

Appendix D – Watershed Risk and Aquatics Risks by 6th Level HUC

Methods and Assumptions

Roads account for most of the sediment problems in a watershed because they are a link between sediment source areas (skid trails, landings, and cutslopes, etc.) and stream channels. They directly affect the channel morphology of streams by accelerating erosion and sediment delivery and by increasing the magnitude of peak flow (Furniss et al. 1991). Wemple (1994) focused on the interaction of forested roads with stream networks in Western Oregon and found that nearly 60% of the road network drained into streams and gullies, and are therefore, hydrologically integrated with the stream network. From a qualitative standpoint, the following assumptions can be used as general indicators of sediment delivery risk associated with roads: 1) the higher the road density the higher the potential for sediment yield increases due to the larger acreage of exposed surfaces, 2) the more drainage ways that are crossed the higher probability that direct sediment introduction will occur, and 3) the greater the distance, or higher on the slope, that the road is from the drainage network, the less probability for delivered sediment to occur (erosion may occur but is less likely to be routed to the stream).

Analysis of the aquatic questions for the Malheur National Forest forest-scale roads analysis utilized the Forests existing roads database, GIS queries, and professional judgment. Due to the time constraints and scale of the assessment, a decision was made to use only existing information, with no new data being collected. The roads database was assumed to be relatively accurate and up to date. The database for streams is based on class 1-4 streams in the Forests GIS stream layer, which represents perennial and intermittent streams – this information likely under-represents the true stream network, but is more extensive than what is shown by the USGS blue-lines (IRI1995).

A risk assessment was accomplished using GIS analysis to determine where the road system may be affecting the water and aquatic resources. Since it is impossible to field verify every road at this scale of analysis, assumptions were made about the level of risk roads pose in each sub-watershed. This analysis used sub-watersheds (sixth-level HUCCS), which are small enough to differentiate areas of concern but large enough for forest scale analyses, to show the relative degree of risk for each sub-watershed.

This risk assessment identifies those sub-watersheds where the existing road system may be negatively affecting or causing a high risk to watershed function and/or aquatic species. This assessment will help prioritize those watersheds on which to focus sub-forest analyses. For this reason, all classified roads, regardless of maintenance level, were used for this portion of the analysis (note: only a relatively small proportion of unclassified roads are currently inventoried and in the INFRA database). Looking at all

classified roads allowed a broad-scale assessment of the risk to watershed function associated with the entire road system rather than just the potential minimum primary road system. The broad forest scale analysis provides the basic framework for sub-watershed or project level analysis. Sub-forest scale analyses will identify site-specific areas being affected by the existing road system, any potential new road construction, as well as opportunities to address these concerns.

Watershed Risk Assessment

Road Density

For each sub-watershed, GIS queries were used to determine total road density (maintenance level 1-5) and the density of maintenance level 1-2 roads. An assumption made was that maintenance level 3-5 roads receive more frequent maintenance and are generally a lower risk of significantly affecting aquatic resources, whereas, level 1-2 roads receive less maintenance and generally less use, and are more likely to have inadequate or poorly maintained drainage. Many of the level 1-2 roads were built between 1950-1980 and did not incorporate Best Management Practices (BMPs). For this reason, it is assumed that the level 1-2 roads have the greatest potential for affecting aquatic resources; this is consistent with road condition surveys across the Forest.

The following table, Appendix D TBL 2, lists the road density risk ratings for maintenance level roads 1-5 and for maintenance level 1 and 2 roads. Rating categories were based on qualitative field observations and natural groupings of the data. Please remember, these are only risk ratings and they do not represent actual watershed conditions. However, the higher the road density, the greater the potential for watershed/aquatic resource concerns.

Appendix D TBL 1-- Road density risk ratings for maintenance level 1-5 roads and maintenance level 1-2 roads.

Risk Rating based on Total Road Density	Density Value (miles/mi²)	Risk Rating based on Level 1-2 Road Density	Density Value (miles/mi²)
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+

Proximity of Roads to Stream Courses

Roads are disturbed areas that are a potential source of sediment to the stream system, especially when there is a pathway that connects water and sediment from the road

system to the local stream network. This analysis used the miles of road within 200 feet of stream courses (perennial and intermittent streams) to identify the potential for connected disturbed areas, other than road-stream crossings. The following assumptions were made:

- The closer the road is to a stream or channel the higher the probability that drainage structures connected to the stream system, especially during spring runoff or intense thunderstorm events.
- Where roads are located 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 have a higher likelihood of reaching the stream system due to higher velocities.

