

Rainbow Bridge Post-Fire Response Plan

Lake Chelan National Recreation Area



Rainbow Bridge Post-Fire Response Plan | 2010

PARK: Lake Chelan National Recreation Area

DATE: September 18, 2010

PREPARED BY: National Park Service Rainbow Bridge BAER Team

SUBMITTED BY: _____ Date: _____
Chip Jenkins, Superintendent, North Cascades National Park Service Complex

Rainbow Bridge Post-Fire Response Plan | 2010

BURNED AREA EMERGENCY RESPONSE PLAN REVIEW AND APPROVAL

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

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 Rainbow Bridge Fire in North Cascades National Park. 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 Rainbow Bridge 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, the Pacific West Regional Office, and National Interagency Fire Center.

The Rainbow Bridge Fire

The Rainbow Bridge Fire began on July 29, 2010 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 near Rainbow Bridge camp on the Rainbow Loop Trail and burned in the Rainbow, Boulder and Little Boulder drainages. Initial attack forces were quick to jump on the fire but with the weather and fuels conditions, it was quick to grow to 100 acres by 2200 hours. On Friday, July 30th, Washington Incident Management Team 3 was activated and dispatched to the incident.

On Friday July 30th, the fire made significant runs to the north, east, and west and the growth was estimated between 3,500 to 4,000 acres. However, on the afternoon and night of July 31, 2010, the fire received approximately one inch of precipitation. This decreased fire behavior and slowed fire movement. By August 1st, demobilization of resources began. Washington Incident Management Team 3 turned the fire over to a Type 3 team on August 6th.

The fire triggered Level 3 evacuations with two building closures in the upper valley of Stehekin and temporarily closed the main road to bicycle traffic. The Stehekin Landing Resort and valley businesses remained open. Trail Closures included the Rainbow Lake Trail for its entire length and the Rainbow Creek Trail from McAlester Pass to Bench Creek Camp. Bench Creek, Bowan and Rainbow Meadows Camps were temporarily closed. These areas were not directly affected by the Rainbow Bridge Fire. The Rainbow Loop Trail, Boulder Creek Trail and Rainbow Creek

Trail from the junction with the Rainbow Loop Trail to Bench Creek Camp remain closed. These trails are closed due to trail impacts, hazardous trees, or remaining potential for fire activity.

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

The Rainbow Bridge Fire Burned Area Emergency Response (BAER) Team assessed the incident to determine post-fire impacts to life, property, and critical and natural resources. 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
- Assess impacts and threats to cultural resources
- 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 cultural and natural 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 Rainbow Bridge Fire:

- Stehekin Valley
- Invasive species infestations into Rainbow Bridge and other invasive vectors at fire hand lines, hiking trails, and roads
- Rainbow Loop Trail, Boulder Creek Trail and Rainbow Creek Trail from the junction with the Rainbow Loop Trail to Bench Creek Camp
- Wildlife and threatened or endangered species concerns
- Undisclosed cultural resource sites and districts
- Missing signage consumed by wildfire

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 unlikely occurrence of extreme weather events. Hazard warning signs and public information/education materials (*Specification W-1*) will be funded by this activity through Burned Area Emergency Response

funds. Three unfunded management recommendations are provided to address a damaged culvert in the Little Boulder Creek area, monitor debris at the Boulder Creek box culvert under the Stehekin Valley road, and close trails and camps within the burn area until at minimum the spring of 2011.

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*). None of these species is known to currently use habitat within the fire area, although both the spotted owl and gray wolf are known to use areas within a few miles of the burn area. Consultation with park and contract wildlife biologists familiar with the area lead to a conclusion that impacts were anticipated to either of the species, and thus no treatment specifications are requested under the BAER or BAR programs. One unfunded management recommendation is provided for the state-listed Western grey squirrel (*Sciurus griseus*) to protect nesting habitat for that species within the Stehekin Valley.

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. Vegetation specialists completed ground reconnaissance and analyzed inventory work completed within the past four years to develop two treatment specifications to address cheatgrass and other invasive species issues within the burn area. Within the Burned Area Rehabilitation program, funds will be requested for management of several invasive species, specifically herbicidal control of cheatgrass (*Specification R-1*) and primarily manual control of other invasive species (*Specification R-2*). One unfunded management recommendation is provided that addresses post-fire survey needs for state-listed plant species, particularly for Sierra cliff brake (*Pellea brachyptera*), a species documented in 2003 within the area that burned.

Minor Facilities: Minor facilities included within the burn area include several trails (Rainbow Loop trail; Rainbow Creek trail; Boulder Creek trail), campgrounds (Rainbow Bridge camp and Hooter camp), the Rainbow Bridge that spans Rainbow Creek, and signs along the trails. Field reconnaissance by trail crew employees and the BAER Team documented damage to several of these facilities, and funding is requested through the Burned Area Rehabilitation program to replace trails, signs, campsite facilities, and a bridge crib wall that burned (*Specification R-3*).

Cultural Resources: A review of cultural resource inventory and research records and field reconnaissance of sites below the burn area revealed no direct burn impacts to known cultural resources, but funding is requested through the Burned Area Rehabilitation program to prevent bark beetle infestations that lead to the creation of hazard trees around a National Register structure (old Stehekin School) (*Specification R-4*). One unfunded management recommendation is to have NPS staff monitor hill-slope conditions above the Stehekin School, given the slope immediately above the school burned in the fire and some possibility exists for erosion and subsequent damage to the school.

Miscellaneous: Also submitted are specifications to fund preparation of the Rainbow Bridge Post-Fire Response Plan (*O-1—Rainbow Bridge BAER Plan Preparation*) and implementation of both the BAER and BAR plans (*O-2—BAER Implementation Leader* and *R-5—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	Watershed safety/public education	each	\$ 13,569	1	F	\$ 13,569
2	O-1	BAER Plan Preparation	each	\$ 40,098	1	F	\$ 40,098
3	O-2	BAER Implementation Leader	year	\$ 9,404	3	F	\$ 3,042
TOTAL COSTS							\$ 56,709

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

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 2010	COSTS FY 2011	COSTS
1	W-1	Watershed safety/public education	each	\$ 13,569	1	F		\$ 13,569	\$ 13,569
2	O-1	BAER Plan Preparation	each	\$ 40,098	1	F	\$ 40,098		\$ 40,098
3	O-2	BAER Implementation Leader	year	\$ 3,042	3	F		\$ 3,042	\$ 3,042
TOTAL COSTS							\$ 40,098	\$ 16,611	\$ 56,709

Below is a summary of the rehabilitation costs proposed for funding from the subactivity B11 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	acre	\$ 148	480	F	\$ 197,912
2	R-2	Invasive Plant Species	acre	\$ 66	200	F	\$ 39,834
3	R-3	Trails, Bridges, and Signposts	miles	\$ 5,293	4	F	\$ 63,510
4	R-4	MCH - Stehekin School	each	\$ 2	100	F	\$ 200
5	R-5	BAR Implementation Leader	year	\$ 6,844	3	F	\$ 18,807
6							
TOTAL COSTS							\$ 320,263

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

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 2011	COSTS FY 2012	COSTS FY 2013	TOTAL COSTS
1	R-1	Invasive Plant Species	acre	\$ 148	480	F	\$ 75,375	\$ 60,273	\$ 62,264	\$ 197,912
2	R-2	Invasive Plant Species	acre	\$ 66	200	F	\$ 12,934	\$ 13,272	\$ 13,628	\$ 39,834
3	R-3	Trails, Bridges, and Signposts	miles	\$ 5,293	4	F	\$ 37,230	\$ 17,250	\$ 9,030	\$ 63,510
4	R-4	MCH - Stehekin School	each	\$ 2	100	F	\$ 200			\$ 200
5	R-5	BAR Implementation Leader	year	\$ 6,844	3	F	\$ 6,084	\$ 6,268	\$ 6,455	\$ 18,807
6										
TOTAL COSTS							\$ 131,823	\$ 97,063	\$ 91,377	\$ 320,263

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

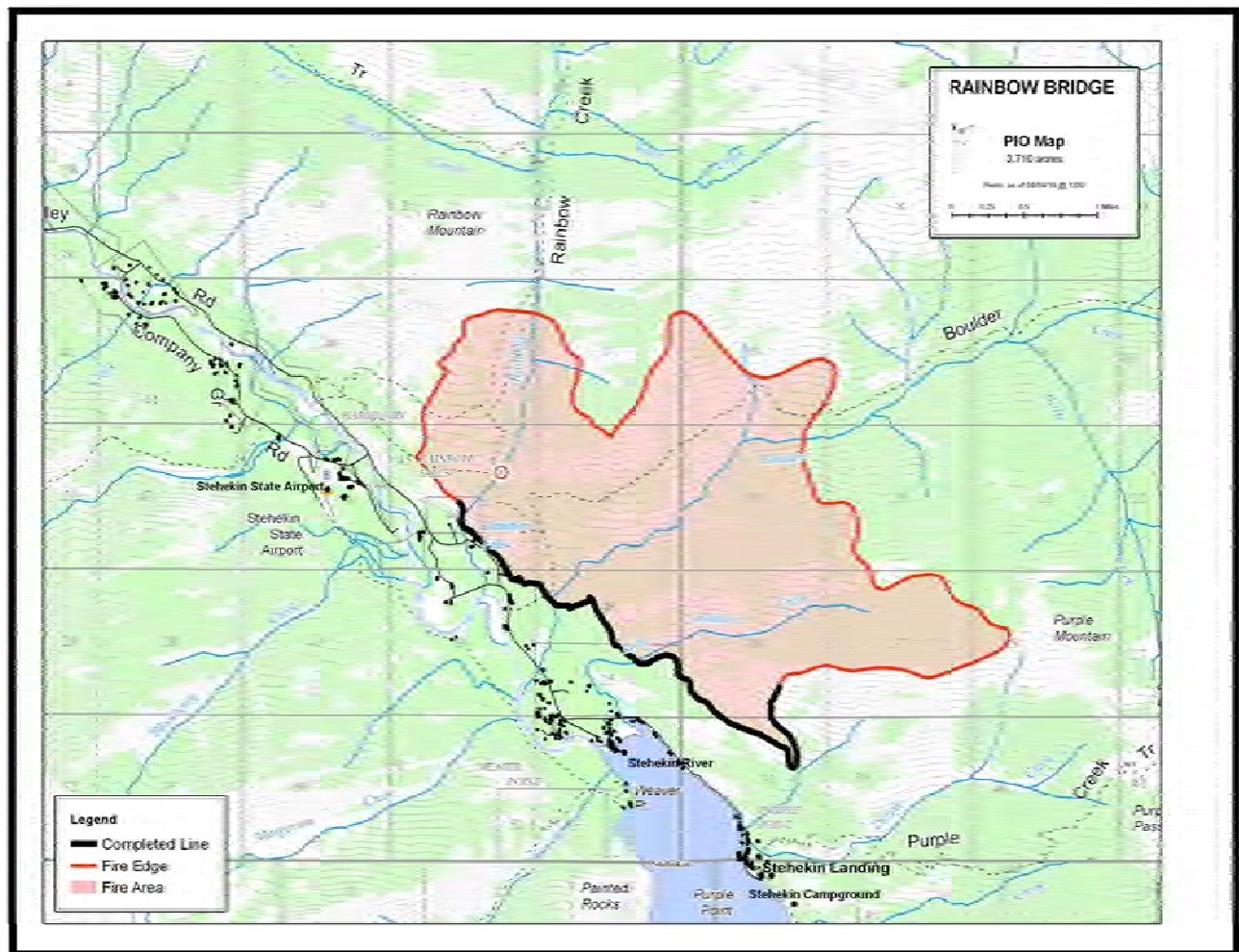
Fire Information

FIRE LOCATION AND BACKGROUND	
FIRE NAME	RAINBOW BRIDGE
FIRE CODE	9475-FN3G
PARK	LAKE CHELAN NRA
STATE	WASHINGTON
REGION	PACIFIC WEST
IGNITION DATE	JULY 29, 2010
CONTAINMENT DATE	UNCONTAINED
ACRES	3,710

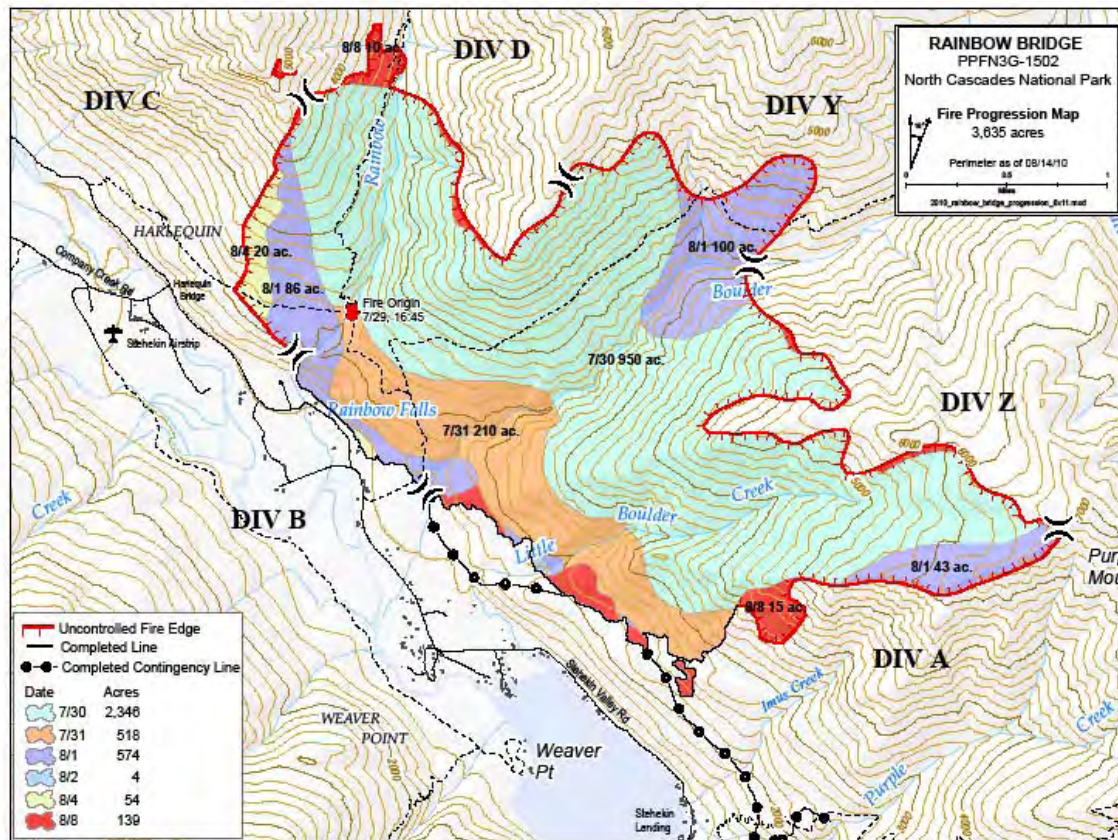
Assessment Team

TEAM MEMBERS	
TEAM LEADER, CHIEF OF RESOURCES	JACK OELFKE, NORTH CASCADES
GEOLOGIST	BRIAN RASMUSSEN, WHISKEYTOWN
HYDROLOGIST	JIM ROCHE, YOSEMITE
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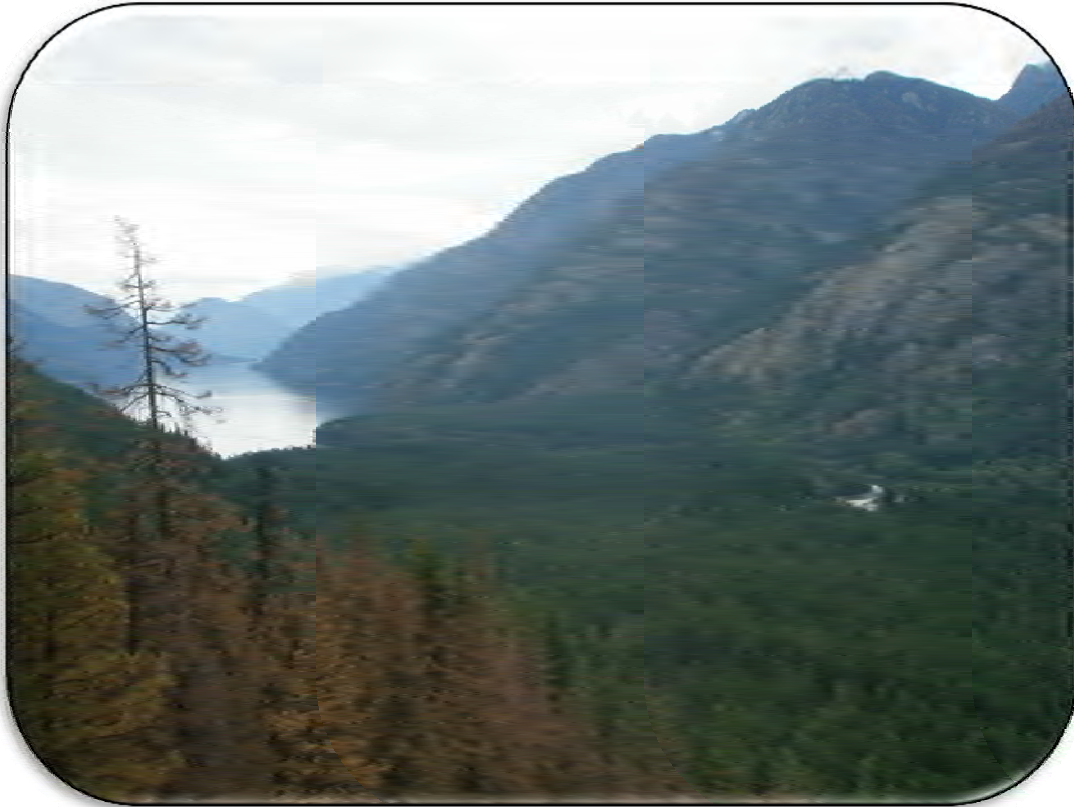
Rainbow Bridge Fire - Perimeter Map



Rainbow Bridge Fire - Progression 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 Rainbow Bridge Fire.

