

**Bitter Creek and Killpecker Creek Watershed Management Plan
And Implementation Project**



**Bitter Creek and Killpecker Creek
Spring 2010 Bacteria and Chloride Sampling
Results Summary Report**

Prepared For:

Sweetwater County Conservation District
79 Winston Drive, Suite 110
Rock Springs, WY 82901

Prepared By:

Environmental Design Engineering Consultants
23 N. Scott Street, Suite 27
Sheridan, WY 82801

September 7, 2010

Table of Contents

1.0	Executive Summary	1
2.0	Introduction and Background	3
3.0	Spring 2009 Chloride Sampling and Soils Sampling	6
4.0	Spring 2009 Bacteria Sampling	15
5.0	Summary and Conclusions	21
6.0	References.....	23

Table of Tables

Table 1 – 2004-2010 Bitter and Killpecker Creek Chloride Sampling Results	7
Table 2 – 2006–2010 Bitter and Killpecker Creek Chloride Soils Sampling Results	14
Table 3 – 2004-2010 Bitter and Killpecker Creek E. coli Sampling Results	17

Table of Figures

Figure 1 - 2004-2010 Bitter and Killpecker Creek Chloride Sampling Results	8
Figure 2 - 2004-2010 Upper Bitter Creek Chloride Sampling Results.....	9
Figure 3 - 2004-2009 Killpecker Creek Chloride Sampling Results	10
Figure 4 - 2004-2010 Bitter and Killpecker Creek E. coli Sampling Results.....	18
Figure 5 - 2004-2010 Lecacy Site E. coli Sampling Results	19
Figure 6 - 2004-2010 Lower Killpecker Creek E. coli Sampling Results	20

Plates

Plate 1	2010 Monitoring Site Locations
---------	--------------------------------

1.0 Executive Summary

EDE Consultants conducted bacteria and chloride sampling for the Sweetwater County Conservation District (SWCCD) along portions of Bitter Creek and Killpecker Creek and their tributaries during spring 2010. A portion of Bitter Creek is listed as impaired for both chloride and E. coli, and a portion of Killpecker Creek is listed as impaired for E. coli on Wyoming's 303d list of waters requiring Total Maximum Daily Loads (TMDLs).

Sampling begun in 2004 and continued through 2009 was conducted to confirm the impairment and evaluate areas contributing to exceedences of the chloride and E. coli bacteria standards in Bitter and Killpecker Creeks. In 2010 the scope of the sampling was greatly reduced pending development of a (TMDL) by the Wyoming Department of Environmental Quality (WDEQ) for both chloride and bacteria in these drainages. Bacteria sampling was shifted to tracking E. coli at four "legacy" sites without further source investigative sampling. Chloride sampling was also scaled back but continued to measure chloride concentrations in two areas that are potential source areas contributing to chloride exceedences. Killpecker Creek is being sampled for chloride along Elk St. in Rocks Springs, south of Yellowstone Rd. Bitter Creek is being sampled for chloride in the vicinity of Point of Rocks, Wy., where Deadman Wash, Ten Mile Draw and Bitter Creek converge

Results of sampling completed during spring 2010 are summarized in this report, and reviewed in context with 2004 through 2009 sampling. Spring 2010 sampling suggests:

- The 2008 extended Wyoming Department of Environmental Quality 303d impairment listing from Rock Springs to Point of Rocks is supported.
- Chloride concentrations in Bitter Creek are elevated at, and just upstream of Point of Rocks as well as in Ten Mile Draw and Deadman Wash pointing to chloride inputs in this vicinity.
- Native soils in and along Bitter Creek just upstream of Point of Rocks and the lower reaches of Ten Mile Draw and Deadman Wash

potentially contribute to increased chloride concentrations seen within Bitter Creek in this reach.

- Chloride concentrations within Killpecker Creek continue to show a significant increase between the Yellowstone Road crossing and the confluence with Bitter Creek downstream. This reach is currently experiencing significant road and infrastructure construction in the area just downstream of Yellowstone Road.
- Spring 2010 E. coli sampling at the 4 legacy sites does not by itself support the extended impairment for E. coli between Rock Springs and Point of Rocks on Bitter Creek or the lower reaches of Killpecker Creek. However, historic sample data in these reaches does support the impairment.
- Spring 2010 E. coli concentrations in Bitter Creek downstream of the City of Rock Springs, are less than observed in 2004, 2005 or 2009. Overall water quality in this reach continues to support the impaired listing.
- Spring 2010 E. coli concentrations in Killpecker Creek just upstream of the Bitter Creek confluence were the lowest recorded during the sampling project to date. Sampling was not conducted this year at the Highway 191 road crossing near Reliance, WY.

Fall 2010 monitoring using the reduced number of stream sites for chloride and the four legacy sites for E. coli will be conducted in September. Additional soils sampling will be done at that time also. A 2010 comprehensive sampling report will be submitted following the fall sampling discussing the 2010 results and developing suggestions for any additional monitoring necessary for the Watershed Assessment.

2.0 Introduction and Background

This report provides an update of ongoing chloride and E. coli bacteria monitoring under the Bitter Creek and Killpecker Creek Watershed Management Plan and Implementation Project, for the Sweetwater County Conservation District (SWCCD). This report is presented as an interim sampling summary for 2010 monitoring, and supplements previous monitoring review documents prepared for the Bitter and Killpecker Creek studies (EDE 2006-1, EDE 2006-2, EDE 2009-1, EDE 2009-2).

Sampling for this project is being done to address Wyoming Department of Environmental Quality (WDEQ) 303d chloride and bacteria impairment listings on Bitter and Killpecker Creeks. The 303d list is an account of impaired waters in Wyoming requiring computation of Total Maximum Daily Load (TMDL) developed by WDEQ in accordance with Environmental Protection Agency (EPA) standards and requirements set forth in the Clean Water Act of 1972. The SWCCD sampling program allows:

- Confirmation of the accuracy of the 303d listings.
- Evaluation of what may be causing the impairment(s).
- Assessment of whether best management practices (BMPs) may be implemented to improve water quality.

During 2008 the WDEQ revised the extent of the impaired listing for chloride and bacteria on Bitter Creek within the 303d list, increasing the length of listed reaches. The Bitter Creek chloride and bacteria 303d impairment was previously listed from the confluence of Bitter Creek with the Green River through the City of Rock Springs, WY. The 2008 revision extended this impaired zone to include Bitter Creek from the City of Rock Springs, WY to Point of Rocks, WY. Killpecker Creek is listed as impaired for bacteria only, from Bitter Creek upstream to Reliance, WY.

The 2010 sampling program was reduced in scope due to the pending development of TMDL's for both chloride and E. coli by the WDEQ in 2012. 2004 through 2010 monitoring locations are presented on Plate 1.

