# My Raw Water Facilities are Vulnerable. What Should I do if a CSZ EQ Happens Tomorrow?



May 7th, 2026

PNWS-AWWA 2026 Section Conference, Tacoma, WA

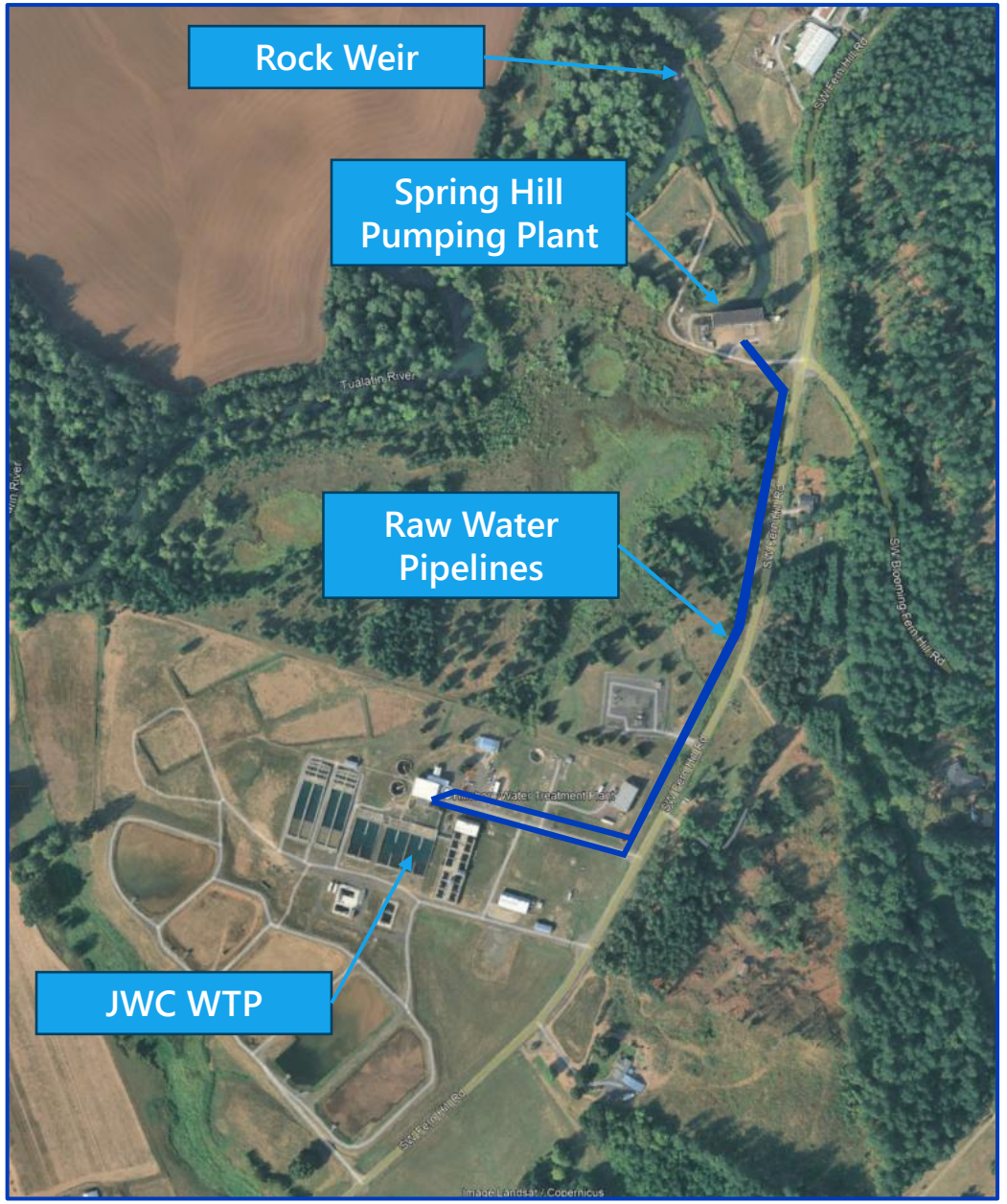
# Agenda

- Background and Site Conditions
- Purpose and Level of Service Goals
- Alternatives and Evaluation
- Raw Water Supply Contingency Plan
- Conclusion

# Background & Site Conditions

# Background

- JWC WTP receives its raw water supply via:
  - » Spring Hill Pumping Plant
    - Located on a back channel of Tualatin River
  - » Two raw water pipes
    - 36- and 42-inch welded steel pipe
- Original plant facilities, constructed in the 1970s



# Raw Water Intake – Spring Hill Pumping Plant

- Spring Hill Pumping Plant (owned by USBOR)
  - » JWC shares the capacity with Tualatin Valley Irrigation District
  - » Rock Weir at the head of the backchannel helps maintain water level
- **Importance**: Critical for providing raw water to the JWC WTP
- **Key Risks**: Structural damage, loss of pumping capacity, complete loss of facility.



# Rock Weir

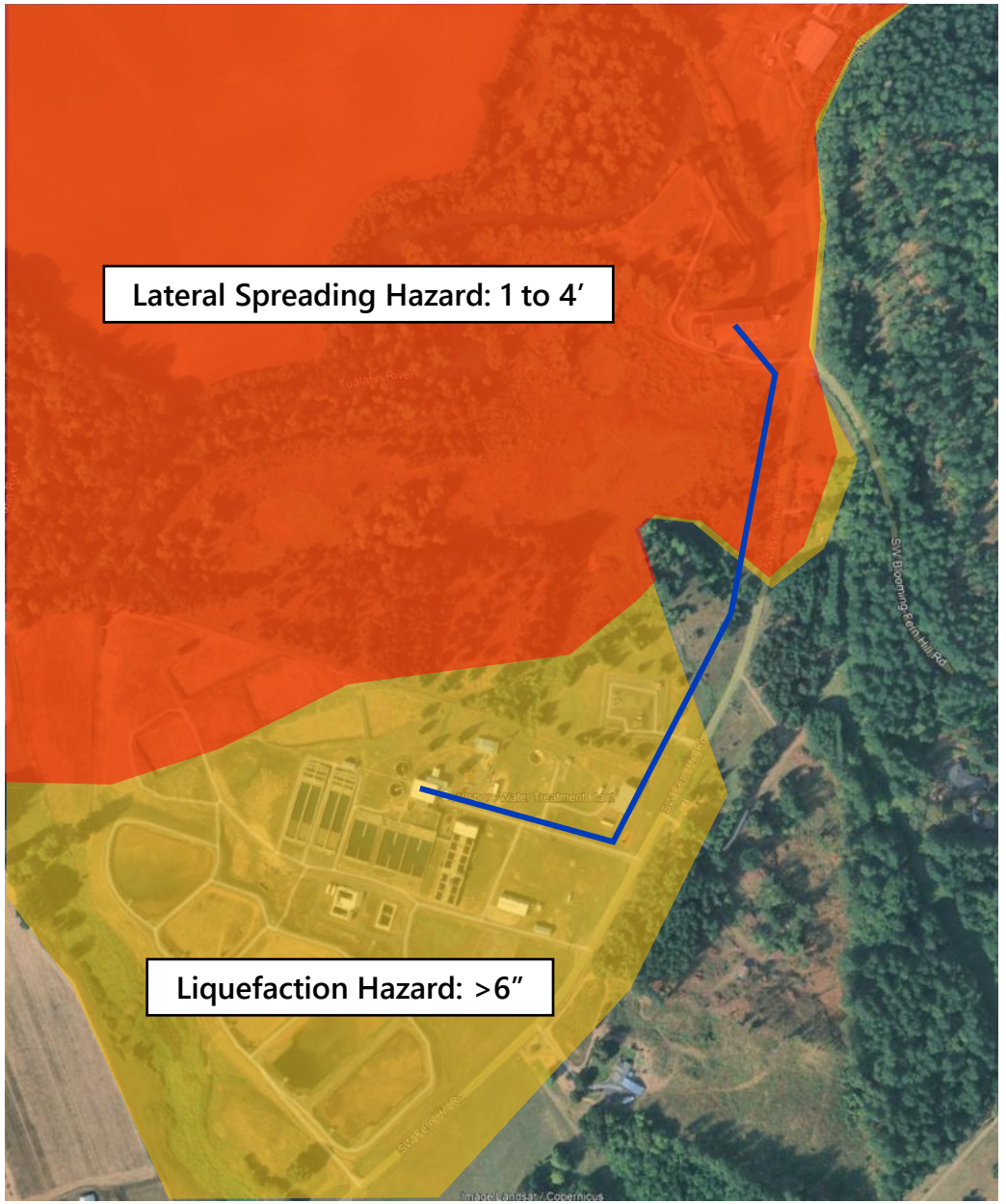
- **Importance:** Critical for maintaining river levels and ensuring the long-term performance of SHPP.
- **Key Risks:** Potential damage and/or loss of elevation after major seismic event, impacting water levels.



