

Addressing Resiliency



John Milton

*The WSDOT
Experience*

Resiliency in a changing environment

Considering risk to WSDOT Assets



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Peer Exchange**
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Preparing a plan of action for Washington

RECOMMENDATION 6. Strengthen regional transportation networks.

PRIORITY ACTIONS:

6a. Further define critical state routes into and out of ports, airports, and other key areas (e.g. the Kent/Duwamish Valley) and identify priority routes for retrofitting/hardening as a systematic approach that includes 6b. Decisions about these routes should be made in consultation with all necessary administrative levels/jurisdictions.

RECOMMENDED ORGANIZATIONS:
WSDOT

6b. Facilitate collaboration between state and local jurisdictions to identify regional lifeline routes and prioritize retrofitting of city and county roads and bridges. Incorporate this into the Transportation Improvement Program.

*WSDOT;
Regional & Metropolitan
Transportation
Planning
Organizations*

6c. Develop interagency agreements between WSDOT and local jurisdictions to facilitate the rerouting of traffic following an earthquake.

6d. Require that transit agencies (both large and small) develop robust continuity of operations plans.

State Legislature

KEY TO THE TABLE

TARGETS TO ACHIEVE DIFFERENT LEVELS OF RECOVERY:

Minimal (A minimum level of service is restored, primarily for the use of emergency responders, repair crews, and vehicles transporting food and other critical supplies.)

Functional (Service is not yet restored to full capacity, but is sufficient to get the economy moving again— e.g. some truck/freight traffic can be accommodated. There may be fewer lanes in use, some weight restrictions, and lower speed limits.)

Operational (Restoration is up to 80–90% of capacity: A full level of service has been restored and is sufficient to allow people to commute to school and to work.)

X

TIME NEEDED FOR RECOVERY TO 80–90% OPERATIONAL GIVEN CURRENT CONDITIONS:

For a number of components, the timeframes marked in the table reflect the estimated recovery period following a worst case scenario earthquake. See the notes in Workshop Report II for details.

TARGET STATES OF RECOVERY: WASHINGTON'S TRANSPORTATION SECTOR									
	Event occurs	0–24 hours	1–3 days	3–7 days	1 week–1 month	1–3 months	3 months–1 year	1–3 years	3+ years
Interstate 5									
<i>Puget Sound (center & north)</i>								X	
<i>South end (Chehalis south)</i>							X		
Interstate 90									
<i>Puget Sound (Snoqualmie Pass west)</i>								X	
<i>Cascades to eastern WA (Snoqualmie to Idaho)</i>							X		
Interstate 405									
<i>South end (Tukwila to I-90)</i>								X	
<i>North end (I-90 to Lynnwood)</i>								X	
Ferry operations							X		
Floating Bridges									
SR 520								X	
I-90							X		
Hood Canal					X				



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TARGET STATES OF RECOVERY: WASHINGTON'S TRANSPORTATION SECTOR (CONTINUED)									
	Event occurs	0–24 hours	1–3 days	3–7 days	1 week–1 month	1– 3 months	3 months–1 year	1– 3 years	3+ years
25% of major & minor arterials					X				
50% of major & minor arterials						X			
75% of major & minor arterials							X		
90% of major & minor arterials								X	
Airports								X	
Airport for emergency traffic					X				
Ports and navigable waterways								X	
Rail (freight & passenger)								X	
Mass transit: estimates mirror those of major & minor arterials									

Goal: Preserve assets in a changing environment

- **Apply an asset management approach**
 - Be ready for severe weather events *and* long-term changes in site conditions
 - Inform long-term decisions
 - Build resilience where possible
- **Conduct a statewide vulnerability assessment**
 - Test-drive the FHWA model
 - Understand and communicate current science
 - Scope: Consider impacts on our all WSDOT assets
Highways, Ferries, State-owned Rail and Airports



