APPENDIX F
Fire Effects on Watershed Health

Appendix F1

Fires 2000 Assessment

WATERSHED HEALTH CONSIDERATIONS

October 2000

Steve Johnson

Introduction: Improving watershed health should be a "given" in any rehab or value recovery activities. Fires burned within watersheds that were near or even out of watershed equilibrium before the fires, within a municipal watershed and within watersheds containing both threatened and sensitive fish species. Several of the fires occurred within watersheds that were extensively burned and salvage-logged following the 1994 fire-year. In addition, a topic that we know will come up in subsequent analyses is the potential for reduced fire interval, increased intensity of subsequent fires in the burned areas (re-burn)?

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The intent of all fire-recovery activities is to be responsive to watershed concerns, to "make things better", not add to the existing degraded condition. Considerations relating to watershed health were developed because of the sensitive nature of some of these watersheds impacted by fire. However, these considerations need to be taken into perspective:

- How many acres burned in the watershed, and how many of the burned acres were of high intensity?
- How many acres of high intensity fires burned in proximity to stream channels?
- How many acres of high intensity fires burned above and near to roads, particularly ones that need BMP work?
- How far from any channels will our proposed units be?
- Is there an opportunity to repair or rehab an existing problem with funds generated from these activities?
- What is the expected overall watershed health ***trend*** of each drainage basin, given the history, condition and consequences of these fires?

The Process: The process begins with a **channel review** of stream segments that would be expected to indicate overall watershed health. The channel condition-type is determined by using the channel review and other information such as the percent of the watershed that burned; extent of past harvest in the basin, particularly riparian harvest; and the severity of burning which occurred in and along the channel.