# Seismic Hazards

- WTP,  pumping plant, and raw water pipelines located in high seismic hazard area, jeopardizing structural integrity and functionality of these facilities.
- JWC has implemented a resiliency improvement plan for WTP via system upgrades and replacement overtime.
- New intake and raw water pipelines are recommended; however, timing is uncertain.

- **Contingency plan for raw water supply in emergencies is required.**



# Purpose & Level of Service Goals

# Purpose of the Emergency Raw Water Supply Plan

- To ensure a reliable raw water supply to the WTP immediately after a seismic event by:
  - Evaluating alternatives for supplying raw water, assuming significant seismic damage to the current facilities.
  - Developing a contingency strategy for providing raw water following an earthquake.

# Level of Service Goals

- Level of service (LOS) goals evaluated for JWC:
  - » *2008 JWC seismic study*
  - » *2013 Oregon Resilience Plan*
  - » *2018 JWC facility plan*
  - » *2020 JWC Master Plan*

| Seismic Event | Immediate Capacity (mgd) | Short-Term Capacity (mgd) | Short-Term Restoration Time (Days) |
|---|---|---|---|
| 72-year Event | 42 (ADD) | 42 (ADD) | 0 |
| M9.0 CSZ Event | 0 | 28 (WADD) | 1 |
| 2,475-year Event (Day 3) | 0 | 14 (1/2 WADD) | 3 |
| 2,475-year Event (Day 14) | 0 | 28 (WADD) | 7 to14 |
| 2,475-year Event (Day 90) | 0 | 42 (ADD) | 60 to 90 |
| ***ADD – Average Day Demand; WADD – Winter Average Day Demand.*** | | | |

***These LOS goals are for the resilient RW intake/pipes, WTP and transmission systems (after the completions of the resilience improvement projects in the next 40 years)***

# Design Criteria for Emergency Raw Water Supply

## Primary Criteria

- **Develop a practical, cost-effective system for efficient deployment following an emergency**

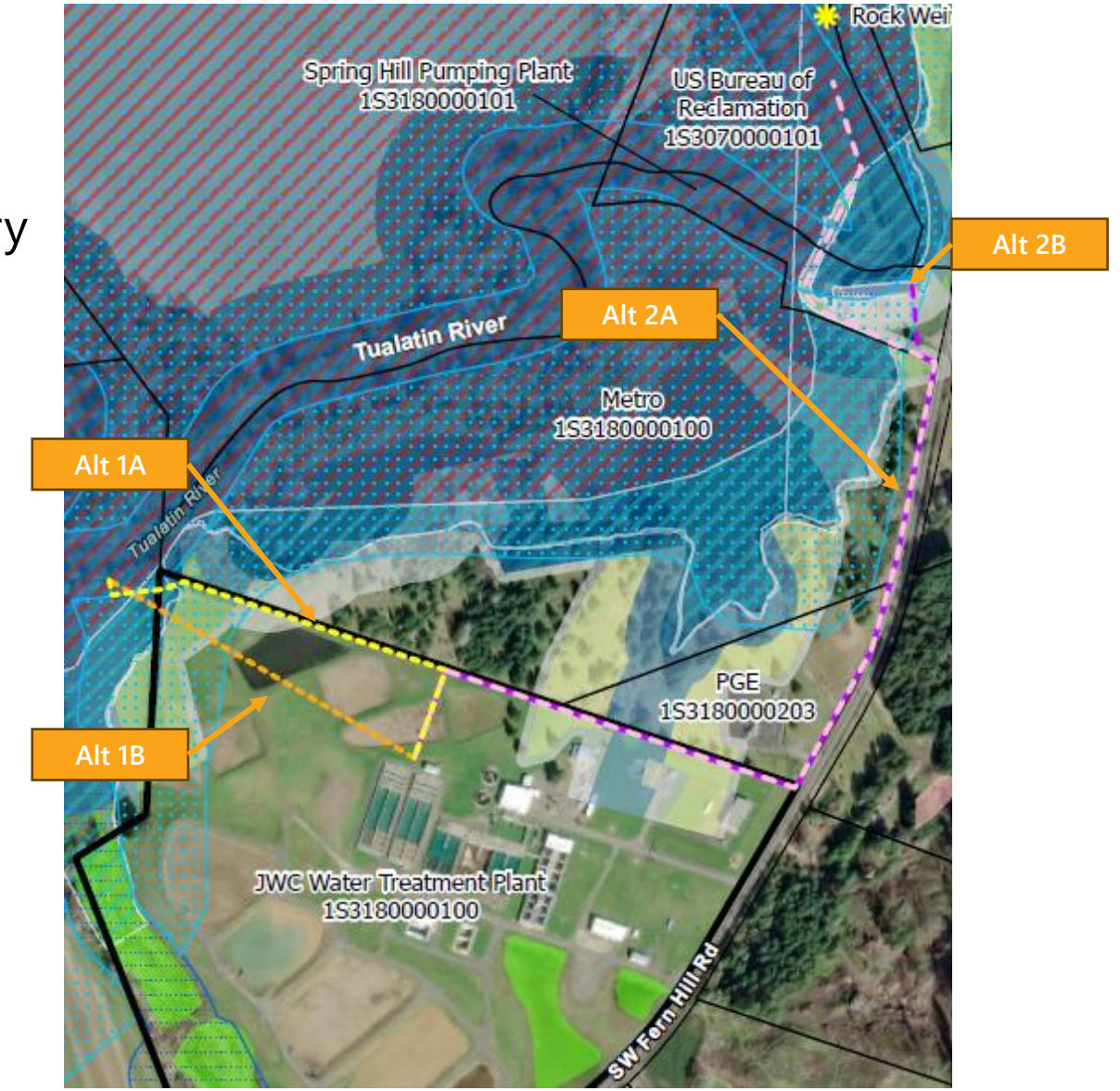
## Design Criteria

- **Design Earthquake:** M9.0 CSZ (475-year event).
- **Immediate Response:** Provide 8 MGD in 3 days.
- **System Repair/Recovery Process:** Increase capacity to 12 MGD with an additional pump.

