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Hydrologic Characterization for Spring Creek and Hydrologic Budget and Model Scenarios for Sheridan Lake, South Dakota, 1962–2007

Scientific Investigations Report 2009–5059

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By Daniel G. Driscoll and Parker A. Norton

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Contents

Figures

Tables

Conversion Factors and Datums

Multiply	By	To obtain
Length		
inch (in.)	2.54	centimeter (cm)
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
Area		
acre	4,047	square meter (m^2)
acre	0.4047	hectare (ha)
acre	0.4047	square hectometer (hm^2)
acre	0.004047	square kilometer (km^2)
square foot (ft^2)	929.0	square centimeter (cm^2)
square foot (ft^2)	0.09290	square meter (m^2)
square mile (mi^2)	259.0	hectare (ha)
square mile (mi^2)	2.590	square kilometer (km^2)
Volume		
acre-foot (acre-ft)	1,233	cubic meter (m^3)
acre-foot (acre-ft)	0.001233	cubic hectometer (hm^3)
cubic yard (yd^3)	0.7646	cubic meter (m^3)
Flow rate		
acre-foot per day (acre-ft/d)	0.01427	cubic meter per second (m^3/s)
acre-foot per year (acre-ft/yr)	1,233	cubic meter per year (m^3/yr)
acre-foot per year (acre-ft/yr)	0.001233	cubic hectometer per year (hm^3/yr)
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
inch per day (in/d)	0.6096	meter per hour (m/h)

Temperature in degrees Fahrenheit (°F) may be converted to degrees Celsius (°C) as follows:

$$°C=(°F-32)/1.8$$

Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29).

Horizontal coordinate information is referenced to the North American Datum of 1927 (NAD 27).

Altitude, as used in this report, refers to distance above the vertical datum.

Water year (WY) is the 12-month period, October 1 through September 30, and is designated by the calendar year in which it ends. Thus, the water year ending September 30, 2006, is called the "2006" water year.

Under the downstream order system for streamflow-gaging stations, station numbers increase in the downstream direction.

Abbreviations and Acronyms

MOVE.1   maintenance of variance type I

NWS   National Weather Service

r   Pearson's correlation coefficient

r^2 coefficient of determination

SDGF&P South Dakota Game, Fish and Parks

USFS   U.S. Forest Service

USGS   U.S. Geological Survey

WY   water year

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Abstract

The U.S. Geological Survey cooperated with South Dakota Game, Fish and Parks to characterize hydrologic information relevant to management of water resources associated with Sheridan Lake, which is formed by a dam on Spring Creek. This effort consisted primarily of characterization of hydrologic data for a base period of 1962 through 2006, development of a hydrologic budget for Sheridan Lake for this timeframe, and development of an associated model for simulation of storage deficits and drawdown in Sheridan Lake for hypothetical release scenarios from the lake. Historically, the dam has been operated primarily as a "pass-through" system, in which unregulated outflows pass over the spillway; however, the dam recently was retrofitted with an improved control valve system that would allow controlled releases of about 7 cubic feet per second (ft^3/s) or less from a fixed depth of about 60 feet (ft).

Development of a hydrologic budget for Sheridan Lake involved compilation, estimation, and characterization of data sets for streamflow, precipitation, and evaporation. The most critical data need was for extrapolation of available short-term streamflow records for Spring Creek to be used as the long-term inflow to Sheridan Lake. Available short-term records for water years (WY) 1991–2004 for a gaging station upstream from Sheridan Lake were extrapolated to WY 1962–2006 on the basis of correlations with streamflow records for a downstream station and for stations located along two adjacent streams. Comparisons of data for the two streamflow-gaging stations along Spring Creek indicated that tributary inflow is approximately proportional to the intervening drainage area, which was used as a means of estimating tributary inflow for the hydrologic budget. Analysis of evaporation data shows that sustained daily rates may exceed maximum monthly rates by a factor of about two.

A long-term (1962–2006) hydrologic budget was developed for computation of reservoir outflow from Sheridan Lake for the historical pass-through operating system. Two inflow components (stream inflow and precipitation) and one outflow component (evaporation) were considered. The hydrologic budget uses monthly time steps within a computational year that includes two 6-month periods—May through October, for which evaporation is accounted for, and November through April, when evaporation is considered negligible. Results indicate that monthly evaporation rates can substantially exceed inflow during low-flow periods, and potential exists for outflows to begin approaching zero-flow conditions substantially prior to the onset of zero-inflow conditions, especially when daily inflow and evaporation are considered. Results also indicate that September may be the month for greatest potential benefit for enhancing fish habitat and other ecosystem values in downstream reaches of Spring Creek with managed releases of cool water. Computed monthly outflows from Sheridan Lake for September are less than 1.0 ft^3/s for 8 of the 44 years (18 percent) and are less than 2.0 ft^3/s for 14 of the 44 years (32 percent). Conversely, none of the computed outflows for May are less than 2.0 ft^3/s.

A short-term (July through September 2007) data set was used to calculate daily evaporation from Sheridan Lake and to evaluate the applicability of published pan coefficients. Computed values of pan coefficients of approximately 1.0 and 1.1 for two low-flow periods are larger than the mean annual pan coefficient of 0.74 for the area that is reported in the literature; however, the computed values are consistent with pan coefficients reported elsewhere for similar late summer and early fall periods. Thus, these results supported the use of variable monthly pan coefficients for the long-term hydrologic budget.

A hydrologic model was developed using the primary components of the hydrologic budget and was used to simulate monthly storage deficits and drawdown for Sheridan Lake using hypothetical release scenarios of 1, 2, 3, 4, 5, 6, and 7 ft^3/s for the months May through October for 1962–2006. Five computational years (3 years that include 1987–90 and 2 years that include 2004–06) tend to be "defining" years for purposes of drawdown considerations for Sheridan Lake. These 5 years include the only years with storage deficits for the historical pass-through operating condition (zero-release scenario). Computed drawdowns for 1987–90 approach or exceed 1 ft for many months for a prescribed release of 1 ft^3/s and approach or exceed 2 ft during many months for a prescribed release of 2 ft^3/s. For prescribed releases of 1 and

2 ft^3/s, the maximum computed drawdowns of 1.6 and 2.4 ft, respectively, occur in February of the 1988–89 computational year. For a prescribed release of 7 ft^3/s, computed drawdown exceeds 12 ft for one-half of the months of the 1989–90 computational year. During the 2004–05 and 2005–06 computational years, storage deficits were computed for 16 of 24 months for a prescribed release of 2 ft^3/s.

Computed storage deficits occur for 25 of 36 months during the 1987–90 computational years for a prescribed release of 1 ft^3/s, as opposed to a combined total of only 13 months with storage deficits for the other 41 years. For a prescribed release of 2 ft^3/s, storage deficits are computed for 60 months during 15 of the 44 years, and deficits exist for 22 of the 24 months during the 1988–90 computational years. Computed storage deficits become progressively larger and more frequent for each of the progressively larger release scenarios.

Introduction

Sheridan Lake is located in the central Black Hills of western South Dakota (fig. 1) and is formed by a dam on Spring Creek. The dam was constructed in 1938–40 by the Civilian Conservation Corps for recreational purposes, which remains the primary use today. The dam, lake, and associated recreational facilities are on Federal lands managed by the U.S. Forest Service (USFS). Sheridan Lake has a surface area of about 383 acres and has a maximum depth of about 96 feet (ft) near the dam. Historically, the dam has been operated primarily as a "pass-through" system, in which unregulated outflows pass over the spillway. The dam recently was retrofitted with an improved control valve system that would allow controlled releases from a fixed depth of about 60 ft (South Dakota Game, Fish and Parks, 2005).

The fishery resource in Sheridan Lake and in Spring Creek downstream from the lake is managed by South Dakota Game, Fish and Parks (SDGF&P). SDGF&P has proposed collaborating with the USFS to manage future releases from Sheridan Lake to enhance fish habitat and other ecosystem values in downstream reaches of Spring Creek. Spring Creek is essentially perennial upstream from Sheridan Lake; however, low-flow conditions occasionally can approach zero flow (U.S. Geological Survey, 2008). Evaporation from Sheridan Lake can approach or exceed inflows during low-flow periods; thus, extended periods of zero-flow or extremely low-flow conditions can occur downstream from the dam, especially during prolonged drought periods. Warm water temperatures during low-flow conditions are detrimental to trout and other aquatic organisms in reaches of Spring Creek downstream from Sheridan Lake; thus, augmentation of downstream flow rates with relatively small quantities of cool water released at depth could benefit cold-water aquatic ecosystems.

Sheridan Lake is located very close to several population centers in the Black Hills area and is used extensively for various recreational purposes, including fishing, boating, swimming, camping, and picnicking. Drawdown of Sheridan Lake below the spillway crest historically has occurred only when evaporation has exceeded inflows, and the limited occurrences of drawdown usually have not exceeded a few inches (Ron Koth, South Dakota Game, Fish and Parks, oral commun., 2008). Thus, most of the existing recreational infrastructure is not designed to accommodate large water-level fluctuations, which would provide a constraint for future potential management alternatives.

In cooperation with SDGF&P, the U.S. Geological Survey (USGS) compiled and characterized hydrologic information relevant to management of water resources associated with Sheridan Lake. This effort included the development of a hydrologic model for use in simulating storage deficits and drawdown in Sheridan Lake for various release scenarios. The hydrologic model consists of a long-term (1962–2006) monthly hydrologic budget for Sheridan Lake that allows for optional release scenarios. The model output can be used in (1) evaluating the feasibility of management plans that would include alternatives for limited releases from Sheridan Lake, and (2) potential development of operating criteria.

The purposes of this report are to (1) characterize hydrologic data for Spring Creek and Sheridan Lake that are critical components of the hydrologic budget for Sheridan Lake (and downstream reaches of Spring Creek), (2) present a hydrologic budget for Sheridan Lake, and (3) present a summary of output from the hydrologic model of Sheridan Lake for various hypothetical release scenarios. Efforts consisted primarily of compilation and analysis of existing hydrologic data for 1962 through 2006; however, a short-term data set was collected during 2007 to facilitate computation of a daily hydrologic budget during a low inflow period. Inflow data for Sheridan Lake consist of measured streamflow records for 1991–2004 and extrapolated monthly streamflow values for 1962–90, which are based on correlations with records for other streamflow-gaging stations.

Description of Study Area

The study area includes the Spring Creek Basin and surrounding areas (fig. 1) in the Black Hills of western South Dakota. The primary focus is on Sheridan Lake and Spring Creek in the reach between streamflow-gaging stations 06406920 and 06407500; however, available hydrologic data for various sites located considerable distances from Sheridan Lake were used for analyses described in this report.

Sheridan Lake and Dam

Sheridan Lake is formed by an earthen dam (575,000 cubic yards) on Spring Creek that was constructed in 1938–40 by the Civilian Conservation Corps for recreational purposes, which remains the primary use today. An account
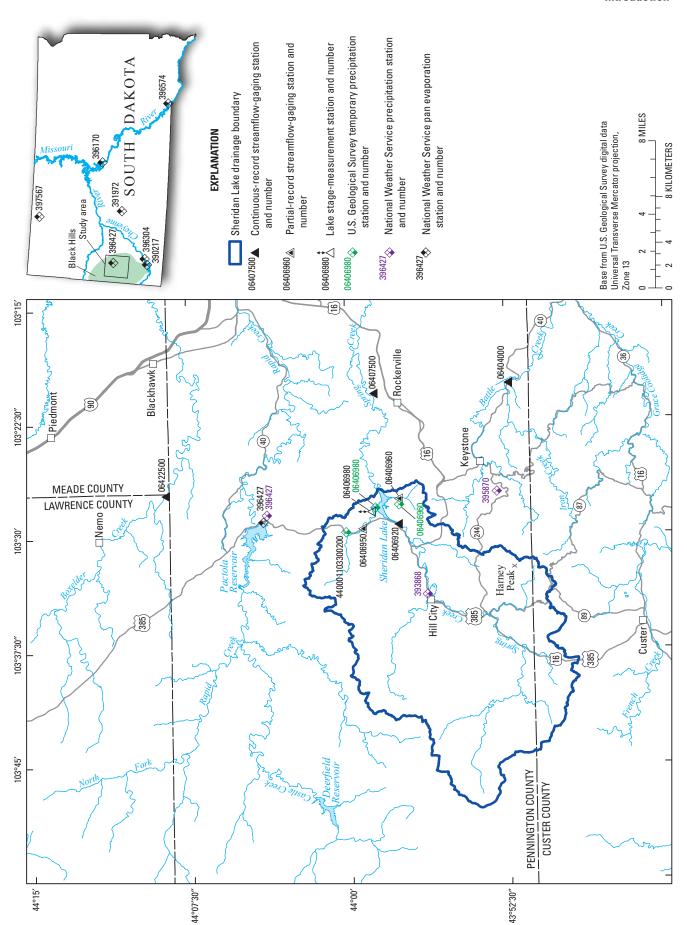
Figure 1. Study area and locations of hydrologic data sites.

The primary spillway is located just north of the dam on Sheridan Lake. Photograph by Ron Koth, South Dakota Game, Fish and Parks.

of construction details and history was provided by Powell (1940). The primary outlet consists of a concrete spillway 40 ft wide that is situated within a cut excavated through a bedrock slope located just north of the dam. A secondary spillway is located just south of the dam at an elevation slightly above the crest of the primary spillway. A 24-inch diameter pipe was emplaced in a tunnel about 60 ft below the primary spillway that was constructed by drilling and blasting through bedrock. The tunnel was used to divert the flow of Spring Creek during construction of the dam. During 2004, the pipe was retrofitted with a new valve system (South Dakota Game, Fish and Parks, 2005) that would allow improved capability for low-flow releases of about 7 cubic feet per second (ft^3/s) or less.

The dam, lake, and associated recreational facilities are on Federal lands managed by the USFS. Sheridan Lake has a surface area of about 383 acres at an altitude of about 4,624 ft, with a maximum depth of about 96 ft near the dam and a mean depth of about 30 ft (South Dakota Game, Fish and Parks, 2005). The total storage volume of Sheridan Lake at full pool is about 11,500 acre-feet (acre-ft).

Historically, the dam has been operated primarily as a simple pass-through system, in which unregulated outflows are allowed to pass over the spillway. The primary spillway is fitted with a tainter gate that can provide 1.0 ft of additional storage above the spillway crest when closed. In 1961, the USFS made application to the State of South Dakota for (and subsequently was granted) a water right (No. 731–2) for storage of 1.0 ft of water above the spillway crest. Stored water occasionally was released by lifting the gate, which was used as a means of providing a single slug of water to downstream agricultural users. The water right was last exercised in 1991 and was cancelled in 2004 because of abandonment (Mark Rath, South Dakota Department of Environment and Natural Resources, written commun., 2008).

Releases of water from Sheridan Lake would obviously benefit downstream ecosystems during periods when zero-outflow conditions are approached. Benefits also could be derived from augmentation of downstream flow rates with relatively small quantities of cool water released at depth. Erickson (2002) provided a summary of available information regarding water temperatures and potential effects of releasing cool water. Cool water released from below a thermocline that typically develops (South Dakota Game, Fish and Parks, 2005) could potentially affect in-lake water-quality dynamics. Water-quality information is available from various sources, including South Dakota Game, Fish and Parks (2005) and from total maximum daily load studies of Sheridan Lake and Spring Creek (South Dakota Department of Environment and Natural Resources, 2008).

Hydrogeology and Climate

Sheridan Lake is situated primarily on metamorphic rocks of Precambrian age (DeWitt and others, 1989), with schists being the most common rock type in the immediate vicinity of the lake. The majority of the Spring Creek drainage upstream from gaging station 06407500 (Spring Creek near Keystone) is within the "crystalline core" hydrogeologic setting identified by Driscoll and Carter (2001). Within this setting, streamflow generally is very responsive to precipitation and other climatic variables. However, a very small part of the headwater of the drainage is within the "limestone headwater" hydrogeologic setting. Within this setting, direct runoff is uncommon and streamflow is dominated by relatively stable springflow that originates from ground-water discharge.

Land-surface altitudes in the Spring Creek drainage range from 7,242 ft at Harney Peak to about 3,885 ft at gaging

Sheridan Lake is formed by an earthen dam on Spring Creek. The secondary spillway is visible on the far side of the dam. Photograph by Ron Koth, South Dakota Game, Fish and Parks.

A 24-inch diameter pipe was emplaced in a tunnel about 60 feet below the primary spillway of Sheridan Lake. The pipe was retrofitted with a new valve system in 2004 that would allow improved capability for low-flow releases of about 7 cubic feet per second or less. Photograph at left by Ron Koth, South Dakota Game, Fish and Parks; photograph at right courtesy of South Dakota Game, Fish and Parks.

station 06407500 (Spring Creek near Keystone). Most of the drainage area is forested with ponderosa pine and is managed by the USFS (South Dakota Game, Fish and Parks, 2005). Mean annual precipitation generally increases with increasing altitude and from south to north (Driscoll and Carter, 2001) and ranges from about 19 to 23 inches in the study area. The mean annual temperature at Hill City is 41.9 degrees Fahrenheit (°F), and monthly means range from 21.5°F in January to 64.3°F in July (1971–2000; South Dakota State University, 2008a). Ice generally forms on Sheridan Lake during November or December and is remains through most of March or into April.

The primary spillway is fitted with a tainter gate that can provide 1 foot of additional storage above the spillway crest when closed. Photograph by Ron Koth, South Dakota Game, Fish and Parks.

Hydrologic Budget Concepts and Characterization of Hydrologic Data

Development of a long-term hydrologic budget was prerequisite to development of a hydrologic model for use in simulating potential release scenarios for management of Sheridan Lake. Concepts used in developing hydrologic budgets are described in this section. Characterizations of relevant hydrologic data sets, including streamflow, precipitation, and evaporation, also are provided.

Hydrologic Budget Concepts

All of the hydrologic budget applications presented in this report are based on the hydrologic continuity equation, which states that the sum of all inflows to a "control volume" is equal to the sum of all outflows, plus any changes in storage (Streeter and Wylie, 1979). The primary hydrologic budget application within this report was the development of a long-term monthly hydrologic budget for Sheridan Lake, for which the most basic equation is

$$\textit{Stream inflow} + \textit{Precipitation} = \textit{Evaporation} + \textit{Reservoir outflow} + \Delta\textit{Storage}, \qquad (1)$$

where

$\Delta\textit{Storage}$ is change in storage, with a positive value indicating increased storage.

The largest variables in equation 1 are stream inflow and reservoir outflow, which generally are very similar because the reservoir is operated as a pass-through system. Stream inflow includes Spring Creek and several small tributaries that

contribute directly to Sheridan Lake. Precipitation that falls directly on Sheridan Lake and evaporation also were considered, but these variables usually are relatively small, except during periods of low streamflow that are critical for potential management considerations.

Ground-water inflow and outflow (including seepage from the dam) were neglected in equation 1 because these variables generally are very small relative to other variables in the equation and also tend to be offsetting. Powell (1940) described extensive grouting efforts and noted that following construction of Sheridan Dam there was "… no apparent loss of water from the basin either by seepage to the tunnel or under the dam." This general absence of seepage was confirmed by Dan Driscoll (USGS) and Ron Koth (SDGF&P) during a field inspection on July 19, 2007, when the lake elevation was just below the spillway crest, such that there was no discharge through the spillway. On that date, streamflow in the reach about one-half mile downstream from the dam was estimated as about 0.01 ft^3/s. Farther downstream, zero-flow conditions were noted in many riffle sections, with several other riffle sections having minor flow of about 0.01 ft^3/s, or less.

Several hydrologic budget applications involved comparisons of streamflow for two locations along Spring Creek. These comparisons were based on computations of downstream flow minus upstream flow, which provides a positive result for gaining flow. Similarly, all computations involving reservoir storage were done such that positive storage changes reflect an increase in storage.

Potential alternatives for reservoir operations would be restricted to a narrow range of water-level fluctuations. During discussions in public settings, SDGF&P has proposed that the maximum allowable drawdown would be limited to no more than about 2 ft below the spillway crest (Ron Koth, South Dakota Game, Fish and Parks, written commun., 2008). An existing bathymetric map (South Dakota Game, Fish and Parks, 2005) indicates extremely steep relief in the lakebed along almost all of the shoreline of Sheridan Lake. Thus, volumetric computations for Sheridan Lake were performed using a constant area of 383 acres, which neglected the minor changes in surface area associated with water-level fluctuations.

An initial hydrologic budget application involved development of a "historical" hydrologic budget using monthly time steps. Because a pass-through operating system typically has been used at Sheridan Lake, monthly changes in lake storage generally are very small, relative to other variables. Historically, several factors have potentially contributed to very minor variations in end-of-month lake storage, including (1) differences in hydraulic head above the spillway crest, (2) minor drawdown of the lake below the spillway crest during infrequent (and generally undocumented) periods when lake evaporation has exceeded inflows, and (3) occasional operation of the tainter gate, for which records of operations are not available. All changes in storage associated with these factors were considered negligible for the purpose of

characterizing the long-term hydrologic budget for Sheridan Lake; however, for subsequent hydrologic budget applications involving simulation of release scenarios, changes in lake storage were accounted for.

Computations presented in this report commonly involve a volumetric unit of an acre-foot (acre-ft), which is 1 ft of water over an area of 1 acre (43,560 square ft). Flow rates (in cubic feet per second) averaged over time also commonly are used. An average flow rate of 1 ft^3/s is equivalent to about 1.98 acre-ft per day, 59.5 acre-ft per 30-day month, and 724 acre-ft per year.

Availability of Hydrologic Data and Timeframes Considered

Development of a hydrologic budget for Sheridan Lake involved compilation and estimation of data sets for streamflow, precipitation, and evaporation. Table 1 provides selected information for all hydrologic data sites considered within this report, and locations of sites are shown in figure 1. Most of the data sets were collected prior to 2007; however, a short-term data set was collected during 2007 to facilitate computation of a daily hydrologic budget during a low-inflow period.

Selection of an appropriate timeframe for hydrologic budgeting was based primarily on availability of applicable streamflow data for estimation of stream inflow to Sheridan Lake. Streamflow records are available for two continuous-record streamflow-gaging stations along Spring Creek— above Sheridan Lake (station 06406920) and near Keystone (station 06407500). The downstream gaging station is located about 5 miles east (downstream) from Sheridan Lake (fig. 1). Periods of record for both stations are relatively short (table 1), and streamflow during these periods is not representative of long-term conditions, as indicated by comparisons with annual flow data (fig. 2 and table 2) for two nearby longer term continuous-record gaging stations (table 1, fig. 1) located along Battle Creek (station 06404000) and Boxelder Creek (station 06422500). Figure 2 shows that the available streamflow records for Spring Creek are primarily within periods of hydrologic extremes that have occurred over the substantially longer periods of record that are available for the two longer term stations. Table 2 includes the ranks (smallest to largest) of annual flows for each gaging station. Figure 2 and table 2 show that for the two longer term stations (1) many of the driest years of record occurred during water years (WY) 1988–89 and 2002–06 and (2) many of the wettest years of record occurred during WY 1993–99.

For development of a long-term hydrologic budget for Sheridan Lake, monthly streamflow records for Spring Creek above Sheridan Lake (station 06406920) were extrapolated to a base period of WY 1962–2006. This corresponds with the period of available record for Battle Creek near Keystone (station 06404000), which is the longest viable period for which streamflow could be extrapolated. Methods used in extrapolating streamflow records for Spring Creek above Sheridan Lake are described in the following section.

Table 1.   Site information for selected hydrologic data sites.

[Locations of sites are shown on figure 1. NGVD 29, National Geodetic Vertical Datum of 1929; ND, not determined; NA, not applicable]

Station number	Station name	Latitude	Longitude	Period of record used	Drainage area (square miles)	Altitude (in feet above NGVD 29)
		(degrees, minutes, seconds)				
Continuous-record streamflow-gaging stations						
06404000	Battle Creek near Keystone	435221	1032010	1962–2006	58.5	NA
06406920	Spring Creek above Sheridan Lake	435739	1032918	1991–2004, 2007	127	NA
06407500	Spring Creek near Keystone	435843	1032048	1987–2006	163	NA
06422500	Boxelder Creek near Nemo	440838	1032716	1967–2006	96.0	NA
Partial-record streamflow-gaging stations						
06406950	Horse Creek at Highway 385 near Hill City	435905	1032913	2007	ND	NA
06406960	Sheridan Lake tributary near Calumet Ridge near Keystone	435751	1032735	2007	ND	NA
Lake stage gage						
06406980	Sheridan Lake near Hill City	435852	1032827	2007	NA	NA
National Weather Service precipitation stations						
393868	Hill City	435600	1033400	1962–2006	NA	4,980
395870	Mt. Rushmore National Memorial	435300	1032700	1962–2006	NA	5,250
396427	Pactola Dam	440400	1032900	1962–2006	NA	4,720
Short-term U.S. Geological Survey precipitation stations						
06406960	Sheridan Lake tributary near Calumet Ridge near Keystone	435751	1032735	2007	NA	4,635
06406980	Sheridan Lake near Hill City	435852	1032827	2007	NA	4,624
440001103300200	Precipitation near Sheridan Lake near Hill City	440001	1033002	2007	NA	4,790
National Weather Service pan evaporation stations						
396427	Pactola Dam	440400	1032900	1962–1974, 1976, 1978–2006	NA	4,720
390217	Angostura Dam	432100	1032600	1962–2006	NA	3,140
396304	Oral	432400	1031600	1971–2006	NA	2,960
NA	Angostura Dam/Oral (combined)	NA	NA	1962–2006	NA	NA
391972	Cottonwood	435800	1015200	1962–2006	NA	2,414
397567	Shadehill Dam	454600	1021200	1966–76	NA	2,230
396170	Oahe Dam	442700	1002500	1962–2006	NA	1,660
396574	Pickstown	430400	983200	1962–2006	NA	1,490
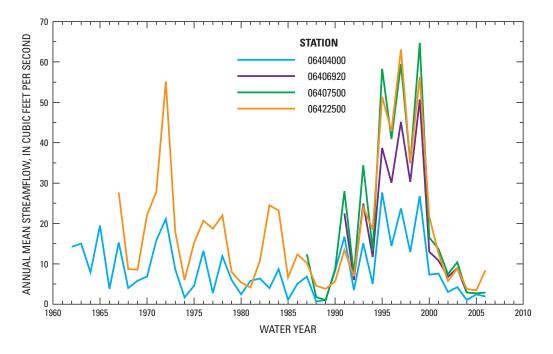
Figure 2.   Annual mean streamflow for selected streamflow-gaging stations.

Estimation and Characterization of Hydrologic Data

Most of the available hydrologic data sets by themselves were not directly applicable for development of a hydrologic budget for Sheridan Lake because (1) the data-collection sites were not located at the exact locations where data were required or (2) the hydrologic records were incomplete during the WY 1962–2006 base period. Thus, it was necessary to esti-mate some of the hydrologic variables. This section provides details regarding approaches used in estimating hydrologic data sets and also provides characterizations of relevant data for streamflow, precipitation, and evaporation.

Streamflow

Hydrologic budget and model applications involved extensive consideration of streamflow records for the two gaging stations along Spring Creek (06406920 and 06407500). This section of the report describes approaches used to extrapolate monthly streamflow records for station 06406920 and provides selected characterizations of historical stream-flow data for both stations. Extrapolation of records for station 06406920 also involved utilization of streamflow data for Battle Creek (station 06404000) and Boxelder Creek (station 06422500). Monthly records for all four of these stations (table 1) are presented in tables 18–21 in the Appen-dix. Available streamflow data were compiled from the USGS National Water Information System database (U.S. Geological Survey, 2008).

Extrapolation of Streamflow Data

Extrapolation of the monthly flow record for Spring Creek above Sheridan Lake (station 06406920) to a timeframe of WY 1962–2006 was based on relations with records for the three other continuous-record gaging stations listed in table 1. Pearson's correlation coefficients (r) (Helsel and Hirsch, 1992) for linear correlation of monthly flows (WY 1991–2004) between Spring Creek above Sheridan Lake and the other three stations are strong, with r values generally greater than 0.90 and always 0.80 or greater (table 3). Thus, the three other stations are suitable for use as index stations for extrapola-tion of monthly flow records for Spring Creek above Sheridan Lake. Correlations with the other Spring Creek station that is downstream from Sheridan Lake (06407500) are especially strong (r = 0.98–0.99). Correlations with annual flows are greater than or equal to 0.96 for all three stations.

Extrapolation of the monthly flow record for Spring Creek above Sheridan Lake was accomplished using a "mixed-station" procedure described by Alley and Burns (1983). This procedure is based on the use of multiple poten-tial index stations and the use of a maintenance of variance type I (MOVE.1) straight-line fitting procedure rather than an ordinary least-squares straight-line fitting procedure. The MOVE.1 procedure is analogous to ordinary least-squares regression, but results in an extended record with a variance comparable to that of the unextended record (Cary and Parrett, 1996).

The extrapolated monthly and annual values for station 06406920 are shown in table 22 in the Appendix. The mean standard error of prediction for the MOVE.1 procedure

Table 2.   Annual mean streamflow and rank for selected streamflow-gaging stations.

