WEBBERS FALLS RECENT PROJECTS AND SCOUR REPAIR

SAME Meeting September 18, 2025

Webbers Falls, OK.

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Meeting Agenda

- 10:30 – 11:40 – Travel from Tulsa to Webbers Falls Powerhouse, eat boxed lunches (gather at USACE office Visitor's Parking Lot for caravaning, travel Highway 51 East)
- 11:40 – 12:10 – Sponsor Spotlight, Safety Briefing, Q&A with Contractor
- 12:10 – 12:20 – Recent projects overview (Project Signage, Upstream Dike Repair, Downstream Site Work, Tainter Gate Rehab)
- 12:20 – 12:40 – Scour Repair Background, Design, Construction Products
- 12:40 – 13:05 – Field Visit, Staging Area Viewing
- 13:05 – 14:15 – Travel from Webbers Falls to Tulsa

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Presentation Agenda

Recent Projects Overview

- Project Signage
- Upstream Dike Repair
- Downstream Channel Site Work
- Tainter Gate Rehab/Replacement

Scour Repair

- Background
- Design Detailing
- Construction

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Scheduling Challenges

- President's Budget FY21-24 presented concurrent challenges
- Continuing Resolution Authority (CRA) has limited historic and present Operations and Maintenance Budgets
- Government has operated under CR for 27 consecutive years, dating back to FY98
- Generally, limits new fiscal year budgets to 0-5% above the average of previous 5 fiscal years
- Increasing construction costs outpace budgets to perform the required O&M work
  - Thus, work gets "piled up" and may occur simultaneously

Project Signage

- Replaces existing aged signage with new signage meeting modern standards for font size, color, reflectivity, and material
- Work was performed concurrently with tainter gate rehab project on the downstream side of the dam

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Upstream Dike Repair

Basis of Project:

- Significant vegetative growth undermines dike cohesion
- 2019 Flood inundation resulted in dike breaches
- Historic dike degradation for elevation and cross section

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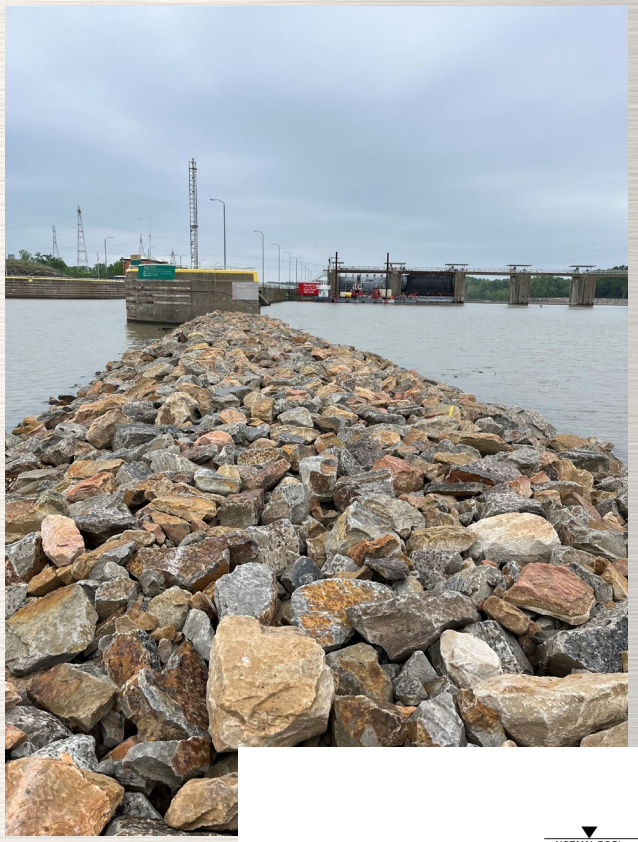
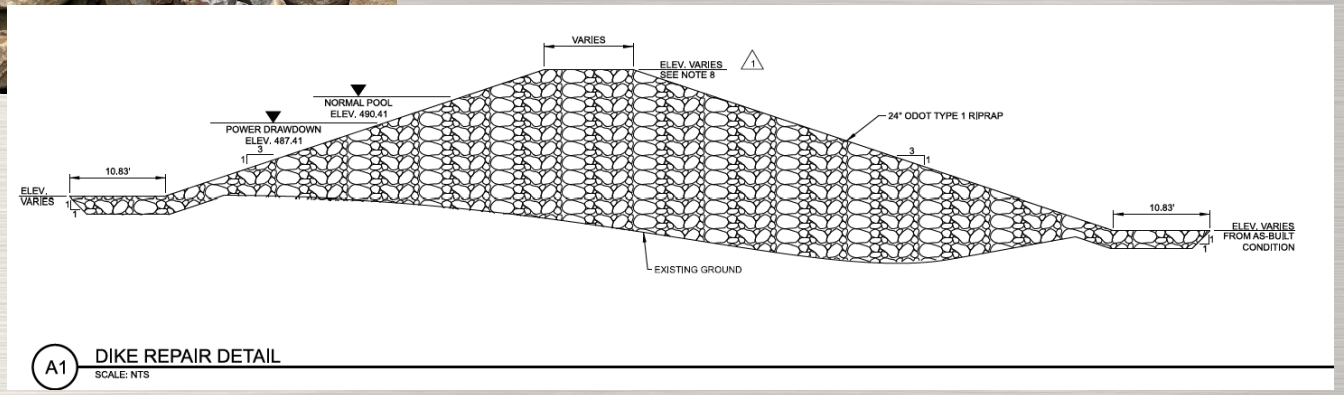
Upstream Dike Repair



