USDA-FOREST SERVICE FS-2500-8

Date of Report: 9/12/2014

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: Thompson River Complex

B. Fire Number: MT-LNF-005093

C. State: MT

D. County: Sanders

E. Region: 01

F. Forest: Lolo

G. District: Plains Thompson Falls

H. Fire Incident Job Code: P1JAQO

I. Date Fire Started: 8/01/2014
rain slowed fire on August 20,2014

J. Date Fire Contained: not contained as of 8/26/2014 Rain

K. Suppression Cost: As of 8/22/2014 $8,350,000

L. Fire Suppression Damages Repaired with Suppression Funds
1. Dozer Fireline repaired (miles): 2.38 miles of line repair ongoing as of 9/07/2014
2. Hand Fireline repaired (miles): 14.46 repair ongoing as of 9/07/2014

M. Watershed Numbers: National Forest

170102130407, 170102130405, 170102130512

N. Total Acres Burned: NFS: 1588 acres Other Federal (BLM): -0- State: 51 acres Private: .2 acre

O. Vegetation Types:

The fire complex encompasses various forest types from the low elevation, wet cedar bottoms to the mid-elevation dry Douglas fir and ponderosa pine ridges to the non-forested, alpine meadows and avalanche chutes. The various tree types include cedar, Douglas fir, ponderosa pine, grand fir, western larch, western white pine, lodgepole pine, mountain hemlock, spruce, whitebark pine, and subalpine fir.
The break down of forest types in acres is as follows:

Forest type	**Acres**
Cedar	182
Douglas fir	626
Ponderosa pine	96
Grand fir	311
Western larch	95
Lodgepole pine	35
Western hemlock/ subalpine fir	17
Subalpine fir	45
Non-forested	174

P,Q. Dominant Soils and Geologic Type:

Soils within the Thompson River Complex perimeter are weakly developed, shallow to moderately deep with gravelly to extremely gravelly, silty loam textures. Parent Material is primarily composed of Argillites, Siltites, and Quartzites from the belt supergroup, with a limestone component in some areas. Primary taxonomic classifications include: Andic and Typic Ustocrepts, Mollic Eutroboralfs, Dystric and Andic Eutrocrepts, Andic Cryochrepts, and Typic and Calcixerollic Xerochrepts. Most Land Type Association units (LTAs) tend to be excessively drained with rock outcrop, and silty surface textures. Surface rock ranges in cover from 5 to 70 percent and are primarily cobble size, subsoils have 35 to 90 percent rock fragment content. LTAs and attributes used in the analysis are from the Lolo National Forest Land Systems Inventory (1988).

Table 1. General characteristics from the Land Type Association (LTA) unit analysis for the Thompson River Complex

LT	**Landform**	**Slope Range (%)**	**Parent Material**	**Soil Family**	**Soil Surface Texture**
13	Alluvial Terraces	0-45	Argillites, Siltites & Quartzites	Andic Ustocrepts Typic Ustocrepts	Cobbly silt loam
26	Stream Breaklands	55-100	Argillites, Siltites & Quartzites	Rock outcrop and talus, Ochrepts	Rock outcrop and talus, gravelly loam
32	Broadly Convex Ridges	10-35	Argillites, Siltites & Quartzites	Andic Cryochrepts,	Gravelly Loam
45	Avalanche Chutes	40-80	Argillites, Siltites & Quartzites	Cryochrepts, Cryumbrepts	Silt loam, gravelly silt loam
60	Stream Breaklands	55+	Argillites, Siltites, Quartzites & Limestone.	Typic & Calcixerollic Xerochrepts, Andic & Dytstric Eutrochrepts, Typic Ustochrepts	Cobbly silt Loam

61	Dissected Stream Breaklands	65-100	Argillites, Siltites, Quartzites & Limestone	Typic Eutrochrepts, Calcixerollic Xerochrepts	Silt Loam, Gravelly silt loam
64	Steep Mountain Slopes	55+	Argillites, Siltites & Limestone	Typic and Calciexerollic Xerochrepts, Typic Ustochrepts, Mollic Eutroboralfs	Gravelly silt loam

R. Miles of Stream Channels by Order or Class: National Forest

Stream Order	Length (Miles)
1	3.50
2	0.43
3	0.00
4	0.24
5	0.00
Total	4.17

S. Transportation System: Trails: National Forest <1 mils Other -0-miles
Roads: National Forest .8 miles Other -0- miles

PART III - WATERSHED CONDITION

A. Burn Severity (acres): 35% unburned; 37% low; 20% moderate; 8% high

B. Water-Repellent Soil (acres): <10* ; present at isolated burning of stumps/down trees.*caused by fire, some natural hydrophobicity is present in the soils in the fire area when they are dry

C. Soil Erosion Hazard Rating (acres): 931 (57%) low 591 (36%) moderate 104 (6%) high

D. Erosion Potential: tons/acre (first year) **: Average**:8 tons/acre **Maximum:**10 tons/acre

E. Sediment Potential: 2268 (y/mi^2)

PART IV - HYDROLOGIC DESIGN FACTORS

A. Estimated Vegetative Recovery Period, (years): 2 grass/shrubs; 20-50 confiers

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

C. Equivalent Design Recurrence Interval, (years): 10

D. Design Storm Duration, (hours): 10yr-6 hr & 2yr-30 minute

E. Design Storm Magnitude, (inches): 1.4 inches (10yr-6hr) 0.44 inches (2yr-30min)

F. Design Flow, (cubic feet / second/ square mile: 9 cfs/mi^2

G. Estimated Reduction in Infiltration, (percent): 32

H. Adjusted Design Flow, (cfs per square mile): 74 cfs/mi2 (Note: This design flow is for land inside the fire perimiter on the west side of the West Fork of the Thompson River, and is for unbulked 10year post fire water discharge. Total discharge volumes could be much larger if bulk augmented with mass wasting sediment. The USGS WRI reports in Montana have measured cfs/mi^2 at over 400 cfs following 0.41" of rainfall in 30 minutes near Helena (USGS WRI 03-4319).

