2013
City of Fort Collins
Lower Cache la Poudre River
& Urban Creek
Water Quality Report

Pre-Flood, 04-September-2013

Post-Flood, 18-September-2013

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Introduction:

This 2013 Lower Poudre and Urban Creek Water Quality Report provides a water quality-focused summary of the scope, status and trends of the City's monitoring efforts on the Cache la Poudre River through Fort Collins and three urban creeks in our community. The presentation includes discussion of current and future regulatory changes and initiatives that affect the Poudre. In addition, key stormwater quality enforcement and improvement efforts, regulatory requirements, activities and associated compliance and non-compliance issues are also highlighted. Details on river and creek monitoring site locations, test parameters, key results and trends are presented. It must be noted, however, that aspects of this report are limited in scope: flow and water quality are just two of many key factors that influence and reflect the health of a river or creek. Other factors include man-made changes and activities as well as stream geomorphology and the abundance and diversity of its biological community. The ability of the biological community in a stream to survive and thrive is dependent, in part, on the quantity, quality and physical characteristics of the water flow as well as stream habitat. Future monitoring reporting efforts and programs will strive to identify, assess and explain the interdependencies that tie together the many factors affecting the health of the Poudre and urban creeks in our community.

Purpose of the Report:

In order to fulfill City Council's goal of protecting and enhancing the Poudre River as outlined in Council Resolution **92-14** "Framework for Environmental Action", Resolution **95-14** "Approving the Watershed Approach to Stormwater Quality Management" and **Resolution 2000-128** "Recognizing the Need to Protect Water Quality", City staff has prepared the following status report on water quality conditions in key urban creeks and the Cache la Poudre River through Fort Collins. This report also includes summaries on the 2013 status of several MS4 and low impact development (LID) improvement programs in the City's Stormwater Program.

Executive Summary:

In 2013 several significant regulatory changes occurred that reveal both positive and negative trends in current water quality conditions in the Poudre through Fort Collins as well as our urban creeks.

1. **September 2013 Poudre Flood.** The Poudre watershed provides approximately half of the City's drinking water and is a critical asset to our community. The High Park Fire that began in early June 2012 and burned for a month was followed in September 2013 by a significant flood. Impacts in the aftermath of the fire and flood to the watershed including potential drinking water issues as well as impacts on the plains portion of the river through the City

will be felt for many years into the future. Additional details regarding river flows during the September flood are presented starting on page 6.

2. **Municipal Separate Storm Sewer System (MS4) Permit Program Activities**: In 2003, the City obtained coverage under the Phase 2 MS4 General Permit and began implementation of the required program. This federally mandated program is administered by the Colorado Department of Public Health and Environment (CDPHE), Water Quality Control Division (WQCD). Fort Collins is currently in its second permit term, which expired in 2013 but has been administratively extended until the WQCD renews it. The goal of the program is to minimize the amount of pollutants entering streams, creeks, lakes and rivers as a result of rain water and snowmelt from residential, commercial and industrial areas. The following six minimum control measures must be met: public education and outreach, public participation, illicit discharge detection and elimination, construction site stormwater runoff control, post-construction site stormwater management, and pollution prevention/good housekeeping for municipal operations. Details on 2013 MS4 program activities begin on page 8.

3. **Low Impact Development Program and Progress:** In effect since March 1, 2013, Ordinance 152-2013, commonly referred to as the City's Low Impact Development (LID) Policy, addresses the City's requirements and incentives for a more distributed stormwater runoff management program. It requires a minimum level of stormwater treatment and controls that rely primarily on filtration and infiltration to manage storm runoff. Additional details on current LID programs begin on page 15.

4. **Nutrient Control Regulations**: The WQCD implemented a new pollution control program in March 2013. The regulation focuses on limiting the discharge of the nutrients nitrogen and phosphorus into state waterways. These nutrients can promote the growth of nuisance algae that can adversely affect water quality and disrupt the food web in lakes, reservoirs, rivers, and streams. In addition, algae blooms can create aesthetic problems (visual, taste, and odor) for drinking water supplies and adversely impact recreational activities like swimming and fishing. This program will have long-term significant cost impacts on capital improvements and operation of the City's two water reclamation facilities. This program is called "Nutrient Criteria" or Regulation 85 (Reg85). Additional details about this regulatory change and where we currently stand are presented beginning on page 31.

5. **Selenium levels in the Poudre**: Water quality conditions in the Cache la Poudre River from Shields Street downstream to just above Boxelder Creek are currently better than all WQCD-defined aquatic life stream standards except for the levels of selenium. Selenium is associated with shale and is naturally present in the soils, river- and creek-banks in our area. Over the years, higher selenium levels in the Poudre have <u>not</u> been observed. However, the WQCD's re-defined stream standard is now more restrictive. Therefore selenium levels reported in the past now exceed that new stricter standard. The exceedences were sufficient for the WQCD to list the stretch of the Poudre through the City as 303(d)-impaired for chronic exposure aquatic life selenium standards. The WQCD gave this listing a low 303(d) priority for corrective action. Further details regarding this issue are presented on page 35.

6. **Both Fossil Creek and Boxelder Creek are listed as "303(d)-impaired" (low priority) for high selenium levels.** Like the Poudre, exceedences of regulated selenium levels in Fossil and Boxelder Creeks were the result of stricter selenium standards and not reduced water quality in the creeks. City data show that high selenium levels in our urban creeks are observed during and immediately after major storm events. In addition, any activities that erode creek banks or otherwise contribute to soil erosion can contribute to higher selenium levels in the water. Further details on this issue are presented on page XX .

7. **Both Fossil Creek and Spring Creek 303(d) listed as impaired, *high priority*, for seasonal *E. coli* contamination**: *E. coli* is an indicator of fecal contamination. Although these bacteria can be pathogens, their presence in water also indicates that other water-borne disease-causing enteric bacteria (Salmonella, Shigella) may also be present. In our urban creeks, high *E. coli* levels show strong seasonal trends with the highest levels appearing during the late spring and summer months and the lowest levels during the late fall and winter. These urban creeks are listed as a "high priority" because of the corresponding high probability of human and animal contact during recreational activities in nearby parks. The State is expecting proactive corrective control measures to be taken on this issue. In response, additional creek water quality monitoring and field survey efforts are underway to ensure that possible illicit discharges such as leakage from sewer pipes or septic systems are not contributing to the problem. Additional details on this issue begin on page XX.

Natural disasters, regulatory changes and corresponding impacts at the local level point to the continued need for long-term, proactive monitoring and testing programs for the Poudre and our urban creeks. Successful water quality monitoring programs will help keep our community at the forefront of environmental protection efforts and provide the data necessary for careful stewardship of our limited resources.

• History of the City's River, Creek and Stormwater Quality Monitoring Programs:

In the mid-1970s, the Colorado Water Quality Control Commission held its first stream classification hearings for the Cache la Poudre River. At that time, both Federal and State Clean Water Act mandates were being implemented across the state and the nation. Unfortunately, little or no water quality data were available for the Poudre as it flowed past the City's two wastewater treatment plants. At the Commission's hearings it quickly became apparent that because of this lack of data, the City was at both a tactical and strategic disadvantage: data was needed to assess the impacts of the treated discharges from its two wastewater treatment plants on the river. As a result, the City initiated several long-term monitoring efforts to gather flow and water quality data to protect both the Poudre and City interests.

Since the late 1970s and in cooperation with the US Geological Survey (USGS), the City has been monitoring both flow and water quality in the Cache la Poudre River above and through Fort Collins. Beginning in the early 1980s, and in cooperation with Colorado State University and Kodak Colorado Division (KCD), the USGS program was expanded to include assessments of the fish and benthic macro-invertebrate communities in the Poudre. At that same time, City

staff from the Pollution Control Lab began weekly water quality monitoring both up- and down-stream of the City's two wastewater treatment plants. The City-CSU-KCD cooperative program expanded in 2007 to form the Poudre Monitoring Alliance.

The Poudre Monitoring Alliance is part of the Environmental Protection Agency's (EPA) award winning *Performance Track* program. It brings together under one roof the monitoring efforts of the City, Boxelder and South Fort Collins Sanitation Districts, the Town of Windsor, Carestream Health (formerly KCD) and the City of Greeley. The alliance monitors over 42 miles of the Poudre at ten separate sites from Lincoln Street to its confluence with the Platte.

In the fall of 2012, the Alliance was expanded to meet the requirements of the Colorado Nutrient Control Regulations, Reg85. Leprino Foods, Inc., joined as a cooperating agency. Net effects of this consolidation include reduced costs and heightened cooperation among the affected agencies and communities that discharge to the lower Poudre.

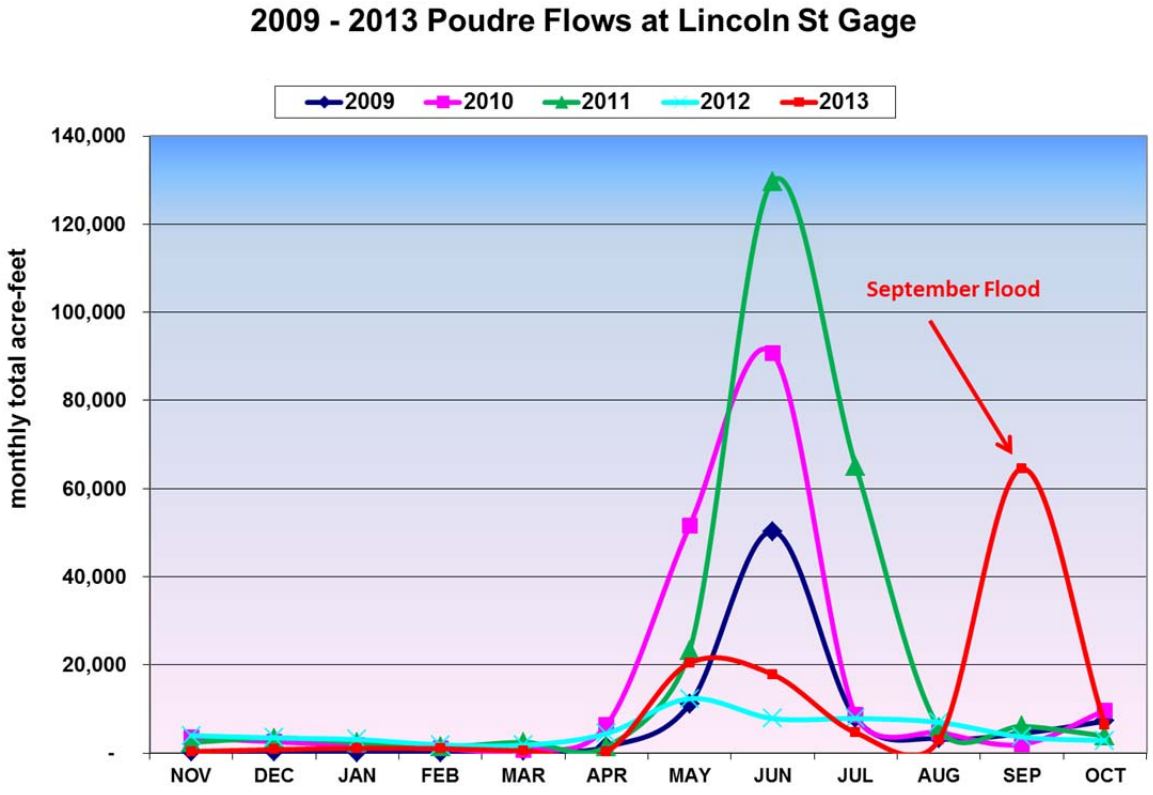
Since 1984, the City has monitored water quality in Parkwood Lake. The lake receives storm water inputs from the area bounded by Drake and Lemay Avenues. Beginning in 2000, the program was expanded to include routine testing at three urban creeks: Boxelder Creek, Spring Creek and Fossil Creek. Two sites on each creek are monitored each calendar quarter for a variety of water quality parameters including potential *E. coli* and selenium contamination that have been issues in the past.

Agencies with Monitoring Activities on the Poudre & Urban Creeks in Fort Collins:

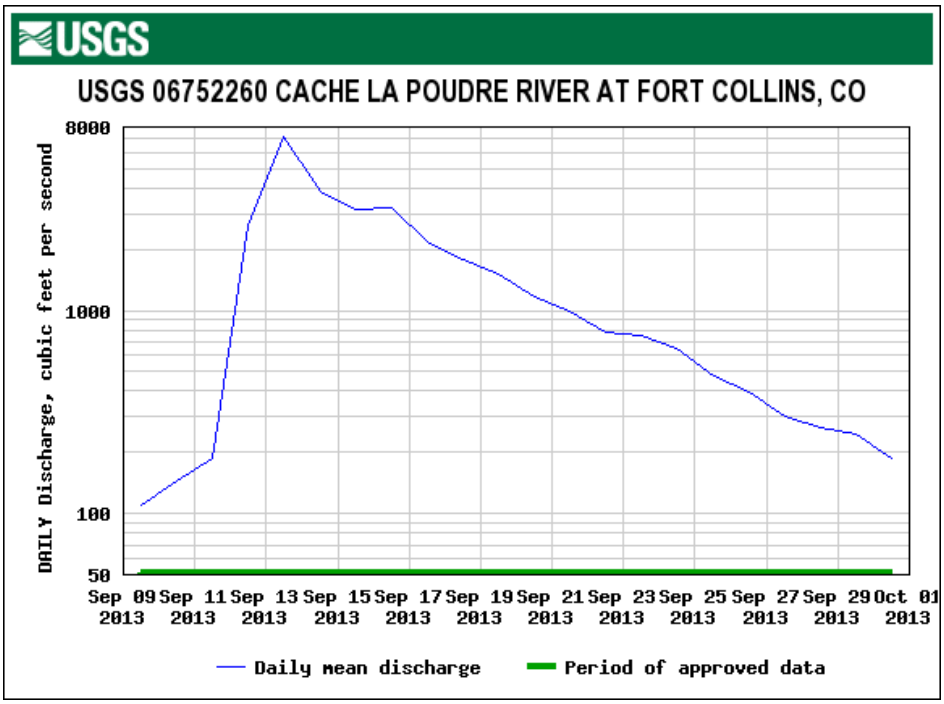
Natural water bodies in the Fort Collins area are actively monitored at numerous locations to evaluate the impacts of human and natural activities on water quality. Water quality datasets for some locations on the Poudre in the City begin in the mid-1970s. The Poudre, as it flows through town from Shields Street to Boxelder Creek (Segment 11), is currently sampled, monitored, and tested by several agencies, including: the City of Fort Collins, Colorado State University (CSU), the WQCD, CDPHE, Colorado Parks & Wildlife, the USGS, In-Situ, Inc., Boxelder Sanitation District, and RiverWatch.

2013 Lower Poudre River Flows and the September Flood

In 2013 spring runoff flow rates in the Poudre were substantially below the levels observed in 2009 through 2011 but were higher than 2012. The 2013 September flood flow rates exceeded the monthly total acre-feet during spring runoff flows by almost a factor of three. It is of interest to note that the numbers and biomass of brown trout observed during the November 2012 CSU fish survey upstream of Lincoln Street exceeded levels observed in 2011. However, the fish survey completed after the 2013 flood showed reductions in both the abundance and biomass of fish recovered from the Poudre. The September flood also scoured much of the ash sediments from the riverbed. The fall 2014 fish survey may reveal if this scouring had a positive effect on restoring macro-invertebrates and recovery of the fish populations in the Poudre.



