

# Integrating Climate Change Considerations into Public Works Project Planning and Design in Snohomish County

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Linking climate  
science

with real world  
decision-making



# Presentation Outline

## **Introduction to Snohomish County**

- County characteristics
- Exposure to climate impacts
- The role of Public Works

## **Approaches to building climate resilience**

- The role of a decision-support tool

## **Tool pilot study**

- Process
- Findings and lessons learned
- Next steps



**What does climate change mean  
for Snohomish County?**

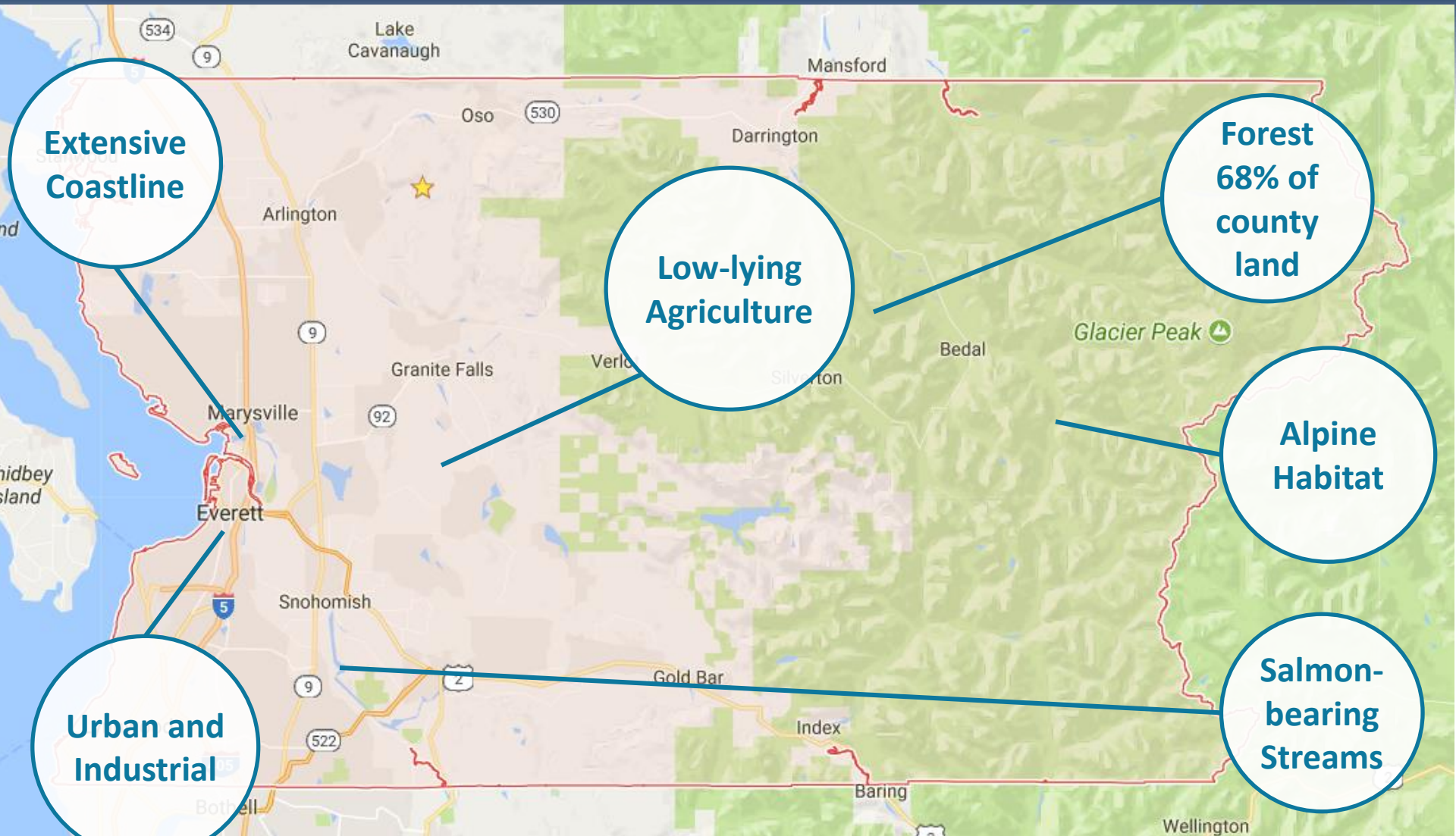


Photo courtesy Google Maps.

