FPB Reservoir Discussion

Frankfort Electric and Water Plant Board
Frankfort, Kentucky
David Billings, Chief Water Engineer

Agenda

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- This meeting is not the Public Meeting (December 15th)
- History
- Issues
- Decision to Replace the Reservoir
- Physical Constraints
- Design Constraints
- Going Forward

FPB Water History

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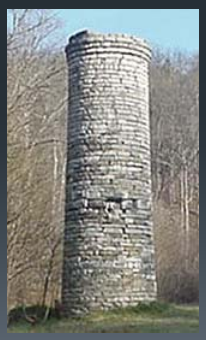
- 1804, City of Frankfort established first water works in KY – Frankfort Water Company. First water source was Cedar Cove Spring
- 1839, Improvements to Cedar Cove Spring and new gravity piping system installed which supplied an adequate water supply till 1880's



Reservoir History

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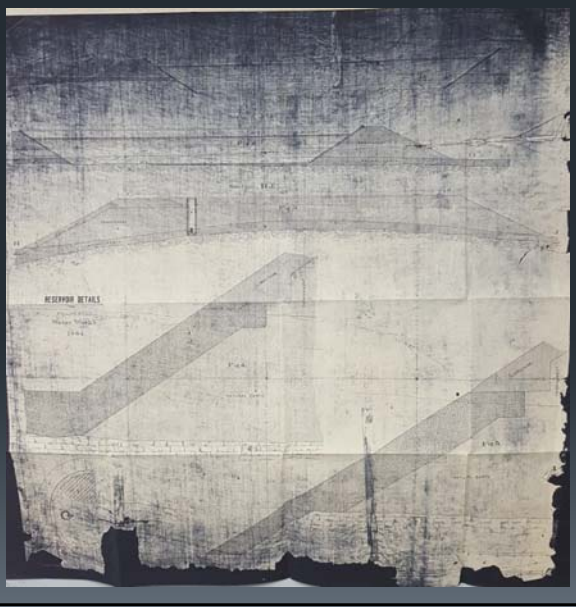

- Circa 1885, the Kentucky River becomes our water source with the construction of a new pumping plant and the Reservoir. Original capacity was approximately 6.5 MG.

Reservoir History (cont.)

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1962 - Vertical wall section (ring wall being added to increase overall capacity to 9.2 MG

Reservoir History (cont.)

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1962 -Roof system consisting of columns, support beams, and roof system added for health concerns and to provide limited nuclear fallout protection.

Gunite (thin layer of concrete) applied over limestone pavers.

Reservoir History (cont.)

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1961 – During construction photo showing ½ work complete.

Reservoir History (cont.)

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Since 1961, Reservoir has remained relatively unchanged and represents 60% of our total system storage.

Lifespan
1886 – 2016
(130 years)

Reservoir History (cont.)

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1974, New treatment plant and 36” water line constructed to the Reservoir. In total, there are 36”, 20”, 14”, and 12” water lines on the existing Reservoir site.

Issues with Reservoir

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- Age (130 years old)
- Increasing Maintenance Issues
  - Ongoing deterioration of roof system components
  - Ongoing deterioration of gunite lining
  - Seepage

Issues with Reservoir

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- Inherent Design Shortfalls
  - Earthen Embankment
  - No seismic design incorporated
  - Interior sloped walls (not efficient cross section)
  - Steep exterior side slopes
  - Flat roof
    - Requires separate support structure (majority of current issues)
    - Higher potential for roof leaks

