

# WATER QUALITY MONITORING PLAN

## 2019



WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY  
WATER QUALITY DIVISION  
WATERSHED PROTECTION PROGRAM

## Table of Contents

Wyoming’s Surface Water Quality Monitoring Strategy.....	3
Purpose of the Annual Water Quality Monitoring Plan .....	3
Annual Monitoring Objectives – 2019 Field Season.....	3
Objective 1 – Conduct Water Quality Standards Attainment Studies (Figure 1; Table 1)...	3
Objective 2 – Provide Data Collection Support for Nutrient Criteria Development (Figure 1; Table 2) .....	4
Objective 3 – Provide Data Collection Support for Water Quality Criteria Development ....	5
Objective 4 - Provide Data Collection Support for TMDL Projects (Figure 1, Table 3) .....	7
Objective 5 – Evaluate Potential Harmful Cyanobacteria Blooms .....	8
Objective 6 - Evaluate Candidate or Existing Reference Sites .....	8
Watershed Protection Program Monitoring List for 2019.....	8
Quality Assurance and Quality Control .....	9
Other Watershed Protection Program-Supported Projects for 2019 .....	9
WDEQ-USGS Statewide Monitoring Network .....	9
References.....	9
Figure 1. Waterbodies included in the 2019 Water Quality Monitoring Plan .....	11
Figure 2. Map of sites included in the USGS-WDEQ cooperative monitoring agreement. ....	14
Table 1. Targeted Water Quality Standards Attainment Studies .....	12
Table 2. Monitoring for nutrient criteria development.....	12
Table 3. TMDL Program Assistance .....	13
Table 4. WDEQ/USGS Cooperative Agreement.....	13

## Wyoming's Surface Water Quality Monitoring Strategy

Wyoming's surface water quality monitoring strategy (WDEQ 2010) specifies primary and secondary monitoring objectives used to meet the agency's surface water quality decision-making needs. Primary objectives are achieved mostly by rotating-basin probabilistic surveys to assess statewide and regional water quality conditions and direct future targeted monitoring for making designated use-support determinations. Secondary objectives are achieved through cooperation between the Watershed Protection Program (WPP) Monitoring (MP), Water Quality Standards (WQS), Non-Point Source (NPS) and Total Maximum Daily Load (TMDL) sub-programs and other entities. The MP works closely with WQS to develop and implement study designs to develop new or revised water quality criteria. Best management practices used to reduce non-point source pollutants are evaluated through a joint effort between MP, NPS and TMDL. Likewise, some TMDL study designs and supporting data collection occurs through coordinated efforts between MP and TMDL.

### Purpose of the Annual Water Quality Monitoring Plan

The annual water quality monitoring plan identifies annual objectives used to achieve the overall objectives of the monitoring strategy and ties them to specific WPP monitoring projects planned for a given year. The plan serves as an information-sharing tool for the public, government, non-profits and other stakeholders. The plan highlights work being done by the MP and does not contain a complete account of surface water data collection activities of the WPP. Other sub-programs of the WPP may be collecting surface water quality data in support of their own needs.

### Annual Monitoring Objectives – 2019 Field Season

- 1) Conduct Water Quality Standards Attainment Studies
- 2) Provide Data Collection Support for Nutrient Criteria Development
- 3) Provide Data Collection Support for Water Quality Criteria Development
- 4) Provide Data Collection Support for TMDL Projects
- 5) Evaluate Potential Harmful Cyanobacteria Blooms
- 6) Evaluate Candidate or Existing Reference Sites

