

2016 State of Our Watersheds Report

Nisqually River Watershed



We have to have hope. I think of the destruction of our fisheries, each time we see them wear away. We have to have hope; salmon are too much a part of us.

— **GEORGIANA KAUTZ,**
NISQUALLY TRIBE



Nisqually Indian Tribe

The Nisqually people have lived in the watershed for thousands of years. According to legend, the Squalli-absch (ancestors of the modern Nisqually Indian Tribe), came from the Great Basin and erected their first village in a basin now known as Skate Creek, just outside the Nisqually River watershed's southern boundary. Later, a major village would be located near the Mashel River. The Nisqually have always been a fishing people. The salmon has not only been the mainstay of their diet, but the foundation of their culture as well. The Nisqually Tribe is the prime steward of the Nisqually River fisheries resources, and operate two fish hatcheries: one on Clear Creek and one on Kalama Creek. In the 1855 Treaty of Medicine Creek, the Nisqually Tribe reserved their right to fish, hunt and gather in their traditional areas. Because of that agreement, the federal government is obligated to protect those treaty-reserved resources. This report will focus on the Nisqually River basin and surrounding marine waters.



Future of the Nisqually River Watershed

The Nisqually River basin is one of the least developed watersheds in south Puget Sound and also has the largest underdeveloped delta in Puget Sound. The watershed encompasses a broad range of land uses and jurisdictions: rural communities; national and state parks and forests; public and private timberlands; municipal hydropower dams and reservoirs; farmlands; the Nisqually Indian Reservation; Fort Lewis Military Reservation and the Nisqually National Wildlife Refuge.

It is the only Puget Sound watershed with its headwaters in a national park and its estuary in a national wildlife refuge. Development has largely occurred in the lower reaches and elevations of the watershed. Habitat degradation was identified as one of the

primary reasons for the decline of Nisqually Chinook, stemming from hydroelectric dams, forest practices, agricultural development and urbanization.¹

There has been tremendous work performed in the Nisqually River watershed to protect existing habitat, recover damaged habitat, mitigate harmful conditions and plan for future progress. Much of this success has been through the work, leadership, coordination and support of the Nisqually Indian Tribe and the Nisqually River Council, their members and parent organizations. Reliable and sufficient funding has been the greatest restriction inhibiting further progress within this watershed.

Nisqually River Salmon Recovery Plan

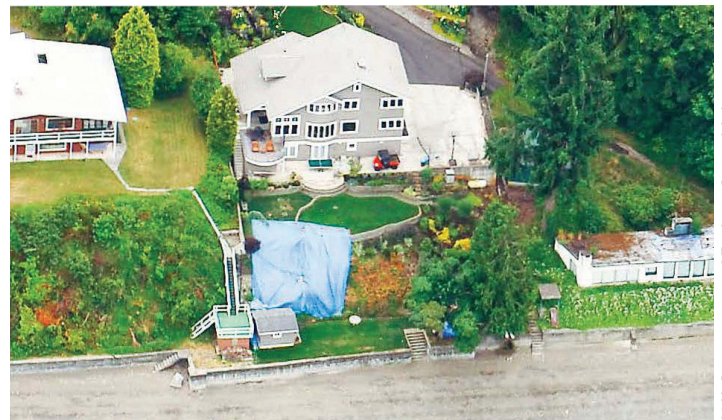
The Nisqually Chinook Recovery Plan adopted a habitat strategy to protect, enhance and restore prioritized habitat in the basin. Recovery actions were prioritized to:

- Protect and secure habitat that supports the existing core population;
- Enhance that habitat; and
- Restore habitat associated with secondary or lost population segments.²

Based on these priorities and an analysis of current productivity within each stream reach of the watershed, restoration and preservation priorities were focused on the estuary and nearshore marine environments and within the freshwater habitats, the mainstem, as well as the Mashel and Ohop sub-basins.³

Consequently, the habitat actions identified for the Nisqually watershed within the Puget Sound Salmon Recovery Plan were:

- Restore estuary and nearshore marine environments;
- Restore and preserve the Nisqually River mainstem;
- Restore and preserve the Ohop Creek and the Mashel River sub-basins;
- Protect and restore key mainstem tributaries; and
- Evaluate the effects of water well withdrawals.⁴



Example of shoreline modifications in the Nisqually Watershed.

WA Department of Ecology Coastal Atlas

Population Growth & Groundwater Demands

At the 10-year mark of the Puget Sound Salmon Recovery Plan, a review of key environmental indicators for the Nisqually watershed shows that there are significant concerns with the continued growth of the watershed's population, especially in the middle of the watershed, along with the associated increase in water wells and impervious surface area. The continued degradation of marine shoreline habitat conditions remains a priority issue for the sur-

vival of the juveniles leaving the Nisqually watershed. In general, there is a shortage of staff at all levels (e.g., federal, state, tribal, county) needed to address the issues and implement actions to restore and protect habitat and to monitor and enforce compliance of existing regulations. In addition, funding shortfalls for large-scale projects (e.g. Interstate 5 overpass/floodplain restoration) contribute to the slow pace of progress.

Review of the status of these key environmental indicators since the 2012 State of Our Watersheds Report shows an improvement from restoration activities but a steady loss in habitat status:

Tribal Indicator	Status	Trend Since SOW 2012 Report
Shoreline Modifications / Forage Fish	From 2005 to 2014, 329 hydraulic project approvals were issued in Pierce and Thurston counties, resulting in an additional 1.5 miles of armored shoreline and the removal of 0.3 miles of armoring, resulting in a net increase of 1.2 miles.	Declining
Water Wells	The number of water wells in the Nisqually watershed continued to grow during 2010-2014 by 300 (3.2%) additional new wells. Most growth, 256 of the 300 wells (85%), occurred in the middle portion of the watershed, bordered by the towns of Eatonville, Roy and Yelm.	Declining
Impervious Surface	From 2006 to 2011, the lower and middle extents of the Nisqually watershed continued to see an increase (0.8%) in impervious surface. Though the increase in this time period is slight, the trend shows impervious surface will continue to increase as people move into the watershed.	Declining
Population Growth	The middle portion of the watershed, bordered by the towns of Eatonville, Roy and Yelm saw an estimated population increase of almost 6% during 2010-2014 and the area's population growth is estimated to be over 5% in 2020. Population growth leading to a high percentage of urban or rural-residential use is an identified concern in this watershed's Chinook recovery plan.	Concern
Restoration	Over 900 acres of the Nisqually Delta estuary has been restored, representing the largest estuary restoration project in the Pacific Northwest and one of the most significant advances to date towards the recovery of Puget Sound. More resources will be needed for additional studies in order for managers to develop plans for addressing substantial impacts to the habitat forming processes in the Delta. Our work to date provides a solid base of information to build upon.	Improving

The Tribe continues to work toward the protection and restoration of healthy and functional nearshore, estuarine and river habitat, restoring those areas that are degraded, and conducting research to understand the organisms and the habitats they occupy.

Making Progress with Restoration and Protection

Along with other local restoration efforts, 22 miles of the historic Nisqually delta system have been restored, increasing salt-marsh habitat in southern Puget Sound by over 50 percent. Since 2009, scientists have closely monitored changes to the ecosystem using aerial photographs, permanent land-based panoramic photographs, sediment gauges, vegetation transects, bird and fish counts, and tidal gauges. Results indicate that the historical delta ecosystem is returning and that the dike removal has increased the area's salmon population. Studies indicate that juvenile salmon have benefited from the dike removal. Continued monitoring will allow managers and scientists to detect subtle changes within the delta as the system acclimates to tidal flows.⁵

Construction has officially concluded in the latest phase of the Ohop Valley Restoration Project. The old ditch has been removed and the newly created channel is flowing with water. Ohop Creek is one of two major tributaries to the Nisqually River. The new channel was constructed to recreate a sinuous stream that connected to its floodplain. The floodplain, now replanted with native vegetation, will create 80 acres of a healthy riparian habitat that provides temperature control to the creek and increases bank stabilization. Additionally, the project removed old buildings and removed invasive plants.



K. Turner - USGS

Beach seine pull at the Nisqually delta monitoring site.

Looking Ahead



Ohop Valley Restoration Project.

Future projects, investigations, and research efforts by the Nisqually Tribe:

- Work on crafting a long term management plan for the delta.
- Develop plans for addressing substantial impacts to the habitat forming processes in the delta.
- Continue research and monitoring in the delta restoration effort
- Investigate effects of climate change induced sea level rise and how it will impact delta structure and function if habitat forming processes are not restored or enhanced.
- The Nisqually Indian Tribe and the Washington State Department of Transportation are looking at design alternatives, cost estimates, permitting issues, and impacts on transportation to moving to a less impactful crossing of I-5 through the delta.