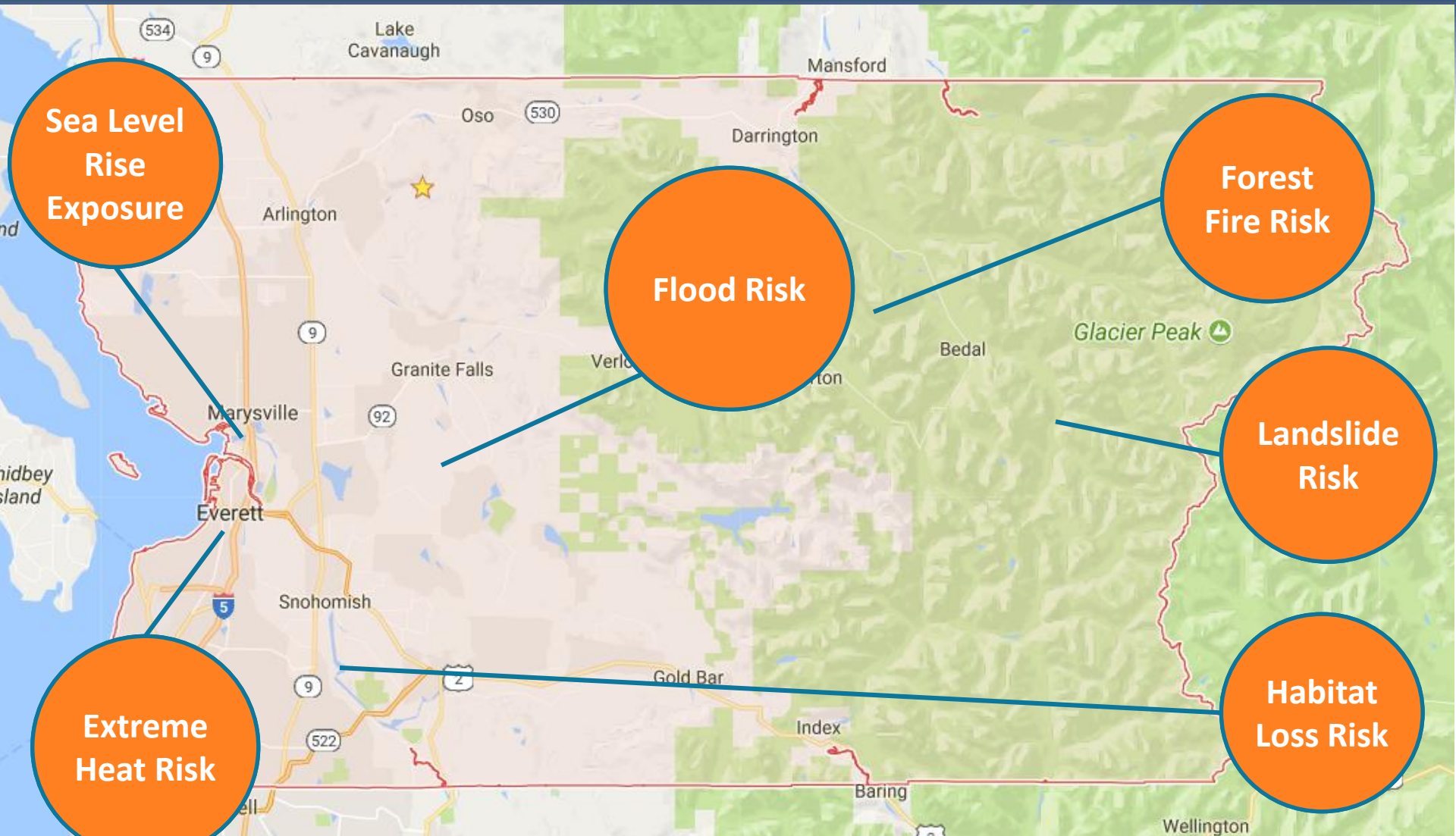


Photo courtesy Google Maps.



# What the County is doing



**Hazard  
Mitigation Plan**



**Puget Sound  
Initiative**



**Sustainable  
Operations  
Action Plan**

# Public Works



## 6 Divisions including:

- Engineering Services
- Road Maintenance
- Surface Water Management
- Solid Waste

*Climate change matters because...*

we plan for, design, build, operate and maintain **millions of dollars** in public infrastructure to support citizens and businesses in the county and region.

***A resilient Snohomish County can better withstand, recover, and adapt to a changing climate.***



# Our Resilience-building Journey



2010: Started **exploring options** for climate change integration.

Decided that a **tool would help ensure** all staff have **easy access to climate information**.

2015-2017: **Funded, beta-tested, and rolled out** decision-support tool.

**Currently applying** to several road and bridge projects.

# Benefits to Public Works



## Educational

- Science-based, objective way to communicate and manage risk



## Easy to use and consistent

- Minimizes need for multiple staff in multiple departments to all collect and analyze complex scientific data on climate change, or read long assessment reports
- Filters out extraneous information: focus on timescale of interest



## Averts costly damage

- Helps County make cost-effective upfront planning/project decisions
- Reduces harm to people, projects & assets

# Benefits to Public Works



## Flexible

- Can be regularly updated and expanded



## Provides guidance to support decision-making

*but...*



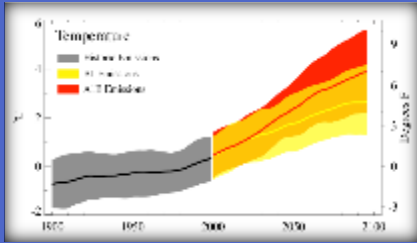
## Does not provide all the answers

- Does not give “investment-grade” analysis or change design standards
- Does not address climate mitigation

