

Lone Mountain 1 Post-Fire Response Plan

Lake Chelan National Recreation Area



Lone Mountain 1 Post-Fire Response Plan | 2014

PARK: Lake Chelan National Recreation Area

DATE: September 23, 2014

PREPARED BY: National Park Service Lone Mountain 1 BAER Team

SUBMITTED BY: _____ Date: _____
Karen Taylor-Goodrich, Superintendent, North Cascades National Park
Service Complex

Lone Mountain 1 Post-Fire Response Plan | 2014

BURNED AREA EMERGENCY RESPONSE PLAN REVIEW AND APPROVAL

I. Chief of Resources/BAER Team Leader: Approval that the Lone Mountain 1 Post-Fire Response Plan meets approved land management plan management objectives.

/s/ Jack Oelfke

9/23/14

Jack Oelfke Chief of Resources, North Cascades National Park Service Complex

Date

II. Regional BAER Coordinator: Concurrence that the plan fits the technical definition for use of Emergency Stabilization and Rehabilitation funding.

Nelson Siefkin, BAER Coordinator, Pacific West Region

Date

III. Burned Area Rehabilitation Funding Concurrence (check one box below):

☐ Approved

☐ Approved with Revision (see attached)

☐ Disapproved

IV. Emergency Stabilization Funding Approval (check one box below):

☐ Approved

☐ Approved with Revision (see attached)

☐ Disapproved

Christine Lehnertz, Regional Director, Pacific West Region

Date

EXECUTIVE SUMMARY

Introduction

This post-fire response plan consists of assessments and treatment specifications to stabilize and rehabilitate the Lone Mountain 1 Fire in the Lake Chelan National Recreation Area (LACH) of the North Cascades National Park Service Complex (NOCA). It has been prepared in accordance with Department of the Interior and National Park Service policy, including DM 620 Part 3: Burned Area Emergency Stabilization and Rehabilitation and the Interagency Burned Area Emergency Response Guidebook.

There are two funding sources for post-fire activities; emergency stabilization and burned area rehabilitation. The primary objectives of emergency stabilization are to assess and prescribe cost effective post-fire stabilization measures necessary to protect human life, property, and critical cultural and natural resources in accordance with approved land management plans and policies, and all relevant federal, state, and local laws, and regulations. The park also recognizes the need to perform non-emergency burned area rehabilitation treatments to prevent the encroachment of invasive species and to repair minor infrastructure.

This plan provides recommendations from both funding sources for all lands burned within the Lone Mountain 1 Fire. It was prepared by a local Burned Area Emergency Response (BAER) team comprised of North Cascades National Park Service Complex staff and personnel from other parks and the Pacific West Regional Office.

The Lone Mountain 1 Fire

The Lone Mountain 1 Fire began on July 14, 2014 and is located within the Lake Chelan National Recreational Area of the North Cascades National Park Complex near Stehekin, Washington. The fire began from a lightning strike in the Butte Creek drainage of the Boulder Creek watershed, and eventually spread into the Rennie, Reynolds, upper Boulder, and other unnamed drainages. Smokejumpers arrived on the fire on July 16, but given the very steep terrain and the significant downfall and thick brush from the previous 1994 Boulder Fire, they were unable to catch the fire. Other requested resources were not available, and by July 17 the fire had grown to 300 acres. A point protection strategy was put in place to keep the fire out of the Stehekin Valley and the War Creek drainage to the east of the fire. By July 21 the Type 2 Northern Rockies Wildland Fire Management Team was activated and assumed command of the incident; the fire was at 1700 acres then. This team remained in place until a transfer of command to a Type 3 organization on Aug. 3, followed by a transfer to a Type 4 organization on/around Aug. 28.

Suppression activity during the fire focused in two primary areas: upper Butte Creek, to prevent the fire from advancing toward War Creek Pass and threatening the War Creek drainage on the Okanogan-Wenatchee NF; and in the Boulder Creek drainage (in the next drainage downvalley of Rennie Creek), to prevent the fire from advancing downvalley toward the Stehekin Valley.

In the initial stages of the incident the fire burned primarily in Butte Creek and upper Boulder Creek drainages; later growth carried it northward into the Reynolds, Rennie, and the unnamed drainage west of Rennie Creek. The last significant fire growth occurred Aug. 10-11, and following a rainfall event beginning Aug. 12 fire acreage has remained at or near 2770 acres (as of Sept. 3 it is mapped at 2774 acres). As of Sept. 3 the fire was considered 70% contained.

The fire caused minimal disruption to the Stehekin Valley, other than occasional smoke. Park operations, concessioners, and valley businesses remained active and open. Trail Closures were limited to the Boulder Creek drainage on NPS lands, and the War Creek Trail on the adjacent Okanogan-Wenatchee Forest lands. The Juanita Lake campground was occupied into late August by fire personnel and was essentially off-limits to the public. The Boulder Creek trail will remain closed for the remainder of 2014 due to trail impacts, hazardous trees, or remaining potential for fire activity.

Burned Area Emergency Response and Burned Area Rehabilitation – Assessments and Specifications

The Lone Mountain 1 Fire Burned Area Emergency Response (BAER) Team assessed the incident to determine post-fire impacts to life, property, and critical natural resources. It is noted that many of the same resources and values at risk that were identified in the 2010 Rainbow Bridge fire, which burned within a mile downstream of the Lone Mountain 1 fire, are applicable to this assessment, although fewer resources are at risk or threats exist due to the Lone Mountain 1 fire being upslope from Rainbow Bridge. The team conducted field visits to review resource conditions after the fire, completed literature reviews, and consulted resource specialists. The main objectives of the field visits were as follows:

- Identify and inventory values at risk
- Identify the physical and biological mechanisms that are creating risks
- Develop soil burn severity and watershed response maps to identify potential debris flow, flood, and erosion source areas
- Review channel morphology and riparian conditions
- Inspect hill slope conditions
- Determine needs for emergency stabilization
- Assess post-fire invasive species concerns and identify treatments

Values at risk are properties, capital improvements, and natural and cultural resources located within or downstream of the fire that may be subject to damage from flooding, ash, mud and debris deposition, debris flows, hill slope erosion, hazard trees, and invasive species. The following chief values at risk and were assessed for potential associated hazards for the Lone Mountain 1 Fire:

- Stehekin Valley (road and building infrastructure near Boulder Creek)
- Invasive species infestations into Lone Mountain 1 and other invasive vectors at fire hand lines, hiking trails, and roads
- The Boulder Creek trail and Rennie Camp

The BAER Team Leader discussed wildlife and cultural resource concerns with park personnel (NOCA Wildlife Biologist, Archeologist) prior to the BAER assessment and it was agreed there were no subject concerns associated with the Lone Mountain 1 fire. Both resources are discussed briefly below.

Watershed: A combination of aerial and ground reconnaissance were utilized to assess the threats of post-fire watershed conditions within and downstream of the Rainbow Bridge fire. In addition, a Burned Area Reflectance Classification (BARC) image, generated in August, was used to assist classification of soil burn severity within the fire perimeter. Through the watershed assessment the observed burn severity, hydro morphology, and values at risk locations ruled out the threats of damaging flooding and debris flows except in the occurrence of extreme weather events (which are, however, becoming more common here). Hazard warning signs and public information/education materials (*Specification W-1*), road and culvert debris removal following storm events (*W-2*), and a followup site assessment for debris flow risk (*W-3*) will be funded by this activity through Burned Area Emergency Response funds. Unfunded management recommendations include completing a broader risk management assessment related to debris flows; closing the Boulder Creek trail until Spring 2015; assessing the McGregor Mountain area specifically regarding debris flow concerns; closing or restricting use of the Purple Point Campground in Stehekin due to debris flow concerns; and conducting water quality monitoring along the Stehekin River due to potential septic waste concerns.

Wildlife: Four federally listed species have suitable habitat with the boundaries of the fire, including gray wolf (*Canis lupus*), grizzly bear (*Ursus arctos*), Canada lynx (*Lynx canadensis*), and spotted owl (*Strix occidentalis*). The gray wolf may occasionally pass through the upper Boulder Creek watershed, but is not known to occupy the area. The closest known pack did have its den and rendezvous sites burned over from the large Carleton Complex fires, several miles east of the park, which burned at the same time as Lone Mountain 1. Potential spotted owl habitat extends up to roughly 4000' elevation, which would include the lowest part of the fire in Boulder Creek, but there are no known spotted owl activity areas in this area, and thus no impacts are expected from the Lone Mountain 1 fire. Neither the grizzly bear nor Canada lynx are known to currently use habitat within the fire area. Consultation with the park wildlife biologist familiar with the area lead to a conclusion that no impacts were anticipated to either of the species, and thus no treatment specifications are requested under the BAER or BAR programs.

Vegetation: The primary vegetation issue that emerged through assessments was the likelihood of the establishment and/or expansion of invasive plant species into the burned areas. One aggressive invasive species, Canada thistle (*Cirsium arvense*), was found along the trail within the burn perimeter, and will require monitoring and control. Other species seen or expected to occur within the burn area along the trail include sheep sorrel (*Rumex acetocella*), white clover (*Trifolium repens*), and dandelion (*Traxacum occidentalis*). The highly invasive cheatgrass (*Bromus tectorum*) is not believed to be within the burn area, but is present downvalley in parts of the 2010 Rainbow Bridge fire. Control efforts have been ongoing within the 2010 Rainbow Bridge fire perimeter through prior Burned Area Rehabilitation funds and other funding the NPS has been awarded. Within the Burned Area Rehabilitation program, funds will be requested for management of those invasive species listed above (*Specification R-1*). One unfunded

management recommendation is provided that addresses post-fire survey needs for white-bark pine (*Pinus albicaulis*), a federal candidate species that is known to have burned within the Lone Mountain 1 fire.

Minor Facilities: Minor facilities included within the burn area include the Boulder Creek trail and the Rennie Creek campground. Field reconnaissance by trail crew employees and the BAER Team documented damage to the trail and campground, and funding is requested through the Burned Area Rehabilitation program to replace/repair the trail and campsite facilities that burned (*Specification R-2*).

Cultural Resources: There are no known cultural resources within the burn area or at risk in the Stehekin Valley near Boulder Creek. The cultural resources noted in the 2010 Rainbow Bridge Post-Fire Response Plan are not at risk from the Lone Mountain 1 fire, and no cultural resources are known within or downstream from the Lone Mountain 1 fire.

Miscellaneous: Also submitted are specifications to fund preparation of the Lone Mountain 1 Post-Fire Response Plan (*O-1—Lone Mountain 1 BAER Plan Preparation*) and implementation of both the BAER and BAR plans (*R-3- BAR Implementation Leader*).

SUMMARY OF TREATMENTS AND ACTIVITIES

Below is a summary of the emergency stabilization treatments activities proposed for funding from the subactivity E13 BAER funding source, followed by the proposed funding by fiscal year. Individual treatment specifications are found in the **SPECIFICATIONS** section of this plan.

		SUMMARY OF ACTIVITIES AND COSTS - BAER							
LINE ITEM NUMBER	SPECIFICATION NUMBER	TITLE	UNIT	UNIT COST	NUMBER OF UNITS	WORK AGENT			COSTS
1	W-1	Install hazard warning signs	each	\$ 188	30	F			\$ 5,632
2	W-2	Clean bridges, culverts, roads	each	\$ 3,038	6	F			\$ 18,230
3	W-3	Fire and debris flow risk assessment	each	\$ 11,000	1	F			\$ 11,000
4	O-1	BAER/BAR Plan preparation	each	\$ 12,560	1	F			\$ 12,560
						TOTAL COSTS			\$ 47,422
		SUMMARY OF ACTIVITIES AND COSTS BY FISCAL YEAR - BAER							
LINE ITEM NUMBER	SPECIFICATION NUMBER	TITLE	UNIT	UNIT COST	NUMBER OF UNITS	WORK AGENT	COSTS FY 2014	COSTS FY 2015	COSTS
1	W-1	Install hazard warning signs	each	\$ 188	30	F		\$ 5,632	\$ 5,632
2	W-2	Clean bridges, culverts, roads	each	\$ 3,038	6	F		\$ 18,230	\$ 18,230
3	W-3	Fire and debris flow risk assessment	each	\$ 11,000	1	F		\$ 11,000	\$ 11,000
4	O-1	BAER/BAR Plan preparation	each	\$ 12,560	1	F	\$ 12,560		\$ 12,560
					TOTAL COSTS		\$ 12,560	\$ 34,862	\$ 47,422

Work Agent: C=Coop Agreement, F=Force Account, G=Grantee, P=Permittees, S=Service Contract, T=Timber Sales Purchaser, V=Volunteer

Below is a summary of the rehabilitation costs proposed for funding from the BAR funding source, followed by the proposed funding for each fiscal year. Individual treatment specifications are found in the **SPECIFICATIONS** section of this plan.

SUMMARY OF ACTIVITIES AND COSTS - BAR								
LINE ITEM NUMBER	SPECIFICATION NUMBER	TITLE	UNIT	UNIT COST	NUMBER OF UNITS	WORK AGENT	COSTS	
1	R-1	Invasive plant species	miles	\$ 3,790	3	F	\$	11,371
2	R-2	Trails and camps	miles	\$ 14,350	3	F	\$	43,052
4	R-3	BAR implementation leader	year	\$ 3,707	3	F	\$	11,121
TOTAL COSTS							\$	65,544

SUMMARY OF ACTIVITIES AND COSTS BY FISCAL YEAR - BAR										
LINE ITEM NUMBER	SPECIFICATION NUMBER	TITLE	UNIT	UNIT COST	NUMBER OF UNITS	WORK AGENT	COSTS FY 2015	COSTS FY 2016	COSTS FY 2017	COSTS
1	R-1	Invasive plant species	miles	\$ 3,790	3	F	\$ 3,698	\$ 3,781	\$ 3,892	\$11,371
2	R-2	Trails and camps	each	\$ 14,350	3	F	\$23,682	\$ 9,552	\$ 9,818	\$43,052
4	R-3	BAR implementation leader	each	\$ 3,707	3	F	\$ 3,598	\$ 3,706	\$ 3,817	\$11,121
TOTAL COSTS							\$30,978	\$17,039	\$ 17,527	\$65,544

Work Agent: C=Coop Agreement, F=Force Account, G=Grantee, P=Permittees, S=Service Contract, T=Timber Sales Purchaser, V=Volunteer

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APPENDIX I: Environmental Compliance

Fire Information

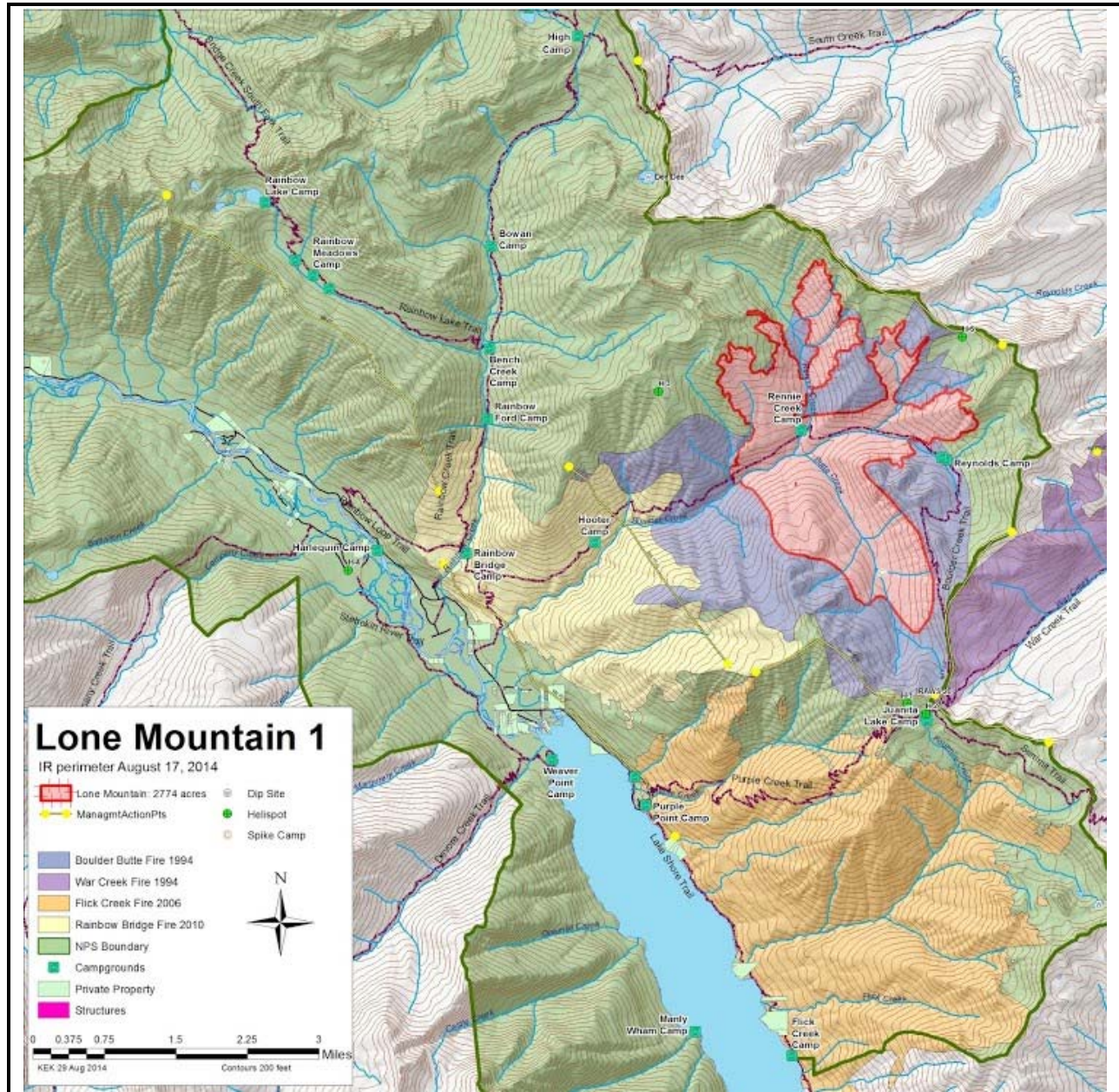
FIRE LOCATION AND BACKGROUND	
FIRE NAME	LONE MOUNTAIN 1
FIRE CODE	PF.FEH8FP014.00.1
PARK	LAKE CHELAN NRA
STATE	WASHINGTON
REGION	PACIFIC WEST
IGNITION DATE	JULY 14, 2014
CONTAINMENT DATE	UNCONTAINED
ACRES	2,774