[ft³/s, cubic feet per second; --, no data or not applicable]

Water year	06404000 Battle Creek near Keystone		06406920 Spring Creek above Sheridan Lake		06407500 Spring Creek near Keystone		06422500 Boxelder Creek near Nemo	
	Annual mean (ft³/s)	Rank	Annual mean (ft³/s)	Rank	Annual mean (ft³/s)	Rank	Annual mean (ft³/s)	Rank
1962	14.20	34	--	--	--	--	--	--
1963	15.00	36	--	--	--	--	--	--
1964	7.90	27	--	--	--	--	--	--
1965	19.50	41	--	--	--	--	--	--
1966	3.79	12	--	--	--	--	--	--
1967	15.30	38	--	--	--	--	27.70	33
1968	4.01	14	--	--	--	--	8.70	15
1969	5.80	20	--	--	--	--	8.55	14
1970	6.83	23	--	--	--	--	22.10	29
1971	15.80	39	--	--	--	--	27.90	34
1972	21.10	42	--	--	--	--	55.10	38
1973	8.61	29	--	--	--	--	17.90	23
1974	1.65	5	--	--	--	--	5.98	9
1975	4.58	16	--	--	--	--	15.20	22
1976	13.20	33	--	--	--	--	20.70	26
1977	2.78	9	--	--	--	--	18.70	25
1978	11.90	31	--	--	--	--	22.00	28
1979	6.00	21	--	--	--	--	7.99	12
1980	2.48	8	--	--	--	--	5.40	6
1981	5.79	19	--	--	--	--	4.14	4
1982	6.38	22	--	--	--	--	10.80	18
1983	3.98	13	--	--	--	--	24.50	32
1984	8.65	30	--	--	--	--	23.20	30
1985	1.11	4	--	--	--	--	6.61	10
1986	5.05	18	--	--	--	--	12.30	19
1987	6.84	24	--	--	12.40	10	10.20	17
1988	.69	1	--	--	1.80	2	4.61	5
1989	1.02	2	--	--	.98	1	3.81	3
1990	8.32	28	--	--	8.69	8	5.62	7
1991	16.70	40	22.50	8	28.00	14	13.50	21
1992	3.50	11	6.06	2	7.46	7	6.88	11
1993	15.10	37	24.90	9	34.40	15	24.00	31
1994	5.03	17	11.70	6	13.30	11	18.50	24
1995	27.70	45	38.70	12	58.30	18	51.40	37
1996	14.40	35	30.10	10	40.90	17	42.90	36
1997	23.70	43	45.20	13	59.50	19	63.10	40
1998	12.90	32	30.30	11	35.00	16	34.90	35
1999	26.80	44	50.70	14	64.70	20	56.30	39
2000	7.29	25	13.00	7	16.50	13	21.70	27

Table 2.   Annual mean streamflow and rank for selected streamflow-gaging stations.—Continued

[ft^3/s, cubic feet per second; --, no data or not applicable]

Water year	06404000		06406920		06407500		06422500	
	Battle Creek near Keystone		Spring Creek above Sheridan Lake		Spring Creek near Keystone		Boxelder Creek near Nemo	
	Annual mean (ft^3/s)	Rank	Annual mean (ft^3/s)	Rank	Annual mean (ft^3/s)	Rank	Annual mean (ft^3/s)	Rank
2001	7.58	26	10.80	5	13.70	12	12.60	20
2002	3.04	10	6.81	3	7.45	6	5.77	8
2003	4.24	15	8.92	4	10.40	9	8.90	16
2004	1.06	3	2.80	1	2.87	5	3.74	2
2005	2.45	7	--	--	2.73	3	3.46	1
2006	1.95	6	--	--	2.85	4	8.43	13
Count	45	--	14	--	20	--	40	--

applied to Spring Creek above Sheridan Lake was small (35.8 percent), which indicates generally reliable estimates for the extrapolated monthly flow records. A comparison of selected statistics for monthly and annual flows for the actual period of record (WY 1991–2004) and extrapolated period (WY 1962–2006) is presented in table 4, and a graphical comparison is shown in figure 3. The mean monthly and annual values and all of the percentile values are larger for the actual period of record than for the extrapolated period, which indicates that the short-term record is biased by especially large streamflow that occurred during the 1990s.

Characterization of Historical Streamflow Data for Spring Creek

This section provides a characterization of historical streamflow data for Spring Creek above Sheridan Lake (station 06406920) and near Keystone (station 06407500). This characterization provides useful insights regarding hydrologic conditions in the reach between the two stations and is used in development of approaches for the hydrologic budget.

Monthly Flow Conditions

Primary hydrologic influences in the reach along Spring Creek between stations 06406920 and 06407500 are evaporation from Sheridan Lake, evapotranspiration along Spring Creek, and ungaged tributary inflows. Tributary inflows in this reach can be characterized by examination of monthly flow data. Graphs showing flow at the downstream station (06407500) as a function of the upstream station (06406920) for monthly values and for annual values for WY 1991–2004 are presented in figure 4. The slopes of the regression lines for monthly and annual flow are 1.39 and 1.36, respectively, which correspond closely with the ratio (1.28) of the drainage areas for the downstream and upstream stations (163 and 127 square miles (mi^2), respectively). This indicates that tributary inflows to the intervening reach (which includes

Sheridan Lake) are approximately proportional to drainage area. The y-intercepts for both graphs are slightly negative, which is consistent with evaporation from Sheridan Lake and evapotranspiration along the reach from Sheridan Lake to the downstream station during low-flow conditions.

Figure 5 shows a regression plot of monthly streamflow differences between the two Spring Creek gaging stations as a function of flow at the upstream station. The monthly differences were computed as downstream minus upstream; thus, positive values indicate a gain, and negative values indicate a loss in the intervening reach. The graph shows that combined effects of lake evaporation and evapotranspiration along the stream reach can exceed tributary inflows during low-flow periods. The negative y-intercept (-2.05) is again consistent with effects of evaporation and evapotranspiration during low-flow conditions. Computed monthly differences between the two gaging stations are provided in table 5. The majority of the negative values for summer and fall months occurred during WY 2002–04, which were dominated by especially dry climatic conditions. Streamflow records for both gaging stations can be highly affected by substantial channel icing; thus, uncertainties regarding streamflow records are greater for winter months than for other months.

Low-Flow Conditions

Low-flow statistics (that is, the lowest mean streamflow that occurred during each year for selected numbers of consecutive days) for Spring Creek near Keystone (station 06407500) are presented in table 6. These statistics indicate that many short and extended periods of flow conditions that could be detrimental to trout and other aquatic organisms have occurred during the period of record (WY 1987–2006), especially during the particularly dry conditions of the late 1980s and early to mid-2000s. These data are not necessarily representative of long-term conditions, however, because of the short-term nature of the data set.

Table 3. Pearson's correlation coefficients (r) for monthly and annual flows (water years 1991–2004) at Spring Creek above Sheridan Lake (station 06406920) and flows at three longer term gaging stations.

Station	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Annual
	Month												
Battle Creek near Keystone (06404000)	0.89	0.97	0.97	0.85	0.81	0.84	0.93	0.93	0.93	0.88	0.89	0.96	0.96
Spring Creek near Keystone (06407500)	.99	.99	.99	.99	.99	.98	.99	.99	.99	.98	.99	.99	.99
Boxelder Creek near Nemo (06422500)	.95	.97	.94	.93	.94	.82	.80	.91	.95	.95	.96	.94	.96

Table 4. Selected statistics for actual and extrapolated streamflow for Spring Creek above Sheridan Lake (station 06406920).

Statistic	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Annual
	Streamflow, in cubic feet per second												
	Month												
	Water years 1991–2004 (actual period of record)												
Mean	10.90	11.30	8.19	5.74	6.20	11.60	20.96	55.23	72.04	28.46	17.33	10.77	21.61
Maximum	35.80	51.20	34.80	21.90	19.20	21.80	64.20	144.50	184.70	63.30	50.10	26.20	50.72
75th percentile	15.75	12.00	9.49	6.01	8.47	15.93	23.13	86.23	121.28	50.23	22.80	16.50	30.25
50th percentile	6.86	6.51	4.50	3.42	3.63	9.07	16.75	34.40	58.10	26.95	12.65	6.79	17.75
25th percentile	4.42	3.86	2.62	1.99	2.36	7.24	11.23	21.03	15.10	6.62	4.37	3.55	9.40
Minimum	2.59	2.37	1.62	1.01	1.21	4.66	5.38	4.12	2.21	2.92	2.19	1.32	2.80
Standard deviation	9.32	12.94	9.05	6.06	5.32	6.14	15.85	44.51	64.54	22.60	15.42	8.96	15.48
	Water years 1962–2006 (extrapolated period)												
Mean	7.55	6.35	4.16	2.98	3.31	8.65	16.33	37.64	64.15	23.21	12.92	7.15	16.23
Maximum	35.80	51.20	34.80	21.90	19.20	21.80	64.20	144.50	363.03	95.81	50.10	26.20	50.72
75th percentile	8.94	6.46	4.05	3.08	3.22	10.66	19.73	53.49	110.35	31.50	15.05	8.88	24.90
50th percentile	5.92	4.99	2.83	2.00	2.39	7.91	12.69	27.30	27.52	12.52	11.77	5.91	11.69
25th percentile	3.00	3.32	1.62	1.20	1.60	5.43	8.94	7.98	8.94	5.75	5.01	2.82	6.95
Minimum	.00	.02	.07	.00	.02	1.08	2.83	3.01	1.45	.14	.04	.07	1.55
Standard deviation	6.57	8.17	5.86	3.94	3.67	5.04	12.09	36.85	76.41	21.51	10.57	6.29	12.65
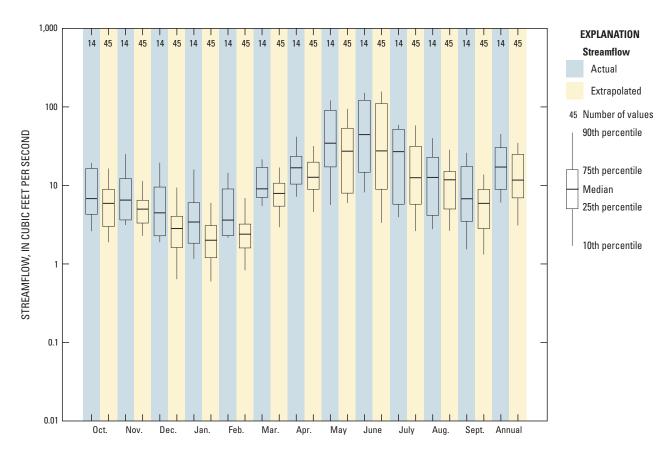
Figure 3. Boxplots for monthly and annual streamflow for Spring Creek above Sheridan Lake (station 06406920) for the actual period of record (water years 1991–2004) and extrapolated period (water years 1962–2006).

Table 7 provides a comparison between the monthly mean flow and minimum daily flow for each month for Spring Creek near Keystone (station 06407500) for WY 1987–2006. This table shows that the monthly means are not necessarily indicative of when short-term, low-flow conditions can develop that might be critical to maintaining fish populations. The months of July through September for WY 2002–05 provide several excellent examples.

Precipitation

Monthly precipitation for the WY 1962–2006 base period for Sheridan Lake was estimated primarily by averaging monthly precipitation values for three National Weather Service (NWS) stations (table 1) located approximately equidistant from Sheridan Lake (fig. 1). The monthly precipitation data for these three NWS "source" stations were obtained from South Dakota State University (2008b). The estimated monthly values for Sheridan Lake and a statistical summary are provided in table 23 in the Appendix. Monthly values were missing for 20 months of the base period for one of the NWS source stations. For 18 of the 20 months, precipitation estimates for the missing source station were obtained from estimated data tabulated by Driscoll and others (2000), and values for Sheridan Lake could then be derived by averaging the precipitation for all three stations. For 2 of the 20 months, estimates for the missing source station were not available from Driscoll and others (2000), and the values for Sheridan Lake were derived by averaging the data available for the other two source stations.

A Monthly streamflow

$y = 1.39x - 2.05$
$r^2 = 0.98$

B Annual streamflow

$y = 1.36x - 1.33$
$r^2 = 0.98$
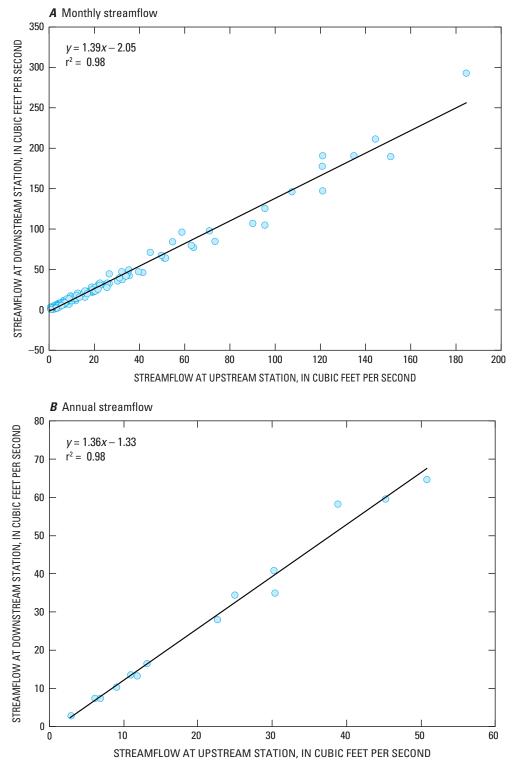
Figure 4. Regression plots of monthly and annual streamflow for Spring Creek near Keystone (downstream station, 06407500) against Spring Creek above Sheridan Lake (upstream station, 06406920), water years 1991–2004.
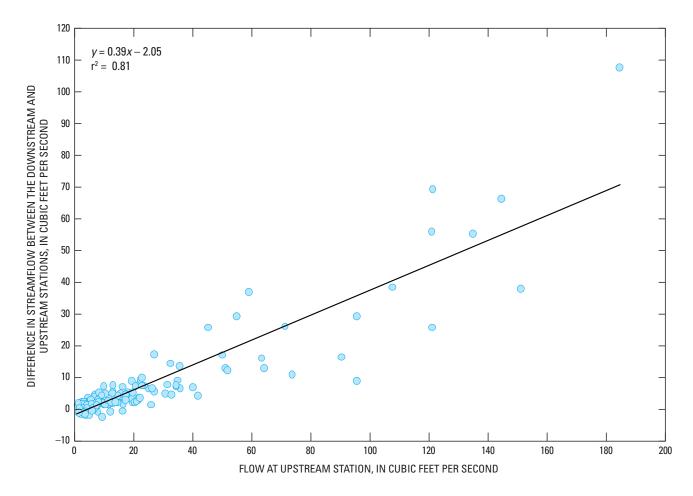
Figure 5. Regression plot of monthly streamflow difference for Spring Creek stations (06407500 minus 06406920) against flow at upstream station (06406920), water years 1991–2004.

Table 5.   Computed differences in monthly and annual streamflow for Spring Creek stations (06407500 minus 06406920), water years 1991–2004.

[Computed difference is downstream minus upstream. Thus, positive values indicate a gain in the intervening reach, and negative values indicate a loss]

| Water year/ statistic | Streamflow, in cubic feet per second | | | | | | | | | | | | Annual |
| | Month | | | | | | | | | | | | |
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	
1991	-0.74	-0.04	-0.34	-0.84	1.18	0.97	4.70	10.70	25.50	17.10	7.40	0.13	5.50
1992	.90	.71	.91	2.07	2.18	3.78	1.47	.85	2.16	2.50	.20	-.89	1.40
1993	-1.51	.82	1.07	1.33	1.34	1.82	4.30	25.90	38.30	25.50	9.70	4.80	9.50
1994	3.80	-1.10	-2.77	1.02	.40	3.00	3.80	6.80	4.00	.06	-.13	.16	1.60
1995	2.81	3.31	1.91	1.28	.71	4.05	1.61	66.10	107.70	36.80	7.20	1.90	19.60
1996	3.50	7.01	4.35	2.47	2.41	5.40	7.10	16.20	69.20	7.50	2.10	2.70	10.80
1997	4.90	6.20	1.90	3.70	1.80	2.50	3.90	55.80	55.20	11.90	16.90	6.30	14.30
1998	8.70	1.40	1.32	.90	.43	1.90	4.70	4.30	8.60	15.80	6.60	1.10	4.70
1999	6.30	12.60	8.80	7.80	3.40	3.40	12.70	29.10	37.70	29.00	13.30	3.40	14.00
2000	1.10	1.50	1.49	1.01	1.30	2.90	9.00	14.20	6.80	4.19	.06	-1.48	3.50
2001	.78	2.42	1.72	1.34	1.37	2.59	4.40	4.60	6.90	5.30	1.80	.92	2.90
2002	-1.00	-.49	.58	.88	.97	1.29	3.70	4.30	1.10	-.54	-2.17	-.79	.64
2003	.01	.17	.47	1.09	1.47	4.96	-.90	7.40	4.90	1.35	-2.17	-1.76	1.48
2004	-1.08	-.55	.16	.96	1.54	2.76	.76	.98	.10	-1.70	-1.72	-1.29	.07
Statistical summary													
Mean	2.03	2.43	1.54	1.79	1.46	2.95	4.37	17.66	26.30	11.05	4.22	1.09	6.43
Maximum	8.70	12.60	8.80	7.80	3.40	5.40	12.70	66.10	107.70	36.80	16.90	6.30	19.60
75th percentile	3.73	3.09	1.86	1.89	1.74	3.69	4.70	23.48	38.15	16.78	7.35	2.50	10.48
50th percentile	1.00	1.11	1.20	1.19	1.36	2.83	4.10	9.05	7.75	6.40	1.95	.54	4.10
25th percentile	-.55	.01	.50	.97	1.02	2.05	2.13	4.38	4.23	1.64	-.08	-.87	1.51
Minimum	-1.51	-1.10	-2.77	-.84	.40	.97	-.90	.85	.10	-1.70	-2.17	-1.76	.07
Standard deviation	3.08	3.80	2.60	2.00	.80	1.29	3.47	20.33	32.23	12.19	6.06	2.47	6.16

Table 6. Low-flow statistics for Spring Creek near Keystone (station 06407500), water years 1987–2006.

[ft³/s, cubic feet per second]

Water year	1 Flow (ft³/s)	1 Rank	3 Flow (ft³/s)	3 Rank	7 Flow (ft³/s)	7 Rank	14 Flow (ft³/s)	14 Rank	30 Flow (ft³/s)	30 Rank	60 Flow (ft³/s)	60 Rank	90 Flow (ft³/s)	90 Rank	120 Flow (ft³/s)	120 Rank	183 Flow (ft³/s)	183 Rank
1987	0.06	6	0.06	6	0.08	6	0.11	6	0.74	7	2.03	8	3.88	12	5.15	11	10.30	14
1988	.00	1	.00	1	.00	1	.00	1	.00	1	.01	3	.02	1	.25	3	1.07	3
1989	.00	2	.00	2	.00	2	.00	2	.00	2	.00	2	.03	2	.04	1	.17	1
1990	.27	7	.27	7	.29	7	.30	7	.36	6	.68	6	.86	6	.93	5	1.33	4
1991	.51	9	.58	10	.83	11	1.16	10	1.56	11	1.75	7	2.00	7	2.17	7	3.10	7
1992	.76	12	.86	12	1.02	12	1.30	12	2.81	14	4.71	15	5.22	15	5.67	14	6.70	12
1993	.55	10	.56	9	.60	9	.97	9	1.45	9	2.34	12	2.44	8	2.61	8	4.31	8
1994	.97	13	.99	13	1.12	13	1.40	13	1.53	10	2.18	9	3.41	11	6.88	15	11.50	15
1995	1.60	15	1.73	15	2.80	15	3.75	16	4.16	15	4.58	14	5.03	13	5.58	13	7.38	13
1996	3.10	17	3.37	17	4.03	18	4.60	18	6.69	18	8.32	18	9.53	18	11.00	18	13.60	17
1997	8.60	19	9.00	19	10.30	19	13.10	19	15.10	19	16.40	19	17.80	19	19.90	19	22.70	19
1998	3.10	18	3.40	18	3.73	17	3.83	17	5.89	17	6.87	17	7.85	17	7.99	16	15.00	18
1999	17.00	20	17.70	20	18.40	20	19.60	20	20.70	20	23.30	20	25.60	20	28.50	20	37.70	20
2000	1.20	14	1.37	14	1.40	14	1.49	14	1.71	12	2.92	13	6.27	16	10.20	17	12.40	16
2001	1.90	16	2.33	16	2.99	16	3.70	15	4.42	16	4.78	16	5.06	14	5.39	12	6.62	11
2002	.35	8	.39	8	.50	8	.67	8	1.07	8	2.27	10	3.22	10	3.86	10	4.88	9
2003	.58	11	.60	11	.74	10	1.20	11	1.74	13	2.32	11	2.90	9	3.16	9	5.13	10
2004	.00	3	.00	3	.00	3	.00	3	.01	4	.25	5	.57	5	.94	6	2.54	6
2005	.01	5	.01	5	.01	5	.02	5	.03	5	.04	4	.12	4	.18	2	.83	2
2006	.00	4	.00	4	.00	4	.00	4	.00	3	.00	1	.05	3	.26	4	1.44	5

Table 7.   Comparison of monthly mean and minimum daily flow values for Spring Creek near Keystone (station 06407500), water years 1987–2006.

Water year	Statistic	Streamflow, in cubic feet per second											
		Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1987	Mean	15.70	8.10	5.00	4.15	4.04	24.00	24.00	31.00	19.90	7.89	3.33	0.74
	Minimum	8.20	6.80	3.50	2.80	3.30	3.00	8.00	8.70	10.00	3.30	2.80	.06
1988	Mean	.30	.35	.22	.17	.80	4.54	5.29	8.18	1.58	.05	.02	.00
	Minimum	.06	.20	.12	.05	.32	1.10	3.80	5.20	.20	.00	.00	.00
1989	Mean	.00	.01	.08	.10	.01	.74	3.47	5.11	1.61	.16	.00	.49
	Minimum	.00	.00	.00	.07	.00	.00	.81	.82	.39	.00	.00	.00
1990	Mean	.37	1.01	1.23	1.08	1.13	3.17	11.40	26.90	35.80	13.00	7.41	1.58
	Minimum	.27	.79	.80	.50	.40	.60	.79	2.30	6.60	4.10	2.50	.59
1991	Mean	1.87	3.28	1.94	1.58	3.34	6.53	15.10	84.40	147.00	44.00	20.40	6.25
	Minimum	.51	2.00	1.50	1.10	1.80	3.50	6.20	17.00	82.00	18.00	8.40	4.10
1992	Mean	6.25	7.31	5.85	4.57	5.40	10.80	8.67	6.49	10.00	13.70	7.25	2.81
	Minimum	4.60	4.30	4.50	4.10	4.00	7.80	7.00	4.30	3.40	9.70	2.90	.76
1993	Mean	1.49	3.19	2.69	3.13	3.64	11.30	21.90	97.20	146.00	70.70	32.50	17.50
	Minimum	.55	1.90	1.60	2.70	1.80	4.00	13.00	35.00	81.00	50.00	6.00	14.00
1994	Mean	17.60	11.10	6.65	7.03	6.64	19.90	19.70	41.20	18.70	5.81	2.65	1.70
	Minimum	13.00	4.00	4.00	5.00	5.00	9.50	15.00	24.00	3.10	2.50	.97	1.40
1995	Mean	8.73	7.84	5.96	4.75	4.40	12.70	8.90	211.00	292.00	95.80	30.00	15.70
	Minimum	1.60	5.50	5.50	4.00	3.40	5.10	5.40	16.00	146.00	43.00	18.00	13.00
1996	Mean	16.40	16.90	11.20	7.57	11.40	18.40	30.50	107.00	190.00	39.00	23.00	20.10
	Minimum	12.00	14.00	6.80	3.90	3.10	5.70	16.00	25.00	94.00	24.00	15.00	15.00
1997	Mean	22.90	31.20	21.40	19.70	16.30	24.00	45.70	177.00	190.00	63.80	67.00	32.50
	Minimum	15.00	24.00	11.00	13.00	8.60	15.00	17.00	90.00	77.00	33.00	43.00	26.00
1998	Mean	28.00	12.80	11.30	6.89	7.34	22.30	35.50	37.00	104.00	79.10	46.60	27.10
	Minimum	27.00	3.10	9.50	4.80	5.90	8.50	26.00	24.00	27.00	53.00	25.00	18.00
1999	Mean	42.10	63.80	43.60	29.70	22.60	25.20	76.90	125.00	189.00	83.90	48.90	25.40
	Minimum	21.00	47.00	27.00	25.00	20.00	17.00	26.00	95.00	93.00	50.00	22.00	19.00
2000	Mean	17.50	14.30	11.00	8.86	11.30	14.60	31.30	46.70	23.10	13.40	4.21	1.71
	Minimum	15.00	12.00	9.10	7.90	9.50	13.00	12.00	37.00	17.00	6.70	1.20	1.30
2001	Mean	5.61	8.16	5.62	4.71	4.93	10.50	21.60	20.20	27.50	32.30	14.10	8.37
	Minimum	1.90	4.00	4.30	4.10	4.20	5.90	9.70	12.00	14.00	18.00	7.10	5.30
2002	Mean	6.80	5.93	4.23	2.72	3.24	5.95	17.40	21.50	11.40	3.40	1.70	5.12
	Minimum	4.60	5.10	2.00	1.70	2.90	3.40	10.00	15.00	5.90	.35	.36	.44
2003	Mean	4.29	3.80	2.75	2.25	4.01	13.30	15.40	41.80	24.50	7.10	2.84	1.74
	Minimum	3.20	3.20	1.10	1.30	3.40	3.20	11.00	22.00	18.00	1.10	.58	.67
2004	Mean	1.51	2.58	2.05	1.97	2.75	8.26	6.14	5.10	2.31	1.22	.47	.03
	Minimum	.96	1.80	1.70	.70	1.60	3.60	4.10	3.30	.93	.08	.00	.00
2005	Mean	.03	.06	.29	.46	1.59	2.51	4.97	9.26	8.94	2.35	2.30	.04
	Minimum	.01	.05	.05	.07	1.10	1.30	2.20	1.90	3.50	.22	.20	.01
2006	Mean	.02	.06	.09	.93	1.16	5.73	10.90	7.87	6.57	.97	.00	.00
	Minimum	.01	.01	.02	.16	.48	2.00	6.40	3.90	1.50	.00	.00	.00

Estimated annual precipitation for Sheridan Lake ranged from 13.17 inches in 1985 to 30.58 inches in 1962 (table 23). Precipitation was substantially above average for many years during the 1990s and substantially below average for many years during the late 1980s and the 2000s, which is consistent with streamflow conditions during these periods (table 2).

Evaporation

Variability in daily and monthly evaporation generally is much smaller than for streamflow or precipitation. However, evaporation is shown in subsequent sections of this report to be a critical variable in the hydrologic budget, relative to potential management options for Sheridan Lake during low-flow conditions. Thus, a thorough characterization of evaporation characteristics is useful.

Estimates of monthly evaporation for Sheridan Lake during the WY 1962–2006 base period were based primarily on measurements of pan evaporation (table 24 in the Appendix) that are available for the NWS station 396427 at Pactola Dam (table 1; fig. 1). Months of missing evaporation record are common for Pactola Dam, especially for May and October, when freezing temperatures (or other factors) commonly have precluded collection of complete records for these months. When possible, missing data were estimated using the same mixed-station (MOVE.1) procedure that was used for extrapolation of streamflow records for gaging station 06406920. NWS index stations from table 1 (Angostura Dam/Oral, Cottonwood, Shadehill Dam, Oahe Dam, and Pickstown) that were used in estimating pan evaporation (table 24) are located at considerable distances from Pactola Dam because the available network of evaporation pans is very sparse (fig. 1). Data for all stations were obtained from South Dakota State University (2008b). The evaporation measurements at Angostura Dam (station 390217) were discontinued after 1970 and resumed nearby at Oral (station 396304) during 1971; however, these stations were treated as a single station. The index stations generally have substantially larger monthly evaporation than the station at Pactola Dam because of substantially lower altitudes; however, this general relation is consistent among stations, and resulting estimates are adequate for hydrologic budget purposes.

Compilation of summary statistics for comparisons among Pactola Dam and other evaporation stations was precluded by the sporadic nature of available data (table 24). For example, data sets for 1968 are complete, with the exception of one missing month at Cottonwood, and examination of the data indicates that for each month (1) evaporation is quite similar for all of the index stations and (2) evaporation for Pactola Dam is consistently smaller than evaporation for the index stations. As another example, all months for 1977 required estimation of evaporation for Pactola Dam, and many months also were missing for some of the index stations.

During the entire period (1962–2006), evaporation data were missing for all of the evaporation stations for 8 months (2 months for May and 6 months for October).

Linear least-squares regression analyses (table 8) were applied for these individual months to estimate pan evaporation at Pactola Dam (table 24) as a function of estimated precipitation at Sheridan Lake (using data from table 23). Although the relations are weak (r values of -0.40 for May and -0.18 for October), the negative correlations are logical (inverse relation to monthly precipitation). The resulting estimates for the missing months (table 24) are very similar to the long-term means for May and October (table 9).

Although monthly evaporation data were used as input for hydrologic budgeting purposes, consideration of maximum daily evaporation values could be critical for development of possible operating criteria for Sheridan Lake. Monthly pan evaporation for July averaged about 6.45 inches at Pactola Dam (table 9), or about 0.2 inch per day, and only 3 months (June of 1988 and July of 2002 and 2003) had recorded evaporation that exceeded 8.0 inches (table 24). A summary of maximum daily pan evaporation values for Pactola Dam for July (obtained from South Dakota State University, 2008b) is provided in table 10. This table provides moving average maximum values for 1- through 7-day intervals and ranks (largest to smallest) for all months with at least 7 consecutive days of data. The reliability of data for some of the largest maximum evaporation values for individual days is unknown. The six largest 1-day maxima range from 0.67 to 0.87 inch (1965, 1970, 1976, 1984, 1993, and 1994); however, the next largest value is 0.59 inch in 1980. Nonetheless, examination of the collective data set indicates that pan evaporation rates approaching 0.4 inch per day probably have been sustained for periods of several days or longer. Thus, sustained daily evaporation rates may exceed maximum monthly values by a factor of about two.

Table 8.   Results of linear least-squares regression between monthly pan evaporation at Pactola Dam and estimated monthly precipitation for Sheridan Lake for May and October, 1962–2006.

[r, Pearson's correlation coefficient]

Parameter	May	October
Slope	-0.14	-0.08
y-intercept	4.96	2.68
r	-.40	-.18

Hydrologic Budget for Sheridan Lake

The hydrologic budget for Sheridan Lake primarily involved long-term computations for monthly time steps, as described in the following section. However, a short-term daily budget also was developed and used for evaluation of monthly pan evaporation coefficients, as described in a subsequent section.

Table 9. Summary statistics for monthly pan evaporation data at Pactola Dam, 1962–2006.

