Rehabilitation of Chester Water Authority’s Pine Grove Dam Tainter Gates

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Business Hours & Phone
Walk-in: 8:00 a.m. to 5:00 p.m.
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Emergency Hours & Phone
24 HOURS PER DAY
7 DAYS PER WEEK
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Pine Grove Dam

- 650 ft. long, 65 ft. high at maximum
- 138 sq. mile watershed
- Storage: 2.2 billion gallons
- Uncontrolled ogee spillway 71.5 ft. long
- Two 44 ft. wide by 30 ft high Tainter Gates
- Gate Crest Elevation: 280 ft
- Gate Sill Elevation: 250 ft
- Low-Head Hydropower Facility (520 kw)
  - FERC Regulated Dam
Tainter Gate Section
U.S. Bureau of Reclamation
1955
Imagine you’re the person who went to open up a Tainter Gate on Monday morning, July 17, 1995 …
• Sustained Release of 25,800 MGD
• Drained 40% of reservoir until flow stopped
Folsom Dam, California

- Forensic Analysis
  - Diagonal brace joint next to trunnion was the initial point of failure
  - Friction in the trunnion was not considered in the design
Trunnion
FERC Response to Folsom Dam

- FERC required **ALL** dams with tainter gates to analyze whether friction was accounted for in the design of the gate structure.
- Conduct a full gate opening every 5 or 10 years, depending on category of dam.
- Conduct a close-up, detailed inspection every 10 years.
Project Team & Schedule

- **Consultant - Gannett Fleming**
  - Structural Analysis and Design in response to FERC directive
  - Preparation of the Bid Document
  - Services during Construction

- **Bid Project - March 2005**
  - Crofton Diving Corporation, Newport News, VA

- **Construction Phase:**
  - Field work started Fall 2005
  - Fabrication of Bulkhead and Abutment Plates – 2006/07
  - Gate 1 – 2008 and Gate 2 - 2009
  - Stored Bulkhead in Summer of 2010
Challenges at Pine Grove Dam

- No stop-log or bulkhead arrangement in original construction that would allow for inspection of the gates in a dewatered condition
- Reservoir and water supply intake had to stay in operation 24/7
- Plant personnel had to be very nimble with flood events while one gate was out of service
- No winter work
How?

- **Customized Floating Bulkhead**
  - 6 caissons – 25” thick by 58” high by 44’ wide
  - Valves for flooding caisson with water and pumping air for flotation

- **Abutment Plates – 304 SS**
  - 10” wide face for bulkhead seating
  - 59 anchor bolts for each abutment
  - Installation with cofferdam
Anchor Bolts

- Abutment Plates – 59 anchor bolts each side
- 1.25” and 1.50” diameter bolts with 11” to 16” embedment
- Loaded to 25,600 lbs
- Tested 25% of anchor bolts after installation
Barge
Abutment Plates
Bulkhead

- Delivery to Site
- Installation - Rigid
Repairs
Dead End Attachment:
Top of chain
(Pin threads damaged)

Removable link pin:
Bottom of chain
Full Height Lift
Bulkhead Removal Process

- Roll-up Garage Door
Caisson Storage

- Location: Fishing HQ
- Power washed & touch-up paint
- Treated seals to prevent dry-rot
- Purge chambers with nitrogen
Final Project Costs

- Engineering - $150,000
- Construction - $1,728,000

Thanks to:
- Treatment Plant Staff
- Gannett Fleming – Richard Horvath, P.E.
- Crofton Diving Corporation
  - Jay Crofton & Kurt Feairheller
QUESTIONS?