Appendix F
Aquatic Specialist Report: Methods and Assumptions

Analysis of the aquatic questions for the Medicine Bow National Forest forest-scale roads analysis utilized the existing database, GIS queries, and professional judgment. Due to the time constraints and scale of the assessment, we decided to use only existing information; no new data was collected. We assumed that the database for the roads was relatively accurate and up to date. The database for streams is based on the USGS blue-lines which represent the backbone stream network, but under-represent the true stream network; the true stream network is more extensive than what is shown by the blue-lines (IRI 1995).

We did a risk assessment using GIS analysis to determine where the road system might be affecting the water and aquatic resources. Since it is impossible to field verify every road at this scale of analysis, we made some assumptions about the level of risk roads pose in each watershed. We analyzed maps to identify specific maintenance level 3-5 roads which have the highest risk of affecting the water and aquatic resources were also identified.

This analysis used sixth-level watersheds to show the degree of risk for each watershed. Sixth-level watersheds are small enough to differentiate areas of concern but large enough for forest scale analyses.

Road density: For each sixth-level watershed, we used GIS queries to determine total road density—the miles of road by maintenance level 1-2 and 3-5 in each sixth-level watershed. Road density was then broken down into the density of maintenance level 1-2 roads, and maintenance level 3-5 roads. We assumed that level 3-5 roads receive regular maintenance and are generally not significantly affecting the aquatic resources. Level 1-2 roads receive less maintenance and generally less use. These roads are more likely to have inadequate or poorly maintained drainage, and problem areas on these roads may go unnoticed because fewer people use them. Many of the level 1-2 roads were built between 1950-1970 and did not incorporate Best Management Practices (BMPs). For this reason, we assumed that the level 1-2 roads have the greatest potential for affecting aquatic resources; this is consistent with field reconnaissance.

The following table lists the road density risk ratings for maintenance level roads 1-5 and for maintenance level 1 and 3 roads. The categories were based on qualitative field observationsand natural groupings of the data. Please remember, these are only risk ratings; they do not represent actual watershed condition. However, the higher the road density, the greater the potential for aquatic resource concerns.

Table F-1. Road density risk ratings for maintenance level 1-5 roads and maintenance level 1-2 roads.

Total Road Density Risk rating	Density value (miles/mi^2)	Road density level 1-2 roads Risk rating	Density value (miles/mi^2)
Low	0-1	Low	0-1
Moderate	1-3	Moderate	1-2.5
High	3-5	High	2.5-4.0
Extreme	5+	Extreme	4+

Soil risk: The effects of roads on watershed health is highly dependent on the soil type. Some soils are susceptible to surface erosion, while others are highly susceptible to mass movement. Extremely sensitive soils are susceptible to both surface erosion and mass movement. For this analysis, we queried the acres of soil map units susceptible to surface erosion and those susceptible to mass movement by

sixth-level watershed. The percent of the watershed with sensitive soils was then used as a risk factor for existing roads and new road construction. The following table identifies the values used to rate soil risk.

Table F-2. Percent of watersheds in the three soil risk rating categories.

Soil risk rating	Percent of watershed with sensitive soils
Low	1-20%
Moderate	20-50%
High	50-100%

Road-stream crossing density: We determined the density of road-stream crossings through map analysis. We tallied the number of road crossings for each watershed then divided by the drainage area in square miles. This included only the USGS blue-line streams, which under-represent the stream network as noted above; the density of road-stream crossings is most likely higher than what was accounted for in this analysis.

Road-stream crossings act as connected disturbed areas. Connected disturbed areas are defined as "high runoff areas like roads and other disturbed sites that discharge surface runoff into a stream or lake. Connected disturbed areas are the main source of damage in all regions" (FSH 2509.25). The higher the density of road-stream crossings, the higher the potential for increased sedimentation to the stream network. Roads which do not incorporate BMPs are often the greatest contributors of sediment to the stream network through these connected disturbed areas.

Table F-3. Road-stream crossing densities and associated risk rating.

Road-stream crossing density risk rating	Road-stream crossing density value (# crossings/mi^2)
Low	0-1
Moderate	1-2
High	2-3
Extreme	3+

Miles of road within 200 feet of stream courses: Roads are disturbed areas which are a potential source of sediment to the stream system, especially when there is a pathway which connects water and sediment from the road system to the stream network through these connected disturbed areas. In this analysis, we used the miles of road within 200 feet of stream courses to identify the potential for connected disturbed areas other than road-stream crossings. We made the following assumptions:

- There is a high probability that drainage relief structures drain directly into the stream system during spring runoff and act as connected disturbed areas.
- Where roads are on flatter grades, there is a possibility that dispersed campsites have developed between the road and the stream system and that runoff from the dispersed sites reaches the stream network.
- On steeper slopes, water and sediment from drainage relief structures reach the stream system since the steeper slopes result in higher velocities.

The following table identifies the values used to rate the risk of connected disturbed areas associated with roads close to the stream network. As with road density, we assumed that maintenance level 1-2 roads have the highest risk of having connected disturbed areas which are degrading water quality and aquatic habitat.

Table F-4. Risk rating and associated road densities for maintenance level 1-5 roads and maintenance level 1-2 roads.

Total density of miles of road within 200 ft of stream courses		Density for level 1-2 roads of miles of road within 200 ft of stream courses	
Risk rating	**(miles/mi^2)**	**Risk rating**	**(miles/mi^2)**
Low	0-0.2	Low	0-0.2
Moderate	0.2-0.6	Moderate	0.2-0.5
High	0.6-0.9	High	0.5-0.8
Extreme	0.9+	Extreme	0.8+

Factor and cumulative risk ratings: We used a numerical system to determine the cumulative risk of the different factors such as road density, sensitive soils etc. Each factor was given a numerical value, and the values for the individual factor were added together to come up with an overall risk rating (see following table).

Table F-5. Individual factor and overall risk ratings used to determine cumulative risk.

Individual factor rating	Factor numerical value	Overall risk rating	Overall risk values
Low	1	Low	1-5
Moderate	2	Moderate	6-10*
High	3	High	10-14**
Extreme	4	Extreme	15+
Extremely high risk	5		

*Unless one factor had a high or extreme rating. Where this occurred, the watershed was bumped up to the 'High' risk category even if the overall risk value was 10 or less

**Unless one or more factors had an extreme rating, then the watershed was bumped up to the 'Extreme' category even if the overall risk value was less than 15.

The risk rating represents the road system's potential to degrade watershed function and aquatic habitat. This is only a risk analysis to determine high priority areas where we should focus more detailed assessments. There may be watersheds with high risk ratings where the road system is only having minor effects. Similarly, there may be watersheds with low risk ratings which are being significantly affected by the road system. The risk rating **does not** represent the true watershed condition; it merely indicates the potential for road-related effects.

References:

IRI, 1995: Integrated resource inventory training guide chapter 3: common water unit. US Forest Service Rocky Mountain Region, Lakewood CO.