Executive Summary: Gap Fire BAER Initial Assessment

The Gap Fire started on July 1, 2008, and was contained on July 28, 2008. The fire burned approximately 9,544 acres within Santa Barbara County, of which 4,573 acres (48%) is National Forest System (NFS) lands, and the remainder is private land. The initial Burned Area Emergency Response Assessment has been completed and addressed all National Forest System lands within the burned area.

A high percent (76%) of the burn area was rated as moderate or high burn severity, with 24% rated as low burn severity or unburned. The fire completely burned off all effective cover on the majority of the burned area with the exception of some of the riparian areas in the bottom of the larger drainages. While soil burn severity was largely moderate, watershed response to precipitation events is expected to be high over nearly all of the fire area due to loss of cover on steep slopes. The potential for increased flows leading to flooding and debris flows is high to very high. Runoff and sediment yield is expected to increase substantially in the first three years. Vegetation is expected to re-sprout in the majority of the burned area, with effective cover re-established within 5 years.

Within the fire perimeter there are multiple high value resources including but not limited to the Southern California Edison powerline, Goleta Water District water treatment plant, orchards, several reservoirs, Cachuma Operations and Maintenance Board buried water pipeline, and roads that access these different facilities, as well as a significant cultural resource site. In addition, the fire lies immediately upstream of the community of Goleta, Santa Barbara Airport, the Goleta Slough, Highway 101, a railroad, and other high value developments. These high value developments all lie within 0 to 5 miles downstream of the burned area. Given the predicted effects of the fire, all of the high value resources listed above are at serious risk for severe consequences should a storm of any significance rain on the burned area within the next three years. Impacts would occur from a combination of increases in flood flows, sediment yield, landslides and debris flows.

The BAER assessment team worked with cooperating agencies through interagency meetings to identify initial concerns and information needs, discuss potential treatment recommendations, and discuss the draft BAER report. These meetings helped the BAER team to identify downstream values at risk, and consider treatment options for NFS lands.

Given the terrain and access limitations, the BAER team identified aerial hydromulch to replace some of the lost cover as the most effective treatment on NFS lands. Hydromulch refers to fiber mulches and soil stabilizers that, when mixed with water and applied to the soil surface, form a matrix that helps reduce erosion and fosters plant growth. Numerous areas were identified for aerial hydromulch treatment on slopes less than 60 percent in moderate to high burn severity in the highest risk watersheds (Upper Los Carneros, Upper Glen Annie, Upper San Pedro Creek, and Upper San Jose Creek).

While additional treatments on NFS lands were evaluated (straw bale check dams, straw wattles, water control structures, riparian planting and channel clearing, to list a few), significant terrain and access limitations limited further consideration of these treatments. However, the initial 2500-8 funding request includes funding for further assessment by a licensed engineer and geologist to determine if opportunities exist for installation of debris racks or other structures at the national forest boundary in order to minimize impacts to downstream values at risk.

While treatments on NFS lands will help to reduce the impacts of the fire following precipitation events, treatments will not completely mitigate the effects of the fire, nor will they be as effective without additional treatments on private lands within and downstream of the fire perimeter. Given the topography of the burned area and lands downstream, the appropriateness and effectiveness of individual treatments varies by location. Cumulatively, the greatest potential to reduce impacts to downstream values would be through a variety of treatments appropriate for the site specific terrain and setting on both NFS lands and private lands.

USDA-FOREST SERVICE FS-2500-8
Date of Report: August 4, 2008

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: Gap Fire

B. Fire Number: CA-LPF-001778

C. State: CA

D. County: Santa Barbara

E. Region: 5

F. Forest: Los Padres

G. District: Santa Barbara

H. Fire Incident Job Code: P5D9MC

I. Date Fire Started: 07/01/2008

J. Date Fire Contained: 07/28/08

K. Suppression Cost: $20.5 million as of 07/27/08

L. Fire Suppression Damages Repaired with Suppression Funds
1. Fireline waterbarred (miles): 42 miles
2. Fireline seeded (miles): None to date
3. Other (identify):

M. Watershed Number: 6th field HUC: 1806000130104 (Don Pueblos); 180600130201 (San Jose Cr)

N. Total Acres Burned: 9544
NFS Acres(4573: 48%) Other Federal ( ) State ( ) Private (4971: 52%)

O. Vegetation Types: Alternating soft and hard chaparral follow bands of faulted and folded sedimentary rock formations across the landscape. Predominately south-facing slopes are dominated by chaparral with oak woodlands and avocado and citrus orchards at lower elevations. Conifers exist in small patches along ridgetops and on north-facing slopes. Narrow riparian corridors contrast sharply with the otherwise dry landscape.

P. Dominant Soils: See Table 1.

Table 1: Dominant soils within the Gap Fire.

Map Unit	Name	Texture* pH	Soil Depths	Runoff Potential	Permeability	Erosion Hazard	Slope Gradient
17	Lodo-Livermore-Chualar families association	SL, gSL, SiL 7.0 -7.6	shallow to deep	moderately low to high	rapid to moderately rapid	high to very high	30% – 60%
26	Millerton-Millsholm families – rock outcrop complex	SL 6.0	shallow	high	rapid	very high	30% – 80%
42	Rincon-Modesto-Los Osos families association	SL, gSL, SiL 6.5 – 7.2	moderately deep to deep	moderately high	moderately slow	high - low slope stability	30% – 60%
45	Stonyford-Ramona association	L 6.0-6.5	shallow to moderately deep	moderately low to high	moderate	high	30% – 65%

S=Sandy; L=loam; Si=Silt; g= Gravelly

Q. Geologic Types: Steeply dipping sedimentary rock, predominantly sandstone, crossed by east/west to northwest trending faults.

R. Miles of Stream Channels by Order or Class:

Perennial: 6.8 miles (2.9 miles USFS; 3.9 miles non-federal);
Intermittent: 34.1 miles (13.8 miles USFS; 20.3 miles non-federal)

S. Transportation System

Trails: 0 miles Roads: 24.1 miles (2.5 miles USFS; 21.6 non-federal)

PART III - WATERSHED CONDITION

A. Burn Severity by total and FS (acres): 2298 (USFS: 744) (low) 6241 (USFS: 3179) (moderate) 1014 (USFS: 641) (high)

B. Water-Repellent Soil by total and FS (acres): 572 acres (USFS: 274 ac; Private: 278 ac)

C. Soil Erosion Hazard Rating by total and FS (acres):
0 (low) 0 (moderate) 9544 (USFS: 4573) (high)

D. Erosion Potential: 23-70 tons/acre

E. Sediment Potential: See Table 2

Table 2: Summary of sediment potential (cubic yards/ square mile)

		Sediment potential 1-year following Gap Fire	
Watershed	**Normal**	**Post-fire**	**% of pre-fire**
Upper San Jose Creek	2810	18830	670%
Upper Las Vegas Creek	1030	2480	240%
Upper San Pedro Creek	2340	32250	1380%
Upper Carneros Creek	2690	48200	1790%
Upper Glen Annie Canyon	3400	55600	1640%
Bell Canyon	3080	51720	1680%
Tecolote Canyon	2330	17500	750%
Eagle Canyon	3290	5080	150%

PART IV - HYDROLOGIC DESIGN FACTORS

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

B. Design Chance of Success, (percent): 64

C. Equivalent Design Recurrence Interval, (years): 5

D. Design Storm Duration, (hours): 6 hour

E. Design Storm Magnitude, (inches): 4.66 inches

F. Design Flow, (cubic feet / second/ square mile): See Table 3 below

G. Estimated Reduction in Infiltration, (percent): 6%

H. Adjusted Design Flow, (cfs per square mile): See Table 3

Table 3: Design flow and post-fire adjusted design flow (cfs per square mile): Based on Rowe et al. (1949) method*

	F. Normal watershed peak discharge per storm type (cfs/sq.mi.) [Design Flow Q5]				**G. 1-year post burn peak discharge per storm type (cfs/sq.mi.) with approximate equivalent recurring storm rank [Design Flow Q5]**			
Watershed	**Q2**	**Q5**	**Q10**	**Q25**	**Q2**	**Q5**	**Q10**	**Q25**
Upper San Jose Creek	53.5	97.0	134	191	73.5 (Q4.5)	125 (Q12)	166 (Q20)	229 (Q40)
Upper Las Vegas Creek	20.8	38.4	52.8	76.2	22.7 (Q3)	41.0 (Q6)	55.9 (Q12)	80.0 (Q28)
Upper San Pedro Creek	47.2	86.8	119	172	86.6 (Q7)	142 (Q12)	183 (Q30)	251 (Q100)
Upper Carneros Creek	55.1	102	142	207	118 (Q8)	189 (Q20)	246 (Q45)	335 (>Q100)
Upper Glen Annie Canyon	69.5	128	179	261	141 (Q7)	227 (Q25)	296 (Q40)	404 (Q100)
Bell Canyon	64.8	119	165	242	132 (Q7)	211 (Q17)	274 (Q35)	378 (Q100)
Tecolote Canyon	49.4	92.2	130	192	70 (Q3)	122 (Q9)	165 (Q20)	236 (Q50)
Eagle Canyon	67.3	122	170	246	69.6 (Q2)	126 (Q5)	174 (Q10)	251 (Q25)

* Note: The modeled peak flow values should only be used as an indicator of the relative increase in peak flows after the fire. Values are based on a model that was developed using gage data from streams in Southern California following a fire, and implicitly include bulking factors etc. The hydrologist specialist report on file with the Los Padres National Forest contains additional information.

