



United States
Department of
Agriculture

Forest
Service

July 2015



Amendment to the Geology Report

Westside Fire Recovery Project

Happy Camp Oak Knoll and Salmon/Scott River Ranger Districts,
Klamath National Forest
Siskiyou County, California

For Information Contact: Angie Bell, Forest Geologist
1711 S. Main Street, Yreka, CA 96097
530-841-4583

Non-Discrimination Policy

The U.S. Department of Agriculture (USDA) prohibits discrimination against its customers, employees, and applicants for employment on the bases of race, color, national origin, age, disability, sex, gender identity, religion, reprisal, and where applicable, political beliefs, marital status, familial or parental status, sexual orientation, or all or part of an individual's income is derived from any public assistance program, or protected genetic information in employment or in any program or activity conducted or funded by the Department. (Not all prohibited bases will apply to all programs and/or employment activities.)

To File an Employment Complaint

If you wish to file an employment complaint, you must contact your agency's EEO Counselor (PDF) within 45 days of the date of the alleged discriminatory act, event, or in the case of a personnel action. Additional information can be found online at www.ascr.usda.gov/complaint_filing_file.html.

To File a Program Complaint

If you wish to file a Civil Rights program complaint of discrimination, complete the [USDA Program Discrimination Complaint Form](#) (PDF), found online at www.ascr.usda.gov/complaint_filing_cust.html, or at any USDA office, or call (866) 632-9992 to request the form. You may also write a letter containing all of the information requested in the form. Send your completed complaint form or letter to us by mail at U.S. Department of Agriculture, Director, Office of Adjudication, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410, by fax (202) 690-7442 or email at program.intake@usda.gov.

Persons with Disabilities

Individuals who are deaf, hard of hearing or have speech disabilities and you wish to file either an EEO or program complaint please contact USDA through the Federal Relay Service at (800) 877-8339 or (800) 845-6136 (in Spanish).

Persons with disabilities who wish to file a program complaint, please see information above on how to contact us by mail directly or by email. If you require alternative means of communication for program information (e.g., Braille, large print, audiotape, etc.) please contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).

Table of Contents

I.	Summary of Modifications between Draft and Final EIS.....	1
II.	Environmental Consequences of Modified Alternatives	7
	Modified Alternative 2.....	7
	Methods.....	7
	Environmental Consequences.....	7
	Project Area A: Beaver Fire.....	7
	Project Area B: Happy Camp Complex.....	8
	Project Area C: Whites Fire.....	8
	Modified Alternative 3.....	8
	Methods.....	8
	Environmental Consequences.....	8
	Project Area A: Beaver Fire.....	8
	Project Area B: Happy Camp Complex.....	9
	Project Area C: Whites Fire.....	9
III.	Summary of Environmental Consequences by Fire Area	10
	Methods.....	10
	Affected Environment.....	10
	Project Area A: Beaver Fire.....	10
	Project Area B: Happy Camp Complex.....	10
	Project Area C: Whites Fire.....	11
	Environmental Consequences.....	11
	Alternative 1.....	11
	Project Area A: Beaver Fire.....	11
	Project Area B: Happy Camp Complex.....	12
	Project Area C: Whites Fire.....	12
	Alternative 2.....	12
	Project Area A: Beaver Fire.....	12
	Project Area B: Happy Camp Complex.....	14
	Project Area C: Whites Fire.....	16
	Alternative 3.....	17
	Project Area A: Beaver Fire.....	17
	Project Area B: Happy Camp Complex.....	17
	Project Area C: Whites Fire.....	18
	Alternative 4.....	18
	Project Area A: Beaver Fire.....	18
	Project Area B: Happy Camp Complex.....	19
	Project Area C: Whites Fire.....	19
	Alternative 5.....	20
	Project Area A: Beaver Fire.....	20

Project Area B: Happy Camp Complex.....	20
Project Area C: Whites Fire.....	20
Modified Alternative 2.....	21
Project Area A: Beaver Fire.....	21
Project Area B: Happy Camp Complex.....	21
Project Area C: Whites Fire.....	22
Modified Alternative 3.....	22
Project Area A: Beaver Fire.....	22
Project Area B: Happy Camp Complex.....	23
Project Area C: Whites Fire.....	23
Summary of Effects	23
Compliance with law, regulation, policy, and the Forest Plan	25
IV. Additional Literature Cited.....	25
V. Maps and Supporting Tables	26

List of Tables

Table 1 (Modified from Table 2 of Geology report): Comparison of Alternatives for 7 th field watersheds with effects to duration of elevated risk.....	24
Table 2: Summary of effects to naturally occurring asbestos, cave resources, groundwater, unique geological area and rock material sources.	25
Table 3 (Modified from Table 3 of the Geology report): Landslide Risk Assessment for the Affected Environment and No Action with fire area information.	32
Table 4 (modified from Table 4 of the Geology report): Landslide Risk Assessment for Alternative 2 and Actions Considered for Cumulative Effects.	34
Table 5 (modified from Table 5 of the Geology report): Results of percent high and moderate disturbance analysis for alternatives 3, 4 and 5, alternative 2 as modified and Alternative 3 as modified. Cumulative percent disturbance includes the high and moderate disturbance expected from future actions analyzed in the cumulative effects analysis.	36
Table 6 (modified from Table 6 of the Geology report): Duration of elevated landslide risk due to the wildfire for all alternatives.	40
Table 7: Acres of unstable lands by fire area and treatment type. The estimates for salvage exclude streamside buffers and inner gorges where project design prohibits salvage and areas with very low or low fire severity according to the RAVG data.	44

List of Figures

Figure 1: Refined mapping of unstable lands for the Beaver Fire area.....	26
Figure 2: Refined mapping of unstable lands for the Happy Camp Fire area.....	27
Figure 3: Refined mapping of unstable lands for the Whites Fire area.....	28
Figure 4: Location of limestone bedrock in the Beaver fire area.....	29
Figure 5: Location of limestone bedrock in the Happy Camp fire area.....	30
Figure 6: Location of limestone bedrock in the Whites fire area (Note: there is no limestone in the Whites fire area this is included for completion).	31

I. Summary of Modifications between Draft and Final EIS

Changes and Clarifications in Methods Section

Methodology

There was 10 days for field review to validate geologic bedrock and geomorphic mapping, not three as was stated in the DEIS (page 235).

The detailed methods for determining the landslide risk and duration of elevated risk is in the methods section of the Geology report, not Appendix A as is stated in the DEIS (page 236).

For this analysis, active landslides include active earthflows (DEIS page 235 and Geology report page 8).

The geology analysis only uses the cumulative watershed effects model for alternative 2 in the landslide risk assessment (Geology report page 8). It makes the assumption that since there was no change in risk categories as a result of alternative 2 there is no change in landslide risk for alternatives 3, 4 or 5 (Geology report page 8). This assumption is supported by the model results in the Hydrology report (Appendix B). The differences between alternatives are less than 0.05. This is not enough to change the landslide risk for any 7th field watershed in the analysis area.

The landslide risk assessment used soil burn severity (Geology report page 9) which was finalized by the Burned Area Emergency Response team for each fire. The soil burn severity model represents the change in ground surface characteristics which is used to estimate hydrologic and erosive response of the watersheds (Parsons et al 2010). The duration of elevated risk used the Rapid Assessment of Vegetation Condition (RAVG) to estimate where the percent of trees killed by fire is enough to compromise root support.

The acres of salvage harvest on unstable lands for alternatives 2, 3, 4, 5, alternative 2 as modified and alternative 3 as modified excludes stream course Riparian Reserves and inner gorges and areas where RAVG predicted less than 50% basal area loss. The acres of unstable lands for other treatments for all action alternatives were calculated excluded stream course Riparian Reserves and inner gorges as mapped in the corporate GIS layer because only hand treatments of the understory are proposed in these landforms. There were exemptions made for the prohibition of salvage harvest on active landslides and toe zones of dormant landslides per field work. The treatments on unstable lands in discussion below include steep, weathered granitic lands, active landslides and toe zones of dormant landslides.

Landslide Risk

Site specific effects to landslide risk from temporary road and landing actions are added to the effects analysis.

Duration of Elevated Risk

To clarify the language in the duration of elevated risk methods section (DEIS page 236 and Geology report page 12), when 7th field watershed has more than 25% of the area burned at high and moderate vegetation severity and is planted the duration of elevated risk is reduced to about 30 years. If less than 25% of the high and moderate severity areas are planted the duration of elevated risk will be greater than

80 years. The exception is if a watershed has less than 10% high and moderate vegetation burn severity overall, then the landslide rate at the watershed scale will be recovered within 2-5 years.

The RAVG data used for the analysis in the DEIS was misclassified. This error was fixed and the percent watershed area with high and moderate vegetation burn severity has been recalculated for the FEIS analysis in this amendment. Areas not being salvaged harvested in salvage units were assumed to have not planting (retention areas, stream course Riparian Reserves and inner gorges) and areas with that had less than 50% basal area removed (RAVG). The information in the corporate GIS layer was used to estimate the extent of Riparian Reserves and inner gorges. In site preparation units it was assumed that all areas that had more than 50% basal area removed (RAVG) would be site prepped and planted.

Additional literature review was completed regarding the assumptions made in the analysis of duration of elevated risk. The assumptions made in the duration of elevated risk analysis are in the Geology Report (pg. 12). Marden (2012) discusses the effectiveness of reforestation on sediment yields including that from landslides in New Zealand. The climate is maritime, so the estimates of tree growth do not apply, but the benefit to physical processes from forests is applicable. Closed canopy and full-root occupancy are the desired condition when using reforestation as a method for reducing landslide rates (Marden, 2012).

Berndt and Gibbon (1958) excavated Douglas fir and ponderosa pine roots in Colorado. They found that a 5.5 inch diameter at breast height Douglas fir had roots as deep as 5 feet and with between 13 and 21 feet of lateral spread. A 4.5 inch diameter at breast height ponderosa pine had roots as deep as 5 feet and lateral spread of 20 feet. With those dimensions in mind, the assumption that landslide rate begins to be reduced with 10 inch diameter at breast height trees seems reasonable. Ten inch diameter at breast height trees will likely have roots with a lateral spread of at least 20 feet, which will provide nearly full-root coverage even if the trees are 40 feet apart. Finally, Reid and Page (2002) found that about 25% of the watershed must be reforested in order to see a 40% reduction in the landslide sediment rate. This supports the assumption that the landslide rate will be reduced, and thus the landslide risk, if 25% of the areas deforested by the wildfire are replanted.

A combination of Forest Vegetation Simulator (FVS) and professional judgment of the project Silviculturist were used to determine how long it would take to have 10 inch diameter at breast height in areas deforested by the wildfire (personal communication, January 30, 2015).

The watersheds with very high landslide risk means that should a landslide event occur it could potentially put human safety and private property at risk. Watersheds with high landslide risk could have landslide events that affect essential infrastructure (power lines, municipal water supplies, major roadways, etc.). These situations call for immediate mitigation of the landslide risk where possible. The best mitigation for wildfire effects to landslide processes on this scale is reforestation. Literature review indicates that any reforestation benefits the landslide process; however the most benefit is from planting more than 25% of the area with affected landslide processes (Reid and Page 2002). This is especially true where shallow landslides are the dominate process, such as in steep, severely weathered granitic lands. It is not safe to plant under large snags, so planting in this project will only occur where salvage logging or site preparation occur. So there is a direct positive relationship between the amount of

salvage logging and site preparation and the recovery of landslide processes and reduction of the amount of time a watershed has an elevated landslide risk.

Table 6 in the Geology report (Appendix C) indicates that watersheds with greater than or equal to 25% high and moderate burn severity have a duration of elevated risk of 50 years. This is incorrect. These watersheds have a duration of elevated risk of 30 years. Table 6 of this addendum contains the corrected duration of elevated risk information.

Effects to Unique Geologic Areas

Unique geologic areas include Geologic Special Interest Areas (SIA), Geologic Research Natural Areas (RNA), as well as features and landforms that are unique to the Klamath or Cascade Mountain Geologic Province. In the project area there is about 10 acres of the Marble Caves RNA in the Marble Mountain Wilderness and the entire North Russian Landslide Dam Special Interest Area. There are no treatments proposed within the boundary of the Marble Caves RNA. There is roadside treatment and underburning within the North Russian Landslide Dam Special Interest Area but no treatments on the landslide for which the special interest area was designated. There will be no effect to the character of the RNA or the SIA, so it is not discussed in any additional detail.

Likelihood of Effects to Cave Resources

Likelihood of effecting cave resources protected under the Federal Cave Resource Protection Act analysis was added to Section III of this amendment for each alternative and by fire area. Cave resources are only likely to be found in limestone or marble bedrock in the project area. The areas where limestone or marble bedrock overlapped with salvage, mechanical site preparation or hazard tree removal were field reviewed and assessed for the potential for cave resources to be present and the likelihood that should any caves occur in the area they would meet the requirements for significant caves.

The spatial scale for the analysis is the project boundary. Caves are non-renewable resources so once it is effected it will not recovery to pre-impact condition.

Likelihood of Effects to Groundwater Resources

The biggest influence on groundwater associated with vegetation management projects is the removal of live trees that are currently using groundwater for survival. A large portion of a watershed has to have green trees removed to have a measurable effect on groundwater resources (Kinal 2009). Most of the vegetation being removed by the Westside Fire Recovery project is dead or dying. These trees are not using any groundwater. There is no likely to be any effect to groundwater resources from the project and it is not analyzed any further in this report.

Likelihood of Effect to Rock Material Sources

There is no proposal to use or develop rock sources in the Westside Fire Recovery project. There will be no effect to rock material sources and it will not be discussed further in the analysis.

Disturbance of Naturally Occurring Asbestos

A discussion of naturally occurring asbestos has been added to address public comments. Naturally occurring asbestos is most likely to be found in ultramafic bedrock on the Klamath National Forest. There is one regulation that is applicable to the project regarding naturally occurring asbestos. This is the Asbestos Airborne Toxic Control Measure for Construction, Grading, Quarrying, and Surface Mining Operations (Section 93105) (<http://www.arb.ca.gov/toxics/atcm/asb2atcm.htm>). Timber harvest activities are explicitly exempt from this regulation (Section 3) except for new road construction. There is no new road construction in this project as defined in the regulation. This project does proposed temporary access road construction to allow for timber harvest, but these roads will be used to allow for temporary access to the units for harvest activities and closed after the project is complete. Their use will be temporary (less than 1-2 months) and they will never be open to public use. There are no regulations on Naturally Occurring Asbestos for this project. Disturbance of ultramafic rock (proxy for naturally occurring asbestos) will be analyzed per public comment.

The acres and length of temporary access roads proposed on ultramafic rock will be reported for each alternative by fire area in Section II and III of this report. The temporal boundary for the effects is during the ground disturbance plus about 10 minutes for the dust to settle. The spatial boundary for the effects is the road bed plus 100 feet on either side because that is all the further the asbestiform mineral dust is likely to travel.

Changes and Clarifications in Environmental Consequences Section

There were changes to the data analyzed for the DEIS due to additional field work and additional interdisciplinary review. The changes to the data analyzed between the DEIS and the FEIS are summarized in the project record.

The cumulative watershed effects models were not re-ran with the updated GIS data for the FEIS. The changes to the model risk ratio from the alternatives are less than 0.1 across watersheds and models (Appendix B of the Hydrology report). The changes in any given watershed from the data used in the cumulative watershed effects model for the DEIS are less than 1% on average in the 7th field watersheds with Lower Grider having a 4.4% reduction in proposed actions. The model is an approximation of effects and is not sensitive enough to distinguish such a small change at the 7th or 5th field watershed scale.

The tables in this addendum were updated from the Geology report to include the fire area information, modifications to analysis as a result of GIS data changes, and to add the effects of Modified alternative 2. Changes in the effects are described below by alternative.

Site preparation, roadside hazard removal and fuels treatments on unstable lands are subject to project design features Watershed 4, 8, 9, 22, 31, 32, and 33 in Chapter 2 of the FEIS.

Acres of Unstable Lands with Treatment

The acres of unstable lands with treatments were updated to reflect the change in the alternatives between the DEIS and FEIS. There were exemptions made for the prohibition of salvage harvest on active landslides and toe zones of dormant landslides per field work. All exemptions are for skyline and helicopter systems only and will only allow for the removal of dead or trees with more than a 70%

chance of dying in the next three to five years. The areas were field reviewed to determine if there were any recent movement on the landslides (<10 years) and the existing vegetation condition. The last major storm event was in 2006, so this criteria is intended to encompass any landslides that were activated during that storm which may still be sensitive to disturbance. The exemptions were made to ensure reforestation efforts are undertaken on the unstable lands where removal of salvage trees would be minimized via logging systems and needed infrastructure. The treatments on unstable lands in discussion below include steep, weathered granitic lands, active landslides and toe zones of dormant landslides.

Alternative 1

The analysis is the same as in the Geology report except there are two watersheds that have a change in the duration of elevated landslide risk. The change is due to the reclassification of the RAVG data (see above). The Geology report initially stated that Deep Creek and Rainy Valley Creek had elevated risks for more than 80 years. The analysis using the correctly classified RAVG data resulted in Deep Creek and Rainy Valley having a 2-5 year elevated risk because they had less than 10% high and moderate vegetation burn severity.

Alternative 2

There are about 2,500 acres of salvage harvest proposed on unstable lands as defined by the Forest Plan and considered to be Riparian Reserves. There is about 1,275 acres of roadside hazard tree removal on unstable lands. Fuels treatments will occur on about 385 acres of unstable lands and site preparation and planting on about 400 acres. Some of these treatments on unstable lands overlap the total footprint of treatment on unstable lands for this alternative are about 4,207 acres.

