

Neches River Basin Water Availability Model Report

Neches Water Availability Model (WAM) Update
Texas Commission on Environmental Quality

August 27, 2021

Team Members

HDR Engineering, Inc.
Freese and Nichols, Inc.
Robert J. Brandes Consulting
Kennedy Resource Company
Susan Roth Consulting, LLC
Baer Engineering & Environmental Consulting, Inc.

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by

HDR Engineering, Inc.


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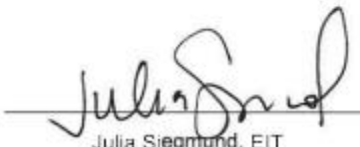
Zachary A. Stein, PE
HDR Engineering, Inc.



27 Aug 2021



Samuel K. Vaughn, PE
HDR Engineering, Inc.



Julia Siegmund, EIT
HDR Engineering, Inc.

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Acronyms

acft	acre-feet
BPI	Bureau of Plant Industry
cfs	cubic feet per second
ECHO	Enforcement and Compliance History Online database
FNI	Freese and Nichols, Inc.
HDR	HDR Engineering, Inc.
ICIS	Integrated Compliance Information System database
LNVA	Lower Neches Valley Authority
mgd	million gallons per day
Neches WAM	Neches River Basin Water Availability Model
TCEQ	Texas Commission on Environmental Quality
TNRCC	Texas Natural Resource Conservation Commission
TWDB	Texas Water Development Board
UNRMWA	Upper Neches River Municipal Water Authority
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
WAM	water availability model
WRAP	Water Rights Analysis Package

Executive Summary

Pursuant to House Bill 723, 86th Texas Legislature, 2019, the Texas Commission on Environmental Quality (TCEQ) was directed to develop updated water availability models for the Brazos River, Neches River, Red River, and Rio Grande River basins. The TCEQ engaged the professional services of a team led by HDR Engineering, Inc. (HDR)¹ to extend and refine the naturalized streamflow and net evaporation datasets through December 2018 for the Neches River Basin Water Availability Model (Neches WAM).

This report provides the detailed technical approach applied to update the existing datasets and extend these datasets through 2018. In this report, the existing Neches WAM datasets have a period of record of 1940 to 1996, referred to as the existing period; the period, 1997 to 2018, is referred to as the extension period. The extension of the existing datasets provides an additional 22 years to the period of record of the Neches WAM, an increase of almost 40 percent, and includes the recent drought generally occurring in the basin from the mid-2000s to mid-2010s.

Naturalized streamflows were updated at all 20 primary control points included in the existing dataset and net evaporation estimates were updated at each major permitted reservoir in the Neches River Basin with an authorized storage greater than 5,000 acre-feet (acft). The completed naturalized flow and net evaporation datasets organized by primary control point and reservoir can be found in **Appendix A** and **Appendix B**, respectively. Summary tables of water rights and return flow discharge locations included in the naturalized flow update can be found in **Appendix C** and **Appendix D**, respectively.

Methodology

The extension and refinement of the datasets was accomplished using substantially the same methodology applied in the development of original datasets with the following exceptions:

- Historical monthly rainfall estimates used in the development of the naturalized flow and net evaporation datasets were computed using Texas Water Development Board (TWDB) quadrangle data and an inverse distance weighting procedure. This procedure replaced individual station records used in the development of the existing datasets for the 1940 to 1996 period. Comparisons of the computed monthly rainfall using the quadrangle data and individual station records suggest the computed data is not significantly different and the use of the quadrangle data will expedite future updates.
- The existing naturalized flow dataset includes the frequent occurrence of total negative naturalized flows for the July through November months at primary control points throughout the basin. These total negative flows become prevalent at primary control points following the construction of a major reservoir upstream of the control point location. During the update, the apparent cause of the negative naturalized flows in the dataset was found to be inaccurate estimates of gross evaporation from reservoirs. Findings from a supplemental evaluation indicate the pan coefficients used by the TWDB did not provide an accurate estimate of evaporation from reservoirs in the Neches River Basin when applied to historical

¹ Additional members of the team led by HDR include: Freese & Nichols, Inc. (FNI), Baer Engineering & Environmental Consulting, Inc. (Baer), Susan Roth Consulting, LLC (SRC), Robert J. Brandes Consulting (RJBC), and Kennedy Resource Company (KRC).

pan data. Findings from the evaluation indicate pan coefficients developed for the Young Screened Pan applied to Class A pan data provide a more accurate estimation of gross evaporation in the Neches River Basin. The TWDB quadrangle evaporation data was adjusted to improve gross evaporation estimates in the existing and the extension periods. The adjustments resulted in over an 80 percent reduction in the occurrence of total negative naturalized flows at primary control points throughout the basin. Procedures for adjusting the evaporation data are summarized in **Section 5.6** and the 11 March 2021 HDR technical memorandum summarizing findings of the supplemental evaluation is included in **Appendix E**.

- Statistical relationships were used to estimate naturalized flow when historical flow data is not available at primary control point locations. These statistical relationships were developed using naturalized streamflow at one or more control points for overlapping periods when historical flows are available. Statistical relationships for each control point requiring the fill of missing naturalized flows in the existing naturalized flow dataset were revisited using linear and non-linear regression techniques. All statistical relationships used in the development of the existing data were updated to account for changes made to the naturalized flow dataset in the existing period as part of the update and in consideration of the extended period, which provides a greater length of concurrent records for many control points. **Appendix F** provides a comparison summary of the relationships and coefficient of determination values from the original and updated statistical relationships for all linear and non-linear regression techniques applied. All updated relationships selected for use in updating the naturalized flow datasets resulted in an increase in the coefficient of determination (r^2) value when compared to the relationships used in the development of the original dataset. The average r^2 value of the updated relationships is 0.90, indicating the relationship explains 90 percent of the variation in the dependent variable.

Comparison of Historical Droughts

The updated naturalized flow dataset was used to compare drought periods occurring in the extension period (1997-2018) to those present in the existing period (1940-1996). Naturalized streamflows at selected primary control point locations were reviewed for short-term (6-month and annual) and long-term (3-, 5-, and 7-year) drought duration periods. Additional details of the comparison are summarized in **Section 10** and comparison figures at each of the selected primary control points are provided in **Appendix G**.

A summary follows of findings from the drought comparisons at the selected streamflow.

- The most significant periods of drought occurred throughout the Neches and Angelina River Basins during the 1950s, 1960s, and mid-2000s to mid-2010s. A significant period of drought also occurred in the upper Neches basin during the late 1970s to the mid-1980s.
- The lowest 6-month naturalized streamflow periods throughout the Neches and Angelina River Basins occurred during the summer and fall of 1956.
- The lowest naturalized flow total occurring during a calendar year was 1964 in the upper Neches River Basin and 2006 in the upper Angelina River Basin. The 2011 calendar year naturalized flow was the lowest for all other selected streamflow locations.

- The longer-term drought periods (3-, 5-, and 7-years) are generally similar in severity with the most severe period often varying depending on the duration considered. However, comparison of longer term drought periods shows that the most severe drought periods occurred in the existing period of record (prior to 1997) at all the selected primary control point locations.

Hydrologic Trends

The updated naturalized flow and net evaporation datasets were reviewed to identify the presence of long-term trends. Annual naturalized flow, annual rainfall, and annual runoff as a percentage of rainfall were investigated for trends at selected primary control point locations. The investigation of these hydrologic parameters considered the cumulative contributing drainage area of the selected locations². Trends in annual gross evaporation were also investigated at three key water supply reservoirs in the basin: Sam Rayburn Reservoir, Lake Palestine, and Lakes Tyler and Tyler East.

A statistical analysis was completed for the 1940 through 2018 updated period of record of the datasets using linear regression techniques to identify long-term trends. Results of the statistical analysis indicate that no significant long-term trends are present in naturalized streamflow, rainfall, or runoff as a percentage of rainfall. Results of the analysis did identify a significant long-term trend in gross evaporation. Based on the statistical analysis, an increasing trend between 0.17 and 0.20 inches per year in gross evaporation was identified at the three reservoirs.

² Annual rainfall of the cumulative contributing watersheds of the selected primary control points was calculated using TWDB quadrangle rainfall data and a weighted average procedure.

1 Introduction

Pursuant to House Bill 723, 86th Texas Legislature, 2019, the Texas Commission on Environmental Quality (TCEQ) was directed to develop updated water availability models for the Brazos River, Neches River, Red River, and Rio Grande River basins. The TCEQ engaged the professional services of a team led by HDR Engineering, Inc. (HDR)³ to extend and refine the naturalized streamflow and net evaporation datasets through December 2018 for the Neches River Basin Water Availability Model (Neches WAM).

Naturalized streamflows are the flows that would have occurred in the absence of human activities such as reservoir development, diversions, and return flows. These naturalized flows are based on historical hydrologic records, as adjusted to remove the influence of water management activities. Net evaporation is the water lost or gained from the surface of a reservoir resulting from rainfall and evaporation.

The naturalized flows and net evaporation datasets are used as input to the WAM, which simulates the operations of existing water rights considering their diversion locations, permit conditions, and relative priority under Texas water law using the Water Rights Analysis Package (WRAP)⁴. The existing Neches WAM datasets have a period of record of 1940 to 1996, referred to as the existing period. This report provides the detailed technical approach applied to update the existing datasets and to extend these datasets through 2018, referred to as the extension period. This report includes the following technical information related to the project.

- Existing Neches WAM
- Methodology for Updating Existing Naturalized Streamflow Dataset
- Methodology for Updating Existing Net Evaporation Dataset
- Procedures for Collecting and Estimating Missing Hydrologic and Water Management Data
- Procedures for Updating Existing Statistical Relationships in the Naturalized Flow Datasets
- Procedures for Addressing Negative Naturalized Flows
- Procedures for Addressing Negative Incremental Naturalized Flows
- Procedures for Incorporating Extended Datasets in the TCEQ Neches WAM
- Comparison of Historical Droughts
- Hydrologic Trends
- Independent Peer Review
- Procedures for Incorporating Updated Datasets in the TCEQ Neches WAM

³ Additional members of the team led by HDR include: Freese & Nichols, Inc. (FNI), Baer Engineering & Environmental Consulting, Inc. (Baer), Susan Roth Consulting, LLC (SRC), Robert J. Brandes Consulting (RJBC), and Kennedy Resource Company (KRC).

⁴ The WRAP modeling system is maintained by Texas A&M University and provides capabilities for computer simulation of the management of the water resources of river and reservoir systems.
<https://wrap.engr.tamu.edu/wrap-description/>

2 Existing Neches Water Availability Model

Pursuant to Senate Bill 1, 75th Texas Legislature, 1997, the predecessor agency to the TCEQ, the Texas Natural Resource Conservation Commission (TNRCC), was directed to develop new simulation models in order to determine water availability in all river and coastal basins within Texas. The TNRCC retained Brown & Root Services to provide technical assistance for developing the Neches WAM. Freese and Nichols, Inc., Espey-Padden Consultants, and Crespo Consulting Engineers served as sub-consultants to Brown & Root in this effort. Naturalized streamflows were developed for selected United States Geological Survey (USGS) gage locations as well as specific reservoir sites in the Neches River Basin for each month over the historical period of 1940 to 1996. Development of the existing Neches WAM required developing historical naturalized streamflows and net evaporation datasets using historical hydrologic and water management data from the Neches River Basin.

The following technical resources were available to assist in understanding the methods used to develop the existing naturalized flow and evaporation datasets for the Neches WAM.

- 1998 Original Work Plan developed and provided by Freese and Nichols, Inc. (FNI);
- 2000 Neches River Basin Water Availability Study Final Report (Revised Version No. 6) developed by Brown & Root and subconsultants FNI, Espey-Padden Consultants, and Crespo Consulting Engineers and provided to HDR by the TCEQ; and
- Original Neches River Basin naturalized flow workbooks provided by the TCEQ and FNI. These workbooks were confirmed to be the complete set used to calculate the existing datasets with the exception of the workbooks used to develop the statistical relationships between control points and the evaporation datasets for Lake Columbia (not constructed) and Lake Naconiche (not constructed at the time of existing dataset development).

2.1 Primary Control Points

Table 1 lists the primary control points included in the existing naturalized flow datasets and the period of record of available recorded streamflow or reservoir inflows. **Figure 1** provides the primary control point locations and periods of record of historical streamflow and major reservoirs (over 5,000 acre-feet of permitted storage) in the Neches River Basin. **Figure 2** shows a timeline of the periods of records for each of the primary control points. These control points were selected for inclusion in the existing naturalized flow datasets using the following criteria:

- Locations with streamflow gages with over 25 years of record and drainage areas greater than 80 square miles, except for the Angelina River near Horger gage, which is very near Sam Rayburn Dam.
- Reservoirs with data from which historical inflows can be determined except for Lake B.A. Steinhagen, which is represented by the Neches River gage at Town Bluff.

