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SKAGIT RIVER GENERAL INVESTIGATION
Seattle District 2011 Response to HQUSACE Comments to the 2009 FSM Read-Ahead Packet
Enclosure 3
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Skagit River Flood Risk Management General Investigation
Skagit River Basin Narrative
September 2011

Contents

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1. Introduction

The purpose of the Skagit River Basin Narrative (narrative) is to provide a watershed description of the Skagit River Basin (Basin) and to provide a general narrative of flooding in the Basin during flood events per HQUSACE comments to the 2009 Skagit River GI Feasibility Scoping Meeting Read-Ahead. The narrative was developed from a narrative produced by Skagit County. The original Skagit County narrative is attached (Attachment 3a.)

2. Location and Study Area

The Basin is located in the northwest corner of Washington State, approximately 60 miles north of the City of Seattle. (Figure 1.) The Basin has a total drainage area of 3,115 square miles and extends about 110 miles in a north-south direction. The Skagit River (River) watershed originates near the 8,000-foot level of the Cascade Mountains in British Columbia, Canada and flows south and then west to the Skagit delta where it discharges through two distributaries, the North Fork and South Fork, to Puget Sound. It provides 20 percent of the fresh water flowing into Puget Sound, or nearly 10 billion gallons a day. Principal tributaries of the Skagit River are the Sauk, Baker, and Cascade rivers (USACE 2010). Both the Basin and River are habitat for a number of Endangered Species Act (ESA) listed species such as Puget Sound Chinook Salmon (*Oncorhynchus tshawytscha*) and the Puget Sound Steelhead (*Oncorhynchus mykiss*). The River was historically the most productive salmon river in the continental US (Smith, 2003).

The study area encompasses the Skagit River watershed and the Skagit River floodplain from the Seattle City Light's Ross Dam reservoir (Ross Lake) to Puget Sound, a total of approximately 150 river miles. The uppermost portion of the river basin, from Lake Shannon on the Baker River and the Gorge, Diablo, and Ross dams on the Skagit River, lies within Whatcom County. The majority of the lower basin is within Skagit County. A southern portion of the basin also lies within Snohomish County, the Sauk-Suiattle basin lies upstream at river mile of the Skagit River mainstem and Stanwood lies south of the mouth of the South Fork of the Skagit River. The upper Basin is mountainous, largely forested and sparsely populated. The lower Basin or Skagit River Delta (roughly from the town of Sedro-Woolley at RM 24 to the mouth) is largely comprised of agricultural lands, some of the most productive in the state. Extensive diking of the lower river, dating back to the last part of the 19th century, has allowed the Skagit floodplain to be farmed and developed for residential, commercial and industrial purposes. The most densely populated and developed areas of Skagit County, including the cities of Sedro-Woolley, Burlington, Mount Vernon, and La Conner also lie within the delta. This development has resulted in alteration of natural riverine processes. The floodplain is bisected north-south by Interstate 5 (I-5) and the Burlington Northern Santa Fe Railroad near the cities of Mount Vernon (river mile 10) and Burlington (river mile 15).

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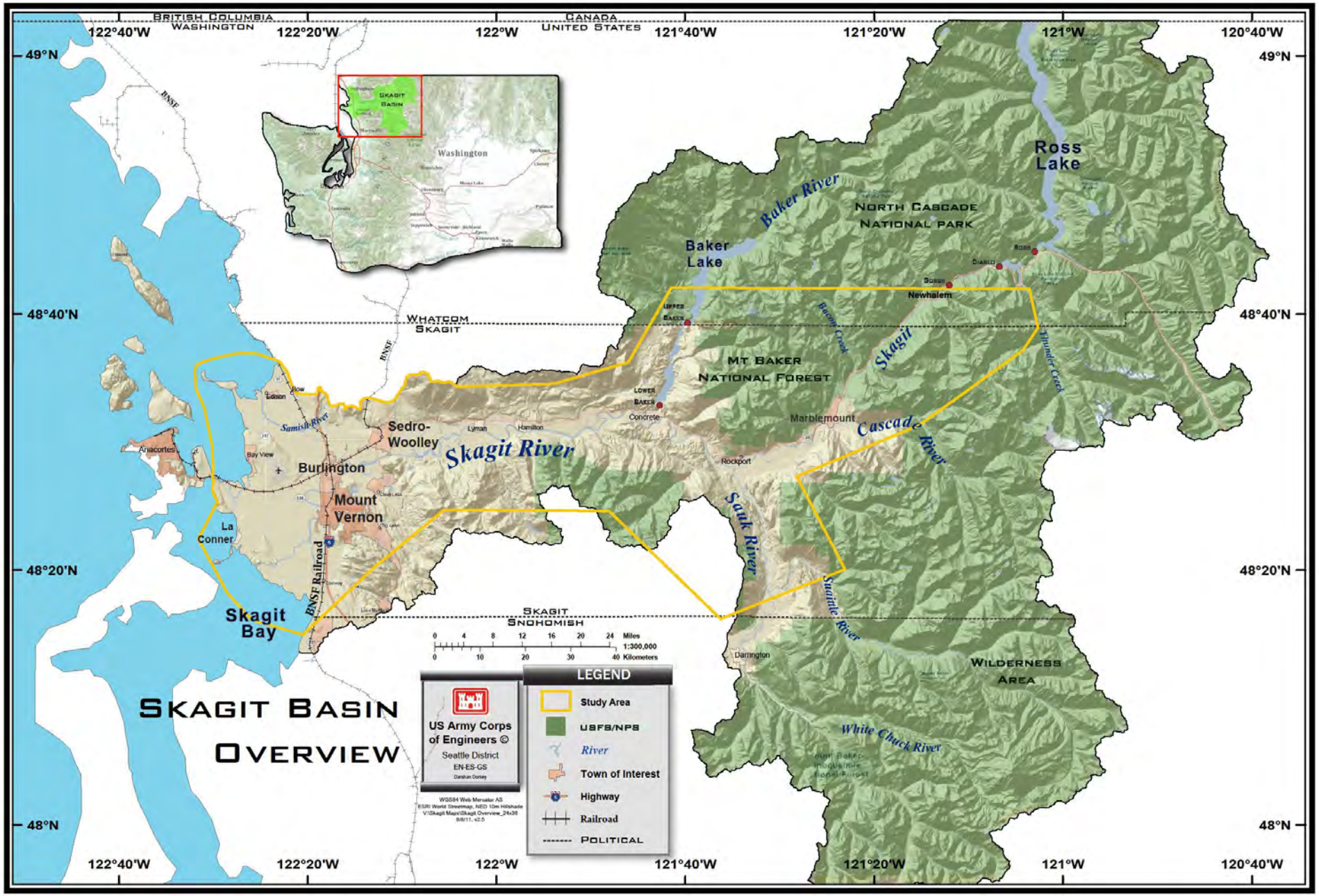
Figure 1. Overview of the Skagit River Basin



The non-federal sponsor is Skagit County and comprises the majority of the study area. The study area within the United States borders is part of Congressional District No. 2, currently represented by U.S. Representative Rick Larsen.

