Stressor Identification for Assessment Unit # ID17010104PN003_02
Lower Kootenai River Subbasin

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Summary

Assessment Unit #ID17010104PN003_02 includes a number of 1st and 2nd order tributaries to Grass Creek, a tributary to Boundary Creek with confluence on the north side of the Canadian border. Stressor identification for Assessment Unit #ID17010104PN003_02 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 #ID17010104PN003_02 was listed in the Idaho DEQ 2002 Integrated Report Section 5 as impaired for reasons associated with temperature. In the Idaho DEQ 2008 Integrated Report Section 5, this assessment unit continued to be listed as impaired for temperature, however, it was also listed as impaired for reasons associated with benthic macroinvertebrate 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 headwaters portion of the Grass Creek watershed experienced considerable loss of forest vegetation due to wildfire in 1967. Additionally, timber harvest activities have taken place throughout the watershed. The streams examined do not show habitat impairment, however historic impacts may have caused extensive sediment pollution to move through the system eliminating sensitive taxa in at least one reach. Temperature may also be a widespread problem throughout the watershed due to loss of shade. Therefore, the most likely causes of low biological scores in AU# ID17010104PN003_02 are past excess sediment and altered hydrology due to wildfire and possibly high stream temperatures due to lack of shade. Although what is happening in other streams in the assessment unit is unknown, based on similarity of landscape position and land use, we assume that other streams in the assessment unit are likely similarly impacted.

Section 1.0 Scope of Investigation

Assessment Unit #ID17010104PN003_02 includes a number of 1st and 2nd order tributaries to Grass Creek near the Canadian border (see Figure 1). Several of these tributaries are larger named streams on the east side of Grass Creek (i.e. Search Creek, Marsh Creek, and Silver Creek). Still more are smaller un-named tributaries from throughout the watershed.

The Grass Creek watershed is a forested watershed that is almost entirely within Kaniksu National Forest (see Figure 1). There are some small tracts of state endowment lands at the very top of the watershed. The watershed has evidence of a large historic fire that removed vegetation from the top of the watershed, as well as evidence of roads and timber harvest activity throughout (Figure 2).

A Cumulative Watershed Effects (CWE) Assessment was conducted in the Grass Creek watershed in 2002 by the Idaho Department of Lands (IDL, 2003). That report described the watershed as follows:

"*Grass Creek is a 18,363 acre forested watershed in northern Idaho managed for agriculture, wildlife, and timber production. For the purposes of this assessment, Grass Creek, along with major and minor tributaries, are referred to as Grass Creek. Grass Creek flows into Boundary Creek approximately 12 miles west of Porthill, Id. The watershed is generally accessed from Bonners Ferry, Idaho by heading north on U.S. Highway 95 approximately fourteen (14) miles to State Highway 1 and continue on one (1) mile then head northwest on County Route Road 45 for twelve (12) miles and continue north approximately twenty (20) miles to the Forest Route Road 655. Continue east on the Forest Route Road 655 approximately seven (7) miles to the Forest Route Road 2454, then continue five more miles to the Forest Route Road 1009. Land ownership within the watershed is entirely United States Forest Service. The watershed is located in Boundary, Idaho (Figure 1).*

Grass Creek is a Third order tributary, with a dendritic stream feeder pattern to Boundary Creek. The drainage is oriented in a northeasterly direction with side tributaries entering mostly from the southwest and northeast. Elevation in the watershed ranges from 3,800 feet above sea level where Grass Creek empties into Boundary Creek to 6,893 feet above sea level in the headwaters on Trapper Peak.

The Grass Creek drainage is predominantly underlain by Metasediments (weakly weathered) and granitic rock (weakly weathered). These geologic types are typically divided, with the highly weathered material occurring along the lower elevations and dominating the main stem flood plain and lower tributary flood plains. The weakly weathered material occupies the uplands and ridgelines.