PART V - SUMMARY OF ANALYSIS

Describe Critical Values/Resources and Threats:

- **Private Property:** No downstream threats to human life from storm events were found in the Thompson River Complex Fire.
- **Heritage/Cultural Resources:** There are no concerns to heritage from fire effects.
- **Road System and Trails:** A road segment in the West Fork Thompson River has potential road surface drainage problems and an undersized large culvert which may be at risk for increased flows, and be unable to pass potential large woody debris in high water. There may be potential for the Spruce Creek culvert to plug up with debris producing a risk of road failure on FS Road 603. Increased sediment is a risk to ESA Critical habitat for bull trout populations in West Fork Thompson River. Approximately 2/3 of a mile of the Spruce Creek trail has potential for surface drainage problems and loss of a short trail sections due to upslope erosion and flow.
- **Soil Productivity:** Potential exists for post-fire soil erosion if high intensity rainstorm occurs prior to sufficient re-vegetation following the fire. The loss of topsoil would reduce soil productivity on those sites. In addition, pre-fire populations of noxious weeds on FS Road 603 are anticipated to increase as a result of the fire and potentially impact soil productivity.
- **Water Quality:** Increased sediment may occur from road surfaces and below portions of the watershed that burned at moderate or high severity. Some populations of aquatic species may be impacted.

B. Watershed Description and Hydrologic Response

Soils and Erosion

Soil Erosion Hazard Rating combines the natural erosion potential of a soil type (low, moderate, or high) with the increased erosion potential caused by soil burn severity (unburned, low, moderate, or high), to produce a single Soil Erosion Hazard Rating value (low, moderate, high) in acres of burn area. Potential erodibility, sediment delivery, and landslide risk for soils in the fire area are detailed in Table 2. Approximately 64% of the fire area was found to have moderate to high landslide potential prior to fire occurance. For the Thompson River Complex, natural erosion potential and soil burn severity by soil type are detailed in Tables 2, and 3 of the soils report. Soil Erosion Hazard Rating values were calculated as follows: Low= low or unburned severity AND low erosion potential; Moderate= moderate burn severity AND low or moderate erosion potential; High=high burn severity AND moderate or high erosion potential.

Table 2 Soil Erosion Ratings and Landslide Potential of Thompson Complex Burn Area

Land Type	Geologic Group	Surface Erodibility*	Sediment Delivery Efficiency*	Landslide Potential*	Percent of Burn Area
13	J	High	Low	Moderate	3.2

13	U	Low	Low	Moderate	3.2
26	U	Low	High	High	26.1
32	Q	Moderate	Low	Low	0.1
45	U	Low	Very High	Moderate-High	2.4
60	M	Moderate	High	Low	16.1
60	Q	Low	High	Low	8.5
61	M	Moderate	Very High	Moderate	29.0
64	M	Low	Moderate	Low	9.0
64	Q	Low	Moderate	Low	0.8

* Watershed properties affecting sediment yield – Lolo National Forest Land Systems Inventory, 1988.

Soil scientists from the Forest Service applied the above outlined standards and benchmarks to validate the BARC imagery. Methodology involved sampling in each of the representative intensity categories (Unburned, Low, Moderate) to determine soil burn severity. Areas with high burn severity were inaccessible due to steep terrain and were verified with visual reconnaissance and collaboration with the fire management team. Reconnaissance also helped field crews target larger landscape level areas to narrow sampling given the narrow window of availability for field work. Burn severity acreages derived from the field validated BARC map were used as the basis for post wildfire predictions.

Erosion risk in the fire area was modeled using ERMiT and was completed to estimate the amount of post fire. erosion potential for all burned areas.

Severity of burn on the soil was influenced by a combination of high density, mixed conifer fuels and steep, mountainous terrain. Field documentation determined that a majority of high severity burn occurred in high density stands in steep drainages, and/or on south-facing slopes. While there were significant areas of high severity fire in individual watersheds in the fire area, total percentage of high severity areas was limited to <10% of the total fire area. Soil burn intensity derived from BARC imagery and field verification for the both fires was correlated to burn severity based on results from field reconnaissance made by BAER team members.

. Soil burn severity results based on field work, BARC and ERMiT modeling–Thompson Creek Complex

BARC Burn Severity Classification	**Soil Burn Severity % of total**	**Burn severity indicator(s)**	**Water Repellency Degree**	**1st Year Maximum Erosion Potential (tons/acre)**
Unburned	35	Viable roots and above ground crowns remaining, no change in soil structure, abundant ground cover	N/A to Weak (depth N/A), discontinuous	--
Low (Forested)	37	Viable roots, no change in soil structure, shallow ash depth, moderate ground cover	Weak to moderate with shallow to moderate depth, discontinuous	2.5
Moderate (Forested)	20	Most roots still viable, ash clearly present, little change in soil structure	Moderate to Strong with Moderate to Deep depth, discontinuous to continuous	6.4
High (Forested)	8	No viable roots, white/red ash present, lacking soil structure	Moderate to strong with moderate to deep depth, continuous	13.2

Water repellency was generally fairly strong at the soil surface throughout the fire area. Soil Scientists observed that water repellent soil conditions occurred naturally in unburned areas within the fire area, especially on south-facing slopes. It could not be determined if water repellency in low and moderate soil severity areas was naturally occurring or due to fire activity. Water repellant conditions in these soils tend to naturally weaken within several weeks with short duration, low intensity rains. However, the length of time a soil retains this water repellent condition can be quite variable (Huffman et al 2001). Strong water repellent conditions can remain for several years. Even once the water repellent conditions have naturally weakened, the loss of the duff layer in the burned area will produce increased post fire runoff because the water storage capacity of surface soil layers has been lost. Higher than normal runoff flows are expected in the Thompson River Complex Fire area.

Field observations across the fire indicate that the low burn severity sites have a good potential for rapid natural revegetation. Limited sprouting of grasses was noted. The moderate soil burn severity sites appeared to have a variable amount of viable shrub root crowns and roots of grasses and forbs which will probably retard revegetation in these areas, but the remaining root mat may potentially limit erosion.

The surface erosion potential for representative landform hill-slopes within the Thompson River Complex was estimated using the ERMiT (Erosion Risk Management Tool) model (Robichaud et al 2008). ERMiT combines weather variability with spatial and temporal variability of soil properties to model the range of post-fire erosion rates that are likely to occur. The ERMiT model limitations are primarily related to the difficulty of applying the model across a landscape. ERMiT modeling is usually applied to a relatively small area that is typical and extrapolated across a wider view. Recent validation of the model in Montana and Idaho do indicate that results are improving with refinement of the model.

