

**Burned Area Emergency Response
Roads/Engineering Report**

Rough Fire South Zone

**Sequoia National Forest
October 19, 2015**



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Rough Fire South Zone (SQF) BAER Roads/Engineering Report

Resource Specialty: Roads / Engineering

Fire Name: Rough Fire South Zone (SQF) CA-SNF-001746

Month and Year: October 2015

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I. **Potential Values at Risk** (identified prior to the on-the-ground survey)

A. **Critical Values:**

Life and Safety; Risk to road users along the Davis Road 12S01 and Maintenance Level 2 roads within the burned area.

Property; Risk to road improvements and loss of road functions on segments of the Davis Road, and Maintenance Level 2 roads. Loss of access to private property owners, permittees, and forest users.

B. **Resource Condition Assessment**

(a) **Resource Setting:**

The soils report shows an overview of the burn severity with the roads for the Rough Fire South Zone.

National Forest Service System Roads (NFSR) within the burn perimeter are listed in INFRA as Maintenance Level (ML) 1 – 5 single and double lane with native, aggregate, and paved surfacing. ML 1 roads are closed. ML 2 roads are maintained for High Clearance Vehicles. ML 3 – 5 roads are maintained for Passenger Cars. Road designs are both in-slope and out-slope with road way ditch lines, rolling dips with associated led off ditches. Most road segments are constructed with culvert cross drains and culverts at perineal drainages varying in size from 12” to 72” in diameter.

There are approximately 170 miles of NFSR within the Burn Perimeter. Approximately 90.44 miles of NFSR were accessible and surveyed for the purposes of this report.

Table 1 Transportation System inside the Burned Perimeter

Maintenance Level	Definition	Miles
1	Basic Custodial Care (Closed)	17.02
2	High Clearance Vehicles	134.41
3	Suitable for Passenger Cars	8.87
4	Moderate Degree of User Comfort	7.73
5	High Degree of User Comfort	1.97
	TOTAL	170.00

- (b) **Findings of the On-The-Ground Survey:** The Rough Fire South Zone Burned approximately 151,000 Acres of which the Burn Severity consisted of (4%) of Acres in High, (28%) of Acres in Moderate, and (68%) of Acres in Low/Unburned. Soils report shows an overview of the burn severity with the roads for the Rough Fire South Zone.

The field survey was conducted over September 29 – October 4 (6 days) by the roads engineering team along with field coordination with team Hydrologist, Geologist, and Archeologist. Dominate Forest Service roads within the fire perimeter are;

12S01 Davis Road: Provides access to the Kings River from State Highway 180, private property, grazing allotments, several dispersed camping along the road and OHV opportunities.

12S19 Delilah: Provides access to Delilah Lookout, private property, grazing allotments, several dispersed camping along the road, and OHV opportunities.

13S03 Chicago Stump: Provides access to monumental Chicago Stump and dispersed camping along the road.

13S09 Tenmile: Provides access to Hume Lake dam, government facilities, private property (Christian Camp), campgrounds, dispersed camping, day use areas, and recreation trails.

13S05 Camp 7 and 13S58 Abbott: Provides access to dispersed camping along the road and access to recreation trails.

13S70 Mill Flat Creek, 13S78 Mill, and 13S92 Mill Flat: Provides access to dispersed camping along the road and grazing allotments, and OHV opportunities.

Other secondary roads were also surveyed in the high and moderate burn severity for the purposes of this report. Approximately 90.44 miles of Forest Service roads are proposed for treatments.

(c) **Consequences of the fire on values at risk**

- **Life and Safety (12S01):** As a result of the burned watersheds, it has been determined through the BAER risk assessment process, that the risk to road users along the Davis Road 12S01 is considered very high due to the high and moderate burned slopes above the road creating the potential for rock fall, debris flows, and washouts during the first winter season or until the post burn watershed stabilizes. Major consequence along these road segments is considered likely due to rock fall, debris flows, and washouts.
- **Life and Safety (ML 2 Roads):** As a result of the burned watersheds, it was determined through the BAER risk assessment process, that the risk to road users on Forest Service Maintenance Level 2 roads is considered very high due to the high and moderate burned slopes above the road creating the potential for rock fall, debris flows, and washouts, the first winter season or until the post burn watershed stabilizes. Major consequence along these road segments is considered very high due to rock fall, debris flows, and washouts.
- **Property (12S01):** As a result of the burned watersheds, it was determined through the BAER risk assessment process, that the risk to Davis Road 12S01 is considered very likely

with major consequences. Damage to the invested road improvements, loss of road functions, and inability of private property owners, permittees, and forest users' access.

