Telegraph Fire
Burned Area Emergency Response Assessment (BAER)
Executive Summary Report

Globe Ranger District
Tonto National Forest
July 9, 2021

View from Madera Ridge Road looking northwest on June 17, 2021.

Aerial view of Pinal Ridge on June 22, 2021.

Introduction

The Telegraph Fire began on June 4, 2021, on the Tonto National Forest approximately 5 miles southeast of Superior, Arizona, and the cause of the fire is still under investigation. By June 5, the Telegraph Fire was estimated at 7,000 acres and a Type 1 Incident Management Team was ordered. At the time of this report, the fire has burned more than 180,000 acres of US Forest Service (USFS), Bureau of Land Management (BLM) and Arizona State Trust lands in the southern portion of the Pinal Mountains (Figure 1). The fire burned through mixed conifer forest, ponderosa pine forest, madrean encinal woodland, interior chaparral, and Sonoran desert vegetation types. Within the boundaries of the Telegraph Fire was most of the 2017 Pinal Fire burn scar.

Core team members of the Burned Area Emergency Response (BAER) team were formally deployed into the field on June 15, 2021, when the fire was approximately 91,227 acres, 75% contained, and still actively burning on the southeast flank and within interior pockets on the northeast side. Importantly, several BAER team members were assigned to the Type 1 Team prior to July 15th and were already collecting applicable information on critical values for their BAER assessments. The team consisted of specialists in soils, hydrology, wildlife, roads, recreation, weeds, cultural resources, mineral resources, geographic information systems (GIS), and public information (PIO).

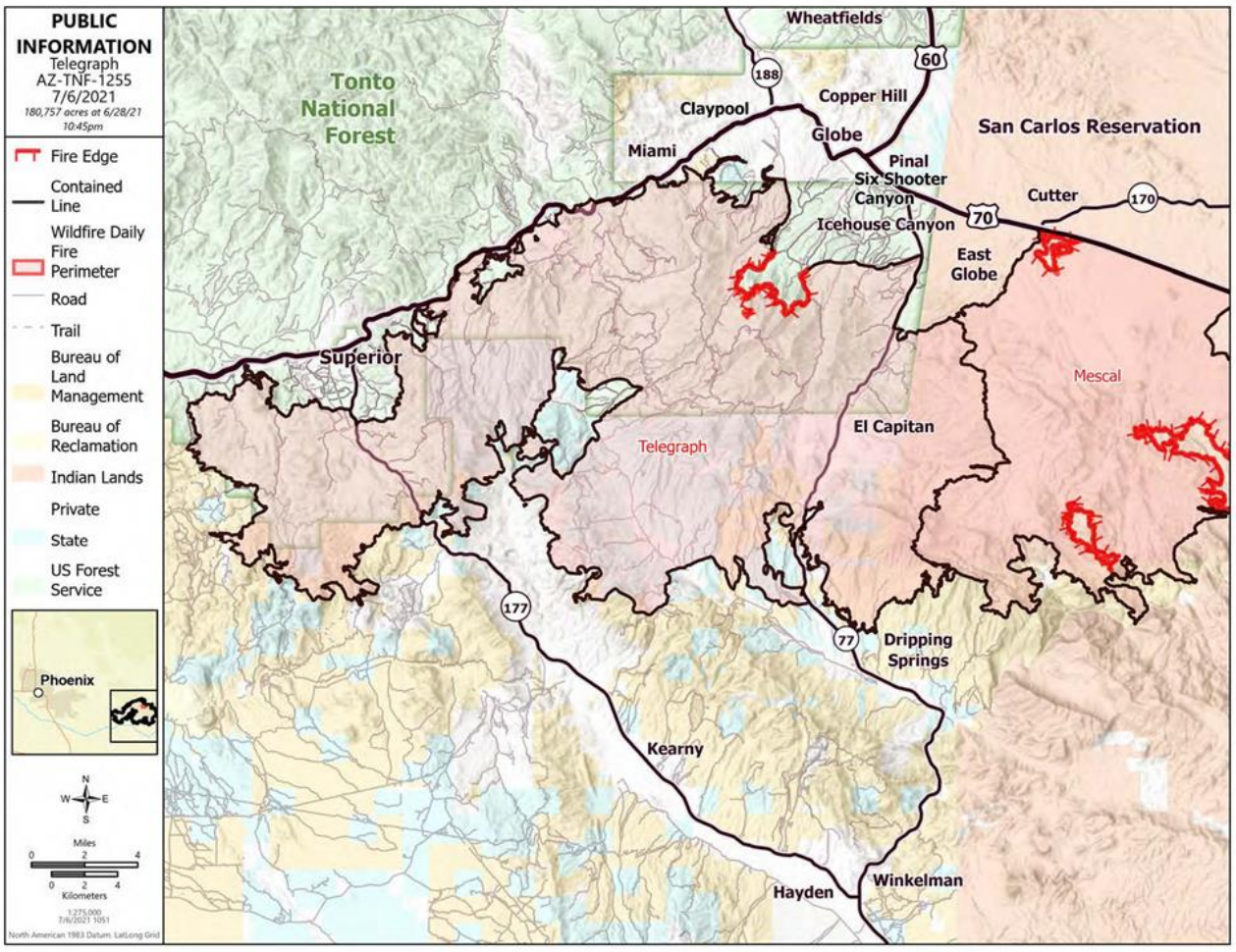

Figure 1: Telegraph fire burn perimeter as of June 28, 2021.

The first phase of the BAER assessment was to field validate the satellite data and prepare a soil burn severity (SBS) map and to assess whether unacceptable risks to National Forest System (NFS) critical values including life, property, natural, and cultural resources exist. After the team had collected this information, the soils and hydrology experts then modeled the impacts of the fire to soil erosion, flooding, and debris flows. Once the threats to BAER critical values were better understood, the team worked together to recommend emergency response actions to manage the unacceptable risks. The Telegraph BAER team PIO assisted with providing current and accurate information to stakeholders, partners, and the public through an Inciweb page: https://inciweb.nwcg.gov/incident/7560/

An important piece of this BAER assessment was the collaboration between three separate BAER teams established to address critical values on their respective lands. The USFS BAER team worked closely with the other two BAER teams, who each took the lead in understanding and addressing the risk from watersheds that drained from NFS lands towards tribal lands and BLM lands.