Assessment Team

TEAM MEMBERS	
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LONE MOUNTAIN 1 FIRE INFORMATION

Lone Mountain 1 Fire - Perimeter Map



BURNED AREA ASSESSMENTS



WATERSHED RESOURCE ASSESSMENT

OBJECTIVES

- Assess overall soil and watershed changes caused by the fire, particularly those that pose substantial threats to human life and property, and critical natural and cultural resources. This includes evaluating changes to soil conditions, hydrologic function, and watershed response to precipitation events;
- Identify potential flood and erosion source areas and sediment deposition areas;
- Identify potential threats to life, property, and critical natural and cultural resources in relation to flooding, debris flows, erosion, sediment deposition;
- Develop treatment recommendations, if necessary;
- Identify future monitoring needs, if necessary.

ISSUES

- Risks to human life and property from floods, mudflows, and debris flows within and downstream of the Lone Mountain 1 Fire.
- Risk to critical infrastructure such as Stehekin Valley Road and Boulder Creek Trail and its associated camps.

OBSERVATIONS

Background

The purpose of a burned area assessment is to determine if the fire caused emergency watershed conditions and if there are potential values at risk from these conditions. Identification of values at risk occurs through consultation with individuals, state, and federal agencies, and through field investigation. Not all values initially identified are determined to be at risk. If emergency watershed conditions are found, and values at risk are identified and confirmed, then the magnitude and scope of the emergency is mapped and described, values at risk and resources to be protected are analyzed, and treatment prescriptions are developed to protect values at risk if possible.

The most significant factor leading to emergency watershed conditions after a fire is loss of ground cover, which leads to erosion and changes in hillslope hydrologic function in the form of decreased infiltration and increased runoff. Such conditions lead to increased flooding, sedimentation, and deterioration of soil condition. Values at risk are human life, property, and critical natural and cultural resources located within or downstream of the fire that may be subject to damage from flooding, ash, mud, debris deposition, and hillslope erosion.

Physiography/Geology/Climate

The Lone Mountain 1 Fire burned on the northeast side of Lake Chelan in the Boulder Creek watershed draining into Stehekin River. The Boulder Creek watershed is administered by the

National Park Service. The landscape is characterized by glacial troughs eroded on granodiorite and gneiss that served as melt-water drainage during the continental and alpine glaciation. Elevation ranges from 1,200 feet near lake level to about 7,000 feet near the upper ridge of the Boulder Creek watershed in the eastern part of the fire.

Geologists from North Cascades National Park have mapped surficial geology (Riedel et al., 2009). At 1:62,000-scale, broad, primarily erosional landform features such as U-shaped valleys, valley floors, and glacial cirques were mapped from air photos. At 1:24,000-scale, small, primarily depositional landforms such as terraces, alluvial fans, floodplains, and mass movements were mapped in the field. These features were created by distinct geological processes, many of which are still active, and their location and distribution provides important information on disturbance, aquatic and terrestrial habitat, plant communities, fire frequency, geologic hazards, and archeological potential.

Landform features include oversteepened bedrock slopes in the upper parts of the watersheds, debris chutes, and debris aprons across lower valley walls, bedrock benches, steep stream channels with narrow to no floodplains, bedrock canyons, and debris cones or alluvial fans at stream outlets. Relict alluvial fans are evident as terraces above modern fans, a result of lowering lake level since the beginning of the Holocene.

The Stehekin area is characterized by a xeric moisture regime (cold and wet winters, hot and dry summers). Average annual precipitation in the area is approximately 30 to 35 inches. Precipitation occurs in two distinct seasons, early winter to spring snow storms and late summer convective thunderstorms. Rain-on-snow events in the fall of the year can lead to significant flooding events (i.e., 1948, 2003 and 2006 floods) on the Stehekin River. Peak runoff events on watersheds within the Lone Mountain 1 Fire perimeter are dominated by spring snowmelt and convective thunderstorms. Precipitation, while low along the lakeshore, increases dramatically with elevation.

Shallow rapid debris flows are a natural hydrologic process on the mountain slopes surrounding Lake Chelan. Drainages are very steep and rocky. Natural (pre-fire) landform sediment delivery and routing efficiency is considered very high but episodic. Runoff is routed rapidly into a series of parallel first-order channels that form a dense network of tributary streams. Runoff from these tributaries can be flashy. The major source of sediment delivery is in the form of debris flows from tributary streams or first order debris chutes into the main channels. This delivered sediment has and continues to contribute to the formation of debris cones and alluvial fans (characterized by sediment size and steep slope) at the mouth of subwatersheds. Larger debris flow deposits, such as at Little Boulder Creek, tend to gradually heighten their debris cones by channel aggradation and overtopping which can cause diversion of subsequent flows with resultant channel migration. Lower sloping alluvial fans, such as the Boulder Creek, also display depositional features indicative of channel migration across the fan. Consequently, structures on active cones and fans are at risk of being damaged or destroyed during a debris flow event even in channels that appear to have had no recent activity.

Normally debris flows occur in response to dramatic changes in vegetation due to landscape-level fires and/or from intense early summer thunder storms. Based upon local fire and debris

flow history, increased erosion rates induced by fire will elevate the extant risk of debris flows for at least the next 5 years or until vegetation has substantially recovered in the burned areas. Higher surface erosion rates on hillslopes will also increase the rate of debris failures as ephemeral drainages become bulked with excess sediment. Less extreme precipitation and snow-melt events can trigger debris failures from burned areas than would be required under pre-fire conditions. Large debris flows, such as the event in Thimbleberry Creek in 2014, can also occur without the presence of fire. The Thimbleberry event was triggered by a large summer thunderstorm in August 2014 which stalled in the high mountains, and appears to be a large event as compared to the others (**Table 1**). There have been seven debris flows as a result of 4 or 5 events, several that were a result of storms.

Table 1. Recent Debris Flows in Stehekin Valley.

Date	Debris Flow	Related to
2008	9.2 Mile	Storm
2010	Hazard Creek	Storm: possibly 2006 Flick Creek
2010	Four-Mile Creek	Storm: possibly 2006 Flick Creek
2010	Other Small Drainages	Storm: possibly 2006 Flick Creek
2012	Little Boulder Creek	2010 Rainbow Bridge
2013	Little Boulder Creek	2010 Rainbow Bridge/storm
2013	Imus Creek	Storm; possibly 2006 Flick Creek
2014	Thimbleberry Creek	Storm

Soil Burn Severity

Soil burn severity mapping is intended to reflect the degree to which fire has caused changes to soil characteristics that affect soil health and hydrologic function, and hence erosion rate, and runoff potential. It is not a map of vegetation consumption. In mapping soil burn severity, the team evaluated field-observable parameters such as the amount and condition of surface litter and duff remaining, soil aggregate stability, amount and condition of fine and very fine roots remaining, and surface infiltration rate (water repellency). Ash and soil color may also indicate how intense the heat was and how long it remained at a given place (residence time). These parameters were compared to similar soils under unburned conditions to estimate the degree of change caused by the fire.

While soil burn severity is not based primarily on fire effects to vegetation, the team used post-fire vegetative condition as one of the visual indicators in assessing soil burn severity. In some cases there may be complete consumption of vegetation by fire, with little effect on soil properties, such as in a shrub ecosystem. Dense vegetation, with a deeper litter and duff layer, results in longer heat residence time, hence more severe effects on soil properties. For example, deep ash after a fire usually indicates a deeper litter and duff layer prior to the fire, which generally supports longer residence times. This promotes loss of soil organic cover and organic matter which are important for erosion resistance, and the formation or exacerbation of water repellent layers at or near the soil surface. The results are increased potential for runoff and soil particle detachment and transport by water, wind, and gravity. This would be mapped as high soil burn severity.

Conversely, sparse or light pre-fire vegetation such as grasses or sparse shrubs usually have negligible litter layer and surface fuels and experience extremely rapid consumption and spread rates, with very little heat residence time at the soil surface. The result is very little alteration of soil organic matter and little or no change in soil structural stability. Water repellency, usually present under shrubs before the fire, may or may not be exacerbated by the fire. Areas between shrubs or grass crowns usually had very little fuel to burn, thus only experienced brief radiant heat as the flashy grasses and sparse shrubs burned. In these cases, soil burn severity would be low.

In between these extremes, the moderate class of soil burn severity is far more diverse in observed soil conditions and can include various vegetation types, ranging from forests to shrub communities. In the case of a forest, the litter layer may be largely consumed, but scorched needles and leaves remain in the canopy and will rapidly become mulch. This is important in re-establishing protective ground cover and soil organic matter. This factor can result in the classification of the area as moderate, rather than high. Generally, however, there will also be less destruction of soil organic matter, roots, and structure in an area mapped as moderate. In a shrub ecosystem, even where pre-fire canopy density was high, litter layer is generally thin, and while the shrub canopy may have been completely consumed by the fire, the soil structure, roots, and litter layer may remain intact beneath a thin ash layer. Above ground indicators such as size of unconsumed twigs remaining to help the team determine how long the heat may have persisted on the site. If only root stubs' and large diameter twigs remain, it was likely a more intense fire with longer heat residence time, and combined with other observations of soil conditions may result in a call of high soil burn severity. More common in chaparral is a condition of remaining small diameter twigs, indicating a flashy fire with short residence time. Combined with other observations of soil conditions this usually resulted in a classification of moderate soil burn severity even though the canopy was partially consumed.

In general, areas mapped as unchanged/low and low soil burned severity have little effect on post fire watershed conditions; whereas areas mapped as moderate to high soil burned severity areas have increasingly greater potential to affect to post fire watershed conditions.

Soil Erosion/Debris Flow

Soil erosion potential following a fire is generally increased over pre-fire potential. This is largely due to loss of soil cover (forbs, grass, leaf, and needle litter), surface horizon soil organic matter responsible for structural stability, and in some cases, increased water repellency at or near the soil surface. The amount of increase over pre-fire condition is related to the degree of soil changes. The degree of soil alteration influences the potential of post-fire soil erosion and debris flow process.

The factors most affected by fire are: 1) the amount of effective soil cover, 2) the inherent susceptibility to soil particle detachment by wind, water, or gravity (a function of soil texture and structural stability), and 3) the surface infiltration rate. Areas of high soil burn severity can be expected to show a larger increase in sediment production than an area of low soil burn severity due to the concomitant decrease in soil cover, increase in susceptibility of soil particle detachment, and decrease in the infiltration capacity of the soil. It is important to understand

pre-fire erosion behavior when assessing post-fire erosion, since some areas have water repellant surfaces and inherently high erosion potential even before the fire.

Shallow rapid debris flows are a natural hydrologic process on the mountain slopes surrounding Lake Chelan, even without the presence of fire. Drainages are very steep and rocky. Natural (pre-fire) landform sediment delivery and routing efficiency is considered very high but episodic. Runoff is routed rapidly into a series of parallel first-order channels that form a dense network of tributary streams. Runoff from these tributaries can be flashy. Recent examples include the August 4th, 2010 debris flows on Fourmile, Hazard, and an unnamed creek in between these drainages (east of the area covered in this report) resulting from an intense thunderstorm centered on this area. This area was burned during the 2006 Flick Fire. Another recent example is the debris flows on Little Boulder Creek which occurred in August 2013 after the Rainbow Bridge Fire of 2010.

The major source of sediment delivery in these watersheds is in the form of debris flows from tributary streams or first order debris chutes into the main channels. This delivered sediment has and continues to contribute to the formation of debris cones and alluvial fans (characterized by sediment size and steep slope) at the mouth of subwatersheds. Larger debris flow deposits, such as at Little Boulder Creek, tend to gradually heighten their debris cones by channel aggradation and overtopping which can cause diversion of subsequent flows with resultant channel migration. Lower sloping alluvial fans, such as at Rainbow and Boulder Creeks, also display depositional features indicative of channel migration across the fan. Consequently, structures on active cones and fans are at risk of being damaged or destroyed during a debris flow event.

Relatively large debris flows trigger pulses of episodic sediment delivery. Normally debris flows occur in response to dramatic changes in vegetation due to landscape-level fires and/or from intense summer thunder storms. Based upon local fire history, increased erosion rates induced by fire will substantially elevate the already extant risk of debris flows for at least the next 5 years or until vegetation has substantially recovered in the burned areas. Less extreme precipitation and snow-melt events can trigger debris failures from burned areas. However, debris flows are major land forming process, particularly in the upper first order and second order streams, and debris flows can and do occur even without the presence of fire as demonstrated by the Thimbleberry Creek debris flow of 2014, the Imus flow of 2013, and the Little Boulder flow of 2014. The hazard from rockfall and falling debris on very steep slopes may be increased below burn areas due to spalling of rock, and loss of vegetation and roots supporting logs, rocks, and other debris. Spalling of rock occurs as a result of unequal heating of rocks in fire that causes rocks to shatter into potentially more mobile pieces. Rock, soil, logs, and other debris often accumulate behind trees and other vegetation on steep slopes. Loss of this vegetation during a fire can destabilize this material leading to an increased potential for mobilization downslope.

Watershed Response

Overland flow occurs as a result of rainfall that exceeds soil infiltration capacity and the storage capacity of depressions. On the unburned forest floor, overland flow is often absent, though when it does occur flow is forced to follow a myriad of interlinking paths that constantly change

as organic material (litter and duff layers) and inorganic material (rock) are encountered. Consumption of the forest floor by fire alters the path of overland flow by reducing the overall length of the flow path, resulting in the concentration of flow into a shorter flow path. This concentration of overland flow increases the hydraulic energy of the flow and can result in rill erosion. At the watershed scale, the reduction of hillslope flow path lengths and the formation of rills that have a high water conveyance capacity reduce the times of concentration or the amount of time for overland flow to reach a defined point within the watershed.

Overland flow is also increased if there is an increase in water repellency (hydrophobicity) of the soils because of the fire. This can reduce infiltration and increase overland flow (runoff). Infiltration curves for water repellent soils reflect increasing wettability over time once the soil is placed in contact with water. Water repellency decreases (hence infiltration increases) with time as the substances responsible for hydrophobicity begin to break down, thereby increasing wettability. In general, fire-induced hydrophobicity is broken up or is sufficiently washed away within one to two years after a fire. The thicker and deeper the water repellent layer, the longer it will take to dissipate. However, once soil cover and vegetative canopy begin to recover, this persistent water repellency becomes less significant to the runoff response as litter and canopy quickly restore protection of soil and obstruction of overland flow, thus enhancing infiltration and reducing energy for runoff and erosion.

