

**Goose Creek Drainages  
Section 319 Water Quality Assessment**

**SAMPLING AND ANALYSIS PLAN  
Revision No. 2**

**Submitted by:**

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**Original Document Prepared: March 2001**  
**Revision No. 1 Prepared: March 2002**  
**Revision No. 2 Prepared: September 2002**

**GOOSE CREEK DRAINAGES  
WATER QUALITY ASSESSMENT PROJECT**

**Signature Approval Sheet**

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## ABSTRACT

This Sampling and Analysis Plan (SAP) was prepared to meet the Quality Assurance/Quality Control requirements of the Wyoming Department of Environmental Quality, Water Quality Division, Watershed Program and the United States Environmental Protection Agency (USEPA) for water samples collected for the Goose Creek Drainages Water Quality Assessment funded through Section 319(h) of the Clean Water Act. In addition, the collection of data will meet the requirements of state law, Wyoming Statutes (W.S.) 35-11-103(b) and (c) and W.S. 35-11-302 and State of Wyoming Enrolled Act 47, the Credible Data Bill (Attachment D).

Samples will be collected according to the Sheridan County Conservation District, Water Quality Monitoring Project, Quality Assurance Project Plan (SCCD, 2001). Standard Operating Procedures are based on methods, procedures, and/or protocols in the Natural Resources Conservation Service *National Handbook of Water Quality Monitoring* (NRCS, 1996), the Wyoming Department of Environmental Quality, Water Quality Division, Watershed Program *Manual of Standard Operating Procedures for Sample Collection and Analysis* (WDEQ, 1999) and other accepted referenced methods. Activities included in the project will be in accordance with the *Wyoming Nonpoint Source Management Plan Update* (WDEQ, 2000a) and the *Wyoming Watershed Strategic Plan* (1996) incorporated by reference in this document.

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Appendix H	Standards and Classifications
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## Attachments:

Attachment A	MSDS Sheets
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Attachment B	Sheridan County Conservation District QAPP
Attachment C	Laboratory Quality Assurance Plans
Attachment D	Credible Data Legislation
Attachment E	Chain of Custody Forms
Attachment F	Personnel Qualifications
Attachment G	Field Manual

# I

# INTRODUCTION

Goose Creek Drainages Advisory Group  
Sampling and Analysis Plan  
Adopted: March 2001 Revision: 2  
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**SAMPLING AND ANALYSIS PLAN**  
**Document Changes and Revisions**

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NOTES: The following changes described below are not reflected in the original Sampling and Analysis Plan (SAP) as approved March, 2001. Sections that have been edited must be referenced in this revision document.

LIST OF SECTIONS AFFECTED:

Edit No.	SAP Section No.	SAP Page No(s).
1	Section II. C. Sampling Locations and ID Codes	16-18
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**Edit No. 1 Section II.C. Sampling Locations and ID Codes**

Table 2-3 has been revised to reflect the new location of the BG16 (Rapid Creek) sampling site. BG16 was relocated because it was previously placed below a reach in Rapid Creek used as irrigation conveyance for Ditch No. 9. Exact locations for macro-invertebrate sampling sites were not known at the time the SAP was written; Table 2-3 has been revised as necessary. Minor changes have been made to the Description column to clarify site locations.

Table 2-3. HUC Codes and Legal Descriptions for Sampling Sites.<sup>2</sup>

Site ID	HUC Code <sup>1</sup>	Legal Description	Ownership	Description
GC1	10090101-010	SE1/4 NE1/4 SE1/4 S. 28 T.57N R. 84W	ROW	Downstream Hwy 339 Bridge-USGS Station 06305700 <sup>2</sup>
GC2	10090101-010	SE1/4 SE1/4 SW1/4 S.15 T.56N R.84W	ROW	Downstream Sheridan WWTP-USGS Site06305500 <sup>2</sup>
GC3	10090101-010	NW1/4 NW1/4 NE1/4 S.22 T. 56N R.84W	ROW	Downstream Soldier Creek; Upstream Fort Road Bridge
GC4	10090101-010	SW1/4 NW1/4 NE1/4 S.22 T. 56N R.84W	ROW	Soldier Creek Downstream CR80 Bridge-USGS Site <sup>2</sup>
GC5	10090101-010	NW1/4 SW1/4 NE1/4 S.22 T. 56N R.84W	ROW	Upstream Thornrider Park Footbridge-USGS site <sup>2</sup>
GC6	10090101-010	SE1/4 SW1/4 SE1/4 S.22 T. 56N R.84W	ROW	Below Little and Big Goose Confluence
BG1	10090101-010	NE1/4 NE1/4 SW1/4 S.27 T.56N R.84W	ROW	Footbridge at Kendrick Park-USGS Site <sup>2</sup>
BG2	10090101-010	SE1/4 NW1/4 SW1/4 S.27 T.56N R.84W	Easement	Near W. Works and Elk Street
BG3	10090101-010	SW1/4 SE1/4 NW1/4 S.33 T.56N R.84W	Private	Downstream Wyoming Brewery; West End of Leopard Street
BG4	10090101-010	NE1/4 NW1/4 NW1/4 S.5 T.55N R. 84W	Private	Upstream Brayton Lane Bridge at Normative Services
BG5	10090101-010	NE1/4 NW1/4 NW1/4 S.6 T.55N R.84W	ROW	Upstream Hwy. 331 Bridge Crossing USGS Site <sup>2</sup>
BG6	10090101-010	SE1/4 SW1/4 NW1/4 S.1 T.55N R.85W	Private	Near Paulson Youth Camp
BG7	10090101-010	NE 1/4 NE1/4 SE1/4 S.2 T.55N R.85W	Private	Downstream Pierce Lane Structure
BG8	10090101-010	NW1/4 NW1/4 NW1/4 S.11 T.55N R.85W	Private	Downstream Beaver Creek Confluence; Upstream Daisy Ditch Intake
BG9	10090101-010	SW1/4 NW1/4 NW1/4 S.11 T.55N R.85W	Private	On Beaver Creek-Upstream of Confluence
BG10	10090101-010	SE1/4 NE1/4 NE1/4 S.10 T.55N.R.85W	ROW	Upstream CR87 Bridge Crossing-USGS Site <sup>2</sup>
BG11	10090101-010	NW1/4 SW1/4 SE1/4 S.9 T.55N R.85W	ROW	Upstream CR81 (Beckton Hall) Bridge Crossing
BG12	10090101-010	SW1/4 SW1/4 SE1/4 S.8 T.55N R.85W	Private	Downstream Park Creek Confluence
BG13	10090101-010	SE1/4 SE1/4 SW1/4	Private	On Park Creek-Upstream of Confluence

Table 2-3. HUC Codes and Legal Descriptions for Sampling Sites.

