093	<0.0005	0.00056	0.00831	0.0212	0.00219	0.0177	0.00165	0.00178			<0.00050	0.00052		
06/04/14	9:35	G	Trib 02	0.00113	<0.0005	0.00073	0.00839	0.0253	0.00098	0.021	0.00177	0.00177			<0.00050	<0.00050		
06/04/14	9:50	G	Trib 03	0.00099	<0.0005	0.00051	0.00843	0.0214	0.00118	0.0175	0.00172	0.00173			<0.00050	0.00052		
NS	NS	G	Trib 04															
06/04/14	10:20	G	Trib 11	0.00131	<0.0005	0.00056	0.00819	0.036	0.00087	0.0178	0.00178	0.00178			<0.00050	<0.00050		
NS	NS	G	Trib 22a															
NS	NS	G	Trib 22d															
NS	NS	G	Trib 27 (New Church Ditch Inlet)															
07/02/14	9:15	G	Trib 01															
07/02/14	9:35	G	Trib 02															
07/02/14	9:50	G	Trib 03															
NS	NS	G	Trib 04															
07/02/14	10:20	G	Trib 11															
NS	NS	G	Trib 22a															
NS	NS	G	Trib 22d															

Tribs

Method				EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8
Reporting Limit Goal				0.00010	0.00050	0.00050	0.00025	0.00025	0.00020	0.00020	0.00050	0.00050	0.005	0.005	0.00050	0.00050	0.0005	0.0005
Max Sig figs				3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Max decimals				5	5	5	5	5	5	5	5	5	4	4	5	5	5	5
Reporting Units				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sample Date	Sample Time	Sample Type	Location ID	Cadmium, Total	Chromium, Dissolved	Chromium, Total	Copper, Dissolved	Copper, Total	Lead, Dissolved	Lead, Total	Molybdenum, Dissolved	Molybdenum, Total	Nickel, Dissolved	Nickel, Total	Selenium, Dissolved	Selenium, Total	Silver, Dissolved	Silver, Total
NS	NS	G	Trib 27 (New Church Ditch Inlet)															
08/13/14	8:45	G	Trib 01															
08/13/14	9:00	G	Trib 02															
08/13/14	9:10	G	Trib 03															
NS	NS	G	Trib 04															
08/13/14	9:55	G	Trib 11															
NS	NS	G	Trib 22a															
NS	NS	G	Trib 22d															
08/13/14	9:45	G	Trib 27 (New Church Ditch Inlet)															
09/03/14	9:20	G	Trib 01	0.00047	<0.0005	<0.0005	0.00316	0.00568	<0.00020	0.0007	0.00251	0.00266			<0.00050	<0.00050		
09/03/14	9:30	G	Trib 02	0.00047	<0.0005	<0.0005	0.00326	0.00539	<0.00020	0.00067	0.00252	0.00259			<0.00050	<0.00050		
09/03/14	9:40	G	Trib 03	0.00038	<0.0005	<0.0005	0.00338	0.00593	<0.00020	0.00079	0.00277	0.00285			<0.00050	<0.00050		
NS	NS	G	Trib 04															
09/03/14	10:45	G	Trib 11	0.0002	<0.0005	<0.0005	0.00242	0.00453	<0.00020	0.00113	0.00264	0.00266			<0.00050	<0.00050		
NS	NS	G	Trib 22a															
09/03/14	10:30	G	Trib 22d	<0.0001	<0.0005	<0.0005	0.00141	0.00154	<0.00020	0.00044	0.00101	0.00101						
09/03/14	10:15	G	Trib 27 (New Church Ditch Inlet)	0.00028	<0.0005	<0.0005	0.0024	0.00432	<0.00020	0.00077	0.00251	0.00255			<0.00050	<0.00050		
10/01/14	9:00	G	Trib 01															
10/01/14	9:15	G	Trib 02															
10/01/14	9:25	G	Trib 03															
NS	NS	G	Trib 04															
10/01/14	11:20	G	Trib 11															
NS	NS	G	Trib 22a															
10/01/14	10:05	G	Trib 22d															
10/01/14	9:55	G	Trib 27 (New Church Ditch Inlet)															
11/05/14	9:15	G	Trib 01															
11/05/14	9:30	G	Trib 02															
11/05/14	9:40	G	Trib 03															
11/05/14	10:20	G	Trib 04															
NS	NS	G	Trib 11															
NS	NS	G	Trib 22a															
NS	NS	G	Trib 22d															
NS	NS	G	Trib 27 (New Church Ditch Inlet)															
12/03/14	9:10	G	Trib 01	0.00074	<0.0005	<0.0005	0.00339	0.00788	<0.00020	0.00064	0.00222	0.00222			<0.00050	<0.00050		
12/03/14	9:25	G	Trib 02	0.00067	<0.0005	<0.0005	0.00333	0.00731	<0.00020	0.00061	0.00252	0.00233			<0.00050	<0.00050		
12/03/14	9:40	G	Trib 03	0.00063	<0.0005	<0.0005	0.00295	0.00727	<0.00020	0.00064	0.00243	0.00251			<0.00050	<0.00050		
12/03/14	10:10	G	Trib 04	0.00016	<0.0005	<0.0005	0.00105	0.00439	<0.00020	0.00419	0.0028	0.00257			<0.00050	<0.00050		
NS	NS	G	Trib 11															
NS	NS	G	Trib 22a															
NS	NS	G	Trib 22d															
NS	NS	G	Trib 27 (New Church Ditch Inlet)															

Tribs

Method							
Reporting Limit Goal							
Max Sig figs							
Max decimals							
Reporting Units							
Sample Date	Sample Time	Sample Type	Location ID	Notes	Conclusion	Field Notes	Lab Notes
01/08/14	10:10	G	Trib 01			Golden removing ice. Sample a little dirty.	
01/08/14	10:25	G	Trib 02				
01/08/14	10:40	G	Trib 03				
01/08/14	11:20	G	Trib 04				
NS	NS	G	Trib 11	Not Sampled			
NS	NS	G	Trib 22a	Not Sampled			
NS	NS	G	Trib 22d	Not Sampled			
NS	NS	G	Trib 27 (New Church Ditch Inlet)	Not Sampled			
02/05/14	9:40	G	Trib 01				
NS	NS	G	Trib 02	Not sampled. Water was diverted at this location.			
02/05/14	10:05	G	Trib 03				
02/05/14	10:40	G	Trib 04				
NS	NS	G	Trib 11				
NS	NS	G	Trib 22a				
NS	NS	G	Trib 22d				
NS	NS	G	Trib 27 (New Church Ditch Inlet)				
03/05/14	9:20	G	Trib 01				
03/05/14	9:35	G	Trib 02				
03/05/14	9:45	G	Trib 03				
03/05/14	10:15	G	Trib 04				
NS	NS	G	Trib 11				
NS	NS	G	Trib 22a				
NS	NS	G	Trib 22d				
NS	NS	G	Trib 27 (New Church Ditch Inlet)				
04/02/14	9:05	G	Trib 01				
04/02/14	9:15	G	Trib 02				
04/02/14	9:30	G	Trib 03				
04/02/14	9:55	G	Trib 04				
NS	NS	G	Trib 11				
NS	NS	G	Trib 22a				
NS	NS	G	Trib 22d				
NS	NS	G	Trib 27 (New Church Ditch Inlet)				
05/07/14	8:50	G	Trib 01				
05/07/14	9:00	G	Trib 02				
05/07/14	9:15	G	Trib 03				
NS	NS	G	Trib 04				
05/07/14	9:45	G	Trib 11				
NS	NS	G	Trib 22a				
NS	NS	G	Trib 22d				
NS	NS	G	Trib 27 (New Church Ditch Inlet)				
06/04/14	9:15	G	Trib 01				
06/04/14	9:35	G	Trib 02				
06/04/14	9:50	G	Trib 03				
NS	NS	G	Trib 04	Not sampled			
06/04/14	10:20	G	Trib 11				
NS	NS	G	Trib 22a	Not sampled			
NS	NS	G	Trib 22d	Not sampled			
NS	NS	G	Trib 27 (New Church Ditch Inlet)	Not sampled			
07/02/14	9:15	G	Trib 01				
07/02/14	9:35	G	Trib 02				
07/02/14	9:50	G	Trib 03				
NS	NS	G	Trib 04	Not sampled			
07/02/14	10:20	G	Trib 11				
NS	NS	G	Trib 22a	Not sampled			
NS	NS	G	Trib 22d	Not sampled			

Tribs

Method							
Reporting Limit Goal							
Max Sig figs							
Max decimals							
Reporting Units							
Sample Date	Sample Time	Sample Type	Location ID	Notes	Conclusion	Field Notes	Lab Notes
NS	NS	G	Trib 27 (New Church Ditch Inlet)	Not sampled			
08/13/14	8:45	G	Trib 01				
08/13/14	9:00	G	Trib 02				
08/13/14	9:10	G	Trib 03				
NS	NS	G	Trib 04	Not sampled			
08/13/14	9:55	G	Trib 11				
NS	NS	G	Trib 22a	Not sampled			
NS	NS	G	Trib 22d	Not sampled			
08/13/14	9:45	G	Trib 27 (New Church Ditch Inlet)				
09/03/14	9:20	G	Trib 01				
09/03/14	9:30	G	Trib 02				
09/03/14	9:40	G	Trib 03				
NS	NS	G	Trib 04	Not sampled			
09/03/14	10:45	G	Trib 11				
NS	NS	G	Trib 22a	Not sampled			
09/03/14	10:30	G	Trib 22d				
09/03/14	10:15	G	Trib 27 (New Church Ditch Inlet)				
10/01/14	9:00	G	Trib 01				
10/01/14	9:15	G	Trib 02				
10/01/14	9:25	G	Trib 03			very little perceptible flow	
NS	NS	G	Trib 04	Not sampled			
10/01/14	11:20	G	Trib 11				
NS	NS	G	Trib 22a	Not sampled			
10/01/14	10:05	G	Trib 22d				
10/01/14	9:55	G	Trib 27 (New Church Ditch Inlet)				
11/05/14	9:15	G	Trib 01				
11/05/14	9:30	G	Trib 02				
11/05/14	9:40	G	Trib 03			very little perceptible flow	
11/05/14	10:20	G	Trib 04				
NS	NS	G	Trib 11	Not sampled			
NS	NS	G	Trib 22a	Not sampled			
NS	NS	G	Trib 22d	Not sampled			
NS	NS	G	Trib 27 (New Church Ditch Inlet)	Not sampled			
12/03/14	9:10	G	Trib 01				
12/03/14	9:25	G	Trib 02				
12/03/14	9:40	G	Trib 03				
12/03/14	10:10	G	Trib 04				
NS	NS	G	Trib 11	Not sampled			
NS	NS	G	Trib 22a	Not sampled			
NS	NS	G	Trib 22d	Not sampled			
NS	NS	G	Trib 27 (New Church Ditch Inlet)	Not sampled			

Ambient Autosamplers (with TH metals)

Method				SM2550B	SM4500H+B	SM2510B	SM2130B	SM4500NH3H	SM4500NO3I	SM4500NO3I	SM4500PE	SM4500PE	SM5310B	SM2540D	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8
Reporting Limit Goal				1.0	1.0	10	1.0	0.01	0.01	0.02	0.0025	0.0025	0.5	1	0.00015	0.00015	0.00010	0.00010	0.00010
Max Sig figs				3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Max decimals				1	1	0	1	2	2	2	4	4	1	0	5	5	5	5	5
Reporting Units				°C	s.u.	µS/cm	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sample Date	Sample Time	Sample Type	Location ID	Temp	pH	Conductivity, Specific	Turbidity	Nitrogen, Ammonia (Salicylate)	Nitrogen, Nitrate+Nitrite	Nitrogen, Total Nitrogen	Phosphorus, Dissolved (DRP)	Phosphorus, Total	Carbon, Total Organic	Solids, Total Suspended	Arsenic, Dissolved	Arsenic, Total	Barium, Dissolved	Barium, Total	Cadmium, Dissolved
05/27/14	1:00	24C	CC AS 26	16.2	S 9.4	139	13.4	< 0.01	0.12	0.33	0.0033	0.0245	5.2	17					
05/28/14	1:00	24C	CC AS 26	14.5	S 8.8	102	10.9	< 0.01	0.12	0.28	0.0036	0.0169	4.6	33					
05/27/14	5:00	24C	CC AS 49	17.3	7.4	148	22.4	< 0.01	0.11	0.35	0.0044	0.0308	4.8	35					
05/28/14	5:00	24C	CC AS 49	17.1	7.5	142	23.5	< 0.01	0.11	0.37	0.0038	0.0394	4.6	33					
05/26/14	21:00	24C	CC AS 50	18.4	7.5	135	67.8	< 0.01	0.09	0.37	0.0042	0.0766	4.3	147					
05/28/14	5:00	24C	CC AS 50	17	7.4	128	55.1	< 0.01	0.08	0.35	0.0053	0.0669	4	96					
NS	NS	24C	CC AS 59																
NS	NS	24C	CC AS 59																
05/28/14	16:00	24C	CC AS T11	20.9	7.6	195	77.4	0.01	0.16	0.59	0.0057	0.0856	4.4	138	0.0003	0.001	0.0263	0.0553	0.00017
05/29/14	16:00	24C	CC AS T11	20	7.4	177	38.2	0.01	0.13	0.41	0.0053	0.0472	4.2	57	0.00024	0.0007	0.0245	0.0384	0.00021
06/23/14	1:30	24C	CC AS 26	10.9	7.2	87	1.8	< 0.01	0.12	0.24	0.0101	0.0187	2.3	5					
06/24/14	1:30	24C	CC AS 26	11.6	7.3	90	1.8	< 0.01	0.12	0.24	0.0049	0.0155	3	8					
06/23/14	5:00	24C	CC AS 49	15.2	7.9	94	4.3	< 0.01	0.11	0.23	0.0031	0.0104	2.4	12					
06/24/14	5:00	24C	CC AS 49	15	7.8	97	4.1	< 0.01	0.11	0.25	< 0.0025	0.0111	2.4	10					
06/23/14	5:00	24C	CC AS 50	16.7	7.7	148	5.6	< 0.01	0.09	0.26	0.0059	0.0155	3.4	10					
06/24/14	5:00	24C	CC AS 50	16.6	7.7	150	4.5	0.01	0.07	0.24	0.004	0.0127	2.8	9					
06/23/14	8:00	24C	CC AS 59	19.8	7.8	98	13.5	< 0.01	0.1	0.26	0.0025	0.0341	2.7	60					
06/24/14	8:00	24C	CC AS 59	19.4	7.8	100	4.3	0.01	0.1	0.25	0.0106	0.013	2.4	12					
06/23/14	15:00	24C	CC AS T11	19.2	7.5	112	23.2	< 0.01	0.1	0.32	0.0029	0.0355	2.5	63	0.0002	0.00072	NT	NT	0.00010
06/24/14	15:00	24C	CC AS T11	19	7.4	113	16.7	< 0.01	0.1	0.32	0.0043	0.0281	2.8	31	0.00019	0.00048	NT	NT	0.00011
07/22/14	0:00	24C	CC AS 26	20	7.8	128	1.2	< 0.01	0.1	0.19	0.0148	0.0257	1.2	<1					
07/23/14	0:00	24C	CC AS 26	19.7	7.7	127	1.5	< 0.01	0.09	0.17	< 0.0025	0.0114	1.1	1					
07/22/14	5:00	24C	CC AS 49	21	7.8	136	2.6	< 0.01	0.09	0.15	0.0028	0.0106	1.3	1					
07/23/14	5:00	24C	CC AS 49	20.9	7.7	139	2.7	< 0.01	0.09	0.13	0.0026	0.009	1.4	<1					
07/22/14	5:00	24C	CC AS 50	22	7.6	325	19.1	0.02	0.39	0.68	0.0035	0.0405	2.5	20					
07/23/14	5:00	24C	CC AS 50	21.8	7.6	335	20.4	0.02	0.35	0.6	0.0028	0.0301	2.7	20					
07/22/14	9:00	24C	CC AS 59	22.8	7.9	141	2.7	0.02	0.09	0.17	< 0.0025	0.0103	1.7	4					
07/23/14	9:00	24C	CC AS 59	22	7.7	142	2.8	< 0.01	0.1	0.18	< 0.0025	0.0109	2.1	3					
07/22/14	16:30	24C	CC AS T11	23.2	7.8	153	17.6	0.02	0.13	0.33	0.004	0.04	1.9	43	0.000195	0.00066	NT	NT	<0.00010
07/23/14	16:30	24C	CC AS T11	22.6	7.8	160	12.4	< 0.01	0.1	0.27	0.007	0.0368	1.5	10	0.000206	0.00048	NT	NT	<0.00010
08/25/14	15:30	24C	CC AS 26	13.1	7	159	<1	< 0.01	0.13	0.28	0.0102	0.0192	1.3	3					
08/26/14	15:30	24C	CC AS 26	12.9	7	195	<1	< 0.01	0.11	0.23	0.0041	0.0105	1.4	3					

