Portland Water Bureau's Asset Management Approach to Risk

Peter Nierengarten, PE

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What is Risk?

- Risk is a measure of the degree of exposure to the consequences that might result from an event that might happen – **AWWA**
- Risk is the threat that an event (action or inaction) will adversely affect an organization's ability to achieve its business objectives and execute its strategies successfully - **EPA**
- Process for quantifying and comparing **likelihood** and **consequence** of asset failure - **PWB**

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Risk = Likelihood x Consequence

The Terminology Nightmare

Unfortunate Synonyms and Confused Concepts

Risk Criticality Peril Hazard *Probability* *Chance*	=	**Frequency** **Probability** Failure rate Likelihood Chance *Risk*	X	**Consequence** Effect Severity Importance Criticalness Criticality

Those in **red** are preferred, those in *blue* are incorrect

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Types of Failure

- Capacity
- LOS
- Mortality
- Efficiency

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Risk - CLEM

Likelihood	Consequences				
	1 Very low	2 Low	3 Moderate	4 High	5 Very high
Very low (1)	VL	VL	L	M	M
Low (2)	VL	VL	M	M	H
Moderate (3)	L	L	H	H	E
High (4)	L	M	H	E	E
Very high (5)	L	M	H	E	E

E = extreme
H = high
M = medium
L = low
VL = very low

Consequence
Likelihood
Evaluation
Matrix

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What is CLEM intended to accomplish?

- Quantify consequence & likelihood of failure
- Identify high risk assets
- Compare risk
- Determine a Utility's risk profile

Likelihood

Likelihood Rating	Recurrence Interval for a single asset failure (years)	Failure Rate of a Population
5	<= 5	0.3
4	5-20	0.1
3	20-50	0.03
2	50-100+	0.013
1	>> 100	<.01

Consequence

- 10 Categories
  - Water Quality
  - Illness
  - Regulations
  - Supply Continuity
  - Public Confidence
  - Social/Health and Safety
  - Environmental
  - Loss of Revenue/Expenditure
  - Customer Service
  - Service Level Indications
- 31 Sub Categories

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Tier 5 Consequence

- Contamination causing a single fatality
- Major service area out of water for longer than 72 hours
- >$20 million of damages
- Bills not generated for 60 days

Factors that can affect Consequence

- Redundancy
- Location
- $$ of damages
- Affect on service

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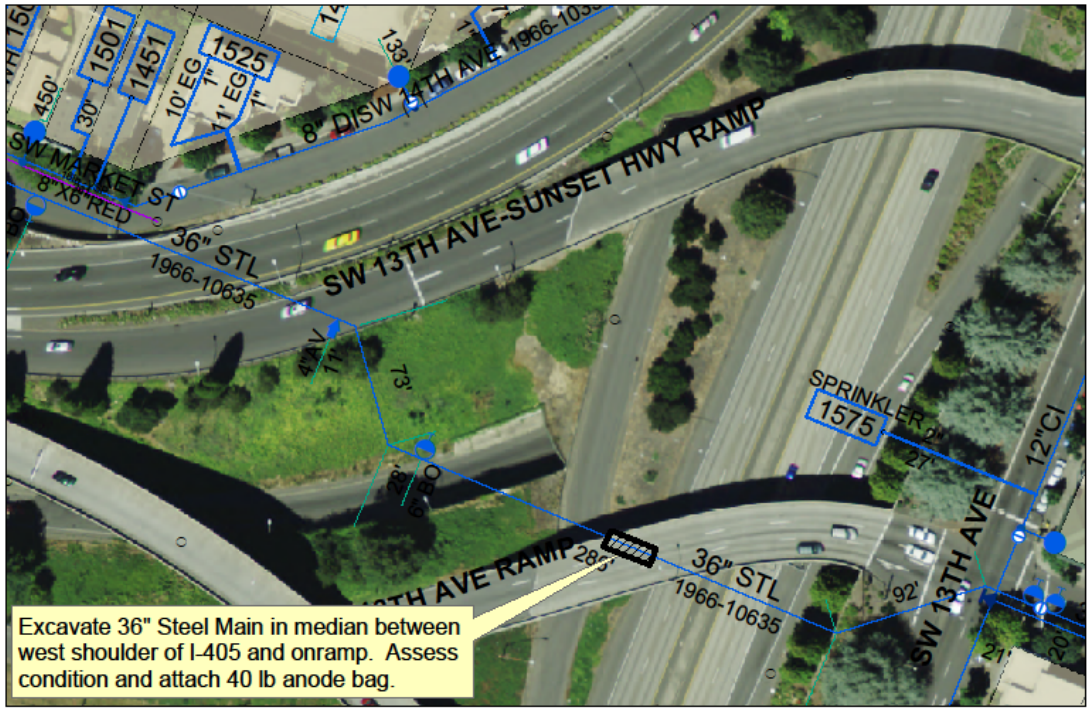
Risk Service Level