Maintenance Issues

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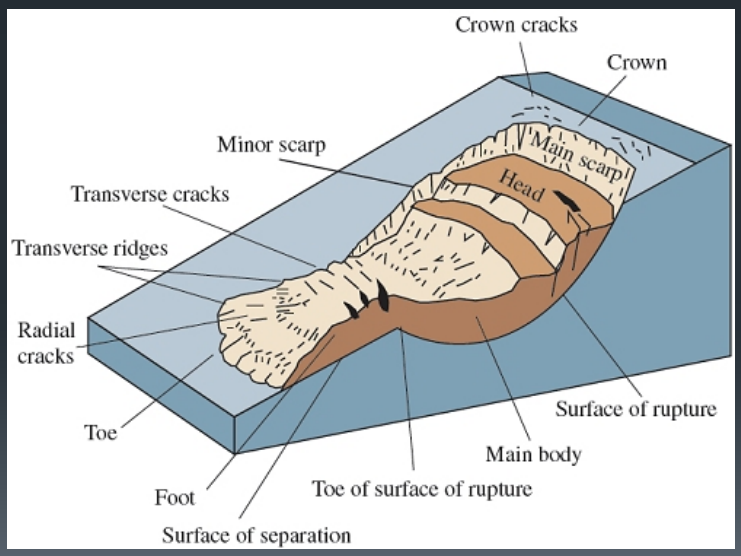
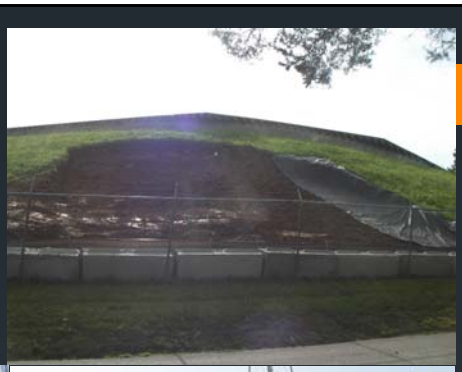
- Recent History
  - 2011 - Slippage repair on South Basin
    - Steeper side slopes more prone to soil failures
  - 2013 - Interim repairs
  - Conducted various repairs following annual inspections in 2014, 2015, 2016
  - Dec 2015 - Exterior seepage event

Slope Slippage (Earth Slump) 2011[13]

Slope Slippage (Earth Slump) 2011[14]



Slope Repair 2011



Interim Repairs 2013

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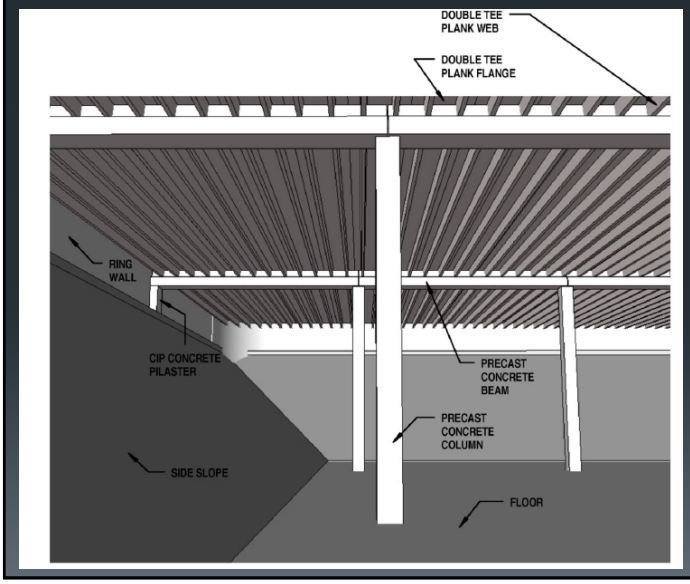

- Surface repairs to double tee roof planks
- Surface repairs to inverted tee beams
- Pilaster repairs
- Bearing surface repairs
- Added additional support brackets
- Crack injection repairs

Seepage 2015

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Exterior embankment leakage event

- The situation was effectively mitigated but could have developed into a potentially serious situation had it continued unnoticed (piping)
- Event occurred on the South Basin on the Reservoir Rd side

Seepage 2015

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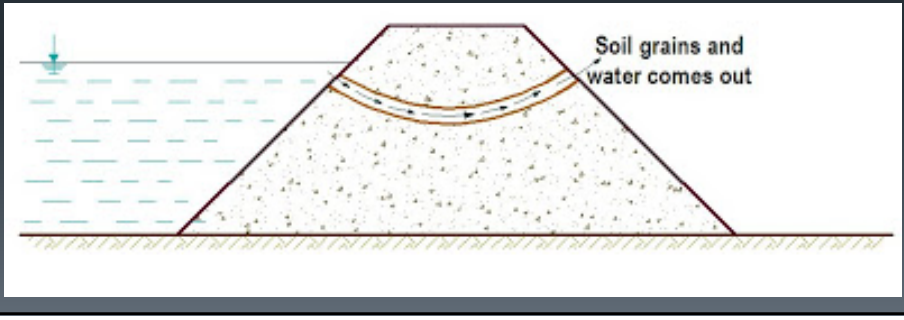
What is Piping?

- Piping is internal erosion of the embankment or foundation material caused by seepage



Mitigating the seepage required internal repairs to stop leakage

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Mitigating required external repairs to control leakage

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Seepage Mat

A seepage mat was installed in the affected area to control seepage that might continue. The seepage mat allows any remaining leakage to be released at a controlled manner such that piping doesn't occur. Piezometric monitoring wells were also installed near the seepage area to gauge water levels in the earthen embankment.

