Lake Fire
June/July 2015

Date of Report: July 8, 2015

BURNED-AREA REPORT
(Reference FSH 2509.13)

PART I - TYPE OF REQUEST

A. Type of Report

[x] 1. Funding request for estimated emergency stabilization funds
[ ] 2. Accomplishment Report
[ ] 3. No Treatment Recommendation

B. Type of Action

[x] 1. Initial Request (Best estimate of funds needed to complete eligible stabilization measures)

[ ] 2. Interim Report #____
[ ] Updating the initial funding request based on more accurate site data or design analysis
[ ] Status of accomplishments to date

[ ] 3. Final Report (Following completion of work)

PART II - BURNED-AREA DESCRIPTION

A. Fire Name: Lake

B. Fire Number: CA-BDF- 7894

C. State: CA

D. County: San Bernardino

E. Region: 05

F. Forest: San Bernardino

G. District: Front Country/Mountaintop

H. Fire Incident Job Code: P5JS38

I. Date Fire Started: June 17, 2015

J. Date Fire Contained: N/A

K. Suppression Cost: Est. $34,000,000

L. Fire Suppression Damages Repaired with Suppression Funds
1. Fireline waterbarred (miles):56.2
2. Fireline seeded (miles):
3. Other (identify):

M. Watershed Number: 180702030201 Fish Creek-Santa Ana River, 180702030202 Deer Creek-Santa Ana River, 180702030501 Mill Creek, 181001000601 Rattlesnake Spring-Rattlesnake Canyon, 181001000901 Pipes Spring-Pipes Wash, 181001000902 Antelope Creek, 181002010301 South Fork Whitewater River-Whitewater River, 181002010303 Mission Creek, 181002010402 Little Morongo Creek, and 181002010401 Big Morongo Creek

N. Total Acres Burned: NFS Acres (23,387) Other Federal (1,861) State (0) Private (5,240)

O. Vegetation Types: Upper montane conifer forest , subalpine conifer forest, montane chaparral, meadow, riparian, pinyon/juniper, joshua tree, great basin sage, and desert transitional chaparral.

P. Dominant Soils: Wapal, Lithic Xerorthents, Springdale, Merkel Rock outcrop, Rubble land, Merkel, Wapi, Pacifico. Soils within the burned area generally have high rock content, coarse textures and most of the organic component is in the surface layer. Consequently, they are sensitive to fire effects. Soil productivity is likely impacted where heavy surface fuels were consumed but these areas are not extensive. Ground cover removal in moderate and high burn soil severity areas was extensive and high rates of erosion are expected in these areas.

Q. Geologic Types: Mesozoic plutonic rock and Precambrian mixed rock comprise approximately 87% of the burned area. Paleozoic and Quaternary sedimentary rock makes up the remaining 13% of the area. Geologic types include Mixed granitic and metamorphic rocks, Gneissic granitoid rocks and gneiss, Monzogranite of San Gorgonio Mountain, Bonanza King Formation and Granodiorite of Anderson Peak. The area features very young to old alluvial fan deposits, very young to old landslide deposits, young and old alluvial valley deposits, very young talus deposits, very young glacial deposits and very young wash deposits. Debris flow channels and fans were observed in numerous locations the field. The mapping and field observations indicate that debris flows and other natural geologic processes, described above, will continue to occur in this relatively active landscape landscape.

R. Miles of Stream Channels by Order or Class:

16.1 miles perennial, 71 miles intermittent

S. Transportation System

Trails: 37.6 miles Roads: 25.6 miles (NFS)

PART III - WATERSHED CONDITION

A. Burn Severity* (acres): 4,327 unburned 17,100 (low) 8,420 (moderate) 640 (high)

*Soil Burn Severity as described by the Burned Area Reflectance Classification Map. See Appendix A for Soil Burn Severity Map

B. Water-Repellent Soil (acres): Water-Repellent Soil (acres): The extent of water repellent soils is estimated to be 2625 acres or 25% of the moderate and high burn severity areas. The degree and extent of water repellent soils is largely unknown due to limited collection of field data. However, observations indicated strong repellency at the surface over several vegetation types and moderate to high burn severities. Areas with coarse textured surface layers, high burn severities, and/or thick ash layers commonly had strong water repellency at a depth of 2-3 inches. Water repellent soils were also observed in unburned areas. The pattern of water repellent soils is likely to be patchy and mosaic.

Increased runoff due to hydrophobic conditions is reflected in the peak flow analysis contained in the Hydrology Report. Increased overland flow due to the hydrophobic conditions may increase hill-slope rill and sheet erosion. Hydrophobic layers will usually take six months to two years to break down. Plant root development, soil microbial activity, and freeze-thaw cycling all contribute to the degradation of hydrophobic conditions.

C. Soil Erosion Hazard Rating (acres): 5,195 (low) 1,042 (moderate) 24,370 (high)

Pre-fire erosion hazard for burned area soils was obtained from existing soil erosion hazard rating information in the SBNF Soil Survey. The EHR interpretation is based on soil properties such as soil texture, slope, aggregate stability, infiltration rate, subsoil permeability, depth to restrictive layers, and soil rock content. The rating is the maximum EHR for the soil Actual pre and post fire erosion potential is better reflected by the ERMiT modeling runs outlined in the BAER soils report.

D. Erosion Potential:

ERMIT Erosion Model Outputs for the First Year Following the Fire

	Erosion in tons/acre by soil burn severity		
Vegetation Type	Low	Moderate	High
Forest (Slopes (5-30%)	2-10	3-13	4-16
Forest (Slopes, 30-60%)	10-15	13-20	16-24
Shrub (Slopes (5-30%)	3-15	4-18	5-21
Shrub (Slopes, 30-60%)	15-22	18-27	21-32

ERMiT allows users to predict the probability of a given amount of sediment delivery to the base of a hillslope following variable burns on forest, rangeland, and chaparral conditions in each of five years following wildfire. The ERMiT model can be accessed at http://forest.moscowfsl.wsu.edu/fswepp/
ERMiT Model Assumptions and Inputs:

- Slope length was 300 feet for all ERMiT runs
- Soil surface texture was sandy loam
- Soil Rock Content was 20%/Volume
- There is a low (10%) probability the rates of erosion will exceed the amounts shown in the preceding table in the first year following the fire.