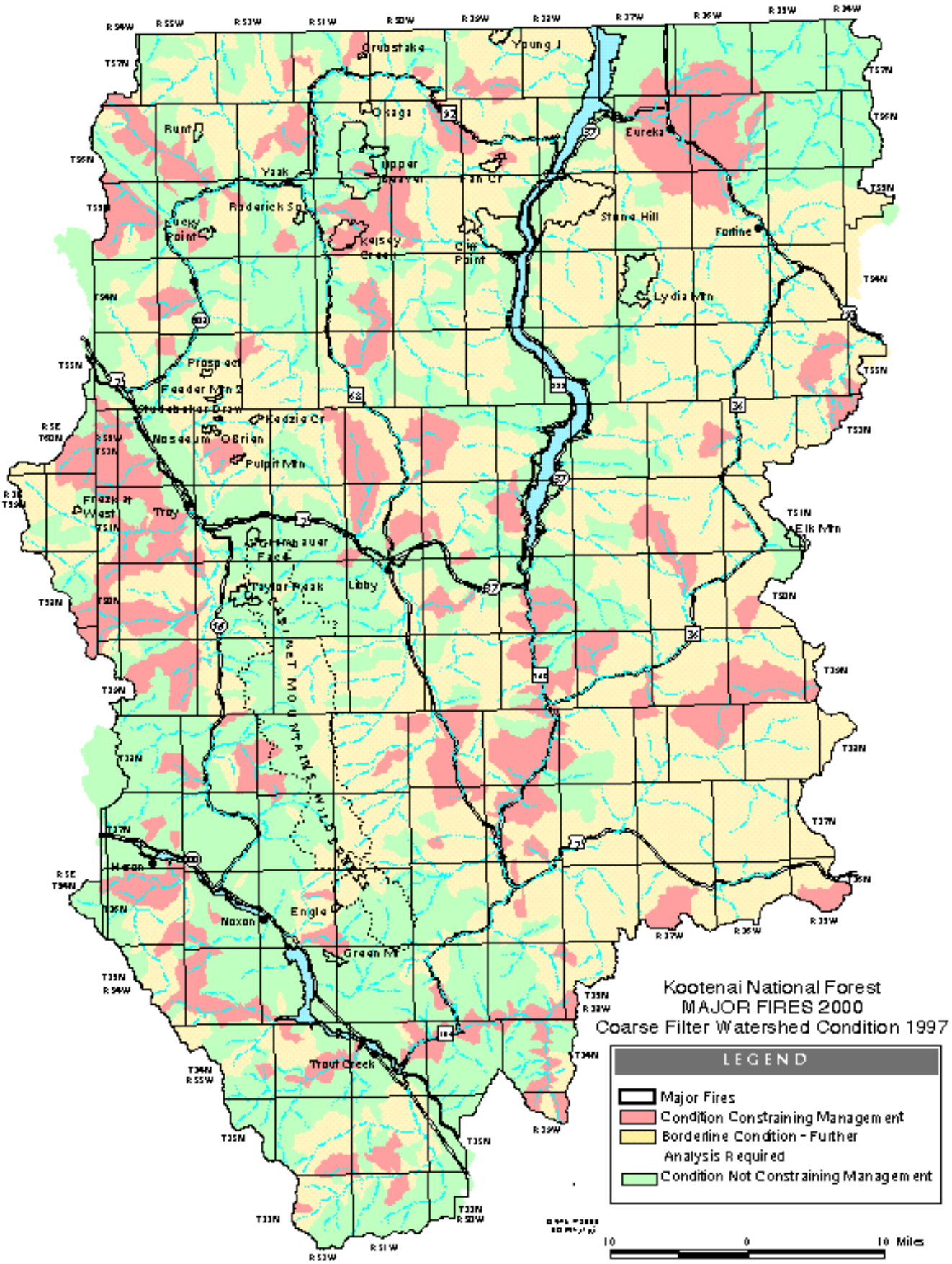
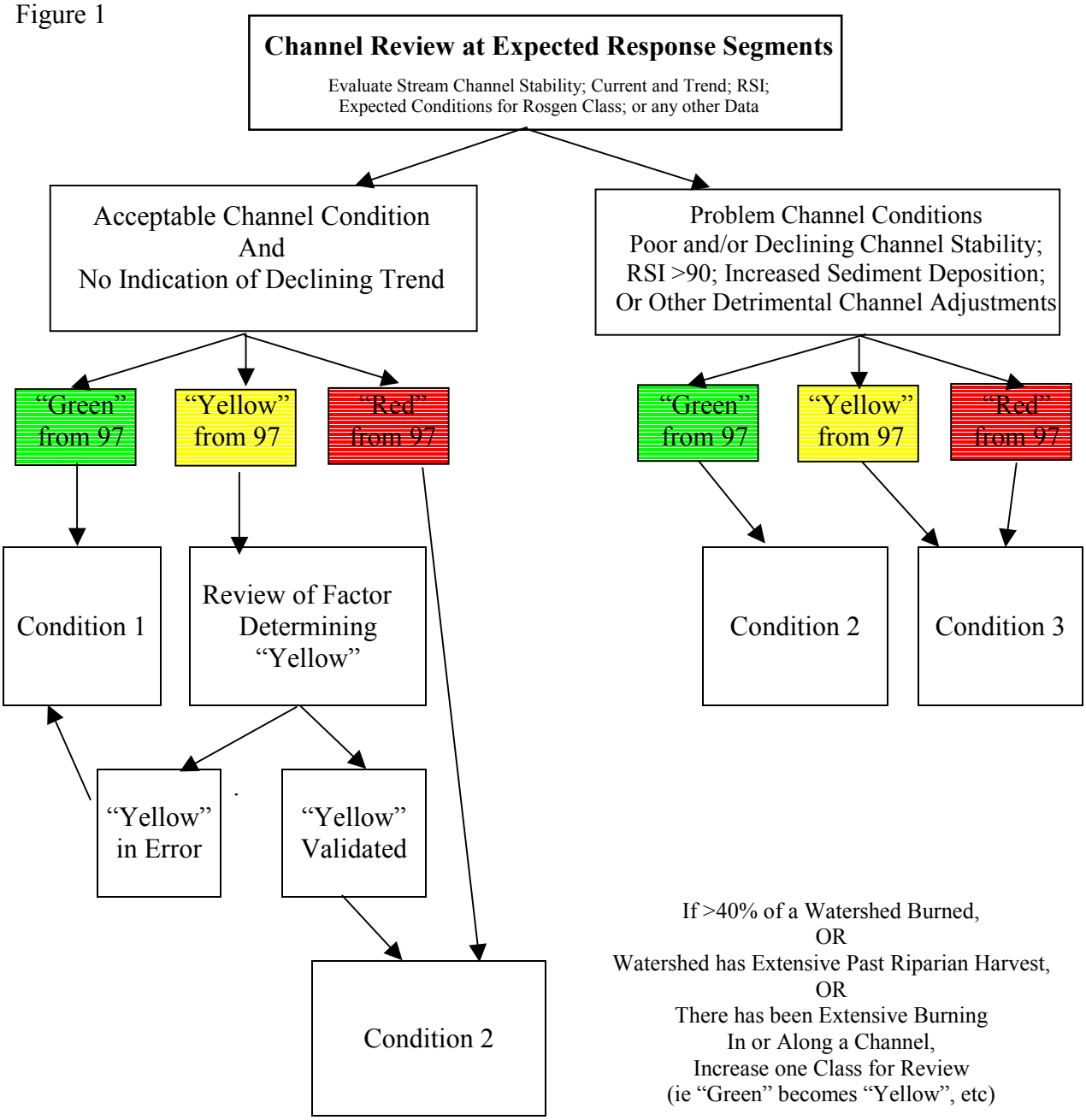

