



SAN JUAN
COUNTY
WASHINGTON

San Juan County

Climate Vulnerability Assessment

2025





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San Juan County Staff

Angela Broderick, Project Co-Lead

Kendra Smith, Project Co-lead

Climate Policy Working Group

Greg Sawyer

John Roach

Erin Andrews

Brandon Andrews

Brendan Cowan

Sophia Cassam

Colin Huntemer

Jane Fuller

Mackenzie Sims

Lincoln Bormann

Kyle Dodd

Climate and Sustainability Advisory Committee

Jay Kimball, Chair

Chris Greacen, Vice Chair

Janet Alderton

Vincent Dauciunas

Grant Carlton

Adrian Kilpatrick

Barbara Marret

Michael Shanks

Kendra Smith

Matilda Twigg

Jerry Whitfield

Partners

OPALCO

Town of Friday Harbor

Consultant Team

Jenna Decker Sherry, Cascadia Consulting Group

Sebastian Espinosa, Cascadia Consulting Group

Meg Horst, Cascadia Consulting Group

Taylor Magee, Cascadia Consulting Group

Mary Ann Rozance, Cascadia Consulting Group



Executive Summary

San Juan County is including a Climate Element (CE) in their 2025 Comprehensive Plan update while simultaneously developing a Climate Action Plan (CAP) to both reduce greenhouse gas (GHG) emissions and prepare for and respond to climate change impacts. As a baseline step in this process, the County has completed a 2024 Climate Vulnerability Assessment (CVA). The CVA was prepared in compliance with the Washington State Department of Commerce [Climate Element Planning Guidance](#). The CVA was developed using a literature and document review along with two listening sessions; the first with County and key partners and the second was offered community-wide to identify climate risks and resilience opportunities from broad perspectives.

Climate Impacts

San Juan County faces escalating risks from climate change. Historical trends indicate a 1.3°F temperature increase since 1895, with projections of an additional 8.9°F rise by 2090 under the high-emission RCP8.5 scenario. Key climate impacts include more frequent and severe heatwaves, decreased summer precipitation, heightened drought and increased wildfire risks. Winter rainfall is expected to intensify, increasing the likelihood of landslides and erosion. Rising sea levels (up to 4.8 feet by 2100) threaten coastal areas with inundation, erosion, and saltwater intrusion.

Key impacts and projections, detailed in subsequent sections, are summarized below and are under the Representation Concentration Pathway 8.5 (RCP8.5) Scenario:

- **Extreme Heat:** San Juan County has warmed approximately 1.3°F from 1895 to 2024, and projected average daily maximum temperatures are expected to increase 8.9°F by 2090 (Abatzoglou and Brown 2012).
- **Heavier Winter Precipitation:** Winter precipitation is expected to increase 7% by 2050 and 10.4% by 2080 (Nijssen, et al. 2017).
- **Coastal Impacts:** Relative sea levels along the islands are projected to rise significantly, with estimates ranging from 2.0 to 4.8 feet by 2100 (Miller 2018).
- **Drought:** A 10% decrease in summer precipitation will lead to elevated levels of drought and reduced groundwater recharge (Salathé, et al. 2010).

Assessing Vulnerability

The CVA evaluates the susceptibility of San Juan County's systems and communities to climate change by examining exposure, sensitivity, and adaptive capacity. *Exposure* refers to the extent a system encounters climate hazards, *sensitivity* assesses the system's likelihood of being



affected, and *adaptive capacity* reflects the system's ability to cope with or adjust to climate impacts.

Key Takeaways:

The CVA focuses on three primary areas: buildings and energy, water resources, and transportation. These categories guide the identification of vulnerabilities and inform strategies for resilience. Key findings for each include:

Buildings & Energy

- San Juan County's buildings and critical infrastructure, including homes, fire stations, healthcare facilities, and marinas, face significant risks from climate change impacts such as sea level rise, coastal erosion, wildfires, and severe storms. While adaptive capacity remains low, opportunities exist to mitigate risks through strategic siting of new development and enhanced fire protections.
- The County relies on energy from mainland Washington but is taking steps toward local resilience with OPALCO managing underground lines and renewable energy initiatives. Challenges include barriers to large-scale renewable projects and growing demand for electricity, but community engagement and policy support can help address vulnerabilities in energy production, demand, and delivery.

Water Resources

- San Juan County's stormwater systems in low lying coastal areas will be impacted by sea level rise and flooding. Wastewater systems, especially aging septic systems, are at high risk of inundation and failure, with some ongoing efforts to improve infrastructure inspection and maintenance.
- The County's water supply and quality are vulnerable to climate change impacts, including drought, which threatens aquifer recharge and system reliability. Costly water supply alternatives highlight the need for greater focus on building water resilience to secure sustainable resources for the future.

Transportation

- San Juan County's transportation network is highly vulnerable to climate change impacts, including sea level rise, coastal flooding, and storm surges, which threaten highways, roads, and ferry terminals. These risks could disrupt essential connectivity for goods, healthcare, and emergency response. While efforts are underway to identify alternative routes, challenges such as private land ownership limit siting alternative routes.
- Active transportation options are limited and face challenges to route expansion. Public transit is constrained by minimal service and ferry delays during severe storms,



highlighting the need for enhanced mobility solutions to strengthen community resilience.

Next Steps

The results of the CVA will be used to develop policies for the County's CAP and CE for the Comprehensive Plan update.



Introduction

San Juan County, like the broader Puget Sound region, is already experiencing the effects of climate change, including rising temperatures, more frequent extreme heat events, prolonged wildfire smoke episodes, extreme precipitation, and sea level rise. These impacts are projected to intensify, with their severity depending on efforts to reduce GHG emissions and the ability for the County to adapt to the projected impacts.

Climate change and associated hazards will impact San Juan County in different ways—such as stressing infrastructure systems, affecting community wellbeing and resiliency, and transforming local ecosystems and habitats. The burden of these impacts will be unevenly experienced across the county. Areas with fewer community services, transportation options, aging infrastructure, and more exposures to climate impacts, are more likely to be more vulnerable to climate-related extreme events. Many systems are inherently connected so impacts to one system will often have cascading impacts to broader services, assets, and community wellbeing.

San Juan County is preparing a CE as part of its 2025 Comprehensive Plan update and is developing a CAP to help implement the goals and policies developed through that process. This work will comply with WA State HB1181 requirements and the Department of Commerce grant which is funding the effort. The new CE of the Comprehensive Plan will further establish the policy framework for climate resilience based on local findings and public input. The supporting CAP will outline the strategies for implementing local climate action and investment in resiliency. As part of this effort, the County is developing a CVA.



Approach and Methodology

This CVA provides an assessment of the key climate risks and hazards in San Juan County, utilizing local, regional, and federal climate assessments and plans as well as additional resources. See Appendix A: Reviewed and Synthesized Documents.

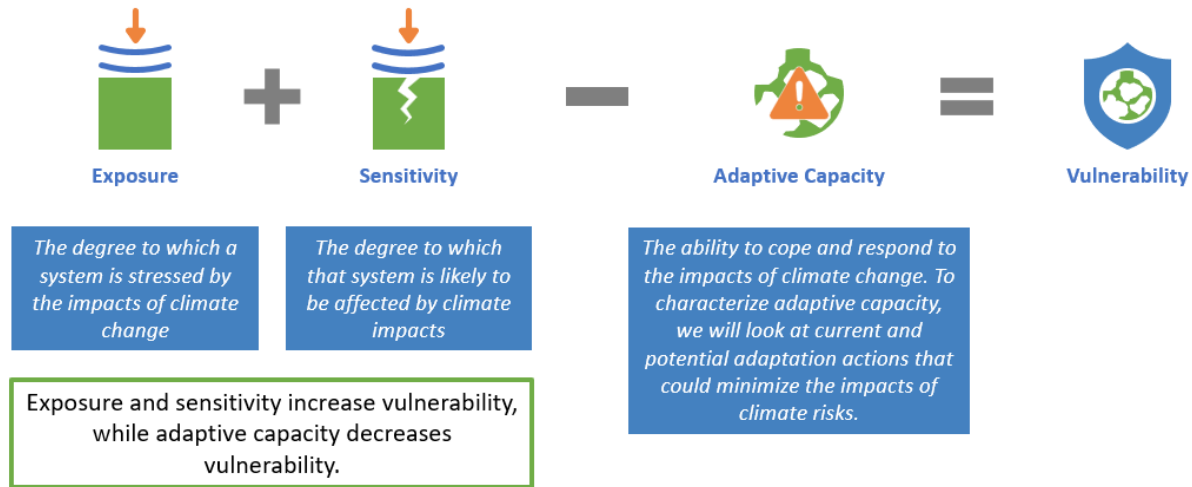
Climate Vulnerability Framework

Climate vulnerability is the degree to which a system or community could be harmed from climate change stressors. This is thought of as the sum of exposure to climate change impacts and the sensitivity of people, infrastructure, and environment to those impacts, minus the ability to adapt or be resilient to those impacts (Figure 1). This assessment uses the following definitions of climate exposure, sensitivity, and adaptive capacity to better understand climate vulnerabilities for this CVA:

- **Exposure** is the degree to which a system is exposed to climate hazards. For example, low elevation coastal areas are more exposed to sea level rise and coastal flooding compared to higher elevation inland areas.
- **Sensitivity** is the degree to which that system is likely to be affected by climate change. For example, older adults are less able to regulate their body temperatures and are often more physically sensitive to extreme heat than younger people.
- **Adaptive capacity** is the ability to moderate the damage of, cope with, or adjust to climate change. For example, access to a vehicle and health insurance increases people's ability to manage health impacts from extreme heat, smoke, and any injuries related to climate hazards.

Figure 1. Climate vulnerability framework.

Climate risks are the range of potential impacts a system would be affected by climate change and are dependent on exposure and sensitivity.



We used a combination of desktop research and two listening sessions, one with County staff and key partners and the second community-wide, to evaluate climate risk across three focus areas that address information needs for developing the Climate Element (Table 1).

Table 1. CVA focus areas and sub areas.

Focus Area	Sub Areas
Buildings & Energy	- Buildings and critical infrastructure - Energy assets, demand, and delivery
Water Resources/Water Supply	- Stormwater - Wastewater - Water supply & quality
Transportation/Mobility	- Highways & roads - Active transportation - Public transit systems

SCORING MATRIX

Each sub-sector within the three focus areas received a vulnerability ranking based on a scale that assesses climate risk, adaptive capacity, and an overall vulnerability score. This scale provides a general understanding of the county's vulnerability to climate change impacts, ranging from low to high vulnerability levels (Table 2 and

Table 3). For example, a "high vulnerability" designation indicates a high level of risk, sensitivity, and adaptive capacity within a sub-sector. These rankings are qualitatively assessed and meant



to be informative for prioritizing climate resilience policies and efforts. These rankings only look at the focus areas within this assessment and may not encapsulate some of the nuances of climate vulnerability across San Juan County.

Table 2. Climate risk (exposure + sensitivity) scoring framework.

Low	Moderate	High
Low exposure and sensitivity to climate impacts.	Moderate exposure and sensitivity to climate impacts.	High exposure and sensitivity to climate impacts.

Table 3. Adaptive capacity (what the County is doing and has the capacity to accomplish) scoring framework.

Low	Moderate	High
The sector is plan- and resource-poor or there is little redundancy. The County may have a plan and some staff, but limited resources within the sector.	Plans and resources are in place that address climate issues but may not account for future climate trajectories. There is staff capacity and resources available to address the climate impacts coming to the sector.	Robust plans in place with staffing and resources for implementation. Actions are being taken to address the issue and those actions are already having an impact.



Climate Impacts Trends

This climate impacts summary discusses historical trends and future climate projections to provide a foundational understanding of how future changes in the climate and associated hazards will affect San Juan County. San Juan County is expected to face the following impacts:

- **Extreme heat:** Higher annual average temperatures, with especially high temperature increases during the summer months. San Juan County has warmed approximately 1.3°F from 1895 to 2024 and projected average daily maximum temperatures are expected to increase 8.9°F by 2090 (Abatzoglou and Brown 2012).
- **Heavy winter rainfall:** Winter precipitation is projected to increase in frequency and intensity. These changes could lead to an increased risk of landslides and erosion. Winter precipitation is expected to increase 7% by 2050 and 10.4% by 2080 (Nijssen, et al. 2017).
- **Drought:** Projected decreases in summer precipitation could exacerbate drought, alter groundwater recharge, and increase the likelihood of wildfires and wildfire smoke. Summer rainfall is projected to decrease 13% by 2050 and 16% by 2080 that can lead to elevated levels of drought and less groundwater recharge (Nijssen, et al. 2017). The county is projected to see an increase of 21 high fire danger days by 2050, increasing the public's exposure risk to wildfire smoke (Abatzoglou and Brown 2012).
- **Coastal impacts:** Sea level rise and more intense storm surge events resulting in flooding, increased erosion, and saltwater intrusion. Relative sea levels along the islands are projected to rise significantly, with estimates ranging from 2.0 to 4.8 feet by 2100 (Miller 2018).

Climate Variability

The climate in the Puget Sound region, including San Juan County, is influenced by natural variability such as the El Niño, La Niña, and Pacific Decadal Oscillation which are long term variations in the sea surface temperature. These cycles can significantly impact the county's climate on a yearly basis. For instance, during an El Niño year, the region tends to experience warmer and drier winters, while in a La Niña year, winters are typically cooler and wetter.

It's crucial to consider human-caused climate change within the broader framework of natural variability. Year-to-year weather patterns can be unpredictable, influenced by both natural variability and human activities. However, despite these natural fluctuations, there are clear trends showing that the climate in the region is changing significantly in specific ways, including increased temperatures, changes to precipitation patterns, and sea level rise.

Climate Scenarios and Models

This CVA relies on climate change scenarios known as Representative Concentration Pathways (RCPs), which depict a range of GHG concentration trajectories. RCPs cover a broad spectrum of potential futures, influenced by factors such as land use, technological advancements, economic activities, energy sources, and other human activities. For this assessment, we utilize the RCP8.5 scenario (“business-as-usual”). This scenario represents a high-emissions trajectory, closely aligning with historical trends in GHG emissions. By using RCP8.5, we ensure that informed adaptation policies are robust enough to prepare for the severe potential impacts of climate change. This approach will help the County to effectively protect its communities, infrastructure, and natural resources against the most extreme climate risks.

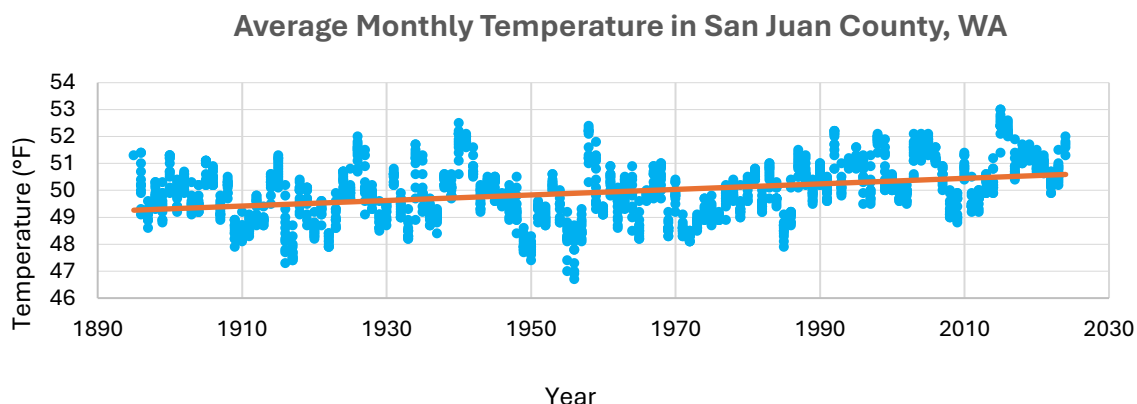
Climate Trends and Projections

The sections below provide an overview of historical climate trends and future projections.

TEMPERATURE

San Juan County's average annual temperature has increased by about 1.3°F between 1895 and 2024 (Figure 2; NOAA, National Centers for Environmental Information). The maximum August temperature, which indicates potential summer heat stress, has risen from 71.3°F in 1895 to 75.2°F in 2023 (NOAA, National Centers for Environmental Information). While year-to-year temperature variability exists, much of it is influenced by natural climate cycles such as El Niño-Southern Oscillation (ENSO) and Pacific Decadal Oscillation (PDO).