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.

The most significant factor leading to emergency watershed conditions 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 Rainbow Bridge Fire burned on the northeast side of Lake Chelan northwest into watersheds draining into Stehekin River. The watersheds burned include Rainbow Creek, Boulder Creek, and Little Boulder Creek in Chelan County, Washington. All burned watersheds are administered by the National Park Service. Additional inter-watersheds that drain facets between the major watersheds were named Stehekin 1 through 4 for purposes of this report

(Figure 1). 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 6,760 feet near the upper ridge of the watersheds 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., 2003 and 2006 floods) on the Stehekin River. Peak runoff events on watersheds within the Rainbow Bridge 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 torrents (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.

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 already 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.

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.

Overall, 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 repellent 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. 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.

The major source of sediment delivery in these watersheds is in the form of debris flows from tributary streams or first order debris torrents (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 early 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.

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

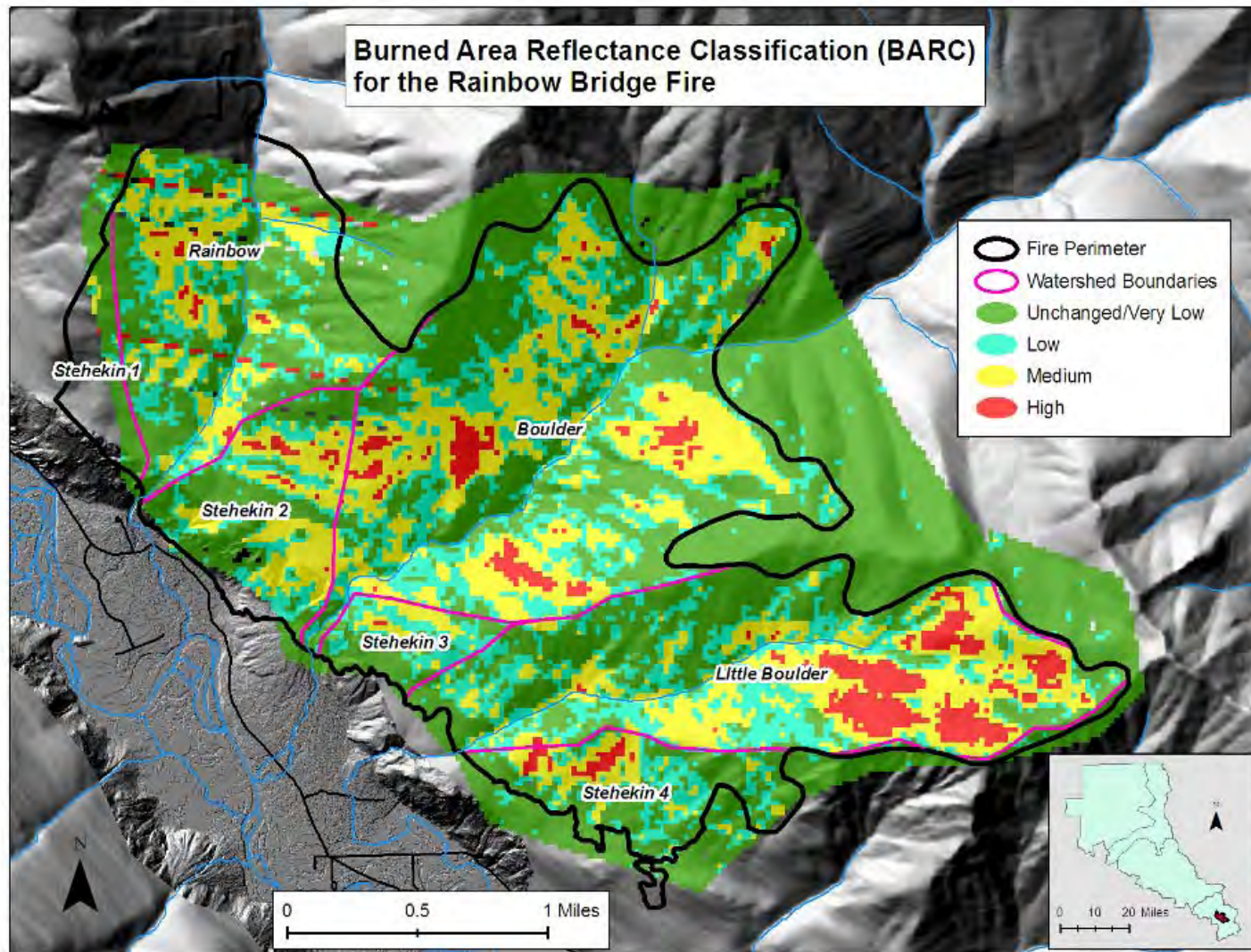
In order to assess the degree of threat to values at risk from post-fire watershed conditions, several environmental aspects need to be evaluated including: soil burn severity, erosion and debris flow potential, and watershed response. The watershed assessment team conducted field and helicopter reconnaissance of the fire area on August 24-26, 2010. 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 5 and 7 data collected on August 4-5, 2010 and pre-fire Landsat 7 data collected on August 2, 2009. This data was initially classified at the USGS EROS Data Center in Sioux Falls, South Dakota.

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**).

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Figure 1. Burned Area Reflectance Classification (BARC) Map for the Rainbow Bridge Fire



Rainbow Creek Watershed

In the Rainbow Creek watershed, 650 acres or about 8% of the watershed burned (**Table 1**). 25% of this area was mapped as moderate to high soil burn severity.

Table 1. Rainbow Creek Watershed Soil Burn Severity by Area and Percent Burned.

Soil Burn Severity	Acres Within Burned Area	Percent of Watershed Area
Unchanged/Low	336	4
Low	150	2
Moderate	145	2
High	19	0
Total	650	8

Boulder Creek Watershed

In the Boulder Creek watershed, 1,341 acres or about 13% of the watershed burned (**Table 2**). About 37% of this area was mapped as moderate to high soil burn severity.

Table 2. Boulder Creek Watershed Soil Burn Severity by Area and Percent Burned.

Soil Burn Severity	Acres Within Burned Area	Percent of Watershed Area
Unchanged/Low	496	5
Low	349	3
Moderate	432	4
High	64	1
Total	1341	13

Little Boulder Creek Watershed

In the Little Boulder Creek watershed, 894 acres or about 88% of the watershed burned (**Table 3**). About 42% of this area was mapped as moderate to high soil burn severity. **Photo 1** depicts an extensive area of high soil burn severity ringed by areas of low and moderate severity in the upper portion of this watershed.

Table 3. Little Boulder Creek Watershed Soil Burn Severity by Area and Percent Burned.

Soil Burn Severity	Acres Within Burned Area	Percent of Watershed Area
Unchanged/Low	282	28
Low	233	23
Moderate	268	27
High	111	11
Total	894	88



Photo 1. Soil burn severity mosaic in upper Little Boulder Creek watershed with extensive areas of soil burn severity also indicated on the BARC map. High severity is indicated by the lack of needles on the trees and a white ash layer. Moderate severity is indicated by the presence of brown or scorched needles still on the trees.

Stehekin Watersheds

Four areas within the burned area fall outside of the three major watersheds of Rainbow Creek, Boulder Creek, and Little Boulder Creek (**Figure 1**). The watersheds are named in this report from northwest to southeast as Stehekin 1 through 4. Stehekin 1 is located adjacent to and northwest of Rainbow Creek. Stehekin 2 is located between Rainbow Creek and Boulder Creek. Stehekin 3 is located between Boulder Creek and Little Boulder Creek. Stehekin 4 is located adjacent to and southwest of Little Boulder Creek (**Figure 1**). **Table 4** summarizes soil burn severity across these four areas.

Table 4. Minor Watersheds Stehekin 1 through 4 Total Soil Burn Severity by Area and Percent Burned.

Soil Burn Severity	Acres Within Burned Area	Percent of Burned Area
Unchanged/Low	379	52
Low	165	22
Moderate	166	23
High	22	3
Total	732	100

In the Stehekin 1 watershed 100 acres burned, 4 percent of which received moderate to high burn severity with less than 1 percent mapped as high soil burn severity.

In the Stehekin 2 watershed 295 acres burned, 35 percent of which received moderate to high burn severity with 3 percent mapped as high soil burn severity. **Photo 2** depicts the mosaic of soil burn severity evident in this inter-watershed.



Photo 2. Mosaic of soil burn severity in upper Stehekin 2 inter-watershed. High severity is indicated by the lack of needles on the trees and a white ash layer. Moderate severity is indicated by the presence of brown or scorched needles still on the trees.

In the Stehekin 3 watershed 103 acres burned, 22 percent of which received moderate to high burn severity with 1 percent mapped as high soil burn severity.

In the Stehekin 4 watershed 234 acres burned, 24 percent of which received moderate to high burn severity with 5 percent mapped as high soil burn severity.

Erosion Potential/Debris Flow Potential

The potential for erosion has increased in the burned areas of the Rainbow Bridge Fire. Typically, the most significant increases occur in areas of high soil burn severity and slopes greater than 35 degrees. Hillslopes in the main watersheds range from 32 to 38 degrees, so any increased erosion potential resulting from the Rainbow Bridge Fire will likely be the result of the portion of the drainage that sustained moderate to high soil burn severity as summarized in the

above section. The potential increase in erosion potential as a result of the fire is summarized in **Table 5**.

Table 5. Erosion Potential by Watershed.

Watershed	Hillslope Angle(s)	Increased Post-fire Erosion Potential
Rainbow	33-38°	Moderate
Boulder	32-35°	Moderate to High
Little Boulder	36-37°	High
Stehekin 1	39°	Unchanged to Low
Stehekin 2	29°	Low to Moderate
Stehekin 3	26°	Low
Stehekin 4	33°	Low to Moderate

There is substantial field evidence for debris flows as a dominant process within Rainbow, Stehekin 2, Boulder, and Little Boulder watersheds. Evidence includes channel levees on fans in the valley area below the fire perimeter, slopes greater than 10° on the Little Boulder Creek fan, and recent debris flow paths within the Boulder Creek watershed. The debris flow potential for each of these areas is discussed below. Other drainages within the fire perimeter did not exhibit debris flow potential.

The Rainbow Creek watershed above the Stehekin Valley floor exhibited evidence of past debris flows from scars in first and second order streams that flow into the creek. Channel levees within 200 meters of the base of the falls indicate that debris flows have reached the Stehekin Valley floor in the past. Given evidence of past events coupled with a moderate probability of increased erosion from post-fire conditions, there is likewise a moderate probability that debris flows will occur due to post-fire conditions.

The Boulder Creek watershed contained evidence of recent and past debris flows, though no evidence that debris flows have reached the Stehekin Valley floor. Fresh debris flow scars on two second order stream channels above the valley floor and within the fire perimeter may have resulted from the August 4th, 2010 storm that caused debris flows on nearby Fourmile and Hazard Creeks. Recent and past evidence of debris flows along with a moderate to high probability of increased erosion potential due to post-fire conditions indicate that there is a moderate to high probability of further debris flows resulting from post-fire conditions. However, it is unlikely that these debris flows would reach the Stehekin Valley floor.

The Little Boulder Creek watershed contained evidence of past debris flow paths in the upper watershed and a debris cone developed on the Stehekin Valley floor. A debris cone is analogous to an alluvial fan, though the dominant mechanism for formation is the deposition of debris flows rather than fluvially-transported sediment. Evidence of an active debris flow regime in this watershed and extensive areas of moderate to high soil burn severity indicate a high probability of debris flows resulting from post-fire conditions. Given the high slope of the stream course (19°), it is also highly likely that debris flows resulting from post-fire conditions will reach the Stehekin Valley floor.

The Stehekin 2 watershed exhibited signs of debris flow activity reaching the Stehekin Valley floor. Evidence consisted of channel levees. Given a low to moderate potential for increased post-fire erosion along with evidence of past debris flows, there is a moderate probability of post-fire related debris flows that reach the Stehekin Valley floor.

There is a low to moderate probability of increased rock and debris falling from the Stehekin 1 and Stehekin 4 watershed areas. The lower edge of these watersheds corresponds with the top of the steep valley walls in these locations. Given the complicated and steep topography above these edges, it is possible for rolling material from within the fire perimeter to reach the valley edge and fall to the valley floor below. However, much of the burned area lies above a low relief bench that may capture rockfall and other erosion in both areas. As such, it is likely that post-fire conditions have only a slightly elevated the probability of this occurrence.

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 Rainbow Bridge 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 Rainbow Bridge Fire area.

The largest response is expected in the Little Boulder Creek drainage. This is due primarily to the fact that 38% of the drainage area received moderate to high soil burn severity. This burn severity will likely result in a moderate to high probability of increased sediment delivery and peak flows as a result of post-fire conditions.

Five 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 channel during a helicopter reconnaissance of the burned area. This situation may increase the overall amount of sediment delivery over the next several years.

Just 2% of the total watershed area for Rainbow Creek had soil burn severity ratings of moderate and high indicating that the probability of increased peak flow and sediment delivery is in the low to moderate range due to post-fire conditions. Furthermore, very little debris was observed in this channel during a helicopter reconnaissance flight.

The only Stehekin watershed that has any increased potential for flooding or sediment delivery is Stehekin 2. Most of this small watershed was burned - 35% at a moderate to high soil burn severity. Given the very small size of the watershed, however, the potential for increased peak flow and sediment delivery is moderate.

Values at Risk

In regards to post-fire watershed conditions, Standard Operating Procedures (SOP) for BAER evaluations and treatments 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. 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 and implementation that exceeds the rapid implementation of such treatment.

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:

- A visitor use area below Rainbow Falls, a bridge across Rainbow Creek, a water diversion for the Buckner Orchard, a historic school, a community building, and private structures were identified in the Rainbow Creek watershed;
- A bridge over Boulder Creek and private structures were identified in the Boulder Creek watershed;
- Private structures were identified in the Little Boulder Creek watershed;

- Stehekin Valley Road between the lake head to Stehekin Landing was also identified below Stehekin 4 watershed.

After field reconnaissance by BAER Team members, other values at risk were identified within and downstream of the fire:

- In the Rainbow Creek watershed downstream of the fire a water production well was identified near the old school as a value at risk by the BAER Team. Within the burned area the Rainbow Bridge Campsite and Rainbow Creek Trail were identified as values at risk;
- Downstream of the Stehekin 2 watershed, the new school was identified as a value at risk due to fire on the slopes above the school;
- In the Boulder Creek watershed downstream of the fire, a box culvert on Stehekin Valley Road west of the Boulder Creek Bridge was identified as a value at risk by the BAER Team. Within the burned area, the Hooter Campsite and Boulder Creek Trail were identified as values at risk.

Rainbow Creek Watershed

In the Rainbow Creek watershed, the BARC map indicates that 650 acres burned, 25 percent of which received moderate to high soil burn severity – 3 percent as high soil burn severity. Given the low percentage of moderate and very low percentage of high soil burn severity within this watershed as a whole (2%), the increased probability of mass wasting or flooding as a result of the fire is less likely to have downstream impacts. Specifically, there is moderate potential for increased erosion and debris flows and a low probability of increased peak flows and sediment delivery over pre-fire conditions. 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.

The Rainbow Falls visitor use area below Rainbow Falls was evaluated for potential damage due to post fire watershed conditions. The entire site is located on a relic alluvial fan and is well situated above any threats posed by post fire watershed conditions. However, there exists a low to moderate risk from rockfall from the burned area with the Stehekin 1 watershed. To help mitigate the potential for loss of human life or injury specifications for warning signs and public education is proposed.

