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- ❖ Small Engineering Project (less than \$5M)
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American Water Works Association  
**Pacific Northwest** Section

# Challenges Extending Earthquake Resilience to Hydrants and Water Services

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Outline

Earthquake Impacts  
Project Challenges  
Solutions







# Earthquake Impacts

## Earthquake Zones

Strike/slip Fault Zone: <7.3 magnitude earthquakes

Cascadia Subduction Zone: 9.3 magnitude earthquakes

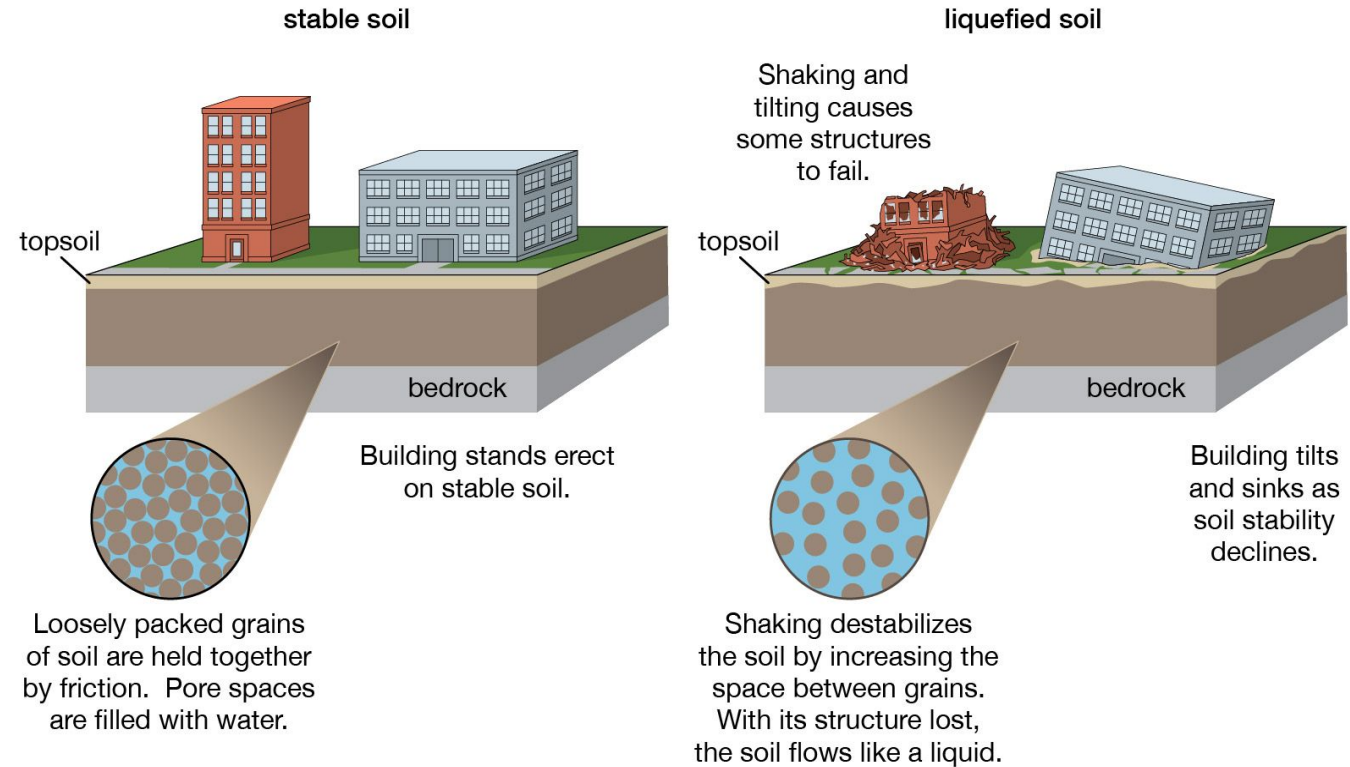
## Ground Response

Liquefaction

Faulting

Tsunami

### Soil liquefaction

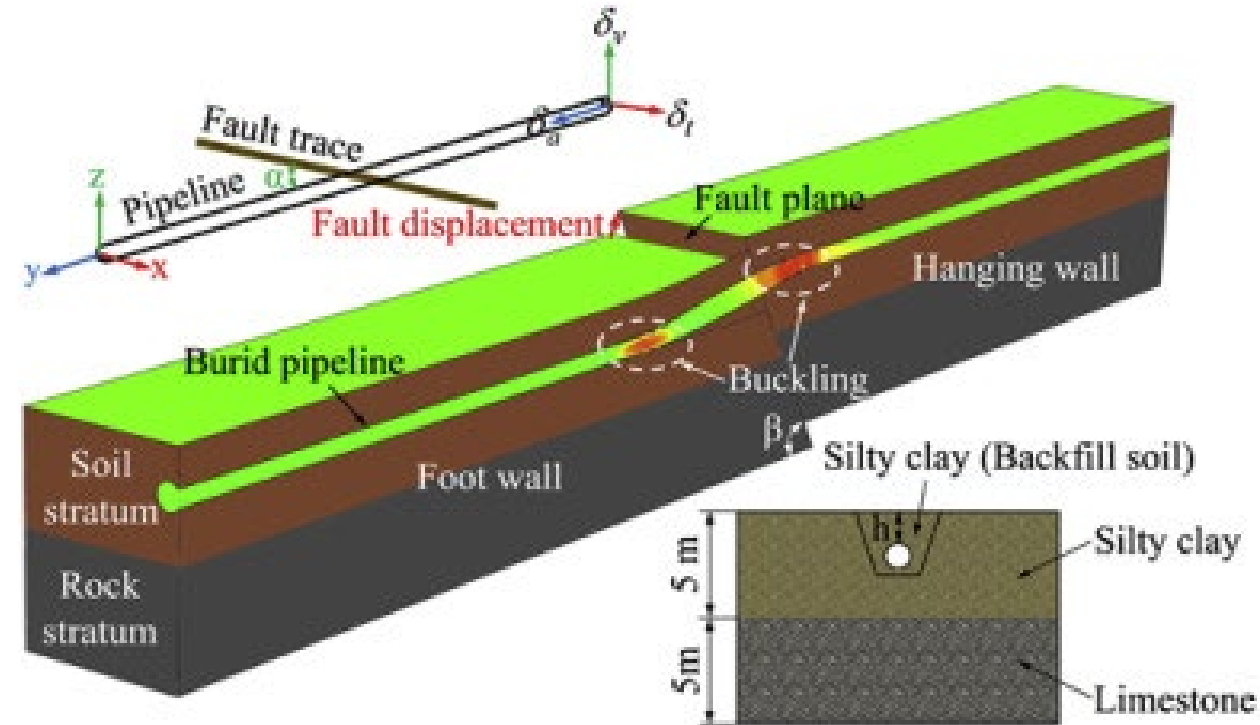


# Earthquake Impacts

Pipeline deformation in faults

Buckling

Displacement

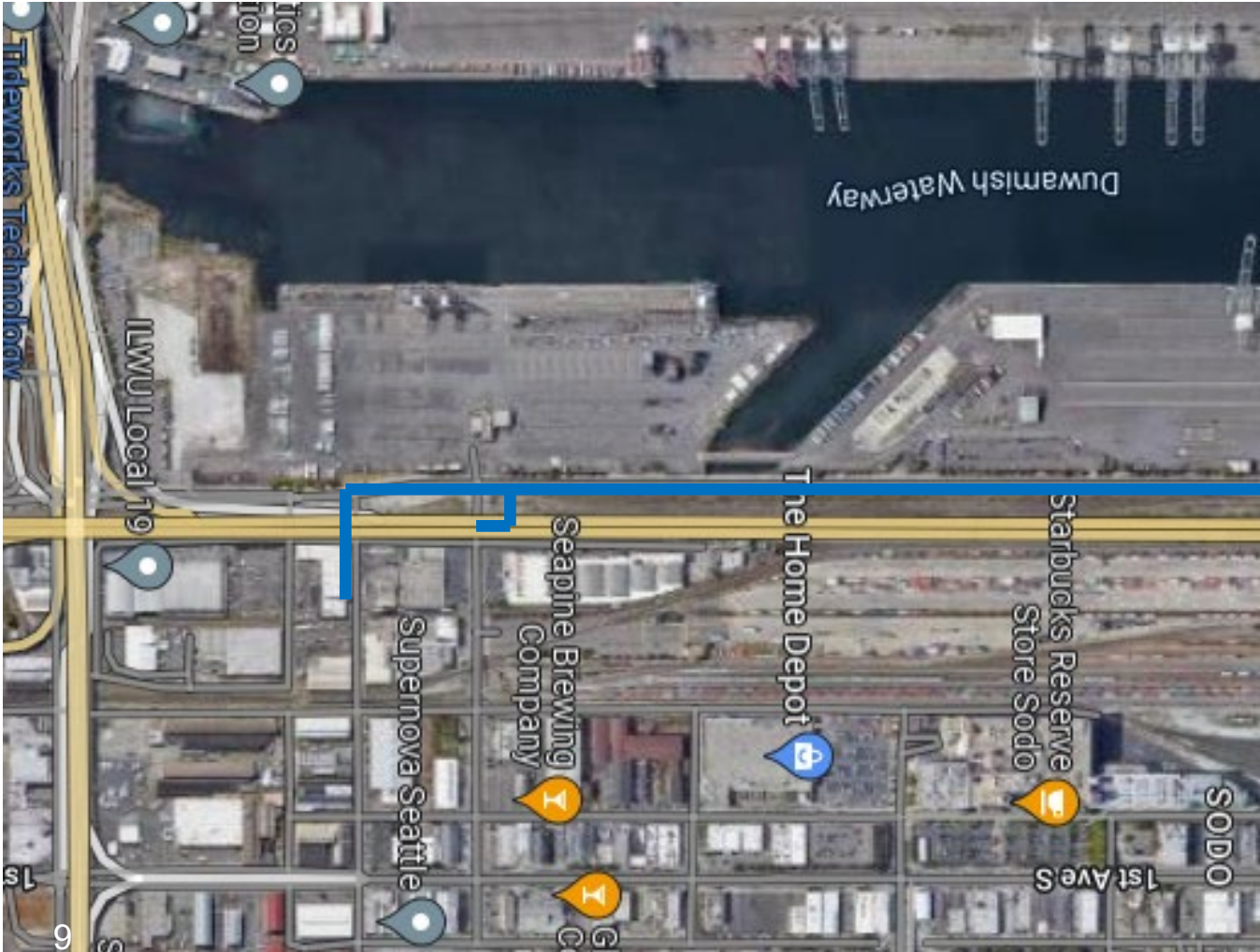


## Earthquake Impacts





# Project Overview



## Arterial Roadway

- Heavy freight corridor
- Protected Bike Lane