3 Population

Skagit County is home to 116,901 residents, 50 percent of which live in unincorporated Skagit County, covers 1,735 square miles of land, contains 8 incorporated jurisdictions, and numerous communities (U.S. Census Bureau, 2011). The majority of the urban population is centered in the major cities of Mount Vernon, Burlington, and Sedro-Woolley. From 2000 to 2010, the County's population increased by 13.5 percent. By 2060, the County's population is expected to reach almost 218,000, an increase of 86 percent from 2010, or 101,100 new residents (Skagit County 2011). To plan for this growth, the County has developed a 50-year plan titled Envision Skagit 2060, to ensure the protection of the watershed and promote the economic growth of the region. The Envision 2060 planning effort will end in December 2012. Implementation of recommendations will be pending funding.

There are five tribal nations with reservations or Usual and Accustomed (U&A) fishing rights in the Basin. They are the Swinomish Tribe (population 800) and Upper Skagit Tribe (population 230), the Samish Tribe (population 1200), the Sauk-Suiattle (population 230) and the Lummi Tribe (population 5000). The tribal nations are active influential participants in management of the River and have strong cultural and economic interests in the Basin.

3.1 Land Use/Basin Description

3.2.1 Upper Basin

The northern end of the basin extends 28 miles into Canada covering 400 square miles. The headwaters of the Skagit River arise in the steep Cascade Mountains of Canada and flow west and south into the United States into the North Cascade Mountain range, Whatcom County. The River continues to flow through a narrow valley surrounded by steep forested mountains for the next 40 miles where it passes through Ross, Diablo, and Gorge Dams owned by Seattle City Light, a private power utility, above the town of Newhalem (population of approximately 25). The USACE has authorized flood control storage in Ross Dam. The Skagit River flows into Skagit County at RM 90.

Large tracks of both old-growth and secondary growth coniferous forests dominate the landscape. Almost 90 percent of the Upper Skagit basin above Sedro-Woolley is either designated as national forest or national park (Ross Lake National Recreation Area and portions of the North Cascades National Park and the Mt. Baker Snoqualmie National Forest). The primary land use here in the upper Basin is recreation and open space preservation. State Route 20 runs along the Skagit River south of Ross Lake. This is the main access road from Interstate-5 to the North Cascades National Park and the northernmost east-west route through the North Cascade Mountains.

State Route 20 parallels the Skagit River as it flows downstream though the town of Marblemount (population of 250). Below the confluence with Bacon Creek (near Marblemount)

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to Sedro-Woolley, the river is classified "recreational" under the Wild and Scenic River system. The Cascade River enters the Skagit River at RM 78.1, just upstream of the town of Marblemount. The Sauk River is the largest tributary to the Skagit River and flows into it on the left bank at RM 67.2 south of Marblemount. The Sauk, Suiattle, and Cascade Rivers, tributaries to the Skagit River are classified as scenic under the Wild and Scenic River system, therefore these three rivers cannot be regulated (downstream flows cannot be controlled by dams or other structures). The Sauk-Suiattle System contributes approximately one third of the total flow of the Skagit River. The River then flows past the town of Concrete (population of 866, [Census Bureau 2010]). The confluence of the Baker River occurs at Concrete at river mile 56.5. Baker Lake and Lake Shannon on the Baker River are several miles north of Concrete and are behind Upper Baker Dam and Lower Baker Dam respectively. Upper and Lower Baker Dams are owned and operated by Puget Sound Energy, a private power utility. The USACE has authorized flood control storage in Upper Baker Dam. The Skagit River flows from Concrete past the communities of Hamilton (population 310 [Census Bureau 2010], RM 40) and Lyman (population 427, RM 36). Large tracks of both old-growth and secondary growth coniferous forests dominate the landscape. Primary land use along this sparsely populated reach is recreation and timber.

3.2.2 Lower Basin

The Skagit River then flows into the City of Sedro-Woolley (population 11,024, RM 24). (Figure 2) The Skagit River floodplain that is within the study area extends approximately 22,000 acres east of Sedro-Woolley and 74,000 acres west of Sedro-Woolley. The majority of the developed portion of the town falls outside the flood plain. The topography transitions from a river valley surrounded by steep forested slopes to open coastal lowlands. A few small tributaries enter the Skagit River from both banks. Large tracks of secondary growth coniferous forests dominate the landscape. This is an area of low density residential development. Hwy 20 continues to run along the northern edge of the River and through Sedro-Woolley. Land uses in the area of Sedro-Woolley and State Route 20 include: residential, agricultural, commercial, and industrial. Critical infrastructure in Sedro-Woolley includes State Routes 9 and 20, (critical local access routes), United General Hospital, a sewage treatment plant, and an assisted living facility, Life Care.