- 1) Chloride samples are being collected in Ten Mile Draw, Deadman Wash and Bitter Creek just upstream of the Deadman Wash confluence to identify potential source areas of chloride contributing to elevated concentrations previously observed in Bitter Creek at site BC-6. Chloride samples are being collected on Killpecker Creek between Yellowstone Road and the confluence with Bitter Creek. The intent is to observe potential contributions to elevated chloride concentrations from ongoing road and bridge construction in this area which has been shown (2009) to apparently contribute chloride to Killpecker Creek..
- 2) Soil samples are being collected in order to identify potential sources of chloride contributing to the Bitter Creek 303d impairment to Point of Rocks.
- 3) E. coli samples are being collected at four "legacy sites" to serve as reference points for future monitoring that will be conducted as part of the WDEQ's TMDL for E. coli bacteria in both the Killpecker and Bitter Creek drainages. No further exploratory E. coli sampling will be conducted to investigate areas of elevated E. coli concentrations in these watersheds.

From 2004 through 2008, bacteria monitoring for these studies was for both fecal coliform and E. coli to address a changeover period in the EPA standard, from fecal coliform to E. coli. In 2009 permission was given by the WDEQ to conduct bacteria sampling only for E. coli (the new standard) to minimize costs. The bacteria criteria analysis for the project will be met by sampling only for E. coli from this point forward.

EDE Consultants (EDE) conducted spring 2010 bacteria and chloride sampling within surface waters of Bitter Creek, Killpecker Creek, and their tributaries for the SWCCD during May and June 2010. Spring soils sampling within the Bitter Creek drainage near Point of Rocks was conducted during late May 2010.

Spring 2010 sampling results are summarized in this report along with discussion of the results in relation to the impairment listings, the sampling objectives listed above, and EPA standards. Both Bitter and Killpecker Creeks have been classified by the WDEQ as recreational waters. EPA E. coli bacteria standards

are based on anticipated levels of recreation designated; 1) primary contact (ingestion or full body immersion) or; 2) secondary contact (incidental or accidental exposure not resulting in ingestion or immersion). The primary contact standard for *E. coli* applies from May 1 through September 30. For the remainder of the year all Wyoming waters are protected for secondary contact recreation.

- The primary contact standard for *E. coli* is exceeded when the geometric mean of not less than five samples taken not less than twenty-four hours apart in a period of not more than thirty days, is greater than 126 organisms per 100 mL.
- The secondary contact standard for *E. coli* is exceeded when the geometric mean of not less than five samples taken not less than twenty-four hours apart in a period of not more than thirty days, is greater than 630 organisms per 100 mL.

The chloride criterion applies to Class 1, 2AB, 2B, and 2C waters only. WDEQ classifies Bitter and Killpecker Creeks as 2C and 3B respectively. Although Killpecker Creek samples have shown high chloride concentration, as a 3B classified stream, Killpecker Creek *is not* listed as impaired for chloride. Previous sampling implicates Killpecker Creek as a major contributor of chloride to Bitter Creek (2C), which *is* listed as impaired for chloride. The chloride standards consist of a chronic and acute standard.

- The acute standard for chloride is exceeded when the one hour average concentration exceeds 860 mg/L more than once every three years on average.
- The chronic standard for chloride is exceeded when the four day average concentration exceeds 230 mg/L more than once every three years on average.

A summary of 2010 sampling results obtained to date (Spring 2010) is provided in this report. Following the 2010 fall sampling, a comprehensive 2010 sampling report will be produced.

3.0 Spring 2009 Chloride Sampling and Soils Sampling

Chloride (inorganic) sampling from 2004 through 2005 was conducted at 15 sites along Bitter and Killpecker Creeks (Plate 1, EDE 2006-1, EDE 2006-2). Ten potential chloride source sites were established along Killpecker Creek, north of I-80 and south of Yellowstone Road, and sampled in 2006, 2007, and 2008 (EDE 2009). 19 sites were sampled for chloride in spring 2009 along Bitter and Killpecker Creeks and their tributaries to refine evaluation of potential chloride sources observed from the 2004-2008 sample analysis. Chloride sampling was significantly reduced in 2010 to 10 sites. Chloride sampling sites for the 2004-2010 Watershed Assessment Project are shown on Plate 1.

Chloride concentrations in samples collected at the Bitter and Killpecker Creek sites from 2004 through 2010 are presented in Table 1. 2004-2010 Bitter and Killpecker Creek comprehensive sampling results are presented on Figure 1 for context of the data collected at all sites to date. 2004-2010 Upper Bitter Creek chloride sample results, and 2004-2010 Killpecker Creek chloride sample results, are presented on Figures 2 and 3 respectively.

Spring 2010 chloride water sampling revisited 2 existing sites on Killpecker Creek and 5 existing sites on Bitter Creek. Additionally 3 new Bitter Creek sites, were also monitored (Plate 1). 2010 chloride monitoring goals (Section 1) and interim results based on spring 2010 sampling analysis are summarized below:

- 1) *Confirm the 2008 Bitter Creek 303d impairment reach to Point of Rocks.*

Spring 2010 chloride sampling results continue to support the 2008 303d impairment extension to Point of Rocks based on chloride concentrations greater than the chronic criteria standard (Table 1), observed at two sites in this reach. These results, in conjunction with previous results from 2004-2009, further validate the impairment listing. Fall 2010 sample results at these sites will be used in conjunction with 2009 and 2008 sample results to determine if actual exceedence of the standard has occurred at these sites (Section 1.0).

Table 1 – 2004-2010 Bitter and Killpecker Creek Chloride Sampling Results

Sites	March 2004	April 2004	August 2004	Sept. 2004	May 2005	Sept. 2005	June 2006	Sept. 2007	June 2008	Nov. 2008	May 2009	Sept. 2009	May 2010
BC-7	4	23		37	29	41				16			
BC-15											4.4	26	
BC-14											7.5	21	
BC-13											14		
BCS-6												46	
BCS-5												96	
BC-17													320
TM-2													640
TM-1	340	200		200	190	290				230	180		490
DM-1	47	85		190	130	200				49			160
DM-2													360
BC-6	43	140		510	270	740				130	600	590	380
BC-12											770	810	
BC-11											54		
BC-10											1700		
SWC-1													
BC-5	68	660		240	630	220				480	590		
DHC1		160											
BC-4	67	730		150	300	580				690			1000
BT Well											92	91	
MH Well											150	160	
KC-3	98	440			390								
KC-7											64		
KC-2	130	240	80	310	390	26					170	37	
KCS-2							3300	2400		3100			
KCS-1							1500						
KC-5											4400	3800	3400
KC-4											5500	4700	
KCS-8									7.4				
KCS-7									8.1				
KCS-3							28000	31000	11400	22000	17000	16100	
KCS-10										21000			
KCS-4							33000	37000	16000	22000	29000	29200	
KCS-9										30000			
KCS-6									54000				
KCS-5							2500	7000					
KC-RStrib1											170	160	
KC-1	600	4000	4800	2200	2900	7000					8800	11600	8300
BC-3A		1200			990	2000							
BC-3	200	2000		1100	1900	2100				1800			
LBC-1	710	1300			680								
BC-2	260	1500		820	1700	1800							1800
BC-1	420	1300		670	1600	1600							