Dry ravel may also occur on loosely consolidated soils on steep slopes (>50%) under dry conditions immediately after a fire. It can often produce higher soil loss rates than that created by rainfall events, especially during a low rainfall year. Dry ravel is an ongoing process that increases after a fire because the vegetation that was holding the soil in place on the hillside is removed. Dry ravel could produce an additional **2-25 tons of soil loss** on some hill-slopes

Conclusions:

- There is a high probability that rates of soil erosion and sediment delivery to stream channels will be significantly higher in moderate and high soil burn severity areas.
- High intensity, short duration summer thundershowers are storm events of concern. Additionally, longer duration medium intensity storms over the winter months are like to generate erosion and flooding within and downstream from the burned area.
- In addition to fire, existing ground disturbance (roads, trails, etc) influence soil erosion and watershed response to precipitation events within the burned area.

  Forested: Burned forested areas were mapped ranged from low to high soil burn severity. Extensive removal of forest floor ground cover occurred in moderate and high soil burn severity areas. Generally, soil heating effects were low over most of the area. Some needle cast is likely to occur in the low and moderate soil burn severity polygons and recovery of slope stability and watershed hydrologic response will be accelerated where this occurs.

  Shrub: Most of the shrub vegetation within the burned area was mapped as low or moderate soil burn severity. Although these areas had areas of bare ground before the fire, removal of ground cover was often high and it is expected that erosion and sediment delivery to stream channels from these slopes will be high. Vegetative recovery is likely to occur through sprouting of shrubs and establishment of grasses and herbaceous vegetation. Recovery of watershed hydrologic response depends on many factors and is likely to take at least 3-5 years.

  Grass, Bare Ground and Rock Outcrop: Grass, bare ground and rock outcrop areas within the burn were mapped as unburned or low burn severity. Soil heating in these areas was very low and, although minimally affected by the fire, recovery of watershed response is expected to occur rapidly.

E. Sediment Potential: 2,934 cubic yards / square mile

PART IV - HYDROLOGIC DESIGN FACTORS

A. Estimated Vegetative Recovery Period, (years): 3-5

B. Design Chance of Success, (percent): 80%

C. Equivalent Design Recurrence Interval, (years): 2

D. Design Storm Duration, (hours): .5

E. Design Storm Magnitude, (inches): .402-.594

F. Design Flow, (cubic feet / second/ square mile): 12.1

G. Estimated Reduction in Infiltration, (percent): 9%

H. Adjusted Design Flow, (cfs per square mile): 28.2

PART V - SUMMARY OF ANALYSIS

Introduction/Background:

The Lake Fire has burned over 31,000 acres in the San Bernardino Mountains and full containment cannot be predicted at this time. A significant percentage of this area burned intensely, consuming all organic duff on the soil surface along with all leaves and needles on standing live vegetation.

The soil burn severity (SBS) map shows approximately 30% burned at high and moderate soil burn severity. The rest of the fire was either low soil burn severity or unburned. It is very important to understand the difference between *fire intensity* and *burn severity*, and *soil burn severity* as defined for watershed condition evaluation in Burned Area Emergency Response BAER analyses. Fire intensity or burn severity as defined by fire, fuels, or vegetation specialists may consider such parameters as flame height, rate of spread, fuel loading, thermal potential, canopy consumption, tree mortality, etc. For BAER analyses, mapping is not simply vegetation mortality or above-ground effects of the fire – soil burn severity considers additional surface and below-ground factors that relate to soil hydrologic function, runoff and erosion potential, and vegetative recovery. Areas of high soil burn severity are scattered throughout the San Gorgonio Wilderness. Minimal high soil burn severity exists in the northeastern part of the fire. Areas of high soil burn severity are at risk due to flooding and sedimentation affecting water quality, roads, hydroelectric powerhouses, and private camps.

Based on historic precipitation patterns, it can be expected that thunderstorms have a high probability of occurring in the weeks following the Lake Fire. The risk of flooding and erosional events will increase as a result of the fire, creating hazardous conditions within and downstream of the burned area. These hazardous conditions may be worsened in the case of a rain-on-snow event, where long-duration rainstorms falling on a shallow snowpack can produce very high peak flows.

The fire was divided into sub-watersheds with “pourpoints” established at the bottom of burned watersheds, or where values at risk were located. Watershed runoff response is referenced to these points.

Erosion Response:

Erosion response is heavily influenced by soil burn severity and hill slope. The burn affected soil aggregate stability, canopy cover, ground cover, and infiltration rates. Before the fire, most of the forested areas had protective ground cover in the form of litter, duff, or ground vegetation. In high and moderate soil burn severity

areas, it is highly likely that increased rates of soil erosion and sediment delivery to stream channels will occur, in the first and second year following the fire, particularly on steep slopes.

ERMIT Erosion Model Outputs for the First Year Following the Fire

	Erosion in tons/acre by soil burn severity		
Vegetation Type	Low	Moderate	High
Forest (Slopes (5-30%)	2-10	3-13	4-16
Forest (Slopes, 30-60%)	10-15	13-20	16-24
Shrub (Slopes (5-30%)	3-15	4-18	5-21
Shrub (Slopes, 30-60%)	15-22	18-27	21-32

Pre-fire slope stability and recovery of watershed hydrologic reponse is dependent on many factors and typically occurs within 3-5 years following the fire. Recovery of high burn severity areas is slower because little or no vegetative ground cover remains, the potential for needle cast is low and soils may be impacted by fire effects.

Watershed Response:

Hydrologic Response:
Based on historic precipitation patterns, it can be expected that thunderstorms have a high probability of occurring in the weeks following the fire. Winter frontal systems are also possible over the burn area. The risk of flooding and erosional events will increase as a result of the fire, creating hazardous conditions within and downstream of the burned area. These hazardous conditions may be worsened in the case of a rain-on-snow event, where long-duration rainstorms falling on a shallow snowpack can produce very high peak flows.

The fire was divided into sub-watersheds with “pourpoints” established at the bottom of burned watersheds, or where values at risk were located. In most cases the pourpoints are located at the bottom of watersheds as they enter the Santa Ana River. Watershed runoff response is referenced to these points.