Nisqually Indian Tribe

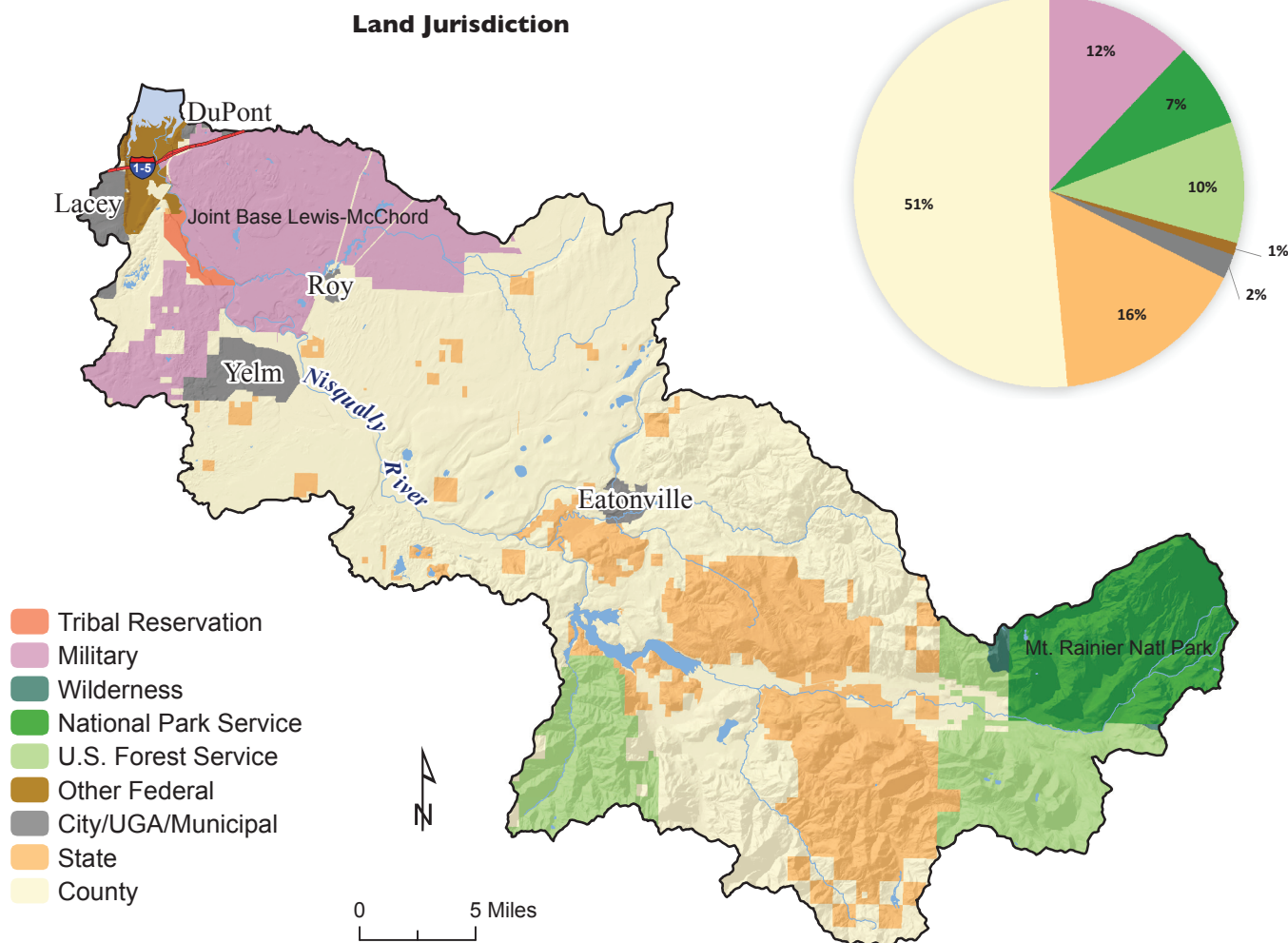
Nisqually Watershed

The Nisqually River basin (WRIA 11) and the surrounding marine waters are the ancestral home of the Nisqually Indian Tribe. The basin includes the Nisqually River, which originates from five separate glaciers on Mount Rainier, including the Nisqually Glacier, to its delta at Puget Sound with a total drainage area of 720 square miles. The Nisqually is one of the least developed and most pristine major rivers in Washington state. The river flows through national and state parks and forests, public and private timberlands, municipal hydropower projects, farmlands, the Nisqually Indian Reservation, Fort Lewis and the Nisqually National Wildlife Refuge.

Land use within the basin varies from agriculture in the valley bottom to forestry in the uplands, with increasing urban uses in several key areas in the watershed. The lower Nisqually watershed

is one of the most intensely farmed basins in western Washington. Salmonid species existing within the basin include Chinook, coho, chum, coastal cutthroat, pink, steelhead and bull trout. Chinook and steelhead are listed as threatened under the Endangered Species Act, while coho are listed as a candidate.

Five urban centers currently have boundaries within the Nisqually watershed (Lacey, DuPont, Eatonville, Roy and Yelm) comprising 8.9 square miles. The planned Urban Growth Areas (UGA) within the watershed adds the potential of another 14.2 square miles of use, for a total of 23.1 square miles or an increase of 160%. Based upon the Office of Financial Management (WAOFM) population forecasts, the watershed population could increase by as much as another 46,000 by 2026.¹



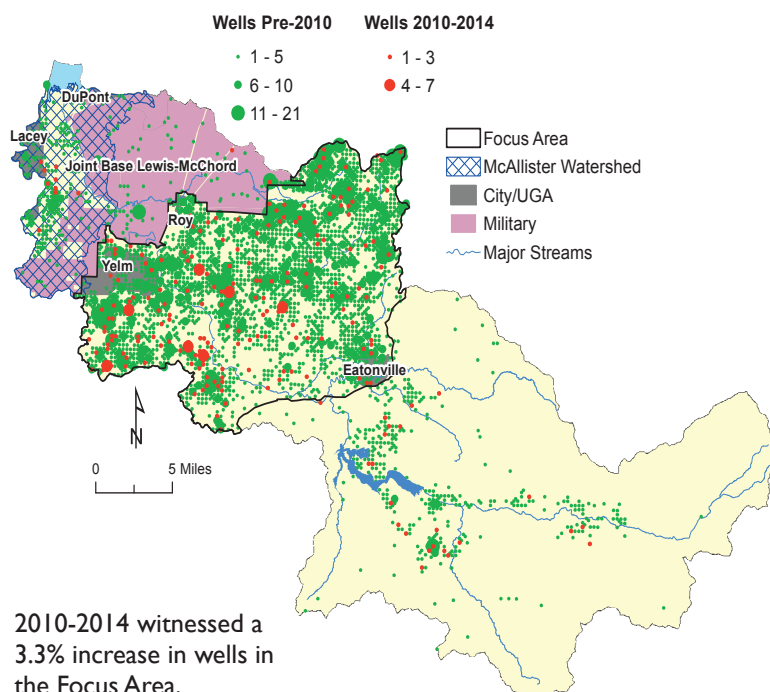
Population Growth Increases Demand for Wells

The number of water wells in the Nisqually watershed continued to grow during 2010-2014 by 300 (3.2%) additional new wells. Most growth, 256 of the 300 wells (85%), occurred in the middle portion of the watershed, bordered by the towns of Eatonville, Roy and Yelm. This area saw an estimated population increase of almost 6% during 2010-2014 and the area's population growth is estimated to be over 5% in 2020.

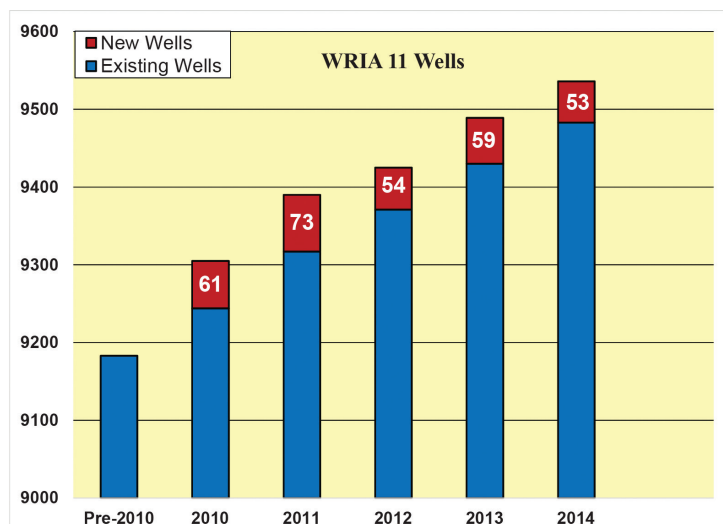
Most land in the upper extent of the Nisqually watershed is restricted from rural growth: it is either steep (slope over 30%), National Park, National Forest, state-owned or private forestland. A large block of land in the lower extent of the watershed consists of Joint Base Lewis-McChord (JBLM) and the Nisqually Indian Reservation. Between the upper and lower extents is a focus area of 230 square miles with mostly flat to gently sloping land, three urban areas (Eatonville, Roy and Yelm) and 87% of the watershed's water wells. This middle focus area of the watershed has seen the majority of water well growth in the past and in the last four years saw an increase of 85%. This area controls some of the most important and productive freshwater stream reaches for salmon in the Nisqually watershed. Unchecked growth and its associated increase in groundwater demand will reduce aquifer volume and thus the outflow to the streams, wetlands, lakes and saltwater nearshore vital to salmon.