2009 – 2013 Comparative monthly flows at the Lincoln St Gage



September 2013 Flood Flows at the Lincoln Street Gage Reported by the USGS

Lower Poudre Water Quality Programs & Municipal Separate Stormwater Sewer System (MS4) Monitoring Programs and Costs:

2013 Monitoring Program Description	Cost	Comment
USGS: October 2012 – September 2013 U.S. Geologic Survey cooperative monitoring program for six flow and two water quality sites on the Cache la Poudre from the Michigan River near Cameron Pass to the gage station upstream of Boxelder Cr.	$140,740	City's share: $103,388. Federal funds cover the remaining portion of the cooperative program.
Poudre River: City's Pollution Control and Water Quality Lab monitoring on Cache la Poudre River at both up- and down-stream sites from water reclamation facilities with both a weekly schedule and 8 special data collections for the Poudre Monitoring Alliance including the CSU fish and benthic macro invertebrate surveys.	$92,152	Cost value of field sampling, field measurements and lab work; includes City's portion of Lower Poudre Monitoring Alliance Program.
Urban Creeks: City's Pollution Control and Water Quality Lab quarterly monitoring at two sites on three urban creeks plus Parkwood Lake at three locations twice each year.	$6,939	Cost value of field sampling, field measurements and lab work.
2013 **CSU** Fish and Macro-invertebrate Biosurveys on the Poudre through the City as part of the Lower Poudre Monitoring Alliance Program	$23,225	Fort Collins share of this portion of Lower Poudre Monitoring Alliance Program
2013 Nutrient Control Regulation – Reg85 Cooperating Agencies	$17,750	Fort Collins portion was $2,700
Municipal Separate Storm Sewer System (MS4) Permit Compliance Program	$300,000	Managed by the Division of Government and Regulatory Affairs

In 2013, the City committed over $580,000 to collect flow and water quality data on the lower Cache la Poudre River as well as water quality data on key urban creeks, Parkwood Lake, stormwater and for MS4 permit compliance. USGS flow and water quality data are used to help manage operations at the City's two water reclamation facilities and to manage its extensive water rights portfolio. The data is also used to assess regulatory compliance and stormwater impacts on key urban creeks in the City as well as the river.

2013 Municipal Separate Storm Sewer System (MS4) Program Highlights:

Storm Drain Marker contest winning design: Mayfly by Alison Dickson

The City must implement a Colorado Discharge Permit System (CDPS) Stormwater Management Program in accordance with its MS4 permit. The City's Stormwater Management Program is a comprehensive program comprised of six minimum control measures designed to minimize the discharge of pollutants from its MS4. Each measure requires several detailed elements that must be implemented annually or on an ongoing basis.

City staff takes pride in implementation of these pollution prevention measures and protection of water quality. Listed below are the minimum control measures, a summary of the requirements and 2013 highlights.

1. **Public Education and Outreach** - *The permittee must implement a public education program in an effort to promote behavior change by the public to reduce water quality impacts associated with pollutants in stormwater runoff and illicit discharges.*

Community outreach events that included watershed and stormwater education included the Poudre Watershed Tours, ClimateWise EnvirOvation, the Udall Stormwater Treatment Ponds Tour, and the UniverCITY Connections Poudre River Tour. Other 2013 public education program highlights included:

- The City's WaterSHED (Stormwater Habitat Education Development) program educated 3,570 students and 1,022 adults, for a total of 6,231 student and 1,783 adult contact hours.
- Staff trained seventeen teachers and two community volunteers in a two-day watershed protection workshop.

Fifth grade students learn about stream ecology during Eco-Week

- Interpretive signage is displayed at selected outdoor classrooms in Fort Collins, as well as the LID pilot projects.
- Storm drain markers using designs submitted to the Art in Public Places storm drain marker design contest were installed on 284 storm drain inlets.
- The Children's Water Festival had over 1750 student participants.

- The 2013 Stormwater Business Outreach Program delivered pollution prevention information to multi-family residence businesses in a multi-faceted approach, addressing the following potential sources of pollution from these business sectors: power washing, painting, carpet cleaning, landscaping, automotive fluids and trash and recycling receptacles
- Stormwater quality information was distributed to 70 residents at the Riverglen Apartments on 'move-in' day.

Poudre School District students participate in a wide variety of educational water activities at the annual Children's Water Festival.

An electronic flyer with links to additional information was distributed to multi-family residential businesses along with an invitation to an outreach luncheon

2. **Public Participation and Involvement** - *The permittee must provide a mechanism and process to allow the public to review and provide input on the CDPS Stormwater Management Program.*

   - An annual update of the Stormwater Management Program was presented to the Natural Resources Advisory Board and the Water Board. The 2013 MS4 update included a summary of the 2012 MS4 Permit annual report, highlights of the 2012 minimum control measures, and a regulatory update on the EPA stormwater Rulemaking and proposed changes to MS4 Permit.

   - The City's MS4 Permit Stormwater Management Program description and 2008-2013 annual reports are posted on the City's website at: http://www.fcgov.com/utilities/what-we-do/stormwater/stormwater-quality/management-program

3. **Illicit Discharge Detection and Elimination (IDDE) -** *The permittee must develop, implement and enforce a program to detect and eliminate illicit discharges into the permittee's MS4.*

Sometimes the party responsible for a spill cannot be identified. Staff must attend Hazardous Waste training in order to respond to and clean up certain types of spills. They often call on the expertise of Poudre Fire Authority when evaluating the hazards of an unknown substance.

Other IDDE activities included:

- Response to 46 spill complaint calls, including site visits, incident investigations, on-site and phone education, delivery of educational door hangers and follow-up letters.
- Issuing seven written and four verbal notices of violation and provided education for seventeen separate incidents.
- Summarizing and presenting monitoring data for the WQCD stormwater monitoring stakeholder's meeting.
- Continued collaboration with the Poudre Fire Authority Hazmat Team.

One Challenge of the IDDE program is acts of vandalism such as dumping restaurant grease recycling barrels. Staff worked with this restaurant to ensure the grease was cleaned properly and did not enter the storm sewer system.

4. **Construction Site Runoff Control** – *The permittee must develop and implement a program to assure adequate design, implementation, and maintenance of Best Management Practices (BMPs) at construction sites within the MS4 to reduce pollutant discharges and protect water quality.*

Lack of BMPs to control stormwater run-on from the street -and unmaintained tracking BMPs caused rill erosion to occur with subsequent discharge of sediment.

Staff conducted 2,023 inspections on 97 construction sites for sediment and erosion control.

Inspections included 720 individual building sites and 71 development sites.

Enforcement measures for noncompliance with erosion control requirements included: 512 verbal notices, one stop work order, and 56 building permits and Certificates of Occupancy withheld until staff signed off on 605 Soil Amendment Certifications

Properly selected and installed Best Management Practices (BMPs) on construction sites minimize the discharge of pollutants, such as sediment, to the storm sewer system.

Other construction site control activities included:

- Response to over 500 phone calls addressing customer questions about erosion control, stormwater pond inspections and permit compliance.
- Advising City departments and contractors on erosion control plans, construction stormwater permit and stormwater management plan requirements for various projects.
- Providing Project Manager training: CDOT Erosion Control Supervisor class and certification for City project managers

5. **Post-Construction Stormwater Management in New Development/Redevelopment** - *The permittee must develop, implement, and enforce a program to address stormwater runoff from new development and redevelopment projects that disturb greater than or equal to one acre, including projects less than one acre that are part of a larger common plan of development or sale, that discharge into the MS4. The program must ensure that controls are in place that would prevent or minimize water quality impacts.* 2013 activities in this work area included:

   - Performing221 inspections of private water quality ponds and 333 additional inspections of private stormwater detention/retention ponds.
   - Developing 124 written enforcement measures and 58 verbal notices of violation for maintenance issues.
   - Adding 16 stormwater basins to the Stormwater Information Management System (SWIMS) database.

High Velocity stormwater flows caused erosion of this channel into a wetland detention basin.

This channel was repaired by re-grading the area, installing rip rap and vegetating with native seed.

6. **Pollution Prevention/Good Housekeeping (P2/GH) for Municipal Operations** - *The permittee must develop and implement an operation and maintenance program that includes an employee training component and has the ultimate goal of preventing or reducing pollutants in runoff from municipal operations.* 2013 P2/GH activities included:

- Conducting Stormwater Pollution Prevention/Good Housekeeping/Hazardous Waste Training for 371 City employees.
- Performing stormwater inspections at ten City facilities.
- Advising on discharge options for hydraulic cleaning of North Mason water lines.

- Advising on discharge options for waste generated from cathodic protection drilling.
- Conducting Snow and Ice Training for Streets.

Proper management of outdoor storage of materials is an essential element of the P2/GH program. Transformers in the Light and Power yard are stored on a secondary containment pad that will collect transformer oil in an underground oil/water separator in the event of a spill.

Stormwater Quality Control Low Impact Development (LID) Program

City Council requested a review of the Stormwater Program in October 2008. Council directed that additional emphasis be placed on improving stormwater quality and protecting the City's urban watersheds while preserving natural and beneficial functions of floodplains. The resulting Stormwater Utility Repurposing program review consisted of 14 major components:

- Stormwater Purpose Statement
- BMP Policy Update
- Urban Stream Health
- Floodplain Regulations
- City-Owned BMP Review
- LID Demo Projects
- Stormwater Criteria Update
- Stormwater Rates
- LID Policy Review
- Level of Protection Policy
- Stormwater Quality Sampling
- Detention Pond Landscaping
- Homeowner Association (HOA) Assistance Program
- Stormwater Quality Geographic Information System (GIS) Coverage

In effect since March 1st, 2013, Ordinance 152-2013, commonly referred to as the City's LID Policy, addresses City requirements and incentives for a more distributed stormwater runoff management program. It includes a minimum level of stormwater treatment and controls that rely primarily on filtration and infiltration to manage storm runoff. The overall goal of this effort is to improve the quality of life, to support economic health and to enhance and protect the City's natural resources.

Key components of the LID program include:

- An overall site planning approach that promotes conservation design at both the watershed and site levels.
- A site design philosophy that emphasizes multiple controls distributed throughout a development, as opposed to a central treatment facility.
- The use of swales and open vegetated conveyances, as opposed to curb and gutter systems.
- A focus on stormwater volume reduction rather than peak flow reduction.

The City has been engaged in construction of LID of both public and private demonstration projects since 2009. These projects were intended to provide guidelines for specific measures that should be recommended for different types of land uses. The existing projects are currently being monitored for structural integrity, cost of maintenance as well as for stormwater quantity reduction and water quality improvement. Ongoing monitoring will guide refinement of future LID policies.

New development projects must have at least 50% of their site area treated through LID-type (infiltration based) technology and at least 50% of any added pavement needs to be pervious. This reduces the volume of runoff from paved areas and improves water quality. The ordinance also allows for an equal or better standard. The intent of this equal or better standard was to enable staff to make informed judgments in cases where one standard cannot be met. However, it ensures that the entirety of the site design meets the scope, spirit and the intent of the ordinance.

Since March 2013, a total of 22 development projects have been approved that comply with the ordinance. These projects used a combination of techniques to reach the minimum 50% LID requirement. In general this requirement has been easily met through a combination of measures including bio-retention (more commonly known as rain gardens) and pervious pavement.

Bioretention has been used in 21 of these projects and pervious pavement used in 12. A combination of both measures was used at nine of these sites. The equal or better standard was applied in four cases. 100 % LID-type technology was provided through bioretention, while the 25% permeable pavement requirement was not met due to site physical conditions including excessively steep slopes or presence of expansive clay. Some projects noted above did not have to meet the pervious pavement requirement since none was added.

Next Steps in the LID Program

The City staff intends to closely monitor LID performance in meeting the goals of the ordinance. This will include investigation of implementation barriers and challenges such as unfamiliarity with construction techniques, lack of coordination between different sub-contractors and lack of training for construction inspectors.

To that end, the City has contracted with CSU to complete a survey of all existing LID facilities in the City. Four tasks have been identified: 1) monitoring of the performance of recently constructed LID facilities, 2) evaluation of compliance of new developments with industry recognized construction techniques, 3) evaluation of LID performance with respect to clogging

and maintenance, and 4) evaluation of construction inspection procedures that will minimize future performance and maintenance issues.

In addition, the City is creating a database that will allow it to track the location, type and performance of all existing LID installations. It will be tied to the City's GIS mapping program. It is expected that this database will facilitate performance evaluation of LID structures and guide the establishment of inspection frequencies.

A report will be developed in 2014 that highlights lessons learned from this survey regarding construction inspection, recommended maintenance regimes and standard operating procedures for inspection and maintenance. In early 2015 stormwater will provide a report to City Council updating results of the LID installations survey and recommending potential updates to the LID ordinance based on the survey findings.

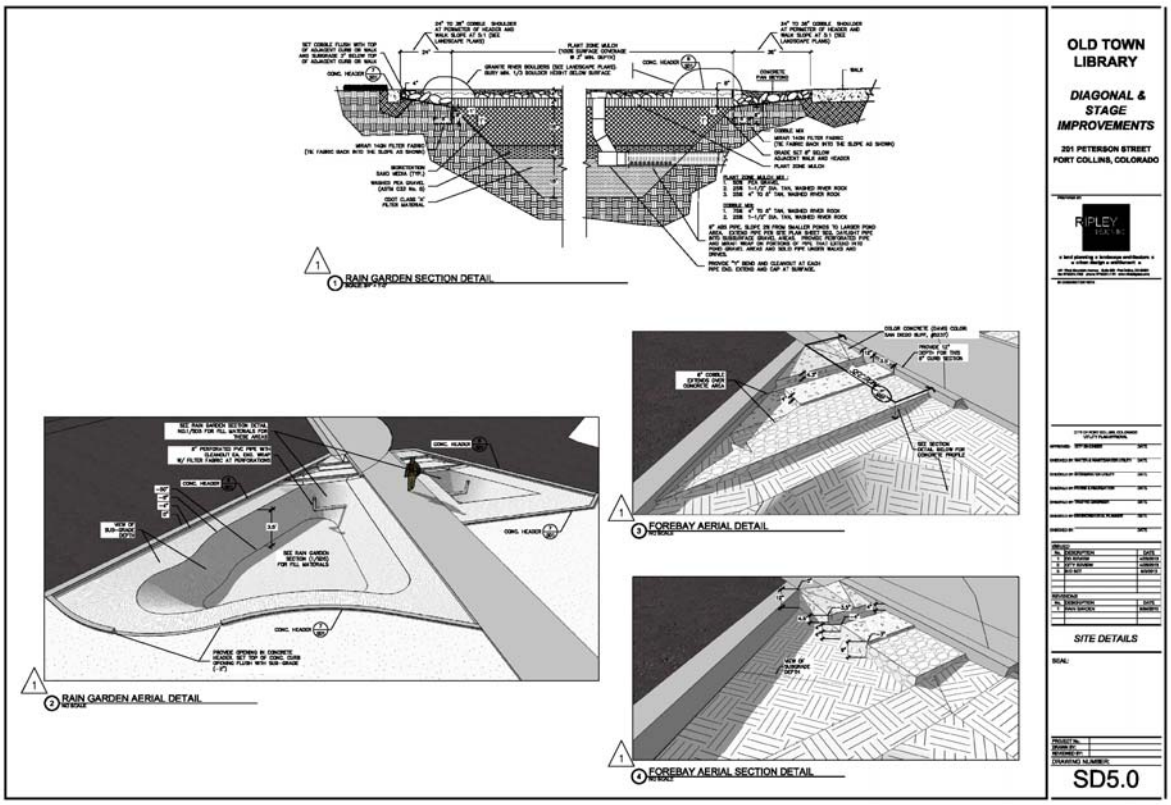
Potential Updates to the LID Ordinance: At the end of this evaluation period the Utility may be recommending updates to the LID ordinance. Potential updates include:

- Adding more flexibility and variety in the types of LID facilities that are accepted, enabling more innovative and cost effective designs.
- Providing additional incentives for the installation of LID-type facilities.
- Allowing LID-type facilities to be constructed on a block scale. This would allow multiple adjacent small developments the use of a shared facility, reducing construction costs and the amount of land consumed.
- Establishing a payment in lieu of construction fund that would allow the City to use the funds to construct LID facilities in retrofitted areas within regional City-owned facilities. This would help reduce the maintenance issues associated with privately owned and maintained sites.