Kootenai National Forest
MAJOR FIRES 2000
Coarse Filter Watershed Condition 1997
LEGEND
Major Fires
Condition Constraining Management
Borderline Condition - Further Analysis Required
Condition Not Constraining Management
10 0 10 Miles
Grubstake
Young J
Okaga
Runt
Eureka
Upper Beaver
Yaak
Fan Cr
Roderick Sp
Lucky Point
Kelsey Creek
Cliff Point
Stone Hill
Fortine
Lydia Mtn
Prospect
Feeder Mtn 2
Studebaker Draw
Kedzie Cr
Noseeum
O'Brien
Pulpit Mtn
Troy
Elk Mtn
Taylor Peak
Libby
Heron
Noxon
Engle
Green Mt
Trout Creek

Figure 1



1997 Color Coding was taken from 1997
KNF Watershed Condition Assessment. (Bojonell, 1997

The flow chart (figure 1) explains the process used to determine condition-type. The conditions-types are defined below:

CONDITION 1: Watersheds in dynamic equilibrium where channel condition is acceptable, the hydrologic condition is not limiting, and no other factors are present that could push it beyond thresholds.

CONDITION 2: Watersheds showing signs of stress or are expected to show signs of stress in the near future. Channel conditions are acceptable at the present time, but at least one criteria of concern has been exceeded (1997 Watershed Condition Assessment, Bojonell).

CONDITION 3: Watersheds out of dynamic equilibrium, where channels have been found to be in a degraded condition or are expected to be in a degraded condition as a result of fire.

Condition 1 – Considerations

- In all recovery activities, provide for large woody debris (LWD) recruitment both in and along stream channels. LWD availability will determine the rate of channel recovery from these fires;
- Look for opportunities to improve watershed condition, including rehabilitation of existing problems, particularly road drainage problems;
- Use the Forest Plan Riparian Area Guidelines, as amended by INFS, for streamside management zones (SMZ), unless a positive benefit can result from the use of an alternative practice in the SMZ.

Condition 2 – Considerations

- In addition to Condition 1 considerations**, minimize** ground-disturbing activities. As appropriate, use winter logging, temporary roads, temporary bridges, forwarders, and FMC's.

Condition 3 – Considerations

The emphasis in these types of watersheds is to be very "light on the land" and to aggressively look for opportunities to improve watershed conditions. Activities should not be automatically precluded in these watersheds, but extreme care is needed. Based on the channel condition, in conjunction with the fire and fire suppression actions, the following should be considered:

- **Preclude** *ground-disturbing* activities. Do nothing to the soil surface which will: 1) increase the amount of runoff or reroute surface runoff, or intercept subsurface flow; 2) cause rutting in wet areas; or 3) cause compaction. This does NOT mean that all surface activities are precluded. It means that activities will not contribute to the degraded condition. Examples of acceptable activities included winter logging, helicopter logging or other methods that do not disturb the ground;