The Skagit River flows out from Sedro-Woolley into the floodplain through low density residential development and agricultural lands to the major cities of Burlington (population 8,704 and RM 15) and Mt. Vernon (population 32,139 and RM 10) into the delta. The lower Skagit river basin is composed of floodplains and terraces, historically dominated by Western red cedar and Western hemlock forest. Riparian and riverine wetland habitats were common in the lower basin prior to European settlement. Extensive diking of the lower river, dating back to the last part of the 19th century, has allowed the floodplain to be farmed and developed for residential, commercial, and industrial purposes. The floodplain stretches north-south about 19 miles, from Samish Bay on the north, to Camano Island on the south, and to the west to Skagit Bay. The floodplain is a rich agricultural area and contains the most developed areas of the basin. Beginning from downstream of Sedro-Woolley, from approximately RM 25, the mainstem

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Figure 2. Lower Skagit River Basin and Areas of Interest

channel is hardened with riprap along the channel's edge in an almost contiguous system of levees and revetments. Nookachamps Creek is the only significant tributary in this section of the River (river mile 22). Land use within the Nookachamps basin is largely agricultural. The Nookachamps Basin contains rich wetland and riparian habitat, and several mitigation banks are under construction. The Nookachamps Basin is under consideration for use as basin storage. State Route 9 and 20, which are critical local transportation corridors, run along this section of the Basin. I-5 and the Burlington Northern Santa Fe railroad run through Burlington and Mount Vernon in a north-south direction. The three bridge corridor, where the bridges for I-5, BNSF, and Old Highway 99 cross the Skagit River, is located between Burlington and Mount Vernon (RM 10) and is a major constriction point in conveyance of flood waters. This is a constriction point largely because the bottom cord of the BNSF Bridge restricts that amount of water that can be conveyed; large woody debris accumulates on the BNSF Bridge and prevents water flow; and the river corridors are lined with levees with no setback.

The City of Burlington (8,388 [Census Bureau 2010]) is located almost entirely in the flood plain. Burlington's assessed value was $1,276,473, 786 in 2009. (City of Burlington 2010). Since 1989 the city's assessed value of real property has increased more than tenfold. The City continues to be a hub of commercial growth (including big box retailers) with some residential development. The city is protected by levees managed by Diking District 12. The city's critical public services that lie within the floodplain include: I-5, SR 20, BNSF Railroad, one school (the remaining 5 are located outside the floodplain), one fire station (the other fire station is located outside the floodplain), natural gas pipeline, the sole post office in the city, the sole police station in the city and City Hall.

Mount Vernon is a rapidly growing city with a population of approximately 32,000. Mount Vernon's core downtown area, many important public facilities, and the bulk of the city's commercial base are located in the Skagit River flood plain protected by levees in Diking Districts 17 and 3. Approximately 25 percent of the city area and 81percent of the city's commercial zoned property is within the floodplain. The city's critical public services that lie within the floodplain include: I-5, SR 536, SR 538, BNSF Railroad, Skagit Transit Station, schools, Mount Vernon School District Transportation Center, a wastewater treatment plant, city hall, a fire station (the other two fire stations are located outside the floodplain), the city's sole police campus, wastewater and surface water pump stations, Skagit County facilities, and the Skagit County Jail.

The Skagit River continues to flow past Burlington and Mount Vernon, into a broad outwash plain through agricultural lands. Most historic active side channels from Nookachamps to the North and South Forks have been disconnected through the extensive diking of the area. At approximately river mile 15, the River splits into the North and South Fork at Fir Island before entering Puget Sound. This area of the basin is rural and the predominate land use is agriculture. This lower section of river has been extensively modified with levees, bank protection, and dredging over the past 100 years or more. Levees line both sides of the river, with minimal setback distances. The banks are continuously armored with riprap. This area represents the estuarine portion of the river, tidally influenced but highly altered by diking. Many sloughs on Fir Island were closed off by farmers over the years with tide gates to allow for agricultural use. The North Fork is tightly confined with many distributary channels. Browns Slough was

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historically connected to the North Fork and is cut off from the North Fork by levees. However, this slough is tidally influenced.. The South Fork, while constrained by dikes, is wider and has several large, intact distributary channels including Deepwater and Freshwater Sloughs with expansive riparian vegetation on the lower part of the reach. These two distributaries carry about 60 percent and 40 percent of the normal flows of the Skagit River. The town of La Conner (population 763) is located north of the North Fork on Skagit Bay on the Swinomish Slough, a federally authorized navigation channel. La Conner has developed into a local center for artists and boaters and has a strong tourist trade. The Swinomish Tribal Center is located opposite the Town of La Conner on the west bank of the slough. The primary land-use in this area is agriculture.

3.2.3 Associated Areas of Interest outside of the Immediate Floodplain

The City of Anacortes (population 16,933) is located on Fidalgo Island lies immediately west of the Skagit River Basin. Fidalgo Island is not in the study area, but infrastructure critical to the island runs through the Skagit floodplain, including SR 20, a gas pipeline, and a key water supply line. SR 20 is the primary transit route from the "mainland" to Fidalgo and Whidbey Islands, Naval Air Station Whidbey Island and the ferries to/from the San Juan Islands and British Columbia, Canada.

The City of Stanwood (population 5,402) is located on Puget Sound 5 miles south of the mouth of the South Fork of the Skagit River and the Stillaguamish River. In extreme flood events on the Skagit, Stanwood can get flooded from Skagit River flows that break out of the southern end of the system. The floodwaters flow into Stanwood from a southern direction over a large, flat delta area primarily used for agriculture.

Padilla Bay is located at the western edge of the Skagit Basin and is connected to the Swinomish Channel. It has historically received flood waters from the Skagit River during major flood events. The bay is broad and shallow, and an important site for eelgrass beds in Puget Sound. These beds (8,000 acres) serve as a nursery habitat for various marine species, including Endangered Species Act listed Puget Sound Chinook Salmon juveniles. Padilla Bay has been designated as a National Estuarine Research Reserve and is managed by the National Oceanic and Atmospheric Administration and Washington State Department of Ecology. Padilla Bay serves as an important research and education center. Padilla Bay may be impacted by implementation of the Skagit River General Investigation plan formulation measure 17 (Attachment 2c), the Swinomish (Avon) Bypass which is designed to divert water out of the Skagit and into the Swinomish Channel and Padilla Bay.

The Samish River basin is located northwest of the Skagit River floodplain. The Samish River flows west to its mouth on Samish Bay, Puget Sound. During large flood events, flood flows from the Skagit Basin flow into the Samish basin. The Samish Basin is one of the most productive agricultural areas in Washington State, producing seed crops, bulbs, and fruit. The river is popular for boating. Since 1919 Samish Bay has supported significant commercial and recreational oyster harvests. The Samish River and Bay are U&A fishing areas for the Samish, Upper Skagit, Lummi, and Swinomish tribes. The river supports salmon runs, including Endangered Species Act (ESA) listed species. The town of Edison (population 144) is located in

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the Samish Basin and is a center for local artists and agriculture. In 2009 the Environmental Protection Agency, Washington Department of Ecology, Skagit County, and local tribes and stakeholders approved and implemented a Watershed Total Maximum Daily Load (TMDL) and Implementation Plan to improve water quality in Samish Bay, primarily from the effects of agricultural runoff and septic systems. The Samish River Basin may be impacted by implementation of Skagit River General Investigation plan formulation measure 19, the Samish Bypass which is designed to divert water from the Skagit River, along the Samish River, and to Samish Bay.