#### Objective 1 – Conduct Water Quality Standards Attainment Studies (Figure 1; Table 1)

##### Sweetwater River Class 1 Segment

The Sweetwater River from Alkali Creek upstream to its origin was designated as Class 1 in 1979. Section 4(a) of Chapter 1 of Wyoming's Water Quality Rules and Regulations (Chapter 1, WDEQ 2018a) describes class 1 waters as *those surface waters in which no further water quality degradation by point source discharges other than from dams will be allowed. Nonpoint sources of pollution shall be controlled through implementation of appropriate best management practices. Pursuant to Section 7 of these regulations, the water quality and physical and biological integrity which existed on the water at the time of designation will be maintained and protected.* Despite its Class 1 designation, the Sweetwater River was never formally assessed. The MP will evaluate water quality conditions and standards attainment to enable a designated

use support assessment for the Class 1 segment of the Sweetwater River. Select tributaries are included in the evaluation to increase the stream miles that can be assessed and categorized in the Integrated Report. Although water quality was collected at various locations with various objectives over the years, there is not adequate data to determine if water quality has degraded since the Sweetwater was designated as Class 1 in 1979. MP will collect monthly water quality and flow data at two or more locations on the Class 1 segment for two years or longer to build a dataset that can be used as baseline for Tier 3 anti-degradation reviews in the future. A sampling and analysis plan is under development in accordance to WPP guidance.

### Horse Creek

Horse Creek in Goshen County, eventual tributary to the North Platte River in Nebraska, had dissolved arsenic concentrations that exceeded Chapter 1, Appendix B (Human Health-Consumption of Fish and Drinking Water) criteria at two of four sampled locations during the 2016 Platte Basin probabilistic survey. Horse Creek is a class 2AB water that includes aquatic life, fisheries, drinking water, agriculture, industry, and scenic value uses. While no permitted drinking water intakes are present on Horse Creek and it is primarily a non-game fishery in the portion where arsenic was elevated, it is a water source for Hawk Springs, Bump-Sullivan, and Goshen Hole Reservoirs, all of which support a game fishery to some degree. MP will conduct a more detailed evaluation of arsenic concentrations including defining the spatial extent of criteria non-attainment and preliminary identification of possible source areas. Possible sources of arsenic are both natural and anthropogenic. A Sampling and Analysis Plan (SAP) is under development in accordance with WPP guidance.

### Shoshone River

The Shoshone River between Cody and Bighorn Lake is being evaluated due to ongoing concerns about effects of anthropogenic sediment on aquatic life uses in the river. A designated use support study was conducted by MP in 2012 and 2013 that stemmed from a history of public concerns about impacts of sediment from agricultural operations, natural sources, and operations of Willwood Dam on the fish community of the river. In October 2016, maintenance work on Willwood Dam resulted in a large release of sediment to the Shoshone River. Extensive sediment deposition occurred on the river bed from Willwood Dam to Lovell and turbidity was elevated for an extended period of time. MP monitored total suspended solids concentrations and turbidity for much of the fall and early winter, and collected benthic macroinvertebrate and algae data after the worst of the sediment release had ended. In consultation with stakeholders, MP elected to continue monitoring the river for at least two more years (2017-18) to further evaluate impacts of the sediment concentrations and management on aquatic life uses. To ensure representative data collection following abnormally high flows in 2017, MP is collecting monthly water quality samples and benthic macroinvertebrate and algae samples for an additional year. Monthly samples will be collected through November and biological samples will be collected in late summer or early Fall of 2019. The WGFD has conducted fish community surveys concurrent to MP monitoring. A sampling and analysis plan was developed and approved in accordance to WPP guidance. For more information regarding the 2016 sediment release and subsequent developments, visit <http://deg.wyoming.gov/wqd/willwood-dam-and-shoshone-river/>.

## **Objective 2 – Provide Data Collection Support for Nutrient Criteria Development (Figure 1; Table 2)**

### Lake and Reservoir Nutrient Monitoring

MP is in the seventh year of collecting nutrient and supporting physical and chemical data on lakes and reservoirs to support development of nutrient-based water quality criteria. Five small reservoirs in eastern Wyoming will be sampled by MP during 2019 during the first of a planned two-year evaluation period. Data from this study will be used to ascertain the status of nutrient conditions in these waters to assist with prioritization for development of water quality criteria for southeast Wyoming reservoirs and implementation of Wyoming's Nutrient Strategy. These data will also be used to determine whether these waters should be prioritized for protection and/or restoration as part of Wyoming's Nutrient Strategy (<http://deq.wyoming.gov/wqd/nutrient-pollution/resources/wyoming-nutrient-reduction-strategy/>). The primary sampling design for this study is similar to what was used in lake and reservoir nutrient monitoring studies during 2013-2018. An updated SAP was developed and approved in accordance with WPP guidance.