Table 1. Summary of Primary Control Points Included in Naturalized Flow Update

Control Point	I.D.	Type	Period of Record
Kickapoo Creek near Brownsboro	KIBR	USGS Gage	5/1962-9/1989
Lake Palestine Dam	NEPA	Reservoir	2/1962-Present
Neches River at Neches	NENE	USGS Gage	1/1939-Present
Neches River near Alto	NEAL	USGS Gage	1/1944-12/1978
Neches River near Diboll	NEDI	USGS Gage	10/1923-9/1925 & 3/1939-9/1985 & 10/2014-Present
Neches River near Rockland	NERO	USGS Gage	7/1903-Present
Lakes Tyler and Tyler East Dams	MUTY	Reservoir	3/1949-Present
Mud Creek near Jacksonville	MUJA	USGS Gage	3/1939-9/1979 & 8/2001-Present
East Fork Angelina near Cushing	EFACU	USGS Gage	1/1964-9/1989 & 10/2015-Present
Angelina River near Alto	ANAL	USGS Gage	10/1940-3/1949 (sporadic) & 3/1959–Present
Angelina River near Lufkin	ANLU	USGS Gage	10/1923-9/1934 & 8/1939-9/1979
Attoyac Bayou near Chireno	ATCH	USGS Gage	7/1939-10/1954 & 10/1955-9/1985
Ayish Bayou near San Augustine	AYSA	USGS Gage	3/1959-9/1985
Sam Rayburn Dam	ANSR	Reservoir	1/1965-Present
Neches River at Town Bluff	NETB	USGS Gage	4/1951-Present
Neches River at Evadale	NEEV	USGS Gage	4/1921-Present
Village Creek near Kountze	VIKO	USGS Gage	3/1939-Present
Pine Island Bayou near Sour Lake	PISL	USGS Gage	10/1967-Present
Neches River at Beaumont	NEBA	---	None ¹
Neches River at Sabine Lake	NESL	---	None

1-U.S. Geological Survey (USGS) Gage 8041780 (Neches River Saltwater Barrier at Beaumont) is located at the NEBA control point and has a period of record of 6/2003 to present. However, this gage is influenced by tidal flows and records from this gage are not considered suitable for use in developing naturalized flows.

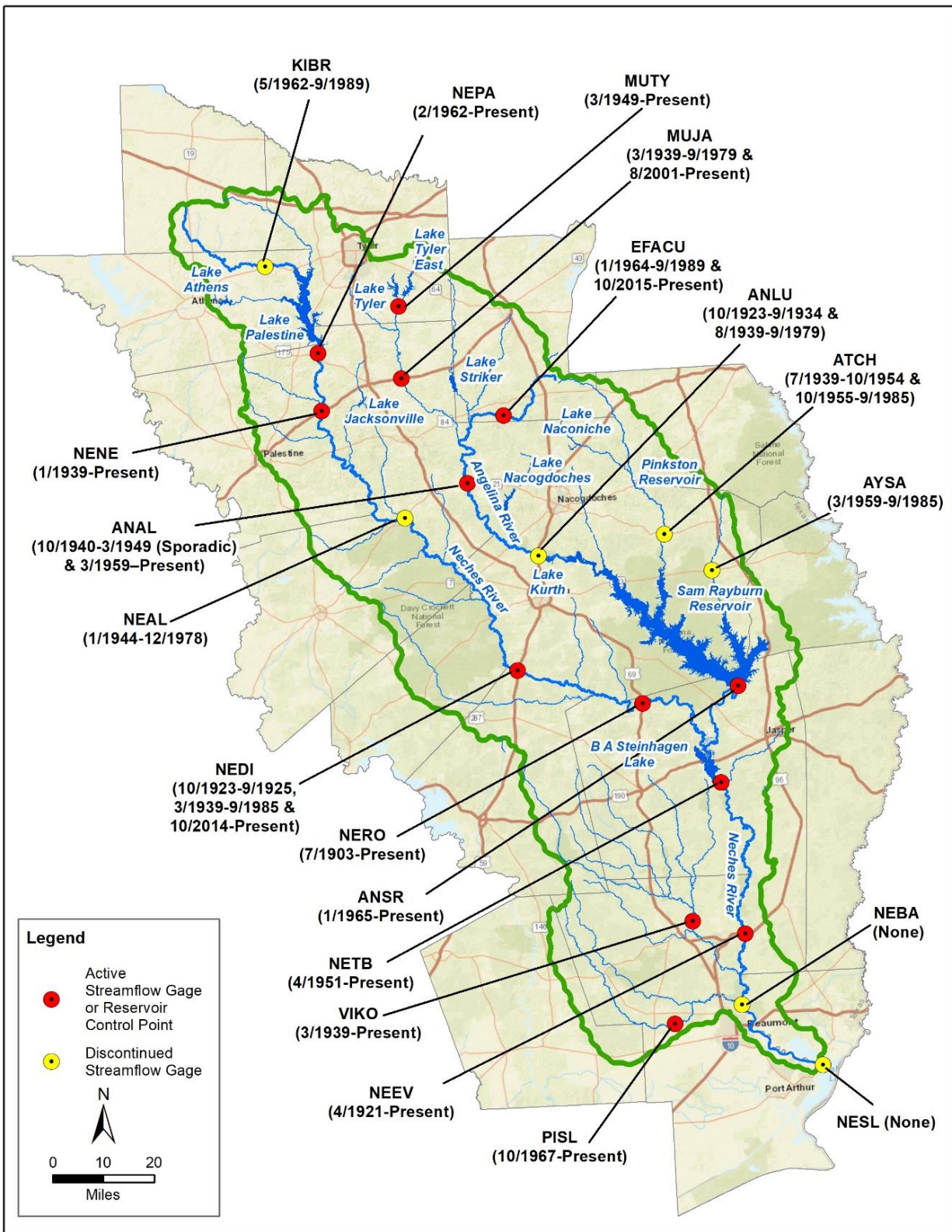


Figure 1. Location Map of Primary Control Points

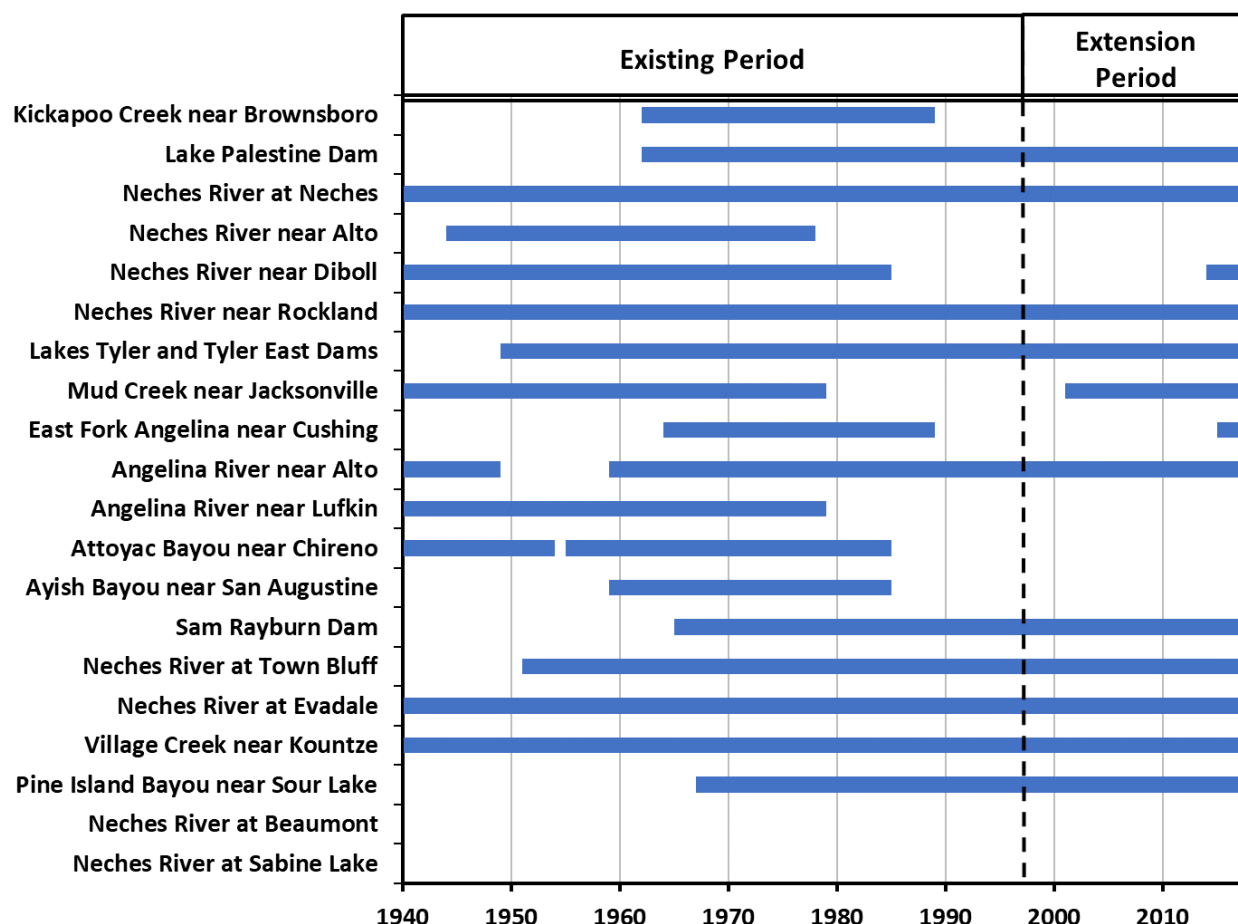


Figure 2. Timeline of Historical Streamflow Periods of Record for Primary Control Points

3 Methodology for Updating Existing Naturalized Streamflow Dataset

The following methodology was applied to update the existing naturalized flow dataset and extend the period of record through 2018. The existing naturalized flow workbooks were modified to include the extension period and updated statistical relationships for estimating naturalized flows when historical streamflow is not available. New workbooks were created to calculate evaporation rates and content change for Lake Naconiche and evaporation rates for Lake Columbia.

3.1 Primary Control Points

Since the development of the existing Neches WAM, no long-term stream gages have been installed in the Neches River Basin, and the only major reservoir constructed was Lake Naconiche in 2009. As a result, no additional control points were added to the existing naturalized flow dataset as part of the update.

3.2 Naturalization of Streamflow

The extension of naturalized streamflow at the selected control points was accomplished using substantially the same methodology as the original streamflow naturalization. Naturalized streamflow

data are based on historical flows, adjusted to remove the effects of water management activities. Naturalized streamflows were calculated on a monthly timestep for consistency with the existing dataset and the simulation timestep of the Neches WAM. As a result of the monthly timestep, travel time is neglected in the streamflow naturalization procedures. The following equation was used to calculate naturalized streamflow at each primary control point.

$$\textbf{Naturalized Flow} = \textbf{Historical Flow} + \textbf{Upstream Diversions} - \textbf{Upstream Return Flows} \\ + \textbf{Changes in Upstream Reservoir Contents} + \textbf{Upstream Reservoir Net Evaporation}$$

Following are several instances where reservoirs make releases for diversion and use downstream at one or more locations that are below downstream primary control points. In the computation of naturalized flows, these releases are treated as diversions at the point of use and not at the reservoirs.

- The Upper Neches River Municipal Water Authority (UNRMWA) makes releases from Lake Palestine for downstream diversion by the City of Palestine at Rocky Point Diversion Dam on the Neches River.
- The Lower Neches Valley Authority (LNVA) releases water from Sam Rayburn Reservoir and Lake B. A. Steinhagen for downstream water users.
- The Angelina and Nacogdoches Counties Water Control and Improvement District #1 (ANCWCID#1) made releases from Lake Striker until the 1990s for downstream diversion into Lake Kurth for use by the Lufkin Paper Mill.

Channel losses were not included in the development of the existing naturalized streamflow dataset. The 2000 *Neches River Basin Water Availability Study Final Report* includes the following statement regarding the consideration of channel losses.

“According to TWDB major and minor aquifer maps, the upper portion of the Neches River Basin contains outcrops of the Carizzo-Wilcox, Queen City and Sparta aquifers. The lower portion of the basin overlies the Gulf Coast aquifer. There may be some localized channel losses due to recharge of these aquifers or bank storage. However, given the relatively high rainfall in the basin and resulting high recharge into these aquifers, it is unlikely that significant channel losses occur in the Neches River Basin. This assumption was borne out in the investigation of negative incremental inflows during the creation of naturalized flows. In most cases, the negative incremental inflows could be explained by problems with a particular gage, inaccurate spill estimates from reservoirs, or timing problems. There is no evidence of consistent channel losses in the Neches River Basin; therefore, channel losses were not derived in this study.”

HDR generally concurs with the opinions of the authors of the original Neches WAM report that natural channel losses represent a negligible component of the water balance in the Neches River Basin. Therefore, the development of channel loss estimates and integration of channel losses into flow naturalization procedures was not included as a part of the update.

