

**Hazardous Areas Component
Bonner County Comprehensive Plan**

Hazardous Areas Component Bonner County Comprehensive Plan

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- Slope Aspect in Bonner County*
- 100-Year Flood Zone in Bonner County, Idaho*
- Slope Features of Bonner County, Idaho*

HAZARDOUS AREAS COMPONENT

This component includes an analysis of known hazards as may result from susceptibility to surface ruptures from faulting, ground shaking, ground failure, landslides or mudslides; avalanche hazards resulting from development in the known or probable path of snowslides; and avalanches, and flood plain hazards.

CHAPTER 1 - FAULTING/EARTHQUAKES

Section 1.1 - History

The great movements of the crustal plates in western North America yield some of the most severe earthquakes. Central Idaho's high mountain ranges provide evidence of this crustal movement. Idaho is situated where the Basin and Range and Rocky Mountain provinces meet. Most of Idaho experiences the effects of tremendous crustal stretching. Earthquakes from crustal movements in the adjoining states of Montana, Utah, and Nevada also cause severe ground shaking in Idaho.

In Bonner County, most ground shaking activity in the past has been the result of earthquakes centered elsewhere. One such earthquake was the Borah Peak event on October 28, 1983. This earthquake is the largest ever recorded in Idaho, both in terms of magnitude and in the amount of property damage. The earthquake caused two deaths in Challis, about 120 miles northeast of Boise, and an estimated \$12.5 million in damage in the Challis-Mackay area. A maximum Modified Mercalli intensity of IX was assigned to this earthquake because of surface faulting. (Figure 1 details this scale.) Vibrational damage to structures was assigned intensities in the VI to VII range. The quake read 7.4 on the Richter Scale. The Richter scale is a measurement of earthquake energy and ranges from 1.0 (very weak) to 9.0 (very strong).

Many after shocks occurred through 1983. The

Earthquake Intensity¹	
I.	Only instruments detect the earthquake.
II.	A few people notice the shaking.
III.	Many people indoors feel shaking. Hanging objects swing.
IV.	People outdoors may feel ground shaking. Dishes, windows, and doors rattle.
V.	Sleeping people are awakened. Doors swing, objects fall from shelves.
VI.	People have trouble walking. Damage is slight in poorly-built buildings.
VII.	People have difficulty standing. Damage is considerable in poorly built buildings.
VIII.	Drivers have trouble steering. Poorly built structures suffer severe damage; chimneys may fall.
IX.	Well built buildings suffer considerable damage. Some underground pipes are broken.
X.	Most buildings are destroyed. Dams are seriously damaged. Large landslides occur.
XI.	Structures collapse. Underground utilities are destroyed.
XII.	Almost everything is destroyed. Objects are thrown into the air.

¹ Adapted from the Modified Mercalli Scale

Figure 1: Modified Mercalli Earthquake Intensity Scale

earthquake was also felt in parts of Montana, Nevada, Oregon, Utah, Washington, Wyoming, and in the Canadian provinces of Alberta, British Columbia, and Saskatchewan, Figure 2 provides a map of the area. (University of Idaho)

Priest Lake is in an area of low volcanic hazard, which implies small seismic risk (Buck). Several earthquakes have been documented with epicenters near Rathdrum, Idaho, 60 miles south of Priest Lake. The largest of these events occurred in 1918, registering 5.5 on the Richter Scale with a Modified Mercalli scale intensity of VII (Buck). The most recent was in 1969, with a Modified Mercalli scale intensity of IV. (Stover)

Several quakes have occurred since 1953 with epicenters near Bonners Ferry, Idaho, approximately 22 miles east of Priest Lake and 33 miles north of Sandpoint. The most recent of these was in 1968 and the largest had a Modified Mercalli scale intensity of IV. (Stover)

An earthquake occurred in April 1965 and was documented with an epicenter in the Priest Lake vicinity. This event occurred one day prior to a quake in the Bonners Ferry area. Documentation of the quake was based on "felt" data rather than instrument data, with a Modified Mercalli scale intensity of V. (Stover)

Section 1.2 - Fault Lines

Location

The United States Geological Survey recognizes two major geologic faults that cross Bonner County: the Purcell Trench and the Hope Fault. The Purcell Trench extends from the southern boundary of Bonner County, intersecting Hope Fault at the city of Sandpoint, and continues to the city of Bonners Ferry.

The Hope Fault (or fault zone) is a major structural element that extends for about 80 miles southeast of Hope, Idaho, and probably many miles to the northwest. The main Hope Fault traverses Bonner County, and then branches far out to the northwest from the town of Hope, across the Purcell Trench, and into the Selkirk Mountains.