Hydrologic design factors used to analyze the effects of the Lake Fire considered the vegetative recovery period to be 3 to 5 years; treatment chance of success as 80%. Storm recurrence interval of 2 years and 30-minutes using NOAA Precipitation Frequency Data Server for 2-year 30-minute precipitation yielded a design storm magnitude of 0.402 to 0.594 inches of rainfall. Estimated reduction in infiltration was based on the percentage of hydrophobic soil in the burn area, which was determined to be 9%. Pre-fire design flow was estimated at 12.1 cubic feet per second per square mile and post-fire design flow was estimated at 28.21 cubic feet per second per square mile. These values vary by watershed analysis and are described in detail along with the analysis method in the Hydrology and Watershed specialist report.

Water Quality:
Wildfires primarily affect water quality through increased sedimentation. As a result, the primary water quality constituents or characteristics affected by this fire include color, sediment, settleable material, suspended material, and turbidity. Floods and debris flows can entrain large material, which can physically damage infrastructure associated with the beneficial utilization of water (e.g., water conveyance structures; hydropower structures; transportation networks). The loss of riparian shading and the sedimentation of channels by floods and debris flows may increase stream temperature. Fire-induced increases in mass wasting along with extensive tree mortality can result in increases in floating material – primarily in the form of large woody debris. Post-fire delivery of organic debris to stream channels can potentially decrease dissolved oxygen concentrations in streams. Fire-derived ash inputs can increase pH, alkalinity, conductivity, and nutrient flux (e.g. ammonium, nitrate, phosphate, and potassium), although these changes are generally short lived. Post-fire increases in runoff and sedimentation within the urban interface, and burned structures and equipment within the fire perimeter may also lead to increases in chemical constituents, oil/grease, and pesticides.

The most noticeable effects on water quality will be possible increases in sediment and ash from the burned area into the Santa Ana River, Jenks Lake, and other waterbodies in and downstream of the fire area. Most damaging precipitation in the burn area comes predominately in the form of summer thunderstorms

occurring between late July and earily August. Winter frontal systems are also common in this area and also have the potential to cause flooding in the fire area. Occasionally the area is subject to a rain-on-snow event, resulting in extensive flooding. This is not, however, an annual event. The climate is characterized by cool, dry winters followed by hot, dry summers. Within the Lake Fire, the post-fire watershed threat should be reduced measurably after three to five years with favorable precipitation.

		Burn Severity			
Watershed	**Watershed Acres**	**Percent High**	**Percent Moderate**	**Percent Low**	**Percent Unburned**
1. 180702030201 Fish Creek-Santa Ana River	27,123	1	14	19	66
2. 180702030202 Deer Creek-Santa Ana River	55,328	1	9	11	79
3. Falls Creek	3,046	0	2	3	95
4. 181001000901 Pipes Springs-Pipes Wash	14,477	0	2	11	87
5. 181001000902 Antelope Creek	15,712	0	7	19	74
6. 181002010301 SF Whitewater River-White Water	30,406	1	2	4	93
7. 181002010303 Mission Creek	23,475	0	3	13	83
8. 181002010402 Little Morongo Creek	33,568	0	2	5	92
9. Big Morongo Creek	21,946	0	0	0	100
10. Big Meadow	5,146	0	1	16	83
11. Fish Creek	4,422	2	35	52	11
12. Lost Creek	1,766	4	53	33	11
13. SF Santa Ana River	4,525	3	28	23	45
14. Santa Ana River at Camp River Glen	30,963	1	12	17	70
15. Santa Ana River at 7 Oaks	36,589	1	11	14	74
16. Frog Creek at Glass Road	3,642	4	25	26	45
17. Frog Creek at SF Trailhead	205	0	22	0	75
18. East Fork Barton Creek at Visitor Center	1,376	1	27	37	35
19. Frog Creek at Hwy 38	1,210	11	41	23	25
20. West Fork Barton Creek	794	0	6	19	73
21. East Fork Barton Creek at Jenks Lake Road	1,011	2	30	41	28
22. 1N78 at Spring	96	7	67	13	7
23. Fish Creek Meadow	2,278	2	22	60	15
24. South Fork Santa Ana River below Dry Lake	928	3	12	15	70
25. Mission Creek at PCT Crossing (BLM)	10,522	0	7	30	62
26. NF Whitewater River	3,654	4	19	32	45

Geologic Response:

Debris flows are eminent in the Lake Fire Area. Debris flows and flooding have occurred in the past during high storm events under non-fire conditions. Within the burned area, some watersheds show a great deal of past debris slide/debris flows activity that will be increased during future storms.

Predictive debris flow model results were provided by the USGS-Geologic Hazards Division. http://landslides.usgs.gov/hazards/postfire_debrisflow/

For this report, the discussion of debris flow risk is based on field observations and visual review of the maps generated from the USGS model.

The model outputs used are:

- Probability of debris-flow occurrence in % and classified probabilities where 1 = 0-20%, 2 = 20-40%, 3 = 40-60%, 4 = 60-80%, 5 = 80-100%
- Predicted volume for the design storm, in m^3 and classified volume predictions where 1 = <1,000m^3, 2 = 1,000-10,000m^3, 3 = 10,000-100,000m^3, 4 >100,000m^3
- Combined (numeric) hazard ranking = classified volume + classified probability
- Classified relative hazard ranking is based on the combined (numeric) hazard rating where 1-3 = low, 4-6=moderate and 7-9=high
- Stream segment predictions associated with the 2 year recurrence interval rainstorm

Throughout the burned area, the combined hazard ratings for debris-flow in side drainages tributary to the main stem stream channels are low and moderate. At the fire perimeter, the hazard ratings are high for all main stem channels exiting the burned area.

At the burned area perimeter, volumes are predicted to be >100,000m^3 for West Fork Barton, South Fork Santa Ana, Lost, Fish, North Fork Whitewater, South Fork Mission and Little Morongo. Lower volumes in the range of 10,000 to 100,000m^3 are predicted for East Fork Barton, Frog, Pipes Wash and Antelope.

A. Describe Critical Values/Resources and Threats:

A BAER team began assessing the area for post-fire emergencies on June 28, 2015. In that time the team has identified the following values at risk to post-fire threats. Interim reports may be submitted as additional assessments are completed.

