USDA-FOREST SERVICE FS-2500-8 (6/06)

Date of Report: 09/06/2013

BURNED-AREA REPORT
(Reference FSH 2509.13)

PART I - TYPE OF REQUEST

A. Type of Report

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

B. Type of Action

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

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

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

PART II - BURNED-AREA DESCRIPTION

A. Fire Name: Eureka

B. Fire Number: MT-BDF-000181

C. State: Montana

D. County: Madison

E. Region: Northern (1)

F. Forest: Beaverhead-Deerlodge

G. District: Madison

H. Fire Incident Job Code: P1HU8T

I. Date Fire Started: August 12, 2013

J. Date Fire Contained: Not yet contained

K. Suppression Cost: $5.0 million

L. Fire Suppression Damages Repaired with Suppression Funds
1. Hand Line (miles):
2. Dozer Line (miles): 6.4 miles of contingency line, mostly dozer and skidgine, small amount of hand line
3. Other (identify): 0

M. Watershed Numbers: 10020003102, 10020003103, 100200070601,100200070603

N. Total Acres Burned:
NFS Acres(6,468) BLM (0) State (0) Private (0)

O. VegetationTypes: Whitebark pine,subalpine fir, lodgepole pine, spruce. Grass within the fire perimeter did not burn.

P. Dominant Soils:

The Eureka fire is located in a area of complex geology composed primarily of various types of sedimentary rock. The table below lists the most common landforms in the fire perimeter.

Map Unit	Landform	Parent Material	Soil Classification
704	Landslide Deposits	Complex landslide deposits over limestone, sandstone, and shale residuum	Fine-loamy, mixed, superactive Pachic Haplocryolls
524	Gentle Mountain Slopes	Limestone, sandstone, and shale colluvium	Loamy-skeletal, mixed, superactive Typic Eutrocryepts
534	Moderately Steep Mountain Slopes	Limestone, sandstone, and shale colluvium	Fine, mixed, superactive Ustic Argicryolls

The most dominant landform is landslide deposits. These areas have complex, rolling topography, much like that found in glacial moraine deposits. Some areas contain kettle ponds. Much of this landform is located in the Coal Creek watershed and is vegetated with grass and smaller clumps of timber, including whitebark pine, spruce, and subalpine fir. Some limited areas on mid and upper slopes do not support vegetation and are actively sloughing material. Islands of unburned grass are interspersed with larger areas of primarily moderate burn severity.

Limited areas of the forested headwater slopes of Perkins Creek burned at high and moderate severity, right down to the creek. Moderately steep slopes with short runs of steep slopes combined with deep, fine-textured, naturally erosive soils and high and moderate burn severity with associated hydrophobicity, justify in-channel treatments such as trash racks to reduce the amount of sediment impacting Perkins and Coal Creek. Perkins is not 303d listed, but it drains into Coal Creek, which is a 303d listed stream for sediment impairments.

Other landforms in the fire area include gentle mountain slopes and moderately steep mountain slopes with various sedimentary geology types including limestone, sandstone, and shale.

Q. Geologic Types: The most common geology type in the fire area is landslide deposits of Holocene and Pleistocene age. These deposits are up to 60 meters thick and are comprised of coarse, unconsolidated deposits of locally derived, angular pebbles, cobbles, and boulders associated with fine-grained matrix of silt and sand. On south and east sides of Gravelly Range, huge landslides where length and width are measured in kilometers include large toreva blocks of Huckleberry Ridge Tuff deposited on unconsolidated sand and silt of the Neogene Six Mile Creek Formation.

   Other common geology types in the fire area include the Frontier and Muddy formations of Upper Cretaceous age, and the Mowry Formation, Thermopolis Shale, and the Kootenai Formation of Lower Cretaceous age. These formations are all comprised of various types of sedimentary rock including sandstone, limestone, mudstone, shale, bentonite, and siltstone.

R. Miles of Stream Channels by Order or Class:

Stream miles by order within perimeter.

Stream Order	Length (Miles)
1	9
2	0
3	0
4	0
5	0

Grand Total	9

S. Transportation System

Trails: 3.9 miles Roads: 3.3 miles

PART III - WATERSHED CONDITION

A. Burn Severity (acres): 2,163 (unburned); 1,472 (low); 2,243 (moderate); 590 (high),

Burn Severity	Acres
Unburned/Very Low	2,163
Low	1,472
Moderate	2,243
High	590

B. Water-Repellent Soil (acres): All high severity and some moderate portions have varying degrees of water repellency. North facing slopes were observed to have stronger hydrophobicity than south facing slopes.