The bridge on the Stehekin Valley Road that crosses Rainbow Creek was evaluated for potential damage due to post fire watershed conditions. The bridge shows no signs of damage from past high water events. Recent debris flow deposits are not present in the area, and given the erosion/debris flow potential, watershed response, and soil burn severity from post fire watershed conditions, it is unlikely that the bridge will be damaged. Consequently, no actions are recommended to protect lives and property at this structure.

The Buckner Orchard water diversion located on the right bank just below the previously mentioned bridge was evaluated for potential damage due to post fire watershed conditions.

Given its location within the 1.5 to 2 year flood plain, the structure is at risk to flood damage on a regular basis regardless of post fire watershed conditions, and consequently no actions are recommended to protect this structure.

The historic school house and modern water supply well located along Stehekin Valley Road was evaluated for potential damage due to post fire watershed conditions. The building was originally constructed in the early 1900's and has been modified since then. The building shows no signs of damage from past high-water events or debris flows and no debris flow deposits exist in the near vicinity of the structure or well. The building and well are situated away from Rainbow Creek and a levee of unknown age has been constructed along the left bank which provides protection from high water events. Given the erosion/debris flow potential, watershed response, and soil burn severity, no treatments are recommended to protect this structure from post fire watershed conditions.

The Stehekin Community Center located along Stehekin Valley Road near the left bank of Rainbow Creek was evaluated for potential damage due to post fire watershed conditions. The building does show signs of long term nuisance flooding as parts of the building closest to the creek are buried in small rock and fine sediment. The building was constructed in the early 1900's and has survived past high-water events. Given the age of the building, past flooding, erosion/debris flow potential, watershed response, and soil burn severity it is unlikely that the building will be damaged from post fire watershed conditions. Consequently, no treatments are recommended to protect lives and property at this site.

The Rainbow Creek Trail and associated Rainbow Bridge Campsite are located within 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 Rainbow Bridge Fire only exacerbates this situation. Given the erosion/debris flow potential, watershed response, and soil burned severity for this watershed in post fire watershed conditions, there exists a potential for loss of life or injury from use of the trail and campsite under certain precipitation and runoff conditions such as thunderstorms and snowmelt. To help mitigate the potential for loss of human life or injury specifications for warning signs and public education is proposed. Additionally, it is recommended to close the trail and campsite through the fall and winter and reopen the trail after the spring snowmelt.

Two areas where private residential structures occur downstream of the fire include the Gans residence and the Buckner Orchard residence. The Gans residence is situated along the left bank of Rainbow Creek. Examination of the property and conversation with the Gans indicated past nuisance flooding. However, the structure construction is elevated above the active flood plain. Additionally, a levee of unknown age has been constructed along the left bank of Rainbow Creek upstream and along the structure's location which provides additional protection from flooding. No debris flow deposits were present in the area. Given the erosion/debris flow probability, watershed response, soil burn severity, elevated construction, and levee, it is unlikely that the Gans residence will be damaged from post fire watershed conditions. The Buckner Orchard structures are situated well away from Rainbow Creek on a river terrace elevated above the creek and are at no risk from post fire watershed conditions. Given these conditions, no treatments are proposed to protect the Gans or Buckner structures.

Boulder Creek Watershed

In the Boulder Creek watershed, the BARC map indicates that 1,341 acres burned, 37 percent of which received moderate to high soil burn severity – 5 percent as high soil burn severity. Given the elevated percentage of moderate and low percentage of high soil burn severity within this watershed as a whole (5%), there is a slightly 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 and sediment delivery over pre-fire conditions. However, debris flows are a 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.

Several 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 well away from the current active channels of Boulder Creek (with the exception of the Boulder Cabin which will be analyzed later) and debris flow deposits do not occur near any structures. Some of the homes evaluated are built above relict channels. However, due to the dynamic nature of alluvial fans, relict 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. 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 active channels of Boulder Creek via a bridge and box culvert and these structures were evaluated for potential post fire watershed conditions. Also related to risks posed to these structures is the Boulder Cabin situated near the left bank of Boulder Creek downstream of the bridge. The bridge and box culvert are at risk from flooding and debris transport. Large woody debris has the potential to lodge against the upstream side of the bridge and box culvert creating log jams which could cause plugging of these structures. If this occurs, there is potential to lose the 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. Also, if plugging occurs, and water is diverted over or around the bridge, this may place the Boulder cabin at risk to flooding and debris transport. A relief channel does exist along the left bank of Boulder Creek; however, during a large flood event and bridge plugging, this

relief channel could be overwhelmed by water and debris, potentially forcing the water and debris towards the Boulder Cabin. 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. However, the periodic monitoring and cleaning of the bridge and box culvert is proposed as a non-funded management recommendation to maintain awareness of this concern within Boulder Creek.

The Boulder Creek Trail and associated Hooter Campsite are located within 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 Rainbow Bridge Fire only exacerbates this situation. Given the erosion/debris flow potential, watershed response, and soil burn severity for this watershed in post fire watershed conditions, there exists a potential for loss of life or injury from use of the trail and campsite during certain precipitation and runoff conditions such as thunderstorms and snowmelt. To help mitigate the potential for loss of human life or injury specifications for warning signs and public education is proposed. Additionally, it is recommended to close the trail and campsite through the fall and winter and reopen the trail after the spring snowmelt.

Little Boulder Creek Watershed

In the Little Boulder Creek watershed, the BARC map indicates that 894 acres burned, 42 percent of which received moderate to high soil burn severity – 12 percent as high soil burn severity. Given the high percentage of moderate and elevated percentage of high soil burn severity within this watershed as a whole (38%), there is an increased probability of mass wasting or flooding likely to have downstream effects as a result of the fire. Specifically, there is a high potential for increased erosion and debris flows and a high probability of increased peak flows and sediment delivery over pre-fire conditions.

Private and commercial structures are located downstream of the fire on the alluvial fan formed by Little Boulder Creek and can be accessed from the Stehekin Valley Road and an access road to Keller's Park. All known structures were evaluated for potential damage from post fire watershed conditions. Examination of the structures south of the Stehekin Valley Road shows that the placements of these structures are on a river terrace and are well away from the current active channel of Little Boulder Creek and debris flow deposits do not occur near any structures. One structure and one trailer on the access road to Keller's Park, north of the Stehekin Valley Road, were evaluated for post fire watershed conditions. The Staley's house and the trailer are located on the alluvial fan of Little Boulder Creek. The Staley's house is located on the right bank of the current active channel of Little Boulder Creek. No debris flow deposits are located in the vicinity of the home; however there is evidence that the house may have had some nuisance flooding issues in the past. The active channel by the house has been hardened with a small levee to protect the house from nuisance flooding. Additionally the house is slightly elevated above the ground surface. No evidence exists on the structure to indicate that flooding and debris transport have damaged the house in the past high water events. The age of the house is unknown. The trailer located at the end of the access road is situated well away from the active channel and currently is not at risk. The home and trailer are located near relict channels

and 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 channel of Little Boulder Creek, it will occur from 300 yards or further downstream of the apex of the alluvial fan, potentially 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 Little 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 channel, it is unlikely that the house and trailer are at risk to flooding and debris transport from post fire watershed conditions. Given the erosion/debris flow potential, watershed response, soil burn severity, structure and trailer placement, and location of the current active channel, no treatments are recommended to protect lives and property from post fire watershed conditions.

Stehekin 1 Watershed

Although technically the Rainbow Bridge visitor use area falls under the Stehekin 1 watershed, values at risk are analyzed under the Rainbow Creek watershed analysis (above) given its name sake and close proximity to Rainbow Creek.

Stehekin 2 Watershed

In the Stehekin Creek 2 watershed, the BARC map indicates that 295 acres burned, 35 percent of which received moderate to high soil burn severity – 3 percent as high soil burn severity. Given the elevated percentage of moderate and low percentage of high soil burn severity within this watershed, there is a slightly increased probability of mass wasting or flooding likely to have downstream effects as a result of the fire. Specifically, there is low to moderate potential for increased erosion and debris flows and a moderate probability of increased peak flows and sediment delivery over pre-fire conditions. 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.

The only value at risk identified in this watershed due to post fire watershed conditions is the new school located along Stehekin Valley Road. The watershed above the school is considerably smaller than the three major watersheds previously analyzed. Field observations of the watershed show that small debris flows have occurred, but the deposits are limited in size and distribution; and the lateral extent of the flows stop well before reaching the school. The active channel morphology behind the schools shows two main channels, one of which drains away from the school to the west and currently poses no threat to the school from debris flows or flooding. The second active channel drains towards the school but disperses well above the school into several channels which appear to drain to the west of the school, but no clear path is currently evident. This channel poses little threat to the school from debris flows or flooding due to post fire watershed conditions. Due to the dynamic nature of alluvial fans, relic channel capture and migration due to flooding, debris transport, or debris flows can be an unpredictable threat. If channel capture and migration does occur on the channels of Stehekin 2 watershed, it will occur from the apex of the alluvial fan down to the base of the active fan, potentially transporting water, rocks, and sediment well away from the existing channel, and potentially towards structures that previously appeared to be safe. Given the limited magnitude of events present in this watershed, even if channel capture and migration does occur, it should pose no

threat to the school. However, the area behind the school above the playground in the forested area should be avoided during intense rainfall. Given the erosion/debris flow potential, watershed response, soil burn severity, location of the school, and limited extent of debris flows, post fire watershed response should pose no threat to the school. However, since this is a school, caution should be exercised and a specification for public education is proposed to inform school administrators of the risks due to post fire watershed conditions.

Stehekin 3 Watershed

The Stehekin 3 watershed has no values at risk present under the burned slopes and is not considered a threat to lives or property.

Stehekin 4 Watershed

In the Stehekin 4 watershed, the BARC map indicates that 233 acres burned, 57 percent of which received moderate to high soil burn severity – 12 percent as high soil burn severity. Given the high percentage of moderate and elevated percentage of high soil burn severity within this watershed, there is an increased probability of mass wasting as a result of the fire. This is mitigated by the low-relief bench at the base of the burned area that may capture rolling debris preventing it from moving further downslope and affecting downstream areas. As such, there is a low to moderate potential for increased erosion and rockfall over pre-fire conditions.

The Stehekin 4 watershed has one identified value at risk due to post fire watershed conditions: the Stehekin Valley Road between the Stehekin Landing and the lake head. The drainage within this watershed is poorly understood and may pose a threat for rockfall to Stehekin Valley Road. Given the unclear nature of the drainage of this watershed a specification is proposed to place warning signs for rockfall.

Critical Natural Resources

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

RECOMMENDATIONS

Emergency Stabilization

Safety Warning Signs on Roads and Trails and Public Education (W-1)

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: 1) trailheads of Rainbow Creek and Boulder Creek, 2) other entry points into the fire on Boulder Creek and Rainbow Creek, 3) rockfall hazard zone at the Rainbow Falls visitor use area, 4) rockfall hazard zone along road between Stehekin Valley lakehead to Stehekin Landing, and 5) at Hooter and Rainbow Falls backcountry campsites. Funding is

recommended to develop appropriate messages and design, fabricate, install, and remove the signs. Signs should be installed prior to initial fall rains and removed at the park's discretion prior to September 2011. Leaving the signs in place for 2-5 years may be appropriate given the longer term hazard posed by debris flows and falling debris in some of these areas; park staff will complete removal of those signs when it is deemed appropriate, using park funds.

Given the diffuse nature of potential hazards resulting from post-fire conditions above the community of Stehekin, a public information campaign is strongly advised. While installing warning signs noted above addresses hazards at key localities, an educational campaign that connects fire processes and ecology with hazards and landscape recovery would increase public awareness of hazards within and below the fire perimeter. The target of this message would be the visiting public as well as area residents. This specification covers time for interpretive/educational specialists to develop, produce, and install materials deemed appropriate by the park for this endeavor. A specific audience for this work should include the Stehekin School staff and students given the school's proximity to the burned area and potential hazards nearby. BAER Team and park staff met onsite with members of the school board and the Stehekin school teacher on September 10, 2010 to discuss potential post-fire debris flows above the school and the recommendations of the BAER team in this area.

Non-Funded Management Recommendations

Close trails and backcountry campsites within the burn perimeter for the fall of 2010 and winter 2011 at a minimum. 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.

A poorly installed 6-foot culvert on Little Boulder Creek along the Keller's Park access road poses a substantial hazard to vehicular traffic. The road way over the culvert is of insufficient thickness to support vehicle weight and prevent collapse of the culvert. The culvert has already been slightly crushed and make-shift wooden supports have been placed inside. This is a tenuous situation and until substantial improvements are made, NPS vehicles should avoid driving over this structure.

Careful monitoring of floatable debris within the Boulder Creek channel from the Stehekin Valley road to the apex of the Boulder Creek fan, a distance of about 2,000 feet, is recommended. Similarly, routine monitoring of the bridge over Boulder Creek and the box culvert immediately west of it is recommended to ensure they remain free of debris that could plug them.

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WILDLIFE BURNED AREA ASSESSMENT

OBJECTIVES

- Assess effects of the fire and suppression tactics to Federally listed Threatened and Endangered species and their habitats
- Prescribe emergency stabilization measures and/or monitoring.
- Assess effects of proposed stabilization actions to listed species and habitats.

ISSUES

- Four federally listed species have suitable habitat within the boundaries of the fire area, including gray wolf (*Canis lupus*), grizzly bear (*Ursus arctos*), Canada lynx (*Lynx canadensis*), and spotted owl (*Strix occidentalis*).
- Of these species, only the spotted owl is known to potentially use habitat within the fire area. No recent sightings of spotted owls within the burned area have been documented.
- One state-listed species, the Western Grey Squirrel (*Sciurus griseus*), has a small population in the Stehekin Valley, including lands within the burn area.

OBSERVATIONS

Background

The Rainbow Bridge Fire Area lies within the Lake Chelan National Recreation Area (LACH). LACH is located along the east slope of the Washington Cascades Range in Chelan County and lies within the semi-arid continental zone. East of the Cascade crest a rainshadow effect exists creating cool winters and warm dry summers. Below 1,220 m, forested habitat is dominated by the Douglas-fir cover type with western red cedar, lodgepole pine (*Pinus contorta*), western white pine (*Pinus monticola*), and Ponderosa pine (*Pinus ponderosa*) commonly found as minor components (Agee and Kertis 1986). Above the 1,220 m elevation line, forested habitat is dominated by the subalpine fir (*Abies lasiocarpa*) cover type (Agee and Kertis 1986). Other tree species that are common in this cover type include mountain hemlock and Englemann spruce (*Picea engelmannii*). Although less common, the Pacific silver fir cover type is also found on the east side above 1,220 m, most notably in the Bridge Creek section of the Stehekin River drainage. Both western hemlock and mountain hemlock were commonly found in this cover type.

Wildlife of the Rainbow and Boulder Creek areas is typical of the dry eastslope of the Cascade Range. From the summer of 1988 through late winter 1992, Kuntz and Glesne (1993) documented 138 wildlife species within or near the Rainbow Bridge burn area. This included 5 amphibian species, 8 reptile species, 25 mammal species, and 104 species of birds. No Federal listed or candidate species are currently known to occur within the Rainbow Bridge burn area; however, suitable habitat for four listed species (Spotted Owl, Gray Wolf, Canada Lynx, and Grizzly Bear) occurs within this burn area. The state-listed Western Grey Squirrel (Threatened) has a small population within and around the burn area.

Although spotted owl activity sites exist both downvalley and upvalley of the Rainbow Bridge burn area, the last verified sighting of a spotted owl within or adjacent to the burn was in 1993, near the head of Lake Chelan, at about 2400' elevation. One male spotted owl was seen, and subsequent surveys that same year failed to confirm either the residency or presence of a pair in this area. Subsequent surveys in 1994, 1995, and 1996 produced no detections. During the recent resurveys of LACH for spotted owls (2007-2008), no sign of spotted owl presence was found at this possible historic activity site. If the site did have a pair of owls, the site is now considered inactive. Most likely, the 1993 detection was of a dispersing subadult owl that may have been coming into breeding condition and was looking for a vacant territory. This was not that territory.

There have been no confirmed sightings of grizzly bear or Canada lynx within the burn area for at least several decades. The gray wolf has been documented upvalley of the burn area within the upper Rainbow Creek drainage within the past three years, near McAlester Pass, and an unverified sighting from near the upvalley end of the burn in Rainbow Creek was turned in to park wildlife staff in 2009.

The western gray squirrel is the largest native tree squirrel in Washington State, and ranges from north-central Washington south through Oregon to southern California. Today only three geographically isolated populations of this species remain in Washington (Bartels 2000, Linders 2000, Ryan and Carey 1995). Within each of these isolated populations, the numbers of squirrels or squirrel nests are thought to be declining. One population, found in Chelan and Okanogan counties, may be fragmented further into small sub-populations. One of these small sub-populations of squirrels is located within the Stehekin Valley. Inventory (Hamer, et al, 2005) and current research work (Stuart, et al, personal communication) completed within the Stehekin Valley is providing important life history information on this species, and is of particular interest to the NPS given the extensive forest fuel treatments, planned road and infrastructure development, and private land development within the Stehekin Valley. The NPS has provided research funding to address management concerns related to the western grey squirrel, and this burned area wildlife assessment includes a non-funded management specification that relates to the early findings of that research. The western gray squirrel population remains small within LACH, and includes habitat burned within the Rainbow Bridge fire.

