

**CAMPBELL COUNTY CONSERVATION DISTRICT
POWDER RIVER AND UPPER BELLE FOURCHE
WATERSHEDS MONITORING PROJECT**

**Water Quality
Sample and Analysis Plan
2014**

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1.0 INTRODUCTION

The Campbell County Conservation District (CCCD) Sampling and Analysis Plan (SAP) is written and approved by the CCCD to meet the Quality Assurance/Quality Control regulatory requirements of the Wyoming Department of Environmental Quality, Water Quality Division, Watershed Protection Program and the United States Environmental Protection Agency (USEPA) for water quality samples collected under projects funded by Clean Water Act (CWA) Section 319 grants, as well as other sources of local, state, and federal funding. The CCCD SAP will meet the requirements of Wyoming Statutes § 35-11-103 (c) (xix) and § 35-11-302 (b).

The CCCD SAP is intended as a field guide for CCCD personnel who will be conducting the water quality monitoring. Additionally, the CCCD SAP will serve as guidance for Quality Assurance/Quality Control procedures and data management regarding water sampling.

Samples are collected using the methods, procedures, and protocols in the Natural Resources Conservation Service “National Handbook of Water Quality Monitoring,” Part 600, May 1998, as amended and the Wyoming Department of Environmental Quality, Water Quality Division, Watershed Program “Manual of Standard Operating Procedures for Sample Collection and Analysis,” 2011 as amended. The two (2) referenced documents are hereby incorporated by reference into the CCCD SAP.

TABLE OF CONTENTS

1.0 INTRODUCTION	iv
2.0 BACKGROUND	7
2.1 Project Area Description	8
2.1.1 Upper Belle Fourche (HUC 10120201)	8
2.1.2 Little Powder River.....	9
3.0 PURPOSE STATEMENT	11
3.1 Objectives.....	11
3.2 Credible Data Legislation.....	11
3.3 Corrective Actions.....	12
4.0 SAMPLING.....	13
4.1 Sampling Design.....	13
4.2 Sampling Personnel, Training and Experience	13
4.3 Sampling Site Locations	13
4.4 Parameters, Units, Analytical Methods, SOPs, Preservatives, Holding Times	16
4.5 Sampling Bottles	19
4.6 Sampling Schedule and Frequency	19
4.7 Health and Safety	21
4.7.1 Emergency Action Plan.....	21
4.7.2 Hospital.....	21
4.8 Standard Operating Procedures	21
4.9 Sample Labeling\	22
4.10 Sample Shipping.....	22
4.11 Waste Disposal.....	23
5.0 QUALITY ASSURANCE/QUALITY CONTROL	24
5.1 Field Audits.....	24
5.2 Field Log Books	24
5.3 Calibration Standards	25
5.4 Chain of Custody	25
5.5 Equipment Calibration and Maintenance	25
5.6 Data Verification and Validation.....	26
5.7 Field Quality Control (QC) Samples.....	27
5.8 Data Quality Objectives	28
5.9 Sampling Methods	28
5.10 Assessment and Response Actions	28
6.0 LABORATORIES	29
6.1 Laboratory QA/QC Plans	29
6.2 Contract Laboratory	29
6.3 Laboratory Results.....	30

7.0 DATA.....	31
7.1 Data Entry.....	31
7.2 Data Archiving	31
7.3 Statistical Analysis	31
8.0 REPORTS	32
8.1 Corrective Action Report.....	32
8.2 Final Report	32

LIST OF TABLES

Table 4.1	CCCD Personnel	13
Table 4.2	Sampling Site Locations	15
Table 4.3	Parameters and Sample Collection Methods.....	16
Table 5.1	Equipment Calibration and Maintenance	26
Table 5.2	Sample Quality Control	27
Table 5.3	Summary of Data Quality Objectives	28
Table 7.1	Data Archiving	31

LIST OF APPENDICES

- Appendix A. Forms and Reports
- Appendix B. Field Logs and Laboratory Results
- Appendix C. Sample Site Location Maps
- Appendix D. References and Information Resources
- Appendix E. Equipment Manuals/Instructions
- Appendix F. SOPs and Methods
- Appendix G. Amendments

2.0 BACKGROUND

Under the Clean Water Act, States are required to determine and describe the condition of all water of the State, including surface waters; this is done by assessing the watercourse condition and classifying waters by their existing and potential beneficial uses. Each use classification has a specific set of water quality numeric and narrative criteria that describes the classification. Wyoming has classified their surface waters and these classifications are presented in the Water Quality Rules and Regulations, Chapter 1 – Wyoming Surface Water Quality Standards.

Additionally, the CWA mandates that every two years the States evaluate water quality data. The results are summarized in a report and the impaired waterbodies are tabulated into a list, known as the Wyoming 303(d) List. The 303(d) List includes all of the waters within Wyoming that are impaired and do not fully support existing or designated uses. **Water is deemed to be “impaired” or “non-supporting” if any of the narrative or numeric criteria associated with the classification of the stream reaches in question are shown to be unmet or adversely affected by human activity.** The most recent report entitled “Wyoming Water Quality Assessment and Impaired Waters List (2012 Integrated 305(b) and 303(d) Report)” includes four streams located within Campbell County. The following table summarizes the stream listings by watershed.

Table 2.1 List of Impaired Waters in the CCCD

Watershed	Stream	Classification	Impairment Source
Upper Belle Fourche	Donkey Creek	3B	Fecal Coliform
	Stonepile Creek	3B	Fecal Coliform
Little Powder River	Little Powder River	2AB	<i>E.coli</i>
Upper Powder River	Middle Prong Wild Horse Creek	3B	<i>E.coli</i>

Fecal coliform and *E.coli* are indicator bacteria types. These bacteria are specific to fecal material from humans and other warm-blooded animals. While these bacteria are generally not harmful themselves, they indicate the possible presence of pathogen bacteria, viruses, and protozoans that also live in human and animal digestive systems. Since *E.coli* provides the best indicator of health risk from water contact in recreational water, both WDEQ and EPA base the water quality standards on *E.coli*.

Upper Belle Fourche Watershed

Donkey Creek and Stonepile Creek lie within the Upper Belle Fourche watershed. Donkey Creek was put on the 303(d) List for Fecal Coliform in 2000, while Stonepile Creek was added in 2002 for fecal coliform impairment. Both Donkey and Stonepile Creeks are directly influenced by storm water discharge, permitted point-source discharge and other non-point and point discharges within and near the City of Gillette.

In Crook County the Belle Fourche River is listed as impaired for *E.coli* both upstream and downstream of Keyhole Reservoir; and the river's reach from Keyhole Reservoir upstream to the Donkey Creek confluence is also listed for ammonia and chloride.

Little Powder River

The Little Powder River was included on the 303(d) List in 2010 for not supporting its designated use for recreation due to *E.coli*. The listing includes the stream reach from the Wyoming/Montana state line upstream to the confluence of Spring Creek. The source of the listing is unknown, however the river is influenced by wildlife, recreation, agriculture, coal mines and CBNG discharges.

2.1 CCCD Project Area Description

The project area includes three watersheds: Upper Belle Fourche, Upper Powder River, and Little Powder River. Map 1 in Appendix D delineates the watersheds, while a description of each watershed is discussed below.