The area is characterized by warm dry summers and cold wet winters with an average annual precipitation ranging from 50 inches at the lower elevations to 60 inches at the

higher elevations. The majority of precipitation occurs as winter snowfall and spring rain. High-volume runoff occurs during spring snowmelt and major rain-on-snow events. Vegetation varies with elevation and aspect. Strong south to west facing slopes at lower elevations support forbs, grasses. On north slopes, and with increasing elevation, forest stands become denser with a greater number of coniferous species. The presence of Douglas-fir, grand fir, western hemlock, western larch, lodgepole pine, western red cedar, and western white pine increases with increasing elevation and effective precipitation."

Stressor identification for Assessment Unit #ID17010104PN001_02 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 #ID17010104PN003_02.

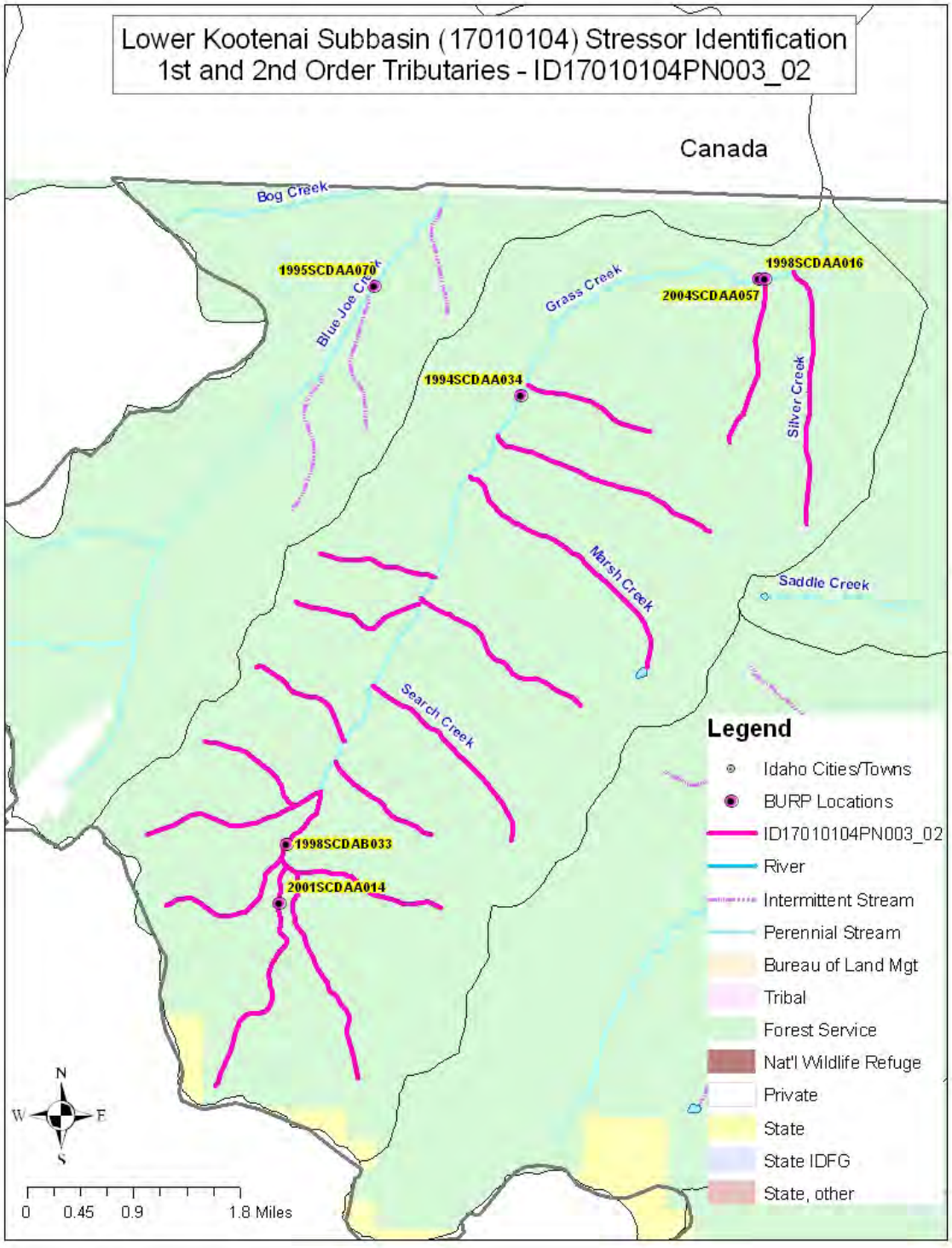
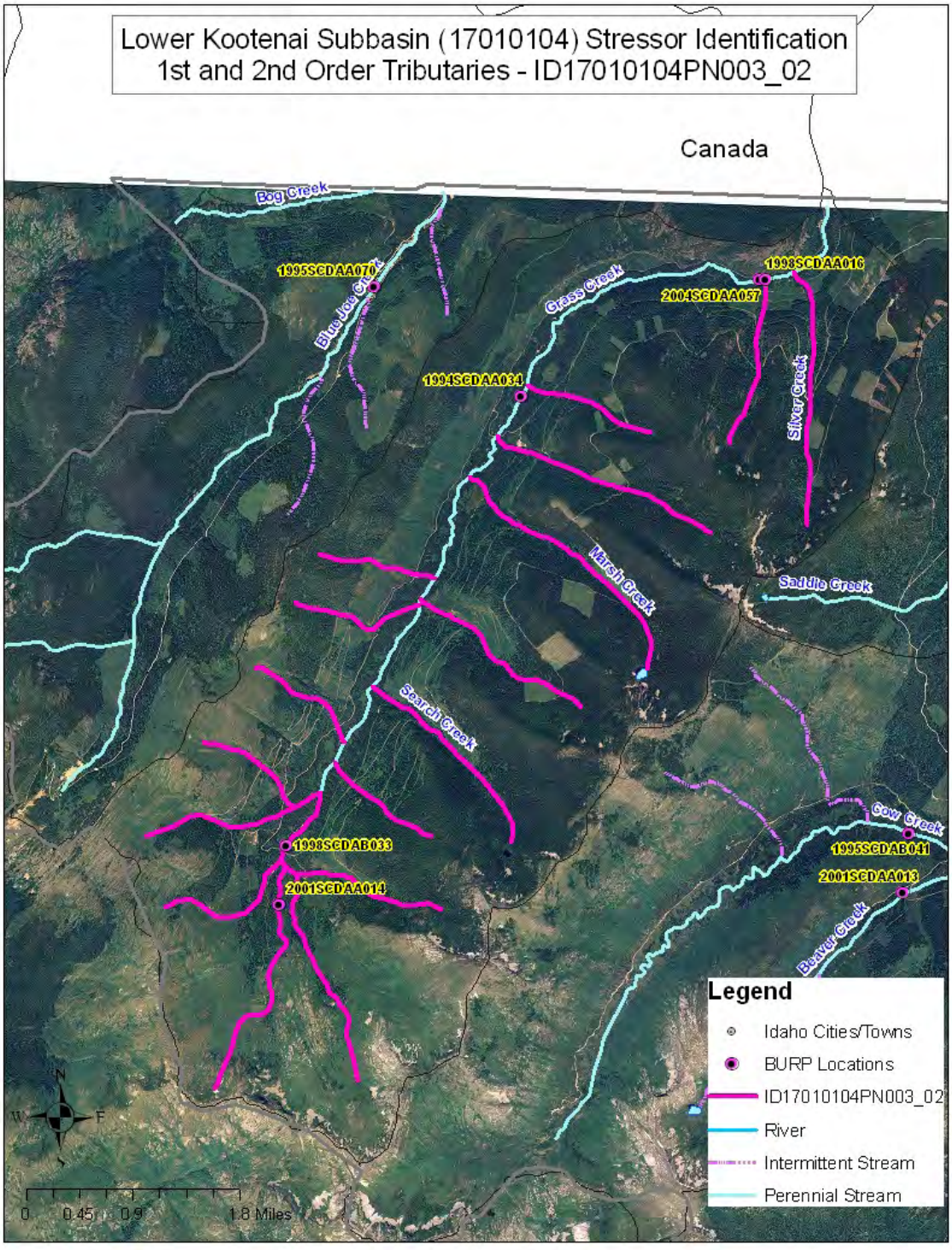


Figure 2. Aerial View of Assessment Unit #ID17010104PN003_02.



