Water Supply Reservoirs

A Traditional Water Management Practice

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Reservoirs can be expensive and controversial

- Many people support the construction of reservoirs
- Many people are vehemently opposed
Why build reservoirs?

Reservoirs are often a necessary component of a surface water supply system.
In many geologic regions, significant groundwater resources are not available and surface water streams are the only feasible source for medium and larger size public water systems.
What is the function of a reservoir in a water supply system?

Reservoirs have one principal function: Storage
The Need for Storage

In a dynamic system where inputs and outputs are not constantly equal, storage must be utilized.

- Analog electronic circuits require capacitors, the sole purpose of which is storage of electric charge.
- Computers cannot function without data storage.
- Warehouses store inventory to allow for variations between supply and demand of a product.
- Detention ponds utilize storage to reduce peak flows from storm events.
- Elevated tanks store water so that water distribution system pressures will remain relatively constant in spite of short term variances in supply and demand.
- In a water supply system dependent on surface water, storage from raw water reservoirs is used to supply water to the system during periods of low stream flow.
Determining Storage Volume Requirements

Graphical Determination of Required Storage Volume
Rippl, 1883
Determining Storage Volume Requirements

• Modern techniques for reservoir sizing use detailed computer simulations of the system operation including proposed reservoir configurations and can include other variables in the analysis.

• Trial and error simulations are run until the point of system failure is determined.

• These analysis techniques use historic stream flow records and simulate the system operation during droughts of record.

• The reservoir alternative must assure that minimum instream flow criteria are met in the operation of the reservoir. This is the most critical component of the safe yield analysis.
Mathematical Simulation Results

Reservoir Storage

Storage - Million Gallons

Dead Pool - 20% of Full Volume
Protected Minimum Instream Flow

• In Georgia, prior to 1977 water withdrawal permits issued by the state had no protected stream flow requirement.

• In 1977, new regulations were issued that required the protection of the Annual 7Q10 flow. A stream’s annual 7Q10 is a statistical figure that reflects the lowest seven-day running average of a stream’s flow with a recurrence frequency of once in ten years.

• In 2001, a new policy was issued requiring more stringent protected flow levels. Typically, Monthly 7Q10 flows became the new requirement. Monthly 7Q10 is a statistical figure that reflects the lowest seven-day running average of a stream’s flow for each calendar month with a recurrence frequency of once in ten years.

• Minimum Instream Flow requirements have been adopted for the purpose of protecting aquatic wildlife resources.

• The greater the Minimum Instream Flow requirement, the greater will be the required reservoir volume.
Reservoir Configurations

- Water supply reservoirs are seldom built on large streams due to environmental impacts.
- The current trend is to build reservoirs on tributaries and, in most cases, pump water from the main stream to the reservoir for filling.
- In some cases, the water supply withdrawal is taken from the main stream and water is released from the reservoir during low flow periods for streamflow augmentation.
Option 1

- No Pumping from Main Stream
- Water Supply taken from reservoir
- Only feasible for smaller systems
Option 2

- No pumping from main stream
- Water supply taken from main stream
- Reservoir provides flow augmentation during low flow periods
Option 3

- Reservoir fills with pumping from main stream
- Water supply taken from reservoir
Option 4

- Reservoir fills with pumping from main stream
- Water supply taken from main stream
- Reservoir provides flow augmentation during low flow periods
Planning and Permitting a Reservoir (a lengthy and arduous process)

- Needs Assessment – prepare a projection of future water supply needs. Must consider water conservation efforts.
- Alternatives Analysis – determine the least environmentally damaging most practicable alternative.
- Cultural Resources
- Analysis of Environmental Impacts (EIS may be required)
  - Wetlands
  - Stream Loss
  - Threatened/Endangered Species Habitat
- Compensatory Mitigation Plan
  - Purchase credits from a mitigation bank
  - Develop a mitigation site
  - Can be very expensive
Alternatives to Reservoir Construction

Water Conservation

- It seems that most reservoir opponents are convinced that all future water supply needs can be met through water conservation.
- Water Conservation (Demand management) is a tool that must be used as much as is practical to reduce the need for expanded water supplies but it is risky to assume that all water needs for future population growth can be met through reductions in usage by the existing population.
- Water conservation must be included in the Needs Assessment that is performed as part of the reservoir planning process.
Alternatives to Reservoir Construction

Upland Storage Lagoons

• It may be possible to construct upland storage lagoons to provide required water storage.
• If a lagoon could be located that would not directly impact a stream it would be more acceptable from an environmental perspective.
• This alternative should be investigated in an alternatives analysis.
• Unfortunately, the terrain in the piedmont is not very conducive to locating an upland lagoon having adequate volume without impacting a stream. Such a structure would require very large amounts of earth moving and likely require much rock excavation.
• Control of seepage would be expensive.
Alternatives to Reservoir Construction

Wastewater Reuse

• Reuse of wastewater for potable water supplies is probably the most promising solution for increasing supply in the future.
• Wastewater treatment technology is becoming more advanced and more reliable. However, it is not likely that direct potable reuse, which means pumping treated wastewater directly to the water treatment facility, will be accepted in the near future.
• The best option is indirect potable reuse with the reclaimed water being applied to the upper end of a water supply reservoir.
• If an existing reservoir is available, its water supply yield could be increased by utilizing reclaimed wastewater.
• A proposed discharge to Lake Lanier is being opposed by environmental groups.