2.1.1 Upper Belle Fourche (HUC 10120201)

The Upper Belle Fourche watershed includes the City of Gillette and the land areas south and east to the Campbell County boundary lines. The Belle Fourche River originates in the plains west of Wright. The river flows northeast, crossing into Crook County south of Moorcroft.

Donkey Creek originates west southwest of Gillette, Wyoming and flows east through the Gillette Fishing Lake. The creek then generally follows Interstate 90 until it flows into the Belle Fourche River, near Moorcroft, Wyoming. Donkey Creek should be classified as an effluent dominated water due to the permitted flow emanating from the Gillette Wastewater Treatment Plant.

Stonepile Creek originates approximately 5 miles west of Gillette and intermittently flows near Echeta Road west of Gillette. The creek is then confined in an engineered concrete channel through the City of Gillette where it can receive intermittent flows from streets and adjacent lands and even includes a point source flow just west of the Butler Spaeth bridge crossing. There are locations in the concrete channel that allows the water to pool and lie dormant for many days. The concrete channel and adjacent lands can also exhibit refuse and debris. South of Interstate 90, and just east of Gillette, the creek returns to its natural channel and continues past the Gillette Wastewater Treatment Plant just prior to its confluence with Donkey Creek.

Streamflow – A United States Geological Survey (USGS) station (06425720), located near Cordero-Rojo Mine, has recorded discharge rates in the Belle Fourche River between 1975 and 1983; and 2001 to present. The data indicates that the highest discharge rates occur between the months of March and June (average discharge rates range from 3.2 to 8.4 cfs). Similarly, instantaneous flow measurements taken by the USGS on Donkey Creek and Stonepile Creek indicate highest flows during the spring/summer. In general, flows are highest just below the confluence of Donkey and Stonepile Creeks, which is likely due to the inflows by the Gillette Wastewater Treatment Plant in Stonepile Creek. Flows above the discharge point on Stonepile

Creek are typically less than 1.5 cfs, while flows below the discharge point increase to approximately 5 cubic feet per second (cfs).

Land Use – The principle land uses in the Belle Fourche watershed are agriculture/grazing, open space for wildlife/recreation, and energy development. Beyond the influences of the City of Gillette on the streams in terms of water quality and quantity, a number of other potential influences exist. These include various coal mines and coal bed natural gas producers holding Wyoming Pollution Discharge Elimination Systems (WYPDES) permits which can discharge to Donkey Creek.

Precipitation/Seasonal Distribution – Average precipitation generally ranges from 15-17 inches a year with some areas receiving 12-14 inches a year. Normal high flow peaks March through June responding to snowmelt and spring rains/wet snows. Short term and long term drought has been experienced in the CCCD, and greatly effects the average annual precipitation.

Geology – The Upper Belle Fourche watershed within Campbell County has three primary geologic units. From west to east these include; Tertiary Wasatch Formation and two members of the Tertiary Fort Union Formation (Lebo Shale and Tullock).

2.1.2 Little Powder River (HUC 10090208)

Originating north of Gillette, the Little Powder River watershed is bounded on the east by the Belle Fourche River and the Little Missouri River watersheds and on the west by the Powder River watershed. The Little Powder flows northward, entering the state of Montana near Broadus before draining into the Powder River. Few population centers exist in the watershed with Recluse, Wyoming located on the drainage divide between Little Powder River and Powder River.

Streamflow – USGS data indicates that perennial flow is common on the stream with peak flows occurring in early summer.

Land Use – The principal land uses in the Little Powder River watershed are agriculture/grazing, wildlife/recreation, and energy development. Potential influences to water quality and quantity in the watershed include surface coal mines and discharges of water from oil and gas production. Existing and operational surface coal mines include: Buckskin Mine, Eagle Butte, Rawhide Mine, and Dry Fork Mine all north of Gillette.

Precipitation/Seasonal Distribution – The average precipitation within the watershed is similar to the Upper Powder River and Upper Belle Fourche watershed. Average precipitation is around 15 inches a year, with the majority occurring between the months of March and June.

Geology – Tertiary age geologic units dominate geology of the Little Powder River watershed. From south to north these include the Wasatch Formation, and Tongue

River Member, Lebo Shale Member and Tullock Member of the Fort Union Formation, with the parent materials providing the silt/sand substrate typical of the high plains prairie streams in Campbell County.

3.0 PURPOSE STATEMENT

Pathogen impairment of the several streams within Campbell County is of great concern to the CCCD. Since the source of impairment on all of the listed streams is unknown, the CCCD will continue water monitoring efforts to identify potential contributors and assess the effectiveness of Best Management Practices (BMPs). The CCCD will also cooperate with the Crook County Natural Resource District (CCNRD) to collaborate monitoring efforts on the lower end of Donkey Creek and its confluence with Belle Fourche River. This collaborative effort will allow both Districts to better understand the bacteria impairment as it moves through Donkey Creek as well as identify contributors and possible solutions through the use of BMPs.

The CCCD SAP incorporates by reference the Wyoming Department of Environmental Quality, Water Quality Division, Watershed Protection Program Monitoring Quality Assurance Project Plan (QAPP), 2001, as amended.

3.1 Objectives

- To determine the sources of the *E. coli* impairment on Donkey Creek, Stonepile Creek, and Little Powder River.
- To determine Best Management Practices to address those sources on Donkey Creek, Stonepile Creek, and Little Powder River.
- To assess sources of excess nutrients on Donkey and Stonepile Creek and their effect downstream on the Belle Fourche River.
- To evaluate the effect of Best Management Practices on *E. coli* loads in Donkey Creek, Stonepile Creek and the Little Powder River.
- To evaluate long terms trends in water quality on Donkey Creek, Stonepile Creek, and Little Powder River.

3.2 Credible Data Legislation

Monitoring completed under the CCCD SAP is in accordance with Wyoming Statute (W.S.) §35-11-103 (c) (xix) and W.S. 35-11-302 (b), and are listed below.

§35-11-103 (c) (xix): “Credible Data” means scientifically valid chemical, physical, and biological monitoring data collected under an acceptable sampling and analysis plan, including quality control, quality assurance procedures and available historical data.”

§35-11-302 (b) The administrator, after receiving public comment and after consultation with the advisory board, shall recommend to the director rules, regulations and

standards to promote the purposes of this act. The rules, regulations and standards shall prescribe:

(i) A schedule for the use of credible data in designating uses of surface water consistent with the requirements of the Federal Water Pollution Control Act (33 U.S.C. sections 1251 through 1387). The use of credible data shall include consideration of soils, geology, hydrology, geomorphology, climate, stream succession and human influence on the environment. The exception to the use of credible data may be in instances of ephemeral or intermittent water bodies where chemical or biological sampling is not practical or feasible;

(ii) The use of credible data in determining water body's attainment of designated uses. The exception to the use of credible data may be in instances where numeric standards are exceeded or in ephemeral or intermittent water bodies where chemical or biological sampling is not practical or feasible.

