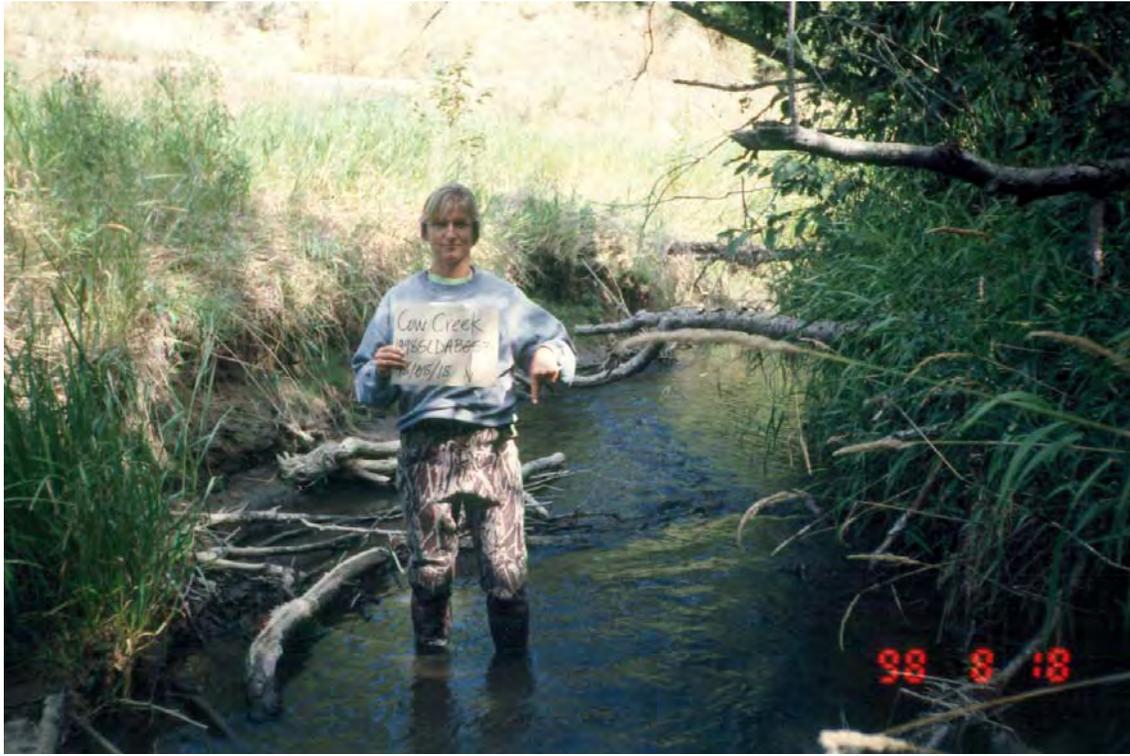


Stressor Identification for Assessment Unit # ID17010104PN030_03

Lower Kootenai River Subbasin



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Table of Contents

Summary	3
Section 1.0 Scope of Investigation	4
Section 2.0 Description of the Impairment	7
Section 3.0 Candidate Causes	10
Section 4.0 Existing Data	12
4.1 Physical Habitat Data.....	12
4.2 Biological Data	12
4.3 Water Chemistry	13
Section 5.0 Analysis	14
5.1 Stressor Refinement	14
5.2 Candidate Cause Elimination.....	15
Section 6.0 Conclusions	15
Section 7.0 References	16

List of Tables

Table 1. Assessment Scores and Rating for AU #ID17010104PN030_03.....	7
Table 2. Index Rating for Northern Idaho Streams.....	7
Table 3. Habitat Metrics for BURP Sites in AU #ID17010104PN030_03.	12
Table 4. Fish Metrics for BURP Sites in AU #ID17010104PN030_03.	12
Table 5. Macroinvertebrate Metrics for BURP Sites in AU #ID17010104PN030_03.....	13
Table 6. Water Chemistry Data Collected in AU #ID17010104PN030_03.....	13

List of Figures

Figure 1. Land Status Map for Assessment Unit #ID17010104PN030_03.....	5
Figure 2. Aerial View of Assessment Unit #ID17010104PN030_03.....	6
Figure 3. Conceptual Model of Candidate Causes for AU #ID17010104PN030_03.....	11

Summary

Assessment Unit #ID17010104PN030_03 includes the lowest portion of Cow Creek and Brush Creek from the confluence of Brush Creek and Cabin Creek to the mouth of Cow Creek. Stressor identification for Assessment Unit #ID17010104PN030_03 was completed with aid from CADDIS (Causal Analysis/Diagnosis Decision Information System), EPA's *Stressor Identification Guidance Document* (EPA, 2000), and from physical, chemical and biological data collected in the unit.