Ambient Autosamplers (with TH metals)

Method				SM2550B	SM4500H+B	SM2510B	SM2130B	SM4500NH3H	SM4500NO3I	SM4500NO3I	SM4500PE	SM4500PE	SM5310B	SM2540D	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8
Reporting Limit Goal				1.0	1.0	10	1.0	0.01	0.01	0.02	0.0025	0.0025	0.5	1	0.00015	0.00015	0.00010	0.00010	0.00010
Max Sig figs				3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Max decimals				1	1	0	1	2	2	2	4	4	1	0	5	5	5	5	5
Reporting Units				°C	s.u.	µS/cm	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sample Date	Sample Time	Sample Type	Location ID	Temp	pH	Conductivity, Specific	Turbidity	Nitrogen, Ammonia (Salicylate)	Nitrogen, Nitrate+Nitrite	Nitrogen, Total Nitrogen	Phosphorus, Dissolved (DRP)	Phosphorus, Total	Carbon, Total Organic	Solids, Total Suspended	Arsenic, Dissolved	Arsenic, Total	Barium, Dissolved	Barium, Total	Cadmium, Dissolved
08/26/14	0:00	24C	CC AS 49	15.4	7.9	201	7	< 0.01	0.12	0.23	0.0026	0.0164	1.3	8					
08/27/14	0:00	24C	CC AS 49	15.8	7.9	196	12.3	< 0.01	0.11	0.22	0.0028	0.0138	1.2	12					
08/26/14	0:00	24C	CC AS 50	15.9	7.6	454	43.1	< 0.01	0.56	0.78	<0.0025	0.0387	2.2	45					
08/27/14	0:00	24C	CC AS 50	15.6	7.6	418	69.3	< 0.01	0.48	0.73	0.0028	0.0591	2.5	76					
08/26/14	7:00	24C	CC AS 59	19	7.9	216	4	< 0.01	0.13	0.26	0.0028	0.0114	1.7	6					
08/27/14	7:00	24C	CC AS 59	18.7	7.9	217	14.4	< 0.01	0.12	0.25	0.0026	0.0281	1.5	18					
08/26/14	17:00	24C	CC AS T11	17.9	7.8	236	3.3	0.01	0.12	0.24	0.0025	0.0124	1.1	5	<0.00015	<0.00015	0.0313	0.0347	<0.00010
08/27/14	17:00	24C	CC AS T11	17.8	7.9	235	3.8	0.01	0.12	0.25	< 0.0025	0.0134	1.3	4	<0.00015	0.00025	0.0309	0.0352	<0.00010
09/29/14	13:30	24C	CC AS 26	7.5	7.7	209	1.7	< 0.01	0.16	0.29	< 0.0025	0.0141	1.3	3					
09/30/14	13:30	24C	CC AS 26	7.4	7.8	210	1.5	< 0.01	0.15	0.27	< 0.0025	0.0195	1.2	5					
09/29/14	23:30	24C	CC AS 49	10.2	7.9	221	18.8	< 0.01	0.16	0.31	0.0039	0.0197	1.5	21					
09/30/14	23:30	24C	CC AS 49	9.9	8	219	4	< 0.01	0.13	0.24	< 0.0056	0.0143	1.6	8					
09/29/14	23:30	24C	CC AS 50	8.8	7.4	809	313	< 0.01	0.53	1.14	0.0056	0.186	4.1	244					
09/30/14	23:30	24C	CC AS 50	8.2	7.6	508	44	< 0.01	0.45	0.84	0.0045	0.056	3.4	28					
09/30/14	8:00	24C	CC AS 59	14.1	7.8	248	23	< 0.01	0.18	0.38	0.0034	0.0248	2.1	27					
10/01/14	8:00	24C	CC AS 59	13.4	7.8	245	5.8	< 0.01	0.19	0.32	0.003	0.0138	1.6	7					
09/30/14	18:15	24C	CC AS T11	9.3	7.8	278	11.8	< 0.01	0.22	0.47	0.005	0.027	2.1	25	0.00025	NT	0.0322	NT	<0.00010
10/01/14	18:15	24C	CC AS T11	9.6	7.7	273	13.7	< 0.01	0.17	0.32	0.0029	0.0194	1.8	17	0.00019	NT	0.0334	NT	<0.00010
10/26/14	10:00	24C	CC AS 26	2.4	7.3	149	1.1	< 0.01	0.2	0.33	0.0071	0.0159	1.3	<1					
10/27/14	10:00	24C	CC AS 26	1.9	7.2	138	1.2	< 0.01	0.2	0.27	0.0063	0.0112	1.1	<1					
10/26/14	22:00	24C	CC AS 49	5.9	8	276	1.3	< 0.01	0.18	0.26	< 0.0025	0.0061	1.2	<1					
10/27/14	22:00	24C	CC AS 49	5.7	8	277	1.4	< 0.01	0.18	0.26	< 0.0025	0.007	1.2	1					
10/26/14	23:00	24C	CC AS 50	3.2	7.4	687	21.4	< 0.01	0.79	1.04	< 0.0025	0.0141	2.3	5					
10/27/14	22:00	24C	CC AS 50	2.7	7.6	673	19.9	< 0.01	0.6	0.83	< 0.0025	0.0091	2.1	10					
NS	NS	24C	CC AS 59																
NS	NS	24C	CC AS 59																
10/27/14	19:00	24C	CC AS T11	5.4	8.1	321	3	< 0.01	0.16	0.27	< 0.0025	0.0086	1.5	2	<0.00015	<0.00015	0.0346	0.0419	<0.00010
10/28/14	19:00	24C	CC AS T11	5.4	8.1	324	2.2	< 0.01	0.17	0.24	< 0.0025	0.0087	1.6	2	<0.00015	<0.00015	0.0345	0.0405	<0.00010

Ambient Autosamplers (with TH metals)

Method				EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.7	EPA200.7	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8
Reporting Limit Goal				0.00010	0.00050	0.00050	0.00025	0.00025	0.01	0.01	0.00020	0.00020	0.00025	0.00025	0.00050	0.00050	0.00050	0.00050	0.0025	0.0025
Max Sig figs				3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Max decimals				5	5	5	5	5	3	3	5	5	5	5	5	5	5	5	4	4
Reporting Units				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sample Date	Sample Time	Sample Type	Location ID	Cadmium, Total	Chromium, Dissolved	Chromium, Total	Copper, Dissolved	Copper, Total	Iron, Dissolved	Iron, Total	Lead, Dissolved	Lead, Total	Manganese, Dissolved	Manganese, Total	Molybdenum, Dissolved	Molybdenum, Total	Selenium, Dissolved	Selenium, Total	Zinc, Dissolved	Zinc, Total
05/27/14	1:00	24C	CC AS 26																	
05/28/14	1:00	24C	CC AS 26																	
05/27/14	5:00	24C	CC AS 49																	
05/28/14	5:00	24C	CC AS 49																	
05/26/14	21:00	24C	CC AS 50																	
05/28/14	5:00	24C	CC AS 50																	
NS	NS	24C	CC AS 59																	
NS	NS	24C	CC AS 59																	
05/28/14	16:00	24C	CC AS T11	0.00187	<0.00050	0.00068	0.0104	0.0624	0.131	1.53	0.00082	0.0194	0.00876	0.627	0.0012	0.00232	<0.00050	0.00058	0.0507	0.453
05/29/14	16:00	24C	CC AS T11	0.00081	<0.00050	0.00056	0.0104	0.032	0.142	0.973	0.00085	0.00993	0.0141	0.303	0.00225	0.00177	<0.00050	<0.00050	0.0547	0.228
06/23/14	1:30	24C	CC AS 26																	
06/24/14	1:30	24C	CC AS 26																	
06/23/14	5:00	24C	CC AS 49																	
06/24/14	5:00	24C	CC AS 49																	
06/23/14	5:00	24C	CC AS 50																	
06/24/14	5:00	24C	CC AS 50																	
06/23/14	8:00	24C	CC AS 59																	
06/24/14	8:00	24C	CC AS 59																	
06/23/14	15:00	24C	CC AS T11	0.00088	NT	NT	0.00464	0.021	0.094	1.02	0.00052	0.0103	0.00535	0.305	0.00132	0.00132	NT	NT	0.0708	0.197
06/24/14	15:00	24C	CC AS T11	0.00052	NT	NT	0.00461	0.0132	0.098	0.657	0.00055	0.00577	0.00988	0.174	0.00148	0.00148	NT	NT	0.0752	0.128
07/22/14	0:00	24C	CC AS 26																	
07/23/14	0:00	24C	CC AS 26																	
07/22/14	5:00	24C	CC AS 49																	
07/23/14	5:00	24C	CC AS 49																	
07/22/14	5:00	24C	CC AS 50																	
07/23/14	5:00	24C	CC AS 50																	
07/22/14	9:00	24C	CC AS 59																	
07/23/14	9:00	24C	CC AS 59																	
07/22/14	16:30	24C	CC AS T11	<0.00010	NT	NT	0.00302	0.0162	0.026	0.772	<0.0002	0.00839	0.001	0.213	0.00173	0.00173	NT	NT	0.0245	0.171
07/23/14	16:30	24C	CC AS T11	<0.00010	NT	NT	0.00274	0.0116	0.018	0.509	<0.0002	0.00508	0.00084	0.141	0.00188	0.00188	NT	NT	0.0275	0.115
08/25/14	15:30	24C	CC AS 26																	
08/26/14	15:30	24C	CC AS 26																	

Ambient Autosamplers (with TH metals)

Method				EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.7	EPA200.7	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8
Reporting Limit Goal				0.00010	0.00050	0.00050	0.00025	0.00025	0.01	0.01	0.00020	0.00020	0.00025	0.00025	0.00050	0.00050	0.00050	0.00050	0.0025	0.0025
Max Sig figs				3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Max decimals				5	5	5	5	5	3	3	5	5	5	5	5	5	5	5	4	4
Reporting Units				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sample Date	Sample Time	Sample Type	Location ID	Cadmium, Total	Chromium, Dissolved	Chromium, Total	Copper, Dissolved	Copper, Total	Iron, Dissolved	Iron, Total	Lead, Dissolved	Lead, Total	Manganese, Dissolved	Manganese, Total	Molybdenum, Dissolved	Molybdenum, Total	Selenium, Dissolved	Selenium, Total	Zinc, Dissolved	Zinc, Total
08/26/14	0:00	24C	CC AS 49																	
08/27/14	0:00	24C	CC AS 49																	
08/26/14	0:00	24C	CC AS 50																	
08/27/14	0:00	24C	CC AS 50																	
08/26/14	7:00	24C	CC AS 59																	
08/27/14	7:00	24C	CC AS 59																	
08/26/14	17:00	24C	CC AS T11	0.00018	NT	NT	0.00235	0.00441	<0.01	0.171	<0.00020	0.00121	0.00223	0.0379	0.00258	0.00258	NT	NT	0.0141	0.0409
08/27/14	17:00	24C	CC AS T11	0.0002	NT	NT	0.00239	0.00476	<0.01	0.202	<0.00020	0.00137	0.00059	0.0412	0.00247	0.00247	NT	NT	0.0157	0.0462
09/29/14	13:30	24C	CC AS 26																	
09/30/14	13:30	24C	CC AS 26																	
09/29/14	23:30	24C	CC AS 49																	
09/30/14	23:30	24C	CC AS 49																	
09/29/14	23:30	24C	CC AS 50																	
09/30/14	23:30	24C	CC AS 50																	
09/30/14	8:00	24C	CC AS 59																	
10/01/14	8:00	24C	CC AS 59																	
09/30/14	18:15	24C	CC AS T11	NT	<0.00050	NT	0.00324	NT	0.011	NT	<0.00020	NT	0.00052	NT	0.00248	NT	<0.00050	NT	0.0235	NT
10/01/14	18:15	24C	CC AS T11	NT	<0.00050	NT	0.00267	NT	0.014	NT	<0.00020	NT	0.00123	NT	0.00251	NT	<0.00050	NT	0.0259	NT
10/26/14	10:00	24C	CC AS 26																	
10/27/14	10:00	24C	CC AS 26																	
10/26/14	22:00	24C	CC AS 49																	
10/27/14	22:00	24C	CC AS 49																	
10/26/14	23:00	24C	CC AS 50																	
10/27/14	22:00	24C	CC AS 50																	
NS	NS	24C	CC AS 59																	
NS	NS	24C	CC AS 59																	
10/27/14	19:00	24C	CC AS T11	0.00031	<0.00050	<0.00050	0.00228	0.00447	<0.01	0.124	<0.00020	0.00102	0.0132	0.067	0.00224	0.00224	<0.00050	<0.00050	0.0234	0.083
10/28/14	19:00	24C	CC AS T11	0.00025	<0.00050	<0.00050	0.00277	0.00405	<0.01	0.119	<0.00020	0.00075	0.0335	0.0614	0.00251	0.00251	<0.00050	<0.00050	0.0249	0.0795

