Collaborative Upper Cache la Poudre Monitoring Program

SOURCE WATER MONITORING

The Upper Cache la Poudre (UCLP) Watershed Collaborative Monitoring Program was established in 2008 between the City of Fort Collins, the City of Greeley and Soldier Canyon Water Authority, to help meet present and future drinking water treatment goals.

Water quality monitoring of our raw, Cache la Poudre River drinking water supply is conducted from April through November. Monitoring sites are strategically located throughout the UCLP. Water quality data provide valuable information about the health of our source watershed and raw water supply.

The *Spring 2018 Water Quality Update* provides a seasonal summary of watershed conditions in the UCLP watershed by highlighting snowpack and streamflow conditions, as well as water quality information collected over the months of April and May.

Water quality during spring snowmelt runoff is highly variable. To better capture this seasonal variability, monitoring is conducted two times per month from April through June. Results are reported for six key monitoring sites located throughout the UCLP watershed, which capture water quality conditions above and below major tributaries and near water supply intake structures ***(Figure 1)***. Present water quality conditions are compared to baseline water quality conditions collected over the period of 2008 to 2012.

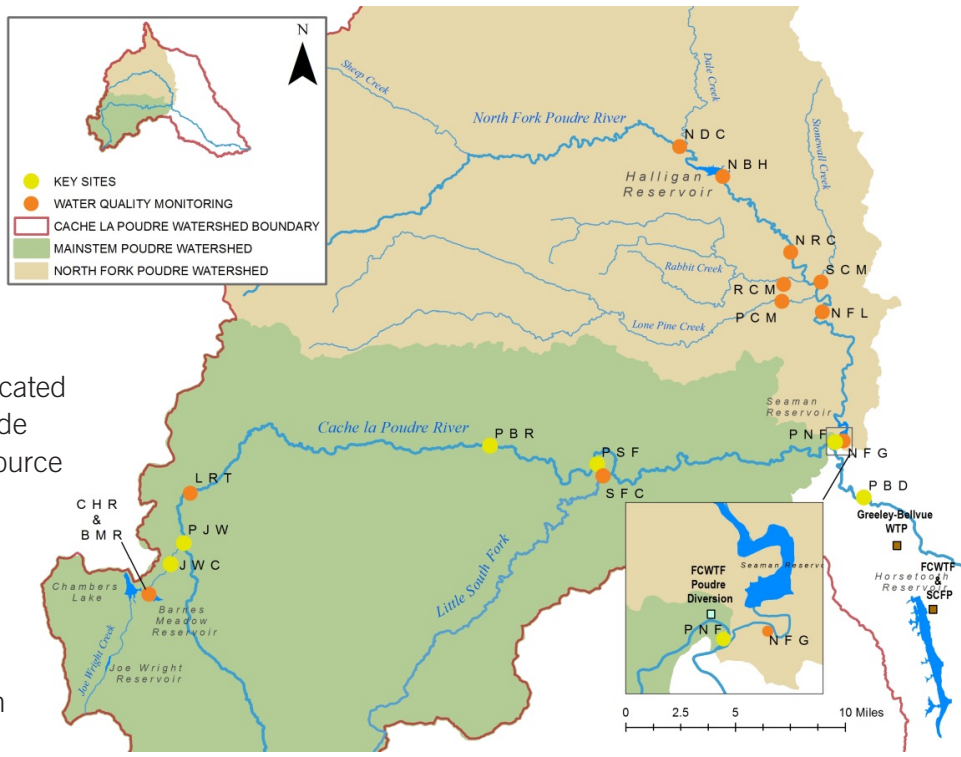


Figure 1 *- Upper Cache la Poudre Collaborative Monitoring Program sampling locations*

JWC - Joe Wright Creek above the confluence with the Poudre River
PJW - Poudre River above the confluence with Joe Wright Creek
PBR - Poudre River below the Town of Rustic
PSF - Poudre River below the confluence with the Little South Fork
PNF - Poudre River above the confluence with the North Fork at the City of Fort Collins' Intake
PBD - Poudre River below the confluence with the North Fork at the Bellvue Diversion