The data entered into the ERMiT model includes climate, soil texture, rock content of the soil profile, vegetation type (forest, range, or chaparral), hillslope gradient and horizontal length, and soil burn severity. The climatic data for the Thompson River Complex was modified using the PRISM function to adjust climate data. Assumptions for modeling parameter inputs are:

Primary Climate Location: Libby, MT
Prism Adjustments: Lat. 47.69, Long. 115.22
Vegetation: Forest
Soil Texture: Silt Loam
Rock Content: 50%
Gradient of top 10% of hillslope (i.e. ridgetops): 10%
Gradient of middle 80% of hillslope: 40%, 60%, and 70%
Gradient of hillslope toe: 10%
Soil burn severity class: moderate, high
Probability that sediment yield will be exceeded: 10%

The results from the ERMiT runs were used to create untreated and treated sediment delivery potentials in tons/acre specific to the Thompson River Complex. Treated and untreated sediment delivery potentials were recorded for years one and two following the fire. Treatment results considered mulch applied at a coverage rate of 1 ton/acre. Results for treated and untreated sediment delivery potentials are displayed in table 6 for both high and moderate severity, for slopes of 40%, 60%, and 70%.

Results of ERMiT modeling for sediment delivery potential in tons/acre.

	Moderate Soil Burn Severity				**High Soil Burn Severity**			
	Erosion Year 1	*Erosion Year 2*	*Mulch (1T/ac): Erosion Year 1*	*Mulch (1T/ac): Erosion Year 2*	*Erosion Year 1*	*Erosion Year 2*	*Mulch (1T/ac): Year 1*	*Mulch (1T/ac): Year 2*

Silt Loam, 70% avg slope	5.52	1.35	0	0.01	9.58	4.34	0	0.55
Silt Loam, 60% avg slope	6.4	1.35	0	0	13.19	4.09	0	0.54
Silt Loam, 40% avg slope	4.85	1.16	0.36	0.68	7.72	2.66	1.55	1.2
Average t/a	5.6	1.3	0.1	0.2	10.2	3.7	0.5	0.8

Hydrologic Response

Assessment of values at risk:

Resource damage following wildfire is commonly caused by increased storm runoff and debris torrents. Increased storm runoff and debris threaten infrastructure including roads, culverts, buildings, heritage resource sites, and other developments in stream floodplains and on old flood deposits. On National Forest, the primary infrastructure-related values at risk for the Thompson River complex fire are on the West Fork Thompson Road 603. The Big Spruce culvert on Road 603 was identified as a value at risk. The Big Spruce trail was also identified as a value at risk. The Big Spruce trail is addressed in the Recreation report. US Highway 200 runs immediately below the Koo Koo Sint fire, and was identified as a value at risk from rolling debris.
Aside from roads, culverts, trails and heritage resource sites, no Forest Service structures were judged to be at risk from post-fire storm runoff or debris flows.

Post-fire peak flow estimation:

The unit hydrograph and runoff curve number (RCN) methods (SCS, 1973) were used to calculate precipitation events and storm water runoff rates for Big Spruce Creek. The unit hydrograph method uses storm precipitation, duration and intensity, soil type, land use, cover condition, and average watershed slope to estimate peak rates of discharge and runoff volumes from high precipitation events. This method is one of the most widely used empirical techniques in the western United States for small watersheds (less than 5,000 acres). Since soil type and land cover condition are considered, the RCN method is useful for estimating changes in storm flow resulting from wildfire-induced soil and land cover change. While widely used in this capacity, the unit hydrograph method is a simplistic approximation of complex natural and physical processes, and should be used with an understanding of its limitations.
The RCN method requires an estimate of burn severity for post-fire runoff estimation. The land inside the fire perimeter was divided into Unburned/Very Low, Low, Moderate, and High severity classes using satellite imagery, field assessments, and GIS data. A BARC map derived from SPOT satellite infrared reflectance imagery provided initial estimates of burn severity. Forest Service scientists verified the burn severity map using a combination of visual observation and soil plots. Surface ground cover, soil structure, root viability, and water repellency were recorded at each soil plot. Visual observation, including remote view points from the Eddy Mountain and View Point lookouts was also used to verify the burn severity map. Once the burn severity map was verified, burn severity in Big Spruce watershed was calculated.
Runoff curve numbers for the dominant vegetation type in the burned area were derived from standard values (SCS, 1973), and were refined based on field assessment of the burned area, and previous experience with similar wildfires (Table 2). The Hydrologic Soil Group (HSG) for the fire was modelled as Group B, based on field verified soil type (silt loam) and based on adjacent areas with similar geology, which are also mapped as HSG B. Pre-fire soil condition was considered fair, and pre-fire vegetation type was considered well forested. Field soil surveys did not find extensive water repellant soils in Moderate to High burn severity areas.

Runoff curve numbers used for post-fire discharge estimates.

Land Cover Description and Condition	**HSG**	**RCN**
Unburned	B	60

Low Severity Burn	B	65
Moderate Severity Burn	B	75
High Severity Burn	B	80

Design storms and precipitation intensities were evaluated using the Precipitation Frequency Atlas of the Western United States—Montana (NOAA, 1973) for the Big Spruce watershed for 6 hour and 24 hour storms. Although the precipitation data are somewhat dated, they are the only readily available dataset, and are still representative of potential conditions. Results are displayed in Table 3. Although the NRCS template for the RCN method uses 6 and 24 hour precipitation values, the actual rain event applied to the watershed uses a SCS Type 2 storm distribution with the peak flow derived from the most intense part of the event. This technique provides a reasonable approximation of 30 to 60 minute storm intensities, which are most commonly associated with large post-fire runoff events (Cerelli, 2000).

Table 3. Design Precipitation for Thompson River Complex Fire area (NOAA, 1973).

2 Year, 24 hour Prec. (in)	1.9	2 Year, 6 hour Prec. (in)	1.0
5 Year, 24 hour Prec. (in)	2.5	5 Year, 6 hour Prec. (in)	1.3
10 Year, 24 hour Prec. (in)	2.7	10 Year, 6 hour Prec. (in)	1.5
25 Year, 24 hour Prec. (in)	3.2	25 Year, 6 hour Prec. (in)	1.7
50 Year, 24 hour Prec. (in)	3.6	50 Year, 6 hour Prec. (in)	1.9
100 Year, 24 hour Prec. (in)	4.1	100 Year, 6 hour Prec. (in)	2.1

A Microsoft Excel spreadsheet version of the unit hydrograph (Cerelli, 2002) was used calculate pre- and post-fire peak storm discharge for the Big Spruce watershed. Results are displayed in Table 4.

