Chemical Grouting of Leaking Joints in the Weber Coulee Siphon

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Outline

- Project Description
- Construction
- Repairs during construction
- Water Leakage & Site Visit
- Logistical Challenges
- Chemical Grout Repairs

Columbia Basin Project

- Over 2,600 Miles of canals, laterals, and pipelines
- 2,500 miles of drains
- Irrigates 671,000 acres of land
- Produces $1.4 Billion in produce annually
Existing Barrel
New Barrel

Formwork
Minor Repairs

Rubber Waterstop

Major Repairs

Major Repairs - CIPP
Joint Testing
• Leaks > 2 gallons in 10 minutes = FAIL
• 50% of joints failed water test and required repair

Joint Repairs During Construction
Acrylic latex concrete bonding agent mixed at 1:3 ratio with water
Hydrophilic polyurethane mixed at 1:1 to 2:1 ratio with water and injected into the joint

WEKO-Seals Installed
1/12/18

- Water ponding
- I-90 Leak Location
- Monitoring Well
- Soft shoulder and settled area
- Ponding
- Dye Testing

February 1, 2016
Sinkholes and Settled Areas

Interior Inspection
Logistical Challenges

- Access to siphon entrance
- Siphon length & repair locations
  - Siphon 5894 ft long
  - Furthest repair 4718 ft
- Considered confined space
  - Good air flow but long distances
  - Personnel transport
- Electrical power
- Joint tester wouldn’t fit past WEKO Seal (tight tolerances)
- Weather

Site Access

- 480V Power
- Entrance
- Baffle Wall

Step-down transformer to 120V
Weather Was a Factor

- Multiple days of freezing rain
  - 2-1/2 days of delay overall
- Periodic drifted snow removal
- Removal of ice buildup at entrance

Chemical Grout Repairs
Grout Holes

- Offset from joint
- 45 degree angle
- 1-ft spacing (to start)
- Cleaned with oil-free compressed air
- Plastic bang-in ports with zerk fittings
- Water injected first
  - Clean out
  - Water for reaction

Grout Diagram

- Previous repair acted as bulkhead to keep grout in joint
- Not all joints were previously grouted
- Hoping to filling voids around embedded waterstop

Chemical Grouts

- Hydrophilic polyurethane
  - Require water to propagate the chemical reaction
  - Flexible foam
  - Shrinks when dehydrated (water is half, or more, of the volume)
- Hydrophobic polyurethane
  - Require little or no water, typically use a catalyst
  - Can be two component
  - Little to no shrinkage upon drying
- Acrylic based resins
- Epoxy resins
  - Structural applications
Grouting

- Flexible Hydrophobic Polyurethane
  - Two products, similar characteristics
  - Mixed with 5% catalyst
  - Final cure time in 4-5 min @ 50°F

- Grouting sequence
  1. Invert to haunch
  2. Haunch to spring line
  3. Spring line to shoulder
  4. Shoulder to crown

Grouting takes
- Average of ~2.5 gallons per joint
- Highest take ~4 gallons
- Lowest take ~0.5 gallons

Grout Travel
- Average of 3-4 feet
- Some travel of 23 feet (half the circumference)
- A few noticeable "voids" under invert (could be unbounded interface between rat slab and siphon barrel)

Before and After
A Dry Siphon

Acknowledgements

• Bureau of Reclamation Personnel
  – Denver Technical Services Center
  – Ephrata Field Office
  – Yakima Field Office
• East Columbia Irrigation District Personnel
• ICRI
Thank you!
Questions?

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