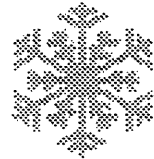
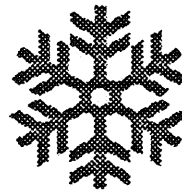
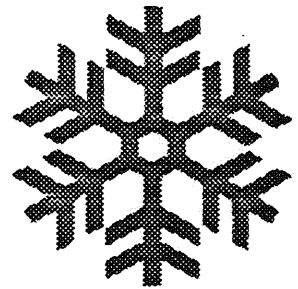




*Avalanche Hazard
Workshop
Report*



*The Municipality of Anchorage
Department of Economic Development and Planning*

April 1992

AVALANCHE HAZARD WORKSHOP REPORT

TABLE OF CONTENTS

<u>Title</u>	<u>Page</u>
INTRODUCTION	1
HISTORICAL PERSPECTIVE	1
ORGANIZATION OF THE AVALANCHE HAZARD WORKSHOP.	3
PROCEEDINGS OF THE AVALANCHE HAZARD WORKSHOP	4
Understanding Avalanches	5
Avalanches in Anchorage	5
Avalanche Hazard Mapping: Needs, Methods, and Limitations	6
Avalanche Hazard Management in Norway	8
Avalanche Defense Options	9
Avalanche Hazard Management in Other Communities	10
Current Policies and Practices of Local Realtors, Real Estate Appraisers, Insurance Agencies, and Lending Institutions	16
The Question of Liability	18
Open Forum: Where do we go from here?	20
FINDINGS AND CONCLUSIONS	23
APPENDICES	
Appendix A. Assembly Memorandum (12/9/86) re. avalanche hazard policy	
Appendix B. Avalanche hazard regulations for Ketchum, Idaho; Alta, Utah; and Vail, Colorado.	
Appendix C. Open forum results	
Appendix D. Letter from Arthur Mears as follow-up to issues discussed during the workshop	

INTRODUCTION

On December 6 and 7, 1991, the Department of Economic Development and Planning hosted the Avalanche Hazard Workshop. The workshop was organized in response to continuing controversy over how avalanche hazard areas are identified and how property owners are affected by avalanche hazard in the Anchorage area. Because the workshop was funded at the Municipal Assembly's directive to examine the avalanche hazard issue, this report has been prepared primarily for that body's information and review.

The report begins by describing the history of the avalanche hazard issue in the Municipality. Next, the organization of the Avalanche Hazard Workshop is outlined. Following that, the proceedings of the workshop are detailed. Finally, a summary of findings and conclusions is provided.

HISTORICAL PERSPECTIVE

The fact that avalanche hazard exists in the Municipality of Anchorage is acknowledged. However, while this hazard may be more often associated with backcountry recreation, avalanche hazard also affects some residential areas in mountainous terrain.

It is estimated that over 500 parcels within the Municipality may be affected by avalanche hazard. These properties are located throughout the Municipality -- from Chugiak-Eagle River to the Hillside area to the Turnagain Arm communities. The most extensively impacted areas, however, are Girdwood/Crow Creek, Eagle River Valley and South Fork.

The need for a study of avalanche hazard potential came to the attention of the Municipality in the late 1970's with the development of new subdivisions along several mountain slopes in Eagle River Valley and South Fork. During 1979 and 1980, avalanches damaged or destroyed a number of homes in the area. As a result, the Platting Board and the Planning and Zoning Commission became increasingly concerned about approving development in mountainous areas without a better understanding of potential avalanche hazard in those areas.

This concern led to a study of avalanche hazard within the Municipality and the subsequent report Anchorage Snow Avalanche Zoning Analysis, completed in 1982 by Arthur Mears, an internationally recognized snow avalanche authority. The basic scope of the study was to identify avalanche hazard areas within the Municipality that affect privately and municipally owned properties, to describe the methodology for hazard

identification, and to propose a land management program to address the hazard.

Avalanche location and frequency within the Municipality were determined using the following methods: (1) field observations of major avalanche destruction, (2) compilation of avalanche history, (3) terrain analysis, and (4) calibration and application of equations of motion. Based on this information, avalanche hazard boundaries were delineated on large-scale topographic maps and later transferred to parcel base maps for ease of identification.

Drawing on Swiss and Norwegian experience in defining avalanche hazard, as well as data from American communities, avalanche hazard in the Municipality was delineated as high and moderate hazard zones. The distinction between these zones is based on probability and magnitude factors. The high hazard (red) zone designates an area affected by frequent events (return periods of 10 years or less) and/or by events with large mass and energy. The moderate hazard (blue) zone designates an area affected by both rare events (return periods of 10 to 100 years) and by reduced destructive force. The downhill limit of the blue zone boundary usually defines the "design-magnitude avalanche" (return period of 100 years).

Following completion of the avalanche hazard study, the Geotechnical Advisory Commission, the Platting Board, and the Planning and Zoning Commission all reviewed and accepted the findings and methodology of the study. Direction was then given to prepare an avalanche hazard ordinance.

After receiving approval from the board and commissions, a draft ordinance reached the Assembly in 1985. The proposed ordinance was controversial, particularly with property owners affected by the identified hazard areas. Extensive testimony was given on both sides of the issue. The Assembly ended up deciding the ordinance was too restrictive and voted against its adoption. However, the Assembly gave direction to prepare a less restrictive ordinance that included provisions for disclosure and for subdivision design to prohibit new lots from being created wholly within the high hazard (red) zone.

A new ordinance was prepared and then approved by the board and commissions. In 1986, the ordinance was scheduled to be forwarded to the Assembly. However, Mayor Knowles withdrew the ordinance from consideration and submitted a memorandum describing what municipal policy would be. The Assembly concurred at that time. (The 1986 Assembly Memorandum is included in Appendix A.)

In place of a new ordinance, municipal policy has been to use existing land use regulatory authority to address disclosure and subdivision design in new subdivisions, conditional uses, and rezonings. However, it does not address in any way those

platted or developed lots in existence prior to the 1986 decision. So, land use and building permits may be issued irrespective of what the degree of hazard may be on those lots.

The avalanche hazard maps created as a result of the 1982 study have never been formally adopted. They are considered technical information and municipal policy has been to make the information available to the public on request. Many realtors and lending institutions have been using information from the maps in the buying/selling and financing of properties in avalanche areas. Some of the major lending institutions have changed their lending policies and practices in the past few years and financial transactions on some avalanche-affected properties have become very difficult. In many cases information from the avalanche hazard maps is being applied in ways that were not intended by the consultant or the Municipality. As a result, property owners affected by avalanche hazards are being impacted economically in a negative way by what many of them believe to be inaccurately drawn conclusions regarding the location and degree of hazard identified in the 1982 study. To some, the maps have become a de facto ordinance.

In response to this continuing problem, the Assembly appropriated funds in 1991 to examine the problem of providing appropriate protection from avalanche hazard without imposing undue hardship on individual property owners. The Avalanche Hazard Workshop was organized in response to that directive.

ORGANIZATION OF THE AVALANCHE HAZARD WORKSHOP

The Avalanche Hazard Workshop was designed to provide information that would enable participants to make better informed decisions in determining what policies and practices should be used in situations where private property is impacted by avalanche hazard. The workshop was intended to be useful for owners of affected properties, public policy-makers, and individuals from various professions associated with avalanche hazard issues.

The goal of the workshop was to develop an acceptable definition of what the avalanche hazard problem is and to identify possible solutions to the problem. To help achieve that goal, the workshop brought together a group of speakers that included technical experts, officials from other communities that deal with avalanche hazard issues, and local representatives whose professions are involved with avalanche hazard issues.

To encourage a varied participant involvement, notice of the workshop targeted property owners, municipal policy makers, and business people in real estate (realtors and appraisers), insurance, lending, and engineering/design professions.

Notices were mailed to all potentially-affected property owners, as well as to various professional groups and associations. In addition, notice of the workshop was published in daily newspapers and community and professional newsletters, and public announcements were made on radio and television.

The workshop agenda was arranged in a natural progression. Speaker presentations were made on the following topics: the nature of avalanches; an historical overview of avalanche areas in Anchorage; the needs, methods, and limitations of avalanche hazard mapping; avalanche defense options; avalanche hazard management in other communities; the policies and practices of lending institutions, real estate professionals, and insurance companies; and the question of legal liability.

The workshop concluded with an open forum session designed to encourage dialogue among all participants (attendees and speakers), focusing on what Anchorage should do about its avalanche hazard problem.

Because of the extraordinary amount of information shared during the workshop, the entire event was videotaped so that the information can be used in future work on avalanche hazard issues.

PROCEEDINGS OF THE AVALANCHE HAZARD WORKSHOP

The proceedings of the workshop are described in the order of the program schedule. The title of each session and the presenting speaker(s) are listed first. A brief sketch of each featured speaker is provided, followed by a summary of the presentation and discussion topics. The description of the proceedings closes with a synopsis of the open forum session.

In addition to the speakers, approximately 40 people attended the workshop. About two-thirds of the attendees were affected property owners and real estate professionals. The rest of the group included municipal policy makers, municipal staff, representatives from state agencies, and other interested parties.

Cathy Hammond, Land Use Planner with the Municipality, introduced the workshop by outlining the two-day program schedule and providing a background summary of Anchorage's avalanche hazard problem.

The speaker presentations began with an introduction to the avalanche phenomenon and what it means to the Anchorage area.

Understanding Avalanches presented by Jill Fredston.

Avalanches in Anchorage presented by Doug Fesler.

Jill Fredston and Doug Fesler specialize in avalanche hazard investigation and evaluation. They also operate Alaska Mountain Safety Center, Inc., a non-profit organization dedicated to promoting public safety in the mountain environment. Both Doug and Jill are recognized for their extensive knowledge of state and local avalanche hazard conditions.

Ms. Fredston introduced participants to the avalanche process by providing an overview of avalanche characteristics, causes, and modes of failure as they relate to the local area. Using slides to illustrate her presentation, she described the types of avalanches that occur in the Municipality, saying that the "slab avalanche" is the biggest threat with the most snow moving at once. Various factors affecting the size and runout distance of an avalanche slide, such as snowpack depth and slope roughness or smoothness, were also described.

Ms. Fredston provided the basic information needed to understand what conditions can lead to an avalanche event. There are three primary variables (terrain, snowpack, and weather) to consider in evaluating avalanche hazard in an area. Examining the terrain includes an assessment of slope angle; understanding the snowpack involves an evaluation of the bonding strength of the snow layers; and consideration of the weather incorporates information on variables such as wind and temperature. She stressed the importance of understanding these three variables, as well as the human factor, in evaluating avalanche hazard in an area.

Mr. Fesler gave an historical overview of avalanche problem areas in the Municipality. He noted that he has spent 15 years researching the history of avalanches in Alaska. Illustrations of avalanche events affecting areas in the Municipality from Turnagain Arm communities to the Eagle River area were presented. Included were illustrations of events that affected highway and railway transportation corridors and powerline structures. Also shown were residential areas affected by avalanches, including areas in Eagle River Valley and South Fork where buildings have been damaged or destroyed within the last twenty years. The locations of paths where existing and future homes may be subject to avalanche events were also displayed.

Evidence was shown that, contrary to the belief of many residents, the presence of trees is not a good indicator of the absence of avalanche hazard. Throughout his presentation, Mr. Fesler emphasized his concern that unprotected residential areas in the Municipality continue to be exposed to avalanche hazard.

Avalanche Hazard Mapping: Needs, Methods, and Limitations
presented by Arthur Mears, P.E.

Arthur Mears is a highly respected snow avalanche authority with over 18 years experience in natural hazards consulting services. He has specialized in geotechnical and avalanche-control engineering in Alaska, Canada, and throughout the western United States. Mr. Mears prepared the 1982 study of avalanche hazard within the Municipality of Anchorage.

In his presentation, Mr. Mears gave an overview of the methodologies used to determine avalanche runout potential for mapping. He began by explaining that a snow avalanche, like other geophysical events, such as floods and earthquakes, has a magnitude vs probability factor. In explaining this factor, he defined the concept of the return period associated with an avalanche event. For example, an area with a 100-year return period, or moderate hazard, would have a 1% probability of an avalanche event occurring in any given year. An area with a 10-year return period, or high hazard, would have a 10% annual probability of an event.

