	STRESSORS Warmer Summer	Warmer Winter	Warmer Water	Increasing Drought	Increasing Storminess	Sea-Level Rise	Ocean Acidification	Population Change
Goal 1: Create vibrant centers, corridors and neighborhoods while accommodating growth	(-) Causes urban heat islands, which affect livability/health in heavily developed centers and corridors [Sec. 2.1, pg. 17] + ↑ Incentive for Green Building Practices ie vg. roofs	+		(-) Limits water available to support new development [Sec. 3.4, pg. 53] + changes to xeric landscaping (more drought tolerant)	(-) Increases volume of urban runoff and flooding and renders inadequate some stormwater/flood-control facilities [Sec. 2.3, pg. 27]	(-) Increases frequency, depth and duration of inundation of low coastal areas (e.g., downtown Olympia), which may damage or disrupt use infrastructure (e.g., homes, roads, etc.) [Sec. 4.1, pg. 54] Utilities Emergency Access & Egress	Loss of Cultural Resources	(+) Presents opportunity to focus growth in existing urban areas [Sec. 6.5, pg. 89]
Goal 3: Create a robust economy	(-) Raises risk of low crop yields or failure due to warmer temperature, reduced summer precipitation and increased pest prevalence [Sec. 5.1, pg. 69] (-) Increases demand/cost for emergency medical services and hospitalizations [Sec. 2.1, pg. 17] (-) Impacts outdoor occupations, especially in the construction industry, and could result in project delays and increased costs [Sec. 2.1, pg. 17]	(-) Reduces snowpack and alters streamflow volume and temperature, impacting long-term productivity of anadromous fish populations and fisheries [Sec. 3.1, pgs. 32-36] (+) Supports longer growing season, new range of crops [Sec. 5.1, pg. 68]	(-) Increases the risk of marine water stratification and hypoxia and could alter the timing of spring plankton blooms that support the marine food web, including salmon and other economically important fish [Sec. 4.2, pg. 66] (-) Thermally stresses salmonids, which support economically important fisheries [Sec. 3.1, pg. 38]	(-) Decreases summer streamflow, which could reduce the habitat, health, and survival of salmonids [Sec. 3.1, pg. 34] (-) Increases wildfire risk -- especially amid the urban-wildland interface -- which can damage forests and infrastructure critical to the region's economy [Sec. 5.2, pg. 73] (-) Reduces summer hydropower production, a comparatively clean and inexpensive electricity source for commercial and residential customers [Sec. 3.1, pgs. 36-37] (-) Reduces water supply, which is critical for agriculture and industry [Sec. 5.1, pg. 67] - ↓ H_2O supply impacts growth & econ. development	(-) Raises the risk of floods and landslides, which could damage utility infrastructure and close roads, cutting off access to goods, natural resources, and services vital to region's economy [Sec. 6.2, pg. 78] - prolong power outages will impact local businesses (-) Raises the risk of flooding, which could damage agricultural crops, buildings and equipment [Sec. 5.1, pg. 67] (-) Raises the risk of flooding that could disrupt transportation, business, school, emergency service, and public works and private utility operations [Sec. 6.2, pg. 78] (-) Increases risk of flooding that could damage private property and result in economic losses [Sec. 6.2, pg. 78] - ↑ cost of Dev.	(-) Threatens to flood local highways, railways, bridges, port marine terminal and other transportation infrastructure that are critical to moving people and goods throughout the region [Sec. 4.1, pg. 35] (-) Threatens to flood low-lying industrial, commercial, agricultural, and residential properties, disrupt commerce and damage infrastructure [Sec. 4.1, pg. 67] (+) Inundates coastal marshes, which could turn them into mudflats that support shellfish and estuarine fish [Sec. 4.1, pg. 63] (-) Increases the rate of erosion of unprotected coastal bluffs, which may threaten the property and safety of nearby residents [Sec. 4.1, pg. 63]	(-) Threatens Puget Sound fisheries (e.g., shellfish, crabs and salmon) -- both commercial and recreational harvests [Sec. 4.2, pg. 65]	(+) Increases local demand for goods and services and supports local job creation and demand [Sec. 6.5, pg. 89] (-) Increases demand for and cost to provide services (social, emergency, etc.) [Sec. 6.5, pg. 89] (-) Puts more strain on transportation (roads, transit, etc.) [Sec. 6.5, pg. 89]
Goal 11: Provide opportunities for everyone in the Thurston Region to learn about and practice sustainability	(+) Creating a Thurston Climate Adaptation Plan presents another opportunity for the region to learn about and practice sustainability. Cumulative stressors necessitate climate adaptation, which IPCC says is now "unavoidable" because accumulation of past GHG emissions [Sec. 7, pg. 90]. + Investors, companies looking to relocate business will look favorably at communities with clear strategies to address & mitigate their risks.							

