

THE URBAN AVALANCHE INTERFACE AND COMMUNITY IMPACTS
A CASE STUDY: KETCHUM, SUN VALLEY & THE WOOD RIVER VALLEY, IDAHO

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ABSTRACT: The reality of dealing with urban development in avalanche terrain can look simple on paper but is challenging and complex in real life. Other factors come into play beyond what is described on avalanche zoning maps. It is not just the home we are trying to protect, but also the lives of those that occupy and service the structure. Increasing population density, more homes built in avalanche terrain and recent avalanche cycles have produced numerous avalanche incidents and management problems throughout the communities of the Wood River Valley. This case study highlights close calls, management efforts and identifies individuals and groups placed at risk during an avalanche event. Other communities may benefit from this knowledge and improve their existing problems or recognize future avalanche issues. Before approval of new development in avalanche terrain local planners need to fully identify all individuals that may be put at risk – these often extend beyond the building’s occupants and may include emergency services, maintenance personnel, neighbors and visitors. In addition, local planners must consider how many locations may be simultaneously affected by avalanche events during large storms. Communities need to have avalanche-educated leaders, decision makers and planners who with the support of avalanche professionals, can accurately identify and understand local avalanche problems. Proactive management strategies can then be developed and applied on a case-by-case basis in order to reduce the increased avalanche risk associated with new development.

KEYWORDS: hazard, zoning & planning, urban interface, risk management

1. INTRODUCTION:

Avalanches are not new to the communities surrounding world-renowned Sun Valley Resort. Numerous historic records mention avalanche accidents and fatalities around the early mining camps. Since Sun Valley Ski Resort’s opening in 1936, avalanche accidents have primarily been recreational or residentially oriented. In the early days of development, homes were kept away from the steep valley slopes. Now, tourism and real estate have created a resort town economy with increasing pressures to develop and build beneath the valley’s steeper slopes and out narrow side canyons.

The City of Ketchum realized the threat and consequences of avalanches within city limits in 1969, when an avalanche destroyed the Borlase house adjacent to Warm Springs Road. By 1979, the city of Ketchum was among the first cities in the United States to institute an avalanche-zoning program. The neighboring cities of Sun Valley, Hailey and Bellevue developed some avalanche recognition in their planning, but none have as formal a zoning plan as Ketchum.

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Figure 1: Warm Springs avalanche slopes above the City of Ketchum, 2008. Photo by J. Kellam

“Urban” avalanche cycles in the Wood River Valley do not occur every year, but have taken place several times some winters and in a variety of locations during storms. The intermittent nature of these events, sometimes with long return intervals, means the thought of avalanches slips “out of sight, out of mind”. People forget, and some residents and visitors have never been exposed to avalanche conditions or information.

Urban avalanche events and close calls in recent years indicate that the human activity outside of any structure in avalanche zoned neighborhoods needs to be included in risk assessment and community planning decisions. Multiple avalanche events stretch small town emergency resources, which also have many non-avalanche related calls during storms. Two separate avalanche cycles in January 2008 illustrate these points.

2. GEOGRAPHY, WEATHER & CLIMATE:

The Wood River Valley is a narrow mountain valley. State Highway 75 provides access up the main travel corridor from 1524m (5,000ft) Bellevue to 2652m (8,701ft) high Galena Summit. The communities of Bellevue, Hailey, Ketchum and Sun Valley are often collectively referred to as "the Wood River Valley". Approximately 18,000 people reside in the 24 km (15 mile) long populated corridor and side canyons. Relatively few residential structures exist beyond the Sawtooth National Recreation Area headquarters 11 km (7 miles) north of Ketchum.

Annual snowfall increases significantly in the upper end of the valley and in the high-elevation terrain surrounding the settlements. Bellevue and Hailey average 216cm (85in) of snow annually. Ketchum averages 274cm (108in) near the base of Bald Mountain Ski Area and the top of Bald Mountain averages 508cm (200 in). Winter temperatures are typically cold with extended periods of dry, clear weather. The snowpack is often thin and more characteristic of a continental snow climate than intermountain. Thirty to sixty centimeter storms are not frequent, but do occur throughout the winter.

3. ZONING PROGRAMS:

Ketchum City Code states the intent and purpose of their regulation is to "...allow practicable latitude for the owner and maintain adequate provisions for the security of the health, safety and general welfare of the community's inhabitants."

