

SAMPLING AND ANALYSIS PLAN

Crow Creek in Cheyenne

SUBMITTED TO
WYOMING DEPARTMENT OF
ENVIRONMENTAL QUALITY
WATER QUALITY DIVISION

for

Laramie County Conservation District

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SIGNATURE APPROVAL SHEET

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TABLE OF CONTENTS

I.	Introduction	4
	<i>Project Background</i>	
	<i>Purpose</i>	
II.	Locations and Timing	4-5
	<i>Designated Sampling Sites</i>	
	<i>Additional Sites</i>	
	<i>Timing</i>	
III.	Personnel	6
IV.	Sampling and Analysis	6-7
	<i>Sample Collection</i>	
	<i>Physical and Chemical Parameters</i>	
	<i>Biological Parameters</i>	
V.	Quality Assurance/Quality Control	7-9
	<i>Corrective Actions</i>	
	<i>Field Notebooks</i>	
	<i>Chain of Custody</i>	
	<i>Sample Identification</i>	
	<i>Equipment Calibration</i>	
	<i>Data Quality Objectives</i>	
VI.	Data Management and Presentation	9-10
	<i>Data Validation</i>	
	<i>Data Storage</i>	
	<i>Data Availability</i>	
	<i>Data Management</i>	
VII.	Reports	10
VIII.	References	10
APPENDICES		
	Map	
	Laboratory Data Sheet	
	Field Data Sheet	

INTRODUCTION

Project Background

In 1998 one reach of Crow Creek was listed as impaired by the Wyoming Department of Environmental Quality (DEQ) and placed on the Clean Water Act (CWA), Section 303(d) list of impaired waters for ammonia, cadmium and fecal coliform. In 2002, cadmium was no longer detected in Crow Creek and was removed from the 303(d) list. Ammonia appears to be localized to the area below Cheyenne's two waste water treatment plants. The facilities are scheduled for upgrades by 2007, which will address ammonia discharges into Crow Creek. If ammonia continues to be detected above acceptable levels after the facility upgrades, further efforts will be necessary to find additional ammonia sources.

Fecal coliform levels in Crow Creek consistently exceed DEQ standards in the urban area of Cheyenne and occasionally near the Wyoming/Colorado border. Urban fecal coliform levels are most likely results of storm water runoff. LCCD has worked cooperatively with the City of Cheyenne and Laramie County Government to implement urban Best Management Practices (BMP) for storm water runoff. Fecal coliform bacteria levels near the Wyoming/Colorado border also appear to be storm related because high levels occur following storm events. Possible contributors to fecal coliform in the rural areas include septic systems, livestock waste and wildlife waste. At this time, the reach of stream in urban Cheyenne is the highest priority for monitoring and implementing BMPs. Elevated levels of fecal coliform bacteria combined with high public access pose increased human health risks and greater concern for the Cheyenne area.

In 2004, the Crow Creek Watershed Plan was completed by a local steering committee as a way of addressing local water quality concerns. The steering committee identified water quality monitoring as an action to evaluate the effectiveness of the watershed plan and BMPs.

Purpose

LCCD has been awarded Section 319 grant money through the Wyoming DEQ for implementing the action items identified by the watershed plan. This Sampling and Analysis Plan (SAP) will outline water quality monitoring activities for the Crow Creek Watershed for 2005 through 2007. Each year the SAP will be reviewed and amended as needed. The resulting data will be used for BMP selection and placement as well as land use planning. The water quality objectives include:

1. Collect geometric mean data in the Cheyenne area to monitor bacterial levels in Crow Creek
2. Collect minimal ammonia samples below Cheyenne's waste water treatment plants
3. Collect additional single bacteria samples as needed or as requested by private landowners

LOCATIONS AND TIMING

Many of the sampling locations were chosen based on the availability of historical data. LCCD has collected data at most of the sites listed below and will be able to use past data for comparisons. The 1st Street location is an upstream location from the historical Morrie Avenue sampling site and Deming Drive is a downstream location from the historical Ames Avenue sampling site. In both cases, sampling sites have been moved slightly in order to obtain better sampling conditions. County Road 51 has been added as an additional location for 2005 and will

be evaluated at the end of the monitoring season to determine if sampling at the site should be continued.

Designated Sampling Sites

The following locations will serve as designated sampling sites for the Cheyenne area of the Crow Creek Watershed. If for some reason a sample cannot be collected at the designated site, a notation will be made to the data sheet and/or the field notebook.

