

BIG DRY CREEK ANNUAL WATER QUALITY SUMMARY FOR 2020



**Prepared for the
Big Dry Creek Watershed Association
Board of Directors**

**Prepared by
Wright Water Engineers, Inc.**

August 2021

Contacts for More Information:

Big Dry Creek 2020-2021 Board of Directors

Lesa Julian, City and County of Broomfield

John Winterton, City of Northglenn

David Carter, City of Westminster

Juliana Archuleta, Adams County

Lyndsay Holbrook, Weld County

Al Quintana, City of Thornton

Big Dry Creek Watershed Association Website

www.bigdrycreek.org

Watershed Coordination/Report Preparation

Jane Clary, Project Manager

Wright Water Engineers, Inc.

2490 West 26th Ave., Suite 100A

Denver, CO 80122

303-480-1700

clary@wrightwater.com

BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

Table of Contents

1.	INTRODUCTION AND BACKGROUND	1
2.	OVERVIEW OF MONITORING ACTIVITIES AND FIELD CONDITIONS DURING 2020	2
3.	APPLICABLE STREAM STANDARDS, DATA SUMMARY, AND STANDARDS ASSESSMENT	6
4.	OVERVIEW OF WATER QUALITY DATA	8
5.	<i>E. COLI</i>	11
	<i>E. coli</i> Data Summary.....	11
	<i>E. coli</i> TMDL Summary.....	17
6.	METALS	19
	Selenium.....	19
	Iron	20
	Manganese	22
	Arsenic.....	23
7.	WATER SUPPLY STANDARDS FOR INORGANIC POLLUTANTS (SULFATE AND CHLORIDE)	24
	Sulfate	24
	Chloride	25
8.	NUTRIENTS	26
	Ammonia	26
	Nitrate and Nitrite	27
	Colorado’s 2012 Nutrient Criteria for Nitrogen and Phosphorus (as updated Dec. 2017)	28
	Total Nitrogen	30
	Phosphorus.....	32
	Phosphorus in Relation to Colorado’s Interim Total Phosphorus Values	32
	Phosphorus in Relation to Barr-Milton TMDL.....	37
9.	TEMPERATURE	40
10.	MACROINVERTEBRATE DATA AND MMI ANALYSIS.....	41
	Background on Aquatic Life Use Attainment Policy 10-1.....	41
	Big Dry Creek MMI Results.....	42
11.	FLOW CONDITIONS	44
	Stream Flows.....	44
	USGS Stream Flow Measurements for 2020.....	44
	Colorado Division of Water Resources Stream Flow Measurements for 2020.....	47
	Wastewater Treatment Plant Discharges	49

BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

Seasonal Flow Regime	50
12. QUALITY ASSURANCE/QUALITY CONTROL PROGRAM	55
13. DATA GAPS IN CURRENT MONITORING PROGRAM	55
14. INTEGRATED TREND ANALYSIS AND SOURCE CHARACTERIZATION	56
15. CONCLUSIONS AND RECOMMENDATIONS	65
16. REFERENCES.....	67

Tables

Table 1. Description of Instream Monitoring Locations in 2020	3
Table 2. Summary of Field Conditions during 2020 Sampling Events	5
Table 3. Regulation 38 Stream Standards for Big Dry Creek Adopted in 2020	7
Table 4. Statistical Summary for 2020 Big Dry Creek Data and Comparison to Standards.....	9
Table 5. Annual Geometric Mean Summary of Big Dry Creek <i>E. coli</i> Data (MPN/100 mL)	12
Table 6. Seasonal Summary of Instream Big Dry Creek <i>E. coli</i> Data for 2016-2020.....	13
Table 7. 2020 <i>E. coli</i> Data (MPN/100 mL)	14
Table 8. Big Dry Creek Selenium Data Summary (2016-2020)	20
Table 9. Median Annual Total Phosphorus (mg/L) 1999-2020.....	33
Table 10. Total Phosphorus Concentrations at bdc6.0 (2003-2020).....	38
Table 11. Fall MMI Scores for Big Dry Creek Sites (2012-2020)	43
Table 12. Annual WWTP Discharges to Big Dry Creek.....	49
Table 13. Field Quality Control Program in Sampling and Analysis Plan.....	55
Table 14. Spearman Correlation Matrix Big Dry Creek 2011-2020	58
Table 15. Pollutant Trends Related to Storm-influenced Stream Conditions	63
Table 16. Summary of Water Quality Issues, Sources and Potential Solutions.....	64

Figures

Figure 1. Big Dry Creek Watershed Location Map.....	2
Figure 2. Big Dry Creek <i>E. coli</i> Geometric Mean Values (2016-2020).....	13
Figure 3. Big Dry Creek <i>E. coli</i> Geometric Mean Concentrations (2016-2020).....	14
Figure 4. Big Dry Creek Monthly <i>E. coli</i> 2020 for all Sites.....	15
Figure 5. Seasonal <i>E. coli</i> Matrix (2016-2020)	16
Figure 6. Load Duration Curve for BDC1.5 and the USGS Gauge at Westminster	17
Figure 7. Load Duration Curve for BDC2.0 and the USGS Gauge at Westminster	18
Figure 8. Load Duration Curve for BDC6.0 and the USGS Gauge at Fort Lupton	18
Figure 9. BDCWA Monitoring Locations for Total Iron (2020).....	21
Figure 10. 2020 Iron vs. TSS BDC Monitoring Locations.....	21
Figure 11. Big Dry Creek 2020 Dissolved Manganese.....	23
Figure 12. Big Dry Creek 2020 Total Recoverable Arsenic.....	24

BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

Figure 13. Big Dry Creek 2020 Sulfate.....	25
Figure 14. Big Dry Creek 2020 Chloride	26
Figure 15. Comparison of Big Dry Creek 2020 Ammonia Data to Chronic Ammonia Standards	27
Figure 16. Big Dry Creek 2020 Nitrate + Nitrite	28
Figure 17. Big Dry Creek 2020 Total Nitrogen	30
Figure 18. Big Dry Creek Total Nitrogen Trends (2014-2020).....	31
Figure 19. Big Dry Creek 2020 Total Phosphorus	33
Figure 20 (a-d). Total Phosphorus over Time at Selected Big Dry Creek Monitoring Locations	34
Figure 21. Decreases in Total P Concentrations in Broomfield WWTP Discharge (2002-2020).....	36
Figure 22. Decreases in Total P Concentrations in Westminster WWTP Discharge (2004-2020)...	36
Figure 23. Decreases in Total P Loads at bdc6.0 Plotted with Total P Concentration Data	39
Figure 24. Biennial Big Dry Creek MMI Scores (2012-2020).....	44
Figure 25. Mean Daily Discharge at USGS Gauge Big Dry Creek at Westminster, CO.....	45
Figure 26. Mean Daily Discharge at USGS Gauge Big Dry Creek at Fort Lupton, CO.....	45
Figure 27. Annual Peak Streamflow at USGS Gauge Big Dry Creek at Westminster.....	46
Figure 28. Annual Peak Streamflow at USGS Gauge Big Dry Creek at Fort Lupton.....	46
Figure 29. Average Annual Streamflows Measured at USGS Gauges.....	47
Figure 30. Relationship between BIGDAFCO and USGS 06720990	48
Figure 31. Colorado Division of Water Resources Gauge Measurements for 2020.....	48
Figure 32. Annual WWTP Discharges to Big Dry Creek.....	50
Figure 33. Hydrologic Influences Affecting the Main Stem of Big Dry Creek	52
Figure 34. Average Monthly Percentage of Standley Lake Releases Relative to Big Dry Creek Flows at the USGS Westminster Gauge (2013-2017)	53
Figure 35. Average Monthly Percentage of Municipal WWTP Releases Relative to Big Dry Creek Flows at the USGS Fort Lupton Gauge (2013-2017)	54
Figure 36. Selected Pollutant Concentrations by Location During Standley Lake Releases.....	59
Figure 37. Boxplots of Selected Pollutants Influenced by Stormwater/Runoff Conditions	59
Figure 38. Boxplots of Selected Pollutants Influenced by Wastewater Discharges	61
Figure 39. Boxplots of Selected Pollutants Not Influenced by Stormwater	62

Appendices

Appendix A. Big Dry Creek Watershed Location Map

Appendix B. Big Dry Creek 2020 Instream Sampling Results

Appendix C. Big Dry Creek 2020 Quality Control (QC) Samples

Appendix D. 2020 WWTP Discharge Samples for Broomfield, Westminster and Northglenn
Collected for CDPS Discharge Monitoring Reports

Appendix E. Metro Wastewater 2020 Iron Sampling on Lower Big Dry Creek

BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

Abbreviations and Acronyms

ac	acute
BDCWA	Big Dry Creek Watershed Association
BMP	best management practice
BMW	Barr Milton Watershed
CDPHE	Colorado Department of Public Health and Environment
CDPS	Colorado Discharge Permit System
CDWR	Colorado Division of Water Resources
cfs	cubic feet per second
ch	chronic
cfu	colony forming unit
CWQCC	Colorado Water Quality Control Commission
CWQCD	Colorado Water Quality Control Division
DM	daily maximum
DMR	discharge monitoring report
DO	dissolved oxygen
EDAS	Ecological Data Application System
EPA	U.S. Environmental Protection Agency
HBI	Hilsenhoff Biotic Index
HSW	high scoring water
kg/yr	kilograms per year
MCL	maximum contaminant level
µg/L	micrograms per liter
µS/cm	microsiemens per centimeter
mg/L	milligrams per liter
MG/YR	million gallons per year
mL	milliliter
MMI	multi-metric index
MPN	most probable number
MS4	municipal separate storm sewer system
MWAT	maximum weekly average temperature
NTU	nephelometric turbidity unit
QA/QC	quality assurance/quality control
RPD	relative percent difference
SAP	sampling and analysis plan
SDI	Shannon Diversity Index
TIN	total inorganic nitrogen
TKN	total Kjeldahl nitrogen
TMDL	total maximum daily load
TOC	total organic carbon
TN	total nitrogen

BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

TP	total phosphorus
TSS	total suspended solids
USGS	U.S. Geological Survey
WWTP	wastewater treatment plant

This page intentionally left blank.

1. INTRODUCTION AND BACKGROUND

The Big Dry Creek Watershed Association (BDCWA) is a 501(c)(3) non-profit corporation focused on developing a sound scientific understanding of water quality, flow, aquatic life, and habitat conditions in the Big Dry Creek watershed and acting to improve these conditions. To support these objectives, BDCWA implements an instream monitoring program and analyzes results from the program on an annual basis. The monitoring program is described in the *Cooperative Sampling and Analysis Plan for the Mainstem of Big Dry Creek (SAP)*, which was reviewed and updated in 2018 and can be obtained from the BDCWA website (www.bigdrycreek.org). The monitoring program is conducted by the City and County of Broomfield, City of Westminster, City of Northglenn, and the City of Thornton (Cities). The program includes water quality, flow, and biological monitoring. On an annual basis, data collected under this program are reviewed by the BDCWA Board and uploaded into a master database and then analyzed for compliance with stream standards, for water quality trends, and with regard to other priorities or areas of interest to BDCWA.

Following a brief introduction to the monitoring program and an overview of field conditions during 2020, this report summarizes findings from the 2020 monitoring program, focusing on these primary topics:

- Annual data summary and comparison to stream standards
- Targeted discussion regarding these key water quality constituents:
 - *Escherichia coli* (*E. coli*)
 - Selected metals (selenium, iron, manganese, arsenic)
 - Chloride and sulfate
 - Nutrients
- Biological monitoring
- Annual flow conditions
- Quality assurance/quality control (QA/QC)
- Recommendations and conclusions

Statistical data summaries supporting these discussions are provided in Appendix B.

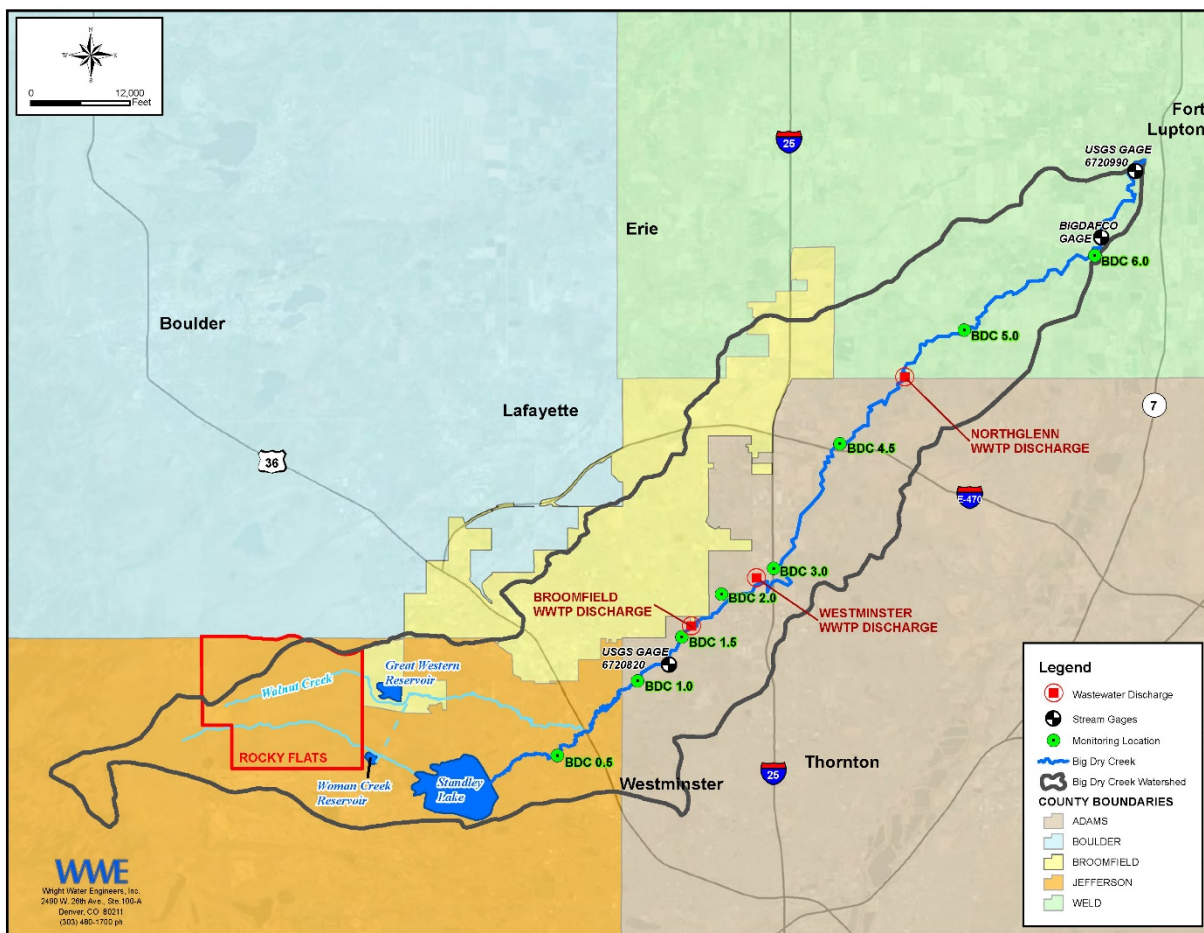
BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

2. OVERVIEW OF MONITORING ACTIVITIES AND FIELD CONDITIONS DURING 2020

During 2020, the City and County of Broomfield and the cities of Northglenn, Thornton, and Westminster (Cities) worked together to collect water quality and flow data along the main stem of Big Dry Creek (Figure 1), consistent with the long-term BDCWA monitoring program, as described in the SAP (BDCWA 2018) and in Table 1. The Cities and BDCWA also helped to fund operation of the U.S. Geological Survey (USGS) gauging station at Westminster behind Front Range Community College.

A conceptual-level understanding of the hydrologic regime for Big Dry Creek is important due to its significant effect on pollutant loading and instream concentrations. For general context, Figure 33 (later in this report) provides a conceptual summary of the key discharges and diversions along the creek, along with the USGS gauging station locations.

Figure 1. Big Dry Creek Watershed Location Map



BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

Table 1. Description of Instream Monitoring Locations in 2020

Site	Location/Selection Criteria	Constituents
bdc0.5	Big Dry Creek at Old Wadsworth Ave. Represents background conditions upstream of the WWTP outfalls, and urbanization impacts.	Water Quality, Habitat, Macroinvertebrates, Fish, Flow
bdc1.0	Big Dry Creek at 112 th Ave. Represents conditions downstream of the confluence with Walnut Creek and Rocky Flats discharge.	Water Quality, Habitat, Macroinvertebrates, Fish, Flow
bdc1.5	Big Dry Creek at 120 th Ave. Represents conditions immediately upstream of Broomfield's WWTP (BWWTP) outfall.	Water Quality, Flow
bdc1.5C	Big Dry Creek downstream of 120 th Ave. upstream of the BWWTP. Serves as reference site representing habitat conditions prior to the BWWTP outfall.	Habitat, Macroinvertebrates, Fish
bdc2.0	Big Dry Creek at 128 th Ave. Represents conditions downstream of BWWTP and upstream of the Westminster WWTP (WWWTP) outfall.	Water Quality, Habitat, Macroinvertebrates, Fish, Flow
bdc3.0	Big Dry Creek at I-25 Represents conditions downstream of the WWWTP outfall, but upstream of Northglenn.	Water Quality, Habitat, Macroinvertebrates, Fish, Flow
bdc4.5	Big Dry Creek downstream of York St. Represents urban development impacts, agricultural impacts, and background conditions for the Northglenn WWTP (NWWTP). (Replaces bdc4.0; site moved downstream April 2011 for safety reasons)	Water Quality
bdc5.0	Big Dry Creek at Weld County Rd. 4. Represents conditions downstream of the NWWTP, and agricultural influences.	Water Quality, Habitat, Macroinvertebrates, Fish
bdc6.0	Big Dry Creek at Weld County Rd. 23 near the confluence with the S. Platte. Represents conditions just prior to the confluence with the South Platte River (end of Segment 15).	Water Quality
120 th & BDC	Big Dry Creek at 120 th Avenue. Same approximate location as bdc1.5.	Mercury

BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

During 2020, city staff collected and analyzed water quality samples for a variety of constituents, resulting in over 2,800 records being added into the BDCWA water quality database. Most metals, boron, and cyanide were monitored on a quarterly basis, with the exception of total recoverable iron, which is monitored monthly due to elevated iron in the lower watershed. The selenium monitoring frequency is also being increased to monthly to support potential future longevity plan requirements for site-specific standards, but was monitored quarterly during most of 2020. Mercury is monitored at only one location at 120th Avenue due to the high cost of mercury analysis at sufficiently low detection limits. All other constituents are monitored on a monthly basis. The Big Dry Creek monitoring program is an ambient-based program. The program does not target wet-weather events, but typically includes one or more sampling events associated with precipitation that happen to fall on the designated sampling date.

Table 2 summarizes field conditions during each sampling event, as recorded at various locations in the watershed. Standley Lake releases and instream flow on the sample date are provided in cubic feet per second (cfs). Based on information shown in Table 2, Standley Lake releases occurred from June through October. Some of the January and February samples at upstream locations were affected by icy conditions, which is common. The June and September sampling events were affected by a rainfall-runoff event, with precipitation greater than 0.1 inches. The February sampling event also followed a snowfall event.

BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

Table 2. Summary of Field Conditions during 2020 Sampling Events

Date	Precip. (inches) ¹	Release (cfs) ¹	Flow (cfs) ²		Comments
	Standley Lake	Standley Lake	USGS Westminster	USGS Ft. Lupton	
1/9/2020	0	0	1.97	17.7	No Standley releases this month. BDC 0.5 & 1.0 inaccessible due to ice. No precip. at Standley Lake Dam on sample date.
2/13/2020	0.28	0	2.56	16.9	No Standley releases this month. BDC 0.5, 1.0 & 1.5 inaccessible due to ice. Snow at Standley Lake Dam on sample date.
3/12/2020	0	0	2.32	22.3	No Standley releases this month. No precip. at Standley Lake Dam on sample date.
4/9/2020	0	0	2.97	30.3	No Standley releases this month. No precip. at Standley Lake Dam on sample date.
5/14/2020	0.07	0	4.89	30.4	No Standley releases this month. 0.07" precip. at Standley Lake Dam on sample date.
6/11/2020	0.56 (prior)	37.1	61.5	53.1	Standley releasing at 37.1 cfs on sample date. 0.56" of precip. at Standley Lake Dam 6/9-10/20.
7/9/2020	0	0 (2.4 prior)	3.87	28.7	Small Standley releases of 1-2 cfs from 7/4-7/8 prior to sampling event. Standley not releasing on sample date. No precip. at Standley Lake Dam on sample date.
8/13/2020	0	30.76	29.4	18.1	Standley releasing 30.76 cfs on sample date. No precip. at Standley Lake Dam on sample date.
9/10/2020	0.27	18.27	22.6	70.3	Standley releasing at 18.27 cfs on sample date. 0.5" at Standley Lake Dam with 0.87" at Northglenn over 9/9-9/10/2021
10/8/2020	0	10	10.3	29.7	Standley releasing at 10 cfs on sample date. No precip. at Standley Lake Dam on sample date.
11/12/2020	0.10	0	1.42	14.0	No Standley releases this month. Minor precip. at Standley Lake Dam on sample date.
12/10/2020	0	0	1.24	20.1	No Standley releases this month. No precip. at Standley Lake Dam on sample date.

¹ Standley Lake precipitation and release data recorded at Standley Lake Dam by dam tender.

² USGS flow data were obtained from USGS NWIS website for USGS 06720820 Big Dry Creek at Westminster and USGS 06720990 Big Dry Creek at Mouth near Fort Lupton.

3. APPLICABLE STREAM STANDARDS, DATA SUMMARY, AND STANDARDS ASSESSMENT

In 2020, the Colorado Water Quality Control Commission (CWQCC) adopted major changes to stream standards for Segment 1 of Big Dry Creek. These changes applied more stringent designated uses including an upgrade of the stream from Aquatic Life 2 to Aquatic Life 1, upgrade from Potential Recreation to Existing Recreation, and addition of a Water Supply use. Agricultural use standards continue to apply. Big Dry Creek is also identified as a “Use Protected” stream, which means that it is not subject to anti-degradation review.¹

Table 3 identifies the currently applicable Regulation 38 stream standards for Segment 1 of Big Dry Creek. Attainment of stream standards is evaluated based on comparison of specific statistical values to chronic stream standards and determining whether acute standards are exceeded in any samples. For most constituents, the relevant statistic for comparison to the chronic standard is the 85th percentile value. Exceptions include use of the 50th percentile value for metals with standards in the total recoverable form, the geometric mean² for *E. coli*, and the 15th percentile value for dissolved oxygen (DO) and the lower acceptable range for pH. For total phosphorus and total nitrogen, annual medians with an allowable exceedance of no more than once every three years are used as “interim values” until final stream standards are adopted. For nitrate, the maximum value is used, with no more than one exceedance every three years. More complex evaluation approaches are required for *E. coli*, selenium, ammonia, and temperature, as described later in this report. (*Note that from a regulatory perspective, five years of data would be used in such a comparison to standards.*)

As part of the 2020 Regulation 38 Rulemaking Hearing, the CWQCC adopted Segment 1 stream standards for chloride, sulfate, dissolved iron, and dissolved manganese that are based on “secondary” drinking water standards developed pursuant to the federal Safe Drinking Water Act. These secondary standards are not health based, but rather are based upon “welfare” impacts such as taste, odor and discoloration of laundry or fixtures. Stream standards for these parameters can either be based on the “table value standards” in Regulation 31, or they can be based on “existing conditions” as of January 1, 2000, with the exception of chloride. Assessment procedures for these constituents are discussed in more detail later in this report.

The time periods evaluated in this report vary, depending on the nature of the water quality and/or regulatory issue. For constituents with current or historic water quality concerns, five to ten years of data may be included in the discussion, whereas for most other constituents, new data collected during 2020 are the primary focus.

¹ For more information on Use Protected and Reviewable designations related to antidegradation requirements in Regulation 31, see 5 CCR 1002-31 Section 31.8 Antidegradation.

² The geometric mean is calculated as the n^{th} root of the product of n values. The geometric mean is used for regulatory purposes because it dampens the impact of extremely high or low values, relative to the arithmetic mean.

BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

Table 3. Regulation 38 Stream Standards for Big Dry Creek Adopted in 2020

COSPBD01		Classifications		Physical and Biological				Metals (ug/L)		
		Designation	Agriculture	DM	MWAT	acute	chronic	acute	chronic	
1. Mainstem of Big Dry Creek, including all tributaries and wetlands, from the outlet of Standley Lake to the confluence with the South Platte River, Walnut Creek, including tributaries and wetlands, from the outlet of Great Western Reservoir to the confluence with Big Dry Creek.		UP	Aq Life Warm 1 Water Supply Recreation E	WS-I	WS-I	---	WS-I	---	---	---
Qualifiers:										
Fish Ingestion Standards Do Not Apply										
Other:										
*chlorophyll a (mg/m ²)(chronic) = applies only above the facilities listed at 38.5(4).										
*Phosphorus(chronic) = applies only above the facilities listed at 38.5(4).										
*Selenium(acute) = 19.1 ug/L from 11/1 - 3/31 TVS from 4/1 - 10/31.										
Refer to Section 38.6(4)(d).										
*Selenium(chronic) = 15 ug/L from 11/1 - 3/31 7.4 ug/L from 4/1 - 10/31.										
Refer to Section 38.6(4)(d).										
*Uranium(acute) = See 38.5(3) for details.										
*Uranium(chronic) = See 38.5(3) for details.										
Temperature °C		WS-I	WS-I	---	WS-I	---	WS-I	---	---	
D.O. (mg/L)		---	---	6.5 - 9.0	5.0	---	---	---	0.02-10 A	
pH		---	---	---	---	---	---	---	100	
chlorophyll a (mg/m ²)		---	---	---	150*	---	---	---	TVS	
E. Coli (per 100 mL)		---	---	---	126	---	---	---	TVS	
Inorganic (mg/L)				acute		chronic				
Ammonia		TVS	TVS	---	---	---	---	---	---	
Boron		---	---	---	0.75	---	---	---	WS	
Chloride		---	---	---	250	---	---	---	1000	
Chlorine		0.019	0.011	---	---	---	---	---	TVS	
Cyanide		0.005	---	---	---	---	---	---	---	
Nitrate		10	---	---	---	---	---	---	TVS	
Nitrite		---	---	---	4.5	---	---	---	0.01	
Phosphorus		---	---	---	0.17*	---	---	---	150	
Sulfate		---	---	---	WS	---	---	---	TVS	
Sulfide		---	---	---	0.002	---	---	---	100	
Arsenic		---	---	---	---	---	---	---	---	
Arsenic(T)		---	---	---	---	---	---	---	0.02-10 A	
Beryllium(T)		---	---	---	---	---	---	---	100	
Cadmium		---	---	---	---	---	---	---	TVS	
Cadmium(T)		---	---	---	---	---	---	---	---	
Chromium III		---	---	---	---	---	---	---	TVS	
Chromium III(T)		---	---	---	---	---	---	---	---	
Chromium VI		---	---	---	---	---	---	---	50	
Copper		---	---	---	---	---	---	---	TVS	
Iron		---	---	---	---	---	---	---	TVS	
Iron(T)		---	---	---	---	---	---	---	---	
Lead		---	---	---	---	---	---	---	---	
Lead(T)		---	---	---	---	---	---	---	50	
Manganese		---	---	---	---	---	---	---	TVS	
Mercury(T)		---	---	---	---	---	---	---	TVS	
Molybdenum(T)		---	---	---	---	---	---	---	---	
Nickel		---	---	---	---	---	---	---	0.01	
Nickel(T)		---	---	---	---	---	---	---	TVS	
Selenium		---	---	---	---	---	---	---	---	
Selenium		---	---	---	---	---	---	---	varies*	
Silver		---	---	---	---	---	---	---	varies*	
Uranium		---	---	---	---	---	---	---	TVS	
Zinc		---	---	---	---	---	---	---	varies*	
		---	---	---	---	---	---	---	TVS	

BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

To calculate hardness-based stream standards, a hardness value of 361 milligrams per liter (mg/L) was used, consistent with the value used by the Colorado Water Quality Control Division (CWQCD) in 2019 wastewater discharge permits for Broomfield, Westminster, and Northglenn. The mean hardness value for the stream as a whole during 2020 was 345 mg/L. Hardness values have a significant effect on certain metals standards. For example, a hardness value of 250 mg/L results in a chronic zinc standard of 271 micrograms per liter ($\mu\text{g/L}$), whereas a hardness value of 350 mg/L results in a chronic zinc standard of 362 $\mu\text{g/L}$ (i.e., the higher the hardness value, the less stringent the water quality standard is for certain metals). For purposes of the 303(d) List (which identifies impaired stream segments), the CWQCD uses the mean hardness value associated with the five-year assessment period for assessment of chronic table value standards for metals. Alternatively, a detailed assessment may also be conducted calculating the chronic table value standard for each pair of hardness and concentration data. The acute table value standards for metals are calculated for each paired hardness/concentration and attainment is determined for each data pair (CWQCD 2019).

In addition to the stream standards and classifications for Big Dry Creek, it is also important to be aware of the 303(d) Listing Methodology, which provides additional information on how impairment decisions are made and how streams can be delisted from being impaired. This methodology is updated every two years.

4. OVERVIEW OF WATER QUALITY DATA

Table 4 provides a summary of the numbers of samples collected and key summary statistics for each constituent analyzed during 2020 and identifies whether the stream attained the standard for each constituent with an applicable stream standard.

A complete summary of individual sampling event results during 2020 for each monitoring station is provided in Appendix B. Quality control (QC) samples, collected in accordance with the Big Dry Creek SAP (BDCWA 2018), are provided in Appendix C.

Discharge monitoring report (DMR) data from municipal wastewater treatment plant (WWTP) discharges to Big Dry Creek during 2020 are provided in Appendix D. The DMR samples were collected in accordance with Colorado Department of Public Health and Environment (CDPHE) Colorado Discharge Permit System (CDPS) permit requirements and are provided as a courtesy from the City and County of Broomfield, the City of Westminster, and the City of Northglenn to provide supplemental information on the quality of discharges to Big Dry Creek at the time of instream sample collection. Broomfield, Westminster, and Northglenn are permitted to discharge to Big Dry Creek, and all three did so during 2020.

Appendix E provides instream iron monitoring results at two sites on lower Big Dry Creek that are monitored by Metro Wastewater Reclamation District (Metro Wastewater) biweekly.

BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

Table 4. Statistical Summary for 2020 Big Dry Creek Data and Comparison to Standards

Analyte	Nbr	Min	Max	Mean	15th	Median	85th	Standard	Standard Exceeded?
General									
ALKALINITY (mg/L)	86	51	317	159	88	156	229	N/A	N/A
BORON, T (mg/L)	31	ND	0.30	0.15	0.04	0.18	0.25	0.75	No
CHLORIDE, D (mg/L)	90	38	1080	213	72	159	316	250	Yes
CHLOROPHYLL-a, corr_ (ug/L)	86	1	32	5	2	4	7	N/A	N/A
CHLOROPHYLL-a, uncor_ (ug/L)	86	1	37	7	3	6	10	N/A	N/A
CONDUCTIVITY (uS/cm)	86	9	3500	1444	583	1416	2127	N/A	N/A
DO (mg/L)	87	3	22	10	8	9	14	5 (min)	No
pH (SU)	86	6.7	8.1	7.7	7.5	7.7	7.9	6.5-9.0	No
E. coli (MPN/100 mL)	82	20	2420	307	74	170	539	126	Yes
CALCIUM, Total (mg/L)	90	35	187	92	52	91	122	N/A	N/A
MAGNESIUM, D (mg/L)	90	7	57	28	13	28	43	N/A	N/A
HARDNESS (mg/L)	90	118	680	345	187	350	484	N/A	N/A
POTASSIUM, D (mg/L)	90	2	12	7	3	7	11	N/A	N/A
SODIUM, D (mg/L)	90	20	568	163	54	145	252	N/A	N/A
SULFATE (mg/L)	90	50	560	269	108	277	408	250	Yes
TDS (mg/L)	90	197	2580	917	377	884	1340	N/A	N/A
TEMPERATURE (°C)	86	1	23	12	5	12	18	WS-1 Stds.	Not Assessed
TOC (mg/L)	89	2	9	6	4	7	8	N/A	N/A
TSS (mg/L)	90	ND	138	26	6	17	46	N/A	N/A
TURBIDITY (NTU)	90	2	90	15	5	11	26	N/A	N/A
CYANIDE, Total (mg/L)	19	ND	ND	ND	ND	ND	ND	0.005	No
Nutrients									
NITROGEN, TOTAL (mg/L)	90	0.24	14.08	5.23	0.79	5.24	9.66	2.01	Yes (future std.)
NO3+NO2 (mg/L)	90	0.05	13.32	4.45	0.25	4.57	8.65	10	Yes
NO2 (mg/L)	90	0.00	0.31	0.06	0.00	0.03	0.14	4.5	No
PHOSPHORUS, TOTAL (mg/L)	90	0.04	1.17	0.29	0.09	0.21	0.50	0.17	Yes (future std.)
PHOSPHORUS, ORTHO AS P (mg/L)	90	ND	0.987	0.15	0.00	0.06	0.32	N/A	N/A
AMMONIA, Total (mg/L)	90	ND	2.18	0.10	0.00	0.04	0.13	Varies	No
Metals									
ARSENIC, Trec (ug/L)	31	0.37	1.77	0.85	0.43	0.78	1.21	0.02-10	No (for hyphenated)
CADMIUM, D (ug/L)	31	ND	0.06	0.01	ND	ND	ND	1.1/8.4	No
CADMIUM, T (ug/L)	23	ND	0.07	0.02	ND	ND	0.07	5 (ac)	No
CHROMIUM, D (ug/L)	31	ND	0.23	0.09	ND	0.11	0.15	Cr-III: 212 / 1,630 Cr-VI: 11 / 16	No
CHROMIUM, T (ug/L)	0							Cr-III: 50 (ac)	Not Sampled
COPPER, D (ug/L)	31	0.77	15.03	3.53	1.88	3.08	4.65	27 / 45	No
IRON, D (ug/L)	23	5.61	43.9	17.8	12.8	16.3	23.9	300	No
IRON, Trec (mg/L)	90	ND	2	0.58	0.22	0.43	1.06	1	No
LEAD, D (ug/L)	31	0.08	0.38	0.16	0.11	0.13	0.23	9.8 / 253	No
LEAD, T (ug/L)	23	0.09	4.43	1.52	0.64	1.61	2.11	50	No
MANGANESE, D (ug/L)	31	13.1	1022	135	19	31	169	50 (WS)	Yes
MERCURY, Trec (ug/L)	4	0.0011	0.0032	0.0025	0.0018	0.0029	0.0031	0.01	No
NICKEL, D (ug/L)	31	0.67	2.57	1.72	0.94	1.85	2.38	154 / 1,387	No
NICKEL, T (ug/L)	23	1	4.17	2.19	1.65	2.04	2.70	100	No
SELENIUM, D (ug/L)	39	ND	8.33	3.26	0.66	3.40	5.48	Site-specific	No
SILVER, D (ug/L)	31	ND	0.19	0.03	ND	ND	0.11	2.9 / 18	No
ZINC, D (ug/L)	31	1.01	39.70	10.44	1.37	7.25	21.46	389 / 514	No

Notes: Geometric mean provided for *E. coli* instead of arithmetic mean. Table Value Standards (TVS) calculated based on a hardness of 361 mg/L. N/A = no standard; #/# = acute/chronic; ND = Non-detect. WS-1 indicates warm water tier 1 temperature standard, but was not evaluated.

BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

Segment 1 (the main stem) of Big Dry Creek is listed on the 2020 303(d) List for Colorado for non-attainment of stream standards for *E. coli* for the entire segment and for total recoverable iron for the portion of the stream below Weld County Road 8 (CWQCC 2020). The iron impairment in the lower watershed is based on data collected by Metro Wastewater. The Division retained these listings for the proposed 2022 303(d) List, without additional listings. A brief synopsis of these two regulatory issues as of 2020 includes:

- *E. coli*: Big Dry Creek did not meet the *E. coli* standard during 2020. A Total Maximum Daily Load (TMDL) for *E. coli* in Big Dry Creek segment COSPBD01 was approved by the U.S. Environmental Protection Agency (EPA) in September 2016. This TMDL was based on a Potential Recreational Contact standard of 205 colony forming units per 100 milliliters (cfu/100 mL). As a result of the 2020 standards change to Big Dry Creek Segment 1, this standard is now 126 cfu/100 mL. Special studies to identify sources of *E. coli* in the watershed are currently underway for the stream reach between Standley Lake and I-25.
- Iron: Although BDCWA's long-term water quality data set shows attainment of the total recoverable iron standard, the portion of Big Dry Creek below Weld County 8 was identified as impaired on the 2016 303(d) List based on data submitted to the CWQCC by Metro Wastewater. The Metro Wastewater data set is also discussed in this report and summarized in Appendix E.

The 2020 changes to the applicable stream standards for Big Dry Creek result in additional anticipated impairment listings in the future, driven primarily by the addition of Water Supply standards based on identification of alluvial wells used for drinking water in the lower watershed. These impairments are discussed later in the report but include sulfate, chloride, dissolved manganese and nitrate.

Other future impairment concerns include total nitrogen and total phosphorus, which are constituents included in the CWQCC's 10-Year Water Quality Road Map. Currently, interim values for total nitrogen and total phosphorus are exceeded for the portion of the stream segment beginning below the WWTP discharges. A final decision by the CWQCC on application of these instream standards is expected in 2027.

More detailed discussion of these constituents of interest to Big Dry Creek is provided in the remainder of this report. See Appendix B for tabular summaries for 2020 water quality data.

5. *E. coli*

In 2020, the recreational use classification and associated stream standards for *E. coli* changed from a potential primary contact recreation use classification to existing primary contact recreation use, based on the potential for waterplay by children and lack of fencing to preclude access. This change decreased the stream standard for *E. coli* from 205 cfu/100 mL to 126/100 mL. Neither standard is attained for the stream and a TMDL was completed in 2016 for *E. coli* based on the 205 cfu/100 mL standard. This section summarizes the data analysis for *E. coli* and provides a brief summary of the 2016 *E. coli* TMDL.

***E. coli* Data Summary**

BDCWA has 21 years of *E. coli* data collected on a monthly basis at eight instream locations, as well as DMR data from the WWTPs (Tables 5 through 7 and Figures 2 through 4). Standards assessment methods for *E. coli* have changed several times over the years with regard to the duration (timeframe) during which standards are assessed. The 2018 303(d) Listing Methodology included the most recent changes to the *E. coli* assessment method. This method is now based on a 61-day rolling geometric mean for future 303(d) listing and delisting decisions. Five samples within a 61-day period, corresponding to the same time period for which impairment was originally identified, are needed for delisting (CWQCD 2017). Because the BDCWA sampling program is based on a monthly program, only two samples per assessment period are available. For this reason, BDCWA applies a seasonal approach for data analysis in this report, dividing the analysis into a recreation season (May-October) and a non-recreation season (November-April). This approach provides six samples for calculation of a geometric mean for each season. The CWQCD also used these seasons in the 2016 *E. coli* TMDL. If sampling results begin to approach attainment of the stream standard, then more frequent sampling may be warranted to demonstrate attainment of the stream standard.

Prior to discussion of findings related to *E. coli*, the following tables and figures are presented:

- Table 5 summarizes *E. coli* data by monitoring location on an annual basis for the entire period of record. (Note: most probable number per 100 milliliter [MPN/100 mL] units are associated with the IDEXX analysis method, but can be compared directly against the stream standard expressed as cfu/100 mL.) Values shaded in pink exceed the previous standard of 205 cfu/100 mL and values shaded in yellow are “new” exceedances due to the change in standard to 126 cfu/100 mL. Although annual geometric means are not used by the CWQCD to assess attainment, the tabular summary is still useful for general information regarding trends over time and identifying locations where *E. coli* is persistently elevated.
- Tables 6 and 7 summarize data for the last five years and 2020 only, respectively. Table 6 is useful for showing which seasonal time periods tend to be elevated over time.

BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

- Figure 2 shows seasonal geometric mean bar charts of *E. coli* from 2016-2020 from upstream to downstream. Figure 3 shows the 2016-2020 *E. coli* boxplots from upstream to downstream, and Figure 4 shows the geometric mean of the 2020 concentrations for all monitoring locations on a monthly basis.

Table 5. Annual Geometric Mean Summary of Big Dry Creek *E. coli* Data (MPN/100 mL)

Year	bdc0.5	bdc1.0	bdc1.5	bdc10.0 (Broom. WWTP) ²	bdc2.0	bdc11.0 (West. WWTP) ²	bdc3.0 (I-25)	bdc4.5	bdc5.0	bdc6.0
2000	212	151	389	--	574	--	294	500	212	323
2001	477	118	332	215	649	68	387	634	442	510
2002	858	230	363	364	934	16	536	441	451	572
2003 ³	191	210	293	27	615	24	382	225	249	339
2004	279	181	217	18	346	28	205	187	156	377
2005	152	122	281	26	328	35	204	113	182	301
2006	76	241	316	20	309	48	214	163	179	333
2007	196	177	257	14	324	66	230	231	198	364
2008	266	197	267	10	461	6	439	376	290	380
2009 ⁴	61	78	147	5	207	14	251	137	149	197
2010	111	191	193	12	483	16	376	280	235	368
2011	64	228	323	6	622	8	518	537	380	730
2012	267	397	260	7	555	8	544	497	390	545
2013	239	214	292	3	398	10	424	342	272	505
2014	119	269	254	5	323	9	371	410	287	1085
2015	257	251	230	4	311	9	528	415	266	490
2016	207	254	221	5	312	18	358	315	300	536
2017	178	194	217	5	327	19	444	392	349	371
2018	81	89	194	3	277	15	352	273	314	300
2019	163	117	157	2	192	25	490	204	275	350
2020	220	121	106	2	138	15	389	174	211	256

1. Pink-shaded cells exceed the 205 cfu/100 mL stream standard. Yellow-shaded cells exceed the 2020 stream standard of 126 cfu/100 mL.

2. Broom. = Broomfield; West. = Westminster; Northglenn excluded due to historically infrequent discharge to Big Dry Creek. During 2015-2020, Northglenn discharged to Big Dry Creek more frequently.

3. For consistency between sampling years, the 2003 weekly samples were converted to monthly geometric means prior to calculating the annual geometric mean for 2003.

4. The 2009-2020 Broomfield and Westminster geometric means are based on DMR values. Prior samples were based on synoptic monitoring program grab samples. Northglenn's 2015-2020 *E. coli* data are based on these annual geometric mean DMR values: 18 MPN/100 mL in 2015, 9.7 MPN/100 mL in 2016, 4.8 MPN/100 mL in 2017, 5.2 MPN/100 mL in 2018, 1.9 MPN/100 mL in 2019, & 2.2 MPN/100 mL in 2020.

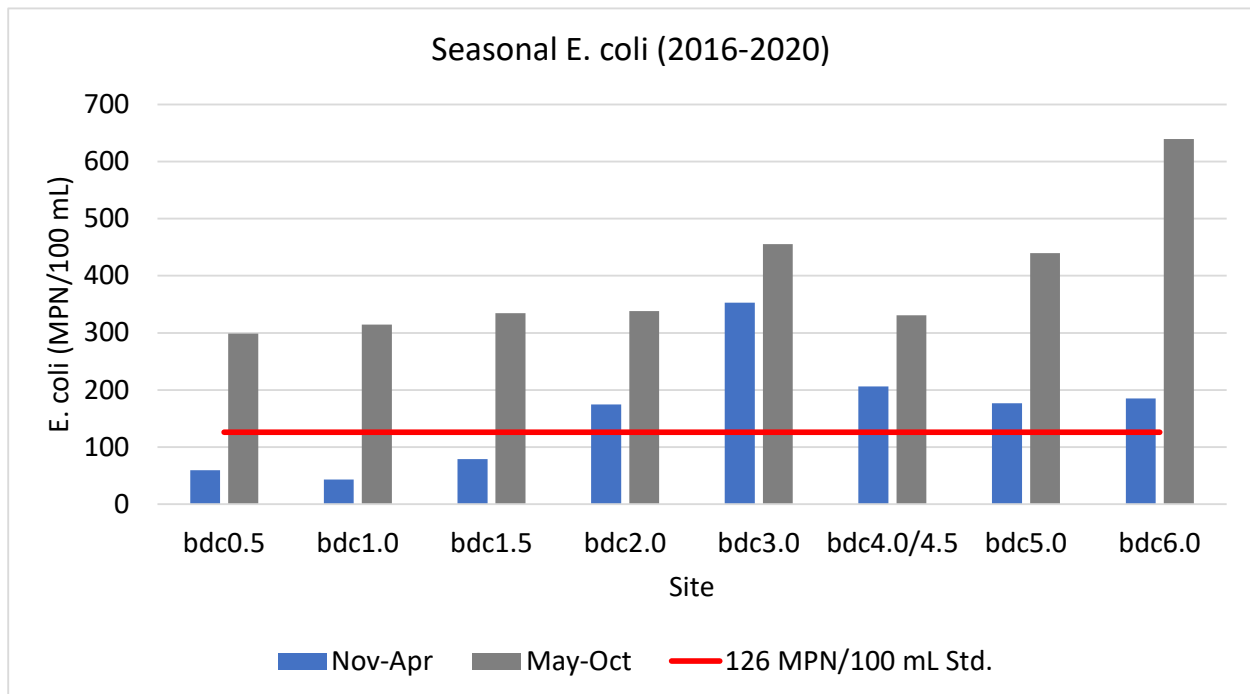
BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

Table 6. Seasonal Summary of Instream Big Dry Creek *E. coli* Data for 2016-2020

Station	Geometric Mean <i>E. coli</i> (MPN/100 mL)	
	Recreation Season	Non-recreation Season
	May-Oct	Nov-Apr
bdc0.5	299	60
bdc1.0	315	44
bdc1.5	334	79
bdc2.0	338	174
bdc3.0	456	353
bdc4.5	331	206
bdc5.0	440	177
bdc6.0	639	185

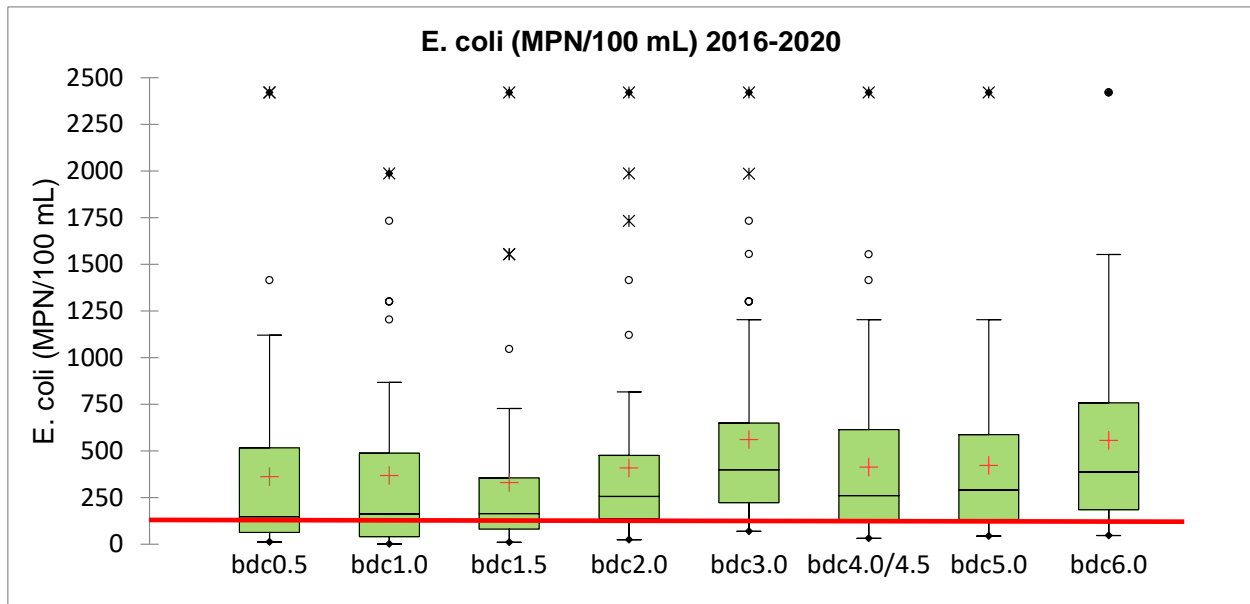
Note: Shaded cells exceed the stream standard. Pink-shaded values exceed the pre-2020 standard of 205 cfu/100 mL and yellow-shaded cells exceed the 2020 stream standard of 126 cfu/100 mL.

