Cedar Creek Burned Area Summary

2500-8 Burned Area Report

Fire Background

The Cedar Creek Fire started from a lightning strike on July 8, 2021. The fire started approximately 3.2 miles west-southwest of the community of Mazama, merged with the Varden Fire, and was referred to as the Cedar Creek Fire (Figure 1). This ~55,000-acre fire caused evacuations and multiple temporary closures remain in place due to the fire effects. The fire burned within the Methow River drainage. Several headwater streams within the burned area have extensive fire impacts.

Figure 1 Cedar Creek Fire activity from Goat Creek Road.

The Forest Service assembled a Burned Area Emergency Response (BAER) team on August 25, 2021, to assess both the Cedar Creek and Cub Creek 2 Fires. This team of experts in various natural resource disciplines began assessing the post-fire effects to critical values on Forest Service lands. The team developed a soil burn severity (SBS) map to document the degree to which soil properties had changed within the burned area. Fire-damaged soils have low strength, high root mortality, and exhibit increased rates of water runoff and erosion. Using the SBS map, BAER team members ran models to estimate changes in stream flows (hydrology) and debris flow (geology) potential. The modeled results were then used to determine the relative risk to different critical values and inform recommendations to address risks that were determined to be an emergency. This document acts as a summary of the formal assessment and FS-2500-8, Burned Area Report.

Watershed Response

Soils

Soils within the burned area are formed in materials comprised primarily of glacial till, glacial outwash, alluvium, colluvium, and residuum from various rock sources. The soils vary widely in texture, depth, content of rock fragments, drainage, and temperature. Most of the soils are blanketed with a mantle of volcanic ash of varying thickness. Soils throughout the burned area generally shows weak development since most are derived from glacial materials. Additionally, alluvial and colluvial processes have retarded soil forming processes and the development of strong soil structure.

An estimated 48% of the burned area within the Cedar Creek Fire exhibit high or moderate soil burn severity and may have developed water repellent soils as a result (see map on page 7). Like the Cub Creek 2 Fire, vegetation mortality in the moderate and high soil burn severity areas ranged from 80 – 100%.

Geology

Much of the Pacific Northwest is very geologically active and many steep slopes are prone to landslides and debris flows as a natural process. The Cedar Creek Fire may speed up some of those natural processes in certain watersheds. Fire increases the potential for debris flows, partly due

to the removal of vegetation.

A storm event of 32 mm/h (about 0.3 inches in 15 minutes) was predicted to have greater than 80% probability of debris flows in several drainages, including but not limited to many of the tributaries to Wolf Creek, several tributaries to the Methow River, several tributaries to Early Winters Creek, and two tributaries to Little Bridge Creek in the Twisp River drainage.

The probability of debris flows is even higher in the Cedar Creek burned area in response to a 15-minute intensity of 40 mm/h (about 0.4 inches in 15 minutes), a rain event with roughly a 10-year recurrence interval.

Most of these watersheds are roughly estimated to produce more than 1,000 m^3 of debris, resulting in a high debris flow hazard.

Non-FS values within and downstream of the burned area may also be threatened by inundation from flooding and debris flows, including but not limited to homes on debris fans along the northeast face of the fire, homes on the Wolf Creek debris fan and on fans south of Wolf Creek, and State Highway 20 (see map on page 8). The Washington Geological Survey's full Wildfire-Associated Landslide Emergency Response Team Report (WALERT) can be found at https://www.dnr.wa.gov/publications/ger_hazards_landslide_walert_report_cedar_cub_2021.pdf. A map showing alluvial fans on the edge of the fire perimeter from their report is duplicated on page 10 of this summary.

Hydrology

Watershed response will likely include an initial flush of ash and fine sediment, rill and gully erosion in headwater drainages and in small, steeper drainages within the burned area, debris-laden flash floods (Figure 2) and debris flows in response to high-intensity rain events, as well as elevated snowmelt peak flows.

Preliminary hydrologic modeling indicates flow increases in many headwater channels of >100x the pre-fire flow rates for a given storm. Water quality will be diminished during seasonal peak runoff, as well as after high-intensity summer rains, due to elevated ash, fine sediment, and nutrient loading. Elevated post-fire response will gradually diminish over time as vegetation and groundcover levels recover over the next several years, although some impacts are likely to persist for a decade or longer (see map on page 9).

