Prepared in cooperation with the Prairie Band Potawatomi Nation

Streamflow Conditions Along Soldier Creek, Northeast Kansas

Introduction

The availability of adequate water to meet the present (2017) and future needs of humans, fish, and wildlife is a fundamental issue for the Prairie Band Potawatomi Nation in northeast Kansas. Because Soldier Creek flows through the Prairie Band Potawatomi Nation Reservation (fig. 1), it is an important tribal resource. An understanding of historical Soldier Creek streamflow conditions is required for the effective management of tribal water resources, including drought contingency planning.

Historical data for six selected U.S. Geological Survey (USGS) streamgages along Soldier Creek were used in an assessment of streamflow characteristics and trends by Juracek (2017). Streamflow data for the period of record at each streamgage were used to compute annual mean streamflow, annual mean base flow, mean monthly flow, annual peak flow, and annual minimum flow. Results of the assessment are summarized in this fact sheet.

Description of Soldier Creek Basin

The Soldier Creek Basin (fig. 1) is an area of about 334 square miles in northeast Kansas. In addition to Little Soldier Creek, other lesser tributaries to Soldier Creek include Crow Creek, South Branch Soldier Creek, James Creek, Dutch Creek, Walnut Creek, Messhoss Creek, Silver Lake Ditch, Halfday Creek, and Indian Creek. Land use in the basin mostly is a mix of cropland and grassland (Jin and others, 2013) (fig. 1). Spatially averaged annual precipitation for the Soldier Creek Basin for calendar years 1951 through 2014, derived from Parameter-elevation Relationships on Independent Slopes Model (PRISM) monthly precipitation data (Daly and others, 2008), was about 35 inches and was characterized by substantial year-to-year variability with no apparent long-term trend.