### Supplemental Lake, Reservoir, Stream and River Nutrient Monitoring

MP will sample 18 lakes and reservoirs with full body contact recreational uses and/or drinking water uses to characterize existing nutrient concentrations and phytoplankton communities where little or no data currently exist. Of particular interest is occurrence of potential harmful cyanobacteria blooms (HCBs).

MP will continue to opportunistically acquire the data necessary to support development of numeric nutrient criteria for Wyoming. Nutrient and associated response variable data will be collected as part of other monitoring objectives for 2019.

The Wyoming Nutrient Strategy and supporting documents are available here:  
<http://deq.wyoming.gov/wqd/nutrient-pollution/resources/wyoming-nutrient-strategy/>.

## **Objective 3 – Provide Data Collection Support for Water Quality Criteria Development**

### Badwater Creek Site-Specific Criteria

Badwater Creek and its tributary Alkali Creek are located in northeast Fremont County and northwest Natrona County, WY. Badwater Creek is Class 2AB stream and designated for drinking water, cold water game fish, nongame fish, aquatic life other than fish, recreation, industry, wildlife, agriculture, and scenic value uses. Alkali Creek is Class 3B and designated for aquatic life other than fish, recreation, industry, wildlife, agriculture and scenic value uses. Chapter 1 contains a number of water quality criteria for Class 2AB designated uses, including chloride criteria (230 milligrams per liter (mg/L) chronic and 860 mg/L acute) to protect game and nongame fisheries. Since Alkali Creek is Class 3B, most of the water quality criteria are the same as those that apply to Badwater Creek, with the exception of human health criteria for drinking water and fish consumption as well as aquatic life criteria for temperature, ammonia, and chloride. In the case of aquatic life criteria for temperature, ammonia, and chloride, narrative rather than numeric criteria apply to Alkali Creek.

Produced water from the Moneta Divide gas field, previously known as Frenchie Draw, is discharged to Alkali Creek via a series of outfalls at approximately 25,000 barrels per day or 1.2 cubic feet per second (cfs). Water from Alkali Creek then flows into Badwater Creek which is a tributary to Boysen Reservoir. The oil field was originally developed by Exxon in the 1960's and has since traded hands to Tom Brown, Inc., then Encana Oil and Gas, and in 2015 to the current operator, Aethon Energy (Aethon). The original permits for discharges of produced water were issued by the United States Army Corps of Engineers and transferred to the United States Environmental Protection Agency (USEPA) in 1972 upon adoption of the federal Clean Water Act. Regulatory responsibility transferred to the WDEQ in January 1975 when USEPA approved the WDEQ National Pollutant Discharge Elimination Systems (NPDES) program, known in the State of Wyoming as the Wyoming Pollutant Discharge Elimination System (WYPDES), and suspended the issuance of NPDES permits by USEPA.

Aethon is interested in increasing production from the oil and gas field and updating their WYPDES permit to accommodate the increase in produced water. As a result, MP is assisting other WPP programs with evaluating the surface water quality standards (i.e., antidegradation requirements, designated uses, and water quality criteria) associated with Badwater Creek, which is a downstream receiving water. This evaluation will determine whether the existing water quality standards, including numeric aquatic life criteria for chloride, are appropriate. Chemical, physical, and biological data are therefore needed to characterize Badwater Creek above and below its confluence with Alkali Creek and, if appropriate, develop scientifically defensible water quality criteria protective of designated uses and/or modify the designated uses for Badwater Creek. A SAP is being developed and approved in accordance with WPP guidance.