3.1 City of Ketchum:

The 1971 Yodelin, Washington accident (seven cabins damaged, four people killed, four injured, and a total of thirteen people buried), and a Washington state appellate court ruling in favor of "the duty to warn", changed how people looked at building in avalanche areas. The City of Ketchum began to research and develop an avalanche

zoning plan. Norm Wilson (1977), and Art Mears, (1978, 1979) completed studies for the City of Ketchum on the Warm Springs area and the Back of Dollar Subdivision. Some, but not all of the recommendations were incorporated by the city into the Ketchum Avalanche Zone Overlay District, Ordinance #208. With Warm Springs already subdivided into numerous residential lots, significant opposition arose to ordinances that could restrict land use, require extra expense for studies, increase building costs and possibly reduce property values. This residential area, along 3 kilometers (1.8 miles) of Warm Springs Road between Ketchum and the Warm Springs lifts, is premium real estate and has experienced extensive development since the 1970's.

As specified in Ordinance #208, the city carries out the "duty to warn" by placing disclosure requirements upon sellers, real estate companies, and landlords. All sales information, documents, advertising, and rental contracts must state in writing the property is in an avalanche zone. The city relies on this method to inform buyers and renters. The city also places permanent avalanche danger signs in the public right of way, visible when entering into the avalanche zones. Ketchum City code prohibits any type of daycare operation in the avalanche zone.

The most notable difference in Ketchum, compared to other avalanche zoning in US communities, is red and blue zones are combined into one avalanche hazard zone. A single-family residence can be built in the avalanche zone (i.e. red and blue zones) without any avalanche engineering studies and construction, as long as it is not rented or leased between November 15th and April 15th. All rentals, duplexes, condos or apartments must have proper avalanche engineering studies and be built to withstand the anticipated impact pressures. The end result is that a variety of structures exist in avalanche zones and especially in the high-density neighborhoods of Warm Springs Road. Some owners later add windows, hot tubs and decks not in approved plans.

Any property owner applying for a building permit in the avalanche zone is directed to review the city avalanche studies (1977, 1978, 1979) and sign a statement acknowledging they have read the studies, indemnify the city and have full recognition of and responsibility for building in the avalanche zone. They also acknowledge the following:

"I fully understand that building within the Avalanche Zone may pose a substantial hazard to life, health, and property for residents, guests, visitors, both invited and uninvited, children, city employees, utility workers, public servants, and animals. I also fully understand that City services, including fire protection, police, and medical and ambulance service may be suspended during times of high hazard."

The Code requires an executed copy of the acknowledgements, stamped by the Ketchum Planning Department to be attached to real property deeds and filed with the Blaine County Recorder. Property owners within the mapped avalanche zones who have not pursued a building permit, do not have any signed documents on record except the purchase and sale of avalanche zoned property within the City of Ketchum.

Approximately 75 homes and a number of vacant lots lie within the Warm Springs avalanche zone; additional homes and lots lie within the Back of Dollar avalanche zone. Other Ketchum properties may have avalanche potential and warrant consideration, but are not identified by the avalanche overlay. Administrative oversight, including enforcement and continuity of the avalanche overlay program, has proven challenging and difficult as the number of homes, real estate transactions and building permits has increased. There is a regular turnover of officials and department heads, reducing familiarity with the program. City budgets are tight and other large, demanding issues often require city priority.

3.2: Sun Valley, Hailey and Blaine County:

The neighboring City of Sun Valley hired avalanche professionals Art Mears and Norm Wilson in the 1970's to identify seven potential avalanche areas. Some new land parcels with avalanche potential have been annexed into the city since then. With diverse terrain within city limits, a number of avalanche-built homes exist. Avalanches have hit several homes, although no major damage is on record. Sun Valley has a lower population density than Ketchum. Planning review is handled on a case-by-case basis and properties identified with avalanche potential need to have a professional study prior to building.

The Blaine County avalanche overlay, based on 1971 aerial photos and maps, prohibits building in the red zone. Any building site determined to potentially be in an avalanche area is required to obtain a professional study. The City of Hailey

sometimes refers to the Blaine County overlay. In Hailey City Codes, avalanche considerations can be included in the category of natural hazards and require a professional study. Although the southern part of the valley typically has less snow than Ketchum or Sun Valley, avalanches have impacted several neighborhoods and roads in Hailey and central Blaine County.