<i>Site Name</i>	<i>Legal Description</i>	<i>GPS Coordinates</i>
1. Roundtop Road (Above Cheyenne)	R67W T14N Sec 27	N41°09'31.3" W104°52'49.1"
2. County Road 51 (Above Cheyenne)	R67W T14N Sec 37	N41°08'00.7" W104°50'21.4"
3. MLK Park (in Cheyenne)	R66W T13N Sec 6	N41°07'48.4" W104°49'39.0"
4. Deming Drive (in Cheyenne)	R66W T13N Sec 6	N41°07'36.3" W104°49'00.7"
5. 1 st Street (in Cheyenne)	R66W T13N Sec 5	N41°07'14.8" W104°48'08.3"
6. Waste Water Treatment Plant (below Cheyenne)	R66W T13N Sec 3	N41°07'15.0" W104°45'33.6"
7. Missile Road, County Rd 217 (below Cheyenne)	R64W T13N Sec 10	N41°06'43.1" W104°31'23.9"
8. State Section, State Hwy 207 (below Cheyenne)	R63W T13N Sec 16	N41°06'03.4" W104°26'45.2"
9. 11410 Campstool Road – Ammonia only	R65W T13N Sec 4	

Additional Sites

LCCD will conduct additional sampling as requested by landowners within Laramie County and/or within the Crow Creek Watershed. Single samples may be collected throughout the watershed to provide additional information as needed.

Timing

A minimum of five samples per 30 days will be collected for bacterial samples for the purpose of calculating geometric mean data. Additional single samples may be collected throughout the watershed as needed. One ammonia sample will be collected in the summer and field tests for temperature, pH, conductivity and turbidity will be collected three times during the year.

Parameter	April	May	June	July	Aug	Sept	Oct
Temperature		X		X		X	
pH		X		X		X	
Conductivity		X		X		X	
Turbidity		X		X		X	
Ammonia			X				
<i>E.coli</i>	X		X		X		X

PROJECT PERSONNEL

Liberty Blain is the Water Specialist for the Laramie County Conservation District's water monitoring program. She will be working under the direct supervision of Jim Cochran, District Manager.

SAMPLING AND ANALYSIS

Sample Collection

Bacterial samples (*E. coli*) will be collected using sterile Whirl-Pak™ bags, chilled and returned to the Wyoming Department of Agriculture (WDA) Analytical Services Laboratory according to WYDEQ SOP Manual for fecal coliform. Samples are labeled in the field at the sampling location. Sample identification consists of stream name, site name, date of collection and parameter. Collection times, collector's name and chain of custody information are recorded on the laboratory data sheet. Samples are taken from the middle of the moving stream just below the surface. The samples are taken immediately after breaking the sterile seal of the Whirl-Pak™ bags. Samples are then placed in a cooler with ice and delivered to the lab within 6 hours. A minimum of one trip blank and one duplicate will be collected per sampling trip. Additional duplicates will be taken as necessary to provide one duplicate for every ten samples collected.

Ammonia samples will be collected using a sterile bottle provided by the WDA Lab preserved with sulfuric acid having a pH less than 2. The sample will be collected in the middle of the stream from a representative reach. Samples are placed in a cooler with ice and delivered to the lab the same day.

Field tests (pH, temperature, conductivity and turbidity) will be conducted at each of the sampling locations from the middle of the stream. Attention will be paid to conduct these tests at the same location bacterial samples are collected.

Physical and Chemical Parameters:

Specific Conductivity will be measured using a Hanna Portable 9033 Conductivity Meter. The calibration will be checked using a standard solution (> 1000 μ S) before each sampling day and recalibrated (one point) if calibration standard readings vary from known values by more than 1%.

pH will be measured using a Hanna Portable 991003 pH Meter. The calibration will be checked using a two point method of standard pH 7 and pH 10 buffers each sampling day. Recalibration will be performed if calibration standard readings vary from known values by more than 1%.

Water temperature will be measured using a Hanna Portable 991003 pH Meter and does not require calibration.

Turbidity will be measured using a HACH Portable 2100P Turbidimeter. The calibration will be checked on the day of testing using Gelex® secondary standards. Recalibration will be performed using StableCal® Stabilized Formazin Turbidity Solution if Gelex® standard readings vary from known values by more than 2%.

Streamflow data will be acquired using USGS data at the 19th Street station in Cheyenne. The data is available at <http://wy.water.usgs.gov/data.htm#Streamflow>.