C. Soil Erosion Hazard Rating (acres):

Erosion Hazard Rating	Acres
Low	515
Moderate	4,850
High	1,103

D. Erosion Potential: 3 tons/acre (disturbed WEPP, 10-year return period, Perkins Creek modeled, Lakeview, MT climate adjusted for location (correct lat/long and elevation) using PRISM) This event has a ~50% chance of happening during a 5 year recovery period. There is a ~25% chance of 6 tons/acre of erosion occurring during a 5 year recovery period.

E. Sediment Potential: 2.1 tons/acre (disturbed WEPP, same run as erosion potential above). This event has a ~50% chance of happening during a 5 year recovery period. There is a ~25% chance of 5.4 tons/acre of sedimentation occurring during a 5 year recovery period.

PART IV - HYDROLOGIC DESIGN FACTORS

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

B. Design Chance of Success, (percent): 90

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

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

E. Design Storm Magnitude, (inches): 4.2 inches

F. Design Flow, (cubic feet / second/ square mile): 15 cfs/mi^2

G. Estimated Reduction in Infiltration, (percent): 75

H. Adjusted Design Flow[1,2] (cfs per square mile): 67 cfs/sq.mi. (entire watershed including unburned portions)

[1]Based on Forest Service Peak Flow Calculator.

A high intensity thunderstorm has the potential to produce relatively large flood events. Due to post fire bulking of flow with sediment and other debris and the likelihood of in channel log jam failure (breach hydrology) it is difficult to accurately model post fire peak discharge. Smaller watersheds areas such as the 1.8 mi^2 portion of the Sleeping Child watershed on the Bitterroot NF which burned at moderate to severe intensity yielded 111 cfs/mi2 following 0.66" in a 30 min. convectional storm. This 10 to 25 year return interval yielded >500 year return interval bulked flow. Over 400 cfs/mi^2 was measured following 0.41" of rainfall in 30 minutes on the severely burned 2.3 mi2 Crittenden Gulch watershed on the Helena NF. This 30 minute storm event was a 2-5 year return interval yielded a 200 year return interval runoff event (USGS WRI Report 03-4319). In lower gradient stream reaches, significant deposition is possible which raises the channel bed and makes more stream adjacent areas susceptible to flood flows. This deposition may also reduce local channel gradient and induce channel meander, further adding to the post fire risks of flooding.

PART V - SUMMARY OF ANALYSIS

A. Describe Critical Values/Resources and Threats:

Summary of Potential Watershed Response

The Eureka fire burned high elevation (~9,000 feet) stands of subalpine fir, whitebark pine, and spruce on moderate and steep mountain slopes along the top of the Gravelly Mountains. These high elevation stands are interspersed with large, gently rolling grassy parks, which did not burn. There is a high proportion of unburned and low burn severity with this fire, and more limited areas of moderate and high burn severity. It is the location of the moderate and high burn severity in relation to road and trail structures and 303d listed streams with conservation populations of cutthroat trout that warrant road and trail work in locations across the fire, and limited in-channel treatments in Perkins Creek (see Figure 1, below) to accommodate expected higher flows and bulking associated with post-fire runoff.

[2] Post-fire runoff events are extremely variable. Relatively small storm events (2-5 year recurrence interval) can produce very large flood events. The adjusted design discharge represents the entire burned area. Past post-fire measurements indicate there is potential for much larger runoff events to occur (Parrett et al. 2004. USGS WRIR 03-4319).

Figure 1. Representative photo of burned conditions above Perkins Creek.

The majority of precipitation in the burned area occurs as snow during the winter months. Peak runoff typically occurs during snowmelt, but spring and summer thunderstorms often produce runoff events. Runoff potential is relatively high in areas that have moderate and high burn severity. Hillslopes vary from rolling to moderately steep with a low to moderate rock content. In areas classified as low burn severity, needle-cast has created a degree of ground cover which will slow runoff and enhance infiltration during rain events.

A few small thunderstorms have brought 0.1 to 0.2 inches of rain to the fire. No evidence of overland flow was observed; however, the rain was not continuous across the burned area.

Soil hydrophobic conditions were investigated in unburned, moderate and high burn severity areas in the West Fork of the Madison River near the West Fork cabin. Unburned soils on north facing slopes are strongly hydrophobic down to 3 inches. On north facing slopes, high burn severity areas also have hydrophobic areas down to 3 inches. South facing slopes with high burn severity were not found to be hydrophobic below ½ inch.