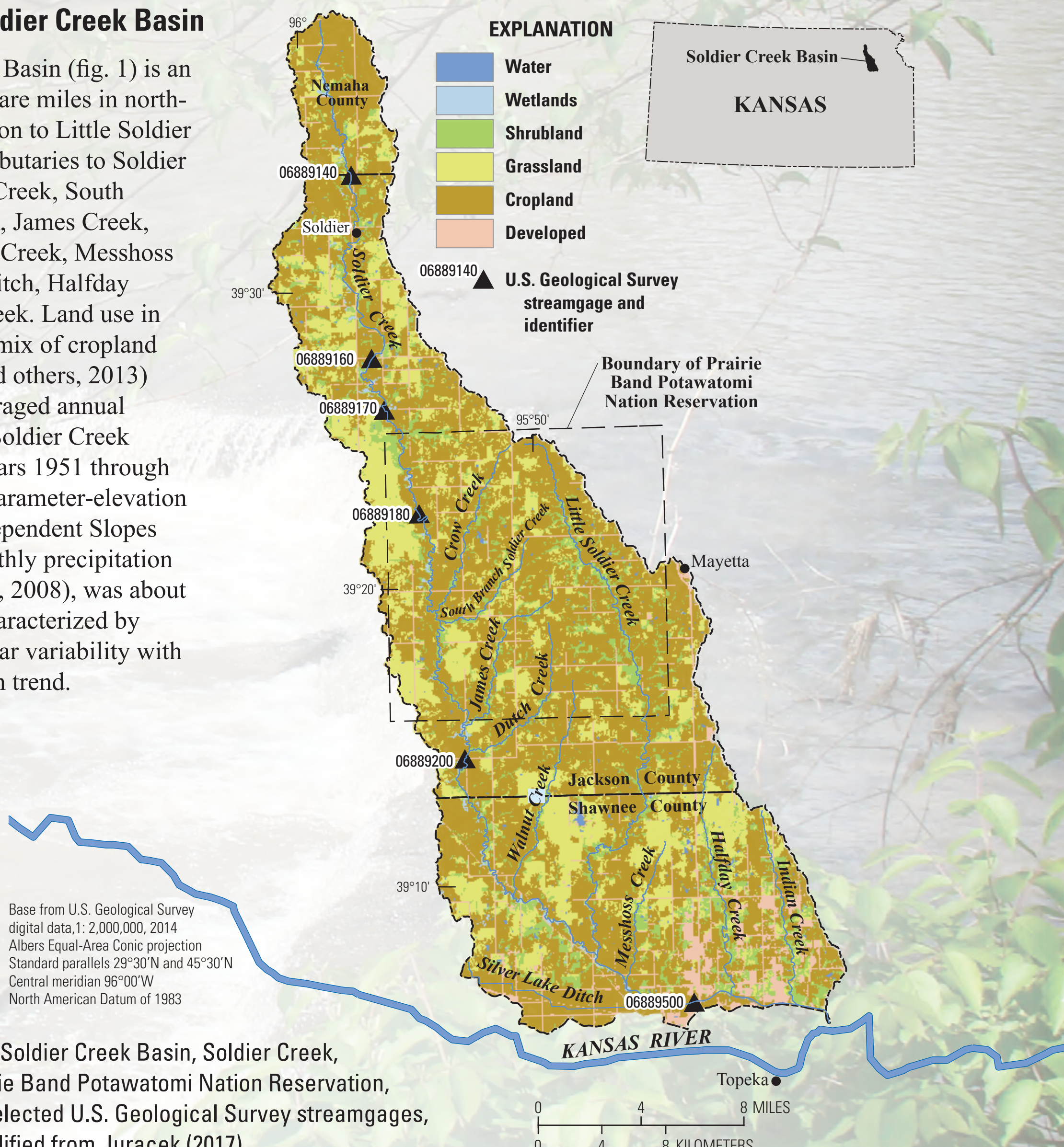

Figure 1. Location of Soldier Creek Basin, Soldier Creek, major tributaries, Prairie Band Potawatomi Nation Reservation, land use (2011), and selected U.S. Geological Survey streamgages, northeast Kansas. Modified from Juracek (2017).

Streamflow Characteristics and Trends

Streamflow characteristics and trends were examined for the period of record for six USGS streamgages along Soldier Creek in northeast Kansas (fig. 1; table 1). The streamflow data used for this study were collected as part of the USGS national streamgaging network using standard USGS methods (Turnipseed and Sauer, 2010) and are available from the USGS National Water Information System (NWIS) (USGS, 2016). For each streamgage, streamflow characteristics were computed for each water year (October 1 to September 30) during the period of record using daily mean streamflow values downloaded from NWIS (USGS, 2016). Specific streamflow characteristics computed were annual mean streamflow, annual mean base flow, mean monthly flow, annual peak flow, and annual minimum flow (1-day, 30-day, and 90-day means).

Table 1. Six U.S. Geological Survey streamgages along Soldier Creek, northeast Kansas, used in this study to examine streamflow characteristics and trends. Modified from Juracek (2017).

[USGS, U.S. Geological Survey; mi^2, square mile]

USGS streamgage identifier (fig. 1)	USGS streamgage name	Drainage area (mi^2)	Period of record
06889140	Soldier Creek near Soldier, Kansas	17	1964–1998
06889160	Soldier Creek near Circleville, Kansas	49	1964–2001
06889170	Soldier Creek near Holton, Kansas	61	2001–2007
06889180	Soldier Creek near Saint Clere, Kansas	80	1964–1981
06889200	Soldier Creek near Delia, Kansas	157	1958–2015
06889500	Soldier Creek near Topeka, Kansas	290	1936–2015

Annual Mean Streamflow and Base Flow

Along Soldier Creek, annual mean streamflow was characterized by substantial year-to-year variability with no pronounced long-term trend (fig. 2). To compare Soldier Creek flow into and out of the reservation, annual mean streamflows upstream near Circleville (streamgage 06889160) and downstream near Delia (streamgage 06889200) (fig. 1) were compared for 1965 to 2000 (that is, the period for which complete water year streamflow data were available for both sites). The comparison indicated an average increase in streamflow from the Circleville streamgage to the Delia streamgage of about 240 percent. Overall, along Soldier Creek, annual mean base flow accounted for an average of about 20 percent of annual mean streamflow (Juracek, 2017).