Section 2.0 Description of the Impairment

Assessment Unit #ID17010104PN003_02 was listed in the Idaho DEQ 2002 Integrated Report Section 5 as impaired for reasons associated with temperature. In the Idaho DEQ 2008 Integrated Report Section 5, this assessment unit continued to be listed as impaired for temperature, however, it was also listed as impaired for reasons associated with benthic macroinvertebrate 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 data.

Table 1 shows the index scores for BURP sites in the assessment unit. 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 #ID17010104PN003_02.

Assessment Unit	Stream	BURP ID	SMI (rating)	SFI (rating)	SHI (rating)	Overall Rating
ID17010104PN003_02	UnNamed Trib	2001SCDAA014	55.43 (1)	N/A	64 (2)	1
ID17010104PN003_02	Grass Creek	1998SCDAB033	66.37 (3)	N/A	83 (3)	3

Note that in this assessment unit only two BURP sites, one on Grass Creek (Photo 1) near its headwaters and the other on a nearby un-named tributary (Photo 2). Other BURP sites in the watershed are on lower Grass Creek and are in a separate assessment unit. Therefore, the assessment unit's biological impairment rating is solely based on results obtained from the two sites in Table 1. The Grass Creek site had sufficient scores to pass the impairment test, however the un-named tributary did not. Electrofishing did not take place at either site, thus there are no fish (SFI) scores available. Field comments indicate that brook trout were observed at the 2001SCDAA014 site.

Table 2. Index Rating for Northern Idaho Streams.

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

Photo 1. BURP Site 1998SCDAB033. Looking downstream from sampled reach.