The changes between the DEIS and the FEIS are not enough to change the landslide risk for any of the watersheds (Table 4). The analysis using the correctly classified RAVG changed Deep Creek and Rainy Valley Creek from a duration of greater than 80 years to 2-5 years. The new analysis shows that Tompkins Creek, Upper East Fork Elk and Lower East Fork Elk now have a 30 year duration of elevated risk, where it was greater than 80 years in the Geology report (Table 6).

There are three temporary access road are proposed that will likely be built directly on ultramafic bedrock. These are new temporary access road 10 (accesses unit 22), temporary access road 18 (accesses unit 510) and temporary access road 26 (accesses unit 525). Temporary access road 10 will be on about 0.09 miles or about 0.5 acres of ultramafic bedrock and is more than 0.5 miles from any sensitive receptors. Temporary access road 18 will be on about 0.06 miles or 0.3 acres of ultramafic bedrock and is about 2.5 miles from any sensitive receptors. Temporary access road 26 will be on about 0.2 miles or 0.8 acres of ultramafic bedrock and is about 4.5 miles from sensitive receptors.

Alternative 3

There are about 2,280 acres of salvage harvest proposed on unstable lands as defined by the Forest Plan and considered to be Riparian Reserves. There is about 1,275 acres of roadside hazard tree removal on unstable lands. Fuels treatments will occur on about 385 acres of unstable lands and site preparation and

planting on about 400 acres. Some of these treatments on unstable lands overlap the total footprint of treatment on unstable lands for this alternative are about 3,927 acres.

The changes between the DEIS and the FEIS are not enough to change the landslide risk for any of the watersheds (Table 5). The analysis using the reclassified RAVG changed Deep Creek and Rainy Valley Creek from a duration of elevated risk of greater than 8- years to 2-5 years. The new analysis shows that Tompkins Creek, Horse Creek, Upper East Fork Elk Creek and Lower East Fork Elk Creek now have a 30 year duration of elevated risk, where it was greater than 80 years in the Geology report. Lower Grider Creek went from greater than 80 year duration of elevated risk in the Geology report to a 30 year duration (Table 6).

The temporary access roads directly on ultramafic rock are the same as for alternative 2.

Alternative 4

There are about 2,360 acres of salvage harvest proposed on unstable lands as defined by the Forest Plan and considered to be Riparian Reserves. There is about 1,260 acres of roadside hazard tree removal on unstable lands. Fuels treatments will occur on about 385 acres of unstable lands and site preparation and planting on about 400 acres. Some of these treatments on unstable lands overlap the total footprint of treatment on unstable lands for this alternative are about 4,067 acres. The original analysis was not clear on the change in effects due to modifications to temporary road access for alternative 4. There is no temporary road access (new temporary roads, temporary roads in existing roadbeds or re-opening of decommissioned roads) with stream crossings in this alternative. This reduces the site scale effects on debris flow volume described in the effects analysis of alternative 2. There will be no additional volume contributed to debris flows (should they occur) from temporary road crossings, since they will not occur in this alternative. There will be some temporary road access using ridgetop roads and spurs. The probability of these roads contributing to the likelihood of landsliding is negligible.

The changes between the DEIS and the FEIS are not enough to change the landslide risk for any of the watersheds (Table 5). The analysis using the reclassified RAVG changed Deep Creek and Rainy Valley Creek from a duration of elevated risk of greater than 8- years to 2-5 years. The new analysis shows that Cliff Valley Creek, Tompkins Creek, Horse Creek, Upper East Fork Elk Creek and Lower East Fork Elk Creek now have a 30 year duration of elevated risk, where it was greater than 80 years in the Geology report. Upper Elk Creek went from greater than 80 year duration of elevated risk in the Geology report to a 30 year duration (Table 6).

The temporary access roads directly on ultramafic rock are the same as for alternative 2.

Alternative 5

There are about 285 acres of salvage harvest proposed on unstable lands as defined by the Forest Plan and considered to be Riparian Reserves. There is about 1,275 acres of roadside hazard tree removal on unstable lands. Fuels treatments will occur on about 385 acres of unstable lands and site preparation and planting on about 40 acres. Some of these treatments on unstable lands overlap the total footprint of treatment on unstable lands for this alternative are about 1,852 acres.

The changes between the DEIS and the FEIS are not enough to change the landslide risk for any of the watersheds (Table 5). The analysis using the reclassified RAVG changed Deep Creek and Rainy Valley Creek from a duration of elevated risk of greater than 8- years to 2-5 years. The new analysis shows that O'Neil Creek, Walker Creek and Caroline Creek now have a 30 year duration of elevated risk, where it was greater than 80 years in the Geology report. Lower East Fork Elk Creek went from greater than 80 year duration of elevated risk in the Geology report to a 30 year duration (Table 6). There is no proposed temporary access roads construction directly on ultramafic rock in this alternative.

Map Additions

Maps of the unstable lands with a more refined steep, weathered granitic lands and active landslides layer were included in this amendment.

Maps showing the location of limestone/marble bodies for each fire area were added for reference related to areas with cave potential.

II. Environmental Consequences of Modified Alternatives

Modified Alternative 2

Methods

The methods used for this analysis can be found in detail in the Geology Resource report with the clarifications in Section I of this report incorporated.

Environmental Consequences

Project Area A: Beaver Fire

Direct Effects and Indirect Effects

There are 3 acres of salvage harvest proposed on unstable lands as defined by the Forest Plan and considered to be Riparian Reserves. There is about 60 acres of roadside hazard tree removal on unstable lands. Fuels treatments will occur on about 60 acres of unstable lands and site preparation and planting on about 10 acres. Some of these treatments on unstable lands overlap the total footprint of treatment on unstable lands for this alternative are about 77 acres. The indirect effects for landslide risk are the same as for alternative 2. The duration of elevated risk is the same as for alternative 2. The effects to landslide risk at the site scale are the same as for alternative 2.

The likelihood of effects to cave resources protected under the Federal Cave Resources Protection Act is the same as for alternative 2. There are no temporary access roads proposed directly on ultramafic rock.

Cumulative Effects

The cumulative effects are the same as for Alternative 2.

Project Area B: Happy Camp Complex

Direct Effects and Indirect Effects

There are about 2,285 acres of salvage harvest proposed on unstable lands as defined by the Forest Plan and considered to be Riparian Reserves. There is about 1,205 acres of roadside hazard tree removal on unstable lands. Fuels treatments will occur on about 310 acres of unstable lands and site preparation and planting on about 375 acres. Some of these treatments on unstable lands overlap the total footprint of treatment on unstable lands for this alternative are about 3,804 acres. The indirect effects for landslide risk are the same as for alternative 2. The duration of elevated risk is the same as alternative 2. The effects to landslide risk at the site scale are the same as for alternative 2.

The likelihood of effects to cave resources protected under the Federal Cave Resources Protection Act is the same as for alternative 2. The temporary access roads directly on ultramafic rock are the same as for alternative 2.

Cumulative Effects

The cumulative effects are the same as for Alternative 2.

Project Area C: Whites Fire

Direct Effects and Indirect Effects

There is less than 0.1 acres of salvage harvest proposed on unstable lands as defined by the Forest Plan and considered to be Riparian Reserves. There is about 10 acres of roadside hazard tree removal on unstable lands. Fuels treatments will occur on about 20 acres of unstable lands and site preparation and planting on about 10 acres. Some of these treatments on unstable lands overlap the total footprint of treatment on unstable lands for this alternative are about 23 acres. The duration of elevated risk is the same as for alternative 2. The effects to landslide risk at the site scale are the same as for alternative 2.

The likelihood of effects to cave resources protected under the Federal Cave Resources Protection Act is the same as for alternative 2. There are no temporary access roads proposed directly on ultramafic rock.

Cumulative Effects

The cumulative effects are the same as for Alternative 2.

Modified Alternative 3

Methods

The methods used for this analysis can be found in detail in the Geology Report.

Environmental Consequences

Project Area A: Beaver Fire

Direct Effects and Indirect Effects

There are no acres of salvage harvest proposed on unstable lands as defined by the Forest Plan and considered to be Riparian Reserves. There is about 60 acres of roadside hazard tree removal on unstable lands. Fuels treatments will occur on about 60 acres of unstable lands and site preparation and planting on about 8 acres. Some of these treatments on unstable lands overlap the total footprint of treatment on unstable lands for this alternative are about 75 acres. The indirect effects for landslide risk are the same as for alternative 2. The duration of elevated risk is the same as for alternative 2. The effects to landslide risk at the site scale are the same as for alternative 2.

The likelihood of effects to cave resources protected under the Federal Cave Resources Protection Act is the same as for alternative 2. There are no temporary access roads proposed directly on ultramafic rock.

Cumulative Effects

The cumulative effects are the same as for alternative 2.

Project Area B: Happy Camp Complex

Direct Effects and Indirect Effects

There are about 1,973 acres of salvage harvest proposed on unstable lands as defined by the Forest Plan and considered to be Riparian Reserves. There is about 1,077 acres of roadside hazard tree removal on unstable lands. Fuels treatments will occur on about 741 acres of unstable lands and site preparation and planting on about 380 acres. Some of these treatments on unstable lands overlap the total footprint of treatment on unstable lands for this alternative are about 3,128 acres. The indirect effects for landslide risk are the same as for alternative 2. The duration of elevated risk is the same as alternative 2 except Lower Grider Creek and Tompkins Creek have a duration of elevated risk of more than 80 years in alternative 3 as modified instead of 30 in alternative 2 (Table 6). The effects to landslide risk at the site scale are the same as for alternative 2.

The likelihood of effects to cave resources protected under the Federal Cave Resources Protection Act is the same as for alternative 2. The temporary access roads directly on ultramafic rock are the same as for alternative 2.

Cumulative Effects

Cumulative effects are the same as for alternative 2.

Project Area C: Whites Fire

Direct Effects and Indirect Effects

There is less than 0.1 acres of salvage harvest proposed on unstable lands as defined by the Forest Plan and considered to be Riparian Reserves. There is about 10 acres of roadside hazard tree removal on unstable lands. Fuels treatments will occur on about 20 acres of unstable lands and site preparation and planting on about 10 acres. Some of these treatments on unstable lands overlap the total footprint of treatment on unstable lands for this alternative are about 23 acres. The duration of elevated risk is the same as for alternative 2. The effects to landslide risk at the site scale are the same as for alternative 2.

The likelihood of effects to cave resources protected under the Federal Cave Resources Protection Act is the same as for alternative 2. There are no temporary access roads proposed directly on ultramafic rock.

Cumulative Effects

Cumulative effects are the same as for alternative 2.

III. Summary of Environmental Consequences by Fire Area

Methods

Clarifications to the methods in the Geology report and the DEIS are described above in Section I of this addendum.

Affected Environment

The general underlying geology and landslide processes were discussed by fire area in the Geology Resource Report.

Project Area A: Beaver Fire

The projects that were included in the affected environment analysis for the Beaver Fire area are Fish Meadow project, Johnny O'Neil Late Successional Reserve Habitat Restoration and Fuels Reduction project, private land salvage, timber harvest plans since 2005, and Burned Area Emergency Response treatments. The landslide risk is mainly moderate or high for watersheds in the Beaver Fire area with Miller Gulch being the exception with a low landslide risk. There are no watersheds with a very high landslide risk in the Beaver Fire area. Lumgreys Creek, Soda Creek, Lower West Fork Beaver Creek, Buckhorn Creek, Doggett Creek and Kohl Creek have high landslide risk meaning that there is a reasonable probability of a landsliding event given a 10 year storm event and that non-essential infrastructure may be impacted. The elevated risk is due to the wildfire effects and the effects of past (10 years) private land harvest. Currently, the duration of the elevated risk is about 80 years – which is about how long it is expected to take for forested landscape to recover (10 inch diameter at breast height trees).

On July 8, 2015 there was a rain event that, along with the fire effects, produced a debris flow event and sediment laden flows in Fish Gulch (a tributary to Beaver Creek). Field observations indicate that the debris flow was a result of the mobilization of the bulked sediment in the channel. The loss of tree canopy interception and water repelling (hydrophobic) soils lead to an increase in water delivered to the channel. This in combination with the increase in sediment in the channel from fire related soil erosion is the primary drivers of the debris flow event. There is no evidence of landsliding (debris slide or translational/rotational landslides) associated with this event.

Project Area B: Happy Camp Complex

The projects that were included in the affected environment analysis for the Happy Camp Fire area are Elk Thin project, Happy Camp Fire Protection Phase 2 project, Lake Mountain Foxtail Pine project, Lower Scott Roads project, Oak Flat Thin project, Two-Bit Vegetation Management project, Singleton

project, Thom Seider Vegetation Management and Fuels Reduction project, timber harvest plans since 2005, private land harvest and Burned Area Emergency Response treatments. The landslide risk is mainly moderate or high for the watersheds in the Happy Camp fire area. The three watersheds with very high landslide risk are in this fire area. They are Rancheria Creek, Walker Creek, and Lower Grider Creek. The elevated risk is due to the combination of the amount of high and moderate fire severity and the prevalent amount of steep, weathered granitic lands (unstable lands) in the watersheds. A very high landslide risk means that there is a reasonable probability of a landslide event given a 10 year storm event. Also that human safety and/or essential infrastructure is a risk from such a landslide event.

On July 8, 2015 there was a rain event that, along with the fire effects, produced a debris flow event in Grider Creek and Walker Creek. Field observations indicate that the debris flow and sediment laden flow was a result of the mobilization of the bulked sediment in the channel. The loss of tree canopy interception and water repelling (hydrophobic) soils lead to an increase in water delivered to the channel. This in combination with the increase in sediment in the channel from fire related soil erosion is the primary drivers of the debris flow event. There is no evidence of landsliding (debris slide or translational/rotational landslides) associated with this event.

Project Area C: Whites Fire

The projects that were included in the affected environment analysis for the Whites Fire area are the Jess project, Eddy Late Successional Reserve project and the North Fork Roads Storm-proofing project. The landslide risk is mainly very low, low and moderate for the watersheds in the Whites Fire area. There are four watersheds with high landslide risks are Lower North Russian Creek, Yellow Dog Creek, Whites Gulch and Jessups Gulch in the Whites Fire area. A high landslide risk means that there is a reasonable probability of a landsliding event given a 10 year storm event and that non-essential infrastructure may be impacted. The elevated risk is due to the wildfire effects and the effects of past (10 years) private land harvest.

On July 6, 2015 reports of a slug of sediment in North Russian Creek. Field observations indicate that the debris flow and sediment laden water was a result of the mobilization of the bulked sediment in the channel. The loss of tree canopy interception and water repelling (hydrophobic) soils lead to an increase in water delivered to the channel. This in combination with the increase in sediment in the channel from fire related soil erosion is the primary drivers of the debris flow event. There is no evidence of landsliding (debris slide or translational/rotational landslides) associated with this event.

Environmental Consequences

Alternative 1

Project Area A: Beaver Fire

The effects of taking no action for the Beaver Fire area are the same as for the other fire areas as described in the Geology Resource report.

Cumulative Effects

The only project analyzed as a future or on-going project is the McCollins project for the Beaver Fire area. There are no additional cumulative effects to the landslide risk or duration of elevated risk for the Beaver Fire Area.

Project Area B: Happy Camp Complex

Direct Effects and Indirect Effects

The effects of taking no action for the Happy Camp Fire area are the same as for the other fire areas as described in the Geology Resource report. The exception is the change in duration of elevated risk for Deep Creek and Rainy Valley Creek which changed from greater than 80 years to 2-5 years because the amount of high and moderate vegetation burn severity is less than 10% of the watershed using the reclassified RAVG data.

Cumulative Effects

Lovers Canyon project and the Scott Bar Fuels Reduction project are the only projects considered as on-going or future projects for this analysis. Other projects were analyzed in the affected environment (see Geology report). The Scott Bar Fuels Reduction has no effect on landslide risk. Lovers Canyon increases the risk ratios for South Fork Kelsey and Middle Creek by 0.03 and 0.02 respectively and the percent disturbed is increased by 3.3% for both watersheds. This change is not enough to increase the landslide risk in any of the 7th field watersheds. Neither of these projects have an effect on the duration of elevated risk.

Project Area C: Whites Fire

Direct Effects and Indirect Effects

The effects of taking no action for the Whites Fire area are the same as for the other fire areas as described in the Geology Resource report.

Cumulative Effects

The Jess project and Sawyers Bar Fuels Reduction project are the only projects considered as on-going or future projects for this analysis. The Sawyers Bar Fuels Reduction project has no effect on landslide risk. Jess project increases the risk ratio for 0.01 and 0.07 for the Eddy Gulch and Jessups Gulch respectively. The Jess project increases the percent of the watershed with high and moderate disturbance by 1.5% for both watersheds. This change is not enough to increase the landslide risk in any of the 7th field watersheds. Neither of these projects have an effect on the duration of elevated risk.

Alternative 2

Project Area A: Beaver Fire

Direct Effects and Indirect Effects

There are about 3 acres of salvage harvest proposed on unstable lands as defined by the Forest Plan and considered to be Riparian Reserves. There is about 60 acres of roadside hazard tree removal on unstable lands. Fuels treatments will occur on about 60 acres of unstable lands and site preparation and planting on about 10 acres. Some of these treatments on unstable lands overlap the total footprint of treatment on unstable lands for this alternative are about 75 acres.

