Kimley»Horn

MEMORANDUM

July 31, 2024

To: Mindy Brooks, Senior Long-Range Planner
Lewis County, Washington

From: Heidi Rous
Climate Director, Kimley-Horn

RE: SUMMARY OF POTENTIAL CLIMATE IMPACTS/RISKS/VULNERABILITIES & POTENTIAL OPPORTUNITIES, CLIMATE ELEMENT AND RESILIENCY SUB-ELEMENT 2025 COMPREHENSIVE PLAN UPDATE, LEWIS COUNTY

Purpose

As a follow-up to the current policy gaps and opportunities memorandum submitted earlier, this memorandum summarizes potential impacts, risks, and vulnerabilities to key assets in the County. Due to a changing climate, the memorandum identifies potential opportunities for the County to take actions to improve the resiliency of those assets. This memo informs new Climate Element and Resiliency Sub-Element, consistent with House Bill 1181 ("HB 1181") and Washington state's Growth Management Act (GMA) policies, that is part of the Comprehensive Plan update (RCW 36.70A.070(9)). Under HB 1181 and the GMA for Lewis County, a resiliency sub element must, among other things, equitably enhance resiliency to, and avoid or substantially reduce the adverse impacts of, climate change in human communities and ecological systems through goals, policies, and programs consistent with the best available science and scientifically credible climate projections and impact scenarios (RCW 36.70A.070(9)(e)(i)).

Scope

Critical infrastructure located within the County are assessed for vulnerability and risk to prioritize climate hazards (see "Analysis" section below). Assets identified are the same as those mentioned in the previous memorandum, *Summary of Climate Hazards and Policy Gaps & Opportunities, Climate Element and Resiliency Sub-Element 2025 Comp Plan Update Lewis County* ("Assets Memorandum"). According to the 2023 DOE Guidance, assets are defined as community groups, places, natural resources, infrastructure, and services that the community finds valuable and wants to protect against climate-exacerbated hazardous events. This analysis characterizes the exposure of each asset to a climate hazard ("sensitivity") along with how frequent the hazard will occur (probability), how adaptive the asset is to disturbances (adaptive capacity), and how significant functional and physical costs would be (magnitude). This memorandum strives to describe the findings and provide a basis for developing goals and policies that make up the Climate Element and Resiliency Sub-Element.

Methodology

Following the guidance document from the Washington State Department of Commerce's Intermediate Planning Guidance document, the Climate Element Workbook was utilized to assess climate impacts, risk, and vulnerabilities, and develop recommended actions. For this assessment, each asset-hazard pair from the Assets Memorandum was

assessed in terms of infrastructure sensitivity or exposure and adaptive capacity. Both sensitivity and adaptive capacity characterized vulnerability outcomes on a low, medium, and high rating (see definitions in "Analysis" section below). As determined by analysis, outreach, and review of the County's existing plans (such as Comprehensive Emergency Management Plan, Flood Management Plan, and those further mentioned in the "Analysis" section below), the climate hazards most relevant to the County are:

- Extreme precipitation,
- Flooding,
- Reduced snowpack/avalanche, and
- Wildfire

Based on these specific climate hazards, a total of 56 asset-hazard pairs were analyzed for sensitivity and adaptive capacity using a qualitative rating system (Low, Medium, and High). Ratings were determined based on indicators such as age, asset condition, physical design, social assets, economic costs, etc. Based on the sensitivity and adaptive ratings, an appropriate vulnerability risk rating (Low, Medium, High) was determined. For example, a low sensitivity and a low adaptive capacity would suggest a medium vulnerability for an asset-hazard pair.

Similarly, the same 56 asset-hazard pairs were analyzed for its probability or frequency of hazard occurrence and the magnitude of potential losses/consequences using a low, medium, and high rating. The ratings were determined based on indicators such as location, social assets, revenue, operations, and safety, etc. Using both the probability and magnitude rating, a composite risk rating was calculated. Based on the composite risk rating, a decision of "Take Action" or "Accept Risk" was identified for each asset-hazard pair. For example, a high probability with a medium magnitude for an asset would indicate a high composite risk rating; thus, a "Take Action" decision was indicated.

Analysis

Vulnerability Characterization

Existing reports, documents, and the County Website were used to gather relevant data pertaining to each hazard. Existing reports and documents include:

- Lewis County Comprehensive Plan Periodic Update
- Lewis County Public Utility District (PUD) Outage Map
- Lewis County Public Utility District (PUD) No.1 2020 Integrated Resource Plan
- Federal Emergency Management Agency (FEMA) Flood Maps
- National Oceanic and Atmospheric Administration (NOAA) Advanced Hydrologic Prediction Service
- Lewis County Risk Factor Website
- Lewis County Hazard Mapper Website
- Lewis County Municipal code
- 2009 Comprehensive Flood Hazard Management Plan
- 2016 Water System Plans for Vader-Enchanted Valley
- 2020 Community Strategic Plan
- 2022 Lewis County Public Works Annual Bridge Report
- 2022 Comprehensive Economic Development Strategic Plan
- 2023 Department of Ecology Inventory of Dams Report
- 2023 Televate Public Safety Radio System Engineering Study Report
- 2023 Lewis County Long Range Strategic Plan
- 2023 Lewis County Draft Comprehensive Solid and Hazardous Waste Management Plan

- 2016 Lewis County Comprehensive Emergency Management Plan
- 2020 Lewis County Public Utility District Broadband Assessment
- 2024 Packwood Airport Master Plan
- 2023 Ed Carlson Memorial Field Airport Master Plan Update

Through utilization of data found in the above documents, the sensitivity and adaptive capacity for each asset-hazard pair were determined based on a low, medium, and high rating according to the appropriate indicators. In accordance with DOE guidance, indicators are identified to qualitatively rank the sensitivity and adaptive capacity of each asset. **Table 1: Sensitivity and Adaptive Capacity Definitions** describes examples of key indicators that exhibit low, medium, and high sensitivity and adaptive capacity.

Table 1: Sensitivity and Adaptive Capacity Definitions

Example Key Indicators of "Sensitivity"		Example Key Indicators of "Adaptive Capacity"	
Low	• Minor repairs and accommodations required. • Slight inconveniences and temporary loss of services. • Minor disruption to business continuity and minimal loss of revenue and wages. • Little to no increase in costs and demands to respond to emergency events.	**Low**	• Adaptive solutions are innovative but costly. • Adaptive solutions may require coordination with multiple agencies to implement, leading to disruptions in service and longer implementation times. • Solutions require change in lifestyle or changes in political decisions. • Ability to avoid damage is limited.
Medium	• Temporary loss of food production, transportation, and distribution. • Temporary loss of functionality and operations closure of emergency response services. • Moderate repairs and replacements required. • Moderate increase in costs and demands to respond to emergency events.	**Medium**	• Impacts can be reduced or mitigated to a certain extent; however, adaptive solutions are only feasible for limited assets. • Some assets may face difficulties in adapting in terms of cost and implementation. • Coordination with third party agencies may be necessary for adaptivity measures. • Solutions require some change in systematic operations but are somewhat executable.
High	• Significant impact requiring reconstruction of parts or an entirety of an asset. • Extensive rehabilitation of assets resulting in long-term or permanent loss of functionality or operations closure. • Significant impact to vulnerable populations due to flooding and	**High**	• Assets can adapt with little to no difficulty. • Direct influence on the implementation of strategies or solutions for the asset is apparent. • Adaptive solutions are highly feasible for most, if not all assets with affordable costs.

Table 1: Sensitivity and Adaptive Capacity Definitions			
	extreme precipitation-related deaths and illnesses, population displacement, or migration. • Permanent loss of species not able to adapt to weather events exacerbated by climate change.		• Solutions are implemented immediately and face little to no resistance.
Sources: Orange County Transportation Authority, *Vulnerability Assessment*, Kimley Horn 2023.			

Based on the definitions above and relevant indicators, each asset-hazard pair was evaluated and given an appropriate sensitivity and adaptive capacity rating. Using the sensitivity and adaptive rating, an appropriate vulnerability rating was determined. Each asset-hazard pair describes climate indicators to determine sensitivity, adaptive capacity, and vulnerability ratings (Refer to **Appendix A: Lewis County Climate Element Workbook** for more details).

Risk Characterization

Similar to the Vulnerability Characterization described above, the same resources were used to determine the probability and magnitude ratings for each asset-hazard pair. The definitions for a low, medium, and high probability and magnitude rating are shown in **Table 2: Probability and Magnitude Definitions**.

Table 2: Probability and Magnitude Definitions[1]			
Probability		**Magnitude**	
Low	Very limited historic events recorded. Frequency of hazardous events to occur is periodic with likelihood of future events to occur episodically. For example, the likelihood of hazardous event(s) to occur once in 20 years.	Low	Minimal destruction to applicable assets with adequate functionality. In addition, minimal injuries and functionality to daily livelihood. Applicable assets may be easily repaired with available resources within a short duration of time without complications.
Medium	Limited, but some available historic events recorded. Frequency of hazardous events to occur is somewhat periodic. For example, likelihood of hazardous event(s) to occur once in 5 to 20 years.	Medium	Moderate destruction to applicable assets with decreased functionality. Injuries and functionality to daily livelihood are moderately heightened. Applicable assets may have increased difficulty for repair and functionality due to increased restoration times and complications. Health concerns are also a higher likelihood with strong suggestions for evacuation plans.
High	Recent, multiple historic events recorded. Hazardous events occur frequently. For example, likelihood of hazardous event(s) to occur within 5 years.	High	Extreme destruction to applicable assets with little to no functionality. Injuries and functionality to daily livelihood are extremely heightened. Applicable assets will have significant challenges for repair and elongated periods of construction before functionality can be

Table 2: Probability and Magnitude Definitions[1]			
			resumed. Health concerns are at an extreme likelihood with strong coercion for evacuation plans.

1. Definitions for low, medium, and high probability and magnitude were derived from the U.S. Climate Resilience Toolkit, https://toolkit.climate.gov/steps-to-resilience/assess-vulnerability-risk. Accessed June 2024.

Based on the definitions above and relevant indicators, each asset-hazard pair were evaluated and given an appropriate rating. Each asset-hazard pair describes climate indicators to determine probability, magnitude, and climate risk (Refer to **Appendix A** for more details). It is also important to note that the recommended decisions of "Take Action" or "Accept Risk" should be not understood as a "final" decision for the County. These decisions are strictly based on the structure of the climate workbook analysis.

Summary of Analysis

Based on the vulnerability and risk analysis, **Table 3: Asset Vulnerability and Climate Hazard Risks** showcase which asset/critical infrastructure are exposed to a priority climate hazard throughout the County. An asset-hazard pair which received a composite risk rating of medium or high are denoted with color scales associated with low (yellow), medium (orange), and high (red) ratings. Composite risk is comprised of an asset's level of vulnerability to a climate hazard and the probability and magnitude of impact to the asset from a climate hazard. A summary of asset vulnerability and climate hazard risks to critical infrastructure within the County is further provided below.

Table 3: Asset Vulnerability and Climate Hazard Risks					
	Priority Climate Hazards				
	Assets	Extreme Precipitation	Flooding	Reduced Snowpack/ Avalanche	Wildfire
Community Assets	General Government				
	Utility Substations				
	Radio Communications				
	Energy Facilities				
	Historic buildings & sites				
	Airports				
	Fiber optics				
	Fire stations				
	Shorelines				
	Civic centers				
	County Roads				
	Bridges & Railways				
	Solid waste infrastructure				
	Wastewater infrastructure				
	Water Supply				
	Educational Institutions				
1. Composite risk ratings are based on a low (yellow), medium (orange), and high (red). Boxes that are grey were not analyzed because of a lack of data from the CMRW tool.					

Although certain assets may not be exposed to a particular climate hazard, they may be affected by secondary hazards such as wildfire smoke/ash, landslides from riverine flooding and exposed soil following wildfire and precipitation events, flooding from overtopping of levees and unpredictable snowmelt, and heat waves from prolonged extreme heat events. The section below focuses on asset-hazard pairs with a Medium to High vulnerability rating and Medium to High composite risk rating. Additional details can be found in **Appendix A.**

Vulnerability

- ***Sensitivity[1]:*** Assets most vulnerable to priority climate hazards are fire stations, airports, roadway infrastructure, and civic centers. Rural households with mobility difficulties are also exposed and vulnerable to climate hazards. Assets are most likely to be impacted by hazards from increased flooding and wildfire frequency. Assets are in wildfire interface zones where there is an increased exposure to wildfire conditions i.e., fuel loads, resulting in wildfire events. Risk of flooding and wildfire hazards are expected to impact communities Countywide. Examples of climate impacts to assets are further described below:
    - Airports located in a 100-yr FEMA floodplain zones are potentially at risk of facing a temporary loss of functionality and operations.
    - The broadband pilot area of unincorporated County west of Chehalis to Pe Ell is located in wildfire interface zones, exposing fiber cables and towers to wildfire risk and resulting in potential destruction and loss of internet services to approximately 900 households and businesses.

[1] Information for this section is derived from the County's updated Multi-Jurisdictional Hazard Mitigation Plan.

- Hazards may cause irreparable damage to historic buildings and sites due to limited resources for replacement of damaged structures.
- Rail lines are exposed to flooding potential in 100-Year FEMA flood zones (Chehalis River in west, Newaukum River to southwest, and tributaries in south) and wildfire interface zones, particularly in northern County area. Rail lines may become structurally unstable and not operable, disrupting services that impacts the economy.
- UGA census tracts with high rates of mobility disabilities and low-income are more susceptible to being stranded and need to rely on relationships and emergency services for care – limited County resources in east and south County area, rural environment, far from care centers: Unincorporated Census tracts (530-419-70-700, -400), UGA census tracts (530-419-71-300, -200, -800, -900).
- Many bridges are located in floodplains, 25 of which are structurally deficient and functionally obsolete and 84 of which are experiencing critical scouring. 77 bridges are located within the 100-year floodplain and 78 bridges are located within the 500-year floodplain (2020 County Bridge Report). Structurally deficient and functionally obsolete bridges are more vulnerable to flood impacts and can delay evacuation for rural communities.

- ***Adaptive Capacity:*** Exposed assets can adjust to hazards by retrofitting older buildings and infrastructure and implementing design features that consider increased climate hazards. Other methods such as land use controls may be enforced to site assets in non-hazardous areas and create development standards that can withstand climate hazard events. Adaptive capacity measures are intended to increase climate resiliency and are further provided in "Recommended Actions" section below.

Composite Risk Characterization

- ***Probability:*** The frequency of priority climate hazards is anticipated to increase and become more unpredictable among all assets.
  - *Frequency of Extreme Precipitation*: Total precipitation from 25-year extreme precipitation storm events are expected to increase by an average of 6% by the end of the century.
  - *Frequency of Flooding*: Peak streamflow is anticipated to increase by 10-30% by the end of the century along the Cowlitz River, Tilton River lower tributaries, and Cispus River. Historical records predict that minor flooding may occur each winter, moderate flooding may occur every 2-5 years on the Chehalis and Cowlitz Rivers, and major flooding may occur every 5-7 years.
  - *Frequency of Reduced snowpack/avalanche*: Streamflow from reduced snowpack is projected to shift three to four weeks earlier than the 20th century average by mid-century.
  - *Frequency of Wildfire*: Increased extreme heat events are predicted to cause an average of 6 additional fire hazard days per year within the next 30 years. Wildfire risk is anticipated to increase by 26% by the end of the century, where areas east of I-5 freeway are 17-77% more likely to have conditions that are favorable to wildfire.
- ***Magnitude:*** Moderate destruction to certain assets will result in potential losses and consequences. Some assets are anticipated to experience significant destruction resulting in permanent losses. Some examples are included below:
  - Increased extreme precipitation events can destroy households through flooding from overtopping levees and may result in permanent displacement of more than 22,000 households by mid-century.

- More than 4,300 individuals who live in high wildfire risk areas (Morton, Randle, Packwood, Mossyrock), not including tourists and absentee landlords. Approximately 2,118 buildings are exposed valuating at $572.2 million.
- Broadband service zones correspond with a PUD electrical substation area, indicating that internet and electrical services located in east County and west County may be simultaneously interrupted. There is an existing fiber optic system along the eastern border of Lewis County.
- Airport closures due to climate-hazard events reduces revenue from recreational flying opportunities and firefighting-related activities. Operating expenses may increase due to additional labor and maintenance costs from climate hazard events. For example, extreme weather can damage pavement that more frequent airstrip maintenance.
- Flooding in Chehalis River basin is anticipated to experience an increase in FEMA 100-year floods by 33% by mid-century and is anticipated to impact more than 13,000 households.

Recommended Actions

This section is preliminary for discussion purposes only. Recommended actions are based on cumulative factors in the climate hazard analysis and is subject to change based on further discussions with the County and community members.

- Municipal code and other regulatory documents should consider updating development standards for buildings and infrastructure located in expanded FEMA 100-year flood zones and wildfire interface zones.
- Airport master plans should consider including climate adaptation measures for assets such as levees and siting of airstrips since hazards could impact the County's ability to respond to emergencies.
- Although emergency drinking water is provided separately by third party contractors (Red Cross, Salvation Army), water system plans should consider measures for recovering from climate hazard scenarios. Design standards for water treatment facilities should be flexible and account for contamination from landslides and liquefaction.
- Municipal code requirements on design, siting, and other development criteria for broadband infrastructure should consider future wildfire impacts. Construction of broadband infrastructure is primarily driven by the private market.
- Consider secondary evacuation routes at critical junctions. Investigate the possibility of a Study Plan that evaluates redundancy and contingencies for how individuals evacuate at critical junctions i.e., east County alternative evacuation route when bridge fails.
- Bridges should be reconstructed for increased flood and wildfire loads. Adaptation measures include applying fire blankets to bridges in high fire risk areas.

Kimley-Horn looks forward to collaborating with the County to identify potential opportunities to identify priority climate hazard impacts and increase resiliency among all sectors within the community.

Sincerely,

Heidi Rous
Climate Director, Kimley-Horn

On Behalf of County of Lewis, Washington State

Tasks 3.1-3.3: Assess sensitivity and adaptive capacity to characterize vulnerability						
Number	**Asset-Hazard Pair** *(from Column B of Task 1.3 tab)*	**Sensitivity — Task 3.1 (Low, Medium, or High)** ***refer to definitions for Low, Medium, or High in Cell H2**	**Adaptive Capacity — Task 3.2 (Low, Medium, or High)** ***refer to definitions for Low, Medium, or High in Cell N2**	**Vulnerability — Task 3.3** (*Low, Medium, or High*)	Notes *(The CMRW tool used in Step 1 describes general factors that affect a given sector's sensitivity (susceptibility to change). To qualitatively rate the sensitivity and adaptive capacity of a specific local asset or a broader asset category, start with a core question and then select indicators and available information (e.g., online census data, local plans, and community knowledge) to answer the question. Use the sensitivity and adaptive capacity ratings -- and other information, as desired -- to characterize the asset's vulnerability.)*	**Indicators Discussion** *(If desired, use this column to discuss your indicators and how they affected your ratings.)* For physical assets: 1. Age (What's the asset's age relative to its design life?); 2. Condition (What's the condition of the asset — poor, good, or excellent?); 3. Physical design (Is the asset physically protected from the hazard?) For environmental assets (i.e., fragmentation of forest, temperature range, exposure to pests & disease, etc.)
1	*General Government - Wildfire*	**Low**	**Low**	**Medium**	A majority of general government/administrative buildings are located in downtown Centralia with little to no tree canopy. Buildings are more likely to experience increased demands for air purification tech or building closure from wildfire events and may be limited for older buildings. Majority of County buildings in urban center of Centralia was built in mid-1900s, some in early 2000s. Retrofitting County buildings with air purification tech is a relatively low-cost adaptive solution, but can be high-cost from other construction activities i.e., mold infection, lead walls, etc. = **L (adaptive capacity).** Repairs/maintenance costs vary depending on building conditions, not in wildfire intermix zone (fuels loads) but in wildfire interface (exposure to wildfire effects i.e., smoke) zone = **L (sensitivity).**	Age; Condition; Physical design, Wildfire zone
2	Utility substations - wildfire *(Buildings & Energy)*	**Medium**	**Medium**	**Medium**	Increased energy demand from building usage may cause additional stress on infrastructure, leading to power outages and increased stress on PUD personnel, potentially increasing reliance on County or external agency personnel, but upgrades increase capacity of dealing with stressors = **L (sensitivity).** Increase reliance on back-up generators or other forms of energy, Substations are being upgraded by Lewis County PUD from 2021-2025. Unknown as to whether the upgrades include protection against climate hazards = **L (adaptive capacity).** Substations are more susceptible to wildfire damage in high wildfire risk areas. A local vulnerability assessment found that wildfire risk is higher in eastern County.	Age, Condition
3	Radio Communications - Wildfire *(Buildings & Energy)*	**Medium**	**Medium**	**Medium**	Drier vegetation and soils from extreme heat events increase likelihood of wildfires and landslides that may increase destruction of towers. Increased extreme heat events are predicted to cause average of 6 additional fire hazard days per year within the next 30 years, towers located in eastern County are more vulnerable = **M (sensitivity).** Towers are made of metal or wood. Equipment are typically located in concrete, brick, custom block bldgs, or fire station bldgs. Backup power mainly using batteries and generator, some using solar and UPS = **M (adaptive capacity).**	Condition, Physical design, Building material
4	Power Plant - Wildfire (*Buildings & Energy*)	**Low**	**Medium**	**Low**	Part of power plant is located in wildfire interface zone and in close proximity to intermix zone **= L (sensitivity)**. Plant will be completely decommissioned in 2025. Wildfire impacts power grid (poles, towers, power lines, etc.) which may stop power generation at power plant facilities. Would require alternative power sources = **M (adaptive capacity).**	Condition, Physical design, Building material

5	Wind farm - Wildfire	**Low**	**Low**	**Medium**	Not located in wildfire interface or intermix zone = **L (sensitivity)** - more susceptible to earthquake damage. Project lease contracts to third party to suppress wildfire on mitigation forest lands, wildfire suppression strategy per state natural conservation dept. Wildfire is unpredictable and unprecedented in the surrounding area per Skookumchuck wind energy project HCP; no design element that considers wildfire damage = **L (adaptive capacity).**	Condition, Wildfire zone, Conservation, Physical Design
6	Natural gas pipelines - Wildfire	**Medium**	**Medium**	**Medium**	Olympic and Williams pipelines distribute liquid petroleum and natural gas, respectively, throughout County. Pipelines run parallel to highways and large transportation corridors, exposing pipelines to wildfire risk = **M (sensitivity).** There may be extensive pipeline failure, taking hours, days, or weeks to repair resulting in temporary loss of service = **M (adaptive capacity).**	Physical design
7	Historical Buildings & Sites - Flooding *(Cultural Resources & Practices)*	**Low**	**Low**	**Medium**	Buildings constructed in mid-1800s or early 1900s, conditions may vary and are sensitive to changes but not located in flood hazard zones **= L. (Sensitivity)** More frequent flooding events can reduce access to culturally important sites and resources. Limited availability of physical resource (i.e., historic wood type, etc.) for rehabilitation = **L (adaptive capacity)**	Age, Condition
8	Historical Buildings & Sites - Wildfire *(Cultural Resources & Practices)*	**Medium**	**Low**	**High**	Buildings located in wildfire interface zones = **M (sensitivity).** More frequent wildfires can also reduce access to culturally important sites and resources; limited availability of physical resources to replace damaged historic buildings = **L (adaptive capacity).**	Age, Physical design
9	Airports - Extreme Precipitation & Flooding *(Economic Dev)*	**Medium**	**Medium**	**Medium**	Lewis County GOP is $2,573.06 million per year. Extreme precipitation events can warp pavement i.e., potholes, undulating surfaces, etc., requiring more frequent airstrip maintenance. $346,164 of damages at Chehalis-Centralia Airport. Packwood airport is located in a 100-yr FEMA floodplain where 1-3 ft. of flood can occur = **M (sensitivity).** Somewhat adaptive - can use recreational aircraft for critical needs. Packwood airport is situated close to Mt. Rainier NP - tourism dollars generate revenue = **M (adaptive capacity)**	Age, Condition, Physical design
10	Airports - Reduced Snowpack/Avalanche *(Economic Dev)*	**Low**	**Medium**	**Low**	Avalanche prone hillsides exist in high elevation mountainous areas in eastern County. County has high vulnerable population exposure to avalanche risk (WA state Enhanced haz mit plan). Airports are sited away from mountainous areas and within UGAs = **L (sensitivity).** Reduced snowpack affects peak streamflow timing which can result in temporary flooding during earlier months of the year, impacting general aviation activities such as emergency response, air ambulance service, flight training, and personal flying - about 85% of total operations are GA itinerant i.e., skydive operation, flying club, transient flying. Non-fire year annual operating revenue at Packwood airport is less than $2,000, fire-related years more than double annual operating revenue. Operating expenses total ~$30,000 for labor, maintenance, and internal/County transfers. Packwood airport master plan lists CIP projects that do not include climate adaptation measures i.e., levees, siting, etc., may increase maintenance costs and capital expenditures = **L (adaptive capacity)**	Airport activity, Physical design; Revenue