Raindrops striking exposed mineral soil with sufficient force can dislodge soil particles and is known as splash erosion. These dislodged particles can fill in and seal pores in the soil thereby reducing infiltration. Further, once soil particles are detached by splash erosion they are more easily transported in overland flow. Surface erosion is defined as the movement of individual soil particles by a force (wind, water, or gravity), and is initiated by the planar removal of material from the soil surface (sheet erosion) or by concentrated removal of material in a downslope direction (rill erosion). Surface erosion is a function of four factors: 1) susceptibility of the soil to detachment, 2) magnitude of external forces (raindrop impact or overland flow), 3) the amount of protection available by material that reduces the magnitude of the external force (soil cover), and 4) management practices that can reduce erosion.

On-the-ground field observations within and downstream of the burned area were conducted to determine potential watershed response. Channel morphology related to transport and deposition processes were noted, along with channel crossings and stream outlets. Observations included condition of riparian vegetation and the volume of sediment and wood stored in channels and on slopes that could be mobilized.

FINDINGS

In order to assess the degree of threat to values at risk from post-fire watershed conditions, several environmental aspects need to be evaluated including: soil burn severity, erosion and debris flow potential, and watershed response. The watershed assessment team conducted field and helicopter reconnaissance of the fire area and downstream areas on September 1-4, 2014. Evidence gathered from this investigation coupled with a Burned Area Reflectance Classification (BARC) map and input from local staff was used to prepare the following assessment of post-fire watershed conditions. The BARC was derived from post-fire Landsat data collected on August

7, 2014 and pre-fire Landsat data collected on August 13, 2013. This data was initially classified at the USGS EROS Data Center in Sioux Falls, South Dakota. Weather conditions (cloud cover) prevented use of imagery collected after August 7, and as a consequence the Rennie Creek subwatershed of Boulder Creek had no BARC data, as the watershed continued to burn after August 7. Helicopter recon assessed the Rennie Creek area on September 4, 2014.

Soil Burn Severity

A true soil burn severity map is derived from the BARC map through field calibration (ground truthing) of soil burn severity. This is a time intensive process, and given the extreme relief, remote locations, and time frame for assessment of fire effects observed on the ground, it was determined that calibration of the BARC map to a true soil burn severity map was not possible. However, this does not preclude using the BARC map to approximate a soil burn severity map using one key generalization – in areas of moderate to dense mixed conifer ecosystems, BARC maps require limited field calibration to adjust a BARC map into a true soil burn severity map. Given this assumption and predominance of moderate to dense conifer forests in the area, the BARC map will be utilized as a soil burn severity map (**Figure 1**) without field calibration.

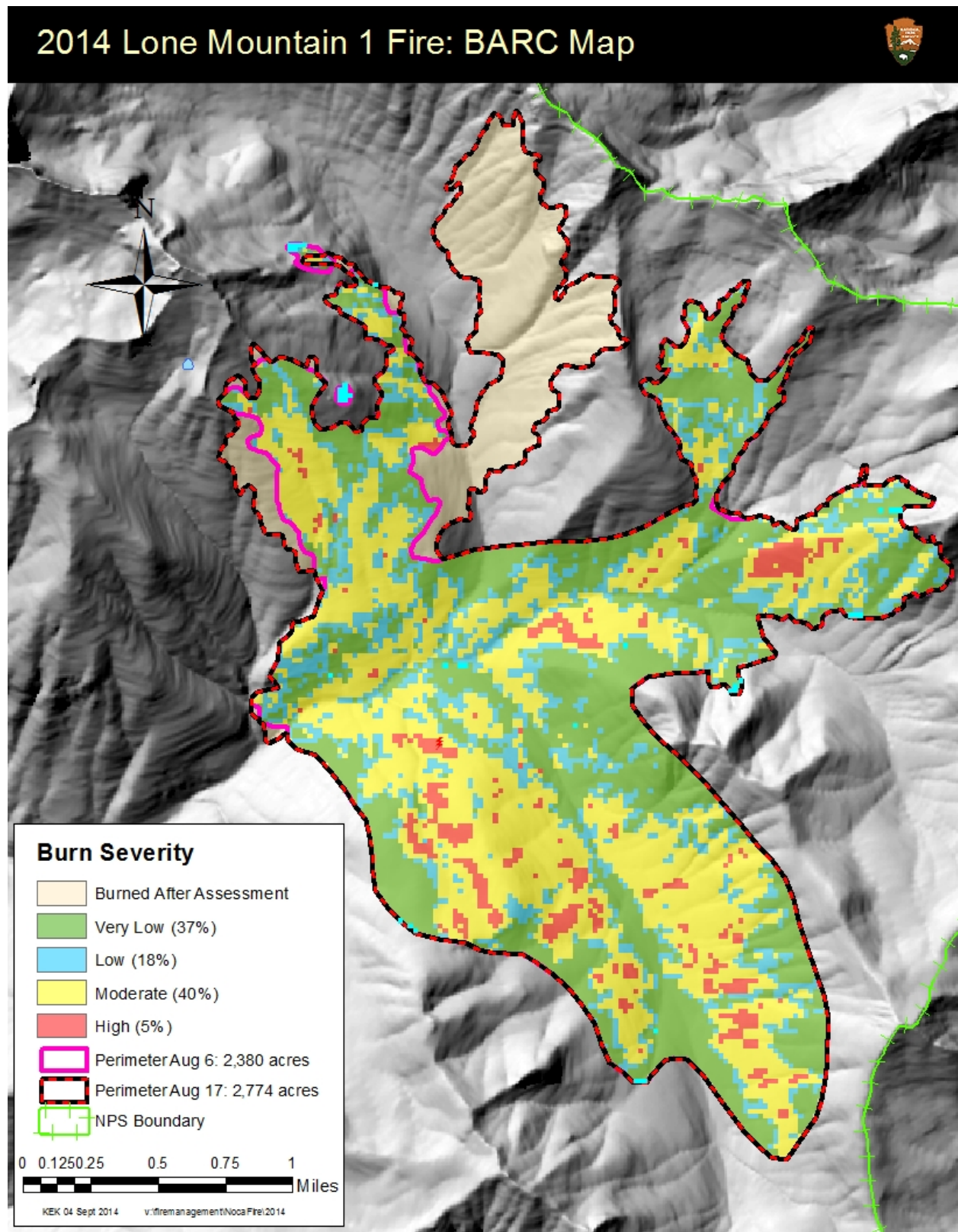


Figure 1. Burned Area Reflectance Classification (BARC) Map for the Lone Mountain 1 Fire excluding the Rennie Creek subwatershed.

In the Boulder Creek watershed, 2,774 acres or about 27% of the watershed burned in the upper elevations (**Table 2**). The BARC map, which does not include the Rennie Creek subwatershed, shows only 2380 acres of fire activity. Of these acres, about 45% of the burned area was mapped as moderate to high soil burn severity, with a predominance of moderate. The Boulder Creek watershed is approximately 10,315 acres in size. Within the Rennie Creek (**Figure 2**) subwatershed of Boulder Creek, 394 acres burned for which no BARC data was gathered, and helicopter recon was used to assess soil burn severity. The majority of the burned area is considered low to moderate with a large section of Unchanged/Low in the bottom portion of the watershed. Approximately 10 acres in the upper watershed is considered high.

Table 2. Boulder Creek Watershed Soil Burn Severity by Area and Percent Burned excluding the Rennie Creek subwatershed.

Soil Burn Severity	Acres Within Burned Area	Percent of Burned Area
Unchanged/Low	881	37
Low	428	18
Moderate	952	40
High	119	5
Total	2380	100



Figure 2. A view up Rennie Creek Watershed showing burned conditions.

Erosion Potential/Debris Flow Potential

The potential for erosion has increased in the burned areas of the Lone Mountain 1 Fire. Typically, the most significant increases occur in areas of high soil burn severity and slopes greater than 35 degrees. Hillslopes in the Boulder Creek watershed range from 32 to 35 degrees, so any increased erosion potential resulting from the Lone Mountain 1 Fire will likely be the result of the portion of the drainage that sustained moderate to high soil burn severity, such as the subwatershed of Butte Creek or the headwaters of Boulder Creek. The potential increase in erosion as a result of the fire is summarized as moderate to high given the slopes (32 to 35 degrees) and the large area of moderate and high soil burn severity.

There is substantial field evidence for debris flows as a dominant process within the Boulder Creek watershed. Evidence includes channel levees on fans in the valley area below the fire perimeter, slopes greater than 10° on the Boulder Creek fan, and recent debris flow paths within the Boulder Creek watershed. The Boulder Creek watershed contains evidence of recent and past debris flows, some of which may have reached the Stehekin Valley floor.

As compared to the Rainbow Bridge fire of 2010, the burned areas are larger and higher in the watershed. Since the Lone Mountain 1 fire is higher in elevation there is more potential energy to allow debris flows originating in this area to gather greater momentum and greater scour area which may enable larger debris flows to reach the valley floor; however field evidence for such an event is inconclusive or absent.

Recent and past evidence of debris flows along with a moderate to high probability of increased erosion potential due to post-fire watershed conditions indicate that there is a moderate to high probability of further debris flows resulting from post-fire conditions and the probability of these debris flows reaching the valley floor seems remote (Jon Riedel, personal communication) due to the low gradient of the Boulder Creek alluvial fan and lack of sufficient field evidence supporting such an event.

A cluster of three homes on the west side of the Boulder Creek alluvial fan appear well away from the active channels of Boulder Creek and are not at risk to debris flows due to post-fire watershed conditions. Additionally, no field evidence exists to suggest that debris flows have impacted this area.

Watershed Response

The effect of wildfires on storm runoff is well documented. Wildfires typically cause an increase in watershed responsiveness to precipitation events. Burned watersheds can quickly yield runoff due to the removal of protective tree and shrub canopies and litter and duff layers, thus producing flash floods. Burned areas often respond to the local storm events in a much flashier way. The amount of water yield increase is variable and it is often orders of magnitude larger than pre-fire events. Fires may increase the number of runoff events as well since it generally takes a smaller storm to trigger runoff until vegetation begins to recover. Peak flow increases

from the fire may also be augmented by floatable and transportable material within the active channels.

Throughout the fire area, vegetation recovery is largely dependent on climatic cycles. If wet winters occur, vegetation recovery could be rapid, with forbs and grasses providing ground cover similar to that observed in unburned areas throughout the fires. By the second winter season, forbs, grasses, and re-established shrubs should provide sufficient cover to reduce any increase in watershed response to near pre-fire levels. Once sprouting vegetation begins to produce brushy crowns and a duff/litter layer, watershed response will be reduced further. However, if winters are dry, vegetation recovery will be slow, and thus the establishment of ground cover and shrub communities will be slow, and watershed response will remain slightly elevated over pre-fire conditions.

A consequence of significant runoff, erosion, and sediment and debris delivery is a short-term degradation of water quality as ash, sediment, and burned organic debris are delivered to streams and lakes within and downstream of burned areas during the first few fall storms. The impacts of this effect depend largely on the vegetative recovery times in combination with storm characteristics in the same time period.

The primary watershed response of the Lone Mountain 1 fire is expected to be elevated sediment delivery and peak flows in response to post-fire rainfall. An analysis of the expected increase in peak flows on the Flick Fire in 2006 indicated potential increases of 6-8% due to post-fire conditions for 5- to 25-year flood events (Davis et al., 2006). It is assumed that similar increases may be expected for waterways in the Lone Mountain 1 Fire area, however these number are based on average precipitation values over a large area and do not account for intense localized precipitation, such as summer thunderstorms which can stall in the upper elevations with short duration high intensity precipitation. These are the conditions that can produce debris flows in burned and unburned areas, and appear to be the conditions that have influenced some of the recent debris flows in the Stehekin Valley.

Flood deposits and a flood relief channels exists along both banks of Boulder Creek near the Boulder Creek Bridge (and upstream) which appears to have been deposited in the June 1948 rain-on-snow event. Tree cores taken from Douglas fir trees on top of these flood deposits, debris flow, or anthropogenic deposits, give age dates near or after 1948 (**Figure 3**) corresponding well to the 1948 flood event. Additionally, old 8x8 posts are present on the debris piles which may be part of the bridge that was destroyed. However, these posts are on top of the debris flow plies, and not completely incorporated into them making their correlation to the storm suspect. Downstream of the bridge to the west, two cabins owned by the Ward and Morehead families are on the left bank downstream of the bridge. Field evidence suggests that the areas were not affected by the 1948 floods or other more recent smaller events. When the 48 floods occurred, it is believed that these houses were not yet constructed (Vicki Gempko, personal communication). There is a chance that in the area where the houses are located the development of the properties removed the evidence of past flooding by grading activities. However, spoil piles are lacking in the area.

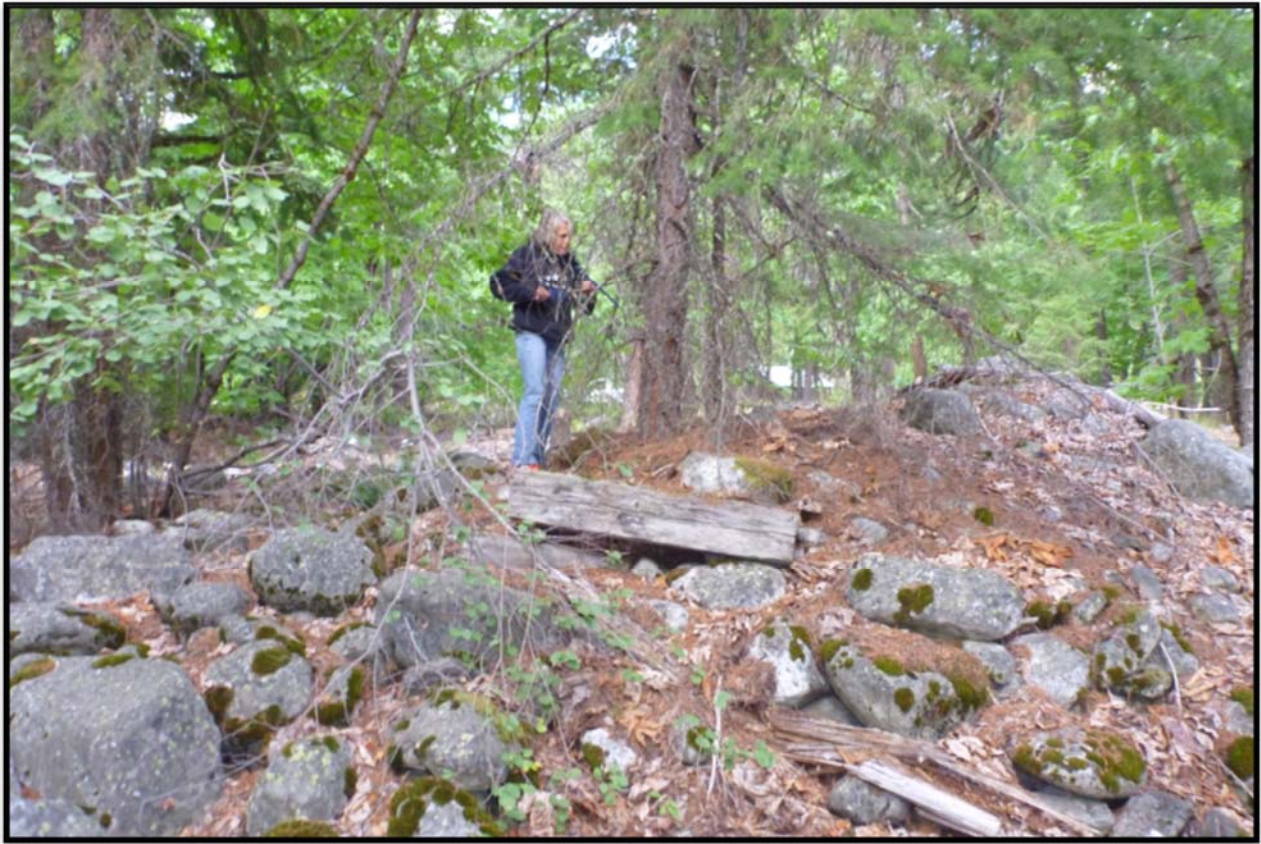


Figure 3. Flood, debris flow, or anthropogenic deposits with tree ring age dates of around 1948 or later. Old 8x8 posts on the debris in foreground, which may be part of the old bridge from 1948.

There is a moderate probability of increased flooding downstream of the fire area of the Lone Mountain 1 Fire as compared to pre-fire conditions. The six homes on the Boulder Creek alluvial fan are also at increased risk to flooding. The two homes in the Ward house area may see nuisance flooding of the properties, particularly if the Boulder Creek Bridge plugs from large woody debris and overtops. However, these homes are well away from the established channel and are built on raised foundations that will allow water to pass under.