- Reduce road effects. Examples include road restoration (obliteration, seeding…) and repairing existing problems (adding relief culverts, drain dips…);

- Include a 100' SMZ on all KNF Class I, II, IIIA or IIIB stream channels;

- Consider risk of activities or magnitude of effects by reviewing factors such as routing time, sediment delivery potential, and distance from major channels (large downstream fisheries);

- Note that Hydrologic Zone I (from KNF Hydrologic Guide) has a much greater chance of rain-on-snow events than does Zone III;

- If activities are planned in a Condition 3 watershed, monitor the watershed conditions to determine effectiveness of mitigation and improvement of the watershed.

Some of the potential rehabilitation and restoration areas are within watersheds identified in the 2000 303(d) list: Wolf Creek, Lake Creek and West Fork Yaak River. Proposed activities in these areas will need to coordinate and share information with the MDEQ-Planning and Prevention Bureau. We have to demonstrate that our post-fire activities will overall improve or at least not cause additional deterioration of watershed conditions, particularly in the existing poor condition watersheds.

S.Johnson
10/19/2000
Attachments:1997 Watershed condition Documentation (Bojonell 1997)

Appendix F2

1997 Watershed Condition Documentation

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Hydrologist
1/22/98

Purpose: This project was designed to update the 1992 Watershed Condition Assessment. The analysis attempted to make a preliminary review of all watersheds on the forest, evaluating their current condition based on information that was readily available as of FY 97. We attempted to duplicate the methodology used for the 1992 assessment as much as possible. The same watershed boundaries were used to determine the watershed condition.

Use: The data contained in the watershed condition database should only be used for coarse filter analysis. The data should be verified with more detailed analysis for project work.

The analysis placed the watersheds into one of the following three categories:

1) **Functioning** - Watersheds where the hydrologic condition is not limiting. This means that none of the evaluated factors are outside of the estimated threshold of concern, and none of the reports or existing analysis suggest an immediate problem. There is a high probability (but not certainty) that these watersheds are below critical thresholds with opportunity for additional management activities utilizing BMPs and other Forest Plan guidance.

2) **Functioning at Risk** - Watersheds where at least one of the criteria of concern has been exceeded (RIF; percent harvested; or identified by districts as "red flags"). In these watersheds, the threshold level of acceptable hydrologic condition may have been reached. This suggests that further detailed analysis, including ground review, will be necessary to confirm the condition and to define what management options are available, if any.

3) **Not Functioning** - Watersheds where the existing condition is unacceptable because at least one of the evaluating factors is double the threshold condition, or where a field review has documented an existing watershed problem, or where threshold conditions for this class were nearly reached and local information suggests damage.

Methods:
Criteria for determining watershed condition:

General Rosgen Stream Type	WS Sensitivity Condition	Historical % of WS harvested	Road Impact Factor (RIF) >38" precip	<38" precip
	Functioning	<35	<15	<20
A	Functioning at Risk	>=35 OR	>=15 OR	>=20
	Not Functioning	>=70 OR	>=30 OR	>=40
	Functioning	<30	<12	<15
B	Functioning at Risk	>=30 OR	>=12 OR	>=15
	Not Functioning	>=60 OR	>=24 OR	>=30
	Functioning	<25	<10	<10
C or E	Functioning at Risk	>=25 OR	>=10 OR	>=10
	Not Functioning	>=50 OR	>=20 OR	>=20

Queries were run in Arcview based on the above criteria which resulted in a first approximation of watershed condition. A map of the first approximation was generated and sent to the districts. The districts then edited the watershed condition based on field knowledge and/or analysis of the watersheds. Please note that the map will continue to be updated as more specific watershed analyses are completed by the districts.

The general Rosgen stream type was based on a modeled Rosgen type for the lower 1/3 of channel, the lower 1/3 of the channel was assumed to be the most sensitive to disturbance. Field verified Rosgen data was used where possible.

Rather than using all harvest only harvest within the past 40 years was included in the historical harvest factor. The 40 year-old harvest date was used because it tiered to the Columbia River Basin Assessment that assumed early seral was younger than 40 years old. This is one difference between the 1992 and 1997 criteria.