Work occurred concurrently with tainter gate rehab, site work, signage replacement, scour repair, and powerhouse repairs

Completed Dike Repair:

- Removed Vegetation
- Re-established crest width
- Improved riprap and bedding
- Re-established channel toe alignment for lock and spillway



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Downstream Site Work

Work occurred concurrently with tainter gate rehab, dike repair, signage replacement, scour repair, and powerhouse repairs

2019 Flooding in northeast Oklahoma and southeast Kansas resulted in significant flows which degraded the channel banks

Existing riprap and subgrade was washed downstream, significant damage to powerhouse access road

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Downstream Site Work

Repair Access Road to Powerhouse Gate

Demolish damaged roadway, foundation prep, agg base

Access Road, Guard Rail and Fence

Demolish damaged roadway, foundation prep, agg base, asphalt (option)

Remove and replace damaged guardrail and fencing

Riprap Embankment Repair and Debris Removal Downstream

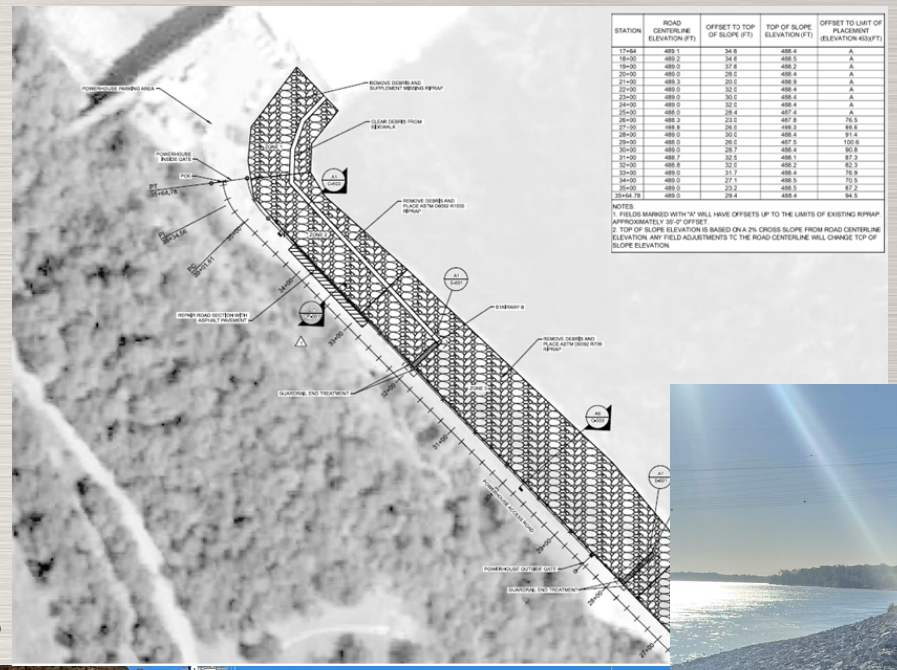
Two (2) gradations of riprap, limits of each shown on plans

Walkway and Stairs Replacement

Repair one stair to remain in place, replace one stair, repair damaged walkway

Guardrail and Fence Repair

Remove and replace damaged guardrail and fencing



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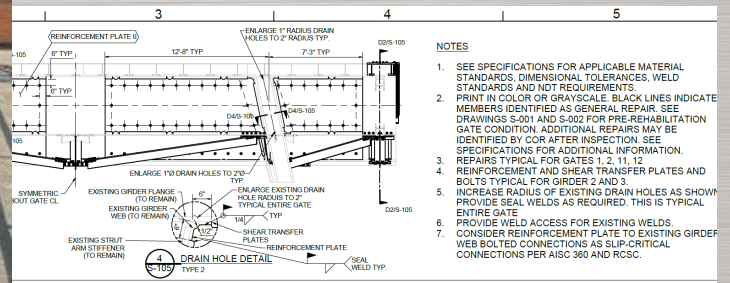
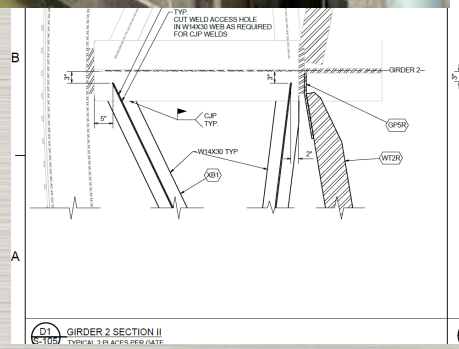
Tainter Gate Rehabilitation

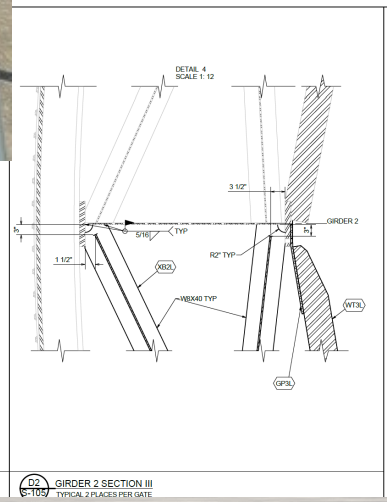
Work occurred concurrently with site work, signage replacement, dike repair, scour repair, and powerhouse repairs

