

Island County
Multi-Jurisdiction Hazard Mitigation Plan
Section Three
Island County Profile and
Hazard Identification and Vulnerability Assessment

Introduction

The *Island County Hazard Identification and Vulnerability Assessment* (HIVA) was originally compiled as a stand-alone document supporting the Comprehensive Emergency Management Plan (CEMP). It has been synopsisized in this section for inclusion in this text. The detailed HIVA is at Appendix B.

Scope

The HIVA (Appendix B) from which this section is derived addresses all the natural hazards that are present in all areas of the county but may not impact all areas of the county. Flood and tsunamis vulnerability and risk, for example, are limited to specific county locations. Earthquakes may affect the whole county but with varying risk. Political subdivisions and other participating jurisdictions may recognize a local hazard that the county has not assessed for their jurisdiction or service area. Any unique or locally identified hazards should be included in the development of jurisdictional profiles, hazard assessments, and mitigation programs.

This HIVA assesses natural hazards over the whole of Island County including its towns, neighborhoods, and its surroundings. Assessment is the initial step in the emergency management process that leads to mitigation against, preparedness for, response to, and recovery from hazards. Hazards have the potential of becoming disasters or emergencies that can adversely affect the people, environment, economy, and property of the county.

County Profile

Background

Island County has experienced or could experience impacts from natural hazards including floods, storms, wildland fires, earthquakes, and volcanoes. From 1956 to 2006, Washington State qualified for 37 Presidential Major Disaster Declarations. Island County was identified in at least eight of these. These

include the May 1980 eruption of Mount St. Helens, November 1990 flood, December 1990 Flood, November-December 1995 floods, the February 2001 earthquake, the June through October 2003 drought and floods, and the 4 February 2006 Severe Storm. In addition to the Presidential Major Disaster Declarations, other events occur that result in severe localized impacts to the county, its towns, businesses, and environment.

Geography and Transportation

Island County is one of the 39 counties of Washington State. The county seat is at Coupeville on Whidbey Island. The county consists of approximately 212 square miles on 8 islands in Puget Sound. Six of those are: Baby, Ben Ure, Camano, Deception, Smith, and Whidbey Islands. Two other islands, Minor and Kalamut were recently officially recognized by the legislature although Minor appears as an extension of Smith Island and Kalamut Island is actually a submerged sandbar off the east side of Maylor Point. In size, Island County ranks 38th of 39 Washington counties. San Juan County being the only county smaller in area. Whidbey and Camano Islands make up the majority of the land area. Ben Ure has only 19 residential lots; the other islands are uninhabited. Both Whidbey and Camano have flat to rolling terrain of mixed forest and farmland. There are several areas of significant flood plain that lie at sea level. High unstable banks and bluffs mark other coastal areas of both islands. Except in the vicinity of towns, other small residential areas, and along the few major roads, a large portion of Island County is agricultural land or second and third growth timber and brush. While there are no rivers in Island County, there are several small streams. On the south end of Whidbey Island there is Glendale and Maxwellton Creeks. On Camano Island are Kristofferson, Carp, and Cavalero Creeks. The flow rates of these streams range from 1 to 2 cubic feet per second (CFS) in the winter to fractional CFS in the summer. Whidbey and Camano Islands do have a number of small pothole lakes. The counties contiguous to Island County are Skagit County to the north and east and Snohomish County to the south and east. Jefferson County is across Admiralty Inlet and Admiralty Bay on the west.

Whidbey Island is 168.67 square miles and is approximately 50 highway miles long with an irregular coastline. Camano Island is 43 square miles and is approximately 17 road miles long also with a shoreline of 52 miles. Whidbey and Camano Islands lie adjacent to each other separated by the Saratoga Passage. The only major north-south road on Whidbey Island is State Highway 20. Highway 20 is a two-lane highway that connects Whidbey Island to Fidalgo Island and the mainland by bridge on the north at Deception Pass. Highway 20 ends on the island's west coast at the Washington State Ferry (WSF) terminal at Keystone near Fort Casey. This route connects to Port Townsend on the Olympic Peninsula. State Route 525 continues south to the WSF terminal at Clinton. This route connects Whidbey to the mainland at Mukilteo. Camano Island has one two-lane road, State Route 532 connecting its northeast coast by

bridge to the mainland in the vicinity of Stanwood. There is no other bridge or ferry access to the Camano. Oak Harbor on Whidbey Island has commuter airline access to Seattle and other Puget Sound destinations through Kenmore Air Service at Wes Lupien Airport (Oak Harbor Air Park). There are 5 airfields in Island County including 2 military (Navy) and 3 private or commercial. Four of the airfields are on Whidbey Island and one is on northern Camano Island.