Additional maintenance as result of the monitoring program

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- Monitoring program began following the 2013 Interim Improvements Project
- Every Spring, the Reservoir is taken out of service and inspected
- Additional various repairs have been completed following the inspection (2014, 2015, 2016)
- Increasing number of maintenance issues in recent years (age related)

What does all this mean?

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- Reservoir has reached the end of it's useful life
- Been scheduled for replacement since 2010
- Replacement was delayed because of the Cable Head End
- Currently in preliminary design phase for replacement (as of Aug 2016)

How did we get to this point?

Past Options Considered

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- Do Nothing
- Repair
- Move
- Replace

Do Nothing?

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Repair? - Strand Evaluated Alternatives in 2010

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Repair Existing Structure (15-20 year fix)
- Structural improvements
- Roof repairs
- Lining system
- Total Estimated Budget $2.8M – $4.2M

Complete Roof Replacement
- New ring wall and foundation
- New support system
- New roof system
- Still have earthen embankment with no seismic protection
- Not a cost effective solution

New Tanks Were Recommended (50+ year fix)
- Partially buried
- Low maintenance costs
- Improved safety
- Designed in accordance with current codes (seismic protection)
- Total Estimated Budget $3.5M – $3.75M (two 4.5 MG Tanks)
- New tanks are more cost effective, provide better assurances, and longer service life

Move? – Staff Evaluated Alternative Locations

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Before we discuss location alternatives we need to understand design constraints

- Tank type
- Elevation (tank type and subsequent pumping systems)
- Costs

Move? – Tank type is a factor

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Two basic types of water tanks, elevated storage and ground storage.

<u>Elevated Storage</u>

Size limitations	up to approx. 3 MG max
Height	up to 230 feet
Costs	**$2.00-$3.75** (per gallon)

<u>Ground Storage</u>

Size limitations	up to approx. 30 MG max
Height	up to 70 feet
Costs	**$0.25-$0.50** (per gallon)

Move? – Water elevation is a significant factor

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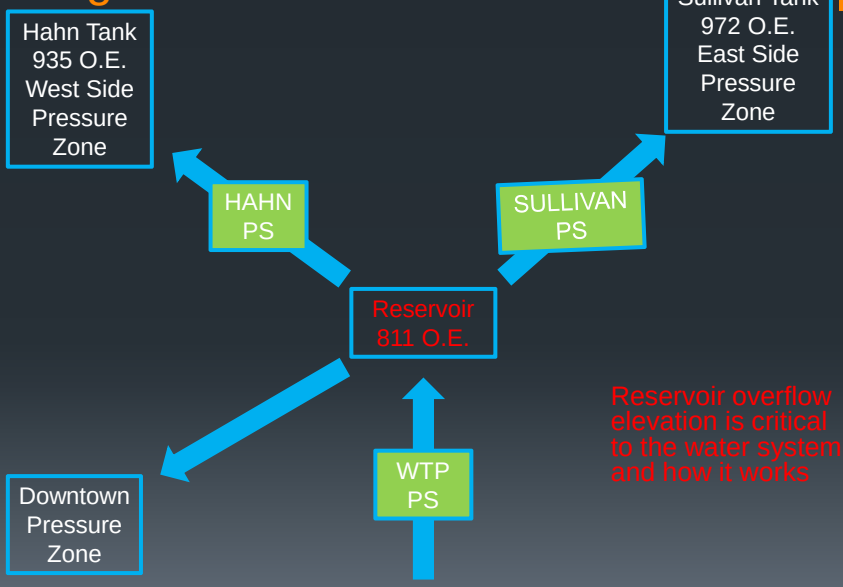

Move? – Limited Choices

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<u>Potential undeveloped areas with necessary ground elevation of approximately 780 ft.</u>

- Existing location
- Berry Hill / Golf course area
- Behind Franklin Square area
- Next to AT&T tower site off Sower BLVD

Move? – Limited Choices

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Move? – What are the costs?

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Costs for each site considered (Infrastructure + Land)

▪ Option 1 - behind Franklin Square	$8.9M	additional
▪ Option 2 - Next to AT&T tower site off Sower BLVD	$5.8M	additional
▪ Option 3 - Berry Hill / Golf course area	$1.6M	additional
▪ Stay at existing location	N/A	N/A

Notes:

Tank costs for each option not included. Moving from existing location would require 36" pipe for all options plus new pump station for options 2 & 3. 36" pipe costs approx. $288 per ft or $1.5M per mile

Past Options Recap

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- Do Nothing 

- Repair — Not Cost Effective
- Move — Limited Options and Very Costly
- Replace — Most Cost Effective and Best Option

Where Are We Now?