Biological Parameters

E. coli samples will be analyzed using the Colilert® method. Colilert®, developed by IDEXX Laboratories, Inc., is an enzyme substrate containing nutrient indicators that simultaneously detects both total coliforms and *E. coli* in water. IDEXX's multi-well quantification procedures (Quanti-Tray® and Quanti-Tray®/2000) estimate bacterial density according to the same probability model of the Most Probable Number (MPN). The Colilert® method of *E. coli* analysis will be administered by the WDA Analytical Services Laboratory according to procedures specific to the Colilert® method.

QUALITY ASSURANCE/QUALITY CONTROL

Quality assurance will be achieved by closely following the Wyoming Department of Environmental Quality Manual of Standard Operating Procedures for Sample Collection and Analysis. A copy of the manual will be maintained in the district office for easy reference and an additional copy will be taken to the field in case of questions arise during actual field monitoring. Field monitoring equipment will be calibrated according to the manufacture's guidelines. Calibrations will also be recorded in the calibration log book. Calibration solutions will be used in accordance with manufacture's recommendations.

The Crow Creek Water Quality Monitoring Plan is covered by the Wyoming Department of Environmental Quality, Water Quality Division, Watershed Program, Draft, BURP Monitoring Quality Assurance Project Plan (QAPP) (2001). This plan also complies with Wyoming Statutes W.S. 35-11-103 (b) and (c) and W.S. 35-11-302, (Wyoming credible data statute).

Samples for lab analysis will be collected following the Wyoming Department of Environmental Quality Manual of Standard Operating Procedures for Sample Collection and Analysis (Available at the division's web site www.deq.state.wy.us). Samples will be stored and transported to the Wyoming Department of Agriculture (WDA) Analytical Services Lab. The Wyoming Association of Conservation Districts provides training for district personnel in water quality monitoring. The district will continue working with Wyoming DEQ and USGS on sample analysis. The conservation district will run blanks and duplicates on all samples taken to help insure quality on both lab and field sampling procedures.

Corrective Actions

For bacterial data, the LCCD Water Specialist will review data sheets received from the lab to verify that holding times do not exceed 6 hours and that all data fields are completed. The district will work cooperatively with the lab to verify that requirements are met. If chemical data is questionable or values seem odd, instruments will be recalibrated and standards will be checked for accuracy.

In order to identify any problem(s), the District Manager will conduct an assessment of the data sampling and analysis at least once per year during the project. If a major problem exists, corrective action will be taken immediately and documented. In those situations where

independent expertise is needed to assess a certain aspect of the project, the district will request technical assistance from the Wyoming Department of Environmental Quality (DEQ).

The Wyoming DEQ Project Officer may conduct any type of assessment at any time during the length of the project. This includes assessments of any contractor or sub-contractor performing sampling, analysis, or any other activity directly related to the program. If any major problems are identified during the length of this project, the district will request technical assistance from the Wyoming DEQ.

Field Notebook

Field notebooks will be kept by the Laramie County Conservation District (LCCD) Water Specialist and remain in the district's office when not in use. Field conditions, field observations, sampling location information and narrative information concerning any special circumstances or corrective action will be recorded in the field notebooks.

Chain of Custody

Forms provided by the WDA Analytical Services Laboratory serve as chain of custody forms. The forms include sample ID, date, time and the signature of the sampler. Employees of the lab record the date and time when the sample is received and assign the sample a lab ID. Analysts at the lab record the time at which procedures are started and the time when the sample is read. The laboratory manager signs off on the completed data sheet. Hard copies of these records remain in the laboratory office and a copy is sent electronically to the LCCD office. These records are kept electronically and backed up weekly in addition to printed copies that are kept in a notebook at the LCCD office.

Sample Identification

Samples will be labeled in the field at the sampling location. Sample location, date of collection, watershed name and the initials of the sample collector will be included on sample identification labels. The lab form will be used to record time of sample collection and chain of custody.

Equipment Calibrations

The calibration of the Hanna Portable 991003 pH Meter will be conducted using standard pH 7 and pH 10 buffer solutions for the two point calibration method. Specific conductivity will be checked using a standard solution (1413 μ S) on a weekly basis. All equipment will be calibrated according to the manufacturers' recommendations. A calibration log will be kept with the equipment to record calibrations completed. The log will include the dates of calibration, calibration solutions, expiration dates and initials of the person performing the calibrations.

