

# **Water System Seismic Resiliency Study Update**

## **Mitigation Recommendations**

Doug Lane, Utilities Department Senior Engineer  
Presented to the Environmental Services Commission

June 3, 2021



# ESC Informational Briefing

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- No decision needed



# Agenda

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1. Background
2. Mitigation  
Recommendations
3. Benefits vs. Costs
4. Next Steps



# Background

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Emergency Well Evaluation



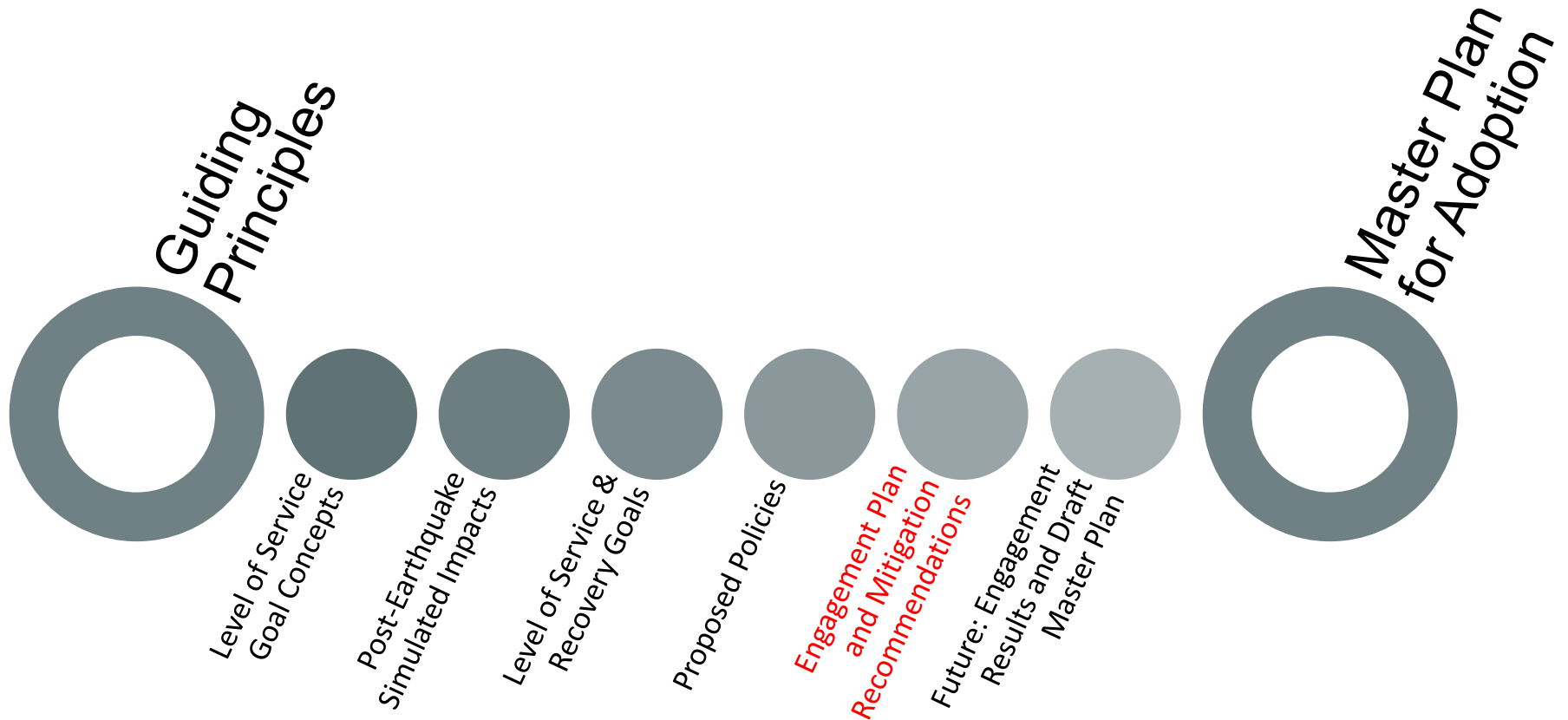
Emergency  
Water  
Supply  
Master Plan



Seismic Vulnerability  
Assessment/ Resiliency Plan



# ESC Timeline



## **Water System Seismic Resiliency Study Update**

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# **Mitigation Recommendations**



# Recommendations

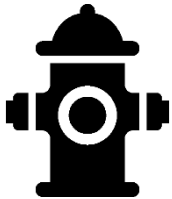
Three improvement categories:



Supply



Backbone



Distribution System

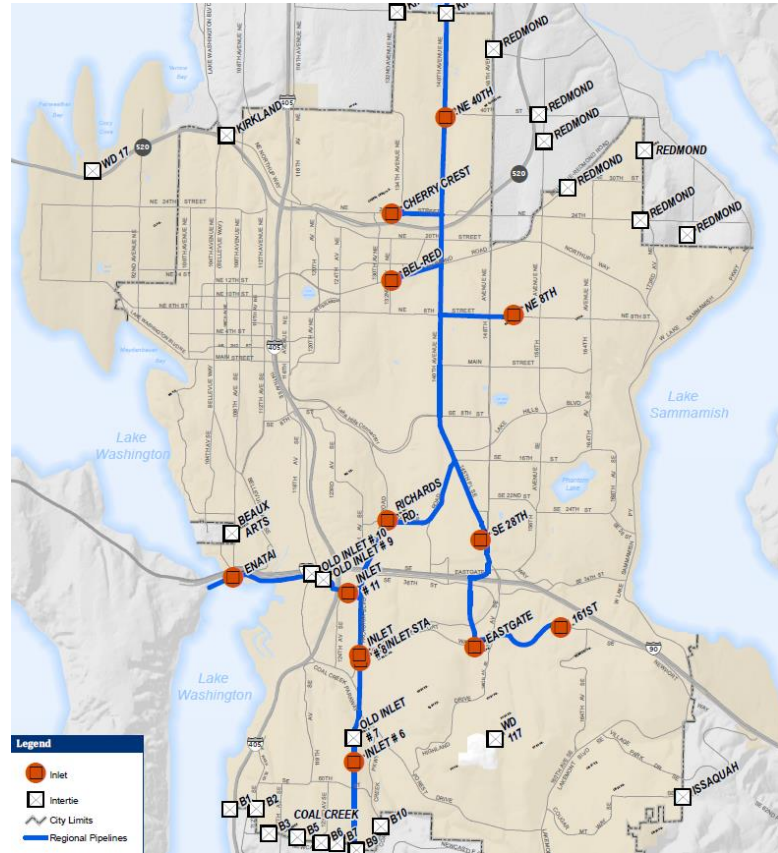




# Supply: SPU Supply Resilience

## Concept:

- Work with Cascade to influence SPU priorities
- May require Cascade investment
- Bellevue has no direct control
- Recommended but not assumed





# Supply: Emergency Wells

Assume 6 locations, TBD

Benefits:

- Positive Benefit/Cost
- Independence and Control

Challenges:

- Staffing for treatment
- New water rights
- Land





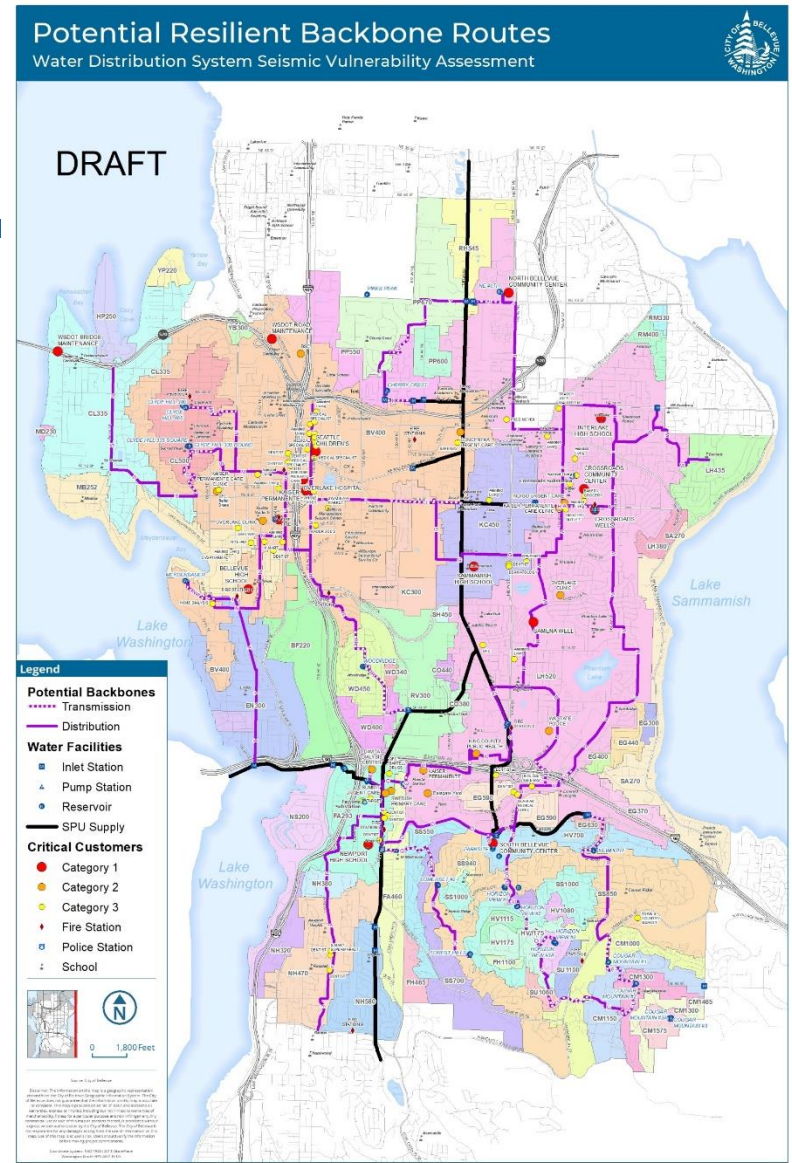
# Backbones

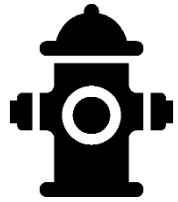
## Function:

- Resilient Pipe to Key Points
- Isolated for Controlled Restoration

## Challenges

- Equity
- Time Needed to Isolate from leaking pipes

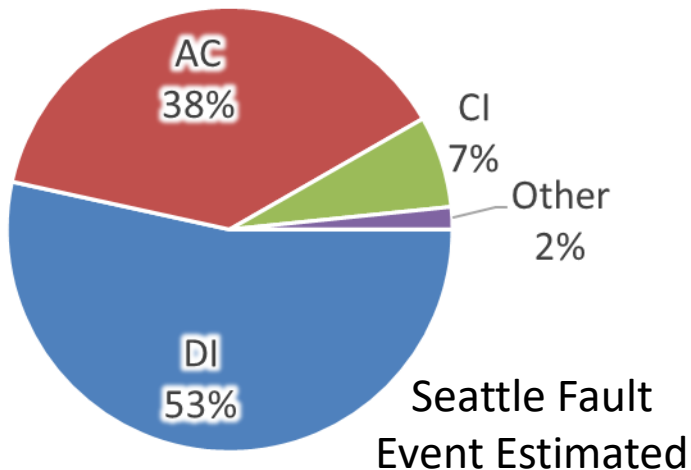




# Distribution: Main Replacement

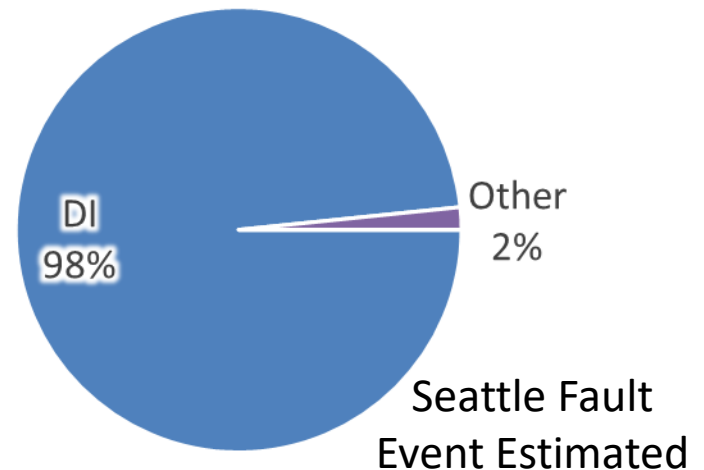
- Continue *existing* program (Replace AC, CI pipe)
- Earthquake resistant pipe in vulnerable soils (< 4%)
- Predicted main breaks reduced more than 50%

Existing Piping (% of System):



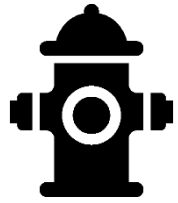
**460 Repairs**

Future Piping (% of System):



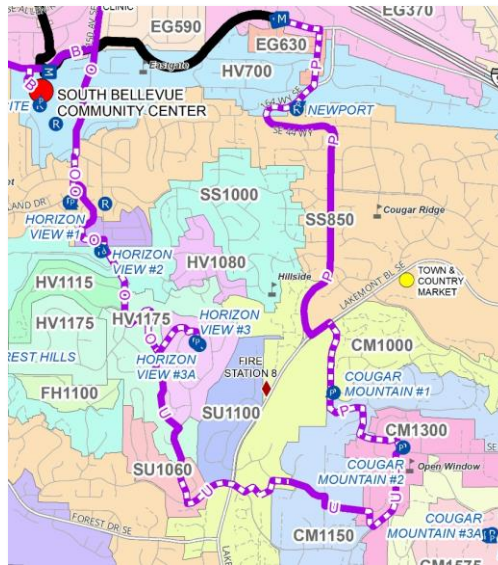
**220 Repairs**





# Distribution: Pumps, Reservoirs

- Already part of R&R program
- Prioritize pump stations along backbones
- Improve redundancy for vulnerable reservoirs



