

**Santiago Fire
Roads/Trails
BAER SPECIALIST REPORT**

Cleveland National Forest	November 10, 2007
Assessment by:	(Corrected Version, Nov. 19, 2007)
Mike Bradshaw	
Supervisory Civil Engineer	
Stanislaus National Forest	

I. Resource Condition Assessment

A. Resource Setting

This report covers the National Forest System Roads and managed trails in the Santiago Fire area. Figure A-1 shows an overview of the NFSR roads in the fire area and Figure A-2 shows the burn severity for the fire area.

The Forest Service transportation system is the value at risk. The roads and trails within the burn represent an investment of public funds and are critically needed to access National Forest lands for fire, administrative, recreational, and other emergency access. A brief narrative for each road is provided in Appendix B.

Approximately 15 miles of NFSR roads are located within the burned area. This includes 7 miles of roads, managed as trails. Approximately 5 to 6 miles of NFSR roads are adjacent to the burn and located topographically down slope of the burn. Most are single lane native surfaced roads. Drainage features are unsophisticated, consisting primarily of dips, overside drains, and a few culverts. Approximately 3 miles of Maple Springs Road is single lane paved road.

The dominant transportation features are Maple Springs Road, Harding Road, Joplin Trail (old Santiago Truck Trail), and Silverado Ridge Road/Trail (old Silverado Truck Trail).

Findings of the On-The-Ground Survey:

Value at Risk	Reason
Maple Springs Road, 5S04	Life and Property
	Loss of control of water
	Sedimentation
Silverado Ridge Road/Trail, 5S08	Loss of Property
	Loss of control of water
	Sedimentation
Harding Road, 5S08--Access to North Main Divide Road and Maple Springs Road.	Life and Property
	Loss of control of water
	Sedimentation
Santiago Truck Trail, 5S09 (Joplin Trail)	Loss of Property
	Loss of control of water.
	Sedimentation
The Luge Trail	Life and Property
	Loss of control of water.
	Sedimentation

II. Emergency Determination

The National Forest terrain within the burn is steep and much is considered unstable. The fire stripped area of ground cover and vegetation. This is expected to result in increased, more flashy runoff; down slope movement of ash and sediments; and rock fall. Approximately 60% of the burn within the National Forest boundaries is mapped as moderate to high burn severity. This combined with steep slopes are expected to intensify the runoff response. The road and managed trail systems are identified as the values at risk.

III. Treatments to Mitigate the Emergency

The following treatments were identified as BAER treatments for the Forest Service transportation facilities within the Santiago burned area:

- A. Restore Drainage Function
- B. BAER Warning Signs
- C. Monitoring/Emergency Storm Patrol
- D. Armored or Hardened Crossing
- E. Intercepting Dips

- F. Overside Drains
- G. Retaining Walls

More detailed treatment descriptions are included below and in Appendix C, Treatment Prescriptions. The treatments proposed will help protect life and property, infrastructure investments, and adjacent resource values and/or preserve critical infrastructure function and assure future availability.

Value at Risk	Treatment Objective	Treatment Type or Description (Refer to Appendix)
Maple Springs Road, 5S04	To open and restore full function of all drainage facilities and features.	Restore Drainage Function
	Ensure and/or restore the function of drainage facilities and identify and correct hazards associated with storm events.	Storm Patrol
	Improve drainage	Install Intercepting Road Dips and Overside Drains
	Install signs to inform the public of post-burn hazards to road users, burned area closures and/or road closures, where applicable, and the reasons for the closures.	BAER Warning/Informational Signs
Silverado Ridge Road/Trail, 5S08	Improve drainage	Install Intercepting Dips
	Install signs to inform the public of post-burn hazards to road users, burned area closures and/or road closures, where applicable, and the reasons for the closures.	BAER Warning/Informational Signs
Harding Road, 5S08 (Essential and critical access to Santiago Peak area)	To protect life and property of road users and to assure continued critical and essential access needs are met	Construct new retaining walls to replace the two walls consumed by the fire.
	To open and restore full function of all drainage facilities and features.	Restore Drainage Function
	Improve drainage	Install Intercepting Road Dips, Overside Drains, and hardened crossing.
	Ensure and/or restore the function of drainage facilities and identify and correct hazards associated with storm events.	Storm Patrol
	Install signs to inform the public of post-burn hazards to road users, burned area	BAER Warning/Informational Signs

