SECTION VIII– NATURAL FEATURES ELEMENT

Purpose/Introduction

The purpose of the Natural Features Element is to expand upon the community's commitment to the stewardship of natural resources as expressed in the vision statement and to provide a policy basis for City decisions that affect the natural environment. Residents are sensitive to the surrounding environment and place a high value on protecting it as evidence by the Shoreline Master Program and existing environmental regulations.

The Natural Features Element is not required under GMA, but GMA contains the following goal concerning the environment:

> ". . . protect the environment and enhance the State's high quality of life, including air and water quality, and the availability of water."

Moreover, GMA contains specific requirements for the designation and protection of "critical areas," defined as wetlands, areas with critical recharging effect on aquifers used for potable water, fish and wildlife habitat conservation areas, frequently flooded areas, and geologically hazardous areas. The Act requires jurisdictions to designate interim critical areas and to adopt regulations prior to the adoption of the Comprehensive Plan, and to finalize such regulations following plan adoption.

In compliance with GMA, the Stanwood City Council adopted the Interim Critical Areas Ordinance (ICAO) in October 1991. Following the adoption of the Comprehensive Plan, a final Critical Areas Ordinance replaced the ICAO. Also, all critical area ordinances were reviewed and updated after the City completed the 2004 GMA Comprehensive Plan update.

Best Available Science

In 1995, GMA was amended to include requirements for the utilization of Best Available Science in Comprehensive Plan designations, goals and policies, and development regulations (RCW 36.70A.172 and WAC 365-195-900 et seq.). Inclusion of BAS in the development of locally appropriate policies and regulations must be balanced with the many other substantive goals and mandates of the GMA. Further, cities and counties "shall give special consideration to conservation or protection measures necessary to preserve or enhance anadromous fisheries" (RCW 36.70A.172). Nonscientific information (e.g., social, legal, cultural, economic, or political) resulting in

departures from scientifically valid critical areas recommendations must be identified and justified, and potential consequent impacts must also be identified.

In response to this requirement, in 2001 through 2003, the City contracted with The Watershed Company, a group of professionally certified wetland and stream biologists, who has assisted the City with professionally prepared documents establishing BAS for the City of Stanwood. These include:

> *Shoreline Inventory and Stream Study for the Stillaguamish River, Church Creek, and Douglas Creek, Final Report,* prepared by The Watershed Company, December, 2002
>
> *Analysis of and Recommendations for the Existing Critical Areas Regulations and Comprehensive Plan, City of Stanwood, Snohomish County, Final Report,* prepared by The Watershed Company, Month, 2003

These documents include inventories of the City's critical areas, as well as a complete literature review, and analysis of the City's existing comprehensive Plan goals and policies, background materials, and development regulations. The documents rely on literature that meets the RCW criteria for BAS. These documents are herein incorporated by reference as documentation of the City's Best Available Science in order to meet the letter and intent of RCW 36.70A.172. The information in these documents has been used as the basis for the 2004 GMA update.

Natural Features Goals and Policies

Goal

NFG-1 - To achieve a well-balanced relationship between the built and natural environments utilizing guidance derived from best available science.

Policies

NFP-1.1 - Choose land use alternatives (where they exist) to maintain critical areas and their buffers in a natural state. Where an alternative land use is not available, apply mitigation sequencing in the following order to address impacts: avoid, minimize, repair, reduce over time, compensate, and monitor to ensure success.

NFP-1.2 – Approve wetland mitigation that provides mitigation benefits before or at the same time that wetlands are impacted.

NFP-1.3 - Promote improved air quality through land use decisions and public facility siting's which create a compact and efficient community design, insofar as such design reduces the quantity and length of single occupancy vehicle trips.

NFP- 1.4 - Encourage the protection of the natural environment and open space

through the use of clustering (i.e. Planned Residential Developments [PRDs]).

NFP-1.5 – Consider the use of density transfers or other incentives to promote clustering for the protection of critical areas and open space.

NFP-1.6 - Promote appropriate uses and design techniques to minimize the risk to human life, property, and public facilities in geologically hazardous and frequently flooded areas.

NFP-1.7 – Prevent cumulative adverse environmental impacts to water quality, wetlands, and fish and wildlife habitat and the overall net loss of wetlands, frequently flooded areas and habitat conservation areas.

Goal

NFG-2 - To promote inter-jurisdictional stewardship of the natural environment for future generations.

