Date of Report: 8/26/2021

BURNED-AREA REPORT

PART I - TYPE OF REQUEST

A. Type of Report

☒ 1. Funding request for estimated emergency stabilization funds
☐ 2. No Treatment Recommendation

B. Type of Action

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

☐ 2. Interim Request #___
☐ Updating the initial funding request based on more accurate site data or design analysis

PART II - BURNED-AREA DESCRIPTION

A. Fire Name: Muddy Slide

B. Fire Number: WYMRF-000195

C. State: CO

D. County: Routt

E. Region: 02

F. Forest: Medicine Bow-Routt NF

G. District: Yampa

H. Fire Incident Job Code: P2N3D4 (0206)

I. Date Fire Started: June 20, 2021

J. Date Fire Contained: 80% as of 8/19/2021

K. Suppression Cost: 13.1 million as of 8/19/2021

L. Fire Suppression Damages Repaired with Suppression Funds (estimates):

1. **Fireline repaired (miles):** 12.2 miles
2. **Other (identify):** 1.8 miles handline

M. Watershed Numbers:

Table 1: Acres Burned by Watershed

HUC #	Watershed Name	Total Acres	Acres Burned	% of Watershed Burned
	Morrison Creek	23,940	3,996	16.7
	Toponas Creek	12,136	97	0.8

N. Total Acres Burned:

Table 2: Total Acres Burned by Ownership

OWNERSHIP	ACRES
NFS	3,929
OTHER FEDERAL (LIST AGENCY AND ACRES)	
STATE	
PRIVATE	165

OWNERSHIP	ACRES
TOTAL	4,094

O. **Vegetation Types:** Subalpine fir, Engelmann spruce, and beetle kill lodgepole pine with pockets of heavy dead/down and standing snags. Aspen stands occur in drainages and wet meadows. The vegetation transitions to grass and sagebrush in the valleys and on lower elevation southern aspects.

P. **Dominant Soils:** Soils within the burn area reflect a wide range of lithologies. Soils formed from sedimentary deposits are dominantly a sandy to sandy loam texture. Pre-fire conditions likely exhibited thin O horizons especially in timber stands characterized predominately by lodgepole pine. Similarly, soils derived from glacial deposits tend to be of a coarser texture and not as well developed. In general, much of the area is characterized by Alfisols. This soil order typically forms under a hardwood forest cover, has a clay-enriched subsoil, and relatively high native fertility. In areas where soil formation was favored and promoted, soils have developed a finer texture and larger deposits of clay and organic matter, like in lower gradient basins and foot slopes. In general, the soils reflect the most recent glacial periods in the region and the geologic deposits subjected to those glacial forces.

Q. **Geologic Types:** The Gore Range lies mostly south of Gore Pass, along a similar trend as the Park Range. The Gore Range, much like the Front Range, is a faulted anticline with Precambrian core rocks. Pleistocene glaciers of the Bull Lake and Pinedale glacial periods carved out the valleys in this area and shaped much of the present day landscape. The Pinedale glaciation was the last of the major ice ages to appear in the Rocky Mountains and lasted from approximately 30,000 to 10,000 years ago. Much of the landscape in the Muddy Slide area is characterized by Tertiary volcanic and intrusive processes along with their preceding metamorphic formations. There are dispersed extrusive Tertiary igneous deposits in the area as well. Also contained in these ranges are interspersed sedimentary deposits reflected in thick stratum of sandstones and shales which mostly cap the volcanic formations and have since eroded away in some areas exposing the Tertiary formations.

R. Miles of Stream Channels by Order or Class:

Table 3: Miles of Stream Channels by Order or Class

STREAM TYPE	MILES OF STREAM
PERENNIAL	3.5
INTERMITTENT	11.6
EPHEMERAL	9.6
OTHER (DEFINE)	

S. **Transportation System:**
Trails: *National Forest (miles):* 2.2 miles *Other (miles):*
Roads: *National Forest (miles):* 2.2 miles *Other (miles):*

PART III - WATERSHED CONDITION

A. Burn Severity (acres):

Table 4: Burn Severity Acres by Ownership

Soil Burn Severity	NFS	Other Federal (List Agency)	State	Private	Total	% within the Fire Perimeter
Unburned	323			59	381	9%
Low	868			50	918	22%
Moderate	1,825			43	1868	46%
High	913			14	926	23%
Total	3,929			165	4,093	100%

B. Water-Repellent Soil (acres): 926

C. **Soil Erosion Hazard Rating:** The ratings in this interpretation indicate the hazard of soil loss from off-road and off-trail areas after disturbance activities that expose the soil surface. The ratings are based on slope, soil erosion factor K, and an index of rainfall erosivity (R).