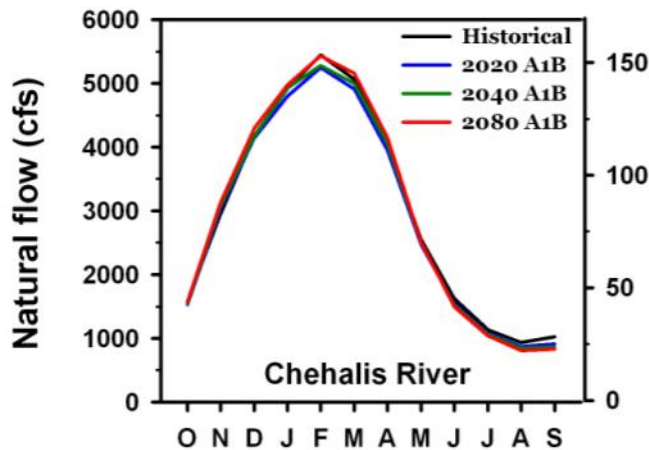


Changes in Flood Risks



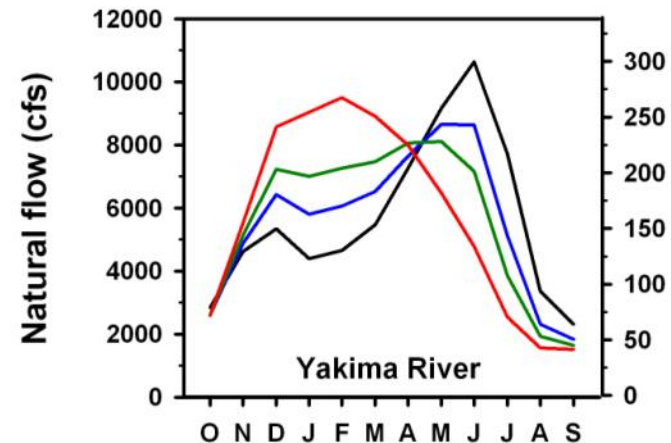
- Floods in western Washington will likely increase in magnitude due to the combined effects of warming and increasingly intense winter storms.
- In other parts of the State, changes in flooding are mixed, and in eastern Washington projected *reductions* in spring flood risk are common due to loss of spring snow cover.