11	Airports - Wildfire *(Economic Dev)*	**Medium**	**Medium**	**Medium**	Airports located in wildfire interface zones (wildland fuel) = **M (sensitivity).** Loss of tourism/non-emergency related revenue but increases fire-related revenue = **M (adaptive capacity).**	Airport activity, Physical design; Revenue
12	Fiber optics - Extreme Precipitation & Flooding	**Medium**	**Medium**	**Medium**	Rural UGAs of the County are in need of fiber optic connections, the 2020 broadband assessment shows a pilot area in Pe Ell/western County area that will have updated broadband infrastructure, some areas exposed to 100-year FEMA floodplain = **M (sensitivity).** Site location, development standards, and design does not consider climate impacts per Chap. 15.50 of municipal code = **M (adaptive capacity).**	Location, Physical design, Municipal code
13	Fiber optics - Reduced snowpack/Avalanche	**Low**	**Medium**	**Low**	Reduced snowpack and avalanche less likely to occur in western County area where new broadband infrastructure is slated for development = **L (sensitivity)**. Code does not consider climate impacts to design, siting, etc. = **M (adaptive capacity)**	Location, Physical design, Municipal code
14	Fiber optics - Wildfire	**High**	**Low**	**High**	Broadband infrastructure located in wildfire interface zones in UGAs exposes fiber cables, towers, etc. to wildfire risk, can result in destruction and loss of service to internet **= H (sensitivity).** Code does not consider design, siting, etc. for future wildfire impacts, siting limited to pilot area; construction of infrastructure is private market driven **= L (adaptive capacity).**	Location, Physical design, Municipal code, Market
15	Shorelines - Flooding *(Ecosystem)*	**Low**	**High**	**Low**	SMP classifies shorelines for different uses - some uses allow recreation and development "high intensity, shoreline residential" while others conserve "rural/urban conservancy", "natural", and "aquatic" = **L (sensitivity).** SMP considers impacts of flooding to shoreline i.e., prohibit chemicals from agriculture and mining in shoreline areas subject to flooding, limit dredging to safety/restoration activities, etc. SMP uses 2010 FEMA flood zone maps and is outdated = **H (adaptive capacity)**	Use type, Shoreline classification, Flood zones
16	Shorelines - Reduced Snowpack/ Avalanche *(Ecosystem)*	**Low**	**High**	**Low**	Altered peak streamflow from reduced snowpack impacts all use types within shoreline areas. Streams/rivers with mean annual flow greater than 20 cubic feet per sec is a protected shoreline. Reduced peak streamflow impacts protection status and interpretation of allowed uses i.e., aquaculture, mining, recreation, etc. Increased maintenance needs for private facilities and public recreation facilities utilizing shoreline areas = **L (sensitivity).** Shoreline maps updated regularly to accommodate different uses and protection status = **H (adaptive capacity).**	Use type, Shoreline classification, Peak streamflow volume
17	Shorelines - Wildfire *(Ecosystem)*	**Low**	**High**	**Low**	Shoreline segments located in wildfire interface zones, wildfire intermix located throughout County due to fragmentation of forest = **L (sensitivity).** Wildfire impacts to shoreline varies depending on uses, increased impact for "high intensity", "shoreline residential", and "aquatic" shorelines due to residential and commercial developments; SMP does not consider impact of wildfire hazard on these developments, but County code and fire districts provide materials and education for fire risk prevention and mitigation = **H (adaptive capacity).**	Use type, Shoreline classification, Wildfire zone, Municipal code
18	Public Safety Radio - Extreme Precipitation *(Emergency Mgmt)*	**Medium**	**Medium**	**Medium**	Cost-prohibitive budget constraints associated with system upgrades (changing frequency) and equipment upgrades - limits ability to respond to emergencies and may require frequent maintenance and temporary loss of communication **= M (sensitivity).** Radio infra is limited to high elevation hillside areas and may be exposed to landslide hazard, does not require significant upgrades as frequency from channels can be altered to improve communications (source: 2023 Elevate report) = **M (adaptive capacity).**	Location, Radio upgrades

19	Public Safety Radio - Flooding *(Emergency Mgmt)*	**Medium**	**Medium**	**Medium**	Flooding can knock over towers and stop radio signals from being emitted and received. Costs associated with system upgrades (changing frequency) and equipment upgrades (law enforcement user radios for P25 capability) required, temporary loss of function from flooding of radio tower infrastructure = **M (sensitivity).** UGA census tracts with high rates of mobility disabilities and low-income are more susceptible to being stranded and need to rely on relationships and emergency services for care - limited County resources in east and south County area, rural environment, far from care centers = **M (adaptive capacity).** Unincorporated Census tracts (530-419-70-700, -400), UGA census tracts (530-419-71-300, -200, -800, -900) are disadvantaged: above 65th percentile low-income households, above 10% of adults have high school education or less. 96th percentile unemployed (CT -900). 19.41% of County has a disability.	Social assets, Natural disasters
20	Public Safety Radio - Wildfire *(Emergency Mgmt)*	**Medium**	**High**	**Low**	Fire coverage is limited in many County areas; Use of a simplex channel for fire hampers the ability of field users to communicate directly with each other and they must relay messages through dispatch in many situations - delayed response to emergencies and deployment of life-saving equipment. Delayed response and service to vulnerable populations i.e., elderly, mobility impaired persons, etc. = **M (sensitivity).** Destruction to radio towers adaptable by changing frequencies - County coordinates with ARES/RACES to augment radio communication during emergencies. Emergency mgm't plan lists channels, communication methods, and users for emergency support including safety and backup procedures = **H (adaptive capacity).** County's senior population (65+) = 20.69% Owner-occupied HH = 63.64% Hospitals per 10,000 people = 0.37	Social assets, Radio channel, Emergency response

21	Fire Stations - Extreme Precipitation *(Emergency Mgmt)*	**Medium**	**Medium**	**Medium**	Peak streamflow changes from extreme precip events cause secondary hazards like riverbank erosion and landslides that can undermine bldg structure stability; stations in flood plain/landslide hazard areas more likely to experience significant impact and loss of entirety of asset = **M (sensitivity).** Stations habitable space typically in upper stories while emergency response equipment in lower stories, loss of life can be mitigated = **M (adaptive capacity).**	Physical design
22	Fire Stations - Flooding *(Emergency Mgmt)*	**Medium**	**Low**	**High**	Flooding directly damages or destroys fire station buildings and infrastructure. 2007 flood is 100-year flood that resulted in 10 fire district vehicles damaged, 5 fire stations damaged, total costs of damages to all infra $ 166 million to replace infrastructure and equipment. Temporary loss of service and functionality to serve vulnerable populations = M (sensitivity). Fire station not designed for flood mitigation, protection zones i.e., levees or other structures = **L (adaptive capacity).**	Social assets, Costs
23	Fire Stations - Wildfire *(Emergency Mgmt)*	**Medium**	**Low**	**High**	Wildfire directly damages or destroys fire station buildings and infrastructure. Potential high costs to replace infrastructure and equipment. Temporary loss of service and functionality to serve vulnerable populations = **M (sensitivity).** Fire station designed for fire safety such as safe space buffers surrounding buildings = **L (adaptive capacity).**	Social assets, Costs
24	Airports - Extreme Precipitation & Flooding (*Emergency Mgmt)*	**Medium**	**Low**	**High**	Packwood Airport is located in Cowlitz River FEMA 100-Year flood zone and subject to 1-3 feet of flooding; closure of airport to runway activities; other airports are not in flood zone = **M (sensitivity).** Extreme precipitation events can warp pavement, requiring more frequent airstrip maintenance; divert emergency response services to other airports i.e., Chehalis-Centralia airport serves as primary local airport. Packwood airport master plan lists CIP projects that do not include climate adaptation measures i.e., levees, siting, etc., impacts ability to respond to emergencies = **L (adaptive capacity)**	Flood zone, Capital improvement programs
25	Airports - Wildfire *(Emergency Mgmt)*	**Medium**	**Low**	**High**	Airports located in wildfire interface zones (wildland fuel) - loss of emergency response services would occur or diverted to other airport i.e., Chehalis-Centralia airport = **M (sensitivity).** Potential wildfire damage; Fire stations and ARFF facilities located nearby to respond to aerial wildfire emergencies within 15 minutes = **L (adaptive capacity).**	Wildfire zone, Timing response
26	County roads - Extreme Precipitation *(Transportation)*	**Medium**	**Medium**	**Medium**	Extreme precipitation events can warp pavement or cause sinkholes, requiring more frequent road maintenance = **M (sensitivity).** Road closures impact evacuation routes, goods delivery, etc., pavement tech such as all-weather asphalt is available = **M (adaptive capacity)**	Physical design, Costs
27	County roads - Flooding *(Transportation)*	**Medium**	**Low**	**High**	Exposure and therefore sensitivity varies = **M (Sensitivity)** (Physical infrastructure damage is very costly - $4,479,000 of damages to state highway. Interstate 5 is frequently affected by flooding in the Chehalis River floodplain. Freight delays negatively impact economy - $47,070,000 economic impact from four-day I-5 closure). Road closures from flooding disrupt services, 7.1% unemployment, Percent Below Poverty Level: 13.17% Median HH Income: $60,581 = **L (adaptive capacity)**	Loss of revenue; Unemployment rates; Low income rates
28	County roads - Reduced snowpack/ Avalanche *(Transportation)*	**Low**	**Medium**	**Low**	Reduced snowpack may decrease avalanche severity but increase frequency, leading to road closures and increased repairs/maintenance. Avalanche damage to roads limited to remote hillside areas in eastern County = **L (sensitivity).** National weather service issues avalanche warnings, County public works closes roads that expose people to danger and fixes roads = **M (adaptive capacity).**	Communications; Location;
29	County roads - Wildfire *(Transportation)*	**Low**	**Low**	**Medium**	Conditions of County roads vary and are widespread = M; Roads can withstand wildfire events and is important for evacuation = **L (sensitivity);** If damaged from burned vegetation, becomes inaccessible and not adaptable to wildfire conditions = **L (adaptive capacity)**; Evacuation from disadvantaged census tracts make travel more burdensome and long, exposing to more hazards.	Condition; Physical design; Social assets

30	Bridges - Extreme Precipitation *(Transportation)*	**Low**	**Medium**	**Low**	Similar to roads, extreme precipitation can cause bridge deck material to deteriorate i.e., potholes, divots, etc. but would still be functional = L. Bridge repair and maintenance can be costly and labor intensive = **M (adaptive capacity).**	Condition

31	Bridges - Flooding *(Transportation)*	**Medium**	**Medium**	**Medium**	Many bridges are located in floodplains (77 bridges located within the 100-year floodplain and 78 located within the 500-year floodplain). Conditions vary b/c engineering design based on varying flood levels (1 bridge identified as structurally deficient, 24 identified as functionally obsolete, 84 as scour critical (2022 Bridge Report, Lewis County)). Ceres Hill bridge (#102) built in 1948 is most structurally deficient - not located in disadvantaged area, mostly agricultural and open space uses. May be important for evacuation = **M (sensitivity)**. Bridge repair or construction is expensive and labor intensive, new engineer standards set for increase flood levels to mitigate scouring and climate impacts, limited by funding and personnel = **M (adaptive capacity).**	Age; Condition; Physical design; Social assets
32	Bridges - Reduced snowpack/ Avalanche *(Transportation)*	**Medium**	**Medium**	**Medium**	Reduced snowpack may decrease avalanche severity but increase frequency, leading to bridge closures and increased repairs/maintenance. Snowmelt is projected to shift three to four weeks earlier than the 20th century average by the year 2050, snowmelt events that coincide with heavy rainfall events exacerbate bridge scouring = **M (sensitivity).** Bridge repair or construction is expensive and labor intensive, new engineer standards can be set for increased flood levels to mitigate scouring - new bridge designs are limited by available funding and personnel = **M (adaptivity).**	Condition; Physical design
33	Bridges - Wildfire *(Transportation)*	**High**	**High**	**Medium**	Bridges that are located throughout County are exposed to wildfire. Eastern County has higher wildfire risk than western County. There are more bridges in western County than eastern County, bridges are non-functional if burned = **H (sensitivity).** Only one main highway (HWY 12) from west to east County, which may be a critical evacuation route, and access for personnel to respond to emergencies. Adaptation measures include designing for fire loads, and applying fire blankets to bridges in high fire risk areas, no mention of fire mitigation in 2022 bridge report = **H (adaptive capacity).**	Physical design; Location in high fire risk zones; Asset serves disadvantaged census areas
34	Airports - Extreme Precipitation & Flooding *(Transportation)*	**Medium**	**Medium**	**Medium**	Airports used for transportation of goods and emergency services. Flooding would prevent transportation and interrupt business and stall responsiveness. Extreme precip can also cause interruptions by creating sinkholes on runway, stopping operations and requiring maintenance = **M (sensitivity).** Airports can be protected with levees/dikes or other measures = **M (adaptive capacity).**	Physical design; Location in flood zones; Loss of revenue
35	Airports - Reduced snowpack/ Avalanche *(Transportation)*	**Low**	**Medium**	**Low**	Avalanche prone hillsides exist in high elevation mountainous areas in eastern County. Airports are sited away from mountainous areas and within UGAs = **L (sensitivity).** Reduced snowpack affects peak streamflow timing which can result in temporary flooding during earlier months of the year, impacting general aviation activities such as emergency response, air ambulance service, flight training, and personal flying - about 85% of total operations are GA itinerant reasons. Emergency response i.e., military, evacuation, etc. planned = **M (adaptive capacity).**	Location; Aviation operations type
36	Airports - Wildfire *(Transportation)*	**Low**	**Medium**	**Low**	Airports located in wildfire interface zones (wildland fuel) - closure of airport for 6 months to recreational flying for aerial wildfire fighting = **L (sensitivity).** Airports are general aviation airports that connect to other airports within region for emergency response and military operations i.e., Chehalis-Centralia, Morton, Toledo = **M (adaptive capacity).**	Wildfire zone; Operations
37	Railways - Extreme Precipitation & Flooding	**Medium**	**Low**	**High**	Flooding of rail lines would temporarily pause delivery of goods and impact economy/business. Rail lines are located in 100-Yr FEMA flood zones (Chehalis river in west, Newaukum river to southwest, and tributaries in south) = **M (sensitivity).** Mitigation methods include relocating ralline, elevating rails, or decommissioning rail usage, which can be costly and labor intensive = **L (adaptive capacity).**	Exposure to frequent flooding, Location, Physical design
38	Railways - Reduced snowpack/ Avalanche	**Low**	**Medium**	**Low**	Reduced snowpack may decrease avalanche severity but increase frequency, leading to closures and increased repairs/maintenance. Railways are not located in avalanche-prone zones. Streamflow timing from snowpack runoff has limited impacts to railways = **L (sensitivity)**. No adaptation measures = **M (adaptive capacity)**	Location

39	Railways - Wildfire	**Medium**	**Low**	**High**	Portions of rail lines located in wildfire interface zones, particularly in northern County where the Industrial Access Transportation Study is taking place for future improvements. Significant impacts to economy would occur, fires destroys wood foundation making rail lines structurally unstable and inoperable = **M (sensitivity).** Mitigation includes utilizing other materials, fireproofing existing foundations, but are costly and labor intensive = **L (adaptive capacity).**	Physical design, Location in fire zones, Loss of revenue, Opportunity costs
40	Solid Waste transfer station - Extreme Precipitation *(Waste Mgmt)*	**Low**	**Medium**	**Low**	Located in low risk liquefaction area. Decreased capacity due to waste generated from other storm events = **L (sensitivity).** Transfer stations allow waste to be temporarily housed in facilities before being transported to landfills out of the County, stations have a maximum capacity which may overfill due to post hazard event clean up = **M (adaptive capacity).**	Physical design
41	Solid Waste transfer station - Flooding *(Waste Mgmt)*	**Low**	**Medium**	**Low**	Not located in 100-year FEMA floodplain. Decreased capacity due to waste generated from other storm events = **L (sensitivity).** Transfer stations allow waste to be temporarily housed in facilities before being transported to landfills out of the County, stations have a maximum capacity which may go over due to post hazard event clean up = **M (adaptive capacity).**	Physical design
42	Solid Waste transfer station - Wildfire *(Waste Mgmt)*	**Low**	**Medium**	**Low**	Not located in wildfire interface zone. Decreased capacity due to waste generated from other hazard events **= L (sensitivity).** Transfer stations allow waste to be temporarily housed in facilities before being transported to landfills out of the County, stations have a maximum capacity which may go over due to post hazard event clean up = **M (adaptive capacity).**	Physical design
43	Sewer infrastructure - Extreme Precipitation *(Waste Mgmt)*	**Low**	**High**	**Low**	Infrastructure = Private septics, Middle Fork Water Sewer system, Onalaska Wastewater Treatment Plant ("OWTP" - built in 1975). OWTP collection system has 3 basins. Consists of an oxidation ditch, secondary clarifier, and sludge holding with chlorine disinfection prior to discharge to the Newaukum River. Sludge disposal method is to have a septic tank pumper pump an aerobic digestor out once every 2 months and dispose of in landfill or other proper methods. Discharge outfall pipe is 8-in. diameter suspended above an overflow channel before going to river (wet conditions) or percolating thru a gravel bar (dry conditions). Heavy precip would have limited impacts, private septics can contaminate groundwater due to high precip infiltration = **L (sensitivity).** Efficiency upgrades to system was proposed under a NPDES permit = **H (adaptive capacity).**	Age, Condition, Physical design
44	Sewer infrastructure - Flooding *(Waste Mgmt)*	**Medium**	**Medium**	**Medium**	Increased frequency of peak streamflow events may impact outfall pipe and discharge functions. Private septics can experience backup and temporary loss of function, contamination of drinking water. Part of the facility is in 1% annual chance climate change flood zone = **M (sensitivity).** Adaptation may include other treatment methods or temporary shutdown of facilities **= M (adaptive capacity).**	Condition, Physical design
45	Sewer infrastructure - Wildfire *(Waste Mgmt)*	**Low**	**Medium**	**Low**	Not located in wildfire interface zone. Located in wildfire intermix zone, similar to most County areas. Temporary loss of functionality if wildfire damages infrastructure, UV sanitation tech system includes a power distribution center and warning system. Failure scenarios considered in NPDES permit **= L (sensitivity).** Unsure if failure scenarios include climate hazards, would require consideration in new permit and infrastructure upgrades which may be costly and labor intensive = **M (adaptive capacity)**	Condition, Physical design, Cost
46	Dump stations - Extreme Precipitation *(Waste Mgmt)*	**Low**	**Medium**	**Low**	Items are "dropped off" by individuals at transfer stations/Packwood Community drop off center. Located in low risk liquefaction area. Decreased capacity due to waste generated from other storm events = **L (sensitivity).** Transfer stations allow waste to be temporarily housed in facilities before being transported to landfills out of the County. Increased hazard events, individuals may increase disposal of weather-damaged personal property, resulting in stations having a maximum capacity which may overfill = **M (adaptive capacity).**	Physical design

47	Dump stations - Flooding *(Waste Mgmt)*	**Low**	**Medium**	**Low**	Not located in 100-year FEMA floodplain. Decreased capacity due to waste generated from other storm events = **L (sensitivity).** Increased hazard events, individuals may increase disposal of weather-damaged personal property, resulting in stations having a maximum capacity which may overfill = **M (adaptive capacity).**	Physical design
48	Dump stations - Wildfire *(Waste Mgmt)*	**Low**	**Medium**	**Low**	Not located in wildfire interface zone. Decreased capacity due to waste generated from other storm events = **L (sensitivity)**. Increased hazard events, individuals may increase disposal of weather-damaged personal property, resulting in stations having a maximum capacity which may overfill = **M (adaptive capacity).**	Physical design
49	Water infrastructure - Reduced snowpack/Avalanche *(Water Resources)*	**Low**	**Medium**	**Low**	Vader-Enchanted Valley water treatment plant (source Cowlitz River), County wells (Middle Fork Newaukum river), private wells. Unpredictable peak streamflow's leading to temporary flooding, higher water temperatures, and/or seasonal drought, which can contaminate drinking water supplies = **L (sensitivity).** VEV drinking water is stored in 250,000-gal steel reservoir built in 1979 at ground level but elevated from ground at 315 ft. Wells are required to have a 100-ft. buffer to prevent contamination, pump house is routinely monitored. Design flexibility: design standards are set in Title 13 of County municipal code, water mains equipped with backflow prevention valves = **M (adaptive capacity).**	Age, Condition, Physical design, Design flexibility, Hazard type (exposure to landslide)
50	Water infrastructure - Wildfire *(Water Resources)*	**Medium**	**Low**	**High**	Debris from wildfires or mudslides/landslides resulting from wildfire damaged areas can contaminate water sources. VEV transmission main goes thru an area that experiences a lot of landslides, slowing down raw water supply which may temporarily impact potable water and firefighting supply = **M (sensitivity).** Design flexibility: design standards account for limiting contamination, does not account for climate hazards. Lewis County Comp Emergency Mgm't Plan outlines that Dept. of Emergency Mgm't contracts with third parties (Red Cross, Salvation Army) to provide bulk drinking water during emergencies = **L (adaptive capacity).**	Condition, Physical design, Hazard type, Design flexibility
51	Civic Centers - Extreme Precipitation *(Zoning & Development)*	**Low**	**Medium**	**Low**	Civic centers include recreation centers with large concentrations of people who may be exposed to hazard events and include vulnerable individuals i.e., children, elderly, special needs, etc. = **L (sensitivity).** Civic centers with appropriate facilities may act as temporary shelters for extreme hazard events, requires collaboration with Am Red Cross, NGOs, faith based orgs, Salvation Army, law enforcement/other County depts, Nat'l Guard = **M (adaptive capacity).**	Vulnerable groups, Population density
52	Civic Centers - Flooding *(Zoning & Development)*	**High**	**Medium**	**High**	Civic centers located thru-out County, and may be flooded in unincorporated City-adjacent areas/UGAs. Fixed buildings/civic centers located in 100-year FEMA floodplains would experience peak stream flows resulting in loss of building functions and services and possibly reconstruction = **H (sensitivity).** Certain sites may be selected as a secondary/alternate emergency operations center, in collab with above-mentioned organizations - limited to facilities with large indoor area, plumbing, road connectivity, and bldg design accessibility = **M (adaptive capacity).**	Building, Site selection, Vulnerable groups
53	Civic Centers - Reduced snowpack/ Avalanche *(Zoning & Development)*	**Low**	**Medium**	**Low**	Civic centers can act as temporary evacuation shelters, located in UGAs and cities. Avalanches occur in remote hillside areas away from UGAs and cities. Reduced snowpack affects peak streamflow timing that may temporarily flood, impacting civic centers in urban areas. Some bldgs located in 1% annual chance climate change flood **= L (sensitivity).** Civic centers that have capacity as evac shelter: Centralia college, Red Cross, Morton Hospital, Providence Hospital = **M (adaptive capacity)**	Flood zone, Shelters
54	Civic Centers - Wildfire *(Zoning & Development)*	**High**	**Medium**	**High**	UGAs located in wildfire interface zones expose fixed buildings/civic centers to wildfire risk. Would result in complete loss of building functions and services, reconstruction needed = **H (sensitivity).** EMP describes emergency/warning notification method and evacuation routes. County continues to collaborate with fire districts to educate property owners on defensible space and other prevention methods = **M (adaptive capacity)**	Site selection, Multiple agency collaboration, Communications

55	Colleges - Extreme Precipitation & Flooding	**Low**	**Medium**	**Low**	College campuses such as Centralia college and WSU extension are located in incorporated areas outside of 100-year FEMA flood zone = **L (sensitivity).** Campuses may act as a secondary facility for emergency operations, but are limited to non-flood areas **= M (adaptive capacity).**	Multiple agency collaboration
56	Colleges - Wildfire	**High**	**Medium**	**High**	College campuses are located in wildfire interface zones and exposing students, faculty, and staff to wildfire risk = **H (sensitivity).** Wildfires may significantly impact buildings even with fireproof designs i.e., defensible space, fireproof bldg materials, etc. = **M (adaptive capacity) .**	Physical design, fragmentation of forest, vulnerable populations

Tasks 3.4-3.5: Characterize risk and decide course of action

In Column B [*below*], list the assets you identified in Task 3.3 as having *medium* or *high* vulnerability. In Column C, characterize the **Probability** of hazard occurrence for each asset as *low, medium, or high* . In Column E, characterize the **Magnitude** of the potential loss/consequences as *low, medium, or high.* Put each asset's number [*from Column A*] in the appropriate cell of the Risk Characterization Matrix [*right*], and note the composite risk rating in Column G. Based on the asset's risk characterization, note your decision [*Take Action of Accept Risk*] in Column H.