4 Methodology for Updating Existing Evaporation Dataset

The existing evaporation dataset includes net evaporation estimates at each major permitted reservoir in the Neches River Basin with an authorized storage greater than 5,000 acre-feet (acft). Extending the evaporation datasets was accomplished using substantially the same methodology used in the development of the existing datasets and is based on the following equation:

$$\text{Net Reservoir Evaporation} = \text{Gross Reservoir Evaporation} - \text{Rainfall} + \text{Runoff Adjustment}$$

The evaporation dataset for the existing period includes the major reservoirs listed in **Table 2**. The only major reservoir with a storage greater than 5,000 acft to have been permitted during the extension period in the Neches River Basin is Lake Naconiche with a priority date of 30 April 1997. Lake Naconiche is already included in the existing evaporation dataset and was updated and extended as part of the project. **Table 2** also lists the Texas Water Development Board (TWDB) quadrangle weighting factors used in the development of the gross evaporation component for each major reservoir in the existing evaporation dataset, and **Figure 3** provides the locations of the major reservoirs in relation to the TWDB quadrangles, where gross evaporation data are reported. The quadrangle weighting factors used for the existing period are based on the approximate centroid of each reservoir and were reviewed before being used for the extension period. Quadrangle weighting factors used for Sam Rayburn Reservoir in the existing dataset development were found to be inaccurate and were revised for the update.

The runoff adjustment accounts for the runoff from rainfall that would have resulted in the absence of the reservoir. **Table 2** includes the USGS streamflow gages used to calculate the runoff adjustment for the updated datasets. The monthly streamflow data is converted to a unit runoff depth using the contributing drainage area of the streamflow gage.

The gages originally used for the existing dataset for the 1940 to 1996 period were not revised except for the Angelina River near Zavalla gage (USGS 08038500). The Zavalla gage was used during the 1950s period to estimate the runoff adjustment in the existing evaporation dataset for Lakes Nacogdoches, Naconiche, Kurth and Sam Rayburn Reservoir. Per the Texas Department of Water Resources Report 244, Southland Paper Mills pumped approximately 22 cubic feet per second (cfs) from wells prior to August 1956, of which approximately 18 cfs was later discharged into Mill Creek upstream of the gage. After August 1956, approximately 28 cfs was pumped from wells and approximately 24 cfs was discharged into Mill Creek. These discharges influence recordings at the Zavalla gage and result in inaccurate estimates of runoff adjustment at the aforementioned reservoirs. The gages used in place of Zavalla gage are shown in **Table 2**. The runoff component of the evaporation calculation is further discussed in **Section 5**.

Table 2. Summary of Reservoirs Included in Evaporation Dataset and Sources of Data

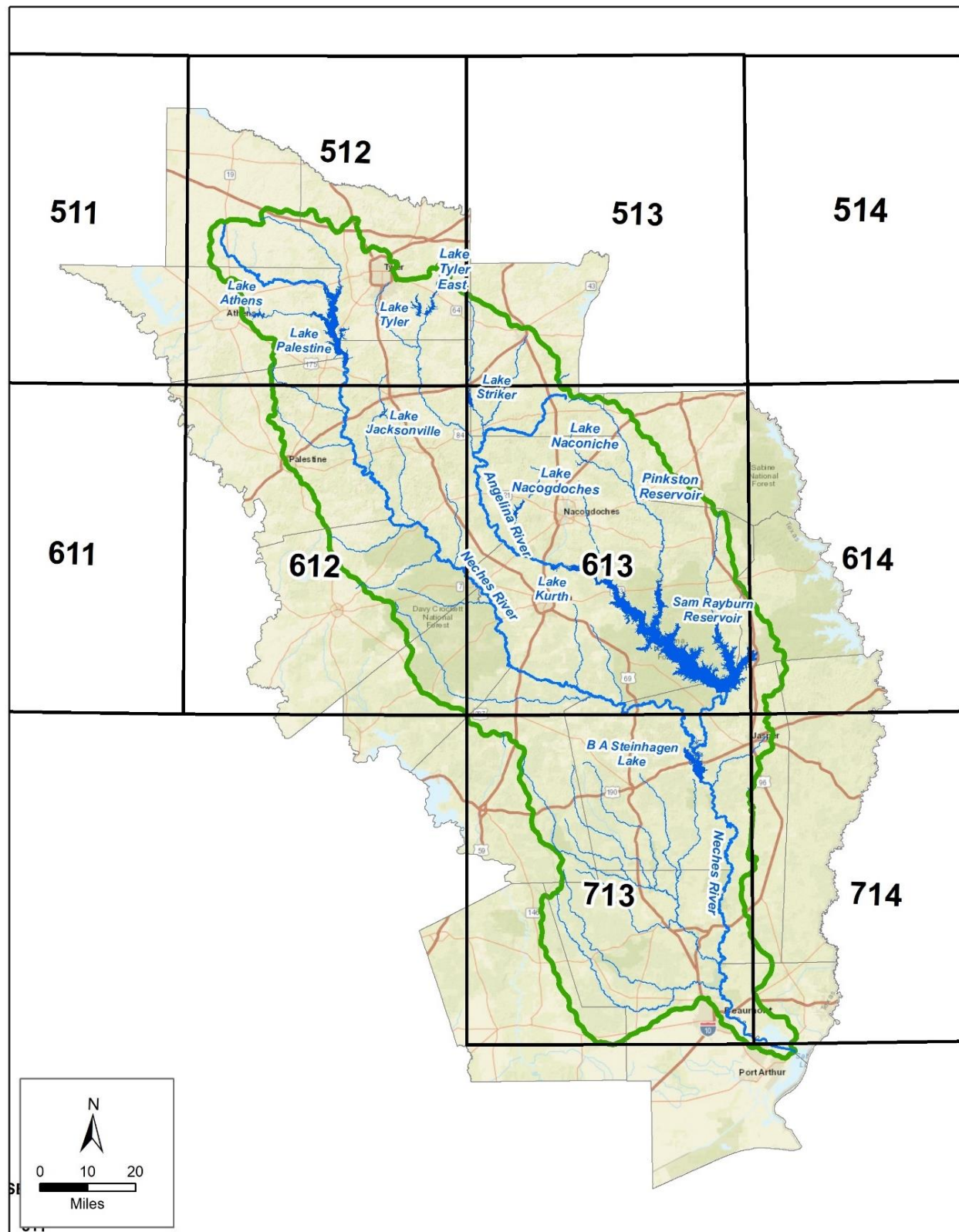
Reservoir	Sources of Data	
	Quadrangle Weighting Factors Used in Original Dataset Development	Gages for Runoff Adjustment
Athens	$0.18 \times 511 + 0.13 \times 611 + 0.51 \times 512 + 0.18 \times 612$	1/1940-4/1962 Neches River at Neches
		5/1962-9/1989 Kickapoo Creek near Brownsboro
		10/1989-12/2018 Big Sandy Creek near Big Sandy
Palestine	$0.68 \times 512 + 0.32 \times 612$	1/1940-4/1962 Neches River at Neches
		5/1962-9/1989 Kickapoo Creek near Brownsboro
		10/1989-12/2018 Big Sandy Creek near Big Sandy
Jacksonville	$0.25 \times 512 + 0.35 \times 612 + 0.19 \times 513 + 0.21 \times 613$	1/1940-12/1948 Mud Creek near Jacksonville
		1/1949-4/1962 Neches River at Neches
		5/1962-9/1989 Kickapoo Creek near Brownsboro
		10/1989-9/2015 Big Sandy Creek near Big Sandy
		10/2015-12/2018 East Fork Angelina near Cushing
Tyler and Tyler East	$0.38 \times 512 + 0.19 \times 612 + 0.26 \times 513 + 0.17 \times 613$	1/1940-12/1948 Mud Creek near Jacksonville
		1/1949-9/1949 Striker Creek near Summerfield
		10/1949-9/1963 Big Sandy Creek near Big Sandy
		10/1963-1/1977 Rabbit Creek at Kilgore
		2/1977-12/2018 Big Sandy Creek near Big Sandy
Lake Columbia	$0.32 \times 512 + 0.23 \times 612 + 0.25 \times 513 + 0.20 \times 613$	Same gages as Tyler and Tyler East
Striker	$0.23 \times 512 + 0.24 \times 612 + 0.26 \times 513 + 0.27 \times 613$	1/1940-9/1940 Mud Creek near Jacksonville
		10/1940-9/1949 Striker Creek near Summerfield
		10/1949-12/1963 Big Sandy Creek near Big Sandy
		1/1964-9/1989 East Fork Angelina near Cushing
		10/1989-9/2015 Big Sandy Creek near Big Sandy
		10/2015-12/2018 East Fork Angelina near Cushing
Nacogdoches ¹	$0.13 \times 512 + 0.22 \times 612 + 0.15 \times 513 + 0.50 \times 613$	1/1940-10/1954 Attoyac Bayou near Chireno
		11/1954-9/1955 Tenaha Creek near Shelbyville
		10/1955-2/1959 Attoyac Bayou near Chireno
		3/1959-9/1964 Angelina near Lufkin – Angelina near Alto
		10/1964-9/1986 Bayou LaNana at Nacogdoches
		10/1986-5/1988 East Fork Angelina near Cushing
		6/1988-9/1993 Bayou LaNana at Nacogdoches
		10/1993-9/2015 Big Cow Creek near Newton
		10/2015-12/2018 East Fork Angelina near Cushing
Naconiche ¹	$0.14 \times 512 + 0.17 \times 612 + 0.19 \times 513 + 0.50 \times 613$	Same as gages used for Nacogdoches



Table 2. Summary of Reservoirs Included in Evaporation Dataset and Sources of Data

Reservoir	Sources of Data	
	Quadrangle Weighting Factors Used in Original Dataset Development	Gages for Runoff Adjustment
Kurth ¹	0.21 x 612 + 0.79 x 613	1/1940-10/1954 Attoyac Bayou near Chireno
		11/1954-9/1955 Tenaha Creek near Shelbyville
		10/1955-2/1959 Attoyac Bayou near Chireno
		3/1959-9/1964 Angelina near Lufkin – Angelina near Alto
		10/1964-9/1986 Bayou LaNana at Nacogdoches
		10/1986-5/1988 East Fork Angelina near Cushing
		6/1988-9/1993 Bayou LaNana at Nacogdoches
		10/1993-9/2015 Big Cow Creek near Newton
		10/2015-12/2018 East Fork Angelina near Cushing
Pinkston	0.19 x 513 + 0.46 x 613 + 0.15 x 514 + 0.20 x 614	1/1940-10/1954 Attoyac Bayou near Chireno
		11/1954-9/1955 Tenaha Creek near Shelbyville
		10/1955-9/1985 Attoyac Bayou near Chireno
		10/1985-9/1986 Bayou LaNana at Nacogdoches
		10/1986-5/1988 East Fork Angelina near Cushing
		6/1988-9/1993 Bayou LaNana at Nacogdoches
		10/1993-9/2015 Big Cow Creek near Newton
		10/2015-12/2018 East Fork Angelina near Cushing
Sam Rayburn ^{1,2}	0.40 x 613 + 0.22 x 713 + 0.21 x 614 + 0.17 x 714	1/1940-10/1954 Attoyac Bayou near Chireno
		11/1954-9/1955 Tenaha Creek near Shelbyville
		10/1955-2/1959 Attoyac Bayou near Chireno
		3/1959-9/1985 Ayish Bayou near San Augustine
		10/1985-12/2018 Big Cow Creek near Newton
B. A. Steinhagen	0.24 x 613 + 0.32 x 713 + 0.20 x 614 + 0.24 x 714	01/1940-12/2018 Village Creek near Kountze

- 1- Angelina River near Zavalla gage (USGS 08038500) was used during the 1950s period to estimate runoff adjustment in existing evaporation dataset. Per TDWR Report 244, Southland Paper Mills pumped about 22 cfs from wells prior to August 1956, of which about 18 cfs was later discharged into Mill Creek upstream of gage. After August 1956, about 28 cfs was pumped from wells and about 24 cfs was discharged into Mill Creek. The gages used in place of Zavalla gage are shown in table.
- 2- Quadrangle weighting factors used for Sam Rayburn Reservoir in the existing dataset development were found to be inaccurate and were revised for the update.



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Figure 3. TWDB Quadrangles used in the Development of the Evaporation Dataset

5 Procedures for Collecting and Estimating Missing Hydrologic and Water Management Data

The data collection effort was comprised of obtaining publicly-available data from online sources and contacting major water users, return flow dischargers, and major reservoir operators in the Neches River Basin. Following is a list of entities who provided data. For data that could not be obtained from identified sources or was determined to be inaccurate, estimates were made as necessary to complete naturalized flow calculations.