Rain Dominant



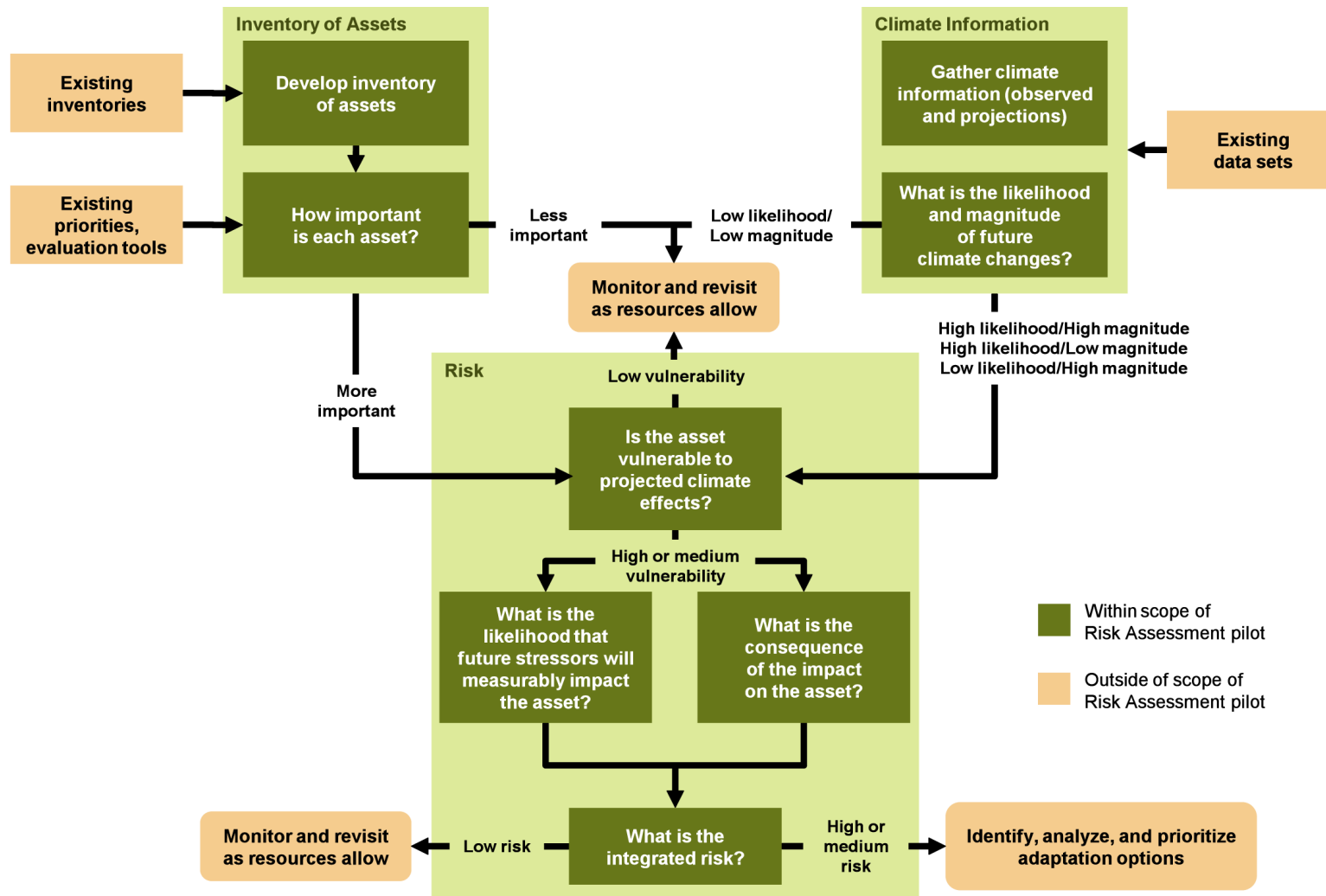
Chehalis River (Western WA)

Mixed Rain/Snow




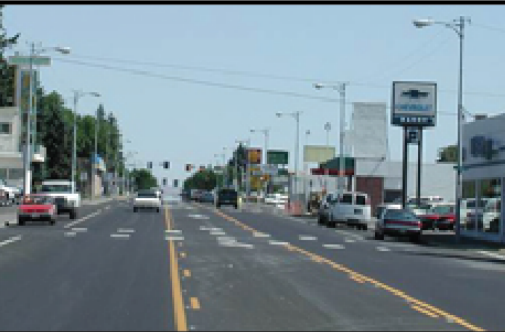

Yakima River (Eastern WA)

FHWA risk assessment model



Step 1 – How critical is the asset?

WSDOT Methodology

Very low to low			Moderate			Critical to Very Critical			
1	2	3	4	5	6	7	8	9	10
Criticality of asset									
<p>Notice that along with the qualitative terms there is an associated scale of 1 to 10, this is to serve as a facilitation tool for some people who may find it useful to think in terms of a numerical scale - although the scoring by each individual is of course subjective. The scale is a generic scale of criticality where “1” is very low (least critical) and “10” is very critical.</p>									
									
<p>Typically involves: non-NHS low AADT alternate routes available</p>			<p>Typically involves: some-NHS non-NHS low to medium AADT serves as an alternative for other state routes</p>			<p>Typically involves: Interstate Lifeline some NHS sole access no alternate routes</p>			

Step 2: What are the Climate Threats?

- Began with climate change forecast from UW Climate Impacts Group
- Talked about observed changes and extreme events – what is happening now
- WSDOT’s internal experts ranked all WSDOT assets
- Key Questions:
 - “What keeps you up at night?”
 - “What if it gets worse (given the scenario)?”
 - “How resilient is our existing system?”