	closures and/or road closures, where applicable, and the reasons for the closures.	
Santiago Truck Trail, 5S09/Joplin Trail	Improve drainage	Install Intercepting Dips
	Install signs to inform the public of post-burn hazards to road users, burned area closures and/or road closures, where applicable, and the reasons for the closures.	BAER Warning/Informational Signs
House adjacent to the Luge Trail, on private property immediately downslope of NF lands.	To protect house and property from mudflow deposition by providing drainage as necessary on gullied trail, known locally as the Luge.	Intercepting Trail Dips (approx. 5). SW/4, SW/4 Sec 34, T5S, R7W,

IV. Discussion/Summary/Recommendations

- A. Implement treatments as described above.
- B. Acquire rights-of-way or licenses, where appropriate, prior to implementing BAER treatments.
- C. Restrict vehicle weight and access on Harding Road (5S08) to 10,000 lbs gvw and emergency traffic over the two burnt-out retaining walls, pending replacement or further assessment by a geotechnical engineer.

V. References

- A. INFRA Travel Routes Inventory.
- B. BAER Team meetings and discussions.
- C. Telephone and/or personal conversations with Michelle Bearmar, Mark Marquette, Debra Clarke.

VI. Appendices

- A. Maps
- B. Road Narratives
- C. Treatment Costs
- D. Treatment Prescriptions

Appendix A Maps

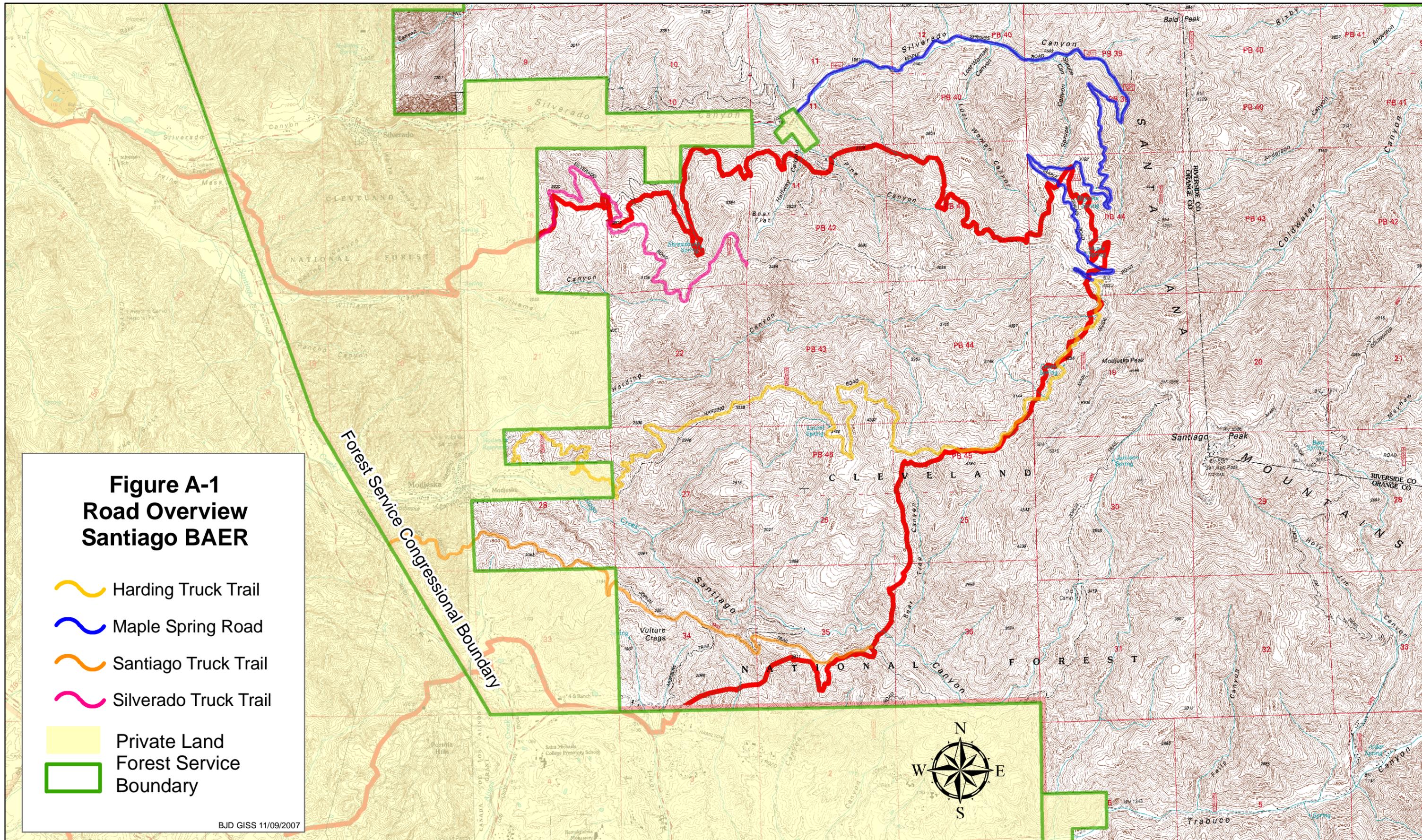
Figure A-1 – Road Overview, Santiago BAER

