Overview of the Embankment Remediation Project

Perris Dam Remediation Project

May 2015
Location of Perris Dam and Lake

State Water Project

LAKE PERRIS

Perris Dam Remediation Project
Local Faults Could Produce Large Motion That Affects Dam

Design Earthquake - San Jacinto Fault Zone
Magnitude Mw7.5 @ 5 miles from Dam
Dam Features

- Construction 1970 – 1972
- Type of Dam – Earthfill
- Dam Height – 126 feet
- Dam Length – 2.2 Miles
Embankment Design and Construction

- Embankment Section
  - Primarily Silty Sand
  - Inclined Sandy Clay Core
  - Compaction Requirements
    - DWR Standard
      - (20,000 ft-lb/ft³)

<table>
<thead>
<tr>
<th>Zone</th>
<th>Spec.</th>
<th>Average As-Placed</th>
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<tbody>
<tr>
<td>1</td>
<td>70-25</td>
<td>97% 98%</td>
</tr>
<tr>
<td>2</td>
<td>97%</td>
<td>101%</td>
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Crest El. = 1600 ft
Toe El. = 1480 ft
10' Riprap
Dam Axis
Bench

Perris Dam Remediation Project
Embankment Design and Construction

- **Foundation Preparation**
  - 3 ft excavation beneath Zone 2
    - Remove organic material & loose surface sands
  - 6 ft excavation beneath Zone 1 (core)
    - 10-25 ft Core Trench
Example of Cross Section Evaluation

Summary of Field Exploration
SPT Drill Holes = 120
SPT's = 1,318
CPT Drill Holes = 139

Red Areas Indicate Problem Soils

Perris Dam Remediation Project
Design Evaluated with FLAC
Design and Review

- **Division Of Engineering**
  
  Responsible for design, development of plans and specifications, administration and inspection of construction contract

- **Division of Safety of Dams (DSOD)**
  
  As dam regulator, ensures a safe design
  
  Approves design analysis, plans, and specifications
  
  Oversees the construction in accordance with the approved designs

- **Board of Consultants (BOC)**
  
  Appointed by the Director of DWR
  
  Comprised of a group of experts
  
  Performs independent review of the dam design
  
  Approves design work for construction
Design Concept

• Remove and replace loose shallow soils

• Improve the deeper foundation soils by Cement Deep Soil Mixing (CDSM)

• Construct a stability berm on the downstream side of the dam and include drainage features
Construction Contract
Scope of Work

- Clearing and Grubbing
- Lake Bed Haul Roads
- Sitework
- Production Blasting
- Controlled Blasting
- Rock Processing and Stockpiling (Filter and Drain)
- Dewatering at Dam Toe and Borrow Area
- Seepage Collection System (Remove and Replace)
- Relief Well System (Remove and Replace)
- Cement Deep Soil Mixing (CDSM)
- Stability Berm
- Right Abutment Dam Repair
Foundation Treatment
Controlled Blasting

• Low ground velocity restriction
• Protect existing facilities
Production Blasting
Production Blasting
Rock Processing and Stockpile

- Rock from blasting used for filter and drain system
- Cleanliness requirements
- Segregation requirements

- Limited work and staging areas
Seepage Collection System

- Manage the existing system's flowing water
- Remove existing wells and drain system
- Construct new system at berm
Design Phase Test Sections

• DWR conducted testing to evaluate design and construction of the foundation treatment, other construction features, dewatering.

  • Identified potential problems
  • Provided confidence in the design
  • Refined design of foundation repairs. Resulted in final design with shallower excavation and confirmed CDSM treatment.
Test Sections

Dewatering Test Excavation Area

CDSM Test Section Area
Test Contract
Pre-drilling
Test Contract
Soil Mixing using Multi-Auger Method
Test Section
Soil mixing using CSM method
Test Section - Soil Mixing Operation

Spoil Trench

CDSM Spoils

Multi-Auger Method

Spoil Trench

CSM Spoils

CSM Method
Dewatering Test Excavation

Evaluated Dewatering Methods
Evaluated Excavation and Drilling Methods