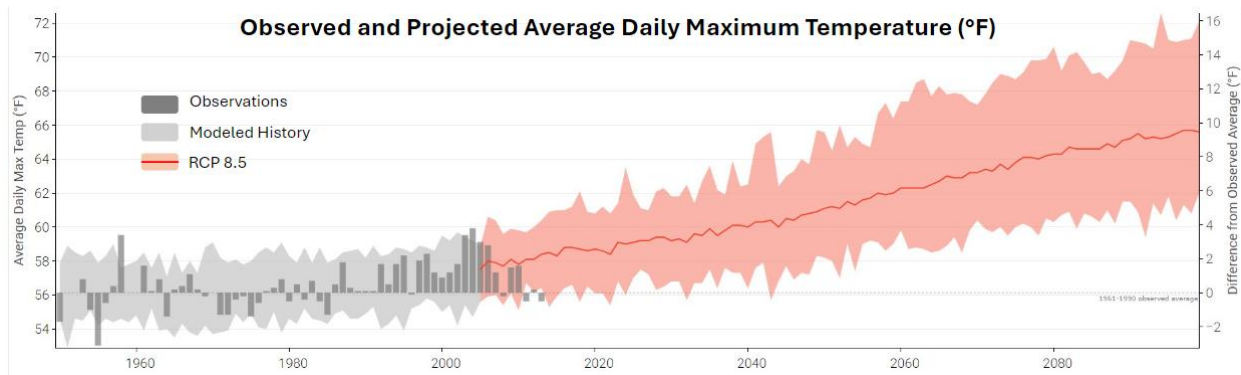
Figure 2. Average monthly temperature between 1899-2024 in San Juan County, WA. Data from NOAA's National Centers for Environmental Information. Graph created by Cascadia Consulting Group. Accessed 20 June 2024.



Relative to the 1952-2004 baseline, the average daily maximum temperature in San Juan County is projected to rise by an additional 8.5°F by 2099 under the RCP8.5 scenario (Figure 3; (U.S. Climate Resilience Toolkit Climate Explorer 2023)). This warming trend is expected to result

in more frequent and intense heatwaves, as well as an increase in extreme heat days. Specifically, by 2099, there will likely be five more days each year with temperatures exceeding 90°F compared to the 1952-2004 baseline (U.S. Climate Resilience Toolkit Climate Explorer 2023).

Figure 3. Projected average daily maximum temperature (°F) under RCP8.5, relative to 1952-2004. Data from the U.S. Climate Resilient Toolkit Climate Explorer, version 3.1. Climate projections and graphics were produced by the National Environmental Modeling and Analysis Center (NEMAC) at the University of North Carolina Asheville. Accessed 20 June 2024.



PRECIPITATION

San Juan County is historically characterized by relatively low annual precipitation compared to other areas of Western Washington, primarily due to the rain shadow effect from the Olympic Mountains. However, climate projections under the RCP8.5 scenario indicate significant changes by the end of the century. Specifically, summer precipitation west of the Cascades is expected to decrease, while fall and winter precipitation is projected to increase, relative to 1950 -1999 (Table 4; (Rogers and Mauger 2021).

Table 4. Projected change in average precipitation (%) for the region west of the Cascades relative to 1950-1999 (RCP8.5). Data from Climate Mapping for a Resilient Washington. Prepared by the Climate Impacts Group, University of Washington, Seattle and Research Data & Computing Services, University of Idaho, Moscow. Accessed 22 June 2024.

Season	2050	2080
Winter	7% increase	10.4% increase
Spring	2.6% increase	2.7% increase
Summer	13% decrease	15.9% decrease
Fall	2.8% increase	5.7% increase



Precipitation is also expected to increase in intensity and frequency. By the end of the century (2070-2099), the magnitudes of extreme precipitation events (25-year storm) across San Juan County are expected to increase by an average of 30%, relative to 1980-2009 (Salathé, et al. 2010).¹

DROUGHT

The rain shadow effect over San Juan County coupled with its distinctive bedrock geology, steep terrain, and small watershed catchment areas results in limited water resources (Washington Water Science Center 2021). Approximately 77% of the county’s land mass is currently classified as abnormally dry (National Integrated Drought Information System n.d.). Under the RCP8.5 scenario it is projected that total summer (July through September) precipitation will decrease by an average of 10% across the county by the end of the century (Salathé, et al. 2010).²

Annual ground water recharge rates within the islands are already very low, meaning that a small proportion of precipitation contributes to the replenishment of groundwater. Table 5 below shows these low recharge amounts and the percentage of rainfall that contributes to the county's groundwater recharge. Any changes in precipitation trends could further reduce aquifer recharge with the county (U.S. Geological Survey 2002).

Table 5. Annual recharge amounts by island. Data collected from USGS and San Juan County Health and Community Services’ Water-Resources Investigations Report 02-4114 (U.S. Geological Survey 2002), Accessed 22 June 2024.

Island	Average Annual Recharge Amount	Percent of Total Rainfall
Lopez	2.49 inches	9%
San Juan	1.99 inches	6%
Orcas	1.46 inches	5%
Shaw	1.44 inches	5%

¹ Data downscaled at 12km grid cell, which meant that San Juan Island is the primary location for modeling this climate projection.

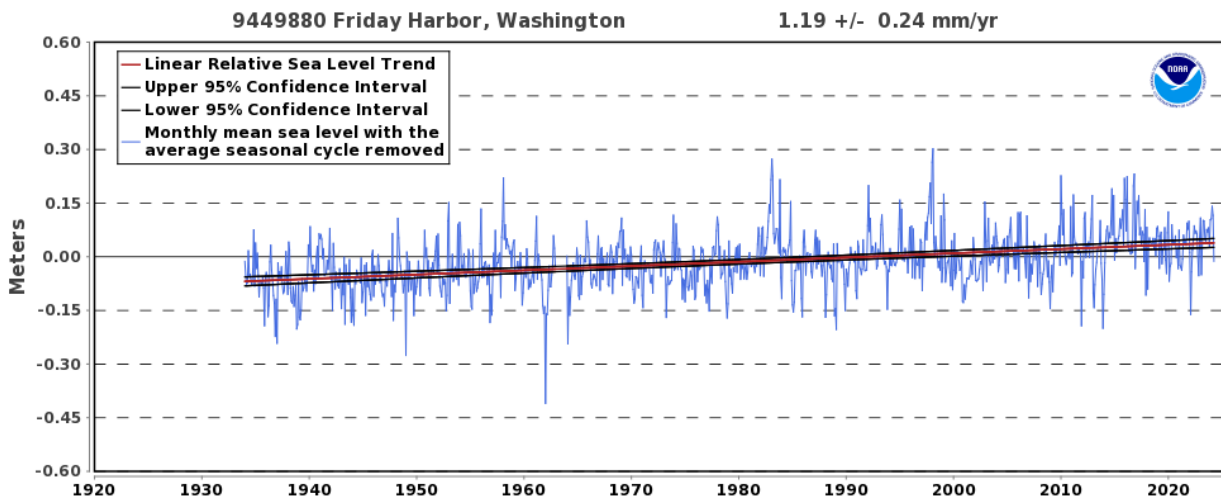
² Data downscaled at 12km grid cell, which meant that San Juan Island is the primary location for modeling this climate projection.

San Juan County's aquifers face increased risks from saltwater intrusion due to fresh groundwater being extracted faster than it can naturally replenish, allowing encroaching seawater to infiltrate (National Park Service 2015). Elevated chloride levels in several wells across the islands indicate that saltwater intrusion in the county is already an issue that could be made worse by precipitation trends (Islands Climate Resilience 2017).

SEA LEVEL RISE

Sea levels in the Salish Sea have risen 0.12 feet between 1930 and 2024 (Figure 4; NOAA). This rise is influenced by various factors, including ice melt from glaciers and ice sheets, thermal expansion of water, and vertical land movement. While vertical land movement significantly impacts relative sea level rise in the surrounding areas of Washington, it is not currently a primary driver of sea level rise in San Juan County (Newton, et al. 2021).

Figure 4. Relative sea level trends at NOAA Tide Gauge 9449880 Friday Harbor, WA, from 1934 to 2023.



Plots show monthly mean sea levels without the regular seasonal fluctuations from coastal ocean temperatures, salinity, wind, atmospheric pressure, and ocean currents. The relative sea level trend is also shown with its 95% confidence interval. Data collected from NOAA, Accessed 17 June 2024.

Sea levels are expected to continue to rise through the end of the century within the county, as confirmed in the County's 2024 Sea Level Rise Vulnerability Assessment. Under the RCP8.5, there is a 50% likelihood that sea levels along the islands increase to 0.6 feet by 2050 and 1.9 feet by 2100 (Table 6; (Miller 2018)). Data collected from Climate Impacts Group, University of Washington, Seattle. Accessed 17 June 2024.



Table 6. Sea level rise projections, in feet, under RCP8.5 for San Juan County 50% likelihood scenario, relative to MHHW.

Year	San Juan Island Ferry Terminal (48.5° N, -123.0° W)	Orcas Island Ferry Terminal (48.6° N, -123.0° W)	Lopez Island Ferry Terminal (48.6° N, -122.9° W)	Shaw Island Ferry Terminal (48.6° N, -122.9° W)
2050	0.7	0.6	0.6	0.6
2100	2.0	1.9	2.0	2.0

Under the RCP8.5, there is a 17% likelihood that sea levels would exceed 0.9 feet by 2050 and 2.7 feet by 2100 (Table 7; (Miller 2018)). Data collected from Climate Impacts Group, University of Washington, Seattle. Accessed 17 June 2024.

Table 7. Sea level rise projections, in feet, under RCP8.5 for San Juan County 17% likelihood scenario, relative to MHHW.

Year	San Juan Island Ferry Terminal (48.5° N, -123.0° W)	Orcas Island Ferry Terminal (48.6° N, -123.0° W)	Lopez Island Ferry Terminal (48.6° N, -122.9° W)	Shaw Island Ferry Terminal (48.6° N, -122.9° W)
2050	0.9	0.9	0.9	0.9
2100	2.7	2.8	2.8	2.8

The 1% probability projections indicate that there is only a 1% likelihood that sea levels would exceed 1.3 feet by 2050 and 4.7 feet by 2100 (Table 8; (Miller 2018)). Data collected from Climate Impacts Group, University of Washington, Seattle. Accessed 17 June 2024.

Table 8. Sea level rise projections, in feet, under RCP8.5 for San Juan County 1% likelihood scenario, relative to MHHW.

Year	San Juan Island Ferry Terminal (48.5° N, -123.0° W)	Orcas Island Ferry Terminal (48.6° N, -123.0° W)	Lopez Island Ferry Terminal (48.6° N, -122.9° W)	Shaw Island Ferry Terminal (48.6° N, -122.9° W)
2050	1.3	1.3	1.4	1.4
2100	4.8	4.7	4.8	4.8

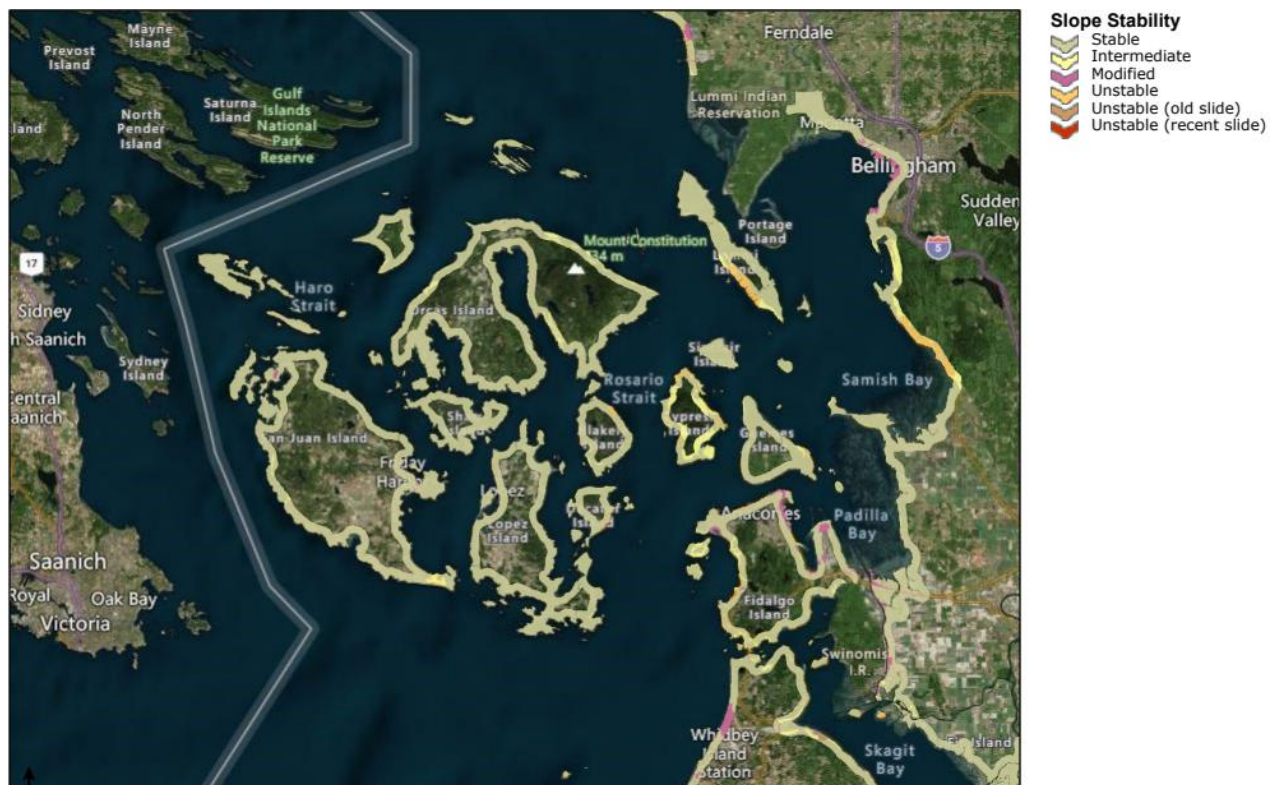
EROSION AND LANDSLIDES

The San Juan County coastline has generally experienced low rates of long-term erosion and bluff retreat (MacLennan, et al. 2013). However, San Juan County's recent Sea Level Rise report

identified local areas across the islands that are more prone to higher erosion rates (ESA 2024). The county's shoreline is also threatened by increasing coastal flooding due to storm surges and sea level rise. Additionally, more intense storm and wind events are expected to exacerbate the process, leading to accelerated rates of coastal erosion across the Puget Sound Basin (Johannessen and MacLennan 2007), posing new challenges for San Juan County coastal management.

Due to its bedrock formation, only 3% of the San Juan County coast is considered unstable, which means that the overall risk of landslides is low. At the same time, the risk of landslides in landslide hazard areas (e.g., hallow landslide areas (Shipman 2004) will likely increase due to projected increases in precipitation frequency and severity will lead to higher soil water content (Casola, et al. 2015).

Figure 5. The slope stability of San Juan County coastlines is relatively stable. Map from Washinton Department of Ecology Coastal Atlas Map. Accessed 25 June 2024.



WILDFIRES AND WILDFIRE SMOKE

San Juan County typically experiences low wildfire risk due to its historically temperate weather and geographical features (Washington State Department of Natural Resources 2022). Wildfire smoke is also generally of lower risk to the County, as it has one of the lowest average cumulative wildfire smoke scores in the state. This score reflects the sum of wildfire smoke-



impacted PM2.5 concentration on days designated as wildfire smoke-affected from 2016-2022 (Washington Tracking Network 2023). However, with climate change causing higher temperatures and reduced precipitation, vegetation dryness is likely to increase, creating conditions more favorable for wildfire ignition and spread. Under the RCP8.5 scenario, the county could experience 21 more high fire danger days by 2050 (days when the moisture content of dead woody fuels is less than the historical 20th percentile), significantly increasing the risk of wildfires and wildfire smoke (Abatzoglou and Brown 2012).³

OCEAN ACIDIFICATION

Ocean acidification occurs when the ocean's pH level decreases due to the absorption of carbon dioxide (CO₂) from the atmosphere, adversely affecting marine ecosystems. In the Salish Sea and the Strait of Juan de Fuca, decreased pH levels are likely driven by several factors, including increases in upwelled acidified water, eutrophication processes, freshwater inputs, acid rain, and higher levels of dissolved organic carbon (Crummett 2020). These lower pH levels create harsher habitat conditions for ecologically, economically, and culturally significant species across Washington state waters, such as oysters, mussels, and clams (Washington State Blue Ribbon Panel on Ocean Acidification 2012). Moreover, the species most likely to be affected by ocean acidification serve as the foundation for many food webs, including those of salmon and other key species, further impacting marine ecosystems. Ocean acidification will be additionally compounded by rising seawater temperatures brought on by climate change (North Olympic Peninsula Resource Conservation & Development Council 2015).

Rising sea surface temperatures in the Salish Sea, along with lower pH levels and decreased dissolved oxygen, are expected to result in more frequent, severe, and toxic harmful algal blooms (HABs). Under the RCP8.5 Scenario, algal biomass in the Salish Sea may increase by 23% from the 2000 baseline by 2095, potentially leading to significant disruptions to the ecosystem. Moreover, as stream temperatures rise across the state (Mantua, Tohver and A.F. 2010), HABs will likely become more frequent in lakes and rivers, posing risks to freshwater ecosystems and drinking water (Lindquist 2021).

³ Data downscaled at 12km grid cell, which meant that San Juan Island is the primary location for modeling this climate projection.



Buildings and Energy

San Jaun County is a fast-growing county with around 14,000 houses, mainly single-family (United States Census Bureau n.d.), with around 10% of homes being vacation rentals (Devaux 2022). Other critical building and energy infrastructure include fire stations (seven on San Juan Island, seven on Orcas, and four on Lopez Islands), health care facilities, marinas, and energy assets including substations and transmission/distribution lines managed by Orcas Power & Light Cooperative (OPALCO). The county is reliant on energy from Bonneville Power Administration from mainland Washington state. Climate change impacts, especially sea level rise and associated flooding and erosion, wildfires, warming temperatures, and severe storms pose some risks to the buildings and energy sector. The County is taking steps towards adaptive capacity, like on-island renewable energy production, but barriers remain. The overall climate vulnerability is summarized in Table 9 below, with further details and explanation to follow.