4. Infrastructure

Interstate-5, BNSF Railroad, state routes (SR 20, 9, and 536), numerous water and gas pipelines, light industry, an airport, and municipal infrastructure are located in the flood plain.

Interstate commerce between Washington State and British Columbia, Canada is substantial. I-5 and BNSF railroad are critical routes through Skagit County that carry commerce between the United States and Canada. The average daily traffic count along I-5 is 70,000, of which twelve percent are trucks transporting commerce to and from Canada (WSDOT 2010). I-5 is also the primary commute route for people who live in the Basin and work in the larger cities of Seattle and Everett to the south. State Routes 20, 9, and 536 provide the region with the transportation network to support the local and regional economy. State Route 20 serves as the primary commute route for people who work in Anacortes but live in the Basin. Burlington Northern Santa Fe and Amtrak operate a primary railroad that runs in a north-south direction through the floodplain. BNSF currently runs 13 trains per day across the Skagit River carrying 56 million tons of freight. (WSDOT, 2007) The BNSF line would be used to transport bulk goods to the proposed Gateway Pacific Terminal in Whatcom County. If constructed, the train traffic through Skagit County could more than double with coal and other bulk commodities exports (Le, 2011).

The Anacortes Water Treatment Plant located in Mount Vernon on the bank of, and within the 100-year floodplain of the Skagit River, serves approximately 56,000 residential, commercial, and industrial customers. The plant is the primary source of water for two oil refineries (Tesoro Northwest and Shell Puget Sound Refining Company petroleum refineries); the cities of Anacortes, La Conner and Oak Harbor; the Whidbey Island Naval Air Station; and a significant portion of Skagit Public Utility District #1. The Tesoro Northwest and Shell Puget Sound Refining Company petroleum refineries, located in Anacortes, draw more than 60 percent of the potable water from the Anacortes Water Treatment Plant. Burlington, Mount Vernon, and Sedro-Woolley obtain their water from the Judy Reservoir System which is operated by the Skagit Public Utility District. The Judy Reservoir System is fed by tributaries draining the Cultus Mountains. The municipal waste water treatment plants in Burlington and Mount Vernon serve more than 15,000 homes and businesses.

One out of six Burlington-Edison School District's Schools are in the floodplain. Mount Vernon's Washington Elementary School is also in the flood plain

Several hydroelectric dam facilities are located in the upper Skagit basin. Upper and Lower Baker Dam, managed by Puget Sound Energy, and Ross Dam, managed by Seattle City Light.

There are USACE flood control project at these dams that provide a significant reduction to large and small floods. In a 100year event, approximately 20 percent of the flow is regulated.

Four oil and gas pipelines that cross Skagit County are within the floodplain. These include: Kinder Morgan Pipeline, BP Olympic Pipeline, Williams Northwest Pipeline, and Cascade Natural Gas Pipeline. BP's Olympic Pipeline is the sole supplier of jet fuel for SeaTac airport (Baker 2011).

5 Industry

Skagit County is home to diverse commercial enterprise. The largest private employers, including Draper Valley Farms chicken processor, employs approximately 500 people and has annual sales of approx 80 million [Washington State University 2010]), Shell Puget Sound Refinery (Petroleum Refinery, located in Anacortes, produces 145,000 barrels per day [Shell Puget Sound Refinery 2010]), Janicki Industries (high precision tooling for aerospace, marine, wind energy and transportation, located in Sedro-Woolley), Tesoro Northwest (Oil refinery located in Anacortes, processes 120,000 barrels per day [Tesoro, 2008]), the Anacortes Casino (owned by the Swinomish Tribe near the mouth of the Swinomish Slough), Regence BlueShield (healthcare), Dakota Creek Industries (ship yard located in Anacortes), Trident Seafoods Corporation (seafood processing plant located in Anacortes), and Sierra Pacific Industries (sawmill located in Burlington), employ over 5,000 of the total county population. Large public employers, including three hospitals, five school districts, the five largest cities, and the county employ an additional 6,000 people. Most of these employers are located in the lower Skagit River basin.

6. Agriculture

The lower Skagit River Basin has some of most productive farmland in Washington State. As of the 2007 Census of Agriculture (USDA), Skagit County has 108,541 acres of land in farms. (USDA, 2009), a large portion of which is located in the Basin and is protected through Skagit County's Farmland Legacy Program, a county initiative that purchases agricultural easements on Skagit farmland. Agriculture in the Basin is predominately fruit and vegetable, seed, flower production, and dairy, with some chicken production as well. . Vegetable and fruit crops produced in the basin include blueberries, cauliflower and broccoli, peas, potatoes, raspberries, and strawberries. The Basin is the fifth largest dairy producer in Washington State (Washington State University, 2009). Organic farming is on the increase in the basin. In 2009, there were 5,820 acres in certified organic production (Washington State University, 2009).

Seed production is a major agricultural industry in the Basin and requires coordination among the eight vegetable seed companies. Seed production is highly technical and involves long rotation intervals (years, even decades). Approximately 8percent of the world's spinach seed, 25percent of the world's cabbage seed, and 50percent of the world's beet seed is produced in the basin (Washington State University, 2009). Other seeds produced in the basin include arugula, broccoli, Chinese cabbage, coriander, mustard, parsley, parsnip, rutabaga, swiss chard and turnip.

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The Skagit River Basin is a major producer of tulips, daffodils, and iris bulbs, with approximately 1,100 acres planted per year for bulbs and cut flowers. The Basin contributes approximately 75percent of U.S. commercial tulip production (Washington State University, 2009).

7 Levees and Diking Districts

A complex system of approximately 50 miles of non-Federal levees and 39 miles of sea dikes, overseen by five different autonomous Diking Districts, provides a large portion of the flood control for the lower basin. The existing levee system is based on earthen levees built by the original European settlers, farmers and homesteaders, of the Skagit Valley for flood control. Each levee is composed of various materials and there is no uniform construction among the levees. The embankment material is mostly sand, silt, and silty sand with some small gravel. All reaches are armored with riprap for erosion protection. The armor is a Class IV riprap. Generally, there are few to no animal burrows. All the levees are drivable, usually with gravel or crushed rock driving surface. Portions of levees along the river bank are generally lined with willows and small brush. Most levee prisms have a good sod cover. They are mowed three times per year, with grass left to be 8" tall by flood season.