Site ID	HUC Code <sup>1</sup>	Legal Description	Ownership	Description
		S.8 T.55N R.85W		
BG14	10090101-010	NW1/4 SE1/4 NW1/4 S.17 T.55N.R.85W	ROW	Upstream CR53 Bridge, South of Beckton-USGS Station 06302200 <sup>2</sup>
BG15	10090101-010	SE1/4 NE1/4 NW1/4 S.19 T.55N R.85W	Private	Downstream Rapid Creek Confluence
BG16	10090101-010	NW1/4 SW1/4 NE1/4 S.19 T.55N R.85W	Private	On Rapid Creek-Upstream of Ditch No. 9 conveyance
BG17	10090101-010	SW1/4 SE1/4 SW1/4 S.19 T.55N R.85W	Private	Upstream Section 19 Irrigation Intake
BG18	10090101-010	NE1/4 NW1/4 NE1/4 S.35 T.55N R.86W	Private	At USGS Gaging Station 06302000 <sup>2</sup>
LG1	10090101-010	SW1/4 NE1/4 NE1/4 S.27 T.56N R.84W	ROW	Upstream Confluence with Big Goose Creek
LG2	10090101-010	NW1/4 SW1/4 NW1/4 S.23 T.56N R.84W	Easement	Upstream Abandoned Railroad Bridge
LG3	10090101-010	SW1/4 SW1/4 NE1/4 S.35 T.56N.R.84W	Easement	Storm drain at Coffeen Avenue Bridge
LG4	10090101-010	SW1/4 SW1/4 NE1/4 S.35 T.56N.R.84W	Easement	Upstream Bridge Crossing at Coffeen Ave.
LG5	10090101-010	NW1/4 SW1/4 NW1/4 S.2 T.55N.R.84W	ROW	Upstream Brundage Lane Bridge Crossing-USGS Site <sup>2</sup>
LG6	10090101-010	NW1/4 NE1/4 NE1/4 S.15 T.55N R.84W	ROW	Downstream CR66 Bridge Crossing
LG7	10090101-010	SE1/4 NE1/4 SW1/4 S.14 T.55N.R.84W	ROW	Upstream Hwy. 87 Bridge Crossing-USGS Site <sup>2</sup>
LG8	10090101-010	SW1/4 SW1/4SW1/4 S.23 T.55N R.84W	Private	Downstream McCormick Creek Confluence
LG9	10090101-010	NE1/4 NE1/4 NE1/4 S.27 T.55N R.84W	Private	On McCormick Creek-near confluence, Downstream Hwy. 87
LG10	10090101-010	SW1/4 SE1/4 NE1/4 S.27 T.55N R.84W	ROW	Upstream Hwy. 87 Bridge near Big Horn Y-USGS Site <sup>2</sup>
LG11	10090101-010	NE1/4 NW1/4 SE1/4 S.27 T.55N R.84W	Private	On Kruse Creek-near mouth
LG12	10090101-010	SW1/4 NW1/4 SE1/4 S.27 T.55N R.84W	Private	Upstream Kruse Creek Confluence
LG13	10090101-010	NW1/4 NE1/4 NW1/4 S.34 T.55N R.84W	Private	Upstream Knode Subdivision Bridge
LG14	10090101-010	SE1/4 SE1/4 NE1/4 S.33 T.55N R.84W	Private	Upstream Powder Horn Subdivision Bridge
LG15	10090101-010	SE1/4 SE1/4 SW1/4 S.33 T.55N R.84W	Private	Upstream Gerdle Ditch at Powder Horn Subdivision
LG16	10090101-010	SW1/4 SE1/4 SW1/4 S.33 T.55N R.84W	Private	Downstream Jackson Creek
LG17	10090101-010	NW1/4 NE1/4 NW1/4 S.4 T.54N R.84W	Private	On Jackson Creek-Upstream of Confluence
LG18	10090101-010	SW1/4 SE1/4 NW1/4 S.4 T.54N.R.84W	ROW	Downstream Bird Farm Road Bridge Crossing

Table 2-3. HUC Codes and Legal Descriptions for Sampling Sites.