PART V - SUMMARY OF ANALYSIS

A. Describe Critical Values/Resources and Threats:

Values at risk

The Gap Fire burned approximately 9544 acres of which 4573 acres (48%) were on National Forest System lands, and 4971 acres (52%) were on non-federal/private lands. National Forest System lands are located in the higher elevations with private land comprising the lower elevations. A high percent (76%) of the burn area was rated as moderate or high burn severity, with 24% rated as low burn severity or unburned. The fire completely burned off all effective cover on the majority of the burned area with the exception of some of the riparian areas in the bottom of the larger drainages. While soil burn severity was largely moderate, watershed response to precipitation events is expected to be high over nearly all of the fire area due to loss of cover on steep slopes. The potential for increased flows leading to flooding and debris flows is high to very high. Runoff and sediment yield is expected to increase substantially. Vegetation is expected to re-sprout in the majority of the burned area, with expected effective cover re-established within a 5 year period.

Within the fire perimeter there are multiple high value resources including the Southern California Edison Powerline, Goleta Water District water treatment plant, orchards, several reservoirs, Cachuma Operations and Maintenance Board buried water pipeline, and roads that access these different facilities, as well as a significant cultural resource site. In addition, the fire lies immediately upstream of the community of Goleta, Santa Barbara Airport, Highway 101, a railroad, and other high value downstream developments. These high value developments all lie within 0 to 5 miles of the fire, and there is high potential that they will be severely affected by increases in flood flows, sediment yield, and debris flow potential.

The Santa Barbara Airport experienced closures in 1995 and 1998 from flooding. The airport estimates that if that were to happen today, the economic impact would be aproximately $1.4 million per closure. As indicated by the City of Goleta, the culvert on San Pedro Creek at Highway 101 is overwhelmed with a 10 year storm in pre-fire conditions.

Three of the drainages that were severely burned drain into the Goleta Slough in which a $10 million wetland restoration project is nearing completion. The cumulative effect following the fire of these three drainages is likely to significantly affect the slough with potential to completely destroy the wetland restoration project.

East facing slopes with greater than 55% gradient and high soil burn severity have a very high risk of both landslides and debris flows. This is particularly significant in the area of the water treatment plant because failure could result in collapse of part of the water treatment facility resulting in catastrophic flooding. In addition, these landslides and debris flows could affect the Cachuma Operations and Maintenance Board water pipeline which provides water to over 200,000 (80%) clients in the area. Other specific concerns include a high risk of failure of the access road for both the powerline and Cachuma waterline due to rockfall, debris flows, and landslides. This may result in partial to complete loss of the road prism in certain locations. Loss of access to the powerline and pipeline could limit the response time to address breaks in the water line or problems with the powerline which would affect all of the downstream identified communities, airport, etc. Postfire sedimentation is also expected to reduce the capacity of several reservoirs within the burn area.

Given the predicted effects of the fire, all of the high value resources listed above are at serious risk for severe consequences should a storm of any significance rain on the burned area, particularly if antecedent moisture conditions are high.

The BAER assessment team has met with interested cooperating agencies that may be affected by changes in physical processes that would affect downstream values at risk. Meetings were held to identify initial concerns and information needs, to discuss potential treatment recommendations, and to discuss the draft BAER report. These meetings helped the BAER team to identify downstream values at risk, and consider treatment options. While treatments on National Forest System lands will help to reduce the impacts of the fire from precipitation events, any treatments would not completely mitigate the effects of the fire, nor will they be as effective without

additional treatments on the private lands within and downstream of the fire perimeter. Given the topography of the burned area and lands downstream, the appropriateness and effectiveness of individual treatments varies by location. Cumulatively the greatest potential to reduce impacts to downstream values would be through implementation of a variety of treatments appropriate for the site specific topography and setting.

Soil Burn Severity

The Forest Service BAER team assessed both the National Forest System (NFS) lands as well as the private lands affected by the fire. Soil burn severity was determined to be 24% low, 65% moderate, and 11% high. The moderate and high areas of the burn are expected to have a high hydrologic response. Approximately 76% of the area the BAER team analyzed will produce high runoff and sediment yield.

Hydrologic and Erosion Response

The burn area is located upslope from the community of Goleta and surrounding subdivisions, Santa Barbara Airport, and major transportation systems (US Highway 101, railroad). This warranted analysis on a smaller scale than the sixth field hydrologic unit code watersheds typically used by the Forest Service. For this reason, smaller sub-watersheds that have been delineated by Santa Barbara County were used to better assess the hazards to these developments. Hydrologic response, relative to downstream values at risk, is most extreme in the Upper San Pedro, Upper Glen Annie, Upper Los Carneros, Bell Canyon, and Upper San Jose Creek subwatersheds. Post-fire change in peak flows range from 1.03 to 1.8 times higher than pre-fire flows for the 5-year storm. Sediment yield increases substantially from 7 to 18 times pre-fire conditions in the above sub-watersheds. Sediment yield is most extreme in Upper Los Carneros, Bell Canyon, Upper Glen Annie, and Upper San Pedro Creek, although still significant in Tecolote and Upper San Jose Creek. The high values identified above are located immediately downstream of the burned area and are at risk.

Threats to life: Threats to life have been identified downstream from the fire from increased runoff and flooding potential, debris flows, erosion and sedimentation, and landslides. Initial estimates indicate that over 120 residences and 70+ business properties are at risk from flooding and sedimentation, and/or debris flows. Lives are potentially at risk in these homes and businesses which are located in flood prone and debris flow prone areas, or on roads where flash flooding may cause washouts, loss of road structures, and loss of water control.

Threats to property: Increased flooding, sedimentation, and debris flow probability have the potential to damage 120+ residences, 70+ business properties, impact Highway 101 and the railroad which could result in closure, close the Santa Barbara Airport, cause power outages if debris flows affect the powerline, and affect domestic water supplies through impacts to the water treatment plant and the Cachuma Operation and Maintenance board water pipeline. These potential serious and long-lasting impacts to downstream values are estimated to be over $23 million. Table 4 below identifies potential impacts by subwatershed.

Table 4: Hazards and values as risk by subwatershed.

Watershed	Hazard & Values at Risk
Upper San Jose Creek	Hazard: Flooding and Debris Flows. Values at risk: Homes along main drainage; City of Goleta; Southern California Edison Powerline; Highway 101; Railroad crossing Dennis Reservoir; orchards; Goleta Beach County Park; Cachuma Operations and Maintenance Board water pipeline.
Upper Las Vegas	Hazard: Flooding and Debris Flows. Values at risk: Southern California Edison Powerline, Santa Barbara Airport; City of Goleta; Highway 101; railroad crossing. No treatments are proposed in this watershed since it is on private land; Cachuma Operations and Maintenance Board water pipeline.
Upper San Pedro	Hazard: Flooding, Debris Flows. Values at risk: Homes along main drainage, below smaller tributaries and below burned slopes. Roads. Southern California Edison Powerline, Santa Barbara Airport; Highway 101; Railroad crossing; orchards; Cachuma Operations and Maintenance Board water pipeline; Goleta Slough.
Upper Los Carneros	Hazard: Flooding and Debris Flows. Values at risk: Santa Barbara Airport; Goleta Water District water treatment plant; Southern California Edison powerline and access road. Homes, roads and bridges along main drainage; orchards; Cachuma Operations and Maintenance Board water pipeline; Goleta Slough.
Upper Glen Annie	Hazard: Flooding and Debris Flows. Values at risk: Glen Annie Reservoir; Goleta Water District water treatment plant; Water pipelines. Orchards downstream. Highway 101 and railroad crossings. Southern California Edison powerline and access road. Homes along main drainage, below smaller tributaries and below burned slopes. Cultural Resource site; Cachuma Operations and Maintenance Board water pipeline; Goleta Slough.
Bell Canyon	Hazard: Flooding and Debris Flows. Values at risk: Southern California Edison Powerline and access road. Permitted diversion and waterline. Homes along mainstem; orchards. Highway 101 and railroad crossing; Cachuma Operations and Maintenance Board water pipeline.
Tecolote Subwatershed	Hazard: Flooding and Debris Flows. Values at risk: Homes at bottom of drainage. Highway 101; Railroad crossing; Cachuma Operations and Maintenance Board water pipeline.
Eagle Canyon	Overall low risk due to low percent of the watershed burning.

Threats to water quality: Glen Annie Reservoir is located within the fire perimeter, but has not been identified as critical for domestic water supplies. The Glen Annie Reservoir and the Dennis Reservoir will experience increased sedimentation and some loss of storage. Increased stream water draining the burned area will result in higher turbidity during peak runoff events. The Goleta Water District water treatment plant is located within the fire. It appears that there may be threats from landslides on slopes immediately below the water treatment plant that may affect a large water storage tank or other structures. The Cachuma Operations and Maintenance Board has a buried pipeline that may be affected by debris flows. While the debris flows would not directly affect water quality, a failure in the pipeline would affect domestic water supplies.

Threats to natural resources: No significant threats to natural resources are expected. While 76 percent of the burned area is considered to be of high or moderate burn severity, root systems are largely intact, and natural revegetation is expected to initiate within the first year, with full vegetative recovery expected within 3-5 years. There is potential for invasion of noxious weeds following the fire, but this potential cannot be evaluated until a later date.

Threats to cultural resources: There is one significant cultural site within the burn perimeter on NFS lands. Direct impacts to this site from the fire have been minimal, but there is potential for increased vandalism due to increased access from loss of vegetation.

Other Threats: Recreation – There is an extremely high risk of unauthorized OHV activity following the fire. Unauthorized OHV activity will greatly disturb the natural landscape, visual quality, recreational opportunity expectations of forest users, and the ability of the vegetation to regenerate. Past experience shows administrative closures are ineffective in preventing unauthorized OHV activity. The Gap Fire is adjacent to highly urbanized areas with OHV users in the area. Physical barriers plus signage and OHV regulation enforcement by patrol personnel are the only proven effective methods of reducing unauthorized OHV activity.