Erosion Hazard Rating	Acres
Slight	118
Moderate	2194
Severe	1804

D. Erosion Potential: 0.5-13 lbs/acre/year based on WEPP model

E. **Sediment Potential:** 10-20 tons/year (also based on the WEPP model "sediment discharge"

F. Estimated Vegetative Recovery Period (years): 3-5 years

G. Estimated Hydrologic Response (brief description): The Muddy Slide fire burned primarily within the Morrison Creek (HUC6) watershed. Morrison Creek drains north from Lynx Pass into the Yampa River downstream of Stagecoach Reservoir. Many geologic hazards exist within the Morrison Creek watershed, including at Clear Creek, Muddy Creek, and each of the northeast-flowing tributaries of Morrison Creek. These existing hazards are active and inactive landslide terrain, past mudflows along Muddy and Clear Creeks, and unstable hillslopes with evident downslope creeping.

It is common to see high-intensity, short- duration thunderstorms in the summer during monsoon season. A 10-Yr 1-Hr thunderstorm was modelled to determine hydrologic response. The total depth of this rain event trends NW to SE over the burn area from 1.05 inches near the headwaters of Clear Creek on Greenridge to 0.87 inches near the headwaters of Morrison Creek at Lynx Pass. This thunderstorm is heavily front-loaded, where approximately 75% of the rain falls in the first 15 minutes. The expected post fire response to this type of storm event is elevated sediment-laden flood flows and flash flooding.

The Wildcat rainfall-runoff model was used to model two subwatersheds within the burn area to get an idea of post fire flood flows from summer monsoon flows (*See table and map below*).

- MS1: The moderate and high soil burn severity (SBS) was 23%. An increase in runoff of 277% is predicted during a 10-year 1-hour rainfall event.
- MS2: The moderate and high SBS was 69%. A substantial increase in runoff of 862% is predicted during a 10-year 1-hour rainfall event.
- Unmodeled, burned watersheds (Unnamed tributaries to Morrison Creek and Clear Creek): increased runoff is expected where large areas of moderate and high SBS (see map below)

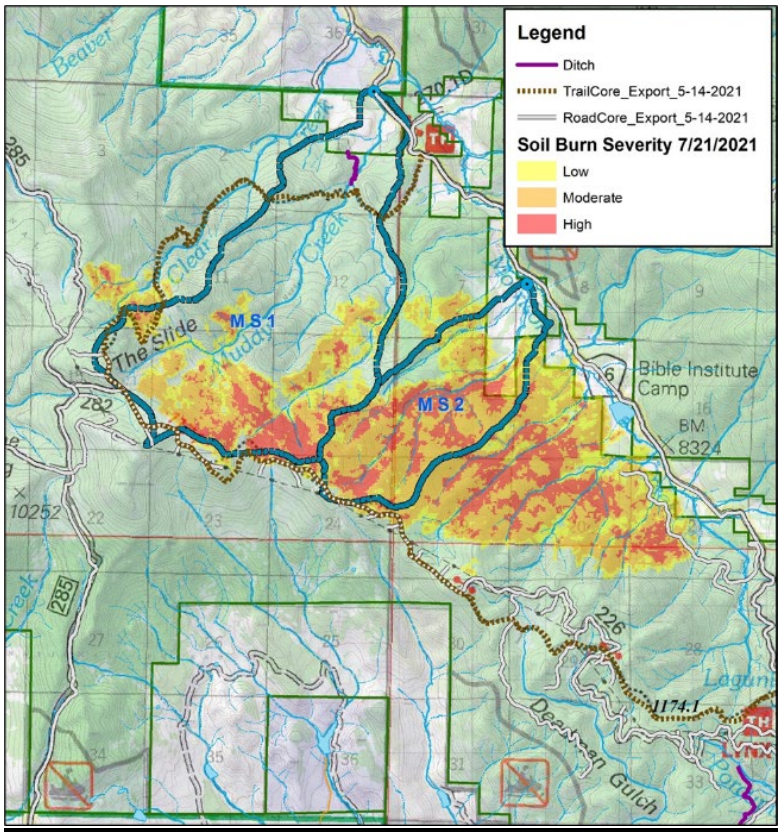
The post-fire watershed effects (increased flows, erosion, sedimentation) will likely decrease each year over the next 3-5 years as vegetation recovers. Within the 3-5 years, the burned watersheds will remain at risk for flash flooding. Full hydrologic recovery is not expected for several decades.