Table 9. Climate vulnerability score for buildings and energy.

	Climate Risk	Adaptive Capacity	Vulnerability
Buildings & Energy			
Buildings & critical infrastructure	High Sea level rise and coastal erosion pose risk to houses and coastal infrastructure. Wildfire also poses a risk to some areas.	Low Little ability to move structures out of harm’s way or plans to build in protections.	Medium Housing and infrastructure are currently exposed to sea level rise and coastal erosion. There is an opportunity to site new development in areas that do not pose the same risks for future growth. There also are opportunities to increase fire protections.
Energy assets, demand and delivery	Low/Medium Increased demand from hotter summers, though not as extreme as other places and likely accompanied by	Medium OPALCO local and cooperative utility planning for changes in the energy sector. Local barriers to large scale	Low Climate change will impact energy production and demand. The local energy cooperative OPALCO is working



	Climate Risk	Adaptive Capacity	Vulnerability
Buildings & Energy			
	reduced heating demand in winters. While winters are expected to be warmer, more extreme winter weather events can also tax energy systems. Lines buried underground and vegetation removal crews addressing above ground wind and fire risk exposure.	renewable energy projects and reliance on mainland energy puts the county in a more tenuous position.	to address these risks and while barriers around siting and maximizing energy projects remain, community engagement, and policy efforts can support those initiatives.

Buildings and Critical Infrastructure

Climate Risks

Sea Level Rise

Sea level rise, with associated erosion/bluff recession and inundation or flooding, is a risk to some buildings and critical infrastructure. A 2013 study by Coastal Geologic Services, inc. estimated that 69 structures are located below the highest observed water levels to date, which puts them at risk for inundation in the future (Coastal Geologic Services Inc. 2013). A 2024 study identified between 490 and 1,431 structures at risk of annual flooding in the mid- (2 feet of sea level rise) and long-term (5 feet of sea level rise) time horizons (ESA 2024). This is notably more than identified on FEMA maps, which have historically focused on riverine and coastal flooding and have been slow to include risks from climate change (Kuta 2022). Many at-risk structures are residential, with other vulnerable buildings including boat houses, hangars, and net sheds. Notably, no schools or hospitals are identified within high-risk areas for sea level rise and coastal inundation from storm surge.

Table 10. Number of structures at risk of erosion/bluff recession and inundation due to sea level rise (ESA 2024).

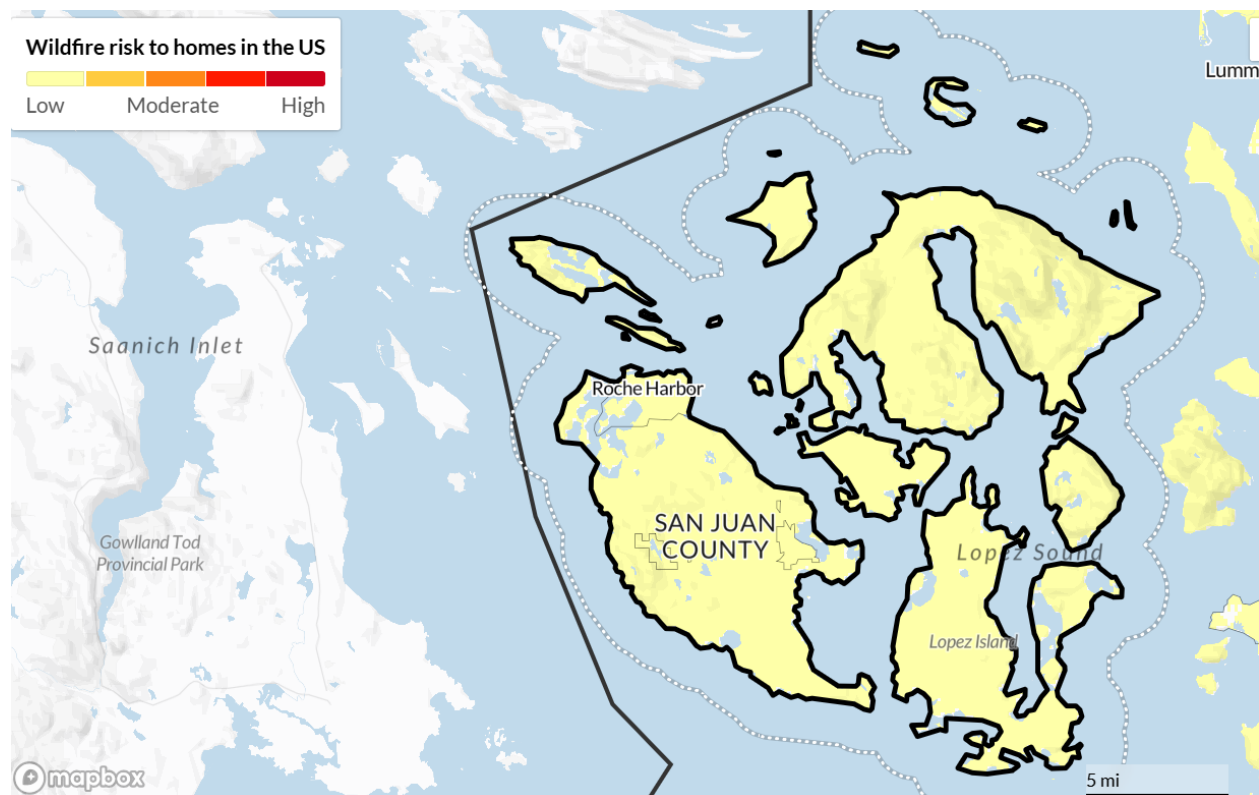
Threat type	Unit	SLR 2+ ft + 1 year storm	SLR 2 ft + 100-yr Storm	SLR 5 ft + 1-yr Storm	SLR 5 ft + 100-yr Storm
Building footprints	Acres	7	19	22	34
Building counts	Count	499	1,276	1,771	2,637

Specific areas at risk for sea level rise and coastal inundation on the most populous islands include: Fisherman Bay, Port Stanley, and Islandale on Lopez Island, and Crescent Bay, Deer Harbor, and Olga on Orcas Island.

Wildfire

Wildfire is another important climate risk, though less than in other places due to relatively high humidity even during the summer season (Wildfire Risk to Communities n.d.). The USDA characterizes wildfire likelihood in the county as low (see Figure 6), risk to homes as low, and risk to vulnerable populations including people over 65 years and people in poverty as medium.

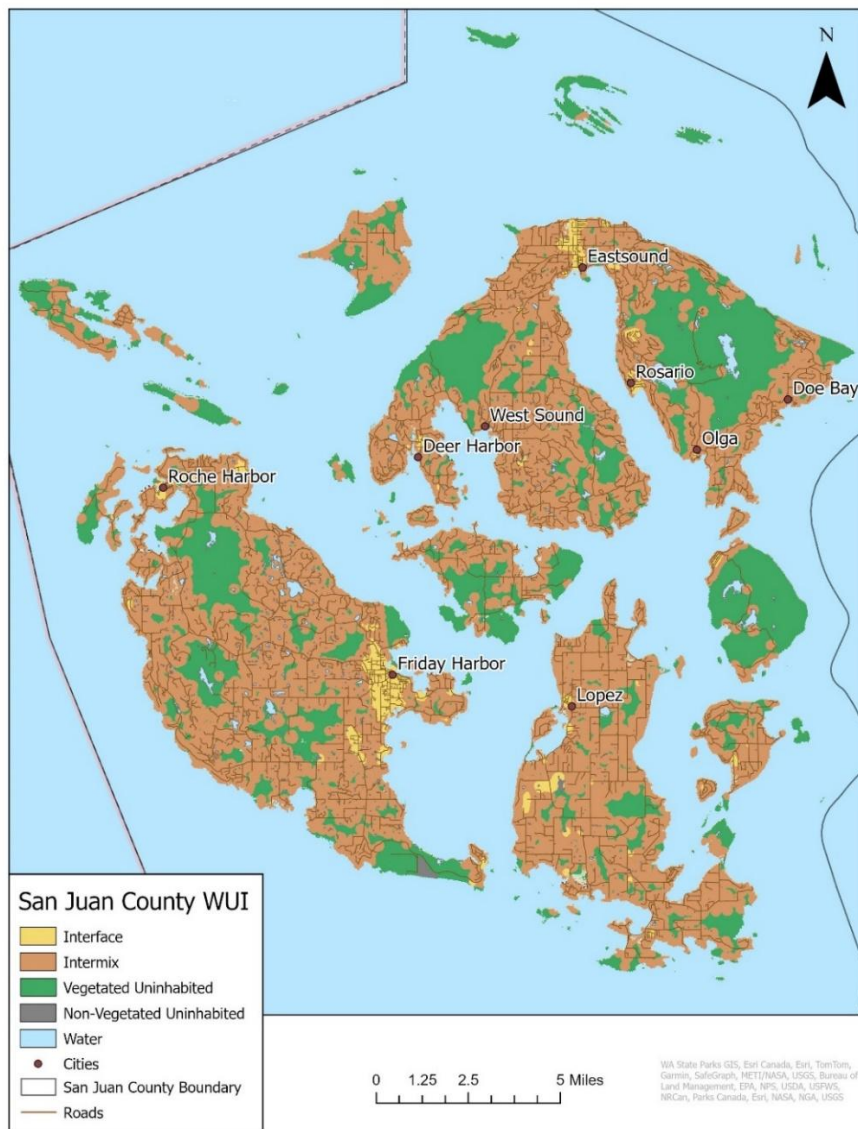
Figure 6: Wildfire risk in San Juan County is low relative to other counties in the U.S. (Wildfire Risk to Communities n.d.).



As of 2012, there had been a downward trend in ignitions per year in the county since 1970, and generally less than 50 acres burned per year (San Juan County Community Wildfire Protection Plan Steering Committee 2012). The 2025 update to the Community Wildfire Protection Plan is forthcoming. With expected increasing summer droughts and some ongoing wildland urban interface development, however, the risk of fire to buildings and energy infrastructure will likely increase in the future, though the primary variable will likely be winds. Overall, the chances of a fire becoming large and extremely difficult to handle remains low, but there is a chance of conditions becoming severe enough one season that the county is at risk of a major event.

While overall risk is low, the United States Department of Agriculture estimates that 78% of housing units in San Juan County are in the Wildland Urban Interface, or proximate to flammable vegetation (Wildfire Risk to Communities n.d.). The below map from Washington State Department of Natural Resources shows in yellow where structures and wildland meet or intermingle, notably near Argyle and Friday Harbor and Roche Harbor on San Juan Island, parts of western Lopez Island, and around Eastsound and in a few other areas on Orcas Island (Washington State Department of Natural Resources 2024).

Figure 7. Map showing WUI- Interface (WUI) in yellow, where wildlands and human development meet. These are typically on the outskirts of urban or developed areas. WUI- Intermix lands, shown in green, are areas with structures that intermingle with wildlands. These are often found between the Interface and wildlands, and/or in undeveloped and low-density pockets of urban areas. This is not a specific fire risk map; instead the WUI depicts areas or zones of Washington where structures and wildland overlap with specific structure densities. Map provided by San Juan County using data from Washington State Department of Natural Resources, WA State's Wildland Urban Interface Map.





Adaptive Capacity

The County and action partners have initiated efforts to strengthen the adaptive capacity of buildings and critical infrastructure to climate hazards like flooding. In 2018, the County adopted updated new FEMA regulations and Flood Insurance Rate Maps, though these maps do not show the complete number of properties at risk of sea level rise discussed above.

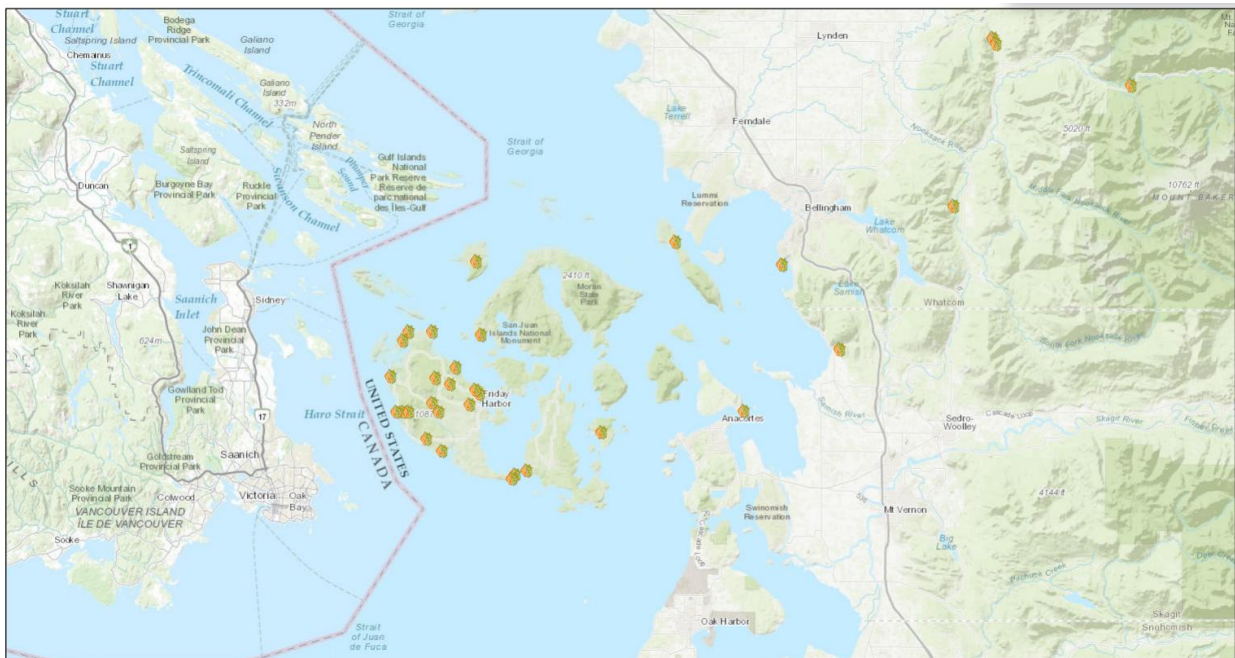
Opportunities to build climate resilience from flooding include empowering building owners to use flood prevention and mitigation practices, restricting development in flood-prone areas and sensitive watersheds, and expanding the use of Low Impact Development (LID) practices including permeable paving, rain gardens, and swales. Resilience solutions for existing buildings at risk from sea level rise will be costly and challenging. County planners to date are only aware of two houses that have been relocated away from the shore. San Juan County is working to develop a County-wide approach to addressing sea level rise, including hosting community conversations. Individual building owners at high risk may need to invest in expensive infrastructure to reduce erosion or inundation risk or even consider relocation.

San Juan County's resilience activities for addressing wildfire risks include updating its Community Wildfire Protection Plan. Entities like the Fire and Rescue department from each Island are partners with the Washington State Department of Natural Resources on Wildfire Ready Neighbors. Many homes are at low risk due to proper fuel management nearby. San Juan County is one of the leading counties in the country for the number of communities and households participating in the Firewise program (San Juan County 2018). That said, some specific areas, developments, (e.g. near Humphrey Head, Dusty Road, Mud Bay and Hunter Bay areas, Skid Road, and Lopez Sound area on Lopez Island) and a number of individual homes have a much higher wildfire risk largely due to the use of highly ignitable materials in home construction, and/or the lack of defensible space surrounding the home. Other limits to the County's adaptive capacity are that rural fire departments are largely staffed by trained volunteers rather than career firefighters (Wheeler, San Juans assess fire risk, in the aftermath of Lahaina 2023). Water supply is another issue. Most water systems on the islands are privately owned by homeowner's associations and under-sized relative to fire protection needs. In addition, few remote areas on the islands have hydrants, requiring water to be brought to the site.

In terms of smoke-related air quality, the County has been collecting air quality data using Purple Air, which enables residents to get real-time data and make informed decisions to the extent possible. That said, residents of housing and occupants of buildings without good windows and without air filters may be unable to protect themselves during extended smoke events. Additionally, residents may also not be aware of what the different air quality levels mean and what to do to protect themselves and their dependents from respiratory issues

related to smoke. More broadly, it is difficult for low-income renters to shelter in place during smoke events and other climate events like storms and extended heat waves. At the community listening session, residents noted the worsening impact of wildfire smoke and supported creating smoke shelters for vulnerable populations during wildfire smoke events (Community Listening Session 2024). During COVID, the County had relatively robust response programs to help keep people in their homes and support shelter in place, though these efforts are not easily implemented during climate-related events. The [San-Juan-County-COVID-19-After-Action-Report](#) highlights key lessons learned and ideas for corrective action, including the need to update emergency communications plans (San Juan County 2023).

Figure 8. Map showing Firewise communities in San Juan County.