3.3 Corrective Actions

The District will evaluate and monitor the watershed monitoring project on an annual basis. Any modifications to the sampling plan, including site locations, sampling schedule, sample collection, choice of laboratory, quality assurance/quality control, sampling methods or standard operating procedures will be decided by the District employees and the CCCD Board of Supervisors. Records such as field personnel and training which may change yearly will be updated as necessary. In the event of a monitoring plan change the District will amend the SAP, including the date of the amendment. The amendment will be included in the SAP in the Appendix G and all field personnel will be notified. Historical data and information will be added to and or revised in the SAP as time allows and information becomes available. Such historical information amendments or additions to the CCCD SAP will be located in the Appendix and approved by the Board.

If quality control samples are not meeting project criteria or if any other event requires corrective action the District will follow the procedures included in the WDEQ QAPP for assessment and response actions.

4.0 SAMPLING

4.1 Sampling Design

The original sampling design was based on previous monitoring conducted by WDEQ as well as sites established by CCCD to assess the impacts of coal bed methane water production and disposal. The sample design is now focused on *E.coli* and gathering data to determine trends in the watershed. Additionally, the chemical and physical parameters sampled and measured in combination with the *E.coli* sampling will provide the CCCD and State of Wyoming an understanding of overall water quality within each stream; help determine if the streams are meeting their designated uses; help define BMP and ultimately un-list the streams. The CCCD will also be incorporating DNA Pyrosequencing® technology to assist in effectively targeting sources of bacterial impairments as well as focus BMPs efforts to more effectively deal with those sources. Additionally, the CCCD will cooperate with the Crook County Natural Resource District (CCNRD) to collaborate monitoring efforts on the lower end of Donkey Creek and its confluence with Belle Fourche River. This collaborative effort will allow both Districts to better understand the bacteria impairment as it moves through Donkey Creek as well as identify contributors and possible solutions through the use of BMPs.

4.2 Sampling Personnel, Training and Experience

CCCD currently employs four full-time people as well as collaboration with the CCNRD Water Quality Sampler as presented in Table 4.1. Field sampling is always completed by a two person crew.

Table 4.1 CCCD Personnel

Name	Organization/Title	Training	Date of Last Training	Previous Experience
Tim Morrison	CCCD District Manager	WACD Water Quality Monitoring Training	2014 (Recertification)	10 years
Debbie Hepp	CCCD Program Assistant	WACD Water Quality Monitoring Training	2014 (Recertification)	8 years
Crystal Kellebrew	CCCD Administrative Assistant	WACD Water Quality Monitoring Training	-----	-----
Kevin Quick	CCCD Water/Range Technician	WACD Water Quality Monitoring Training	2013 (All Modules)	3 years
TJ Schroll	CCNRD Water Quality Sampler	WACD Water Quality Monitoring Training	2009, 2011	4.5 years

4.3 Sampling Site Locations

A Garmin GPS unit was/is used to determine latitude and longitude coordinates for each monitoring site. Written permission between CCCD and the landowners has been/is obtained for monitoring sites located on private, State, and Federal lands as well as

permission of access to each monitoring site. CCCD will also notify each landowner before and after each monitoring season. The CCCD takes landowner permission and privacy seriously. Proof of the landowner agreements obtained by CCCD can be viewed at the CCCD office. A list of sample site, latitude/ longitude coordinates for each site, and a description of each site are presented in Table 4.2 below. Maps of the route CCCD takes to access each site is located in Appendix C.

Table 4.2 Sampling Site Locations

Stream	Station ID Code	Latitude Longitude (GPS)	HUC Code	Land Ownership	Site Description
Belle Fourche River	BF2	44.2680 -104.9795	10120201	Private	Belle Fourche River on state land below the confluence of Buffalo Creek. On Belle Fourche River Road (about a mile off of highway) above the Moorcroft wastewater treatment plant
Belle Fourche River	BF3n	44.2768 -104.9730	10120201	State	Belle Fourche River 300 meters downstream of I-90 below Moorcroft and upstream from the confluence of Donkey Creek.
Donkey Creek	DC2n	44.2813 -105.0637	10120201	Private	Donkey Creek upstream of the confluence with the Belle Fourche River. 5 miles west of Moorcroft on Donkey Creek Road.
Donkey Creek	DC3	44.28555 -105.20606	10120201	Private	From Gillette 15 mi east on I-90, take exit #141 right on to Jack Smith Road. South approx. 1/2 mi to culvert crossing road. Sample site is on west side of road 50' down wildlife trail and close to a tree in the creek bank.
Donkey Creek	DC4	44.28955 -105.37336	10120201	Wyodak Resources	From Gillette 6 miles east on I-90, take exit #132 right on to American Road, site is east of Wyodak power plant before train tracks. Take dirt road to left after corner, follow road past well house, go through gate. Site is 30' from gate.
Donkey Creek	DC7	44.2646 -105.47095	10120201	Gillette Country Club Golf Course	From intersection of S. Douglas Hwy and Boxelder, go east on Boxelder 0.75 miles to intersection. Turn right and go south on Butler Spaeth Rd .15 miles to Country Club Rd. Follow Country Club Rd to parking lot of Country Club Golf Course. Take gravel maintenance Rd south along east side of golf course to bridge. Site approx. 300' down creek where creek enters natural channel
Donkey Creek	DC8	44.26721 -105.48458	10120201	City of Gillette	From intersection of S. Douglas Hwy and Lakeway, go south on S. Douglas Hwy one block to Edwards Rd. Turn left of Edwards Rd and go east until turns to gravel. Run right before gravel. Follow road around to east end of Gillette Fishing Lake. Site is a cross road in trees below outfall of Lake.
Donkey Creek	DC9	44.25951 -105.51805	10120201	City of Gillette	From CCCD office travel south on 4J Rd 1.4 miles to intersection. Turn right on West 4J Rd, .5 miles to Brobry Blvd. Turn left on Brobry Blvd .13 miles to Donkey Creek crossing. Sample site is to the left approx. 50'
Stonepile Creek	SC1	44.26859 -105.43847	10120201	Private	From intersection of S. Dgls Hwy and Boxelder, go east on Boxelder 2 mi to 4 way stop. Turn right and go south 1 mi to Gillette Waste Water Treatment Plant entrance. Across from plant entrance is a locked gate on the right. Take the dirt road staying to the left. Site is approximately .5 mi to USGS monitor site. below City of Gillette Sewage Treatment Outfall
Stonepile Creek	SC3A	44.28418 -105.47076	10120201	City of Gillette	From intersection of S. Dgls Hwy and Boxelder, go east 1.2 miles to Chara Ave. Turn left on Chara Ave, go .3 miles and turn right on gravel access road. Follow road to end. Sample site is below I-90 where stream returns to natural channel.
Little Powder River	LPR1	44.646267 -105.312717	10090208	Private	From Gillette north on Highway 59 approx. 25 miles to Weston turn out, then turn right on Heald Road. Travel 1.5 miles to Soda Wells Road and turn right. Go past picnic site to wire gate entering John Norfolk pasture. Sample site is below Curt Shatzer home site, which is approx. 200' to the left of the old Soda Wells road bridge.
Little Powder River	LPR2	44.901394 -105.35839	10090208	Private	From Gillette north on Highway 59 North past Sterling Thrush residence approx. 43 miles, to highway marker 163. Right hand turnoff just past mile marker 163. Travel approximately 1 mile to the bridge over the Little Powder River. Sample site is downstream below the bridge approximately 100'.