SNOWPACK CONDITIONS IN 2018 WATER YEAR

Snow water equivalent (SWE), the amount of water held in the snowpack, measured at Joe Wright snow telemetry station near Cameron Pass, was below the long-term median for most of the snow accumulation season ***(Figure 2a)***. The snow accumulation season began several weeks later than normal in 2018. The start of the winter season experienced above average precipitation ***(Figure 2b)***, but any snow that accumulated in early October was completely melted out by late-October ***(Figure 2a)***. Above average precipitation in November helped improve SWE conditions in the UCLP watershed, but average precipitation in December and January ***(Figure 2b)*** was not enough to increase SWE to normal conditions. Precipitation was above average from February through April, and over these months SWE rebounded to normal. Dry and warm weather returned in May and the snowpack began to melt initiating spring snowmelt runoff in the Poudre watershed ***(Figure 2)***.

The maximum amount of water contained in the snowpack, referred to as peak SWE, was observed at the Joe Wright SNOTEL on April 23 measured at 23.6 inches– 99 percent of the historical median ***(Figure 2a)***. Based on the 30- year period of record, peak SWE at Joe Wright SNOTEL normally occurs on April 29.

Peak SWE for the Upper CLP basin was measured at 103 percent of the median for the 2018 water year ***(Figure 3)***. Peak SWE was near or above the long-term median at higher elevations and only 60 – 69 percent of median at lower elevations. The North Fork CLP watershed received slightly more snow than the Mainstem and South Fork CLP watersheds with peak SWE measured at 109 percent of median. The Mainstem and South Fork CLP watersheds were slightly below the long-term median at 95 percent and 92 percent, respectively.

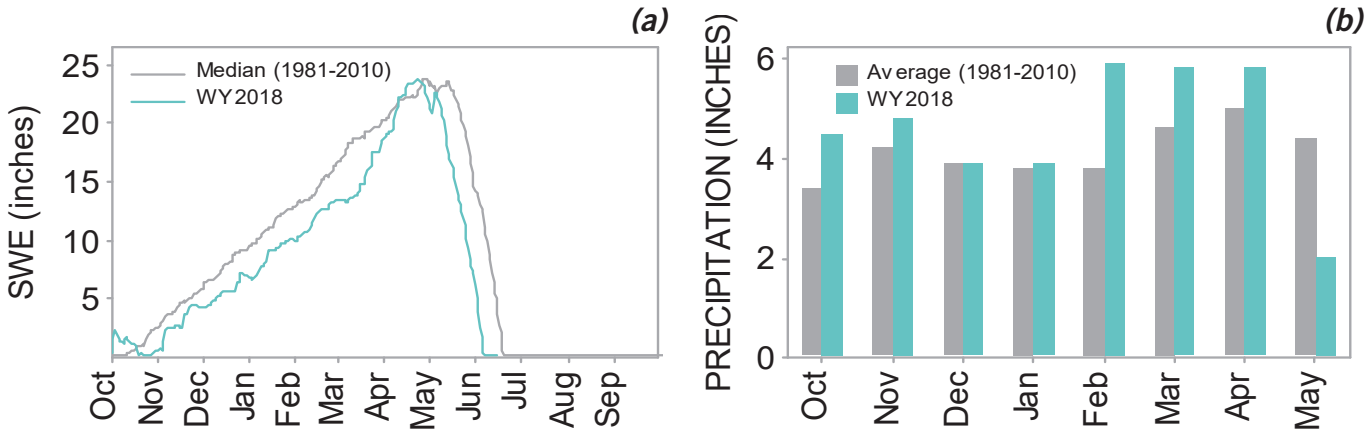


Figure 2 *– Snowpack conditions (left) in the Poudre River watershed over the 2018 water year and monthly accumulated precipitation totals (right).*