Virtually all the levees in the basin are controlled by independent diking districts. Skagit County has no direct control over the levees. The five autonomous Diking Districts (1, 3, 12, 17, and 22) along the lower Skagit River delta are responsible for construction, repair, and maintenance of the systems within the boundaries of their districts. There is no inter-agency agreement between the diking districts. Each diking districts has the power to levy taxes for construction and maintenance of their respective levees. Since each diking district has a different tax base, therefore each has different maintenance and construction budgets which results in varying degrees of protection throughout the levee system. Since the 1930s, the USACE has been a partner during emergencies, and repairs of these levees under the PL 84-99 program. The level of flood protection provided by the levees varies from 20-30 year to up to 50 years. Personnel from the five Diking Districts are very involved in flood fighting exercises in the basin. Known low points such as the low point along SR 20 in Sterling between Sedro-Woolley and Burlington on the right bank of the Skagit River are flood fought to prevent discharge of flood waters into the Samish Basin and Burlington. The levee and floodwall system in Mount Vernon on the left bank is regularly sandbagged to protect downtown.

8 Environment

The Basin is rich in ecological resources. Almost 90 percent of the Upper Skagit basin above Sedro-Woolley is either designated as national forest or national park. Large tracks of both old-growth and secondary growth coniferous forests dominate this landscape. The western edge of the Basin lies along Skagit Bay, within Puget Sound. There are approximately 229 miles of marine shoreline in County with many islands, bays, coves, and cliffs. The Skagit River delta was originally a very large salt marsh/tidal wetland complex covering over 50 square miles. By the late 1800s dikes were constructed throughout the delta to drain the lowlands for agriculture, destroying delta habitat. In the last century, the lower Skagit basin has lost approximately 45 percent of the historic side slough habitat (424,200 m^2) that provided critical rearing and refuge

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functions in the floodplain. The Skagit basin has lost approximately 72 percent of historic estuarine delta habitat.

The remaining delta habitat and lower basin agricultural lands provides either over-wintering grounds or year round habitat for numerous species of birds including snow geese, trumpeter swans, belted kingfishers, great blue herons, double crested cormorants, osprey, golden and bald eagles, and at least 87 species of song birds. Skagit County's bays and estuaries support more than 93 percent of the overwintering waterfowl in Western Washington including the Western High Arctic snow goose, trumpeter swans, black brant, plus many other species. The expansive, high-density eelgrass meadow (8,000 acres) within Padilla Bay is the largest contiguous eelgrass meadow in the State of Washington and one of the largest on the west coast.

The lower basin of the Skagit River was historically dominated by Western red cedar and Western hemlock forest. Riparian and riverine wetland habitats were common in the lower basin prior to European settlement. Construction of levees along the Skagit River and adjacent channels has drastically reduced the quality of riparian habitat. Today, the majority of the riparian habitat zones downstream of Sedro-Woolley are either entirely devoid of trees or consist of sparse, narrow, and patchy strips of vegetation. Much of the vegetation on levees are composed of grasses and invasive species due to the participation of approximately 45 miles of levee in the PL 84-99 program and are therefore subject to USACE's levee vegetation maintenance requirement. Additionally, the quality of river and channel bank habitats has also been drastically reduced by the placement of rip rap along the edge of the river and channels.

A number of fish, mammal, and bird species in the Skagit Basin are listed as threatened or endangered species under Endangered Species Act (Table 1).

Table 1. Listed Species

SPECIES	SCIENTIFIC NAME	STATUS	CRITICAL HABITAT
Puget Sound Chinook Salmon	*Oncorhynchus tshawytscha*	Threatened	Designated-Skagit River
Coastal/Puget Sound Bull Trout	*Salvelinus confluentus*	Threatened	Designated-Skagit River
Puget Sound Steelhead	*Oncorhynchus mykiss*	Threatened	No Designation
Southern Resident Killer Whale	*Orcinus orca*	Endangered	Designated
Marbled Murrelet	*Brachyramphus marmoratus*	Threatened	Designated-Upper Skagit Basin
Northern Spotted Owl	*Strix occidentalis*	Threatened	Designated-Upper Skagit Basin
Grizzly Bear	*Ursus arctos*	Threatened	No Designation
Gray Wolf	*Canis lupus*	Endangered	No Designation

8.1 Salmon

Of all the drainages in Puget Sound, the Skagit River is the largest and produces the greatest abundance of salmonid and the greatest number of salmonid stocks. The Skagit is the only river system in Washington which supports all five specific species of salmon (Ecology 2011.) The Skagit River and the Skagit Estuary are critically important to all five species of Pacific salmon (including the ESA listed Puget Sound Chinook Salmon and Puget Sound steelhead), and sea-run cutthroat. There are numerous runs that utilize both the mainstem Skagit and several of its

tributaries, most of which spawn in the reaches above Sedro-Woolley. The Skagit River and its tributaries also host the largest population of ESA listed Puget Sound bull trout in Puget Sound Basin. The River produces the most abundant chum and pink salmon populations in the contiguous United States. The Skagit is also the origin of the most abundant wild Chinook salmon populations estimated at 30 percent in Puget Sound (Washington State Conservation Commission, 2003). Salmon need native vegetated riparian and delta habitats - to serve as nursery habitat for young salmon migrating out to sea and for spawning habitat for returning adults. The reduction in quality of riparian and delta habitat adversely affects all salmon species that depend on cold clean water, organic detritus and benthic invertebrates for food, and large woody debris (LWD) and bank complexity for cover. The historic loss of tidal wetland and channel habitat has been identified as one of the most significant limiting factors in the recovery of Skagit Chinook.