blue = exceedance of chronic chloride criteria = 230 mg/L

red = exceedance of acute chloride criteria = 860 mg/L

Figure 1 - 2004-2010 Bitter and Killpecker Creek Chloride Sampling Results

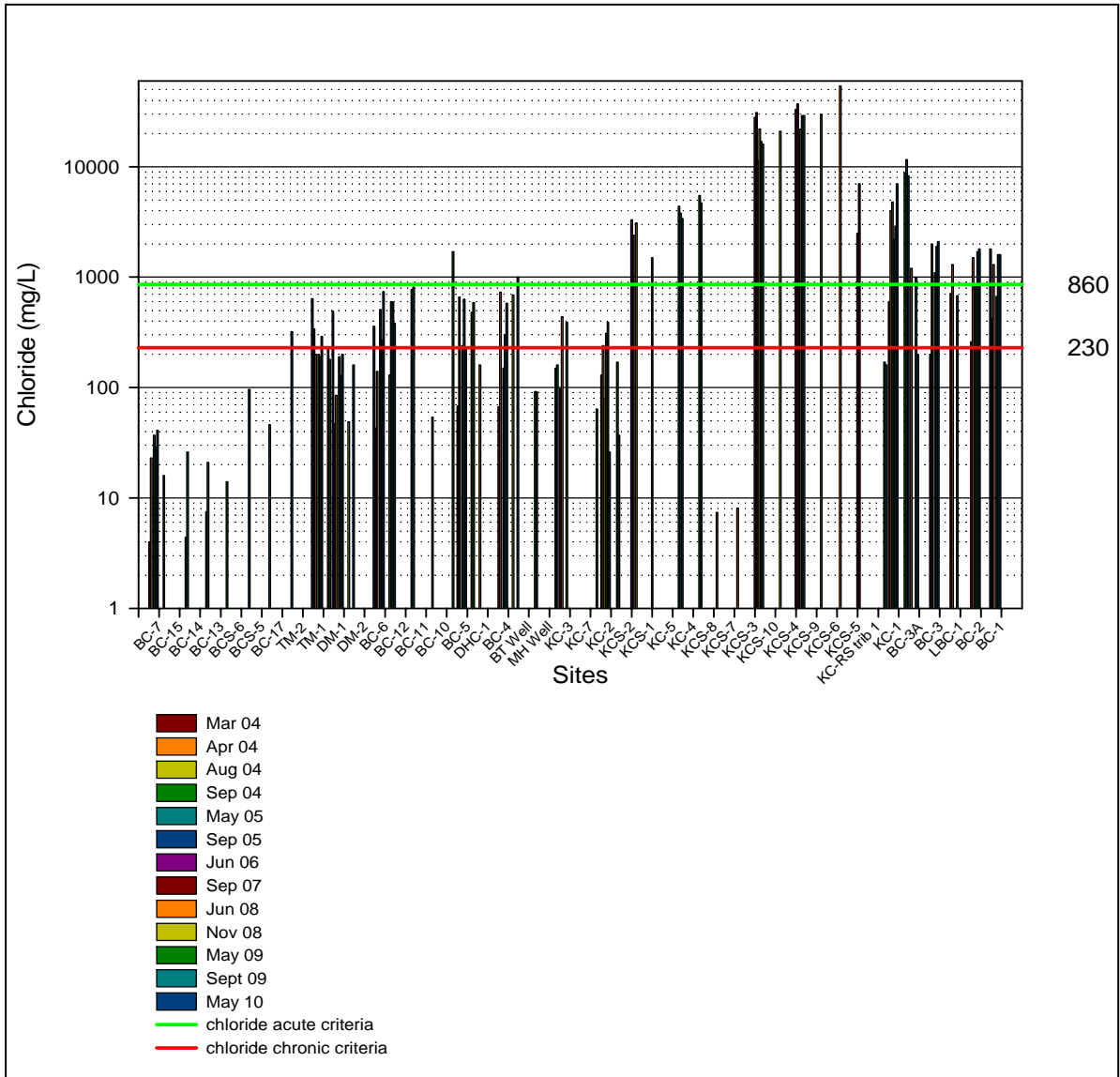


Figure 2 - 2004-2010 Upper Bitter Creek Chloride Sampling Results

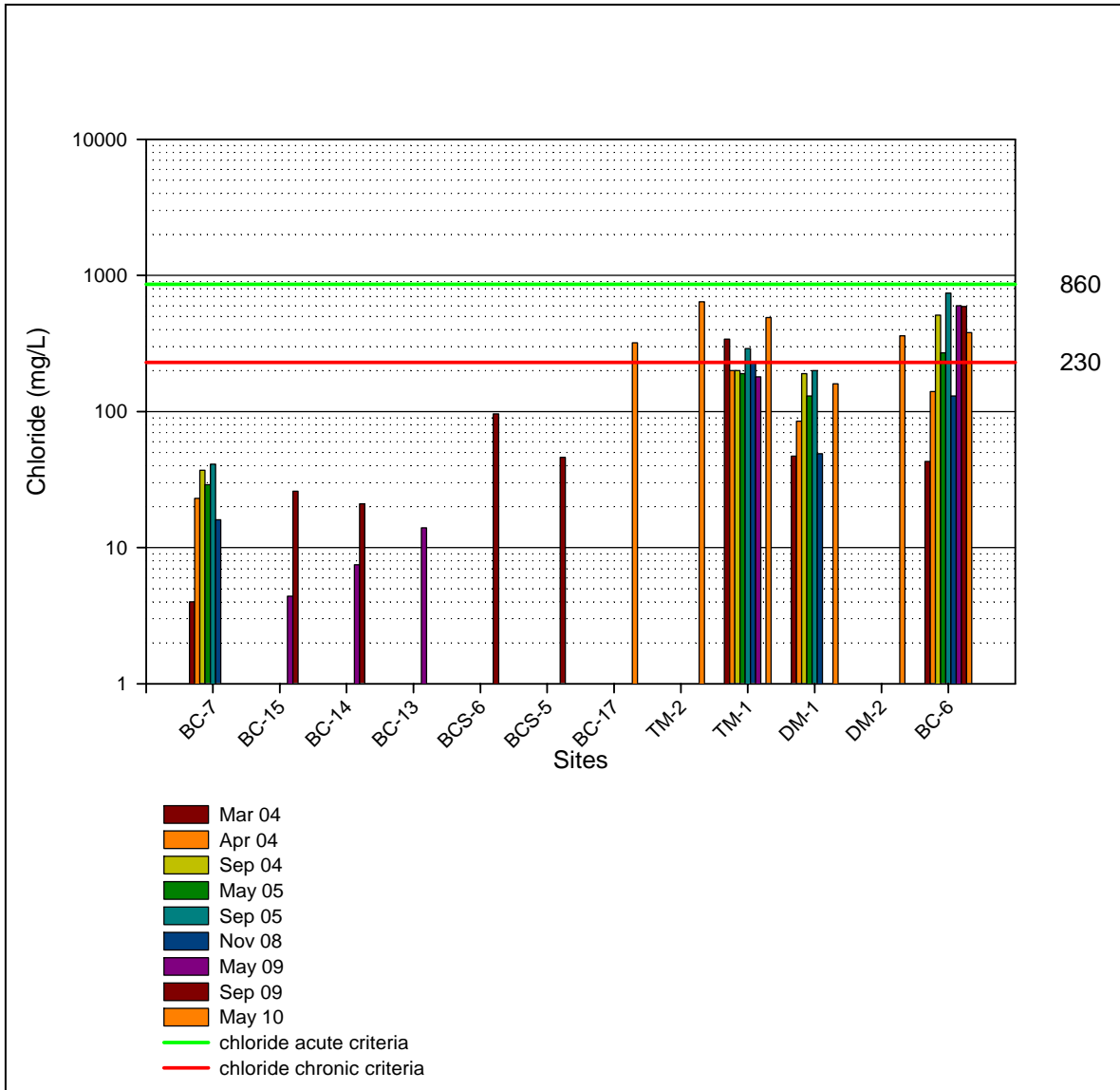
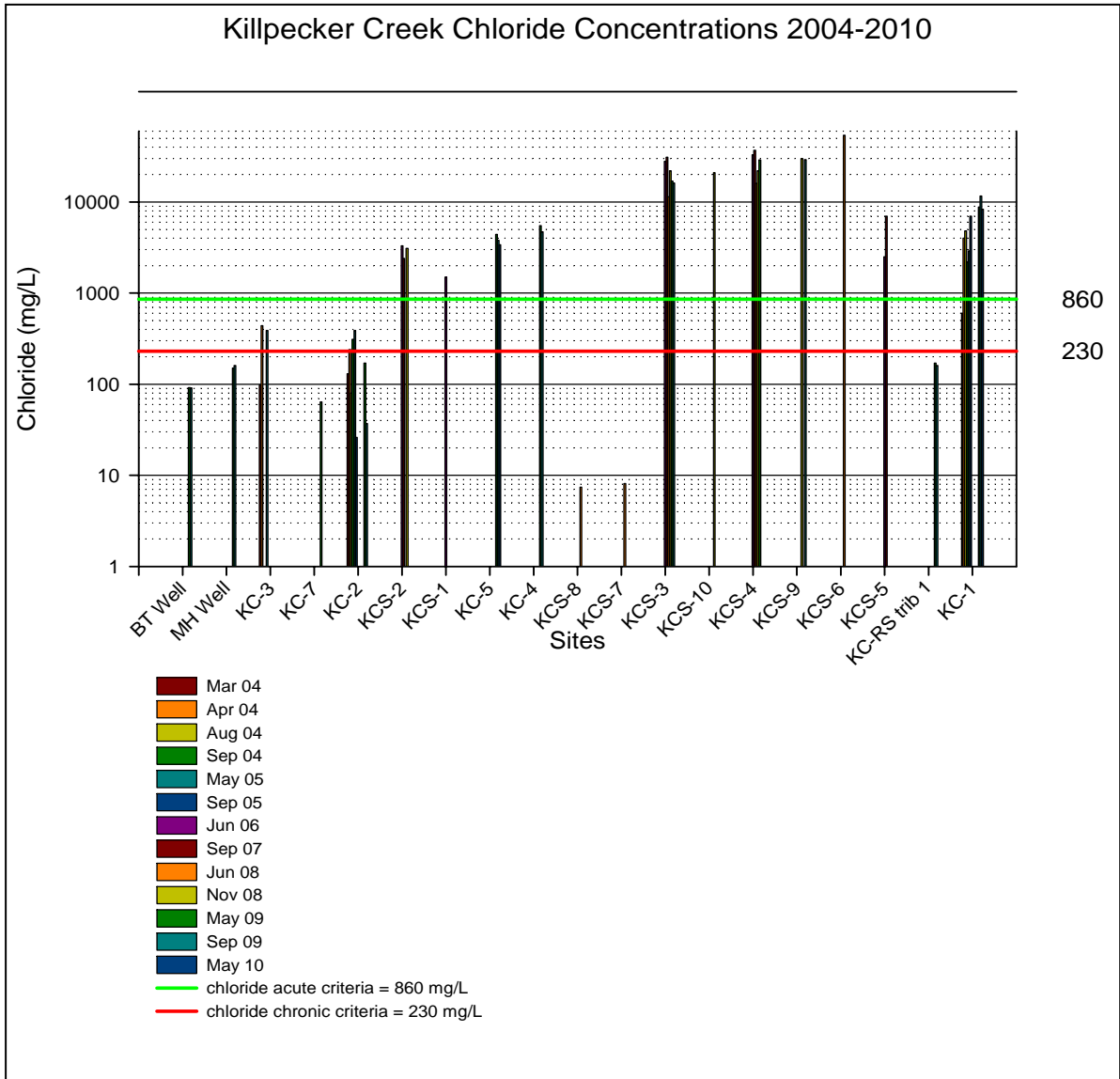


Figure 3 - 2004-2009 Killpecker Creek Chloride Sampling Results



- 2) *Identify potential source areas of chloride contributing to elevated concentrations observed in Bitter Creek at site BC-6.*

The spring 2010 chloride sampling results indicate that chloride sources are present in the vicinity of Point of Rocks (Table 1, Plate1). Previous sampling showed a large chloride increase between BC-13 and BC-6 at Point of Rocks. Site BC-17 shows that some of the increase occurs in Bitter Creek itself for an undetermined distance upstream of the confluence with Deadman Wash. 2009 sampling indicates minimal levels of chloride approximately 1.5 miles upstream at site BC-13. Further sampling in Ten Mile Draw (sites TM-1 and TM-2) show that significant amounts of chloride are present when stream flow occurs. This appears to be diluted by flow from Deadman Wash as these two tributaries converge. However, the combined flow does then contribute significant amounts of chloride to Bitter Creek just upstream of site BC-6 at Point of Rocks. This further refinement of sampling at the upper end of the impairment suggests that the alluvial areas in the immediate vicinity of Point of Rocks are a likely contributor to the marked increase in chloride that is observed at site BC-6. Further sampling upstream in Ten Mile Draw may be warranted to explore where the chloride increase begins in that drainage. Sampling results from two surface water stations operated by Bridger Coal Company suggest that the chloride inputs begin upstream of mining activity in Ten Mile Draw. Further data regarding a spring on BLM land upstream of Bridger Coal may be helpful in determining if the chloride is coming from underground sources, soil contributions or both. It is noteworthy to remember that input from the main stem of Bitter Creek and its tributaries in the vicinity of Point of Rocks is ephemeral in nature and does not constitute a year round contribution to the extended impairment reach of Bitter Creek.

