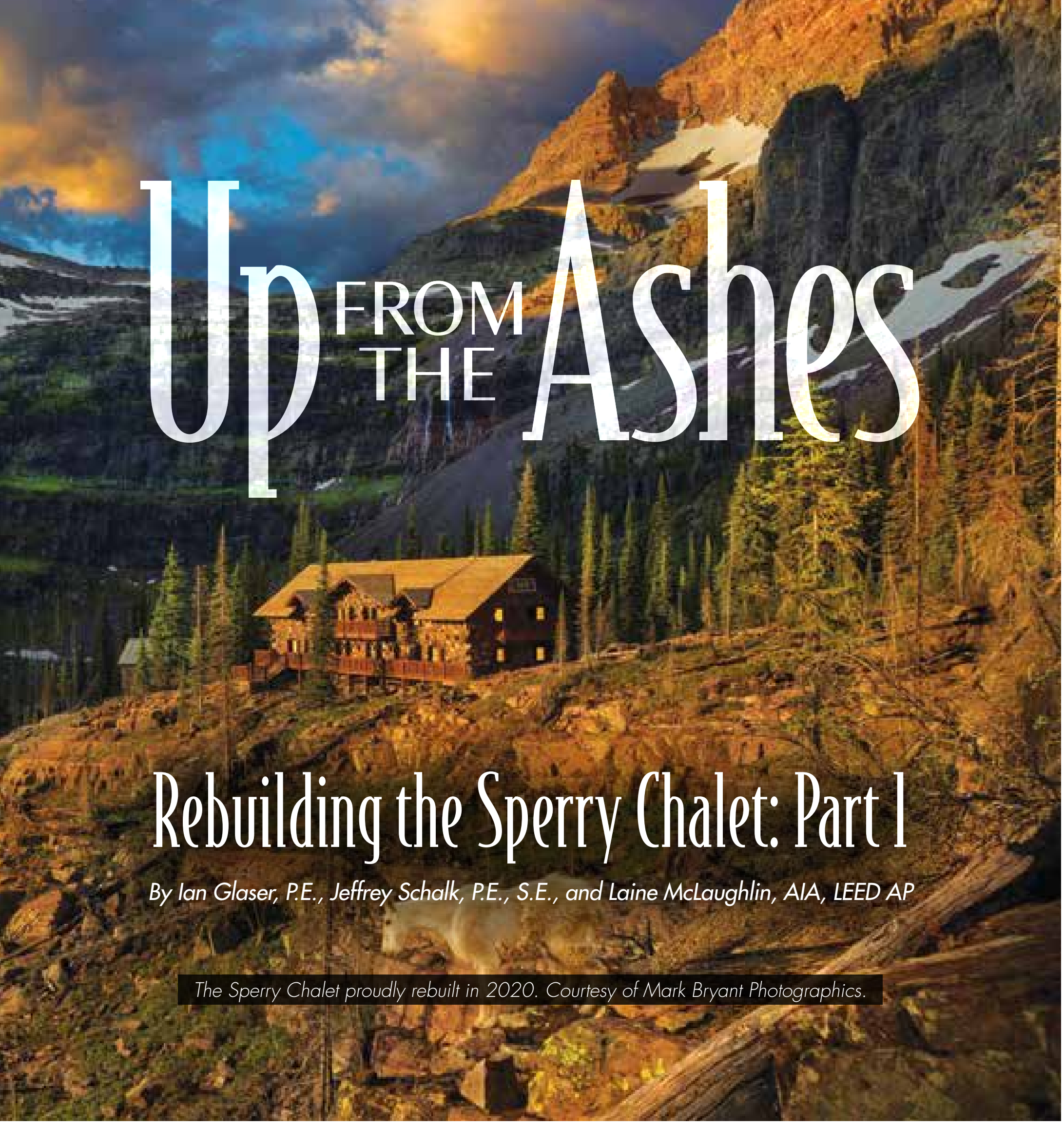

Up from the Ashes

Rebuilding the Sperry Chalet: Part 1

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The Sperry Chalet proudly rebuilt in 2020. Courtesy of Mark Bryant Photographics.

On August 31, 2017, the Sprague Fire, roaring through Glacier National Park, reached the remote backcountry site of Sperry Chalet. It was one of two remaining chalets out of nine built by the Great Northern Railway Company in the 1910s within Glacier National Park's high country. Despite preemptive mitigation efforts by park staff to protect the building, a spark from the nearby fire's ember storm caught in one of the chalet's eaves. The log-framed interior structure burned completely, leaving only the four stone masonry walls and the two interior stone chimneys still standing. Two accessory structures on the site were spared.

In October, National Park Service (NPS) crews raced to temporarily stabilize the free-standing walls with interior timber bracing before the snows began. The character-defining exterior masonry walls were at risk of collapse from snowdrifts and wind gusts over the upcoming winter season (*Figure 1*). This emergency stabilization effort was spearheaded by the NPS and the Glacier National Park Conservancy, the park's non-profit funding partner.