Table 4. Pre- and post-fire peak flows for Big Spruce Creek.

Watershed	**Area (acres)**	**Assess - ment method**	**Pre-fire flow (cfs)**						**Post-fire flow (cfs)**		
			2-yr	**5-yr**	**10-yr**	**25-yr**	**50-yr**	**100-yr**	**2-yr**	**5-yr**	**10-yr**
Big Spruce	2397	RCN	5	21	35	84	152	248	7	25	41

Culvert capacity analysis:

The Big Spruce culvert on Forest Road 603 was evaluated for design storm capacity. Field survey data for culvert hydraulic analysis were collected on August 28, 2014. Survey data include stream, culvert, and road prism dimensions, culvert condition, and photos. Following field data collection, culvert capacity was estimated using the HY-8 Culvert Hydraulic Analysis Program (FHWA, 2014). The analysis assumed the culvert inlet and outlet was clear of debris.

Capacity analysis results:

The existing Big Spruce crossing on Road 603 is a 67” x 95” plate arch culvert. With a span of 7.9 feet, the existing culvert restricts the field-measured bankfull width of 18 feet with a constriction ratio of 2.3. The observed rust line was at 33”, which indicates that the existing structure has flowed at or above half full for extended durations during pre-fire conditions. As described in the Fisheries report, the structure is also a fish barrier.

Big Spruce culvert inlet showing rust line and stream constriction.

Hydraulic modelling results for the Big Spruce culvert are displayed in the Table below. Existing culvert capacity is barely sufficient to pass a pre-fire 100-year flow. It is important to consider that calculated design flows are for unbulked water discharge. Total discharge volumes could be much larger if bulk augmented with mass wasting sediment. The USGS WRI reports in Montana have measured over 400 cfs/mi2 following 0.41 inches of rainfall in 30 minutes near Helena (USGS WRI 03-4319). When bulked flow and potential for culvert inlet blockage associated with post-fire debris is considered, the Big Spruce culvert is at a moderate risk of failure.

Big Spruce culvert capacity.

Site	**Drainage area (ac)**	**Culvert diameter (in)**	**Outlet depth fill above pipe (ft)**	**Current capacity (cfs)**	**Pre-fire 100-year flow (cfs)**	**Post-fire 10-year flow (cfs)**
Big Spruce	2397	67” x 95” Plate Arch	3.9	285	248	41

Storm runoff and rolling debris

In the Spruce fire, increased water delivery and rolling debris from steep, burned slopes above the West Fork Thompson Road 603 were considered. Two dry swales cross Road 603 in the northern portion of the Spruce fire. These crossings were investigated in the field on 8/28/2014. Neither of the two crossings have existing drainage structures. Both crossings are buffered from rolling debris and increased storm flow by a buffer of Very Low to Low severity burn. The two watersheds do not have a well-defined drainage bottom to effectively channel water and debris flows. As a result, replacement structures are not recommended at the two swale crossing locations on Road 603. Along the remainder of the road, a moderate risk of rolling debris and storm runoff was observed.

For the Koo Koo Sint fire, increased water delivery and rolling debris from burned slopes above Highway 200 was considered. The lower, unburned portion of the watershed has extensive unburned vegetation, talus and cliffs, and does not have a well-defined drainage bottom. For the design storms considered in this analysis, unburned vegetation and talus piles along with the lack of a defined drainage channel at the bottom of the watershed should be sufficient to buffer increased storm runoff and debris flows before they reach Highway 200. However, debris in burned areas above Highway 200 will be susceptible to movement from rain storm lubrication and freeze-thaw cycles. As a result, increased rolling debris onto Highway 200 from the fire is likely during and after high precipitation events and during freeze-thaw cycles until vegetation is well established over the next three to five years.

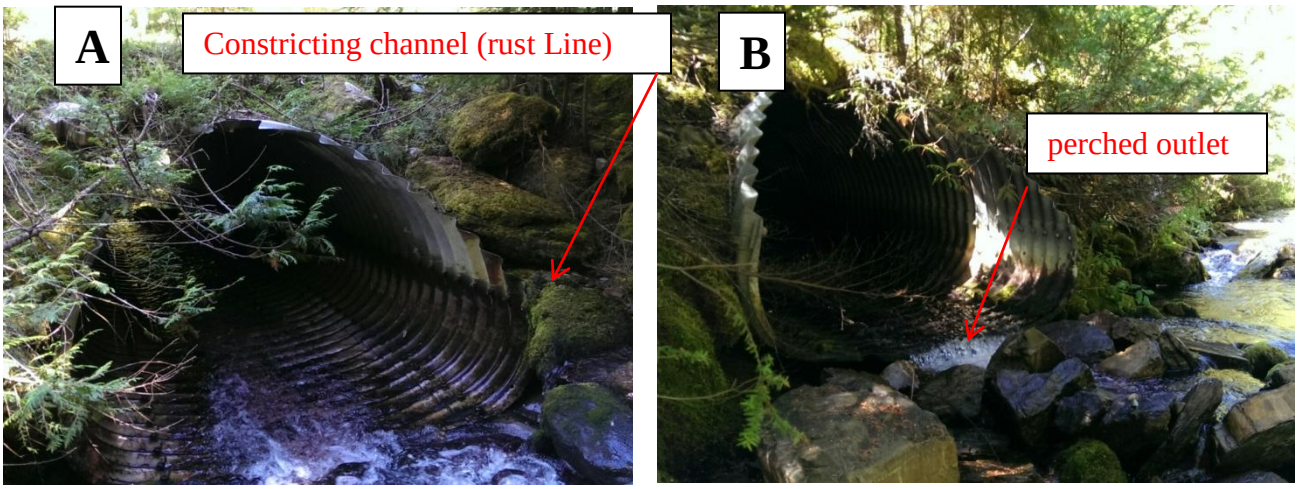
Koo Koo Sint fire showing the extent of the burn as well as vegetative and talus buffer above Highway 200

Road Infrastructure

General Description of Road System

The majority of the roads in the Thompson River Complex are outside the burned area boundaries. However, a segment of the W. Fk. Thompson River Road #603 from M.P. 2.9-5.6 has been identified as moderate risk and road treatments are recommended prior to runoff.