The risk matrix below, Exhibit 2 of Interim Directive No.: ***2520-2010-1*** *was used to evaluate the Risk Level for each value identified during Assessment. Only values at risk that had a risk of Intermediate or above are discussed.*

Probability of Damage or Loss	**Magnitude of Consequences**		
	Major	Moderate	Minor
	RISK		
Very Likely	**Very High**	**Very High**	**Low**
Likely	**Very High**	**High**	**Low**
Possible	**High**	**Intermediate**	**Low**
Unlikely	**Intermediate**	**Low**	**Very Low**

Human Life, Safety and Property

1) Roads

The transportation system consisting of approximately 28 miles of National Forest System Roads (NFSR) within the fire perimeter. Of the 28 miles of NFSR within the fire perimeter, approximately seven miles are suitable for passenger cars (maintenance level 3 and 4) and 18 miles are suitable for high-clearance vehicles (maintenance level 2). State highway 38 traverses the area north of the burned area and immediately downstream of major drainages that were burned. Jenks Lake Road (San Bernardino County) is immediately south of state highway 38 and crosses many of the same major drainages as the highway. Glass Road and Seven Oaks Road (San Bernardino County) are north of Highway 38 and are immediately downstream of the East Fork and main stem of Barton Creek. In addition, there are extensive access roads associated with organization camps, recreation residence tracts, and developed recreation sites that are not part of the National Forest System. Roads throughout the burned watersheds are likely to be impacted by runoff, sediment, and debris derived from burned areas.

Approximately .14 miles of high and 2.9 miles of moderate severity impacted level 2 roads. .29 miles of moderate impacted level 3 roads. State, County, Forest Service, organization camp, and recreation residence roads were assessed in order to determine the level of risk of damage as a result of the changed watershed condition. Primary NFSR roads suitable for passenger cars within and adjacent to the burn area include 1N05, 1N45, 1N77, and 1N81. Main NFSR Level 2 roads within and adjacent to the burned area include 1N55, 1N78, and 1N81. Organization camp and recreation residence roads were assessed because of their potential impact on water quality and other infrastructure if they were to fail. Culverts associated with these roads are at risk of plugging from debris carried down channels from burned watersheds. Some culverts are undersized for the expected increases in peak flows and are at risk of failure from overtopping. Culvert failures may increase the magnitude of flood, sediment and erosion hazards in downstream communities and private lands and increase scouring of stream channels on NFS lands. Table 1 below shows the risk assessment for each road based on the probability of damage or loss and the magnitude of consequences.

Table 11. Roads BAER Risk Ratings

Low	Intermediate	High	Very High
• FS 1N01 • FS 1N02 • FS 1N05A • FS 1N05B • FS 1N05C • FS 1N37 • FS 1N37A • FS 1N39 • FS 1N39A • FS 1N45A • FS 1N47 • FS 1N60 • FS 1N62Y • FS 1N62YA • FS 1N72 • FS 1N74 • FS 1N75 • FS 1N78A • FS 1N79 • FS 1N82 • FS 1N84 • 2N61YB • South Fork Trailhead Parking • Other organization camp roads not otherwise listed • Other Recreation Residence roads not otherwise listed		• Jenks Lake Road • Glass Road • State Route 38 • FS 1N05 • FS 1N45 • FS 1N55/Barton Flats Road • FS 1N77 • FS 1N81 • College Camp access road • Camp La Verne access road • South Fork Rec. Residence Road main access road • Barton Flats Recreation Residence access road (Barton Creek Road)	• FS 1N78 • Camp Ta Ta Pochon access road

2) Trails

Emergency conditions exist for specific trails and sections of trail within the burned area. These emergency conditions are based on threats associated with anticipated post wildfire impacts on trails and trail users. Threats to trails include excessive erosion of the trail tread caused by interception and diversion of runoff from steep burn hill slopes. Trails may also be impacted where they intersect with drainages and crenulations. Approximately 1.1 miles of systems trails are in high burn severity areas with 10.1 miles in moderate burn severity areas (due to topography and post-fire conditions moderate severity is estimated to have a high watershed response). Approximately .32 miles of Pacific Crest Trail (PCT) is in moderate burn severity. Life and safety of trail users is also at risk in some areas within the burn. Specific trails and sections of trail at increased risk from post wildfire threats are the South Fork Trail, Dollar Lake Trail, Aspen Trail, Fish Creek Trail, and sections of the Pacific Crest Trail and Santa Ana River Trail. This determination is based on professional judgement and field based identification of segments of trail where implementing treatments would effectively lower the risk of major and trail damage, thus a favorable benefit to cost ratio was determined. Also based on professional judgement

and field review, the BAER Team recommended against treatments for Lost Lake trail based on concerns for treatment effectiveness and an unfavorable benefit to cost ratio.

Table 2 and 3 summarize the risk ratings for developed recreation sites based on the Soils and Hydrology modeling results including expected debris flow and peak flows based on a 2-year storm event.

Table 2. Dispersed Recreation BAER Risk Ratings			
Low	Intermediate	High	Very High
• Coon Creek Dispersed Recreation Sites • Grinnell Trail Camp • Red Rock Trail Camp • Shields Trail Camp • Jackstraw Trail Camp	• Fish Creek Saddle • Dry Lake Trail Camp • Trail Flats Trail Camp • Mineshaft Flat Trail Camp • Big Tree Trail Camp	• South Fork Dispersed Recreation Sites • Fish Creek Trail Camp • Dollar Lake Trail Camp	

Table 3. Trails/Trailheads BAER Risk Ratings			
Low	Intermediate	High	Very High
• San Bernardino Peak Trail • Columbine Springs • Mountain Home	• Lodgepole • Santa Ana River Trail • PCT • Poopout Hill • Dollar Camp Spur	• South Fork • Dry Lake • Dollar Lake • Fish Creek • Aspen Grove	• Lost Creek

3) Special Uses

The Lake Fire BAER assessment included 58 lands special uses and 255 recreation special uses. The BAER Assessment Team systematically evaluated each of these.

Lands Special Uses: The lands special uses evaluated include 14 water systems, multiple phone and power lines, a service building, and an education center and associated parking lot. There were 31 permitted roads evaluated in the Lake Fire Engineering BAER Report.

For those that are at risk, threats include threat to life and safety of permittees and their staffs, threat to permitted infrastructure, loss of ingress or egress via access roads, etc. Threats are due to the potential for increased storm water runoff velocity and volume, risk of debris flow, and the presence of hazard trees.