Throughout the assessment, the USFS team coordinated with technical partners, local jurisdictions, stakeholders, elected officials, State and County emergency services, and direct interaction with community members, the public, and the media. BAER information was also provided via Facebook community meetings with the Type 1 IMT, meetings with local jurisdictions and elected officials, and interviews with local media. Notably, the team was helped by the Arizona Geological Survey and the US Geological Survey to provide assessments of debris flow potential from the burned area.

Ecological Setting

Elevation within the Telegraph Fire footprint ranges from 2,800 to 7,800 feet. This range of elevation covers many ecosystems including Sonoran Desert, Semidesert grassland, Juniper grassland, Pinyon-Juniper woodland, Interior Chaparral, and Ponderosa Pine forest. Dominant vegetation types in the Sonoran Desert include Saguaro Cactus, Yellow Paloverde, and Jojoba. Semidesert grasslands are dominated by woody species such as Mesquite and Acacia. The characteristic species of interior Chaparral are Mountain Mahogany, Manzanita, and Sonoran scrub oak. Pinyon-juniper woodlands include single leaf Pinyon pine, Alligator Juniper, and Redberry Juniper. The Ponderosa Pine ecosystems have an overstory dominated by Ponderosa Pine with alligator juniper and Arizona white oak in the understory.

The burned area lies within portions of sixteen 12-digit Hydrologic Unit Code (HUC) watersheds that drain to four 8-digit HUC watersheds. Three watersheds drain to Queen Creek, three to Pinal Creek and ultimately the Salt River, three to the San Carlos River, five to the Gila River, and one to Roosevelt Lake (Figure 2). Eleven of these watersheds have more than 25% of their area within the burn area, including: Arnett Creek, Bloody Tanks Wash, Devils Canyon, Lower Ranch Canyon, Lyons Fork, Russell Gulch, Silver Creek, Upper Dripping Spring Wash, Upper Mineral Creek, Upper Ranch Creek, and Walnut Canyon. Some watersheds, such as Arnett Creek, were entirely within the fire perimeter, but experienced predominantly low soil burn severity. Watersheds with this burn pattern consisted of mostly desert grassland and Sonoran grassland vegetation types. These vegetation types experienced low residency time of fire therefore reducing anticipated post-fire effects.