#### Kendrick Reclamation Area Site-Specific Selenium Criteria

The North Platte River near Casper, Poison Spider Creek, Poison Spring Creek, Casper Creek, Oregon Trail Slough, Ilco Pond, Goose Lake, and Rasmus Lee Lake within the Kendrick Reclamation Area were added to the 1998 and 2000 303(d) lists of impaired waters due to selenium concentrations that exceed Chapter 1 aquatic life criteria.

The Kendrick Watershed Plan is a 10-year initiative of the Natrona County Conservation District (NCCD), and was developed to address and reduce these high concentrations of selenium in surface water runoff and ground water migration in the Kendrick watershed. Plan implementation, funded in part by a WDEQ 319 Grant, is a long-term collaborative effort by those who have influence or guardianship of surface water runoff areas and discharge locations in the Kendrick watershed, such as: Natrona County Conservation District (NCCD), Casper Alcova Irrigation District (CAID), Natural Resources Conservation Services (NRCS), landowners, sportsmen and environmental groups.

NCCD began implementing the Kendrick Watershed Plan in mid-2008, in cooperation with CAID, NRCS, and local landowners in the watershed, to establish more efficient and effective irrigation water delivery. NCCD investigated and field tested alternative irrigation water delivery

systems to reduce selenium migration. Existing scientific studies and local field demonstrations indicated that certain irrigation practices implemented as alternatives to the standard furrow (flood) irrigation, decreased selenium migration through the soil and to runoff drainages and groundwater.

Due to BMP's implemented by stakeholders, selenium concentrations no longer exceed selenium aquatic life criteria in the North Platte River, thus the impaired segment was removed from the 303(d) list in 2018 (WDEQ 2018c). The aquatic life criteria likely are not attainable for the tributary streams due to natural influences of underlying seleniferous geology and soils. In order for a TMDL to be developed for these streams, site-specific selenium criteria must be developed that represents natural background concentrations. The TMDL will use these criteria to calculate the remaining load reductions needed for the tributaries to reach these expected concentrations.

In 2019 and 2020, MP will identify sites within these tributary watersheds and in the nearby South Fork Powder River that share similar hydrology, geology and soils conditions as the impaired streams but lack the primary human factors that contribute to elevated selenium, which are point source discharges and surface irrigation. A SAP will be developed for streams that meet selection criteria. Suitable sites will be sampled regularly for approximately two years over a range of flow conditions with the resultant data used to develop site specific selenium criteria for the impaired North Platte River tributaries. A SAP is being developed and approved in accordance with WPP guidance.

#### **Objective 4 - Provide Data Collection Support for TMDL Projects (Figure 1, Table 3)**

##### TMDL Projects

MP will assist TMDL and WQS with biological data collection on Bitter Creek and Kilpecker Creek as part of efforts to address the current aquatic life impairment due to total chlorides concentrations. The monitoring program also will assist TMDL with suspended and bedload sediment data collection on the Little Medicine Bow River and with E. coli data collection on Wheatland and Rock Creeks to support TMDL document or watershed plan development for those waters. Collecting data for these waters will help the TMDL Program achieve the goals set for the EPA 2022 Long-term Vision Strategy, and remove streams and rivers from the 303(d) list of impaired waterbodies.

##### Shoshone River Suspended Sediment Data Collection

Sampling for suspended-sediment concentration (SSC) began in October 2018 at one site upstream and one site downstream of Willwood Dam using bank-operated cableways that were installed cooperatively by WDEQ and the U.S. Geological Survey during the summer of 2018. The SSC samples will be used by USGS to develop relationships between streamflow, acoustic backscatter signals, turbidity, and suspended-sediment concentrations so that suspended sediment concentrations will be estimated in real-time and used to quantify sediment loads into and out of Willwood Dam. MP will collect SSC samples as needed to support USGS and WDEQ efforts to characterize a sediment budget and develop revised operating criteria for the Dam.