4.4 Parameters, Units, Analytical Methods, SOPs, Preservatives, Holding Times

The CCCD will collect credible data that includes the physical, chemical, and biological parameters of the water body. Due to the intermittency and ephemeral characteristics of CCCD streams and geomorphologic features not all chemical or biological data can be collected and analyzed. For example there are times during the year that the streams are dry with no flow evident or are stagnant which in those cases samples of water will not be retrieved. The WDEQ approved sampling parameters, analytical methods, preservative required and holding times are listed in Table 4.3. Additionally, a summary of the rationale for each parameter is presented.

Table 4.3 Parameters and Sample Collection Methods

Parameter	Units	Analytical Method	Preservative	Holding Times
BIOLOGICAL				
E.coli	col/100 mL	SM 9223B	Iced and kept between 1 – 4 °C	6 hours
Total Coliform	Col/100 mL	SM 9223B	Iced and kept between 1 – 4 °C	6 hours
DNA Pyrosequencing	N/A	Roche 454 GS-FLX+	Freezing	N/A
CHEMICAL (LABORATORY)				
Ammonia as N	mg/L	EPA 350.1	Sulfuric Acid Cool to 4 °C	28 days
Chloride	mg/L	EPA 300.0	Cool to 4 °C	28 days
Electrical Conductivity	µhos/cm	SM 2510B	Cool to 4 °C	28 days
Nitrate – Nitrite as N	mg/L	EPA 353.2	Sulfuric Acid to pH<2	28 days
Total Phosphorous	mg/L	EPA 200.7	Nitric Acid to pH<2, Cool to 4 °C	28 days
Sulfate	mg/L	EPA 353.2	Cool to 4 °C	28 days
Total Dissolved Solids (TDS)	mg/L	SM2540	Cool to 4 °C	7 days
Total Suspended Solids (TSS)	mg/L	SM2540	Cool to 4 °C	7 days
PHYSICAL (FIELD)				
Air Temperature	°C	see 2011 SOP	N/A	N/A
Stream Temperature	°C	See 2011 SOP	N/A	N/A
pH	unit less	See 2011 SOP	N/A	N/A
Range Transects	N/A	see 2011 SOP	N/A	N/A
Specific Conductance	µhos/cm	See 2011 SOP	N/A	N/A
Dissolved Oxygen	%, mg/L	see 2011 SOP	N/A	N/A
Turbidity	NTUs	See 2011 SOP	N/A	N/A

Biological Parameters

Indicator Bacteria: *E. coli* are any bacterium in the Family *Enterobacteriaceae* named *Escherichia coli* where the *Escherichia* is the Genus and *coli* is the Species. These bacteria are generally not harmful themselves but indicate the possible presence of

bacteria/pathogens originating from humans and/or warm-blooded animals e.g. livestock, wildlife, and pets. Microbiological parameters to be sampled include *E. coli* and Total Coliform bacteria. Samples must be delivered to the contract Laboratory within 6 hours from when they were collected to insure Lab personal adequate time to prepare and process samples.

Pyrosequencing®

An evaluation of microbial diversity using a customized assay for tagged Pyrosequencing® by the Research and Testing Laboratory located in Lubbock, Texas, will be conducted on two (2) sites, LPR1 and LPR2 in the Little Powder River Watershed, with the possibility to be performed in the Upper Belle Fourche watershed when specified by the grant agreement/landowners. Pyrosequencing® technology is sequencing by synthesis, which is a technique for quantitative analysis of DNA sequences that relies on detection of pyrophosphate release on nucleotide incorporation using an array-based technology for large-scale DNA sequencing.

Pyrosequencing® samples are to be collected at all sites, during each monitoring event throughout the project unless otherwise specified in the grant agreement/landowner. At each site the samples are to be collected in a 15 mL screw top Centrifuge Tube. Volumes in tubes should be 50% of the total capacity of tube to prevent breakage during freezing or shipping. The samples are to be labeled with the site name, date, and time the sample was taken. After samples are collected, they are to be placed in an iced cooler at approximately 4°C. The samples are then to be stored in labeled baggies in an adequate freezer for storage until the end of the sampling season. These samples should be submitted in accordance with the Research and Testing Laboratory's *Sample Submission Guidelines* (February 2013), as described in Appendix F. When all the Pyrosequencing® samples have been collected for the season, they need to be sent to: Research and Testing Laboratory, 4321 Marsha Sharp FWY, Door #2, Lubbock, Texas 79407.

Chemical Parameters

1. Conductivity: In general, the more dissolved material present in water, the higher the electrical conductivity or specific conductance. Dissolved materials are required to establish and maintain diverse macro invertebrate communities. However, water with specific conductance that is too high can negatively affect aquatic organisms and water quality for ungulate/wildlife use. Streams with natural sandy silt substrate may affect specific conductance and aquatic organisms or the lack thereof in the stream system.
2. Nitrate and Nitrite as N: Is an essential nutrient for plant growth. Indirect effects include stimulation of bacteria including total coliform, and fecal coliform. Periphyton, algae and in stream macrophyte growth can also benefit from nitrites and nitrates.

3. Total Dissolved Solids: TDS is a measurement of the total substances dissolved in water and correlates with conductivity and salinity.
4. Total Phosphorus: Phosphorus is an essential element for plant growth and is considered one of the primary nutrients associated with non-point source pollution. Although phosphorus is also a limiting factor to plant growth the sustained presence of nitrates and nitrite can dramatically increase phytoplankton and macrophyte growth in the stream.
5. Total Suspended Solids: TSS in Wyoming streams is primarily due to suspended sediment. High TSS concentrations during low stream flow regimes results in sedimentation deposition to the streambed. A variety of adverse biological impacts are caused by sediment deposition. Total suspended solids may also be part of the natural order and background of the stream system due to geology and climate.
6. Sulfates: Sulfate is a naturally occurring constituent in Wyoming streams. However, artificial increases in levels of sulfate can occur due to introduction of water originating as a by-product during oil field production activity. Increases in sulfate concentration above a threshold can negatively impact benthic macro invertebrates.
7. Ammonia: Ammonia is a by-product of the decomposition of organic material and converts quickly to Nitrite and then to Nitrate, and is also a product of high energy fixation of atmospheric nitrogen. It is toxic to all forms of aquatic organisms at high concentrations.
8. Chloride: Streams draining from sedimentary deposits high in salt may have naturally occurring high chloride levels. Oil and gas produced water, industrial and municipal effluent can increase the level of chloride in streams. Elevated concentrations of chloride in streams are toxic to all forms of aquatic life.

Physical Parameters

1. pH: A standard measurement conducted for water quality, indicating acidity or alkalinity of water.
2. Dissolved Oxygen: The amount of free oxygen available to aquatic organisms and critically important to fisheries health.
3. Turbidity: A measure of the amount of light intercepted by a given volume of water due to the presence of suspended and dissolved matter and microscopic biota. Increasing the turbidity of the water decreases the amount of light that penetrates the water column. High levels of turbidity are harmful to aquatic life.
4. Temperature: Stream water temperature influences growth, distribution and survival of aquatic organisms and fisheries. Temperature related data will be obtained with field instruments in-situ.