The three homes on the west side of the Boulder Creek alluvial fan are also at risk to flooding. There are abandoned channels throughout the area, and in the case of channel migration on the fan, water may be channeled to these homes. However, this is a very unpredictable situation, and it is unlikely that this will happen. In the remote chance that this does happen, it is likely that the water will be channeled away or in between the homes in abandoned channels (**Figure 4**). Additionally, the homes are well suited for such an event due to solid rock lower stories or raised foundations.



Figure 4. Abandoned channels around and between homes on the west side to the Boulder Creek alluvial fan.

The Washington Department of Fish & Wildlife (WA DFW) cabin on the left side upstream side of Boulder Creek Bridge is also at increased risk of flooding as demonstrated by deposits from what is considered the 1948 flood (**Figure 5**). However, the cabin is situated away from the active channel, and flood relief channels should keep water away from this cabin. It is believed that the cabin did exist in 1948. There is no field evidence to suggest that the cabin has been flooded in the past, however ditches have been dug around the cabin to divert water away. The cabin should only be subject to nuisance flooding, unless an even bigger than the 1948 storm occurs, in which case BAER treatments would be ineffective due to the magnitude of the flood (see Values at Risk introduction below).



Figure 5. WA DFW Cabin with flood deposits of unknown age (1948?) in background.

Approximately 45 percent of the Boulder Creek watershed had a soil burn severity of moderate to high. As such, there is a moderate probability of increased peak flow magnitude and sediment delivery as a result of post-fire conditions. Additionally, a relatively large amount of wood and other debris was observed in the upper channel during a helicopter reconnaissance of the burned area. This situation may increase the overall amount of sediment delivery over the next several years. This pulse of large woody debris appears to be a product to the 1994 Boulder Butte Fire and this material is, and will be transported downstream for many years to come. In addition to this, large woody debris from the Rainbow Bridge Fire will also start to be transported downstream. The large woody debris from these fires places the Boulder Creek Bridge and box culvert at risk to plugging and overtopping or complete loss of these structures. Additionally, this large woody debris could cause channel migration across the alluvial fan. Several abandoned channels lead to the Stehekin Valley Road with no water relief such as culverts, bridges, or low water crossings. If channel migration does occur, and these channels reactivate, the road could be at risk to flooding, sediment deposition, and potentially complete loss.

Values at Risk

In regards to post-fire watershed conditions, Standard Operating Procedures (SOP) for BAER evaluations and treatments for flooding are only considered up to 25-year storm events. The ability for BAER to prescribe temporary treatments that withstand storm events greater than a

25-year magnitude becomes problematic, particularly in the case of debris flows which can be triggered by much smaller events. The nature of BAER activities allows for rapid assessment and rapid implementation of treatments to protect human lives, property, and critical natural and cultural resources. Design of treatments and implementation of treatments beyond 25-year storm events usually requires complex engineering that exceeds the rapid implementation of such treatment. Debris flows can be triggered by much smaller events, and are high energy events that are particularly difficult to protect values at risk against.

All areas within the burned area and downstream of the burned area were evaluated for values at risk due to post-fire watershed conditions. Prior to arrival of the BAER Team, several values at risk were identified:

- Stehekin Valley Road and a bridge over Boulder Creek's active channel and box culvert on and abandoned channel of Boulder Creek;
- Six private structures were identified in the Boulder Creek watershed;
- Boulder Creek Trail including Hooter Camp, Rennie Camp, and Reynolds Camp.

Roughly 2,774 acres burned in the Lone Mountain 1 Fire, all within the Boulder Creek watershed. Moderate to High burn severity totaled 45%, most (40%) of which was moderate. Given the elevated percentage of moderate and high soil burn severity within this watershed, there is an increased probability of mass wasting or flooding likely to have downstream effects as a result of the fire. Specifically, there is moderate to high potential for increased erosion and debris flows and a moderate probability of increased peak flows over pre-fire conditions.

Six private structures are located downstream of the fire on the alluvial fan formed by Boulder Creek and can be accessed from Stehekin Valley Road. All known structures were evaluated for potential damage from post fire watershed conditions. Examination of the structures shows that the placement of these structures is away from the current active channels of Boulder Creek. Some of the homes evaluated are built above relict channels. However, due to the dynamic nature of alluvial fans, relic channel capture and migration due to flooding, woody debris transport, or debris flows can be an unpredictable threat. If channel capture and migration does occur on the main channels of Boulder Creek, the most likely scenario is migration to an existing active channel which flows through a box culvert on Stehekin Valley Road just west of the Boulder Creek Bridge. Although this is the most likely scenario, channel capture and migration could occur at any point below the first 100 yards downstream of the apex of the alluvial fan, transporting water, rocks, sediment, and woody debris well away from the existing channel, and potentially towards structures that previously appeared to be safe. Given the highly dynamic nature of the Boulder Creek alluvial fan, it is impossible to predict potential damage to structures built upon the alluvial fan. If the channel maintains its current active channels, it is unlikely that any of the existing structures are at risk to flooding and debris transport due to post fire watershed conditions for a 25 year event. Given the erosion/debris flow potential, watershed response, soil burn severity, structure placement, and location of the current active channels, no treatments are recommended to protect lives and property.

The Stehekin Valley Road crosses the two channels of Boulder Creek via a bridge and box culvert and these structures were evaluated for potential post fire watershed conditions. The

bridge crosses the active channel and the box culvert is on a recently abandoned channel. Upstream of the box culvert, large woody debris has diverted the channel away from the box culvert to the main active channel. In flood conditions, this log jam could be dislodged allowing flood waters to re-occupy the channel that leads to the box culvert. The bridge and box culvert (if the channel re-occupies) are at risk from flooding and debris transport. Large woody debris which is present upstream of each structure has the potential to lodge against the upstream side of the bridge and box culvert creating log jams which could cause plugging and overtopping of these structures. If this occurs, there is potential to lose the road, bridge and/or box culvert or cause flows to divert over the top and around the structures. This is an important concern given that Stehekin Valley Road is the only transportation corridor connecting Stehekin Landing with up-valley residents and infrastructure.

BAER Team members and park staff considered a specification for channel clearing of floatable debris within the Boulder Creek channel, but park staff ultimately decided that the negative ecological impacts to the Boulder Creek channel, both above and below the waterline within the active stream channel, were too significant to pursue such a treatment. To protect the bridge and culvert periodic monitoring and cleaning is proposed. If flooding does occur funds are proposed for road clearing.

The Boulder Creek Trail and associated Rennie Camp are located within the burned area. Reynolds and Hooter Camp are not in the burned area, but are downslope of the burned area. The trail crosses several second order streams in the upper watershed that are prone to debris flow without the presence of fire, and the Lone Mountain 1 Fire only exacerbates this situation. Rennie Camp is situated well away from active channels on a ridge and is not at risk. The Reynolds and Hooter Camps are not at risk from burned slopes given their location relative to burned areas. Given the increased erosion, debris flow potential, and watershed response in post fire watershed conditions, a potential for loss of life or injury from use of the trail and during certain precipitation and runoff conditions such as thunderstorms and snowmelt exists. To help mitigate the potential for loss of human life or injury, specifications for warning signs and public education are proposed. Additionally, it is recommended to close the Boulder Creek Trail through the fall and winter (2014) and reopen the trail after the spring 2015 snowmelt.

Critical Natural Resources

In consultation with NOCA resource managers, no critical natural resources were identified within or downstream of the Lone Mountain 1 Fire that would require Emergency Stabilization.

Critical Cultural Resources

In consultation with NOCA resource managers, no critical cultural resources were identified within or downstream of the Lone Mountain 1 Fire that would require Emergency Stabilization.

RECOMMENDATIONS

Emergency Stabilization

W-1 Install Hazard Warning Signs (\$5,632)

Hazardous watershed conditions resulting from post-fire conditions including rockfall, flooding,

and in some cases hazard trees should be communicated to the public via warning signs at the following locations: trailheads of Rainbow Creek, Boulder Creek, and Purple/Imus 2) trail intersections of Summit and Boulder Creek Trails and the intersection of War Creek and Boulder Creek Trails 3) Rainbow Bridge, Hooter, Rennie, and Reynolds Camps. Signs should be installed prior to initial fall rains and removed at the park's discretion, typically 5 years after the fire.

W-2 Road and Culvert Cleaning (\$18,230)

It is recommended that funding be provided to monitor and clean the Boulder Creek Bridge and box culvert along Stehekin Valley Road after precipitation events, and road clearing after large storm events if needed. It is estimated that on a yearly average, six high water events happen during the spring melt and summer thunderstorm season and the park should be prepared to clean the bridge, culvert, and potentially the road to keep this critical infrastructure open.

W-3 Fire and Debris Flow Risk – Site Assessment (\$11,000)

In the past 20 years there have been at least four fires in the Stehekin Valley and Landing areas, three of which have occurred since 2006 and include the: 1994 Boulder Butte, 2006 Flick Creek, 2010 Rainbow Bridge, and 2014 Lone Mountain 1 Fires. In the last seven years there have been seven debris flows that have made it to the valley floor, one of which (Imus Creek, 2013) that severely damaged a historic building and narrowly missed other occupied buildings at the Landing. Not all debris flows are related to fire, Thimbleberry Creek in 2014 as an example, however the majority had the potential to be influenced by fire events. There is significant risk to lives and property below the mountain drainages from debris flows within the Stehekin Valley and Landing areas including federal and private property, and the risks may be increasing with a change of weather patterns and climate over time.

Following the 2006 and 2010 fires in the valley, through major planning efforts such as the Stehekin River Corridor Implementation Plan, and via site-specific planning such as for the Purple Point campground following the Imus debris flow of 2013, the park has been working to both educate residents and visitors about debris flow hazards and apply the hazard concerns to park management. The park now includes debris flow hazards as a specific threat for future site development in the Stehekin Valley. Nonetheless, a focused, proactive plan that anticipates fire and storms in the watersheds above the Stehekin Valley and Landing areas, assesses the risks, and prepares these areas for the possible effects of those anticipated events would provide a valuable resource for park management.

As a start toward this goal, funding is recommended for one USGS scientist from the USGS Landslide Hazard Division meet onsite with NOCA staff (particularly Dr. Jon Riedel, staff geologist) to 1) gain an understanding of the specific Lone Mountain 1 fire event and its possible risk of debris flows in Boulder Creek, and 2) especially to obtain a thorough orientation to the Stehekin Valley, the numerous debris flows that have occurred there in the past 7 years, and the larger regional geological and climatic context to consider the need for a broader comprehensive survey. That regional survey would consider, amongst other things, fire frequency and timing, weather patterns, debris flow frequency, intensity, and timing (both fire and non-fire related), landforms, drainages, and structures. The USGS Landslide Hazard Division could be involved in this comprehensive study, but NOCA staff specialists and academia would be strong partners in such an effort. A reasonable goal would be to have results peer-reviewed and published by

September 2019 to facilitate timely management recommendations of this important topic.

Non-Funded Management Recommendations

- **USGS Risk Assessment**

As noted in the Site Assessment specification above, a broader, regional survey of the debris flow risk in this area is recommended. From the time of the Rainbow Bridge Fire assessment to the Lone Mountain 1 Fire assessment things have changed in the Stehekin Valley in regards to debris flow frequency and intensity, and this may be a result of changing weather patterns and climate. Many areas within the valley are subject to debris flows and the potential for loss of life or injury from these events is present. Many structures including federal buildings and private homes are at grave risk as demonstrated by the Imus Creek debris flow and others, but the real risk to infrastructure and lives resides in the Purple Creek drainage due to the density of structures and infrastructure. A comprehensive understanding of these risks needs to be in place to further management actions to protect lives and property and for future development. Recommendation is to engage the USGS Landslide Hazard Division and/or park staff and academic partners to undertake a comprehensive study to understand the changing weather patterns, timing and intensity of debris flows, and the consequence of these debris flows on structures below them including both public and private lands throughout the valley from High Bridge to Flick Creek Camp and the Company Creek Road to Manly Wham Camp.

- **Close Boulder Creek Trail**

It is recommended closing the Boulder Creek Trail within and below the burn perimeter for the fall of 2014 through the 2015 spring snow melt. The burned area contains the following hazards: 1) increased rockfall and rolling debris potential, 2) increased debris flow potential, and 3) increased potential for flash flooding. The first wet season following the fire should mitigate many of these hazards to a large degree, though some hazards will remain elevated for several years following the fire.

- **McGregor Mountain Debris Flows**

Ground and aerial observations suggest that two areas high on McGregor Peak may be at increased risk to debris flows. It appears that both these areas discharge to the “Ranch” (personal communication, Vicki Gempko, Sept 2014). It is recommended having the NOCA Geologist further assess the areas and assess the downstream paths.

- **The Purple Point Camp.** The campground on Purple Point is built upon a debris cone and is considered at risk to debris flow with or without fire in the watershed. Aerial recon shows that the drainage is loaded with debris in the second order streams and at least three first order streams have produced debris flows in the very recent past (2013). This raises the probability of debris flows that could strike the campground, threatening visitor safety. The park should consider closing and abandon the Purple Point Camp or restrict use during spring melt and summer thunderstorm events.

- **Monitoring Septic Systems along Stehekin River.** Although not part of the fire analysis, ground observations along Company Creek road suggest that a septic contamination of Stehekin River may be occurring due to the fact that most of the homes are built in the floodplain

and many of these homes are older and may have failing septic systems. Monitoring for *E. coli* as a fecal indicator along Stehekin Creek in the Company Creek Road area would assess this potential condition. No single sample should exceed 235 MPN as a federal standard. It is also recommended monitoring at least two times, once after the spring floods when the water table is high and once in the fall when the water table is low.

REFERENCES

Davis, M, M. Bennett, T. Lillybridge, and J. Riedel, 2006. Soil and Watershed Resource Assessment *in* Flick Creek Fire Burned Area Emergency Response Plan, North Cascades National Park.

Riedel, J., S. Dorsch, J. Wenger, S. Brady, 2009. Geomorphology of the Stehekin Watershed, Landform Mapping at North Cascades National Park Service Complex, WA. Natural Resource Report NPS/NCCN/NRTR – 2009/####, 89 pp.

Watershed Assessment written by:

Brian Rasmussen, NPS Geologist, Lone Mountain 1 Fire NPS BAER Team.

VEGETATION BURNED AREA ASSESSMENT

OBJECTIVES

- Evaluate and assess the fire impact to the vegetation resources including potential state listed plant species.
- Determine emergency stabilization, monitoring, early detection and eradication of weeds supported by specification to aid in the vegetation and soil stabilization efforts.
- Provide management recommendations to assist in habitat protection, revegetation, and rehabilitation if needed.

ISSUES

- Establishment and expansion of invasive plant species into burned areas and locations of fire suppression activity.
- Evaluate fire activity on populations of state listed Salish fleabane (*Erigeron salishii*) and Federal candidate species whitebark pine (*Pinus albicaulis*).

OBSERVATIONS

Findings and recommendations contained within this assessment are based on NOCA reconnaissance of impacted areas via ground surveys on September 2, 2014 by NOCA Plant Ecologist (Mignonne Bivin), NOCA Chief of Natural and Cultural Resources (Jack Oelfke) and Stehekin District Resource Management Specialist (Vicki Gempko) and via aerial observation on September 4, 2014 by Bivin.

The Lone Mountain 1 fire was a mixed severity fire. Most of the area was low severity with some areas of moderate and high severity.

Findings

NOCA is floristically diverse, with approximately 1400 vascular plant species. NOCA has an existing vegetation map developed in 1990 under contract by Pacific Meridian Resources. In 2004, a revision of the existing vegetation maps in the NCCN and the development of an associated vegetation classification system began by the NPS. Vegetation maps are being developed for all 7 parks in the NCCN. NOCA will be the last of the 7 parks within the network to be completed. The vegetation map and classification for NOCA are expected to be completed by 2016.

Vegetation Type Descriptions

In the summer season of 2003, a contract botanist (Joe Arnett) surveyed the Stehekin area for sensitive plant species. This contract was initiated by the Fire Management Office of NOCA in preparation for proposed landscape prescribed burns on the walls above the Stehekin Valley. The vegetation community types within the units were also documented in the course

of the survey. The area surveyed in the contract spanned from the NPS/USFS boundary on the south to the Coon Lake drainage approximately 12 miles to the north.

The fire area is a mosaic of rocky outcrops, benches and has steep to very steep slopes. The forests on the site had open to very dense stands (dog-hair) of Douglas fir. Douglas fir/Ponderosa stands varied from dense forests to open woodlands. Understory of the forested stands ranged from very sparse to a dense cover of shrubs or forbs and grasses. Riparian forests were restricted to the narrow stream corridors. A dense shrub layer dominated the understory of the riparian forests. Rock outcrops or balds often associated with talus slopes are abundant throughout the fire area. Scattered shrublands also can be found throughout the fire area.