Policies

NFP-2.1 - Work with other local, state, and federal jurisdictions on regional environmental issues such as surface and ground water quality and quantity and the maintenance/enhancement of the Stillaguamish River, Church Creek and Douglas Creek.

NFP-2.2 – Work with other local jurisdictions to preserve and manage vegetated and open space corridors that extend beyond the City's boundaries, but are necessary to provide habitat connectivity in the region.

NFP-2.3 – Participate in and, where appropriate, implement the products of the Stillaguamish Implementation Review Committee (SIRC) for the protection of the Stillaguamish Watershed.

NFP-2.4 – Promote wetlands as school amenities for educational purposes.

Goal

NFG-3 - To protect, preserve, and enhance natural features most sensitive to human activities and most critical to fish and wildlife survival and propagation.

Policies

NFP-3.1 – Protect the functions and values of Stanwood's critical areas by maintaining and updating the Critical Areas Regulations that are consistent with the best available science, while maintaining Stanwood's unique character. Designation and classification of critical areas should be consistent with the most recent systems and protocols prepared by the appropriate state and federal agencies.

NFG-3.2 – Prepare an updated City-wide comprehensive map and inventory of critical areas, including identification of natural corridors and open space that should be retained and maintained to provide connectivity and migration routes between critical areas and other designated open space.

*NFP-3.*3 - Seek to protect and enhance a diverse fish and wildlife habitat, preferably in corridors as designated in the Natural Features Element.

NFP-3.4 - Preserve and enhance the composition, diversity and structure of vegetation of the Church and Douglas Creek corridors and the Stillaguamish River corridor as essential for fish and wildlife habitats. Prohibit the introduction of non-native and invasive plant species into streams, wetlands and their buffers.

NFP-3.5 - Concentrate urban land uses in areas with fewer environmental constraints to reduce intrusion into critical areas.

NFP-3.6 - Apply environmentally sensitive site design and construction methods to protect critical areas and their buffers. Designs should seek to allow recharge of groundwater and reduce harmful short-term and long-term runoff through lot clustering, impervious surface limitations, and vegetation preservation, among others.

NFP-3.7 - Consider carrying capacity of land when reviewing proposals intended to intensify land uses.

NFP-3.8 - Preserve and maintain sensitive and critical areas in as natural a state as possible, discouraging alterations when alternatives exist. When impacts to critical areas or their buffers are proposed, require applicants to demonstrate that no reasonable alternative exists and document their mitigation sequencing process and results.

NFP-3.9 – Critical areas regulations are intended to protect environmentally sensitive portions of properties without unduly limiting development on environmentally unconstrained portions. The City recognizes that in order to be effective, this approach relies heavily on enforcement of critical areas regulations. The City shall monitor developments containing critical areas for any degradation to those critical areas

resulting from violations of regulations. Any violations of the Critical Areas Regulations will be pursued by the City.

NFP-3.10 – Support public education programs that encourage individuals and businesses to prevent pollution from sources such as household hazardous waste, boating activities, and pesticides and fertilizers on gardens and lawns.

NFP-3.11 – Explore the possibilities of utilizing the Public Benefit Rating System as a tax incentive program to preserve high quality natural habitats.

NFP-3.12 - Incorporate appropriate elements of the Department of Ecology's updated Stormwater Management Manual for Western Washington and the Puget Sound Water Quality Action Team's Puget Sound Water Quality Management Plan into the City's stormwater manuals and practices.

NFP-3.13 – Manage stormwater in areas draining to fish and wildlife habitat conservation areas by considering regulations that limit and disconnect impervious surfaces, retain native forest cover, and encourage low impact stormwater management techniques for new developments to treat and infiltrate stormwater on site.

Goal

NFG-4 - Preserve rural quality and community vision for open space.

Policies

NFP-4.1 - Provide adequate open space and greenbelts within developing areas. Where possible, greenbelts should be located and maintained to provide connectivity between critical areas and/or natural open space.

NFP-4.2 – Discourage conversion of agricultural land to high- or medium-intensity uses, particularly where the agricultural land also provides substantial wildlife benefits.

Goal

NFG-5- Protect shorelines of statewide significance.

Policy

NFP-5.1 - The goals and policies of the City's Shoreline Master Program are located in Section X of the Comprehensive Plan.