4. AVALANCHE EVENTS

4.1 Recent Urban Avalanche Events:

A clear history of avalanche events around the Wood River Valley has not existed until the past few decades. Old timer's stories, family journals and anecdotal tales indicate slides periodically came into the outskirts of towns and over roads. A few deaths and accidents are found in old records. Recent incidents of note include:

- 1) In the 1970's, slides covered the highway, four miles south of Ketchum. Forest Service personnel probed the debris for cars but none were found.
- 2) 1976- Hailey city limits, Carbonate Peak. Slides ran across the river, filled one living room with snow, river water and trout! A concrete splitter incorporated into the original wall has protected the building from subsequent slides.
- 3) 1980-January 9-12th, Warm Springs-Sage Road (the "Creek") slide path ran across Warm Springs road. Several large slides ran near the Elkhorn-Sunrise development, City of Sun Valley.
- 4) 1999-February 9, East Fork of the Wood River, Meadowbrook subdivision. Mine Bender slide paths ran across the river (class R3-D3+), hitting a large, stoutly built but unoccupied house. The back walls were damaged, and some rooms completely filled with snow. A separate debris flow stopped in front of another home's garage door.
- 5) 2002-City of Sun Valley, Trail Creek subdivision. One home hit, occupants felt the impact but no structural damage. The family dog, buried several feet deep, dug himself out.
- 6) January 1, 2004- Upper Warm Springs Road blocked by slides beyond city limits. In the city avalanche zone, three houses were hit, two cars damaged, one road blocked, one garage door destroyed and a construction site portable toilet damaged and pushed into the road. In neighboring Camas County, near Soldier Mountain Ski Resort, one cabin was destroyed, 2 people killed and 5 other family members survived in the upstairs loft.

THE COMPONENTS OF AVALANCHE HAZARD AND RISK

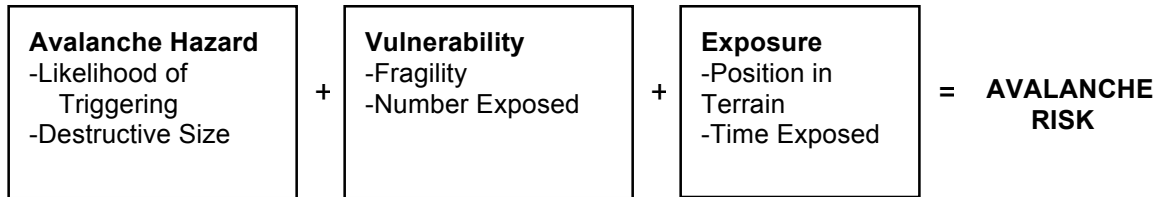


Figure 2: The determination of avalanche risk includes evaluating vulnerability and exposure. Statham (2008)

4.2 January 2008 Avalanche Events:

The following series of avalanche incidents portray how challenging it is to manage and protect people in the urban interface due to sheer numbers, lack of knowledge of avalanche safety and residents underestimating consequences.

January of 2008, two separate avalanche cycles occurred in the populated Wood River corridor from south of Hailey to north of Ketchum. Many 911 avalanche calls were received by county sheriff's dispatch. Fire department teams and Sawtooth National Forest Avalanche Center (SNFAC) forecasters responded to the calls, often leaving one incident and immediately traveling to the next. Although not extremely large or unprecedented storms, the local SNFAC had issued avalanche warnings and was in close coordination with Ketchum Fire Department before and during the avalanche events. Both storms consisted of 30-60cm of snow over 24 hours, warming temperatures and strong winds. Some of the avalanches ran at the new snow interface and some avalanches ran within the new snow.

January 4-5, 2008

- 1) Upper Warm Springs Road beyond city limits, blocked by several slides (D3, D2). Blaine County Road and Bridge crew, attempting to clear debris, retreated after their loader was hit by a new slide.
- 2) 911 call-Lower Board Ranch adjacent to city limits: Warm Springs Creek blocked by slides, one house flooded for approximately 24 hours.
- 3) SNFAC forecasters drive through Warm Springs and Board Ranch area, cautioning homeowners and snow removal crews to avoid exposure to avalanche slopes.
- 4) 911 call-Two snowshoers on a summer trail near Sun Valley homes reported widespread collapsing of snow and were afraid to descend. Sun Valley Fire Chief, Ketchum Fire Chief and SNFAC forecasters responded. SNFAC forecasters safely escorted snowshoers down.

5) 911 call-Warm Springs house, Huffman Drive hit by a slide, class D2+. Deck damaged, garage severely damaged, small electrical fire in garage. No reported injuries or burials. Idaho Power was called to disconnect garage power lines.

6) Penny Hill, a popular sledding hill, had unusually unstable conditions and dangerous activity by sledders and snowboarders. Sun Valley Fire Department closed the hill to sledding.