Figure A-2 – BARC Overview, Santiago BAER (Burn Severity)

**Figure A-1
Road Overview
Santiago BAER**

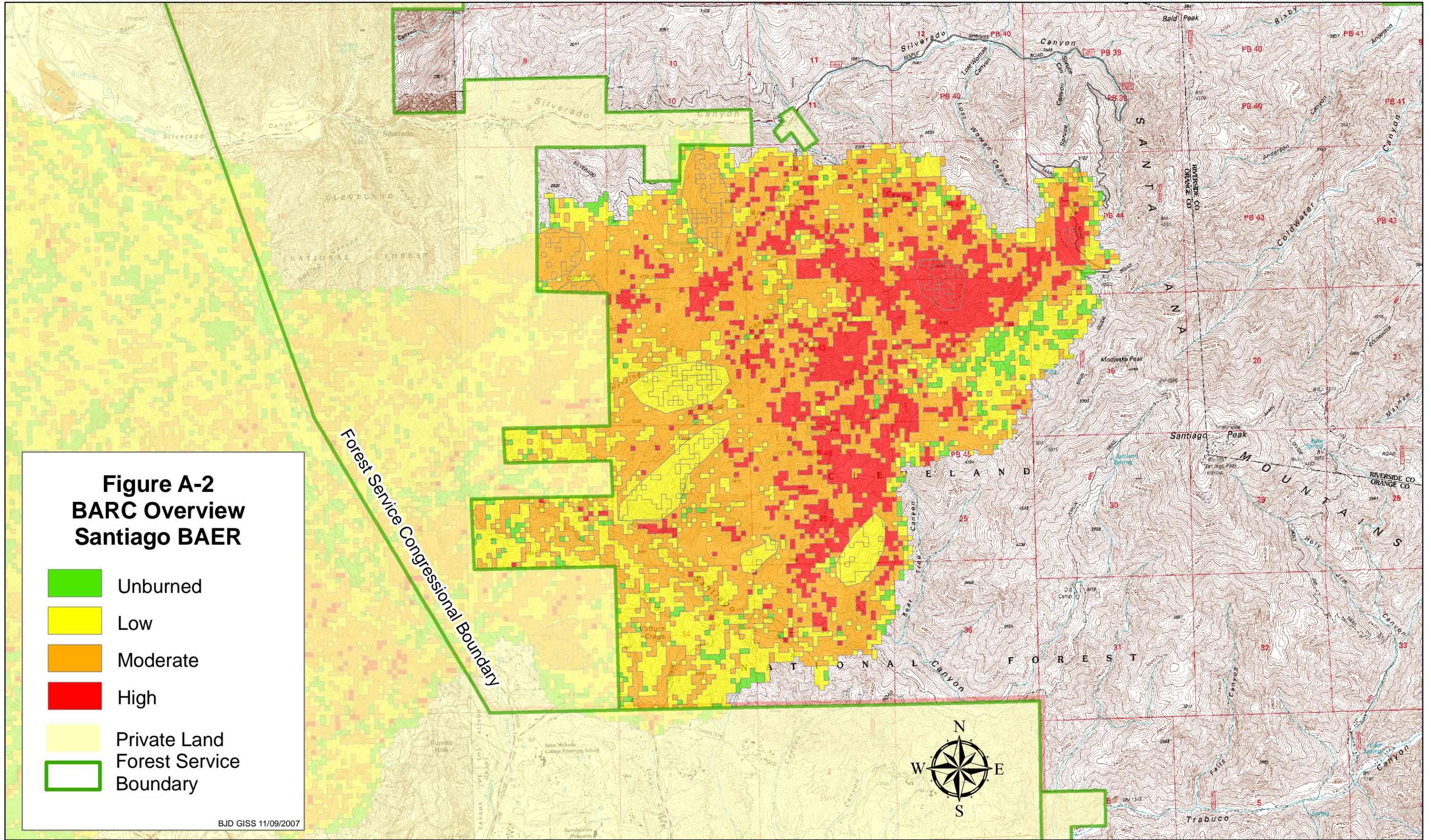
- Harding Truck Trail
- Maple Spring Road
- Santiago Truck Trail
- Silverado Truck Trail

