AeLsidef (Quilceda) WATERSHED

For thousands of years the Snohomish people living near what is now the Tulalip Reservation have benefited from the plentiful resources of the AeLsidef watershed. It is one of only two distinct watersheds within the bounds of the reservation and at one time supplied habitat for four different salmon species important to the people of Tulalip. It's tidally influenced lower reach makes ideal habitat for smolting salmon as they begin the process of preparing for their long journey in the offshore environments. It plays an important role in upstream migration habitat for chum and coho salmon to reach upstream spawning ground in coho creek and the east, west, and middle fork of AeLsidef creek. As recent as 1999 coho spawning numbers reached several hundred fish per mile in the Middle Fork Quilceda Creek (Nelson, 1996)

AeLsidef is very culturally and historically significant for the Tulalip people. Several longhouses were located within the watershed, near the mouth of this creek as well as near Sturgeon Creek. Because of the importance of salmon availability to traditional lifestyles AeLsidef played an important role in the everyday lives of Snohomish people for thousands of years. Its value as a place of giving to our people cannot be overstated. It has been a part of our landscape, our people, our history, and our culture since time immemorial and will continue to be until the end of time.

QUILCEDA WATERSHED

The Marysville Trough area of the Reservation is distinguished from the central core of the Reservation by its geologic origins as a glacial outwash plain located between the Tulalip Plateau and Getchell Plateau. Sandy outwash sediments within the Trough act as a large sand bathtub that fills and drains rapidly in response to precipitation and runoff originating from the Getchell and Tulalip Plateaus. The nearly flat topography throughout the Trough area of the reservation contributes to its unique characteristics with near surface water tables, and with wetlands found in depressional areas . Near the east-facing slopes of the Tulalip plateau, and located generally along a north-south corridor with Rainwater Road (19th Ave NE), large wetland areas are fed by seeps, springs and streams draining from the hardpan subsoils of the Tulalip plateau. Several documents characterize the Quilceda watershed, starting with the Quilceda-Allen Watershed Plan (Snohomish County, 1995), including the 1996 Tulalip Watershed Plan (Tulalip Tribes, 1996), and the Quilceda Creek Drainage Needs Assessment in 2002(Snohomish County, 2002). The Trough flashy Custer soils, near surface groundwater, and aging stormwater infrastructure make it sensitive to predicted climate changes.

CLIMATE RISKS

INCREASED WINTER AND SPRING PRECIPITATION

While total precipitation is not projected to change significantly and has not shown any increased annual trend, rainfall intensity or 24 hour precipitation totals of the wettest days, are predicted to increase by 10-15% by 2050, and up to 22% by 2080 (Mauger, G.S. et al, 2015). With predicted heavier and more frequent winter rainfall and increased rain, the expected future conditions for Tulalip Reservation lands within the Quilceda watershed are more near surface water tables for longer duration. Current water table monitoring within the Lower Quilceda watersheds of Sturgeon and Coho

Creeks indicate that, in high rainfall weeks and months, water tables are at or near the surface for large areas, including upland areas.

Within the Quilceda watershed, hydrologic analyses and monitoring have indicated a direct relationship of groundwater to streamflow and stormwater flows (Marti, 1996). The WA Department of Ecology found that groundwater accounted for 46-60% of streamflow during times when surface water was absent. Streamflow recharge from precipitation was found to be greatest in the northern portion of the Quilceda watershed, and groundwater recharge greatest in the southern portion of the watershed. With increased rainfall with spring storms, groundwater levels will increase and it is therefore predictable that streamflow will be elevated. These data suggest that there is little room for this system to accommodate more water, so increased rainfall will result in more frequent flooding.