Climatology

Island County at the east end of the Strait of Juan De Fuca is exposed to the marine air blowing east along the Strait of Juan De Fuca and is partially in the rain shadow of the Olympic Peninsula. The surrounding waters have a moderating effect on temperatures in both summer and winter. Snow, while not rare, does not normally accumulate to any significant depth. Prevailing wind direction varies with the season. Late autumn, winter, and early spring winds are generally southeasterly. The prevailing winds at Ault Field (Naval Air Station Whidbey Island - NASWI) from October through March are southeasterly at 10 to 12 knots. Frontal winds from that direction can be strong, often reaching gale force (34-47 knots) and stronger gusts occur (4 February 2006, 68 MPH).

Economy

Government employment (specifically the U.S. Navy) makes up the largest part of the economy including federal, state, county, city, and public schools. Retired persons make up a growing portion of the population, as do commuters who work in Skagit, Whatcom, Snohomish, and King Counties. A commercial mussel farming operation in Penn Cove has become a significant economic factor in the Coupeville area as has a growing boat building business at Freeland.

Demographics

Island County is estimated to have a density of 370.38 persons per square mile (2006 State estimate). Island County's cultural base is 92% white, 4% Filipino/Asian, 2% African American, 1% Native, and 1% other. Populations (2000 census and 2005 estimates) for Island County Towns and Areas follow:

Whidbey Island	59,195
Camano Island	17,000
Oak Harbor	22,290
Coupeville	1,785
Langley	1,055
Freeland (unincorporated)	615
Unincorporated county	50,520

Since 1970, the county has grown faster than the state as a whole and is ranked as the fifth most densely populated county with approximately 370 persons per square mile.

NATURAL HAZARDS

DROUGHT

Definition and History

Drought is a condition of climatic dryness that is severe enough to reduce soil moisture and water and snow levels below the minimum necessary for sustaining plant, animal, and economic systems. Island County and the surrounding region have been repeatedly affected by drought and near drought conditions. As discussed in the Climatology Section, Island County is historically drier than many of the counties to the east. When rainfall levels decrease, mild dry conditions quickly move toward drought. The county's lack of rivers, streams, and large lakes or reservoirs means that wells and the aquifers that supply them are impacted when rainfall does not replenish ground water. Finally, the island nature of the county also means that wells are subject to saltwater intrusion when aquifers are depleted.

In the summer of 2001 the Governor declared a statewide Stage 2 drought in response to the worst dry spell since records began in 1929. Island County received only 66 percent of its normal precipitation and there were sporadic problems with saltwater intrusion into wells. In 2003, the state and the county were again in another drought. The county went for over 60 days without substantial rain. The office of the State Climatologist stated that this was the driest summer since records have been kept. Island County was later included in Presidential Disaster Declaration Number 1499 due to failure of several crops in the county and Western Washington.

Hazard Identification and Vulnerability Assessment

Nearly all areas of the state, including Island County are vulnerable to drought. In every drought, agriculture is adversely impacted, especially in non-irrigated areas. Droughts impact individuals (farm owners, tenants, and farm laborers), the agricultural industry, and other agriculture-related sectors. Lack of snow pack has decreased Cascade hydroelectric generating capacity and raised electricity prices impacting Island County. There is also increased danger of wildland and interface fires. Most county residents (72%) obtain their drinking water from ground wells. Drought conditions increase pressure on aquifers and increased pumping can result in saltwater intrusion into fresh water aquifers and reductions in, or restrictions on economic growth and development.

History suggests a high probability of drought occurrence and reoccurrence. Although the entire population of the county is vulnerable to the effects of drought, severity has historically been low, being more inconvenient than threatening.

