**Project Scope**
**Project: Lake Tansi Water Harvesting Project**
Client: City of Crossville
Project No.: 7035
Status: Preliminary
Date: December 26, 2007
Revised: January 9, 2008

The proposed project is planned to harvest water from the Lake Tansi reservoir located within the Lake Tansi Development in the southern portion of Cumberland County, Tennessee. The goal of the Project is to increase the water supply resources of the City of Crossville with a minimal impact on the environment and minimum capital and operational cost. This project scope is to address the impacts associated with building a permanent water harvesting system in comparison to a temporary harvesting system.

Life cycle costs are a function of capital cost, operational costs, and useful life. A lower capital cost project with higher operating costs or a short useful life often will be more expensive and harder to finance than projects that have a higher capital cost but longer useful lifes.

Therefore, the design objectives for the Project should include:

- The system should be capable of effectively harvesting the safe yield of the Lake Tansi Reservoir. The system should be able to harvest the entire safe yield of the reservoir through a variety of operating strategies including lowering of the lake prior to winter rainfall periods; direct harvesting during periods of rainfall to capture excess water that would flow out the spillway; and harvesting of the lake during extreme droughts to use all readily available water. Ultimately, the objective is to harvest as much water as possible without detrimental environmental effects from the Lake Tansi Reservoir.

- The system should have a useful life upon construction or with minor upgrades to achieve a useful life of at least fifty years.

- The system should keep operational costs to a minimum during the useful life through the use of quality materials and strict guidelines for power consumption. Energy usage and costs have recently become a major concern in the United States due to the high rate of inflation associated with energy costs. It is anticipated that energy costs will grow significantly faster than other costs.

Lake Tansi is a man-made lake with a surface area of approximately 404.1 acres and a drainage area of 13.67 square miles. A preliminary analysis of the lake's storage from normal pool to eight feet below normal pool was conducted and revealed that the volume of water stored in the top eight feet of the lake is between 2750 and 3000 acre-feet. The lake compares to the other two City of Crossville water supply impoundments as summarized in the following table:

**Water Supply Reservoir Comparison Table**

(most data taken from Safe Dam records)

| | Meadow Park Lake | Lake Holiday | Lake Tansi |
|---|---|---|---|
| Surface Area at Normal Pool (acres) | 274 | 223 | 404.1 |
| Drainage Area (sq. mi.) | 5.19 | 8.14 | 13.67 |
| Ratio of Surface Area to Drainage Area | 0.082 | 0.043 | 0.046 |
| Normal Pool Elev. (feet) | 1817.5 | 1758.4 | |
| Estimated Storage at Normal Pool (acre-feet) | 3069 | | |
| Number of Days of Water Supply from top 1.0 foot of lake without any rainfall | 22.3 | 18.2 | 32.9 |

The addition of the Lake Tansi reservoir would constitute a 103% increase in drainage area supplying water for the City of Crossville's system and approximately an 80% increase in storage volume. However, since water pumped from Lake Tansi would require some storage within Meadow Park Lake, the effective storage increase would not be as high as 80% in a water harvesting situation.

Water harvesting from Lake Tansi into Meadow Park Lake would significantly augment the City of Crossville's water supply during drought periods. Additional benefit could be derived from the harvesting of the lake without compromising the usefulness of the reservoir for recreational purposes if additional storage was available to store the harvested water. If adequate additional storage was available, the harvesting system could effectively double the amount of raw water available to the City.

The proposed intake would be located as near as practical to the Meadow Park Lake and would require the construction of piping, screens, and a raw water intake with a wetwell. The intake should be sized to pump the 8 feet of stored volume or the rechargeable volume of the lake within a four to five month period. Preliminary calculations indicate that the required pumping rate should be approximately 5750 gpm for a four-month period or 4000 gpm for a five-month period. In either situation, the piping from the intake pumps to the discharge location should be a 36" diameter pipeline.

There is approximately 9200 linear feet of pipe required along the proposed route to reach a discharge into the Meadow Park Lake at the surface of the lake. An additional 3000 linear feet of pipe would be required to reach the Meadow Park Water Treatment Plant directly.

A preliminary cost estimate is presented for the Project. The estimate involves using a 36" ductile iron raw main and 4000 gpm pumps in the intake. Design of a project within the above scope would provide an ultimate capacity to pump up to 22,000 gpm.

A primary consideration for the sizing of piping and pumps has been the cost of electrical power to run the system. The following table shows the estimated monthly electrical power required to pump at different flow rates for each of the pipe sizes.

| **Monthly Electrical Power Costs based on Pump Rate and Pipe Size** | | | |
|---|---|---|---|
| | *24" Raw Main* | *30" Raw Main* | *36" Raw Main* |
| 4000 gpm | $8800 | $8200 | $7300 |
| 6000 gpm | $14,100 | $12,300 | $11,900 |
| 8000 gpm | $22,600 | $18,000 | $15,800 |
| 10,000 gpm | N/A | $24,700 | $20,100 |
| 15,000 gpm | N/A | $44,500 | $34,700 |

Obviously, the 36" main has the higher capital cost but can have operating cost savings of over $30,000 per year at an operating rate of 8000 gpm and operating for 5 months of each year. Ultimately, the most economical solution is dependent upon the amount of usage that the system will see over its useful life. The more the system is used or planned for use, the larger the raw water main should be.

Preliminary design on several components has been performed by ECE Services in an effort to provide an accurate cost analysis.