USDA-FOREST SERVICE FS-2500-8 (7/00)

Date of Report: Sept. 11, 2006

BURNED-AREA REPORT
(Reference FSH 2509.13)

PART I - TYPE OF REQUEST

A. Type of Report

[**X**] 1. Funding request for estimated WFSU-SULT funds
[ ] 2. Accomplishment Report
[ ] 3. No Treatment Recommendation

B. Type of Action

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

[**X**] 2 Interim Report # 1
[X] Updating the initial funding request based on more accurate site data or design analysis
[X] Status of accomplishments to date

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

PART II - BURNED-AREA DESCRIPTION

A. Fire Name: Sand

B. Fire Number: AZ-ASF-060100 (P3CH9C)

C. State: AZ

D. County: Coconino

E. Region: 03

F. Forest: Apache-Sitgreaves

G. District: Black Mesa

H. Date Fire Started: April 22, 2006

I. Date Fire Contained: April 27, 2006

J. Suppression Cost: $847,000 (as of 5/4/06)

K. Fire Suppression Damages Repaired with Suppression Funds
1. Fireline waterbarred (miles): 6.6
2. Fireline seeded (miles): 0 (seeding will be accomplished in conjunction with BAER rehab if feasible)
3. Other (identify): 0.5 miles of fence repair

L. Watershed Number: 1502001001

M. Total Acres Burned: 1280
NFS Acres(1280) Other Federal ( ) State ( ) Private ( )

N. Vegetation Types: Ponderosa pine, pinyon-juniper

O. Dominant Soils: 051,186, 189, 061, 052, 182, 187

P. Geologic Types: Limestone and sandstone

Q. Miles of Stream Channels by Order or Class: intermittent 2.0 miles, ephemeral 2.7 miles

R. Transportation System

Trails: 0 miles Roads: 1.25 miles

PART III - WATERSHED CONDITION

A. Burn Severity (acres): 943 (low-unburned) 0 (moderate-high) 336 (high)
Note (305 acres of high are about a 60-40 mix of interspersed moderate and high severity burn)

B. Water-Repellent Soil (acres): 180

C. Soil Erosion Hazard Rating (acres):
933 (low) 62 (moderate) 283 (high)

D. Erosion Potential: 13 tons/acre

E. Sediment Potential: 6710 cubic yards / square mile

PART IV - HYDROLOGIC DESIGN FACTORS

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

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

C. Equivalent Design Recurrence Interval, (years): 25

D. Design Storm Duration, (hours): 1

E. Design Storm Magnitude, (inches): 1.8

F. Design Flow, (cubic feet / second/ square mile): 98 (in principal internal drainage)

G. Estimated Reduction in Infiltration, (percent): 67

H. Adjusted Design Flow, (cfs per square mile): 352 (in principal internal drainage)

PART V - SUMMARY OF ANALYSIS

A. Describe Emergency:

Life and Private Property There is no known threat to life or property.

Cultural Resources

The upper West Chevelon Canyon vicinity is an area of remarkably high archaeological site density. Although there has been limited archaeological inventory within the burn, previous surveys in the West Chevelon and Clear Creek Canyon areas have recorded hundreds of prehistoric sites, many of which are

large, complex, prehistoric pueblo villages (see Heritage reports: R1996-401; R2001-PLOG). In elevations below 6800 feet, such as the Sand Fire burned area, site density ranges from 15-30 sites per square mile.

During fire suppression five new archaeological resources were identified and recorded. One of these sites, 03-01-02-03593 (Prison Point Kiva), is one of the largest and most intact NRHP eligible cultural resources identified on the forest. This site is at risk of damage from burned area conditions.

In addition, a total of eleven new cultural resource sites were identified during the BAER assessment cultural resource survey, 03-01-03598-3603 and 03-01-03605-3609. Of these sites, 03-01-02- 03602 (a single room fieldhouse with dispersed artifact scatter) and 03-01-02-3607 (two single room and one two-room features with dispersed artifact scatter) were identified as at risk from burned area conditions.

