Fullerton Reservoirs

63 Million Gallons of New Finished Water Storage for the Baltimore Distribution System

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Dennis Funk, PE

Baltimore County Department of Public Works
Gerald McHenry, PE
Mike Mazurek, PE
History at Fullerton

- 1953: Susquehanna River identified as alternate supply
- 1955: Purchase of Fullerton Site for WFP, Storage, Transmission Facilities
- 1962: Construction of 108” begins
- 1996: Construction of Transmission Facilities begin
Purpose

First Zone
- Distribute storage throughout the zone
- Fire flow protection

Pumping Station
- Meet required NPSH
- Attenuate impacts of the PS on the Fullerton Transmission Main

Reservoir Storage
- 63 MG - design capacity
Fullerton Filtration Plant Study Including 1 MGD Pilot Plant.

- Recommendations
  - Q = 120 MGD
  - Baffle the New Reservoirs
Zone 1 Hydraulics (Ultimate)

O.E. = 215

Q = 120 MGD

O.E. = 230

1st Zone
Glen Burnie, Baltimore City, Dundalk, Essex, Middle River
Total Design Storage

- Head Storage
- Operating Storage
- CT Storage

OE: 230
FFE: 190
40’
Baffle Walls

Concentric “C” walls

Radial Wall

Adjacent Inlet and Outlet

4’ x 4’ Removable Plate for Maintenance

Periodic 18-inch Wide Floor Level Openings for Drainage
Site Hydraulics

- **West tank**: 300’ Ø, 40’ Water Depth
- **Middle tank**: 300’ Ø, 40’ Water Depth
- **East tank**: 300’ Ø, 40’ Water Depth
- **Ex. 84”**: 42’
- **FFP Connection**
- **Check Valve (inf)**
- **Check Valve (eff)**
- **Disinfection (inf)**
- **Disinfection (eff)**
- **Flow Meter (inf)**
- **Flow Meter (eff)**
- **PCCP Yard Piping (typ)**
Reducing Minor Losses

**Slanting Disc Check Valve**
- Disc mounted nearer to center of gravity.
- Results in over 5x less headloss than swing check.
- Mountable dashpot prevents slamming and water hammer.

**Reducing Wye**
- Fixed connection point and alignment geometry favored wye.
- Use of fabricated pipe allowed for custom fitting.

**Magnetic Flow Meter**
- No energy loss.
Site Utilization

Tanks
• AWWA D110 Type 3
• Column Supported, Flat Roof
• Partially Backfilled

Location Onsite
• Near Finished Water Connections and FPS
• Existing Topography
• Allowed Ample Space for Future FFP Siting

Orientation
• Along Ridgeline, High Elevation of the Site.
Earthwork Balance
Construction Grading

- 380,000 Cu. Yd. of Cut (EL 210 – 187)
- 250,000 Cu. Yd. of Fill (EL 230 – 280)
- 130,000 Cu. Yd. of Fill (EL 210 – 230)

- Steep slopes
- Wetlands
- Wall panel work area
- 108” Raw Water
Final Grading

Perm. Pile 1
(EL 280–240)

Perm. Pile 2
(EL 230–220)

Perm. Fill Around West and Middle Tanks
(EL 200–210)

Grading for Potential FFP Access Road

Roof
EL 232±
## Award of Contract

<table>
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<th>Bid Amount</th>
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<td>Bidder 1</td>
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<td>Engineer's Estimate</td>
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- Contract Awarded November 21, 2016
- NTP Given February 1, 2017
- 3 Year Contract Duration
Construction Progress
Site Progression – July 2017

- Channel Stabilization
- Sediment Pond Construction
- Site Clearing
- Excavate West and Middle Tanks
- Stockpile 1
- West Tank Subgrade
- Complete Mass Excavation
- Concrete Batch Plant
- West Tank Floor Pour 1
- West Tank Column and Panel Casting
- Middle Tank Subgrade
- Vault Construction

Stockpile 1
Stockpile 2
Subgrade
Pour 1 (Complete)
Pour 2 (Rebar and Formed)
Pour 3 (Subgrade)
Site Progression – March 2018

- West Tank Roof Construction
- Middle Tank Column and Panel Casting
- East Tank Floor Pour 1
- Vault and Piping Construction
Concrete Work

- Onsite Batch Plant Operated and by Ready Mix Supplier

- Noise and Work Hour Restrictions Relaxed for Large Pours (Floor / Roof)

- Community Notifications Required for Each Large Pour
Floor Pours

- Two Joints Max, No Radial Joints Allowed
- Batch Plant and Delivered Concrete

- 4,050 yds (per Tank)
- 10 hours (Avg. per pour)
Roof Pours

- Fewer Joint Restrictions
- Batch Plant Concrete
- 1,800 Yards (per Tank)
- 6 hours (First Pour)
- Q1 Poured on April 6th

Q1 Pour
450 Yards

Q2 Pour
450 Yards
Liebherr LR-1300

- Required to Lift 10 Ton Baffle Wall Panels to Tank Center and 40 Ton Wall Panels
- 350 Ton Crawler
- 300 ft of Total Boom
- 200 Tons of Total Counterweight
Lessons Learned

• Standards for Specials

• Geotechnical Liability

• Submittal Management

• Project Team Cooperation
C200 and Testing Specials

- Transition from PCCP to Steel in Vaults
- AWWA C200 Requires Hydrostatic Testing Around 350 PSI for Each Pipe Length
- Hydrostatic Not Required for Special Section (Bends and Fittings)
C200 and Testing Specials

- Can be Argued that C200 Only Requires Visual Weld Inspections for Specials
- Manufacturer Provided Dye Penetrant Testing
- Hydrostatic Field Testing Required
Subgrade Approval

- Intent to Have Tank Manufacturer Responsible for All Tank Design and Construction
- GF Provided Tank Subgrade Recommendations for Tank Design
- Specs Called For Engineer Approval for All Subgrades
Submittal Management

• Contractor Provided and Manages Submittal Database

• 1 Year Into Construction
  • 500 Submittals
  • 100 RFI’s
  • 450 Concrete Test Reports
  • Daily Soils Reports
  • Schedule Updates
Baffle Wall Joint Plate

- Baffle Walls Constructed with ±1” Gap Between Panels
- Design Called for 6” Wide x 3/8” Thick FRP Strip to Cover Joint with Intermediate Tacking “As Required”
- Contractor Requested Use of 1/4” Strip, Secured Solely by Compression
Baffle Wall Joint Mock-Up

- 20 FT High Joint
- Modeled Tightest Radius
- 4FT and 8FT Compression Plate Spacing
- 4FT Preferential
- Strip Thickness Was Acceptable
- Concern that Wood Surface was Smoother than Concrete
Cover Plate Installation

- Requires Tacking

FRP Strip

4'-0"