Library Park Rain Garden

In 2013, City staff identified an unsightly and hazardous drainage problem in the parking lot near Library Park at 207 Peterson St. After every rainstorm, the sloped lot would become a standing pool of debris, water, oil and chemicals from vehicles and rainwater runoff. Fort Collins Utilities' Stormwater Utility and Poudre River Libraries staff recognized this as an opportunity to improve the existing landscape and solve drainage issues by building a rain garden.

Stormwater staff collaborated with the Libraries, Utilities' Water Conservation and Parks departments to restore the area into three rain gardens filled with native landscapes.
To minimize costs and overall impacts to the park, crews also leveraged an existing sidewalk and landscape-improvement project planned by the Poudre River Library. The City's Innovation Fund, in addition to funds from the Water Conservation and Stormwater departments, paid for the project. Beyond the improved aesthetics, benefits include safety, water conservation, enhanced drainage and improved water quality. Signage in the garden area serves as an educational tool for the public.



Library Park Rain Gardens Design Cross-Section

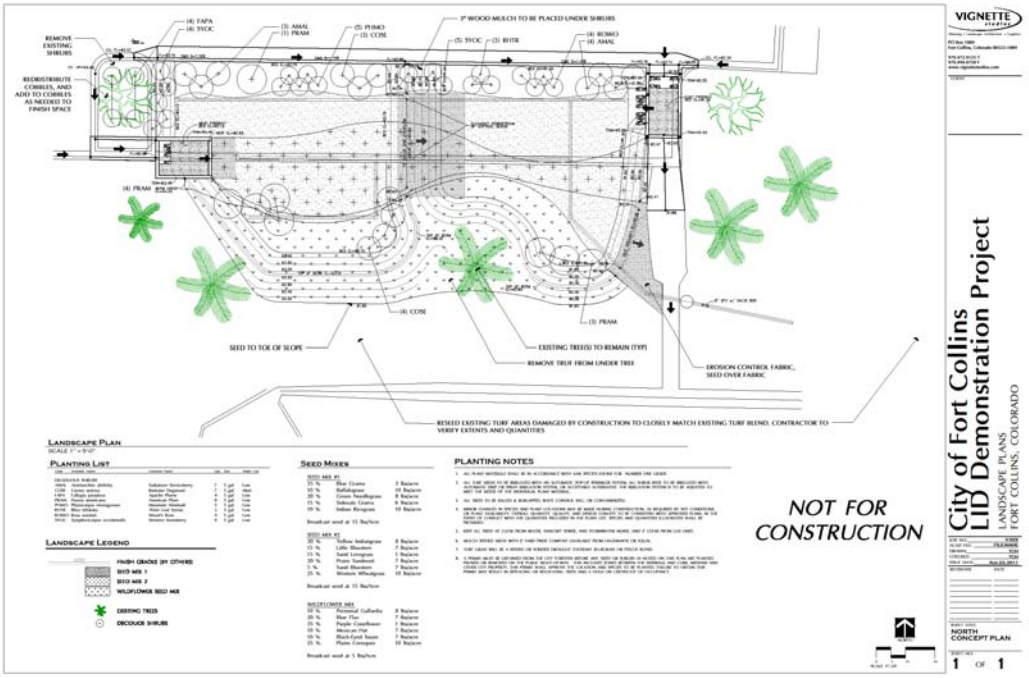
Library Park Parking Lot (Before Rain Garden Installation)

Library Park after Rain Garden Construction

Utility Service Center Bioretention Cell Monitoring

The City has initiated a demonstration project to construct a retrofit-bioretention basin at the Utility Service Center parking lot. The original drainage basins was made of highly impervious material and lacked room for idealized construction conditions or standard designs, and contain a significant amount of public right-of-way or paved areas typical of urbanized environments. The Utility has partnered with CSU and the City of Loveland to collect and analyze data from a variety of LID-type BMPs.

This project will increase our level of understanding regarding water quality improvements and runoff volume reductions achievable with bioretention in a semi-arid climate. The monitoring approach consists of flumes, weirs, pressure transducers, and soil moisture sensors to assess the amount of evaporated moisture in each cell. Native plants were chosen that can flourish in adverse environments. Plants include a number of grasses and shrubs that are both aesthetically pleasing and functional. Health of the plants will be monitored to improve future plant selection options.



Bioretention Cell Landscape Plan

Bioretention Cell completed landscape.

In 2013 the City continued to monitor the performance of the bioretention cell (otherwise referred to as a "Rain Garden") located at the Utilities Service Center parking lot at 700 Wood Street.

Table 1 provides a summary of results for this facility. It displays information on precipitation events used for sampling at the Utility Building's Bioretention Cell (BRC). The table shows whether runoff quantity and quality analyses were performed.

Table 1: Sampled events

	Precipitation (in)	Storm Duration (hr)	Water Quantity	Water Quality
June 28, 2013	0.31	5.65	X	X
July 5, 2013	0.51	0.65	X	X
July 18, 2013	0.59	6.65	X	X
July 25, 2013	0.12	0.05	X	
July 28, 2013	0.16	25.03	X	X
September 22, 2013	0.28	9.7	X	X
September 27, 2013	0.24	9.74	X	X
October 4, 2013	0.59	12.28	X	X

Bioretention Cell (BRC) Results for Runoff Quantity

Figure 1 depicts results for runoff volume. Measured quantities include runoff entering the BRC and direct rainfall (Influent), runoff that exited the BRC through the underdrain (Underdrain), runoff that infiltrated into the groundwater (Infiltration) and runoff that evaporated from BRC soil storage (ET).

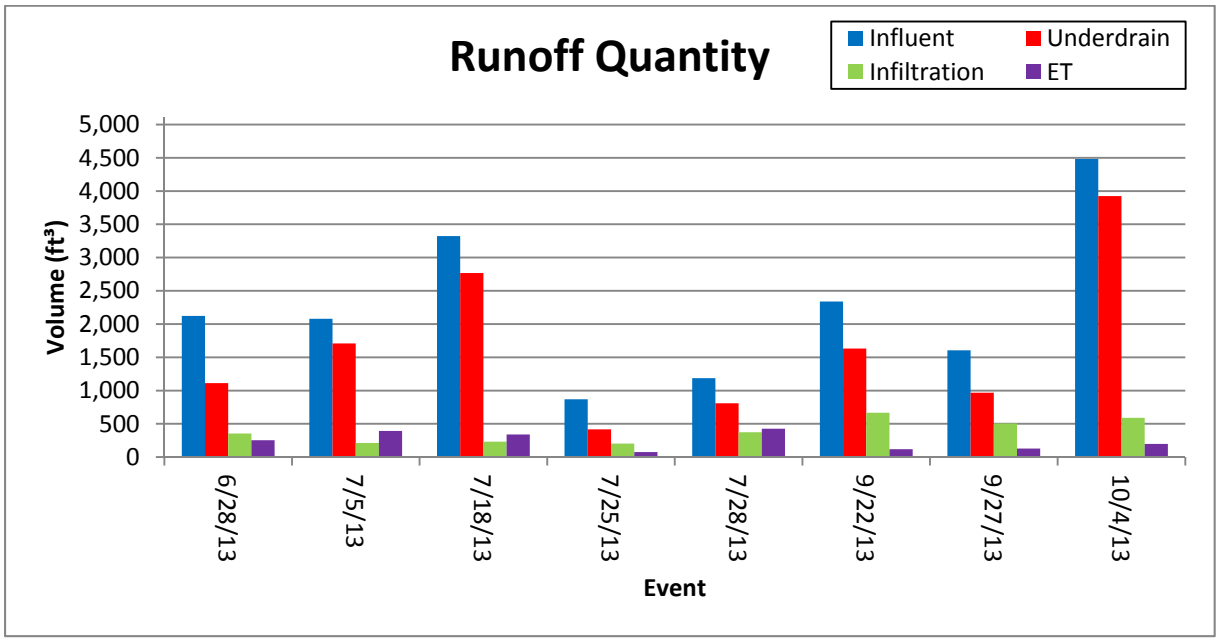


Figure 1: Runoff Quantity Results

Results show that the majority of runoff entering the BRC exited via the underdrain. On average, 68% of all runoff which entered the BRC exited through the underdrain. The remaining 32% of runoff either infiltrated into the groundwater (19%) or evapotranspirated (13%). The ability of the BRC to infiltrate more than 19% of runoff was hindered by low infiltration rates in the native soil under the BRC (0.17 in/hr on average). As a result, the BRC's storage layer quickly filled, forcing subsequent runoff to exit through the underdrain. If more runoff is to be diverted from the underdrain, storage volume inside the BRC for infiltration must be increased.

BRC Results – Runoff Quality

Figures 2, 3 and 4 displays the event mean concentration (EMC) of total suspended solids (TSS), total nitrogen (TN) and total phosphorus (TP) in the influent and effluent runoff of the BRC. All EMC's are reported in milligrams per liter (mg/L).

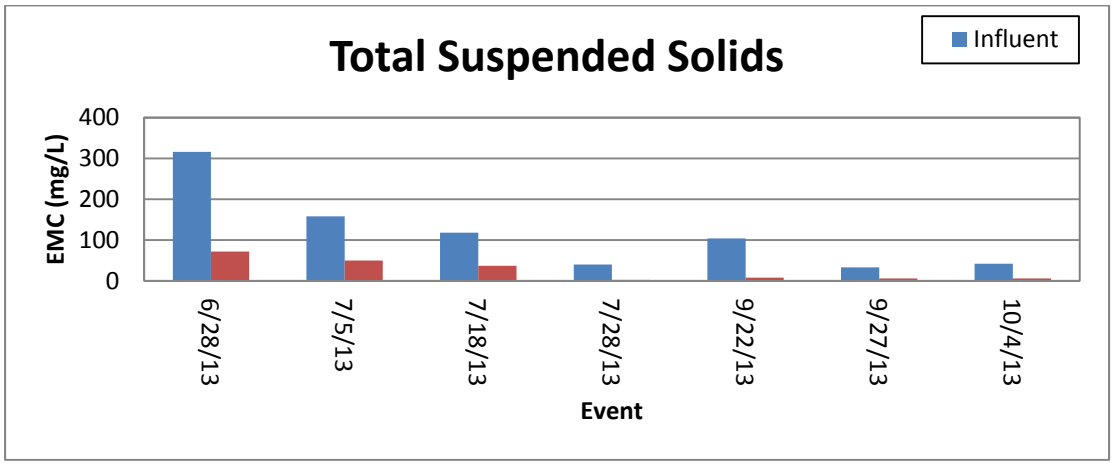


Figure 2: Total suspended solids influent and effluent EMC
Note: TSS EMC for 7/28/13 was 2.5 mg/L; too small to illustrate

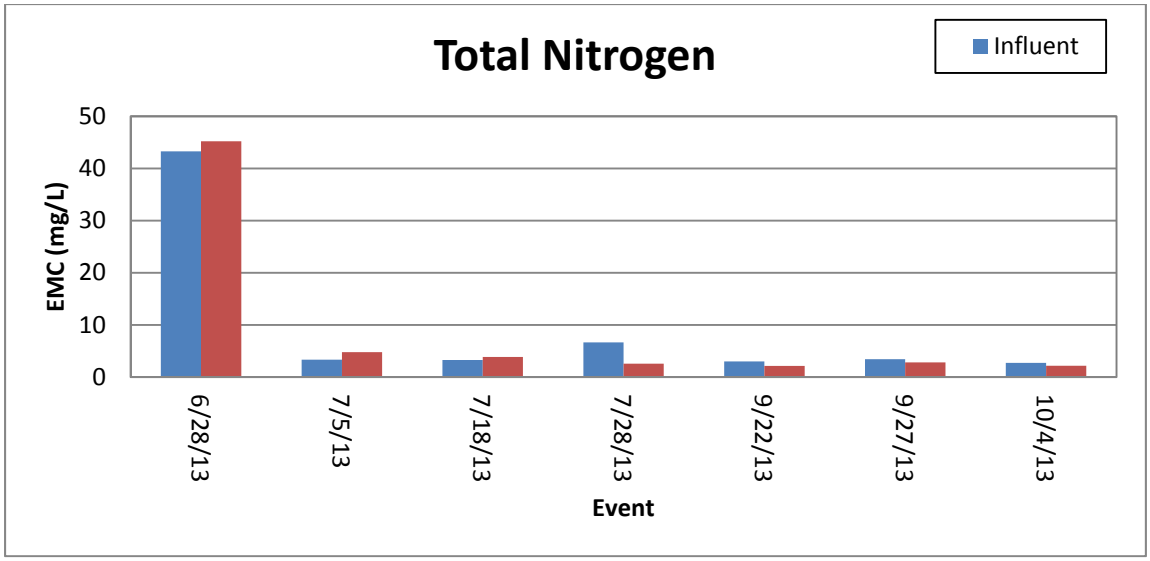


Figure 3: Total nitrogen influent and effluent EMC

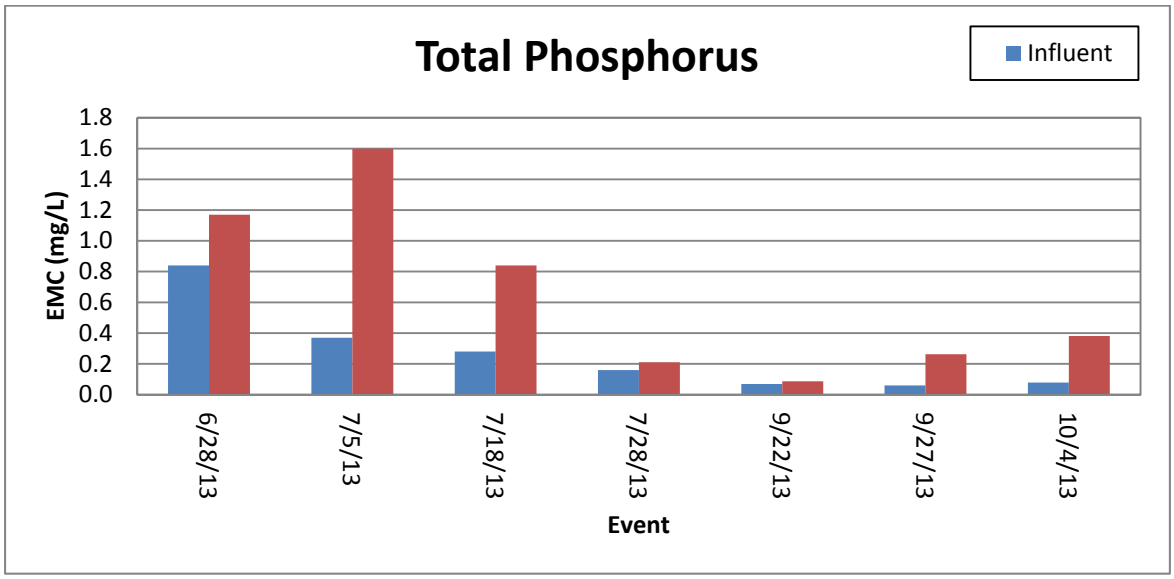


Figure 4: Total Phosphorus (TP) influent and effluent EMC

The BRC performed well at reducing the concentration of TSS. On average, the concentration of TSS was reduced by 81%. This reduction was a consequence of two fore bays and the engineered media in the BRC. Concentrations of total nitrogen changed very little between the influent and effluent. On average, concentrations were reduced by 8%. These results suggest that denitrification is not occurring at an effective level in the BRC. This may be due to a lack of an adequae carbon source for nitrate to convert it into nitrogen gas and/or that anaerobic conditions are not present inside the BRC. As expected, the concentration of TP increased in the BRC's effluent. Phosphorous is naturally present in the engineered media and dissolved into the BRC's effluent resulting in the observed higher concentration. However, it is hypothesized over the course of two or three years, the majority of TP will leach out of the BRC. At that point, TP concentrations may no longer be higher in the BRC's effluent.