- **Property (ML 2 Roads):** As a result of the burned watersheds, it was determined through the BAER risk assessment process, that the risk to Maintenance Level 2 roads are considered very likely with major consequences. Damage to the invested road improvements, loss of road functions, and denial of access to road users, grazing allotments, and private property owners.

II. BAER Risk Assessment Refer to: Chapter 2520 - Watershed Protection and Management

Value (Life/Property/ Resources)	Value At Risk	Probability of Damage or Loss	Magnitude of Consequences	Risk	Types of Treatments	Estimated Cost*
<ul style="list-style-type: none"> Life and Safety; Injury to Humans by Use of Road During Storms and Possible Loss of Access. 	<u>Road</u> <ul style="list-style-type: none"> 12S01 	<ul style="list-style-type: none"> Likely; Rock Fall, Road Failure, Washouts, Prism Gone, Debris Flow. 	Major	Very High	Install BAER Warning Signs	
					Boulder Barriers	
					Install Closure and Information Sign	
					Install Standard Traffic Gate 16' Wide	
<ul style="list-style-type: none"> Property; Road Investment. 	<u>Road</u> <ul style="list-style-type: none"> 12S01 	<ul style="list-style-type: none"> Likely; Rock Fall, Road Failure, Washouts, Prism Gone, Debris Flow, Rut. 	Major	Very High	Install Drainage Armor (Class 2)	
					Install Drainage Armor (Class 3)	
					Install Critical Dip	
					Install Critical Dip w/Armor	
					Install Metal End Section 24"	
					Install Over Size Drain	
					Install Over Size Drain Big Mac w/Flume	
					Install Flume	
					Remove and Disposed Culvert 12"	
					Remove and Disposed Culvert 18"	
					Install Dip for Low Water Crossing	
Restore Drainage Function						
Damage Response & Clean-Up (spring)						
<ul style="list-style-type: none"> Life and Safety; Injury to Humans by Use of Roads During Storms and Possible Loss of Access. 	<u>Roads</u> <ul style="list-style-type: none"> Maintenance Level – 2 Rds. 	<ul style="list-style-type: none"> Likely; Rock Fall, Road Failure, Washouts, Prism Gone, Debris Flow. 	Major	Very High	Install BAER Warning Signs	
					Boulder Barriers	
					Install Closure and Information Sign	
					Install Standard Traffic Gate 16' Wide	
<ul style="list-style-type: none"> Property; Road Investment. 	<u>Roads</u> <ul style="list-style-type: none"> Maintenance Level – 2 Rds. 	<ul style="list-style-type: none"> Likely; Rock Fall, Road Failure, Washouts, Prism Gone, Debris Flow, Rut. 	Major	Very High	Install Drainage Armor (Class 2)	
					Install Critical Dip	
					Install Critical Dip w/ Armor	
					Install Metal End Section 18"	
					Install Metal End Section 24"	
					Install Vertical Riser 18" x 3'	
					Install Vertical Riser 18" x 4'	
					Install Vertical Riser 18" x 5'	
					Install Over Size Drain	
					Install Flume	
					Install Dip for Low Water Crossing	
Restore Drainage Function						
Damage Response & Clean-Up (spring)						

*These costs do not include Overhead. See Appendix A for cost details.

A. Summary:

a) Emergency Determination:

This assessment determines an emergency and very high risk related to life, safety and property related to the Forests developed road system.

- **Life and safety (12S01)** - Risk to road users is determined to be very high with major consequences along Davis Road 12S01. Potential for rock fall, debris flows, and washouts are considered to be very likely the first winter due to the burned watershed on steep slopes above the road. Based on Travel Management, Davis Road 12S01 is open year round for wheel traffic and over snow vehicles. Although the first winter has the highest potential, it is recommended to maintain an effective and consistent closure on Davis Road 12S01 for the first winter or until the post burned watershed stabilizes. Closure applies to wheel traffic and over snow vehicles.
- **Life and safety (ML 2 Roads)** - Risk to road users is determined to be very high with major consequences on the remaining Maintenance Level 2 roads. Potential for rock fall, debris flows, and washouts are considered to be very likely the first winter due to the burned watershed on steep slopes above the roads. Based on Travel Management, these ML-2 roads are closed to wheel traffic during the winter, but open to over snow vehicles. Although the first winter has the highest potential, it is recommended to maintain an effective and consistent closure on these roads for the first winter or until the post burned watershed stabilizes. Closure applies to wheel traffic and over snow vehicles.
- **Property (12S01)** - Risk to road improvements and loss of road functions is considered to be very likely with major consequences on road segments along Davis Road 12S01. Diversion of uncontrolled water from road drainage courses on to the road surface, results in degradation and unacceptable erosion, gullies, and loss of road functions and denial of access to road users, grazing allotments, and private property owners.
- **Property (ML 2 Roads)** - Risk to road improvements and loss of road function is considered very likely with major consequences on road segments along ML-2 roads. Diversion of uncontrolled water from road drainage courses on to the road surface, results in degradation and unacceptable erosion, gullies, and loss of road functions and inability of private property owners, permittees, and forest users' access.