5. Photo Documentation: Digital photographs will be taken in a panorama beginning facing upstream and making a 360 degree sweep. Visual records are valuable in supporting the qualitative aspects of the monitoring.
6. Channel Cross Sections: To be used to calculate discharge rates and evaluate long term stream changes.
7. Velocity: To establish the rate of discharge with an optical flow meter, velocity is measured at 60% total depth from the water's surface at sufficient intervals in a cross section of the stream to provide 20 – 25 readings. Data is then calculated to determine discharge rate. Discharge rates will allow CCCD to assess relationships between biological/chemical parameters and water flow. Additionally, the data will provide insight into runoff and significant precipitation events.
8. Riparian Transects: Vegetative cover is an important component in the stability of both stream banks and the ability of the soils to handle surface runoff. It is important to document any potential improvement or degradation in order to determine actual impacts. Riparian transects maybe performed by CCCD staff with the assistance of NRCS when specified by the grant agreement/landowners. If required, CCCD will conduct riparian transect 200 ft. upstream and downstream of the sampling site.

4.5 Sampling Bottles

CCCD will utilize one 125 mL plastic bottles, one 250 mL plastic bottle, one 500 mL plastic bottle, one 100 mL sterile plastic bottle and one 15 mL screw top Centrifuge Tube at each monitoring site. Biological samples and chemical samples will be collected in the plastic bottles. All bottles will be stored at the CCCD office and taken to the field unopened. All bottles except for *E.coli* (100mL) and total coliform bottles will be rinsed three times, with same water from stream, before the sample is collected. The bottle for *E.coli* and total coliform is sealed with plastic and taken off right before sample is collected. Powder from laboratory in the bottle prevents CCCD from rinsing prior to sample.

4.6 Sampling Schedule and Frequency

CCCD receives 319 federal funding and state grants to conduct monitoring. If these grants are not received, funding is not available for monitoring. When funds are available, CCCD monitors each site year round in order to understand environmental and seasonal influences on water quality and quantity. The frequency of monitoring varies depending on the watershed. If obtaining Geometric Means are the objective, then each site will be sampled five (5) times in sixty (60) days with each sample separated by no less than ten (10) days to meet WDEQ standards for *E-coli*. In years of drought, the CCCD may not retrieve samples due to no flow/low flow conditions. Table 4.6 below illustrates CCCD proposed sampling schedule.

Table 4.6 CCCD Proposed Sampling Schedule

Sample Location	Proposed Sampling Frequency	Parameters to be Sampled/Measured in the Field under this SAP	Parameters to be Measured by Contact Labs listed in this SAP
Little Powder River (LPR1,LPR2)	12 months, 2 to 3 times a month	<i>E. coli</i> sampling only, pH, conductivity, Dissolved Oxygen, Barometer, Air/water temperature, Turbidity, Velocity	<i>E. coli</i> analyses, nitrite+nitrate, ammonia, chloride, TDS, TSS, Sulfate, Total Phosphorus, conductivity, DNA Pyrosequencing®
Donkey Creek (DC3,DC4,DC7,DC8,DC9)	12 months, 2 to 3 times a month	<i>E. coli</i> sampling only, pH, conductivity, Dissolved Oxygen, Barometer, Air/water temperature, Turbidity, Velocity	<i>E. coli</i> analyses, nitrite+nitrate, ammonia, chloride, TDS, TSS, Sulfate, Total Phosphorus, conductivity, DNA Pyrosequencing®
Stonepile Creek (SC1,SC3)	12 months, 2 to 3 times a month	<i>E. coli</i> sampling only, pH, conductivity, Dissolved Oxygen, Barometer, Air/water temperature, Turbidity, Velocity	<i>E. coli</i> analyses, nitrite+nitrate, ammonia, chloride, TDS, TSS, Sulfate, Total Phosphorus, conductivity, DNA Pyrosequencing®
Belle Fourche River (BF2,BF3n) CCNRD sites	Weekly beginning May 1 through September 30	Velocity	N/A
Donkey Creek (DC2n) CCNRD site	Weekly beginning May 1 through September 30	Velocity	N/A
Donkey Creek (DC3,DC4)	Every 11 days beginning May 1 through September 30	<i>E. coli</i> sampling only, pH, conductivity, Dissolved Oxygen, Barometer, Air/water temperature, Turbidity, Velocity, TDS	<i>E. coli</i> analyses, nitrite+nitrate, ammonia, chloride, DNA Pyrosequencing®

4.7 Health and Safety

Safety must be a primary concern at all times and in all sampling situations for field sampling personal. In any marginal or questionable safety situation, samplers are required to assume worst case conditions and use safety precautions and equipment appropriate to that situation. Samplers who encounter conditions which, in their best professional judgment, may exceed the protection of their safety equipment or may in any way represent a potential hazard to human health and safety should immediately leave the area and report to their supervisor.

During field sampling there ***must*** be a ***minimum*** of two sampling personnel present. To avoid direct contact with contaminated water, water-proof gloves (6-18 inches) will be worn when sampling surface water. Samplers will thoroughly wash hands and arms with bacterial soap after sampling and before eating or drinking. In the field, antibacterial wipes should be used prior to eating or drinking. Samplers should be vaccinated for Hepatitis-A, and have had a Tetanus shot within the last ten years. Samplers should be familiar with basic first aid and CPR.

Samplers are strongly recommended to carry a cell phone. Samplers will inform supervisor/office personnel when they leave for the field, the location where they will be sampling, and their estimated time of return. The supervisor /office personnel will initiate the emergency action plan below if the samplers have not returned to the office within the allotted time. To avoid unnecessary worry and concern, samplers will call the office if they are running behind schedule.

4.7.1 Emergency Action Plan

A supervisor or personnel on duty will be notified of the departure time of each sampling trip, know the itinerary, persons involved, and estimated time of return. The contact person(s) will also know whom to contact to initiate rescue efforts. If samplers have not returned or reported on time, the supervisor or personnel on duty will contact the Campbell County Sheriff's Department.

4.7.2 Hospital

The nearest hospital to the monitoring sites is located in Gillette.

Campbell County Memorial Hospital
501 S. Burma
Gillette, WY 82716

4.8 Standard Operating Procedures

The CCCD follows the applicable Standard Operating Procedures (SOPs) 2011 in the WDEQ-WQD, Watershed Program, Manual of Standard Operating Procedures for Sample Collection and Analysis, and is adopted by reference here and in Appendix F. Copies of the applicable Standard Operating Procedures will be kept in a folder in the water sampling truck for reference while in the field.

4.9 Sample Labeling

Water chemistry and biological samples will be labeled with a permanent, waterproof marking pen, such as a “Sharpie” or “write-in-rain™” pen on “write-in-rain™” paper. The sample identification will be recorded on the bottle, on the Chain of Custody form, on the lab’s analytical report, and in the field logbook. At a minimum, sample labels must include:

1. Sampler’s initials, as recorded in the field log book.
2. Julian or consecutive day of the year followed by the year (ex. 12 for 2012)
3. The time, using a 24 hour clock (military time)
4. Station ID code

Station ID codes identified in Table 4.2 will be utilized on all sample labels.