Table 5: Pre- and post-fire rainfall-runoff model results indicate a high risk for flash flooding within the next 3-5 years until vegetation recovers in burned areas.

						Est. 10 Yr-1 Hr Thunderstorm Runoff

Pourshed Name	Area (ac)	Pre-Fire Bankfull Flow (2-Yr RI) (cfs)	% Low SBS	% Mod SBS	% High SBS	Pre-Fire Q (cfs)	Post-Fire Q (cfs)	% Incr.	Time to peak flow (hrs)
MS1 - Muddy Creek	2810	64	11	15	8	49.1	185	277	1.29
MS2 - Morrison Creek Trib	1148	25	11	45	24	21.8	210	862	0.76

Map 1: Modelled watersheds for a 10-year, 1-hour thunderstorm.



PART V - SUMMARY OF ANALYSIS

Introduction/Background: The Muddy Slide fire started June 20th, 2021 approximately 20 miles south of Steamboat Springs, CO on the Routt National Forest. It burned through beetle kill lodgepole pine and mixed spruce-fir conifer stands. The Muddy Slide is a large scale geologic feature that occurred prior to the 1900's. The historic Morrisson Divide Trail (also known as Muddy Slide Trail) was the first recreation focused trail/road built on the Routt National Forest to bring visitors to the top of the Muddy Slide geologic feature and is popular for motorized and non-motorized recreation as well as hunting.

A. Describe Critical Values/Resources and Threats (narrative):

Table 5: Critical Value Matrix

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**

1. **Human Life and Safety (HLS):** Human life and safety of Forest visitors and employees traveling on NFS roads, the Muddy Slide Trail, and hunting in the burnscar is threatened due to the potential for injury or loss of life from falling hazard trees, flash floods, debris flows, and other burned area hazards. The probability of damage or loss is **Possible** as the area is popular with recreationists including motorized and non-motorized use on the Muddy Slide trail, NFSR 223, and hunting throughout the burn scar. The hazard tree threat is particularly concerning as much of the burned area had standing, beetle killed trees before the fire that are now further weakened. The magnitude of consequence is **major** since an overhead hazard strike, entrapment in a flood or debris flow, or motorized vehicle collision with downed trees could result in serious injury or loss of life. The risk level is **High**. Administrative closure of the Muddy Slide Trail and warning signs are recommended. See treatments P1a, P1b.

2. **Property (P):**
   a. The Morrison Divide Trail (aka Muddy Slide trail) within the burn scar is threatened due to increased post-fire runoff that may result in accelerated erosion of the trail prism downslope of areas of moderate and high SBS. While limited in extent, the portions on steep slopes or below steep slopes have the potential to intercept overland flow from upslope burned areas resulting in damage to this historic trail. The probability of damage or loss is **likely** because erosion rates are high on the steeper slopes with high or moderate SBS, and the vulnerable portion of trail has steep grades and drainage features unable to withstand the expected increases in post-fire runoff. The magnitude of consequence is **moderate** because of the limited extent at risk, although it would result in loss of a historic trail; the BAER risk level is **High**. Treatments are recommended. See treatment RT13 and RT2.
   b. There are no maintenance level 3-5 roads within or immediately downstream of the burned area, so there are no threats to these high level roads. However NFSR 227 on the southern end of the fire provides the only administrative access to the lower portion of the Morrison Creek drainage, and is popular with hunters. This road is at risk of increased erosion, flood flows and debris flows from post-fire events due to extensive areas of high and moderate SBS upslope of the road; additional stabilization measures will be needed to stabilize the road. The probability of damage is **Likely**, and the magnitude of consequences is **Minor** since this is a low volume road; the BAER risk is **Low** and treatments are not warranted.