Assessment Unit #ID17010104PN030_03 was listed in the Idaho DEQ 2002 Integrated Report Section 5 as impaired for unknown pollutants. In the Idaho DEQ 2008 Integrated Report Section 5, this assessment unit was listed as impaired for reasons associated with combined biota/habitat bio-assessments. This stressor identification analysis was initiated to elucidate the causes of the bio-assessment test failure.

Eight candidate causes were identified and were analyzed based on the available data. Those causes that are unlikely to be involved in the habitat/biological impairments of the assessment unit will be eliminated from consideration. This analysis brings forth likely candidate causes for further in depth investigation.

The lower portion of Cow Creek to some extent would be expected to be a depositional area with higher sediment bedload. However, land uses in the watershed suggest that agricultural and timber harvest activities and roads are common. There is minor evidence that Cow Creek in this lowland section has had channel alterations leading to partial removal and replacement of natural tree/shrub riparian vegetation, and some loss of canopy. Therefore, the most likely causes of low biological/habitat scores in lower Cow Creek are excess sediment, lack of flow and possibly high water temperature.

Section 1.0 Scope of Investigation

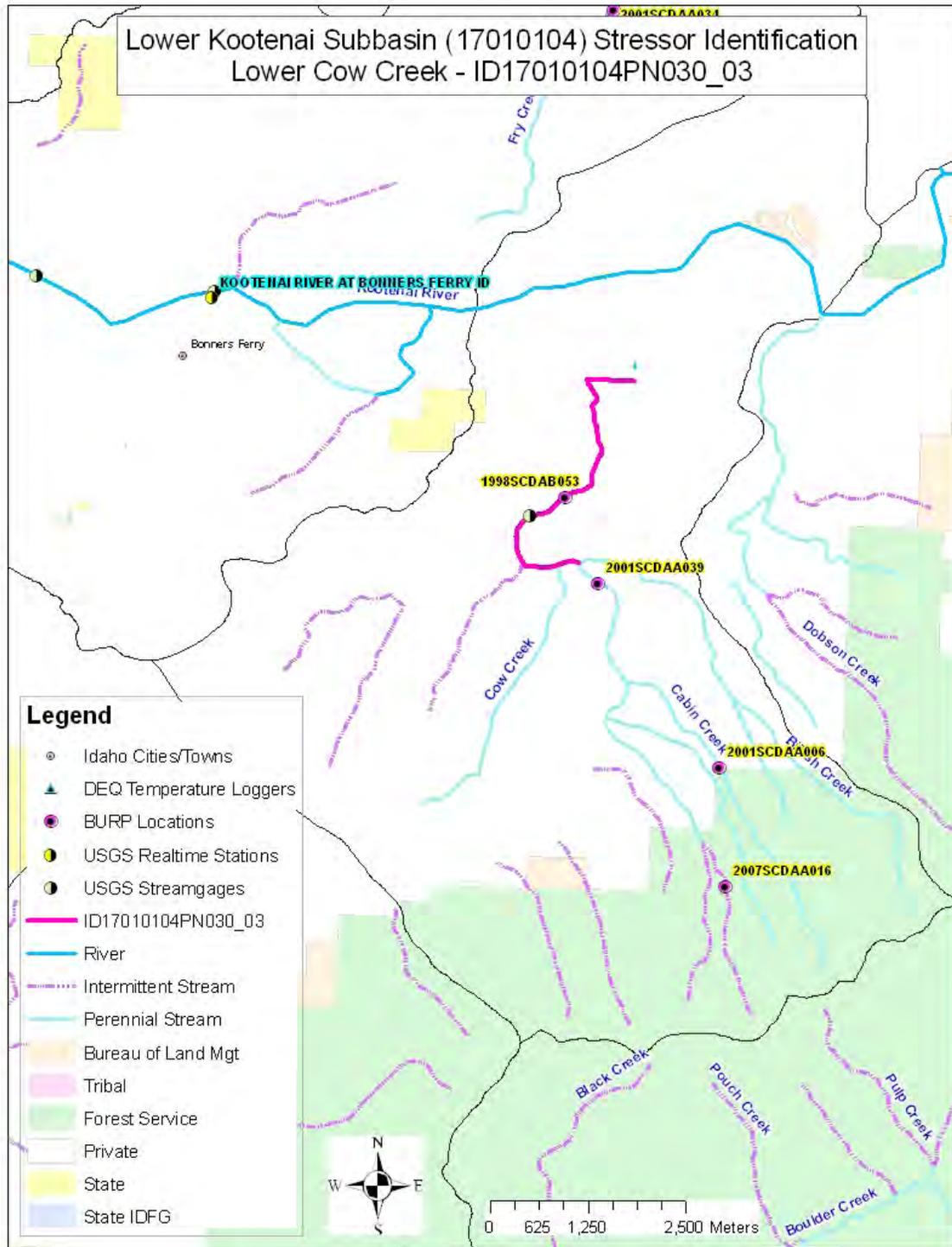
Assessment Unit #ID17010104PN030_03 includes the lowest portions of Brush Creek from its confluence with Cabin Creek and the lower portion of Cow Creek from Brush Creek to where Cow Creek enters into various canal structures on the Kootenai River plain (see Figures 1 & 2). This portion of the Cow Creek watershed runs through a narrow agricultural valley before opening up on to the Kootenai River valley.