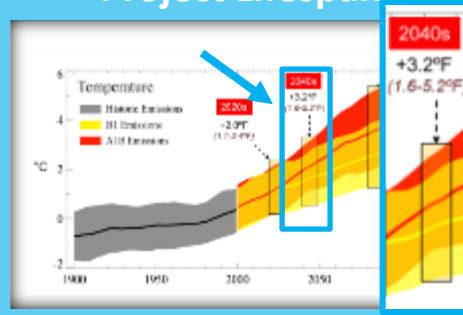


# The CIMPACT-DST Case Study

## Local Climate Projections



## Project Lifespan



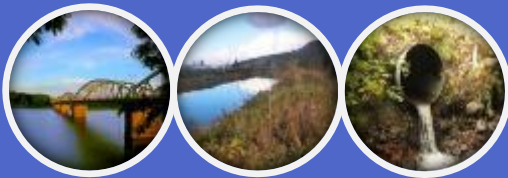
## Climate Hazard Maps



## Project Location (Risk)



## Sector-specific Impacts and Policy Information



**EMBEDDED  
INFORMATION**

## Project Sector



**USER INPUTS**

**1. Brief summary of latest climate information**  
*(precipitation, temperature, flooding)*

**2. Brief summary of local impacts for specific sectors**  
*(forestry, roads, buildings)*

**3. Sector-specific guidelines & recommendations**  
*(areas not to build, materials to use)*

**OUTPUTS**

**(THE PROBLEM)**

**(THE SOLUTION)**

# Tool Snapshot

## Project Exposure

Salmon Way Bridge



**PLANNING HORIZON** ?

2040-2059

What are the coordinates of your project area?

X (negative value):  ?

Y (positive value):

**STEP 2.** Select the most appropriate planning horizon for your project.

**STEP 3.** Click the button to determine the coordinates of your project area.

[CLICK HERE TO VIEW ALL CLIMATE MAPS FOR CHOSEN TIME PERIOD](#)

**STEP 4:** Click on the center of your project area in the map to find the coordinates, and enter them here.

**NOTE:** If map values are not available for your area, then enter your best guess based on proximate values or other information sources.

When clicking on the icons, maps are provided for the timeframe that most closely matches the project planning horizon.

In cases where a climate impact map is not available for a chosen timeframe, the maps show projected impacts for next available time period. The maps and corresponding do NOT interpolate between time periods.

**STEP 5:** Click on the icons to open climate impact maps for your planning area.

**STEP 6:** Click on your project area in each map to find data to be entered on this page.

Scroll down to complete this page!

### TEMPERATURE

Average Ambient Temperature Increase (in degrees F):

	low-end	high-end	
Annual	4.3	5.6	degrees F increase compared to historic baseline conditions
Summer	5.1	6.9	degrees F increase compared to historic baseline conditions
Winter	3.9	4.9	degrees F increase compared to historic baseline conditions
Growing Degree Days	957	1322	degree-days compared to historic baseline conditions

Stream Temperature Increase (in degrees C):

Is there a stream associated with your project? (see stream temperature map)

Mean August temperature for measured streams closest to this project is projected to be approximately  degrees C by the selected time period, which is at the  range.

Wildfire Risk:

Currently, this project is located in a . This risk may increase with projected climate change.