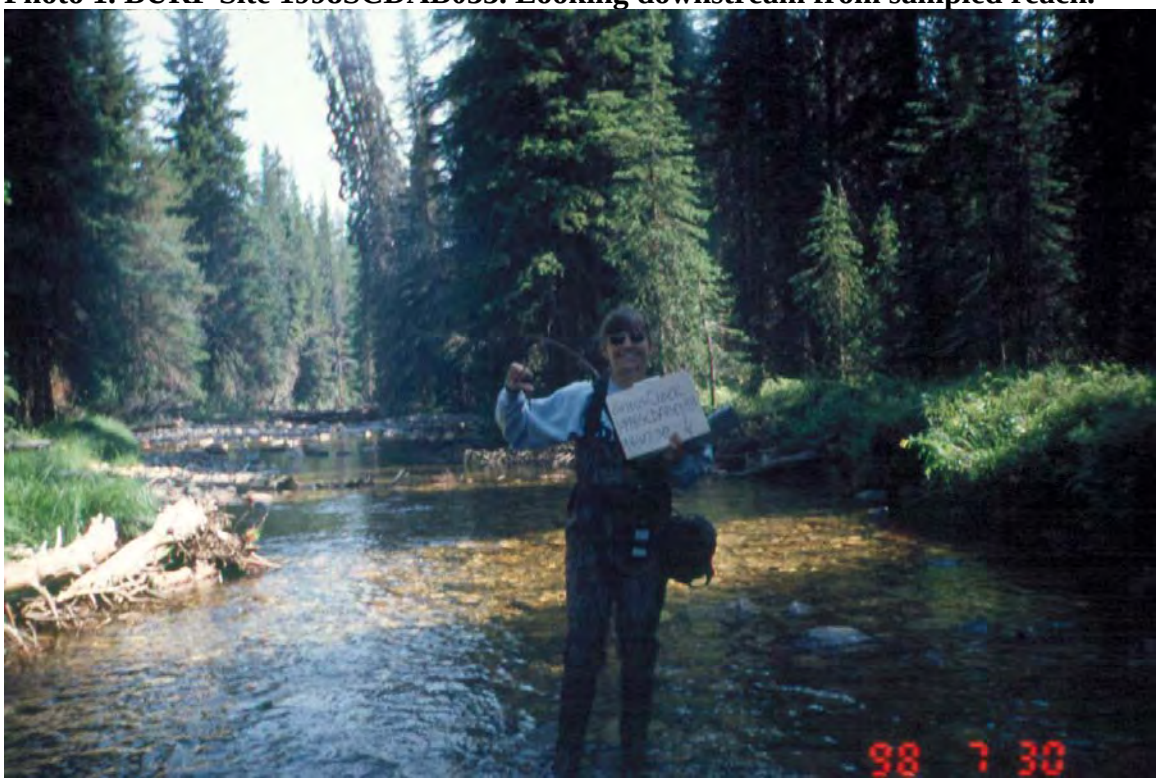


Photo 2. BURP Site 2001SCDAA014. .Looking upstream through sampled reach.

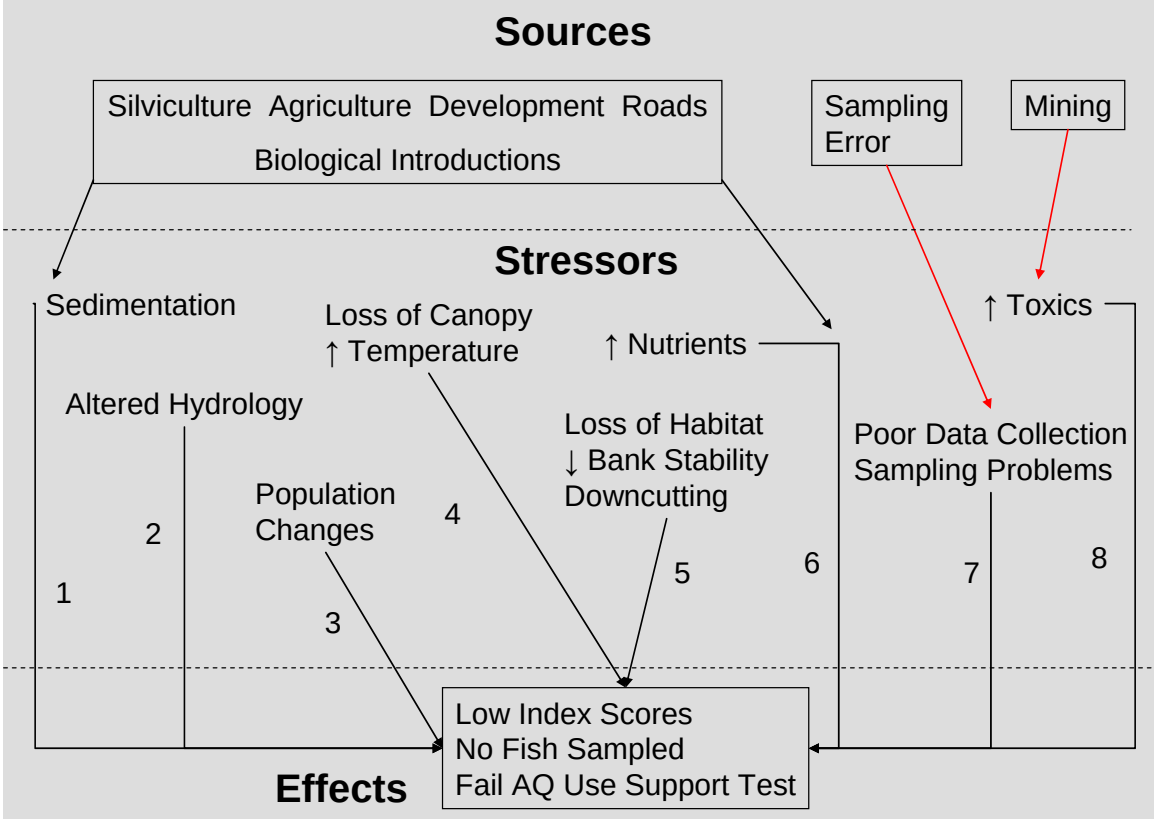
Section 3.0 Candidate Causes

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 #ID17010104PN003_02.



