SLURRY WALLS FOR SEEPAGE CUTOFF IN LEVEE APPLICATIONS – RECENT EXPERIENCE AND CONSTRUCTION CHALLENGES IN THE NORTHERN CENTRAL VALLEY OF CALIFORNIA

Deep Foundation Institute
Slurry Wall Committee
July 22, 2010

TRLIA Cutoff Walls Designed by GEI
### Summary of TRLIA Cutoff Walls Designed by GEI

<table>
<thead>
<tr>
<th></th>
<th>Bear River Setback Levee</th>
<th>Feather River Setback Levee</th>
<th>Feather River Levee Segments 1 and 3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Soil-Bentonite Cutoff Wall</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length (LF)</td>
<td>9,390</td>
<td>25,800</td>
<td>2,600</td>
<td>37,790</td>
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<tr>
<td>Max Depth (FT)</td>
<td>70</td>
<td>78</td>
<td>68</td>
<td>78</td>
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<tr>
<td>Area (SF)</td>
<td>439,000</td>
<td>1,668,000</td>
<td>176,000</td>
<td>2,283,000</td>
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<tr>
<td><strong>Soil-Cement-Bentonite Cutoff Wall</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length (LF)</td>
<td>11,100</td>
<td></td>
<td>11,100</td>
<td></td>
</tr>
<tr>
<td>Max Depth (FT)</td>
<td>65</td>
<td></td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>Area (SF)</td>
<td>620,000</td>
<td></td>
<td>620,000</td>
<td></td>
</tr>
</tbody>
</table>

**SOIL-BENTONITE CUTOFF WALL**
TYPICAL SOIL-BENTONITE CUTOFF WALL SPECIFICATION:

- WALL WIDTH: 3 FT
- BACKFILL PERMEABILITY: LESS THAN 5 \times 10^{-7} \text{ CM/SEC}
- CONTENT OF DRY BENTONITE IN THE BACKFILL: NOT LESS THAN 1.5\% BY WEIGHT
- DEPTH OF KEY INTO PREVIOUSLY EXPLORED FINE-GRAINED STRATUM: NOT LESS THAN 3 FT
- BACKFILL FINES CONTENT: NOT MORE THAN 50\%
Heading Overlaps

- Pothole to confirm location of existing wall
- Monitor trench excavation cuttings to confirm excavation into existing wall
- 4(H):1(V) slope of cut into existing wall
- Minimum 10-foot overlap at the bottom
CUTOFF WALL ADJACENT TO CULTURAL SITE

Wall Construction Adjacent to Sensitive Cultural Site
PREVENTIVE MEASURES TO AVOID TRENCH CAVE-IN

- RAISED SLURRY LEVEL
- INCREASED WORK HOURS
- ALLOWED TOE OF BACKFILL CLOSER TO EXCAVATION FACE
- ATTEMPTED TO INCREASE SLURRY UNIT WEIGHT
- ATTEMPTED TO STIFFEN BACKFILL TO STEEPEN THE BACKFILL SLOPE WITHIN TRENCH
CUTOFF WALL AT TOE OF EXISTING LEVEE
Soil-Bentonite Cutoff Wall at Toe of Levee
Foundation Shear Strength Characterization

Field Vane Shear Strength of Cutoff Wall Backfill
(6 months after construction of cutoff wall)
SOIL-CEMENT-BENTONITE CUTOFF WALL
TYPICAL SOIL-CEMENT-BENTONITE CUTOFF WALL SPECIFICATION:

- WALL WIDTH: 2.5 FT
- BACKFILL PERMEABILITY: LESS THAN $5 \times 10^{-7}$ CM/SEC
- BACKFILL UNCONFINED COMPRESSIVE STRENGTH: 30 TO 300 PSI
- DEPTH OF KEY INTO PREVIOUSLY EXPLORED FINE-GRAINED STRATUM: INCREASED TO NOT LESS THAN 8 FT AFTER CONCERNS RAISED AS PART OF SAFCA WORK ABOUT CONTINUITY OF BACKFILL AT THE BOTTOM OF THE WALL
Soil-Cement-Bentonite Cutoff Wall Through Levee

Exposed Recently Constructed Cutoff Wall
CONSTRUCTION ISSUES WE ENCOUNTERED

- TRENCH CAVE-IN
- LARGE OBSTRUCTION
- BACKFILL WITH HIGHER-THAN-SPECIFIED PERMEABILITY

CUTOFF WALL TRENCH CAVE-IN
Cutoff Wall Trench Cave-in – Cross Section

Cutoff Wall Trench Cave-in – Temporary Berm
Three Rivers Levee Improvement Authority

Cutoff Wall Trench Cave-in
Final Repair Plan and Profile

Cutoff Wall Trench Cave-in
Final Repair Seepage Berm
CUTOFF WALL TRENCH
OBSTRUCTION

Obstruction in Levee Foundation
Abandoned Pump Station Sump
CUTOFF WALL REACH WITH HIGHER-THAN-SPECIFIED PERMEABILITY
CUTOFF WALL REACH WITH HIGHER-THAN-SPECIFIED PERMEABILITY

Permeability Data:
- Average of 44 QC Tests: $9.1 \times 10^{-7}$ cm/sec
- Maximum Value of QC Permeability Tests: $2.2 \times 10^{-6}$ cm/sec
- Average of 4 QA Tests: $5.8 \times 10^{-7}$ cm/sec
- Maximum Value of QA Permeability Tests: $7.1 \times 10^{-6}$ cm/sec
Three Rivers Levee Improvement Authority

Cutoff Wall with Higher Permeability
Unconfined Strength Data

Segment 3 - 28-Day Unconfined Compressive Strength

Cutoff Wall with Higher Permeability – Piezometers
QUESTIONS?

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