Quenching Central Ohio's Thirst for Additional Water Supply:

The Columbus Upground Reservoir Project

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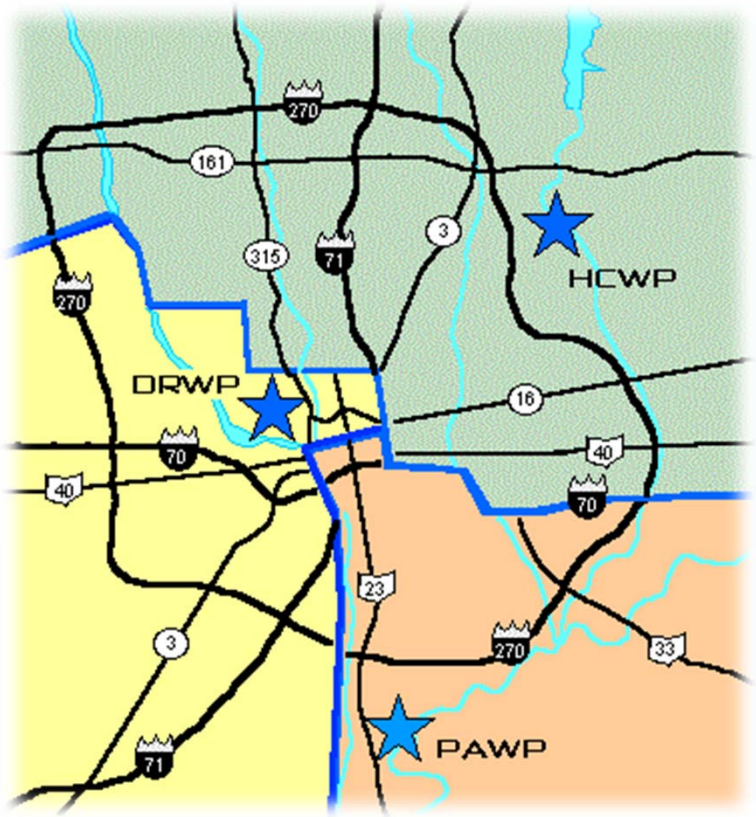
Columbus, Ohio PWS

- Serves 1.1 M people in the city & 20+ surrounding communities
- 3 WTP's (2 SW & 1 GW)
- Combined capacity of 240 mgd
- On stream reservoirs
  - HCWP
    - Hoover (23.7 Bgal)
    - Alum Creek (25.8 Bgal)
  - DRWP
    - O'Shaughnessy (4.8 Bgal)
    - Griggs (1.3 Bgal)



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Project Justification

City of Columbus – existing supply sources did not have capacity to meet existing demand

- 1:50 Safe yield per WB 2000 = 130 mgd
- Usage rate in CY 2005 = 148 mgd
- Projected demand for year 2025 = 185.2 mgd
- Safe yield with South Well Field Expansion = 145 mgd

Del-Co Water Company- provide additional 8 mgd supply

- Additional supply and treatment capacity needed for future demands
- Planning new storage reservoir and plant

Increase in safe yield of 45 mgd needed

Project Goals

- ✓ Implement the plan in the water Beyond 2000 Report
- ✓ Adequate supply for Columbus & Del-Co Water Co. beyond 2020
- ✓ Construct 3 upground reservoirs over time
- ✓ Build on 2,500 acres of land secured by City

Water Beyond 2000
Upground Reservoir Project
Division of Water - City of Columbus

Growth and Development in Columbus

Year	Avg. Raw Water Demands (mgd)*	Safe Yield (mgd)	Water Supply Project
1909	17.0	20	Griggs
1925	29.7	47.8	O'Shaughnessy
1955	58.3	100.2	Hoover Reservoir
1978	111.3	131.2	Alum Creek Reservoir
1983	125.1	150.2	South Well-Field
2014	168.9 (140 act)	171.1	Reservoir R2
2017	175.7	188.5	South Well-Field
2040**	(180)**		