Figure 2. Big Dry Creek *E. coli* Geometric Mean Values (2016-2020)



BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

Figure 3. Big Dry Creek *E. coli* Geometric Mean Concentrations (2016-2020)



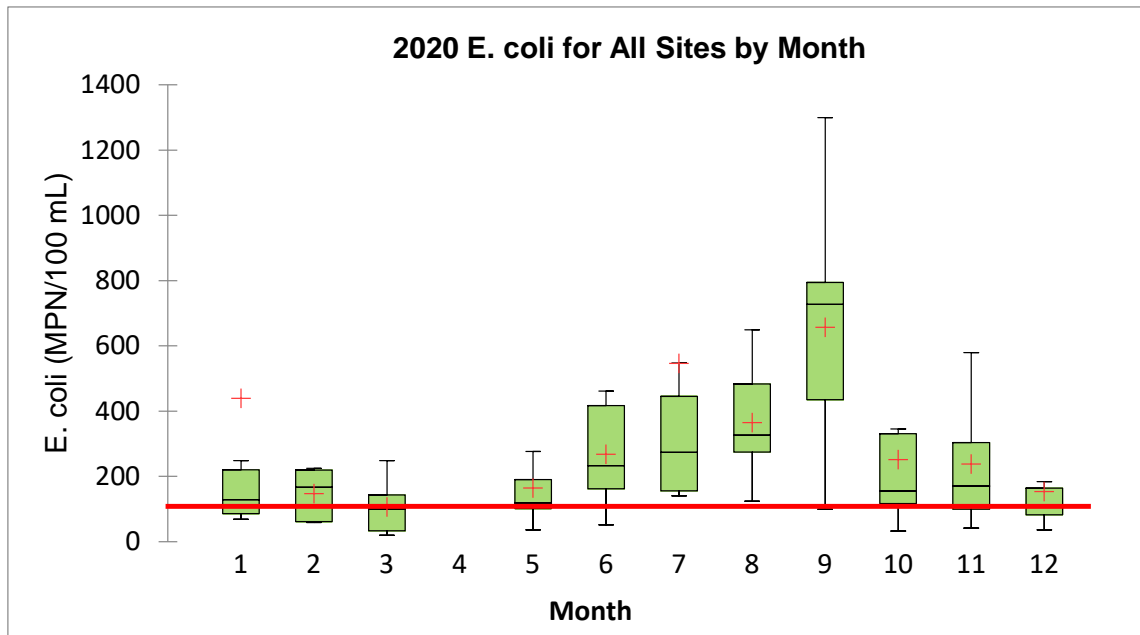
Note: At least one value >2,419 MPN/100 mL present at most locations. Outliers shown

Table 7. 2020 *E. coli* Data (MPN/100 mL)

Station ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Geomean
bdc0.5	Ice	Ice	86	N/A	162	51	2420	173	99	770	579	91	220
bdc1.0	Ice	Ice	20	N/A	36	261	308	326	488	122	41		121
bdc1.5	74	Ice	36	N/A	110	167	161	326	276	142	50	36	106
bdc2.0	122	59	24	N/A	81	204	140	548	770	167	116	105	138
bdc3.0	1986	225	194	N/A	127	146	411	461	1300	326	548	435	389
bdc4.5	248	219	112	N/A	108	411	140	124	727	32	222	184	174
bdc5.0	135	167	126	N/A	276	435	240	308	727	101	142	143	211
bdc6.0	69	61	248	N/A	411	461	548	649	866	345	199	74	256
Geomean All Sites	186	124	75	N/A	130	220	326	322	529	173	162	117	186

Note: Shaded cells exceed the stream standard. Pink-shaded values exceed the pre-2020 standard of 205 cfu/100 mL and yellow-shaded cells exceed the 2020 stream standard of 126 cfu/100 mL.

Figure 4. Big Dry Creek Monthly *E. coli* 2020 for all Sites



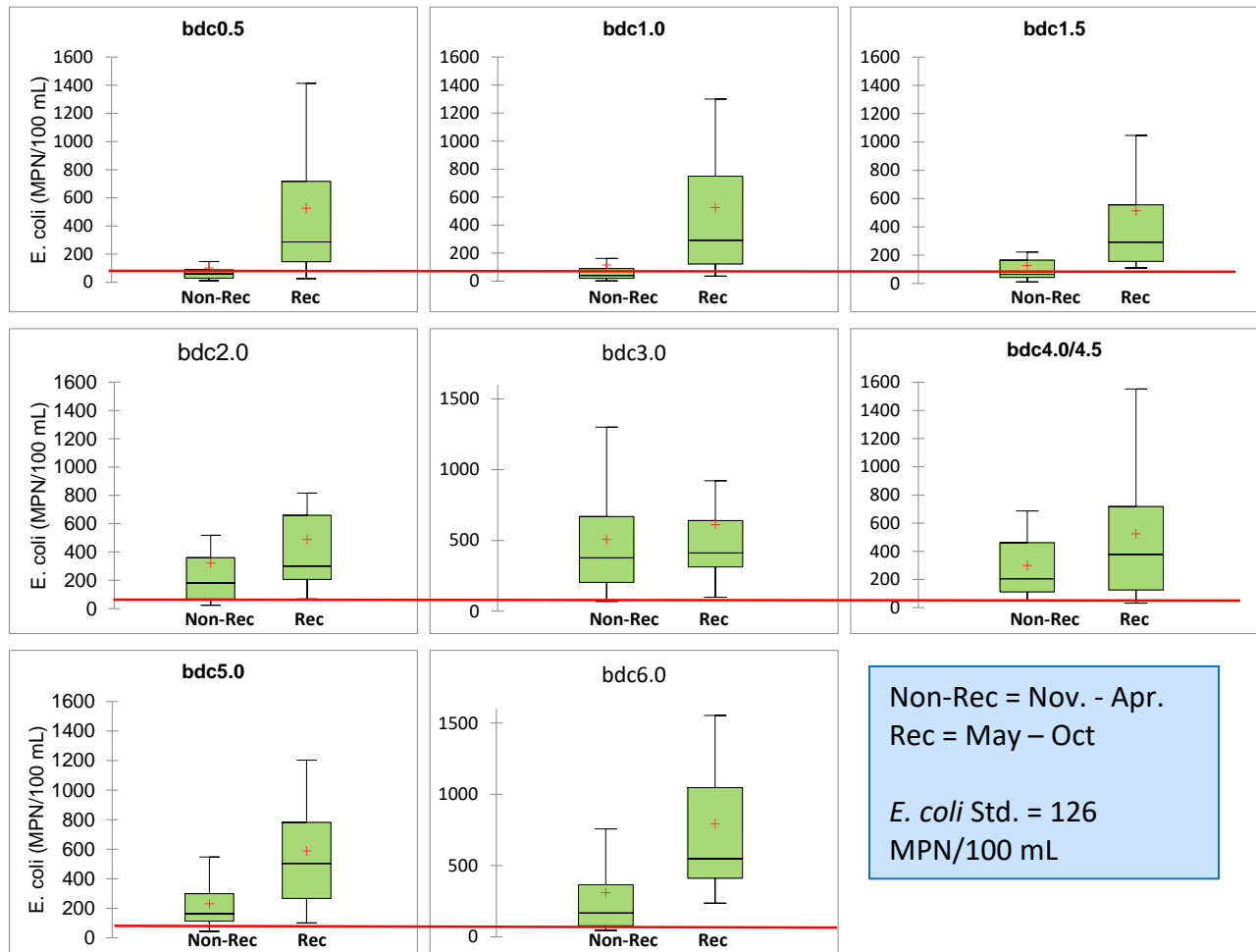
Based on review of the *E. coli* data, the following observations are noteworthy:

- Table 5 indicates the *E. coli* concentrations in 2019 and 2020 were on the lower end of the range of geometric means that have been observed since about 2010 at most monitoring locations.
- The historic data in Table 5 show significant reductions in the Broomfield WWTP's effluent concentrations following plant upgrades and expansion in the 2001-2004 time period. Significant reductions in Westminster's WWTP effluent concentrations are also apparent beginning in 2008, following plant upgrades including ultraviolet (UV) treatment and other operational changes. Based on review of geometric mean concentrations from 2003-2020, *E. coli* concentrations are consistently the lowest in samples from the Broomfield and Westminster WWTP discharges (Table 5), which are well below the stream standard. This is also true for Northglenn WWTP samples reported since 2015.
- The 2020 data set does not meet stream standards, although some upstream sites attained the standard during several winter months. Based on field observations and Google Earth aerial photos, cattle are present in and along the stream above bdc6.0 and are hypothesized to contribute to elevated *E. coli* in this portion of the stream. *E. coli* was lower at bdc6.0 than it has been in the past; cattle access to the stream is still present in 2021 aerial imagery.

BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

- For 2016-2020, the highest *E. coli* concentrations for all stations were experienced during the May-October recreation season, which is the typical pattern for the stream. Statistically significant seasonal differences in *E. coli* concentrations have been consistently observed, with winter values being significantly lower than summer values. Boxplots of upstream to downstream monitoring locations (Figure 3) show highly variable ranges of *E. coli* concentrations at each monitoring location.
- Figure 5 provides a boxplot matrix of seasonal *E. coli* by monitoring location for the past five years, with recreation season (May-October) consistently having higher *E. coli*. However, the seasonal pattern is weaker at locations bdc2.0 to bdc4.5 through the more urbanized portion of the watershed. Special studies are underway to identify sources of *E. coli* in the watershed between Standley Lake and I-25, which generally corresponds to this area. Section 14 of this report provides an updated trend analysis for multiple pollutants in this report, including *E. coli*.

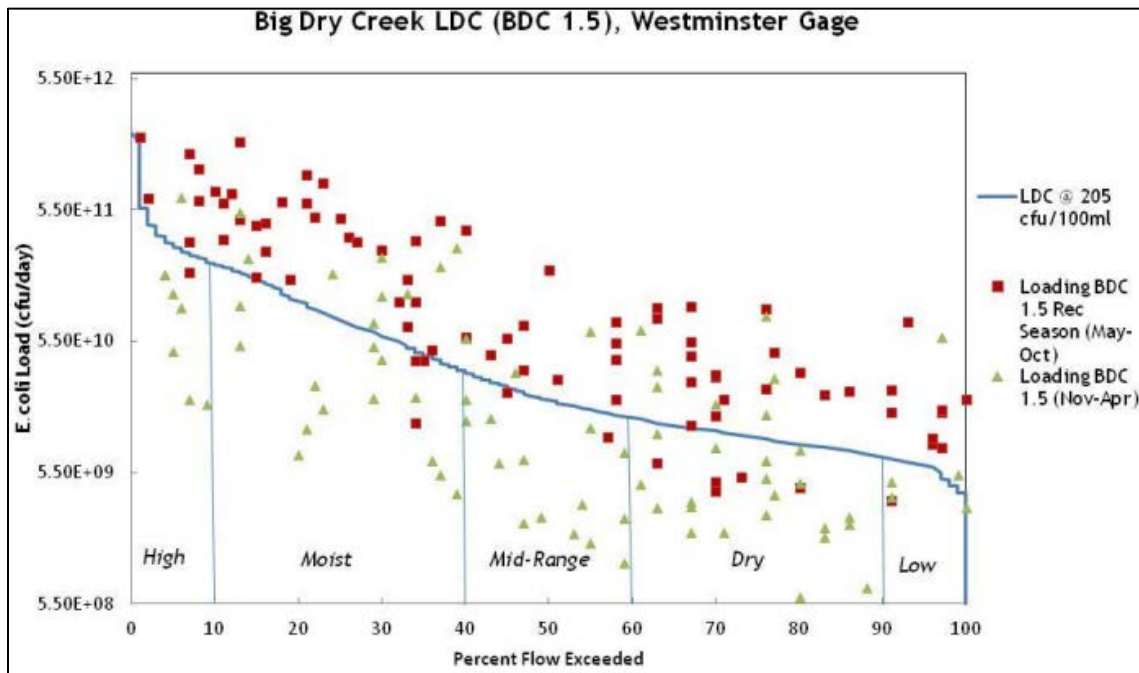
Figure 5. Seasonal *E. coli* Matrix (2016-2020)



***E. coli* TMDL Summary**

As part of the TMDL for Big Dry Creek, the CWQCD developed load duration curves for three portions of Big Dry Creek. The segment was divided into three distinct reaches to account for changes in land use, influences from instream flow (diversions, reservoir releases, WWTP contributions, etc.), and location of permitted point sources. The three reaches correspond to Standley Lake to bdc1.5 (bdc0.5 to bdc1.5), from bdc1.5 to 152nd Avenue (bdc2.0 and bdc3.0), and 152nd Avenue to the Weld County Line (bdc4.0/4.5 to bdc6.0). These curves are based on data from 2003 through 2014 and are shown in Figures 6 through 8. These figures illustrate that recreation season (May-October) stream loads generally exceed the allowable stream load for *E. coli* during all flow regimes. The TMDL has assigned load reductions needed for each of these three portions of the stream. BDCWA is currently working source identification and potentially feasible load reductions in the urbanized portion of the watershed. These investigations are prioritizing potential human waste sources. Since development of the TMDL, the stream standard has become more stringent (126 cfu/100 mL vs. 205 cfu/100 mL.)

Figure 6. Load Duration Curve for BDC1.5 and the USGS Gauge at Westminster
(Source: CWQCD 2016)



BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

Figure 7. Load Duration Curve for BDC2.0 and the USGS Gauge at Westminster
(Source: CWQCD 2016)

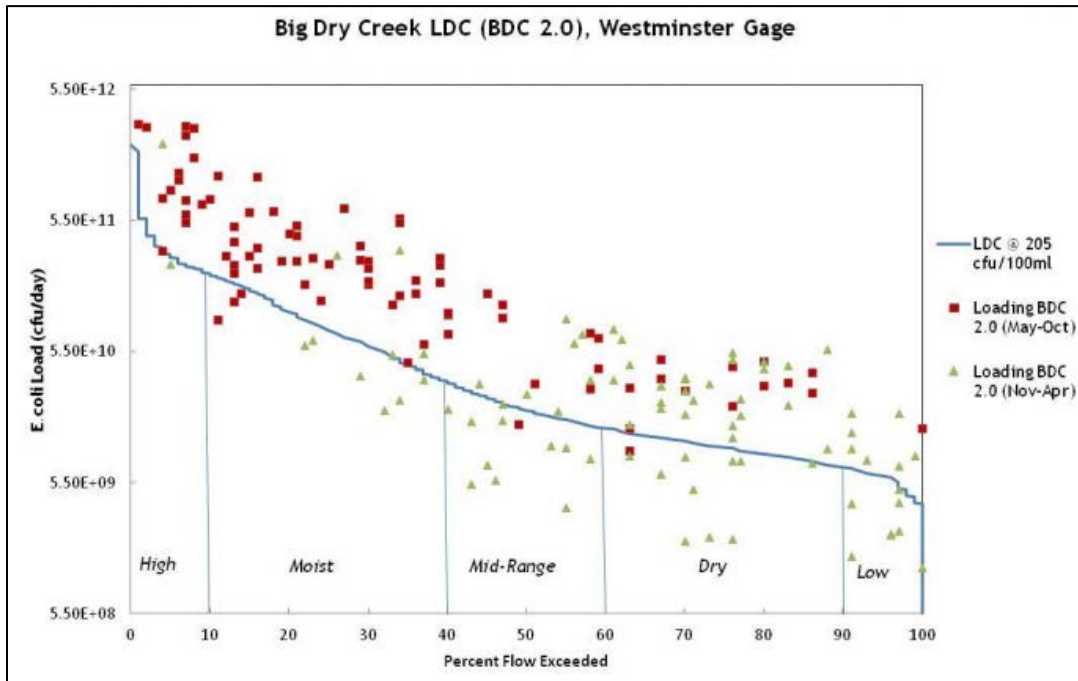
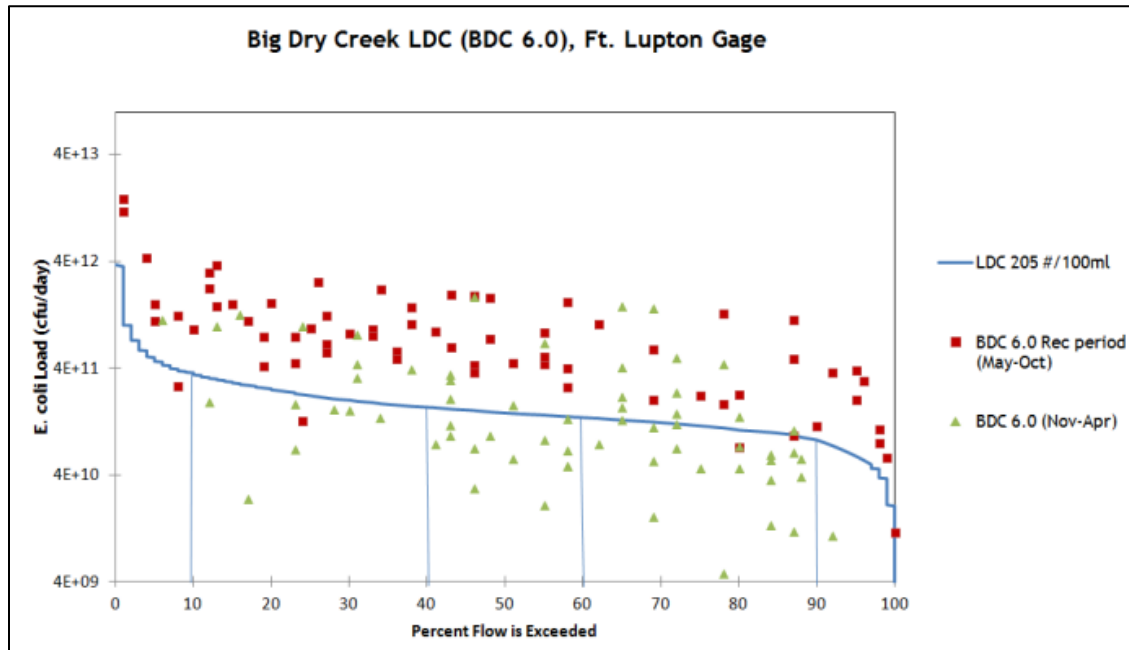


Figure 8. Load Duration Curve for BDC6.0 and the USGS Gauge at Fort Lupton
(Source: CWQCD 2016)



6. METALS

Big Dry Creek attains most metals standards assigned for protection of aquatic life, including arsenic, cadmium, chromium, copper, lead, manganese, selenium, silver, zinc and mercury. Since 2016, a portion of Big Dry Creek below Weld County Road 8 has been identified as impaired on the 303(d) List for total recoverable iron. In the past, selenium was a metal of concern; however, adoption of a site-specific standard for selenium on Big Dry Creek in 2007 and some changes to assessment methodology for ambient-based standards have resulted in attainment of the selenium standard. In 2020, a new Water Supply classification resulted in addition of more metals standards to the stream segment, including more stringent total recoverable arsenic and dissolved manganese standards and new standards for dissolved iron and total cadmium, chromium, lead, and nickel. Dissolved manganese is expected to be a future impairment for Big Dry Creek due to adoption of a Water Supply standard for the stream and is also discussed further.

See Appendix B for tabular statistical summaries for Big Dry Creek samples analyzed for metals, with additional information on selenium, iron, manganese and arsenic discussed further below.

Selenium

Elevated selenium concentrations in the upper reach of Big Dry Creek are due to naturally occurring selenium in geologic formations. BDCWA conducted special studies in 2006-2007 to support a site-specific standard. Background on this site-specific standard can be obtained in Regulation 38. The site-specific standard includes irrigation and non-irrigation seasonal standards assessed at three specific monitoring locations: bdc1.5, bdc2.0 and bdc4.0/4.5.³ BDCWA is increasing the sampling frequency for selenium to monthly. This change is related to “longevity plans” for site-specific standards that may include more detailed review of the basis of the underlying standard as part of triennial reviews of stream standards in the future.

Based on the site-specific selenium standards for Big Dry Creek, the 2020 data set and the data set for the most recent five years (2016 through 2020) attain both the non-irrigation season (winter) and irrigation season (summer) standards for Big Dry Creek, as summarized in Table 8. WWTP grab samples collected during this time period were below chronic and acute stream standards for selenium. As an additional observation in the context of longevity plans for the standards, the stream still needs a site-specific standard—the underlying selenium standard is not attained.

³ In 2015, the CWQCC adopted a formal change to the site-specific selenium standard assessment locations in Regulation 38 because sampling location bdc4.0 was relocated in 2011 for safety reasons and has been replaced with bdc4.5, although both sites may still be used for standards assessment, if needed.

Table 8. Big Dry Creek Selenium Data Summary (2016-2020)

Selenium (µg/L)				
	Irrigation Season		Non-irrigation Season	
	2016-2020 (Apr-Oct)	Reg. 38 Standard	2016-2020 (Nov-Mar)	Reg. 38 Standard
bdc1.5, 2.0, 4.5 (85th Percentile)	6.1	7.4 (ch)	9.0	15.0 (ch)
bdc1.5, 2.0, 4.5 (Maximum)	13.4	18.4 (ac)	11.1	19.1 (ac)

Table Notes: ch = chronic; ac = acute

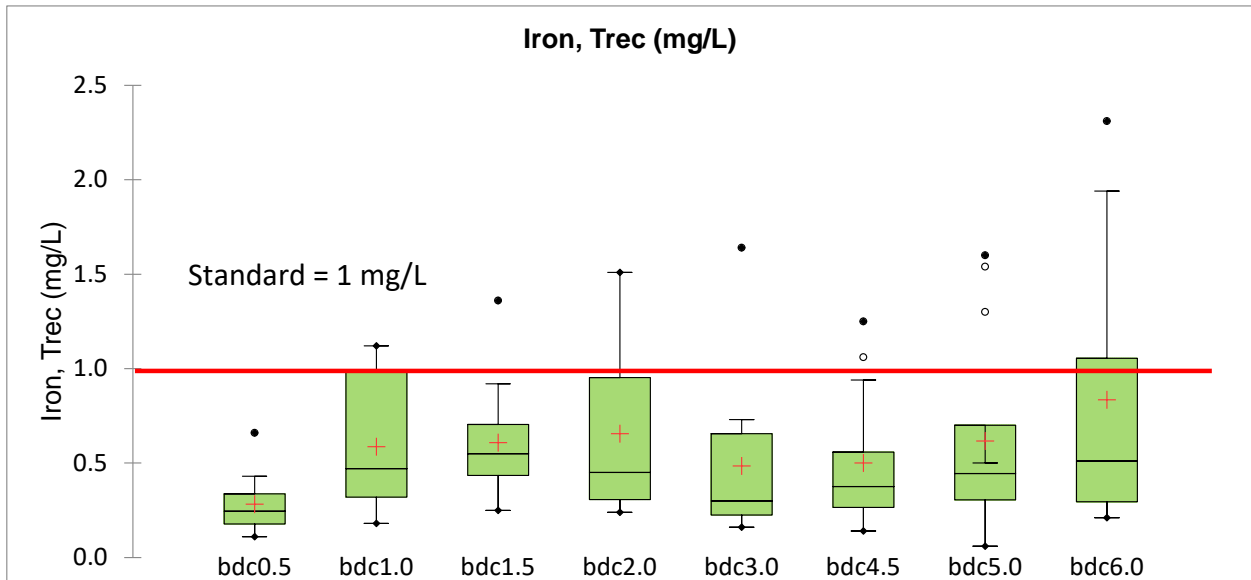
Iron

BDCWA currently monitors total recoverable iron (Figure 9) on a monthly basis, after increasing the sample frequency from quarterly to monthly in May 2018 due to Big Dry Creek being added to the 303(d) List for total recoverable iron based on monitoring conducted by Metro Wastewater. Metro Wastewater conducts sampling twice per month at two locations in the lower watershed. Metro Wastewater’s upstream-most site, “BDC-8,” is located where Big Dry Creek crosses Weld County Road 8 and has been monitored by Metro Wastewater since 2007. This site is located in proximity to BDCWA site bdc6.0. Metro Wastewater’s downstream site, “BDC,” is located approximately 30-50 yards upstream of the State Engineer’s gauge “Big Dry Creek at Mouth” also known as BIGDAFCO (see Figure 30 for general location). Both of these sites were at or below the stream standard of 1 mg/L during 2020, with median values of 0.67 mg/L and 1.0 mg/L for BDC-8 and BDC, respectively. Although Big Dry Creek’s five-year data set shows attainment of the iron standard for the stream as a whole and at bdc6.0 at Weld County Road 8, Metro Wastewater’s five-year data set still shows impairment with a median value of 1.2 mg/L total recoverable iron value.

The expected source of elevated iron is streambank and soil erosion in the watershed. Previous analyses by BDCWA have shown that total iron and total suspended solids (TSS) are highly correlated, with both concentrations tending to be elevated during storm events (Figure 10). Also see discussion in Section 14 of this report related to runoff-influenced pollutants in the agricultural area.

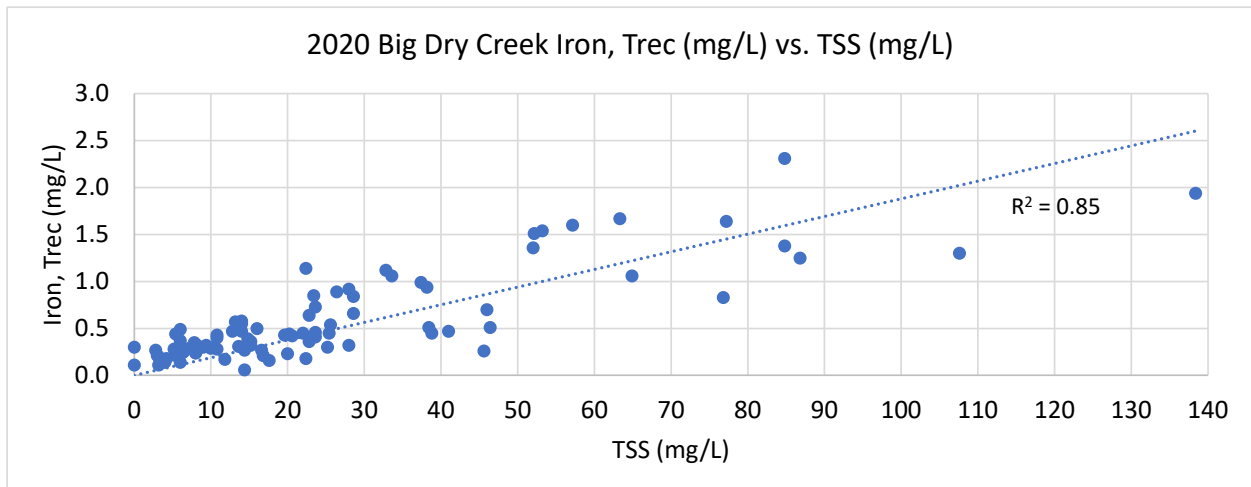
In 2020, a dissolved iron standard of 300 µg/L was added to Big Dry Creek to protect water supply uses. BDCWA began monitoring for dissolved iron in June of 2020. The 85th percentile value of 23.9 µg/L is well below the stream standard. Metro Wastewater’s dissolved iron monitoring in the lower watershed also shows attainment of the dissolved iron standard. Additionally, review of the CWQCD’s existing quality data library for Big Dry Creek shows an existing condition for dissolved iron of 90 µg/L, further indicating that dissolved iron is likely to attain the new stream standard.

Figure 9. BDCWA Monitoring Locations for Total Iron (2020)



Note: Total recoverable iron is assessed as a median (50th percentile), which corresponds to the line in the box portion of the boxplot.

Figure 10. 2020 Iron vs. TSS BDC Monitoring Locations



Manganese

In the 2020 Regulation 38 Rulemaking Hearing, the CWQCC adopted a dissolved manganese standard to protect Water Supply uses associated with alluvial wells near Big Dry Creek in the lower watershed. Dissolved manganese standards can be applied as either of the less restrictive of the following two options:

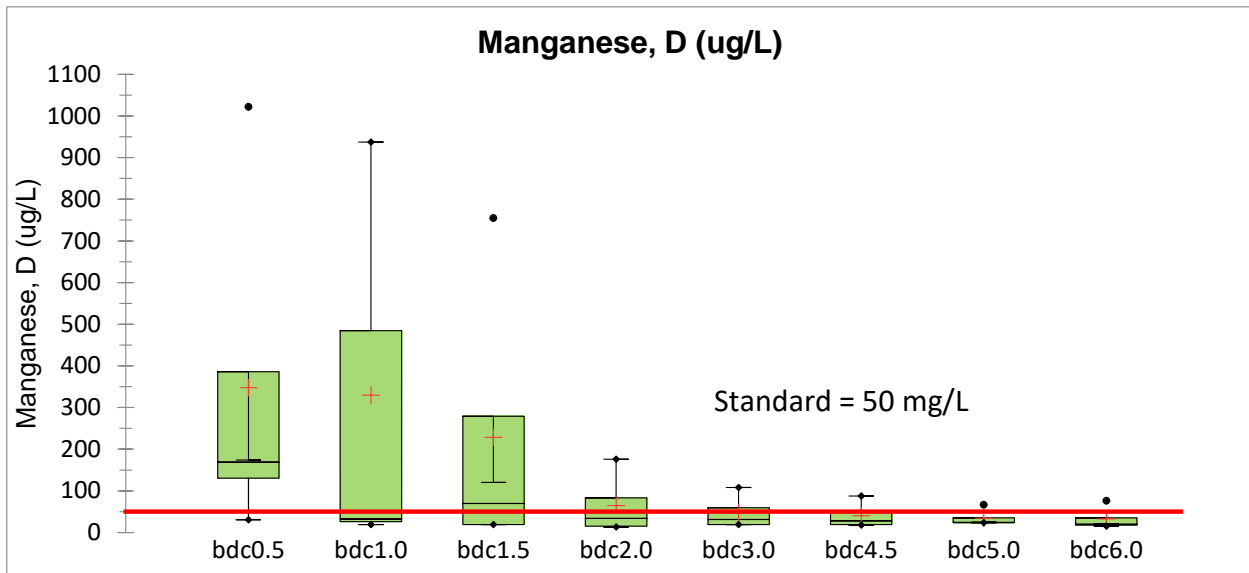
1. existing quality as of January 1, 2000; or
2. a table value criterion of 50 µg/L dissolved manganese.

Based on dissolved manganese in the CWQCD's existing quality library,⁴ which does not currently include BDCWA's data set, existing quality for 1995-1999 would be 85 µg/L. Using the entire period of record in the library, the existing quality value would be 78 µg/L. BDCWA's database only includes dissolved manganese for 30 samples in 1999, with an 85th percentile value of 57 µg/L.

The primary cause of the elevated dissolved manganese is thought to be groundwater inflows in the upper watershed. Review of seasonal patterns shows elevated concentrations in the winter, when Standley Lake is not releasing and the stream is dominated by groundwater above the WWTP discharges. This is also the cause of higher variation in the upper watershed, as illustrated by the large ranges in the boxplots for bdc0.5, bdc1.0 and bdc1.5 in Figure 11. The 85th percentile value for dissolved manganese is 169 µg/L for the 2020 Big Dry Creek data set, which exceeds both the underlying standard of 50 µg/L and the existing quality standard as of January 1, 2000.

⁴ The CWQCD library is in the process of being updated and the most current working version of the database was provided as a courtesy from the CWQCD on 6/24/2020.

Figure 11. Big Dry Creek 2020 Dissolved Manganese

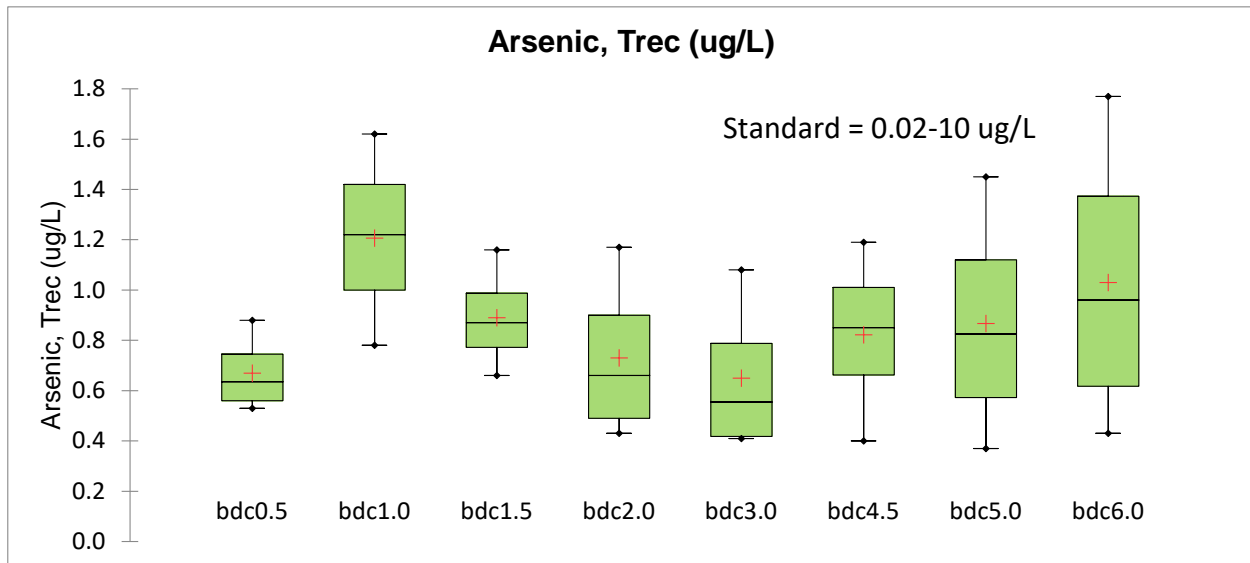


Arsenic

In the 2020 Regulation 38 Rulemaking Hearing, the CWQCC adopted a more stringent total recoverable arsenic standard to protect Water Supply uses associated with alluvial wells near Big Dry Creek. Previously, Big Dry Creek’s arsenic standard was much higher at 100 µg/L. The new Water Supply standard is expressed as a hyphenated standard of 0.02-10 µg/L. The first number in the range is a strictly health-based value, based on the CWQCC’s established methodology for human health-based standards. The second number in the range (i.e., 10 µg/L) is a maximum contaminant level (MCL), as established under the federal Safe Drinking Water Act, that has been determined to be an upper limit for arsenic in public water supplies, taking treatability and laboratory detection limits into account. Discharge permit effluent limitations are established using the first number in the range as the ambient water quality target, provided that no effluent limitation will require an “end-of-pipe” discharge concentration more restrictive than the second number in the range. Waterbodies are considered in attainment of this standard and not included on the 303(d) List, provided that the existing ambient quality does not exceed the second number in the range (i.e., 10 µg/L).

Big Dry Creek attains the 10 µg/L MCL for total recoverable arsenic and exceeds the 0.02 µg/L underlying health-based value. Thus, the segment would be considered to attain the hyphenated arsenic standard. In the 2020 Regulation 38 Rulemaking Hearing, the CWQCC considered adoption of a more stringent Water + Fish standard of 0.02 µg/L (without the hyphenated 10 µg/L value). Because there was no evidence of fish ingestion for Big Dry Creek meeting the criterion of “fish normally consumed on a recurring basis,” the Water + Fish standard was not adopted.

Figure 12. Big Dry Creek 2020 Total Recoverable Arsenic



7. WATER SUPPLY STANDARDS FOR INORGANIC POLLUTANTS (SULFATE AND CHLORIDE)

In the 2020 Regulation 38 Rulemaking Hearing, the CWQCC adopted sulfate and chloride standards to protect Water Supply uses associated with alluvial wells near Big Dry Creek.

Sulfate

The sulfate standard can be applied as either of the less restrictive of the following two options

1. existing quality as of January 1, 2000; or
2. sulfate at 250 mg/L.

Based on sulfate data in the BDCWA database from 1995-1999, the existing quality standard for sulfate would be 380 mg/L. Based on sulfate in the CWQCD's existing quality library,⁵ which does not currently include BDCWA's data set, existing quality for 1995-1999 would be 308 mg/L. Using the entire period of record in the library, existing quality would be 383 mg/L. Based on review of sulfate data, Big Dry Creek would not be expected to attain the sulfate standard.

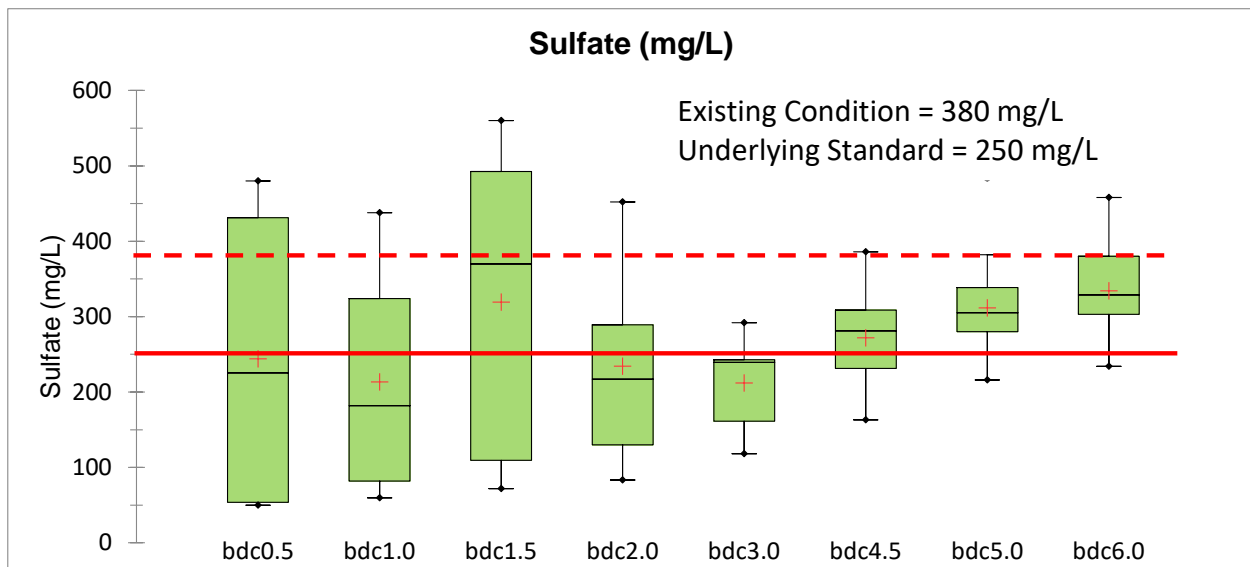
For sulfate, the 85th percentile value for the overall stream segment is 408 mg/L for 2020, which is greater than BDCWA's existing condition calculation of 380 mg/L. Additionally, the 85th percentile value for the past five years of samples on Big Dry Creek also exceeds both standards.

⁵ The CWQCD library is in the process of being updated and the most current working version of the database was provided as a courtesy from the CWQCD on 6/24/2020.

BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

The primary cause of this standards exceedance is seasonally elevated sulfate in the upper portion of the watershed above the WWTP discharges. During time periods when Standley Lake is not releasing flows to the stream, the stream flows are dominated by groundwater, which is high in sulfate (as well as other parameters like chloride, total dissolved solids, selenium, and manganese). Other sources in the lower watershed could potentially include ammonium sulfate fertilizer. A potential solution to this potential standards issue would be to apply the existing condition provision on a sampling location-specific basis. For example, the 85th percentile value for bdc1.5 for 1995-1999 was 555 µg/L. If recent monitoring data for bdc1.5 are compared to historic water quality data as of the January 1, 2000 for bdc1.5, then the standard would be attained. Although this location-specific comparison technique is not currently expressly included in the 303(d) Listing Methodology, there is precedent for this approach (CWQCD 2020). Additionally, historic data may not be representative of hydrologic conditions in the upper watershed in the future because releases from Standley Lake to the stream are expected to decrease as a result of changes in water rights administration.

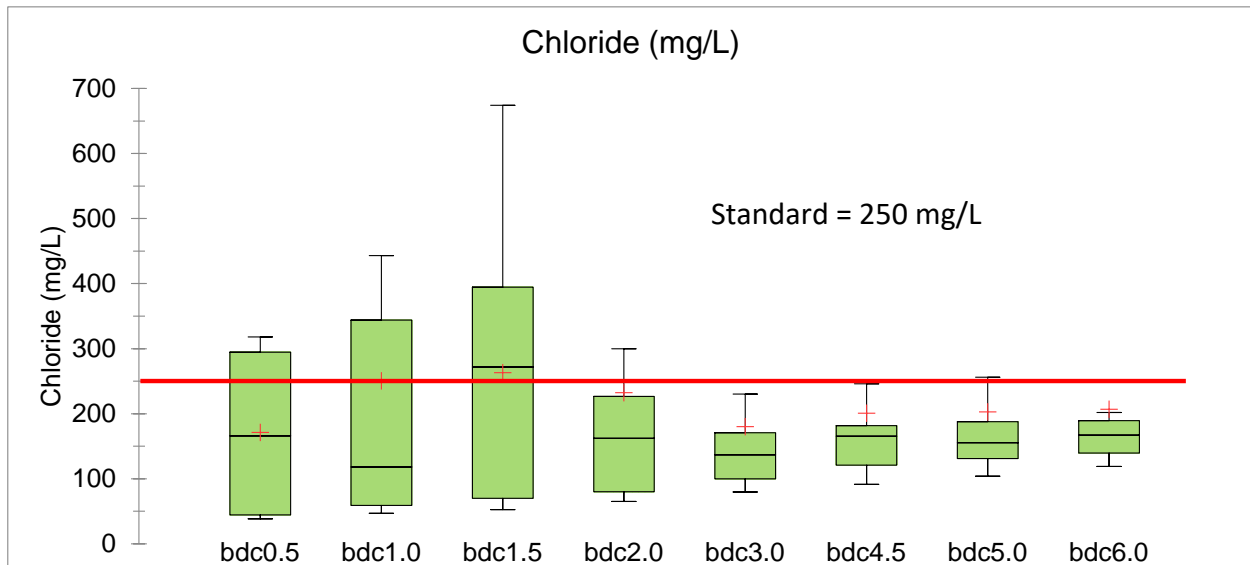
Figure 13. Big Dry Creek 2020 Sulfate



Chloride

The chloride standard added to Big Dry Creek in the 2020 Regulation 38 Rulemaking Hearing is 250 mg/L. For chloride, an existing condition provision is not provided in Regulation 31, so the 250 mg/L standard applies. Big Dry Creek's 2020 85th percentile value for chloride is 316 mg/L, which exceeds the stream standard. As discussed for sulfate, groundwater inflows are expected to be the primary cause of elevated chloride in Big Dry Creek. Other sources of chloride such as road deicing chemicals could also contribute to chloride in the watershed, but the spatial and temporal pattern suggests groundwater as a more likely source.

Figure 14. Big Dry Creek 2020 Chloride



8. NUTRIENTS

Currently applicable nutrient standards for the main stem of Big Dry Creek include ammonia, nitrate and nitrite. In 2012, the CWQCC adopted new interim nutrient criteria for total phosphorus and total nitrogen, which are expected to become effective for the main stem of Big Dry Creek in 2027 (CWQCC 2012, 2017). Additionally, Big Dry Creek has been assigned a Load Allocation in a downstream TMDL for Barr Lake and Milton Reservoir and has been assigned a load reduction target for total phosphorus.

A discussion of ammonia, nitrate and nitrite results, total nitrogen and total phosphorus data for Big Dry Creek are provided below.

Ammonia

After a five-year transition period from an unionized ammonia standard to a total ammonia standard, a total ammonia standard became effective on Big Dry Creek on January 1, 2012. In 2013, EPA published a revision to the aquatic life criteria for ammonia. Although these criteria have not yet been adopted in Colorado, these criteria can be accessed at EPA's website:

<http://water.epa.gov/scitech/swguidance/standards/criteria/aqlife/ammonia/index.cfm>.

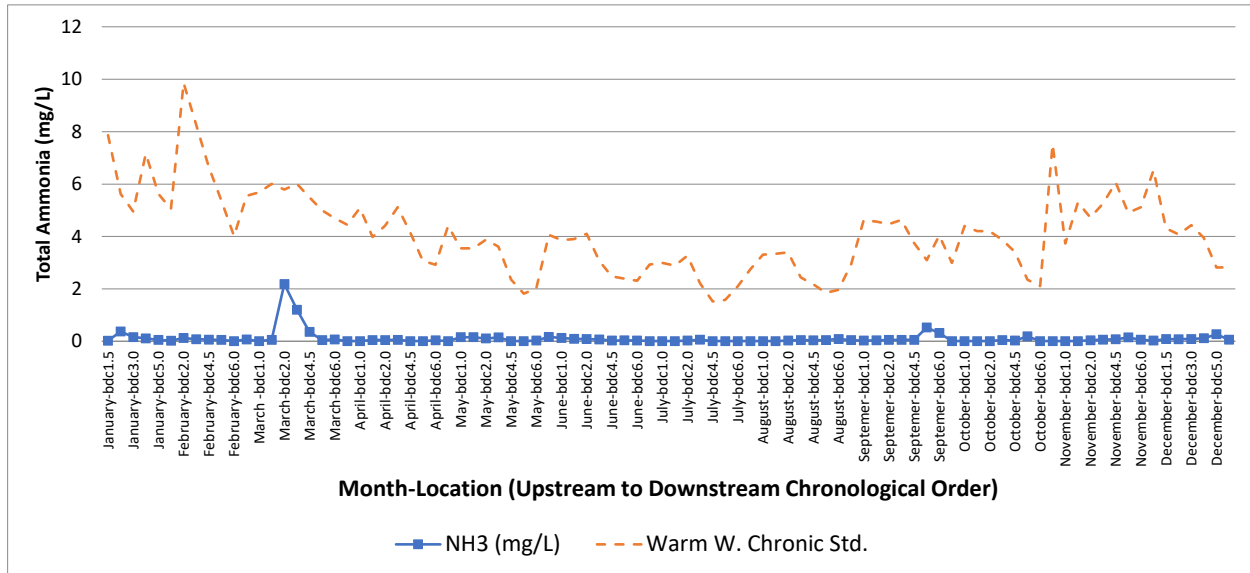
As part of Colorado's 10-year Water Quality Road Map, ammonia standards will be revisited in 2027.

Total ammonia concentrations for Big Dry Creek are plotted in Figure 15, along with the chronic standards, which are calculated using a formula based on pH and temperature. During 2020, the stream attained both chronic and acute total ammonia standards. Acute standards are higher

BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

than chronic standards and are not shown in Figure 15 since all results were below chronic standards.