Balance of power needs/avail | Pollinators | Urban Ag | Expand Crops | Species migration & invasive species | Ag practices + Hydroponic – trade) ↓ energy

	STRESSORS							
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Goal 7: Support a local food system to increase community resilience, health, and economic prosperity	(+) Supports "carbon fertilization," more atmospheric CO2 and warmer temperature that increases the biomass and productivity of some crops grown in the region, including beans and grasses [Sec. 5.1, pg. 68] +Rooftop gardens (-) Increases in atmospheric CO2 decreases the nutritional quality of forage and pasture lands for livestock and wild animals [Sec. 5.1, pg. 68] (-) Increases heat stress risk for horses, dairy cows and other large livestock [Sec. 5.1, pg. 67] chickens	(-) Increases range and survival of pests and diseases that affect crops [Sec. 5.1, pg. 68] waterfowl (+) Extends the growing season and supports crops that tolerate warmer temperatures [Sec. 5.1, pg. 68] · wetland impacts (what we regulate might increase)	(-) Threatens the sustainability of local fisheries [Sec. 3.1, pg. 38] Algae greenhouse growth expanded (other grow opp	(-) Decreases the viability of berries, tree fruit, tubers and other crops grown in the region [Sec. 5.1, pg. 68] Need for diversity – drought-resistant species Animal waste/veg waste. (-) Reduces water available for junior water right holders, threatening the survival of livestock and crops for newer farmers [Sec. 5.1, pg. 70] Need diff fertilizers (nitrogen?) (-) Raises the risk of lower crop yield or failure [Sec. 5.1, pg. 69] < less productivity > Pressure to use more land	(-) Increases risk of flooding that could damage agricultural lands and assets (crops and livestock) [Sec. 5.1, pg. 68] > erosion (see below)	(-) Pushes saltwater further into estuaries, which may inundate near-coastal farms and ranches [Sec. 5.1, pg. 67] Contamination of fresh water (-) Turns upland habitat (e.g., marshes and forests) into mudflats that destroys habitat for ducks and other waterfowl [Sec. 4.1, pg. 64] → adjacent W. lands (+) Turns upland habitat (e.g., marshes and forests) into mudflats that support shellfish and estuarine fish [Sec. 4.1, pg. 64]	(-) Reduces food available for and survival of salmon and other marine life [Sec. 4.2, pg. 65] (-) Makes it harder for calcifying organisms to form shells, and ultimately harms shellfisheries [Sec. 4.2, pg. 65]	(+) Increases demand for locally grown food [Sec. 6.5, pg. 89] (-) Increases pressure on rural land to develop [Sec. 6.5, pg. 89]
Goal 9: Move toward a carbon-neutral community	(-) Increases energy demand for cooling residential and commercial buildings, which -- depending on the energy source -- may increase carbon emissions [Sec. 3.1, pg. 37] (-) Decreases production of hydropower (more summer evaporation) [Sec. 3.1, pg. 36] · Maintain adequate stream flows. · Pressure to dam removal	(-) Reduces extent and volume of snowpack and glaciers, exacerbating sediment runoff that builds up in Alder Lake and reduces the reservoir's capacity to generate hydropower [Sec. 3.1, pg. 37] will not balance not most is not gas (+) Decreases energy demand for heating residential and commercial buildings [Sec. 3.1, pg. 36] (+) Increases production of hydropower (less snow, more rain due to warmer air temperatures) [Sec. 3.1, pg. 36] Impact on resources?	· Processing at Lott? = rec. H2O too · Impact on wells – more stuff growing in water (fish)	(-) Decreases capacity to produce clean hydropower (less rainfall and water behind dams) [Sec. 3.1, pg. 36] · Will move water further = ↑ $ = energy costs · Soils, plant mat breakdown faster (-) Raises the risk of wildfires, which could destroy forests that serve as a net carbon sink [Sec. 6.1, pgs. 73-74] Landscaping: (-) Lowers reservoir levels, which exposes organic materials and causes them to decay and emit greenhouse gases [Sec. 3.1, pgs. 36-37]	(-) Causes erosion and loss of organic materials (e.g., plants) that build up in reservoirs (e.g., Alder Lake and Skookumchuck), decay and emit greenhouse gases (e.g., methane) [Sec. 3.1, pg. 36] Predictibity ↓ (+) Increases production of clean hydropower (warmer, wetter winters) [Sec. 3.1, pg. 36] · Timing · Pressure to site more rooftop energy	(-) Increases energy consumed to pump wastewater and stormwater [Sec. 4.1, pg. 57] & reclaimed · Will move people out of some urban areas.	warmer water absorbs more gas	(-) Increases overall energy consumption [Sec. 6.5, pg. 89] · shellfish travels further move energy getting info out to people · Mass Transit · More Telework opp