B. Emergency Treatment Objectives:

As noted above, the greatest threats are to life and property from increased erosion and sedimentation, flooding potential, and increased debris flow potential. For these reasons the primary treatment objectives are to minimize loss of life and risk to human safety, and minimize threats to property. Other treatments are identified to reduce the risk of degradation of significant natural resources including the potential spread of noxious weeds, protection of a significant cultural resource site, and erosion and loss of landscape integrity by unauthorized OHV activity.

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

Land **90** % Channel **--** % Roads/Trails **80** % Protection/Safety **90** %

D. Probability of Treatment Success: The probability of success listed below is for reduction in hillslope erosion and reduction in downstream flooding from 2-5 year storm events on NFS lands. However, without treatment to private lands downstream of NFS lands, the probability of success in significantly reducing overall erosion and flooding downstream to the values at risk will be lower.

	Years after Treatment: This refers only to NFS lands, not all lands downstream		
	1	3	5
Land	65	80	100*
Channel	n/a	n/a	n/a
Roads/Trails	80	80	80
Protection/Safety	50	50	50

*It is assumed that there will be a full vegetative recovery by year 5.

E. Cost of No-Action (Including Loss): See Appendix H: Summary of cost-risk analysis

F. Cost of Selected Alternative (Including Loss): See Appendix H: Summar of cost-risk analysis

G. Skills Represented on Burned-Area Survey Team:

[X] Hydrology	[X] Soils	[X] Geology	[ ] Range	[X] Public Information
[ ] Forestry	[X] Wildlife	[ ] Fire Mgmt.	[X] Engineering	[X] Inter-agency coordinator
[ ] Contracting	[ ] Ecology	[X] Botany	[X] Archaeology	[X] NRCS
[X] Fisheries	[ ] Research	[ ] Landscape Arch	[X] GIS	

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H. **Treatment Narrative:**

The treatments listed below are those that are considered to be the most effective on National Forest System lands given the local setting including topography and access. Other treatments that were considered but not carried forward are identified in Appendix J. There may be opportunities for these treatments to be implemented on private lands downstream that would make the treatments on NFS lands more effective.

Land Treatments:

Aerial Hydromulching – This treatment is considered to be the most effective treatment available for National Forest System lands given the complete loss of vegetative cover, and the topography and access. This treatment will reduce the potential for increased flood flows and erosion and sedimentation, but will not eliminate the potential for these adverse effects, nor the potential for debris flows. This treatment addresses the primary objective of reducing loss of life and property. With aerial hydromulch, a wood and paper mulch matrix with a non water-soluble binder would be applied to National Forest System lands on slopes under 60% where there is no rock outcrop in the four watersheds with the highest risk to downstream values (Upper Los Carneros, Upper Glen Annie, Upper San Pedro Creek, and Upper San Jose Creek). This treatment would provide immediate ground cover and increase infiltration which will help reduce flood peaks and sediment yield downstream to areas where there are lives and multiple high values at risk (Table 4). These areas were selected to stabilize sediment from becoming mobilized, and to reduce the initiation of rilling and subsequent debris flows high in the watershed. Mulch would be applied as slurry by helicopter and/or fixed wing aircraft.

(Note: Helimulching with dry straw, though less costly than aerial hydromulching, was considered but discounted because it would not likely remain in place due to strong sundowner winds in the area. Seeding was also considered but discounted because research has shown it has little or no effectiveness and can have adverse effects on native plant communities).

Table 1: *Estimates of Sediment Production and Comparison of Reduction Potential for Proposed Mulch Treatment* based on ERMiT modeling. Note these are hill-slope soil erosion estimates that are not routed through the stream system.*

		Event Sediment Delivery t/ac		
Watershed	**Treatment**	**1st Year**	**2nd Year**	**5th Year**
Upper San Jose Creek	Untreated	53	34.4	3.9
	Mulched (1t/ac)	*4.9*	*7.8*	*3.9*
Upper Glen Annie	Untreated	54.5	36.2	3.9
	Mulched (1t/ac)	*5.1*	*8.2*	*3.9*
Los Carneros Creek	Untreated	56.3	36.8	4.2
	Mulched (1t/ac)	*5.2*	*8.2*	*4.2*
Upper San Pedro Creek	Untreated	53.6	35.5	3.9
	Mulched (1t/ac)	*5.0*	*8.0*	*3.9*

**The model is calibrated for straw mulch but is the best available modeling tool at hand at this point*.

Debris rack location evaluation: This treatment involves evaluation by a licensed geologist and engineer of potential locations for debris racks or geo-netting on National Forest System lands. The City of Goleta identified several potential locations for debris racks. This evaluation would allow the Forest Service to identify if any additional structures could be installed on National Forest System lands that would be effective at reducing the potential of downstream impacts. This evaluation would also take into consideration the potential for adverse downstream effects should the debris racks be overwhelmed and fail.

Botany: The treatment includes noxious weed detection surveys and spot treatment of dozer lines, safety zones, and selected roads affected by the Gap fire. Assessing the establishment of weeds and treating small outlying populations before they expand will prevent the weeds from becoming serious threats to the recovery of native/rare plants.

Channel Treatments: None recommended at this time.

Road Treatments:

Powerline access road: The Southern California Edison Powerline and Cachuma Operations and Maintenance Board access road is at risk of loss from post-fire runoff due to lack of adequate drainage and non-current design standards. Substantial sediment yield can occur under post-fire conditions. Recommended road treatments include installing drainage features to improve drainage and minimize concentration of increased runoff on the road surface which could lead to significant degradation of the road, including making the road impassable. This treatment would help to maintain the infrastructure function and future access, which may be needed to address impacts to the powerline or Cachuma Operations and Maintenance Board water pipeline from debris flows following the fire. The Los Padres National Forest will work with the special use permittees for this road to implement these treatments.

Protection/Safety Treatments:

Extended Emergency Coordination – 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. The Gap Fire may need follow-up activities due to the complexity of issues. Actions include but are not limited to coordinating treatments across administrative boundaries, cooperating with other agencies on hazard notification systems, installing rain gages and soil moisture instruments to monitor conditions within the burn in support of National Weather Service forecasts, and exchanging information and coordinating the BAER implementation plan as needed when subsequent recovery plans are developed by other agencies. The initial cost request plans for this effort to include a primary coordinator assigned to the district to facilitate coordination, and part time technical specialists (i.e., geologist and hydrologist) to aid the coordination for the primary resource issues associated with this fire. Additional coordination needs may ensue, costs for which will need to be requested on an interim 2500-8.

Public safety and preparedness: While the land treatments will reduce downstream flooding potential, a key component to address the loss of life is public safety and preparedness. The treatment proposed here is to work with cooperating agencies to develop posters, brochures, and information for other media by participating in interagency meetings and other media regarding increased safety hazards associated with the Gap Fire. The Forest Service contribution for these media presentations will be matched or exceeded by cooperating agency partners.

Signs—Approximatley 50 signs will be placed at key access points to inform Forest users of safety hazards, and reinforce physical barriers placed to promote revegetation and recovery. Trespass by OHVs has already been experienced in the burn area, and these signs along with the physical barrier will be critical to control impacts from unauthorized OHV use. Three cultural resource signs will also be placed at key access points to the significant cultural resource site that is on National Forest System lands. These signs will identify the sensitivity of cultural resources on public lands, and associated penalties for looting etc. This cultural resource site has become readily accessible as a result of loss of vegetative cover which also restricted access.

Barriers: – Barriers will be installed at sites highly vulnerable to intrusion by OHV's into the burn area from West Camino Cielo Drive. Trespass has already occurred along this route. This treatment is needed to prevent land damage caused by unauthorized vehicular entry. Without physical protection, vehicular and other damage is expected to be significant on NFS lands since there is virtually no post-fire vegetation to act as a barrier. Administrative closures have proven to be ineffective in preventing intrusion and damage in this highly urbanized forest setting. Signing of all vulnerable areas and subsequent monitoring of this treatment will be done in addition to placement of physical barriers.

I. **Monitoring Narrative:**

Forest personnel will monitor the BAER treatments to check that treatments are present and functioning properly.

This report is an initial funding request based on a rapid assessment. If additonal treatment needs are identified through more site specific on the ground investigation in cooperation with interested agencies, or through the debris rack location evaluation or noxious weed detection surveys, interim requests for additional funding will be filed. These funding requests will identify the purpose for each treatment, and specific treatment specifications, locations, and number of each treatment.

Part VI – Emergency Stabilization Treatments and Source of Funds

*****Specific dollar amounts for different tasks have been removed (redacted) from this version to ensure that no advantage is given to vendors who may be bidding on the various work items.*****

PART VII - APPROVALS

1. /s/ Peggy Hernandez — August 4, 2008
   Forest Supervisor (signature) — Date

2. /s/ Arthur L. Gaffrey (for) — August 8, 2008
   Regional Forester (signature) — Date

APPENDICES[1]: Supporting Information

Appendix A: Summary of soils findings.

Appendix B: Summary of geology findings

Appendix C: Summary of hydrology findings

Appendix D: Summary of botany findings

Appendix E: Summary of weeds findings

Appendix F: Summary of wildlife and fisheries findings

Appendix G: Summary of cultural resource findings

Appendix H: Summary of cost-risk analysis (redacted)

Appendix I: BAER team members

Appendix J: Treatments considered but not carried forward

[1] Appendix A-G are summary reports only. The full specialist reports and cost risk analysis are on file in the Gap Fire BAER administrative file.