Reconnaissance Methods

The BAER Team Leader consulted with NOCA Wildlife Biologist Robert Kuntz in late August, 2010 regarding potential wildlife concerns associated with the Rainbow Bridge fire, and again on Sept. 9, 2010 specifically regarding spotted owl population information. These consultations led to the list of wildlife issues discussed in this assessment. The entire BAER Team consulted with field biologists Rose Agbalog and Kira Kransler on Sept. 8, 2010 to obtain an update on the current western grey squirrel research and their perspective on fire effects to the squirrel population.

The primary purpose of BAER assessments is to discuss the potential effects of fire, suppression tactics and propose emergency stabilization activities to federally listed species. Because no federally listed species are known to occur within the Rainbow Bridge fire, such detailed discussion is not necessary. However, given the presence of the state-listed western grey squirrel within the burn area and concern for the persistence of this population within LACH, discussion is provided for that species. This assessment is not intended to definitively answer the many specific species effects questions that are inevitably brought up in an incident such as the Rainbow Bridge Fire.

Findings

As noted, no federally-listed species were known to occupy the area burned within the Rainbow Bridge fire. The relatively recent gray wolf sightings upvalley, and potentially near, the fire within the Rainbow Creek drainage are of interest, but the known occupied portion of the Rainbow Creek drainage by wolves was not burned. Wolves are habitat generalists and highly mobile, and neither direct impacts to wolves or indirect harmful impacts to habitat for them or their prey are considered likely from the burn.

Although no known active territories for the spotted owl exist within the Rainbow Bridge burn area, roughly 20-30% of the burn acreage was suitable habitat for this species (Robert Kuntz, personal communication). Two spotted owl territories that have been active within the past few years lie roughly 1.5 miles from the fire perimeter (downvalley, near Hazard Creek) and 3 miles from the fire perimeter (upvalley, near McGregor Meadows). It is unlikely that the Rainbow Bridge fire will directly affect those nest activity areas. Direct habitat loss within the burn area would likely affect prey species for the spotted owls in the near-term, but long-term effects of the fire to future nesting spotted owls, should they attempt to occupy the burn area, are probably minimal. Active spotted owl territories that were burned over in the 2006 Flick Fire, which produced similar burn effects as this Rainbow Bridge fire, appear to not have negatively impacted those territories.

Western grey squirrel

Although not a federally-listed species, NPS concerns for the state-listed western grey squirrel (**Photo 3**) prompts a brief assessment for this species.

Hamer, et al (2005) noted that although most western gray squirrel populations have been associated with Oak forest communities, the Stehekin Valley population of western gray squirrel appears to have adapted to the conifer dominated low elevation mixed Douglas-fir/ponderosa pine/big leaf maple habitat types. These sites typically have low shrub densities and sparse herbaceous ground cover resulting in very open understories. The stands are typically park-like, with lower densities of dominant and subdominant trees resulting in low canopy cover (<75%). In addition, nest sites were often located near streams indicating riparian areas and water availability may be an important habitat component to these populations. These areas also commonly had an overstory component of deciduous mast producing trees which could be used as a supplemental food source.



Photo 3: Western grey squirrel (*Sciurus griseus*)

Parts of the Stehekin Valley near residences have been treated with prescribed understory burns (roughly 1995- present) in order to reduce fuel loads and decrease chances of high intensity natural burns. Hamer et al (2005) found that nest sites were clustered in and out of areas that received burn treatments. Although about two thirds of nests were outside burned areas, the burned areas did not seem to deter squirrel activity or inhibit nest building at these sites.

Agbalog and Kransler (personal communication) recently observed western grey squirrels within the burn area (between Boulder and Little Boulder creeks) extensively using ponderosa pine cones as a food source. It is expected they will exploit the anticipated mushroom increase that typically follows a large fire. Squirrels don't require ground cover for travel, and they tend to avoid brush or thick groundcover. Thus, the open understory created by the Rainbow Bridge burn is not a negative impact for them.

Hamer et al (2005) found that western grey squirrels within the Stehekin Valley preferred large conifers as nest trees, perhaps to allow them access to other tall trees via the canopies without ever needing to be on the ground. Similarly, nest locations were typically located in the upper 1/3 of the tree. Agbalog and Kransler (personal communication) have noted that western grey squirrels use mistletoe trees for nesting, particularly mistletoe brooms that occur in the upper canopy of the tree. Although it is likely that potential nesting trees were consumed in the fire, observations from both this burn and the 2006 Flick Creek fire indicate that western grey squirrels will continue to use the recently burned areas.

In summary, it appears the Rainbow Bridge fire is unlikely to negatively impact the western grey squirrel population within LACH, and recent observations by researchers indicate squirrels are using food sources within the recently burned area. One non-funded management recommendation follows from these findings.

RECOMMENDATIONS

Given there are no federally listed Threatened or Endangered species within the burn unit, no specifications are permitted under BAER.

Management (non-specification related)

The NPS manages 1209 acres of the Stehekin Valley floor as part of the Forest Fuel Reduction Area (FFRA) program. The program, in effect since 1995, is designed to reduce fuel loadings to mitigate the potential for a catastrophic wildfire to move through the valley floor. Treatments consist of large diameter thinning and fuel removal offsite, smaller fuels handpiling and burning, and prescribed burning. Mistletoe brooms have been identified as a ladder fuel concern, but as noted above, mistletoe brooms are important nesting habitat for the western grey squirrel. A recommendation to preserve nesting habitat for western grey squirrels is to limit the removal of mistletoe brooms to near ground level, or preferably to maintain some pockets of unmanipulated natural mistletoe infestations within the larger burn units. In all cases, keeping mistletoe brooms within the higher canopy of trees within burn units is strongly recommended to maintain nesting habitat for the western grey squirrel.

NOCA wildlife biologists and fire management staff need to cooperatively evaluate fuel treatments within the Stehekin Valley to identify opportunities to manage the FFRA treatment areas for the benefit of squirrels as well as achieve fire management objectives. It is expected that the next scheduled FFRA 5-year program review will occur in 2011; one topic of discussion needs to include a discussion on western grey squirrel population needs within the FFRA units, as informed by the current research.

CONSULTATIONS:

- Robert Kuntz III, NOCA Wildlife Biologist
- Rose Agbalog, contract biologist (Western Grey Squirrel)
- Kira Kransler, contract biologist (Western Grey Squirrel)

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Wildlife Assessment written by Jack Oelfke, BAER Team Leader

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 suppression activities (line building) and the fire on populations of Sierra Cliff brake (*Pellea brachytera*).

OBSERVATIONS

Findings and recommendations contained within this assessment are based on NOCA reconnaissance of impacted areas via ground surveys on September 8-9 2010 by NOCA Plant Ecologist (Mignonne Bivin), North Coast and Cascades (NCCN) Exotic Plant Management Team (EPMT) Lead (Todd Neel) and Stehekin District Resource Management Specialist (Vicki Gempko).

The Rainbow Bridge 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 2015.

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 found within the Rainbow Bridge Fire area included rock outcrops, grassland patches, dry coniferous forest, riparian corridor, shrublands and seeps.

Vegetation Type Descriptions

Rock outcrops are dominated by low shrubs, annual grasses and forbs, and perennial species. Species include, kinnikinnick (*Arctostaphylos nevadensis*), cheatgrass (*Bromus tectorum*), Indian's dream fern (*Aspidotis densa*), yarrow (*Achillea millifolium*) buckwheat (*Erigeron unbellatum*), arrowleaf balsamroot (*Balsamorhiza sagittata*), and hawkweed (*Hieracium scouleri*).

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*).

Seeps are found mostly in rock outcrops and are dominated by ephemeral herbaceous species. Species include long spurred plectritis (*Plectritis macrocera*), Saxifrage (*Saxifraga integriflora*), suksdorfia (*Suksdorfia ranunculifolia*) and monkeyflower (*Mimulus guttatus*).

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 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*) in the understory.

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 (*Symphoricarpos albus*), mock orange (*Philadelphus lewisii*),

bitter cherry (*Prunus emarginata*), Scouler's willow (*Salix scouleriana*) and some patches of quaking aspen (*Populus tremuloides*)

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*).

State Listed Species

NOCA has no known federally listed plant species, but the Complex has approximately 56 potential state listed plant species. One of these state listed plant species, Sierra cliff brake (*Pellea brachyptera*), occurs within the Rainbow Bridge Fire area. The Sierra cliff brake is a state listed sensitive species. This species has a disjunct population, occurring in the eastside of Lake Chelan and in the Sierra Nevada Mountains of California. Six locations of the Sierra cliff brake were identified in the 2003 Arnett survey within the Rainbow Bridge Fire area. No post-fire surveys have been conducted to document the effect of the Rainbow Bridge Fire on these sensitive plant species. Surveys are scheduled to be conducted in the 2011 field season.

Invasive plant species

Approximately 223 species (16% of the NOCA flora) are invasive species. Three species of concern are known to occur within the boundaries of the Rainbow Bridge fire area: downy brome (*Bromus tectorum*) (also known as cheatgrass), six-week fescue (*Vulpia* spp.) and diffuse knapweed (*Centaurea diffusa*). Additionally, there are several species of concern that occur adjacent to the boundary of the fire, which have the potential to rapidly colonize burned / disturbed areas. These include populations of Scott's broom (*Cytisus scoparius*), yellow toadflax (*Linaria vulgaris*), bull thistle (*Cirsium vulgare*), and sowthistle (*Sonchus asper*).

The primary invasive plant species of concern within the Rainbow Bridge Fire is cheatgrass. Several areas of the Rainbow Bridge Fire including 204 acres of the proposed Upper Rainbow Forest Fuel Reduction Area (FFRA) (NOCA Fire Management Plan (2007)) were surveyed for the presence of cheatgrass in 2006 (**Figures 2 and 3**). During these surveys populations of cheatgrass totaling 11.3 infested acres were identified within the boundary of the FFRA and approximately half of these populations now fall within moderate to high severity burn areas of the Rainbow Bridge Fire. An additional 280 acres of moderate to high severity burned areas along the Boulder Creek Trail adjacent to the FFRA has not been surveyed for cheatgrass, however, there is a high probability that a number of populations existed in this area prior to the Rainbow Bridge Fire. Based on existing research, and monitoring of cheatgrass populations burned during the Flick Creek Fire of 2006, increases in cheatgrass population size and density of up to 100 percent can be expected to occur in moderate to severe areas of burn intensity within one year of the fire. Additionally, a number

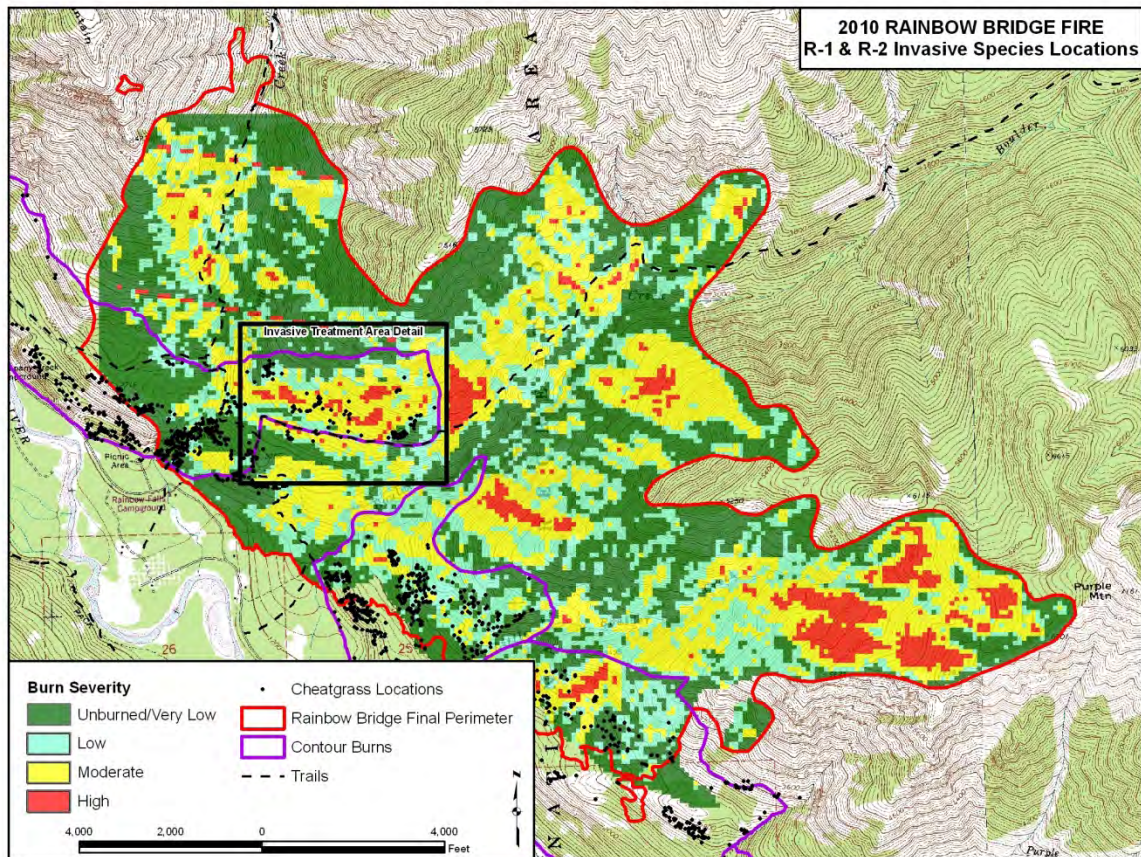


Figure 2: Known cheatgrass infestations within Rainbow Bridge fire, including proposed treatment area

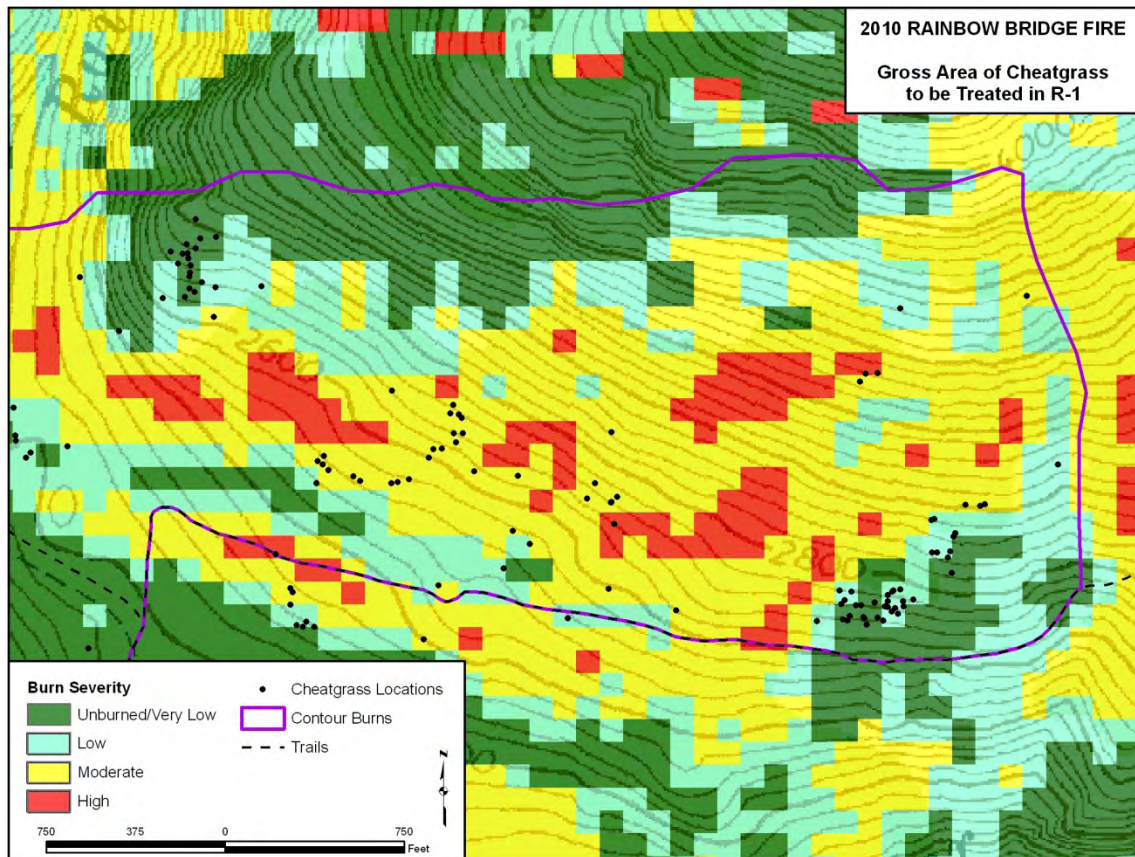


Figure 3: Detail of proposed cheatgrass treatment area, Rainbow Bridge fire

of factors observed during field assessment of the Rainbow Bridge Fire may contribute to optimal conditions for cheatgrass expansion especially on the benches and moderate slopes along the upper portion of the Rainbow Loop and Boulder Creek trails:

- Needle cast in several areas of the fire will providing litter and mulch necessary for cheatgrass seed germination (Young and Evans 1978). **(Photo 4)**
- A substantial decrease in the forest canopy due to conifer mortality and subsequent increase in light availability on the forest floor. **(Photo 5)**
- The temporary loss of understory vegetation and ground cover, providing habitat openings for cheatgrass to establish and allowing for a greater range of seed dispersal from nearby cheatgrass populations.
- Increased wind dispersal of seeds from cheatgrass plants up-slope and outside of burned areas (Upadhyaya et al. 1986)
- One fire retardant drop consisting of a total of 5,118 gallons of LCG was made perpendicular to the lower section of the Boulder Creek trail, through an area with several known populations of cheatgrass. This retardant consists of ammonium polyphosphate

with a clay thickener and an iron oxide colorant. Fire retardant has been shown to have several effects on vegetation, including an increase annual grass biomass, decreases in foliar cover and species richness, and the reduction of post germination survivorship of some native legume species (Larson and Newman 1996; Adams and Simmons 1999). The likely effects of retardant drop on the vegetation of the Rainbow Bridge Fire area are an increase in the cover and abundance of annual weedy grasses such as cheatgrass and six-week bromes.