Ambient Autosamplers (with TH metals)

Method							
Reporting Limit Goal							
Max Sig figs							
Max decimals							
Reporting Units							
Sample Date	**Sample Time**	**Sample Type**	**Location ID**	**Notes**	**Conclusion**	**Field Notes**	**Lab Notes**
05/27/14	1:00	**24C**	**CC AS 26**	Sample A. Start time 0200 on 05/26/14, end time 0100 on 05/27/14.		pH data is suspect	
05/28/14	1:00	**24C**	**CC AS 26**	Sample B. Start time 0200 on 05/27/14, end time 0100 on 05/28/14.		pH data is suspect	
05/27/14	5:00	**24C**	**CC AS 49**	Sample A. Start time 0600 on 05/26/14, end time 0500 on 05/27/14.			
05/28/14	5:00	**24C**	**CC AS 49**	Sample B. Start time 0600 on 05/27/14, end time 0500 on 05/28/14.			
05/26/14	21:00	**24C**	**CC AS 50**	Sample A. Start time 0600 on 05/26/14, end time 2100 on 05/26/14.		Bottles 3 and 9-12 did not fill. Debris (plastic bag) wrapped around sample line.	
05/28/14	5:00	**24C**	**CC AS 50**	Sample B. Start time 1000 on 05/27/14, end time 0500 on 05/28/14.		Bottles 13, 14, 17 and 18 (1st sample) did not fill. Debris (plastic bag) wrapped around sample line.	
NS	NS	**24C**	**CC AS 59**	Not sampled			
NS	NS	**24C**	**CC AS 59**	Not sampled			
05/28/14	16:00	**24C**	**CC AS T11**	Sample A. Start time 2200 on 10/27/13, end time 2100 on 10/28/13.			
05/29/14	16:00	**24C**	**CC AS T11**	Sample B. Start time 2200 on 10/28/13, end time 2100 on 10/29/13.			
06/23/14	1:30	**24C**	**CC AS 26**	Sample A. Start time 0230 on 06/22/14, end time 0130 on 06/23/14.			
06/24/14	1:30	**24C**	**CC AS 26**	Sample B. Start time 0230 on 06/23/14, end time 0130 on 06/24/14.			
06/23/14	5:00	**24C**	**CC AS 49**	Sample A. Start time 0600 on 06/22/14, end time 0500 on 06/23/14.			
06/24/14	5:00	**24C**	**CC AS 49**	Sample B. Start time 0600 on 06/23/14, end time 0500 on 06/24/14.			
06/23/14	5:00	**24C**	**CC AS 50**	Sample A. Start time 0600 on 06/22/14, end time 0500 on 06/23/14.			
06/24/14	5:00	**24C**	**CC AS 50**	Sample B. Start time 0600 on 06/23/14, end time 0500 on 06/24/14.			
06/23/14	8:00	**24C**	**CC AS 59**	Sample A. Start time 0900 on 06/22/14, end time 0800 on 06/23/14.			
06/24/14	8:00	**24C**	**CC AS 59**	Sample B. Start time 0900 on 06/23/14, end time 0800 on 06/24/14.			
06/23/14	15:00	**24C**	**CC AS T11**	Sample A. Start time 1600 on 06/22/14, end time 1500 on 06/23/14.			
06/24/14	15:00	**24C**	**CC AS T11**	Sample B. Start time 1600 on 06/23/14, end time 1500 on 06/24/14.			
07/22/14	0:00	**24C**	**CC AS 26**	Sample A. Start time 0100 on 07/21/14, end time 0000 on 07/22/14.			
07/23/14	0:00	**24C**	**CC AS 26**	Sample B. Start time 0100 on 07/22/14, end time 0000 on 07/23/14.			
07/22/14	5:00	**24C**	**CC AS 49**	Sample A. Start time 0600 on 07/21/14, end time 0500 on 07/22/14.			
07/23/14	5:00	**24C**	**CC AS 49**	Sample B. Start time 0600 on 07/22/14, end time 0500 on 07/23/14.			
07/22/14	5:00	**24C**	**CC AS 50**	Sample A. Start time 0600 on 07/21/14, end time 0500 on 07/22/14.			
07/23/14	5:00	**24C**	**CC AS 50**	Sample B. Start time 0600 on 07/22/14, end time 0500 on 07/23/14.			
07/22/14	9:00	**24C**	**CC AS 59**	Sample A. Start time 1000 on 07/21/14, end time 0900 on 07/22/14.			
07/23/14	9:00	**24C**	**CC AS 59**	Sample B. Start time 1000 on 07/22/14, end time 0900 on 07/23/14.			
07/22/14	16:30	**24C**	**CC AS T11**	Sample A. Start time 1730 on 07/21/14, end time 1630 on 07/22/14.			
07/23/14	16:30	**24C**	**CC AS T11**	Sample B. Start time 1730 on 07/22/14, end time 1630 on 07/23/14.			
08/25/14	15:30	**24C**	**CC AS 26**	Sample A. Start time 1630 on 08/24/14, end time 1530 on 08/25/14.			
08/26/14	15:30	**24C**	**CC AS 26**	Sample B. Start time 1630 on 08/25/14/14, end time 1530 on 08/26/14.			

Ambient Autosamplers (with TH metals)

Method							
Reporting Limit Goal							
Max Sig figs							
Max decimals							
Reporting Units							
Sample Date	**Sample Time**	**Sample Type**	**Location ID**	**Notes**	**Conclusion**	**Field Notes**	**Lab Notes**
08/26/14	0:00	**24C**	**CC AS 49**	Sample A. Start time 0100 on 08/25/14, end time 0000 on 08/26/14.			
08/27/14	0:00	**24C**	**CC AS 49**	Sample B. Start time 0100 on 08/26/14, end time 0000 on 08/27/14.			
08/26/14	0:00	**24C**	**CC AS 50**	Sample A. Start time 0100 on 08/25/14, end time 0000 on 08/26/14.			
08/27/14	0:00	**24C**	**CC AS 50**	Sample B. Start time 0100 on 08/26/14, end time 0000 on 08/27/14.			
08/26/14	7:00	**24C**	**CC AS 59**	Sample A. Start time 0800 on 08/25/14, end time 0700 on 08/26/14.			
08/27/14	7:00	**24C**	**CC AS 59**	Sample B. Start time 0800 on 08/26/14, end time 0700 on 08/27/14.			
08/26/14	17:00	**24C**	**CC AS T11**	Sample A. Start time 1800 on 08/25/14, end time 1700 on 08/26/14.			
08/27/14	17:00	**24C**	**CC AS T11**	Sample B. Start time 1800 on 08/26/14, end time 1700 on 08/27/14.			
09/29/14	13:30	**24C**	**CC AS 26**	Sample A. Start time 1430 on 09/28/14, end time 1330 on 09/29/14.			
09/30/14	13:30	**24C**	**CC AS 26**	Sample B. Start time 1430 on 09/29/14, end time 1330 on 09/30/14.			
09/29/14	23:30	**24C**	**CC AS 49**	Sample A. Start time 0030 on 09/29/14, end time 2330 on 09/29/14.			
09/30/14	23:30	**24C**	**CC AS 49**	Sample B. Start time 0030 on 09/30/14, end time 2330 on 09/30/14.			
09/29/14	23:30	**24C**	**CC AS 50**	Sample A. Start time 0030 on 09/29/14, end time 2330 on 09/29/14.		Storm during this ambient sample collection	
09/30/14	23:30	**24C**	**CC AS 50**	Sample B. Start time 0030 on 09/30/14, end time 2330 on 09/30/14.			
09/30/14	8:00	**24C**	**CC AS 59**	Sample A. Start time 0900 on 09/29/14, end time 0800 on 09/30/14.			
10/01/14	8:00	**24C**	**CC AS 59**	Sample B. Start time 0900 on 09/30/14, end time 0800 on 10/01/14.			
09/30/14	18:15	**24C**	**CC AS T11**	Sample A. Start time 1915 on 09/29/14, end time 1815 on 09/30/14.			
10/01/14	18:15	**24C**	**CC AS T11**	Sample B. Start time 1915 on 09/30/14, end time 1815 on 10/01/14.			
10/26/14	10:00	**24C**	**CC AS 26**	Sample A. Start time 1100 on 10/25/14, end time 1000 on 10/26/14.			
10/27/14	10:00	**24C**	**CC AS 26**	Sample B. Start time 1100 on 10/26/1409/29/14, end time 1000 on 10/27/14.			
10/26/14	22:00	**24C**	**CC AS 49**	Sample A. Start time 2300 on 10/25/14, end time 2200 on 10/26/14.			
10/27/14	22:00	**24C**	**CC AS 49**	Sample B. Start time 2300 on 10/26/14, end time 2200 on 10/27/14.			
10/26/14	23:00	**24C**	**CC AS 50**	Sample A. Start time 2300 on 10/25/14, end time 2200 on 10/26/14.			
10/27/14	22:00	**24C**	**CC AS 50**	Sample B. Start time 2300 on 10/26/14, end time 2200 on 10/27/14.			
NS	NS	**24C**	**CC AS 59**	Autosampler failure			
NS	NS	**24C**	**CC AS 59**	Autosampler failure			
10/27/14	19:00	**24C**	**CC AS T11**	Sample A. Start time 2000 on 10/26/14, end time 1900 on 10/27/14.			
10/28/14	19:00	**24C**	**CC AS T11**	Sample B. Start time 2000 on 10/27/14, end time 1900 on 10/28/14.			

Clear Creek Ambient Autosamplers - Metals (Golden)

Method				EPA200.7	EPA200.7	EPA200.7	EPA200.7	EPA200.7	EPA200.7	EPA200.7	EPA200.7	EPA200.7	EPA200.7	EPA200.7
DL				variable	variable	variable	variable	variable	variable	0.004	0.004	0.01	0.01	0.001
Reporting Units				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sample Date	Sample Time	Sample Type	Location ID	Cadmium, Dissolved	Cadmium, Total	Chromium, Dissolved	Chromium, Total	Copper, Dissolved	Copper, Total	Iron, Dissolved	Iron, Total	Lead, Dissolved	Lead, Total	Manganese, Dissolved
5/27/2014		24C	CC26A	<0.004	<0.004	NT	NT	0.02	0.03	0.12	0.94	<0.01	<0.01	0.14
5/27/2014		24C	CC49A	<0.004	<0.004	NT	NT	0.02	0.03	0.15	1.76	<0.01	0.02	0.16
5/27/2014		24C	CC50A	<0.004	0.004	NT	NT	0.02	0.1	0.3	10.03	<0.01	0.06	0.3
5/28/2014		24C	CC26B	<0.004	<0.004	NT	NT	0.01	0.02	0.12	0.63	<0.01	<0.01	0.14
5/28/2014		24C	CC49B	<0.004	<0.004	NT	NT	0.01	0.04	0.15	2.25	<0.01	0.016	0.16
5/28/2014		24C	CC50B	<0.004	<0.004	NT	NT	0.02	0.08	0.32	6.42	<0.01	0.03	0.28
6/23/2014		24C	CC26A	<0.004	<0.004	NT	NT	0.009	0.01	0.05	0.12	<0.01	<0.01	0.05
6/23/2014		24C	CC49A	<0.004	<0.004	NT	NT	0.005	0.007	0.05	0.32	<0.01	<0.01	0.06
6/23/2014		24C	CC50A	<0.004	<0.004	NT	NT	0.02	0.03	1.09	1.7	<0.01	<0.01	0.35
6/23/2014		24C	CC59A	<0.004	<0.004	NT	NT	0.006	0.02	0.12	2.9	<0.01	0.01	0.05
6/24/2014		24C	CC26B	<0.004	<0.004	NT	NT	0.01	0.01	0.04	0.17	<0.01	<0.01	0.05
6/24/2014		24C	CC49B	<0.004	<0.004	NT	NT	<0.005	0.007	0.04	0.33	<0.01	<0.01	0.06
6/24/2014		24C	CC50B	<0.004	<0.004	NT	NT	0.03	0.04	1.2	1.74	<0.01	<0.01	0.37
6/24/2014		24C	CC59B	<0.004	<0.004	NT	NT	0.005	0.009	0.1	0.5	<0.01	<0.01	0.06
7/22/2014		24C	CC26A	<0.004	<0.004	NT	NT	0.011	0.014	0.095	0.11	<0.01	<0.01	0.053
7/22/2014		24C	CC49A	<0.004	<0.004	NT	NT	<0.005	0.005	0.032	0.225	<0.01	<0.01	0.07
7/22/2014		24C	CC50A	<0.004	<0.004	NT	NT	0.007	0.05	0.041	4.1	<0.01	0.012	1
7/22/2014		24C	CC59A	<0.004	<0.004	NT	NT	<0.005	0.007	0.042	0.35	<0.01	<0.01	0.064
7/23/2014		24C	CC26B	<0.004	<0.004	NT	NT	0.007	0.009	0.041	0.113	<0.01	<0.01	0.054
7/23/2014		24C	CC49B	<0.004	<0.004	NT	NT	<0.005	0.0056	0.033	0.21	<0.01	<0.01	0.074
7/23/2014		24C	CC50B	<0.004	<0.004	NT	NT	0.007	0.047	0.03	4.3	<0.01	0.012	1.06
7/23/2014		24C	CC59B	<0.004	<0.004	NT	NT	<0.005	0.007	0.031	0.34	<0.01	<0.01	0.076
8/25/2014		24C	CC26A	<0.004	<0.004	NT	NT	0.01	0.02	0.05	0.13	<0.01	<0.01	0.08
8/26/2014		24C	CC26B	<0.004	<0.004	NT	NT	0.008	0.01	0.04	0.13	<0.01	<0.01	0.08
8/26/2014		24C	CC49A	<0.004	<0.004	NT	NT	0.004	0.007	0.03	0.62	<0.01	<0.01	0.12
8/26/2014		24C	CC50A	<0.004	<0.004	NT	NT	0.006	0.07	0.02	7.5	<0.01	0.02	1.38
8/26/2014		24C	CC59A	<0.004	<0.004	NT	NT	0.003	0.007	0.03	0.45	<0.01	<0.01	0.1
8/27/2014		24C	CC49B	<0.004	<0.004	NT	NT	0.004	0.009	0.03	1	<0.01	0.006	0.12
8/27/2014		24C	CC50B	<0.004	0.004	NT	NT	0.006	0.1	0.02	10.4	<0.01	0.04	1.28
8/27/2014		24C	CC59B	<0.004	<0.004	NT	NT	0.004	0.01	0.03	1.3	<0.01	<0.01	0.11
9/29/2014		24C	CC26A	<0.004	<0.004	NT	NT	<0.005	0.011	0.04	0.23	<0.01	<0.01	0.07
9/29/2014		24C	CC49A	<0.004	<0.004	NT	NT	<0.005	0.009	0.028	1.68	<0.01	<0.01	0.076
9/29/2014		24C	CC50A	<0.004	0.008	NT	NT	0.006	0.16	0.023	28.2	<0.01	0.042	1.46
9/30/2014		24C	CC26B	<0.004	<0.004	NT	NT	<0.005	0.007	0.044	0.194	<0.01	<0.01	0.077
9/30/2014		24C	CC49B	<0.004	<0.004	NT	NT	<0.005	0.007	0.047	0.41	<0.01	<0.01	0.1
9/30/2014		24C	CC50B	<0.004	<0.004	NT	NT	0.007	0.059	0.038	6.52	<0.01	0.018	1.52
9/30/2014		24C	CC59A	<0.004	<0.004	NT	NT	<0.005	0.015	0.04	2.28	<0.01	<0.01	0.067
10/1/2014		24C	CC59B	<0.004	<0.004	NT	NT	<0.005	0.008	0.04	0.63	<0.01	<0.01	0.093
10/26/2014		24C	CC26A	<0.004	<0.004	NT	NT	0.016	0.024	0.027	0.155	<0.01	<0.01	0.13
10/26/2014		24C	CC49A	<0.004	<0.004	NT	NT	<0.005	0.007	0.027	0.16	<0.01	<0.01	0.15
10/26/2014		24C	CC50A	<0.004	<0.004	NT	NT	0.005	0.024	0.02	2.84	<0.01	<0.01	1.93
10/27/2014		24C	CC26B	<0.004	<0.004	NT	NT	0.009	0.014	0.027	0.165	<0.01	<0.01	0.13
10/27/2014		24C	CC49B	<0.004	<0.004	NT	NT	<0.005	0.006	0.02	0.155	<0.01	<0.01	0.16
10/27/2014		24C	CC50B	<0.004	<0.004	NT	NT	0.005	0.025	0.026	2.87	<0.01	<0.01	1.93