### WATER QUALITY/AVAILABILITY

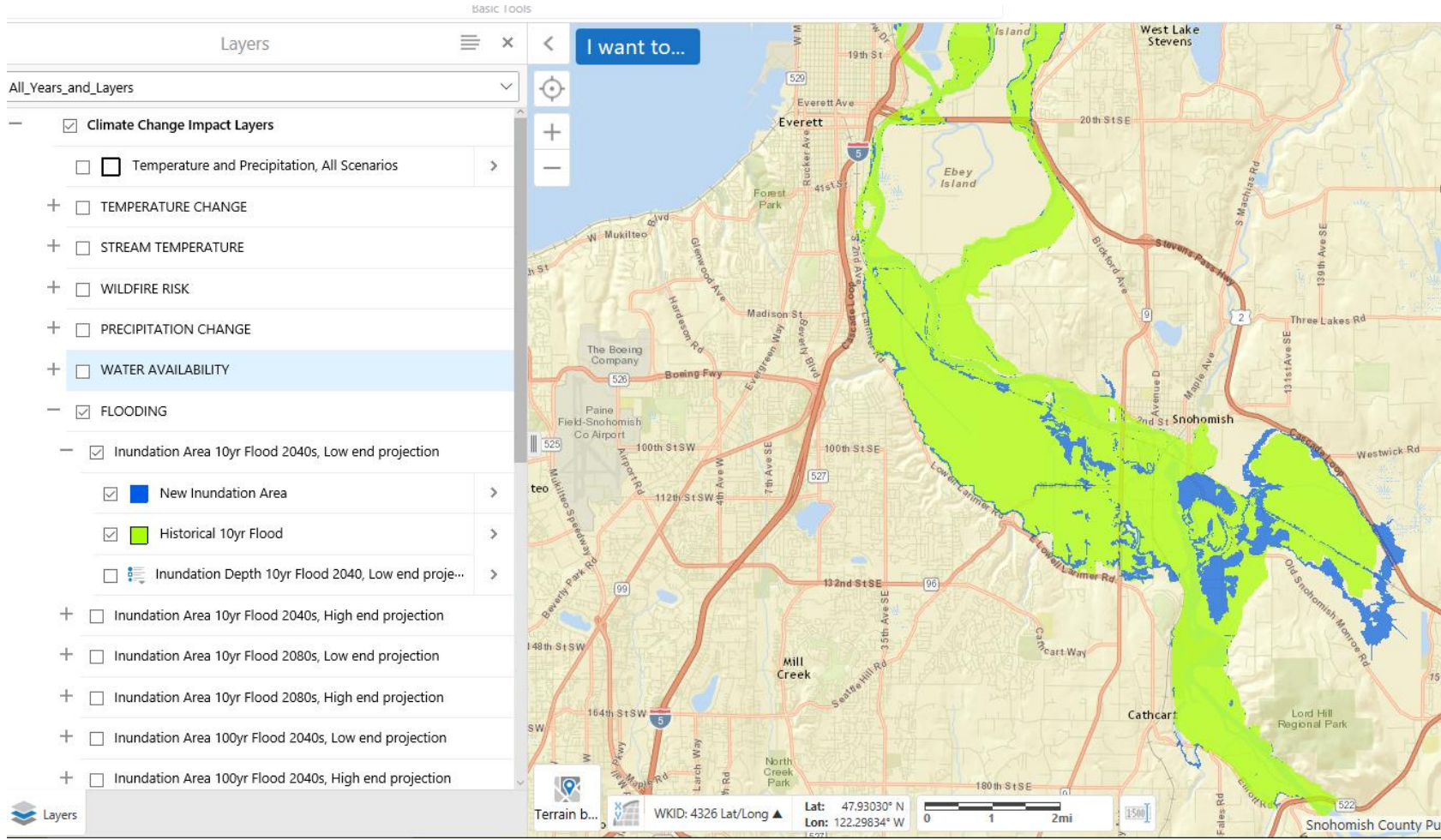
Precipitation Change (percent):

	low-end	high-end	
Annual	2	2	percent change in monthly precipitation compared to historic baseline conditions
Dry Season	-8	-9	percent change in monthly precipitation compared to historic baseline conditions
Wet Season	7	8	percent change in monthly precipitation compared to historic baseline conditions

Seasonal Timing of Streamflow:

Historically, this project was located within a  watershed.

By the selected time period, the project may be within a  watershed under the high-end scenario.



Layers

BASIC TOOLS

I want to...

All\_Years\_and\_Layers

- Climate Change Impact Layers
  - Temperature and Precipitation, All Scenarios
  - +  TEMPERATURE CHANGE
  - +  STREAM TEMPERATURE
  - +  WILDFIRE RISK
  - +  PRECIPITATION CHANGE
  - +  WATER AVAILABILITY
- FLOODING
  - Inundation Area 10yr Flood 2040s, Low end projection
    - New Inundation Area
    - Historical 10yr Flood
    - Inundation Depth 10yr Flood 2040, Low end proje...
  - +  Inundation Area 10yr Flood 2040s, High end projection
  - +  Inundation Area 10yr Flood 2080s, Low end projection
  - +  Inundation Area 10yr Flood 2080s, High end projection
  - +  Inundation Area 100yr Flood 2040s, Low end projection
  - +  Inundation Area 100yr Flood 2040s, High end projection

Layers



WKID: 4326 Lat/Long ▲ Lat: 47.93030° N Lon: 122.29634° W



Snohomish County Pu

# Sample Output

## Temperature Impacts

Salmon Way Bridge - 2040-2059

Project: bridge with 30-year lifespan



Tip! Scroll down to view more.

### Projected Impacts

#### Project Area

The below projected impacts are based on downscaled climate projections that are summarized in the project impact maps.

- ANNUAL AMBIENT: Climate models project that annual temperature in this project area will be, on average, between 4.3 and 5.6 degrees F higher by the 2050s under low and high emissions scenarios, respectively, compared to the historic baseline time period (1970-1999).
- SUMMER AMBIENT: Climate models project that summer temperature in this project area will be, on average, between 5.1 and 6.9 degrees F higher by the 2050s under low and high emissions scenarios, respectively, compared to the historic baseline time period (1970-1999).

#### Snohomish County

The below projected impacts are summarized from downscaled climate projections that are averaged across Snohomish County.

- ANNUAL AMBIENT: Climate models project that annual temperature in Snohomish County in the 2050s will be, on average, +4.3 (+4.0 to +4.6) degrees F higher under the low emissions scenario and +5.7 (+5.4 to +5.9) degrees F higher under the high emissions scenario compared to the historic baseline time period (1970-1999).
- SUMMER AMBIENT: Climate models project that summer air temperature in Snohomish County in the 2050s will be, on average, +5.1 (+4.8 to +5.4) degrees F higher under the low emissions scenario and +7.1 (+6.7 to +7.4) degrees F higher under the high emissions scenario compared to the historic baseline time period (1970-1999).