Site ID	HUC Code <sup>1</sup>	Legal Description	Ownership	Description
LG19	10090101-010	SW1/4 SE1/4 NW1/4 S.4 T.54N R.84W	Private	On Sackett Creek-Upstream of Confluence
LG20	10090101-010	NW1/4 SW1/4 NW1/4 S.9 T. 54N R.84W	ROW	Upstream CR103 Bridge Crossing south of Big Horn-USGS Site <sup>2</sup>
LG21	10090101-010	SW1/4 NE1/4 SW1/4 S.17 T.54N.R.84W	ROW	Upstream CR103 Bridge at Bradford Brinton-USGS Site <sup>2</sup>
LG22	10090101-010	NW1/4 SE1/4 SE1/4 S.25 T.54N.R.85W	ROW	Upstream CR77 Bridge Crossing-USGS Station 06303700 <sup>2</sup>
<b>MACROINVERTEBRATE and HABITAT ASSESSMENT SITES</b>				
GC1	10090101-010	NW1/4NW1/4 S.28 T.57N R.84W	Private	Upstream Hwy 339 Bridge-near USGS Station No. 06305700 <sup>2</sup>
GC1A	10090101-010	NW1/4NE1/4 S.15 T.56N R.84W	Private	1 <sup>st</sup> riffle downstream KOA Sewage Treatment Plant
GC1B	10090101-010	NE1/4 S.15 T.56N R.84W	Private	1 <sup>st</sup> riffle upstream KOA Sewage Treatment Plant
GC2	10090101-010	NW1/4SE1/4 S.15 T.56N R.84W	Private	Riffle 2 bends downstream Sheridan STP
GC3	10090101-010	NW1/4NE1/4 S.22 T.56N R.84W	Easement	1 <sup>st</sup> riffle upstream Fort Road
BG2	10090101-010	NW1/4SW1/4 S.27 T.56N R.84W	Easement	1 <sup>st</sup> riffle upstream footbridge at corner W. Works and Elk St.
BG4	10090101-010	NW1/4NE1/4 S.6 T.55N R.84W	Private	1 <sup>st</sup> riffle upstream footbridge at Normative Services
BG8	10090101-010	NW1/4NW1/4 S.11 T.55N R.85W	Private	1 <sup>st</sup> riffle downstream mixing zone Beaver Creek confluence
BG10	10090101-010	NE1/4NE1/4 S.10 T.55N R.85W	Private	1 <sup>st</sup> riffle upstream CR 87 and Beaver Creek confluence
BG14	10090101-010	NE1/4NW1/4 S.17 T.55N R.85W	Private	Riffle approximately 100 yards upstream of CR53
BG15	10090101-010	NE1/4NW1/4 S.19 T.55N R.85W	Private	Riffle downstream Rapid Creek confluence
BG18	10090101-010	SW1/4NE1/4 S.35 T.55N R.86W	Private	Riffle downstream USGS gage station No. 06302000 <sup>2</sup>
LG2A	10090101-010	SW1/4NW1/4 S.2 T.55N R.84W	Private	Riffle about 200 feet downstream Coffeen Avenue
LG5	10090101-010	SW1/4NE1/4 S.35 T.56N R.84W	Private	Riffle about 200 yards upstream Brundage Lane bridge crossing
LG7	10090101-010	SE1/4SW1/4	Private	Upstream Highway 87 bridge crossing near

Table 2-3. HUC Codes and Legal Descriptions for Sampling Sites.

Site ID	HUC Code <sup>1</sup>	Legal Description	Ownership	Description
		S.14 T.55N R.84W		Woodland Park
LG10	10090101-010	NW1/4SE1/4 S.27 T.55N R.84W	Private	First riffle downstream Kruse Creek confluence
LG18A	10090101-010	NE1/4NW1/4 S.19 T.55N R.85W	Private	First riffle upstream Bird Farm Road near Big Horn
LG21	10090101-010	SW1/4SW1/4 S.17 T.54N R.84W	Private	Riffle upstream CR103 Bridge at Bradford Brinton
LG22	10090101-010	SW1/4NW1/4 S.30 T.54N R.84W	Private	Riffle upstream Canyon Ranch house east side Little Goose Cr.

<sup>1</sup>HUC Codes correspond to the 1981 Small Watershed and Hydrologic Unit Map

<sup>2</sup>USGS Station refers to an actual gauging station while a USGS site refers to a location where USGS grab samples were taken

**Edit No. 2 Section II.D. Site Descriptions**

Table 2-4 has been modified to document the new location of the BG16 (Rapid Creek) sampling site. Exact locations for some macro-invertebrate sampling sites were not known at the time the SAP was written; Table 2-4 has been revised as necessary for sites GC1, GC1A, GC1B, BG8, BG10, BG14, BG18, LG2A, LG10, LG18A, and LG22. Sample site descriptions in Table 2-4 that were not edited are not included in the table below. Please refer to Table 2-4 in the SAP for the correct information about those sites.

Table 2-4. Sample site descriptions and location information for Goose Creek Drainages Sample Sites.

Site	Description	Coordinates	Access	Gauge	Bench Mark	Di (Cros
BG16	Rapid Creek - upstream of Ditch No. 9 conveyance	N 44°43.752' W 107°08.667'	Park at driveway entrance north of county road crossing of Rapid Creek and walk to site.	Left	Placed on opposite bank from gauge and approximately 10 feet downstream from gauge	Down from g
<b>MACROINVERTEBRATE and HABITAT ASSESSMENT SITES</b>						
GC1	Riffle upstream Hwy 339 bridge near USGS Station No. 06305700	N 44°52.858' W 106°59.252'	Private	n/a	n/a	n/a
GC1A	1 <sup>st</sup> riffle downstream KOA	N 44°50.127' W 106°57.684'	Private	n/a	n/a	n/a
GC1B	1 <sup>st</sup> riffle upstream KOA	N 44°50.046' W 106°57.811'	Private	n/a	n/a	n/a
BG8	1 <sup>st</sup> riffle downstream mixing zone Beaver Creek confluence	N 44°45.635' W 107°04.438'	Private	n/a	n/a	n/a
BG10	1 <sup>st</sup> riffle upstream CR 87 and Beaver Creek confluence	N 44°45.621' W 107°04.501'	Private	n/a	n/a	n/a
BG14	Riffle approximately 100 yards upstream of CR53	N 44°44.510' W 107°07.863'	Private	n/a	n/a	n/a
BG18	Riffle downstream USGS gage station No. 06302000	N 44°41.58' W 107°11.07'	Private	n/a	n/a	n/a
LG2A	Riffle about 200 feet downstream Coffeen Avenue	N 44°47.205' W 106°56.480'	Municipal	n/a	n/a	n/a
LG10	First riffle downstream Kruse Creek confluence	N 44°42.697' W 106°57.520'	Private	n/a	n/a	n/a
LG18A	First riffle upstream Bird Farm Road near Big Horn	N 44°41.008' W 106°59.240'	Private	n/a	n/a	n/a
LG22	Riffle upstream bridge at Little Goose Ranch	N 44°37.191' W 107°02.290'	Private	n/a	n/a	n/a

TBD = To be determined  
n/a = Not applicable

**Edit No. 3**    **Section IV.D.1. Duplicates**

Table 4-3 has been revised to include Data Quality Objectives (DQO) for stage - discharge relationships, E. coli, pesticides, and herbicides. Parameter minimum detection limits have also been added and the DQO's for fecal coliform have been modified to reflect realistic goals. The fecal coliform DQO is now consistent with WDEQ's fecal coliform DQO used on it's water quality monitoring programs (WDEQ, 2001).