**Assumes 6% loss through treatment plant. **Comprehensive Plan 2012*

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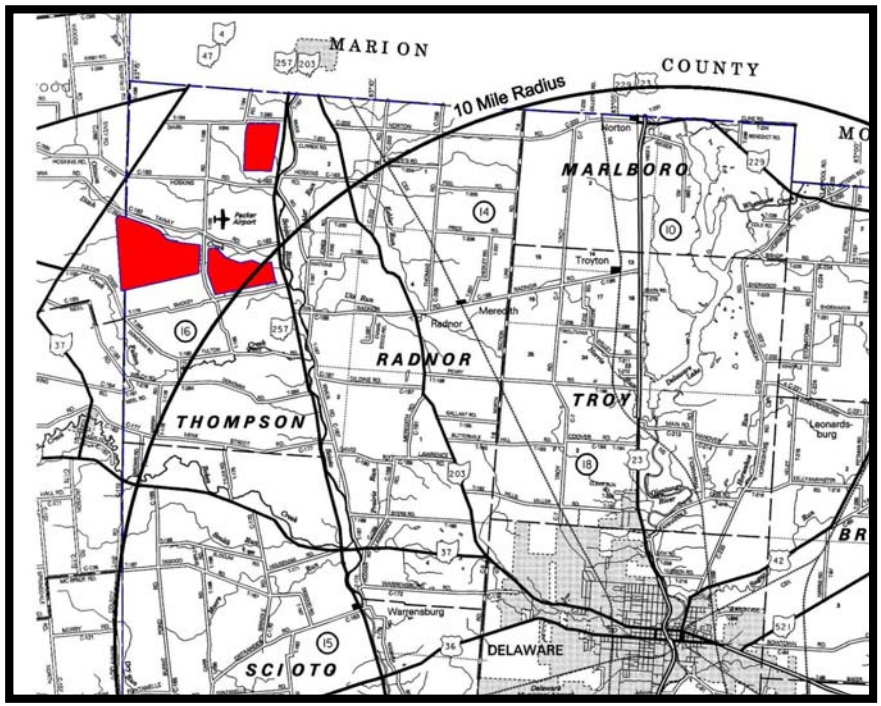
Facts



- 2500 acres of land purchased by the City of Columbus for the upground reservoirs from willing sellers
- Process started in 1993
- Total cost of land approximately $9,389,365.47
- Water Beyond 2000 started in 1990, completed in 1998, and updated in 2001

Columbus Share 24.5 mgd + Del-Co Share 4.5 mgd = Safe Yield of R2 29 mgd

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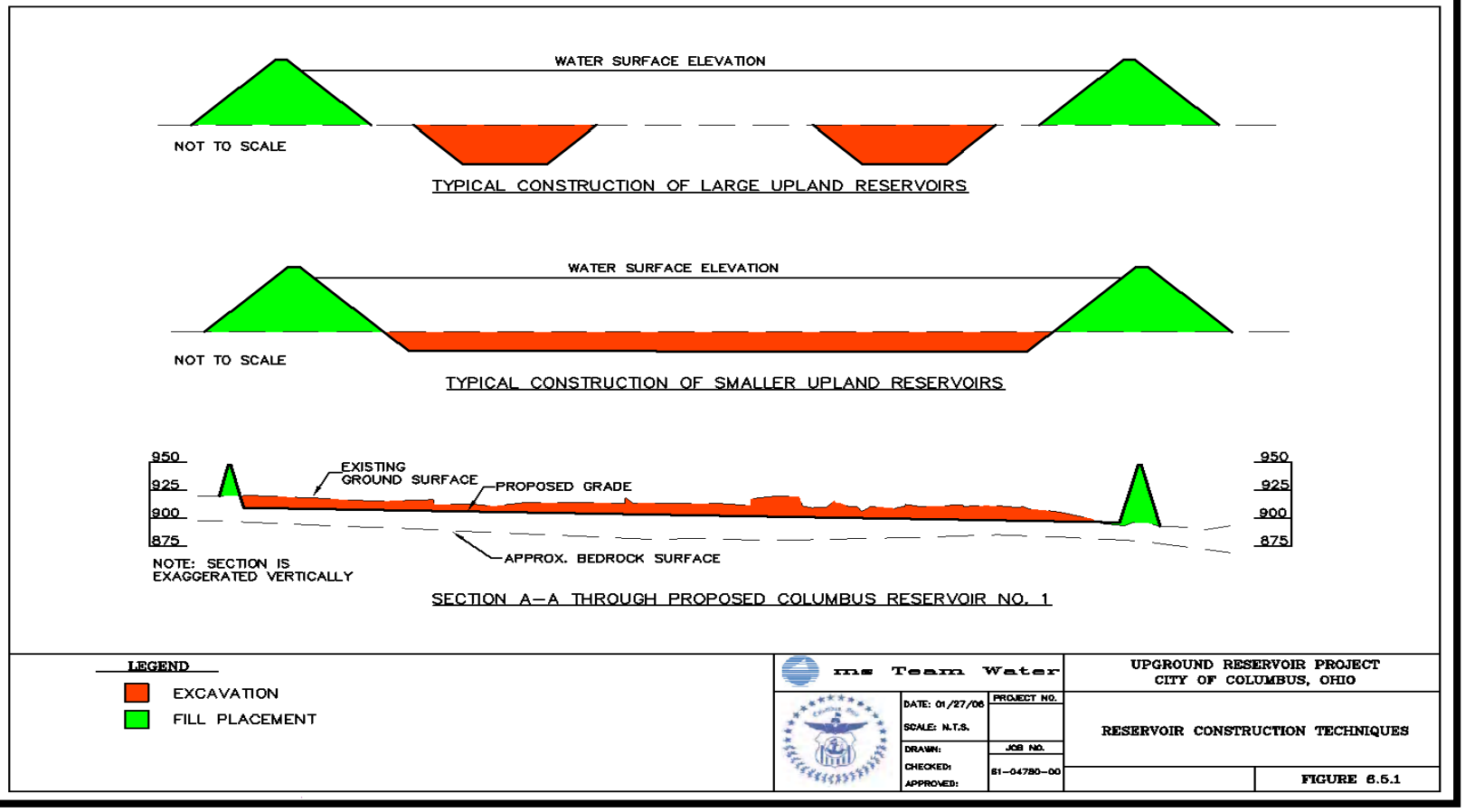
What is an Upground Reservoir?