#### Puget Sound Region

The below projected impacts are summarized from climate projections for the Puget Sound area.

- HOTTEST DAYS: Climate models project that the hottest days in the Puget Sound region will be, on average, +6.5 (+4.0 to +10.2) degrees F higher by the 2050s under low and high emissions scenarios compared to the historic baseline time period (1970-1999).
- COOLEST NIGHTS: Climate models project that the coolest nights in the Puget Sound region will be, on average, +5.4 (+1.3 to +10.4) degrees F higher by the 2050s under low and high emissions scenarios compared to the historic baseline time period (1970-1999).
- EXTREME HEAT EVENTS: Extreme heat events will become more frequent while extreme cold events will become less frequent in the Pacific Northwest.
- STREAM TEMPERATURE: Climate models project that stream temperatures in the Puget Sound region will be, on average, +4.0 to +4.5 degrees F higher by the 2080s under a moderate emissions scenario compared to the historic baseline time period (1970-1999), due to increasing air temperature and reduced summer streamflow.

### Transportation Planning Impact Summary

#### Increased Ambient Temperature

- Segments with high volumes of truck traffic may be more sensitive to rutting as temperatures increase. [25, p. 2]
- Higher temperatures with more heat waves may increase rutting and concrete cracking in roadway pavement. [36, p. 11]
- Increased temperatures could overheat rail and roadway electrical systems and communications equipment and cause thermal expansion and buckling. [66]

### Transportation Planning Guidance Information

#### Increased Ambient Temperature

##### Planning

- Expand canopy cover along transportation corridors to minimize urban heat island and flooding. Develop new landscape standards if needed. [66, p. 77]
- Higher temperatures will increase urban heat island effects in dense developments with few trees and limited water. [6]

##### Design

- Consider developing design standards that would afford higher protection to transportation infrastructure for increased average and extreme temperatures. [6]
- Consider using highly reflective pavement (e.g. concrete) to deflect heat and reduce warming effects on the underlying soil layer. [39, p. 155]
- Utilize asphalt and concrete mixes and/or designs that perform well under high temperatures. [6]

##### Operations and Maintenance

Expected temperature change in project lifetime

What that change could mean for the project

Possible measures to build resilience

## CASE STUDY: MARTA

Metropolitan Atlanta Rapid Transit Authority (MARTA) is incorporating climate change vulnerability into several existing decision-making frameworks. MARTA is adding a field to its Enterprise Asset Management System to track whether assets are sensitive to climate, adding a climate-related objective to its resource allocation decision-making software (which also tracks objectives such as safety of good repair), and will integrate climate impacts in its Asset Management Plan.





# Data Sources



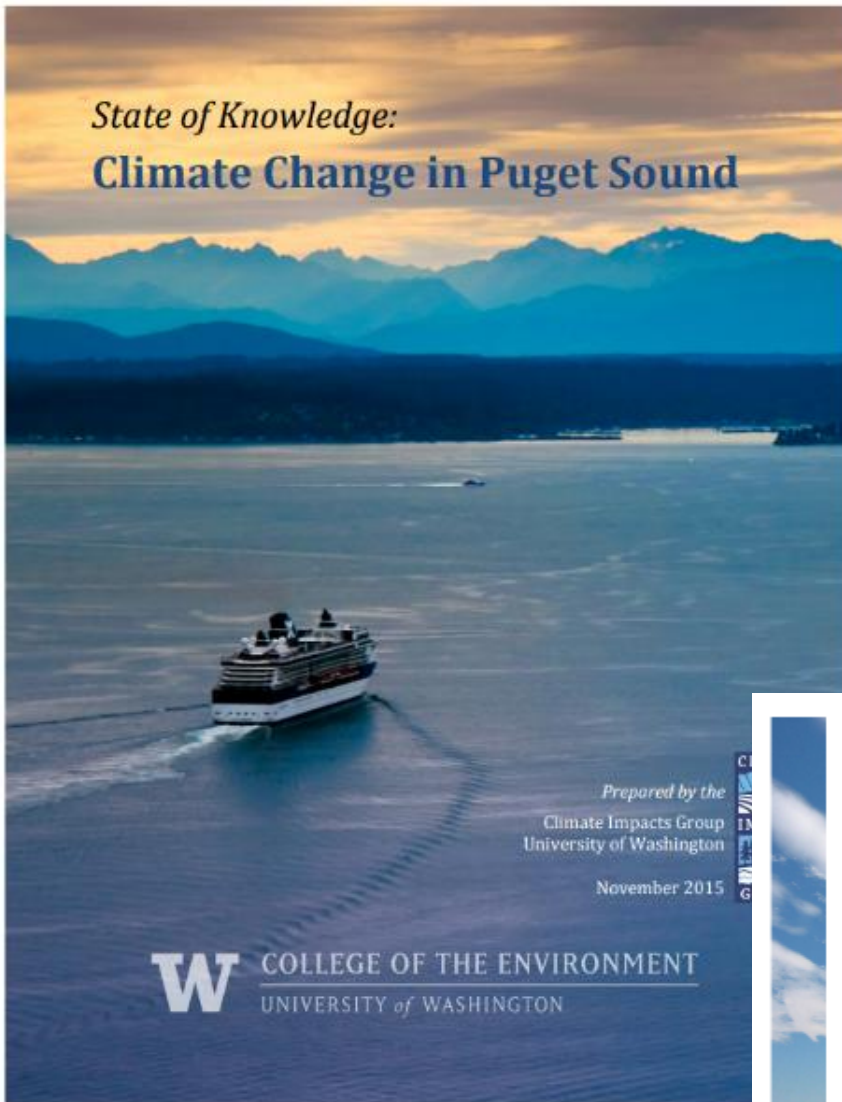
DEPARTMENT OF  
**ECOLOGY**  
State of Washington