APPENDIX A: Soils

Date: July 24, 2008
Author: Gina Rone, Soil Scientist

Long Term Soil Productivity

Resource Setting

The soils in the Gap Fire area formed from sedimentary parent material that accumulated over a long period of marine and continental deposition that was followed by the coastal uplift of the Santa Ynez mountains. Consolidated rocks are exposed in the steep uplands while more gradual slopes, alluvial plains, and terraces are present in the foothills that eventually deposit as uncompacted fill deposits towards the ocean. See geology report for more detail.

Soils within the Gap Fire area have developed in associations of mixed chaparral and oak woodland. This fire-adapted vegetation consists most commonly of chamise, ceanothus, manzanita, scrub oak, live oak, madrone, coastal sagebrush, salvia, yucca, and annual grasses. Soils are shallow to deep in the uplands, shallow in the mid-portion, and moderately deep to deep along the lower mountain slopes and valley bottoms and are directly associated with the underlying geology. Slope gradient averages between 40 to 80 percent in the western and mid-sections of the burn area and changes into more gentle terrain in the northeastern uplands and all along the foothills.

Most soils identified within the burn area consist of primarily sandy to gravelly sandy loams, especially in the upper two thirds of the burn area. Textures increase in silt and clay content towards lower elevations.

Findings of On-The-Ground Surveys

Aerial reconnaissance and field observations of the Gap Fire revealed that most burned area soils fall into a moderate to high burn soil severity classification. Soils with a high burn severity classification are primarily present across the mid-section of the burn area at elevations between 1000 to 2400 feet. This unusual pattern was driven by so called “Sundowner” downslope winds.

In the moderate to high burn severity areas, the majority of the ground cover was removed by the fire. Many of the areas still contain some sort of charred and distinguishable litter component, although groundcover is largely missing. Areas with white ashes are most dominant in the upper Tecolote and Ellwood drainages and represent sites with very deep ash layers that reflect moderate or complete consumption of the prior vegetation and litter layer. However, fine and coarse roots are still present and natural regeneration in this fire-adapted ecosystem should be robust.

All soils reflect a high to very high erosion potential despite displaying generally rapid permeability. Cover is lacking for erosion control in the moderate to high burn severity areas due to complete vegetative consumption. This is especially pronounced across the mid-portion of the burn area. Tecolote, Bell Canyon, Glen Annie, Upper Carneros, and lower San Pedro canyons still contain stretches of intact riparian area, while the remaining main drainages, such as McCoy Canyon, contain less live vegetation.

Based on the results of the field survey, it appears that there was only a modest change in overall water repellency from background natural levels. This is possibly the effect of fast-moving fire with short residence times in any one spot, which would lead to relatively low soil heating and low increases in water repellency.

Hydrophobicity was present but varied greatly and was discontinuous across the landscape. Unburned areas were also sampled as a control and found to be naturally hydrophobic, making it very difficult to determine if the majority of the water repellency was fire induced. When hydrophobicity starts at a depth of ~1/2 inch and extends for an additional inch into the soil, water repellency is believed to be fire induced.

Sediment and Erosion Modeling

The purpose of the post-fire assessment is to analyze fire effects on soils, determine the potential for negative effects to values at risk, and to consider possible treatment options. The surface erosion potential for each representative landform within the Gap Fire area was estimated using the Erosion Risk Management Tool (ERMiT). ERMiT (http://forest.moscowfsl.wsu.edu/fswepp/) is a web-based application that uses Water Erosion Prediction Project (WEPP) technology to estimate erosion, in probabilistic terms, on burned and recovering chaparral lands with and without the application of erosion mitigation treatments.

There is a potential for significant runoff and associated soil erosion to occur on moderate and high soil burn severity sites if intense and/or long duration rainstorms impact the fire area, especially if soils are already saturated. The ERMiT soil erosion model estimates are equal to erosion rates with a 2-year return interval rainstorm. Estimates using moderate to high soil burn severity with adjusted acres for different slope gradients in individual watersheds predict that 23 to 70 tons per acre of soil erosion can be expected when an intense rainstorm occurs. Note these are hill-slope soil erosion estimates that are not routed through the stream system.

Emergency Determination

Low Burn Severity Areas

Erosion reduction and/or emergency revegetation treatments are not recommended for any of the low burn severity sites because of the rapid natural revegetation and the low soil erosion potential.

Moderate and High Burn Severity Areas – Steep Slopes (>60 percent)

Erosion reduction and/or emergency revegetation treatments on the majority of slopes >60 percent are not recommended for most of the moderate and high soil burn severity areas because of steepness of slope, slope lengths, accessibility, and surface rock content. Debris racks and other in-channel structures are seldom installed in headwaters and are treatment options reserved for downstream stabilization to collect sediment, rocks, and organic debris from plugging culverts.

Moderate and High Burn Severity Areas – Gentle and Moderate Slopes (<60 percent)

Erosion reduction and/or emergency treatments in the form of aerial hydromulching are recommended for terrain on slopes at or below 60 percent in the upper portions of the burn area including the Upper Glen Annie, Upper Carneros Creek, Upper San Pedro Creek, and Upper San Jose Creek watersheds.

The ERMiT soil erosion model was used to estimate post-fire soil erosion and potential soil erosion reduction with a mulching BAER treatment. The model is calibrated for straw mulch but is the best available modeling tool at this time.

Estimates of Sediment Reduction for Proposed Mulch Treatment Site.

Table 1: *Estimates of Sediment Production and Comparison of Reduction Potential for Proposed Mulch Treatment based on ERMiT modeling.*

		Event Sediment Delivery t/ac		
Watershed	**Treatment**	**1st Year**	**2nd Year**	**5th Year**
Upper San Jose Creek	Untreated	53	34.4	3.9
	Mulched (1t/ac)	*4.9*	*7.8*	*3.9*
Upper Glen Annie	Untreated	54.5	36.2	3.9
	Mulched (1t/ac)	*5.1*	*8.2*	*3.9*
Los Carneros Creek	Untreated	56.3	36.8	4.2
	Mulched (1t/ac)	*5.2*	*8.2*	*4.2*
Upper San Pedro Creek	Untreated	53.6	35.5	3.9
	Mulched (1t/ac)	*5.0*	*8.0*	*3.9*

Results showed that the expected post-fire potential erosion rate with a 2-year return interval rainstorm in the fire area ranges between 6 to 8 tons/acre on low burn severity, 7 to 96 tons/acre on moderate burn severity, and 8 to 113 tons/acre on high burn severity soils. The mulch treatment would reduce that to 0.6 to 6 tons/acre on low burn severity, 0.7 to 9 tons/acre on moderate burn severity, and 1 to 11 tons/acre on high burn severity soils. The mulch treatment would reduce the erosion rate with a 10% chance that the erosion rate would be exceeded the first year following the fire.

APPENDIX B: Geology

Date: July 23, 2008
Author: Thomas E. Koler, PhD, PG; Eldorado NF

Note: This is an abridged version of the geology report providing an executive summary of the assessment of the geologic risks in the wildfire area. This version should not be used as a substitute for the final geology report.

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

Potential values at risk from geologic hazards (i.e., landslides, debris flows, and rockfalls) are the health and safety for people, residences, roads, bridges and other facilities within and downstream from the wildfire area. Of particular concern is the potential risk for loss of life and limb. Most of these resources are located on the valley floor within and near the City of Goleta located immediately south from the forest boundary.

II. Resource Condition Assessment

A. Resource Setting

The geology of the wildfire area is complicated with steeply dipping sedimentary beds and faults that trend east-west to northwest. The rock type in this area is sedimentary and Tertiary to Quaternary in age.

B. Findings of the On-The-Ground Survey

1. Resource condition resulting from the fire and risk assessment

Geologic risk is defined in the literature as a function of the likelihood that a geologic hazard will occur and the consequences that will result. USFS BAER policy recommends that only resources with a high risk be provided with treatments for mitigating the risk. Therefore only those areas that have been assigned a high risk are discussed below in the treatment discussion. Table 1 provides the information for qualitatively assigning risk values for rock fall, landslides and debris flows. **Those areas that have slopes greater than 55% gradients with high soil burn severities were assigned likelihoods in Table 1 of possible or greater (e.g., possible, likely, and almost certain)** based on a physically-based modeling of the area. **Likelihoods of geologic hazards occurring and predicted consequences for resources at risk for each watershed are provided in Table 2**.

II. Emergency Determination –

The emergency to values at risk from geologic hazards (i.e., debris landslides, debris flows, and rockfalls) caused by the fire include adverse effects for the health and safety of people, residences, roads and bridges within the wildfire area. Of particular concern is the potential risk for loss of life and limb.

III. Treatments to Mitigate the Emergency

A. Treatment Type (including monitoring if applicable)
Aerial Hydro-Mulching

The BAER team is recommending aerial hydromulch as the most effective means of reducing potential impacts to the values at risk. There are few short-term treatments (as required for BAER) that will mitigate the emergencies resulting from debris landslides, debris flows and rockfall other than treating the soil in areas where the hillslopes are not steep (i.e., less than 60% slope gradient). Potential areas where the more gentle slopes can be found are in the upper slopes of Upper Glen Annie Canyon, Upper Carneros

Creek, Upper San Pedro Creek and Upper San Jose Creek. In these locations it is feasible to apply aerial hydro-mulching to help prevent the initiation of debris landslides and debris flows.