Clear Creek Ambient Autosamplers - Metals (Golden)

Method				EPA200.7	EPA200.7	EPA200.7				
DL				0.001	0.030	0.030				
Reporting Units				mg/L	mg/L	mg/L				
Sample Date	Sample Time	Sample Type	Location ID	Manganese, Total	Zinc, Dissolved	Zinc, Total	Notes	Conclusion	Field Notes	Lab Notes
5/27/2014		24C	CC26A	0.26	0.09	0.17				
5/27/2014		24C	CC49A	0.37	0.12	0.24				
5/27/2014		24C	CC50A	1.13	0.19	0.62				
5/28/2014		24C	CC26B	0.23	0.11	0.17				
5/28/2014		24C	CC49B	0.44	0.12	0.28				
5/28/2014		24C	CC50B	0.63	0.2	0.43				
6/23/2014		24C	CC26A	0.06	0.05	0.06				
6/23/2014		24C	CC49A	0.1	0.08	0.11				
6/23/2014		24C	CC50A	0.37	0.29	0.31				
6/23/2014		24C	CC59A	0.28	0.08	0.18				
6/24/2014		24C	CC26B	0.07	0.05	0.06				
6/24/2014		24C	CC49B	0.11	0.09	0.11				
6/24/2014		24C	CC50B	0.39	0.31	0.33				
6/24/2014		24C	CC59B	0.11	0.08	0.11				
7/22/2014		24C	CC26A	0.063	0.045	0.05				
7/22/2014		24C	CC49A	0.093	0.076	0.096				
7/22/2014		24C	CC50A	1	0.28	0.54				
7/22/2014		24C	CC59A	0.098	0.072	0.1				
7/23/2014		24C	CC26B	0.06	0.042	0.05				
7/23/2014		24C	CC49B	0.095	0.084	0.105				
7/23/2014		24C	CC50B	1.07	0.29	0.52				
7/23/2014		24C	CC59B	0.096	0.073	0.1				
8/25/2014		24C	CC26A	0.09	0.04	0.05				
8/26/2014		24C	CC26B	0.08	0.04	0.05				
8/26/2014		24C	CC49A	0.13	0.1	0.12				
8/26/2014		24C	CC50A	1.43	0.5	0.81				
8/26/2014		24C	CC59A	0.11	0.08	0.11				
8/27/2014		24C	CC49B	0.14	0.09	0.13				
8/27/2014		24C	CC50B	1.36	0.43	0.83				
8/27/2014		24C	CC59B	0.14	0.08	0.13				
9/29/2014		24C	CC26A	0.13	0.04	0.06				
9/29/2014		24C	CC49A	0.17	0.069	0.13				
9/29/2014		24C	CC50A	2.13	0.28	1.15				
9/30/2014		24C	CC26B	0.11	0.043	0.063				
9/30/2014		24C	CC49B	0.14	0.095	0.12				
9/30/2014		24C	CC50B	1.55	0.61	0.83				
9/30/2014		24C	CC59A	0.2	0.06	0.16				
10/1/2014		24C	CC59B	0.14	0.077	0.12				
10/26/2014		24C	CC26A	0.122	0.06	0.063				
10/26/2014		24C	CC49A	0.17	0.13	0.145				
10/26/2014		24C	CC50A	1.87	0.76	0.87				
10/27/2014		24C	CC26B	0.12	0.064	0.066				
10/27/2014		24C	CC49B	0.16	0.14	0.15				
10/27/2014		24C	CC50B	NT	0.81	0.89				

Event Autosamplers (with TH metals)

Method				SM2550B	SM4500H+I	SM2510B	SM2130B	M4500NH3-	M4500NO3	M4500NO3	SM4500PE	SM4500PE	M4500NH3	EPA 300.0	M4500Norg	Calc	SM4500PE	SM4500PE	SM5310B	SM2540D	EPA200.8	EPA200.8	EPA200.8
Reporting Limit Goal				1.0	1.0	10	1.0	0.01	0.01	0.02	0.0025	0.0025	0.05	0.02	0.01	0.10	0.01	0.01	0.5	1	0.00015	0.00015	0.00010
Max Sig figs				3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Max decimals				1	1	0	1	2	2	2	4	4	2	2	2	2	2	2	1	0	5	5	5
Reporting Units				°C	s.u.	µS/cm	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sample Date	Sample Time	Sample Type	Location ID	Temp	pH	Conductivity, Specific	Turbidity	Nitrogen, Ammonia (Salicylate)	Nitrogen, Nitrate+Nitrite	Nitrogen, Total Nitrogen	Phosphorus, Dissolved (DRP)	Phosphorus, Total	Nitrogen, Ammonia	Nitrogen, Nitrate+Nitrite	Nitrogen, Total Kjeldahl	Nitrogen, Total Nitrogen	Phosphorous, Dissolved (SRP)	Phosphorous, Total	Carbon, Total Organic	Solids, Total Suspended	Arsenic, Dissolved	Arsenic, Total	Barium, Dissolved
04/09/14	14:30	CE	CC AS T2	22.3	8	446	7.3	0.02	0.29	0.42	< 0.0025	0.012							1.7	14	<0.00015	0.00029	NT
04/10/14	14:00	CE	CC AS T11	15.4	7.8	453	5.1	< 0.01	0.18	0.28	< 0.0025	0.013							1.6	11	0.00027	0.00036	NT
7/8/2014	3:19	CE	CC AS T11	20.1	LE	148	182						NT	<0.2	2.4	2.4		0.63	4.4	257	0.00084	0.0016	NT
7/8/2014	14:06	CE	CC AS T11	17	7.3	164	229						NT	<0.2	1.5	1.5		0.38	3.8	242	0.00053	0.00112	NT
07/12/14	23:53	CE	CC AS 50	22.3	6.2	515	6400						NT	<0.2	2.4	2.4		8.1	7.1	3970			
7/13/2014	18:00	CE	CC AS T11	22.4	7.6	151	144						NT	<0.2	0.89	0.89		0.3	2	168	<0.00015	<0.00015	NT
07/13/14	3:35	CE	CC AS 59	21	7.6	135	243						NT	<0.2	0.82	0.82		0.39	2.2	220			
07/28/14	3:27	CE	CC AS 59	19.6	7.8	156	306						NT	<0.2	1.5	1.5		0.68	3	340			
7/28/2014	20:08	CE	CC AS T11	20	7.9	164	199						NT	<0.2	0.91	0.91		0.3	3.3	207	NS	NS	NS
07/29/14	20:45	CE	CC AS T11	17.3	7.5	173	205						NT	0.18	1.2	1.4		0.62	1.9	111	NS	NS	NS
08/07/14	16:32	CE	CC AS 49	18.7	8	163	586						NT	0.1	0.76	0.86		0.77	4.9	285			
08/07/14	14:02	CE	CC AS 50	20.2	8.2	370	3400						NT	0.35	1.83	2.18		6.3	4.2	3513			
08/07/14	21:45	CE	CC AS 59	20	7.8	183	290						NT	0.12	0.6	0.72		0.55	2.1	370			
08/08/14	12:30	CE	CC AS T11	22.2	8	195	250						NT	0.13	0.73	0.86		0.41	1.6	58	<0.00015	0.00165	0.0304
08/15/14	1:03	CE	CC AS 59	19.2	7.8	192	221						NT	0.11	0.6	0.71		0.42	1.8	88			
11/04/14	9:00	CE	CC AS T3	14.8	8.2	326	3	<0.01	0.24	0.4	< 0.0025	0.0127							1.5	1	<0.00015	<0.00015	0.0396
11/05/14	9:00	CE	CC AS T3	14.2	8.2	311	1.7	<0.01	0.23	0.32	< 0.0025	0.008							1.2	<1	<0.00015	<0.00015	0.0383
11/04/14	10:33	CE	CC AS T4	12.5	8.1	376	13	<0.01	0.24	0.32	0.0091	0.0318							2	12	0.00109	0.00163	0.0462
11/05/14	10:33	CE	CC AS T4	11.5	8.1	377	9.3	<0.01	0.11	0.26	0.006	0.0225							2.2	11	0.00102	0.00144	0.0458

Event Autosamplers (with TH metals)

Sample Date	Sample Time	Sample Type	Location ID	Barium, Total	Cadmium, Dissolved	Cadmium, Total	Chromium, Dissolved	Chromium, Total	Copper, Dissolved	Copper, Total	Iron, Dissolved	Iron, Total	Lead, Dissolved	Lead, Total	Manganese, Dissolved	Manganese, Total	Molybdenum, Dissolved	Molybdenum, Total	Selenium, Dissolved	Selenium, Total	Zinc, Dissolved	Zinc, Total	E. coli,
Method				**EPA200.8**	**EPA200.8**	**EPA200.8**	**EPA200.8**	**EPA200.8**	**EPA200.8**	**EPA200.8**	**EPA200.7**	**EPA200.7**	**EPA200.8**	**EPA200.8**	**EPA200.8**	**EPA200.8**	**EPA200.8**	**EPA200.8**	**EPA200.8**	**EPA200.8**	**EPA200.8**	**EPA200.8**	**SM9221D**
Reporting Limit Goal				**0.00010**	**0.00010**	**0.00010**	**0.00050**	**0.00050**	**0.00025**	**0.00025**	**0.01**	**0.01**	**0.00020**	**0.00020**	**0.00025**	**0.00025**	**0.00050**	**0.00050**	**0.00050**	**0.00050**	**0.0025**	**0.0025**	**1**
Max Sig figs				**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
Max decimals				**5**	**5**	**5**	**5**	**5**	**5**	**5**	**3**	**3**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**4**	**4**	**0**
Reporting Units				**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**cfu/100mL**
04/09/14	14:30	CE	CC AS T2	NT	0.00051	0.00073	NT	NT	0.00452	0.0134	<0.01	0.469	<0.00020	0.00236	0.245	0.296	0.0022	0.0022	NT	NT	0.0947	0.174	1
04/10/14	14:00	CE	CC AS T11	NT	0.00017	0.00031	NT	NT	0.00318	0.00607	<0.01	0.204	<0.00020	0.00097	0.00086	0.0386	0.00258	0.00258	NT	NT	0.0286	0.0545	23
7/8/2014	3:19	CE	CC AS T11	NT	0.00107	0.00171	NT	NT	0.0104	0.0358	0.0801	0.919	0.00103	0.0182	0.191	0.617	0.00071	0.001	NT	NT	0.251	0.371	2
7/8/2014	14:06	CE	CC AS T11	NT	<0.00010	0.00086	NT	NT	0.00541	0.0225	0.0543	1.85	0.000492	0.0124	0.00983	0.315	0.0014	0.0014	NT	NT	0.0176	0.212	>2420
07/12/14	23:53	CE	CC AS 50																				
7/13/2014	18:00	CE	CC AS T11	NT	0.000268	0.00171	NT	NT	0.00465	0.0581	0.0629	1.69	0.00046	0.0288	0.0121	0.384	<0.0005	<0.0005	NT	NT	0.0609	0.441	NT
07/13/14	3:35	CE	CC AS 59																				
07/28/14	3:27	CE	CC AS 59																				
7/28/2014	20:08	CE	CC AS T11	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	388
07/29/14	20:45	CE	CC AS T11	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	308
08/07/14	16:32	CE	CC AS 49																				
08/07/14	14:02	CE	CC AS 50																				
08/07/14	21:45	CE	CC AS 59																				
08/08/14	12:30	CE	CC AS T11	0.0815	0.0001	0.00108	<0.00050	0.00147	0.0032	0.0336	0.0294	2	0.00028	0.0275	0.0031	0.34	0.0007	0.0007	<0.00050	<0.00050	0.029	0.306	NT
08/15/14	1:03	CE	CC AS 59																				
11/04/14	9:00	CE	CC AS T3	0.0409	0.0004	0.0004	<0.00050	<0.00050	0.00324	0.00631	<0.01	0.213	<0.00020	0.00117	0.115	0.193	0.00245	0.00245	<0.00050	<0.00050	0.1	0.152	
11/05/14	9:00	CE	CC AS T3	0.0389	0.00046	0.00053	<0.00050	<0.00050	0.00299	0.00555	<0.01	0.177	<0.00020	0.00067	0.148	0.183	0.00225	0.00225	<0.00050	<0.00050	0.126	0.168	
11/04/14	10:33	CE	CC AS T4	0.0503	<0.00010	0.00024	<0.00050	<0.00050	0.00198	0.00728	0.011	0.309	<0.00020	0.00615	0.00087	0.072	0.00297	0.00297	<0.00050	<0.00050	0.0147	0.0527	
11/05/14	10:33	CE	CC AS T4	0.0487	<0.00010	0.00015	<0.00050	<0.00050	0.00218	0.00519	0.013	0.299	<0.00020	0.00479	0.00116	0.0539	0.0031	0.0031	<0.00050	<0.00050	0.0173	0.0474	