Data Quality Objectives

Data quality objectives in terms of accuracy, precision and completeness are outlined in the table below. Geometric mean sampling of *E. coli* will consist of collecting six samples within a 30-day period with the objective of having at least five of the six samples to be of good data quality. When all six samples are of good quality, all six results will be used for calculating geometric means. If fewer than five samples in a 30-day period are of good quality, LCCD will consult with DEQ concerning the appropriate use of the data. Blanks will be run with each sample set to establish that samples are not contaminated but are a true representation of the stream water quality. The Colilert® method utilizes the MPN (most probable number) value to estimate the

mean density of coliforms in the sample. The method will provide counts from 1 cfu (coliform forming unit) per 100mL up to 2,419 cfu/100mL. When a result is recorded as >2,419 cfu/100mL, the value 2,419 cfu/100mL will be used. If a specific sampling location consistently results in values >2,419 cfu/100mL, dilutions will be performed in an effort to more accurately reflect the water quality of that location.

Parameter	Precision from Duplicates	Accuracy	Resolution	Completeness	Method Reference
Temperature	+/- 10%	+/-0.5°C	0.1°C	90%	EPA 170.1
pH	+/- 5%	+/-0.01pH	0.01pH	90%	EPA 150.1
Conductivity	+/- 10%	+/- 1% full scale, excluding probe error	0 to 1999µS/cm	90%	EPA 120.1
Turbidity	+/- 10%	+/- 2% of reading plus stray light from 0 to 1,000 NTU	0.01 NTU on lowest range	90%	EPA 180.1
<i>E. coli</i>	*40%	**	1 cfu/100mL	85%	See WDEQ <i>E. coli</i> SOP

*Relative % difference between two different samples

**Duplicate counts of the number of positive wells identified from a Quanti-Tray® sample for the same analyst should agree within 5% and those between two different analysts within 10%.

DATA MANAGEMENT AND PRESENTATION

Data Validation

The Water Specialist will be responsible for receiving the data sheets and field/ laboratory notebooks, checking for errors in identification, decimal placement, dates, times, units reported and comments. Personnel collecting data will be contacted immediately if there are data gaps or if scheduled sampling times were missed.

Sample results will be evaluated individually by performing appropriate mathematical analysis for precision or accuracy for each sample. The District Manager and Water Specialist will be allowed to access project data and submit reports to data users. All data will be accompanied by quality control information.

Data will be printed out in lists and graphs with lists checked against original data sheets. The Water Specialist will be responsible for correcting data entry errors. It is the responsibility of the Water Specialist to evaluate the raw data generated by the contract laboratory for appropriate numeric reduction, data quality, and accuracy. All data will be reviewed and reported in units specified at the detection level of the analytical methods used.

To reduce data point loss, data that are reported as “less than” the detection level will be incorporated at a value equal to the minimum detection level. Once data are generated, they will be compiled in a data base file. During this data transfer, the information will be reviewed and verified in accordance with data quality objectives.

Biological data will be reported in milligrams per liter (mg/l). Conductivity will be reported in µS and turbidity will be reported in NTU. Scientific notation will be used if necessary 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.

Established data quality objectives will be compared with the results of all quality assurance and quality control samples. Data that does not meet data quality objectives will be evaluated on a case-by-case basis to determine if the data is useful for watershed planning or provides valuable information relative to the water quality objectives. The Water Specialist and District Manager will evaluate completeness, accuracy, precision, and comparability. If the data quality objectives have not or cannot be met, the problem will be addressed either by correcting errors in the system, or by adjusting the objectives.

Data Storage

Data will be maintained and kept on file at Laramie County Conservation District, 11221 US Hwy 30, Cheyenne, WY. Laramie County Conservation District will provide copies of all data to the Wyoming Department of Environmental Quality after completion of each sampling season. Electronic copies of raw data sheets, geometric means and compiled data will be kept on the LCCD server. The LCCD server is backed up to a removable hard drive weekly. The data will also be copied to compact disks and stored in the fire-resistant safe in the LCCD office.

Data Availability

Data will be made available to any interested party upon request as soon as lab results are available. Data will be identified as provisional, until analysis and reporting is completed.

Data Management

Data analysis will involve calculation of geometric means according to the WYDEQ SOP Manual for Sample Collection and Analysis. When duplicate samples are taken, the arithmetic mean of those samples will be used as the data point for that sample. All data will be organized in spreadsheet format and charts and/or graphs will be generated when needed.

REPORTS

The Laramie County Conservation District will compile water quality data and submit the information to DEQ for review and to fulfill Section 319 grant reporting requirements. Annual reports may be written to capture both numeric and narrative data. The district will also report to the Crow Creek Watershed Steering Committee on an annual basis regarding the water quality objectives and data collected.

REFERENCES

Manual of Standard Operating Procedures for Sample Collection and Analysis (Revised September 2004). Wyoming Department of Environmental Quality, Water Quality Division, Watershed Program. Cheyenne, WY.

Manual of Standard Operating Procedures, Wyoming State Analytical Laboratory. Laramie, WY.