[The number of observations for May and October excludes values derived using regression analysis (from table 8)]

Period/number of observations	Pan evaporation, in inches						
	Mean	Standard deviation	Maximum	75th percentile	50th percentile (median)	25th percentile	Minimum
May/43	4.48	0.74	6.67	4.90	4.35	3.93	3.20
June/45	5.38	.91	8.14	6.01	5.35	4.76	3.73
July/45	6.45	.99	8.45	7.25	6.40	5.86	3.99
August/45	5.55	.70	7.24	6.00	5.59	4.96	4.43
September/45	3.88	.59	5.34	4.23	3.90	3.64	2.45
October/39	2.57	.53	3.73	2.92	2.51	2.21	1.49
Annual/45	28.29	2.57	35.35	29.68	28.31	25.85	20.56

Long-Term Monthly Budget

A long-term (1962–2006) historical hydrologic budget was developed for Sheridan Lake using monthly time steps within an annual period running from May through April, referred to as a computational year. The computational year includes a 6-month period (May through October) for which evaporation is accounted for and another 6-month period (November through April) when evaporation is considered negligible due to ice cover on Sheridan Lake or minimal evaporation potential.

The long-term historical budget is based on equation 1 that assumes a pass-through operating system, which typically has been used for Sheridan Lake. The historical budget was used as the basis for a hydrologic model for simulating release scenarios and also is useful for long-term characterization of estimated natural outflows for the historical pass-through operating system. Selected input and output data sets for the long-term budget are presented as tables 25–30 in the Appendix. All computations are shown to two decimal places for the sake of consistency; however, this is not intended to imply that this level of accuracy is appropriate for reporting of all individual values.

Stream inflow and precipitation were considered as inflow components (equation 1). Stream inflow was computed as the flow of Spring Creek at gaging station 06406920 (above Sheridan Lake) plus inflow from ungaged tributary areas between the gaging station and the spillway of Sheridan Lake Dam. Ungaged tributary inflow was assumed to be proportional to the flow of Spring Creek, relative to drainage area, as characterized in a previous section titled "Characterization of Historical Streamflow Data for Spring Creek." Thus, total monthly stream inflow was computed by multiplying flow at the gaging station (table 22) by the ratio (1.146) of the total area at the dam (145.5 mi^2) to the area at the gaging station (127 mi^2). Monthly values of total stream inflow in units of acre-feet are shown in table 25, and a summary of monthly values in cubic feet per second is shown in table 11.

Inflow resulting from precipitation on Sheridan Lake was treated as "effective precipitation" that was computed by multiplying monthly precipitation (in inches) by an "effective precipitation coefficient." Coefficients of 1.0 were used for May through October (table 12), and coefficients of 0.5 were chosen for December through February, when ice cover typically prevails and potential exists for reduction of water content in snow pack through sublimation. Coefficients of 0.7, 0.6, and 0.8 were chosen for November, March, and April, respectively, to reflect assumed conditions during transition periods. Monthly values of effective precipitation in units of acre-feet are shown in table 26. A summary of monthly values in cubic feet per second is provided in table 11, which shows that precipitation generally is a small component of the overall hydrologic budget, relative to stream inflow.

Evaporation from Sheridan Lake was estimated by multiplying monthly pan evaporation data (table 24) for Pactola Dam (NWS station 396427) by the monthly pan coefficients shown in table 12. Resulting monthly evaporation estimates in units of acre-feet are shown in table 27 in the Appendix. A summary of monthly values in cubic feet per second is provided in table 11, which shows that variability in evaporation for any given month tends to be relatively small. This table also shows that lake evaporation can substantially exceed minimum values of precipitation for all months when evaporation is considered (May through October). Similarly, lake evaporation can potentially approach or exceed total stream inflow during low-flow conditions for most months, with the general exception of May. Short-term evaporation rates can substantially exceed monthly evaporation rates, as previously described regarding data from table 10. Thus, evaporation is a particularly critical variable during low-flow periods, and potential exists for outflows to begin approaching zero-flow conditions substantially prior to the onset of zero-inflow conditions, especially when daily inflow and evaporation are considered.

The mean of the monthly pan coefficients that were selected (table 12) is 0.75, which is consistent with an annual pan coefficient of 0.74 for the area (Farnsworth and others,

Table 10. Moving average maximum values and ranks for 1- through 7-day intervals for pan evaporation at Pactola Dam, 1962–2006.

[--, available data not sufficient to perform computation]

| Year | \| Number of consecutive days | | | | | | | | | | | | |
| | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | |
	Maximum evapo-ration (inches)	Rank	Maximum evapo-ration (inches)	Rank	Maximum evapo-ration (inches)	Rank	Maximum evapo-ration (inches)	Rank	Maximum evapo-ration (inches)	Rank	Maximum evapo-ration (inches)	Rank	Maximum evapo-ration (inches)	Rank
1962	0.25	42	0.24	41	0.23	41	0.21	42	0.21	42	0.21	40	0.21	40
1963	.28	40	.24	41	.23	41	.22	40	.23	39	.22	38	.22	35
1964	.37	25	.32	24	.30	26	.28	24	.27	21	.26	21	.26	20
1965	.67	6	.40	10	.36	10	.32	13	.31	12	.29	14	.28	14
1966	.43	12	.42	8	.37	7	.34	10	.33	7	.32	8	.31	8
1967	.29	38	.28	35	.26	34	.26	33	.25	33	.24	31	.23	32
1968	.30	33	.28	35	.25	38	.26	33	.26	28	.24	31	.23	32
1969	.36	26	.32	24	.31	21	.29	22	.27	21	.26	21	.26	20
1970	.80	2	.52	2	.42	1	.38	2	.32	9	.34	1	.33	2
1971	.30	33	.29	30	.29	27	.27	27	.27	21	.26	21	.26	20
1972	.30	33	.26	38	.26	34	.25	37	.25	33	.24	31	.24	30
1973	.40	16	.32	24	.31	21	.26	33	.23	39	.24	31	.22	35
1974	.39	19	.34	20	.32	19	.30	18	.30	14	.30	10	.28	14
1975	.32	32	.32	24	.29	27	.27	27	.27	21	.26	21	.25	26
1976	.68	5	.45	6	.39	4	.35	6	.31	12	--	--	--	--
1977	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1978	.51	9	.32	24	.29	27	.28	24	.27	21	.26	21	.26	20
1979	.35	27	.30	29	.28	31	.27	27	.26	28	.26	21	.25	26
1980	.59	7	.43	7	.41	3	.38	2	.36	1	.30	10	.30	10
1981	.51	9	.48	4	.42	1	.39	1	.36	1	.34	1	.32	6
1982	.48	11	.37	15	.34	15	.30	18	.29	20	.27	19	.26	20
1983	.35	27	.34	20	.31	21	.30	18	.30	14	.30	10	.29	12
1984	.75	4	.50	3	.39	4	.35	6	.32	9	.28	18	.27	17

Table 10. Moving average maximum values and ranks for 1- through 7-day intervals for pan evaporation at Pactola Dam, 1962–2006.—Continued

[--, available data not sufficient to perform computation]

Year	Number of consecutive days													
	1		2		3		4		5		6		7	
	Maximum evaporation (inches)	Rank	Maximum evaporation (inches)	Rank	Maximum evaporation (inches)	Rank	Maximum evaporation (inches)	Rank	Maximum evaporation (inches)	Rank	Maximum evaporation (inches)	Rank	Maximum evaporation (inches)	Rank
1985	0.38	20	0.36	16	0.35	11	0.35	6	0.35	3	0.34	1	0.34	1
1986	.33	31	.28	35	.26	34	.24	39	.24	37	.23	36	.22	35
1987	.38	20	.35	18	.31	21	.27	27	.26	28	.26	21	.26	20
1988	.38	20	.36	16	.33	18	.33	11	.32	9	.33	7	.31	8
1989	.42	13	.41	9	.34	15	.33	11	.34	5	.34	1	.33	2
1990	.41	14	.38	13	.37	7	.36	4	.33	7	.32	8	.33	2
1991	.56	8	.40	10	.35	11	.32	13	.30	14	.29	14	.28	14
1992	.23	43	.20	43	.20	43	.19	44	.18	44	.18	43	.17	43
1993	.78	3	.46	5	.35	11	.29	22	.26	28	.24	31	.23	32
1994	.87	1	.55	1	.37	7	.30	18	.27	21	.26	21	.25	26
1995	.30	33	.26	38	.25	38	.25	37	.24	37	.22	38	.22	35
1996	.38	20	.34	20	.32	19	.31	16	.30	14	.29	14	.27	17
1997	.35	27	.29	30	.28	31	.26	33	.25	33	.25	29	.24	30
1998	.27	41	.25	40	.25	38	.22	40	.22	41	.21	40	.20	41
1999	.30	33	.29	30	.27	33	.27	27	.27	21	.27	19	.27	17
2000	.29	38	.29	30	.29	27	.28	24	.25	33	.23	36	.22	35
2001	.34	30	.29	30	.26	34	.27	27	.26	28	.25	29	.25	26
2002	.40	16	.40	10	.38	6	.36	4	.35	3	.34	1	.32	6
2003	.40	16	.35	18	.34	15	.32	13	.30	14	.30	10	.30	10
2004	.23	43	.20	43	.20	43	.20	43	.20	43	.19	42	.18	42
2005	.38	20	.34	20	.31	21	.31	16	.30	14	.29	14	.29	12
2006	.41	14	.38	13	.35	11	.35	6	.34	5	.34	1	.33	2

Table 11.   Summary of selected hydrologic budget components for Sheridan Lake, 1962–2006.

[NA, not applicable; NC, not computed]

Statistic	Monthly and annual values, in cubic feet per second, for hydrologic budget components												
	May	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**	**Jan.**	**Feb.**	**Mar.**	**Apr.**	**Annual**
	Total stream inflow												
Maximum	166	416	110	57.0	30.0	41.0	59.0	39.9	25.1	22.0	24.98	74.0	NC
Mean	43.9	75.0	27.2	15.1	8.28	8.85	7.44	4.87	3.50	3.88	10.1	19.0	19.0
Minimum	3.45	1.66	.16	.05	.08	.72	.02	.15	.18	.02	1.79	3.24	NC
	Effective precipitation												
Maximum	5.26	5.75	4.45	2.55	3.30	2.51	0.67	0.44	0.24	0.47	1.07	2.57	NC
Mean	1.95	2.09	1.70	1.10	.84	.69	.22	.11	.09	.15	.33	1.00	0.86
Minimum	.07	.34	.19	.35	.04	.02	.02	.00	.01	.02	.07	.08	NC
	Lake evaporation												
Maximum	1.73	2.62	3.07	3.01	2.58	1.94	NA	NA	NA	NA	NA	NA	NA
Mean	1.16	1.73	2.34	2.30	1.87	1.34	NA	NA	NA	NA	NA	NA	NA
Minimum	.83	1.20	1.45	1.84	1.19	.77	NA	NA	NA	NA	NA	NA	NA

Table 12.   Monthly coefficients for effective precipitation and pan evaporation for Sheridan Lake.

[--, evaporation not computed for November through April]

Coefficient	**May**	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**	**Jan.**	**Feb.**	**Mar.**	**Apr.**
Effective precipitation	1.0	1.0	1.0	1.0	1.0	1.0	0.7	0.5	0.5	0.5	0.6	0.8
Pan coefficient	.5	.6	.7	.8	.9	1.0	--	--	--	--	--	--

1982) that also is based on data for May through October. Farnsworth's coefficients commonly are used for estimating annual evaporation from lakes or reservoirs and generally are suitable for estimating monthly evaporation from relatively shallow water bodies. However, evaporation rates from deep water bodies are affected by seasonal trends in surface-water temperatures (Kohler, 1954), which tend to lag trends in mean daily air temperatures and associated trends in water temperatures for evaporation pans. Kohler (1954) reported pan coefficients (computed for Lake Hefner in Oklahoma) larger than 1.0 for 2 months (November and December) and smaller than 0.60 for several months (late winter through early summer). Sacks and others (1994) reported similar results in comparing computed pan coefficients for two lakes in Florida with substantially different mean depths, with larger deviations from mean values for the deeper lake.

A short-term data set was collected during late July through September 2007 to facilitate development of a daily hydrologic budget for calculating evaporation from Sheridan Lake. Results are reported in the following section titled

"Short-Term Daily Water Budget" and support the use of variable monthly pan coefficients.

Variability in calculated lake evaporation resulting from selection of monthly pan coefficients is relatively small, as indicated by a sensitivity analysis that is provided in table 13. Each incremental change of 0.1 in monthly pan coefficients results in an incremental change of about 13 percent in lake evaporation, relative to use of a constant pan coefficient of 0.75. However, lake evaporation can substantially exceed inflows during low-flow periods; thus, relatively small differences in evaporation rates could substantially affect rates of reservoir drawdown during periods when the lake level drops below the spillway elevation.

Monthly values of "net inflow" (in units of cubic feet per second) are shown in table 28. These values were computed as

$$Net\ inflow = Stream\ inflow + Precipitation - Evaporation. \quad (2)$$

Net inflow is equivalent to the variable reservoir outflow from equation 1, with the exception of months with negative values,

Table 13. Comparison of ranges in monthly lake evaporation for Sheridan Lake for selected pan coefficients.

Pan coefficient	Statistic	Computed monthly lake evaporation, in inches					
		May	June	July	August	September	October
0.65	Maximum	4.34	5.29	5.49	4.71	3.47	2.42
	Mean	2.90	3.48	4.18	3.61	2.52	1.68
	Minimum	2.08	2.42	2.59	2.88	1.59	.97
.75	Maximum	5.00	6.11	6.34	5.43	4.01	2.80
	Mean	3.35	4.02	4.82	4.16	2.91	1.93
	Minimum	2.40	2.80	2.99	3.32	1.84	1.12
1.0	Maximum	6.67	8.14	8.45	7.24	5.34	3.73
	Mean	4.46	5.35	6.43	5.55	3.88	2.58
	Minimum	3.20	3.73	3.99	4.43	2.45	1.49

which occur only for the months of July through October and during four of the computational years, including the 3 years from 1987 through 1990 and 2005–06 (table 28). During such months, the reservoir pool would drop below the crest of the spillway and would result in a condition of reduced storage and zero outflow through the spillway.

Monthly values of end-of-month storage change for Sheridan Lake then were computed from the net inflow deficits (table 28), and accumulated storage deficits (in units of acre-feet) are shown by negative values in table 29. Consideration of the accumulated deficits allowed computation of monthly values (table 30) for the variable reservoir outflow (equation 1) for the pass-through operating system that historically has been used. A good example of the overall computational approach is provided by the 1987–88 computational year. A deficit value for net inflow (-0.46 ft^3/s) was computed for September (table 28), which resulted in an equivalent volumetric storage deficit of -27.50 acre-ft (table 29) and an assigned value of 0.00 ft^3/s for reservoir outflow (table 30). The storage deficit increased slightly for October because of continued deficit net inflow; however, the storage deficit decreased for November and was eliminated during December, for which a positive value of 1.82 acre-ft is shown (table 29). The only months for which positive values of end-of-month storage are shown in table 29 are when deficits are eliminated, and these values then could be used to compute the monthly values for reservoir outflow, which is 0.03 ft^3/s for the example December (table 30). Values of reservoir outflow for the remaining months of the 1987–88 computational year are identical to the computed values of net inflow (table 28).

Monthly differences between computed values of reservoir outflow (table 30) and the area-adjusted flow values (for the period of available record) at gaging station 06407500 (located about 5 miles downstream from Sheridan Lake, fig. 1) are shown in table 14. The area-adjusted flows were obtained by multiplying measured flows by 0.893, which is the ratio of the drainage areas at the dam (145.5 mi^2) and at the gaging station (163 mi^2). The area-adjusted flows were subtracted from the computed reservoir outflows, which result in positive values for months when computed outflows exceed the area-adjusted flows. There are slightly more positive (136) than negative (96) values, which indicates a slight bias towards more frequent overestimation of reservoir outflows than underestimation, relative to the area-adjusted flows. The largest potential source of error for this computation probably is the adjustment of measured values relative to tributary inflows from the intervening drainage area between the dam and the downstream gaging area, which is inconsequential relative to hydrologic budget applications. The mean of the differences between the computed outflows and area-adjusted flows is very small (-0.03) and opposite in sign to the slight bias towards more frequent overestimation. Figure 6A shows that the computed values for reservoir outflow plot closely along a one-to-one line for the area-adjusted flows. Figure 6B shows that differences between computed reservoir outflows and area-adjusted flows generally are quite small for the smaller flow values (less than 10 ft^3/s), which is the flow regime of particular interest for the hydrologic budget purposes.

Table 15 provides a ranked list of the monthly values of reservoir outflow that are provided in table 30, and examination of these values provides a useful perspective on long-term streamflow conditions downstream from Sheridan Lake. Table 15 shows that September may be the month for greatest potential benefit associated with potential release scenarios for purposes of enhancing fish habitat and other ecosystem values in downstream reaches of Spring Creek. Computed monthly outflows for September are less than 1.0 ft^3/s for 8 of the 44 years (18 percent) and are less than 2.0 ft^3/s for 14 of the 44 years (32 percent). Conversely, none of the computed outflows for May are less than 2.0 ft^3/s. A graphical representation of computed outflows over the full range of values is provided by the quantile plots that are presented in figure 7.

Table 14.   Monthly differences between computed reservoir outflows and area-adjusted flow values for Spring Creek near Keystone (station 06407500), 1986–2006.

[--, no data]

Year	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
						Difference, in cubic feet per second						
1986–87	--	--	--	--	--	1.22	1.15	0.35	-0.28	-0.08	2.04	1.27
1987–88	2.57	-0.87	0.74	2.03	-0.66	-.26	-.31	-.17	.22	-.22	-.31	.58
1988–89	.38	-.30	-.04	-.02	.00	.00	-.01	-.07	-.09	-.01	5.08	.89
1989–90	.16	-.23	-.14	.00	-.43	-.33	-.10	.23	-.16	-.23	-.03	1.42
1990–91	2.42	-.62	2.29	2.20	-.67	-.14	1.07	1.03	1.39	-.32	.74	.12
1991–92	11.80	9.19	-9.19	-4.62	.09	-.17	1.41	.44	-1.19	-1.06	-.92	1.09
1992–93	.34	.90	1.31	.36	-.09	.90	-.01	-.36	-.56	-.37	.97	1.87
1993–94	-3.18	-5.48	-11.22	-3.95	-2.02	-.24	4.22	4.98	.70	1.40	1.81	1.40
1994–95	2.35	-1.27	-.10	-.89	-1.42	.18	-1.67	-.56	-.25	.52	-1.15	1.44
1995–96	-19.23	-47.90	-17.61	-2.31	1.04	.42	-3.59	-2.11	-.68	.15	-1.02	.58
1996–97	11.18	-31.77	.02	3.44	1.64	.99	.95	3.53	.83	2.29	3.33	8.42
1997–98	-17.44	-15.03	3.11	-2.98	.31	-3.71	1.67	1.44	.86	1.62	4.19	4.09
1998–99	4.89	18.49	1.79	3.95	5.33	4.79	2.31	.99	-1.18	1.86	2.80	6.40
1999–2000	-1.35	7.23	-12.79	-3.48	1.64	2.01	2.00	1.13	1.21	1.45	.71	-.41
2000–2001	-3.93	-2.73	-1.97	-1.10	.45	.19	-.18	-.47	-.27	-.04	-.07	1.49
2001–02	.06	-.43	2.20	.39	.38	2.16	2.31	.42	-.28	-.22	.53	1.13
2002–03	.84	.56	.15	1.75	2.21	.34	.90	.19	-.49	-.51	-1.70	6.34
2003–04	2.18	.49	-2.63	2.03	1.31	.50	1.76	.43	-.51	-.76	-.92	1.36
2004–05	.28	-.24	2.06	.63	1.04	1.03	.13	.04	.43	-.41	-.20	.98
2005–06	1.87	.26	.43	1.68	-.03	.25	.15	.70	-.11	-.28	.18	1.35
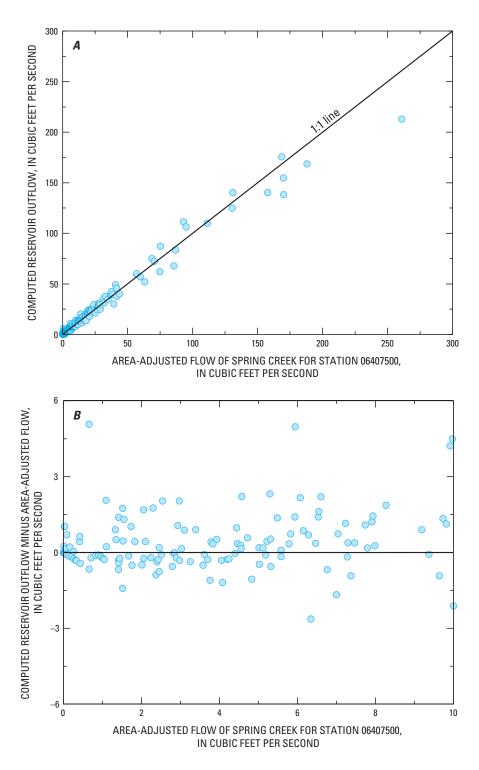
Figure 6.   Relations between computed reservoir outflow for Sheridan Lake and area-adjusted flow of Spring Creek for station 06407500 (near Keystone), 1986–2006. *A,* Computed reservoir outflow plotted against area-adjusted flow. *B,* Computed reservoir outflow minus area-adjusted flow plotted against area-adjusted flow (for values less than or equal to 10 cubic feet per second).

Short-Term Daily Budget

    Short-term hydroclimatic data were collected at various sites during late July through September of 2007, which facilitated development of a hydrologic budget with daily time steps. The daily budget was used to calculate evaporation from Sheridan Lake and to evaluate the applicability of published pan coefficients. Data collection sites that were operated specifically for this effort were (1) a short-term continuous-record streamflow gage at the discontinued station (06406920) above Sheridan Lake, (2) two partial-record streamflow gages, (3) a lake stage gage on Sheridan Lake, and (4) three short-term precipitation gages read by observers. Site information for all sites is provided in table 1 and locations are shown on figure 1.

    Selected data and water-balance computations are shown in table 16 for two short-term periods during 2007 when evaporation from Sheridan Lake exceeded total inflows. The lake stage during these periods decreased below the crest of the spillway (elevation of approximately 1.74 ft, relative to

the datum of the lake stage gage), which eliminated the stream outflow component of the water budget and thus simplified computation of lake evaporation. This also substantially increased the accuracy of evaporation estimates because the outflow from Sheridan Lake is not measured directly.

    The first column in table 16 shows the date, and the second column shows daily mean streamflow (in cubic feet per second) for station 06406920. The third column shows total stream inflow, which is considered representative of additional contributions from ungaged areas downstream from the gage and is calculated by multiplying measured inflow by 1.146 and converting to acre-feet per day. The fourth column shows the same daily volume of total stream inflow expressed as feet of water in the lake, and is computed by dividing column 3 by the lake surface area of 383 acres.

    Partial-record streamflow gages (table 1) were operated along two of the largest tributaries to Sheridan Lake (fig. 1); however, the resulting data sets were of minimal utility for estimation of tributary inflows. Measurable flow was not recorded at the partial-record gage south of Sheridan Lake

Table 15.   Ranked monthly values of computed reservoir outflows from Sheridan Lake for pass-through operating system, 1962–2006.

Ranked monthly computed reservoir outflows, in cubic feet per second						Ranked monthly computed reservoir outflows, in cubic feet per second					
May	**June**	**July**	**August**	**September**	**October**	**May**	**June**	**July**	**August**	**September**	**October**
2.57	1.11	0.00	0.00	0.00	0.00	32.23	32.15	15.50	12.98	6.23	6.50
4.72	1.21	.00	.00	.00	.00	34.24	36.57	15.63	13.25	6.78	6.56
4.83	1.82	.72	.14	.00	.00	37.76	46.03	17.81	13.43	6.91	6.88
6.13	2.37	1.41	1.05	.00	.26	37.92	53.13	20.08	13.59	6.95	7.54
6.5	2.75	2.53	1.42	.10	1.05	38.62	63.87	20.32	13.80	7.40	7.86
7.25	3.08	2.63	1.48	.60	1.53	39.13	68.66	20.94	13.82	7.45	7.93
7.34	3.44	3.15	2.66	.74	1.85	39.49	86.56	30.09	14.16	7.69	7.97
7.36	7.95	3.18	3.27	.92	2.23	40.77	109.98	31.03	14.21	7.85	8.23
7.68	8.24	3.71	3.73	1.07	2.31	41.05	111.50	33.96	14.73	9.13	8.71
8.38	10.09	4.85	4.57	1.14	2.51	43.25	124.85	34.02	14.96	9.22	9.33
10.14	10.74	5.09	5.00	1.16	2.60	65.62	126.54	34.83	15.29	9.43	9.60
11.58	11.08	5.56	5.91	1.21	3.03	75.2	138.28	44.62	15.43	11.20	10.74
12.16	12.45	5.82	6.65	1.54	3.11	80.23	139.83	51.89	17.01	11.26	12.32
18.09	15.42	7.78	6.65	1.98	3.27	83.58	140.14	55.08	23.76	12.29	14.31
20.03	16.89	8.84	6.83	2.42	4.17	87.14	153.98	56.16	23.97	12.60	15.06
20.07	17.64	9.99	8.03	2.52	4.41	106.34	154.75	60.06	24.47	13.60	15.23
21.29	17.89	11.46	8.16	2.86	4.64	107.29	175.85	62.10	25.06	15.05	15.47
25.17	18.05	12.35	8.81	3.68	5.07	109.85	182.45	65.59	31.95	15.61	17.63
26.43	22.36	12.57	9.85	4.01	5.20	110.05	193.34	67.90	33.53	19.58	21.28
26.57	24.12	13.54	11.60	4.41	5.41	133.96	213.11	72.40	40.17	24.31	21.43
30.24	27.86	13.59	11.69	5.36	5.80	140.38	278.45	106.03	45.55	29.32	21.66
30.92	31.34	13.89	12.18	5.67	5.86	168.76	420.04	111.25	56.83	29.52	42.37

(station 06406960); however, minor flow (estimated as less than 0.01 ft³/s) was observed a short distance upstream. Flow measurements of 0.083 and 0.082 ft³/s were obtained for two dates (July 25 and August 17, 2007, respectively) at station 06406950 along Horse Creek (just north of Sheridan Lake), and observations of stage for seven other dates indicated minimal fluctuations in stage and associated discharge. The flow of Horse Creek ceased entirely just downstream from the gage site (about 0.3 mile upstream from Sheridan Lake); thus, the applicability of flow observations is somewhat dubious. On the basis of these considerations, it was decided that the most appropriate approach for estimation of ungaged tributary inflows was by assuming proportionality relative to the gaged drainage area, which is the same approach used in development of the monthly hydrologic budget.

Column 5 in table 16 shows precipitation (in inches) on Sheridan Lake, which was estimated by averaging measurements obtained by observers at three USGS precipitation stations (table 1). Column 6 shows precipitation converted to feet, and column 7 shows the total daily inflow (streamflow plus precipitation), in feet. Column 8 shows mean daily lake stage, in feet, and column 9 shows the associated change in stage, relative to the previous day. This is equivalent to change in storage, expressed in feet, and is consistent with the units for the daily inflow volumes.

Because reservoir outflow was zero for all days considered, evaporation from Sheridan Lake could be computed by modifying equation 1 as

$$Evaporation = Stream\ inflow + Precipitation - \Delta Storage. \quad (3)$$

Computed values of lake evaporation (in feet) are shown in column 10 of table 16, and values converted to inches are shown in column 11. Measured daily values of pan evaporation for the station at Pactola Dam are shown in column 12. Values for computed lake evaporation (column 11) and measured pan evaporation (column 12) are summed for each of the two individual periods. For the first period, the summed values for lake evaporation are approximately equal to measured pan evaporation and would relate to a pan coefficient of 1.0. For the second period, the computed pan coefficient would be 1.1.

The accuracy associated with the computed values for daily evaporation is difficult to evaluate because of the large number of hydrologic variables involved in the computations. The resulting values for the associated short-term pan coefficients (approximately 1.0 and 1.1) are larger than the mean
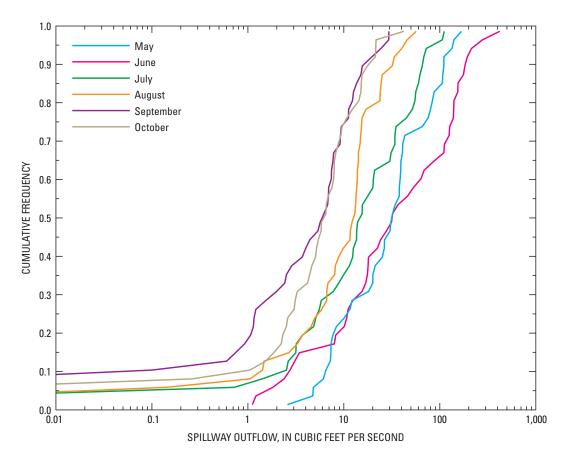
Figure 7.   Quantile plots showing distribution of monthly values of computed reservoir outflow from Sheridan Lake for pass-through operating system, 1962–2006.

Table 16. Computations of lake evaporation for two low-flow periods during 2007.