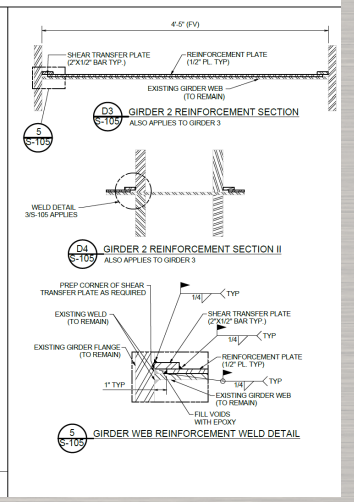
Many phases for complete Tainter Gate Repair:

- Deconstruction of gate, blasting, inspection and report
- Removing skin plate
- Reinforcing girders and stringers
- New members and welds
- Skin Plate and Stiffener Plate Rehab
- Seal and Wire Rope Rehab
- Painting, Reinstall, Testing, Inspection









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Scour Repair

Brief History

- Webbers Falls Lock and Dam has historically had scour noted immediately downstream of the spillway (since 1974)
- SWT utilized services of the USACE Inland Navigation Design Center to evaluate stability of structures based on scour and provide recommendations for scour countermeasures in 2015.
- No instabilities were found however, the INDC recommended to address the scour holes by filling them with unreinforced unanchored underwater concrete (1,778 CY)
- SWT utilized Mead&Hunt to develop plans and specifications to address the scour holes; however, they proposed a much bigger area of concrete (15,000 CY) in 2019 at an est. cost of $8M
- Record pool event in May 2019 which increased scour

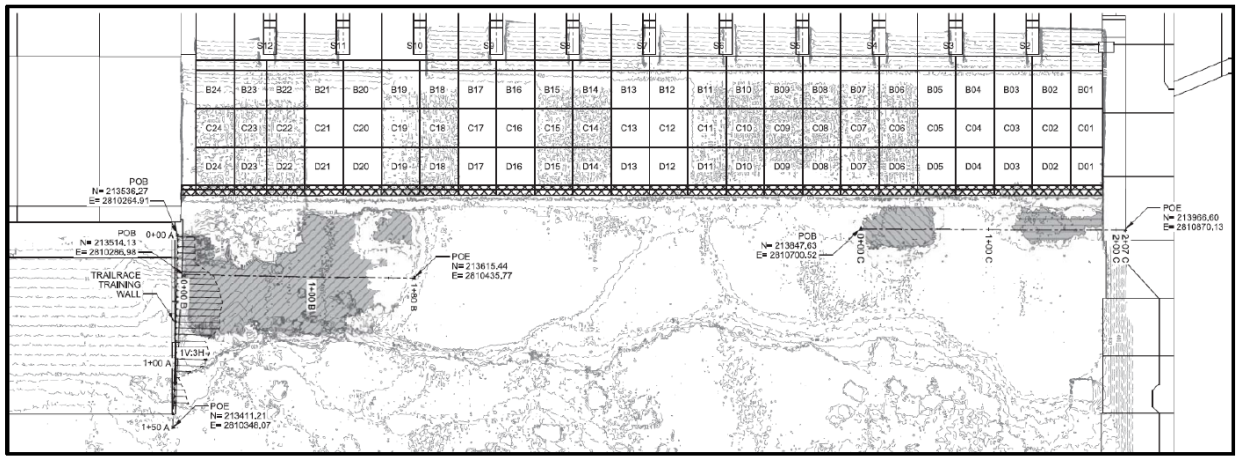

Figure 1: Scour Repair Areas (Webber Falls L&D 16 Downstream Scour Engineering Evaluation Report, INDC 2015)