Event Autosamplers (with TH metals)

Method							
Reporting Limit Goal							
Max Sig figs							
Max decimals							
Reporting Units							
Sample Date	**Sample Time**	**Sample Type**	**Location ID**	**Notes**	**Conclusion**	**Field Notes**	**Lab Notes**
04/09/14	14:30	CE	CC AS T2	First Flush. Bottles 1-12. Start time 15:30 on 04/08/14, end time 14:30 on 04/09/14.			
04/10/14	14:00	CE	CC AS T11	First Flush. Bottles 7-18. Start time 03:00 on 04/09/14, end time 02:00 on 04/10/14.			
7/8/2014	3:19	CE	CC AS T11	Event. Bottles 1-2. Start time 0304 on 07/08/14, end time 0319 on 0708/14.			Nutrient analyses performed by SGS.
7/8/2014	14:06	CE	CC AS T11	Event. Bottles 3-8. Start time 1251 on 07/08/14, end time 1406 on 07/08/14.			Nutrient analyses performed by SGS.
07/12/14	23:53	CE	CC AS 50	Event. Bottles 1-4. Start time 1906 on 09/9/13, end time 1951on 09/9/13.			Nutrient analyses performed by SGS. Turbidity diluted 2x; diluted result = 3232 NTU on 2100AN Turbidimeter. TP result by ICP = 5.4 mg/L.
7/13/2014	18:00	CE	CC AS T11	Event. Bottles 1-10. Start time 1545 on 07/13/14, end time 1800 on 07/13/14.		Turbidity at T-2 approximately 250 NTU. Significant solids settled out in the FHL.	Nutrient analyses performed by SGS. TP result by ICP = <0.2 mg/L.
07/13/14	3:35	CE	CC AS 59	Event. Bottles 1-9. Start time 0140 on 07/13/14, end time 0335 on 07/13/14.			Nutrient analyses performed by SGS. TP result by ICP = 0.2 mg/L.
07/28/14	3:27	CE	CC AS 59	Event. Bottles 1-12. Start time 0046 on 07/28/14, end time 0327 on 07/28/14.			Nutrient analyses performed by SGS. TP result by ICP = 0.33 mg/L.
7/28/2014	20:08	CE	CC AS T11	Event. Bottles 1-12. Start time 1723 on 07/28/14, end time 2008 on 07/28/14.			Nutrient analyses performed by SGS. TP result by ICP = 0.20 mg/L.
07/29/14	20:45	CE	CC AS T11	Event. Bottles 1-5,10-18. Start time 1631 on 07/29/14, end time 2045 on 07/29/14.			Nutrient analyses performed by SGS. TP result by ICP = 0.28 mg/L.
08/07/14	16:32	CE	CC AS 49	Event. Bottles 1-10. Start time 1347 on 08/07/14, end time 1632 on 08/07/14.			Nutrient analyses performed by SGS. TP result by ICP = 0.41 mg/L.
08/07/14	14:02	CE	CC AS 50	Event. Bottles 1-5. Start time 1302 on 08/07/14, end time 1402 on 08/07/14.			Nutrient analyses performed by SGS. TP result by ICP = 2.2 mg/L.
08/07/14	21:45	CE	CC AS 59	Event. Bottles 1-17. Start time 1750 on 08/07/14, end time 2145 on 08/07/14.			Nutrient analyses performed by SGS. TP result by ICP = 0.27 mg/L.
08/08/14	12:30	CE	CC AS T11	Event. Bottles 8-18. Start time 1000 on 08/08/14, end time 1230 on 08/08/14.			Nutrient analyses performed by SGS. TP result by ICP = 0.16 mg/L.
08/15/14	1:03	CE	CC AS 59	Event. Bottles 1-9. Start time 1105 on 08/14/14, end time 0147 on 08/15/14.			Nutrient analyses performed by SGS. TP result by ICP = 0.24 mg/L.
11/04/14	9:00	CE	CC AS T3	First Flush. Croke Headgate. Botttles 1-12. Start time 1000 on 11/03/14, end time 0900 on 11/04/14.			
11/05/14	9:00	CE	CC AS T3	First Flush. Croke Headgate. Botttles 13-24. Start time 1000 on 11/04/14, end time 0900 on 11/05/14.			
11/04/14	10:33	CE	CC AS T4	First Flush. Botttles 1-12. Start time 1115 on 11/03/14, end time 1033 on 11/04/14.		Manual start time, then automated sampling starting with Bottle #3.	
11/05/14	10:33	CE	CC AS T4	First Flush. Botttles 13-24. Start time 1133 on 11/04/14, end time 1033 on 11/05/14.			

Clear Creek Event Autosamplers - Metals (Golden)

Method				**EPA200.7**	**EPA200.7**	**EPA200.7**	**EPA200.7**	**EPA200.7**	**EPA200.7**	**EPA200.7**	**EPA200.7**	**EPA200.7**	**EPA200.7**	**EPA200.7**	**EPA200.7**	**EPA200.7**	**EPA200.7**	**SM5310B**				
DL				**variable**	**variable**	**variable**	**variable**	**variable**	**variable**	**0.004**	**0.004**	**0.01**	**0.01**	**0.001**	**0.001**	**0.030**	**0.030**	**0.5**				
Reporting Units				**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**				
Sample Date	**Sample Time**	**Sample Type**	**Location ID**	**Cadmium, Dissolved**	**Cadmium, Total**	**Chromium, Dissolved**	**Chromium, Total**	**Copper, Dissolved**	**Copper, Total**	**Iron, Dissolved**	**Iron, Total**	**Lead, Dissolved**	**Lead, Total**	**Manganese, Dissolved**	**Manganese, Total**	**Zinc, Dissolved**	**Zinc, Total**	**Carbon, Total Organic**	**Notes**	**Conclusion**	**Field Notes**	**Lab Notes**
6/5/2014		CE	CC 59 Event	<0.004	<0.004	NT	NT	0.008	0.04	0.11	6.72	<0.01	0.04	0.06	0.79	0.06	0.35	NT	Bottles 1-10			
6/5/2014		CE	CC 59 Event	<0.004	<0.004	NT	NT	0.008	0.03	0.13	3.93	<0.01	0.03	0.06	0.58	0.07	0.28	NT	Bottles 11-20			
7/12/2014		CE	CC 50 Event	0.064	0.16	NT	NT	0.04	4.9	0.01	187	<0.01	4.9	4	7.3	10	17.3	NT	Performed a repeat sample and a 1:4 dilution on 10/24/2014. The repeat sample was very reproducible. The dilution results were reproducible except in Fe and Zn. I ran out of sample but would have done a 1:10 dilution to get the numbers lower.			
7/13/2014		CE	CC 59 Event	0.0015	0.007	NT	NT	0.005	0.225	0.05	18.3	<0.01	0.25	0.14	0.53	0.18	1	NT	Bottles 1-9			
7/28/2014		CE	CC 59 Event	<0.004	0.004	NT	NT	0.003	0.069	0.08	17.2	<0.01	0.19	0.011	0.64	0.03	0.35	NT	Bottles 1-12			
8/7/2014		CE	CC 49 Event	<0.004	0.007	NT	NT	0.004	0.122	0.05	31.2	<0.01	0.33	0.14	0.86	0.02	0.51	NT	Bottles 1-10			
8/7/2014		CE	CC 50 Event	<0.004	0.04	NT	NT	0.007	0.51	0.03	133.2	<0.01	0.12	0.26	4.65	<0.02	1.09	NT	Bottles 1-5			
8/7/2014		CE	CC 59 Event	<0.004	0.005	NT	NT	0.004	0.086	0.1	23.3	<0.01	0.18	0.13	0.64	0.022	0.38	NT	Bottles 1-17			
8/15/2014		CE	CC 59 Event	<0.004	0.005	NT	NT	0.005	0.15	0.05	15.3	<0.01	0.23	0.11	0.5	0.09	0.64	NT	Bottles 1-9			

Standley Lake															
Method				electrode	SM2510B	electrode	SM4500OG	SM4500H+B	SM2550B	SM2130B	Secchi Disk	SM4500NH3I	SM4500NO3	SM4500NO3	SM10200H
Reporting Limit Goal				1.0	10	1	1.0	1.0	1.0	1.0	0.1	0.01	0.01	0.02	1.0
Max Sig figs				3	3	3	3	3	3	3	3	3	3	3	3
Max decimals				1	0	0	1	1	1	1	2	2	2	2	1
Reporting Units				µg/L	µS/cm	mv	mg/L	s.u.	°C	NTU	m	mg/L	mg/L	mg/L	µg/L
Sample Date	**Sample Time**	**Sample Type**	**Location ID**	**Chlorophyll a, Field**	**Conductivity, Specific**	**ORP Oxidation Reduction Potential**	**Oxygen, Dissolved**	**pH**	**Temp**	**Turbidity**	**Secchi Depth,**	**Nitrogen, Ammonia (Salicylate)**	**Nitrogen, Nitrate+Nitrite**	**Nitrogen, Total Nitrogen**	**Chlorophyll a, Lab (Methanol)**
01/14/14	10:00	G	SL 10-00	6.4	280	287	11.5	8	1.8	3.1	3				
01/14/14	10:05	C	SL 10-PZ									0.02	0.06	0.32	5.2
01/14/14	10:20	G	SL 10-70	7.1	281	293	11.3	8	1.9	3.5		0.02	0.06	0.39	
02/19/14	11:00	G	SL 10-00	1.2	289	250	11.7	8.1	1.9	2.1	3.5				
02/19/14	11:05	C	SL 10-PZ									0.03	0.06	0.31	3.1
02/19/14	11:25	G	SL 10-70	3.3	345	267	10.7	7.7	2.7	3.4		0.04	0.08	0.32	
03/04/14		G	SL 10-00	1.6	297	248	11.3	7.9	2.7	2.5	3.6				
03/04/14		C	SL 10-PZ									0.03	0.07	0.4	3.6
03/04/14		G	SL 10-70	4.2	297	264	11	8	2.6	2.6		0.04	0.07	0.6	
03/17/14		G	SL 10-00	2.3	302	249	11	8	4.2	2.8	3				
03/17/14	10:00	C	SL 10-PZ									0.02	0.07	0.35	2.6
03/17/14	10:20	G	SL 10-70	4.9	303	263	10.8	8	4.1	3.2		0.03	0.07	0.33	
04/02/14		G	SL 10-00	2.5	308	283	10	8.1	6.1	2.7	1.9				
04/02/14		C	SL 10-PZ									0.02	0.06	0.34	4.2
04/02/14		G	SL 10-70	6.2	308	296	9.7	8.1	5.9	3.8		0.02	0.06	0.38	
04/02/14		G	69-00												
04/15/14		G	SL 10-00	2.8	311	278	10.1	8.1	8.3	3.7	2				
04/15/14		C	SL 10-PZ									0.03	0.04	0.25	5.8
04/15/14		G	SL 10-70	5.2	310	301	9.5	7.9	6.7	5.9		0.02	0.05	0.26	
05/06/14		G	SL 10-00	1.1	312	310	9.2	8.3	12.9	2.2	2.6				
05/06/14		C	SL 10-PZ									0.03	0.03	0.32	3.5
05/06/14		G	SL 10-70	2.6	314	346	7.9	7.8	8.9	10.8		0.06	0.04	0.22	
05/20/14		G	SL 10-00	< 1.0	314	254	9	8.3	15	1.6	3.8				
05/20/14		C	SL 10-PZ									0.03	0.04	0.33	2.9
05/20/14		G	SL 10-70	1.3	317	291	6.5	7.5	9	9.6		0.1	0.04	0.34	
05/20/14		G	69-00												
06/02/14		G	SL 10-00	2.2	306	308	8.2	8.4	19.4	1	5.1				
06/02/14		C	SL 10-PZ									0.02	0.02	0.39	1.4
06/02/14		G	SL 10-70	2	316	377	5.6	7.4	9.4	4.9		0.12	0.06	0.65	
06/16/14		G	SL 10-00	1	294	285	7.8	8.2	20	1.5	5.4				
06/16/14		C	SL 10-PZ									0.02	0.02	0.21	1.5
06/16/14		G	SL 10-70	< 1	316	343	4.9	7.2	9.7	12.8		0.08	0.09	0.31	
06/16/14		G	69-00												
07/08/14		G	SL 10-00	1.8	272	309	7.5	8.2	22	1.3	3.8				
07/08/14		C	SL 10-PZ									< 0.01	< 0.01	0.21	2.7
07/08/14		G	SL 10-70	2.5	313	395	2.2	7	10.4	15.4		0.02	0.21	0.61	
07/21/14		G	SL 10-00	< 1	268	297	7.3	8.4	23.4	1	5.2				
07/21/14		C	SL 10-PZ									0.02	0.01	0.2	1.7
07/21/14		G	SL 10-70	1.6	317	368	1.7	7.2	10.8	18.3		< 0.01	0.22	0.37	
07/21/14		G	69-00												
08/04/14		G	SL 10-00	1.3	256	229	7.4	8.4	23.4	< 1	5.2				
08/04/14		C	SL 10-PZ									0.03	0.02	0.63	2.5
08/04/14		G	SL 10-70	3.8	313	170	< 1	7.1	11.1	10.4		0.05	0.23	0.69	