Should cheatgrass become widespread within areas of the Rainbow Creek Fire, there is a high probability that its presence and expansion could shorten the interval between fire cycles, resulting in frequent, low intensity fires which would prevent native vegetation from successfully re-establishing after this event.



Photo 4. Areas of needle cast will provide a seed bed for increased germination of cheatgrass



Photo 5. Lack of canopy as a result of high fire severity will provide a competitive advantage for cheatgrass populations to establish

RECOMMENDATIONS

Specifications

R-1: Early detection and eradication of cheatgrass

Early detection and management of new and expanding populations of cheatgrass will be critical to the recovery of native vegetation consumed during the Rainbow Bridge Fire. Within the fire area, a total of 484 acres were identified by the NOCA plant ecologist and Network exotic plant management specialist as areas potentially threatened by cheatgrass infestation. Of these 484 acres, it is estimated given current information that approximately 30 acres could be subject to dense cheatgrass infestation by Spring 2011; however, it is possible that additional acreage could be identified, in which case a new specification may need to be prepared. Early detection and control of the identified invasive species will occur primarily within these areas and along associated trails, however, detection surveys of fire lines (including contingency lines, and lines

re-used from the Flick Creek Fire of 2006), heli-spots, and staging areas will also be subject to detection surveys.

Detection surveys will be conducted concurrently with the eradication of non-native target species beginning in Spring 2011 and ending in Fall 2014, as the cheatgrass seed bank is expected to last for a maximum of three years. Seasonal teams will survey and map invasive species populations in areas considered having high infestation potential, and removal of plants will be accomplished by a combination of chemical and mechanical means, in conjunction with methods specified in the NOCA Invasive Species Management Plan and EA (to be completed Winter 2010-2011).

Surveyed and controlled populations will be mapped using GPS units, and photo-points will be installed in areas of dense infestation and at locations that characterize the overall treatment area. 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. Spring efficacy monitoring will be based on percent mortality, and take place within one month of treatment to not only determine treatment efficacy, but also to identify any areas that may have germinated post-application, or been skipped / missed during the initial application. Missed / skipped populations will be treated after efficacy monitoring if seed heads have not developed.

Recommendations for Control:

- **Cheatgrass, Spring 2011:**

Initiate Spring 2011 control after detection surveys are completed but prior to grass heading. Chemical control activities will consist of a targeted broadcast application with backpack sprayers of a solution of glyphosate (41% Active ingredient formulation) at 1-1.5 quarts/A; ½ gallon / A of non-ionic surfactant (NIS); 8.5 pounds / A of Ammonium Sulfate (AMS) to improve herbicide efficacy when mixed with water drawn from localized sources. This mixture will be delivered in water at a rate of approximately 50 gallons per acre. 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 cheatgrass infestation exceeds the projected acreage (30 A) by a factor of more than two, control options will be re-evaluated for 2012.

- **Cheatgrass, Fall 2011:**

Evaluate efficacy of Spring 2011 treatments. Perform follow-up work using pre-emergence treatments of imazapic at a maximum rate of 8oz/A + 1 qt / A of Methylated Seed Oil (MSO).

- **Cheatgrass Spring 2012:**

Continue targeted glyphosate applications begun in Spring 2011.

- **Cheatgrass, Fall 2012:**

Continue targeted imazapic applications begun in Fall 2011.

- **Cheatgrass Spring 2013:**

Continue targeted glyphosate applications begun in Spring 2012, anticipate 50% follow-up acreage (15 acres).

- **Cheatgrass, Fall 2013:**

Continue targeted imazapic applications begun in Fall 2012 anticipate 25% follow-up acreage (7.5 acres).

Prevention and Public education

Specifications

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 Rainbow Bridge Fire.

Chemical control has not been used previously used in the Stehekin area to control cheatgrass. 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 Rainbow Bridge area 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.

To prevent the potential spread of non-native species from the trailheads to the pristine wilderness areas, boot brush stations will be established at trailheads and at the highest known extent of the weed populations focusing on mapped cheatgrass populations. These stations will consist for a bench, boot brush and a small informational sign to educate visitors on invasive non-native plants and their role in the reduction of the spread of these species.

R2: Early detection and eradication of other invasive plant species

Early detection and eradication of other invasive plant species of concern will be critical in preventing species such as bull thistle, yellow toadflax, Scotch broom, sowthistle, and diffuse knapweed 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 focused near areas of wildland urban interface (WUI) (behind the new and old schools, along contingency lines constructed from Rainbow to Little Boulder, and around the Skinny Wilson property). In conjunction with methods specified in the NOCA Invasive 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. Should large populations of these species be detected in wilderness areas outside the WUI, control options will be re-evaluated and a new specification prepared.

Surveyed and controlled populations will be mapped using GPS units, and photo-points will be installed in areas of dense infestation and at locations that characterize the overall treatment area. 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.

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 Rainbow Bridge Fire.

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 2011. 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.

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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 Rainbow Creek, Rainbow Loop, and Boulder Creek trails; the burning of a portion of the bridge over Rainbow Creek, and signposts in several locations; and fire damage to Hooter and Rainbow Bridge camps render these popular recreational facilities unusable by the public.

OBSERVATIONS

Background

The Rainbow Loop trail is a popular five mile loop trail in the Lower Stehekin Valley; roughly 3.5 miles of the loop burned in the fire, with fire extending on both sides of Rainbow Creek itself. This trail serves as the gateway to two other trails within the burn area, the Rainbow Creek and Boulder Creek trails, and includes a wooden bridge (Rainbow Creek bridge) over a major and at times hazardous creek crossing on Rainbow Creek. The Rainbow Bridge camp is located near the bridge crossing of Rainbow Creek. This trail and campground have been closed to public use since initiation of the Rainbow Bridge fire.

The Rainbow Creek trail extends up the Rainbow Creek drainage beyond the Rainbow Loop trail, providing access to popular trails and destinations in the high country of the Lake Chelan National Recreation Area, including Rainbow Lakes, McAlester Pass, Hidden Meadows, and over South Pass to USFS Forest Service lands into the Twisp River valley. Roughly 1.5 miles of this trail lies within the burned area, extending from Rainbow Bridge camp upvalley. This portion of the trail has also been closed since initiation of the Rainbow Bridge fire.

The Boulder Creek trail follows the Boulder Creek drainage off the Rainbow Loop trail. Roughly 4 miles of the Boulder Creek trail lie within the burn area, and within the burned area along this trail is Hooter Camp. 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. Like the other trails within the burn area, the Boulder Creek trail has been closed to the public since initiation of the fire.

Reconnaissance Methods

All of the burned-over trail sections and the two burned-over camps were surveyed in either late August or early September by Stehekin Trails Maintenance Worker Aaron Robinson, and all but the Rainbow Creek trail were surveyed on September 8 or 11 by BAER Team members including the NPS National BAER Coordinator and NOCA staff (Chief of Resource Mgmt; Plant

Ecologist; Stehekin Natural Resource Manager; and the NCCN Exotic Plant Mgmt Coordinator). Reconnaissance efforts concentrated on identifying and documenting potential hazard trees, trail tread and bridge conditions, camp conditions, potential debris flow routes and targets, and fire suppression impacts.

Findings

In general, there are two key lessons learned from the 2006 Flick Fire that relate to trails and maintaining safe access. One is that windfallen trees increase substantially for the next several years following the fire; even in 2010, four years following the Flick Creek fire, windfall amounts are higher than pre-fire and occur throughout the year, requiring considerable more trail maintenance response than before the fire. A second lesson learned is that vegetation will grow quickly and thickly along the trails and on the trail tread itself, causing trail users to move toward the outside edge of the trail and cause sloughing of the outside trail berm.

On the Rainbow Loop trail there is roughly 2500' of tread that has been damaged by the 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. Two signs have burned; the Rainbow/Boulder Creek trail junction sign, and the Rainbow Bridge camp sign. The toilet from Rainbow Bridge camp burned, and several hazard trees exist in the camp that will need to be dropped to make the area safe to visitor use. On the east side of the Rainbow Creek Bridge, one side of the crib wall burned in the fire, making the crib wall structurally unstable (**Photo 6**).

On the Rainbow Creek trail, roughly 1500' of trail tread has been damaged by the fire, again due to root/organic material burnout or rock fall/debris fall onto the trail.

The Boulder Creek trail has roughly 4000' of trail tread damage due to root/organic material burnout or rock fall/debris fall onto the trail (**Photo 7**). Roughly one month after the fire, there are some sections with vegetation already growing directly on the trail tread. The Hooter camp was burned over completely; at least 15 hazard trees now surround the camp (**Photo 8**). The camp sign was burned in the fire.

Figure 4 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.

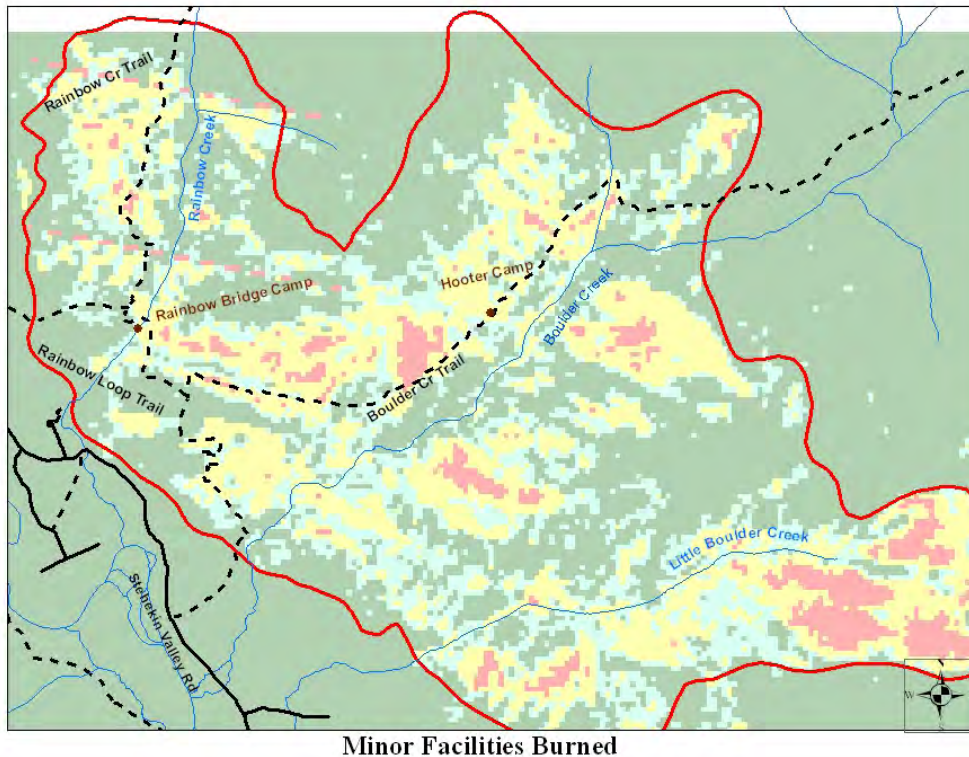


Figure 4. Location of minor facilities burned in Rainbow Bridge fire

RECOMMENDATIONS

Specifications

R-3: Trails, bridges, and signposts

All trail and bridge work will be completed according to NOCA trail standards. Those 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 wooden crib wall on the Rainbow Bridge, toilets, and signposts will be replaced in-kind.

All trail and camp-related work will commence in the spring of 2011. Based on the experience of the 2006 Flick Creek fire, which has very similar trail conditions as the Rainbow Bridge fire, BAR funds are also sought to continue trail repairs and maintenance and log removal in 2012 and 2013, although at reduced levels because the amount of tread work needed to be addressed should diminish in the out years.

CONSULTATIONS

Aaron Robinson, Trails Maintenance Worker, NOCA

Vicki Gempko, Resource Management Specialist, NOCA

Brian Rasmussen, Geologist, Whiskeytown NRA

Jim Roche, Hydrologist, Yosemite NP

Rich Schwab, NPS National BAER Coordinator, National Interagency Fire Center

Minor Facilities Assessment written by Jack Oelfke, BAER Team Leader

PHOTOS



Photo 6. Crib wall of Rainbow Creek bridge.



Photo 7. Boulder Creek trail with windfall, rockfall, and tread damage



Photo 8. Hooter Camp, with all trees surrounding it burned.

CULTURAL RESOURCE BURNED AREA ASSESSMENT

OBJECTIVES

- Assess damages to known historic and prehistoric cultural resources as the result of fire effects.
- Assess potential risks to known/documented cultural resources as the result of post-fire events (e.g., erosion, flooding).
- Assess potential risks to known cultural resources as the result of emergency stabilization activities.

ISSUES

- No cultural resources are known from inside the Rainbow Bridge Fire perimeter.
- One cultural resource lies immediately adjacent and downslope of the fire perimeter, and its condition could potentially change due to erosion or debris flows, or on-site tree mortality.
- Emergency stabilization and/or protection needs for cultural resources within or downstream of the fire need to be identified.

OBSERVATIONS

Cultural History Overview

Within the Stehekin watershed is preserved a rich historic record of pre-contact and post-contact period cultural sites. Cultural resource inventory and research activities began in the early 1970s with the first professional archeological survey (Rice, n.d.), and in the 1980s with the first historic structures inventory (Luxemburg 1984). Beginning in the mid-1980s with field investigations related to preparation of the park's first archeological overview and research design (Mierendorf 1986), park cultural resources staff have conducted numerous systematic cultural resources surveys that have recorded sites representing all time periods of the Holocene (the last 10,000 years).

The archeology of the Stehekin watershed is well-studied compared to other interior mountain basins draining the eastern slopes of the northern Cascade Range. To date, ca. 45 archeological sites have been inventoried and registered, based on numerous intensive and reconnaissance-level cultural resource surveys. Test excavations at five pre-contact period archeological sites have revealed a long and complex history of Native American use and travel throughout the watershed, from its high elevation limits above Cascade Pass to the head of Lake Chelan.

Based on these excavation data, a set of 30 radiocarbon dates on anthropogenic charcoal has furnished the most precise and detailed chronology of Native American use in the North Cascades. These dates span from 9600 to 200 years ago and reveal peak periods in use of the valley at 9600-7000, 3000-1000, and 600-200 (Mierendorf and Foit 2008; unpublished NOCA archeological site records). Although no evidence for permanent habitations has been recovered,

numerous intact, food preparation hearths and other local resource uses are documented, including fish and ungulates, berries, and tool stone materials.

At historic contact and based on ethnohistoric records, bands of Chelan Indian people regularly visited the Stehekin area and used the valley as a travel corridor linking eastern and western sides of the Cascade Range, as did members of other bands from the Columbia Plateau to the east and the Northwest Coast to the west. Today these bands are represented by today's federally-recognized Colville and Yakima tribal governments (Mierendorf 1986).

Euro-american exploration and settlement began in the 1870s and by the 1890s a small resident population of settlers and miners became well-established. By the turn of the century, recreational uses of the valley were also well-established. Today, numerous structures associated with settlement, agriculture, mining, tourism, and federal administration are preserved in the valley (Luxenberg 1984, 1986).