Many entities are working towards restoring floodplain habitat and salmon populations. In Skagit County, salmon recovery is coordinated by the Skagit Watershed Council (SWC), a not-for-profit community partnership. Their guiding documents include the Skagit Chinook Recovery Plan and the SWC Habitat Protection and Restoration Strategy (SWC, 1998). The SWC is currently focused on a restoration plan for the Middle Skagit. In 2005, the *Skagit Chinook Recovery Plan* was co-authored by the Washington Department of Fish and Wildlife (WDFW) and the Skagit River System Cooperative (SRSC). The plan outlines biologically-based recovery goals, limiting factors of Chinook production, and actions that will restore Skagit River Chinook to optimum levels. The SRSC provides natural resources services for both the Swinomish Tribe and the Sauk-Suiattle Tribe. The Tribes of Skagit County are all actively engaged in habitat restoration. In October 2010, the Skagit County Board of Commissioners signed a resolution ordering Skagit County departments to consider salmon recovery in all of its actions, and pursue grant funding for salmon enhancement. Additionally, Skagit County is also actively engaged in salmon recovery and floodplain restoration in numerous areas, including habitat restoration projects, water quality monitoring program, floodplain homeowner buyouts, the Comprehensive Flood Hazard Management Plan, and watershed-scale restoration planning.

9 Cultural Resources

The Skagit Delta contains important cultural resources associated with the original native use of the region, potentially represented in archaeological sites and traditional cultural properties, as well as historic era settlement patterns expressed primarily as domestic, agricultural, and commercial buildings and structures. The Delta and adjacent uplands have been used and occupied by human populations for a considerable span of time. Although the exact duration is not known precisely, evidence discovered elsewhere in the Puget Sound region supports an estimate of 12,000 years. The oldest cultural resources found in the Skagit Delta area date to less than 5,000 years ago.

Before the 1850s, the Skagit Delta constituted a part of the territory associated with several culturally similar Indian groups. The northern delta was occupied by the Swinomish and Samish. The North Fork and adjacent areas were inhabited by the Lower Skagits. The South Fork was Kikiallu territory. The Upper Skagits resided in the area north and east of Mount Vernon. Euro-American settlement and dislocation of the resident Indian populations did not begin until the

late 1850s. The Point Elliot Treaty of 1855 required most of the local Indians to resettle outside the delta on either the Swinomish or Tulalip Reservations.

The first Euro-American homestead along the Skagit River was settled in 1859. In 1863, the first trading post in the delta was opened at the point of divergence between the North and South Forks of the river. Six years later, the post became the site of Skagit City, the earliest river town. As the area's population grew, many additional towns were founded. Today, Mount Vernon, Burlington, and Sedro-Woolley remain as important centers of population and commerce. The early settlers quickly recognized the need for dikes to protect their holdings against the Skagit River's frequent floods. Initially, levees were the responsibility of individual land owners, but the magnitude of the task soon prompted collective action and diking districts were formed in the late 1890s. Agriculture was initially, and continues to be, the principal economic activity in the delta. Logging operations began around 1865, but on the lowlands the resource was expended before 1920.

Reconnaissance, survey, and excavation of prehistoric cultural resources have been carried out sporadically in the Skagit Delta, although the vast potential of the delta's cultural resources, both prehistoric and historic, has largely remained unexplored. There is no comprehensive inventory of prehistoric or historic archaeological sites, or traditional cultural properties. Currently, two properties within the Skagit Delta are listed in the National Register of Historic Places: the town of La Conner and the Skagit City School. In addition, the Fishtown Archeological District, a constellation of three prehistoric sites at the mouth of the North Fork, was nominated to the register. The Washington State Register of Historic Places includes the Old Skagit County Courthouse in Mount Vernon and the Methodist Church in Fir. The Washington State Inventory of Historic Places includes the town sites of Fir, Sterling, and Skagit City. During the summer and fall of 1978, the USACE contracted with Seattle Central Community College to conduct a cultural resources reconnaissance of the project area on the proposed Skagit River Levee Project. The reconnaissance identified 54 cultural resource sites, 20 prehistoric sites, and 34 historic sites. The prehistoric sites are largely habitation shell middens; the historic sites include elements of towns, farms, refuse areas, a cemetery, granary, and logging establishments.

10 Skagit River Flooding

The Skagit River Basin is subject to winter rain floods and an increase in discharge during spring snowmelt runoff. Rain-type floods usually occur in November or December, but may occur as early as October or as late as February. Generally, flooding in the basin is overland flow, typically due to levee failure or overtopping. Flood depths are an average of 4-8 feet for a 100-year event with flood durations of 2-3 days. Large volumes of debris tend to accumulate on bridges at Sedro-Woolley (SR 9 and the out of service Great Northern Railroad) and the three bridge corridor, blocking the flow of water downstream. High hazard areas in a 100-yr event are the urban areas of Mount Vernon and Burlington. These areas contain the highest density of infrastructure, such as roads, hospitals and water treatment plants in the basin. The majority of this infrastructure is located in areas at risk for flooding (Figure 3, Illustrative 100yr Floodplain). Flood fight efforts of the cities, towns, and diking districts during flood events (such as 1990, 1995, 2003, and 2006) have helped to prevent flooding and damages of areas located in the

floodplain. However, flood fighting efforts may be overwhelmed in large flood events and are not sustainable for long term flood risk management.

10.1 Basic Hydrology

Major floods usually follow a sequence of events, including antecedent precipitation building up ground water reserves, a light snow pack formed over most of the basin, followed by a heavy rainfall and warm winds. The intense rainfall and warm winds are produced by a weather system technically termed atmospheric river and commonly referred to as *The Pineapple Express*. Atmospheric rivers generate in the tropic latitudes and are conveyed by the jet stream in a narrow band of heavy moisture, often 200 miles wide or less, to the West Coast of North America (USACE, 1965 and 2011).

10.2 Description of Flooding Upstream to Downstream

10.2.1 Upper Basin

For purposes of this flood narrative, the upper basin dams will be used as the most upstream reference point for flooding. Upper Baker Dam and Ross Dam are the primary flood storage projects in the Basin. Upper Baker Dam, on the Baker River, is required to provide 74,000 acre-feet of storage by November 15th, and Ross Dam, on the Skagit River, is required to provide 120,000 acre-feet by December 1st. Lower Baker, Diablo and Gorge Dams may have some storage available during flood events but this space is not managed by the USACE and is not part of flood control operations. Additional storage at Upper Baker and Ross Dams could be made available with preemptive draw downs by the projects independent of the water control manual.