Number	**Asset-Hazard Pair** *(Note applicable sector(s) in parenthesis.)*	**Probability** ***refer to definitions for**	**Notes** *(Note the indicators, data, and ruleset used to characterize probability of loss.)*	**Magnitude** ***refer to definitions**	**Notes** *(Note the indicators, data, and ruleset used to characterize magnitude of loss.)*	**Composite Risk Rating** *(Low = Green;*	**Decision** (*Take Action* or *Accept Risk*)
1	*General Government - Wildfire*	**High**	**Costly retrofitting.** Repairs/maintenance costs for HVAC/air filtering vary depending on building conditions since asset is exposed to wildfire smoke**.** **Probability:** Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. **Future Likelihood Indicator: Location.** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. County admin buildings are predominantly located in west County area which has low wildfire risk (average of less than 4,000 acres burned annually in western WA since 1984). However, large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). Eastern county will have a 30% chance each year that there will be climate and fuel conditions conducive to wildfires (by mid century). Larger east county areas will have a 30-50% chance of being conducive to wildfire conditions each year (by late century).	**Medium**	More than 4,244 people who live in high wildfire risk areas (Morton, Randle, Packwood, Mossyrock) = **H (Probability).** This does not include tourists and absentee landlords who would need effective communication and evacuation plans/knowledge. ~2,118 buildings exposed, valuating $572.2 million = **M (Magnitude)**	**High**	**Take Action**
2	Utility substations - wildfire *(Buildings & Energy)*	**Medium**	Increased reliance on backup generators or other forms of energy. Substations are being upgraded by Lewis County PUD from 2021-2025, increasing chances of withstanding climate hazard events. **Probability:** Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. **Future Likelihood: Location, Operations.** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. Electricity provided by the Lewis County Public Utility District No. 1 (PUD) serves all of Lewis County, except the City of Centralia and areas covered by Centralia City Light. Centralia City Light supplies power to customers in the City of Centralia and nearby areas, including Cooks Hill, Seminary Hill, and Salzer Valley. Puget Sound Energy offers natural gas service to customers in Centrali, Chehalis, Toledo, and Winlock. As described above, utility substations are spread throughout Lewis County. Increased extreme heat events are predicted to cause average of 6 additional fire hazard days per year by mid-century. Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). Eastern county will have a 30% chance each year that there will be the climate and fuel conditions conducive to wildfires (by mid-century). Larger east county areas will have a 30-50% of conducive wildfire conditions each year (by late century). Higher chance that substations located in high risk areas experience wildfire damage even with upgrades.	**Medium**	More than 4,244 people who live in high wildfire risk areas (Morton, Randle, Packwood, Mossyrock) can experience temporary disruption in livelihood via mandatory evacuations = **M (Probability).** This does not include tourists and absentee landlords in eastern County (near Mount Rainier) who would need effective communication and evacuation plans/knowledge. Approximately 2,118 buildings are exposed, valuating at $572.2 million = **M (Magnitude).**	**Medium**	**Take Action**

3	Radio Communications - Wildfire *(Buildings & Energy)*	**Medium**	**Delayed emergency response services.** Increased likelihood of wildfires and landslides that may increase destruction of towers located throughout the County. Radio towers are sometimes made of flammable material. **Probability:** Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. **Future Likelihood: <u>Social Assets</u>** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). Eastern county will have a 30% chance each year that there will be the climate and fuel conditions conducive to wildfires (by mid-century). Larger east county areas will have a 30-50% of conducive wildfire conditions each year (by late century) = M (Probability). Higher chance that radio communication towers located in high risk areas in eastern County experience wildfire damage - more remote locations.	**Low**	More than 4,244 people who live in high wildfire risk areas (Morton, Randle, Packwood, Mossyrock) can experience temporary disruption in livelihood via mandatory evacuations. This does not include tourists and absentee landlords in eastern County (near Mount Rainier) who would need effective communication and evacuation plans/knowledge. There are a variety of telecommunications providers that offer service in Lewis County. Ongoing changes in cellular and fiber technology have transformed the delivery of telecommunications, and these shifts in equipment and providers have contributed to an industry that offers several options for customers. Anticipating future characteristics given these shifting conditions is highly unlikely. Moving into the future, improvements to telecommunication infrastructure and services will play an increasingly important role especially in underserved areas. The magnitude of wildfire on radio communications may impact how underserved areas improve their telecommunications; however, there are many shifts in equipment and providers for telecommunications that could accommodate these areas **= L (Magnitude);** Indicator: Social Assets	**Low**	**Accept Risk**
4	Power Plant - Wildfire (*Buildings & Energy*)	**Low**	**Decreased power supply.** Wildfire impacts power grid (poles, towers, power lines, etc.) which may temporarily stop/shut-down power generation and distribution at power plant facilities. Plant is planned to decommission by 2025. **Probability:** Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. **Future Likelihood: <u>Location</u>** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). Hydroelectrical facilities are mostly located on the western side of the County = **L (Probability).**	**Low**	Columbia Generating Station (CGS) is a nuclear project with generating capacity of 1,150 MW that is owned and operated by Energy Northwest (ENW). Based on the 2020 Integrated Resource Plan for Lewis County, under the current Bonneville Power Administration (BPA) power contract, Lewis PUD's contract high-water mark (HWM) is 115.4 aMW. The wildfire magnitude for power plants was based on the county's contracted load of nuclear power and the county's PUD fuel mix = **L (Probability).** The contracted nuclear power load compared to the generating capacity of the CGS is approximately 10% and nuclear in the PUD fuel mix is also 10.02% in 2021. Therefore, the magnitude of wildfire impacts to power plants is low as the county does not heavily rely on this power source = **L (Magnitude)**	**Low**	**Accept Risk**
5	Wind farm - Wildfire	**Low**	**Other hazard risk.** Skookumchuck wind energy farm is not highly susceptible to wildfire risk. Hires third party to suppress wildfire on mitigation forest lands, wildfire suppression strategy per state natural conservation dept. **Probability:** Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. **Future Likelihood: <u>Location</u>** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). Eastern county will have a 30% chance each year that there will be the climate and fuel conditions conducive to wildfires (by mid-century). Larger east county areas will have a 30-50% of conducive wildfire conditions each year (by late century). Lewis County PUD receives wind energy from the White Creek Wind Project and the Nine Canyon Wind Project which are located in Klickitat County and ten miles southeast of Kennewick, respectively. =**L (Probability)**	**Low**	Lewis County PUD receives about 6 average MW of power through its 10% share of the White Creek Wind Project. The project is located in southeast of Lewis County and has 89 turbines with a nameplate capacity of 204 MWs. Lewis County PUD's share is approximately 6 MW of the Nine Canyon Wind Project which has 63 turbines with a installed capacity of 95.9 MW, located east of Lewis County in Kennewick. The magnitude of wildfire on wind farms rely Lewis County's reliance to wind power and the location of the wind power sources. As described, the wind farms that source Lewis County PUD are not within the county and a small MW is shared with Lewis County for both projects; therefore, magnitude is low. = **L (Magnitude)**	**Low**	**Accept Risk**

6	Natural gas pipelines - Wildfire	**Low**	**Temporary loss of service.** Pipelines run parallel to highways and large transportation corridors, exposing pipelines to wildfire risk. There may be extensive pipeline failure, taking hours, days, or weeks to repair resulting in temporary loss of service. **Probability:** Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. **Future Likelihood**: **Location** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). All of the natural gas consumed by homes and businesses in the Pacific Northwest comes from western Canada and the U.S. Rocky Mountain States. All the majority of natural gas moves straight to the customer through network of pipelines, local gas mains, and other utility infrastructure. Northwest consumers, however, also receive a share a significant share of their natural gas supply - mainly in winter - from underground storage reservoirs. =**L (Probability)**	**Low**	As natural gas is derived from western Canada and the U.S. Rocky Mountain States, the magnitude of wildfire impacting the pipelines that deliver this natural gas is low. Further, in winter where there is a lesser likelihood of wildfire, natural gas supply from underground storage reservoirs will have a lower magnitude of effects. = **L (Magnitude)**	**Low**	**Accept Risk**
7	Historical Buildings & Sites - Flooding *(Cultural Resources & Practices)*	**Low**	**Loss of cultural identity.** Not located in flood zones; however, more frequent flooding events can reduce access to culturally important sites and resources. Limited availability of physical resource (i.e., historic wood type, etc.) for rehabilitation. **Probability:** There are certain areas of Lewis County that are in more flood areas than others. According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. Flooding is most common from October through April, when storms from the Pacific Ocean, bring intense rainfall to the area. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. **Future Likelihood: Location** Climate change is projected to increase the stream flows which is expected to increase riverine flooding within existing floodplains and could expand flooding to new areas not currently in existing floodplains. In addition, there are 17,626 properties in Lewis County that have risk of flooding over the next 30 years,. This represents 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. Historic buildings/cultural sites are vulnerable to flooding from dam and levee failure w/in dam inundation areas: Skookumchuck Dam* (Condition = satisfactory), Mossyrock* (Condition = unsatisfactory) and Mayfield* (Condition = unsatisfactory) Dams. Percentage of affected properties w/ historic structures is unknown. *Dams have updated Emergency Action Plan.	**Low**	Buildings constructed in mid-1800s or early 1900s, conditions may vary and are sensitive to changes due to outdated building codes. Percentage of affected properties w/ historic structures or sites are unknown. Dam failure and high streamflow magnitude affecting historic sites/buildings is likely = **L (Probability);** thus, there is a low magnitude for impacts. = **L (Magnitude).**	**Low**	**Accept Risk**
8	Historical Buildings & Sites - Wildfire *(Cultural Resources & Practices)*	**Medium**	**Loss of cultural identity.** Buildings are located in wildfire interface zones. More frequent wildfires can reduce access to culturally important sites and resources. Rehabilitation efforts may be limited due to the availability of physical resources to replace damaged historic buildings. **Probability**: Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. **Future Likelihood: Location** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). Historical buildings are subject to increased wildfire risk.	**High**	Buildings constructed in mid-1800s or early 1900s, conditions may vary and are sensitive to changes. Most historical buildings are located in wildfire prone areas = **H (Probability);** therefore the magnitude of impacts should be highly considered for the goal of preserving historical buildings and sites.= **H (Magnitude)**	**High**	**Take Action**

9	Airports - Extreme Precipitation & Flooding *(Economic Dev)*	**Medium**	**Decreased revenue.** Some airports i.e., Packwood is located in a 100-yr FEMA floodplain where 1-3 ft. of flood can occur, warping pavement i.e., potholes, undulating surfaces, etc. and requiring more frequent airstrip maintenance. **Probability:** There are certain areas of Lewis County that are in more flood areas than others. According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. Flooding is most common from October through April, when storms from the Pacific Ocean, bring intense rainfall to the area. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. Rainfall is light during the summer and frequent during the remainder of the year. **Future Likelihood: <u>Location, Revenue, Operations</u>** Climate change is projected to steadily increase the magnitude of 25-year storm, increasing total precipitation by 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation increases riverine streamflow within existing floodplains and could expand flooding to new areas not currently in existing floodplains, which could affect infrastructure and operations. In addition, in 30 years, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets, making it more costly to repair and maintain airport infrastructure. = **M (Probability)**	**Medium**	The magnitude of extreme precipitation regarding airports was determined based on the rate of heavier precipitation. With the steady increase of precipitation in the future, the magnitude of extreme precipitation regarding airports is medium as the operations of airports may be impacted with severe rain conditions = **M (Magnitude)**. In addition, the magnitude of flooding for airports is determined based on the flood history and proximity of major rivers that are near operating airports. = **M (Magnitude).**	**Medium**	**Take Action**

10	Airports - Reduced Snowpack *(Economic Dev)*	**Low**	**Other hazard risk.** Airports are sited away from avalanche-prone mountainous areas and within UGAs. Airports are located in flood zones that may experience temporary closures from riverine flooding due to earlier snowmelt. **Probability**: On average, snowfall in the region is not heavy, but the potential exists for extremely large amounts of occasion. The average annual snowfall is approximately 9 inches, with recorded extreme annual maximums at 45 inches. Most of the snowfall occurs in the month of January, with the monthly average at about 4.5 inches. **Future Likelihood: Location** Based on the April 1st snowpack readings, there is steady decrease in this snowpack with a decrease ranging from 68% to 97%. April 1st snowpack readings are an indicator of water storage capacities - airports are not affected by water storage capacities from reduced snowpack = **L (Probability).**	**Low**	The magnitude of reduced snowpack on airports is evaluated based on how operations would be impacted. Reduced snowpack would indicate that there would be less flooding and precipitation; thus, operations would not be affected heavily as operations should be conducted regularly. =**L (Magnitude)**	**Low**	**Accept Risk**
11	Airports - Wildfire *(Economic Dev)*	**Medium**	**Increased operational costs/decreased revenue.** Airports are located in wildfire interface zones and subject to wildfire risk. Tourism continues to provide revenue to cover added costs. Airport master plans should address wildfire risk and exposure. **Probability**: Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. **Future Likelihood: Location, Revenue**, Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). Airports are scattered all across Lewis County =**M (Probability) .** The County may experience Increased direct (fire damage to airports) and indirect costs (firefighting activities).	**Medium**	Airports are located in wildfire zones. As such, in the events of wildfires, operations would need to be halted and evacuations would occur. This may also increase flight cancelations and delayed restoration of the airports which decreases overall revenue and increases maintenance costs = **M (Magnitude)**	**Medium**	**Take Action**
12	Fiber optics - Extreme Precipitation & Flooding	**Medium**	**Site Constraints.** The pilot area in Pe Ell/western County area that will have updated broadband infrastructure, some portions of this area are exposed to 100-year FEMA floodplain. **Probability:** There are certain areas of Lewis County that are in more flood areas than others. According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. Flooding is most common from October through April, when storms from the Pacific Ocean, bring intense rainfall to the area. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. Rainfall is light during the summer and frequent during the remainder of the year. **Future Likelihood: Location, Operations** Climate change is projected to steadily increase the magnitude of 25-year storm, increasing total precipitation by 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation increases riverine streamflow within existing floodplains and could expand flooding to new areas not currently in existing floodplains, which could affect infrastructure and operations. In addition, in 30 years, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. Heavier precipitation is an indicator of flooding which could affect infrastructure and operations. = **M (Probability).**	**Medium**	According to the Lewis County PUD, service territory of fiber optics are divided into 17 broad service zones. Each of the broadband service zone correspond with a PUD electrical substation area. As there are multiple electrical substations throughout Lewis County, this indicates that the fiber optics associated with each substation may be impacted as it could interrupt service for many people= **M (Magnitude).**	**Medium**	**Take Action**
13	Fiber optics - Reduced snowpack	**Low**	**Other hazard impacts.** Reduced snowpack and avalanche are less likely to occur in western County area where new broadband infrastructure is slated for development (little to no exposure). **Probability:** On average, snowfall in the region is not heavy, but the potential exists for extremely large amounts of occasion. The average annual snowfall is approximately 9 inches, with recorded extreme annual maximums at 45 inches. Most of the snowfall occurs in the month of January, with the monthly average at about 4.5 inches. **Future Likelihood: Location, Operations** Based on the April 1st snowpack readings, there is steady decrease in this snowpack with a decrease ranging from 68% to 97% =**L (Probability).**	**Low**	Reduced snowpack is less likely to occur in western County area where new broadband infrastructure is slated for development; however, existing fiber optic networks associated with electrical substations may be impacted as it could interrupt service for many people. **= L (Magnitude)**	**Low**	**Accept Risk**

14	Fiber optics - Wildfire	**Medium**	**Site Constraints.** Broadband infrastructure is located in wildfire interface zones in UGAs and exposes fiber cables, towers, etc. to wildfire risk. Site location, development standards, and design does not consider climate impacts per Chap. 15.50 of municipal code. **Probability**: Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. **Future Likelihood: <u>Location, Operations</u>** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). = **M (Probability).** Increasing exposure to wildfire risk results in destruction of infrastructure and loss of service to internet/emergency communications.	**High**	Broadband infrastructure located in wildfire interface zones in UGAs exposes fiber cables, towers, etc. to wildfire risk, can result in destruction and loss of service to internet = **H (Magnitude).**	**High**	**Take Action**
15	Shorelines - Flooding *(Ecosystem)*	**Medium**	Riverine and lake shorelines experience flooding and bank erosion from flooding. The County's Shoreline Master Plan considers impacts of flooding to the shoreline i.e., prohibit chemicals from agriculture and mining in shoreline areas subject to flooding, limit dredging to safety/restoration activities, etc. **Probability:** There are certain areas of Lewis County that are in more flood areas than others. According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. Flooding is most common from October through April, when storms from the Pacific Ocean, bring intense rainfall to the area. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. **Future Likelihood: <u>Ecosystem Health</u>** Climate change is projected to increase the stream flows which is expected to increase riverine flooding within existing floodplains and could expand flooding to new areas not currently in existing floodplains. Vegetation and habitat that exist along shorelines would be impacted, including cultural resources and recreational uses. In addition, in 30 years, 31.7% of properties in Lewis County will have a risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. = **M (Probability).**	**High**	The shore master plan (SMP) considers impacts of flooding to shoreline i.e., prohibit chemicals from agriculture and mining in shoreline areas subject to flooding, limit dredging to safety/restoration activities, etc. SMP uses 2010 FEMA flood zone maps and is outdated. Higher likelihood of flooding may indicate more episodic events of bank erosion and landslides that damage existing shorelines = **H (Magnitude)**	**High**	**Take Action**
16	Shorelines - Reduced Snowpack *(Ecosystem)*	**Low**	**Conflicting uses and changing ecosystem health.** Reduced peak streamflow impacts protection status and interpretation of allowed uses i.e., aquaculture, mining, recreation, etc. **Probability:** On average, snowfall in the region is not heavy, but the potential exists for extremely large amounts on occasion. The average annual snowfall is approximately 9 inches, with recorded extreme annual maximums at 45 inches. Most of the snowfall occurs in the month of January, with the monthly average at about 4.5 inches. **Future Likelihood: <u>Ecosystem Health</u>** Based on the April 1st snowpack readings, there is steady decrease in this snowpack with a decrease ranging from 68% to 97% = **L (Probability).** Decreased snowpack reduces peak streamflows that impact existing habitat and tribal resources. Enforcing allowable uses would require a Master Plan update to avoid conflicting uses that impact ecosystem habitat. Increased maintenance needs may increase for private facilities and public recreation facilities utilizing shoreline areas.	**Low**	Reduced snowpack indicates a lesser likelihood of flooding which impacts shorelines = **L (Magnitude)**	**Low**	**Accept Risk**
17	Shorelines - Wildfire *(Ecosystem)*	**Low**	**Other hazard risks - landslides, erosion**. Shoreline segments located in wildfire interface zones (wildfire risk) throughout the County. Wildfire impacts vary depending on uses. SMP does not consider impact of wildfire hazard on these developments, but County code and fire districts provide materials and education for fire risk prevention and mitigation. **Probability**: Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. **Future Likelihood: <u>Ecosystem Health</u>** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). = **L (Probability).** Increased wildfire risk is an indicator for dry vegetation and soils that degrade ecosystem habitat and erode from flooding events.	**Low**	Wildfire impacts to shoreline varies depending on uses, increased impact for "high intensity", "shoreline residential", and "aquatic" shorelines due to residential and commercial developments = **L (Magnitude).**	**Low**	**Accept Risk**

18	Public Safety Radio - Extreme Precipitation *(Emergency Mgmt)*	**Medium**	Radio infrastructure is limited to high elevation hillside areas and may be exposed to landslides as a result of extreme precipitation events and dry soils/vegetation. **Probability:** In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. Rainfall is light during the summer and frequent during the remainder of the year. **Future Likelihood: <u>Communications, Operations</u>** There is a steady increase in percent change in the magnitude of 25-year storm ranging from an increase of precipitation that falls in the range of 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation is an indicator of flooding which could affect infrastructure and operations. = **M (Probability)**	**Medium**	Public Safety radios are crucial for evacuation notices, regular news, weather updates, etc. Extreme precipitation may impact the telecommunications associated with the public safety radio; thus impacting the operational capacity and system reliability of public safety radios = **M (Magnitude)**	**Medium**	**Take Action**
19	Public Safety Radio - Flooding *(Emergency Mgmt)*	**Medium**	**Emergency services delay.** Radio towers are located throughout the County. Towers are typically located in remote hillside areas and are less susceptible to riverine flooding. Radio infrastructure needs to be updated - existing conditions include limited ability to respond to emergencies and may require frequent maintenance and temporary loss of communication. **Probability:** There are certain areas of Lewis County that are in more flood areas than others. According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. Flooding is most common from October through April, when storms from the Pacific Ocean, bring intense rainfall to the area. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. **Future Likelihood: <u>Communications, Operations</u>** Climate change is projected to increase the stream flows which is expected to increase riverine flooding within existing floodplains and could expand flooding to new areas not currently in existing floodplains. In addition, in 30 years, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. = **M (Probability)**. Increased flooding events destroy radio infrastructure, resulting in communication losses and delays in emergency services.	**Medium**	Public safety radios are crucial for evacuation notices, regular news, weather updates, etc. Flooding may impact the structural integrity that house public safety radio; thus impacting the operational capacity and system reliability of public safety radios = **M (Magnitude)**	**Medium**	**Take Action**
20	Public Safety Radio - Wildfire *(Emergency Mgmt)*	**Medium**	**Emergency services delay.** Radio towers are located in wildfire risk areas throughout the County. **Probability**: Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. **Future Likelihood: <u>Communications, Operations</u>** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). = **M (Probability).** Direct impacts include destruction of radio towers. Indirect impacts include delayed emergency response and deployment of emergency services/resources. Evacuation routes for mobility-impaired in rural areas subject to increased wildfire risk is necessary.	**Medium**	Fire coverage is limited in many County areas; Use of a simplex channel for fire hampers the ability of field users to communicate directly with each other and they must relay messages through dispatch in many situations, resulting in delayed responses to emergencies and deployment of equipment = **M (Magnitude).** Delayed response and service to vulnerable populations i.e., elderly, mobility impaired persons, etc. may be an issue, resulting in strong implications for identifying options in an evacuation plan = **M (Magnitude)**	**Medium**	**Take Action**