The Newport Fault zone parallels the entire length of

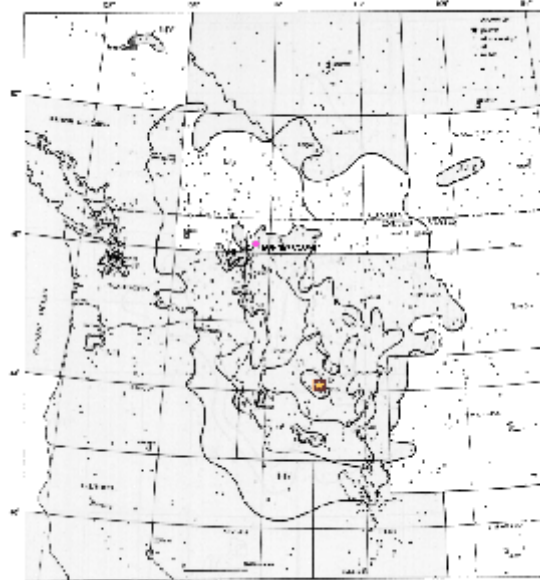


Figure 2: Area affected by the 1983 Borah Peak earthquake.

the eastern shore of Priest Lake. However, the fault is buried under glacial and fluvial deposits through most of the area. Areas where the fault zone is exposed, and other areas where bedrock is heavily fractured, should be considered as potentially hazardous areas. (Bonner County)

According to a Geologic and Bouguer Gravity Map compiled by J.E. Harrison in 1969, there are a number of faults in the mountainous areas on the eastern side of Lake Pend Oreille. The names and general locations are unavailable. Additional supporting text regarding these faults was also unavailable. The base map is U.S. Geological Survey, Sandpoint 1:25,000.

Types

Faults of the area can be conveniently discussed under four systems: Hope Fault, block faults, thrust faults, and trench faults. The Hope Fault is discussed on page 1-3 of this document. Block faults characterize much of the terrain south of the Gold Creek granodiorite body and east of the Purcell Trench. The blocks show a general pattern of stepping down from east to west and from north to south.



Figure 3: Uniform Building Code Seismic Zone Map

Status

There are no active faults in Bonner County according to the Idaho Transportation Department's map of effective peak velocity-related acceleration coefficient.

Significance

The State of Idaho is ranked fifth nationally in terms of its seismic safety risk, with California having the greatest risk. The 1991 *Uniform Building Code (UBC)*, a nationwide industry standard, sets construction standards for different seismic zones in the nation. The *Uniform Building Code* ranks seismic zones in the United States on a scale of 1 (low) to 4 (extreme). Bonner County is in the moderate seismic zone of 2B, as illustrated in Figure 3.

A map developed by the Idaho Geological Survey, showing areas of relative seismic shaking hazard, puts Bonner County in two risk categories, which are illustrated in Figure 4. Most

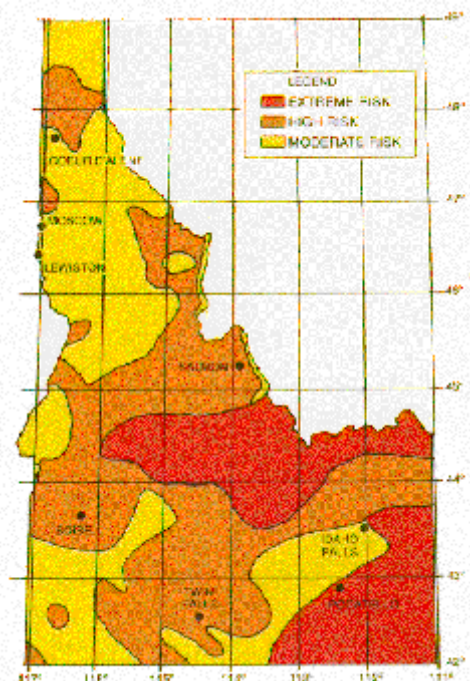


Figure 4: Seismic Shaking Hazard of Idaho

of the southern half of the county is in the high-risk category, while most of the northern half is in the moderate risk category. These designations are largely based on the potential for earthquakes centered elsewhere to cause damage locally (*Uniform Building Code*).

A map showing the location of major fault lines and other geological features of Bonner County, titled *Geology of Bonner County, Idaho*, can be found following the Bibliography of the Hazardous Areas Component of the Comprehensive Plan.