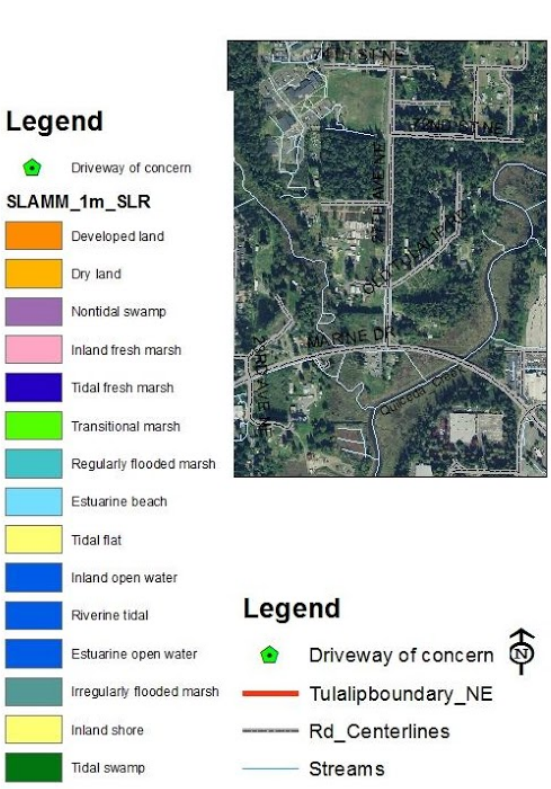
Nevertheless, as noted above, rain is expected to arrive in more intense storms with more runoff. Predictions indicate 5-15% increase in Snohomish basin peak streamflow by 2040 (Mauger et al, 2015). Floods that are now expected to occur an average of once every 100 years will come more frequently. Within recent higher rainfall years, flooding in the vicinity of 116th St, north of Quil Ceda Village have affected roads, properties and homes in the area. A legacy of ditching stream and wetlands in upstream areas and inadequate stormwater has pushed increasing amounts of stormwater downstream to areas already at capacity during much of the wet season. Inadequate stormwater infrastructure throughout the watershed creates a problematic combination on the Reservation when rainfall is high and groundwater rises sharply.

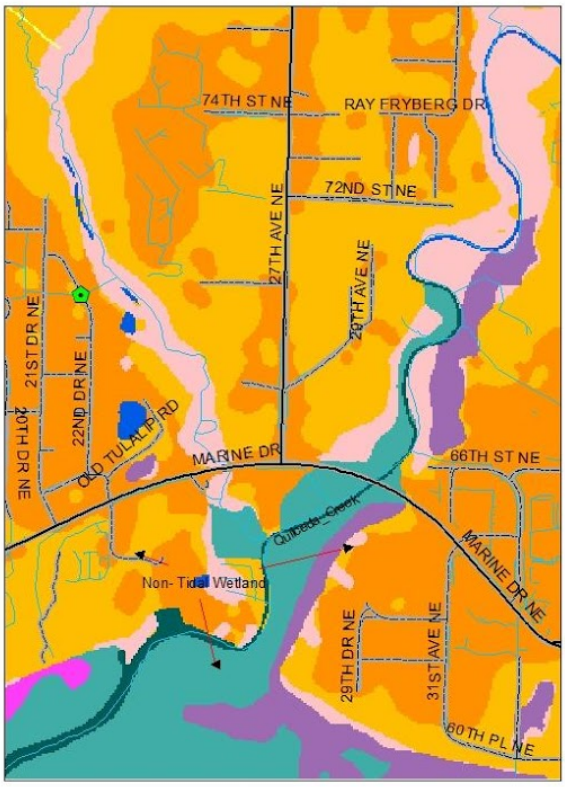
Fig X. January 2013 Flooding on Quilceda Boulevard after above normal rainfall.

