

SUSTAINABLE REMEDIATION IN WASHINGTON STATE



DEPARTMENT OF
ECOLOGY
State of Washington



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Sustainable Remediation: Climate Change Resiliency and Green Remediation

A guide for Cleanup Project Managers to:

Increase resiliency of cleanup remedies to climate
change impacts
-and-
Increase benefits and reduce impacts from the
MTCA Cleanup Process

Toxics Cleanup Program
Washington State Department of Ecology
Olympia, Washington

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Climate Change Resiliency

1. Identify impacts & risks
2. Implement protective measures

Green Remediation

1. Reduce impacts/emissions
2. Increase environmental benefits

Sustainable Remediation



CLIMATE CHANGE & CLEANUP

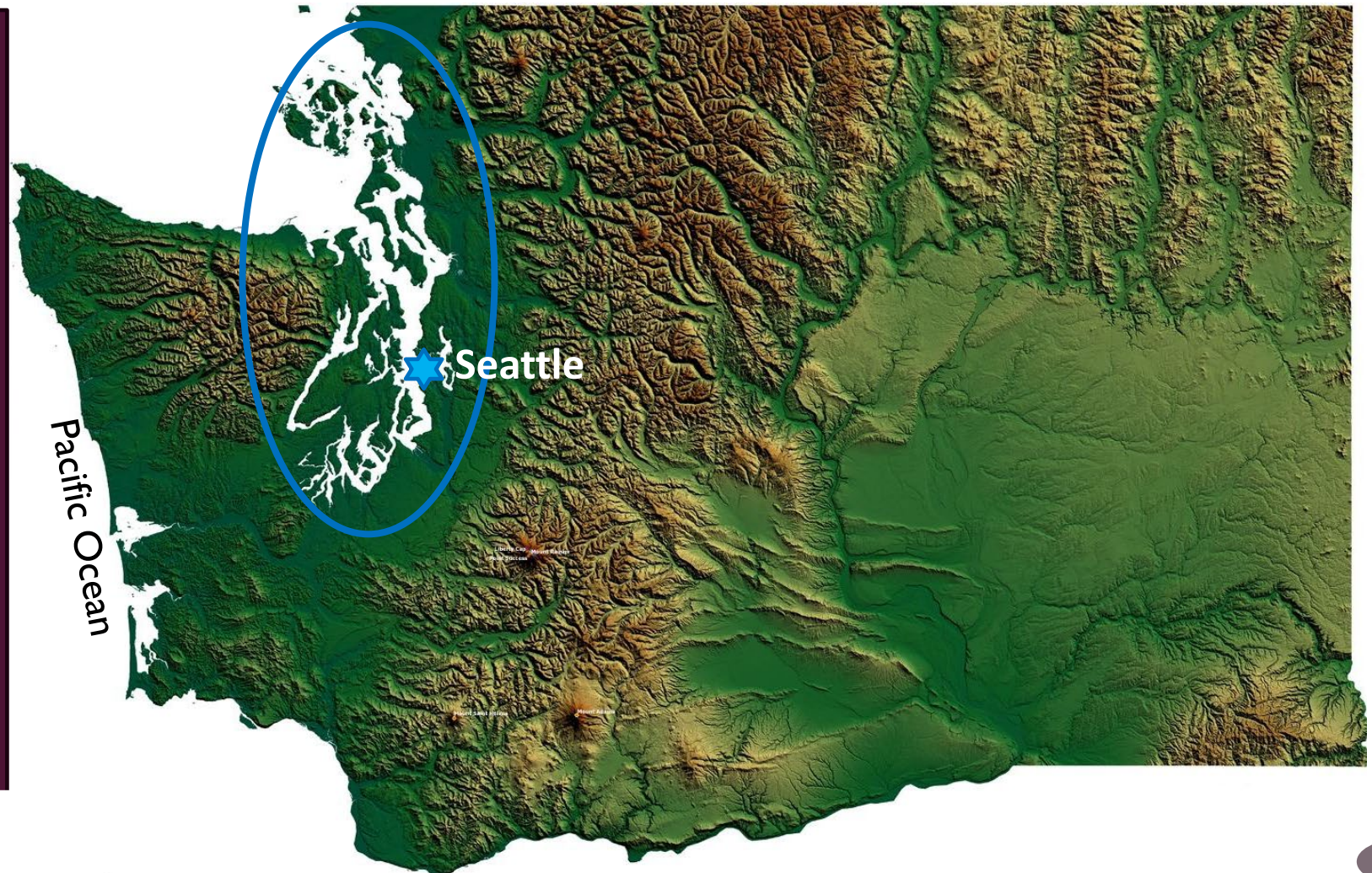
Why is it a critical issue?

- Witnessing impacts
- Past may not be prologue
- Climate change projections
- Unplanned:
 - Repair
 - Maintenance
 - Costs
- Complex environmental interactions
- Protective remedies?

