

## Draft Environmental Work Group Report -- Current Environmental Flows

- I. Introduction: What are environmental flows?
  - A. Water in the Southwest. In the generally arid conditions of Arizona, surface water and the groundwater that supports it in perennial and intermittent streams are often the limiting factors for riparian vegetation, and wildlife and fish habitat. A high proportion of plants and wildlife (including fish) depend directly or indirectly on riparian and aquatic habitats [INSERT RELEVANT STATS].
  - B. Objective. This work group report makes a reasonable estimate based on existing data of the quantity of water in use to maintain the current condition of Arizona fauna and flora. That quantity is the environmental flow. As listed in the WRDC Workplan, the evaluation of environmental water uses will include:
    1. Identification of current environmental resources—Task 1.3.1 (See attached Maps/table) and available supplies as defined basin-by-basin--Task 3.1.1
    2. Identification of conditions [quantity of water available] necessary to support environmental resources -- Task 1.3.2
    3. Identification of current and future gaps between available environmental water and need for water to maintain healthy water-dependent natural resources during the study periods—Task 3.1.2
    4. Summary of findings and recommendations, including needed studies and research—Task 1.3.3 and 3.2
  - C. Ecosystems are dynamic. Riparian and aquatic systems are among the most dynamic, expanding or contracting in response to precipitation, drought, and withdrawals of water. Therefore, this report cannot be more than a snapshot in time in which the environmental flows quantified here are the dependent variables, responding to many factors, such as the introduction of non-native species, livestock grazing, management goals of government agencies, and others. When conditions are drier, or withdrawals for cultural uses increase, riparian and aquatic communities will be reduced in health and size.

## II. Environmental Resources Dependent on Environmental Flows

- A. Obligate Riparian Species
- B. Obligate Aquatic Species
- C. Other Water-Dependent Resources and Values
  - 1. Recreation
  - 2. Fly-ways for non-obligate migrating birds
  - 3. Education and educational activities
  - 4. Channel maintenance for proper hydrologic function
  - 5. Other?
- D. Economic values of environmental resources to the State (**Insert Davidson Economic Evaluation here or in V.1.c**)

## III. The components of environmental flow

- A. Base flow (add definition)
- B. Evapo-transpiration (ET) of riparian and aquatic vegetation (add discussion, if determined to be needed)
- C. Flood flows (add discussion, including why flood flow will not be quantified in environmental flow totals)
- D. Under flow-- Defined as "subsurface water flowing... down-gradient... [and] including both shallow groundwater in the Holocene alluvium and [ground]water contained in the Tertiary basin fill (Marshall, 2010). Broader alternate definition: "groundwater necessary to maintain the current condition of Arizona Fauna and flora (Citron, 2011). Include discussion on why it will not be quantified in environmental flow totals.
  - 1. Add additional discussion (if needed) on how environmental surface flows usually depend on under flow in the floodplain aquifer, and often the groundwater movement in regional aquifer.
  - 2. Add discussion on the characteristics of properly functioning environmental flow conditions including duration, timing and frequency of flows, and how they must include sufficient overbank flow for channel maintenance, establishment of favorable native fish habitat, and bank and floodplain recharge.

## IV. Quantifying Environmental Flows

- A. Analysis by groundwater basin (define) and by county
  - 1. This section may include brief descriptions and key features of the 18 groundwater basins, including identified environmental resources (**as per Calhoun bullet #6**).
  - 2. Other sources of needed environmental water
    - a. Tributaries and springs
    - b. Effluent
    - c. Reservoirs and stockponds
    - d. Other

3. This section may also include the purposes of environmental flows in State or federally designated areas: wilderness areas, wild and scenic rivers, national wildlife refuges, areas of critical habitat, unique water, etc.
- B. Determination of environmental resource water needs related to specific components of environmental flow
  1. Water needs of sport fish
  2. Water needs of native fish and other aquatic species
  3. Water needs of riparian vegetation
    - a. Native vegetation or proper functioning riparian areas + tamarisk and other non-native species that now provide habitat
    - b. How ET is quantified
  4. Quantifying other water needs described in Sec. II
- C. Presentation of the Findings in Table and Maps
  1. Data which can be quantified will be presented in a table
    - a. Table and Maps will be organized by groundwater basin and county
    - b. A column for water features will itemize primary drainages, tributaries, existing instream flows, federal or state designations, springs, effluent or other water, reservoirs, stockpond numbers, other features such as floodplain groundwater depth when available
    - c. Existing environmental values will include quantified water feature characteristics (where available) and wildlife species with emphasis on listed species
    - d. Current environmental flows will be quantified for base flow (acre-feet per year), riparian ET based on [GS? TNC? ARS? Other?] data
    - e. Quantification of additional environmental flow features, such as miles of perennial stream, spring and effluent discharge, reservoir numbers and storage, and environmental allocations (water rights designated for environmental purposes)
  2. Data to be presented qualitatively in most cases: flood flow component, stockpond volume, federal or state designations, and in some cases environmental flow allocations
- V. Findings, Recommendations, Needed Studies
  1. Findings: Identify current and future gaps between water available for environment and water needed to meet environmental goals (in terms of environmental flow needs in IV.B and any other environmental goals that have not yet been clearly defined, if any)
    - a. General adequacy of current environmental flow volumes

- b. Vulnerabilities of water-dependent resources
  - 1) Probable impacts on water dependent resources from future diversion of environmental flow to other uses: correlation between reduced environmental flows and reduced riparian and aquatic resource health
  - 2) Protection status
    - a) Current protection status of key existing environmental flows
    - b) Ways to address unprotected environmental flows
      - (1) Partnerships, local augmentation/conservation, education, etc.
      - (2) Water Rights
      - (3) New legislation?
      - (4) Increase public understanding of return on investment in environmental flows

c. Data Gaps

d. Needed Studies

2. Additional Recommendations

- a. General recommendations on key environmental flows that should be maintained at current levels
- b. Identification of areas where discrepancy between current environmental flow and flow needs should be addressed
- c. Addressing future conflicts between environmental water needs and community water needs and identifying opportunities for sustainable water management