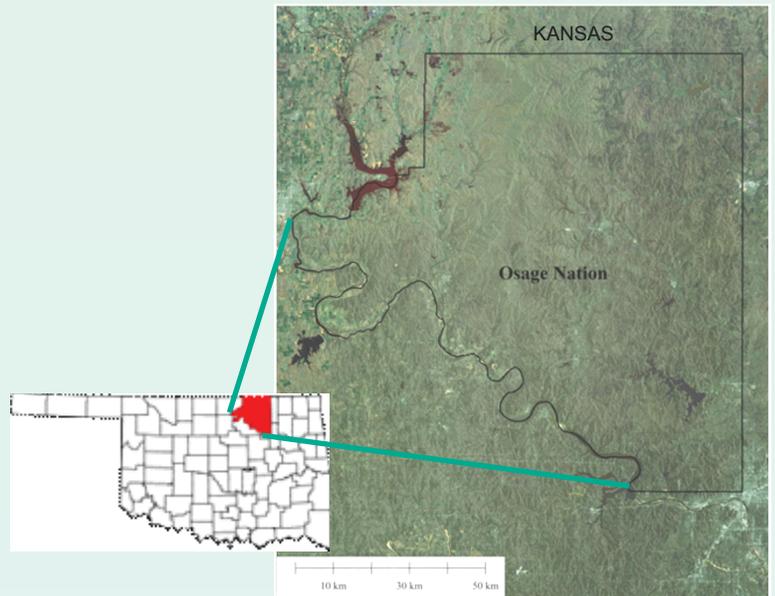


## Project with the Osage Nation

The U.S. Geological Survey Oklahoma Water Science Center is working in collaboration with the Osage Nation to evaluate the water resources of the Osage Nation and gaps in existing data that, if filled, would provide more complete information about water resources. Results of this project will be used by the Osage Nation to produce a comprehensive Tribal water plan that will describe the quality and quantity of water resources in the Osage Nation and describe future sustainable development of those resources. A Tribal water plan will help to provide a better future for Tribal members and their neighbors, while preserving water resources for the benefit of the surrounding environment and future generations.



## Our Work with Tribes

The U.S. Geological Survey (USGS), a bureau of the Department of the Interior, regularly works with Native American Tribes in Oklahoma to conduct assessments related to the available quantity and quality of water in Tribal jurisdictions. By combining traditional ecological knowledge of Tribes with applied science, Tribes and the USGS can increase mutual understanding and respect for the land and its resources. The USGS provides information to Tribes as part of our mission to produce high-quality, defensible scientific data and interpretations that assist in better understanding the environment and meeting Federal trust responsibilities to Tribes. USGS projects with Tribes typically are conducted with Tribal funds supplemented by funding from the USGS Cooperative Water Program.

The USGS has worked previously with the Osage Nation to: conduct geological surveys, understand the effects of petroleum production on water and soils, characterize aquifer properties and water quality of the Quaternary and Vamoosa-Ada aquifers, and measure surface-water characteristics and quality since the early 1900s.

## Project Description

The study area of the planned project is the Osage Nation of Northeastern Oklahoma, a 2,300-square-mile area shown in the figure above.

This area primarily consists of rolling pastures and remnants of Tallgrass prairie, with some woodlands. One of the notable features of the Osage Nation is the drilling of more than 40,000 wells for oil and gas, which has affected the history, economy, culture, and environment of the Nation.

The planned project will consist of 5 tasks:

- 1) Compilation and interpretation of existing hydrologic and related data,
- 2) Gathering of new geophysical, hydrologic, and related data,
- 3) Development of a computer model of surface-water and groundwater resources that can be used to test the effects of development scenarios on water resources,
- 4) Analysis of water availability, and
- 5) Preparation, review, and publishing of summary reports.

Drilling large-diameter aquifer-test wells.



# Investigation of Hydrogeology and Water Availability in the Osage Nation of Oklahoma

## Project Task Details

### Task 1--Retrospective

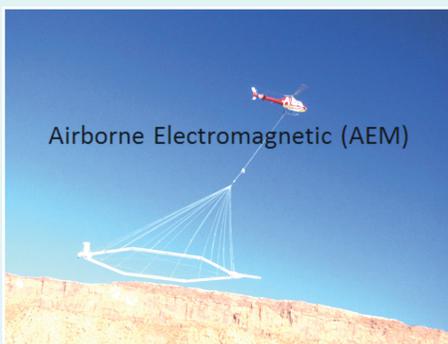
Hydrologists from the USGS Oklahoma Water Science Center and staff of the Osage Nation will gather and summarize existing climate, land-use, geologic, hydrologic, water-quality, and geodetic information into a Geographic Information System.

Organizing these data and filling data gaps will enable better characterization of water resources in the Osage Nation and will be summarized in a USGS Scientific Investigations Report. That information also will be used to determine locations of sampling sites and monitoring well installation, and will provide the basis for a 3-D visualization of the hydrogeologic system for modeling.

### Task 2--New Data

New hydrogeologic and geochemical data will be collected to fill gaps in existing data, provide updated data about current conditions, and assist in compiling a geologic and groundwater framework model to replicate current conditions and test the effects of future development on water resources.

Part of the work for this task will consist of flying airborne electromagnetic surveys by helicopter. Such surveys can indicate the type of subsurface rocks and amount of saline water below fresh groundwater. In addition, as many as 10 new multiple-well aquifer testing or monitoring sites will be constructed in the Osage Nation.



### Task 3--Hydrologic Models

Hydrologic models use field data of aquifer and water properties to estimate flow of surface-water

and groundwater and flow between surface water and groundwater under current and projected future conditions. For this project, the USGS-designed MODFLOW-2005 3-dimensional finite-difference hydrologic model will be used to simulate steady and non-steady groundwater flow and surface-water interaction based on the 3-D geologic model developed in earlier tasks of this project. This program will enable simulation of the effects of changes in climate, installation of new wells, and changes in pumping on the amounts of groundwater and directions of groundwater flow in aquifers underlying the Osage Nation. The MF-FMP2 modeling package will be used to simulate the effects of agricultural activities on groundwater. Other modeling software will be used to simulate recharge from the land surface to the saturated zones of aquifers. The Precipitation Runoff Modeling System (PRMS) and SFR2 Modeling package will be used to estimate runoff and to simulate streamflow routing of water in the Osage Nation. Groundwater and surface-water models will be linked into an integrated hydrologic model.

### Task 4--Water Availability

The integrated hydrologic model developed in Task 3 of this project will be used to evaluate how selected scenarios of future climate and water use will affect the availability of water in the Osage Nation. Potential change scenarios include lesser rainfall and greater evaporation with drought, changes in agricultural land uses and irrigation, increased urbanization, and increased industrial water use.

### Task 5--Reports

A USGS Scientific Investigations Report summarizing previously collected data related to climate, geology, land use, groundwater and surface-water resources, and water use and spatial and temporal gaps in those data will be published in mid-summer of 2014. A final USGS Scientific Investigations Report summarizing the geologic framework, hydrologic budget, and results of the integrated hydrologic model will be published by September 30, 2017. These reports will provide the Osage Nation with water availability and related data and scenarios needed for the Nation to compile a comprehensive Tribal water management plan covering the extent of the Osage Nation.

For additional information, please contact David Mott at (405) 810-4417 ([dmott@usgs.gov](mailto:dmott@usgs.gov)) with the USGS, or Jann Jones at (918) 287-5333 ([Jannjones@osage tribe.org](mailto:Jannjones@osage tribe.org)) with the Osage Nation Environmental Resources Department.