## Pipeline serves critical facilities

- Waterfront Port – Major Shipping
- US Coast Guard Facilities
- Emergency Response Center

## Federal Funding timelines

## Problem – Thrust Blocks

### Restraints

What is problem with Thrust Blocks?

Sink in liquified soils (anchor)

Larger attached surface area and get pulled by flowing soils (sail)

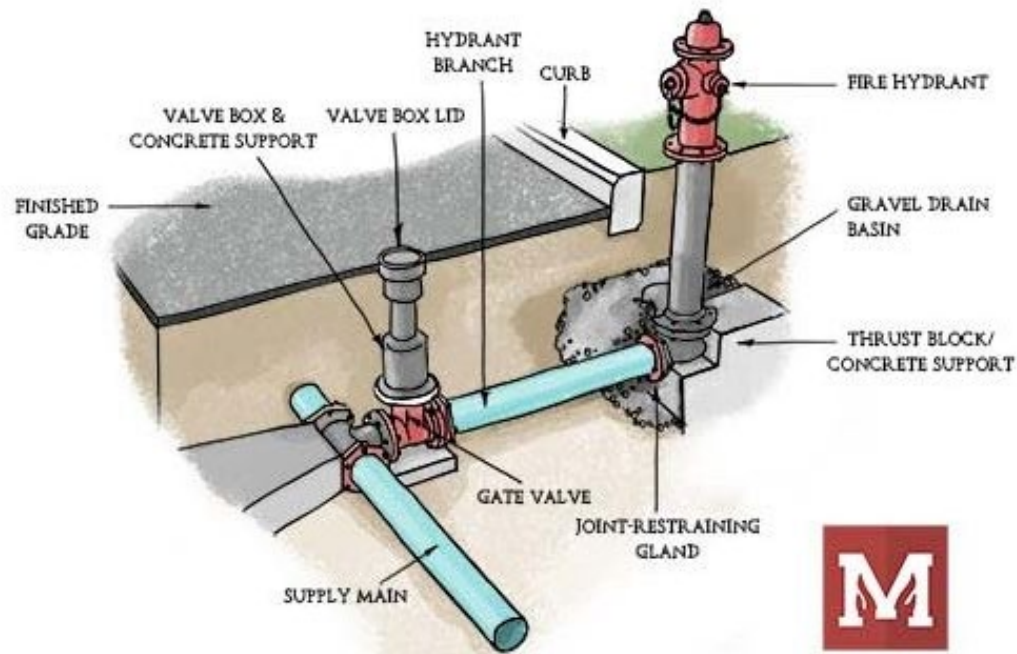
Most of hydrants and services were waterward side, if attached would increase forces and pull waterline out of alignment