There is no increase in landslide risk even at the site scale from salvage harvest even on unstable lands (Geology Report, page 10). Vegetation management can affect hillslope hydrology and root support which will increase landslide risk. The removal of fire-killed trees is not likely to cause measurable changes in hillslope hydrology as these trees no longer transpire or intercept precipitation (Jackson & Roering, 2009). The trees being removed will lose half their root support three years after the wildfire and will have nearly no effective root support after about 8 years. So the removal of fire killed trees will not reduce root strength (Ziemer and Swanston 1977 and Ziemer 1981). The salvage, site preparation and reforestation will decrease the time needed to reestablish conifer forest on unstable lands. This meets the Forest Plan Standard and Guideline 2-1 (page 4-18). It also helps to meet the Aquatic Conservation Strategy objective focused on sediment regimes. The reduction in landslide risk will reduce the probability of sediment delivery to streams from landslides from unstable lands which will put watersheds on a trajectory to maintain and restore the sediment regime.

Alternative 2 does not change the landslide risk for any watershed in the Beaver Fire area. There is a change in the risk ratio or the percent of watersheds with high or moderate disturbance for five watersheds due to treatments. The average change in risk ratio is 0.03 and the maximum change was 0.04. All four watersheds with a change in percent high and moderate disturbance have a change of 0.1%.

None of the watersheds in the Beaver Fire area have more than 75% of the high and moderate vegetation burn severity replanted. The expected duration of elevated risk for watersheds in the fire area with more than 10% of the area affected by high and moderate vegetation fire severity is greater than 80 years. This includes all of the watersheds with high landslide risk in the project area (Table 5). If less than 10% of the watershed was burned with high or moderate vegetation burn severity the elevated risk is assumed to be acute and will recover in 2-5 years (Table 6).

There are four connected actions that influence landslide risk- reopening of decommissioned roads, use of temporary roads on existing roadbeds, construction of new temporary roads and the construction of new landings. These activities were considered high disturbance and incorporated into the 7th field scale landslide risk assessment in the Geology report. The site scale effects are further analyzed here. There are two primary effects of reopening of decommissioned roads, use of temporary roads on existing roadbeds, construction of new temporary roads and the construction of new landings.

The first is changes to the hillslope mass balance such as undercutting and increasing the weight in unstable areas (spoil piles) from earthwork. There are no new temporary roads or landings being constructed on toe zones of dormant landslides, active landslides or inner gorges. The slope stability in

these areas is the most susceptible to the change in mass balance. Project design feature Watershed-20 restricts excess material from temporary roads, landings and other actions from being stored on active landslides. This minimizes the potential for landslide re-activation due to increased weight. The second is poor drainage on the roads and landings which concentrates water onto the hillslope which can exacerbate existing unstable lands or create new landslides. The cessation of the use of temporary roads per the Wet Weather Operations (Project Design Feature Watershed-1) will minimize any rutting or tire tracks that can concentrate water on the road and hillslope. Project design feature Watershed-22 requires the hydrologic stabilization of all temporary roads which includes control of the drainage on the roadbed. Project design feature Watershed-23 requires new landings to be configured for long-term drainage with the intention to establish natural runoff patterns. The landslide risk will remain above pre-project through the first winter after stabilization. Then they will be back to pre-project levels or below in areas where legacy sites are being addressed on temporary road access.

While the project design features minimize the effects to landslide risk it does not eliminate them. The likelihood of a landslide at the site scale from temporary road actions and the construction of new landings will be increased. The increase will be the most during implementation of the project and will be reduced after the hydrologic stabilization has occurred at the completion of the project.

There are no salvage units underlain by limestone or marble. There are two site preparation units (P094 and P085) that have mechanical site preparation with small bodies of limestone or marble in them. There are a few slivers of limestone or marble in roadside hazard tree units. Field review revealed little outcropping of bedrock and no caves were found in the proposed treatment units. There is not likely to be an effect to cave resources protected under the Federal Cave Resource Protection Act. There are no temporary access roads proposed directly on ultramafic rock.

Cumulative Effects

The only project analyzed as a future or on-going project is the McCollins project for the Beaver Fire area. There are no additional cumulative effects to the landslide risk or duration of elevated risk for the Beaver Fire Area with the addition of the effects of the McCollins project. There are no direct or indirect effects to cave resources so there are not cumulative effects.

Project Area B: Happy Camp Complex

Direct Effects and Indirect Effects

There are about 2,450 acres of salvage harvest proposed on unstable lands as defined by the Forest Plan and considered to be Riparian Reserves. There is about 1,205 acres of roadside hazard tree removal on unstable lands. Fuels treatments will occur on about 310 acres of unstable lands and site preparation and planting on about 375 acres. Some of these treatments on unstable lands overlap the total footprint of treatment on unstable lands for this alternative are about 4,108 acres.

Alternative 2 does not change the landslide risk for any watershed in the Happy Camp Fire area. There is a change in the risk ratio or the percent watershed high or moderate disturbance for twenty-one

watersheds. The average change in risk ratio is 0.03 and the maximum change was 0.10. The average change in percent watershed with high and moderate disturbance is 0.26% and the maximum change is 0.9% (Table 5). The site scale effects of salvage and reforestation on active landslides and toe zones of dormant landslides is the same as for the Beaver fire area.

There are two watersheds with a very high landslide risk that will have a reduced duration of elevated risk. Watersheds with a very high landslide risk have a high potential of landsliding that may affect human life and safety. These watersheds are Lower Grider and Walker Creek. There are four watersheds with a high landslide risk that will have a reduced duration of elevated risk for alternative 2. These watersheds have a reasonable probability of landsliding that may affect essential infrastructure and safety. They are Upper Grider, Cliff Valley, O'Neil, and Caroline Creeks. There are also six watersheds that have a moderate landslide risk that will have a reduced duration of elevated risk (see Table 1). In this alternative, these twelve watersheds will have this elevated risk for about 30 years, as opposed to greater than 80 years under the no action alternative. All watersheds that have more than 10% high and moderate vegetation fire severity will have a duration of elevated risk of greater than 80 years. If less than 10% of the watershed was burned with high or moderate vegetation burn severity the elevated risk is assumed to be acute and will recover in 2-5 years (Table 6).

The effect of landslide risk at the site scale is the same as for the Beaver Fire area.

There is one salvage unit underlain by limestone or marble (unit 228). This body was field reviewed for cave potential. The outcrops resemble small piles of boulders. They are scattered over the steep hillslope. No openings large enough to meet the legal definition of a cave were found. If a cave was missed during field review the likelihood of it meeting the criteria for significant is small. The outcrop is near the ridge so it is not likely to be hydrologically connected. It is a hot, dry site with small discreet bodies of limestone/marble and is not likely to contain any rare or endemic biota. The limestone/marble body is isolated and is not likely to be sought out for recreation or educational value and there is on the hillside without any great views so it is unlikely to have any significant cultural value. There was no extraordinary geologic value to the outcrop relative to other areas of limestone/marble on the forest. So even if a cave opening was missed during field evaluation it is not likely to meet the significance criteria outlined by the Federal Cave Resources Protection Act. There is not likely to be an effect to cave resources protected under the Federal Cave Resource Protection Act.

There are three temporary access road are proposed that will likely be built directly on ultramafic bedrock. These are new temporary access road 10 (accesses unit 22), temporary access road 18 (accesses unit 510) and temporary access road 26 (accesses unit 525). Temporary access road 10 will be on about 0.09 miles or about 0.5 acres of ultramafic bedrock and is more than 0.5 miles from any sensitive receptors. Temporary access road 18 will be on about 0.06 miles or 0.3 acres of ultramafic bedrock and is about 2.5 miles from any sensitive receptors. Temporary access road 26 will be on about 0.2 miles or 0.8 acres of ultramafic bedrock and is about 4.5 miles from sensitive receptors. Dust mitigation is a requirement for all access in the project area (temporary or existing). The temporary access lengths are short so speeds will remain low (less than 15 miles per hour). The dust mitigation combined with the slow speeds means that the potential for naturally occurring asbestos to leave the project area is very

low. Equipment is being washed before moving to new areas per the botany project design features intended to reduce weed spread and there are mitigations in place to minimize track out onto paved roads. Despite being exempt from the regulation the project will likely meet the requirements for construction in areas less than one acre.

Cumulative Effects

Lovers Canyon project and the Scott Bar Fuels Reduction project are the only projects considered as on-going or future projects for this analysis. Other projects were analyzed in the affected environment (see Geology Resource Report). The Scott Bar Fuels Reduction has no effect on landslide risk. Lovers Canyon increases the risk ratios for South Fork Kelsey and Middle Creek by 0.03 and 0.02 respectively (modified Table 3) and the percent disturbed is increased by 3.3% for both watersheds (modified Table 4). The landslide risks are not increased for any 7th field watershed by the addition of the effects of these projects. None of the projects effect the duration of elevated risk in the watersheds. There is no direct or indirect effects to cave resources therefore there is no cumulative effects. There are no projects that overlap in space or time with the use of temporary access roads on ultramafic rock so there are no cumulative effects.

Project Area C: Whites Fire

Direct Effects and Indirect Effects

There are less than 0.1 acres of salvage harvest proposed on unstable lands as defined by the Forest Plan and considered to be Riparian Reserves. There is about 10 acres of roadside hazard tree removal on unstable lands. Fuels treatments will occur on about 20 acres of unstable lands and site preparation and planting on about 10 acres. Some of these treatments on unstable lands overlap the total footprint of treatment on unstable lands for this alternative are about 23 acres.

Alternative 2 does not change the landslide risk for any watershed in the Whites Fire area (modified Table 4). There is no change in risk ratio and an average change in percent watershed with high and moderate disturbance is 0.15% and the maximum change is 0.2%. The effect of landslide risk at the site scale is the same as for the Beaver Fire area. The site scale effects of salvage and reforestation on active landslides and toe zones of dormant landslides is the same as for the Beaver fire area.

None of the watersheds in the Whites Fire area have more than 75% of the high and moderate vegetation burn severity replanted. The expected duration of elevated risk for watersheds in the fire area with more than 10% of the area affected by high and moderate vegetation fire severity is greater than 80 years (modified Table 7). If less than 10% of the watershed was burned with high or moderate vegetation burn severity the elevated risk is assumed to be acute and will recover in 2-5 years (Table 6).

There is no limestone or marble bedrock in the White Fire area so there is not likely to be an effect to cave resources protected under the Federal Cave Resource Protection Act.

There are no temporary access roads proposed directly on ultramafic rock.

Cumulative Effects

Jess project increases the risk ratio for 0.01 and 0.07 for the Eddy Gulch and Jessups Gulch respectively (modified Table 3). The Jess project increases the percent of the watershed with high and moderate disturbance by 1.5% for both watersheds (modified Table 4). The landslide risks are not increased for any 7th field watershed by the addition of the effects of these projects. None of the projects effect the duration of elevated risk in the watersheds. There are no direct or indirect effects to cave resources so there are no cumulative effects.

Alternative 3

Project Area A: Beaver Fire

Direct Effects and Indirect Effects

There are no acres of salvage harvest proposed on unstable lands as defined by the Forest Plan and considered to be Riparian Reserves. There is about 60 acres of roadside hazard tree removal on unstable lands. Fuels treatments will occur on about 60 acres of unstable lands and site preparation and planting on about 10 acres. Some of these treatments on unstable lands overlap the total footprint of treatment on unstable lands for this alternative are about 73 acres.

The indirect effects to the landslide risk and duration of elevated risk are the same as for alternative 2. The effects to landslide risk at the site scale are the same as for alternative 2. The likelihood of effects to cave resources protected under the Federal Cave Resources Protection Act is the same as for alternative 2. There are no temporary access roads proposed directly on ultramafic rock.

Cumulative Effects

The cumulative effects are the same as for Alternative 2.

Project Area B: Happy Camp Complex

Direct Effects and Indirect Effects

There are about 2,280 acres of salvage harvest proposed on unstable lands as defined by the Forest Plan and considered to be Riparian Reserves. There is about 1,205 acres of roadside hazard tree removal on unstable lands. Fuels treatments will occur on about 310 acres of unstable lands and site preparation and planting on about 375 acres. Some of these treatments on unstable lands overlap the total footprint of treatment on unstable lands for this alternative are about 3,831 acres. The indirect effects to the landslide risk for the watershed and site scales are the same as for alternative 2. The duration of elevated risk will not be reduced in Lower Grider Creek, because the percent of the 7th fields planted drops below 25%. All other duration of elevated risks will remain the same as alternative 2. The effects to landslide risk at the site scale are the same as for alternative 2. The likelihood of effects to cave resources protected under the Federal Cave Resources Protection Act is the same as for alternative 2. The temporary access roads on ultramafic rock are the same as for alternative 2.

Cumulative Effects

The cumulative effects are the same as for Alternative 2.

Project Area C: Whites Fire

Direct Effects and Indirect Effects

There are less than 0.1 acres of salvage harvest proposed on unstable lands as defined by the Forest Plan and considered to be Riparian Reserves. There is about 10 acres of roadside hazard tree removal on unstable lands. Fuels treatments will occur on about 20 acres of unstable lands and site preparation and planting on about 10 acres. Some of these treatments on unstable lands overlap the total footprint of treatment on unstable lands for this alternative are about 23 acres.

The indirect effects to the landslide risk at the watershed and site scale and duration of elevated risk are the same as for alternative 2 (Table 5 and Table 6). The effects to landslide risk at the site scale are the same as for alternative 2.

The likelihood of effects to cave resources protected under the Federal Cave Resources Protection Act is the same as for alternative 2. There are no temporary access roads proposed directly on ultramafic rock.

Cumulative Effects

The cumulative effects are the same as for Alternative 2.

Alternative 4

There is no temporary road access (new temporary roads, temporary roads in existing roadbeds or re-opening of decommissioned roads) with stream crossings proposed within the Beaver, Whites, or Happy Camp fire areas in this alternative. This reduces the site scale effects on debris flow volume described in the effects analysis of alternative 2. There will be no additional volume contributed to debris flows (should they occur) from temporary road crossings, since they will not occur in this alternative. There will be some temporary road access using ridgetop roads and spurs. The probability of these roads contributing to the likelihood of landsliding is negligible.

Project Area A: Beaver Fire

Direct Effects and Indirect Effects

There are about 3 acres of salvage harvest proposed on unstable lands as defined by the Forest Plan and considered to be Riparian Reserves. There is about 55 acres of roadside hazard tree removal on unstable lands. Fuels treatments will occur on about 60 acres of unstable lands and site preparation and planting on about 10 acres. Some of these treatments on unstable lands overlap the total footprint of treatment on unstable lands for this alternative are about 71 acres. The indirect effects to landslide risk at the watershed and site scale and duration of elevated risk are the same as for alternative 2.

The likelihood of effects to cave resources protected under the Federal Cave Resources Protection Act is the same as for alternative 2. There are no temporary access roads proposed directly on ultramafic rock.

Cumulative Effects

The cumulative effects are the same as for Alternative 2.

Project Area B: Happy Camp Complex

Direct Effects and Indirect Effects

There are about 2,360 acres of salvage harvest proposed on unstable lands as defined by the Forest Plan and considered to be Riparian Reserves. There is about 1,200 acres of roadside hazard tree removal on unstable lands. Fuels treatments will occur on about 375 acres of unstable lands and site preparation and planting on about 310 acres. Some of these treatments on unstable lands overlap the total footprint of treatment on unstable lands for this alternative are about 3,972 acres. The indirect effects to landslide risk are the same as for alternative 2. There are nine 7th field watersheds that have a reduction in the duration of elevated risk (modified Table 6). Upper Grider, Lower Grider, and Upper Elk Creeks will have an elevated risk for more than 80 years under this alternative compared to 30 years in alternative 2. All other watersheds have a duration of elevated risk that is the same as alternative 2. The effects to landslide risk at the site scale are the same as for alternative 2.

The likelihood of effects to cave resources protected under the Federal Cave Resources Protection Act is the same as for alternative 2. The temporary access roads on ultramafic rock are the same as for alternative 2.

Cumulative Effects

The cumulative effects are the same as for Alternative 2.

Project Area C: Whites Fire

Direct Effects and Indirect Effects

There are less than 0.1 acres of salvage harvest proposed on unstable lands as defined by the Forest Plan and considered to be Riparian Reserves. There is about 10 acres of roadside hazard tree removal on unstable lands. Fuels treatments will occur on about 20 acres of unstable lands and site preparation and planting on about 10 acres. Some of these treatments on unstable lands overlap the total footprint of treatment on unstable lands for this alternative are about 23 acres. The indirect effects to landslide risk and duration of elevated risk are the same as for alternative 2. The effects to landslide risk at the site scale are the same as for alternative 2.

The likelihood of effects to cave resources protected under the Federal Cave Resources Protection Act is the same as for alternative 2. There are no temporary access roads proposed directly on ultramafic rock.

Cumulative Effects

The cumulative effects are the same as for Alternative 2.

Alternative 5

Project Area A: Beaver Fire

Direct Effects and Indirect Effects

There are about 3 acres of salvage harvest proposed on unstable lands as defined by the Forest Plan and considered to be Riparian Reserves. There is about 60 acres of roadside hazard tree removal on unstable lands. Fuels treatments will occur on about 60 acres of unstable lands and site preparation and planting on about 10 acres. Some of these treatments on unstable lands overlap the total footprint of treatment on unstable lands for this alternative are about 77 acres. The indirect effects for landslide risk are the same as for alternative 2. The duration of elevated risk is the same as for alternative 2. The effects to landslide risk at the site scale are the same as for alternative 2.

The likelihood of effects to cave resources protected under the Federal Cave Resources Protection Act is the same as for alternative 2. There are no temporary access roads proposed directly on ultramafic rock.

Cumulative Effects

The cumulative effects are the same as for Alternative 2.