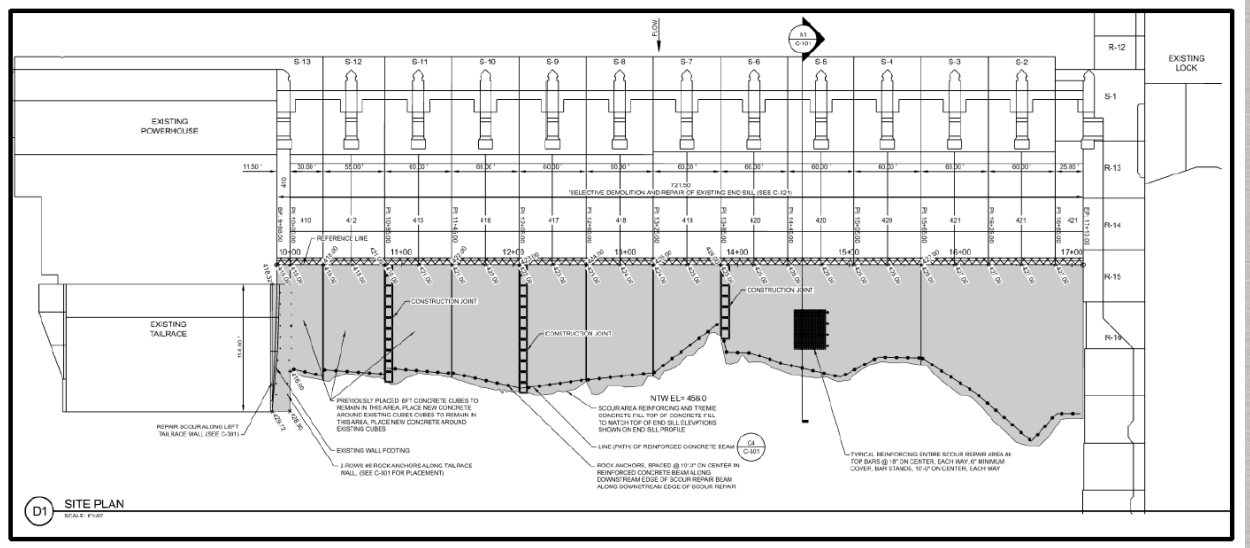

Figure 3: Underwater Concrete Fill Areas (Webber Falls L&D 16 Scour Hole Repairs Design Documentation Report, Mason & Hanger + Mead & Hunt, April 2019)

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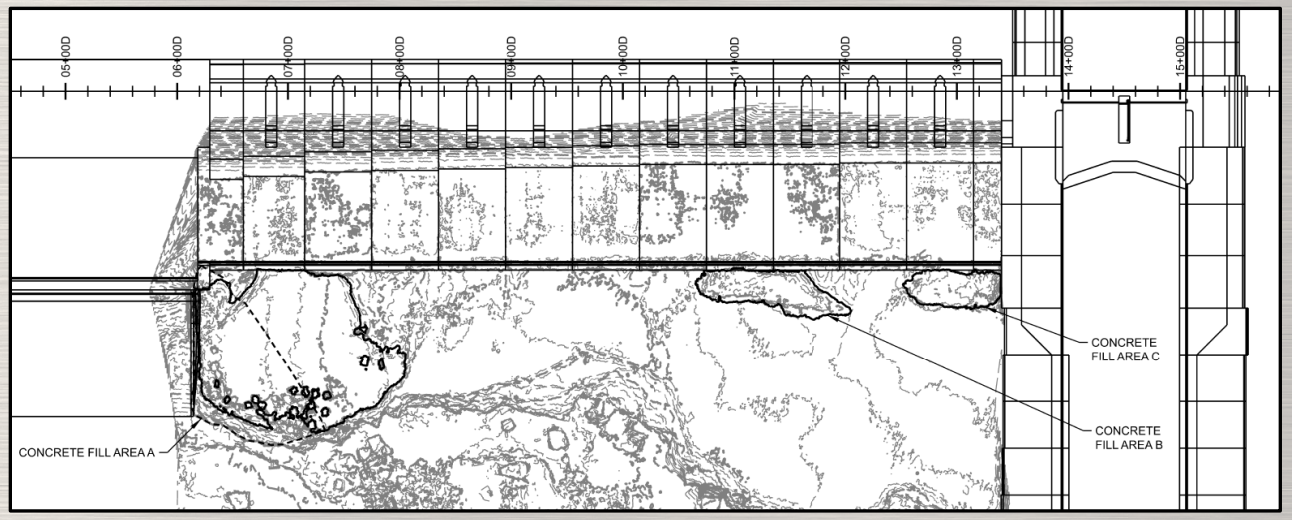
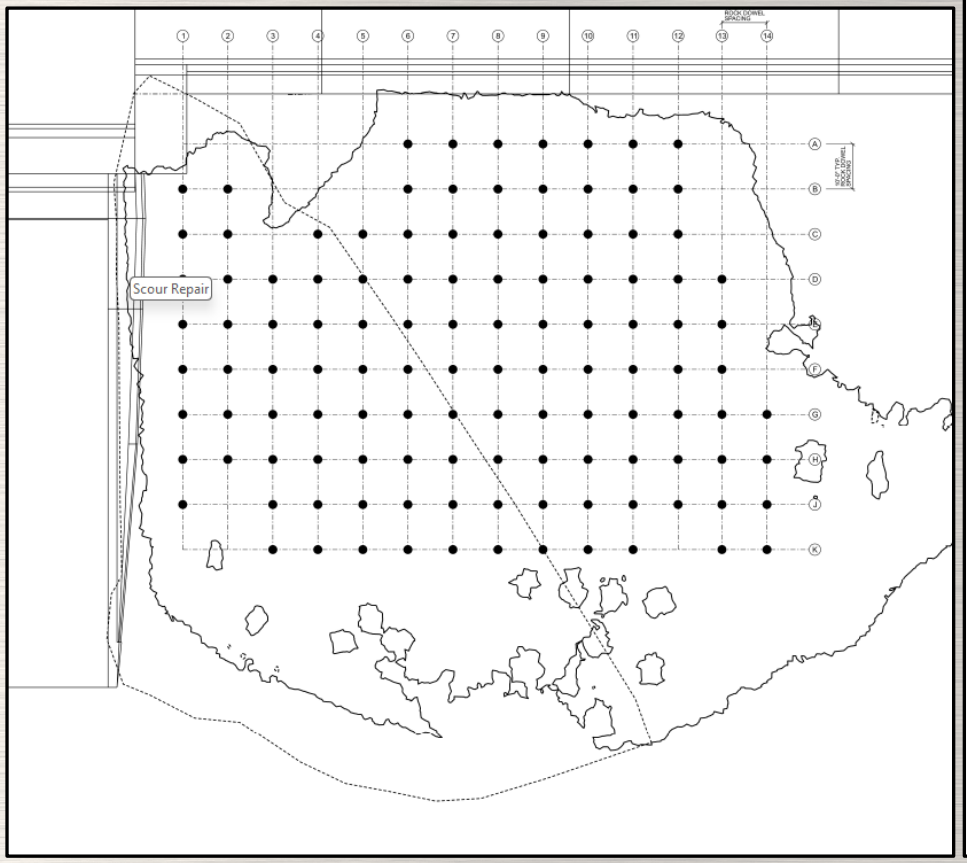
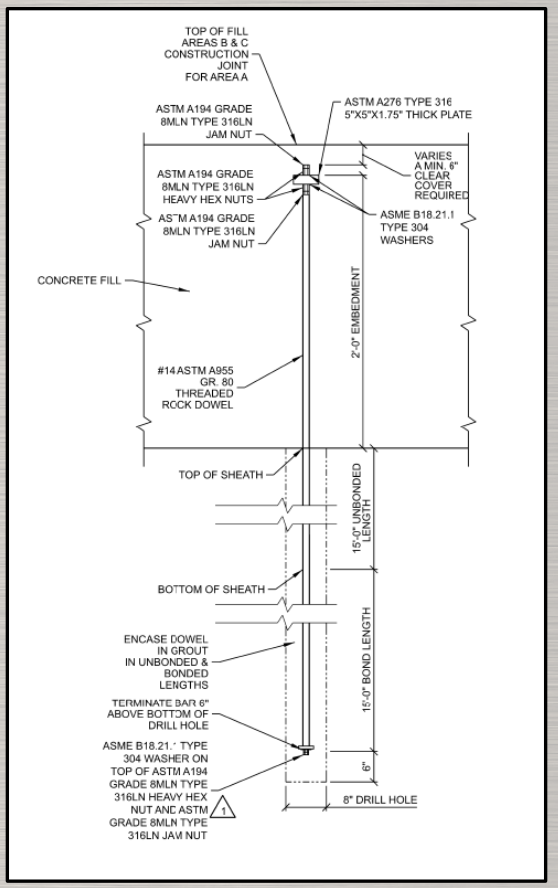
Scour Repair