# System Alternatives and Evaluation

# Alignment Alternatives

- Four alignments were evaluated in the preliminary screening phase:
  - » Alternative 1A – West Perimeter
    - 1,350 LF, Buried/On-Grade
  - » Alternative 1B – West Direct
    - 1,050 LF, On-Grade
  - » Alternative 2A – East River
    - 3,760 LF, On-Grade
  - » Alternative 2B – East Backchannel
    - 2,900 LF, On-Grade



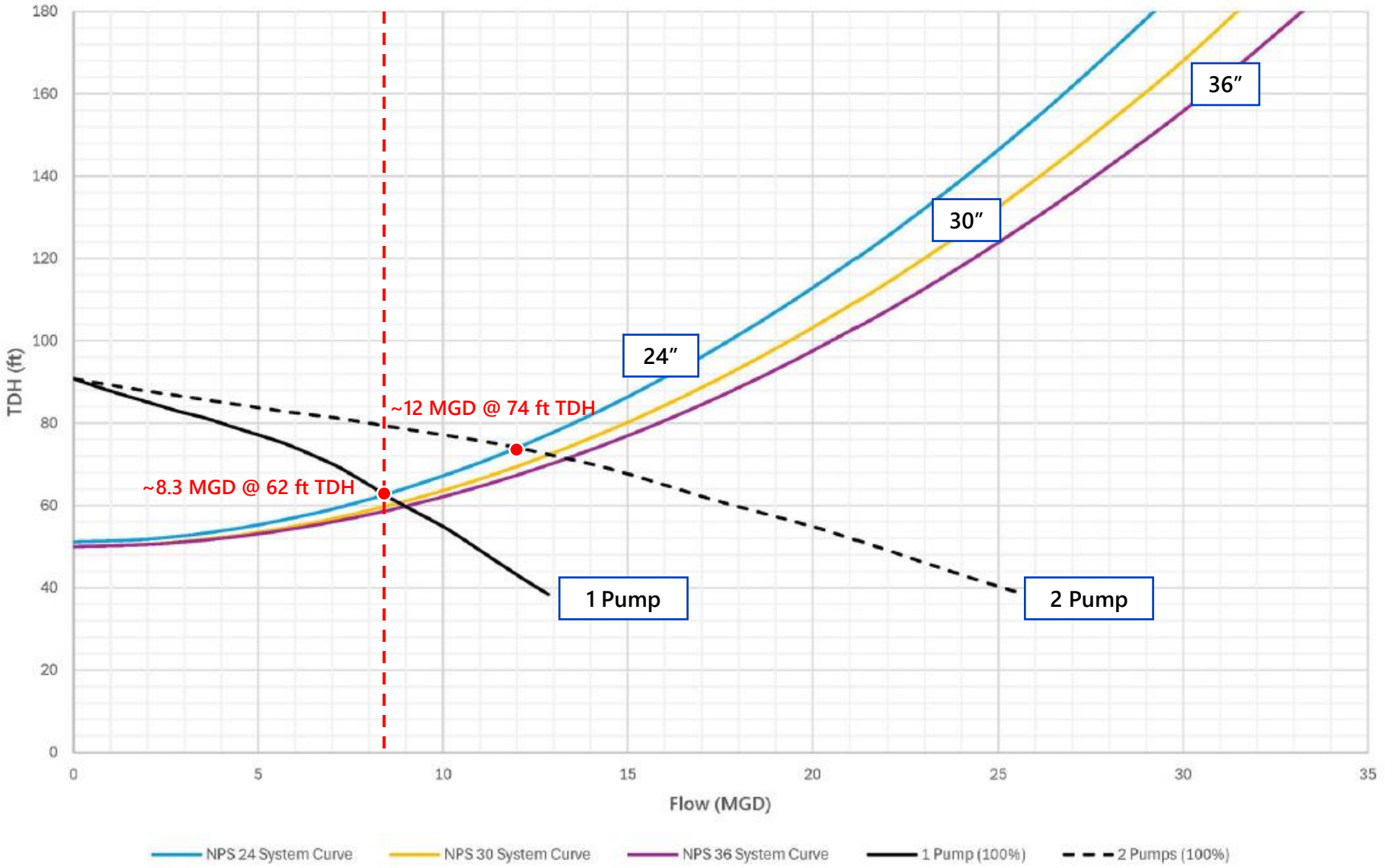
# Pipeline Material

- HPDE, PVC and DI pipelines were evaluated
- HDPE was recommended
  - **Cost-effective**
  - **Durable and Resilient**
  - **Leak-proof joints without requirements for thrust restraints.**
  - **Resistant to UV**
  - **Easy to transport, handle, and move around site.**
- A minimum dimension ratio (DR) of DR 17 is recommended to handle pressure fluctuations.



# System Sizing

- System curves used to select pipeline diameter and pump duty point.
- Recommended nominal pipe size:
  - » **24-inch**