- Angelina and Nacogdoches Counties WCID #1
- Apex Texas Power LLC (Neches Station near Cuney)
- Athens Municipal Water Authority
- City of Athens
- City of Austin (Nacogdoches Generating Facility)
- City of Center
- City of Diboll
- City of Henderson
- City of Jasper
- City of Lufkin
- City of Nacogdoches
- City of Palestine
- City of Port Neches
- City of Rusk
- City of San Augustine
- City of Tyler
- City of Woodville
- U.S Army Corps of Engineers
- Lower Neches Valley Authority
- Luminant Generation (Stryker Creek Power Plant)
- Upper Neches River Municipal Water Authority
- Westrock Texas, LP (Evadale Paper Mill)

Several large industrial water users are located downstream of the Neches River at Beaumont control point (NEBA). These entities were not contacted because diversions and return flows from these water users, which are saline water rights, are not included in the naturalized flow development. Naturalized flows were estimated at the control point downstream of these entities (Neches River at Sabine Lake) using statistical relationships with upstream control points. This approach is consistent with the approach used to estimate naturalized streamflow in the existing dataset.

5.1 Historical Streamflow

The USGS maintains a network of streamflow gages throughout the Neches River Basin and USGS gage measurements are considered the most reliable source of historical streamflow data. **Table 3** lists USGS streamflow gages in the Neches Basin with discharge records during the existing and extended dataset periods; **Figure 4** is a map of the Neches Basin showing the locations of these gages. Gages located at primary control points are designated in the table by their abbreviated names in parentheses. The USGS has revised the published contributing drainage areas at several gages as noted in **Table 3**. These revisions were accounted for in the naturalized flow calculations.

The following procedure was used for acquiring streamflow data and filling missing data:

- Average daily streamflow data in cubic feet per second was acquired from the online USGS database for the entire period of record for gages to be used in the naturalized flow update.

- Average daily streamflow data was summed to monthly streamflow values in acre-feet.
- Monthly streamflow values for the existing period were compared to values included in the original naturalized flow workbooks. If substantial differences were identified in the existing period, streamflow data in the original naturalized flow workbooks were updated and naturalized flows were revised in the existing dataset for months in which differences were identified.

The following techniques were used to estimate historical streamflows where records are not available:

- Missing daily data spanning less or equal to 14 consecutive days, not including a significant streamflow rise due to storm runoff (based on nearby gage records), were interpolated from surrounding daily data. If a significant streamflow rise was identified, flows for the missing days were estimated using a drainage area or statistical relationship with a partner gage.
- If the missing data span is greater than 14 consecutive days, historical streamflow was not used to calculate naturalized streamflow in the month with missing data and naturalized flows at the control point were estimated using drainage area or statistical relationships with naturalized flows at a partner control point (or control points).

Table 3. Summary of USGS Streamflow Gages in the Neches River Basin

Gage	USGS Gage Number	Drainage Area (Square Miles)	Period of Daily Data Discharge Record
Kickapoo Creek near Brownsboro (KIBR)	08031200	232	5/1962-9/1989
Neches River near Reese	08031500	851	10/1924-9/1927
Neches River near Neches (NENE)	08032000	1,145	2/1939-Present
Neches River near Alto (NEAL)	08032500	1,945	1/1944-12/1978
Neches River near Diboll (NEDI)	08033000	2,724	10/1923-9/1925 & 3/1939-9/1985 & 10/2014-Present
Piney Creek near Groveton	08033300	79	10/1961-9/1989
Neches River near Rockland (NERO) ¹	08033500	3,636	7/1903-Present
Striker Creek near Summerfield	08033700	146	10/1940-9/1949
East Fork Angelina near Cushing (EFACU)	08033900	158	1/1964-9/1989 & 10/2015-Present
Mud Creek near Jacksonville (MUJA)	08034500	376	3/1939-9/1979 & 8/2001-Present
Mud Creek near Ponta	08035000	475	10/1924-9/1927
Angelina River near Alto (ANAL)	08036500	1,276	10/1940-3/1949 (sporadic) & 3/1959-Present
Angelina River near Lufkin (ANLU)	08037000	1,600	10/1923-9/1934 & 8/1939-9/1979
Bayou LaNana at Nacogdoches	08037050	31.3	10/1964-9/1986 & 5/1988-9/1993 & 10/2015-10/2018
Arenoso Creek near San Augustine	08037500	75.3	6/1938-9/1940
Attoyac Bayou near Chireno (ATCH)	08038000	503	7/1939-10/1954 & 10/1955-9/1985
Angelina River near Zavalla ²	08038500	2,892	10/1951-1/1965
Ayish Bayou near San Augustine (AYSA)	08039100	89	3/1959-9/1985
Angelina River near Ebenezer ³	08039500	3,486	4/1928-3/1951 & 10/1965-9/1973
Neches River near Town Bluff (NETB) ⁴	08040600	7,574	4/1951-Present
Neches River at Evadale (NEEV) ⁵	08041000	7,951	4/1921-Present
Village Creek near Kountze (VIKO) ⁶	08041500	860	3/1939-Present
Pine Island Bayou near Sour Lake (PISL)	08041700	336	10/1967--Present
Pine Island Bayou above BI Pump Plant, Beaumont	08041749	633	8/1903-4/1915 & 6/1917-Present
Neches River Saltwater Barrier at Beaumont (NEBA)	08041780	9,789	6/03-Present (tidal influenced)

1-Drainage area for the Neches River near Rockland gage was revised from 3,637 square miles on May 23, 1973.

2- Per TDWR Report 244, Southland Paper Mills pumped over 22 cubic feet per second (cfs) from wells upstream of gage and discharged into Mills Creek upstream of the gage during period of record.

3-Gage name changed from Angelina River at Horger to Angelina River near Ebenezer. For 10/1965-9/1973, gage recorded only releases from Sam Rayburn Dam.

4-Drainage area for the Neches River near Town Bluff gage was revised from 7,573 square miles on October 27, 1989, and the gage was called Neches River at Town Bluff (8040500).

5- Drainage area for the Neches River at Evadale gage was revised from 7,952 square miles on November 8, 1963.

6- Drainage area for the Village Creek near Kountze gage was revised from 861 square miles on September 30, 1966.

USGS = U.S. Geological Survey

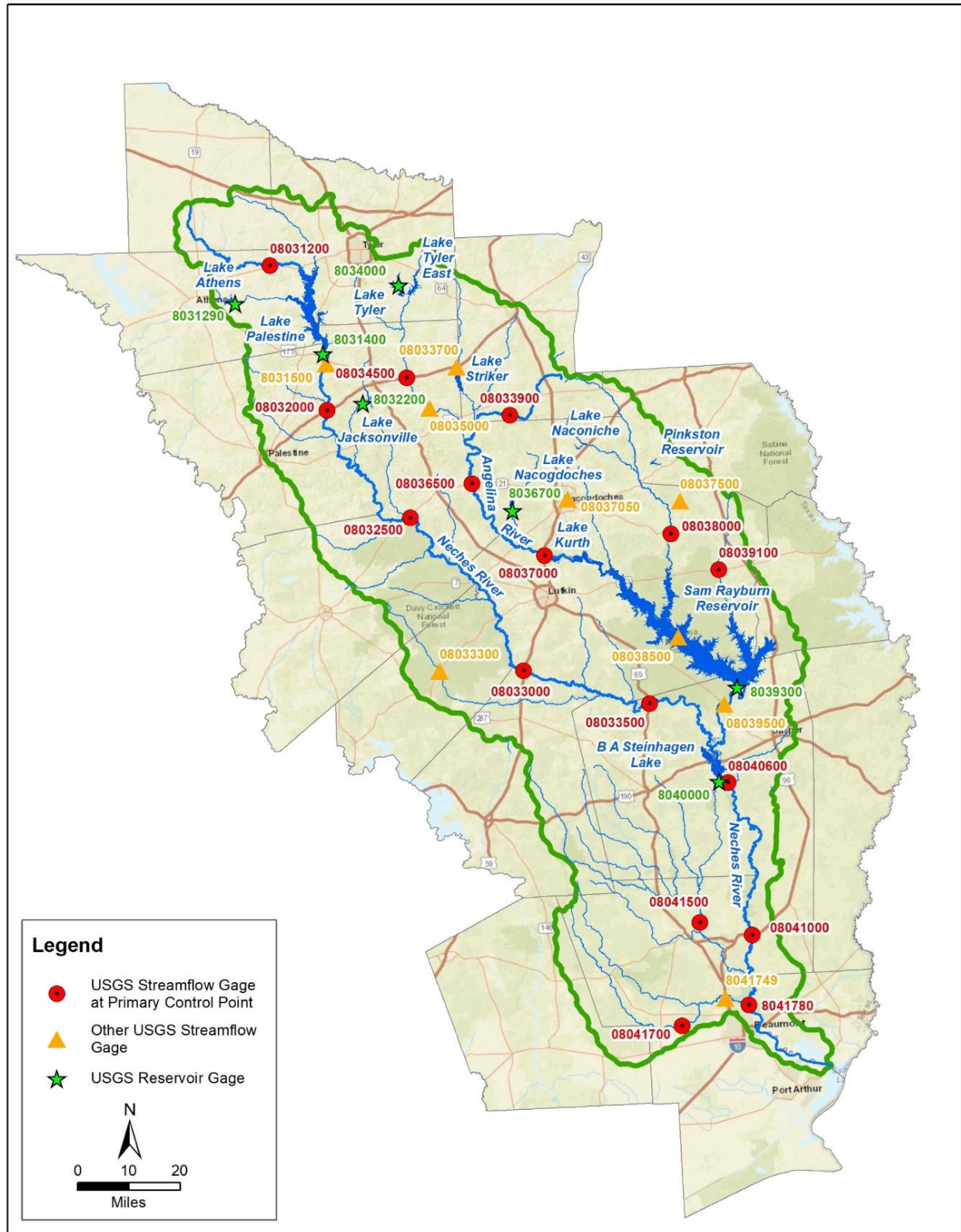


Figure 4. Location Map of USGS Streamflow and Reservoir Gages in the Neches River Basin

Where reservoirs are used as primary control points, historical reservoir inflows were calculated using available reservoir data (including an elevation–area–capacity relationship). Historical reservoir inflows were calculated using a mass balance procedure if concurrent data are available for reservoir contents, diversions, return flows, net evaporation, spills, and releases. The equation used for developing historical inflows from reservoir data is as follows:

$$\text{Historical Reservoir Inflow} = \text{Spills} + \text{Releases} + \text{Diversions} + \text{Change in Reservoir Contents} + \text{Reservoir Net Evaporation} - \text{Return Flow}$$

Table 4 lists the sources of data for the calculation of historical reservoir inflows at reservoir locations that are also designated as primary control points in the existing period of record and the data sources used in the extension period. Net evaporation and return flow data sources are described in the following sections. If data is unavailable from the online sources or the entities listed, historical inflows were not developed and naturalized flows at the reservoir control point were estimated using drainage area or statistical relationships with naturalized flows at a partner control point (or control points).

Table 4. Sources of Data for Reservoir Control Points

Reservoir	Time Period	Spills	Releases	Diversions	Content Changes	Surface Area
Palestine	1/1940-1/1962	N/A	N/A	N/A	N/A	N/A
	2/1962-12/1972	None	TNRCC	TNRCC	USGS	USGS
	1/1973-9/1994	UNRMWA	UNRMWA	TNRCC	USGS	USGS
	10/1994-4/1999	UNRMWA	UNRMWA	UNRMWA/ TCEQ	UNRMWA	UNRMWA
	5/1999-12/2018	UNRMWA	UNRMWA	UNRMWA/ TYLER/ TCEQ	UNRMWA/ USGS	UNRMWA/ USGS
Tyler & Tyler East	1/1940-12/1948	N/A	N/A	N/A	N/A	N/A
	1/1949-9/1986	Calculated ¹	TNRCC	TNRCC	USGS	USGS
	10/1986-12/1986	Estimated	TNRCC	TNRCC	No data	No data
	1/1987-7/1989	Tyler	TNRCC	TNRCC	Tyler	Tyler
	8/1989-11/1990	Estimated	TNRCC	TNRCC	Estimated	Estimated
	12/1990-12/1996	Calculated ¹	TNRCC	TNRCC	Tyler	Tyler
	1/1997-3/1999	Calculated ¹	Tyler	Tyler	Tyler	Tyler
	4/1999-12/2018	Calculated ¹	Tyler	Tyler	Tyler/USGS	Tyler/USGS
Sam Rayburn	1/40-12/64	N/A	N/A	N/A	N/A	N/A
	1/65-12/18	USACE	USACE	USACE	USACE	USACE

¹ Spills calculated using stage and rating curve.

N/A = not applicable; UNRMWA = Upper Neches River Municipal Water Authority; USACE = U.S. Army Corps of Engineers; TNRCC = Texas Natural Resource Conservation Commission; TCEQ = Texas Commission on Environmental Quality; USGS = U.S. Geological Survey

5.2 Water Use (Diversions)

The TCEQ and entities contacted as part of the data collection effort provided monthly records of historical use of surface water in the Neches River Basin authorized under existing water rights. TWDB historical water use data was used to fill missing values if data from the TCEQ and the

contacted entities was unavailable or incomplete. The following techniques were used to estimate missing water use data where historical records could not be obtained:

- Where appropriate, missing values of historical water use were estimated based on available records and documented in the naturalized flow workbooks.
- Several instances occurred where only annual estimates of historical water use were available with surrounding years of monthly data available. For these instances, the annual estimates were disaggregated into monthly estimates using the monthly patterns of water use from surrounding years.
- For smaller irrigation water users with an authorized annual diversion of less than 100 acft, if a good estimate could not be made, the historical diversion and use were assumed to be zero. Assuming zero use results in a conservatively low estimate of naturalized flow.