Although there is a lower probability of an avalanche event occurring in a longer return period area, the size of the event would be greater than a shorter return period event. In other words, the longer the period of time without an event in an avalanche-prone area, the greater the magnitude of the event when it occurs.

People often assess avalanche danger based on what they have observed while living in an area. Most avalanches that have been observed in the Municipality are shorter return period events and there is limited information on long-term events. Mr. Mears emphasized that short-term observations based on small events cannot provide information on what can occur in the long-term -- the runout distance of an event can far exceed what has been observed in the short-term. Because of this, the design magnitude event, or 100-year event, must be used in land use planning.

The runout distance in the avalanche mapping process is determined through direct and indirect methods. Using the direct method involves analysis of one or more of the following factors: observations, history, vegetation, terrain damage, and aerial photos (for historical comparisons). Two hundred years of detailed records are necessary with analysis using observations and history in order to predict a 100-year event. Illustrations were provided showing how the different direct method techniques can be applied.

The indirect method, using statistics and dynamics equations, is employed when no direct options are available. This method is reflected in two models: a physical model developed in

Switzerland and an empirically-based model developed by the Norwegian Geotechnical Institute (NGI). The Swiss method models the avalanche process by assuming friction terms to determine velocity and runout distance. Application of this model is considered subjective because different runout distances can be calculated with different sets of assumptions.

The NGI method, on the other hand, is more objective, according to Mr. Mears. With this empirical model, data is collected on avalanche activity in a selected study area. Statistical analysis of that data is then applied to paths where data is not available, allowing predictions of avalanche runout distance in those areas.

The direct and indirect methods must be used together to produce objective avalanche mapping. Because there is little information available on long-term events in Anchorage, mapping of avalanche zones relied on the indirect method and direct methods such as examining aerial photography and vegetation.

In explaining red zone/blue zone determination, Mr. Mears said that the high hazard (red) and moderate hazard (blue) areas are defined by the frequency of avalanche activity (return period) and/or by the magnitude or destructive force of an event. A high hazard area is characterized by more frequent activity (10-year return) and more destructive force than a moderate hazard area. The lower limit of the moderate hazard area represents the runout extent of a design magnitude avalanche, or 100-year event.

In Anchorage most high hazard (red zone) areas were defined by force criteria rather than frequency. Because of the high hazard in the red zone, buildings that concentrate human activity should be prohibited. However, buildings may be designed and constructed to withstand the force of an avalanche event in a moderate hazard (blue zone) area.

Based on his observations of American society, Mr. Mears illustrated different types of acceptable land uses in different avalanche return period areas. For example, utilities would be acceptable in a 10-year return period zone, private buildings in a 30-year zone, and schools in a 300-year zone. This level of risk acceptance in the U.S. would be considered unacceptable in countries such as Switzerland and Norway, where there is more historical data on long-term events.

In closing, Mr. Mears stated that the maps done for Anchorage are valid, and that even if they were redone the information would be essentially the same. He said it is possible that an avalanche zone boundary could be amended based on a site-specific, detailed study of the area.

He also stated that he believes an individual should be able to choose to take an informed risk involving exposure to avalanche hazard. However, it becomes a matter of public concern when other people and/or public infrastructure, such as roads and utilities, are exposed to the risk.

Avalanche Hazard Management in Norway
presented by Jan Otto Larsen.

Jan Otto Larsen has been a Senior Engineer with the Norwegian Geotechnical Institute in Oslo since 1974. He has extensive experience in all types of snow engineering.

Using slides to complement his presentation, Mr. Larsen provided the workshop participants with a Norwegian perspective on defining avalanche hazard zones, making land use recommendations in avalanche-affected areas, and the results of long-term observations in avalanche hazard management.

Mr. Larsen described the types of natural hazards that Norway's residents are exposed to along the coast and in the mountains. In addition to snow avalanches, these hazards include landslides and floodwaves, which affect coastal communities when large slide events run out into the water.

Historical records based on observed avalanche events in Norway date back to the 16th century. Early avalanche mapping was based on historical information that mapped only the location of the slide not the runout area. After several accidents where people were killed and/or property destroyed in areas where there had been no record of avalanche events for 100 to 200 years, the government-sponsored Norwegian Geotechnical Institute (NGI) decided to revise the existing avalanche mapping.

NGI developed a model to calculate avalanche runout distance. The model uses terrain analysis combined with mathematical calculations to measure runout distance. In response to the government's request, NGI is mapping natural hazard areas at 1:50,000 scale for the entire country. The maps identify possible release areas and calculate runout distance. The hazard areas are first calculated by computer model, then projections are field checked by NGI staff. The maps are intended for use in development and land use planning in the communities of Norway.

Over the years, Norway's communities have become more concerned about avalanche hazard. At one time construction in a 300-year return period area was accepted. Now there is a building law that prohibits new construction in all avalanche areas. The results of long-term observations have contributed to this lowered level of risk acceptance that Norwegian communities are willing to tolerate in relation to avalanche hazard.

Before 1980, if a community approved construction in an identified avalanche zone, it was liable for property loss or damage or for buying the property later if the owner became unwilling to accept the risk. The community was also responsible for existing construction in avalanche areas. At that time, the national government assisted the community with the cost of purchasing avalanche-affected property, finding and purchasing new property for affected owners, moving existing buildings, or providing mitigation. Since 1980, the government has adopted a national natural hazard insurance policy to which all residents contribute.

Avalanche Defense Options presented by Arthur Mears and Jan Otto Larsen.

Arthur Mears and Jan Otto Larsen provided an overview of various avalanche defense options and other alternatives, with a discussion concerning their effectiveness and limitations.

Mr. Mears listed the various avalanche control options in order of reliability as:

1. zoning or avoidance of the hazard;
2. structural, such as protection located in avalanche paths;
3. forecast and/or evacuate during periods of instability; and
4. explosive release (unacceptable where buildings are located).

The decision on which option to use is based on: available information, risk tolerance, economics (expenses), and other factors, such as environmental, aesthetic, and safety concerns.

Structural control options are available as the following types (with examples noted):

- supporting (wire rope netting used in avalanche starting zones);
- deflecting (wedge-shaped walls);
- retarding (earthen mounds);
- catching (dams); and
- direct protection (building reinforcement).

Direct protection is the most popular option in the U.S.; however, it can add up to 20% to normal building construction cost. The decision on which structural option to use is based on: risk tolerance, physical setting, engineering considerations, economics, and environmental factors.

The type of data necessary to design supporting structures includes: the design snowpack depth, foundation characteristics, and slope roughness. In designing structures to withstand avalanche forces, it is necessary to know: avalanche velocity, flow height, and density, and the object

size, shape, and location. With this data, the dynamic and static loads of an avalanche event are computed.

Jan Otto Larsen explained that in Norway residents have the option to use protection or move to a new location (with financial support from the government). In most cases the cost of protection is more than moving the structures, so buildings are often moved to avoid danger.

Tunnels are commonly used to protect roads in Norway. A red/green signal light system is also used for road protection. With this system, sensors anchored in the avalanche release zone are tripped when a slide occurs, switching on the red light to warn travelers on the road below.

Both speakers noted some of the advantages and disadvantages of the various options. Earthen deflecting walls are often the cheaper option; however, it is important that the design of the angle not be too sharp. Also, in using a deflecting structure, a large land area is usually required to avoid the legal liability of deflecting the hazard onto adjacent property.

Supporting structures located in release areas must be strong enough to withstand the actual release. It was also noted that while a catching dam structure may handle one avalanche, another slide might run over the dam. The importance of understanding the potential size and return period of an avalanche event in designing protection was stressed.

Both speakers responded to numerous questions from participants. Discussion items are summarized as follows:

Mr. Mears noted that direct protection of an individual building is the most effective option. He pointed out that earth berms, barriers, and mounds are unreliable without professional design guidance.

Mr. Mears explained the limitation of using protective structures, saying they don't protect activities outside the building. Mr. Larsen added that in Norway these activities are taken into consideration in assessing avalanche risk.

None of the protective structures discussed are maintenance free and there can be a problem with erosion limiting the effectiveness of a structure. Other concerns include the expense of installation and the aesthetics of such structures.

**Avalanche Hazard Management in Other Communities presented by
Linda Haavik, John Guldner, and Peter Patten.**

In this session, avalanche hazard issues and management techniques in the communities of Ketchum, Idaho; Alta, Utah; and Vail, Colorado; were presented. The avalanche regulations for each of these communities are provided in Appendix B.

Ketchum, Idaho:

Linda Haavik has been Planning and Zoning Administrator with the City of Ketchum since 1978. She was responsible for the preparation and adoption of Ketchum's avalanche hazard ordinance.

Ketchum is a recreational resort area with a tourism-based economy. Its population of 2,500 permanent residents swells to 12,000 during peak season. Avalanche hazard is a concern in Ketchum, particularly in the Warm Springs area of the city, which was subdivided prior to knowledge of avalanche hazard in the area.

Ketchum has had regulations in place governing development in avalanche hazard areas since 1974. The earlier regulations were based on an avalanche zone boundary developed by a local engineer, not an avalanche expert. Under these regulations, owner-occupied development was permitted in the avalanche zone. A disclaimer of city liability was included.

The city later became concerned about the defensibility of its regulations after learning of a 1975 lawsuit involving an avalanche event in Washington that struck a home in a known hazard area and killed members of a family. The lawsuit was filed against the seller, who did not disclose the hazard to the buyer, and also involved the county that issued a building permit for the residence.

In 1979, as a result of its concern, the City of Ketchum adopted a new ordinance regulating avalanche hazard that was based on two separate avalanche hazard studies with the same conclusions. The new ordinance established one avalanche zone district, applied as an overlay district to other use restrictions. The ordinance does not distinguish between red and blue zone hazard, although these designations are otherwise recognized by the city. Approximately 150 parcels are affected by the avalanche zone district, ranging in lot size from 8,000 to 10,000 square feet.

During the public hearing process prior to adoption of the ordinance, the main concerns involved questions regarding the probability factor (of an avalanche event) and the "taking" issue.

The ordinance established requirements for building construction and notification. Prior to the issuance of a building permit for any structure in the avalanche zone, except a single-family residence, the proposed structure must be designed, by a licensed engineer, to withstand avalanche forces as shown in a site-specific study by a recognized avalanche expert. Despite the exemption for single-family construction, about 95% of new development has a site-specific study done

anyway, a practice the city actively encourages for all development in the avalanche area.

The underground installation of all utilities in the avalanche zone is also required. In addition, the ordinance prohibits the use of any protective structures that might deflect avalanches onto or otherwise threaten adjacent property. Construction of protective structures is permitted only as a conditional use and must be designed by a licensed engineer.

Another provision of the ordinance states that structures located in the avalanche zone that have been constructed without an engineering study may not be leased, rented, or sublet from November 15 through April 15.

The ordinance also prohibits any further subdivision of property that would create a lot in part or in whole within the avalanche zone. A variance may be granted if a building site is not located within the zone and conforms to other provisions of the ordinance.

General notice requirements of the ordinance include the following:

- the avalanche zone must be identified and designated on subdivision plats;
- prior to building permit approval, the applicant must appear before the town council to receive personal notice of the hazard risk and the associated studies;
- title reports must include notice of the hazard and associated regulations;
- the city must post avalanche hazard signs in public R.O.W.'s;
- written notice must be given to a prospective owner or tenant advising of the hazard and associated regulations;
- all advertisements of properties for rent or sale must disclose the hazard.

The ordinance also gives the city the right to suspend services during periods of high avalanche danger and includes a disclaimer of city liability.

Ms. Haavik also provided information on the effects of the hazard regulations on property value and lending and insurance practices. Property value in the avalanche zone was somewhat negatively affected in the year after adoption of the ordinance. However, because property in that area is desirable and the regulations did not prove to be unnecessarily prohibitive, property values returned to those of unaffected properties.

Lending institutions in the area finance on a case-by-case basis, relying on the engineering stamp for construction approval. Despite the exemption for single-family

construction, a loan for a single-family home in a high hazard area would probably be denied without a site-specific study. A 10% to 15% additional cost is estimated for development in the avalanche zone. Local insurance practice is to make a risk assessment, but coverage for avalanche damage is not excluded under the standard homeowner's policy.