The Eureka fire burned the headwaters of 4 sub-watersheds with a mosaic pattern of low to high burn severity. Where contiguous forest stands were present, burn severity was generally moderate to high with the largest blocks of high burn severity occurring on north facing slopes. Most of the grass parks present did not burn or burned very lightly which created the mosaic pattern found on the ground. Spotting distances were long, however, and most forested blocks were burned within the fire perimeter.

<u>Elk River</u>
A small area in very headwaters of Elk River burned on the slopes of Black Butte which are very steep and have a high number of dead Whitebark Pine, which increased the fire severity in some stands including a small basin above the 9653 Road. There is evidence of high flows and alluvial fan development below this small basin and we would expect a large event following the fire based on the areas burned. This has prompted us to propose hardened crossings in two locations along Road 9653 and Trail 6402 to minimize the impact to FS infrastructure and allow the event to occur and not destroy the road/trail prisms and mobilize it into the upper parts of Elk River. This is especially important because Elk

River is a 303d listed stream. This was the only noteworthy location we found that would have considerable impacts to Elk River.

East Fork Ruby

The East Fork of the Ruby headwaters did burn, but many areas are buffered with a wide riparian corridor. Extensive areas of beaver activity are also present providing good catchment areas for the increased sediment expected from post-fire runoff. The FS infrastructure at risk in this watershed is limited to a trail which burned moderately in a couple of sections and an admin road that had some crossings on tributaries coming off of Black Butte. The activities proposed are limited trail work on Trail 6402 to prevent erosion, and a crossing on Road 6404 to handle higher flows expected.

Headwaters Ruby River

Coal Creek and its primary tributary Perkins Creek were the watersheds most affected by the Eureka Fire. The largest area of moderate and high severity fire was found in the Perkins Creek. Some areas of the watershed had all of the adjacent slopes burned and others had some riparian buffers. Perkins Creek is the stream where we expect the largest flooding events to occur due to the amount of the watershed burned and the severity of the fire. The stability of the channel is a concern from a sediment and fisheries standpoint, so we plan to strategically place a few trash racks between the confluence of Coal Creek and the headwaters to store transported materials and dissipate energy to alleviate effects downstream and in sensitive areas. This is especially important because Coal Creek is 303d listed for sediment and has a number of stream segments that could degrade and possibly entrench downstream.

West Fork Madison

The very upper portion of the West Fork burned with varied intensity, some areas were buffered by a gradual unburned riparian corridor and other locations burned down to the creek with increased runoff and debris anticipated from fire effects. This is important because the upper burned area was above Road 9628 which has a number of structures that are at high risk of failure with the higher post-burn flows expected. We have proposed a number of projects (see cost spreadsheet) to replace these high risk structures to account for the expected increased flows. This should reduce the risk for more sediment delivery from structure failure to a sediment listed stream and provide more vertical stability by allowing more flow to be passed. Below the road there are some heavily burned areas but it constitutes such a small part of the watershed and the distance to FS infrastructure is so great that we do not anticipate the need to do any additional work to stabilize slopes or dissipate energy due to the nature of the stream.

Values at Risk:

The risk matrix below was used to evaluate the Risk Level for each value identified during Assessment (Exhibit 2 of Interim Directive No.: 2520-2010-1). Proposed treatments and their associated risk levels are discussed below in the following categories: Life, Property, and Natural Resources.

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

Human Life and Safety: *Human/Bear Encounters*

The Eureka fire is located in the Gravelly range on the Madison Ranger District and is part of the Greater Yellowstone Ecosystem. This area is currently occupied by grizzly and black bears and human/bear

encounters are common in this area, especially during fall hunting season. The Madison District typically has one human/bear conflict a year where injuries are sustained and these encounters usually occur in the Gravelly Range.

Since the fire, grizzly and black bear encounters with firefighters and other personnel are increasing due to the activity associated with the fire. Additionally, the location of bears in the area has been unpredictable since the fire. During suppression activities, human safety related to bear encounters was one of the main concerns for personnel fighting the fire. Since this fire is located in such a popular hunting area and archery season opens in seven days, human life and safety is a main concern, particularly near the fire area. Communicating to the public about the displacement of bears in the area and the unpredictability of bear movements in the area is key to ensuring the public is prepared when they encounter grizzly or black bears this fall. Fire killed carrion may explain some of the increased bear encounters.

Risk Assessment—Threats to forest users (primarily hunters) from erratic bear behavior and an increased risk of grizzly and black bear encounters.

