Floodproofing Critical Infrastructure:
The Tacoma Central Treatment Plant Flood Protection Project

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Agenda

1. Drivers
2. Physical Context
3. Key Design Elements
4. Implementation Challenges (non-technical)
5. Key Take-Aways
Drivers
Drivers

Increased risk

- increased probability:
  - sediment load
  - increased number of large floods
- 2009 close call
  - 17,000 sandbags
  - 5” rain in two days
  - I-5 lanes closed over Puyallup River
  - came within inches of overtopping levees
- Existing levees
  - certified in 1980s with 3’ of freeboard
  - no longer protect against the base flood
- Flooding mechanisms:
  - from the ‘dry’ side
  - stormwater
Drivers

Increased risk

- increased magnitude of consequence
- WWTP offline for months at least
  Plant assets: just electrical system is $10M; total plant value = $1B)
- significant impacts to maritime economy, tourism, aquatic ecosystems, and beneficial uses
Physical Context
Project Stats

- 2500-ft floodwall surrounding the WWTP
- Ranges from 1-8 feet high above grade; 25’ below ground
- 6 gates
  - Three manual gates
  - Three passive/automatic
- Under budget and 2 months ahead of schedule
- $9M construction costs
- Multiple regional and national awards
- Floodproofed to 0.2% chance event (500 year) + 1 foot
Physical Context

USACE Levee on river side
- Required coordination with USACE
- Critical that levee and floodwall provide complete protection
Physical Context

Utilities

- 32" Stormdrain – brings flow from off site
  - Multiple shutoff valves
- 48" water main
- 42" sewer
Physical Context

Urban Setting

- Major highway (SR 509) - elevated
- Railroad
- City streets
- Main gate & 4 service gates
Key Design Elements
Key Design Elements
Pre-trench for Utilities

• Numerous known utility crossings
  – 32” storm drain
  – 48” water main
  – 42” sewer

• High possibility for unknown utility crossings

Clearing Trench
(3’ X 8’ Deep)
Key Design Elements
Pre-trench for Utilities

• Pre-trench findings
  – Unknown abandoned utilities
  – Unknown “live” utilities
  – Unknown debris

• Pile Driving: proceeded without problems after construction of clearing trench

• Liability: owner → contractor

• Contractor
  – Before: resistant to pre-trench
  – After: biggest supporter of pre-trench

• Cost certainty…for a (small) price
Key Design Elements
Crossing 48” Water Main

Challenges:
- Maintain water line service during flood wall construction
- Existing permeable bedding
Key Design Elements
Crossing 48” Water Main

Low Density Cellular Concrete
Key Design Elements
Passive / Automated Flood Gates

• Closure Structures & Gates
• 6 openings in the flood wall: RR, main entry, and 4 secondary vehicle gates
• Challenges at 3 lowest openings:
  • Nuisance flooding and more frequent closures
  • False alarms leading to operator fatigue
  • Potentially short notice needed to close gates

Passive/Automated Gates

FloodBreak Gate – as delivered
Key Design Elements
Passive / Automated Flood Gates

- Foundation
- Concrete pad
- Subgrade
- Side plates
Key Design Elements
Passive / Automated Flood Gates

Testing

Gate raising
Key Design Elements
Passive / Automated Flood Gates
Implementation Challenges (non-technical)
Implementation Challenges (non-technical)

• Getting to ‘yes’
  – Benefit-cost ratio ($10M in just electrical assets, versus $9M construction cost)
  – Concurrent conversations: pitch to rate-payers in Tacoma; pitch to County and State about regional significance

• Quantify significant environmental and economic impacts to the Region
  – maritime economy, tourism, aquatic ecosystems, and beneficial uses
Implementation Challenges (non-technical)

• Funding – where to get $9M?
  – Initially – all [City] utility rate funded
  – Significant collaboration – Tacoma Environmental Services, with City and County elected officials
  – Pierce County Flood District provided $6M
  – City fronted cost, Flood District pays back $1M a year
  – elected officials – big scissors and awards
    • Groundbreaking
    • Ribbon cutting
Key Take-aways
Key Take-aways: general

- Flood proofing necessary for critical infrastructure in the floodplain
  - 500 yr + 1 foot
- Benefits & impacts: quantify across the region, not just to site assets
- Funding: multiple and varied sources and entities
Key Take-aways: technical

• Creative construction methods needed for building in industrialized floodplain areas
  • Maintaining functionality of existing infrastructure can conflict with floodproofing requirements
  • Extra cost of pre-trenching was worth it to eliminate surprises

• Passive gates – worth the added cost (and generally preferred)

Constructing in the floodplain is complicated. pre-trenching helps
Key Take-aways: coordination

• Coordinate with other nearby infrastructure owners:
  • USACE levees
  • BNSF railroad
  • City of Tacoma stormwater pipe
  • WSDOT State Highway
Thank you!

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