In response to questions, Ms. Haavik said that there have been no changes in the ordinance since its adoption nor has there been any litigation. No avalanche event has occurred that damaged a structure or took a life since adoption of the ordinance. Also, the city has not yet had occasion to suspend services to the avalanche zone area.

Alta, Utah:

John Guldner has been the Mayor's Assistant/Town Manager of Alta, Utah, since 1982. He oversees the daily operations of Alta, including the enforcement of avalanche hazard regulations and coordination with the U.S. Forest Service in avalanche control efforts.

Alta is a full-service resort community and one of the more popular ski areas in the U.S. It also may have the distinction of having the highest avalanche exposure of any developed community in North America.

Alta is located at the top of a narrow, eight-mile long canyon. There are 36 identified major avalanche paths along the canyon road, 14 of them within the town limits of Alta. Average annual snowfall in Alta is 500", although it's not uncommon to have up to 800" in a season.

While the permanent population numbers only 397, during peak season 5,000 visitors are in the area daily. Because of its high avalanche susceptibility, Alta experiences yearly incidents involving property damage, personal injury and/or death, according to Mr. Guldner.

Alta has had regulations associated with avalanche hazard since 1970. However, initial regulations prohibiting permanent structures in avalanche areas were not enforced and there were no avalanche maps.

Alta's avalanche regulations were reassessed in 1973 when a master plan was done for Salt Lake County. At that time, the burden was placed on the developer/property owner to show the town that development would not create an "unreasonable risk." The town also adopted a hold harmless agreement that released Alta and the U.S. Forest Service from any liability in the event of personal injury or property damage due to an avalanche. This agreement was signed by Alta property owners and is transferred with title to the property.

In 1979 an avalanche study was done for the Town of Alta and avalanche maps were produced designating red, blue, and yellow (powder blast) hazard zones. However, the maps were not adopted because of concerns regarding the prohibition of development in high hazard areas where property might be valued at \$100,000 to \$150,000 for a 5,200 square foot lot. There were also concerns regarding the town's liability if areas outside the designated zones were considered safe and these areas subsequently experienced avalanche events.

In 1987 the town decided that, because of the continuing controversy, the maps would not be officially adopted. Instead, the entire Alta area was declared an area of avalanche risk. The resulting Avalanche Review Ordinance requires that any development, including additions, must have a site-specific study done by an avalanche expert and mitigation for any proposed development must be designed by a qualified engineer. Initially, this policy exempted single-family construction, but that exemption will be eliminated in 1992.

While the avalanche ordinance and hold harmless agreement address the avalanche problem for buildings, Alta has another method for addressing public safety. The Avalanche Interlodge Ordinance requires mandatory confinement and road closure during periods of high avalanche danger. This policy often creates a false sense of security among residents and often there is inadequate lead time to give sufficient warning.

Property values have not been affected by Alta's avalanche policy, according to Mr. Guldner. He is not aware of any financing problems associated with the hazard. Like Ketchum, insurance for avalanche damage in Alta is not excluded under the standard homeowner's policy coverage.

Currently, Alta has no disclosure requirement for natural hazards in real estate transactions. Public notice of the hazard is accomplished through the posting of warning signs along the road and in lodges. Alta has never experienced any litigation because of the avalanche regulations. Public comment has focused on the extra time and expense involved in construction projects to comply with the ordinance.

Vail, Colorado:

Peter Patten was the Director of Community Development for the Town of Vail from 1984 to 1990. He was responsible for the enforcement and refinement of avalanche regulations in Vail. He also directed the process in creating and adopting Vail's debris avalanche and rockfall ordinance.

In the last 30 years, Vail has developed into the largest ski area in North America. The town is located in a ten-mile long valley that is less than a mile wide. The permanent population

of 5,000 grows to 35,000 during the holiday season. About two million people visit Vail each year.

The Bighorn area of Vail is the largest, most dangerous avalanche area in the valley. In the late 1970's, avalanche mapping was done, by an avalanche expert, for each slide area in the Bighorn area. The maps identified red and blue zones in order to guide land use planning for that area.

In 1977 Vail adopted an avalanche ordinance based on four zones: high, moderate, powder blast, and possible avalanche zone. Under this ordinance, building in the high hazard zone is prohibited. A site specific study is required for proposed development in the other zones. Building with mitigation may or may not be required based on the study. If mitigation is not feasible, building on the site is prohibited. The avalanche ordinance has worked smoothly since its inception.

After a series of serious debris/rockfall events in the early 1980's, Vail adopted a debris avalanche hazard ordinance in addition to the existing avalanche ordinance. The town resisted efforts to create one inclusive natural hazard ordinance.

The requirements for site specific studies and public notice are the key elements of the debris avalanche hazard ordinance. Building construction in any of the identified hazard zones requires a site-specific study. However, existing buildings may add on or rebuild without mitigation.

The ordinance established different standards for single-family/duplex development and multi-family/commercial construction. For single-family and duplex construction (and major additions), the decision to allow building or not, with or without mitigation, depends on the assessed risk to other property, not the proposed structure. With multi-family and commercial construction (and major additions), the risk is assessed for the proposed structure.

The public notice requirements involve identification of existing hazard areas on new subdivision plats and building permit applications, property owner acknowledgement of the hazard before issuance of a building permit, and disclosure in real estate transactions (selling and leasing).

There is also a provision in the ordinance for revising the hazard maps if a site-specific study is approved by the town council.

With separate regulations in effect for avalanche hazard and debris avalanche hazard, a property may be impacted by hazard designations in both ordinances. When this occurs, the more restrictive ordinance prevails.

After understanding the intent of the debris avalanche ordinance, Vail's real estate community accepted the concept of "informed risk" and supported the use of mitigation in hazard areas. Financing is available for property in the hazard areas if the property is insurable. Some homes damaged in the high hazard rockfall area were uninsurable for a number of years, but after the homeowners had a protective berm constructed, there were no problems with obtaining insurance or financing. However, some catastrophe policies have been written for property in hazard areas with cost at twice that of normal homeowner's insurance.

Current Policies and Practices of Local Realtors, Real Estate Appraisers, Insurance Agencies, and Lending Institutions

(Note: The real estate appraiser scheduled to participate on this panel did not attend the workshop.)

Jeanne Webster, President of the Anchorage Board of Realtors, stated that the policy of all realtors in the State of Alaska is to discover and disclose any adverse facts found in researching any properties for clients. A realtor could be held liable and subject to lawsuit if this policy were not followed.

Rosie MacDonald, an agent from State Farm Insurance in Eagle River, explained that avalanche damage is not excluded from the general homeowner's policy, so coverage would be provided. This policy could be subject to change if a number of claims for avalanche damage were to be filed.

Ron Maze, Claims Superintendent with State Farm Insurance in Anchorage, further explained that a home would be covered only if damage were done by a "pure snow avalanche." If any earth movement were involved in any part of the damage process, coverage would not be provided without earthquake insurance. So, if an avalanche triggered by an earthquake damaged a home, that property would not be insured under the standard homeowner's policy.

In response to numerous questions, Mr. Maze said that an expert evaluation would be required to determine whether or not the avalanche resulted from a seismic event. He also said that damage caused by an avalanche carrying earth debris would not be covered even if no seismic event were involved. In essence, all earth movement is excluded under the standard homeowner's policy.

Despite this discussion, it remained uncertain what constituted a "pure snow avalanche," as defined by Mr. Maze, since Art Mears noted that avalanche slides commonly involve snow and debris, such as rocks, brush, and trees, depending on the area and size of the event.

Neither Ms. MacDonald nor Mr. Maze has ever had a claim filed for avalanche damage. According to a State Farm underwriter, the company has never had a claim filed for avalanche damage in its northwest region.

Sue Benedetti, Mortgage Operations Officer with Alaska Housing Finance Corporation (AHFC), explained that AHFC handles financing of avalanche-affected properties on a case-by-case basis. AHFC becomes aware of the problem when it is included in the appraisal report. The impact of the hazard on the value of the property is considered based on that report. AHFC also requires that adequate insurance coverage be provided for avalanche-affected properties.

In response to questions, Ms. Benedetti stated that regulations regarding the financing of avalanche-affected properties have been in effect for more than a year. To date there has been no instance where financing has been refused. One workshop participant expressed frustration that AHFC's financing approval for avalanche-affected properties can take much longer than is usual for other properties.

Depending on the property, earthquake insurance may be required to obtain financing with AHFC, although this is not mandated in the AHFC lending guide. While AHFC evaluates avalanche affected properties, the corporation does not apply the same practice to properties in identified seismic zones.

Gene Dobrzynski, Chief of Housing Development with the Department of Housing and Urban Development (HUD), explained that Federal Housing Administration (FHA) policy is based on national regulations for mortgage insurance eligibility. One of the eligibility requirements is that the property be free from natural hazard, although the type of hazard is not delineated in the policy. The decision not to issue mortgage insurance in avalanche hazard areas was based on: (1) the potential loss incurred in the mortgage insurance program if the property is foreclosed on and (2) the issue of lender liability for life safety.

Like AHFC, FHA becomes aware of an avalanche hazard through the appraisal report on a property. The policy decision was that the property line, not the amount of hazard on the property, would determine eligibility. If the hazard boundary, red or blue, is within the property boundary at all, then the property is ineligible for mortgage insurance. There are no FHA guidelines to determine how much hazard area encroaching on a property would be considered acceptable or to otherwise do an individual assessment of an affected property.

Mr. Dobrzynski responded to numerous questions from participants. A summary of those responses follows:

Under current policy, FHA would not lend on a property with a site specific study and structure mitigation designed by an expert. He thought that FHA would have to reevaluate its policy if presented with a financing application for this situation. He also said that FHA might have to reevaluate its policy if the Municipality were to adopt a policy of mandatory disclosure and notice of avalanche hazard.

Also, FHA would have to reevaluate its policy if there were no avalanche hazard maps or if the zone boundaries were to change; however, the financing decision would be based on the appraisal report whether the maps exist or not.

FHA also evaluates seismic hazard based on the appraisal report, which considers Uniform Building Code (UBC) standards for Anchorage. For older properties not affected by UBC standards, FHA still relies on the appraiser's assessment. FHA has not applied the same policy of exclusion to properties in seismic zones that it has to avalanche-affected properties.

In response to this discussion, Art Mears said that mortgage insurance should cover avalanche-affected areas because there is such a relatively small number of properties affected. More to the point, FHA's application of the avalanche hazard information is a distortion of the original intention of himself and the Municipality.

Designating entire lots as hazardous when only small portions are within avalanche areas is an arbitrary and illogical extension of the original avalanche hazard maps. This practice places an unjustified burden on affected property owners. An example of a more logical approach would be to deny financing if no buildable area exists outside the hazard area.

Where there is substantial hazard on a property, there must be a consideration of the type of hazard designation because the moderate hazard zone is considered an area of minimal risk compared to the high hazard zone. Buildings may be designed to withstand avalanches in the moderate hazard zone and risk to persons outside of buildings is considered small.

The Question of Liability presented by Marc Bond.

Marc Bond is an attorney with Delaney, Wiles, Hayes, Reitman, and Brubaker, Inc., in Anchorage. He has been with the firm since 1979. Mr. Bond's primary areas of practice include representing Alyeska Ski Resort and the National Ski Patrol, which focuses on avalanche mitigation measures and rescue techniques.

This session of the workshop focused on three issues:

- (1) Who (if anyone) is legally responsible for damage and injury by avalanches within the Municipality?

- (2) What are the potential arguments that could be made by a claimant?
- (3) How can people involved with real estate located in avalanche hazard zones protect themselves from liability?

Mr. Bond explained that, in litigation related to avalanche hazard, the plaintiff's approach would be to consider everyone possible until the responsible party or parties are discovered. For example, parties who might be legally responsible for damage and/or injury caused by avalanches include developers, property owners, realtors and appraisers, lenders, avalanche experts, and government.

A property owner has no duty to disclose what he or she doesn't know, but an owner might be held liable if it were reasonable to assume that he or she should have known about the hazard. It's possible that the Municipality would be held liable if an avalanche event occurred outside a mapped avalanche hazard area, despite a disclaimer of liability by the Municipality. Avalanche experts associated with the mapping might also be considered liable.