Unmanaged population growth within the Nisqually watershed will have an increase demand on groundwater resources. Surface and groundwater withdrawals in WRIA 11 tributaries for irrigation and domestic use will continue to grow and will impact instream flows during adult salmon upstream migration and spawning. Unmanaged growth in the middle extent of the watershed may also lead to a decrease in summer flows thus reducing rearing area for fish residing year-round in the watershed.

In May 2008, the city of Olympia and the Nisqually Indian Tribe entered into a historic agreement – the first such agreement between a tribe and a municipality in the country – to jointly develop a new regional water source at McAllister Wellfield. The city is actively developing a new water source that will replace McAllister Springs as the city's primary supply of drinking water. The new water source will be significantly more protected, more productive, and will meet water supply needs for generations. For years, the city has been working closely with other agencies and municipalities to plan for development of the McAllister Wellfield. Construction began on August 13, 2012.¹



2010-2014 witnessed a 3.3% increase in wells in the Focus Area.



Population Change

Jurisdiction	2010 Population Census	2014 Population Estimate	Percent Increase
Yelm	6,848	7,915	16%
Eatonville	2,758	2,840	3%
Roy	793	805	2%
Unincorporated Thurston County	135,123	138,160	2%
Unincorporated Pierce County	366,738	381,970	4%

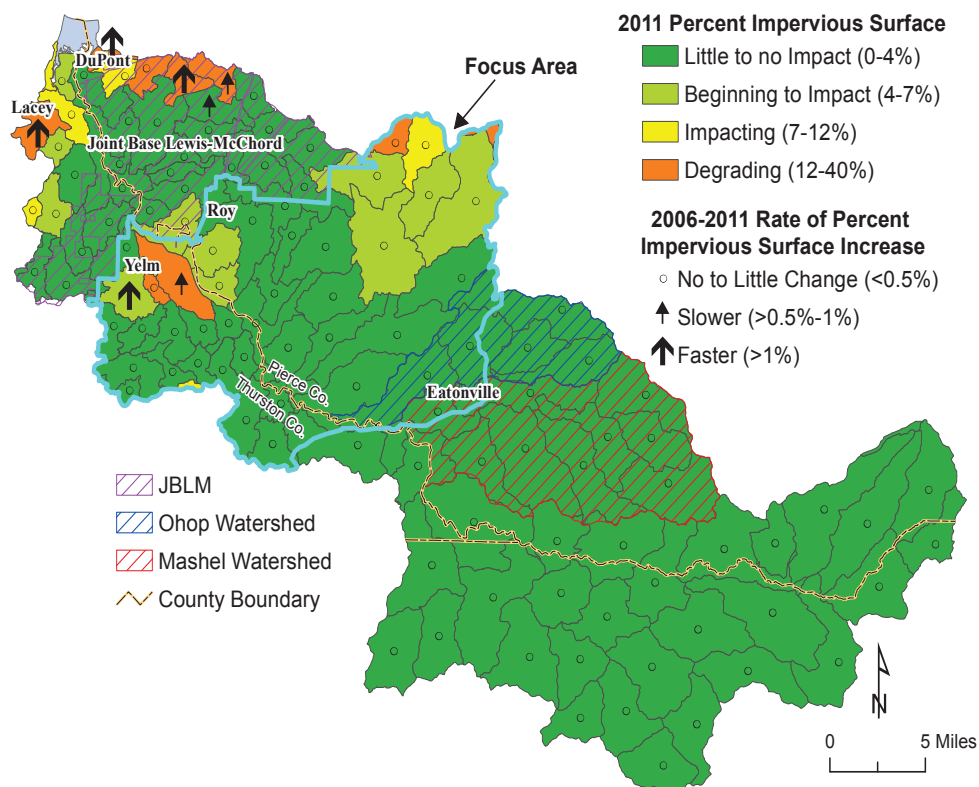
From 2010-2014 the population of Yelm grew by 16%, Dupont grew by 12% and Lacey increased by 7%.² Population growth leading to a high percentage of urban or rural-residential use is an identified concern in this watershed's Chinook recovery plan.

Increased Population Growth and Impervious Surface in the Lower Nisqually Watershed

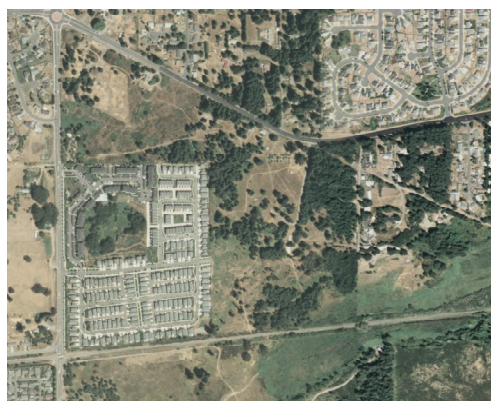
From 2006 to 2011, the lower and middle extents of the Nisqually watershed continued to see an increase (0.8%) in impervious surface. Though the increase in this time period is slight, the trend shows impervious surface will continue to increase as people move into the watershed.¹

As the population continues to increase, so will the impervious surface area, causing a disruption of both the ground and surface water ecology. This disruption will negatively impact the ecosystems dependent upon the proper function of the hydrologic cycle. Tributary watersheds important for Chinook (Mashel and Ohop) are mostly managed for forest products in the upper portions of their drainage areas. There is a concern that in the future human population growth in the Mashel River and Ohop Creek may result in portions of these watersheds being converted to urban or rural-residential use.²

Impervious surfaces cause increased stream temperatures and decreased stream biodiversity – as evidenced by reduced numbers of insect and fish species – and contribute to pollutants in stormwater runoff, which can contaminate local aquatic systems.³ Currently, the Nisqually watershed is in relatively good condition, but as population continues to grow within the watershed, the impervious surface will likewise increase. Without proper management and resource protection, the forecast is for impervious surfaces to have grown to an impacting level within 15 years.