Figure 15. Comparison of Big Dry Creek 2020 Ammonia Data to Chronic Ammonia Standards

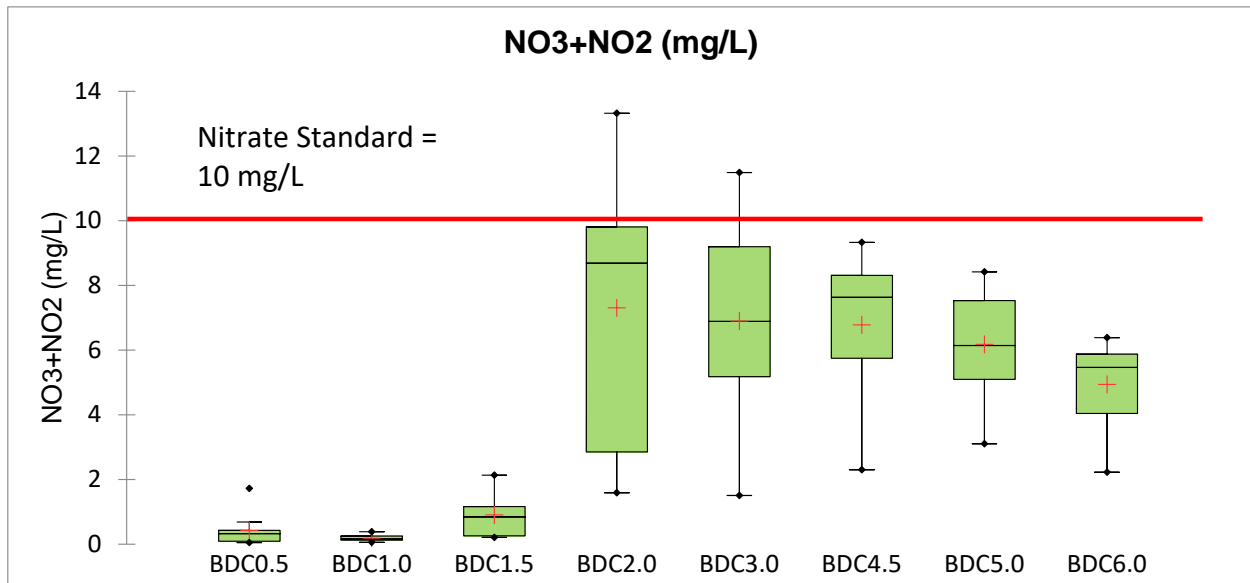


Nitrate and Nitrite

The CWQCC adopted a nitrate standard of 10 mg/L for Big Dry Creek in 2020 for the protection of Water Supply uses, which is a more stringent standard than the previously applicable 100 mg/L for agricultural uses. Big Dry Creek monitors for nitrate+nitrite instead of nitrate; however, the nitrite component is very small. For this reason, nitrate+nitrite results are compared against the 10 mg/L nitrate standard in this report. As shown in Figure 16, Big Dry Creek’s instream nitrate+nitrite concentrations are below 10 mg/L at most sampling locations; however, bdc2.0 and bdc3.0 (below the Broomfield and Westminster WWTPs, respectively) have a few nitrate+nitrite results above 10 mg/L, resulting in exceedance of the stream standard. The stream standard is assessed based on the maximum daily value and allows only one exceedance of the 10 mg/L every three years. An increase in instream nitrate concentrations occurs below the WWTP discharges, but gradually decreases in the agricultural area, consistent with the trend for total nitrogen.

Nitrite concentrations at all locations on Big Dry Creek are well below the 4.5 mg/L stream standard, with an 85th percentile value of 0.14 mg/L for 2020.

Figure 16. Big Dry Creek 2020 Nitrate + Nitrite



Colorado’s 2012 Nutrient Criteria for Nitrogen and Phosphorus (as updated Dec. 2017)

Nationally, statewide, and locally, control of nutrient loading to streams is a significant regulatory topic. In June 2012, the CWQCC adopted Regulation 85 (Nutrient Management Control) and updated the nutrient portion of Regulation 31 (Colorado Basic Standards). Although many requirements under these regulations originally had a 10-year delay until May 31, 2022, some requirements became effective in 2013. For example, monitoring requirements for municipal WWTPs, a data gap evaluation process for the municipal separate storm sewer (MS4) discharge permit holders, and other requirements, became effective in 2013. Additionally, municipal wastewater dischargers to Big Dry Creek now have compliance plans to attain new discharge permit limits for total phosphorus and total inorganic nitrogen (TIN) in accordance with Regulation 85. Compliance plans allow time to implement upgrades to meet the limits.

As a result of requirements under Regulation 85, BDCWA has developed an instream nutrient monitoring plan, which was implemented in March 2013. Additionally, MS4s in the Big Dry Creek watershed participated in a joint nutrient data gap analysis for stormwater runoff characterization in conjunction with the Colorado Stormwater Council and Urban Drainage and Flood Control District (WWE et al. 2013). This “data gap analysis” was submitted to and accepted by the CWQCD in fulfillment of the Regulation 85 requirement for MS4s pertaining characterizing nutrients in urban runoff.

BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

Under Regulation 31, interim nutrient “values” were developed that may be applicable to Big Dry Creek in the future.⁶ These interim values include:

- Median annual total phosphorus concentration of 0.17 mg/L, and
- Median annual total nitrogen concentration of 2.01 mg/L.

Both interim values have a once every five years allowable exceedance frequency. Additionally, streams with recreational uses have a not-to-exceed 150 milligrams per square meter (mg/m²) chlorophyll-*a* interim value for attached algae. At the June 2015 Regulation 38 Rulemaking Hearing, it was determined that the total phosphorus and chlorophyll-*a* standards would not apply at this time to the mainstem of Big Dry Creek downstream of Standley Lake, because the lake is filled by ditches that withdraw water downstream of multiple permitted domestic wastewater treatment facilities. These standards may, however, apply in the future after the 2027 rulemaking hearing.

At the October 2017 CWQCC Rulemaking Hearing related to nutrients, the CWQCD presented its 10-year water quality roadmap for pollutants including total nitrogen, total phosphorus, cadmium, ammonia, selenium, arsenic and temperature. As a result of this hearing, phased adoption of instream total nitrogen and total phosphorus standards was extended from 2022 to 2027. As part of this decision, a new CWQCC policy, Policy 17-1 Voluntary Incentive Program for Early Nutrient Reductions, was adopted. The Roadmap and Incentives Policy were a result of extensive stakeholder meetings and dialogue through the Water Quality Forum. Among other provisions, the Incentive Program will allow a WWTP to accrue time under a post-2027 compliance schedule through trading or watershed nutrient reductions as part of its nutrient reduction plan. Such opportunities should be further explored as part of the Big Dry Creek Watershed Management Plan update. All three municipal WWTPs discharging to Big Dry Creek are participating in the Voluntary Incentive Program.

The Voluntary Incentive Program is intended to encourage facilities to make voluntary reductions of nutrients, and in exchange the facility will receive an extended compliance schedule as well as certainty about the year in which the facility will need to meet water-quality-based effluent limits. An extended compliance schedule means the facility will be given additional time to comply with effluent limits that would be based on water quality standards or variances adopted in 2027 or nutrient-related wasteload allocations.

Big Dry Creek data for nitrogen and phosphorus are discussed further below. Monitoring for chlorophyll-*a* as attached algae has not been conducted for Big Dry Creek to date. Monitoring

⁶ For consistency with terminology used in Regulation 31, the term interim nutrient “value” has been used, as opposed to criterion or standard. These “values” may be adopted as stream standards in the future but have not been adopted as stream standards on the main stem of Big Dry Creek.

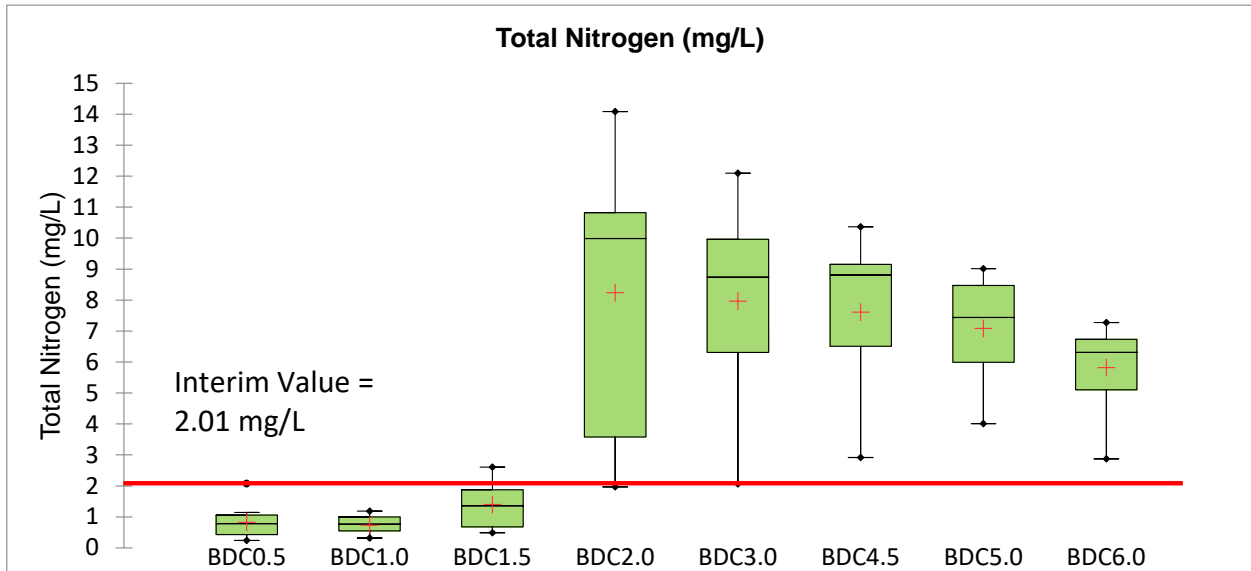
procedures are not currently well-defined for a stream like Big Dry Creek which has a sandy bottom through much of the watershed.

Total Nitrogen

Total nitrogen is calculated based on total Kjeldahl nitrogen (TKN) plus nitrate/nitrite or through direct analysis of total nitrogen. TKN includes organic nitrogen and ammonia. During 2017, BDCWA changed its analysis methodology for total nitrogen from a calculation-based method to a laboratory analysis method (conductimetric persulfate determination of total nitrogen using Timberline analyzer; 4500-N C). Figure 17 provides box plots of total nitrogen from upstream to downstream during 2020, also showing the interim total nitrogen value in Regulation 31 of 2.01 mg/L. Figure 18 provides a matrix of boxplots illustrating total nitrogen trends from 2013 to 2020. Total nitrogen data were not available instream prior to 2013.

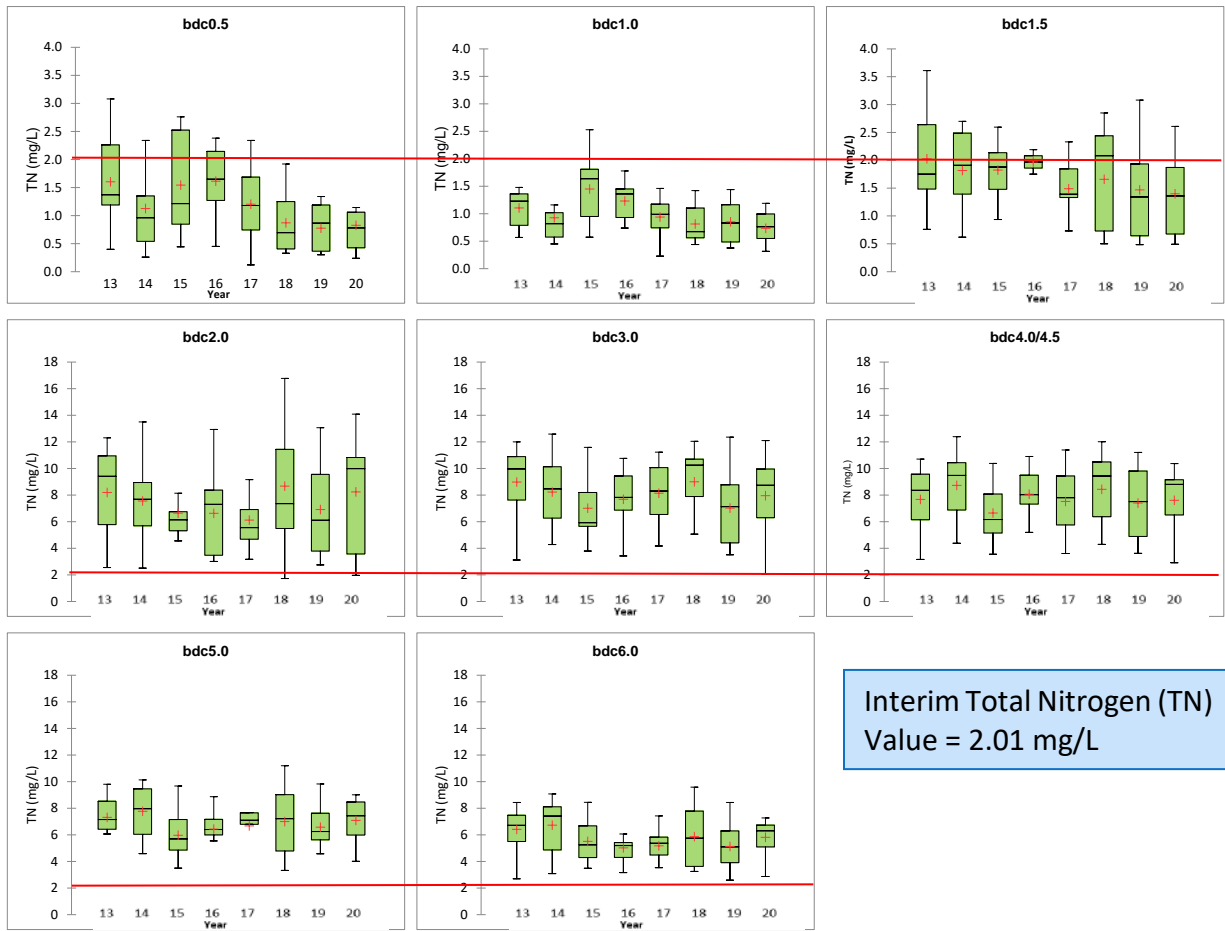
Municipal WWTPs discharging to Big Dry Creek have compliance plans to achieve total inorganic nitrogen limits. During 2020, annual median TIN values for the WWTPs were 15.6 mg/L for Broomfield, 8.8 mg/L for Westminster, and 6.6 mg/L for Northglenn. All three facilities have a compliance schedule to attain a running annual median of 15 mg/L and maximum of 20 mg/L by July 1, 2024.

Figure 17. Big Dry Creek 2020 Total Nitrogen



BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

Figure 18. Big Dry Creek Total Nitrogen Trends (2014-2020)



Key observations from Figure 17 and Figure 18 include:

- At locations upstream of the WWTP discharges to Big Dry Creek (bdc0.5, bdc1.0 and bdc1.5), the 2020 median total nitrogen values ranged from 0.76 to 1.36 mg/L. This indicates that locations upstream of the WWTPs are likely to meet the interim stream value.
- Below the Broomfield WWTP at bdc2.0, a noticeable increase in total nitrogen concentrations is observed. The 2020 median concentration at bdc2.0 was 10 mg/L, exceeding the interim total nitrogen value. Below the Westminster WWTP at bdc3.0, the 2020 median total nitrogen concentration was 8.7 mg/L, exceeding the interim total nitrogen value. Although total nitrogen concentrations decline in the lower watershed, instream total nitrogen is still well above the interim nitrogen value at all locations downstream from the WWTP discharges. Dilution from instream flows and natural losses associated with the nitrogen cycle result in lower total nitrogen concentrations downstream.

BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

- From Figure 18, there are not clear trends over time at individual monitoring locations from 2013 to 2020, with year-to-year variability present at each location; however, the most recent two years have lower median total nitrogen above the Broomfield WWTP. City of Westminster staff indicate that this decrease may be due to operational changes in the outlet used for Standley Lake releases. The upper release outlet is used from approximately the end of July to after lake turnover and mixing in October (Personal Communication with Kelly Cline, May 2021). Upstream to downstream trends for the period of record are similar to those discussed for 2020. In summary, despite WWTP upgrades over the past decade at the Broomfield and Westminster WWTPs, the interim total nitrogen value would not be attained under current conditions in Big Dry Creek from below the Broomfield WWTP discharge to the South Platte River.

Phosphorus

Phosphorus is of interest to BDCWA in two contexts: 1) Colorado's interim total phosphorus values in the context of Colorado's 10-year Water Quality Road Map, and 2) the downstream Barr-Milton TMDL, as discussed below.

Phosphorus in Relation to Colorado's Interim Total Phosphorus Values

Total phosphorus concentrations in Big Dry Creek are of interest with regard to the interim warm water total phosphorus value (0.17 mg/L) adopted by the CWQCC in June 2012. Based on conditions described in nutrient-related criteria in Regulation 31, these interim values are not expected to be adopted as stream standards for the main stem of Big Dry Creek prior to 2027, as part of Colorado's 10-year Water Quality Roadmap. Nonetheless, it is important to develop an understanding of nutrient conditions in Big Dry Creek with regard to these interim values.

Table 9 and Figure 19 show that Big Dry Creek would have difficulty meeting this interim value from below the Broomfield WWTP to the South Platte River, with the median phosphorus concentration during 2020 ranging from 0.15 to 0.45 mg/L at locations in this reach. Figures 20a-d provide boxplots of annual total phosphorus concentrations over time at selected monitoring locations upstream of the Broomfield WWTP (bdc1.5), below Broomfield's discharge (bdc2.0), below Westminster's discharge (bdc3.0), and in the agricultural area (bdc6.0). These figures show that locations upstream of the Broomfield WWTP can meet the interim total phosphorus value. Significant reductions in total phosphorus are evident beginning in 2010 below Broomfield's discharge. Significant reductions in total phosphorus below Westminster's discharge are evident beginning in 2009. Despite overall phosphorus reductions at both WWTPs (Figure 21 and Figure 22), median annual total phosphorus concentrations instream are still above the interim total phosphorus value from below the Broomfield WWTP to the confluence with the South Platte River. Northglenn's 2020 median total phosphorus discharge from outfall 007 was 0.22 mg/L. All three WWTPs are now required to attain a running annual median of 1.0 mg/L and a 95th percentile value of 2.5 mg/L effective January 1, 2021.

BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

Figure 19. Big Dry Creek 2020 Total Phosphorus

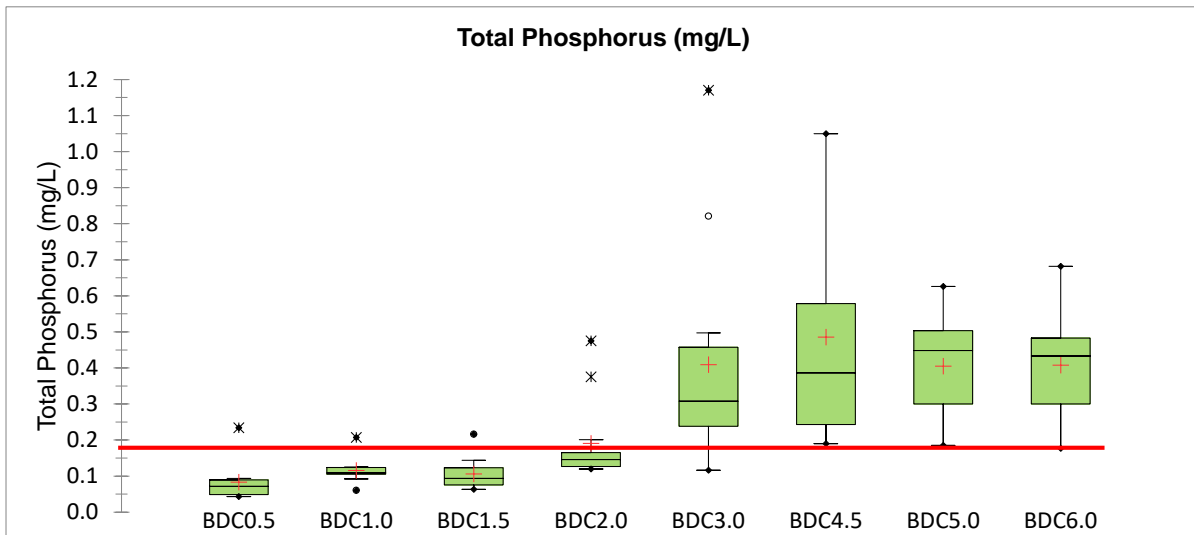


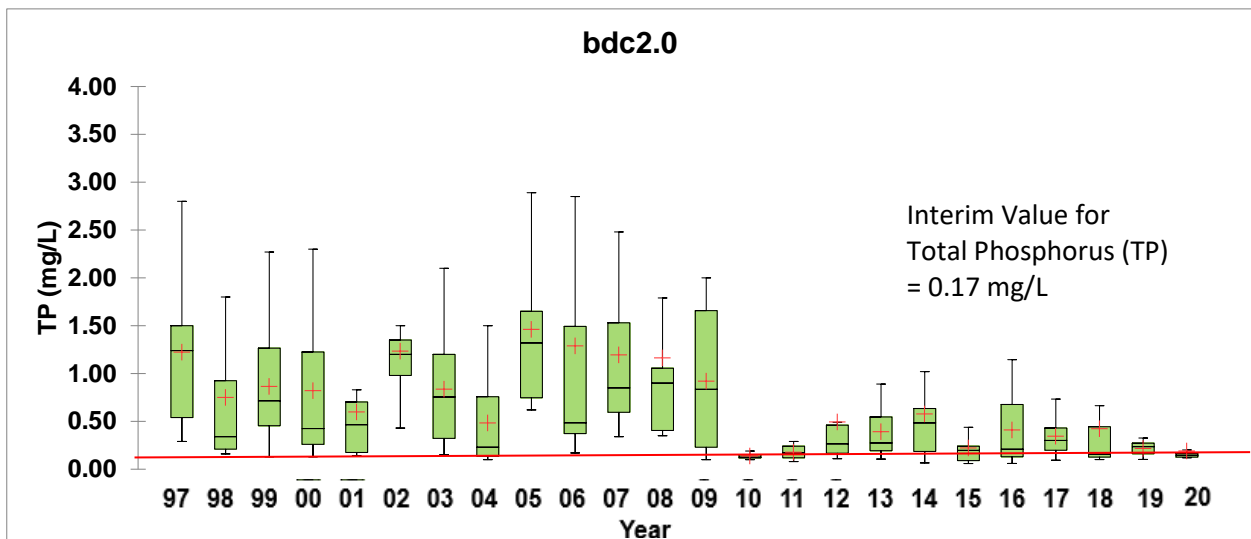
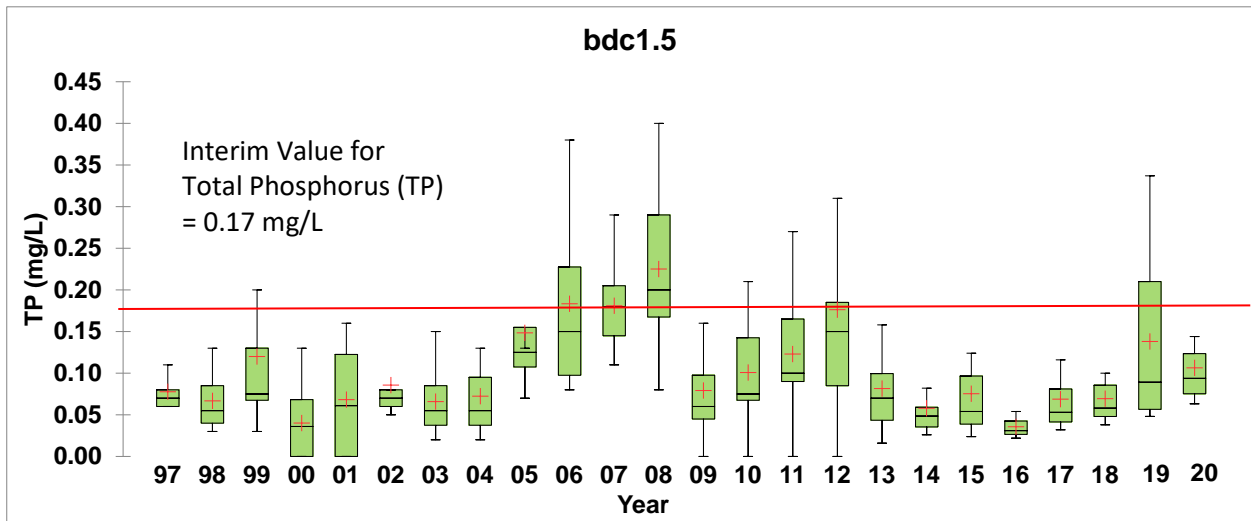
Table 9. Median Annual Total Phosphorus (mg/L) 1999-2020

Year	bdc0.5	bdc1.0	bdc1.5	bdc2.0	bdc3.0	bdc4.0/4.5	bdc5.0	bdc6.0
2000	0.00	0.07	0.04	0.43	1.85	1.60	1.45	1.25
2001	0.00	0.06	0.06	0.47	1.90	1.10	1.20	0.93
2002	0.00	0.06	0.07	1.20	2.25	1.50	1.80	1.60
2003	0.04	0.04	0.05	0.75	2.25	1.55	1.40	1.15
2004	0.04	0.05	0.05	0.23	1.75	1.15	1.10	0.94
2005	0.09	0.12	0.12	1.32	2.54	1.68	1.68	1.40
2006	0.12	0.13	0.15	0.48	2.04	1.38	1.30	1.13
2007	0.12	0.16	0.18	0.85	2.21	1.24	1.29	1.23
2008	0.14	0.23	0.20	0.90	1.73	1.18	1.10	1.22
2009	0.03	0.07	0.06	0.84	0.76	0.57	0.77	0.60
2010	0.06	0.09	0.08	0.13	0.34	0.31	0.33	0.44
2011	0.07	0.10	0.10	0.17	0.55	0.49	0.32	0.49
2012	0.11	0.13	0.15	0.27	0.96	0.85	0.68	0.62
2013	0.04	0.07	0.07	0.27	0.78	0.64	0.52	0.48
2014	0.04	0.04	0.05	0.48	0.52	0.63	0.58	0.53
2015	0.04	0.09	0.05	0.20	0.66	0.50	0.45	0.55
2016	0.04	0.06	0.03	0.21	0.72	0.68	0.56	0.43
2017	0.08	0.06	0.05	0.30	0.99	0.78	0.64	0.55
2018	0.05	0.07	0.06	0.16	0.36	0.46	0.35	0.40
2019	0.15	0.14	0.09	0.24	0.34	0.36	0.32	0.28
2020	0.07	0.11	0.09	0.15	0.31	0.39	0.45	0.43

Pink-shaded cells exceed the interim value of 0.17 mg/L total phosphorus.

BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

Figure 20 (a-d). Total Phosphorus over Time at Selected Big Dry Creek Monitoring Locations



BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

Figure 20 (a-d) (cont). Total Phosphorus over Time at Selected Big Dry Creek Monitoring Locations

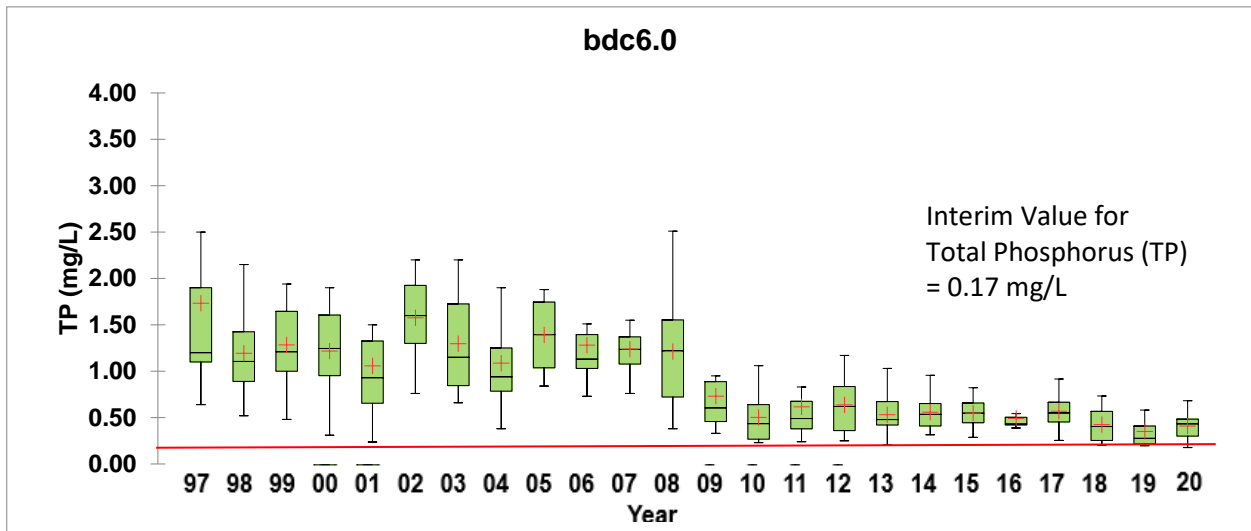
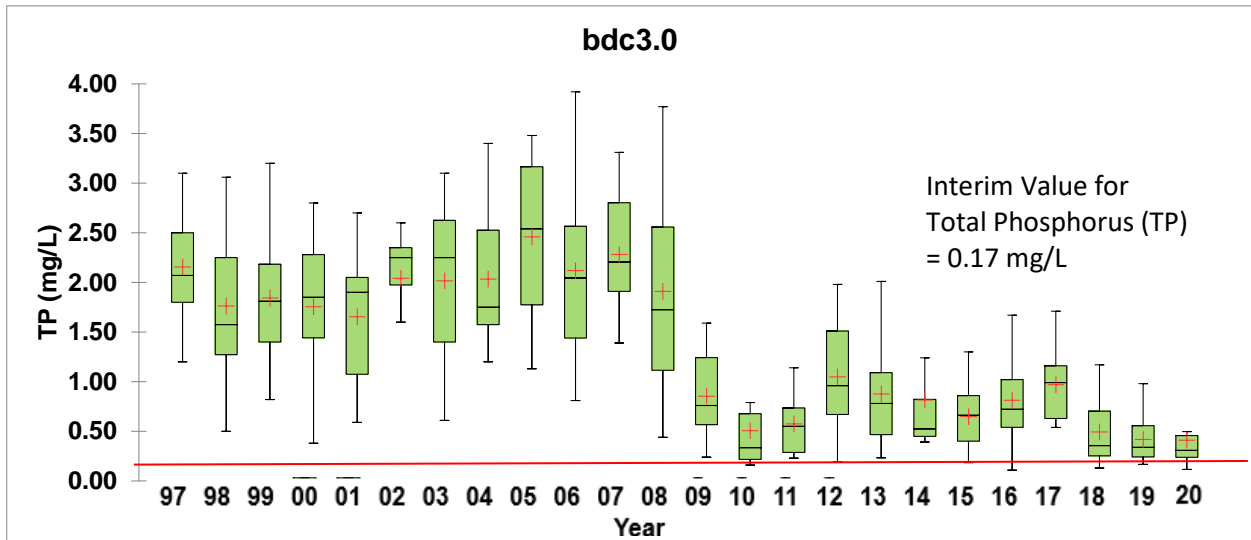


Figure 21. Decreases in Total P Concentrations in Broomfield WWTP Discharge (2002-2020)

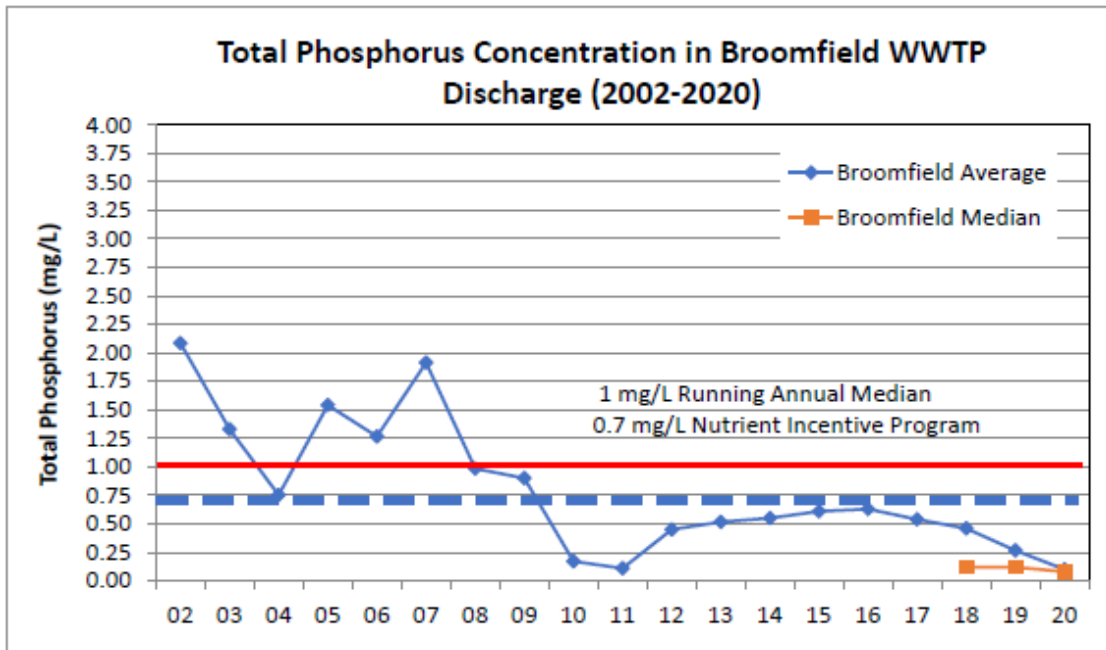


Figure 22. Decreases in Total P Concentrations in Westminster WWTP Discharge (2004-2020)

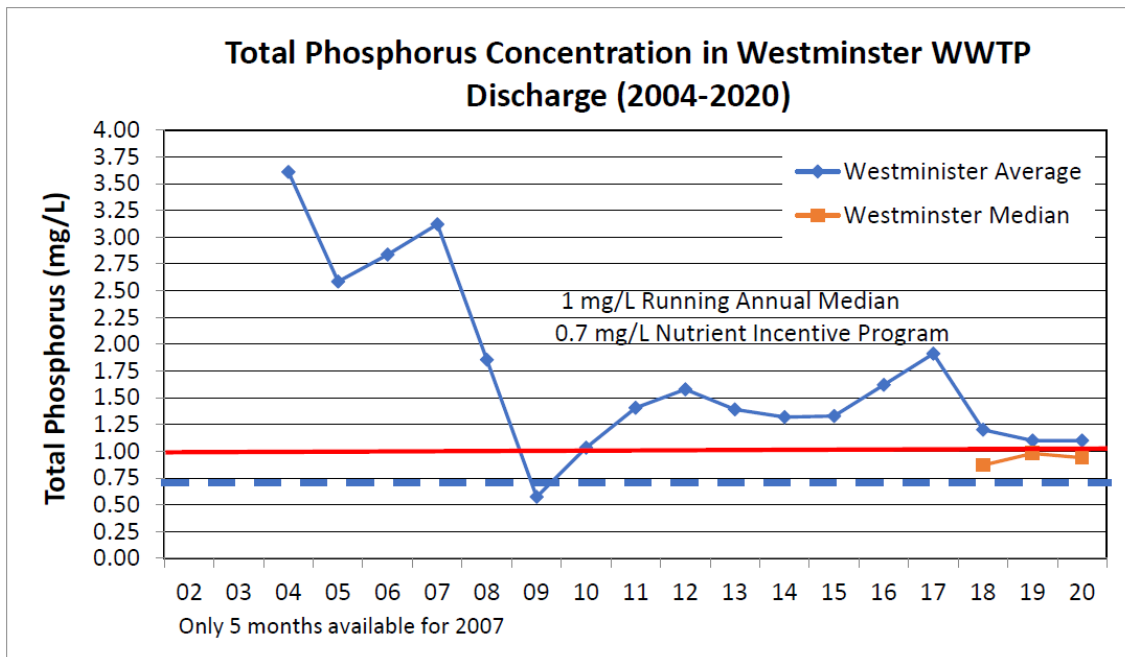


Figure Note: Medians are calculated for the past two years because this statistic forms the basis for accrual of additional compliance schedule time under the Voluntary Nutrient Incentive Program. Both WWTPs attain the 0.7 mg/L total phosphorus target under this program.

Phosphorus in Relation to Barr-Milton TMDL

The Barr-Milton Watershed Association (BMW) is addressing pH exceedances and low dissolved oxygen in the Barr-Milton reservoir system. These pH exceedances and low dissolved oxygen are attributed to excessive algal growth caused by nutrient loading, specifically phosphorus. BMW has established a database for modeling conditions in the reservoirs and has included water quality data from Big Dry Creek, as well as many other tributaries upstream of the Barr-Milton system. BDCWA representatives have participated in various aspects of the BMW effort over the years. In August 2009, AECOM released the final report titled “Watershed and Lake Modeling for a TMDL Evaluation of Barr Lake and Milton Reservoir,” which forms the underlying basis for the TMDL.⁷ In July 2013, EPA approved the Barr-Milton TMDL for pH and DO, which is focused on controlling phosphorus loads to the reservoirs. In the final TMDL, Big Dry Creek was identified as contributing approximately 5.9 percent of the phosphorus loading to Milton Reservoir. Big Dry Creek has been targeted for a 20 percent total phosphorus load reduction from 2,301 kilograms per year (kg/yr) (baseline year of 2003-2004) down to 1,840 kg/yr (Integral 2011).⁸ Because Big Dry Creek is identified as a nonpoint source of loading, “application of best management practices (BMPs) to the greatest extent feasible” is the recommended approach for achieving these reductions. BMW updated their watershed plan in 2017 (BMW 2017).

As a result of the Barr-Milton TMDL process, BDCWA reviewed phosphorus data collected along Big Dry Creek, with primary focus on monitoring station bdc6.0, which is the downstream-most instream monitoring location on Big Dry Creek in the agricultural portion of Weld County. Although instantaneous flow measurements are conducted by BDCWA on a monthly basis, the USGS Fort Lupton gauging station is combined with the bdc6.0 water quality data to estimate loads because the USGS gauge provides a more comprehensive data set. Table 10 and Figure 23 summarize changes in total phosphorus concentrations at bdc6.0 over time, indicating total phosphorus concentration reductions on the order of 62 percent since 2003 and 54 percent since 2004. Total phosphorus load reductions for the overall watershed (based on bdc6.0) over time are also shown in Figure 23. Phosphorus load reductions are also substantial, with some year-to-

⁷ In 2019, BMW began updating this model. Since then, BMW has concluded that the SWAT model provides reasonable predictive estimates of the phosphorus loads to the reservoirs; however, the in-reservoir WASP model may need to be recalibrated or another model option selection. BDCWA provided data to the BMW Association to support the model update initiated in 2019. With the floods of 2013 and recent phosphorus treatment at Metro Wastewater, phosphorus concentrations in both Barr and Milton Reservoirs are at about half of the 2003-2004 concentrations. Over the last four years, BMW has also removed over 6,000 carp from Barr Lake; carp disturb bottom sediments and can be a source of phosphorus release. More details are at www.barr-milton.org (Personal Communication with Steve Lundt, May 2021).

⁸ This load reduction applies to the portion of the Big Dry Creek load that enters Milton Reservoir, which is a significantly smaller load than occurs at bdc6.0.

BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

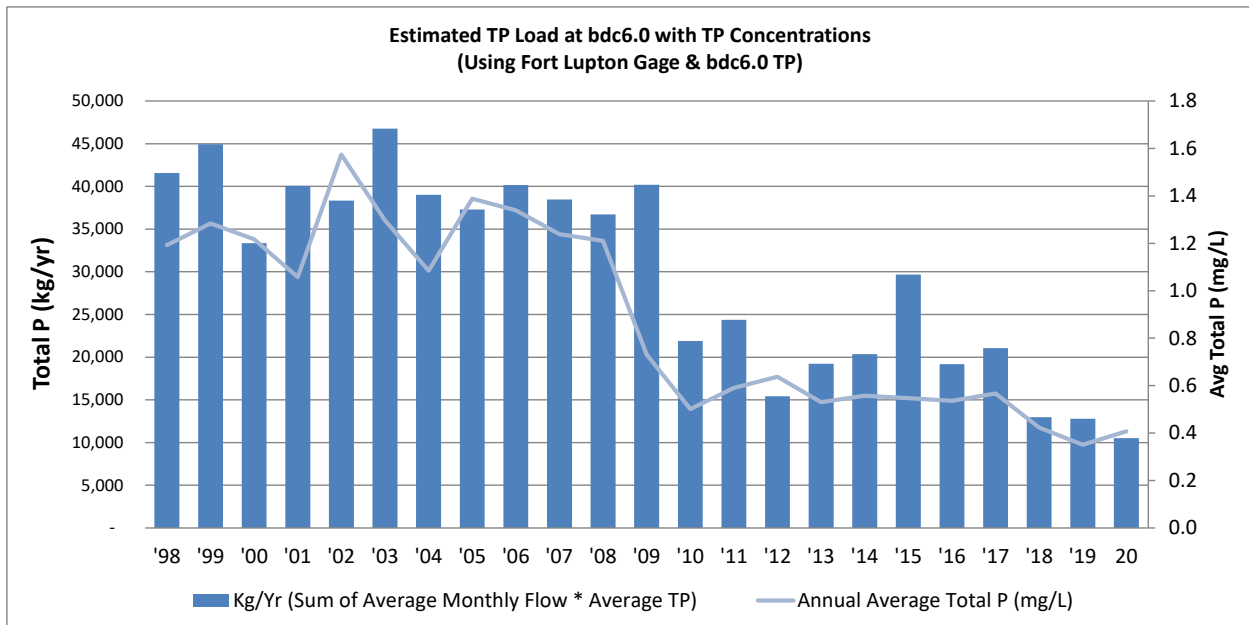
year variation depending on flow volumes. The 2020 phosphorus loads are 78 and 73 percent lower than loads in 2003 and 2004, respectively.

Table 10. Total Phosphorus Concentrations at bdc6.0 (2003-2020)

Year	No. of Samples	Median	Mean	Min.	Max.	25th Percentile	75th Percentile
2003	12	1.15	1.30	0.66	2.20	0.85	1.73
2004	12	0.94	1.08	0.38	2.00	0.78	1.25
2005	12	1.40	1.39	0.84	1.88	1.04	1.75
2006	11	1.13	1.28	0.73	2.65	1.03	1.39
2007	12	1.23	1.24	0.76	1.97	1.08	1.37
2008	12	1.22	1.21	0.38	2.51	0.72	1.55
2009	12	0.60	0.73	0.33	2.10	0.46	0.89
2010	12	0.44	0.50	0.23	1.06	0.27	0.64
2011	11	0.49	0.62	0.24	1.83	0.38	0.68
2012	12	0.62	0.64	0.25	1.17	0.36	0.84
2013	12	0.48	0.53	0.2	1.03	0.42	0.67
2014	12	0.53	0.56	0.32	0.96	0.41	0.65
2015	12	0.55	0.55	0.29	0.82	0.45	0.66
2016	10	0.43	0.49	0.39	0.86	0.42	0.50
2017	12	0.55	0.57	0.25	0.92	0.45	0.66
2018	12	0.40	0.42	0.21	0.73	0.25	0.57
2019	12	0.28	0.35	0.20	0.80	0.22	0.41
2020	12	0.43	0.41	0.18	0.68	0.30	0.48
Percent Reduction in P (mg/L) (2003 - 2020)		62%	69%				
Percent Reduction in P (mg/L) (2004 - 2020)		54%	62%				

Note: For 2016 data, May and December total phosphorus results were not available for use in these calculations.

Figure 23. Decreases in Total P Loads at bdc6.0 Plotted with Total P Concentration Data



Note: 2013 load estimate uncertain due to missing flow data following September Flood. The 2016 load estimate is uncertain due to missing phosphorus results for May and December 2016. Estimated phosphorus concentrations were substituted for those months for purposes of an annual load estimate.

Several additional observations related to the volume-related component of phosphorus load reductions include:

- In addition to phosphorus concentration reductions at the Broomfield and Westminster WWTPs, both cities have implemented significant reclaimed water programs, which help to manage nutrient loading to Big Dry Creek. Factors such as population growth and demand for reclaimed water affect volumes discharged. The current and future effects of reclaimed water programs have not been fully evaluated for purposes of this report but are important considerations should more in-depth analysis be conducted related to Big Dry Creek phosphorus loading to the South Platte River.
- Historically, Northglenn has discharged infrequently to Big Dry Creek; however, during 2015 through 2020, Northglenn discharged to Big Dry Creek much more frequently. These discharges represent a new source of phosphorus loads to Big Dry Creek relative to the 2003-2004 baseline conditions used in the Barr Milton TMDL.
- As illustrated in Figure 33 (later in this report), the hydrology of Big Dry Creek is highly managed and complex. Future evaluation of measures to reduce phosphorus loading from Big Dry Creek must consider these complexities. Other hydrology-related considerations include:

- It is important to be aware that bdc6.0 is located upstream from the USGS gauge. Instantaneous flow measurements at bdc6.0 and the average daily flow measurements at the USGS Fort Lupton gauge vary substantially. On average, flows at the USGS gauge are approximately 20 percent higher than measured flows at bdc6.0; however, there is large variation in the magnitude of the difference between individual pairs of flow measurements.
- It is important that the water quality sample location used for modeling Big Dry Creek phosphorus contributions to the South Platte River be located upstream of the Lupton Bottoms Ditch discharge to Big Dry Creek. Sampling location bdc6.0 is upstream of Lupton Bottoms Ditch, but Metro Wastewater Reclamation District also collects water quality samples below Lupton Bottoms ditch, which may be influenced by South Platte water discharged from the Lupton Bottoms Ditch to Big Dry Creek.

9. TEMPERATURE

The currently applicable classification for temperature standards on Big Dry Creek is Warm Stream Tier I (WS-I), due to the presence of the Johnny darter in some locations in the upper portion of the stream. Attainment of standards is assessed based on comparison of the maximum weekly average temperature (MWAT) and daily maximum (DM) temperature to seasonal temperature standards established for March-November and December-February. Values above these standards are allowed under these conditions:

- The DM may exceed the acute temperature standard once every three years. The DM means the highest two-hour average water temperature recorded during a given 24-hour period.
- The MWAT may exceed the chronic standard once every three years (1E3). The MWAT is calculated as the largest mathematical mean of multiple, equally spaced, daily temperatures over a seven-day consecutive period, with a minimum of three data points spaced equally through the day.
- Values measured during conditions meeting air temperature, low-flow, winter “shoulder season” or “warming event” excursion criteria in Regulation 31 and the 2018 303(d) Listing Methodology are not considered exceedances.

The CWQCD determines whether temperature limits are to be included in permits in accordance with the Basic Standards 31.14(14) “Integration into Discharge Permits.” Currently, the municipal WWTP dischargers to Big Dry Creek are required to “report only” under terms of the 2019 permits, but temperature limits are anticipated in the next permit renewals. Additional instream monitoring data have been collected at several instream locations in support of this effort using

HOBO data loggers recording temperature measurements at 15-minute intervals. For a more robust evaluation of temperatures on Big Dry Creek in the vicinities of the WWTP discharges, 15-minute incremental temperature data collected as part of CDPS DMRs for each WWTP should be obtained and reviewed but is beyond the scope of this report.

10. MACROINVERTEBRATE DATA AND MMI ANALYSIS

BDCWA conducts a biennial macroinvertebrate monitoring program during the month of October in even years. This section provides a summary of multi-metric index (MMI) results for macroinvertebrate data collected in the fall of 2012, 2014, 2016, 2018 and 2020 for the aquatic monitoring program on Big Dry Creek. Analysis in this section was provided by Aquatics Associates, Inc., with more detailed information for fish, macroinvertebrates, and habitat available in biennial reports completed by Aquatics Associates (2014, 2019a, 2019b), along with a forthcoming report addressing sampling conducted during 2020.

Background on Aquatic Life Use Attainment Policy 10-1

The CWQCC adopted Policy 10-1 on October 12, 2010 (CWQCC 2010), which provides for the evaluation of the biotic integrity of streams through use of a multi-metric index (MMI) calibrated for the State of Colorado (Jessup 2010). Policy 10-1 was updated on August 7, 2017 (CWQCC 2017) and included a recalibration of the MMI (Jessup and Stribling 2017). This recalibration resulted in a different algorithm used in the CWQCD's Ecological Data Application System (EDAS) to calculate the MMI, as well as different attainment and impairment thresholds for determining attainment and impairment.