The vegetation types documented in the Arnett survey and surveys conducted by the NOCA Plant Ecologist, Mignonne Bivin and found within the Lone Mountain 1 Fire area included rock outcrops, grassland patches, dry coniferous forest, riparian corridor, shrublands and subalpine forests.

Vegetation Type Descriptions

Grassland patches are often above or adjacent to rock outcrops. Species include ferns, annual and perennial grasses and herbs. Species include blue bunch wheatgrass (*Pseudoroegneria spicata*), Indian's dream fern (*Aspidotis densa*), Dogbane (*Apocynum androsaemifolium*), woodland star (*Lithophragma pariflora*), and Lomatium species (*Lomatium geyeri*, *L. brandegei* and *L. triternatum*).

Dry coniferous forests are dominated by Douglas fir (*Pseudotsuga menziesii*) and ponderosa pine (*Pinus ponderosa*). The understory is sparse or absent. In some areas shrubs occur. Common shrubs include red stem ceanothus (*Ceanothus sanguineus*), spirea (*Spirea betulifolia*), serviceberry (*Amelanchier alnifolia*), rose (*Rosa gymnocarpa*), and in moist areas big leafed maple (*Acer macrophyllum*) and Western dogwood (*Cornus nuttallii*) are abundant. There are occasional patches of well-developed pine grass (*Calamagrostis rubencens*) and blue bunch wheatgrass (*Pseudoroegneria spicata*) in the understory.

Riparian forest occur along drainages and are dominated by a canopy of big leafed maple (*Acer macrophyllum*) with a shrub layer including thimbleberry (*Rubus parviflorus*), snowberry (*Symphoricarpus albus*), and oceanspray (*Holodiscus discolor*).

Shrublands are generally found on stabilized talus in avalanche chutes, on steep slopes in the transition zone between forest and steeper cliffs above. The dominant species include: serviceberry (*Amelanchier alnifolia*), ocean spray (*Holodiscus discolor*), choke cherry (*Prunus virginiana*), thimbleberry (*Rubus parviflorus*), Oregon grape (*Mahonia aquifolium*), snowberry (*Symphoricarpus albus*), mock orange (*Philadelphus lewisii*), bitter cherry (*Prunus emarginata*), Scouler's willow (*Salix scouleriana*) and some patches of quaking aspen (*Populus tremuloides*).

Subpine forests are found in upper elevations. These forests are composed of subalpine fir (*Abies lasiocarpa*), subalpine larch (*Larix lyallii*) and whitebark pine (*Pinus albicaulis*). Understory is lacking in dense stands. In more open stands understory may include pink heather (*Phylloce empetriiformis*), white heather (*Phyllodoce glanduliflora*), green fescue (*Festuca viride*), low bush blueberry (*Vaccinium deliciosum*) and high bush blueberry (*Vaccinium membranaceum*)

State Listed Species and Federal Candidate species

NOCA has no known federally listed plant species, but the Complex has approximately 56 potential state listed plant species. Salish fleabane (*Erigeron salishii*), occurs within the Lone Mountain 1 Fire area. The Salish fleabane is a state listed sensitive species. This species is one of the few southern populations of a species that are found more commonly to the north in central Vancouver B.C. These populations were located in 2005 by University of Washington herbarium volunteers and relocated in 2012 by NOCA plant ecologist M. Bivin and NOCA Biological Technician R. Peace. These populations are found primarily in the Rennie Creek basin and were most likely not effected by the fire activity. No post-fire surveys have been conducted to document the effect of the Lone Mountain Fire on the on these sensitive plant species. Surveys are scheduled to be conducted in the 2015.

Whitebark pine (*Pinus albicaulis*) is primarily found on the eastern slopes of LACH with in the North Cascades National Park Service Complex, however, some small populations can be found scattered north of LACH in North Cascades National Park and within Ross Lake NRA. Whitebark pine (*Pinus albicaulis*) is a federally listed candidate species. It was listed in July of 2011 by the U.S.F.W.S. as a Listing of Priority Number (LPN) 2, which means that it had been determined that threats are of a high magnitude and are imminent. Threats to this species are white pine blister rust, a non-native introduced rust, Mountain pine beetle, catastrophic fire, fire suppression, and the environmental effects of climate change. Whitebark pine is found on the ridges and upper areas of the drainages found within the Lone Mountain 1 Fire. Many trees with the Rennie Creek Basin have been burned (**Figure 6**) (personal comm. Michael Koenen, and observations by M. Bivin via helicopter, 9/4/2014).



Figure 6. Burned whitebark pine trees in Rennie Creek Basin

Invasive plant species

Approximately 223 species (16% of the NOCA flora) are invasive species. Four species of concern are known to occur within the boundaries of the Lone Mountain 1 fire area. A small population of Canada thistle (*Cirsium arvense*) was found within the current fire perimeter in 2013 by Stehekin District Resource Management Specialist Vicki Gempko. Canada thistle is listed as a Class C weed in Washington State. The population is approximately 1.5 miles within the fire perimeter (6.7 miles from the Stehekin Valley Road). Currently the population is small, consisting of approximately 30 rosettes in an area of 4 x 4 meters. This species is of highest concern because the seeds are dispersed by wind and can travel long distances from the existing population. In addition to Canada thistle, Sheep sorrel (*Rumex acetocella*), white clover (*Trifolium repens*), and dandelion (*Traxacum occidentalis*) were also observed within the fire perimeter. A population of cheatgrass was located and pulled approximately 1.5 miles west of the fire perimeter. Cheatgrass (*Bromus tectorum*) was identified and control efforts are underway with in the adjacent Rainbow Bridge Fire (2010). Small populations of bull thistle (*Cirsium vulgare*), sowthistle (*Sonchus asper*) and

Himalayan blackberry (*Rubus americanus*) and cheatgrass still persist in the adjacent Rainbow Bridge Fire.

The primary invasive plant species of concern within the Lone Mountain 1 Fire is Canada thistle (**Figure 7**), for the following reasons:

- A substantial decrease in the forest canopy due to conifer mortality and subsequent increase in light availability on the forest floor will provide increased area for infestation.
- There is a temporary loss of understory vegetation and ground cover, which will provide habitat openings for Canada thistle to establish and allow for a greater range of seed dispersal from the Canada thistle population.
- There will be increased wind dispersal of seeds from Canada thistle plants up-slope and within burned areas.



Figure 7. Canada thistle infestation along the Boulder Creek Trail.

Specifications

R-1: Early detection and eradication of Canada thistle and other species (\$11,371)

Early detection and management of new and expanding populations of Canada thistle will be critical to the recovery of native vegetation consumed during the Lone Mountain 1 Fire. The population is approximately 6.7 miles on the Boulder Creek Trail from the Stehekin Valley Road trailhead. The population will be surveyed and treatment applied each spring and fall beginning in the spring of 2015.

Early detection and eradication of other invasive plant species of concern that occur within the fire perimeter will be critical in preventing species such as sheep sorrel, bull thistle, sowthistle, and cheatgrass from establishing in burned areas that may serve as corridors to the park's wilderness areas. Detection and management of these species will primarily consist of mechanical removal efforts. In conjunction with methods specified in the NOCA Invasive Non-native Species Management Plan and EA, spot application of herbicides may be used to control populations that exceed the ability of crews to remove mechanically, or where mechanical removal would be ineffective against the target species.

Surveyed and controlled populations will be mapped using GPS units. Information collected will include the total (gross) area of treatment, the net (actual) infested and treated area, and the phenological stage at which plants were treated. For herbicide treatments, efficacy monitoring will be based on percent mortality, and take place within one month of treatment.

Recommendations for Control:

- **Canada thistle, Spring 2015:**

Initiate Spring 2015 control after detection surveys are completed but prior to budding. Treatment perimeters will be flagged so that efficacy can be assessed, and if necessary Fall follow-up treatments can be successfully performed. If it is determined that the Canada thistle infestation exceeds the projected acreage, Spring treatment will be Transline 7oz. of 1 pint /Acre + 2 quarts of Methylated Seed Oil (MSO) before bud formation.

- **Canada thistle, Fall 2015:**

Evaluate efficacy of Spring 2015 treatments. If necessary, apply Milestone at a rate of 8oz/Acre + 2 quarts of Methylated Seed Oil (MSO).

- **Canada thistle Spring 2016:**

Evaluate efficacy of Fall 2015 treatments. If needed, continue targeted applications of Transline begun in Spring 2015.

- **Canada thistle Fall 2016:**

If needed, continue targeted Milestone applications begun in Fall 2015.

- **Canada thistle Spring 2017:**

Evaluate efficacy of Fall 2016 treatments. If needed, continue targeted applications of Transline begun in Spring 2015.

- **Canada thistle Fall 2017:**

Evaluate efficacy of Spring 2017 treatments. If needed, continue targeted Milestone applications begun in Fall 2015.

Prevention and Public education

Public education in the form of signing, interpretive talks, public meetings and brochures will be an important part of the continued reduction and control of invasive species management for the Lone Mountain 1 Fire.

Chemical control has been used previously used in the Stehekin area to control Canada thistle. This treatment will be covered by NEPA through the NOCA Invasive Species Management Plan and EA. However, the concept of the use of chemicals in the Lone Mountain1 Fire will require public education to inform the public and home owners in the Stehekin Valley of the importance of the control of these aggressive weed species and the potential to the ecosystem through lack of action.

Weed identification cards will be available for individuals who are interested in volunteering to eradicate targeted weed species by hand pulling.

Management (non-specification related)

Survey, assess and monitor the State listed plant species

A survey and assessment of state listed species will be performed and a monitoring plan developed to track the post-fire response of these plant populations. The surveys will be conducted in early summer 2015. Funding for these activities will be obtained from sources other than BAER or BAR; in-kind support from the University of Washington's Rare-Care program, which utilizes volunteer botanists, will be sought.

Funding will be sought to support surveys to document the health of whitebark pine populations within the fire perimeter. Surveys would include trees affected by the fire, the extent of white pine blister rust, and Mountain pine beetle infestation in trees unaffected by fire.

REFERENCES

Arnett, J. 2002. Unpublished report. Sensitive plant surveys of the proposed landscape burn units in the Stehekin Valley, Lake Chelan NRA. NOCA Plant Ecologist files, Marblemount, WA.

National Park Service. 2007. Wildland Fire Management Plan. North Cascades National Park Service Complex

National Park Service. 2012. Invasive Non-native Plant Management Plan/EA. North Cascades National Park Service Complex.

Vegetation Assessment written by:

Mignonne Bivin, NOCA Plant Ecologist

MINOR FACILITIES BURNED AREA ASSESSMENT

OBJECTIVES

Identify and mitigate non-emergency damage to minor facilities within the burned area.

ISSUES

- Trail tread damage along the Boulder Creek trail and fire damage to Rennie Creek camp render these popular recreational facilities unusable by the public.

OBSERVATIONS

Background

The Boulder Creek trail follows the Boulder Creek drainage. Roughly 3 miles of the trail burned in the Lone Mountain 1 fire, with fire extending on both sides of Boulder Creek. This trail serves as a connection of Lake Chelan National Recreation Area with Lake Chelan Sawtooth Wilderness (within the Okanogan-Wenatchee NF) and is a preferred route for stock and many visitors due to the more moderate grade.

The Boulder Creek trail is part of a loop trail passing through War Creek Pass and the Juanita Lake area; from War Creek Pass visitors can head down the Purple Creek trail to Stehekin, down the War Creek Trail onto USDA Forest Service lands, or along the Summit Trail, eventually onto USDA Forest Service lands.

Rennie Creek camp is a six-person site located at the confluence of Boulder and Rennie Creeks. It is approximately 6.2 miles from the Stehekin Valley.

The Boulder Creek trail and Rennie Creek camp have been closed to the public since initiation of the fire.

Reconnaissance Methods

The trail and camp were surveyed in late August by Stehekin Trails Maintenance Worker Aaron Robinson and on September 2, 2014 by the BAER Team (NOCA Chief of Resource Mgmt; NOCA Plant Ecologist; Stehekin Natural Resource Manager). Reconnaissance efforts concentrated on identifying and documenting potential debris flow routes and targets, hazard trees, damage to trail tread, foot log crossings and camps.

Findings

Recent fires (Flick Creek 2006, Rainbow Bridge 2010) have demonstrated that windfallen trees increase substantially for the next several years following the fire; even eight years following the Flick Creek fire, windfall amounts are much higher than pre-fire and occur throughout the year.

Those areas now require substantially more trail maintenance than before the fire. In addition vegetation (particularly ceanothus) grows quickly and thickly along and within the trail tread itself, causing hikers to move toward the outside edge of the trail, causing sloughing of the outside trail berm.

Figure 8 shows those facilities within the burn area that require repair; damage to trail tread is spread throughout the burn area and it is impossible to map specific damaged areas.

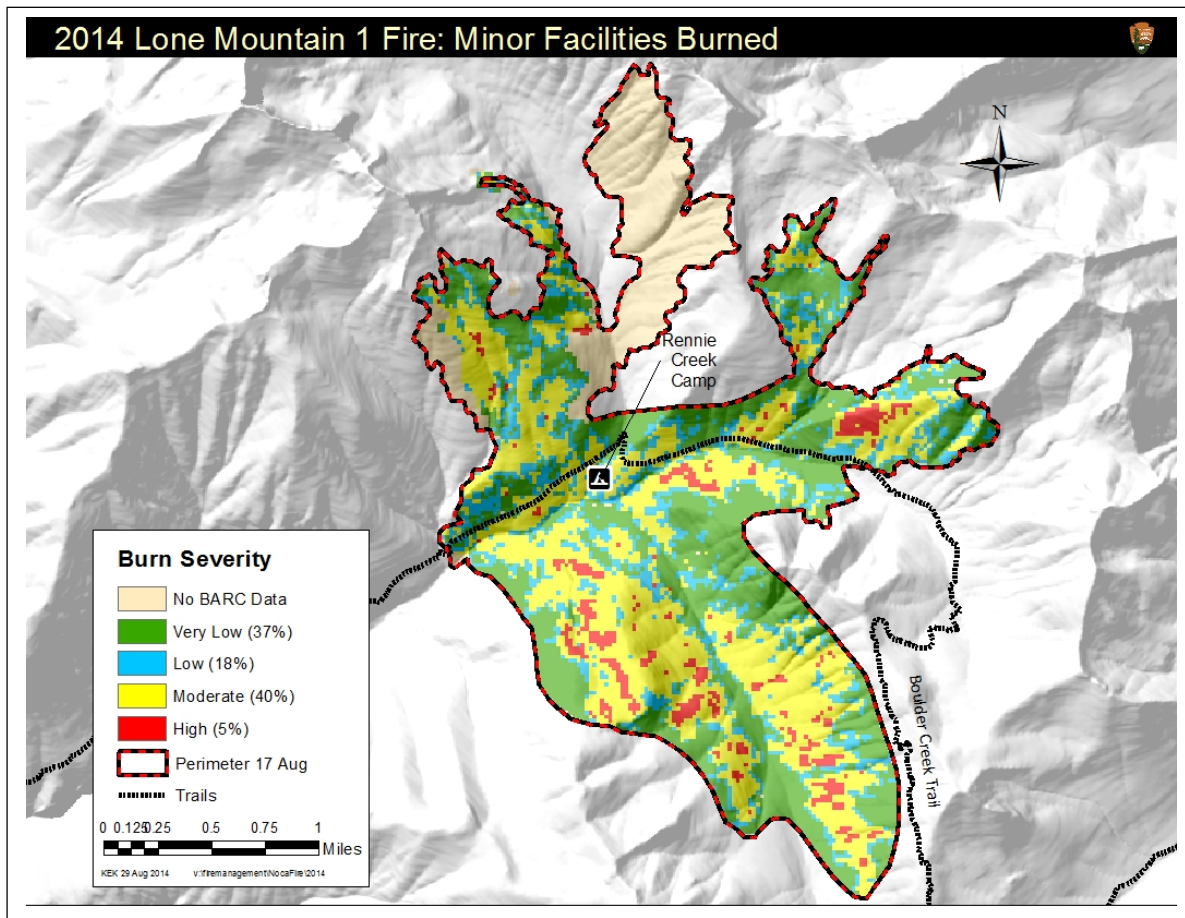


Figure 8. Location of minor facilities burned in Lone Mountain fire

No trail signs or bridges/footlogs burned in the fire.

Approximately 3,000 linear feet of tread on the Boulder Creek trail was damaged by fire, either by debris falling onto it or by having roots and organic material (duff) burned out beneath it. Many trees have fallen across the trail already (**Figure 9**).