A summary of water rights by primary control point is included in **Appendix C**. The largest surface water users in the basin include LNVA, City of Beaumont, UNRMWA, City of Tyler, and the City of Nacogdoches. These entities primarily use surface water for municipal and industrial purposes. Surface water use for industrial purposes upstream of the Neches River at Beaumont control point has significantly declined during the recent decades due to the closing of most of the paper mills located in the Neches River Basin.

Water use from several large industrial water users located downstream of the Neches River at Beaumont control point were not included in the naturalized flow development. Diversion and use of water by these entities is authorized under saline water rights. Naturalized flows were estimated at the control point downstream of these entities (Neches River at Sabine Lake) using statistical relationships with upstream control points. This approach is consistent with the approach used to estimate naturalized streamflow in the existing dataset.

5.3 Upstream Return Flows

All return flows with permitted discharge amounts equal to or greater than 1 million gallons per day (mgd) were included in the naturalization of streamflow in the extension period. The original naturalized streamflow dataset was adjusted to include these return flows if they were not already included. If the original naturalized streamflow calculations included return flow discharges with permitted amounts less than 1 mgd, the extension calculations also included these discharges for consistency.

Return flow discharge locations, provided by the TCEQ, are summarized by control point in **Appendix D**. Historical discharge data was obtained from the U.S. Environmental Protection Agency (EPA) Enforcement and Compliance History Online (ECHO) and Integrated Compliance Information System (ICIS) databases. Treated wastewater return flow records included in the ICIS and ECHO databases begin in 1998 and 2007, respectively, and do not cover the full extension period of the naturalized flow datasets. As a result, return flow data for 1997 was estimated unless data was provided by the entity discharging the return flows.

The following techniques were used to estimate return flows where records are not available:

- For municipalities without return flow records or estimates in the extension period, return flows were interpolated from the data in adjacent months and years after confirmation that the wastewater treatment facility was operational during periods of missing data.
- For industries without return flow records but known to have made discharges, return flows were estimated as a percentage of historical water use (to the extent that historical water use records are available). The percentages were based on available records for the facility. If no records are available, the percentage was based on typical factors for the industry. The only identified instance of groundwater based industrial return flows in the Neches Basin occurred as part of operations of the Lufkin Paper Mill. These return flows ceased in 2004 when the mill was shut down.
- Agricultural return flows were not included. These return flows in the Neches River Basin generally occur downstream of the most downstream gaged control points (Village Creek near Kountze, Neches River at Evadale, Pine Island Bayou near Sour Lake) or in the adjacent coastal basins.

5.4 Reservoir Contents

Changes in contents for constructed reservoirs with conservation storage capacity greater than 5,000 acft were included in the flow naturalization. Changes in content for the extension period were calculated using USGS lake level or storage records or records obtained from the reservoir owner and/or operators and elevation-area-capacity relationships from the most recent reservoir survey.

Table 5 lists the existing USGS reservoir gages in the Neches River Basin and their respective periods of record; the locations of these gages are shown in **Figure 4**.

Table 5. Summary USGS Reservoir Gages in the Neches River Basin

Gage	USGS Gage Number	Period of Daily Data Reservoir Content Record	Period of Daily Data Surface Elevation Record
Lake Athens near Athens, TX ¹	08031290	10/1985-1/1987 & 4/1999-9/2002	4/1999-9/1999 & 10/2000-Present
Lake Palestine near Frankston	08031400	2/1962-5/1995 & 5/1999-9/2010	5/1999-Present
Lake Jacksonville near Jacksonville	08032200	5/1999-6/2005 & 8/2005-9/2010	5/1999-6/2005 & 8/2005-Present
Lake Tyler near Whitehouse ²	08034000	10/1985-9/1986 & 4/1999-9/2002	4/1999-9/1999 & 9/2000-5/2003 & 9/2003-Present
Lake Nacogdoches near Nacogdoches	08036700	3/1977-9/1980 & 10/1981-9/1987 & 10/1988-Present	10/1996-Present
Sam Rayburn Res near Jasper	08039300	1/1965-9/2010	6/1988-Present
B. A. Steinhagen Lake at Town Bluff	08040000	4/1951-7/2006 & 6/2007-9/2010	10/1987-Present

1-Published records of monthly reservoir contents are available for 10/1964-12/1975 period in TDWR Report 244.

2-Published records of monthly reservoir contents are available for 3/1949-12/1975 period in TDWR Report 244.

If historical lake level information was not available, historical reservoir storage and associated lake level were estimated using a reservoir mass balance approach. Inflows for the mass balance approach were based on USGS gages shown in **Table 2** and adjusted for differences in drainage areas.

Table 6 summarizes the reservoirs for which content changes are included in the naturalized flow calculations along with the data sources and the date of the most recent volumetric survey. Content changes for Lake Kurth are neglected because the reservoir has an extremely small drainage area and is considered off-channel. As a result, the impact of content changes and evaporation from Lake Kurth is assumed to be included in recorded diversions from the Angelina River. Lake Columbia on the Angelina River has received a TCEQ water rights permit but has not been constructed to date.

Table 6. Summary of Reservoirs Included in Content Change Calculations

Reservoir	Downstream Control Point	Date of Deliberate Impoundment	Records		Conservation Storage Capacity (acft)		Date of Most Recent Survey
			Source	Period	Permitted	Most Recent Survey	
Athens	NEPA	11/1/1962	USGS	10/1964-12/1986 & 4/1999-12/2018	32,840	29,440	Feb-1998
			Athens	1/1989-12/1996			
Palestine	NEPA	5/1/1962	USGS	2/1962-9/1994 & 5/1999-12/2018	411,840	367,303	Aug-2012
			UNRMWA	2/1962-12/2018			
Jacksonville	NEAL	Jun-1957	USGS	5/1999-12/2018	30,500	25,670	May-2006
Tyler	MUTY	1/8/1949	USGS ¹	3/1949-9/1986 & 4/1999-5/2003 & 9/2003-12/2018	43,100	72,073	Jan-2013 (Combined)
Tyler East	MUTY	11/22/1966	USGS ¹	5/1968-9/1986 & 4/1999-5/2003 & 9/2003-12/2018	44,000		
Striker	ANAL	5/1/1957	Freese & Nichols	5/1957-12/1985	26,960	16,930	Dec-1996
			ANCWCID#1	1/1986-12/2018			
Nacogdoches	ANLU	7/14/1976	USGS	3/1977-12/2018	42,318	39,521	Mar-1994
Naconiche	ATCH	2009	---	---	9,072	---	---
Pinkston	ATCH	1978	---	---	7,380	---	---
Sam Rayburn	ANSR	3/29/1965	USGS	1/1965-12/2018	2,852,585 ²	2,876,033 ³	Apr-2004 ⁴
			USACE	2/1965-12/2018			
B.A. Steinhagen	NETB	4/16/1951	USGS	4/1951-12/2018	94,250 ²	69,186	Oct-2011
			USACE	5/1951-12/2018			

1-Missing USGS data filled with data provided by City of Tyler.

2-Conservation storage for Lake B.A. Steinhagen and Lake Sam Rayburn is the original capacity according to the Corps of Engineers. The permits associated with these reservoirs do not establish a capacity.

3-Capacity at top of power pool (164.4 feet mean sea level).

USGS = U.S. Geological Survey; UNRMWA = Upper Neches River Municipal Water Authority; ANCWCID#1 = Angelina and Nacogdoches Counties Water Control and Improvement District #1; USACE = U.S. Army Corps of Engineers; acft = acre-feet

5.5 Reservoir Surface Area

Net evaporation for major reservoirs was estimated by multiplying the monthly net reservoir evaporation rate by the average of the previous and current end of month reservoir surface area. Surface area was estimated during the extension period using USGS lake level or storage records or records obtained from the reservoir owner and/or operators and elevation-area-capacity relationships from the most recent reservoir survey.

5.6 Gross Reservoir Evaporation

The TWDB supplied monthly gross evaporation rates for the development of the existing evaporation dataset. The TWDB data is available by quadrangle for the 1954 to 2019 period and monthly gross evaporation rates are estimated at the major reservoirs by an inverse distance ratio weighted averaging procedure using the surrounding quadrangles. Prior to 1954, gross evaporation data from the TWDB is used in the existing period and was derived by the TWDB using an alternate set of pan coefficients⁵.

The existing naturalized flow dataset includes the frequent occurrence of total negative naturalized flows for the July through November months at primary control points throughout the basin. Generally, these total negative flows become more prevalent at primary control points following the construction of a major reservoir upstream of the control point location. During the update, HDR found the apparent cause of most of the negative naturalized flows in the dataset to be inaccurate estimates of gross evaporation. Findings from an HDR supplemental evaluation indicate the pan coefficients used by the TWDB did not provide an accurate estimate of reservoir evaporation when applied to historical pan data. Findings from the evaluation indicate pan coefficients developed for the Young Screened Pan applied to Class A pan data provide a more accurate estimation of gross evaporation in the Neches River Basin. Additional details of the supplemental evaluation are provided in the 11 March 2020 technical memorandum located in **Appendix E**.

The following adjustments were made to the TWDB quadrangle evaporation data to improve gross evaporation estimates used in the development of the naturalized flow and net evaporation datasets.

- For the 1940 to 1953 period, TWDB quadrangle evaporation estimates in the Neches River Basin were developed using Bureau of Plant Industry (BPI) and Young coefficients applied to pan evaporation data from these types of pans. The equivalent pan evaporation from a Class A pan was estimated from the TWDB quadrangle evaporation data by applying the monthly pan conversion factors published in the USGS Circular 2296 and shown in **Table 7**. Because the TWDB used both BPI and Young pans to develop the quadrangle lake evaporation data for the 1940 to 1953 period, and detailed calculations providing the weights of the individual pans in the quadrangle calculations are unavailable, the monthly average of the pan conversion factors for the two pan types were applied to the TWDB data to estimate the equivalent evaporation from a Class A pan. The resulting quadrangle lake evaporation estimates are essentially Class A pan data with the application of BPI and Young coefficients

⁵ Kane, John W., Texas Water Development Board, 1967, *Report 64: Monthly Reservoir Evaporation Rates for Texas 1940 through 1965*.

⁶ U.S. Dept. of the Interior, Geological Survey. *Water-Loss Investigations: Volume 1--Lake Hefner Studies Technical Report*. Circular, 229, 1952, <http://pubs.er.usgs.gov/publication/cir229>.

to estimate lake evaporation. Because the weighting of the individual pans in the development of the TWDB quadrangle data for the 1940 to 1953 period is unknown, the combination of the BPI and Young coefficients applied by the TWDB were not adjusted to estimate evaporation using only the Young coefficients applied to Class A pan data.

Table 7. Monthly Conversion Factors for Estimating Class A Pan Data from BPI and Young Screened Pans

Month	Bureau of Plant Industry	Young Screened	Average
JAN	1.28	1.06	1.17
FEB	1.67	1.46	1.57
MAR	1.29	1.17	1.23
APR	1.35	1.27	1.31
MAY	1.35	1.48	1.42
JUN	1.33	1.51	1.42
JUL	1.34	1.46	1.40
AUG	1.31	1.47	1.39
SEP	1.25	1.38	1.32
OCT	1.36	1.33	1.35
NOV	1.19	0.99	1.09
DEC	1.30	0.96	1.13
ANNUAL	1.34	1.32	1.33

Source: USGS Circular 229, Table 25.

- For the 1954 to 2018 period, TWDB quadrangle Class A pan evaporation depths were back-calculated using the new TWDB coefficients. The Young monthly pan coefficients shown in **Table 7** were applied to the back-calculated TWDB quadrangle Class A pan evaporation depths to estimate gross lake evaporation.

5.7 Rainfall

Precipitation data for development of the existing evaporation datasets was obtained from National Oceanic and Atmospheric Administration weather stations. Previous experience in using this data source has shown that weather stations are often not operated for long-term periods and that data recorded is often sporadic. As a result, multiple stations at different locations were often used to estimate precipitation at a reservoir in the development of the existing evaporation datasets.

As part of the update, TWDB quadrangle precipitation data was used to update the existing evaporation dataset and for the extension period. Use of the TWDB quadrangle data provides a consistent and complete dataset for the 1940 to 2018 period and will likely be the most accessible data source for the next net evaporation dataset update. Cumulative rainfall comparisons indicate the differences between the two data sources are insignificant and the TWDB data provides reasonable long-term results compared to gage data.