Award Scour Repair

- Total amount of underwater concrete
  - 4,595 CY Area A
  - 470 CY Area B
  - 315 CY Area C
- #10 & #14 ASTM A955 Grade 80 rock dowels spaced 10’ in each direction
- Concrete compressive strength at 56 days 4500 psi





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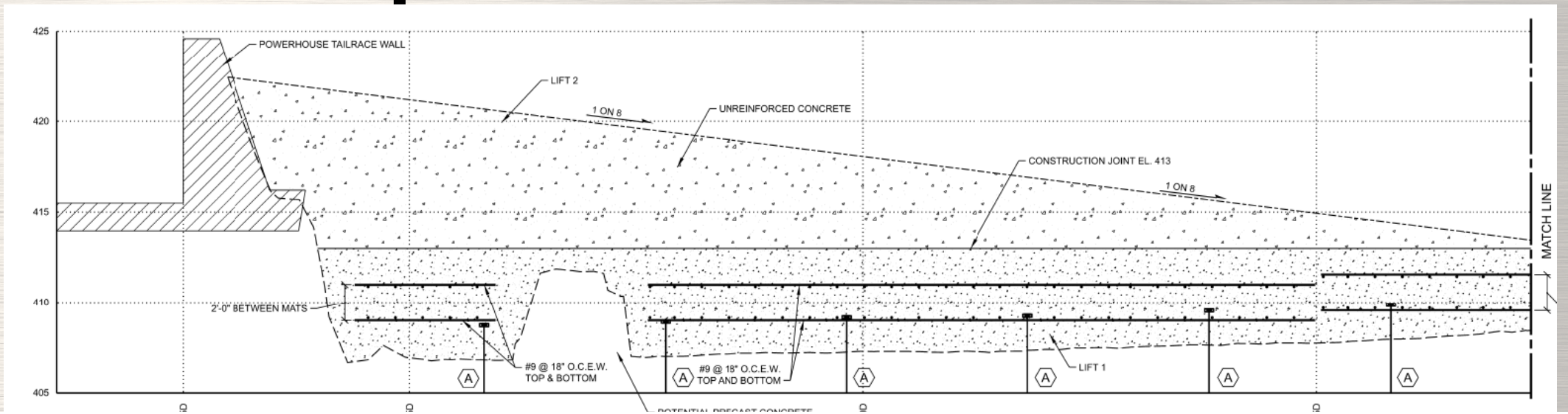
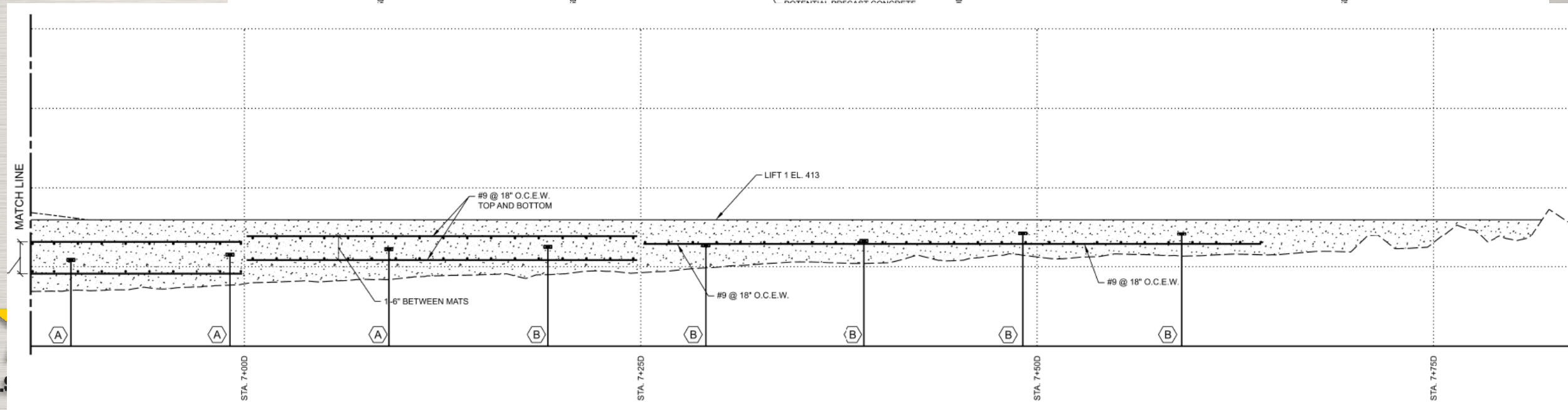
Scour Repair