U.S. Department  
of Transportation  
**Federal Transit  
Administration**



## State of Knowledge: Climate Change in Puget Sound



## Evaluation of Potential Climate Change Impacts on Rainfall Volume, Stormwater Facility Size and Stream Flashiness

December 2014

Depart  
W  
Scien  
K  
201  
www.k  
Alte

## Hazard Mitigation Plan September 2015 Update

Summary

Volume 1  
Risk Assessment

Volume 2  
Planning Partner Annexes

**W** COLLEGE OF THE ENVIRONMENT  
UNIVERSITY OF WASHINGTON

## Climate change and flooding in the lower Snohomish



Guillaume Mauger, UW  
Se-yeun Lee, UW  
Krik Johnson, The Nature Conservancy  
Ray Walton, WEST consultants



ASFPM, 5 June 2014



# Translating available information...

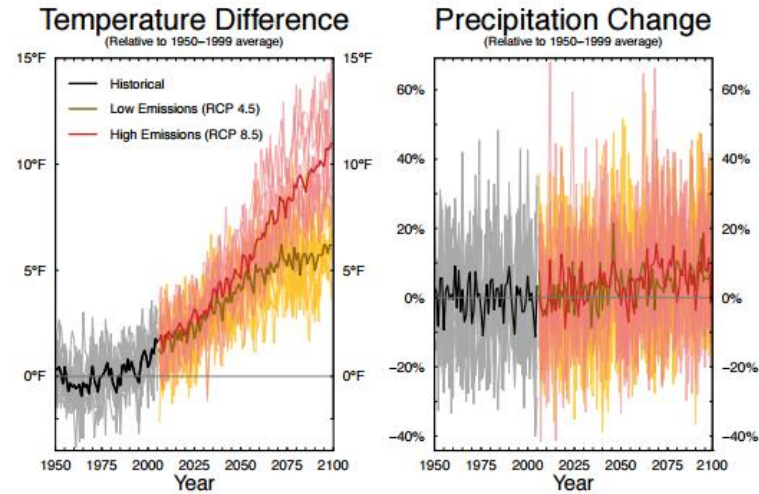
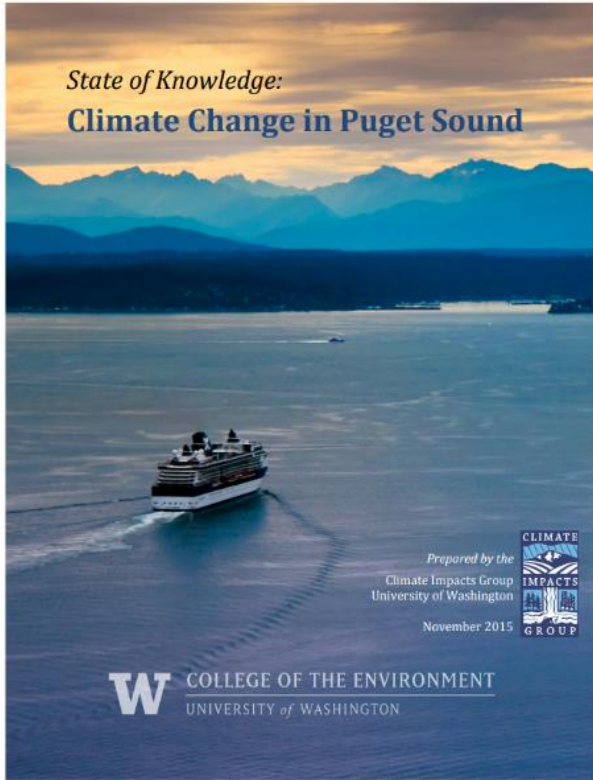


Figure 2-2. All scenarios project warming in the Puget Sound region for the 21<sup>st</sup> century; projected changes in annual precipitation are small compared to year-to-year variability.

Annual average air temperatures are projected to increase.

Warming is projected for all greenhouse gas scenarios, and the amount of warming depends on the amount of greenhouse gases emitted.