Figures 5, 6 and 7 show the load of TSS, TN, and TP in the influent and effluent runoff for each event, measured in pounds (lbs).

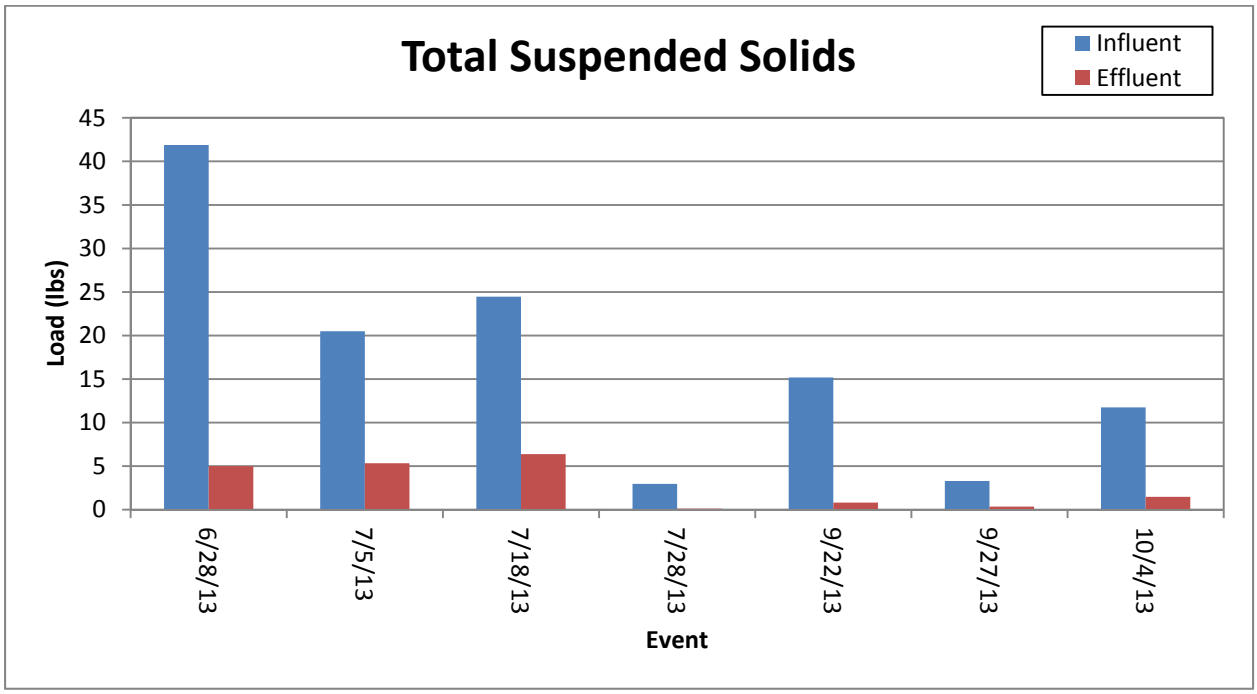


Figure 5: Total suspended solids influent and effluent loads

Note: TSS effluent load for 7/28/13 was 0.13 lbs; too small to illustrate on Figure 5

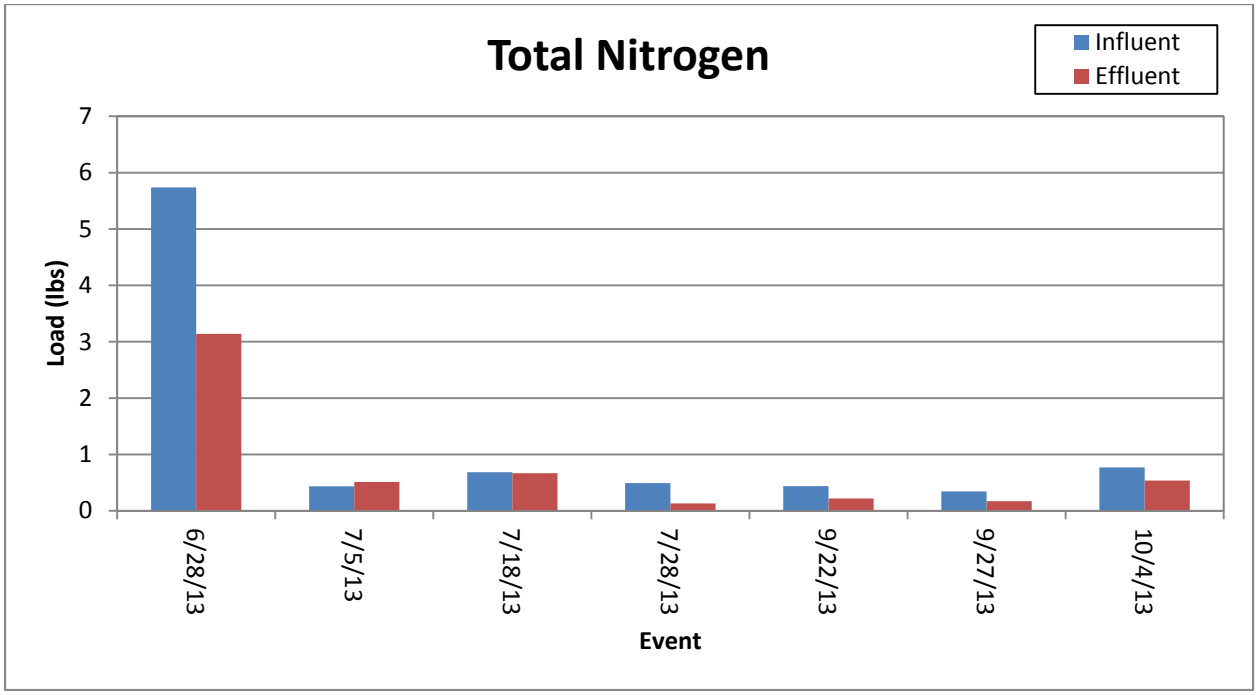


Figure 6: Total nitrogen influent and effluent loads

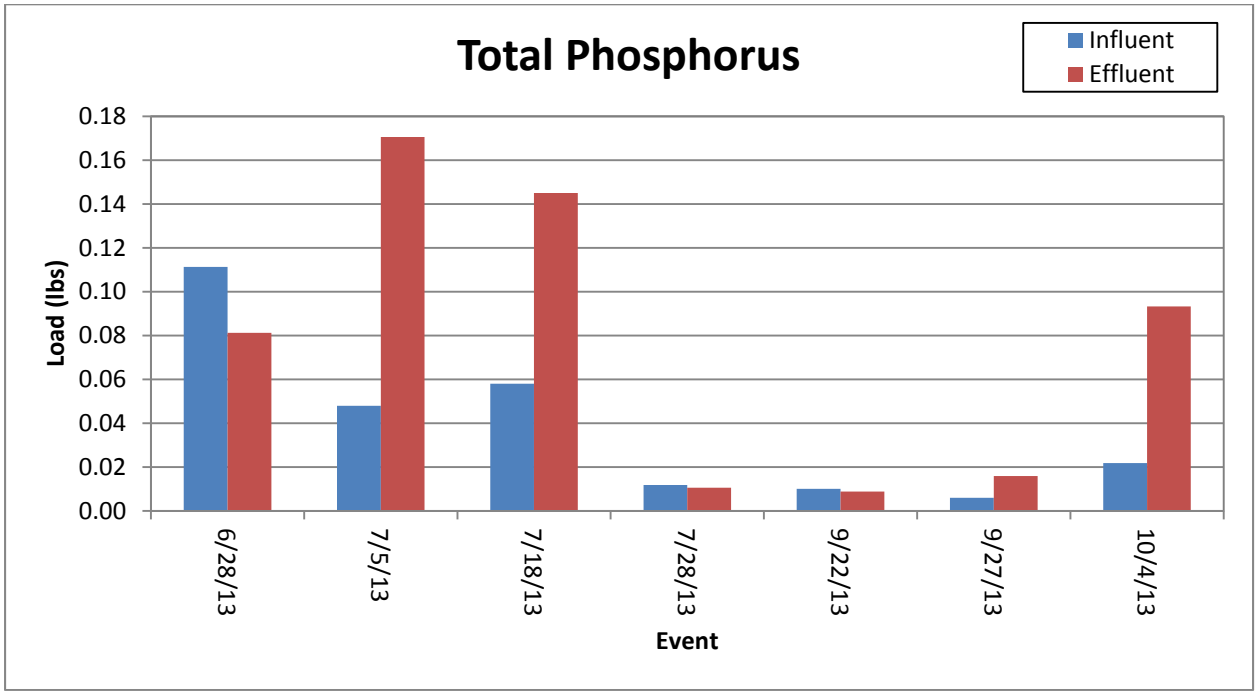


Figure 7: Total phosphorus influent and effluent loads

Similar to reducing the concentration of TSS, the BRC was efficient at reducing the overall load of TSS. On average, TSS loads were reduced by 86% and the load of influent and effluent TN was reduced by 33%. Comparing this reduction in load to the reduction in concentration, this indicates the primary method of TN removal in the BRC was through infiltration and evapotranspiration (ET). In parallel to the observed increase in concentration of TP, the TP load in the effluent was higher when compared level in the influent. On average, the TP load increased by 121%. Although TP was removed from the effluent by infiltration and ET, it was not sufficient to overcome the addition of TP contributed by the BRC's engineered media.

Average Annual Removal

The average annual runoff reduction and average annual pollutant load reduction is presented in Table 2. Average annual reductions were extrapolated assuming Fort Collins receives 15 in of precipitation per year (Colorado Climatology Center).

Table 2: Average annual reduction of runoff and pollution

	Runoff (ft^3)	TSS (lbs)	TN (lbs)	TP (lbs)
Average Annual Reduction	27,700	560	20	-1.4

2013 Stormwater Quality Monitoring Program Costs

Program Description	Cost	Comments
Event-based Best Management Practices (BMP) Stormwater Quality Monitoring Program	$ 2,200	Equipment, Replacement and Repair
Library Park Rain Garden Construction and Landscaping Costs	$ 31,000	Jointly funded from the City's Innovation Fund -$25,000, Stormwater $ 4,500 and Water Conservation 1,500
USC Bioretention Cell/ Rain Garden Monitoring	$ 3,000	Includes Lab Analysis Costs
CSU Contract for Research Activities	$ 55,000	Data collection data analysis and site evaluation. Funded through a Stormwater Utility-CSU research contract
Total	$ 91,200	

Colorado Nutrient Criteria for Lakes, Reservoirs, Rivers & Streams

Background: Nutrient criteria were adopted in the March 2012 Regulation 31 Basic Standards Hearing. In preparation for that hearing, the CDPHE - WQCD developed preliminary criteria for total phosphorus and total nitrogen.

The nutrient criteria will consist of both treated effluent quality limits via a "**Control Regulation 85**" for permitted dischargers and "**Stream Standards**" defined in the Water Quality Control Division's **Regulation 31**:

The **Control Regulation** will define technology-based requirements for dischargers to "control" the release of nutrients and will be based on best available technology:

Treated Effluent Control Parameter	Annual Median Effluent Concentration	95 Percentile Effluent Concentration
Total Phosphorus	1.0 mg/L	2.5 mg/L
Total *Inorganic* Nitrogen (TIN)	15 mg/L	20 mg/L

TIN: The sum of Ammonia-Nitrogen, Nitrate-Nitrogen and Nitrite-Nitrogen in milligrams per liter.

Municipal Separate Stormwater System (MS4) to implement control measures including:

- Public education and outreach targeting potential nutrient sources and
- Identification and control of nutrient sources from municipal operations
- Both wet and dry weather monitoring at representative stormwater outfalls throughout the MS4 (urban growth) area.
- Monitoring requirements for Publicly Owned Treatment Works (POTWs):
- Monthly effluent monitoring for TIN, TP and total daily flow and
- Monthly in-stream monitoring above and below the POTW discharge for TN and TP as well as total daily stream flow from an established gaging station

Results of the first year of monitoring were reported to the Colorado Water Quality Control Division in March of 2014.

Cost Implications for the City to Implement Required Wastewater Treatment Nutrient Controls:

- BNR upgrades were completed at MWRF in the summer of 2011. If future Colorado regulations require Enhanced Nutrient Removal (ENR) of phosphorus and nitrogen to achieve tougher limits, an additional eight million dollars in capital improvements will be needed at the MWRF.

- Both capital improvements and operational changes are underway that will bring the DWRF into compliance with the proposed tighter BNR limits on discharges of phosphorus and TIN.