An undersized stream crossing has been identified at M.P. 3.7 where the road crosses Big Spruce Creek. The existing arch culvert is constricting the channel and as a result the outlet is perched slightly. Furthermore, the rust lines on the inside of the culvert provide evidence that the existing culvert is already at maximum capacity on an annual basis. The post fire runoff will cause increased velocities through the culvert and lead to additional scour at the outlet. The culverts will likely plug due to increased movement of woody debris and as a result the culvert may fail. Furthermore, these culverts do not meet USFS stream simulation criteria for accommodating bankfull channel widths and aquatic organism passage.



Constricting channel at inlet(A) and perched outlet(B) in undersized culvert on W.Fk Road #603

In addition to the undersized stream crossing, the W. Fk. Thompson River Road #603 from MP 2.9 to 5.6 has been identified as moderate risk for failure (See Map Appendix B). In the post-fire condition, road cut slopes are prone to heavy rilling, raveling, and localized cut slope failure. Slope stability, ditch blockage, and culvert plugging are substantive concerns on this moderate risk segment of road. It is evident that substantial effort has been made to provide proper drainage on this road to protect the road and adjacent stream. However, the road drainage features will need to be improved to avoid failure (ie clean culvert inlets and outlets, clean and

shape ditches, install cross drainage, construct drain dips, etc).

Debris in ditches that could cause blockage or plugging culverts (C) and (D)

There is very little vegetation buffer between the road and stream. During run off it is highly likely that there will be increased erosion and sedimentation in the W.Fk. Thompson River.

Road and Road-Stream Crossing Emergency Determination

Engineering, hydrology, and fisheries findings all indicate moderate concern for post-fire precipitation and runoff risk scenarios relative to the undersized culvert in Big Spruce Creek and the moderate risk road segment noted above (See Map Appendix B). Prudent options to avoid post-fire impact scenarios are to replace the undersized culvert on W.Fk. Thompson Road 603 at the Big Spruce stream crossing and maintain and improve road drainage on the W.Fk. Thompson Road #603 from MP 2.9 to 5.6.

Trails:

The Big Spruce Trail (1102) was burned over by a portion of the Spruce Creek Fire and some rehabilitation work is recommended. About 2/3 mile trail has either burn on both sides, burn on one side, or burn a short distance above the trail. The portion of the trail burned over is in some older stands with abundant, tall, hemlock, cedar, grand fir, and larch. Many of the snags near the trail in these areas were cut during suppression activities to avoid additional hazards to firefighters. However, fire killed trees along the trail will be falling in the trail for the next several years. Because of the tree height and steep slope, trees as far as 200-300 feet from the trail could block the trail as they fall and possibly slide down the hill. There is a risk to recreational user of the trail from both the falling trees and trying to negotiate large logs over the trail on a steep side-slope – especially on horseback. The trail is also relatively steep within the burned area. Increased water yields from the fire area above the trail may cause some rilling and damage to the trail tread.

Fisheries:

The Spruce fire was located on both sides of the West Fork Thompson River (WFTR) and included the lower mile of Big Spruce Creek. First order tributaries within the fires footprint drain directly into the WFTR. Fish populations exist only within WFTR and Big Spruce Creek. The WFTR is designated ESA Critical Habitat for bull trout. Bull trout densities within the WFTR are some of the highest in the Lower Clark Fork drainage, with estimates in 2010 at 44 bull trout per 100 m directly upstream of the fire. 2010 estimates of bull trout directly downstream of Big Spruce Creek were 22 bull trout per 100 m, and 22 westslope cutthroat trout per 100 m as well. Multiple fish surveys have been completed within the WFTR by Montana Fish, Wildlife & Parks since 1998 indicating this is a strong and stable population of bull trout. The importance of WFTR to bull trout populations within the Thompson River drainage and the Lower Clark Fork bull trout core area cannot be overstated.

Spruce Creek does not contain bull trout but has a robust population of westslope cutthroat trout. There is an existing fish barrier on the undersized culvert on Road 603 at the Big Spruce stream crossing.

Fishery Values at Risk are related to potential erosion issues associated with culvert failures and increased sediment reaching WFTR and Big Spruce Creek.

Road #603 runs immediately parallel to WFTR and from MP 2.9 to 5.6 has been identified as a high risk area for delivery of sediment to WFTR. Road drainage features will need to be improved to accommodate the expected increase in flows associated with post fire runoff to avoid impacts to bull trout and bull trout critical habitat. Requested actions include installing proper road drainage structures such as drain dips with appropriate spacing for the expected runoff increases, installing erosion and sediment control measures at drain dips and culvert outlets (slash filter windrows), ensuring ditches are of adequate capacity and unblocked by debris, and protecting and cleaning culvert inlets, outlets, and catch basins to minimize erosion.

Fire debris in culvert inlet of Road #603.

Increased flow related to the undersized culvert on Big Spruce Creek has the potential for this culvert to fail and deliver fill sediment to Spruce Creek and WFTR. Increasing the capacity of this culvert would mitigate for the potential added water yield and debris associated with post fire conditions.

Mitigating post-fire sediment affects to Big Spruce Creek and WFTR would cost substantially less than rectifying road drainage and culvert failures both from a road infrastructure standpoint and impacting bull trout populations and critical habitat within the drainage.

Weed Infestation

The main weed species of concern within the fire perimeter are spotted knapweed, meadow hawkweed complex, and St. Johnswort. These species are present along access roads and the roads within the fire perimeter, at least 50 feet either side of the road, mostly on the fill and cut slopes, and to a small extent within the interior of the fire. Seed dispersal from residual populations and regrowth is probable for these species. The occurrence of spotted knapweed, St. Johnswort and meadow hawkweed is expected to continuously increase into the burned area following the fire.

For most noxious weed species identified, disturbed sites and dry potential vegetation types are the most at risk from invasion and spread. Disturbed areas include roads, dispersed recreation sites, game trails and where ground disturbing fire suppression actions occurred (i.e. dozer lines, hand lines, and drop points). Burned sites can have altered soil structure and reduced organic matter content creating a more favorable germination substrate for weed seeds. Undisturbed areas in drier vegetation types of the fire area are also at risk.

Overall, the presences of known weed infestations adjacent to the fire perimeter pose a high risk for weed introduction into the area.

Habitat Types at High Ecological Risk within the fire perimeter	Sum of Stand Acres	Weed Species that threaten these habitat types
260	380	Spotted knapweed, St. Johnswort, meadow hawkweed
280	205	Spotted knapweed, St. Johnswort, meadow hawkweed

585 acres within the Thompson River Complex are at high risk of weed infestation based on the Lolo NF Plan Amendment No. 11 (Noxious Weed Management). Typically less vulnerable habitat types are at an increased risk of weed infestation and spread due to mineral soil exposure from fire as well.