The Cow Creek watershed contains Brush Creek, Cabin Creek, Cow Creek, and several unnamed perennial and intermittent streams that flow south to north towards the Kootenai River east of the town of Bonners Ferry, Idaho. The watershed is of mixed land use with a forested region in the upper Brush and Cabin Creeks portion within Kaniksu National Forest (see Figure 1). Lower portions of Brush and Cabin Creeks as well as all of Cow Creek are in private ownership, some of which is woodland and other parts are agricultural fields.

Stressor identification for Assessment Unit #ID17010104PN030_03 was completed with aid from the CADDIS (Causal Analysis/Diagnosis Decision Information System) program (<http://cfpub.epa.gov/caddis/>), EPA's *Stressor Identification Guidance Document* (EPA, 2000), and from physical, chemical and biological data collected by Idaho DEQ, Idaho Department of Lands (IDL), U.S. Forest Service (USFS) and others.

A map and an aerial photo view of the Assessment Unit are found in Figures 1 and 2.

Figure 1. Land Status Map for Assessment Unit #ID17010104PN030_03.



Section 2.0 Description of the Impairment

Assessment Unit #ID17010104PN030_03 was listed in the Idaho DEQ 2008 Integrated Report Section 5 as impaired for reasons associated with combined biota and habitat assessment scores. Essentially, this second listing indicates that BURP sampling in the assessment unit revealed that streams failed to pass assessment tests conducted on biological and stream habitat data.

Table 1 shows the index scores for the BURP site in the assessment unit (1998SCDAB053), as well as for several sites in the upper portion of the watershed. These scores were generated using the Idaho DEQ Water Body Assessment Guidance (WBAG) protocols (Grafe et al., 2002). Multimetric indices were generated from macroinvertebrate, fish and stream habitat data collected at BURP sites. These indices are then rated based on their values relative to bio-regional values calculated for least disturbed sites (Table 2). Ratings (0 to 3) for the macroinvertebrate index (SMI), the fish index (SFI), and the habitat index (SHI) are then combined to form an overall rating (also 0 to 3). In order to pass an assessment test the overall rating needs to be 2 or greater.

Table 1. Assessment Scores and Rating for AU #ID17010104PN030_03.