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Columbus Reservoir Site No. 2 Overview

- 9.3 billion gallon upground reservoir
- Clay & underlying saturated sand & gravel and Karst geology
- 4.6 mil cy of embankment (5 miles)
- Inboard Slope Protection
- 785-acre composite liner
  - 18” CCL; 40 mil fPP; geotextile & 18” soil cover
- Bid price $76.6 million

Design Phase Rendering

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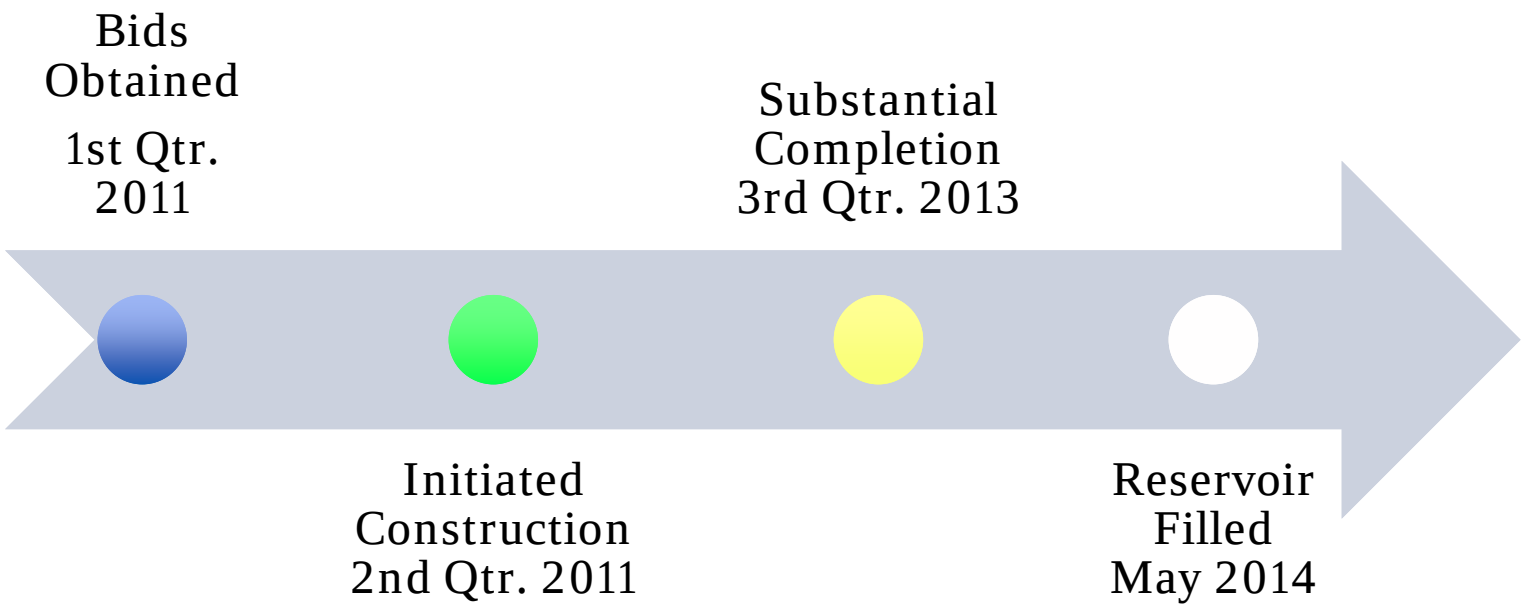
Key Project Team Members - Reservoir