- 3) *Refine/confirm the source area identified on lower Killpecker Creek during 2006-2008.*

Spring 2010 chloride samples taken at sites KC-5 and KC-1 confirm the source area identified in 2004-2008 sampling north of I-80 and south of Yellowstone Road (Table 1, Figure 3, Plate 1). The spring 2010 sample results seen at site KC-5 indicate that this source area may continue some distance north of Yellowstone Road at site KC-5 but south of site KC-2 (Table 1). The magnitude of the chloride concentrations at these lower Killpecker Creek basin sites is much greater than it is within the upper Killpecker Creek basin. This, in conjunction with the perennial nature of the stream in this area, indicates that the *principal* reach of Killpecker Creek *consistently* contributing to elevated chloride within Bitter Creek is located in this area downstream of site KC-2. In addition, significant, ongoing road and infrastructure construction is occurring in the stream reach south of Yellowstone Rd. It is unclear as to what specific impacts this construction will have as it disturbs the various small tributaries entering Killpecker Creek. At present, downstream chloride levels are higher than upstream chloride levels. However, both up and downstream chloride contributions are lower than had been observed in 2009 sampling.

12 soils samples were collected from 2006 through 2008 within the potential chloride source area along Killpecker Creek between I-80 and Yellowstone Road. Spring 2009 chloride soils sampling was conducted to build on 2006-2008 sampling, and better define potential areas where soils may be contributing to elevated chloride concentrations observed within both Bitter and Killpecker Creeks. In spring 2009, 7 soils samples were collected along Bitter Creek upstream of Rock Springs, and 4 soils samples were collected along Killpecker Creek upstream of KC-2. In 2010 four soil samples were collected. Three looked at chloride levels along Ten Mile Draw and one was taken near Bitter Creek site BC-17. 2006-2010 soils sample results are shown in Table 2, site locations are shown on Plate 1.

Spring 2010 soils sample chloride concentrations were mostly very high with results similar to those seen along lower Killpecker Creek (Table 2). Three samples were collected in the alluvial fan through which Ten Mile Draw enters Deadman

Wash. TMSS-1 which displayed the highest chloride concentration recorded in the seven year study was furthest upstream near stream sample site TM-2. TMSS-2 was halfway between stream sites TM-2 and TM-1 and measured almost exactly half the amount of chloride. TMSS-3 was collected near the existing TM-1 stream site and showed negligible amounts of chloride. All three soil samples in the Ten Mile Draw drainage were collected on the bench running adjacent to the south side of the stream channel. A fourth soil sample was collected on the bench on the south side of the Bitter Creek channel adjacent to stream sample site BC-17. It also displayed high levels of chloride similar to those seen in the Ten Mile Draw and the lower Killpecker Creek drainage. The data suggests that areas near Point of Rocks contain soils high in chloride which may contribute to elevated chloride levels during run-off events and seasonal flows from both Bitter Creek and surrounding tributaries. The ephemeral nature of these streams would result in chloride contributions during portions of the year when flow exists. Further soil sampling in fall 2010 will seek to refine the potential source area of native soils contributing chloride to the ten Mile draw and Deadman Wash tributaries.

Table 2 – 2006–2010 Bitter and Killpecker Creek Chloride Soils Sampling Results

Sample ID	Sample Date	Chloride PE meq/L
KC Soil - 1	6/15/2006	420.00
KC Soil -2	6/15/2006	534.00
KC Soil -3	6/15/2006	530.00
KC Soil -4	6/15/2006	155.00
KC Soil -5	6/15/2006	417.00
KCSS-6	9/6/2007	341.00
KCSS-7	9/6/2007	203.00
KCSS-8	9/6/2007	125.00
KCSS-9	6/10/2008	0.15
KCSS-10	6/10/2008	3.05
KCSS-11	6/10/2008	0.18
KCSS-12	6/10/2008	2.74
BCSS-1	5/29/2009	12.20
BCSS-2	5/29/2009	35.80
BCSS-3	5/29/2009	5.13
BCSS-4	5/29/2009	17.10
BCSS-5	5/29/2009	0.12
BCSS-6	5/11/2009	1.17
KCSS-13	5/13/2009	0.31
KCSS-14	5/13/2009	1.68
KCSS-15	5/13/2009	371.00
LCSS-1	5/13/2009	0.37
NBBSS-1	5/29/2009	5.23
BCSS-7-01	9/23/2009	0.09
BCSS-7-02	9/23/2009	0.05
BCSS-8	9/23/2009	13.00
BCSS-9	9/23/2009	0.23
BCSS-10	9/23/2009	1.36
BCSS-11	9/17/2009	21.20
BCSS-12	9/17/2009	14.50
BCSS-13	9/17/2009	19.20
BCSS-14	9/17/2009	10.40
BCSS-15	9/17/2009	0.14
BCSS-16	9/17/2009	0.13
BCSS-17	5/25/2010	421.00
TMSS-1	5/26/2010	679.00
TMSS-2	5/26/2010	341.00
TMSS-3	5/26/2010	3.62

4.0 Spring 2009 Bacteria Sampling

Bacteria sampling from 2004 through 2005 was conducted at 15 sites along Bitter and Killpecker Creeks (Plate 1, EDE 2006-1, EDE 2006-2). 6 potential source sites (4 discharging to Bitter Creek, and 2 groundwater wells) were established along Bitter Creek within the City of Rock Springs and sampled in 2006, 2007, and 2008 (EDE 2009). Spring 2009 E-coli sampling was conducted at 7 of the original (2004-2005) Bitter and Killpecker Creek sites and at 9 new Bitter and Killpecker Creek sites. An additional 4 sites were attempted to be sampled for E. coli to broaden the evaluation, but these sites were dry during the sampling round (these include historic sites SWC-1 and KC-3). For 2010 E. coli sampling throughout both drainages was reduced to four "legacy sites". Samples from sites near Point of Rocks, upstream of the Bitter/Killpecker Creek confluence in Rock Springs, lower Killpecker Creek in Rock Springs and in Bitter Creek downstream of Rock Springs are intended to act as reference measurements as the WDEQ seeks to implement a TMDL for E. coli on both Bitter and Killpecker Creeks.