We used our experience to gauge future impacts



Workshops: How might climate impact assets?

<i>Primary climate drivers</i>		<i>Can lead to impacts on...</i>
Temperature	→	Expansion joints, pavement, rail tracks, construction periods, habitat projects, electrical equipment
Precipitation	→	Flooding of surface roads & tunnels, road washout, pump capacity, drainage
Hydrologic shifts	→	Soil instability, water supply, bridge and road support structures
Sea level rise, storm surge	→	Coastal erosion, coastal and upriver flooding, bridge footings, drainage, roadside stability, salt / corrosion

Record impact score

10
9
8
7
6
5
4
3
2
1



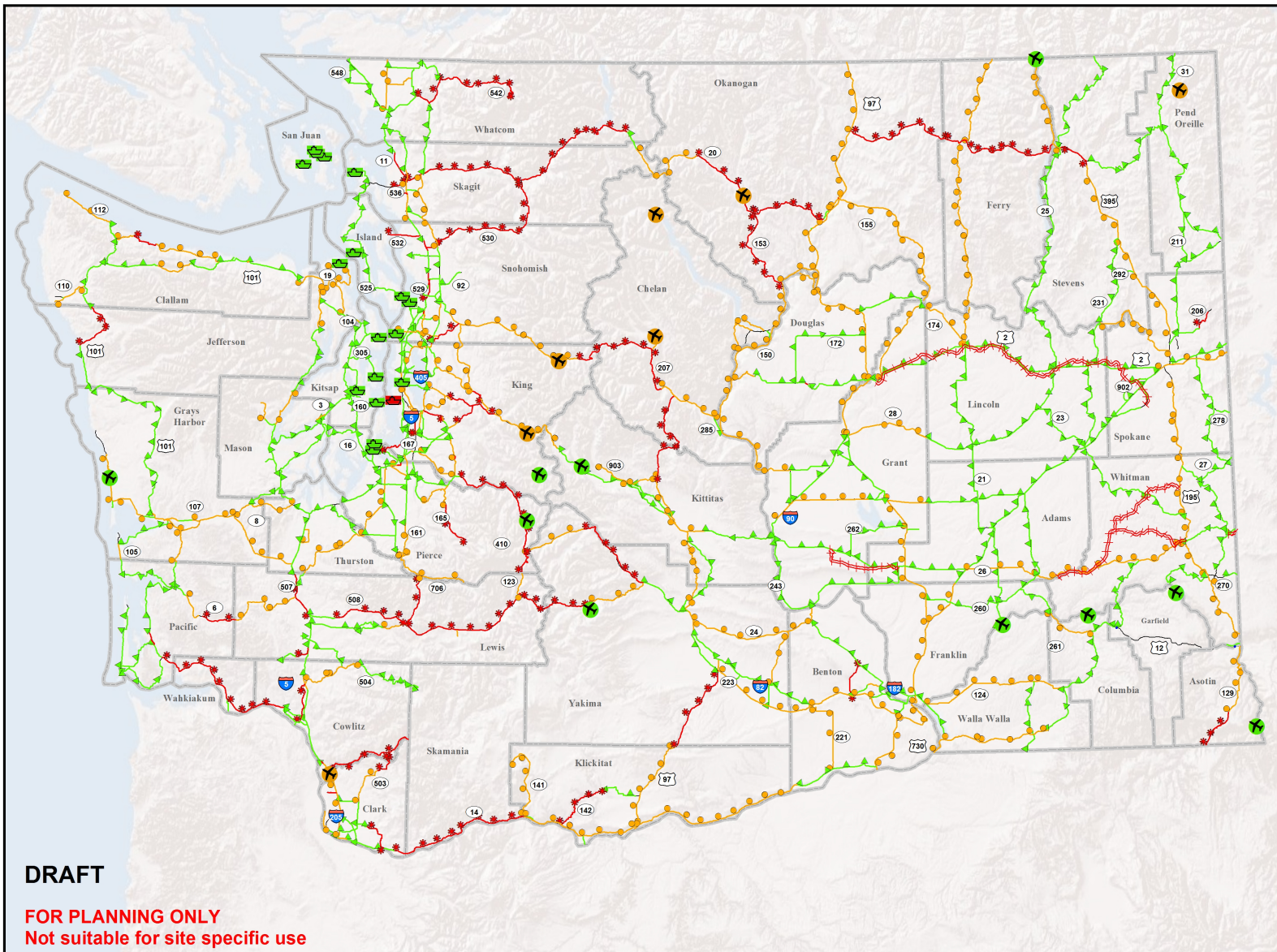
	<p>Complete catastrophic failure</p> <p>Results in total loss or ruin of asset. Asset <i>may</i> be available for <i>limited</i> use after at least 60 days and would require major repair or rebuild over extended period of time. “Complete and/or catastrophic failure” typically involves:</p> <ul style="list-style-type: none"> • Immediate road closure; • Disruptions to travel; • Vehicles forced to re-route to other roads; • Reduced commerce in affected areas; • Reduces or eliminates access to some destinations; • May sever some utilities located within right-of-way; • May damage drainage conveyance or storage systems.
	<p>Temporary operational failure</p> <p>Results in minor damage and/or disruption to asset. Asset would be available with either full or limited use within 60 days and may have immediate limited use still available. “Temporary Operational Failure” typically involves:</p> <ul style="list-style-type: none"> • Temporary road closure, hours to weeks; • Reduced access to destinations served by the asset; • Stranded vehicles; • Possible temporary utility failures.
	<p>Reduced capacity</p> <p>Results in little or negligible impact to asset. Asset would be available with full use within 10 days and has immediate limited use still available. “Reduced capacity” typically involves:</p> <ul style="list-style-type: none"> • Less convenient travel; • Occasional/ brief lane closures, but roads remain open; • A few vehicles may move to alternate routes;