Some of the potential arguments that could be made by a claimant include negligence, misrepresentation, failure to disclose, breach of contract, breach of fiduciary duty on the part of the realtor, (ambiguity of) insurance contract, lender involvement, professional malpractice, and government duties.

In discussing some of these possible arguments, it was noted that, to avoid ambiguity, an insurance policy must specifically note exclusion of avalanche coverage, because the courts usually resolve such an ambiguity in favor of the insured. In another situation, a lender might become liable if involved in the development of a property beyond the lending process. Also, in taking a property in default, a lender has the same disclosure duties as a private party in marketing the property.

Regarding government duties, it may be the duty of the Municipality to investigate the avalanche hazard problem and to provide public notification. However, even if this duty were fulfilled, it is uncertain how liable the city would be in taking or not taking other protective measures based on the avalanche hazard information. Given the lack of court cases to test these issues, the legal liability of government in relation to avalanche hazard is not entirely clear.

The next topic examined how people involved with real estate in avalanche hazard zones can protect themselves from liability. These approaches include investigation of potential avalanche hazard, determination of feasibility of development, mitigation of avalanche hazard, and disclosure to those to whom a duty is owed. Mr. Bond noted that there might be a problem in defining duties owed to third parties, such as visitors or delivery and

repair people, who are temporarily on an avalanche-affected property.

Mr. Bond responded to questions and possible scenarios introduced by the participants. On the issue of regulatory taking, he said that, based on the Euclid ruling in 1920, "the diminution of property by regulations promulgated by local government does not constitute taking" when use of the property is not prevented. So, even if a property's value were to be reduced as a result of avalanche hazard identification, it would not constitute a taking by the Municipality.

A question was raised about the potential liability of an owner whose land contains an avalanche release area that might impact a lower property. If the owner does nothing intentional to cause a change in the avalanche path or direction so as to affect adjacent property, he or she would probably not be held liable.

Regarding the duties of a realtor to research avalanche hazard beyond the appraiser's report, this would be based on accepted community standards. For example, if it were the custom in the community for realtors to rely on the appraisers' reports, the courts would rely on that standard. If more realtors began to research beyond the appraisers' report, that might become the community standard instead.

Finally, Mr. Bond touched again on the question of the Municipality's duty to inform the public of its avalanche hazard knowledge. If the Municipality did not inform anyone of the information, it might be held liable. However, it is uncertain whether that liability is affected by the use of the knowledge as technical information rather than adopted regulations. Again, many of the questions surrounding the issue of liability related to avalanche hazard do not have definitive answers because of the lack of legal precedent in this area.

Open Forum: Where do we go from here?

The workshop concluded with an open forum that provided an opportunity for the local participants to define the extent of the avalanche hazard problem and to identify possible solutions by applying information shared during the preceding workshop sessions. (Questionnaires asking participants to identify components of the avalanche problem and to suggest possible solutions had also been completed prior to the open forum.)

In the open forum, participants were asked to divide into small groups and to define the three most important problems associated with the avalanche hazard issue. Responses from each group were presented and displayed for reference during discussion. Participants were then asked to identify the top three problems out of those responses and to prioritize them.

After that, the small groups reconvened and identified solutions to each of the top three problems.

Of the top three problems, ensuring the safety of property and people was voted as the most important. Issues surrounding this problem included awareness and disclosure of avalanche hazard, building construction standards and use of mitigation, and the ability of emergency services to respond to avalanche disaster.

The second most important problem was defined as property resale and development factors, particularly the issue of financing and mortgage insurance eligibility requirements.

Thirdly, the group said that the Municipality needs to provide the public with reasonable notification of avalanche hazard.

Other problems mentioned included the lack of an ordinance addressing avalanche hazard issues and the question of liability in relation to avalanche hazard. The preliminary listing of components of the avalanche hazard problem from the small group discussions is provided in Appendix C. Participant ranking of these components is also shown.

The participants proposed a variety of solutions to the top three components of the avalanche problem. Due to a lack of time, the proposed solutions were not prioritized during the open forum. A summary of the solutions is provided here. A complete list of the solutions is included in Appendix C.

Solutions to the safety issue included: install defense structures in avalanche release areas and paths; adopt a general natural hazard ordinance, including hazard maps with a definition of their application and a process for revision; develop standards for avalanche protection including the adoption of building standards for avalanche-affected areas; provide avalanche education to the general public; and provide training for emergency response to avalanche disasters.

In response to the second issue, property resale and development, the group proposed that the Municipality establish a policy of notification regarding the intent of the avalanche study and maps and how that information should be applied. It was also suggested that avalanche education requirements be established for realtors and appraisers as part of their annual recertification. Another recommendation was to adopt a statewide natural hazard insurance program similar to the one in Norway.

The group suggested that resolution of the third place problem, public notification of avalanche hazard, could be accomplished through notice provisions in a natural hazard ordinance and through the posting of warning signs in avalanche areas. Avalanche advisory notices could also be provided, as in

Ketchum and Alta, and signal lights along roadways, such as those used in Norway, could be implemented.

During the final session, Art Mears was asked to explain, for the record, his intent in developing the avalanche study and Tom Nelson, Land Use Planning Supervisor with the Municipality, was asked to explain municipal policy regarding the avalanche maps. Mr. Mears said his intent was as follows:

- to provide technical detail; i.e., data and maps (to determine the location and extent of the hazard);
- to discuss mitigation possibilities;
- to suggest land use/zoning options based on what is done in other places and what mitigation is used for other geophysical processes; and
- to describe the methodology used that determined the results of the study and his objectives in providing the technical report and maps.

(Note: Mr. Mears reiterated his opinion about several issues discussed during the workshop in a letter to the Municipality. A copy of this correspondence is provided in Appendix D.)

Mr. Nelson explained that the Municipality regards the avalanche hazard study and maps as technical information that is made available to the public on request. The Municipality has interpreted the study and the maps as Mr. Mears intended. In other words, avalanche-affected properties, as identified by the mapped avalanche zone boundaries, should be considered on a case-by-case basis in interpreting the degree of hazard. Physical features of the property, the amount of area impacted by an avalanche zone, and options for avalanche protection should be taken into consideration.

For example, if a lot is wholly within a red or blue zone, the hazard type is easily interpreted and appropriate land use restrictions can be applied. If 80% of a lot is in the red zone and 20% is in the blue zone and the only feasible building area is in the red zone, then for all practical purposes, the lot would be considered a high hazard property.

If only a small area of a lot is affected by the blue zone and the remainder of the lot is not affected by avalanche hazard, then the parcel could basically be considered hazard-free. Where the only buildable area on a property is affected by avalanche hazard, a site-specific study could be done to determine development options with the use of avalanche protection.

Mr. Nelson emphasized that decisions impacting avalanche affected properties, based on misinterpretation and misapplication of the study and the maps, are being made by other user groups not the Municipality.

At the conclusion of the workshop, participants were informed that a report on the proceedings of the workshop would be prepared and forwarded to the Assembly. They were also told that further action on resolving the avalanche hazard problem would be at the Assembly's directive.

FINDINGS AND CONCLUSIONS

Based on the history of the avalanche hazard problem in Anchorage and the proceedings of the Avalanche Hazard Workshop, the following findings and conclusions are made:

1. There is an avalanche hazard problem in the Municipality of Anchorage that affects an estimated 500 or more privately and municipally owned parcels.

2. A study of avalanche hazard within the Municipality was completed by Arthur Mears, P.E., in 1982, and avalanche hazard maps were produced. This technical information is still considered valid by Mr. Mears and the Municipality.

3. As defined by the 1982 study, the high hazard (red) zone is characterized by more frequent avalanche activity and/or greater destructive force than the moderate hazard (blue) zone. Buildings and other facilities that concentrate human activity should be excluded from the red zone.

The blue zone is considered an area of minimal risk, as defined by commonly accepted tolerances to other geo-physical hazards in the U.S. Buildings that are designed and constructed to withstand design-magnitude avalanche loads should be permitted in the blue zone.

4. There are various structural options available for use in avalanche protection. In some cases, these structures can be used to permanently change the avalanche red and blue zones, and possibly remove a building from a hazard designation.

5. The Municipality has never adopted an ordinance regulating building in avalanche hazard areas and/or requiring disclosure and notification of avalanche hazard. Thus, the general public may be largely unaware of the extent of the avalanche problem in relation to residential development.

6. Avalanche hazard regulations have been successfully adopted and implemented in other avalanche-affected communities, without becoming prohibitively restrictive or onerous to property owners. These regulations may include: use restrictions that govern building design and construction and/or site mitigation based on site-specific study; notification and disclosure requirements; and disclaimer of local government liability.

7. Municipal policy has been to make the avalanche hazard maps available as technical information for public use. The information from these maps has been misinterpreted and misapplied by some user groups, in particular FHA in determining a property's eligibility for mortgage insurance. As a result of this misuse, some property owners are being impacted economically in a negative way.

8. The Municipality has interpreted the avalanche study and the maps as the author intended the information to be used; i.e., that affected properties, as identified by the mapped avalanche zone boundaries, should be considered on a case-by-case basis in interpreting the degree of hazard affecting the use of a property.

9. Application of the avalanche hazard information by lenders is inconsistent. Financing is available for avalanche-affected properties from some lenders who evaluate these properties on a case-by-case basis. However, FHA policy is to consider any property with an avalanche hazard zone designated within its boundary as ineligible for mortgage insurance. Neither the degree of hazard nor any protection possibilities are considered. This policy is not applied to properties located in seismic hazard zones.

10. While avalanche damage is not excluded under the standard homeowner's insurance policy, coverage is only provided for damage resulting from a "pure snow avalanche." Earthquake insurance is required for damage resulting from a slide associated with earth movement. However, since avalanche slides commonly involve both snow and debris, it is uncertain what constitutes a "pure snow avalanche" and whether coverage under the standard homeowner's insurance policy can be considered adequate.

11. It is the policy of all realtors in the State of Alaska to discover and disclose any adverse facts found in researching properties for clients, including avalanche hazard information based on the municipal maps.

12. The issue of liability in relation to avalanche events is complex. Many of the questions surrounding the issue of liability do not have definitive answers because of the lack of legal precedent in this area. For example, although it may be the duty of a community to investigate the avalanche hazard problem and to provide public notification, it is uncertain how liable a community would be in taking or not taking other protective measures based on the information.

13. Short-term observations of avalanche events cannot provide information on what can occur in the long-term. The runout distance of an event can far exceed what has been observed in the short-term. Most avalanches observed in the Municipality are shorter return period events. With limited historical data

on long-term events, a higher level of risk acceptance is tolerated in relation to avalanche hazard.

14. It is not disputed that an individual should have the right to take an informed risk involving exposure to avalanche hazard. However, it becomes a matter of public concern when people are unknowingly exposed to that risk. A community's risk acceptance policy of informed choice should include, at a minimum, codification of disclosure and notification.

15. The main components of the avalanche hazard problem, as identified by workshop participants, are (in order of importance):

1. Ensuring the safety of property and people.
2. Property resale and development factors, particularly the issue of financing and mortgage insurance eligibility requirements.
3. Public notification of avalanche hazard by the Municipality.

Possible solutions to these problems were suggested (but not prioritized) by workshop participants. These include:

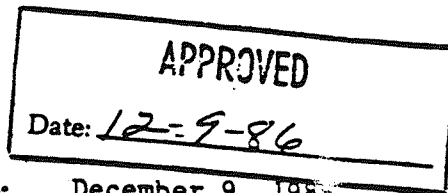
- 1.a. Adopt a general natural hazard ordinance.
- b. Use avalanche protection with established standards for design and construction.
- c. Provide avalanche education to the public.
- d. Provide training for emergency response to avalanche disasters.
- 2.a. Establish a municipal policy of notification re. the interpretation and application of the avalanche hazard information.
- b. Establish avalanche education requirements for realtors and appraisers.
- c. Adopt a statewide natural hazard insurance program.
- 3.a. Include provisions for notification in a natural hazard ordinance.
- b. Post warning signs, issue advisory notices, and use signal lights in avalanche hazard areas.