Sites 03-01-02-03593 (Prison Point Kiva), 03-01-02-03602, and 03-01-02-03607 are all NRHP eligible sites located in moderate to severe burn areas in which the duff, ladder fuels, and crowns have been completely consumed. Soils within and immediately upslope of these resources show observable levels of hydrophobicity. Resource threats include: 1. rilling through these sites which may expose buried cultural resources or human remains; 2. an increased level of sheet wash that may transport artifacts off site and/or expose buried cultural deposits. 3. fire killed trees within these sites falling due to unstable soils and pulling their roots systems (as well as cultural deposits) with them. Since looting and vandalism was absent at all sites encountered, it is assumed that these sites had received protection from previous episodes of looting and vandalism due to their obscurity caused by limited, pre-fire visibility. As exposed in the post-fire environment, these sites are clearly visible from a distance.

Figure 1. Overview of Great Kiva feature at Prison Point site.

Water Quantity and Stream Channel Stability

Hydrophobic conditions were encountered in moderate to high severity burned areas surveyed on the central and northern portions of the Sand fire. This portion of the fire was dominated by pinyon-juniper forests with pre-existing high mortality of pinyon due to bark beetle infestation. The survey team noted a spatial pattern, typical of severe burns in this vegetation type, of highly variable levels of hydrophobicity with moderate to severe hydrophobicity in areas of higher pre-fire organic matter accumulation beneath trees and no to light hydrophobicity in grass dominated openings in the pre-fire tree canopy. Some degree of recovery of grasses (primarily blue grama) is expected in these former openings. However, nearly 100% of pre-fire vegetative ground cover in the moderate to severely burned areas has been lost as well as nearly 100% the tree and shrub canopy. The removal of the canopy and ground cover combined with the hydrophobicity has decreased the infiltration rate of these areas and will lead to highly elevated levels of runoff and consequent highly elevated soil erosion from them.

Only isolated areas of moderate to severe burns occurred in the southern third of the fire, primarily near the confluence of Alder Canyon and West Chevelon Canyon. It is assumed that these areas also will exhibit hydrophobic conditions, especially where vegetation and ground cover are similar to the north end of the fire.

Only a minor amount of drainage bottom was burned in either stream causing little or no long term damage to riparian resources. The increase in runoff from the Sand fire will likely not result in a damaging levels of increased peak flow in West Chevelon or Alder Canyons. Burned areas in the Sand fire account for only 2% of the West Chevelon Creek watershed and 0.9% of the Alder Creek watershed. The primary impact to these streams will be related to water quality.

The primary emergency concerns due to the increased runoff rates from the fire are the increased peak flood flows and consequent erosion in the 1st and 2nd order ephemeral canyons and drainages within the burned area as opposed to the adjacent reaches of West Chevelon Canyon. Hydrologic modeling of the principal north end drainage in the fire indicates that peak flows in the drainage will increase by 260% (i.e, 2.6 times pre-fire peak flows) in response to the fire. These channels will likely convey most of the erosional products from hillslope erosion and channel downcutting directly to West Chevelon Canyon. Channel downcutting will be limited in extent by the occasional outcrops of bedrock in the drainage bottoms.

Figure 2: Typical severe burn area

Water Quality

The principal water quality concerns are increases in sediment and ash into the lower reaches of West Chevelon Creek and to a much lesser extent to the last 0.4 mile of Alder Creek. The distribution of moderate and high burn severities, the high sediment transport capacity of the drainages within the severely burned areas of the fire, and the surface drainage patterns of the burned area will result in a concentration of sediment and ash inputs to the reaches of West Chevelon Canyon near and immediately downstream of the north end of the fire. Both Alder and West Chevelon Creeks are now intermittent in nature. Although there is much evidence of channel and streambank degradation due to extreme management impacts that occurred in the early part of the 20th century, riparian vegetation has to some extent recovered. It is supported by sub-surface flow of water in the bottom alluvium. Perennial pools occur in the reaches of West Chevelon Canyon adjacent to and below the burned area. Water quality impacts due to sediment and ash may be detrimental to aquatic species which survive in the perennial pools near and downstream of the burned area.

Soil Loss

There are three groups of soils within the area of the Sand Fire, soils on slight to moderately steep slopes under pinyon-juniper overstory, soils on slight to moderately steep slopes under ponderosa pine overstory, and soils on steep and very steep slopes.