E. coli geomean concentration (Section 1.0) sample results collected at the Bitter and Killpecker Creek sites from 2004 through 2010 are presented in Table 3. 2004-2010 Bitter and Killpecker Creek comprehensive E-coli geomean concentration sample results are presented on Figure 4 for context of the data collected at all sites to date. 2004-2010 legacy site E. coli geomean concentration sample results are presented on Figures 5 and Killpecker Creek geomean concentration sample results are shown on Figure 6. Site locations are presented on Plate 1.

2010 E. coli sampling monitoring goals (Section 1.0) and interim results based on spring 2010 sampling analysis are summarized below:

- 1) *Monitor E. coli levels at 4 legacy sites spread over the 3 impaired reaches of Bitter and Killpecker Creeks to serve as reference points for upcoming TMDL development.*

The E. coli concentrations sampled during the spring 2010 sampling round do not initially support the impairment listings for Killpecker Creek or

the extended impairment on Bitter Creek. However, given the seasonal variations noted in the past at these locations better conclusions can be drawn after inclusion of the fall sampling results. Samples were collected at the upper end of the extended Bitter Creek impairment at Point of Rocks (site BC-6), immediately upstream of the Bitter/Killpecker Creek confluence in Rock Springs (site BC-4), at the lower end of Killpecker Creek in Rock Springs (site KC-1) and downstream of Rock Springs (site BC-2). The furthest downstream site (BC-2) showed E. coli concentrations of 150.53 col/100ml, indicating that this lower reach of Bitter Creek continues to exceed the full contact recreation limit of 126 col/100ml. However the KC-1 site has shown 3 consecutive decreases in E. coli concentration, all below the level of the more stringent full contact recreation criterion. This gives rise to some cautious optimism that improvements along Killpecker Creek are having positive effects on overall E. coli contributions to Bitter Creek within the Rocks Springs City limits. Again, the inclusion of fall 2010 sampling will allow more definitive conclusions to be drawn. The much less robust number of samples collected also limits the ability to speak to the effectiveness of BMPs in stream reaches that were of specific concern in previous sampling such as Killpecker creek near Reliance and Bitter Creek as it enters the east side of Rock Springs.

Table 3 – 2004-2010 Bitter and Killpecker Creek E. coli Sampling Results

Sites	Spring 2004	Fall 2004	Spring 2005	Fall 2005	Spring 2006	Fall 2007	Spring 2008	Fall 2008	Spring 2009	Fall 2009	Spring 2010
BC-7	2.61	132.54	99.81	1033.13							
TM-1	77.25	33.59	56.70	963.14							
DM-1	7.63		37.81	98.50							
BC-6	3.59	1.82	27.74	266.80					212.75	54.33	85.44
BC-12									54.89	726.17	
BC-10									896.33		
SWC-1											
BC-5	5.72		28.80	406.00					4.24		
BC-9									49.28		
BC-SYN 4										3030.00	
BC-SYN 3										2370.00	
BC-8									2031.78	1747.67	
BC-SYN 2									0.50		
DHC1	1.00	377.77									
BC-SYN 1									63		
BC-4	14.49	351.74	42.62	1324.25					2410.67	749.49	75.88
KC-3	1.58		92.52								
KC-6									6382.19	601.65	
KC-2	66.09	889.42	297.37	3109.38					5703.00	1669.13	
KC-RStrib 1									1.66	19.97	
KC-1	45.68	727.12	399.21	424.76					87.06	70.44	17.91
BCW-1					0.50	0.50	1.21	0.50			
BCS-4					179.81	31.26	28.22	79.34			
BCS-3					0.50	0.50	1.86	2.47			
BCW-2					0.91	0.50	1.21	3.78			
BC-16									320.52	314.10	
BCS-2					0.50	0.50	6.14	0.50			
BC-3A	3.59	2.71	123.76	1774.69							
BC-3	61.68	169.86	269.83	2324.92					136.52	570.28	
BCS-1					1.05	5.24	0.50	0.50			
BC-RStrib2										0.5	
BC-Syn5/trib1										22400.00	
LBC-1	65.21		2.46								
BC-2	26.04	224.85	243.58	1163.32					82.16	219.39	150.53
BC-1	26.03	705.98	194.22	681.71							