Example Labels:

Surface Water Chemistry Sample
Date: 15509 Time: 0940
Sample number: 1 of ? (consecutive number if multiple samples are taken)
Sampler: KQ
Sample ID #: LPR1-15501-KQ-01

Explanation of Sample ID

Sample ID #: LPR1-15501-KQ-01

LPR1 = Little Powder River sampling site
15509 = Julian Day equivalent to June 4, 2009
KQ = Sampler initials (Kevin Quick)
01 = normal sample as opposed to a blank or duplicate sample

Quality Control Examples

Sample ID: LPR1-15501-KQ-02

LPR1 = Little Powder River sampling site
15509 = Julian Day equivalent to June 4, 2009
KQ = Sampler initials (Kevin Quick)
02 = Duplicate sample

Sample ID: BL1-15501-KQ-01

BL1 = Blank sampling site
15509 = Julian Day equivalent to June 4, 2009
KQ = Sampler initials (Kevin Quick)
01= 1 blank sample taken

4.10 Sample Shipping

Chemical and biological samples are packed in a cooler with ice and hand delivered/mailed to the contract laboratories with Chain of Custody form. When all the Pyrosequencing® samples have been collected for the season, the samples will be sent

to: Research and Testing Laboratory, 4321 Marsha Sharp FWY, Door #2, Lubbock, Texas 79407, along with a Chain of Custody form.

4.11 Waste Disposal

All plastic sample bottles will be disposed of by Inter-Mountain Laboratory except for the Turbidity sample bottle which will be recycled at the CCCD office due to sample being tested by the CCCD Water Quality staff.

5.0 QUALITY ASSURANCE/QUALITY CONTROL

5.1 Field Audits

CCCD will work with WDEQ or any other qualified third party to preform and complete a Field audit when and if requested.

5.2 Field Log Books

The CCCD will follow the WDEQ SOPs for field log books, including archiving. Field logs will be kept in hard-back field books. These books will be scanned weekly or copied into digital format for storage on an external hard drive. Log books will be stored in a fire safe cabinet at the CCCD office when not in use. Electronic records will be put on an external hard drive monthly and stored in a safe deposit box at First National Bank in Gillette. Examples of field logbook entries can be found in Appendix B. Field log books will contain names of samplers, date and time, weather conditions, general observations of environment, notes on working condition of equipment, and notes and justification on the need to modify any aspect of the SAP or a specific SOP.

The field log books will include the following:

Key points are as follows:

The outside front cover must contain:

1. The samplers printed names,
2. The from-to date periods covered by the log book (mm/dd/yy),
3. The sequential log book number.

The inside front cover must contain:

1. The signature identification of the samplers and all other persons who make entries in the logbook.
 - a. These signatures must be used for all entries in the logbook and for any sample labeling.
 - b. Any person making an entry must sign the inside front cover of the logbook.

The log must have:

1. All pages sequentially numbered.
2. No pages removed.

All entries:

1. Must be made in permanent pen.
2. If pencil is used, the reason should be noted in the entry

All corrections:

1. Made with one line through the incorrect information, so that the original information can still be read.
2. The correct information is written in the next available space.
3. If an entire page is incorrect, one diagonal line is drawn through the entire page and the correct information is recorded in the next available space.

Procedure for change of personnel:

1. Samplers who resign or transfer must leave all logbooks.

2. Conservation District Manager must verify that all logbooks are complete, numbered, accounted for and filed.

Data recorder:

1. If a field crew appoints one member as data recorder, all participants involved in the collection of that data must sign the inside front cover, and have the name in the field log book entries.

Additional data that will be recorded in the surface water field logbooks are as follows:

1. Date
2. Time
3. Site ID #
4. Parameters sampled
5. How blanks, spikes, and duplicates were identified
6. Any pertinent information not already considered

5.3 Calibration Standards

The dates of calibration standards will be recorded in the equipment calibration log, on file in the CCCD office. Material Safety Data Sheets (MSDS) for all chemicals used by CCCD are on file at the CCCD office.

5.4 Chain of Custody

CCCD utilizes Chain of Custody (COC) forms provided by the contract laboratories. A blank COC is included in Appendix A. Following each monitoring event the sampler records the sample ID, data and time sampled, and parameters to be analyzed.

1. It is mandatory to submit a completed and signed COC form with the samples.
2. The CCCD sampler relinquishes the samples to the lab by signing and dating the COC.
3. The lab receives the COC form and signs it.
4. The lab provides a carbon copy of the COC to the CCCD sampler.
5. CCCD files the original in the COC file and maintains it indefinitely.

5.5 Equipment Calibration and Maintenance

Equipment calibration and maintenance will be performed by the field sampler prior to each monitoring event. All equipment will be calibrated according to the manufacturer's recommendations and/or WDEQ SOP Part 5, **Instrument Calibration and Calibration Logs** (2012). Table 5-1 presents the calibration and maintenance procedures, schedule of service and references. At the end of the sampling day the equipment will be stored according to the standard set by the manufacturers of said equipment. Once a year, the two YSI parameter probes are shipped to Geotech in Denver for maintenance and calibration.

Table 5.1 Equipment Calibration and Maintenance

Parameter	Calibration	Maintenance	Schedule	Reference
YSI 650 Multi-Parameter Water Quality Monitor (Model# 650MDS, Serial# 02D0579AE)				
Specific Conductance	1.413 μ S/cm Solution	Check batteries	Prior to Monitoring	Equipment Manual
pH	Buffer Solutions 7 & 10			
Temperature				
YSI Pro ODO Version 2.7.0 (Model# Pro ODO Serial# 11G101562)				
Dissolved Oxygen	Barometer 25.4	X	Check Batteries	Prior to Monitoring Equipment Manual
Parameter	Calibration	Maintenance	Schedule	Reference
Marsh McBirney Portable Flow Meter (Model# 2000, Serial # 2004362)				
Velocity	N/A	Check batteries	Daily	N/A
Garmin GPSmap 60CSx (Model# 10R-022491, Serial# N20233)				
Location	N/A	Check batteries	Daily	Equipment Manual
Sper Scientific Digital Pocket Thermometer (Serial # 80038)				
Air Temperature	N/A	Check Batteries	Daily	N/A
Scientific, Inc. Micro TPW Turbidimeter (Model # 20000, Serial # 201101243)				
Turbidity	1000 NTU Standard	Check Batteries	Every three months	Equipment Manual
Kodak Easy Share Digital Camera (Model# Z5010, Serial# KIYXV13328039)				
Photo Documentation	N/A	Check batteries	Daily	N/A

The equipment calibration log will be kept in the CCCD office and updated as equipment is calibrated or maintenance is completed. Any calibration or maintenance completed in the field will be noted in the field log book. If calibration of the multi-parameter probe occurs in the field, data will be downloaded upon return to the CCCD office.

5.6 Data Verification and Validation

CCCD will follow the requirements and methods of data review, validation, and verification outlined in the WDEQ QAPP. CCCD staff will be responsible for receiving the data sheets and field log books, checking for omissions in identification, decimal placement, dates, times, units reported, and comments. Water quality technical staff collecting data will be contacted immediately if there are data gaps or if scheduled sampling times were missed and mentioned in the logbook.

It is the water quality technical staff's responsibility to evaluate raw data generated by the contract laboratories for appropriate numeric reduction, data quality, and accuracy.

All data will be reviewed and reported in units specified at the detection level of the analysis methods used. To reduce data point loss, data that is reported as “less than” detection level should be incorporated at a value of 1/2 the detection level. Once data is generated, it will be compiled in a database file. During any data transfer, the information will be reviewed and verified in accordance with data quality objectives.