Washington

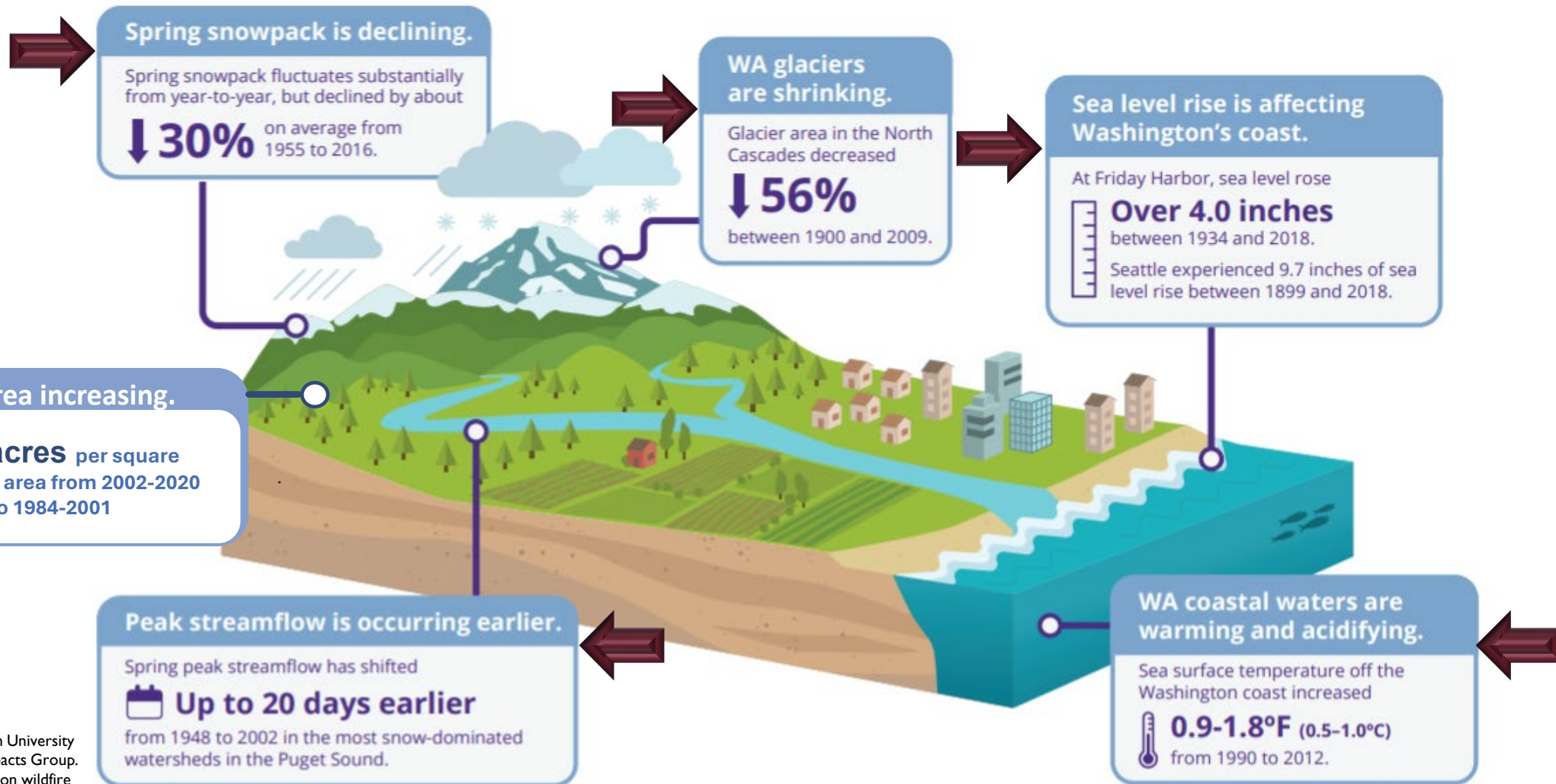
The Evergreen State

- 25 mountains >8,000 feet
- 28,000 miles of shoreline
- Puget Sound
 - 2nd largest U.S. estuary
 - 2,500 miles shoreline
- 600 miles Pacific coastline
- 30 - 200 inches rain / year