[Volumetric computations are based on a lake surface area of 383 acres. Gaged inflow was measured at station 06406920. Precipitation is the mean of measurements for three U.S. Geological Survey precipitation stations (table 1). Pan evaporation was measured at Pactola Dam (National Weather Service station 396427). --, not applicable]

Date	Gaged inflow	Gaged inflow x 1.146		Precipitation on lake		Total inflow	Lake stage[1]	Change in stage	Computed evaporation for Sheridan Lake		Measured pan evaporation
	(ft³/s)	(acre-feet)	(feet)	(inches)	(feet)	(feet)	(feet)	(feet)	(feet)	(inches)	(inches)
8/10/2007	--	--	--	--	--	--	1.75	--	--	--	--
8/11/2007	0.72	1.64	0.0043	0.000	0.0000	0.0043	1.73	-0.02	0.0243	0.29	0.20
8/12/2007	.50	1.14	.0030	.000	.0000	.0030	1.71	-.02	.0230	.28	.23
8/13/2007	.44	1.00	.0026	.000	.0000	.0026	1.70	-.01	.0126	.15	.25
8/14/2007	.26	.59	.0015	.160	.0133	.0149	1.69	-.01	.0249	.30	.21
8/15/2007	.20	.45	.0012	.030	.0025	.0037	1.69	.00	.0037	.04	.15
8/16/2007	.24	.55	.0014	.000	.0000	.0014	1.68	-.01	.0114	.14	.15
Sum	--	--	--	--	--	--	--	--	--	1.20	1.19
9/12/2007	--	--	--	--	--	--	1.75	--	--	--	--
9/13/2007	.76	1.73	.0045	.000	.0000	.0045	1.74	-.01	.0145	.17	.08
9/14/2007	.74	1.68	.0044	.000	.0000	.0044	1.74	.00	.0044	.05	.11
9/15/2007	.71	1.61	.0042	.000	.0000	.0042	1.73	-.01	.0142	.17	.15
9/16/2007	.69	1.57	.0041	.000	.0000	.0041	1.72	-.01	.0141	.17	.15
9/17/2007	.61	1.39	.0036	.000	.0000	.0036	1.71	-.01	.0136	.16	.13
9/18/2007	.50	1.14	.0030	.030	.0025	.0055	1.70	-.01	.0155	.19	.09
9/19/2007	.60	1.36	.0036	.000	.0000	.0036	1.70	.00	.0036	.04	.09
9/20/2007	.54	1.23	.0032	.000	.0000	.0032	1.69	-.01	.0132	.16	.25
9/21/2007	.48	1.09	.0028	.000	.0000	.0028	1.69	.00	.0028	.03	.15
9/22/2007	.42	.95	.0025	.000	.0000	.0025	1.67	-.02	.0225	.27	.19
9/23/2007	.36	.82	.0021	.030	.0025	.0046	1.66	-.01	.0146	.18	.15
9/24/2007	.30	.68	.0018	.000	.0000	.0018	1.65	-.01	.0118	.14	.08
9/25/2007	.24	.55	.0014	.000	.0000	.0014	1.64	-.01	.0114	.14	.07
9/26/2007	.18	.41	.0011	.000	.0000	.0011	1.63	-.01	.0111	.13	.08
Sum	--	--	--	--	--	--	--	--	--	2.01	1.77

[1]Mean lake stage in feet above arbitrary datum. Lake spills at stage of about 1.74 feet.

pan coefficients reported by Farnsworth and others (1982); however, they are consistent with results reported by Kohler (1954) and Sacks and others (1994) for late summer and early fall periods. Thus, the values of monthly pan coefficients (table 12) used for hydrologic budgeting are considered reasonable.

If future management alternatives are implemented, lake evaporation could be a critical factor in management of drawdown conditions in Sheridan Lake. As such, future monitoring of variables involved in computation of evaporation rates and associated pan coefficients could have future value.

Hydrologic Model and Scenarios for Sheridan Lake

Within this section, the modeling approach and model scenarios are described. Model limitations also are described.

Modeling Approach and Model Scenarios

Numerous approaches and scenarios for hydrologic modeling are possible. For the sake of simplicity, however, a very basic approach was used to simulate storage deficits and drawdown in Sheridan Lake under different release scenarios. This approach entailed an initial assumption of a constant release (for various hypothetical release rates) for the months of May through October for all 44 years (1962–2006) of the historical monthly hydrologic budget. Although more detailed manipulation of releases probably would be expected under actual operating conditions, this approach has no effect on monthly outflow and storage conditions, when natural outflows exceed prescribed releases.

The hydrologic model was developed using the primary components of the hydrologic budget that were described in a previous section titled "Long-Term Monthly Budget." The model was used to simulate storage deficits and drawdown for Sheridan Lake using prescribed hypothetical release scenarios. Model output consisted simply of computed monthly values for end-of-month storage for prescribed release scenarios.

The computational process involved consideration of equation 4:

Reservoir outflow = Spillway outflow + Prescribed release, (4)

where

Reservoir outflow	is from equation 1,
Spillway outflow	is the portion of reservoir outflow that occurs through the spillway, and
Prescribed release	is the portion of reservoir outflow that occurs through the control valve.

Computations were performed by first calculating spillway outflow for each month, which could be done by subtracting the prescribed release for each month (May through October) from the matrix of monthly values of net inflow (table 28), because reservoir outflow was shown in equation 2 to be essentially equivalent to net inflow for the historical pass-through operating condition. Negative values of spillway outflow are not physically possible, but were computed for months when the prescribed release exceeds net inflow. This condition prompted computation of a monthly value for the storage deficit, based on the negative value for spillway outflow. Monthly storage deficits then were accumulated on a month-by-month basis, as was done in the computational process that was described in a previous section titled "Long-Term Monthly Budget." Maintaining aquatic ecosystems downstream from Sheridan Lake would require continuation of releases into November (or beyond), for cases when storage deficits occur for October. Thus, releases of 1 ft^3/s were assigned for November for such cases, prior to computation of the storage deficit for November. This process was continued on a month-by-month basis through the month of April for each year and into the following May, if necessary.

Model output is shown in tables 31–37 in the Appendix for release scenarios of 1, 2, 3, 4, 5, 6, and 7 ft^3/s and consists of monthly values of end-of-month storage (in acre-feet) for each of the seven scenarios. These scenarios cover the range of plausible low-flow releases for the new valve system. A summary of model output is provided in table 17. For each computational year, table 17 shows the number of months for which storage deficits were computed for each of the release scenarios, along with the maximum storage deficit (in acre-feet) and an approximate value for the associated maximum drawdown, in feet below the spillway crest. Figure 8 shows the maximum computed drawdown by year for each of the hypothetical release scenarios.

The drawdown values in table 17 and figure 8 were approximated by dividing the storage deficits in acre-feet by the lake surface area of 383 acres. This approach was used because relations between area and capacity have not been developed for Sheridan Lake. A lake survey was performed by SDGF&P during 2007 to determine the approximate configuration of the shoreline at a drawdown of 2 ft, and results indicated that the surface area would be reduced by about 8 acres with 1 ft of drawdown and by about 15 acres with 2 ft of drawdown (Ron Koth, SDGF&P, written commun., 2008). Thus, within the planned potential operating range of about 2 ft of drawdown, the effect on the computed drawdown is only about 3.9 percent and does not substantially affect the model results. For progressively larger drawdowns, actual results would exceed model results by progressively larger percentages, and would quickly reach a threshold of general unreliability. Computations involving storage volumes associated with depths of precipitation and evaporation also would be affected slightly by relations between area and capacity; however, effects on model results are considered negligible.

Table 17. Summary of selected output from hydrologic model for various release scenarios, 1962–2006.

[For each computational year and release scenario, this table shows the number (no.) of months with storage deficits, the maximum computed deficit (acre-feet), and the associated maximum drawdown (feet). ft³/s, cubic feet per second; <, less than; --, no storage deficit]

Year	Release = 0 ft³/s			Release = 1 ft³/s			Release = 2 ft³/s			Release = 3 ft³/s			Release = 4 ft³/s			Release = 5 ft³/s			Release = 6 ft³/s			Release = 7 ft³/s		
	no.	acre-feet	feet	no.	acre-feet	feet	no.	acre-feet	feet	no.	acre-feet	feet	no.	acre-feet	feet	no.	acre-feet	feet	no.	acre-feet	feet	no.	acre-feet	feet
1962–63	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1963–64	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1964–65	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2	71	0.2	3	192	0.5	3	313	0.8
1965–66	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1966–67	--	--	--	--	--	--	--	--	--	1	15	<0.1	2	74	0.2	2	143	.4	3	264	.7	3	385	1.0
1967–68	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1968–69	--	--	--	--	--	--	--	--	--	1	43	.1	2	123	.3	3	244	.6	5	365	1.0	7	486	1.3
1969–70	--	--	--	--	--	--	1	51	0.1	1	110	.3	2	170	.4	2	230	.6	4	346	.9	5	467	1.2
1970–71	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	7	<.1
1971–72	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1972–73	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1973–74	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2	30	.1
1974–75	--	--	--	--	--	--	3	83	.2	8	264	.7	9	561	1.5	10	864	2.3	10	1,168	3.0	10	1,471	3.8
1975–76	--	--	--	--	--	--	--	--	--	1	28	.1	2	88	.2	2	169	.4	3	290	.8	3	411	1.1
1976–77	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	12	<.1	2	79	.2
1977–78	--	--	--	--	--	--	--	--	--	--	--	--	1	54	.1	1	114	.3	2	173	.5	4	233	.6
1978–79	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2	77	.2
1979–80	--	--	--	--	--	--	1	27	.1	2	87	.2	2	206	.5	2	327	.9	4	453	1.2	7	636	1.7
1980–81	--	--	--	1	5	<0.1	3	64	.2	3	154	.4	4	275	.7	6	515	1.3	9	759	2.0	10	1,003	2.6
1981–82	--	--	--	1	24	.1	2	83	.2	2	143	.4	4	247	.6	6	368	1.0	7	489	1.3	7	610	1.6
1982–83	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1983–84	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	59	.2	1	119	.3	2	178	.5
1984–85	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1985–86	--	--	--	3	70	.2	6	243	.6	9	450	1.2	10	815	2.1	11	1,180	3.1	11	1,545	4.0	11	1,910	5.0
1986–87	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	22	.1
1987–88	3	46	0.1	7	307	.8	7	428	1.1	8	549	1.4	8	670	1.7	9	791	2.1	9	974	2.5	9	1,156	3.0
1988–89	8	246	.6	9	609	1.6	11	906	2.4	11	1,209	3.2	12	1,532	4.0	12	2,018	5.3	12	2,565	6.7	12	3,113	8.1
1989–90	4	89	.2	9	270	.7	11	704	1.8	12	1,372	3.6	12	2,059	5.4	12	2,910	7.6	12	3,823	10.0	12	4,735	12.4

Table 17. Summary of selected output from hydrologic model for various release scenarios, 1962–2006.—Continued

[For each computational year and release scenario, this table shows the number (no.) of months with storage deficits, the maximum computed deficit (acre-feet), and the associated maximum drawdown (feet). ft³/s, cubic feet per second; <, less than; --, no storage deficit]

Year	Release = 0 ft³/s			Release = 1 ft³/s			Release = 2 ft³/s			Release = 3 ft³/s			Release = 4 ft³/s			Release = 5 ft³/s			Release = 6 ft³/s			Release = 7 ft³/s		
	no.	acre-feet	feet	no.	acre-feet	feet	no.	acre-feet	feet	no.	acre-feet	feet	no.	acre-feet	feet	no.	acre-feet	feet	no.	acre-feet	feet	no.	acre-feet	feet
1990–91	--	--	--	1	15	<0.1	2	104	0.3	3	225	0.6	4	346	0.9	6	840	2.2	8	1,814	4.7	11	2,788	7.3
1991–92	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2	56	.1	2	177	.5
1992–93	--	--	--	--	--	--	--	--	--	2	82	.2	4	203	.5	5	324	.8	6	445	1.2	8	577	1.5
1993–94	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1994–95	--	--	--	1	53	.1	2	145	.4	2	266	.7	3	387	1.0	4	508	1.3	6	685	1.8	7	867	2.3
1995–96	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1996–97	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1997–98	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1998–99	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1999–2000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2000–2001	--	--	--	--	--	--	1	1	<.1	2	82	.2	3	203	.5	3	324	.8	4	494	1.3	5	676	1.8
2001–02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2002–03	--	--	--	--	--	--	--	--	--	--	--	--	2	95	.2	4	218	.6	7	408	1.1	8	652	1.7
2003–04	--	--	--	--	--	--	1	9	<.1	2	79	.2	4	200	.5	8	427	1.1	9	671	1.8	9	915	2.4
2004–05	--	--	--	--	--	--	9	274	.7	11	517	1.4	11	821	2.1	12	1,134	3.0	12	1,499	3.9	12	1,864	4.9
2005–06	1	87	.2	6	196	.5	7	317	.8	8	438	1.1	10	666	1.7	12	1,208	3.2	12	1,938	5.1	12	2,668	7.0
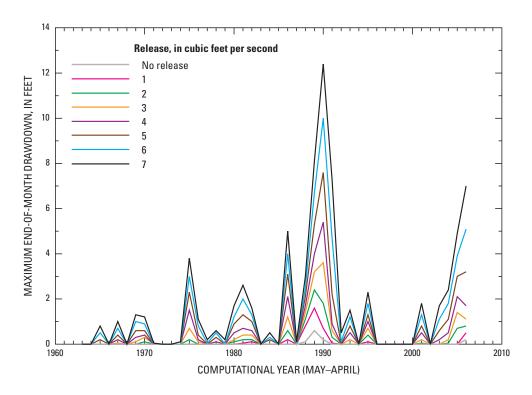
Figure 8.   Maximum drawdown by year for hypothetical release scenarios, 1962–2006.

Results of the hydrologic model show that five of the computational years (3 years that include 1987–90 and 2 years that include 2004–06) tend to be "defining" years for purposes of drawdown considerations for Sheridan Lake. These 5 years include the only years that had storage deficits for the historical pass-through operating condition (zero-release scenario). Computed drawdowns for 1987–90 approach or exceed 1 ft (383 acre-ft) for many months for a prescribed release of 1 ft^3/s and approach or exceed 2 ft (766 acre-ft) for many months for a prescribed release of 2 ft^3/s (tables 31 and 32). For prescribed releases of 1 and 2 ft^3/s, the maximum computed drawdowns of 1.6 and 2.4 ft, respectively (table 17), occur in February of the 1988–89 computational year. For a prescribed release of 7 ft^3/s, computed drawdown exceeds 12 ft (4,596 acre-ft) for one-half of the months of the 1989–90 computational year (table 37). During the 2004–05 and 2005–06 computational years, 16 of 24 months have computed storage deficits for a prescribed release of 2 ft^3/s.

The extent to which 1987–90 are defining years for drawdown considerations is further exemplified by examination of table 31, which provides results for a prescribed release of 1 ft^3/s. Computed storage deficits occur for 25 of 36 months during these 3 computational years, as opposed to a combined total of only 13 months with storage deficits for the other 41 years. Storage deficits are eliminated by April for the 3 years during the 1987–90 period and by March or earlier for the other 6 years for which storage deficits are computed.

For a prescribed release of 2 ft^3/s (table 32), storage deficits are computed for 60 months during 15 of the 44 years. For this scenario, a storage deficit is computed for May of the

1989–90 computational year. This is the only computational year in which a storage deficit persists from a previous year, and deficits exist for 22 of the 24 months for these 2 years (1988–90). For a prescribed release of 3 ft^3/s (table 33), storage deficits exist at the end (April) of four computational years, but are eliminated during the following May for three of these cases. For this release scenario (3 ft^3/s), a storage deficit also is initiated during May of the 1985–86 computational year and persists through much of that year. Net inflow of 2.57 ft^3/s for this month (table 28) is the minimum that was computed for the entire 1962–2006 base period.

Examination of tables 34 through 37 shows that computed storage deficits become progressively larger and more frequent for each of the progressively larger release scenarios of 4 through 7 ft^3/s. This observation is consistent with the results that are summarized in figure 8 and table 17. It also is informative from examination of table 17 that there were five consecutive years (1995–2000) for which storage deficits do not occur for any of the modeled release scenarios.

Model Limitations

A primary limitation of the hydrologic model is the uncertainty associated with development of the extrapolated estimates of monthly streamflow for Spring Creek above Sheridan Lake (table 22). Although the estimates are inexact, they do provide a much more realistic perspective of long-term flow conditions than what could be derived from the short-term streamflow records that exist for Spring Creek.

The 44 year base period that is modeled (1962–2006) probably is reasonably representative of long-term climatic conditions. Driscoll and others (2000) noted severe, sustained drought conditions for the Black Hills area during 1931–40 and 1948–61; however, extrapolation of streamflow records for these periods is not feasible. Driscoll and others (2000) also note that the late 1900s was the wettest recorded period since 1931. Thus, the wetter end of the hydrologic regime is well represented by this period and by conditions during 1962 through 1986, which is noted as a period for which computed storage deficits did not occur for the pass-through operating system that historically has been used for Sheridan Lake (table 29).

The monthly time steps that were used cannot account for short-term (weekly and daily) variability that is commonplace for hydrologic events. However, the overall purpose of representing general, long-term conditions has been satisfied. Considering all factors, the hydrologic budget provides a reasonable representation of long-term conditions, and the model similarly provides a reasonable representation of drawdown for the release scenarios that were considered.

Summary

The U.S. Geological Survey cooperated with South Dakota Game, Fish and Parks to compile and characterize hydrologic information relevant to management of water resources associated with Sheridan Lake, which is located in the central Black Hills of western South Dakota and is formed by a dam on Spring Creek. This effort consisted primarily of compilation, characterization, and analysis of hydrologic data for a base period of 1962 through 2006, development of a hydrologic budget for Sheridan Lake for this timeframe, and development of an associated model for simulation of storage deficits and drawdown in Sheridan Lake for hypothetical release scenarios from the lake. Historically, the dam has been operated primarily as a "pass-through" system, in which unregulated outflows pass over the spillway. In 2004, the dam was retrofitted with an improved control valve system that would allow controlled releases of about 7 cubic feet per second (ft³/s) or less from a fixed depth of about 60 feet (ft). Such releases potentially could provide benefits to downstream fishery resources and other cold-water aquatic ecosystems; however, associated drawdowns of the reservoir pool would need to be very small, probably no more than about 2 ft below the spillway crest.

Development of a hydrologic budget for Sheridan Lake involved compilation, estimation, and characterization of data sets for streamflow, precipitation, and evaporation. Most available hydrologic data sets were not directly applicable for development of the hydrologic budget; thus, it was necessary to estimate many of the hydrologic variables. The most critical data need was for extrapolation of available short-term streamflow records for Spring Creek to be used as the long-term inflow to Sheridan Lake. Available short-term records for water years (WY) 1991–2004 for gaging station 06406920 (above Sheridan Lake) are biased by especially large streamflow that occurred during the 1990s. These records were extrapolated to WY 1962–2006 on the basis of correlations with streamflow records (WY 1987–2006) for a downstream station and for stations located along two adjacent streams (Battle Creek, WY 1962–2006; and Boxelder Creek, WY 1967–2006). Comparisons of historical data for the two streamflow-gaging stations along Spring Creek indicate that contributions of streamflow from the intervening drainage area are approximately proportional to drainage area, which was used as a means of estimating tributary inflow for the hydrologic budget. Analysis of evaporation data shows that sustained daily evaporation rates may exceed maximum monthly rates by a factor of about two.

A long-term (1962–2006) hydrologic budget was developed for computation of reservoir outflow from Sheridan Lake for the historical pass-through operating system. Two inflow components (stream inflow and precipitation) were considered in the hydrologic budget, and evaporation was the only outflow component that was considered. The hydrologic budget uses monthly time steps within an annual period running from May through April, referred to as a computational year. The computational year includes a 6-month period (May through October) for which evaporation is accounted for and another 6-month period (November through April) when evaporation is considered negligible due to ice cover on Sheridan Lake or minimal evaporation potential. The hydrologic budget indicates that monthly evaporation rates can substantially exceed monthly inflow during low-flow periods. Thus, evaporation is a particularly critical variable during low-flow periods, and potential exists for outflows to begin approaching zero-flow conditions substantially prior to the onset of zero-inflow conditions, especially when daily inflow and evaporation are considered. Results also indicate that September may be the month for greatest potential benefit for enhancing fish habitat and other ecosystem values in downstream reaches of Spring Creek with managed releases. Computed monthly outflows for Sheridan Lake are less than 1.0 cubic feet per second (ft³/s) for 8 of the 44 years (18 percent) and are less than 2.0 ft³/s for 14 of the 44 years (32 percent). Conversely, none of the computed outflows for May are less than 2.0 ft³/s.

A short-term data set was collected during late July through September 2007 to facilitate development of a hydrologic budget with daily time-steps, which was used to calculate evaporation from Sheridan Lake and to evaluate the applicability of published pan coefficients. Computed values of pan coefficients of approximately 1.0 and 1.1 for two low-flow periods are larger than the mean annual pan coefficient of 0.74 for the area that is reported in the literature; however, the computed values are consistent with pan coefficients reported elsewhere for late summer and early fall periods. Thus, these results supported the use of variable monthly pan coefficients for the long-term hydrologic budget.

A hydrologic model was developed using the primary components of the hydrologic budget and was used to simulate storage deficits and drawdown for Sheridan Lake using hypothetical release scenarios from the lake. Model output consisted of monthly values of storage deficits for prescribed constant releases for the months May through October for 1962–2006. Release scenarios of 1, 2, 3, 4, 5, 6, and 7 ft^3/s were considered, which covers the range of plausible low-flow releases for the new valve system. Although more detailed manipulation of releases probably would be expected, this approach has no effect on monthly outflow and storage conditions when natural outflows exceed prescribed releases. Maintaining aquatic ecosystems downstream from Sheridan Lake would require continuation of releases into November (or beyond), for cases when storage deficits occur in October. Thus, releases of 1 ft^3/s were assigned for November for such cases, prior to computation of the storage deficit for November. This process was continued on a month-by-month basis through the month of April for each year and into the following May, if necessary.

Five computational years (3 years that include 1987–90 and 2 years that include 2004–06) tend to be "defining" years for purposes of drawdown considerations for Sheridan Lake. These include the only years with storage deficits for the historical pass-through operating condition (zero-release scenario). Computed drawdowns for 1987–90 approach or exceed 1 ft for many months for a prescribed release of 1 ft^3/s and approach or exceed 2 ft during many months for a prescribed release of 2 ft^3/s. For prescribed releases of 1 and 2 ft^3/s, the maximum computed drawdowns of 1.6 and 2.4 ft, respectively, occur in February of the 1988–89 computational year. For a prescribed release of 7 ft^3/s, computed drawdown exceeds 12 ft for one-half of the months of the 1989–90 computational year. During the 2004–05 and 2005–06 computational years, storage deficits were computed for 16 of 24 months for a prescribed release of 2 ft^3/s.

Computed storage deficits occur for 25 of 36 months during the 1987–90 computational years for a prescribed release of 1 ft^3/s, as opposed to a combined total of only 13 months with storage deficits for the other 41 years. All of the storage deficits are eliminated by April for the 3 years during the 1987–90 period and by March or earlier for the other 6 years for which storage deficits are computed. For a prescribed release of 2 ft^3/s, storage deficits are computed for 60 months during 15 of the 44 years, and deficits exist for 22 of the 24 months during the 1988–90 computational years. For a prescribed release of 3 ft^3/s, storage deficits exist at the end (April) of four computational years, but are eliminated during the following May for three of these cases. Computed storage deficits become progressively larger and more frequent for each of the progressively larger release scenarios of 4 through 7 ft^3/s.

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Appendix

Table 18. Monthly and annual streamflow data for Battle Creek near Keystone (station 06404000), water years 1962–2006.

| Water year | Streamflow, in cubic feet per second | | | | | | | | | | | | Annual |
| | Month | | | | | | | | | | | | |
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	
1962	0.00	0.06	0.03	0.00	0.02	0.46	2.17	36.60	65.00	46.30	14.70	3.59	14.20
1963	5.20	3.09	2.11	1.25	2.11	7.11	19.40	22.90	85.50	21.30	3.90	6.11	15.00
1964	2.93	3.00	2.24	1.94	3.03	2.57	5.82	12.50	29.10	25.70	4.16	1.81	7.90
1965	1.25	1.32	1.32	1.29	1.01	1.13	4.64	67.60	91.10	44.30	13.00	4.87	19.50
1966	4.70	3.56	3.13	1.88	1.40	4.39	11.30	6.20	1.93	1.35	2.90	2.64	3.79
1967	4.14	2.55	1.64	1.76	1.73	2.54	4.22	9.37	131.40	19.10	4.02	2.74	15.30
1968	2.12	2.50	1.85	2.07	2.42	3.40	3.14	2.93	16.50	5.84	3.26	2.26	4.01
1969	1.10	1.34	1.34	1.05	.74	1.35	4.38	3.06	7.83	41.90	4.25	.56	5.80
1970	1.48	1.72	.93	.16	.33	1.03	9.78	17.80	40.90	3.35	3.36	1.37	6.83
1971	2.18	1.20	.63	.83	1.19	3.46	38.80	71.20	59.80	6.77	1.64	1.46	15.80
1972	2.25	2.18	1.68	.67	.66	3.54	4.93	13.40	199.20	15.80	7.61	3.78	21.10
1973	2.73	2.89	1.65	1.64	1.20	4.83	37.60	24.50	13.40	5.89	4.80	2.13	8.61
1974	1.89	2.47	1.04	.87	1.20	2.62	3.61	3.05	1.74	1.08	.10	.11	1.65
1975	.32	.86	.13	.00	.37	1.44	13.00	10.50	21.10	5.21	2.14	.00	4.58
1976	.07	.45	1.48	1.35	1.85	1.77	5.24	49.80	72.30	13.90	7.95	1.94	13.20
1977	1.84	1.53	1.54	.72	1.43	3.58	11.60	3.91	1.61	1.43	2.84	1.40	2.78
1978	1.89	1.77	1.47	.69	.96	4.25	5.20	89.80	25.40	5.45	3.07	.86	11.90
1979	.95	1.21	1.02	.53	.80	2.50	5.05	2.78	4.72	33.00	15.60	3.08	6.00
1980	1.40	2.77	2.01	.43	.96	3.29	7.49	5.19	3.87	1.28	.98	.15	2.48
1981	1.85	1.32	2.28	.95	.65	1.44	1.49	44.70	6.16	4.02	3.43	.25	5.79
1982	1.38	1.05	.76	.50	1.38	2.96	3.68	20.10	31.90	8.50	2.48	1.84	6.38
1983	4.85	2.64	1.83	1.27	1.45	2.65	5.57	16.90	8.20	1.78	.39	.00	3.98
1984	.75	1.32	1.15	1.80	1.73	1.96	5.19	22.70	51.40	12.90	2.68	.47	8.65
1985	1.46	1.22	.69	.75	.04	3.78	3.71	1.24	.22	.07	.01	.04	1.11
1986	.25	.48	.63	1.46	1.67	3.03	11.60	16.60	14.70	4.51	1.05	4.70	5.05
1987	12.70	5.24	4.25	2.64	2.91	12.80	12.70	18.10	8.50	1.77	.09	.00	6.84
1988	.21	.76	.42	.12	.28	1.47	1.90	2.25	.65	.23	.03	.00	.69
1989	.00	.00	.00	.00	.00	1.95	1.77	1.64	.64	.04	.00	6.20	1.02
1990	2.57	1.82	1.14	.69	1.52	3.83	6.46	33.40	23.80	17.00	5.45	1.45	8.32
1991	1.04	1.68	.98	.62	1.55	2.65	9.22	73.60	92.80	10.30	3.92	1.60	16.70
1992	2.16	2.47	1.78	2.17	2.72	4.90	3.37	2.71	6.20	9.86	2.95	.66	3.50
1993	.59	1.61	1.66	1.45	1.05	4.75	12.30	58.00	68.00	17.30	10.10	4.16	15.10
1994	5.89	4.62	5.69	4.54	5.64	9.99	5.34	12.60	4.53	.80	.45	.17	5.03
1995	7.09	4.04	3.21	2.06	3.29	4.40	6.06	153.30	115.10	21.40	6.94	3.68	27.70
1996	4.59	4.74	3.64	4.66	9.57	6.35	10.60	66.70	39.20	8.20	8.63	5.90	14.40
1997	7.56	22.70	9.21	12.70	6.63	8.97	19.90	112.30	48.30	15.40	12.30	7.20	23.70
1998	3.59	3.60	3.72	3.96	4.39	7.35	14.70	13.60	55.70	20.30	19.10	5.29	12.90
1999	22.50	36.00	25.80	7.34	7.52	7.63	36.60	33.20	94.80	23.70	20.50	5.78	26.80
2000	4.41	5.51	4.09	3.47	4.54	4.85	20.00	24.60	10.60	4.67	.64	.10	7.29
2001	1.03	3.23	2.03	1.77	2.20	6.52	15.20	11.20	16.10	22.50	6.86	1.91	7.58
2002	2.67	2.99	2.28	1.22	.68	1.29	7.14	12.00	3.99	1.19	.15	.76	3.04

Table 18.   Monthly and annual streamflow data for Battle Creek near Keystone (station 06404000), water years 1962–2006.—Continued

| Water year | Streamflow, in cubic feet per second | | | | | | | | | | | | Annual |
| | Month | | | | | | | | | | | | |
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	
2003	1.04	1.55	1.03	0.83	1.33	5.65	7.50	22.50	7.79	1.16	0.15	0.07	4.24
2004	.12	.57	.86	.44	.89	2.57	1.80	2.07	1.52	1.06	.15	.67	1.06
2005	.23	.50	.42	.40	.74	1.48	2.69	7.93	6.23	6.36	2.17	.03	2.45
2006	.69	.63	.32	.57	.53	3.02	5.99	4.72	5.72	.42	.28	.56	1.95
Statistical summary													
Number of values	45	45	45	45	45	45	45	45	45	45	45	45	45
Mean	2.88	3.31	2.38	1.72	1.96	3.86	9.55	27.59	35.45	11.43	4.69	2.10	8.93
Maximum	22.50	36.00	25.80	12.70	9.57	12.80	38.80	153.30	199.20	46.30	20.50	7.20	27.70
75th percentile	3.59	3.00	2.24	1.88	2.20	4.83	11.60	33.40	55.70	17.30	6.86	3.59	14.20
50th percentile	1.85	1.77	1.54	1.22	1.38	3.29	5.99	16.60	16.10	6.36	3.07	1.46	6.83
25th percentile	.95	1.21	.93	.62	.74	1.96	4.22	5.19	5.72	1.43	.64	.25	3.79
Minimum	.00	.00	.00	.00	.00	.46	1.49	1.24	.22	.04	.00	.00	.69

Table 19.   Monthly and annual streamflow data for Spring Creek above Sheridan Lake (station 06406920), water years 1991–2004.