EDAS (Version 4.0 CO) was used to calculate MMI and other metrics for the Big Dry Creek analysis summarized below. Application of this method requires the collection and analysis of benthic macroinvertebrate samples according to Policy 10-1 protocols (CWQCC 2017). Use-attainment thresholds have been established for three separate stream biotypes which include Transition (Biotype 1), Mountain (Biotype 2), and Plains & Xeric (Biotype 3). The Big Dry Creek study sites are all designated as Biotype 3 per EDAS. The thresholds for Biotype 3 streams are MMI >42 for use attainment and MMI <29 for impairment. Class 1 streams (Cold or Warm) with MMI scores falling in between the attainment and impairment thresholds require additional analysis using two auxiliary metrics: the Hilsenhoff Biotic Index (HBI) and the Shannon Diversity Index (SDI). Also, MMI scores >51 for Biotype 3 streams indicate a high scoring water (HSW) and any drop in HSW scores of 22 points or more for samples collected 12 or more months apart within a 5-year span of time may indicate impairment. Failure to meet use attainment thresholds for streams in their particular biotype may result in the affected segment(s) being listed as provisionally impaired for aquatic life on the 303(d) List. For differing MMI scores on the same representative segment taken in different calendar years, the most recent MMI score is used in the impairment listing decision. The representative nature of all aquatic life data is to be considered before listing

decisions are made. Clear and convincing evidence is required to show impairment (CWQCC 2018).

Big Dry Creek MMI Results

Results of the MMI analyses for the macroinvertebrate samples collected at the six BDC sites in the fall of 2012, 2014, 2016, 2018 and 2020 are presented in Table 11 and Figure 24. The changes to EDAS in 2018 and the new Warm Water 1 stream classification required re-evaluation of historic data presented in previous annual reports; therefore, previous tabulations of these data sets will show different results. As described above, the main difference in evaluation methodology for Class 1 and Class 2 streams is that MMI values between the attainment (MMI > 42) and impairment (MMI < 29) thresholds require evaluation of two auxiliary metrics (the HBI and SDI). If either the SDI is >7.6 or the HBI is < 2.4 for values in the “grey zone”, then the stream is considered impaired for aquatic life under Policy 10-1.

All samples for the five years met or were better than the impairment threshold (MMI score of 29) with the exception of bdc5.0 in 2016. No consistent upward or downward trends were noted. All sites attained the HBI and SDI thresholds for these five sampling years.

During 2016, the MMI at bdc5.0 was the lowest on record; however, field observations did not identify unusual conditions that would be contributing to these scores. Preliminary review of the raw data suggested that the score may be due in part to relatively high numbers of aquatic worms (Personal Communication with Tami Schneck, 2017).

Based on the MMI results for the six sampling sites for the five most recent years analyzed, the aquatic macroinvertebrate community in Big Dry Creek is generally healthy and meets MMI use-attainment criteria for Aquatic Life Class 1 warm water streams. Additionally, the long-term data set demonstrates the significant year-to-year variability that can occur at individual sites. Although the last five sampling events show attainment (other than 2016), a retrospective analysis of the effects of a regulatory upgrade of the stream from Aquatic Life Warm 2 to Aquatic Life Warm 1 indicates an increase in frequency of impairment determinations using Policy 10-1 from 4 percent to 19 percent for the longer monitoring record.

More detailed analysis of the 2020 monitoring will be provided in a written report by Aquatics Associates later in 2021.

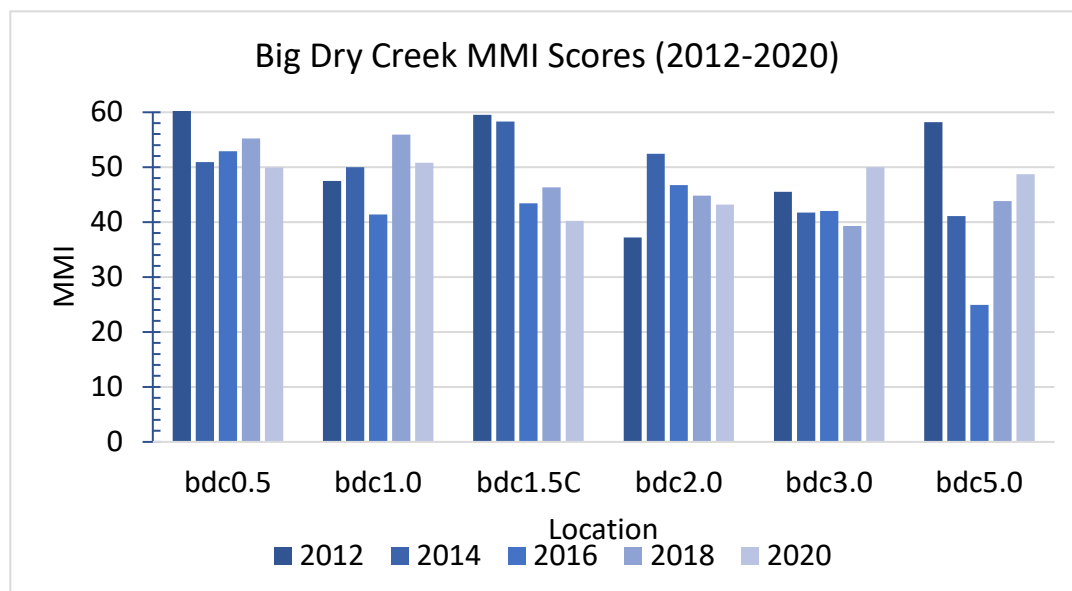
BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

Table 11. Fall MMI Scores for Big Dry Creek Sites (2012-2020)
(Source: Aquatics Associates 2020)

MMI Scores					
Site	2012	2014	2016	2018	2020
0.5	60.2	50.9	52.9	55.2	49.9
1.0	47.5	50.0	41.4	55.9	50.8
1.5C	59.5	58.3	43.4	46.3	40.2
2.0	37.2	52.4	46.7	44.8	43.2
3.0	45.5	41.7	42	39.3	50.0
5.0	58.2	41.1	24.9	43.8	48.7
Shannon Diversity Index (SDI) Scores					
Site	2012	2014	2016	2018	2020
0.5	4.23	3.60	3.63	3.63	3.28
1.0	3.64	3.78	4.00	4.13	3.97
1.5C	3.00	3.83	3.75	3.41	3.34
2.0	2.75	3.73	3.73	3.69	3.63
3.0	3.44	4.06	3.20	3.73	3.44
5.0	3.78	3.25	2.25	3.58	3.11
Hilsenhoff Biotic Index (HBI) Scores					
Site	2012	2014	2016	2018	2020
0.5	6.44	6.15	6.62	6.45	5.79
1.0	6.66	6.31	6.17	6.45	6.18
1.5C	6.61	6.92	6.74	7.27	6.68
2.0	7.02	6.43	6.87	7.10	6.37
3.0	8.01	7.29	7.90	7.11	6.95
5.0	6.40	5.65	7.77	6.56	6.38

Notes: Pink-shaded MMIs are below the impairment threshold. Yellow-shaded cells are between attainment and impairment thresholds and require evaluation of auxiliary metrics for assessment. Bold MMI scores indicate High Scoring Water (MMI >51 for Biotype 3). MMI Impairment threshold for Warm Water Class 1 streams is <29. SDI scores >7.6 and HBI scores <2.4 are thresholds for evaluation of auxiliary metrics for “grey zone” MMI scores.

Figure 24. Biennial Big Dry Creek MMI Scores (2012-2020)



11. FLOW CONDITIONS

The hydrology of Big Dry Creek is discussed below in terms of: 1) annual stream flows relative to period of record, 2) WWTP discharges, and 3) seasonal variation related to release and diversion patterns.

Stream Flows

Stream gauges are managed by several entities in the watershed. A discussion of USGS gauges and a Colorado Division of Water Resources (CDWR) gauge are discussed further below.

USGS Stream Flow Measurements for 2020

USGS mean daily discharge data for the Westminster and Fort Lupton gauges are shown in Figures 25 and 26. Figures 27 and 28 identify peak stream flows for the period of record at both gauges. Figure 29 shows the average annual stream flows at both gauges.

During 2020, average daily flows at the Westminster gauge ranged from 0.8 cfs to 90.8 cfs with an average of 12.4 cfs. Average daily flows for the Fort Lupton gauge data ranged from 7.5 cfs to 210 cfs with an average of 28.8 cfs. Peak flows at both gauges were within historic ranges (Figures 27 and 28). Flows in 2020 were relatively low compared to the range of historic average flow conditions.

BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

Figure 25. Mean Daily Discharge at USGS Gauge Big Dry Creek at Westminster, CO

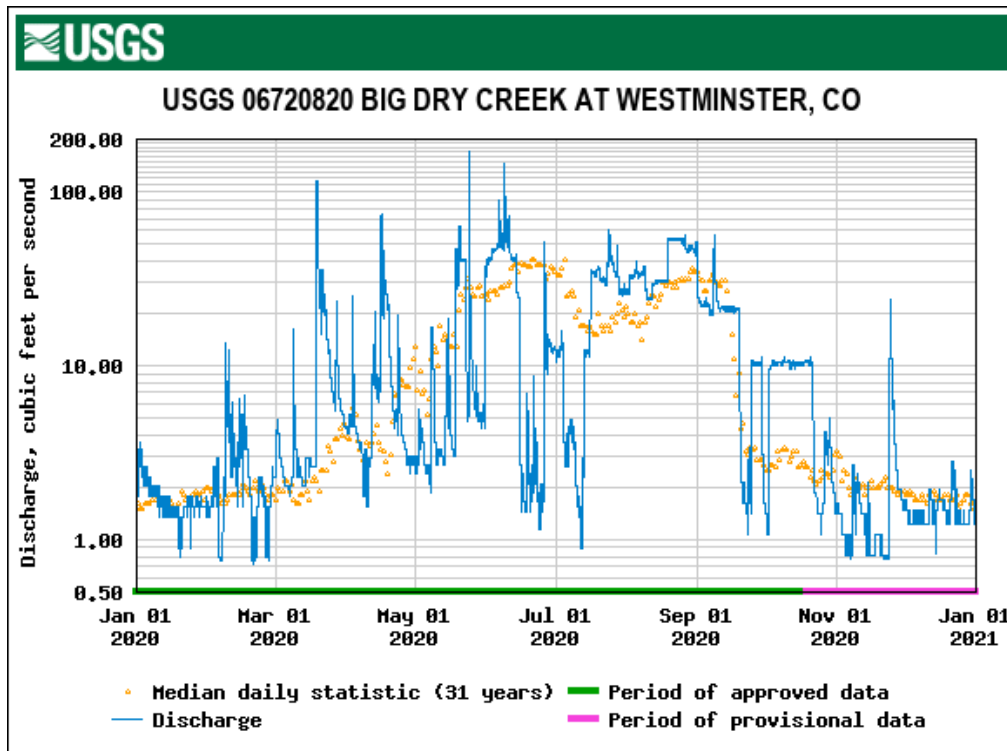
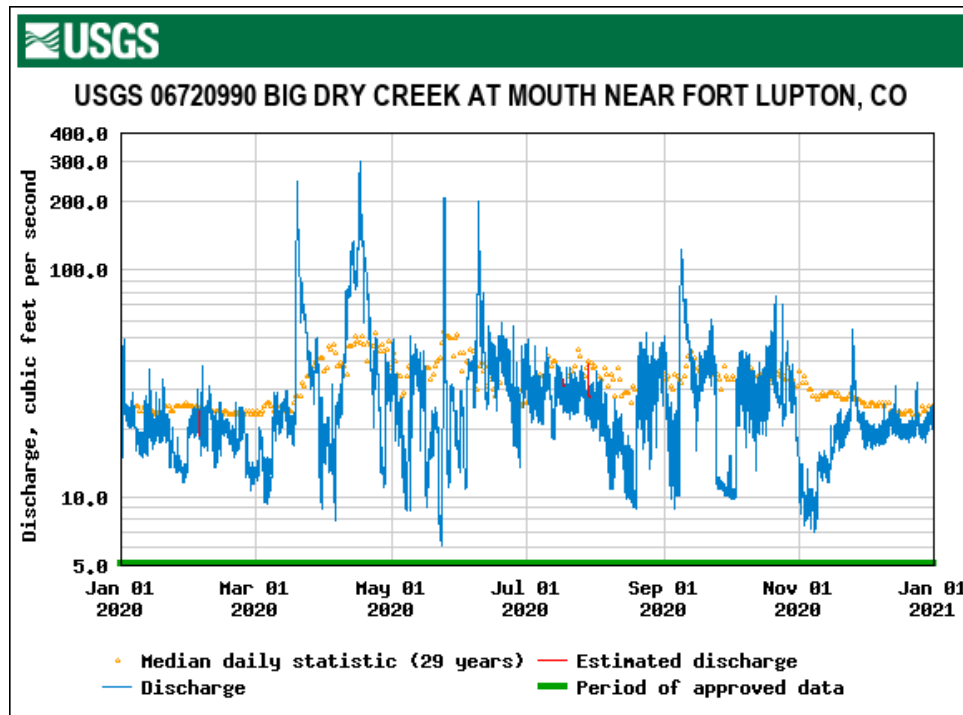


Figure 26. Mean Daily Discharge at USGS Gauge Big Dry Creek at Fort Lupton, CO



BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

Figure 27. Annual Peak Streamflow at USGS Gauge Big Dry Creek at Westminster

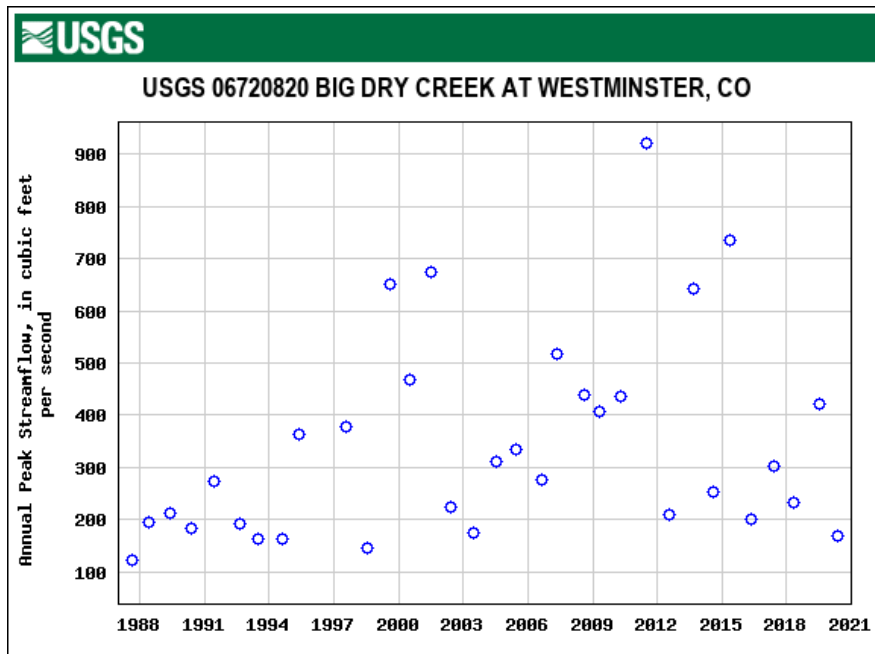
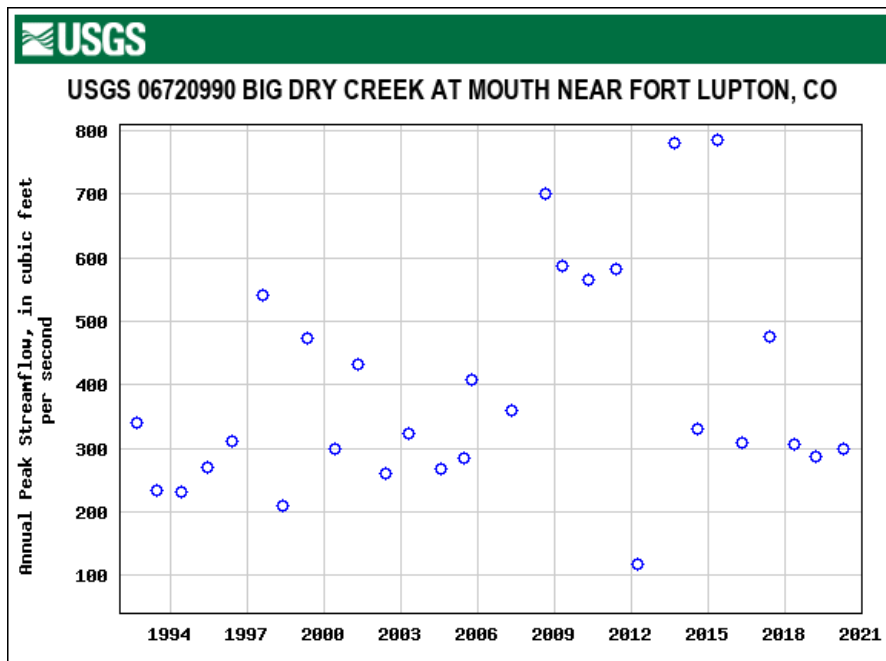
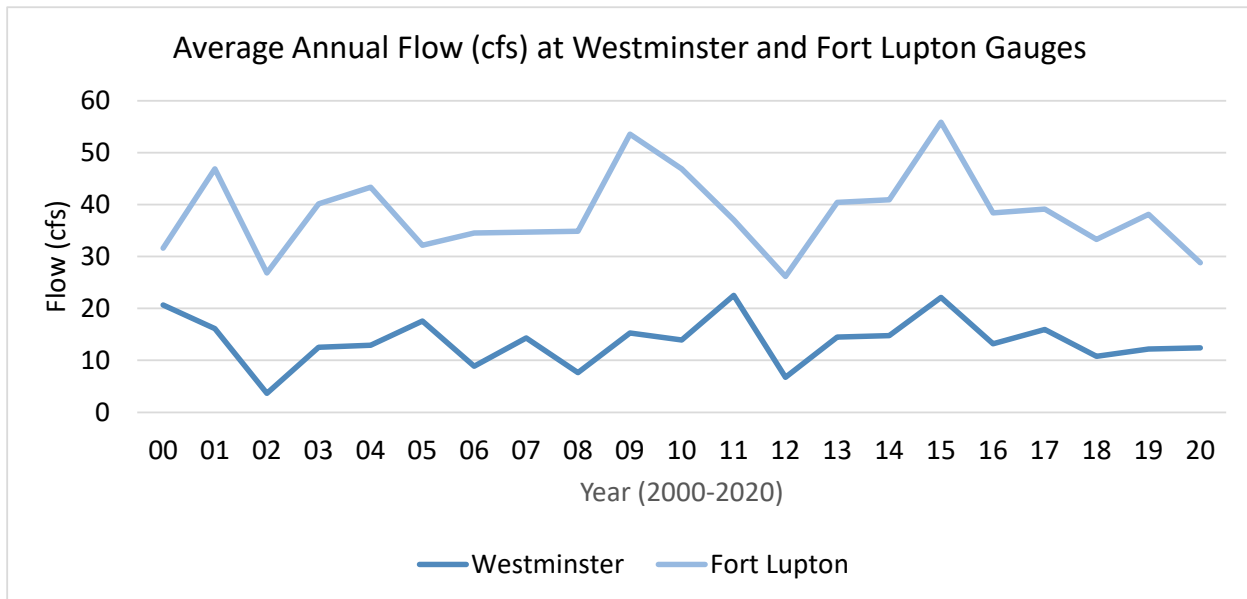


Figure 28. Annual Peak Streamflow at USGS Gauge Big Dry Creek at Fort Lupton



BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

Figure 29. Average Annual Stream Flows Measured at USGS Gauges



Note: Some data missing at Ft. Lupton gauge in December 2013 due to ice.

Colorado Division of Water Resources Stream Flow Measurements for 2020

Although BDCWA has historically used the two USGS stream gauges on Big Dry Creek for purposes of analysis in this annual report, other gauge data are available for various locations on Big Dry Creek. These locations include four relatively new (<10 years old) gauges installed by Northern Water; however, these gauges have had a series of issues over the years and are no longer expected to be a source of flow data for Big Dry Creek. A flood alert gauge was installed by Mile High Flood District near I-25 and Thorn Creek golf course, but it is not calibrated to measure baseflow conditions.

Another gauge operated by CDWR is named Big Dry Creek Near Ft. Lupton, CO (BIGDAFCO). BIGDAFCO is located approximately 3.8 stream miles upstream of the USGS's 06720990 Big Dry Creek at Fort Lupton stream gauge.⁹ Between the two gauges, several notable hydrologic influences occur (Figure 30), including augmentation returns to Big Dry Creek, a diversion off of the South Platte River to Big Dry Creek and a diversion from Big Dry Creek to the Lupton Bottoms Ditch. Additionally, there are irrigation tailwaters accruing to the system in the intervening reach due to irrigation practices as well as percolation return flows from irrigation. The Lupton Bottoms Ditch has a diversion structure on the South Platte River that diverts water to Big Dry Creek. The diversion is situated in such a way that it can receive water from both Big Dry Creek and the South Platte River. Below this confluence point, another diversion structure diverts water from Big Dry

⁹ Metro Wastewater's instream monitoring location "BDC" is located 30-50 yards upstream of BIGDAFCO.

BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

Creek into their ditch system. Regardless of the irrigation waters returning to the system between the two gauges, the interactions among the Lupton Bottoms Ditch, the South Platte River and Big Dry Creek cause significant and regular differences in flows measured by CDWR and the USGS (Figure 31).¹⁰ (Personal Communication with Russel Stroud, CDWR).

Figure 30. Relationship between BIGDAFCO and USGS 06720990

(Source: Russell Stroud, CDWR)

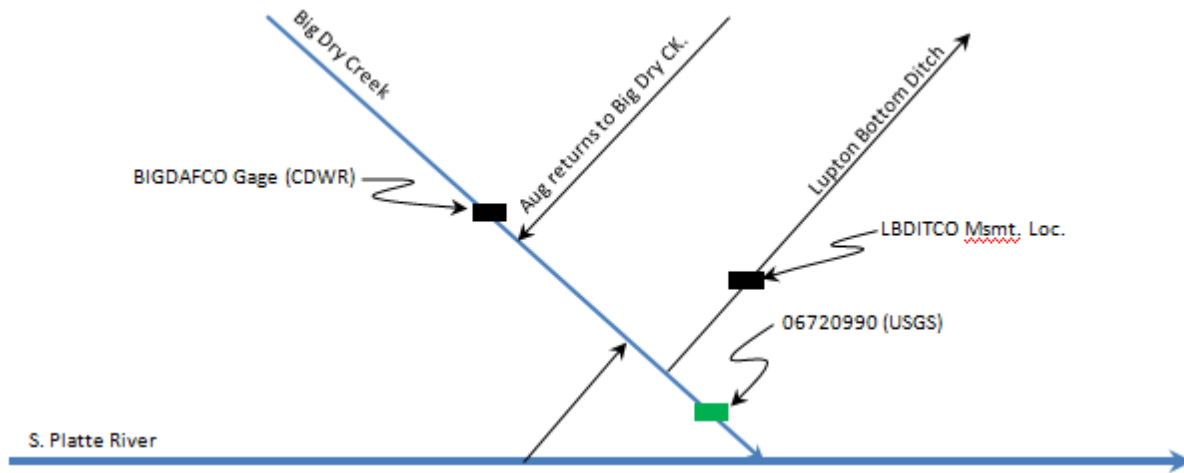
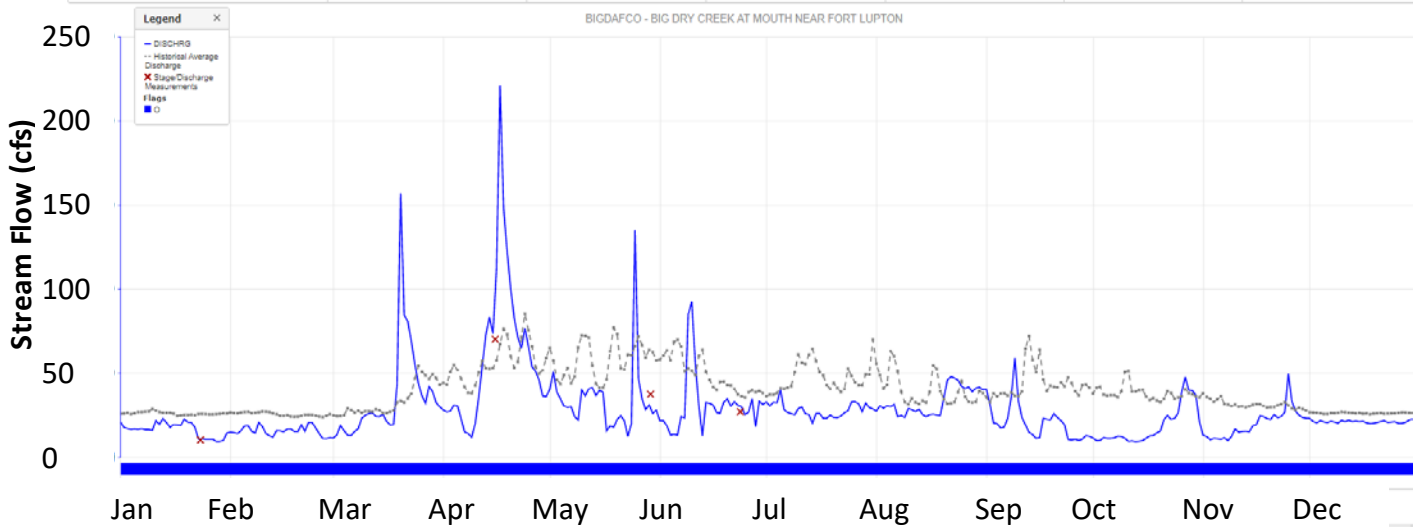


Figure 31. Colorado Division of Water Resources Gauge Measurements for BIGDAFCO 2020



¹⁰CDWR recently relocated the BIGDAFCO stream gauge slightly downstream from its historic location. This relocation was done to address several issues including aging infrastructure, damage incurred to the gauge by the 2013 flood event and frequent and regular backwater conditions due to debris as a result of farming and ranching practices in the immediate vicinity of the old gauge location.

BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

Wastewater Treatment Plant Discharges

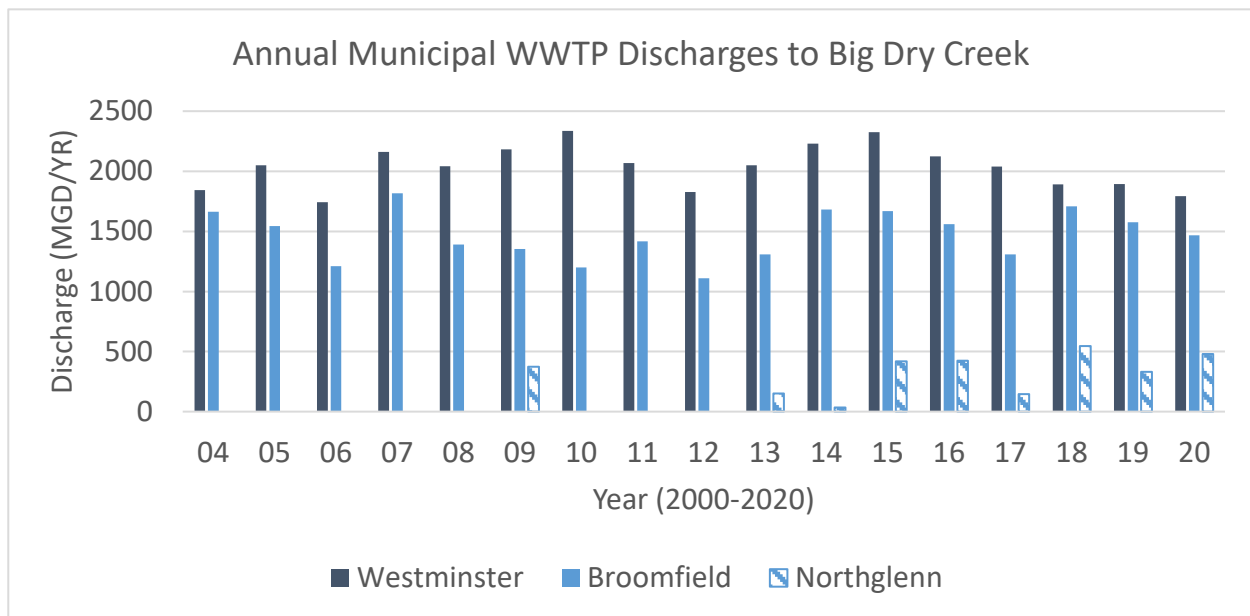
Table 12 and Figure 32 summarize total annual WWTP discharges to Big Dry Creek over time for the Westminster, Broomfield and Northglenn WWTPs since 2004. Through implementation of reclaimed water programs, both Broomfield and Westminster have been working to limit or reduce discharges from their WWTPs to Big Dry Creek. The volume of wastewater discharged is a critically important component in determining nutrient loading to the stream. For purposes of the Barr-Milton TMDL load reduction objectives, the year 2004 is the baseline year for measuring progress relative to the TMDL. Thus, volume changes relative to 2004 can affect overall nutrient loading relative to the TMDL.

Table 12. Annual WWTP Discharges to Big Dry Creek

	Westminster WWTP (MG/YR)	Broomfield WWTP (MG/YR)	Northglenn WWTP (MG/YR)
2004	1843	1663	NR
2005	2051	1545	NR
2006	1742	1211	NR
2007	2161	1817	NR
2008	2043	1392	NR
2009	2183	1355	374
2010	2337	1201	0
2011	2070	1418	0
2012	1827	1109	0
2013	2050	1310	151
2014	2229	1681	34
2015	2326	1668	420
2016	2123	1559	423
2017	2039	1309	147
2018	1891	1709	546
2019	1894	1576	331
2020	1792	1467	480

NR = not reported for purposes of report; historically, Northglenn rarely discharged to Big Dry Creek.

Figure 32. Annual WWTP Discharges to Big Dry Creek



Seasonal Flow Regime

In 2011, an evaluation of Standley Lake discharges, irrigation diversions and WWTP discharges was completed for the 2005-2009 time period (WWE 2011). This evaluation was updated in 2018 as part of the ongoing BDCWA watershed plan update, with flows included through 2017. Figure 33 summarizes the primary hydrologic influences on Big Dry Creek, based on analysis of five years of data for 2013-2017. This analysis was not updated for purposes of this report, but will be updated periodically to support trend evaluation in the watershed.

Figure 34 and Figure 35 illustrate how sources of flows in the creek vary seasonally. Figure 34 illustrates months when the stream is dominated by releases from Standley Lake. Figure 35 illustrates the relative proportion of wastewater flows in the creek in the lower watershed seasonally. Key observations include:

- Significant seasonal variation in release patterns from Standley Lake is present in accordance with releases for irrigation purposes. During June through September, Standley Lake releases comprise 50 to 75 percent of the flows measured at the USGS Westminister gauge. During April, May and October the percent of instream flow from Standley releases is on the order of 5 to 10 percent of the flows at the Westminister gauge.
- With regard to relative percentages of WWTP discharges, during the winter months of December through March, WWTP flows comprise roughly 50 percent or more of the

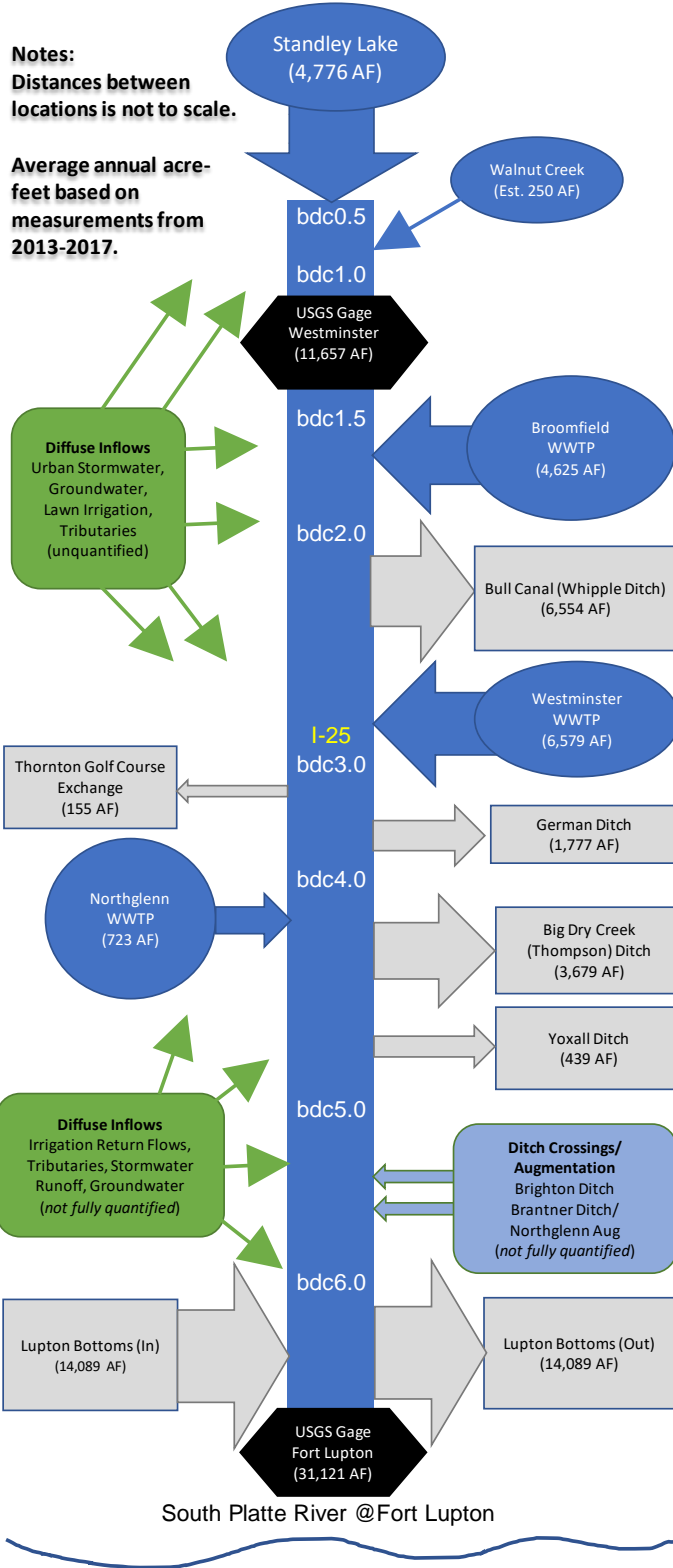
BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

flows present at bdc6.0. During the summer and fall months, WWTP flows are on the order of 25 to 40 percent of the flows at bdc6.0.

Variations in dominant sources of water in the creek during different seasons affect water quality conditions in the creek. For example, in the absence of Standley Lake releases, selenium, chloride, dissolved manganese, sulfate, total dissolve solids and other groundwater-related parameters may be elevated in the upper watershed. With regard to nutrient loading, it is important to recognize that winter months are dominated by wastewater contributions and relatively low flow conditions. Summer months have higher flows with lower relative contributions from wastewater.

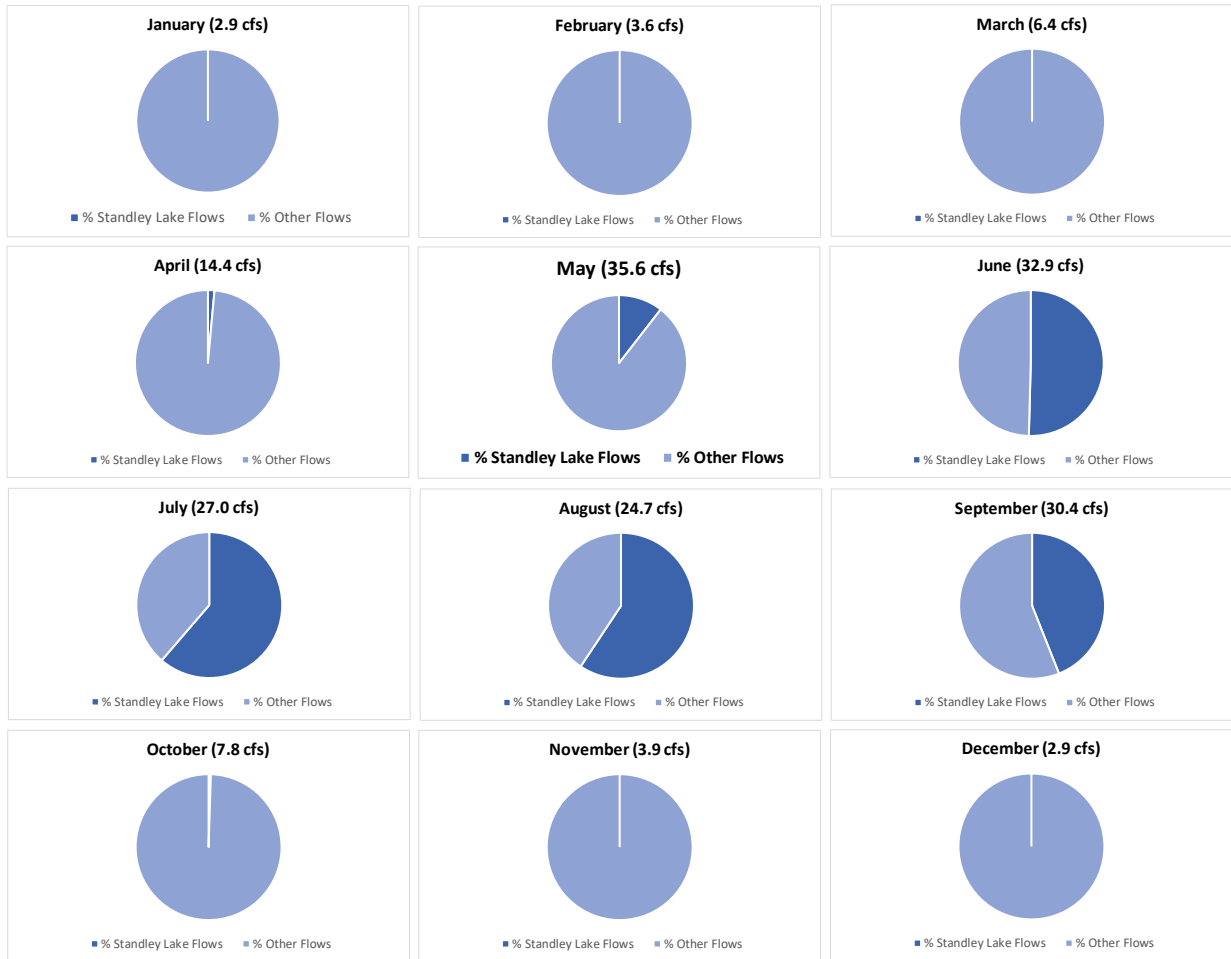
BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

Figure 33. Hydrologic Influences Affecting the Main Stem of Big Dry Creek



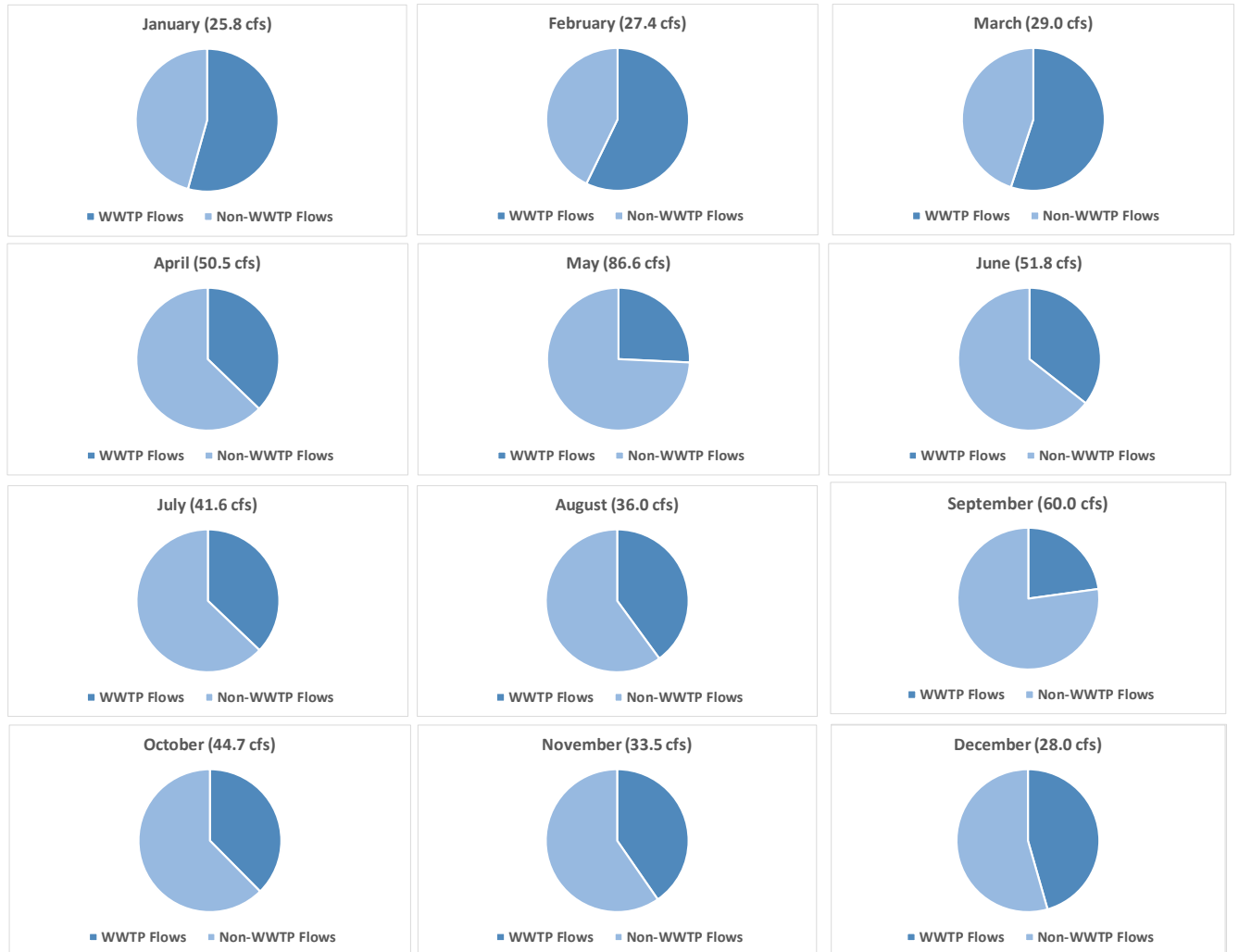
BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

Figure 34. Average Monthly Percentage of Standley Lake Releases Relative to Big Dry Creek Flows at the USGS Westminster Gauge (2013-2017)



BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

Figure 35. Average Monthly Percentage of Municipal WWTP Releases Relative to Big Dry Creek Flows at the USGS Fort Lupton Gauge (2013-2017)



12. QUALITY ASSURANCE/QUALITY CONTROL PROGRAM

During 2020, quality assurance/quality control (QA/QC) samples were collected using the guidelines set forth in the Big Dry Creek SAP (BDCWA 2018). Under this program, field blanks and duplicates are collected and analyzed in accordance with Table 13.

Table 13. Field Quality Control Program in Sampling and Analysis Plan

Month	QC Test	Site
March	Field blanks, full set	bdc6.0
	Field duplicates and blanks for nutrients	bdc2.0
June	Field duplicates for Selenium, Dis. and Iron, Trec	bdc1.5
	Field duplicate for <i>E. coli</i>	bdc2.0
	Field duplicates for nutrients @bdc2.0	bdc2.0
September	Field duplicates, full set	bdc5.0
	Field blanks and duplicates for nutrients @ bdc2.0	bdc2.0
December	Field duplicates for Selenium, Dis. and Iron, Trec	bdc1.5
	Field duplicate for <i>E. coli</i>	bdc2.0
	Field duplicates for nutrients	bdc2.0

Appendix C summarizes analysis of field blank, trip blank, and duplicate samples for 2020. The QC program was followed in 2020. Analysis of relative percent differences (RPD) for the sample duplicates and review of field blanks show acceptable accuracy for most constituents, with these exceptions:

- Elevated field blank result on 3/12/2020 for dissolved copper at 0.78 µg/L relative to a detection limit of 0.1 µg/L.
- Elevated field blank result on 9/10/2020 for total phosphorus of 0.088 mg/L relative to a detection limit of 0.008 mg/L and a reporting limit of 0.025 mg/L.
- An elevated RPD result of 35 percent for total phosphorus occurred on 3/12/2020 at bdc2.0. Samples were re-analyzed by Colorado Analytical on 4/2/20 and the results were confirmed.

13. DATA GAPS IN CURRENT MONITORING PROGRAM

In June 2020, BDCWA began sampling for additional sample fractions for several metals with new stream standards adopted. These metals included total cadmium, lead and nickel. Dissolved iron was also added. For this reason, only a half year of data is available for those metals during 2020.

Total chromium-III is not currently included in the sampling program. Given historical data on Big Dry Creek that indicates total chromium is typically below stream standards, total chromium will be added as opposed to total chromium-III.

Other constituents with stream standards not analyzed under the monitoring program include sulfide, beryllium, uranium and molybdenum. Additionally, chlorophyll-a as attached periphyton is not currently part of the monitoring program. (Chlorophyll measurements in the water column are, however, part of the monitoring program.) At this time, the BDCWA Board has chosen not to add these constituents to the program.

14. INTEGRATED TREND ANALYSIS AND SOURCE CHARACTERIZATION

Given the increased focus on monitoring requirements in municipal separate storm sewer system (MS4) discharge permit renewals, an analysis of the past 10 years of instream monitoring data was completed for pollutants of interest to better characterize portions of the watershed with elevated pollutant concentrations and to identify conditions under which the pollutants are elevated. For purposes of this targeted analysis, pollutants of interest include:

- *E. coli*, which has a TMDL;
- total phosphorus, which is high priority due to the Barr-Milton TMDL and Regulation 85;
- total nitrogen and nitrate due to Regulation 85 and nitrate standards exceedances;
- secondary drinking water parameters exceeding the new stream standard (chloride, sulfate, manganese); and
- selenium, which has a site-specific standard.

The targeted analysis was limited to three monitoring locations representing different conditions:

- bdc1.5 represents conditions above the WWTPs with hydrology controlled by Standley Lake;
- bdc3.0 represents conditions below the dominant WWTPs discharging to the creek; and
- bdc6.0, which represents agricultural conditions in Weld County.

The analysis included these components:

- Spearman correlation analysis (Table 14) to identify potential relationships for further exploration (i.e., pollutants and flow conditions that tend to trend together, either positively or inversely). In Table 14, statistically significant correlations are shown in bold. Shading is added to highlight stronger correlations (e.g., positive correlations >0.5 and inverse correlations < -0.5), with positive correlations shaded in pink and inverse correlations shaded in green.

BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

- For the upper watershed monitoring location of bdc1.5, categorizing sampling events as during Standley Lake releases (or not) for the purpose of characterizing conditions where groundwater is the dominant inflow to baseflow conditions. Results are shown in boxplots in Figure 36.
- Retrieval of storm event data for the past 10 years for purposes of identifying streamflow as influenced by wet or dry weather conditions. A sampling event was categorized as wet weather if 0.1 inch or more precipitation occurred on the day preceding the sampling event or on the date of the sampling event. The National Oceanic and Atmospheric Administration Northglenn gauge was used for convenience and simplicity (but other precipitation gauges could also be used for a more refined analysis in the future.) On average, May is the wettest month with 2.9 inches of precipitation. Results are shown in boxplots in Figures 37 through 39.
- Seasonal boxplots were also prepared; however, seasonal trends are similar to, and interrelated with, the wet vs. dry and Standley release vs. non-Standley release data and are not reproduced in the report.

BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

Table 14. Spearman Correlation Matrix Big Dry Creek 2011-2020

Correlation matrix (Spearman) / Group bdc1.5:

Variables	E_coli (MPN/100 mL)	IRON, Trec (mg/L)	TSS (mg/L)	TP (mg/L)	TN (mg/L)	NO3+NO2 (mg/L)	SELENIUM, D (mg/L)	CHLORIDE, D (mg/L)	MANGANESE, D (mg/L)	SULFATE, D (mg/L)	TEMPERATURE (°C)	Westminster (cfs)	Fort Lupton (cfs)
E_coli (MPN/100 mL)	1.00	0.29	0.50	0.29	-0.19	-0.34	-0.39	-0.47	-0.51	-0.45	0.43	0.52	0.34
IRON, Trec (mg/L)	0.29	1.00	0.82	0.54	-0.52	-0.62	-0.68	-0.53	-0.36	-0.64	0.52	0.62	0.36
TSS (mg/L)	0.50	0.82	1.00	0.55	-0.44	-0.65	-0.73	-0.68	-0.59	-0.70	0.62	0.70	0.29
TP (mg/L)	0.29	0.54	0.55	1.00	-0.41	-0.49	-0.36	-0.34	-0.05	-0.45	0.41	0.40	0.28
TN (mg/L)	-0.19	-0.52	-0.44	-0.41	1.00	0.93	0.91	0.66	0.68	0.84	-0.63	-0.71	-0.17
NO3+NO2 (mg/L)	-0.34	-0.62	-0.65	-0.49	0.93	1.00	0.95	0.72	0.66	0.92	-0.72	-0.82	-0.24
SELENIUM, D (mg/L)	-0.39	-0.68	-0.73	-0.36	0.91	0.95	1.00	0.75	0.72	0.94	-0.70	-0.89	-0.33
CHLORIDE, D (mg/L)	-0.47	-0.53	-0.68	-0.34	0.66	0.72	0.75	1.00	0.80	0.84	-0.78	-0.70	-0.23
MANGANESE, D (mg/L)	-0.51	-0.36	-0.59	-0.05	0.68	0.66	0.72	0.80	1.00	0.74	-0.55	-0.73	-0.27
SULFATE, D (mg/L)	-0.45	-0.64	-0.70	-0.45	0.84	0.92	0.94	0.84	0.74	1.00	-0.74	-0.89	-0.32
TEMPERATURE (°C)	0.43	0.52	0.62	0.41	-0.63	-0.72	-0.70	-0.78	-0.55	-0.74	1.00	0.63	0.27
Westminster (cfs)	0.52	0.62	0.70	0.40	-0.71	-0.82	-0.89	-0.70	-0.73	-0.89	0.63	1.00	0.44
Fort Lupton (cfs)	0.34	0.36	0.29	0.28	-0.17	-0.24	-0.33	-0.23	-0.27	-0.32	0.27	0.44	1.00

Values in bold are different from 0 with a significance level alpha=0.05

Correlation matrix (Spearman) / Group bdc3.0:

Variables	E_coli (MPN/100 mL)	IRON, Trec (mg/L)	TSS (mg/L)	TP (mg/L)	TN (mg/L)	NO3+NO2 (mg/L)	SELENIUM, D (mg/L)	CHLORIDE, D (mg/L)	MANGANESE, D (mg/L)	SULFATE, D (mg/L)	TEMPERATURE (°C)	Westminster (cfs)	Fort Lupton (cfs)
E_coli (MPN/100 mL)	1.00	0.33	0.45	-0.16	-0.13	-0.18	-0.03	-0.34	-0.41	-0.17	0.18	0.15	0.08
IRON, Trec (mg/L)	0.33	1.00	0.78	-0.38	-0.54	-0.60	-0.46	-0.58	-0.49	-0.61	0.61	0.73	0.49
TSS (mg/L)	0.45	0.78	1.00	-0.28	-0.37	-0.43	-0.18	-0.39	-0.50	-0.37	0.44	0.59	0.41
TP (mg/L)	-0.16	-0.38	-0.28	1.00	0.37	0.38	0.38	0.30	0.34	0.32	-0.19	-0.35	-0.07
TN (mg/L)	-0.13	-0.54	-0.37	0.37	1.00	0.98	0.50	0.34	0.56	0.47	-0.28	-0.76	-0.22
NO3+NO2 (mg/L)	-0.18	-0.60	-0.43	0.38	0.98	1.00	0.37	0.34	0.51	0.40	-0.30	-0.75	-0.27
SELENIUM, D (mg/L)	-0.03	-0.46	-0.18	0.38	0.50	0.37	1.00	0.38	0.52	0.84	-0.09	-0.32	-0.12
CHLORIDE, D (mg/L)	-0.34	-0.58	-0.39	0.30	0.34	0.34	0.38	1.00	0.73	0.60	-0.64	-0.45	-0.07
MANGANESE, D (mg/L)	-0.41	-0.49	-0.50	0.34	0.56	0.51	0.52	0.73	1.00	0.64	-0.57	-0.61	-0.35
SULFATE, D (mg/L)	-0.17	-0.61	-0.37	0.32	0.47	0.40	0.84	0.60	0.64	1.00	-0.27	-0.52	-0.13
TEMPERATURE (°C)	0.18	0.61	0.44	-0.19	-0.28	-0.30	-0.09	-0.64	-0.57	-0.27	1.00	0.48	0.20
Westminster (cfs)	0.15	0.73	0.59	-0.35	-0.76	-0.75	-0.32	-0.45	-0.61	-0.52	0.48	1.00	0.39
Fort Lupton (cfs)	0.08	0.49	0.41	-0.07	-0.22	-0.27	-0.12	-0.07	-0.35	-0.13	0.20	0.39	1.00

Values in bold are different from 0 with a significance level alpha=0.05

Correlation matrix (Spearman) / Group bdc6.0:

Variables	E_coli (MPN/100 mL)	IRON, Trec (mg/L)	TSS (mg/L)	TP (mg/L)	TN (mg/L)	NO3+NO2 (mg/L)	SELENIUM, D (mg/L)	CHLORIDE, D (mg/L)	MANGANESE, D (mg/L)	SULFATE, D (mg/L)	TEMPERATURE (°C)	Westminster (cfs)	Fort Lupton (cfs)
E_coli (MPN/100 mL)	1.00	0.57	0.52	0.24	-0.28	-0.51	-0.54	-0.50	-0.41	-0.51	0.57	0.55	0.41
IRON, Trec (mg/L)	0.57	1.00	0.85	0.40	-0.19	-0.31	-0.48	-0.48	-0.65	-0.63	0.39	0.51	0.65
TSS (mg/L)	0.52	0.85	1.00	0.56	-0.17	-0.33	-0.46	-0.36	-0.64	-0.56	0.31	0.51	0.51
TP (mg/L)	0.24	0.40	0.56	1.00	0.03	-0.10	-0.32	-0.09	-0.35	-0.31	0.07	0.23	0.27
TN (mg/L)	-0.28	-0.19	-0.17	0.03	1.00	0.93	0.64	0.42	0.26	0.36	-0.56	-0.66	-0.18
NO3+NO2 (mg/L)	-0.51	-0.31	-0.33	-0.10	0.93	1.00	0.66	0.47	0.36	0.43	-0.64	-0.66	-0.23
SELENIUM, D (mg/L)	-0.54	-0.48	-0.46	-0.32	0.64	0.66	1.00	0.60	0.46	0.84	-0.66	-0.67	-0.28
CHLORIDE, D (mg/L)	-0.50	-0.48	-0.36	-0.09	0.42	0.47	0.60	1.00	0.51	0.57	-0.67	-0.51	-0.24
MANGANESE, D (mg/L)	-0.41	-0.65	-0.64	-0.35	0.26	0.36	0.46	0.51	1.00	0.47	-0.52	-0.31	-0.49
SULFATE, D (mg/L)	-0.51	-0.63	-0.56	-0.31	0.36	0.43	0.84	0.57	0.47	1.00	-0.45	-0.57	-0.35
TEMPERATURE (°C)	0.57	0.39	0.31	0.07	-0.56	-0.64	-0.66	-0.67	-0.52	-0.45	1.00	0.66	0.19
Westminster (cfs)	0.55	0.51	0.51	0.23	-0.66	-0.66	-0.67	-0.51	-0.31	-0.57	0.66	1.00	0.41
Fort Lupton (cfs)	0.41	0.65	0.51	0.27	-0.18	-0.23	-0.28	-0.24	-0.49	-0.35	0.19	0.41	1.00

Values in bold are different from 0 with a significance level alpha=0.05

BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

Figure 36. Selected Pollutant Concentrations by Location During Standley Lake Releases

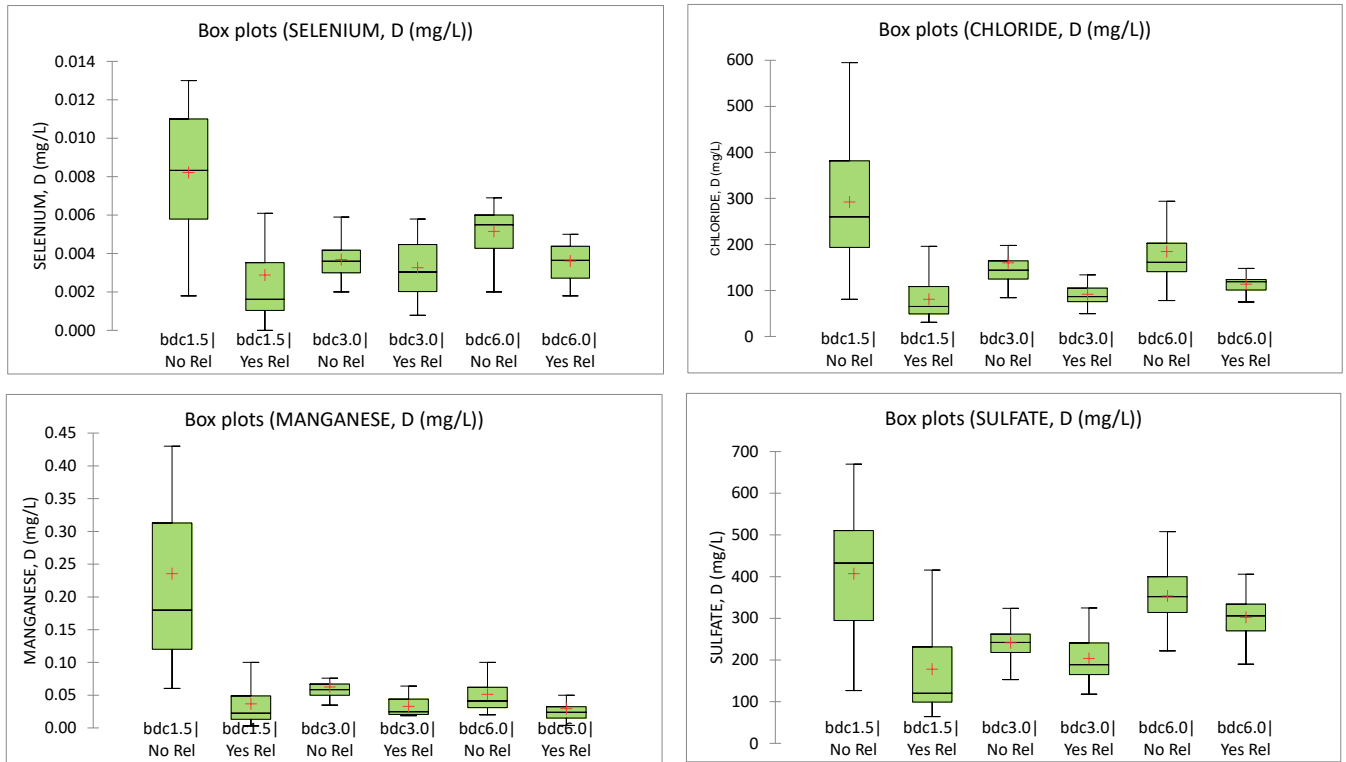


Figure 37. Boxplots of Selected Pollutants Influenced by Stormwater/Runoff Conditions

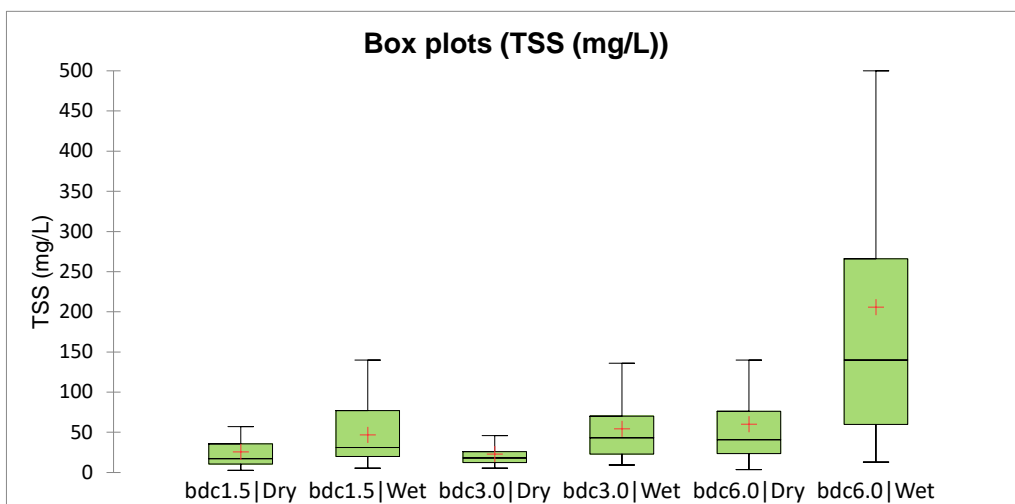
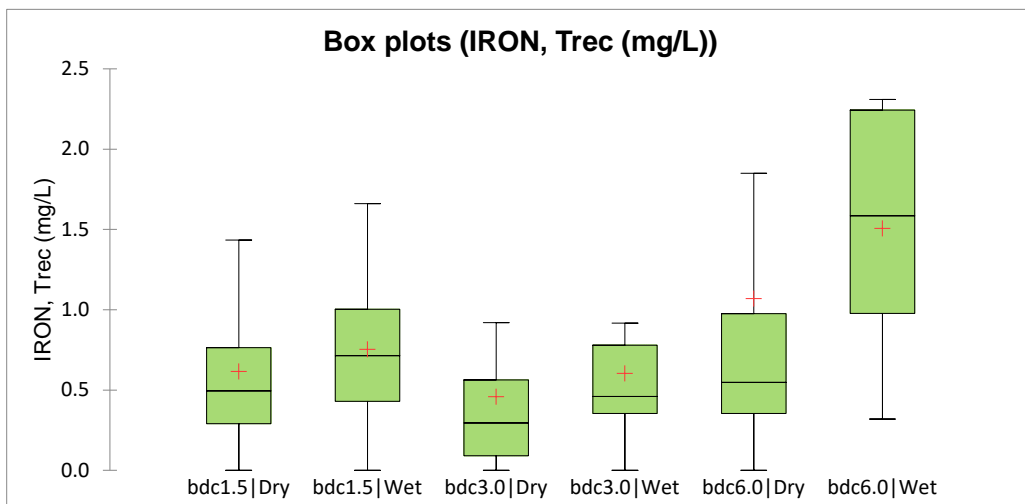
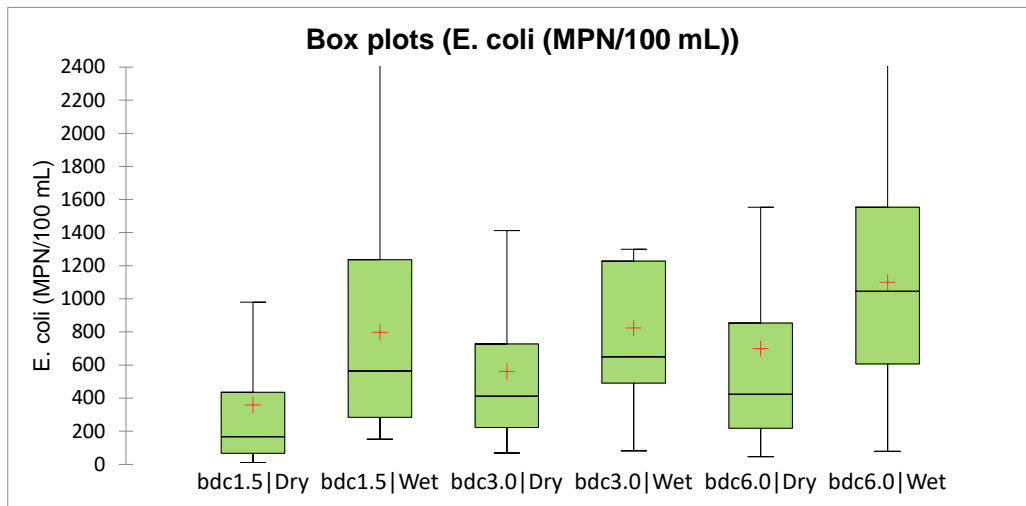
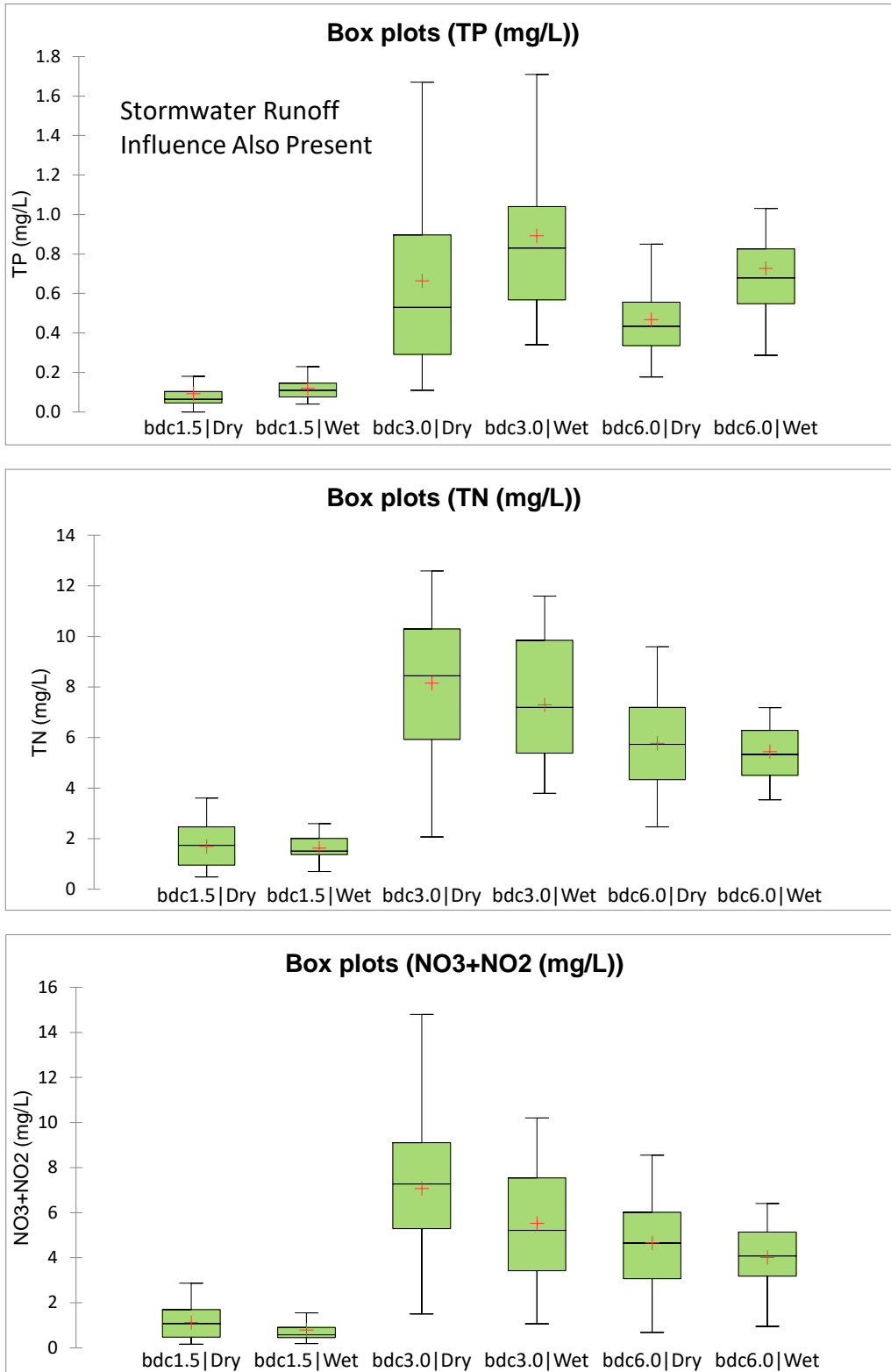
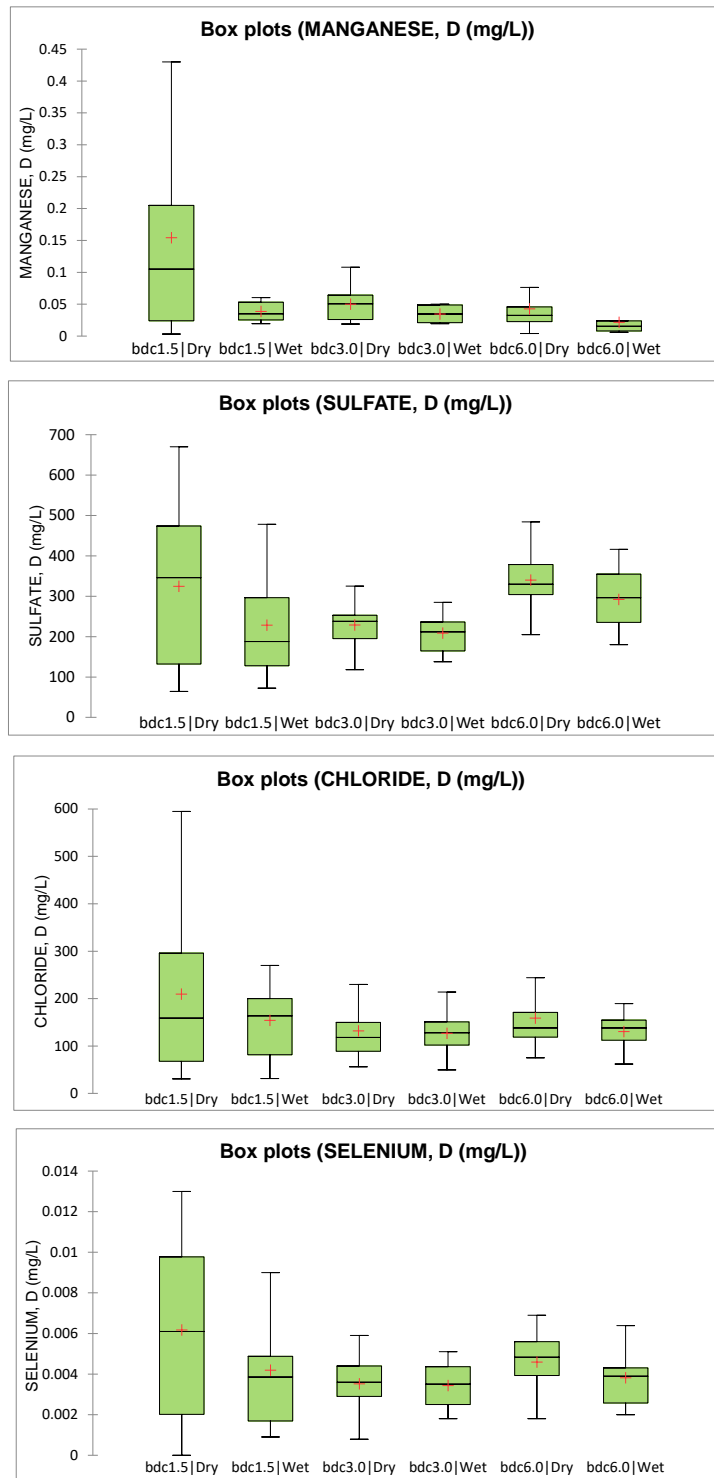


Figure 38. Boxplots of Selected Pollutants Influenced by Wastewater Discharges



BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

Figure 39. Boxplots of Selected Pollutants Not Influenced by Stormwater



BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

Table 15 provides a summary of wet vs. dry weather influences on selected pollutants to simplify observations in Figures 37 through 39. Table 16 provides a summary of anticipated sources and control strategies that should be further considered by BDCWA as part of watershed planning activities and future Regulation 38 rulemaking hearings based in part on this analysis. Key findings from the analysis for pollutants of interest include:

1. ***E. coli***: *E. coli* is elevated throughout the watershed under both dry and wet flow conditions. *E. coli* concentrations are higher during wet weather influenced sampling events throughout the watershed. Nonetheless, because *E. coli* is also elevated under dry weather conditions, it is recommended that BDCWA continue to focus on identifying persistent dry weather sources of *E. coli*.
2. **Nitrogen**: Elevated nitrogen in the watershed is limited to the portion of the stream between the Broomfield WWTP and the confluence with the South Platte River. The dominant influence on the nitrogen conditions at this time is the wastewater facilities.
3. **Phosphorus**: Elevated total phosphorus above the interim limit of 0.17 mg/L in the watershed is limited to the portion of the stream between the Broomfield WWTP and the confluence with the South Platte River. Wet weather influenced events have higher phosphorus concentrations throughout the watershed; however, the wet weather influenced events above the WWTP discharges still attain the interim limit of 0.17 mg/L.
4. **Total Recoverable Iron**: Total recoverable iron is elevated under wet weather-influenced conditions throughout the watershed; however, the only portion of the watershed exceeding the total recoverable iron standard under any condition is the lower watershed in the agricultural area.
5. **Secondary Drinking Water Parameters**: Chloride, manganese and sulfate are elevated in the upper watershed above the WWTP discharges during dry weather, low-flow conditions when Standley Lake is not releasing. Groundwater-dominated flow conditions lead to these elevated values, similar to selenium, which has a site-specific standard due to natural or irreversible human-induced conditions. Stormwater runoff BMPs are not expected to be effective in addressing these pollutants.

Table 15. Pollutant Trends Related to Storm-influenced Stream Conditions

Watershed Portion	Bacteria	Iron	Nutrients		Secondary Drinking Water Params.			Se**
	<i>E. coli</i>	Iron	TP	TN & NO3	Mn	Cl	SO4	Se**
Upper (bdc1.5)	Higher	Higher*	Higher*	Lower*	Lower	Lower/ Neutral	Lower	Lower*
WWTP-Urban (bdc3.0)	Higher	Higher*	Higher	Lower	Lower*	Neutral*	Lower*	Lower*
Agricultural (bdd6.0)	Higher	Higher	Higher	Lower	Lower*	Neutral*	Lower*	Lower*

TP = total phosphorus; TN = total nitrogen; NO3 = nitrate; Mn = manganese; Cl = chloride; SO4 = sulfate; Se = selenium
 *Meets stream standard. **Site-specific standard in place.

BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

Table 16. Summary of Water Quality Issues, Sources and Potential Solutions

Watershed Portion	Pollutants of Interest	Observations for Sources and Trends	Treatment/BMPs/Solutions to Explore
Between Standley Lake Dam and Broomfield WWTP	Chloride, Manganese, Sulfate & Selenium	Groundwater.	Expected to be groundwater-related during low-flow conditions. Site-specific standard similar to selenium standard.
	<i>E. coli</i>	<i>E. coli</i> elevated under all conditions, with summer and storm-influenced concentrations notably higher.	Continue dry weather source investigations and source controls. Continue to implement MS4 permanent stormwater control measures, with preference toward Green Infrastructure practices providing volume reduction.
	Nutrients	Nutrients in this reach meet the stream standards. Phosphorus increases during runoff events, but not at levels exceeding standards.	Continue to implement MS4 nutrient-related programs and permanent stormwater control measures.
Broomfield WWTP to South Platte	Total Nitrogen & Nitrate	WWTP discharges.	WWTPs dominant source of nutrients; continued WWTP upgrades.
	Total Phosphorus	WWTP discharges; Stormwater Runoff.	Total phosphorus also increases under runoff conditions: stormwater BMPs & bank stabilization. Support agricultural BMPs for nutrients in lower watershed.
	<i>E. coli</i>	<i>E. coli</i> elevated under all conditions, with summer and storm-influenced concentrations notably higher.	Continue dry weather source investigations and source controls. Continue to implement MS4 permanent stormwater control measures, with preference toward Green Infrastructure practices providing volume reduction. Explore private property owner interest in agricultural BMPs where cattle are adjacent to stream.
Downstream of WCR 8*	Total Recoverable Iron	Storm events that mobilize sediment and associated iron.	Runoff-related agricultural and/or channel stabilization BMPs.

*Pollutants identified from Broomfield WWTP to South Platte are also applicable below Weld County Rd. 8.

15. CONCLUSIONS AND RECOMMENDATIONS

1. Water quality in Big Dry Creek attained stream standards for stream standards applicable in 2019, with the exception of *E. coli* for the entire stream and iron for the reach below Weld County Road 8. For new stream standards assigned in 2020 related to addition of a Water Supply classification, Big Dry Creek is expected to have future attainment issues for sulfate, chloride, nitrate and dissolved manganese.
2. *E. coli* concentrations are elevated at multiple instream locations. *E. coli* concentrations in the WWTP discharges are very low and do not exceed stream standards. As part of the BDCWA Watershed Plan update, additional efforts to identify sources of *E. coli* are needed. The current monitoring program is useful for identifying elevated stream reaches and trends over time but is not sufficient for identifying and mitigating sources of *E. coli*. For this reason, BDCWA and partnering cities have begun a microbial source identification study on the creek.
3. Although total recoverable iron samples collected and analyzed by BDCWA show attainment of the total recoverable iron standard at all monitoring locations, additional data collected by Metro Wastewater in the lower watershed show elevated iron concentrations. For this reason, Big Dry Creek below Weld County Road 8 is listed as impaired on the 2020 303(d) List. Elevated iron concentrations are expected to be due to stream bank and soil erosion in the lower watershed.
4. Sources of sulfate, chloride and dissolved manganese in the watershed include groundwater inflows in the upper watershed, as evidenced by seasonal patterns in the data set. Other sources of sulfate may also be present in the lower watershed, but at levels below the stream standard. These constituents are secondary drinking water parameters, not related to human health risk. All of these constituents are expected to have exceedances of the stream standards resulting in impairment listing on future 303(d) lists. Further exploration of existing quality conditions as of January 1, 2020 may provide regulatory relief for sulfate.
5. For the most recent five-year analysis period (2016-2020), Big Dry Creek attained its site-specific selenium standard. In 2016, the stream was removed from the 303(d) List of impaired waters. From a longevity plan perspective related to the site-specific standard, a site-specific standard for selenium is still needed in order for the stream to attain selenium standards.
6. Big Dry Creek exceeds the recently assigned nitrate standard of 10 mg/L for a few sampling events below the Broomfield and Westminster WWTPs. Compliance plans in the 2019 WWTP discharge permits are expected to address this issue.
7. Big Dry Creek does not attain the interim warm water instream nitrogen and phosphorus “interim values” below municipal WWTP discharges (from the Broomfield WWTP to the South Platte River). Although these values are not expected to be adopted as stream standards on the main stem of Big Dry Creek prior to December 31, 2027, addressing nutrient sources on

BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

Big Dry Creek should be an increasing area of focus for BDCWA. More stringent CDPS permit limits with compliance schedules have been included in the 2019 permit renewal for the WWTPs. Under the new CWQCC Policy 17-1, a Voluntary Incentive Program for Early Nutrient Reductions was established. The Incentive Program allows enrolled WWTPs to accrue time under a post-2027 compliance schedule through trading or watershed nutrient reductions as part of its nutrient reduction plan. All three of the municipal WWTP dischargers are enrolled in this program.

8. Phosphorus concentrations and loads to Big Dry Creek have decreased over time as a result of treatment plant upgrades at the Broomfield and Westminster WWTPs, along with reuse programs that continue to be implemented at these WWTPs. Despite these improvements, the stream would not meet the interim total phosphorus criteria from below the Broomfield WWTP to the confluence with the South Platte River. Recent sampling at bdc2.0 below the Broomfield WWTP indicates possible attainment at this location in the future, but currently more than one year has a median total phosphorus value above the interim limit.
9. Aquatic life monitoring is conducted in even years for Big Dry Creek, so the most recent monitoring results are for 2020. Big Dry Creek does not show impairment of aquatic life uses in 2020, based on calculation of MMI scores in accordance with CWQCC's Aquatic Life Use Attainment Policy 10-1, EDAS Version 4. Scores were calculated at six biological monitoring locations for fall monitoring conducted during 2012, 2014, 2016, 2018 and 2020. MMI scores vary substantially, both temporally and spatially.
10. Stream flows were relatively low during 2020. Stream flow is a significant factor influencing instream water quality and pollutant loads. WWTP discharges from Northglenn were higher than historic discharges, as were discharges from Broomfield.

BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

16. REFERENCES

- AECOM, 2009. Watershed and Lake Modeling for a TMDL Evaluation of Barr Lake and Milton Reservoir, Final. August.
- AECOM, 2010. Total Maximum Daily Load to Achieve pH Compliance in Barr Lake and Milton Reservoir, Colorado. Prepared for Barr-Milton Watershed Association. Revised March 2010.
- Aquatics Associates, Inc. 2012. Results of the Aquatic Monitoring Program in Big Dry Creek, 2010. June 2012. Prepared for the Big Dry Creek Watershed Association, Colorado.
- Aquatics Associates, 2013. Big Dry Creek Summary of MMI Results for 2008-2012 Macroinvertebrate Data. Memorandum to Big Dry Creek Watershed Association Board of Directors, February 14, 2013.
- Aquatics Associates, Inc. 2014. Results of the Aquatic Monitoring Program in Big Dry Creek, 2012. January 2014. Prepared for the Big Dry Creek Watershed Association, Colorado.
- Aquatics Associates, Inc. 2016. Results of the Aquatic Monitoring Program in Big Dry Creek, 2014. December 2016. Prepared for the Big Dry Creek Watershed Association, Colorado.
- Aquatics Associates, 2019a. Results of the Aquatic Monitoring Program in Big Dry Creek, 2014. March.
- Aquatics Associates, 2019b. Results of the Aquatic Monitoring Program in Big Dry Creek, 2016. March.
- Aquatics Associates, 2019c. Presentation of Results of the Aquatic Monitoring Program in Big Dry Creek for 2018. Powerpoint presentation to the Big Dry Creek Watershed Association, December.
- Barr Milton Watershed Association, 2017. Watershed Plan Update. https://barr-milton.org/wp-content/uploads/2019/07/sept_watershedplan_update_ew09202017.pdf
- Big Dry Creek Watershed Association, 2018. *Cooperative Sampling and Analysis Plan for the Mainstem of Big Dry Creek, Monitoring Conducted by the Cities of Broomfield, Westminster, Northglenn and Thornton*. (Initial Plan Prepared in 2003 by Hallie Mahan, City of Broomfield.) Revised February 2018.
- Colorado Water Quality Control Commission, 2010. Policy Statement 10-1, Appendices A-F. Aquatic Life Use Attainment, Methodology to Determine Use Attainment for Rivers and Streams. Approved October 12, 2010, Expires December 31, 2013. Colorado Department of Health and Environment, Colorado Water Quality Control Commission, Denver, CO.

BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

- Colorado Water Quality Control Commission, 2011. *Regulation No. 38 Classifications and Numeric Standards South Platte River Basin, Laramie River Basin, Republican River Basin, Smoky Hill River Basin*. 5 CCR 1002-38. Effective January 1, 2012.
- Colorado Water Quality Control Commission, 2012. *Regulation No. 31 The Basic Standards and Methodologies for Surface Water*. 5 CCR 1002-31. Effective September 30, 2012.
- Colorado Water Quality Control Commission, 2015. Section 303(d) Listing Methodology, 2016 Listing Cycle.
- Colorado Water Quality Control Commission, 2016. *Regulation No. 93 Section 303(d) List Water-Quality-Limited Segments Requiring TMDLs*.
- Colorado Water Quality Control Commission, 2017a. *Regulation No. 31 The Basic Standards and Methodologies for Surface Water*. 5 CCR 1002-31. Effective January 31, 2018.
- Colorado Water Quality Control Commission, 2017b. Section 303(d) Listing Methodology, 2018 Listing Cycle.
- Colorado Water Quality Control Commission, 2017c. Water Quality Control Commission Policy 17-1, a Voluntary Incentive Program for Early Nutrient Reductions. Regulation #85 – Section 85.5(1.5) Approved: November 13, 2017. Expires: December 31, 2020.
- Colorado Water Quality Control Commission, 2018a. Regulation No. 38 Classifications and Numeric Standards South Platte River Basin, Laramie River Basin, Republican River Basin, Smoky Hill River Basin. 5 CCR 1002-38. Effective January 31, 2018.
- Colorado Water Quality Control Commission, 2018b. *Regulation No. 93 Section 303(d) List Water-Quality-Limited Segments Requiring TMDLs*.
- Colorado Water Quality Control Commission, 2019. Section 303(d) Listing Methodology, 2020 Listing Cycle.
- Colorado Water Quality Control Commission, 2020a. *Regulation No. 93 Section 303(d) List Water-Quality-Limited Segments Requiring TMDLs*.
- Colorado Water Quality Control Commission, 2020b. *Regulation No. 38 Classifications and Numeric Standards South Platte River Basin, Laramie River Basin, Republican River Basin, Smoky Hill River Basin*. 5 CCR 1002-38.
- Colorado Water Quality Control Division, 2007. Proponents Prehearing Statement of the Water Quality Control Division Regarding Revisions of Ammonia Water Quality Standards for Multiple Segments in Regulation Nos. 32, 33, 36, 37 & 38. January 4, 2007.

BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

- Colorado Water Quality Control Division, 2009. Proponents Prehearing Statement of the Water Quality Control Division for the South Platte River July 2009 Regulation 38 Rulemaking Hearing, Exhibit 38-6, Big Dry Creek Basin Rationale.
- Colorado Water Quality Control Division, 2012a. Exhibit 1 – Regulation #31: Water Quality Control Division, Notice of Public Rulemaking before the Colorado Water Quality Control Commission, March.
- Colorado Water Quality Control Division, 2012b. Exhibit 2 – Regulation #85: Water Quality Control Division, March.
- Colorado Water Quality Control Division, 2015. Proponents Prehearing Statement of the Water Quality Control Division for the South Platte River June 2015 Regulation 38 Rulemaking Hearing, Exhibit 38-1, Big Dry Creek Basin Rationale.
- Colorado Water Quality Control Division, 2020. Rebuttal Statement of the Water Quality Control Division in the Matter of the 2020 List of Impaired Water and 2020 Monitoring and Evaluation List (Regulation #93).
- Integral Consulting, 2010. Colorado Nonpoint Source Pollution Control Program Watershed Project Final Report, Barr Lake and Milton Reservoir Watershed pH TMDL Development. Prepared for Barr Lake and Milton Reservoir Watershed Association.
- Jessup, B.K., 2010. Recalibration of the Macroinvertebrate Multi-Metric Index for Colorado. Prepared for Colorado Department of Health and Environment, Colorado Water Quality Control Division, Monitoring Unit, Denver, CO and EPA Region 8. Tetra Tech, Inc., Center for Ecological Sciences, Montpelier, VT.
- Jessup, B.K. and J.B. Stribling 2017. Recalibration of the Macroinvertebrate Multi-Metric Index for Colorado. Prepared for: Colorado Department of Public Health and Environment, Denver, CO. Prepared by: Tetra Tech, Inc., Center for Ecological Sciences, Owings Mills, Maryland.
- U.S. Environmental Protection Agency, 1999. *1999 Update of Ambient Water Quality Criteria for Ammonia*. December.
- Wright Water Engineers, Geosyntec Consultants, R. Pitt and L. Roesner, 2013. Colorado Regulation 85 Nutrient Data Gap Analysis Report. Prepared for Colorado Stormwater Council and Urban Drainage and Flood Control District. December.
- Wright Water Engineers, Inc., 2007. Technical Memorandum to the Big Dry Creek Watershed Association Board of Directors regarding Exploration of Potential Selenium Sources in Big Dry Creek Watershed. December. (downloadable from www.bigdrycreek.org).

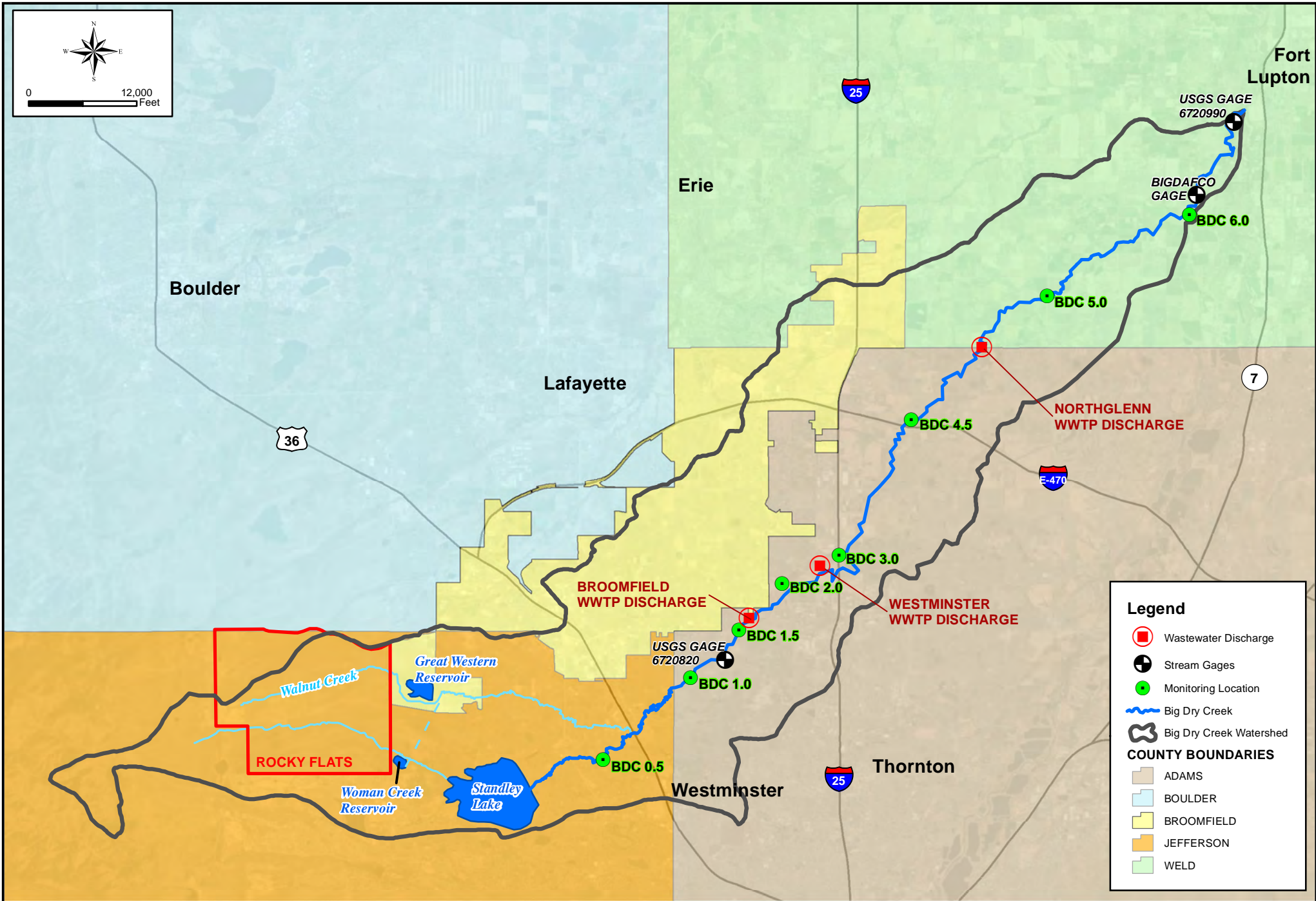
BIG DRY CREEK WATER QUALITY SUMMARY FOR 2020

Wright Water Engineers, Inc., 2009. Overview of *E. coli* Source Characterization Efforts for Big Dry Creek (2006-2008). (Notebook compendium of special studies conducted from 2006-2008.) Prepared for the Big Dry Creek Watershed Association. March.

Wright Water Engineers, Inc., 2011. Technical Memorandum Regarding Big Dry Creek Water Quality Summary for 2010.

Wright Water Engineers, Inc., 2012. Big Dry Creek Annual Water Quality Summary for 2011. March. Prepared for the Big Dry Creek Watershed Board of Directors.