- Investigation and Design
  - ms; S&ME (formerly BBC&M) and Moody Nolan

- Construction Management Team
  - URS; Stantec; H.R. Gray; Resource International; Prime

- Construction
  - Prime Contractor: Beaver Excavating Company
  - Subcontractors
    - Environmental Protection, Inc. (EPI)
    - Contract Dewatering Services

Projected Project Schedule



Construction Progress

November 1, 2011

Contractor's Equipment
July 31, 2012

August 25, 2012

August 14, 2013

April 21, 2014

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Raw Water Intake and Pump Station
(3Q 2011 – 3Q 2013)

- Kokosing Construction Company
- Bid Price $23.5 million
- 150' Pneumatic Weir Gate & Intake
- Gripper Rake
- Traveling Water Screens (2)
- 40 mgd pumps (4)

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Raw Water Pump Station

Construction Progress October 2012-February 2013

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Raw Water Pump Station

Weir and Pump Operational Photos, July 2013 – May 2014

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Phase 1 Raw Water Pipeline (1Q 2012 – 3Q 2013)

- S.J. Louis Construction Company
- Bid Price $15 million
- 22,000 LF 72” pipe (AWWA C200 steel or PCCP)
- Links Pump Station to all 3 reservoir sites
- Dual functionality
  - Pump Station fills reservoir
  - Stored water released back to Scioto River

Phase 1 Raw Water Pipeline

Construction Progress June 2012 – November 2012

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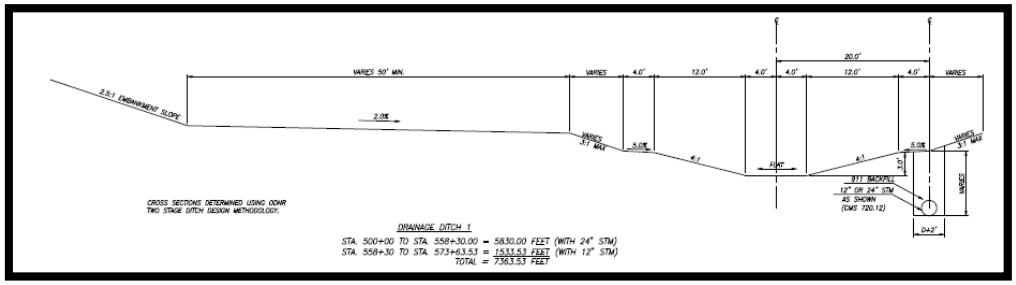
Reservoir Site Drainage

- Surface water to be diverted around proposed reservoir footprint
- New two-stage perimeter ditches to be constructed around each reservoir to intercept tile & surface drainage



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Reservoir Inlet & Outlet Control

- 72-inch pipeline links pump station to all reservoirs
- Isolation valves direct flow in/out of each reservoir
- 30' wide inlet structure – spillway with chute blocks

Outlet Structure

- Nine 3-foot-diameter drilled piers for uplift resistance

Outlet Structure

- Tower has draw-off gates at 6 levels
- 72-inch outlet
- 86’ service bridge
- Pool level and WQ profiler instruments