orange = exceedance of primary E.coli bacteria criterion = 126 col/100ml

Figure 4 - 2004-2010 Bitter and Killpecker Creek E. coli Sampling Results

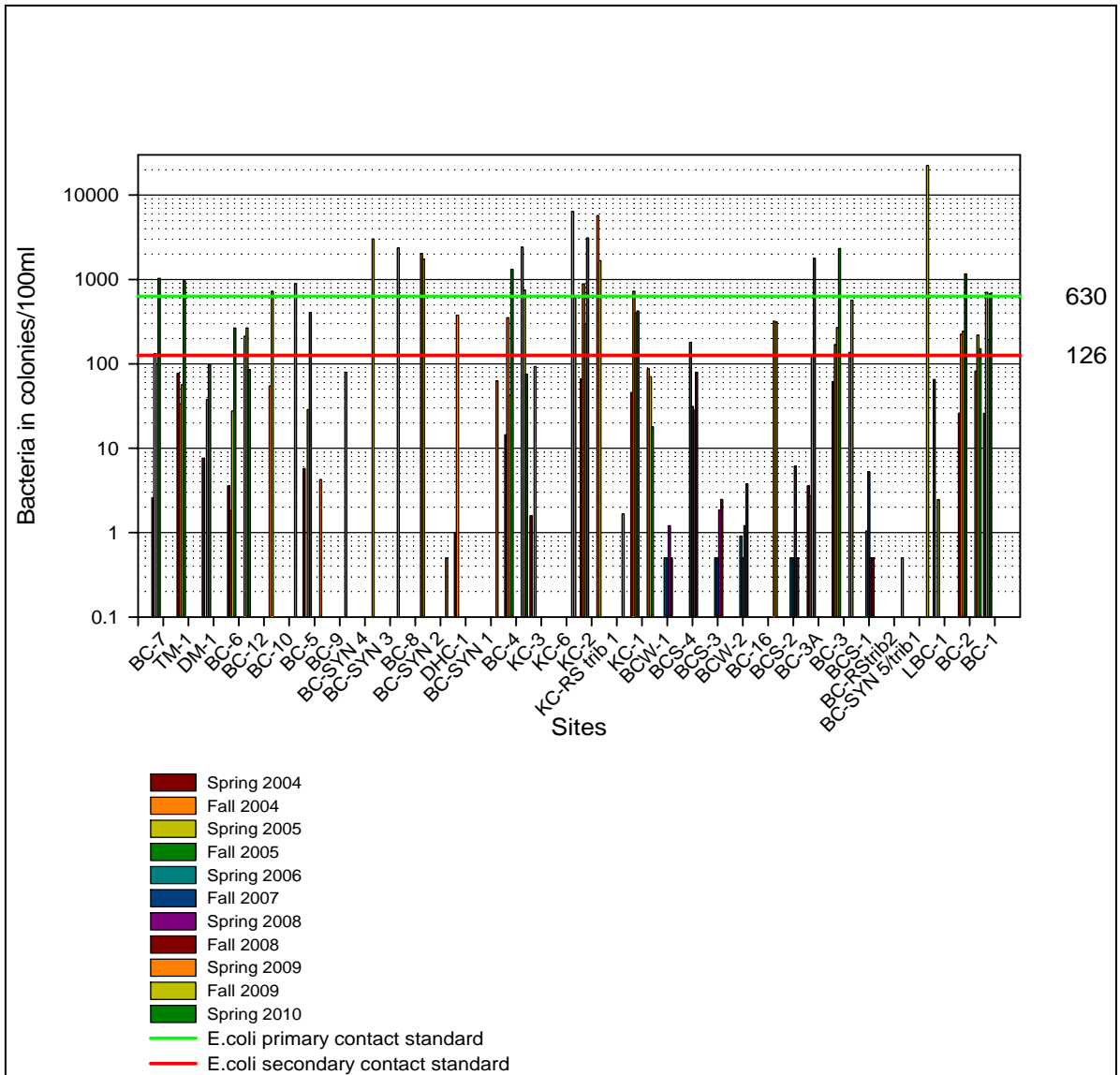


Figure 5 - 2004-2010 Legacy Site E. coli Sampling Results

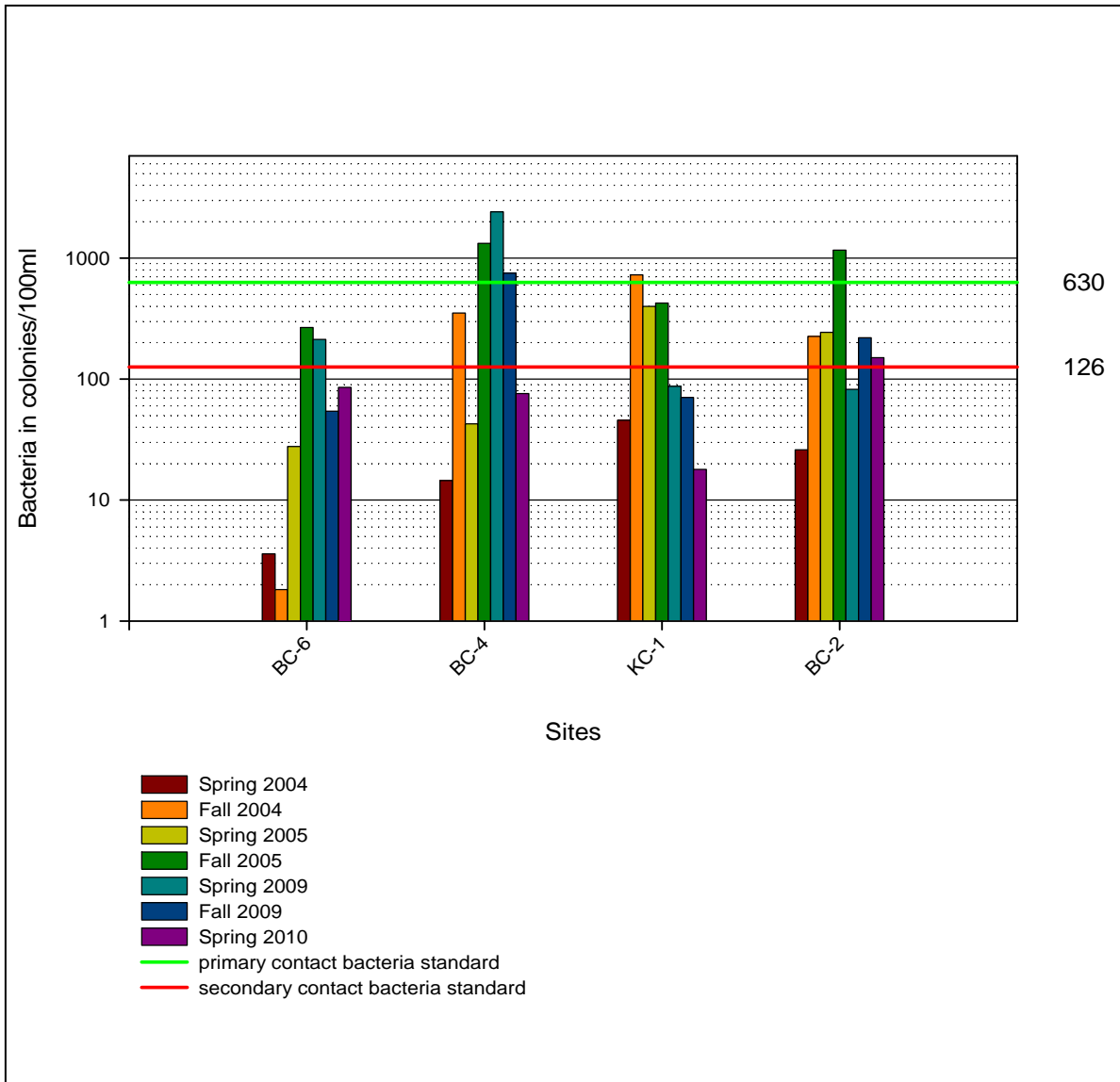
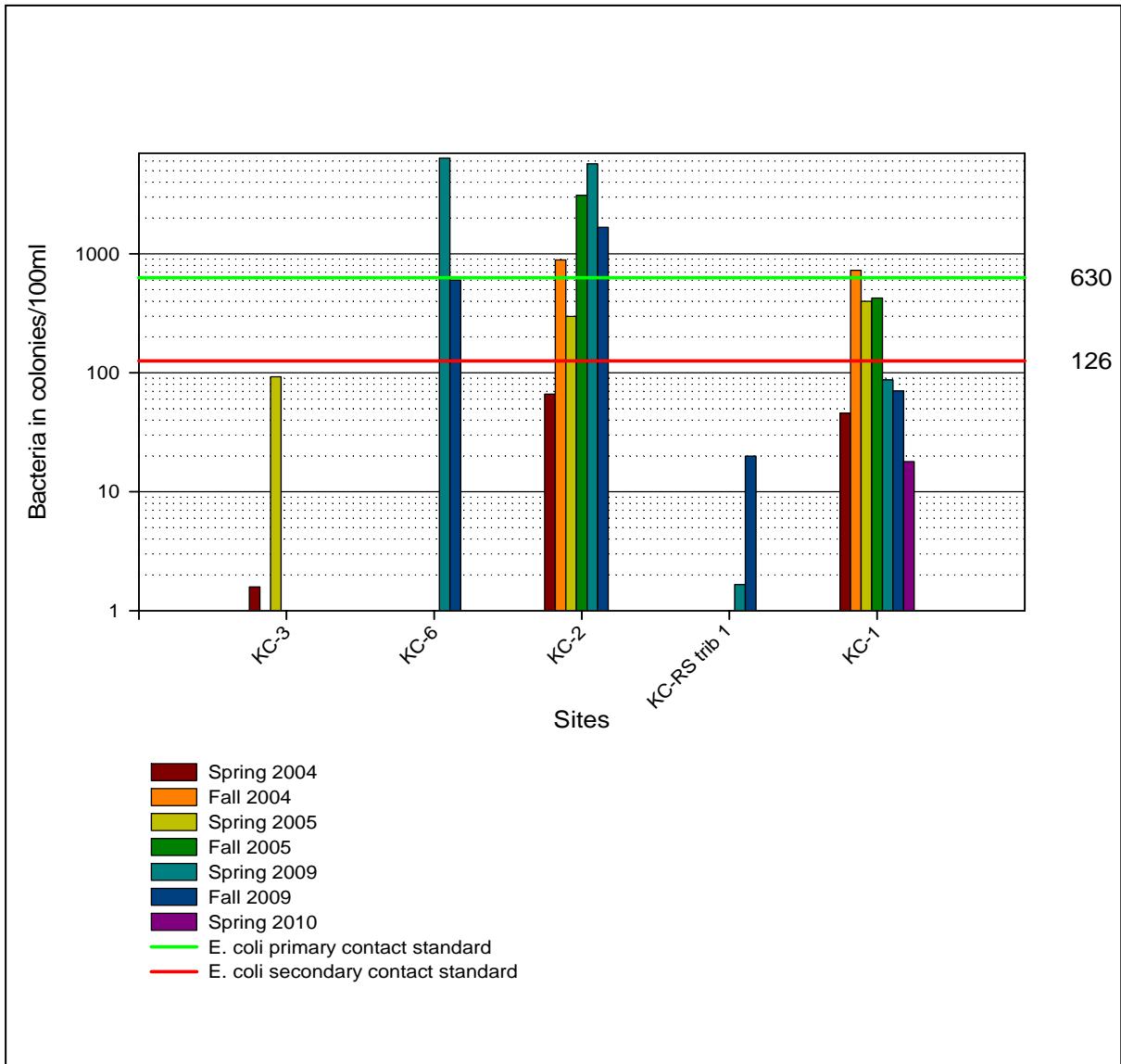