The following table, Appendix D TBL 2, identifies the values used to rate the risk of connected disturbed areas associated with roads close to the stream network. As with road density, an assumption was made that maintenance level 1-2 roads likely have a higher risk of having connected disturbed areas that are degrading water quality and aquatic habitat.

Appendix D TBL 2. Risk rating and associated road densities for maintenance level 1-5 roads and maintenance level 1-2 roads.

Risk Rating based on Total Road Density within 200 ft. of Streams	Density Value (miles/mi²)	Risk Rating based on Level 1-2 Road Density within 200 ft. of Streams	Density Value (miles/mi²)
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+

Road-Stream Crossing Density

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. The higher the density of road-stream crossings, the higher the potential for increased sedimentation to the stream networks. Roads that do not incorporate BMPs are often the greatest contributors of sediment to the stream network through these connected disturbed areas. Current road crossings were acquired from the Malheur National Forest GIS road and stream layers, and an accuracy check was completed on thirteen Malheur River sub-watersheds. Those crossings determined to be “non-existent” within these sub-watersheds were deleted, with the number of crossings being removed averaging 27%. This percent average removed was then used to correct the number of crossing in the remaining sub-watersheds across the Forest. Appendix D

TBL 3 which follows identifies values used to rate the risk associated with road-stream crossings at the sub-watershed scale.

Appendix D TBL 3--Road-stream crossing densities and associated risk rating.

Road-Stream Crossing Risk Rating	Road-Stream Crossing Density Value (# Crossings/mi²)
Low	0-1.5
Moderate	1.5-3
High	3-4.5
Extreme	4.5+

Geology and Soil Erosion

The effect of roads on watershed health is highly dependent on the geology/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, queries were made of the acres of soil map units susceptible to surface erosion (watershed hazard rating GIS layer for Malheur National Forest lands and slope-erosion hazard rating GIS layer for the old Snow Mountain R.D., Ochoco National Forest lands) as well as those areas with sensitive geology or those susceptible to mass movement (data from Oregon Geology GIS layer) within each sub-watershed.

The Oregon Geology GIS layer coverage used at the time the analysis was done had some known inaccuracies (a corrected version is in progress and will soon be available). Geologic features that affect stability include faults, fractures, shear zones and contact zones between different formations, rock competency (rock strength and resistance to erosion), and the slope of bedding planes. Considering the time available and the scope of this analysis it was only practical to consider the parent geologic materials and their relative stability based professional knowledge and a limited inventory of recent mass movement activity. The geologic types rated as having the highest sensitivity included the Clarno Formation, granitic, serpentine, ultramafic formations, and mapped areas of landslide debris or debris flow deposits. Geologic types rated as moderate sensitivity included sedimentary and metamorphic formations that were not rated as highly sensitive. The more recent volcanic rock types such as the Strawberry Volcanic Formation and the welded tuff formations in the southern portion of the Forest were rated as least sensitive.

The percent of each sub-watershed with sensitive soils and the percent of each sub-watershed with sensitive geology were then used as a risk factor for existing roads and new road construction. The following table, Table D-4, identifies the risk ratings and values used to rate sensitive geology and soil risk (for individual road risk ratings, see the Road Tables in Appendix A).

Appendix D TBL 4--Percent of sub-watershed with the three soil and geology risk rating categories.

Risk Rating based on Sensitive Geology	Percent of Sub-watershed with Sensitive Geology	Risk Rating based on Sensitive Soils	Percent of Sub-watershed with Sensitive Soils
Low	1-20%	Low	1-20%
Moderate	20-50%	Moderate	20-50%
High	50-100%	High	50-100%

Individual Factor and Overall Watershed Risk Ratings

A numerical system was used to determine the overall or cumulative watershed 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 factors were added together to come up with an overall watershed risk rating – see Table D-5 below.

Appendix D TBL 5. Individual factor and overall watershed ratings used to determine overall watershed risk.

Individual Factor Rating for each Watershed Risk Rating	Factor Numerical Value	Overall Watershed Risk Rating	Overall Risk Values
Low	1	Low	7-11
Moderate	2	Moderate	11-17
High	3	High	17-23
Extreme	4	Extreme	23+

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 the Forest should focus more detailed assessments. There may be sub-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, but merely indicates the potential for road-related effects.