The Bear Valley Mutual Water Division – Jenks Lake Flume diverts water from the South Fork Santa Ana River to Frog Creek where it is further diverted downstream to feed Jenks Lake. Jenks Lake is used by the Forest Service and nearby special uses camps as a recreation area and a drafting location for fire suppression. The Barton Flats Water System (currently operated under permit by the Barton Flats Camp Association) is the main water source for several special use organizational camps, 4 Forest Service campgrounds, 1 Forest Service amphitheater, and 1 Forest Service visitor center located in the Barton Flats area. The intake structure for the water system resides in the South Fork Santa Ana River and is at very high risk of damage or loss. Such impacts to the intake structure would shutdown water access for the system and subsequently impact its users. Higher levels of sediment in the intake waters may also cause damage and increase wear / tear to the water system filtration equipment

Table 4 summarizes the risk ratings for Lands Special Uses based on the Soils and Hydrology modeling results including expected debris flow and peak flows based on a 2-year storm event.

Table 4. Lands Special Uses BAER Risk Ratings			
Low	**Intermediate**	**High**	**Very High**
• SB County Sheriff – Heartbar Fire Station • Mill Creek FERC • San Gorgonio FERC • SCE Powerlines • So Cal Water Co Powerlines • General Telephone Co of California Power/Phone Lines • City of Redlands Water Division – Mill Creek Water Diversion	• SAR FERC • Barton Flats Camp Association Outfitter Guide • Camp Wasewagon	• Seven Oaks Mountain Cabins	• Bear Valley Mutual Water Division – Jenks Lake Flume • Barton Flats Camp Association – Barton Flats Water System

Recreation Special Uses: There were 233 recreation residences (in 8 tracts), 17 organization camps, 2 clubs, 2 hotels/motels, and 1 outfitting and guide service that were evaluated for post-fire effects. The organization camps may each have 200-300 campers and staff at the site at any given time (for a total of 3000-4500 people).

The BAER Team prioritized assessing the recreation special uses due to high levels of concern from Post-fire watershed response and users. The Team systematically assessed each area to develop the risk ratings outlined in Tables 5 and 6 below.

These special use sites may have multiple buildings and facilities, roads and utilities (water systems, sewage system, powerlines, telephone lines, gas tanks and lines, etc.) associated with their use.

Threats may include threat to life and safety of the permittees, guests, and staff, threats to permitted infrastructure, loss of access roads/driveways (stranding people), loss of water quality (due to contamination from sewage or from debris/ash), etc. due to the potential for increased storm water runoff velocity and volume, increased debris flow, and hazard trees.

Tables 5 and 6 summarize the risk ratings for Recreation Special Uses based on the Soils and Hydrology modeling results including expected debris flow and peak flows based on a 2-year storm event.

Table 5. Organization Camp BAER Risk Ratings			
Low	**Intermediate**	**High**	**Very High**
• Camp Round Star • Camp Morning Star • Camp DeBenneville Pines • Camp Nawakwa • Camp Metoche • Camp Tautona • Camp Mile High Pines • Camp Pine Mountain	• Camp River Glen • Camp Mtn Chai/Alpine Meadows Retreat Center • Camp Radford • Camp Arbolado • Camp Sky Meadows • Camp Conrad • Camp Edwards	• Camp LaVerne	• Camp Ta Ta Pochan

Table 6. Recreation Residence BAER Risk Ratings			
Low	**Intermediate**	**High**	**Very High**
• Round Cienega • Stetson Creek • Forest Falls	• Seven Oaks • Fish Creek • Lost Creek	• Barton Flats • South Fork (N of 38)	• South Fork (S of 38)

Camp Ta Ta Pochan and Camp LaVerne are located on East Fork Barton Creek which contains 28% high and moderate soil burn severity. We expect a peak flow increase of 3.2x from pre-fire conditions. South Fork Recreation Residences (south of Hwy 38) are located on the South Fork Santa Ana River which contains 32% high and moderate soil burn severity. A peak flow increase of 4.01x from pre-fire conditions is expected.

4) Developed Recreation

South Fork Campground Water System: The South Fork Campground Water System consists of one diesel tank, one diesel generator, one vertical well (with pump), one 15,000 gallon water tank, distribution pipeline and several faucets throughout the South Fork campground. The wellhead, well pump generator, and diesel tank are all in very close proximity to the South Fork Santa Ana River. The water tank is located on the hill above between the campground and the wellhead. The burn area is located uphill and within 10' of the tank.

Probability of Damage or Loss: Possible. This determination is based on the proximity of the diesel tank, generator, and wellhead to the South Fork Santa Ana River. Also, there is currently a burned hazard log that threatens the tank and adjacent valves/valve boxes.

Magnitude of Consequence: Moderate.

Risk Level: High.

Other Developed Recreation: The fire area and areas downslope of the fire support a number of additional developed recreation sites (see Table 7) were addressed in the BAER analysis.

Threats may include threat to life and safety of the people using Forest Service campgrounds, dispersed recreation sites, day use areas (including picnic areas), threats to Forest Service infrastructure, loss of access roads/driveways (stranding people), loss of water quality (due to contamination from sewage or from debris/ash), etc. due to the potential for increased storm water runoff velocity and volume, increased debris flow, and hazard trees.

Table 7 summarizes the risk ratings for developed recreation sites based on the Soils and Hydrology modeling results including expected debris flow and peak flows based on a 2-year storm event.

Table 7. Developed Recreation BAER Risk Ratings

Low	Intermediate	High
• Thurman Flats Picnic Area • Big Falls Picnic Area • Greyback Amphitheater • San Gorgonio Campground • Barton Flats Campground • Oso and Lobo Campground • Council Camp Campground • Skyline Campground • Heart Bar Campground • Heart Bar Equestrian Camp • Wildhorse Equestrian Campground • Coon Creek Cabin Campground • Juniper Springs Campground • Deer Springs (Arrastre) Campground	• Barton Flats Visitor Center • South Fork Campground • Jenks Lake Picnic Area	• South Fork Campground – Outer Loop Only

Natural Resources

1) Ecosystem Stability and Vegetation Recovery

Invasive Weeds: An emergency threat exists with post-fire invasive weed introduction and spread for the following reasons:

1) There is the potential for the *establishment of new and persistent weed populations*. There was no weed wash station for equipment and no preventative weed spread measures implemented for incident suppression activities. Fire equipment, particularly bulldozers and brush engines, are vectors for the introduction and dispersal of invasive weeds into soils disturbed by fire suppression and rehabilitation work. New invasive weeds from other Forests and other states could be introduced in this way.

