Fort Smith
Regional Water Supply Project Update

Fall 2000

Highlights:

- A large earthen dam is much more than a well-packed pile of soil and rock. Major components include foundation, impervious core, filter zones, and fill.
- A trout stream below the new Lake Fort Smith dam is technically feasible but would have significant costs.
- The Arkansas Department of Environmental Quality accepts the city's minimum flow release proposal and issues a Section 401 Water Quality Certification for the project.

Anatomy of an Earthen Dam

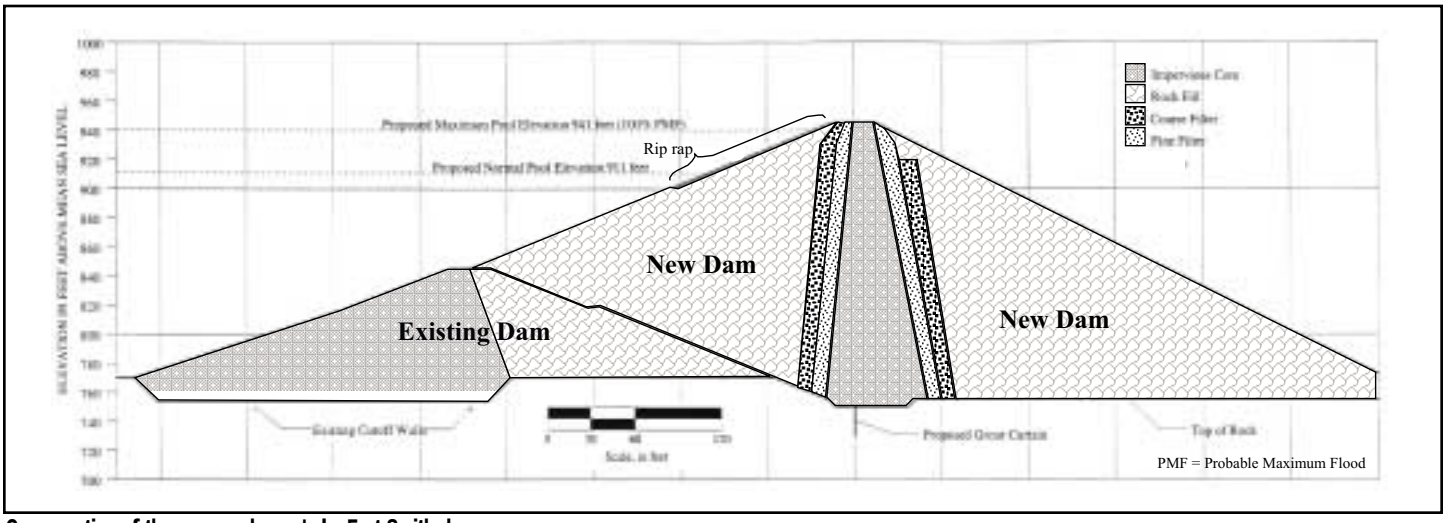
Enlarging Lake Fort Smith includes construction of many facilities, including the outlet works, principal and auxiliary spillways, and other improvements. At the heart of the project lies the proposed dam which will be more than twice as high as the existing dam and will contain approximately 4 million cubic yards of material. A dam of this size is not simply a well-packed pile of soil and rock, but a highly engineered structure consisting of zones of different types of materials that serve distinct purposes. The main components of the dam are the foundation, impervious core, filter zones and rock fill. Each component extends the length of the dam and ties into the abutments on each side of the valley.

The foundation supports the weight of the embankment and is designed to reduce seepage beneath the dam. At Lake Fort Smith, the area under the footprint of the dam will be stripped of any existing soil and broken rock so that the dam can be constructed on solid bedrock. A core trench will be excavated in the bedrock near the dam centerline. A series of holes will be drilled in the bottom of the trench to a depth of approximately 30 feet. A cement and water mixture called grout will be pumped into these holes under pressure to fill any joints or fractures in the rock that could provide a pathway for water seepage. This relatively impervious wall of grouted rock is referred to as a "grout curtain."