Conclusion

Island County will remain vulnerable to the effects of a regional drought. The risk of a drought occurring is high while the impact to the county economy is probably limited.

EARTHQUAKE

Definition and History

An earthquake is ground shaking caused by an abrupt shift along a fracture in the earth, called a fault. Washington State, especially the Puget Sound basin, has a history of frequent earthquakes. More than 1,000 earthquakes are recorded in the state annually, only a dozen or more cause shaking and occasional damage. Large earthquakes in 1949 (magnitude 7.1) and 1965 (magnitude 6.5) killed 15 people and caused more than \$200 million (1984 dollars) in damage in several counties. The state experienced at least 20 damaging events in the last 125 years. The most recent earthquake, on February 28, 2001, was a deep, 6.8 magnitude earthquake located 17.6 kilometers northeast of Olympia in the Puget Sound. One person died of a heart attack, over 700 people were injured, and damages were upward of \$1 billion at the time of the earthquake

Hazard Identification and Vulnerability Assessment

Washington is vulnerable to earthquakes originating from three sources: the subducting slab, the overriding plate, and between the colliding plates. Island County contains at least two faults, the North Whidbey Island Fault and the more significant South Whidbey Fault. Smaller faults such as the Devil's Mountain, Utsalady Point, and Strawberry Point faults are thought to be parts of the North Whidbey fault. In addition to these, there are several other suspected faults that may cross south Whidbey Island from south to north. Various sources and diagrams indicate that parts of the North Whidbey fault probably run through a portion of Oak Harbor. One fault scarp is visible on NAS Ault Field at the Rocky Point area. Langley also sits very close to the plotted location of the South Whidbey Fault. Several neighborhoods on south Whidbey Island: Clinton, Useless Bay, and Freeland are on or close to the South Whidbey Fault as it cuts

the Island from the southeast to the northwest. Geologists have not determined likely occurrence intervals for these faults.

Conclusion

All of Island County, like all of western Washington, is vulnerable to damage and injuries from a large earthquake. The risk of an earthquake occurring and impacting Island County is high. Oak Harbor and Langley are both very close to known faults. Only Island County's more rural economy, lack of large buildings (more than two stories), and lack of large population concentrations mitigates the risk for catastrophic damage.

FLOOD

Definition and History

A flood is an inundation of dry land with water. Since 1971, every Washington State county has received a Presidential Disaster Declaration for flooding. The SHEL DUS (Spatial Hazard Events and Loss Database for the United States) database compiled and maintained by the Hazards Research Lab at the University of South Carolina is a county level dataset that lists a number of different hazard events where the total damage was over \$50,000. In the period 1960 to 2002, the database lists 24 events for Island County. Of these flooding accounted for 5 events. While flooding made up only 21 percent of the listed events, the damage costs from flooding accounted for the majority of the property damage reported. The most recent tidal flooding in Island County occurred in February 2006.

Hazard Identification and Vulnerability Assessment

Flooding in Island County results primarily from extremely high wind driven tides and the rapid accumulation of runoff surface water (ponding). Other possible causes of flooding in Island County include tsunamis, sieches, and structural failure of dikes. The reality is that FEMA has rated the likelihood of flooding in most of the county as very small. The FEMA Flood Insurance Rate Maps (FIRM) for the 100-year annual chance of flood in almost all cases indicates flooding would occur in shore areas from wind driven storm surge. The areas indicated for inundation are those one would expect to have a greater chance of flood, i.e. those beach communities, dike and drainage district areas, and saltwater marshes. The remainder of the county falls into what FEMA rates as having a .2% chance of annual flooding (500 year flood).

Higher flood danger occurs during the winter and early spring due to seasonal extreme tides coupled with winter windstorms. Island County's continued growth has resulted in numerous beach level residential areas on both Whidbey and Camano Islands that are at risk from tidal flooding. Currently in the county there are four dike districts and three drainage districts in the county.

Conclusion

Many coastal areas of Island County are vulnerable to tidal flooding. The risk of a flood occurring in any one year is high while the magnitude of the flood will be restricted by the geography of the islands.