CHAPTER 2 - GROUND FAILURE

Section 2.1 - Landslides

Locations

Landslides occur in every state and U.S. territory. The Appalachian Mountains, the Rocky Mountains, the Pacific Coastal Ranges, and some parts of Alaska and Hawaii have severe landslide problems. Any area composed of very weak or fractured materials resting on a steep slope can and likely will experience landslides. Although the physical cause of many landslides cannot be removed, geologic investigations, good engineering practices, and effective enforcement of land-use management standards can reduce landslide hazards. (USGS)

The majority of the mass failures in Bonner County have occurred in the mountainous terrain away from populated areas. A few of the failures have occurred near Bonner County and State Roads (Idaho Department of Lands). Most landslide areas generally have the following characteristics:

- Scallop shapes, scarps, tension fractures, or hummocky topography
- Unstable - usually at equilibrium
- Deranged drainage
- Steep slope (30 percent or greater)

(Buck)

A map titled *IDL-Identified Mass Failures in Pend Oreille Lake and Lower Clark Fork Watersheds*, depicts recently identified areas of mass wasting and can be found in the following the Bibliography of the Hazardous Areas Component of the Comprehensive Plan.

Significance

Landslides are perhaps the most widespread geologic hazard in the United States and since they are a function of gravity, an intractable one. Despite growing scientific knowledge about where and why landslides occur, the threat they pose continues to increase for reasons familiar to students of ecological hazards: increasing development in vulnerable terrain, global climate changes that exacerbate severe weather, and deforestation. According to the National Research Council, ground failures of various sorts occur in every state. Annually, ground failures cause more deaths (25 to 50) and greater economic loss (roughly estimated at \$1.5 billion) than all other natural hazards combined. Yet, they get little public attention. Because there is no nationwide system for reporting landslides, hard statistics are difficult to obtain. (Bell)

Section 2.2 - Liquefaction

Location

Liquefaction occurs in saturated soils, that is, soils in which the space between individual particles is completely filled with water. This water exerts a pressure on the soil particles that influences how tightly the particles themselves are pressed together. Prior to an earthquake, the water pressure is relatively low. However, earthquake shaking can cause the water pressure to increase to the point where the soil particles can readily move with respect to each other. Because liquefaction only occurs in saturated soil, its effects are most commonly observed in low-lying areas near bodies of water such as rivers, lakes, bays, and oceans. The effects of liquefaction may include major sliding and slumping of soil toward the body of water.

Studies or reports regarding liquefaction information specific to Bonner County is unavailable.

Significance

When designing and constructing new buildings and structures, including bridges, tunnels, and roads, three options exist to reduce liquefaction hazards: avoiding liquefaction-susceptible soils, building liquefaction-resistant structures, and improving the soil.

Avoid Liquefaction-Susceptible Soils

The first option is to avoid construction on liquefaction-susceptible soils. There are various criteria to determine the liquefaction susceptibility of a soil. By characterizing the soil at a particular building site according to these criteria, one can decide if the site is susceptible to liquefaction and, therefore, unsuitable for the desired structure.

Liquefaction Resistant Structures

The second options it to make the structures you build liquefaction resistant. If it is necessary to construct on liquefaction-susceptible soil because of space restrictions, favorable location, or other reasons, it may be possible to make the structure liquefaction resistant by designing the foundation elements to resist the effects of liquefaction.

Improve the Soil

The third option involves mitigation of the liquefaction hazards by improving the strength, density, and drainage characteristics of the soil. This can be done using a variety of soil improvement techniques (University of Washington).

CHAPTER 3 - AVALANCHES

Section 3.1 - General Discussion

What is an avalanche?

An avalanche is a mass of snow sliding down a mountainside. Avalanches are also called snowslides; there is no difference in these terms.

What causes an avalanche?

An avalanche occurs when the stress (from gravity) trying to pull the snow downhill exceeds the strength (from bonds between snow grains) of the snow cover. There are four ingredients of an avalanche:

1. A steep slope.
2. A snow cover.
3. A weak layer in the snow cover.
4. A trigger.

When are avalanches most likely to occur?

The avalanche danger increases with major snowstorms and periods of thaw. Most avalanches occur during or just after large snowstorms. The most avalanche-prone months, in order of frequency, are February, March, and January. Avalanches caused by thaw occur most often in April.

Where do avalanches occur?

About 90 percent of all avalanches start on slopes of 30-45 degrees, and 98 percent of all avalanches occur on slopes of 25-50 degrees. Avalanches release most often on slopes above timberline that face away from prevailing winds (leeward slopes collect snow blowing from the windward sides of ridges). Avalanches can run, however, on small slopes well below timberline, such as gullies, road cuts, and small openings in the trees. Very dense trees can anchor the snow to steep slopes and prevent avalanches from