**Table 4-3 . Data Quality Objectives**

Parameter	Precision (%)	Accuracy (%)*	Completeness (%)	Minimum Detection Limit
Temperature	10	10	95	0.2 °C
pH	5	5	95	0.01 S.U.
Conductivity	10	10	95	1 umho/cm
Dissolved Oxygen	20	20	95	0.2 mg/L
Total Residual Chlorine	10	10	95	0.01 mg/L
Turbidity	10	10	95	0.1 NTU
T. Suspended Solids	10	10	95	5 mg/L
Alkalinity	10	10	95	1 mg/L
Total Sulfate	20	20	95	1 mg/L
Total Chloride	10	10	95	0.1 mg/L
Total Nitrate	20	20	95	0.01 mg/L
Total Phosphorus	20	20	95	0.05 mg/L
Total Ammonia	20	20	95	0.05 mg/L
Total Hardness	10	10	95	1 mg/L
Fecal Coliform	50	NA	95	1 CFU/100 mL
E. coli	50	NA	95	1 CFU/100 mL
BOD	20	20	95	2 mg/L
Macroinvertebrates	NA	NA	95	NA
Total Abundance	50	NA	95	NA
Total Taxa	15	NA	95	NA
Habitat Assessment	NA	NA	95	NA
Intra-Crew	15	NA	10	NA

Parameter	Precision (%)	Accuracy (%)*	Completeness (%)	Minimum Detection Limit
Discharge	NA	NA	95	NA
Stage-Discharge Relationships	NA	NA	95	Minimum $r^2 = 0.95$
Atrazine	30	30	95	0.5 µg/L
Simazine	30	30	95	0.5 µg/L
Tebuthiuron	30	30	95	1.0 µg/L
Prometon	30	30	95	0.5 µg/L
Diazanone	30	30	95	0.5 µg/L
Malathion	30	30	95	0.5 µg/L
Parathion	30	30	95	0.5 µg/L
Methyl-Parathion	30	30	95	0.5 µg/L
Dicamba	50	12-157	95	1.0 µg/L
Picloram	50	14-181	95	1.0 µg/L
2,4-D	50	45-117	95	1.0 µg/L
Carbaryl	20	30	95	1.0 µg/L
Carbofuran	20	30	95	1.0 µg/L

\*The accuracy values shown are acceptable departures from 100 percent accuracy. A 10 percent accuracy value means accuracy values of 90 to 110 percent are acceptable. The accuracy values shown for pesticides and herbicides were provided by Inter-Mountain Laboratories and represent their internal DQO's.

**Edit No. 4**      **Section II.B.1. Field Water Chemistry**  
**Section II.B.3. Laboratory Analyzed Biological Parameters**  
**Appendix H. Standards and Classifications**

During July 2001, WDEQ revised the existing Wyoming Surface Water Quality Standards. Changes to these regulations which affect the above stated sections include a more detailed stream classification list, changes to the maximum allowable stream temperature, and a revised fecal coliform bacteria standard. As provided in the June 21, 2001 Wyoming Surface Water Classification List, the new stream classifications for the Goose Creeks watershed are provided as follows:

- Goose Creek - Class 2AB;
- Soldier Creek - Class 2AB;
- Big Goose Creek - Class 2AB;
- Beaver Creek - Class 3B;
- Park Creek - Class 2AB;
- Rapid Creek - Class 2AB;
- Little Goose Creek - Class 2AB;
- McCormick Creek - Not Classified;
- Kruse Creek - Class 2AB;
- Jackson Creek - Class 2AB; and
- Sackett Creek - Class 2AB.

As defined by WDEQ, Class 2AB streams are those streams known to support game fish populations, have sufficient quality for drinking water supplies, and are also protected for non-game fisheries, fish consumption, aquatic life other than fish, primary contact recreation, wildlife, industry, agriculture, and scenic value uses. Class 3B streams are intermittent tributaries which meet the uses for aquatic life other than fish, primary contact recreation, wildlife, industry, agriculture, and scenic value uses.

As described in Chapter 1, Section 25 (d) of the revised regulations, the maximum allowable stream temperature shall not exceed 68 degrees F (20 degrees C) except for Class 3 and Class 4 waters. The standard contained in the previous regulations allowed for a maximum allowable stream temperature of 78 degrees F (25.6 degrees C).

Chapter 1, Section 27 now defines the fecal coliform bacteria standard as follows: "During the entire year, fecal coliform concentrations shall not exceed a geometric mean of 200 organisms per 100 mL (based on a minimum of not less than 5 samples obtained during separate 24 hour periods for any 30 day period), nor shall the geometric mean of 3 separate samples collected within a 24 hour period exceed 400 organisms per 100 mL in any Wyoming surface water." This replaces the previous definition which read: "During the recreation season (May 1 through September 30), fecal coliform concentrations shall not exceed a geometric mean of 200 organisms per 100 mL (based on a minimum of not less than 5 samples obtained during separate 24 hour periods for any 30 day period), nor shall 10 percent of the samples exceed 400 groups per 100 mL during any 30 day period in all Wyoming surface waters and are hereby classified as full body contact recreation waters."

Sampling and Analysis Plan  
Revision No.: 1  
Date Adopted: March 20, 2002

## **Edit No. 5    Section II. F. Sample Collection**

Additional water quality parameters will be sampled in 2002 and require a brief description of the proper sampling methodology. These new methods are described below.