Fort Collins Water Reclamation Facility BNR Construction Timeline and Costs: The Mulberry WRF re-started with BNR operations on July 5th, 2011. Treatment processes are being fine-tuned to achieve effluent levels of nutrients below the newly Reg85 established control limits. Design and construction improvements to the Drake WRF for BNR are underway as described in the following table:

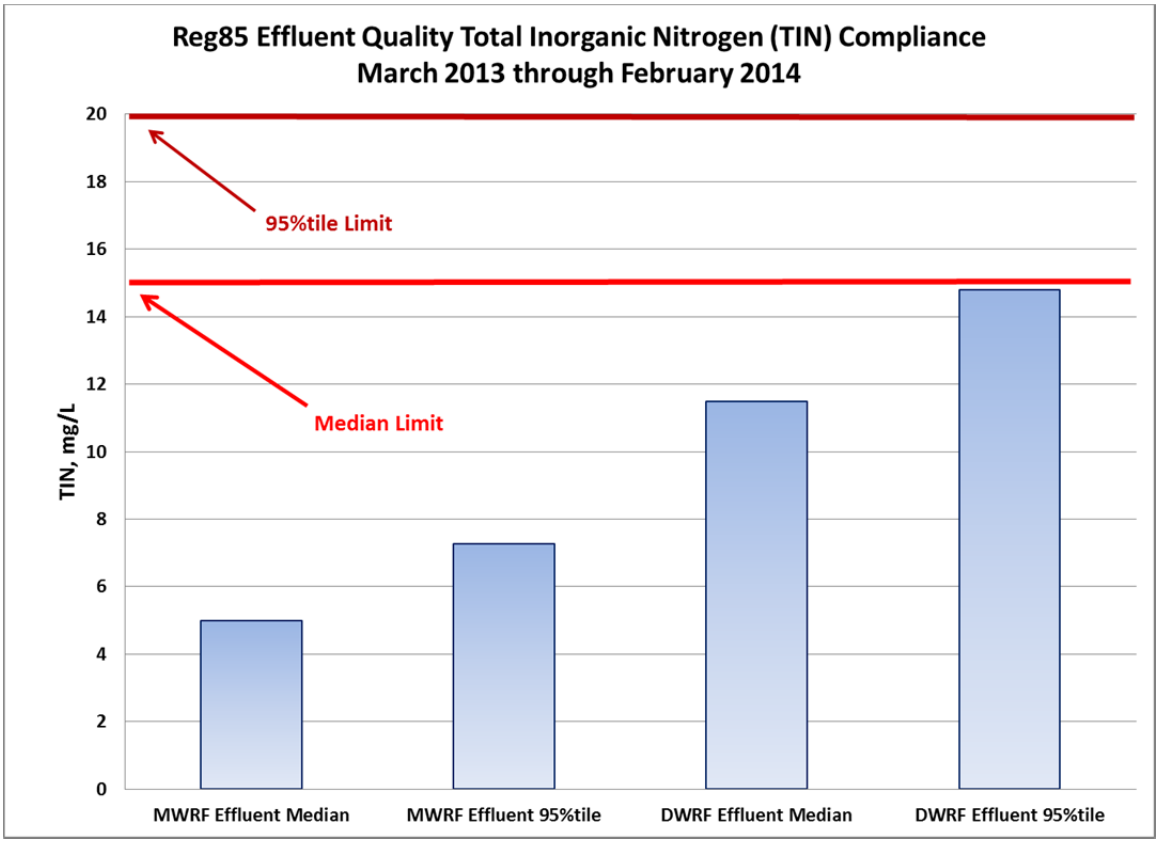
Reclamation Facility	Current Status	Cost
MWRF	Upgrades Complete	$25.2 Million
DWRF: North Treatment Trains	Construction completed in October 2012	$7.5 Million
DWRF: South Treatment Train	Design: 2014 Construction: 2015	$5.9 Million

***Note**: Should ENR be required in the future, an additional $50 to $60 million dollars in capital improvements will be required at the DWRF.*

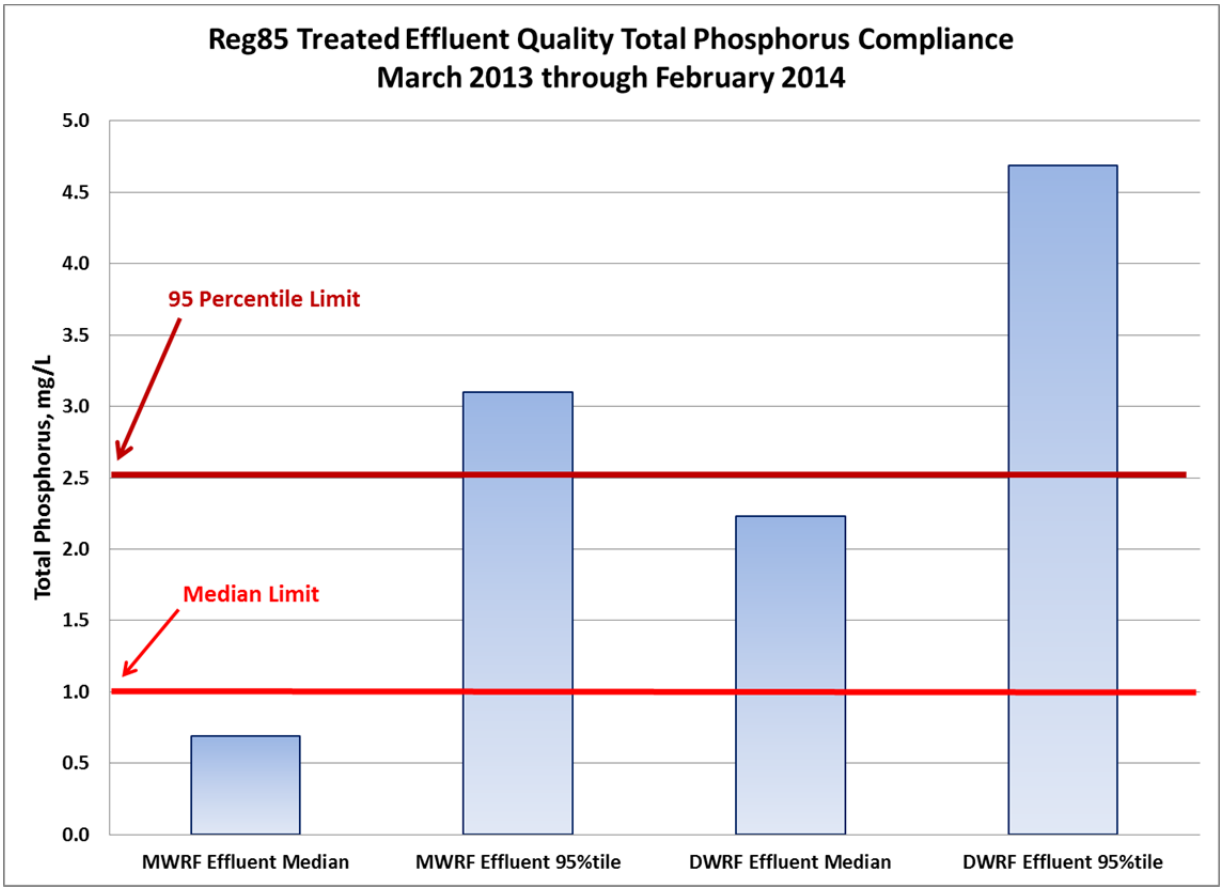
Implementation Timeline for Nutrient Control Regulation, Reg85," for the Mulberry and Drake Water Reclamation Facilities:

Water Quality Control Commission Nutrient Control Rulemaking Hearing	March 2012
Final Action on Rulemaking	June 11, 2012
Control Limits Effective Date	September 30, 2012
City must comply with nutrient control effluent limitations (or receive a compliance schedule)	After November 30, 2013 or upon discharge permit renewal anticipated in 2015

Are we meeting the Nutrient Control regulatory requirements? 'Yes', for TIN removal but 'No' for TP Removal. Why not? The process needs an effective carbon source. We are investigating the use of beer waste from a local brewer to meet that need. Also, the related Drake process improvements for full BNR are not complete.



Official Reg85 monitoring for the removal of TIN began in March of 2013. The graph above depicts the results of one year of testing. TIN is defined as the sum of the individual levels of Ammonia-Nitrogen, Nitrite-Nitrogen and Nitrate-Nitrogen in the treated effluent. Monitoring is required monthly but if more samples are tested, those results must be included in the calculations. In this first year of testing, both the MWRF and DWRF were in full compliance with the new Reg85 limits for removing TIN.



Compliance monitoring for Reg85 began in March of 2013. Data collected through February 2014 shows that the MWRF treated effluent is in compliance with the "Annual Median Limit" for TP removal but not the 95th percentile limit. Capital improvements for BNR-level treatment are *not* complete and hence the DWRF effluent is not yet in compliance with the TP limit.

Nutrient Control River and Stream Standards (Regulation 31): This regulation will set water quality standards based on the need to protect designated uses (water supply, agriculture, etc.). The WQCD has developed the following stream standards for TP and TIN levels for rivers and streams:

Proposed Nutrient Criteria Regulated Standards for Rivers and Streams (*From Shields Street to the Platte, the Poudre is classified as "warm water"*)

Designation	TP†	TN ‡	Chlorophyll-a[a]
Cold Water	0.11 mg/L	1.25 mg/L	150 mg/m^2
Warm Water	0.17 mg/L	2.01 mg/L	150 mg/m^2

† Running annual median of TP (µg/L) with an allowable exceedence frequency of 1-in-5 years.
‡ Running Annual median TN. TN is the sum of the levels of Total Kjeldahl Nitrogen, Nitrate-Nitrogen and Nitrite-Nitrogen.
[a] Summer (July 1 – September 30) maximum attached algae, not to exceed.

- **Nutrient Control Regulations and the Lower Poudre Monitoring Alliance:**

In the fall of 2012, the Lower Poudre Monitoring Alliance extended their cooperative efforts to meet the requirements of Reg85. This alliance includes the Cities of Fort Collins and Greeley, the Town of Windsor, Carestream Health, the Boxelder Sanitation District and Leprino Foods, Inc. As required by regulation, all of these entities now collect river water samples once each month both up and downstream of their respective discharge points. River samples along with treated effluent samples are delivered to and tested at the City's Pollution Control Lab. Lab results are reported once each year to the participants, CDPHE and uploaded to EPA's national Water Quality Exchange internet database. The data will be used to assess compliance with the requirements of Reg85 and the program will continue indefinitely.

Aerial map showing locations of key gaging stations, effluent discharger points and water quality monitoring sites on the lower Poudre that are part of the cooperative *Lower Poudre Monitoring Alliance*. A detailed sampling and analysis plan was submitted to the WQCD in

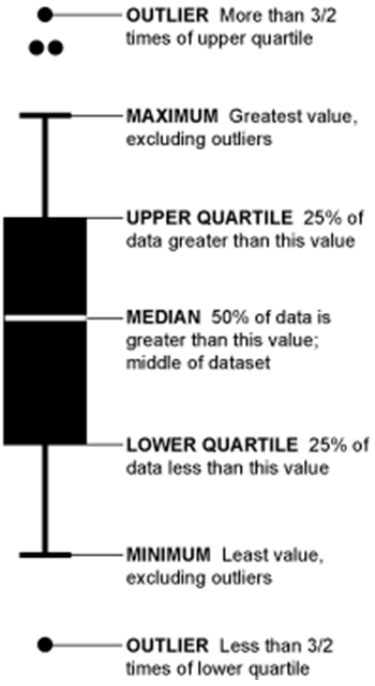
February 2013 and is available for review. Full implementation of the cooperative monitoring program began in March 2013. USGS and Colorado Department of Water Resources (DWR) gaging stations used for Reg85 compliance are located on the Poudre at:

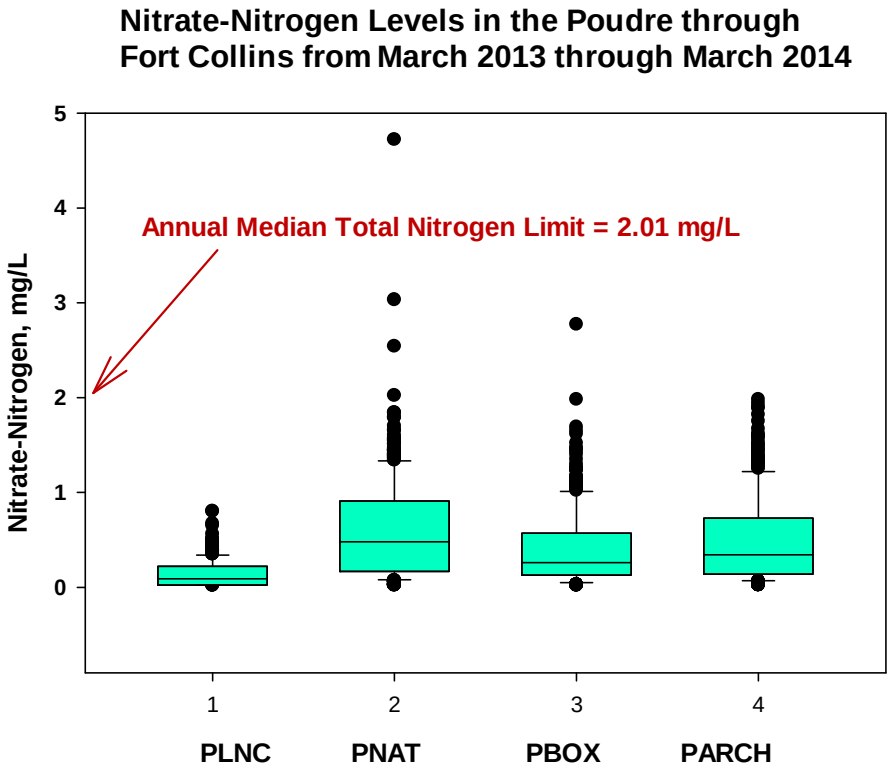
- Lincoln Street (432 PLNC) in Fort Collins,
- above the confluence with Boxelder Creek (370 PBOX),
- below Fossil Creek Reservoir at the New Cache Ditch (DWR CLARIVCO gage),
- the Staff Gage (225 SGage) above the Town of Windsor and Carestream Health outfalls,
- the DWR CLAWASCO gage above Greeley's and Leprino Foods discharge points and
- the DWR CLAGRECO gage below the City of Greeley near Fern Avenue.

Note: the numeric descriptive before the site abbreviation, **432** PLNC for example, is code for the approximate river mile location (43.2 miles) upstream of the confluence of the Poudre with the Platte River

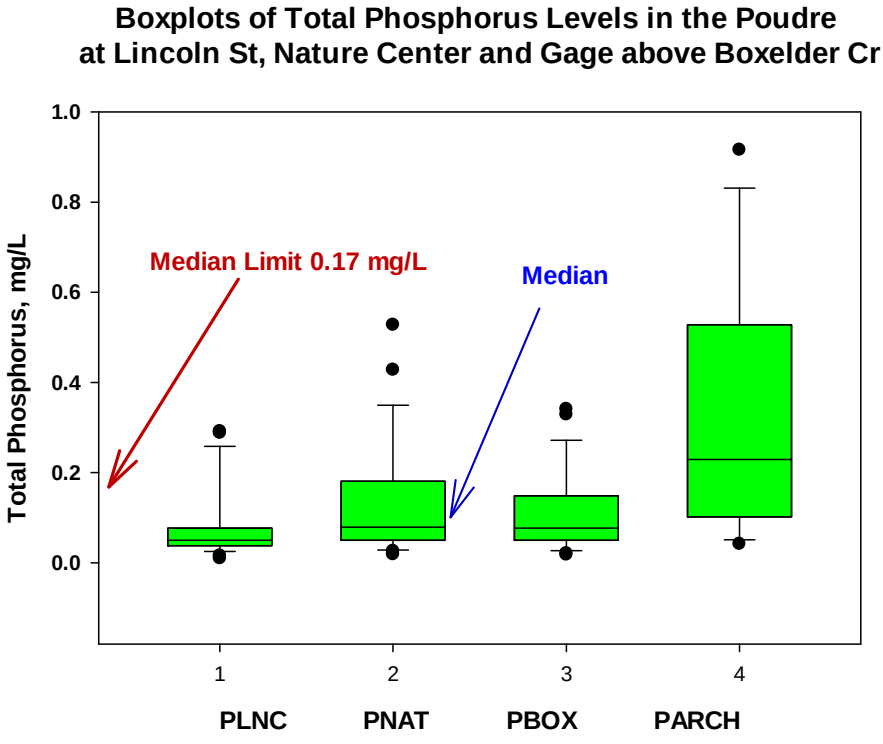
How to Read a Boxplot or a Box & Whisker Plot

1. First note the location of the median (white line) in the box. If the median is in the middle the box, the data is not skewed to a predominance of high or low values. The overall height of the box indicates the overall range or distribution of the data. A tall box indicates a wide range in values.
2. The top and bottom of the box define the upper and lower quartiles at 25% and 75%.
3. The maximum and minimum values (excluding outliers) are represented by the horizontal lines at the end of the whiskers.
4. Outlier data points are represented by dots.