Goal

NFG-6- Protect species listed as threatened or endangered under the Endangered

Species Act.

Policies

NFP-6.1 - Work with the National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS), Washington Department of Fish and Wildlife (WDFW), other state agencies, and neighboring jurisdictions to protect federally listed and state priority species and habitats.

NFP-6.2 – Give special consideration to conservation or protection measures necessary to preserve or enhance anadromous fisheries by considering the following during review of all development proposals:

1. Inappropriate areas such as unstable slopes, wetlands, areas of high habitat value, areas already in a proper functioning condition, areas that are more functional than neighboring sites, and areas with the potential to be fully restored, and similarly constrained sites should be avoided.
2. Stormwater discharge impacts on water quality and quantity and stream flow patterns in the watershed, including peak and base flows in perennial streams, should be avoided.
3. Riparian areas should be protected to attain or maintain "properly functioning condition" (PFC) around all rivers, estuaries, streams, lakes, deepwater habitats, and intermittent streams. Compensatory mitigation should be provided to offset unavoidable damage to PFC in riparian management areas. Activities should be quite limited in areas adjacent to all perennial and intermittent streams and waters supporting listed salmonids in order to avoid soil disturbance and maintain vegetated riparian corridors.
4. Stream crossings should be avoided, whether by roads, utilities, or other linear development, wherever possible and, where crossings must be provided, impacts should be minimized. In addition, all crossings should be regularly monitored and maintained and intermittent and perennial streams should not be closed over.
5. Historic stream meander patterns and channel migration zones should be preserved and hardening of stream banks and shorelines should be avoided.
6. Wetlands, wetland buffers, and wetland function should be protected—including isolated wetlands.
7. Permanent and intermittent streams' ability to pass peak flows should be preserved. Landscaping with native vegetation should be stressed to reduce the need to water and apply herbicides, pesticides, and fertilizer.

8. Erosion and sediment run-off during (and after) construction should be prevented and thus prevent sediment and pollutant discharge to streams, wetlands and other water bodies that support listed fish.

9. Demands on the water supply should be met without affecting, either directly or through groundwater withdrawals, the flows salmon need. Any new water diversions should be positioned and screened in a way that does not injure or kill fish.

NFP-6.3 – Use best available science to adopt appropriate buffer widths and other appropriate code updates to work toward the goal of "properly functioning conditions."

NFP-6.4 - Incorporate Department of Ecology's updated Stormwater Management Manual for Western Washington and the Puget Sound Water Quality Action Team's Puget Sound Water Quality Management Plan into the City's manuals and practices.

NFP-6.5 – Consider updating the City's Capital Improvement Program to include projects to remove fish barriers, address storm water impacts, and make any other improvements considered necessary to promote achievement of PFC.

NFP-6.6 – Use an adaptive management approach to incorporating new information into existing plans and policies as it becomes available during development review.

Goal

NFG-7 – Protect and preserve groundwater resources for future generations.

Policies

NFP-7.1 – Encourage the minimization of impervious surfaces in areas identified as medium or high infiltration potential. Where practical, encourage the use of alternative storm water collection designs that allow for more infiltration.

NFP-7.2 – Wherever feasible, especially in the high or medium infiltration areas, encourage the retention of existing, well-established native vegetative communities.

NFP-7.3 – Work with local property owners to reduce their use of materials that may contaminate groundwater resources. Also, work with Snohomish County to help protect aquifers that cross jurisdictional boundaries.

NFP-7.4 – Work with the State Department of Ecology to ensure that guidelines for wellhead protection are strictly enforced.

Goal

NFG-8 – To preserve natural green spaces in downtown Stanwood, consistent with the Downtown Plan.

Policies

NFP-8.1 – Encourage a "green" connection between the districts of downtown (along the south side of 271st and SR 532 and at the north edge of the downtown).

NFP-8.2 – Reconnect the city center to the Stillaguamish River, through park and trail development to and along the waterfront.

NFP-8.3 – Encourage the preservation and incorporation of natural streams, wetlands, and open spaces into new commercial development.

NFP-8.4 – Provide a "green" connection and trail from downtown to the uptown district.

NFP-8.5 -- Use grant opportunities to acquire land for a new waterfront park west of the City's Waste Water Treatment Plant.

NFP-8.6 – Work with Snohomish and Island Counties to provide trail connections to Camano Island.