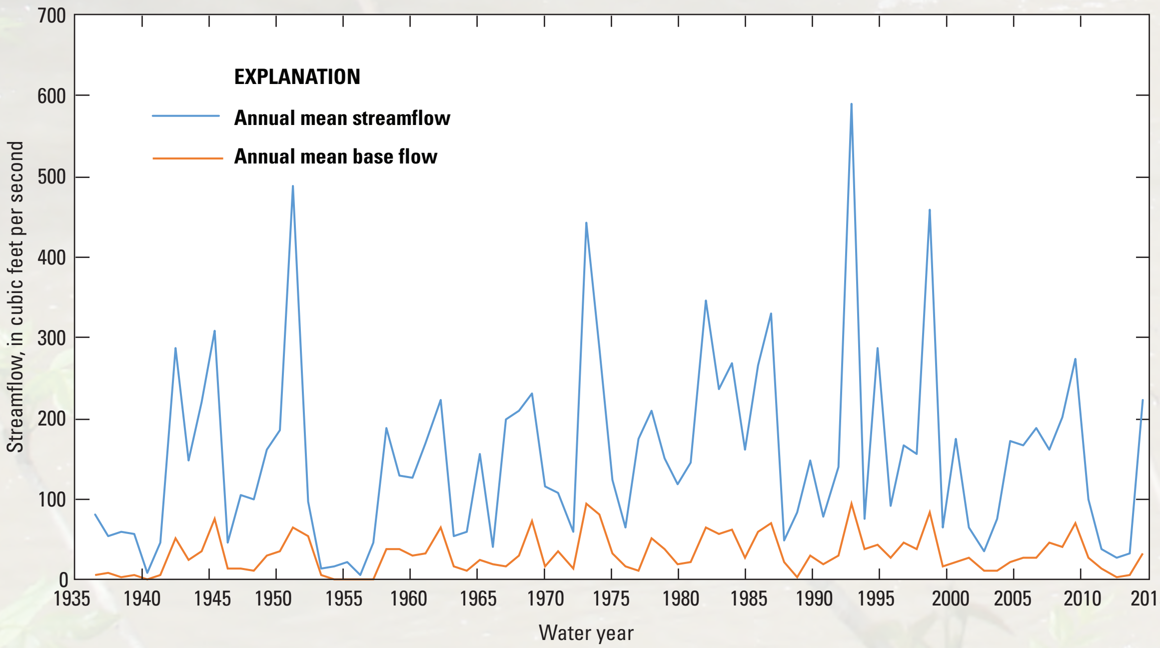

Figure 2. Variation in annual mean streamflow and annual mean base flow at the Soldier Creek near Topeka, Kansas (06889500), streamgage. Modified from Juracek (2017).

Mean Monthly Flow

Along Soldier Creek, a general seasonal pattern for mean monthly flows (fig. 3) was evident for the six selected streamgages that followed the seasonal variability in precipitation. Beginning with low flows in January, the mean monthly flows progressively increased to peak values in May or June. Subsequently, mean monthly flows declined in July and August. Following an increase in September, mean monthly flows again declined in October, November, and December (fig. 3).

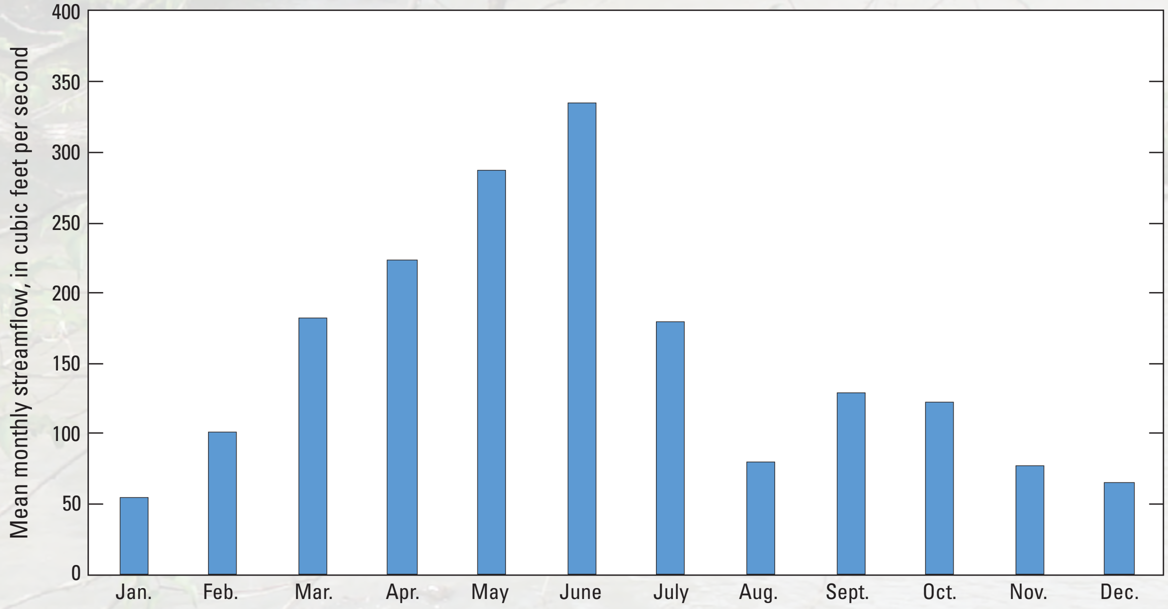

Figure 3. Mean monthly flows for the period of record at the Soldier Creek near Topeka, Kansas (06889500), streamgage. Modified from Juracek (2017).