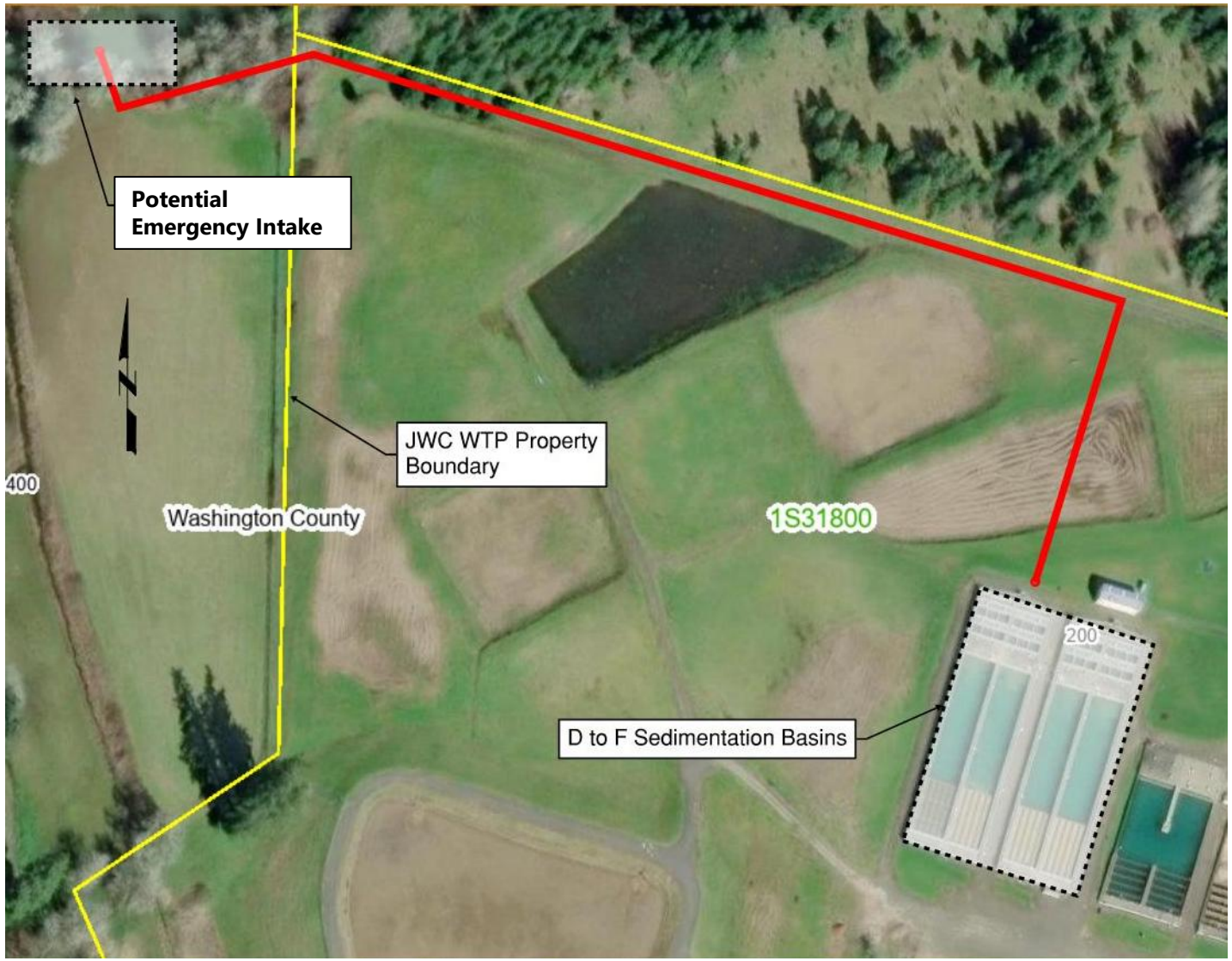
# Evaluation Criteria

- **Deployability (60%)**
  - » Schedule, Equipment, Crew/Staff Requirements
- **Operations and Maintenance (10%)**
  - » Storage and Preventative Maintenance Requirements
- **Property Requirements (10%)**
  - » ROW and Access
- **JWC WTP Impacts (10%)**
  - » Constraints to WTP or future improvements, impact on facility repair or recovery
- **Environmental Impacts (10%)**
- **Cost (Unweighted)**

# Alignment Alternatives Evaluation Summary

| Criteria | Alternative 1A | Alternative 1B | Alternative 2A | Alternative 2B |
|---|---|---|---|---|
| Deployability | 5 | 3 | 2.3 | 2.3 |
| Crew/Staff Requirements | 5 | 3 | 3 | 3 |
| Property Requirements | 3 | 3 | 5 | 5 |
| JWC WTP Impacts | 4.5 | 3 | 2 | 2 |
| Environmental Impact | 5 | 5 | 5 | 5 |
| Unweighted Score | 21.5 | 17 | 16.3 | 16.3 |
| **Weighted Score** | **22.3** | **16** | **14** | **14** |
| | | | | |
| ROM (Class 5) Cost Estimate | $662,000 | $518,000 | $824,000 | $727,000 |
| +40% Contingency | $927,000 | $725,000 | $1,154,000 | $1,018,000 |

# Recommended Alignment – Alternative 1A




## Alignment 1A

- Intake location approximately 3,500 feet upstream of rock weir.
- Pipeline is approximately 1,500 LF, 24" HDPE pipe primarily along north perimeter of WTP.
- Alignment within the WTP - buried to expedite response in an emergency.
- Emergency access to the property west of the WTP required.

# Raw Water Treatment During Emergency

***Key considerations:***

- Seismic activity may negatively impact raw water quality - leading to elevated sediment levels and higher turbidity.
  - Existing WTP utilizes conventional pretreatment process such as coagulation, flocculation and sedimentation, followed by filtration and disinfection.

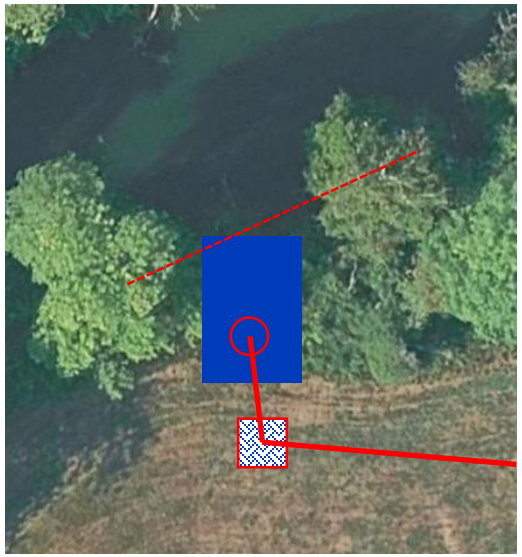
- Moderate to significant damage is anticipated to most of the existing WTP.
  - Rapid mixing basins, piping and chemical feeds are not anticipated to be operable.
  - Filters 15 and 16 and flocculation/sedimentation basins D to G are anticipated to remain operable.

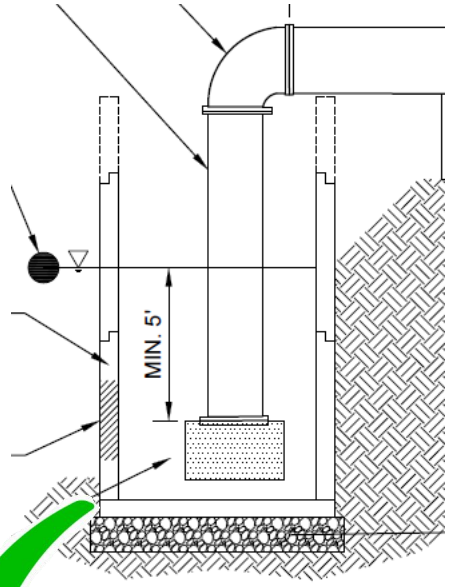
# Raw Water Treatment

- **Aluminum sulfate** for coagulation, added near the sedimentation basins via static mixer.
- **Sodium hypochlorite** for pre-chlorination and to improve coagulation, added near the pump via injection quill.
- **Sodium hydroxide** to boost pH and alkalinity, added near the pump via injection quill.

Chemical storage totes should be purchased and stored on site to transfer and deploy existing chemical near the temporary system.

# Alternatives for Intake Layout






## Screened Intake

- A screened pump suction pipe housed within a manhole provides a basic intake solution.

### Advantages:

- Easy to install and has a lower initial cost.

### Disadvantages:

- *Debris Management:* Larger openings may allow more debris to pass though, which may require inspection and cleaning.
- *System Vulnerability:* A robust pretreatment system is essential to handle debris.



## Self-Cleaning Intake

- Pressurized internal backwash system automatically cleans the screen.

### Advantages:

- Finer screen minimizes debris entering the system.