## Problem –Thrust Blocks

Design vs. Reality

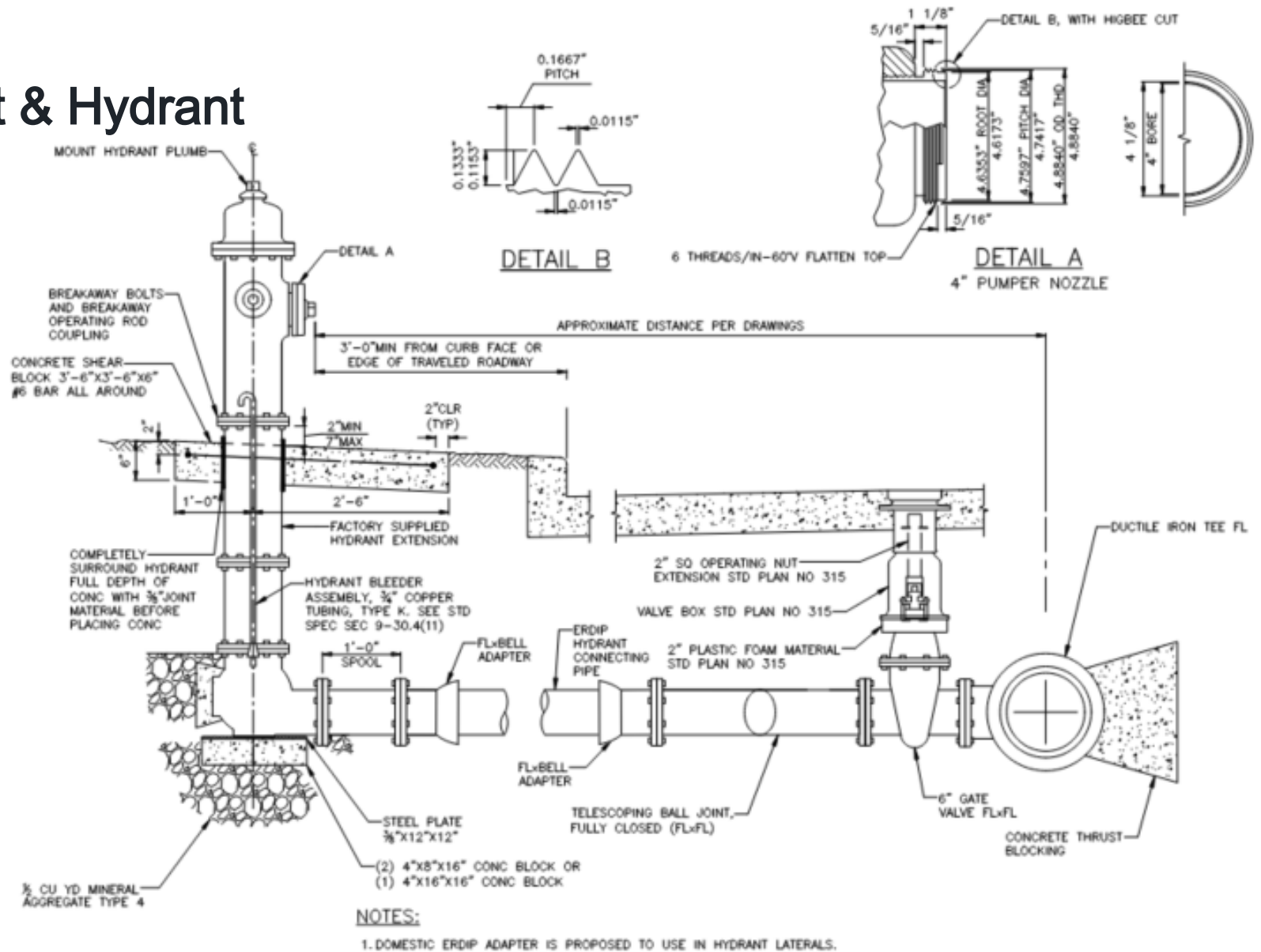


How to...

install a concrete thrust block

# Solutions –Thrust & Hydrant

How to install thrust blocks that are not anchors?