- Standards are defined as:
  - Extreme risk: test, inspect or repair "immediately"; renew or replace within 12 months
  - High risk: test, inspect or repair within 12 months; renew or replace with 5 years
  - Medium risk: test, inspect or repair within 3 years.
- Meet at least 80% of standards established for inspection, testing, repair and replacement of assets that are identified as medium, high or extreme risk

Case Studies – How Condition Assessment can Affect Risk

- *36” Uncased Steel Main running under Freeway* Interchange



36" Steel Main Condition Assessment at I-405 & SW Market St.

0 50 100 200 Feet

N

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I – 405 & SW Market St.

- Likelihood – 3
  - 47 year old steel main
  - Condition unknown - PWB has experienced problems with similar type mains
  - Uncased for 450’
  - No Cathodic Protection
  - Likely to fail within next 20 – 50 years
- Consequence – 3
  - Major traffic disruption
  - Damage freeway interchange
  - Damage private property
  - Likely that greater than $5 M in damages could be caused by failure
  - Moderate impact on supply

Risk

Likelihood	Consequences				
	1 Very low	2 Low	3 Moderate	4 High	5 Very high
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- Majority of manageable risk was associated with likelihood of failure as a result of the asset's assumed mortality.

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Condition Assessment

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Condition Assessment

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Condition Assessment

- Pipe material excellent shape
- No corrosion
- Cathodic Protection added to extend pipe life

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Condition Assessment Findings

- Coating in excellent shape
- Not likely to fail in next 20 – 50 years
- Reduced Likelihood from 3 to 2

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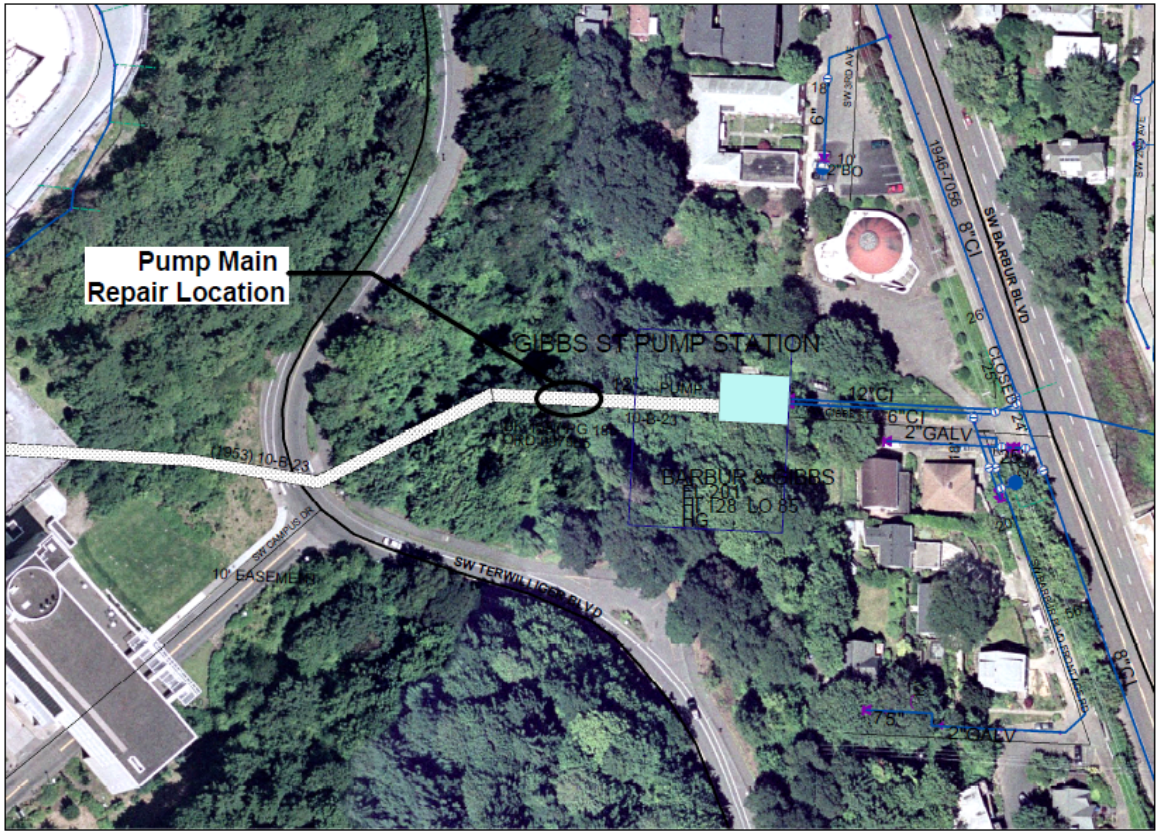
Inspection Conclusions