5.8 Runoff Adjustment

Runoff adjustment is the runoff amount (expressed as inches) from rainfall that would have occurred in the absence of a reservoir. A summary of USGS gages used in the update is shown in **Table 2**

and **Section 4** provides additional details of the methodology for applying the runoff adjustment in the net evaporation calculations.

6 Procedures for Updating Existing Statistical Relationships in the Naturalized Flow Dataset

Statistical relationships were used to estimate naturalized flow when historical flow data is not available at primary control point locations. These statistical relationships were developed using naturalized streamflow at one or more control points for overlapping periods when historical flows are available. Statistical relationships for each control point requiring the fill of missing naturalized flows were revisited using linear and non-linear regression techniques. All statistical relationships used in the development of the existing data were updated to account for changes made to the naturalized flow dataset in the existing period as part of this update and in consideration of the extended period, which provides a greater length of concurrent records for many control points.

Table 8 summarizes the periods in which historical streamflow data is available and the periods filled to complete naturalized flows for each primary control point. Additionally, **Table 8** provides the relationships and partner control points used in the update of the naturalized flow dataset. Similar to the development of the fill relationships for the existing dataset, linear regression techniques with the intercept coefficient assumed equal to zero were found to provide reasonable coefficient of determination (i.e. r^2) values, which quantify the proportion of the variation in the dependent variable explained by application of the relationship to the independent variable.

Appendix F provides a comparison summary of the relationships and coefficient of determination values from the original and updated statistical relationships for all linear and non-linear regression techniques applied⁷. All updated relationships selected for use in updating the naturalized flow datasets resulted in an increase in the coefficient of determination value when compared to the relationships used in the development of the original dataset.

⁷ The workbooks used to develop the statistical relationships for filling in missing periods for the existing naturalized flow datasets are not available; however, the relationships that were used are known along with the associated coefficient of determination values.

Table 8. Summary of Calculation Methodology and Statistical Relationships Used in Naturalized Flow Development

Control Point		Period of Record	Calculation Methodology	Fill Relationships	Period of Overlap
KIBR	Kickapoo Creek near Brownsboro	1/1940-4/1962	Fill Relationship	0.2100 NENE	5/1962-9/1989
		5/1962-9/1989	Streamflow Computation	---	---
		10/1989-12/2018	Fill Relationship	0.2691 NEPA	1/1973-9/1989
NEPA	Lake Palestine Dam	1/1940-12/1972	Fill Relationship	0.6948 NENE	1/1973-12/2018
		1/1973-12/2018	Reservoir Computation	---	---
NENE	Neches River at Neches	1/1940-12/2018	Streamflow Computation	---	---
NEAL	Neches River near Alto	1/1940-12/1943	Fill Relationship	0.6748 NENE + 0.4023 NEDI	1/1944-12/1978
		1/1944-12/1978	Streamflow Computation	---	---
		1/1979-9/1985	Fill Relationship	0.6748 NENE + 0.4023 NEDI	1/1944-12/1978
		10/1985-9/2014	Fill Relationship	0.9119 NENE + 0.2011 NERO	1/1944-12/1978
		10/2014-12/2018	Fill Relationship	0.6748 NENE + 0.4023 NEDI	1/1944-12/1978
NEDI	Neches River near Diboll	1/1940-9/1985	Streamflow Computation	---	---
		10/1985-9/2014	Fill Relationship	0.5446 NERO + 0.4806 NENE	1/1940-9/1985 & 10/2014-12/2018
		10/2014-12/2018	Streamflow Computation	---	---
NERO	Neches River near Rockland	1/1940-12/2018	Streamflow Computation	---	---
MUTY	Lakes Tyler and Tyler East Dams	1/1940-2/1949	Fill Relationship	0.3277 MUJA	3/1949-9/1979 & 8/2001-12/2018
		3/1949-12/2018	Streamflow Computation	---	---
MUJA	Mud Creek near Jacksonville	1/1940-9/1979	Streamflow Computation	---	---
		10/1979-7/2001	Fill Relationship	0.2970 ANAL	3/1959-9/1979 & 8/2001-12/2018
		8/2001-12/2018	Streamflow Computation	---	10/1940-3/1949 when available ---

Table 8. Summary of Calculation Methodology and Statistical Relationships Used in Naturalized Flow Development

Control Point		Period of Record	Calculation Methodology	Fill Relationships	Period of Overlap
EFACU	East Fork Angelina River near Cushing	1/1940-3/1949	Fill Relationship	0.1603 (ANAL – MUJA) or 0.3401 MUJA when ANAL not available.	1/1964-9/1979 & 10/2015-12/2018
		4/1949-2/1959	Fill Relationship	0.1111 (ANLU – MUJA)	1/1964-9/1979
		3/1959-12/1963	Fill Relationship	0.1603 (ANAL – MUJA)	1/1964-9/1979 & 10/2015-12/2018
		1/1964-9/1989	Streamflow Computation	---	---
		10/1989-9/2015	Fill Relationship	0.1242 ANAL	1/1964-9/1989 & 10/2015-12/2018
		10/2015-12/2018	Streamflow Computation	---	---
ANAL	Angelina River near Alto	1/1940-6/1942	Fill Relationship	0.7661 ANLU	10/1940-3/1949 when available & 3/1959-9/1979
		7/1942-12/1943	Streamflow Computation	---	
		1/1944-2/1959	Fill Relationship	0.7661 ANLU	10/1940-3/1949 when available & 3/1959-9/1979
		3/1959-12/2018	Streamflow Computation	---	---
ATCH	Attoyac Bayou near Chireno	1/1940-10/1954	Streamflow Computation		---
		11/1954-9/1955	Fill Relationship	0.1923 (NETB – NERO – ANLU)	5/1951-10/1954 & 10/1955-9/1979
		10/1955-9/1985	Streamflow Computation	---	---
		10/1985-12/2018	Fill Relationship	0.2415 (ANSR – ANAL)	1/1965-9/1985
ANLU	Angelina River near Lufkin	1/1940-9/1979	Streamflow Computation	---	---
		10/1979-12/2018	Fill Relationship	0.9214 ANAL + 0.1341 ANSR	1/1965-9/1979
AYSA	Ayish Bayou near San Augustine	1/1940-3/1951	Fill Relationship	0.2042 ATCH	3/1959-9/1985
		4/1951-2/1959	Fill Relationship	0.0487 (NETB – NERO – ANLU)	3/1959-9/1979
		3/1959-9/1985	Streamflow Computation	---	---
		10/1985-12/2018	Fill Relationship	0.0536 (ANSR – ANAL)	1/1965-9/1985
ANSR	Sam Rayburn Dam	1/1940-3/1951	Fill Relationship	0.9826 Nat. Flow Angelina River @ Horger	None (Drainage Area Ratio)
		4/1951-9/1951	Fill Relationship	0.8553 (NETB – NERO)	1/1965-12/2018
		10/1951-12/1964	Fill Relationship	1.1926 Nat. Flow Angelina River @Zavala	None (Drainage Area Ratio)
		1/1965-12/2018	Reservoir Computation	---	---

Table 8. Summary of Calculation Methodology and Statistical Relationships Used in Naturalized Flow Development

Control Point		Period of Record	Calculation Methodology	Fill Relationships	Period of Overlap
NETB	Neches River at Town Bluff	1/1940-3/1951 4/1951-12/2018	Fill Relationship Streamflow Computation	0.9259 NEEV ---	4/1951-12/2018 ---
NEEV	Neches River at Evadale	1/1940-12/2018	Streamflow Computation	---	---
VIKO	Village Creek near Kountze	1/1940-12/2018	Streamflow Computation	---	---
PISL	Pine Island Bayou near Sour Lake	1/1940-9/1967 10/1967-12/2018	Fill Relationship Streamflow Computation	0.5153 VIKO ---	10/1967-12/2018 ---
NEBA	Neches River at Beaumont	1/1940-12/2018	Fill Relationship	$NEEV + (1824 / (860 + 336)) (VIKO + PISL)$	None (Drainage Area Ratio)
NESL	Neches River at Sabine Lake	1/1940-12/2018	Fill Relationship	$NEEV + (2060 / (860 + 336)) (VIKO + PISL)$	None (Drainage Area Ratio)

7 Procedures for Addressing Total Negative Naturalized Flows

The calculation of naturalized flows using the methodology previously described results in negative values for some months. These negative naturalized flows are also referred to as total negative naturalized flows. Possible reasons for these total negative naturalized streamflows include the following:

- Incorrect data.
- Errors in the reporting or estimation of hydrologic and water management data.
- Lack of precision in USGS gage records.
- Lack of precision in reservoir mass balance data.

Where total negative naturalized flow values occurred at a primary control point, historical streamflow and water management data were inspected to identify and correct potential erroneous data. If no errors in the data were found, total negative flows were set to zero, and flows for surrounding months were adjusted to preserve mass balance. This approach is consistent with the approach used in the development of the existing naturalized flow dataset and these adjustments are made in the “ADJUSTED” tab of the naturalized flow workbooks.

In the existing naturalized flow dataset, total negative naturalized flows are present at the Angelina River at Sam Rayburn primary control point in the months from July through November. **Table 9** summarizes these total negative flows in the existing naturalized flow dataset prior to the update. These total negative flows were initially believed to occur from inaccurate estimates of releases from the reservoir for hydropower generation.

The scope of work for this study includes a review of hydropower releases in the Neches River Basin to verify that the method used in the existing dataset development minimizes the occurrence of these negative flows. A comparison of hydropower and gated releases from Sam Rayburn Reservoir reported by the U.S. Army Corps of Engineers (USACE) to available USGS gaged streamflow at the Angelina River near Ebenezer (USGS Gage 08039500) downstream of the dam tends to validate the accuracy of the reported releases. **Figure 5** provides the location of the downstream gage in relation to Sam Rayburn Reservoir dam. **Figure 6** shows the comparison of USACE release data and available USGS streamflow records at the Ebenezer gage adjusted for difference in drainage areas for the October 1965 to September 1973 overlapping period. The figure shows a high correlation between the USACE reported releases and the USGS recorded streamflow indicating the release data reported by the USACE is accurate.

Table 9. Summary of Total Negative Naturalized Flows Occurring at Angelina River at Sam Rayburn in the Existing Naturalized Flow Dataset (Does not include fill period of 1940-1964)

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
1965	1,321	106,626	132,691	187,379	123,589	132,914	6,750	7,078	22,796	-1,294	12,860	124,698
1966	122,652	403,107	78,566	192,226	649,646	67,098	-8,667	33,123	31,167	-17,102	4,037	17,535
1967	29,527	47,549	51,366	78,167	68,725	79,019	-7,876	-7,235	-16,647	-12,763	-6,396	8,619
1968	198,543	72,894	209,690	742,538	333,849	192,474	112,948	21,210	114,500	19,436	82,857	353,193
1969	151,629	306,879	757,685	604,020	565,338	79,248	-6,277	-13,756	-3,034	-2,301	22,774	60,760
1970	84,082	91,217	265,818	149,472	97,311	4,138	-12,793	-20,444	-16,134	13,207	8,451	25,540
1971	28,575	38,198	41,723	27,778	55,641	6,047	-3,900	-2,519	-7,432	7,590	-3,494	127,058
1972	192,113	107,793	112,938	58,492	62,828	13,918	1,391	1,850	-7,718	10,766	100,606	223,092
1973	426,948	219,179	455,680	506,011	201,570	390,594	87,923	9,908	69,869	262,608	264,248	608,566
1974	879,516	316,465	172,017	138,031	79,639	7,003	-2,728	-17,416	53,833	70,149	377,413	392,016
1975	347,464	669,720	237,286	194,672	462,136	159,604	39,646	8,624	-18,945	4,593	50,470	45,823
1976	98,204	130,648	215,940	133,716	244,744	164,374	175,266	-17,716	-18,361	-8,347	17,832	143,834
1977	147,859	245,753	255,038	212,540	54,116	12,441	-13,971	8,979	-8,599	-9,051	15,433	40,921
1978	214,832	231,759	113,890	87,000	43,845	5,570	-22,290	-11,203	90,442	-5,351	14,422	141,234
1979	592,103	568,875	521,427	548,829	341,488	511,993	36,470	24,333	66,839	40,325	123,228	209,619
1980	292,529	350,463	287,580	470,491	487,188	22,478	-74,397	-13,316	-10,548	-36,596	-9,724	13,241
1981	13,489	50,221	73,424	33,786	85,727	143,312	15,762	-33,474	127,985	52,924	54,080	-6,662
1982	60,906	109,690	117,048	608,056	285,647	43,421	28,546	-20,840	-15,050	7,530	130,372	658,534
1983	244,892	586,119	363,111	140,136	473,011	176,010	50,050	31,217	5,435	-9,640	27,703	315,961
1984	187,257	381,014	442,046	108,895	86,168	34,036	-5,461	4,833	-11,574	150,769	124,505	151,995
1985	193,029	371,642	331,599	130,639	140,643	7,725	5,042	-1,306	-25,636	106,693	306,551	454,036
1986	91,580	217,146	65,850	80,321	227,709	558,964	28,460	-318	13,474	23,688	379,099	405,640
1987	235,022	394,088	370,171	89,058	79,678	115,312	44,428	11,968	9,628	-12,452	166,270	343,391
1988	317,202	136,665	263,591	139,288	24,517	7,478	4,525	-32,096	-27,900	-15,310	9,373	47,303
1989	337,360	379,335	274,598	500,328	481,115	500,462	358,837	24,623	-10,045	4,836	-4,341	30,038
1990	369,581	399,262	256,155	229,812	544,607	352,043	-1,844	-7,131	-2,917	15,306	92,536	103,438
1991	889,307	496,571	303,377	763,011	637,726	171,857	85,779	148,734	82,191	42,638	116,448	424,183
1992	528,632	929,963	642,497	196,890	105,302	63,903	23,728	8,809	7,840	-5,402	41,994	306,568
1993	427,090	164,262	590,395	381,507	279,389	430,122	161,678	9,194	3,887	10,860	58,720	98,622
1994	142,241	447,337	368,406	171,437	179,068	79,548	8,644	49,506	54,913	580,428	137,607	598,616
1995	751,960	272,675	688,114	548,664	370,607	32,234	44,479	24,977	-17,163	-7,418	-988	123,341
1996	58,305	42,264	22,096	57,455	25,857	10,950	-19,086	20,508	74,611	43,908	58,479	172,995