Figure 2.1 Photo depictions of qualitatively assessed climate change consequences

Climate Impacts Vulnerability Assessment Statewide Results



State Routes

- ▲ Low Vulnerability
- Moderate Vulnerability
- ✱ High Vulnerability

State Airports

- ✪ Low Vulnerability
- ✪ Moderate Vulnerability

State Ferry

- Low Vulnerability
- High Vulnerability

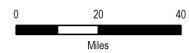
State Rail

- ⋈ High Vulnerability

November 30, 2011

Data Source: Climate Impacts Vulnerability Assessment from WSDOT Internal Scenario-based Planning Workshops Conducted March - October 2011; State Routes from WSDOT at scale of 1:24K; County Boundaries from WSDOT at scale of 1:500K

NOTE: Statewide results assess 2-foot Sea Level Rise (see Appendix E for 4-foot and 6-foot)



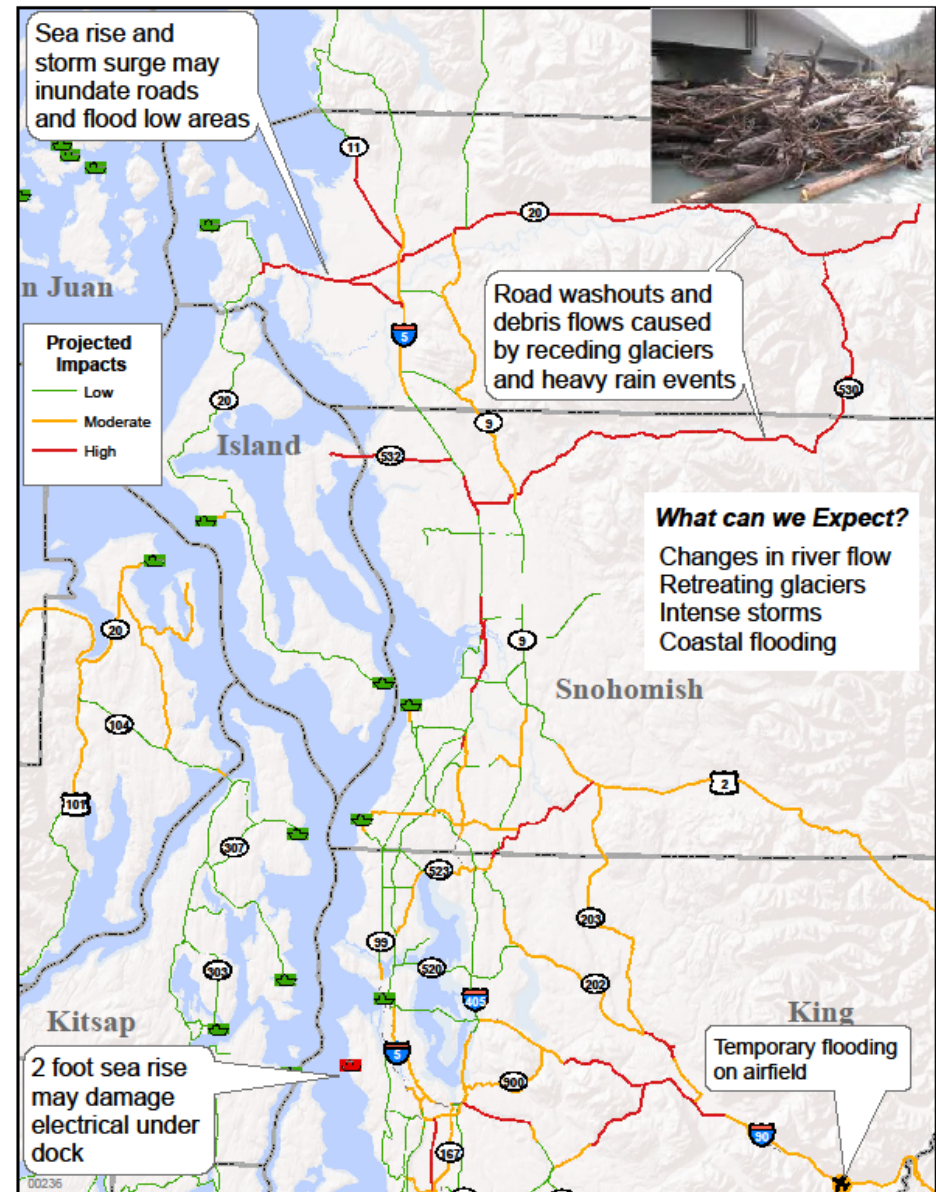
Washington State Department of Transportation

DRAFT

**FOR PLANNING ONLY
Not suitable for site specific use**

What did we find?

- Intensifies known threats
- Reinforces value of our current maintenance and retrofit programs
- Some surprises
- Unique way to capture knowledge of field staff



NW Region Area 3

Sample Location: I-5 mp 192.6 to 201; Snohomish River basin to Quilceda Creek. (in red)