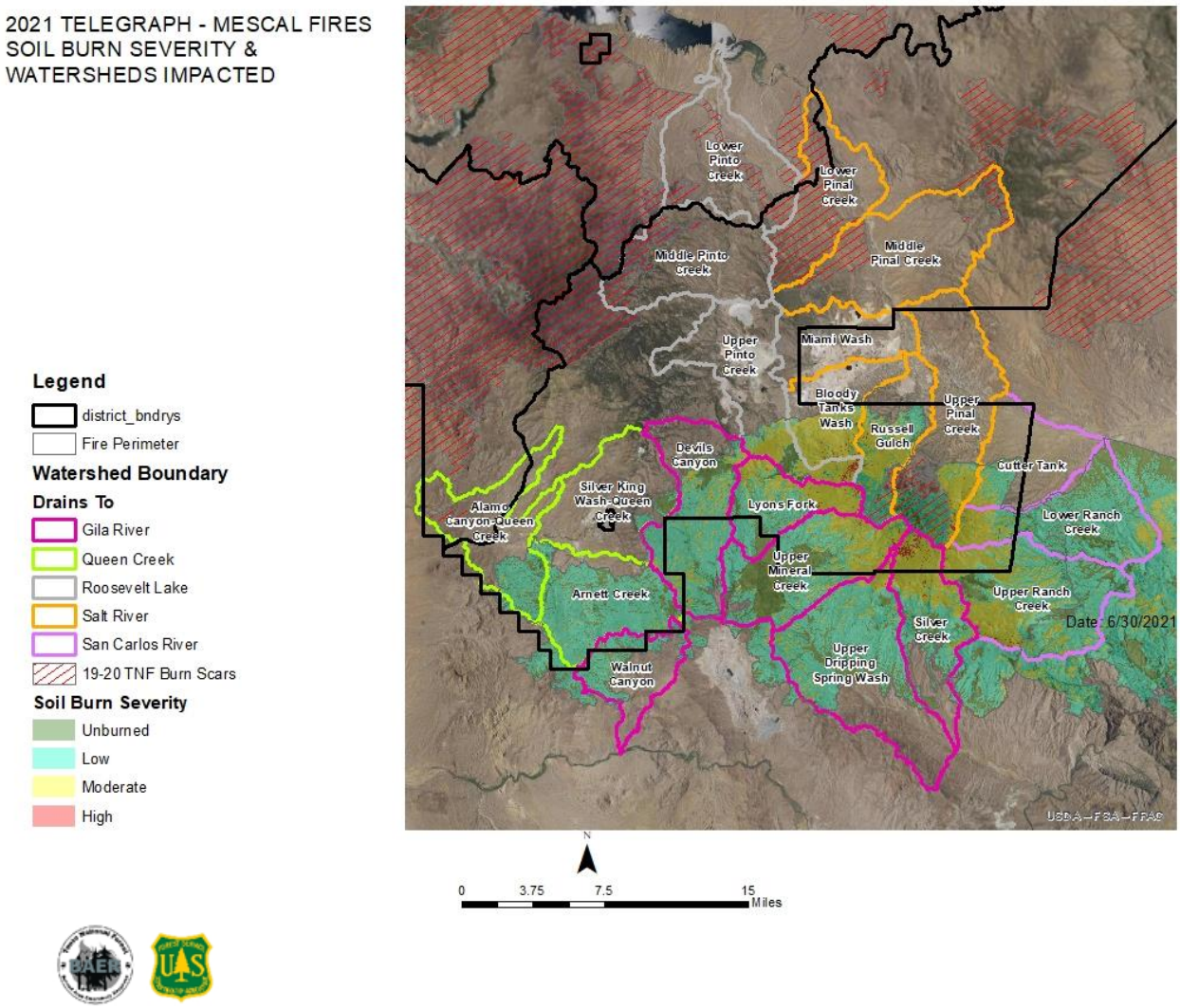

Figure 2: Map of HUC 12 Watersheds and Soil Burn Severity

Post-Fire Soil Conditions

Soil burn severity indicates the effect of the fire on soil productivity and health. Soil burn severity assessment begins with acquisition of a Burned Area Reflectance Class (BARC) image that compares infrared reflectance values intercepted by Sentinel 2 satellites prior to and after the fire. BARC imagery is a useful starting point for developing a soil burn severity map but only "sees" above ground effects of fire and must be field verified before it can be turned into a final Soil Burn Severity (SBS) map. In addition to above ground vegetative indicators, soil burn severity also accounts for below ground soil heating effects and associated impacts to soil hydrologic function, runoff and erosion potential, and vegetative recovery. These additional factors include: amount and condition of residual ground cover, viability of native seed banks, condition of residual fine roots, degree of fire-induced repellency, soil physical factors (texture, structural stability, porosity, restricted drainage), soil chemical factors (oxidation, altered nutrient status), and topography (slope gradient, length, and profile).

High and moderate severity burns to the soil can often result in hydrophobic (water repellent) conditions. Field verification revealed that a significant amount of moderate burn severity areas were characterized by water repellent soils and complete consumption of ground cover and canopy cover, particularly within the woodland and chaparral vegetation communities. Overall, burn severity was a mosaic of unburned, and low to moderate burn severity with some sections of high burn severity. The low burn severity was primarily within the lower elevation Sonoran Desert vegetation type, while the moderate burn severity was found primarily in the forest and woodland types. Burn severity acreage is displayed below in Table 1. Notably, the burn scar from the 2017 Pinal Fire, which was a fire managed for natural resource benefit, burned at low severity even though it was primarily dominated by forest and woodland vegetation types that burned at moderate and high soil burn severity in other parts of the fire. The outline of the Pinal Fire burn scar can be clearly seen in Figure 3 one as the island of light and unburned (blue and green) in the middle of moderate and high in the north central portion of the Telegraph Fire. Overall, 29.2% of the entire Telegraph fire burned area, across all jurisdictions, burned with moderate to high soil burn severity, as depicted in the SBS map below (Figure 3).

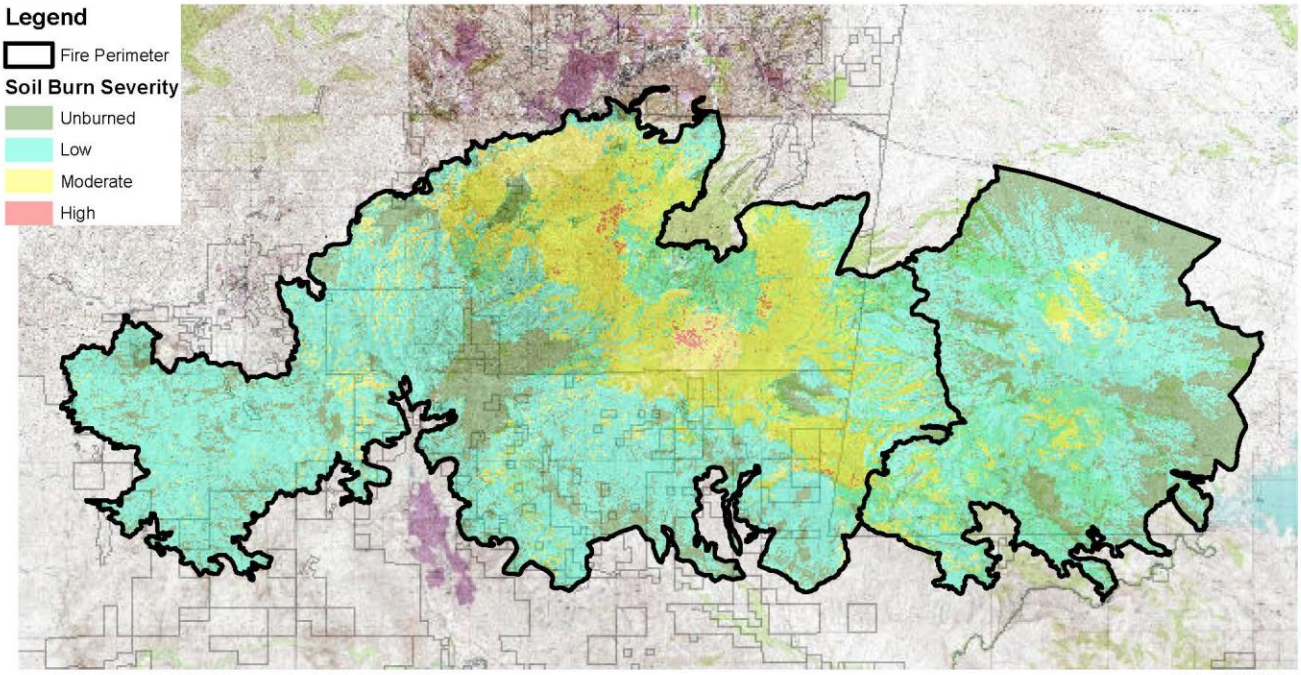

Figure 3: Soil Burn Severity map for Telegraph and Mescal fires.