Goal

NFG-9 – Work with public and private partners to develop strategies and programs to prepare for and mitigate the potential impacts of climate change, both on city government operations and on the general Stanwood community.

Policies

*NFP-9.*1 – Develop a strategic plan that will help guide and focus City resources and program initiatives to (1) reduce greenhouse gas production and the carbon footprint of City government and the Stanwood community, and, (2) reduce and minimize the potential risks of climate change.

NFP-9.2 – Undertake a policy review of City comprehensive, strategic and specific plans to assure that City policies are appropriately targeted to prepare for and mitigate

potential impacts of climate change.

Inventory

The natural environment is a complex system of interrelated components including air, water, soils, plants, and animals. All of these systems are affected by human activity. The goal of this environmental element and the policies within it is to ensure that the relationship between humans and the natural environment is a mutually supportive one that balances competing objectives to the maximum extent possible.

Physical Description

Geology

The geology in Stanwood is the result of a combination of Pleistocene glaciation, fluctuations in relative sea level, and deposition of floodplain and delta sediments from the Stillaguamish and Skagit rivers. In the period between 2.4 million years ago and 10,000 years ago, glaciers advanced and retreated over Western Washington as many as 12 times (Easterbrook 1993), eroding and depositing sediments. Over the same time period, sea level changed dramatically in response to the growth and retreat of the glaciers, while the ground surface in the Puget Lowlands changed, sinking under the weight of the glaciers, and rising again when the glaciers retreated. Finally, as the last glaciers retreated, the Stillaguamish and Skagit rivers carried vast quantities of water and glacial sediment to the Puget Sound, depositing the sediments on the floodplain and delta complex in which downtown Stanwood is located. Deposition from the rivers continues today.

Thus, geologic formations in Stanwood consist primarily of relatively young sediments, some of which were sculpted and compressed by glaciers (evident as "hardpan" in the East Hill outcroppings) and others which were deposited by water. See Figure NF-1.

Soils

The Stanwood area soil is generally Puget silt loam, including soils in the Bellingham, Mulkilteo, Norma, Pastik, Snohomish, Tokul, and Winston series (according to the U.S.D.A. Soils Conservation Service maps for the area). See Figure NF-2. This soil is very acidic and very productive for grasses, berries, vegetable and vegetable seed crops. Surface water runoff is slow and the soil has slow internal drainage, making it unsuitable for septic drainfield systems. Winter water tables are usually high.

Frequently Flooded Areas/100-Year Floodplain

All of west Stanwood lies in the 100-year flood plain. See Figure NF-3. This area includes land to the west of the railroad tracks and approximately 29 acres that lie to

the west of the Pioneer Highway, as well as east of the railroad tracks and to the north of where 271st Street becomes Cedarhome Drive.

Topography

The Stanwood area fluctuates between flat areas in the flood plain and the hills to the east of the City. Flat areas are typically four to five feet above mean sea level. The hills reach 100 to 200 feet in elevation. See Figure NF-4.

Slope Stability

The newer eastern portion of Stanwood is separated from the older western section of the City by a steep escarpment. The eastern portion of the City is situated on an extensive plateau. The soils throughout much of the glaciated plateau are poorly drained loams. Drainage is impeded by sub-soils with a high clay content (hardpan), forcing water to travel laterally toward the edge of the plateau. According to the U.S.D.A. Soil Conservation Service, the soil in the creek gullies and on the edge of the plateau possess moderate to severe erosion and slippage ratings. It is important that areas near steep slopes in eastern Stanwood considered for a change in land use be analyzed for potential slope failure due to high stormwater runoff or other natural hazards such as earthquakes.

Insert Figure NF-1

Insert Figure NF-2

Insert Figure NF-3 Frequently Flooded Areas

Insert Figure NF-4

Drainage

Most of the area within Stanwood and the UGA drains to the Stillaguamish, primarily via Irvine Slough. Church Creek, which runs a northeast-southwest direction and is tributary to the Stillaguamish, drains a portion of the eastern side of the City. Douglas Creek, which drains the northern portion of the City to the west, is connected to Douglas Slough, which runs north and east between the Stillaguamish and Puget Sound. Water from Douglas Creek can flow either to the Stillaguamish or directly to Puget Sound, depending on tides and the condition of the tide gates at either end of the slough. See Figure NF-5.