Goal 12: Make strategic investments to advance sustainability regionally	Sitting variable physical policy	Short: (low energy heating & cooling) (rainwater & greywater) (or desuwalk) (more open space) Long term: (Lns impact dev) → cooling centers	Education · More riparian shade + habitat	Policy: H2O rts' · Xeriscaping · increase water use house/municipality · ↑ water costs	(-) Necessitates retrofitting stormwater and wastewater infrastructure to mitigate flooding and backups that threaten water quality and human health and welfare [Sec. 2.3., pg. 27; 4.1, pg. 57] . . .	→ dykes/$ h2o barriers · Relocate Roads · opp to restore Estuaries.	de-salinization →	↑ trans options. ↑ stormwater infrastructure infiltration target

	STRESSORS							
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Goal 2: Preserve environmentally sensitive lands, farmlands, forest lands, prairies, and rural lands, and develop compact urban areas	(-) Decreases climatic suitability of areas that currently support Garry oak and Douglas fir but may increase the range of western hemlock, western red cedar and other species that can withstand warmer temperatures [Sec. 5.2, pgs. 70-71] (-) Decreases freshwater wetland habitat [Sec. 3.3, pg. 49] (-) Stresses sensitive species, leaving them more vulnerable to pests and pathogens [Sec. 5.2, pg. 71] ~~Make competition~~	(-) Supports survival of invasive species that could outcompete native flora and fauna throughout the region's forests, prairies and grazing lands [Secs. 5.1 and 5.2, pgs. 67-71] (-) Shifts the timing of flowering and abundance of pollinators, which could reduce some species of plants throughout the region [Sec. 5.2, pg. 70]	(-) Increases periods of low dissolved oxygen and hypoxic conditions in both freshwater and marine areas [Sec. 3.2, pg. 45] Salman habitat	(-) Raises the risk of wildfires, which could damage forests and other sensitive habitat [Sec. 5.2, pg. 73] Soil loss through erosion (wind) (-)Stresses sensitive plants and habitat, reducing long-term viability of preserved and restored areas [Sec. 5.2, pg. 71] Competing demands for water • hydro • salmon • agriculture • households • Junior water Rights holders	(-) Increases frequency and intensity of heaviest 24-hour rain events and overall volume of winter streamflow, which could scour streambeds and degrade sensitive riparian areas [Sec. 3.1, pg. 32] (-) Pollution ~~Transport~~ Runoff marine + freshwater (+) Erosion, landslides flooding (+) Coastal storms flooding changing shoreline due to wind + wave action (+) bigger facilities for stormwater More volume, longer duration (+) More large woody debris?	(-) Increases frequency, depth and duration of inundation of low-lying coastal areas, which could turn marshes ~~and~~ other upland areas ~~into~~ and mudflats [Sec. 4.1, pg. 54] Rate of sedimentation (in Nisqually delta) may Not be great enough to counteract sea-level rise (+) Increases the rate of erosion of unprotected coastal bluffs, which contributes sand and gravel that allows for down-drift shores to become higher and move landward, thereby maintaining the beach profile [Sec. 4.1, pg. 63]	(-) Risk to aqua culture shell fish Any thing other than shellfish?	(-) increased demand ~~water~~ for water More roads, vehicles stormwater ... all impact wildlife + Quality of habitats (-) Increases pressure on existing parks and open space [Sec. 6.5, pg. 89]
Goal 6: Ensure that residents have the resources to meet their daily needs (needs include water, food, shelter, healthcare, employment, education, transportation)	(-) Increases extreme temperatures that could cause hyperthermia -- a major risk for people who are homeless or work outdoors [Sec. 2.1, pg. 17] (-) Introduces or exacerbates disease vectors (e.g., plants that carry fungi and insects that carry viruses), which could harm human health (warmer, wetter winters also exacerbate exposure to pathogens and other health threats) [Sec. 6.4, pg. 84] costs of installing home cooling system (-) Raises home cooling costs (e.g., buying, installing and using air-conditioning), leaving less money to meet basic needs [Sec. 3.1, pg. 