| Water year | Streamflow, in cubic feet per second | | | | | | | | | | | | Annual |
| | Month | | | | | | | | | | | | |
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	
1991	2.61	3.32	2.28	2.42	2.16	5.56	10.40	73.70	121.20	26.90	13.00	6.12	22.50
1992	5.35	6.60	4.94	2.50	3.22	7.02	7.20	5.64	8.14	11.20	7.05	3.70	6.06
1993	3.00	2.37	1.62	1.80	2.30	9.48	17.60	71.30	107.70	45.20	22.80	12.70	24.90
1994	13.80	12.20	9.42	6.01	6.24	16.90	15.90	34.40	14.70	5.75	2.78	1.54	11.70
1995	5.92	4.53	4.05	3.47	3.69	8.65	7.29	144.50	184.70	59.00	22.80	13.80	38.70
1996	12.90	9.89	6.85	5.10	8.99	13.00	23.40	90.40	121.30	31.50	20.90	17.40	30.10
1997	18.00	25.00	19.50	16.00	14.50	21.50	41.80	121.00	135.00	51.90	50.10	26.20	45.20
1998	19.30	11.40	9.98	5.99	6.91	20.40	30.80	32.70	95.60	63.30	40.00	26.00	30.30
1999	35.80	51.20	34.80	21.90	19.20	21.80	64.20	95.70	151.20	54.90	35.60	22.00	50.70
2000	16.40	12.80	9.51	7.85	10.00	11.70	22.30	32.50	16.30	9.21	4.15	3.19	13.00
2001	4.83	5.74	3.90	3.37	3.56	7.91	17.20	15.60	20.60	27.00	12.30	7.45	10.80
2002	7.80	6.42	3.65	1.84	2.27	4.66	13.70	17.20	10.30	3.94	3.87	5.91	6.81
2003	4.28	3.63	2.28	1.16	2.54	8.34	16.30	34.40	19.60	5.75	5.01	3.50	8.92
2004	2.59	3.13	1.89	1.01	1.21	5.50	5.38	4.12	2.21	2.92	2.19	1.32	2.80
Statistical summary													
Number of values	14	14	14	14	14	14	14	14	14	14	14	14	14
Mean	10.90	11.30	8.19	5.74	6.20	11.60	20.96	55.23	72.04	28.46	17.33	10.77	21.61
Maximum	35.80	51.20	34.80	21.90	19.20	21.80	64.20	144.50	184.70	63.30	50.10	26.20	50.70
75th percentile	15.75	12.00	9.49	6.01	8.47	15.93	23.13	86.23	121.28	50.23	22.80	16.50	30.25
50th percentile	6.86	6.51	4.50	3.42	3.63	9.07	16.75	34.40	58.10	26.95	12.65	6.79	17.75
25th percentile	4.42	3.86	2.62	1.99	2.36	7.24	11.23	21.03	15.10	6.62	4.37	3.55	9.39
Minimum	2.59	2.37	1.62	1.01	1.21	4.66	5.38	4.12	2.21	2.92	2.19	1.32	2.80

Table 20. Monthly and annual streamflow data for Spring Creek near Keystone (station 06407500), water years 1987–2006.

| Water year | Streamflow, in cubic feet per second | | | | | | | | | | | | Annual |
| | Month | | | | | | | | | | | | |
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	
1987	15.70	8.10	5.00	4.15	4.04	24.00	24.00	31.00	19.90	7.89	3.33	0.74	12.40
1988	.30	.35	.22	.18	.80	4.54	5.29	8.18	1.58	.05	.02	.00	1.80
1989	.00	.01	.08	.10	.01	.74	3.47	5.11	1.61	.16	.00	.49	.98
1990	.37	1.01	1.23	1.08	1.13	3.17	11.40	26.90	35.80	13.00	7.41	1.58	8.69
1991	1.87	3.28	1.94	1.58	3.34	6.53	15.10	84.40	146.70	44.00	20.40	6.25	28.00
1992	6.25	7.31	5.85	4.57	5.40	10.80	8.67	6.49	10.30	13.70	7.25	2.81	7.46
1993	1.49	3.19	2.69	3.13	3.64	11.30	21.90	97.20	146.00	70.70	32.50	17.50	34.40
1994	17.60	11.10	6.65	7.03	6.64	19.90	19.70	41.20	18.70	5.81	2.65	1.70	13.30
1995	8.73	7.84	5.96	4.75	4.40	12.70	8.90	210.60	292.40	95.80	30.00	15.70	58.30
1996	16.40	16.90	11.20	7.57	11.40	18.40	30.50	106.60	190.50	39.00	23.00	20.10	40.90
1997	22.90	31.20	21.40	19.70	16.30	24.00	45.70	176.80	190.20	63.80	67.00	32.50	59.50
1998	28.00	12.80	11.30	6.89	7.34	22.30	35.50	37.00	104.20	79.10	46.60	27.10	35.00
1999	42.10	63.80	43.60	29.70	22.60	25.20	76.90	124.80	188.90	83.90	48.90	25.40	64.70
2000	17.50	14.30	11.00	8.86	11.30	14.60	31.30	46.70	23.10	13.40	4.21	1.71	16.50
2001	5.61	8.16	5.62	4.71	4.93	10.50	21.60	20.20	27.50	32.30	14.10	8.37	13.70
2002	6.80	5.93	4.23	2.72	3.24	5.95	17.40	21.50	11.40	3.40	1.70	5.12	7.45
2003	4.29	3.80	2.75	2.25	4.01	13.30	15.40	41.80	24.50	7.10	2.84	1.74	10.40
2004	1.51	2.58	2.05	1.97	2.75	8.26	6.14	5.10	2.31	1.22	.47	.03	2.87
2005	.03	.06	.29	.46	1.59	2.51	4.97	9.26	8.94	2.35	2.30	.04	2.73
2006	.02	.06	.09	.93	1.16	5.73	10.90	7.87	6.57	.97	.00	.00	2.85
Statistical summary													
Number of values	20	20	20	20	20	20	20	20	20	20	20	20	20
Mean	9.87	10.09	7.16	5.62	5.80	12.22	20.74	55.44	72.56	28.88	15.73	8.44	21.10
Maximum	42.10	63.80	43.60	29.70	22.60	25.20	76.90	210.60	292.40	95.80	67.00	32.50	64.70
75th percentile	16.68	11.53	7.74	6.93	6.82	18.78	25.63	87.60	146.18	48.95	24.75	16.15	34.55
50th percentile	5.93	6.62	4.62	3.64	4.03	11.05	16.40	34.00	23.80	13.20	5.73	2.28	12.85
25th percentile	1.21	2.19	1.76	1.46	2.46	5.90	8.84	8.99	9.96	3.14	2.15	.67	6.31
Minimum	.00	.01	.08	.10	.01	.74	3.47	5.10	1.58	.05	.00	.00	.98

Table 21. Monthly and annual streamflow data for Boxelder Creek near Nemo (station 06422500), water years 1967–2006.

| Water year | Streamflow, in cubic feet per second | | | | | | | | | | | | Annual |
| | Month | | | | | | | | | | | | |
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	
1967	6.62	5.14	3.54	3.38	5.00	15.00	17.20	39.00	157.30	48.10	19.20	13.50	27.70
1968	11.10	9.77	5.90	6.89	7.40	9.42	10.10	9.74	14.80	8.24	5.60	5.49	8.70
1969	3.97	4.49	2.74	1.78	2.40	5.17	18.30	23.70	13.30	16.10	6.38	3.70	8.55
1970	5.30	5.70	3.41	2.65	3.37	5.26	30.90	77.30	77.90	23.30	19.30	9.61	22.10
1971	7.73	9.04	6.39	3.51	10.00	11.00	84.40	93.70	64.70	23.30	10.50	10.90	27.90
1972	10.70	9.75	5.31	3.78	3.05	11.80	11.40	22.50	488.70	57.50	29.20	14.00	55.10

Table 21. Monthly and annual streamflow data for Boxelder Creek near Nemo (station 06422500), water years 1967–2006. —Continued

Water year	Streamflow, in cubic feet per second												
	Month												Annual
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	
1973	12.70	9.47	7.11	7.95	7.71	9.00	40.10	57.00	29.10	15.60	10.20	8.33	17.90
1974	7.71	7.77	6.30	5.87	5.99	8.30	9.31	6.20	4.09	3.84	3.48	2.96	5.98
1975	3.14	3.88	2.71	2.45	2.14	5.31	32.10	50.20	39.10	24.50	11.10	4.94	15.20
1976	5.49	5.49	6.12	5.49	9.05	9.59	14.20	20.60	114.30	36.30	14.00	9.26	20.70
1977	7.43	6.34	6.42	5.73	6.02	10.90	86.70	49.10	20.40	10.20	7.89	7.34	18.70
1978	8.86	5.96	4.75	4.03	3.71	14.50	16.20	125.60	33.40	19.90	15.70	9.41	22.00
1979	8.19	7.89	6.39	4.19	6.02	12.40	13.30	8.63	7.32	10.30	7.05	4.09	7.99
1980	3.80	3.92	3.46	2.28	3.44	7.50	12.80	10.70	7.47	3.45	3.10	2.92	5.40
1981	3.15	3.22	4.70	4.21	3.39	2.66	3.03	7.08	6.45	5.75	3.05	2.86	4.14
1982	3.06	2.79	2.02	1.42	2.12	5.97	6.79	43.60	27.40	14.20	11.10	8.57	10.80
1983	26.80	22.30	10.50	8.50	9.47	17.60	50.40	76.50	36.10	19.00	9.88	6.55	24.50
1984	7.90	7.10	5.27	6.52	7.66	9.86	20.50	71.00	72.10	35.50	23.20	11.70	23.20
1985	8.70	7.74	7.79	5.17	3.72	15.00	11.30	7.31	5.22	2.67	2.11	2.31	6.61
1986	3.39	2.59	2.25	3.45	6.36	11.20	25.60	33.90	24.30	14.80	8.16	11.20	12.30
1987	11.90	8.40	5.73	3.34	7.23	15.00	29.10	16.90	12.20	5.78	3.28	3.93	10.20
1988	4.46	4.59	3.40	1.72	2.03	7.29	11.60	11.70	3.92	1.70	1.65	1.17	4.61
1989	1.85	1.66	1.65	1.60	1.36	7.64	6.46	12.00	6.41	2.58	.76	1.51	3.81
1990	1.88	2.56	2.57	3.14	3.79	10.10	13.50	15.30	7.60	3.25	2.11	1.52	5.62
1991	2.07	2.33	1.65	1.64	1.44	4.45	10.60	39.40	64.30	16.40	8.80	8.91	13.50
1992	7.25	8.05	7.39	6.64	5.80	8.58	8.28	6.58	8.91	7.69	3.79	3.62	6.88
1993	3.02	3.88	2.64	3.05	3.83	11.90	18.70	64.20	90.00	49.70	22.10	13.40	24.00
1994	12.40	8.59	5.19	7.29	8.35	23.00	43.80	63.40	24.00	13.00	6.56	5.25	18.50
1995	11.00	9.79	7.40	7.17	7.60	13.40	12.40	274.90	168.60	58.10	26.50	15.70	51.40
1996	16.80	14.10	9.71	7.75	8.94	31.80	61.80	133.70	149.60	34.80	23.90	21.60	42.90
1997	24.50	28.90	17.40	16.40	18.20	44.50	148.80	175.60	136.20	54.40	51.30	40.00	63.10
1998	26.70	23.50	18.80	15.40	7.19	22.40	63.10	27.40	78.00	53.20	57.00	24.70	34.90
1999	71.10	64.10	37.70	26.40	17.30	22.60	84.30	84.30	142.50	64.60	37.70	21.60	56.30
2000	15.90	15.00	14.80	12.10	12.50	14.40	38.00	63.30	34.60	19.50	11.50	9.12	21.70
2001	9.19	11.80	8.79	8.27	8.18	12.50	26.30	20.00	15.90	12.80	9.85	7.33	12.60
2002	6.66	5.53	4.90	3.35	3.29	4.10	14.50	10.90	5.53	3.25	3.04	4.11	5.77
2003	4.26	3.74	3.41	4.01	3.78	14.80	12.80	26.60	17.20	7.76	4.29	3.74	8.90
2004	3.40	3.53	3.83	3.20	3.77	7.43	5.79	4.51	3.44	3.46	1.38	1.15	3.74
2005	1.68	2.24	1.77	1.94	2.68	3.46	4.31	7.24	7.66	4.11	2.90	1.49	3.46
2006	2.09	2.07	1.62	1.51	1.62	3.45	25.40	36.10	14.20	4.31	3.81	4.74	8.43
Statistical summary													
Number of values	40	40	40	40	40	40	40	40	40	40	40	40	40
Mean	9.85	9.12	6.59	5.63	5.92	12.01	28.85	48.18	55.86	20.32	12.56	8.61	18.64
Maximum	71.10	64.10	37.70	26.40	18.20	44.50	148.80	274.90	488.70	64.60	57.00	40.00	63.10
75th percentile	11.03	9.54	7.18	6.96	7.67	14.58	33.58	63.60	73.55	27.08	16.58	10.98	23.40
50th percentile	7.34	6.15	5.23	4.02	5.40	10.50	16.70	30.65	24.15	14.50	8.48	6.94	13.05
25th percentile	3.40	3.85	3.24	2.95	3.35	7.40	11.38	11.50	7.65	5.39	3.43	3.68	6.81
Minimum	1.68	1.66	1.62	1.42	1.36	2.66	3.03	4.51	3.44	1.70	.76	1.15	3.46

Table 22. Actual and extrapolated monthly and annual streamflow values for Spring Creek above Sheridan Lake (station 06406920), water years 1962–2006.

[Shaded cells indicate extrapolated values. Unshaded cells indicate actual record]

Water year	Streamflow, in cubic feet per second												
	Month												Annual
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	
1962	0.00	0.27	0.07	0.00	0.14	1.08	4.60	53.49	119.84	95.81	30.51	8.81	26.35
1963	12.90	6.62	3.99	2.18	3.53	14.42	31.79	35.90	157.19	49.47	14.52	13.50	28.79
1964	8.94	6.46	4.23	3.31	4.99	5.49	10.98	21.45	54.10	58.05	15.05	5.08	16.58
1965	5.19	3.32	2.54	2.24	1.75	2.52	8.99	90.14	167.37	92.28	28.48	11.25	34.80
1966	12.09	7.43	5.85	3.21	2.39	9.13	19.73	11.81	3.69	4.73	12.30	6.88	8.31
1967	5.67	5.67	3.13	3.02	2.92	10.94	12.69	16.79	240.50	40.16	14.77	10.78	30.41
1968	8.86	5.58	3.52	3.52	4.02	7.68	8.69	6.24	30.86	6.46	13.13	4.25	8.56
1969	3.65	3.36	2.57	1.84	1.30	4.87	13.26	6.48	14.76	12.93	15.23	2.82	6.95
1970	4.68	4.12	1.81	2.00	2.56	4.93	19.24	28.97	75.77	18.96	13.36	7.58	15.31
1971	6.49	7.28	1.24	1.47	2.04	8.64	39.27	94.21	110.35	18.96	8.94	8.64	25.65
1972	8.59	4.99	3.20	1.20	1.16	9.11	9.48	22.76	363.03	48.31	21.10	11.19	41.74
1973	9.96	6.27	3.15	2.82	2.06	7.42	23.15	38.02	25.11	12.52	16.31	6.54	12.84
1974	6.47	5.52	2.01	1.54	2.06	6.98	8.21	6.46	3.33	2.93	2.65	2.24	4.21
1975	2.98	3.32	.27	1.84	1.60	4.97	19.77	18.49	39.36	19.97	10.38	3.81	10.57
1976	4.83	4.58	2.83	2.34	3.11	7.79	11.08	69.51	133.15	30.01	11.19	7.29	23.98
1977	6.27	3.74	2.94	1.29	2.43	8.58	40.03	7.98	3.08	8.06	12.16	5.74	8.52
1978	7.30	4.21	2.81	1.23	1.66	10.66	12.16	114.77	47.29	16.11	12.70	7.42	20.03
1979	6.82	6.41	1.98	.96	1.40	9.47	10.57	5.97	8.94	8.14	5.50	3.13	5.79
1980	3.51	6.06	3.81	.79	1.66	6.46	10.29	10.16	7.35	2.62	6.70	2.21	5.15
1981	2.99	3.32	4.31	1.68	1.15	2.94	3.70	63.41	11.64	4.45	13.51	2.16	9.72
1982	2.92	2.76	1.49	.91	2.35	5.43	6.56	32.13	59.25	11.36	11.27	6.73	11.93
1983	18.97	5.83	3.48	2.21	2.47	12.35	27.23	27.72	15.45	15.35	7.80	5.10	12.06
1984	6.61	3.32	2.22	3.08	2.92	7.95	14.37	35.63	95.00	29.32	11.77	9.29	18.45
1985	7.18	6.30	1.35	1.34	2.84	10.94	9.42	3.01	4.03	2.01	1.58	1.73	4.31
1986	3.18	2.28	1.24	2.52	2.82	8.76	16.83	27.30	27.52	11.85	6.97	8.88	10.03
1987	13.15	6.98	4.20	2.97	2.67	20.01	19.73	24.78	16.12	8.08	4.99	.91	10.44
1988	.63	.36	.18	.26	.35	3.05	4.33	6.85	1.45	.14	.04	.86	1.55
1989	1.89	.02	.13	.16	.02	6.55	2.83	4.35	1.47	.35	.55	.63	1.60
1990	.74	.98	1.03	.69	.54	2.03	9.35	21.61	28.20	12.07	8.74	1.76	7.34
1991	2.61	3.32	2.28	2.42	2.16	5.56	10.40	73.70	121.20	26.90	13.00	6.12	22.50
1992	5.35	6.60	4.94	2.50	3.22	7.02	7.20	5.64	8.14	11.20	7.05	3.70	6.07
1993	3.00	2.37	1.62	1.80	2.30	9.48	17.60	71.30	107.70	45.20	22.80	12.70	24.90
1994	13.80	12.20	9.42	6.01	6.24	16.90	15.90	34.40	14.70	5.75	2.78	1.54	11.69
1995	5.92	4.53	4.05	3.47	3.69	8.65	7.29	144.50	184.70	59.00	22.80	13.80	38.67
1996	12.90	9.89	6.85	5.10	8.99	13.00	23.40	90.40	121.30	31.50	20.90	17.40	30.17
1997	18.00	25.00	19.50	16.00	14.50	21.50	41.80	121.00	135.00	51.90	50.10	26.20	45.16
1998	19.30	11.40	9.98	5.99	6.91	20.40	30.80	32.70	95.60	63.30	40.00	26.00	30.27
1999	35.80	51.20	34.80	21.90	19.20	21.80	64.20	95.70	151.20	54.90	35.60	22.00	50.72
2000	16.40	12.80	9.51	7.85	10.00	11.70	22.30	32.50	16.30	9.21	4.15	3.19	13.01
2001	4.83	5.74	3.90	3.37	3.56	7.91	17.20	15.60	20.60	27.00	12.30	7.45	10.83

Table 22. Actual and extrapolated monthly and annual streamflow values for Spring Creek above Sheridan Lake (station 06406920), water years 1962–2006.—Continued

[Shaded cells indicate extrapolated values. Unshaded cells indicate actual record]

Water year	Streamflow, in cubic feet per second												Annual
	Month												
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	
2002	7.80	6.42	3.65	1.84	2.27	4.66	13.70	17.20	10.30	3.94	3.87	5.91	6.81
2003	4.28	3.63	2.28	1.16	2.54	8.34	16.30	34.40	19.60	5.75	5.01	3.50	8.93
2004	2.59	3.13	1.89	1.01	1.21	5.50	5.38	4.12	2.21	2.92	2.19	1.32	2.80
2005	1.74	.10	.24	.60	.83	1.56	4.06	7.73	7.53	3.06	3.86	.07	2.63
2006	2.10	.10	.64	.59	.56	3.97	8.94	6.60	5.61	1.50	2.91	3.65	3.10
Statistical summary													
Number of values	45	45	45	45	45	45	45	45	45	45	45	45	45
Mean	7.55	6.35	4.16	2.98	3.31	8.65	16.33	37.64	64.15	23.21	12.92	7.15	16.23
Maximum	35.80	51.20	34.80	21.90	19.20	21.80	64.20	144.50	363.03	95.81	50.10	26.20	50.72
75th percentile	8.94	6.46	4.05	3.08	3.22	10.66	19.73	53.49	110.35	31.50	15.05	8.88	24.90
50th percentile	5.92	4.99	2.83	2.00	2.39	7.91	12.69	27.30	27.52	12.52	11.77	5.91	11.69
25th percentile	3.00	3.32	1.62	1.20	1.60	5.43	8.94	7.98	8.94	5.75	5.01	2.82	6.95
Minimum	.00	.02	.07	.00	.02	1.08	2.83	3.01	1.45	.14	.04	.07	1.55

Table 23.   Monthly and annual precipitation for Sheridan Lake, 1962–2006.

[Values were derived by using the mean of monthly data for three National Weather Service (NWS) stations (table 1; Hill City, Mt. Rushmore National Memorial, and Pactola Dam). Shading indicates that one of three monthly NWS precipitation values was missing. For gray shading, estimates for the NWS stations were obtained from Driscoll and others (2000) and were used in deriving the values for Sheridan Lake. For red shading, estimated values from Driscoll and others (2000) were not available, and values for Sheridan Lake were estimated by using the mean of two NWS stations]

Year	Precipitation, in inches												Annual
	Month												
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
1962	0.33	0.97	0.61	0.68	10.14	7.19	6.47	1.22	1.16	1.53	0.26	0.04	30.58
1963	.44	.42	1.46	5.00	2.02	7.31	3.09	1.17	3.09	.95	.11	.30	25.35
1964	.41	.42	.64	1.42	3.59	6.19	2.60	1.49	1.23	.04	.37	1.68	20.06
1965	.64	.19	.55	1.50	9.68	5.82	4.29	2.55	1.85	.14	.16	.34	27.70
1966	.15	.67	.91	3.05	.13	.97	4.48	3.82	2.45	.95	.48	.70	18.76
1967	.19	.50	.48	2.81	3.45	7.53	1.71	1.48	1.28	.36	.33	.46	20.57
1968	.59	.22	.28	1.05	2.38	5.71	1.59	2.86	1.28	.12	.34	.54	16.97
1969	.23	1.17	.50	1.80	2.43	3.92	6.21	.99	.73	1.37	.32	.13	19.81
1970	.24	.35	1.51	3.31	4.37	3.67	2.10	2.53	1.34	1.20	.64	.58	21.85
1971	.82	.71	1.46	5.98	5.71	3.40	1.70	1.17	2.52	1.73	.98	.23	26.42
1972	.25	.30	.69	1.95	2.92	10.72	3.22	3.13	.51	.75	.32	.31	25.07
1973	.09	.27	3.42	3.67	1.63	2.45	3.69	1.19	1.80	.74	1.22	.58	20.76
1974	.41	.18	.24	1.03	1.68	1.05	3.98	1.42	.93	2.15	.29	.12	13.47
1975	.72	.55	1.01	2.82	2.40	4.85	1.33	.88	.07	.47	.53	.80	16.43
1976	.25	.99	.34	4.37	3.74	6.12	3.61	2.02	1.12	.19	.47	.22	23.44
1977	.41	.29	2.00	1.68	1.54	3.11	4.01	2.67	1.94	.84	.68	.76	19.92
1978	.35	.74	.27	2.68	6.75	1.66	4.05	1.81	.57	.52	.76	.66	20.85
1979	.38	.43	.40	1.17	1.52	4.80	8.58	2.79	.19	.75	.30	.15	21.45
1980	.27	.37	.92	1.59	2.33	2.74	2.19	2.80	.76	1.94	.41	.43	16.75
1981	.05	.13	.23	.65	6.74	1.50	5.19	1.30	.39	2.33	.06	.73	19.30
1982	.53	.41	1.18	.87	5.82	4.08	3.17	2.31	2.57	2.14	.37	.52	23.98
1983	.32	.13	1.68	.95	2.80	3.39	1.29	2.88	.52	2.17	1.19	.56	17.89
1984	.13	.20	.57	3.62	1.97	5.17	4.83	1.34	1.12	.74	.80	.34	20.83
1985	.21	.07	1.02	1.10	1.04	1.23	2.08	1.20	2.10	.63	1.79	.69	13.17
1986	.11	1.20	.70	3.67	1.79	4.78	1.67	1.97	6.15	1.80	1.02	.01	24.87
1987	.07	1.64	1.71	.19	5.40	.64	1.67	2.75	.71	.73	.24	.35	16.09
1988	.29	.31	.78	.80	2.34	3.85	1.92	2.68	.26	.57	1.18	.24	15.22
1989	.05	.55	.93	1.75	2.00	2.00	1.85	2.81	4.68	.95	.34	.58	18.49
1990	.03	.57	1.51	2.06	4.80	1.65	4.61	1.63	1.14	.69	.54	.59	19.81
1991	.13	.63	.63	3.91	7.44	5.33	2.89	1.26	1.04	1.20	1.00	.00	25.44
1992	.07	.23	2.17	1.36	2.71	3.74	4.13	1.25	.63	.67	.32	.70	17.99
1993	.66	.82	.65	2.92	5.78	5.19	3.41	1.95	1.11	1.82	.40	.48	25.21
1994	.34	.63	.64	1.76	2.28	1.05	1.34	1.89	.72	4.81	.37	.46	16.29
1995	.04	.75	.90	2.39	8.03	5.24	4.28	1.28	1.45	2.75	.46	.15	27.72
1996	.93	.11	1.59	2.31	7.27	1.94	2.27	4.91	2.25	4.84	.40	1.06	29.88
1997	.28	.77	.35	3.05	5.25	3.16	5.16	2.54	2.06	1.09	.10	.33	24.14
1998	.57	.87	2.31	1.11	2.99	6.15	3.34	3.37	3.30	4.63	1.55	.11	30.29
1999	.90	.11	.99	3.43	2.59	7.74	2.99	2.90	1.32	.25	.23	.18	23.63
2000	.47	.29	1.07	4.59	3.14	2.15	3.03	.68	.67	1.64	1.38	.29	19.38

Table 23.   Monthly and annual precipitation for Sheridan Lake, 1962–2006.—Continued

[Values were derived by using the mean of monthly data for three National Weather Service (NWS) stations (table 1; Hill City, Mt. Rushmore National Memorial, and Pactola Dam). Shading indicates that one of three monthly NWS precipitation values was missing. For gray shading, estimates for the NWS stations were obtained from Driscoll and others (2000) and were used in deriving the values for Sheridan Lake. For red shading, estimated values from Driscoll and others (2000) were not available, and values for Sheridan Lake were estimated by using the mean of two NWS stations]

| Year | Precipitation, in inches | | | | | | | | | | | | Annual |
| | Month | | | | | | | | | | | | |
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
2001	0.28	0.99	0.76	2.48	2.68	4.16	4.58	2.79	1.74	1.51	0.63	0.08	22.68
2002	.15	.24	1.61	2.24	3.00	1.60	3.12	2.30	3.39	1.18	.34	.12	19.29
2003	.73	.56	1.95	3.29	1.94	2.47	.37	3.21	1.23	.48	1.26	.35	17.85
2004	.36	1.06	.48	1.57	2.43	1.54	2.86	1.33	2.46	.48	.19	.06	14.84
2005	.59	.22	.80	1.80	4.49	2.18	2.93	2.41	1.12	1.23	.24	.21	18.23
2006	.17	.43	2.37	1.93	3.30	2.37	1.13	3.18	2.02	.54	.70	.12	18.26
Statistical summary													
Mean	0.35	0.53	1.05	2.30	3.74	3.86	3.22	2.14	1.58	1.30	0.58	0.41	21.04
Standard deviation	.24	.35	.69	1.28	2.30	2.24	1.61	.90	1.18	1.14	.42	.32	4.42
Maximum	.93	1.64	3.42	5.98	10.14	10.72	8.58	4.91	6.15	4.84	1.79	1.68	30.58
75th percentile	.47	.74	1.51	3.05	5.25	5.24	4.13	2.79	2.06	1.73	.76	.58	24.14
50th percentile	.29	.43	.90	1.95	2.92	3.67	3.09	2.02	1.23	.95	.40	.34	20.06
25th percentile	.15	.24	.57	1.36	2.28	2.00	1.92	1.30	.73	.57	.32	.15	17.99
Minimum	.03	.07	.23	.19	.13	.64	.37	.68	.07	.04	.06	.00	13.17

Table 24.   Pan evaporation data for Pactola Dam and other selected stations, 1962–2006.