## Solutions –Service Lines



## Solutions –Service Lines

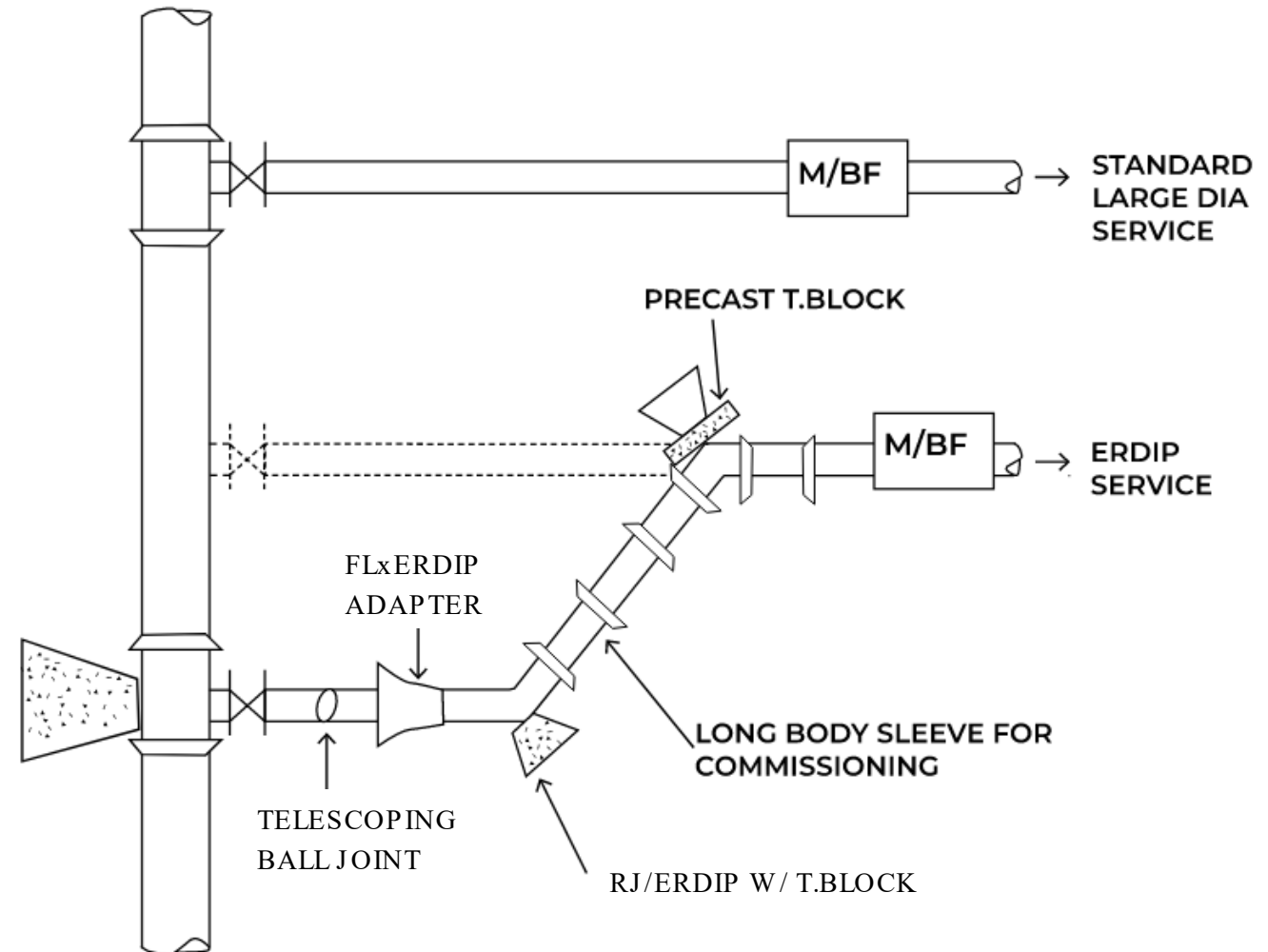
Offset alignment

Transition to RJ or MJ fittings

Test and commission prior to last bend

Use daily or ECO Block for final bend