Section 4.0 Existing Data

Existing data for AU #ID17010104PN003_02 are very limited. No data have been acquired from Idaho Fish and Game or U.S. Forest Service. However, IDL performed a CWE assessment on the watershed in 2002 (IDL, 2003) Most of the streams in this assessment unit are similar in location to the streams sampled by the two BURP sites so it is likely, although not guaranteed, that conditions are similar among all streams in the assessment unit.

The CWE assessment indicated that the watershed is stable with low to moderate risk in erosion, mass failure, sediment delivery, hydrologic, and channel stability ratings. However, the mainstem of Grass Creek (outside of this assessment unit) had a high stream temperature risk rating due to reaches that lacked adequate shade to meet targets. Within the assessment unit in question, shade levels were adequate to meet CWE targets. An important observation contained within the CWE report (IDL, 2003) is as follows:

"*Some general observations were that Grass Creek has had large historical clear cuts paralleling the creek and had a 1967 fire at the headwaters (which would increase the HRR* [Hydrologic Risk Rating]*). It is apparent that a large amount of fine sediment has historically moved through the system leaving at the mouth a sub-striaght of gravel and cobble. Local loggers and ranchers stated that between 1968 and the mid 80's salmonids seam to have migrated out of Grass Creek not to return until about the mid 90's (probiblly a result of the large amount of bed load moving through this creek).*"

That historic fire is quite evident from the lack of forest vegetation in the Grass Creek headwaters and surrounding watersheds as seen in the aerial photograph (Figure 2).

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 two BURP sites in the assessment unit. Note that both sites had an SHI score high enough to pass the assessment test. Their metric values are relatively consistent with the average of all BURP sites in the Lower Kootenai subbasin with passing SHI scores (Ave Supporting). Both sites had relatively low pool/riffle ratios which may result from past disturbance to the watershed from the 1967 fire.

Table 3. Habitat Metrics for BURP Sites in AU #ID17010104PN003_02.

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
2001SCDAA014	95	100	48	0	4	5	0.1	2.4	0.09	28	0.43	64
1998SCDAB033	100	100	71	0.05	19	7	0.3	6.8	0.11	61	2.7	83
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

No sites were electrofished in the assessment unit therefore there are no SFI scores. Macroinvertebrate metrics (Table 4) for both sites were generally similar to the average

of all BURP sites in the Lower Kootenai subbasin with passing SMI scores (Ave Supporting). The un-named tributary site (2001SCDAA014) showed a lack of species especially mayfly, stonefly and caddisfly (EPT) taxa when compared to the subbasin average supporting scores. Hilsenhoff Biotic Index (HBI) was not different from average supporting sites in the subbasin suggesting that pollution tolerant organisms were not dominating the system. Thus, chemical pollution is less likely the cause of the impairment. The loss of EPT taxa suggests that impacts have occurred on the un-named tributary and are the driving mechanism inflicting macroinvertebrate impairment.

Table 4. Macroinvertebrate Metrics for BURP Sites in AU #ID17010104PN003_02.

BURP ID	Total Taxa	Ephemeroptera Taxa	Plecoptera Taxa	Trichoptera Taxa	% Plecoptera	HBI	% Dominance of top 5 taxa	% Scraper	% Clinger	SMI
2001SCDAA014	26	4	5	7	22.5	4.48	77.5	47.5	77.5	55.4
1998SCDAB033	26	8	9	4	23.2	4.29	79	15.6	36	66.4
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 assessment unit are limited to temperature. A temperature logger deployed near the upper Grass Creek site in 1998 showed numerous violations of the fall salmonid spawning criteria as temperatures exceeded 13 °C from August 1st to September 15th. General cold water aquatic life criteria were never exceeded at this site.

Table 5. Water Chemistry Data Collected in AU #ID17010104PN003_02.