Project Area B: Happy Camp Complex

Direct Effects and Indirect Effects

There are about 285 acres of salvage harvest proposed on unstable lands as defined by the Forest Plan and considered to be Riparian Reserves. There is about 1,205 acres of roadside hazard tree removal on unstable lands. Fuels treatments will occur on about 310 acres of unstable lands and site preparation and planting on about 30 acres. Some of these treatments on unstable lands overlap the total footprint of treatment on unstable lands for this alternative are about 1,753 acres. The indirect effects for landslide risk are the same as for alternative 2. Only Middle Creek and Lower East Fork Elk Creek will have a reduced duration of elevated risk of 30 years in this alternative (Table 1). The salvage that is underlain by the limestone body described in alternative 2 is not included in this alternative. The effects to landslide risk at the site scale are the same as for alternative 2.

There are no salvage activities underlain by limestone or marble and the likelihood of effecting cave resources is unlikely for this alternative. There are no temporary access roads proposed directly on ultramafic rock.

Cumulative Effects

The cumulative effects are the same as for Alternative 2.

Project Area C: Whites Fire

Direct Effects and Indirect Effects

There are no acres of salvage harvest proposed on unstable lands as defined by the Forest Plan and considered to be Riparian Reserves. There is about 10 acres of roadside hazard tree removal on unstable lands. Fuels treatments will occur on about 20 acres of unstable lands and site preparation and planting on about 10 acres. Some of these treatments on unstable lands overlap the total footprint of treatment on unstable lands for this alternative are about 22 acres. The indirect effects for landslide risk are the same as for alternative 2. The duration of elevated risk is the same as for alternative 2.

The likelihood of effects to cave resources protected under the Federal Cave Resources Protection Act is the same as for alternative 2. There are no temporary access roads proposed directly on ultramafic rock.

Cumulative Effects

The cumulative effects are the same as for Alternative 2.

Modified Alternative 2

Project Area A: Beaver Fire

Direct Effects and Indirect Effects

There are about 3 acres of salvage harvest proposed on unstable lands as defined by the Forest Plan and considered to be Riparian Reserves. There is about 60 acres of roadside hazard tree removal on unstable lands. Fuels treatments will occur on about 60 acres of unstable lands and site preparation and planting on about 10 acres. Some of these treatments on unstable lands overlap the total footprint of treatment on unstable lands for this alternative are about 77 acres. The indirect effects for landslide risk are the same as for alternative 2. The duration of elevated risk is the same as for alternative 2. The effects to landslide risk at the site scale are the same as for alternative 2.

The likelihood of effects to cave resources protected under the Federal Cave Resources Protection Act is the same as for alternative 2. There are no temporary access roads proposed directly on ultramafic rock.

Cumulative Effects

The cumulative effects are the same as for Alternative 2.

Project Area B: Happy Camp Complex

Direct Effects and Indirect Effects

There are about 2,285 acres of salvage harvest proposed on unstable lands as defined by the Forest Plan and considered to be Riparian Reserves. There is about 1,205 acres of roadside hazard tree removal on unstable lands. Fuels treatments will occur on about 310 acres of unstable lands and site preparation and planting on about 375 acres. Some of these treatments on unstable lands overlap the total footprint of treatment on unstable lands for this alternative are about 3,804 acres. The indirect effects for landslide risk are the same as for alternative 2. The duration of elevated risk is the same as for alternative 2 except Lower Grider will have a duration of elevated risk of greater than 80 years (Table 1). The effects to landslide risk at the site scale are the same as for alternative 2.

The likelihood of effects to cave resources protected under the Federal Cave Resources Protection Act is the same as for alternative 2. The temporary access roads on ultramafic rock are the same as for alternative 2.

Cumulative Effects

The cumulative effects are the same as for Alternative 2.

Project Area C: Whites Fire

Direct Effects and Indirect Effects

There are less than 0.1 acres of salvage harvest proposed on unstable lands as defined by the Forest Plan and considered to be Riparian Reserves. There is about 10 acres of roadside hazard tree removal on unstable lands. Fuels treatments will occur on about 20 acres of unstable lands and site preparation and planting on about 10 acres. Some of these treatments on unstable lands overlap the total footprint of treatment on unstable lands for this alternative are about 23 acres. The indirect effects for landslide risk are the same as for alternative 2. The duration of elevated risk is the same as for alternative 2. The effects to landslide risk at the site scale are the same as for alternative 2.

The likelihood of effects to cave resources protected under the Federal Cave Resources Protection Act is the same as for alternative 2. There are no temporary access roads proposed directly on ultramafic rock.

Cumulative Effects

The cumulative effects are the same as for Alternative 2.

Modified Alternative 3

Project Area A: Beaver Fire

Direct Effects and Indirect Effects

There are no acres of salvage harvest proposed on unstable lands as defined by the Forest Plan and considered to be Riparian Reserves. There is about 60 acres of roadside hazard tree removal on unstable lands. Fuels treatments will occur on about 60 acres of unstable lands and site preparation and planting on about 8 acres. Some of these treatments on unstable lands overlap the total footprint of treatment on unstable lands for this alternative are about 75 acres. The indirect effects for landslide risk are the same as for alternative 2. The duration of elevated risk is the same as for alternative 2. The effects to landslide risk at the site scale are the same as for alternative 2.

The likelihood of effects to cave resources protected under the Federal Cave Resources Protection Act is the same as for alternative 2. There are no temporary access roads proposed directly on ultramafic rock.

Cumulative Effects

The cumulative effects are the same as for alternative 2.

Project Area B: Happy Camp Complex

Direct Effects and Indirect Effects

There are about 1,973 acres of salvage harvest proposed on unstable lands as defined by the Forest Plan and considered to be Riparian Reserves. There is about 1,077 acres of roadside hazard tree removal on unstable lands. Fuels treatments will occur on about 741 acres of unstable lands and site preparation and planting on about 380 acres. Some of these treatments on unstable lands overlap the total footprint of treatment on unstable lands for this alternative are about 3,128 acres. The indirect effects for landslide risk are the same as for alternative 2. The duration of elevated risk is the same as alternative 2 except Lower Grider and Tompkins Creek 7th field watersheds will have a duration of elevated risk of more than 80 years instead of 30 years under alternative 2. The effects to landslide risk at the site scale are the same as for alternative 2.

The likelihood of effects to cave resources protected under the Federal Cave Resources Protection Act is the same as for alternative 2. The temporary access roads directly on ultramafic rock are the same as for alternative 2.

Cumulative Effects

Cumulative effects are the same as for alternative 2.

Project Area C: Whites Fire

Direct Effects and Indirect Effects

There is less than 0.1 acres of salvage harvest proposed on unstable lands as defined by the Forest Plan and considered to be Riparian Reserves. There is about 10 acres of roadside hazard tree removal on unstable lands. Fuels treatments will occur on about 20 acres of unstable lands and site preparation and planting on about 10 acres. Some of these treatments on unstable lands overlap the total footprint of treatment on unstable lands for this alternative are about 23 acres. The duration of elevated risk is the same as for alternative 2. The effects to landslide risk at the site scale are the same as for alternative 2.

The likelihood of effects to cave resources protected under the Federal Cave Resources Protection Act is the same as for alternative 2. There are no temporary access roads proposed directly on ultramafic rock.

Cumulative Effects

Cumulative effects are the same as for alternative 2.

Summary of Effects

There is no change in landslide risk compared to current conditions for any watershed in any of the three fire areas. There is no reduction in the duration of elevated risk for any of the watersheds in Beaver or Whites Fire area. There are nine watersheds in the Happy Camp fire area that have changes in duration of elevated risk for at least one alternative (See modified Table 2).

Table 1 (Modified from Table 2 of Geology report): Comparison of Alternatives for 7th field watersheds with effects to duration of elevated risk.

7th field Watershed	Landslide Risk for all alternatives	Duration of Elevated Risk Alternative 1	Duration of Elevated Risk Alternative 2	Duration of Elevated Risk Alternative 3	Duration of Elevated Risk Alternative 4	Duration of Elevated Risk Alternative 5	Duration of Elevated Risk Modified Alternative 2	Duration of Elevated Risk Modified Alternative 3
Upper Grider Creek	High	Greater than 80 years	30 years	30 years	Greater than 80 years	Greater than 80 years	30 years	30 years
Cliff Valley	High	Greater than 80 years	30 years	30 years	30 years	Greater than 80 years	30 years	30 years
Lower Grider Creek	Very High	Greater than 80 years	30 years	Greater than 80 years	Greater than 80 years	Greater than 80 years	Greater than 80 years	Greater than 80 years
O'Neil Creek	High	Greater than 80 years	30 years	30 years	30 years	Greater than 80 years	30 years	30 years
Walker Creek	Very High	Greater than 80 years	30 years	30 years	30 years	Greater than 80 years	30 years	30 years
Caroline Creek	High	Greater than 80 years	30 years	30 years	30 years	Greater than 80 years	30 years	30 years
Middle Creek	Moderate	Greater than 80 years	30 years	30 years	30 years	30 years	30 years	30 years
Tompkins Creek	Moderate	Greater than 80 years	30 years	30 years	30 years	Greater than 80 years	30 years	Greater than 80 years
Horse Creek	Moderate	Greater than 80 years	30 years	30 years	30 years	Greater than 80 years	30 years	30 years
Upper East Fork Elk Creek	Moderate	Greater than 80 years	30 years	30 years	30 years	Greater than 80 years	30 years	30 years
Upper Elk Creek	Moderate	Greater than 80 years	30 years	30 years	Greater than 80 years	Greater than 80 years	30 years	30 years
Lower East Fork Elk Creek	Moderate	Greater than 80 years	30 years	30 years	30 years	30 years	30 years	30 years

Table 2: Summary of effects to naturally occurring asbestos, cave resources, groundwater, unique geological area and rock material sources.

	Acres of New Temporary Road on Ultramafic Rock	Likelihood of Affecting Cave Resources	Likelihood of Affecting Groundwater Resources	Likelihood of Affecting Unique Geological Areas	Likelihood of Affecting Rock Material Sources
Alternative 2	1.6	Very Low	No Effect	No Effect	No Effect
Alternative 3	1.6	Very Low	No Effect	No Effect	No Effect
Alternative 4	1.6	Very Low	No Effect	No Effect	No Effect
Alternative 5	0.0	Very Low	No Effect	No Effect	No Effect
Alternative 2 as Modified	1.6	Very Low	No Effect	No Effect	No Effect
Alternative 2 as Modified	1.6	Very Low	No Effect	No Effect	No Effect

Compliance with law, regulation, policy, and the Forest Plan

There is no change to compliance with law, regulation, policy and the Forest Plan from the Geology Resource report. All alternatives meet law, policy and regulation including Standards and Guidelines in the Forest Plan.

IV. Additional Literature Cited

- Berndt, H., Gibbon, R. 1958. Root Distribution of Some Native Trees and Understory Plants Growing on Three Sites Within Ponderosa Pine Watersheds in Colorado. US Department of Agriculture, Rocky Mountain Research Station. Station Paper No. 37.
- Jackson, M., Roering, J. 2009. Post-fire geomorphic response in steep, forested landscapes: Oregon Coast Range, USA. *Quaternary Geology*.
- Jones, M. and Paulo, J. January 30, 2015. Personal Communication.
- Marden, M. 2012. Effectiveness of Reforestation in Erosion Mitigation and Implications for Future Sediment Yields, East Coast Catchments, New Zealand: A Review. *New Zealand Geographer*, Vol. 68.
- Parsons, A., Robichaud, P., Lewis, S., Napper, C., Clark, J. 2010. Field Guide for Mapping Post-fire Soil Burn Severity. US Department of Agriculture, Rocky Mountain Research Station. RMRS-GRT 245.
- Reid LM, Page MJ (2002). Magnitude and frequency of landsliding in a large New Zealand catchment. *Geomorphology* 49 (1–2), 71–88.
- Ziemer, R. 1981. The role of vegetation in the stability of forested slopes. Pacific Southwest Research Station, Arcata, CA.
- Ziemer, R., Swanston, D. 1977. Root Strength Changes After Logging in Southeast Alaska. US Department of Agriculture, US Forest Service Pacific Northwest Experimental Station.

V. Maps and Supporting Tables

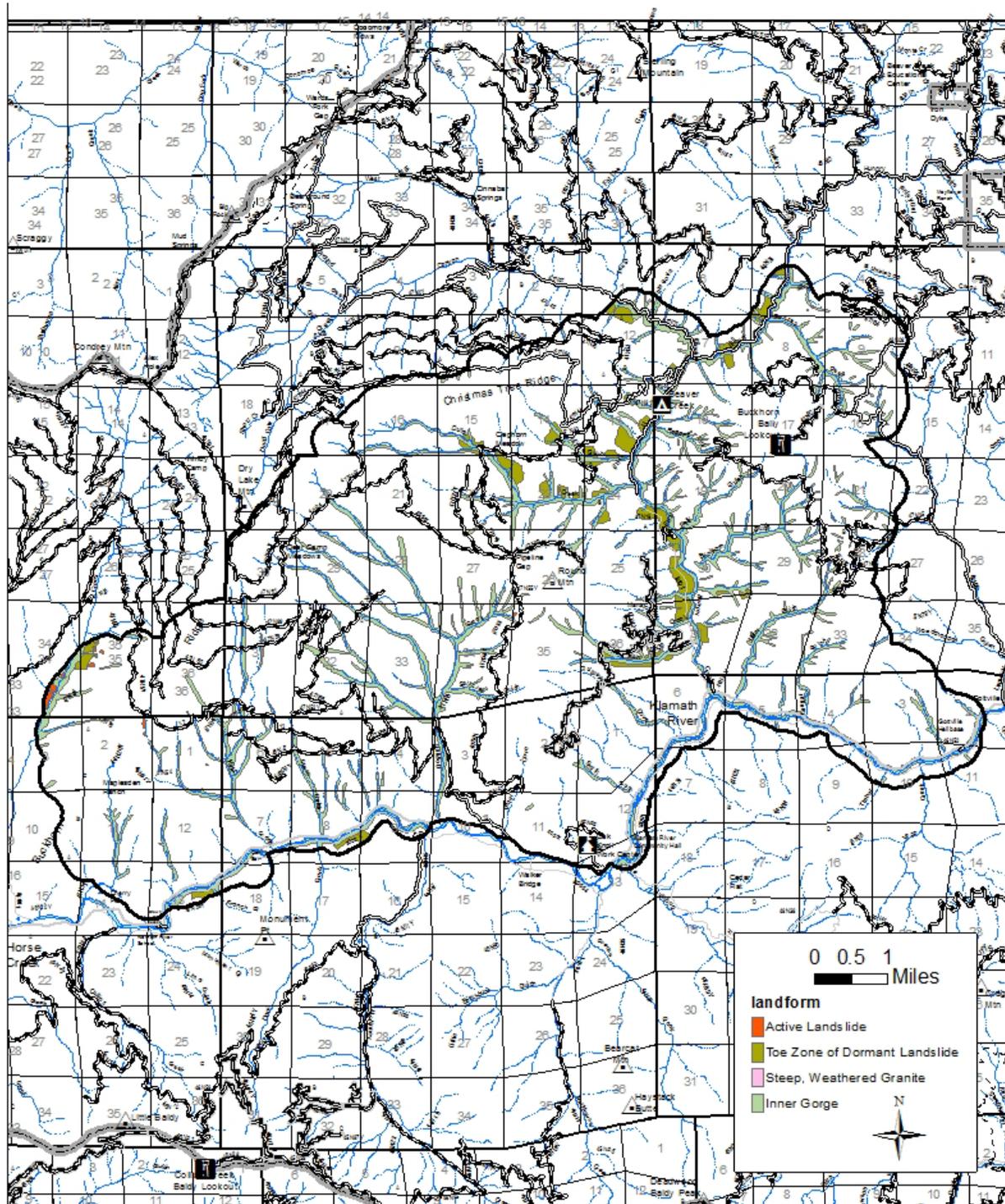


Figure 1: Refined mapping of unstable lands for the Beaver Fire area.

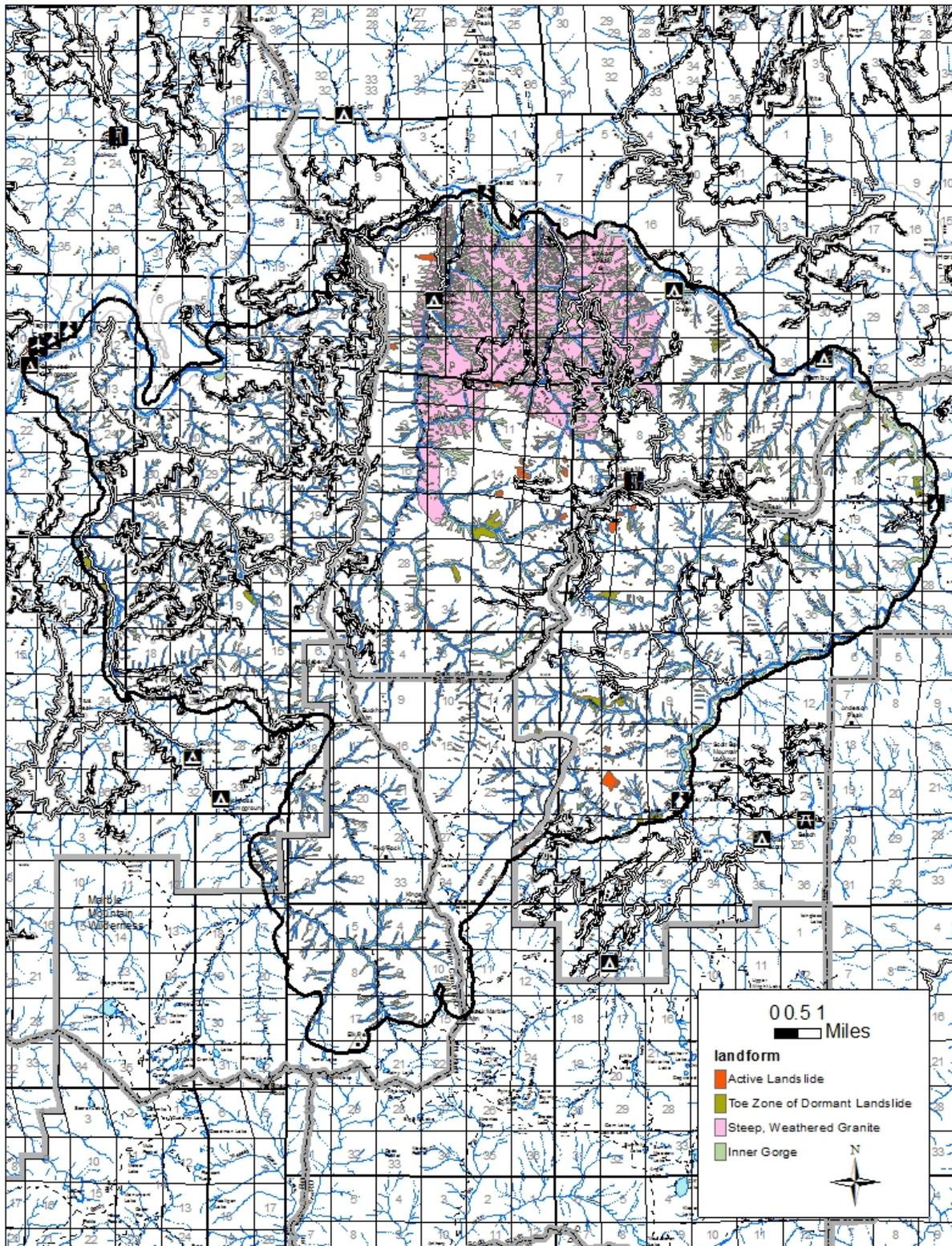


Figure 2: Refined mapping of unstable lands for the Happy Camp Fire area.