37]	(+) Lowers home heating demand and utility bills, leaving more money to meet basic needs [Sec. 3.1, pg. 37] • skiing, Mountain activities effects on energy grid	(-) Threatens the survival of salmon, which support cultural and economic practices and ecosystem services [Sec. 3.1, pg. 38] (+) lower water heating costs	(-) Raises the risk of wildfires, which could damage utility infrastructure, close roads and cut off access to vital goods and services [Sec. 6.1, pg. 73] competing demands for water (-) Decreases summer streamflow, which makes it harder to balance competing demands for water and reduces energy security for residents and businesses. [Sec. 3.1, pg. 36] • food security • wildfires on homes • Risk to lives • Reduced air Quality due to air Quality, erosion/wind, • ~~Make population - more vehicles~~ ~~Lower air Quality~~ • MORE WATER shortages	(-) Raises the risk of floods and landslides, which could damage utility infrastructure and close roads, cutting off access to vital goods and services [Sec. 6.2, pg. 78] • homes too • More power outages esp. during Winter (-) Raises the risk of flooding that could displace residents [Sec. 6.2, pg. 78] landslides • Make demand on emergency services	(-) Raises the risk of coastal inundation, which could damage key infrastructure (wastewater, port, roads, government buildings) and cut off key routes that provide residents access to vital goods and services [Sec. 6.2, pg. 78] • homes + businesses • Saltwater intrusion • Impacts on Recreation, any Shoreline activities	(-) Threatens the ability of people to harvest and consume shellfish, which support cultural and economic practices and ecosystem services [Sec. 6.4, pg. 84] what are effects further up the food chain (salmon?)	(-) Puts more strain on services (social, emergency, etc.) [Sec. 6.5, pg. 89] More strain on Energy grid (+) More people, grows economy (+/-) Make development (-) Puts more strain on schools (e.g., unplanned influx or loss of students) [Sec. 6.5, pg. 89] (+) greater diversity (-) spread of diseases • more vehicles = worse air Quality (-) Puts more strain on transportation (roads, transit, etc.) [Sec. 6.5, pg. 89]
Goal 8: Ensure that the region's water supply sustains people in perpetuity while protecting the environment	• increased demand for water • Reduced streamflows • increased evaporation, evapotranspiration • (+) Positive behavioral changes re/ conservation	Less snowpack esp. Nisqually basin	balancing demands for salmon, households	(-) Reduces aquifer recharge and could spur more groundwater pumping when surface water is scarce, which could lower well levels raise the cost of pumping water from greater depths [Sec. 3.4, pg. 53] competing demand for water (-) Decreases precipitation volume and groundwater recharge, which may raise pollutant concentrations in shallow wells and surface waters [Sec. 3.4, pg. 51] • Make water shortages	~~Deep~~ Decreases groundwater Increased Runoff, less infiltration?	(-) Reduces aquifer recharge, which makes coastal groundwater more vulnerable to saltwater intrusion and inundation [Sec. 3.4, pg. 49]		(-) Increases demand for water (drinking, irrigation, etc.) [Sec. 6.5, pg. 89] ↑ Commercial, industrial Demand

	STRESSORS							
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Goal 4: Protect and improve water quality, including groundwater, rivers, streams, lakes and Puget Sound (Water quality measured by temperature, volume, habitat and pollution)	(-) Degrades water quality by supporting algal blooms [Sec. 3.2, pg. 45] (-) Degrades critical habitat due to increasing temperatures in freshwater (non-tidal) wetlands [Sec. 3.3, pg. 49] (-) Degrades critical habitat due to decreased habitat extent [Sec. 3.3, pg. 49] - Greater use of water reservoir recreational use (fuel spills) - Increased water withdrawals reduce flows Species Shifts * warmer water + warmer summers	(+) Increases the extent of seasonal (winter) wetlands on poorly drained soils (e.g., prairies) [Sec. 5.2, pg. 70] (-) Degrades critical habitat (temperature) due to decreases snowpack [Sec. 3.1, pgs. 32-39] (-) Degrades critical habitat (altered stream volume) due to increased rainfall and runoff [Sec. 3.1, pgs. 32-39] - Altered reproductive cycles for animals change spawning seasons (life cycle specific for waterfowl) + less de-icing used on roads (salt + sand) cost savings + water quality	(-) Degrades critical habitat due to increasing water temperature (alters fish migration timing, reach and success) [Sec. 3.1, pg. 38] (-) Increases the growth and reach of pathogens (e.g., cyanobacteria) harmful to humans, fish and other water users [Sec. 3.2,pg. 46] (-) Increases the risk of marine water stratification and hypoxia and could alter the timing of spring plankton blooms that support the marine food web [Sec. 4.2, pg. 66] (-) Degrades critical habitat due to increasing water temperature (expands range for warm water-adapted invasive fish) [Sec. 3.1, pg. 38]	(-) Contaminates water (turbidity and sedimentation) due to wildfires that burn water-filtering plants [Sec. 6.1, pg. 73-74] (-) Alters stream depth and breadth (erosion) due to greater incidence of wildfires [Sec. 6.1, pgs. 73-74] (-) Reduces groundwater recharge (drinking water) [Sec. 3.4, pg. 49] (-) Degrades critical habitat due to changes in lake, river and stream volume [Sec. 3.1, pg. 32] - Increased pollutants (sediment, sand) overwhelm stormwater facilities during summer/drought - Increased saltwater intrusion affecting groundwater	(-) Contaminates water (nutrients, pathogens, turbidity and sedimentation) due to flooding [Sec. 6.2, pg. 79] (-) Contaminates water (turbidity and sedimentation) due to landslides [Sec. 6.2, pg. 81] (-) Contaminates water (bacteria, pathogens) due to a greater incidence of combined stormwater/sewer system overflows [Sec. 2.3, pg. 36] (-) Contaminates water (nutrients, turbidity, sedimentation) due to stormwater overflows [Sec. 2.3, pg. 36] - Greater mobilization of pollutants due to greater saturation of soils	(-) Inundates former industrial sites, which could mobilize pollutants in the soil and degrade water quality [Sec. 4.1, pg. 57] (-) Inundates downtown Olympia and LOTT wastewater treatment plant assets, threatening ability to treat and discharge water [Sec. 4.1, pg. 58]	(-) Increases in ocean pH, coupled with increases in ocean temperature and land-borne pollution, threatens marine water quality [Sec. 4.2, pg. 65] (-) Increases in freshwater runoff with organic matter, which releases CO2 as it decomposes, exacerbates to ocean acidification and degrades marine water quality [Sec. 4.2, pg. 66]	(-) Increases pollution related to development (e.g., more septic systems and impervious surfaces) [Sec. 4.2, pg. 65] - Increases pollution related to transportation More polluted stormwater runoff + spills - When CSO occurs, more waste into water CSO = combined sewer overflow
Goal 5: Plan and act toward zero waste in the region	(-) Raises the risk of greater die-off of vegetation (e.g., trees, crops) and volume of organic waste [Sec. 5.1, pg. 72]	- More waste because of more recreational use More facilities/maintenance needed at parks	- More waste associated w/ greater recreation	(-) could damage public- and private-sector infrastructure (homes, businesses, roads, etc.) and create waste that cannot be reused or recycled [Sec. 6.1, pg. 73]	(-) Raise landslides, which could damage public- and private-sector infrastructure (homes, businesses, roads, etc.) and create waste that cannot be reused or recycled [Sec. 6.2, pg. 78] * Potential for more high wind events cause more waste + coastal storm events	aises the risk of coastal inundation, which could damage public- and private-sector infrastructure (homes, businesses, roads, etc.) and create waste that cannot be reused or recycled [Sec. 6.2, pg. 78]		(-) Increases solid and organic waste [Sec. 6.5, pg. 78] - More spills
Goal 10: Maintain air quality standards	(-) Increases production of surface ozone and accumulation of PM2.5 [pg. Sec. 2.2, pg. 22] (-) Increases summer energy peak demand for cooling [Sec. 3.1, pg. 36] - Greater release of VOCs	+ less wood burning so less particulate matter - Affect of warmer summer on farming to water down water another goal		(-) Raises the risk of wildfires and elevated levels of PM10 from smoke [Sec. 6.1, pg. 74] (-) Parches farm fields and other open spaces which could release windblown dust (e.g., PM10) that degrades air quality and harms human health [Sec. 5.1, pg. 68]	- Increase use of generators due to power outages - more air pollution + fewer inversion events in winter * Not sure about science to support this			(-) Increases overall energy consumption [Sec. 6.5, pg. 89] emissions particulate matter