Appendix A. Supplemental Figures



**BIG DRY CREEK WATERSHED -
KEY FEATURES AND MONITORING LOCATIONS**

Appendix B. Big Dry Creek 2020 Instream Sampling Results

Appendix B. General Monthly Water Quality Parameters and Total Recoverable Iron

Location ID	Activity Start Date	ALKALINITY (mg/L)	CHLORIDE, D (mg/L)	CHLOROPHYLL-a, corr_ (ug/L)	CHLOROPHYLL-a, uncor_ (ug/L)	CONDUCTIVITY (uS/cm)	DO (mg/L)	pH (SU)	E_coli (MPN/100 mL)	IRON, Trec (mg/L)	CALCIUM, Total (mg/L)	MAGNESIUM, D (mg/L)	Hardness (mg/L)	POTASSIUM, D (mg/L)
bdc0.5	3/12/2020	235	312	1.5	3.3	1965	6.90	7.68	86	0.17	116	35.4	435	4.8
bdc0.5	4/9/2020	205	318	3.9	6.0	2107	7.47	7.48		0.21	116	47.7	486	4.2
bdc0.5	5/14/2020	214	278	11.6	14.6	2117	14.59	7.49	162	0.2	120	48.8	501	3.8
bdc0.5	6/11/2020	61	51	2.3	3.8	423	9.03	7.58	51	0.66	43	7.98	141	2.4
bdc0.5	7/9/2020	90	66	1.2	2.2	588	6.60	7.73	2420	0.11	52	13.3	184	2.4
bdc0.5	8/13/2020	51	42	3.9	8.0	358	9.73	7.77	173	0.35	37	7.24	122	2.2
bdc0.5	9/10/2020	55	42	1.0	2.5	396	7.57	7.86	99	0.43	35	7.42	118	2.1
bdc0.5	10/8/2020	55	38	1.0	2.9	374	8.91	7.89	770	0.28	37	7.33	122	2.1
bdc0.5	11/12/2020	245	300	2.3	3.3	2158	9.16	7.43	579	0.11	128	39.2	481	4.7
bdc0.5	12/10/2020	296	266	1.0	3.1	2215	11.58	7.59	91	0.3	158	43.8	575	3.3
bdc1.0	3/12/2020	236	860	32.4	37.3	3500	7.55	7.66	20	0.32	143	46.2	547	6.5
bdc1.0	4/9/2020	226	344	11.8	15.6	2100	7.40	7.3		0.3	105	38.9	422	4.0
bdc1.0	5/14/2020	188	260	2.6	4.9	1743	13.67	7.68	36	0.37	114	35.3	430	4.0
bdc1.0	6/11/2020	69	59	3.4	6.5	491	8.36	7.58	261	1.06	45	9.22	150	2.5
bdc1.0	7/9/2020	119	118	2.6	5.5	951	7.45	7.6	308	0.47	73	19.4	262	3.0
bdc1.0	8/13/2020	60	47	5.3	10.5	451	13.12	7.63	326	0.99	38	8.6	131	2.3
bdc1.0	9/10/2020	75	66	4.5	7.0	555	8.26	7.61	488	1.12	46	11.2	160	2.7
bdc1.0	10/8/2020	72	56	3.9	6.9	531	9.53	7.64	122	0.47	52	10.2	172	2.3
bdc1.0	11/12/2020	249	443	4.9	5.4	2686	9.17	8.04	41	0.18	161	44.9	587	4.7
bdc1.5	1/9/2020	302	430	2.2	4.1	2758	9.20	7.37	74	0.49	158	52.5	611	4.4
bdc1.5	3/12/2020	262	674	13.1	16.8	3224	7.72	7.65	36	0.57	138	48.3	543	5.7
bdc1.5	4/9/2020	218	332	3.5	4.9	2089	10.06	7.6		0.27	126	45.4	502	3.8
bdc1.5	5/14/2020	230	272	2.6	4.0	1991	14.34	7.71	110	0.25	134	41.6	506	3.7
bdc1.5	6/11/2020	78	63	2.9	5.5	520	8.36	7.62	167	0.83	48	9.91	162	2.5
bdc1.5	7/9/2020	168	142	2.2	4.8	1261	7.41	7.68	161	0.4	87	27.4	331	2.9
bdc1.5	8/13/2020	64	53	4.6	9.0	472	14.24	7.62	326	1.36	42	9.89	146	2.4
bdc1.5	9/10/2020	88	75	5.4	7.9	638	8.69	7.67	276	0.92	50	13.1	180	2.8
bdc1.5	10/8/2020	92	65	6.2	8.7	655	9.98	7.69	142	0.55	58	12.5	196	2.2
bdc1.5	11/12/2020	291	413	5.2	6.5	2765	10.12	7.78	50	0.58	172	52.5	646	4.5
bdc1.5	12/10/2020	317	376	8.0	12.8	2658	10.78	7.94	36	0.47	187	51.8	680	3.7
bdc2.0	1/9/2020	228	270	2.4	5.2	2048	8.46	7.73	122	0.26	109	35	416	7.3
bdc2.0	2/13/2020	317	1080	8.5	10.1	2899	3.37	6.74	59	0.27	165	57.3	648	8.3
bdc2.0	3/12/2020	167	300	4.8	6.8	1817	7.18	7.46	24	0.24	84	28	326	10.6
bdc2.0	4/9/2020	106	159	4.1	5.4	1277	9.02	7.49		0.32	72	25.7	285	11.0
bdc2.0	5/14/2020	149	181	2.4	3.4	1464	13.68	7.54	81	0.44	99	31.4	376	9.1
bdc2.0	6/11/2020	83	71	4.7	8.0	607	8.60	7.57	204	1.38	56	12.7	193	3.4
bdc2.0	7/9/2020	124	124	2.0	3.8	1105	8.30	7.48	140	0.41	70	22.7	269	7.3
bdc2.0	8/13/2020	71	65	5.0	8.6	568	15.20	7.56	548	1.51	45	11.2	158	3.8
bdc2.0	9/10/2020	89	81	7.8	9.1	723	8.98	7.62	770	0.89	51	14.4	187	5.2
bdc2.0	10/8/2020	106	79	3.7	6.9	778	10.54	7.66	167	0.54	60	15.5	215	3.4
bdc2.0	11/12/2020	143	165	5.6	4.0	1384	8.47	7.8	116	1.14	73	22.7	276	9.9
bdc2.0	12/10/2020	179	212	2.4	3.8	1656	9.66	7.98	105	0.46	142	30.3	479	7.8
bdc3.0	1/9/2020	146	135	1.0	1.0	1245	8.63	7.65	1986	0.21	77	21.6	281	11.8
bdc3.0	2/13/2020	167	676	8.3	9.9	2880	5.90	7.3	225	0.17	102	30.7	381	12.0
bdc3.0	3/12/2020	149	230	5.4	7.3	1506	8.43	7.49	194	0.3	78	25.6	301	11.9
bdc3.0	4/9/2020	226	157	3.3	4.6	1276	9.56	7.29		0.3	79	26.2	305	11.1
bdc3.0	5/14/2020	160	176	2.6	3.7	1537	14.99	7.62	127	0.29	103	33.5	395	8.8
bdc3.0	6/11/2020	93	80	4.0	6.3	722	9.40	7.62	146	1.64	56	15	202	3.8
bdc3.0	7/9/2020	132	125	2.6	7.1	1156	9.33	7.65	411	0.7	76	24.3	289	7.8
bdc3.0	8/13/2020	87	80	2.1	5.3	739	17.23	7.65	461	0.73	50	14.9	186	4.6

Appendix B. General Monthly Water Quality Parameters and Total Recoverable Iron

Location ID	Activity Start Date	ALKALINITY (mg/L)	CHLORIDE, D (mg/L)	CHLOROPHYLL-a, corr_ (ug/L)	CHLOROPHYLL-a, uncor_ (ug/L)	CONDUCTIVITY (uS/cm)	DO (mg/L)	pH (SU)	E_coli (MPN/100 mL)	IRON, Trec (mg/L)	CALCIUM, Total (mg/L)	MAGNESIUM, D (mg/L)	Hardness (mg/L)	POTASSIUM, D (mg/L)
bdc3.0	9/10/2020	96	102	4.0	5.3	912	8.88	7.44	1300	0.64	60	16.8	220	8.3
bdc3.0	10/8/2020	118	94	3.0	5.7	907	9.78	7.6	326	0.45	64	17.4	230	6.2
bdc3.0	11/12/2020	138	169	2.2	4.4	9	8.03	7.58	548	0.23	84	23.2	306	10.4
bdc3.0	12/10/2020	120	138			1175	7.93	7.67	435	0.16	83	19.9	289	11.8
bdc4.5	1/9/2020	168	160	1.0	1.4	1469	9.06	7.49	248	0.39	91	29.8	350	12.3
bdc4.5	2/13/2020	195	718	6.9	8.7	3048	6.78	7.57	219	0.42	110	43.6	454	10.6
bdc4.5	3/12/2020	166	246	6.4	9.1	1598	8.52	7.63	112	0.27	93	28.6	350	10.9
bdc4.5	4/9/2020	124	204	1.0	2.2	1651	11.85	7.56		0.18	107	37.6	422	9.7
bdc4.5	5/14/2020	161	174	2.7	3.9	1604	17.31	7.96	108	0.25	104	33.1	396	9.7
bdc4.5	6/11/2020	118	91	5.3	7.8	893	9.36	7.83	411	1.25	60	19.2	229	4.4
bdc4.5	7/9/2020	140	138	3.2	6.2	1275	12.13	8.01	140	0.36	83	27.9	323	8.4
bdc4.5	8/13/2020	105	97	2.7	6.3	928	20.78	7.83	124	0.94	63	20	240	6.3
bdc4.5	9/10/2020	117	123	3.1	6.8	1095	9.16	7.73	727	1.06	68	21.1	258	7.5
bdc4.5	10/8/2020	141	114	1.2	2.3	1160	10.62	7.77	32	0.14	81	24.5	303	6.1
bdc4.5	11/12/2020	148	171	1.6	3.1	1471	9.43	7.62	222	0.32	97	25.8	349	10.0
bdc4.5	12/10/2020	167	173			1477	10.19	7.96	184	0.43	103	29.7	379	10.9
bdc5.0	1/9/2020	194	166	2.4	4.0	1590	9.60	7.73	135	0.45	97	33.3	380	11.1
bdc5.0	2/13/2020	207	688	8.8	11.1	3096	6.88	7.77	167	0.44	117	36	440	11.8
bdc5.0	3/12/2020	167	256	10.2	15.1	1656	9.96	7.75	126	0.45	92	29.8	351	10.5
bdc5.0	4/9/2020	204	216	1.7	2.7	1880	11.79	7.83		0.29	122	47.1	499	8.4
bdc5.0	5/14/2020	165	178	4.9	6.9	1604	17.31	8.06	276	0.5	117	34.2	433	9.5
bdc5.0	6/11/2020	127	111	4.6	9.3	1089	8.98	7.83	435	1.3	76	23.8	289	5.8
bdc5.0	7/9/2020	155	145	3.8	6.1	1351	11.39	8	240	0.32	93	30	356	8.4
bdc5.0	8/13/2020	116	104	5.8	10.7	1009	19.84	7.89	308	1.6	70	22.3	267	7.4
bdc5.0	9/10/2020	125	133	4.6	7.2	1166	9.20	7.85	727	1.54	75	22.4	280	8.5
bdc5.0	10/8/2020	162	125	3.5	5.4	1334	10.93	8	101	0.14	94	30.9	363	8.7
bdc5.0	11/12/2020	158	158	1.0	2.4	1491	10.16	7.84	142	0.31	100	28.9	369	9.9
bdc5.0	12/10/2020	158	153			1413	11.14	8.21	143	0.06	104	27.3	372	10.7
bdc6.0	1/9/2020	238	171	5.5	8.0	1714	10.32	7.82	69	0.3	108	36	418	9.0
bdc6.0	2/13/2020	225	636	7.3	9.1	2963	8.28	7.99	61	0.21	122	41.7	476	9.9
bdc6.0	3/12/2020	189	278	28.1	35.1	1778	9.79	7.83	248	0.51	97	33.6	380	10.1
bdc6.0	4/9/2020	232	202	2.9	4.3	1838	13.10	7.87		0.85	122	47.7	501	8.4
bdc6.0	5/14/2020	186	177	5.5	9.5	1590	17.80	8.01	411	0.84	118	34.4	436	9.2
bdc6.0	6/11/2020	139	119	6.0	10.5	1183	9.96	7.86	461	1.94	82	25.8	312	5.8
bdc6.0	7/9/2020	181	147	5.0	8.3	1457	12.42	7.83	548	0.51	102	34.3	396	8.5
bdc6.0	8/13/2020	157	125	7.7	13.2	12	22.16	7.86	649	1.67	88	26.9	331	8.5
bdc6.0	9/10/2020	151	140	6.4	8.9	1224	9.36	7.72	866	2.31	84	24.6	312	7.9
bdc6.0	10/8/2020	206	138	7.0	9.7	1448	11.72	8.08	345	0.24	108	32.9	405	7.9
bdc6.0	11/12/2020	195	163	2.0	3.6	1578	10.59	7.81	199	0.28	108	30.4	395	8.2
bdc6.0	12/10/2020	198	185			1675	11.76	8.22	74	0.36	128	35.1	464	8.8
Count		90	90	86	86	90	90	90	82	90	90	90	90	90
Min		51	38	1	1	9	3	7	20	0	35	7	118	2
Max		317	1080	32	37	3500	22	8	2420	2	187	57	680	12
Mean		159	213	5	7	1444	10	8	189	1	92	28	345	7
15th		88	72	2	3	595	8	8	74	0	52	13	187	3
Median		158	159	4	6	1431	9	8	170	0	91	28	350	7
85th		227	316	7	10	2114	13	8	539	1	122	43	484	11

Appendix B. General Monthly Water Quality Parameters and Total Recoverable Iron

Location ID	Activity Start Date	SODIUM, D (mg/L)	SULFATE, D (mg/L)	TDS (mg/L)	TEMPERATURE (°C)	TOC (mg/L)	TSS (mg/L)	TURBIDITY (NTU)	CYANIDE, Total (mg/L)
bdc0.5	3/12/2020	221	362	1230	8.09	7.78	3.4	2.53	
bdc0.5	4/9/2020	280	480	1390	9.66		3.0	2.26	
bdc0.5	5/14/2020	258	454	1340	13.97	6.99	3.2	3.26	
bdc0.5	6/11/2020	28	60	248	14.08	2.41	28.6	18.1	0
bdc0.5	7/9/2020	46	89	339	17.14	2.99	0.0	2.92	
bdc0.5	8/13/2020	23	50	213	17.45	2.33	7.8	6.47	
bdc0.5	9/10/2020	24	50	219	14.59	2.27	10.8	7.27	0
bdc0.5	10/8/2020	24	52	197	13.74	2.19	5.2	5.61	
bdc0.5	11/12/2020	248	363	1280	1.96	8.62	3.2	1.77	
bdc0.5	12/10/2020	231	480	1400	0.91	5.01	0.0	1.67	0
bdc1.0	3/12/2020	457	404	2110	8.03	6.42	8.2	6.21	
bdc1.0	4/9/2020	228	324	1180	9.60	6.70	8.6	5.12	
bdc1.0	5/14/2020	196	280	1070	15.04	7.71	6.0	7.68	
bdc1.0	6/11/2020	35	65	283	15.30	2.79	64.9	38.4	0
bdc1.0	7/9/2020	90	182	586	18.95	4.58	14.0	11.9	
bdc1.0	8/13/2020	30	60	248	16.95	2.61	37.4	17.2	
bdc1.0	9/10/2020	46	85	322	12.08	3.88	32.8	18.7	0
bdc1.0	10/8/2020	40	82	305	12.34	2.71	12.8	9.57	
bdc1.0	11/12/2020	312	438	1610	1.62	6.49	22.4	9.35	
bdc1.5	1/9/2020	325	552	1720	1.61	4.90	6.0	6.12	
bdc1.5	3/12/2020	435	472	1980	7.34	5.99	13.2	9.21	
bdc1.5	4/9/2020	254	410	1340	8.16	6.51	2.8	4.01	
bdc1.5	5/14/2020	228	370	1250	14.50	6.76	6.4	6.36	
bdc1.5	6/11/2020	40	73	298	14.02	2.86	76.8	48.1	0
bdc1.5	7/9/2020	127	270	803	18.22	4.56	10.8	10.7	
bdc1.5	8/13/2020	36	72	277	16.97	2.98	52.0	22.8	
bdc1.5	9/10/2020	56	106	371	11.27	4.24	28.0	15.6	0
bdc1.5	10/8/2020	53	113	378	12.20	2.86	14.0	10.4	
bdc1.5	11/12/2020	337	513	1730	2.17	6.52	14.0	9.38	
bdc1.5	12/10/2020	304	560	1680	0.98	5.09	41.0	26.8	0
bdc2.0	1/9/2020	202	358	1200	5.22	5.93	45.6	25.7	
bdc2.0	2/13/2020	568	452	2580	7.80	4.51	14.4	6.46	
bdc2.0	3/12/2020	190	244	1030	10.68	7.58	8.0	6.58	
bdc2.0	4/9/2020	135	218	778	11.75	8.91	9.4	4.14	
bdc2.0	5/14/2020	159	266	902	15.83	7.54	5.4	7.3	
bdc2.0	6/11/2020	53	91	376	13.82	3.63	84.8	50.1	0
bdc2.0	7/9/2020	111	211	686	19.31	7.33	23.6	14.8	
bdc2.0	8/13/2020	20	83	336	17.59	3.54	52.2	23.2	
bdc2.0	9/10/2020	71	115	432	12.41	5.75	26.4	15	0
bdc2.0	10/8/2020	67	135	462	12.75	3.41	25.6	13.9	
bdc2.0	11/12/2020	143	216	786	8.42	7.14	22.4	14.5	
bdc2.0	12/10/2020	174	420	1240	5.23	5.95	23.6	13.3	0
bdc3.0	1/9/2020	116	246	743	10.35	8.38	16.8	9.97	
bdc3.0	2/13/2020	379	262	1590	6.15	6.66	11.8	6.43	
bdc3.0	3/12/2020	155	238	893	9.71	8.26	9.0	9.11	
bdc3.0	4/9/2020	135	242	802	11.65	8.22	10.4	5.03	
bdc3.0	5/14/2020	169	292	968	15.73	8.29	10.0	5.54	
bdc3.0	6/11/2020	67	118	439	18.30	2.33	77.2	50.5	0
bdc3.0	7/9/2020	119	241	732	22.88	7.35	46.0	25.7	
bdc3.0	8/13/2020	73	130	448	21.34	4.37	23.6	13.3	

Appendix B. General Monthly Water Quality Parameters and Total Recoverable Iron

Location ID	Activity Start Date	SODIUM, D (mg/L)	SULFATE, D (mg/L)	TDS (mg/L)	TEMPERATURE (°C)	TOC (mg/L)	TSS (mg/L)	TURBIDITY (NTU)	CYANIDE, Total (mg/L)
bdc3.0	9/10/2020	92	151	546	14.40	6.66	22.8	11.4	0
bdc3.0	10/8/2020	83	165	550	14.99	4.89	38.8	18.2	
bdc3.0	11/12/2020	140	242	854	10.51	7.49	20.0	9.84	
bdc3.0	12/10/2020	115	214	716	11.75	7.70	17.6	6.67	0
bdc4.5	1/9/2020	148	310	904	5.16	7.96	14.8	11.7	
bdc4.5	2/13/2020	397	306	1780	3.97	5.96	20.6	12	
bdc4.5	3/12/2020	165	282	979	9.07	9.19	16.6	10.1	
bdc4.5	4/9/2020	183	386	1070	10.20	7.44	4.2	2.86	
bdc4.5	5/14/2020	167	310	985	15.93	7.54	6.4	4.92	
bdc4.5	6/11/2020	89	163	548	17.89	5.22	86.8	47.1	0
bdc4.5	7/9/2020	136	278	808	21.64	8.11	22.8	13.9	
bdc4.5	8/13/2020	98	190	593	19.94	4.94	38.2	18.6	
bdc4.5	9/10/2020	121	206	671	13.30	6.86	33.6	16.1	0
bdc4.5	10/8/2020	115	240	698	14.03	5.06	6.0	4.8	
bdc4.5	11/12/2020	146	280	929	7.70	7.73	15.2	10.2	
bdc4.5	12/10/2020	156	308	920	7.93	6.95	19.6	15.7	0
bdc5.0	1/9/2020	157	364	963	2.69	7.48	22.0	15.2	
bdc5.0	2/13/2020	428	382	1830	2.06	7.17	20.2	12.7	
bdc5.0	3/12/2020	170	308	1030	8.48	7.43	25.4	18.5	
bdc5.0	4/9/2020	212	484	1280	9.80	6.76	7.2	5.35	
bdc5.0	5/14/2020	170	330	1020	17.70	7.59	16.0	10.1	
bdc5.0	6/11/2020	114	220	677	18.45	6.12	107.6	65.3	0
bdc5.0	7/9/2020	141	301	861	21.33	7.82	28.0	20.4	
bdc5.0	8/13/2020	109	216	645	21.20	6.21	57.1	26.6	
bdc5.0	9/10/2020	131	223	726	14.00	7.27	53.2	25.9	0
bdc5.0	10/8/2020	141	299	818	15.13	6.48	4.0	2.92	
bdc5.0	11/12/2020	151	306	938	7.05	7.04	13.6	9.71	
bdc5.0	12/10/2020	143	304	875	7.33	7.30	14.4	11.3	0
bdc6.0	1/9/2020	160	411	1070	1.92	7.36	25.2	25.3	
bdc6.0	2/13/2020	387	380	1740	2.25	5.20	5.4	4.5	
bdc6.0	3/12/2020	193	332	1190	7.94	7.16	46.4	20.8	
bdc6.0	4/9/2020	210	458	1220	9.71	6.20	23.4	12.3	
bdc6.0	5/14/2020	168	330	1020	17.39	7.49	28.6	14.1	
bdc6.0	6/11/2020	123	240	722	18.34	6.42	138.4	90.3	0
bdc6.0	7/9/2020	152	328	938	20.46	7.12	38.4	20.5	
bdc6.0	8/13/2020	134	276	793	20.90	6.84	63.3	29.3	
bdc6.0	9/10/2020	140	234	768	12.34	7.73	84.8	38	0
bdc6.0	10/8/2020	148	312	911	14.95	5.59	8.0	5.22	
bdc6.0	11/12/2020	151	328	1000	6.73	6.22	10.8	8.24	
bdc6.0	12/10/2020	180	380	1080	4.98	6.27	15.2	14.1	0
Count		90	90	90	90	89	90	90	23
Min		20	50	197	1	2	0	2	0
Max		568	560	2580	23	9	138	90	0
Mean		163	269	917	12	6	26	15	0
15th		54	108	377	5	4	6	5	0
Median		145	277	884	12	7	17	11	0
85th		252	408	1340	18	8	46	26	0

Appendix B. Nutrients

Location ID	Activity Start Date	NITROGEN, TOTAL (mg/L)	NO3+NO2 (mg/L)	NO2 (mg/L)	AMMONIA, Total (mg/L)	PHOSPHORUS, TOTAL (mg/L)	PHOSPHORUS, ORTHO AS P (mg/L)
BDC0.5	3/12/2020	0.91	0.33	0.00	0.06	0.04	0.000
BDC0.5	4/9/2020	0.99	0.44	0.02	0.00	0.05	0.000
BDC0.5	5/14/2020	1.08	0.31	0.02	0.00	0.07	0.000
BDC0.5	6/11/2020	0.52	0.11	0.00	0.16	0.09	0.015
BDC0.5	7/9/2020	0.65	0.37	0.00	0.00	0.05	0.012
BDC0.5	8/13/2020	0.25	0.05	0.00	0.00	0.08	0.000
BDC0.5	9/10/2020	0.40	0.08	0.00	0.04	0.07	0.012
BDC0.5	10/8/2020	0.24	0.05	0.00	0.00	0.23	0.000
BDC0.5	11/12/2020	1.14	0.68	0.02	0.00	0.09	0.000
BDC0.5	12/10/2020	2.08	1.72	0.02	0.02	0.05	0.024
BDC1.0	3/12/2020	1.19	0.20	0.00	0.00	0.11	0.000
BDC1.0	4/9/2020	0.82	0.12	0.00	0.00	0.06	0.000
BDC1.0	5/14/2020	0.99	0.24	0.02	0.15	0.11	0.016
BDC1.0	6/11/2020	0.58	0.14	0.01	0.12	0.12	0.013
BDC1.0	7/9/2020	0.76	0.25	0.00	0.00	0.11	0.011
BDC1.0	8/13/2020	0.36	0.08	0.00	0.00	0.13	0.000
BDC1.0	9/10/2020	0.55	0.15	0.00	0.02	0.09	0.011
BDC1.0	10/8/2020	0.32	0.06	0.00	0.00	0.21	0.000
BDC1.0	11/12/2020	1.03	0.38	0.01	0.00	0.11	0.000
BDC1.5	1/9/2020	2.48	2.13	0.01	0.02	0.08	0.000
BDC1.5	3/12/2020	1.64	0.86	0.00	0.05	0.09	0.000
BDC1.5	4/9/2020	1.35	0.84	0.01	0.04	0.07	0.000
BDC1.5	5/14/2020	1.50	0.77	0.04	0.15	0.06	0.000
BDC1.5	6/11/2020	0.65	0.21	0.01	0.09	0.14	0.01
BDC1.5	7/9/2020	1.36	0.85	0.01	0.00	0.06	0.01
BDC1.5	8/13/2020	0.49	0.21	0.00	0.00	0.12	0.00
BDC1.5	9/10/2020	0.70	0.27	0.00	0.03	0.13	0.00
BDC1.5	10/8/2020	0.51	0.23	0.00	0.00	0.22	0.00
BDC1.5	11/12/2020	2.10	1.45	0.01	0.00	0.10	0.00
BDC1.5	12/10/2020	2.61	2.04	0.01	0.08	0.09	0.03
BDC2.0	1/9/2020	10.64	9.72	0.24	0.37	0.15	0.03
BDC2.0	2/13/2020	8.93	7.45	0.12	0.12	0.15	0.06
BDC2.0	3/12/2020	11.17	8.94	0.31	2.18	0.38	0.04
BDC2.0	4/9/2020	14.08	13.32	0.13	0.04	0.48	0.35
BDC2.0	5/14/2020	10.71	9.82	0.20	0.10	0.12	0.04
BDC2.0	6/11/2020	2.29	1.72	0.02	0.08	0.15	0.02
BDC2.0	7/9/2020	9.76	8.42	0.12	0.02	0.13	0.03
BDC2.0	8/13/2020	2.87	2.61	0.00	0.02	0.12	0.01
BDC2.0	9/10/2020	3.82	2.93	0.01	0.05	0.13	0.02
BDC2.0	10/8/2020	1.97	1.58	0.01	0.00	0.20	0.00
BDC2.0	11/12/2020	12.44	11.28	0.05	0.03	0.14	0.03
BDC2.0	12/10/2020	10.21	9.80	0.04	0.07	0.14	0.05
BDC3.0	1/9/2020	7.63	6.12	0.05	0.15	0.82	0.34
BDC3.0	2/13/2020	6.85	5.59	0.05	0.07	0.29	0.12
BDC3.0	3/12/2020	9.62	7.39	0.18	1.20	0.44	0.21
BDC3.0	4/9/2020	12.10	11.49	0.14	0.05	1.17	0.91
BDC3.0	5/14/2020	10.20	9.46	0.23	0.14	0.17	0.10
BDC3.0	6/11/2020	2.07	1.50	0.02	0.07	0.32	0.16
BDC3.0	7/9/2020	11.12	9.30	0.16	0.05	0.20	0.06
BDC3.0	8/13/2020	3.84	3.60	0.01	0.04	0.12	0.03

Appendix B. Nutrients

Location ID	Activity Start Date	NITROGEN, TOTAL (mg/L)	NO3+NO2 (mg/L)	NO2 (mg/L)	AMMONIA, Total (mg/L)	PHOSPHORUS, TOTAL (mg/L)	PHOSPHORUS, ORTHO AS P (mg/L)
BDC3.0	9/10/2020	7.85	6.38	0.02	0.05	0.50	0.281
BDC3.0	10/8/2020	4.70	3.95	0.03	0.04	0.34	0.046
BDC3.0	11/12/2020	9.88	8.77	0.06	0.06	0.25	0.116
BDC3.0	12/10/2020	9.68	9.16	0.04	0.08	0.29	0.105
BDC4.5	1/9/2020	9.05	8.02	0.12	0.10	1.05	0.744
BDC4.5	2/13/2020	6.82	5.88	0.07	0.06	0.55	0.342
BDC4.5	3/12/2020	8.87	7.73	0.19	0.35	0.50	0.325
BDC4.5	4/9/2020	8.74	8.12	0.10	0.00	1.03	0.951
BDC4.5	5/14/2020	9.28	8.90	0.09	0.00	0.67	0.570
BDC4.5	6/11/2020	2.92	2.30	0.02	0.02	0.39	0.179
BDC4.5	7/9/2020	9.11	7.52	0.06	0.00	0.37	0.170
BDC4.5	8/13/2020	5.57	5.32	0.03	0.03	0.22	0.058
BDC4.5	9/10/2020	6.97	5.90	0.02	0.05	0.38	0.246
BDC4.5	10/8/2020	3.88	3.39	0.02	0.02	0.19	0.080
BDC4.5	11/12/2020	10.37	8.86	0.07	0.07	0.25	0.182
BDC4.5	12/10/2020	9.79	9.32	0.11	0.11	0.24	0.134
BDC5.0	1/9/2020	6.72	5.98	0.06	0.05	0.45	0.234
BDC5.0	2/13/2020	6.22	5.22	0.16	0.04	0.44	0.314
BDC5.0	3/12/2020	9.01	7.78	0.11	0.04	0.51	0.342
BDC5.0	4/9/2020	7.76	7.44	0.07	0.00	0.50	0.393
BDC5.0	5/14/2020	8.42	7.85	0.10	0.00	0.55	0.449
BDC5.0	6/11/2020	4.01	3.10	0.03	0.03	0.63	0.307
BDC5.0	7/9/2020	7.86	6.30	0.12	0.00	0.26	0.147
BDC5.0	8/13/2020	5.13	4.71	0.09	0.04	0.47	0.286
BDC5.0	9/10/2020	7.11	5.59	0.11	0.52	0.34	0.159
BDC5.0	10/8/2020	5.33	4.43	0.20	0.18	0.21	0.061
BDC5.0	11/12/2020	8.61	7.22	0.17	0.14	0.19	0.101
BDC5.0	12/10/2020	8.86	8.42	0.22	0.26	0.31	0.126
BDC6.0	1/9/2020	6.69	6.30	0.06	0.02	0.50	0.300
BDC6.0	2/13/2020	4.93	4.22	0.03	0.00	0.22	0.153
BDC6.0	3/12/2020	6.84	5.90	0.08	0.06	0.44	0.987
BDC6.0	4/9/2020	6.47	5.63	0.03	0.03	0.43	0.302
BDC6.0	5/14/2020	6.53	5.50	0.06	0.02	0.48	0.360
BDC6.0	6/11/2020	4.04	3.07	0.02	0.03	0.60	0.283
BDC6.0	7/9/2020	7.28	5.86	0.22	0.00	0.33	0.182
BDC6.0	8/13/2020	5.88	5.42	0.22	0.08	0.68	0.458
BDC6.0	9/10/2020	5.16	3.49	0.05	0.31	0.40	0.151
BDC6.0	10/8/2020	2.87	2.23	0.05	0.00	0.43	0.221
BDC6.0	11/12/2020	6.15	5.25	0.14	0.05	0.18	0.095
BDC6.0	12/10/2020	6.99	6.38	0.05	0.05	0.20	0.124
Count		90	90	90	90	90	90
Min		0.24	0.05	0.00	0.00	0.04	0.00
Max		14.08	13.32	0.31	2.18	1.17	0.99
Mean		5.23	4.45	0.06	0.10	0.29	0.15
15th		0.79	0.25	0.00	0.00	0.09	0.00
Median		5.24	4.57	0.03	0.04	0.21	0.06
85th		9.66	8.65	0.14	0.13	0.50	0.32

Appendix B. Metals

Monitoring Location ID	Activity Start Date	ARSENIC, Trec (ug/L)	BORON, Total (mg/L)	CADMIUM, D (ug/L)	CADMIUM, T (ug/L)	CHROMIUM, D (ug/L)	COPPER, D (ug/L)	IRON, D (ug/L)	LEAD, D (ug/L)	LEAD, T (ug/L)	MANGANESE, D (ug/L)	NICKEL, D (ug/L)	NICKEL, T (ug/L)	SELENIUM, D (ug/L)	SILVER, D (ug/L)	ZINC, D (ug/L)
bdc0.5	3/12/2020	0.57	0.12	0.00		0.00	2.35		0.13		1022.0	1.72		4.08	0.00	4.09
bdc0.5	6/11/2020	0.70	0.02	0.00	0.00	0.11	3.39	15.89	0.10	1.34	30.8	0.67	1.62	0.00	0.00	1.75
bdc0.5	9/10/2020	0.88	0.00	0.00	0.00	0.00	0.77	9.26	0.08	1.04	164.0	0.68	1.00	0.14	0.13	1.01
bdc0.5	11/12/2020													4.28		
bdc0.5	12/10/2020	0.53	0.19	0.00	0.00	0.00	5.23	5.61	0.14	0.65	174.0	1.86	2.04	5.83	0.00	1.57
bdc1.0	3/12/2020	1.22	0.15	0.00		0.12	2.41		0.12		937.0	2.39		4.17	0.00	1.38
bdc1.0	6/11/2020	1.62	0.03	0.00	0.00	0.09	3.22	14.07	0.12	1.80	19.3	0.73	1.99	0.00	0.00	2.24
bdc1.0	9/10/2020	0.78	0.02	0.00	0.07	0.00	0.94	15.92	0.10	1.94	32.8	0.97	1.71	0.35	0.13	1.36
bdc1.0	11/12/2020													3.79		
bdc1.5	3/12/2020	0.81	0.21	0.00		0.00	15.03		0.13		755.0	2.27		6.83	0.00	1.24
bdc1.5	6/11/2020	1.16	0.03	0.00	0.00	0.10	1.80	18.24	0.11	1.35	18.9	0.74	1.73	0.00	0.00	1.12
bdc1.5	9/10/2020	0.93	0.04	0.00	0.00	0.00	1.16	16.32	0.12	1.61	19.5	1.10	1.60	0.90	0.12	1.40
bdc1.5	11/12/2020													6.31		
bdc1.5	12/10/2020	0.66	0.30	0.00	0.00	0.00	4.94	5.74	0.10	0.61	120.0	2.37	2.10	8.33	0.00	1.12
bdc2.0	3/12/2020	0.51	0.18	0.00		0.15	7.07		0.15		176.0	2.09		4.46	0.00	7.25
bdc2.0	6/11/2020	1.17	0.08	0.00	0.00	0.11	3.47	16.17	0.12	1.96	15.7	0.92	2.40	0.25	0.00	2.37
bdc2.0	9/10/2020	0.81	0.08	0.00	0.00	0.14	1.23	19.27	0.12	1.47	13.1	1.34	1.76	1.46	0.08	3.32
bdc2.0	11/12/2020													3.16		
bdc2.0	12/10/2020	0.43	0.26	0.00	0.00	0.00	4.23	24.56	0.15	1.64	52.3	2.41	2.17	6.42	0.00	9.27
bdc3.0	3/12/2020	0.42	0.18	0.00		0.23	4.01		0.22		108.0	1.85		3.78	0.00	25.06
bdc3.0	6/11/2020	1.08	0.09	0.00	0.05	0.00	4.36	15.45	0.10	2.18	18.8	0.95	2.71	0.79	0.00	4.62
bdc3.0	9/10/2020	0.69	0.13	0.00	0.00	0.13	2.72	16.66	0.13	1.13	19.5	1.50	1.71	1.90	0.10	14.15
bdc3.0	11/12/2020													2.97		
bdc3.0	12/10/2020	0.41	0.22	0.00	0.06	0.20	3.08	43.90	0.35	0.49	43.6	1.78	1.73	2.51	0.00	39.70
bdc4.5	3/12/2020	0.75	0.20	0.00		0.16	5.33		0.21		87.7	2.04		3.90	0.00	21.82
bdc4.5	6/11/2020	1.19	0.12	0.00	0.00	0.11	3.94	14.83	0.13	1.78	19.4	1.13	2.57	1.53	0.00	4.42
bdc4.5	9/10/2020	0.95	0.15	0.00	0.00	0.13	1.96	18.77	0.13	1.62	17.9	1.76	2.35	2.40	0.16	9.07
bdc4.5	11/12/2020													5.33		
bdc4.5	12/10/2020	0.40	0.26	0.06	0.00	0.14	3.96	25.24	0.29	0.64	36.1	2.20	1.76	4.74	0.00	34.00
bdc5.0	3/12/2020	0.64	0.21	0.00		0.15	2.64		0.19		66.2	2.36		4.27	0.00	18.97
bdc5.0	6/11/2020	1.45	0.16	0.00	0.07	0.00	2.15	12.68	0.12	1.69	23.4	1.52	3.27	2.28	0.00	7.35
bdc5.0	9/10/2020	1.01	0.19	0.00	0.00	0.19	2.22	22.31	0.24	2.18	24.9	2.01	2.66	2.91	0.19	12.01
bdc5.0	11/12/2020													4.64		
bdc5.0	12/10/2020	0.37	0.27	0.00	0.00	0.15	4.00	26.58	0.38	0.09	23.7	2.35	1.46	3.40	0.00	33.90
bdc6.0	3/12/2020	0.68	0.23	0.06		0.13	2.71		0.20		76.2	2.44		4.40	0.00	17.69
bdc6.0	6/11/2020	1.77	0.18	0.00	0.07	0.13	4.05	18.56	0.17	2.69	18.3	1.94	4.17	1.80	0.05	9.80
bdc6.0	9/10/2020	1.24	0.19	0.06	0.07	0.12	2.47	20.05	0.21	4.43	15.4	2.54	3.61	2.29	0.08	9.62
bdc6.0	11/12/2020													4.19		
bdc6.0	12/10/2020	0.43	0.29	0.00	0.00	0.09	2.63	12.96	0.24	0.69	21.2	2.57	2.21	6.42	0.00	21.10
Count		31	31	31	23	31	31	23	31	23	31.0	31	23	39	31	31
Min		0.37	0.00	0.00	0.00	0.00	0.77	5.61	0.08	0.09	13.1	0.67	1.00	0.00	0.00	1.01
Max		1.77	0.30	0.06	0.07	0.23	15.03	43.90	0.38	4.43	1022.0	2.57	4.17	8.33	0.19	39.70
Mean		0.85	0.15	0.01	0.02	0.09	3.53	17.78	0.16	1.52	134.5	1.72	2.19	3.26	0.03	10.44
15th		0.43	0.04	0.00	0.00	0.00	1.88	12.76	0.11	0.64	18.6	0.94	1.65	0.66	0.00	1.37
Median		0.78	0.18	0.00	0.00	0.11	3.08	16.32	0.13	1.61	30.8	1.85	2.04	3.40	0.00	7.25
85th		1.21	0.25	0.00	0.07	0.15	4.65	23.89	0.23	2.11	169.0	2.38	2.70	5.48	0.11	21.46

Appendix B. Mercury Data

Location ID	Activity Start Date	MERCURY, Trec ($\mu\text{g/L}$)
bdc1.5	2/26/2020	0.0027
bdc1.5	5/7/2020	0.0032
bdc1.5	8/6/2020	0.0030
bdc1.5	11/5/2020	0.0011
Count		4
Min		0.0011
Max		0.0032
Mean		0.0025
15th		0.0018
Median		0.0029
85th		0.0031

Appendix B. Instantaneous Flow Measurements

Location ID	Activity Start Date	FLOW (cfs)
bdc0.5	6/11/2020	66.04
bdc0.5	7/9/2020	2.08
bdc0.5	8/13/2020	32.40
bdc0.5	9/10/2020	21.50
bdc0.5	10/8/2020	11.31
bdc1.0	6/11/2020	83.15
bdc1.0	7/9/2020	1.56
bdc1.0	8/13/2020	29.91
bdc1.0	9/10/2020	23.70
bdc1.0	10/8/2020	9.81
bdc1.5	6/11/2020	67.27
bdc1.5	7/9/2020	2.55
bdc1.5	8/13/2020	24.31
bdc1.5	9/10/2020	24.80
bdc1.5	10/8/2020	11.38
bdc2.0	1/9/2020	2.98
bdc2.0	3/12/2020	7.94
bdc2.0	7/9/2020	8.18
bdc2.0	9/10/2020	40.83
bdc2.0	10/8/2020	14.90
bdc2.0	11/12/2020	10.32
bdc2.0	12/10/2020	missing
bdc3.0	1/9/2020	8.02
bdc3.0	2/13/2020	14.66
bdc3.0	3/12/2020	21.38
bdc3.0	6/11/2020	46.05
bdc3.0	7/9/2020	7.49
bdc3.0	8/13/2020	14.43
bdc3.0	9/10/2020	38.30
bdc3.0	10/8/2020	17.58
bdc3.0	11/12/2020	16.23
bdc6.0	1/9/2020	18.70
bdc6.0	2/13/2020	17.50
bdc6.0	3/12/2020	22.40
bdc6.0	5/14/2020	39.80
bdc6.0	6/11/2020	30.20
bdc6.0	7/9/2020	31.30
bdc6.0	8/13/2020	21.10
bdc6.0	9/10/2020	69.30
bdc6.0	10/8/2020	34.50
bdc6.0	11/12/2020	27.20

Appendix C. Big Dry Creek 2020 Quality Control (QC) Samples

Appendix C. Big Dry Creek 2020 QC Samples

Activity Start Date	Characteristic Name	Result Detection Condition	Result Value	Result Unit	Method Detection Limit (MDL)	Minimum Level / Lower Reporting Level (ML/LRL)	Result Detection Limit Unit	Field Blank Comment
3/12/2020	Alkalinity, Total		1.00	mg/L	1	1	mg/L	Poured at bdc6.0
3/12/2020	Ammonia	Non-detect	0.02	mg/L	0.02	0.05	mg/L	Poured at bdc2.0
3/12/2020	Ammonia	Non-detect	0.02	mg/L	0.02	0.05	mg/L	Poured at bdc6.0
3/12/2020	Arsenic, Total Recoverable	Non-detect	0.07	ug/L	0.07	0.1	ug/L	Poured at bdc6.0
3/12/2020	Boron	Non-detect	0.01	mg/L	0.01	0.01	mg/L	Poured at bdc6.0
3/12/2020	Cadmium, Dissolved	Non-detect	0.05	ug/L	0.05	0.1	ug/L	Poured at bdc6.0
3/12/2020	Calcium		0.00	mg/L	1	1	mg/L	Poured at bdc6.0
3/12/2020	Carbon, Total Organic		0.38	mg/L	0.25	0.25	mg/L	Poured at bdc6.0
3/12/2020	Chloride		0.29	mg/L	0.5	0.5	mg/L	Poured at bdc6.0
3/12/2020	Chlorophyll-a		1.0	ug/L	1	1	ug/L	Poured at bdc6.0
3/12/2020	Chlorophyll-a, corrected		1.0	ug/L	1	1	ug/L	Poured at bdc6.0
3/12/2020	Chromium, Dissolved	Non-detect	0.09	ug/L	0.09	0.1	ug/L	Poured at bdc6.0
3/12/2020	Copper, Dissolved		0.78	ug/L	0.1	0.1	ug/L	Poured at bdc6.0
3/12/2020	E. coli	Non-detect	1	MPN/100 mL	1	1	MPN/100 mL	Poured at bdc6.0
3/12/2020	Iron, Total Recoverable		0.00	mg/L	0.05	0.05	mg/L	Poured at bdc6.0
3/12/2020	Lead, Dissolved		0.14	ug/L	0.05	0.1	ug/L	Poured at bdc6.0
3/12/2020	Magnesium		0.01	mg/L	1	1	mg/L	Poured at bdc6.0
3/12/2020	Manganese, Dissolved		0.06	ug/L	0.05	0.1	ug/L	Poured at bdc6.0
3/12/2020	Nickel, Dissolved	Non-detect	0.07	ug/L	0.07	0.1	ug/L	Poured at bdc6.0
3/12/2020	Nitrogen, Total as N	Non-detect	0.03	mg/L	0.03	0.1	mg/L	Poured at bdc2.0
3/12/2020	Nitrogen, Total as N	Non-detect	0.03	mg/L	0.03	0.1	mg/L	Poured at bdc6.0
3/12/2020	Nitrogen, Nitrite as N	Nondetect	0.00	mg/L	0.01	0.01	mg/L	Poured at bdc6.0
3/12/2020	Phosphorus, Total as P		0.03	mg/L	0.01	0.01	mg/L	Poured at bdc2.0
3/12/2020	Phosphorus, Total as P		0.05	mg/L	0.01	0.01	mg/L	Poured at bdc6.0
3/12/2020	Phosphorus, Orthophosphate as P	Non-detect	0.00	mg/L	0.01	0.01	mg/L	Poured at bdc6.0
3/12/2020	Potassium	Non-detect	0.01	mg/L	0.5	0.5	mg/L	Poured at bdc6.0
3/12/2020	Selenium, Dissolved		0.11	ug/L	0.1	0.1	ug/L	Poured at bdc6.0
3/12/2020	Silver, Dissolved	Non-detect	0.05	ug/L	0.05	0.05	ug/L	Poured at bdc6.0
3/12/2020	Sodium	Non-detect	0.72	mg/L	1	1	mg/L	Poured at bdc6.0
3/12/2020	Solids, Total Dissolved		3	mg/L	1	1	mg/L	Poured at bdc6.0
3/12/2020	Solids, Total Suspended	Non-detect	2	mg/L	2	2	mg/L	Poured at bdc6.0
3/12/2020	Sulfate	Non-detect	0.34	mg/L	1	1	mg/L	Poured at bdc6.0
3/12/2020	Turbidity		0.11	NTU	0.1	0.1	NTU	Poured at bdc6.0
3/12/2020	Zinc, Dissolved	Non-detect	0.3	ug/L	0.3	1	ug/L	Poured at bdc6.0
9/10/2020	Ammonia	Non-detect	0.02	mg/L	0.02	0.05	mg/L	Poured at bdc2.0
9/10/2020	Nitrogen, Total as N		0.031	mg/L	0.03	0.1	mg/L	Poured at bdc2.0
9/10/2020	Phosphorus, Total as P		0.088	mg/L	0.008	0.025	mg/L	Poured at bdc2.0

Appendix C. Big Dry Creek 2020 QC Samples

Location	Sample Date	Characteristic Name	Method Species	SampleFr action	Result Detection Condition	Analysis Value_0	Result Value	Result Unit	Minimum Level / Lower Reporting Level (ML/LRL)	Method Detection Limit (MDL)	QC_Type	Comment	RPD
bdc2.0	3/12/2020	Ammonia as N, Total	as N	Total		2.14	2.14	mg/L	0.05	0.02	Field Replicate		1%
bdc2.0	3/12/2020	Ammonia as N, Total	as N	Total		2.18	2.18	mg/L	0.05	0.02	Not Applicable		
bdc2.0	3/12/2020	Nitrogen, Total as N	as N	Total		11.17	11.17	mg/L	0.1	0.03	Not Applicable		1%
bdc2.0	3/12/2020	Nitrogen, Total as N	as N	Total		11.49	11.49	mg/L	0.1	0.03	Field Replicate		
bdc2.0	3/12/2020	NO3+NO2 as N	as N			8.39	8.39	mg/L			Field Replicate	Calculated Result	3%
bdc2.0	3/12/2020	NO3+NO2 as N	as N			8.94	8.94	mg/L			Not Applicable	Calculated Result	
bdc2.0	3/12/2020	Phosphorus, Total as P	as P	Total		0.18	0.18	mg/L	0.01	0.01	Field Replicate	Samples were re-analyzed by Colorado Analytical on 4/2/20. Results were confirmed (0.19). - David	35%
bdc2.0	3/12/2020	Phosphorus, Total as P	as P	Total		0.38	0.38	mg/L	0.01	0.01	Not Applicable	Samples were re-analyzed by Colorado Analytical on 4/2/20. Results were confirmed (0.39). - David	
bdc1.5	6/11/2020	Iron, Total Recoverable				0.83	0.83	mg/L	0.05	0.05	Not Applicable		1%
bdc1.5	6/11/2020	Iron, Total Recoverable				0.81	0.81	mg/L	0.05	0.05	Field Replicate		
bdc1.5	6/11/2020	Selenium, Dissolved		Dissolved	Non-detect	0.00	0.10	ug/L	0.1	0.1	Field Replicate		0%
bdc1.5	6/11/2020	Selenium, Dissolved		Dissolved	Non-detect	0.00	0.10	ug/L	0.1	0.1	Not Applicable		
bdc2.0	6/11/2020	Ammonia as N, Total	as N	Total		0.08	0.08	mg/L	0.05	0.02	Field Replicate		1%
bdc2.0	6/11/2020	Ammonia as N, Total	as N	Total		0.08	0.08	mg/L	0.05	0.02	Not Applicable		
bdc2.0	6/11/2020	E. coli				204	204	MPN/100 mL		1	Not Applicable	RPD with reason for E. coli.	28%
bdc2.0	6/11/2020	E. coli				365	365	MPN/100 mL		1	Field Replicate		
bdc2.0	6/11/2020	Nitrogen, Total as N	as N	Total		2.29	2.29	mg/L	0.1	0.03	Not Applicable		6%
bdc2.0	6/11/2020	Nitrogen, Total as N	as N	Total		2.03	2.03	mg/L	0.1	0.03	Field Replicate		
bdc2.0	6/11/2020	NO3+NO2 as N	as N			1.72	1.72	mg/L			Not Applicable	Calculated Result	7%
bdc2.0	6/11/2020	NO3+NO2 as N	as N			1.49	1.49	mg/L			Field Replicate	Calculated Result	
bdc2.0	6/11/2020	Phosphorus, Total as P	as P	Total		0.15	0.15	mg/L	0.01	0.01	Not Applicable		4%
bdc2.0	6/11/2020	Phosphorus, Total as P	as P	Total		0.14	0.14	mg/L	0.01	0.01	Field Replicate		
bdc2.0	8/13/2020	Ammonia as N, Total	as N	Total		0.02	0.02	mg/L	0.05	0.02	Not Applicable	Values both below RL; RPD not noteworthy.	33%
bdc2.0	9/10/2020	Ammonia as N, Total	as N	Total		0.04	0.04	mg/L	0.05	0.02	Field Replicate		
bdc2.0	9/10/2020	Nitrogen, Total as N	as N	Total		3.84	3.84	mg/L	0.1	0.03	Field Replicate		0%
bdc2.0	9/10/2020	Nitrogen, Total as N	as N	Total		3.82	3.82	mg/L	0.1	0.03	Not Applicable		
bdc2.0	9/10/2020	NO3+NO2 as N	as N			2.93	2.93	mg/L			Not Applicable	Calculated Result	1%
bdc2.0	9/10/2020	NO3+NO2 as N	as N			2.96	2.96	mg/L			Field Replicate	Calculated Result	
bdc2.0	9/10/2020	Phosphorus, Total as P	as P	Total		0.13	0.13	mg/L	0.025	0.008	Not Applicable		0%
bdc2.0	9/10/2020	Phosphorus, Total as P	as P	Total		0.12	0.12	mg/L	0.025	0.008	Field Replicate		
bdc5.0	9/10/2020	Alkalinity, Total		Total		Missing	0.00	mg/L	1	1	Field Replicate		Missing Replicate
bdc5.0	9/10/2020	Alkalinity, Total		Total		125.00	125.00	mg/L	1	1	Not Applicable		
bdc5.0	9/10/2020	Ammonia as N, Total	as N	Total		0.52	0.52	mg/L	0.05	0.02	Not Applicable		0%
bdc5.0	9/10/2020	Ammonia as N, Total	as N	Total		0.52	0.52	mg/L	0.05	0.02	Field Replicate		
bdc5.0	9/10/2020	Arsenic, Total Recoverable		Total Recoverable		1.01	1.01	ug/L	0.1	0.07	Not Applicable		0%
bdc5.0	9/10/2020	Arsenic, Total Recoverable		Total Recoverable		1.02	1.02	ug/L	0.1	0.07	Field Replicate		
bdc5.0	9/10/2020	Boron		Total		0.19	0.19	mg/L	0.01	0.01	Not Applicable	CO Analytical	3%
bdc5.0	9/10/2020	Boron		Total		0.18	0.18	mg/L	0.01	0.01	Field Replicate	CO Analytical	
bdc5.0	9/10/2020	Cadmium, Dissolved		Dissolved	Non-detect	0.00	0.05	ug/L	0.1	0.05	Field Replicate		0%
bdc5.0	9/10/2020	Cadmium, Dissolved		Dissolved	Non-detect	0.00	0.05	ug/L	0.1	0.05	Not Applicable		
bdc5.0	9/10/2020	Cadmium, Total		Total	Non-detect	0.00	0.05	ug/L	0.1	0.05	Field Replicate	Both values below RL with one non-detect. RPD not noteworthy.	100%
bdc5.0	9/10/2020	Cadmium, Total		Total		0.09	0.09	ug/L	0.1	0.05	Field Replicate		
bdc5.0	9/10/2020	Calcium		TOTAL		77.20	77.20	mg/L	1	1	Field Replicate		1%
bdc5.0	9/10/2020	Calcium		TOTAL		75.20	75.20	mg/L	1	1	Not Applicable		
bdc5.0	9/10/2020	Carbon, Total Organic		Total		7.64	7.64	mg/L	0.25	0.25	Field Replicate		2%
bdc5.0	9/10/2020	CARBON, TOTAL ORGANIC		Total		7.27	7.27	mg/L	0.25	0.25	Not Applicable		
bdc5.0	9/10/2020	Chloride		Dissolved		133.00	133.00	mg/L	5	0.5	Field Replicate		0%
bdc5.0	9/10/2020	Chloride		Dissolved		133.00	133.00	mg/L	5	0.5	Not Applicable		
bdc5.0	9/10/2020	Chlorophyll-a		Total	Non-detect	Missing	0.00	ug/L	1	1	Field Replicate		Missing Replicate
bdc5.0	9/10/2020	Chlorophyll-a		Total		7.20	7.20	ug/L	1	1	Not Applicable		
bdc5.0	9/10/2020	Chlorophyll-a, corrected		Total		4.60	4.60	ug/L	1	1	Not Applicable		Missing Replicate
bdc5.0	9/10/2020	Chlorophyll-a, corrected		Total	Non-detect	Missing	0.00	ug/L	1	1	Field Replicate		
bdc5.0	9/10/2020	Chromium, Dissolved		Dissolved		0.19	0.19	ug/L	0.1	0.09	Not Applicable		19%
bdc5.0	9/10/2020	Chromium, Dissolved		Dissolved		0.13	0.13	ug/L	0.1	0.09	Field Replicate		
bdc5.0	9/10/2020	Conductivity				1166.00	1166.00	uS/cm	0.5	0.5	Not Applicable		0%
bdc5.0	9/10/2020	Conductivity				1169.00	1169.00	uS/cm	0.5	0.5	Field Replicate		
bdc5.0	9/10/2020	Copper, Dissolved		Dissolved		2.63	2.63	ug/L	0.1	0.1	Field Replicate		8%
bdc5.0	9/10/2020	Copper, Dissolved		Dissolved		2.22	2.22	ug/L	0.1	0.1	Not Applicable		
bdc5.0	9/10/2020	Cyanide		Total	Non-detect	0.00	0.01	mg/L	0.005	0.005	Field Replicate		0%
bdc5.0	9/10/2020	Cyanide		Total	Non-detect	0.00	0.01	mg/L	0.005	0.005	Not Applicable		
bdc5.0	9/10/2020	Dissolved Oxygen		Dissolved		9.23	9.23	mg/L	0	0	Field Replicate		0%
bdc5.0	9/10/2020	Dissolved Oxygen		Dissolved		9.20	9.20	mg/L	0	0	Not Applicable		