b) Treatments to Mitigate the Emergency:

- **Life and Safety(12S01)** - Proposed BAER road treatments to mitigate the emergency for Davis Road 12S01 are; Install BAER warning signs (entering burned watershed beyond this point) at main entry points of road, install gates, install information sign, install rock barriers adjacent to existing gates to discourage OHV usage, inspect road after damaging storms for rock fall, debris flows and washouts, identify problem areas and respond as needed with personnel and equipment as needed when road opens and safe to access.
- **Life and Safety (ML 2 Roads)** - Proposed BAER road treatments to mitigate the emergency for ML-2 roads are; Install BAER warning signs (entering burned watershed beyond this point) at main entry points of roads, install gate (13S68), install information signs, install

rock barriers adjacent to existing gates to discourage OHV usage, inspect road after damaging storms for rock fall, debris flows and washouts, identify problem areas and respond as needed with personnel and equipment as needed when road opens during Spring time and safe to access.

- **Property (12S01)** - Proposed BAER road treatments to mitigate the emergency to invested road improvements, road functions, and assure access to road users in segments of high burned severity along the David Road 12S01 are; Installing drainage armor (riprap), critical dips, armored dips, over side drains w/flume to protect fill slopes, armor low water crossings, culvert inlet modifications (metal end sections), culvert removal and upsize on selected locations, and restore drainage functions on some segments.
- **Property (ML 2 Roads)** - Proposed BAER road treatments to mitigate the emergency to road improvements, road functions, and assure access to road users in segments of high burned severity on ML-2 roads are; Installing drainage armor (riprap), critical dips, armor dips, over size drains w/flume to protect fill slopes, armor low water crossings, culvert inlet modifications (metal end sections and risers), culvert removal on selected locations, and restore drainage functions on some segments.
- **Cultural Resources:** It has been determined that the road related emergency and consequences described above, could have potential impacts on cultural resources on some of the roads/road segments. Therefore, coordination with the district archeologist is recommended for mitigations. See Archeology report for further details.
- ❖ It is recognized that BAER is NOT intended to correct past maintenance deficiencies. The changed conditions due to fire activity has created an urgency for correction and storm proofing of some of these drainage features on segments along the road, in the high and moderate burned severity on steep slopes above the road.

Accepted BAER road treatments along these road segments include:

- ❖ Install Road Closure and Information signs.
- ❖ Install Standard Traffic Gates (12S01 & 13S68).
- ❖ Install BAER Warning Signs.
- ❖ Boulder Barriers.
- ❖ Install Drainage Armor (class 2 & 3).
- ❖ Install Critical Dips
- ❖ Install Armor Dips (class 2).
- ❖ Install Over Size Drains
- ❖ Install Low Water Crossing w/ Drainage Armor (class 2 & 3).
- ❖ Install Culvert Inlet Modifications (metal end sections & risers).
- ❖ Remove and Dispose of Existing Culvert (selected locations).
- ❖ Restore Drainage Functions (culvert inlets and outlets, roadway ditch lines rolling dips and water bars w/ run-off-ditch, maintain cross slopes of roads in-slope & out-slope).
- ❖ Damage Response & Cleanup (spring).