Example of Build-out in the Lower Nisqually Watershed



2006



2011

From 2010-2014 the population of Yelm grew by 16%, Eatonville 3%, Roy 2% and both unincorporated Pierce and Thurston County grew by 4 and 2% respectively. Population growth leading to a high percentage of urban or rural-residential use is an identified concern in the Nisqually River Watersheds Chinook recovery plan.

Population Change

Jurisdiction	2010 Population Census	2014 Population Estimate	Percent Increase
Yelm	6,848	7,915	16%
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Roy	793	805	2%
Unincorporated Thurston County	135,123	138,160	2%
Unincorporated Pierce County	366,738	381,970	4%

Nearshore Impairment Near Nisqually Delta

From 2005-2014, 329 Hydraulic Project Approvals (HPAs) were issued in Pierce and Thurston counties resulting in an additional 1.5 miles of armored shoreline and the removal of 0.3 miles of armoring, resulting in a net increase of 1.2 miles.¹

Construction of bulkheads and other types of hard shoreline armoring, groins, and docks reduce the amount of suitable habitat for juvenile salmon rearing and forage fish spawning. Armoring also affects salmon by reducing prey density, increasing predation and changing migration patterns that cause a decline in growth and lower survival rates.² Shoreline modification also starves the beach of new sediment that is crucial to maintain a healthy and diverse ecosystem.³

Two species of forage fish – sand lance and surf smelt – use the beaches along the edge of the Nisqually Reach Aquatic Reserve as spawning grounds. Surf smelt spawning sites are heavily impacted by shoreline modifications, such as boat ramps, seawalls and culverts. Sand lance spawn on sandy beaches, depositing microscopic eggs in the upper intertidal zone just below the log line.⁴

The Nisqually Salmon Recovery Plan 3-Year Work Plan prioritizes protection and restoration of the nearshore habitat in the Nisqually watershed. The area with the least amount of restoration progress is the Puget Sound nearshore, and modeling continues to indicate that this nearshore habitat is critical to the survival and abundance of fish. This habitat falls outside of the Nisqually watershed/lead entity's designated area, but the Nisqually Work Plan still chose to list specific projects and initiatives in their plan to indicate the great importance of this work in order to recover Nisqually Chinook. The success of this part of their plan is dependent on the success of Puget Sound as a region and of the individual watershed leads that are accountable for this habitat to protect and restore these areas.⁵

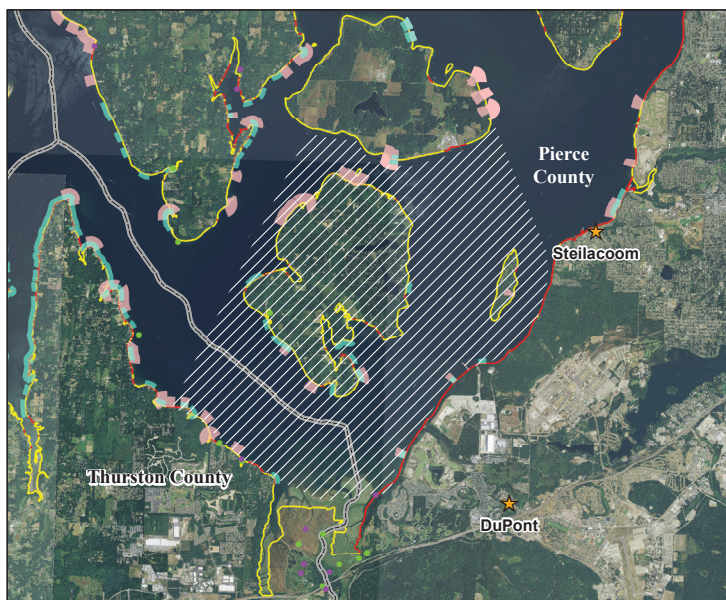
Surf Smelt



Sand Lance



Forage fish are an important food source for salmon.

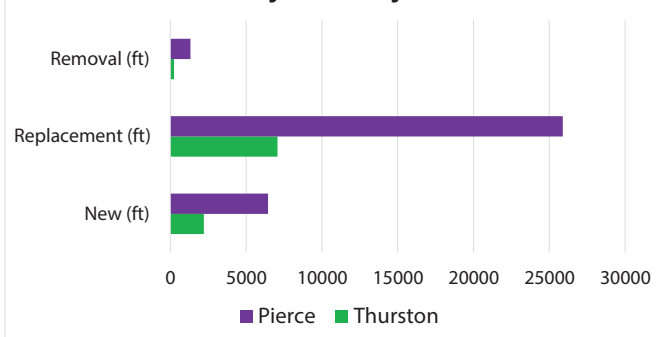


Shoreline Armoring in the Nisqually Watershed



WA Dept. Ecology Coastal Atlas

HPA County Summary 2005-2014



Data Sources: Carman et al. 2015,⁶ HWS 2015,⁷ NAIP 2013,⁸ PSNERP 2008,⁹ WADFW 2015,¹⁰ WADNR,¹¹ WADOT 2010¹²