Table 1: Qualitative terminology for use in assessing rock fall, landslide and debris flow risk to property

Qualitative measures of likelihood of landsliding		
Level	**Descriptor**	**Description**
A	Almost certain	The event is expected to occur
B	Likely	The event will probably occur under adverse conditions
C	Possible	The event could occur under adverse conditions
D	Unlikely	The event could occur under very adverse circumstances
E	Rare	The event is conceivable but only under exceptional circumstances
F	Not credible	The event is inconceivable or fanciful
Qualitative measures of consequences to the resource		
1	Catastrophic	Resource is completely destroyed or large scale damage occurs requiring major engineering works for stabilization
2	Major	Extensive damage to most of the resource, or extending beyond site boundaries requiring significant stabilization
3	Medium	Moderate damage to some of the resource, or significant part of the site requires large stabilization works
4	Minor	Limited damage to part of the resource, or part of the site requires some reinstatement/stabilization works
5	Insignificant	Little damage

Qualitative risk analysis matrix – classes of risk to resource					
	Consequences to the resource				
Likelihood	Catastrophic	Major	Medium	Minor	Insignificant
Almost certain	VH	VH	H	H	H
Likely	VH	H	H	M	L-M
Possible	H	H	M	L-M	VL-L
Unlikely	M-H	M	L-M	VL-L	VL
Rare	M-L	L-M	VL-L	VL	VL
Not credible	VL	VL	VL	VL	VL

Legend – VH: very high risk; H: high risk; M: moderate risk; L: low risk; VL: very low risk

Table 2: Risk summary table.

Resources at Risk	**Table 1 Likelihood Descriptor**	**Table 1 Consequence Descriptor**	**Risk Rating**
Residences, farms, roads, bridges and Highway 101 within the **Eagle Canyon Watershed**	Possible	Insignificant to Minor	Very Low to Moderate

Resources at Risk	Table 1 Likelihood Descriptor	Table 1 Consequence Descriptor	Risk Rating
Residences, farms, roads, bridges and Highway 101 within the **Tecolote Canyon Watershed**	Possible	Minor to Medium	Low to Moderate
Residences, farms, roads, bridges and Highway 101 within the **Bell Canyon Watershed**	Likely to Almost Certain	Minor to Medium	Moderate to High
Residences, farms, roads, powerline and Glen Annie Reservoir in the **West Fork Glen Annie Canyon of Upper Glen Annie Canyon**	Possible to Almost Certain	Medium to Major	Moderate to Very High
Residences, farms, roads, powerline, Highway 101, City of Goleta and the Campus of the University of California at Santa Barbara downstream from **McCoy Canyon within the Upper Glen Annie Canyon**	Possible to Almost Certain	Medium to Major	Moderate to Very High
Water treatment facility for the Goleta Water District located within **Dry Creek of Upper Carneros Creek**	Likely to Almost Certain	Medium to Catastrophic	High to Very High
Residences, farms, roads, bridges, powerline, Highway 101, City of Goleta, Goleta Airport, and the University of California at Santa Barbara within the **Upper Carneros Creek**	Possible to Likely	Minor to Major	Low to High
Residences, farms, roads, bridges, powerline, Highway 101, schools, City of Goleta and Santa Barbara Airport within the **Upper San Pedro Creek**	Possible to Likely	Minor to Major	Low to High
Residences, farms, roads, bridges, powerline, Highway 101, schools, City of Goleta and Santa Barbara Airport within the **Upper Las Vegas Creek**	Possible	Minor to Medium	Low to Moderate
Residences, farms, roads, bridges, powerline, Highway 101, schools, Goleta Valley Hospital, and City of Goleta within the **Upper San Jose Creek**	Possible to Likely	Minor to Major	Low to High

III. Treatments to Mitigate the Emergency (Continued)

PAM

PAM-12 was considered, but not selected to carry forward for treatment due to lack of information regarding effectiveness. PAM-12 is a recent development in stabilizing recently burned areas. This treatment has been successfully applied for wildfire areas in Utah, but at this time it remains untested in California. One possibility is to work with Dr. Cannon and her staff at the US Geological Survey with their debris flow research to test the viability of this product. Small areas carefully selected in the low to moderate risk watersheds, such as Tecolote Canyon, may be the best areas for this testing.

Pipe Debris Racks

Stakeholders have proposed that pipe debris racks be placed to help slow and/or stop debris flows and large woody debris. Unfortunately these structures are not temporary. If it was possible to utilize this treatment, the design requirements would make this an unlikely candidate because they require the placement in the catchment areas of culverts due to the lack of suitable areas within National Forest System lands (i.e., new roads would need to be constructed to reach these areas).

B. Treatment Objective

To stabilize potential source areas for debris landslide and debris flow initiation in which the risk to the resources has been assigned a high risk value.

C. Treatment Description

Aerial hydro-mulching provides a temporary cover for soils to help them regain native vegetation before heavy winter rains occur.

IV. Discussion/Summary/Recommendations

In summary, debris landslides, debris flows and rockfall are the geologic hazards in the wildfire area within National Forest System lands. These forms of slope movement have occurred under vegetated conditions and therefore are assumed that they will occur with some frequency in the next few months due to the loss of vegetated cover from the wildfire. Treatments within National Forest System lands include aerial hydro-mulching for the gentle slopes. Within the Forest there is a lack of access as well as suitable areas for constructing structures to slow or stop failed slope materials.

V. References

Please see the final geology report

APPENDIX C: Hydrology

Date: July 25, 2008
Author: Robert G. Taylor, San Bernardino National Forest

Resource Setting

The Gap Fire occurred in a marine coastal environment. Peak flow events are dominated by orographic effects resulting in rainfall that can result in flash flood events. A majority of the drainages only flow when rainfall is present, typically in the winter months.

Hydrologic Emergency Determination Summary

Loss of Water Control

The use of eight local subwatersheds for the analysis, instead of the larger 5th or 6th level HUCs, provides a more pronounced and indicative increase in water yields by watershed because there is less averaging across unburned areas. At this smaller scale increases in peak discharge for the design storm (Q5) increases range from 3 to 7 percent for low severity watersheds including Eagle Creek and Las Vegas Creek, 28 to 32 percent for watersheds with about 20% moderate and high burn severity (San Jose Creek and Tecolote Creek), and 63 to 120 percent for those watersheds with near double peak discharge including Bell Canyon, Upper Glen Annie Canyon, Upper Carneros Creek, and Upper San Pedro Creek. These four watersheds include 75% of the burn, and the modeling indicates that a Q5 storm would react similar to a Q12 to Q25 storm. This constitutes an emergency.

Increase in sediment potential

Increases in sediment potential for the eight subwatersheds range from 1.5 to 2.4 times, 6.7 to 7.5 times, and 13.8 to 17.9 times. The low values reflect very small amount of burn and/or very low soil burn severity in Eagle Creek and Las Vegas Creek. The moderate values are from watersheds with about 20% moderate and high soil burn severity (San Jose Creek and Tecolote Creek). Those watersheds with the highest increase in sediment potential values include Bell Canyon, Upper Glen Annie Canyon, Upper Carneros Creek, and Upper San Pedro Creek. These four watersheds include 75% of the burn and the modeling indicates that a Q5 storm would react similar to a Q12 to Q25 storm. This constitutes an emergency.

Residential & Commercial Development, Transportation Corridors, Airport

Sediment and peak flow increases have the potential to cause a cumulative debris flow and flooding effect. These effects have varying potentials for the various watersheds and are discussed further in the geology, soils, and cost benefit analysis report. This potential for flooding and debris flow has the added risk of causing erosion to orchards, erosion control structures and housing developments. In addition to homes in the floodplain, there are bridges for roads, highways and a rail road trestle span above the multiple creeks, and have the potential to be affected by debris and flooding. Finally, the Santa Barbara Airport and the Goleta Slough is located such that multiple watersheds discharge into the area.

With the general infrastructure capacity of the City of Goleta being Q10 to Q25, the fire has exacerbated an already fragile system. This indicates that there is an emergency condition to downstream development, county/city roads, Highway 101, and the railroad.

Table 2 indicates that the design storm (Q5) will result in a Q20 to Q25 storm on Upper Carneros Creek and the Upper Glen Annie Canyon watersheds, respectively, at a point about one mile north of the northern edge of the airport. Given the information available, this constitutes an emergency condition to the Santa Barbara airport.

Orchards

Agricultural land and “homesteads” along the various rivers are at risk from the potential of increased runoff, scour, and deposition.

For orchards located adjacent to creeks in the Upper Glen Annie Canyon, Upper Carneros Creek, Upper San Pedro Creek, and Upper San Jose Creek there is an emergency condition to life for occasions when workers may be in that vicinity during the design storm event and for property from increased watershed response.

Water Developments

Estimated information of capacity of the reservoir and the available sediment available for erosion indicates that there is a flooding emergency determination for the Glen Annie Reservoir.

The Cachuma operation and maintenance board pipelines are not at risk from a flooding perspective, although considered to be at high risk from a debris flow/landslide perspective.

Determination of risk due to slope loss below the Goleta Water District water treatment plant is addressed in the geologic report.

No locations were provided as to specific water tanks. Without this information, no emergency determination can be made.

A capacity of available storage for sediment and water was not determined for Dennis Reservoir. Without this calculation, it is difficult to indicate if there is an emergency condition for the reservoir relative to peak flow and sediment in-filling. Determination of emergency should be coupled with the soils report.

Southern California Edison

Though information indicated that SCE had recently graded the road surface, almost no drainage control structures, such as overside drains, culverts, or rolling dips were observed. This lack of drainage structure and drainage design capacity potentially is a pre-fire condition. However, the lack of vegetation will increase the runoff and sediment delivery potential and could cause the loss of the road. There is an emergency determination for the road surface.

Potential for damage from debris flows and undercutting of towers due to slope instability is addressed in the geologic report. No emergency determination is made at this time.