3. **Natural Resources (NR):**Water on NFS lands within and downstream of the burn scar that is used for municipal and agriculture supply is threatened due to potential water quality impacts from increased sediment and nutrient loading following runoff producing events. The probability of damage or loss is **likely** because hillslope erosion and deposition of sediment, ash, and nutrients in downslope water bodies is expected to occur following high intensity short duration storm events. The magnitude of consequence is **moderate** because the impacts will be of short duration following summer thunderstorms, but these effects to water quality are expected to persist for the next 3 to 5 years until canopy cover, ground cover, and soil water repellency return to pre-fire conditions. The risk rating is **high.** While the natural processes and associated impacts will likely impact water storage, conveyance and treatment infrastructure, the BAER team did not determine a BAER risk rating for these non-USFS values as they are outside of BAER authority and USFS responsibility. Treatments are not recommended for water quality on NFS lands as there are not cost-effective measures that would reduce the threat to an acceptable level.

b. Soil productivity in areas of high SBS is threatened by post-fire erosion and loss of soil horizons. The probability of damage or loss is **possible** because there is a short-term potential for large increases in hillslope erosion. The magnitude of consequence is **moderate** because the considerable loss of soil productivity is within the expected variability for soil productivity in fire adapted landscapes. The risk rating is **intermediate**; treatments are not warranted.

c. Hydrologic function in areas of moderate and high SBS is threatened due to the presence of hydrophobic soils, loss of ground cover, and reduced infiltration. The probability of damage or loss is **likely** given the amount of moderate and high SBS that is present within the burn scar. The magnitude of consequence is **moderate** because the expected increases in runoff and erosion will cause channel adjustments. The risk rating is **high**. However, there are not cost-effective treatments that would reduce the threat to acceptable; therefore, treatments to reduce the risk are not recommended.

d. Suitable occupied Lynx habitat is threatened by the loss of vegetative cover across all burn severities and the loss of soil productivity in high SBS areas that could inhibit recovery of the habitat. The probability of damage or loss **very likely** where vegetative cover has been consumed by the fire. The magnitude of consequence for both threats is **minor** because any loss of vegetative cover is expected to be temporary and extensive suitable lynx habitat remains on the landscape. The risk rating for both threats is **low**; treatments are not warranted.

e. Native plant communities are most likely threatened by potential introduction of noxious weeds into areas that were disturbed by unmitigated fire suppression activities and by loss of native vegetation that was consumed during the fire. Fires can quickly and dramatically change the landscape and alter the competitive balance within the biotic community. Fire has consumed plant biomass, which increases the availability of light and reduces the consumption of soil nutrients, thus increasing invasion potential. Most invasions by nonnative plants that have been reported in the scientific literature report situations where invasive plants were already established within landscapes prior to fire. However, disturbance as a result of a fire event served as an opportunity for invasive plants to expand their local distributions and dominance and may allow the population to expand to the point that it harms the local ecosystem. Forest Service policy mandates the Forest to minimize the establishment of non-native invasive species to prevent unacceptable degradation of the burned area.

   Oxeye Daisy (Leucanthemum vulgare), Canada Thistle (Cirsium arvense), Yellow Toadflax (Linaria vulgaris), Musk Thistle (Carduus nutans) and Bull Thistle (Cirsium vulgare) are known to occur within the burn area and along adjacent access routes to the burn. However, Musk Thistle is by far the most prevalent and widespread species throughout the geographic area. Several plant vectors such as Forest roads, trails, areas impacted by fire suppression, high winds, and waterways occur within the fire area. Even though a weed washing station was utilized, seed could have been transported into the burn on suppression vehicles and equipment that arrived on the fire before the washing station was established. Fire is known to enhance the establishment of all weed species present. An emergency was determined to exist as the probability for infestations expanding from known populations adjacent to high and moderate SBS as well as in areas disturbed by suppression activities is very likely and the magnitude of consequences is moderate resulting in a VERY HIGH risk rating.; see treatments L1a and L1b.

4. **Cultural and Heritage Resources:**A file search was conducted using the best available spatial data for cultural resource locations managed by the MBRTB (See Table 1 for summary). Two sites were eligible, one prehistoric property and one historic property (homestead).

Table 1: Summary of known eligible cultural resources within the burn area:

Smithsonian Number	Site Description	NRHP Eligibility
5RT0074	Historic Homestead	Field Eligible
5RT2938	Prehistoric Lithic Scatter	Eligible

Historic Homestead (5RT0074):
The site was possibly burned over. However, no remanence of the site was identified leading us to believe that the site may have been incorrectly plotted within the Heritage database.