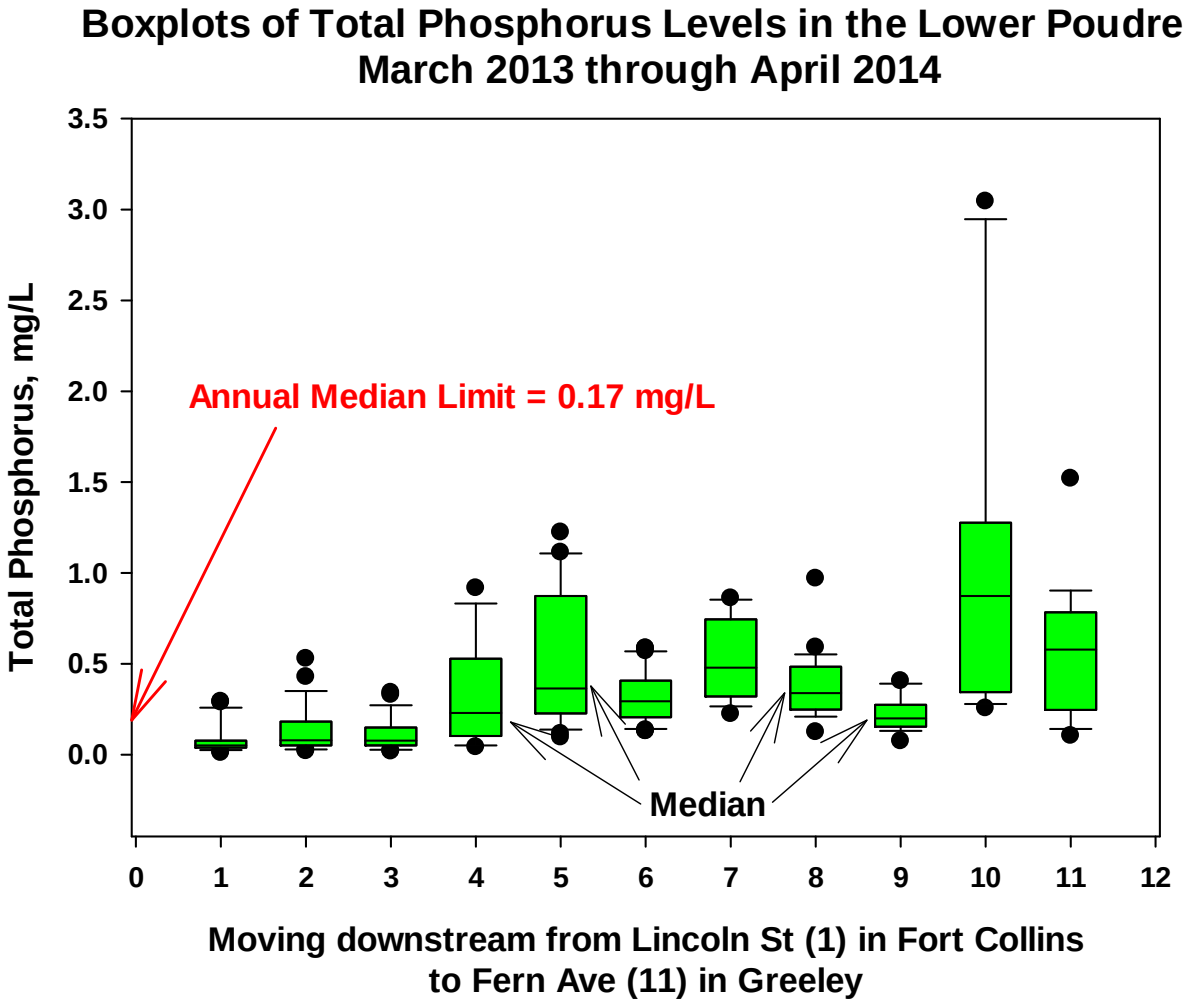


Nitrate-Nitrogen (NO_3-N) levels in the lower Poudre are a key indicator of potential compliance issues with Reg85. The City monitors four sites on the Poudre for nitrate levels. Proceeding from Lincoln Street (PLNC), to the Nature Center (PNAT), then to the USGS Gage above Boxelder Cr (PBOX), and then at the Archery Range, the *running annual median* Nitrate-N levels do not exceed the stream standard of 2.01 mg/L.



TP levels are another key indicator of the "nutrient" status of the Poudre and compliance with Reg31. High levels of Phosphorus can promote algal growth, lower dissolved oxygen levels in the water, create nuisance odor and adversely affect the aesthetics of an out-of-doors experience. Under extreme conditions, algae can produce toxins that can affect both the aquatic community and animals including humans, pets and livestock.

With near weekly monitoring completed since June of 2012 and even with the spikes in levels nutrients observed in High Park Fire stormwater samples, the Cache la Poudre River through Fort Collins upstream of Boxelder Creek is in compliance with the Reg85. However, median TP levels at the Archery Range below the confluence with Boxelder Creek exceeded the annual median limit of 0.17 mg/L. In the Spring of 2014, the Boxelder Sanitation District completed a ten million dollar upgrade to its treatment plant to perform full Biological Nutrient Removal. BNR will help bring next year's data at PArch into compliance with the new TIN and TP limits.



Poudre Site Legend: 1-PLnc (Lincoln St), 2-PPros (Prospect), 3-PNat (Nature Center), 4-PBox (above Boxelder Creek), 5-PArch (Archery Range), 6-PFos (below Fossil Creek Reservoir), 7-SGage (Staff Gage), 8-FSpur (Farmer's Spur, below Windsor & Carestream), 9-WPCF Greeley discharge point , 10- PLep (Leprino Foods discharge point) , 11-Fern (Fern Ave in Greeley). Results since March 2013 indicate that the Poudre at the Archery Range as well as sites downstream are not in compliance with the Reg31 limits. These high levels of phosphorus are due, in part, to return waters from irrigated fields and stormwater runoff from confined animal feeding operations. Other sources of nutrients include municipal stormwater as well as industrial and community wastewater treatment plant effluents.

- **Urban Creek Water Quality Monitoring Program Highlights:**

The CDPHE has established public use classifications and water quality standards for Spring Creek and Fossil Creek designed to protect aquatic life and support public uses, recreation and agriculture. Available water quality data from November 2000 through August 2007 show that Fossil Creek and Spring Creek consistently meet water quality standards for pH, dissolved oxygen, and nitrite designed to support aquatic life.

The water quality standard for the indicator bacteria, *E. coli*, is designed to protect recreational use. Spring Creek and Fossil Creek are both designated as "Recreation Class 1a" water bodies. This classification indicates waters where primary contact occurs including swimming and frequent water play by children. Water quality data for *E .coli* show strong seasonal trends with individual values above the water quality standard primarily during summer months. Sources of *E. coli* contamination include human and animal waste. Controlling or minimizing contamination from improper connections to the City's river and creeks is the focus of the Utility's Illicit Discharge Program, a component of the City's stormwater quality program.

In 2006, Fossil Creek was included on CDPHE's list of impaired waterbodies for non-attainment of the selenium water quality standard. Available monitoring data shows selenium values consistently above the water quality standard. High concentrations of selenium are found in local shale deposits.

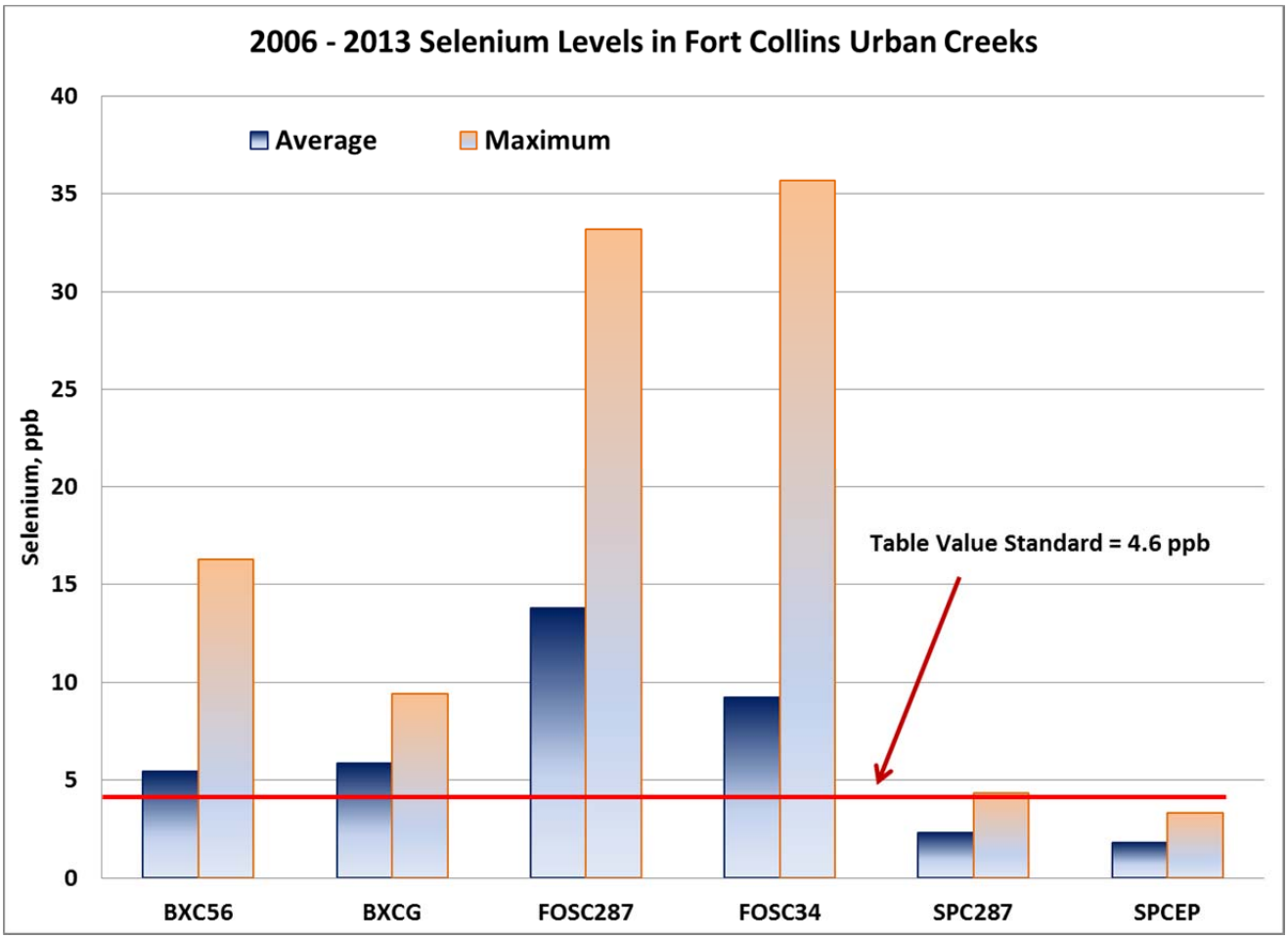
The EPA has published more stringent selenium standard of 4.6 ppb in a revision of water quality criteria. Consequently in 2006, Colorado adopted this as a water quality standard and is now placing numerous river and stream segments on the 303(d) list for selenium. The following local stream segments were put on the 303(d) list in 2006 due to exceeding the new selenium standard:

- the Poudre River from Boxelder Creek to where it meets the South Platte River,
- all of Fossil Creek, and
- Boxelder Creek, from its origin in northern Colorado to where it meets the Poudre River.

Selenium is naturally occurring in the underlying shale. The listings given above were a result of a new lower standard and not changing water quality. Selenium can be mobilized by precipitation runoff and infiltration to surface water and groundwater, resulting in elevated stream concentrations.

As directed in City Council Resolution 2000-128, "Recognizing the Need to Protect Water Quality", the City monitors Boxelder Creek, Spring Creek, and Fossil Creek at two sites every calendar quarter for inorganic chemicals, dissolved oxygen and bacteria. Parkwood Lake is sampled twice per year for bacteriological, physical, and chemical parameters.

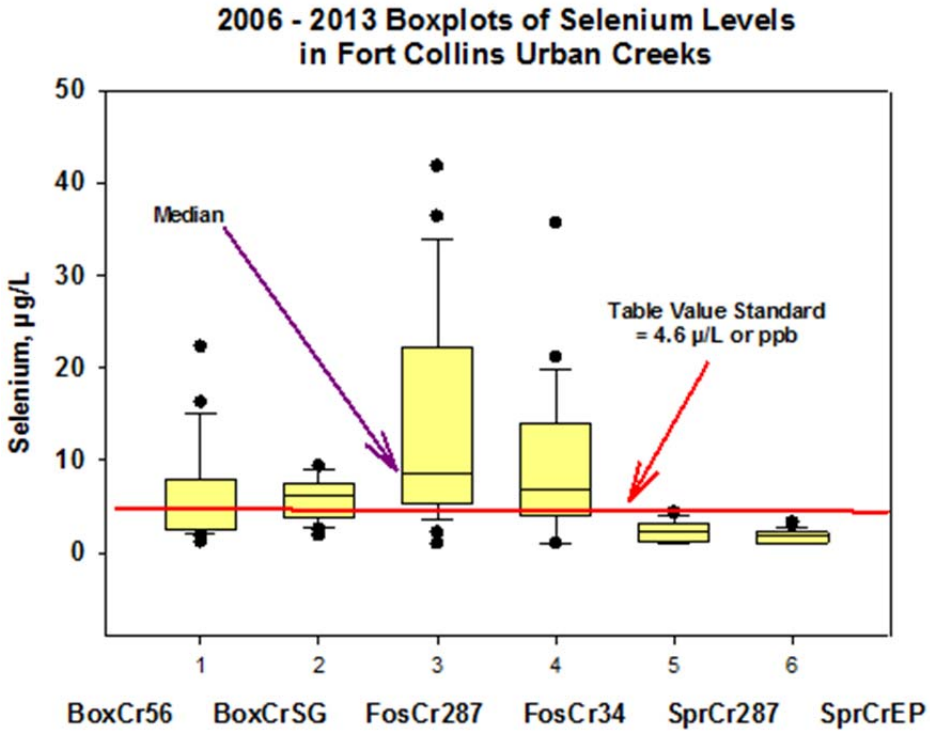
2006 – 2012 Maximum, Average and Aquatic Life Table Value Standard for Selenium Levels in Fort Collins Urban Creeks.