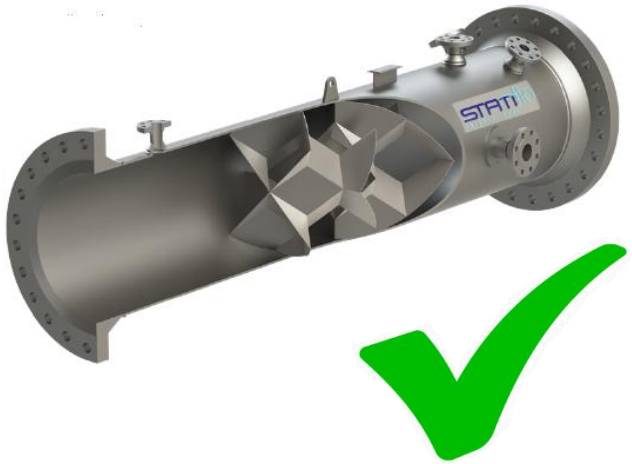
### Disadvantages:

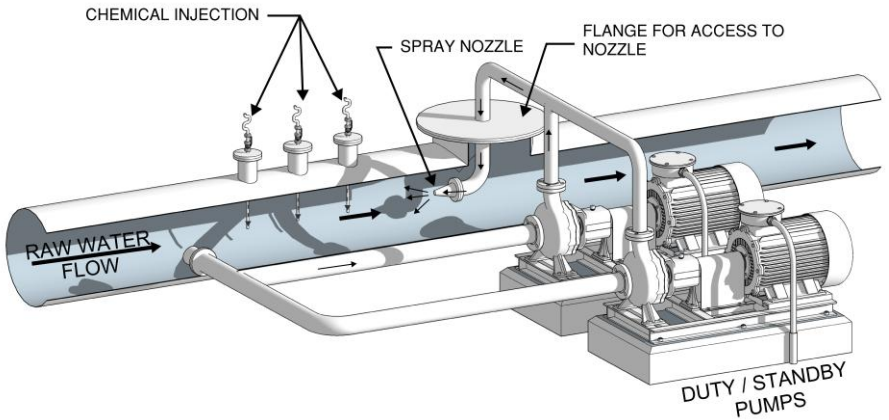
- *Higher Cost & Complexity:* More expensive option that requires a larger intake and potentially more extensive preparation time.
- *Ongoing Needs:* Maintenance may still be required to manually clean the screens.



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# Alternatives for Chemical Addition and Mixing






**Static Mixer**

- *Principal*: Creates a turbulent flow path to mix fluids without moving parts.

**Advantages:**

- Low energy and maintenance requirements.
- Compact in-line installation without additional moving parts.

**Disadvantages:**

- Mixing increases head loss.
- Limited contact time for mixing.
- Potential risk of debris clogging the baffles.

**Pumped Diffusion**

- *Principal*: A pressurized water jet mixes with injected chemicals.

**Advantages:**

- Minimal head loss without additional moving parts in the pipeline.
- Lower risk of clogging from debris.

**Disadvantages:**

- Requires additional pumping and piping components.

# Raw Water Supply Contingency Plan

# Rock Weir Resiliency Plan

## Recommendation and Actions:

- Stockpile angular riprap material near the existing weir for rapid reconstruction after a seismic event.
  - » ODOT Class 700 gradation.



# Temporary Raw Water Supply Plan

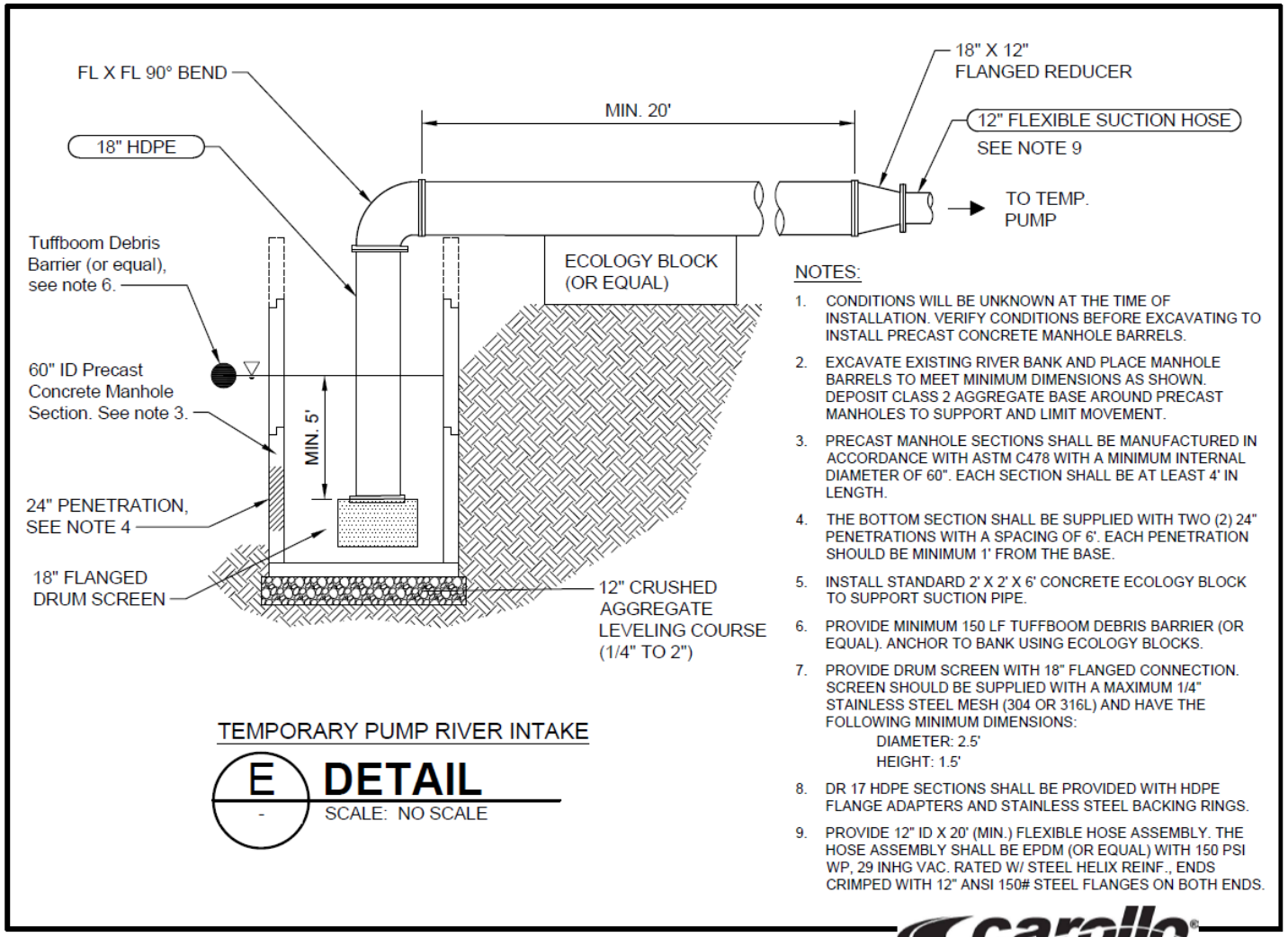
## Recommended Emergency System Components

- **Intake & Pumping**
  - » ~50 LF of 18-inch DR 17 HDPE Suction Piping
  - » Temporary 125-hp Pump Trailer
  - » 24-inch Pump Manifold (w/ Check and Isolation Valves)
- **Transmission Piping**
  - » 24-inch DR 17 HDPE Pipeline
    - – ~160-200 LF on-grade
    - – ~1,300 LF buried
    - – ~100 LF discharge piping
- **Pretreatment**
  - » Diffusion Quills and Static Mixer
  - » Ultrasonic non-intrusive flow meter
- Aggregate stockpile for access roads and equipment pads.