10.2.2 Concrete

Concrete (population 866) consists of houses, a school, and administration buildings for Puget Sound Energy. Flooding resulting in closure of SR 20, the main access road for Concrete. The Crofoot's Subdivision in Concrete, lies in the low elevation area and is the furthest community upstream that is of concern during Skagit River Flooding. In 2003, this area flooded yards and streets. This neighborhood would experience several feet of flooding during a 1 percent exceedance event. Residents are given evacuation warnings within 24 hours of expected flooding.

10.2.3 Hamilton

The town of Hamilton is home to 352 residents. The majority of structures at risk of several feet of inundation during major floods are residences. Many are temporary structures (campers/trailers). The entire community is evacuated prior to flood events as most of the area is at risk of flooding several feet during floods greater than a 40-year event. The access roads to the town are also at risk of being inundated during floods. Hamilton has experienced flooding in 1990, 1995, 2003, and 2006. In the 1980's the USACE conducted a Section 205 flood risk management study for the town. The study concluded that there was no economically justified structural or nonstructural project that qualified for USACE assistance.

10.2.4 Sedro-Woolley

The City of Sedro-Woolley is home to 11,024 residents. The east side of Sedro-Woolley is more prone to flooding compared to the west side. During a major flood event, Sedro-Woolley will first flood at Riverfront Park and along River Road. Structures at risk of several feet of inundation during major floods are the United General Hospital, Life Care, waste water treatment plant, light industry buildings, and residences. United General Hospital and Life Care have not flooded in the past but both facilities are built in the vicinity of the historic Gages Slough which has historically flooded. The waste water treatment plant has not flooded in past floods largely due to flood fight efforts around the facility. The access roads to the town can become inundated during floods. During smaller flood events, State Route 9 south (Clear Lake) becomes inundated and in large flood events, State Route 20 west of Sedro-Woolley is likely to become inundated with water (Sedro-Woolley, 2011). The access to the city is limited to SR 9 from the north and possibly F&S Grade Road from the west. SR 9 is the only route to rock sources for flood fighting. During flood events, roads are typically closed to anything but emergency traffic. These routes can also be closed due to coincidental flooding on the Samish and Nooksack River (Whatcom County). In the event SR 9 is closed, the United General Hospital is not accessible by vehicle; and the only access to another hospital from Sedro-Woolley would be by air.

During a flood event, actions taken to mitigate damages and threat to public safety include: door to door welfare checks and requests that people evacuate conducted by the Sedro-Woolley Fire Department and Police Department; flood fight actions at the wastewater treatment plant; evacuation of United General Hospital and Life Care. City staff would provide sandbags to citizens for household protection. Sand bags are placed along SR 20 to keep the road open at the beginning of a major flood event to allow for evacuation out of the area and to allow for access to flood fighting resource.

10.2.5 Burlington

The City of Burlington (population 8,704), is located almost entirely in the flood plain. Structures at risk of several feet of inundation during major floods are the light industry buildings, retail/businesses and residences. Burlington is protected by levees maintained by Diking District 12. The existing levee system is generally thought to safely provide approximately 50-year flood protection to the City. Burlington has not been flooded by the Skagit River since 1921 largely due to the existing levee system and extensive flood fighting efforts during the 1990, 1995, 2003, and 2006 flood events. Debris accumulation on the BNSF railroad bridge threaten the integrity of the levees and bridge and could result in flood waters overtopping the levees along the eastern edge of Burlington in which flood waters would enter the City of Burlington.

During a flood event, actions taken to mitigate damages and threat to public safety include evacuation of residents and businesses, and placement of material such as sandbags to raise low areas of levee.

10.2.6 Mount Vernon

The city is home to 32,139 residents. In general it is the west side of the City that falls within the floodplain. Approximately 25% of Mount Vernon falls within the existing regulatory floodplain. The predominant zoning designations within the floodplain of the City of Mount Vernon include: Commercial/Limited Industrial, Public, General Commercial District, Residential Agricultural District, and Central Business District, with limited Residential. The majority of Residential zoning is outside of the floodplain. Generally, the west side of the city is more at risk for flooding, especially the section known as the "River bend" (river mile 13) which is surrounded by levee on three sides and has some agricultural and residential development. The Anacortes Water Treatment Plant is located in the "Riverbend" area. The "Riverbend" area falls predominantly within unincorporated Skagit County and is designated as "Agricultural-Natural Resources" in the County's Comprehensive Plan. (Skagit County, 2007)

Structures at risk of several feet of inundation during major floods are the light industry buildings, retail and other commercial businesses, and residences. Mt. Veron's core downtown area, many important public facilities, and the bulk of the city's commercial base are located in the Skagit River flood plain protected by levees maintained by Diking District 17. Unfortunately, the levees protecting downtown contains a low area in the levee system that is the focus for major flood fights. In order to protect the city during a major flood event, a temporary flood wall system is installed, and 1,500 to 2,000 volunteers are mobilized for an intense effort to build a sand bag revetment approximately 1,500 feet long and four feet high behind the flood wall in the downtown core. This occurred in 1990, 1995, 2003, and 2006. After a flood event, depending on the time of year, the sandbags are removed, affected areas are cleaned up and equipment put back in its place, inspection of the levees and assessments of damage occur. A typical flood fight that successfully prevents flooding, without major losses, still costs nearly $200,000 for the flood fight and repair of minor damage to affected facilities. Other flood fight efforts include evacuation and raising low areas of levees with additional material. The city is currently constructing a permanent floodwall in the downtown area. Flood fighting is still required since only the upstream portion of the wall has been completed.

The Anacortes Water Treatment Plant is located in the floodplain but has not flooded due in part to flood fight efforts around the facility in 1990, 1995, 2003, and 2006. Currently, in a large flood event, operations at the Anacortes Water Treatment Plant may be halted, disrupting distribution of water to Anacortes, La Conner and Oak Harbor, the Whidbey Island Naval Air Station, and a significant portion of Skagit Public Utility District #1. Without this primary source of water, refineries would have to shut down for 1-3 days. The plant is currently being upgraded. All critical equipment, including standby power generation will be located above the 100 year flood elevation. The plant will have enough fuel and process chemicals onsite to stand alone for up to 7 days. All structures below the 100 year flood elevation will be sealed, and will include sump areas to remove water if needed.