21	Fire Stations - Extreme Precipitation *(Emergency Mgmt)*	**Medium**	Peak streamflow changes from extreme precipitation events cause secondary hazards like riverbank erosion and landslides that can undermine the structural stability of fire stations. Stations located in flood plain/landslide hazard areas are more likely to experience significant damages and loss of entirety of asset. **Probability:** In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. Rainfall is light during the summer and frequent during the remainder of the year. **Future Likelihood: Operations, Structural stability, Response Time** There is a steady increase in percent change in the magnitude of 25-year storm ranging from an increase of precipitation that falls in the range of 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation is an indicator of flooding which could affect infrastructure and operations. = **M (Probability)**	**Medium**	Extreme precipitation could lead to flooding in areas where fire stations are stationed. This may impact the structural integrity of fire stations; thus, hindering operations and decreasing response time in the event of emergencies = **M (Magnitude)**	**Medium**	**Take Action**
22	Fire Stations - Flooding *(Emergency Mgmt)*	**Medium**	**Delays in emergency response**. Stations located in flood plain/landslide hazard areas are more likely to experience significant damages and loss of entirety of asset. Stations located in flood zones are susceptible to riverine and stormwater flooding. **Probability:** There are certain areas of Lewis County that are in more flood areas than others. According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. Flooding is most common from October through April, when storms from the Pacific Ocean, bring intense rainfall to the area. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. **Future Likelihood: Operations, Structural Stability, Response Time** Climate change is projected to increase the stream flows which is expected to increase riverine flooding within existing floodplains and could expand flooding to new areas not currently in existing floodplains. In addition, in 30 years, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. = **M (Probability).** Stations are anticipated to experience more frequent destruction of buildings that delay emergency response and is costly to recover.	**Medium**	Flooding of fire stations will inhibit smooth operations in the case of an emergency and increase response time durations = **M (Magnitude)**. In addition, the structural integrity of fire stations is compromised. = **M (Magnitude)**	**Medium**	**Take Action**
23	Fire Stations - Wildfire *(Emergency Mgmt)*	**Medium**	Stations located in wildfire risk areas are more likely to experience significant damages and loss of entirety of asset from wildfire events. **Probability**: Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. **Future Likelihood: Operations, Structural Stability, Response Time, Siting** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. Large wildfires are anticipated to occur more frequently throughout Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). = **M (Probability).** Destruction of asset results in temporary loss of service and functionality to serve vulnerable populations. Fire stations are designed for fire safety such as safe space buffers surrounding buildings.	**Medium**	Wildfires will directly damage the structure of fire stations; thus inhibiting operations and decreasing the likelihood of smooth dispatchments to emergency events in need of their assistance. = **M (Magnitude)**	**Medium**	**Take Action**

24	Airports - Extreme Precipitation & Flooding (*Emergency Mgmt)*	**Medium**	**Delays in emergency services.** Some airports i.e., Packwood are located in 100-Yr FEMA flood zones and are subject to 1-3 inches of flooding, resulting in temporary closure of airport and delays in emergency services. **Probability**: According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. Flooding is most common from October through April, when storms from the Pacific Ocean, bring intense rainfall to the area. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. Rainfall is light during the summer and frequent during the remainder of the year. **Future Likelihood: <u>Location, Operations, Response Time</u>** Climate change is projected to steadily increase the magnitude of 25-year storm, increasing total precipitation by 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation increases riverine streamflow within existing floodplains and could expand flooding to new areas not currently in existing floodplains, which could affect infrastructure and operations. In addition, in 30 years, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets, making it more costly to repair and maintain airport infrastructure. = **M (Probability).**	**Medium**	Packwood Airport is located in Cowlitz River FEMA 100-Year flood zone and subject to 1-3 feet of flooding; closure of airport to runway activities; other airports are not in flood zone = **M (Magnitude)**. Extreme precipitation events can warp pavement, requiring more frequent airstrip maintenance; divert emergency response services to other airports i.e., Chehalis-Centralia airport serves as primary local airport. = **M (Magnitude)**.	**Medium**	**Take Action**
25	Airports - Wildfire *(Emergency Mgmt)*	**Medium**	**Delayed emergency response times.** Airports are located in wildfire risk areas throughout the County. Fire stations and ARFF facilities located nearby to respond to aerial wildfire emergencies within 15 minutes. **Probability**: Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. **Future Likelihood: <u>Location, Operations, Response Time</u>** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). = **M (Probability).** Airports are anticipated to experience increased wildfire risk, resulting in damage to structure or loss of services during wildfire events. Loss of emergency response services would occur or services diverted to other airport i.e., Chehalis-Centralia airport, delaying emergency services.	**Medium**	Airports located in wildfire interface zones (wildland fuel) increase chances of wildfire events resulting in loss of emergency response services. Services may stop or be diverted to other airport i.e., Chehalis-Centralia airport further delaying service response times **= M (Magnitude).**	**Medium**	**Take Action**
26	County roads - Extreme Precipitation *(Transportation)*	**Medium**	**Costly repairs and disruption to services.** Extreme precipitation events can damage pavement i.e., potholes, sinkholes, etc. on roads located throughout the County. **Probability:** In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. Rainfall is light during the summer and frequent during the remainder of the year. **Future Likelihood: <u>Safety, Structural Integrity, Location</u>** There is a steady increase in percent change in the magnitude of 25-year storm ranging from an increase of precipitation that falls in the range of 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation is an indicator of flooding which could affect infrastructure and operations. = **M (Probability).** Increased extreme precipitation events means requiring more frequent road maintenance that is costly to repair and disrupt services. Interstate 5 is frequently affected by flooding in the Chehalis River floodplain. Freight delays negatively impact economy. For example, $47,070,000 economic impact occurred from a four-day I-5 closure due to the Chehalis river flood.	**Medium**	Extreme precipitation events can warp pavement or cause sinkholes, requiring more frequent road maintenance and potential for increased road accidents (hydroplaning) = **M (Magnitude).** Road closures impact evacuation routes, goods delivery, etc. Pavement technology such as all-weather asphalt is available but may be costly to implement = **M (Magnitude).**	**Medium**	**Take Action**

27	County roads - Flooding *(Transportation)*	**High**	**Economic opportunity loss.** Roads throughout County are subject to flooding, including I-5 freeway and roads within 100-Yr floodplains. Flooded roads are subject to road closures and evacuation, disrupting services. **Probability:** There are certain areas of Lewis County that are in more flood areas than others. According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. Flooding is most common from October through April, when storms from the Pacific Ocean, bring intense rainfall to the area. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. **Future Likelihood: <u>Operations, Structural Stability, Flood Prone Zone</u>** Climate change is projected to increase peak stream flows which is expected to increase riverine flooding within existing floodplains and could expand flooding to new areas not currently in existing floodplains. In addition, in 30 years, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. Interstate 5 is frequently affected by flooding in the Chehalis River floodplain. = **H (Probability).** Other major impacts include freight delays that negatively impact the economy (for example, $47,070,000 economic impact from four-day I-5 closure).	**High**	Flooding may lead to the potential for increased road accidents and roadway closures= **H (Magnitude)**. Road closures impact evacuation routes, goods delivery, etc., pavement tech such as all-weather asphalt is available = **H (Magnitude).**	**High**	**Take Action**
28	County roads - Reduced snowpack *(Transportation)*	**Low**	**Operations:** Snowpack accumulation may lead to lane and road obstruction which reduces capacity and increases travel delay time. **Probability:** The considered hazard risks associated with county roads concentrate on the level of safety and structural stability of the roads. For instance, on average, snowfall in the region is not heavy, but the potential exists for extremely large amounts of occasion. The average annual snowfall is approximately 9 inches, with recorded extreme annual maximums at 45 inches. Most of the snowfall occurs in the month of January, with the monthly average at about 4.5 inches. As the probability of snowpack is low within Lewis County, it is unlikely county roads will have a high risk of impact from snowpack. **Future Likelihood: <u>Safety, structural stability</u>** Based on the April 1st snowpack readings, there is steady decrease in this snowpack with a decrease ranging from 68% to 97% = **L (Probability)**. Thus, snowpack is projected to heavily decrease. The April 1st snowpack is used as an indicator for the amount of stored water that becomes available during the melt season.	**Low**	Snowpack may not significantly increase the magnitude of impacts regarding county roads as there is a projected decrease in snowpack. However, it is important to note that snowpack would impact the structural stability and safety of county roads as there is increased likelihood of ice on the road which may lead to dangerous road conditions; however, with reduced snowpack, this is unlikely. = **L (Magnitude)**	**Low**	**Accept Risk**
29	County roads - Wildfire *(Transportation)*	**Medium**	**Operations:** Commonly after a wildfire, county roads may develop an increased susceptibility to erosion and can generally alter the terrain and ground conditions of the affected county road(s). This may lead to unsafe travel conditions during normal travel and emergency evacuations. Existing conditions of county roads are very varied and widespread. Additionally, roads can generally withstand wildfire events as a means for emergency evacuation. **Probability:** Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. Despite large fires being infrequent, wildfires can still be anticipated to have a medium probability of impacting county roads. **Future Likelihood: <u>Safety, Structural stability</u>** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). **= M (Probability)**	**Medium**	Wildfires will directly damage road surfaces, cause road closures, and increase safety precautions. This may cause drivers to avoid certain roads due to safety concerns which leads to longer travel times. Further, emergency evacuation routes may become harder to reach; thus, increasing the human risk significantly. Repair of roads will also take certain durations of time and materials depending on the severity of the wildfire. = **M (Magnitude)**	**Medium**	**Take Action**

30	Bridges - Extreme Precipitation *(Transportation)*	**High**	**Structural Integrity:** Extreme precipitation may lead to flooding. Flooding can also cause scour around piers and abutments, which can damage bridges and cause structural integrity issues. These issues may range from insignificant to significant and may need varied construction times. Heavily damaged bridges from flooding may take extremely long periods of construction; thus, operations may halt for long periods of time. To combat this risk, updated engineer standards may need to be adopted to increase flood design measures and mitigate scouring. **Probability:** In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. Rainfall is light during the summer and frequent during the remainder of the year. **Future Likelihood: <u>Operations, Safety, Structural Integrity, Location</u>** There is a steady increase in percent change in the magnitude of 25-year storm ranging from an increase of precipitation that falls in the range of 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation is an indicator of flooding which could affect infrastructure and operations. Within Lewis County's Bridge inventory there are 204 NBI reportable bridges and 17 short span bridges. One of the County's bridges is classified as structurally deficient (SD), 24 are classified as functionally obsolete (FO) , and 84 are coded as scour critical. Bridges classified as FO and structurally deficient bridges that should be considered for future replacement or rehabilitation. =**H (Probability)**	**High**	Due to the various structurally categorized bridges, the magnitude of extreme precipitation varies. However, the damage mainly focusses on the weakening of the structural integrity of bridges (especially the already weakened ones) which could lead to expediated bridge collapses =**H (Magnitude).** In addition, the compose of bridge integrity emphasizes that bridges are not able to inadequately carry its intended traffic load; thus, operational usage of bridges due to extreme precipitation is decreased and safety concerns increase. Severe damage to bridges from extreme precipitation will take long durations of repair and resources which could halt the operation of specific bridges for long periods of time; thus significantly halting usability for many people. = **H (Magnitude)**	**High**	**Take Action**

31	Bridges - Flooding *(Transportation)*	**High**	**Structural Integrity:** Flooding can erode and damage bridge approach slabs and abutments. Flooding can also cause scour around piers and abutments, which can damage bridges and cause structural integrity issues. These issues may range from insignificant to significant and may need varied construction times. Heavily damaged bridges from flooding may take extremely long periods of construction; thus, operations may halt for long periods of time. To combat this risk, updated engineer standards may need to be adopted to increase flood design measures and mitigate scouring. **Probability:** In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. Extreme precipitation may eventually lead to flooding. Rainfall is light during the summer and frequent during the remainder of the year. However, it is important to note that many bridges are located in floodplains (approximately 77 bridges located within the 100-year floodplain and approximately 78 located within the 500-year floodplain). = **H (Probability)** **Future Likelihood: <u>Operations, Safety, Structural Integrity, Location</u>** There is a steady increase in percent change in the magnitude of 25-year storm ranging from an increase of precipitation that falls in the range of 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation is an indicator of flooding which could affect infrastructure and operations. Within Lewis County's Bridge inventory there are 204 NBI reportable bridges and 17 short span bridges. One of the County's bridges is classified as structurally deficient (SD), 24 are classified as functionally obsolete (FO) , and 84 are coded as scour critical. Bridges classified as FO and structurally deficient bridges that should be considered for future replacement or rehabilitation. As such, this indicates that the impacts associated with flooding may heavily affect bridges.= **H (Probability)**	**High**	Due to the various structurally categorized bridges, the magnitude of flooding varies. However, the damage mainly concentrates on the weakening of the structural integrity of bridges (especially the already weakened ones) which could lead to expediated bridge collapses = **H (Magnitude).** In addition, the composition of bridge integrity emphasizes that bridges are not able to adequately carry its intended traffic load; thus, operational usage of bridges due to flooding is decreased and safety concerns increase. = **H (Magnitude)** Severe damage to bridges from extreme precipitation will take long durations of repair and resources which could halt the operation of specific bridges for long periods of time; thus significantly halting usability for many people. = **H (Magnitude)**	**High**	**Take Action**
32	Bridges - Reduced snowpack *(Transportation)*	**Low**	**Structural Integrity:** Snowpack may lead to increased erosion and degrade bridges. Further, transportation with bridges may become dangerous for travel as ramps may become extra slippery as snow adheres to ground more quickly. To combat snowpack impacts to bridges, updated standardized engineering standards can be set for increased flood levels to mitigate scouring. **Probability:** On average, snowfall in the region is not heavy, but the potential exists for extremely large amounts of occasion. The average annual snowfall is approximately 9 inches, with recorded extreme annual maximums at 45 inches. Most of the snowfall occurs in the month of January, with the monthly average at about 4.5 inches. = **L (Probability)** **Future Likelihood: <u>Operations, Safety, Structural Integrity, Location</u>** Based on the April 1st snowpack readings, there is steady decrease in this snowpack with a decrease ranging from 68% to 97% = L (Probability). The April 1st snowpack is used as an indicator for the amount of stored water that becomes available during the melt season. Within Lewis County's Bridge inventory there are 204 NBI reportable bridges and 17 short span bridges. One of the County's bridges is classified as structurally deficient (SD), 24 are classified as functionally obsolete (FO) , and 84 are coded as scour critical. Bridges classified as FO and structurally deficient bridges should be considered for future replacement or rehabilitation. =**L (Probability)**	**Low**	Reduced snowpack indicates a decrease in flooding which helps decrease bridge impacts relating to snowpack. Further as there is reduced snowpack, there is a less likelihood of increased erosion which usually increases bridge degradation. **L = (Magnitude)**	**Low**	**Accept Risk**

33	Bridges - Wildfire *(Transportation)*	**High**	**Structural Integrity:** Wildfires burning undergrowth along valleys and washes can damage bridges by burning underneath them; thus, resulting in prolonged damage assessments and unsafe structural integrity. These impacts lead to unsafe travel utilizing bridges; as such, business destinations may be harder to reach, transportation of goods is delayed, and travel risks increase. Measures to combat wildfire risk include designing bridges for fire loads, and applying fire blankets to bridges in high fire risk areas. **Probability:** Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. Generally, bridges that are located throughout Lewis County are exposed to wildfire. There are more bridges in western County than eastern County. It is important to note that, burned bridges are non-functional as transportation on them may vary in risk. = **H (Probability)** **Future Likelihood: Safety, Structural stability, Operations** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). Within Lewis County's Bridge inventory there are 204 NBI reportable bridges and 17 short span bridges. One of the County's bridges is classified as structurally deficient (SD), 24 are classified as functionally obsolete (FO) , and 84 are coded as scour critical. Bridges classified as FO and structurally deficient bridges should be considered for future replacement or rehabilitation. = **H (Probability)**	**High**	The magnitude of wildfires will impact the structural integrity of bridges heavily as it will weaken the materials composed in the bridge. Consequently, the structural integrity of the bridge is compromised. This indicates potential bridge operation closures due to increased safety concerns. = **H (Magnitude)** Bridge closures will increase travel time and inconvenience for destinations as alternate routes will need to be utilized. **H (Magnitude)**	**High**	**Take Action**
34	Airports - Extreme Precipitation & Flooding *(Transportation)*	**High**	**Operations:** Extreme precipitation can usually lead to flooding. Extreme precipitation may halt operations as poor visibility increases. In turn, flight delays or cancellations may be increased during these severe weather events. Flooding may also damage airport infrastructure such as landing lights, radar and navigation installations, and communications networks will also inhibit the passage of aircraft. All these impacts may lead to severe economic losses in terms of passenger and freight traffic. To combat extreme precipitation and flooding, some measures such as utilization of levees/dikes or other measures may be used. **Probability:** According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napa vine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Wewaykum Rivers and Coal, Selzer, and Dille Baugh Creeks, as well as the Cowlitz and Tilton Rivers. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. **Future Likelihood: Operations, Flood Prinze Zone** Climate change is projected to increase the stream flows which is expected to increase riverine flooding within existing floodplains and could expand flooding to new areas not currently in existing floodplains. In addition, in 30 years, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. = **H (Probability)** There is a steady increase in percent change in the magnitude of 25-year storm ranging from an increase of precipitation that falls in the range of 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation is an indicator of flooding which could affect infrastructure and operations. = H (Probability). Most airports are protected by a dike systems in events of flooding; however, flood events have occurred in the past (e.g. January 1990 flood event) which closed the Chehalis-Centralia Airport. = **H (Probability)**	**Medium**	Transportation in airports is impacted by extreme precipitation and flooding as airport closures may occur due to risky departure and landing conditions. This indicates that the magnitude of extreme precipitation and flooding to airport transportation is high as operations is halted; thus, travel, delivery of goods, medical supplies, and etc. are halted. New flight arrival and departure times will be necessary and delays should be accepted more frequently due to these weather conditions = **M (Magnitude)**	**High**	**Take Action**

35	Airports - Reduced snowpack *(Transportation)*	**Low**	**Operations:** Snowpack reduces visibility, clings to surfaces, and prompts runway maintenance procedures. Additionally, heavy snow may lead to roadways requiring more frequent maintenance. This may cause increased delays and decrease operation efficiency for airports. **Probability:** On average, snowfall in the region is not heavy, but the potential exists for extremely large amounts of occasion. The average annual snowfall is approximately 9 inches, with recorded extreme annual maximums at 45 inches. Most of the snowfall occurs in the month of January, with the monthly average at about 4.5 inches. It is also important to note that airports are sited away from mountainous areas and within UGA's. **Future Likelihood: Operations** Based on the April 1st snowpack readings, there is steady decrease in this snowpack with a decrease ranging from 68% to 97% = **L (Probability).** The April 1st snowpack is used as an indicator for the amount of stored water that becomes available during the melt season. = **L (Probability)**	**Low**	As mentioned in the probability notes, snowpack generally impacts many airport operations; however as Lewis County is projected to have a decrease of snowpack, the magnitude of snowpack impacts may be low. = **L (Magnitude)**	**Low**	**Accept Risk**
36	Airports - Wildfire *(Transportation)*	**High**	**Operations:** Wildfires will emit smoke from burning which leads to two immediate hazards: turbulence and reduced visibility. Thus, flight delays may become more frequent during wildfires as safety concerns are significantly increased. In addition to flight risk, airports impacted by wildfires may face structurally damage that may take long periods of reconstruction; therefore, lowering operation efficiency and general operations. **Probability:** Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. However, airports are located in wildfire interface zones and will likely face impacts related to wildfire risks. **Future Likelihood Indicator: Location, Operations, Safety.** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. County admin buildings are predominantly located in west County area which has low wildfire risk (average of less than 4,000 acres burned annually in western WA since 1984). However, Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). Eastern county will have a 30% chance each year that there will be the climate and fuel conditions conducive to wildfires (by mid-century). Larger east county areas will have a 30-50% of conducive wildfire conditions each year (by late century). **= H (Probability)**	**High**	The magnitude of wildfires could burn down sections or all of an airport which would halt operations and repairs would need to begin as soon as possible. Repairs may need various resources and time which delays operation of airports. This may impact the travel of many people and supplies. In addition, as airports are located in wildfire interface zones, the magnitude of wildfire risks on the operations of airports may be significant. = **H (Magnitude)**	**High**	**Take Action**
37	Railways - Extreme Precipitation & Flooding	**High**	**Structural integrity and Operations:** Extreme precipitation can usually lead to flooding. Extreme precipitation can destabilize terrain, resulting in dirt or rocks on the tracks. Further, events of flooding can wash away railway tracks or even push train cars off the rails. Flooding may also lead to damage to rail infrastructure which can take days, weeks, or months to repair based on severity. Railway mitigation methods to prevent hazard damage include relocating ralline, elevating rails, or decommissioning rail usage; however, these methods are all costly and labor intensive. **Probability:** According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. **Future Likelihood: Operations, Flood Pronze Zone** Climate change is projected to increase the stream flows which is expected to increase riverine flooding within existing floodplains and could expand flooding to new areas not currently in existing floodplains. In addition, in 30 years, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. = **H (Probability)** There is a steady increase in percent change in the magnitude of 25-year storm ranging from an increase of precipitation that falls in the range of 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation is an indicator of flooding which could affect infrastructure and operations. = H (Probability). A main railroad line (Burlington Northern Railway) crosses the floodplain from east to west on the Chehalis River near Chehalis. The tracks are subject to damage at various locations during large floods. = **H (Probability)**	**High**	The magnitude of extreme precipitation and flooding on railways would demonstrate a high magnitude as railways are located on a floodplain. This indicates a high potential for damaged rail infrastructure. This indicates that operations of this railroad will be severely impacted which could lead to long closure times for repair and return of functionality. = **H (Magnitude).**	**High**	**Take Action**

38	Railways - Reduced snowpack	**Low**	**Operations:** Snowpack has generally (either direct snowfall or drifting) can prevent rail operations from performing efficiently or at all. This is because the quantity of snowpack can be too much for the train to punch its way through without derailing or coming to other issues. On the contrary, reduced snowpack would not pose as a risk for trains to travel on railways effectively as blockages are unlikely. **Probability:** On average, snowfall in the region is not heavy, but the potential exists for extremely large amounts of occasion. The average annual snowfall is approximately 9 inches, with recorded extreme annual maximums at 45 inches. Most of the snowfall occurs in the month of January, with the monthly average at about 4.5 inches. As snowpack is anticipated to reduce, operations of railways are not anticipated to face increased closures and/or delays. Further, there is a low probability of reduced snowpack risk to railways based on data mentioned above. Further, existing railways are also not located in avalanche-prone zones.**= L (Probability)** **Future Likelihood: Operations** Based on the April 1st snowpack readings, there is steady decrease in this snowpack with a decrease ranging from 68% to 97%**= L (Probability).** The April 1st snowpack is used as an indicator for the amount of stored water that becomes available during the melt season. As there is an increased percentage of snowpack decrease, operations are significantly anticipated to have fewer operational issues. **= L (Probability)**	**Low**	The magnitude of reduced snowpack on railways is low as railways will be able to operate under "normal" conditions as reduced snowpack would not likely increase blockages. = **L (Magnitude)**	**Low**	**Accept Risk**
39	Railways - Wildfire	**High**	**Operations:** Wildfires pose track damage to railways as stock damage and derailments, power and communication disruptions, and destabilization of track beds increase as soil erosion increases. Wildfire increases the potential for accelerated erosion primarily through its effects on vegetation and soil. Therefore, with damaged railways, operations may be delayed heavily for reconstruction. **Probability:** Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. Portions of rail lines are located in wildfire interface zones, particularly in northern County; thus, based on historically wildfire data and existing conditions, there is high probability of wildfire risk for railways. = **H (Probability)** **Future Likelihood Indicator: Operations, Structural Integrity** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. County admin buildings are predominantly located in west County area which has low wildfire risk (average of less than 4,000 acres burned annually in western WA since 1984). However, Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). Eastern county will have a 30% chance each year that there will be the climate and fuel conditions conducive to wildfires (by mid-century). Larger east county areas will have a 30-50% of conducive wildfire conditions each year (by late century). Intense heat and flames can damage railway tracks and signal systems, forcing service interruptions. Further, the Industrial Access Transportation Study in northern County where portions of existing rail lines are located is taking place for future improvements. **= H (Probability)**	**High**	The magnitude of wildfire on railways focuses on service/operations being halted. Wildfires have historically damaged railway tracks and signal systems which compromise smooth operations in terms of travel and communications. Further, as mentioned there are a lot of existing and future rail in wildfire zones= **H (Magnitude)**	**High**	**Take Action**