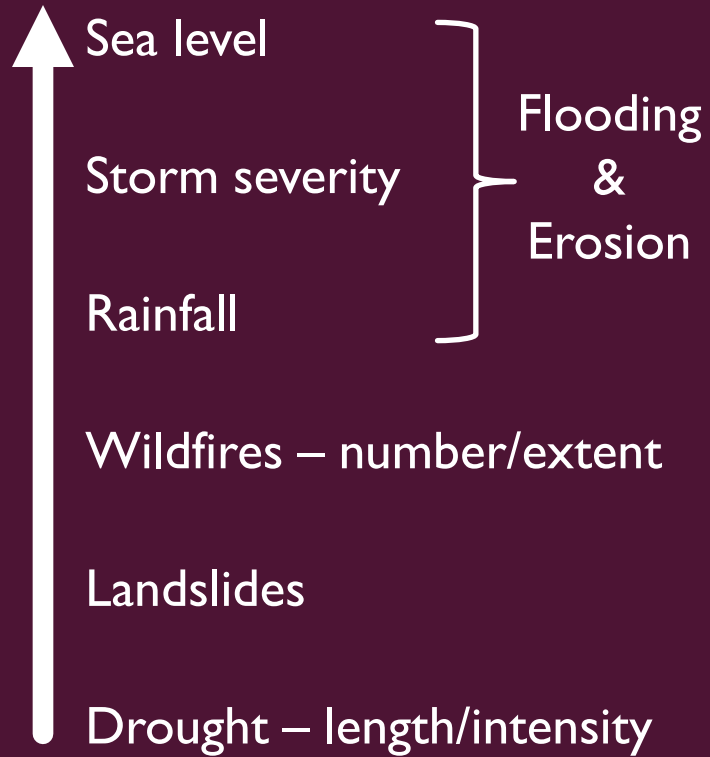


CLIMATE CHANGE TRENDS

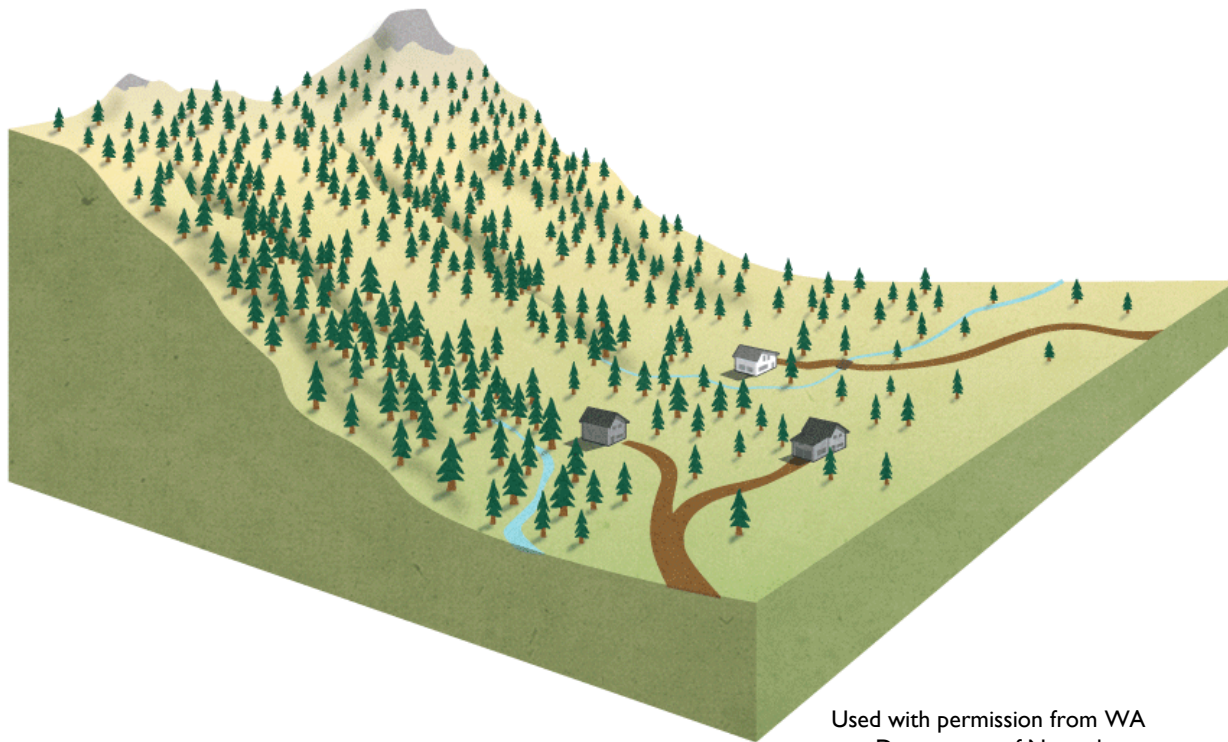
Pacific Northwest



Climate Change Impacts: Washington Cleanup Sites



WILDFIRE AND HEAVY PRECIPITATION EVENTS: Landslides Can Impact Groundwater, Soil, Sediment