Appendix D: Botany

Date: July 23, 2008
Author: Tom Murphey, Wildlife Biologist, Los Padres NF
Technical consultation provided by: Lloyd Simpson, Forest Botanist, Los Padres NF

I. Potential Values at Risk

This report assesses the effects of the Gap Fire and the proposed effects of the burned area emergency rehabilitation (BAER) treatments on the following Forest Service Region Five Sensitive plant species:

- Sonoran maiden fern (*Thelypteris puberula var. sonorensis*)
- Refugio manzanita (*Arctostaphylos refugioensis*)
- Late-flowering mariposa lily (*Calochortus weedii var. vestus*)
- Santa Barbara honeysuckle (*Lonicera subspicata var. denudata*)
- Santa Ynez false lupine (*Thermopsis macrophylla*)

There are no plants within the Gap Fire area that are listed as federally threatened or Endangered with the US Fish & Wildlife Service.

II. Resource Condition Assessment

A. Resource Setting

The overall soil burn severity for the 9,544 acre Gap Fire consists as a mix of 13% unburned, 11% low, 65% moderate, and 11% high. Based on the fire history maps most of the high soil burn severity areas had not burned since the 1955 Refugio Fire. The Gap Fire impacted a number of different plant communities and environments. It burned Costal Sage Scrub, oak woodland, as well as riparian areas.

B. Finding of On-the-Ground Survey

1. Resource condition resulting from the fire.

All known populations of sensitive plant species (above) were overlaid with the Gap Fire boundary. All of the species potentially occur along or within the fire perimeter.

2. Consequences of the fire on values at risk.

Based on conditions found in the field survey and references on the specific fire ecology of each species, these populations should not be adversely affected by the wildfire. In fact, all of these species are well adapted to endure and/or thrive following wildfire.

III. Emergency Determination

None

IV. Treatments to Mitigate the Emergency

A. Treatment type: No treatments under BAER are recommended because of the lack of effective options and because under natural recovery conditions all of the above species are expected to recover from this fire.

B. Treatment objective: N/A

C. Treatment Description: N/A

D. Treatment Cost: N/A

V. Discussion/Summary/Recommendations

It is recommended that surveys for some of the above species are pursued using non-BAER funding in order to establish the presence of these species. Past survey efforts were many years or decades prior to the Gap Fire, and the geographical distribution is only vaguely known. Species that are lacking data or that could be updated include:

- Refugio manzanita
- Late-flowering mariposa lily

VI. **References** See sensitive plant specialist report

Appendix E: Noxious Weeds

Date: July 23, 2008
Author: Tom Murphey, Wildlife Biologist, Los Padres NF
Technical consultation provided by: Lloyd Simpson, Forest Botanist, Los Padres NF
Ken Krueger, Biological Technician, Los Padres NF

VII. Potential Values at Risk

The Gap Fire burned within the Los Padres NF on the Santa Barbara Ranger District, within the Santa Barbara Front Country. A number of private in-holdings within the forest, as well as private lands outside the forest were also burned. The fire burned during the month of July 2008 and affected 9,544 acres of which 4,573 acres were on National Forest System (NFS) lands.

Many non-native plants are found in California wildlands, but some are much more invasive and noxious than others. Invasive weeds are very effective at occupying disturbed soil and displacing native plants and habitat. Non-native invasive weeds have the potential to displace native vegetation, degrade habitat function, and lower ecosystem stability. Ecological stability relates to the value of native plant communities for wildlife habitat and watershed function.

The potential values at risk, in relation to invasive noxious weeds are the ecological stability of native plant communities and the degradation of Region 5 Sensitive plant habitat.

VIII. Resource Condition Assessment

A. Resource Setting

Many invasive noxious weeds are known to occur within the Gap Fire area (Table 1).

Table1. Invasive Noxious Weeds Known In, and Adjacent to the Gap Fire Area

Scientific Name	Common Name
Centaurea solstitialis	Yellow starthistle
Carduus pycnocephalus	Italian thistle
Centaurea melitensis	Tocalote
Foeniculum vulgare	Wild fennel
Tamarix ramossica	Tamarisk
Spartium junceum	Spanish broom
Eucalyptus globulus	Tasmanian blue gum
Cortaderia selloana	Pampas grass

B. Finding of On-the-Ground Survey

1. Resource condition resulting from the fire.

During the BAER team limited survey, noxious weed populations were confirmed or discovered on NFS lands, mainly along or near West Camino Cielo:

- Yellow starthistle
- Italian thistle
- Tocalote
- Wild fennel
- Spanish broom

2. Consequences of the fire on values at risk.

If any weeds were introduced, they could take advantage of the disturbance associated with the fire and displace native vegetation, degrade habitat function, lower ecosystem stability.

IX. Emergency Determination

The unknowing introduction of invasive noxious weeds into areas disturbed by fire suppression and rehabilitation has the potential to establish persistent weed populations. These persistent populations could affect the structure and habitat function of plant communities within the burn area. Forest Service direction is to minimize the establishment of non-native invasive species to prevent unacceptable degradation of the burned area. Consequently, delayed assessment of roads, dozer lines, drop points, and safety zones is necessary to detect the spread and introduction of weeds in the first year after fire. Assessing the establishment of weeds and treating small outlying populations before they expand, will prevent the weeds from becoming serious threats to the recovery of native plants.

X. Treatments to Mitigate the Emergency

A. **Treatment type:** The treatment is noxious weed detection surveys of all roads, dozer lines, drop points, and safety zones affected by the Gap Fire. These areas will be surveyed for evidence of introduction or spread of noxious weeds. If any new or outlying populations are found in these surveys, a supplementary request for noxious weed treatment will be submitted
B. **Treatment objective:** Evaluate and eliminate the potential for noxious invasive weed establishment and spread, in all areas affected by the Gap fire suppression activities.
C. **Treatment Description:** Inspect all areas and monitor for newly established weed occurrences. Monitoring will include documentation and hand pulling small new weed occurrences at the time of inspection.
D. **Treatment Cost:** Variable; see noxious invasive weed specialist report.

XI. Discussion/Summary/Recommendations

Continue monitoring surveys, post BAER funding, to ensure complete weed eradication.

XII. **References** See noxious invasive weed specialist report.

Appendix F: Wildlife and Fisheries

Date: July 23, 2008
Author: Tom Murphey, Wildlife Biologist, Los Padres NF

XIII. Potential Values at Risk

This report assesses the effects of the Gap Fire and the proposed effects of the burned area emergency rehabilitation (BAER) treatments on the federally listed:

- California condor (*Gymnogyps californianus*)
- Southern California coast steelhead (*Oncorhynchus mykiss*) Distinct Population Segment (DPS) and critical habitat for the southern California coast steelhead

This analysis also assesses the effects of the Gap Fire and proposed BAER treatments on the following Forest Service Region Five Sensitive species:

- California Spotted Owl (*Strix occidentalis occidentalis*)
- Peregrine falcon (*Falco peregrinus anatum*)
- Pallid Bat (*Antrozous pallidus*)
- Western Red Bat (*Lasiurus blossevillii*)
- Southern Pacific Pond Turtle (*Actinemys marmorata pallida*)
- San Diego Horned Lizard (*Phrynosoma coronatum blainvillii*)
- California Legless lizard (*Anniella pulchra*)
- Two-striped Garter Snake (*Thamnophis hammondii*)

XIV. Resource Condition Assessment

A. Resource Setting

The overall soil burn severity for the 9,544 acre Gap Fire consists as a mix of 13% unburned, 11% low, 65% moderate, and 11% high. Based on the fire history maps most of the high soil burn severity areas had not burned since the 1955 Refugio Fire. There are three general classes of sensitive wildlife that were affected by the fire: chaparral, oak woodland and riparian species.

The chaparral species of special interest is the San Diego Horned Lizard.

The oak woodland species are:

- California spotted owl
- California legless lizard
- Pallid bat

The riparian species are:

- Southern Pacific pond turtle
- Two-striped garter snake
- Southern California coast steelhead
- Western red bat

The California condor and peregrine falcon often roost on cliff or snags along ridges and fly over the entire area.

B. Finding of On-the-Ground Survey

1. Resource condition resulting from the fire.

Chaparral habitat is the dominate vegetation type within the burn perimeter. Chaparral habitat burned more completely than other habitat, but some unburned areas remain.
Oak woodland habitat generally burned with low to moderate intensity and left some unburned islands.
Riparian habitats generally burn very light or not at all, however some exceptions did occur throughout the fire area, so direct impacts to this habitat are minimal.
Cliff habitats were either not affected or very lightly burned due to the low fuel content.

2. Consequences of the fire on values at risk.

Chaparral species: Horned lizards likely experienced direct mortality during the burn, but are expected to recolonize the area from nearby unburned habitat.

Oak woodland species: Habitat within the moderately burned areas will likely regenerate, as the coast live oak will trunk sprout, except in areas where the high duff layer burned and girdled the trees. Spotted owls and pallid bats were most likely not directly impacted by the burn due to their ability to leave the area. The former will be impacted temporarily by the loss of prey species, woodrats in particular, that were killed in the fire. Legless lizards undoubtedly sustained a high mortality, due to the consumption of the leaf litter habitat by the fire.

Riparian species: Burned riparian areas typically recover rapidly post fire due to high soil moistures and ability of most riparian woody plants to crown sprout. Riparian areas throughout and below the fire area will be subjected to increased scouring and debris flows over the next three to five years resulting in changes to channel morphology, lowered water quality, and erosion of stream banks and associated riparian vegetation. Reptilian species such as the aquatic two-striped garter snake and southern Pacific pond turtle will be temporarily displaced, however they should benefit by the establishment of sand bars and regeneration of riparian vegetation.