Aquatic Risk Assessment

Number of Aquatic Species Present

The number of important and unique fish stocks that occur within each of the 6th field sub-watersheds was identified, with numbers ranging from 0-5 across the Forest. Information was based on presence/absence surveys, redd counts, population sampling, population trend and juvenile density, where available, as well as local knowledge of fish

distribution. The following was a list of species considered to be present or absent within each sub-watershed (lamprey and sculpin were not considered for this assessment):

- Spring Chinook salmon
- Steelhead trout.
- Bull trout.
- Cutthroat trout.
- Redband trout.

Aquatic Strongholds

Areas of excellent habitat or known concentrations of important/unique species were identified as aquatic strongholds. When a sub-watershed was found to be an aquatic stronghold it was given a value of 3 points, otherwise a value of 0 was assigned to the sub-watershed. Habitat quality was based on professional judgment, local knowledge and stream survey data. Habitat parameters considered were: pool quality, water quality, bank stability, gradient, geology, channel profile, road density, and relative human impacts. Population strength was based on redd counts, population sampling, population trend and juvenile density, where available, as well as local knowledge.

Overall Aquatics Risk Rating

The overall aquatics risk rating was simply determined by adding the number from the aquatic species present column (0-5) with the number from the aquatic stronghold column (either 0 for no stronghold or 3 for strongholds) to come up with an overall aquatic risk rating – see Appendix D TBL 6 below.

Appendix D TBL 6. Overall Aquatic Risk Rating used to determine overall cumulative risk.

Overall Aquatic Risk Rating	Overall Risk Values
Low	0-2
Moderate	3-4
High	5-8

Watershed/Aquatics Risk Rating Results

A composite watershed/aquatics risk rating was determined for each of the sub-watersheds by simply overlaying the overall aquatics risk assessment results with the

overall watershed risk assessment results, utilizing GIS tools. Map D1 displays the results of this overlay.

Table D-7 displays a summary of the risk rating results:

Appendix D TBL 7 – Sub-watershed Risk Rating Summary

OVERALL WATERSHED RISK			OVERALL AQUATIC RISK		
Rating	Number of sub-watersheds	Percent of total sub-watersheds	Rating	Number of sub-watersheds	Percent of total sub-watersheds
Extreme	13	8%	N/A	N/A	N/A
High	79	49%	High	25	15%
Moderate	55	34%	Moderate	30	19%
Low	14	9%	Low	106	66%
Total	161	100%	Total	161	100%

Sub-watersheds with an extreme or high watershed risk and a high aquatic risk should be considered as the highest priority for future analyses. Those sub-watersheds as well as those with extreme or high watershed risk and moderate aquatic risk ratings are displayed below in table D-8:

Appendix D TBL 8 – High Priority Sub-watersheds on the Malheur

Extreme Watershed Risk and High Aquatic Risk (3%)	
Name	HUC Number
Fields Creek	170702011103
Granite Boulder Creek	170702030203
Middle Camp Creek	170702030206
Lick Creek	170702030207
Lower Camp Creek	170702030208
High Watershed Risk and High Aquatic Risk (4%)	
Bosenberg Creek	170501160103
Cliff Creek	170501160105
Crane Creek	170501161103
Upper Canyon Creek	170702010701
Mill Creek	170702030106
Vinegar Creek	170702030201
Little Boulder Creek	170702030202
Extreme Watershed Risk and Moderate Aquatic Risk (2%)	
Bear Creek	170702010803
Magone Creek	170702010901
Indian Creek	170702030303

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High Watershed Risk and Moderate Aquatic Risk (10%)	
Vance Creek	170702010703
Dixie Meadows	170702010802
High Watershed Risk and Moderate Aquatic Risk (10%)	
Cottonwood Creek	170702010902
Clear Creek	170702010903
Squaw Creek	170702030101
Idaho/Summit Creek	170702030102
Dry Fork	170702030103
Coyote Creek/Balance Creek	170702030205
Mosquito Creek/Bear Creek	170702030301
Upper Scotty Creek	171200020103
Upper Bear Creek	171200020201
Upper Camp Creek	171200020302
Trout Creek Forks	171200020307
Crowsfoot Creek	171200020601
Bear Canyon Creek	171200030603
Little Emigrant Creek	171200020604

Table D-9 displays the results of the risk ratings for Forest lands in each 6th level HUC on the Forest, including ratings for each of the elements used to determine watershed and aquatic risk ratings, as well as the overall risk ratings for each sub-watershed.