Standley Lake

Sample Date	Sample Time	Sample Type	Location ID	Chlorophyll a, Field	Conductivity, Specific	ORP Oxidation Reduction Potential	Oxygen, Dissolved	pH	Temp	Turbidity	Secchi Depth,	Nitrogen, Ammonia (Salicylate)	Nitrogen, Nitrate+Nitrite	Nitrogen, Total Nitrogen	Chlorophyll a, Lab (Methanol)
Method				electrode	SM2510B	electrode	SM4500OG	SM4500H+B	SM2550B	SM2130B	Secchi Disk	SM4500NH3H	SM4500NO3I	SM4500NO3I	SM10200H
Reporting Limit Goal				1.0	10	1	1.0	1.0	1.0	1.0	0.1	0.01	0.01	0.02	1.0
Max Sig figs				3	3	3	3	3	3	3	3	3	3	3	3
Max decimals				1	0	0	1	1	1	1	2	2	2	2	1
Reporting Units				µg/L	µS/cm	mv	mg/L	s.u.	°C	NTU	m	mg/L	mg/L	mg/L	µg/L
08/18/14		G	SL 10-00	<1.0	255	309	7.3	8.2	22.7	1.1	6.1				
08/18/14		C	SL 10-PZ									0.03	0.01	0.47	1.2
08/18/14		G	SL 10-70	1.1	311	387	< 1	6.9	11.8	10.7		0.09	0.18	0.51	
08/18/14		G	69-00												
09/02/14		G	SL 10-00	1.4	253	286	7.1	8	21.1	1.2	3.8				
09/02/14		C	SL 10-PZ									0.03	0.02	0.38	2.1
09/02/14		G	SL 10-70	1.7	311	73	< 1	7	12	6.2		0.22	0.08	0.7	
09/16/14		G	SL 10-00	1.2	251	278	7.3	7.9	19.2	1.6	5.5				
09/16/14		C	SL 10-PZ									0.03	0.02	0.33	1.9
09/16/14		G	SL 10-70	1.4	318	21	< 1	7.1	11.9	13.3		0.34	<0.01	0.67	
09/16/14		G	69-00												
09/16/14		G	2 meters									<0.01	0.02	0.22	
09/16/14		G	4 meters									<0.01	0.02	0.22	
09/16/14		G	6 meters									<0.01	0.02	0.22	
09/16/14		G	8 meteres									0.01	0.02	0.28	
09/16/14		G	10 meters									0.01	0.03	0.27	
09/16/14		G	12 meters									0.02	0.04	0.28	
09/16/14		G	14 meters									0.03	0.05	0.31	
09/16/14		G	16 meters									0.01	0.02	0.29	
09/16/14		G	18 meters									0.09	0.06	0.39	
09/16/14		G	20 meters									0.17	0.04	0.51	
09/16/14		G	22 meters									0.35	<0.01	0.63	
10/06/14		G	SL 10-00	2.6	257	330	7	7.5	16.8	2.4	2.2				
10/06/14		C	SL 10-PZ									0.03	0.03	0.36	3.1
10/06/14		G	SL 10-70	2	314	191	< 1	7.2	13	7.1		0.29	0.01	0.65	
10/21/14		G	SL 10-00	2.8	258	266	7.5	7.9	15.4	1.5	4.6				
10/21/14		C	SL 10-PZ									0.03	0.04	0.29	2.5
10/21/14		G	SL 10-70	2.2	267	235	4.9	7.5	14.4	31.7		0.06	0.05	0.34	
10/21/14		G	69-00												
11/04/14		G	SL 10-00	2.5	262	287	7.6	7.8	13.1	3	2.2				
11/04/14		C	SL 10-PZ									0.03	0.05	0.21	2.5
11/04/14		G	SL 10-70	2.4	263	263	7.3	7.7	13	5.6		0.03	0.05	0.21	
11/19/14		G	SL 10-00	LE	259	230	9.3	7.9	6.8	2.6	2.3				
11/19/14		C	SL 10-PZ									0.03	0.05	0.34	3.7
11/19/14		G	SL 10-70	LE	260	216	9.1	7.8	6.7	5.5		0.03	0.05	0.25	
12/09/14		G	SL 10-00	LE	268	241	10.5	8.1	4.8	1.3	4.3				
12/09/14		C	SL 10-PZ									0.04	0.05	LE	6
12/09/14		G	SL 10-70	LE	269	224	10.1	8.1	4.7	2		0.04	0.05	LE	

Standley Lake															
Method				**SM5910B**	**SM7110B**	**SM7110B**	**SM7110B**	**SM7110B**	**SM4500PE**	**SM4500PE**	**EPA200.8**	**EPA200.8**	**EPA200.8**	**EPA200.8**	**EPA200.8**
Reporting Limit Goal				**0.001**	**variable**	**variable**	**variable**	**variable**	**0.0025**	**0.0025**	**0.00015**	**0.00015**	**0.00010**	**0.00010**	**0.00015**
Max Sig figs				**3**	**2**	**2**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
Max decimals				**3**	**1**	**1**	**1**	**1**	**4**	**4**	**5**	**5**	**5**	**5**	**4**
Reporting Units				**cm-1**	**pCi/L**	**pCi/L**	**pCi/L**	**pCi/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Sample Date	**Sample Time**	**Sample Type**	**Location ID**	**UV 254**	**Gross Alpha**	**Gross Alpha, Uncertainty**	**Gross Beta**	**Gross Beta, Uncertainty**	**Phosphorus, Dissolved (DRP)**	**Phosphorus, Total**	**Arsenic, Dissolved**	**Arsenic, Total**	**Barium, Dissolved**	**Barium, Total**	**Beryllium, Dissolved**
01/14/14	10:00	G	SL 10-00		2.5	2	1	2.3							
01/14/14	10:05	C	SL 10-PZ	0.474	0.5	1.4	1.3	2	0.0034	0.0107					
01/14/14	10:20	G	SL 10-70	0.474	1.5	1.5	0.7	2.2	0.006	0.0095					
02/19/14	11:00	G	SL 10-00												
02/19/14	11:05	C	SL 10-PZ	0.42					0.0029	0.0089					
02/19/14	11:25	G	SL 10-70	0.421					0.0027	0.013					
03/04/14		G	SL 10-00		0.9	1.9	0.5	3							
03/04/14		C	SL 10-PZ	0.412	0.9	2.2	3.7	3.5	0.0027	0.01					
03/04/14		G	SL 10-70	0.42	2.3	2.2	0	2.9	0.0031	0.0079					
03/17/14		G	SL 10-00												
03/17/14	10:00	C	SL 10-PZ	0.417					0.0029	0.0089					
03/17/14	10:20	G	SL 10-70	0.417					0.0027	0.007					
04/02/14		G	SL 10-00												
04/02/14		C	SL 10-PZ	0.405					< 0.0025	0.0097					
04/02/14		G	SL 10-70	0.399					< 0.0025	0.0095					
04/02/14		G	69-00												
04/15/14		G	SL 10-00												
04/15/14		C	SL 10-PZ	0.411					< 0.0025	0.0088					
04/15/14		G	SL 10-70	0.393					< 0.0025	0.0075					
05/06/14		G	SL 10-00												
05/06/14		C	SL 10-PZ	0.418					< 0.0025	0.0109					
05/06/14		G	SL 10-70	0.399					< 0.0025	0.018					
05/20/14		G	SL 10-00												
05/20/14		C	SL 10-PZ	0.423					< 0.0025	0.019					
05/20/14		G	SL 10-70	0.379					< 0.0025	0.0134					
05/20/14		G	69-00												
06/02/14		G	SL 10-00		0	1.8	0	2.9							
06/02/14		C	SL 10-PZ	0.466	0.9	1.7	0	3.4	< 0.0025	0.0103	0.0005	0.0005	0.0462	0.0474	
06/02/14		G	SL 10-70	0.382	2.3	2	0	2.8	< 0.0025	0.0085	0.00047	0.00059	0.0493	0.0516	
06/16/14		G	SL 10-00												
06/16/14		C	SL 10-PZ	0.529					< 0.0025	0.008					
06/16/14		G	SL 10-70	0.377					0.0031	0.0165					
06/16/14		G	69-00												
07/08/14		G	SL 10-00												
07/08/14		C	SL 10-PZ	0.507					0.0029	0.0066					
07/08/14		G	SL 10-70	0.365					0.0053	0.019					
07/21/14		G	SL 10-00												
07/21/14		C	SL 10-PZ	0.486					0.0033	0.0102	0.00041	0.00044	0.0398	0.0416	
07/21/14		G	SL 10-70	0.378					0.0051	0.0121	0.00026	0.00037	0.0498	0.0543	
07/21/14		G	69-00												
08/04/14		G	SL 10-00												
08/04/14		C	SL 10-PZ	0.425					< 0.0025	0.0089					
08/04/14		G	SL 10-70	0.35					0.0046	0.0179					

Standley Lake

Method				SM5910B	SM7110B	SM7110B	SM7110B	SM7110B	SM4500PE	SM4500PE	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8
Reporting Limit Goal				0.001	variable	variable	variable	variable	0.0025	0.0025	0.00015	0.00015	0.00010	0.00010	0.00015
Max Sig figs				3	2	2	2	2	3	3	3	3	3	3	3
Max decimals				3	1	1	1	1	4	4	5	5	5	5	4
Reporting Units				cm-1	pCi/L	pCi/L	pCi/L	pCi/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sample Date	**Sample Time**	**Sample Type**	**Location ID**	**UV 254**	**Gross Alpha**	**Gross Alpha, Uncertainty**	**Gross Beta**	**Gross Beta, Uncertainty**	**Phosphorus, Dissolved (DRP)**	**Phosphorus, Total**	**Arsenic, Dissolved**	**Arsenic, Total**	**Barium, Dissolved**	**Barium, Total**	**Beryllium, Dissolved**
08/18/14		G	SL 10-00		0.6	1.4	0	3							
08/18/14		C	SL 10-PZ	0.434	0.6	1.6	0	3.5	LE	0.0089	<0.00015	0.0005	0.0393	0.0405	
08/18/14		G	SL 10-70	0.401	1.4	1.8	0	2.9	LE	0.0142	<0.00015	<0.00015	0.0396	0.0396	
08/18/14		G	69-00												
09/02/14		G	SL 10-00												
09/02/14		C	SL 10-PZ	0.418					< 0.0025	0.0083					
09/02/14		G	SL 10-70	0.468					0.0111	0.0375					
09/16/14		G	SL 10-00		1.9	2.1	0	3.1							
09/16/14		C	SL 10-PZ	0.403	0.2	1.8	0	2.8	< 0.0025	0.009	0.00049	0.00052	0.0367	0.0432	
09/16/14		G	SL 10-70	0.525	1.1	1.8	0	3.3	0.0293	0.0843	0.00076	0.00184	0.0414	0.051	
09/16/14		G	69-00												
09/16/14		G	2 meters						< 0.0025	0.0078					
09/16/14		G	4 meters						< 0.0025	0.0077					
09/16/14		G	6 meters						< 0.0025	0.0085					
09/16/14		G	8 meteres						0.0028	0.0097					
09/16/14		G	10 meters						< 0.0025	0.0112					
09/16/14		G	12 meters						< 0.0025	0.0116					
09/16/14		G	14 meters						< 0.0025	0.0099					
09/16/14		G	16 meters						< 0.0025	0.0102					
09/16/14		G	18 meters						< 0.0025	0.0145					
09/16/14		G	20 meters						0.0174	0.0397					
09/16/14		G	22 meters						0.0167	0.1002					
10/06/14		G	SL 10-00												
10/06/14		C	SL 10-PZ	0.385					0.0041	0.0123	NT	0.0005			
10/06/14		G	SL 10-70	0.485					0.0076	0.0317	NT	0.00158			
10/21/14		G	SL 10-00		1.2	1.7	0	3.1							
10/21/14		C	SL 10-PZ	0.377	1.2	1.4	0	2.7	< 0.0025	0.0065	<0.00015	<0.00015	0.0427	0.0449	
10/21/14		G	SL 10-70	0.363	1.5	1.9	0	3.3	0.0071	0.0256	<0.00015	0.00069	0.0421	0.0514	
10/21/14		G	69-00												
11/04/14		G	SL 10-00												
11/04/14		C	SL 10-PZ	0.376					0.0027	0.0148					
11/04/14		G	SL 10-70	0.358					0.0031	0.0132					
11/19/14		G	SL 10-00												
11/19/14		C	SL 10-PZ	0.369					< 0.0025	0.0107					
11/19/14		G	SL 10-70	0.357					< 0.0025	0.0116					
12/09/14		G	SL 10-00		NT	NT	NT	NT							
12/09/14		C	SL 10-PZ	0.346	NT	NT	NT	NT	< 0.0025	0.0075					
12/09/14		G	SL 10-70	0.344	NT	NT	NT	NT	< 0.0025	0.0076					