There was not any direct mortality to California Condors from the fire and they may benefit from an increase in foraging areas and snag generation. Peregrine falcons were not likely affected by the fire directly but may have a different host of prey species that respond to habitat changes; for instance there may be a shift in prey items toward woodpeckers and other species that respond favorably to increased insects in burned areas.

XV. Emergency Determination

Emergency conditions resulting from the Gap Fire exist for the following species:

Species	Emergency condition
San Diego horned lizard	Direct mortality from the fire
California spotted owl	Temporary loss of habitat
California legless lizard	Direct mortality from the fire and loss of habitat
Southern Pacific pond turtle	High water flows
Two-striped garter snake	High water flows
Southern California coast steelhead	High water flows and excessive sedimentation

XVI. Treatments to Mitigate the Emergency

A. Treatment type: No treatments under BAER are recommended because of the lack of effective options and because under natural recovery conditions all of the above species are expected to recover from this fire.

B. Treatment objective: N/A

C. Treatment Description: N/A

D. Treatment Cost: N/A

XVII. Discussion/Summary/Recommendations

It is recommended that surveys for several of the above species are pursued using non-BAER funding in order to establish the presence of these species. Past survey efforts were many years or decades prior to the Gap Fire, and the geographical distribution is only vaguely known. Species that are lacking data include:

- Western red bat
- Pallid bat
- Legless lizard
- California spotted owl

Species that have recent surveys but whose records need updating to assess the effects of the fire include:

- Southern California coast steelhead

XVIII. **References** See wildlife specialist report

Appendix G: Cultural Resources

Date: July 24, 2008
Author: Steven Galbraith; Staff Archaeologist Vandenberg Air Force Base, California

I. Potential Values at Risk

The values at risk are archaeological sites, both prehistoric and historic, as well as ethnographic sites, within and in the vicinity of the burn. Many of the values are fragile and their loss considered irreversible and irretrievable. Those values are information and data contained in the archaeological sites regarding prehistoric populations, environments, and climates as well as tangible cultural items. Values include artistic and spiritual elements as represented in rock art and specific geographical places.

Vandalism or theft of archaeological materials from National Forest lands is of high concern. Ground visibility and access to areas within the burn area have been greatly enhanced due to the removal of vegetative groundcover by the fire. Large losses of archaeological materials can be expected as a result of this increased visibility and access. Areas within the burn area have a history of looting and vandalism; rock art panels in the vicinity have been vandalized, including graffiti, being shot at, and even to the extent of chiseling off sections of rock art elements.

II. Resource Condition Assessment

A. Resource Setting

Minimal survey coverage for cultural resources exists within the burn area due to rugged terrain, thick vegetation, and the paucity of related projects that would initiate Section 106 of the National Historic Preservation Act. An archaeological records search was conducted to ascertain the presence of known cultural resources within the vicinity of the burn. Since there have been only minimal archaeological surveys previously conducted within the fire area and the constraints of steep and rugged terrain, just 16 cultural properties are recorded within the burn area, 1 of which is situated on National Forest land. Surrounding areas that have been surveyed, and previous sporadic heritage related findings, clearly show that the area is rich in prehistoric use including ceremonial activities evidenced by rock art sites within the vicinity. Given the known cultural resources of the area and rugged terrain characterized by rock outcroppings, it is expected that more rock art sites may exist.

B. Findings of the On-Ground Survey

A total of 16 cultural sites are recorded within the burn area. Most of the sites, 13, are from the prehistoric period representing Native American use. Five cultural resources were inspected within the burn area, none appear to have been significantly impacted by the fire. These resources have burned over in the past and minimal impacts from the fire were noted at three prehistoric sites, the burning over of site constituents on the surface such as marine shell and lithic material. There is only one known recorded site on National Forest land, CA-SBa-0138—a Chumash rock art site. The fire burned up next to the site but there was no impacts noted to the rock art panel or associated bedrock mortars. Sites inspected on non-federal lands within the burn area include a segment of an old stagecoach route known locally as slippery rock and prehistoric sites containing marine shell and lithic material. No direct impacts to any of the sites inspected were noted during site assessments.

There are however, a number of known cultural resources recorded downstream of the burn area situated on county or public lands. These locations became increasingly inaccessible as county facilities and private landowners began to secure and lock out access. It is recommended that agencies and landowners responsible for these resources inspect locations for potential site degradation by storm runoff and erosion.

III. Emergency Determination

Two factors affect the potential for adverse effects to the cultural resources within the burn area. The first is the environmental change from the severity of the burn, loss of vegetation, potential for soil erosion or deposition, and superheating of rock outcrops. The second factor is the susceptibility of the individual cultural elements that constitute the sites, or the fragility of the resource. The fire has or may change the environment for cultural resources in the following ways:

- Physical effects of fire on the rock outcrops in which the pictographs are located

- Vegetation loss and peak water flows resulting in soil loss or redeposition
- Accessibility from removal of vegetation
- Unauthorized use of Off-Highway Vehicles (OHV) in areas now easily accessible

A. Treatment Type

A three-part treatment is proposed for the Gap Fire area. The first is the placement of signs at trailheads entering recreational areas within the Forest that will advise people of the sensitivity of cultural resources on public lands and the civil and criminal penalties associated with looting, damaging, and/or vandalizing these resources. The second is to construct barriers to keep unauthorized OHV use out of archaeologically sensitive areas within the burn area. The third is monitoring and patrolling for treatment effectiveness within areas of archaeological sensitivity.

B. Treatment Objective

Specific objectives of proposed treatments are to help protect cultural resources on National Forest lands that are now easily accessible and an attractant from being impacted or adversely effected by deliberate or inadvertent damage, vandalism, and/or looting.

C. Treatment Description

Install signage that will carry a simple yet sensitive educational message about the cultural resources within the recreation areas, particularly rock art, the frailty of the images and importance of respect and not touching. The signs will also inform the public that antiquity violations are a federal offense and violators will be prosecuted.

Fencing and barricades should be constructed along West Camino Cielo Road to prevent unauthorized OHV use within archaeologically sensitive areas. Partial closure of West Camino Cielo Road will increase public visitation with in these areas. Design of the fencing and barricades will be at the discretion of the Forest but Pipe and Cable fencing and large rock boulder placement is suggested.

Monitoring is required to ensure fencing and barricading remain effective against OHV trespass in archaeologically sensitive areas and that educational and awareness signage remains present and legible. Cultural properties within these areas are now at risk of looting and vandalism. Immediate areas of concern are the burn areas south of the recreation area of Lizard's Mouth and exposed rock outcroppings. These locations as well as known cultural properties within the burn area need to be patrolled to discourage and watch for any looting or vandal activities.

It is proposed to conduct these patrols using a largely volunteer workforce from the Forest's Site Steward program that consists of both professional and vocational archaeologists who have been trained by Forest archaeological staff. An archaeologist assigned specifically for the project with oversight provided by Forest archaeological staff would supervise the patrol crew. This supervisory archaeologist will be responsible for final report preparation as well as supervision of the crew and site records, maps, and other documentation. Forest Service Law Enforcement and Wilderness Rangers will also be contacted to monitor the area for illicit activities pertaining to cultural resources.

Requirements for Proposed BAER Treatments -

Any proposed BAER treatment must comply with Section 106 of the National Historic Preservation Act and 36CFR 800.2(0). As such, prior to the implementation of any proposed treatment under BAER, consultation with the Los Padres National Forest's Planner and Archaeologist is required.

IV. Summary and Recommendations

Relatively little archaeological survey has been conducted in the burn area due to both vegetative coverage and steep terrain. There is a high probability that there are undocumented cultural resources that are now accessible within the burn area. There is now a significant threat to both documented and undocumented cultural resources on National Forest land by the increased accessibility the burn created. There will be an

expected increase of public use in culturally sensitive recreational areas from the proposed closure of West Camino Cielo Road just north of the Winchester Gun Club.

Treatments proposed include educational and awareness signage to be installed at select entry points into the burn area where the public is expected to pass, fencing and/or barricading sections of West Camino Cielo along the burn area to prevent or deter unauthorized OHV use within culturally sensitive areas, and monitoring and patrolling for effectiveness of treatments.

Appendix I: BAER team members

Core Team members

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Appendix J: Treatments considered but not carried forward

Much of this information comes from the U.S. Forest Service BAER Catalog.