Assessment Unit	Stream	BURP ID	SMI (rating)	SFI (rating)	SHI (rating)	Overall Rating
ID17010104PN030_03	Cow Creek	1998SCDAB053	48.95 (1)	41.91 (1)	50 (1)	1
ID17010104PN030_02	Cabin Creek	2001SCDAA039	N/A	N/A	N/A	N/A
ID17010104PN030_02	Cabin Creek	2001SCDAA006	53.76 (1)	N/A	81 (3)	2

Note that in this assessment unit only one BURP site on Cow Creek, near the middle of the assessment unit (1998SCDAB053, Photo 1 and cover photo), was involved in the assessment. Other BURP sites in the watershed are on Cabin Creek and are in a separate assessment unit. The 2001SCDAA039 BURP site on Cabin Creek (Photo 2) was just upstream from the assessment unit; however, this site had insufficient flow to produce assessment scores. The 2001SCDAA006 site (Photo 3) is further up Cabin Creek at the National Forest boundary. A fourth BURP site (2007SCDAA016) exists on an intermittent tributary to Cabin Creek further within the National Forest (see Figure 1); however, that data has yet to be incorporated into any assessments. Therefore, the ID17010104PN030_03 assessment unit's biological impairment rating is solely based on results obtained from the first site in Table 1, which had insufficient scores to pass the impairment test.

Table 2. Index Rating for Northern Idaho Streams.

Condition Category	SMI (Northern Mountains)	SFI (Forest)	SHI (Northern Rockies)	Condition Rating
Above 25 th percentile of reference condition	≥65	≥81	≥66	3
10 th to 25 th percentile of reference condition	57-64	67-80	58-65	2
Minimum to 10 th percentile of reference condition	39-56	34-66	<58	1
Below minimum of reference condition	<39	<34	N/A	0

Photo 1. BURP Site 1998SCDAB053. .Looking upstream from sampled reach.



Photo 2. BURP Site 2001SCDAA039. Looking downstream from road crossing.



Photo 3. BURP Site 2001SCDAA006. Looking downstream from sampled reach.



Section 3.0 Candidate Causes

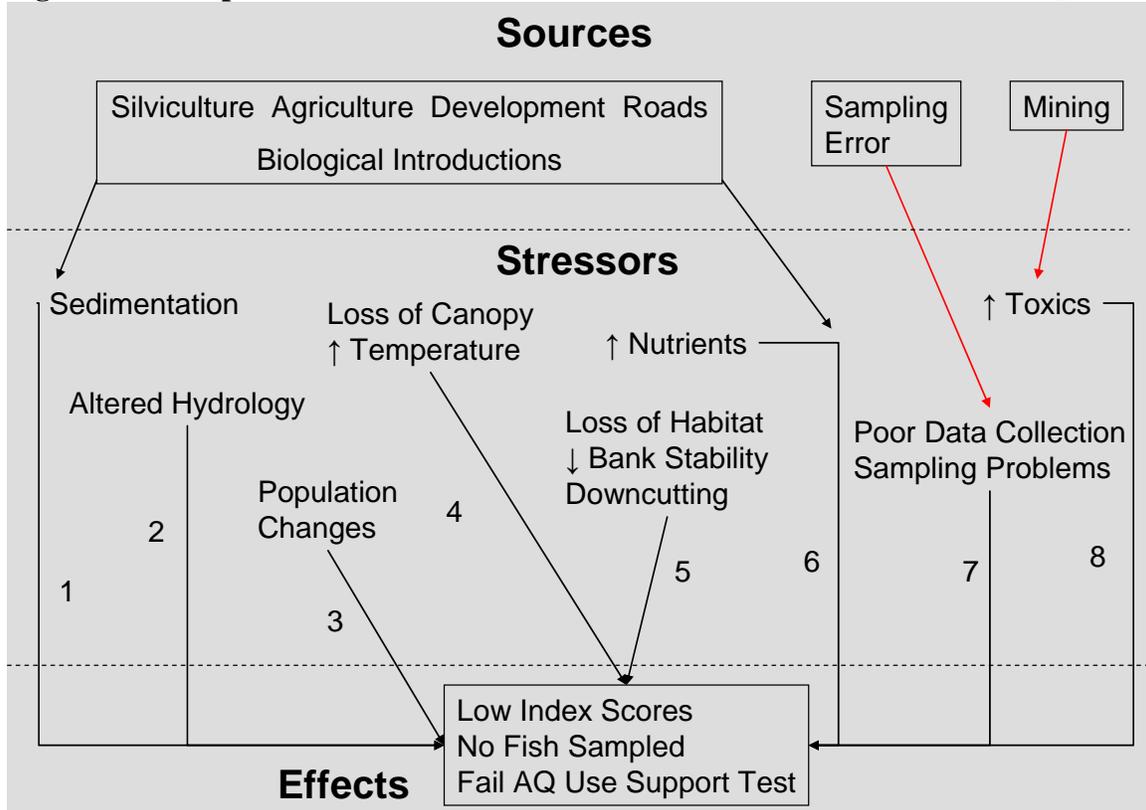
In order to suggest what may affect index scores for the assessment unit in question, a list of possible causes needs to be constructed. Figure 3 presents a simple conceptual model of candidate causes that may lead to poor biological/habitat scoring. The model presents eight candidate causes as stressors that include:

1. Increased **sedimentation** (bedload and suspended) from many of the activities that could occur in the watershed (silviculture, agriculture, rural development, and roads) may result from field and trail runoff, mass failures, road cuts and fills, etc. Excess sediment leads to loss of habitat for macroinvertebrates and fish by the filling of gravel spaces with sand and silt. An over-abundance of sediment can decrease intergravel dissolved oxygen needed for fry development and drive sensitive macroinvertebrates out of the system to be replaced by more tolerant species.
2. Many activities that change the face of the land and increase runoff can alter the hydrology. An **altered hydrology** affects the streams ability to maintain flow and prevent bank erosion and downcutting. Streams can lose baseflow resulting in insufficient water during dry season for aquatic life. Streams can over-widen and increase width/depth ratios resulting in decreased shade and increased water temperatures resulting in loss of cold water species.
3. **Population changes** can result from a variety of interspecies conflicts that result from introductions of alien species including competition, parasitism and predation. Additionally, population changes can result from complications due to small populations (genetic loss, inbreeding, genetic alteration, etc.). Small populations result from habitat loss and loss of connectivity to regional populations.
4. Many activities and natural wildfire can cause a **loss of canopy** shade through direct removal of riparian vegetation. Again, this can result in increased water temperatures that affect biological communities.
5. **Loss of instream habitat** and bank stability can result from modifications to the channel (channelization, trenching and field draining, dikes, berms, instream structures) and changes to the hydrology of the system (see #2). This in turn affects the ability of some species to remain in the system due to loss of habitat, sedimentation, temperature increases, etc.
6. Certain kinds of activities may lead to **increased nutrients** (phosphorus and nitrogen) in the water column. Increased nutrients can cause algae blooms and other un-wanted plant growth instream, the decomposition of which uses up valuable dissolved oxygen, cause warming and can eliminate habitat.
7. Poor macroinvertebrate and fish scores may result from **sampling errors** where field methods are not followed correctly resulting in poor collection events. Sample containers may leak or be inadvertently destroyed resulting in a loss of data. This stressor category may include errors that arise through the assessment

process where data were incorrectly interpreted or reported resulting in an incorrect assessment call.

8. **Toxic pollutants** that are heavy metals may be introduced into the system from mining operations or legacy mine problems should they exist in the watershed. Other toxic pollutants may occur but are unlikely given the rural setting, unless they are localized introductions of farm chemicals. Increased concentrations of metals and other toxic pollutants can lead to reduction or elimination of sensitive species.

Figure 3. Conceptual Model of Candidate Causes for AU #ID17010104PN030_03.



Section 4.0 Existing Data

Existing data for AU #ID17010104PN030_03 are very limited. No data have been acquired from Idaho Department of Lands, Idaho Fish and Game or U.S. Forest Service. Existing data for the assessment unit are solely based on BURP sites. The USGS had a gage station on Cow Creek (#12309000) that measured discharge during March through September from 1928 to 1934. Flows varied from a mean monthly average of 1.1 cfs in September to 19 cfs in May during that time period. See Figures 1 and 2 for station location.