Figure 2 Debris in burned channels is easily mobilized by rain and increased flows.

Critical Values

Roads and Drainage Features

The watersheds burned in the Cedar Creek Fire are predicted to exhibit varying degrees of response through increased runoff, and debris and sediment transport. This creates a future concern for roads, culverts (Figure 3), bridges, and channels along the drainage paths of the burned watersheds in that they may be plugged, overtopped, or washed away more frequently than experienced under pre-fire conditions.

Forest system roads within the burn perimeter (61 miles) or connected to it are located on soils derived from alpine glacial till at lower elevations

or volcanic ash and pumice over igneous or metamorphic residuum as elevation increases. Slopes range from moderately steep to very steep throughout the Cedar Creek Fire and corresponding drainages.

Potential critical values at risk addressed in this report include Forest Service System Roads and related drainage features.

Specific Forest Service roads and their associated drainage features at risk include:

4410	4410440
4410100	4415
4410200	4415040
4410400	5310100
4410415	5310145
4410500	5210200
4410522	

Also, all non-surveyed roads within or immediately adjacent to high or moderate soil burn severity are considered at risk and warrant an assessment as they become accessible.

The proposed treatments include signs warning travelers of the increased danger, construction of dips and armored dips to facilitate drainage, installation of drop inlets to ensure drainage functions remain intact with added debris, cut off damaged section of pipes to ensure free drainage, clean inlets, catch basins and outlets to restore functional drainage, and regular storm inspection and response.

While there are no known Forest Service owned or maintained bridges or large culverts at risk from the, there are other public and private at-risk bridges and culverts that should be evaluated for channel-way adequacy (often included in bridge inspection reports), abutment condition and exposure, vegetation content on banks upstream and downstream of the structure, adequacy of culvert inlet (basins, headwalls, bevel), existence of livestock stream-fencing, or any other factors that impact the hydraulic and debris-passing capacity of the structure.

Figure 3 Burned debris can quickly plug undersized culverts.

Recreation

Many recreation resources are located within or near the perimeter of the fire on NFS lands, including two campgrounds, three trailheads, numerous dispersed use sites, seven terra trails, one sno-park, groomed motorized and non-motorized trails, and the Lake Chelan-Sawtooth Wilderness area designation. Recreational use occurs throughout the year within this area and seasonal use occurs at each of the developed infrastructure assets.

Camping: Fire impacts to campgrounds were observed through site visits. Klipchuck and Early Winters campgrounds are both outside the fire perimeter and are not directly impacted by the fire. Both are located downstream from some moderate and high soil burn severity areas, but the threat of flooding or debris flows is unlikely due to their location and the fact that relatively little of the Early Winters watershed burned. No treatments are recommended.

Dispersed camping is a popular activity in this area as well. While no infrastructure is at risk in these areas, human life and safety is still a major concern at many of these sites, due to falling trees and flooding. Recommended treatment is for temporary site closures, warning, or closure signs to

be posted at sites along trails outside of wilderness (especially including the Cedar Creek area with a few sites in the Chickadee area), and hazard tree assessment to be completed. Sites with unacceptable risks should be closed until hazards are reduced through natural recovery of the area. For sites in the Lake Chelan-Sawtooth Wilderness, warning signs should be posted at the trailhead. Consistent with Forest Service wilderness policy, signs are typically not posted inside the wilderness and instead are located at trailhead bulletin boards. There is a higher expectation of risk while in wilderness with increased need for self-reliance by visitors. These factors result in the recommendation for warning signs, rather than closure, of established campsites inside the Lake Chelan-Sawtooth wilderness

Trailheads and Trails: The Wolf Creek trailhead was burned over resulting in loss of infrastructure and the presence of hazard trees. Because the trailhead is a location for congregation of the public and administrative personnel, there is a high risk to life and safety due to the threat of overhead hazards from hazard trees. The toilet (Figure 4) burned leaving an open vault containing human waste, resulting in high risk to life and safety. Recommended treatments include temporary closure of the trailhead and treating or pumping the toilet and sealing the open holes to prevent them from filling with water and snow.