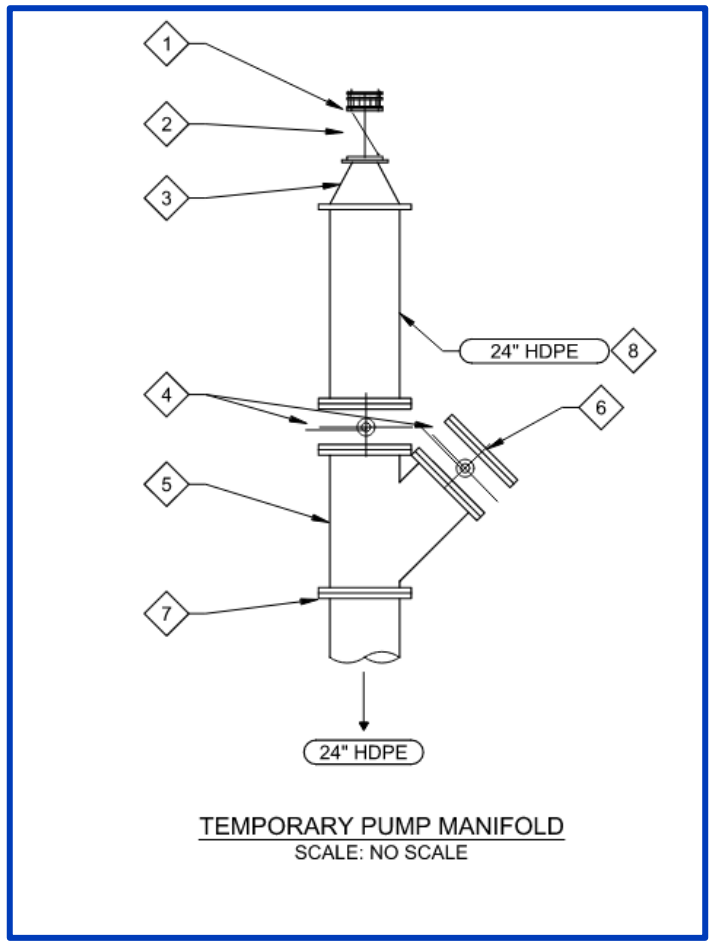

APPROXIMATE LIMIT OF BURIED PIPING. INSTALL PIPE PER DET CY111
TUALATIN RIVER
TEMPORARY RIVER INTAKE (DET E)
22.5 DEG BEND DR 17 HDPE BEND
TEMPORARY PUMP LOCATION AND PUMP MANIFOLD
A
2
1
JWC WTP PROPERTY LIMIT
JWC WTP PROPERTY LIMIT
90 DEG BEND DR 17 HDPE BEND
A
APPROXIMATE LIMIT OF BURIED PIPING. INSTALL PIPE PER DET CY111
B
2
C
EX. OFFICE
D
EX. SEDIMENTATION BASINS (D-G)
EX. SEDIMENTATION BASINS (A-C)
EX. FILTERS
SW FERN HILL RD
KEY NOTES:
1. INSTALL APPROXIMATELY 1,150 LF OF BELOW GRADE PIPING WITH MINIMUM 4 FT COVER PER TYPICAL DETAIL CY111.
2. INSTALL ABOVE GROUND PIPING. RESTRAIN GROUND PIPING USING EARTHEN BERMS WITH A MINIMUM
GENERAL NOTES:
1. CONDITION OF AREA ADJACENT TO RIVER MAY VARY FOLLOWING AN EARTHQUAKE. IT IS RECOMMENDED THAT ADDITIONAL SEGMENTS OF PIPE ARE STORED TO BE ABLE TO MAKE CONNECTION.
2. BURIED UTILITIES ARE NOT SHOWN IN FIGURE. VERIFY LOCATION PRIOR TO ANY EXCAVATION AND INSTALLATION.
FIGURE 1 - JWC HAZARD MITIGATION PLAN
TEMPORARY PIPELINE ALIGNMENT
0
75'
150'
300'
SCALE: 1" = 150' (HORIZ)
carollo

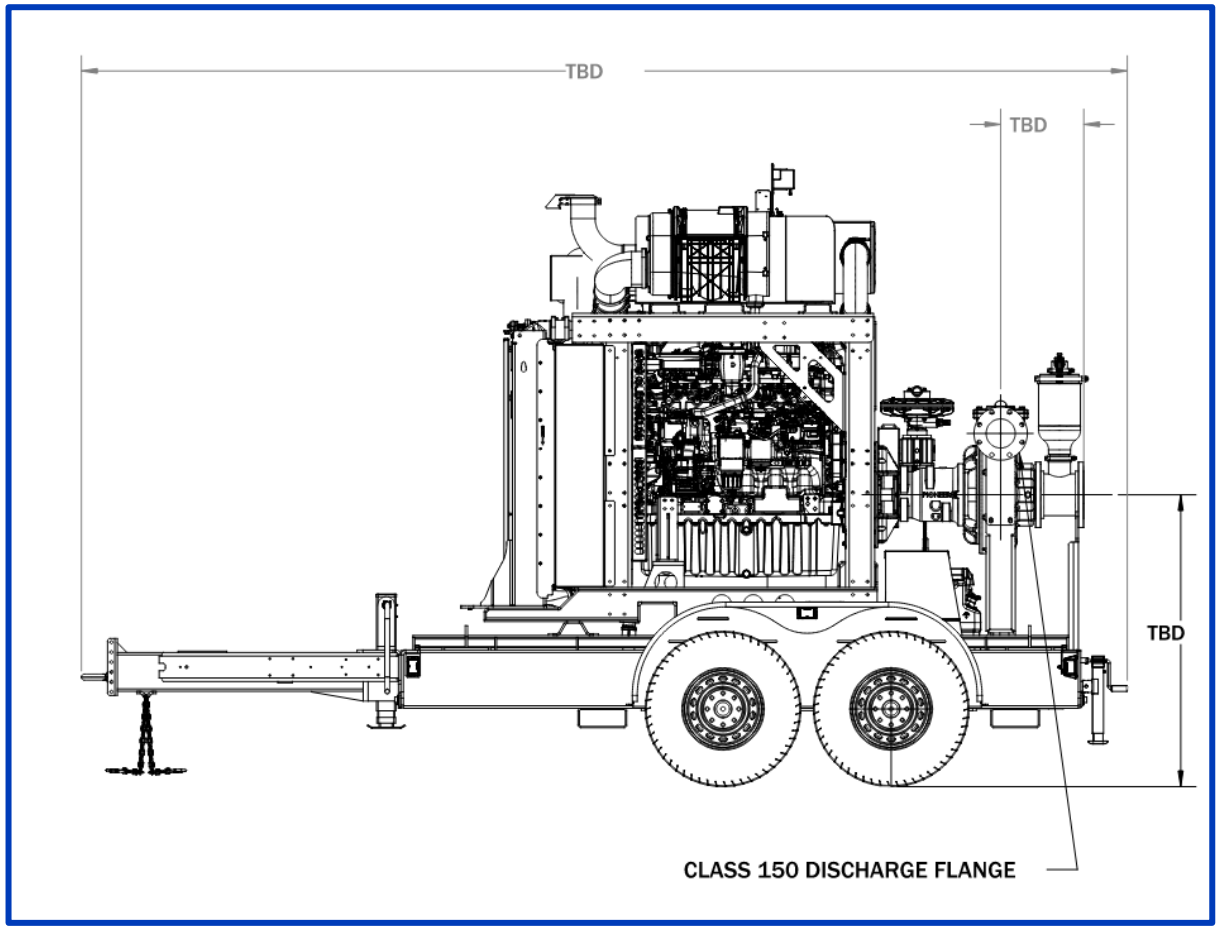
# Intake

- **River conditions are unpredictable after a seismic event; high likelihood of significant floating debris.**
- **Solution:** A robust pump intake design that can adapt to these challenges.
- **Design Elements:**
  - Excavate existing bank to set manhole barrel.
  - Buoy or aquatic vegetation scree for floating debris.
  - Finer screens on MH and pump intake.