Critical Areas

Critical areas are lands that are subject to natural hazards; contain significant renewable resources; support unique, fragile or valuable elements of the natural environment; or contain valuable cultural resources and the protective buffers necessary to protect the public health, safety and welfare of residents. More commonly these are such elements as wetlands, fish and wildlife habitat conservation areas, geologically hazardous areas, aquifer recharge areas, and frequently flooded areas. The following sections discuss the significance of critical areas and identify their location within the Stanwood area.

The primary critical areas within the City limits and the UGA are the:

- Fish and Wildlife habitat conservation areas (streams)
- Wetlands
- Frequently flooded areas
- Geologically hazardous areas (seismic, landslide, erosion, volcanic, and possibly tsunami)
- Critical aquifer recharge areas (CARAs)

Insert Figure NF-5 (To be Completed)

Wetlands

Wetlands are generally defined as lands that are inundated or saturated long enough during the growing season so that vegetation must adapt to saturated soil conditions.

It is difficult to make any reliable estimate of the wetland acreage in the Stanwood area. The City of Stanwood has relied on several wetland maps for baseline inventory information. One wetland map that the City utilized was the "National Wetlands Inventory Map" (NWI) produced by the U.S. Fish and Wildlife Service issued in 1987. It depicts the general locations of wetlands for the Stanwood area. These wetlands were identified based on vegetation, hydrology, and geography in accordance with "Classification of Wetlands and Deepwater Habitats of the United States" (Lewis M. Cowardin, December 1979). Another wetland map was produced by Snohomish County. This map was based on the NWI maps, Soil Conservation Service soil maps, and staff field checks.

The approximate wetland boundaries are illustrated on Figure NF-6. These figures portray both the Snohomish County Wetland Inventory and National Wetlands Inventory.

The information provided on these maps contradictory in some places. The only reliable method of determining specific wetland boundaries is a wetland delineation for a specific area. The cost to do this for the entire city would be prohibitive and would become periodically outdated. Because of this, it is the responsibility of the land owner to determine the presence and extent of wetlands in a specific area in the event of a proposed land use action.

The majority of the wetlands in Stanwood and the UGA are associated with the headwaters and riparian corridor of Church Creek or its tributaries, Douglas Creek, and associated floodplains of the Stillaguamish River. The primary source of water for these wetlands is precipitation and surface flow. Wetlands provide many beneficial functions such as water quality protection, groundwater and surface water recharge, flood and storm water storage, fish and wildlife habitat, food chain support, shoreline stabilization, aesthetics, and recreation.

The wetlands classification scheme is based on five distinct systems (Marine, Estuarine, Riverine, Lacustrine, and Palustrine) with classes, subclasses, and dominance types based on substrate material, flooding regime, and/or dominant vegetative types. There are also modifying terms for type of water regime, water chemistry, and soils. Special modifiers describe wetlands and deepwater habitats that have been either created or highly modified by man or beavers. Two types of these systems are present in the Stanwood area, and are described below:

- The Palustrine System includes all pond-like wetlands less than 20 acres in size. These are nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens. Emergent plants are characterized as free-standing, non-woody plants. They can be found in either freshwater or saltwater environments.

- The Riverine System consists of all wetlands and deepwater habitats contained within a channel except those areas dominated by trees, shrubs, emergent or other palustrine-type vegetation, and habitats with water containing ocean derived salts. Water is usually flowing in the Riverine System which is bounded on the landward side by upland or channel banks (including natural and man-made levees) and, often, palustrine wetlands.

Numerous small Palustrine wetlands are located along the riparian corridors of the Stillaguamish River, Church Creek and its tributaries, and Douglas Creek. These wetlands fall into Emergent, Scrub-Shrub, Forested, or Unconsolidated Bottom Subsystems. These are further modified as being temporarily or seasonally flooded.

Insert Figure NF-6 Stanwood Wetlands According to Snohomish County and National Wetland Inventory

Riverine wetlands are found primarily within the Hat Slough section of the Stillaguamish River channel in the Stanwood area. The subsystems are identified in terms of water permanence, gradient, water velocity, substrate, and the extent of floodplain development. Within this area, Riverine wetlands are defined as Perennial within the unconsolidated bottom class.

Wetlands and riparian corridors perform valuable functions within the ecosystem. Clearing of vegetation, grading, filling, draining, and other activities associated with land development may destroy and decrease the ability of the riparian zone to provide drainage, stabilize stream banks, provide wildlife habitat, and filter pollutants from the water. Wetlands receive surface water from the surrounding area and filter or convert pollutants entering these ecosystems by a combination of physical, chemical and biological processes.