Data generated in the laboratory will be validated by performance checks such as a duplicates and trip blanks (table 5.2). Data will be reported in the units that have been designated to each parameter in the Analytical Methods, Holding Times, Parameters, and Sample Collection Methods section tables. Scientific notation will be used and significant figures will correlate with detection levels. Both graphing and narrative conclusions will be used to describe the water quality results and trend variations.

5.7 Field Quality Control (QC) Samples

The following table outlines quality control measures CCCD will use to ensure credible data collection.

Table 5.2 Sample Quality Control

Parameter	QC Check	Frequency	Acceptable Range	Corrective Actions
Blanks/ Lab Blanks	Contamination which might affect analytical results	1 per trip/ one per test run	Pass/Fail	Notify appropriate staff; repeat procedure; find contamination source; decide whether to accept or disallow data.
Chain of Custody Form	Laboratory notes errors and omissions on sheet and in laboratory database	Each group of samples shipped to the lab	No errors or omissions	Notify appropriate staff; audit and train the field sampler; test results from samples which are sent to the laboratory without a Chain of Custody form are not suitable for use in legal actions
Chain of Custody Seal	Laboratory records on Chain of Custody Form and in Laboratory database	Each container of samples shipped to the lab	No errors or omissions	Notify sampler and appropriate management; audit and train the field sampler; test results from samples which do not have a seal are not suitable for legal actions
Dissolved Oxygen	Written record of calibration.	Daily before each use	Instrument specific	Verify altitude; if still not correct return meter to YSI Incorporated for repair or replacement
Duplicates	Required	1 (once) every 10 sample sites per trip per parameter (1 minimum)	Required	Notify appropriate staff if missing; audit and train field sampler. Water Quality Specialist decides whether to accept or disallow data.
pH	2 point meter check with pH 7 and 10 buffer standards	Daily before each use	±5%	Repeat field check; if still not correct return meter to YSI Incorporated for repair or replacement

Sample Preservation	Sample label and Chain of Custody agrees with parameter SOP	All samples	No errors or omissions	Notify appropriate staff; resample; data is flagged to indicate that it should not be entered in a database or used for decision making
Temperature	Annual calibration against a thermometer traceable to an NBS thermometer	Annually	On the calibration mark	Repeat measurement with different thermometer; if not correct contact YSI Incorporated

5.8 Data Quality Objectives

Data quality objectives (DQOs) in terms of precision, accuracy, and completeness for the monitoring completed under CCCD SAP are presented in Table 5.3.

Table 5.3 Summary of Data Quality Objectives

Parameter	Precision DQO	Accuracy DQO	Completeness DQO	Reference
Temperature	+/- 10 %	+/- 0.15 °C	95%	WDEQ
pH	+/- 5 %	+/- 0.2	95%	WDEQ
Conductivity	+/- 10 %	+/- 0.5%	95%	WDEQ
Dissolved Oxygen	+/- 20 %	+/- 0.2 mg/L or 2%	95%	WDEQ
Turbidity	+/- 10 %	+/- 2%	95%	WDEQ
<i>E.coli</i>	+/- 50 %		95%	WDEQ

5.9 Sampling Methods

The CCCD SAP meets all of the quality control (QC) requirements described in the WDEQ QAPP. CCCD utilizes the methods outlined in Table 5.2 to meet the QC requirements.

5.10 Assessment and Response Action

The District will evaluate The Powder River and Belle Fourche River Drainages Watershed Project on an annual basis. Any modifications to the sampling plan, including site locations, sampling schedule, sample collection, choice of laboratory, quality assurance/quality control, sampling methods or standard operating procedures will be decided by the District employees and recommended to the CCCD Board of Supervisors. Records, such as field personnel and training, which may change yearly, will be updated as necessary. In the event of a monitoring plan change the District will amend the SAP, including the date of the amendment. The amendment will be included in the SAP Appendix G and all field personnel will be notified. If quality control samples are not meeting project criteria or if any other event requires corrective action the District will follow the procedures included in the WDEQ QAPP for assessment and response actions.

6.0 LABORATORIES

6.1 Laboratory QA/QC Plans

The contract laboratories, Inter-Mountain Laboratory (IML) and Wyoming Department of Agricultural and Analytical Laboratory, have a Quality Assurance Manual, and the Manual is available upon request. Also a copy of this manual will be on file at the CCCD office. Biological samples may be submitted to the CCNRD for processing and will be subjected to QA/QC outlined in CCNRD SAP as well as in WDEQ QAPP. Copies of these documents are available upon request and are also on file in the CCCD office.

6.2 Contract Laboratory

Chemical and biological analysis will be conducted by Inter-Mountain Laboratory (IML). All samples will be dropped off at the IML office in Gillette.

Inter-Mountain Lab
1701 Phillips Circle
Gillette, Wyoming 82718
(307) 682-8945

IML will transport some of the samples to their lab in Sheridan for analysis, observing all necessary holding times and storage temperatures for the samples

Inter-Mountain Lab
1633 & 1673 Terra Avenue
Sheridan, WY 82801
(307) 672-8945

Chemical analysis may also be conducted by Wyoming Department of Agricultural Analytical Services Laboratory in Laramie, Wyoming. Samples will be shipped to the Lab.

Wyoming Department of Agricultural Analytical Service Laboratory
1174 Snowy Range Rd
Laramie, WY 82070
(307) 742-2984

Biological analysis may also be conducted by The Crook County Natural Resource District using the Colilert Method. These samples will be obtained with the assistance of CCNRD and transported back to their lab in Sundance observing all necessary holding times and storage temperatures for the samples.

Crook County Natural Resource District
117 South 21st Street
Sundance, WY 82729
(307) 283-2501

DNA Pyrosequencing® analysis will be conducted by Research and Testing Laboratory. All samples will be shipped to the labs office in Lubbock, Texas.

Research and Testing Laboratory
4321 Marsha Sharp FWY, Door #2
Lubbock, Texas 79407
(806) 771-1134

6.3 Laboratory Results

Hard copies of the lab results will be stored in a fire-proof file cabinet in the CCCD office. Electronic records will be stored on the CCCD's network and recorded to an external hard drive monthly. The external hard drive will be stored in a safe deposit box at First National Bank of Gillette. If changes are made to the originals, the copies will be amended immediately. A copy of the lab results will be located in Appendix B and/or an indexed reference to the data on the external hard drive.

7.0 DATA

7.1 Data Entry

Field and laboratory data will be entered into Excel spreadsheets following the monitoring season. Kevin Quick, Water Technician, will enter all data into the spreadsheets. The data is then reviewed by Debbie Hepp, Program Assistant and Tim Morrison, District Manager (DM).