[Gray shading indicates estimates derived from the MOVE.1 analysis. Red shading indicates estimates derived from regression analysis with precipitation data. Blue shading indicates the "annual" total pan evaporation at Pactola Dam using measured and estimated data for May–October of each year. Unshaded values indicate measured data. --, no data]

| Month and year | Evaporation data, in inches, for selected National Weather Service stations (station number) | | | | | | |
	Pactola Dam (396427)	Angostura Dam (390217)	Oral (396304)	Cottonwood (391972)	Shadehill Dam (397567)	Oahe Dam (396170)	Pickstown (396574)
May 1962	3.61	7.33	--	7.03	--	--	6.60
June 1962	4.23	7.38	--	7.40	--	6.84	5.68
July 1962	5.26	9.29	--	8.31	--	7.39	7.07
August 1962	4.97	9.23	--	11.07	--	9.11	7.55
September 1962	3.29	6.33	--	7.89	--	6.96	4.08
October 1962	2.44	4.07	--	5.23	--	4.20	2.54
Annual 1962	23.80						
May 1963	4.37	7.12	--	7.46	--	7.93	6.86
June 1963	5.02	8.60	--	9.15	--	8.41	7.63
July 1963	5.89	10.96	--	11.00	--	11.58	9.35
August 1963	6.05	10.34	--	11.94	--	10.29	6.95
September 1963	3.13	5.94	--	6.14	--	5.39	3.99
October 1963	2.72	5.40	--	6.10	--	5.42	5.75
Annual 1963	27.18						
May 1964	4.92	7.44	--	8.36	--	9.16	8.31
June 1964	4.52	7.69	--	7.62	--	7.62	8.05
July 1964	6.32	9.23	--	11.02	--	10.40	9.08
August 1964	6.24	9.95	--	10.88	--	10.07	7.33
September 1964	4.29	7.13	--	7.95	--	7.03	4.81
October 1964	3.00	.00	--	6.11	--	5.66	4.59
Annual 1964	29.29						
May 1965	3.98	7.66	--	7.19	--	6.75	6.47
June 1965	4.95	7.50	--	7.10	--	8.24	6.48
July 1965	5.36	8.91	--	8.81	--	9.03	7.68
August 1965	4.84	8.52	--	9.20	--	9.11	7.88
September 1965	2.65	4.67	--	4.98	--	4.69	3.21
October 1965	3.10	4.44	--	.00	--	4.76	2.89
Annual 1965	24.88						
May 1966	5.51	8.31	--	8.13	--	8.05	7.52
June 1966	6.22	8.93	--	10.52	--	10.47	7.49
July 1966	7.96	12.70	--	11.61	10.98	11.04	10.71
August 1966	5.45	7.86	--	8.63	9.02	8.05	7.79
September 1966	3.71	6.09	--	6.21	6.23	6.47	4.86
October 1966	2.19	4.28	--	.00	4.35	.00	4.09
Annual 1966	31.04						

Table 24. Pan evaporation data for Pactola Dam and other selected stations, 1962–2006.—Continued

[Gray shading indicates estimates derived from the MOVE.1 analysis. Red shading indicates estimates derived from regression analysis with precipitation data. Blue shading indicates the "annual" total pan evaporation at Pactola Dam using measured and estimated data for May–October of each year. Unshaded values indicate measured data. --, no data]

Month and year	Evaporation data, in inches, for selected National Weather Service stations (station number)						
	Pactola Dam (396427)	Angostura Dam (390217)	Oral (396304)	Cottonwood (391972)	Shadehill Dam (397567)	Oahe Dam (396170)	Pickstown (396574)
May 1967	3.71	5.83	--	5.87	6.36	6.96	--
June 1967	3.73	6.45	--	5.75	6.35	6.14	5.40
July 1967	6.30	9.50	--	8.58	10.74	11.78	9.14
August 1967	5.80	10.48	--	8.95	10.85	11.55	8.26
September 1967	3.81	7.20	--	6.39	6.19	8.48	5.95
October 1967	3.14	5.78	--	--	3.90	5.49	3.89
Annual 1967	26.49						
May 1968	3.93	6.81	--	6.22	6.95	6.96	6.06
June 1968	5.80	10.13	--	7.46	7.43	8.78	8.08
July 1968	6.62	10.70	--	8.67	9.16	10.11	9.31
August 1968	5.72	8.94	--	8.37	8.75	8.68	8.86
September 1968	3.88	7.03	--	7.11	6.17	6.81	5.15
October 1968	3.73	5.48	--	--	4.48	5.11	3.22
Annual 1968	29.68						
May 1969	5.55	8.76	--	7.41	7.86	8.69	7.13
June 1969	4.27	8.22	--	7.54	7.54	8.11	6.87
July 1969	7.00	11.42	--	10.14	8.38	9.21	8.44
August 1969	7.24	11.79	--	11.41	11.15	13.15	9.01
September 1969	5.13	8.40	--	8.55	7.47	8.91	5.40
October 1969	1.92	.00	--	--	3.26	--	--
Annual 1969	31.11						
May 1970	4.72	8.20	--	6.89	--	7.30	6.88
June 1970	6.96	10.98	--	9.60	8.55	10.12	8.63
July 1970	7.54	12.16	--	10.66	9.89	13.04	9.67
August 1970	6.79	11.10	--	10.88	10.31	10.66	7.81
September 1970	4.06	7.30	--	7.54	7.08	8.68	5.94
October 1970	2.27	.00	--	--	3.79	4.26	4.02
Annual 1970	32.34						
May 1971	4.13	--	--	6.82	6.81	7.26	6.46
June 1971	5.42	--	7.26	7.84	7.69	8.37	8.03
July 1971	6.31	--	8.17	10.11	9.45	11.89	8.27
August 1971	6.49	--	8.84	11.15	10.34	12.83	9.58
September 1971	3.77	--	4.76	7.06	5.92	6.72	5.55
October 1971	2.19	--	--	--	3.73	5.22	4.68
Annual 1971	28.31						

Table 24. Pan evaporation data for Pactola Dam and other selected stations, 1962–2006.—Continued

[Gray shading indicates estimates derived from the MOVE.1 analysis. Red shading indicates estimates derived from regression analysis with precipitation data. Blue shading indicates the "annual" total pan evaporation at Pactola Dam using measured and estimated data for May–October of each year. Unshaded values indicate measured data. --, no data]

Month and year	Evaporation data, in inches, for selected National Weather Service stations (station number)						
	Pactola Dam (396427)	Angostura Dam (390217)	Oral (396304)	Cottonwood (391972)	Shadehill Dam (397567)	Oahe Dam (396170)	Pickstown (396574)
May 1972	3.93	--	--	--	6.37	7.21	5.71
June 1972	5.41	--	7.49	8.48	7.93	7.84	6.85
July 1972	5.36	--	7.74	9.15	9.14	8.61	8.21
August 1972	4.93	--	7.54	8.73	7.21	9.70	7.28
September 1972	3.80	--	6.12	--	6.63	8.84	5.10
October 1972	2.04	--	--	4.61	3.46	4.06	--
Annual 1972	25.47						
May 1973	4.47	--	6.88	--	8.04	8.55	7.53
June 1973	6.95	--	9.74	10.08	9.07	11.22	8.41
July 1973	7.37	--	10.29	--	10.78	13.25	8.59
August 1973	5.54	--	8.64	--	9.10	11.90	9.06
September 1973	3.12	--	4.66	--	--	5.48	3.42
October 1973	2.38	--	--	--	3.95	4.50	3.29
Annual 1973	29.83						
May 1974	3.60	--	6.24	--	5.48	6.72	6.08
June 1974	6.27	--	8.90	--	8.68	10.17	8.62
July 1974	7.69	--	10.70	--	10.60		11.15
August 1974	5.69	--	8.58	--	7.68	11.09	7.51
September 1974	3.84	--	--	--	6.31	7.93	6.19
October 1974	2.75	--	--	--	4.51	5.05	4.68
Annual 1974	29.84						
May 1975	4.39	--	--	--	--	7.58	6.86
June 1975	5.21	--	7.47	--	5.93	8.26	7.83
July 1975	7.25	--	10.14	--	9.50	12.59	10.88
August 1975	6.03	--	8.62	--	--	8.77	7.58
September 1975	3.90	--	6.38	--	6.39	6.73	5.68
October 1975	2.20	--	--	--	3.69	4.87	5.01
Annual 1975	28.98						
May 1976	5.28	--	--	8.23	7.91	8.76	7.31
June 1976	5.87	--	9.08	10.57	9.61	13.30	9.70
July 1976	6.19	--	9.30	10.80	9.88	14.50	10.90
August 1976	5.46	--	8.25	11.45	9.63	13.91	10.14
September 1976	4.22	--	6.98	10.03	6.77	9.94	6.70
October 1976	2.86	--	--	6.07	4.14	--	3.35
Annual 1976	29.88						

Table 24.   Pan evaporation data for Pactola Dam and other selected stations, 1962–2006.—Continued

[Gray shading indicates estimates derived from the MOVE.1 analysis. Red shading indicates estimates derived from regression analysis with precipitation data. Blue shading indicates the "annual" total pan evaporation at Pactola Dam using measured and estimated data for May–October of each year. Unshaded values indicate measured data. --, no data]

| Month and year | Evaporation data, in inches, for selected National Weather Service stations (station number) | | | | | | |
	Pactola Dam (396427)	Angostura Dam (390217)	Oral (396304)	Cottonwood (391972)	Shadehill Dam (397567)	Oahe Dam (396170)	Pickstown (396574)
May 1977	6.04	--	--	9.13	--	9.47	6.13
June 1977	6.57	--	9.02	8.80	--	10.53	7.68
July 1977	6.83	--	9.58	11.32	--	11.09	8.42
August 1977	4.56	--	6.50	9.16	--	8.01	6.20
September 1977	4.69	--	--	9.71	--	6.78	4.94
October 1977	1.82	--	--	--	--	3.27	2.48
Annual 1977	30.51						
May 1978	4.13	--	--	6.82	--	6.75	5.41
June 1978	6.07	--	8.45	8.31	--	8.46	7.01
July 1978	7.57	--	9.80	10.01	--	9.76	7.81
August 1978	5.39	--	7.96	9.43	--	10.52	7.20
September 1978	5.34	--	6.09	9.00	--	9.41	6.52
October 1978	3.07	--	--	--	--	5.43	3.93
Annual 1978	31.57						
May 1979	4.35	--	6.88	--	--	7.20	5.68
June 1979	5.43	--	8.49	8.88	--	8.86	6.51
July 1979	6.40	--	8.54	8.20	--	8.80	6.36
August 1979	4.43	--	6.59	7.95	--	7.56	6.00
September 1979	4.46	--	6.09	10.37	--	8.62	6.30
October 1979	2.65	--	--	5.70	--	--	--
Annual 1979	27.72						
May 1980	4.88	--	7.40	--	--	9.54	5.93
June 1980	6.01	--	8.48	9.97	--	11.01	7.60
July 1980	7.52	--	10.73	12.63	--	11.46	9.27
August 1980	5.97	--	8.76	9.79	--	9.46	7.50
September 1980	4.18	--	5.63	9.19	--	7.66	5.33
October 1980	3.72	--	--	--	--	6.55	4.51
Annual 1980	32.28						
May 1981	3.71	--	6.13	--	--	6.10	5.56
June 1981	5.27	--	8.69	--	--	9.05	7.14
July 1981	6.16	--	8.40	9.81	--	10.06	7.92
August 1981	4.69	--	5.92	7.98	--	8.28	7.03
September 1981	4.32	--	--	9.01	--	7.64	5.71
October 1981	2.49	--	--	--	--	--	--
Annual 1981	26.64						

Table 24.   Pan evaporation data for Pactola Dam and other selected stations, 1962–2006.—Continued

[Gray shading indicates estimates derived from the MOVE.1 analysis. Red shading indicates estimates derived from regression analysis with precipitation data. Blue shading indicates the "annual" total pan evaporation at Pactola Dam using measured and estimated data for May–October of each year. Unshaded values indicate measured data. --, no data]

Month and year	Evaporation data, in inches, for selected National Weather Service stations (station number)						
	Pactola Dam (396427)	Angostura Dam (390217)	Oral (396304)	Cottonwood (391972)	Shadehill Dam (397567)	Oahe Dam (396170)	Pickstown (396574)
May 1982	4.71	--	--	7.72	--	6.08	5.49
June 1982	4.43	--	6.82	6.86	--	7.20	6.35
July 1982	5.77	--	8.34	9.71	--	9.13	7.19
August 1982	4.66	--	7.11	8.65	--	9.11	6.51
September 1982	2.90	--	--	6.21	--	7.07	4.28
October 1982	2.30	--	--	--	--	3.29	--
Annual 1982	24.77						
May 1983	3.83	--	6.86	--	--	7.06	--
June 1983	4.58	--	6.37	7.72	--	8.21	6.06
July 1983	7.24	--	9.77	11.77	--	11.23	8.11
August 1983	5.80	--	7.83	11.48	--	11.69	8.04
September 1983	4.38	--	5.77	9.45	--	7.66	6.01
October 1983	1.49	--	--	3.54	--	3.34	2.97
Annual 1983	27.32						
May 1984	4.17	--	--	--	--	7.26	5.68
June 1984	5.16	--	7.05	7.96	--	7.75	6.99
July 1984	5.91	--	9.21	10.61	--	10.00	7.46
August 1984	6.00	--	8.57	11.64	--	10.92	6.98
September 1984	4.21	--	5.60	7.75	--	6.45	4.34
October 1984	2.07	--	--	--	--	--	2.94
Annual 1984	27.52						
May 1985	5.48	--	7.69	--	--	8.23	6.34
June 1985	5.71	--	8.46	9.20	--	8.14	6.84
July 1985	7.31	--	10.09	13.01	--	11.79	8.15
August 1985	5.53	--	7.91	9.47	--	8.24	5.21
September 1985	4.03	--	--	8.04	--	5.62	3.80
October 1985	2.63	--	--	--	--	--	--
Annual 1985	30.69						
May 1986	5.00	--	--	--	--	7.46	6.67
June 1986	6.06	--	9.01	--	--	8.58	7.70
July 1986	5.77	--	9.52	--	--	10.35	8.22
August 1986	5.70	--	7.64	--	--	8.89	8.72
September 1986	2.45	--	3.77	--	--	4.01	3.53
October 1986	1.49	--	--	--	--	2.69	2.71
Annual 1986	26.47						

Table 24. Pan evaporation data for Pactola Dam and other selected stations, 1962–2006.—Continued

[Gray shading indicates estimates derived from the MOVE.1 analysis. Red shading indicates estimates derived from regression analysis with precipitation data. Blue shading indicates the "annual" total pan evaporation at Pactola Dam using measured and estimated data for May–October of each year. Unshaded values indicate measured data. --, no data]

Month and year	Evaporation data, in inches, for selected National Weather Service stations (station number)						
	Pactola Dam (396427)	Angostura Dam (390217)	Oral (396304)	Cottonwood (391972)	Shadehill Dam (397567)	Oahe Dam (396170)	Pickstown (396574)
May 1987	3.69	--	--	--	--	7.52	6.96
June 1987	5.98	--	8.09	8.91	--	10.20	8.04
July 1987	6.46	--	9.35	11.54	--	12.62	9.70
August 1987	5.17	--	7.38	9.78	--	8.78	6.57
September 1987	3.90	--	5.48	9.25	--	6.95	5.15
October 1987	2.71	--	--	--	--	--	3.81
Annual 1987	27.91						
May 1988	5.33	--	--	--	--	9.57	8.23
June 1988	8.14	--	9.52	11.94	--	13.07	9.35
July 1988	7.69	--	9.25	10.84	--	13.68	8.13
August 1988	6.70	--	7.99	12.30	--	11.48	8.60
September 1988	4.54	--	5.44	8.74	--	7.06	6.02
October 1988	2.95	--	--	--	--	5.23	3.02
Annual 1988	35.35						
May 1989	5.03	--	--	--	--	8.48	6.40
June 1989	4.79	--	7.20	9.32	--	10.41	7.60
July 1989	6.89	--	9.92	12.78	--	13.45	9.49
August 1989	5.76	--	8.26	12.41	--	11.88	7.69
September 1989	4.21	--	--	7.61	--	7.86	5.77
October 1989	2.86	--	--	--	--		4.02
Annual 1989	29.54						
May 1990	3.20	--	--	--	--	7.07	5.36
June 1990	5.79	--	7.83	9.33	--	--	7.83
July 1990	6.43	--	7.91	10.84	--	9.29	7.37
August 1990	4.96	--	7.74	9.67	--	--	7.62
September 1990	3.91	--	--	10.61	--	7.89	7.96
October 1990	3.50	--	--	--	--	--	4.88
Annual 1990	27.79						
May 1991	4.54	--	--	7.33	--	7.47	--
June 1991	5.02	--	7.47	6.96	--	7.29	8.90
July 1991	6.15	--	8.18	10.79	--	12.29	10.08
August 1991	4.73	--	7.38	10.58	--	11.42	9.24
September 1991	3.93	--	--	9.46	--	7.70	7.82
October 1991	2.59	--	--	--	--	--	--
Annual 1991	26.96						

Table 24. Pan evaporation data for Pactola Dam and other selected stations, 1962–2006.—Continued

[Gray shading indicates estimates derived from the MOVE.1 analysis. Red shading indicates estimates derived from regression analysis with precipitation data. Blue shading indicates the "annual" total pan evaporation at Pactola Dam using measured and estimated data for May–October of each year. Unshaded values indicate measured data. --, no data]

Month and year	Evaporation data, in inches, for selected National Weather Service stations (station number)						
	Pactola Dam (396427)	Angostura Dam (390217)	Oral (396304)	Cottonwood (391972)	Shadehill Dam (397567)	Oahe Dam (396170)	Pickstown (396574)
May 1992	6.67	--	--	9.86	--	10.82	7.33
June 1992	3.87	--	5.96	7.54	--	7.90	5.95
July 1992	3.99	--	6.19	6.60	--	6.38	5.74
August 1992	4.57	--	5.97	7.63	--	6.22	--
September 1992	4.48	--	5.71	9.02	--	7.29	5.97
October 1992	3.00	--	--	--	--	5.32	4.34
Annual 1992	26.58						
May 1993	4.33	--	--	7.07	--	7.93	--
June 1993	4.22	--	6.86	7.22	--	7.85	6.07
July 1993	4.62	--	7.69	7.81	--	7.16	6.19
August 1993	5.01	--	7.45	8.32	--	9.59	6.90
September 1993	3.21	--	--	5.81	--	6.37	4.89
October 1993	2.48	--	--	--	--	4.42	--
Annual 1993	23.87						
May 1994	5.66	--	--	9.08	--	9.38	8.13
June 1994	6.20	--	8.27	8.49	--	9.98	6.16
July 1994	6.04	--	8.40	9.83	--	9.87	6.84
August 1994	6.47	--	8.07	9.98	--	8.15	6.93
September 1994	4.23	--	--	9.09	--	6.71	6.10
October 1994	2.51	--	--	--	--	4.47	--
Annual 1994	31.11						
May 1995	3.87	--	--	--	--	--	--
June 1995	4.26	--	6.32	6.95	--	8.79	8.02
July 1995	5.32	--	9.17	10.61	--	10.22	9.96
August 1995	5.59	--	7.62	10.38	--	9.29	7.85
September 1995	3.18	--	4.70	8.21	--	6.70	5.56
October 1995	2.21	--	--	--	--	--	3.13
Annual 1995	24.43						
May 1996	3.98	--	--	--	--	--	--
June 1996	5.52	--	7.34	9.41	--	9.15	7.07
July 1996	6.74	--	9.30	10.74	--	10.78	8.12
August 1996	6.09	--	8.19	11.60	--	11.21	7.47
September 1996	3.24	--	--	7.79	--	7.93	5.52
October 1996	3.30	--	--	--	--	--	4.61
Annual 1996	28.87						

Table 24.   Pan evaporation data for Pactola Dam and other selected stations, 1962–2006.—Continued

[Gray shading indicates estimates derived from the MOVE.1 analysis. Red shading indicates estimates derived from regression analysis with precipitation data. Blue shading indicates the "annual" total pan evaporation at Pactola Dam using measured and estimated data for May–October of each year. Unshaded values indicate measured data. --, no data]

Month and year	Evaporation data, in inches, for selected National Weather Service stations (station number)						
	Pactola Dam (396427)	Angostura Dam (390217)	Oral (396304)	Cottonwood (391972)	Shadehill Dam (397567)	Oahe Dam (396170)	Pickstown (396574)
May 1997	3.90	--	--	6.52	--	--	6.26
June 1997	5.13	--	--	8.33	--	8.27	7.85
July 1997	5.78	--	8.98	9.62	--	8.27	7.92
August 1997	4.58	--	5.94	7.00	--	6.83	6.15
September 1997	3.75	--	5.58	7.13	--	6.92	5.11
October 1997	2.71	--	--	--	--	4.81	--
Annual 1997	25.85						
May 1998	4.23	--	--	6.94	--	7.45	6.70
June 1998	4.24	--	6.19	6.50	--	8.07	6.16
July 1998	5.15	--	7.69	8.80	--	9.52	7.46
August 1998	4.90	--	6.85	8.87	--	8.80	7.88
September 1998	4.24	--	5.08	7.13	--	7.79	6.37
October 1998	2.05	--	--	--	--	3.67	2.75
Annual 1998	24.81						
May 1999	3.70	--	--	6.26	--	6.30	5.58
June 1999	4.91	--	6.64	7.64	--	8.98	5.97
July 1999	6.51	--	8.32	9.60	--	10.78	7.75
August 1999	5.15	--	6.72	8.88	--	10.03	7.15
September 1999	3.32	--	4.90	5.92	--	5.87	4.94
October 1999	2.48	--	--	--	--	4.41	--
Annual 1999	26.07						
May 2000	4.29	--	--	7.02	--	8.38	6.16
June 2000	6.04	--	7.42	9.25	--	9.64	7.77
July 2000	5.86	--	8.66	9.40	--	10.89	8.24
August 2000	5.91	--	8.36	11.72	--	--	7.68
September 2000	4.22	--	--	8.50	--	10.26	6.92
October 2000	2.29	--	--	--	--	--	3.23
Annual 2000	28.61						
May 2001	4.55	--	--	7.34	--	--	5.51
June 2001	5.35	--	6.72	8.50	--	7.21	7.22
July 2001	6.28	--	8.93	9.29	--	10.46	7.24
August 2001	6.19	--	8.56	9.99	--	10.93	7.68
September 2001	3.35	--	--	7.57	--	7.73	5.48
October 2001	2.88	--	--	--	--	--	4.05
Annual 2001	28.60						

Table 24. Pan evaporation data for Pactola Dam and other selected stations, 1962–2006.—Continued

[Gray shading indicates estimates derived from the MOVE.1 analysis. Red shading indicates estimates derived from regression analysis with precipitation data. Blue shading indicates the "annual" total pan evaporation at Pactola Dam using measured and estimated data for May–October of each year. Unshaded values indicate measured data. --, no data]

Month and year	Evaporation data, in inches, for selected National Weather Service stations (station number)						
	Pactola Dam (396427)	Angostura Dam (390217)	Oral (396304)	Cottonwood (391972)	Shadehill Dam (397567)	Oahe Dam (396170)	Pickstown (396574)
May 2002	4.78	--	--	7.63	--	8.28	7.00
June 2002	5.96	--	8.33	10.99	--	11.68	9.47
July 2002	8.14	--	9.96	12.17	--	15.48	10.63
August 2002	5.70	--	8.57	10.16	--	10.39	7.94
September 2002	3.75	--	--	7.16	--	8.74	6.41
October 2002	2.59	--	--	--	--	--	--
Annual 2002	30.92						
May 2003	3.61	--	--	6.14	--	5.95	5.66
June 2003	4.42	--	--	7.19	--	8.32	5.63
July 2003	8.45	--	--	12.90	--	13.84	9.20
August 2003	6.84	--	10.01	13.01	--	14.03	8.77
September 2003	3.76	--	--	7.38	--	9.35	6.49
October 2003	2.64	--	--	--	--	--	--
Annual 2003	29.72						
May 2004	4.42	--	6.96	8.47	--	8.07	6.49
June 2004	4.76	--	7.96	8.81	--	9.39	6.49
July 2004	4.63	--	8.66	10.01	--	10.56	7.72
August 2004	5.18	--	8.39	9.61	--	9.80	7.37
September 2004	3.64	--	5.66	8.05	--	--	6.47
October 2004	2.30	--	--	--	--	--	3.25
Annual 2004	24.93						
May 2005	4.06	--	5.91	6.52	--	6.98	6.85
June 2005	4.85	--	7.05	8.03	--	7.86	7.13
July 2005	6.87	--	10.36	12.05	--	9.51	9.78
August 2005	4.68	--	8.04	10.26	--	12.17	7.49
September 2005	4.44	--	--	8.59	--	--	7.57
October 2005	2.65	--	--	--	--	--	3.73
Annual 2005	27.55						
May 2006	4.21	--	6.78	--	--	9.98	7.08
June 2006	6.37	--	8.79	10.46	--	12.19	7.77
July 2006	7.38	--	10.07	14.36	--		9.73
August 2006	5.60	--	8.11	10.31	--	7.16	7.93
September 2006	3.80	--	5.74	5.08	--		4.51
October 2006	2.64	--	--	--	--	--	--
Annual 2006	30.00						

Table 25. Total monthly stream inflow to Sheridan Lake, 1962–2006.

[Total inflows include ungaged tributary inflows and were computed by multiplying inflows at gaging station 06406920 (Spring Creek above Sheridan Lake, table 22) by 1.146. Monthly volumes (in acre-feet) then were computed by multiplying by 1.98 times the number of days in each month]

Year	Monthly stream inflow, in acre-feet											
	May	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**	**Jan.**	**Feb.**	**Mar.**	**Apr.**
1962–63	3,769.19	8,172.30	6,751.34	2,149.61	600.99	908.79	451.64	281.00	153.72	224.93	1,016.39	2,167.74
1963–64	2,529.60	10,719.07	3,485.73	1,023.15	920.53	630.25	440.33	298.21	233.04	317.67	386.76	748.56
1964–65	1,511.37	3,689.26	4,090.77	1,060.66	346.31	365.85	226.12	178.93	158.02	111.63	177.70	612.89
1965–66	6,351.67	11,413.49	6,502.31	2,006.96	767.01	852.22	506.38	411.97	226.27	152.17	643.16	1,345.39
1966–67	831.93	251.70	333.26	866.98	468.89	399.67	386.78	220.74	212.75	186.05	771.05	865.19
1967–68	1,183.02	16,399.93	2,829.66	1,040.99	734.88	624.10	380.23	247.80	247.80	256.03	541.09	592.66
1968–69	439.64	2,104.66	455.01	925.39	289.79	257.02	229.09	181.39	129.74	82.75	343.10	904.46
1969–70	456.85	1,006.21	911.25	1,072.96	192.20	329.57	280.86	127.28	140.81	162.72	347.40	1,312.07
1970–71	2,041.39	5,166.74	1,336.13	941.38	517.09	457.47	496.26	87.31	103.30	129.96	608.73	2,677.69
1971–72	6,638.20	7,524.89	1,336.13	630.25	589.09	605.04	340.36	225.66	84.85	73.86	641.93	646.21
1972–73	1,603.60	24,755.50	3,403.95	1,486.77	762.84	701.57	427.83	221.97	198.60	131.07	522.64	1,578.64
1973–74	2,679.01	1,712.53	882.35	1,149.20	445.69	455.62	376.66	141.42	108.22	131.07	491.90	559.93
1974–75	455.01	227.31	206.60	186.92	152.93	210.29	226.12	19.06	129.74	101.63	350.48	1,348.36
1975–76	1,302.92	2,684.23	1,407.45	731.70	260.03	340.64	312.40	199.22	164.79	197.71	549.08	755.70
1976–77	4,898.10	9,079.74	2,114.56	788.27	496.86	442.10	255.27	207.21	91.00	154.39	604.42	2,729.45
1977–78	562.61	210.05	568.15	857.14	391.54	514.65	286.81	197.99	86.70	105.52	751.38	829.49
1978–79	8,087.46	3,224.53	1,135.06	894.64	505.79	480.83	437.36	139.58	67.64	88.86	667.14	720.60
1979–80	420.58	609.92	573.68	387.37	213.62	247.18	412.96	268.70	55.95	105.52	455.01	701.55
1980–81	715.72	501.02	184.46	472.22	150.55	210.90	226.12	303.75	118.67	73.31	207.21	252.30
1981–82	4,468.30	793.79	313.59	951.83	147.57	205.98	188.03	105.14	63.95	149.40	382.45	447.47
1982–83	2,263.97	4,040.33	800.57	794.42	458.78	1,336.74	397.49	245.34	155.56	157.17	870.05	1,857.12
1983–84	1,953.46	1,053.82	1,081.57	549.70	347.50	466.08	226.12	156.18	217.05	186.05	560.15	980.03
1984–85	2,510.54	6,478.21	2,065.98	829.47	633.72	506.04	429.62	95.31	94.69	180.50	771.05	642.64
1985–86	212.13	274.91	141.42	111.29	117.82	223.81	155.31	87.31	177.70	179.39	617.34	1,147.83
1986–87	1,923.95	1,876.76	835.00	491.29	605.75	926.62	476.03	295.76	209.06	169.94	1,409.91	1,345.39
1987–88	1,746.25	1,099.04	569.38	351.71	61.88	44.27	24.40	12.91	18.45	22.21	215.21	295.14
1988–89	482.68	98.78	9.84	3.07	58.91	133.43	1.19	9.22	11.07	1.11	461.77	192.79
1989–90	306.82	99.97	24.60	38.74	42.84	52.26	66.64	72.56	48.58	34.43	143.27	637.88
1990–91	1,523.05	1,923.17	850.37	616.11	120.20	183.85	226.12	160.48	170.32	137.73	391.68	709.29
1991–92	5,193.24	8,265.12	1,895.66	916.17	417.12	376.92	449.85	348.02	176.47	204.93	494.36	490.91

Table 25.   Total monthly stream inflow to Sheridan Lake, 1962–2006. —Continued

[Total inflows include ungaged tributary inflows and were computed by multiplying inflows at gaging station 06406920 (Spring Creek above Sheridan Lake, table 22) by 1.146. Monthly volumes (in acre-feet) then were computed by multiplying by 1.98 times the number of days in each month]

Year	Monthly stream inflow, in acre-feet											
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1992–93	397.21	555.17	789.50	496.82	252.30	211.52	161.85	114.37	126.66	146.62	667.76	1,200.20
1993–94	5,024.15	7,344.00	3,185.06	1,606.67	865.79	972.12	831.87	664.07	423.65	397.09	1,191.01	1,084.17
1994–95	2,423.84	1,002.64	405.20	196.15	104.73	416.89	308.83	285.30	244.72	234.92	609.34	496.86
1995–96	10,182.35	12,595.24	4,157.18	1,606.67	940.76	908.79	674.18	482.68	359.09	572.03	916.17	1,595.90
1996–97	6,370.12	8,271.67	2,219.70	1,472.63	1,186.51	1,268.49	1,704.79	1,374.25	1,127.68	923.03	1,515.05	2,850.25
1997–98	8,526.49	9,205.88	3,657.28	3,530.00	1,786.91	1,360.11	777.12	703.42	421.80	439.85	1,437.58	2,100.50
1998–99	2,303.94	6,519.27	4,460.31	2,818.59	1,773.22	2,522.84	3,491.70	2,452.13	1,543.34	1,221.82	1,535.96	4,377.72
1999–2000	6,743.35	10,310.88	3,868.80	2,508.69	1,500.10	1,155.35	872.93	670.21	553.39	636.46	824.55	1,520.93
2000–2001	2,290.41	1,111.54	648.69	292.68	217.79	340.64	391.54	274.85	237.34	226.59	557.08	1,172.83
2001–02	1,099.40	1,404.89	1,902.43	866.98	508.17	549.70	437.95	257.02	129.74	144.40	328.34	934.21
2002–03	1,211.92	702.15	277.92	273.00	402.84	301.29	247.54	160.48	81.78	161.61	587.82	1,111.54
2003–04	2,423.84	1,336.46	405.20	352.94	238.61	182.62	213.62	133.43	71.33	77.20	387.37	367.14
2004–05	290.22	150.55	205.98	154.33	89.85	122.36	6.55	17.22	42.43	52.76	110.06	276.69
2005–06	544.78	513.52	215.82	271.78	4.76	148.19	6.55	44.89	41.81	35.54	279.77	609.92
					Statistical summary							
Number of values	44	44	44	44	44	44	44	44	44	44	44	44
Mean	2,702.14	4,465.47	1,670.34	926.69	492.98	544.33	442.44	299.59	214.98	215.45	621.40	1,131.69
Maximum	10,182.35	24,755.50	6,751.34	3,530.00	1,786.91	2,522.84	3,491.70	2,452.13	1,543.34	1,221.82	1,535.96	4,377.72
75th percentile	3,943.97	7,686.74	2,372.19	1,063.74	612.74	648.08	442.71	287.92	219.36	209.93	756.30	1,346.13
50th percentile	1,938.71	1,899.97	896.80	843.31	409.98	429.50	358.51	203.22	147.27	153.28	558.62	884.83
25th percentile	677.44	679.09	405.20	378.76	182.38	220.74	226.12	124.05	86.24	104.55	385.68	612.15
Minimum	212.13	98.78	9.84	3.07	4.76	44.27	1.19	9.22	11.07	1.11	110.06	192.79

Table 26.   Effective monthly precipitation on Sheridan Lake, 1962–2006.