10.2.7 Burlington Northern Santa Fe Railroad Bridge

The BNSF Bridge across the Skagit River may be threatened during a large flood event. Substantial accumulations of debris can accumulate on the bridge piers and block the flow of flood waters, causing damage to the bridge and water to back up which can create conditions that

can undermine levees immediately upstream of the bridge and induce scour adjacent to levees immediately downstream of the bridge. In a 1995 flood event, the debris captured by the BNSF bridge caused scour (erosion) to occur that displaced a bridge pier and caused damage to the left bank levee (WSDOT 2007). BNSF is responsible for debris management on the bridge. During a flood event, BNSF and their debris removal contractor, use boats to dislodge the large woody debris that has accumulated on upstream side of the BNSF Railroad Bridge. BNSF continues to operate the rail line when debris accumulates on the bridge (WSDOT 2007). BNSF also conducts preventative debris management work outside of flood events. (WSDOT 2007) Domestic rail commerce beyond Skagit County could potentially be impacted during large flood events if flooding resulted in bridge damage and/or closure. International commerce could potentially be impacted as this rail line is used to move goods between the US to Mexico and Canada. (WSDOT 2007) International trade could further be impacted if plans to construct a bulk commodities terminal in Whatcom County move forward continues.


4a.

4b.

Figure 4a and 4b: Debris accumulation on the BNSF Bridge during 1995 flood event looking upstream.

10.2.8 Interstate 5

I-5 has not flooded in recent flood events. In floods greater than a 50 year event, I-5 may be subject to closure. During flood events that do not result in closure of I-5 itself, access to I-5 may be affected by flooding of local access routes to I-5 or flooding of I-5 entrance and exit ramps. Closure of I-5 would negatively impact domestic and international commerce. Alternative routes would add significant time and cost. The closest north-south route, US 97 lies on the eastern side of the Cascades. Typically, US 97 could be accessed via SR 20 but SR 20 is closed during the winter when flooding in the basin typically occurs. Drivers would need to cross the Cascades at a more southern route, potentially adding 400 miles to their travel and enter into Canada to reach destinations north of the Basin.

10.2.9 La Conner

La Conner is located in the Skagit River Delta along the edge of Puget Sound, at the mouth of the north fork of the Skagit River. The city is home to 763 residents, with a majority of those at risk of several feet of inundation during major floods. La Conner has multiple threats from flooding events; levee failure on the mainstream and North Fork of the Skagit River dike system and storm surge from the Swinomish Channel. Skagit River levee failure can eventually inundate

the town. Such flooding would close the primary roads into and out of La Conner, and would necessitate evacuations of areas around and within La Conner.

La Conner has not experienced a flood event from the Skagit River since early 1951. Levee breaks also occurred during floods in 1990 and 1995, but only flooded surrounding farmland but not inside the city limits of La Conner. A flood insurance study for La Conner identified the regulatory 100-year flood elevations for the La Conner area at 8.0 feet, National Geodetic Vertical Datum (NGVD). (La Conner 2003) It is expected that floodwaters from dike breaks on the Skagit River would flow across the valley until they reach the sea dikes along the Swinomish Channel and could potentially "pond up" to the elevation of the top of the levees (8 feet NGVD), and then over-flow into the Swinomish Channel or the North Fork of the Skagit Bay depending on tidal conditions of Skagit Bay. (La Conner 2003)

La Conner's at risk critical facilities include the sewer treatment plant, fire station, schools, emergency response facility, and storm water system.

10.2.10 Fir Island

Fir Island is in the delta between the north and south forks of the Skagit River. The area contains approximately 130 parcels with land use code "household" (Skagit County 2011), with a majority at risk of several feet of inundation during major floods. Fir Island is largely agricultural land. The island is protected by Diking District 22. In 1990, a levee on the North Fork of the Skagit failed, inundating Fir Island and causing major damage. It took weeks for the area to drain as water was trapped behind the remaining levees and sea dikes. Flooding in this area, and inability of the area to drain during and following floods, would result in losses to commercial agricultural infrastructure and some residences.

10.2.11 Fidalgo Island (Anacortes)

Fidalgo Island is located outside the study area. Residents and industries (oil refineries) located in Anacortes on Fidalgo Island would be adversely impacted by closure of transportation routes (I-5, SR 20, BNSF) or disruption of services (loss of water from the Anacortes Water Treatment Plant) located in the floodplain. SR 20 is the primary commute route for a large portion of refinery and NAS Whidbey Island workers that live in the Basin and would be adversely impacted by a closure of SR 20.

11 Regional Flood Response

Skagit County follows the Unified Incident Command (UIC) National Incident Management System when faced with flooding. The County has established flood response protocols for various stages of flooding ranging from monitoring of river flows and heights when the National Weather Service issues a Flood Watch Warning for evacuation and emergency sandbagging operations when flooding is imminent. The County is assisted by the diking districts, fire districts, cities, and towns during flood response operations. The USACE and National Guard may assist in flood response activities during larger events. Each jurisdiction in the floodplain also has its specific flood response strategy. The County also participates in flood preparedness

activities, including the coordination of an annual Flood Awareness Week with all flood related project partners, distribution a flood preparedness news campaign, and during flood season provides daily updates to a River Level Hotline, which anyone can call for gauge readings and any flood related news.

The County is actively engaged in numerous long-range flood planning efforts, including partnering with the USACE on the Skagit River GI. Other flood planning efforts include the County's Natural Hazards Mitigation Plan, Comprehensive Flood Hazard Management Plan, and the Lower Samish River Comprehensive Flood Hazard Management Plan. More than 60 jurisdictions and agencies are signatories to the Multi Hazard Mitigation Plan that has been in place for several years. Skagit County's National Flood Insurance Program (NFIP) rating as a 5 in the Community Rating System puts the community in the top 1percent of the nation for its flood risk reduction activities in the lower basin.

12 Environmental Implications of flooding

There would likely be a decrease in water quality of the Skagit River, Bay and channels, during a major flood event where levee breach in the Skagit Basin that would cause effects to habitat and potentially to public health. Flood waters may come in contact with sewage from flooded septic systems; flooded waste water treatment plants; manure lagoons farms; chemicals (pesticides, fertilizers, cleaners) from fields, lawns, markets, and storage areas; petrochemicals from gas stations, and contaminated sediments. Contaminated sediment may drop out of the floodwaters and be deposited on agricultural fields, homes, and businesses in the delta.

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