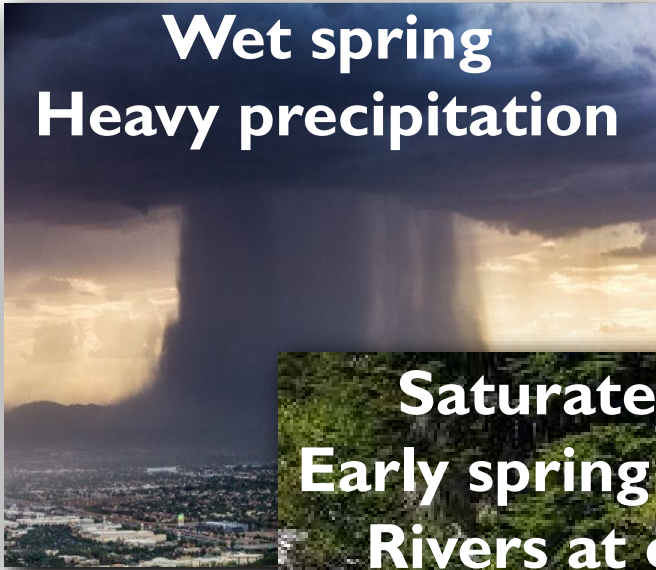


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Resources



HEAVY PRECIPITATION EVENTS: Floods Can Impact Groundwater, Soil, Sediment

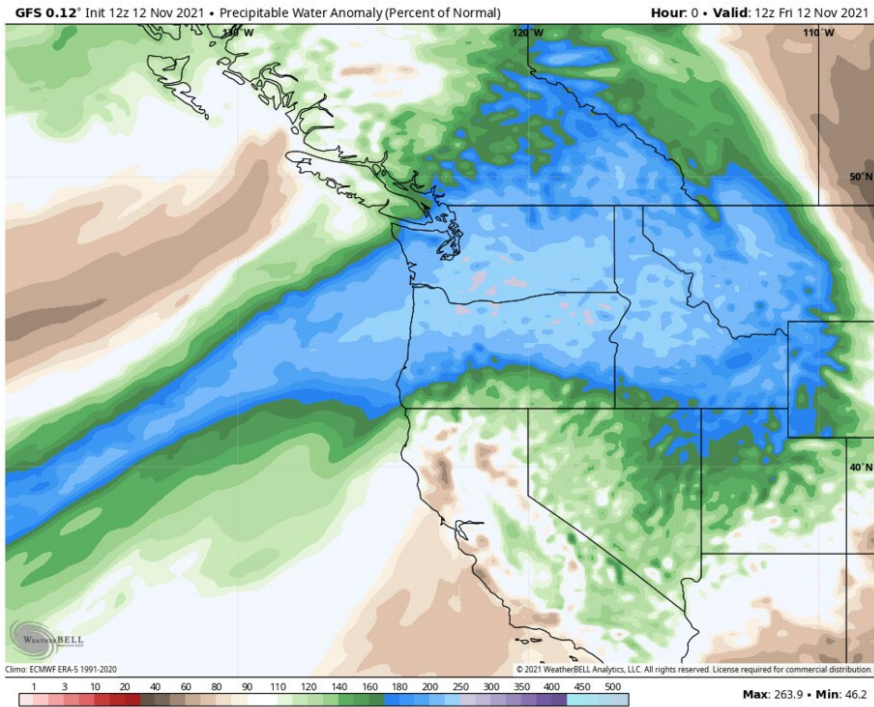
**Wet spring
Heavy precipitation**



**Saturated soils
Early spring snowmelt