MUNICIPALITY OF ANCHORAGE

ASSEMBLY MEMORANDUM

No. AIM 347-86



Meeting Date: December 9, 1986

From: Mayor
Subject: Avalanche Hazards

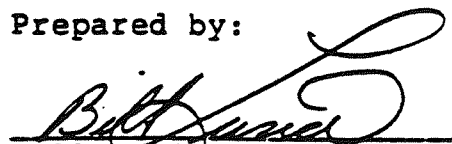
The debate over avalanches within the Municipality has centered around finding the most appropriate ways to protect public safety and minimize economic losses due to these natural hazards. Sufficient discretionary authority already exists under the land use code within the rezoning (AMC 21.20), conditional use (21.50), and platting (21.75.85) sections to accomplish the following specific public policy objectives:

- * signage of public buildings to inform the public of the existence of an avalanche danger.
- * disclosure of the existence of a potential avalanche danger for lots in future subdivisions.
- * prohibition of the creation of habitable structures and lots that can be used for such structures within high hazard areas through the subdivision process.

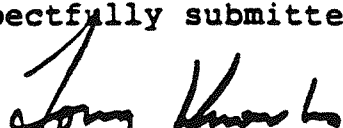
Each of these objectives can be realized by specific conditions of approval as part of a new rezoning, conditional use or subdivision review approval. And, in fact, these objectives are being and have been realized by actions of the Planning Commission and Platting Board.

The Administration proposes to continue current platting and related land use approvals to implement the specific objectives described above. This action will ensure that adequate steps are taken to protect health and safety and that only future subdivisions and future developments will be affected, not existing subdivisions or developments. Therefore, no additional actions related to avalanche hazards are necessary nor will be pursued unless directed otherwise by the Assembly.

Prepared by:


Bill Luria
Director of Community Planning

Respectfully submitted,


Tony Knowles
Mayor

APPENDIX B

The A, Avalanche Zone District, is established to identify those areas where, after due investigation and study, the City Council finds that avalanche potential exists. Avalanches are caused by steepness of slope, exposure, snow pack composition, wind, temperature, rate of snowfall and other little understood interacting factors. Due to the potential avalanche hazard special regulations should be imposed within said district.

16.1 Purposes - An Avalanche Zone District is hereby established as a zoning overlay district for the following purposes:

(1) To identify those areas within the City of Ketchum where, after due investigation and study, avalanche potential is found to exist.

(2) To give notice to the public of those areas within the City where such avalanche potential has been found to exist.

(3) To give notice to and provide the public with the opportunity to review pertinent avalanche studies and reports including the avalanche study report made by Mr. Norm Wilson, dated September, 1977, and the avalanche study report made by Mr. Art Mears, dated July, 1978, and avalanche study report made by Mr. Art Mears, dated January, 1979, together with any future studies made. Copies of the said studies are available for public inspection at the office of the Ketchum City Clerk. It is recommended that said studies be examined prior to purchase, development, construction or use of land located within the Avalanche Zone.

(4) To minimize health and safety hazards, disruption of commerce and extraordinary public expenditures.

(5) To promote the general public health, safety and welfare.

(6) To allow for construction of single-family residences by persons informed of potential avalanche danger with regard to a specific parcel of real property, while providing regulations to protect lessees, renters and subtenants of property within said zone.

16.2 Avalanche Zone District Boundaries - The Avalanche Zone District Boundaries shall be an "overlay district" and designate those areas within said City found subject to potential avalanche danger. The Avalanche Zone shall consist of two sub-zone designation areas as follows:

(1) High Avalanche Zone.

(2) Moderate Avalanche Zone.

The Avalanche Zone shall include all of those areas within the City of Ketchum so designated by the amendment to the Ketchum Zoning Map adopted herewith. Designation as Avalanche Zone, High Avalanche, or Moderate Avalanche Zone shall replace any existing avalanche zoning designation.

16.3 Uses Permitted - The Avalanche Zoning District shall be an "overlay district", and shall apply to the additional requirements of the Avalanche Zoning District to the uses otherwise permitted in the district. All uses allowed in the district with which the Avalanche Zone District combines shall be subject to the additional restrictions of the Avalanche Zoning District. If any of the regulations specified in this Section differ from corresponding regulations specified for a district with

which the Avalanche Zone District is combined, the regulations contained in this Section shall apply and govern.

16.4 Use Restrictions - The following restrictions are hereby imposed upon construction, development and use of all real property located within the Avalanche Zone:

(1) All utilities installed after the effective date of this Ordinance for development of a subdivision or providing utility services to a building, or replacing existing utility services to a building or subdivision shall be installed underground in order to minimize possible avalanche damage to said utilities and injury to persons and property.

(2) Avalanche protective, defective and preventative structures, devices or earthwork which threaten to deflect avalanches toward property of others or otherwise threaten to increase the danger to persons or property are prohibited. The construction of such structures, devices or earthwork shall be permitted only as a conditional use. Prior to granting of a conditional use permit therefor, the applicant shall submit to the City plans thereof signed by an engineer licensed in the State of Idaho, certifying that the proposed construction will withstand the avalanche forces set forth in the avalanche studies on file with the City and that the proposed construction will not deflect avalanches toward the property of others. Other information and engineering studies may be requested in consideration of an application for conditional use permit. As a further condition of any conditional use permit, appropriate landscaping may be required where such structures, devices or earthwork alter the natural slope or beauty of the land. This shall not apply to reforestation. Alteration or removal of any existing natural barriers is prohibited.

(3) Prior to the issuance of a building permit for any structure within the Avalanche Zone, except a single-family residence, the applicant therefor shall submit to the Ketchum Building Inspector plans signed by an engineer licensed in the State of Idaho, certifying that the proposed construction as designed will withstand the avalanche forces as set forth in the avalanche studies on file with the City of Ketchum, or the avalanche forces set forth in a study of the property in question prepared at the owner's expense and submitted to the City by a recognized expert in the field of avalanche occurrence, force and behavior. **WARNING** - The avalanche forces set forth in said studies are to be considered minimum standards only, and the City of Ketchum does not represent, guarantee or warrant the ultimate safety of any construction, use or occupancy of structures constructed to those standards. Avalanches may occur with forces greater than those set forth in said studies, and areas of the City not designated as Avalanche Zone may be subject to potential avalanche danger.

(4) Any structure which has been constructed within the Avalanche Zone and without engineering study, shall not be leased, rented, or sublet from November 15th through April 15th of each year. Any residence being leased or rented on the effective date of this Ordinance shall be deemed a non-conforming use and continued leasing or rental thereof shall be governed by Section XXIV of Ordinance Number 208.

(c) There shall be no further subdivision of any real property, including lot splits, which would result in the creation of a lot or building site, in whole or part, within the Avalanche Zone. A variance to this provision may be granted if a lot can be created in which the building site conforms to all other provisions of this Ordinance and is located entirely outside of the Avalanche Zone.

16.5 General Notice Requirements - In order to provide reasonable notice to the public of the avalanche potential within all areas designated Avalanche Zone, the following notice regulations and requirements are hereby adopted for all real property and structures located within said zone:

(1) All subdivision plats shall identify and designate each lot and block, or portions thereof, located within the Avalanche Zone together with applicable sub-zone designation by a stamp or writing in a manner providing reasonable notice to interested parties.

(2) All plans submitted with a building permit application for property within said Avalanche Zone shall be stamped "Avalanche Zone", together with the applicable sub-zone designation.

(3) Prior to issuance of any building permit for construction within the Avalanche Zone the applicant shall appear before the Council for the purpose of receiving personal notice of the fact said building is within the Avalanche Zone and notice of the studies conducted to date with regard thereto.

(4) The City shall file with the office of the Blaine County Recorder such document(s) as necessary to provide record notice of each existing lot and/or parcel of real property within the Avalanche Zone; and such document(s) as necessary to provide record notice that each owner who rents or leases any structure located in whole or part within the Avalanche Zone shall provide tenant, lessee, or subtenant with written notice that said property is located within the Avalanche Zone prior to any occupancy thereof.

(5) The City shall post signs in the public right-of-way to reasonably identify the boundaries of the Avalanche Zone.

(6) All persons who rent, lease, or sublet any structure or premises within the Avalanche Zone shall provide the tenant, lessee or subtenant with written notice that said property is located within said Avalanche Zone prior to occupancy thereof.

(7) Each and every real estate agent, sales person and broker, and each and every private party who offers for sale or shows a parcel of real property and/or structure for sale, lease or rent within said Avalanche Zone shall upon first inquiry provide the prospective purchaser, lessee, or tenant prior to viewing said real property with written notice that said real property and/or structure is located within said Avalanche Zone. Furthermore, said written notice shall state that the studies referred to in Subsection 16.8 of this Ordinance are available for public inspection at the office of the Ketchum City Clerk and that said studies should be reviewed prior to any party entering any agreement, contract or lease with regard thereto.

(8) That all brochures and other printed materials advertising and/or soliciting reservations for sale,

rental or lease of living units within the Avalanche Zone shall contain a provision designating that said unit or units are located within the Avalanche Zone.

16.6 Suspension of City Services - During periods of avalanche danger, City services may be suspended or otherwise not provided to property within the Avalanche Zone; nor, shall the City accept responsibility for or guarantee that such services, rescue efforts or emergency services will be provided during periods of avalanche danger.

16.7 Warning and Disclaimer of Safety and Liability-Avalanches occur naturally, suddenly and unpredictably based upon steepness of slope and run out area, exposure, snow pack composition, wind, temperature, rate of snowfall and other little understood interacting factors. The Avalanche Zone designated in this Ordinance is considered reasonable for regulatory purposes and is based upon and limited by the engineering and scientific methods of study. This Ordinance does not represent or imply that areas outside the Avalanche Zone District are free from avalanches or avalanche danger.

The fact that the City of Ketchum has not prohibited development, construction or use of real property within the Avalanche Zone District does not constitute a representation, guarantee or warranty of any kind as to the safety of any construction, use or occupancy thereof. The granting of any permit or approval for any structure or use, or the declaration or failure to declare the existence of an avalanche hazard shall not constitute a representation, guarantee or warranty of any kind or nature by the City of Ketchum, or any official or employee, of the practicality or safety of any construction, use or occupancy thereof, and shall create no liability upon or cause of action against such public body, or its officials or employees for any injury, loss or damage that may result thereby.

Avalanches occur naturally, suddenly and unpredictably and persons who develop or occupy real property within said Avalanche Zone do so at their own risk.

16.8 Notice of Avalanche Studies - The City of Ketchum has received the following avalanche studies of areas within the City:

(1) Avalanche study report by Norm Wilson, dated September, 1977.

(2) Avalanche study report by Art Mears, dated July, 1976.

(3) Avalanche study report by Art Mears, dated January, 1975.

Copies of said studies are available for public inspection at the office of the Ketchum City Clerk, City Hall. Persons interested in building, using or occupying real property within the Avalanche Zone are encouraged and should examine the studies. However, the City of Ketchum does not represent or warrant the completeness or accuracy of those studies.

16.9 Amendment to Zoning Map - The Official Zoning Map of the City of Ketchum is hereby amended to include the Avalanche Zone with sub-category designation of High Avalanche Zone and Moderate Avalanche Zone as part of the Avalanche Zone District. The boundaries of said Avalanche Zone are hereby adopted as set forth on said amended Official Zoning Map hereby made a part of this Ordinance.

Alta, Utah

*Copy
Avalanche Ordinance
Engineering Analysis...*

ORDINANCE NO. _____

AN ORDINANCE ESTABLISHING AN INDEPENDENT ENGINEERING ANALYSIS AND REVIEW OF POTENTIAL AVALANCHE HAZARDS AND STRUCTURAL AND DESIGN CALCULATIONS FOR AVALANCHE IMPACT ON NEW CONSTRUCTION.

WHEREAS, the Town of Alta, Utah is situated in a recognized avalanche hazard area and its citizens and property owners from time to time make application to the Town of Alta and its planning commission to construct improvements in recognized avalanche hazard areas, and

WHEREAS, the Town Council of Alta desires that its citizens and property owners prior to the construction and/or ~~remodelling~~ *additions* ~~to~~ ~~of~~ buildings, dwellings or other improvements have said proposed construction analyzed, designed and constructed for potential avalanche hazards and impact.

