Large Diameter Force Main Condition Assessment

Bay Area Clean Water Agencies

Collection Systems Committee

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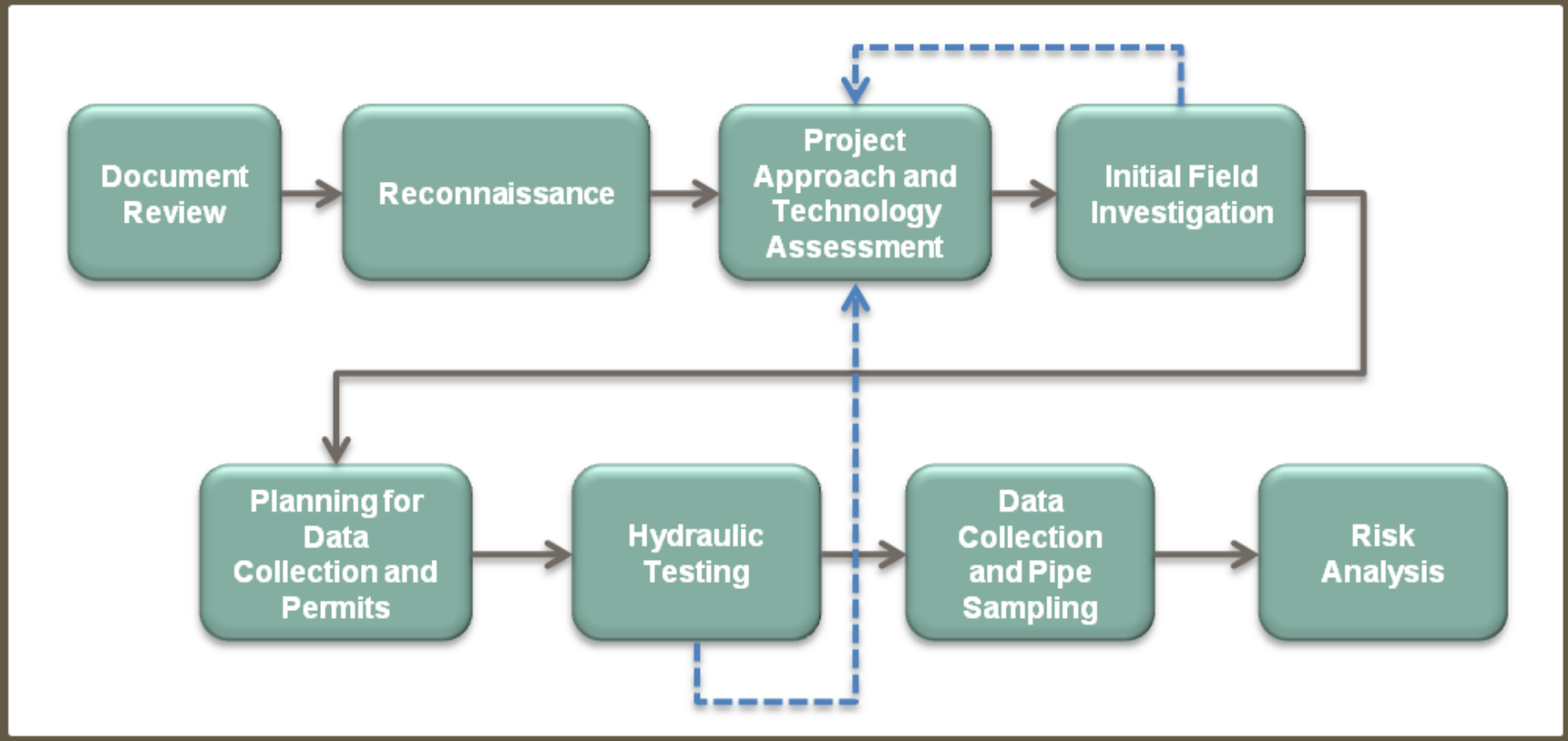
Force Mains
A Maintenance Challenge

- Each force main is unique
  - Variety of designs and materials of construction
  - Different operating conditions (e.g., pressure, volume)
  - Different exposures/surrounding issues (e.g., soils, alignment)
- Many technical issues/disciplines
  - Difficult to assess/evaluate all aspects
- Each force main will require unique assessments and recommendations

Where to Start?

- No silver bullet
- Define system boundary/control volume
  - Pipe, pumps, controls, etc.
- Force main assessment is an iterative process

Assessment Flow Chart



Define the Objectives – Remaining Life?

- Definitions of life expectancy
  - Varies by service, exposure, mitigation, etc.
- Typical design life expectancies:

Material Type	Typical Design Life Expectancy
Ductile Iron	50 years
Asbestos Cement	50 years
PVC	60 years

Functional Definitions of Life Expectancy

- Design Life: The expected length of time an asset is projected to last based on initial considerations of conditions.
- Service Life: The expected length of time an asset is projected to last based on current conditions with the assumption that conditions will stay the same over time.
- Useful Life: The expected length of time an asset is projected to last based on current conditions with management to control known conditions to prolong the service life.