*Projected change in Puget Sound average annual air temperature:*

**2050s** (2040-2069, relative to the average for 1970-1999):<sup>1,2,3</sup>

Low emissions (RCP 4.5): +4.2°F (range: +2.9 to +5.4°F)

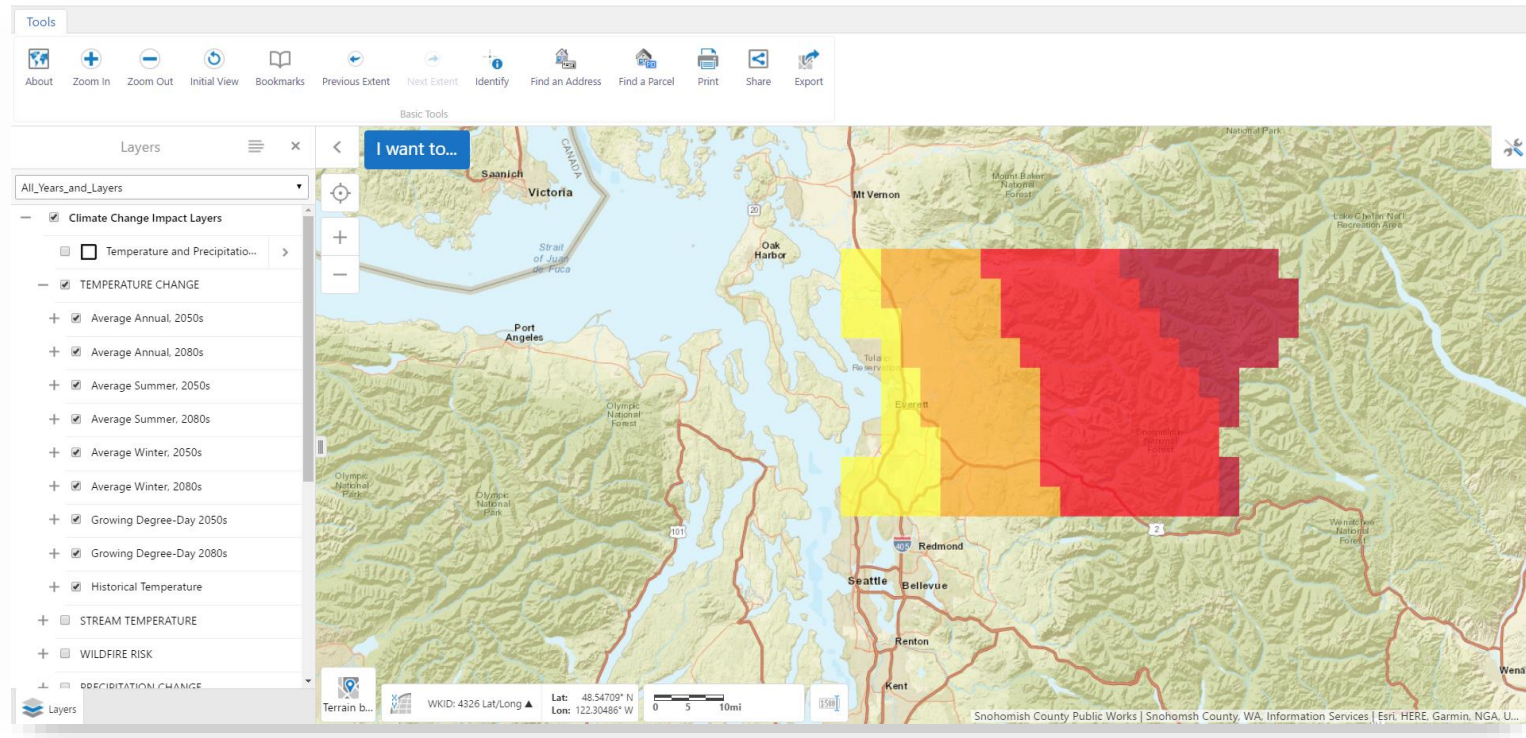
High emissions (RCP 8.5): +5.5°F (range: +4.3 to +7.1°F)

**2080s** (2070-2099, relative to the average for 1970-1999):<sup>1,2,3</sup>

Low emissions (RCP 4.5): +5.5°F (range: +4.1 to +7.3°F)

High emissions (RCP 8.5): +9.1°F (range: +7.4 to +12°F)

# ...into customized, local, and accessible information.



## Snohomish County

*The below projected impacts are summarized from downscaled climate projections that are averaged across Snohomish County.*

- **ANNUAL AMBIENT:** Climate models project that annual temperature in Snohomish County in the 2050s will be, on average, +4.3 (+4.1 to +4.5) degrees F higher under the low emissions scenario and +5.7 (+5.4 to +5.9) degrees F higher under the high emissions scenario compared to the historic baseline time period (1970-1999).

