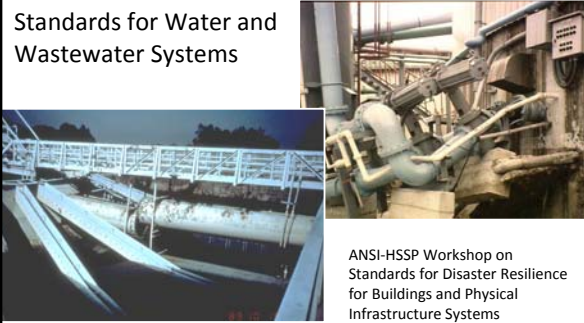



Standards for Water and Wastewater Systems



ANSI-HSSP Workshop on Standards for Disaster Resilience for Buildings and Physical Infrastructure Systems


November 10, 2011

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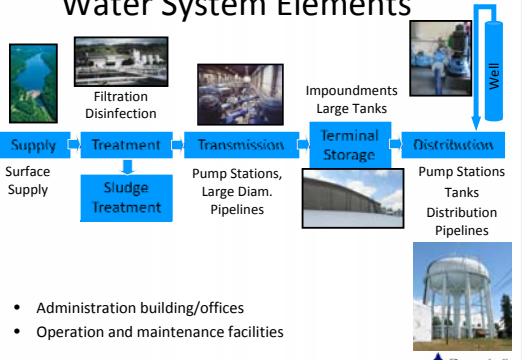


Overview


- What's in a water or wastewater system?
- Level of service
- Standards ownership
- Probabilistic hazards approach
- Damage data
- System metrics
- System and component standards
- Summary and questions



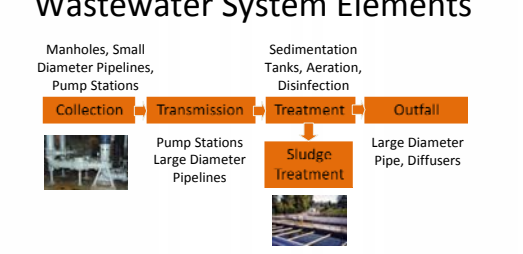
Water System Elements




- Administration building/offices
- Operation and maintenance facilities



Wastewater System Elements




- Administration building/offices
- Operation and maintenance facilities




Water/Wastewater Level of Service

- Impacts and Associated Time Frame for Required Service
 - Water for fire suppression
 - Public health
 - Business interruption end users
 - Environmental Impact
- Compare these drivers and time frame with other infrastructure – Community Resilience
 - Other lifeline systems
 - Transportation systems
 - Building infrastructure use categories




Example Water Level of Service Goals

Performance Category	Acceptable Adverse Consequences	
	OBE (50% chance in 50 years)	DBE (10% chance in 50 years)
Life Safety	Minimal - Injury or loss of life not acceptable	Minimal - Injury or loss of life not acceptable
Fire Suppression	Minimal - Water for fire suppression should be available for entire service area.	Moderate - Water for fire suppression available for 70% of service area.
Public Health	Low - Water should be available for all but a few isolated areas.	Moderate - Provide service for at least 50% of system. Restore 100% service in 1 week.
System Restoration/ Business Operation	Low - Water should be available for all but a few isolated areas.	Moderate - Provide service for at least 50% of system. Restoration to 100% service within one week.
Property Damage	Low - Any damage should not affect facility functionality and should be repairable.	Moderate - 100% loss of nonessential facilities acceptable if not cost-effective to upgrade.





Water/Wastewater Standards Ownership

- Stovepiped
 - American Water Works Association (AWWA)
 - American Lifelines Alliance (ALA)(No longer active)
 - American Society of Civil Engineers (ASCE)
 - International Building Code (IBC)
- Need to be close to users
 - I.E. - water works people don't look to ASCE for standards
- Public versus Private
 - Different drivers and hurdles




Probabilistic Hazards Approach (All Infrastructure)

- 50 years as facility life span
- Earthquake
 - 50% in 50 years – 72 year return or
 - 10% in 50 years – 500 year return
 - 2% in 50 years – 2,500 year return
- Flood
 - 40% in 50 years - 100-year flood plain
 - 10% in 50 years – 500 year flood plain