Rivers at capacity**



SEA LEVEL RISE AND ATMOSPHERIC RIVERS: Floods Can Impact Infrastructure



- 12 inches precipitation/6 days
- King Tide

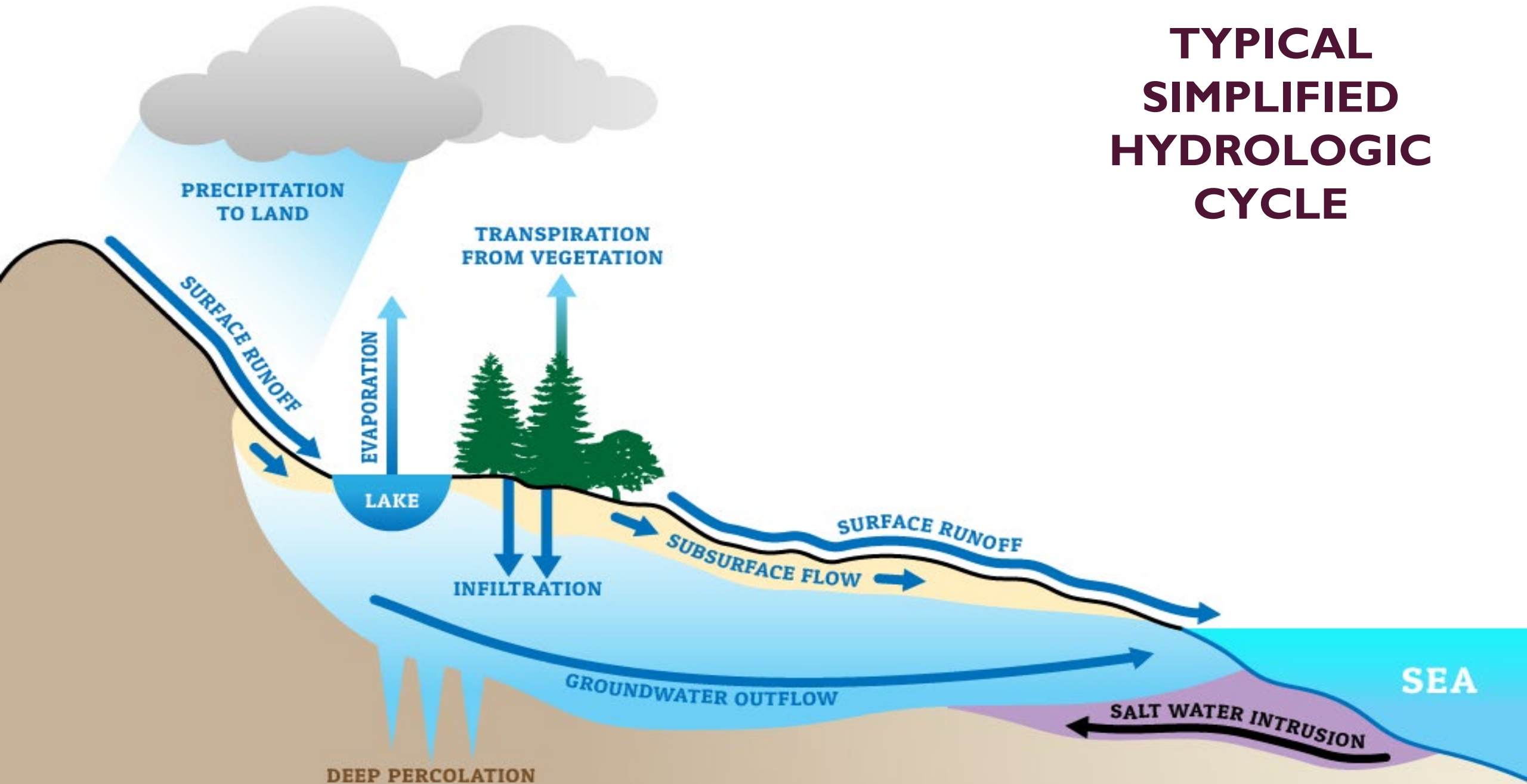


Interstate 5
landslide

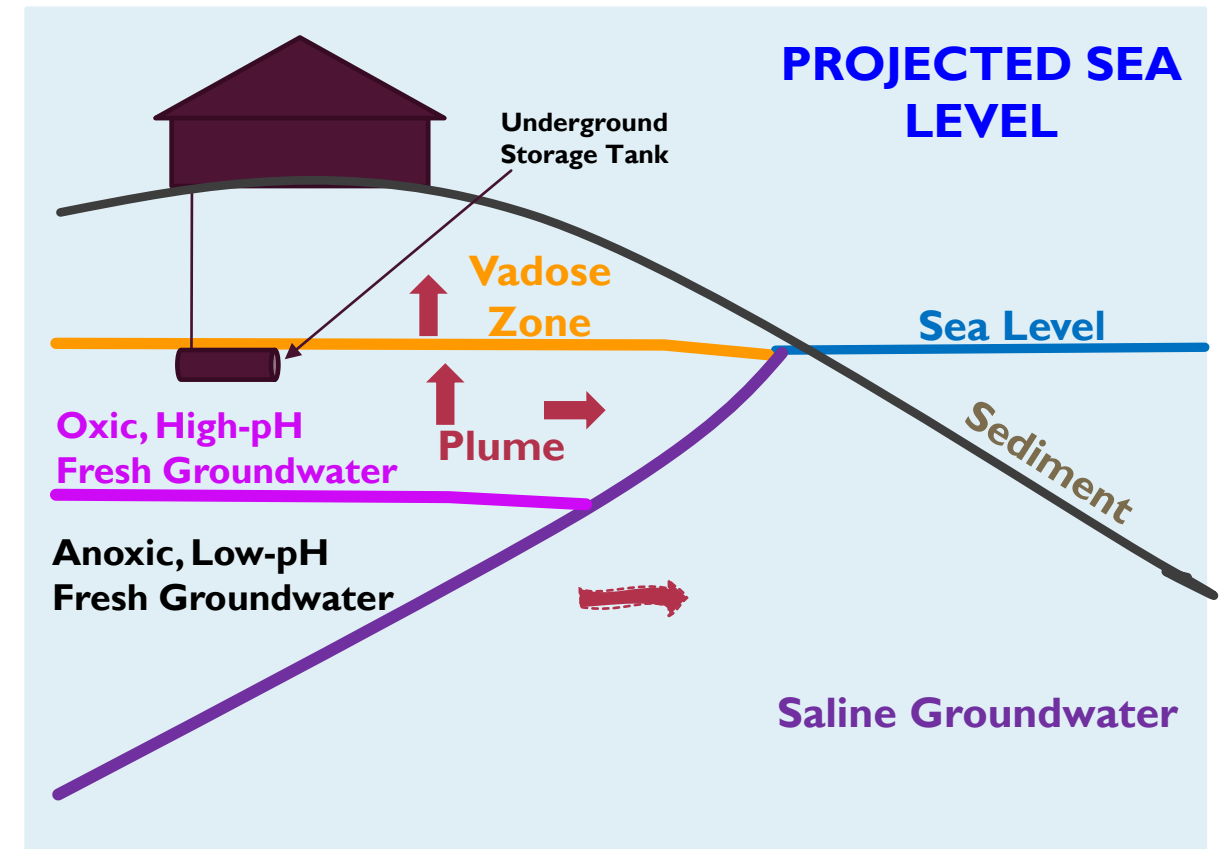
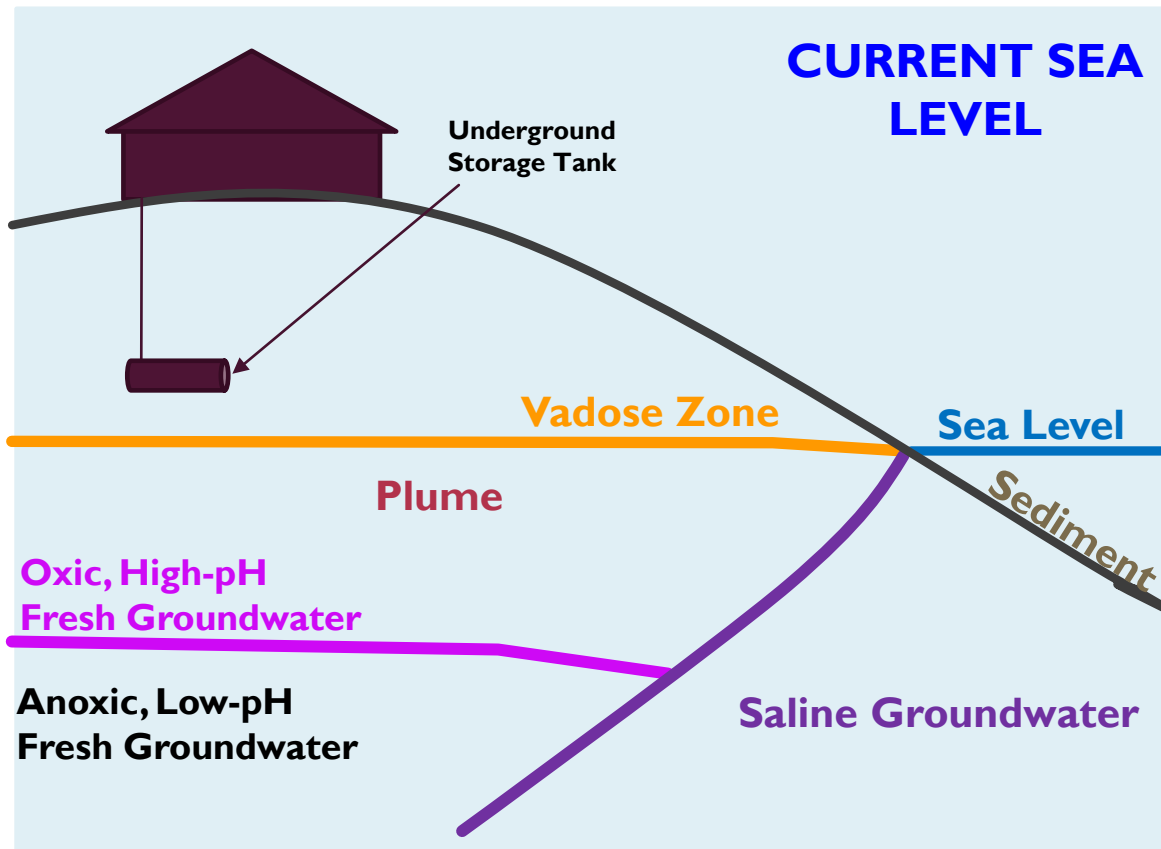