Treatment	Advantages	Disadvantages	Most effective location
No treatment	▪ Natural site recovery	▪ No protection from incursion ▪ Values at risk not protected in short term	▪ Low burn severity; unburned areas; where cost-risk analysis supports
Seeding	▪ Reduce erosion in areas with limited perennial plants ▪ Minimize wind erosion ▪ Could limit invasive species ▪ Promote revegetation ▪ High burn severity ▪ Highly erodible soils without cover ▪ Slopes up to 60% ▪ 3x more stable after 2 years	▪ Minimally effective in first year o Less than 60% effective ▪ Chaparral regrowth environment established ▪ Could introduce invasive species ▪ May inhibit growth of native species (allelopathic) ▪ Interfere with natural succession ▪ Rarely reduces erosion - multiple studies o 1st year erosion can move seed ▪ Within or adjacent to high values at risk ▪ Ryegrass shown to be counterproductive ▪ Most successful in least needed locations - gentle slopes and riparian areas ▪ Competes with native species	▪ Where natural recovery not likely to occur

Treatment	Advantages	Disadvantages	Most Effective location
Riparian Planting	▪ Used on National Forest lands post-fire ▪ Improve water quality (stream shading, etc.) ▪ Displace invasive species ▪ Stabilize stream banks ▪ Provide habitat	▪ Montana and Oregon and Tahoe Basin Angora Fire applications not through BAER - long term with NEPA ▪ Installation - access and safety ▪ No identified habitat on National Forest lands needed protection ▪ Competes with native species ▪ Disturbance to TES species that may be present	▪ Where critical TES habitat identified; where natural recovery not likely to occur
Channel Clearing	▪ Remove sediment or debris prior to landslide activation ▪ Reduce chance of channel debris dams causing flash floods ▪ Good effectiveness when trash racks cannot be used	▪ Can require heavy equipment ▪ Can do more harm than good ▪ Implementation - access and safety ▪ Poor effectiveness in 1/3 of cases due to lack of debris and more damage to stream banks than help (fws.gov) ▪ Poor access, extreme terrain	▪ Where there are structures immediately downstream where debris could cause structure failure

	▪ Reduce risk of debris plugging downstream culverts/drainage structures.	conditions creates safety concerns for hand crews doing the work. ▪ Large woody debris is not generally removed because of its benefit to creating favorable habitat for fish. Large woody debris often becomes incorporated into stream channels, trapping sediment and gravel ▪ Impacts to TES species	

Treatment	Advantages	Disadvantages	Most Effective location
Add large woody debris to channels	▪ Maintain channel stability ▪ Replace woody material ▪ Improve fish habitat ▪ Dissipates stream energy ▪ Trap sediment ▪ Possible reduction of in-channel debris flow ▪ Channels with unstable bedload and high sediment loading potential	▪ Installation - access and safety ▪ High burn severity where woody material consumed - not applicable for most of fire ▪ Where values at risk are road crossings or aquatic habitat ▪ Debris could move downstream and plug culverts/drainage structures	▪ Where loss of woody debris result in channel instability; critical aquatic habitat
Geo-netting	▪ Effective for rockfall ▪ High strength values for kinematic failures ▪ Easy to install in collection areas such as roads and landings ▪ Easy to maintain in areas such as roads/landings	▪ Most effective around roads/highways ▪ High costs for installation and maintenance ▪ Installation and maintenance - access and safety ▪ Permanent structures ▪ Very difficult to install and maintain on hill slopes ▪ Chance of catastrophic failure	▪ Immediately above structures at risk of impacts from rockfall
Straw bale check dams	▪ Modify sediment and water movement in small ephemerals ▪ Capture and store sediment ▪ High burn severity ▪ Highly erodible soils ▪ Areas of <20% ground cover ▪ High values at risk	▪ Only used in ephemeral swales of less than 20% slope ▪ Installation and maintenance - access and safety ▪ Rarely attenuates peak flows ▪ Watersheds of less than 5 acres ▪ Large events can cause failure ▪ Cause more problems by trapping sediment and releasing at once ▪ 20% failure even in good conditions	▪ Small low gradient watersheds where not likely to be overwhelmed and fail after first runoff event; immediately above houses, orchards etc where very small amount of sediment could have large effect

Treatment	Advantages	Disadvantages	Most effective location

Debris catchments/ sediment basins	▪ Temporarily store sediment ▪ Attenuates peak flows ▪ Durable structure ▪ Values at risk include life and property and threat is imminent ▪ Control deterioration of water quality ▪ Areas of moderate to high burn severity ▪ Areas of pre-fire debris flow and landslides	▪ Installation and maintenance - access and safety ▪ Shallow soils limit capacity ▪ Last resort due to cost, maintenance, timeframe of design, and permit approvals ▪ No qualitative effectiveness available - seldom used ▪ Not designed for headwaters	▪ Low gradient slopes with easy access for cleaning following each precipitation event
Straw wattles on slopes	▪ High and moderate burn severity ▪ High values at risk ▪ On slopes with <40% ground cover ▪ Trap sediment ▪ Function for 2 years ▪ Improve infiltration ▪ Reduce rilling ▪ Minimize water quality degradation	▪ Partial reduction of erosion ▪ Partial slope length reduction ▪ Sediment trapped small ▪ Only on slopes between 20 and 40 percent ▪ Soils not less than 8 inches deep ▪ Slopes with <25% surface rock ▪ Installation and maintenance - access and safety ▪ Reduced effectiveness without maintenance ▪ Expensive and labor intensive ▪ Can cause damage if not installed properly	▪ Where have low rock content and potential for good contact with ground in a closely spaced series of wattles ▪ Best where specific structure or improvement to be protected and upslope area meets specifications
Weather modification	▪ Could reduce rainfall events	▪ Untried for BAER ▪ Complex process to predict time and location of use ▪ China involved since 2006 ▪ Only works on small scale ▪ Russia is most advanced ▪ No studies of effectiveness	▪ Not feasible at this time

Treatment	**Advantages**	**Disadvantages**	**Most effective location**
Channel deflector	▪ Protect structures or infrastructure from increased streamflows ▪ Reduce potential loss or damage to property of infrastructure	▪ Use for roads paralleling stream channels and facilities at risk from streambank erosion or flooding ▪ Installation and maintenance - access and safety ▪ Availability of material ▪ No documented effectiveness - rarely used ▪ May be inadequate time to conduct surveys and design the treatment prior to first damaging storm ▪ Permit acquisition required ▪ Requires heavy equipment	▪ In front of developments such as roads, railroad crossings etc where culvert or bridge blockage likely to occur

Debris Deflectors (trash racks)	▪ Used for medium to large floating debris ▪ Reduce the risk of plugging downstream culverts and drainage structures.	▪ Designed to protect culverts from plugging - no identified culverts on Forest ▪ Use in watershed away from culvert out of prescription - theoretical ▪ Installation and maintenance - access and safety ▪ Permit acquisition required ▪ Debris racks must be frequently checked during the winter to determine whether excessive debris must be removed to prevent catastrophic failure. ▪ Debris racks should only be constructed where winter access with heavy equipment is certain.	▪ At developments such as roads, railroad crossings etc where culvert or bridge blockage likely to occur

Treatment	**Advantages**	**Disadvantages**	**Most effective location**
Bios lids	▪ Local source available ▪ Can increase hydraulic conductivity of soils ▪ Total porosity and moisture retention can be increased ▪ Has been used post fire in Colorado in 1997	▪ Can contain heavy metals ▪ Phosphorous can be problem if soil eroded to surface water ▪ Specialized equipment needed ▪ Permits may be needed ▪ Not a standard BAER treatment ▪ Anaerobic conditions created ▪ Installation - access and safety ▪ Generally used with seeding	▪ Small isolated areas where soil productivity lacking
Streambank armoring	▪ Reduces impacts from increased peak flows ▪ Reduce erosion and sediment in stream channels ▪ Reduce degradation of water quality ▪ Areas with high values at risk	▪ Streambanks major source of sediment ▪ Suitable rock source ▪ Haul distance ▪ Instability and maintenance - access and safety ▪ Can accelerate streambank erosion downstream of installation ▪ Rarely used ▪ Requires permit acquisition ▪ Impacts to TES species	▪ Where streambank failure could result in direct loss of life or property in the immediate vicinity
Water control structure	▪ Trap sediment ▪ Control downcutting ▪ Control grade to destabilized systems ▪ Reduce water quality deterioration ▪ Downstream beneficial use high ▪ High percentage of watershed burned ▪ Persistent	▪ Careful hydrologic and sediment yield analysis needed ▪ Loss of cover and runoff would result in channel downcutting o Would require more precise assessment ▪ Require implementation hydrologist familiar with design and installation	▪ Low gradient channels <6%

	hydrophobic condition	▪ Installation and maintenance - access and safety ▪ Only used in seasonal channels with low to moderate flow ▪ Channel gradient <6%	

Treatment	Advantages	Disadvantages	Most effective location
Raking (Soil scarification)	▪ Increases infiltration ▪ High erosion hazard rating ▪ High burn severity ▪ High values at risk	▪ Used with seeding ▪ Rarely reduces erosion ▪ Slopes less than 20% with machinery ▪ Slopes 20-40% require handcrews ▪ Installation - access and safety ▪ Requires cultural clearance ▪ Erosion rates not statistically different between treated and untreated ▪ Raked soil more apt to erode ▪ Increase chance of noxious weed invasion	▪ Where erosion rates would be significantly reduced, but soil erosion rates would not be increased
Storm inspection and response (formerly storm patrol)	▪ High to moderate burn severity areas where access required ▪ High risk of loss of water control ▪ Inadequate drainage structures ▪ Provides ongoing road drainage function ▪ Roads susceptible to landslides ▪ Cost effective because bigger road problems avoided	▪ Fire does not have roads on National Forest ▪ Road crossings not applicable on National Forest System lands ▪ Access on road not needed by Forest Service ▪ Location of disposal site ▪ Number of anticipated storm responses	▪ Where structures are in place that could be affected by individual precipitation events.

<u>Primary reasons and associated treatments</u>

- Low effectiveness of protecting downstream values at risk in the first year: No treatment, Seeding, Straw wattles on slopes, Raking, Storm inspection and response

- Installation and maintenance - safety and access: Riparian planting, Channel clearing, Add large woody debris to channels, Geo-netting, Straw bale check dams, Debris catchment/sediment basins, Straw wattles on slopes, Channel deflector, Debris deflector, Biosolid application, Streambank armoring, Water control structure, Raking

- Unproven or seldom used treatments making effectiveness questionable on National Forest System lands: Weather modification, Debris catchments/sediment basins, Channel deflector, Biosolid application

- Long term treatments needing permits or NEPA: Riparian planting, Biosolid application, Channel deflector, Debris deflector, Biosolid application, Streambank armoring, Water control structure, Raking

- Negatively effect Forest Resources (invasive species, TES species, natural recovery): Seeding, Riparian planting, Channel clearing, Straw wattles on slopes, Biosolid application, Streambank armoring, Raking

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