Scour Repair

Dresden Lock & Dam Illinois River

- INDC Report provided this case study
- Rock Island District used underwater concrete to fill scour holes immediately downstream of navigation lock
- Successfully placed 10,000 CY of underwater concrete
- Concrete mixed onsite and pumped across spillway to floating barge

Photograph 5. Dresden Lock and Dam Construction

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Scour Repair

Underwater Concrete (VERY Complex Mix)

- USACE Technical Report INP-SL-1 September 1999
- Maximum water to cementitious materials is 0.40
- Over half of cementitious materials is slag and fly ash
- Fine aggregates to total aggregates is 45-50%
- Nominal Maximum Size Aggregate is 1 inch
- Ratio of volume of coarse aggregate to the volume of total solids must be between 0.37 and 0.5
- Ratio of weight of water to the total weight of cementitious materials and aggregate finer than 150 micrometer sieve combined must be between 0.14 and 0.17
- Encourages fines content
- Anti-washout admixture, high range water reducer, retarder, viscosity modifying admixture for SCC
- Limit placing temperature to 60 degrees F maximum

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Scour Repair

Existing Debris Removed from Scour

New Rock Dowel Anchors

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Scour Repair

New Lift 1 Reinforcing Cage Tied to Rock Dowel Anchors

New Lift 2 Custom Sloped Formwork, Transition from Wall

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Scour Repair

Confirmation of Work

- Advanced Sonar Imaging
- Bathymetric Surveys
- Diver Inspections

Coda Octopus
Sound Underwater Intelligence

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Parallel Intelligent Processing Engine

The World's Most Advanced Real Time Sonars

First Real Time 5-Dimensional ("5D") and 6-Dimensional ("6D") Sonars

Triple Frequency | Dual Frequency | Surface | XL

Scour Repair

Multiple Parallel 4D Data Sets Simultaneously for Different Requirements of Underwater Operations in Real Time