Probablity of Damage or Loss: Likely

Magnitude of Consequence: Major – Loss of life or injury to humans

Risk Level: Very High – Fund GS-6 Bear Aware employee for 10 days to perform public contacts, work with game officials, produce news releases, and produce and place signs informing them of the risk of bear encounters, and required food storage regulations.

Signs will also be made that worn about additional risks due to the fire such as rolling rocks and hazard trees.

Human Life and Safety: *Roads*
The monetary costs associated with not completing the proposed work is difficult to estimate based on the range of probabilities for runoff events over the next couple of years, when significant effects are anticipated. The ecological effects are easier to account for given the existing condition of the sites in question.

In the West Fork of the Madison watershed, there are 4 structures that are proposed for replacement located on main system roads accessing the area. All of the structures have varying degrees of burn severity in the drainage basins above the structures. Engineering and hydrology staff surveyed the current structures and found evidence that they were not capible of handling post fire flow events. The probability of failure is very high from the expected increase in flow and debris from fire response.

The failure of the structures is only part of the cost when comparing the no-action to the proposed actions. The greater cost is the ecological cost of a catastrophic failure which would completely take out the road which acts as a dam during a high flow event. The road prism failure adds exponentially more sediment to downstream sections of perennial streams which are currently on the 303d list for sediment impairments. The roads in question are heavily used roads that provide access FS cabins and a number of recreation sites on a loop route.

The upper East Fork of the Ruby and Elk River are additional watersheds that have some proposed work. The Road and Trail in question (9653 and 6402) are not as heavily used as the roads in the West Fork of the Madison and which can be modified more cost effectively to account for the increase on water yield and runoff debris anticipated from fire effects. There are currently some culverts in place that will not handle post-fire increased flows. We propose to remove and install hardened crossings that will stabilize the road prism and allow the high flows to pass over the road without displacing the road which is expected to occur if the proposed actions are not completed. The no-action would allow the high flow

events to transport sections of the road and the structures present downstream into two streams listed for sediment impairments.

Risk Assessment – Threats to road users from hazard trees and/or falling rocks

Probablity of Damage or Loss: Very Likely

Magnitude of Consequence: Moderate – personal injury, moderate property damage

Risk Level: Very High

Natural Resources: Soil Productivity, Water Quality, and TES Aquatic Species and Habitat

Areas burned at high and moderate severity are at elevated risk of soil erosion. Soils in moderate and high severity are hydrophobic. Accelerated erosion and sediment delivery are very likely to occur, but will decrease as vegetation becomes established. Needle cast in low burn severity areas will reduce potential erosion and sediment delivery.

Risk Assessment – Threats to soil productivity, watershed function, and fisheries

Probablity of Damage or Loss: Very Likely – These watersheds naturally move high sediment loads; increased bare ground and hydrophobic soils will likely result in higher sediment loads.

Magnitude of Consequence: Moderate – systems naturally move high sediment loads; most major streams in the fire area are 303d listed for sediment impairment. Four drainages within the fire perimeter are inhabited by Westslope cutthroat trout conservation populations and Western/Boreal toad (both TES aquatic species) and are considered aquatic resource values at risk. The drainages include Coal and Basin creeks and the East Fork Ruby and West Fork Madison Rivers. These drainages are tributaries to the Ruby and Madison Rivers. Moderate and high burn severity acres are limited in extent and proximity to streams. There is a good deal of green buffer around most stream miles in the burned area.

Risk Level: Very High – Although limited in extent, there is enough moderate and high burn severity acreage in close proximity to Perkins Creek to warrant installation of bioengineered trash racks near the head of the creek to collect sediment to reduce the amount entering Coal Creek, a 303d listed stream for sediment impairment. Proposed road and trail work will also reduce sediment entering streams in the fire area due to culverts that are unlikely to handle post-fire increased flows, and insufficient drainage.

Natural Resources: Native Plant communities

The area of the fire is relativily pristine and noxious weed free. There are known infestations of Canada thistle within and adjacent to burned areas. Noxious weed infestations of yellow toadflax, spotted knapweed and houndstongue are known along the access routes into the area. Also, many resources assigned to the fire originated from major noxious weed epicenters. A weed wash station was implemented early on the incident but the potential for weed seed introduction was still present.

Risk Assessment – Threats to native plant communities due to the establishment or spread of noxious weeds.

Probablity of Damage or Loss: Very Likely - Based on moderate and high burn severity and proximity to known weed infestations.