Figure 6 - 2004-2010 Lower Killpecker Creek E. coli Sampling Results



5.0 Summary and Conclusions

Spring 2010 sampling was conducted according to the prepared sampling plan to verify the extent and potential sources for the extended Bitter Creek Chloride impairment near point of Rocks and to monitor four "legacy sites" for the Bitter and Killpecker Creek E.coli impairment listings on the WDEQ 303d list. Fall 2010 sampling which will augment the spring sampling is yet to be conducted. Preliminary conclusions can be drawn for the spring 2010 sampling, but should be considered in the context that additional data is yet to be compiled. Preliminary conclusions are:

- Spring 2010 chloride sampling support the extended 303d impairment listings from Rock Springs to Point of Rocks.
- A potential source area for elevated chloride concentrations in Bitter Creek occurs upstream of site BC-6 and downstream of site BC-13 including the Ten Mile Draw and Deadman Wash tributaries near point of Rocks.
- Native soils in and along Bitter Creek and Ten Mile Draw upstream of site BC-6 downstream of BC-13 may be contributing to increased chloride concentrations seen within Bitter Creek in this reach. Further soils sampling may be undertaken in fall 2010 to better define potential chloride contributions from native soils to these tributaries. Water quality data from the BLM for the spring upstream of Bridger Coal Company on Ten Mile Draw and surface water quality reports from Bridger Coal Company from its two sites on Ten Mile Draw may contribute additional understanding to chloride concentrations in this tributary to Bitter Creek.
- The primary source of elevated chloride concentrations within Killpecker Creek appears to be downstream of site KC-2. A noteworthy portion of that source is native soils upstream of I-80, downstream of Yellowstone Road, and west of Killpecker Creek. It is unclear what, if any, impact ongoing road and infrastructure construction in the area has on chloride levels in this reach of Killpecker Creek. Spring 2010

chloride concentrations were lower than those seen in 2009 but higher than those recorded in 2004-2005 before significant construction began.

- Spring 2010 E. coli concentrations within Bitter Creek at Point of Rocks (site BC-6) and within the City of Rock Springs at site BC-4 are lower than the 126 col/100ml criteria that would confirm the impairment. The E. coli concentration in Killpecker Creek at site KC-1 was the lowest observed during the entire project and well below the impairment criteria. Three consecutive samples have been below 126 col/100ml with each new sample being significantly reduced from the previous one. However, water quality downstream of Rock Springs at site BC-2 continues to support the impaired listing on the lower portion of Bitter Creek.
- The discharge to Killpecker Creek at site KC-6 near Reliance was not sampled in 2010. The City and County have been notified of the high E. coli concentrations observed there in 2009. No further sampling will be conducted at this site by the SWCCD as per the reduced sampling plan decided on for 2010.

EDE will conduct fall 2010 monitoring at the spring 2010 stream sites, as possible, in September. Additional soils sampling will also be done at that time. The proposed sampling plan may be adjusted based on observations from the spring monitoring and discussion developed in this report, in order to aid confirmation of apparent water and soil quality trends and conditions within Bitter and Killpecker Creeks. The monitoring goals will remain as those presented in Section 1.0. A 2010 comprehensive sampling report will be submitted following the fall sampling, discussing the 2010 results and developing suggestions for any additional monitoring necessary for the Watershed Assessment.

6.0 References

EDE Consultants, "Bitter and Killpecker Creeks Watershed Study 319 (h) Grant Project Report 2004-2005 Monitoring Period", 23 N. Scott St. Suite 27, Sheridan, WY 82801, June 2006 (EDE 2006-1).

EDE Consultants, "Bitter Creek and Killpecker Creek Watershed Management Plan", 23 N. Scott St. Suite 27, Sheridan, WY 82801, June 2006 (EDE 2006-2).

EDE Consultants, "Bitter Creek and Killpecker Creek 2008 Bacteria and Chloride Sampling Results and Source Identification Summary Report", 23 N. Scott St. Suite 27, Sheridan, WY 82801, March 16th, 2009 (EDE 2009).

EDE Consultants, "Bitter Creek and Killpecker Creek 2009 Bacteria and Chloride Sampling Results Comprehensive Report", 23 N. Scott St. Suite 27, Sheridan, WY 82801, February 5th, 2010 (EDE 2010).

Wyoming Department of Environmental Quality, Water Quality Division, "Wyoming's Draft 2008 305 (b) Integrated State Water Quality Assessment Report and Draft 2008 303(d) List of Waters Requiring TMDLs", 2008.

Wyoming Department of Environmental Quality, Water Quality Division, "Chapter 1, Water Quality Rules and Regulations – Draft", 2008.