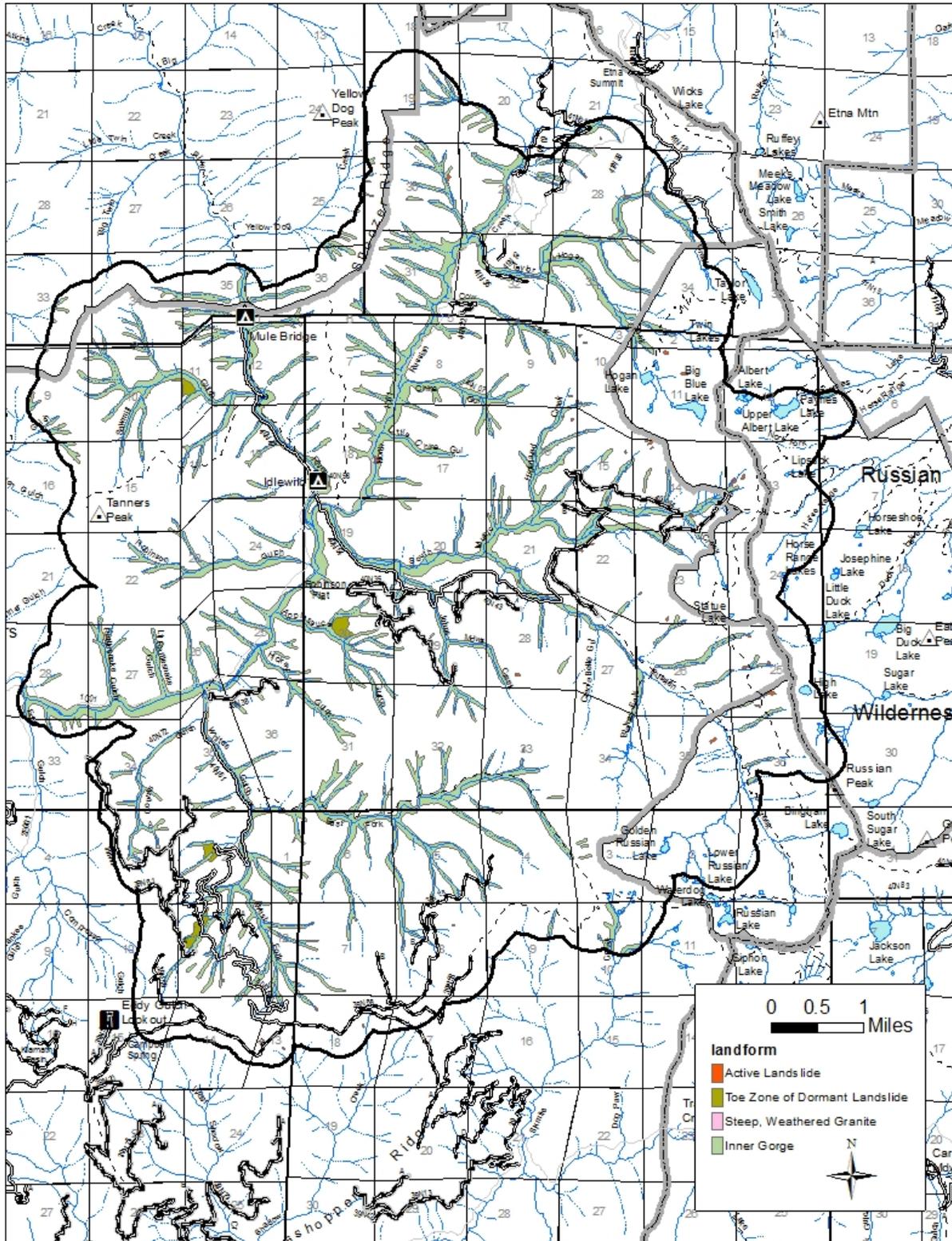


Figure 3: Refined mapping of unstable lands for the Whites Fire area.

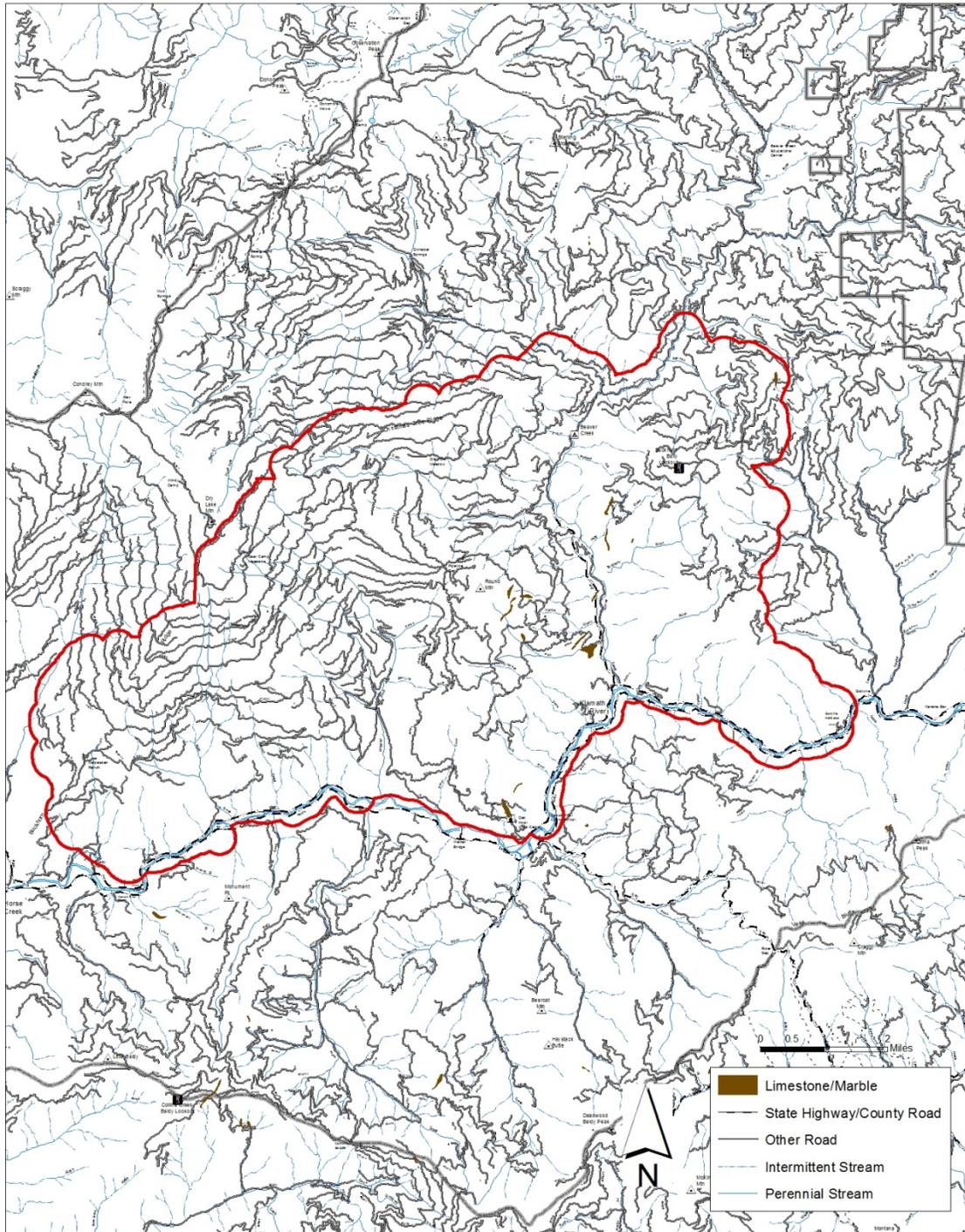


Figure 4: Location of limestone bedrock in the Beaver fire area.

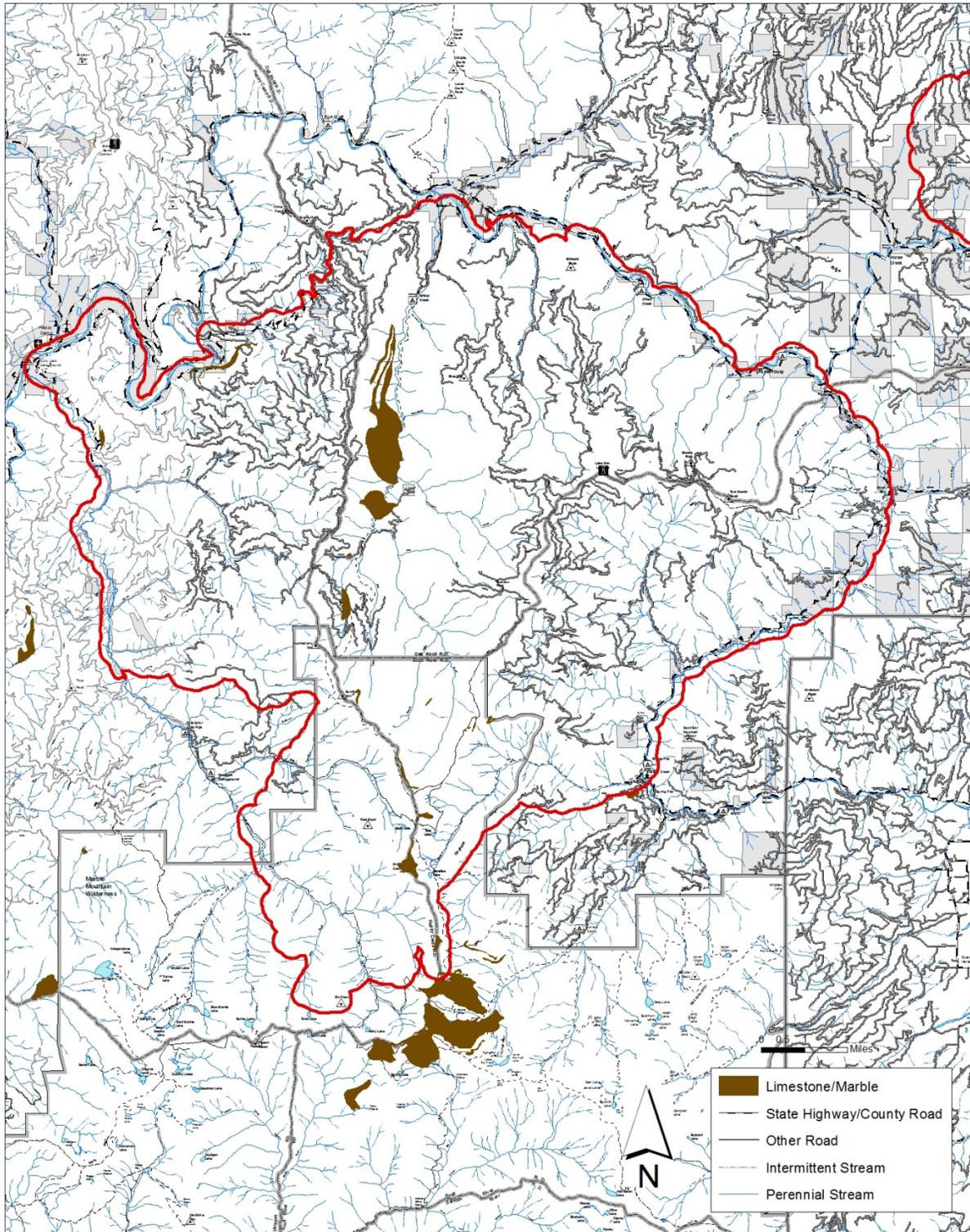


Figure 5: Location of limestone bedrock in the Happy Camp fire area.

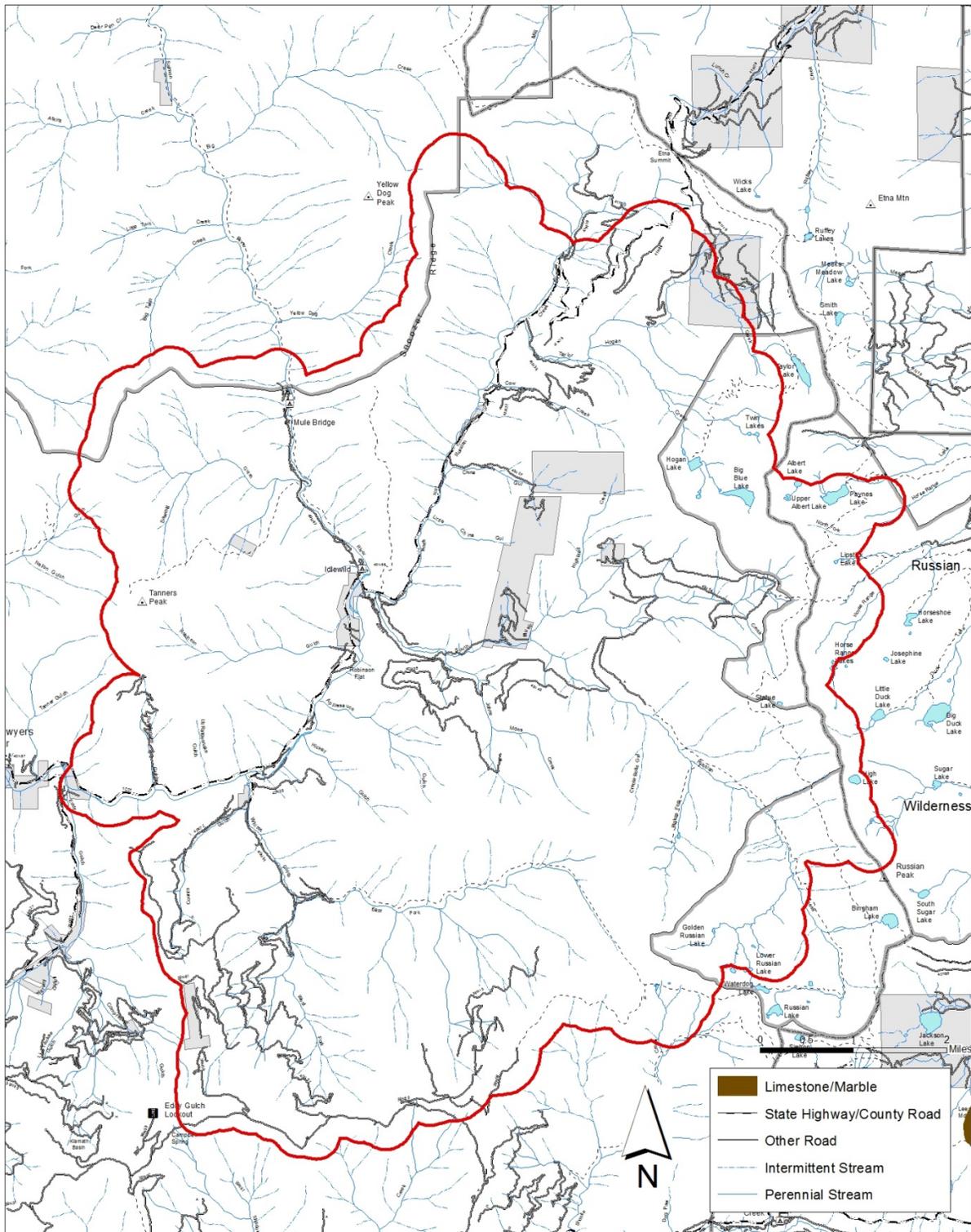


Figure 6: Location of limestone bedrock in the Whites fire area (Note: there is no limestone in the Whites fire area this is included for completion).

Table 3 (Modified from Table 3 of the Geology report): Landslide Risk Assessment for the Affected Environment and No Action with fire area information.