Limit service interruption to single day





## Solutions –Service Lines

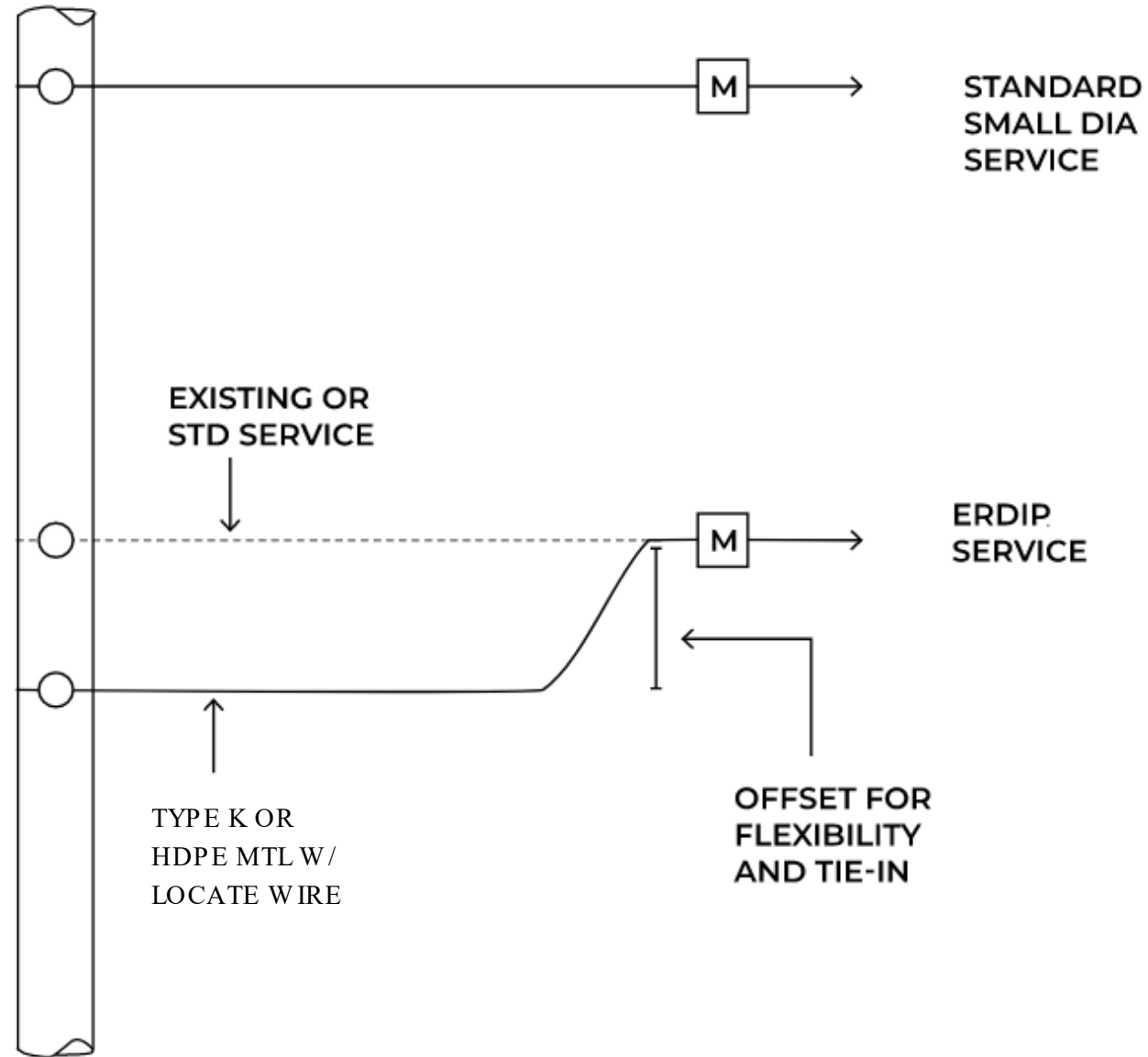
### Flexible Piping

- Type K Copper
- HDPE

### Offset for flexibility

### Offset for shutdown