- Managed the likelihood of failure
- Risk Cost Reduction of $85,000/year
- Project Cost = $4200

12” Steel Pump Main



Barbur-Gibbs Pump Main Repair

0 50 100 200 300 Feet

N W E S

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Barbur-Gibbs Pump Main

- Likelihood – 3
  - 54 year old steel main
  - Leaks in recent years
  - Steep slopes - Landslide
  - Over 200 psi
  - Likely to fail within next 20 - 50 years
- Consequence – 4
  - Damage to environmental zone
  - Damage to Hospital Buildings > $10M
  - Cause landslide
  - Loss of main water supply to Hospital

Risk

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- 5 ft of pipe exposed
- Significant corrosion on exposed pipe
- Pipe wall thickness seriously compromised
- Likely to fail in next 5 years
- Increase Likelihood from 3 to 5
- Adjacent buried pipe in reasonable good condition

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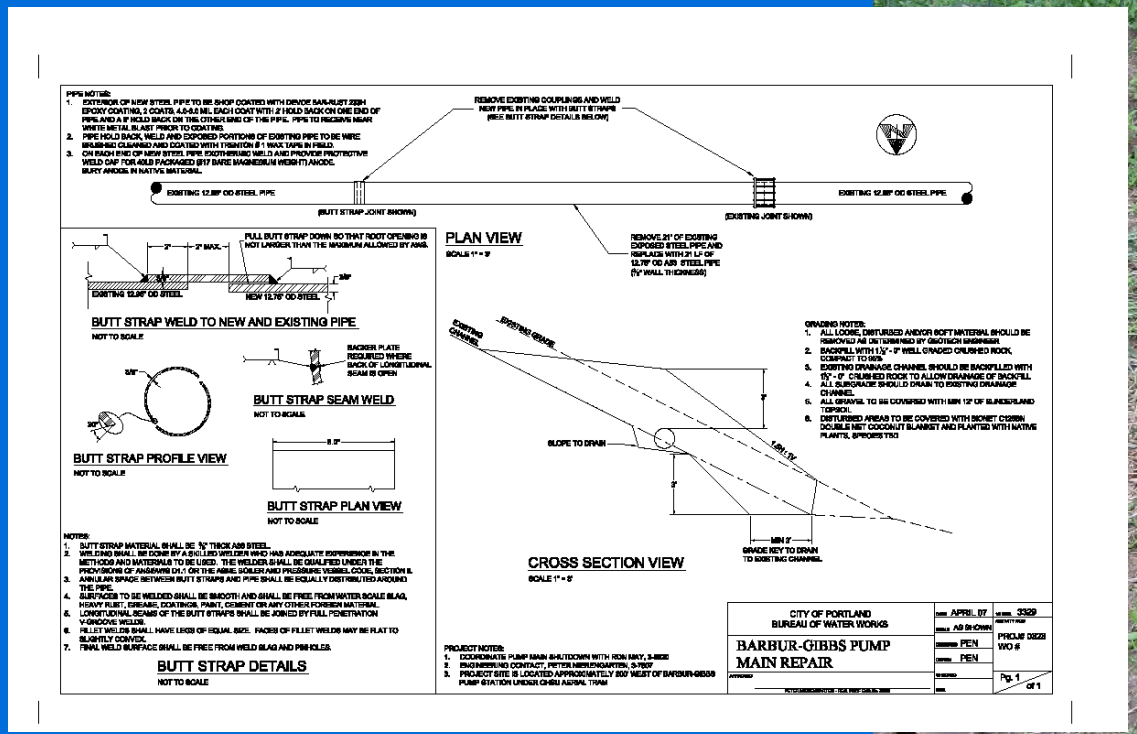
Main Repair



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Inspection/Repair Conclusions

- Slope Stabilization Added
- Managed the likelihood of failure
- Risk Cost Reduction of $2.7M/year
- Project Cost = $20,000

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Risk Assessment Conclusions

- National forecast for $200 Billion in pipeline replacement in next 20 years
- Maximize each $ spent
- Stretch investment
- Find the sweet spot between too soon and too long

Questions?

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