Appendix D TBL 9: **Sub-watershed Risk Ratings.**

Subwatershed Risk Ratings for Watershed/aquatics risk assessment												
6TH LEVEL HUC NAME	HUC NUMBER	ROAD DENSITY RISK OML 1-5	ROAD DENSITY RISK OML 1-2	ROAD 200' PROXIMITY RISK ML 1-5	ROAD 200' PROXIMITY RISK ML 1-2	ROAD CROSSINGS RISK	GEOLOGIC SENSITIVITY	SOIL EROSION SENSITIVITY	OVERALL WATERSHED RISK	NUMBER OF TES SPECIES	STRONGHOLD (HES OR NO)	OVERALL AQUATICS RISK
UPPER BIG CREEK	170501160101	M	M	M	M	L	L	L	M	2	Y	H
LAKE CREEK	170501160102	H	M	H	H	M	L	L	M	2	N	L
BOSONBERG CREEK	170501160103	H	H	E	E	M	L	L	H	2	Y	H
SUMMIT CREEK	170501160104	H	H	E	E	H	L	L	H	1	N	L
CLIFF CREEK	170501160105	H	H	H	H	M	L	M	H	2	Y	H
BLUEBUCKET CREEK	170501160106	M	M	E	E	M	L	M	H	1	N	L
COYOTE CREEK	170501160107	M	M	M	M	E	L	H	M	0	N	L
UPPER WOLF CREEK	170501160201	H	H	H	M	M	L	M	M	1	Y	M
EAST FORK WOLF CREEK	170501160202	H	H	H	M	L	L	M	M	1	Y	M
SQUAW CREEK	170501160203	H	M	E	H	M	L	H	H	1	N	L
CALAMITY CREEK	170501160204	H	M	E	E	H	L	M	H	1	N	L
DUCK CREEK	170501160205	M	M	M	M	L	M	H	M	1	N	L
UPPER PINE CREEK	170501160301	H	H	E	E	M	L	M	H	1	N	L

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Subwatershed Risk Ratings for Watershed/aquatics risk assessment												
6TH LEVEL HUC NAME	HUC NUMBER	ROAD DENSITY RISK OML 1-5	ROAD DENSITY RISK OML 1-2	ROAD 200' PROXIMITY RISK ML 1-5	ROAD 200' PROXIMITY RISK ML 1-2	ROAD CROSSINGS RISK	GEOLOGIC SENSITIVITY	SOIL EROSION SENSITIVITY	OVERALL WATERSHED RISK	NUMBER OF TES SPECIES	STRONGHOLD (HES OR NO)	OVERALL AQUATICS RISK
MIDDLE PINE CREEK	170501160302	M	M	L	L	L	L	M	L	1	N	L
MILLER RESERVOIR	170501160501	M	M	L	L	L	L	H	M	0	N	L
MUDDY CREEK	170501160502	M	M	H	H	M	L	H	M	0	N	L
TAMARACK CREEK	170501160601	H	E	E	E	M	L	M	H	1	N	L
COTTONWOOD RESERVOIR	170501160602	L	L	L	L	L	L	L	L	1	N	L
SWAMP CREEK	170501161101	M	M	H	H	M	L	L	M	2	Y	H
ELK CREEK	170501161102	M	M	M	L	L	L	L	M	2	Y	H
CRANE CREEK	170501161103	H	H	H	H	M	L	L	H	2	Y	H
BEAR CREEK	170501161104	M	M	H	H	M	L	M	M	1	N	L
SKAGWAY CREEK	170501161105	M	M	L	L	L	L	M	L	2	Y	H
UPPER LITTLE MALHEUR RIVER	170501161201	M	M	H	H	M	L	M	M	1	Y	M
LONESOME CREEK	170702010101	H	H	E	H	M	L	M	H	1	N	L
UPPER SOUTH FORK JOHN DAY	170702010102	H	H	E	H	M	L	H	H	1	N	L
CORRAL CREEK	170702010103	H	H	E	E	H	L	H	H	1	N	L
UTLEY CREEK	170702010104	L	L	L	L	L	L	H	L	1	N	L
LEWIS CREEK	170702010105	H	H	E	E	E	L	M	H	1	N	L