It is important not to overlook potential seed spread vectors within the burn area as well. Although these sites (such as game trails, roads and recreation trails) are converted areas where ecosystem integrity has already been altered, they are the main sources of weed seeds that can facilitate and greatly exacerbate the spread of weeds into more pristine areas. It is critical that these areas are treated as well to protect currently unaffected but vulnerable areas within the fire.

The fire-caused weed emergency to resource recovery is of a high priority, especially in those areas which had highly invasive species' concentrations prior to the burn and in or near sensitive plant populations. Large portions of the access roads are infested with spotted knapweed St. Johnswort, oxeye daisy and meadow hawkweed complex. The roadsides provide a seed bank where seeds can continue to germinate, grow, and spread.

Cultural Resources

The burn perimeter was review by the archeologist on the fire severity map and visited a potential site in the field and verified that there was not a site at risk due to fire effects.

Values at Risk:

In accordance with the revised manual, the risk matrix below, Exhibit 2 of Interim Directive No.: 2530-201—1, was used to evaluate the Risk Level for each value identified. Only treatments that had a risk level of Intermediate or above are recommended for BAER authorized treatment. For the Thompson Falls Complex Fire risk levels by resource included weeds, roads, road-stream crossings, and trails. These resources had risk levels of imtermediate or greater and therefore are the only resources recommended for BAER funded treatments.

Values at Risk Matrix

Probability of Damage or Loss	**Magnitude of Consequences**		
	Major	Moderate	Minor
	RISK		
Very Likely	**Very High** Weeds, trails snag hazard tree removal	**Very High**	**Low**
Likely	**Very High** roads, fish habitat	**High**	**Low**
Possible	**High**	**Intermediate**	**Low**
Unlikely	**Intermediate**	**Low**	**Very Low**

.

Emergency Treatment Objectives

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

Land 70**%** **Channel** N/A **Roads/Trails** 70% **Protection/Safety**

D. Probability of Treatment Success

	Years after Treatment		
	1	3	5
Weed treatment	80*		
Roads/Trails	85	90	90

*Only one year of detection and treatment is allowed using BAER funding.

E. Cost of No-Action (Including Loss): $274,000

The potential cost of no action includes the failure of the culverts/stream crossings on NFS Road #603 below the burned area, erosion damage on roads needed for FS and public access, entrainment and deposition of road sediment in important fishery streams, and erosion damage and failure on the Spruce Creek Trail # . The cost of repairing roads, trails, and stream crossings would most likely exceed the cost of the selected alternative. The value of critical habitat for three Threatened bulltrout, as well as species of concern, cannot easily be quantified, but would likely far exceed the cost of sediment-mitigation measures proposed here. The value of protecting the ecological integrity and soil productivity of the burned area from noxious weed infestation likely exceeds the cost of weed treatment and monitoring, although this too was not quantified.

Cost calculated by Nate Kegel Zone Engineering (Report Engineering Folder)

F. Cost of Selected Alternative (Including Loss): **$60,767**

Cost calculated by cost of treatments plus the Cost of BAER Analysis

G. Skills Represented on Burned-Area Survey Team:

[x] Hydrology [x] Soils [x] Range [x]Weeds
[x] Forestry [x] Wildlife [x] Fire Mgmt. [x] Engineering
[ ] Contracting [ ] Ecology [x] Botany [x] Archaeology
[x] Fisheries [ ] Research [ ] Air Quality [x] GIS

BAER Team Members

Scott Shrenk Fire Manager
Jon Hanson Fisheries
Nate Kegel Engineering
Debora Job GIS
Ann Hadlow Soils
Beth Anderson Soils
Brian Story Hydrology
Mike Mueller Weeds
Dave Wrobleski Wildlife and Trails
Craig Odegard Botany
Jared Koskela Engineering

Team Leader: Marci Nielsen-Gerhardt
Email: mgerhard@camasnet.com Phone: 208-926-4360- FAX: none

Lolo Forest Contact: Ann Hadlow
Email: ahadlow@fs.fed.us Phone: 406-822-3915

H. Treatment Narrative:

A replacement structure for the undersized culvert on the West Fork Road 603 at Big Spruce creek was reccommended in both the engineering and fisheries reports. Hazards related to the failure of this culvert were supported by both the hydrology and soils reports. BAER policy prohibits the use of BAER funding to improve forest infrastructure that is insuffiecient or damaged prior to wildfire occurance. In this case, the culvert at Big Spruce Creek was undersized prior to the Thompson Complex Fire. Although the risks of the culvert failing are increased due possible increased post-fire erosion and flow, the culvert is not a candidate for replacement using BAER funding. The costs of culvert replacement have been removed from the final funding request.

It is reccommeded that the forest consider other sources of funding to replace the culvert. A replacement structure for the undersized culvert on the West Fork Road 603 at Big Spruce creek should at a minimum span the bankfull width of the stream and pass a pre-fire Q100 flow of 248 cfs with adequate freeboard. A bridge is the recommended replacement structure. The bridge should span the bankfull width of the channel, maintain stream grade and dimensions through the crossing, and be designed to accommodate aquatic organism passage.

An alternative recommendation that is acceptable to fund with BAER is to improve the existing culvert at Big Spruce Creek. The road- stream crossing (culvert) on Big Spruce Creek will be armored to reduce the risk of culvert erosion and channel scour and protection of the road from washing out. The work will consist of placing Class IV riprap at along the headwalls of the culvert inlet and outlet. This alternative is included in the proposed road treatments and the final funding request.
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Roads and Trail Treatments
Hydrology Objectives for Road Treatments

Armored waterbars or rolling dips should be constructed at the downstream side of the Big Spruce stream crossing to provide for emergency overflow without washing out the road. The dip should be armored on the fill-slope down to the toe of the fill with large cobbles or boulders. Ideally, all replacement structures should be installed before winter 2013/2014, and at a minimum, the replacement structures should be installed before thunderstorms begin in early July 2014. Since culvert capacity analysis assumes that the Big spruce stream crossing is clear of debris, stream crossing inlets and outlets should be checked and cleared of sediment and debris before winter 2014/2015, and regularly for the next three to five years.