### Locate wire



## Solutions –Maintain Fire Flow

Confirm fire flow requirements

Perform hydraulic modeling

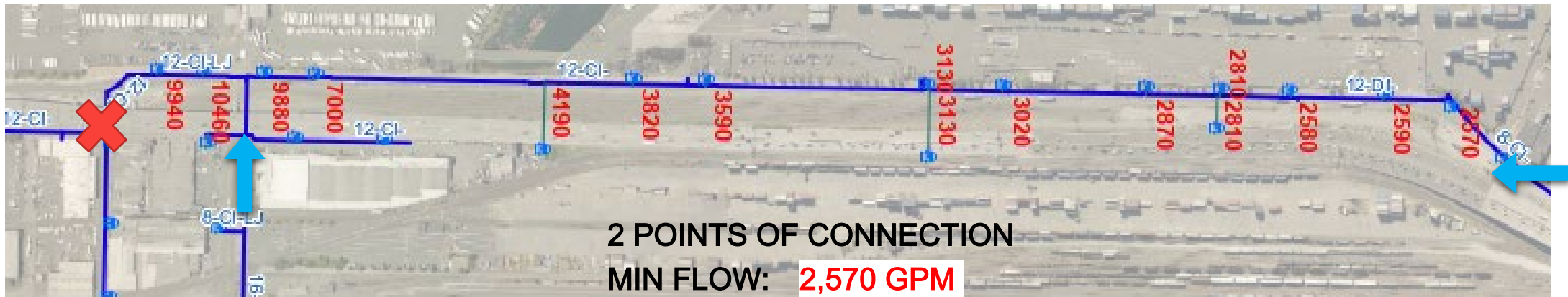
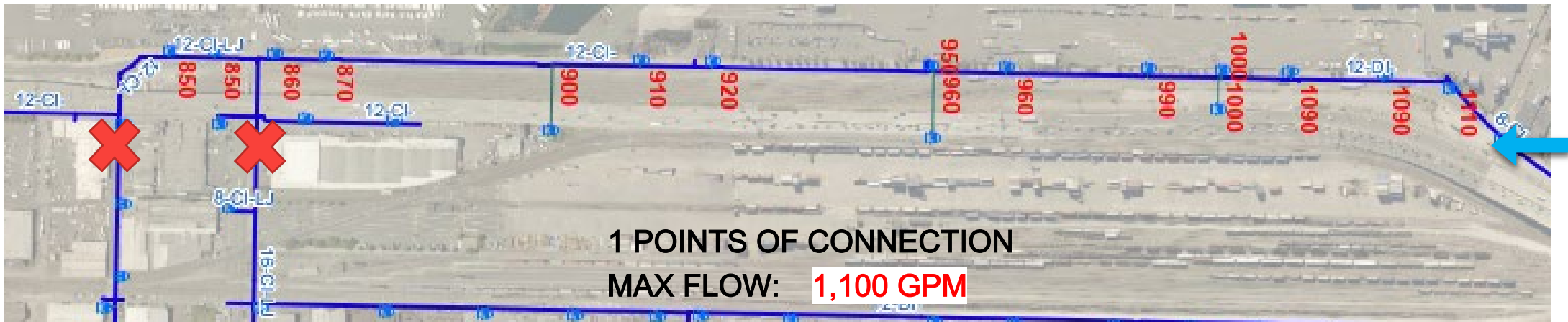
Evaluate alternatives