7) 911 call-Private driveway blocked near Warm Springs base lodge. Slide most likely triggered by out of bounds skiers, no witnesses. Probe lines, beacon search and avalanche dog clear debris. Local skiers arrived on scene with beacons but no avalanche rescue training, hindering the search.

The City of Ketchum closed several Warm Springs side streets to all but local traffic and prohibited pedestrian traffic. Sawhorses with signs were posted at each street junction but only one policeman was available. Large illuminated signs placed at the beginning of Warm Springs Road, warned of High Avalanche Danger. It was nearly impossible to keep people off the streets, everyone wanted to see the avalanches or walk their dog. It was a busy weekend.

The SNFAC backcountry avalanche warning stayed in effect through the next day, although urban slide activity had ended. Three weeks later another storm produced more urban avalanche events.

January 28, 2008

Two slide cycles took place within 24 hours, during the storm and with the frontal passage. SNFAC had issued an avalanche warning.

- 1) Hailey city limits-Della Peak's east face slid in several places damming the Big Wood River. Neighborhood streets flooded, some homes and garages flooded.
- 2) Sun Valley-Trail Creek Road at Sun Peak. Three slides blocked the road and covered a Sun

Valley Nordic Center ski trail. The City of Sun Valley plowed the debris but closed the road with signs and a police guard. Later in the day, without a police guard and as windloading increased the hazard, many people walked with dogs or friends beneath those slopes and similar slopes just beyond.

3) Warm Springs Road-Warning signs and local street closures, including no pedestrian traffic, were enacted similar to January 5th

4) Warm Springs-Sage Road blocked by 8 to 10 foot deep avalanche debris, three avalanche built homes hit and one garage door destroyed.

5) Warm Springs- suspected gas line leak due to avalanche debris against a home. Inability to shut off gas flow, KFD considers evacuation of two city blocks. Situation resolved without evacuation.

6) Warm Springs-Hispanic crews dragging equipment over debris were turned away from closed areas by SNFAC until conditions subsided. Some of their shoveling jobs were unoccupied second homes. Landscape services notified.

7) Warm Springs-Huffman drive house hit again, no damage. People on the street in front of the house, moving a car, ran out of the powder cloud.

8) Upper Warm Springs Road-several avalanches blocked the road, Class D2, D3.

9) Hulen Meadows two miles north of Ketchum- a house below a short steep hill was hit by a slide, surrounded by debris at the back of the structure but incurred minor damage, Class D2.

10) Lake Creek two miles north of Ketchum-Class D2 slides blocked the highway early in the morning. Afternoon avalanches brought debris 8-10 ft deep across the walking/snowshoe/ski trail, just beyond the homes up the canyon.

11) Eagle Creek six miles north of Ketchum-several slides reported with one house hit, one house lightly grazed and a suspected burial of a person snowblowing. Class D2+. Avalanche dog and handler brought on scene to clear the site. Three hours later a second slide hit and surrounded the house that had previously been lightly hit. Very low-density debris traveled far and crossed the road but no structural damage.

12) Hailey Woodside Elementary School: Schools were closed for a snow day. Children sledding triggered a slide (class D2) on the slope behind the school. Fortunately no one was caught.

5. DISCUSSION: EXPOSURE AND RISK

Avalanche zoning and hillside ordinances in the Wood River Valley help reduce some of the human exposure to "urban" avalanches. But as the numbers of people and frequency of exposure

have increased, so has overall avalanche risk. (Figure 2) More extensive city management to reduce public exposure during avalanche events is critical.

The SNFAC is a US Forest Service program and does not have responsibility or oversight of city and county avalanche programs. It provides many education programs and issues avalanche advisories for backcountry conditions and general avalanche warnings with the National Weather Service. SNFAC does not do site specific evaluations or forecasts for the cities. However, beginning with early USFS snow rangers like Butch Harper, there has been a real concern for community wide exposure during avalanche conditions. Informal, working partnerships have developed between SNFAC and the communities. SNFAC offers education programs to a variety of groups including the schools. SNFAC also provides pertinent newspaper articles, media releases and radio announcements throughout the winter and during avalanche warnings.

The City of Ketchum programs focus on providing avalanche awareness and reducing exposure during avalanche warnings. Some tools used are portable warning signs, reverse 911 phone and text messages, and temporary side street closures allowing local traffic only. The City of Ketchum tries to mail out avalanche awareness reminders to avalanche zone property owners each fall. A countywide dispatch system, a City of Ketchum Avalanche Plan and avalanche training for area emergency responders has improved communication and coordination during urban avalanche events. A few officials have participated in Incident Command System Training. All officials (elected and appointed) and department heads should have ICS training. This would not only help during emergencies but would lead to better understanding and informed decisions when any community planning takes place.