Appendix D. Big Dry Creek 2020 QC Samples

Location	Sample Date	Characteristic Name	Method Species	SampleFr action	Result Detection Condition	Analysis Value_0	Result Value	Result Unit	Minimum Level / Lower Reporting Level (ML/LRL)	Method Detection Limit (MDL)	QC_Type	Comment	RPD
bdc5.0	9/10/2020	E. coli				816	816	MPN/100 mL		1	Field Replicate		6%
bdc5.0	9/10/2020	E. coli				727	727	MPN/100 mL		1	Not Applicable		
bdc5.0	9/10/2020	Iron, Total Recoverable				22.31	22.31	ug/L	1	0.3	Not Applicable		5%
bdc5.0	9/10/2020	Iron, Total Recoverable				20.10	20.10	ug/L	1	0.3	Field Replicate		
bdc5.0	9/10/2020	Iron, Total Recoverable				1.39	1.39	mg/L	0.05	0.05	Field Replicate		5%
bdc5.0	9/10/2020	Iron, Total Recoverable				1.54	1.54	mg/L	0.05	0.05	Not Applicable		
bdc5.0	9/10/2020	Lead, Dissolved		Dissolved		0.24	0.24	ug/L	0.1	0.05	Not Applicable		4%
bdc5.0	9/10/2020	Lead, Dissolved		Dissolved		0.22	0.22	ug/L	0.1	0.05	Field Replicate		
bdc5.0	9/10/2020	Lead, Total		Total		2.18	2.18	ug/L	0.1	0.05	Not Applicable		7%
bdc5.0	9/10/2020	Lead, Total		Total		1.91	1.91	ug/L	0.1	0.05	Field Replicate		
bdc5.0	9/10/2020	Magnesium		Dissolved		22.40	22.40	mg/L	1	1	Not Applicable		1%
bdc5.0	9/10/2020	Magnesium		Dissolved		22.10	22.10	mg/L	1	1	Field Replicate		
bdc5.0	9/10/2020	Manganese, Dissolved		Dissolved		24.90	24.90	ug/L	0.1	0.05	Not Applicable		1%
bdc5.0	9/10/2020	Manganese, Dissolved		Dissolved		25.50	25.50	ug/L	0.1	0.05	Field Replicate		
bdc5.0	9/10/2020	Nickel, Dissolved		Dissolved		2.01	2.01	ug/L	0.1	0.07	Not Applicable		4%
bdc5.0	9/10/2020	Nickel, Dissolved		Dissolved		1.85	1.85	ug/L	0.1	0.07	Field Replicate		
bdc5.0	9/10/2020	Nickel, Total		Total		2.63	2.63	ug/L	0.1	0.07	Field Replicate		1%
bdc5.0	9/10/2020	Nickel, Total		Total		2.66	2.66	ug/L	0.1	0.07	Not Applicable		
bdc5.0	9/10/2020	Nitrogen, Total as N	as N	Total		7.18	7.18	mg/L	0.1	0.03	Field Replicate		0%
bdc5.0	9/10/2020	Nitrogen, Total as N	as N	Total		7.11	7.11	mg/L	0.1	0.03	Not Applicable		
bdc5.0	9/10/2020	Nitrogen, Nitrite (NO2)		Dissolved		0.12	0.12	mg/L	0.01	0.01	Field Replicate		1%
bdc5.0	9/10/2020	Nitrogen, Nitrite (NO2)		Dissolved		0.11	0.11	mg/L	0.01	0.01	Not Applicable		
bdc5.0	9/10/2020	NO3+NO2 as N	as N	Total		5.64	5.64	mg/L			Field Replicate	Calculated Result	0%
bdc5.0	9/10/2020	NO3+NO2 as N	as N	Total		5.59	5.59	mg/L			Not Applicable	Calculated Result	
bdc5.0	9/10/2020	pH				7.88	7.88	su	0	0	Field Replicate		0%
bdc5.0	9/10/2020	pH				7.85	7.85	su	0	0	Not Applicable		
bdc5.0	9/10/2020	Phosphorus, Total as P	as P	Total		0.32	0.32	mg/L	0.025	0.008	Field Replicate		3%
bdc5.0	9/10/2020	Phosphorus, Total as P	as P	Total		0.34	0.34	mg/L	0.025	0.008	Not Applicable		
bdc5.0	9/10/2020	Phosphorus, Orthophosphate as P		Dissolved		0.16	0.16	mg/L	0.01	0.01	Not Applicable		1%
bdc5.0	9/10/2020	Phosphorus, Orthophosphate as P		Dissolved		0.16	0.16	mg/L	0.01	0.01	Field Replicate		
bdc5.0	9/10/2020	Potassium		Dissolved		8.45	8.45	mg/L	0.5	0.5	Not Applicable		0%
bdc5.0	9/10/2020	Potassium		Dissolved		8.39	8.39	mg/L	0.5	0.5	Field Replicate		
bdc5.0	9/10/2020	Selenium, Dissolved		Dissolved		2.91	2.91	ug/L	0.1	0.1	Not Applicable		11%
bdc5.0	9/10/2020	Selenium, Dissolved		Dissolved		2.35	2.35	ug/L	0.1	0.1	Field Replicate		
bdc5.0	9/10/2020	Silver, Dissolved		Dissolved		0.19	0.19	ug/L	0.05	0.05	Not Applicable		3%
bdc5.0	9/10/2020	Silver, Dissolved		Dissolved		0.18	0.18	ug/L	0.05	0.05	Field Replicate		
bdc5.0	9/10/2020	Sodium		Dissolved		131.00	131.00	mg/L	1	1	Not Applicable		1%
bdc5.0	9/10/2020	Sodium		Dissolved		128.00	128.00	mg/L	1	1	Field Replicate		
bdc5.0	9/10/2020	Solids, Total Dissolved		Filterable		721.00	721.00	mg/L	1	1	Field Replicate		0%
bdc5.0	9/10/2020	Solids, Total Dissolved		Filterable		726.00	726.00	mg/L	1	1	Not Applicable		
bdc5.0	9/10/2020	Solids, Total Suspended		Total		53.20	53.20	mg/L	2	2	Not Applicable		0%
bdc5.0	9/10/2020	Solids, Total Suspended		Total		53.20	53.20	mg/L	2	2	Field Replicate		
bdc5.0	9/10/2020	Sulfate		Dissolved		224.00	224.00	mg/L	10	1	Field Replicate		0%
bdc5.0	9/10/2020	Sulfate		Dissolved		223.00	223.00	mg/L	10	1	Not Applicable		
bdc5.0	9/10/2020	Temperature				14.00	14.00	°C	0	0	Not Applicable		0%
bdc5.0	9/10/2020	Temperature				14.01	14.01	°C	0	0	Field Replicate		
bdc5.0	9/10/2020	Turbidity		Total		26.70	26.70	NTU	0.1	0.1	Field Replicate		2%
bdc5.0	9/10/2020	Turbidity		Total		25.90	25.90	NTU	0.1	0.1	Not Applicable		
bdc5.0	9/10/2020	Zinc, Dissolved		Dissolved		12.01	12.01	ug/L	1	0.3	Not Applicable		1%
bdc5.0	9/10/2020	Zinc, Dissolved		Dissolved		12.31	12.31	ug/L	1	0.3	Field Replicate		
bdc1.5	12/10/2020	Iron, Total Recoverable				0.46	0.46	mg/L	0.05	0.05	Field Replicate		1%
bdc1.5	12/10/2020	Iron, Total Recoverable				0.47	0.47	mg/L	0.05	0.05	Not Applicable		
bdc1.5	12/10/2020	Selenium, Dissolved		Dissolved		8.33	8.33	ug/L	0.1	0.1	Not Applicable		9%
bdc1.5	12/10/2020	Selenium, Dissolved		Dissolved		9.98	9.98	ug/L	0.1	0.1	Field Replicate		
bdc2.0	12/10/2020	Ammonia as N, Total	as N	Total		0.07	0.07	mg/L	0.05	0.02	Not Applicable		3%
bdc2.0	12/10/2020	Ammonia as N, Total	as N	Total		0.07	0.07	mg/L	0.05	0.02	Field Replicate		
bdc2.0	12/10/2020	E. coli				108	108	MPN/100 mL		1	Field Replicate		1%
bdc2.0	12/10/2020	E. coli				105	105	MPN/100 mL		1	Not Applicable		
bdc2.0	12/10/2020	Nitrogen, Total as N	as N	Total		10.20	10.20	mg/L	0.1	0.03	Field Replicate		0%
bdc2.0	12/10/2020	Nitrogen, Total as N	as N	Total		10.21	10.21	mg/L	0.1	0.03	Not Applicable		
bdc2.0	12/10/2020	NO3+NO2 as N	as N	Total		9.90	9.90	mg/L			Field Replicate	Calculated Result	0%
bdc2.0	12/10/2020	NO3+NO2 as N	as N	Total		9.80	9.80	mg/L			Not Applicable	Calculated Result	
bdc2.0	12/10/2020	Phosphorus, Total as P	as P	Total		0.13	0.13	mg/L	0.025	0.008	Field Replicate		7%
bdc2.0	12/10/2020	Phosphorus, Total as P	as P	Total		0.14	0.14	mg/L	0.025	0.008	Not Applicable		

Appendix D. 2020 WWTP Discharge Samples for Broomfield, Westminster and Northglenn Collected for CDPS Discharge Monitoring Reports

Appendix D. Broomfield WWTP Sampling Data for 2020

NPDES 2020 permit Daily 1/1/2020 - 12/31/2020	Effluent TSS mg/L	Effluent cBod mg/L	Effluent Phosphorus Total mg/L	Effluent Ammonia mg/L	Effluent Nitrate + Nitrite mg/L	Effluent TKN mg/L	Effluent Total Inorganic Nitrogen mg/L	Effluent Total Nitrogen mg/L	Effluent Alkalinity mg/L	Effluent COD mg/L	Plnt Ef WAD CYANIDE ug/L	Effluent E.COLI #/100ML	Effluent Flow MGD
1/1/2020				0.75	17.1		17.9						1.17
1/2/2020	3.00	2.26	0.07	0.25	18.7	1	18.9	19.9	60.6			1	1.07
1/3/2020				0.18	18.4		18.6						1.22
1/4/2020				0.23	18.9		19.1						1.19
1/5/2020													1.09
1/6/2020				0.1	17.3		17.4					2	1.73
1/7/2020			0.17	0.084	18	1	18.1	19.1	53.2	30	<1.000	3.1	1.09
1/8/2020				0.22	19.4		19.6						1.43
1/9/2020	4.00	2.22	0.13	0.54	20.5	1.7	21	22.7					1.36
1/10/2020				0.33	21.3		21.6						1.25
1/11/2020													4.92
1/12/2020													5.94
1/13/2020				0.23	16.4		16.6					3.1	4.82
1/14/2020			0.04	0.22	14.8	3.6	15	18.6	73.2				3.95
1/15/2020	2.63	1.89		0.491	17		17.5					2.6	5.51
1/16/2020			0.12	0.88	18.3	3.03	19.2	22.23					5.51
1/17/2020				0.47	18.5		19						5.53
1/18/2020													5.39
1/19/2020													5.56
1/20/2020				0.14	15.7		15.8						5.82
1/21/2020			0.1	0.15	16.1	1.82	16.2	18.02	66.6			1	5.71
1/22/2020	4.00	2.50		0.19	17.7		17.9						5.66
1/23/2020			0.02	0.4	18.8	1.61	19.2	20.81					5.52
1/24/2020				0.29	18.7		19						5.83
1/25/2020													5.68
1/26/2020													5.46
1/27/2020				0.12	16.3		16.4					1	2.88
1/28/2020			0.04	0.063	16.8	1.05	16.9	17.95	58				2.23
1/29/2020	4.00	2.52		1.92	18		19.9						2.07
1/30/2020			0.05	1.77	18.9	3.27	20.7	23.97					1.65
1/31/2020				0.78	18.4		19.2						1.88
2/1/2020													1.80
2/2/2020													2.24
2/3/2020				0.22	15.8		16					2	4.02
2/4/2020			0.15	0.065	13.6	1.47	13.7	15.17	53				2.60
2/5/2020	3.07	2.49		0.2	15.6		15.8						1.61
2/6/2020			0.03	0.36	17.6	1.68	18	19.68					1.35
2/7/2020				0.13	17.3		17.4						1.22
2/8/2020													1.44
2/9/2020													1.28
2/10/2020	2.59			0.1	14.7		14.8					1	1.75
2/11/2020			0.1	0.12	15.2	3.25	15.3	18.55	52.8				1.37
2/12/2020	2.60	1.19		0.16	17.1		17.3						1.62
2/13/2020			0.28	0.36	17.4	3.83	17.8	21.63		31			1.36
2/14/2020	2.33			0.73	18.8		19.5						1.55
2/15/2020													1.49
2/16/2020													1.53
2/17/2020				0.18	15.5		15.7						1.46
2/18/2020			0.06	0.11	14	3.4	14.1	17.5	72.2			1	1.43
2/19/2020	2.47	2.08		0.14	17.6		17.7						1.45
2/20/2020			0.29	0.17	20.8	0.48	21	21.48					1.50
2/21/2020				0.92	19.9		20.8						1.43
2/22/2020													1.53
2/23/2020													1.38
2/24/2020				0.1	16.6		16.7					5.2	1.78
2/25/2020			0.11	0.13	14.2	0.85	14.3	15.15	69.2				1.38

Appendix D. Broomfield WWTP Sampling Data for 2020

NPDES 2020 permit Daily 1/1/2020 - 12/31/2020	Effluent TSS mg/L	Effluent cBod mg/L	Effluent Phosphorus Total mg/L	Effluent Ammonia mg/L	Effluent Nitrate + Nitrite mg/L	Effluent TKN mg/L	Effluent Total Inorganic Nitrogen mg/L	Effluent Total Nitrogen mg/L	Effluent Alkalinity mg/L	Effluent COD mg/L	Plnt Ef WAD CYANIDE ug/L	Effluent E.COLI #/100ML	Effluent Flow MGD
2/26/2020	3.00	2.83		1.01	14.5		15.5						1.60
2/27/2020			0.37	2.31	14.9	3.67	17.2	20.87					1.41
2/28/2020				2.89	17.8		20.7						1.45
2/29/2020													1.36
3/1/2020													1.67
3/2/2020				0.1	14.1		14.2					1	1.88
3/3/2020			0.1	0.08	13.6	2.33	13.7	16.03	70				1.58
3/4/2020	3.00	2.60		0.09	17.1		17.2						1.57
3/5/2020			0.35	0.85	16.9	6.53	17.8	24.33					1.41
3/6/2020				0.38	16.7		17.1						3.07
3/7/2020													5.74
3/8/2020													5.74
3/9/2020				0.13	14.8		14.9					2	5.52
3/10/2020			0.05	0.15	12.4	1.89	12.6	14.49	75.6	29			5.28
3/11/2020	3.00	2.28		0.17	13.6		13.8						6.35
3/12/2020			0.1	0.65	14.1	2.19	14.7	16.89					5.32
3/13/2020				1.46	15.6		17.1						5.65
3/14/2020													6.28
3/15/2020													2.88
3/16/2020				0.03	13.4		13.4					2	1.45
3/17/2020			0.1	0.36	12.7	2.26	13.1	15.36	87.8				1.59
3/18/2020	1.00	2.23		0.53	13.2		13.7						1.50
3/19/2020			0.07	1.69	16.1	3.27	17.8	21.07					2.88
3/20/2020				3.2	14.6		17.8						2.92
3/21/2020													2.16
3/22/2020													2.89
3/23/2020				1.45	10.4		11.9					2	4.42
3/24/2020	1.00	2.68	0.04	1.5	11.1	3.33	12.6	15.93	127	36			4.71
3/25/2020				1.5	14.3		15.8						5.20
3/26/2020			0.04	2.8	15.6	3.8	18.4	22.2					6.72
3/27/2020				2.13	16.8		18.9						5.70
3/28/2020													6.24
3/29/2020													6.24
3/30/2020				0.27	13.9		14.2					7.5	6.05
3/31/2020			0.12	0.12	13.5	2	13.6	15.6	105				5.88
4/1/2020	2.00	3.11		0.16	15		15.2						5.82
4/2/2020			0.07	0.55	16.4	2.42	16.9	19.32					5.87
4/3/2020				0.61	19.2		19.8						5.93
4/4/2020													5.76
4/5/2020													6.02
4/6/2020				0.17	16.3		16.5					1	5.98
4/7/2020			0.07	0.13	16.8	2.97	16.9	19.87	77.2	21			5.86
4/8/2020	3.00	2.18		0.5	18.7		19.2						4.54
4/9/2020			1.08	0.15	18.8	3.32	19	22.32					5.44
4/10/2020				0.46	19.9		20.4						5.15
4/11/2020													5.58
4/12/2020													5.99
4/13/2020				0.16	16.1		16.3					7.4	6.25
4/14/2020			0.05	0.18	14.7	2.21	14.9	17.11	85				5.82
4/15/2020	3.00	2.37		0.14	15.6		15.7						5.05
4/16/2020			0.03	0.16	16.8	2.89	17	19.89					7.32
4/17/2020				0.72	14.7		15.4						6.05
4/18/2020													7.13
4/19/2020													7.31
4/20/2020			0.15	0.14	11.6		11.7					2	6.94
4/21/2020				0.28	12.1	4.73	12.4	17.13	139				6.56

Appendix D. Broomfield WWTP Sampling Data for 2020

NPDES 2020 permit Daily 1/1/2020 - 12/31/2020	Effluent TSS mg/L	Effluent cBod mg/L	Effluent Phosphorus Total mg/L	Effluent Ammonia mg/L	Effluent Nitrate + Nitrite mg/L	Effluent TKN mg/L	Effluent Total Inorganic Nitrogen mg/L	Effluent Total Nitrogen mg/L	Effluent Alkalinity mg/L	Effluent COD mg/L	Plnt Ef WAD CYANIDE ug/L	Effluent E.COLI #/100ML	Effluent Flow MGD
4/22/2020	4.00	2.03	0.04	1.35	12.7		14.1						6.70
4/23/2020			0.14	0.49	13.3	10.3	13.8	24.1					6.68
4/24/2020				0.18	13.5		13.7						5.29
4/25/2020													5.71
4/26/2020													6.17
4/27/2020			0.08	0.39	14.7		15.1					5.2	5.92
4/28/2020				0.29	13.6	2.23	13.9	16.13	115				5.02
4/29/2020	2.00	1.94	0.06	0.14	14.8		14.9						5.12
4/30/2020			0.05	0.24	16.2	1.32	16.4	17.72					6.09
5/1/2020				0.17	16.4		16.6						6.07
5/2/2020													5.65
5/3/2020													6.27
5/4/2020			0.1	0.26	14.1		14.4						5.99
5/5/2020				0.21	13.3	1.7	13.5	15.2	115				5.87
5/6/2020	2.10	1.49	0.07	0.33	16.5		16.7					4.2	5.71
5/7/2020			0.07	0.18	16.2	0.85	16.4	17.25					5.95
5/8/2020				0.24	16.3		16.5						5.99
5/9/2020													5.98
5/10/2020													5.81
5/11/2020			0.08	0.24	14.8	2.8	15	17.8				2	6.12
5/12/2020				0.56	14.2	3.04	14.8	17.84	101				5.76
5/13/2020	3.00	1.95	0.07	0.37	15.9		16.3						5.70
5/14/2020			0.07	0.31	15.9	1.62	16.2	17.82					5.76
5/15/2020				0.31	15.4		15.7						5.87
5/16/2020													5.91
5/17/2020													5.95
5/18/2020			0.04	0.16	16.4	2.86	16.6	19.46				1	5.97
5/19/2020				0.17	15.2		15.4		95		<1.000		5.96
5/20/2020	2.00	1.59	0.09	0.15	16.4	1.8	16.6	18.4					5.77
5/21/2020			0.09	0.14	17.3	1.57	17.4	18.97					5.91
5/22/2020				0.21	18.1		18.3						6.09
5/23/2020													5.43
5/24/2020													6.30
5/25/2020			0.09	0.24	15.2	2.2	15.4	17.6					6.41
5/26/2020				0.14	12.6		12.7		108			1	6.14
5/27/2020	2.00	1.29	0.04	0.13	13.1	0.89	13.2	14.09		20			6.28
5/28/2020			0.08	0.12	14.2	1.88	14.3	16.18					6.83
5/29/2020				0.12	14.6		14.7						6.08
5/30/2020													5.88
5/31/2020													6.03
6/1/2020	2.20		0.1	0.14	14.6	2.23	14.7	16.93				1	6.24
6/2/2020				0.16	12.3		12.5		90.6				5.91
6/3/2020	1.80	2.15	0.08	0.2	13.5	1.81	13.7	15.51					6.24
6/4/2020			0.08	0.41	14.2	2.51	14.6	17.11					5.92
6/5/2020	2.00			0.51	14.5		15						6.10
6/6/2020													5.74
6/7/2020													7.21
6/8/2020			0.1	0.2	12.4	1.11	12.6	13.71				2	6.22
6/9/2020				0.15	12.4		12.6		106				6.22
6/10/2020	2.07	1.69	0.02	0.12	12.9	1.88	13	14.88		31			6.57
6/11/2020			0.02	0.16	13.4	1.39	13.6	14.99					6.12
6/12/2020				0.11	13		13.1						6.06
6/13/2020													5.99
6/14/2020													6.11
6/15/2020			0.04	0.28	12.3	2.88	12.6	15.48				2	6.01
6/16/2020				0.48	12.8		13.3		98				6.56

Appendix D. Broomfield WWTP Sampling Data for 2020

NPDES 2020 permit Daily 1/1/2020 - 12/31/2020	Effluent TSS mg/L	Effluent cBod mg/L	Effluent Phosphorus Total mg/L	Effluent Ammonia mg/L	Effluent Nitrate + Nitrite mg/L	Effluent TKN mg/L	Effluent Total Inorganic Nitrogen mg/L	Effluent Total Nitrogen mg/L	Effluent Alkalinity mg/L	Effluent COD mg/L	Plnt Ef WAD CYANIDE ug/L	Effluent E.COLI #/100ML	Effluent Flow MGD
6/17/2020	3.00	1.83	0.09	1.63	13	3.83	14.6	18.43					6.24
6/18/2020			0.08	0.72	13.5	2.38	14.2	16.58					6.04
6/19/2020				0.64	14		14.6						6.26
6/20/2020													5.97
6/21/2020													6.10
6/22/2020			0.06	0.54	13	2.97	13.5	16.47				1	6.54
6/23/2020				0.75	12.3		13		96.4				6.49
6/24/2020	2.00	1.24	0.04	0.27	12.1	2.64	12.4	15.04					6.00
6/25/2020			0.07	0.12	13.9	3.11	14	17.11					5.96
6/26/2020				0.43	14		14.4						6.27
6/27/2020													6.07
6/28/2020													6.09
6/29/2020			0.09	0.38	13.2	2.02	13.6	15.62				3.1	6.37
6/30/2020				0.39	13.4		13.8		97.8				6.23
7/1/2020	1.60	1.18	0.04	0.18	13.4	1.89	13.6	15.49					6.35
7/2/2020			0.06	0.21	14.3	1.29	14.5	15.79					5.81
7/3/2020				0.21	14		14.2						5.76
7/4/2020													5.66
7/5/2020													5.87
7/6/2020			0.06	0.29	14.1	2.01	14.4	16.41				3.1	5.89
7/7/2020				0.22	14		14.2		88.6				6.34
7/8/2020	1.78	1.31	0.07	0.7	14.1	2.57	14.8	17.37					6.07
7/9/2020			0.05	0.17	13.9	1.56	14.1	15.66					5.93
7/10/2020				0.33	14.6		14.9						5.81
7/11/2020													5.70
7/12/2020													6.13
7/13/2020	1.73		0.1	0.54	15	6.63	15.5	22.13				2	6.10
7/14/2020				0.18	14.5		14.7		78		1.3		6.39
7/15/2020	1.40	1.40	0.1	0.4	14.5	1.4	14.9	16.3					5.87
7/16/2020			0.14	0.14	14.2	3.73	14.3	18.03					5.77
7/17/2020	1.93			0.21	14.9		15.1						5.77
7/18/2020													5.36
7/19/2020													5.87
7/20/2020			0.15	0.3	14.5	1.93	14.8	16.73				1	5.88
7/21/2020				0.22	14.4		14.6		76				5.78
7/22/2020	2.67	3.16	0.08	0.17	16	2.17	16.2	18.37		30			6.24
7/23/2020			0.07	0.37	15.7	1.91	16.1	18.01					6.08
7/24/2020				0.35	17.3		17.6						5.92
7/25/2020													6.00
7/26/2020													6.02
7/27/2020			0.06	0.16	15.5	0.68	15.7	16.38					6.08
7/28/2020				0.15	15.1		15.3		80				6.01
7/29/2020	1.35	2.22	0.07	0.212	17.2	0.61	17.4	18.01				3.6	5.97
7/30/2020			0.07	0.21	17.5	4.33	17.7	22.03					5.85
7/31/2020				0.27	17.6		17.9						5.86
8/1/2020													5.78
8/2/2020													5.88
8/3/2020			0.07	0.18	15.7	0.52	15.9	16.42				2	5.99
8/4/2020				0.16	16.8		17		70.4				5.85
8/5/2020	2.00	4.55	0.09	0.13	18	0.94	18.1	19.04					5.96
8/6/2020			0.08	0.17	18.5	0.68	18.7	19.38					5.74
8/7/2020				0.17	17.3		17.5						5.76
8/8/2020													5.57
8/9/2020													5.74
8/10/2020			0.12	0.15	16.3	0.15	16.5	16.65				5.1	5.89
8/11/2020				0.16	19.6		19.8		57.6				5.81

Appendix D. Broomfield WWTP Sampling Data for 2020

NPDES 2020 permit Daily 1/1/2020 - 12/31/2020	Effluent TSS mg/L	Effluent cBod mg/L	Effluent Phosphorus Total mg/L	Effluent Ammonia mg/L	Effluent Nitrate + Nitrite mg/L	Effluent TKN mg/L	Effluent Total Inorganic Nitrogen mg/L	Effluent Total Nitrogen mg/L	Effluent Alkalinity mg/L	Effluent COD mg/L	Plnt Ef WAD CYANIDE ug/L	Effluent E.COLI #/100ML	Effluent Flow MGD
8/12/2020	3.80	7.19	0.19	0.46	20	1.17	20.5	21.67					5.73
8/13/2020			0.12	0.2	17.5	0.36	17.7	18.06					5.64
8/14/2020				0.15	17		17.1						5.69
8/15/2020													6.69
8/16/2020													6.96
8/17/2020			0.13	0.15	16.8	3.01	17	20.01				4.1	6.12
8/18/2020				0.22	19.5		19.7		64				6.03
8/19/2020	2.80	6.57	0.09	0.12	19	0.33	19.1	19.43		36			5.91
8/20/2020			0.12	0.1	19.2	0.6	19.3	19.9					5.89
8/21/2020				0.13	17.2		17.3						6.04
8/22/2020													5.76
8/23/2020													5.92
8/24/2020			0.09	0.15	13.7	0.88	13.8	14.68				11.2	3.66
8/25/2020				0.15	15.1		15.3		79				2.02
8/26/2020	2.63	6.88	0.05	0.13	15.7	0.74	15.8	16.54					5.21
8/27/2020			0.06	0.13	15.9	1.3	16	17.3					1.58
8/28/2020				0.16	16.7		16.9						1.64
8/29/2020													1.73
8/30/2020													1.85
8/31/2020			0.07	0.16	15	3.33	15.2	18.53				2	1.73
9/1/2020				0.13	14.2		14.3		81.4				1.38
9/2/2020	2.40	4.38	0.08	0.13	15.1	0.12	15.2	15.32					1.19
9/3/2020			0.06	0.17	15.5	0.13	15.7	15.83					1.43
9/4/2020				0.12	15.9		16						1.03
9/5/2020													1.08
9/6/2020													3.48
9/7/2020			0.07	0.13	15.3	0.3	15.4	15.7					6.04
9/8/2020				0.16	13.2		13.4		90			70	6.76
9/9/2020	2.47	3.18	0.09	0.2	14	0.2	14.2	14.4					6.28
9/10/2020			0.08	0.17	13.5	0.12	13.7	13.82					6.03
9/11/2020				1.12	15.9		17						5.43
9/12/2020													4.13
9/13/2020													4.17
9/14/2020			0.17	0.13	14.6	0.37	14.7	15.07				1	4.13
9/15/2020				0.16	13		13.2						3.04
9/16/2020	3.30	4.75	0.13	0.15	13.6	0.69	13.7	14.39		27			3.95
9/17/2020			0.1	0.16	14.7	<0.07	14.9		90.2				3.65
9/18/2020				0.17	13.3		13.5						3.28
9/19/2020													3.33
9/20/2020													3.54
9/21/2020			0.1	0.19	13.4	1.26	13.6	14.86				1	3.80
9/22/2020				0.12	12.7		12.8		106				3.62
9/23/2020	4.30	4.11	0.07	0.15	13.1	<0.07	13.2						2.71
9/24/2020			0.08	0.15	12.9	4.73	13.1	17.83					2.49
9/25/2020				0.14	12.2		12.3						1.93
9/26/2020													1.37
9/27/2020													1.09
9/28/2020			0.08	0.15	12.5	0.55	12.6	13.15				2	1.57
9/29/2020				0.11	12.4		12.5		89				1.46
9/30/2020	2.00	2.74	0.06	0.1	13.2	0.54	13.3	13.84					1.22
10/1/2020			0.07	0.15	13.1	0.43	13.3	13.73					1.47
10/2/2020				0.2	16.6		16.8						2.11
10/3/2020													2.83
10/4/2020													1.62
10/5/2020			0.06	0.11	12.9	1.28	13	14.28				3	1.49
10/6/2020				0.09	12.2		12.3		96				2.00

Appendix D. Broomfield WWTP Sampling Data for 2020

NPDES 2020 permit Daily 1/1/2020 - 12/31/2020	Effluent TSS mg/L	Effluent cBod mg/L	Effluent Phosphorus Total mg/L	Effluent Ammonia mg/L	Effluent Nitrate + Nitrite mg/L	Effluent TKN mg/L	Effluent Total Inorganic Nitrogen mg/L	Effluent Total Nitrogen mg/L	Effluent Alkalinity mg/L	Effluent COD mg/L	Plnt Ef WAD CYANIDE ug/L	Effluent E.COLI #/100ML	Effluent Flow MGD
10/7/2020	1.60	2.46	0.07	0.16	13.8	0.35	14	14.35					1.58
10/8/2020			0.14	0.22	11.8	1.24	12	13.24					2.77
10/9/2020				0.2	13.2		13.4						1.47
10/10/2020													2.53
10/11/2020													3.24
10/12/2020			0.1	0.38	14	1.83	14.4	16.23				2	2.83
10/13/2020				0.24	14.2		14.4		86.2				2.83
10/14/2020	2.00	2.57	0.04	0.1	15.5	1.53	15.6	17.13					1.90
10/15/2020			0.04	0.13	15.5	0.32	15.6	15.92					2.21
10/16/2020				0.1	15.6		15.7						3.94
10/17/2020													4.05
10/18/2020													4.56
10/19/2020			0.08	0.27	14.1	0.32	14.4	14.72				2	4.52
10/20/2020				0.15	12.8		13		74				2.38
10/21/2020	1.80	2.67	0.06	0.15	15.9	0.19	16.1	16.29					2.54
10/22/2020			0.04	0.13	16.2	0.34	16.3	16.64					2.56
10/23/2020				0.13	15.3		15.4						3.70
10/24/2020													3.21
10/25/2020													3.59
10/26/2020			0.11	0.38	15.2	1.57	15.6	17.17				2	4.14
10/27/2020				0.34	13.2		13.5		66.4				3.62
10/28/2020	1.67	1.62	0.17	0.11	15.3	0.76	15.4	16.16					3.77
10/29/2020			0.04	0.1	14.6	<0.07	14.7						3.63
10/30/2020				0.09	14.9		15			27			3.60
10/31/2020													3.97
11/1/2020													3.58
11/2/2020			0.09	0.42	16.4	3.07	16.8	19.87				2	2.82
11/3/2020				0.16	14		14.2		67.2		<3.000		1.68
11/4/2020	1.87	2.54	0.15	0.19	15.2	0.99	15.4	16.39					2.41
11/5/2020			0.07	0.22	15.4	5.77	15.6	21.37					2.58
11/6/2020				0.19	15.7		15.9						1.91
11/7/2020													2.80
11/8/2020													2.39
11/9/2020			0.12	0.22	13.9	1.38	14.1	15.48				2	2.65
11/10/2020				0.11	14.3		14.4		65				2.48
11/11/2020	1.47	2.00	0.09	0.12	14.7	0.56	14.8	15.36					2.08
11/12/2020			0.09	0.17	14.3	0.74	14.5	15.24					2.21
11/13/2020				0.14	14.7		14.8						1.72
11/14/2020													2.33
11/15/2020													2.64
11/16/2020	2.20		0.1	0.24	13.9	0.69	14.1	14.79		14		3	2.35
11/17/2020				0.14	13.3		13.4		68.6				2.59
11/18/2020	1.60	2.72	0.1	0.12	13.4	0.71	13.5	14.21					1.60
11/19/2020			0.08	0.16	15.6	0.85	15.8	16.65					1.40
11/20/2020	1.70			0.16	16		16.2						2.58
11/21/2020													2.61
11/22/2020													3.06
11/23/2020			0.11	0.27	15.3	0.25	15.6	15.85				1	2.83
11/24/2020				0.15	15.3		15.5		59.8				2.96
11/25/2020	2.07	0.89	0.06	0.99	15.2	1.32	16.2	17.52					3.03
11/26/2020			0.13	0.23	14.8	0.76	15	15.76					2.73
11/27/2020				0.23	12.5		12.7						2.54
11/28/2020													2.43
11/29/2020													2.26
11/30/2020			0.11	0.38	14.6	0.41	15	15.41				3.1	2.54
12/1/2020				0.11	14		14.1		57.6				1.66

Appendix D. Broomfield WWTP Sampling Data for 2020

NPDES 2020 permit Daily 1/1/2020 - 12/31/2020	Effluent TSS mg/L	Effluent cBod mg/L	Effluent Phosphorus Total mg/L	Effluent Ammonia mg/L	Effluent Nitrate + Nitrite mg/L	Effluent TKN mg/L	Effluent Total Inorganic Nitrogen mg/L	Effluent Total Nitrogen mg/L	Effluent Alkalinity mg/L	Effluent COD mg/L	Plnt Ef WAD CYANIDE ug/L	Effluent E.COLI #/100ML	Effluent Flow MGD
12/2/2020	1.20	2.06	0.09	0.11	14.8	0.29	14.9	15.19					1.45
12/3/2020			0.06	0.1	14.7	0.65	14.8	15.45					1.76
12/4/2020				0.11	15.7		15.8						1.55
12/5/2020													0.87
12/6/2020													1.41
12/7/2020			0.1	0.14	16.4	0.5	16.5	17				3.1	1.06
12/8/2020				0.072	15.6		15.7		42.2				0.96
12/9/2020	1.40	1.46	0.05	0.13	17	0.19	17.1	17.29					1.03
12/10/2020			0.09	0.18	16.3	1.14	16.5	17.64					0.88
12/11/2020				0.11	16.8		16.9						0.85
12/12/2020													1.07
12/13/2020													1.47
12/14/2020			0.08	0.13	16.5	0.25	16.6	16.85		27		1.6	1.31
12/15/2020				0.081	14.9		15		53.6				1.15
12/16/2020	1.87	1.73	0.06	0.204	16	0.37	16.2	16.57					1.01
12/17/2020			0.07	0.1	16.2	0.28	16.3	16.58					0.86
12/18/2020				0.12	16.9		17						0.92
12/19/2020													1.02
12/20/2020													0.86
12/21/2020			0.08	0.14	17.6	0.53	17.7	18.23				3.1	0.78
12/22/2020				0.11	15.3		15.4		53.2				0.92
12/23/2020	1.93	1.32	0.1	0.085	14.9	0.45	15	15.45					0.83
12/24/2020			0.11	0.32	14.7	1.07	15	16.07					1.29
12/25/2020				0.33	17.2		17.5						0.69
12/26/2020													0.54
12/27/2020													0.85
12/28/2020			0.12	0.16	13.1	0.91	13.3	14.21				1	1.18
12/29/2020				0.16	12.4		12.6		54.2				1.32
12/30/2020	1.73	1.32	0.07	0.1	13.9	0.25	14	14.25					1.20
12/31/2020			0.08	0.3	14.3	0.76	14.6	15.36					1.07

City of Westminster - Big Dry Creek Wastewater Treatment Facility - 2020

	E004 ANTIMONY (TOTAL)	E004 ARSENIC (TOTAL)	E004 BERYLLIUM (TR)	E004 CADMIUM (TOTAL)	E004 CHROMIUM (TOTAL)	E004 COPPER (TOTAL)	E004 IRON (TR)	E004 LEAD (TOTAL)	E004 MERCURY (TOTAL)	E004 MOLYBDENUM (TOTAL)	E004 NICKEL (TOTAL)	E004 SELENIUM (TOTAL)	E004 SILVER (TOTAL)	E004 THALLIUM (TOTAL)	E004 ZINC (TOTAL)	E004 BORON (TOTAL)	E004 CYANIDE (TOTAL)	E004 PHENOLS (TOTAL)
Method Number	200.8	200.8	200.8	200.8	200.8	200.8	200.7	200.8	1631c	200.8	200.8	200.8	200.8	200.8	200.8	SM4500 B B	SM4500 CN E	420.2
Units	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ng/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(mg/L)	(ug/L)	(ug/L)
Frequency	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	2x/Month	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly
Sample Date																		
1/7/2020							35											
1/14/2020							35											
2/4/2020							34											
2/18/2020		< 0.6	< 0.1	< 0.1	< 1.5	4.8	35	0.3		2.6	1.5	< 0.8	< 0.50		51	0.20		< 15
2/19/2020									1.78								< 5	
3/3/2020							50											
3/10/2020							40											
4/7/2020							21											
4/14/2020							15											
5/5/2020							25											
5/19/2020		< 0.6	< 0.1	< 0.1	< 1.5	5.0	52	0.2		3.0	1.6	1.0	< 0.5		57	0.21		< 15
5/20/2020									3.70								< 5	
6/2/2020							44											
6/9/2020							46											
7/7/2020							126											
7/14/2020							139											
8/4/2020							90											
8/11/2020							64											
9/1/2020							36											
9/8/2020		< 0.6	< 0.1	< 0.1	< 1.5	6.4	72	0.2	1.17	3.2	2.0	1.4	< 0.5		47	0.20		< 15
9/9/2020																	< 5	
10/6/2020		< 0.6	< 0.1	< 0.1	< 1.5	5.3	105	0.2	1.83	3.0	2.0	1.8	< 0.5		46	0.12		< 15
10/7/2020																	< 5	
10/13/2020							103											
11/3/2020							65											
11/10/2020							67											
12/1/2020							40											
12/8/2020							43											
Average							57.58											
Maximum	0.0	< 0.6	< 0.10	< 0.10	< 1.5	6.4	139	0.30	3.70	3.2	2.0	< 1.8	< 0.50	0.00	57	0.21	< 5	< 15
Minimum	0.0	< 0.6	< 0.1	< 0.1	< 1.5	4.8	15	0.20	1.17	2.6	1.5	< 0.8	< 0.5	0	46	0.12	< 5	< 15

NOTE: If some values for a parameter were <(X), (X) was used in calculating the average.

	E004 CADMIUM (PD)	E004 COPPER (PD)	E004 LEAD (PD)	E004 MANGANESE (PD)	E004 NICKEL (PD)	E004 SELENIUM (PD)	E004 SILVER (PD)	E004 ZINC (PD)	E004 CYANIDE (WAD)
Method Number	200.9	200.7	200.7	200.7	200.7	200.8	200.8	200.7	SM4500 CN E
Units	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
Frequency	Quarterly	Quarterly	Quarterly	2x/Month	Monthly	Monthly	Monthly	Monthly	Quarterly
Sample Date									
1/7/2020				27.4				1.9	
1/14/2020				31.2					
2/4/2020				55.2					
2/18/2020		4.8		56.8		< 0.8			
2/19/2020									
3/3/2020				108.0		1.7			
3/10/2020				71.5					
4/7/2020				31.5		4.5			
4/14/2020				18.3					
5/5/2020				24.9					
5/19/2020		4.5		40.0		1.0			
5/20/2020									
6/2/2020				40.8		3.2			
6/9/2020				46.8					
7/7/2020				64.6		2.3			
7/14/2020				63.4					
8/4/2020				43.4		2.1			
8/11/2020				129.2					
9/1/2020				9.9					
9/8/2020		5.4		16.2		1.4			
9/9/2020									
10/6/2020		4.9		48.0		1.7			
10/7/2020									
10/13/2020				49.5					
11/3/2020				43.1		1.7			
11/10/2020				52.1					
12/1/2020				18.9		1.6			
12/8/2020				13.8					
Average				46.0		< 1.99			
Maximum	0	5.4	0	129.2	0.0	4.5	0	0	0
Minimum	0	4.5	0	9.9	0.0	< 0.8	0	0	0

NOTE: If some values for a parameter were <(X), (X) was used in calculating the average.