Watershed Code	Watershed Name	Fire Area	Consequence of Landslide Event	Percent Watershed Unstable	Current Risk Ratio	Percent Disturbance last decade	Current Landslide Likelihood	Current Landslide Risk
18010206080302	Lumgrey Creek	Beaver	Moderate	9.5%	1.04	2.1%	Highly Likely	High
18010206080304	Miller Gulch-Klamath River	Beaver	Minor	10.3%	0.75	8.6%	Likely	Low
18010206090203	Soda Creek-Beaver Creek	Beaver	Moderate	17.0%	1.46	12.7%	Highly Likely	High
18010206090301	Jaynes Canyon	Beaver	Moderate	14.3%	0.85	14.8%	Likely	Moderate
18010206090304	Lower West Fork Beaver Creek	Beaver	Moderate	13.5%	1.05	12.0%	Highly Likely	High
18010206090401	Dutch Creek	Beaver	Minor	13.0%	0.93	45.2%	Highly Likely	Moderate
18010206090402	Buckhorn Gulch-Beaver Creek	Beaver	Moderate	18.1%	1.16	55.1%	Highly Likely	High
18010206100202	Quigleys Cove-Klamath River	Beaver	Moderate	5.9%	0.72	21.7%	Likely	Moderate
18010206100301	Doggett Creek	Beaver	Moderate	9.7%	1.11	49.3%	Highly Likely	High
18010206100303	Dona Creek-Klamath River	Beaver	Minor	12.8%	1.16	25.6%	Highly Likely	Moderate
18010206100406	Buckhorn Creek	Beaver	Moderate	11.2%	0.68	10.5%	Likely	Moderate
18010206100501	Kohl Creek	Beaver	Moderate	8.1%	1.18	66.9%	Highly Likely	High
18010206100502	Collins Creek-Klamath River	Beaver	Moderate	8.8%	0.78	13.7%	Likely	Moderate
18010206110101	Upper Grider Creek	Happy Camp	Catastrophic	11.5%	0.31	24.0%	Likely	High
18010206110102	Cliff Valley Creek	Happy Camp	Catastrophic	12.3%	0.33	12.8%	Likely	High
18010206110103	Rancheria Creek	Happy Camp	Catastrophic	21.6%	0.68	46.4%	Highly Likely	Very High
18010206110104	Lower Grider Creek	Happy Camp	Catastrophic	58.5%	1.09	36.5%	Almost Certain	Very High
18010206110301	Tom Martin Creek-Klamath River	Happy Camp	Minor	16.3%	0.44	26.2%	Highly Likely	Moderate
18010206110303	O'Neil Creek	Happy Camp	Moderate	56.1%	1.5	28.6%	Almost Certain	High
18010206110304	Schutts Gulch-Klamath River	Happy Camp	Nuisance	31.3%	1.15	6.8%	Highly Likely	Low
18010206110305	Walker Creek	Happy Camp	Catastrophic	69.8%	1.89	29.6%	Almost Certain	Very High
18010206110306	Caroline Creek-Klamath River	Happy Camp	Moderate	68.4%	1.64	11.4%	Almost Certain	High
18010206110307	West Grider Creek-Klamath River	Happy Camp	Minor	16.0%	0.59	2.3%	Likely	Low
18010208020301	Upper French Creek	Whites	Moderate	5.8%	0.78	4.8%	Likely	Moderate
18010208020402	Sugar Creek	Whites	Minor	5.4%	0.45	0.1%	Unlikely	Very Low
18010208060101	Upper Canyon Creek	Happy Camp	Minor	5.3%	0.07	2.8%	Unlikely	Very Low
18010208060301	North Fork Kelsey Creek	Happy Camp	Moderate	12.0%	0.46	17.7%	Likely	Moderate
18010208060302	South Fork Kelsey Creek	Happy Camp	Moderate	16.1%	0.35	2.6%	Likely	Moderate
18010208060401	Middle Creek	Happy Camp	Minor	15.0%	1.09	19.6%	Highly Likely	Moderate
18010208060402	Deep Creek-Scott River	Happy Camp	Minor	16.7%	1.39	10.1%	Highly Likely	Moderate
18010208060403	Tompkins Creek	Happy Camp	Moderate	15.5%	0.85	18.6%	Likely	Moderate
18010208060601	McCarthy Creek-Scott River	Happy Camp	Moderate	13.3%	0.43	18.1%	Likely	Moderate
18010208060602	Big Ferry-Swanson	Happy Camp	Moderate	10.9%	0.61	31.5%	Highly Likely	High
18010208060603	Franklin Gulch-Scott River	Happy Camp	Minor	17.4%	0.39	11.3%	Likely	Low
18010209020302	China Creek	Happy Camp	Moderate	12.6%	0.75	5.2%	Likely	Moderate
18010209020303	Horse Creek	Happy Camp	Moderate	14.9%	0.76	12.5%	Likely	Moderate

Watershed Code	Watershed Name	Fire Area	Consequence of Landslide Event	Percent Watershed Unstable	Current Risk Ratio	Percent Disturbance last decade	Current Landslide Likelihood	Current Landslide Risk
18010209020305	Fryingpan Creek-Klamath River	Happy Camp	Moderate	14.4%	0.75	5.1%	Likely	Moderate
18010209030101	Headwaters Elk Creek	Happy Camp	Moderate	11.4%	0.15	21.7%	Likely	Moderate
18010209030102	Rainy Valley Creek	Happy Camp	Moderate	12.2%	0.02	5.2%	Likely	Moderate
18010209030103	Toms Valley Creek-Elk Creek	Happy Camp	Moderate	11.2%	0.6	14.9%	Likely	Moderate
18010209030104	Granite Creek	Happy Camp	Moderate	9.3%	1.52	32.8%	Almost Certain	High
18010209030105	Middle Elk Creek	Happy Camp	Moderate	18.9%	2.85	56.0%	Almost Certain	High
18010209030201	Upper East Fork Elk Creek	Happy Camp	Moderate	13.0%	0.54	22.9%	Likely	Moderate
18010209030202	Upper Elk Creek	Happy Camp	Moderate	13.8%	0.43	17.7%	Likely	Moderate
18010209030203	Lower East Fork Elk Creek	Happy Camp	Moderate	15.4%	0.48	21.1%	Likely	Moderate
18010209030301	Bear Creek	Happy Camp	Moderate	12.9%	1.01	26.4%	Highly Likely	High
18010209030302	Bishop Creek-Elk Creek	Happy Camp	Moderate	17.6%	1.76	18.0%	Highly Likely	High
18010209030303	Doolittle Creek	Happy Camp	Moderate	15.3%	0.46	25.7%	Highly Likely	High
18010209030304	Cougar Creek-Elk Creek	Happy Camp	Moderate	16.4%	0.64	6.3%	Likely	Moderate
18010209030305	Hoop&Devil-Elk Creek	Happy Camp	Moderate	15.2%	0.6	2.1%	Likely	Moderate
18010209060103	Benjamin Creek-Klamath River	Happy Camp	Minor	15.6%	0.63	5.1%	Likely	Low
18010210010304	Sixmile Creek	Whites	Minor	13.6%	0.38	2.2%	Likely	Low
18010210010306	Shadow Creek	Whites	Minor	17.3%	0.45	3.7%	Likely	Low
18010210020301	Upper South Russian Creek	Whites	Minor	4.4%	0.78	19.6%	Likely	Low
18010210020302	Music Creek	Whites	Minor	13.5%	1.21	43.5%	Highly Likely	Moderate
18010210020303	Lower South Russian Creek	Whites	Moderate	12.6%	0.66	20.7%	Likely	Moderate
18010210020401	Upper North Russian Creek	Whites	Minor	14.5%	0.98	4.3%	Highly Likely	Moderate
18010210020402	Taylor Creek	Whites	Minor	10.7%	0.53	13.3%	Likely	Low
18010210020403	Lower North Russian Creek	Whites	Moderate	18.8%	0.83	34.1%	Highly Likely	High
18010210020502	Big Creek	Whites	Minor	14.9%	0	0.0%	Likely	Low
18010210020503	Yellow Dog Creek-North Fork Salmon River	Whites	Major	16.1%	0.28	13.7%	Likely	High
18010210020603	Specimen Creek	Whites	Minor	18.0%	0.65	0.2%	Likely	Low
18010210020701	Whites Gulch	Whites	Moderate	13.4%	0.64	31.7%	Highly Likely	High
18010210020702	Robinson Gulch-North Fork Salmon River	Whites	Minor	17.0%	0.8	41.3%	Highly Likely	Moderate
18010210020703	Eddy Gulch	Whites	Moderate	16.4%	0.76	0.0%	Likely	Moderate
18010210020704	Jessups Gulch-North Fork Salmon River	Whites	Major	15.6%	0.59	0.1%	Likely	High
18010210020705	Jackass Gulch	Whites	Minor	18.7%	0.19	16.0%	Likely	Low

Table 4 (modified from Table 4 of the Geology report): Landslide Risk Assessment for Alternative 2 and Actions Considered for Cumulative Effects.

Watershed Code	Watershed Name	Fire Area	Alt 2 Risk Ratio	Total Percent Disturbance (current % plus Alt 2 %)	Alt. 2 Landslide Likelihood	Alt. 2 Landslide Risk	Cumulative Risk Ratio	Total percent disturbance (current % plus Alt 2 % plus Future %)	Alt 2 Cumulative Landslide Likelihood	Alt 2 Cumulative Landslide Risk
18010206080302	Lumgrey Creek	Beaver	1.04	2.1%	Highly Likely	High	1.04	2.1%	Highly Likely	High
18010206080304	Miller Gulch-Klamath River	Beaver	0.75	8.6%	Likely	Low	0.75	8.6%	Likely	Low
18010206090203	Soda Creek-Beaver Creek	Beaver	1.46	12.7%	Highly Likely	High	1.46	12.7%	Highly Likely	High
18010206090301	Jaynes Canyon	Beaver	0.85	14.8%	Likely	Moderate	0.85	14.8%	Likely	Moderate
18010206090304	Lower West Fork Beaver Creek	Beaver	1.05	12.0%	Highly Likely	High	1.05	12.0%	Highly Likely	High
18010206090401	Dutch Creek	Beaver	0.96	45.4%	Highly Likely	Moderate	0.96	45.4%	Highly Likely	Moderate
18010206090402	Buckhorn Gulch-Beaver Creek	Beaver	1.17	55.2%	Highly Likely	High	1.17	55.2%	Highly Likely	High
18010206100202	Quigleys Cove-Klamath River	Beaver	0.76	21.8%	Likely	Moderate	0.76	21.8%	Likely	Moderate
18010206100301	Doggett Creek	Beaver	1.15	49.4%	Highly Likely	High	1.15	49.4%	Highly Likely	High
18010206100303	Dona Creek-Klamath River	Beaver	1.2	25.6%	Highly Likely	Moderate	1.2	25.6%	Highly Likely	Moderate
18010206100406	Buckhorn Creek	Beaver	0.68	10.5%	Likely	Moderate	0.68	10.5%	Likely	Moderate
18010206100501	Kohl Creek	Beaver	1.19	67.0%	Highly Likely	High	1.19	67.0%	Highly Likely	High
18010206100502	Collins Creek-Klamath River	Beaver	0.78	13.7%	Likely	Moderate	0.78	13.7%	Likely	Moderate
18010206110101	Upper Grider Creek	Happy Camp	0.35	24.2%	Likely	High	0.35	24.2%	Likely	High
18010206110102	Cliff Valley Creek	Happy Camp	0.34	13.1%	Likely	High	0.34	13.1%	Likely	High
18010206110103	Rancheria Creek	Happy Camp	0.68	46.4%	Highly Likely	Very High	0.68	46.4%	Highly Likely	Very High
18010206110104	Lower Grider Creek	Happy Camp	1.11	36.8%	Almost Certain	Very High	1.11	36.8%	Almost Certain	Very High
18010206110301	Tom Martin Creek-Klamath River	Happy Camp	0.46	26.3%	Highly Likely	Moderate	0.46	26.3%	Highly Likely	Moderate
18010206110303	O'Neil Creek	Happy Camp	1.51	29.1%	Almost Certain	High	1.51	29.1%	Almost Certain	High
18010206110304	Schutts Gulch-Klamath River	Happy Camp	1.15	6.8%	Highly Likely	Low	1.15	6.8%	Highly Likely	Low
18010206110305	Walker Creek	Happy Camp	1.92	29.8%	Almost Certain	Very High	1.92	29.8%	Almost Certain	Very High
18010206110306	Caroline Creek-Klamath River	Happy Camp	1.72	12.5%	Almost Certain	High	1.72	12.5%	Almost Certain	High
18010206110307	West Grider Creek-Klamath River	Happy Camp	0.59	2.3%	Likely	Low	0.59	2.3%	Likely	Low
18010208020301	Upper French Creek	Whites	0.78	4.8%	Likely	Moderate	0.78	4.8%	Likely	Moderate
18010208020402	Sugar Creek	Whites	0.45	0.1%	Unlikely	Very Low	0.45	0.1%	Unlikely	Very Low
18010208060101	Upper Canyon Creek	Happy Camp	0.07	2.8%	Unlikely	Very Low	0.07	2.8%	Unlikely	Very Low
18010208060301	North Fork Kelsey Creek	Happy Camp	0.46	17.7%	Likely	Moderate	0.46	17.7%	Likely	Moderate
18010208060302	South Fork Kelsey Creek	Happy Camp	0.35	2.6%	Likely	Moderate	0.38	5.9%	Likely	Moderate
18010208060401	Middle Creek	Happy Camp	1.2	19.9%	Highly Likely	Moderate	1.2	19.9%	Highly Likely	Moderate
18010208060402	Deep Creek-Scott River	Happy Camp	1.39	10.1%	Highly Likely	Moderate	1.41	13.9%	Highly Likely	Moderate
18010208060403	Tompkins Creek	Happy Camp	0.86	18.7%	Likely	Moderate	0.86	18.7%	Likely	Moderate
18010208060601	McCarthy Creek-Scott River	Happy Camp	0.43	18.2%	Likely	Moderate	0.43	18.2%	Likely	Moderate
18010208060602	Big Ferry-Swanson	Happy Camp	0.61	31.6%	Highly Likely	High	0.61	31.6%	Highly Likely	High
18010208060603	Franklin Gulch-Scott River	Happy Camp	0.39	11.3%	Likely	Low	0.39	11.3%	Likely	Low

Watershed Code	Watershed Name	Fire Area	Alt 2 Risk Ratio	Total Percent Disturbance (current % plus Alt 2 %)	Alt. 2 Landslide Likelihood	Alt. 2 Landslide Risk	Cumulative Risk Ratio	Total percent disturbance (current % plus Alt 2 % plus Future %)	Alt 2 Cumulative Landslide Likelihood	Alt 2 Cumulative Landslide Risk
18010209020302	China Creek	Happy Camp	0.77	5.6%	Likely	Moderate	0.77	5.6%	Likely	Moderate
18010209020303	Horse Creek	Happy Camp	0.85	13.2%	Likely	Moderate	0.85	13.2%	Likely	Moderate
18010209020305	Fryingpan Creek-Klamath River	Happy Camp	0.75	5.3%	Likely	Moderate	0.75	5.3%	Likely	Moderate
18010209030101	Headwaters Elk Creek	Happy Camp	0.15	21.7%	Likely	Moderate	0.15	21.7%	Likely	Moderate
18010209030102	Rainy Valley Creek	Happy Camp	0.02	5.2%	Likely	Moderate	0.02	5.2%	Likely	Moderate
18010209030103	Toms Valley Creek-Elk Creek	Happy Camp	0.6	14.9%	Likely	Moderate	0.6	14.9%	Likely	Moderate
18010209030104	Granite Creek	Happy Camp	1.52	32.8%	Almost Certain	High	1.52	32.8%	Almost Certain	High
18010209030105	Middle Elk Creek	Happy Camp	2.85	56.0%	Almost Certain	High	2.85	56.0%	Almost Certain	High
18010209030201	Upper East Fork Elk Creek	Happy Camp	0.5	23.0%	Likely	Moderate	0.5	23.0%	Likely	Moderate
18010209030202	Upper Elk Creek	Happy Camp	0.41	18.5%	Likely	Moderate	0.41	18.5%	Likely	Moderate
18010209030203	Lower East Fork Elk Creek	Happy Camp	0.43	21.3%	Likely	Moderate	0.43	21.3%	Likely	Moderate
18010209030301	Bear Creek	Happy Camp	1.01	26.4%	Highly Likely	High	1.01	26.4%	Highly Likely	High
18010209030302	Bishop Creek-Elk Creek	Happy Camp	1.76	18.0%	Highly Likely	High	1.76	18.0%	Highly Likely	High
18010209030303	Doolittle Creek	Happy Camp	0.44	25.7%	Highly Likely	High	0.44	25.7%	Highly Likely	High
18010209030304	Cougar Creek-Elk Creek	Happy Camp	0.6	6.3%	Likely	Moderate	0.6	6.3%	Likely	Moderate
18010209030305	Hoop&Devil-Elk Creek	Happy Camp	0.57	2.1%	Likely	Moderate	0.57	2.1%	Likely	Moderate
18010209060103	Benjamin Creek-Klamath River	Happy Camp	0.63	5.1%	Likely	Low	0.63	5.1%	Likely	Low
18010210010304	Sixmile Creek	Whites	0.38	2.2%	Likely	Low	0.38	2.2%	Likely	Low
18010210010306	Shadow Creek	Whites	0.45	3.7%	Likely	Low	0.45	3.7%	Likely	Low
18010210020301	Upper South Russian Creek	Whites	0.78	19.7%	Likely	Low	0.78	19.7%	Likely	Low
18010210020302	Music Creek	Whites	1.21	43.5%	Highly Likely	Moderate	1.21	43.5%	Highly Likely	Moderate
18010210020303	Lower South Russian Creek	Whites	0.66	20.7%	Likely	Moderate	0.66	20.7%	Likely	Moderate
18010210020401	Upper North Russian Creek	Whites	0.98	4.3%	Highly Likely	Moderate	0.98	4.3%	Highly Likely	Moderate
18010210020402	Taylor Creek	Whites	0.53	13.3%	Likely	Low	0.53	13.3%	Likely	Low
18010210020403	Lower North Russian Creek	Whites	0.83	34.1%	Highly Likely	High	0.83	34.1%	Highly Likely	High
18010210020502	Big Creek	Whites	0	0.0%	Likely	Low	0	0.0%	Likely	Low
18010210020503	Yellow Dog Creek-North Fork Salmon River	Whites	0.28	13.7%	Likely	High	0.28	13.7%	Likely	High
18010210020603	Specimen Creek	Whites	0.65	0.2%	Likely	Low	0.65	0.2%	Likely	Low
18010210020701	Whites Gulch	Whites	0.64	31.9%	Highly Likely	High	0.64	31.9%	Highly Likely	High
18010210020702	Robinson Gulch-North Fork Salmon River	Whites	0.8	41.3%	Highly Likely	Moderate	0.8	41.3%	Highly Likely	Moderate
18010210020703	Eddy Gulch	Whites	0.76	0.0%	Likely	Moderate	0.77	1.5%	Likely	Moderate
18010210020704	Jessups Gulch-North Fork Salmon River	Whites	0.59	0.1%	Likely	High	0.66	15.1%	Likely	High
18010210020705	Jackass Gulch	Whites	0.19	16.0%	Likely	Low	0.19	16.0%	Likely	Low

Table 5 (modified from Table 5 of the Geology report): Results of percent high and moderate disturbance analysis for alternatives 3, 4 and 5, alternative 2 as modified and Alternative 3 as modified. Cumulative percent disturbance includes the high and moderate disturbance expected from future actions analyzed in the cumulative effects analysis.