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Subwatershed Risk Ratings for Watershed/aquatics risk assessment												
6TH LEVEL HUC NAME	HUC NUMBER	ROAD DENSITY RISK OML 1-5	ROAD DENSITY RISK OML 1-2	ROAD 200' PROXIMITY RISK ML 1-5	ROAD 200' PROXIMITY RISK ML 1-2	ROAD CROSSINGS RISK	GEOLOGIC SENSITIVITY	SOIL EROSION SENSITIVITY	OVERALL WATERSHED RISK	NUMBER OF TES SPECIES	STRONGHOLD (HES OR NO)	OVERALL AQUATICS RISK
VENATOR CREEK	170702010106	H	H	H	H	M	L	M	H	1	N	L
ROSEBUD CREEK	170702010301	H	H	E	E	H	L	H	H	1	N	L
MORGAN CREEK	170702010302	E	E	E	E	H	L	H	E	1	N	L
CORRAL CREEK	170702010305	H	E	E	E	E	L	M	H	2	N	L
LOWER DEER CREEK	170702010306	H	H	E	E	H	L	M	H	2	N	L
IZEE FALLS	170702010307	H	H	E	M	E	L	H	H	2	N	L
TEX CREEK	170702010401	H	H	E	E	E	L	M	H	2	N	L
BARK CABIN	170702010402	M	M	E	E	H	L	M	H	2	N	L
DUNCAN	170702010403	M	M	H	H	M	L	M	M	2	N	L
TODD	170702010404	L	L	L	L	L	L	L	L	2	N	L
LOWER MURDERERS CRK.	170702010405	M	M	M	M	L	L	H	M	2	Y	H
CORNER CREEK/BLACK PINE CREEK	170702010502	M	M	M	M	L	L	H	M	2	N	L
LOWER SOUTH FORK JOHN DAY	170702010505	L	L	L	L	L	L	M	L	2	N	L
RAIL CREEK	170702010601	M	M	M	M	L	L	L	M	5	Y	H
DEARDORFF CREEK	170702010602	H	H	M	M	L	L	L	M	5	Y	H
REYNOLDS CREEK	170702010603	H	H	M	H	L	L	L	M	5	Y	H

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Subwatershed Risk Ratings for Watershed/aquatics risk assessment												
6TH LEVEL HUC NAME	HUC NUMBER	ROAD DENSITY RISK OML 1-5	ROAD DENSITY RISK OML 1-2	ROAD 200' PROXIMITY RISK ML 1-5	ROAD 200' PROXIMITY RISK ML 1-2	ROAD CROSSINGS RISK	GEOLOGIC SENSITIVITY	SOIL EROSION SENSITIVITY	OVERALL WATERSHED RISK	NUMBER OF TES SPECIES	STRONGHOLD (HES OR NO)	OVERALL AQUATICS RISK
ISHAM CREEK	170702010604	H	H	M	M	L	L	L	M	1	N	L
DADS CREEK	170702010605	E	E	E	E	E	M	M	E	1	N	L
UPPER CANYON CREEK	170702010701	H	H	E	H	H	L	M	H	3	Y	H
EAST FORK CANYON CREEK	170702010702	L	L	L	L	L	L	M	L	3	Y	H
VANCE CREEK	170702010703	H	H	E	E	H	L	H	H	4	N	M
LOWER CANYON CREEK	170702010704	L	L	L	L	L	M	M	L	4	N	M
STRAWBERRY CREEK	170702010801	L	L	L	L	L	L	M	L	3	Y	H
DIXIE MEADOWS	170702010802	H	H	H	M	H	H	L	H	3	N	M
BEAR CREEK	170702010803	H	E	E	E	E	H	H	E	3	N	M
SHAW GULCH	170702010804	H	H	H	E	H	H	M	H	1	N	L
INDIAN CREEK	170702010805	M	M	M	M	L	H	M	M	4	Y	H
CASTLE CREEK	170702010806	M	M	L	L	L	M	M	M	3	N	M
GRUB CREEK	170702010807	H	E	E	E	E	H	M	E	2	N	L
DOG CREEK	170702010808	L	L	L	L	L	H	M	L	1	N	L
MAGONE LAKE	170702010901	H	H	E	E	E	H	M	E	3	N	M
COTTONWOOD CREEK	170702010902	H	H	E	E	H	L	M	H	3	N	M