Reconnaissance Methods

Pre-field Documents and Records Review

A records search was conducted utilizing various park resources to determine the extent, nature and fire-sensitivity of resources that may have been affected by fire suppression activities and direct and indirect fire effects. A large part of the burned area along the lower valley walls had been previously inventoried for cultural resources through a historic structures inventory and through archeological surveys by NOCA archeologists. Eighteen (18) historic structures have been located on NPS land between the Stehekin River and the valley wall below the fire perimeter. Most of these structures are within the Buckner Homestead Historic National Register District, and the others include the original Stehekin School, the Community Center, and the Rice Residence (Luxenberg 1984). Most of these structures are on the List of Classified Structures. The Buckner Homestead and the Stehekin School are listed on the National Register of Historic Places, and the Buckner Homestead has been inventoried as a cultural landscape (Gilbert 1985). The National Park Service considers protection of these structures a high priority.

Ten archeological sites have been located on NPS land between the Stehekin River and the valley wall below the fire perimeter (Mierendorf 1986 and NOCA cultural resources files). Four of these represent the historic period (FS 231, -227, -249, and -234; two represent the pre-contact period (FS 26 and -248); and four cannot be assigned to time period based on current evidence (FS 179, -180, -215, and -216). Although none of these have been nominated to or determined eligible for the National Register of Historic Places, FS 26 has been recommended as significant according to National Register criteria and FS 248 is likely to be significant based on inventory data. Both of these pre-contact period sites are managed by NPS as significant properties through avoidance of all actions that could result in changes or alterations of their current conditions.

Field Investigations

Between September 7 and 10, 2010, the NOCA park archeologist conducted field assessments of cultural resources potentially affected by the Rainbow Bridge Fire. All known historic structures and archeological sites east of the Stehekin River, from between Little Boulder Cr. alluvial fan on the southeast to the Rainbow Falls loop trail on the northwest, were examined to assess the potential for fire damage, indirect fire effects, post-fire damage, and potential risks from erosion, looting, vandalism, and carbon contamination of archeological features.

Findings

No cultural resources are known to be located inside the fire perimeter. Furthermore, it was determined that no cultural resources were directly affected in any way by the fire. One historic structure, the Stehekin School, could potentially be affected by post-fire erosion, mud/debris flows, and tree mortality due to its close proximity to the fire perimeter along the steep north valley wall.

Fire and Post-fire Effects to the Stehekin School

The Stehekin School was built in 1921 by valley residents and in May, 1974, it was listed on the National Register of Historic Places by the National Park Service (**Photo 9**). Use of this one-room log structure as a school ceased in 1988 following the dedication of a new school located a short distance down valley. Today the school serves as a self-guided museum, allowing park visitors to view furnishings, photographs, and displays that tell the stories of Stehekin school life, and evoking the feel of community-based education that developed in Stehekin valley in the 19th Century.

Built by residents of the valley using timber from on-site, this one-story structure was constructed on round logs of the joist and sill foundation, and round log walls with hand-hewn planked ends and saddle-notched corners, a wood-shaked gable roof, and board and batten siding beneath gables at the ends. A one-story, 21 ft clapboard addition set on concrete was added on the north ca. 1980 and the front porch was rebuilt in 1982 (Luxenberg 1984).

The Rainbow Bridge Fire descended steep boulder block talus on the steep valley wall behind the school, burning duff, scattered woody debris, brush, and several mature trees. The fire perimeter approached to within ca. 100 ft of the back of the school. Suppression and containment actions included digging of a fire line and placement of water hose on the ground between the back of the school and the fire perimeter (**Photo 10**). Neither the fire or suppression/containment actions affected the structure or changed the integrity of setting, workmanship, design, materials, or feeling.

Potential Future Threats

Two potential threats to the National Register integrity of the site consist of 1), hillslope erosion or debris flows emanating from the steep valley wall behind the school, and 2), mortality of

mature Douglas-firs in the stand of trees behind the school that could result in tree fall damage to the structure.

1) Erosion/debris flows. Due to vegetation denudation and hydrophobic “scorched” soils, the potential exists for hillslope erosion and debris flows. Generally, vegetation is sparse and soils are poorly developed on the cliffs and scree slopes comprising the steep valley walls above the school. Due to the coarse, boulder-block matrix of scree, and the resulting entrainment and anchoring effect of the interlocking boulder matrix, significant hillslope erosion seems unlikely. Examination of surficial soil and topography behind the school offers no evidence of previous erosional events. On this basis, it appears unlikely that erosion will affect the Stehekin School.

The school structure was built at the distal end of a naturally formed, fan-shaped, bouldery debris flow (**Photo 11**). The age of this landform is undated, but based on the mature stand of trees it supports and the presence of well-developed soil, it appears to have great age and to have been stable for a long time. Burn severity of the hillside in the very small catchment that heads this debris flow deposit is classed as predominately very low and low, with one area classed as moderate. Using these data, it appears unlikely that debris flow deposition would resume in the vicinity of the Stehekin School.

2) Tree mortality. Based on prior experience in other locations in the Stehekin valley, tree mortality from fires (and other events) sets the stage for Douglas-fir beetle infestations of the fire-killed trees and live trees in close proximity. Beetle-caused tree mortality in Douglas-firs surrounding the Stehekin School could result in tree-fall damage to the structure, with the ensuing loss of integrity of design, materials, and feeling. Such a loss would constitute an adverse effect to the historic property.

Recommendations

The National Park Service recommends protection from beetle infestation in the high-risk Douglas-fir stand on the east and south sides of the Stehekin School. Preventing a post-fire beetle infestation is likely to preserve the historic integrity of the Stehekin School without adversely affecting the structure’s National Register-significant qualities.

Specifications

R-4 Treat Douglas-firs to prevent beetle infestation.

Douglas-firs in the immediate vicinity of the Stehekin School are at high risk for infestation of Douglas-fir beetles. These beetles prefer stands dominated by Douglas-firs averaging >14 in. dbh and >120 years old (Ross et. al. 2006), characteristics that closely match the Stehekin School stand of trees.

A disaggregation pheromone that prevents Douglas-fir beetles from aggregating in high-risk stands has proven successful in preventing infestations in the Cascade Range (Ross et. al. 2006). For optimal effectiveness, the bubble capsules containing the disaggregation pheromone MCH should be attached to trees in late-April to early May, when beetles are flying. Bubble capsules

should not be removed before September, and can be reapplied each year for protection in 1-3 annual applications. Areas less than an acre, comparable to the Stehekin School tract, have been successfully treated. Typically, application rate is 30 bubble caps per acre, evenly spaced throughout the stand. The Stehekin School tract is ca. 1 acre.

Management (non-specification related)

To the extent possible, NPS staff will monitor post-fire conditions in the small catchment above the rocky debris cone located immediately southeast of the Stehekin School. Although current available evidence suggests that this catchment has been stable and depositionally inactive since before the contact period (ca. A.D. 1880), there remains the possibility that the Rainbow Bridge Fire could contribute to destabilization of steep hillside's rock and wood detritus and soils. In the unlikely event of an up-slope erosional episode, the resulting down-slope deposition of material could compromise the historic integrity of the Stehekin School and the immediately adjacent Stehekin Valley road.

It is recommended that NPS staff monitor hill-slope conditions above the Stehekin School.

CONSULTATIONS

The NOCA archeologist will consult with several key agency and tribal offices regarding the assessments and recommendations in this report. Consultations will include:

Dr. Jesse Kennedy III, Chief of Cultural Resources Branch, North Cascades National Park Service Complex.

The Confederated Tribes of the Colville Reservation and Yakama Nation.

Washington State Department of Archaeology and Historic Preservation, including the Washington State archeologist and the State Historic Preservation Officer. Additional consultations regarding Section 106 issues will be conducted, as needed, based upon proposed undertakings related to any other BAER treatments and undertakings.

REFERENCES

- Gilbert, Cathy
1985 *Cultural Landscape Inventory, Buckner Homestead, Stehekin, Washington*. Lake Chelan National Recreation Area, National Park Service.
- Luxenberg, Gretchen
1986 *Historic Resource Study*. Department of Interior, National Park Service, Pacific Northwest Region, Seattle, WA.
- 1984 *Historic Structures Inventory: North Cascades National Park Service Complex*. Department of Interior, National Park Service, Pacific Northwest Region,

Seattle, WA.

Mierendorf, Robert R.

1986 *People of the North Cascades..* Pacific Northwest Region, National Park Service
Department of Interior, Seattle, WA.

Mierendorf, Robert R. and Franklin F. Foit, Jr.

2008 *9,000 Years of Earth, Wind, Fire, and Stone at Cascade Pass.* Program Abstracts,
73rd Annual Meeting of the Society for American Archaeology, March 2630,
Vancouver, B.C.

Ross, Darrell W., Gibson, Kenneth E., and Daterman, Gary E.

2006 *Using MCH to Protect Trees and Stands From Douglas-fir Beetle Infestation.*
USDA, Forest Service, FHTET-2001-09.

Cultural Assessment written by Bob Mierendorf, NOCA Archeologist

PHOTOS



Photo 9. National Register plaque in the foreground, Stehekin School in the background.



Photo 10. The back of the Stehekin School, showing the sprinkler hose layed during the Rainbow Bridge Fire.



Photo 11. Showing the front of the Stehekin School, the Stehekin Valley road, and the toe of the debris cone in the center of the photo.

SPECIFICATIONS



Rainbow Bridge Post-Fire Response Plan | 2010

PART F - INDIVIDUAL SPECIFICATION

TREATMENT/ACTIVITY NAME	Watershed safety/public education	PART E SPECIFICATION #	W-1
NFPORS TREATMENT CATEGORY*	Protection and Warning	FISCAL YEAR(S) (list each year):	2011
NFPORS TREATMENT TYPE *	Public Education	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):

Number and Describe Each Task:
A. General Description: For human health and safety purposes, create and install hazard signs and create informational brochure, interpretive programs to provide notice of potential hazards (debris flows, flooding and rock fall) to those entering or living in the burn area. B. Location/(Suitable Sites: 1) Hazard Warning Signs: a) trailheads of Rainbow Creek and Boulder Creek, b) other entry points into the fire on Boulder Creek and Rainbow Creek c) rockfall hazard zone at the Rainbow Falls visitor use area e) rockfall hazard zone along road between head of Lake Chelan to Stehekin Landing, f) hazard signs at Hooter and Rainbow Bridge backcountry campsites g) outside the burn perimeter on roads and trails. 2) Informational brochures and interpretive program Golden West Visitor Center. C. Design/Construction Specifications: 1) Design signs to fit NPS and park visual appearance. 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 time driving. Trail sign should meet applicable visual standards. Signs should remain in place for at least two years and up to 5 years, though funding is provided to remove the signs after one year as needed (BAER funding is only available for 1 year following a fire.). 2) Develop interpretive products deemed appropriate for the local situation to effectively convey the nature of post-fire watershed conditions and hazards therein such as debris flows, flooding, and hazard trees. Products may include flyers, presentations, trailhead kiosks, etc. Ideally this material would be integrated with a larger message incorporating fire ecology, watershed dynamics and geomorphology, and potentially climate change. D. Purpose of Treatment Specifications: To protect employees, residents, and visitors from post fire watershed conditions (debris flows and falling debris). E. 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
2 WG-5 Laborers (2 x \$27.50/hr x 40 hrs x 1 FY)	\$ 2,200
GS-9 Visual Information Spec (\$32.18/hr x 40 hrs x 1 FY)	\$ 1,287
GS-9 Interpretive Specialist (\$32.18/hr x 80 hrs x 1 FY)	\$ 2,574
GS-5 Interpretive Ranger (\$18.85 hr x 80 hrs x 1 FY)	\$ 1,508
TOTAL PERSONNEL SERVICE COST	\$ 7,569
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.	COST / ITEM
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	\$ -
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	COST / ITEM
Sign construction, materials, and shipping	\$ 6,000
TOTAL MATERIALS AND SUPPLY COST	\$ 6,000
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL TRAVEL COST	\$ -
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL CONTRACT COST	\$ -
	\$ 13,569

Rainbow Bridge Post-Fire Response Plan | 2010

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
FY 2011	10/01/10	09/30/11	F	each	\$ 13,569	1	\$ 13,569
TOTAL					\$ 13,569	1	\$ 13,569

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, E, and 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

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TOTAL COST BY JURISDICTION

JURISDICTION	UNITS TREATED	COST
NPS - North Cascades NPS Complex	1	\$ 13,569
TOTAL COST		\$ 13,569

Rainbow Bridge Post-Fire Response Plan | 2010

PART F - INDIVIDUAL SPECIFICATION

TREATMENT/ACTIVITY NAME	Rainbow Bridge BAER Plan Prep	PART E SPECIFICATION #	O-1
NFPORS TREATMENT CATEGORY*	Planning	FISCAL YEAR(S) (list each year):	2010
NFPORS TREATMENT TYPE *	ES / BAER Plan	WUI? Y / N	Y
IMPACTED COMMUNITIES AT RISK	Stehekin	IMPACTED T&E SPECIES	Grey Squirrel (State Listed)

* 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):

Number and Describe Each Task:
A. General Description: Staff from North Cascades National Park, other PNW National Parks, and the National Interagency Fire Center developed the BAER Plan for the Rainbow Bridge fire. Staff met separately on two occasions due to staff availability and the need to conduct emergency assessments B. Location/(Suitable Sites): Team was based out of Stehekin, WA. C. Design/Construction Specifications: 1. Complete a BAER/BAR Plan for emergency stabilization and burned area rehabilitation treatments on the Rainbow Bridge fire. D. Purpose of Treatment Specifications: No treatments are prescribed under this specification. The planning activity is submitted as a specification in order to detail PWE E-13 costs for full transparency. E. Treatment Effectiveness Monitoring Proposed: Not Applicable.

LABOR, MATERIALS AND OTHER COST:

PERSONNEL SERVICES: (Grade @ Cost/Hour X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	COST / ITEM
NOTE: GRADES AND COST PER HOUR AVAILABLE UPON REQUEST	
Natural Resource Staff (Bivin \$4,220, Neel \$3,850, Gempko \$3,900)	\$ 11,970
Cultural Resource Staff (Mierendorf \$5,100)	\$ 5,100
Watershed Staff (Rasmussen \$5,550, Roche \$4,310)	\$ 9,860
Overhead (Oelfke \$7,220, Schwab \$460)	\$ 7,680
Information Technology (Valenti \$210)	\$ 210
TOTAL PERSONNEL SERVICE COST	\$ 34,820
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.	COST / ITEM
None	\$ -
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	\$ -
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	COST / ITEM
None	\$ -
TOTAL MATERIALS AND SUPPLY COST	\$ -
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	COST / ITEM
NOCA staff travel and per diem.	\$ 2,079
PWRO staff travel and per diem (Rasmussen \$1,325 Roche \$1,720)	\$ 1,329
FMPC staff travel and per diem (Schwab \$1,575)	\$ 1,575
Lake Chelan Boat Company ferry to Stehekin, 5 tickets x \$59/each	\$ 295
TOTAL TRAVEL COST	\$ 5,278
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	COST / ITEM
None	\$ -
TOTAL CONTRACT COST	\$ -
	\$ 40,098

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
FY 2010	08/06/10	09/21/10	F	Plan	\$ 40,098	1	\$ 40,098
TOTAL					\$ 40,098	1	\$ 40,098

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

Rainbow Bridge Post-Fire Response Plan | 2010

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 JURISDICTION

JURISDICTION	UNITS TREATED	COST
NPS North Cascades National Park Service Complex	1	\$ 40,098
	TOTAL COST	\$ 40,098

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PART F - INDIVIDUAL SPECIFICATION

TREATMENT/ACTIVITY NAME	BAER Implementation Leader	PART E SPECIFICATION #	O-2
NFPORS TREATMENT CATEGORY*	Administration	FISCAL YEAR(S) (list each year):	2010
NFPORS TREATMENT TYPE *		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):

Number and Describe Each Task:
A. General Description: Provide funding to support a part-time BAER Implementation Leader to ensure prompt implementation of the rehabilitation B. Location/(Suitable Sites): Rainbow Bridge Fire : North Cascades National Park C. Design/Construction Specifications: 1. Coordinate all aspects of rehabilitation actions approved in the Rainbow Bridge 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 in NFPORS, and coordinating w/ private landowners, universities, research groups and other affected agencies. 2. Contract and coordinate on-the-ground implementation of treatments including site orientation of contractors, developing daily/weekly work plans and supervising implementation activities. 3. Monitor work to ensure compliance with all relevant Federal laws and regulations. Such laws and regulation include but are not limited to NEPA and NHPA mitigation requirements and all OSHA regulations and safety standards. 4. Provide quarterly accomplishment reports in NFPORS and written fiscal year annual accomplishment reports detailing percent accomplishment for each project specifications, dates of completion, funds expended, quality control inspection reports, and treatment effectiveness monitoring reports. 5. 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 the three 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 BAER plan D. Purpose of Treatment Specifications: To provide fiscal support for proper administration of the short and long-term treatments prescribed in the Rainbow Bridge 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 prescribe within DOI policy and the BAER plan.