Figure 4 All that remains of the Wolf Creek TH toilet is the metal roof.

The Cedar Creek trail (476 – Figure 5), Wolf Creek trail (527), and some trails in the Chickadee area, including Thompson Ridge trail, experienced moderate to high burn severity. These trails are high or medium use trails that were in good condition prior to the fire. Due to post fire threats, these trails have a very high level of risk for infrastructure damage or failure. These trails are recommended for treatment to stabilize, stormproof, or mitigate the anticipated impact of post-fire storm events.

Additional recommended treatment includes temporary closure of the Cedar Creek trail (476), Wolf Creek trail (527), and some trails in the Chickadee area, including portions of the Thompson Ridge trail. These are the highest use and most impacted trails.

Temporary closure of the Wolf Creek trail (527) will effectively also close the South Fork Wolf Creek trail (527.1), North Fork Wolf Creek trail (528), and the Milton Mountain trail (508) due to access to those trails being dependent upon travelling the Wolf Creek trail.

Figure 5 Cedar Creek Trail damage may get worse with eroding hillslopes.

One groomed winter motorized, and numerous groomed winter non-motorized trail routes are located within the fire perimeter, including in the Chickadee area. A high life and safety risk exists to users of these trails that are in moderate and high soil burn severity areas during the winter season due to the threat of hazard trees whether by direct impact from a falling tree, or by newly fallen trees causing accidents, or limiting egress. This is a very dense trail network with overlapping summer and winter trails. Some trails in the Chickadee area are only lightly affected and may remain open.

For snow trails that remain open, warning signs are recommended to be posted at the Eightmile sno-park, the Chickadee trailhead, and other access points alerting users to the increased risk of hazard trees especially due to winter storms during the season of use. The groomed snowmobile trail going up SR20 is at lower risk due to being in an area with mostly low burn severity. It is not recommended for closure, but a warning sign at the sno-park is recommended.

Trail conditions and hazards should be reassessed in the spring or summer of 2022, and thereafter as needed, to determine if risks have been reduced to an acceptable level to reopen closed trails.

Botany

The Cedar Creek fire burned into fire-sensitive riparian and shrub-steppe communities and reburned patches of forests and woodlands recovering from recent severe fire effects. The unknowing introduction and dispersal of invasive weeds into areas disturbed by fire suppression and rehabilitation has the potential to establish large and persistent weed populations. In addition, it is highly likely that extant weed infestations adjacent to the burn area will expand due to their accelerated growth and reproduction and a release from competition with natives.

Approximately 43 miles of dozer line and 8 miles of handline (Figure 6) were constructed outside and within the burn perimeter. In addition to causing an increase in weed invasion, the disturbances caused by dozer lines are expected to create accelerated erosion and soil compaction that may also inhibit the recovery of native plant populations. The Cedar Creek fire overlapped with five different fires that have occurred on USFS land within the past 35 years. It is expected that 109 acres of shrub steppe communities, and 23,215 acres of dry and hot forested plant communities that reburned within the past 35 years will face impacts given the invasion of cheatgrass, knapweed, dalmatian toadflax and whitetop that are changing the ecological response and fire resiliency of these ecosystems. It is also expected that the 10 acres of riparian communities that burned at moderate to high severity are vulnerable to establishment of noxious weeds from off forest wind dispersed species. If weed infestations are not detected and controlled within the first year post-fire, these previously intact native communities will likely type-convert into exotic species dominance.

Figure 6 Newly dug firelines are good host locations for invasive weeds.

The Forest recommends a treatment of Early Detection, Rapid Response (EDRR) to monitor for noxious weed infestation and expansion. In areas disturbed due to mechanical suppression activity (approximately 360 acres) and burned areas prone to new noxious weed infestations (120 acres), weed technicians will perform regular surveys and treat new infestations.

Cultural Resources

There are historically significant sites within the Cub Creek 2 burned area and assessments of those sites is planned. While the initial focus of the BAER team was human life and safety, the team also recognizes that heritage resources are critical values. These significant sites will be evaluated as soon as possible by district staff to assess fire damage and new risks from the post-fire conditions.