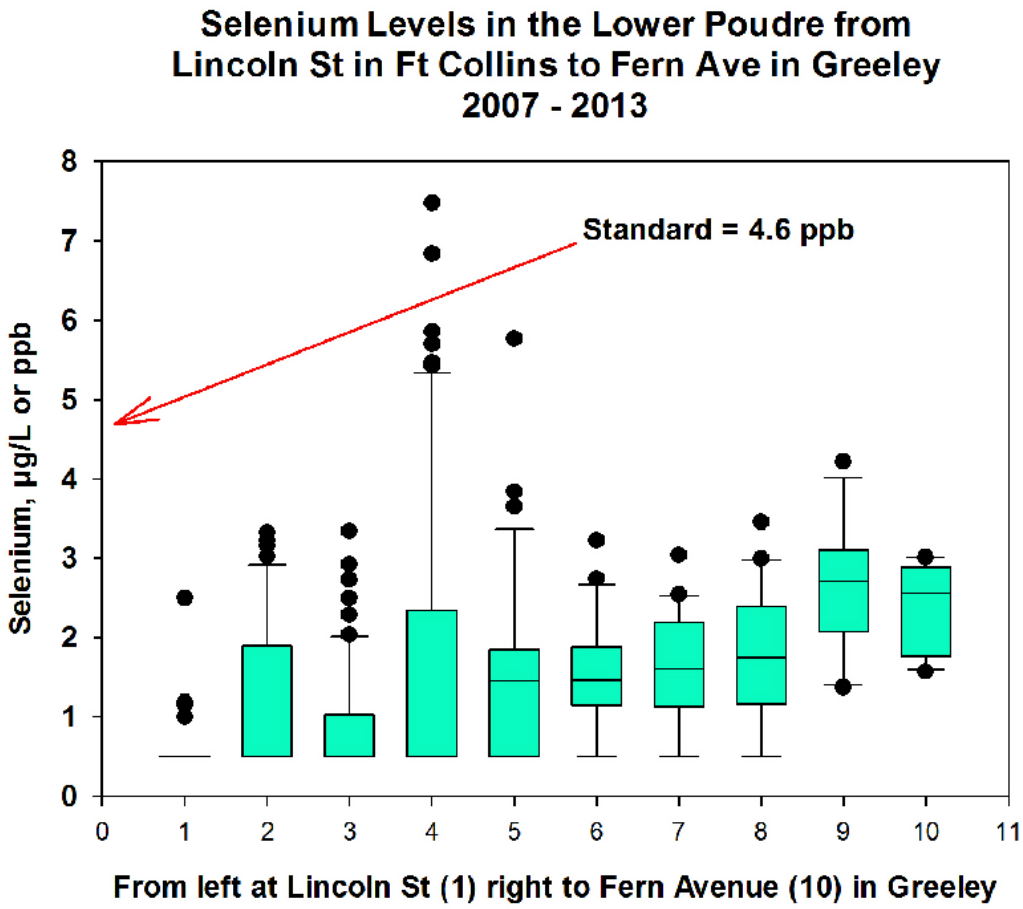
Legend:

BoxCr56 = Boxelder Creek at County Road 56
BoxCrSG = Boxelder Creek at Staff Gage located south of Prospect St.
FosCr287 = Fossil Creek at Hwy 287
FosCr34 = Fossil Creek at County Road 34
SprCr287 = Spring Creek at Hwy 287
SprCrEP = Spring Creek at Edora Park

The WQCD has listed both Boxelder Creek and Fossil Creek as 303(d)-impaired for the naturally elevated levels of selenium. The Table Value Standard (TVS) for selenium in these creeks is set at 4.6 micrograms per liter (parts per billion, ppb). Selenium is associated with the shale common to soils in our geographic region. The City's Pollution Control Lab monitors the selenium levels in waters from each of these three urban creeks at two locations every calendar quarter. Additional testing is done at these sites each calendar quarter for the presence of nutrients, temperature, pH, dissolved oxygen, *E. coli*, etc.



These boxplots show substantially higher and a broader range of selenium concentrations in waters from Fossil Creek than in either Boxelder or Spring Creeks. Selenium levels in both Boxelder Creek and Fossil Creek exceed the table value standard for aquatic life. Hence, they have been listed as 303(d)-impaired for selenium. Selenium levels in Spring Creek are below the Table Value Standard and are in compliance. Storm events, construction and other physical-mechanical events can mobilize selenium from creek-beds.



Legend:

1. Poudre at Lincoln Street above discharge point for the Mulberry WRF
2. Poudre at Nature Center at Poudre diversion to Fossil Creek Reservoir Inlet Ditch
3. Poudre at Boxelder Gage, USGS 6752280
4. Poudre at Archery Range downstream of Boxelder Sanitation District discharge
5. Poudre at CR 32E below discharge from Fossil Creek Reservoir;
6. Poudre at Staff Gage above the Windsor and Carestream Health discharge points
7. Poudre below Windsor Discharge point and above Carestream Health's discharge point
8. Poudre below Carestream Health's discharge point to the river
9. Poudre above Greeley's and Leprino Foods discharge points to the Poudre
10. Poudre at Fern Avenue approximately 2 miles above confluence with the Platte

Very low selenium levels have been observed in the Poudre at the Lincoln Street Gage. Moving downstream, selenium levels gradually increase to Site 4 below the confluence of Boxelder Creek where the height of the boxplot and outliers indicates highly variable data. Then selenium levels continue to increase moving downstream past the discharge points for Windsor, Carestream Health, Greeley and Leprino Foods. Much of that selenium increase may be attributed to irrigation return waters and non-point-source discharges to the Poudre.

Parkwood Lake Water Quality: Since 1983, the City has shared in an agreement with the Parkwood Property Owner's Association (POA) for water quality monitoring on Parkwood Lake. The lake receives water from Arthur Ditch and stormwater from City streets. In return for giving permission for the City to use the lake as a receiving waterbody for stormwater, the City committed to an ongoing water quality monitoring program.

Twice each year, field measurements are taken and water samples are collected for testing at three defined locations near the shoreline of the lake. A summary of the data since 2006 is presented in the table below. Water quality is currently meeting applicable standards. However, there may be issues complying with the strict "nutrient criteria" standard for TP in the future. Phosphorus is a common constituent of lawn and garden fertilizers as well as a contaminant in animal and bird feces.

2006 - 2013 Parkwood Lake Water Quality Summary

Parameter	Average	Max	Min	Std	Meets Standard?
Ammonia-N (Nitrogen), mg/L	<0.1	0.3	<0.1	TVS †	**Yes**
Biochemical Oxygen Demand-5 Day, mg/L	5.81	13	<2	none	**Yes**
Conductivity, µmhos/cm	380	712	234	none	**Yes**
Dissolved Oxygen, mg/L	8.8	13	**4.4**	5	**Yes**
E. coli per 100 ml	16.1 (geomean)	**9,800**	<1	126 ‡	**Yes**
Hardness, mg/L as CaCO3	149	263	111	none	**Yes**
Lead, µg/L	<5.0	<5.0	<5.0	10.55	**Yes**
Nitrate-N, mg/L	<0.05	0.09	<0.05	10	**Yes**
Nitrite-N, mg/L	<0.05	<0.05	<0.05	0.5	**Yes**
pH	8.4	8.7	**5.9**	6.5 - 9.0	**Yes**
Silver, µg/L	<0.2	<0.2	<0.2	3.27	**Yes**
Temperature, °C	16.9	24.6	8.4	*I.D.*	**Yes**
Total Phosphorus, mg/L	0.10	**0.21**	<0.05	**0.083** [a]	**Yes**
Zinc, µg/L	<5.0	<5.0	<5.0	393.2	**Yes**

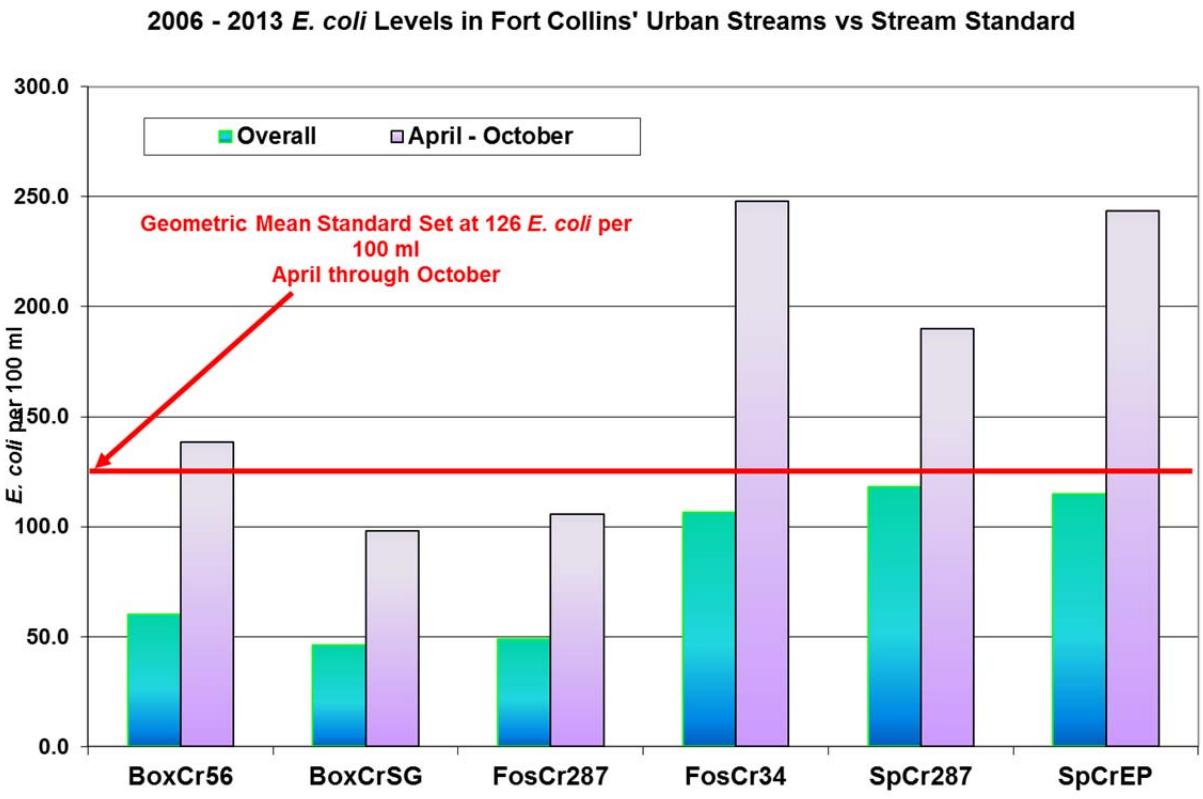
Legend:
† TVS: Table Value Standard based on pH and temperature calculation
‡ Standard is based on geometric mean calculation of available stream or lake data
I.D. = Insufficient Data
a: Possible problem with very strict future "Nutrient Criteria" Standards for Total Phosphorus in Lakes and Reservoirs. *Exceedence of the standard only allowed once every five years.* High phosphorus levels may contribute to the growth of nuisance algae on the lake.

The maximum *E. coli* value of 9,800 per 100ml occurred with a single grab sample collected on October 29th, 2013. However, the Table Value Standard of 126 *E. coli* per 100ml is calculated as a geometric mean. Geometric mean calculations using log10 exert a leveling effect on the result by reducing the extremes. The geometric mean value for the lake is well below the standard at a level of 16.1 per 100ml. The pH at that location was also low at a value of 5.9. The other two sites had pH values of 6.5 and 7 that day. The minimum observed dissolved oxygen level of 4.4 mg/L was at one of three locations on the lake tested on June 5th, 2012. The other two sites tested that day gave normal results of approximately 7.5 mg/L dissolved oxygen.

E. coli contamination in Fossil Creek and Spring Creek:

Using several years of City and USGS data and focusing on the months of April through October, the Colorado WQCD has determined that both Fossil Creek and Spring Creek are now 303(d)-listed as "impaired" for *E. coli* contamination. Both creeks were also given a "high priority" designation for developing corrective actions. Potential sources of *E. coli* contamination include failing septic systems, leaking sewer lines, domestic animals (pets, cattle, horses, etc.) and wildlife. Additional monitoring to identify potential point sources of contamination within the creeks will need to be completed.

The diagram presented below depicts the overall and seasonal geometric mean values of *E. coli* levels found in key Fort Collins urban creeks for the 2006 – 2013 timeframe compared to the stream standard of 126 *E. coli* per 100 ml. *E. coli* levels were monitored once each calendar quarter for this time period and the overall and seasonal (*April through October*) geometric means were calculated per WQCD procedures. The overall geometric mean values (n=20) for each site were all below the 126 *E. coli* / 100 ml limit set by the WQCD. However, data for the April through October showed the creeks to be in violation of the water quality standard.



Plot of 2006 – 2013 Overall and April through October *E. coli* levels in Fort Collins key urban creeks versus the stream standard of 126 *E. coli* per 100 milliliters (ml). All three sites are listed as 303(d) – seasonally impaired for high *E. coli* levels during the spring and summer months. Two sites each at Fossil Creek, Spring Creek, and Boxelder Creek are sampled quarterly.

Site locations: BoxCr56 is Boxelder Creek at CR56; BoxCrSG is Boxelder Cr at the staff gage located upstream of Boxelder Sanitation District's discharge; FosCr287 is Fossil Creek at College Avenue; FosCr34 is Fossil Creek at CR34; SpCr287 is Spring Creek at College Avenue; and SpCrEP is Spring Creek at Edora Park.

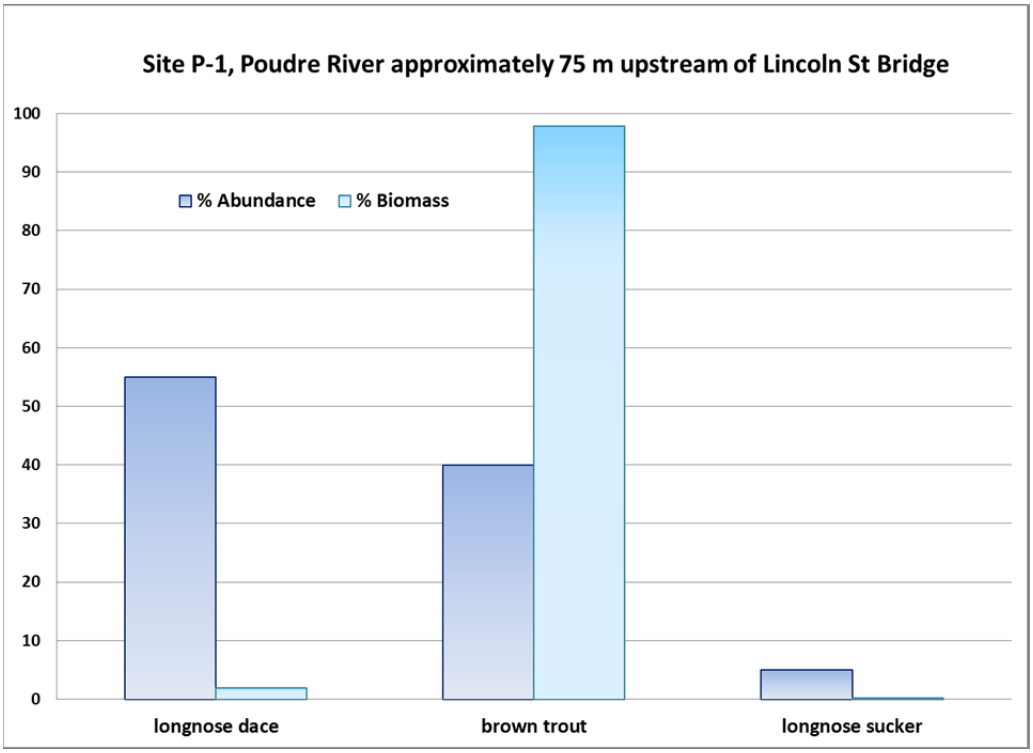
Appendix A. Fish and Macro-invertebrate Surveys with CSU on the Poudre:

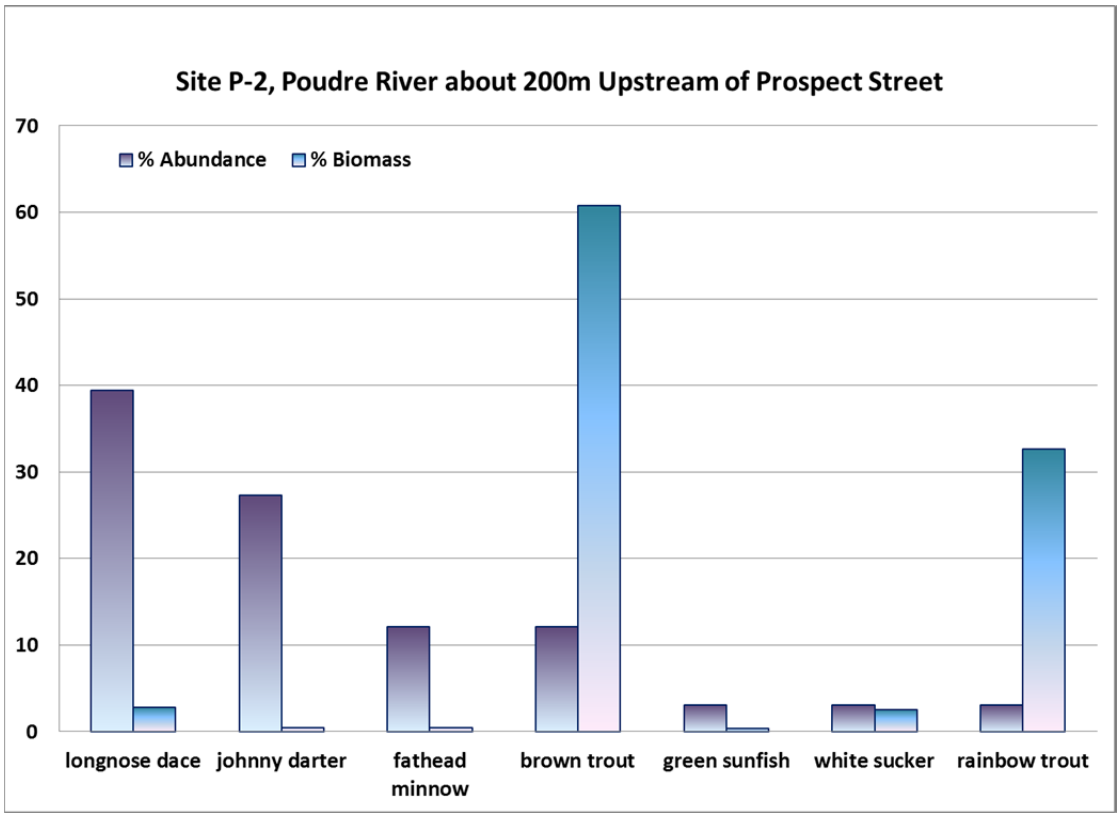
To evaluate the potential impacts of the City's two wastewater treatment plants on the Cache la Poudre River, the Utilities sponsors a biosurvey program of fish and bottom-dwelling macro-invertebrates in the river both upstream and downstream of the City's water reclamation facilities. CSU provides the field experience and technical expertise for these studies. The City, Carestream Health, Inc. (formerly Kodak Colorado Division) and CSU have participated for over 30 years, and Boxelder Sanitation District joined the program eight years ago.

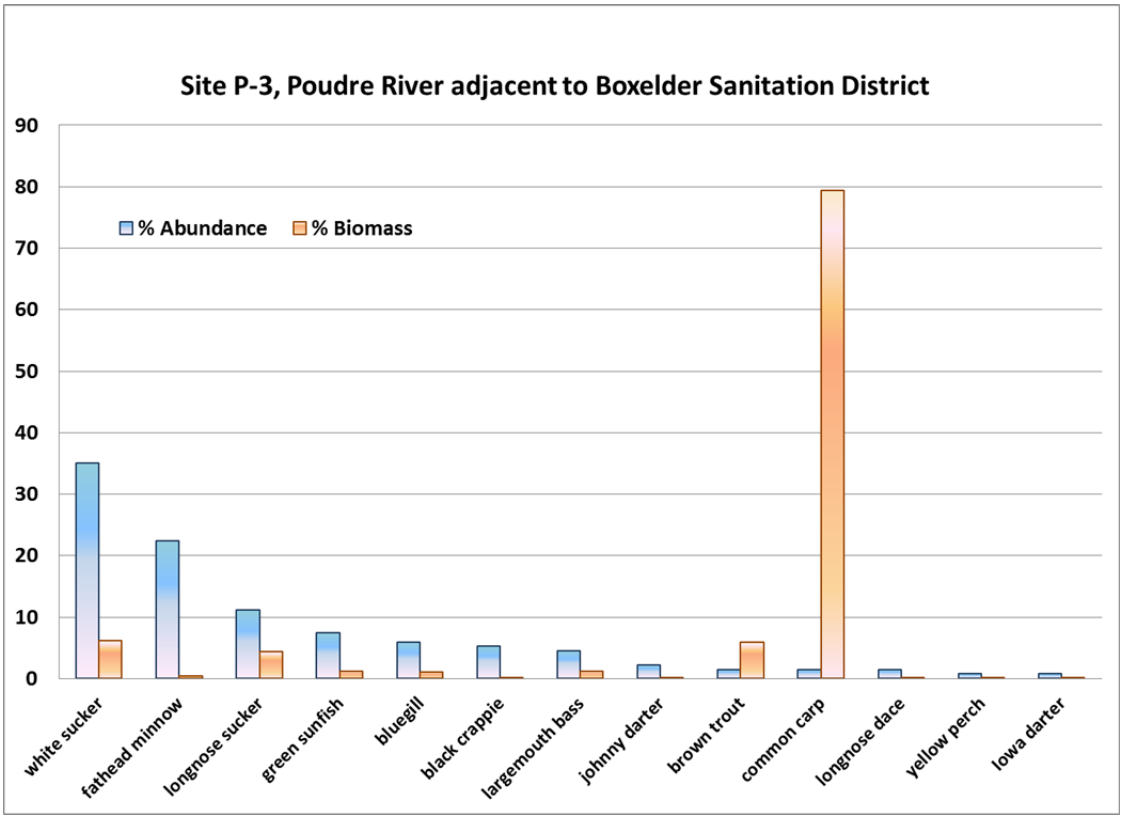
The biosurvey program expanded in 2007 and became an integral part of the Poudre Monitoring Alliance. For the City of Fort Collins and as part of the regional Poudre Monitoring Alliance, this biosurvey program includes: 1) testing four sites eight times each year for bacteriological, physical, and chemical parameters, 2) testing three sites four times each year for benthic macro-invertebrate population abundance and diversity, and 3) testing two sites once each year for fish abundance and diversity. Overall the data show strong seasonal trends with generally the highest species diversity and population numbers in early summer months. Similarly, the data show that the Poudre River below Shields Street to the confluence with the Platte River is primarily flow and habitat-limited rather than water quality-limited.

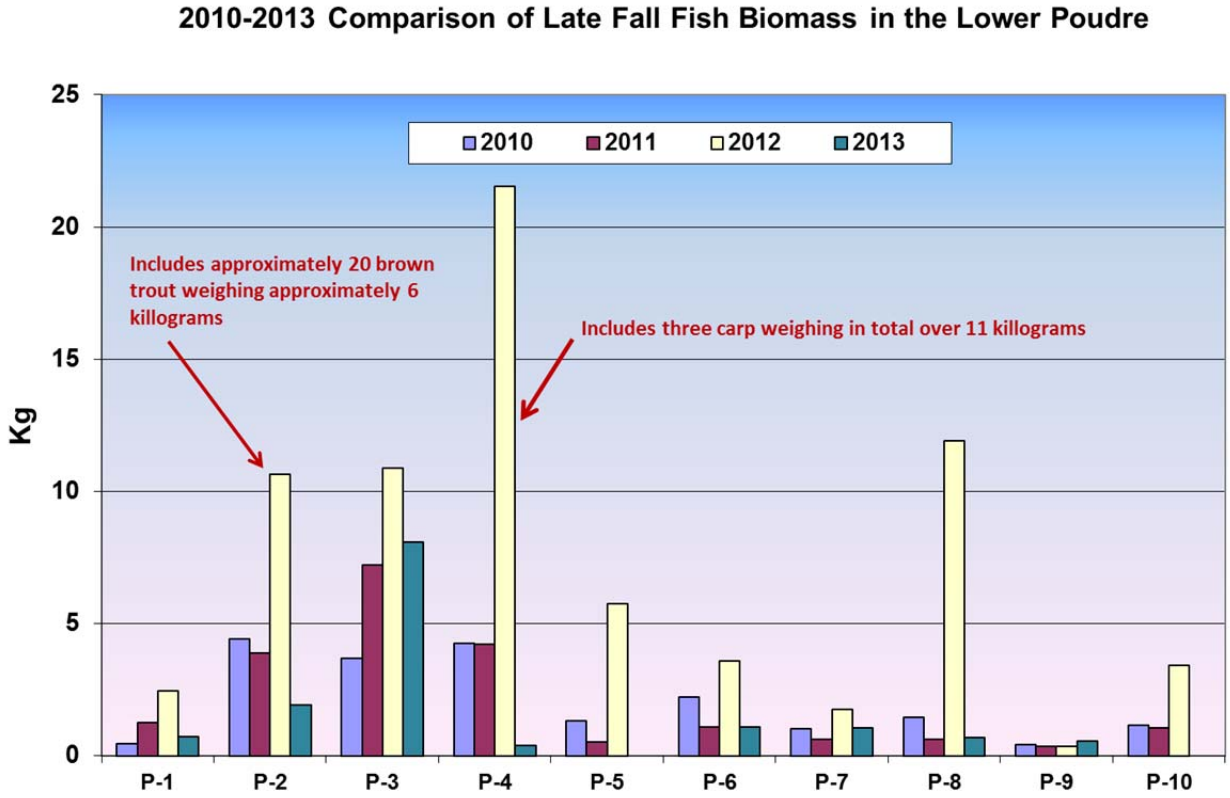
2013 Fall Season Fish Survey Results on the Cache la Poudre from Dr. Kevin Bestgen, CSU

Percent abundance and biomass results by species are presented for four sites on the Poudre starting upstream of Lincoln Street in Old Town to the Strauss Cabin located upstream of I-25. The complete 2013 Poudre water quality, fish and macroinvertebrate survey report from CSU is available from the Utility's Environmental Services Division.

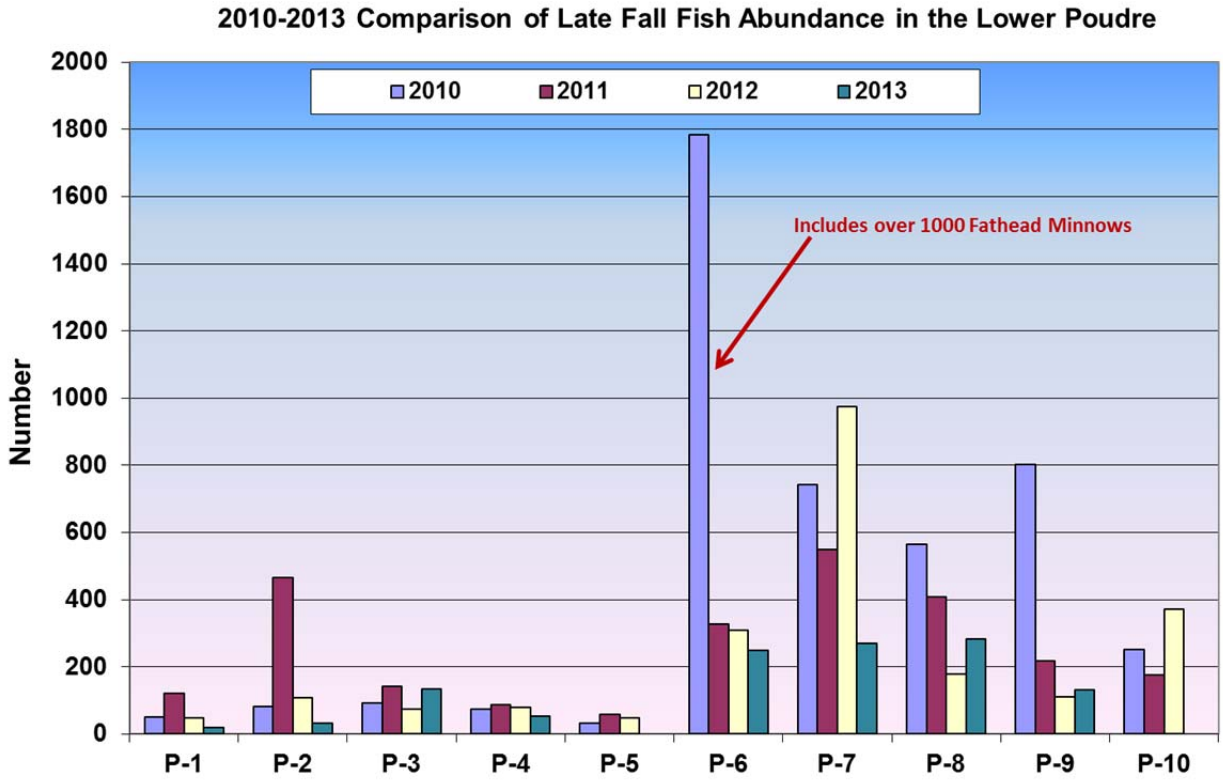

Site P-1, Poudre River approximately 75 m upstream of Lincoln St Bridge
100
90
80
70
60
50
40
30
20
10
0
% Abundance
% Biomass
longnose dace
brown trout
longnose sucker


Site P-2, Poudre River about 200m Upstream of Prospect Street
70
60
50
40
30
20
10
0
% Abundance
% Biomass
longnose dace
johnny darter
fathead minnow
brown trout
green sunfish
white sucker
rainbow trout


Site P-3, Poudre River adjacent to Boxelder Sanitation District
90
80
70
60
50
40
30
20
10
0
% Abundance
% Biomass
white sucker
fathead minnow
longnose sucker
green sunfish
bluegill
black crappie
largemouth bass
johnny darter
brown trout
common carp
longnose dace
yellow perch
Iowa darter


2010-2013 Comparison of Late Fall Fish Biomass in the Lower Poudre
25
20
15
10
5
0
Kg
2010
2011
2012
2013
Includes approximately 20 brown trout weighing approximately 6 killograms
Includes three carp weighing in total over 11 killograms
P-1
P-2
P-3
P-4
P-5
P-6
P-7
P-8
P-9
P-10

Site Legend:
P-1: Approximately 75 m upstream of the Lincoln Street Bridge in Fort Collins
P-2: Approximately 200 m upstream of the Prospect Street Bridge in Fort Collins
P-3: Poudre River adjacent Boxelder treatment plant, east edge Environmental Learning Center
P-4: Poudre River near the Strauss Cabin upstream of I-25
P-5: Poudre River, 1/4 mile upstream of CR 32E below Fossil Creek Reservoir discharge
P-6: Poudre River, Staff gage site just above Windsor sewage effluent
P-7: Poudre River at Sharks tooth, old bridge crossing below Carestream Health discharge
P-8: Poudre River, about 1/3 mile upstream of 59th Avenue above Greeley
P-9: Poudre River, just upstream of Hwy 85 upstream of the Greeley WWTP discharge
P-10: Poudre River, above confluence of South Platte River



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