## **Objective 5 – Evaluate Potential Harmful Cyanobacteria Blooms**

MP will assist with preliminary screening of suspected Harmful Cyanobacteria Blooms (HCBs, also known as Harmful Algal Blooms, or HABs) to determine if they are comprised of harmful cyanobacteria. If harmful cyanobacteria are present, MP will collect samples using standard operating procedures and determine if cyanotoxins and/or cell densities are at unsafe levels. WPP will notify the Wyoming Department of Health if toxins and/or the amount of cyanobacteria exceed unsafe levels so an Advisory can be issued. The Advisory will be posted around the water body and include recommendations on how to keep people and animals safe. WPP will coordinate with the Wyoming Department of Health and the water management agency to monitor the bloom until the toxins and/or the amount of cyanobacteria return to safe levels.

For more information on Wyoming’s Harmful Algal Bloom Action Plan and HCBs in Wyoming, visit WDEQ’s website at [WyoHABs.org](http://WyoHABs.org).

## **Objective 6 - Evaluate Candidate or Existing Reference Sites**

Wyoming’s reference site network consists of over 200 sites identified between 1992 and the present and distributed across six level III ecoregions. Most of the earlier (pre-2000) sites have been sampled two or more times since their establishment, with their reference status verified, though several remain unverified and sampled only once. In 2019, remaining unverified sites may be revisited, evaluated with the reference site screening checklist, and re-sampled, if their reference status is confirmed.

In addition to verifying historic sites, several existing verified or new reference sites may be surveyed with the intent of measuring various geomorphic parameters at each site. Reference site geomorphic data will be used with other datasets to enhance the Stream Quantification Tool (SQT). WPP is part of an interagency workgroup assisting the Corps of Engineers with developing the Wyoming Stream Mitigation Procedure (WSMP). The WSMP utilizes the SQT and other factors to calculate the appropriate mitigation (credits) for functional stream loss (debits) associated with Corps of Engineers authorized activities in Wyoming. For more information about the WSMP and QT visit <http://www.nwo.usace.army.mil/Missions/Regulatory-Program/Wyoming/Mitigation/>.

At the time this document was developed, specific reference sites to be evaluated in 2019 had not yet been selected.

## **Watershed Protection Program Monitoring List for 2019**

The 2019 monitoring list is shown in Tables 1-4. General locations of most waters selected for monitoring in 2019 are illustrated in Figure 1 and Figure 2. Monitoring staff contact information is shown below:

**Statewide:** Jeremy Zumberge (phone: 307-675-5638, email [jeremy.zumberge@wyo.gov](mailto:jeremy.zumberge@wyo.gov))  
Monitoring Supervisor  
Wyoming Department of Environmental Quality - Water Quality Division  
2100 W. 5<sup>th</sup>, Sheridan, WY 82801

**Cheyenne:** Lanny Goyn (phone: 307-777-6353, email: [lanny.goyn@wyo.gov](mailto:lanny.goyn@wyo.gov))  
Eric Hargett (phone: 307-777-6701, email: [eric.hargett@wyo.gov](mailto:eric.hargett@wyo.gov))  
Wyoming Department of Environmental Quality - Water Quality Division  
200 West 17<sup>th</sup> Street, Cheyenne, WY 82002

**Lander:** Tavis Eddy (phone: 307-335-6957, email: [tavis.eddy@wyo.gov](mailto:tavis.eddy@wyo.gov))  
Mike Wachtendonk (phone: 307-335-6751, email: [michael.wachtendonk@wyo.gov](mailto:michael.wachtendonk@wyo.gov))  
Wyoming Department of Environmental Quality - Water Quality Division  
510 Meadowview Drive, Lander, WY 82520

**Sheridan:** Jason Martineau (phone: 307-675-5632, email: [jason.martineau@wyo.gov](mailto:jason.martineau@wyo.gov))  
Chad Rieger (phone: 307-675-5637, email: [chad.rieger@wyo.gov](mailto:chad.rieger@wyo.gov))  
Wyoming Department of Environmental Quality - Water Quality Division  
2100 W. 5<sup>th</sup>, Sheridan, WY 82801

## Quality Assurance and Quality Control

Quality assurance and quality control (QA/QC) procedures are critical aspects of WPP monitoring plans. QA/QC procedures are applied to all monitoring strategy operations to ensure that the results obtained are of known and suitable quality to meet WPP's objectives. Read WDEQ (2016) and WDEQ (2018b) for details regarding QA/QC procedures integrated into the MP.