TIDAL EFFECTS

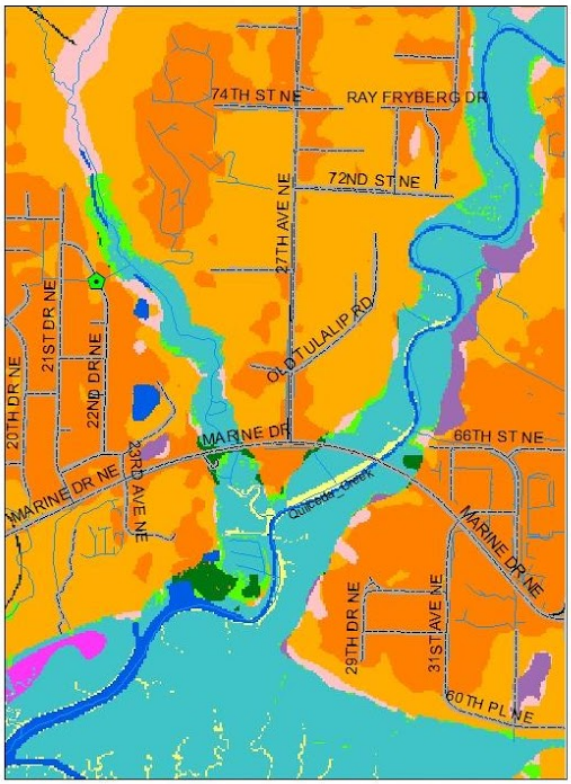
Both Coho Creek and Sturgeon Creek currently experience tidal influence in the lowest stream reaches above their confluence with Quilceda Creek, approximately a quarter mile of their length. These tidal areas are located where the stream is incised and do not affect groundwater tables further upstream, in Quil Ceda village or along 27th Ave. Sea level rise scenarios conducted by (Georgian et al, 2016) indicate tidal influence will extend to nearly 88th St NE on Coho Creek and 70th St NE on Sturgeon Creek by 2040 to 2080, two to three times further upstream than the current tidal reach. For the main stem Quilceda Creek, tidal influence will cross northeast of I-5.

It can be expected that during winter and spring storms, this higher tidal flood will "back up" outflows during stormwater events creating higher groundwater, and more severe flooding during the high tide fluctuation, twice a day. This could dramatically increase flooding conditions during increasingly more intense storm events. Some hydrologic analysis is needed to model potential tidal effects, culvert and ditch capacities, to ascertain what kind of events will be catastrophic, or whether there are management and infrastructure changes needed to prevent damage and emergencies. Several key culverts in the watershed need to be further assessed utilizing the sea level rise scenarios and tidal influence zones to determine needed capacity when taking into account increased rainfall and tidal "push" against the flow of the creeks. Modelling is also needed for storm surge effects added to tidal zone of influence changes.