- (a) Treatment Type – Accepted and economical BAER road treatments as described but not limited to chapter 4 BAER catalog.
- (b) Treatment Objective – mitigate risks to life and safety and the invested Sequoia National Forest road improvements.
- (c) Treatment Description – Install accepted and economical BAER road treatments as described above and outlined in chapter 4 of the BAER catalog.
- (d) Treatment Cost – estimated treatment cost by road:

Miles Treated & Cost per Road		
Road #	Miles	BAER Cost
12S01	13.47	
12S19	2.69	
13S03	7.89	
13S03A	0.96	
13S04*	2.20	
13S05	5.68	
13S05A	1.25	
13S06	1.65	
13S07	1.79	
13S16	1.20	
13S26*	6.64	
13S50	0.85	
13S55*	2.82	
13S58	6.13	
13S66	4.20	
13S68*	2.20	
13S70	4.14	
13S70B	1.75	
13S70C	1.36	
13S73	1.38	
13S78	2.41	
13S86	1.33	
13S88*	1.27	
13S92	6.25	
13S97*	1.43	
14S01*	3.50	
14S02*	4.00	
TOTAL	90.44	
Estimate Includes Mobilization & Overhead (contract prep, administration, implementation)		
*Road is being treated by installing BAER warning signs or gate.		

- There are approximately 90.44 miles of FS Roads proposed for treatment. Treatment cost is estimated at \$REDACT. Estimated cost for treatments per mile is \$REDACT. The average value and replacement cost of the roads is estimated at \$REDACT per mile for a total cost of \$REDACT.

Cost per Mile	
Miles	Cost
90.44	\$

Cost Benefit Matrix					
Road #	Name	Miles Treated	Treatment Cost	Cost/Mile	Road Value/Mile
12S01	DAVIS	13.47			
12S19	DELILAH	2.69			
13S03	CHICAGO STUMP	7.89			
13S03A	CHICAGO STUMP	0.96			
13S04	BUCK ROCK	2.20			
13S05	CAMP 7	5.68			
13S05A	CAMP 7	1.25			
13S06	SANDY COVE	1.65			
13S07	CONVERSE	1.79			
13S16	TORNADO CREEK	1.20			
13S26	TORNADO MDW	6.64			
13S50	CONVERSE CUTOFF	0.85			
13S55	CONVERSE MTN	2.82			
13S58	ABBOTT	6.13			
13S66	HOIST RIDGE	4.20			
13S68	MILLWOOD ROAD	2.20			
13S70	MILL FLAT CR.	4.14			
13S70B	MILL FLAT CR.	1.75			
13S70C	MILL FLAT CR.	1.36			
13S73	MILL FLAT EAST	1.38			
13S78	MILL	2.41			
13S86	CLOVER MEADOW	1.33			
13S88	SAMPSON VIEW	1.27			
13S92	MILL FLAT	6.25			
13S97	MILL WOOD	1.43			
14S01	NORTH BIG MDW.	3.50			
14S02	BURTON	4.00			

Appendix – B of this report includes the detailed cost break down of proposed BAER road treatments.

- (e) The proposed BAER road treatments are recommended for private contractors. The probability of completing treatment in first year prior to damaging storms or events is considered to be high and achievable.
- (f) The proposed BAER road treatments will restore drainage features to full capacity. The probability of the proposed road treatments is considered to be at the 80 to 90 percent success rate depending on the 2015/16 winter storm cycle.

III. Discussion/Summary/Recommendations

- ❖ Implement BAER road treatments before the first damaging storm events of the season.
- ❖ Coordinate gates installation, BAER warning signs, size, wording, and exact locations on the ground with the Forest Engineer or Road Engineer from the Sequoia National Forest.
- ❖ Install Closure and Information Signs for the roads that are being recommended for closure.
- ❖ Coordinate with CALTRANS on potential State HW 180 closure.
- ❖ Identify and Fall Hazard trees in adjacent working areas.
- ❖ Refer to the South Zone Suppression and Repair Plan for the Roads that need repair.

IV. Contacts and References

- ❖ INFRA Travel Routes Inventory, and Quad Maps.
- ❖ Federal standards for the construction of Roads and Bridges.
- ❖ Culvert Nomograph
- ❖ BAER Catalog (chapter 4)
- ❖ BAER Team meetings and discussions.
- ❖ Steven Ray, Forest Engineer, Sequoia National Forest.
- ❖ Shelby Charley, District Fire Management Officer.
- ❖ Carol Hallacy, Recreation Officer, Sequoia National Forest, Hume Lake Ranger District.
- ❖ Kyle Lane, Recreation Technician OHV, Sequoia National Forest, Hume Lake Ranger District.

V. Appendices

- A. Roads Treatment Cost Estimate
- B. Road Treatment Specifications
- C. Road treatment map for the Rough Fire South Zone BAER.