40	Solid Waste transfer station - Extreme Precipitation *(Waste Mgmt)*	**Low**	**Pollution:** Extreme precipitation can potentially lead to flooding of a solid waste transfer station. Flooding of a solid waste transfer station may increase the volume of leachate generated by raising the percolation and piezometric head of the leachate, which will cause the leachate leakage to increase. Surges of debris from solid waste transfer stations may also increase. With increased hazard events, it is likely for an increase in disposal of weather-damaged personal property, resulting in stations having a maximum capacity which may overfill. **Probability:** According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. **Future Likelihood: <u>Operations, Contaminants</u>** Climate change is projected to increase the stream flows which is expected to increase riverine flooding within existing floodplains and could expand flooding to new areas not currently in existing floodplains. In addition, in 30 years, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. = **L (Probability)** There is a steady increase in percent change in the magnitude of 25-year storm ranging from an increase of precipitation that falls in the range of 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation is an indicator of flooding which could affect infrastructure and operations. Solid waste facilities in flood prone areas may increase the risk of unwanted waste distribution and increased lag time of solid waste collection times =**L (Probability).**	**Medium**	Located in low risk liquefaction area. Decreased capacity due to waste generated from other storm events which lowers the risk of solid waste contaminants= **M (Magnitude).** Transfer stations allow waste to be temporarily housed in facilities before being transported to landfills out of the County, stations have a maximum capacity which may overfill due to post hazard event clean up and hinder smooth operations = **M (Magnitude).**	**Low**	**Accept Risk**
41	Solid Waste transfer station - Flooding *(Waste Mgmt)*	**Low**	**Pollution:** Flooding of a solid waste transfer station may increase the volume of leachate generated by raising the percolation and piezometric head of the leachate, which will cause the leachate leakage to increase. Surges of debris from transfer stations may also increase. With increased hazard events, it is likely for an increase in disposal of weather-damaged personal property, resulting in stations having a maximum capacity which may overfill. Transfer stations also allow waste to be temporarily houses in facilities before being transported to landfills out of the County; however, as mentioned, stations have a maximum capacity. **Probability:** According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. **Future Likelihood: Operations, Flood Pronze Zone, Contaminants** Climate change is projected to increase the stream flows which is expected to increase riverine flooding within existing floodplains and could expand flooding to new areas not currently in existing floodplains. In addition, in 30 years, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. = **L (Probability)** There is a steady increase in percent change in the magnitude of 25-year storm ranging from an increase of precipitation that falls in the range of 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation is an indicator of flooding which could affect infrastructure and operations. Solid waste facilities in flood prone areas may increase the risk of unwanted waste distribution = **L (Probability).**	**Medium**	Not located in 100-year FEMA floodplain. Decreased capacity and contaminant risk due to waste generated from other storm events = **L (Magnitude). T**ransfer stations allow waste to be temporarily housed in facilities before being transported to landfills out of the County, stations have a maximum capacity which may go over due to post hazard event clean up and inhibit effective operations **= M (Magnitude).**	**Low**	**Accept Risk**

42	Solid Waste transfer station - Wildfire *(Waste Mgmt)*	**Low**	**Toxic contaminants:** Wildfire at solid waste transfer stations threaten the environment there through toxic pollutants emitted into the air, water, and soil. Further, wildfires that spread to solid waste transfer stations pose a risk to firefighters and civilians who are exposed to the hazardous chemical compounds they emit. The degree of risk is dependent on the contents buried in the landfill, the geography of the landfill, and the nature of the fire. For instance, in increased hazard events, individuals may increase disposal of weather-damaged personal property; thus, resulting in transfer stations having a maximum capacity which may overfill and exacerbate impacts. It is also important to note, transfer stations allow waste to be temporarily housed in facilities before being transported to landfills out of the County. **Probability:** According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. **Future Likelihood: Operations, Flood Pronze Zone, Contaminants** Climate change is projected to increase the stream flows which is expected to increase riverine flooding within existing floodplains and could expand flooding to new areas not currently in existing floodplains. In addition, in 30 years, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. = **L (Probability)** There is a steady increase in percent change in the magnitude of 25-year storm ranging from an increase of precipitation that falls in the range of 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation is an indicator of flooding which could affect infrastructure and operations. Solid waste facilities in flood prone areas may increase the risk of unwanted waste distribution = **L (Probability).**	**Medium**	Not located in wildfire interface zone. Decreased capacity and contaminant risk due to waste generated from other hazard events **= M (Magnitude).** Transfer stations allow waste to be temporarily housed in facilities before being transported to landfills out of the County, stations have a maximum capacity which may go over and impact operation schedules due to post hazard event clean up **= M (Magnitude).**	**Low**	**Accept Risk**
43	Sewer infrastructure - Extreme Precipitation *(Waste Mgmt)*	**Low**	**Structural integrity and treatment quality:** Extreme precipitation influences the effects of flooding. As such, flooding or surge can damage sewer infrastructure and destroy process equipment, communications controls, field equipment, and important data records while blocking access to the plant. These impacts will result in decreased treatment quality as process equipment may be damaged; thus lowering, process efficiency and treated effluent quality. Adaptation for these impacts may include other treatment methods or temporary shutdown of facilities. **Probability:** According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. **Future Likelihood: Operations, Structures, Contaminants, Health** Climate change is projected to increase the stream flows which is expected to increase riverine flooding within existing floodplains and could expand flooding to new areas not currently in existing floodplains. In addition, in 30 years, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. = **L (Probability)** There is a steady increase in percent change in the magnitude of 25-year storm ranging from an increase of precipitation that falls in the range of 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation is an indicator of flooding which could affect infrastructure and operations. Older sewer infrastructure may not be upgraded with larger inflow and outflow volumes which may impact operations. = **L (Probability).**	**Medium**	Sewer infrastructures are normally built to handle 25, 50, 100-year storm volumes; however, older treatment plants may have decreased in efficiency and structural integrity; as such, a higher magnitude of damage may affect older plants and plants that are near floodplains. Older plants may need to be decommissioned or undergo construction for plant upgrades to decrease the magnitude of impacts from extreme precipitation. = **M (Magnitude)** In addition to impacts to operations and structural integrity, chemical contaminants utilized in different processes of sewer infrastructure may be leaked due to the extreme precipitation and impact waterways. = **M (Magnitude).**	**Low**	**Accept Risk**

44	Sewer infrastructure - Flooding *(Waste Mgmt)*	**Low**	**Structural integrity and treatment quality:** Flooding or surge can damage sewer infrastructure and destroy process equipment, communications controls, field equipment, and important data records while blocking access to the plant. These impacts will result in decreased treatment quality as process equipment may be damaged; thus lowering, process efficiency and treated effluent quality. Adaptation for these impacts may include other treatment methods or temporary shutdown of facilities. **Probability**: According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen throughout Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. Exiting facilities are located in a 1% annual chance climate change flood zone; thus, there is a low probability of risk for sewer infrastructure from flooding. **Future Likelihood: Operations, Flood Prone Zone, Contaminants, Health**. Climate change is projected to increase the streamflows which is expected to increase riverine flooding within existing floodplains and could expand flooding to new areas not currently in existing floodplains. In addition, by mid-century, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. =**L (Probability)** Most in County rely on private septic systems. There is a steady increase projected in percent change in the magnitude of 25-year storm ranging from an increase of precipitation that falls in the range of 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation is an indicator of flooding which could affect infrastructure and operations. Centralia's new wastewater treatment plant on Goodrich road is out of the 100-year floodplain and should remain operable through any floods up to and including the 100-year event. =**L (Probability).**	**Medium**	Sewer infrastructures are normally built to handle 25, 50, 100-year storm volumes; however, older treatment plants may have decreased in efficiency and structural integrity; as such, a higher magnitude of damage may affect older plants and plants that are near floodplains. Flooding of sewer infrastructure may impact inflow and outflow of sewage as some sewer infrastructures may not be built to handle extremely large volumes of sewage. Large influxes of sewage may lead to overflow of systems and sewage spillage which would impact waterways that lead to residential, commercial, and industrial pipes. = **M (Magnitude).**	**Low**	**Accept Risk**
45	Sewer infrastructure - Wildfire *(Waste Mgmt)*	**Low**	**Water contamination and structural integrity:** Wildfires may disrupt sewage infrastructure with impacts such as: direct structural damage to the infrastructure/facilities due to the fire or firefighting activities, loss of power, debris/contaminants in waste stream, and blockage and dirtying of pumps. It is also important to note, backup protocols for sewer infrastructure may not include climate hazard impacts; thus, new protocols, permits, and infrastructure upgrades may be costly and labor intensive. **Probability:** Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. Additionally, as most sewer infrastructure are not are located in wildfire intermix zones similar to the rest of Lewis county **Future Likelihood Indicator: Operations, Structural Integrity** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. County admin buildings are predominantly located in west County area which has low wildfire risk (average of less than 4,000 acres burned annually in western WA since 1984). However, Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). Eastern county will have a 30% chance each year that there will be the climate and fuel conditions conducive to wildfires (by mid century). Larger east county areas will have a 30-50% of conducive wildfire conditions each year (by late century). =**L (Probability)**	**Medium**	The magnitude of wildfire impacts on sewer infrastructure may be detrimental as operations may significantly halt due to operational malfunctions as described in the probability notes section. However, as most sewer infrastructure is not located in wildfire interface zone, the magnitude of these impacts are decreased significantly. Further, it is located in a wildfire intermix zone, similar to most County areas. **= M (Magnitude)**	**Low**	**Accept Risk**

46	Dump stations - Extreme Precipitation *(Waste Mgmt)*	**Low**	**Pollution:** Extreme precipitation can potentially lead to flooding of a dump station. Flooding of a dump station may increase the volume of leachate generated by raising the percolation and piezometric head of the leachate, which will cause the leachate leakage to increase. In addition, erosion from historic dump stations pose a greater threat than leaching. Surges of debris from dump stations may also increase. With increased hazard events, it is likely for an increase in disposal of weather-damaged personal property, resulting in stations having a maximum capacity which may overfill. **Probability:** According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. **Future Likelihood: <u>Physical Design, Operations</u>** Climate change is projected to increase the streamflows which is expected to increase riverine flooding within existing floodplains and could expand flooding to new areas not currently in existing floodplains. In addition, in 30 years, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. =**L (Probability)** There is a steady increase in percent change in the magnitude of 25-year storm ranging from an increase of precipitation that falls in the range of 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation is an indicator of flooding which could affect infrastructure and operations. =**L (Probability).**	**Medium**	The magnitude of impacts would concentrate on the level of pollution that occurs; resulting in increased cleanups, equipment improvements, and operation costs. Items are "dropped off" by individuals at transfer stations/Packwood Community drop off center. Located in low risk liquefaction area**. = M (Magnitude).** Transfer stations allow waste to be temporarily housed in facilities before being transported to landfills out of the County. Increased hazard events, individuals may increase disposal of weather-damaged personal property, resulting in stations having a maximum capacity which may overfill and lead to a decrease in operations/efficiency **= M (Magnitude).**	**Low**	**Accept Risk**
47	Dump stations - Flooding *(Waste Mgmt)*	**Low**	**Pollution:** Flooding of a dump station may increase the volume of leachate generated by raising the percolation and piezometric head of the leachate, which will cause the leachate leakage to increase. In addition, erosion from historic dump stations pose a greater threat than leaching. Surges of debris from dump stations may also increase. With increased hazard events, it is likely for an increase in disposal of weather-damaged personal property, resulting in stations having a maximum capacity which may overfill. **Probability:** According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. However, dump stations in Lewis County are not located in a 100-year FEMA floodplain; thus, the probability of flood events impacting dump stations is low. **Future Likelihood: <u>Operations, Flood Pronze Zone, Structure</u>** Climate change is projected to increase the streamflows which is expected to increase riverine flooding within existing floodplains and could expand flooding to new areas not currently in existing floodplains. In addition, in 30 years, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. =**L (Probability)** In addition, as flooding is an impact influenced by extreme precipitation, there is a steady increase in percent change in the magnitude of 25-year storm ranging from an increase of precipitation that falls in the range of 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation is an indicator of flooding which could affect infrastructure and operations. Solid waste facilities in flood prone areas may increase the risk of unwanted waste distribution = **L (Probability).**	**Low**	The magnitude of impacts would concentrate on the level of pollution that occurs; resulting in increased cleanups, equipment improvements, and operation costs. However, the magnitude of impacts from flooding to dump stations is low as dump stations are not located in 100-year FEMA floodplain and are in a low risk liquefaction area. **= L (Magnitude).**	**Low**	**Accept Risk**

48	Dump stations - Wildfire *(Waste Mgmt)*	**Low**	**Toxic contaminants:** Wildfire at dump stations threaten the environment there through toxic pollutants emitted into the air, water, and soil. Further, wildfires that spread to dump stations pose a risk to firefighters and civilians who are exposed to the hazardous chemical compounds they emit. The degree of risk is dependent on the contents buried in the landfill, the geography of the landfill, and the nature of the fire. For instance, in increased hazard events, individuals may increase disposal of weather-damaged personal property; thus, resulting in stations having a maximum capacity which may overfill and exacerbate impacts. **Probability:** Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent and dump stations are not located in fire interface zone. **Future Likelihood Indicator: Operations, Structural Integrity, Fire Prone Area** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. County admin buildings are predominantly located in west County area which has low wildfire risk (average of less than 4,000 acres burned annually in western WA since 1984). However, Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). Eastern county will have a 30% chance each year that there will be the climate and fuel conditions conducive to wildfires (by mid century). Larger east county areas will have a 30-50% of conducive wildfire conditions each year (by late century). However, as mentioned above, dump stations are generally not located in fire interface zone(s)= **L (Probability)**	**Low**	Toxic contaminants emitted from wildfires that have spread to dump stations pose health, environmental, and economical impacts. These impacts may drastically influence the operations of dump stations; However, as stated, dump stations in Lewis County are not located in wildfire interface zone and the magnitude of these impacts are low = **L (Magnitude).**	**Low**	**Accept Risk**
49	Water infrastructure - Reduced snowpack *(Water Resources)*	**High**	**Water scarcity:** Reduced snowpack would lead to a decreased water supply for water infrastructure. A decreased supply of water for treatment can have a pronounced effect on process efficiency as well as associated operational costs. It is important to note that design standards set in Title 13 of the Lewis County municipal code, states water mains are to be equipped with backflow prevention valves. **Probability:** On average, snowfall in the region is not heavy, but the potential exists for extremely large amounts on occasion. The average annual snowfall is approximately 9 inches, with recorded extreme annual maximums at 45 inches. Most of the snowfall occurs in the month of January, with the monthly average at about 4.5 inches. **Future Likelihood: Operations** Based on the April 1st snowpack readings, there is steady decrease in this snowpack with a decrease ranging from 68% to 97% = **H (Probability)**. The April 1st snowpack is used as an indicator for the amount of stored water that becomes available during the melt season, indicating decreased water storage capabilities Countywide. =**H (Probability).**	**High**	Reduced process efficiency may lead to reduced water quality; thus, can lead to reduced water which can lead to serious effects on aquatic organisms and plants, as well as potential human costs. The magnitude of impact regarding reduced snowpack to water infrastructure focuses on reduced process efficiency and operational costs. As there is a high probability of reduced snowpack affecting water infrastructure, the magnitude of decreased process efficiency and operation costs is heightened. Treated water faces a higher risk of being treated improperly; thus, impacting the subjects listed above. = **H (Magnitude)**	**High**	**Take Action**

50	Water infrastructure - Wildfire *(Water Resources)*	**Medium**	**Water contamination and structural integrity:** Wildfires have been historically known to compromise water quality during active burning and for months and years after the fire has been extinguished. Water infrastructures may face increased treatment costs, need for alternative supplies, and potentially diminished reservoir capacities. Extensive water system damage and related water quality contamination to water infrastructure may significantly impact the operations of the system; thus, leaving many businesses, residents, etc. loss of water for long periods of time. It is also important to note that many design standards account for limiting contamination, but it does not account for climate hazards. **Probability:** Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. **Future Likelihood Indicator: <u>Operations, Structural Integrity, Contaminants</u>** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. County admin buildings are predominantly located in west County area which has low wildfire risk (average of less than 4,000 acres burned annually in western WA since 1984). However, Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). Eastern county will have a 30% chance each year that there will be the climate and fuel conditions conducive to wildfires (by mid century). Larger east county areas will have a 30-50% of conducive wildfire conditions each year (by late century). =**M (Probability)**	**High**	Debris (soot) from wildfires may compromise treatment of water and expediate filter deterioration in water treatment processes. Further, compromised treatment of water may impact outflow of water which may contaminate groundwater aquifers and nearby waterways. = **H (Magnitude).**	**High**	**Take Action**

51	Civic Centers - Extreme Precipitation *(Zoning & Development)*	**Low**	**Structural damage:** Civic centers may face increased problems regarding building stormwater management systems in place, vegetation (e.g. mold) issues, and roof damage due to extreme precipitation. In addition, with extreme precipitation, there is an increased potential of flooding. In civic centers, sheet flooding may cause structural damage to the buildings such as loose or buckling floors and foundation cracks. These impacts may significantly affect civic center operations. It is also important to note that many civic centers with appropriate facilities may act as temporary shelters for extreme hazard events, requires collaboration with American Red Cross, NGOs, faith based organizations, Salvation Army, and law enforcement/other County departments. **Probability:** According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. **Future Likelihood: <u>Vulnerable Groups, Population Density, Operations</u>** Climate change is projected to increase the streamflows which is expected to increase riverine flooding within existing floodplains and could expand flooding to new areas not currently in existing floodplains. In addition, in 30 years, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. = **L (Probability)** There is a steady increase in percent change in the magnitude of 25-year storm ranging from an increase of precipitation that falls in the range of 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation is an indicator of flooding which could affect infrastructure and operations. **= L (Probability).**	**Medium**	Civic centers include recreation centers with large concentrations of people who may be exposed to hazard events and include vulnerable individuals i.e., children, elderly, special needs, etc. Many communities may utilize civic centers as part of their daily lives; however, extreme precipitation may hinder their ability to use these centers. Further, as described with increased extreme precipitation, the effects of structural damage to civic centers is greater; thus, further impacting the operations of these buildings as reconstruction would potentially take extended periods of time. = **M (Magnitude).**	**Low**	**Accept Risk**
52	Civic Centers - Flooding *(Zoning & Development)*	**Medium**	**Structural Damage:** Civic centers may face increased problems regarding building stormwater management systems in place and vegetation (e.g. mold) issues. Further, sheet flooding may cause structural damage to the buildings such as loose or buckling floors and foundation cracks. These impacts may significantly affect the structural aspects of civic centers; thus, a secondary impact of impacting the operations of civic centers. It is also important to note that many civic centers have been designated as evacuation shelters (Centralia College, Red Cross, Morton Hospital, Providence Hospital to name a few). **Probability:** According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. **Future Likelihood: <u>Operations, Flood Pronze Zone, Structure</u>** Climate change is projected to increase the streamflows which is expected to increase riverine flooding within existing floodplains and could expand flooding to new areas not currently in existing floodplains. In addition, in 30 years, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. = **M (Probability)**	**Medium**	Civic centers located thru-out County, and may be flooded in unincorporated City-adjacent areas/UGAs. Fixed buildings/civic centers located in 100-year FEMA floodplains would experience peak streamflows resulting in loss of building functions and services and possibly reconstruction. Civic centers not located in floodplain zones would be able to resume operations sooner than civic centers that are located in floodplain zones as structural damages may not be as significant as reconstruction periods are much shorter. However, civic centers located on floodplain zones may face increased structural damage; thus, will need to undergo longer periods of reconstruction, halting operations. **= M (Magnitude).**	**Medium**	**Take Action**

53	Civic Centers - Reduced snowpack *(Zoning & Development)*	**High**	**Water scarcity:** Reduced snowpack indicates changes in streamflows; thus, water supply that may be diverted for use in civic centers. For instance, civic centers need water supply for on-site facilities, recreational uses, sewage flow, etc. Reduced water supply could potentially pose restrictions on the water budget for civic centers to conserve supply. It is also important to note that many civic centers have been designated as evacuation shelters (Centralia College, Red Cross, Morton Hospital, Providence Hospital to name a few). **Probability:** On average, snowfall in the region is not heavy, but the potential exists for extremely large amounts of occasion. The average annual snowfall is approximately 9 inches, with recorded extreme annual maximums at 45 inches. Most of the snowfall occurs in the month of January, with the monthly average at about 4.5 inches. **Future Likelihood: <u>Operations</u>** The April 1st snowpack is used as an indicator for the amount of stored water that becomes available during the melt season. Based on the April 1st snowpack readings, there is steady decrease in this snowpack with a decrease ranging from 68% to 97% =**H (Probability).** Based on the projection, there is a high probability of reduced snowpack; thus, water scarcity is more likely to occur and impact the operations of civic centers located in Lewis County.	**Medium**	The magnitude of reduced snowpack on civic centers would focus on the operational uses of civic centers. Water uses of civic centers are diverted into many purposes. Some of which include: landscape irrigation, fire sprinkler systems, toilet flushing, HVAC cooling, etc. As there is a high probability of reduced snowpack occurring for Lewis County, the magnitude of these activities being halted is a medium as some activities may not be necessary (e.g., landscape irrigation) for the full functionality of civic centers. However, activities such as HVAC cooling and fire sprinkler systems cannot be removed from the operations of a civic center. = **M (Magnitude)**	**High**	**Take Action**
54	Civic Centers - Wildfire *(Zoning & Development)*	**Medium**	**Probability:** Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. County collaboration with fire districts to educate property owners on defensible space and other prevention methods will be more consistent. **Future Likelihood Indicator: <u>Location</u>** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. County admin buildings are predominantly located in west County area which has low wildfire risk (average of less than 4,000 acres burned annually in western WA since 1984). However, Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). Eastern county will have a 30% chance each year that there will be the climate and fuel conditions conducive to wildfires (by mid century). Larger east county areas will have a 30-50% of conducive wildfire conditions each year (by late century). =**M (Probability)**	**Medium**	UGAs located in wildfire interface zones expose fixed buildings/civic centers to wildfire risk. Would result in complete loss of building functions and services, reconstruction needed **= M (Magnitude).**	**Medium**	**Take Action**