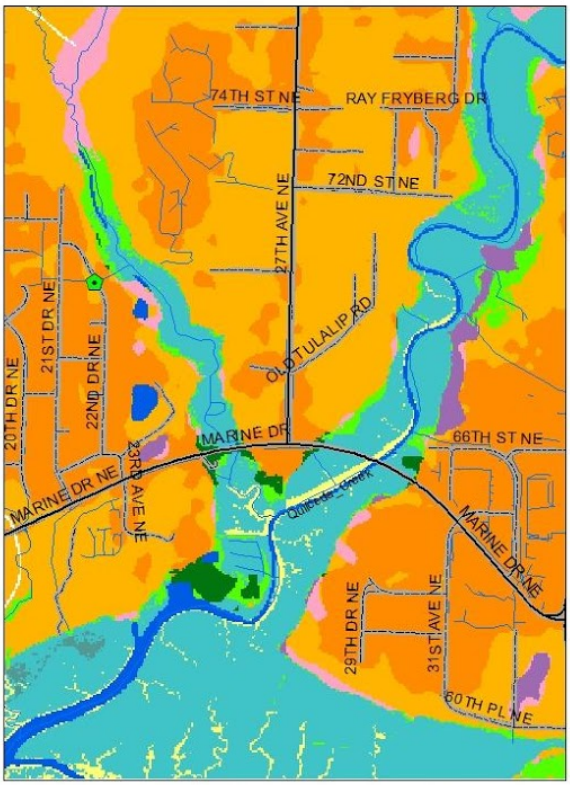




Current Tidal Reach- Sturgeon Creek



Tidal Reach - 1.5 FT Sea Level Rise



Tidal Reach - 3.0 FT Sea Level Rise

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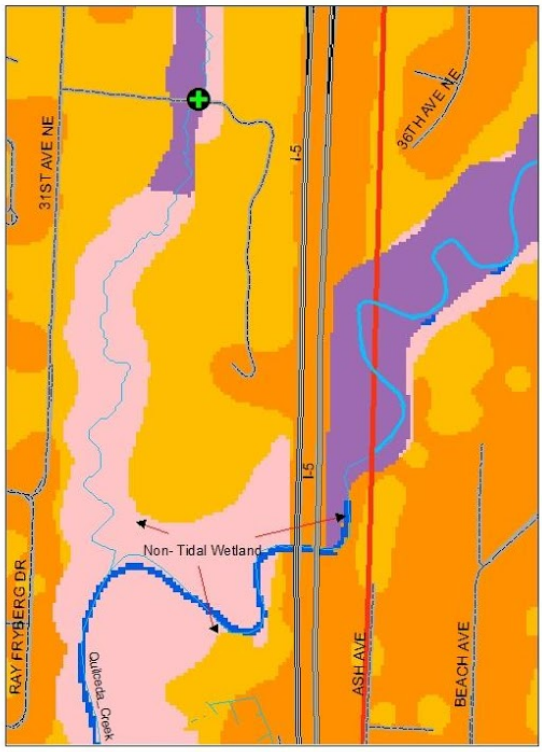
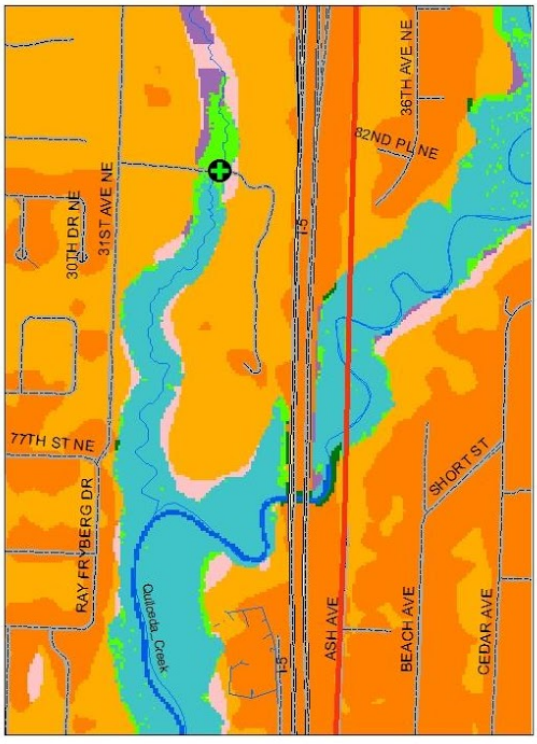
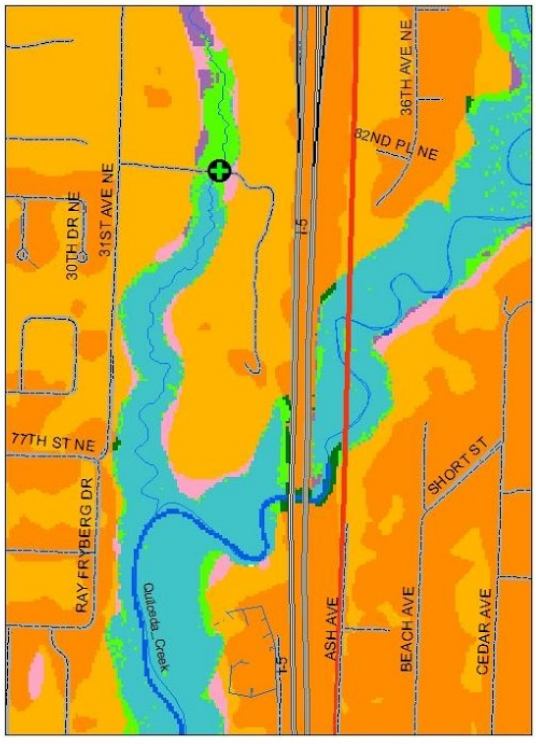
Figure 1. Tidal reach on Quilceda Creek and Sturgeon Creek, showing change in estuarine and riverine habitat types.