BE IT ORDAINED by the Town Council of Alta,

That prior to the Town of Alta building official issuing a building permit for the construction of a dwelling unit, building or other structure to be occupied by one or more persons other than a detached single family residence, the applicant must provide to the Town of Alta and its building official for review by the Town and its planning commission:

1. A written report prepared and signed by a recognized avalanche expert analyzing the potential avalanche hazards and the potential physical forces created thereby upon the proposed improvements or structure;

2. A structural analysis of the proposed building prepared and signed by a Utah licensed structural engineer reflecting an engineering analysis and design that takes into account the potential force from an avalanche as set forth in the avalanche report referred to in this ordinance.

PASSED, ADOPTED AND ORDERED posted by the Town Council of the Town of Alta, Alta, Utah, this 30 day of April, 1987.

William H. Leitch
MAYOR

ATTEST:

Katherine [Signature]
TOWN CLERK

DATE of first posting or publication:

MAY 1, 1987

Alta, Utah

HOLD HARMLESS AND INDEMNITY AGREEMENT

THIS AGREEMENT, made and entered into this
____ day of _____, 1983, by and between
THE TOWN OF ALTA, Utah, a municipal corporation of the
State of Utah, hereinafter "Town of Alta" and

hereinafter collectively referred to as the "Property
Owner".

WITNESSETH:

WHEREAS, the Property Owner owns the follow-
ing described real property within the Town of Alta,
Salt Lake County, State of Utah:

and

WHEREAS, the Town of Alta has determined and
observed that said property is located in an area fre-
quented by avalanches and that the hazards and dangers
arising therefrom pose serious threats of destruction,
injury and harm to property located within said area or
to individuals residing or visiting said area; and

WHEREAS, the Property Owner is fully apprised
of such hazards, dangers and risks to property and indi-
viduals but has nevertheless sought to build a build-
ing or structure upon said property and now desires to
occupy the same.

NOW, THEREFORE, in consideration of mutual
covenants, agreements and other valuable consideration,
the parties agree as follows:

1. That upon proper execution of this agreement by the Property Owner and upon satisfactory compliance by the Property Owner of all applicable ordinances, statutes, and resolutions of the Town of Alta which are conditions precedent to the issuance of occupancy, the Town of Alta will issue to the Property Owner certificates of occupancy of said building or structure.

2. The Property Owner, his heirs, successors and assigns, agrees and covenants by his execution of this Agreement to hold the Town of Alta and the United States Forest Service, their employees, agents, successors and assigns, harmless from any and all claims, damages, losses, expenses, or costs arising from injury to persons or property resulting from avalanches, either natural or man-made.

3. The Property Owner, further agrees to hold the Town of Alta and the United States Forest Service, their employees, agents, successors and assigns, harmless from all claims, damages, losses, expenses or costs arising from injury to persons or property resulting from activities associated with avalanche control, including but not limited to conduct associated with the use of explosives and projectiles.

4. The Property Owner, agrees and covenants to indemnify the Town of Alta and the United States Forest Service, their successors and assigns, from any and all claims, demands, losses, expenses or costs, connected with or arising out of those activities of the Town of Alta and the United States Forest Service as hereinabove described in Paragraphs 2 and 3 and brought or made by co-owners, occupants, visitors, tenants, licensees, lessees, sublessees, invitees, or trespassors, (including their successors, assignees and survivors where applicable) of the subject property.

5. In the event suit is filed to enforce the rights and obligations provided herein, the Property Owner agrees that the Town of Alta and the United States Forest Service, their successors and

assigns, shall be entitled to recover from the Property Owner court costs and reasonable attorney's fees.

6. In the event the Property Owner sells, assigns, transfers, conveys his interest in the real property described herein, he agrees that he will bind his successors, heirs and assigns, to the terms and conditions of this Hold Harmless Agreement by recording a special warranty deed or similar conveyance setting forth the restrictive covenants and conditions of this agreement to run forever with the real property described within.

IN WITNESS WHEREOF, the parties have executed this Agreement the day and year first above written.

THE TOWN OF ALTA

By _____

ATTEST:

PROPERTY OWNER:

STATE OF UTAH)
 :
COUNTY OF SALT LAKE)

On the ____ day of _____, 1983, personally appeared before me _____ and _____, who being by me duly sworn, did say that they are the Mayor and _____ respectively, of the Town of Alta, a Utah municipal corporation, that the foregoing instrument was signed in behalf of said corporation by authority of a motion of the Board of Trustees and said persons acknowledged to me that said corporation executed the same

NOTARY PUBLIC, Residing at:

My Commission Expires:

HAZARD REGULATIONS

date for a public hearing to consider the zoning districts to be imposed on the annexed area. (Ord. 23(1974) § 3 (part): Ord. 8(1973) § 22.301.)

18.68.050 Zoning district determination—Hearing notice and conduct.

Notice shall be given, the hearing shall be conducted, and a report of the planning commission stating its findings and recommendations shall be transmitted to the town council in accordance with the applicable provisions of Chapter 18.66. (Ord. 23(1974) § 3 (part): Ord. 8(1973) § 22.302.)

18.68.060 Zoning district determination—Council action.

Upon receipt of the report of the planning commission, the town council shall determine the zoning districts to be imposed on the annexed area in accordance with the applicable provisions of Sections 18.66.150 and 18.66.160. (Ord. 23(1974) § 3 (part): Ord. 8(1973) § 22.303.)

18.68.070 Zoning district determination—Ordinance.

The determination of zoning district by the town council shall be made through its enactment of an ordinance imposing zoning districts on the annexed area. (Ord. 23(1974) § 3 (part): Ord. 8(1973) § 22.304.)

Chapter 18.69

HAZARD REGULATIONS

Sections:

- 18.69.010 Purpose.
- 18.69.020 Definitions.
- 18.69.030 Master hazard plans.
- 18.69.031 Approval of master plans.
- 18.69.032 Supplemental studies.

ZONING

- 18.69.033 Supplemental studies—Individual.
- 18.69.034 Report to town council.
- 18.69.035 Interpretation.
- 18.69.036 Disclaimer of liability.
- 18.69.040 Development restricted.
- 18.69.045 Designation of flood hazard zones and flood hazard studies.
- 18.69.047 Procedures for the substantial improvement of legal nonconforming structures located, in part or in whole, in a flood hazard zone.
- 18.69.049 Duties of the zoning administrator.
- 18.69.050 Special restrictions for developments on lots where the average slope of the site beneath the proposed structure and parking area is in excess of thirty percent in single-family residential, two-family residential and two-family primary/secondary residential zones.
- 18.69.052 Special restrictions for development in geologically sensitive areas.
- 18.69.060 Right of appeal.
- 18.69.070 Requirement of bond.

18.69.010 Purpose.

The purpose of this chapter is to help protect the inhabitants of the town from dangers relating to development of flood plains, avalanche paths, steep slopes and geologically sensitive areas; to regulate the use of land areas which may be subject to flooding and avalanche or which may be geologically sensitive; and further to regulate development on steep slopes; to protect the economic and property values of the town, to protect the aesthetic and recreational values and natural resources of the town, which are sometimes associated with flood plains, avalanche areas and areas of geologic sensitivity and slopes; to minimize damage to public facilities and utilities and minimize the need for relief in clean-up operations; to give notice to the public of certain areas within the town where flood plains, avalanche areas and areas of geologic sensitivity exist; and to promote the general public health, safety and welfare.
(Ord. 5(1985) § 1: Ord. 12(1978) § 4 (part).)

HAZARD REGULATIONS

18.69.020 Definitions.

For the purposes of this chapter, the words contained in this section are defined as follows:

- A. A "blue hazard avalanche area" means an area impacted by a snow avalanche producing a total static and dynamic pressure less than six hundred pounds per square foot on a flat surface normal to the flow and/or a return interval in excess of twenty-five years.
- B. A "red hazard avalanche area" means any area impacted by a snow avalanche producing a total static and dynamic pressure in excess of six hundred pounds per square foot on a flat surface normal to the flow and/or a return interval of less than twenty-five years.
- C. "Flood hazard zone" means that area covered by the base flood. The base flood area is any numbered A, AO, AH, or area of one hundred year shallow flooding indicated on the Flood Insurance Rate Map, associated work maps, and Flood Insurance Study. The flood hazard zone is also any area indicated as floodplain as defined by the "Gore Creek Flood Plain Information Report," 1975, as designated in Section 18.69.045.
- D. "Slope" is as defined in Chapter 18.04.
- E. The "Zone of influence" means any area in a potential avalanche hazard zone where detailed information is not currently available but which may be impacted by said hazard. These zones of influence shall be designated on the appropriate maps of the zoning administrator of the town.
- F. "Flood Insurance Study" means the official report provided by the Federal Emergency Management Agency that includes flood profiles and water surface elevation of the base flood.
- G. "Substantial improvement" means any repair, reconstruction, or improvement of a structure, the cost of which equals or exceeds fifty percent of the market value of the structure. Market value shall be determined by a qualified assessor designated by the zoning administrator. The market value of a structure is determined either:
 1. Before the improvement or repair is started; or
 2. If the structure has been damaged and is being restored, before the damage occurred. For the purposes of this definition "substantial improvement" is considered to

ZONING

occur when the first alteration of any wall, ceiling, floor, or other structural part of the building commences, whether or not that alteration affects the external dimensions of the structure. The term does not, however, include any project for improvement of a structure to comply with existing state or local health, sanitary, or safety code specifications which are solely necessary to assure safe living conditions.

H. "Geologically sensitive area" means an area within the Town of Vail which may be subject to rock falls, mud flows, debris flows, debris avalanches, and unstable soil, slopes or rocks.

(Ord. 5(1985) § 2: Ord. 16(1983) § 1 (part): Ord. 12(1978) § 4(part).)

18.69.030 Master hazard plans.

The town manager shall formulate and develop master hazard plans for the town. Said hazard plans shall be based on engineering studies and shall indicate the location of known floodplains, avalanche and geological hazard zones of influence, known red and blue avalanche and geological hazard areas, and forty percent slope areas. In addition, the plans may show any other information or data deemed to be desirable by the town manager. Maximum citizen participation during the formulation of the master hazard plans as well as other phases of the information implementation of the hazard studies and regulations, shall be encouraged. The purpose of the master hazard plans is to identify and alleviate present and future problems created by the construction of improvements in the hazard areas within the town by means of presenting in an orderly fashion the general data and information which are essential to the understanding of the relationship between the hazards and improvements located within said areas. The master hazard plans may be altered from time to time to conform with new information or existing conditions. (Ord. 12(1978) § 4 (part).)

18.69.031 Approval of master plans.

The master hazard plans shall not be considered to be official hazard master plans of the town until and unless the town council

HAZARD REGULATIONS

adopts the same, by motion. No substantial modification of the master hazard plan shall be made unless it is first approved by the town council in a similar manner. As soon as the master hazard plans are adopted, or portions thereof are adopted, a copy of it shall be placed on file in the office of the town clerk, where it may be inspected by any interested party during normal business hours. (Ord. 12(1978) § 4 (part).)

18.69.032 Supplemental studies.

The town manager, with the advice and approval of the planning commission, shall continue to study and accumulate information as to hazard areas. When additional information is available, it shall be reviewed by the planning commission and added to the master hazard plans. (Ord. 12(1978) § 4 (part).)

18.69.033 Supplemental studies—Individual.

If an application is made to build in an identified avalanche hazard zone of influence or modification to the floodplain, the zoning administrator may require the applicant to conduct supplemental studies as specified in this chapter. The information submitted by the applicant following completion of said studies shall be viewed by the town staff and the planning commission and may be added to the master hazard plans. (Ord. 12(1978) § 4 (part).)

18.69.034 Report to town council.

The town manager shall report to the town council not less than once each year on any additions that have been made to the master hazard plan. (Ord. 12(1978) § 4 (part).)

18.69.035 Interpretation.

The provisions of this section shall be deemed to be minimum requirements. Nothing herein shall impair the obligations of or interfere with private agreements in excess of the minimum requirements. Where this chapter imposes

ZONING

a restriction different from that imposed by other applicable provisions of law, contract, or deed, the more restrictive provision shall control.

(Ord. 5(1985) § 3.)

