

## Habitat Characterization Study

Increasingly stringent water quality standards for the nation's surface waters raise questions about the applicability of such nationally-derived standards to the West, where water uses are different and the value of water is intrinsically greater. Treated effluent discharged in arid areas of the West often produces the only surface water available, thus creating unique riparian and aquatic environments, or effluent-dependent waters, that are host to a variety of aquatic and riparian species while also providing water for agricultural and recreational uses.

### Project Purpose & Objectives

The Habitat Characterization Study was commissioned to document the physical, chemical, and biological characteristics of ten effluent-dependent waters in the arid West. Effluent-dependent waters are created by the discharge of treated effluent into



*Santa Cruz River  
Nogales, Arizona*

normally dry streambeds or streams that would have minimal flow during part of the year in the absence of effluent discharge. These ten sites represent case studies, and as such, the study was not conducted to scientifically verify any particular hypothesis, but to collect data to objectively describe and characterize effluent-dependent ecosystems. The need for this activity was generated by the fre-

quently asked question: When we implement water quality programs in effluent-dependent waters, what are we trying to protect?

The physical, chemical and biological characteristics of habitats at each of the ten case study sites were documented upstream and downstream of the wastewater treatment plant (WWTP) discharge point. The objectives of this effort were to (1) review existing physical, chemical and biological data; (2) conduct a site reconnaissance level survey to characterize habitats using established protocols and protocols adapted for arid West conditions, (3) identify similarities and differences among sites; (4) discuss potential approaches to protect these habitats in the context of existing regulatory programs; and (5) recommend areas for additional study.

### Compilation and Evaluation of Case Study Data

Historical and site reconnaissance data were collected at the following ten case study sites: Santa Cruz River below Nogales and Tucson, AZ; Salt River below Phoenix, AZ; Santa Ana River below San Bernardino, CA; Fountain Creek below Colorado Springs, CO; South Platte River below Denver, CO; Las Vegas Wash below Las Vegas, NV; Santa Fe River below Santa Fe, NM; Carrizo Creek below Carrizo Springs, TX; and Crow Creek below Cheyenne, WY.

*Physical Data Summary* – Historical physical data included electronic records of streamflow upstream and downstream of WWTP outfalls, and climate and stage-discharge relationship data. If available, results from site-specific hydrology and geomorphology studies were incorporated, and a reconnaissance level field geomorphology assessment was conducted at each site.



*Chemical Data Summary* – Historical water quality data included Environmental Protection Agency, U.S. Geological Survey and discharger records collected upstream and downstream of each WWTP outfall. If available, results from site-specific water quality studies were also incorporated.

*Biological Data Summary* – Where available, site-specific historical aquatic and terrestrial species data from fish and wildlife agencies, state environmental departments and other historical studies were evaluated. In addition, a site reconnaissance level field assessment of aquatic habitat, aquatic species, terrestrial habitat and terrestrial species was conducted at each site.

## Project Results

The project team utilized the available historical and site reconnaissance data to characterize the aquatic and terrestrial habitats of the ten case study sites. Commonalities as well as differences among sites were identified and these findings were used to develop an effluent-dependent stream ecosystem model based on accepted riverine ecological models. A review of the data also identified the following:

- Effluent-dependent waters are sufficiently different from other waterbody types to represent a distinct waterbody class;
- Physical habitat of an effluent-dependent water results from a combination of several factors, most significant of which are the physical dynamics associated with the discharge itself and channel modifications associated with development of urban areas;
- Differences exist between the chemical composition of waters at the study sites and laboratory water used for whole effluent toxicity testing and pollutant-specific laboratory toxicity studies;
- Aquatic and terrestrial biological communities are a reflection of the physical and chemical template resulting from instream flow characteristics (natural and effluent-driven); and
- Increased levels of wastewater treatment may not be the most cost-effective approach for improving the aquatic communities of waters receiving discharges of treated effluent.



*Santa Fe River upstream from the WWTP  
Santa Fe, New Mexico*

## Final Report

The Habitat Characterization Study final report represents the results of a comprehensive review from AWWQRP scientific and regulatory advisors and other interested stakeholders. The finding that effluent-dependent waters represent a distinct waterbody class has significant implications for the implementation of water quality programs in these created ecosystems. Implications range from potential limitations on what is biologically attainable in the aquatic community to the economics of wastewater treatment. Accordingly, the final report presents results and findings, from not only a technical perspective, but also from a regulatory and economic perspective. The final report, including supporting appendices, is available on a CD from the AWWQRP Office or may be downloaded from the AWWQRP website.

## Additional Project Information

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