Standley Lake															
Method				**EPA200.8**	**EPA524.2**	**EPA524.2**	**EPA524.2**	**EPA524.2**	**EPA200.8**	**EPA200.8**	**SM5310B**	**EPA200.8**	**EPA200.8**	**SM9221D**	**EPA200.8**
Reporting Limit Goal				**0.00015**	**0.0005**	**0.0005**	**0.0005**	**0.0005**	**0.00010**	**0.00010**	**0.5**	**0.00050**	**0.00050**	**1**	**0.00025**
Max Sig figs				**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
Max decimals				**4**	**4**	**4**	**4**	**4**	**5**	**5**	**1**	**5**	**5**	**0**	**5**
Reporting Units				**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**cfu/100mL**	**mg/L**
Sample Date	**Sample Time**	**Sample Type**	**Location ID**	**Beryllium, Total**	**BTEX, Benzene**	**BTEX, Ethylbenzene**	**BTEX, Toluene**	**BTEX, Xylenes**	**Cadmium, Dissolved**	**Cadmium, Total**	**Carbon, Total Organic**	**Chromium, Dissolved**	**Chromium, Total**	**E. coli,**	**Copper, Dissolved**
01/14/14	10:00	G	SL 10-00											2	
01/14/14	10:05	C	SL 10-PZ								1.8				
01/14/14	10:20	G	SL 10-70								1.8			2	
02/19/14	11:00	G	SL 10-00												
02/19/14	11:05	C	SL 10-PZ								2				
02/19/14	11:25	G	SL 10-70								1.9				
03/04/14		G	SL 10-00											4	
03/04/14		C	SL 10-PZ								2				
03/04/14		G	SL 10-70								2.2			9	
03/17/14		G	SL 10-00												
03/17/14	10:00	C	SL 10-PZ												
03/17/14	10:20	G	SL 10-70												
04/02/14		G	SL 10-00											14	
04/02/14		C	SL 10-PZ								1.8				
04/02/14		G	SL 10-70								1.7			9	
04/02/14		G	69-00		<0.0005	<0.0005	<0.0005	<0.0005							
04/15/14		G	SL 10-00												
04/15/14		C	SL 10-PZ												
04/15/14		G	SL 10-70												
05/06/14		G	SL 10-00											7	
05/06/14		C	SL 10-PZ								2.1				
05/06/14		G	SL 10-70								2.1			NT	
05/20/14		G	SL 10-00												
05/20/14		C	SL 10-PZ												
05/20/14		G	SL 10-70												
05/20/14		G	69-00		<0.0005	<0.0005	<0.0005	<0.0005							
06/02/14		G	SL 10-00											<1	
06/02/14		C	SL 10-PZ						<0.00010	0.00012	2.2	<0.00050	<0.00050		0.00233
06/02/14		G	SL 10-70						<0.00010	<0.00010	2.1	<0.00050	<0.00050	2	0.00113
06/16/14		G	SL 10-00												
06/16/14		C	SL 10-PZ												
06/16/14		G	SL 10-70												
06/16/14		G	69-00		<0.0005	<0.0005	<0.0005	<0.0005							
07/08/14		G	SL 10-00											7	
07/08/14		C	SL 10-PZ								2.1				
07/08/14		G	SL 10-70								1.9			<1	
07/21/14		G	SL 10-00												
07/21/14		C	SL 10-PZ						<0.00010	<0.00010		<0.00050	<0.00050		0.00211
07/21/14		G	SL 10-70						<0.00010	<0.00010		<0.00050	<0.00050		0.00134
07/21/14		G	69-00		<0.0005	<0.0005	<0.0005	<0.0005							
08/04/14		G	SL 10-00											3	
08/04/14		C	SL 10-PZ								1.9				
08/04/14		G	SL 10-70								1.9			5	

Standley Lake															
Method				**EPA200.8**	**EPA524.2**	**EPA524.2**	**EPA524.2**	**EPA524.2**	**EPA200.8**	**EPA200.8**	**SM5310B**	**EPA200.8**	**EPA200.8**	**SM9221D**	**EPA200.8**
Reporting Limit Goal				**0.00015**	**0.0005**	**0.0005**	**0.0005**	**0.0005**	**0.00010**	**0.00010**	**0.5**	**0.00050**	**0.00050**	**1**	**0.00025**
Max Sig figs				**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
Max decimals				**4**	**4**	**4**	**4**	**4**	**5**	**5**	**1**	**5**	**5**	**0**	**5**
Reporting Units				**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**cfu/100mL**	**mg/L**
Sample Date	**Sample Time**	**Sample Type**	**Location ID**	**Beryllium, Total**	**BTEX, Benzene**	**BTEX, Ethylbenzene**	**BTEX, Toluene**	**BTEX, Xylenes**	**Cadmium, Dissolved**	**Cadmium, Total**	**Carbon, Total Organic**	**Chromium, Dissolved**	**Chromium, Total**	**E. coli,**	**Copper, Dissolved**
08/18/14		G	SL 10-00												
08/18/14		C	SL 10-PZ						<0.00010	<0.00010		<0.00050	<0.00050		0.0017
08/18/14		G	SL 10-70						<0.00010	<0.00010		<0.00050	<0.00050		0.00074
08/18/14		G	69-00		<0.0005	<0.0005	<0.0005	<0.0005							
09/02/14		G	SL 10-00											2	
09/02/14		C	SL 10-PZ								1.8				
09/02/14		G	SL 10-70								2			56	
09/16/14		G	SL 10-00												
09/16/14		C	SL 10-PZ						<0.00010	<0.00010		<0.00050	<0.00050		0.00164
09/16/14		G	SL 10-70						<0.00010	<0.00010		<0.00050	<0.00050		0.00053
09/16/14		G	69-00		<0.0005	<0.0005	<0.0005	<0.0005							
09/16/14		G	2 meters												
09/16/14		G	4 meters												
09/16/14		G	6 meters												
09/16/14		G	8 meteres												
09/16/14		G	10 meters												
09/16/14		G	12 meters												
09/16/14		G	14 meters												
09/16/14		G	16 meters												
09/16/14		G	18 meters												
09/16/14		G	20 meters												
09/16/14		G	22 meters												
10/06/14		G	SL 10-00											5	
10/06/14		C	SL 10-PZ								2				
10/06/14		G	SL 10-70								2.2			80	
10/21/14		G	SL 10-00												
10/21/14		C	SL 10-PZ						<0.00010	<0.00010	NS	<0.00050	<0.00050		0.00169
10/21/14		G	SL 10-70						<0.00010	<0.00010	NS	<0.00050	<0.00050		0.00119
10/21/14		G	69-00		<0.0005	<0.0005	<0.0005	<0.0005							
11/04/14		G	SL 10-00											59	
11/04/14		C	SL 10-PZ								2				
11/04/14		G	SL 10-70								1.9			55	
11/19/14		G	SL 10-00												
11/19/14		C	SL 10-PZ												
11/19/14		G	SL 10-70												
12/09/14		G	SL 10-00											4	
12/09/14		C	SL 10-PZ								2.2				
12/09/14		G	SL 10-70								2.6			2	

Standley Lake															
Method				**EPA200.8**	**EPA130.2**	**EPA200.7**	**EPA200.7**	**EPA200.8**	**EPA200.8**	**EPA200.8**	**EPA200.8**	**EPA245.1**	**EPA200.8**	**EPA200.8**	**EPA200.8**
Reporting Limit Goal				**0.00025**	**5**	**0.01**	**0.01**	**0.00020**	**0.00020**	**0.00025**	**0.00025**	**0.0002**	**0.00050**	**0.00050**	**0.005**
Max Sig figs				**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
Max decimals				**5**	**0**	**3**	**3**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**4**
Reporting Units				**mg/L**	**g/L as CaC**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Sample Date	**Sample Time**	**Sample Type**	**Location ID**	**Copper, Total**	**Hardness, Total**	**Iron, Dissolved**	**Iron, Total**	**Lead, Dissolved**	**Lead, Total**	**Manganese, Dissolved**	**Manganese, Total**	**Mercury, Total**	**Molybdenum, Dissolved**	**Molybdenum, Total**	**Nickel, Dissolved**
01/14/14	10:00	G	SL 10-00												
01/14/14	10:05	C	SL 10-PZ		106										
01/14/14	10:20	G	SL 10-70		116										
02/19/14	11:00	G	SL 10-00												
02/19/14	11:05	C	SL 10-PZ		112										
02/19/14	11:25	G	SL 10-70		116										
03/04/14		G	SL 10-00												
03/04/14		C	SL 10-PZ		114										
03/04/14		G	SL 10-70		112										
03/17/14		G	SL 10-00												
03/17/14	10:00	C	SL 10-PZ												
03/17/14	10:20	G	SL 10-70												
04/02/14		G	SL 10-00												
04/02/14		C	SL 10-PZ		NT										
04/02/14		G	SL 10-70		NT										
04/02/14		G	69-00												
04/15/14		G	SL 10-00												
04/15/14		C	SL 10-PZ												
04/15/14		G	SL 10-70												
05/06/14		G	SL 10-00												
05/06/14		C	SL 10-PZ		116										
05/06/14		G	SL 10-70		112										
05/20/14		G	SL 10-00												
05/20/14		C	SL 10-PZ												
05/20/14		G	SL 10-70												
05/20/14		G	69-00												
06/02/14		G	SL 10-00												
06/02/14		C	SL 10-PZ	0.00295	NT	<0.01	0.064	<0.00020	0.00035	0.00279	0.00911	<0.00020	0.00279	0.00279	
06/02/14		G	SL 10-70	0.00161	NT	<0.01	0.094	0.00044	0.00044	0.0617	0.218	<0.00020	0.00297	0.00297	
06/16/14		G	SL 10-00												
06/16/14		C	SL 10-PZ												
06/16/14		G	SL 10-70												
06/16/14		G	69-00												
07/08/14		G	SL 10-00												
07/08/14		C	SL 10-PZ		108										
07/08/14		G	SL 10-70		128										
07/21/14		G	SL 10-00												
07/21/14		C	SL 10-PZ	0.00212	84	<0.01	0.049	<0.00020	0.00033	0.00178	0.00857	<0.00020	0.0025	0.0025	
07/21/14		G	SL 10-70	0.00191	124	<0.01	0.153	<0.00020	0.00108	0.0017	0.0901	<0.00020	0.00248	0.00257	
07/21/14		G	69-00												
08/04/14		G	SL 10-00												
08/04/14		C	SL 10-PZ		92										
08/04/14		G	SL 10-70		122										

Standley Lake															
Method				EPA200.8	EPA130.2	EPA200.7	EPA200.7	EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA245.1	EPA200.8	EPA200.8	EPA200.8
Reporting Limit Goal				0.00025	5	0.01	0.01	0.00020	0.00020	0.00025	0.00025	0.0002	0.00050	0.00050	0.005
Max Sig figs				3	3	3	3	3	3	3	3	3	3	3	3
Max decimals				5	0	3	3	5	5	5	5	5	5	5	4
Reporting Units				mg/L	g/L as CaC(	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sample Date	**Sample Time**	**Sample Type**	**Location ID**	**Copper, Total**	**Hardness, Total**	**Iron, Dissolved**	**Iron, Total**	**Lead, Dissolved**	**Lead, Total**	**Manganese, Dissolved**	**Manganese, Total**	**Mercury, Total**	**Molybdenum, Dissolved**	**Molybdenum, Total**	**Nickel, Dissolved**
08/18/14		G	SL 10-00												
08/18/14		C	SL 10-PZ	0.00186	102	<0.01	0.034	<0.00020	<0.00020	0.00055	0.00428	<0.00020	0.00265	0.00268	
08/18/14		G	SL 10-70	0.00095	114	<0.01	0.09	<0.00020	<0.00020	0.376	0.376	<0.00020	0.00323	0.0035	
08/18/14		G	69-00												
09/02/14		G	SL 10-00												
09/02/14		C	SL 10-PZ		98										
09/02/14		G	SL 10-70		126										
09/16/14		G	SL 10-00												
09/16/14		C	SL 10-PZ	0.00192	108	0.00459	0.046	<0.00020	0.00024	0.00084	0.00628	<0.00020	0.00255	0.00255	
09/16/14		G	SL 10-70	0.00115	116	0.00394	0.745	<0.00020	0.00089	1.57	1.85	<0.00020	0.0047	0.0047	
09/16/14		G	69-00												
09/16/14		G	2 meters												
09/16/14		G	4 meters												
09/16/14		G	6 meters												
09/16/14		G	8 meteres												
09/16/14		G	10 meters												
09/16/14		G	12 meters												
09/16/14		G	14 meters												
09/16/14		G	16 meters												
09/16/14		G	18 meters												
09/16/14		G	20 meters												
09/16/14		G	22 meters												
10/06/14		G	SL 10-00												
10/06/14		C	SL 10-PZ		NT										
10/06/14		G	SL 10-70		NT										
10/21/14		G	SL 10-00												
10/21/14		C	SL 10-PZ	0.00169	94	<0.01	<0.01	<0.00020	0.00028	0.00603	0.0181	<0.00020	0.00243	0.00243	
10/21/14		G	SL 10-70	0.00119	102	<0.01	0.315	<0.00020	0.00258	0.0369	0.267	<0.00020	0.00223	0.00223	
10/21/14		G	69-00												
11/04/14		G	SL 10-00												
11/04/14		C	SL 10-PZ		NT										
11/04/14		G	SL 10-70		NT										
11/19/14		G	SL 10-00												
11/19/14		C	SL 10-PZ												
11/19/14		G	SL 10-70												
12/09/14		G	SL 10-00												
12/09/14		C	SL 10-PZ		NT										
12/09/14		G	SL 10-70		NT										

Standley Lake														
Method				**EPA200.8**	**EPA200.8**	**EPA200.8**	**EPA200.8**	**EPA200.8**	**SM2540D**	**EPA200.8**	**EPA200.8**	**EPA200.7**		
Reporting Limit Goal				**0.005**	**0.00050**	**0.00050**	**0.0005**	**0.0005**	**1**	**0.0025**	**0.0025**	**0.050**		
Max Sig figs				**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**		
Max decimals				**4**	**5**	**5**	**5**	**5**	**0**	**4**	**4**	**2**		
Reporting Units				**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**		
Sample Date	**Sample Time**	**Sample Type**	**Location ID**	**Nickel, Total**	**Selenium, Dissolved**	**Selenium, Total**	**Silver, Dissolved**	**Silver, Total**	**Solids, Total Suspended**	**Zinc, Dissolved**	**Zinc, Total**	**Silicon, Dissolved**	**Notes**	**Conclusion**
01/14/14	10:00	G	SL 10-00											
01/14/14	10:05	C	SL 10-PZ						5			1.1		
01/14/14	10:20	G	SL 10-70						5			1.1		
02/19/14	11:00	G	SL 10-00											
02/19/14	11:05	C	SL 10-PZ									0.89		
02/19/14	11:25	G	SL 10-70									1.2		
03/04/14		G	SL 10-00											
03/04/14		C	SL 10-PZ						3			0.92	This mallamonas species does not produce chlorophyll a. It is a mixotroph which feeds heterotrophically.	
03/04/14		G	SL 10-70						8			0.92	This mallamonas species does not produce chlorophyll a. It is a mixotroph which feeds heterotrophically.	
03/17/14		G	SL 10-00											
03/17/14	10:00	C	SL 10-PZ									0.89		
03/17/14	10:20	G	SL 10-70									0.89		
04/02/14		G	SL 10-00											
04/02/14		C	SL 10-PZ						8			0.87		
04/02/14		G	SL 10-70						9			0.89		
04/02/14		G	69-00											
04/15/14		G	SL 10-00											
04/15/14		C	SL 10-PZ									0.69		
04/15/14		G	SL 10-70									0.76		
05/06/14		G	SL 10-00											
05/06/14		C	SL 10-PZ									0.62		
05/06/14		G	SL 10-70									0.8		
05/20/14		G	SL 10-00											
05/20/14		C	SL 10-PZ									0.61		
05/20/14		G	SL 10-70									0.83		
05/20/14		G	69-00											
06/02/14		G	SL 10-00											
06/02/14		C	SL 10-PZ		<0.00050	<0.00050			5	0.0073	0.0131	0.75		
06/02/14		G	SL 10-70		<0.00050	<0.00050			4	0.0125	0.0151	0.94		
06/16/14		G	SL 10-00											
06/16/14		C	SL 10-PZ									0.93		
06/16/14		G	SL 10-70									1.1		
06/16/14		G	69-00											
07/08/14		G	SL 10-00											
07/08/14		C	SL 10-PZ						3			0.95		
07/08/14		G	SL 10-70						10			1.3		
07/21/14		G	SL 10-00											
07/21/14		C	SL 10-PZ		<0.00050	<0.00050				0.005	0.0083	1		
07/21/14		G	SL 10-70		<0.00050	<0.00050				0.0081	0.0162	1.2		
07/21/14		G	69-00											
08/04/14		G	SL 10-00											
08/04/14		C	SL 10-PZ						1			1.1		
08/04/14		G	SL 10-70						9			1.1		