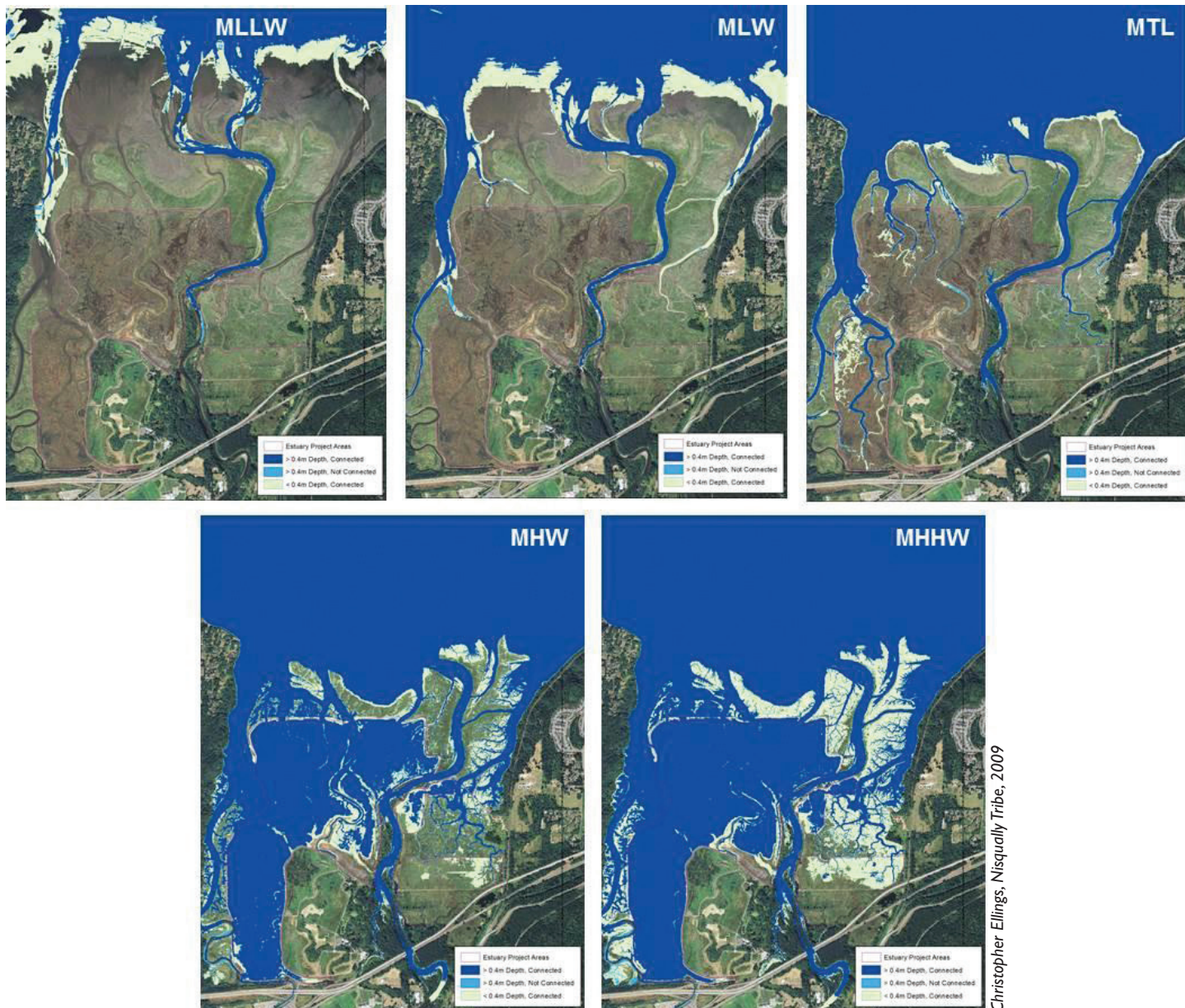
Nisqually Delta Restoration Efforts

The return of tidal inundation to over 750 acres of the U.S. Fish and Wildlife Service Nisqually National Wildlife Refuge (NWR) in fall of 2009 was the crowning moment in the effort to protect and restore the Nisqually delta. The Nisqually NWR project complemented three earlier restoration projects completed by the Nisqually Indian Tribe on tribal property. Over 900 acres of

the estuary has been restored, representing the largest estuary restoration project in the Pacific Northwest and one of the most significant advances to date toward the recovery of Puget Sound. However, it remains uncertain how the delta will respond to this new inundation in light of many altered physical processes (e.g., river flow control, reduced sediment inputs) and the 100-year

history of subsidence and freshwater peat development since initial diking. The Nisqually delta restoration projects were decades and many millions of dollars in the making. Thus, the need for project monitoring and research as the magnitude of the Nisqually delta restoration project makes its potential contribution to restoration science unprecedented in Puget Sound.

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Christopher Ellings, Nisqually Tribe, 2009

Maps show results of habitat connectivity modeling at select water levels as the tides inundate the restored Nisqually delta.

NISQUALLY INDIAN TRIBE

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The cutting-edge research conducted by the Nisqually Indian Tribe, three U.S. Geological Survey partners and others focused on assessing the effectiveness of the delta projects at restoring estuarine processes, habitats and ultimately the capacity of the delta in support of Chinook salmon and other fishes. Restoration effectiveness information from this project will support the implementation of Puget Sound estuary restoration efforts by tribes and others. An additional outcome of the project is the advancement of adaptive management indicators for management of the Nisqually delta by the Nisqually Indian Tribe and Nisqually National Wildlife Refuge.

The Nisqually Fall Chinook stock is one of the 27 stocks in the Puget Sound evolutionarily significant unit listed as threatened under the federal Endangered Species Act.¹ Our efforts have explored some of the process/structure/function linkages presented by the Puget Sound Nearshore Ecosystem Restoration Project (PSNERP)^{2,3} to ultimately determine the success of the Nisqually delta restoration effort. These linkages are: 1) sediment delivery to the delta via the Nisqually River; 2) hydrodynamics affecting sediment transport and estuarine mixing; 3) geomorphic change; 4) vegetation community colonization and succession; 5) insect, benthic and neustonic invertebrate community response; 6) Chinook salmon functional response to process and structure changes as expressed by their distribution and relative abundance, feeding ecology, estuarine and delta residence time and growth, and their life history diversity.

In order to better understand the ecosystem response of their combined efforts in the estuary, the Nisqually Indian Tribe and USFWS Billy Frank Jr. Nisqually National Wildlife Refuge must utilize the results of our monitoring efforts and follow up research to craft a long-term management plan for the delta. Results thus far have generated the following key insights that must be considered:

1. Juvenile Chinook rely heavily on all habitat components of the Nisqually delta and Nisqually reach nearshore for rearing, including the tidally influenced freshwater area around I-5. An area truncated by the I-5 bridge and flood control dikes.