Some homeowners and renters do minimize their exposure in the avalanche zones during an avalanche warning, but typically friends and services continue to come and go. If all residents could simply reduce their exposure and ask the same of friends and service people during avalanche warnings, the number of people at risk would be dramatically reduced. The City of Ketchum and the SNFAC tried a bilingual education program "Viviendo y trabajando en zonas de avalanchas", without much success.

However, one local snow removal company has worked to adopt some elements for their crews. Idaho Power, who is frequently called out during storms and in avalanche conditions, has developed avalanche training and avalanche plans with the support of the SNFAC. Intermountain Gas has no avalanche plan or training. There are no gas isolation valves for avalanche zones and it is a difficult and lengthy process to shutdown gas lines. Many homes and businesses would lose heat and freeze pipes. Re-instating gas service to so many buildings is a complicated and dangerous process. Any future development of gas infrastructure should include an emergency shut off system for properties in avalanche zones.

The following is a list of the people who frequently come and go in the urban interface and are placed at risk during high avalanche danger. Much of this activity was simply not a consideration in 1979 when the zoning code was written.

- 1) Private services-snow removal in vehicles and on foot, garbage and recycling, property management, hot tub care, house cleaners, babysitters, UPS & Fed Ex delivery, Intermountain Gas, Idaho Power, Century Link phone, Cox cable, and security or fire alarm response (this happens frequently during storms).
- 2) City Services- street plowing, water & sewer, fire, emergency medical and ambulance.
- 3) Real estate- agents, appraisers, open houses
- 4) Building contractors and subcontractors. New construction and remodel activity goes winter-long.
- 5) Public transportation- bus stops are frequented by locals and visitors traveling into town or to the ski area. Some stops lie within avalanche zones.
- 6) Dog walkers, exercise walkers and children playing on snowbanks or lower slide paths.
- 7) Visitors, tourists and renters unfamiliar with avalanches- walking and parking cars.
- 8) Curious spectators- large numbers gather in the event of an avalanche, often in dangerous areas.

Zoning decisions are challenging, as new development proposals seek to build in and beneath steeper terrain. Current codes do not have a clear and objective way to evaluate human activity in avalanche zones, only structure placement and engineering requirements. Larger avalanche events can block roads in blue zones, critically restricting emergency responses. Avalanche potential should be more closely considered when new residential roads are proposed in avalanche terrain. Highways utilize the highway index for calculating risk, but local

access roads and neighborhood roads need a different evaluation in order to include the large number of pedestrians each winter. Walkers, dog walkers, children playing along the roads and on the slopes, snowshoers, skiers, snowboarders and even hikers frequent any area where local roads provide plowed walking and access to hillsides.

It is often only after serious events have taken place with injury, loss of life and property damage, that a community will more realistically evaluate what they consider to be the acceptable risk of building in areas prone to natural hazards. The Wood River Valley has been lucky. There have been many close calls, but no loss of life or injury due to "urban" avalanches in recent years. The possibility of an extremely large-scale urban avalanche event is unlikely but should be acknowledged it can happen. Multiple events similar to the ones of 2008 should be expected.

6. CONCLUDING THOUGHTS

This case study portrays real avalanche events in real communities. With more structures and greater population density there is a growing diversity of human activity and exposure to avalanche slopes. Small town resources are challenged to meet the demands for services. The overall risk to public health, safety and welfare is increasing. What was considered an acceptable level of risk when zoning and management plans were initiated for a smaller population may no longer be acceptable.

Community leaders in the mountainous western US need to better understand avalanches and the impacts when multiple buildings and neighborhoods lie in avalanche prone areas, even if avalanches do not occur every year. Education programs oriented specifically for community leaders could result in better funding and management strategies for existing problems, and reduce future problems. Land planners need the support of new zoning tools and avalanche specific information to establish clear and objective standards for any new development in and around avalanche terrain.

In closing, this paper is not intended to provide full answers. The hope is to assist communities with their current situations and promote discussion about how we look at and manage the "urban avalanche interface" in the future. Now may be a good time to update our perspectives and programs, based on what we've learned from US, Canadian and European urban avalanche events.

7. ACKNOWLEDGEMENTS

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*Figure 3: Warm Springs Avalanche Zone.
Photo by J. Kellam*