

## Chapter 4 Appendix

### Criteria for Determining Potential Water Availability from Rivers

The available yield for each river was calculated using its established minimum flow and its current permitted allocation. If the minimum flow for the river was not yet established, a planning-level minimum flow criteria was utilized. The five-step process used to estimate potential surface water availability is described in the following paragraphs.

**Step 1. Estimation of Unimpacted Flow.** If the minimum flow for a river was not yet established, an adjusted flow history was constructed. This was done by adding historical withdrawals into the flow record and accounting for ungaged portions of watersheds to estimate the total flow of the rivers at the locations of interest, prior to withdrawals.

**Step 2. Selection of Analysis Period.** The period used to quantify available yield (1965-2003) was selected based on previous work by the District and others that found average annual rainfall prior to 1960 to be higher than after the early 1960s (Palmer and Nguyen 1986; Barcelo and others 1990; Hancock and Smith 1996; and Basso and Schultz 2003). Enfield (2001) indicated that in Florida, the period from the late 1920s to the early 1960s was a relatively wet period; whereas, the period from 1965 to 1995 was a drier period. With this in mind, Kelly (2004) documented trends in flow patterns for rivers throughout the District and Florida. He concluded that river flows in the District were about 30 percent higher during the period from 1940 to 1969 as compared to the period from 1970 to 1999. Surface water availability estimates were based on the period of lower rainfall in order to provide a more reliable planning level quantity that could reasonably be expected to be available during both wet and dry periods. Using the higher rainfall period to estimate available surface water supplies would result in yields that would not be sustainable during extended dry periods without impacting natural systems. For those rivers where data for the period from 1965-2003 were incomplete, the available period of record was used.

**Step 3. Application of Minimum Flow or Planning Level Criteria.** For rivers with established or proposed minimum flows, availability of water for withdrawal was determined using those values. Planning level minimum flows were developed to estimate availability in rivers without established or proposed minimum flows or surface water availability studies. Planning level minimum flow criteria include a series of constraints designed to ensure that existing uses and water supply needs of natural systems would be protected (CH2M Hill 2000). The minimum flow was assumed to be the flow that is equaled or exceeded 85 percent of the time (P85). Diversions for water supply were zero when flows were below the assumed minimum flow. Therefore, 15 percent of the time, which occurs primarily in the dry season months of April, May, and early June, water would not be available for withdrawal from the rivers. This ensured that during periods of low flow, sufficient water would be available to sustain natural systems. Availability was further constrained by limiting new and existing withdrawals to ten percent of the total daily flow of the river when the flow exceeded the P85. Individual withdrawals were limited to ten percent of the total daily flow at the point of the withdrawal. This is consistent with the ecological guideline used by the District during the 1980s and early 1990s to evaluate potential surface water withdrawals. Based on a comparison of potentially available yields calculated using the P85/ten percent criteria and available yields calculated using the established minimum freshwater flows, the P85/ten percent criteria are reasonable.

**Step 4. Consideration of Existing Legal Users.** Once available yields were calculated, permitted withdrawals (if applicable) were subtracted from the quantity of water available. For cases

where a flow schedule is prescribed in a water use permit, the flow schedule was used to determine the quantity of water that has been permitted and is unavailable for future allocation. Most permitted quantities are not being used at full capacity, leaving some permitted but unused quantities that could be used to meet future demand. The amount of water to be developed in the future will be determined through the permitting process and based on established minimum flows.

Step 5. Application of Engineering Limitations. Maximum withdrawals were restricted to twice the median flow of the river as a practical engineering limitation.