Wildlife

Impacts to aquatic systems are directly related to the anticipated increases to runoff, erosion, and sedimentation in streams. Proposed treatments for road drainage will help to reduce those impacts to stream habitats. District fish biologists are reviewing the assessment and preparing emergency consultation documentation and coordinating with aquatic habitat restoration partners.

Non-Forest Service Values

Since fire effects know no administrative boundaries, additional threats exist for assets not owned or managed by the Forest Service. This includes recreation residences, private property, municipal water sources, etc., and the BAER team is already engaged with interagency partners to ensure that off-Forest values covered by other programs are addressed by the relevant responsible entities.

Conclusion

The BAER team has identified imminent threats to values at risk based on a rapid scientific and engineering assessment of the area burned by the Cedar Creek Fire. Despite taking significant precautions to minimize exposure to COVID-19, the assessment was conducted using the best available methods to analyze the potential for flooding and debris flows. The findings provide the information needed to prepare and protect against post-fire threats. The Forest Service will continue to provide information and participate in interagency efforts to address threats to public and private values at risk resulting from the Cedar Creek Fire.

Maps of soil burn severity, debris flow hazards, runoff potential, and alluvial fans adjacent to the burned area can be found on the following pages.

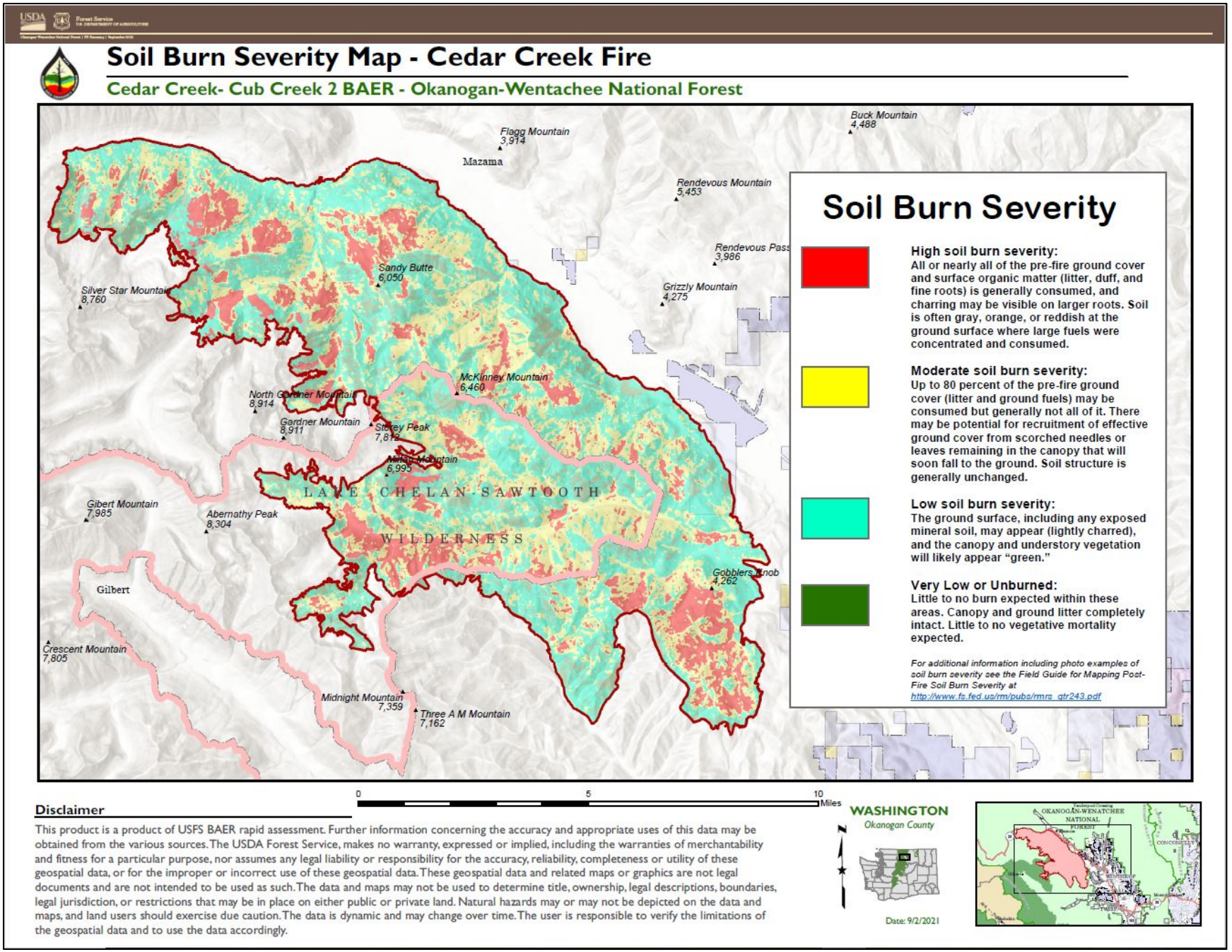

Figure 7 Soil burn severity map of the Cedar Creek Fire.