Quilceda Creek Tidal Zone of Influence- Current



Quilceda Creek Tidal Reach- 1.5 FT Sea Level Rise



Quilceda Creek Tidal Reach- 1.5 FT Sea Level Rise

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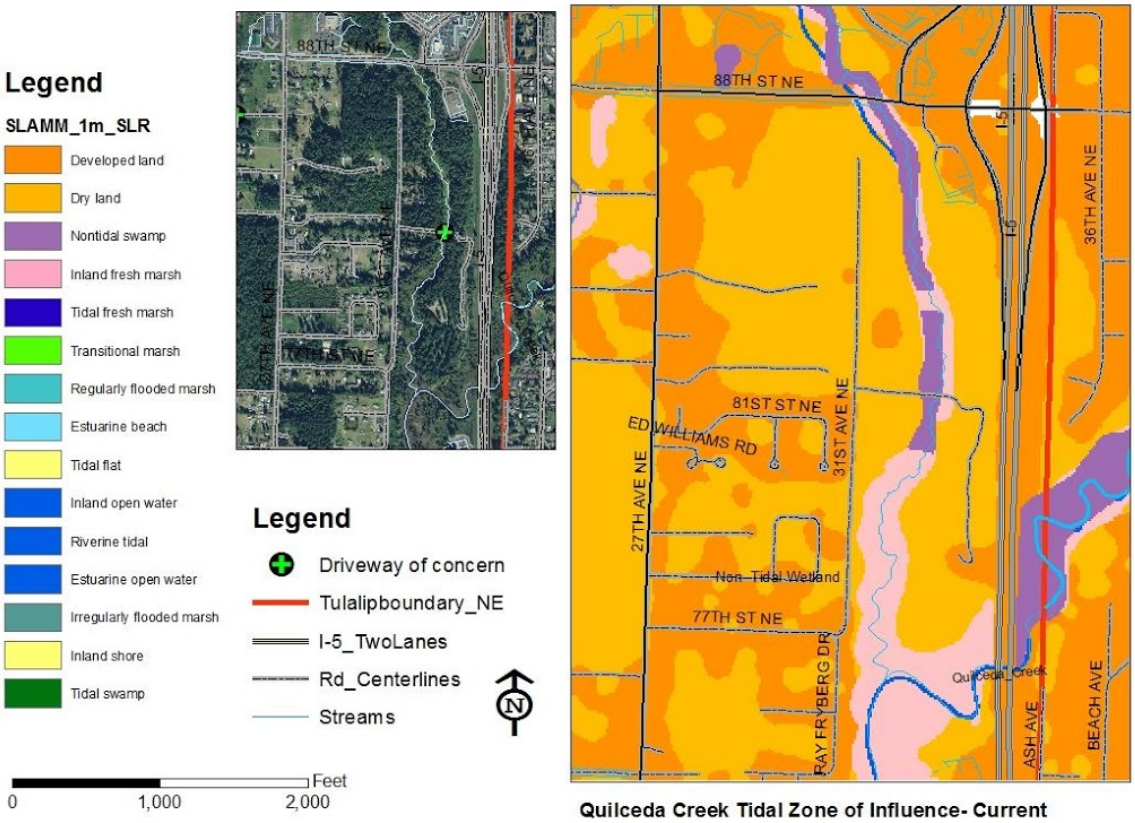
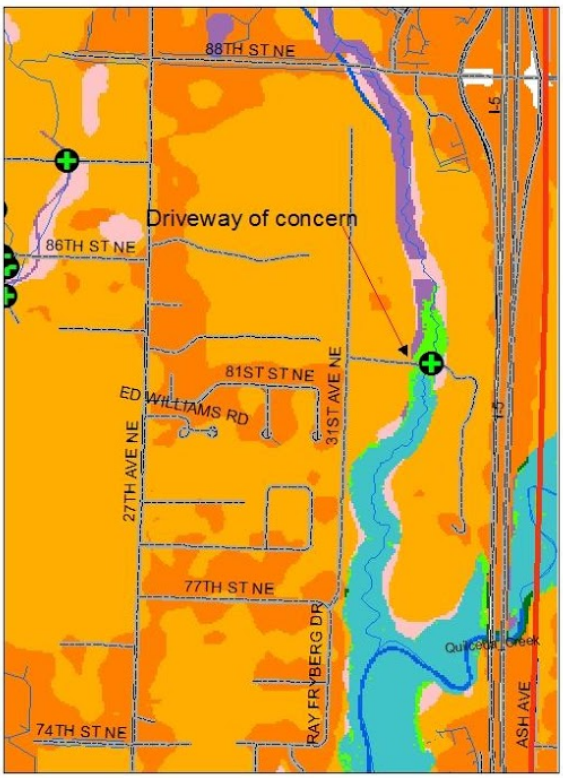
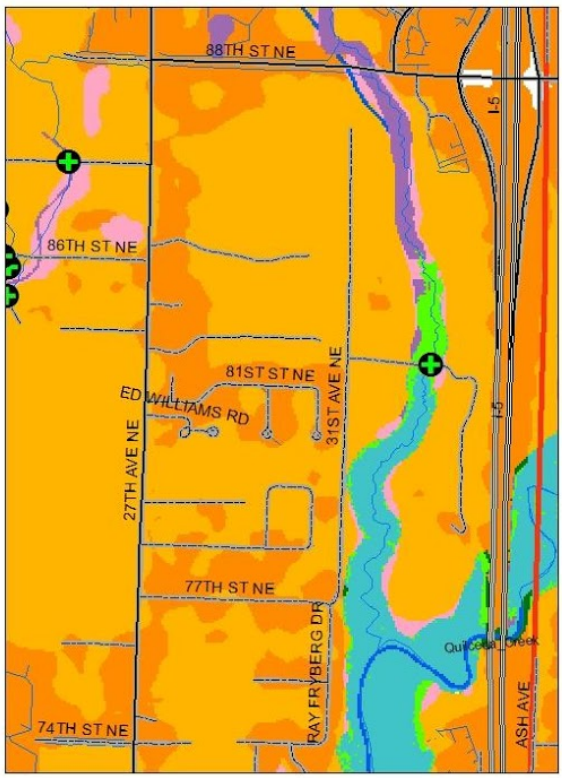
Figure 2. Tidal reach on Quilceda Creek and Coho Creek, showing the migration inland of tidal "flooding".