Example List of Hazards (All Infrastructure)

<p>Natural</p> <ol style="list-style-type: none"> 1. Earthquakes/tsunamis 2. Wildland fire 3. Urban Fire 4. Flooding - Heavy rainfall and associated landslides 5. Lightning 6. High winds 7. Tornado 8. Water quality event 9. Microbial contamination <p>Human/Technological</p> <ol style="list-style-type: none"> 10. Staff Unavailable 11. Intentional act of vandalism or sabotage 12. Computer disruption 13. Chemical release 14. Mechanical failure 	<p>Human/Technologic - continued</p> <ol style="list-style-type: none"> 15. Operational error 16. Building fire/explosion 17. Building Flood 18. Accidental third-party damage <p>Transportation Accidents</p> <ol style="list-style-type: none"> 19. Airplane collision 20. Airplane fuel dump 21. Truck/car collision 22. Rail collision <p>Lifeline Service Loss</p> <ol style="list-style-type: none"> 23. Regional electricity outage 24. Wireless communications outage 25. Wire communications outage 26. Liquid fuel service loss 27. Treatment chemical supply and delivery disruption
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Collection and Storage of Damage Data Following Earthquakes (All Infrastructure)

- Damage data used for fragility development
- No system in place to address:
 - Standardization of data
 - Collection of data
 - Storage of data

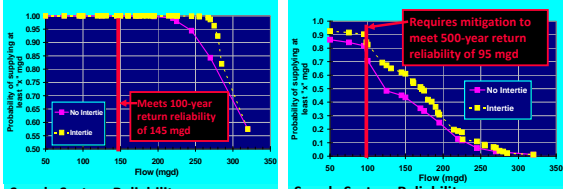


Water/Wastewater Metrics

- Functionality (Level of Service)
 - Capacity/Probability of achieving
- Planning & Response
 - Emergency planning
 - Emergency response – Near-Real-Time Assessment
 - Restoration planning
- Financial
 - Direct losses
 - Insurance coverage assessment
 - Post-event financial planning
 - Reliability assessment for bond sales
- Social Impacts/Indirect Losses
 - Outage time
 - Capacity during recovery
 - Business interruption – end users
 - Resilient community goals
- Asset Management/Capital Improvements
 - Identification of deficiencies
 - Prioritization of capital improvements
 - Benefit/cost analysis
 - Input to asset management plan (annualized losses)



Portland Earthquake Reliability



Supply System Reliability, 100-Year Return Earthquake

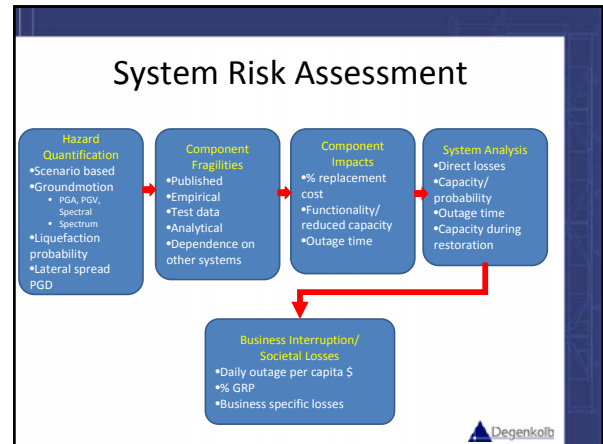
Supply System Reliability, 500-Year Return Earthquake

Requires mitigation to meet 500-year return reliability of 95 mgd

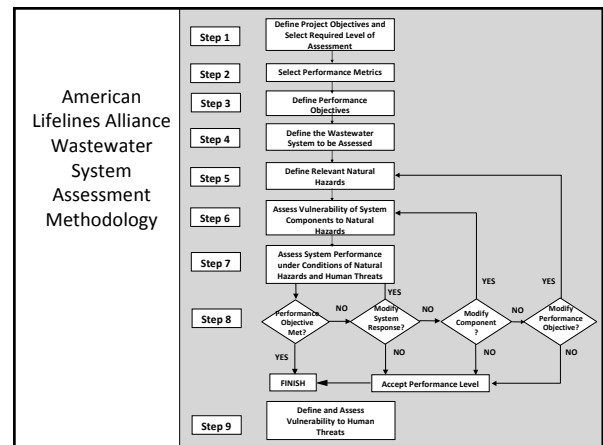
Santa Clara Valley WD Baseline Level of Service Results