Erosion and sediment yield modeling of soils in the burned area found that the overall natural pre-fire erosion rates for the burned area averaged less than 1 ton per acre. Soil generally regenerates itself on an annual basis at a rate of 3 tons per acre. Based on field surveys and modeling results, the overall post-fire erosion rate for the entire burned area averaged greater than 10 tons per acre, indicating that a significant amount of soil will be lost due to post-fire conditions. Increased hillslope erosion is expected to occur throughout the burned area.

Table 1. Telegraph Fire Soil Burn Severity on NFS lands

Soil Burn Severity	Acres	Percent of NFS Lands
Unburned	11,903	12.6%
Low	44,179	46.7%
Moderate	37,488	39.7%
High	958	1%
Total	94,528	100%

Post-Fire Watershed Conditions

Watershed conditions following a fire, such as loss of stabilizing vegetation, decreased soil porosity, and increased hydrophobicity in soils, are all factors that can increase the magnitude, timing, and volume of stormwater runoff. Sediment and ash that these flows can transport can cause aggradation, down cutting, and/or widening of stream channels that can significantly reduce the functioning condition of these channels. The increased peak flows pose a threat to life, property, and resources within and below the burned area.

Initial concerns that the team identified were threats to downstream life and property in the Lyons Fork, Russell Gulch, Upper Dripping Spring Wash, Upper Ranch Creek, Bloody Tanks Wash, Russell Gulch, Upper Pinal Creek, Silver Creek, and Upper Pinto Creek watersheds. Each of these watersheds either have greater than 75% of the watershed within the burn scar or have significant amounts of moderate and high soil burn severity. Bloody Tanks Wash, Russell Gulch and Upper Pinal Creek drain toward the towns of Miami and Globe and contain roads that lead to critical communications equipment. Upper Pinto Creek contains or drains to three CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act) sites as well as private land. Silver Creek drains towards the town of Dripping Springs.

To evaluate threats to BAER critical values, BAER team hydrologists analyzed watersheds with computer modeling tools (Wildcat5 and HEC-HMS). A smaller set of watersheds were also evaluated post fire flash flood risk for the first few storms after the fire using empirical formulas developed by The National Weather Service (NWS) designed for southeastern and central Arizona. The watersheds of primary concern are those characterized by more moderate and high soil burn severity (Figure 4).

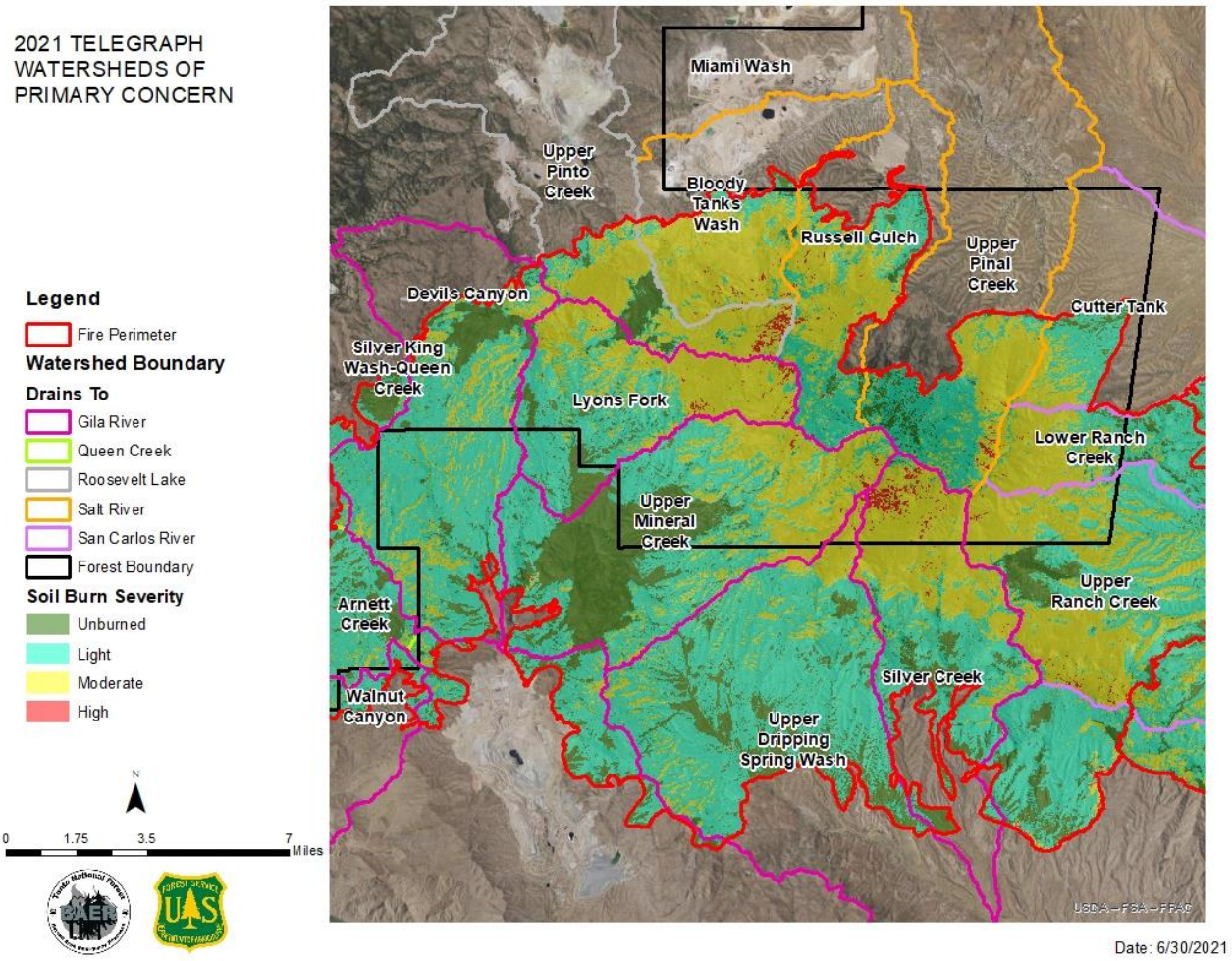

Figure 4: Watersheds with Moderate and High Soil Burn Severity

Post fire peak flows often begin with an initial flush of water, sediment, ash, and entrained post-burn debris that are sometimes characterized as hyper-concentrated flows. Post fire flows have greater energy to scour channels and transport material than do regular rainfall runoff events that occur over unburned landscapes. These flows can cause substantial damage to channels and structures and are a threat to life and property. The magnitude of these flows should decline as ash and debris are transported from the watershed. Once the initial flush of burned material has been washed from the watershed, peak flows are governed more by watershed condition than by post fire ash, sediment, and post burn debris. The first few high intensity storms following the fire pose the greatest flash flood hazard to downstream areas.