Quilceda Creek Tidal Zone of Influence- Current



Quilceda Creek Tidal Reach- 1.5 FT Sea Level Rise



Quilceda Creek Tidal Reach- 1.5 FT Sea Level Rise

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Figure 3. Tidal reach on Coho Creek, showing the migration inland of tidal "flooding".

STREAM SPECIFIC GROUNDWATER AND FLOOD RISKS

WEST FORK QUILCEDA

Under current conditions, flooding of roads and properties in the West Fork Quilceda subbasin have been shown in higher rainfall years to have increased dramatically. Areas within the vicinity of 19th Ave NE, near the toe of the Tulalip plateau, can flood regularly in the spring. With expected double digit increases in peak flow storm events by 2040, it is expected this will become an even more common occurrence leading to lost travel times and property damage.

Snohomish County evaluated and inventoried flooding problems in the Quilceda Creek Drainage Needs Assessment in 2001-2002. The West Fork Quilceda watershed, which has its headwaters on the east facing slopes of the Tulalip plateau, historically contained extensive wetlands which were farmed within the past 100 years. Water was managed with a system of ditches installed to drain fields, lower water tables, and relocate channels. Currently the primary drainage infrastructure in the subwatershed consists of an extensive system of stream channels and drainage ditches along fields and roads. Most of the flooding problems were identified as resulting from undersized culverts which also restrict salmon passage. Because the Marysville trough is so flat, the undersized culverts can create widespread ponding over roads and fields during flood events. A total of 41 sites with flooding problems were identified in the West Fork Quilceda subbasin, equal to the number in all of the remaining subbasins of the Quilceda watershed. Nearly all of the problems were related to inadequately sized culverts, causing road and driveway flooding, and adjacent property flooding in some cases. (Snohomish County, 2002). Solutions for upsizing culverts proposed in the plan also recognized the need to establish adequate stormwater detention to prevent shifting flooding further downstream. It is well understood that simply increasing conveyances can increase runoff and exacerbate flooding further down channel. A list of problem culverts and needed solutions provided in the plan established the need for companion stormwater detention projects. While some of these projects have been completed, they were not implemented with climate change variables and flow rates integrated in hydrologic calculations. An assessment of ditches and culverts with inadequate capacity should be made, integrating potential rainfall increases to identify projects for a twenty year projection window.