Appendix D. Northglenn WWTP Sampling Data for 2020

		UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007
		Flow MGD	pH SU Grab Daily	E. coli MPN/100 mL Grab Weekly	Ammonia mg/L as N Comp. 3xWeek Method TMA-001	NO2 mg/L as N Comp. 3xWeek Method TMA-001	NO3 mg/L as N Comp. 3xWeek Method TMA-001	TIN mg/L as N Comp. 3xWeek Method TMA-001	WAD - CN ug/L Grab 2x Monthly	Boron (T) mg/L Composite 2x Monthly
	Sum flows									
Sunday, April 26, 2020										
27-Apr	0.00									
28-Apr	0.00									
29-Apr	1.14	1.14	7.12		0.29	0.26	4.83	5.38	<5	0.31
30-Apr	1.14	1.14	7.04		0.27	0.36	5.30	5.93		
1-May	1.14	1.14	6.93		0.25	0.36	4.63	5.24		
2-May	1.14	1.14	7.11							
Sunday, May 3, 2020	1.14	1.14	6.99		0.36	0.26	4.59	5.21		
4-May	1.14	1.14	7.01							
5-May	1.14	1.14	7.02	2.0	0.13	0.22	4.60	4.95		
6-May	1.14	1.14	6.98							
7-May	1.14	1.14	7.17		0.22	0.24	5.48	5.94	<5	0.22
8-May	1.14	1.14	7.00							
9-May	1.14	1.14	7.03							
Sunday, May 10, 2020	1.14	1.14	7.02		0.29	0.18	5.53	6.00		
11-May	1.14	1.14	7.15	3.1	0.21	0.24	5.32	5.77		
12-May	1.14	1.14	7.13							
13-May	1.14	1.14	7.14							
14-May	1.14	1.14	7.81		0.15	0.25	5.04	5.44		
15-May	1.14	1.14	7.17							
16-May	1.14	1.14	7.20							
Sunday, May 17, 2020	1.14	1.14	7.20		0.53	0.30	5.50	6.33		
18-May	1.14	1.14	7.09	2.0	0.62	0.42	5.48	6.52		
19-May	1.14	1.14	7.19							
20-May	1.62	1.62	7.03							
21-May	1.62	1.62	7.73		0.49	0.51	5.58	6.58	<5	0.4
22-May	1.62	1.62	7.01							
23-May	1.62	1.62	7.01							
Sunday, May 24, 2020	1.62	1.62	7.03							
25-May	1.62	1.62	6.96		0.92	0.42	5.49	6.83		
26-May	1.62	1.62	6.92	1.0	0.65	0.49	4.99	6.13		
27-May	1.62	1.62	7.00		0.31	0.36	5.04	5.71		
28-May	1.62	1.62	7.14							
29-May	1.62	1.62	7.18							
30-May	1.62	1.62	7.10							
Sunday, May 31, 2020	1.62	1.62	7.25		1.39	0.82	2.34			
1-Jun	1.11	1.11	7.24	1.0	2.07	0.68	2.86	5.61		
2-Jun	0.97	0.97	7.25							
3-Jun	0.97	0.97	7.20		0.12	0.31	5.74	6.17	<5	0.09
4-Jun	0.97	0.97	7.19							
5-Jun	0.97	0.97	7.19							
6-Jun	0.97	0.97	7.23							
Sunday, June 7, 2020	0.97	0.97	7.31		0.75	0.69	4.43	5.87		
8-Jun	0.97	0.97	7.26	1.0	0.42	0.57	4.96	5.95		
9-Jun	0.97	0.97	7.41							
10-Jun	0.97	0.97	7.25							
11-Jun	0.97	0.97	7.29		0.10	0.21	4.19	4.50		
12-Jun	0.97	0.97	7.30							
13-Jun	0.97	0.97	7.56							
Sunday, June 14, 2020	0.97	0.97	7.14		0.12	0.16	5.26	5.54		
15-Jun	0.97	0.97	7.04	3.1	0.11	0.21	4.95	5.27		
16-Jun	0.97	0.97	7.12							
17-Jun	0.97	0.97	7.09		0.16	0.26	5.42	5.84	<5	0.29
18-Jun	0.97	0.97	7.24							
19-Jun	0.97	0.97	7.26							
20-Jun	0.00	0.00								
Sunday, June 21, 2020	0.00	0.00								

Appendix D. Northglenn WWTP Sampling Data for 2020

		UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007
		Flow MGD	pH SU Grab Daily	E. coli MPN/100 mL Grab Weekly	Ammonia mg/L as N Comp. 3xWeek Method TMA-001	NO2 mg/L as N Comp. 3xWeek Method TMA-001	NO3 mg/L as N Comp. 3xWeek Method TMA-001	TIN mg/L as N Comp. 3xWeek Method TMA-001	WAD - CN ug/L Grab 2x Monthly	Boron (T) mg/L Composite 2x Monthly
	Sum flows									
22-Jun	0.00	0.00								
23-Jun	0.00	0.00								
24-Jun	0.00	0.00								
25-Jun	0.00	0.00								
26-Jun	0.00	0.00								
27-Jun	0.00	0.00								
Sunday, June 28, 2020	0.00	0.00								
29-Jun	0.00	0.00								
30-Jun	1.62	1.62	7.65		0.12	0.27	5.43	5.82		
1-Jul	1.62	1.62	7.75	4.1		0.47	6.23	6.70	<5	0.28
2-Jul	1.62	1.62	7.68			0.43	8.03	8.46		
3-Jul	1.62	1.62	7.77							
4-Jul	1.62	1.62	7.77							
Sunday, July 5, 2020	1.62	1.62	7.32		0.22	0.44	7.21	7.87		
6-Jul	1.62	1.62	7.09	8.4	0.63	0.86	7.91	9.40		
7-Jul	1.62	1.62	7.04							
8-Jul	2.26	2.26	7.38							
9-Jul	2.26	2.26	7.13		0.35	0.84	7.26	8.45	<5	0.33
10-Jul	2.26	2.26	7.13							
11-Jul	2.26	2.26	7.33							
Sunday, July 12, 2020	2.26	2.26	7.20		0.31	0.64	6.54	7.49		
13-Jul	2.26	2.26	7.10	5.2	0.44	0.77	6.24	7.45		
14-Jul	2.26	2.26	7.31		0.16	0.49	6.35	7.00		
15-Jul	2.26	2.26	7.13							
16-Jul	2.26	2.26	7.31							
17-Jul	2.26	2.26	7.20							
18-Jul	2.26	2.26	7.24							
Sunday, July 19, 2020	2.26	2.26	7.21		0.24	0.58	3.85	4.67		
20-Jul	2.26	2.26	6.99	6.2	0.28	0.66	3.51	4.45		
21-Jul	2.26	2.26	7.10		0.22	0.66	3.36	4.24		
22-Jul	2.26	2.26	7.17							
23-Jul	2.26	2.26	7.30							
24-Jul	2.26	2.26	7.96							
25-Jul	2.26	2.26	7.94							
Sunday, July 26, 2020	2.26	2.26	7.19		0.65	0.96	4.89	6.50		
27-Jul	2.26	2.26	7.69	1.0	0.78	1.09	4.34	6.21		
28-Jul	2.26	2.26	7.90		0.32	0.79	4.73	5.84		
29-Jul	2.58	2.58	7.48							
30-Jul	2.58	2.58	7.40							
31-Jul	2.58	2.58	7.35							
1-Aug	2.71	2.71	7.34							
Sunday, August 2, 2020	3.72	2.70	6.60		1.14	1.23	5.19	7.56		0.32
3-Aug	4.23	2.73	8.80	8.5	1.20	1.45	4.87	7.52	<5	
4-Aug	4.10	2.74	7.80		1.98	1.11	4.77	7.86		
5-Aug	4.10	2.72	7.26							
6-Aug	4.15	2.77	6.99							
7-Aug	4.02	2.62	7.09							
8-Aug	3.97	2.60	7.08							
Sunday, August 9, 2020	4.12	2.74	7.00		0.11	1.14	5.71	6.96		
10-Aug	3.98	2.71	7.01	6.3	1.50	0.79	6.32	8.61		
11-Aug	3.96	2.63	7.05							
12-Aug	4.29	2.68	6.97							
13-Aug	4.29	2.63	7.02		0.53	1.69	7.51	9.73		
14-Aug	4.38	2.69	7.07							
15-Aug	4.40	2.67	7.00							
Sunday, August 16, 2020	4.37	2.65	6.95		1.81	1.54	6.89	10.24		0.27
17-Aug	4.30	2.58	6.97	10.9					<5	

Appendix D. Northglenn WWTP Sampling Data for 2020

		UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007
		Flow MGD	pH SU Grab Daily	E. coli MPN/100 mL Grab Weekly	Ammonia mg/L as N Comp. 3xWeek Method TMA-001	NO2 mg/L as N Comp. 3xWeek Method TMA-001	NO3 mg/L as N Comp. 3xWeek Method TMA-001	TIN mg/L as N Comp. 3xWeek Method TMA-001	WAD - CN ug/L Grab 2x Monthly	Boron (T) mg/L Composite 2x Monthly	
	Sum flows										
18-Aug	4.23	2.53	7.16		0.54	1.02	7.94	9.50			
19-Aug	3.63	1.94	7.27								
20-Aug	3.61	1.94	7.66		0.20	0.78	6.76	7.74			
21-Aug	3.52	1.94	7.44								
22-Aug	3.39	1.94	7.17								
Sunday, August 23, 2020	3.38	1.94	7.26		0.14	0.10	7.55	7.79			
24-Aug	3.34	1.94	7.16	3.0							
25-Aug	3.27	1.94	7.27		1.19	0.49	5.99	7.67			
26-Aug	3.19	1.94	7.32								
27-Aug	3.10	1.94	7.51		0.38	0.33	4.25	4.96			
28-Aug	3.04	1.94	7.44								
29-Aug	2.78	1.94	7.22								
30-Aug	1.94	1.94	7.00		0.84	0.53	6.56	7.93			
31-Aug	1.94	1.94	6.00		0.41	0.54	6.19	7.14			
1-Sep	1.94	1.94	7.11	1.0	1.00	0.51	5.53	7.04			
2-Sep	1.94	1.94	7.70								
3-Sep	1.94	1.94	7.54								
4-Sep	1.94	1.94	7.49								
5-Sep	1.94	1.94	7.26								
Sunday, September 6, 2020	1.94	1.94	7.43								
7-Sep	1.95	1.95	7.11	3.1	0.12	0.08	6.14	6.34			
8-Sep	1.94	1.94	7.22	1.0	0.96	0.19	4.41	5.56			
9-Sep	1.94	1.94	7.36						0.19	0.19	
10-Sep	1.94	1.94	7.36		1.93	0.24	5.47	7.64			
11-Sep	1.94	1.94	7.36								
12-Sep	1.94	1.94	7.28								
Sunday, September 13, 2020	1.94	1.94	7.10								
14-Sep	1.94	1.94	7.00		1.21	0.85	2.96	5.02			
15-Sep	1.94	1.94	7.02	2.0	0.76	0.75	3.43	4.94			
16-Sep	1.94	1.94	7.55		0.42	0.71	3.18	4.31			
17-Sep	1.94	1.94	7.64								
18-Sep	1.94	1.94	7.32								
19-Sep	1.94	1.94	8.03								
Sunday, September 20, 2020	1.94	1.94	7.34		0.23	0.41	5.69	6.33			
21-Sep	1.94	1.94	7.57		1.47	0.63	4.94	7.04	0.25	0.25	
22-Sep	1.94	1.94	7.20		1.69	0.87	4.28	6.84			
23-Sep	1.94	1.94	7.14								
24-Sep	1.94	1.94	7.02								
25-Sep	1.94	1.94	7.21								
26-Sep	1.94	1.94	7.04								
Sunday, September 27, 2020	1.94	1.94	7.00								
28-Sep	1.62	1.62	7.01								
29-Sep	1.62	1.62	7.04								
30-Sep	1.62	1.62	7.15		0.20	0.30	5.87	6.37			
1-Oct	1.62	1.62	7.53	8.4	0.41	0.33	6.01	6.75	0.24	0.24	
2-Oct	1.62	1.62	7.27		3.09	0.34	3.24	6.67			
3-Oct	1.62	1.62	7.27								
Sunday, October 4, 2020	1.62	1.62	7.15		0.69	0.30	4.00	4.99			
5-Oct	1.62	1.62	7.01	1.0	0.46	0.34	4.15	4.95			
6-Oct	1.62	1.62	7.00								
7-Oct	1.62	1.62	7.01								
8-Oct	1.62	1.62	7.06		0.50	0.24	4.95	5.69			
9-Oct	1.62	1.62	7.28								
10-Oct	1.62	1.62	7.01								
Sunday, October 11, 2020	1.62	1.62	7.00		1.09	0.44	3.55	5.08			
12-Oct	1.62	1.62	7.01	2.0	0.92	0.40	4.02	5.34	0.32	0.32	
13-Oct	1.62	1.62	7.22		0.60	0.30	4.21	5.11			

Appendix D. Northglenn WWTP Sampling Data for 2020

		UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007
		Flow MGD	pH SU Grab Daily	E. coli MPN/100 mL Grab Weekly	Ammonia mg/L as N Comp. 3xWeek Method TMA-001	NO2 mg/L as N Comp. 3xWeek Method TMA-001	NO3 mg/L as N Comp. 3xWeek Method TMA-001	TIN mg/L as N Comp. 3xWeek Method TMA-001	WAD - CN ug/L Grab 2x Monthly	Boron (T) mg/L Composite 2x Monthly	
	Sum flows										
14-Oct	1.62	1.62	7.33								
15-Oct	1.63	1.63	7.43								
16-Oct	1.62	1.62	7.33								
17-Oct	1.62	1.62	7.43								
Sunday, October 18, 2020	1.62	1.62	7.17		1.68	0.40	3.76	5.84			
19-Oct	1.62	1.62	7.07	6.3	2.40	0.40	3.76	6.56			
20-Oct	1.62	1.62	7.17		2.90	0.51	4.05	7.46			
21-Oct	1.62	1.62	7.26								
22-Oct	1.94	1.94	7.37								
23-Oct	1.89	1.89	7.06								
24-Oct	1.94	1.94	7.11								
Sunday, October 25, 2020	1.84	1.84	6.78		3.81	0.44	4.41	8.66			
26-Oct	1.64	1.64	7.06	1.0							
27-Oct	2.03	2.03	7.18		2.46	0.47	4.77	7.70			
28-Oct	2.90	2.90	7.10								
29-Oct	2.88	2.88	6.94		2.34	0.55	4.86	7.75			
30-Oct	2.81	2.81	6.95								
31-Oct	2.96	2.96	7.15								
Sunday, November 1, 2020	2.11	2.11	7.08		1.77	0.51	5.06	7.34			
2-Nov	2.11	2.11	7.07	1.0	1.02	0.48	4.56	6.06	0.33	0.33	
3-Nov	2.27	2.27	7.11	1.0							
4-Nov	2.82	2.82	7.14		1.55	0.51	4.48	6.54			
5-Nov	2.11	2.11	7.19								
6-Nov	2.11	2.11	7.09								
7-Nov	2.12	2.12	7.36								
Sunday, November 8, 2020	2.11	2.11	7.10		0.99	0.62	4.53	6.14			
9-Nov	2.10	2.10	6.96	2.0	2.25	0.58	4.07	6.90			
10-Nov	2.10	2.10	7.26								
11-Nov	2.10	2.10	8.46								
12-Nov	2.10	2.10	7.19		1.45	0.80	3.81	6.06			
13-Nov	2.11	2.11	7.16								
14-Nov	2.10	2.10	7.16								
Sunday, November 15, 2020	2.12	2.12	7.20		0.74	0.65	3.78	5.17		0.23	
16-Nov	2.10	2.10	7.22	1.0	1.06	0.77	3.71	5.54	0.23		
17-Nov	2.11	2.11	7.10		0.51	0.61	3.25	4.37			
18-Nov	2.11	2.11	6.95								
19-Nov	2.10	2.10	7.11								
20-Nov	2.10	2.10	7.39								
21-Nov	2.10	2.10	7.03								
Sunday, November 22, 2020	2.10	2.10	7.07		3.22	0.79	4.52	8.53			
23-Nov	2.10	2.10	6.93	4.1	3.17	0.84	4.72	8.73			
24-Nov	2.10	2.10	7.02		2.20	0.89	4.08	7.17			
25-Nov	2.10	2.10	7.04								
26-Nov	2.10	2.10	7.08								
27-Nov	2.10	2.10	6.99								
28-Nov	2.10	2.10	7.20								
Sunday, November 29, 2020	2.10	2.10	7.21		1.86	0.81	4.56	7.23			
30-Nov	2.10	2.10	6.95	2.0	2.47	0.69	3.95	7.11			
1-Dec	1.94	1.94	7.05		2.12	0.81	3.82	6.75			
2-Dec	1.94	1.94	7.05		2.12	0.81	3.82	6.75			
3-Dec	1.94	1.94	7.06								
4-Dec	1.94	1.94	7.10								
5-Dec	1.94	1.94	7.12								
Sunday, December 6, 2020	1.94	1.94	7.10								
7-Dec	1.94	1.94	6.98	1.0	2.36	0.78	6.20	9.34	0.32	0.32	
8-Dec	1.94	1.94	7.01								
9-Dec	1.94	1.94	7.44								

Appendix D. Northglenn WWTP Sampling Data for 2020

		UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007
		Flow MGD	pH SU Grab Daily	E. coli MPN/100 mL Grab Weekly	Ammonia mg/L as N Comp. 3xWeek Method TMA-001	NO2 mg/L as N Comp. 3xWeek Method TMA-001	NO3 mg/L as N Comp. 3xWeek Method TMA-001	TIN mg/L as N Comp. 3xWeek Method TMA-001	WAD - CN ug/L Grab 2x Monthly	Boron (T) mg/L Composite 2x Monthly	
	Sum flows										
10-Dec	1.94	1.94	7.33		1.95	0.85	5.67	8.47			
11-Dec	1.94	1.94	7.42								
12-Dec	1.94	1.94	8.00								
13-Dec	1.94	1.94	7.28		4.03	0.86	4.23	9.12			
14-Dec	1.94	1.94	7.07	1.0	3.74	0.98	4.70	9.42			
15-Dec	2.06	2.06	7.44	1.0	3.63	1.05	3.87	8.55			
16-Dec	1.94	1.94	7.26								
17-Dec	1.80	1.80	7.28						0.19	0.19	
18-Dec	1.80	1.80	7.26								
19-Dec	1.80	1.80	7.38								
Sunday, December 20, 2020	1.81	1.81	6.97		0.99	0.82	5.44	7.25			
21-Dec	1.80	1.80	7.18	2.0	1.29	0.92	4.59	6.80			
22-Dec	1.81	1.81	7.39		0.67	0.87	4.61	6.15			
23-Dec	1.80	1.80	7.28								
24-Dec	1.80	1.80	7.79								
25-Dec	1.80	1.80	7.20								
26-Dec	1.81	1.81	7.03								
Sunday, December 27, 2020	1.80	1.80	7.09		1.34	1.16	4.26	6.76			
28-Dec	1.80	1.80	6.92	2.0	1.01	1.07	4.42	6.50			
29-Dec	1.80	1.80	7.10								
30-Dec	1.80	1.80	7.07		0.72	0.93	3.57	5.22			
31-Dec	1.80	1.80	7.07								

Appendix D. Northglenn WWTP Sampling Data for 2020

	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007
	Fe (Dis) ug/L	Mn (Dis) ug/L	Sulfide as H2S mg/L	Sulfate mg/L	Nonylphenol ug/L	Total Phosphours mg/L
	Composite 2x Monthly	Composite 2x Monthly	Composite 2x Monthly	Composite 2x Monthly	Grab Monthly	Composite Monthly
Sunday, April 26, 2020						
27-Apr						
28-Apr						
29-Apr	16	22.80	<0.01	305.32	<5	0.218
30-Apr						
1-May						
2-May						
Sunday, May 3, 2020						
4-May						
5-May						
6-May						
7-May	23	62.90	<0.01	294.86		0.192
8-May						
9-May						
Sunday, May 10, 2020						
11-May					<5	
12-May						
13-May						
14-May						
15-May						
16-May						
Sunday, May 17, 2020						
18-May						
19-May						
20-May						
21-May	21	225.60	<0.01	304.45		
22-May						
23-May						
Sunday, May 24, 2020						
25-May						
26-May						
27-May						
28-May						
29-May						
30-May						
Sunday, May 31, 2020						
1-Jun						
2-Jun						
3-Jun	22	155.40	<0.01	275.8		
4-Jun						
5-Jun						
6-Jun						
Sunday, June 7, 2020						
8-Jun						
9-Jun						
10-Jun						
11-Jun						0.135
12-Jun						
13-Jun						
Sunday, June 14, 2020						
15-Jun						
16-Jun						
17-Jun	21	304.60	<0.01	273.15		
18-Jun					<5	
19-Jun						
20-Jun						
Sunday, June 21, 2020						

Appendix D. Northglenn WWTP Sampling Data for 2020

	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007
	Fe (Dis)	Mn (Dis)	Sulfide as H ₂ S	Sulfate	Nonylphenol	Total Phosphours
	ug/L	ug/L	mg/L	mg/L	ug/L	mg/L
	Composite	Composite	Composite	Composite	Grab	Composite
	2x Monthly	2x Monthly	2x Monthly	2x Monthly	Monthly	Monthly
22-Jun						
23-Jun						
24-Jun						
25-Jun						
26-Jun						
27-Jun						
Sunday, June 28, 2020						
29-Jun						
30-Jun						
1-Jul	20	147.80	<0.01	258.6		
2-Jul						
3-Jul						
4-Jul						
Sunday, July 5, 2020						
6-Jul						
7-Jul						
8-Jul						
9-Jul	15.0	103.40	<.01	206.6		0.426
10-Jul					<5	
11-Jul						
Sunday, July 12, 2020						
13-Jul						
14-Jul						
15-Jul						
16-Jul						
17-Jul						
18-Jul						
Sunday, July 19, 2020						
20-Jul						
21-Jul						
22-Jul						
23-Jul						
24-Jul						
25-Jul						
Sunday, July 26, 2020						
27-Jul						
28-Jul						
29-Jul						
30-Jul						
31-Jul						
1-Aug						
Sunday, August 2, 2020	16	259.80	0.01	208		
3-Aug						
4-Aug						
5-Aug						
6-Aug					<5	
7-Aug						
8-Aug						
Sunday, August 9, 2020						
10-Aug						
11-Aug						
12-Aug						
13-Aug						2.5
14-Aug						
15-Aug						
Sunday, August 16, 2020	17	273.00	0.05	191.34		
17-Aug						

Appendix D. Northglenn WWTP Sampling Data for 2020

	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007
	Fe (Dis) ug/L	Mn (Dis) ug/L	Sulfide as H ₂ S mg/L	Sulfate mg/L	Nonylphenol ug/L	Total Phosphours mg/L
	Composite 2x Monthly	Composite 2x Monthly	Composite 2x Monthly	Composite 2x Monthly	Grab Monthly	Composite Monthly
18-Aug						
19-Aug						
20-Aug						
21-Aug						
22-Aug						
Sunday, August 23, 2020						
24-Aug						
25-Aug						
26-Aug						
27-Aug						
28-Aug						
29-Aug						
30-Aug						
31-Aug						
1-Sep						
2-Sep						
3-Sep						0.231
4-Sep						
5-Sep						
Sunday, September 6, 2020						
7-Sep						
8-Sep						
9-Sep	27	286.8	<0.01	168.77		
10-Sep						0.21
11-Sep						
12-Sep						
Sunday, September 13, 2020						
14-Sep						
15-Sep						
16-Sep						0.109
17-Sep						
18-Sep						
19-Sep						
Sunday, September 20, 2020						
21-Sep	35	191.1	<0.01	199.55		0.234
22-Sep					<9.7	
23-Sep						
24-Sep						
25-Sep						
26-Sep						
Sunday, September 27, 2020						
28-Sep						
29-Sep						
30-Sep						0.209
1-Oct	23	102.8	<0.01	185.66	<4.8	
2-Oct						
3-Oct						
Sunday, October 4, 2020						
5-Oct						
6-Oct						
7-Oct						
8-Oct						0.171
9-Oct						
10-Oct						
Sunday, October 11, 2020						
12-Oct	25	211.5	<0.01	187.89		
13-Oct						0.165

Appendix D. Northglenn WWTP Sampling Data for 2020

	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007
	Fe (Dis)	Mn (Dis)	Sulfide as H ₂ S	Sulfate	Nonylphenol	Total Phosphours
	ug/L	ug/L	mg/L	mg/L	ug/L	mg/L
	Composite	Composite	Composite	Composite	Grab	Composite
	2x Monthly	2x Monthly	2x Monthly	2x Monthly	Monthly	Monthly
14-Oct						
15-Oct						
16-Oct						
17-Oct						
Sunday, October 18, 2020						
19-Oct						0.22
20-Oct						
21-Oct						
22-Oct						
23-Oct						
24-Oct						
Sunday, October 25, 2020						
26-Oct						
27-Oct						0.23
28-Oct						
29-Oct						
30-Oct						
31-Oct						
Sunday, November 1, 2020						
2-Nov	29	56.9	0.00	190.09		0.235
3-Nov						
4-Nov						
5-Nov						
6-Nov						
7-Nov						
Sunday, November 8, 2020						
9-Nov						
10-Nov						
11-Nov						
12-Nov						0.205
13-Nov						
14-Nov						
Sunday, November 15, 2020						
16-Nov	25	91.7	0.01	214.48		0.179
17-Nov						
18-Nov					<4.8	
19-Nov						
20-Nov						
21-Nov						
Sunday, November 22, 2020						
23-Nov						0.182
24-Nov						
25-Nov						
26-Nov						
27-Nov						
28-Nov						
Sunday, November 29, 2020						
30-Nov						0.23
1-Dec						
2-Dec						
3-Dec						
4-Dec						
5-Dec						
Sunday, December 6, 2020						
7-Dec	30	71.1	0.00	212.38		
8-Dec						
9-Dec						

Appendix D. Northglenn WWTP Sampling Data for 2020

	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007	UV Eff 007
	Fe (Dis) ug/L	Mn (Dis) ug/L	Sulfide as H2S mg/L	Sulfate mg/L	Nonylphenol ug/L	Total Phosphours mg/L
	Composite 2x Monthly	Composite 2x Monthly	Composite 2x Monthly	Composite 2x Monthly	Grab Monthly	Composite Monthly
10-Dec						0.373
11-Dec						
12-Dec						
13-Dec						
14-Dec						0.45
15-Dec						
16-Dec						
17-Dec	23	66.2	0.02	212.23		
18-Dec						
19-Dec						
Sunday, December 20, 2020						
21-Dec						0.466
22-Dec						
23-Dec						
24-Dec						
25-Dec						
26-Dec						
Sunday, December 27, 2020						0.348
28-Dec						
29-Dec						
30-Dec						
31-Dec						

Appendix D. Northglenn WWTP Sampling Data for 2020

	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC
	Flow	pH	E. coli	Ammonia	NO2	NO3	TIN	WAD - CN	Boron (T)	Fe (Dis)	Mn (Dis)	Sulfide as H2S
	MGD	SU	MPN/100 mL	mg/L as N	mg/L as N	mg/L as N	mg/L as N	ug/L	mg/L	ug/L	ug/L	mg/L
		Grab	Grab	Comp. 5xWeek	Comp. 3xWeek	Comp. 3xWeek	Comp. 3xWeek	Composite	Composite	Composite	Composite	Composite
		Daily	Weekly	Method TMA-00	Method TMA-00	Method TMA-00	Method TMA-00	Weekly	2x Monthly	2x Monthly	2x Monthly	2x Monthly
Sunday, April 26, 2020												
27-Apr												
28-Apr												
29-Apr												
30-Apr												
1-May												
2-May												
Sunday, May 3, 2020												
4-May												
5-May												
6-May												
7-May												
8-May												
9-May												
Sunday, May 10, 2020												
11-May												
12-May												
13-May												
14-May												
15-May												
16-May												
Sunday, May 17, 2020												
18-May												
19-May												
20-May												
21-May												
22-May												
23-May												
Sunday, May 24, 2020												
25-May												
26-May												
27-May												
28-May												
29-May												
30-May												
Sunday, May 31, 2020												
1-Jun												
2-Jun												
3-Jun												
4-Jun												
5-Jun												
6-Jun												
Sunday, June 7, 2020												
8-Jun												
9-Jun												
10-Jun												
11-Jun												
12-Jun												
13-Jun												
Sunday, June 14, 2020												
15-Jun												
16-Jun												
17-Jun												
18-Jun												
19-Jun												
20-Jun												
Sunday, June 21, 2020												

Appendix D. Northglenn WWTP Sampling Data for 2020

	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC
	Flow	pH	E. coli	Ammonia	NO2	NO3	TIN	WAD - CN	Boron (T)	Fe (Dis)	Mn (Dis)	Sulfide as H2S
	MGD	SU	MPN/100 mL	mg/L as N	mg/L as N	mg/L as N	mg/L as N	ug/L	mg/L	ug/L	ug/L	mg/L
		Grab	Grab	Comp. 5xWeek	Comp. 3xWeek	Comp. 3xWeek	Comp. 3xWeek	Composite	Composite	Composite	Composite	Composite
		Daily	Weekly	Method TMA-00	Method TMA-00	Method TMA-00	Method TMA-00	Weekly	2x Monthly	2x Monthly	2x Monthly	2x Monthly
22-Jun												
23-Jun												
24-Jun												
25-Jun												
26-Jun												
27-Jun												
Sunday, June 28, 2020												
29-Jun												
30-Jun												
1-Jul												
2-Jul												
3-Jul												
4-Jul												
Sunday, July 5, 2020												
6-Jul												
7-Jul												
8-Jul												
9-Jul												
10-Jul												
11-Jul												
Sunday, July 12, 2020												
13-Jul												
14-Jul												
15-Jul												
16-Jul												
17-Jul												
18-Jul												
Sunday, July 19, 2020												
20-Jul												
21-Jul												
22-Jul												
23-Jul												
24-Jul												
25-Jul												
Sunday, July 26, 2020												
27-Jul												
28-Jul												
29-Jul												
30-Jul												
31-Jul												
1-Aug												
Sunday, August 2, 2020	1.02	8.68			0	0	0	0				
3-Aug	1.5	8.33	2		0	0	0	0 <5	0.36	<5		3.1 <0.1
4-Aug	1.36	8.7			0	0	0.13	0.13				
5-Aug	1.38	8.29										
6-Aug	1.38	8.02										
7-Aug	1.4	8.27										
8-Aug	1.37	8.61										
Sunday, August 9, 2020	1.38	8.18			0.11	0	0	0.11				
10-Aug	1.27	8.29	80.5		0.11	0	0	0.11				
11-Aug	1.33	8.45										
12-Aug	1.61	8.19										
13-Aug	1.66	8.36			0	0	0	0				
14-Aug	1.69	8.11										
15-Aug	1.73	8.16										
Sunday, August 16, 2020	1.72	8.47			0.13	0	0	0.13	0.3	<5		34.9 <0.1
17-Aug	1.72	8.39	52					<5				

Appendix D. Northglenn WWTP Sampling Data for 2020

	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC
	Flow	pH	E. coli	Ammonia	NO2	NO3	TIN	WAD - CN	Boron (T)	Fe (Dis)	Mn (Dis)	Sulfide as H2S
	MGD	SU	MPN/100 mL	mg/L as N	mg/L as N	mg/L as N	mg/L as N	ug/L	mg/L	ug/L	ug/L	mg/L
		Grab	Grab	Comp. 5xWeek	Comp. 3xWeek	Comp. 3xWeek	Comp. 3xWeek	Composite	Composite	Composite	Composite	Composite
		Daily	Weekly	Method TMA-00	Method TMA-00	Method TMA-00	Method TMA-00	Weekly	2x Monthly	2x Monthly	2x Monthly	2x Monthly
18-Aug	1.7	8.68			0	0	0	0				
19-Aug	1.69	8.47										
20-Aug	1.67	8.38		0.1	0	0	0.1					
21-Aug	1.58	8.32										
22-Aug	1.45	8.46										
Sunday, August 23, 2020	1.44	8.4		0.12	0	0	0.12					
24-Aug	1.4	8.52	20.6									
25-Aug	1.33	8.6		0.17	0	0	0.17					
26-Aug	1.25	8.72										
27-Aug	1.16	8.57		0.22	0	0	0.22					
28-Aug	1.1	8.39										
29-Aug	0.84	8.45										
30-Aug												
31-Aug												
1-Sep												
2-Sep												
3-Sep												
4-Sep												
5-Sep												
Sunday, September 6, 2020												
7-Sep												
8-Sep												
9-Sep												
10-Sep												
11-Sep												
12-Sep												
Sunday, September 13, 2020												
14-Sep												
15-Sep												
16-Sep												
17-Sep												
18-Sep												
19-Sep												
Sunday, September 20, 2020												
21-Sep												
22-Sep												
23-Sep												
24-Sep												
25-Sep												
26-Sep												
Sunday, September 27, 2020												
28-Sep												
29-Sep												
30-Sep												
1-Oct												
2-Oct												
3-Oct												
Sunday, October 4, 2020												
5-Oct												
6-Oct												
7-Oct												
8-Oct												
9-Oct												
10-Oct												
Sunday, October 11, 2020												
12-Oct												
13-Oct												

Appendix D. Northglenn WWTP Sampling Data for 2020

	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC
	Flow	pH	E. coli	Ammonia	NO2	NO3	TIN	WAD - CN	Boron (T)	Fe (Dis)	Mn (Dis)	Sulfide as H2S
	MGD	SU	MPN/100 mL	mg/L as N	mg/L as N	mg/L as N	mg/L as N	ug/L	mg/L	ug/L	ug/L	mg/L
		Grab	Grab	Comp. 5xWeek	Comp. 3xWeek	Comp. 3xWeek	Comp. 3xWeek	Composite	Composite	Composite	Composite	Composite
		Daily	Weekly	Method TMA-00	Method TMA-00	Method TMA-00	Method TMA-00	Weekly	2x Monthly	2x Monthly	2x Monthly	2x Monthly
14-Oct												
15-Oct												
16-Oct												
17-Oct												
Sunday, October 18, 2020												
19-Oct												
20-Oct												
21-Oct												
22-Oct												
23-Oct												
24-Oct												
Sunday, October 25, 2020												
26-Oct												
27-Oct												
28-Oct												
29-Oct												
30-Oct												
31-Oct												
Sunday, November 1, 2020												
2-Nov												
3-Nov												
4-Nov												
5-Nov												
6-Nov												
7-Nov												
Sunday, November 8, 2020												
9-Nov												
10-Nov												
11-Nov												
12-Nov												
13-Nov												
14-Nov												
Sunday, November 15, 2020												
16-Nov												
17-Nov												
18-Nov												
19-Nov												
20-Nov												
21-Nov												
Sunday, November 22, 2020												
23-Nov												
24-Nov												
25-Nov												
26-Nov												
27-Nov												
28-Nov												
Sunday, November 29, 2020												
30-Nov												
1-Dec												
2-Dec												
3-Dec												
4-Dec												
5-Dec												
Sunday, December 6, 2020												
7-Dec												
8-Dec												
9-Dec												

Appendix D. Northglenn WWTP Sampling Data for 2020

	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC	004 BDC
	Flow	pH	E. coli	Ammonia	NO2	NO3	TIN	WAD - CN	Boron (T)	Fe (Dis)	Mn (Dis)	Sulfide as H2S
	MGD	SU	MPN/100 mL	mg/L as N	mg/L as N	mg/L as N	mg/L as N	ug/L	mg/L	ug/L	ug/L	mg/L
		Grab	Grab	Comp. 5xWeek	Comp. 3xWeek	Comp. 3xWeek	Comp. 3xWeek	Composite	Composite	Composite	Composite	Composite
		Daily	Weekly	Method TMA-00	Method TMA-00	Method TMA-00	Method TMA-00	Weekly	2x Monthly	2x Monthly	2x Monthly	2x Monthly
10-Dec												
11-Dec												
12-Dec												
13-Dec												
14-Dec												
15-Dec												
16-Dec												
17-Dec												
18-Dec												
19-Dec												
Sunday, December 20, 2020												
21-Dec												
22-Dec												
23-Dec												
24-Dec												
25-Dec												
26-Dec												
Sunday, December 27, 2020												
28-Dec												
29-Dec												
30-Dec												
31-Dec												

Appendix D. Northglenn WWTP Sampling Data for 2020

	004 BDC	004 BDC	004 BDC
	Sulfate	Nonylphenol	Total
	mg/L	ug/L	Phosphours
	Composite	Grab	mg/L
	2x Monthly	Monthly	Composite
			Monthly
Sunday, April 26, 2020			
27-Apr			
28-Apr			
29-Apr			
30-Apr			
1-May			
2-May			
Sunday, May 3, 2020			
4-May			
5-May			
6-May			
7-May			
8-May			
9-May			
Sunday, May 10, 2020			
11-May			
12-May			
13-May			
14-May			
15-May			
16-May			
Sunday, May 17, 2020			
18-May			
19-May			
20-May			
21-May			
22-May			
23-May			
Sunday, May 24, 2020			
25-May			
26-May			
27-May			
28-May			
29-May			
30-May			
Sunday, May 31, 2020			
1-Jun			
2-Jun			
3-Jun			
4-Jun			
5-Jun			
6-Jun			
Sunday, June 7, 2020			
8-Jun			
9-Jun			
10-Jun			
11-Jun			
12-Jun			
13-Jun			
Sunday, June 14, 2020			
15-Jun			
16-Jun			
17-Jun			
18-Jun			
19-Jun			
20-Jun			
Sunday, June 21, 2020			

Appendix D. Northglenn WWTP Sampling Data for 2020

	004 BDC	004 BDC	004 BDC
	Sulfate	Nonylphenol	Total
	mg/L	ug/L	Phosphours
	Composite	Grab	Composite
	2x Monthly	Monthly	Monthly
22-Jun			
23-Jun			
24-Jun			
25-Jun			
26-Jun			
27-Jun			
Sunday, June 28, 2020			
29-Jun			
30-Jun			
1-Jul			
2-Jul			
3-Jul			
4-Jul			
Sunday, July 5, 2020			
6-Jul			
7-Jul			
8-Jul			
9-Jul			
10-Jul			
11-Jul			
Sunday, July 12, 2020			
13-Jul			
14-Jul			
15-Jul			
16-Jul			
17-Jul			
18-Jul			
Sunday, July 19, 2020			
20-Jul			
21-Jul			
22-Jul			
23-Jul			
24-Jul			
25-Jul			
Sunday, July 26, 2020			
27-Jul			
28-Jul			
29-Jul			
30-Jul			
31-Jul			
1-Aug			
Sunday, August 2, 2020			
3-Aug	290.26		
4-Aug			
5-Aug			
6-Aug		<5	
7-Aug			
8-Aug			
Sunday, August 9, 2020			
10-Aug			
11-Aug			
12-Aug			
13-Aug			0.5
14-Aug			
15-Aug			
Sunday, August 16, 2020	293.41		
17-Aug			

Appendix D. Northglenn WWTP Sampling Data for 2020

	004 BDC	004 BDC	004 BDC
	Sulfate	Nonylphenol	Total
	mg/L	ug/L	Phosphours
	Composite	Grab	Composite
	2x Monthly	Monthly	Monthly
18-Aug			
19-Aug			
20-Aug			
21-Aug			
22-Aug			
Sunday, August 23, 2020			
24-Aug			
25-Aug			
26-Aug			
27-Aug			
28-Aug			
29-Aug			
30-Aug			
31-Aug			
1-Sep			
2-Sep			
3-Sep			
4-Sep			
5-Sep			
Sunday, September 6, 2020			
7-Sep			
8-Sep			
9-Sep			
10-Sep			
11-Sep			
12-Sep			
Sunday, September 13, 2020			
14-Sep			
15-Sep			
16-Sep			
17-Sep			
18-Sep			
19-Sep			
Sunday, September 20, 2020			
21-Sep			
22-Sep			
23-Sep			
24-Sep			
25-Sep			
26-Sep			
Sunday, September 27, 2020			
28-Sep			
29-Sep			
30-Sep			
1-Oct			
2-Oct			
3-Oct			
Sunday, October 4, 2020			
5-Oct			
6-Oct			
7-Oct			
8-Oct			
9-Oct			
10-Oct			
Sunday, October 11, 2020			
12-Oct			
13-Oct			

Appendix D. Northglenn WWTP Sampling Data for 2020

	004 BDC	004 BDC	004 BDC
	Sulfate	Nonylphenol	Total
	mg/L	ug/L	mg/L
	Composite	Grab	Composite
	2x Monthly	Monthly	Monthly
14-Oct			
15-Oct			
16-Oct			
17-Oct			
Sunday, October 18, 2020			
19-Oct			
20-Oct			
21-Oct			
22-Oct			
23-Oct			
24-Oct			
Sunday, October 25, 2020			
26-Oct			
27-Oct			
28-Oct			
29-Oct			
30-Oct			
31-Oct			
Sunday, November 1, 2020			
2-Nov			
3-Nov			
4-Nov			
5-Nov			
6-Nov			
7-Nov			
Sunday, November 8, 2020			
9-Nov			
10-Nov			
11-Nov			
12-Nov			
13-Nov			
14-Nov			
Sunday, November 15, 2020			
16-Nov			
17-Nov			
18-Nov			
19-Nov			
20-Nov			
21-Nov			
Sunday, November 22, 2020			
23-Nov			
24-Nov			
25-Nov			
26-Nov			
27-Nov			
28-Nov			
Sunday, November 29, 2020			
30-Nov			
1-Dec			
2-Dec			
3-Dec			
4-Dec			
5-Dec			
Sunday, December 6, 2020			
7-Dec			
8-Dec			
9-Dec			

Appendix D. Northglenn WWTP Sampling Data for 2020

	004 BDC	004 BDC	004 BDC
	Sulfate	Nonylphenol	Total
	mg/L	ug/L	Phosphours
	Composite	Grab	mg/L
	2x Monthly	Monthly	Composite
			Monthly
10-Dec			
11-Dec			
12-Dec			
13-Dec			
14-Dec			
15-Dec			
16-Dec			
17-Dec			
18-Dec			
19-Dec			
Sunday, December 20, 2020			
21-Dec			
22-Dec			
23-Dec			
24-Dec			
25-Dec			
26-Dec			
Sunday, December 27, 2020			
28-Dec			
29-Dec			
30-Dec			
31-Dec			

Appendix E. Metro Wastewater 2020 Sampling on Lower Big Dry Creek

Appendix E. Metro Wastewater Total Recoverable Iron Sampling on Big Dry Creek

Date	Total Recoverable Iron (mg/L)	
	BDC	BDC8
1/4/2012	1.60	1.50
1/18/2012	2.40	1.70
2/1/2012	1.00	1.10
2/15/2012	2.50	2.50
3/7/2012	1.00	0.80
3/21/2012	0.70	0.80
4/4/2012	8.80	7.10
4/18/2012	3.20	0.80
5/2/2012	1.30	1.20
5/16/2012	2.30	0.80
6/6/2012	0.60	0.60
6/20/2012	1.00	0.30
7/3/2012	1.00	0.70
7/18/2012	2.30	3.10
8/1/2012	1.10	0.40
8/15/2012	1.20	0.50
9/5/2012	1.30	1.40
9/19/2012	1.60	2.20
10/3/2012	0.40	0.20
10/17/2012	0.50	1.40
11/7/2012	1.20	0.70
11/21/2012	1.30	1.40
12/6/2012	1.00	1.10
12/19/2012	1.00	1.30
1/2/2013	0.90	1.30
1/16/2013	0.70	1.00
2/6/2013	0.90	0.85
2/20/2013	0.70	0.80
3/6/2013	1.20	1.40
3/20/2013	1.40	1.20
4/3/2013	2.20	2.80
4/17/2013		6.40
5/1/2013	1.60	2.10
5/15/2013	4.00	1.90
6/5/2013	2.00	1.60
6/19/2013	2.10	0.40
7/3/2013	2.60	2.80
7/17/2013	1.50	1.20
8/7/2013	2.60	3.20
8/21/2013	2.90	0.90
9/4/2013	1.90	1.60
9/18/2013		7.20

Appendix E. Metro Wastewater Total Recoverable Iron Sampling on Big Dry Creek

Date	Total Recoverable Iron (mg/L)	
	BDC	BDC8
10/2/2013	3.80	2.60
10/16/2013	1.70	1.90
11/6/2013	0.80	1.10
11/20/2013	0.30	0.50
12/4/2013	0.60	0.80
12/19/2013	0.30	0.50
1/8/2014	0.70	0.30
1/15/2014	1.20	1.30
2/5/2014	1.80	1.40
2/18/2014	1.40	1.20
3/5/2014	0.80	1.10
3/19/2014	0.60	0.70
4/2/2014	0.80	0.30
4/16/2014	1.00	1.30
5/7/2014	1.20	0.80
5/21/2014	2.90	2.30
6/4/2014	3.50	2.80
6/18/2014	2.50	0.80
7/2/2014	2.50	0.38
7/16/2014	5.63	5.80
8/6/2014	4.67	3.19
8/20/2014	1.41	0.42
9/3/2014	1.83	1.85
9/17/2014	1.84	1.83
10/1/2014	4.67	4.98
10/15/2014	2.22	2.29
11/5/2014	0.78	0.48
11/19/2014	0.90	1.33
12/3/2014	0.64	0.42
12/18/2014	0.40	0.58
1/7/2015	1.63	3.36
1/21/2015	0.52	0.58
2/4/2015	1.18	0.88
2/18/2015	1.49	1.51
3/4/2015	1.36	1.40
3/18/2015	0.82	0.98
4/1/2015	0.64	0.35
4/15/2015	1.66	1.70
5/6/2015	5.94	11.40
5/20/2015	10.10	10.40
6/3/2015	2.80	2.79
6/17/2015	4.23	3.72

Appendix E. Metro Wastewater Total Recoverable Iron Sampling on Big Dry Creek

Date	Total Recoverable Iron (mg/L)	
	BDC	BDC8
7/1/2015	1.71	0.66
7/15/2015	2.99	3.56
8/5/2015		0.82
8/19/2015	3.04	3.30
9/2/2015	1.93	1.24
9/16/2015		0.60
10/7/2015	1.06	1.17
10/21/2015		
11/4/2015	1.59	1.32
11/18/2015	4.04	3.33
12/2/2015	1.04	1.02
12/17/2015	1.20	0.77
1/6/2016	0.63	0.58
1/20/2016	0.78	0.66
2/3/2016	0.94	0.87
2/17/2016	0.47	0.41
3/2/2016	0.49	0.53
4/6/2016	1.56	1.91
4/20/2016	7.16	
5/4/2016	2.05	1.89
5/18/2016	3.02	2.43
6/1/2016	3.30	9.51
6/15/2016	2.06	0.96
7/6/2016	1.22	1.54
7/20/2016	3.14	2.76
8/3/2016	2.10	1.20
9/7/2016	1.71	1.87
10/5/2016	0.55	0.63
11/2/2016	1.73	0.97
11/16/2016	0.41	0.22
12/7/2016	1.64	1.36
12/21/2016	4.10	6.27
1/4/2017	1.05	2.04
1/18/2017	3.23	2.90
2/1/2017	0.85	0.84
3/1/2017	0.47	0.59
3/15/2017	0.38	0.31
4/5/2017	12.80	12.30
4/19/2017	1.13	1.64
5/3/2017	1.45	1.45
6/7/2017	11.90	12.50
9/6/2017	0.98	0.55

Appendix E. Metro Wastewater Total Recoverable Iron Sampling on Big Dry Creek

Date	Total Recoverable Iron (mg/L)	
	BDC	BDC8
9/20/2017	0.70	1.05
10/4/2017	3.99	4.21
11/1/2017	1.87	0.67
12/13/2017	0.41	0.37
1/3/2018	0.43	0.66
1/17/2018	0.70	1.45
2/7/2018	1.04	0.90
2/21/2018	1.65	1.37
3/7/2018	0.71	0.42
3/21/2018	3.04	2.59
4/4/2018	1.39	1.35
4/18/2018	2.07	1.95
5/2/2018	1.53	1.06
5/16/2018	2.28	1.80
6/6/2018	1.24	0.72
6/20/2018	2.39	1.85
7/10/2018	1.13	0.85
8/15/2018	2.03	1.81
9/5/2018	1.60	2.55
9/19/2018	1.37	1.60
10/3/2018	0.95	0.25
10/17/2018	0.94	0.73
11/7/2018	1.14	0.98
11/20/2018	0.79	1.01
12/5/2018	0.70	0.96
12/18/2018	0.60	0.83
1/2/2019	0.39	0.36
1/16/2019	0.74	0.88
2/6/2019	0.33	0.43
2/20/2019	0.92	0.70
3/6/2019	0.62	0.77
3/20/2019	0.99	1.01
4/3/2019	0.31	0.46
4/17/2019	0.17	0.94
5/1/2019	2.42	1.28
5/15/2019	0.94	1.47
6/5/2019	1.64	2.41
6/19/2019	2.43	3.70
7/3/2019	3.60	3.55
7/17/2019	1.66	1.84
8/7/2019	0.86	1.32
8/21/2019	0.45	1.16

Appendix E. Metro Wastewater Total Recoverable Iron Sampling on Big Dry Creek

Date	Total Recoverable Iron (mg/L)	
	BDC	BDC8
9/4/2019	1.33	1.29
9/18/2019		0.94
10/2/2019	0.92	0.96
10/16/2019	0.60	0.48
11/6/2019	0.58	0.76
11/20/2019	0.22	0.34
12/3/2019	1.01	1.18
12/18/2019	0.71	1.03
1/8/2020	0.44	0.38
1/15/2020	0.57	0.47
2/5/2020	0.68	0.53
2/19/2020	0.41	0.32
3/4/2020	0.25	0.18
5/6/2020	1.17	0.65
5/20/2020	1.10	0.43
6/3/2020	1.76	0.91
6/17/2020	1.69	1.44
7/1/2020	1.45	0.97
7/15/2020	1.83	1.18
8/5/2020	1.68	1.93
8/19/2020	1.92	2.35
9/2/2020	2.15	3.27
9/16/2020	1.04	0.78
10/7/2020	0.28	0.29
10/21/2020	0.96	0.75
11/4/2020	0.54	0.24
11/18/2020	0.79	0.52
12/2/2020	0.80	0.68
Median 2016-2020	1.04	0.97