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CLEAR CREEK	170702010903	M	M	M	M	M	H	H	H	3	N	M
LOWER BEECH CREEK	170702010904	L	L	L	L	L	L	H	L	3	N	M
LAYCOCK CREEK	170702011001	H	H	M	H	L	L	M	M	3	N	M
RILEY CREEK	170702011003	M	M	M	H	M	L	H	M	1	N	L
CLARK CREEK	170702011004	L	L	L	L	L	L	H	L	0	N	L
BIRCH CREEK	170702011005	H	H	M	M	M	L	M	M	1	N	L
DRY CREEK	170702011006	L	L	M	M	L	L	H	M	0	N	L
BELSHAW CREEK	170702011102	H	E	E	H	M	L	M	H	1	N	L
FIELDS CREEK	170702011103	H	H	E	E	E	M	H	E	3	Y	H
DRY CREEK	170702011104	M	L	L	L	L	H	H	M	0	N	L
CUMMINGS CREEK	170702011105	H	H	M	M	M	L	M	M	0	N	L
BRIDGE CREEK	170702011106	M	M	L	L	L	M	H	M	0	N	L
UPPER FOX CREEK	170702020901	M	M	M	M	L	L	M	M	2	N	L
WILEY CREEK	170702020902	E	E	E	E	H	L	M	E	0	N	L
MIDDLE FOX CREEK	170702020903	M	H	H	H	L	L	H	M	0	N	L
NORTH FACE CREEKS	170702020904	H	E	E	E	E	L	L	H	0	N	L

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Subwatershed Risk Ratings for Watershed/aquatics risk assessment												
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LOWER FOX CREEK	170702020905	H	E	H	E	M	L	M	H	2	N	L
UPPER DEER CREEK	170702021001	H	H	E	E	H	L	M	H	2	N	L
SQUAW CREEK	170702030101	E	E	E	E	H	L	L	H	3	N	M
IDAHO CREEK/SUMMIT CREEK	170702030102	H	H	E	E	E	L	L	H	3	N	M
DRY FORK	170702030103	E	E	E	E	H	L	L	H	3	N	M
CLEAR CREEK	170702030104	H	H	H	M	M	L	L	M	4	Y	H
BRIDGE CREEK	170702030105	E	E	E	E	H	L	L	H	2	N	L
MILL CREEK	170702030106	H	H	E	E	E	L	L	H	3	Y	H
VINEGAR CREEK	170702030201	H	H	E	E	E	M	L	H	4	Y	H
LITTLE BOULDER CREEK/DEERHORN	170702030202	M	M	H	H	H	H	M	H	3	Y	H
GRANITE BOULDER CREEK	170702030203	H	H	E	E	E	H	M	E	4	Y	H
BIG BOULDER CREEK	170702030204	M	M	M	M	H	M	L	M	3	N	M
COYOTE CREEK/BALANCE CREEK	170702030205	H	H	H	H	E	H	M	H	3	N	M
MIDDLE CAMP CREEK	170702030206	E	E	E	E	E	M	M	E	3	Y	H
LICK CREEK	170702030207	E	E	E	E	E	H	H	E	3	Y	H

Malheur National Forest—Roads Analysis—Appendix D

Subwatershed Risk Ratings for Watershed/aquatics risk assessment												
6TH LEVEL HUC NAME	HUC NUMBER	ROAD DENSITY RISK OML 1-5	ROAD DENSITY RISK OML 1-2	ROAD 200' PROXIMITY RISK ML 1-5	ROAD 200' PROXIMITY RISK ML 1-2	ROAD CROSSINGS RISK	GEOLOGIC SENSITIVITY	SOIL EROSION SENSITIVITY	OVERALL WATERSHED RISK	NUMBER OF TES SPECIES	STRONGHOLD (HES OR NO)	OVERALL AQUATICS RISK
LOWER CAMP CREEK	170702030208	H	H	E	E	E	H	M	E	3	Y	H
MOSQUITO CREEK/BEAR CREEK	170702030301	H	E	E	E	H	M	L	H	3	N	M
BIG CREEK	170702030302	M	M	H	M	H	M	L	M	3	Y	H
INDIAN CREEK	170702030303	E	E	E	E	E	M	L	E	3	N	M
SLIDE CREEK	170702030304	H	E	E	E	E	L	L	H	2	N	L
GRANITE CREEK	170702030305	H	E	M	M	M	L	L	M	3	N	M
HOG CREEK/CYCLONE CREEK	170702030401	H	H	E	H	H	M	L	H	2	N	L
CITY WATER	170702030402	M	M	M	M	H	L	M	M	2	N	L
LOWER BASIN CREEK	170702030404	H	M	H	M	E	L	H	H	2	N	L
LOWER PASS CREEK	170702030406	M	M	M	H	M	L	H	M	2	N	L
UPPER SWAMP CREEK	170703030301	M	H	L	L	L	L	H	M	0	N	L
BUCK CREEK	170703030303	H	H	L	L	L	L	H	M	0	N	L
MIDDLE FORK TWELVEMILE CREEK	170703030501	H	H	M	M	L	L	H	M	0	N	L
SOUTH FORK TWELVEMILE CREEK	170703030502	H	H	M	M	L	L	H	M	0	N	L
UPPER TWELVEMILE CREEK	170703030503	M	M	L	L	L	L	H	M	0	N	L