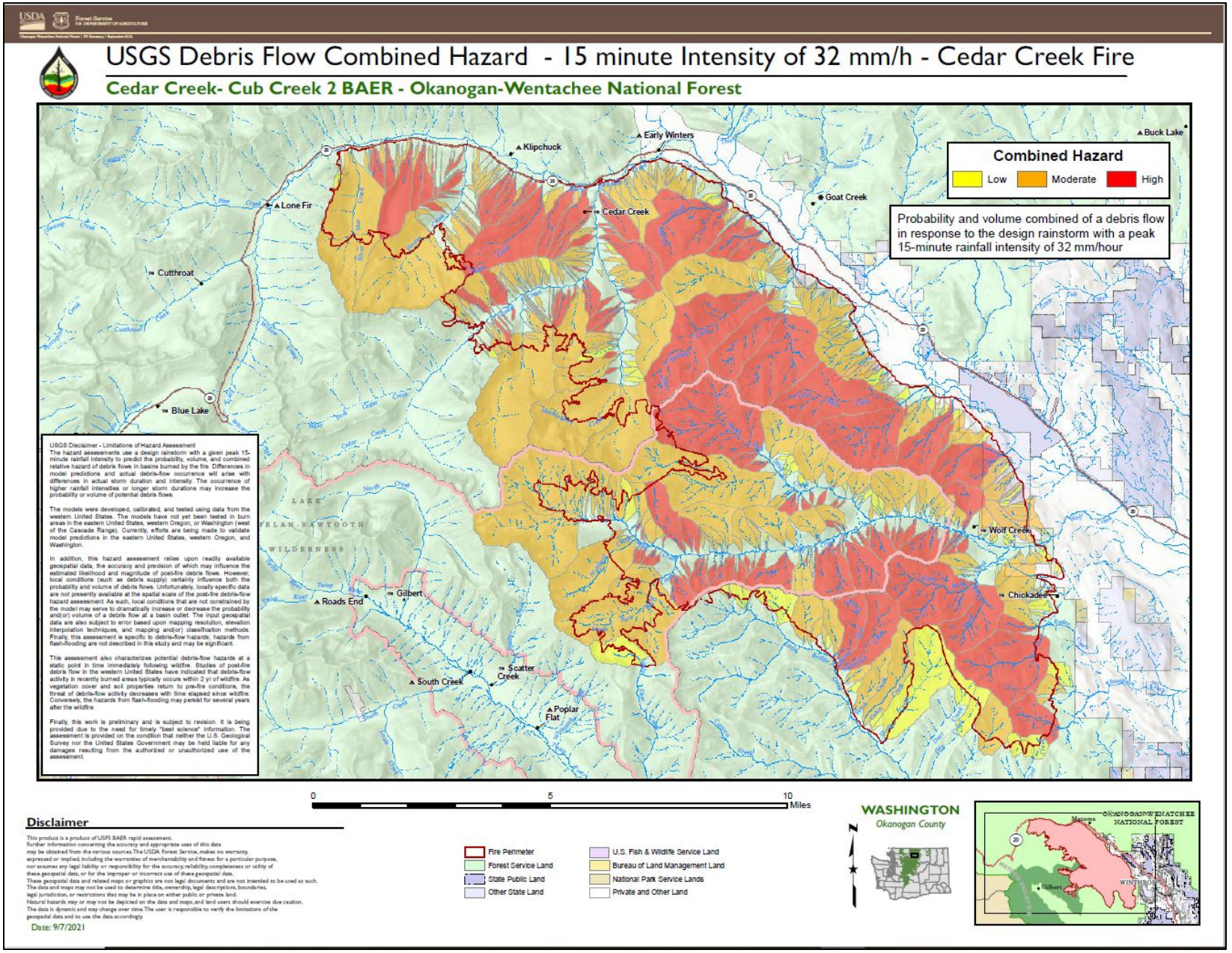

Figure 8 Debris flow hazards for the Cedar Creek Fire

