



Small Reservoirs

their impacts and alternatives



Reservoirs are constructed to address a number of social and natural resource issues, including flood control, electricity generation, community water supply, or simply aesthetics. However, the benefits of reservoirs come with tremendous costs, especially to the health of the stream on which they're built. When deciding whether to construct a reservoir, numerous impacts and issues need to be considered, especially since they'll likely come up in a regulatory review of a proposed reservoir project:

- **Decreased dissolved oxygen** – Reservoirs often create dissolved oxygen shortages in water, limiting a vital resource needed by fish, insects, and a host of other aquatic species. Because reservoir water is still, the amount of atmospheric oxygen that gets dissolved is significantly lower than in a stream; because there is less mixing in reservoir than a stream, the water at the bottom of the reservoir often has lower or no dissolved oxygen; if water is released through the dam from the bottom of the reservoir the stream below the dam will also be low in oxygen.
- **Water temperature changes**– Whereas a moving river has a fairly homogenous water temperature, a reservoir can become cold and denser on the bottom, where sunlight doesn't penetrate, and warm and less dense at the surface where a broad expanse of water is exposed to sunlight. Because of density differences, the two temperature stratum have little chance to mix. This affects the water temperature of the river just below the dam – if water flows through the dam from the bottom of the reservoir, the downstream water will be unnaturally cold. If it comes from the surface of the reservoir, it could be unnaturally warm. Either of these conditions adversely affects stream life below the dam.

- **Aquatic life passage** - Rivers are long strings of aquatic habitat stretching through the landscape, and fish and other life move up and down them. For some species its just a matter of a few feet, for others, it can be a migration of hundreds of miles. When a reservoir is constructed, it splits this long, continuous string of habitat, and can block migrating fish from reaching spawning grounds, or divide populations, separating individuals upstream from those downstream and shrinking the gene pool, possibly reducing the likelihood either group will survive. These impacts aren't limited to fish, but extend to a host of aquatic animals like mussels, snails, and crayfish.
- **Evaporative water loss** - Despite the fact that reservoirs are often created to ensure stable drinking water supplies, they actually reduce the amount of water in a river system because so much is lost to evaporation off the wide expanse of the reservoir's surface. In the Southeast, hundreds of thousands of gallons of water can be lost per acre of reservoir per year.
- **Downstream erosion** – While excess sediment is a major water quality problem, some sediment moving along a stream bottom is natural. A reservoir can block the downstream movement of this sediment, leading to in-stream erosion below the dam as the water begins to carry sediment again.
- **Invasive species** – Constructing reservoirs destroys habitat for native plants and animals reliant on moving water while it creates habitat for potentially invasive species that may be introduced, purposefully or inadvertently, into the reservoir habitat

Given these problems, more benign techniques may be available to achieve your goals without constructing a new reservoir (see table on reverse side).

Meeting your needs without using reservoirs

Purpose or need of the reservoir	Alternative means to achieve your objective
Drinking Water	<ul style="list-style-type: none"> ■ Repair aging and leaking water supply infrastructure ■ Create a water supply system that reclaims wastewater by using soil and wetlands to clean it and put it back into the drinking water supply. Such a system helps insulate your water supply from drought since it withdraws far less water from the stream. ■ Review ordinances to ensure water conservation techniques, such as gray-water capture, are allowed Establish a water rate system that encourages conservation ■ Encourage landscaping that requires no irrigation ■ Encourage household water conservation and the use of design features in new buildings that facilitate water conservation ■ Encourage the conversion of less efficient toilets, shower heads and appliances to newer, more-efficient models ■ Limit new and work to convert existing impervious surfaces to surfaces that allow storm-water to soak into the ground, where it's stored as groundwater and helps ensure stream flow during drought ■ Where impervious surfaces can't be avoided, install storm-water control structures that allow runoff to soak into the ground, where it's stored as groundwater and helps ensure stream flow during drought ■ <i>It's important to note that establishing a water-supply reservoir without setting limits on the number of users who tap into the supply simply postpones water supply problems</i>
Fire suppression	<ul style="list-style-type: none"> ■ Build off-line water intake structures (dry hydrants) to refill fire trucks when needed
Irrigation	<ul style="list-style-type: none"> ■ Build off-line water intake structures with small pump stations to be used when needed ■ Landscape with plants that don't need extra watering ■ Install rain-catching systems, like rain barrels or cisterns ■ Use irrigation systems, like drip irrigation, that use less water. ■ Irrigate at night, when less water is lost to evaporation
Flood Control	<p>While dams may contain flood waters, an alternative that provides benefits to fish and wildlife resources, water quality, and improves the safety of people and property is to move structures out of areas that are prone to flooding. To that end:</p> <ul style="list-style-type: none"> ■ Keep new development out of the 100-year floodplain and work to remove existing floodplain development ■ Protect existing and restore degraded wetlands since they store floodwater and decrease floodwater velocity ■ Limit new and work to convert existing impervious surfaces to surfaces that allow storm-water to soak into the ground, where it's stored as groundwater ■ Where impervious surfaces can't be avoided, install storm-water control structures that allow runoff to soak into the ground at an upland site, instead of being channeled down a storm drain to a stream where it creates or exacerbates flooding
Aesthetics	<ul style="list-style-type: none"> ■ Recognize that natural rivers and streams reflect the unique natural heritage of an area and provide habitat for native flora and fauna ■ Restore degraded streams ■ Establish and protect a stream-side forest, offering an aesthetically pleasing site while protecting stream quality
Habitat improvement	<ul style="list-style-type: none"> ■ Eradicate invasive species ■ Construct wildlife food plots ■ Install nest boxes ■ Construct upland or wetland habitat areas ■ Restore degraded streams ■ Establish and protect a stream-side forest, offering an aesthetically pleasing site while protecting stream quality
Passive recreation-fishing and wildlife viewing	<ul style="list-style-type: none"> ■ Eradicate invasive species ■ Construct food plots ■ Install nest boxes ■ Construct upland or wetland habitat areas ■ Restore degraded streams ■ Establish and protect a stream-side forest, offering an aesthetically pleasing site while protecting stream quality