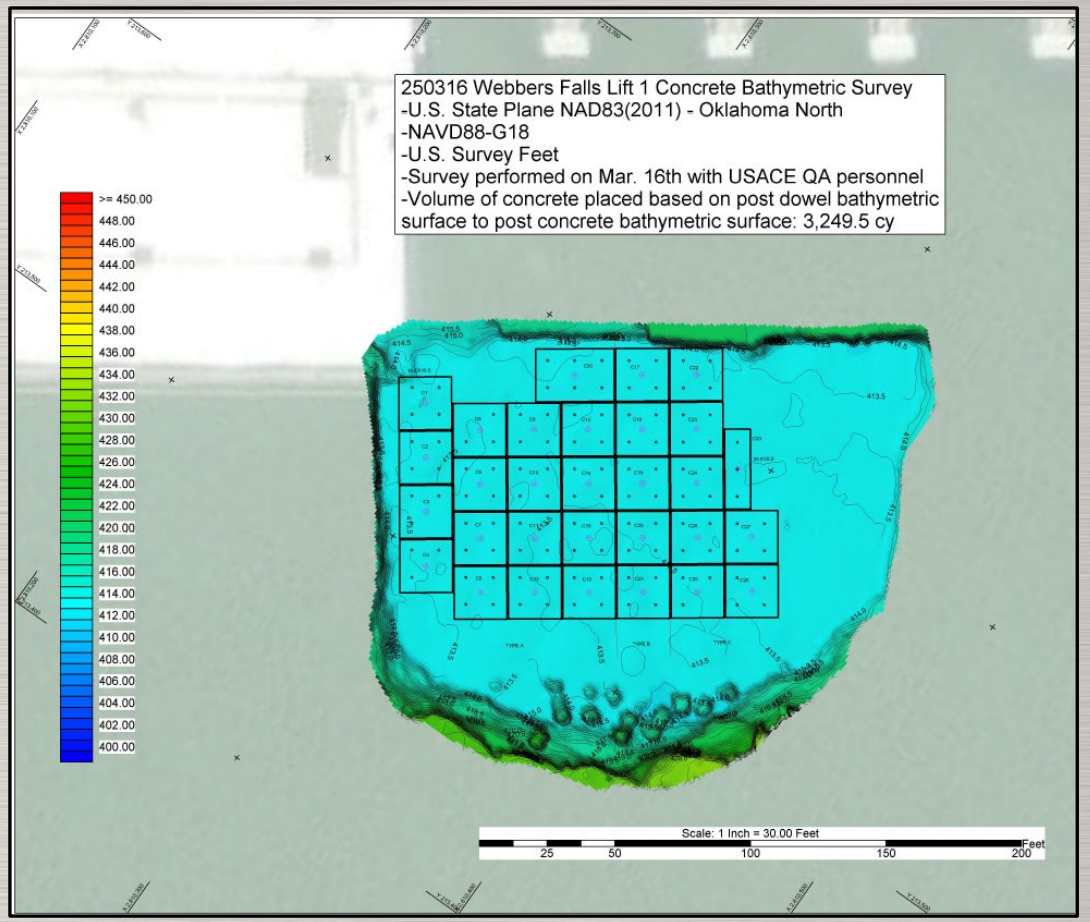
Coda Octopus' 5D and 6D Echoscope PIPE® sonar series ("PIPE" sonars) significantly advances its previous real time 3D sonar series with several revolutionary innovations. At the heart of the 5D and 6D sonars capability is our Parallel Intelligent Processing Engine ("PIPE") which significantly increases the amount of data that can be processed and displayed in real time. It is designed to allow independent users, within the same underwater operations, access in real time to multiple parallel and sequential 4D Imaging Outputs. The 4D imaging Outputs can be matched to individual users' requirements by using different acoustic parameters (such as different frequency, range, filters and processing), thus providing a true multi-sensor platform from a single sonar deployment.

The Parallel Intelligent Processing Engine can capture, process and display in real time significantly higher data density with multiple parallel outputs and much higher ping rates. In addition, increased processing capability allows more advanced beamforming algorithms including phase-based processing resulting in more accurate bottom detection. An innovation of the PIPE series includes 3D full time-series data offering the capability to process up to 164 million data points per ping (256x256x2500), to generate 4D images with typically several hundred thousand 4D points per ping (depending on the insonified scene).

Coda Octopus' PIPE Sonars are 5D and 6D sonars because:

- PIPE sonars can capture and process the full time series backscatter 4D acoustic data (256x256x2500 data points) thus providing 5D data
- PIPE sonars can capture and process multiple 5D images in parallel with different processing parameters thus providing 6D data