Leaking
underground
storage tank

TYPICAL SIMPLIFIED HYDROLOGIC CYCLE

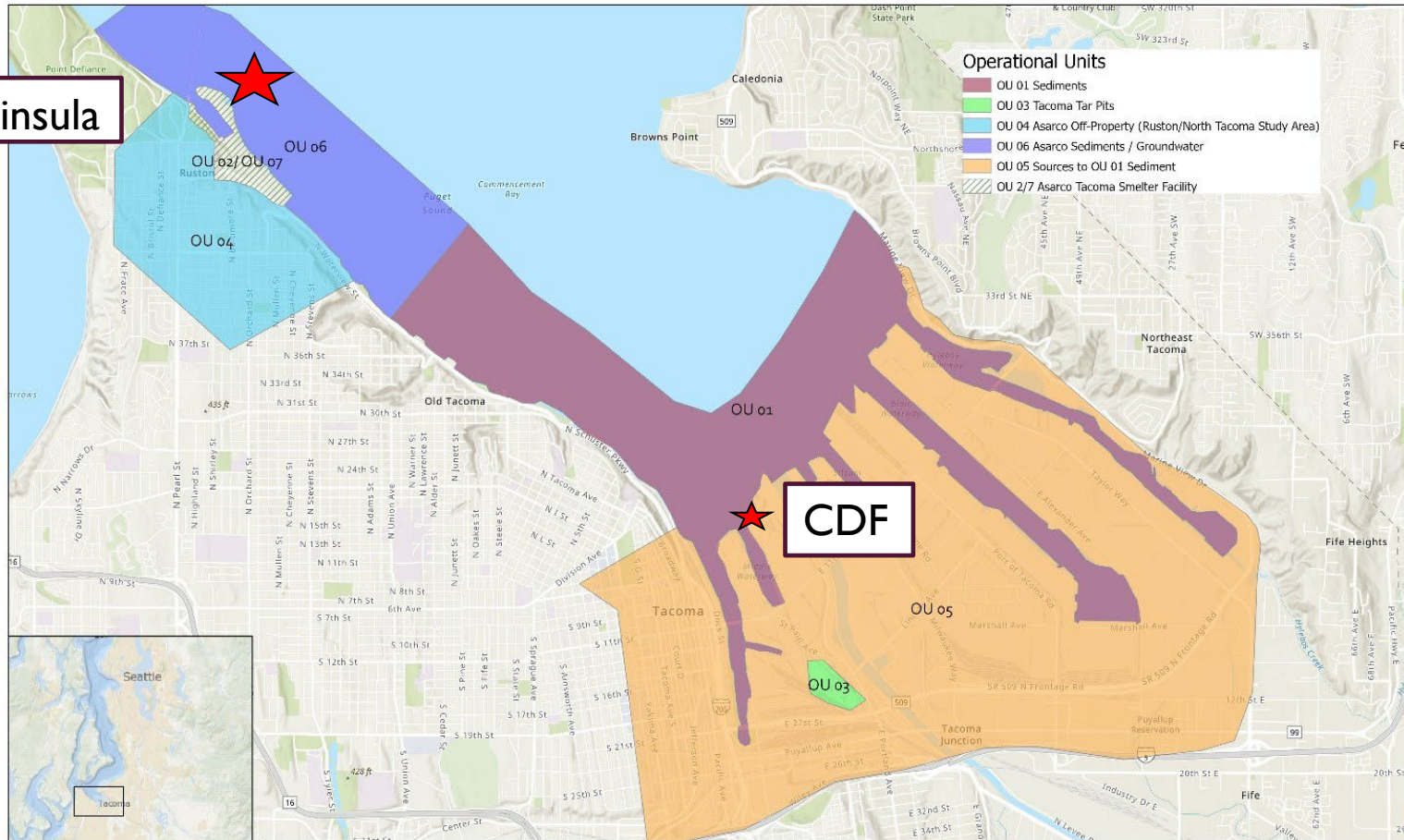


SEA LEVEL RISE: Can Impact Groundwater, Soil, Sediment



COMMENCEMENT BAY NEARSHORE TIDEFLATS

Breakwater Peninsula



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CB/NT Superfund Site

EPA Region 10
GIS Team

Date Printed: 11/20/2022 1:02 PM

Major climate factors:

1. Sea level rise
2. Increased storm severity
3. Change in storm direction

Remedies not designed for climate change:

1. Slope
2. Erosion/scour protection
3. Toe protection
4. Geotextiles
5. Cap thickness
6. O&M



Severe Erosion & Scour

Remedy Modification



CASE STUDY

PAPER MILL

Media:

1. Soil
2. Sediment

Contaminants:

1. PAHs
2. PCBs
3. Dioxins/furans
4. Woodwaste

Remedies:

1. Excavation & Dredging
2. Capping
3. Shoreline protection

SLR LINK



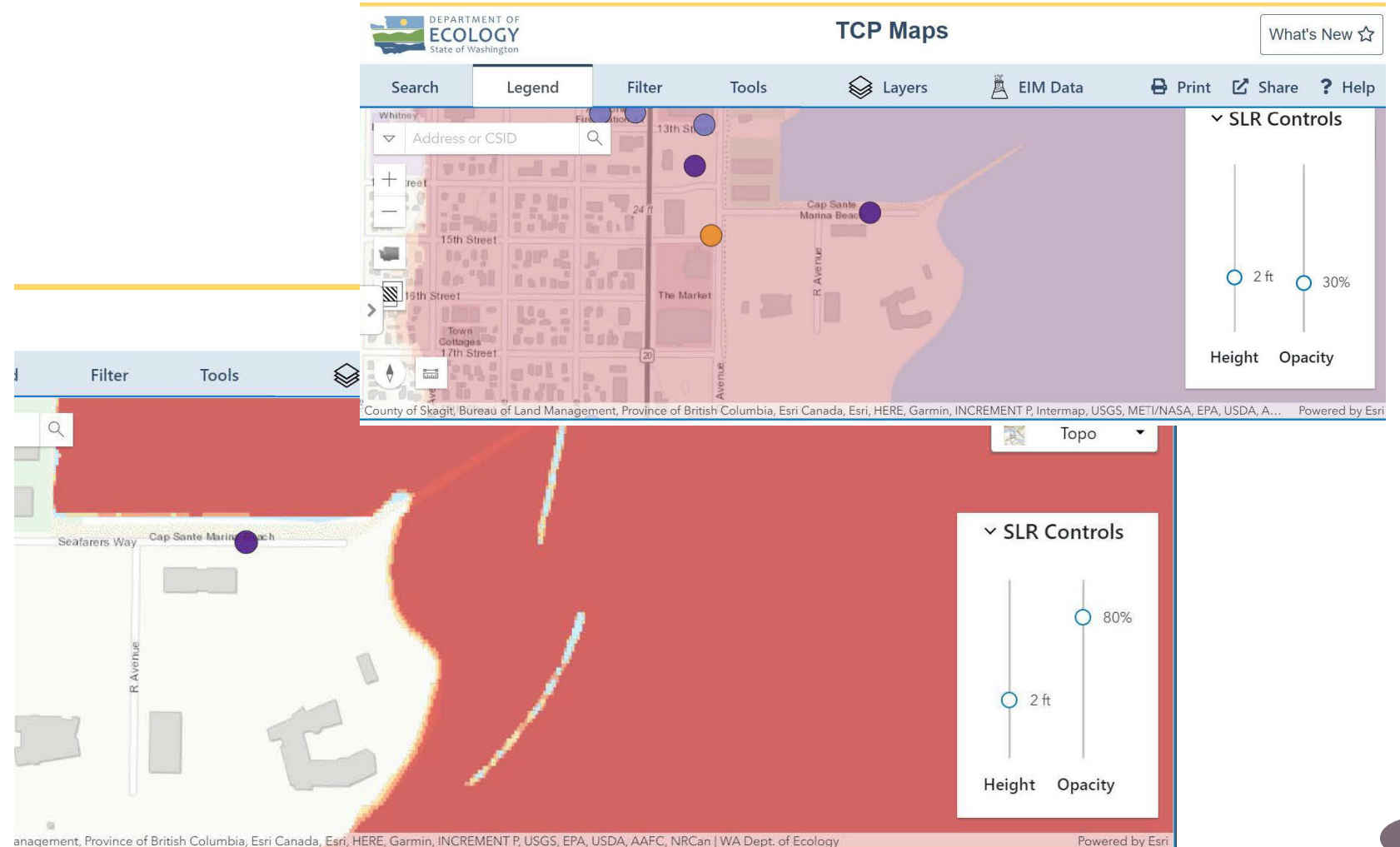
CASE STUDY PAPER MILL

Vulnerability assessment:

- Sea level rise
- Flooding
- Wildfire
- Landslide

Sea level rise:

- Increment slider
- Opaqueness
- Visualize high tide
- Visualize storm





Shoreline & upland protection:

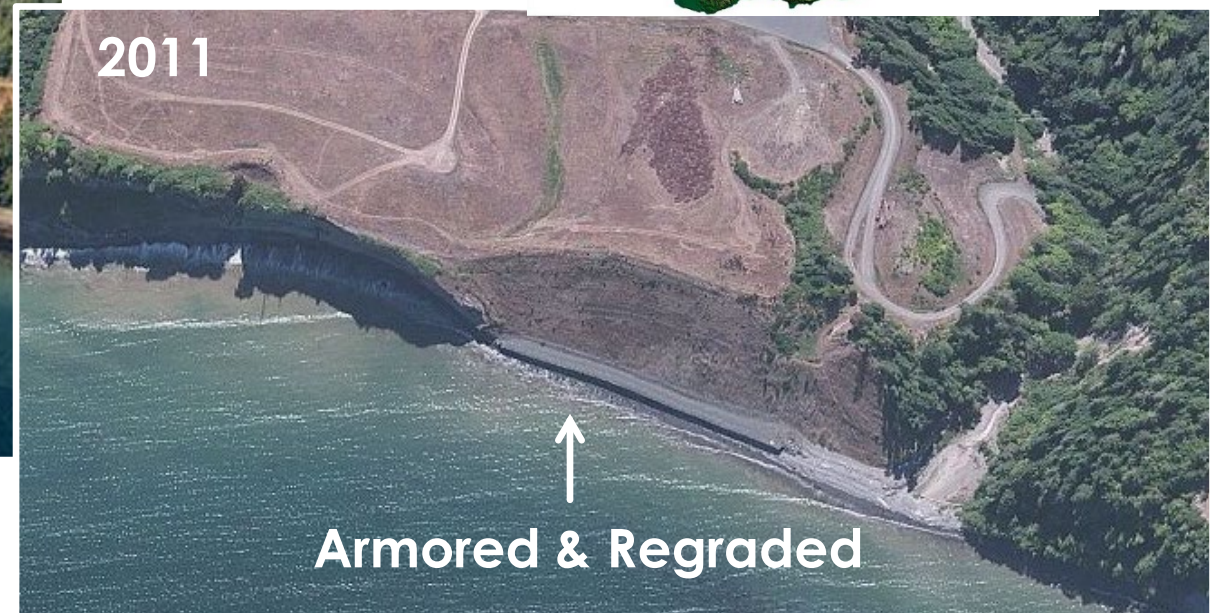
- Wave attenuation structures
- 2-feet sea level rise
- 500-year storm