Fisheries Objectives

Mitigating post-fire sediment affects to Big Spruce Creek and WFTR would cost substantially less than rectifying road drainage and culvert failures both from a road infrastructure standpoint and impacting bull trout populations and critical habitat within the drainage.

Proposed Road Treatments

The Thompson River Complex BAER assessment 2500-8 includes request for $30,650 to perform the following work list treatments needed to protect existing infrastructure, aquatic habitat, and protect public safety (Table 7):

Table 7. Proposed Emergency Treatments for road-related risks

Treatment/Work Item	Treatment Narrative – Work Requirements - Rational
*Major Culvert Replacement in Big Spruce Creek ***Not Approved use of BAER Funding, removed from final funding request.**	One road- stream crossing (culvert) on Big Spruce Creek will be replaced to eliminate the substantial risk of culvert plugging, overtopping, breaching, and channel scour. The work will consist of removing and replacing the existing arch culvert with a bridge that will accommodate Q100 flows and also provided aquatic organism passage. The natural stream channel will be simulated through the structure to accommodate all aquatic organisms. The proper soil erosion control measures will be taken during construction including diverting the stream around the construction site. The resulting BAER treatment will allow for Q100 flow conditions on Big Spruce Creek to handle post fire runoff events.
Culvert Armoring in Big Spruce Creek ****Alternative method to mitigate risk of culvert failure.	One road- stream crossing (culvert) on Big Spruce Creek will be armored to reduce the risk of culvert erosion and channel scour and protection of the road from washing out. The work will consists placing Class IV riprap at along the headwalls of the culvert inlet and outlet.
Erosion Control and Sediment Filtration	Installing erosion and sediment control measures will not only improve the stability of the road but also mitigate sediment in the adjacent stream. Slash filter windrows will be installed at all drain dips and culvert outlets to filter fine sediment during run off. Riprap armoring protection will be place on all culvert inlets, outlets and catch basins to minimize erosion. Additional slash filters may be required at natural drainage points along the road.
Road Drainage Maintenance W. Fk. Thompson Road #603	Road drainage on W.Fk.Thompson Road #603 would be addressed by cleaning and shaping all road drainage features such as drain dips, culvert inlets and outlets, and ditch cleaning. Cross drainage or additional ditch relief may be necessary to handle the additional movement of water.

Hydrologic, Engineering and Fisheries Treatment Summary of Big Spruce Culvert Replacement Objectives on FS Road 603, West Fork Thompson River Road.

Replacing the culvert at Big Spruce Creek and improving road drainage on the W. Fk Thompson River Road #603 treatments would leave the road conditions and stream crossings in a stable condition to accommodate post fire runoff. Threat of soil raveling, erosion, and mass failure would be substantively reduced or eliminated. Proposed treatments are estimated to cost about $190,600 (Table 7). Forest road management objectives will not be changed as a result of the proposed treatments. Revised (final) engineering cost estimate is found in Table 8. Armoring of existing Big Spruce Creek culvert is included as the accepted alternative to culvert replacement. Proposed treatments are estimated to cost $30,650.

Table 7. Engineering cost estimate (with culvert Replacement included)

Item	Unit	Unit Cost	# of Units	Cost
Road Drainage Maintenance	miles	$5,000	2.7	13,500
Soil Erosion/Sediment Control	each	$100	20	$2,000
Culvert Replacement (Bridge)		$155,000	1	$155,000
Contract Total				**$170,500**
Contract Administration	day	$350.00	20	$7,000
Contracting Officer	day	$430	5	$2,150
Contract Preparation and S&D	day	$375.00	40	$15,000
Total Funding Request				**$194,650**

Table 8 Final Engineering cost estimate REVISED

Item	Unit	Unit Cost	# of Units	Cost
Road Drainage and Storm Proof	miles	$5,000	2.7	$13,500
Soil Erosion/Sediment Control	each	$100	20	$2,000
Culvert Armoring		$5,000	1	$5,000
Contract Total				**$20,500**
Contract Administration	day	$350.00	20	$3,000
Contracting Officer	day	$430	5	$2,150
Contract Preparation and S&D	day	$375.00	13	$4,875
Total Funding Request				**$30,525**

Proposed Trail Treatments

Stabilize Trail Prism: Approximately 2/3 of a mile of the Spruce Creek trail is located in a low to moderate burn severity area, however it is also affected by moderate to high burn severity that occurred on steep slopes above the trail. The trail is expected to be at risk of deterioration from additional runoff and sediment from post-fire conditions. The drainage system in the trail was not designed for the increased flow that may occur from the fire, and upland slope erosion and flow may cause soil erosion on the trail surface and fill-slope. Failure of burned water bars may cause stream capture onto trail surface area causing soil erosion, including loss of the trail by rills and gullying. Reference the trails treatment specification sheet for the fire for more information.

Methods:
To reduce risk, install water bars or outslope sections to direct and divert flow off the trail. Rebuild waterbar leadout ditches where necessary. Some trail segments may require tread stabilization to facilitate the proposed drainage structures. These treatments would reduce the risk of the trail washing out, stream capture

and increased sediment to streams. In most cases hazard trees around the work sites must be felled to protect personnell working in the area.

Costs:
Stablilizing trail tread: $200 x 4 days = $800.00
Drainage Repair: Water bars/drain dips x $60.00 = $120.00
Hazard Tree Removal: $360.00

Proposed Weed Treatments

The treatments of roads that cross the fire perimeter or were used as fireline are the highest priority. These roads are the seed source for weed spread into the burned area perimeter. The immediate need is to treat about a mile of Road# 603 that cross the fire perimeter. The main threat along this piece of road is meadow hawkweed. Meadow hawkweed would be able to spread under the partially opened cedar canopy. The surface fire that burned to the road torched individual trees and groups of trees to open the canopy. The treatment would be 7 oz. of Aminopyralid (trade name – Milestone) per acre to control spotted knapweed, St Johnswort, oxeye daisy and meadow hawkweed.

Description	Target Weed Species	Prescription	Estimated Acres	Estimated Cost per Acre	Total Cost	Timing
Ground application (broadcast) on roadways	Spotted Knapweed, St. Johnswort, Meadow Hawkweed Complex, Oxeye Daisy	7 oz. of Aminopyralid / acre	5 (Road # 603 that bisects the Spruce Creek fire)	$90.00/acre (accomplished by district personnel or contractor)	$450.00	Fall 2014-Spring 2015
Monitor	Spotted Knapweed, St. Johnswort, Meadow Hawkweed Complex, Oxeye Daisy	Monitor treatment and retreatment needs	5	$25.00 /acre (1/3 day salary at GS-9 level)	$625.00	Summer 2015

Table 9: Proposed emergency treatments for weed related risks (planning, contract admin and database input included in cost estimate).