LANDSLIDE

Definition and History

Landslide is the sliding movement of masses of loosened rock and soil down a hillside or slope. Landslides causation depends on soil composition, precipitation and soil moisture, seismic shaking, land development and zoning practices, and slope angle.

The county has approximately 200 miles of shoreline that includes bluffs as high as 300 feet. The erosion rates along Island County shores have been measured from as little as a fraction of an inch to more than 2 feet per year.

From November 1996 through March 1997, a series of wet winter storms delivered snow, freezing rain, and warm rain to Western Washington producing floods and landslides. Prior to the storms, the late autumn months had above normal precipitation, building soil moisture and heavy snow packs. The combination of pre-existing soil moisture and heavy rain brought soils to saturation. The lateral movement of ground water toward the free faces of bluffs and banks cause water pressures that trigger landslides. Mudslides were reported in several locations on Camano Island including: Cavalero County Park, Tye Beach, Wilkes Gray Heights, Pebble Beach, Summerland Beach, and Woodland Beach. On Whidbey Island Slides were reported on Madrona Way, Harrington Road, Driftwood Beach, and Marshall Road. On the gentler plains, percolating water and the emergence of ground water from shallow aquifers caused ponding and flooding in low-lying areas.

Recent reviews of steep slope areas show continued slope movement on Whidbey Island at Driftwood Lane, Hidden Beach Drive, and Whidbey Shores at East Point. Other steep slope areas while covered with vegetation, show the

bowing of tree trunks from what may be continued slope subsidence. Discussions with residents in several of these areas indicated that tree fall from these slopes are a continual problem after periods of heavy wind and rain. This presents a risk to persons, property and to access to these mostly single road areas. Finally, the Town of Coupeville and City of Langley both share business area locations on high banks. Oak Harbor has an area adjacent to the city where high bank subsidence has already claimed a portion of Scenic Heights Road (since rerouted).

Hazard Identification and Vulnerability Assessment

Due to the growing population density and desire of people to have a home with a view, an increasing number of structures are built on top of or below slopes subject to land sliding. There are seven characteristics that may be indicative of a potential hazard slope. Most of the county bluff or steep slope areas exhibit one or more of these

Conclusion

Many coastal areas in Island County are vulnerable to landslides and subsidence. The risk of a landslide occurring in the county in any one year is 100% even if the volume of most slides is small. Land stability cannot be absolutely predicted with current technology. The best design and construction measures are still vulnerable to slope failure. The amount of protection, usually correlated to cost, is proportional to the level of risk reduction. Debris and vegetation management is integral to prevent landslide damages. WAC 365-190-080 states that geologically hazardous areas pose a threat to the health and safety of citizens when incompatible development is sited in areas of significant hazard.

SEVERE STORM

Definition and History

An atmospheric disturbance manifested in strong winds, tornadoes, rain, snow, or other precipitation. The SHELDUS database in the period 1960 to 2002 lists 24 events for Island County. Of these, wind as a single factor accounted for 9 of the events and winter weather which included wind accounted for another 7, and thunderstorms, which again included wind, was another 3 for a total of 19 events.

Island County was impacted on the morning of January 20, 1993, the day of the Presidential Inauguration, when a powerful low-pressure system swept through Western Washington with winds up to 100 MPH causing great destruction, numerous injuries, and the loss of life. During the period December 1996 through February 1997 winter storms impacted the Puget Sound region with high snowfall and cold temperatures resulted in significant snow accumulations. The

accumulations aggravated by rain, drifting snow, and ice in roof drains caused excessive weight and the collapse of structures. High winds and ice contributed to the repeated and extended power outages to over 500,000 power customers.

Damage costs resulting from wind related events were generally low compared to flood damage, but wind affects a much wider area. The volume of debris on roads, downed power and telephone lines can quickly overwhelm emergency repair crews at least in the short term. The last major storm struck Island County on 4 February 2006. This combination of extreme wind (60 MPH) and winter extreme tides caused extensive tidal flooding, erosion, and surf and debris damage. In some areas of the county power was out for two days.

