

## CHAPTER II. LITTLE WASHITA WATERSHED

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### A. GENERAL HISTORY AND CHARACTERIZATION

A tributary of the Washita River in southwest Oklahoma, the Little Washita River Watershed is unique in that over a period of several years it has been the target of extensive research. In 1936 the eastern portion of the watershed was chosen as part of a national demonstration project for soil erosion control. In the late 1930's the Civilian Conservation Corps (CCC) did extensive erosion control work, such as terracing, drop-structure building, gully plugging, and tree planting. Since establishing county offices in the 1940's, the U.S. Department of Agriculture's (USDA) Soil Conservation Service (SCS) has applied extensive soil and water conservation structures and measures, including terraces, diversions, farm ponds, floodwater-retarding reservoirs, gully plugging and smoothing, scrub timber removal, and land use planning.

In 1961 the USDA's Agricultural Research Service (ARS), in compliance with U.S. Senate Document 59 (1959), began collecting hydrologic data on the Little Washita River Watershed and other watersheds in the vicinity to determine the downstream hydrologic impacts of the SCS floodwater-retarding reservoirs. This data collection process involved an intensive rain gauge network and a stream gauging station near the watershed outlet that provided data on continuous flow, suspended sediment transport, and to a limited extent, water quality. Data on groundwater levels and channel geometry were also collected to determine possible effects of the treatment program. A more complete summary of the characteristics of the Little Washita watershed and the research data and findings is contained in Allen and Naney (1991).

In 1978 this watershed was one of seven watersheds chosen across the Nation for the Model Implementation Project (MIP), which was jointly sponsored and administrated by the USDA and the U.S. Environmental Protection Agency (EPA). The main objective of the MIP was to demonstrate the effects of intensive land conservation treatments on water quality in watersheds that are larger than about 25 square miles.

The Little Washita River watershed covers 235.6 square miles and is a tributary of the Washita River in southwest Oklahoma. The watershed is in the southern part of the Great Plains of the United States. Landuse can be grouped into 8 categories; range, pasture, forest, cropland, oil waste land, quarries, urban/highways, and water.

The climate is classified as moist and subhumid, and the average annual rainfall was 29.42 inches for the period of data collection by the ARS. Summers are typically long, hot, and relatively dry. The average daily high temperature for July is 94 degrees Fahrenheit, and the average accumulative rainfall for July is 2.22 inches. Winters are typically short, temperate, and dry but are usually very cold for a few weeks. The average daily low temperature for January is 24 degrees Fahrenheit, and the average accumulative precipitation for January is 1.07 inches. Much of the annual precipitation and most of the large floods occur in the spring and fall. A more detailed review of the climate and its variability for this watershed and the surrounding area is contained in Staff (1983).

The bedrock exposed in the watershed consists of Permian age sedimentary rocks. The formations, as reported by Davis (1955), dip gently to the southwest, but the surface drainage is generally to the east. The oldest formation in the watershed, the Chickasha formation, outcrops in the eastern or outlet side of the watershed and comprises 4.6 percent of the total watershed area. As reported by Davis (1955), the Chickasha formation is several hundred feet thick, is relatively impermeable, and consists of a heterogeneous mixture of sandstones, shales, and siltstones. The Dog Creek and Blaine formations, which are undifferentiated and overlie the Chickasha formation, outcrop in 8.0 percent of the watershed and consist of dark red even-bedded shales interbedded with fine-grained gypsiferous sandstones that locally grade into pure gypsum. The Marlow formation overlies the Dog Creek and Blaine formations, comprises 14.2 percent of the watershed, and consists mostly of even-bedded, brick-red sandy shale that is gypsiferous. Near the middle of the Marlow formation lies the Verden sandstone member, which consists of cross-bedded dolomitic sandstone that is about 10 feet thick and one-quarter mile wide. The Rush Springs formation overlies the Marlow formation, outcrops in a central portion of the watershed, and comprises 45.6 percent of the watershed area. The Rush Springs formation consists of fine-grained sandstone and siltstone strata that are even to highly crossbedded. The Cloud Chief formation, outcrops in this watershed as outliers, so only its lower parts can be seen. Alluvial deposits generally cover the bedrock valleys throughout the watershed. The alluvium covers approximately 11 percent of the total area of the watershed.

Surveys of the soils in the watershed have been made by the SCS and published (Bogard et al. 1978, Moffatt 1973, Mobley et al. 1967). In these surveys 64 different soil series were defined for the watershed, and 162 soil phases were mapped within these soil series to reflect differences in surface soil textures, slopes, stoniness, degree of erosion, and other characteristics that affect land use. These survey publications also provide information associated with each soil series, such as depth to bedrock, typical texture found at each depth, permeability, available water capacity, pH, shrink-swell potential, corrosivity, and suitability for use in construction projects, such as road fill, pond embankments, building foundations, and septic tank filter fields. hydrologic soil groups are also listed along with estimated average crop yields for each series under irrigated and nonirrigated conditions.

Except for a few rocky, steep hills near Cement, OK, the upland topography is gently to moderately rolling. Maximum relief in the watershed is only about 600 feet. The flatter upland soils are those developed from the finer textured Dog Creek Shale and Blaine Formations near the eastern end of the watershed and those developed from the Cloud Chief Formation in the western portion of the watershed. The alluvial areas have the flattest slopes, usually 1 percent or less. The channel system is well developed throughout the watershed and extends practically to the drainage divide in most areas, so the watershed is well drained except for a few alluvial areas. Drainageways in western third of the watershed have eroded through the Cloud Chief Formation into the less erosion resistant, underlying Rush Springs Sandstone. Incised channels in the Rush Springs Sandstone are up to 60 to 70 feet deep. The ARS historic data is available or request from:

Manager, Water Data Center  
USDA-ARS Hydrology Laboratory  
Rm 104, Bldg. 007, BARC-West  
Beltsville, MD 20705-2350

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