

## Work Task E34: Salinity and Soil Moisture Monitoring Network

FY14 Estimate	FY14 Actual Obligations	Cumulative Expenditures Through FY14	FY15 Approved Estimate	FY16 Proposed Estimate	FY17 Proposed Estimate	FY18 Proposed Estimate
\$250,000	\$49,616.14	\$81,457.29	\$150,000	\$500,000	\$300,000	\$350,000

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**Start Date:** FY13

**Expected Duration:** FY55

**Long-Term Goal:** Restoration research to guide management actions

**Conservation Measures:** MRM1, MRM2, CLRA1, WIFL1, WRBA2, WYBA3, CRCR2, YHCR2, LEBI1, BLRA1, YBCU1, ELOW1, GIFL1, GIWO1, VEFL1, BEVI1, YWAR1, SUTA1, and MNSW2

**Location:** Conservation areas

**Purpose:** To monitor salinity (soil and groundwater) and soil moisture to facilitate management actions that will allow for the long-term health and survival of established land cover types on LCR MSCP conservation areas

**Connections with Other Work Tasks (Past and Future):** This work task was initiated with funds from Work Tasks E4, E24, F1, and G3.

**Project Description:** Monitoring soil and groundwater conditions provides information about why some restoration sites establish and develop more successfully than others. In addition to guiding decisions for vegetation establishment and health, research suggests that adequate soil moisture levels are an important habitat requirement for certain covered species. The soil and groundwater monitoring network will be expanded, and monitoring efforts will be standardized across all applicable LCR MSCP conservation areas. The process of determining which phases will be monitored and to what level will occur over a period of years. The information gathered through this effort will facilitate decisions about managing soil moisture levels and saline conditions of soils and groundwater and will also ensure the long-term viability of LCR MSCP conservation areas.

**Previous Activities:** Research results from previous studies funded by Work Task G3 indicate that riparian obligate trees will utilize groundwater over applied surface water when they have reached sufficient maturity.

An extensive review of the available literature on salinity and sodicity was conducted to summarize what was already known about managing saline soil and groundwater conditions.

Efforts to ensure that adequate soil moisture existed for recently planted riparian vegetation were initiated in 2007 by installing soil moisture devices on Cibola NWR Unit #1 (Nature Trail and Crane Roost), PVER (Phases 1–5), CVCA (Phases 1–3), and the BLCA. These sites were operated and maintained until the vegetation was adequately established (c. 2010). Data collected at these sites will be used to evaluate past irrigation management of constructed restoration sites and may be used during the expansion of the monitoring network.

A soil and groundwater monitoring network was established at portions of three LCR MSCP conservation areas: the BLCA, PVER, and Cibola NWR Unit #1. Using the data collected from the three conservation areas over 2.5 years, a mass balance model to evaluate salt accretion/loss in soils and groundwater was developed.

A soil moisture monitoring pilot study was completed in Phase 2 of the PVER during 2010–13 under Work Task F1. The results and lessons learned from this study will be used to guide future efforts in monitoring soil moisture at existing and future conservation areas.

**FY14 Accomplishments:** The final version of *Soil and Groundwater Salinity Conditions for Lower Colorado River Multi-Species Conservation Program Habitat Creation Sites* was received early in FY14. The report summarized soil and groundwater salinity conditions at the BLCA, PVER, and Cibola NWR Unit #1 Conservation Area. The final version of *Soil Moisture Monitoring Pilot Study at Palo Verde Ecological Reserve Phase 2* was also received and reviewed during FY14. This report summarized the installation of a soil moisture monitoring network, collection and analyses of soil moisture data, and recommendations for soil moisture management for meeting both vegetation evapotranspiration requirements and covered species habitat requirements.

Reviews of both documents were completed. In general, salinity is not a concern at conservation areas with frequent irrigation and coarse soil texture (the PVER and BLCA), and therefore, the monitoring network density would be lower, and the frequency of sampling could be infrequent. At conservation areas with higher salinity values (Cibola NWR Unit #1), the network density would be higher, and the frequency of sampling should be more frequent.

The conclusions of the soil moisture pilot study report included: (1) expand monitoring to all conservation areas; (2) since no data exist for southwestern willow flycatcher-occupied sites, soil moisture monitoring should be conducted at

these sites; (3) develop target soil moisture values for conservation areas; and (4) target areas with finer-textured soils when making decisions about where to allocate limited water resources.

An inventory of the existing, but unmaintained, soil moisture stations was performed at Cibola NWR Unit #1 (Nature Trail and Crane Roost), the PVER (Phases 1–5), and CVCA (Phases 1–3) to evaluate their operational status. Data were downloaded from select stations.

Expenditures were less than what had been approved, as planning was conducted to define future requirements, which in turn reduced the field effort in FY14.

**FY15 Activities:** Data from the previous soil moisture, salinity, and groundwater monitoring efforts will be sequenced into the LCR MSCP database. A master plan to expand the monitoring network to encompass all conservation areas will be drafted. Based on initial planning performed during FY14, preliminary soil moisture monitoring will begin at a select few sites, including at least one southwestern willow flycatcher-occupied restoration site (non-LCR MSCP conservation area) and two LCR MSCP conservation areas.

**Proposed FY16 Activities:** The long-term soil and groundwater monitoring effort, guided by the master plan, will go into effect, and additional LCR MSCP conservation areas will continue to be added to the network in FY16. The monitoring network will be established over several years, targeting the higher priority (high soil salinity, higher southwestern willow flycatcher potential) areas first. The proposed budget increase in FY16 includes procurement of instrumentation. The bulk purchase of equipment will reduce future purchases, provide backup equipment, and ensure consistency in data collection. Since soil moisture has been added to the parameters to be monitored (in addition to soil salinity and groundwater levels), the future budgets have been increased.

**Pertinent Reports:** The reports titled *Review of Salinity and Sodidity, Monitoring, and Remediation for Riparian Restoration Areas; Groundwater and Soil Salinity Monitoring Network in Support of Long-term Irrigation and Salt Management of MSCP Restoration Areas;* and *Soil Moisture Monitoring Pilot Study at Palo Verde Ecological Reserve Phase 2* have been posted on the LCR MSCP Web site. Once a final review has been completed, the report titled *Soil and Groundwater Salinity Conditions for Lower Colorado River Multi-Species Conservation Program Habitat Creation Sites* will also be posted on the Web site.