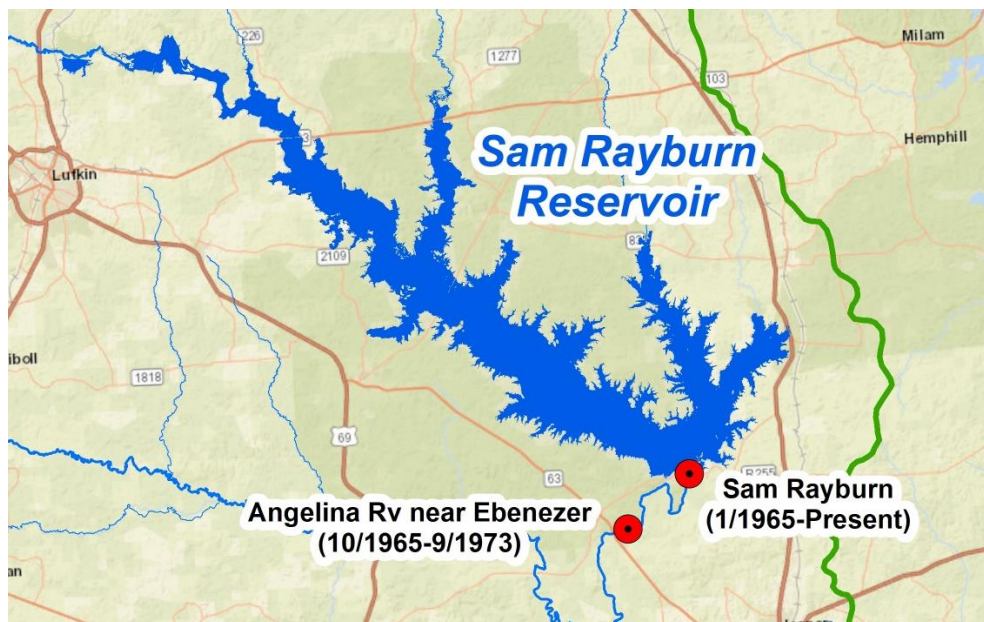


Figure 5. Location Map of Sam Rayburn Reservoir and Angelina River near Ebenezer Gage (USGS Gage 08039500)

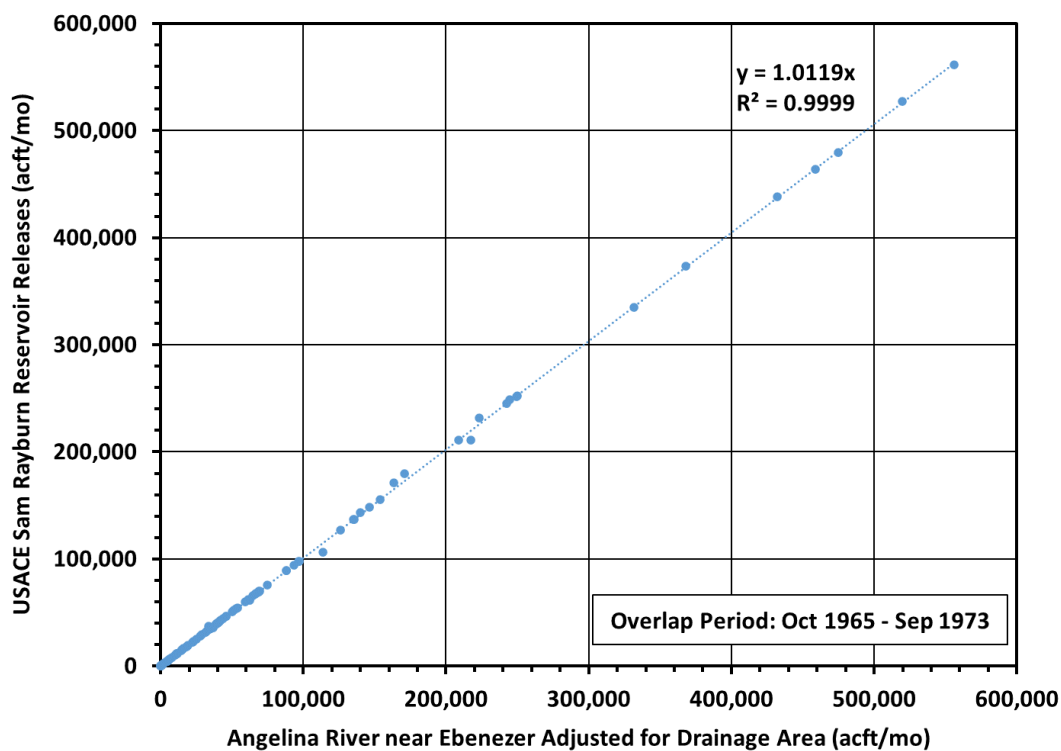


Figure 6. Comparison of USACE Sam Rayburn Release Data and Available USGS Streamflow Records at Angelina River near Ebenezer for October 1965 to September 1973 Overlap Period

Further investigation found these negative flow trends became prevalent at primary control points following the construction of a major reservoir upstream of the control point location(s). HDR investigated the following potential causes of the negative naturalized flows in the dataset.

- Reservoir Bank Storage – Storage of water in the shallow aquifers surrounding the reservoirs was investigated as the possible cause of the negative flows. However, the negative flows occur in the drier summer and fall months when reservoir levels are typically falling and bank storage is released back into the reservoir pool. Accounting for this additional inflow would result in a reduction of natural inflow in the reservoir mass balance calculations and increase the negative streamflow values.
- Inaccurate Runoff Adjustments for Rainfall – Alternative gages were examined for use in estimating the runoff adjustment for rainfall in the reservoir mass balance calculations. HDR found that the runoff adjustments from the selected and alternate gages incrementally affected the resulting naturalized flow calculations and did not reduce the amount of negative naturalized flows, indicating the runoff adjustments were not the apparent cause of the negative flows.
- Wind Influence on Lake Level Recordings – Review of USGS 15-minute interval wind speed, direction, and lake level data for Sam Rayburn Reservoir indicate wind does not significantly influence gage recordings. Additionally, the monthly calculation timestep of naturalized flows make it unlikely that wind influence on gage recordings would cause negative flows in consecutive months and consistently throughout the period of record after the reservoir was constructed.
- Local groundwater pumping – Local groundwater pumping was investigated as a potential source of additional outflow in the reservoir mass balance calculations for Sam Rayburn Reservoir. Review of TWDB groundwater pumping reports for counties surrounding Sam Rayburn Reservoir indicate significant pumping from shallow aquifer formations has not occurred.
- Reservoir gross evaporation estimates – TWDB historical pan evaporation data and pan to lake coefficients were reviewed and found to be the likely cause of the negative naturalized flows.

A supplemental evaluation was completed and findings from the evaluation indicate the TWDB historical gross evaporation data underestimates evaporation losses from reservoirs in the Neches River Basin. The underestimation of evaporation in the reservoir mass balance calculations results in an underestimation of naturalized flows. Adjustments were made to the TWDB historical gross evaporation data to improve the accuracy of the data based on findings from the supplemental evaluation. Details of the supplemental evaluation and adjustments are provided in the 11 March 2021 HDR technical memorandum located in **Appendix E**.

The adjustments made to the TWDB quadrangle evaporation data resulted in a significant reduction of the occurrence and magnitude negative naturalized flows in the dataset. **Table 10** provides a comparison of the frequency and magnitude of negative naturalized flows occurring in the original naturalized flow dataset and those in the updated naturalized flow dataset (including the additional 22 years of data) following the adjustments made to the evaporation data.

Table 10. Summary Comparison of Negative Naturalized Flows Occurring in the Original and Updated Naturalized Flow Datasets

Primary Control Point	Original Naturalized Flows Dataset (1940-1996)			Updated Naturalized Flow Dataset (1940-2018)		
	No. of Months with Negative Flow Value	Average Negative Flow Value	Maximum Negative Flow Value	No. of Months with Negative Flow Value	Average Negative Flow Value	Maximum Negative Flow Value
KIBR	0	---	---	0	---	---
NEPA	29	-2,774	-9,810	2	-2,003	-3,412
NENE	23	-1,566	-3,798	6	-225	-388
NEAL	9	-663	-3,852	6	-227	-392
NEDI	9	-852	-3,316	6	-303	-449
NERO	8	-679	-2,844	4	-216	-381
MUTY	40	-344	-1,240	6	-211	-453
MUJA	13	-325	-749	2	-136	-192
EFACU	0	---	---	0	---	---
ANAL	9	-1,085	-3,056	3	-891	-1,294
ANLU	10	-671	-2,867	3	-283	-436
ATCH	0	---	---	0	---	---
AYSA	0	---	---	0	---	---
ANSR	56	-11,756	-72,409	7	-5,362	-14,033
NETB	14	-9,629	-29,365	0	---	---
NEEV	9	-6,471	-16,205	0	---	---
VIKO	0	---	---	0	---	---
PISL	0	---	---	0	---	---
NEBA	0	---	---	0	---	---
NESL	0	---	---	0	---	---

8 Procedures for Addressing Negative Incremental Naturalized Flows

Negative naturalized flows also occur between control points as a result of channel losses and timing issues created by large flows that pass upstream points in one month and downstream points during the following month. These negative naturalized flows are referred to as negative incremental naturalized flows.

Where negative incremental naturalized flow values occurred at a primary control point, historical streamflow and water management data were inspected to identify and correct potential erroneous data. As previously discussed, channel losses are assumed to be negligible in the Neches River Basin; therefore, channel loss estimates were not developed to address potential negative incremental streamflow issues.

If no errors in the data were found, negative incremental flows were set to zero, and flows for surrounding months were adjusted to preserve mass balance. This approach is consistent with the

approach used in the development of the existing naturalized flow dataset. These adjustments are made in the “INCREMENTAL ADJ” tab of the naturalized flow workbooks.

Significant negative incremental flows are present in both the original and updated naturalized flow calculations and are the result of timing issues. The magnitude and frequency of negative incremental flows in the original and updated naturalized flow calculations were compared and found to be similar.

9 Procedures for Incorporating Extended Datasets in TCEQ Water Availability Model

The following modifications were made to the existing WAM main input file (.dat) and the flow distribution file (.dis) for the purposes of incorporating the extended naturalized streamflow and evaporation datasets.

- Notes were added to the main input file describing significant modifications to the existing naturalized flow and evaporation datasets as part of the update.
- The Simulation Job Control Data (JD Record) Field 2 was changed from 57 to 79 to include the additional 22 years in the extension period in the main input file.

10 Comparison of Historical Droughts

The updated naturalized flow and net evaporation datasets were used to compare drought periods occurring in the extension period (1997-2018) to those present in the existing period (1940-1996). Naturalized streamflows at selected primary control point locations were reviewed for short-term (6-month and annual) and long-term (3-, 5-, and 7-year) drought duration periods. It should be noted that water management activities were not considered in the drought comparisons and the critical drought period of a specific diversion under a water right may not be identical to the critical drought period found in this comparison.

Naturalized streamflow comparisons were performed for the following primary control point locations:

- Neches River at Lake Palestine Dam (NEPA)
- Neches River near Rockland (NERO)
- Mud Creek near Jacksonville (MUJA)
- Angelina River at Sam Rayburn Dam (ANRS)
- Neches River at Evadale (NEEV)
- Neches River at Sabine Lake (NESL)

The streamflow locations selected allow for historical drought comparisons in the upper sub-basins of the Neches and Angelina river basins (NEPA and MUJA), the Neches and Angelina river basins upstream of the confluence (NERO and ANSR), below the confluence (NEEV), and at the basin outlet (NESL).