4.1 Physical Habitat Data

The habitat metrics that go into the formulation of the Stream Habitat Index (SHI) are presented in Table 3 for the one BURP site (1998SCDAB053) in the assessment unit. Note that the site had SHI scores insufficient to pass the assessment test. The site had metric values that showed low canopy cover, low embeddedness score, low pool/riffle ratio, and very high fines when compared to the average of all BURP sites in the Lower Kootenai subbasin with passing SHI scores (Ave Supporting). Bank stability was lower than average supporting streams, but still within the acceptable range (>80%) for this parameter.

Table 3. Habitat Metrics for BURP Sites in AU #ID17010104PN030_03.

BURP ID	Bank Cover (%)	Bank Stability (%)	Canopy (%)	Fines (%)	Embedded Score	Channel Shape Score	Pool/Riffle Ratio	Ave Wetted Width (m)	Ave Wetted Depth (m)	Width/Depth Ratio	Discharge (cfs)	SHI
1998SCDAB053	97.5	85	32.5	71	2	6	0.25	2.3	0.22	10.1	2.2	50
Ave Supporting	98.2	99.3	65.7	5.6	14.6	5.3	0.75	6.6	0.04	18.7	5.9	78.4

4.2 Biological Data

The site in the assessment unit was the only site to be electrofished in the Cow Creek watershed by BURP crews (Table 4). Rainbow trout and brook trout were sampled at that site, thus percent cold water taxa and salmonid age class metrics look good. However, the site was dominated by brook trout which reduced the sensitive species percentage to produce (along with no sculpins) a lower than average SFI score. Macroinvertebrate metrics (Table 5) for the site (1998SCDAB053) showed a lack of mayfly, stonefly and caddis fly (EPT) taxa when compared to the subbasin average supporting scores. Hilsenhoff Biotic Index (HBI) was also higher than the average supporting sites in the subbasin suggesting that pollution tolerant organisms were dominating the lower system. The site also lacked clinger and scraper functional groups. The loss of EPT taxa suggests that impacts have occurred on the lower portion of Cow Creek and are the driving mechanism inflicting macroinvertebrate impairment.

Table 4. Fish Metrics for BURP Sites in AU #ID17010104PN030_03.

BURP ID	Cold Water Taxa	% Cold Water	% Sensitive	Sculpin Age Classes	Salmonid Age Classes	CPUE	SFI
1998SCDAB053	1	100	11.8	0	2	1.3	41.9
Ave Supporting	1.97	93.9	59.3	1.1	3.1	8.7	81.1

Table 5. Macroinvertebrate Metrics for BURP Sites in AU #ID17010104PN030_03.

BURP ID	Total Taxa	Ephemeroptera Taxa	Plecoptera Taxa	Trichoptera Taxa	% Plecoptera	HBI	% Dominance of top 5 taxa	% Scraper	% Clinger	SMI
1998SCDAB053	34	5	5	4	5.7	6.49	71.5	18	28.1	48.9
Ave Supporting	34.3	9.2	6.9	7.5	13.3	4.97	67.2	25.3	58.3	68.1

4.3 Water Chemistry

Water chemistry data for the Cow Creek watershed are limited to temperature and one coliform bacteria sampling event. E. coli sample results for Cabin Creek are essentially not detected and, thus below Idaho WQS action levels. To our knowledge no temperature loggers have been deployed in the watershed, thus little is known about the temperature regime in this system.

Table 6. Water Chemistry Data Collected in AU #ID17010104PN030_03.

Date	Stream	Temperature* (°C)	pH	Dissolved Oxygen (mg/L)	Specific Conductance (µs/cm)	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)	E. coli (#/100mL)	Total Coliform (#/100mL)	Discharge (cfs)
8/18/1998	Cow Creek	12 (10am)								2.21
7/16/2001	Cabin Creek	9 (2:39pm)								0.04
8/16/2001	Cabin Creek							<1	74	

*Temperatures are instantaneous readings unless otherwise noted.

Section 5.0 Analysis

The eight candidate causes identified in Section 3.0 are analyzed here based on the available data. Those causes that are unlikely to be involved in the habitat/biological impairments of the assessment unit will be eliminated from consideration. This analysis brings forth likely candidate causes for further in depth investigation.