LABOR, MATERIALS AND OTHER COST: Fiscal Year 2011

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-11/2 Implementation Leader @ 38.03 / hr x 80 hrs	\$ 3,042
TOTAL PERSONNEL SERVICE COST	\$ 3,042
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.	COST / ITEM
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	\$ -
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL MATERIALS AND SUPPLY COST	\$ -
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL TRAVEL COST	\$ -
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL CONTRACT COST	\$ -
	\$ 3,042

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
FY 2011	10/01/10	09/30/11	F	year	\$ 3,042	1	\$ 3,042
TOTAL					\$ 3,042	3	\$ 3,042

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

Rainbow Bridge Post-Fire Response Plan | 2010

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

JURISDICTION	UNITS TREATED	COST
NPS North Cascades National Park Service Complex	1	\$ 3,042
	TOTAL COST	\$ 3,042

Rainbow Bridge Post-Fire Response Plan | 2010

PART F - INDIVIDUAL SPECIFICATION

TREATMENT/ACTIVITY NAME	Invasive Plant Species	PART E SPECIFICATION #	R-1
NFPORS TREATMENT CATEGORY*	Invasive Species	FISCAL YEAR(S) (list each year):	2011-2013
NFPORS TREATMENT TYPE *	Herbicide treatment	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):

Number and Describe Each Task:

A. General Description: Survey, map and eradicate cheatgrass populations expected to increase as a result of the Rainbow Bridge Fire. Install boot brushing stations (bench / educational sign) to advise hikers to help prevent the spread of cheatgrass at Rainbow Loop Trailheads (2 stations), Upper extent of the infestation on the Rainbow Creek Trail (1 station) and Boulder Creek trail.

B. Location/(Suitable Sites): Based on previously collected data, approximately 480 acres burned within the Rainbow Bridge Fire appear likely to become infested by cheatgrass if left untreated.

C. Design/Construction Specifications: Treatments will consist of spot herbicide applications to control expanding populations of cheatgrass in areas of differing burn severity. 1) Spring glyphosate herbicide applications will occur as average daily temperatures exceed 50 degrees Fahrenheit, and snowmelt allows for access to the site. Helicopter support will be necessary to move equipment (primarily herbicide, blivets of water and / or a pump with hoeslay to provide water for the application) to designated staging areas. Efficacy of Spring applications will be evaluated one month after treatment, at which point it will be determined if Fall Applications are necessary. Areas to be treated in the fall will be marked with stakes or pin-flags to allow a species selective application of imazapic herbicide to infested areas. Efficacy of Fall applications will be assessed in the Spring of the following year, and Spring Glyphosate applications repeated as necessary. Spring and Fall applications will be repeated as necessary, with the expectation of major recruitment from seed during the first two years. Field work will be conducted from April 1, 2011 - September 30, 2013. Install a total of four Boot Brushing stations in critical areas (trailheads and upper extent of the infestations along trails within the burn perimeter). Each station will consist of a bench, brushes, and an educational sign advising hikers in ways to prevent the spread of cheatgrass.

D. Purpose of Treatment Specifications: Control the spread of cheatgrass into susceptible burned areas. Expanding populations of cheatgrass would prevent the recovery of native vegetation, and if left unchecked, potentially change (shorten) the fire-cycle of the ecosystem favoring invasive vegetation and providing fine fuels that could ignite near-by unburned areas. This is supported by NPS policy, the NOCA GMP, and the draft NOCA Invasives Species Management Plan / EA.

E. Treatment Effectiveness Monitoring Proposed: Spring glyphosate treatments will be monitored one month post-treatment, and assessed a reduction in density and total cover. If necessary, Fall imazapic treatments will be scheduled to control either newly emerging populations, or areas where Spring treatment was deemed ineffective (less than 80% reduction in density / area). Fall treatments will be assessed in the Spring of the following year based on the same criteria as Spring treatments, and additional Spring / Fall treatments conducted for up to three years in order to deplete the cheatgrass seedbank. Efficacy monitoring will be conducted with a combination of GPS units and photo-documentation. Data will be analyzed at the end of three years in an effort to provide a better understanding of cheatgrass control in western coniferous forest ecosystems. Compliance will be completed via the NOCA Invasive Species Mgmt Plan/EA, with assistance provided through this specification.

LABOR, MATERIALS AND OTHER COST: FISCAL YEAR 2011

Do not include contract personnel costs here (see contractor services below).	COST / ITEM
GS-12 Plant Ecologist 80 hrs - 4,117	\$ 4,117
GS-11/2 Resource Specialist 160 hrs - 6,084	\$ 6,084
GS-9/6 Weed Scientist / GIS 240 hrs - 8,465	\$ 8,465
GS-7/1 Biological Science Technician (SEA) 80 hrs - 2,110	\$ 2,110
GS-7/1 Biological Science Technician 160 hrs - 3,955	\$ 3,955
GS-7/1 Biological Science Technician 160 hrs - 3,955	\$ 3,955
GS-5 Biological Science Technician 160 hrs - 3,192	\$ 3,192
GS-5 Biological Science Technician 160 hrs - 3,192	\$ 3,192
GS-4 Fire Crew (Pump and Hoselay) 80 hrs - 1,427	\$ 1,427
GS-4 Fire Crew (Pump and Hoselay) 80 hrs - 1,427	\$ 1,427
GS-7 Fire Crew (Helicopter Manager) 10 hrs - 250	\$ 250
GS-7 Interp 80 hrs - 1,978	\$ 1,978
GS-7 Biological Science Tech (Term) 480 hrs x 1yr: \$12,450 - to complete Invasives Plan/EA compliance	\$ 12,450
WG-5 - Trails Laborer x \$27.50 / hr x 40 hrs	\$ 1,100
WG-8 Trails Crew Leader x \$31.24 / hr x 40 hrs	\$ 1,250
TOTAL PERSONNEL SERVICE COST	\$ 54,952
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item):	COST / ITEM
Note: Purchases require written justification that demonstrates cost benefits over leasing or renting.	
Hughes 500 @ \$1,100 /hr x 10hr	\$ 11,000
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	\$ 11,000

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MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	COST / ITEM
Glyphosate herbicide @ \$33/gal X 15 gallons	\$ 165
Non-ionic surfactant @ \$19.50/gal X 15 gallons	\$ 293
Ammonium sulfate fines @ \$0.36 / lb x 250 lbs	\$ 90
Misc. PPE (gloves, eye protection, herbicide containment, wipes, hand cleaner) 1,000	\$ 1,000
Water Containment (1 Blivet) x 275 gallons (23lbs) or 55 gal blivets? (will use existing from cache)	\$ -
Imazapic herbicide @ \$197 / gal x 2.5 gallons	\$ 500
MSO surfactant @ 10 / gal x 5 gallons	\$ 50
Blue Dye @ 32.50 / gal x 5 gal	\$ 165
Boot brush stations: Sign construction, materials and shipping	\$ 2,000
TOTAL MATERIALS AND SUPPLY COST	\$ 4,263
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	COST / ITEM
Stehakin Ferry Travel - 8 persons x \$45 x 3 rt	\$ 1,080
Per diem - 8 persons x 150pp x 3pp	\$ 3,600
Housing 8 persons x \$10 x 6 days	\$ 480
TOTAL TRAVEL COST	\$ 5,160
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	COST / ITEM
	\$ -
TOTAL CONTRACT COST	\$ -
	\$ 75,375

LABOR, MATERIALS AND OTHER COST: FISCAL YEAR 2012

Do not include contract personnel costs here (see contractor services below).	COST / ITEM
GS-12 Plant Ecologist 80 hrs - 4,241	\$ 4,241
GS-11/2 Resource Specialist 160 hrs - 6,267	\$ 6,267
GS-9/6 Weed Scientist / GIS 240 hrs - 8,718	\$ 8,718
GS-7/1 Biological Science Technician (SEA) 80 hrs - 2,172	\$ 2,172
GS-7/1 Biological Science Technician 160 hrs - 4,073	\$ 4,073
GS-7/1 Biological Science Technician 160 hrs - 4,073	\$ 4,073
GS-5 Biological Science Technician 160 hrs - 3,288	\$ 3,288
GS-5 Biological Science Technician 160 hrs - 3,288	\$ 3,288
GS-4 Fire Crew (Pump and Hoselay) 80 hrs - 1,470	\$ 1,470
GS-4 Fire Crew (Pump and Hoselay) 80 hrs - 1,470	\$ 1,470
GS-7 Fire Crew (Helicopter Manager) 10 hrs - 254	\$ 254
GS-7 Interp 80 hrs - 2,036	\$ 2,036
TOTAL PERSONNEL SERVICE COST	\$ 41,350
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item):	COST / ITEM
Note: Purchases require written justification that demonstrates cost benefits over leasing or renting.	
Hughes 500 @ \$1,200 /hr x 10hr	\$ 12,000
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	\$ 12,000
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	COST / ITEM
Glyphosate herbicide @ \$33/gal X 15 gallons	\$ 165
Non-ionic surfactant @ \$19.50/gal X 15 gallons	\$ 293
Ammonium sulfate fines @ \$0.36 / lb x 250 lbs	\$ 90
Misc. PPE (gloves, eye protection, herbicide containment, wipes, hand cleaner) 500	\$ 500
Water Containment (1 Blivet) x 275 gallons (23lbs) or 55 gal blivets? (will use existing from cache)	\$ -
Imazapic herbicide @ \$197 / gal x 2.5 gallons	\$ 500
MSO surfactant @ 10 / gal x 5 gallons	\$ 50
Blue Dye @ 32.50 / gal x 5 gal	\$ 165
TOTAL MATERIALS AND SUPPLY COST	\$ 1,763
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	COST / ITEM
Stehakin Ferry Travel - 8 persons x \$45 x 3 rt	\$ 1,080
Per diem - 8 persons x 150pp x 3pp	\$ 3,600
Housing 8 persons x \$10 x 6 days	\$ 480
TOTAL TRAVEL COST	\$ 5,160
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	COST / ITEM
	\$ -
TOTAL CONTRACT COST	\$ -
	\$ 60,273

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LABOR, MATERIALS AND OTHER COST: FISCAL YEAR 2013

Do not include contract personnel costs here (see contractor services below).	COST / ITEM
GS-12 Plant Ecologist 80 hrs - 4,368	\$ 4,368
GS-11/2 Resource Specialist 160 hrs - 6,455	\$ 6,455
GS-9/6 Weed Scientist / GIS 240 hrs - 8,980	\$ 8,980
GS-7/1 Biological Science Technician (SEA) 80 hrs - 2,238	\$ 2,238
GS-7/1 Biological Science Technician 160 hrs - 4,196	\$ 4,196
GS-7/1 Biological Science Technician 160 hrs - 4,196	\$ 4,196
GS-5 Biological Science Technician 160 hrs - 3,386	\$ 3,386
GS-5 Biological Science Technician 160 hrs - 3,386	\$ 3,386
GS-4 Fire Crew (Pump and Hoselay) 80 hrs - 1,513	\$ 1,513
GS-4 Fire Crew (Pump and Hoselay) 80 hrs - 1,513	\$ 1,513
GS-7 Fire Crew (Helicopter Manager) 10 hrs - 262	\$ 262
GS-7 Interp 80 hrs - 2,098	\$ 2,098
TOTAL PERSONNEL SERVICE COST	\$ 42,591
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.	COST / ITEM
Hughes 500 @ \$1,300 /hr x 10hr	\$ 13,000
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	\$ 13,000
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	COST / ITEM
Glyphosate herbicide @ \$33/gal X 15 gallons	\$ 165
Non-ionic surfactant @ \$19.50/gal X 15 gallons	\$ 293
Ammonium sulfate fines @ \$0.36 / lb x 250 lbs	\$ 90
Misc. PPE (gloves, eye protection, herbicide containment, wipes, hand cleaner) - 250	\$ 250
Water Containment (1 Blivet) x 275 gallons (23lbs) or 55 gal blivets? (will use existing from cache)	\$ -
Imazapic herbicide @ \$197 / gal x 2.5 gallons	\$ 500
MSO surfactant @ 10 / gal x 5 gallons	\$ 50
Blue Dye @ 32.50 / gal x 5 gal	\$ 165
TOTAL MATERIALS AND SUPPLY COST	\$ 1,513
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	COST / ITEM
Stehekin Ferry Travel - 8 persons x \$45 x 3 rt	\$ 1,080
Per diem - 8 persons x 150pp x 3pp	\$ 3,600
Housing 8 persons x \$10 x 6 days	\$ 480
TOTAL TRAVEL COST	\$ 5,160
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL CONTRACT COST	\$ -
	\$ 62,264

SPECIFICATION COST SUMMARY

FISCAL YEAR		PLANNED COMPLETION DATE (M/D/YYYY)	WORK AGENT	UNITS	UNIT COST	PLANNED ACCOMPLISH MENTS	PLANNED COST
FY 2011	04/01/11	09/30/11	F	Acres	\$ 157	480	\$ 75,375
FY 2012	04/01/12	09/30/12	F	Acres	\$ 126	480	\$ 60,273
FY 2013	04/01/13	09/30/13	F	Acres	\$ 130	480	\$ 62,264
TOTAL					\$ 137	1440	\$ 197,912

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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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,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.	
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

Contract helicopter costs are from local contractor who has worked with NOCA for over 30 years; local horse packer is only packer in Stehekin Valley and has worked with the park for over 30 years as well.

TOTAL COST BY JURISDICTION

JURISDICTION	UNITS TREATED	COST
NPS North Cascades National Park	480	\$ 197,912
	TOTAL COST	\$ 197,912

Rainbow Bridge Post-Fire Response Plan | 2010

PART F - INDIVIDUAL SPECIFICATION

TREATMENT/ACTIVITY NAME	Invasive Plant Species	PART E SPECIFICATION #	R-2
NFPORS TREATMENT CATEGORY*	Invasive Species	FISCAL YEAR(S) (list each year):	2011-2013
NFPORS TREATMENT TYPE *	Hand Treatment	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):

Number and Describe Each Task:
A. General Description: Survey, map and eradicate invasive species on approximately 200 acres of WUI within the Rainbow Bridge Fire. Work will be conducted from May 1, 2011 - September 30, 2013. B. Location/(Suitable Sites): Detection and control of identified invasive species will occur within the burn areas along the WUI, along fire lines, helispots, private inholdings, (with Wyden Authority), contingency lines, staging areas, drop points, and any other off-site areas where fire-related suppression activities occurred. C. Design/Construction Specifications: 1) Monitoring will consist of field inventory and mapping of new invasive species populations. Invasive species will be mapped using GPS units. Density, cover and acreage will be recorded for each polygon. General site description including elevation, slope, aspect and canopy cover will be recorded. 2) Invasive plant populations will be removed mechanically, unless species do not respond to mechanical removal, or populations exceed the capacity of mechanical removal, in which case spot herbicide applications will be used. 3) Field work will be conducted May 1, 2011 - September 30, 2013. D. Purpose of Treatment Specifications: Prevent the spread of invasive species that may also serve as future fuels into the burned areas of the WUI. Protect the ecological integrity of the vegetative community at the site. Treatment specifications are supported by NPS policy, NOCA GMP, and the Fire Management Plan. E. Treatment Effectiveness Monitoring Proposed: Efficacy of Spring and Summer treatments will be monitored at one year intervals. Efficacy will be based on reduction in population size and density during each treatment year. If mechanical efforts prove ineffective after year one, the IPM process will be used to determine the next most appropriate treatment methodology. Efficacy monitoring will be conducted with a combination of GPS units and photo-documentation.