2. Juvenile Chinook respond rapidly and positively to delta restoration, even when the restored site lacks mature estuarine habitat characteristics like salt-marsh vegetation.

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Beach seine pull at the Nisqually delta monitoring site.



Intensively monitored sites in the Nisqually delta.

2009 EPA Tribal Implementation Grant report, Nisqually Tribe

Nisqually Delta Restoration Project

NISQUALLY INDIAN TRIBE

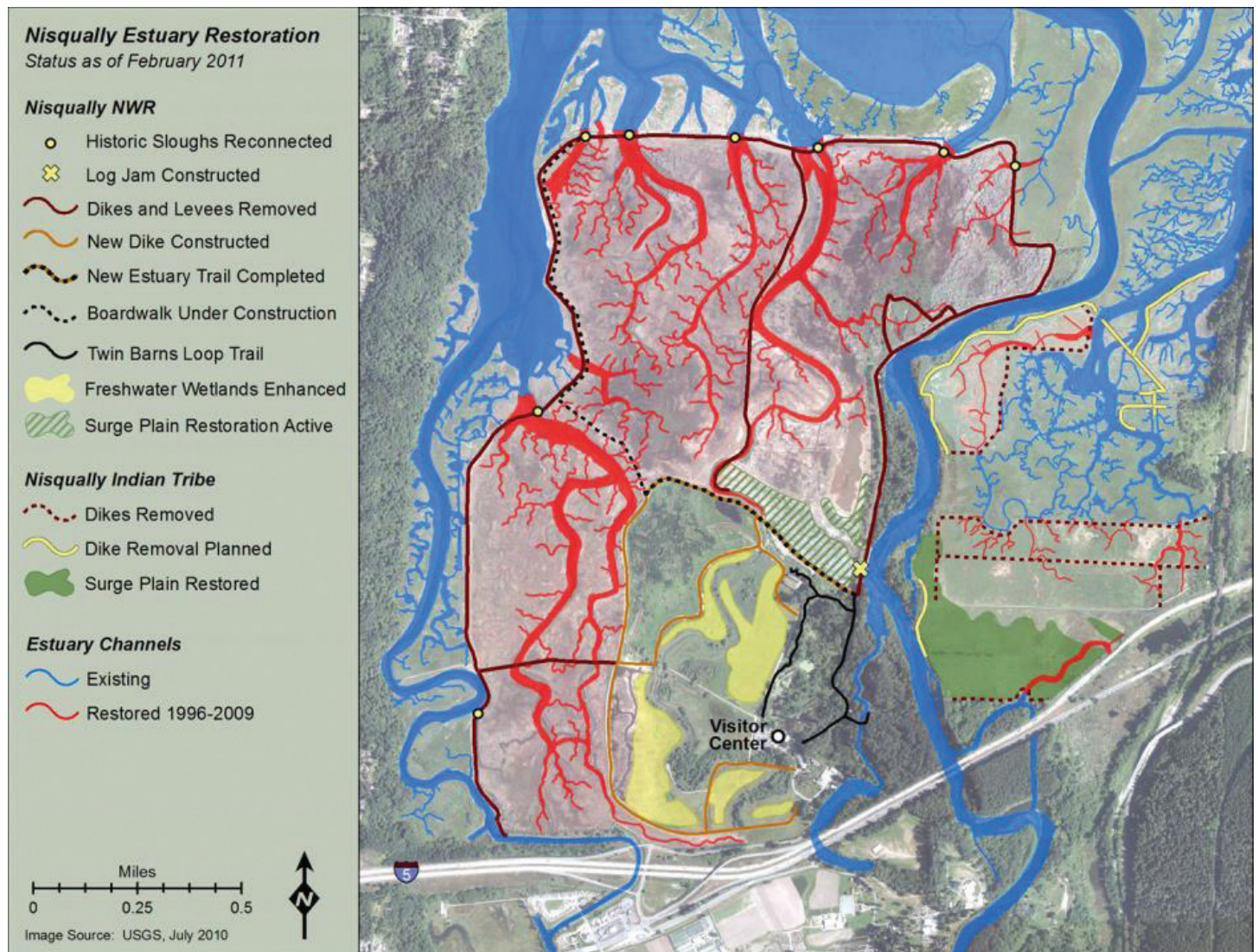
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3. Upstream land use can significantly alter the habitat-forming processes of a delta. In the Nisqually, hydropower operations have dramatically reduced sediment supply to the delta. The near-term habitat development of the restoration area, as well as the long-term viability of the delta is threatened by this constriction. Climate change induced sea level rise will drastically reduce delta structure and function if habitat-forming processes are not restored or enhanced.

4. Upstream flood control, floodplain development, and the I-5 causeway exacerbate the impact of reduced sediment supply caused by hydropower development. Sediment routing to the delta from the Nisqually River relies heavily on tidal forcing via tidal

channels, so much of the riverine sediment is lost offshore. The lack of distributary channels upstream of I-5 impairs the efficient distribution of sediment. Additionally, the I-5 causeway may inhibit the upstream retreat of estuarine habitats as sea level rises.⁴

More resources will be needed for additional studies in order for managers to develop plans for addressing substantial impacts to the habitat-forming processes in the delta. Work to date provides a solid base of information to build upon. Future studies should expand existing hydrodynamic models to included areas upstream of I-5 and use the model to run sediment supply restoration scenarios. Habitat structure and fish utilization information generated during this project can be used to estimate the impact of various scenarios on vegetation, invertebrates and ultimately Chinook salmon.



Success Story of the Nisqually River Council

The Nisqually River watershed has long been recognized for the unique relationships and commitment to collaborative and inclusive decision making. At the center of this effort has been the Nisqually River Council. It has served as the central organizing body for the watershed since its formation in 1987 and is the oldest watershed council west of the Mississippi River. It is a place where ideas are shared, concerns aired, trust is established, and a community is built.