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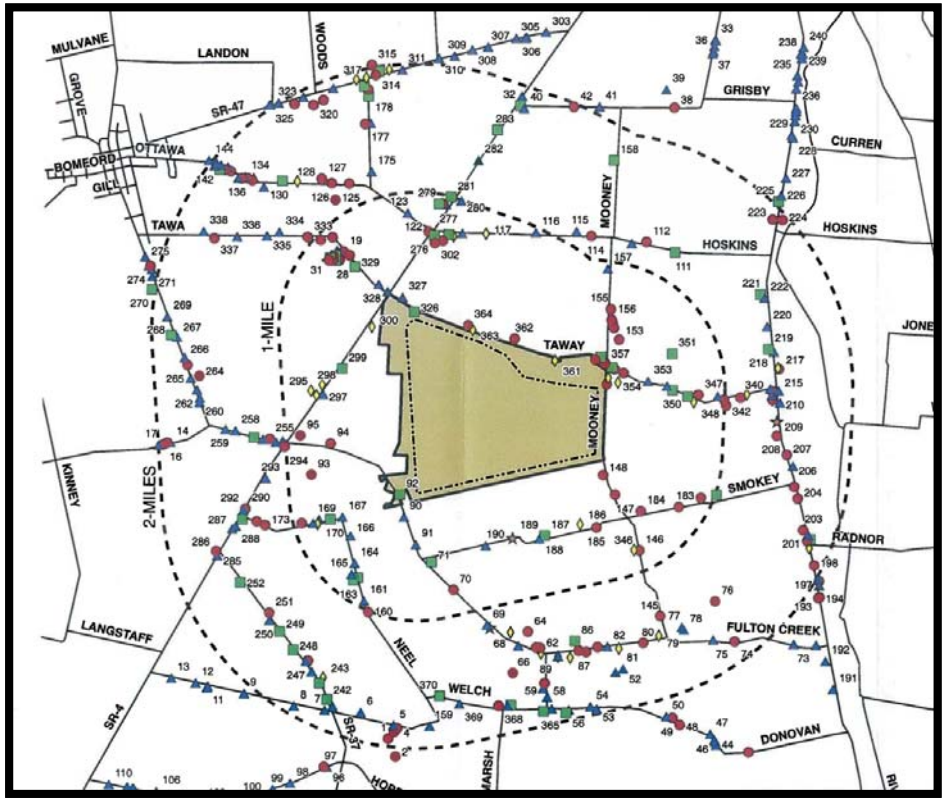
Construction Dewatering

- 14 perimeter wells into limestone bedrock
- Internal shallow wells into sand and gravel
  - Additional dewatering
  - Release of air trapped in sand and gravel under liner