Standley Lake

Sample Date	Sample Time	Sample Type	Location ID	Nickel, Total	Selenium, Dissolved	Selenium, Total	Silver, Dissolved	Silver, Total	Solids, Total Suspended	Zinc, Dissolved	Zinc, Total	Silicon, Dissolved	Notes	Conclusion
Method				EPA200.8	EPA200.8	EPA200.8	EPA200.8	EPA200.8	SM2540D	EPA200.8	EPA200.8	EPA200.7		
Reporting Limit Goal				0.005	0.00050	0.00050	0.0005	0.0005	1	0.0025	0.0025	0.050		
Max Sig figs				3	3	3	3	3	3	3	3	3		
Max decimals				4	5	5	5	5	0	4	4	2		
Reporting Units				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		
08/18/14		G	SL 10-00											
08/18/14		C	SL 10-PZ		<0.00050	<0.00050			<1	0.0058	0.0058	1.2		
08/18/14		G	SL 10-70		<0.00050	<0.00050			6	0.0062	0.00615	1.8		
08/18/14		G	69-00											
09/02/14		G	SL 10-00											
09/02/14		C	SL 10-PZ						2			1.30		
09/02/14		G	SL 10-70						9			2.10		
09/16/14		G	SL 10-00											
09/16/14		C	SL 10-PZ		<0.00050	<0.00050				<0.0025	0.00603	1.4		
09/16/14		G	SL 10-70		<0.00050	<0.00050				<0.0025	0.0102	2.4		
09/16/14		G	69-00											
09/16/14		G	2 meters										Nutrient profile study	
09/16/14		G	4 meters										Nutrient profile study	
09/16/14		G	6 meters										Nutrient profile study	
09/16/14		G	8 meteres										Nutrient profile study	
09/16/14		G	10 meters										Nutrient profile study	
09/16/14		G	12 meters										Nutrient profile study	
09/16/14		G	14 meters										Nutrient profile study	
09/16/14		G	16 meters										Nutrient profile study	
09/16/14		G	18 meters										Nutrient profile study	
09/16/14		G	20 meters										Nutrient profile study	
09/16/14		G	22 meters										Nutrient profile study	
10/06/14		G	SL 10-00											
10/06/14		C	SL 10-PZ						2			1.7		
10/06/14		G	SL 10-70						8			2.7		
10/21/14		G	SL 10-00											
10/21/14		C	SL 10-PZ		<0.00050	<0.00050			1	0.0106	0.0117	1.8		
10/21/14		G	SL 10-70		<0.00050	<0.00050			18	0.0069	0.0215	2.2		
10/21/14		G	69-00											
11/04/14		G	SL 10-00											
11/04/14		C	SL 10-PZ						3			1.9		
11/04/14		G	SL 10-70						5			2		
11/19/14		G	SL 10-00											
11/19/14		C	SL 10-PZ									1.8		
11/19/14		G	SL 10-70									1.8		
12/09/14		G	SL 10-00											
12/09/14		C	SL 10-PZ						1			1.8		
12/09/14		G	SL 10-70						1			1.8		

Standley Lake					
Method					
Reporting Limit Goal					
Max Sig figs					
Max decimals					
Reporting Units					
Sample Date	**Sample Time**	**Sample Type**	**Location ID**	**Field Notes**	**Lab Notes**
01/14/14	10:00	G	SL 10-00		
01/14/14	10:05	C	SL 10-PZ		Silicon analyzed by SGS
01/14/14	10:20	G	SL 10-70		Silicon analyzed by SGS
02/19/14	11:00	G	SL 10-00		
02/19/14	11:05	C	SL 10-PZ		Silicon analyzed by SGS
02/19/14	11:25	G	SL 10-70		Silicon analyzed by SGS
03/04/14		G	SL 10-00		
03/04/14		C	SL 10-PZ		Silicon analyzed by SGS
03/04/14		G	SL 10-70		Silicon analyzed by SGS
03/17/14		G	SL 10-00		
03/17/14	10:00	C	SL 10-PZ		Silicon analyzed by SGS
03/17/14	10:20	G	SL 10-70		Silicon analyzed by SGS
04/02/14		G	SL 10-00		
04/02/14		C	SL 10-PZ		Silicon analyzed by SGS
04/02/14		G	SL 10-70		Silicon analyzed by SGS
04/02/14		G	69-00		
04/15/14		G	SL 10-00		
04/15/14		C	SL 10-PZ		Silicon analyzed by SGS
04/15/14		G	SL 10-70		Silicon analyzed by SGS
05/06/14		G	SL 10-00		
05/06/14		C	SL 10-PZ		
05/06/14		G	SL 10-70		
05/20/14		G	SL 10-00		
05/20/14		C	SL 10-PZ		
05/20/14		G	SL 10-70		
05/20/14		G	69-00		
06/02/14		G	SL 10-00		
06/02/14		C	SL 10-PZ		
06/02/14		G	SL 10-70		
06/16/14		G	SL 10-00		
06/16/14		C	SL 10-PZ		Silicon analyzed by SGS
06/16/14		G	SL 10-70		Silicon analyzed by SGS
06/16/14		G	69-00		
07/08/14		G	SL 10-00		
07/08/14		C	SL 10-PZ		Silicon analyzed by SGS
07/08/14		G	SL 10-70		Silicon analyzed by SGS
07/21/14		G	SL 10-00		
07/21/14		C	SL 10-PZ		Silicon analyzed by SGS
07/21/14		G	SL 10-70		Silicon analyzed by SGS
07/21/14		G	69-00		
08/04/14		G	SL 10-00		
08/04/14		C	SL 10-PZ		Silicon analyzed by SGS
08/04/14		G	SL 10-70		Silicon analyzed by SGS

Standley Lake					
Method					
Reporting Limit Goal					
Max Sig figs					
Max decimals					
Reporting Units					
Sample Date	**Sample Time**	**Sample Type**	**Location ID**	**Field Notes**	**Lab Notes**
08/18/14		G	SL 10-00		
08/18/14		C	SL 10-PZ		Silicon analyzed by SGS
08/18/14		G	SL 10-70		Silicon analyzed by SGS
08/18/14		G	69-00		
09/02/14		G	SL 10-00		
09/02/14		C	SL 10-PZ		Silicon analyzed by SGS
09/02/14		G	SL 10-70		Silicon analyzed by SGS
09/16/14		G	SL 10-00		
09/16/14		C	SL 10-PZ		Silicon analyzed by SGS
09/16/14		G	SL 10-70		Silicon analyzed by SGS
09/16/14		G	69-00		
09/16/14		G	2 meters		
09/16/14		G	4 meters		
09/16/14		G	6 meters		
09/16/14		G	8 meteres		
09/16/14		G	10 meters		
09/16/14		G	12 meters		
09/16/14		G	14 meters		
09/16/14		G	16 meters		
09/16/14		G	18 meters		
09/16/14		G	20 meters		
09/16/14		G	22 meters		
10/06/14		G	SL 10-00		
10/06/14		C	SL 10-PZ		Silicon analyzed by SGS
10/06/14		G	SL 10-70		Silicon analyzed by SGS
10/21/14		G	SL 10-00		
10/21/14		C	SL 10-PZ		Silicon analyzed by SGS
10/21/14		G	SL 10-70		Silicon analyzed by SGS
10/21/14		G	69-00		
11/04/14		G	SL 10-00		
11/04/14		C	SL 10-PZ		Silicon analyzed by SGS
11/04/14		G	SL 10-70		Silicon analyzed by SGS
11/19/14		G	SL 10-00		
11/19/14		C	SL 10-PZ		Silicon analyzed by SGS
11/19/14		G	SL 10-70		Silicon analyzed by SGS
12/09/14		G	SL 10-00		
12/09/14		C	SL 10-PZ		Silicon analyzed by SGS
12/09/14		G	SL 10-70		Silicon analyzed by SGS

Appendix D – Regulation 85 Water-Quality Monitoring Data – 2014

Regulation 85 Data

		Ammonia	Flow	Nitrate	Nitrate+Nitrite	Nitrite	TIN	TKN	TN	TP
Facility Name	**Date**	**mg/L**	**MGD**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
BHCCSD	1/8/2014	0.05	0.355				2.62	1.9	4.5	0.14
BHCCSD	2/5/2014	0.05	0.304				2.12	1.7	3.82	0.11
BHCCSD	3/12/2014	0.05	0.332				1.95	1.5	3.4	0.11
BHCCSD	4/15/2014	0.05	0.35				2.4	1.2	3.6	0.07
BHCCSD	5/13/2014	0.09	0.32				3.25	1.2	4.36	0.07
BHCCSD	6/10/2014	0.09	0.342				5.4	1.4	6.71	0.12
BHCCSD	7/8/2014	0.05	0.28				4.6	2	6.6	0.18
BHCCSD	8/26/2014	0.07	0.424				7.11	1.7	8.74	0.15
BHCCSD	9/9/2014	0.05	0.374				5.28	1.7	6.98	0.18
BHCCSD	10/7/2014	0.24	0.322				4.54	2.7	7	0.34
BHCCSD	11/11/2014	0.05	0.267				2.7	1.4	4.1	0.06
BHCCSD	12/9/2014	0.05	0.308				2.62	1.1	3.7	0.07
CCCSD	3/21/2014	0.11	0.043				31.9	1.7	33.5	1.04
CCCSD	7/31/2014	0.11	0.041				19.6	0.7	20.1	2.7
CCCSD	8/26/2014	0.14	0.046				26.4	0.1	26.4	2.2
CCCSD	9/19/2014	0.13	0.008				36.6			2.36
CCCSD	10/15/2014	0.26					39.7	0.4	39.8	2.38
CCCSD	12/18/2014	0.2	0.059				32.2	0.3	32.2	1.04
Town of Empire	1/14/2014	0.44	0.035		16.75		17.2	0.7	17.4	0.16
Town of Empire	3/26/2014	0.57	0.034		11.4		12	3.8	15.2	1.04
Town of Empire	5/27/2014	1.54	0.035		24.51		26	2.3	26.8	0.26
Town of Empire	7/30/2014	9.72	0.035		32.7		42.7	10.4	43.2	2
Town of Empire	9/23/2014	1.87	0.03		31.06		32.9	2	33.1	0.68
Town of Empire	11/24/2014	18.31	0.04		17.99		36.3	24.3	42.3	11.17
Georgetown	3/5/2014	0.06	0.235		2.99		3.4	0.01	3	0.39
Georgetown	4/2/2014	0.09	0.234		2.7		4.28	4.28	4.4	0.1
Georgetown	5/7/2014	0.09	0.231		3.43		3.6	3.2	3.8	0.09
Georgetown	6/4/2014	0.21	0.234		4.28		4.4	2	6.2	0.72
Georgetown	7/2/2014	1.03	0.299		3.59		4.6	3.5	7.1	1.4
Georgetown	8/6/2014	0.41	0.26		2.91		3	1.6	3.9	0.99
Georgetown	9/3/2014	0.12	0.646		2.01		2.1	2.1	2.6	0.51
Georgetown	10/1/2014	0.19	0.638		3.11		3.3	0.52	3.8	0.26
Georgetown	11/5/2014	0.27	0.442		5.18		5.7	0.4	6.2	1.06
Georgetown	12/3/2014	0.24	0.378		7.28		7.5	1	7.7	0.29
Idaho Springs	1/6/2014	0.61	0.328	2.45	2.55	0.01	3.2	1.7	4.2	0.29
Idaho Springs	3/4/2014	0.11	0.249	0.03	0.03	0	0.1	1.1	1.2	0.14
Idaho Springs	5/1/2014	0.19	0.249	1.29	1.29	0	1.5	1.3	2.6	0.18

Regulation 85 Data

		Ammonia	Flow	Nitrate	Nitrate+Nitrite	Nitrite	TIN	TKN	TN	TP
Facility Name	**Date**	**mg/L**	**MGD**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Idaho Springs	7/8/2014	0.43	0.32	0	0	0	0.4	2.8	2.8	0.51
Idaho Springs	9/3/2014	6.21	0.323	0.4	0.4	0	10.8	12.2	12.6	0.62
Idaho Springs	11/3/2014	0.16	0.366	0.04	0.04	0	0.2	1.4	1.4	0.27
Loveland	5/1/2014	13.76	0.014	0	0	0	13.8	15.2	15.2	0.68
Loveland	7/15/2014	0.55	0.007	9.96	9.96	0	10.5	1.3	11.3	0.65
Loveland	9/15/2014	0.09	0.004	8.18	8.18	0	8.3	1.2	9.4	0.23
Loveland	11/6/2014	3.1	0.008	19.87	19.87	0	23	3.3	23.2	0.16
Loveland	1/22/2015	64.5	0.013	0	0	0	64.5	103	103	4.47
Loveland	3/15/2015	62.85	0.013	0.56	1.39	0.83	64.2	80.7	82.1	0.75
St. Marys Glacier W&S District	1/15/2014	6.3	0.0138		3.91		10.2	7.8	11.7	0.77
St. Marys Glacier W&S District	3/27/2014	0.12	0.0382		12.92		13	1.1	14	1.78
St. Marys Glacier W&S District	5/29/2014	0.46	0.0495		0.76		1.2	2.4	3.2	0.54
St. Marys Glacier W&S District	7/7/2014	2.38	0.0357		0.26		2.6	4.2	4.5	0.43
St. Marys Glacier W&S District	9/24/2014	0.09	0.0104		12.95		13	2.4	15.4	0.98
St. Marys Glacier W&S District	11/24/2014	0.4	0.0067		15.33		15.7	1.9	17.3	1.76