Scenario / Time Increment (Days)	Probability of meeting average winter demand for at least one turnout for each retailer										
	0.0	0.2	0.5	1	3	7	14	21	30	45	60
Earthquakes											
San Andreas Fault	0%	0%	0%	0%	0%	0%	5%	34%	96%	100%	100%
Southern Hayward Fault	44%	10%	15%	73%	74%	75%	85%	100%	100%	100%	100%
Central Calaveras Fault	73%	17%	5%	86%	94%	94%	100%	100%	100%	100%	100%
Floods											
100-Year	82%	77%	74%	75%	75%	81%	88%	100%	100%	100%	100%
500-Year	66%	32%	17%	12%	11%	51%	84%	100%	100%	100%	100%
Power Outages											
Regional	100%	100%	100%	98%	100%	100%	100%	100%	100%	100%	100%

Very Low <= 20% Medium <= 90%
 Low <= 50% High <= 100%



- ### Water/Wastewater Standards
- System Performance – Existing Systems
 - AWWA J-100 Standard– outcome of 9/11
 - ALA
 - Development of Guidelines to Define Natural Hazards Performance Objectives for Water Systems
 - Wastewater System Performance Guidelines
 - Various proprietary methodologies
 - Suggest integrating ALA water document into AWWA J-100 or other similar document
 - Suggest developing wastewater system performance document – organization TBD
 - Standards should be risk based



- ### Water/Wastewater Component Standards
- Facilities/Components – New
 - IBC – buildings and other facilities by reference
 - ASCE 7
 - AWWA – Tank Standards D100-D115
 - ACI – 350 Environmental Engineering Concrete Structures
 - Performance Based Design
 - Only addressed by Importance Factor
 - Risk Category 4 (x1.5) – Fire Suppression, Critical Services
 - Risk Category 3 – (x1.25) – all other water/wastewater
 - Gap – need PBD provisions
 - Existing Facilities
 - IEBC – buildings
 - Gap – need for tanks

- ### Water/Wastewater Pipeline Standards
- Existing US Pipeline Standards and Guidelines
 - AWWA Pipeline Standards
 - ASTM Concrete, PVC, Pipe Standards
 - AWWA/WEF/ASCE – Manuals of Practice
 - No seismic provisions (above)
 - ASME B 31.3 – Welded steel pipe
 - Japanese Water/Wastewater Standards
 - Seismic Design and Construction Guidelines for Water Supply Facilities - Japan Water Works Association
 - Seismic Planning Guidelines for Water Supply System – Japan Ministry of Health and Welfare
 - Earthquake Disaster Countermeasure Manual, Guidelines and Commentary for Sewage System – Japan Sewage Works Association

Water/Wastewater Pipeline Standards - Continued

- Suggested AWWA Pipeline Seismic Design Standard for Water
 - ALA – Seismic Guidelines for Water Pipelines
 - JWWA – Seismic Design and Construction Guidelines for Water Supply Facilities
 - Various utility standards – EBMUD, Marin Municipal WD, SFPUC
 - Various published guidelines
- Suggested WEF (or other) Pipeline Seismic Design Standard for Sewers
 - Earthquake Disaster Countermeasure Manual, Guidelines and Commentary for Sewage System – Japan Sewage Works Association
 - Various utility standards
 - Various published guidelines

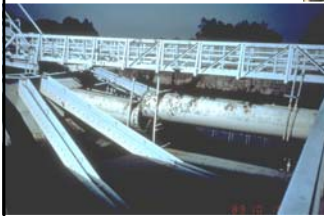


Summary

- Level of service – what's needed for resiliency
- Establish LOS and hazards umbrella, keep standards within lifeline industry
- Probabilistic hazards approach
- Standardize, collect, and store data
- Establish common metrics useful across the industry
- Develop system assessment standards for water and wastewater
- Develop water and sewer pipeline seismic/multi-hazard standards



Standards for Water and Wastewater Systems



QUESTIONS ?

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