55	Colleges - Extreme Precipitation & Flooding	**Low**	**Structural damage:** College buildings may face increased problems regarding building stormwater management systems in place, vegetation (e.g. mold) issues, and roof damage due to extreme precipitation. In addition, with extreme precipitation, there is an increased potential of flooding. In college campuses, sheet flooding may cause structural damage to the buildings such as loose or buckling floors and foundation cracks. These impacts may significantly affect college operations. Campuses may act as secondary facilities for emergency operations (staging areas), but are limited to non-flood areas. **Probability:** According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. College campuses such as Centralia college and WSU extension are located in incorporated areas outside of 100-year FEMA flood zone. **Future Likelihood: <u>Operations, Location</u>** Climate change is projected to increase the streamflows which is expected to increase riverine flooding within existing floodplains and could expand flooding to new areas not currently in existing floodplains. In addition, in 30 years, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. However, as mentioned above, colleges within Lewis County are located outside of the 100-year FEMA flood zone.**= L (Probability)**	**Low**	As mentioned, structural damage would potentially occur with extreme precipitation and flooding. The magnitude of these hazards for instance may include long periods of time for reconstruction. This may lead to loss of revenue for colleges for a long duration of time. However, as colleges within Lewis County are outside of the 100-year FEMA flood zone, the magnitude of these effects impacting the colleges is low. = **L (Magnitude).**	**Low**	**Accept Risk**
56	Colleges - Wildfire	**Medium**	**Structural damage:** Wildfires have historically burned down structures, including homes. Structures that are impacted by wildfires may range in severity in terms of acreages destroyed and renovations required. College campuses are located in wildfire interface zones; therefore, exposing students, faculty, and staff to wildfire risk. Wildfires may significantly impact buildings even with fireproof designs i.e., defensible space, fireproof building materials, etc. **Probability:** Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have historically been infrequent. **= M (Probability)** **Future Likelihood Indicator: <u>Operations, Location, Structure</u>** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events; thus, increasing the likelihood of fires. Additionally, large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). Eastern county will have a 30% chance each year that there will be the climate and fuel conditions conducive to wildfires (by mid century). Larger east county areas will have a 30-50% of conducive wildfire conditions each year (by late century). The nearest college in Lewis County is located in the North Western part of Lewis County which includes Centralia County. Despite not having many college campuses, the likelihood of wildfire impacting the college is likely based on data described above. **= M (Probability)**	**High**	College campuses such as Centralia college and WSU extension may be impacted due to wildfires that have spread onto the campus/near campus. This can lead to indefinite closures of the campus; thus, halting education. Further, wildfire would lead to immediate evacuations of the college campuses and cease of operation for a duration of days for repairs and safety check-ups. = **H (Magnitude).**	**High**	**Take Action**

3	Radio Communications - Wildfire *(Buildings & Energy)*	**Medium**	**Delayed emergency response services.** Increased likelihood of wildfires and landslides that may increase destruction of towers located throughout the County. Radio towers are sometimes made of flammable material. **Probability:** Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. **Future Likelihood: Social Assets** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). Eastern county will have a 30% chance each year that there will be the climate and fuel conditions conducive to wildfires (by mid-century). Larger east county areas will have a 30-50% of conducive wildfire conditions each year (by late century) = M (Probability). Higher chance that radio communication towers located in high risk areas in eastern County experience wildfire damage - more remote locations.	**Low**	More than 4,244 people who live in high wildfire risk areas (Morton, Randle, Packwood, Mossyrock) can experience temporary disruption in livelihood via mandatory evacuations. This does not include tourists and absentee landlords in eastern County (near Mount Rainier) who would need effective communication and evacuation plans/knowledge. There are a variety of telecommunications providers that offer service in Lewis County. Ongoing changes in cellular and fiber technology have transformed the delivery of telecommunications, and these shifts in equipment and providers have contributed to an industry that offers several options for customers. Anticipating future characteristics given these shifting conditions is highly unlikely. Moving into the future, improvements to telecommunication infrastructure and services will play an increasingly important role especially in underserved areas. The magnitude of wildfire on radio communications may impact how underserved areas improve their telecommunications; however, there are many shifts in equipment and providers for telecommunications that could accommodate these areas **= L (Magnitude);** Indicator: Social Assets	**Low**	**Accept Risk**
4	Power Plant - Wildfire (*Buildings & Energy*)	**Low**	**Decreased power supply.** Wildfire impacts power grid (poles, towers, power lines, etc.) which may temporarily stop/shut-down power generation and distribution at power plant facilities. Plant is planned to decommission by 2025. **Probability:** Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. **Future Likelihood: Location** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). Hydroelectrical facilities are mostly located on the western side of the County = **L (Probability).**	**Low**	Columbia Generating Station (CGS) is a nuclear project with generating capacity of 1,150 MW that is owned and operated by Energy Northwest (ENW). Based on the 2020 Integrated Resource Plan for Lewis County, under the current Bonneville Power Administration (BPA) power contract, Lewis PUD's contract high-water mark (HWM) is 115.4 aMW. The wildfire magnitude for power plants was based on the county's contracted load of nuclear power and the county's PUD fuel mix = **L (Probability).** The contracted nuclear power load compared to the generating capacity of the CGS is approximately 10% and nuclear in the PUD fuel mix is also 10.02% in 2021. Therefore, the magnitude of wildfire impacts to power plants is low as the county does not heavily rely on this power source = **L (Magnitude)**	**Low**	**Accept Risk**
5	Wind farm - Wildfire	**Low**	**Other hazard risk.** Skookumchuck wind energy farm is not highly susceptible to wildfire risk. Hires third party to suppress wildfire on mitigation forest lands, wildfire suppression strategy per state natural conservation dept. **Probability:** Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. **Future Likelihood: Location** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). Eastern county will have a 30% chance each year that there will be the climate and fuel conditions conducive to wildfires (by mid-century). Larger east county areas will have a 30-50% of conducive wildfire conditions each year (by late century). Lewis County PUD receives wind energy from the White Creek Wind Project and the Nine Canyon Wind Project which are located in Klickitat County and ten miles southeast of Kennewick, respectively. = **L (Probability)**	**Low**	Lewis County PUD receives about 6 average MW of power through its 10% share of the White Creek Wind Project. The project is located in southeast of Lewis County and has 89 turbines with a nameplate capacity of 204 MWs. Lewis County PUD's share is approximately 6 MW of the Nine Canyon Wind Project which has 63 turbines with a installed capacity of 95.9 MW, located east of Lewis County in Kennewick. The magnitude of wildfire on wind farms rely Lewis County's reliance to wind power and the location of the wind power sources. As described, the wind farms that source Lewis County PUD are not within the county and a small MW is shared with Lewis County for both projects; therefore, magnitude is low. = **L (Magnitude)**	**Low**	**Accept Risk**

6	Natural gas pipelines - Wildfire	**Low**	**Temporary loss of service.** Pipelines run parallel to highways and large transportation corridors, exposing pipelines to wildfire risk. There may be extensive pipeline failure, taking hours, days, or weeks to repair resulting in temporary loss of service. **Probability:** Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. **Future Likelihood**: **Location** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). All of the natural gas consumed by homes and businesses in the Pacific Northwest comes from western Canada and the U.S. Rocky Mountain States. All the majority of natural gas moves straight to the customer through network of pipelines, local gas mains, and other utility infrastructure. Northwest consumers, however, also receive a share a significant share of their natural gas supply - mainly in winter - from underground storage reservoirs. = **L (Probability)**	**Low**	As natural gas is derived from western Canada and the U.S. Rocky Mountain States, the magnitude of wildfire impacting the pipelines that deliver this natural gas is low. Further, in winter where there is a lesser likelihood of wildfire, natural gas supply from underground storage reservoirs will have a lower magnitude of effects. = **L (Magnitude)**	**Low**	**Accept Risk**
7	Historical Buildings & Sites - Flooding *(Cultural Resources & Practices)*	**Low**	**Loss of cultural identity.** Not located in flood zones; however, more frequent flooding events can reduce access to culturally important sites and resources. Limited availability of physical resource (i.e., historic wood type, etc.) for rehabilitation. **Probability:** There are certain areas of Lewis County that are in more flood areas than others. According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. Flooding is most common from October through April, when storms from the Pacific Ocean, bring intense rainfall to the area. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. **Future Likelihood: Location** Climate change is projected to increase the stream flows which is expected to increase riverine flooding within existing floodplains and could expand flooding to new areas not currently in existing floodplains. In addition, there are 17,626 properties in Lewis County that have risk of flooding over the next 30 years,. This represents 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. Historic buildings/cultural sites are vulnerable to flooding from dam and levee failure w/in dam inundation areas: Skookumchuck Dam* (Condition = satisfactory), Mossyrock* (Condition = unsatisfactory) and Mayfield* (Condition = unsatisfactory) Dams. Percentage of affected properties w/ historic structures is unknown. *Dams have updated Emergency Action Plan.	**Low**	Buildings constructed in mid-1800s or early 1900s, conditions may vary and are sensitive to changes due to outdated building codes. Percentage of affected properties w/ historic structures or sites are unknown. Dam failure and high streamflow magnitude affecting historic sites/buildings is likely = **L (Probability);** thus, there is a low magnitude for impacts. = **L (Magnitude).**	**Low**	**Accept Risk**
8	Historical Buildings & Sites - Wildfire *(Cultural Resources & Practices)*	**Medium**	**Loss of cultural identity.** Buildings are located in wildfire interface zones. More frequent wildfires can reduce access to culturally important sites and resources. Rehabilitation efforts may be limited due to the availability of physical resources to replace damaged historic buildings. **Probability**: Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. **Future Likelihood: Location** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). Historical buildings are subject to increased wildfire risk.	**High**	Buildings constructed in mid-1800s or early 1900s, conditions may vary and are sensitive to changes. Most historical buildings are located in wildfire prone areas = **H (Probability);** therefore the magnitude of impacts should be highly considered for the goal of preserving historical buildings and sites.= **H (Magnitude)**	**High**	**Take Action**

9	Airports - Extreme Precipitation & Flooding *(Economic Dev)*	**Medium**	**Decreased revenue.** Some airports i.e., Packwood is located in a 100-yr FEMA floodplain where 1-3 ft. of flood can occur, warping pavement i.e., potholes, undulating surfaces, etc. and requiring more frequent airstrip maintenance. **Probability:** There are certain areas of Lewis County that are in more flood areas than others. According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. Flooding is most common from October through April, when storms from the Pacific Ocean, bring intense rainfall to the area. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. Rainfall is light during the summer and frequent during the remainder of the year. **Future Likelihood: <u>Location, Revenue, Operations</u>** Climate change is projected to steadily increase the magnitude of 25-year storm, increasing total precipitation by 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation increases riverine streamflow within existing floodplains and could expand flooding to new areas not currently in existing floodplains, which could affect infrastructure and operations. In addition, in 30 years, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets, making it more costly to repair and maintain airport infrastructure. = **M (Probability)**	**Medium**	The magnitude of extreme precipitation regarding airports was determined based on the rate of heavier precipitation. With the steady increase of precipitation in the future, the magnitude of extreme precipitation regarding airports is medium as the operations of airports may be impacted with severe rain conditions = **M (Magnitude)**. In addition, the magnitude of flooding for airports is determined based on the flood history and proximity of major rivers that are near operating airports. = **M (Magnitude).**	**Medium**	**Take Action**

10	Airports - Reduced Snowpack *(Economic Dev)*	**Low**	**Other hazard risk.** Airports are sited away from avalanche-prone mountainous areas and within UGAs. Airports are located in flood zones that may experience temporary closures from riverine flooding due to earlier snowmelt. **Probability**: On average, snowfall in the region is not heavy, but the potential exists for extremely large amounts of occasion. The average annual snowfall is approximately 9 inches, with recorded extreme annual maximums at 45 inches. Most of the snowfall occurs in the month of January, with the monthly average at about 4.5 inches. **Future Likelihood: Location** Based on the April 1st snowpack readings, there is steady decrease in this snowpack with a decrease ranging from 68% to 97%. April 1st snowpack readings are an indicator of water storage capacities - airports are not affected by water storage capacities from reduced snowpack = **L (Probability).**	**Low**	The magnitude of reduced snowpack on airports is evaluated based on how operations would be impacted. Reduced snowpack would indicate that there would be less flooding and precipitation; thus, operations would not be affected heavily as operations should be conducted regularly. = **L (Magnitude)**	**Low**	**Accept Risk**
11	Airports - Wildfire *(Economic Dev)*	**Medium**	**Increased operational costs/decreased revenue.** Airports are located in wildfire interface zones and subject to wildfire risk. Tourism continues to provide revenue to cover added costs. Airport master plans should address wildfire risk and exposure. **Probability**: Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. **Future Likelihood: Location, Revenue**, Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). Airports are scattered all across Lewis County = **M (Probability) .** The County may experience Increased direct (fire damage to airports) and indirect costs (firefighting activities).	**Medium**	Airports are located in wildfire zones. As such, in the events of wildfires, operations would need to be halted and evacuations would occur. This may also increase flight cancelations and delayed restoration of the airports which decreases overall revenue and increases maintenance costs = **M (Magnitude)**	**Medium**	**Take Action**
12	Fiber optics - Extreme Precipitation & Flooding	**Medium**	**Site Constraints.** The pilot area in Pe Ell/western County area that will have updated broadband infrastructure, some portions of this area are exposed to 100-year FEMA floodplain. **Probability:** There are certain areas of Lewis County that are in more flood areas than others. According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. Flooding is most common from October through April, when storms from the Pacific Ocean, bring intense rainfall to the area. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. Rainfall is light during the summer and frequent during the remainder of the year. **Future Likelihood: Location, Operations** Climate change is projected to steadily increase the magnitude of 25-year storm, increasing total precipitation by 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation increases riverine streamflow within existing floodplains and could expand flooding to new areas not currently in existing floodplains, which could affect infrastructure and operations. In addition, in 30 years, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. Heavier precipitation is an indicator of flooding which could affect infrastructure and operations. = **M (Probability).**	**Medium**	According to the Lewis County PUD, service territory of fiber optics are divided into 17 broad service zones. Each of the broadband service zone correspond with a PUD electrical substation area. As there are multiple electrical substations throughout Lewis County, this indicates that the fiber optics associated with each substation may be impacted as it could interrupt service for many people= **M (Magnitude).**	**Medium**	**Take Action**
13	Fiber optics - Reduced snowpack	**Low**	**Other hazard impacts.** Reduced snowpack and avalanche are less likely to occur in western County area where new broadband infrastructure is slated for development (little to no exposure). **Probability:** On average, snowfall in the region is not heavy, but the potential exists for extremely large amounts of occasion. The average annual snowfall is approximately 9 inches, with recorded extreme annual maximums at 45 inches. Most of the snowfall occurs in the month of January, with the monthly average at about 4.5 inches. **Future Likelihood: Location, Operations** Based on the April 1st snowpack readings, there is steady decrease in this snowpack with a decrease ranging from 68% to 97% = **L (Probability).**	**Low**	Reduced snowpack is less likely to occur in western County area where new broadband infrastructure is slated for development; however, existing fiber optic networks associated with electrical substations may be impacted as it could interrupt service for many people. **= L (Magnitude)**	**Low**	**Accept Risk**

14	Fiber optics - Wildfire	**Medium**	**Site Constraints.** Broadband infrastructure is located in wildfire interface zones in UGAs and exposes fiber cables, towers, etc. to wildfire risk. Site location, development standards, and design does not consider climate impacts per Chap. 15.50 of municipal code. **Probability**: Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. **Future Likelihood: Location, Operations** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). = **M (Probability).** Increasing exposure to wildfire risk results in destruction of infrastructure and loss of service to internet/emergency communications.	**High**	Broadband infrastructure located in wildfire interface zones in UGAs exposes fiber cables, towers, etc. to wildfire risk, can result in destruction and loss of service to internet = **H (Magnitude).**	**High**	**Take Action**
15	Shorelines - Flooding *(Ecosystem)*	**Medium**	Riverine and lake shorelines experience flooding and bank erosion from flooding. The County's Shoreline Master Plan considers impacts of flooding to the shoreline i.e., prohibit chemicals from agriculture and mining in shoreline areas subject to flooding, limit dredging to safety/restoration activities, etc. **Probability:** There are certain areas of Lewis County that are in more flood areas than others. According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. Flooding is most common from October through April, when storms from the Pacific Ocean, bring intense rainfall to the area. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. **Future Likelihood: Ecosystem Health** Climate change is projected to increase the stream flows which is expected to increase riverine flooding within existing floodplains and could expand flooding to new areas not currently in existing floodplains. Vegetation and habitat that exist along shorelines would be impacted, including cultural resources and recreational uses. In addition, in 30 years, 31.7% of properties in Lewis County will have a risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. = **M (Probability).**	**High**	The shore master plan (SMP) considers impacts of flooding to shoreline i.e., prohibit chemicals from agriculture and mining in shoreline areas subject to flooding, limit dredging to safety/restoration activities, etc. SMP uses 2010 FEMA flood zone maps and is outdated. Higher likelihood of flooding may indicate more episodic events of bank erosion and landslides that damage existing shorelines = **H (Magnitude)**	**High**	**Take Action**
16	Shorelines - Reduced Snowpack *(Ecosystem)*	**Low**	**Conflicting uses and changing ecosystem health.** Reduced peak streamflow impacts protection status and interpretation of allowed uses i.e., aquaculture, mining, recreation, etc. **Probability:** On average, snowfall in the region is not heavy, but the potential exists for extremely large amounts on occasion. The average annual snowfall is approximately 9 inches, with recorded extreme annual maximums at 45 inches. Most of the snowfall occurs in the month of January, with the monthly average at about 4.5 inches. **Future Likelihood: Ecosystem Health** Based on the April 1st snowpack readings, there is steady decrease in this snowpack with a decrease ranging from 68% to 97% = **L (Probability).** Decreased snowpack reduces peak streamflows that impact existing habitat and tribal resources. Enforcing allowable uses would require a Master Plan update to avoid conflicting uses that impact ecosystem habitat. Increased maintenance needs may increase for private facilities and public recreation facilities utilizing shoreline areas.	**Low**	Reduced snowpack indicates a lesser likelihood of flooding which impacts shorelines = **L (Magnitude)**	**Low**	**Accept Risk**
17	Shorelines - Wildfire *(Ecosystem)*	**Low**	**Other hazard risks - landslides, erosion**. Shoreline segments located in wildfire interface zones (wildfire risk) throughout the County. Wildfire impacts vary depending on uses. SMP does not consider impact of wildfire hazard on these developments, but County code and fire districts provide materials and education for fire risk prevention and mitigation. **Probability**: Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. **Future Likelihood: Ecosystem Health** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). = **L (Probability).** Increased wildfire risk is an indicator for dry vegetation and soils that degrade ecosystem habitat and erode from flooding events.	**Low**	Wildfire impacts to shoreline varies depending on uses, increased impact for "high intensity", "shoreline residential", and "aquatic" shorelines due to residential and commercial developments = **L (Magnitude).**	**Low**	**Accept Risk**

18	Public Safety Radio - Extreme Precipitation *(Emergency Mgmt)*	**Medium**	Radio infrastructure is limited to high elevation hillside areas and may be exposed to landslides as a result of extreme precipitation events and dry soils/vegetation. **Probability:** In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. Rainfall is light during the summer and frequent during the remainder of the year. **Future Likelihood: <u>Communications, Operations</u>** There is a steady increase in percent change in the magnitude of 25-year storm ranging from an increase of precipitation that falls in the range of 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation is an indicator of flooding which could affect infrastructure and operations. = **M (Probability)**	**Medium**	Public Safety radios are crucial for evacuation notices, regular news, weather updates, etc. Extreme precipitation may impact the telecommunications associated with the public safety radio; thus impacting the operational capacity and system reliability of public safety radios = **M (Magnitude)**	**Medium**	**Take Action**
19	Public Safety Radio - Flooding *(Emergency Mgmt)*	**Medium**	**Emergency services delay.** Radio towers are located throughout the County. Towers are typically located in remote hillside areas and are less susceptible to riverine flooding. Radio infrastructure needs to be updated - existing conditions include limited ability to respond to emergencies and may require frequent maintenance and temporary loss of communication. **Probability:** There are certain areas of Lewis County that are in more flood areas than others. According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. Flooding is most common from October through April, when storms from the Pacific Ocean, bring intense rainfall to the area. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. **Future Likelihood: <u>Communications, Operations</u>** Climate change is projected to increase the stream flows which is expected to increase riverine flooding within existing floodplains and could expand flooding to new areas not currently in existing floodplains. In addition, in 30 years, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. = **M (Probability)**. Increased flooding events destroy radio infrastructure, resulting in communication losses and delays in emergency services.	**Medium**	Public safety radios are crucial for evacuation notices, regular news, weather updates, etc. Flooding may impact the structural integrity that house public safety radio; thus impacting the operational capacity and system reliability of public safety radios = **M (Magnitude)**	**Medium**	**Take Action**
20	Public Safety Radio - Wildfire *(Emergency Mgmt)*	**Medium**	**Emergency services delay.** Radio towers are located in wildfire risk areas throughout the County. **Probability**: Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. **Future Likelihood: <u>Communications, Operations</u>** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). = **M (Probability).** Direct impacts include destruction of radio towers. Indirect impacts include delayed emergency response and deployment of emergency services/resources. Evacuation routes for mobility-impaired in rural areas subject to increased wildfire risk is necessary.	**Medium**	Fire coverage is limited in many County areas; Use of a simplex channel for fire hampers the ability of field users to communicate directly with each other and they must relay messages through dispatch in many situations, resulting in delayed responses to emergencies and deployment of equipment = **M (Magnitude).** Delayed response and service to vulnerable populations i.e., elderly, mobility impaired persons, etc. may be an issue, resulting in strong implications for identifying options in an evacuation plan = **M (Magnitude)**	**Medium**	**Take Action**

21	Fire Stations - Extreme Precipitation *(Emergency Mgmt)*	**Medium**	Peak streamflow changes from extreme precipitation events cause secondary hazards like riverbank erosion and landslides that can undermine the structural stability of fire stations. Stations located in flood plain/landslide hazard areas are more likely to experience significant damages and loss of entirety of asset. **Probability:** In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. Rainfall is light during the summer and frequent during the remainder of the year. **Future Likelihood: Operations, Structural stability, Response Time** There is a steady increase in percent change in the magnitude of 25-year storm ranging from an increase of precipitation that falls in the range of 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation is an indicator of flooding which could affect infrastructure and operations. = **M (Probability)**	**Medium**	Extreme precipitation could lead to flooding in areas where fire stations are stationed. This may impact the structural integrity of fire stations; thus, hindering operations and decreasing response time in the event of emergencies = **M (Magnitude)**	**Medium**	**Take Action**
22	Fire Stations - Flooding *(Emergency Mgmt)*	**Medium**	**Delays in emergency response**. Stations located in flood plain/landslide hazard areas are more likely to experience significant damages and loss of entirety of asset. Stations located in flood zones are susceptible to riverine and stormwater flooding. **Probability:** There are certain areas of Lewis County that are in more flood areas than others. According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. Flooding is most common from October through April, when storms from the Pacific Ocean, bring intense rainfall to the area. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. **Future Likelihood: Operations, Structural Stability, Response Time** Climate change is projected to increase the stream flows which is expected to increase riverine flooding within existing floodplains and could expand flooding to new areas not currently in existing floodplains. In addition, in 30 years, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. = **M (Probability).** Stations are anticipated to experience more frequent destruction of buildings that delay emergency response and is costly to recover.	**Medium**	Flooding of fire stations will inhibit smooth operations in the case of an emergency and increase response time durations = **M (Magnitude)**. In addition, the structural integrity of fire stations is compromised. = **M (Magnitude)**	**Medium**	**Take Action**
23	Fire Stations - Wildfire *(Emergency Mgmt)*	**Medium**	Stations located in wildfire risk areas are more likely to experience significant damages and loss of entirety of asset from wildfire events. **Probability**: Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. **Future Likelihood: Operations, Structural Stability, Response Time, Siting** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. Large wildfires are anticipated to occur more frequently throughout Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). = **M (Probability).** Destruction of asset results in temporary loss of service and functionality to serve vulnerable populations. Fire stations are designed for fire safety such as safe space buffers surrounding buildings.	**Medium**	Wildfires will directly damage the structure of fire stations; thus inhibiting operations and decreasing the likelihood of smooth dispatchments to emergency events in need of their assistance. = **M (Magnitude)**	**Medium**	**Take Action**
24	Airports - Extreme Precipitation & Flooding (*Emergency Mgmt)*	**Medium**	**Delays in emergency services.** Some airports i.e., Packwood are located in 100-Yr FEMA flood zones and are subject to 1-3 inches of flooding, resulting in temporary closure of airport and delays in emergency services. **Probability**: According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. Flooding is most common from October through April, when storms from the Pacific Ocean, bring intense rainfall to the area. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. Rainfall is light during the summer and frequent during the remainder of the year. **Future Likelihood: Location, Operations, Response Time** Climate change is projected to steadily increase the magnitude of 25-year storm, increasing total precipitation by 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation increases riverine streamflow within existing floodplains and could expand flooding to new areas not currently in existing floodplains, which could affect infrastructure and operations. In addition, in 30 years, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets, making it more costly to repair and maintain airport infrastructure. = **M (Probability).**	**Medium**	Packwood Airport is located in Cowlitz River FEMA 100-Year flood zone and subject to 1-3 feet of flooding; closure of airport to runway activities; other airports are not in flood zone = **M (Magnitude)**. Extreme precipitation events can warp pavement, requiring more frequent airstrip maintenance; divert emergency response services to other airports i.e., Chehalis-Centralia airport serves as primary local airport. = **M (Magnitude)**.	**Medium**	**Take Action**