Hazard Identification and Vulnerability Assessment

All areas of Island County are vulnerable to the severe local storms. The affects are generally transportation problems and loss of utilities due to tree blow down. The most heavily affect areas in Island County are primarily at the edges of expanses of open water and the exposed edges of timber stands. Transportation accidents occur; motorists are stranded, and schools, businesses, and industries close. The affects vary directly with the intensity of the storm, the level of preparation by local jurisdictions and residents, and the equipment and staff available to perform tasks to clean-up effects of severe local storms.

Conclusion

All of Island County remains vulnerable to severe rain, and high winds. Past severe storms have adversely impacted island services and the economy as well as causing large private property losses. Some wind damage can be expected in any year making this one of the more important hazards for the county.

TSUNAMI

Definition and History

“A tsunami is a series of waves usually caused by earthquakes. Underwater volcanic eruptions and landslides can also generate tsunamis. In the early 1800’s, possibly 1820 Snohomish Indian stories indicate that a large landslide at Camano Head caused a tsunami that swept across Saratoga Strait and hit Hat Island causing damage and drowning at an Indian village.”

The Good Friday Alaskan earthquake of 1964 was the most serious tsunami on record to reach the Washington coast. On October 1994, a tsunami warning was issued for the Washington coast due to a magnitude 8.1 earthquake near Russia’s Kuril Islands that spawned a tsunami. Studies indicate that about a dozen very large earthquakes with magnitudes of 8 or more have occurred in the Cascadia Subduction Zone, which is at least 75 miles off the coast of Washington, these prehistoric events likely generated tsunamis.

Hazard Identification and Vulnerability Assessment

The Washington coast and the Strait of Juan de Fuca are vulnerable to tsunamis generated at a considerable distance out in the Pacific Ocean or by a local Cascadia Subduction Zone earthquake. Puget Sound and Island County are also vulnerable to tsunamis or sieches generated by local crustal earthquakes or by surface and submarine landslides. The west coast of Whidbey Island lies in a direct line with the ocean mouth of the Straits of Juan de Fuca making it vulnerable to any eastward moving tsunami.

Large Pacific Ocean tsunamis have wave crest to wave crest distances of 60 miles and can travel at about 600 miles per hour in the open ocean. As the waves reach the shallow water of the coast, the waves are slowed forcing the water to form walls of 30 feet or more. Recent studies and projections for the west coast of Whidbey Island indicate the likely height of a locally caused tsunami would be in approximately 2 meters high or 6.5 feet. While this is not as high as might be expected, structures built at or close to sea level or on the beach will sustain significant damage. Bluff subsidence is also a real possibility. Tsunami evacuation planning tried to move people to areas over 50 feet above sea level. Coupeville, Langley, and Oak Harbor all have water front exposure and portions of their business areas are exposed to possible sieche damage. All three locations are shielded from ocean or open water (Puget Sound) tsunamis, which have the potential to be much larger.

Conclusion

The west coast of Whidbey Island is vulnerable to an ocean or Puget Sound tsunami. Camano Island and the east coast of Whidbey are vulnerable to sieches. The risk or likelihood of a tsunami impacting on Island County is considered low. However given the large number of beach

VOLCANO

Definition and History

A volcano is a vent in the earth's crust through which magma (molten rock), rock fragments, gases, and ashes are ejected from the earth's interior. A volcanic mountain is created over time by the accumulation of these erupted products on the on the earth's surface. On May 18, 1980 at 8:32 a.m., Mount St. Helens erupted killing 57 people. After a 5.1 magnitude earthquake, the volcano's summit slid away in a huge landslide, the largest in earth's recorded history. The landslide depressurized the volcano's magma system, triggering a powerful explosion that ripped through the sliding debris. Rock, ash, volcanic gas, and steam were blasted upwards and outward to the north. Over the course of the day, prevailing winds blew 520 million tons of ash eastward across the United States and caused complete darkness in Spokane. While Mount St. Helens is

many miles south of Island County, the events described indicate some of the local effects if a North Cascade volcano erupted.