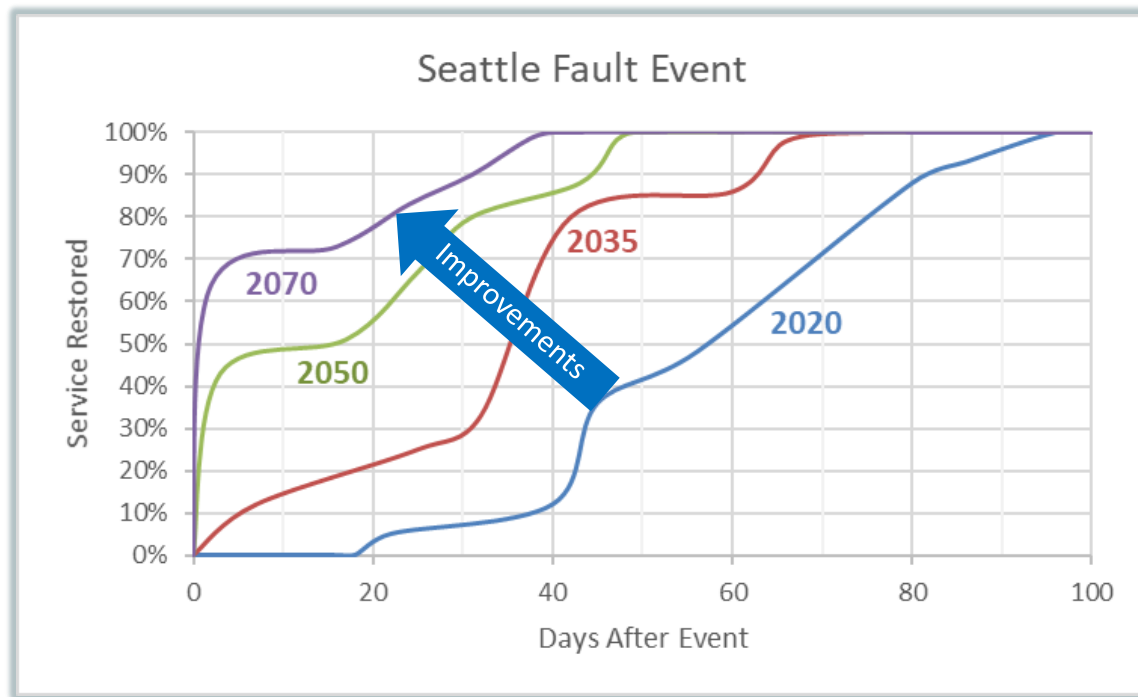
*Pumped Backbone Routes*

*Forest Hills Reservoir & Pump Station*



# Simulated Mitigation Results

- Recovery time with recommended improvements
- Meets proposed level of service goals and policies



# Recommendations Summary



## Supply:

- Install Emergency Wells
- Lobby Cascade/SPU to prioritize transmission

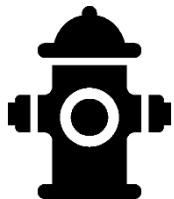


## Backbone

- Resilient pipe to key points
- Reduce valve closure delays



Timeline to meet:  
15, 30, 50-year  
level of service  
goals



## Distribution System

- Continue main replacement
- Prioritize pump stations on Backbones
- Plan for landslide losses



# **Water System Seismic Resiliency Study Update**

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## **Benefits vs. Costs**



# Event Impacts

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- Residents
  - Income loss
  - Inconvenience
- Businesses
  - Revenue loss
  - Productivity loss
- Loss of life
- Fire Losses



# Impact Calculations

- Source data:
  - Income statistics
  - Commuting patterns
  - Tax data
  - Water usage
  - Water sensitivity data
- Isolate water impacts  
(e.g. ignore power outage)



**$\$/\text{day} \times \text{days} = \$ \text{ impact}$**

# Benefit = Reduced Risk

- Risk = Impact x Likelihood (event frequency)
- Both events will happen (cumulative risk)
- Combined \$9.5M/year reduced risk with improvements

Event	Current Impact	Impact after Improvements	Benefit	Frequency	Reduced Risk
Cascadia	\$2.4 billion	\$0.1 billion	\$2.3 billion	$\frac{1}{500 \text{ years}}$	\$4.7 million per year
Seattle Fault	\$8.3 billion	\$0.7 billion	\$7.6 billion	$\frac{1}{800 \text{ years}} \times 50\%^*$	\$4.8 million per year

\*Estimated 50% likelihood of rupture in Bellevue



# Benefit/Cost Ratio

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# **Water System Seismic Resiliency Study Update**

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## **Next Steps**



# Next Steps

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- Seismic vulnerability study final technical report available (June)
- Incorporate into Draft Emergency Water Supply Master Plan



# ESC Direction Needed

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- Informational; feedback only