Wetlands also play a major role in flood control. During flooding, rivers and streams overflow their banks and spread out across the floodplain. Wetland soils act like a groundwater reservoir, storing surplus water as groundwater during wet periods and discharging this stored water into streams later to augment baseflow. The wetland area also provides habitat and a source of food for wildlife, as well as aesthetic qualities, and opportunities for recreation and education.

Frequently Flooded Areas:

A Flood Insurance Study was conducted by the Federal Emergency Management Agency (FEMA) for the City of Stanwood and investigated the existence and severity of flood hazards. On November 16, 1983 a flood boundary map was published that indicated areas subject to 100- and 500-year floods. See Figure NF-3. The 100-year flood has been adopted as the base flood for the purpose of establishing floodplain management measures. A 100-year flood area is defined as those lands that are subject to a one percent or greater chance of flooding in any one year. The 500-year flood is employed to indicate additional areas of flood risk in the community. The data from the engineering study was transformed into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHFs), and flood insurance zone designations for each flooding source studied.

After the determination of reaches and their respective FHFs, the entire incorporated area of Stanwood was divided into zones, each having a specific flood potential or hazard. Flood hazard areas designated as "A" zones include only those areas which are inundated by the 100-year flood. "B" zones include areas of the 500-year flood. "C" zones are areas of minimal flooding.

The City of Stanwood is clearly split into two sections. The low-lying western section is designated primarily as zone "A." The hilly plateau east of the Burlington Northern railroad tracks is designated as zone "X."

Fish and Wildlife Habitat

The Stanwood area contains a variety of habitats for native animals that include wetlands, riparian and upland forests, and pasture grasslands. No specific checklist of wildlife species in the Stanwood area has been compiled. However, the Stillaguamish Watershed Action Plan (Snohomish County, 1989) reported that nearly 75 percent of all wildlife species present in western Washington are also present in the Stillaguamish River Basin. This abundance of wildlife illustrates the diversity of habitats within the basin, even though not all of these species are present in the Stanwood area.

Typical wildlife species found in the area include high concentrations of wintering birds of prey associated with the abundance of wintering waterfowl and small mammals in the agricultural areas of the lower basin. The threatened bald eagle winters in significant numbers along the Stillaguamish River. Many species of waterfowl use open water in the wetlands and areas adjacent to the River for migratory stops, nesting, feeding and breeding. Pasture lands are commonly used as feeding areas by gulls and waterfowl and are also used as hunting areas for raptors and other predatory birds. Small mammals such as rabbits, muskrats, and opossum, along with larger mammals including deer, fox, and coyote are found in the rural and forested areas in and surrounding Stanwood.

Habitat for salmonids and other fish species is provided by the Stillaguamish River, Church Creek, and Douglas Creek. See Figure NF-5. Species listed under the federal Endangered Species Act include threatened chinook salmon in the Stillaguamish River, and candidate coho salmon in the Stillaguamish River and Church Creek. No federally listed species are known to use Douglas Creek.

Designated fish and wildlife habitat conservation areas in the City of Stanwood are the Stillaguamish River, Church Creek, Douglas Creek, and any other perennial or intermittent streams in the City or its UGA. Additional fish and wildlife habitat conservation areas in the City include the vegetated areas surrounding these waterbodies, which serve as migration corridors and habitat for wildlife; wetlands and their buffers; and any other areas found to provide habitat for state priority or federal listed species or that meet other criteria established in the regulations.

Geologically Hazardous Areas

During the advance and retreat of the glaciers, various layers of soils were deposited throughout the region. Subsequent erosional actions created several "step benches" in the Stanwood area. These "benches" are characterized by escarpments with slopes that are often greater than 25 percent. An escarpment that generally parallels the Burlington Northern railroad separates the Stillaguamish (and Skagit) floodplain from one such "bench."