2) It is highly likely that *existing* weed infestations along roadsides and staging areas, will spread and expand into vulnerable burned areas. Tumble mustard (*Sisymbrium altissimum*), Russian thistle (*Salsola tragus*), Cheat grass (*Bromus tectorum*), Tansy mustard (*Descurainia sophia*), and Sweet clover (*Melilotus sp*.) and others are known to occur on access routes used by fire suppression equipment and within the fire perimeter. These existing populations of weeds will colonize and increase in the burn area due to the fresh soil disturbance and decreased competition related to the fire. These weed populations may affect the structure and habitat function of native plant communities within the burn area by outcompeting the seedlings of native species. Native vegetation is expected to recover from fire if weed invasions are minimized.

3) The fire may also cause an increase in the common dandelion (*Taraxacum officinale*) occurrences within the fire perimeter and within critical habitat for the federally endangered California dandelion (*Taraxacum californicum*). The common dandelion is a known to pose a threat to California dandelion because of the potential threat to the genetic integrity of this *rare endemic species* by interbreeding with it.

Approximately 44 miles of dozer line, 14 miles of handline, 12 drop points,14 helispots, 1 spike camp, and 2 or more safety zones were constructed outside and within the burn perimeter. In addition to increasing weed invasions, these supression-activity disturbances are expected to accelerated erosion and soil compaction that will also inhibit the recovery of native plant populations. If weed infestations are not controlled, there is potential for fire return intervals to be altered and lead to vegetation type conversion over time.

Probability of Damage or Loss: Very Likely. This determination is due to the extensive soil-disturbing suppression work done to control the fire without precautions for invasive weed seed removal on the equipment and due to the likelihood of weed colonization and spread, particularly in the more arid northeastern boundary of the fire. The known occurrences of the common dandelion that can now increase in the newly fire-opened critical habitat will threaten the California dandelion.

Magnitude of Consequence: Major. This determination is due to the high potential for vegetation type conversion to non-native annual species particularly in the desert-type communities in the northeastern portion of the fire perimeter where much of the suppression soil disturbance occurred. Loss of habitat quality for the federally-listed California dandelion in the burned portions of critical habitat in meadows is also very possible.

Risk Level: Very High.

2) Water Quality

Threats to Water Quality and Hydrologic Function: An emergency condition exists at four channel crossings; two within the Barton Flats Recreation Residence Tract along roads 1N55 and 1N75 (East Fork Barton Creek) and two along the road within the South Fork Recreation Residence Tract located south of Highway 38 (South Fork Santa Ana River). The emergency condition is caused by a high proportion of high and moderate soil burn severity within the watersheds above channel crossings, the channel being constricted at these points by culverts or bridges, and large amounts of floatable debris that could clog channel crossings. Issues include increases in sedimentation if these crossings failed or water from the channel is diverted down roads.

Probability of Damage or Loss: Likely. This determination is a result of stream crossings located downstream of higher burn severity burn areas of the East Fork Barton Creek and South Fork Santa Ana River drainages. Watersheds above the crossings have a high proportion of high and moderate soil burn severity. Modeling results show a high probability of increased watershed response in these watersheds.

Magnitude of Consequence: Moderate. These crossings have a large amount of floatable debris that could plug crossings causing a failure or diversion of the channel.

Risk Level: High.

3) Wildlife Resources

Mountain Yellow-Legged Frog: An emergency condition exists for this federally listed species as a result of predicted post-fire effects of the Lake Fire on riparian/aquatic habitats. The emergency condition is caused by the predicted debris flows and flooding in mountain yellow-legged frog habitat that is likely to extirpate this species.

Probability of Damage or Loss: Very Likely. This determination is due to the predicted watershed response based on a 2-year storm event resulting in extreme conditions that would likely kill frogs. The determination is also based on data from similar recent post-fire events at other mountain yellow-legged frog populations in Southern California.

Magnitude of Consequence: Major. This determination is due to the limited distribution of this species in southern California and evidence that the only other populations in the San Bernardino Mountains may have been extirpated.

Risk Level: Very High.

Southwestern Willow Flycatcher: Nesting and Critical Habitat for southwestern willow flycatchers will likely be affected by post-fire flooding and debris flows. However, complete scouring and loss of all of the suitable habitat is unlikely. Suitable habitat will be affected but will recover quickly and so there is not an emergency to the critical natural resource value of southwestern willow flycatcher habitat. Because it is not feasible to implement treatments that could inhibit the predicted debris flows and flooding and because of the low risk to this species, no treatments are proposed.

Probability of Damage or Loss: Possible. This determination is due to the predicted watershed response based on a 2-year storm event resulting in debris flows that could scour and remove suitable nesting habitat (willow stands).

Magnitude of Consequence: Moderate. This determination is due to the tendency or willow habitat to recover quickly and that it is likely that patches of suitable habitat would not be lost.

Risk Level: Intermediate.

4) Cultural Resources

South Fork Diversion Canal (Bear Valley Mutual Water Company and Jenks Lake Flume): An emergency condition exists for this unrecorded but known historic resource. The emergency condition is a result of moderate and high soil burn severity above the Lake which has resulted in a high potential for debris flows and breaching of the canal. Breaching of the canal by overland flow would result in loss of integrity to a potentially eligible historic resource.

Probability of Damage or Loss: Very likely. Hydrological modeling confirms that debris flow is highly likely and most probably would cause a breach of the canal.

Magnitude of Consequence: Major. This determination is due to the fact that historic resources cannot be recovered or re-introduced. The feature is irreplaceable.

Risk Level: Very High.

South Fork and Barton Flats Recreation Residence Tracts: An emergency condition exists for these sites. The South Fork Tract is eligible for the National Historic Register and is at a high risk of post-fire flooding and debris flows. The Barton Flats Tract is unrecorded and is also at risk. There are several treatments planned for those tracts (debris clearing, removal of bridges, etc.).

Probability of Damage or Loss: Very likely. Hydrological modeling confirms that debris flow is highly likely and most probably would cause a breach of the canal.

Magnitude of Consequence: Major. This determination is due to the fact that historic resources cannot be recovered or re-introduced. The feature is irreplaceable.