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)
7/30/1998	Grass Creek	14								2.66
7/26/2001	un-named trib.	13								0.43
8/4/1998	Grass Creek	17.5 (MDMT)								

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 Grass Creek. Aerial photos show extensive accumulations of sand bar deposits in Grass Creek close to the headwater tributaries of this assessment unit. Habitat metrics such as percent fines, bank cover and bank stability suggest that the assessment unit has not been affected directly. However, a loss of EPT taxa that are generally sensitive to excess sediment may have resulted form past problems (wildfire and timber harvest activities). Aerial photos show extensive areas lacking forest vegetation (Figure 2). Low macroinvertebrate scores at the un-named tributary 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 considerable sediment accumulation just below this assessment unit in Grass Creek. Additionally, the loss of forest vegetation due to wildfire and timber harvest activities as evidenced in aerial photos (Figure 2) could have led to changes in runoff characteristics and increased hydrologic loading.
3. Although it is a possible cause, there is no evidence of biological invasions that maybe affecting macroinvertebrate populations.
4. Water temperature maybe a problem throughout the Grass Creek watershed. The IDL CWE assessment process showed that Grass Creek below this assessment unit is at risk of high stream temperatures due to a lack of shade. Measured temperature was not extremely high but did exceed salmonid spawning criteria in early fall. If it can be demonstrated that early fall spawning does not occur in these waters and is not appropriate to evaluate in August and early September, then water temperature in this assessment unit may not be impairing uses.
5. Although there is not evidence of loss of habitat through channel morphological changes, this may have occurred in the past and the reaches are in a state of recovery.
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. There were problems with the assessment process as originally the lack of fish data may have been interpreted as a lack of fish in the stream. However, after review of the assessment data, it was discovered that the impairment call would likely result

from a low macroinvertebrate score at one of the two BURP sites. The following comment has been added to the ADB system for this assessment unit: "*This assessment unit was not electrofished and had no fish data to calculate an SFI. The assessment may have inadvertantly interpreted the SFI to equal 0 and failed the assessment on those grounds. Additionally, IDASA shows the SMI score compared to southern and central mountains to score a 2 for site 2001SCDAA014, which is incorrect. The site would score a 1 and fail on those grounds when compared to northern mountain scores. (Mark Shumar, 2/23/09).*"

8. To our knowledge, there are few current or legacy mining activities in the assessment unit. There is the Parker Mine, a gold and copper mine at the very top of the watershed near the ridgeline (directly south of site 2001SCDAA014). However, no water chemistry sampling has taken place to confirm a lack of toxic pollutants. The introduction of accidental spills 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. Temperature does appear to be playing a big role in Grass Creek watershed as recognized by the CWE assessment process and DEQ temperature data. However, it may play less of a role in this particular assessment unit. It is more likely that excess sediment and an altered hydrology in the past, resulting from the 1967 wildfire and timber harvest activities is the leading causes of macroinvertebrate loss.

Section 6.0 Conclusions

It is difficult to draw conclusions about the entire Assessment Unit # ID17010104PN003_02. Most of what we know is about the Grass Creek headwaters and an associated un-named tributary, and not other streams in the assessment unit. One BURP site on the un-named tributary revealed low macroinvertebrate scores to fail assessment tests. No fishing took place to assess this aspect of the unit's biology.

The headwaters portion of the Grass Creek watershed experienced considerable loss of forest vegetation due to wildfire in 1967. Additionally, timber harvest activities have taken place throughout the watershed. The streams examined do not show habitat impairment, however historic impacts may have caused extensive sediment pollution to move through the system eliminating sensitive taxa in at least one reach. Temperature may also be a widespread problem throughout the watershed due to loss of shade. Therefore, the most likely causes of low biological scores in AU# ID17010104PN003_02 are past excess sediment and altered hydrology due to wildfire and possibly high stream temperatures due to lack of shade. Although what is happening in other streams in the assessment unit is unknown, based on similarity of landscape position and land use, we assume that other streams in the assessment unit are likely similarly impacted.

Section 7.0 References

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