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- Currently in design phase (as of Aug 2016)
- Design Guidelines
  - Existing Site
  - Ground Storage
  - One 7 MG tank (Second 7 MG tank at some point in the future)
  - Smaller footprint (approx. 22% less)
  - Less runoff
  - More efficient cross section
  - Improved drainage

Where Are We Now?

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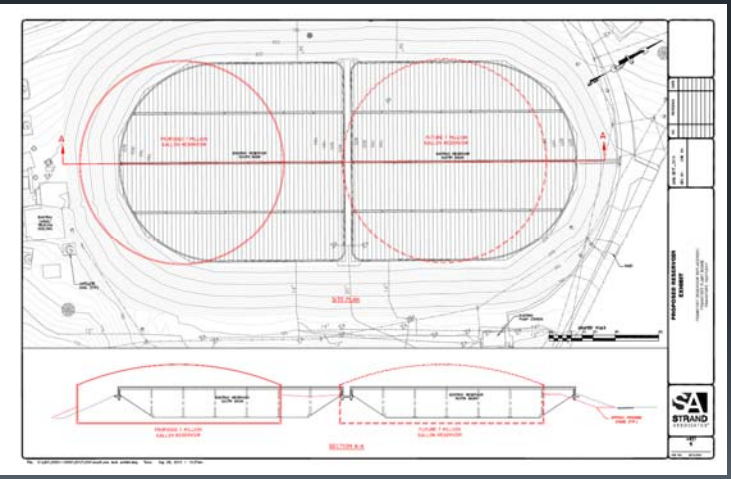
Conceptual Plan View



- Design is not complete
- Open to suggestions
- Available options

What is Next??

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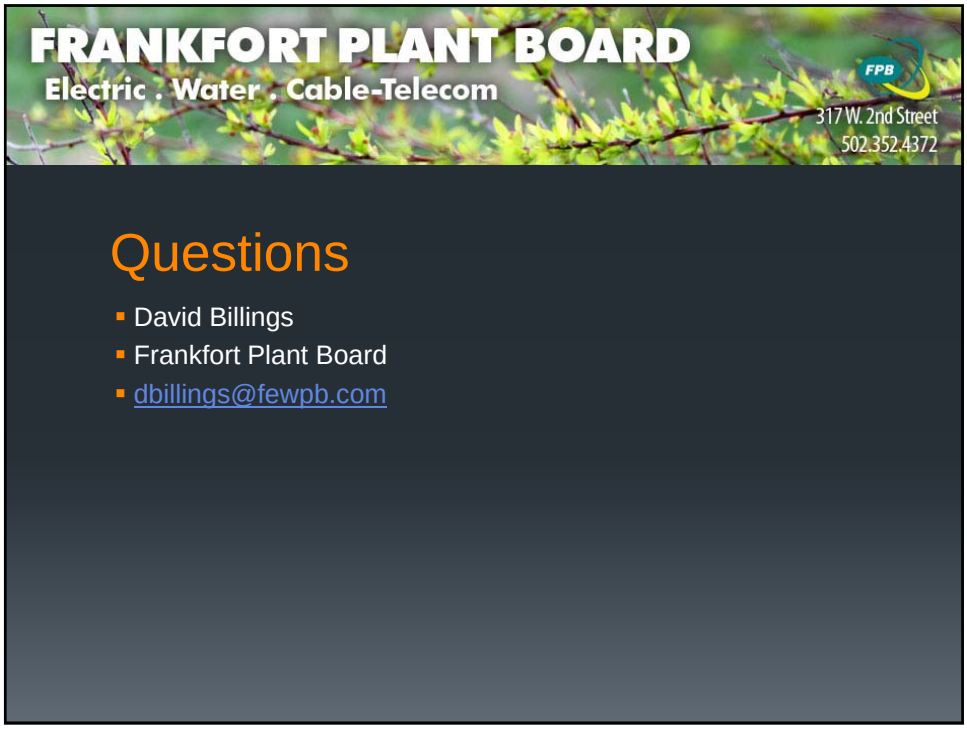
Going Forward

- Tour of existing facility
- Install temporary liner in the existing North Basin before construction
- Public meeting in December to solicit input
- Take suggestions back to engineering firm for consideration
- Presentation to City Commission, possibly others (Rotary / Kiwanis / Etc.)
- Possible press release
- Estimated construction beginning Summer 2017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