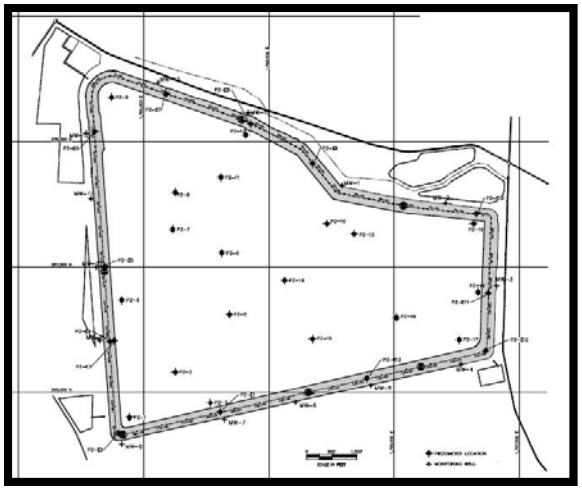
Existing Wells Study

- 16 well complaints to date
- 5 well replacements to date



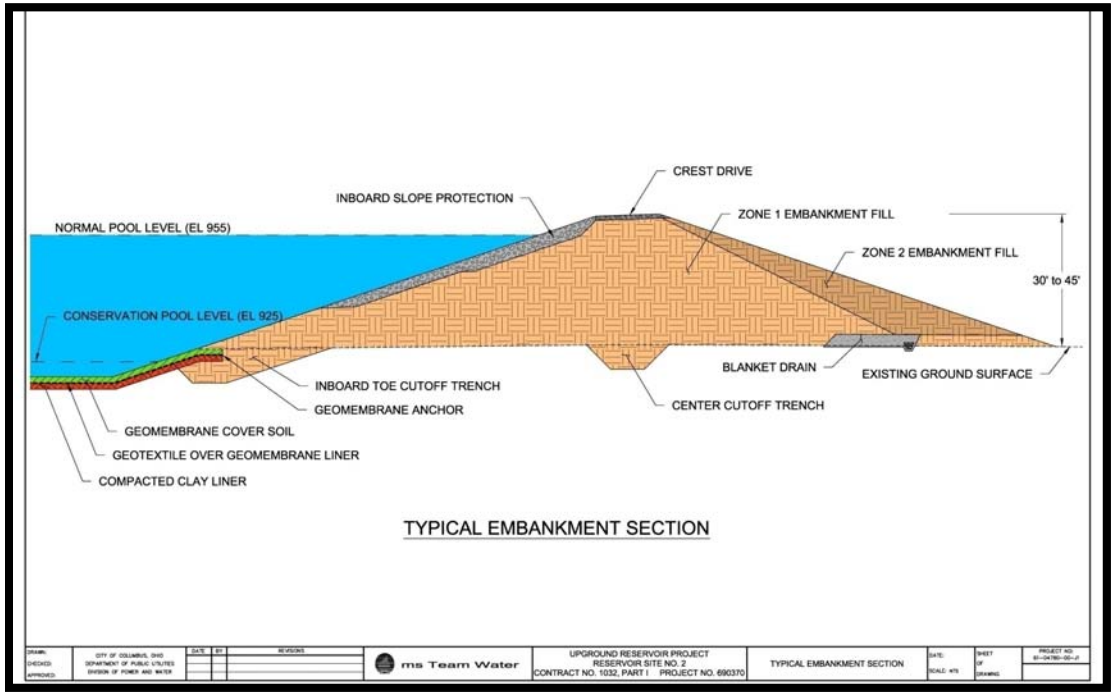
Groundwater Monitoring

- 14 shallow monitoring wells
- 14 deep monitoring wells
- 4 pipe backfill monitoring wells
- Transducers, data loggers, phone modems, solar panels
- 32 vibrating wire piezometers
  - Embankment
  - Liner
- Real time/on-line monitoring



Embankment Construction

- 30-45 feet high
- About 5 miles long
- 4.6 million cubic yards
- No stones larger than 4 inches
- On site lab for compaction testing



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Blanket Drain Construction

- Used to control the seepage through the embankment
- Numerous sources of natural sand
- 128,000 tons of aggregate

- Gravel around perforated pipe
- Sand around gravel
- "Graded filter"

CCL Construction

- 18-inches thick
- Compacted cohesive soil
- 1.9 million cubic yards
- No stones larger than 2 inches
- Remove bumps, obtrusions, stones larger that ½ inch at surface

Linear Fabrication

- Fabrication shop in Marysville, OH
- Less field seams

- fPP comes in 25’ by 250’ rolls
- 125’ by 250’ sheets to site

Fabricated Panel Delivery

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Liner Installation

Field Seaming

- Double thermal fusion welding
- Trial seams
- Air channel testing
- Destructive seam testing

Geotextile Covers

- 11-ounce non-woven geotextile
- Over geomembrane
- Cover soil cushioning
- Sand bag ballasts

Cover Soils

- Cohesive soil, or
- Granular soil, or
- Topsoil
- 18 inches thick
- 1.9 million cubic yards
- No stones larger than 2 inches

Affects of Weather on Liner Installation

- Runoff/sediments onto exposed liner
- Dust impacted field seam adhesion
- Worker heat stress protocols

Liner Whale

- July 2013
- Water/air trapped beneath liner near tie-in after storm
- Cut/vent & patch

Winterization Berm

- Temporary Berm
- Protect constructed CCL from freezing
- Helps keep geomembrane secured

Winterization Pool – June 2013

- 650 acres
- 12” min depth
- 1.3 Bgal

Questions?

www.columbusupgroundreservoirs.com

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Reservoir Excavation Embankment Construction