All data are collected in accordance with the credible data law specified in the Wyoming Environmental Quality Act § 35-11-302 (b)(i) and (b)(ii) and detailed in Chapter 1, Section 35 of the Wyoming Water Quality Rules and Regulations.

## Other Watershed Protection Program-Supported Projects for 2019

### WDEQ-USGS Statewide Monitoring Network

WPP cooperates with the United States Geological Survey (USGS) to monitor 12 stream and river sites across the state (Table 4 and Figure 2). WDEQ supports two streamflow measurement gages though non-WDEQ funded gages exist at many of the sites. The emphasis of this network is data collection to support nutrient criteria development. Sampling is conducted either quarterly or monthly, depending on objectives, amount of historic water quality records, and prioritization for criteria development. Specific sampled parameters also vary by site depending on objectives, but include field parameters, major ions, trace metals, nutrients, sediment, and/or bacteria.

## References

WDEQ. 2018a. Chapter 1, Wyoming Surface Water Quality Standards, Wyoming Department of Environmental Quality, Water Quality Division, Cheyenne, WY.  
<https://rules.wyo.gov/Search.aspx>

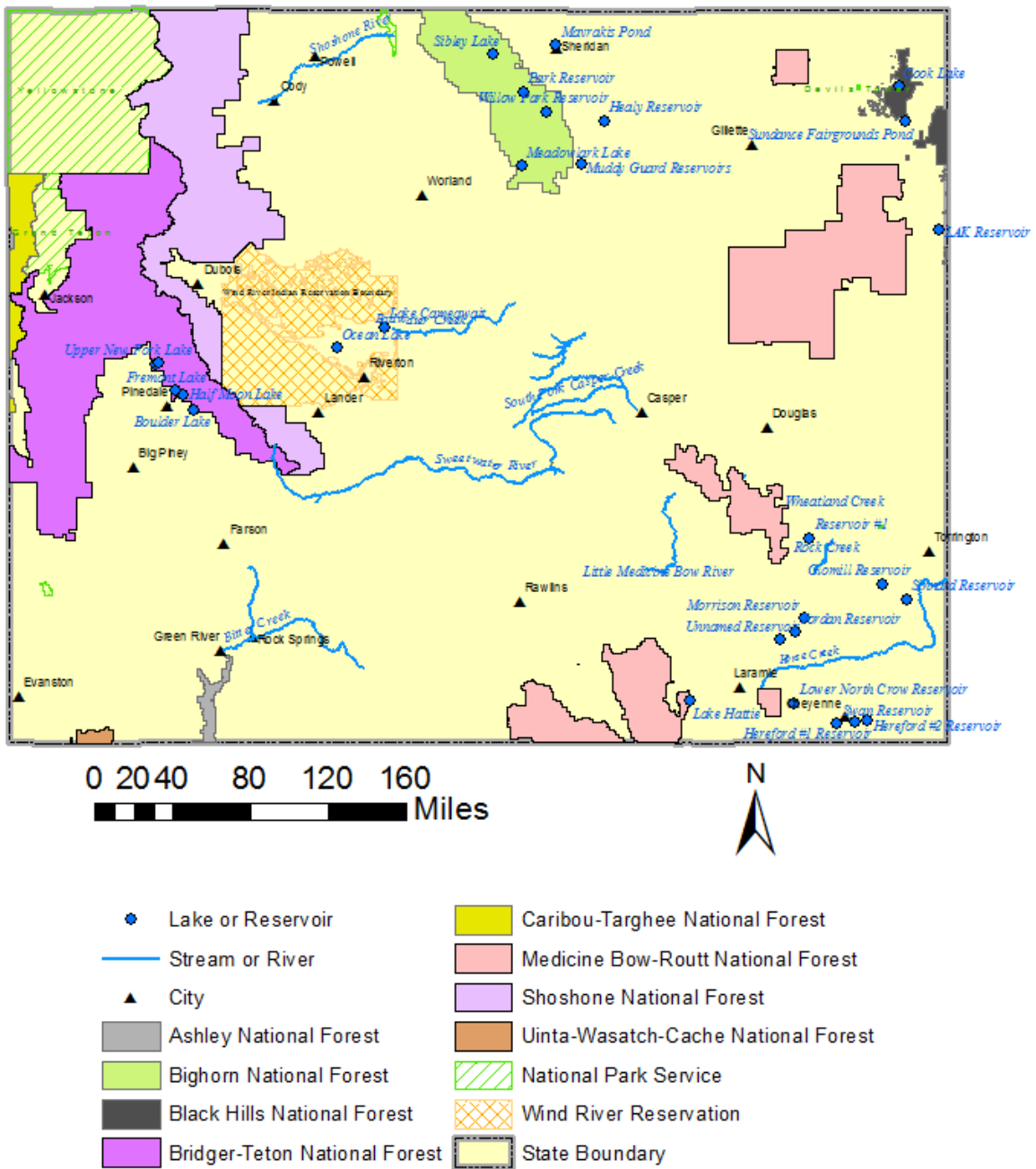
WDEQ. 2018b. Manual of Standard Operating Procedures for Sample Collection and Analysis. Wyoming Department of Environmental Quality, Water Quality Division, Cheyenne, WY.  
<http://deq.wyoming.gov/wqd/qaqc/resources/manual/>