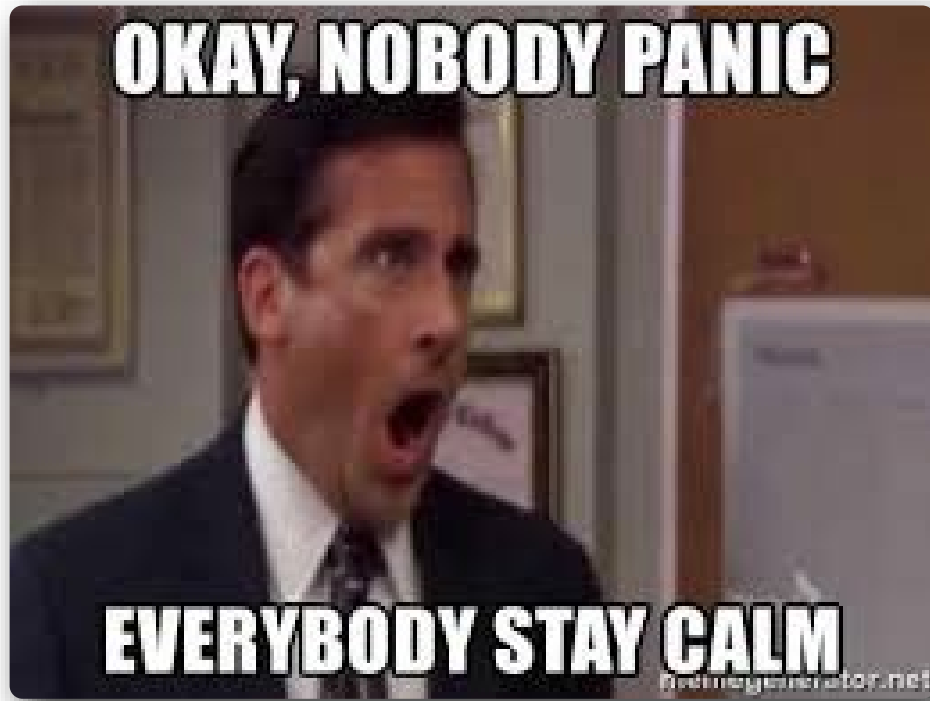
Remedies:

1. Excavation
2. Dredging
3. Capping
4. Shoreline protection
5. Habitat restoration

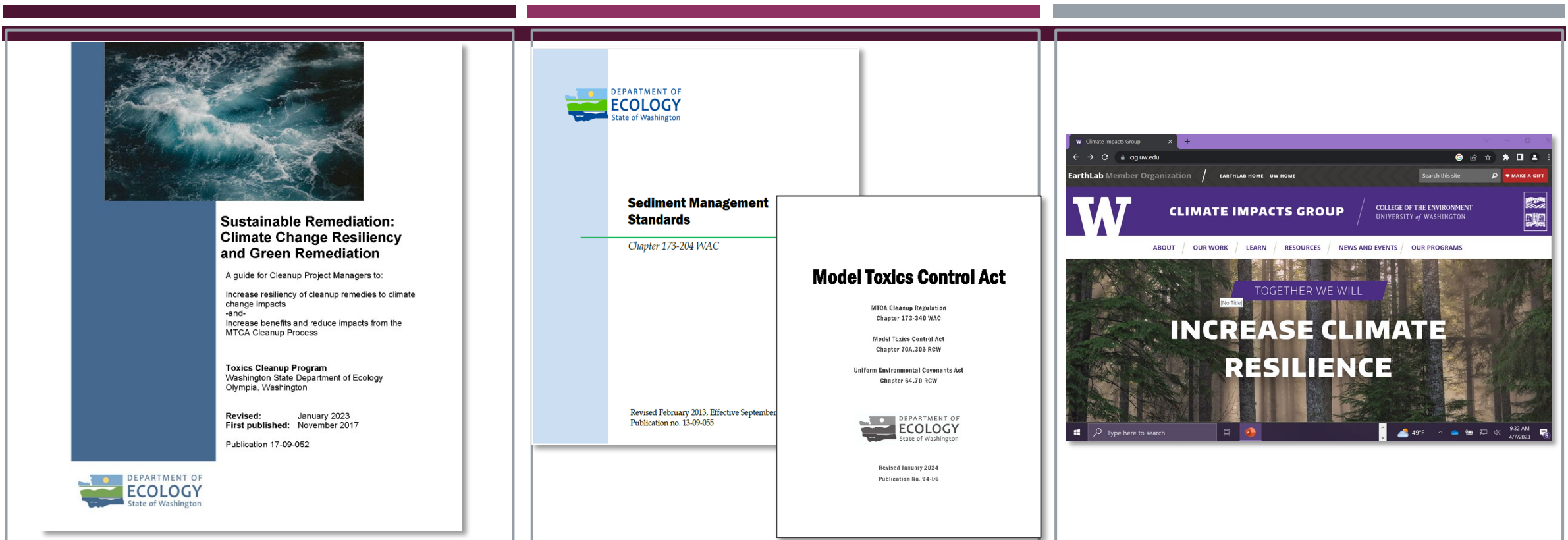
CASE STUDY

PORT ANGELES LANDFILL





We have tools!



Guidance

Regulations

Science

Not Business as Usual

Climate change science:

1. Vulnerabilities
2. Risk tolerance
3. Remedial design

New thinking:

1. Long-term effectiveness
2. Permanence
3. Design-Life

Adaptive management:

1. Long-term monitoring
2. Long-term maintenance
3. Periodic reviews
4. Re-openers





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Vulnerabilities

Sediment
Groundwater
Upland containment
Landfills
Mining
Underground storage tanks

Cleanup Phases

Remedial Investigation
Feasibility Study
Remedial Design
Monitoring
Periodic Reviews

Resilient Remedies

All media
Locations of sites
Types of remedies
Types of sites

Case Studies

Capping remedy
Habitat restoration
Waterfront landfill
Shoreline protection



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Types of Sites Vulnerable to:

Sea level rise
Flooding
Wildfire
Landslide
Drought

GIS Mapping Application

Cleanup site locations
Inundation scenarios
Floodplains
Probabilistic sea level rise
Projected river flooding
Landslide locations
Wildfire projections

Risk Management Scenarios

Low
Short-term
Long-term
Media-specific risks

Site-Specific Vulnerability Assessment

Sea level rise
Flooding
Wildfire
Landslide
Drought



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