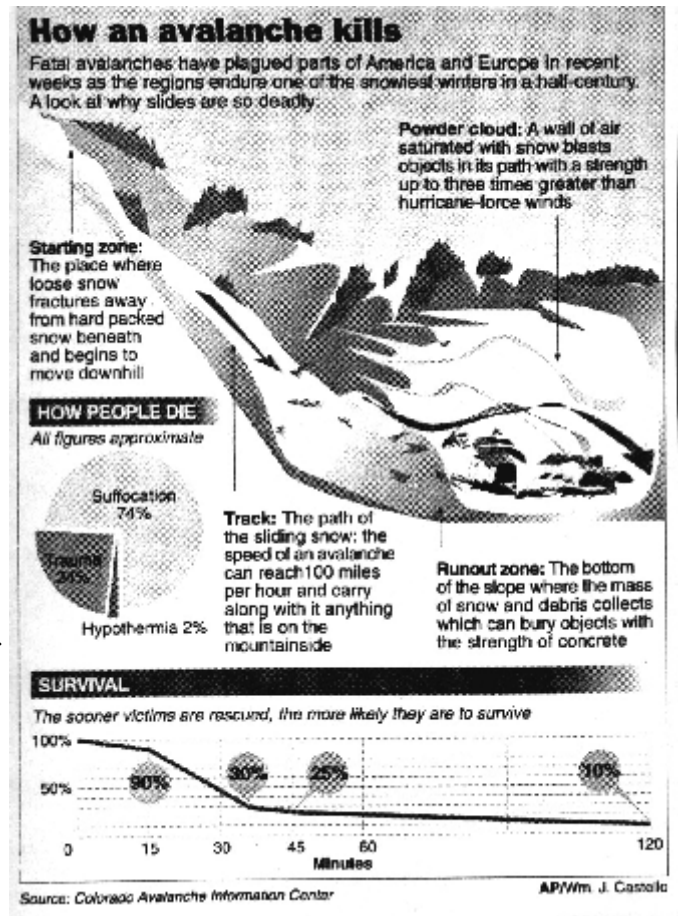


Figure 5: Anatomy of an Avalanche

starting; however, avalanches can release and travel through a moderately dense forest. (Colorado Avalanche Information Center)

Section 3.2 - Known Hazard Areas

Location

Most avalanches occur in the back country, outside of developed ski areas such as Schweitzer Mountain Ski Resort. Areas above the timberline are particularly subject to avalanche potential (Kasun). Schweitzer Mountain Ski Resort reduces avalanche danger at the resort by purposely setting off avalanches during non-operating hours.

Significance

In Bonner County avalanches chiefly affect winter outdoor recreational activities, such as back-country skiing, snowmobiling, telemarking, and snowshoeing. The National Forest Service provides avalanche information and education for back-country recreationalists. (Kasun)

CHAPTER 4 - WILDFIRE

Section 4.1 - General Discussion - History of Wildfires

Fire has plagued forests in the Bonner County area for centuries. Prior to 1905, fall snows were the only means of extinguishing fires. With the advent of the US Forest Service in 1905, meager efforts were made to control wildfires on public lands. These efforts, lacking manpower, were overwhelmed by the fires of 1910. During the 1910 fires, more than three million acres of forest land were burned over in areas of northeast Washington, north Idaho, and western Montana. In the middle of this inferno, four national forests that existed in the present boundaries of Bonner County lost a great deal of timber. As a result, the Pend Oreille National Forest spent over \$45,000 in 1910 to control the fires of that year, compared to the \$2,400 spent in 1909.

In Bonner County, 1926 was the big year for fire. At one point, 240 separate fires were observed in the present Priest Lake Ranger District. While many of the following years had small fires, there were no more catastrophic fires until 1967, when the Kaniksu Mountain, Trapper Peak, and Sundance fires occurred. These three fires burned over 73,000 acres. The Sundance fire will be remembered in history for advancing 16 miles and burning 50,000 acres in nine hours on September 1, 1967. During the period of the fastest spread, the fire burned at a rate of a square mile (640 acres) every three to six minutes and produced a smoke column that rose 35,000 feet into the air. (Cork)

Section 4.2 - Contributing Factors

The following is a list of major contributors to wildland fires (North Idaho Fire Prevention Cooperative).

1. Ground Contour and Slope
 - Level ground with adequate clearing slows the spread of wildfire.
 - Homes on steep, brushing slopes are difficult to defend against spreading wildfires.
 - Narrow, steep draws act as chimneys in accelerating the spread of a wildfire.
2. Aspect
 - South facing slopes are prone to wildfire due to the reduced moisture in vegetation located on exposed, south facing slopes. A map of Bonner County's slope aspects, titled *Slope Aspects in Bonner County* can be found following the Bibliography of the Hazardous Areas Component of the Comprehensive Plan.
3. Vegetative Cover and Landscaping
 - Wildland fires reach high intensities in heavy vegetation.
 - Large green-belt areas help restrict fire spread to structures.