Table 2 displays flash flood risks from select watersheds draining the burned area. The risk ratings are based on criteria developed in Reed, et al (2012) and represent risks based on peak flows per square mile. This is not a comprehensive list of areas with flash flood risk, it is likely that flash flood risks exist at areas other than that shown on Table 2.

Table 2: Flash Flood Risk for Selected Watersheds

Flash Flood Risk					
Selected Sub-Watersheds	Drainage Area (sq mi)	Peak Flow/Square Mile (cfs/sq. mi)			
		Storm Recurrence Interval (yrs)			
		1	2	5	10
Pioneer Pass	0.9	Extreme Risk			
Ellis Mine	0.24	Extreme Risk			
Henderson Blue Gate Mine	2.97	Moderate Risk		High Risk	Extreme Risk
Russel Gulch Community	6.77	Moderate Risk			High Risk
Bloody Tanks Community	5.52	Moderate Risk		High Risk	Extreme Risk
FSR 222 Culvert	2.34	Extreme Risk			

Risk Rating	
Low Risk	< 100 cfs/sq. mi
Moderate Risk	100-1000 cfs/sq. mi
High Risk	1000-2000 cfs/sq. mi
Extreme Risk	>2000 cfs/sq. mi

Of those watersheds considered by the USFS team, hydrologic response for watersheds within the burn scar will be extreme for 20% of the sub-watersheds in the 2-year storm event, very significant for 16% of the subwatersheds, significant for 16% and minimal for 48% (Figure 5). Among the watersheds with higher portions of burned area and/or significant amounts of moderate and high soil burn severity, of most concern were Upper Pinto Creek, Lyons Fork, Russel Gulch, and Bloody Tanks Wash. The last two watersheds drain toward the Town of Miami. Upper Pinal Creek, which drains toward the Town of Globe, has some areas of significant increase and others of minimal increase. Areas of minimal increase coincide with the 2017 Pinal Fire burn scar.

While it appears that the old burn scar mostly prevented moderate and high soil burn severity in those portions of the Upper Pinal Creek Watershed, there are still areas that did burn with high and moderate. Most importantly, there is evidence that debris flow risk can be underestimated in reburned areas, therefore these areas should be assumed to be at higher risk despite the low soil burn severity and minimal modeled hydrologic response. Notably, the primary watersheds that drain toward the Town of Superior had minimal or no burn within them, indicating that the Town of Superior is not threatened by post-fire effects at this time. See Table 3 for a summary of modeled flows.