LABOR, MATERIALS AND OTHER COST: FISCAL YEAR 2011

Do not include contract personnel costs here (see contractor services below).	COST / ITEM
GS-11/2 Resource Specialist 80hrs - 3,042	\$ 3,042
GS-7 Biological Science Tech 80hrs - 1,978	\$ 1,978
GS-5 Biological Science Tech 80hrs - 1,596	\$ 1,596
GS-5 Biological Science Tech 80hrs - 1,596	\$ 1,596
GS-5 Biological Science Tech 80hrs - 1,596	\$ 1,596
GS-5 Biological Science Tech 80hrs - 1,596	\$ 1,596
TOTAL PERSONNEL SERVICE COST	\$ 11,404
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item):	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):	COST / ITEM
TOTAL MATERIALS AND SUPPLY COST	\$ -
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	COST / ITEM
Per Diem \$150 x 6 crew	\$ 900
Ferry Travel \$45 x 1 trip x 6 crew	\$ 270
Housing \$10x 6 days x 6 crew	\$ 360
TOTAL TRAVEL COST	\$ 1,530
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	COST / ITEM
	\$ -
TOTAL CONTRACT COST	\$ -
	\$ 12,934

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LABOR, MATERIALS AND OTHER COST: FISCAL YEAR 2012

Do not include contract personnel costs here (see contractor services below).	COST / ITEM
GS-11/2 Resource Specialist 80hrs - 3,134	\$ 3,134
GS-7 Biological Science Tech 80hrs - 2,036	\$ 2,036
GS-5 Biological Science Tech 80hrs - 1,643	\$ 1,643
GS-5 Biological Science Tech 80hrs - 1643	\$ 1,643
GS-5 Biological Science Tech 80hrs - 1643	\$ 1,643
GS-5 Biological Science Tech 80hrs - 1643	\$ 1,643
TOTAL PERSONNEL SERVICE COST	\$ 11,742
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item):	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):	COST / ITEM
TOTAL MATERIALS AND SUPPLY COST	\$ -
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	COST / ITEM
Per Diem \$150 x 6 crew	\$ 900
Ferry Travel \$45 x 1 trip x 6 crew	\$ 270
Housing \$10x 6 days x 6 crew	\$ 360
TOTAL TRAVEL COST	\$ 1,530
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL CONTRACT COST	\$ -
	\$ 13,272

LABOR, MATERIALS AND OTHER COST: FISCAL YEAR 2013

Do not include contract personnel costs here (see contractor services below).	COST / ITEM
GS-11/2 Resource Specialist 80hrs - 3,228	\$ 3,228
GS-7 Biological Science Tech 80hrs - 2,098	\$ 2,098
GS-5 Biological Science Tech 80hrs - 1,693	\$ 1,693
GS-5 Biological Science Tech 80hrs - 1,693	\$ 1,693
GS-5 Biological Science Tech 80hrs - 1,693	\$ 1,693
GS-5 Biological Science Tech 80hrs - 1,693	\$ 1,693
TOTAL PERSONNEL SERVICE COST	\$ 12,098
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item):	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):	COST / ITEM
TOTAL MATERIALS AND SUPPLY COST	\$ -
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	COST / ITEM
Per Diem \$150 x 6 crew	\$ 900
Ferry Travel \$45 x 1 trip x 6 crew	\$ 270
Housing \$10x 6 days x 6 crew	\$ 360
TOTAL TRAVEL COST	\$ 1,530
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL CONTRACT COST	\$ -
	\$ 13,628

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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
FY 2011	05/01/11	09/30/11	F	Acres	\$ 65	200	\$ 12,934
FY 2012	05/01/12	09/30/12	F	Acres	\$ 66	200	\$ 13,272
FY 2013	05/01/13	09/30/13	F	Acres	\$ 68	200	\$ 13,628
TOTAL					\$ 66	600	\$ 39,834

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,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.	
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

Contract helicopter costs are from local contractor who has worked with NOCA for over 30 years; local horse packer is only packer in Stehekin Valley and has worked with the park for over 30 years as well.

TOTAL COST BY JURISDICTION

JURISDICTION	UNITS TREATED	COST
NPS North Cascades National Park	600	\$ 39,834
	TOTAL COST	\$ 39,834

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PART F - INDIVIDUAL SPECIFICATION

TREATMENT/ACTIVITY NAME	Trails, Bridges, and Signposts	PART E SPECIFICATION #	R-3
NFPORS TREATMENT CATEGORY*	Trails	FISCAL YEAR(S) (list each year):	2011-2013
NFPORS TREATMENT TYPE *	Infrastructure	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):

Number and Describe Each Task:
A. 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). One side of a crib on one wooden bridge will be repaired. Four signposts will be replaced. Burned trails will need to be brushed to keep the tread surface walkable. B. Location/(Suitable Sites): Rainbow Loop trail; Rainbow Creek trail; Boulder Creek trail; Hooter Camp; Rainbow Bridge camp C. Design/Construction Specifications: 1) Repair sections of trail damaged due to fire effects; 2) Replace toilets at Hooter and Rainbow Bridge camps; 3) Repair burned crib section of Rainbow Creek bridge; 4) Brush lush new growth on trail tread surface to keep people on the trail; 5) All trail and bridge work will be completed according to NOCA trail standards; 6) Replace wooden signposts to indicate trail junctions, trails to camps, and trails to outhouses. D. Purpose of Treatment Specifications: Provide safe access for public and employees along trails within the burn area. E. Treatment Effectiveness Monitoring Proposed: Completion of proposed work.

LABOR, MATERIALS AND OTHER COST: FISCAL YEAR 2011

Do not include contract personnel costs here (see contractor services below).	COST / ITEM
WG-7 Maintenance Mechanic (Trails) @ \$32.65/hr x240	\$ 7,840
WG-4 Laborer (Trails) @ \$22.20/hr x 240	\$ 5,330
WG-4 Laborer (Trails) @ \$22.20/hr x 240	\$ 5,330
WG-4 Laborer (Trails) @ \$20.20/hr x 240	\$ 5,330
TOTAL PERSONNEL SERVICE COST	\$ 23,830
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.	COST / ITEM
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	\$ -
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	COST / ITEM
Outhouse lumber/materials, sign posts, log cribbing	\$ 500
TOTAL MATERIALS AND SUPPLY COST	\$ 500
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL TRAVEL COST	\$ -
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	COST / ITEM
Horse packing contract to haul crews/tools in to backcountry	\$ 500
Washington Conservation Corp crew for trail brushing (\$8000/pp for crew of 8, 1 payperiod)	\$ 8,000
Helicopter transport (Hughes 500, local contractor) of toilet, bridge cribbing, and sign materials @ \$1100/ hr x 4 hrs	\$ 4,400
TOTAL CONTRACT COST	\$ 12,900
	\$ 37,230

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LABOR, MATERIALS AND OTHER COST: FISCAL YEAR 2012

Do not include contract personnel costs here (see contractor services below).	COST / ITEM
WG-7 Maintenance Mechanic (Trails) @ \$33.65/hr x 80	\$ 2,695
WG-4 Laborer (Trails) @ \$22.90/hr x 80	\$ 1,835
WG-4 Laborer (Trails) @ \$22.90/hr x 80	\$ 1,835
WG-4 Laborer (Trails) @ \$22.90/hr x 80	\$ 1,835
TOTAL PERSONNEL SERVICE COST	\$ 8,200
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item):	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):	COST / ITEM
	\$ -
TOTAL MATERIALS AND SUPPLY COST	\$ -
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL TRAVEL COST	\$ -
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	COST / ITEM
Horse packing contract to haul crews/tools in to backcountry	\$ 550
Washington Conservation Corp crew for trail brushing (\$8500/pp for crew of 8, 1 payperiod)	\$ 8,500
TOTAL CONTRACT COST	\$ 9,050
	\$ 17,250

LABOR, MATERIALS AND OTHER COST: FISCAL YEAR 2013

Do not include contract personnel costs here (see contractor services below).	COST / ITEM
WG-7 Maintenance Mechanic (Trails) @ \$34.65/hr x 80	\$ 2,775
WG-4 Laborer (Trails) @ \$23.55/hr x 80	\$ 1,885
WG-4 Laborer (Trails) @ \$23.55/hr x 80	\$ 1,885
WG-4 Laborer (Trails) @ \$23.55/hr x 80	\$ 1,885
TOTAL PERSONNEL SERVICE COST	\$ 8,430
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item):	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):	COST / ITEM
	\$ -
TOTAL MATERIALS AND SUPPLY COST	\$ -
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL TRAVEL COST	\$ -
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	COST / ITEM
Horse packing contract to haul crews/tools in to backcountry	\$ 600
TOTAL CONTRACT COST	\$ 600
	\$ 9,030

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
FY 2011	04/01/11	09/30/11	F	Miles	\$ 9,308	4	\$ 37,230
FY 2012	04/01/12	09/30/12	F	Miles	\$ 4,313	4	\$ 17,250
FY 2013	04/01/13	09/30/13	F	Miles	\$ 2,258	4	\$ 9,030
TOTAL					\$ 5,293	12	\$ 63,510

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

Rainbow Bridge Post-Fire Response Plan | 2010

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,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.	
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

Contract helicopter costs are from local contractor who has worked with NOCA for over 30 years; local horse packer is only packer in Stehekin Valley and has worked with the park for over 30 years as well.

TOTAL COST BY JURISDICTION

JURISDICTION	UNITS TREATED	COST
NPS North Cascades National Park	4	\$ 63,510
	TOTAL COST	\$ 63,510

Rainbow Bridge Post-Fire Response Plan | 2010

PART F - INDIVIDUAL SPECIFICATION

TREATMENT/ACTIVITY NAME	MCH - Stehekin School	PART E SPECIFICATION #	R-4
NFPORS TREATMENT CATEGORY*	Heritage Resources	FISCAL YEAR(S) (list each year):	2011
NFPORS TREATMENT TYPE *	Protect Heritage Sites	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):

Number and Describe Each Task:

- A. General Description:** Application of Douglas-fir beetle anti-aggregation pheromone (MCH) to protect the live Douglas fir trees surrounding the Stehekin School site from beetle infestation.
- B. Location/(Suitable Sites):** Stehekin School
- C. Design/Construction Specifications:**
1. Secure the MCH packets to live trees within falling distance of the cultural site in April 2011.
 2. Apply at a rate 30 bubble caps /acre.
 3. Monitor the trees for signs of Doug Fir beetle infestation to determine if additional applications are necessary throughout the growing season.
- D. Purpose of Treatment Specifications:** To prevent mortality of Douglas fir trees within falling distance of the cultural site, due to increased probability of Douglas fir beetle presence and infestation of the burned areas surrounding the site.
- E. Treatment Effectiveness Monitoring Proposed:** Monitor trees for signs of Doug fir beetle infestation (frass and/or pitch stream)

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
Negligible	
TOTAL PERSONNEL SERVICE COST	\$ -
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.	COST / ITEM
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	\$ -
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	COST / ITEM
MCH (3-methyl cyclohex-2-en-1-one) bubble caps @ \$2 x 100	\$ 200
TOTAL MATERIALS AND SUPPLY COST	\$ 200
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	COST / ITEM
None	
TOTAL TRAVEL COST	\$ -
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	COST / ITEM
None	
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
FY 11	04/01/11	05/01/12	F	acre	\$200	3	\$ 200
TOTAL					\$ 200	3	\$ 200

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.	M
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

JURISDICTION	UNITS TREATED	COST
National Park Service	3	\$ 200
TOTAL COST		\$ 200

Rainbow Bridge Post-Fire Response Plan | 2010

PART F - INDIVIDUAL SPECIFICATION

TREATMENT/ACTIVITY NAME	BAR Implementation Leader	PART E SPECIFICATION #	R-5
NFPORS TREATMENT CATEGORY*	Administration	FISCAL YEAR(S) (list each year):	2011 / 2012 / 2013
NFPORS TREATMENT TYPE *	Contract Administration	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):

Number and Describe Each Task:
A. General Description: Provide funding to support a part-time BAR Implementation Leader to ensure prompt implementation of the rehabilitation B. Location/(Suitable Sites): Rainbow Bridge Fire : North Cascades National Park C. Design/Construction Specifications: 1. Coordinate all aspects of rehabilitation actions approved in the Rainbow Bridge 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 in NFPORS, and coordinating w/ private landowners, universities, research groups and other affected agencies. 2. Contract and coordinate on-the-ground implementation of treatments including site orientation of contractors, developing daily/weekly work plans and supervising implementation activities. 3. Monitor work to ensure compliance with all relevant Federal laws and regulations. Such laws and regulation include but are not limited to NEPA and NHPA mitigation requirements and all OSHA regulations and safety standards. 4. Provide quarterly accomplishment reports in NFPORS and written fiscal year annual accomplishment reports detailing percent accomplishment for each project specifications, dates of completion, funds expended, quality control inspection reports, and treatment effectiveness monitoring reports. 5. 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 the three 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: To provide fiscal support for proper administration of the short and long-term treatments prescribed in the Rainbow Bridge 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 prescribe within DOI policy and the BAR plan.

LABOR, MATERIALS AND OTHER COST: Fiscal Year 2011

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-11/2 Implementation Leader @ 38.03 / hr x 160 hrs	\$ 6,084
TOTAL PERSONNEL SERVICE COST	\$ 6,084
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.	COST / ITEM
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	\$ -
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL MATERIALS AND SUPPLY COST	\$ -
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL TRAVEL COST	\$ -
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL CONTRACT COST	\$ -
	\$ 6,084

Rainbow Bridge Post-Fire Response Plan | 2010

LABOR, MATERIALS AND OTHER COST: Fiscal Year 2012

Do not include contract personnel costs here (see contractor services below).	COST / ITEM
GS-11/2 Implementation Leader @ 39.17 / hr x 160 hrs	\$ 6,268
TOTAL PERSONNEL SERVICE COST	\$ 6,268
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.	COST / ITEM
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	\$ -
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL MATERIALS AND SUPPLY COST	\$ -
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL TRAVEL COST	\$ -
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL CONTRACT COST	\$ -
	\$ 6,268

LABOR, MATERIALS AND OTHER COST: Fiscal Year 2013

Do not include contract personnel costs here (see contractor services below).	COST / ITEM
GS-11/2 Implementation Leader @ 40.35 / hr x 160 hrs	\$ 6,455
TOTAL PERSONNEL SERVICE COST	\$ 6,455
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.	COST / ITEM
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	\$ -
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL MATERIALS AND SUPPLY COST	\$ -
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL TRAVEL COST	\$ -
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL CONTRACT COST	\$ -
	\$ 6,455

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
FY 2011	10/01/10	09/30/11	F	year	\$ 6,645	1	\$ 6,084
FY 2012	10/01/11	09/30/12	F	year	\$ 6,840	1	\$ 6,268
FY 2013	10/01/12	09/30/13	F	year	\$ 7,045	1	\$ 6,455
TOTAL					\$ 20,530	3	\$ 18,807

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

JURISDICTION	UNITS TREATED	COST
NPS North Cascades National Park	3	\$ 18,807
TOTAL COST		\$ 18,807

APPENDIX 1: ENVIRONMENTAL COMPLIANCE



RAINBOW BRIDGE 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 Rainbow Bridge 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 Rainbow Bridge 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 Rainbow Bridge 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 Rainbow Bridge 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 Rainbow Bridge Fire Burned Area Post-Fire Response Plan.

C. Summary of Compliance Documentation Relevant to the Rainbow Bridge Post-Fire Response Plan

The following table summarizes the existing NEPA or NHPA compliance in place for the BAER/BAR treatments proposed for the Rainbow Bridge fire. Two treatments may involve ground disturbance and thus would require archeological consultation; one treatment will require completion of an Environmental Assessment before implementation is allowed.

Treatment or Action	NEPA documentation (EIS, EA, or Cat Ex)	Reference to Assessment	Findings of Significance
BAER - W1: Warning Signs	DO-12 CE: 3.4 G.2; 3.4 C.5	Watershed	No Significant Impact; may require archeological consultation
BAER – O-1: BAER assessment and planning	DO-12 CE: 3.3.U	N/A	No Significant Impact
BAER O-2: BAER Implementation Leader	DO-12 CE: 3.3.A	N/A	No Significant Impact
BAR – R-1: Herbicidal treatment of invasive species	Requires completion of NOCA Invasive Species Mgmt Plan	Vegetation	Requires Environmental Assessment as part of NOCA Invasive Species Mgmt Plan; No Significant Impacts expected
BAR – R-2: Manual treatment of invasive species	DO-12 CE: 3.4 E.2; NOCA Invasive Species Mgmt Plan will also cover this	Vegetation	No Significant Impact
BAR – R-3: Repair of minor facilities.	DO-12 CE: 3.4 C.3; DO-12 CE: 3.4 G.2	Minor Facilities	No Significant Impact; may require archeological consultation
BAR – R-4: MCH treatment around cultural resource	DO-12 CE: 3.4 G.2	Cultural	No Significant Impact
BAR – R-5: BAR Implementation leader	DO-12 CE: 3.3.A	N/A	No Significant 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
- Bob Mierendorf, Archeologist, NOCA
- Dr. Jesse Kennedy, Cultural Resource Mgmt Specialist, NOCA
- Robert Kuntz, Wildlife Biologist, NOCA
- 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 Rainbow Bridge fire perimeter.

The Washington State Historic Preservation Officer will be contacted. Should any BAER or BAR treatments lead to activities that may impact cultural resources, consultation will be initiated before any actions are implemented.

Tribal consultation has been initiated (Sept 2010) by North Cascades National Park Service Complex staff (park archeologist) regarding fire suppression and fire effects resulting from the Rainbow Bridge fire.

CONCLUSION

I have reviewed the treatments in the 2010 Rainbow Bridge 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, Rainbow Bridge BAER Team Leader, Sept. 18, 2010

Approved: _____
Superintendent, North Cascades NPS Complex Date