Risk Level: Very High.

B. Emergency Treatment Objectives:

1. **Roads** - To stabilize the transportation roads system and prevent further damage resulting from:
   a. Erosion and other effects of storm water runoff as a result of fire damage on adjacent lands.
   b. Public Safety Hazards as a result of facilities or structures damaged or destroyed.
   c. Improve the safety of Organization Camps and Recreation Residence Tracts.

2. **Trails** – Storm proof trails and close portions of them to the public, as warranted, until properly stabilized.

3. **Ecological integrity -** Reduce the potential for impaired vegetative recovery and introduction/spread of invasive weeds by conducting detection surveys and rapid response eradication efforts where feasible. Minimize unauthorized OHV use in the burned area to prevent impaired vegetative recovery.

4. **Heritage** - Potential loss mitigation.

5. **MYLF** - Protect the viability of the species.

6. **Interagency Coordination** - Continue to work with affected parties and stakeholders to describe the findings of the BAER Team.

7. **Special Uses/Developed Recreation** – Re-evaluate the need for temporary closures.

C. Probability of Completing Treatment Prior to Damaging Storm or Event:

Land **70** % Channel **80** % Roads/Trails **80** % Protection/Safety **95** %

D. Probability of Treatment Success

	Years after Treatment		
	1	3	5
Land	80	100	100
Channel	85	100	100
Roads/Trails	75	95	100
Protection/Safety	95	100	100

E. Cost of No-Action (Including Loss): $4,748,000 Potential lost market value plus assessment costs (see Cost-Risk Assessments for more information)

F. Cost of Selected Alternative (Including Loss): $5,128,891 Potential lost market value plus assessment costs plus treatment costs (see Cost-Risk Assessments for more information)

G. Skills Represented on Burned Area Survey Team:

[x] Hydrology	[x] Soils	[ ] Geology	[ ] Range	[x] Special Uses
[ ] Forestry	[x] Wildlife	[ ] Fire Mgmt.	[x] Engineering	[x] Trails/Recreation
[ ] Contracting	[ ] Ecology	[x] Botany	[x] Archaeology	
[x] Fisheries	[ ] Research	[ ] Landscape Arch	[x] GIS	

Team Leader: Todd Ellsworth, Inyo National Forest

H. Treatment Narrative:

(Describe the emergency treatments, where and how they will be applied, and what they are intended to do. This information helps to determine qualifying treatments for the appropriate funding authorities. For seeding treatments, include species, application rates and species selection rationale.)

1) Land Treatments

OHV (Off Highway Vehicle) Trespass

Increased unauthorized access to the Lake Fire burned area is expected to occur due to removal of vegetation. Unauthorized access is a threat to the burned watersheds. Erosion, spread of invasive species, damage to cultural sites, destruction of rare plant and native plant communities, disturbance to wildlife, destruction of wildlife habitat, and risks to public safety can result from unauthorized access. The BAER Assessment team has identified two Forest Service system roads within the burned area for temporary closure to prevent unauthorized off highway vehicle access: 1N01 and 2N61YB. These roads offer easy unauthorized OHV access to burned areas and thus are recommended for closure to protect vegetative recovery.

Closures will be enforced through installation of gates, fencing, and signage. Funding for materials to construct the barriers and signage is requested. This will also require heritage clearance for the ground disturbance, and coordination by the botanists with implementation crews to be able to identify TES plants to minimize impacts.

Through past experience, the SBNF has determined that signage, gates, fencing, and other hard

closures, installed to discourage soil disturbance and assist in allowing natural vegetative recovery, are not effective without enforcement patrol. Therefore, additional funding is requested to monitor effectiveness these road closures. Funding is also requested for District FPOs to patrol within and adjacent to the burned area to enforce the physical barriers and deter unauthorized access, vandalism, and damage to the identified heritage site and National Forest System lands.

Invasive Weed Detection and Rapid Response

Weed detection surveys will determine whether ground disturbing activities related to the Lake Fire Incident and the fire itself have resulted in new or the expansion of existing invasive weed infestations.

With 44 miles of dozerline, 14 miles of handline, 25 miles of forest road, 12 drop points, 2 or more safety zones, 14 helispots, and 1 spike camp, it is possible that new and expanding weed infestations will proliferate in and along these vector routes. If left unmanaged, vegetation type conversion is possible, making rapid response to control these infestations critical. In addition, given that approximately 3/5 of the fire is in the wilderness, it is imperative to keep new infestations from establishing in the backcountry and to keep infestations on the road perimeters from expanding into dozerlines, riparian areas, and trails. Surveys and rapid response eradication treatments will begin in spring of 2016 during the flowering periods of weed species. Because of differences in rainfall and flowering times for all potential species, two visits may be required over the next year. If timing is such that all the target species are detectable/treatable in one visit, the actual costs would be lower than displayed below. The table below includes survey and contol of common dandelion in known occurrence and Critical Habitat for the Federally endangered California dandelion. Completion of surveys of dozer lines, roads, staging areas, safety zones, and known invasive and sensitive plant populations will be the first priority. The second survey priorities would be along handlines, helispots, and drop points. Surveys of the general habitats in the burned area would be the lowest priority. Detailed weed detection survey specifications are included in the invasive weed report.

South Fork Water System Wellhead Site Protection and Hazard Log Removal

The wellhead, diesel tank, and well pump generator are all at risk from debris impact due to their close proximity to the South Fork Santa Ana and the Hwy 38 box culvert drainage crossing. The primary treatment shall be placement of a temporary barrier (K-Rail or similar) between the river and the water system equipment. The primary treatment for the water tank shall be the removal of the uphill burned hazard log that is at risk of rolling down the hill and damaging the tank and adjacent appurtenances.

2) Channel Treatments

Channel Clearing: Channel clearing is proposed to remove floatable debris within the channel of East Fork Barton Creek and South Fork Santa Ana River that pose a risk for plugging channel crossings. This channel clearing would be located above the 1N55 and 1N75 channel crossings (Barton Flat Tract) and two crossings along the road within the South Fork Tract (south of highway 38). This would reduce the risk of crossings plugging and blowing out. The primary treatment for the removal of floating debris would be completed by a type 2 fire crew using chainsaws. A hydrologist would be present to give the fire crew direction on what debris would be removed. Only floatable debris would be removed, woody debris acting as stabilization for the channel would be left in place. Debris moved from the channel will be moved to a stable location determined by hydrologist. Mileage would be needed to get to field sites and some funds would be needed for supplies and fuel for chainsaws.