Prehistoric Lithic Scatter (5RT2938):
The site was relocated. The majority of the site was not impacted by the fire, some burning on the western edges. Enough detritus is laying on the ground to inhibit erosion.

East Troublesome Fire BAER Cultural Resources Risk Summary

Cultural Resource Name	Burn Severity (BARC Map) High, Moderate, Low, Very Low/Unburned	Erosion Potential	Treatment Recommendation
5RT0074	Low	Very Low	No Heritage treatment is recommended
5RT2938	Very Low	Very Low	No Heritage treatment is recommended

No emergency was determined to exist for cultural resources as the probability is unlikely, and the magnitude is moderate resulting in a **low** risk rating.

B. **Emergency Treatment Objectives:** Raise awareness of post-fire hazards throughout the burned area, minimize post-fire damage to the historic Morrison Divide Trail, and prevent loss of native plant communities due to the spread of noxious weeds.
   a. Minimize threats to life/safety to the extent possible through administrative closure of part of the Morrison Divide trail and signing on roads at entry points and at trailheads
   b. Storm proof and stabilize vulnerable portions of the Morrison Divide Trail to protect historic Forest Service property.
   c. Promote revegetation and soil stabilization by native plant communities through early detection/rapid response surveys to minimize the spread of Colorado State listed noxious weeds.

C. Probability of Completing Treatment Prior to Damaging Storm or Event:
Land: 90
Channel: NA
Roads/Trails: 80
Protection/Safety: 90

D. Probability of Treatment Success

Table 6: Probability of Treatment Success

	1 year after treatment	*3 years after treatment*	*5 years after treatment*
Land	70`	75	80
Channel			
Roads/Trails	80	90	95
Protection/Safety	80	85	90

E. Cost of No-Action (Including Loss): $5,000 for Morrison Divide Trail reconstruction assuming 50% of the proposed treated trail miles would fail. This cost only reflects monetary loss the Morrison Divide trail; it does not reflect loss of life, native plant communities, or the historic nature of the Morrison Divide Trail.

F. Cost of Selected Alternative (Including Loss): $2,550 for Morrison Divide trail treatments; $25,430 for life/safety and natural resource treatments. **Total cost of selected alternative: $26,840**

G. Skills Represented on Burned-Area Survey Team:

☒ Soils ☒ Hydrology ☒ Engineering ☒ GIS ☒ Archaeology
☒ Weeds ☒ Recreation ☒ Fisheries ☒ Wildlife
☐ Other:

Team Leader: Liz Schnackenberg
Email: liz.schnackenberg@usda.gov **Phone(s)** 970.819.2900

Forest BAER Coordinator: Liz Schnackenberg
Email: liz.schnackenberg@usda.gov **Phone(s):** 970.819.2900

Team Members: *Table 7: BAER Team Members by Skill*

Skill	Team Member Name
Team Lead(s)	Liz Schnackenberg
Soils	Ryan Adams
Hydrology	Tyler Carleton
Engineering	Loren Reimer
GIS	Nick Bencke
Archaeology	Jason Strahl
Weeds	Doug Myhre, Marti Aitken
Recreation	John Anarella
Other	Missy Dressen (WL)

H. Treatment Narrative:

Land Treatments: Early detection/rapid response (EDRR) surveys will focus on areas of high and moderate soil burn severity adjacent to known Colorado State listed noxious weeds, as well as areas disturbed by suppression activities. Heavy equipment used for suppression activities travelled through areas of known weed populations to unaffected areas, substantially increasing the risk of noxious weed spread in these disturbed areas. If new weed populations are found, they would be promptly treated to minimize the potential to spread that could result in modification of native plant communities. Surveys will begin as soon as possible starting in the summer of 2022 when species presence become detectable. Current known locations of weed species mapped came from the Yampa Ranger District weed inventory layer. Data will be collected and reported in accordance with Region 2's Direction for the Approach to Mapping and Recording Inventory and Treatment Data.

Treatments would likely be implemented through contracts or agreements but may also use Force account. Biological controls would be used in the steeper less accessible locations. Several locations include multiple weed species which may require treatment at different times and/or with different herbicides. This funding request is based on limiting expansion of known weed populations.