### **Total Residual Chlorine**

Analysis of 2001 Total Residual Chlorine (TRC) samples revealed data which were suspected to be unreliable due to the natural interferences that can create false positives for TRC with the HACH Pocket Colorimeter. In 2002, SCCD plans to collect duplicate samples for analysis by the HACH field method and by a titration method to validate the 2001 HACH method data. TRC sampling during two scheduled 2002 events will be analyzed by both the HACH Pocket Colorimeter and by the Sheridan Waste Water Treatment Plant's laboratory. SCCD may assist the laboratory in performing the titration analyses. Consecutive samples will drawn from the streams for analysis by the HACH and titration methods. The HACH samples will be analyzed immediately and the laboratory samples will be titrated as soon as sampling is completed for the day.

### **Pesticides and Herbicides**

During 2002, pesticides and herbicides will be sampled during a single event at three sites to determine if they are present during run-off conditions within the watershed. This sampling program is not intended to be a comprehensive study of pesticides and herbicides. Rather, it is intended to be an objective examination for their presence/absence during normal high use periods and normal high flow conditions. Grab samples for pesticides and herbicides will be obtained as described in the methodology for collecting laboratory analyzed parameters in the SAP. Field water quality parameters, also described in the SAP, will also be measured during pesticide and herbicide sampling events.

### **Stream Bed Sediment Sampling for Fecal Coliform**

Sampling of disturbed stream bed sediment may help in determining fecal coliform sources and help determine seasonal viability. Fecal coliform samples will be taken while disturbing upstream sediment during two sample events at three sites. Field water quality samples will be obtained and analyzed just downstream of the location where sediment sampling will occur. The field data will be collected immediately prior to the sediment sampling and will include water temperature, pH, conductivity, and dissolved oxygen. Discharge will be estimated by noting the water level on the calibrated staff gauge.

Two sets of instantaneous grab samples for turbidity and fecal coliform will be collected before upstream sediment is disturbed. Approximately 4 square yards will then be disturbed with a lawn rake. The sampler will stand approximately 10 yards downstream from the person raking the sediment in the flow path of the sediment plume. The sampler will then take turbidity and fecal coliform samples 15, 30, 45, and 60 seconds after disturbing the sediment. Samples will be collected in a sample bottle large enough to split into individual fecal coliform and turbidity samples. After all samples have been taken, velocity will be measured at the location from which the samples were collected. This method for obtaining stream bed sediment samples is based on the sampling method as described by Stephenson and Rhychert, 1982.

### ***Escherichia coli* Sampling**

*Escherichia coli* (*E. coli*) will likely be the future indicator used for bacterial pathogens in the Wyoming water quality standards. By conducting a concurrent fecal coliform and *E. coli* sampling program now, a statistical correlation can be made to link these databases for future use. *E. coli* samples will be collected during designated fecal coliform sampling events as outlined in the 2002 sampling schedule. During these scheduled events, two sample bottles will be collected simultaneously for *E. coli* and fecal coliform analysis. These samples will be collected according to the methodology described in the SAP. Inter-Mountain Laboratories will then analyze the samples for *E. coli* and fecal coliform analysis.

### **Edit No. 6    Section II.E. Sampling Schedule**

During 2001, approximately 96% of all BOD samples were analyzed as non-detectable. Due to this high rate of non-detection, SCCD has decided to eliminate the BOD sampling program for 2002 and pursue alternative sampling programs. Therefore, the 2002 sampling schedule has been revised to incorporate the addition of pesticide and herbicide sampling, fecal coliform in bed sediment sampling, *E. coli* sampling, and additional chlorine sampling. SAP Tables 2-10 through 2-14 have been revised accordingly and are provided below.

Table 2-10. Sampling Schedule for April 2002<sup>1</sup>

Date <sup>2</sup>	Sites	Parameters	Sampling Assist. Responsibility
April 1	GC2,LG8,BG18	FC (in sediment), Temp, pH, EC, DO, T, Q, V, Photo	SCCD
April 2	GC1-GC6	FC, Temp, pH, EC, DO, TRC, T, TSS, Alk, N, P, Cl, S, H, Amm, Q, Photo	SCCD
April 3	BG1-BG18	FC, Temp, pH, EC, DO, TRC, T, TSS, Alk, N, P, Cl, S, H, Amm, Q, Photo	SCCD
April 4	LG1-LG22	FC, Temp, pH, EC, DO, TRC, T, TSS, Alk, N, P, Cl, S, H, Amm, Q, Photo	SCCD
April 8	GC1-GC6	FC, Temp, pH, EC, DO, T, Q	City of Sheridan
	GC1,2,4,6	<i>E. coli</i>	
April 9	BG1-BG18	FC, Temp, pH, EC, DO, T, Q	City of Sheridan
	BG1,4,9,11,13,16,18	<i>E. coli</i>	
April 10	LG1-LG22	FC, Temp, pH, EC, DO, T, Q	City of Sheridan
	LG1,6,9,11,14,17,19,22	<i>E. coli</i>	
April 11	BG1-BG18	FC, Temp, pH, EC, DO, T, Q	City of Sheridan
April 15	GC1-GC6	FC, Temp, pH, EC, DO, T, Q	Sheridan County
April 16	LG1-LG22	FC, Temp, pH, EC, DO, T, Q	Sheridan County
April 17	BG1-BG18	FC, Temp, pH, EC, DO, T, Q	Sheridan County
April 18	LG1-LG22	FC, Temp, pH, EC, DO, T, Q	Sheridan County
April 22	GC1-GC6	FC, Temp, pH, EC, DO, T, Q	SCCD
April 23	BG1-BG18	FC, Temp, pH, EC, DO, T, Q	SCCD
April 24	LG1-LG22	FC, Temp, pH, EC, DO, T, Q	SCCD
April 25	GC1-GC6	FC, Temp, pH, EC, DO, T, Q	SCCD

<sup>1</sup> Sampling dates were randomly selected and may be subject to modification due to unforeseen circumstances. Any changes to sampling dates and

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reasons for the changes will be described in the field log. Abbreviations include, FC=Fecal Coliform, T=Turbidity, Q=Flow, Temp=Temperature, EC=Electrical Conductivity, DO= Dissolved Oxygen, TRC=Total Residual Chlorine, TSS=Total Suspended Solids, Alk=Alkalinity, N=Nitrates, P=Total Phosphorus, Cl=Chloride, S,=Sulfate, H=Hardness, V=Velocity, and Amm=Ammonia.