For the road impact factor, precipitation was used rather than hydrologic regions because precipitation information was available and more detailed than hydrologic regions previously used. This is another difference between the 1992 and 1997 criteria. The average precipitation for all the watersheds was 38 inches. This was used as the split between the high and low precipitation areas.

Sample queries based on the above criteria:

1) To determine a Rosgen 'A' FUNCTIONING AT RISK watershed in the <38" precip zone the following query was run in Arcview:
First select all watersheds with less than an average precip of 38": ([Avg_ppt]<38)
Click on New Set
Then query for all Rosgen 'A' watersheds with 35 to 69% of the watersheds harvested OR a Road Impact Factor greater than or equal to 20 but less than 40:
((([Ros]=A) and ([Vegcls10-20]>=35)) and (([Ros]=A) and ([Vegcls10-20]<70)) or (([Ros]=A) and ([Rif]>=20)) and (([Ros]=A) and ([Rif]<40)))
Click on Select from Set
The selected watersheds were then coded FUNCTIONING AT RISK.

2) To determine a Rosgen 'B' NON-FUNCTIONING watershed in the >=38" precip zone the following query was run in Arcview:
First select all watersheds with greater than an average precip of 38": ([Avg_ppt]>=38)
Click on New Set
Then query for all Rosgen 'B' watersheds with 60% or more of the watershed harvested OR a Road Impact Factor greater than or equal to 24:
((([Ros]=B) and ([Vegcls10-20]>=60)) or (([Ros]=B) and ([Rif]>=24)))
Click on Select from Set
The selected watersheds were then coded NON-FUNCTIONING.

3) To determine a Rosgen 'C' or 'E' FUNCTIONING AT RISK watershed in the >=38" precip zone the following query was run in Arcview:
First select all watersheds with greater than an average precip of 38": ([Avg_ppt]>=38)
Click on New Set
Then query for all Rosgen 'C' and 'E' watersheds with 25 to 49% of the watershed harvested OR a Road Impact Factor greater than or equal to 10 but less than 20:
((([Ros]=C) or ([Ros]=E) and ([Vegcls10-20]>=25)) and (([Ros]=C) or ([Ros]=E) and (Vegcls10-20]<50)) or (([Ros]=C) or ([Ros]=E) and ([Rif]>=10)) and (([Ros]=C) or ([Ros]=E) and ([Rif]<20)))
Click on Select from Set
The selected watersheds were then coded FUNCTIONING AT RISK.

Code 6 Data Table Definitions:
*These fields were used as part of the criteria for determining watershed condition.

Shape: Arc generated field, ignore.
Area: Area of the watershed in square meters.
Perimeter: Perimeter of the watershed in meters.
Code6data#: Arc generated field, ignore.
Code6data-id: Arc generated field, ignore.
Code6: The last 7 digits of the KNF 6th code watershed number.
Position: This column was added to indicate a "duplicate" face drainages. These were drainages that, at the 6th code, were lumped into one drainage even though they are individual watersheds at the 7th code. They are located along major rivers (i.e. Yaak, Kootenai, Koocanusa, and Clark Fork). Please note that the values generated for face drainages are inaccurate because they represent values for all the face drainages within a drainage added together.
Region: A random number given to each watershed polygon. It can be used as a substitute for the watershed number in looking for information in Arcview.
Region_acres: The number of acres in the region polygon. These are grid (raster) generated acres and differ from the "Areaacres-st" and "Areaacres-rd" acres (+/- 15%). These acres are roughly equivalent to