Figure 9. Burned over trail showing loss of tread, burned logs, potential for erosion.

At Rennie Creek camp, two tent pads and the wooden pit toilet burned. Although the third tent pad did not burn, it has several hazard trees surrounding it (**Figure 10**).



Figure 10. Rennie Creek campground, tent pad.

Based on experience from both the 2006 Flick Creek fire and the adjacent 2010 Rainbow Bridge fire, trail brush will grow quickly and soon become a trail maintenance issue. **Figures 11 and 12** show the presence of ceanothus in the burn area and adjacent 2010 Rainbow Bridge fire.



Figure 11. Ceanothus-lined trail, Lone Mountain 1 fire.



Figure 12. Extensive ceanothus regrowth in adjacent 2010 Rainbow Bridge fire

RECOMMENDATIONS

Specifications

R-2: Trails and Camps (\$43,052)

All trail and camp work will be completed according to NOCA trail standards. The sections of trail that have been lost or damaged will be reworked to provide a standard trail surface. Lush vegetation growth will be brushed off the trail tread to maintain access on the tread.

The Rennie Creek camp will be relocated to an adjacent unburned area that will provide campers shade and eliminate the need for additional cutting of hazard trees. Because the fire burned patchy in this area, there are suitable sites adjacent to the existing camp. Site capacity will remain as one site (with up to three tent pads). The toilet will be replaced in-kind.

All trail and camp-related work will commence in the spring of 2015. Based on the experience of the 2010 Rainbow Bridge fire, which has very similar trail conditions as the Lone Mountain fire, BAR funds are also sought to continue trail repairs and maintenance and log and brush removal in 2016 and 2017. If the trail sustains substantial damage due to debris flows additional funding will be requested.

CONSULTATIONS

Aaron Robinson, Trails Maintenance Worker, NOCA

Minor Facilities Assessment written by Vicki Gempko

SPECIFICATIONS



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PART F - INDIVIDUAL TREATMENT SPECIFICATION

TREATMENT/ACTIVITY NAME	Install Hazard Warning Signs	PART E Spec-#	W-1
NFPORS TREATMENT CATEGORY*	Protection and Warning	FISCAL YEAR(S) (list each year):	2015
NFPORS TREATMENT TYPE *	Warning Signs	WUI? Y / N	Y
IMPACTED COMMUNITIES AT RISK	Stehekin	IMPACTED T&E SPECIES	N/A

* See NFPORS Restoration & Rehabilitation module - Edit Treatment screen for applicable entries.

WORK TO BE DONE (describe or attach exact specifications of work to be done):

A. General Description: Install warning signs to alert public to the threats of debris flows, flooding, and rock fall on trails. B. Location/(Suitable) Sites: Hazardous watershed conditions resulting from post-fire conditions including rockfall, flooding, and in some cases hazard trees should be communicated to the public via warning signs at the following locations: trailheads of Rainbow Creek, Boulder Creek, and Purple/Imus 2) trail intersections of Summit and Boulder Creek Trails and the intersection of War Creek and Boulder Creek Trails 3) Rainbow Bridge, Hooter, Rennie, and Reynolds Camps. Signs should be installed prior to initial fall rains and removed at the park's discretion, typically 5 years after the fire. C. Design/Construction Specifications: Design signs to fit NPS and park visual appearance standards. Develop language to convey the proper message for the given risk. Road signs should meet applicable visual standards to be well seen during daylight and night. Trail signs should meet applicable visual standards. Signs should remain in place for at least 2 years and up to 5 years. D. Purpose of Treatment Specifications (relate to damage/change caused by fire): watershed conditions resulting from post-fire conditions including rockfall, flooding, and in some cases hazard trees should be communicated to the public via warning signs. E. Treatment consistent with Agency Land Management Plan (identify which plan): GMP, to provide for employee and visitor safety. F. Treatment Effectiveness Monitoring Proposed: Monitor condition of signs and replace as necessary.

LABOR, MATERIALS AND OTHER COST:

PERSONNEL SERVICES: (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	COST / ITEM
1 WG-8 Maintenance Mechanic x \$35.00 /hr x 40 Hours x 1 FY	\$1,400
1 WG-5 Laborer x \$30.80/hr x 40 hours x 1 FY	\$1,232
TOTAL PERSONNEL SERVICE COST	\$2,632
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item): Note: Purchases require written justification that demonstrates cost benefits over leasing or renting.	
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	
Sign @ \$100/sign x 30 x 1 FY	\$3,000
TOTAL MATERIALS AND SUPPLY COST	\$3,000
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	
TOTAL TRAVEL COST	

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CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	
TOTAL CONTRACT COST	

SPECIFICATION COST SUMMARY

FISCAL YEAR	PLANNED INITIATION DATE (M/D/YYYY)	PLANNED COMPLETION DATE (M/D/YYYY)	WORK AGENT	UNITS	UNIT COST	PLANNED ACCOMPLISHMENTS	PLANNED COST
2015	10/01/2015	09/30/2015	F	Each	\$188	30	\$5,632
TOTAL							\$5,632

Work Agent: C=Coop Agreement, F=Force Account, G=Grantee, P=Permittees, S=Service Contract, T=Timber Sales Purchaser, V=Volunteer

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	
3. Estimate supported by cost guides from independent sources or other federal agencies	
4. Estimates based upon government wage rates and material cost.	P & M
5. No cost estimate required - cost charged to Fire Suppression Account	

P = Personnel Services, **E** = Equipment **M** = Materials/Supplies, **T** = Travel, **C** = Contract, **F** = Suppression

RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT:

See Watershed Assessment

TOTAL COST BY JURISDICTION

TRIBAL JURISDICTION				UNITS TREATED	COST
NPS				1	\$5,632
TOTAL COST					\$5,632

Lone Mountain 1 Post-Fire Response Plan | 2014

PART F - INDIVIDUAL TREATMENT SPECIFICATION

TREATMENT/ACTIVITY NAME	Clear and Clean Bridges, Culverts, and Roads	PART E Spec-#	W-2
NFPORS TREATMENT CATEGORY*	Roads	FISCAL YEAR(S) (list each year):	2015
NFPORS TREATMENT TYPE *	Hazards Removal	WUI? Y / N	Y
IMPACTED COMMUNITIES AT RISK	Stehekin	IMPACTED T&E SPECIES	N/A

* See NFPORS Restoration & Rehabilitation module - Edit Treatment screen for applicable entries.

WORK TO BE DONE (describe or attach exact specifications of work to be done):

General Description:

- Remove debris from Stehekin Valley Road at Boulder Creek Bridge, Box Culvert, and on road after large storms.
- Patrol, monitor, and remove debris from bridge and box culvert of Boulder Creek after each storm event to ensure unobstructed flow through the bridge and box culvert.

B. Location/(Suitable) Sites:

- Boulder Creek active channels upstream of the bridge and box culvert on Stehekin Valley Road.
- Stehekin Valley Road, Boulder Creek Bridge, and box culvert.

C. Design/Construction Specifications:

- Remove debris from road, bridge, and box culvert using heavy equipment and crews.
- Monitor and remove debris accumulation from bridge and box culvert as necessary.

D. Purpose of Treatment Specifications (relate to damage/change caused by fire):

To protect road, bridge, and box culvert over Boulder Creek on Stehekin Valley Road from plugging and failure due to accumulation of debris.

E. Treatment consistent with Agency Land Management Plan (identify which plan):

GMP, actions to protect visitor safety and infrastructure.

F. Treatment Effectiveness Monitoring Proposed:

Monitor Channel after storms and remove floatable debris deposited in channel after storm events.

LABOR, MATERIALS AND OTHER COST:

PERSONNEL SERVICES: (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	COST / ITEM
1 WG-8 Maintenance Mechanic x \$35.00/hr x 48 Hours x 1 FY	\$1,680
1 WG-5 Laborer x \$30.80/hr x 48 hours x 1 FY	\$1,480
2 WG-4 Laborer x 22.40/hr x 48 hours x 1 FY	\$2,150
TOTAL PERSONNEL SERVICE COST	\$5,310
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item): Note: Purchases require written justification that demonstrates cost benefits over leasing or renting.	
Front Loader Rental@ \$100/hr x 48 hours x 1 FY	\$4,800
Back-hoe Rental @ \$80/hr x 48 hours x 1 FY	\$3,840
Dump Truck Rental @ \$60/Hr x 48 hours 1 FY	\$2,880
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	\$11,520
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	
Fuel @ \$7.00/gal x 200 gal x 1 FY	\$1,400
TOTAL MATERIALS AND SUPPLY COST	\$1,400
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	
TOTAL TRAVEL COST	

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CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	
TOTAL CONTRACT COST	

SPECIFICATION COST SUMMARY

FISCAL YEAR	PLANNED INITIATION DATE (M/D/YYYY)	PLANNED COMPLETION DATE (M/D/YYYY)	WORK AGENT	UNITS	UNIT COST	PLANNED ACCOMPLISHMENTS	PLANNED COST
2015	10/1/2015	9/30/2015	F	Storm	\$3,038	6	\$18,230
TOTAL							\$18,230

Work Agent: C=Coop Agreement, F=Force Account, G=Grantee, P=Permittees, S=Service Contract, T=Timber Sales Purchaser, V=Volunteer

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	
3. Estimate supported by cost guides from independent sources or other federal agencies	
4. Estimates based upon government wage rates and material cost.	P
5. No cost estimate required - cost charged to Fire Suppression Account	

P = Personnel Services, E = Equipment M = Materials/Supplies, T = Travel, C = Contract, F = Suppression

RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT:

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TOTAL COST BY JURSDICTION

TRIBAL JURISDICTION				UNITS TREATED	COST
NPS				6	\$18,230
TOTAL COST					\$18,230

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PART F - INDIVIDUAL TREATMENT SPECIFICATION

TREATMENT/ACTIVITY NAME	Fire & Debris Flow Risk Assessment	PART E Spec-#	W-3
NFPORS TREATMENT CATEGORY*	Assessment	FISCAL YEAR(S) (list each year):	2015
NFPORS TREATMENT TYPE *	Risk Assessment	WUI? Y / N	Y
IMPACTED COMMUNITIES AT RISK	Stehekin Valley and Landing	IMPACTED T&E SPECIES	N/A

* See NFPORS Restoration & Rehabilitation module - Edit Treatment screen for applicable entries.

WORK TO BE DONE (describe or attach exact specifications of work to be done):

- A. General Description:** Stehekin Valley and Stehekin Landing.
- B. Location/(Suitable) Sites:** Public and private lands throughout the valley from High Bridge to Flick Creek Camp and Company Creek Road to Manly Wham Camp, and other local areas deemed necessary.
- C. Design/Construction Specifications:** Orient a USGS scientist to the debris flow history and hazards in the Stehekin Valley, both associated with the Lone Mountain 1 Fire and the broader Stehekin Valley, to determine if a broader regional debris flow hazard assessment is warranted. A comprehensive regional landslide/debris flow study would include: fire frequency and timing, weather patterns, debris flow frequency, intensity, and timing (both fire and non-fire related), landforms, drainages, and structures will need to be performed. The USGS scientist would engage with park geologist Dr. Jon Riedel to gain a full understanding of the local debris flow history and contributing factors related to the debris flows from the last 7 years. A trip report by the USGS scientist would provide an assessment related to the Lone Mountain 1 Fire and recommendations for a broader study.
- D. Purpose of Treatment Specifications (relate to damage/change caused by fire):** In the past 20 years there have been at least four fire in the Stehekin Valley and Landing areas, three of which have occurred since 2006 and include the: 1994 Boulder Butte, 2006 Flick Creek, 2010 Rainbow Bridge, and 2014 Lone Mountain 1 Fires. In the last seven years there have been seven debris flows that have made it to the valley floor, one of which severely damage a historic building and narrowly missed other occupied buildings at the Landing that occurred on Imus Creek in 2013. Not all debris flows are related to fire, Thimbleberry Creek in 2014 as example, however several have potentially contributed to them. There is significant risk to lives and property below the mountain drainages within the Stehekin Valley and Landing areas from debris flows including federal and private property, and the risks may be increasing with a change of weather patterns and climate over time. A broader regional assessment would enable the completion of a proactive, focused plan that anticipates fire and storms in the watersheds above the Stehekin Valley and Landing areas, assesses the risks, and prepares these areas for the possible effects of those anticipated events. Results of the study would be peer-reviewed and published by September 2019 to facilitate timely management recommendations of this important topic.
- E. Treatment consistent with Agency Land Management Plan (identify which plan):** GMP, to provide for employee and visitor safety.
- F. Treatment Effectiveness Monitoring Proposed:** Report completed by September 2019. Monthly and yearly progress reports to PI COR and peer reviewed final products.

LABOR, MATERIALS AND OTHER COST:

PERSONNEL SERVICES: (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	COST / ITEM
One USGS scientist, one payperiod, 60% overhead	\$9,000
TOTAL PERSONNEL SERVICE COST	\$9,000
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item): Note: Purchases require written justification that demonstrates cost benefits over leasing or renting.	
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	
TOTAL MATERIALS AND SUPPLY COST	\$

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TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	
Travel to Stehekin	\$2,000
TOTAL TRAVEL COST	\$2,000
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	
TOTAL CONTRACT COST	

SPECIFICATION COST SUMMARY

FISCAL YEAR	PLANNED INITIATION DATE (M/D/YYYY)	PLANNED COMPLETION DATE (M/D/YYYY)	WORK AGENT	UNITS	UNIT COST	PLANNED ACCOMPLISHMENTS	PLANNED COST
2015	10/1/15	9/30/16	F				\$11,000
TOTAL							\$11,000

Work Agent: C=Coop Agreement, F=Force Account, G=Grantee, P=Permittees, S=Service Contract, T=Timber Sales Purchaser, V=Volunteer

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	C
3. Estimate supported by cost guides from independent sources or other federal agencies	
4. Estimates based upon government wage rates and material cost.	P
5. No cost estimate required - cost charged to Fire Suppression Account	

P = Personnel Services, **E** = Equipment **M** = Materials/Supplies, **T** = Travel, **C** = Contract, **F** = Suppression

RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT:

See Watershed Assessment

TOTAL COST BY JURSDICTION

TRIBAL JURISDICTION				UNITS TREATED	COST
NPS				1	\$11,000
TOTAL COST					\$11,000

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PART F - INDIVIDUAL TREATMENT SPECIFICATION

TREATMENT/ACTIVITY NAME	Lone Mountain 1 BAER/BAR Plan Prep	PART E Spec-#	O-1
NFPORS TREATMENT CATEGORY*	Planning	FISCAL YEAR(S) (list each year):	2014
NFPORS TREATMENT TYPE *	ES/BAER Plan	WUI? Y / N	Y
IMPACTED COMMUNITIES AT RISK	Stehekin	IMPACTED T&E SPECIES	none

* See NFPORS Restoration & Rehabilitation module - Edit Treatment screen for applicable entries.

WORK TO BE DONE (describe or attach exact specifications of work to be done):

General Description:

Staff from the North Cascades National Park Complex, Whiskeytown NRA, and the PWR office developed the BAER Plan for the Lone Mountain 1 fire. Staff met in Stehekin to conduct the assessments and coordinated the Plan with the PWR BAER Coordinator.

B. Location/(Suitable) Sites:

Team was based out of Stehekin, WA.

C. Design/Construction Specifications:

Complete a BAER/BAR Plan ("Post-Fire Response Plan") for the Lone Mountain 1 fire.

D. Purpose of Treatment Specifications (relate to damage/change caused by fire):

No treatments are prescribed under this specification. The planning activity is submitted as a specification in order to detail BAER planning costs for full transparency.

E. Treatment consistent with Agency Land Management Plan (identify which plan):

GMP, actions to protect visitor safety and infrastructure.