## Project Area

*The below projected impacts are based on downscaled climate projections that are specific to the project area, as identified in the climate impact maps.*

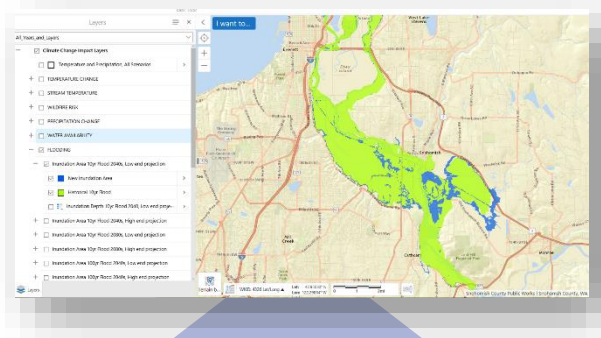
- **ANNUAL AMBIENT:** Climate models project that annual temperature in this project area will be, on average, between 4.3 and 5.6 degrees F higher under the low and high emissions scenarios, respectively, compared to the historic baseline time period (1970-1999).

# Our Process

Surface water management

Transportation planning

Habitat restoration



**1**

Clarify use scenarios/  
sectors

**2**

Gather and synthesize  
available  
information

**3**

Translate data into  
customized  
local platform

**4**

Beta test and  
revise using  
example  
projects

**5**

Train Staff

**6**

Apply to  
infrastructure  
projects

Climate  
projections

Academic  
literature

Case studies

Guidance  
documents



# Tool Application Example

## Ash Way: 164<sup>th</sup> St SW to Gibson Road

Beta-testing:

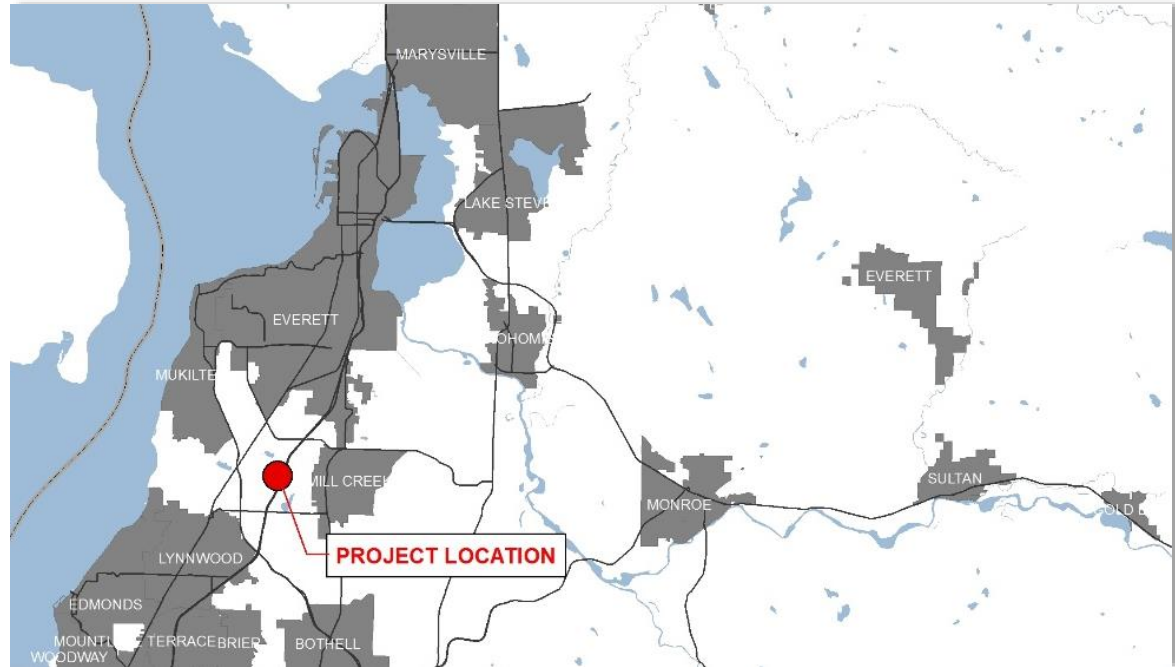
4

Public Works projects run through tool

3

Sectors represented

Currently applying to road and bridge projects



2.5 Mile Corridor

\$50 +/- Million Investment

30-Year Traffic Forecast

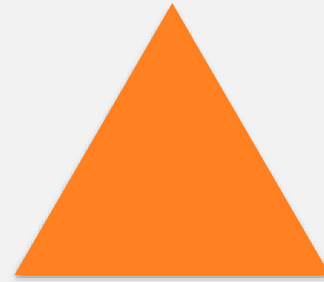
40+ Year Lifespan

# Key Takeaways



## Successes

- ✓ Raised **awareness** and **accessibility** of climate information.
- ✓ Started **meaningful dialogues** and creative thinking.
- ✓ Piqued interest in further **trainings**.
- ✓ Triggered more **proactive** risk management.



## Challenges

- > Best applied **early** in the project.
- > Hard to change **status quo** or design standards.
- > **Cost-benefit analysis** to support decision making can be challenging.
- > Requires an **internal champion** and time/resources.

# Next Steps



Refine how we conduct risk and cost-benefit analyses.



Apply tool to additional projects and expand tool use to additional departments.



Create and update policies relating to climate change.



Update supplemental guidance and expand training.



Expand tool: additional topics, new data & information (e.g., guidance, case studies).

Thank You!