Watershed Code	Watershed Name	Fire Area	Alt3 Disturbance (acre)	Percent Disturbance for Alt 3	Cumulative Percent Disturbance Alt 3	Alt4 Disturbance (acre)	Percent Disturbance for Alt 4	Cumulative Percent Disturbance Alt 4	Alt5 Disturbance (acre)	Percent Disturbance for Alt 5	Cumulative Percent Disturbance Alt 5	Percent Disturbance for Modified Alt. 2	Cumulative Percent Disturbance Modified Alt. 2	Percent Disturbance for Modified Alt. 3	Cumulative Percent Disturbance Modified Alt. 3
18010206080302	Lumgreycreek	Beaver	0.00	2.1%	2.1%	0.00	2.1%	2.1%	0.00	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%
18010206080304	Miller Gulch-Klamath River	Beaver	0.00	8.6%	8.6%	0.00	8.6%	8.6%	0.00	8.6%	8.6%	8.6%	8.6%	8.6%	8.6%
18010206090203	Soda Creek-Beaver Creek	Beaver	0.00	12.7%	12.7%	0.00	12.7%	12.7%	0.00	12.7%	12.7%	12.7%	12.7%	12.7%	12.7%
18010206090301	Jaynes Canyon	Beaver	0.00	14.8%	14.8%	0.00	14.8%	14.8%	0.00	14.8%	14.8%	14.8%	14.8%	14.8%	14.8%
18010206090304	Lower West Fork Beaver Creek	Beaver	0.00	12.0%	12.0%	0.00	12.0%	12.0%	0.00	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%
18010206090401	Dutch Creek	Beaver	7.52	45.4%	45.4%	3.02	45.3%	45.3%	4.49	45.3%	45.3%	45.4%	45.4%	45.4%	45.4%
18010206090402	Buckhorn Gulch-Beaver Creek	Beaver	7.13	55.2%	55.2%	3.02	55.1%	55.1%	2.60	55.1%	55.1%	55.2%	55.2%	55.2%	55.2%
18010206100202	Quigleys Cove-Klamath River	Beaver	3.98	21.8%	21.8%	3.98	21.8%	21.8%	3.98	21.8%	21.8%	21.8%	21.8%	21.8%	21.8%
18010206100301	Doggett Creek	Beaver	9.62	49.4%	49.4%	4.74	49.4%	49.4%	8.11	49.4%	49.4%	49.4%	49.4%	49.4%	49.4%
18010206100303	Dona Creek-Klamath River	Beaver	1.20	25.6%	25.6%	0.99	25.6%	25.6%	1.20	25.6%	25.6%	25.6%	25.6%	25.6%	25.6%
18010206100406	Buckhorn Creek	Beaver	5.92	10.5%	10.5%	5.92	10.5%	10.5%	0.00	10.5%	10.5%	10.5%	10.5%	10.6%	10.6%
18010206100501	Kohl Creek	Beaver	4.78	67.0%	67.0%	4.29	67.0%	67.0%	1.02	66.9%	66.9%	67.0%	67.0%	67.0%	67.0%
18010206100502	Collins Creek-Klamath River	Beaver	2.42	13.7%	13.7%	2.42	13.7%	13.7%	0.00	13.7%	13.7%	13.7%	13.7%	13.7%	13.7%
18010206110101	Upper Grider Creek	Happy Camp	19.68	24.2%	24.2%	3.87	24.0%	24.0%	18.16	24.2%	24.2%	24.2%	24.2%	24.1%	24.1%
18010206110102	Cliff Valley Creek	Happy Camp	12.78	13.1%	13.1%	3.02	12.8%	12.8%	5.22	12.9%	12.9%	13.1%	13.1%	13.0%	13.0%
18010206110103	Rancheria Creek	Happy Camp	0.00	46.4%	46.4%	0.00	46.4%	46.4%	0.00	46.4%	46.4%	46.4%	46.4%	46.4%	46.4%
18010206110104	Lower Grider Creek	Happy Camp	33.47	36.8%	36.8%	21.02	36.7%	36.7%	18.76	36.7%	36.7%	36.8%	36.8%	36.7%	36.7%

Watershed Code	Watershed Name	Fire Area	Alt3 Disturbance (acre)	Percent Disturbance for Alt 3	Cumulative Percent Disturbance Alt 3	Alt4 Disturbance (acre)	Percent Disturbance for Alt 4	Cumulative Percent Disturbance Alt 4	Alt5 Disturbance (acre)	Percent Disturbance for Alt 5	Cumulative Percent Disturbance Alt 5	Percent Disturbance for Modified Alt. 2	Cumulative Percent Disturbance Modified Alt. 2	Percent Disturbance for Modified Alt. 3	Cumulative Percent Disturbance Modified Alt. 3
18010206110301	Tom Martin Creek-Klamath River	Happy Camp	12.95	26.3%	26.3%	12.95	26.3%	26.3%	9.29	26.3%	26.3%	26.3%	26.3%	26.3%	26.3%
18010206110303	O'Neil Creek	Happy Camp	12.25	29.1%	29.1%	6.12	28.9%	28.9%	9.63	29.0%	29.0%	29.1%	29.1%	28.9%	28.9%
18010206110304	Schutts Gulch-Klamath River	Happy Camp	2.35	6.8%	6.8%	1.88	6.8%	6.8%	2.35	6.8%	6.8%	6.8%	6.8%	6.8%	6.8%
18010206110305	Walker Creek	Happy Camp	18.50	29.8%	29.8%	9.99	29.7%	29.7%	10.93	29.7%	29.7%	29.8%	29.8%	29.8%	29.8%
18010206110306	Caroline Creek-Klamath River	Happy Camp	20.14	12.5%	12.5%	7.04	11.8%	11.8%	20.14	12.5%	12.5%	12.3%	12.3%	12.1%	12.1%
18010206110307	West Grider Creek-Klamath River	Happy Camp	0.00	2.3%	2.3%	0.00	2.3%	2.3%	0.00	2.3%	2.3%	2.3%	2.3%	2.3%	2.3%
18010208020301	Upper French Creek	Whites	0.00	4.8%	4.8%	0.00	4.8%	4.8%	0.00	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%
18010208020402	Sugar Creek	Whites	0.00	0.1%	0.1%	0.00	0.1%	0.1%	0.00	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
18010208060101	Upper Canyon Creek	Happy Camp	0.00	2.8%	2.8%	0.00	2.8%	2.8%	0.00	2.8%	2.8%	2.8%	2.8%	2.8%	2.8%
18010208060301	North Fork Kelsey Creek	Happy Camp	0.00	17.7%	17.7%	0.00	17.7%	17.7%	0.00	17.7%	17.7%	17.7%	17.7%	17.7%	17.7%
18010208060302	South Fork Kelsey Creek	Happy Camp	0.00	2.6%	5.9%	0.00	2.6%	5.9%	0.00	2.6%	5.9%	2.6%	5.9%	2.6%	5.9%
18010208060401	Middle Creek	Happy Camp	13.44	19.9%	19.9%	1.51	19.7%	19.7%	13.44	19.9%	19.9%	19.9%	19.9%	19.8%	19.8%
18010208060402	Deep Creek-Scott River	Happy Camp	0.00	10.1%	13.9%	0.00	10.1%	13.9%	0.00	10.1%	13.9%	10.1%	13.9%	10.1%	13.9%
18010208060403	Tompkins Creek	Happy Camp	13.85	18.7%	18.7%	11.90	18.7%	18.7%	0.94	18.6%	18.6%	18.7%	18.7%	18.7%	18.7%
18010208060601	McCarthy Creek-Scott River	Happy Camp	8.51	18.2%	18.2%	6.27	18.2%	18.2%	0.89	18.1%	18.1%	18.2%	18.2%	18.2%	18.2%
18010208060602	Big Ferry-Swanson	Happy Camp	3.24	31.6%	31.6%	3.24	31.6%	31.6%	3.24	31.6%	31.6%	31.6%	31.6%	31.5%	31.5%

Watershed Code	Watershed Name	Fire Area	Alt3 Disturbance (acre)	Percent Disturbance for Alt 3	Cumulative Percent Disturbance Alt 3	Alt4 Disturbance (acre)	Percent Disturbance for Alt 4	Cumulative Percent Disturbance Alt 4	Alt5 Disturbance (acre)	Percent Disturbance for Alt 5	Cumulative Percent Disturbance Alt 5	Percent Disturbance for Modified Alt. 2	Cumulative Percent Disturbance Modified Alt. 2	Percent Disturbance for Modified Alt. 3	Cumulative Percent Disturbance Modified Alt. 3
18010208060603	Franklin Gulch-Scott River	Happy Camp	1.51	11.3%	11.3%	1.51	11.3%	11.3%	1.51	11.3%	11.3%	11.3%	11.3%	11.3%	11.3%
18010209020302	China Creek	Happy Camp	22.01	5.6%	5.6%	12.34	5.4%	5.4%	9.97	5.4%	5.4%	5.5%	5.5%	5.5%	5.5%
18010209020303	Horse Creek	Happy Camp	15.73	13.2%	13.2%	15.73	13.2%	13.2%	10.42	13.0%	13.0%	13.2%	13.2%	13.1%	13.1%
18010209020305	Fryingpan Creek-Klamath River	Happy Camp	9.51	5.3%	5.3%	8.00	5.2%	5.2%	8.00	5.2%	5.2%	5.3%	5.3%	5.2%	5.2%
18010209030101	Headwaters Elk Creek	Happy Camp	0.00	21.7%	21.7%	0.00	21.7%	21.7%	0.00	21.7%	21.7%	21.7%	21.7%	21.7%	21.7%
18010209030102	Rainy Valley Creek	Happy Camp	0.00	5.2%	5.2%	0.00	5.2%	5.2%	0.00	5.2%	5.2%	5.2%	5.2%	5.2%	5.2%
18010209030103	Toms Valley Creek-Elk Creek	Happy Camp	0.00	14.9%	14.9%	0.00	14.9%	14.9%	0.00	14.9%	14.9%	14.9%	14.9%	14.9%	14.9%
18010209030104	Granite Creek	Happy Camp	0.00	32.8%	32.8%	0.00	32.8%	32.8%	0.00	32.8%	32.8%	32.8%	32.8%	32.8%	32.8%
18010209030105	Middle Elk Creek	Happy Camp	0.00	56.0%	56.0%	0.00	56.0%	56.0%	0.00	56.0%	56.0%	56.0%	56.0%	56.0%	56.0%
18010209030201	Upper East Fork Elk Creek	Happy Camp	4.22	23.0%	23.0%	2.00	23.0%	23.0%	1.48	23.0%	23.0%	23.0%	23.0%	23.0%	23.0%
18010209030202	Upper Elk Creek	Happy Camp	23.70	18.5%	18.5%	5.81	17.9%	17.9%	11.25	18.1%	18.1%	18.5%	18.5%	18.4%	18.4%
18010209030203	Lower East Fork Elk Creek	Happy Camp	7.97	21.3%	21.3%	3.86	21.2%	21.2%	7.97	21.3%	21.3%	21.3%	21.3%	21.3%	21.3%
18010209030301	Bear Creek	Happy Camp	0.00	26.4%	26.4%	0.00	26.4%	26.4%	0.00	26.4%	26.4%	26.4%	26.4%	26.4%	26.4%
18010209030302	Bishop Creek-Elk Creek	Happy Camp	0.00	18.0%	18.0%	0.00	18.0%	18.0%	0.00	18.0%	18.0%	18.0%	18.0%	18.0%	18.0%
18010209030303	Doolittle Creek	Happy Camp	1.51	25.7%	25.7%	1.51	25.7%	25.7%	1.51	25.7%	25.7%	25.7%	25.7%	25.7%	25.7%
18010209030304	Cougar Creek-Elk Creek	Happy Camp	1.87	6.3%	6.3%	1.87	6.3%	6.3%	1.87	6.3%	6.3%	6.3%	6.3%	6.3%	6.3%
18010209030305	Hoop&Devil-Elk Creek	Happy Camp	0.74	2.1%	2.1%	0.74	2.1%	2.1%	0.74	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%

Watershed Code	Watershed Name	Fire Area	Alt3 Disturbance (acre)	Percent Disturbance for Alt 3	Cumulative Percent Disturbance Alt 3	Alt4 Disturbance (acre)	Percent Disturbance for Alt 4	Cumulative Percent Disturbance Alt 4	Alt5 Disturbance (acre)	Percent Disturbance for Alt 5	Cumulative Percent Disturbance Alt 5	Percent Disturbance for Modified Alt. 2	Cumulative Percent Disturbance Modified Alt. 2	Percent Disturbance for Modified Alt. 3	Cumulative Percent Disturbance Modified Alt. 3
18010209060103	Benjamin Creek-Klamath River	Happy Camp	0.00	5.1%	5.1%	0.00	5.1%	5.1%	0.00	5.1%	5.1%	5.1%	5.1%	5.1%	5.1%
18010210010304	Sixmile Creek	Whites	0.00	2.2%	2.2%	0.00	2.2%	2.2%	0.00	2.2%	2.2%	2.2%	2.2%	2.2%	2.2%
18010210010306	Shadow Creek	Whites	3.25	3.7%	3.7%	3.25	3.7%	3.7%	0.58	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%
18010210020301	Upper South Russian Creek	Whites	4.51	19.7%	19.7%	4.28	19.7%	19.7%	1.49	19.6%	19.6%	19.7%	19.7%	19.6%	19.6%
18010210020302	Music Creek	Whites	2.33	43.5%	43.5%	0.06	43.5%	43.5%	0.81	43.5%	43.5%	43.5%	43.5%	43.5%	43.5%
18010210020303	Lower South Russian Creek	Whites	0.00	20.7%	20.7%	0.00	20.7%	20.7%	0.00	20.7%	20.7%	20.7%	20.7%	20.7%	20.7%
18010210020401	Upper North Russian Creek	Whites	0.00	4.3%	4.3%	0.00	4.3%	4.3%	0.00	4.3%	4.3%	4.3%	4.3%	4.3%	4.3%
18010210020402	Taylor Creek	Whites	0.00	13.3%	13.3%	0.00	13.3%	13.3%	0.00	13.3%	13.3%	13.3%	13.3%	13.3%	13.3%
18010210020403	Lower North Russian Creek	Whites	0.00	34.1%	34.1%	0.00	34.1%	34.1%	0.00	34.1%	34.1%	34.1%	34.1%	34.1%	34.1%
18010210020502	Big Creek	Whites	0.00	0.0%	0.0%	0.00	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
18010210020503	Yellow Dog Creek-North Fork Salmon River	Whites	0.00	13.7%	13.7%	0.00	13.7%	13.7%	0.00	13.7%	13.7%	13.7%	13.7%	13.7%	13.7%
18010210020603	Specimen Creek	Whites	0.00	0.2%	0.2%	0.00	0.2%	0.2%	0.00	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
18010210020701	Whites Gulch	Whites	11.12	31.9%	31.9%	9.22	31.8%	31.8%	3.21	31.8%	31.8%	31.9%	31.9%	31.8%	31.8%
18010210020702	Robinson Gulch-North Fork Salmon River	Whites	1.51	41.3%	41.3%	1.51	41.3%	41.3%	1.51	41.3%	41.3%	41.3%	41.3%	41.3%	41.3%
18010210020703	Eddy Gulch	Whites	0.00	0.0%	1.5%	0.00	0.0%	1.5%	0.00	0.0%	1.5%	0.0%	1.5%	0.0%	1.5%
18010210020704	Jessups Gulch-North Fork Salmon River	Whites	0.00	0.1%	15.1%	0.00	0.1%	15.1%	0.00	0.1%	15.1%	0.1%	15.1%	0.1%	15.1%
18010210020705	Jackass Gulch	Whites	0.00	16.0%	16.0%	0.00	16.0%	16.0%	0.00	16.0%	16.0%	16.0%	16.0%	16.0%	16.0%

Table 6 (modified from Table 6 of the Geology report): Duration of elevated landslide risk due to the wildfire for all alternatives.