Subwatershed Risk Ratings for Watershed/aquatics risk assessment												
6TH LEVEL HUC NAME	HUC NUMBER	ROAD DENSITY RISK OML 1-5	ROAD DENSITY RISK OML 1-2	ROAD 200' PROXIMITY RISK ML 1-5	ROAD 200' PROXIMITY RISK ML 1-2	ROAD CROSSINGS RISK	GEOLOGIC SENSITIVITY	SOIL EROSION SENSITIVITY	OVERALL WATERSHED RISK	NUMBER OF TES SPECIES	STRONGHOLD (HES OR NO)	OVERALL AQUATICS RISK
UPPER GRINDSTONE CREEK	170703030601	H	H	L	L	L	L	H	M	0	N	L
FREEMAN CREEK	170703030701	H	H	M	M	M	L	H	H	1	N	L
SWAMP CREEK	170703030702	H	H	E	E	E	L	H	H	1	N	L
UPPER POISON CREEK	171200010101	H	H	M	M	L	L	H	M	1	N	L
LOWER POISON CREEK	171200010102	H	H	E	H	H	L	M	H	1	N	L
ARMSTRONG CANYON	171200010103	E	E	E	E	H	L	H	E	1	N	L
COFFEEPOT CREEK	171200010104	M	M	M	M	H	L	M	M	1	N	L
RATTLESNAKE CREEK	171200010105	H	H	E	E	H	L	M	H	1	N	L
COW CREEK	171200010106	H	H	M	M	M	L	M	M	1	N	L
HEADWATERS SILVIES RIVER	171200020101	E	E	E	E	E	L	L	H	1	N	L
STARR CREEK	171200020102	E	E	E	E	H	L	L	H	1	N	L
UPPER SCOTTY CREEK	171200020103	H	E	E	E	H	L	L	H	1	Y	M
VAN ASPEN CREEK	171200020104	E	E	E	E	E	L	L	H	1	N	L
UPPER BEAR CREEK	171200020201	H	H	E	E	M	L	L	H	1	Y	M
MIDDLE BEAR CREEK	171200020202	E	E	E	E	H	L	L	H	1	N	L
ANTELOPE CREEK	171200020203	H	E	E	E	M	L	L	H	1	N	L

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Subwatershed Risk Ratings for Watershed/aquatics risk assessment												
6TH LEVEL HUC NAME	HUC NUMBER	ROAD DENSITY RISK OML 1-5	ROAD DENSITY RISK OML 1-2	ROAD 200' PROXIMITY RISK ML 1-5	ROAD 200' PROXIMITY RISK ML 1-2	ROAD CROSSINGS RISK	GEOLOGIC SENSITIVITY	SOIL EROSION SENSITIVITY	OVERALL WATERSHED RISK	NUMBER OF TES SPECIES	STRONGHOLD (HES OR NO)	OVERALL AQUATICS RISK
LOWER BEAR CREEK	171200020204	E	H	E	E	M	L	M	H	1	N	L
SHIRTTAIL CREEK	171200020301	H	H	E	E	E	L	L	H	1	N	L
UPPER CAMP CREEK	171200020302	E	E	E	H	M	L	L	H	1	Y	M
SODA VALLEY	171200020303	H	H	H	H	M	L	H	H	1	N	L
FLAT CREEK - HOUSE CREEK	171200020304	H	H	E	H	M	L	M	H	1	N	L
MOUNTAIN CREEK	171200020305	H	H	H	H	M	L	H	H	1	N	L
UPPER TROUT CREEK	171200020306	H	H	E	E	H	L	L	H	1	N	L
TROUT CREEK FORKS	171200020307	M	M	H	H	H	L	H	H	1	Y	M
LOWER TROUT CREEK	171200020308	H	H	E	E	M	L	L	H	1	N	L
DOG CREEK - BADGER CANYON	171200020309	H	E	L	L	L	L	H	M	0	N	L
STANCLIFFE CREEK	171200020501	H	H	H	M	M	L	M	M	1	N	L
SAGE HEN CREEK	171200020502	H	H	M	M	M	L	M	M	1	N	L
MYRTLE CREEK	171200020503	H	E	M	M	L	L	M	M	1	Y	M
LANDING CREEK	171200020504	H	H	M	M	L	L	L	M	1	N	L
CROWSFOOT CREEK	171200020601	H	H	E	E	H	L	H	H	1	Y	M
WHISKEY CREEK	171200020602	H	H	E	E	H	L	M	H	1	N	L