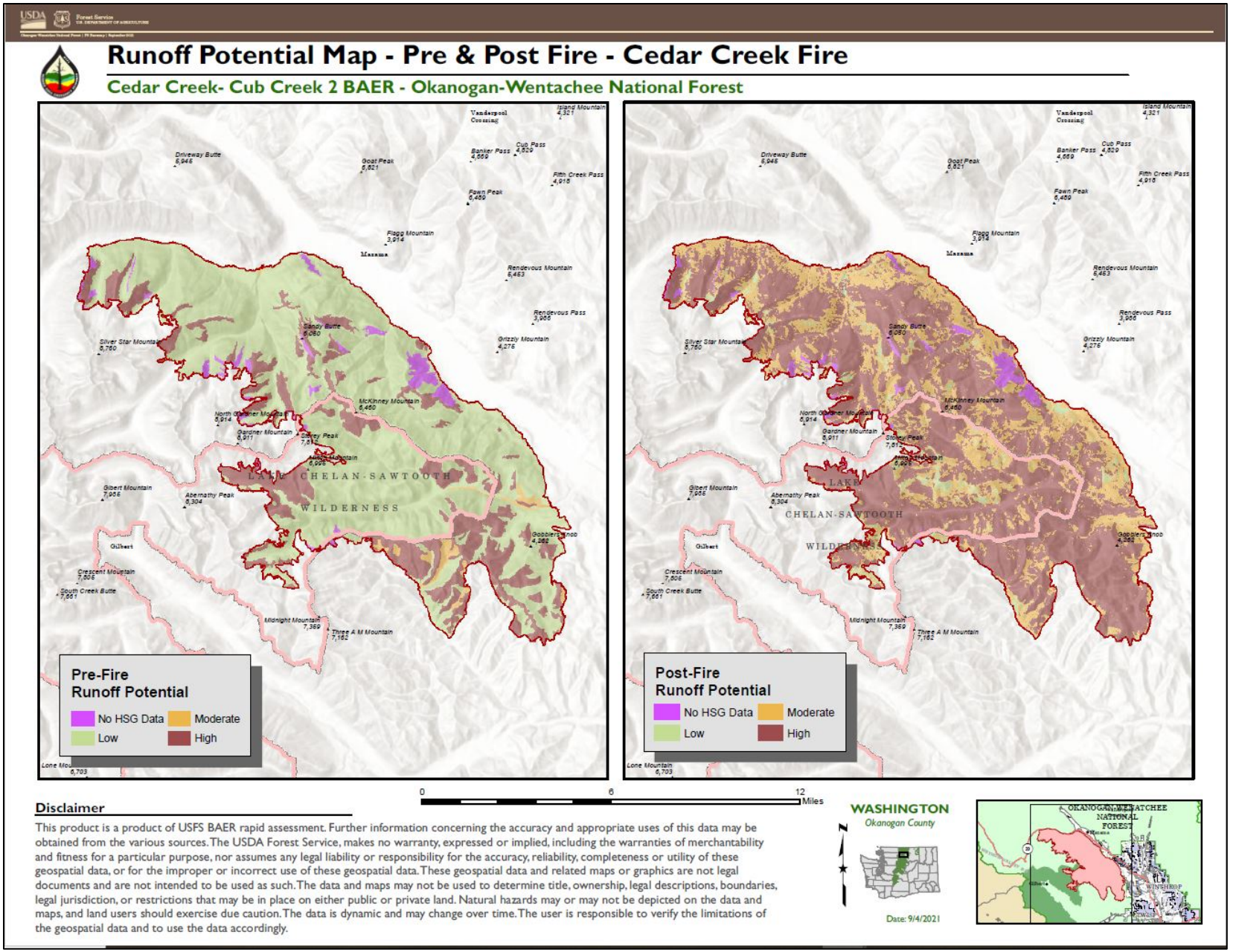

Figure 9 Maps showing pre- and post-fire modeled runoff potential.