- Proliferation of ladder fuels accelerates wildland fires. Ladder fuels are forest vegetation situated at different heights and close enough to allow a surface fire to potentially spread into the forest canopy causing fire to spread from tree crown to tree crown.
- Tree thinning helps remove fuel for wildland fires. Tree thinning is the selective cutting of trees to improve remaining forest stand by removing trees of poor vigor.

4. Precipitation

- At times, nothing can stop the spread of wildland fire due to conditions such as lack of rainfall, wind, lack of fire breaks, or relatively long response time.

5. Population Impacts

- More people built homes in aesthetically pleasing wildland areas in the midst of highly flammable native vegetation. This trend is greatly increasing the potential for human-caused wildland fire, and is increasing the potential loss of life and property to fire, whether human-caused or not.
- Predicting the behavior of a wildland fire is difficult under natural conditions; it becomes even more difficult in a setting of mixed fuel properties that are present in a wildland/urban interface.
- Methods and equipment used in fighting wildland fires are different than those used for structural fires. Typically, fire crews are not cross-trained or equipped to fight both. The cost of being prepared for both is high.
- Prescribed fire for hazard reduction, which is a common practice in the wildland, is often unacceptable in inhabited areas for legal, political, and environmental reasons.

Section 4.3 - Protection

Beginning in the late 1970s and early 1980s, residential home ownership experienced a rapid expansion in the Pacific Northwest. This expansion spread beyond the confines of the urban environment to surrounding foothill and canyon lands. This expansion was partly due to necessity, but largely due to a desire for solitude away from the hectic pace of urban living. This outward growth has resulted in suburbs often located with little consideration for fire risk or protection. As a result, nationwide hundreds of homes have burned and millions of dollars of property losses have occurred due to wildfire.

Suburban/Wildland Interface Area

An interface area is an area where suburban development abuts wildland. The following list outlines techniques for land development that assists in the prevention of the spread of wildfire.

- Good street signs reduce fire department's response time.
- Address visibility is critical in speeding fire department response time.
- Subdivision signs are critical in locating homes within the wildland/suburban interface area.

- Underground power lines and telephone lines are protected from fire and limit the potential for fire starts. Overhead power lines are susceptible to encroaching vegetation, and increase the threat of fire starts.
- Clearly marked water supplies in rural subdivisions are critical for rapid suppression efforts by fire departments.
- Open or exposed decks are ignition points for flying embers.
- Wood shake roofs are a major contributing factor in rapid ignition and spread of structure fires within the wildland/urban interface area.
- Non-flammable roofing and siding materials are important considerations in safeguarding homes.
- Home construction factors which also help prevent spread of fire include screens to keep sparks and burning debris away from areas where it could otherwise be trapped. Chimney screens reduce roof fires.
- Suburban expansion places heavy protection demands on urban fire departments.
- Wood shake roofs in combination with pine needles create extremely hazardous fire conditions.
- Poor roads make fire vehicle access difficult, particularly during winter weather.
- Wide streets with more than one access route provide rapid, safe fire suppression efforts. Single-entry/exit roadways create traffic bottlenecks during emergency fire operations.
- Firewood and other flammables must be stored away from structures.

(North Idaho)

Wildland Areas - U.S. Forest Service

Fire Suppression

As a result of success in training and preparing its fire prevention and suppression forces, the country has learned to depend upon the U.S. Forest Service to take a leadership role in suppressing potentially harmful wildfire.

Effective management of wildland fire in the United States, however, is becoming increasingly complex. Catastrophic wildfire now threatens millions of wildland acres. Enormous public and private values and resources are currently at risk.

Today, fire suppression strategies can range from monitoring a lightning-started wildfire in remote wilderness areas under an approved plan, to launching a full-scale attack on a human-caused blaze that imperils a community.

Bonner County has ten fire districts that provide fire protection for private homes and businesses within their respective districts. The Idaho Department of Lands is responsible for fire prevention and protection of state owned lands within the county, and also responds to fires on private timber lands.

Fire Prevention

Fire prevention and fire readiness and preparation activities are an integral foundation to fire management. For decades, fire suppression actions were the main purpose of the U.S. Forest Service fire management organization. However, fire management activities must begin before the fire starts.

Fire prevention has become an important strategic tool to help mitigate specific wildfire problems. Devastating, unplanned human-caused wildfires must be prevented, and the U.S. Forest Service encourages the use of planned prescribed fire to combat wildfires.

Prescribed Fire

Prescribed fire, both natural (lightning) and management ignited, is very important in maintaining healthy forests and rangelands. Fire can produce dramatic short-term changes. Nevertheless, its more subtle influences are most significant for maintaining healthy ecosystems. In fact, the primary benefits of fire are often long term, biologically complex, and largely inconspicuous.