Soils under pinyon-juniper woodland (743 acres) are shallow to moderately deep, with very gravelly or very cobbly sandy loam surface horizons, and sandy clay loam to clay subsurface horizons occurring from 4 to 6 inches below the surface. The pre-fire condition of the vegetation is characterized as having about 35 percent woodland overstory, with litter below the canopies of the trees, and low density blue grama with little litter between the trees. In areas of moderate and high soil burn severity, the overstory and litter under the tree canopyies were totally consumed. Recent drought conditions have reduced the vigor of remaining plants, leaving less than 10 percent effective ground cover. Hydrophobicity was determined to be moderate to high under the consumed canopies, and low in the intertree spaces where sparce grass previously existed. Test burning in the 1980's on similar vegetation, soils and fire intensities resulted in heavy loss of effective ground cover, soil loss and very slow recovery of vegetation (Tamietti, personal communication). Heavy sedimentation was observed in one stock tank below the test burns. Modelling of conditions created by the Sand fire indicate that without vegetative treatments, soil loss tolerance limits will be exceeded. TES map unit 51 had the largest amount of high burn severity, where potential soil loss is estimated to be 2 times the tolerance level. It is estimated that with no treatment, it will take over 3 years of recovery to return to below tolerance levels as predicted by the model, but could be much longer based on field observations of similar burns. The assessment team has already observed wind erosion in the area, with some small dunes forming.

The second group of soils under ponderosa pine overstory (352 acres)are characterized as being shallow to moderately deep, well drained soils with surface textures of gravelly to very cobbly sandy loams, with clay to very cobbly clay occurring from 4 to 10 inches below the surface. Effective groundcover estimates are from 55 to 75 percent primarily of duff and pine needles. Soil burn severity was generally low (87%) in this group, and soil loss is predicted to return to below tolerance by year 2 with no treatment on these soils.

The third group (183 acres) occur on steep slopes, are moderately deep or deep, well drained, with very cobbly sandy loam or loam surface horizons. Vegetation ranges from pinyon juniper to mixed conifer depending upon aspect, with conifer needles and duff providing most of the effective ground cover. Ground cover in many areas within these units is below the level needed to prevent accelerated erosion, however, only 9 acres are estimated to be in high or moderate soil burn severity class.

Noxious Weeds

No occurances of noxious weeds have been reported within the Sand Fire Area (Hughes, personal communication). However, the area has had no formal weed survey. The pinyon-juniper zone occuring on the north 2/3 of the fire is characterized as having dense woodland overstory, with litter occurring below the crowns of the plants. Interplant cover is limited to very low ground cover density of primarily blue grama, with little litter. In areas of high and moderate burn severity, overstory and litter beneath those canopies were completely consumed, leaving less than 10 percent effective ground cover. Recent drought conditions have most likely reduced the vigor of remaining graminoids, leaving large amounts of bare ground with little competition of native plants. There is a risk in areas of high and moderate burn severity for the establishment of noxious weeds as many noxious weeds reproduce vegetatively, with deep root systems somewhat resistant to fire. Weed seeds may be present in the soil profile, and without competition from native grasses, can establish quickly. Cheat grass is known to occur on other areas of the District and may be one noxious weed present in the soil profile.

Fisheries and Aquatics

West Chevelon Creek is tributary to Chevelon Creek approximately 7.2 miles below the Sand fire. Chevelon Creek is one of only 4 streams where the endangered Little Colorado spinedace *(Lepidomeda vittata)* are currently found. This species is in danger of extirpation. The remaining population in Chevelon Creek can be found in perennial pools located approximately 21 to 23 miles below the Sand fire. It is unlikely that ash flows and sediment generated on the Sand fire will have a measurable impact on this population. However, it is a Forest management objective to minimize sediment input to the Chevelon Creek system to aid in recovery of the species.

For much of the year there is no surface flow in West Chevelon Creek. During these times aquatic species are generally limited to occasional perennial pools or spring areas in the stream bottoms. One such pool in the vicinity of the Sand fire was inspected during the fire by a biologist who did not detect any fish species. A survey of West Chevelon conducted by the Arizona Game and Fish Department in 1999 did not find any fish species in the pools of West Chevelon Canyon adjacent to or below the Sand fire. However, amphibians and macro-invertrebrates were found. Pools in West Chevelon Creek within 3 miles upstream of the burned area did contain native speckled dace *(Rhynichthys osculus)* and bluehead sucker *(Catostomus discobolus).* These species are likely to be found near the burned area in some years in perennial pools as well as during periods of surface flow. Non-natives potentially also found in these reaches in some years include brown trout *(Salmo trutta)*, rainbow trout *(Oncorhynchus mykiss*), and fathead minnows *(Pimephales sp.).*

Transportation

Approximately 1.25 miles of FR213F crosses the Sand fire and another 0.5 miles of the road formed part of the western perimeter of the fire. This road is in Maintenance Objective Class 1 but is still drivable. There were no impacts to the road from the fire which would require stabilization measures. There are no stream crossings or culvert/ford drainage crossings within the Sand fire. The nearest stream crossing below the Sand fire is Mormon Crossing on West Chevelon Creek approximately 6 miles below the Sand fire. This culvert crossing is not expected to be impacted from increased peak flows attributable to the Sand fire.