Backed by a groundswell of public support, the NPS committed resources to rebuild the Sperry Chalet. In March 2018, Anderson Hallas Architects was engaged to lead the design team, which included JVA, Inc. as the structural Engineer of Record and Atkinson-Noland Associates, who evaluated the existing masonry and provided expertise regarding its condition, characteristics, and repair.

With the goal of starting construction immediately following snowmelt (July) and enclosing the building before the onset of winter (October), the design team was tasked with producing construction drawings without the benefit of having been to the site. The team created a Revit model based on the handful of drawings and photographs made available. Roof pitches, wall thicknesses, floor-to-floor heights, log diameters, and log spacing were estimated based on the limited documentation. Undocumented detailing was assumed based on experience with similarly constructed buildings from the era.

With a short timeline to complete the design, structural system selection was a critical early decision. Vital considerations were code compliance and constructability. The preferred alternative, derived from the public outreach process, favored rebuilding the chalet in a way that honored, if not matched, the original character. Structural system selection had to incorporate all of these objectives. In the winter months, the chalet is almost entirely blanketed in snow and previous studies indicated a ground snow load of 350 psf. The new roof design was based on a roof snow load of 275 psf. Reframing the building with logs that were strategically designed with concealed steel flitches satisfied all the design imperatives. The log joists and rafters were manageable to erect and were field adjustable by the timber framers.

The other early pivotal design decision was to phase construction by framing the building in the first summer and repairing the masonry walls in the next summer. The drawings specified a new exterior raker bracing scheme that supplemented the interior timber bracing. The design stipulated progressive removal of the interior bracing as the floor levels were installed from the bottom up. Temporary stud sister walls, located just inboard of the exterior masonry walls, were designed to support the new structure's weight

Figure 1. The chalet survives the first winter after the fire, thanks to emergency bracing. Courtesy of GravityShots.com.

Figure 2. Designers assess the structure in July 2018 amongst the forest of braces.

Figure 3. Engineers core-drill the masonry wall.

as it was being built since the existing masonry was too fragile to bear upon. The sister walls were also detailed to provide out-of-plane stability to what was, in the interim, essentially just a masonry façade.

The design team started and completed the accelerated design, concurrent with NPS reviews, within six weeks. The approved Construction Documents were then issued for competitive bidding. By June, Dick Anderson Construction was awarded the contract, and they mobilized in early July.

Two days after the general contractor arrived on site, the design team trekked the 6.7-mile trail to reach the structure perched on the cliffside 3,300 feet above the trailhead at Lake MacDonald. Provisions and hand tools were carried by mule-train, and testing equipment was delivered by helicopter. The purpose of the visit was to validate the construction drawings and begin assessing the fire-damaged stone masonry (*Figure 2*). While the contractor mobilized and the design team investigated, they collaborated.

Bedrock in the crawlspace was cored for laboratory analysis that ultimately confirmed that the geotechnical criteria assumed for the design were appropriate. Surface penetrating radar was implemented to profile the historic masonry walls' layup, and scans were substantiated in strategic locations with video-scoped cores (*Figure 3*). Several anchors were installed into the masonry walls on the first reconnaissance day. They were load-tested at the end of the trip to verify anchor shear and tension capacities used for the seismic calculations.

During this first trip to the site, several discoveries were made that illuminated inaccuracies in the geometry assumed a few months prior. The assumed grid-to-grid dimensions were off by as much as twelve inches. Measurement of existing beam pockets revealed discrepancies in the estimated floor joist spacing. The profile of the rock below the crawlspace varied more than anticipated. In some places, crawlspace depth was too shallow to allow for dropped framing. In other places, the crawlspace needed to be excavated so that new footings could bear directly on the rock. JVA returned to the office to revise the foundation and first-floor plan and was back on-site five days later to help the contractor understand and implement the changes (*Figure 4*). This process of visiting the site to document existing conditions and construction progress followed by structural drawing revisions continued throughout the summer, level by level, to avoid any delays in the short construction window.

The contractor had initially assumed the ability to use helicopters with a 3000-pound payload capacity to transport materials to the site. But fires in the summer of 2018 reassigned these larger helicopters to firefighting. An available helicopter with a 1000-pound payload capacity was ultimately used. Consequently, more flights were required, and they were scheduled with sensitivity to the natural habitat and busy visitor season.

With two alternating crews working seven days a week, the Chalet was enclosed (*Figure 5*) and the damaged masonry walls re-supported laterally at the end of the first construction phase. The crew demobilized in October as the cold and snow prevented further work. In the summer of 2019, the crews completed the second phase of work, which included repairing the exterior masonry walls and tying them permanently into the structure. The exterior balconies were rebuilt, and the doors, windows, and interior features were installed. Although dampened by COVID-19, the Sperry Chalet welcomed its first guests since the fire in July 2020.

Notwithstanding the aggressive schedule and the logistics of the backcountry site, the ambitious design required creative thinking to overcome several structural challenges. The designers sought to balance code compliance with original framing proportionality while integrating the remaining masonry walls into the structural system. Details of the structural design will be highlighted in the second part of this article.▪

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Figure 4. The first floor is framed as interior bracing is progressively removed.

Figure 5. Timber framers set the log rafters via helicopter assist. Courtesy of A Boring Photo.