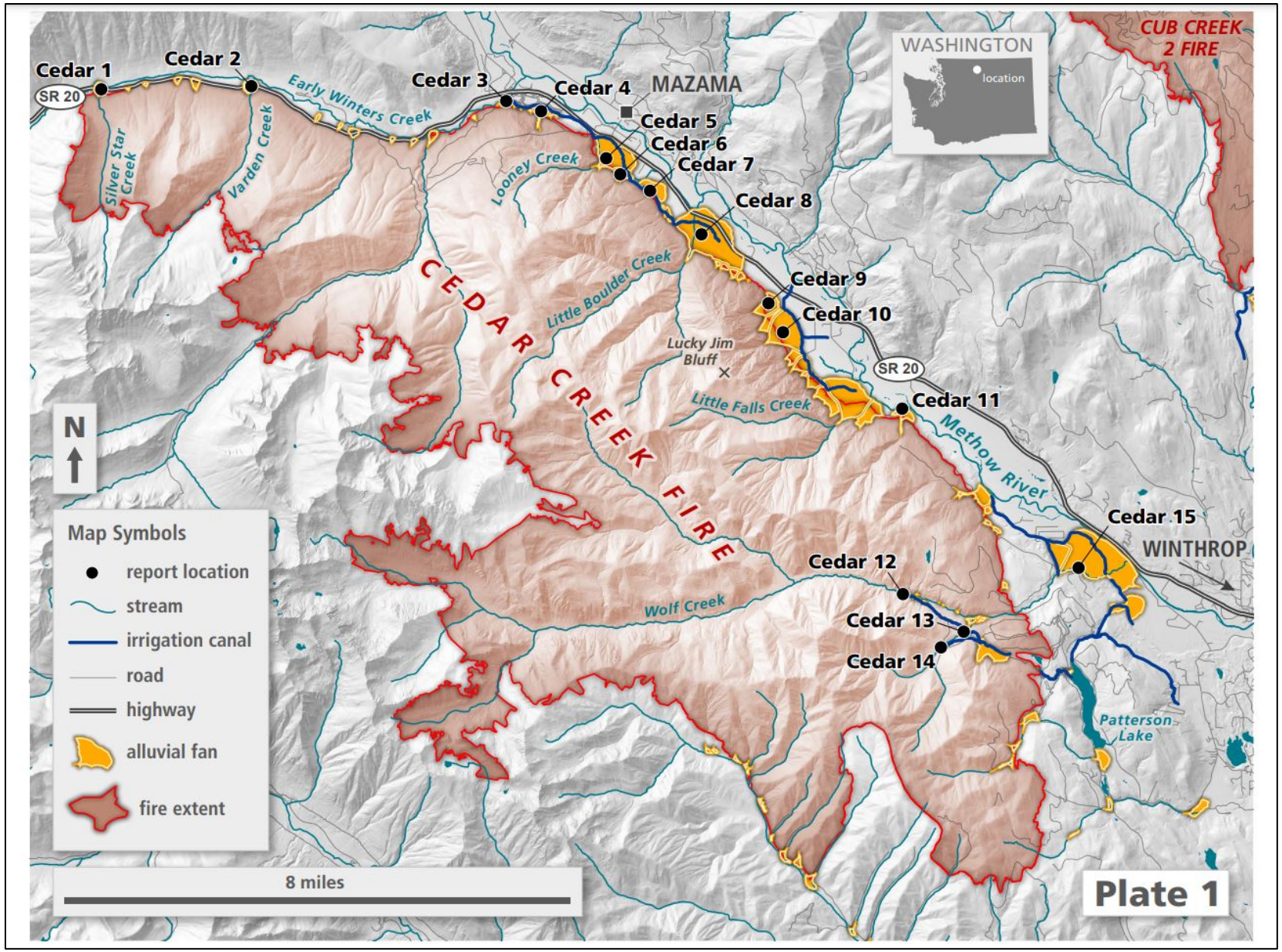

Figure 10 Map of alluvial fans in the vicinity of the Cedar Creek Fire.