COHO CREEK

In 1996, the Tulalip Tribes Environment Department prepared a Tulalip Watershed Management Plan, within which it evaluated potential future development scenarios for the Coho Creek basin (Tulalip Tribes, 1996). A stormwater runoff simulation model predicted increases in the 2 year, 24-hr design storm runoff rate of between 320 – 1900 % without detention, and from 270-1460% in a BMP scenario. The estimated discharge to Quilceda Creek increased by 430% under a BMP scenario. The data clearly indicated that stormwater management issues are essential to be addressed in the Coho Creek (and Sturgeon Creek) basin(s) as development occurs. It will be important to update these analyses with tidal influence and increased rainfall prediction scenarios to guide future development infrastructure planning. Due to the very flat nature of the ground, detention will be difficult to achieve and alternative stormwater methodologies will need to be utilized.

Quil Ceda Village updated the Quilceda Allen watershed plan for its In Lieu Fee program in 2013, compiling information from the original plan, the Drainage Needs Report and the Tulalip Watershed plan of 1996. A team of watershed scientists and practitioners working in the watershed confirmed

restoration priorities and problems in the watershed. The Compensation Planning Framework, a watershed approach to mitigation, recognized that preserving wetlands where possible was key to reducing stormwater peak flows within the basin, and restoring streams and wetlands were seen as key to mitigating current drainage issues in the subwatershed, as well as addressing salmon passage problems.

STURGEON CREEK

Sturgeon Creek headwaters were historically located within the current boundaries of Quil Ceda Village, in what was formerly the Boeing lease site. Large wetlands exceeding 50 acres are located at the toe of the Tulalip plateau with ponded conditions greater than 0.5 feet during spring time. Several culverts on private driveways could be affected during peak flow events with greater frequency. The Sturgeon Creek subwatershed is not expected to have significant development, but properties along 19th Ave NE could experience near surface groundwater tables and flooding, affecting septic systems and roadways.

TULALIP RESPONSE – ADAPTATION STRATEGY

In 1996, The Tulalip Watershed plan evaluated future development planned within Quil Ceda Village Coho and Sturgeon Creek watersheds, and reported results of hydrologic analysis of the basin considering various development scenarios. The analysis indicated increases of up to 1000% in stormwater runoff should the 1500 or so acres at Quil Ceda Village be developed with impervious surfaces. For that reason, alternative stormwater solutions, green building and low intensity development strategies have been considered necessary for the future development within Quil Ceda Village.

As housing for Tribal members is developed within the West Fork Quilceda, it will be important for adequate stormwater detention and culvert sizing to be addressed. Drainage improvements are needed that consider future rainfall scenarios, updating the Drainage Needs Report and other studies that have been conducted in the area.

Climate change solutions will reduce future tribal emergency and infrastructure and capital costs, as well as costs to individual tribal members due to stormwater impacts. A list of solutions to climate change scenarios in the Quilceda Watershed include many of the restoration priorities proposed in the Compensation Planning Framework for the In Lieu Fee program:

- Green building, low intensity development, alternative stormwater solutions.
- Restoring and maintaining existing wetlands.
- Include climate change rainfall scenarios in drainage analyses for new commercial and residential development.
- Reduce impervious surfaces, and restore stream channels and drainage systems.
- Restore fish passage as drainage improvements are addressed.

FURTHER INFORMATION NEEDS

- Tidal flood reach analysis at a finer scale for Sturgeon, Coho and Quilceda Creek.
- Hydrologic analysis for Quil Ceda Village incorporating tidal push impacts on stormwater scenarios. Identification of road and culvert flooding risk areas.

FUNDING NEEDS

- Funding is needed to update all of the above studies to evaluate them for current climate change predictions.
- Funding to conduct further climate change analysis.
- Potential funding for culvert, road upgrades, additional green infrastructure, as well as wetland and stream channel restoration to meet future scenarios.

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