25	Airports - Wildfire *(Emergency Mgmt)*	**Medium**	**Delayed emergency response times.** Airports are located in wildfire risk areas throughout the County. Fire stations and ARFF facilities located nearby to respond to aerial wildfire emergencies within 15 minutes. **Probability**: Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. **Future Likelihood: Location, Operations, Response Time** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). = **M (Probability).** Airports are anticipated to experience increased wildfire risk, resulting in damage to structure or loss of services during wildfire events. Loss of emergency response services would occur or services diverted to other airport i.e., Chehalis-Centralia airport, delaying emergency services.	**Medium**	Airports located in wildfire interface zones (wildland fuel) increase chances of wildfire events resulting in loss of emergency response services. Services may stop or be diverted to other airport i.e., Chehalis-Centralia airport further delaying service response times = **M (Magnitude).**	**Medium**	**Take Action**
26	County roads - Extreme Precipitation *(Transportation)*	**Medium**	**Costly repairs and disruption to services.** Extreme precipitation events can damage pavement i.e., potholes, sinkholes, etc. on roads located throughout the County. **Probability:** In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. Rainfall is light during the summer and frequent during the remainder of the year. **Future Likelihood: Safety, Structural Integrity, Location** There is a steady increase in percent change in the magnitude of 25-year storm ranging from an increase of precipitation that falls in the range of 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation is an indicator of flooding which could affect infrastructure and operations. = **M (Probability).** Increased extreme precipitation events means requiring more frequent road maintenance that is costly to repair and disrupt services. Interstate 5 is frequently affected by flooding in the Chehalis River floodplain. Freight delays negatively impact economy. For example, $47,070,000 economic impact occurred from a four-day I-5 closure due to the Chehalis river flood.	**Medium**	Extreme precipitation events can warp pavement or cause sinkholes, requiring more frequent road maintenance and potential for increased road accidents (hydroplaning) = **M (Magnitude).** Road closures impact evacuation routes, goods delivery, etc. Pavement technology such as all-weather asphalt is available but may be costly to implement = **M (Magnitude).**	**Medium**	**Take Action**
27	County roads - Flooding *(Transportation)*	**High**	**Economic opportunity loss.** Roads throughout County are subject to flooding, including I-5 freeway and roads within 100-Yr floodplains. Flooded roads are subject to road closures and evacuation, disrupting services. **Probability:** There are certain areas of Lewis County that are in more flood areas than others. According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. Flooding is most common from October through April, when storms from the Pacific Ocean, bring intense rainfall to the area. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. **Future Likelihood: Operations, Structural Stability, Flood Prone Zone** Climate change is projected to increase peak stream flows which is expected to increase riverine flooding within existing floodplains and could expand flooding to new areas not currently in existing floodplains. In addition, in 30 years, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. Interstate 5 is frequently affected by flooding in the Chehalis River floodplain. = **H (Probability).** Other major impacts include freight delays that negatively impact the economy (for example, $47,070,000 economic impact from four-day I-5 closure).	**High**	Flooding may lead to the potential for increased road accidents and roadway closures= **H (Magnitude)**. Road closures impact evacuation routes, goods delivery, etc., pavement tech such as all-weather asphalt is available = **H (Magnitude).**	**High**	**Take Action**
28	County roads - Reduced snowpack *(Transportation)*	**Low**	**Operations:** Snowpack accumulation may lead to lane and road obstruction which reduces capacity and increases travel delay time. **Probability:** The considered hazard risks associated with county roads concentrate on the level of safety and structural stability of the roads. For instance, on average, snowfall in the region is not heavy, but the potential exists for extremely large amounts of occasion. The average annual snowfall is approximately 9 inches, with recorded extreme annual maximums at 45 inches. Most of the snowfall occurs in the month of January, with the monthly average at about 4.5 inches. As the probability of snowpack is low within Lewis County, it is unlikely county roads will have a high risk of impact from snowpack. **Future Likelihood: Safety, structural stability** Based on the April 1st snowpack readings, there is steady decrease in this snowpack with a decrease ranging from 68% to 97% = **L (Probability)**. Thus, snowpack is projected to heavily decrease. The April 1st snowpack is used as an indicator for the amount of stored water that becomes available during the melt season.	**Low**	Snowpack may not significantly increase the magnitude of impacts regarding county roads as there is a projected decrease in snowpack. However, it is important to note that snowpack would impact the structural stability and safety of county roads as there is increased likelihood of ice on the road which may lead to dangerous road conditions; however, with reduced snowpack, this is unlikely. = **L (Magnitude)**	**Low**	**Accept Risk**

29	County roads - Wildfire *(Transportation)*	**Medium**	**Operations:** Commonly after a wildfire, county roads may develop an increased susceptibility to erosion and can generally alter the terrain and ground conditions of the affected county road(s). This may lead to unsafe travel conditions during normal travel and emergency evacuations. Existing conditions of county roads are very varied and widespread. Additionally, roads can generally withstand wildfire events as a means for emergency evacuation. **Probability:** Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. Despite large fires being infrequent, wildfires can still be anticipated to have a medium probability of impacting county roads. **Future Likelihood: <u>Safety, Structural stability</u>** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). = **M (Probability)**	**Medium**	Wildfires will directly damage road surfaces, cause road closures, and increase safety precautions. This may cause drivers to avoid certain roads due to safety concerns which leads to longer travel times. Further, emergency evacuation routes may become harder to reach; thus, increasing the human risk significantly. Repair of roads will also take certain durations of time and materials depending on the severity of the wildfire. = **M (Magnitude)**	**Medium**	**Take Action**
30	Bridges - Extreme Precipitation *(Transportation)*	**High**	**Structural Integrity:** Extreme precipitation may lead to flooding. Flooding can also cause scour around piers and abutments, which can damage bridges and cause structural integrity issues. These issues may range from insignificant to significant and may need varied construction times. Heavily damaged bridges from flooding may take extremely long periods of construction; thus, operations may halt for long periods of time. To combat this risk, updated engineer standards may need to be adopted to increase flood design measures and mitigate scouring. **Probability:** In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. Rainfall is light during the summer and frequent during the remainder of the year. **Future Likelihood: <u>Operations, Safety, Structural Integrity, Location</u>** There is a steady increase in percent change in the magnitude of 25-year storm ranging from an increase of precipitation that falls in the range of 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation is an indicator of flooding which could affect infrastructure and operations. Within Lewis County's Bridge inventory there are 204 NBI reportable bridges and 17 short span bridges. One of the County's bridges is classified as structurally deficient (SD), 24 are classified as functionally obsolete (FO) , and 84 are coded as scour critical. Bridges classified as FO and structurally deficient bridges that should be considered for future replacement or rehabilitation. = **H (Probability)**	**High**	Due to the various structurally categorized bridges, the magnitude of extreme precipitation varies. However, the damage mainly focusses on the weakening of the structural integrity of bridges (especially the already weakened ones) which could lead to expediated bridge collapses = **H (Magnitude).** In addition, the compose of bridge integrity emphasizes that bridges are not able to inadequately carry its intended traffic load; thus, operational usage of bridges due to extreme precipitation is decreased and safety concerns increase. Severe damage to bridges from extreme precipitation will take long durations of repair and resources which could halt the operation of specific bridges for long periods of time; thus significantly halting usability for many people. = **H (Magnitude)**	**High**	**Take Action**

31	Bridges - Flooding *(Transportation)*	**High**	**Structural Integrity:** Flooding can erode and damage bridge approach slabs and abutments. Flooding can also cause scour around piers and abutments, which can damage bridges and cause structural integrity issues. These issues may range from insignificant to significant and may need varied construction times. Heavily damaged bridges from flooding may take extremely long periods of construction; thus, operations may halt for long periods of time. To combat this risk, updated engineer standards may need to be adopted to increase flood design measures and mitigate scouring. **Probability:** In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. Extreme precipitation may eventually lead to flooding. Rainfall is light during the summer and frequent during the remainder of the year. However, it is important to note that many bridges are located in floodplains (approximately 77 bridges located within the 100-year floodplain and approximately 78 located within the 500-year floodplain). = **H (Probability)** **Future Likelihood: Operations, Safety, Structural Integrity, Location** There is a steady increase in percent change in the magnitude of 25-year storm ranging from an increase of precipitation that falls in the range of 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation is an indicator of flooding which could affect infrastructure and operations. Within Lewis County's Bridge inventory there are 204 NBI reportable bridges and 17 short span bridges. One of the County's bridges is classified as structurally deficient (SD), 24 are classified as functionally obsolete (FO) , and 84 are coded as scour critical. Bridges classified as FO and structurally deficient bridges that should be considered for future replacement or rehabilitation. As such, this indicates that the impacts associated with flooding may heavily affect bridges.= **H (Probability)**	**High**	Due to the various structurally categorized bridges, the magnitude of flooding varies. However, the damage mainly concentrates on the weakening of the structural integrity of bridges (especially the already weakened ones) which could lead to expediated bridge collapses = **H (Magnitude).** In addition, the composition of bridge integrity emphasizes that bridges are not able to adequately carry its intended traffic load; thus, operational usage of bridges due to flooding is decreased and safety concerns increase. = **H (Magnitude)** Severe damage to bridges from extreme precipitation will take long durations of repair and resources which could halt the operation of specific bridges for long periods of time; thus significantly halting usability for many people. = **H (Magnitude)**	**High**	**Take Action**
32	Bridges - Reduced snowpack *(Transportation)*	**Low**	**Structural Integrity:** Snowpack may lead to increased erosion and degrade bridges. Further, transportation with bridges may become dangerous for travel as ramps may become extra slippery as snow adheres to ground more quickly. To combat snowpack impacts to bridges, updated standardized engineering standards can be set for increased flood levels to mitigate scouring. **Probability:** On average, snowfall in the region is not heavy, but the potential exists for extremely large amounts of occasion. The average annual snowfall is approximately 9 inches, with recorded extreme annual maximums at 45 inches. Most of the snowfall occurs in the month of January, with the monthly average at about 4.5 inches. = **L (Probability)** **Future Likelihood: Operations, Safety, Structural Integrity, Location** Based on the April 1st snowpack readings, there is steady decrease in this snowpack with a decrease ranging from 68% to 97% = L (Probability). The April 1st snowpack is used as an indicator for the amount of stored water that becomes available during the melt season. Within Lewis County's Bridge inventory there are 204 NBI reportable bridges and 17 short span bridges. One of the County's bridges is classified as structurally deficient (SD), 24 are classified as functionally obsolete (FO) , and 84 are coded as scour critical. Bridges classified as FO and structurally deficient bridges should be considered for future replacement or rehabilitation. = **L (Probability)**	**Low**	Reduced snowpack indicates a decrease in flooding which helps decrease bridge impacts relating to snowpack. Further as there is reduced snowpack, there is a less likelihood of increased erosion which usually increases bridge degradation. **L = (Magnitude)**	**Low**	**Accept Risk**
33	Bridges - Wildfire *(Transportation)*	**High**	**Structural Integrity:** Wildfires burning undergrowth along valleys and washes can damage bridges by burning underneath them; thus, resulting in prolonged damage assessments and unsafe structural integrity. These impacts lead to unsafe travel utilizing bridges; as such, business destinations may be harder to reach, transportation of goods is delayed, and travel risks increase. Measures to combat wildfire risk include designing bridges for fire loads, and applying fire blankets to bridges in high fire risk areas. **Probability:** Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. Generally, bridges that are located throughout Lewis County are exposed to wildfire. There are more bridges in western County than eastern County. It is important to note that, burned bridges are non-functional as transportation on them may vary in risk. = **H (Probability)** **Future Likelihood: Safety, Structural stability, Operations** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). Within Lewis County's Bridge inventory there are 204 NBI reportable bridges and 17 short span bridges. One of the County's bridges is classified as structurally deficient (SD), 24 are classified as functionally obsolete (FO) , and 84 are coded as scour critical. Bridges classified as FO and structurally deficient bridges should be considered for future replacement or rehabilitation. = **H (Probability)**	**High**	The magnitude of wildfires will impact the structural integrity of bridges heavily as it will weaken the materials composed in the bridge. Consequently, the structural integrity of the bridge is compromised. This indicates potential bridge operation closures due to increased safety concerns. = **H (Magnitude)** Bridge closures will increase travel time and inconvenience for destinations as alternate routes will need to be utilized. **H (Magnitude)**	**High**	**Take Action**

34	Airports - Extreme Precipitation & Flooding *(Transportation)*	**High**	**Operations:** Extreme precipitation can usually lead to flooding. Extreme precipitation may halt operations as poor visibility increases. In turn, flight delays or cancellations may be increased during these severe weather events. Flooding may also damage airport infrastructure such as landing lights, radar and navigation installations, and communications networks will also inhibit the passage of aircraft. All these impacts may lead to severe economic losses in terms of passenger and freight traffic. To combat extreme precipitation and flooding, some measures such as utilization of levees/dikes or other measures may be used. **Probability:** According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napa vine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Wewaykum Rivers and Coal, Selzer, and Dille Baugh Creeks, as well as the Cowlitz and Tilton Rivers. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. **Future Likelihood: Operations, Flood Prinze Zone** Climate change is projected to increase the stream flows which is expected to increase riverine flooding within existing floodplains and could expand flooding to new areas not currently in existing floodplains. In addition, in 30 years, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. = **H (Probability)** There is a steady increase in percent change in the magnitude of 25-year storm ranging from an increase of precipitation that falls in the range of 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation is an indicator of flooding which could affect infrastructure and operations. = H (Probability). Most airports are protected by a dike systems in events of flooding; however, flood events have occurred in the past (e.g. January 1990 flood event) which closed the Chehalis-Centralia Airport. = **H (Probability)**	**Medium**	Transportation in airports is impacted by extreme precipitation and flooding as airport closures may occur due to risky departure and landing conditions. This indicates that the magnitude of extreme precipitation and flooding to airport transportation is high as operations is halted; thus, travel, delivery of goods, medical supplies, and etc. are halted. New flight arrival and departure times will be necessary and delays should be accepted more frequently due to these weather conditions = **M (Magnitude)**	**High**	**Take Action**
35	Airports - Reduced snowpack *(Transportation)*	**Low**	**Operations:** Snowpack reduces visibility, clings to surfaces, and prompts runway maintenance procedures. Additionally, heavy snow may lead to roadways requiring more frequent maintenance. This may cause increased delays and decrease operation efficiency for airports. **Probability:** On average, snowfall in the region is not heavy, but the potential exists for extremely large amounts of occasion. The average annual snowfall is approximately 9 inches, with recorded extreme annual maximums at 45 inches. Most of the snowfall occurs in the month of January, with the monthly average at about 4.5 inches. It is also important to note that airports are sited away from mountainous areas and within UGA's. **Future Likelihood: Operations** Based on the April 1st snowpack readings, there is steady decrease in this snowpack with a decrease ranging from 68% to 97% = **L (Probability).** The April 1st snowpack is used as an indicator for the amount of stored water that becomes available during the melt season. = **L (Probability)**	**Low**	As mentioned in the probability notes, snowpack generally impacts many airport operations; however as Lewis County is projected to have a decrease of snowpack, the magnitude of snowpack impacts may be low. = **L (Magnitude)**	**Low**	**Accept Risk**
36	Airports - Wildfire *(Transportation)*	**High**	**Operations:** Wildfires will emit smoke from burning which leads to two immediate hazards: turbulence and reduced visibility. Thus, flight delays may become more frequent during wildfires as safety concerns are significantly increased. In addition to flight risk, airports impacted by wildfires may face structurally damage that may take long periods of reconstruction; therefore, lowering operation efficiency and general operations. **Probability:** Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. However, airports are located in wildfire interface zones and will likely face impacts related to wildfire risks. **Future Likelihood Indicator: Location, Operations, Safety.** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. County admin buildings are predominantly located in west County area which has low wildfire risk (average of less than 4,000 acres burned annually in western WA since 1984). However, Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). Eastern county will have a 30% chance each year that there will be the climate and fuel conditions conducive to wildfires (by mid-century). Larger east county areas will have a 30-50% of conducive wildfire conditions each year (by late century). = **H (Probability)**	**High**	The magnitude of wildfires could burn down sections or all of an airport which would halt operations and repairs would need to begin as soon as possible. Repairs may need various resources and time which delays operation of airports. This may impact the travel of many people and supplies. In addition, as airports are located in wildfire interface zones, the magnitude of wildfire risks on the operations of airports may be significant. = **H (Magnitude)**	**High**	**Take Action**

37	Railways - Extreme Precipitation & Flooding	**High**	**Structural integrity and Operations:** Extreme precipitation can usually lead to flooding. Extreme precipitation can destabilize terrain, resulting in dirt or rocks on the tracks. Further, events of flooding can wash away railway tracks or even push train cars off the rails. Flooding may also lead to damage to rail infrastructure which can take days, weeks, or months to repair based on severity. Railway mitigation methods to prevent hazard damage include relocating ralline, elevating rails, or decommissioning rail usage; however, these methods are all costly and labor intensive. **Probability:** According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. **Future Likelihood: Operations, Flood Pronze Zone** Climate change is projected to increase the stream flows which is expected to increase riverine flooding within existing floodplains and could expand flooding to new areas not currently in existing floodplains. In addition, in 30 years, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. = **H (Probability)** There is a steady increase in percent change in the magnitude of 25-year storm ranging from an increase of precipitation that falls in the range of 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation is an indicator of flooding which could affect infrastructure and operations. = H (Probability). A main railroad line (Burlington Northern Railway) crosses the floodplain from east to west on the Chehalis River near Chehalis. The tracks are subject to damage at various locations during large floods. = **H (Probability)**	**High**	The magnitude of extreme precipitation and flooding on railways would demonstrate a high magnitude as railways are located on a floodplain. This indicates a high potential for damaged rail infrastructure. This indicates that operations of this railroad will be severely impacted which could lead to long closure times for repair and return of functionality. = **H (Magnitude).**	**High**	**Take Action**
38	Railways - Reduced snowpack	**Low**	**Operations:** Snowpack has generally (either direct snowfall or drifting) can prevent rail operations from performing efficiently or at all. This is because the quantity of snowpack can be too much for the train to punch its way through without derailing or coming to other issues. On the contrary, reduced snowpack would not pose as a risk for trains to travel on railways effectively as blockages are unlikely. **Probability:** On average, snowfall in the region is not heavy, but the potential exists for extremely large amounts of occasion. The average annual snowfall is approximately 9 inches, with recorded extreme annual maximums at 45 inches. Most of the snowfall occurs in the month of January, with the monthly average at about 4.5 inches. As snowpack is anticipated to reduce, operations of railways are not anticipated to face increased closures and/or delays. Further, there is a low probability of reduced snowpack risk to railways based on data mentioned above. Further, existing railways are also not located in avalanche-prone zones. **= L (Probability)** **Future Likelihood: Operations** Based on the April 1st snowpack readings, there is steady decrease in this snowpack with a decrease ranging from 68% to 97% **= L (Probability).** The April 1st snowpack is used as an indicator for the amount of stored water that becomes available during the melt season. As there is an increased percentage of snowpack decrease, operations are significantly anticipated to have fewer operational issues. **= L (Probability)**	**Low**	The magnitude of reduced snowpack on railways is low as railways will be able to operate under "normal" conditions as reduced snowpack would not likely increase blockages. = **L (Magnitude)**	**Low**	**Accept Risk**
39	Railways - Wildfire	**High**	**Operations:** Wildfires pose track damage to railways as stock damage and derailments, power and communication disruptions, and destabilization of track beds increase as soil erosion increases. Wildfire increases the potential for accelerated erosion primarily through its effects on vegetation and soil. Therefore, with damaged railways, operations may be delayed heavily for reconstruction. **Probability:** Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. Portions of rail lines are located in wildfire interface zones, particularly in northern County; thus, based on historically wildfire data and existing conditions, there is high probability of wildfire risk for railways. = **H (Probability)** **Future Likelihood Indicator: Operations, Structural Integrity** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. County admin buildings are predominantly located in west County area which has low wildfire risk (average of less than 4,000 acres burned annually in western WA since 1984). However, Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). Eastern county will have a 30% chance each year that there will be the climate and fuel conditions conducive to wildfires (by mid-century). Larger east county areas will have a 30-50% of conducive wildfire conditions each year (by late century). Intense heat and flames can damage railway tracks and signal systems, forcing service interruptions. Further, the Industrial Access Transportation Study in northern County where portions of existing rail lines are located is taking place for future improvements. **= H (Probability)**	**High**	The magnitude of wildfire on railways focuses on service/operations being halted. Wildfires have historically damaged railway tracks and signal systems which compromise smooth operations in terms of travel and communications. Further, as mentioned there are a lot of existing and future rail in wildfire zones= **H (Magnitude)**	**High**	**Take Action**

40	Solid Waste transfer station - Extreme Precipitation *(Waste Mgmt)*	**Low**	**Pollution:** Extreme precipitation can potentially lead to flooding of a solid waste transfer station. Flooding of a solid waste transfer station may increase the volume of leachate generated by raising the percolation and piezometric head of the leachate, which will cause the leachate leakage to increase. Surges of debris from solid waste transfer stations may also increase. With increased hazard events, it is likely for an increase in disposal of weather-damaged personal property, resulting in stations having a maximum capacity which may overfill. **Probability:** According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. **Future Likelihood: <u>Operations, Contaminants</u>** Climate change is projected to increase the stream flows which is expected to increase riverine flooding within existing floodplains and could expand flooding to new areas not currently in existing floodplains. In addition, in 30 years, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. = **L (Probability)** There is a steady increase in percent change in the magnitude of 25-year storm ranging from an increase of precipitation that falls in the range of 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation is an indicator of flooding which could affect infrastructure and operations. Solid waste facilities in flood prone areas may increase the risk of unwanted waste distribution and increased lag time of solid waste collection times = **L (Probability).**	**Medium**	Located in low risk liquefaction area. Decreased capacity due to waste generated from other storm events which lowers the risk of solid waste contaminants= **M (Magnitude).** Transfer stations allow waste to be temporarily housed in facilities before being transported to landfills out of the County, stations have a maximum capacity which may overfill due to post hazard event clean up and hinder smooth operations = **M (Magnitude).**	**Low**	**Accept Risk**
41	Solid Waste transfer station - Flooding *(Waste Mgmt)*	**Low**	**Pollution:** Flooding of a solid waste transfer station may increase the volume of leachate generated by raising the percolation and piezometric head of the leachate, which will cause the leachate leakage to increase. Surges of debris from transfer stations may also increase. With increased hazard events, it is likely for an increase in disposal of weather-damaged personal property, resulting in stations having a maximum capacity which may overfill. Transfer stations also allow waste to be temporarily houses in facilities before being transported to landfills out of the County; however, as mentioned, stations have a maximum capacity. **Probability:** According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. **Future Likelihood: Operations, Flood Pronze Zone, Contaminants** Climate change is projected to increase the stream flows which is expected to increase riverine flooding within existing floodplains and could expand flooding to new areas not currently in existing floodplains. In addition, in 30 years, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. = **L (Probability)** There is a steady increase in percent change in the magnitude of 25-year storm ranging from an increase of precipitation that falls in the range of 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation is an indicator of flooding which could affect infrastructure and operations. Solid waste facilities in flood prone areas may increase the risk of unwanted waste distribution = **L (Probability).**	**Medium**	Not located in 100-year FEMA floodplain. Decreased capacity and contaminant risk due to waste generated from other storm events = **L (Magnitude). T**ransfer stations allow waste to be temporarily housed in facilities before being transported to landfills out of the County, stations have a maximum capacity which may go over due to post hazard event clean up and inhibit effective operations **= M (Magnitude).**	**Low**	**Accept Risk**