B. Objectives:

1. Minimize damage to archaeological sites due to effects of falling or uprooting of burned trees; exposure, displacement or loss of archaeological artifacts or human remains by erosion; and looting or vandalism caused by increased public visibility and access.
2. Minimize hillslope soil erosion to protect long-term soil productivity.
3. Prevent establishment of noxious weeds by providing competitive ground cover.
4. Protect water quality and existing pool habitats for aquatic organisms in West Fork Chevelon Creek and to a lesser extent Alder Creek.
5. Prevent short-term increases in sediment transport to occupied habitat of the endangered Little Colorado spinedace.

6. Prevent damaging floods and sediment inputs to the ephemeral drainages crossing the Sand fire.

C. Probability of Completing Treatment Prior to First Major Damage-Producing Storm:

Land **90** % Channel ___ % Roads ___ % Other (cultural resources) **90** %

Note: Principal occurrence of damaging storms in this area occur during the summer monsoon season which normally starts in the month of July. Little rainfall normally occurs during the months of May and June. Therefore, there is a high probability that stabilization measures can be accomplished in time to prevent damage to natural and cultural resources.

D. Probability of Treatment Success

	Years after Treatment		
	1	3	5
Land	80	80	80
Seed/mulch			
Seeding only	40	80	80
Channel			
Roads			
Other	90	90	90

E. Cost of No-Action (Including Loss): **$331,000**

F. Cost of Selected Alternative (Including Loss): **$337,000**

G. Skills Represented on Burned-Area Survey Team:

[X] Hydrology [X] Soils [ ] Geology [X] Range [ ]
[ ] Forestry [X] Wildlife [ ] Fire Mgmt. [ ] Engineering [ ]
[ ] Contracting [ ] Ecology [ ] Botany [X] Archaeology [ ]
[X] Fisheries [ ] Research [ ] Landscape Arch [ ] GIS

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H. **Treatment Narrative:**

Land Treatments:

Aerial Seeding

Objective: Increase infiltration rates, reduce short and long term erosion potential, prevent erosion and sedimentation damages to burned archaeological sites, and prevent establishment of noxious weeds by promoting the establishment of vegetative cover of native perennial grass species in burned areas.

Winter wheat, included in the mix, should provide a quick cover of annual grass to partially protect against the first year monsoon season storm damage.

Method: 320 acres of severe burned areas in the Sand fire will be treated by aerial seeding using NF helicopter, bucket and crews. The seed mix will include Mountain brome *(Bromus marginatus),* Slender Wheat *(Elymus trachycaulus),* Western Wheatgrass *(Pascopyrum smithii)*, Sand Dropseed (Sporobolis cryptandras) (all native perennials) and Winter Wheat (Triticum aesticum) (an annual). The seed mix will be obtained at considerable cost savings from excess supplies from the Rodeo-Chedeski fire of the White Mountain Apache Tribe. If testing of the seed mix reveals near optimal viability, the application rate will be 25 seeds/sq. ft. Otherwise, an increased application rate (up to 60 seeds/ sq.ft) will be used.

Aerial mulching

Objective: Reduce hydrophobicity, increase infiltration rates, reduce short term erosion potential, prevent erosion and sedimentation damages to burned archaeological sites on an economical basis by aerially applying mulch to approx. 60% of the seeded areas.

Method: 200 acres of severe burned areas [including areas requiring treatment for stabilization of archaeological sites, and the more erodable hillslope areas above internal drainages within the Sand fire] will be treated with application of certified weed free chopped wheat straw at a 1 ton/acre rate using using NF helicopter and crews. Consistent application of mulch adjacent to archaeological sites will be assured by re-distributing straw by hand with field crews if necessary.

Archaeology site stabilization:

Objectives: Minimize the exposure, off-site transport or loss of currently buried cultural resources and human remains. Prevent damage to archaeological site structures and cultural deposits from falling or uprooted trees. Provide a vegetative mask to assist in prolonged protection of identified cultural resources from looting and vandalism through site revegetation.