<sup>2</sup> Dates include 5 separate 24-hour sampling days within a 30-day period as required by the fecal coliform bacteria standard for Class 2 waterbodies in Wyoming (WDEQ, 1998).

Table 2-11. Sampling Schedule for May 2002<sup>1</sup>

Date <sup>2</sup>	Sites	Parameters	Sampling Assistance Personnel
May 1	GC1-GC6	FC, Temp, pH, EC, DO, T, Q	Sheridan County
May 2	BG1-BG18	FC, Temp, pH, EC, DO, T, Q	Sheridan County
May 6	GC1-GC6	FC, Temp, pH, EC, DO, TRC, T, TSS, Alk, N, P, Cl, S, H, Q, Amm	SCCD
May 7	BG1-BG18	FC, Temp, pH, EC, DO, TRC, T, TSS, Alk, N, P, Cl, S, H, Q, Amm	SCCD
May 8	LG1-LG22	FC, Temp, pH, EC, DO, TRC, T, TSS, Alk, N, P, Cl, S, H, Q, Amm	SCCD
May 9	BG1-BG18	FC, Temp, pH, EC, DO, T, Q	SCCD
May 13	GC1-GC6	FC, Temp, pH, EC, DO, T, Q	City of Sheridan
	GC1,2,4,6	<i>E. coli</i>	
May 14	LG1-LG22	FC, Temp, pH, EC, DO, T, Q	City of Sheridan
	LG1,6,9,11,14,17,19,22	<i>E. coli</i>	
May 15	BG1-BG18	FC, Temp, pH, EC, DO, T, Q	City of Sheridan
	BG1,4,9,11,13,16,18	<i>E. coli</i>	
May 16	LG1-LG22	FC, Temp, pH, EC, DO, T, Q	City of Sheridan
May 20	GC1-GC6	FC, Temp, pH, EC, DO, T, Q	Sheridan County
May 21	LG1-LG22	FC, Temp, pH, EC, DO, T, Q	Sheridan County
May 22	BG1-BG18	FC, Temp, pH, EC, DO, T, Q	Sheridan County
May 23	LG1-LG22	FC, Temp, pH, EC, DO, T, Q	Sheridan County
May 28	GC1-GC6	FC, Temp, pH, EC, DO, T, Q	SCCD

<sup>1</sup> Sampling dates were randomly selected and may be subject to modification due to unforeseen circumstances. Any changes to sampling dates and reasons for the changes will be described in the field log. Abbreviations include, FC=Fecal Coliform, T=Turbidity, Q=Flow, Temp=Temperature, EC=Electrical Conductivity, DO= Dissolved Oxygen, TRC=Total Residual Chlorine, TSS=Total Suspended Solids, Alk=Alkalinity, N=Nitrates, P=Total Phosphorus, Cl=Chloride, S=Sulfate, H=Hardness, and Amm=Ammonia.

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<sup>2</sup> Dates include 5 separate 24-hour sampling days within a 30-day period as required by the fecal coliform bacteria standard for Class 2 waterbodies in Wyoming (WDEQ, 1998).

Table 2-12. Sampling Schedule for June-July and September 2002<sup>1</sup>

Date	Sites	Parameters	Sampling Assistance Personnel
June 4	GC3,BG3,LG5	Temp, pH, EC, DO, Q, Pesticides, Herbicides	SCCD
June 10	GC1-GC6	Temp, pH, EC, DO, TRC, T, TSS, Alk, N, P, Cl, S, H, Q, Amm	SCCD
June 11	BG1-BG18	Temp, pH, EC, DO, TRC, T, TSS, Alk, N, P, Cl, S, H, Q, Amm	SCCD
June 12	LG1-LG22	Temp, pH, EC, DO, TRC, T, TSS, Alk, N, P, Cl, S, H, Q, Amm	SCCD
June 18	GC1,GC2,GC4,GC5,BG1,BG4, BG9,BG14,BG18,LG1,LG3, LG6,LG13,LG18,LG22	TRC (Field and Titration Methods)	SCCD, City of Sheridan
July 23	GC1,GC2,GC4,GC5,BG1,BG4, BG9,BG14,BG18,LG1,LG3, LG6,LG13,LG18,LG22	TRC (Field and Titration Methods)	SCCD, City of Sheridan
July 29	GC1-GC6	Temp, pH, EC, DO, TRC, T, TSS, Alk, N, P, Cl, S, H, Q, Amm, Photo	Sheridan County
July 30	BG1-BG18	Temp, pH, EC, DO, TRC, T, TSS, Alk, N, P, Cl, S, H, Q, Amm, Photo	Sheridan County
July 31	LG1-LG22	Temp, pH, EC, DO, TRC, T, TSS, Alk, N, P, Cl, S, H, Q, Amm, Photo	Sheridan County
Sep 9-13	GC1, GC1A, GC1B, GC2, GC3, BG2, BG4, BG8, BG9, BG14	Photo, Macro, Habitat	SCCD, City of Sheridan, Sheridan County
Sep 16-20	BG15, BG18, LG3, LG5, LG7, LG10, LG18, LG21, LG22	Photo, Macro, Habitat	SCCD, City of Sheridan, Sheridan County
Sep 24	GC1-GC6	Temp, pH, EC, DO, TRC, T, TSS, Alk, N, P, Cl, S, H, Q, Amm	City of Sheridan
Sep 25	BG1-BG18	Temp, pH, EC, DO, TRC, T, TSS, Alk, N, P, Cl, S, H, Q, Amm	City of Sheridan
Sep 26	LG1-LG22	Temp, pH, EC, DO, TRC, T, TSS, Alk, N, P, Cl, S, H, Q, Amm	City of Sheridan