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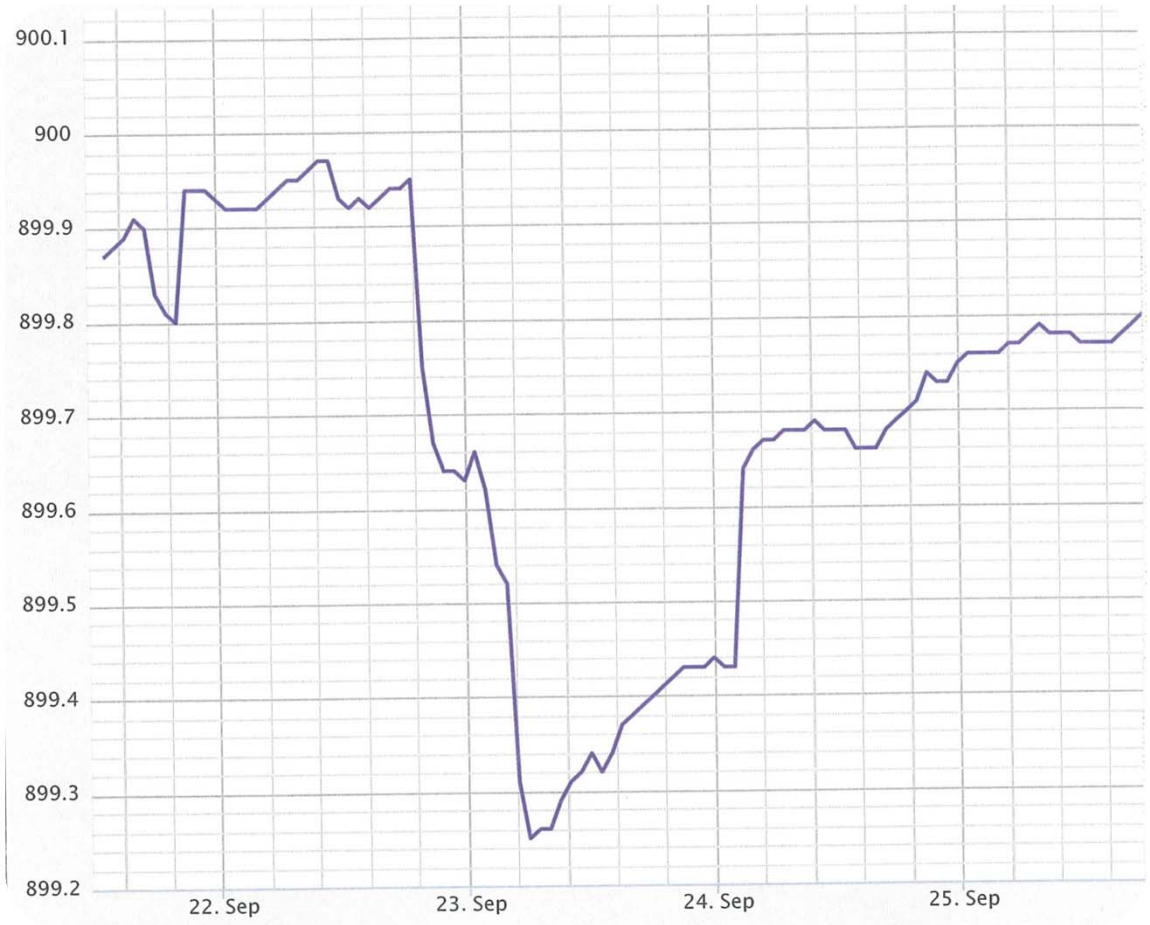
Sedimentation Analysis

- USGS Scioto River Sediment Loads
  - Mean – 50 ppm; Max – 750 ppm

- Annual Volume Loss in R2
  - .4 mg/yr @ 50 ppm; 5.6 mg/yr @ 750 ppm

- 1.3 Bgal Sediment Capacity in Conversation Pool (over 200 years)

Well Level Data – Start of Dewatering



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QA/QC

- Embankment QAP
- Geomembrane QAP
- Compaction testing
- On-site lab for testing

Inboard Slope Protection

- Protects from wind/wave action
- T?
- H?
- QTY?

Field Seams

- Poor Field Seam

- Quality Field Seam

Northwest Portion of Site

Northeast Portion of Site

- Borrow Area B-1
- 72-inch-diameter pipe

Water Quality

- WQ monitored at Scioto River – fill during conductive periods

- Outlet structure has WQ Profiler & gates at variable levels