F. Treatment Effectiveness Monitoring Proposed:

Not applicable

LABOR, MATERIALS AND OTHER COST:

PERSONNEL SERVICES: (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	COST / ITEM
NOTE: GRADES AND COST/HR AVAILABLE UPON REQUEST	
Natural Resource staff (Bivin, Gempko)	\$2,350
Watershed staff (Rasmussen)	4,950
Overhead (Oelfke)	2,630
GIS (Kopper)	660
Boat Support (Lee)	200
Trails staff (Robinson)	300
TOTAL PERSONNEL SERVICE COST	\$11,090
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item): Note: Purchases require written justification that demonstrates cost benefits over leasing or renting.	
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	
TOTAL MATERIALS AND SUPPLY COST	
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	
NOCA staff travel and perdiem (Oelfke, Bivin)	\$ 520
WHIS staff travel and perdiem, rental car (Rasmussen)	950
TOTAL TRAVEL COST	\$1,470
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	
TOTAL CONTRACT COST	
TOTAL SPEC COST	\$12,560

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SPECIFICATION COST SUMMARY

FISCAL YEAR	PLANNED INITIATION DATE (M/D/YYYY)	PLANNED COMPLETION DATE (M/D/YYYY)	WORK AGENT	UNITS	UNIT COST	PLANNED ACCOMPLISHMENTS	PLANNED COST
2014	9/1/14	9/20/2014	F	Plan	\$12,560	1	\$12,560
TOTAL							

Work Agent: C=Coop Agreement, F=Force Account, G=Grantee, P=Permittees, S=Service Contract, T=Timber Sales Purchaser, V=Volunteer

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	P, T
3. Estimate supported by cost guides from independent sources or other federal agencies	
4. Estimates based upon government wage rates and material cost.	
5. No cost estimate required - cost charged to Fire Suppression Account	

P = Personnel Services, E = Equipment M = Materials/Supplies, T = Travel, C = Contract, F = Suppression

RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT:

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TOTAL COST BY JURSDICTION

TRIBAL JURISDICTION				UNITS TREATED	COST
NPS – North Cascades NP Complex				1	\$12,560
TOTAL COST					\$12,560

Lone Mountain 1 Post-Fire Response Plan | 2014

PART F - INDIVIDUAL TREATMENT SPECIFICATION

TREATMENT/ACTIVITY NAME	Invasive plant species	PART E Spec-#	R-1
NFPORS TREATMENT CATEGORY*	Invasive plant species	FISCAL YEAR(S) (list each year):	2015-2017
NFPORS TREATMENT TYPE *	Herbicide treatment	WUI? Y / N	N
IMPACTED COMMUNITIES AT RISK	Stehekin	IMPACTED T&E SPECIES	N/A

* See NFPORS Restoration & Rehabilitation module - Edit Treatment screen for applicable entries.

WORK TO BE DONE (describe or attach exact specifications of work to be done):

General Description:

- 1) Survey, map and eradicate Canada thistle population(s) within the fire perimeter. This population is expected to increase from seeds that will be released from the seed bank in the newly opened ground.
- 2) Public information will be placed at trailheads, bulletin boards and the Golden West Visitor Center to inform the public of the project and importance of invasive species control.
- 3) Survey/monitor Lone Mountain 1 fire area nearest the 2010 Rainbow Bridge fire to watch for any cheatgrass infestations. A population was located within 1.5 miles of the fire perimeter; this population was pulled in September, 2014
- 4) All work will be completed by the local NPS Stehekin Natural Resource Manager, the lone technical specialist in this remote area.

B. Location/(Suitable) Sites: A small population along the Boulder Creek trail is found 6.7 miles from the Stehekin Valley Road, approximately 0.5 miles upvalley from the Rennie Creek campground.

C. Design/Construction Specifications:

- 1) Spot herbicide treatments will be conducted in the spring and fall until the Canada thistle population is eradicated. Prebolt, spring treatments would use the herbicide Transline. Follow-up fall treatments would consist of Milestone. Herbicides chosen and treatment schedule provided by the North Coast and Cascades Network Exotic Plant Management Team Coordinator.
- 2) Monitor and continue to treat as necessary.

D. Purpose of Treatment Specifications (relate to damage/change caused by fire): The spread of Canada thistle into the wilderness of LACH threatens susceptible burned areas surrounding the current population. The existing thistle population is small, and eradicating it now before it expands is highly cost-efficient and best protects the native plant communities there. Expanding populations could threaten the natural revegetation in burned areas. These eradication actions are consistent with NPS policy, NOCA GMP and the Invasive Plant Management Plan/EA (2012)

E. Treatment consistent with Agency Land Management Plan (identify which plan):

These actions are consistent with NPS policy, NOCA GMP and the NOCA Invasive Plant Management Plan/EA (2012)

F. Treatment Effectiveness Monitoring Proposed: Spring treatments with Transline and Fall treatments with Milestone will be assessed to determine future treatments.. The areas adjacent to the known population will be searched for additional plants. Each treatment will be monitored to access treatment effectiveness and to determine if additional treatments are needed.

LABOR, MATERIALS AND OTHER COST: FISCAL YEAR 2015

PERSONNEL SERVICES: (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	COST / ITEM
GS 11/5 Natural Resource Manager X 80 hours (\$44.97/hr x 80 hrs =\$3598	\$3,598
TOTAL PERSONNEL SERVICES COST	\$3,598
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item): Note: Purchases require written justification that demonstrates cost benefits over leasing or renting.	
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	
Supplies and materials (backpack sprayer and herbicides)	\$100
TOTAL MATERIALS AND SUPPLY COST	\$100

2014

TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):		
TOTAL TRAVEL COST		
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):		
TOTAL CONTRACT COST		
TOTAL FISCAL YEAR COST		\$3,698

LABOR, MATERIALS AND OTHER COST: FISCAL YEAR 2016

PERSONNEL SERVICES: (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	COST / ITEM
GS 11/5 Natural Resource Manager X 80 hours (\$46.32/hr x 80 hrs = \$3706	\$3,706
TOTAL PERSONNEL COST	\$3,706
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item): Note: Purchases require written justification that demonstrates cost benefits over leasing or renting.	
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	
Herbicides	\$75
TOTAL MATERIALS AND SUPPLY COST	\$75
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	
TOTAL TRAVEL COST	
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	
TOTAL CONTRACT COST	
TOTAL FISCAL YEAR COST	\$3,781

LABOR, MATERIALS AND OTHER COST: FISCAL YEAR 2017

PERSONNEL SERVICES: (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	COST / ITEM
GS 11/5 Natural Resource Manager X 80 hours (\$47.71/hr x 80 hrs =\$3817	\$3,817
TOTAL PERSONNEL COSTS	\$3,817
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item): Note: Purchases require written justification that demonstrates cost benefits over leasing or renting.	
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	

Lone Mountain 1 Post-Fire Response Plan | 2014

MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	
Herbicides	\$75
TOTAL MATERIALS AND SUPPLY COST	\$75
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	
TOTAL TRAVEL COST	
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	
TOTAL CONTRACT COST	
TOTAL FISCAL YEAR COST	\$3,892

SPECIFICATION COST SUMMARY

FISCAL YEAR	PLANNED INITIATION DATE (M/D/YYYY)	PLANNED COMPLETION DATE (M/D/YYYY)	WORK AGENT	UNITS	UNIT COST	PLANNED ACCOMPLISHMENTS	PLANNED COST
2015	5/15/2015	10/15/2015	F	miles	\$1233	3	\$3,698
2016	5/15/2016	10/15/2016	F	miles	\$1235	3	\$3,781
2017	5/15/2017	10/15/2017	F	miles	\$1273	3	\$3,892
TOTAL							\$11,371

Work Agent: C=Coop Agreement, F=Force Account, G=Grantee, P=Permittees, S=Service Contract, T=Timber Sales Purchaser, V=Volunteer

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	
3. Estimate supported by cost guides from independent sources or other federal agencies	
4. Estimates based upon government wage rates and material cost.	P
5. No cost estimate required - cost charged to Fire Suppression Account	

P = Personnel Services, E = Equipment M = Materials/Supplies, T = Travel, C = Contract, F = Suppression

RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT:

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TOTAL COST BY JURISDICTION

TRIBAL JURISDICTION				UNITS TREATED	COST
NPS				3	\$11,371
TOTAL COST					\$11,371

Lone Mountain 1 Post-Fire Response Plan | 2014

PART F - INDIVIDUAL TREATMENT SPECIFICATION

TREATMENT/ACTIVITY NAME	Trails, Camps	PART E Spec-#	R-2
NFPORS TREATMENT CATEGORY*	Trails	FISCAL YEAR(S) (list each year):	2015-2017
NFPORS TREATMENT TYPE *	Infrastructure	WUI? Y / N	N
IMPACTED COMMUNITIES AT RISK	Stehekin	IMPACTED T&E SPECIES	N/A

* See NFPORS Restoration & Rehabilitation module - Edit Treatment screen for applicable entries.

WORK TO BE DONE (describe or attach exact specifications of work to be done):

General Description:

- Those sections of trails that have been lost or damaged will be reworked to provide a standard trail surface (tread reconstruction, rock removal, excessive windfall). Burned trails will need to be brushed to keep the tread surface walkable. One camp will need to have tent pads moved/rebuilt and hazard trees cut or have the camp relocated to nearby site, and the pit toilet needs to be replaced. Excessive windfall and brush growth in subsequent years, witnessed in the 2006 Flick Creek and 2010 Rainbow Bridge fires, will require substantially increased workload vs. normal trail maintenance

B. Location/(Suitable) Sites: Three miles of the Boulder Creek trail; Rennie Creek campground.

C. Design/Construction Specifications:

- Repair sections of trail damaged due to fire effects;
- repair damaged campsites/tent pads at Rennie Creek campground or relocate to adjacent unburned area;
- replace pit toilet in campground;
- Brush lush new growth on trail tread surface to keep people on the trail;
- all trail and campground work will be completed according to the NOCA trail standards.

D. Purpose of Treatment Specifications (relate to damage/change caused by fire): Provide safe access for public and employees along trails with the burn area

E. Treatment consistent with Agency Land Management Plan (identify which plan):

These actions are consistent with NPS policy and the NOCA trail standards

F. Treatment Effectiveness Monitoring Proposed: Complete of proposed work.

LABOR, MATERIALS AND OTHER COST: FISCAL YEAR 2015

PERSONNEL SERVICES: (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	COST / ITEM
WG-8 Trails Leader, \$35.63/hr x 240 hrs = \$8,552	\$8,552
WG-5 Laborer, Term, \$28.75/hr x 160 hrs = \$4,600	4,600
WG-5 Laborer, \$22.50 hr x 160 hrs = \$3,600	3,600
WG-4 Laborer, \$21.25/hr x 160 hrs = \$3,400	3,400
TOTAL PERSONNEL SERVICES COST	\$20,152
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item): Note: Purchases require written justification that demonstrates cost benefits over leasing or renting.	
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	
pit toilet kit	\$500
TOTAL MATERIALS AND SUPPLY COST	\$500
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	
Backcountry per diem, \$20/day x 8 days x 4 people x 2 pp = \$1,280	\$1,280
TOTAL TRAVEL COST	\$1,280

Lone Mountain 1 Post-Fire Response Plan | 2014

CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	
Horse packing contract to deliver materials	\$1,750
TOTAL CONTRACT COST	\$1,750
TOTAL FISCAL YEAR COST	\$23,682

LABOR, MATERIALS AND OTHER COST: FISCAL YEAR 2016

PERSONNEL SERVICES: (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).		COST / ITEM
WG-8 Trails Leader, \$36.70/hr x 80 hrs = \$2,936		\$2,936
WG-5 Laborer, Term, \$29.61/hr x 80 hrs = \$2,369		2,369
WG-5 Laborer, \$23.18 hr x 80 hrs = \$1,855		1,855
WG-4 Laborer, \$21.89/hr x 80 hrs = \$1,752		1,752
TOTAL PERSONNEL SERVICE COST		\$8,912
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item): Note: Purchases require written justification that demonstrates cost benefits over leasing or renting.		
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST		
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):		
TOTAL MATERIALS AND SUPPLY COST		
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):		
Backcountry per diem, \$20/day x 8 days x 4 people x 1 PP = \$640		\$640
TOTAL TRAVEL COST		\$640
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):		
TOTAL CONTRACT COST		
TOTAL FISCAL YEAR COST		\$9,552

LABOR, MATERIALS AND OTHER COST: FISCAL YEAR 2017

PERSONNEL SERVICES: (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).		COST / ITEM
WG-8 Trails Leader, \$37.80/hr x 80 hrs = \$3,024		\$3,024
WG-5 Laborer, Term, \$30.50/hr x 80 hrs = \$2,440		2,440
WG-5 Laborer, \$23.88 hr x 80 hrs = \$1,910		1,910
WG-4 Laborer, \$22.55/hr x 80 hrs = \$1,804		1,804
TOTAL PERSONNEL SERVICES COST		\$9,178
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item): Note: Purchases require written justification that demonstrates cost benefits over leasing or renting.		
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST		

2014

MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	
TOTAL MATERIALS AND SUPPLY COST	
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	
Backcountry perdiem, \$20/day x 8 days x 4 people x 1 PP = \$640	\$640
TOTAL TRAVEL COST	\$640
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	
TOTAL CONTRACT COST	
TOTAL FISCAL YEAR COST	\$9,818

SPECIFICATION COST SUMMARY

[illegible]

Work Agent: C=Coop Agreement, F=Force Account, G=Grantee, P=Permittees, S=Service Contract, T=Timber Sales Purchaser, V=Volunteer

SOURCE OF COST ESTIMATE

SOURCE OF COST ESTIMATE	
1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	M, C
3. Estimate supported by cost guides from independent sources or other federal agencies	
4. Estimates based upon government wage rates and material cost.	P, T
5. No cost estimate required - cost charged to Fire Suppression Account	

P = Personnel Services, **E** = Equipment **M** = Materials/Supplies, **T** = Travel, **C** = Contract, **F** = Suppression

RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT:

RELEVANT SERVICES, AND OTHER DOCUMENTATION RECEIVED IN THIS REPORT.

TOTAL COST BY JURSDICTION

TRIBAL JURISDICTION				UNITS TREATED	COST
NPS				3	\$43,052
TOTAL COST					\$43,052

Lone Mountain 1 Post-Fire Response Plan | 2014

PART F - INDIVIDUAL TREATMENT SPECIFICATION

TREATMENT/ACTIVITY NAME	BAR Implementation Leader	PART E Spec-#	R-3
NFPORS TREATMENT CATEGORY*	Administration	FISCAL YEAR(S) (list each year):	2015-2017
NFPORS TREATMENT TYPE *	Contract Administration	WUI? Y / N	Y
IMPACTED COMMUNITIES AT RISK	Stehekin	IMPACTED T&E SPECIES	N/A

* See NFPORS Restoration & Rehabilitation module - Edit Treatment screen for applicable entries.

WORK TO BE DONE (describe or attach exact specifications of work to be done):

General Description: Provide funding to support a part-time BAR Implementation Leader to ensure prompt implementation of the rehabilitation projects

B. Location/(Suitable) Sites: Lone Mountain 1 Fire, North Cascades NP Complex.

C. Design/Construction Specifications:

- 1) Coordinate all aspects of rehabilitation actions approved in the Lone Mountain 1 Fire Burned Area Rehabilitation Plan including the contracting of treatment specifications and activities, administering contracts, document treatments installed, maintaining financial tracking of costs, reporting rehabilitation progress, submitting supplemental requests for funding, ensuring the completion of all approved treatments, ensuring information is entered into NFPORS, and coordinating w/private landowners, universities, research groups, and other affected agencies.
- 2) Monitor work to ensure compliance with all relevant Federal laws and regulations. Such laws and regulations include but are not limited to NEPA and NHPA mitigation requirements and all OSHA regulations and safety standards.
- 3) provide quarterly accomplishment reports in NFPORS and written fiscal year annual accomplishment reports detailing percent accomplishment for each project specification, dates of completion, funds expended, quality control inspection reports, and treatment effectiveness monitoring reports.
- 4) At the completion of the one year funding cycle for treatments, the Implementation Leader will prepare an annual accomplishment report and budget request for the following year. At the end of 3 years, a final report will be prepared to summarize all data requests in the quarterly reports and provide a comprehensive and objective compendium of lessons learned of the treatment effectiveness of the prescribed treatments based on the prescribed monitoring plans found within the BAR plan.

D. Purpose of Treatment Specifications (relate to damage/change caused by fire): To provide fiscal support for proper administration of the short and long-term treatments prescribed in the Lone Mountain 1 Fire.

E. Treatment Effectiveness Monitoring Proposed: The Implementation Leader will conduct review of projects, financial accountability, and oversight and provide written and electronic monitoring reports as prescribed within DOI policy and the BAR Plan.