Treatment	Units	Unit Cost	# of Units	Total Cost
L1a - Invasives EDRR	Acres	$130	138	**$17,940**
L1b – Invasives EDRR Suppression	Acres	$130	38	**$4940**
Total				**$22,880**

Channel Treatments: None

Roads and Trail Treatments: Treatments will reduce the risk of damage from elevated post-fire runoff on the historic Morrison Divide Trail by improving the number and efficiency of drainage features along segments within and below areas of moderate and high SBS.

RT13 Trail Drainage/Tread Stabilization: The existing trail system drainage features are insufficient to handle the anticipated increase in post-fire runoff from areas burned at moderate to high severity on approximately 0.6 miles of the historic Morrison Divide Trail. Predicted increased runoff due to water repellant soils and lack of effective ground cover will be intercepted and captured, leading to severe trail tread erosion that will render the trail unusable and/or dangerous to use. Implementing this treatment will decrease the risk of unacceptable loss of trail prism, providing for continued recreation opportunities with reduced risk to human life and safety.

RT13 Trail Drainage	Units	Unit Cost	# of Units	Total Cost
Trail drainage/storm proofing	mile	$5,200	0.5	$2,600
TOTAL				**$2,600**

Protection/Safety Treatments: P1a and P1b Burned Area Warning Signs: The purpose of the Burned Area Warning signs is to reduce risks to human life and safety, to inform forest visitors of potential dangers and/or hazards when entering burned areas on NFS lands. Entering burned areas presents a high risk to human and life and safety, with increased threats from post-fire effects such as falling trees, rolling rocks, flash floods, and debris flows. It is necessary to inform the public of burned-area hazards that are a direct result of wildfire; hazards which are substantially different compared to unburned forest setting and with which many forest visitors may be unfamiliar. Burned area warning signs will be installed to inform the public of the possible dangers associated with a burned area at trailheads and major entry points into the burned area.

P1 Warning Signs	Units	Unit Cost	# of Units	Total Cost
P1a Road Warning Signs (materials and seasonal labor)	sign	$450	3	$1,350
P1b Trail Warning Signs (materials and seasonal labor)	sign	$170	2	$340
TOTAL	**Sign**			**$1,690**

I. Monitoring Narrative:

PART VI – EMERGENCY STABILIZATION TREATMENTS AND SOURCE OF FUNDS

Line Items	Units	Unit Cost	# of Units	BAER $	Other $	# of units	Fed $	# of Units	Non Fed $	Total $
A. Land Treatments										
L1a Invasives EDRR	Acre	130	138	$17,940	$0		$0		$0	$17,940
L1b Invasives EDRR Suppre	Acre	130	38	$4,940	$0		$0		$0	$4,940
Insert new items above this line!				$0	$0		$0		$0	$0
Subtotal Land Treatments				$22,880	$0		$0		$0	$22,880
B. Channel Treatments										
				$0	$0		$0		$0	$0
				$0	$0		$0		$0	$0
Insert new items above this line!				$0	$0		$0		$0	$0
Subtotal Channel Treatments				$0	$0		$0		$0	$0
C. Road and Trails										
RT13- Trail drainage	Mile	5,100	1	$2,550	$0		$0		$0	$2,550
				$0	$0		$0		$0	$0
Insert new items above this line!				$0	$0		$0		$0	$0
Subtotal Road and Trails				$2,550	$0		$0		$0	$2,550
D. Protection/Safety										
P1a Road Warning Signs	Each	450	2	$900	$0		$0		$0	$900
P1b Road Warning Signs	Each	170	3	$510	$0		$0		$0	$510
Insert new items above this line!				$0	$0		$0		$0	$0
Subtotal Protection/Safety				$1,410	$0		$0		$0	$1,410
E. BAER Evaluation										
Initial Assessment	Report	$4,940	1	---	$0		$0		$0	$0
				$0	$0		$0		$0	$0
Insert new items above this line!				---	$0		$0		$0	$0
Subtotal Evaluation				$0	$0		$0		$0	$0
F. Monitoring										
				$0	$0		$0		$0	$0
				$0	$0		$0		$0	$0
Insert new items above this line!				$0	$0		$0		$0	$0
Subtotal Monitoring				$0	$0		$0		$0	$0
G. Totals				$26,840	$0		**$0**		**$0**	**$26,840**
Previously approved										
Total for this request				**$26,840**						

PART VII - APPROVALS

1. RUSSELL BACON Digitally signed by RUSSELL BACON Date: 2021.08.30 11:36:00 -06'00'

Forest Supervisor Date