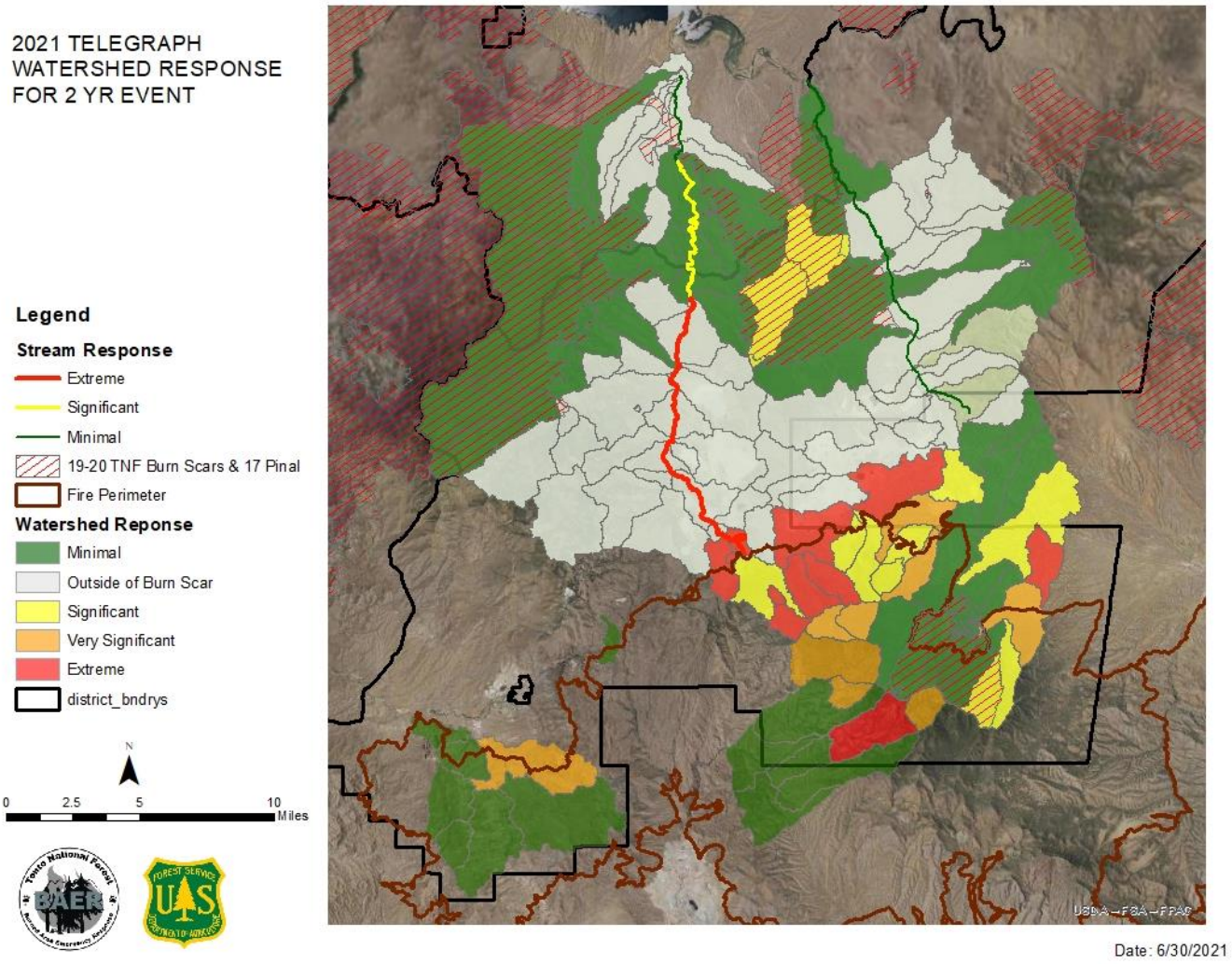

FIGURE 5: TELEGRAPH WATERSHED RESPONSE FOR A 2 YR EVENT

TABLE 3: SUMMARY OF POST-FIRE CHANGE IN FLOWS

12 Digit HUC Number	12 Digit HUC Name	Drains to	Modeled Basin Name	Annual (100% Probability) Storm	50% Probability Flow Change Pre-Post Fire	10% Probability Flow Change Pre-Post Fire
150501000401	Arnett Creek	Queen Creek below Superior	Upper Arnett Creek	Very Significant	Minimal	Minimal
			Telegraph Canyon	Very Significant	Minimal	Minimal
			Outlet to Queen Creek	Very Significant	Minimal	Minimal
150501000402	Silver King Wash-Queen Creek	Queen Creek above Superior	Oak Flat	NA	Minimal	Minimal

12 Digit HUC Number	12 Digit HUC Name	Drains to	Modeled Basin Name	Annual (100% Probability) Storm	50% Probability Flow Change Pre-Post Fire	10% Probability Flow Change Pre-Post Fire
150501000204	Lyons Fork	Gila River	Upper Lyons Fork	Extreme	Very Significant	Very Significant
150501000206	Upper Mineral Creek	Gila River	Pinal Campground	Significant	Very Significant	Extreme
			Mineral Creek	Very Significant	Extreme	Very Significant
			Outlet	Significant	Significant	Minimal
150601030703	Upper Pinto Creek	Roosevelt Lake	Ellis Mine (Headwaters)	Very Significant	Very Significant	Extreme
			MF Ranch	Very Significant	Extreme	Extreme
			Pinto Creek at US60	Very Significant	Extreme	Extreme
			At Iron Bridge (Pinto Ck channel only)	Very Significant	Extreme	Extreme
150601030704	Middle Pinto Creek	Roosevelt Lake	At Outlet to Lower Pinto Creek (Pinto Ck channel only)	Significant	Significant	Significant
150601030706	Lower Pinto Creek	Roosevelt Lake	At Outlet to Roosevelt Lake (Pinto Ck channel only Includes flow from Campaign Ck Watersheds)	Minimal	Minimal	Minimal
150601030604	Upper Pinal Creek	Salt River	Pioneer Pass Campground	Significant	Significant	Extreme
150601030604	Upper Pinal Creek	Salt River	Kellner Canyon	Minimal	Minimal	Minimal
			Icehouse Canyon	Minimal	Minimal	Minimal
			Sixshooter Road Lower	Extreme	Significant	Minimal
			Globe	Significant	Significant	Minimal
			At Outlet to Middle Pinal Creek	Minimal	Minimal	Minimal
150601030601	Russell Gulch	Salt River	Sulfide Del Ray	Minimal	Minimal	Extreme
			Madera Peak/Upper Russel Gulch	Very Significant	Very Significant	Minimal
			At Outlet to Middle Pinal Creek	Very Significant	Very Significant	Minimal
150601030602	Bloody Tanks Wash	Salt River	Copper Springs Canyon	Very Significant	Extreme	Extreme
			Upper Bloody Tanks	Very Significant	Extreme	Extreme
			Live Oak Gulch	None	None	None
			At Outlet to Middle Pinal Creek	Very Significant	Extreme	Minimal
150601030606	Middle Pinal Creek	Salt River	At Outlet to Lower Pinal Creek (Pinal Ck channel only)	Minimal	Minimal	Minimal
150601030607	Lower Pinal Creek	Salt River	At Outlet to Salt River (Pinal Ck channel only)	Minimal	Minimal	Minimal

The US Geological Survey has estimated the probability and magnitude of debris flows within and from the burned area and developed a debris flow hazard rating from the combination of these factors for various rainfall intensities for watersheds within the burned area. According to their analysis, the primary areas of concern for debris flows (60%-80% chance) are in the Silver Creek watershed on the southern boundary of the Tonto and some smaller areas along Pinal Creek, Russel Gulch, and Lyons Fork. Stream segments with elevated risk of debris flows are found throughout the portions of the burn scar with moderate and high soil burn severity. Most watersheds are estimated to produce debris-flow volumes between 10,000 and 100,000 m^3. Figures 6 and 7 provide visual representations of debris flow risk and volumes for the peak 15-minute intensity of 24 mm/hr event.