watershed acres, however, it is recommended that "Areaacres-st" or "Areaacres-rd" be used for watershed acres.
Min_precip: The minimum precipitation in the watershed in inches. Derived from the Kootenai revised Prism model.
Max_precip: The maximum precipitation in the watershed in inches. Derived from the Kootenai revised Prism model.
Avg_precip: The weighted average precipitation in the watershed in inches. Derived from the Kootenai revised Prism model.
Sum-dist-st: Total miles of stream in the watershed, based on the CFF layer.
Areaacres-st: The number of acres in the watershed. These are polygon generated acres and are considered to be more accurate than the "Region_acres". Note that in some cases zero acres were computed because there were no streams in that polygon. In those instances refer to either the "Areaacres-rd" or "Region_acres" to obtain the acres for that watershed.
Areasqmile-st: The area of the watershed in square miles. These were derived from "Areaacres-st".
Milepersqmile-st: Miles of stream per square mile in the watershed.
Sum-dist-rd: Total miles of road in the watershed.
Areaacres-rd: The number of acres in the watershed. These are polygon generated acres and are considered to be more accurate than the "Region_acres". Note that in some cases zero acres were computed because there were no roads in that polygon. In those instances refer to either the "Areaacres-st" or "Region_acres" to obtain the acres for that watershed.
Areasqmile-rd: The area of the watershed in square miles. These were derived from "Areaacres-rd".
Milepersqmile-rd: Miles of road per square mile in the watershed, equivalent to road density.
Rd-st-intersects: Total number of stream crossings.
Inter_dens: Stream crossing density (number of crossings per square mile of watershed).
*Rif: Road Impact Factor. RIF = (road density (mi/mi2)) * (crossing density (#/mi2)). This field was used as part of the criteria for determining watershed condition.
Polynum_lb: Arc generated field, ignore.
*Vegcls10-20: Percent of the watershed with harvest that was approximately 0 to 40 years old as of June 1997. This percentage was used in determining the watershed condition. This field is the sum of "Percent-cls10" and "Percent-cls20". This field was used as part of the criteria for determining watershed condition.
Veg-cls-10: A label, ignore.
Acres-cls10: The number of acres of harvest in the watershed that was 0 to 20 years old as of June 1997. This was derived from TSMRS data and SILC data.
Percent-cls10: The percentage of the watershed with harvest that was 0 to 20 years old as of June 1997.
Veg-cls-20: A label, ignore.
Acres-cls20: The number of acres of harvest in the watershed that was 21 to 40 years old as of June 1997. This was derived from TSMRS data and SILC data.
Percent-cls20: The percentage of the watershed with harvest that was 21 to 40 years old as of June 1997.
Rosnum: A 3 digit number indicating the stream order and Rosgen class for approximately the lower 1/3 of the channel. The first digit indicates the stream order and the third digit indicates the Rosgen class. The second digit has no meaning but was used in the modeling process. Examples: 101 = first order stream, Rosgen "A"; 202 = second order stream, Rosgen "B"; 302 = third order stream, Rosgen "B"; 403 = fourth order stream, Rosgen "C"; 503 = fifth order stream, Rosgen "C".
Frequency: Number of stream segments making up the lower channel. This was used for modeling purposes.
Sum-length: The length in meters of "Rosnum".
Class_percent: The percent of the total stream distance (from "Sum-dist-st") used to calculate "Rosnum". This indicates what percentage of the total channel miles was considered to be the lower 1/3 of the channel. Note that in some cases 100% of the channel was used.
Ros_ord_num: Same as "Rosnum".
List: Arc generated field, ignore.
St-order: The stream order at the mouth of the watershed. This was generated by ArcInfo from a stream-order routine. 1 = 1st order; 2 = 2nd order; 3 = 3rd order; etc.

Wscond: 1997 Watershed condition. 0 = functioning; 1 = not functioning; 2 = functioning at risk. The final rating was generated by the modelling process and then edited according to professional interpretations by the district hydrologists.
*Avg_ppt: The whole number average precipitation in the watershed in inches. This column was added manually because Arcview was inconsistent in how it rounded off. This field was used as part of the criteria for determining watershed condition.
Rostemp: Temporary Rosgen class. A number indicating the Rosgen class. 1 = "A"; 2 = "B"; 3 = "C"; etc. The number was converted to a letter in the "Ros" column.
*Ros: The Rosgen class for the first third of the stream beginning at the confluence. Real data was used where possible otherwise the Rosgen class was modeled. This field was used as part of the criteria for determining watershed condition.
Ordtemp: Temporary stream order. A number indicating the stream order, same as "St-order". 1 = first order; 2 = second order; 3 = third order; etc.
Level: Arc generated field, ignore