[Effective precipitation reflects potential sublimation of snowpack on ice cover]

Year	Effective monthly precipitation, in acre-feet											
	May	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**	**Jan.**	**Feb.**	**Mar.**	**Apr.**
1962–63	323.68	229.51	206.53	38.94	37.03	48.84	5.81	0.64	7.02	6.70	27.96	127.68
1963–64	64.48	233.34	98.64	37.35	98.64	30.33	2.46	4.79	6.54	6.70	12.26	36.26
1964–65	114.60	197.59	82.99	47.56	39.26	1.28	8.27	26.81	10.21	3.03	10.53	38.31
1965–66	309.00	185.78	136.94	81.40	59.05	4.47	3.58	5.43	2.39	10.69	17.43	77.89
1966–67	4.15	30.96	143.01	121.94	78.21	30.33	10.73	11.17	3.03	7.98	9.19	71.76
1967–68	110.13	240.37	54.59	47.24	40.86	11.49	7.37	7.34	9.42	3.51	5.36	26.81
1968–69	75.97	182.27	50.75	91.29	40.86	3.83	7.60	8.62	3.67	18.67	9.58	45.97
1969–70	77.57	125.13	198.23	31.60	23.30	43.73	7.15	2.07	3.83	5.59	28.92	84.53
1970–71	139.50	117.15	67.03	80.76	42.77	38.31	14.30	9.26	13.09	11.33	27.96	152.71
1971–72	182.27	108.53	54.27	37.35	80.44	55.22	21.90	3.67	3.99	4.79	13.22	49.80
1972–73	93.21	342.19	102.79	99.91	16.28	23.94	7.15	4.95	1.44	4.31	65.50	93.72
1973–74	52.03	78.21	117.79	37.99	57.46	23.62	27.26	9.26	6.54	2.87	4.60	26.30
1974–75	53.63	33.52	127.05	45.33	29.69	68.63	6.48	1.92	11.49	8.78	19.34	72.01
1975–76	76.61	154.82	42.46	28.09	2.23	15.00	11.84	12.77	3.99	15.80	6.51	111.60
1976–77	119.38	195.36	115.24	64.48	35.75	6.07	10.50	3.51	6.54	4.63	38.31	42.90
1977–78	49.16	99.27	128.00	85.23	61.93	26.81	15.19	12.13	5.59	11.81	5.17	68.44
1978–79	215.47	52.99	129.28	57.78	18.20	16.60	16.98	10.53	6.07	6.86	7.66	29.88
1979–80	48.52	153.22	273.88	89.06	6.07	23.94	6.70	2.39	4.31	5.91	17.62	40.60
1980–81	74.38	87.46	69.91	89.38	24.26	61.93	9.16	6.86	.80	2.07	4.41	16.60
1981–82	215.15	47.88	165.67	41.50	12.45	74.38	1.34	11.65	8.46	6.54	22.60	22.22
1982–83	185.78	130.24	101.19	73.74	82.04	68.31	8.27	8.30	5.11	2.07	32.18	24.26
1983–84	89.38	108.21	41.18	91.93	16.60	69.27	26.59	8.94	2.07	3.19	10.92	92.44
1984–85	62.88	165.03	154.18	42.77	35.75	23.62	17.88	5.43	3.35	1.12	19.54	28.09
1985–86	33.20	39.26	66.40	38.31	67.03	20.11	40.00	11.01	1.76	19.15	13.41	93.72
1986–87	57.14	152.58	53.31	62.88	196.31	57.46	22.79	.16	1.12	26.18	32.75	4.85
1987–88	172.37	20.43	53.31	87.78	22.66	23.30	5.36	5.59	4.63	4.95	14.94	20.43
1988–89	74.70	122.90	61.29	85.55	8.30	18.20	26.37	3.83	.80	8.78	17.81	44.69
1989–90	63.84	63.84	59.05	89.70	149.39	30.33	7.60	9.26	.48	9.10	28.92	52.61
1990–91	153.22	52.67	147.16	52.03	36.39	22.03	12.07	9.42	2.07	10.06	12.07	99.85
1991–92	237.49	170.14	92.25	40.22	33.20	38.31	22.34	.00	1.12	3.67	41.56	34.73
1992–93	86.51	119.38	131.83	39.90	20.11	21.39	7.15	11.17	10.53	13.09	12.45	74.57

Table 26.   Effective monthly precipitation on Sheridan Lake, 1962–2006.—Continued

[Effective precipitation reflects potential sublimation of snowpack on ice cover]

Year	Effective monthly precipitation, in acre-feet											
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1993–94	184.50	165.67	108.85	62.25	35.43	58.10	8.94	7.66	5.43	10.06	12.26	44.94
1994–95	72.78	33.52	42.77	60.33	22.98	153.54	8.27	7.34	.64	11.97	17.24	61.03
1995–96	256.33	167.27	136.62	40.86	46.29	87.78	10.28	2.39	14.84	1.76	30.45	58.99
1996–97	232.07	61.93	72.46	156.73	71.82	154.50	8.94	16.92	4.47	12.29	6.70	77.89
1997–98	167.59	100.87	164.71	81.08	65.76	34.79	2.23	5.27	9.10	13.89	44.24	28.35
1998–99	95.44	196.31	106.62	107.57	105.34	147.79	34.63	1.76	14.36	1.76	18.96	87.59
1999–2000	82.68	247.07	95.44	92.57	42.14	7.98	5.14	2.87	7.50	4.63	20.49	117.21
2000–2001	100.23	68.63	96.72	21.71	21.39	52.35	30.84	4.63	4.47	15.80	14.56	63.33
2001–02	85.55	132.79	146.20	89.06	55.54	48.20	14.08	1.28	2.39	3.83	30.84	57.20
2002–03	95.76	51.07	99.59	73.42	108.21	37.67	7.60	1.92	11.65	8.94	37.35	84.02
2003–04	61.93	78.85	11.81	102.47	39.26	15.32	28.15	5.59	5.75	16.92	9.19	40.09
2004–05	77.57	49.16	91.29	42.46	78.53	15.32	4.25	.96	9.42	3.51	15.32	45.97
2005–06	143.33	69.59	93.53	76.93	35.75	39.26	5.36	3.35	2.71	6.86	45.39	49.29
Statistical summary												
Number of values	44	44	44	44	44	44	44	44	44	44	44	44
Mean	119.80	124.16	104.38	67.42	50.02	42.13	12.88	6.61	5.55	8.23	20.31	59.59
Maximum	323.68	342.19	273.88	156.73	196.31	154.50	40.00	26.81	14.84	26.18	65.50	152.71
75th percentile	168.79	167.99	133.03	89.06	66.08	55.78	17.21	9.26	7.74	11.45	28.92	79.42
50th percentile	91.30	118.27	99.12	63.68	39.26	30.33	8.94	5.51	4.55	6.78	17.34	51.21
25th percentile	70.71	63.36	65.12	41.34	23.22	19.63	7.04	2.75	2.39	3.79	10.82	35.88
Minimum	4.15	20.43	11.81	21.71	2.23	1.28	1.34	.00	.48	1.12	4.41	4.85

Table 27.   Monthly (May through October) evaporation from Sheridan Lake, 1962–2006.

[Lake evaporation was computed by multiplying pan evaporation data for National Weather Service station 396427 (table 24) by monthly pan coefficients]

Year	Estimated monthly evaporation, in acre-feet, using monthly pan coefficients					
	0.50	0.60	0.70	0.80	0.90	1.00
	May	June	July	August	September	October
1962–63	57.78	81.08	117.47	127.05	94.49	77.89
1963–64	69.91	96.08	131.51	154.50	90.02	86.83
1964–65	78.53	86.51	141.09	159.29	123.22	95.76
1965–66	63.52	94.81	119.70	123.53	76.29	98.96
1966–67	88.10	119.07	177.80	139.18	106.62	69.91
1967–68	59.37	71.50	140.77	148.11	109.49	100.23
1968–69	62.88	111.09	147.79	146.20	111.40	119.07
1969–70	88.74	81.72	156.41	184.82	147.48	61.29
1970–71	75.33	133.43	168.54	173.33	116.51	72.46
1971–72	66.08	103.74	141.09	165.67	108.21	69.91
1972–73	62.88	103.74	119.70	125.77	109.17	65.12
1973–74	71.50	133.11	164.71	141.41	89.70	75.97
1974–75	57.46	120.02	171.74	145.24	110.45	87.78
1975–76	70.23	99.91	162.16	153.86	112.04	70.23
1976–77	84.27	112.36	138.22	139.50	121.30	91.29
1977–78	96.40	125.77	152.58	116.51	134.71	58.10
1978–79	66.08	116.19	169.18	137.58	153.54	98.00
1979–80	69.59	104.06	143.01	113.00	128.00	84.59
1980–81	77.89	115.24	167.90	152.58	120.02	118.75
1981–82	59.37	100.87	137.58	119.70	124.17	79.48
1982–83	75.33	84.91	128.96	119.07	83.31	73.42
1983–84	61.29	87.78	161.84	148.11	125.77	47.56
1984–85	66.72	98.96	132.15	153.22	120.98	66.08
1985–86	87.46	109.49	163.44	141.09	115.87	83.95
1986–87	79.80	116.19	128.96	145.56	70.55	47.56
1987–88	59.05	114.60	144.28	132.15	112.04	86.51
1988–89	85.23	155.77	171.74	171.10	130.56	94.17
1989–90	80.44	91.61	153.86	147.16	120.98	91.29
1990–91	51.07	110.77	143.64	126.73	112.36	111.72
1991–92	72.46	96.08	137.58	120.66	113.00	82.68
1992–93	106.62	74.06	89.06	116.83	128.64	95.76
1993–94	69.27	80.76	103.11	128.00	92.25	79.16
1994–95	90.34	118.75	135.03	165.35	121.62	80.12
1995–96	61.93	81.72	118.75	142.69	91.29	70.55
1996–97	63.52	105.66	150.67	155.46	93.21	105.34
1997–98	62.25	98.32	129.28	116.83	107.89	86.51
1998–99	67.67	81.08	115.24	125.13	121.94	65.44
1999–2000	59.05	94.17	145.56	131.51	95.44	79.16
2000–2001	68.63	115.55	130.88	150.99	121.30	73.10
2001–02	72.78	102.47	140.45	158.01	96.40	91.93
2002–03	76.29	114.28	181.95	145.56	107.89	82.68

Table 27.   Monthly (May through October) evaporation from Sheridan Lake, 1962–2006.—Continued

[Lake evaporation was computed by multiplying pan evaporation data for National Weather Service station 396427 (table 24) by monthly pan coefficients]

Year	Estimated monthly evaporation, in acre-feet, using monthly pan coefficients					
	0.50	**0.60**	**0.70**	**0.80**	**0.90**	**1.00**
	May	**June**	**July**	**August**	**September**	**October**
2003–04	57.78	84.59	188.97	174.61	107.89	84.27
2004–05	70.55	91.29	103.42	132.15	104.70	73.42
2005–06	64.80	92.89	153.54	119.38	127.68	84.59
Statistical summary						
Number of values	44	44	44	44	44	44
Mean	71.28	102.55	143.67	141.69	111.60	82.24
Maximum	106.62	155.77	188.97	184.82	153.54	119.07
75th percentile	78.05	114.76	161.92	153.38	121.70	91.45
50th percentile	69.43	101.67	142.05	142.05	112.04	82.68
25th percentile	62.72	90.41	130.48	126.49	102.63	71.98
Minimum	51.07	71.50	89.06	113.00	70.55	47.56

Table 28. Computed monthly net inflow to Sheridan Lake, 1962–2006. Net inflow is computed as total inflow minus evaporation, and is independent of releases.

[Net inflow was computed as total inflow minus evaporation. Negative values represent a drawdown condition for the historical pass-through operating system]

Year	Monthly net inflow, in cubic feet per second											
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1962–63	65.62	139.83	111.25	33.53	9.13	14.31	7.69	4.58	2.61	4.17	16.98	38.58
1963–64	41.05	182.45	56.16	14.73	15.61	9.33	7.44	4.93	3.90	5.84	6.49	13.19
1964–65	25.17	63.87	65.59	15.43	4.41	4.41	3.94	3.35	2.74	2.06	3.06	10.94
1965–66	107.29	193.34	106.03	31.95	12.60	12.32	8.57	6.79	3.72	2.93	10.74	23.92
1966–67	12.16	2.75	4.85	13.82	7.40	5.86	6.68	3.77	3.51	3.49	12.69	15.75
1967–68	20.07	278.45	44.62	15.29	11.20	8.71	6.51	4.15	4.18	4.67	8.89	10.41
1968–69	7.36	36.57	5.82	14.16	3.68	2.31	3.98	3.09	2.17	1.83	5.74	15.97
1969–70	7.25	17.64	15.50	14.96	1.14	5.07	4.84	2.10	2.35	3.03	6.12	23.47
1970–71	34.24	86.56	20.08	13.80	7.45	6.88	8.58	1.57	1.89	2.54	10.35	47.57
1971–72	109.85	126.54	20.32	8.16	9.43	9.60	6.09	3.73	1.44	1.42	10.65	11.70
1972–73	26.57	420.04	55.08	23.76	11.26	10.74	7.31	3.69	3.25	2.44	9.57	28.10
1973–74	43.25	27.86	13.59	17.01	6.95	6.56	6.79	2.45	1.87	2.41	8.07	9.85
1974–75	7.34	2.37	2.63	1.42	1.21	3.11	3.91	.34	2.30	1.99	6.01	23.87
1975–76	21.29	46.03	20.94	9.85	2.52	4.64	5.45	3.45	2.74	3.84	9.04	14.58
1976–77	80.23	153.98	34.02	11.60	6.91	5.80	4.47	3.43	1.59	2.86	10.45	46.59
1977–78	8.38	3.08	8.84	13.43	5.36	7.86	5.08	3.42	1.50	2.11	12.30	15.09
1978–79	133.96	53.13	17.81	13.25	6.23	6.50	7.64	2.44	1.20	1.72	10.97	12.61
1979–80	6.50	11.08	11.46	5.91	1.54	3.03	7.05	4.41	.98	2.01	7.69	12.47
1980–81	11.58	7.95	1.41	6.65	.92	2.51	3.95	5.05	1.94	1.36	3.44	4.52
1981–82	75.20	12.45	5.56	14.21	.60	3.27	3.18	1.90	1.18	2.81	6.59	7.89
1982–83	38.62	68.66	12.57	12.18	7.69	21.66	6.82	4.13	2.61	2.87	14.67	31.62
1983–84	32.23	18.05	15.63	8.03	4.01	7.93	4.25	2.69	3.56	3.41	9.29	18.02
1984–85	40.77	109.98	33.96	11.69	9.22	7.54	7.52	1.64	1.59	3.27	12.86	11.27
1985–86	2.57	3.44	.72	.14	1.16	2.60	3.28	1.60	2.92	3.57	10.26	20.86
1986–87	30.92	32.15	12.35	6.65	12.29	15.23	8.38	4.81	3.42	3.53	23.46	22.69
1987–88	30.24	16.89	7.78	5.00	-.46	-.31	.50	.30	.38	.49	3.74	5.30
1988–89	7.68	1.11	-1.64	-1.34	-1.06	.93	.46	.21	.19	.18	7.80	3.99
1989–90	4.72	1.21	-1.14	-.30	1.20	-.14	1.25	1.33	.80	.78	2.80	11.60
1990–91	26.43	31.34	13.89	8.81	.74	1.53	4.00	2.76	2.80	2.66	6.57	13.60
1991–92	87.14	140.14	30.09	13.59	5.67	5.41	7.94	5.66	2.89	3.76	8.72	8.83
1992–93	6.13	10.09	13.54	6.83	2.42	2.23	2.84	2.04	2.23	2.88	11.06	21.42

Table 28.   Computed monthly net inflow to Sheridan Lake, 1962–2006. Net inflow is computed as total inflow minus evaporation, and is independent of releases. —Continued

[Net inflow was computed as total inflow minus evaporation. Negative values represent a drawdown condition for the historical pass-through operating system]

Year	Monthly net inflow, in cubic feet per second											
	May	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**	**Jan.**	**Feb.**	**Mar.**	**Apr.**
1993–94	83.58	124.85	51.89	25.06	13.60	15.47	14.13	10.92	6.98	7.33	19.57	18.98
1994–95	39.13	15.42	5.09	1.48	.10	7.97	5.33	4.76	3.99	4.45	10.19	9.38
1995–96	168.76	213.11	67.90	24.47	15.05	15.06	11.50	7.89	6.08	10.33	15.40	27.81
1996–97	106.34	138.28	34.83	23.97	19.58	21.43	28.80	22.63	18.41	16.84	24.75	49.21
1997–98	140.38	154.75	60.06	56.83	29.32	21.28	13.10	11.53	7.01	8.17	24.10	35.78
1998–99	37.92	111.50	72.40	45.55	29.52	42.37	59.26	39.91	25.33	22.03	25.29	75.04
1999–2000	110.05	175.85	62.10	40.17	24.31	17.63	14.76	10.95	9.12	11.54	13.74	27.53
2000–2001	37.76	17.89	9.99	2.66	1.98	5.20	7.10	4.55	3.93	4.36	9.30	20.77
2001–02	18.09	24.12	31.03	12.98	7.85	8.23	7.60	4.20	2.15	2.67	5.84	16.66
2002–03	20.03	10.74	3.18	3.27	6.78	4.17	4.29	2.64	1.52	3.07	10.17	20.09
2003–04	39.49	22.36	3.71	4.57	2.86	1.85	4.06	2.26	1.25	1.69	6.45	6.84
2004–05	4.83	1.82	3.15	1.05	1.07	1.05	.18	.30	.84	1.01	2.04	5.42
2005–06	10.14	8.24	2.53	3.73	-1.46	1.67	.20	.78	.72	.76	5.29	11.08
Statistical summary												
Number of values	44	44	44	44	44	44	44	44	44	44	44	44
Mean	44.73	75.41	26.53	13.86	7.25	8.20	7.65	4.98	3.59	4.03	10.44	20.02
Maximum	168.76	420.04	111.25	56.83	29.52	42.37	59.26	39.91	25.33	22.03	25.29	75.04
75th percentile	68.02	129.48	37.28	15.33	9.87	9.89	7.65	4.77	3.60	3.92	12.40	23.88
50th percentile	31.58	31.75	14.70	12.58	5.95	6.18	6.30	3.44	2.48	2.88	9.44	15.86
25th percentile	11.22	11.00	5.44	5.68	1.21	2.92	3.97	2.09	1.52	2.01	6.48	11.05
Minimum	2.57	1.11	-1.64	-1.34	-1.46	-.31	.18	.21	.19	.18	2.04	3.99

Table 29.   Computed values of accumulated end-of-month storage change for zero-release scenario (pass-through operating system) for Sheridan Lake, 1962–2006.

[Negative values indicate storage deficits, which are accumulated. Values of zero indicate a monthend condition at or above the spillway. Positive values are shown only for months when storage deficits end. NA, not applicable]

Year	Monthly end-of-month storage, in acre-feet											
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1962–63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1963–64	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1964–65	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1965–66	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1966–67	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1967–68	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1968–69	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1969–70	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1970–71	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1971–72	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1972–73	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1973–74	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1974–75	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1975–76	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1976–77	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1977–78	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1978–79	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1979–80	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1980–81	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1981–82	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1982–83	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1983–84	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1984–85	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1985–86	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1986–87	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1987–88	.00	.00	.00	.00	-27.50	-46.44	-16.68	1.82	.00	.00	.00	.00
1988–89	.00	.00	-100.61	-183.09	-246.44	-188.98	-161.42	-148.37	-136.50	-126.61	.00	.00
1989–90	.00	.00	-70.21	-88.93	-17.68	-26.38	47.86	.00	.00	.00	352.97	.00
1990–91	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

Table 29. Computed values of accumulated end-of-month storage change for zero-release scenario (pass-through operating system) for Sheridan Lake, 1962–2006.—Continued

[Negative values indicate storage deficits, which are accumulated. Values of zero indicate a monthend condition at or above the spillway. Positive values are shown only for months when storage deficits end. NA, not applicable]

Year	Monthly end-of-month storage, in acre-feet											
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1991–92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1992–93	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1993–94	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1994–95	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1995–96	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1996–97	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1997–98	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1998–99	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1999–2000	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2000–2001	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2001–02	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2002–03	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2003–04	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2004–05	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2005–06	.00	.00	.00	.00	-87.17	15.69	.00	.00	.00	.00	.00	.00
Statistical summary												
Number of values	44	44	44	44	44	44	44	44	44	44	44	44
Mean	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Maximum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
75th percentile	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
50th percentile	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
25th percentile	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Minimum	.00	.00	-100.61	-183.09	-246.44	-188.98	-161.42	-148.37	-136.50	-126.61	.00	.00

Table 30. Computed monthly values of reservoir outflow from Sheridan Lake for pass-through operating system, 1962–2006.

[Positive values represent computed outflow through the spillway. Values of zero indicate a monthend condition of storage deficit]

Year	Computed monthly values of reservoir outflow, in cubic feet per second											
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1962–63	65.62	139.83	111.25	33.53	9.13	14.31	7.69	4.58	2.61	4.17	16.98	38.58
1963–64	41.05	182.45	56.16	14.73	15.61	9.33	7.44	4.93	3.90	5.84	6.49	13.19
1964–65	25.17	63.87	65.59	15.43	4.41	4.41	3.94	3.35	2.74	2.06	3.06	10.94
1965–66	107.29	193.34	106.03	31.95	12.60	12.32	8.57	6.79	3.72	2.93	10.74	23.92
1966–67	12.16	2.75	4.85	13.82	7.40	5.86	6.68	3.77	3.51	3.49	12.69	15.75
1967–68	20.07	278.45	44.62	15.29	11.20	8.71	6.51	4.15	4.18	4.67	8.89	10.41
1968–69	7.36	36.57	5.82	14.16	3.68	2.31	3.98	3.09	2.17	1.83	5.74	15.97
1969–70	7.25	17.64	15.50	14.96	1.14	5.07	4.84	2.10	2.35	3.03	6.12	23.47
1970–71	34.24	86.56	20.08	13.80	7.45	6.88	8.58	1.57	1.89	2.54	10.35	47.57
1971–72	109.85	126.54	20.32	8.16	9.43	9.60	6.09	3.73	1.44	1.42	10.65	11.70
1972–73	26.57	420.04	55.08	23.76	11.26	10.74	7.31	3.69	3.25	2.44	9.57	28.10
1973–74	43.25	27.86	13.59	17.01	6.95	6.56	6.79	2.45	1.87	2.41	8.07	9.85
1974–75	7.34	2.37	2.63	1.42	1.21	3.11	3.91	.34	2.30	1.99	6.01	23.87
1975–76	21.29	46.03	20.94	9.85	2.52	4.64	5.45	3.45	2.74	3.84	9.04	14.58
1976–77	80.23	153.98	34.02	11.60	6.91	5.80	4.47	3.43	1.59	2.86	10.45	46.59
1977–78	8.38	3.08	8.84	13.43	5.36	7.86	5.08	3.42	1.50	2.11	12.30	15.09
1978–79	133.96	53.13	17.81	13.25	6.23	6.50	7.64	2.44	1.20	1.72	10.97	12.61
1979–80	6.50	11.08	11.46	5.91	1.54	3.03	7.05	4.41	.98	2.01	7.69	12.47
1980–81	11.58	7.95	1.41	6.65	.92	2.51	3.95	5.05	1.94	1.36	3.44	4.52
1981–82	75.20	12.45	5.56	14.21	.60	3.27	3.18	1.90	1.18	2.81	6.59	7.89
1982–83	38.62	68.66	12.57	12.18	7.69	21.66	6.82	4.13	2.61	2.87	14.67	31.62
1983–84	32.23	18.05	15.63	8.03	4.01	7.93	4.25	2.69	3.56	3.41	9.29	18.02
1984–85	40.77	109.98	33.96	11.69	9.22	7.54	7.52	1.64	1.59	3.27	12.86	11.27
1985–86	2.57	3.44	.72	.14	1.16	2.60	3.28	1.60	2.92	3.57	10.26	20.86
1986–87	30.92	32.15	12.35	6.65	12.29	15.23	8.38	4.81	3.42	3.53	23.46	22.69
1987–88	30.24	16.89	7.78	5.00	.00	.00	.00	.03	.38	.49	3.74	5.30
1988–89	7.68	1.11	.00	.00	.00	.00	.00	.00	.00	.00	5.74	3.99
1989–90	4.72	1.21	.00	.00	.00	.00	.80	1.33	.80	.78	2.80	11.60
1990–91	26.43	31.34	13.89	8.81	.74	1.53	4.00	2.76	2.80	2.66	6.57	13.60
1991–92	87.14	140.14	30.09	13.59	5.67	5.41	7.94	5.66	2.89	3.76	8.72	8.83
1992–93	6.13	10.09	13.54	6.83	2.42	2.23	2.84	2.04	2.23	2.88	11.06	21.42

Table 30. Computed monthly values of reservoir outflow from Sheridan Lake for pass-through operating system, 1962–2006. —Continued

[Positive values represent computed outflow through the spillway. Values of zero indicate a monthend condition of storage deficit]

Year	Computed monthly values of reservoir outflow, in cubic feet per second											
	May	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**	**Jan.**	**Feb.**	**Mar.**	**Apr.**
1993–94	83.58	124.85	51.89	25.06	13.60	15.47	14.13	10.92	6.98	7.33	19.57	18.98
1994–95	39.13	15.42	5.09	1.48	.10	7.97	5.33	4.76	3.99	4.45	10.19	9.38
1995–96	168.76	213.11	67.90	24.47	15.05	15.06	11.50	7.89	6.08	10.33	15.40	27.81
1996–97	106.34	138.28	34.83	23.97	19.58	21.43	28.80	22.63	18.41	16.84	24.75	49.21
1997–98	140.38	154.75	60.06	56.83	29.32	21.28	13.10	11.53	7.01	8.17	24.10	35.78
1998–99	37.92	111.50	72.40	45.55	29.52	42.37	59.26	39.91	25.33	22.03	25.29	75.04
1999–2000	110.05	175.85	62.10	40.17	24.31	17.63	14.76	10.95	9.12	11.54	13.74	27.53
2000–2001	37.76	17.89	9.99	2.66	1.98	5.20	7.10	4.55	3.93	4.36	9.30	20.77
2001–02	18.09	24.12	31.03	12.98	7.85	8.23	7.60	4.20	2.15	2.67	5.84	16.66
2002–03	20.03	10.74	3.18	3.27	6.78	4.17	4.29	2.64	1.52	3.07	10.17	20.09
2003–04	39.49	22.36	3.71	4.57	2.86	1.85	4.06	2.26	1.25	1.69	6.45	6.84
2004–05	4.83	1.82	3.15	1.05	1.07	1.05	.18	.30	.84	1.01	2.04	5.42
2005–06	10.14	8.24	2.53	3.73	.00	.26	.20	.78	.72	.76	5.29	11.08
Statistical summary												
Number of values	44	44	44	44	44	44	44	44	44	44	44	44
Mean	44.73	75.41	26.59	13.90	7.29	8.16	7.62	4.97	3.58	4.02	10.39	20.02
Maximum	168.76	420.04	111.25	56.83	29.52	42.37	59.26	39.91	25.33	22.03	25.29	75.04
75th percentile	68.02	129.48	37.28	15.33	9.87	9.89	7.65	4.77	3.60	3.92	12.40	23.88
50th percentile	31.58	31.75	14.70	12.58	5.95	6.18	6.30	3.44	2.48	2.88	9.44	15.86
25th percentile	11.22	11.00	5.44	5.68	1.20	2.92	3.97	2.09	1.52	2.01	6.37	11.05
Minimum	2.57	1.11	.00	.00	.00	.00	.00	.00	.00	.00	2.04	3.99

Table 31. Computed values of accumulated end-of-month storage change for release scenario of 1.0 cubic foot per second, 1962–2006.