Coda Octopus



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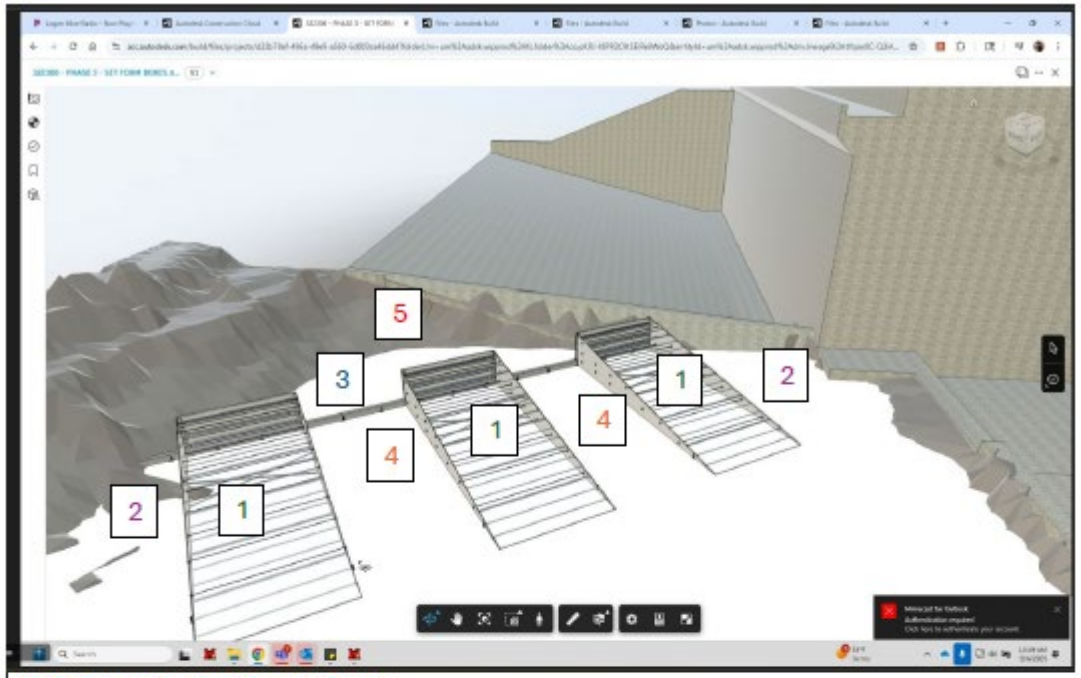
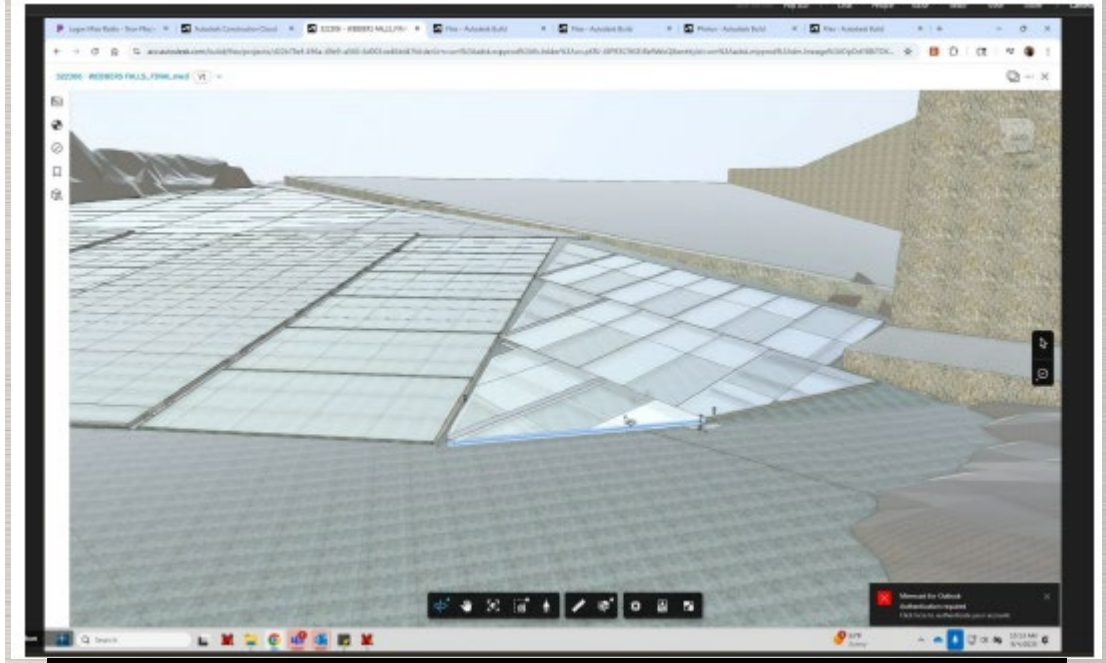
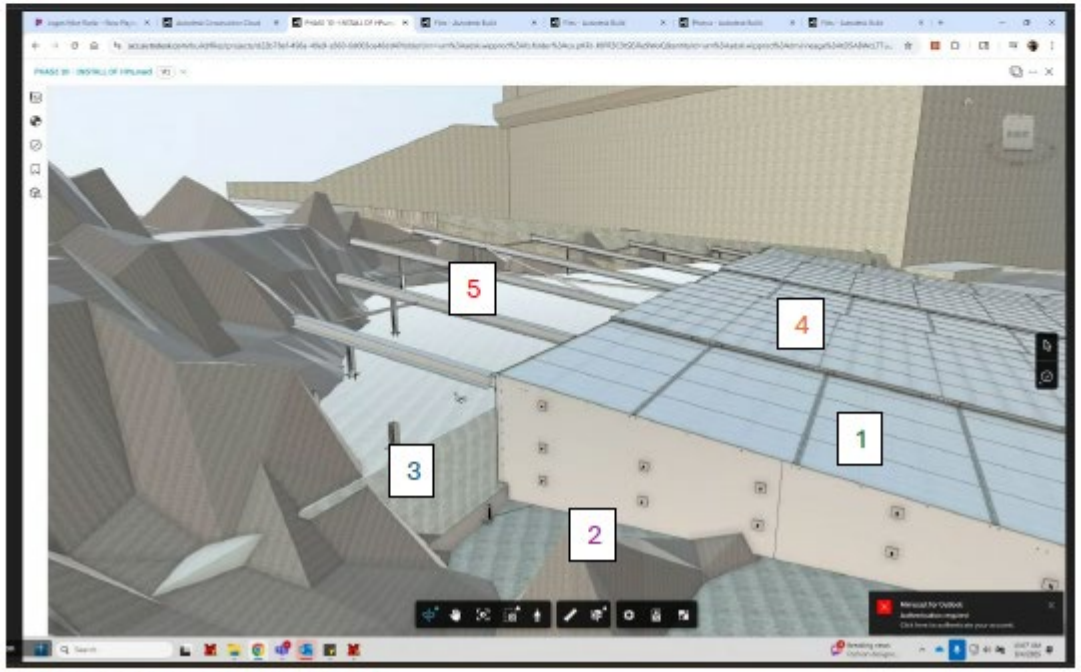


Lift 2 Concrete Placement Order





Lift 2 Concrete Placement Order