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Sep 30	GC2,LG8,BG18	FC (in sediment), Temp, pH, EC, DO, T, Q, V, Photo	SCCD
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<sup>1</sup> Sampling dates were randomly selected and may be subject to modification due to unforeseen circumstances. Any changes to sampling dates and reasons for the changes will be described in the field log. Abbreviations include, FC=Fecal Coliform, T=Turbidity, Q=Flow, Temp=Temperature, EC=Electrical Conductivity, DO= Dissolved Oxygen, TRC=Total Residual Chlorine, TSS=Total Suspended Solids, Alk=Alkalinity, N=Nitrates, P=Total Phosphorus, Cl=Chloride, S=Sulfate, H=Hardness, V=Velocity, and Amm=Ammonia.

Table 2-13. Sampling Schedule for August 2002<sup>1</sup>

<b>Date<sup>2</sup></b>	<b>Sites</b>	<b>Parameters</b>	<b>Sampling Assistance Personnel</b>
August 5	GC1-GC6	FC, Temp, pH, EC, DO, T, Q	Sheridan County
	GC1,2,4,6	<i>E. coli</i>	
August 6	LG1-LG22	FC, Temp, pH, EC, DO, T, Q	Sheridan County
	LG1,6,9,11,14,17,19,22	<i>E. coli</i>	
August 7	BG1-BG18	FC, Temp, pH, EC, DO, T, Q	Sheridan County
	BG1,4,9,11,13,16,18	<i>E. coli</i>	
August 8	LG1-LG22	FC, Temp, pH, EC, DO, T, Q	Sheridan County
	LG1,6,9,11,14,17,19,22	<i>E. coli</i>	
August 12	GC1-GC6	FC, Temp, pH, EC, DO, TRC, T, TSS, Alk, N, P, Cl, S, H, Q, Amm	SCCD
	GC1,2,4,6	<i>E. coli</i>	
August 13	BG1-BG18	FC, Temp, pH, EC, DO, TRC, T, TSS, Alk, N, P, Cl, S, H, Q, Amm	SCCD
	BG1,4,9,11,13,16,18	<i>E. coli</i>	
August 14	LG1-LG22	FC, Temp, pH, EC, DO, TRC, T, TSS, Alk, N, P, Cl, S, H, Q, Amm	SCCD
	LG1,6,9,11,14,17,19,22	<i>E. coli</i>	
August 15	BG1-BG18	FC, Temp, pH, EC, DO, T, Q	SCCD
	BG1,4,9,11,13,16,18	<i>E. coli</i>	
August 19	GC1-GC6	FC, Temp, pH, EC, DO, T, Q	City of Sheridan
	GC1,2,4,6	<i>E. coli</i>	
August 20	LG1-LG22	FC, Temp, pH, EC, DO, T, Q	City of Sheridan
	LG1,6,9,11,14,17,19,22	<i>E. coli</i>	

<b>Date<sup>2</sup></b>	<b>Sites</b>	<b>Parameters</b>	<b>Sampling Assistance Personnel</b>
August 21	BG1-BG18	FC, Temp, pH, EC, DO, T, Q	City of Sheridan
	BG1,4,9,11,13,16,18	<i>E. coli</i>	
August 22	LG1-LG22	FC, Temp, pH, EC, DO, T, Q	City of Sheridan
	LG1,6,9,11,14,17,19,22	<i>E. coli</i>	
August 26	GC1-GC6	FC, Temp, pH, EC, DO, T, Q	City of Sheridan
	GC1,2,4,6	<i>E. coli</i>	
August 27	BG1-BG18	FC, Temp, pH, EC, DO, T, Q	City of Sheridan
	BG1,4,9,11,13,16,18	<i>E. coli</i>	
August 28	GC1-GC6	FC, Temp, pH, EC, DO, T, Q	City of Sheridan
	GC1,2,4,6	<i>E. coli</i>	

<sup>1</sup> Sampling dates were randomly selected and may be subject to modification due to unforeseen circumstances. Any changes to sampling dates and reasons for the changes will be described in the field log. Abbreviations include, FC=Fecal Coliform, T=Turbidity, Q=Flow, Temp=Temperature, EC=Electrical Conductivity, DO= Dissolved Oxygen, TRC=Total Residual Chlorine, TSS=Total Suspended Solids, Alk=Alkalinity, N=Nitrates, P=Total Phosphorus, Cl=Chloride, S=Sulfate, H=Hardness, and Amm=Ammonia.

<sup>2</sup> Dates include 5 separate 24-hour sampling days within a 30-day period as required by the fecal coliform bacteria standard for Class 2 waterbodies in Wyoming (WDEQ, 1998).