SNOWPACK CONDITIONS CONTINUED

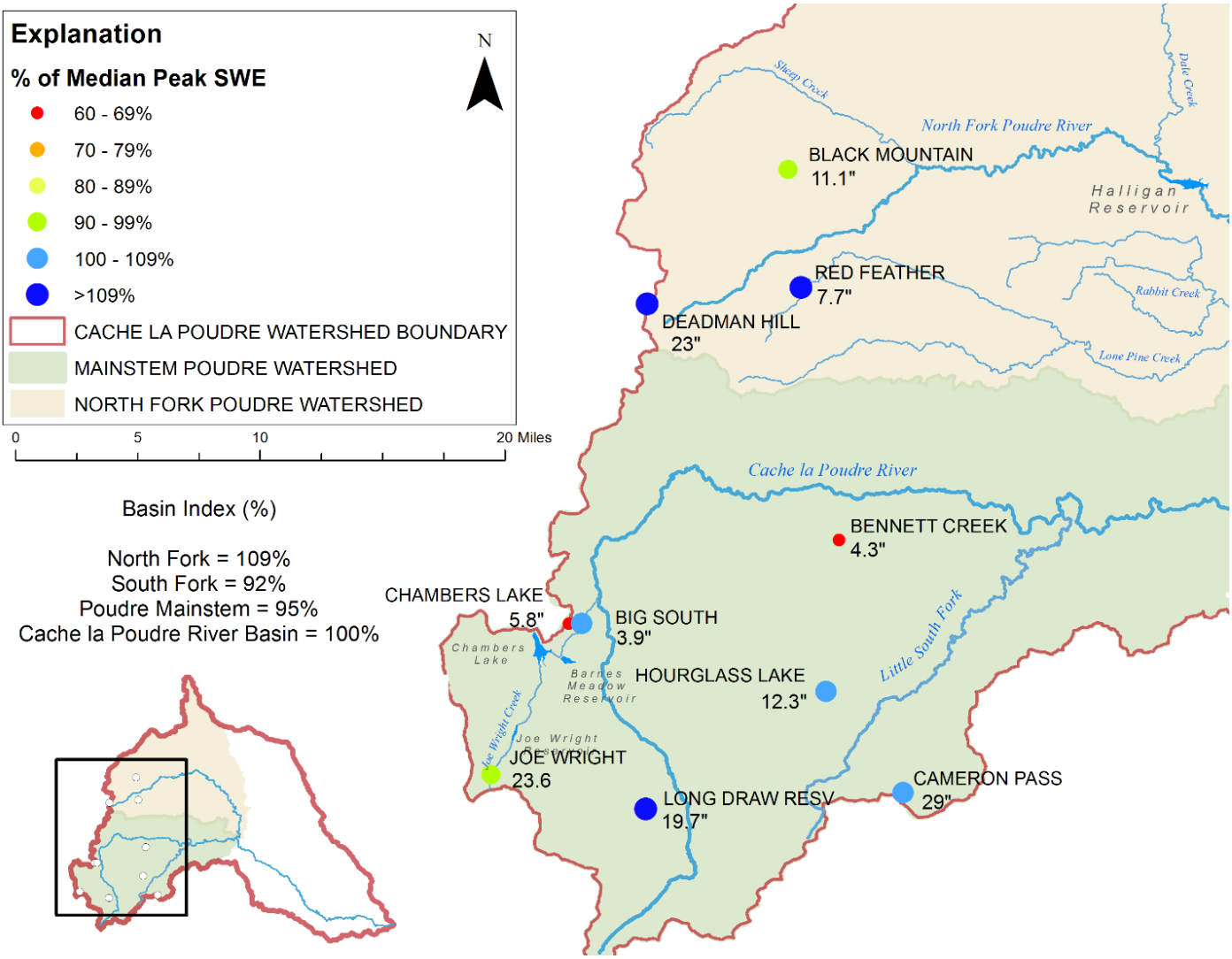


Figure 3 *– Percent of median peak snow water equivalent at snow monitoring sites throughout the Upper Cache la Poudre River watershed.*

STREAMFLOW CONDITIONS

Streamflow, as measured at the Canyon Mouth, began later than normal in 2018 compared to the long-term average. Streamflow was below average for most of April before rapidly rising in early-May. Cooler weather slowed streamflow after the initial rise in the hydrograph, but hot weather in late May melted the remaining snowpack at Joe Wright SNOTEL resulting in an early snowmelt peak.

Peak streamflow was observed on May 28 at 2,120 cfs – 106 percent of the average peak streamflow and two weeks earlier than normal ***(Figure 4a)***. Mean spring streamflow was 624 cfs – 118 percent of the long-term average ***(Figure 4b)***.