Hazard Identification and Vulnerability Assessment

Scientists define a volcano as active if it has erupted in historic time or is seismically or geothermally active. By this definition Mount Rainier and Mount Baker are active volcanoes. Even Glacier Peak has erupted as recently as a thousand years ago and possibly even as late as the 17th century. At some unknown future date, Island County can expect volcanoes to its east to erupt and generate mud and ash flows that will travel down the Skagit and other local rivers to Puget Sound with possible consequences for eastern areas of Island County. While winds over Island County are predominantly from southwest and west to east, Island County could still receive some ash and debris from a Northern Cascade volcanic eruption. The other significant effects of a volcanic eruption important to Island County are earthquakes and possible tsunamis accompanying an eruption.

Conclusion

Island County is vulnerable to indirect volcanic hazards. The risk of a volcanic eruption in the North Cascades, while not zero, is considered low. Due to the relative locations of the Cascade volcanoes and the prevailing winds, the impact on Island County from volcanic ash or other erupted material is considered to be low. However, ash and volcanic chemical products in the Skagit River would contaminate the main water supply to Oak Harbor and Whidbey Island Naval Air Station. Also of concern, would be volcanic related earthquakes or tsunamis. Volcanic eruption consequences to surrounding counties would also cause severe economic and support impacts such as: transportation interruptions, power transmission interruptions, telecommunications outages, interruption of deliveries of essential foods, and medical services. Public service (police, fire, EMT) coverage would be severely stressed in Island County even if it were spared the direct damage of volcanic activity.

WILDLAND-INTERFACE FIRE

Definition and History

Wildland fires are the uncontrolled destruction of forests, brush, field crops and grasslands caused by nature or humans. Interface fires are those that move across the boundary from wildland to urban or urban to wildland.

The 2000 fire season in Washington State was the worst since the Chelan County fires in 1994. The Governor signed a proclamation early in the fire season because the Northwest United States was experiencing a disastrous fire season. The proclamation authorized firefight training for the National Guard in

the event federal, state, local and contracted fire-fighting resources would be unable to handle the fires. The state mobilized fire service resources six times to fight wildland fires in Central Washington that burned over 300,000 acres.

Hazard Identification and Vulnerability Assessment

Island County is at high risk from wildland and interface fires. The fire season runs from mid-May through October. Dry periods can extend the whole season. The possibility of a wildland fire depends on fuel availability, topography, the time of year, weather, and activities such as debris burning, land clearing, camping, and recreation. In Washington, wildland fires start most often in lawns, fields, or open areas, transportation areas, and wooded areas. Most wildland fires have human causes including cigarettes, fireworks, and outdoor burning. The effects of wildland fires vary with intensity, area, and time of year. Factors affecting the degree of risk of fire include rainfall, type of vegetation, and proximity to firefighting agencies.

Conclusion

There is a yearly risk of wildland-interface fire, but most fires that do occur are small quickly controlled and have little economic or safety impact to the county. However, the continued building of new residences in Island County, many of which are in forested areas, increases the probability of interface fire and loss of property.

All three towns on Whidbey Island have heavily wooded areas and boundaries that are nearly all woodland interface. All are at risk from wildfire in the immediate area. Nearly all parts of Camano Island are wooded with residences dispersed under the trees. Often, structures are built with minimal awareness of the need for fire protection and surrounding vegetation clearance zones.

Analysis

Methodology

The hazards just described were assessed for risk using two ranking methods – by formula and intuitive ranking. The details of these ranking is contained in Appendix B. two ranking were done using the same 5 point scale with 1 being the low value.

The ranking by formula tried to specifically follow the frequency, area impact, and magnitude criteria. Scores using half points were allowed to better fit criteria to hazards. The intuitive ranking was simply an experience based “gut feeling” as to how the criteria and the hazards fit together.

Risk Ranking

The ranking process described above while not identical, produced numerous similarities. Both lists placed severe storm as number 1 and earthquake as number 2. Landslide, flood, and wildland-interface fire were all clustered in the third through fifth places with slight ranking differences between the two rankings. Essentially, the differences in the ranking after the top five was probably not significant since the low ranking represented the low probability of occurrence.

Conclusion

The hazard identification and risk assessment process produced a prioritized list of the seven hazards of the highest relative risk to the county. The risk figure is not absolute and only based on historical records and knowledge of how the various hazards may affect the county. The hazards may in fact occur at any time or in almost any combination since they are all nearly independent events.