Energy Assets, Demand and Delivery

Climate Risks

In terms of energy demand, San Juan County benefits from the surrounding Salish Sea which moderates temperatures relative to other places in Washington. That said, predicted hotter temperatures will spur more Cooling Degree Days on the islands. San Juan County will likely experience warmer winters, which could mean less Heating Degree Days. But more frequent and intense extreme weather events are also likely and those lead to greater energy use or peak load events. Expected increases in the county's population (including its over-wintering population) alongside increased load needs for desalination plants (there are 14 so far on the



islands), electrical vehicle charging, and potentially electric ferry charging, will likely also lead to increased energy demand.

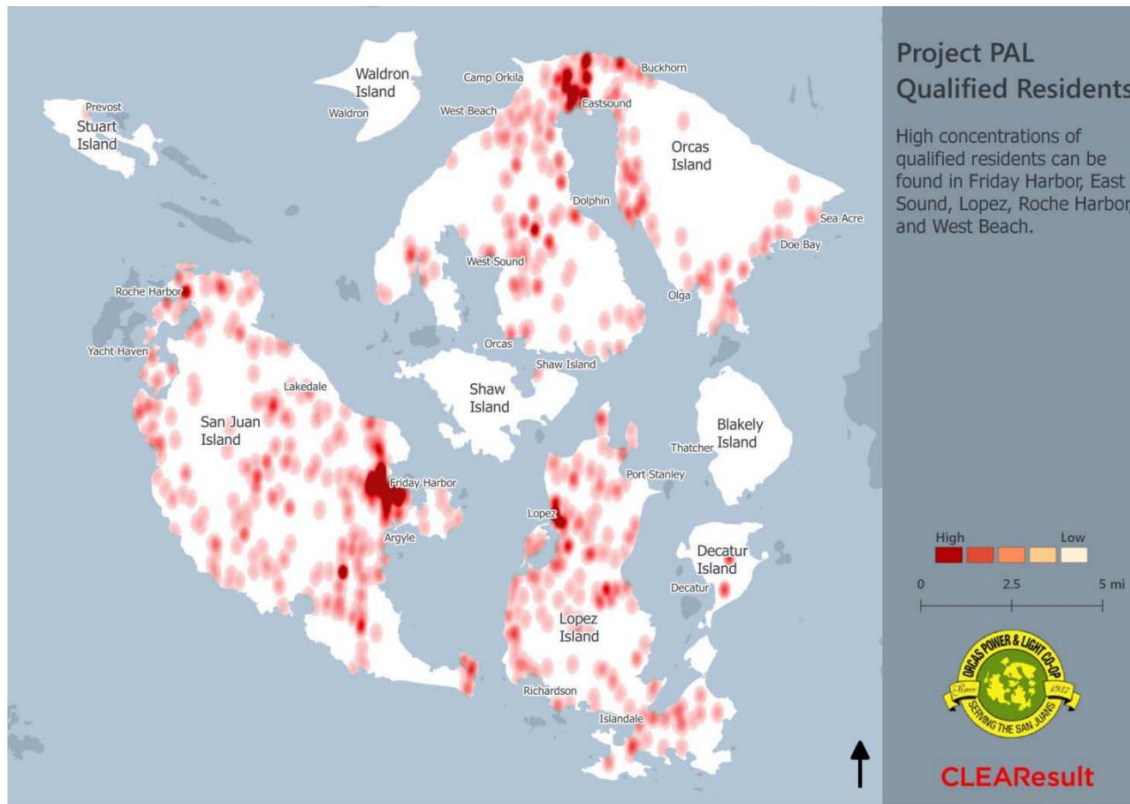
Extreme Precipitation (Including Storms and Flooding)

Climate hazards pose some unique risks to San Juan County energy assets and delivery. Cables not buried beneath the sea floor and high voltage lines are vulnerable to damage from wind and trees during severe storms, which are expected to occur more frequently in the future. Increased power outages due to severe weather and storm damage were noted as a growing concern by residents (Community Listening Session 2024). San Juan County utilities are also affected by damage to surface power lines on the mainland, like the power outages caused by severe storms on the mainland in December 2023 (Wheeler, Tackling the island's power vulnerability 2023). San Juan County's longtime Emergency Management Director has warned island residents, "It has been many years since the Pacific NW has experienced a truly catastrophic windstorm, but it will happen again, and when it does, there will be outages far more significant than anything we've seen in the last 20 years." (Wheeler, Tackling the island's power vulnerability 2023) Power-outage problems vary in degree, ranging from the risk of fire and electrocution caused by downed "hot" wires to the loss of heating, refrigeration, light, and residential and commercial cooking facilities. Most computers, telephones, cash registers, ATMs, and gasoline pumps are also not operable without electricity, which hinders daily life as well as business, economic, and tourist-related activity.

Heat, Drought (Including Lower River Flows), and Air Quality

Other climate risks to energy assets and delivery include changing precipitation and associated changes to streamflow, which affects hydropower produced on the mainland. OPALCO anticipates higher summer BPA wholesale rates in coming years as well as rolling blackouts while new renewable sources are developed. Warmer summer temperatures will especially challenge the county's elder population, which is proportionally larger than the mainland's. Higher energy costs will negatively affect cost-burdened residents. The county's lower income residents are concentrated in the population centers of Friday Harbor, Eastsound, and Lopez and distributed through rural areas of Lopez, San Juan, and Orcas islands, shown in Figure 9 below. While OPALCO offers some programs targeted for low-income residents, including bill offsets from community solar and residential rebates for specific appliances, they do not serve all in need (CLEAResult 2015).

Figure 9. The red areas indicate concentrations of households making below 200% of the federal poverty level (CLEAResult 2015).



About 1,490 houses, or 17% are heated by wood in the county, according to the Census (United States Census Bureau n.d.). Another 19% are heated by propane according to OPALCO. This has multiple intersections with climate vulnerability, including that wood and propane heating are significant causes of local GHG emissions. In addition, wood burning for heat is the main cause of fine particle air pollution in Washington in winter (Washington State Department of Ecology 2023). Some of the long-term health effects of breathing in particles from wood smoke include bronchitis, emphysema, and cancer. It is likely that many owners with wood-burning and propane heating sources will transition to electric heat systems in the future, which will increase the overall demand for electricity.

Another consideration in terms of the building stock and local resident health, is whether homes and other buildings have quality insulation and air filters (Community Listening Session 2024). This is especially important considering the likelihood of extended storms and wildfire smoke events in the future and the likely need for residents to shelter in place.

Adaptive Capacity

In San Juan County, OPALCO has taken several initiatives to enhance the adaptive capacity of energy. OPALCO has buried about 90% of the distribution system which helps harden the grid



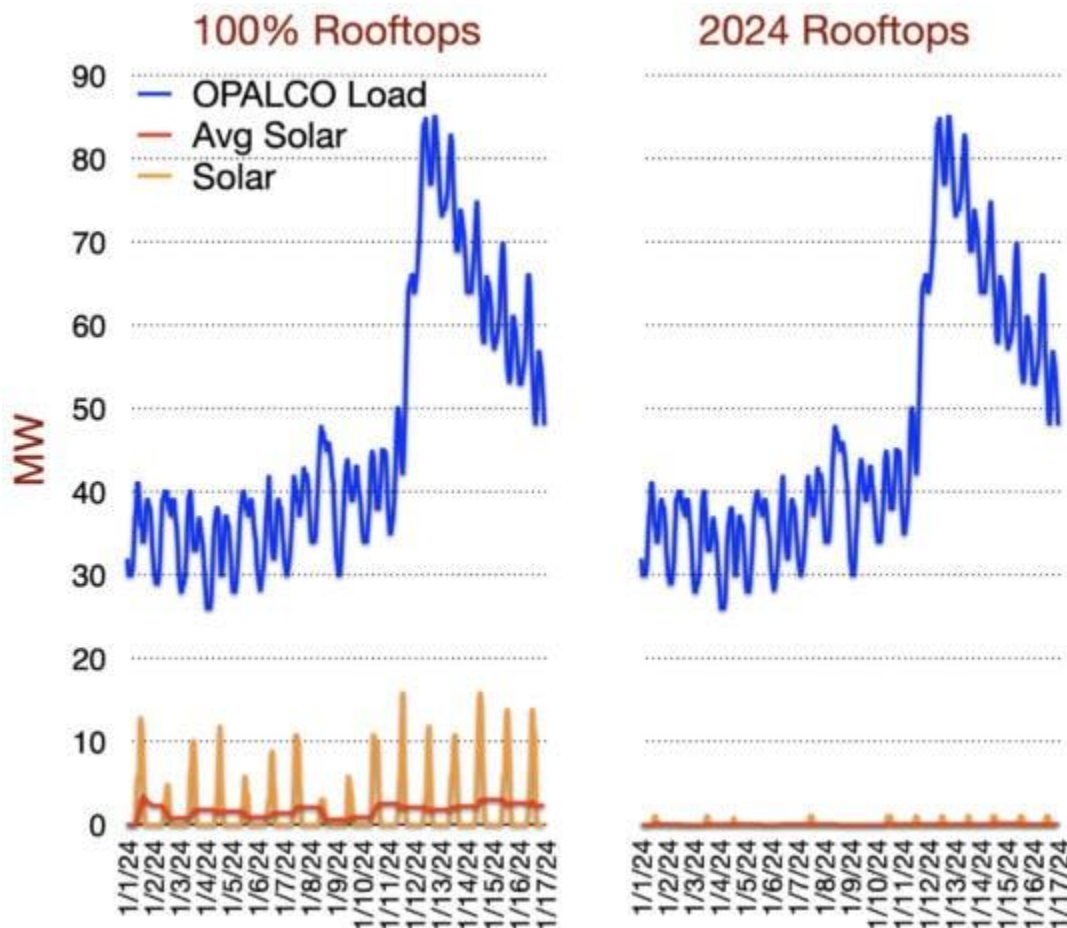
and increase reliability during storms. Today the incidence of power failure is less frequent and generally shorter in duration than in the past, though the remaining above ground transmission remains vulnerable to tree falls and wind events. Another barrier is that many transmission corridors/rights-of-ways were established in the 1970s and are narrower than they should be, like on Shaw Island. The County works with homeowners to educate them on risk management practices and has enacted legislation that allows OPALCO to trim dangerous trees along the corridors and near powerlines.

To offset the rising costs of mainland energy, build energy independence, and to respond to legislative mandates (Washington states' Clean Energy Transformation Act and Climate Commitment Act), OPALCO promotes energy efficiency and the development of renewable energy through programs like "Switch it Up" (currently has \$40 million from USDA). OPALCO also provides incentives and on-bill financing for energy efficient appliances, heat pumps, insulation, windows, solar, and battery storage. These incentives are supported by residents (Community Listening Session 2024). Due to these incentives, there is a growing market share of energy-efficient heat pumps replacing electric resistance heating. Additionally, there are existing energy assistance programs to help residents with rising utility costs, though OPALCO leaders note the need for more resources to ease the energy burden on impacted households.

OPALCO completed the county's first community solar project in 2018 (Decatur Island). A second one, Bailer Hill, is in development and will be the county's first agri-solar project, in cooperation with local sheep farmers who will graze the animals in the shade of the solar array. Individual building owners are also adding renewable energy capacity. Currently, about 720 home/business grid-connected solar systems in San Juan County produce about 2% of the county's energy use (OPALCO 2024). At the community listening session, many residents voiced support for local renewable energy projects or noted they had installed solar panels in their own home (Community Listening Session 2024).

One concern with solar is the noise generated from solar inverters, which can be an issue for neighbors especially as the amount of solar installation increases. Noise mitigation measures may be needed. Another major barrier is that while solar is an important summer energy source, it does not work during outages and only serves a portion of the load in winter. Solar is only projected to supply 4% by 2030. Figure 10 shows that even with 100% of rooftops with solar production, there would still be a need for other energy sources during peak loads.

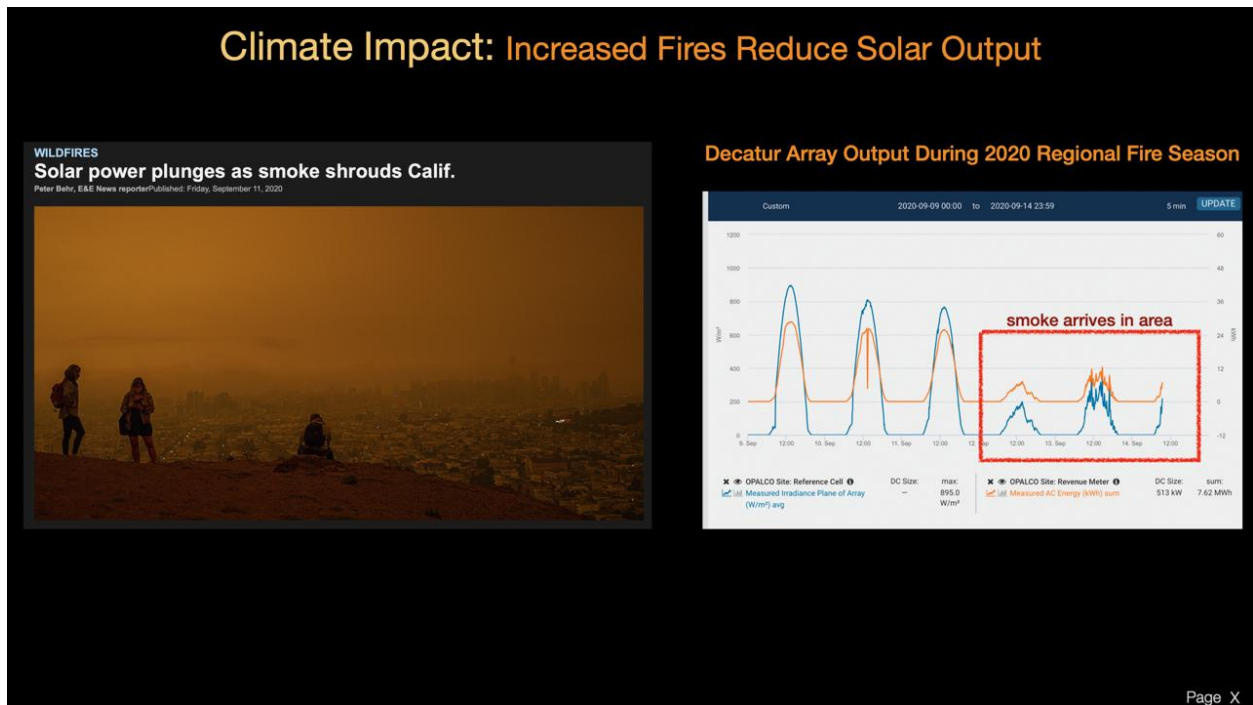
Figure 10. The charts below compare solar production if 100% of members had rooftop solar (orange lines on left chart), or just the 2024 solar member production (right chart), at the time of the cold snap in January 2024, compared to the OPALCO load which peaked on January 12, 2024, shown with the blue lines (OPALCO 2024).



It will take a lot more renewable energy to meet the future load forecast, but there are many barriers to this huge transition. OPALCO leaders emphasize that it will take land for utility-scale solar and water for tidal generation and want to see the County start a solar siting planning process. Public opposition and regulatory, financial, and siting/permitting/ construction hurdles are likely to constrain the development of renewable energy near population centers. As OPALCO leaders put it, “Efficient land use policy evolution is critical in a climate-disrupted world.” OPALCO is asking the County to make changes to its zoning designations to enable renewable energy production on more lands- especially lands identified as having least conflict- in the County (OPALCO 2024). OPALCO is also studying the feasibility of tidal energy in the Rosario Strait (OPALCO 2022). There has also been some interest by the Conservation District in gasification boilers that use wood waste as a fuel source and create biochar for soil improvement, but there has not been implementation of the idea yet.

Some other key challenges to the use of more renewable energy in San Juan County include the “winter problem” and the so-called “duck curve” or the timing imbalance between power generation and peak demand (OPALCO 2019). During recent regional wildfire events, smoke in San Juan County reduced solar production, as shown in Figure 11. Another challenge is qualified workers. It will be important for the County to address its affordable workforce housing crisis. Meanwhile, the county would benefit from stronger Integrated Energy Plans and more leadership and support from the bigger providers as it grows its climate resilience.

Figure 11. The chart below shows output from OPALCO’s Decatur Island Utility Scale solar array (lower right). The blue line is solar irradiance. The orange line is energy produced (OPALCO 2024).





Water Resources

Water resources are vital to ensuring the health of San Juan County communities and ecosystems. Climate change impacts such as increased flooding, drought, heat, and sea level rise jeopardize the county's water resources. Flooding and sea level rise are likely to impact stormwater systems and wastewater systems throughout the county, while drought is likely to impact water supply and quality. The overall climate vulnerability is summarized in Table 11 below, with further details and explanation to follow.

Table 11. Climate vulnerability score for water resources.

	Climate Risk	Adaptive Capacity	Vulnerability
Water Resources			
Stormwater systems	Low/Medium Stormwater systems exposed to sea level rise and coastal flooding. These are mostly concentrated in a few locations.	High The county has low impervious surface cover with opportunities to address stormwater identified in existing plan documents.	Low/Medium Fewer stormwater issues compared to other climate impacts and the County has opportunities to address those stormwater areas.
Wastewater	High Septic systems are at risk of inundation from sea level rise and coastal flooding. Many are aging systems with high potential to fail.	Low/Medium Efforts are underway to identify and document aging septic systems to improve inspection and maintenance compliance. Technical challenges associated with managing septic systems long-term in flood prone areas.	Medium High climate risk due to aging infrastructure and exposure to coastal inundation. Challenges associated with current adaptive capacity.
Water supply & quality	High Drought and heat are likely to impact the water supply and a decline in water quality.	Low The current water system relies on aquifer recharge that may become more limited during periods of drought,	High Current concerns surrounding water availability and quality, expected to worsen with climate impacts.