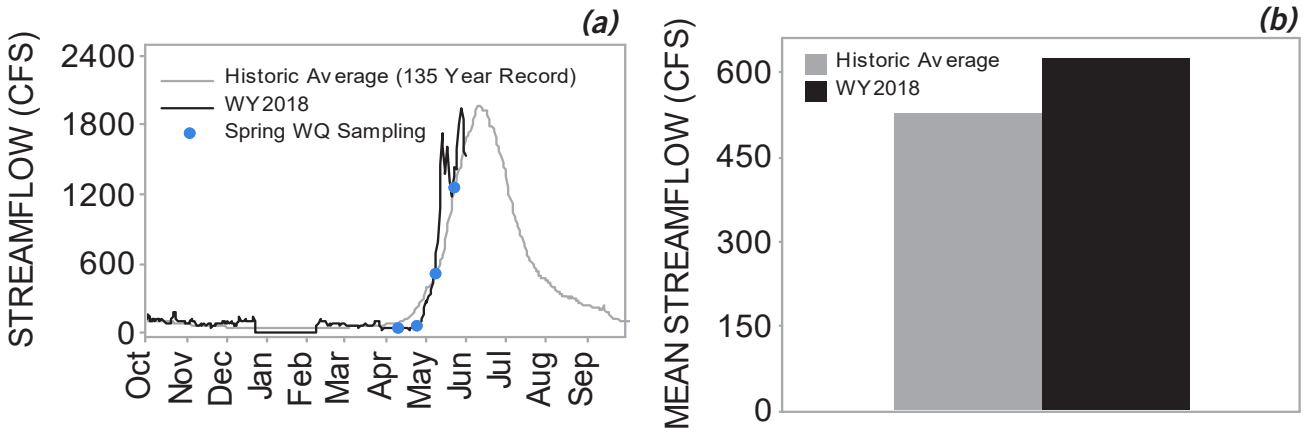


Figure 4 *– Streamflow conditions on the Poudre River over the 2018 water year and mean streamflow measured over the spring season.*

WATER QUALITY INDICATORS

The Upper Cache la Poudre Collaborative Water Quality Monitoring Program uses several key water quality indicators, including pH, conductivity, temperature and turbidity, which act as surrogates for other parameters. ***(Table 1)***. These indicators provide a snapshot of water quality conditions and are useful for indentifying trends or changes in water quality. Significant changes in water quality indicators may provide an early warning of potential water pollution.

Table 1 - *Water quality indicators measured as part of the Upper Cache la Poudre Collaborative Water Quality Monitoring Program.*

Water Quality Indicator	Explanation
Temperature	Water temperature influences other water quality parameters and is a major driver of biological activity and algal growth in rivers, including certain phytoplankton species that produce the taste and odor compound, geosmin.
pH	pH is an important water quality parameter to monitor, because it influences the solubility and biological availability of chemical constituents, including nutrients and heavy metals. pH near 7 is considered neutral, with more acidic conditions occurring below 7 and more basic, or alkaline, conditions occurring above 7.
Conductivity	Conductivity is an index of dissolved ionic solids in water. Conductivity is used as a general measure of water quality. Significant increases in conductivity can be used as an indicator of increased pollution.
Turbidity	Turbidity is monitored to track changes in water clarity. Clarity is influenced by the presence of algae and/or suspended solids introduced to surface waters through various land use activities, including runoff and erosion, urban stormwater runoff and drainage from agricultural lands. For water treatment, turbidity is an important indicator of the amount of suspended material that is available to harbor pollutants, such as heavy metals, bacteria, pathogens, nutrients and organic matter.

Spring water quality monitoring captures water quality conditions from the start of snowmelt runoff to peak streamflow. Water quality conditions vary with changes in elevation and contributing watershed area. All water quality indicators at key sites were measured within the range of baseline conditions indicating normal water quality conditions on the Poudre River during the 2018 snowmelt runoff season ***(Figure 4)***.