18.69.036 Disclaimer of liability.

This chapter is based on scientific and engineering considerations which are continually being developed. Compliance with the provisions herein cannot insure freedom from risk to life, safety or property. This section shall not create liability on the part of the Town of Vail or any officer or employee thereof for any damage that may result from reliance on this chapter, or any administrative decision lawfully made hereunder. The designation of certain areas as hazard areas or geologically sensitive areas pursuant to maps incorporated into this section does not imply in any way that areas not so designated are free from all risk to life, safety or property.

(Ord. 5(1985) § 4.)

18.69.040 Development restricted.

- A. No structure shall be built in any flood hazard zone or red avalanche hazard area. No structure shall be built on a slope of forty percent or greater except in single-family residential, two-family residential, or two-family primary/secondary residential zone districts. The term "structure" as used in this section does not include recreational structures that are intended for seasonal use, not including residential use.
- B. Structures may be built in blue avalanche hazard areas provided that proper mitigating measures have been taken.
- C. The zoning administrator may require any applicant or person desiring to build in an avalanche hazard zone of influence to submit a definitive study of the hazard area in which he proposes to build if the town's master hazard plan does not contain sufficient information to determine if the proposed location is in a red hazard or blue hazard

HAZARD REGULATIONS

area. The requirement for additional information and study shall be done in accord with Chapter 18.56.

- D. The zoning administrator may require any applicant or person desiring to build in an identified blue avalanche hazard zone to submit additional information or reports as to whether or not improvements are required to mitigate against the possible hazard. If mitigation is required, said information and report should specify the improvements proposed therefor. The required information and reports shall be done in accordance with Chapter 18.56.
- E. The zoning administrator may require any applicant or person desiring to modify the floodplain by fill, construction, channelization, grading, or other similar changes, to submit for review an environmental impact statement in accordance with 18.56 to establish that the work will not adversely affect adjacent properties, or increase the quantity or velocity of flood waters.

(Ord. 16(1983) § 1 (part): Ord. 12(1978) §.4 (part).)

18.69.045 Designation of flood hazard zones and flood hazard studies.

There are two sets of flood hazard maps and studies designated and adopted for the Town of Vail. They are:

- A. All areas designated as flood hazard zones in the Flood Insurance Rate Maps, as well as the Flood Insurance Study, dated November 2, 1982, are hereby designated and adopted for the areas encompassed by the Town of Vail as of December 1, 1980.
- B. The "Gore Creek Floodplain Information", 1975 study and accompanying maps are hereby adopted and designated for an area described in the West Vail annexation plat, dated December 18, 1980.

(Ord. 16(1983) § 1 (part).)

ZONING

18.69.047 Procedures for the substantial improvement of legal nonconforming structures located, in part or in whole, in a flood hazard zone.

- A. Structures which are substantially improved must be anchored to prevent flotation, collapse, or lateral movement during a base flood event; substantially improved structures must also elevate the lowest floor elevation, including basement, to at least one foot above the base flood elevation.

HAZARD REGULATIONS

- B. Applications for the substantial improvement for structures shall include the following:
1. Engineered drawings and specifications sufficient to illustrate that the proposed structure will be anchored to prevent flotation, collapse or lateral movement during a base flood event. Such drawings shall bear the stamp of a registered, professional engineer.
 2. Floor plans and elevations illustrating that the lowest floor elevation, including basement, of the structure shall be elevated to at least one foot above the base flood elevation.
 3. Before a temporary certificate of occupancy is issued for a substantially improved structure, an improvement location certificate shall be obtained illustrating structure location in relation to property boundaries, building dimensions, all utility service lines as built, easements, lowest floor elevation, and roof ridge elevation. The improvement location certificate shall bear the stamp of a registered, professional surveyor.

(Ord. 16(1983) § 1 (part).)

18.69.049 Duties of the zoning administrator.

The duties of the zoning administrator shall be to:

- A. Review all building permit applications to ensure that the requirements of this chapter have been satisfied.
- B. Review improvement location certificates for substantially improved structures to ensure that the lowest floor elevation has been elevated to one foot above the base flood elevation.
- C. Submit an annual report to the Federal Emergency Management Agency concerning flood hazard zone management and development activity.

(Ord. 16(1983) § 1 (part).)

ZONING

18.69.050 Special restrictions for developments on lots where the average slope of the site beneath the proposed structure and parking area is in excess of thirty percent in single-family residential, two-family residential, and two-family primary/secondary residential zones.

The following additional special restrictions or requirements shall apply to development on any lot in a single-family residential, two-family residential or two-family primary, secondary residential zone district where the average slope of the site beneath the proposed structure and parking area is in excess of thirty percent:

- A. A soil and foundation investigation, prepared by and bearing the seal of a registered professional engineer shall be required.
- B. Foundations must be designed and bear the seal of a registered, professional engineer.
- C. A topographic survey prepared by a registered surveyor, with contour intervals of not more than two feet, shall be required.
- D. Structures must be designed by a licensed architect.
- E. Site coverage as it pertains to this chapter, as permitted by Sections 18.10.110, 18.12.110 and 18.13.090, is amended as follows: Not more than fifteen percent of the site area may be covered by buildings; and not more than ten percent of the total site area may be covered by driveways and surface parking.
- F. A site grading and drainage plan shall be required.
- G. A detailed plan of retaining walls or cuts and fills in excess of five feet shall be required.
- H. A detailed revegetation plan must be submitted.
- I. The zoning administrator may require an environmental impact report as provided in Section 18.56.020.
- J. Density as permitted by Section 18.12.090 is amended as it pertains to this chapter as follows: Not more than two dwelling units in a single structure shall be permitted on each site in conformance with the provisions of this section. A total of not more than twenty-five square feet of gross residential floor area (GRFA) shall be permitted for each one hundred square feet for the first fifteen thousand square feet of site area, plus not more than ten square feet of gross residential floor area shall be permitted for each one hundred square feet

HAZARD REGULATIONS

of site area over fifteen thousand square feet, not to exceed thirty thousand square feet of site area, plus not more than five square feet of gross residential floor area for each one hundred square feet of site area in excess of thirty thousand square feet.

- K. A minimum of one covered parking space shall be provided for each dwelling unit.
- L. Setbacks, as they apply to this chapter, as required by Sections 18.10.060, 18.12.060, and 18.13.060, are amended as follows: There shall be no required front setback for garages, except as may be required by the design review board.
(Ord. 15(1982) § 1: Ord. 23(1981) § 3: Ord. 37(1980) § 4: Ord. 12(1978) § 4 (part).)

18.69.052 Special restrictions for development in geologically sensitive areas.

- A. The following maps are hereby adopted as the official maps of the Town of Vail, identifying areas of geologic sensitivity:
 - 1. The debris flow and debris avalanche hazard analysis map prepared by Arthur I. Mears, P.E., Inc. and dated November, 1984.
 - 2. The rockfall map prepared by Schmuesser & Associates, Inc. and dated November 29, 1984.
 - 3. All areas within the boundaries of the Geologic Hazards Map, Figure 3, prepared by Lincoln DeVore Engineers Geologists and dated August 16, 1982.
- B. In any area located within the boundaries of the Lincoln DeVore map or in any area identified as a debris flow or debris avalanche area by the Mears map or in any area identified as a rock fall area by the Schmuesser map, no initial application for a building permit, grading permit or major or minor subdivision shall be approved until a site-specific geologic investigation is complete. For the purpose of this section, a site-specific geologic investigation shall be deemed a detailed geologic investigation which is

ZONING

applicable to each respective site. All reports and studies required by this section shall be prepared by a professional geologist, as defined by C.R.S. 34-1-201, as amended, or a registered professional engineer, as defined by C.R.S. 12-25-102, as amended, under the direction of and at the expense of the owner/applicant and submitted to the department of community development.

The extent of the site-specific geologic investigation required shall be determined by the geologist or engineer who is responsible for the investigation, however, the investigation shall be of sufficient thoroughness and accuracy to allow such expert to certify to the following:

1. For all structures other than single family, duplex and primary/secondary dwellings, and accessory uses thereto as defined in Section 18.12.040 of this code:
 - a. Whether the geologic conditions are such that the site can or cannot be developed for the specific structure or use proposed without corrective engineering or engineered construction, or other mitigation or alterations.
 - b. Whether corrective engineering or engineered construction, or other mitigation or alterations can or cannot be accomplished to reduce the danger to the public health, safety or to property due to problems related to geologic sensitivity to a reasonable level, and not increase the hazard to other properties or structures, or to public buildings, rights-of-way, roads, streets, easements, utilities or facilities or other properties of construction.
2. For single family, duplex and primary/secondary dwellings, and accessory uses thereto as defined in Section 18.12.040 of this code, the site-specific geologic investigation shall certify to the following:
 - a. Whether the site can be developed for the specific structure or use proposed without

HAZARD REGULATIONS

- corrective engineering or engineered construction or other mitigation or alterations; or
- b. That the site is a geologically sensitive area but development will not increase the hazard to other property or structures or to public buildings, rights-of-way, roads, streets, easements, utilities or facilities or other properties of any kind.
- C. Following the completion of the site-specific geological investigation and its review by the community development department, a development plan may be approved or a building permit may be issued as follows:
1. For all structures other than single family, duplex and primary/secondary dwellings, and accessory uses thereto as defined in Section 18.12.040 of this code:
 - a. If the conclusion of the engineer or geologist performing the investigation is that the site can be developed for the specific structure or activity proposed without corrective engineering or engineered construction or other mitigation or alterations, the subdivision plan or building permit or grading permit may be approved without conditions relating to the mitigation of the areas of geologic sensitivity.
 - b. If the finding of the engineer or geologist performing the geologic investigation is that the site is a geologically sensitive area, but that corrective engineering or engineered construction or other mitigation or alterations can be accomplished to reduce the danger to the public health and safety or to property to a reasonable level, and such mitigation does not increase the hazard to other property or structures, or to public buildings, roads, streets, rights-of-way, easements, utilities or facilities, approval of the development plan and/or the issuance of the building or grading permit shall be conditional and contingent upon approval of plans for

ZONING

corrective engineering and engineered construction or other mitigation or alterations as set forth in this ordinance.

- c. If the conclusion of the geologist or engineer performing the site-specific geologic investigation is that the site cannot be developed for the structure or use proposed because the danger posed by the geologically sensitive area cannot be reduced or mitigated to a reasonable level, the subdivision plan or building permit or grading permit shall be denied.
2. For single family, duplex and primary/secondary dwellings, and accessory uses thereto as defined in Section 18.12.040 of this code:
 - a. If the conclusion of the engineer or the geologist performing the investigation is that the site can be developed for the specific structure or use proposed without corrective engineering or engineered construction or other mitigation or alterations, or that the site is a geologically sensitive area, but will not increase the hazard to other property or structures or to public buildings, roads, streets, rights-of-way, easements, utilities or facilities, a grading permit or building permit may be issued.
 - b. If the finding of the engineer or geologist performing the site-specific geologic investigation is that the site is a geologically sensitive area, but that corrective engineering or engineered construction or other mitigation or alterations can be accomplished so that there is no increased hazard to other property or structures, or to public buildings, roads, streets, rights-of-way, easements, utilities or facilities, the issuance of a building or grading permit shall be conditional and contingent upon approval of plans for corrective engineering or engineered construction or other mitigation or alterations as set forth in this section.

HAZARD REGULATIONS

- c. If the conclusion of the geologist or engineer performing the site-specific geologic investigation is that the site cannot be developed for the structure proposed because the danger posed by the geologically sensitive area cannot be reduced or mitigated so that the hazard to other properties or structures will not increase from the present level or the hazard to public buildings, roads, streets, rights-of-way, easements, utilities and facilities will not increase from the present level, then the building permit or grading permit shall be denied.
- D. The following requirements shall pertain to the construction of any building or structure to be built in an identified or designated area of geologic sensitivity and which requires corrective engineering or engineered construction or other mitigation or alterations to reduce the danger to public health and safety or to property due to such problems as set forth in paragraphs C.1b or C.2b. above.
 1. The certified site specific reports and plans required by this paragraph shall be prepared by each engineer and geologist as applicable to their area of expertise and specialty and shall certify that:
 - a. Adequate base data as may be pertinent has been provided;
 - b. Said base data is utilized in the design and planning of the proposed project or structure;
 - c. Design and construction procedures derived from said base data are executed;
 - d. Design and construction will reduce danger to the public health, safety or property due to geologic sensitivity to a reasonable level.
 3. No certificate of occupancy, temporary or permanent, shall be issued until the following have been approved by the community development department or its authorized representatives:
 - a. Inspection and certification by the Town of Vail building official and the engineer or geologist

ZONING

who prepared the plans and specifications that the work was properly performed in accordance with the plans and specifications.