Annual Peak Flow

Annual peak flows along Soldier Creek were characterized by considerable year-to-year variability with no pronounced long-term trend. Downstream near Delia (streamgage 06889200) and Topeka (streamgage 06889500) (fig. 1), the variability in annual peak flows apparently increased during the period of record. For example, at the streamgage near Topeka, before 1965, peak flows varied within the relatively narrow range of about 1,000 to 11,000 cubic feet per second (ft^3/s). After 1965, peak flows at Topeka ranged from about 2,000 to nearly 48,000 ft^3/s and exceeded 20,000 ft^3/s in 7 different years. Along Soldier Creek, annual peak flows are most likely in May and June and least likely during November through February (Juracek, 2017).

Annual Minimum Flow

For annual minimum flow, the 1-day, 30-day, and 90-day means were assessed. Similar to the annual peak flows, annual minimum flows along Soldier Creek were characterized by considerable year-to-year variability with no pronounced long-term trend (fig. 4, following page). Annual 1-day mean minimum flows often were at or near zero. One of the worst multiyear droughts in Kansas recorded history was in the mid-1950s (Paulson and others, 1991). The effect of the drought on Soldier Creek was recorded at the Topeka streamgage. For 5 consecutive years, 1953 to 1957, the 30-day minimum was zero or nearly zero. In 1957, the 90-day minimum also was zero. In fact, from August 17, 1956, to February 1, 1957, there was zero flow at the Topeka streamgage for 169 consecutive days. Thus, the streamflow record at Topeka demonstrated that, during an extreme drought, flow in Soldier Creek may be zero continuously for one to several months.

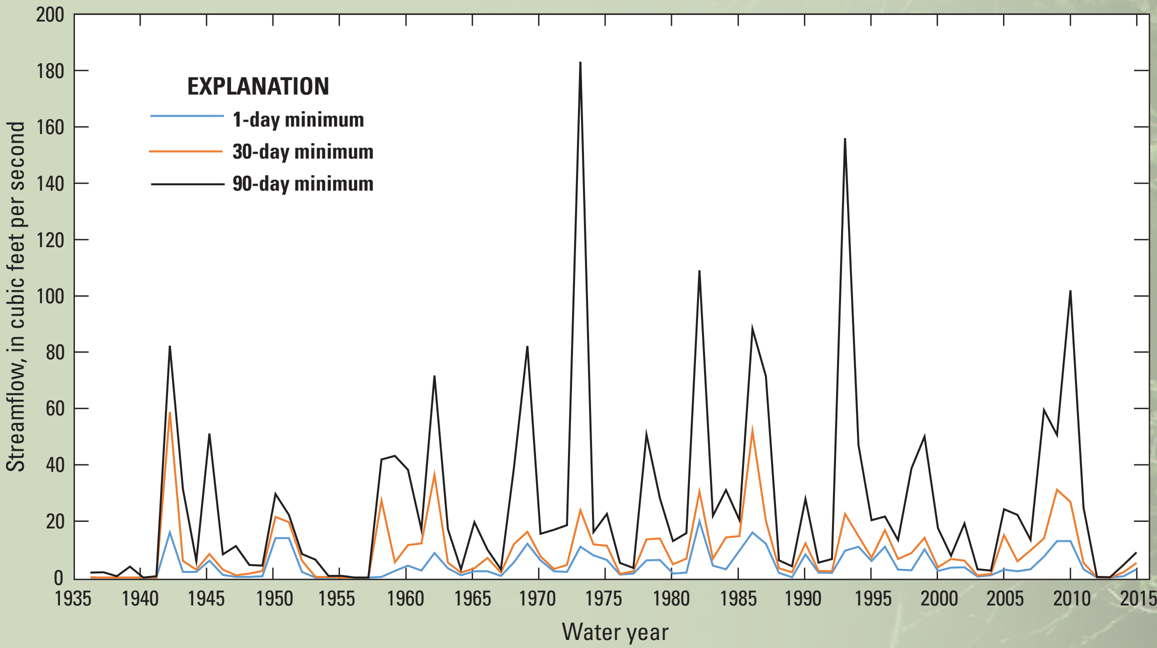

Figure 4. Variation in annual 1-day, 30-day, and 90-day mean minimum flows at the Soldier Creek near Topeka, Kansas (06889500), streamgage. Modified from Juracek (2017).

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