WATER QUALITY INDICATORS CONTINUED

The following lists the range of values measured throughout the Mainstem watershed during spring water quality monitoring in 2018:

- Water temperature = 0.48°C – 13.1°C
- pH = 6.61 – 8.19
- Specific conductivity = 23.8 µS/cm – 124.8 µS/cm
- Turbidity = 0.7 NTU – 11.0 NTU

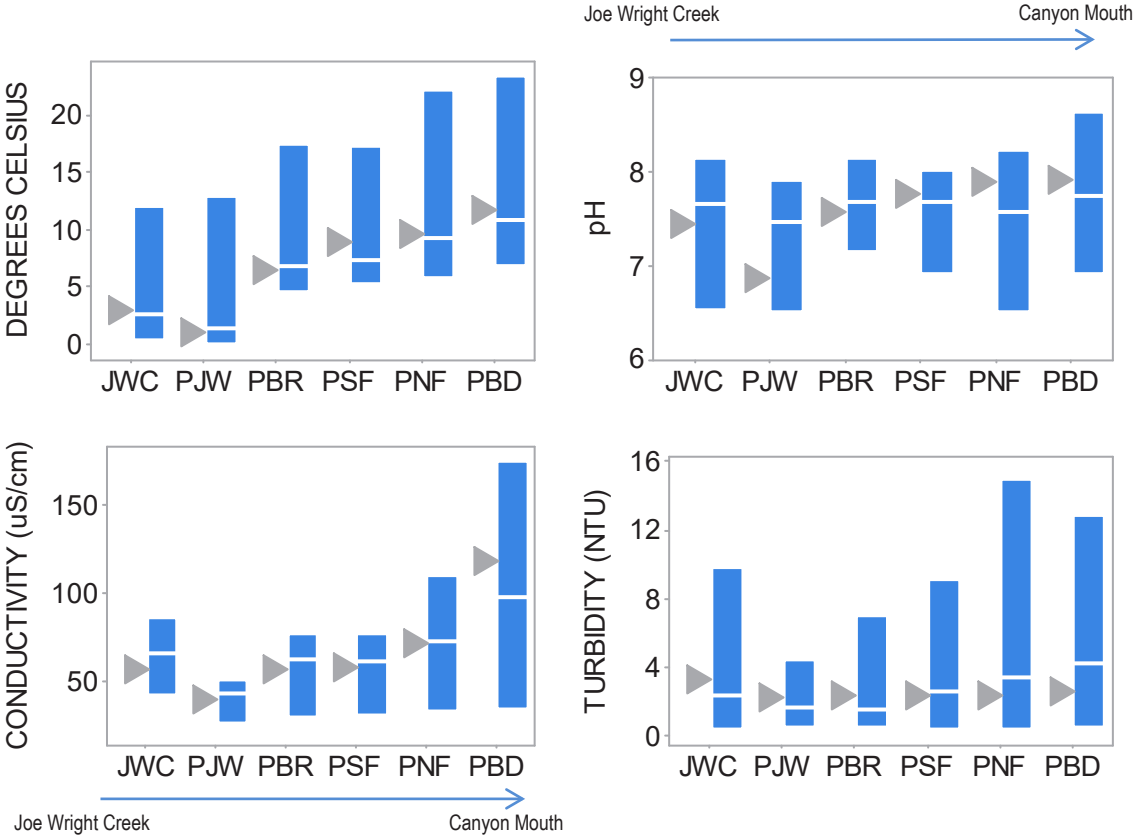
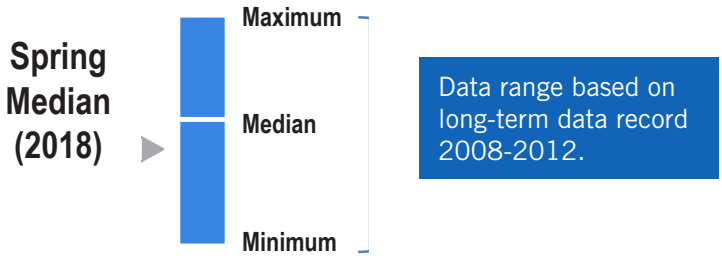


Figure 5 *– Water quality indicator data collected at key monitoring sites over the 2018 spring monitoring season (April and May) compared to baseline spring water quality conditions.*

Graphic Explanation



TOTAL ORGANIC CARBON AND ALKALINITY

Total organic carbon (TOC) is a measure of the total concentration of dissolved and particulate organic matter in water. Water treatment requires the effective removal of TOC because the interaction between residual TOC and chlorine can form regulated disinfection by-products (DBPs). Higher concentrations of TOC in source waters require additional removal requirements at the water treatment facility based on alkalinity levels. The higher concentrations of TOC and low alkalinity, often observed during spring runoff, create challenges for water treatment.