7 th Field Watershed Code	7 th Field Watershed Name	Fire Area	Percent of watershed high and moderate burn severity	Duration of Elevated Risk for Alt. 1	Alt. 2 Percent High and Moderate Planted	Duration of Elevated Risk Alt 2.	Alt. 3 Percent High and Moderate Planted	Duration of Elevated Risk Alt 3.	Alt. 4 Percent High and Moderate Planted	Duration of Elevated Risk Alt 4.	Alt. 5 Percent High and Moderate Planted	Duration of Elevated Risk Alt 5.	Modified Alt. 2 Percent High and Moderate Planted	Duration of Elevated Risk Modified Alt. 2.	Modified Alt. 3 Percent High and Moderate Planted	Duration of Elevated Risk Modified Alt. 3.
18010206080302	Lumgreycreek	Beaver	1.6%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years
18010206080304	Miller Gulch-Klamath River	Beaver	16.9%	>80 years	0.0%	>80 years	0.0%	>80 years	0.0%	>80 years	0.0%	>80 years	0.0%	>80 years	0.0%	>80 years
18010206090203	Soda Creek-Beaver Creek	Beaver	5.7%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years
18010206090301	Jaynes Canyon	Beaver	0.1%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years
18010206090304	Lower West Fork Beaver Creek	Beaver	0.5%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years
18010206090401	Dutch Creek	Beaver	29.1%	>80 years	12.1%	>80 years	6.7%	>80 years	12.1%	>80 years	12.1%	>80 years	12.1%	>80 years	6.7%	>80 years
18010206090402	Buckhorn Gulch-Beaver Creek	Beaver	56.0%	>80 years	8.8%	>80 years	8.5%	>80 years	8.8%	>80 years	8.8%	>80 years	8.8%	>80 years	8.5%	>80 years
18010206100202	Quigleys Cove-Klamath River	Beaver	23.9%	>80 years	10.9%	>80 years	7.8%	>80 years	10.9%	>80 years	10.9%	>80 years	10.9%	>80 years	7.8%	>80 years
18010206100301	Doggett Creek	Beaver	24.9%	>80 years	24.6%	>80 years	14.7%	>80 years	22.6%	>80 years	24.4%	>80 years	14.9%	>80 years	10.6%	>80 years
18010206100303	Dona Creek-Klamath River	Beaver	25.1%	>80 years	15.9%	>80 years	5.5%	>80 years	15.9%	>80 years	15.9%	>80 years	5.5%	>80 years	5.5%	>80 years
18010206100406	Buckhorn Creek	Beaver	5.0%	2-5 years	38.7%	2-5 years	38.7%	2-5 years	38.7%	2-5 years	38.7%	2-5 years	38.7%	2-5 years	38.7%	2-5 years
18010206100501	Kohl Creek	Beaver	62.9%	>80 years	7.7%	>80 years	6.6%	>80 years	6.7%	>80 years	7.3%	>80 years	7.6%	>80 years	6.6%	>80 years
18010206100502	Collins Creek-Klamath River	Beaver	12.0%	>80 years	10.0%	>80 years	10.0%	>80 years	10.0%	>80 years	10.0%	>80 years	10.0%	>80 years	10.0%	>80 years
18010206110101	Upper Grider Creek	Happy Camp	30.5%	>80 years	28.0%	30 years	28.0%	30 years	10.3%	>80 years	0.0%	>80 years	28.0%	30 years	28.0%	30 years
18010206110102	Cliff Valley Creek	Happy Camp	18.5%	>80 years	33.0%	30 years	30.4%	30 years	27.3%	30 years	0.0%	>80 years	33.0%	30 years	26.8%	30 years
18010206110103	Rancheria Creek	Happy Camp	59.1%	>80 years	12.3%	>80 years	12.3%	>80 years	12.3%	>80 years	0.0%	>80 years	12.3%	>80 years	11.9%	>80 years
18010206110104	Lower Grider Creek	Happy Camp	47.8%	>80 years	25.0%	30 years	24.1%	>80 years	24.0%	>80 years	0.0%	>80 years	24.1%	>80 years	22.1%	>80 years
18010206110301	Tom Martin Creek-Klamath River	Happy Camp	32.3%	>80 years	14.1%	>80 years	13.9%	>80 years	14.1%	>80 years	13.5%	>80 years	14.1%	>80 years	12.7%	>80 years
18010206110303	O'Neil Creek	Happy Camp	34.0%	>80 years	44.0%	30 years	36.4%	30 years	44.0%	30 years	0.0%	>80 years	35.1%	30 years	33.1%	30 years
18010206110304	Schutts Gulch-Klamath River	Happy Camp	7.7%	2-5 years	49.8%	2-5 years	49.8%	2-5 years	49.8%	2-5 years	21.6%	2-5 years	47.2%	2-5 years	45.5%	2-5 years
18010206110305	Walker Creek	Happy Camp	33.1%	>80 years	46.8%	30 years	43.7%	30 years	45.7%	30 years	6.2%	>80 years	44.5%	30 years	36.0%	30 years

7 th Field Watershed Code	7 th Field Watershed Name	Fire Area	Percent of watershed high and moderate burn severity	Duration of Elevated Risk for Alt. 1	Alt. 2 Percent High and Moderate Planted	Duration of Elevated Risk Alt 2.	Alt. 3 Percent High and Moderate Planted	Duration of Elevated Risk Alt 3.	Alt. 4 Percent High and Moderate Planted	Duration of Elevated Risk Alt 4.	Alt. 5 Percent High and Moderate Planted	Duration of Elevated Risk Alt 5.	Modified Alt. 2 Percent High and Moderate Planted	Duration of Elevated Risk Modified Alt. 2.	Modified Alt. 3 Percent High and Moderate Planted	Duration of Elevated Risk Modified Alt. 3.
18010206110306	Caroline Creek-Klamath River	Happy Camp	16.2%	>80 years	72.6%	30 years	69.8%	30 years	64.9%	30 years	19.7%	>80 years	72.6%	30 years	68.5%	30 years
18010206110307	West Grider Creek-Klamath River	Happy Camp	0.6%	2-5 years	3.5%	2-5 years	3.5%	2-5 years	3.5%	2-5 years	0.0%	2-5 years	3.5%	2-5 years	3.5%	2-5 years
18010208020301	Upper French Creek	Whites	1.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years
18010208020402	Sugar Creek	Whites	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years
18010208060101	Upper Canyon Creek	Happy Camp	0.1%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years
18010208060301	North Fork Kelsey Creek	Happy Camp	24.7%	>80 years	1.0%	>80 years	1.0%	>80 years	1.0%	>80 years	1.0%	>80 years	1.0%	>80 years	1.0%	>80 years
18010208060302	South Fork Kelsey Creek	Happy Camp	2.0%	2-5 years	2.2%	2-5 years	2.2%	2-5 years	2.2%	2-5 years	2.0%	2-5 years	2.2%	2-5 years	2.2%	2-5 years
18010208060401	Middle Creek	Happy Camp	20.9%	>80 years	52.2%	30 years	50.9%	30 years	52.1%	30 years	41.8%	30 years	52.2%	30 years	50.3%	30 years
18010208060402	Deep Creek-Scott River	Happy Camp	8.1%	2-5 years	20.5%	2-5 years	17.6%	2-5 years	20.5%	2-5 years	2.8%	2-5 years	20.5%	2-5 years	20.5%	2-5 years
18010208060403	Tompkins Creek	Happy Camp	20.4%	>80 years	38.6%	30 years	37.0%	30 years	38.6%	30 years	2.7%	>80 years	37.2%	30 years	17.4%	>80 years
18010208060601	McCarthy Creek-Scott River	Happy Camp	15.8%	>80 years	10.6%	>80 years	10.6%	>80 years	10.6%	>80 years	1.3%	>80 years	10.6%	>80 years	3.7%	>80 years
18010208060602	Big Ferry-Swanson	Happy Camp	16.8%	>80 years	5.1%	>80 years	5.1%	>80 years	5.1%	>80 years	5.1%	>80 years	5.1%	>80 years	1.2%	>80 years
18010208060603	Franklin Gulch-Scott River	Happy Camp	12.9%	>80 years	4.6%	>80 years	4.6%	>80 years	4.6%	>80 years	4.6%	>80 years	4.6%	>80 years	4.6%	>80 years
18010209020302	China Creek	Happy Camp	5.5%	2-5 years	58.4%	2-5 years	45.5%	2-5 years	58.4%	2-5 years	0.4%	2-5 years	48.4%	2-5 years	30.1%	2-5 years
18010209020303	Horse Creek	Happy Camp	14.9%	>80 years	64.5%	30 years	55.6%	30 years	64.5%	30 years	3.9%	>80 years	56.4%	30 years	42.3%	30 years
18010209020305	Fryingpan Creek-Klamath River	Happy Camp	5.7%	2-5 years	62.9%	2-5 years	55.3%	2-5 years	62.9%	2-5 years	62.9%	2-5 years	62.9%	2-5 years	61.6%	2-5 years
18010209030101	Headwaters Elk Creek	Happy Camp	39.6%	>80 years	0.0%	>80 years	0.0%	>80 years	0.0%	>80 years	0.0%	>80 years	0.0%	>80 years	0.0%	>80 years
18010209030102	Rainy Valley Creek	Happy Camp	8.1%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years
18010209030103	Toms Valley Creek-Elk Creek	Happy Camp	20.3%	>80 years	0.0%	>80 years	0.0%	>80 years	0.0%	>80 years	0.0%	>80 years	0.0%	>80 years	0.0%	>80 years
18010209030104	Granite Creek	Happy Camp	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years

7 th Field Watershed Code	7 th Field Watershed Name	Fire Area	Percent of watershed high and moderate burn severity	Duration of Elevated Risk for Alt. 1	Alt. 2 Percent High and Moderate Planted	Duration of Elevated Risk Alt 2.	Alt. 3 Percent High and Moderate Planted	Duration of Elevated Risk Alt 3.	Alt. 4 Percent High and Moderate Planted	Duration of Elevated Risk Alt 4.	Alt. 5 Percent High and Moderate Planted	Duration of Elevated Risk Alt 5.	Modified Alt. 2 Percent High and Moderate Planted	Duration of Elevated Risk Modified Alt. 2.	Modified Alt. 3 Percent High and Moderate Planted	Duration of Elevated Risk Modified Alt. 3.
18010209030105	Middle Elk Creek	Happy Camp	4.7%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years
18010209030201	Upper East Fork Elk Creek	Happy Camp	27.0%	>80 years	47.6%	30 years	45.2%	30 years	47.4%	30 years	23.2%	>80 years	47.6%	30 years	45.1%	30 years
18010209030202	Upper Elk Creek	Happy Camp	20.3%	>80 years	43.8%	30 years	40.2%	30 years	18.6%	80 years	1.9%	>80 years	43.8%	30 years	30.9%	30 years
18010209030203	Lower East Fork Elk Creek	Happy Camp	19.1%	>80 years	53.3%	30 years	53.2%	30 years	41.5%	30 years	53.0%	30 years	53.3%	30 years	40.7%	30 years
18010209030301	Bear Creek	Happy Camp	12.2%	>80 years	0.0%	>80 years	0.0%	>80 years	0.0%	>80 years	0.0%	>80 years	14.3%	>80 years	0.0%	>80 years
18010209030302	Bishop Creek-Elk Creek	Happy Camp	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years
18010209030303	Doolittle Creek	Happy Camp	12.4%	>80 years	23.3%	>80 years	22.0%	>80 years	23.3%	>80 years	14.8%	>80 years	0.0%	>80 years	19.1%	>80 years
18010209030304	Cougar Creek-Elk Creek	Happy Camp	4.0%	2-5 years	68.3%	2-5 years	62.0%	2-5 years	68.3%	2-5 years	68.3%	2-5 years	65.0%	2-5 years	55.7%	2-5 years
18010209030305	Hoop&Devil-Elk Creek	Happy Camp	3.1%	2-5 years	47.3%	2-5 years	41.9%	2-5 years	47.3%	2-5 years	47.3%	2-5 years	41.9%	2-5 years	41.9%	2-5 years
18010209060103	Benjamin Creek-Klamath River	Happy Camp	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years
18010210010304	Sixmile Creek	Whites	1.9%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years
18010210010306	Shadow Creek	Whites	0.7%	2-5 years	0.1%	2-5 years	0.1%	2-5 years	0.1%	2-5 years	0.0%	2-5 years	0.1%	2-5 years	0.1%	2-5 years
18010210020301	Upper South Russian Creek	Whites	18.1%	>80 years	1.9%	>80 years	1.9%	>80 years	1.9%	>80 years	0.0%	>80 years	1.9%	>80 years	1.9%	>80 years
18010210020302	Music Creek	Whites	40.9%	>80 years	19.5%	>80 years	19.5%	>80 years	19.5%	>80 years	0.0%	>80 years	19.5%	>80 years	18.2%	>80 years
18010210020303	Lower South Russian Creek	Whites	16.7%	>80 years	0.7%	>80 years	0.7%	>80 years	0.7%	>80 years	0.0%	>80 years	0.7%	>80 years	0.7%	>80 years
18010210020401	Upper North Russian Creek	Whites	3.9%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years
18010210020402	Taylor Creek	Whites	11.6%	>80 years	1.1%	>80 years	1.1%	>80 years	1.1%	>80 years	0.0%	>80 years	1.1%	>80 years	0.0%	>80 years
18010210020403	Lower North Russian Creek	Whites	29.4%	>80 years	1.4%	>80 years	1.4%	>80 years	1.4%	>80 years	0.0%	>80 years	1.4%	>80 years	1.4%	>80 years
18010210020502	Big Creek	Whites	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years
18010210020503	Yellow Dog Creek-North Fork Salmon River	Whites	12.5%	>80 years	0.0%	>80 years	0.0%	>80 years	0.0%	>80 years	0.0%	>80 years	0.0%	>80 years	0.0%	>80 years
18010210020603	Specimen Creek	Whites	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years
18010210020701	Whites Gulch	Whites	28.1%	>80 years	17.6%	>80 years	16.2%	>80 years	17.6%	>80 years	0.0%	>80 years	16.5%	>80 years	15.7%	>80 years

7 th Field Watershed Code	7 th Field Watershed Name	Fire Area	Percent of watershed high and moderate burn severity	Duration of Elevated Risk for Alt. 1	Alt. 2 Percent High and Moderate Planted	Duration of Elevated Risk Alt 2.	Alt. 3 Percent High and Moderate Planted	Duration of Elevated Risk Alt 3.	Alt. 4 Percent High and Moderate Planted	Duration of Elevated Risk Alt 4.	Alt. 5 Percent High and Moderate Planted	Duration of Elevated Risk Alt 5.	Modified Alt. 2 Percent High and Moderate Planted	Duration of Elevated Risk Modified Alt. 2.	Modified Alt. 3 Percent High and Moderate Planted	Duration of Elevated Risk Modified Alt. 3.
18010210020702	Robinson Gulch-North Fork Salmon River	Whites	36.2%	>80 years	4.0%	80 years	3.4%	>80 years	4.0%	>80 years	1.5%	>80 years	4.0%	>80 years	3.7%	>80 years
18010210020703	Eddy Gulch	Whites	0.0%	2-5 years	43.0%	2-5 years	43.0%	2-5 years	43.0%	2-5 years	0.0%	2-5 years	43.0%	2-5 years	43.0%	2-5 years
18010210020704	Jessups Gulch-North Fork Salmon River	Whites	0.1%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years
18010210020705	Jackass Gulch	Whites	0.9%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years	0.0%	2-5 years

Table 7: Acres of unstable lands by fire area and treatment type. The estimates for salvage exclude streamside buffers and inner gorges where project design prohibits salvage and areas with very low or low fire severity according to the RAVG data.

Fire Area	Fuels Reduction	Salvage	Roadside Hazard	Site Preparation and Plant	Footprint
Alt 2					
Westside Fire Recovery A: Beaver Fire	59	3	61	8	75
Westside Fire Recovery B: Happy Camp Complex	308	2447	1205	375	4,108
Westside Fire Recovery C: Whites Fire	20	<0.1	10	9	23
Grand Total	387	2449	1276	392	
Alt 3					
Westside Fire Recovery A: Beaver Fire	59	0	61	8	73
Westside Fire Recovery B: Happy Camp Complex	308	2281	1205	375	3,831
Westside Fire Recovery C: Whites Fire	20	<0.1	10	9	23
Grand Total	387	2281	1276	392	
Alt 4					
Westside Fire Recovery A: Beaver Fire	59	3	56	8	71
Westside Fire Recovery B: Happy Camp Complex	308	2357	1194	375	3,972
Westside Fire Recovery C: Whites Fire	20	<0.1	10	9	23
Grand Total	387	2359	1261	392	
Alt 5					
Westside Fire Recovery A: Beaver Fire	59	3	61	8	77
Westside Fire Recovery B: Happy Camp Complex	308	285	1205	30	1,753
Westside Fire Recovery C: Whites Fire	20	0	10	0	23
Grand Total	387	287	1276	38	
Alt 2 as Modified					

Fire Area	Fuels Reduction	Salvage	Roadside Hazard	Site Preparation and Plant	Footprint
Westside Fire Recovery A: Beaver Fire	59	3	61	8	77
Westside Fire Recovery B: Happy Camp Complex	308	2285	1205	375	3,804
Westside Fire Recovery C: Whites Fire	20	<0.1	10	9	23
Grand Total	387	2288	1276	392	
Alt 3 as Modified					
Westside Fire Recovery A: Beaver Fire	61	0	60	8	75
Westside Fire Recovery B: Happy Camp Complex	741	1973	1077	380	3,128
Westside Fire Recovery C: Whites Fire	20	<0.2	10	9	23
Grand Total	821	1973	1147	397	