The Nisqually River Council arose from a desire to provide locally based and controlled management of a watershed. At the request of a group of local leaders, including the Nisqually Indian Tribe, the Washington State Legislature created the Nisqually Task Force in 1985. Its mission

was simple – create a management plan for the watershed that was broadly supported by the communities and interests in the watershed. The result was the 1987 Nisqually River Management Plan, which established the Nisqually River Council as its implementing body and a long list of desired outcomes and projects.

The Council has been incredible successful in honoring the commitment of the dedicated citizens that created the management plan in completing well over 80% of the plan elements. Perhaps the most important accomplishment of the Council has been the fostering of a watershed community, instilling a sense of uniqueness, ownership and stewardship throughout the basin. Through its outreach efforts, its Nisqually River Education program, the creation of

the Nisqually Land Trust, and its desire to be inclusive and innovative, the Council has firmly established the Nisqually as the “center of the universe.”

The Council has continued its good work and evolved to address current issues, resulting in a significant update to its guiding document through the Nisqually Watershed Stewardship Plan in 2006. This introspective review produced a plan that is based on the principles of sustainability and expands the Council scope to consider actions and strategies to improve local economies and community health, as well as continue its work in environmental stewardship throughout the entire basin. The Council is poised to continue its mission to create a unique place for future generations.



Nisqually River Council Current Projects¹

- Establishment of the Nisqually Community Forest to protect forestland and salmon habitat, while providing resources for local communities.
- Adapting to climate change through the development of an adaptation plan and a three-year education project.
- Forming the Nisqually River Water Trail to increase non-motorized boat access to the lower Nisqually River.
- Celebrating the five-year monitoring results of the Nisqually Delta Restoration Project through educational tools
- Reducing stormwater runoff and improving water quality through low impact development in Eatonville.
- Placing value on the natural benefits, or ecosystem services, of the Nisqually Watershed by protecting old-growth forests that purify Olympia's drinking water.

Interstate 5 Crossing through the Nisqually Delta

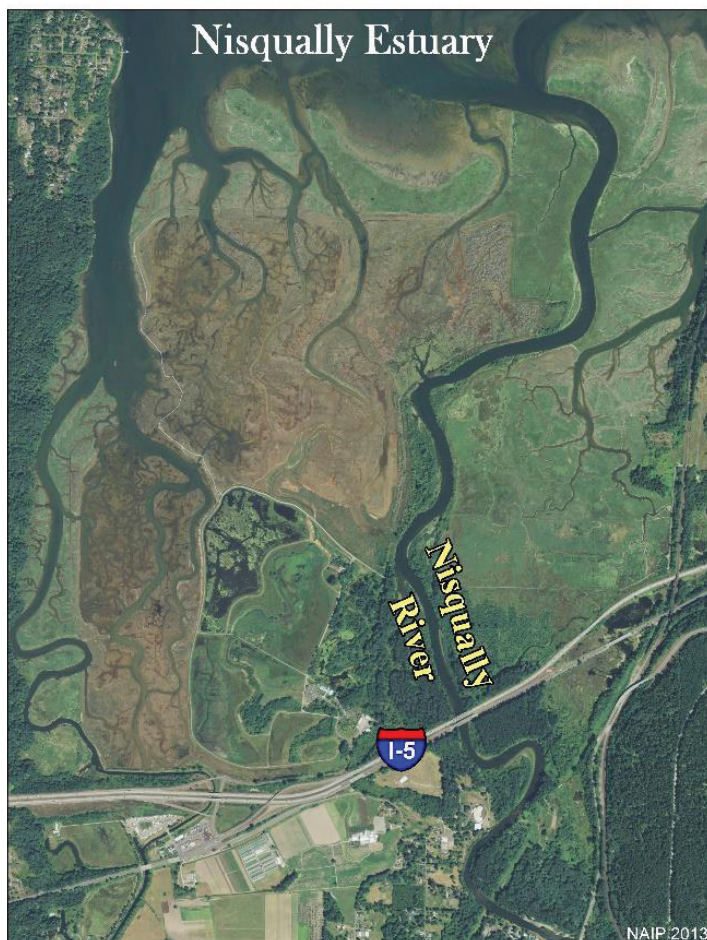
The Nisqually Indian Tribe, in close cooperation with myriad partners, has made significant progress toward the full restoration of the Nisqually Estuary. This work has focused on restoring as much of the historic habitat and associated ecosystem functions as possible. Key to this work has been the cutting-edge research and monitoring work that has revealed much in the way of responses from multiple plant, fish, insect and wildlife species.

This monitoring work is revealing that many of the critical habitat features, physical and chemical, are at significant risk of diminished ecosystem value. Sediment transport, formation and location of various habitat features, vegetation communities and associated biota, and the location and

magnitude of salinity transition zones are all being substantially influenced by two major factors: climate change and the Interstate 5 crossing of the delta.

Climate change is resulting in sea level rise, disruptions of the historic hydrograph, and significant alteration of sediment transport – all of which impact the ability of the estuary to naturally recreate lost habitats and services. The I-5 crossing compounds and magnifies the impacts. The current dike and fill configuration of the highway has disconnected the delta and prevents natural adaptation to sea level changes. It also serves to greatly reduce the flood capacity for the lower valley as well as negatively impact sediment transport to the newly restored estuary.

The Nisqually Indian Tribe has formed a partnership with the Washington State Department of Transportation (WSDOT) to look at design alternatives, cost estimates, permitting issues, and impacts on transportation associated with moving to a less impactful crossing of I-5 through the delta. Possibilities being considered range from creating an elevated causeway across the entire crossing to strategically placed elevated structures potentially phased over time. The commitment from WSDOT is to work closely with the Tribe and come to agreement on an approach to solve our mutual concerns in the summer of 2016, then continue the partnership in securing funds for implementation.



Nisqually River I-5 Crossing.



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Population Growth Increases Demand for Wells

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