Slopes were classified as slight (0%-15%), moderate (15%-25%), and steep (greater than 25%) for the purposes of this analysis and are shown on Figure NF-7a. With the exception of the escarpments, all of the area has slight slopes. The soils which comprise the steep slopes are Everett and Tokul gravely sandy loams and are highly erodible. Steep slopes, coupled with certain soils, indicate potential areas of landslides. The following areas are considered to be subject to landslide hazards:

1. Any area with a combination of:
    a. Slopes 15 percent or steeper,
    b. Impermeable subsurface material (typically silt and clay), frequently interbedded with granular soils (predominantly sand and gravel),
    c. Presence of springs or seeping ground water during the wet season.
2. Steep slopes of 40 percent or greater.
3. Any areas located on a landslide feature that has shown movement during the past 10,000 years or which is underlain by mass wastage debris.

Seismic hazard areas are also classified as geologic hazards, as shown on Figure NF-7b. Seismic hazard data divides the hazards into very low, low, moderate, and high risks. Moderate and high risk areas are considered hazardous.

Geologic hazards also include those areas subject to volcanic lahars (mudflow and/or debris). In the Stanwood area, lahars hazards originate from Glacier Peak, located in the Cascade Mountains. In the event of an eruption, lahars could flow to Stanwood via the Stillaguamish River channel, and thus pose a hazard in Stanwood's flood plain.

Tsunamis ("tidal waves") are the remaining type of geologic hazard affecting mainly coastal counties. Tsunami hazard areas are as yet unmapped for the Stanwood area, but will be incorporated when that work is completed.

Insert Figure NF-7a Slope Stability

Insert Figure NF-7b Seismic/Volcanic/Lahars Hazards

Critical Aquifer Recharge Areas (CARAs)

Aquifers:

The groundwater resources found in and around the City of Stanwood consist of discontinuous aquifers surrounded by lower permeable sediments. This pattern was created by the repeated advance and retreat of glaciers depositing the region. Layers of loosely consolidated coarse sand and gravel from glacial outwash provided the structure for the aquifers. Finer silt and clays, often consolidated by the weight of the glaciers that moved over them, impede water movement.

Groundwater is recharged by rain falling on the surface of the land. Rainfall evaporates back into the atmosphere, runs off into adjacent water bodies, or infiltrates downward until a zone of saturation is reached. In the Stanwood area, this zone is often less than 5 feet deep, due to layers of lower permeability such as glacial till or silt and clay deposits, which slow the downward migration of water. Generally, the permeability of these fine-grained deposits is still high enough to allow much of the infiltrated water to continue downward.

Groundwater is the primary source of municipal and domestic potable water in the Stanwood area.

A major factor in the rate of groundwater recharge is the soil's ability to infiltrate rainfall. Other factors commonly used to evaluate aquifer recharge potential include soil hydraulic conductivity, soil moisture holding capacity, relative position of the soil to surface water features, depth of soil and rooting zone, and relative position of the water table. Based on these factors, the area surrounding Stanwood was divided into three recharge categories: high, medium, and low. These categories reflect the relative rate at which the deeper underlying aquifers (i.e., those commonly used to construct wells) can be recharged from precipitation.

Soil types in the high category generally have permeabilities greater than five inches per hour in all sub-layers. These soils typically have a soil moisture holding capacity less than 1.2 inches per foot of soil depth, are separated from surface water bodies, and do not have seasonal water tables within the upper three feet of the soil profile. The Lynnwood series is characteristic of this category.

Medium category soils generally have an average permeability of 0.8 inches per hour, soil moisture holding capacities of up to 1.5 inches per foot of soil depth, are separated from surface water bodies, and have seasonal water tables in the upper three feet of soil profile. The Everett series is characteristic of this category.

The remaining soils were placed in the low category. These soils had several of the following characteristics which could reduce infiltration potential: one or more layers with hydraulic conductivity of less than 0.8 inches per hour, available soil moisture capacities in one or more layers greater than 1.5 inches per foot, poor drainage with water tables near the surface most of the year, and proximity to the Stillaguamish River or other surface water bodies. Bellingham soils are often characteristic of this category.