At the center of the dam is the impervious core that actually holds back the water. The core will consist of compacted, clay soils. Although no soil is truly impervious, the soils used in the core are chosen so that any flow through the core occurs slowly. The soils used for the impervious core will be obtained from areas around lakes Fort Smith and Lake Shepherd Springs that will be disturbed by construction or inundated as part of the project. The core starts at the bottom of the core trench and extends to the top of the dam. The width of the core is proportional to water pressure; therefore, the core is thickest at the base and thinner toward the top.

While the impervious core retains the water, the remainder of the dam supports the core. The bulk of the dam will be fill material consisting of shale and sandstone rock. Stronger rock is typically placed near the exterior of the dam. The majority of the rock used in the dam will be obtained from excavation of the auxiliary spillway on the northwest abutment.

As water seeps slowly through the clay core, force is exerted on the clay particles in the direction of flow. At the point where the water exits the clay core, particles could be washed into the void spaces in the coarser rock fill. To prevent the core from being washed out of the dam, the core is surrounded by a filter that is designed to trap soil particles.



Cross-section of the proposed new Lake Fort Smith dam

Filter materials consist of sand- and gravel-sized particles, with the smaller-sized particles placed next to the core. Filter material will be obtained primarily by screening or crushing material excavated from the auxiliary spillway.

Trout Stream Feasibility Study

Burns & McDonnell presented the final report on the technical feasibility of creating a trout fishery in Frog Bayou to the Tailwater Fishery Advisory Committee on November 27. The report concluded a limited potential exists to create a trout fishery based on a 10-cubic-foot per second (cfs), cold-water, minimum flow release from the bottom of the new Lake Fort Smith. Significant costs, however, would be associated with this fishery.

Trout could be maintained in Frog Bayou between the new spillway stilling basin and the U.S. Highway 71 bridge for 6 out of 10 years. In the remaining years, water discharged over the spillway of the lake would make the water in the creek too warm for trout. Downstream of the bridge, the inflow of warm water from tributaries, such as Warloop, Clear, and Cedar creeks, would allow suitable conditions for trout to be maintained no more than 1 out of 10 years.

The environmental and economic costs of the trout fishery would be significant. Cold water releases could interfere with the spawning of existing warm-water fishes and the introduced trout could compete for food with and perhaps prey on the native fish species.

Rainbow trout

A 10-cfs release would reduce the yield of the new Lake Fort Smith from 49.6 to 43.6 million gallons per day (MGD). The time until future demand for water equals the yield of the new lake would be reduced by 7 years. The proposed new Lake Fort Smith will have a normal water surface elevation of 911 feet above sea level. A new, smaller Lake Fort Smith with a yield of 43.6 MGD would have a surface elevation of 884 feet. The difference in construction cost between the two lakes is about $13 million. An additional $420,000 would be required to construct an outlet works that could provide the 10-cfs release from near the bottom of the lake. The additional recreational opportunities and spin-off economic benefits needed to offset these costs would have to be derived from a trout fishery restricted primarily to 3,000 feet of Frog Bayou.

Minimum Flow Release Approved

An important prerequisite for obtaining a Section 404 permit from the Corps of Engineers to build the dam is obtaining a Section 401 Water Quality Certification from the Arkansas Department of Environmental Quality (ADEQ). For the Lake Fort Smith expansion, ADEQ made issuance of the 401 Certification contingent on the new lake providing a minimum flow release to restore perennial flow to Frog Bayou. The city of Fort Smith proposed a minimum flow release of 1.2 cfs made up primarily of filter backwash from the Mountainburg Water Treatment Plant and intentional releases of water from the lake.

On August 31, ADEQ approved the city's minimum flow release plan and issued a water quality certification for the project. Issuance of this permit means ADEQ has determined the project will not degrade the water quality or adversely affect the designated uses of Frog Bayou.

The City of Fort Smith ARKANSAS

For more information, please contact:

Utility Department
3900 Kelley Highway
Fort Smith, AR 72904
(501) 785-2801