Private Land
Forest Service
Boundary



**Figure A-2
BARC Overview
Santiago BAER**

-  Unburned
-  Low
-  Moderate
-  High
-  Private Land
-  Forest Service Boundary



Appendix B Santiago BAER Road Narratives

This appendix contains a description of each National Forest System Road substantially in or adjacent to the burn:

5S04, Maple Springs Road:

This 6.9 mile segment of single lane road connects the North Main Divide Road with Silverado Road (county). The lower three miles is paved. A portion of this road is in Arroyo Toad habitat and subject to a Limited Operating Period (LOP) during a portion of the year. This road is reported by the Forest to be particularly susceptible to storm related closures under normal conditions. The upper mile or so was directly affected by the burn. The remainder sits outside of, but topographically downhill of the burn and is expected to be indirectly affected by conditions above. BAER treatments on the portion affected by the burn consist primarily of restoring drainage function.

5S05, Silverado Ridge Road/Trail:

The 1.5 mile National Forest segment of this single lane road is a maintenance level 1 road, managed as a trail. Time did not permit an on-the-ground survey and needs were estimated from the survey of the Santiago Truck Trail/Joplin Trail. A follow-up survey and assessment should be conducted by the Forest.

5S08, Harding Road:

This single lane road is primarily located on National Forest land. It begins at the Tucker Wildlife Sanctuary in Modjeska, California, and extends easterly approximately 7.9 miles to its intersection with Maple Springs Road. This road provides essential and critical emergency access from the west to the Santiago Peak electronics site and vicinity and it provides alternate access from the west when the Maple Springs Road is closed by storms and/or during the LOP. BAER treatments consist of restoring drainage function, improving drainage features, and replacing two timber retaining walls destroyed by the fire.

5S09, Santiago Truck Trail (Joplin Trail):

This is a maintenance level 1 single lane road, managed as a trail. It starts at Modjeska Grade Road and runs generally up the ridge line through the exterior boundary of the fire in Section 35. This road was surveyed by helicopter reconnaissance and approximately half (westerly end) was surveyed on the ground. Needs were estimated from the portion surveyed on-the-ground. The prism is primarily in sloped and heavily eroded. Loss of investment, loss of control of water, and erosion is expected to be exacerbated by the post burn condition. BAER treatments on the portions directly affected by the burn consist primarily of installing intercepting dips to drain the road surface. These would be shorter than those intended for road purposes to more closely meet the needs of the managed trail function.

Road	5S04, Maple Springs Road	5S05, Silverado Ridge Road	5S08, Harding Road	5S09, Santiago Trk Tr/Joplin Tr.	All, or General								Totals
Miles of FS System Road/Trail in Burn	1.1	2.5	7.1	4.5									15
Restore Drainage Function (miles)	2		7.1										9.1
Install Road Intercepting/Rolling Dips	1		20										21
Install Trail Intercepting/Rolling Dips		65		120									185
Retaining wall			2										2
Install 18" Over-side Drains	6		16										22
Install Signs													0
Warning 48x96					8								8
Information 18x12					16								16
Install Hardened Crossing			1										1
Storm Patrol					10								10

Appendix D
Treatments
Santiago Fire BAER

Restore Drainage Function

Treatment Objective: Open and restore function to all drainage facilities and features.