The following are some benefits of prescribed fire:

- Reduces the accumulation of combustible materials
- Recycles forest nutrients
- Minimizes insect populations and spread of disease
- Encourages and maintains the growth of native trees and plants best suited to fire-adapted ecosystems
- Removes unwanted species that threaten an ecosystem's health
- Provides better access and conditions for wildlife
- Used only under appropriate conditions and on appropriate sites
- Meets specific management objectives, such as reducing wildfire potential and enhancing vegetation
- Carefully planned in advance, long before ignition
- Occurs only when optimum temperature, humidity, wind speed, and fuel moisture content occur, which ensures that the fire remains inside designated boundaries and accomplishes its objectives
- Guided by smoke management plans to minimize smoke's impact on populated areas

(U.S. Forest Service)

Wildland Areas - Idaho Department of Lands

All timbered land, whether private, state or federal, is protected by either the National Forest Service or the state. Eighty percent of the land protected by Idaho Department of Lands in Bonner County is private timberland. Private land owners pay for the protection through an assessment basis by acre.

The Idaho Department of Lands has two fire stations located at Cavanaugh Bay at Priest Lake, and one station in the City of Sandpoint. Staffing at these stations vary according to the season. District fire stations are located in the exterior boundary of the state's fire protection boundary. Fire districts are responsible for fighting structure fires. In cases where the district is funded, the decision whether to fight a structure fire is based on the value of the property. Fire districts may also participate in fighting wild fires through mutual aid agreements with the Idaho Department of Lands. This is where the fire districts and state often overlap in jurisdiction. In this case, the state is the lead agency. The state can assist in structure fires when they threaten to cause a wild fire. (Galloway)

Private Lands

Bonner County has 10 fire protection districts that protect approximately 231,820 acres of land. The districts primarily fight structure fires and wild fires that threaten structures (Strom). The districts cover the following areas:

- Coolin-Cavanaugh Bay: This district has one volunteer fire station located at Coolin. The district protects 6,187 acres of rural property.
- North of the Narrows: The district, centered at Huckleberry Bay at Priest Lake, was established February 15, 1995, and began its first tax assessment in 2001. With the new funds, a station will be constructed and equipment purchased possibly as early as 2002 (Fiedler). The fire district covers ±2,271 acres.
- Northside: This fire district has four volunteer fire stations located in Ponderay, Samuels, Rapid Lighting, and Bronx (Sec. 25, TWP 58N, R 02W). The district protects 71,313 acres of property.
- Sagle: Sagle has seven paid staff and three volunteer fire stations located at Cocolalla, Careywood, and Algoma. The district protects 81,406 acres of property. In January, 2002 the Sagle Fire District annexed lands encompassing about 23,000 additional acres in the Bottle Bay, Sunrise Bay, Martin Bay, Glengary Bay, Eliot Bay, Camp Bay and Garfield Bay areas.
- Schweitzer: Schweitzer is a volunteer district with one station at the Schweitzer Mountain Ski Resort. Covering 203 acres, the district protects the Schweitzer Mountain Resort property.
- Spirit Lake: Spirit Lake Fire Protection District has two volunteer stations. One station is located in Spirit Lake (Kootenai County), and the other is in Blanchard. The district protects approximately 24,204 acres.

West Bonner	The West Bonner Fire District contracts with the City of Newport for fire protection. The district covers a small area of Idaho Hill/Oldtown (Cunningham). The district covers 117 acres.
West Pend Oreille:	This district has one volunteer station located at Priest River. The district covers 34,589 acres of property, including the cities of Priest River and Oldtown.
West Priest Lake:	This district has two fire stations located at Nordman, and the Luby Bay area of Priest Lake. The district protects 460 acres of rural property.
Westside:	This district has one volunteer fire station at Dover. The district protects 13,458 acres of property. On July 13, 2001, the Westside Fire District annexed Laclede. The district plans to build a new fire station near Laclede.

For more information regarding population, district boundaries, and apparatus of each district, please see the Public Utilities and Services section of this comprehensive plan.

CHAPTER 5 - FLOOD PLAINS (100-YEAR AND 500-YEAR)

Idaho's Panhandle, and Bonner County in particular, has the most abundant water resources in Idaho. Annual precipitation ranges from 20 inches on the Rathdrum Prairie to 60 inches in the mountainous areas, with the greatest precipitation occurring between October and June. With the great water resources, comes the threat of flooding. The largest floods have occurred in late winter, when warm rains have fallen on melting snow (FEMA, Flood Study).

Section 5.1 - Locations

A majority of flooding in Bonner County is around the various rivers and streams that enter and exit Bonner County lakes. Some notable drainages are Sand Creek, Lightning Creek, Pack River, Pend Oreille River, Priest River, and Clark Fork River.