Risk Based Assessment Prioritization

RISK = Combination of

Probability of a Negative Event & **Resulting Consequences**

- Large force mains generally have high consequence of failure
- Risk analysis

Likelihood of Failure	x	Consequence of Failure	=	Risk Rating
3 – Likely 2 – Unlikely 1 – Very Unlikely		3 – Serious 2 – Moderate 1 – Minor		

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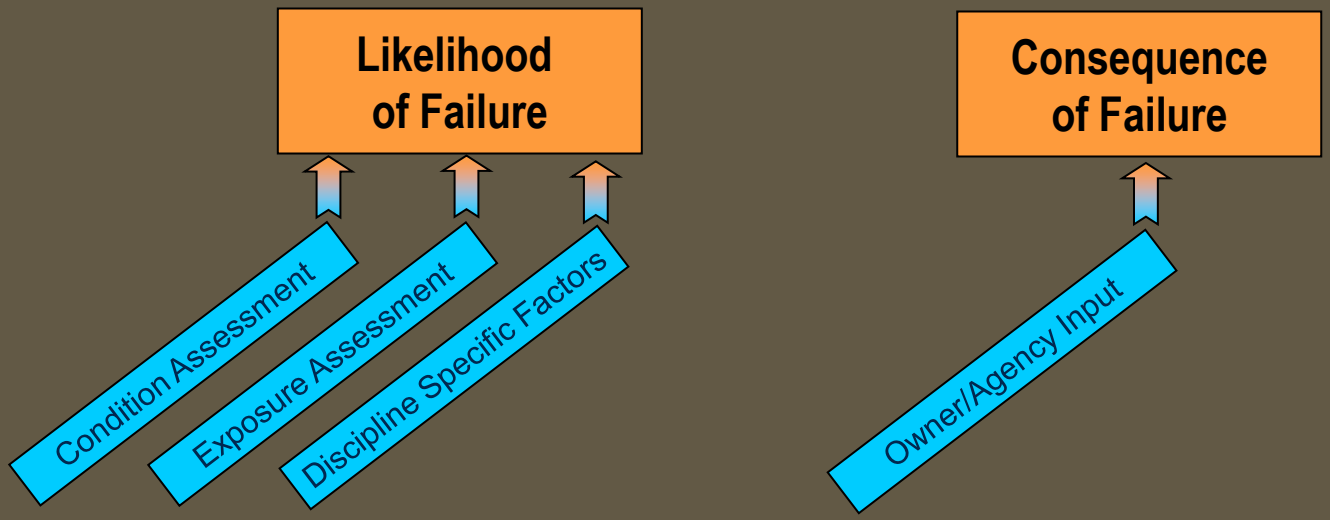
Establishing Ratings

- Likelihood - Based on number of different factors and criteria
- Consequence - Subjective evaluation of potential impacts to public and environment



Note: include externalities and risk from 3rd party damage - adjacent utilities

Planning the Approach

- Perform site reconnaissance
  - Allow time to reverse engineer to understand design
- Obtain buy-in from stakeholders
  - Appropriate public notification
- Owner/agency support critical to success
  - O&M, engineering and management staff intricately involved
  - Field conditions can alter plans, so allow for flexibility in schedule

Assessment Methods

- Non-intrusive preferred for large-dia. FM
  - Internal
    - C-Factor Testing – Highly scalable regardless of magnitude of system
    - Acoustic Testing – Provided conditions are met
    - Constituents of wastewater (i.e. sulfide)
  - External (requiring excavation)
    - Radiography & Ultrasonic
    - Broadband Electromagnetic
    - Corrosivity of surrounding soils