Climate Risk	Adaptive Capacity	Vulnerability
Water Resources		
	with expensive and challenging alternatives.	Opportunities to build climate resilience but have received less attention to date.

Stormwater Systems

Climate Risks

Sea Level Rise

Sea level rise, and associated flooding and erosion, is projected to impact current stormwater systems in the County in both the 2ft and 5ft sea level rise scenarios. Thousands of feet of stormwater ditches and pipes and tens of thousands of feet of stormwater flowlines are exposed to sea level rise risk, see Table 12 for additional for infrastructure exposure.

Table 12. Systems at risk due to sea level rise (ESA 2024).

Asset	Feature type	Unit (Count, Feet, or Acres)	SLR 2ft + 1-yr Storm	SLR 2 ft + 100-yr Storm	SLR 5 ft + 1-yr Storm	SLR 5 ft + 100-yr Storm
Stormwater Ditches	Line	Feet	1,723	3,556	4,484	5,854
Stormwater Flowlines	Line	Feet	36,957	40,476	42,351	50,159
Stormwater Pipes	Line	Feet	1,839	3,347	3,828	5,621
Stormwater Structures	Point	Count	6	12	16	29
Water Systems	Polygon	Acres	662	905	961	1,160

There are currently 100 culverts throughout the county approaching the end of their design life, with 12 systems facing system failure due to current condition and storm damage impacts. See Figure 12 for a map of the county with culverts at risk.

San Juan County has overall low impervious surface cover which benefits stormwater management efforts by reducing stormwater management needs. The highest percent of impervious cover in a watershed occurs in the North Shore of Orcas (which includes most of Eastsound) at 10.2%, followed by Friday Harbor at 9.5%, and Roche Harbor at 9.0%. Virtually all other watersheds have less than 5% impervious cover (Herrera Environmental Consultants, Inc.; AESI; ESA; Hart Pacific Engineering; Stillwater Sciences 2016). Coastal communities within the county focus development along shorelines, increasing the concentration of impervious cover in those areas which puts additional stress on the stormwater systems flowing into marine



waters. Sea level rise and inundation of stormwater systems will reduce drainage and exacerbate coastal flooding issues in near-shore areas.

There are a multitude of stormwater systems along shorelines in San Juan County that face risks from exposure to sea level rise, see Table 13 for areas most likely impacted by sea level rise and the number of structures and risk involved.

Table 13. Coastal stormwater systems at risk due to sea level rise (ESA 2024).

Island	Area at risk	Number of structures at risk	Risk (2ft and 5ft SLR)
Orcas Island	North Beach		1-yr flooding
	Crescent Beach	1	1-yr flooding
	West Sound	6	Erosion
	Killebrew Lake Road		1-yr flooding
Shaw Island	Blind Bay	10	1-yr flooding
	Shaw Park Road	6	1-yr flooding
Lopez Island	Swifts Bay	6	1-yr flooding
	Fisherman Bay	8	1-yr flooding
	Bayshore Road	4	1-yr flooding
	MacKaye Harbor & Barlow Bay	3	1-yr flooding and Erosion
	Outer Bay	3	1-yr flooding
San Juan Island	False Bay	4 (erosion)	Erosion (2ft and 5ft SLR)
		1 (100-yr flooding)	100-yr flooding (5ft SLR)

Extreme Precipitation and Flooding

Current inland and low-lying zones are at risk for flooding during periods of prolonged or heavy rains. This is a result of soil saturation and drainage basins not being large enough to handle the runoff that would, under normal rain conditions, empty out into the sea. Flooding and increased coastal water levels through sea level rise can cause insufficient capacity in the stormwater system, therefore exacerbating this issue (San Juan County 2018). The islands are susceptible to surface flooding during a combination of heavy rains and changes in tide. Areas of surface flooding concerns include (San Juan County 2018):

- **San Juan Island:** San Juan Valley, at the intersection of drainage and Bailer Hill Road.
- **Lopez Island:** Odlin Park and the wetland area on the west side of Richardson Road, north of Vista Road.
- **Orcas Island:** Crow Valley faces localized flooding in agricultural areas.



Adaptive Capacity

Both the Town of Friday Harbor and San Juan County have created stormwater utility districts and are expanding drainage culverts and other storm water infrastructure to withstand larger storm events (San Juan County 2018). Over 1000 feet of bioswales were constructed in Lopez Village (Puget Sound National Estuary Program n.d.), and Northwest Water Source has installed over 60 rainwater collection and use systems in the County (Puget Sound Action Team 2003). Roche Harbor's resort master plan includes plans for Low Impact Development, though the implementation status is unknown (2020 Engineering n.d.).

Stormwater management plans exist for the County and municipalities, with actions underway to understand climate impacts and how to address those impacts, indicating a high adaptive capacity relative to other sectors within the county. San Juan County has a Stormwater Basin Plan that seeks to benefit water supplies, protect property, and support critical natural resource areas such as wetlands and streams, and the species dependent on them. The Plan details stormwater systems across the county and by Island (Herrera Environmental Consultants, Inc.; AESI; ESA; Hart Pacific Engineering; Stillwater Sciences 2016). The County also conducts regular stormwater system maintenance to ensure proper operation.

Lopez Island and SJC have taken measures to reduce the occurrence and impact of flooding, by creating stormwater utility districts, and conducting regular maintenance of stormwater systems (San Juan County 2018). The Island has also implemented two bioswale capital improvement projects with funding from Ecology to mitigate flooding impacts (San Juan County 2024).

The Town of Friday Harbor has a Stormwater Management Plan, last updated in 2005, that contains a Capital Improvements Plan (Town of Friday Harbor 2005). This chapter of the Plan seeks to improve the Town's stormwater management systems to better handle flooding impacts, likely to be worsened by climate change. The Plan contains fourteen recommended projects to better adapt the Town to the impacts of flooding by updating existing drainage systems.

Wastewater

Climate Risks

Sea Level Rise and Flooding

San Juan County has a total of 9,059 septic systems across the islands, with 8,169 systems mapped on parcels. Rising sea levels and flooding are likely to cause inundation of sewers and septic systems, requiring system maintenance. If inundation and/or flooding becomes a



consistent or more serious issue, these systems are likely to fail with potential backwatering into structures and water quality impacts (ESA 2024). The number of septic systems in the county and likely impacts can be seen in Table 14.

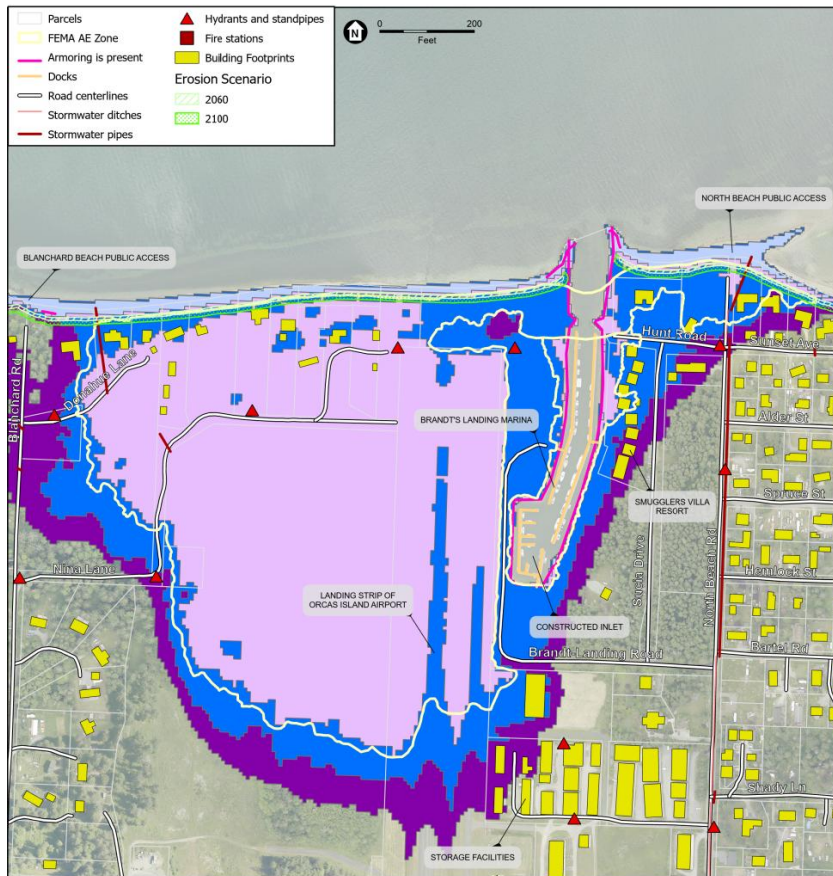
Table 14. Data from San Juan County.

Scenario	Parcels with Septic Systems	Number of Septic Systems
FEMA	2,695	3,010
2ft 1yr	2,479	2,774
2ft 100yr	2,511	2,809
5ft 1yr	2,516	2,815
5ft 100yr	2,540	2,839
Total in County	8,169	9,059

Septic systems located in near-shore areas are more likely to face inundation issues, and the risk of system failure is increased with aging systems. Data on the age of septic and wastewater systems in the County is limited, but most are likely old, and many are likely out of compliance with inspection and maintenance requirements.

There are four wastewater and sewage treatment plants across the islands. Shaw Island does not have a central water or sewer system and is assumed to rely on wells and septic fields (ESA 2024). Orcas Island is serviced by the Eastsound Water District (ESWD) within the Eastsound Urban Growth Area, with approximately 800 connections (ESWD 2024). The ESWD on Orcas is likely to face potential flooding impacts as it is located near the Orcas Island Airport which lies in the flood zone, see Figure 13 (ESA 2024).

Figure 13. Sea level rise risk assessment map of Orcas Island's North Beach.



Adaptive Capacity

There are some activities underway that support adaptive capacity and build climate resilience from climate impacts on wastewater. San Juan County was recently awarded a grant, which they will use to map septic systems within the county noting age of the systems. This will allow the County to properly prepare wastewater systems for climate change impacts, by noting the risks to current systems. At the same time, septic systems are managed by homeowners, so the burden of repair for these systems would likely fall on homeowners who have different levels and ability to address those repairs or replace systems if needed.

Water Supply and Quality

Climate Risks

Drought

Most of the islands' larger water systems depend on surface water, and 40% of the county's population receives its drinking water from surface water systems (San Juan County 2004). Of



the county’s nine water systems with at least 100 connections, seven utilize surface water. Warmer summers, a longer dry season, and increased evaporation could therefore present increasing challenges to these water systems in the future (San Juan Islands Conservation District 2016). Climate change impacts such as rising temperatures, rising water temperatures, and changes to precipitation patterns can also increase the risk of HABs which can impact surface water storage ponds by negatively impacting water quality (EPA 2024).

San Juan County has over 5,000 groundwater wells, or one for every three people. These wells are dependent on water stored in aquifers. Water levels in these aquifers fluctuate seasonally, being drawn down during the summer and refilled during the winter. Drier summers impact aquifer recharge and put water quantity at risk. An estimate of groundwater recharge was developed in 2001 by USGS and can be found on Table 15.

Table 15. USGS groundwater recharge estimates for San Juan County (San Juan Islands Conservation District 2016).

Island	Recharge in inches	Percent of total rainfall
San Juan	1.99	6%
Orcas	1.46	5%
Shaw	1.44	5%
Lopez	2.49	9%

Table 16. Water sources and connections across the islands (Islands Climate Resilience 2017).

Water System	Island	Source Type	Source	Connections
Friday Harbor, Town of	San Juan	Surface Water	Trout Lake	1,808
Eastsound Water Users Association	Orcas	Surface & Ground Water	Purdue Lake	1,300
Rosario	Orcas	Surface Water	Cascade Lake	223
Roche harbor Water System, Inc.	San Juan	Surface Water	Briggs Lake	445



Water System	Island	Source Type	Source	Connections
Doe Bay Water Users Association	Orcas	Surface Water	Mountain Lake	276
Olga Water Users, Inc.	Orcas	Surface Water	Cascade Creek/ Mountain Lake	130
Fisherman Bay Water Association	Lopez	Ground Water		152
Orcas Highlands Association, Inc.	Orcas	Surface Water	Cascade Lake	117
Cape San Juan Water District	San Juan	Ground Water		143

Sea Level Rise

Groundwater aquifers are further at-risk due to saltwater intrusion from rising sea levels contaminating water sources. Lopez Island’s geology creates the highest potential for seawater intrusion, and it is also more dependent on groundwater than San Juan or Orcas (Islands Climate Resilience 2017). Groundwater monitoring results also indicate that chloride levels are rising at .5-1.0ppm annually (Mott MacDonald 2024). Community members have also observed saltwater intrusion at their wells and experienced a salty taste from water supply (Community Listening Session 2024).

Adaptive Capacity

Water availability is a pressing concern for San Juan County and climate change projections of longer and drier summers put these water systems at risk. The County has identified drought and water availability as a priority concern and has taken adaption steps such as developing the Drought Conservation Plan, which provides an overview of water management within the county, how climate change will impact water availability, and various adaption strategies (San Juan Islands Conservation District 2016). County residents have also expressed concerns over water quality availability and noted community conservation efforts to limit water usage especially in summer months (Community Listening Session 2024). Much of the data included in the Drought Conservation Plan is from the early 2000s, including the USGS groundwater recharge estimates, and may therefore be outdated. USGS is currently updating their groundwater recharge estimates, which should be completed in early 2025.

The County should also consider alternative water sources, such as desalination facilities. Further consideration of desalinization facilities should be done in partnership with OPALCO to better assess energy requirements and capacity (Staff Listening Session 2024).



The County has developed a groundwater monitoring program to track groundwater quality and impacts from seawater intrusion. This program exists on Lopez and Orcas Islands; however, East Sound Water District oversees the Orcas well network (Mott MacDonald 2024).

Another adaptive capacity concern across water resources is the lack of qualified water systems operators in the county. For example, San Juan Island has only one qualified operator (Staff Listening Session 2024). If alternative water sources such as desalinization plants are considered, operating staff capacity is limited and may not be able to support the plant. Septic systems operators are also limited, and as more septic systems age and require replacement there may be additional pressure on these operators (Staff Listening Session 2024).



Transportation

San Juan County's transportation network is vital for its economy and community. Its unique island geography makes transportation essential for accessing goods and healthcare services, and ensuring prompt emergency response. Roads, active transportation (e.g., bike lanes and trails), as well as WA State Ferries and private transportation providers make up core elements of the transportation system. Climate change poses significant challenges to San Juan County's transportation infrastructure. Rising sea levels and storm surges increase the risk of flooding trails, roads, bridges, and ferry terminals, potentially disrupting vital transportation services. Additionally, the growing potential for wildfires could damage transportation networks, further impacting connectivity and access across the county. The overall climate vulnerability is summarized in Table 17 below, with further details and explanation to follow.

Table 17. Climate vulnerability score for transportation.

Climate Risk		Adaptive Capacity	Vulnerability
Transportation			
Roads	High Several miles of core transportation routes are at risk of inundation from sea level rise and coastal flooding.	Low While efforts are underway to identify alternative road locations, those pathways are likely to intersect with private land holdings.	High Transportation corridors are essential for community functioning and several key locations are at risk from inundation.
Active transportation	Medium Limited active transportation routes exist and those that do face exposure to sea level rise.	Low/Medium Some planning and expansion of active transportation routes is underway, but the primary adaptive capacity challenge is siting route expansion.	Medium Limited active transportation options present a challenge for current community access. Siting new locations will be a challenge because of private land holdings and space along roads, which would otherwise be useful active transportation locations.



	Climate Risk	Adaptive Capacity	Vulnerability
Transportation			
Public Transit	Low Ferry terminals anticipated to have low vulnerability; however intense storm events can delay sailings.	Medium Ferry system has begun to address service issues. Residents currently face mobility challenges due to limited to no options for public transportation system.	Medium Mobility issues on islands due to limited/no public transportation options.

Roads

Climate Risks

Sea Level Rise and Flooding

The county’s road network typically consists of a few main roads connected by secondary and side roads. Dense vegetation and emergency vehicle clearance are general concerns across the islands, with road risks including inland flooding, erosion, coastal flooding, winter storms (San Juan County 2018). Sea level rise poses the greatest threat, potentially affecting up to 16.3 miles of roads (ESA 2024; Table 18).