During snow melts followed by heavy rains, Bonner County's smaller lakes have been subject to some flooding. The lowlands of the Clark Fork-Pend Oreille River have experienced repeated flooding (FEMA, Flood Study).

Specific information regarding the locations of flood plains may be found by reviewing the following resources:

Flood Insurance Rate Map

A Flood Insurance Rate Map (FIRM) is the official map of a community on which the Federal Emergency Management Agency (FEMA) has delineated both the special flood hazard areas and the flood risk premium zones applicable to that community. Communities are mapped by the Army Corps of Engineers. Special Flood Hazard Areas (SFHA) are darkly shaded areas on a FIRM or Flood Hazard Boundary Map (FHBM) identifying an area with a 1 percent chance of being flooded in any given year. These darkly-shaded areas comprise the "100-year" flood plain. The FIRM also shows property that lies in the 500-year flood plain, indicating that the property has a 0.2 percent chance of flooding in any given year. Any land area susceptible to being inundated by flood waters from any source is identified as a flood plain (FEMA).

FEMA has adopted the 100-year flood as the base flood for purposes of flood plain management measures. The 500-year flood is provided to identify additional areas of flood risk in the County. The County's floodways have also been mapped. The floodway is defined in the National Flood Insurance Program model flood damage prevention ordinance as the "channel of a water course and the portion of the floodplain adjoining the water course which are reasonably required to carry and discharge the flood water of any water course" (FEMA, Flood Study). The floodway is to be kept free of encroachments in order that a 100-year flood may be carried by the channel without substantial increases in flood height.

Encroachments, such as fill, structures, etc., reduce the carrying capacity of the channel (FEMA, Flood Study).

Bonner County Flood Plain Map

The Geographic Information System (GIS) coverage produced by Bonner County titled, *100-Year Flood Zone in Bonner County, Idaho*, depicts land areas of the county within the 100-year flood plain and is found at the end of the Hazardous Areas Component of the Comprehensive Plan. Information for this GIS coverage was acquired from the Bonner County FIRM produced by the FEMA.

Occurrences/Frequency

Flood events are typically associated with the spring snow melt. Flood season generally begins in April, peaks in May/June and ends in July. Bonner County has seen some large flood events since 1948. The Clark Fork-Pend Oreille lowlands flooded in 1894, 1933, 1948, 1956, 1969, 1974 and 1997. Damages in the 1894 flood were estimated at \$6.8 million (FEMA). The highest recorded flood event occurred in 1948 before the Albeni Falls Dam was constructed. During this flood event, Lake Pend Oreille rose to 2,071.5 feet. (Lake water over 2063.08 feet is considered flooding.) At the same time, the river flow was measured at 171,000 cubic feet per second. Over 20.3 million acre-feet of water filled the Lake Pend Oreille basin. When it was all over and the waters receded, flood damage was estimated at \$2,125,000. Sandpoint Mayor Don Diehl estimated municipal damage at \$258,000 (“Lake Pend Oreille”).

There was also flooding in 1972 and 1974 when the level of Lake Pend Oreille reached 2,065 feet, 2.5 feet above normal summer pool, and in 1997 when the level of Lake Pend Oreille crested at 2,066 feet, 3.5 feet above summer pool (Coyle).

Section 5.2 - Types

Floods are the most common of all natural disasters, except fire. Most communities in the United States experience some kind of flooding after spring rains, heavy thunderstorms, or winter snow thaws. Floods can be slow, or fast rising, but generally develop over a period of days.

River/Lake Flood

Flooding along rivers and lakes is a natural event. Some floods occur seasonally when winter snows melt and combine with spring rains. Water fills river basins too quickly, and the river will overflow its banks. Water from incoming rivers fills up the lake faster than the outgoing rivers can drain the water. Often the land around a river or lake will be covered by water for miles.

Urban Flood

As undeveloped land is paved for parking lots and building construction, it loses its ability to absorb rainfall. Rain water cannot be absorbed into the ground and becomes runoff, filling parking lots, making roads into rivers, and flooding basements and businesses.

Flash Flood

A flash flood is the fastest-moving type of flood. It happens when heavy rain collects in a stream or gully, turning the normally calm area into an instant rushing current. The quick change from calm to raging river is what catches people off guard, making flash floods very dangerous.

Section 5.3 - Flood Control Structures

Major water impoundment structures exist on Lake Pend Oreille at Albeni Falls Dam and Cabinet Gorge Dam, east of Clark Fork. The structures are used mainly for hydroelectric power, but also allow the Albeni Falls Dam to control Lake Pend Oreille's minimum lake level to an elevation higher than natural conditions and to reduce the maximum lake level for floods (FEMA, Flood Study). Albeni Falls Dam was built at the site of a natural falls called Albeni Falls, named after an early settler, Albeni Poirier. The dam produces electricity, reduces flooding, and provides recreational areas for visitors. The U.S. Army Corps of Engineers built the dam between 1951 and 1955 at a cost of \$34 million.