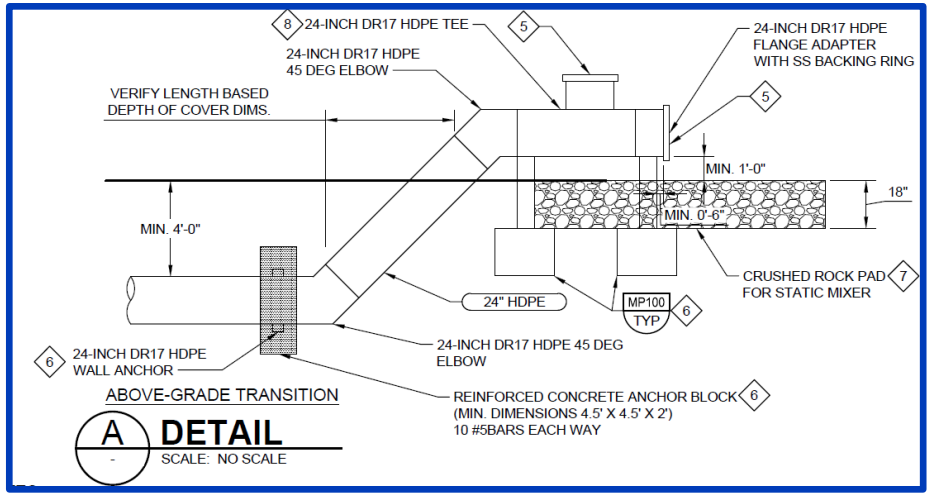


# Pumping Configuration

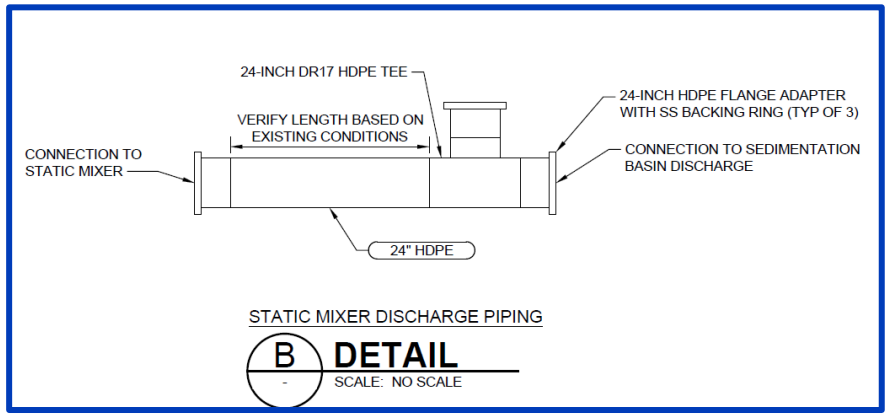


# Pipe Transition & Static Mixer Connection

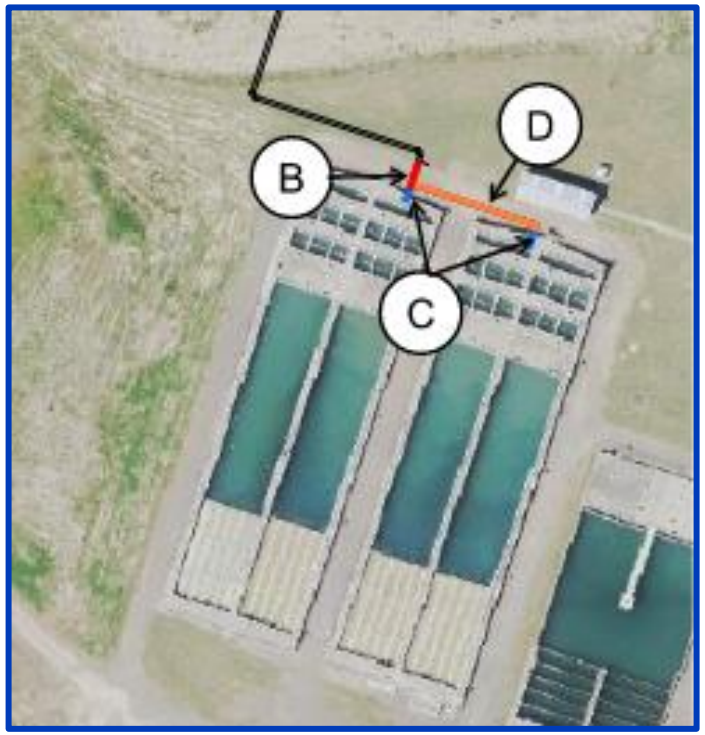


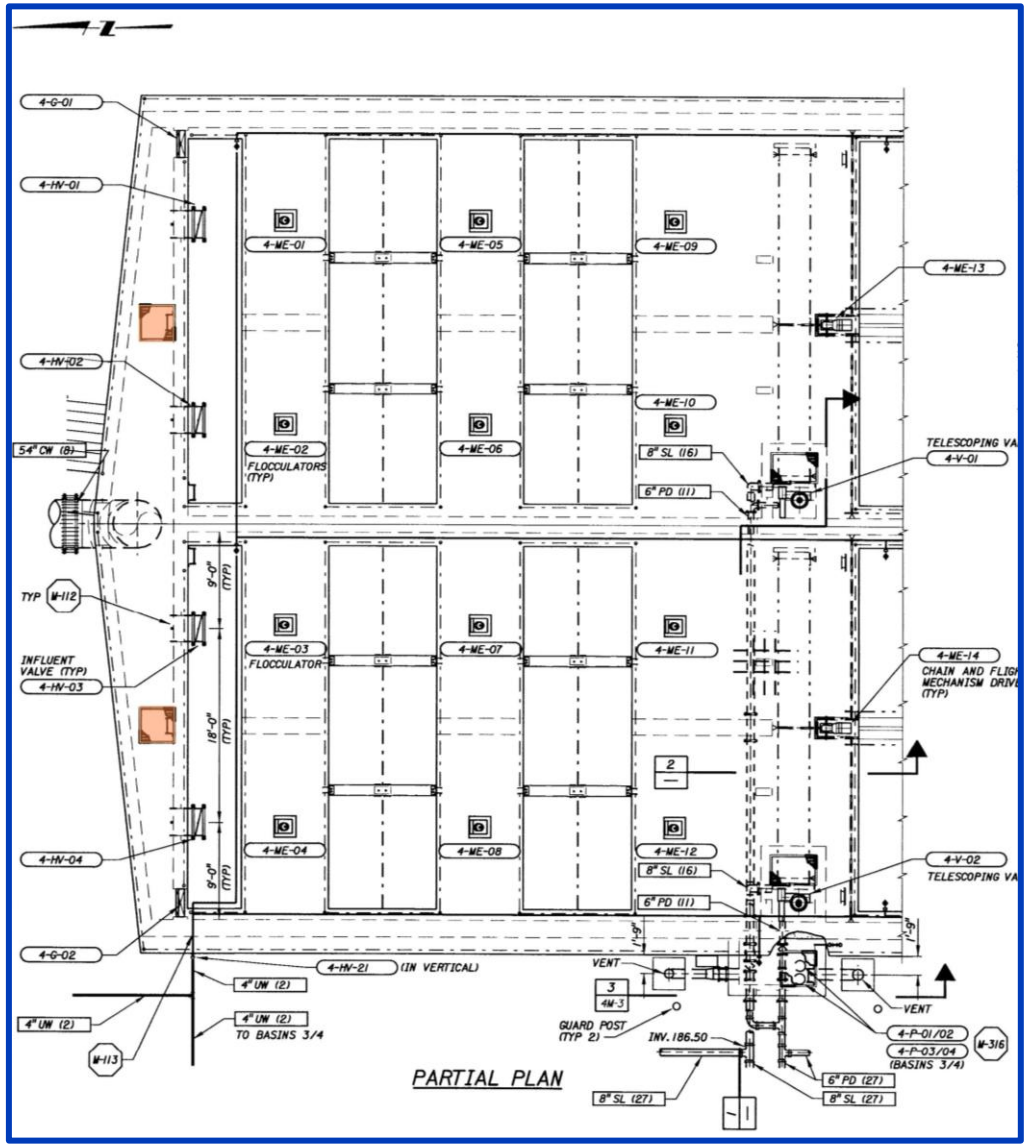


# Discharge Piping

- Pre-assemble several sections on-site.
- Store sections near their final installation points.

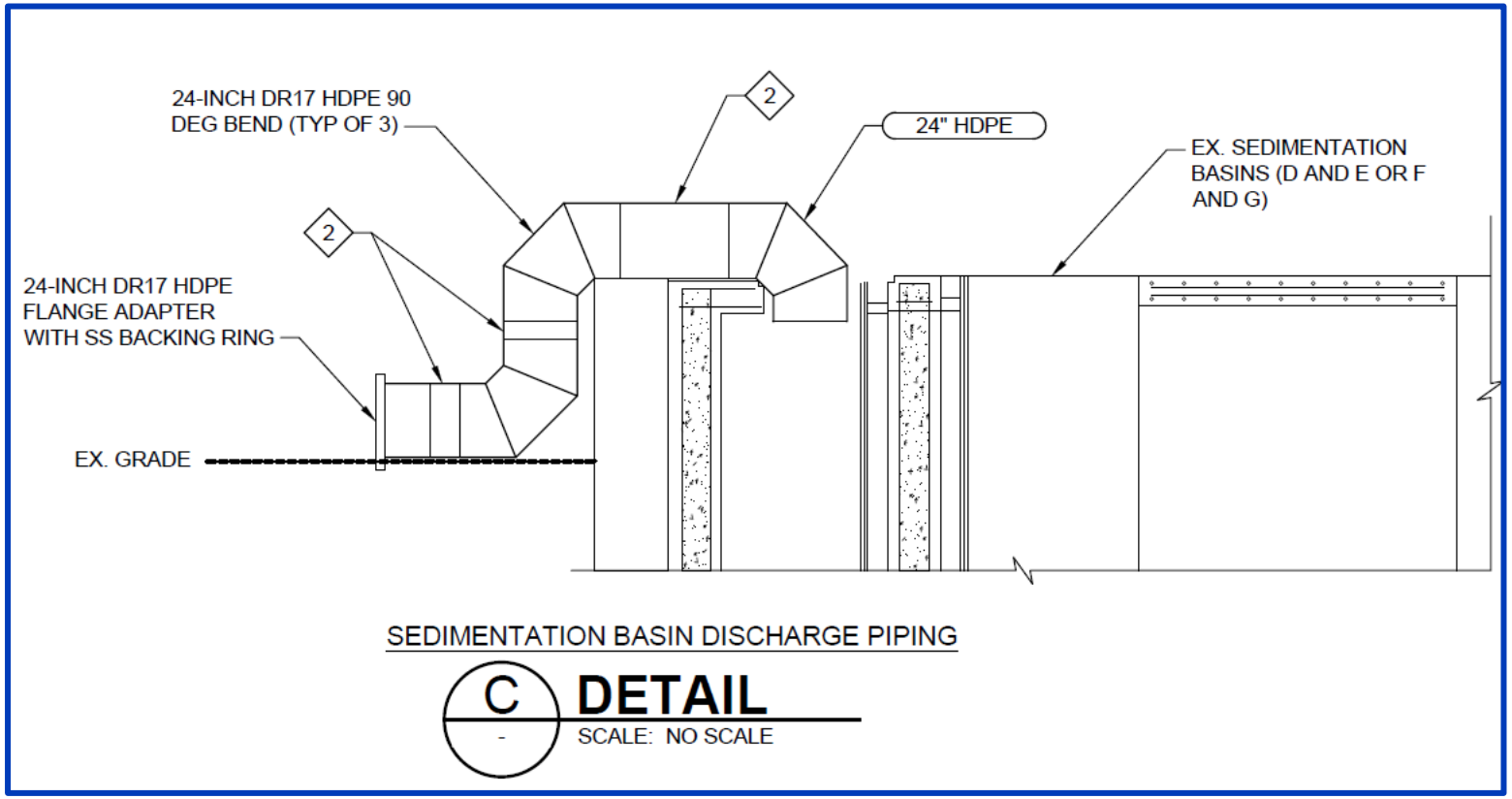


# Discharge to Sedimentation Basins







# Conclusion

# Estimated Costs

- Contractor Performed Early Works:
  - Scope: installing buried pipe sections, access road construction and concrete works.
  - Class 3 Estimated Cost: $781k
  - Accuracy Range: $625k (-20%) to $1.0M (+30%)
- JWC Pre-Purchased & Self-Performed Works:
  - Scope: pump intake structure, pump trailer, pump manifold, valves, static mixer, flow meter, chemical storage totes….
  - Class 3 Estimated Cost: $548k
  - Accuracy Range: $438k (-20%) to $712k (+30%)

# Conclusion

- Significant damages to JWC's raw water facilities after a major seismic event threaten their raw water supply to JWC WTP.
- Seismic improvements and replacements of existing raw water facilities are costly and with time uncertainty.
- JWC is taking proactive measures to address this significant issue by developing a raw water supply contingency plan.
- The plan is developed to focus on system simplicity, practicality and fast deployment immediately after the major seismic event.
- The plan consists of a temporary river intake, pump trailer and manifold, buried pipe section and on-land pipe sections to connect to pre-treatment chemical injection/mixing system and to the existing sedimentation basin for water treatment.
- The plan is developed to supply approximately 8 MGD within 3 days after the earthquake and approximately 12 MGD during the follow-up WTP repair and recovery period.