3) Roads Treatments

Culverts, bridges, low water crossings, roadside ditches, and other road drainage features are at risk from these watersheds. Increased runoff and sediment from the burned areas can negatively affect the road prism, damaging the road, eroding land downslope of the road and routing flow and sediment directly to stream channels. Culverts associated with these roads are at risk of plugging from debris carried down channels from burned watersheds. Some culverts are undersized for the expected increases in peak flows and are at risk of failure from overtopping. Culvert failures may increase the magnitude of flood, sediment and erosion hazards downstream. Without treatment, these roads can have negative impacts on water quality and surrounding infrastructure if they suddenly fail during a storm event. Proposed road treatments will be completed in-house by San Bernardino National Forest Engineering staff.

Trails Treatments

Trail Storm Proofing: Prior to the first damaging rain events and within the first year following the fire, storm proofing is recommended to minimize erosion of the trail tread. Storm proofing treatments, implemented with hand-tools, would include out-sloping, de-berming, water-bars, armored crossings at ephemeral drainages, and other suitable treatments outlined in the BAER Treatments Catalog to protect the trails from accelerated post fire flows and soil erosion. South Fork Trail, Poopout Hill Trail, Dry Lake Trail, Dollar Lake Trail, Camp Trail-spur, Aspen Grove Trail, Fish Creek Trail and sections of the Pacific Crest Trail would be treated. Repairs are recommended for at least least 25 miles of trail within high and moderate soil burn severity where high watershed responses are anticipated.

Trail Storm Inspection and Response: The inspectors would repair and maintain storm proofing treatments by correcting minor expected problems. Information gathered during these site visits may also be used to submit an interim funding request to the region. This treatment would be applied in the same zones of concern identified in the trail storm proofing section, above.

Wilderness Area Closure and Warning Signs for the Pacific Crest Trail: To protect trail user life/safety, closure of the area until after the first winter following the fire is recommended. Following the first winter, the trail and watershed conditions should be evaluated to determine if hazardous conditions still exist. Closure would be implemented through the issuance of a forest order or area closure and trailhead signage.

Wildlife Resource Treatments

Mountain Yellow-legged Frog Salvage and Recovery: The objective of the treatment is to capture a portion of the existing population of mountain yellow-legged frogs affected by the Lake Fire, then maintain and grow this population in a controlled facility such as a zoo specifically equipped to care for frogs. When the threat of debris flows in the natural mountain yellow-legged frog habitat in the Lake Fire has abated, the captive frogs will be re-introduced to suitable habitat in the Lake Fire area. The USFWS and USGS have been involved with similar emergencies in the Old, Mountain, and Station Fires, and are familiar with the habitat conditions in the Lake Fire area and salvage efforts after those fires.

4) Cultural Resource Treatments

Potential loss mitigation*:* There is no known economical or timely proven treatment to manage the unacceptable risk to this historic resource. As such an administrative solution is

proposed (Recordation, Interpretation, and Public Education).

5) Interagency Coordination Treatments

Public Safety: There is a need to continue the interagency coordination initiated during the BAER assessment. This involves communication and coordination with other federal, state and local agencies with jurisdiction over lands where life and property are at risk from post-fire conditions. Actions include but are not limited to cooperating with other agencies on hazard notification systems, exchanging information and coordinating the BAER implementation plan as needed when subsequent recovery plans are developed by other agencies.

In addition, there are numerous organizational camps and recreation resident tracts under Forest Service special use permits that will require follow-up from the Interagency coordinator and Special Use Administrator.

The Forest Service shall work with the Bear Valley Mutual Water Division to take actions to limit damage to the Jenks Lake Flume when conditions are present that may cause damage to the flume and any adjacent hillside and infrastructure. The Forest Service shall work with the Barton Flats Camp Association to limit damage to the Barton Flats Water System intake structure and filtration equipment when such conditions are present where damage potential has increased.

The threat to life and property requires coordination with many agencies. The Forest Service plans on conducting meetings with permittees (including organizational camps and recreational residence cabin owners) in the very near future. The amount of coordination with the organizational camps and recreational residences cannot be overemphasized. Letters and/or follow up coordination will occur for the following entities: (Note: This is not a complete list)

- Recreation Residence and Organizational camps describing the scale of risk based on post-fire effects.
- San Bernardino County Public Works
- NRCS
- County Office of Emergency Service (OES)
- County Sheriff
- National Weather Service
- USGS
- CML (Campground concessionaire)
- Caltrans
- Southern California Edison (SCE)
- Bear Valley Mutual Water Company
- Barton Flats Camp Association
- Bear Valley Electric

6) Special Uses and Developed Recreation Treatments

There is a need to conduct technical evaluations of temporary closure areas (Camp Ta Ta Pochan, South Fork Recreation Residence Tract, and South Fork Campground outer loop) after storm events to determine if adjustments to use need to be made. In addition to post-storm assessments, closure restrictions will need to be re-evaluated in approximately spring of 2016 following winter precipitations events. Specialists from off-Forest may need to be brought in to offer expert recommendations.

I. Monitoring Narrative:

(Describe the monitoring needs, what treatments will be monitored, how they will be monitored, and when monitoring will occur. A detailed monitoring plan must be submitted as a separate document to the Regional BAER coordinator.)

Wilderness Area and Road Closure Effectiveness Monitoring: Monitoring of the wilderness area closure is needed to ensure that warning and closure signs are effective. Monitoring will be conducted by both FS staff and volunteer groups. Time for a trail specialist also includes time to coordinate with volunteer groups.

Special Uses/Developed Recreation Effectiveness Monitoring: Temporary closures have been recommended for several specials use and developed recreation sites. These include: South Fork Recreation Residence Tract, South Fork Campground (Outer Loop), Camp LaVerne and Camp Ta Ta Pochan. Monitoring is needed to ensure that warning and closure signs are effective.

PART VII • APPROVALS

1. Jody Noiron — 7/9/2015

Forest Supervisor (signature) — Date

2. /s/Barnie T. Gyant (for) — 7/14/2015

Regional Forester (signature) — Date

Appendix A: Soil Burn Severity Map