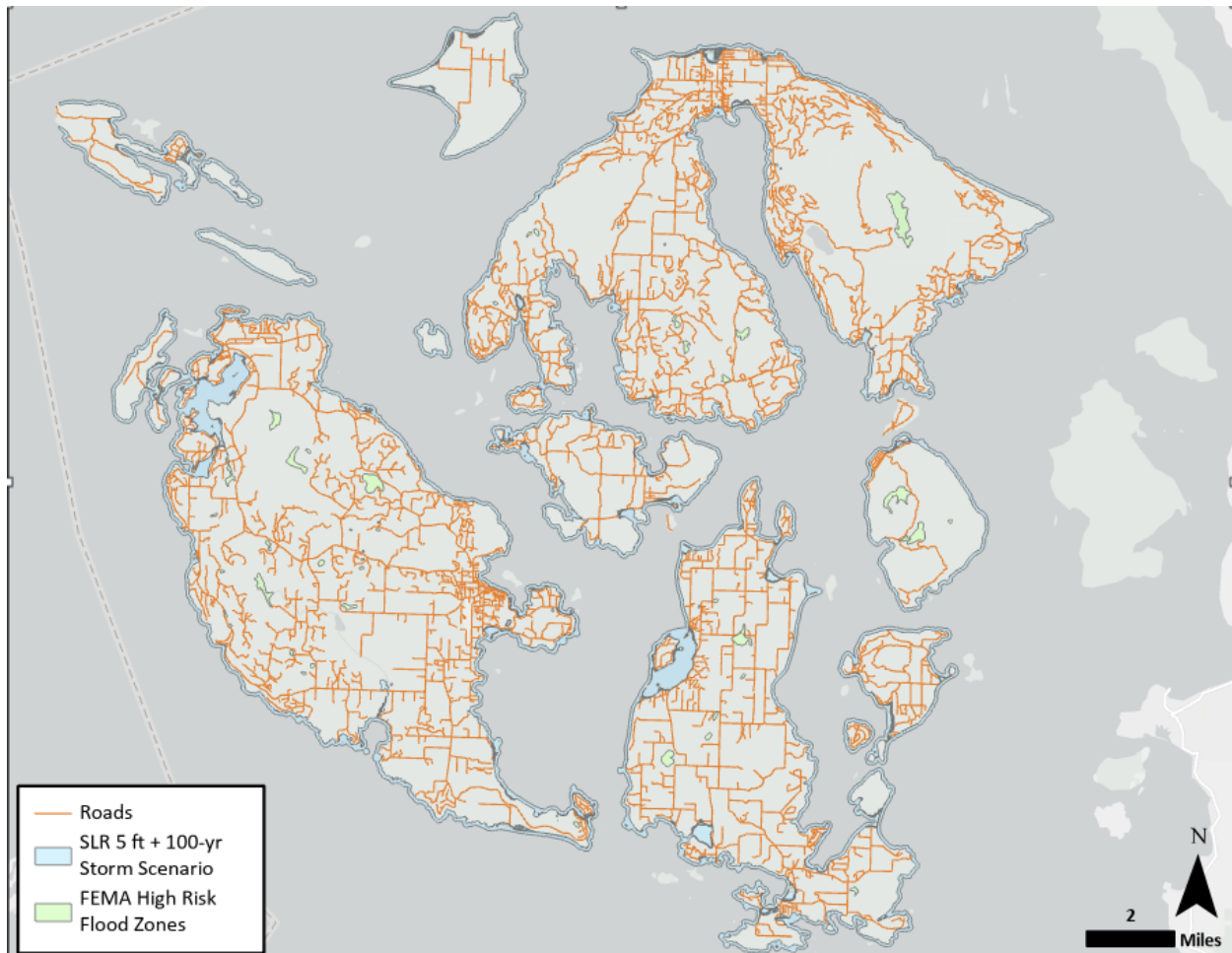
Table 18. Miles of road exposed to SLR across various sea level rise and storm surge scenarios.

SLR 2ft + 1-yr Storm	SLR 2 ft + 100-yr Storm	SLR 5 ft + 1-yr Storm	SLR 5 ft + 100-yr Storm
4.3	10.4	11.9	16.3

Many roads across each island overlap with high-risk inland flood zones and the 5ft SLR + 100-year storm scenario (San Juan County GIS Deptment n.d; Figure 14), with the following expected to see the highest levels of exposure to SLR (ESA 2024).

- **Lopez Island:** Nelson Lane, Shoreland Drive.
- **San Juan Island:** Afterglow Drive, Avenida de Oro, Turn Point Road, Myers Road, Warbass Way, Killdeer Lane, Cape Drive, and Marina Lane.
- **Shaw Island:** Broken Point Road and Neck Point Road.
- **Orcas Island:** Gibson Road, Obstruction Pass Road, Waterfront Way, and Beach Haven Road.

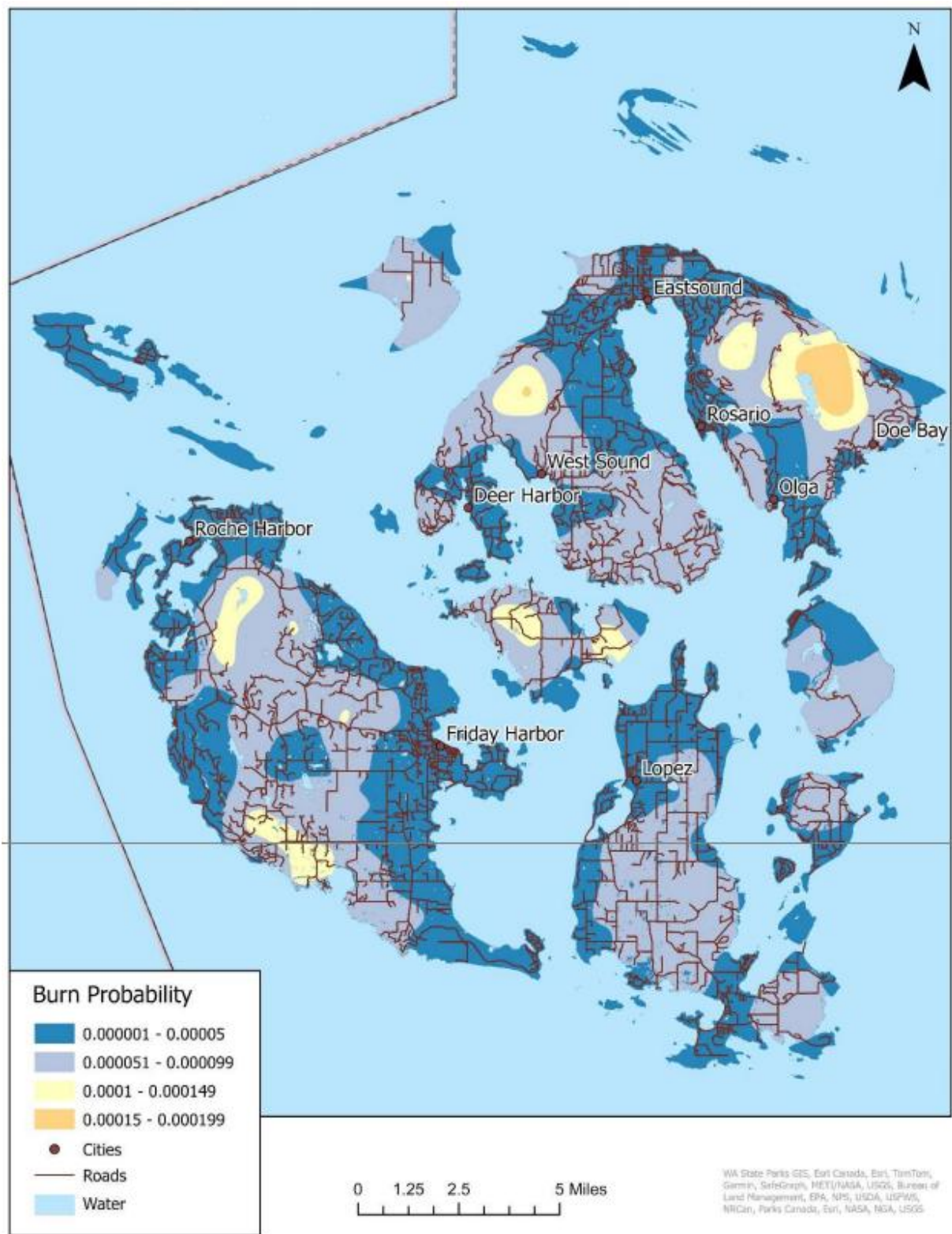
Figure 14. Flood risk exposure in San Juan County, showing roads in proximity to FEMA high-risk flood zones and areas impacted by the projected 5-foot sea level rise + 100-year storm scenario (San Juan County GIS Deptment n.d.).



Wildfire

Wildfire exposure poses additional risks to San Juan County's road system, as many roads pass through or close to areas with moderate to high burn probability (Figure 15). This risk is particularly pronounced in parts of west Orcas Island, southern San Juan Island, and Shaw Island (San Juan County 2024). Roads in these areas are more vulnerable to disruption from wildfires, potentially affecting accessibility and emergency response.

Figure 15. Burn probability across San Juan County, highlighting areas where roads intersect with moderate to high wildfire risk, particularly on west Orcas Island, south San Juan Island, and Shaw Island (San Juan County 2024).





Adaptive Capacity

Sea level rise is projected to cause road closures across the county, though some roads will experience reduced flooding due to existing shoreline armoring, increasing their adaptive capacity. These protected roads include Deer Harbor Road, Killebrew Lake Road, Fisherman Bay Road, Bayshore Road, and MacKaye Harbor Road (ESA 2024). However, many connector roads, located within shorelines vulnerable to inundation and coastal erosion, remain at risk. In response, the Backshore Roads Feasibility Study is underway to explore options for mitigating these risks. The study will assess whether at-risk roads can be relocated inland, elevated, or repurposed to increase redundancy and resilience throughout the island's transportation network. During both the staff and community listening sessions, participants identified challenges with road relocation because of private property holdings.

Active Transportation (Bike Lanes and Trails)

Climate Risks

Sea Level Rise and Flooding

While active transportation systems will likely be exposed to sea level rise and flooding in similar locations that will impact roads, the main sensitivity of San Juan County bike lanes, shoulders and trails is a lack of redundancy. Very few separated, right-of-way trails exist within the county and road shoulders used for cycling need improvement, especially in key corridors. The county has supported the development of park trails, road rights-of-way, and complete streets (San Juan County 2022). Several of these trail systems traverse through or are within proximity to high-risk flood zones or the 5ft SLR + 100-year storm scenario (San Juan County GIS Department n.d.; Figure 16).

Figure 16. Trail systems in relation to FEMA high-risk flood zones and areas projected to be impacted by the projected 5-foot sea level rise + 100-year storm scenario (San Juan County GIS Department n.d.).



Adaptive Capacity

San Juan County has a limited network of bike trails but is working to expand its trail and active transportation infrastructure (San Juan County 2022). Projects that improve the quality and safety of active transportation alternatives will benefit the well-being of all residents, including those who do not have access to a car or prefer to bike or walk (Staff Listening Session 2024).

Public Transit Systems

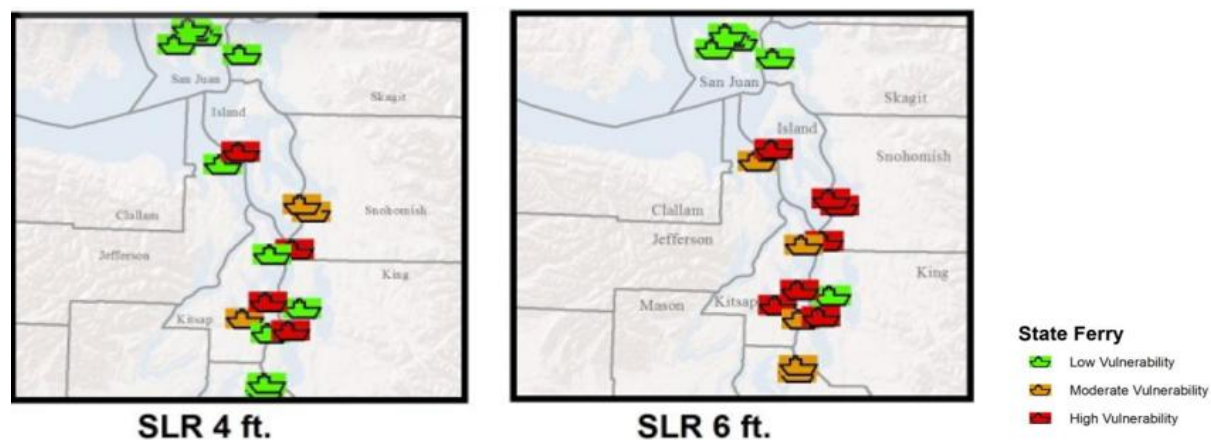
Climate Risks

Sea Level Rise and Storms

The County's transportation system is primarily composed of summer-season shuttles, , private taxi services, and on demand micro-transit for residents in need. The county is also highly dependent on WSDOT Ferry systems, which connect each island to the mainland.

Both the Orcas Island ferry terminal and the Shaw Island ferry terminal are projected to be exposed by sea level rise (ESA 2024), however WSDOT has assessed its ferry system's vulnerability to risk and found that all San Juan County ferry terminals have overall generally low climate vulnerability (Figure 17). San Juan's limited transit options create further challenges for county residents. In a survey conducted by Health Services, 69% of respondents said they found it challenging to get to and from medical appointments (San Juan County 2023). Participants during the community listening session also discussed transportation challenges associated with community members accessing to medical appointments and other daily needs, resulting in a lot of isolation for community members who have limited transportation options. Resident mobility is further strained by inconsistent ferry reliance due to suspended services due to weather and mechanical issues and WSDOT's struggle to maintain staff. Circumstances like these lead to 397 sailing cancellations from June to September in 2023 (San Juan County 2023).

Figure 17. Vulnerability of WSDOT ferry facilities to 4 and 6 feet of SLR (WSDOT 2011).



Adaptive Capacity

San Juan County's transit systems largely operate outside the jurisdiction's direct control. Sand shuttles run only during summer, and residents rely heavily on WSDOT ferry services to travel



between islands, resulting in a lower adaptive capacity score. While establishing a reliable public transit network on the islands is challenging, models like Martha's Vineyard in Massachusetts suggest that a comprehensive system is possible (Community Listening Session 2024). Recent efforts have been made to improve transit access, with the County initiating community planning, fostering public conversations, and engaging with agencies like WSDOT. For instance, a 2024 Lopez public transit survey revealed that 60% of residents would leave their car behind if reliable transit alternatives were available, signaling strong public support for enhanced transit options (Finley 2023). The County has also collaborated with WSDOT to explore alternatives that encourage residents to walk onto the ferry, including fixed-route and on-demand shuttles, medical transportation services, and community care programs (WSDOT 2023).

Additionally, residents on Orcas, San Juan, and Lopez Islands benefit from Island Rides, a nonprofit that has provided over 40,000 free or low-cost on-demand rides since 2013 to those with limited transportation access, enhancing mobility across the county. Island Rides has also introduced a car-sharing program on Orcas Island, offering vehicle access to residents of the *of People and Land* (OPAL) Land Trust neighborhoods (Islandrides.org 2024).

WSDOT has also recently secured emergency funding to improve interisland ferry routes, which will support passenger-only ferries and barges during service disruptions, enhancing both island and mainland access for residents (CDN 2024). Moreover, residents visiting the mainland have access to commuter routes established in Anacortes, providing regional access to the Skagit area (Skagit Transit 2023). However, the access times for these commuter routes are not always aligned with ferry times, and many county residents do not view these commuter routes as a viable option for mainland access.



Next Steps

This section summarizes resilience recommendations from the results of the document review and listening sessions. These recommendations will be considered as part of the policy development process for the CE and the CAP.

Buildings and Energy:

- Expand low impact development efforts to mitigate impacts of flood events on buildings.
- Encourage and incentivize energy efficiency measures (including insulation, heat pumps, and air filters), especially for low-income residents.
- Expand renewable energy production on-island, including by developing an action plan and land use planning/permitting for large-scale solar and other renewable energy, for example through a least-conflict siting process.

Water Resources:

- Landowner education and technical assistance to support compliance with septic system inspections and updates to reduce septic failures from climate impacts.
- Expand monitoring efforts for groundwater recharge and water quality. Incorporate the findings from the updated USGS report should update the aquifer withdrawal rate to better understand future water availability.

Transportation:

- Enhance bicycling and walking infrastructure through expanded shoulders, traffic revisions and separated bike paths.
- Increase community outreach to assess transit needs and explore the feasibility of services like buses, car shares, and bike rentals.
- Collaborate with WSDOT Ferries to ensure reliable service and connectivity between ferry terminals and transit system.
- Identify opportunities to relocate roads that are vulnerable to sea level rise (SLR) and coastal flooding. When relocation is not possible, identify alternative measures, such as culvert expansion, improved drainage, or protective barriers.