Table 2-14. Sampling Schedule for October 2002<sup>1</sup>

Date <sup>2</sup>	Sites	Parameters	Sampling Assistance Personnel
October 1	GC1-GC6	FC, Temp, pH, EC, DO, T, Q	SCCD
	GC1,2,4,6	<i>E. coli</i>	
October 2	BG1-BG18	FC, Temp, pH, EC, DO, T, Q	SCCD
	BG1,4,9,11,13,16,18	<i>E. coli</i>	
October 3	LG1-LG22	FC, Temp, pH, EC, DO, T, Q	SCCD
	LG1,6,9,11,14,17,19,22	<i>E. coli</i>	
October 7	GC1-GC6	FC, Temp, pH, EC, DO, T, Q	City of Sheridan
October 8	BG1-BG18	FC, Temp, pH, EC, DO, T, Q	City of Sheridan
October 9	LG1-LG22	FC, Temp, pH, EC, DO, T, Q	City of Sheridan
October 15	GC1-GC6	FC, Temp, pH, EC, DO, T, Q	Sheridan County
October 16	BG1-BG18	FC, Temp, pH, EC, DO, T, Q	Sheridan County
October 17	LG1-LG22	FC, Temp, pH, EC, DO, T, Q	Sheridan County
October 22	GC1-GC6	Temp, pH, EC, DO, TRC, T, TSS, Alk, N, P, Cl, S, H, Amm, Q, Photo	SCCD
October 23	BG1-BG18	Temp, pH, EC, DO, TRC, T, TSS, Alk, N, P, Cl, S, H, Amm, Q, Photo	SCCD
October 24	LG1-LG22	Temp, pH, EC, DO, TRC, T, TSS, Alk, N, P, Cl, S, H, Amm, Q, Photo	SCCD
October 28	GC1-GC6	FC, Temp, pH, EC, DO, T, Q	City of Sheridan
October 29	BG1-BG18	FC, Temp, pH, EC, DO, T, Q	City of Sheridan
October 30	LG1-LG22	FC, Temp, pH, EC, DO, T, Q	City of Sheridan

<sup>1</sup> Sampling dates were randomly selected and may be subject to modification due to unforeseen circumstances. Any changes to sampling dates and reasons for the changes will be described in the field log. Abbreviations include, FC=Fecal Coliform, T=Turbidity, Q=Flow, Temp=Temperature, EC=Electrical Conductivity, DO= Dissolved Oxygen, TRC=Total Residual Chlorine, TSS=Total Suspended Solids, Alk=Alkalinity, N=Nitrates, P=Total Phosphorus, Cl=Chloride, S=Sulfate, H=Hardness, and Amm=Ammonia.

<sup>2</sup> Dates include 5 separate 24-hour sampling days within a 30-day period as required by the fecal coliform bacteria standard for Class 2 waterbodies in Wyoming (WDEQ, 1998).

**Edit No. 7 Section II. F. Sample Collection**

Table 2-17 found on page 46 of the SAP has been amended to include laboratory methods that will be used for analyzing *E. coli*, pesticides, and herbicides.

Table 2-17 . Standard Field and Laboratory Methods for Chemical, Physical, Biological, and Habitat Sampling

Parameter	Units	Method/Reference <sup>1</sup>	Location of Analyses	Preservative	Holding Time
Temperature	°C	grab/EPA 1983 170.1	On-site	n/a	n/a
Temperature	°C	continuous recorder	On-site	n/a	n/a
pH	SU	grab/EPA 1983 150.1	On-site	n/a	n/a
Conductivity	umhos/cm	grab/EPA 1983 120.1	On-site	n/a	n/a
Dissolved Oxygen	mg/l	grab/EPA 1983 360.1	On-site	n/a	n/a
T. Residual Chlorine	mg/l	grab/ EPA 1983 330.5	On-site	n/a	n/a
Turbidity	NTU	grab/EPA 1983 180.1	IML <sup>2</sup>	Ice; at or below 4°C	48 hours
BOD	mg/l	grab/EPA 1983 405.1	IML	Ice; at or below 4°C	48 hours
Fecal Coliform	col/100 ml	grab/SM 9222D <sup>4</sup>	IML	Ice; at or below 4°C	6 hours
TSS	mg/l	grab/SM 2540D	IML	Ice; at or below 4°C	7 days
Alkalinity	mg/l	grab/ SM 2320B	IML	Ice; at or below 4°C	14 days
Nitrate-Nitrite	mg/l	grab/EPA 1983 353.2	IML	Sulfuric Acid (H <sub>2</sub> SO <sub>4</sub> ); cool to 4°C	28 days
Nitrogen-Ammonia	mg/l	grab/EPA 1983 350.1	IML	Sulfuric Acid (H <sub>2</sub> SO <sub>4</sub> ); cool to 4°C	28 days
T. Phosphorous	mg/l	grab/EPA 1994 200.7	IML	Sulfuric Acid (H <sub>2</sub> SO <sub>4</sub> ); cool to 4°C	28 days
Chloride	mg/l	grab/EPA 1983 300.0	IML	None	28 days
Sulfate	mg/l	grab/EPA 1983 300.0	IML		28 days

Parameter	Units	Method/Reference <sup>1</sup>	Location of Analyses	Preservative	Holding Time
				Ice; at or below 4°C	
Hardness	mg/l	grab/EPA 1983 130.2 SM 2340B	IML	Nitric acid (HNO <sub>3</sub> ); cool to 4°C	6 months
Flow	cfs	Calibrated staff gauge	On-site	n/a	n/a
Flow	cfs	Mid-Section Method	On-site	n/a	n/a
Macroinvertebrates	Metrics	King 1993	ABA <sup>3</sup>	formalin	n/a
Habitat (Reach level)	n/a	King 1993	On-site	n/a	n/a
E. coli	col/100 ml	mColiBlue24	IML	Ice; at or below 4°C	6 hours
Atrazine, Simazine, Tebuthiuron, Prometon, Diazanone, Malathion, Parathion, Methyl-Parathion	µg/l	EPA Method 525	IML	Ice; at or below 4°C	7 days
Dicamba, Picloram, 2,4-D	µg/l	EPA Method 8151	IML	Ice; at or below 4°C	7 days
Carbaryl, Carbofuran	µg/l	EPA Method 531	IML	Ice; at or below 4°C	7 days

<sup>1</sup>Method references for laboratory analyses were provided by the contract laboratories and defined in their SOPs. Refer to Appenix C for SOPs for sample collection and on-site analyses.

<sup>2</sup>IML refers to Inter-Mountain Laboratories in Sheridan, Wyoming.

<sup>3</sup>ABA refers to Aquatic Biology Associates, Inc. in Corvallis, Oregon.

<sup>4</sup> SM refers to Eaton et. al., 1995. Standard Methods for the examination of water and wastewater. Washington, D.C.

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