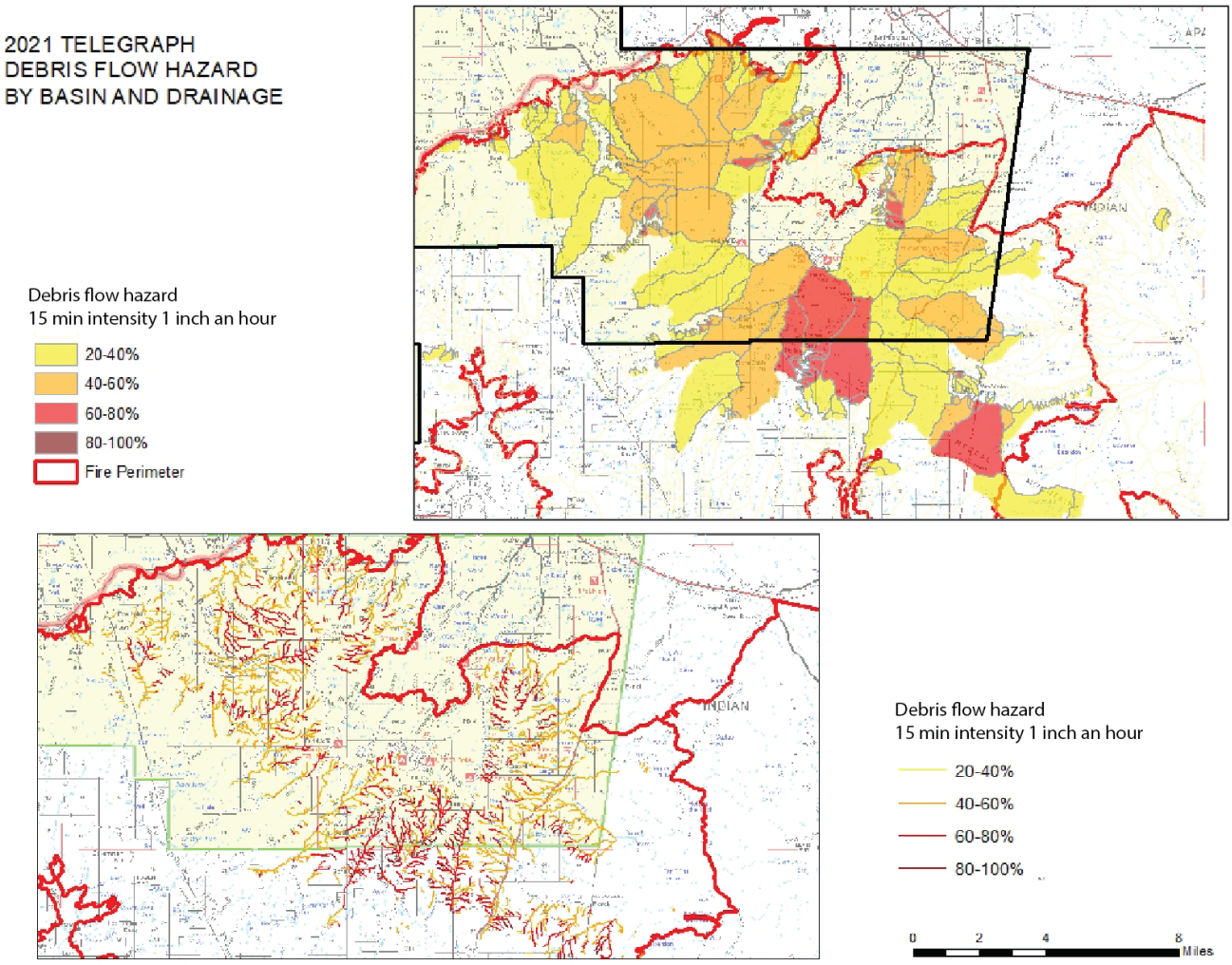

FIGURE 6: OVERVIEW OF DEBRIS FLOW HAZARD FOR 15 MIN – 1 INCH PER HOUR EVENT (USGS GENERATED DATA)