Per the CTED guidance, aquifer recharge areas in the moderate and high susceptibility

categories should be considered critical areas. Susceptibility is determined based on surface soil permeability, geologic matrix, infiltration potential, and depth to water table. Most of this information can be obtained through USDA Soil Conservation

Service soil surveys. Ecology has developed a susceptibility rating system for aquifers that categorizes various aquifers into low, moderate and high susceptibility categories. Using this rating system, all of Stanwood is rated moderate or high. The factors that most influence this determination are the high infiltration potential and the generally shallow groundwater table:

Table NF-1: Stanwood Aquifer Susceptibility Ratings

Determined from USDA Soil Survey 1983 and Ecology tables (above)						
Soil Type	**Permeability**	**Matrix**	**Water Table**	**Infiltration**	**Susceptibility**	**Rating**
7	1	2	3	3	9	High
34	2	1	3	3	9	High
39	2	2	?	3	7	Moderate
47	1	1	3	3	8	High
49	1	1	3	3	8	High
51	3	3	?	3	9	High
55	1	1	2	3	7	Moderate
64	1	1	2	3	7	Moderate
69	2	1	2	3	8	High
72	2	0	3	3	8	High
73	2	0	3	3	8	High
74	2	0	3	3	8	High
77	2	0	3	3	8	High
80	2	3	?	3	8	High
82	1	1	3	3	8	High

Wellhead protection areas:

The City designates wellhead protection areas in its Water System Plan. The City derives its water from three active wells and one spring source (there is also an inactive well). The City has established a wellhead protection program under WAC 246-290-135. Each wellhead has a sanitary control area of 100 feet, and then additional protection area boundaries are established for 1-year, 5-year, and 10-year time of travel. Time of travel indicates the distance a contaminant can travel in a certain period of time. See Figure NF-8. Certain, more intensive land uses in these zones would be minimized or prohibited. The program also contains an emergency response plan.

Open Space Corridors

GMA requires the identification of open space corridors. In the City and UGA, open space corridors largely consist of the stream corridors of the Stillaguamish River and Church and Douglas Creeks. Wetlands, protected open space, and undevelopable steep slopes can be added to the corridors to create an inventory of natural corridors. See Figure NF-9.

Insert Figure NF-8, Critical Aquifer Recharge Areas (CARAs)

Insert Figure NF-9, Open Space Corridors

Climate Change

Introduction.

The quality of the environment we live in is a critical part of what people often describe as the "character" of Stanwood. Even if it is not something we overtly think about, it is an intrinsic part of our everyday experience, whether at work, at rest or at play. Until relatively recently, environmental quality has often been thought of in terms of obvious, easily observable characteristics – such as the visible landscape, the quality of the air, the presence and variety of wildlife, or the availability and character of water in its various forms. However, recent evidence on climate change points to the potential fragility of our assumptions about the environment and the need to integrate and heighten the awareness of environmental issues as they are inter-related with all community policies and activities.

Scientific evidence and consensus continues to strengthen the idea that climate change is an urgent threat to the environmental and economic health of our communities. Many cities, in this country and abroad, already have strong local policies and programs in place to reduce global warming pollution, but more action is needed at the local, state, and federal levels to meet the challenge.

In an effort to reduce Washington State's contribution towards the effects of climate change, Engrossed Substitute Senate Bill 6001 (ESSB 6001) was adopted in 2007 to establish Greenhouse Gas (GHG) emission reduction goals for the State. Those reduction targets became law when a separate bill (HB 2815) was passed in 2008, which included monitoring and reporting mandates for state agencies.

This new law states that GHG emissions must be reduced to 1990 levels by January 1, 2020; to 25 percent below 1990 levels by January 1, 2035; and to 50 percent below 1990 levels by January 1, 2050. To assist State and local agencies in meeting the GHG emissions reduction targets described above, in 2008 the Legislature adopted ESSB 65802, recognizing the following:

- Patterns of land use development influence transportation related GHG emissions and the need for foreign oil;
- Fossil fuel-based transportation is the largest source of GHG emissions in Washington; and,
- The State and its residents will not achieve the GHG emissions reductions defined above without a significant decrease in transportation emissions.

Based on these findings, the Legislature determined that it is in the public interest to aid in the development of policies, practices, and methodologies that may assist counties and cities in addressing challenges associated with GHG emissions and dependence on foreign oil.

In 2008, the Legislature enacted Senate Bill 6580 (now expired) to address mitigation of GHG emissions through land use and transportation planning processes under the Growth Management Act (GMA). The legislature recognized that it is in the public interest to reduce the state's dependence upon foreign oil; and that the state, including cities, counties, and residents, must engage in activities that reduce GHG emissions and dependence on foreign oil.

Given the above, the City of Stanwood in 2014 adopted Resolution 2014-12 adopting GHG reduction policies for the City of Stanwood. The City of Stanwood understands the importance of leadership role within the community as well as the larger region.