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Subwatershed Risk Ratings for Watershed/aquatics risk assessment												
6TH LEVEL HUC NAME	HUC NUMBER	ROAD DENSITY RISK OML 1-5	ROAD DENSITY RISK OML 1-2	ROAD 200' PROXIMITY RISK ML 1-5	ROAD 200' PROXIMITY RISK ML 1-2	ROAD CROSSINGS RISK	GEOLOGIC SENSITIVITY	SOIL EROSION SENSITIVITY	OVERALL WATERSHED RISK	NUMBER OF TES SPECIES	STRONGHOLD (HES OR NO)	OVERALL AQUATICS RISK
BEAR CANYON CREEK	171200020603	H	H	E	E	H	L	M	H	1	Y	M
LITTLE EMIGRANT CREEK	171200020604	H	H	E	E	H	L	M	H	1	Y	M
CRICKET CREEK	171200020605	H	H	H	H	H	L	L	H	1	N	L
SAWTOOTH CREEK	171200020606	H	H	E	H	M	L	H	H	1	N	L
HAY CREEK	171200020608	H	H	E	E	H	L	M	H	1	N	L
YELLOWJACKET CREEK	171200020609	M	M	M	M	M	L	H	M	1	Y	M
EAST WILLOW CREEK	171200020701	H	H	E	E	M	L	H	H	0	N	L
UPPER SAGE HEN CREEK	171200020703	H	H	L	L	L	L	H	M	0	N	L
HOWARD CREEK	171200040101	H	H	E	E	M	L	H	H	1	N	L
COOPER - SILVER	171200040102	H	H	M	M	L	L	H	M	1	N	L
DODSON CREEK	171200040103	H	H	H	H	M	L	H	H	1	N	L
SAWMILL CREEK	171200040104	H	H	E	E	H	L	H	H	1	N	L
NICHOLL CREEK	171200040105	H	H	E	E	H	L	H	H	1	N	L
ROUGH CREEK	171200040106	M	H	H	H	M	L	H	H	1	N	L
EGYPT CREEK	171200040201	M	H	E	E	E	L	H	H	1	N	L
UPPER CLAW CREEK	171200040202	H	H	H	H	H	L	H	H	1	N	L

Subwatershed Risk Ratings for Watershed/aquatics risk assessment												
6TH LEVEL HUC NAME	HUC NUMBER	ROAD DENSITY RISK OML 1-5	ROAD DENSITY RISK OML 1-2	ROAD 200' PROXIMITY RISK ML 1-5	ROAD 200' PROXIMITY RISK ML 1-2	ROAD CROSSINGS RISK	GEOLOGIC SENSITIVITY	SOIL EROSION SENSITIVITY	OVERALL WATERSHED RISK	NUMBER OF TES SPECIES	STRONGHOLD (HES OR NO)	OVERALL AQUATICS RISK
LOWER CLAW CREEK	171200040203	L	L	L	L	L	L	H	L	1	N	L
SRINGS CANY	171200040301	M	M	M	H	E	L	H	H	0	N	L
SUNDOWN	171200040302	M	M	M	M	M	L	H	M	0	N	L
DICK MILLER	171200040303	M	H	E	E	E	L	H	H	0	N	L
ROCK QUARRY RESERVOIR	171200040304	L	L	L	L	L	L	H	L	0	N	L
RYEGRASS FLAT	171200040307	H	H	L	L	L	L	H	M	0	N	L

Malheur National Forest—Roads Analysis

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