CHALLENGING ISSUES
ONE WATER UTILITY'S PERSPECTIVE

MCEER ANNUAL MEETING

SACRAMENTO, CALIFORNIA

FEBRUARY 25, 2005

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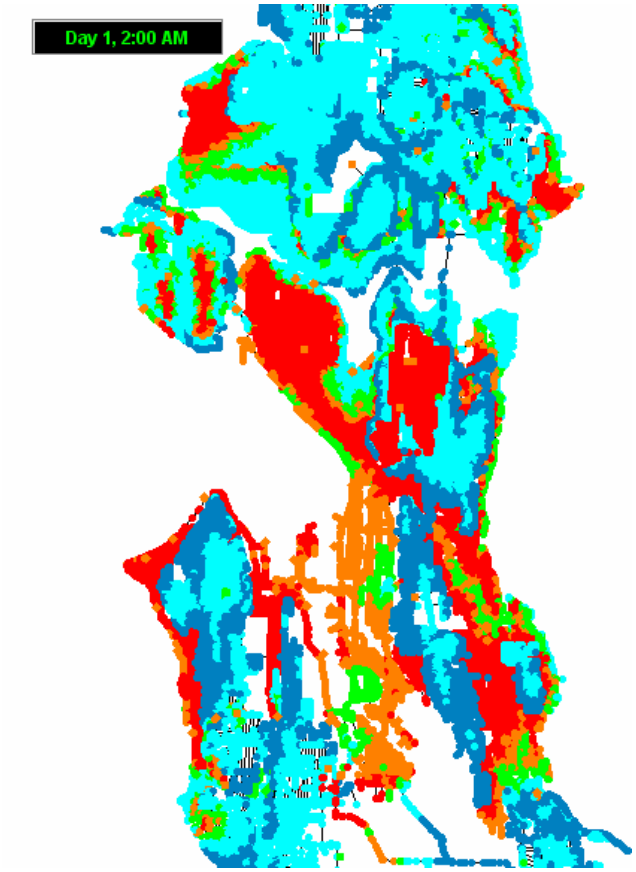
SEATTLE PUBLIC UTILITIES

CHALLENGING ISSUES

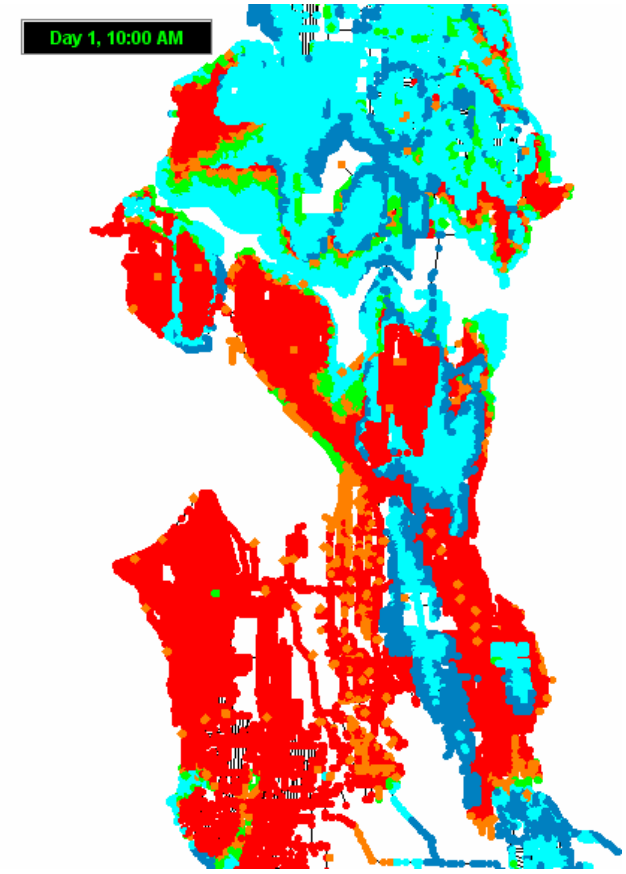
- Mitigating the effects of earthquake-caused pipeline damage
- Developing “realistic” economic loss estimates for earthquake-caused water outages (to be used in life-cycle cost analyses to evaluate seismic mitigation options)

MITIGATING THE EFFECTS OF EARTHQUAKE-CAUSED PIPELINE DAMAGE



SPU system two hours after 500-year earthquake

MITIGATING THE EFFECTS OF EARTHQUAKE-CAUSED PIPELINE DAMAGE



SPU system ten hours after 500-year earthquake

MITIGATING THE EFFECTS OF EARTHQUAKE-CAUSED PIPELINE DAMAGE

- Cost to replace SPU “vulnerable” pipe in poor soils is approximately $500 million
- Alternate strategies?
  - Isolation/control
  - Emergency Planning
  - Prioritization of pipeline replacement (possibly with “seismic” pipe similar to Japanese S-joint ductile iron)

ESTIMATING ECONOMIC BENEFITS OF SEISMIC IMPROVEMENTS

- Repair cost
- Loss of revenue
- Fire
- Loss of business opportunity

ESTIMATING ECONOMIC BENEFITS OF SEISMIC IMPROVEMENTS - TYPICAL APPROACH

$E = 0.5t * [\Sigma_a \Sigma_j (1 - r_j) * w_a * Q_{j,a}]$

where

t = the outage duration/time to repair

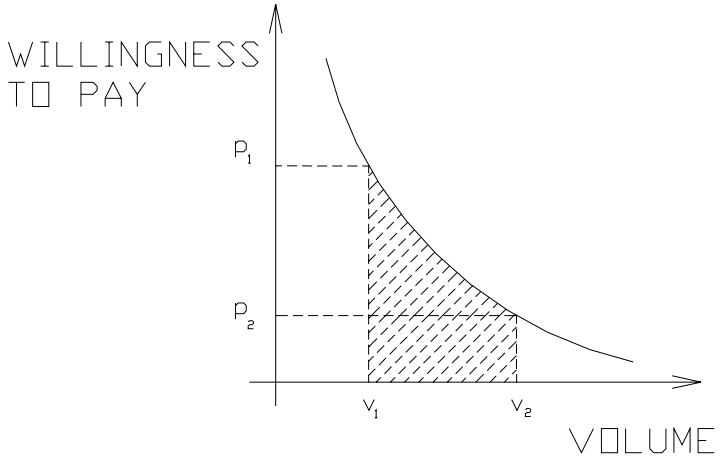
r_j = the resiliency factor (ability to continue production without water) for industry "j"

w_a = fraction of service area "a" without water

$Q_{j,a}$ = economic product for industry "j" in area "a"

ESTIMATING ECONOMIC BENEFITS OF SEISMIC IMPROVEMENTS - ISSUES

- Relationship between water value and quantity is not linear



- Estimates need to be deaggregated so only losses from water outage is considered
- Should only consider portion of value-added economic product that is lost
- Geographic boundary of analysis
- Recovery