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POSSUM KINGDOM LAKE
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INTRODUCTION

Staff of the Hydrographic Survey Unit of the Texas Water Development Board (TWDB) conducted a hydrographic survey on Possum Kingdom Lake in June, 1994. The purpose of the survey was to determine the capacity of the lake at the normal pool elevation and to establish baseline information for future surveys. From this information, future surveys will be able to determine sediment deposition locations and rates over time. Survey results are presented in the following pages in both graphical and tabular form. All elevations presented in this report will be reported in feet above mean sea level based on the National Geodetic Vertical Datum of 1929 (NGVD '29) unless noted otherwise. The results will be compared to the information from the latest sedimentation survey performed by URS/Forrest and Cotton, Inc. Consulting Engineers (1974). At the normal pool elevation of 1,000.00 feet, they reported a surface area of 17,700 acres and a capacity of 570,243 acre-feet.

HISTORY AND GENERAL INFORMATION OF THE RESERVOIR

Possum Kingdom Lake and associated Morris Sheppard Dam are owned and operated by the Brazos River Authority. The facility is located on the Brazos River, 11 miles southwest of Graford and 18 miles northwest of Mineral Wells. The 310 miles of shoreline are located in Palo Pinto, Stephens, Young and Jack Counties. Dam construction commenced May 29, 1938. The structure was completed and deliberate impoundment of water began March 21, 1941. Hydroelectric power was generated for the first time on April 17, 1941, and water was discharged over the spillway for the first time on May 5th of the same year. The general contractors for the construction of Morris Sheppard Dam were C. F. Lytle and A. L. Johnson. Estimated cost of the facility was $7,000,000.

Permit #1262 (Application #1351) was issued May 9, 1938 by the Board of Water

Engineers to the Brazos River Conservation and Reclamation District. It granted the permittee the right to construct a dam in and across the bed of the Brazos River and to impound, divert, appropriate, and use an amount not to exceed 1,500,000 acre-feet of water per annum for the purpose of domestic, municipal, industrial, mining, power generation, recreation and irrigation. Storage capacity was not to exceed 750,000 acre-feet of water. Permit #1262 was later amended February 9, 1987. Records indicate the Brazos River Authority (formerly Brazos River Conservation and Reclamation District) had a priority right to use not to exceed 230,750 acre-feet of water per annum for municipal, industrial, irrigation and mining purposes. The amendment to Permit # 1262 authorized an interbasin transfer to the Trinity River Basin of up to 5,240 acre-feet of water per annum of the municipal authorization. Certificate of Adjudication #12-5155 was issued to the Brazos River Authority on December 17, 1987. The owner was authorized to maintain an existing dam (Morris Sheppard) and reservoir (Possum Kingdom Lake) and impound therein not to exceed 724,739 acre-feet of water. The owner was authorized a priority right to divert and use not to exceed 230,750 acre-feet of water per annum for municipal, industrial, irrigation and mining purposes. For system operation purposes, the owner was authorized to exceed the priority right and to annually divert and use from Possum Kingdom Lake not to exceed 175,000 acre-feet of the municipal authorization of which amount not more than 5,240 acre-feet of water of the municipal authorization may be transferred to the Trinity River Basin for municipal use by the Authority's service area customers; 250,000 acre-feet of water for industrial purposes; 250,000 acre-feet for irrigation purposes and 49,800 acre-feet of water for mining purposes. All diversions and use of waters from Possum Kingdom Lake in excess of 230,750 acre-feet of water in one calendar year would be charged against the sum of the amounts designated as priority rights in the other reservoirs included in the System Operation Order. The owner was also authorized to use the impounded waters of Possum Kingdom Lake for non-consumptive recreation purposes. A non-priority right was authorized to the owner for non-consumptive use of water released from or flowing out of the lake for Hydroelectric power generation. Certificate of Adjudication #5167 (issued December 14, 1987) states the owner is authorized to divert and use not exceed, 30,000 acre-feet of water for municipal purposes and 170,000 acre-feet of water for industrial purposes, to be used in the San Jacinto-Brazos Coastal Basin. This water is to be released from Possum Kingdom Lake (Certificate of Adjudication # 5155) and other reservoirs owned and operated by the Brazos River Authority.

Morris Sheppard Dam consists of a reinforced concrete, Ambursen-type, massive buttress with a flat-slab deck, a section of nine roof-weir gates, two bulkhead sections and an earthen dike. The total length is 2,740 feet with a maximum height of 189 feet at elevation 1,024 feet. The spillway consists of nine roof-weir type gates 73 feet 8 inches wide by 13 feet high with top of gate elevation 1,000.0 feet. Flood-control releases are made from one or more of these gates. They have a total discharge capacity of 550,000 cubic feet per second (cfs) at elevation 1,000.0 feet. There are two 12-foot-diameter penstocks with gates and control tower for water supply to the turbines in the powerhouse. The turbine operation provides regulated releases. When turbines are not operating, necessary low-flow releases are controlled by two 30 inch by 24 inch gates that discharge water into the outlet conduit through the face of the dam. The power facility consists of two 11,250 kw generating units.

Records indicate the original capacity of Possum Kingdom Lake at normal pool elevation of 1,000.0 feet was 724,739 acre-feet with a surface area of 19,800 acres. These records were based on 1935-1938 topographic surveys. A sediment survey performed by URS/Forrest and Cotton Inc. in 1974 revised the volume at the same elevation to 570,243 acre-feet with a surface area of 17,700. acres. The 1974 survey reported an average lake width of one mile with a maximum width of 3.5 miles. The length of the lake was estimated at 65 miles. Depths were reported to be more than 100 feet near the dam.

The drainage area for Possum Kingdom Lake is estimated at 23,596 square miles, of which 9,566 square miles is probably noncontributing. Major tributaries include Rock Creek, Deep Elm Creek, Connor Creek, Cedar Creek, Caddo Creek and Bluff Creek.

HYDROGRAPHIC SURVEYING TECHNOLOGY

The following sections will describe the equipment and methodology used to conduct this hydrographic survey. Some of the theory behind Global Positioning System (GPS) technology and its accuracy are also addressed.