7.2 Data Archiving

Table 7.1 Data Archiving

Record Type	Storage Location	Storage Duration	CCCD Staff
	Original/Copy		
Calibration Logs	CCCD* / FNB*	Indefinite	WQ Tech, DM
Chain of Custody	CCCD / FNB	Indefinite	WQ Tech, DM
Field Log Book	CCCD / FNB	Indefinite	WQ Tech, DM
Lab Results	CCCD / FNB	Indefinite	WQ Tech, DM
Maps	CCCD / FNB	Indefinite	WQ Tech, DM
Reports	CCCD / FNB	Indefinite	WQ Tech, DM
SAP, QAPP, SOP	CCCD / FNB	Indefinite	WQ Tech, DM
Spreadsheets	CCCD / FNB	Indefinite	WQ Tech, DM
Database	CCCD / FNB	Indefinite	WQ Tech, DM
Management System			

*CCCD – Campbell County Conservation District

*FNB-First National Bank

7.3 Statistical Analysis

After data validation and data base construction, data will be analyzed and interpreted using various statistical methods. Summary statistics, interpretive statistics, and graphs that may applicably appear in the monitoring report for the watershed may include, but not necessarily be limited to, the following analyses:

- Average;
- Geometric mean;
- Median;
- Maximum;
- Minimum;
- Range;
- Transformation (for non-normal distributions);
- Linear regression;
- Multiple regression; and/or
- Time series trend analysis.

Water quality data will be evaluated spatially (among stations), temporally (among seasons), and compared to historical data when appropriate. In addition, data will be evaluated according to Wyoming water quality standards. Variation in data will be linked to possible land uses and potential contributing sources when appropriate. Conclusions that affect the human resources of Campbell County will be based on scientific analysis conducted by CCCD in coordination with the appropriate state, federal and/or academic institutions.

8.0 REPORTS

8.1 Corrective Actions Report

The CCCD staff will keep a record of QA/QC procedures performed, such as trip blanks, and sample duplicates. The CCCD staff will also monitor and record Field Logbooks and data entry for accuracy and completeness. If quality control samples are not meeting project criteria or if any other event requires corrective action the District will follow the procedures included in the WDEQ QAPP for assessment and response actions. A blank report is included in Appendix A.

8.2 Final Report

A monitoring report will be developed by the CCCD after all data are collected and subjected to QA/QC procedures and will include a QA/QC report for the project. The report will summarize water quality data collected during the sampling year(s) and compare any changes in water quality to the conditions found during previous monitoring activities. The monitoring report will summarize current water quality conditions with comparisons made to previous monitoring efforts. The monitoring may suggest inferences and contributing factors that are scientifically based on credible biological, chemical and physical data including any historical information that is relevant to the monitoring plan. The monitoring report will be submitted to WDEQ and shared with landowners.

Appendix A
Forms and Reports

Appendix B

Field Logs and Laboratory Results

Appendix C

Sample Site Location Maps

Appendix D

References and Information Resources

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Appendix E

Equipment Manuals/Instructions

Appendix F
SOPs and Methods

Campbell County Conservation District Standard Operating Procedures

Water Quality and *E. coli* Sampling

Make necessary preparatory arrangements (obtain bottles, trip blanks, and coolers from laboratory, arrange for transportation of bacteria samples to the laboratory, purchase ice, perform necessary vehicle maintenance, perform necessary equipment calibrations or maintenance, and review equipment checklist while loading vehicle).

At site:

- Complete field log, including:
 - general weather conditions and record of most recent precipitation;
 - date, time, and samplers names;
 - parameters being sampled;
 - other pertinent information or observations.
- Calibrate equipment (if needed) and record in calibration log.
- Label sample bottles before entering the field
- Enter channel downstream of the point where grab samples are to be taken.
- Take grab samples in a well-mixed portion of the channel, add necessary preservatives, and store bottles in cooler on ice.
- Rinse bucket at least three and fill with water from same location in channel where grab samples were taken. Be careful not to disturb bed sediment and possibly contaminate sample.
- Immerse the pH, temperature, conductivity, and dissolved oxygen probes into the sample bucket. Wait for all meters to stabilize while slowly stirring the dissolved oxygen probe.
- Record information from the meters into the Field Logbook.
- Collect duplicate and blank samples if required.
- Read the water depth on staff gauge (or similar gauge) and record in Field Logbook.
- If applicable, take photographs of sample site and record any appropriate observations/conditions in the Field Logbook.
- Note any problems with calibration, sample collection, or deviations from the SOP's in the field log.
- Double check data sheets for completeness.

Proceed to next location and repeat procedure or proceed to pre-determined meeting spot and transfer samples. Complete Chain of Custody (COC) form when samples are transferred to the laboratory. Water samples will be promptly delivered to the IML laboratory and COC form signed when samples are accepted by the laboratory. Be sure to retain a copy of the COC form for the project files.

Campbell County Conservation District Standard Operating Procedures

Discharge measurements for calibration of staff gauges

Make necessary preparatory arrangements (vehicle and equipment maintenance, review equipment checklist while loading vehicle).

At site:

- Complete field log, including:
 - general weather conditions and record of most recent precipitation;
 - date, time, and samplers names;
 - parameters being sampled;
 - other pertinent information or observations.
- At a suitable location, stretch a tape measure perpendicular to the flow, use stakes to attach to bank.
- Record the wetted width of the channel and select measurement interval based on width (try to record at least 10 points across the channel).
- Record the tape measurement at the starting point (Left Edge of Water (LEW) looking upstream) in the Field Logbook. Note the LEW and Right Edge of Water (REW) (Beginning and end) always have a 0 recorded for discharge (Q) and Depth.
- Proceed to next location and record the Distance moved along the tape.
- Measure and record the depth at that location and adjust top setting rod to 0.6 times the depth of water
- If depth is greater than 3.0 feet, 2 velocity measurements should be taken at 0.2 and 0.8 times the depth of the water.
- Record the velocity at that point in the Field Logbook.
- Proceed to the next location, record the distance, depth, and velocity. Repeat until finished going across the channel.
- Take photos and record in Field Logbook.
- Review Field Logbook for completeness.

Standard Operating Procedure Reference

Topic	Title	SOP Pages
<i>E .Coli</i>	<i>Escherichia coli</i> & Total Coliform Bacteria, Colilert [®] -Defined Enzyme Substrate Method	63-68
Bacteria Sampling	Coliform Bacteria Sampling Procedure	59-62
Geometric Mean	Geometric Mean, Calculating and Using	75-76
Conductivity	Conductance, Specific (Conductivity)	160
pH	pH	170-171
Temperature	Temperature, Water	176
Dissolved Oxygen	Dissolved Oxygen (D.O.)	162
Stream Discharge	Stream Discharge	136-139
Velocity	Current Velocity	108-109
TSS	Total Suspended Solids	177
Turbidity	Turbidity	178
Total Phosphorus	Phosphorus, Total	173-174
Nitrate-Nitrite	Nitrogen, Nitrate - Nitrite	167
Total Metals	Metals, Total and Dissolved	165-166
Chemical Sampling	Chemical Field Measurement Procedure	148-150
Chemical Sampling	Chemical Grab Sampling Procedure	151-153
Calibrating Equipment	Instrument Calibration and Calibration Logs	230-231
Chain of Custody	Chain of Custody	196-202
Field Log Books	Field Log Books	227-228
Blanks	Blanks	191-193
Temperature Blanks	Temperature Blanks	275
Duplicates	Duplicates	222-223
Sample Labeling	Sample Labeling	247
Quality Control	Quality Control Measures, Summary of	239-242
Data Validation	Data Validation	213-215
Data Verification	Data Verification	218-220

Appendix G

Amendments