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Appendix A: Reviewed and Synthesized Documents

Planning Document	Scale
DRAFT SJC Sea Level Rise Vulnerability Assessment 2024-5-14.docx	San Juan County
San Juan County-annual-proj_mod-tmax_NCEI.csv	San Juan County
San Juan County-annual-proj_mod-tmax_NEMAC.csv	San Juan County
SeaLevelRise_MacLennanetal_2014_SJC_Vulnerability_final.pdf	San Juan County
SJC_CommunityHealthAssessment.pdf	San Juan County
SJC_HazardMitigationPlan_2018.pdf	San Juan County
SLR Presentation SanJuans_IanMiller_WASeaGrant.pdf	San Juan County
Washington-StateClimateSummary2022.pdf	Washington State
Raymond, C., M. Rogers, 2022. Climate Mapping for a Resilient Washington. Prepared by the Climate Impacts Group, University of Washington, Seattle and Research Data & Computing Services, University of Idaho, Moscow.	Washington State
ICR climate resilience group – have lots of resources	
2012 USGS water survey data (most recent)	
OPALCO. 2019. <i>2020 - 2040 Integrated Resource Plan</i> . Resource Plan, Eastsound: OPALCO. —. 2022. <i>Quick Fact: OPALCO Tidal Energy Pilot Project</i> . November 3. Accessed November 20, 2024. https://www.opalco.com/quick-fact-opalco-tidal-energy-pilot-project/2022/11/ . —. 2024. <i>Quick Fact: Rooftop Solar and Our Local Energy Future</i> . April 11. Accessed November 20, 2024. https://www.opalco.com/quick-fact-rooftop-solar-and-our-local-energy-future/2024/04/ . —. 2023. <i>Quick Fact: Wildfire Mitigation</i> . August 16. Accessed November 20, 2024. https://www.opalco.com/quick-fact-wildfire-mitigation/2023/08/ . —. 2024. <i>Support Local Renewable Energy Projects</i> . June 14. Accessed November 20, 2024. https://www.opalco.com/support-local-renewable-energy-projects/2024/06/ .	San Juan County
WSDOT long range ferry plan	Washington State



Appendix B: County Staff and Partner Listening Sessions

Tuesday October 15, 2024 | 12:30 – 2:00 PM

MEETING OBJECTIVES

- Introduce the San Juan County Vulnerability Assessment (VA) process
- Present initial findings and gaps from document review
- Solicit expert stakeholder resources & experience to fill gaps identified in focus areas

ATTENDEES

Name	Organization	Role
Angela Broderick	SJC	Climate & Sustainability Coordinator
Kendra Smith	SJC	Environmental Stewardship
John Roach	SJC	Fleet Services Director
Ryan Page	SJC	Housing Program Coordinator
Ethan Schmidt	SJC	Environmental Health & Drinking Water Program
Jane Fuller	SJC	County Council Chair (District 3)
Greg T. Sawyer	SJC	Facilities Director
Jesse Douglas	SJC/Friday Harbor	Public Works
Vince Daucinas	OPALCO	President of OPALCO Board of Directors
Jay Kimball	C&S Advisory	Chair of C&S Advisory Committee
Mary Ann Rozance	Cascadia	VA Lead
Taylor Magee	Cascadia	VA Support

Sector-by-Sector Discussion

BUILDINGS AND ENERGY

What is missing from our assessment? What resources could help fill these gaps?

- Jay Kimball:
 - OPALCO has \$40 million in Switch It Up funds from USDA “electric co-ops” to support GHG emissions reductions and increase local energy efficiency and production.
 - Noted the recognition of rooftop versus large scale solar in the county. Shared a concern with rooftop solar, noting that the more inverters you have, the more noise generated. Noise is a problem for neighbors from inverters- so if we get to a higher share of inverters using this, noise mitigation measures will be needed.
 - Include right of way clearing for fire mitigation, also note the mixed perceptions of right of way clearing, with some residents disagreeing with clearing and reducing tree/forest cover because they don’t understand the importance of the practice.
 - Vince Daucinas: There is adequate funding for right of way clearing, however, many transmission corridors/ right of ways were established in



the 1970s and are narrower than they should be. A new RCW allows them to go after dangerous trees along the corridors. Shaw Island is a strong example of narrow corridors. The County works with homeowners when they can to educate them on the practice.

- Vince Dauciunas:
 - The County needs to get people together and get the least conflict solar siting planning process started. Provided five policies from the WA Commerce Policy Explorer, related to energy resilience:
 - Ensure that energy infrastructure — including generation and transmission — can accommodate renewable energy opportunities and withstand and recover quickly from the impacts of extreme weather and other natural hazards worsened by climate change. Goal - ID#: O
 - Install distributed renewable energy generation and battery infrastructure at public facilities to store renewable electricity generated on site and provide emergency power that ensures continuity of operations. Policy - ID#: O.02
 - Maximize renewable energy sources for the supply of electricity and heat to new and existing buildings. Policy - ID#: E.02
 - Develop local microgrid solar and battery storage facilities in low-impact sites. Policy - ID#: E.04
 - Direct solar development onto lands identified as having “least conflict” through the Least-Conflict Solar Siting process on the Columbia Plateau. Policy - ID#: G.02
 - **MA noted that some of these policies could be consolidated.**
- Greg T. Sawyer:
 - Alternative fuel sources such as gasification boilers that use wood waste as a fuel source, which are community based rather than residential. There was a local working group working on this project and the company providing data was Wise Wood Energy from Portland, OR.
 - Jay Kimball: The gasification project was through the Conservation District. It was a combination of fuel collection, burn for gasification, and biochar for soil improvement
- MA shared that a gap found through the research was the lack of low-income shelter in place options and rising utility costs in the county.
 - Ryan Page: OPALCO has a program to help residents with rising utility costs, and there are utility assistance centers throughout the county. Good to keep as an adaptive capacity challenge, but existing resources should be captured.
 - OPALCO energy assistance programs info:
<https://www.opalco.com/account-services/energy-assist-program/>
 - Ryan Page: It is harder for low-income renters to shelter in place, and that should be kept as an adaptive capacity challenge. During COVID, the County had robust response programs to help keep people in their homes/ support shelter in place.
 - COVID After Action Report: [San-Juan-County-COVID-19-After-Action-Report \(sanjuancountywa.gov\)](#)

Any key climate risks that we haven't captured?

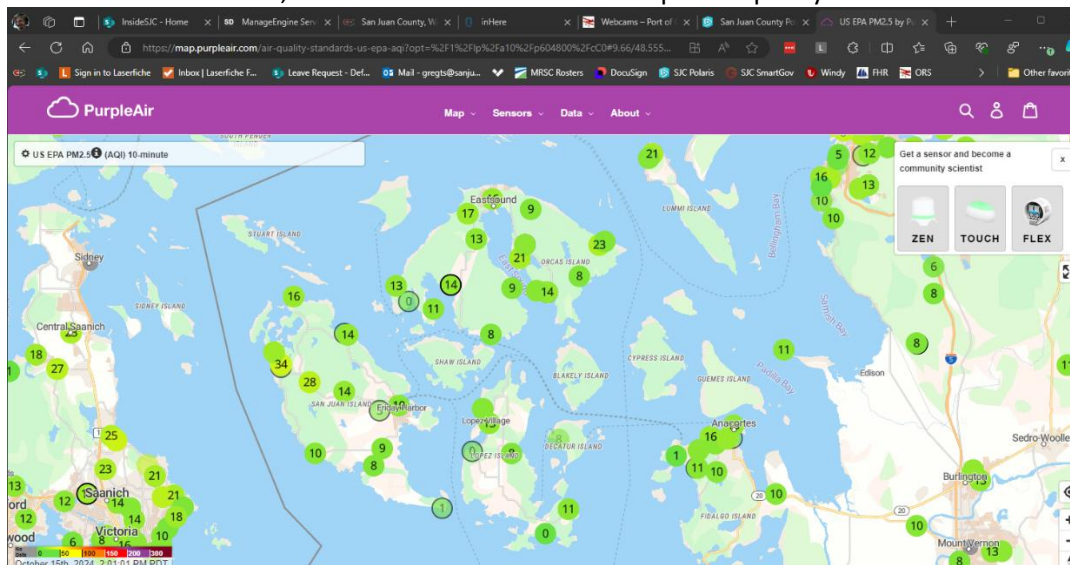
- Greg T. Sawyer: The DNR WUI map may be off/outdated. Greg will follow-up with DNR/EM on other mapping sources.

- Angela noted that HMP and CWPP (which is currently underway) may have more recent maps. Angela will follow up with Brenden on CWPP process.

What current programs, policies, and initiatives are you currently employing to help with these impacts?

Do you have any questions/comments for us?

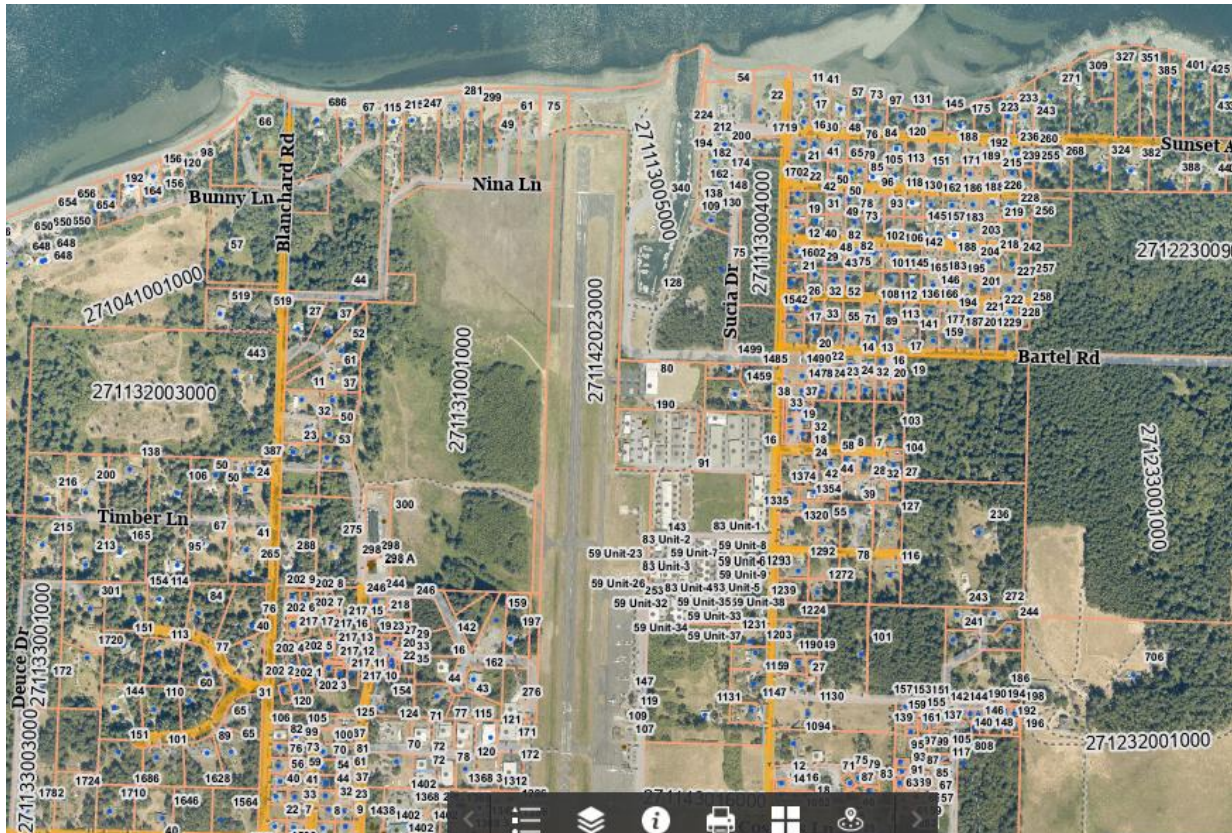
- Greg T. Sawyer: Is air quality related to smoke addressed?
 - Mary Ann noted that air quality related to smoke impacts is covered in the Buildings and Energy sector, with shelter in place and wood burning impacts on air quality. Current air quality considerations primarily focus on ensuring people have access to healthy indoor air spaces during smoke or heat dome events.
 - Greg shared that the County has been collecting air quality data using Purple Air, which can be added under adaptive capacity.



TRANSPORTATION

What is missing from our assessment? What resources could help fill these gaps?

- Greg T. Sawyer:
 - Great image of the Orcas North Shore. Perhaps more concerning is the impact on the airport which faces inundation from SLR. Shared a photo:



Any key climate risks that we haven't captured?

- Jay Kimball:
 - Inland flooding near Massacre Bay by Turtleback Mountain- the steep land in the area cannot properly absorb rain during heavy rain events.

What current programs, policies, and initiatives are you currently employing to help with these impacts?

- Jay Kimball:
 - Island Rides provides on-demand micro-transit to vulnerable communities in the county, driving about 50,000 miles/year. The program is grant funded.
 - The program has used funds to purchase AWD vehicles to help connect rural community members and further navigate severe weather which may worsen with climate change.
 - Island Rides is also deploying public EV charging: <https://islandrides.org>.
 - They are establishing a car-share program at OPAL affordable housing on Orcas Island, modeled after the Lopez Island Land Trust.
 - A challenge with the program is expensive auto insurance, which is around eight times more expensive than traditional car insurance.
- Jane Fuller:
 - The Lopez Island Land Trust has an EV car share program for residents of LILT.
 - The County received emergency funding for passenger only ferries and barges during service disruption periods.
 - Upcoming discussions for on-Island transportation and enforcing resilience in transportation infrastructure.



- Funding is a concern for ensuring transportation routes remain open/resilient to impacts. (funding for culverts, road improvements, etc.)

Do you have any questions/comments for us?

- Jay Kimball:
 - Martha's Vineyard, a single island, with similar population to SJC, has 32 bus public transit (50% EV), serving mostly seniors and teens, plus tourists during summer. They also have mix of taxis, Uber, rental cars services.
 - Met with WSDOT and discussed vulnerable populations in the county and access to transportation. Access to public transportation is a huge concern for vulnerable populations.
- Jane Fuller:
 - As we look at climate impacts on these sectors, should we not be considering which of the three climate factors - increasing temperatures, precipitation, and sea level rise - are going to have the greatest negative impacts on these sectors, and prioritize mitigation measures accordingly; for example, if sea level rise is likely to have greater impacts on these sectors than changes in precipitation and temperature, and if so, then what? Perhaps we should also consider the various ways in which our population and economy are going to be impacted by these different climate factors. Perhaps this type of analysis is not as relevant for policy development, but it may be for prioritization of actions in the action plan that is to be developed following the development of the climate element. Just food for thought perhaps.
 - **Which climate impacts have the greatest impact on a particular sector.**

WATER RESOURCES

What is missing from our assessment? What resources could help fill these gaps?

- Vince Dauciunas:
 - The County needs to study alternative water sources. If the County considers desalination facilities, OPALCO needs to be involved to plan for energy needs.
 - USGS is currently updating the 2004 aquifer recharge study, with a draft plan expected by the end of 2024.
 - The County needs to update the aquifer withdrawal rate to really understand if/what is needed for alternative water sources.

Any key climate risks that we haven't captured?

- Ethan Schmidt:
 - An adaptive capacity concern for the county is the lack of qualified water systems operators in the Islands due to aging out and lack of young people getting into the field. This issue will only be exacerbated if there are more desalination systems as they are more operator intensive. This issue speaks to the lack of trades people on the island. Issue is particular to San Juan Island, with 1 operator.
 - There are more operators in the septic field, but it remains a vulnerability across water resources.

What current programs, policies, and initiatives are you currently employing to help with these impacts?

- Ethan Schmidt:
 - Lopez island has an ongoing groundwater monitoring program for wells on the Island.



- The most recent [2023 Lopez Island Groundwater Monitoring Report.pdf](#) showed a .5-1.0ppm increase annually.
- There is not currently a county-wide log for wells and groundwater monitoring. They are hoping the updated USGS study will identify areas in the county that could benefit from these logs. Orcas and San Juan Island have disconnected aquifers, and monitoring would need to be localized.

Do you have any questions/comments for us?