- b. If the engineer, geologist, or building official of the Town of Vail finds that the work is not being done in accordance with the approved plans and specifications, the discrepancy shall be reported immediately in writing to the contractor and to the community development department of the town. Recommendations for corrective measures, if necessary, shall also be submitted.
 - c. All geologic reports prepared under this section shall be signed by and prepared by or under the responsible direction of professional geologists as defined by C.R.S. Section 34-1-201, as amended. Such professional geologist shall be experienced and competent in the geologic specialty required to meet the objectives of this chapter. Such professional geologist shall be responsible for certification of all geologic maps and reports prepared by him under his responsible direction as specified in this section. All engineering reports required by this section shall be done by a registered professional engineer as defined by C.R.S. Section 12-25-102, as amended.
- E. Existing use of land, structures or premises which are not in conformity with the provisions of this regulation may be continued, except for the following:
1. No building permit will be issued for the exterior expansion, alteration or addition to existing structures in geologically sensitive areas except for windows, skylights and other similar minor alterations unless the requirements of paragraphs B., C., and D. of this section are complied with.
 2. Structures existing on the effective date of this section which are damaged or destroyed may be reconstructed without compliance to this section as long as said structure complies with other applicable

HAZARD REGULATIONS

ordinances and is constructed to substantially the same dimensions as existed prior to damage or destruction, unless given approval by the Town of Vail to alter the design.

F. In order to provide reasonable notice to the public of the problems related to geologically sensitive areas, the following notice regulations and requirements are hereby adopted for all real property and structures located in geologically sensitive areas:

1. All subdivision plats recorded after the effective date of this section shall identify and designate each lot and block, or portions thereof, located within any geologically sensitive area, together with applicable sub-zone designations, by a stamp or writing in a manner providing reasonable notice to interested parties.
2. All plans submitted after the effective date of this section with the building permit application for property within said areas shall be stamped by the applicant "Geologically Sensitive Area" together with the applicable zone designation.
3. Prior to the issuance of any building permit for construction within the geologically sensitive areas, the owner shall submit a written, signed and notarized affidavit certifying acknowledgement of receiving personal notice of the fact that said building or structure is in an area of geologic sensitivity and notice of the studies conducted to date with regard thereto.
4. All owners, lessors or agents who rent, lease or sublet any structure or premises within an area of geologic sensitivity shall provide the tenant, lessee or subtenant with written notice that said property is located within said area prior to any lease being entered into or occupancy, whichever occurs first if said rental, lease or sublease will extend into the period of April 1, through July 1 of any year.
5. Each and every real estate agent, sales person and broker, and each and every private party who offers

ZONING

for sale or shows a parcel of real estate and/or structure for sale, within said area of geologic sensitivity shall provide the prospective purchaser, with written notice that said real property and/or structure is located within said area of geologic sensitivity. Furthermore, written notice shall be made in all instances prior to the execution of any sales documents and shall state that this section and the studies and maps referred to in this section are available for public inspection at the office of the community development department of the Town of Vail and that said maps, studies and this section should be reviewed prior to any party entering into any agreement or contract with regard thereto.

G. In any case where a person wishes to dispute the designation of any property as a geologically sensitive area by one of the maps and studies adopted by this section, the following procedures shall be followed:

1. A written application shall be filed with the community development department requesting such a hearing and providing a supporting site-specific geologic investigation.
2. A hearing shall be set on a date a minimum of thirty days after the application has been filed to allow for a staff review.
3. At the hearing before the town council, the applicant shall be given a reasonable opportunity to present his case and submit technical and geologic evidence to support his claim. If the site-specific geologic investigation establishes by clear and convincing evidence that the property should not be designated as a geologically sensitive area, the town council shall direct the community development department to amend the map appropriately.

H. In any case where a person wishes to have one of the official maps adopted by this ordinance amended to notate more detailed site-specific information is available, the following procedure shall be followed:

1. A written application shall be filed with the community development department requesting such

HAZARD REGULATIONS

a hearing and providing a supporting site-specific geologic investigation.

2. A hearing shall be set on a date not less than thirty days after the application has been filed nor more than sixty days to allow for a staff review.
3. If the applicant establishes at the hearing by clear convincing evidence that the information contained in the site-specific geologic investigation is reliable, the town council shall direct the community development department to keep a copy of said site-specific investigation on file in the community development department and available to the general public and shall further direct the community development department to notate the appropriate official map adopted by this ordinance so that it indicates that said site-specific investigation is on file with the community development department.

(Ord. 20 (1985) § 1; Ord. 5 (1985) § 5.)

18.69.060 Right of appeal.

Nothing in this chapter shall be deemed to deny any interested person his rights to appeal the decision of the zoning administrator

in accordance with Section 18.66.030. Also, nothing in this chapter shall be deemed to deny any interested person his rights to seek a variance from the requirements of this chapter, except in the case where a proposed structure or fill will raise the base flood elevation or increase the quantity or velocities of flood waters during a 100-year flood. Variances shall be governed by the provisions of Chapter 18.62. (Ord. 16(1983) § 1 (part).)

18.69.070 Requirement of bond.

Any applicant under this chapter may be required to post bond, a letter of credit, or other guarantee to insure that the improvements, reports, or other requirements of this chapter are completed and complied with. (Ord. 12(1983) § 1 (part).)

- Chapter 18.71

ADDITIONAL GROSS RESIDENTIAL FLOOR AREA

Sections:

- 18.71.010 Purpose.**
- 18.71.020 Single family, primary/secondary and two family residential dwellings.**
- 18.71.030 Multi-family dwellings.**
- 18.71.040 Procedure.**

18.71.010 Purpose.

The purpose of this chapter is to provide an inducement for the upgrading of individual dwelling units in certain structures which have been in existence within the Town of Vail for a period of at least five years by permitting the addition of up to two hundred fifty square feet of gross residential floor area to dwelling units in said structures, provided the criteria set forth in this chapter are met. This chapter does not assure each dwelling unit located within the Town of Vail an additional two hundred fifty square

APPENDIX C

AVALANCHE HAZARD WORKSHOP - OPEN FORUM RESULTS

Point Ranking	Components of Avalanche Hazard Problem (from small group discussions)
143	1. Safety of property/people -- awareness of problem and disclosure, construction standards and mitigation of problem, ability of emergency services to respond to disaster.
137	2. Getting financing/mortgage insurance for affected properties (for resale and/or development).
127	3. MOA needs to provide reasonable notification of avalanche hazard.
119	4. Original study misapplied, misused by user groups; i.e., lenders, real estate and insurance professions.
114	5. No satisfactory procedure to revise/update original maps and keep records (of avalanche events); (procedure to include cost of doing this).
110	6. No ordinance that establishes development standards, includes maps with zone definitions, and clarifies application of zone boundaries.
101	7. Not enough information available for average property owner to evaluate risk.
86	8. Litigation -- who is responsible, including responsibility of upland owners to lower properties. (upland owners to include private and public, i.e., state park and national forest)
70	9. If structures built to withstand impact of design avalanche, lenders should finance properties.

TOP THREE PROBLEMS (after participants prioritized)

1. Safety of property/people -- awareness of problem and disclosure, construction standards and mitigation of problem, ability of emergency services to respond to disaster.
2. Getting financing/mortgage insurance for affected properties (for resale and/or development).
3. MOA needs to provide public with reasonable notification of avalanche hazard.

Proposed Solutions to Top Three Problems
(from small group discussions - not prioritized)

Problem #1: Safety of property and people

- Install defense structures in avalanche release areas and paths
- MOA adopt general natural hazard ordinance
- MOA focus effort on recognized hazard areas
- MOA adopt building and protection standards in areas with identifiable problems
- Provide educational materials/educational workshops (multi-agency) to general public
- Establish preliminary official hazard zone maps, define how zones to be used, define process for modifying maps
- Set up historical avalanche records
- Provide emergency equipment caches in remote areas

Problem #2: Getting financing/mortgage insurance

- MOA notify everyone of information on and intent of avalanche hazard maps
- MOA work with Congressional representatives to change lending policies
- Perform site specific study by certified consultant to be accepted by lending institution as required by code
- Develop standards for avalanche protection
- Establish avalanche education requirements for appraisers and realtors as part of annual recertification -- education to be done by recognized avalanche experts
- Adopt statewide natural hazard insurance program (similar to Norway)

Problem #3: Public notification

- Include notice provisions in (natural hazard) ordinance
- Government provide avalanche advisories
- Post warning signs, install signal lights along roadways in hazard areas
- Provide training to allow residents and fire and EMS crews in remote areas to cope with emergencies

APPENDIX D

[Faint, illegible text, likely bleed-through from the reverse side of the page]

ARTHUR I. MEARS, P.E., INC.

Natural Hazards Consultants

222 East Gothic Ave.
Gunnison, Colorado 81230
303 - 641-3236

DEC

December 11, 1991

Mr. Tom Nelson
Department of Economic
Development and Planning
P.O. Box 196650
Anchorage, AK 99519-6650

Dear Tom:

Thank you for the opportunity to participate in the Avalanche Hazard Workshop in Anchorage last week. I very much enjoyed meeting and discussing avalanches, avalanche hazard, land-use planning, insurance, and financing issues with concerned local residents.

The following re-iterates my opinion about several issues considered and discussed at the workshop.

(a) HAZARD DESIGNATION. Entire lots must not be designated as hazardous when only small portions are within avalanche boundaries on the Municipal Avalanche Maps. I understand that such arbitrary extensions of hazard zones have been made by personnel in lending or mortgage-insurance organizations in certain cases. Such remapping places an unjustified burden on the property owner, is an illogical extension of the original maps, places an arbitrary "safety factor" on the maps, and tends to undermine the applicability of the 1982 study. Such arbitrary re-mapping of avalanche-hazard zones by personnel who are not qualified to map avalanches is not justified and must be discouraged.

(b) SITE-SPECIFIC STUDIES AND CHANGE IN HAZARD DESIGNATION. Site-specific studies may change the hazard boundaries, thereby making the avalanche zones larger or smaller. Such studies should use hazard designations identical to those used in the 1982 study, and must apply currently available methods and procedures to determine hazard boundaries. Procedures should be based on avalanche return period and design-avalanche dynamics (velocities, pressure potentials, etc.). If current methods are applied, the results will be directly comparable to the 1982 study even if the results are somewhat different.

(c) BLUE (MODERATE-HAZARD) ZONES. Blue zones designate areas affected by both rare events (nominal return periods of 10 to 100 years) and by reduced pressures during the design avalanche ($< 600 \text{ lbs/ft}^2$). The downhill limit of the Blue zone is the limit

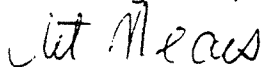
of the "design" avalanche (return period of 100 years). The long return-period designation means that risk to persons outside of buildings is small and should be permitted. This conforms with commonly-accepted tolerances to other geo-physical hazards in the United States.

(d) MITIGATION AND CHANGE IN HAZARD BOUNDARIES. In some cases, avalanche-control structures can be used to permanently change the avalanche Red and Blue zones, and possibly may remove a structure from hazard designation. However, the sizes and strengths of structures must be based on calculations which apply currently-accepted methods and procedures (see "b," above). When systematic procedures are used to calculate the avalanche-control system and determine the new hazard boundaries, the results will be comparable to those of the 1982 study.

(e) DATA COLLECTION. Details (runout extent, damage, deposit height, starting-zone area, fracture thickness, and other measurements) should be made of all large avalanches within the Municipal boundaries. The data must be collected by qualified personnel who can complete an investigation efficiently and safely. This may require the Municipality to enter into an agreement with a qualified outside contractor. The data collected will be invaluable in supporting or refuting the existing avalanche mapping when it can be determined for certain that the return period of the avalanche is similar to the design period (100 years).

Thanks again for asking me to participate in the Workshop. I hope we can work together in the future. Please contact me if you have any questions.

Best regards,



Arthur I. Mears, P.E. (CO, WY)
Avalanche-control engineer

cc: A.M.S.C.