42	Solid Waste transfer station - Wildfire *(Waste Mgmt)*	**Low**	**Toxic contaminants:** Wildfire at solid waste transfer stations threaten the environment there through toxic pollutants emitted into the air, water, and soil. Further, wildfires that spread to solid waste transfer stations pose a risk to firefighters and civilians who are exposed to the hazardous chemical compounds they emit. The degree of risk is dependent on the contents buried in the landfill, the geography of the landfill, and the nature of the fire. For instance, in increased hazard events, individuals may increase disposal of weather-damaged personal property; thus, resulting in transfer stations having a maximum capacity which may overfill and exacerbate impacts. It is also important to note, transfer stations allow waste to be temporarily housed in facilities before being transported to landfills out of the County. **Probability:** According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. **Future Likelihood: Operations, Flood Pronze Zone, Contaminants** Climate change is projected to increase the stream flows which is expected to increase riverine flooding within existing floodplains and could expand flooding to new areas not currently in existing floodplains. In addition, in 30 years, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. = **L (Probability)** There is a steady increase in percent change in the magnitude of 25-year storm ranging from an increase of precipitation that falls in the range of 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation is an indicator of flooding which could affect infrastructure and operations. Solid waste facilities in flood prone areas may increase the risk of unwanted waste distribution = **L (Probability).**	**Medium**	Not located in wildfire interface zone. Decreased capacity and contaminant risk due to waste generated from other hazard events **= M (Magnitude).** Transfer stations allow waste to be temporarily housed in facilities before being transported to landfills out of the County, stations have a maximum capacity which may go over and impact operation schedules due to post hazard event clean up **= M (Magnitude).**	**Low**	**Accept Risk**
43	Sewer infrastructure - Extreme Precipitation *(Waste Mgmt)*	**Low**	**Structural integrity and treatment quality:** Extreme precipitation influences the effects of flooding. As such, flooding or surge can damage sewer infrastructure and destroy process equipment, communications controls, field equipment, and important data records while blocking access to the plant. These impacts will result in decreased treatment quality as process equipment may be damaged; thus lowering, process efficiency and treated effluent quality. Adaptation for these impacts may include other treatment methods or temporary shutdown of facilities. **Probability:** According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. **Future Likelihood: Operations, Structures, Contaminants, Health** Climate change is projected to increase the stream flows which is expected to increase riverine flooding within existing floodplains and could expand flooding to new areas not currently in existing floodplains. In addition, in 30 years, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. = **L (Probability)** There is a steady increase in percent change in the magnitude of 25-year storm ranging from an increase of precipitation that falls in the range of 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation is an indicator of flooding which could affect infrastructure and operations. Older sewer infrastructure may not be upgraded with larger inflow and outflow volumes which may impact operations. = **L (Probability).**	**Medium**	Sewer infrastructures are normally built to handle 25, 50, 100-year storm volumes; however, older treatment plants may have decreased in efficiency and structural integrity; as such, a higher magnitude of damage may affect older plants and plants that are near floodplains. Older plants may need to be decommissioned or undergo construction for plant upgrades to decrease the magnitude of impacts from extreme precipitation. = **M (Magnitude)** In addition to impacts to operations and structural integrity, chemical contaminants utilized in different processes of sewer infrastructure may be leaked due to the extreme precipitation and impact waterways. = **M (Magnitude).**	**Low**	**Accept Risk**

44	Sewer infrastructure - Flooding *(Waste Mgmt)*	**Low**	**Structural integrity and treatment quality:** Flooding or surge can damage sewer infrastructure and destroy process equipment, communications controls, field equipment, and important data records while blocking access to the plant. These impacts will result in decreased treatment quality as process equipment may be damaged; thus lowering, process efficiency and treated effluent quality. Adaptation for these impacts may include other treatment methods or temporary shutdown of facilities. **Probability**: According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen throughout Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. Exiting facilities are located in a 1% annual chance climate change flood zone; thus, there is a low probability of risk for sewer infrastructure from flooding. **Future Likelihood: Operations, Flood Prone Zone, Contaminants, Health** Climate change is projected to increase the streamflows which is expected to increase riverine flooding within existing floodplains and could expand flooding to new areas not currently in existing floodplains. In addition, by mid-century, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. = **L (Probability)** Most in County rely on private septic systems. There is a steady increase projected in percent change in the magnitude of 25-year storm ranging from an increase of precipitation that falls in the range of 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation is an indicator of flooding which could affect infrastructure and operations. Centralia's new wastewater treatment plant on Goodrich road is out of the 100-year floodplain and should remain operable through any floods up to and including the 100-year event. = **L (Probability).**	**Medium**	Sewer infrastructures are normally built to handle 25, 50, 100-year storm volumes; however, older treatment plants may have decreased in efficiency and structural integrity; as such, a higher magnitude of damage may affect older plants and plants that are near floodplains. Flooding of sewer infrastructure may impact inflow and outflow of sewage as some sewer infrastructures may not be built to handle extremely large volumes of sewage. Large influxes of sewage may lead to overflow of systems and sewage spillage which would impact waterways that lead to residential, commercial, and industrial pipes. = **M (Magnitude).**	**Low**	**Accept Risk**
45	Sewer infrastructure - Wildfire *(Waste Mgmt)*	**Low**	**Water contamination and structural integrity:** Wildfires may disrupt sewage infrastructure with impacts such as: direct structural damage to the infrastructure/facilities due to the fire or firefighting activities, loss of power, debris/contaminants in waste stream, and blockage and dirtying of pumps. It is also important to note, backup protocols for sewer infrastructure may not include climate hazard impacts; thus, new protocols, permits, and infrastructure upgrades may be costly and labor intensive. **Probability:** Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. Additionally, as most sewer infrastructure are not are located in wildfire intermix zones similar to the rest of Lewis county **Future Likelihood Indicator: Operations, Structural Integrity** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. County admin buildings are predominantly located in west County area which has low wildfire risk (average of less than 4,000 acres burned annually in western WA since 1984). However, Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). Eastern county will have a 30% chance each year that there will be the climate and fuel conditions conducive to wildfires (by mid century). Larger east county areas will have a 30-50% of conducive wildfire conditions each year (by late century). = **L (Probability)**	**Medium**	The magnitude of wildfire impacts on sewer infrastructure may be detrimental as operations may significantly halt due to operational malfunctions as described in the probability notes section. However, as most sewer infrastructure is not located in wildfire interface zone, the magnitude of these impacts are decreased significantly. Further, it is located in a wildfire intermix zone, similar to most County areas. **= M (Magnitude)**	**Low**	**Accept Risk**

46	Dump stations - Extreme Precipitation *(Waste Mgmt)*	**Low**	**Pollution:** Extreme precipitation can potentially lead to flooding of a dump station. Flooding of a dump station may increase the volume of leachate generated by raising the percolation and piezometric head of the leachate, which will cause the leachate leakage to increase. In addition, erosion from historic dump stations pose a greater threat than leaching. Surges of debris from dump stations may also increase. With increased hazard events, it is likely for an increase in disposal of weather-damaged personal property, resulting in stations having a maximum capacity which may overfill. **Probability:** According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. **Future Likelihood: <u>Physical Design, Operations</u>** Climate change is projected to increase the streamflows which is expected to increase riverine flooding within existing floodplains and could expand flooding to new areas not currently in existing floodplains. In addition, in 30 years, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. = **L (Probability)** There is a steady increase in percent change in the magnitude of 25-year storm ranging from an increase of precipitation that falls in the range of 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation is an indicator of flooding which could affect infrastructure and operations. = **L (Probability).**	**Medium**	The magnitude of impacts would concentrate on the level of pollution that occurs; resulting in increased cleanups, equipment improvements, and operation costs. Items are "dropped off" by individuals at transfer stations/Packwood Community drop off center. Located in low risk liquefaction area**. = M (Magnitude).** Transfer stations allow waste to be temporarily housed in facilities before being transported to landfills out of the County. Increased hazard events, individuals may increase disposal of weather-damaged personal property, resulting in stations having a maximum capacity which may overfill and lead to a decrease in operations/efficiency **= M (Magnitude).**	**Low**	**Accept Risk**
47	Dump stations - Flooding *(Waste Mgmt)*	**Low**	**Pollution:** Flooding of a dump station may increase the volume of leachate generated by raising the percolation and piezometric head of the leachate, which will cause the leachate leakage to increase. In addition, erosion from historic dump stations pose a greater threat than leaching. Surges of debris from dump stations may also increase. With increased hazard events, it is likely for an increase in disposal of weather-damaged personal property, resulting in stations having a maximum capacity which may overfill. **Probability:** According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. However, dump stations in Lewis County are not located in a 100-year FEMA floodplain; thus, the probability of flood events impacting dump stations is low. **Future Likelihood: <u>Operations, Flood Pronze Zone, Structure</u>** Climate change is projected to increase the streamflows which is expected to increase riverine flooding within existing floodplains and could expand flooding to new areas not currently in existing floodplains. In addition, in 30 years, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. = **L (Probability)** In addition, as flooding is an impact influenced by extreme precipitation, there is a steady increase in percent change in the magnitude of 25-year storm ranging from an increase of precipitation that falls in the range of 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation is an indicator of flooding which could affect infrastructure and operations. Solid waste facilities in flood prone areas may increase the risk of unwanted waste distribution = **L (Probability).**	**Low**	The magnitude of impacts would concentrate on the level of pollution that occurs; resulting in increased cleanups, equipment improvements, and operation costs. However, the magnitude of impacts from flooding to dump stations is low as dump stations are not located in 100-year FEMA floodplain and are in a low risk liquefaction area. **= L (Magnitude).**	**Low**	**Accept Risk**

48	Dump stations - Wildfire *(Waste Mgmt)*	**Low**	**Toxic contaminants:** Wildfire at dump stations threaten the environment there through toxic pollutants emitted into the air, water, and soil. Further, wildfires that spread to dump stations pose a risk to firefighters and civilians who are exposed to the hazardous chemical compounds they emit. The degree of risk is dependent on the contents buried in the landfill, the geography of the landfill, and the nature of the fire. For instance, in increased hazard events, individuals may increase disposal of weather-damaged personal property; thus, resulting in stations having a maximum capacity which may overfill and exacerbate impacts. **Probability:** Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent and dump stations are not located in fire interface zone. **Future Likelihood Indicator: Operations, Structural Integrity, Fire Prone Area** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. County admin buildings are predominantly located in west County area which has low wildfire risk (average of less than 4,000 acres burned annually in western WA since 1984). However, Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). Eastern county will have a 30% chance each year that there will be the climate and fuel conditions conducive to wildfires (by mid century). Larger east county areas will have a 30-50% of conducive wildfire conditions each year (by late century). However, as mentioned above, dump stations are generally not located in fire interface zone(s)= **L (Probability)**	**Low**	Toxic contaminants emitted from wildfires that have spread to dump stations pose health, environmental, and economical impacts. These impacts may drastically influence the operations of dump stations; However, as stated, dump stations in Lewis County are not located in wildfire interface zone and the magnitude of these impacts are low = **L (Magnitude).**	**Low**	**Accept Risk**
49	Water infrastructure - Reduced snowpack *(Water Resources)*	**High**	**Water scarcity:** Reduced snowpack would lead to a decreased water supply for water infrastructure. A decreased supply of water for treatment can have a pronounced effect on process efficiency as well as associated operational costs. It is important to note that design standards set in Title 13 of the Lewis County municipal code, states water mains are to be equipped with backflow prevention valves. **Probability:** On average, snowfall in the region is not heavy, but the potential exists for extremely large amounts on occasion. The average annual snowfall is approximately 9 inches, with recorded extreme annual maximums at 45 inches. Most of the snowfall occurs in the month of January, with the monthly average at about 4.5 inches. **Future Likelihood: Operations** Based on the April 1st snowpack readings, there is steady decrease in this snowpack with a decrease ranging from 68% to 97% = **H (Probability)**. The April 1st snowpack is used as an indicator for the amount of stored water that becomes available during the melt season, indicating decreased water storage capabilities Countywide. = **H (Probability).**	**High**	Reduced process efficiency may lead to reduced water quality; thus, can lead to reduced water which can lead to serious effects on aquatic organisms and plants, as well as potential human costs. The magnitude of impact regarding reduced snowpack to water infrastructure focuses on reduced process efficiency and operational costs. As there is a high probability of reduced snowpack affecting water infrastructure, the magnitude of decreased process efficiency and operation costs is heightened. Treated water faces a higher risk of being treated improperly; thus, impacting the subjects listed above. = **H (Magnitude)**	**High**	**Take Action**

50	Water infrastructure - Wildfire *(Water Resources)*	**Medium**	**Water contamination and structural integrity:** Wildfires have been historically known to compromise water quality during active burning and for months and years after the fire has been extinguished. Water infrastructures may face increased treatment costs, need for alternative supplies, and potentially diminished reservoir capacities. Extensive water system damage and related water quality contamination to water infrastructure may significantly impact the operations of the system; thus, leaving many businesses, residents, etc. loss of water for long periods of time. It is also important to note that many design standards account for limiting contamination, but it does not account for climate hazards. **Probability:** Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. **Future Likelihood Indicator: Operations, Structural Integrity, Contaminants** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. County admin buildings are predominantly located in west County area which has low wildfire risk (average of less than 4,000 acres burned annually in western WA since 1984). However, Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). Eastern county will have a 30% chance each year that there will be the climate and fuel conditions conducive to wildfires (by mid century). Larger east county areas will have a 30-50% of conducive wildfire conditions each year (by late century). = **M (Probability)**	**High**	Debris (soot) from wildfires may compromise treatment of water and expediate filter deterioration in water treatment processes. Further, compromised treatment of water may impact outflow of water which may contaminate groundwater aquifers and nearby waterways. = **H (Magnitude).**	**High**	**Take Action**

51	Civic Centers - Extreme Precipitation *(Zoning & Development)*	**Low**	**Structural damage:** Civic centers may face increased problems regarding building stormwater management systems in place, vegetation (e.g. mold) issues, and roof damage due to extreme precipitation. In addition, with extreme precipitation, there is an increased potential of flooding. In civic centers, sheet flooding may cause structural damage to the buildings such as loose or buckling floors and foundation cracks. These impacts may significantly affect civic center operations. It is also important to note that many civic centers with appropriate facilities may act as temporary shelters for extreme hazard events, requires collaboration with American Red Cross, NGOs, faith based organizations, Salvation Army, and law enforcement/other County departments. **Probability:** According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. In terms of precipitation, the total average annual precipitation ranges from 47 inches at Centralia to 62 inches at Packwood. On the average, annual precipitation is 46.7 inches, with annual records showing a range from a low of 28 inches to a high of 60 inches. **Future Likelihood: <u>Vulnerable Groups, Population Density, Operations</u>** Climate change is projected to increase the streamflows which is expected to increase riverine flooding within existing floodplains and could expand flooding to new areas not currently in existing floodplains. In addition, in 30 years, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. = **L (Probability)** There is a steady increase in percent change in the magnitude of 25-year storm ranging from an increase of precipitation that falls in the range of 7-18%. This increase indicates that Lewis County is expected to experience an increase in total precipitation of the 25-year storm. Heavier precipitation is an indicator of flooding which could affect infrastructure and operations. **= L (Probability).**	**Medium**	Civic centers include recreation centers with large concentrations of people who may be exposed to hazard events and include vulnerable individuals i.e., children, elderly, special needs, etc. Many communities may utilize civic centers as part of their daily lives; however, extreme precipitation may hinder their ability to use these centers. Further, as described with increased extreme precipitation, the effects of structural damage to civic centers is greater; thus, further impacting the operations of these buildings as reconstruction would potentially take extended periods of time. = **M (Magnitude).**	**Low**	**Accept Risk**
52	Civic Centers - Flooding *(Zoning & Development)*	**Medium**	**Structural Damage:** Civic centers may face increased problems regarding building stormwater management systems in place and vegetation (e.g. mold) issues. Further, sheet flooding may cause structural damage to the buildings such as loose or buckling floors and foundation cracks. These impacts may significantly affect the structural aspects of civic centers; thus, a secondary impact of impacting the operations of civic centers. It is also important to note that many civic centers have been designated as evacuation shelters (Centralia College, Red Cross, Morton Hospital, Providence Hospital to name a few). **Probability:** According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. The major floods are caused by the overflow of the Chehalis and Newaukum Rivers and Coal, Salzer, and Dillenbaugh Creeks, as well as the Cowlitz and Tilton Rivers. The earliest documented flood on the Chehalis River occurred in December 1887 and since then, there have been major floods every 10-15 years. There have been 13 Presidential Declarations for flooding in the County between 1971 and 2012. **Future Likelihood: <u>Operations, Flood Pronze Zone, Structure</u>** Climate change is projected to increase the streamflows which is expected to increase riverine flooding within existing floodplains and could expand flooding to new areas not currently in existing floodplains. In addition, in 30 years, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. = **M (Probability)**	**Medium**	Civic centers located thru-out County, and may be flooded in unincorporated City-adjacent areas/UGAs. Fixed buildings/civic centers located in 100-year FEMA floodplains would experience peak streamflows resulting in loss of building functions and services and possibly reconstruction. Civic centers not located in floodplain zones would be able to resume operations sooner than civic centers that are located in floodplain zones as structural damages may not be as significant as reconstruction periods are much shorter. However, civic centers located on floodplain zones may face increased structural damage; thus, will need to undergo longer periods of reconstruction, halting operations. **= M (Magnitude).**	**Medium**	**Take Action**

53	Civic Centers - Reduced snowpack *(Zoning & Development)*	**High**	**Water scarcity:** Reduced snowpack indicates changes in streamflows; thus, water supply that may be diverted for use in civic centers. For instance, civic centers need water supply for on-site facilities, recreational uses, sewage flow, etc. Reduced water supply could potentially pose restrictions on the water budget for civic centers to conserve supply. It is also important to note that many civic centers have been designated as evacuation shelters (Centralia College, Red Cross, Morton Hospital, Providence Hospital to name a few). **Probability:** On average, snowfall in the region is not heavy, but the potential exists for extremely large amounts of occasion. The average annual snowfall is approximately 9 inches, with recorded extreme annual maximums at 45 inches. Most of the snowfall occurs in the month of January, with the monthly average at about 4.5 inches. **Future Likelihood: Operations** The April 1st snowpack is used as an indicator for the amount of stored water that becomes available during the melt season. Based on the April 1st snowpack readings, there is steady decrease in this snowpack with a decrease ranging from 68% to 97% = **H (Probability).** Based on the projection, there is a high probability of reduced snowpack; thus, water scarcity is more likely to occur and impact the operations of civic centers located in Lewis County.	**Medium**	The magnitude of reduced snowpack on civic centers would focus on the operational uses of civic centers. Water uses of civic centers are diverted into many purposes. Some of which include: landscape irrigation, fire sprinkler systems, toilet flushing, HVAC cooling, etc. As there is a high probability of reduced snowpack occurring for Lewis County, the magnitude of these activities being halted is a medium as some activities may not be necessary (e.g., landscape irrigation) for the full functionality of civic centers. However, activities such as HVAC cooling and fire sprinkler systems cannot be removed from the operations of a civic center. = **M (Magnitude)**	**High**	**Take Action**
54	Civic Centers - Wildfire *(Zoning & Development)*	**Medium**	**Probability:** Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have been infrequent. County collaboration with fire districts to educate property owners on defensible space and other prevention methods will be more consistent. **Future Likelihood Indicator: Location** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events and increase the likelihood of fires. County admin buildings are predominantly located in west County area which has low wildfire risk (average of less than 4,000 acres burned annually in western WA since 1984). However, Large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). Eastern county will have a 30% chance each year that there will be the climate and fuel conditions conducive to wildfires (by mid century). Larger east county areas will have a 30-50% of conducive wildfire conditions each year (by late century). = **M (Probability)**	**Medium**	UGAs located in wildfire interface zones expose fixed buildings/civic centers to wildfire risk. Would result in complete loss of building functions and services, reconstruction needed **= M (Magnitude).**	**Medium**	**Take Action**

55	Colleges - Extreme Precipitation & Flooding	**Low**	**Structural damage:** College buildings may face increased problems regarding building stormwater management systems in place, vegetation (e.g. mold) issues, and roof damage due to extreme precipitation. In addition, with extreme precipitation, there is an increased potential of flooding. In college campuses, sheet flooding may cause structural damage to the buildings such as loose or buckling floors and foundation cracks. These impacts may significantly affect college operations. Campuses may act as secondary facilities for emergency operations (staging areas), but are limited to non-flood areas. **Probability:** According to the Lewis County GIS Web Map, there are multiple flood zones near Centralia, Chehalis, and Napavine. However, flooding and drainage problems from heavy storms can happen anywhere in Lewis County. College campuses such as Centralia college and WSU extension are located in incorporated areas outside of 100-year FEMA flood zone. **Future Likelihood: Operations, Location** Climate change is projected to increase the streamflows which is expected to increase riverine flooding within existing floodplains and could expand flooding to new areas not currently in existing floodplains. In addition, in 30 years, 31.7% of properties in Lewis County will have risk of flooding with major impacts for residential and severe for commercial, infrastructure, and road assets. However, as mentioned above, colleges within Lewis County are located outside of the 100-year FEMA flood zone. **= L (Probability)**	**Low**	As mentioned, structural damage would potentially occur with extreme precipitation and flooding. The magnitude of these hazards for instance may include long periods of time for reconstruction. This may lead to loss of revenue for colleges for a long duration of time. However, as colleges within Lewis County are outside of the 100-year FEMA flood zone, the magnitude of these effects impacting the colleges is low. = **L (Magnitude).**	**Low**	**Accept Risk**
56	Colleges - Wildfire	**Medium**	**Structural damage:** Wildfires have historically burned down structures, including homes. Structures that are impacted by wildfires may range in severity in terms of acreages destroyed and renovations required. College campuses are located in wildfire interface zones; therefore, exposing students, faculty, and staff to wildfire risk. Wildfires may significantly impact buildings even with fireproof designs i.e., defensible space, fireproof building materials, etc. **Probability:** Wildfires occur every year in Lewis County, average of at least 10 wildfires a year (2008-2023, no record for 2022). In 2022-2023, ~6,917 acres burned comprising 85% of total acres burned since 2008 (1,207.98 acres burned 2008-2022). Large fires have historically been infrequent. **= M (Probability)** **Future Likelihood Indicator: Operations, Location, Structure** Climate change is projected to increase high fire danger days contributed from hotter dryer summers/east wind events; thus, increasing the likelihood of fires. Additionally, large wildfires are anticipated to occur more frequently in Lewis County - western County is predicted to experience 11-12 additional high fire danger days each year (by late century). Eastern county will have a 30% chance each year that there will be the climate and fuel conditions conducive to wildfires (by mid century). Larger east county areas will have a 30-50% of conducive wildfire conditions each year (by late century). The nearest college in Lewis County is located in the North Western part of Lewis County which includes Centralia County. Despite not having many college campuses, the likelihood of wildfire impacting the college is likely based on data described above. **= M (Probability)**	**High**	College campuses such as Centralia college and WSU extension may be impacted due to wildfires that have spread onto the campus/near campus. This can lead to indefinite closures of the campus; thus, halting education. Further, wildfire would lead to immediate evacuations of the college campuses and cease of operation for a duration of days for repairs and safety check-ups. = **H (Magnitude).**	**High**	**Take Action**