Alkalinity is a measure of the effective acid buffering capacity of water, and is derived from the dissociation of mineral carbonates, bicarbonates, and hydroxides. Alkalinity is influenced by local geology, as well as other dissolved constituents derived from land use practices throughout the watershed.

Total organic carbon and alkalinity concentrations measured near the City of Fort Collins' and City of Greeley's raw water intakes (PNF and PBD, respectively) were within the baseline range of concentrations. Alkalinity concentrations were slightly higher than median baseline concentrations. The higher concentrations were likely caused by lower than average streamflow in April. Alkalinity concentrations measured over the spring 2018 monitoring season ranged from 14.2 – 35.2 mg/L at PNF and 18.8 – 49.6 mg/L at PBD, and TOC concentrations ranged from 3.08 – 9.34 mg/L at PNF and 3.08 – 8.20 mg/L at PBD.

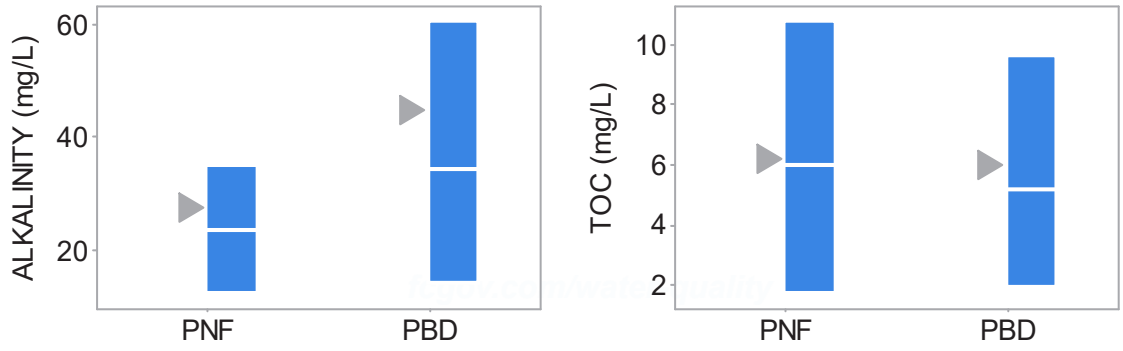


Figure 6 *– Alkalinity and total organic carbon concentrations measured at PNF and PBD during the 2018 spring monitoring season (April and May) compared to baseline spring water quality conditions. Red lines indicate removal requirement threshold concentrations.*

Charlie Beasley, Watershed Technician, collects water quality indicator data on Joe Wright Creek in early Spring using a multi-parameter water quality sonde.

TASTE AND ODOR COMPOUNDS

Geosmin and 2-Methylisoborneol (MIB) are naturally occurring organic compounds which introduces an earthy odor to water that can be detected by the most sensitive individuals at concentrations as low as 4 nanograms per liter (ng/L) or 4 parts per trillion (ppt). These compounds do not pose a public health risk, but it is of concern because its detectable presence can negatively affect customer confidence in the quality of drinking water. Geosmin and MIB are monitored at PBR and PNF during routine UCLP monitoring events. Geosmin was detected slightly above the taste and odor threshold on May 7, 2018 ***(Table 2)***.

Monitor Date	PBR		PNF	
	Geosmin (ng/L)	MIB (ng/L)	Geosmin (ng/L)	MIB (ng/L)
4/9/2018	2.13	BDL	2.37	BDL
5/7/2018	2.46	BDL	4.43	BDL

Table 2 *– Poudre River geosmin and MIB concentrations (ng/L or ppt) during the spring of 2018 at Poudre above the North Fork (PNF) and Poudre below Rustic (PBR) monitoring locations.*

2017 Upper Cache la Poudre Watershed Water Quality Trends Report

The Upper Cache la Poudre Watershed Collaborative Monitoring Program recently released its 2017 Water Quality Trends Report. Trend reports are produced every five years and provide an in-depth analysis of long-term trends in the climate, hydrology and water quality of the Upper CLP watershed. Water quality reports can be found online at *fcgov.com/source-water-monitoring*.