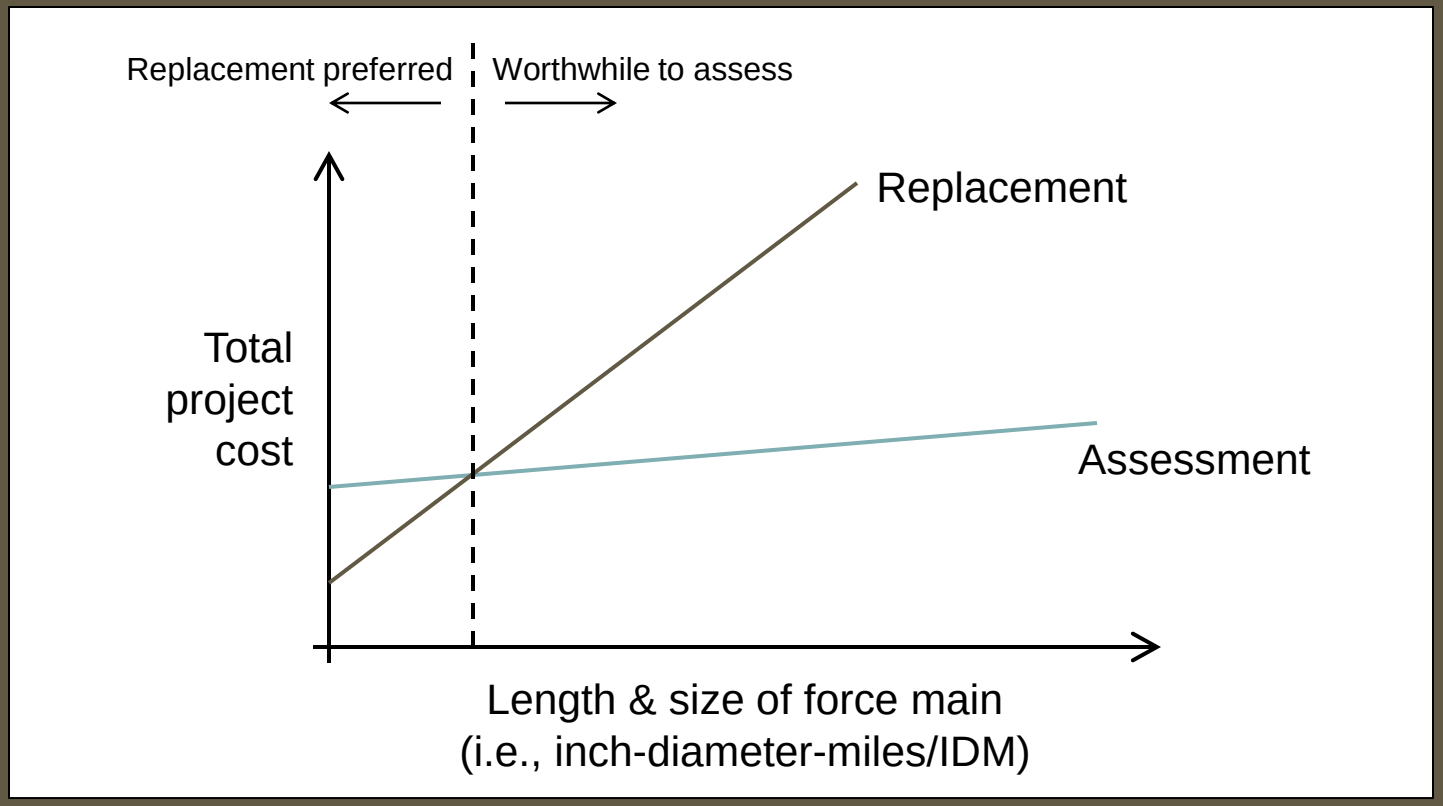
Assessment Methods

- Can it be taken a step further?
  - Provisions for shut down
    - CCTV and/or manned entry
    - Collect sample of pipe

Concluding Considerations

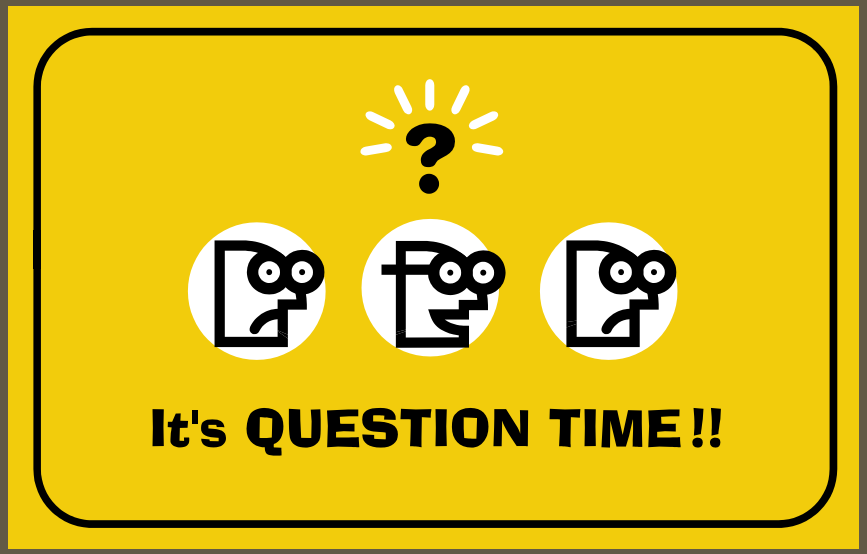
- Incremental assessment
  - Rarely an all or nothing proposition
  - Findings unearth other factors worthy of investigation
- Compilation of multiple data sets
  - Requires multidisciplinary approach
- Costs of assessment vs. pipe renewal
  - Tipping point where cost to rehabilitate exceeds cost to assess (as typically expected with large diameter force mains)

Replacement vs. Assessment Cost



- Replacement can cost less than a thorough assessment.

Thank You



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