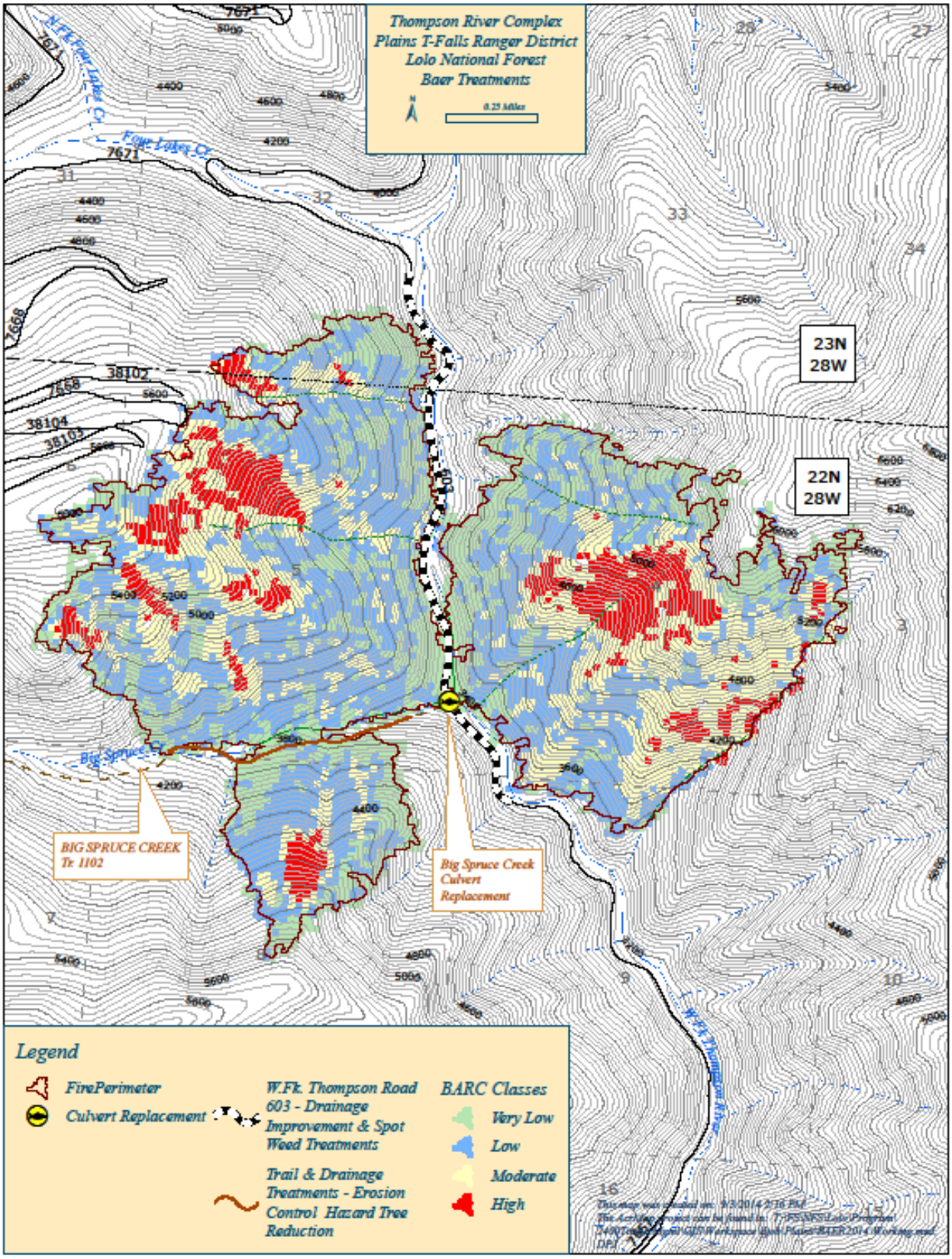
I. Monitoring Narrative

Weed Monitoring:

Weed treatment monitoring on Rd. 603 within and below the fire perimeter will be assessed for treatment effeciveness in the spring and early summer of 2016. The cost for the monitoring is shown in the Table 9 above.

Part VI. Emergency Stabilization Treatments and Source of Funds

Line Items	Units	Unit Cost	NFS Lands # of Units	BAER $	Other $	All Total $
A. Land Treatments						
Weed Spraying	acres	90.00	5	$450		
Subtotal Land Treatments				**$450**		
B. Channel Treatments	-	-	-			
C. Road and Trails						
Spot Retread/slumps/filling holes	days	200	4	$800		
Hazard Tree Removal	each	60	6	$360		
Install Additional Drain structure	each	60	2	$120		
Road Drainage and Storm Proofing	miles	5,000	2.7	$13,500		
Soil/Erosion and Road Sediment Control	each	100	20	$2,000		
Culvert Armoring	each	5,000	1	$5,000		
Contract Administration	day	350	20	$7,000		
Contracting Officer	day	430	5	$2,150		
Contract Preparation and S and D	day	375	13	$4,875		
Subtotal Roads and Trails				**$35,805**		
D. Protection/Safety						
E. BAER Evaluation						
BAER Team Assessment					$23,762	
Subtotal Evaluation					$23,762	
F. Monitoring						
Weeds Spraying Effectiveness Monitoring	day	125	5	$625	-	
Subtotal Monitoring				**$625**	$0	
G. Totals				**$36,880**	$23,762	$60,192
Previously approved						
Total for this request				**$36,880**		


Thompson River Complex
Plains T-Falls Ranger District
Lolo National Forest
Baer Treatments
0.25 Miles
N
23N
28W
22N
28W
BIG SPRUCE CREEK
Tr 1102
Big Spruce Creek
Culvert
Replacement
Legend
FirePerimeter
Culvert Replacement
W.Fk. Thompson Road
603 - Drainage
Improvement & Spot
Weed Treatments
Trail & Drainage
Treatments - Erosion
Control Hazard Tree
Reduction
BARC Classes
Very Low
Low
Moderate
High

PART VII - APPROVALS

1. /s/ Timothy Garcia September 12, 2014
Lolo NF Forest Supervisor Date

2. _____
Region 1 Regional Forester