Impact Score (Precip/SLR 2',4',6'): 8, 10, 10

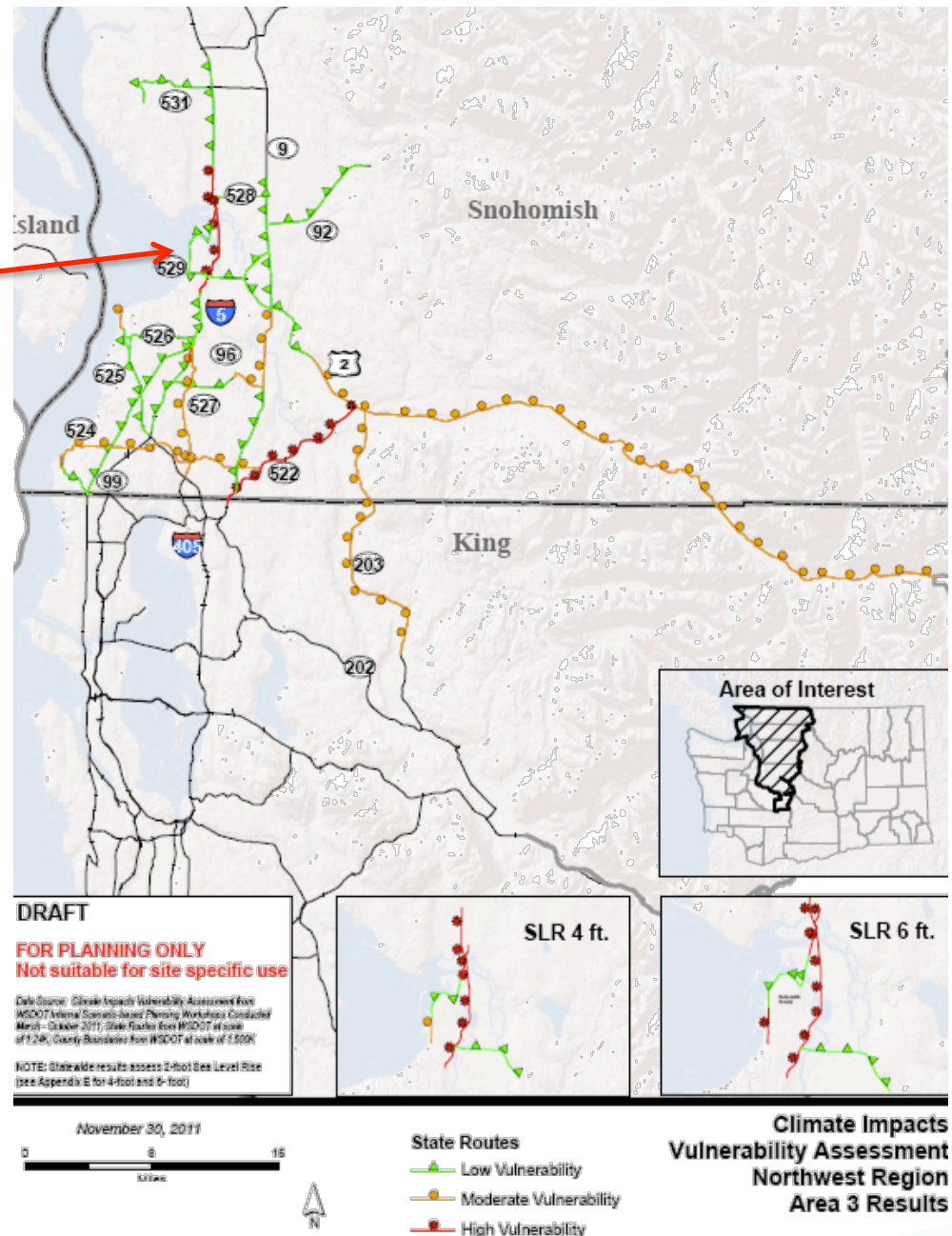
NOTES: Low elevation. River delta, lots of diking districts. Tidal influence with Union and Steamboat sloughs. Saturation of embankment. If dikes rupture, would be major impact.

Roadbed is good, but bridge column would be issue.

Scour critical bridges here.

I-5 Snohomish bridges are good deep piers.

Aggradation is occurring here.



We want to illustrate current practices that are effective adaptation strategies

From disaster to resiliency



Drilled shaft bridges like this one on I-90 near Gold Creek make those structures more resistant to high-velocity flooding.

Where are we today and what are we saying?

Key talking points we are using:

- Responsible asset management: Not a new program
- Our big capital projects incorporated this info
- We don't want to be caught off guard, but we don't want to OVER-design either." – *Rick Keniston (5/1/12 Columbian)*
- 50 years from now, we want people to say: "I'm so glad they thought about this!"