5.1 Stressor Refinement

1. There is some evidence that sedimentation is occurring in the lower reaches of Cow Creek. Habitat metrics such as percent fines and embeddedness scores at the one site suggest that the assessment unit has been affected directly. The loss of EPT taxa that are generally sensitive to excess sediment may have resulted from sedimentation in the assessment reach. Low macroinvertebrate scores at the lower BURP site may indicate excess sediment has moved through this system and eliminated sensitive taxa.
2. Hydrological alteration cannot be ruled out. There was evidence of timber harvest activities in aerial photo (Figure 2) that could have led to changes in runoff characteristics and increased hydrologic loading. Changes in land use in the lower portion of the watershed that result from agricultural activities may also influence hydrologic characteristics. Roads may also influence runoff and hydrology, and there are numerous roads in the watershed including one that parallels the stream throughout the assessment unit. It is not known if diversion of water for agricultural purposes has taken place in the watershed. Measured flow is very low in most instances and one site on Cabin Creek was reported as dry.
3. Although it is a possible cause, there is no evidence of biological invasions that maybe affecting macroinvertebrate populations. Fish species include rainbow trout and brook trout, both of which may have been introduced.
4. It is not known if water temperature is a problem in the lower portion of the Cow Creek watershed. Habitat metrics did show a lack of canopy cover, however there has been insufficient measurements of water temperature to determine if a problem exists.
5. There is evidence of loss of habitat through riparian alteration and possibly channel morphological changes. It has been noted that low canopy cover has occurred in the lower reaches, and photographs of the sites suggest a general lack of riparian vegetation. These changes can lead to loss of habitat and a reduction in biological communities.
6. There is no evidence that nutrients are in excess in this assessment unit. To our knowledge visible slime growth, excess algae and other macrophytes have not been reported for streams in the assessment unit. However, no data have been collected on water chemistry to confirm normal nutrient status.

7. To our knowledge, BURP sampling occurred in an appropriate manner and there were no problems, sample mishandling nor loss of data. This assessment unit has not been sampled or assessed since 1998. Thus, the assessment is based on older data.
8. To our knowledge, there are few current or legacy mining activities in the assessment unit. Other than sand and gravel operations, there is only one (arsenopyrite) mine or prospect that is located north of the BURP site on Cow Creek. The operation does not appear to be large enough or close enough to a stream to produce any mine related discharge. However, no water chemistry sampling has taken place to confirm a lack of toxic pollutants. The introduction of accidental spills to Cow Creek watershed cannot be ruled out.

5.2 Candidate Cause Elimination

There is a lack of information and data about this assessment unit, so ruling out candidate causes is difficult. We feel somewhat confident that excess nutrients, sampling error and toxic pollutants are not causing the problems associated with low biological scores in this assessment unit. It is likely that biological invasion by alien species is not prominent enough to cause low scores either. It is not known if water temperature is a problem in the Cow Creek watershed. There is some evidence that excess sediment and perhaps channel/habitat alteration have occurred. There is evidence of a general lack of flow that can influence biological communities as well. Thus, sedimentation and low flow appear to be the leading causes of macroinvertebrate and fish loss, although water temperature cannot be ruled out as a possible stressor as well.

Section 6.0 Conclusions

It is difficult to draw conclusions about the Assessment Unit # ID17010104PN030_03. Most of what we know about lower Cow Creek is from one BURP site measured over ten years ago that revealed low macroinvertebrate, fish and habitat scores to fail assessment tests. The assessment unit should be re-examined to determine if conditions have improved since that time.

The lower portion of Cow Creek to some extent would be expected to be a depositional area with higher sediment bedload. However, land uses in the watershed suggest that agricultural and timber harvest activities and roads are common. There is minor evidence that Cow Creek in this lowland section has had channel alterations leading to partial removal and replacement of natural tree/shrub riparian vegetation, and some loss of canopy. Therefore, the most likely causes of low biological/habitat scores in lower Cow Creek are excess sediment, lack of flow and possibly high water temperature.

Section 7.0 References

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