WDEQ. 2018c. Wyoming Water Quality Assessment and Impaired Waters List (2018 Integrated 305(b) and 303(d) Report). Document #18-0111. Wyoming Department of Environmental Quality, Water Quality Division, Watershed Program, Cheyenne, WY.  
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WDEQ. 2016. Quality assurance project plan for water quality monitoring. Wyoming Department of Environmental Quality, Water Quality Division, Watershed Protection Program, Cheyenne, WY. <http://deq.wyoming.gov/wqd/qaqc/resources/qapp/>

WDEQ. 2010. Surface water monitoring strategy 2010-2019. Wyoming Department of Environmental Quality, Water Quality Division, Sheridan, Wyoming.  
<http://deq.wyoming.gov/wqd/surface-water-monitoring/resources/strategy-plan/>

Figure 1. Waterbodies included in the 2019 Water Quality Monitoring Plan



**Table 1. Targeted Water Quality Standards Attainment Studies**

Basin	Stream	Parameter(s) of concern	Designated Use(s)	Crew
North Platte	Sweetwater River	None	All	Lander
North Platte	Horse Creek	Arsenic	Drinking Water, Fish Consumption	Cheyenne
Bighorn	Shoshone River	Sediment	Fisheries, Aquatic Life	Sheridan

**Table 2. Monitoring for nutrient criteria development**

Basin	Reservoir	Latitude	Longitude	Crew	Objective*
Powder	Healy Reservoir	44.41014700	-106.60985900	Sheridan	1
Tongue	Mavrakis Pond	44.81053700	-106.96464600	Sheridan	1
Bighorn	Meadowlark Lake	44.17035600	-107.22161200	Sheridan	1
Powder	Muddy Guard Reservoirs	44.17779900	-106.77816500	Sheridan	1
Tongue	Park Reservoir	44.56596400	-107.21239900	Sheridan	1
Tongue	Sibley Lake	44.76162900	-107.43688000	Sheridan	1
Powder	Willow Park Reservoir	44.45839700	-107.04038100	Sheridan	1
Cheyenne	LAK Reservoir	43.82723200	-104.10979700	Sheridan	1
Belle Fourche	Sundance Fairgrounds Pond	44.40644000	-104.36735900	Sheridan	1
Belle Fourche	Cook Lake	44.59138700	-104.40723700	Sheridan	1
North Platte	Glomill Reservoir <i>or</i>	41.88518100	-104.52841800	Cheyenne	2
North Platte	<i>Sinnard Reservoir</i>	41.80196500	-104.35442700	Cheyenne	2
North Platte	Morrison Reservoir <i>or</i>	41.69352400	-105.11097600	Cheyenne	2
North Platte	<i>Jordan Reservoir or</i>	41.618182	105.17749500	Cheyenne	2
North Platte	<i>Unnamed Reservoir</i>	41.575247	-105.29501500	Cheyenne	2
South Platte	Hereford #1 Reservoir <i>or</i>	41.11666800	-104.73786000	Cheyenne	2
South Platte	<i>Hereford #2 Reservoir</i>	41.12443200	-104.64206900	Cheyenne	2
North Platte	Reservoir #1 <i>or</i>	42.140858	-105.07610000	Cheyenne	2
South Platte	<i>Swan Reservoir</i>	41.10144800	-104.87029000	Cheyenne	2