According to John Coyle, U.S. Army Corps of Engineers, Albeni Falls has a minor positive impact in flood control for the Pend Oreille Basin. It is able to reduce a 100-year flood event by 1 foot by maximizing river flow through the dam. The Hungry Horse Dam farther up the Clark Fork River in Montana provides the greatest flood control for the Pend Oreille basin (Coyle).

Minimum winter pool for Lake Pend Oreille is at 2,051 feet. The kokanee draw-down study currently requires a minimum winter pool of 2,055 feet. The regulated summer pool is 2,062.50 feet (Coyle).

The U.S. Army Corps of Engineers has an easement around Lake Pend Oreille that restricts development below an elevation of 2,067.50 feet. This easement dates back to the 1950s. Bonner County's flood plain ordinance requirements are more specific and limit all development to elevations at or above the 100-year flood plain elevation, which is delineated by the FIRM produced by FEMA (Coyle).

A small dam on Priest Lake controls the elevation of the lake for recreation purposes and releases water for downstream power consumption. During high flows, control of Outlet Dam passes to a natural backwater from the river channel leaving the lake (FEMA, Flood Study).

The U.S. Army Corps of Engineers in 1959 constructed a 2-mile long levee on the east bank of Lightning Creek beginning at the mouth of the creek to protect against the 100-year flood event (FEMA).

Section 5.4 - Flood Damage Prevention

Floodplain development standards

Implementation of construction and development standards are the most effective way to reduce future flood losses in high risk areas. Zoning, subdivision standards, building codes and other special codes can be used to establish special conditions for development in special flood hazard areas. These conditions can include setbacks, additional freeboard or other elevation requirements for building lots, roads, bridges, utilities and other structural features. Programs have also been instituted for the acquisition of lands where floods have damaged property in high risk areas. Measures for reducing flood damages include identifying hazards, mapping high risk areas, preparing plans, adopting ordinances setting forth floodplain development standards, enforcing the plans and regulations and incorporating non-regulatory approaches such as financial incentives or public education (FEMA).

The National Flood Insurance Program encourages State and local governments to adopt “sound” flood plain management programs to reduce private and public property losses due to floods. Nationally there are 19,040 communities participating in the National Flood Insurance Program, representing 4.2 million flood insurance policies and \$517 billion in flood coverage (FEMA, Floodplain Management). Bonner County, as of 1997, had 73 flood insurance policies (exclusive of incorporated areas), covering \$7.1 million in property values. The average policy covered \$97,816 in property value.

A flood insurance study has been completed for Bonner County (1984) and a flood prevention ordinance was adopted in 1987 (Ordinance #177, now codified at Chapter 16, Title 12, Bonner County Revised Code). The purpose of the flood damage prevention ordinance was to “guide development in the floodway

and flood fringe areas of any watercourse that floods and; to minimize adverse effects to adjacent property and; to maximize the safety of the public” (Section 12-1610(a), BCRC).

FEMA has identified roles and responsibilities for communities in the flood insurance program. These responsibilities include permit review, compliance determination, inspections, enforcement, record keeping, investigation of complaints, maintenance of flood maps and flood data, and dissemination of floodplain management information (FEMA, Floodplain Management). The responsibilities are currently fulfilled by the Bonner County Planning Department. Reviews of construction plans and inspections of completed structures within the floodplain are presently performed by the private sector.

CHAPTER 6 - SLOPES

Slopes in excess of 30 percent present significant challenges to land development. An illustration of Bonner County's slopes is provided with the map, *Slope Features of Bonner County, Idaho*, provided at the end of the Hazardous Areas Component of the Comprehensive Plan. Roads and septic systems are very difficult to construct on steep slopes. Land development in areas of excessive slopes also increases the potential for erosion hazards.

Areas where potential slope stability hazards exist are delineated based on surficial geology, soils, and slopes. All areas with slopes 55 percent or greater are generally considered hazardous. Areas where slopes are between 35 percent and 55 percent are generally considered potentially hazardous if one or both of the following formations are present:

- Metasedimentary formations, which may or may not be overlain with unconsolidated glacial deposits.
- Unconsolidated glacial deposits, regardless of underlying bedrock materials.

Rockfall areas are the result of extremely steep slopes of exposed rock and cliffs, and may include talus slopes. With some exceptions, these areas are generally on state and federal lands and outlying private timber lands. Any such areas should be considered potentially hazardous to development (Bonner County).

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