- Vince Dauciunas:
 - The current water element has a lot of great water policies related to water availability and quality, and I strongly urge that water resources be elevated in the Comprehensive Plan as a priority concern. Comments from the water element contain policy ideas that could be included in the Climate Element for more awareness and urgency. As population increases, water quantity is a bigger concern.
 - If we consider desalination facilities as a potential solution to water availability, we need to incorporate that into the Comprehensive Plan now so that we are proactively siting and planning for that.
 - Q: Aquifer Recharge Study and Water-Budget Components of San Juan County, Washington ACTIVE by Washington Water Science Center Science Partners. October 19, 2021. Is there any further information on this work?
 - A: The Aquifer Recharge Study and Water-Budget Components for San Juan County, led by the U.S. Geological Survey (USGS) in partnership with San Juan County Health and Community Services, is currently active and aimed at providing crucial insights into the county's water resources. The study focuses on understanding aquifer recharge areas, groundwater use, and updating the county's water balance, which is essential for sustainable water management, especially considering population growth and climate change. As of the most recent updates (2023), the study is continuing its efforts to assess groundwater sustainability. This includes using models like the Soil-Water-Balance (SWB) to estimate recharge rates and compiling water use data to create a more accurate water budget for the islands. This is vital, given that San Juan County's freshwater resources are limited by natural factors such as the rain shadow effect and bedrock geology, making the management of groundwater critical. The study builds on earlier work completed in 2002 and aims to address whether the current rate of water use remains sustainable given the county's growth. The results will play a key role in shaping future land-use planning and water management policies. Further updates or results are expected to be published by the USGS, including maps and tables summarizing the findings, which will be available online.
 - Contacts: Elise Wright, Hydrologist Washington Water Science Center. Email: ewwright@usgs.gov | Phone: 253-552-1672
 - Q: If San Juan County is to consider desalination systems to add to the available fresh water, what planning steps should be taken, and how might the plan affect Land Use, Shoreline restrictions, and energy requirements, and saline discharges back to ocean?
 - A: If San Juan County considers desalination as a method to augment its fresh water supply, several important planning steps must be addressed,



focusing on land use, shoreline restrictions, energy requirements, and environmental impacts from saline discharges. Planning Steps:

- **Regulatory Approvals and Environmental Impact Assessments (EIA):** Desalination projects require thorough regulatory review and environmental assessments, particularly under Washington's Shoreline Management Act. The County must evaluate the potential ecological impacts of intake structures, energy consumption, and brine disposal. This would involve collaboration with agencies such as the Washington Department of Ecology and local environmental groups to ensure compliance with environmental standards.
 - **Land Use and Zoning:** Desalination plants, especially intake and outfall facilities, are likely to be sited near shorelines. San Juan County's shoreline regulations, under the Shoreline Master Program (SMP), would play a critical role in determining suitable locations. The SMP limits development in ecologically sensitive areas, so desalination infrastructure must avoid disrupting shoreline ecosystems, public access, and the rural character of the islands.
 - **Shoreline and Marine Habitat Protection:** Intake structures that draw in seawater must be carefully designed to prevent the harm of marine life. Passive intake systems, which reduce the suction force and minimize fish and organism capture, might be necessary. Moreover, the siting of discharge points for saline brine must ensure minimal impact on local ecosystems, as discharges can raise salinity levels, affecting marine habitats.
 - **Energy Requirements:** Desalination is energy-intensive, and San Juan County would need to evaluate whether its energy infrastructure could support the additional load. Desalination plants generally require substantial amounts of electricity, which may stress local renewable energy supplies or require additional power generation capacity. In an island setting like San Juan County, this could mean importing more energy from the mainland or investing in local renewable sources such as wind or solar.
 - **Brine Management:** One of the most critical environmental challenges of desalination is managing brine discharge. Desalination produces highly saline wastewater, which, if not properly managed, can negatively impact marine environments. The County would need to plan for environmentally safe brine disposal, possibly through diffusers that dilute the brine into deeper ocean currents where it is less likely to affect nearshore ecosystems.
 - **Public Involvement and Long-term Sustainability:** Community input would be crucial, particularly given the county's emphasis on rural character and ecological preservation. Public hearings, reviews, and transparent planning processes would ensure that desalination, if implemented, aligns with the county's values and long-term sustainability goals.
- **Potential Consequences of Not Planning Thoroughly**
 - **Land Use Conflicts:** Failing to adequately plan for desalination could lead to conflicts with existing land-use designations, especially



in shoreline zones. Improper siting could result in legal challenges from environmental groups or residents concerned about preserving the island's aesthetic and environmental integrity.

- **Shoreline and Marine Habitat Degradation:** Without careful planning, desalination could harm sensitive marine ecosystems, particularly if brine discharge elevates salinity levels near vulnerable habitats. This could violate state environmental laws and disrupt local fisheries or tourism.
 - **Increased Energy Costs:** A lack of planning for energy requirements could result in power shortages or higher utility costs for residents. Desalination may place additional burdens on an already strained grid, potentially leading to rate increases, especially if the County must import additional electricity.
- By addressing these factors in a structured planning process, San Juan County can mitigate the environmental and economic risks associated with desalination while helping secure a reliable water supply for its residents.



Appendix C: Community Listening Session

November 19, 2024 | 5:30 – 6:30 PM

MEETING OBJECTIVES

- Introduce the San Juan County Vulnerability Assessment (VA) process
- Present initial findings and gaps from document review
- Solicit community feedback on lived experiences with climate vulnerability and adaptive capacity

ATTENDEES:

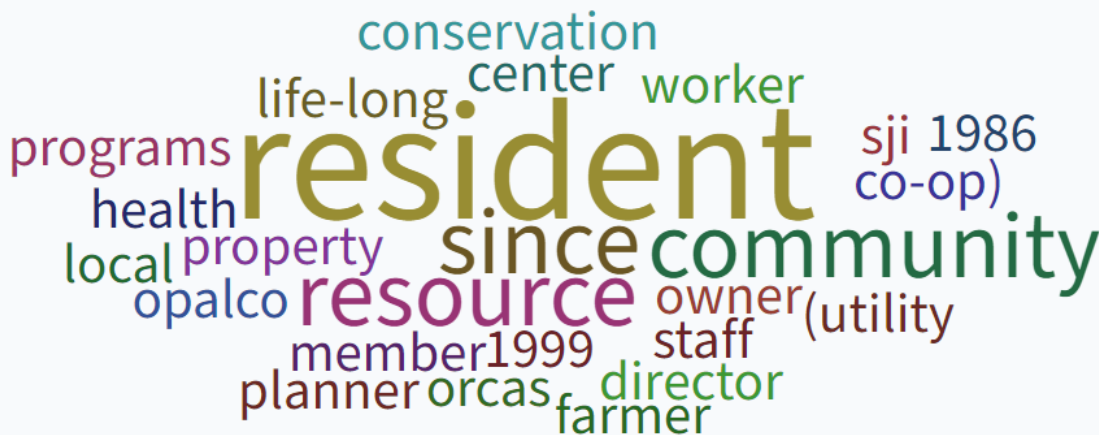
Cascadia Consulting: Mary Ann Rozance, Jenna Decker Sherry, Taylor Magee

San Juan County: Angela Broderick

Public Attendees: 14

WELCOME

The Cascadia team welcomed everyone to the meeting and reviewed the meeting goals and agenda. Participants used “Poll Everywhere” to interact with the presentation and answer questions related to the VA. To get a sense for who was on the call we asked, **What's your role in the community?** E.g. teacher, life-long resident, etc.





ENGAGEMENT UPDATE AND CLIMATE IMPACTS

Cascadia provided an engagement update, noting what has been done for engagement thus far and what's to come. Cascadia also introduced key climate impacts that informed the VA. We asked, **How have you seen climate change impact you and/or your community?**

- Increased wildfire smoke impacts and extreme heat days impacting outdoor recreation and daily life
- Rising tides and larger storms causing damage to roads and property
 - Participants cited Mackay Harbor as an example
- Loss of topsoil nutrients and changes in precipitation impacting agricultural land
- Wells drying up and facing saltwater intrusion

Sector-by-Sector Discussion

BUILDINGS AND ENERGY

Cascadia presented on the Buildings and Energy sector and asked participants for feedback on the vulnerability and adaptation measures of this sector. Below are the summarized responses, detailed responses may be found in Appendix C.1: All Response Data.

- **(Vulnerability) Have you experienced any of the climate vulnerabilities discussed or have any experiences not reflected here? Please share.**
 - Housing availability challenges due to “coastal squeeze”
 - Increased power outages due to severe weather and storm damages
 - Wildfire smoke impacts
- **(Adaptation) What do you think the County can do to best address these climate vulnerabilities?**
 - Partner with OPALCO and create additional incentives
 - Create smoke and heat shelters for vulnerable populations
 - Encourage local renewable energy
- **(Adaptation) What are some adaptive capacity actions you currently take or would like to take?**
 - Drive an EV
 - Installed solar panels
 - Home weatherization measures such as double-pane windows
 - Installed heat pump
 - Installed solar well pump



TRANSPORTATION AND MOBILITY

Cascadia presented the Transportation and Mobility sector and asked participants for feedback on the vulnerability and adaptation measures of this sector. Below are the summarized responses, detailed responses may be found in Appendix C.1: All Response Data.

- **(Vulnerability) Have you experienced any of the climate vulnerabilities discussed or have any experiences not reflected here? Please share.**
 - Ferry interruptions
 - Roads flooding
 - Participants cited Bailer Hill Rd. as an example
 - Challenges to active transportation (e.g. bike) are real and constant
 - Lack of shoulders for bike active transportation on some roads
 - Increased traffic speeds pose a threat to active transportation
 - Road damage and closures brought on by storms and extreme weather
 - Closures around Barlow Bay, Agate Beach
 - Winter storms and road closures have posed safety concerns, making wood stoves necessary for heat/survival
- **(Adaptation) What do you think the County can do to best address these climate vulnerabilities?**
 - Prioritize active recreation in road corridors
 - Improve road shoulders and shoulder safety
 - Participants noted that key corridors need improvement, particularly with vehicle conflict concerns
 - Participants cited Crow Valley Rd on Orcas, Center Rd on Lopez, and Mud Bay Rd on Lopez as examples
 - Questions about the County's responsibility to ensure road access to at-risk neighborhoods such as Fisherman Bay Spit, Humphrey Head, and Salmon Point
 - Increase connectivity of public transportation in Anacortes and Skagit
 - Implement or promote EV car share
 - Improved public bus system using EV buses
- **(Adaptation) What are some adaptive capacity actions you currently take or would like to take?**
 - Increased biking for local needs
 - EV adoption



WATER RESOURCES

Cascadia presented the Water Resources sector and asked participants for feedback on the vulnerability and adaptation measures of this sector. Below are the summarized responses, detailed responses may be found in Appendix C.1: All Response Data.

- **(Vulnerability) Have you experienced any of the climate vulnerabilities discussed or have any experiences not reflected here? Please share.**
 - Many Islanders have needed to start buying additional water for their property in the summer
 - Noticed impacts to water quality, particularly a salty taste
 - Experiencing saltwater intrusion in wells
- **(Adaptation) What do you think the County can do to best address these climate vulnerabilities?**
 - Encourage energy conservation and promote energy efficiency, as many septic systems and other water systems rely on energy
 - Preserve water quantity and availability in the face of rising populations
 - Support and promote grey-water systems
 - Increase education and technical assistance to ensure property owners understand future issues with septic tanks and septic submersion
 - Increase education and technical assistance to ensure property owners are well informed
 - Encourage skillful use of water
- **(Adaptation) What are some adaptive capacity actions you currently take or would like to take?**
 - Irrigate gardens and yard with grey water
 - Installed composting toilet system to conserve water use
 - The San Juan Preservation Trust plans to install artificial beaver dams to facilitate ground water recharge
 - Install low flow showers and toilets
 - Moved septic tank from potentially eroding bank
 - Planted native plant garden
 - Rain capture for domestic and garden and livestock use
 - Conserving water during drier summer months



Appendix C.1: All Response Data

This appendix contains every response received for all questions and is not altered.

WELCOME

What's your role in the community? E.g. teacher, life-long resident, etc.

- Resource Conservation Planner and local farmer on SJI since 1986.
- Resident
- Programs Director, orcas community resource center
- Community Health Worker
- life-long resident
- Staff member at OPALCO (Utility co-op)
- Resident since 1999
- Resident, property owner.
- Resident and utility worker
- Farmer, San Juan Island, resident since 1986
- 20 year resident, property owner, parent.
- resident since 2005.
- Retired and resident 1993
- 30 yr resident and Friends of the San Juans employee!

CLIMATE IMPACTS

How have you seen climate change impact you and/or your community?

- smoke impacts; excessive heat of 106 F during 5 days of the Heat Dome
- so far nothing outside historical events
- Roads damaged at Mackay Harbor and local property owner is opposing road relocation inland.
- Precipitation changes in the growing season starting in 2008. Rapid cold hitting early and killing perennial crops
- Wildfire smoke impacting sports and recreation
- loss of topsoil nutrients
- less habitat for animals
- Damaged roads. Storms
- rising tides
- larger storms
- Pasture land dries out earlier in the summer
- I'm not sure.
- Sea level rise has damaged local roads.
- water quality is changing due to climate events
- hoarding of resources by the affluent members of our community.



- I'm not feeling any great impacts yet, but afraid for the future that we will get stronger and stronger destructive winds, and hotter summers that will affect trees and gardens.
- wells drying up. saltwater intrusion.
- And yes, we've had a lot of smoke from farther-off wildfires.
- I am preparing my property to reduce wildfire risk
- Worried about sea level threat to nearby septic systems.

BUILDINGS AND ENERGY

Have you experienced any of the climate vulnerabilities discussed or have any experiences not reflected here? Please share.

- heat dome impacts
- housing availability challenges due to coastal squeeze
- Looking to increase our rooftop water catchment to reduce our demand for groundwater.
- Have experienced the increase in outages due to severe weather and storm damage
- smoke impacts
- About to do a photovoltaic install.
- I have solar on my home and have invested in Community Solar that I donated to low income people.
- Transitioned from wood heat to heat pump. Wanted to install rooftop solar but cost even with incentives was a road block due to other OPALCO requirements for upgrading transformer and the cost for ditching, etc.
- We have experienced wildfire smoke from off island fires and big snow storms where power was out for several days.

What do you think the County can do to best address these climate vulnerabilities?

- Highlight actual examples of adaptation such as wildfire risk reduction in neighborhoods
- There are transportation challenges coming, like the previously mentioned road damage. Should that go here?
- Incentives!! Will always have more participation
- Put more focus on drinking water demand/availability.
- Create smoke and heat shelters for vulnerable people.
- Listed incentives are a good start.
- Partner with OPALCO with additional incentives
- Encourage off grid living. Local renewable energy. Skillful water usage.

What are some adaptive capacity actions you currently take or would like to take?

- Restoring a Garry Oak habitat
- Would like to have rain catchment system
- Electric vehicle, coupled with rooftop solar.
- I have solar, heat pump, and good windows/weatherization
- Heat pump, solar, double-pane windows, LEDs



- Switched to almost entirely LED lighting
- Expanded drip irrigation system to further expand available irrigation water.
- We live off grid in a small footprint dwelling. Installed solar well pump. Composting toilet.
- We are trying to grow more food for ourselves and community.
- OPALCO is very concerned about climate change and meeting our future energy needs. We are hopeful that the changes to the Comprehensive Plan will translate to real changes within the county to allow for more local utility scale renewable energy projects. The current land-use designations are too restrictive to allow for the Comp Plan goals of energy independence. Goals to transition away from fossil fuels and heat our homes and fuel our vehicles using electricity are proving to be highly challenging for the islands and communities across the nation. We as a community need to figure out how to satisfy the increased demand for electricity while the supply of carbon-free firm power shrinks. Given our remote location, the best bet for clean and affordable power is to build renewable generation projects locally. We can't wait for the situation to be dire before we start to take action on getting our community positioned to deploy climate friendly energy solutions. In order to do this, OPALCO needs STRONG community support and for the county to modify restrictive land use designations to allow for innovative energy solutions.

TRANSPORTATION AND MOBILITY

Have you experienced any of the climate vulnerabilities discussed or have any experiences not reflected here? Please share.

- Ferry interruptions
- Flooding on Bailer Hill Rd
- Described challenges to active transportation (e.g. bike) are real and constant.
- relocate
- Is San Juan County willing to consider use of eminent domain to relate roads?
- Clearly road damage and closures around Barlow Bay, Agate Beach.
- We have experienced winter storms where cold temperatures and road closures made a wood stove an essential tool for survival.
- Landslide, road damage, sinkhole etc.
- Most inland flooding is related to soil type and the location of the restrictive layer. Buildings in these areas have to deal with the rebound effect which brings on flooding due to shallow restrictive layers.
- Vehicle speeds have increased over the last few years way beyond the posted limits.

What do you think the County can do to best address these climate vulnerabilities?

- Push Public Works to prioritize active recreation in road corridors.
- No shoulder on Crow Valley Rd, Orcas
- Implement the requirement for Short-term rentals to have EV charging
- Thinking of road closure/failure. What is county's responsibility to keep access open to at-risk neighborhoods (I'm guessing Fisherman Bay Spit, Humphrey Head, Salmon Point, etc.)



- Shoulder improvements would provide a good portion of the benefits of bike lanes. Current situation is quite bad in some key corridors.
- Biking and walking opportunities could be much improved. Use less energy and more resilient.
- Increase in roadside shoulder width for cycling and walking.

What are some adaptive capacity actions you currently take or would like to take?

- Would like better connectivity of public transport in Anacortes/Skagit
- EV car share?
- I have had an EV since 2015
- More cycling, but it is problematic due to vehicle conflict concerns.
 - Example: mud bay road between center road and southend store.
 - example: center road on Lopez.
- Increase biking for errands. Safer bike lanes would make this more appealing.
- I have been an active cyclist for local transportation for years. Noticed the speed of vehicles and the danger associated with that issue.
- We ride our bikes! We moved from Orcas to Lopez to reduce our dependency on the car. We would ride more and feel better about the kids on the road if there was less tourist traffic.
- It is too bad we can't get to the point of having a scheduled bus system using EV buses on a regular basis.

WATER RESOURCES

Have you experienced any of the climate vulnerabilities discussed or have any experiences not reflected here? Please share.

- I know of multiple islanders who have had to start buying water for their property in summer
- The tap water tasted salty
- Trying to establish a new well...
- A neighbor had salt water intrusion.
- I'm curious why intrusion map was so Lopez-dense. Better data for some reason?
- Salt water intrusion in well.
- I have largely stopped garden irrigation because I am concerned about salt water intrusion in my well.
- Converted our septic system to a gray water only system and installed a composting toilet years ago to reduce well water usage.
- Really excellent insulation in homes would greatly reduce power needs.
- Lopez has more porous geology and has more of a problem with it than other islands