Treatment Description: This treatment includes a broad range of activities designed to open and restore function. It includes: Clean culverts, culvert catch-basins, ditch lines, and clear vegetation blocking drainage ways. Grade road to drain, removing ruts and gullies and restoring needed inslope or outslope. Remove floatable and transportable debris, gravel bars, and the like from catch basins and immediate upstream channel to make the existing drainage facilities and features as effective and efficient as possible to handle the anticipated post burn flows. Restore design capacity.

Treatment Cost: Highly variable, but estimated at approximately \$1,200 per mile.

Install Intercepting/Rolling Dips

Treatment Objective:

Install rolling dips to divert runoff across and off the road/trail and minimize erosion. This prescription includes terminal treatments such as leadoff ditches, energy dissipaters, armoring, and the like. Dips are spaced frequently enough to prevent road/trail runoff from gaining energy great enough to erode the road/trail surfaces or slopes below the road. The dips are constructed to provide adequate serviceability for low volume roads and/or trails and to provide reliable drainage without the frequent maintenance needed for culverts. The standard for trails is similar to roads, but with a shortened runout.

Treatment Description:

Construct and install intercepting/rolling dips at locations designated by the Forest Service. Dip design will meet specifications and drawings supplied by the Forest Service. The dip design will be the standard used by the Cleveland National Forest for low volume road drainage and/or trails.

Treatment Cost:

The treatment cost is variable depending on the frequency and need for leadoffs, energy dissipaters and the like. Estimated at \$1,000 each for roads and \$160 each for trails.

Construct Retaining Walls

Treatment Objective:

The objective of this treatment is to replace the two walls on Harding Road, 5S08, burned in the Santiago Fire.

Treatment Description:

Design and construct two retaining walls to current structural and geotechnical engineering standards. Use materials that will withstand or resist the effects of wildland fire.

Treatment Cost:

Estimated at \$81 per square foot of surface area, including and allowance for engineering and specialists costs.

Install Hardened Crossing

Treatment Objective:

Reconstruct ford-type drainage crossings to prevent erosion of roadbed.

Treatment Description:

Shape roadbed in drainage crossing area to contain stream flow and provide serviceable road template. Armor with riprap to prevent erosion of roadway. Use or modify Stanislaus NF Riprap Drainage typical detail. Riprap size will be designed for each site based on expected flow and conditions. Surface with road base.

Treatment Cost:

Estimated at \$4,000 each.

Install 18” Over-side Drains

Treatment Objective:

Install overside drains at the outlet of rolling dips, drivable water bars and drainage crossings to carry runoff across and down the fill bank without eroding it.

Treatment Description:

Where runoff leaving the road from intercepting or rolling dips, drivable water bars or drainage crossings could pass over the road fill bank and erode the fill, the Forest Service will designate an over-side drain. These metal drains will be constructed and installed according to Forest Service specifications and drawings. Flumes will be sized to meet on-site conditions and riprap will be placed to dissipate energy at the outlet end of the overside-drains, where appropriate.

Treatment Cost:

\$1,500 each, including approximately 20 feet of flume.

Install Signs

Treatment Objective:

Install signs to inform the public of burned area closures and road closures and the reasons for closures and warn drivers of fire-related traffic hazards.

Treatment Description:

Construct and install signs with text, font, colors, size and shape designated by the Forest Service at locations designated by the Forest Service. Information signs will be 18 inches by 24 inches and will provide background on reasons for closures and contact phone numbers for further information. Warning signs will be 48 inches by 96 inches, black on yellow, fabricated to MUTCD standards, and will alert the public to watershed and traffic hazards in order to minimize accidents. Sign text will be in English and Spanish. See attached examples.

Treatment Cost:

Closure and information signs: \$50
Warning signs: \$1,000



Bilingual BAER Warning Sign



BAER Informational Sign

Storm patrol

Treatment Objective:

Ensure and/or restore the function of drainage facilities and identify and correct hazards before, during and/or after storm events.

Treatment Description:

Monitor conditions and initiate corrective action before, during and after storm events, for risks such as flash flooding, rock fall, debris flow clean up, plugged culverts, and closing gates, when warranted. Insure water flow through drainage facilities. Clear blockages to restore drainage function for next storm. Includes minor slump and slide removal where needed to assure continued operation of drainage facilities.

May be used in conjunction with other treatments, depending on conditions and needs.

Treatment Cost:

Varies with storm event, but can be expected to run approximately \$3,685 per patrol-day, depending on the storm event, labor and equipment used, and amount of clean up needed.