[Prescribed release is for May through October, with continued releases of 1 cubic foot per second for subsequent months with persisting storage deficits. Negative values indicate storage deficits, which are accumulated. Values of zero indicate a monthend condition at or above the spillway. Positive values are shown only for months when storage deficits end. NA, not applicable]

Year	Computed end-of-month storage, in acre-feet
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1962–63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1963–64	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1964–65	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1965–66	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1966–67	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1967–68	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1968–69	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1969–70	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1970–71	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1971–72	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1972–73	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1973–74	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1974–75	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1975–76	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1976–77	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1977–78	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1978–79	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1979–80	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1980–81	.00	.00	.00	.00	-4.71	87.88	.00	.00	.00	.00	.00	.00
1981–82	.00	.00	.00	.00	-23.65	115.74	.00	.00	.00	.00	.00	.00
1982–83	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1983–84	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1984–85	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1985–86	.00	.00	-17.11	-70.09	-60.61	37.87	.00	.00	.00	.00	.00	.00
1986–87	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1987–88	.00	.00	.00	.00	-87.00	-167.43	-197.17	-240.16	-278.57	-306.95	-138.29	177.28
1988–89	.00	.00	-162.10	-306.07	-428.92	-432.95	-464.89	-513.33	-562.95	-608.60	-190.51	46.97
1989–90	.00	.00	-131.70	-211.91	-200.16	-270.35	-255.61	-235.28	-247.71	-259.72	-149.02	541.47
1990–91	.00	.00	.00	.00	-15.27	17.40	.00	.00	.00	.00	.00	.00
1991–92	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

Table 31. Computed values of accumulated end-of-month storage change for release scenario of 1.0 cubic foot per second, 1962–2006. —Continued

[Prescribed release is for May through October, with continued releases of 1 cubic foot per second for subsequent months with persisting storage deficits. Negative values indicate storage deficits, which are accumulated. Values of zero indicate a monthend condition at or above the spillway. Positive values are shown only for months when storage deficits end. NA, not applicable]

Year	Computed end-of-month storage, in acre-feet											
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1992–93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1993–94	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1994–95	.00	.00	.00	.00	-53.41	375.41	.00	.00	.00	.00	.00	.00
1995–96	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1996–97	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1997–98	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1998–99	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1999–2000	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2000–2001	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2001–02	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2002–03	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2003–04	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2004–05	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2005–06	.00	.00	.00	.00	-146.67	-105.30	-152.89	-166.14	-183.11	-196.25	128.91	.00
Statistical summary												
Number of values	44	44	44	44	44	44	44	44	44	44	44	44
Mean	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Maximum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
75th percentile	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
50th percentile	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
25th percentile	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Minimum	.00	.00	-162.10	-306.07	-428.92	-432.95	-464.89	-513.33	-562.95	-608.60	-190.51	.00

Table 32. Computed values of accumulated end-of-month storage change for release scenario of 2.0 cubic feet per second, 1962–2006.

[Prescribed release is for May through October, with continued releases of 1 cubic foot per second for subsequent months with persisting storage deficits. Negative values indicate storage deficits, which are accumulated. Values of zero indicate a monthend condition at or above the spillway. Positive values are shown only for months when storage deficits end. NA, not applicable]

Year	Computed end-of-month storage, in acre-feet											
	May	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**	**Jan.**	**Feb.**	**Mar.**	**Apr.**
1962–63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1963–64	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1964–65	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1965–66	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1966–67	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1967–68	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1968–69	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1969–70	.00	.00	.00	.00	-50.99	138.04	.00	.00	.00	.00	.00	.00
1970–71	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1971–72	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1972–73	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1973–74	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1974–75	.00	.00	.00	-35.97	-82.81	-14.65	158.45	.00	.00	.00	.00	.00
1975–76	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1976–77	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1977–78	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1978–79	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1979–80	.00	.00	.00	.00	-27.32	36.23	.00	.00	.00	.00	.00	.00
1980–81	.00	.00	-36.51	249.53	-64.22	-33.12	142.66	.00	.00	.00	.00	.00
1981–82	.00	.00	.00	.00	-83.16	-5.26	124.61	.00	.00	.00	.00	.00
1982–83	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1983–84	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1984–85	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1985–86	.00	.00	-78.60	-193.07	-243.10	-206.11	-70.30	-33.47	145.99	.00	.00	.00
1986–87	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1987–88	.00	.00	.00	.00	-146.51	-288.43	-318.17	-361.16	-399.57	-427.95	-259.29	56.28
1988–89	.00	-53.10	-276.69	-482.15	-664.51	-730.03	-761.97	-810.41	-860.03	-905.68	-487.59	-309.61
1989–90	-142.37	-189.18	-382.37	-524.07	-571.83	-703.51	-688.77	-668.44	-680.87	-692.88	-582.18	48.81
1990–91	.00	.00	.00	.00	-74.78	-103.60	75.09	.00	.00	.00	.00	.00
1991–92	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

Table 32. Computed values of accumulated end-of-month storage change for release scenario of 2.0 cubic feet per second, 1962–2006. —Continued

[Prescribed release is for May through October, with continued releases of 1 cubic foot per second for subsequent months with persisting storage deficits. Negative values indicate storage deficits, which are accumulated. Values of zero indicate a monthend condition at or above the spillway. Positive values are shown only for months when storage deficits end. NA, not applicable]

Year	Computed end-of-month storage, in acre-feet											
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1992–93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1993–94	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1994–95	.00	.00	.00	-31.85	-144.77	222.56	.00	.00	.00	.00	.00	.00
1995–96	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1996–97	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1997–98	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1998–99	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1999–2000	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2000–2001	.00	.00	.00	.00	-1.13	195.78	.00	.00	.00	.00	.00	.00
2001–02	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2002–03	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2003–04	.00	.00	.00	.00	.00	-9.31	172.96	.00	.00	.00	.00	.00
2004–05	.00	-10.59	60.28	-58.34	-113.67	-172.39	-221.09	-264.40	-274.04	-273.31	-209.42	113.24
2005–06	.00	.00	.00	.00	-206.18	-226.30	-273.89	-287.14	-304.11	-317.25	-53.58	605.63
Statistical summary												
Number of values	44	44	44	44	44	44	44	44	44	44	44	44
Mean	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Maximum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
75th percentile	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
50th percentile	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
25th percentile	.00	.00	.00	.00	-54.30	-1.32	.00	.00	.00	.00	.00	.00
Minimum	-142.37	-189.18	-382.37	-524.07	-664.51	-730.03	-761.97	-810.41	-860.03	-905.68	-582.18	-309.61

Table 33. Computed values of accumulated end-of-month storage change for release scenario of 3.0 cubic feet per second, 1962–2006.

[Prescribed release is for May through October, with continued releases of 1 cubic foot per second for subsequent months with persisting storage deficits. Negative values indicate storage deficits, which are accumulated. Values of zero indicate a monthend condition at or above the spillway. Positive values are shown only for months when storage deficits end. NA, Not applicable]

Year	Computed end-of-month storage, in acre-feet											
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1962–63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1963–64	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1964–65	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1965–66	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1966–67	.00	-14.92	99.09	.00	.00	.00	.00	.00	.00	.00	.00	.00
1967–68	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1968–69	.00	.00	.00	.00	.00	-42.68	134.51	.00	.00	.00	.00	.00
1969–70	.00	.00	.00	.00	-110.49	17.06	.00	.00	.00	.00	.00	.00
1970–71	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1971–72	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1972–73	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1973–74	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1974–75	.00	-37.70	-60.25	-157.70	-264.04	-257.36	-84.26	-124.77	-45.03	65.38	.00	.00
1975–76	.00	.00	.00	.00	-28.29	72.66	.00	.00	.00	.00	.00	.00
1976–77	.00	.00	.00	.00	-142.66	-126.24	3.63	.00	.00	.00	.00	.00
1977–78	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1978–79	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1979–80	.00	.00	.00	.00	-86.82	-84.75	275.41	.00	.00	.00	.00	.00
1980–81	.00	.00	-97.99	126.57	-123.72	-154.10	21.68	.00	.00	.00	.00	.00
1981–82	.00	.00	.00	.00	-142.66	-126.24	.00	.00	.00	.00	.00	.00
1982–83	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1983–84	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1984–85	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1985–86	-26.59	-.42	-140.50	-316.45	-425.98	-450.47	-314.66	-277.83	-159.86	38.68	.00	.00
1986–87	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1987–88	.00	.00	.00	.00	-206.01	-409.41	-439.15	-482.14	-520.55	-548.93	-380.27	-124.20
1988–89	163.49	-112.60	-397.67	-664.61	-906.47	-1,033.47	-1,065.41	-1,113.85	-1,163.47	-1,209.12	-791.03	-613.05
1989–90	-507.29	-613.60	-868.27	-1,071.45	-1,178.71	-1,371.87	-1,357.13	-1,336.80	-1,349.23	-1,361.24	-1,250.54	-619.55
1990–91	821.19	.00	.00	.00	-134.28	-224.58	-45.89	124.01	.00	.00	.00	.00
1991–92	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

Table 33.   Computed values of accumulated end-of-month storage change for release scenario of 3.0 cubic feet per second, 1962–2006. —Continued

[Prescribed release is for May through October, with continued releases of 1 cubic foot per second for subsequent months with persisting storage deficits. Negative values indicate storage deficits, which are accumulated. Values of zero indicate a monthend condition at or above the spillway. Positive values are shown only for months when storage deficits end. NA, Not applicable]

Year	Computed end-of-month storage, in acre-feet											
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1992–93	0.00	0.00	0.00	0.00	-34.74	-82.05	27.45	0.00	0.00	0.00	0.00	0.00
1993–94	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1994–95	.00	.00	.00	-93.33	-265.75	40.10	.00	.00	.00	.00	.00	.00
1995–96	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1996–97	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1997–98	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1998–99	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1999–2000	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2000–2001	.00	.00	.00	-21.06	-81.69	53.74	.00	.00	.00	.00	.00	.00
2001–02	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2002–03	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2003–04	.00	.00	.00	.00	-8.53	-79.32	102.95	.00	.00	.00	.00	.00
2004–05	.00	-70.09	-60.70	-180.52	-295.35	-415.55	-464.25	-507.56	-517.20	-516.47	-452.58	-189.42
2005–06	249.43	.00	-28.65	16.22	-265.68	-347.28	-394.87	-408.12	-425.09	-438.23	-174.56	484.65
Statistical summary												
Number of values	44	44	44	44	44	44	44	44	44	44	44	44
Mean	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Maximum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
75th percentile	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
50th percentile	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
25th percentile	.00	.00	.00	.00	-113.80	-82.73	.00	.00	.00	.00	.00	.00
Minimum	-507.29	-613.60	-868.27	-1,071.45	-1,178.71	-1,371.87	-1,357.13	-1,336.80	-1349.23	-1,361.24	-1,250.54	-619.55

Table 34. Computed values of accumulated end-of-month storage change for release scenario of 4.0 cubic feet per second, 1962–2006.

[Prescribed release is for May through October, with continued releases of 1 cubic foot per second for subsequent months with persisting storage deficits. Negative values indicate storage deficits, which are accumulated. Values of zero indicate a monthend condition at or above the spillway. Positive values are shown only for months when storage deficits end. NA, Not applicable]

Year	Computed end-of-month storage, in acre-feet											
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1962–63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1963–64	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1964–65	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1965–66	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1966–67	.00	-74.43	-21.91	581.88	.00	.00	.00	.00	.00	.00	.00	.00
1967–68	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1968–69	.00	.00	.00	.00	-18.77	-122.94	54.25	.00	.00	.00	.00	.00
1969–70	.00	.00	.00	.00	-17.00	-103.94	124.57	.00	.00	.00	.00	.00
1970–71	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1971–72	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1972–73	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1973–74	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1974–75	.00	-97.21	-181.25	-340.19	-506.04	-560.85	-387.75	-428.26	-348.52	-293.65	14.68	.00
1975–76	.00	.00	.00	.00	-87.80	-48.34	216.40	.00	.00	.00	.00	.00
1976–77	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1977–78	.00	-54.47	243.15	.00	.00	.00	.00	.00	.00	.00	.00	.00
1978–79	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1979–80	.00	.00	.00	.00	-146.33	-205.75	154.41	.00	.00	.00	.00	.00
1980–81	.00	.00	-159.48	3.59	-183.23	-275.10	-99.32	149.80	.00	.00	.00	.00
1981–82	.00	.00	.00	.00	-202.17	-247.24	-117.37	-62.07	10.34	.00	.00	.00
1982–83	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1983–84	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1984–85	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1985–86	-88.08	-121.42	-322.99	-560.43	-729.47	-815.45	-679.64	-642.81	-524.84	-381.84	187.42	.00
1986–87	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1987–88	.00	.00	.00	.00	-265.52	-530.41	-560.15	-603.14	-641.55	-669.93	-501.27	-245.20
1988–89	-19.00	-191.11	-537.67	-866.10	-1,167.47	-1,355.96	-1,387.90	-1,436.34	-1,485.96	-1,531.61	-1,113.52	-935.54
1989–90	-891.27	-1,057.09	-1,373.25	-1,637.92	-1,804.69	-2,059.34	-2,044.60	-2,024.27	-2,036.70	-2,048.71	-1,938.01	-1,307.02
1990–91	72.23	.00	.00	.00	-193.79	-345.58	-166.89	-58.48	113.91	.00	.00	.00
1991–92	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

Table 34. Computed values of accumulated end-of-month storage change for release scenario of 4.0 cubic feet per second, 1962–2006. —Continued

[Prescribed release is for May through October, with continued releases of 1 cubic foot per second for subsequent months with persisting storage deficits. Negative values indicate storage deficits, which are accumulated. Values of zero indicate a monthend condition at or above the spillway. Positive values are shown only for months when storage deficits end. NA, Not applicable]

Year	Computed end-of-month storage, in acre-feet											
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1992–93	0.00	0.00	0.00	0.00	-94.25	-203.05	-93.55	-29.50	107.69	0.00	0.00	0.00
1993–94	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1994–95	.00	.00	.00	-154.82	-386.75	-142.39	115.21	.00	.00	.00	.00	.00
1995–96	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1996–97	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1997–98	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1998–99	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1999–2000	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2000–2001	.00	.00	.00	-82.55	-202.69	-128.75	234.13	.00	.00	.00	.00	.00
2001–02	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2002–03	.00	.00	-50.39	-95.48	69.66	.00	.00	.00	.00	.00	.00	.00
2003–04	.00	.00	-17.91	16.94	-68.04	-200.32	-18.05	120.97	.00	.00	.00	.00
2004–05	.00	-129.60	-181.70	-363.01	-537.35	-719.04	-767.74	-811.05	-820.69	-819.96	-756.07	-492.91
2005–06	-115.55	136.65	-90.14	-106.76	-431.95	-575.04	-622.63	-635.88	-652.85	-665.99	-402.32	197.39
Statistical summary												
Number of values	44	44	44	44	44	44	44	44	44	44	44	44
Mean	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Maximum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
75th percentile	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
50th percentile	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
25th percentile	.00	.00	.00	.00	-185.87	-203.73	-36.93	.00	.00	.00	.00	.00
Minimum	-891.27	-1,057.09	-1,373.25	-1,637.92	-1,804.69	-2,059.34	-2,044.60	-2,024.27	-2,036.70	-2,048.71	-1,938.01	-1,307.02

Table 35. Computed values of accumulated end-of-month storage change for release scenario of 5.0 cubic feet per second, 1962–2006.

[Prescribed release is for May through October, with continued releases of 1 cubic foot per second for subsequent months with persisting storage deficits. Negative values indicate storage deficits, which are accumulated. Values of zero indicate a monthend condition at or above the spillway. Positive values are shown only for months when storage deficits end. NA, Not applicable]

Year	Computed end-of-month storage, in acre-feet											
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1962–63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1963–64	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1964–65	.00	.00	.00	.00	-35.17	-71.24	103.65	.00	.00	.00	.00	.00
1965–66	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1966–67	.00	-133.93	-142.90	399.40	.00	.00	.00	.00	.00	.00	.00	.00
1967–68	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1968–69	.00	.00	.00	.00	-78.27	-243.93	-66.74	61.78	.00	.00	.00	.00
1969–70	.00	.00	.00	.00	-229.50	-224.93	3.58	.00	.00	.00	.00	.00
1970–71	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1971–72	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1972–73	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1973–74	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1974–75	.00	-156.71	-302.24	-522.67	-748.02	-864.32	-691.22	-731.73	-651.99	-597.12	-288.79	1,131.58
1975–76	.00	.00	.00	.00	-147.30	-169.33	95.41	.00	.00	.00	.00	.00
1976–77	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1977–78	.00	-113.97	122.16	.00	.00	.00	.00	.00	.00	.00	.00	.00
1978–79	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1979–80	.00	.00	.00	.00	-205.83	-326.74	33.42	.00	.00	.00	.00	.00
1980–81	.00	.00	-220.97	-119.39	-362.12	-515.48	-339.70	-90.58	28.89	.00	.00	.00
1981–82	.00	.00	.00	.00	-261.67	-368.23	-238.36	-183.06	-172.14	-16.20	388.85	.00
1982–83	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1983–84	.00	.00	.00	.00	-59.19	121.16	.00	.00	.00	.00	.00	.00
1984–85	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1985–86	-149.57	-242.41	-505.47	-804.40	-1,032.94	-1,180.41	-1,044.60	-1,007.77	-889.80	-746.80	-177.54	1,064.01
1986–87	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1987–88	.00	.00	.00	-.10	-325.12	-651.50	-681.24	-724.23	-762.64	-791.02	-622.36	-366.29
1988–89	-201.58	-433.19	-841.24	-1,231.16	-1,592.03	-1,842.01	-1,873.95	-1,922.39	-1,972.01	-2,017.66	-1,599.57	-1,421.59
1989–90	-1,438.81	-1,664.13	-2,041.78	-2,367.94	-2,594.21	-2,910.35	-2,895.61	-2,875.28	-2,887.71	-2,899.72	-2,789.02	-2,158.03
1990–91	-840.27	727.28	.00	.00	-253.29	-466.57	-287.88	-179.47	-68.57	79.22	.00	.00
1991–92	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

Table 35. Computed values of accumulated end-of-month storage change for release scenario of 5.0 cubic feet per second, 1962–2006. —Continued

[Prescribed release is for May through October, with continued releases of 1 cubic foot per second for subsequent months with persisting storage deficits. Negative values indicate storage deficits, which are accumulated. Values of zero indicate a monthend condition at or above the spillway. Positive values are shown only for months when storage deficits end. NA, Not applicable]

Year	Computed end-of-month storage, in acre-feet											
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1992–93	0.00	0.00	0.00	0.00	-153.75	-324.04	-214.54	-150.49	-74.79	84.92	0.00	0.00
1993–94	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1994–95	.00	.00	.00	-216.31	-507.74	-324.87	-67.27	163.88	.00	.00	.00	.00
1995–96	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1996–97	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1997–98	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1998–99	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1999–2000	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2000–2001	.00	.00	.00	-144.04	-323.68	-311.23	51.65	.00	.00	.00	.00	.00
2001–02	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2002–03	.00	.00	-111.88	-218.46	-112.82	-163.98	31.66	.00	.00	.00	.00	.00
2003–04	.00	.00	-79.40	-106.04	-233.58	-427.35	-245.08	-167.55	-151.96	-57.84	338.72	.00
2004–05	-10.20	-199.30	-312.89	-555.69	-789.53	-1,032.71	-1,081.41	-1,124.72	-1,134.36	-1,133.63	-1,069.74	-806.58
2005–06	-490.71	-298.01	-449.64	-527.75	-912.44	-1,117.02	-1,164.61	-1,177.86	-1,194.83	-1,207.97	-944.30	-344.59
Statistical summary												
Number of values	44	44	44	44	44	44	44	44	44	44	44	44
Mean	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Maximum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
75th percentile	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
50th percentile	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
25th percentile	.00	.00	.00	-26.59	-255.39	-337.11	-220.50	-105.56	-17.14	.00	.00	.00
Minimum	-1,438.81	-1,664.13	-2,041.78	-2,367.94	-2,594.21	-2,910.35	-2,895.61	-2,875.28	-2,887.71	-2,899.72	-2,789.02	-2,158.03

Table 36. Computed values of accumulated end-of-month storage change for release scenario of 6.0 cubic feet per second, 1962–2006.

[Prescribed release is for May through October, with continued releases of 1 cubic foot per second for subsequent months with persisting storage deficits. Negative values indicate storage deficits, which are accumulated. Values of zero indicate a monthend condition at or above the spillway. Positive values are shown only for months when storage deficits end. NA, Not applicable]

Year	Computed end-of-month storage, in acre-feet											
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1962–63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1963–64	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1964–65	.00	.00	.00	.00	-94.67	-192.23	-17.34	188.40	.00	.00	.00	.00
1965–66	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1966–67	.00	-193.43	-263.89	216.92	.00	-8.84	329.17	.00	.00	.00	.00	.00
1967–68	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1968–69	.00	.00	-10.96	490.59	-137.77	-364.92	-187.73	-59.21	74.20	.00	.00	.00
1969–70	.00	.00	.00	.00	-289.00	-345.92	-117.41	-49.55	95.09	.00	.00	.00
1970–71	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1971–72	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1972–73	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1973–74	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1974–75	.00	-216.21	-423.23	-705.15	-99.00	-1,167.79	-994.69	-1,035.20	-955.46	-900.59	-592.26	768.61
1975–76	.00	.00	.00	.00	-206.80	-290.32	-25.58	186.41	.00	.00	.00	.00
1976–77	.00	.00	.00	.00	.00	-12.05	194.22	.00	.00	.00	.00	.00
1977–78	.00	-173.47	1.17	.00	-38.26	76.17	.00	.00	.00	.00	.00	.00
1978–79	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1979–80	.00	.00	.00	-5.50	-270.83	-453.23	-93.07	116.53	.00	.00	.00	.00
1980–81	.00	.00	-282.46	-242.37	-544.60	-759.45	-583.67	-334.55	-276.57	-256.73	-106.60	162.30
1981–82	.00	.00	-27.25	477.45	-321.17	-489.22	-359.35	-304.05	-293.13	-192.73	212.32	.00
1982–83	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1983–84	.00	.00	.00	.00	-118.69	.17	.00	.00	.00	.00	.00	.00
1984–85	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1985–86	-211.06	-363.40	-687.95	-1,048.37	-1,336.41	-1,545.37	-1,409.56	-1,372.73	-1,254.76	-1,111.76	-542.50	639.55
1986–87	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1987–88	.00	.00	.00	-61.59	-446.11	-833.98	-863.72	-906.71	-945.12	-973.50	-804.84	-548.77
1988–89	-445.55	-736.66	-1,206.20	-1,657.61	-2,077.98	-2,389.45	-2,421.39	-2,469.83	-2,519.45	-2,565.10	-2,147.01	-1,969.03
1989–90	-2,047.74	-2,332.56	-2,771.70	-3,159.35	-3,445.12	-3,822.75	-3,808.01	-3,787.68	-3,800.11	-3,812.12	-3,701.42	-3,070.43
1990–91	-1,814.16	-306.11	178.85	.00	-312.79	-587.56	-408.87	-300.46	-189.56	-97.31	306.44	.00
1991–92	.00	.00	.00	.00	-19.70	-56.08	356.61	.00	.00	.00	.00	.00

Table 36. Computed values of accumulated end-of-month storage change for release scenario of 6.0 cubic feet per second, 1962–2006. —Continued

[Prescribed release is for May through October, with continued releases of 1 cubic foot per second for subsequent months with persisting storage deficits. Negative values indicate storage deficits, which are accumulated. Values of zero indicate a monthend condition at or above the spillway. Positive values are shown only for months when storage deficits end. NA, Not applicable]

Year	Computed end-of-month storage, in acre-feet											
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1992–93	0.00	0.00	0.00	0.00	-213.25	-445.03	-335.53	-271.48	-195.78	-91.61	588.60	0.00
1993–94	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1994–95	.00	.00	-55.99	-333.79	-684.72	-563.34	-305.74	-74.59	170.77	.00	.00	.00
1995–96	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1996–97	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1997–98	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1998–99	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1999–2000	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2000–2001	.00	.00	.00	-205.53	-444.67	-493.71	-130.83	87.16	.00	.00	.00	.00
2001–02	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2002–03	.00	.00	-173.37	-341.44	-295.30	-407.95	-212.31	-111.40	-17.97	152.58	.00	.00
2003–04	.00	.00	-140.89	-229.02	-416.06	-671.32	-489.05	-411.52	-395.93	-357.35	-22.28	384.95
2004–05	-71.69	-320.29	-495.37	-799.66	-1,093.00	-1,397.67	-1,446.37	-1,489.68	-1,499.32	-1,498.59	-1,434.70	-1,171.54
2005–06	-917.16	-783.96	-997.08	-1,136.68	-1,580.87	-1,846.94	-1,894.53	-1,907.78	-1,924.75	-1,937.89	-1,674.22	-1,074.51
Statistical summary												
Number of values	44	44	44	44	44	44	44	44	44	44	44	44
Mean	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Maximum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
75th percentile	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
50th percentile	.00	.00	.00	.00	-28.98	-10.45	.00	.00	.00	.00	.00	.00
25th percentile	.00	.00	-34.44	-97.58	-344.89	-511.12	-341.49	-278.73	-191.12	-93.03	.00	.00
Minimum	-2,047.74	-2,332.56	-2,771.70	-3,159.35	-3,445.12	-3,822.75	-3,808.01	-3,787.68	-3,800.11	-3,812.12	-3,701.42	-3,070.43

Table 37. Computed values of accumulated end-of-month storage change for release scenario of 7.0 cubic feet per second, 1962–2006.

[Prescribed release is for May through October, with continued releases of 1 cubic foot per second for subsequent months with persisting storage deficits. Negative values indicate storage deficits, which are accumulated. Values of zero indicate a monthend condition at or above the spillway. Positive values are shown only for months when storage deficits end. NA, not applicable]

Year	Computed end-of-month storage, in acre-feet											
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1962–63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1963–64	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1964–65	.00	.00	.00	.00	-154.18	-313.22	-138.33	5.92	.00	.00	.00	.00
1965–66	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1966–67	.00	-252.94	-384.88	34.45	.00	-70.32	267.69	.00	.00	.00	.00	.00
1967–68	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1968–69	.00	.00	.00	367.63	-197.28	-485.91	-308.72	-180.20	-108.28	-6.86	345.82	.00
1969–70	.00	.00	-72.44	.00	-348.51	-466.91	-238.40	-170.54	-87.39	80.92	.00	.00
1970–71	.00	.00	.00	.00	.00	-7.09	443.97	.00	.00	.00	.00	.00
1971–72	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1972–73	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1973–74	.00	.00	.00	.00	-3.08	-30.22	314.20	.00	.00	.00	.00	.00
1974–75	.00	-275.72	-544.22	-887.62	-1,231.98	-1,471.25	-1,298.15	-1,338.66	-1,258.92	-1,204.05	-895.72	465.15
1975–76	.00	.00	.00	.00	-266.31	-411.31	-146.57	3.93	.00	.00	.00	.00
1976–77	.00	.00	.00	.00	-5.22	-78.75	127.52	.00	.00	.00	.00	.00
1977–78	.00	-232.98	-119.82	275.63	-97.77	-44.82	197.68	.00	.00	.00	.00	.00
1978–79	.00	.00	.00	.00	-46.08	-77.06	317.78	.00	.00	.00	.00	.00
1979–80	-30.90	211.65	.00	-66.98	-391.82	-635.70	-275.54	-65.94	-5.68	105.75	.00	.00
1980–81	.00	.00	-343.94	-365.33	-727.07	-1,003.40	-827.62	-578.50	-520.52	-500.68	-350.55	-141.15
1981–82	4,052.52	.00	-88.73	354.49	-380.68	-610.21	-480.34	-425.04	-414.12	-313.72	29.84	.00
1982–83	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1983–84	.00	.00	.00	.00	-178.20	-120.82	72.39	.00	.00	.00	.00	.00
1984–85	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1985–86	-272.54	-484.39	-870.42	-1,292.32	-1,639.87	-1,910.31	-1,774.50	-1,737.67	-1,619.70	-1,476.70	-907.44	274.61
1986–87	.00	.00	.00	-21.80	293.18	.00	.00	.00	.00	.00	.00	.00
1987–88	.00	.00	.00	-123.07	-567.10	-1,016.45	-1,046.19	-1,089.18	-1,127.59	-1,155.97	-987.31	-731.24
1988–89	-689.50	-1,040.12	-1,571.14	-2,084.03	-2,563.91	-2,936.86	-2,968.80	-3,017.24	-3,066.86	-3,112.51	-2,694.42	-2,516.44
1989–90	-2,656.63	-3,000.96	-3,501.58	-3,950.71	-4,295.99	-4,735.10	-4,720.36	-4,700.03	-4,712.46	-4,724.47	-4,613.77	-3,982.78
1990–91	-2,787.99	-1,339.45	-915.97	-804.97	-1,177.27	-1,513.52	-1,334.83	-1,226.42	-1,115.52	-1,023.27	-619.52	189.62
1991–92	.00	.00	.00	.00	-79.21	-177.07	235.62	.00	.00	.00	.00	.00

Table 37. Computed values of accumulated end-of-month storage change for release scenario of 7.0 cubic feet per second, 1962–2006. —Continued

[Prescribed release is for May through October, with continued releases of 1 cubic foot per second for subsequent months with persisting storage deficits. Negative values indicate storage deficits, which are accumulated. Values of zero indicate a monthend condition at or above the spillway. Positive values are shown only for months when storage deficits end. NA, not applicable]

Year	Computed end-of-month storage, in acre-feet											
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1992–93	-53.31	130.65	0.00	-10.52	-283.28	-576.54	-467.04	-402.99	-327.29	-223.12	457.09	0.00
1993–94	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1994–95	.00	.00	-117.47	-456.75	-867.19	-807.29	-549.69	-318.54	-134.67	112.22	.00	.00
1995–96	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1996–97	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1997–98	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1998–99	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1999–2000	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2000–2001	.00	.00	.00	-267.01	-565.66	-676.18	-313.30	-95.31	146.50	.00	.00	.00
2001–02	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2002–03	.00	.00	-234.85	-464.40	-477.77	-651.90	-456.26	-355.35	-323.41	-208.40	416.77	.00
2003–04	.00	.00	-202.37	-351.98	-598.53	-915.27	-733.00	-655.47	-639.88	-601.30	-266.23	141.00
2004–05	-133.17	-441.28	-677.84	-1,043.61	-1,396.46	-1,762.61	-1,811.31	-1,854.62	-1,864.26	-1,863.53	-1,799.64	-1,536.48
2005–06	-1,343.58	-1,269.89	-1,544.49	-1,745.57	-2,249.27	-2,576.82	-2,624.41	-2,637.66	-2,654.63	-2,667.77	-2,404.10	-1,804.39
Statistical summary												
Number of values	44	44	44	44	44	44	44	44	44	44	44	44
Mean	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Maximum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
75th percentile	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
50th percentile	.00	.00	.00	.00	.00	-99.78	.00	.00	.00	.00	.00	.00
25th percentile	.00	.00	-140.46	-288.25	-566.02	-708.96	-497.68	-408.50	-349.00	-245.77	.00	.00
Minimum	-2,787.99	-3,000.96	-3,501.58	-3,950.71	-4,295.99	-4,735.10	-4,720.36	-4,700.03	-4,712.46	-4,724.47	-4,613.77	-3,982.78

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