Magnitude of Consequence: Major – Loss of native plant communities and spread of noxious weeds.

Risk Level: Very High – Primary risk comes from the existing infestations within and adjacent to burned area along with introduction of noxious weed seed from fire fighting resources. Invasive species detection surveys and treatment within and adjacent to the burned area is warranted.

B. Emergency Treatment Objectives:

As noted above, threats to life, property, and/or natural resources could potentially result from post-fire conditions in the burned area. For these reasons the primary treatment objectives are:

- Minimize threats to forest users (primarily hunters) from erratic bear behavior and an increased risk of grizzly and black bear encounters through public contact, signing, news releases, and bordcasts of the public about the risks involved with recreating in the area.
- Minimize potential effects of post-fire conditions on native plant communities by assessing and controlling noxious weeds.
- Install 3 warning signs at appropriate locations to warn forest visitors of post-fire hazards. Signs will be placed in the following drainages that have road and trail access:
    - At Poison Creek on the east end of trail 9647
    - On the Gravelly Ridge Road (290) at intersection with Road 9653 that accesses Rebish Sheep Headquarters
    - On the Gravelly Ridge Road (290) at intersection with Road 347 in the Eureka Basin area on the southeast portion of the fire
- Reduce fire related sediment increases in watersheds that are already 303d listed for sediment impairments.
    - Elk River:
        - Replace one pipe with an armored ford .
        - Install five drain dips.
    - East Fork of the Ruby River:
        - Replace one pipe with armored ford.
        - Install fourty-four drain dips.
    - West Fork of the Madison River:
        - Replace six culverts in the West Fork of the Madison River.
    - Headwaters of Ruby River:
        - Place three bioengineered trash rack in the headwaters of Perkins Creek.

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

Land **90** % Channel **50** % Roads/Trails **90** % Protection/Safety **75** %

D. Probability of Treatment Success

	Years after Treatment		
	1	3	5
Land	90	80	70
Channel	50	40	30
Roads/Trails	90	85	80
Protection/Safety	75	75	75

E. Cost of No-Action (Including Loss): $300,000 (does not include potential injury or death due to bear incounter)

F. Cost of Selected Alternative (Including Loss): There remains a 25% chance that the proposed treatments for this initial work may not succeed. Total cost of the action alternative ($127,045) plus this 25% chance of failure is $157,218.

G. Skills Represented on Burned-Area Survey Team:

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

Name	Function	Unit
Pam Fletcher	Team Leader, Soils	Beaverhead-Deerlodge NF
Kevin Weinner	Hydrology	Beaverhead-Deerlodge NF
Darin Watschke	Fisheries	Beaverhead-Deerlodge NF, Madison RD
Kevin Suzuki	Range, Weeds	Beaverhead-Deerlodge NF, Madison RD
Chris Murphy	Engineering	Beaverhead-Deerlodge NF
Kendra Bull	Engineering	Beaverhead-Deerlodge NF
Charlotte Corbett	GIS	Beaverhead-Deerlodge NF