North Platte	Lower North Crow Reservoir	41.22055500	-105.19068500	Cheyenne	1
North Platte	Lake Hattie	41.23048900	-105.97201200	Cheyenne	1
Bighorn	Ocean Lake	43.18575500	-108.59910400	Lander	1
Green	Flaming Gorge	41.21533600	-109.57724700	Lander	1
Green	Half Moon Lake	42.92654100	-109.74040800	Lander	1
Green	Fremont Lake	42.95174200	-109.80083800	Lander	1
Green	Boulder Lake	42.84730800	-109.66267100	Lander	1
Green	Lower New Fork Lake	43.09265000	-109.95348500	Lander	1
Green	Upper New Fork Lake	43.10438400	-109.92548900	Lander	1
Bighorn	Lake Cameawait	43.29948900	-108.24479000	Lander	2

- 1=Nutrient criteria development, 2=Nutrient and phytoplankton characterization for recreation and drinking water suitability

**Table 3. TMDL Program Assistance**

Basin	Stream	Cause of impairment	Designated Use(s)	Crew
Bighorn	Shoshone River	Not currently impaired	Fisheries, Aquatic Life	Sheridan
North Platte	Wheatland/Rock Creek	E. coli bacteria	Recreation	Cheyenne
North Platte	Little Medicine Bow River	Sediment	Aquatic Life	Cheyenne
Green	Bitter Creek	Chloride	Aquatic Life	Cheyenne
Green	Kilpecker Creek	Chloride	Aquatic Life	Cheyenne

**Table 4. WDEQ/USGS Cooperative Agreement**

Station ID	Station Name	Constituents <sup>1</sup>	Frequency
06236100	Wind River above Boysen Reservoir	Field, Nutrients, Bacteria	12/yr
06253000	Fivemile Creek near Shoshoni	Field, Nutrients, Bacteria	12/yr
06258000	Muddy Creek near Shoshoni	Field, Nutrients, Bacteria	12/yr
06259000	Wind River below Boysen Reservoir	Field, Major ions, Nutrients, Trace elements	12/yr
06285100	Shoshone River at Lovell	Field, SSC, TSS	4/yr
06630000	North Platte River above Seminoe, near Sinclair	Field, Nutrients	12/yr
06635000	Medicine Bow River above Seminoe Reservoir near Hanna	Field, Nutrients, Bacteria	12/yr
06634060	Little Medicine Bow River above Sand Creek, near Shirley Basin	Gage only	
06636000	N Platte River ab Pathfinder Reservoir	Field, Major ions, Nutrients, Trace elements	12/yr
06641000	North Platte River below Pathfinder Reservoir	Field, Major ions, Nutrients	4/yr
06639000	Sweetwater River near Alcova	Field, Major ions, Nutrients, Trace Elements, Bacteria	4/yr
06642000	North Platte River at Alcova	Field, Nutrients	4/yr
13025500	Crow Creek near Fairview	Field, Nutrients, Se (FIL), Gage	4/yr

1. Field parameters: discharge, pH, water temperature, dissolved oxygen, electrical conductivity (EC)

Figure 2. Map of sites included in the USGS-WDEQ cooperative monitoring agreement. Refer to Table 4 for site names associated with each station ID.