Method: Approximately 4 acres of site stabilization is required within the site boundaries and immediately upslope of the 3 above mentioned archaeological sites. Previous stabilization treatment and studies have found that the most cost-effective and successful treatments include heavy seeding, straw mulching, felling of fire killed trees within architectural features, and contour felling within and upslope of site boundaries. (Haines et.al. 2005; Robichaud et.al. 2000). These four stabilization measures will be performed by NFS field crews supervised by the Black Mesa District Archaeology staff. In the event that aerial mulching is funded for other stabilization needs, hand mulching will not be employed at the sites. However, it may be necessary to redistribute mulch by hand to assure optimum site stabilization.

Additional Treatment Needs 9/11/06:

As the mulch was applied, it became apparent that the bales were not breaking up as expected. The straw was extremely clumpy and was not meeting the expected objectives of protecting the soil. Therefore, to complete the treatment it is necessary to spread the clumps by hand. Due to the remote site, the crew will be spiked out. Extreme thunderstorms that occur in the area during the monsoon will result in loss of time and additional per diem. This will result in an addition cost of $100 per acre.

I. **Monitoring Narrative:**

Aerial seeding application: Achievement of intended application rates will be monitored using 1 sq. ft. adhesive tiles. Cost is included in application estimates.

Erosion control: 3 photo point monitoring sites will be established within burned areas - 1 within archaeological stabilization treatment areas, 1 within a seeded and mulched treatments area, and 1 within a seeded only treatment area. Photos will be taken before, immediately after and within one year of completion of the land treatment measures. Vegetative recovery will be evaluated to determine the need for further treatments. Monitoring of the photo points may be extended for up to 2 additional years if the first year's monitoring reveals the need for further treatments.

Noxious weed prevention: An annual inspection of the burned areas to evaluate the effectiveness of measures taken to prevent establisment of noxious weeds will be performed after the summer monsoon season in the initial year of treatment and for up to two more years thereafter.

J. Accomplishments to date:

9/11/06-- Aerial seeding, aerial straw application, archaeological treatments are completed. 100 acres of straw spreading has been completed, the rest depends on additional funding. Implementation monitoring will be finalized once straw is spread.

Part VI – Emergency Stabilization Treatments and Source of Funds **Interim # 1**

			NFS Lands				Other Lands				All
		Unit	# of		Other	# of	Fed	# of	Non Fed	Total
Line Items	Units	Cost	Units	BAER $	$	units	$	Units	$	$
A. Land Treatments										
Aerial seeding	acres	$72	320	$23,000	$0		$0		$0	$23,000
Aerial mulching	acres	$655	200	$131,000	$0		$0		$0	$131,000
Cultural site protection	sites	$667	3	$2,000			$0		$0	$2,000
Straw Mulch Spreading	Acres	$100	200	$20,000	$0		$0		$0	$20,000
				$0	$0		$0		$0	$0
Subtotal Land Treatments				$176,000	$0		$0		$0	$176,000
B. Channel Treatments										
				$0	$0		$0		$0	$0
				$0	$0		$0		$0	$0
				$0	$0		$0		$0	$0
Subtotal Channel Treat.				$0	$0		$0		$0	$0
C. Road and Trails										
				$0	$0		$0		$0	$0
				$0	$0		$0		$0	$0
				$0	$0		$0		$0	$0
Subtotal Road & Trails				$0	$0		$0		$0	$0
D. Protection/Safety										
				$0	$0		$0		$0	$0
				$0	$0		$0		$0	$0
				$0	$0		$0		$0	$0
				$0	$0		$0		$0	$0
Subtotal Structures				$0	$0		$0		$0	$0
E. BAER Evaluation										
Team	p-day	279	43	---	$12,000		$0		$0	$12,000
				---	$0		$0		$0	$0
Subtotal Evaluation				---	$12,000		$0		$0	$12,000
F. Monitoring										
	p-day	333	6	$2,000	$0		$0		$0	$2,000
				$0	$0		$0		$0	$0
Subtotal Monitoring				$2,000	$0		$0		$0	$2,000
G. Totals				$178,000	$12,000		**$0**		**$0**	**$190,000**
Previously approved				$158,000						
Total for this request				**$20,000**						

* mulching of archaeological sites included in aerial mulching total

PART VII - APPROVALS

1. _/s/ Elaine J. Zieroth_ _9/11/2006
Forest Supervisor (signature) Date

2. /s/ Abel M. Camarena 9/13/2006
Regional Forester (signature) Date