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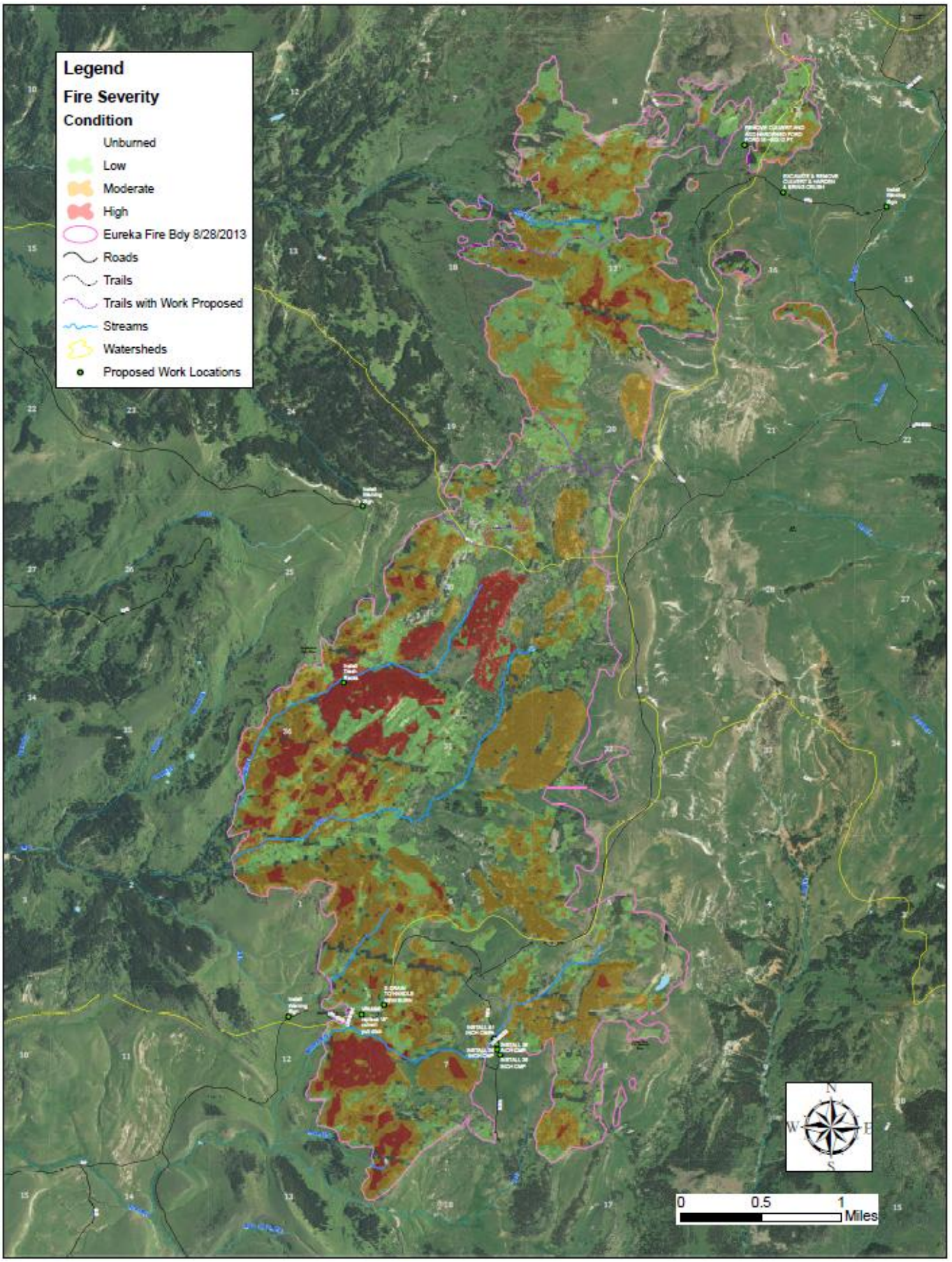
H. Treatment Narrative:

See map on next page for locations of proposed treatments. The proposed treatments on National Forest System lands can help to reduce the impacts of the fire, but treatments will not completely mitigate the effects of the fire. The treatments listed below are those that are considered to be the most effective on National Forest System lands given the local setting including topography and access. The attached Excel worksheet summarizes the funding request.


Legend
Fire Severity
Condition
Unburned
Low
Moderate
High
Eureka Fire Bdy 8/28/2013
Roads
Trails
Trails with Work Proposed
Streams
Watersheds
Proposed Work Locations
N
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1
Miles

Protection/Safety Treatments:

- Install 3 signs warning forest users of hazards associated with the fire (rolling rocks, falling trees).
- Make public contact, place multiple warning signs, and develop news releases regarding the increased risk of bear encounters due to erratic behavior caused by the fire.

Land Treatments:

- Spray noxious weeds on 75 acres.
- Assess noxious weed spread on approximately 950 acres.

Channel Treatments

- Three bioengineered trash racks to be installed in Perkins Creek.

Road and Trail Treatments:

- Elk River:
  - Replace one pipe with an armored ford (Road 9653).
  - Install five drain dips (Road 9653, Trail 6401).
- East Fork of the Ruby River:
  - Replace one pipe with armored ford (Trail 6402).
  - Install fourty-four drain dips (Trail 6402, Trail 6404, Trail 6411).
- West Fork of the Madison River:
  - Replace six culverts in the West Fork of the Madison River (Road 290, Road 9628).

I. Monitoring Narrative:

Effectiveness of weed treatments will be monitored through visual observation. Continual assessment of weed establishment and spread will occur this fall and in early next spring.

Monitoring of the proposed channel treatment in Perkins Creek and the road and trail treatments by a hydrologist and fish biologist should be performed after large storm events to monitor the success of the treatments.

PART VII - APPROVALS

1. /s/Timothy Garcia _____ 9/06/2013
   Forest Supervisor Date

2. /s/ Faye Krueger _____ 9/ /2013
   Regional Forester Date