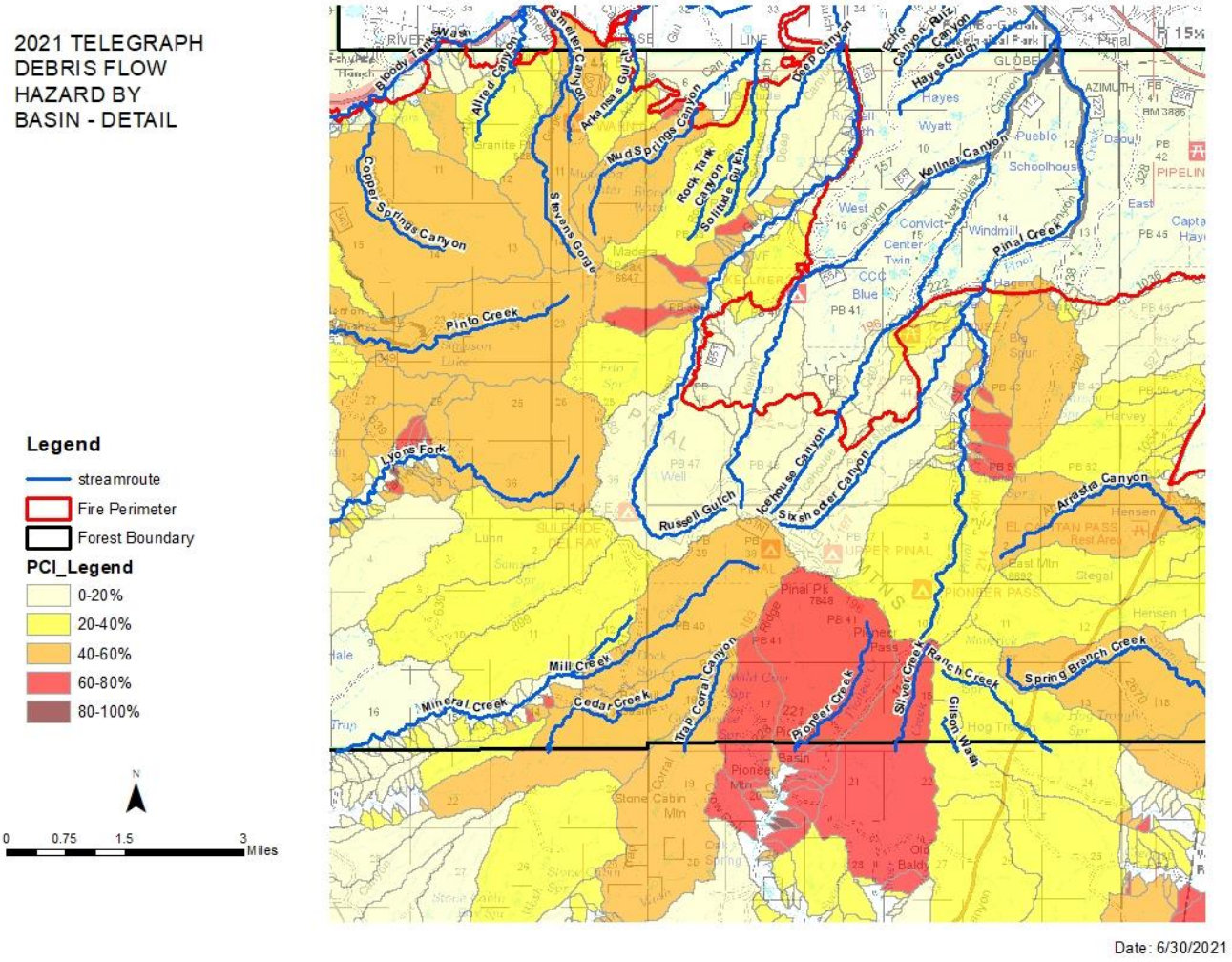

FIGURE 7: DEBRIS FLOW HAZARD FOR 15 MIN - 1 INCH IN AN HOUR EVENT (USGS GENERATED DATA)

Critical Values Assessment

BAER critical values are identified by resource specialists on the BAER team based on guidance provided in FS Directives (Table 4). The risk to these values is then determined by considering 1) the probability that damages would occur, and 2) magnitude of consequences of damage to the critical value. This assessment evaluates critical values using a risk matrix provided in FS Directives (Table 5). This matrix is used to assess whether unacceptable risks exist to human life and safety, property, or critical natural or cultural resources on National Forest System (NFS) lands. When unacceptable risks are identified, treatment actions to reduce the probability of occurrence or lessening the anticipated consequences can be prescribed. The USFS BAER team has completed this risk assessment for NFS critical values.

Table 4: Critical Values to be Considered During Burned-Area Emergency Response

CRITICAL VALUES
HUMAN LIFE AND SAFETY
Human life and safety on National Forest System (NFS) lands.
PROPERTY
Buildings, water systems, utility systems, road and trail prisms, dams, wells or other significant investments on NFS lands.
NATURAL RESOURCES
Water used for municipal, domestic, hydropower, or agricultural supply or waters with special Federal or State designations on NFS lands.
Soil productivity and hydrologic function on NFS lands.
Critical habitat or suitable occupied habitat for federally listed threatened or endangered terrestrial, aquatic animal, or plant species on NFS lands.
Native or naturalized communities on NFS lands where invasive species or noxious weeds are absent or present in only minor amounts.
CULTURAL AND HERITAGE RESOURCES
Cultural resources which are listed on or potentially eligible for the National Register of Historic Places, Traditional Cultural Properties, or Indian Sacred Sites on NFS lands.

Table 5: BAER Risk Assessment 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**

Probability of Damage or Loss: The following descriptions provide a framework to estimate the relative probability that damage or loss would occur within 1 to 3 years (depending on the resource):

- Very likely. Nearly certain occurrence (90% - 100%))
- Likely. Likely occurrence (50% - 89%)
- Possible. Possible occurrence (10% - 49%)
- Unlikely. Unlikely occurrence (0% - 9%)

Magnitude of Consequences:

- Major. Loss of life or injury to humans; substantial property damage; irreversible damage to critical natural or cultural resources.
- Moderate. Injury or illness to humans; moderate property damage; damage to critical natural or cultural resources resulting in considerable or long term effects.
- Minor. Property damage is limited in economic value and/or to few investments; damage to critical natural or cultural resources resulting in minimal, recoverable or localized effects.

BAER Treatments

BAER treatment recommendations must undergo an internal review at the unit, Regional Office, and Washington Office, depending on procurement considerations and funding amount. Treatment recommendations currently under consideration and/or implementation include those listed below. Look for implementation updates on the Telegraph BAER Inciweb page: https://inciweb.nwcg.gov/incident/7560/

- Implement targeted area closures to protect users from risks caused by post-fire conditions, and to protect BAER critical values from potential damage from users.
- Conduct removal of floatable debris along key drainages and sites to reduce risk to roads, cultural resources, and hydrologic function from damage caused by debris flows.
- Conduct storm inspection and response to maintain the roadbed on Forest roads.
- Place warning signs on key roads, trails, or entry points to warn users of dangerous post-fire conditions.
- Stabilize at-risk portions of trails within the Pinal Trails System.
- Install protective measures to protect various CERCLA sites from post fire flooding and erosion.
- Armor a low water crossing on FSR 651, located on the Pinal Mountain Road.
- Conduct early detection and rapid response including the application of chemical herbicide, to prevent the spread of invasive weeds resulting from fire suppression activities.
- Continue to share information with key stakeholders, partners, agencies, and others, so they can properly prepare for potential effects of off-forest flooding.

Conclusion

Potential post-fire effects from the Telegraph Fire vary across the 94,000 acres of NFS lands included within the overall >180,000-acre footprint of the fire. Areas of concern for both erosion and post-fire flooding impacts include, but are not limited to, Upper Pinto Creek, Lyons Fork, Russel Gulch, and Bloody Tanks Wash watersheds. Treatments such as area closures, signage where areas are reopened to the public, and stabilizing CERCLA sites could help mitigate risks to human life and safety. Other treatments could help to mitigate post-fire impacts to natural and cultural resources as well as critical recreation and road infrastructure. Finally, monitoring of threatened and endangered species habitat, streams, roads, and trail conditions could help understand long-term impacts to resources.