Document in detailed sequence plan

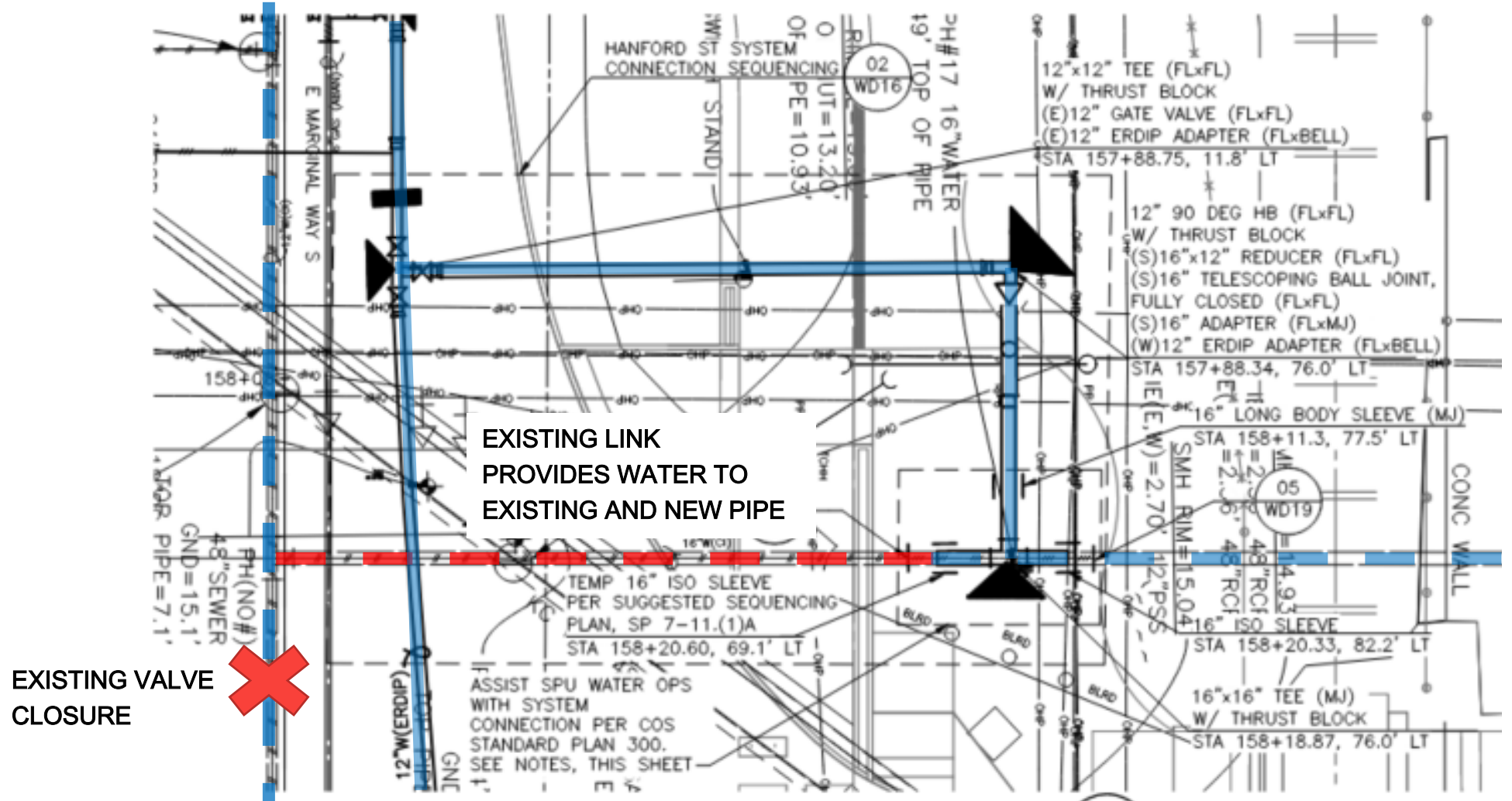




## Solutions –Hydraulic Modeling



# Solutions – Temporary Interties





## Solutions –Detailed Sequencing Recommendations

1. Construct approximately 1,445 lineal feet of main including services and hydrant laterals.
2. Construct Hanford Street connection up to long pattern sleeve.
3. Install temporary block.
4. Flush, pressure test, disinfect, and complete all water quality tests.
5. Remove temporary block to connect Stage 2 and Stage 3 watermains.
6. Owner to complete S Hanford Street System Connection including permanent system connection and temporary system connection. Temporary service connection is necessary to meet Fire Marshal requirements for maintaining fire flow. Temporary system connections to remain active until completion of project and will be disconnected in Stage 6 as described below.
7. Owner to transfer Service #8 (1") and install Irrigation #2 (1.5").
8. Owner to cut/cap/block existing main south of S. Hanford Street.

## Conclusion

### Toolbox additions:

- Thrust block details and specifications critical in seismic design.
- Service line flexibility and offset alignments reduce downtime.
- Different vertical elevation and inertia provide redundant fire flow.







# Thank you

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