LABOR, MATERIALS AND OTHER COST: FISCAL YEAR 2015

PERSONNEL SERVICES: (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	COST / ITEM
GS 11/5 Stehekin Natural Resource Manager X 80 hours (\$44.97/hr x 80 hrs = \$3,598	\$3,598
TOTAL PERSONNEL SERVICES COST	\$3,598
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item): Note: Purchases require written justification that demonstrates cost benefits over leasing or renting.	
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	
TOTAL MATERIALS AND SUPPLY COST	
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	
TOTAL TRAVEL COST	
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	
TOTAL CONTRACT COST	
TOTAL FISCAL YEAR COST	\$3,598

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LABOR, MATERIALS AND OTHER COST: FISCAL YEAR 2016

PERSONNEL SERVICES: (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	COST / ITEM
GS 11/5 Natural Resource Manager X 80 hours (\$46.32/hr x 80 hrs = \$3,706)	\$3,706
TOTAL PERSONNEL SERVICES COST	\$3,706
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item): Note: Purchases require written justification that demonstrates cost benefits over leasing or renting.	
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	
TOTAL MATERIALS AND SUPPLY COST	
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	
TOTAL TRAVEL COST	
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	
TOTAL CONTRACT COST	
TOTAL FISCAL YEAR COST	\$3,706

LABOR, MATERIALS AND OTHER COST: FISCAL YEAR 2017

PERSONNEL SERVICES: (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	COST / ITEM
GS 11/5 Natural Resource Manager X 80 hours (\$47.71/hr x 80 hrs = \$3,817)	\$3,817
TOTAL PERSONNEL SERVICES COST	\$3,817
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item): Note: Purchases require written justification that demonstrates cost benefits over leasing or renting.	
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	
TOTAL MATERIALS AND SUPPLY COST	
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	
TOTAL TRAVEL COST	

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CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	
TOTAL CONTRACT COST	
TOTAL FISCAL YEAR COST	\$3,817

SPECIFICATION COST SUMMARY

FISCAL YEAR	PLANNED INITIATION DATE (M/D/YYYY)	PLANNED COMPLETION DATE (M/D/YYYY)	WORK AGENT	UNITS	UNIT COST	PLANNED ACCOMPLISHMENTS	PLANNED COST
2015	5/15/2015	10/15/2015	F	year	\$3,598	3	\$3,598
2016	5/15/2016	10/15/2016	F	year	\$3,706	3	\$3,706
2017	5/15/2017	10/15/2017	F	year	\$3,817	3	\$3,817
TOTAL							\$11,121

Work Agent: C=Coop Agreement, F=Force Account, G=Grantee, P=Permittees, S=Service Contract, T=Timber Sales Purchaser, V=Volunteer

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	P
3. Estimate supported by cost guides from independent sources or other federal agencies	
4. Estimates based upon government wage rates and material cost.	
5. No cost estimate required - cost charged to Fire Suppression Account	

P = Personnel Services, E = Equipment M = Materials/Supplies, T = Travel, C = Contract, F = Suppression

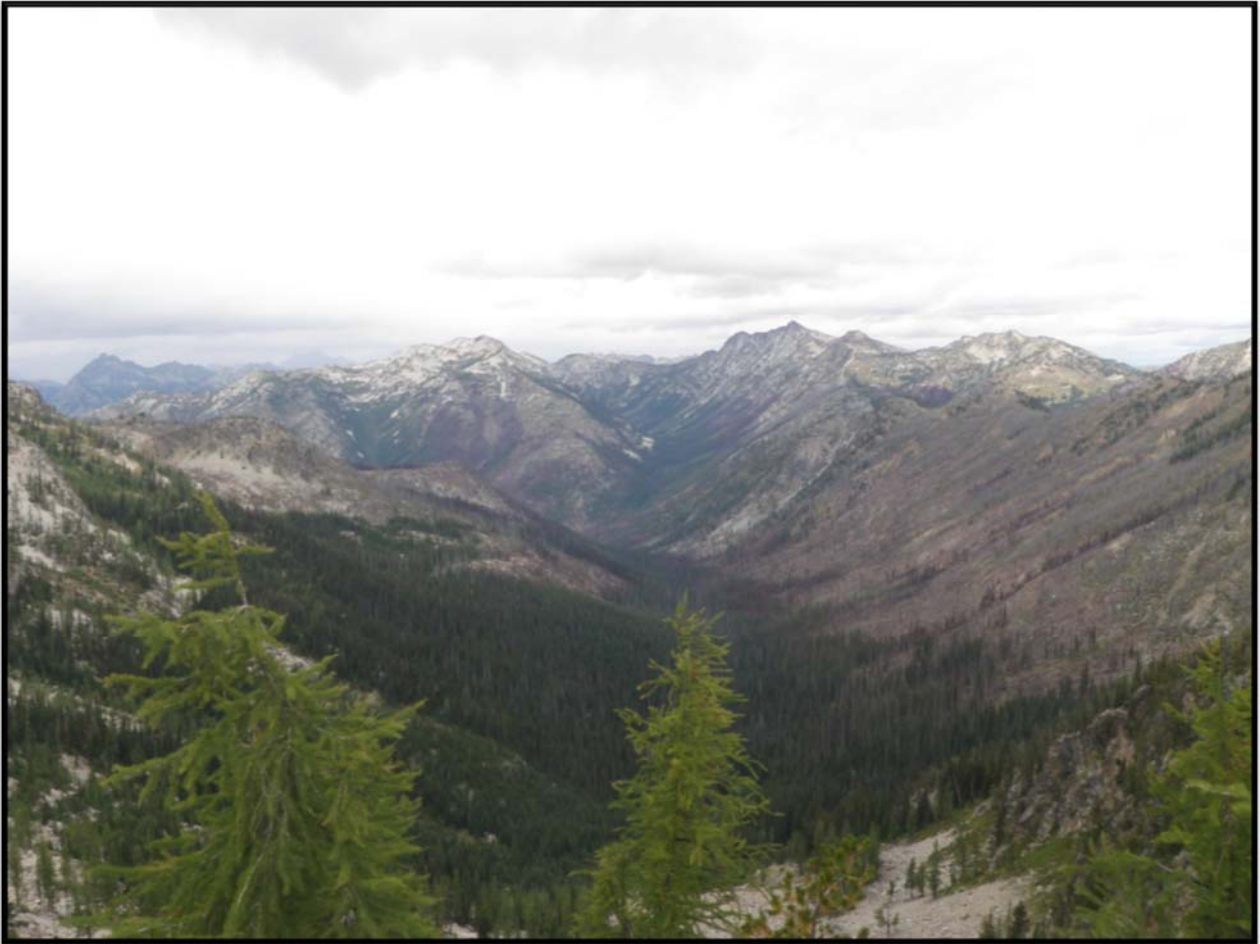
RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT:

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TOTAL COST BY JURISDICTION

TRIBAL JURISDICTION				UNITS TREATED	COST
NPS				3	\$11,121
TOTAL COST					\$11,121

APPENDIX 1: ENVIRONMENTAL COMPLIANCE



LONE MOUNTAIN 1 FIRE POST-FIRE RESPONSE PLAN

Lake Chelan National Recreation Area

Environmental Compliance Considerations and Documentation

A. Federal Environmental Compliance Responsibilities

All projects proposed in the Lone Mountain 1 Fire Post-Fire Response Plan, which includes recommendations for Burned Area Emergency Response (BAER) and Burned Area Rehabilitation (BAR) mitigation actions, that are prescribed, funded, or implemented on park lands are subject to compliance with the *National Environmental Policy Act* (NEPA) in accordance with the guidelines provided by the *Council on Environmental Quality (CEQ) Regulations (40 CFR 1500-1508)*. This Appendix documents the BAER Team considerations of NEPA compliance requirements for prescribed emergency stabilization, rehabilitation and monitoring actions described in this plan for areas affected by the Lone Mountain 1 Fire, Lake Chelan National Recreation Area, Washington.

This plan identifies specific emergency stabilization, rehabilitation, and monitoring actions and recommendations designed to mitigate damages to resources as a result of the Lone Mountain 1 fire and associated fire suppression activities. The park must complete separate NEPA analyses and compliance for fire response activities not addressed in this plan.

Agency Specific Guidance: This NEPA documentation has been developed in accordance with National Park Service specific guidelines. Emergency stabilization and rehabilitation actions proposed on National Park Service lands, involving the agencies permitting, funding, or implementation, must comply with regulations set forth in the *Department of the Interior Manual Part 516 (DM 12)*.

B. Related Plans and Cumulative Impacts Analysis

Lake Chelan National Recreation Area General Management Plan (GMP), 1995. This plan provides management guidance and identifies land use decisions for the preservation of park resources and management of the Stehekin Valley and backcountry and designated wilderness portions of the NRA. One companion document to this GMP is the Stehekin Valley Forest Fuel Reduction Area plan, described below.

Lake Chelan National Recreation Area Forest Fuel Reduction Area plan, 1995. The NPS manages 1209 acres of the Stehekin Valley floor as part of the Forest Fuel Reduction Area (FFRA) program. This action plan tiers off the GMP and provides detailed direction for implementing a forest fuels management program in the valley. The program is designed to reduce fuel loadings to mitigate the potential for a catastrophic wildfire to move through the valley floor. Treatments applied include large diameter mechanical thinning, hand thinning, and prescribed burns.

North Cascades National Park Service Complex Wildland Fire Management Plan, 2007. This plan provides guidance for “Emergency Stabilization and Rehabilitation” actions following wildfires in the Complex, and includes the following guidance:

Specific allowable emergency stabilization actions within the Complex include:

- Placing structures to slow soil and water movement
- Stabilizing soil to prevent loss or degradation of productivity
- Installing protective fences or barriers to protect treated or recovering areas
- Conducting assessments of critical habitat and significant heritage sites in areas affected by emergency stabilization treatments
- Seeding or planting to prevent impairment of designated critical habitat for federal and state-listed, proposed or candidate threatened and endangered species
- Stabilizing critical heritage resources
- Seeding to prevent establishment of invasive plants and direct treatment of invasive plants
- Using integrated pest management techniques to minimize the establishment of invasive species within the burned area.

Specific allowable burned area rehabilitation actions within the Complex include:

- Repair or improve lands unlikely to recover naturally from wildfire damage by emulating pre-fire ecosystem structure, function, diversity, and dynamics consistent with existing land management plans
- Chemical, manual, and mechanical removal of invasive species, and planting of native species to restore or establish a healthy, stable ecosystem even if this ecosystem cannot fully emulate historical or pre-historical or pre-fire conditions
- Repair or replace fire damage to minor operating facilities.

North Cascades National Park Service Complex Hazardous Tree Management Plan, 1995, revised 2000: This document outlines the Hazard Tree Assessment Protocol for rating hazardous trees in determining priorities for treatment.

Cumulative Impact Analysis: The emergency stabilization and rehabilitation treatments for the Lone Mountain 1 fire, as proposed in this plan, do not result in an intensity of impact (i.e., major ground disturbance, etc) that would cumulatively constitute a significant impact on the quality of the environment. The treatments are consistent with the above park management plans and associated environmental compliance documents of the NPS, and categorical exclusions presented below.

No direct or indirect unavoidable adverse impacts to the biological or physical environment would result from the implementation of the Lone Mountain 1 Fire Burned Area Post-Fire Response Plan.

C. Summary of Compliance Documentation Relevant to the Lone Mountain 1 Post-Fire Response Plan

The following table summarizes the existing NEPA or NHPA compliance in place for the BAER/BAR treatments proposed for the Lone Mountain 1 fire. One treatment may involve ground disturbance and thus would require archeological consultation.

Treatment or Action	NEPA documentation (EIS, EA, or Cat Ex)	Reference to Assessment	Findings of Significance
BAER - W1: Hazard warning Signs	DO-12 CE: 3.4 G.2; 3.4 C.5	Watershed	No Significant Impact; will require archeological consultation
BAER – W-2: Clean bridges, culverts, roads	DO-12 CE: 3.4 C.9	Watershed	No impact
BAER – W-3: site visit/assessment	DO-12 CE: 3.4 E.5	Watershed	No impact
BAER – O-1: BAER assessment and planning	DO-12 CE: 3.3.U	N/A	No Impact
BAR – R-1: Herbicidal treatment of invasive species – Canada thistle	DO-12 CE 3.4 E.2 NOCA Non-native Invasive Plant Management Plan (2102); Minimum Requirements Analysis (MRA)	Vegetation	No Significant Impact; an MRA will be completed prior to fieldwork.
BAR – R-2: Repair of minor facilities (trail tread; Rennie Crk campground).	DO-12 CE: 3.4 C.11; DO-12 CE: 3.4 G.2; MRA for campground repair	Minor Facilities	No Significant Impact; will require archeological consultation for pit toilet and tent pad repair; an MRA will be completed prior to fieldwork
BAR – R-5: BAR Implementation leader	DO-12 CE: 3.3.A	N/A	No Impact

D. DOI EXCEPTIONS TO CATEGORICAL EXCLUSIONS

The CEQ Regulations at 40 CFR 1508.4 require agencies to consider whether fairly routine actions involve extraordinary circumstances that, per NEPA, trigger an agency to prepare additional assessment and consideration. If it is determined that any of the exceptions listed in the table below apply to a proposed action, that action may not be categorically excluded, and an EA or an EIS must be prepared. The list below is a Department of the Interior list that applies to all DOI agencies (516 DM 2, Appendix 2); agencies often have additional items on their own list

of Departmental exceptions, appendix 2). All treatments that are proposed as a Categorical Exclusion for Lake Chelan National Recreation Area have been compared against the list of Extraordinary Circumstances listed below and were found not to trigger any exceptions.

Yes	No	Extraordinary Circumstance. Would this action...
	X	2.1 Have significant impacts on public health or safety?
	X	2.2 Have significant impacts on such natural resources and unique geographic characteristics as historic or cultural resources; park, recreation or refuge lands; wilderness areas; wild or scenic rivers; national natural landmarks; sole or principal drinking water aquifers; prime farmlands; wetlands (Executive Order 11990); floodplains (Executive Order 11988); national monuments; migratory birds; and other ecologically significant or critical areas?
	X	2.3 Have highly controversial environmental effects or involve unresolved conflicts concerning alternative uses of available resources [NEPA Section 102(2)(E)]?
	X	2.4 Have highly uncertain and potentially significant environmental effects or involve unique or unknown environmental risks?
	X	2.5 Establish a precedent for future action or represent a decision in principle about future actions with potentially significant environmental effects?
	X	2.6 Have a direct relationship to other actions with individually insignificant but cumulatively significant environmental effects?
	X	2.7 Have significant impacts on properties listed, or eligible for listing, on the National Register of Historic Places as determined by either the bureau or office?
	X	2.8 Have significant impacts on species listed, or proposed to be listed, on the List of Endangered or Threatened Species, or have significant impacts on designated Critical Habitat for these species?
	X	2.9 Violate a Federal law, or a State, local, or tribal law or requirement imposed for the protection of the environment?
	X	2.10 Have a disproportionately high and adverse effect on low income or minority populations (Executive Order 12898)?
	X	2.11 Limit access to and ceremonial use of Indian sacred sites on Federal lands by Indian religious practitioners or significantly adversely affect the physical integrity of such sacred sites (Executive Order 13007)?
	X	2.12 Contribute to the introduction, continued existence, or spread of noxious weeds or non-native invasive species known to occur in the area or actions that may promote the introduction, growth, or expansion of the range of such species (Federal Noxious Weed Control Act and Executive Order 13112)?

E. Consultations

National Park Service

- Roy Zipp, Environmental Compliance Specialist, NOCA
- Vicki Gempko, Natural Resource Manager, NOCA
- Kim Kwarsick, Archeologist, NOCA
- Jon Riedel, Geologist, NOCA
- Roger Christophersen, Wildlife Biologist, NOCA
- Rich Schwab, NPS BAER Coordinator, National Park Service
- Nelson Siefkin, PWR BAER Coordinator, National Park Service

All BAER and BAR treatments will be presented to the NOCA Interdisciplinary Team for discussion of the recommended compliance requirements described above prior to initiation of any of the actions.

US Fish and Wildlife Service and National Historic Preservation Act consultations:

No consultation was required with the US Fish and Wildlife Service for federally listed Threatened and Endangered species because no listed species or designated Critical Habitat is found within or adjacent to the Lone Mountain 1 fire perimeter.

There is no need to contact the Washington State Historic Preservation Officer, given that no BAER or BAR treatments are proposed for activities that may impact cultural resources.

CONCLUSION

I have reviewed the treatments in the 2014 Lone Mountain 1 Fire Post-Fire Response Plan in accordance with the criteria above. Those actions which require additional environmental review will be analyzed and appropriate NEPA compliance completed before they can be implemented; those actions with approved existing compliance would not involve any significant environmental effect and are approved for initiation. Burned area emergency response team technical specialists have completed necessary coordination and consultation to insure compliance with the National Historic Preservation Act, Endangered Species Act, Clean Water Act and other Federal, State and local environment review requirements

Prepared by: Jack Oelfke, Lone Mountain 1 fire BAER Team Leader, Sept. 23, 2014

Approved: _____

Superintendent, North Cascades NPS Complex

Date