Figure 7 compares the 10 lowest 6-month and annual naturalized streamflow totals at the Neches River Basin outlet (NESL). Comparison of the 6-month drought periods at the basin outlet shows that

the July through December period of 1956 was the most severe period during the period of record. The next most severe 6-month period of June through November of 2011 had 77 percent more streamflow compared to the 6-month period occurring in 1956. However, comparison of the annual totals shows 2011 was the most severe drought year as naturalized flows during the spring months of 2011 were significantly less than those occurring in the spring months of 1956.

Figure 8 compares the 3-, 5-, and 7-year running totals of naturalized flows at the Neches River Basin outlet. The comparison shows long-term drought periods occurred during the 1950s, 1960s, and mid-2000s to mid-2010s. These drought periods are all similar in severity when considering the three long-term drought duration periods. However, the most recent drought is not the most severe for any of the durations considered.

Similar drought comparison figures for short and long-term drought durations at all the selected streamflow locations are provided in **Appendix G**. A summary of key findings from the comparisons at the selected streamflow locations are as follows:

- The most significant periods of drought occurred throughout the Neches and Angelina River Basins during the 1950s, 1960s, and mid-2000s to mid-2010s. A significant period of drought also occurred in the upper Neches sub-basin during the late 1970s to the mid-1980s.
- The lowest 6-month naturalized streamflow periods throughout the Neches and Angelina River Basins occurred during the summer and fall of 1956.
- The lowest naturalized flow total occurring during a calendar year was 1964 in the upper Neches River sub-basin and 2006 in the upper Angelina River sub-basin. The 2011 calendar year was the most severe for all other selected streamflow locations.
- The longer-term drought periods (3-, 5-, and 7-years) are generally similar in severity with the most severe period often varying depending on the duration considered. However, comparison of longer term drought periods shows the most severe drought periods occurred in the existing period of record prior to 1997 at all the selected primary control point locations.

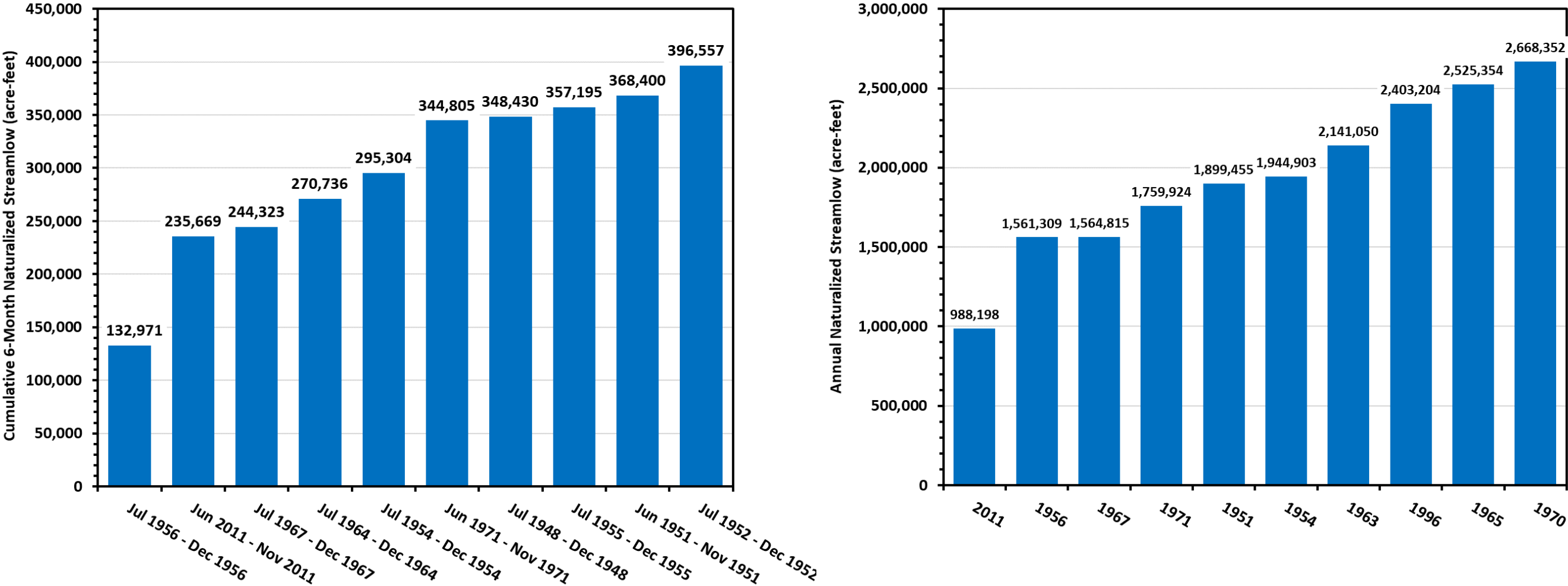


Figure 7. Comparison of 10 Lowest 6-month and Annual Naturalized Streamflow Amounts at the Neches River Basin Outlet (Neches River at Sabine Lake)

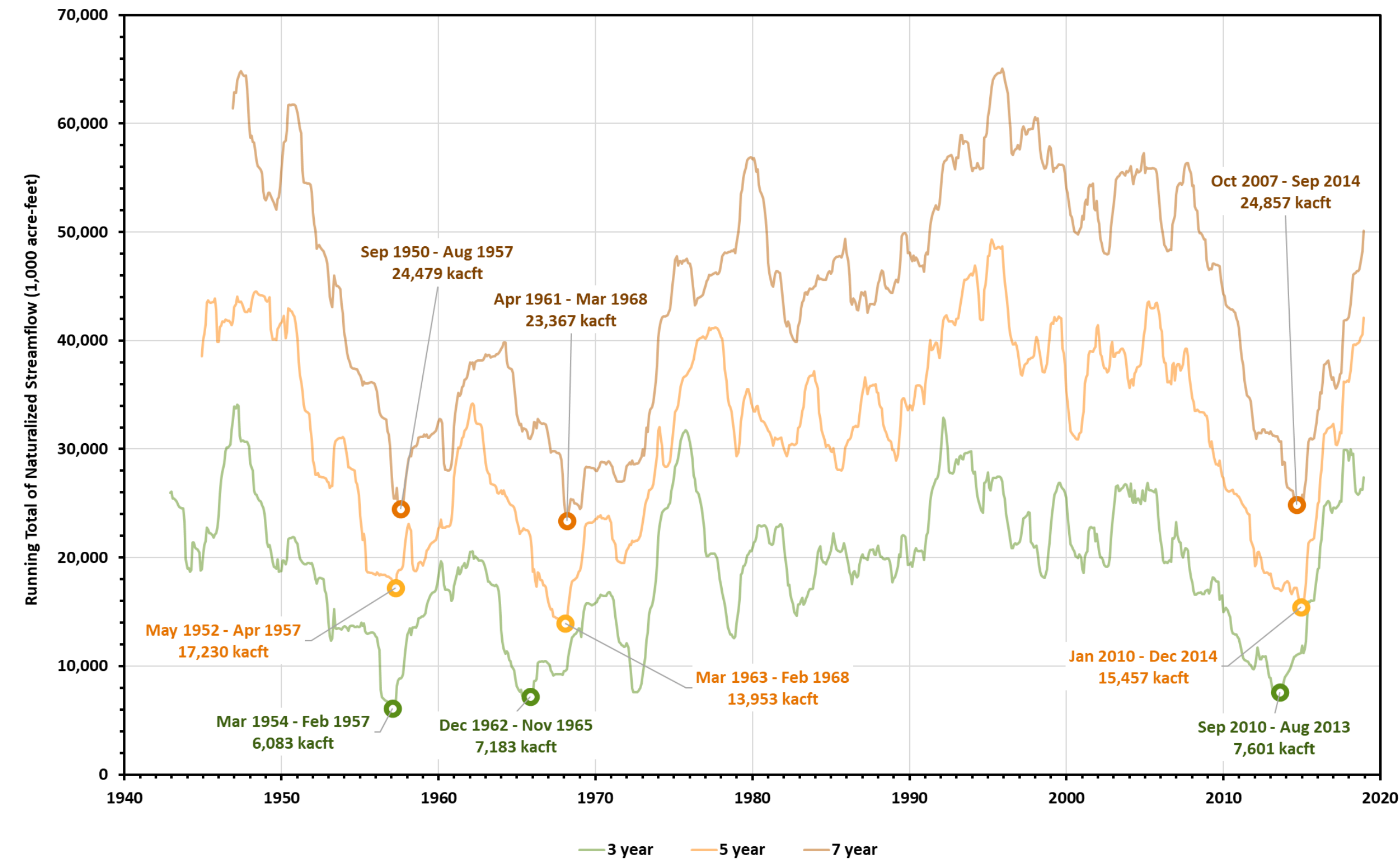


Figure 8. Comparison of 3-, 5-, and 7-year Running Totals of Naturalized Streamflow at the Neches River at Sabine Lake (Neches River Basin Outlet)

11 Hydrologic Trends

The updated naturalized flow and net evaporation datasets were reviewed to identify the presence of long-term trends. Annual naturalized flow, annual rainfall, and annual runoff as a percentage of rainfall were investigated for trends at the same primary control points selected for the drought caparison evaluation. The investigation of these hydrologic parameters considered the cumulative contributing drainage area of the selected locations⁸. Trends in annual gross evaporation were also investigated at the primary water supply reservoirs in the basin: Sam Rayburn Reservoir, Lake Palestine, and Lakes Tyler and Tyler East.

A statistical analysis was completed for the 1940 through 2018 updated period of record of the datasets using linear regression techniques to identify long-term trends. **Table 11** provides a comparison summary of the slope coefficient of the linear regressions and the resulting t statistic and P-values. The linear regressions of annual rainfall and runoff as a percentage of rainfall resulted in slope coefficients not significantly different from zero, indicating no long-term trends are present in these parameters.

Results of the statistical analysis for the annual naturalized flow regressions show positive slope coefficients except for the Mud Creek at Jacksonville location. However, the t statistic, or the slope coefficient divided by its standard error, indicates the standard error of the regression is greater than the slope coefficient. The P-value, or the confidence level at which the null hypothesis (slope coefficient is equal to zero) can be rejected are all significantly greater than 0.05 or 5 percent, indicating the slope coefficient is not statistically significantly different from zero. Based on the results of the statistical analysis, long-term trends were not identified in the annual naturalized flows at the selected locations.

Results of the statistical analysis for annual gross evaporation indicate long-term trends are present in the dataset. The t statistic values indicate the coefficient of the slope is greater than five times the standard error at all three reservoirs. Additionally, P-values are significantly lower than 0.05, indicating the slope coefficient is statistically significantly different from zero with a greater than 95 percent confidence level. Based on the statistical analysis, an increasing trend between 0.17 and 0.20 inches per year in gross evaporation is considered present at the three reservoirs.

Figure 9 through **Figure 12** show the annual values for naturalized flow, annual rainfall, gross evaporation, and runoff as a percentage of rainfall for the selected locations. Included in the figures is the annual average for 20-year periods throughout the 1940-2018 period of record of the updated datasets. Comparison of the figures show that only gross evaporation has increasing 20-year averages throughout the updated period of record, further indicating that a long-term trend is present in only the gross evaporation.

⁸ Annual rainfall of the cumulative contributing watersheds of the selected primary control points was calculated using TWDB quadrangle rainfall data and a weighted average procedure.

Table 11. Linear Regression Summary Comparison of Slope Coefficient, t Statistics and P-value of Hydrologic Parameters at Selected Locations

Annual Naturalized Flow (acft)			
Control Point	Slope Coefficient	t Statistic	P-value
NEPA	241	0.22	0.83
MUJA	-5	-0.01	0.99
ANSR	2,388	0.45	0.65
NERO	3,468	0.70	0.49
NEEV	7,236	0.61	0.54
NESL	10,219	0.65	0.52
Annual Rainfall (in)			
Control Point Watershed	Slope Coefficient	t Statistic	P-value
NEPA	1.64E-03	0.04	0.97
MUJA	2.92E-03	0.06	0.95
ANSR	3.86E-02	0.77	0.45
NERO	3.10E-02	0.68	0.50
NEEV	3.85E-02	0.81	0.42
NESL	4.82E-02	1.00	0.32
Runoff as Percentage of Rainfall (%)			
Control Point	Slope Coefficient	t Statistic	P-value
NEPA	1.18E-04	0.30	0.77
MUJA	1.33E-04	0.27	0.78
ANSR	2.30E-04	0.52	0.60
NERO	3.43E-04	0.81	0.42
NEEV	2.91E-04	0.67	0.51
NESL	2.39E-04	0.54	0.59
Annual Gross Evaporation (in)			
Reservoir	Slope Coefficient	t Statistic	P-value
Palestine	0.17	5.49	4.88E-07
Tyler and Tyler East	0.17	6.59	5.02E-09
Sam Rayburn	0.20	8.59	7.29E-13

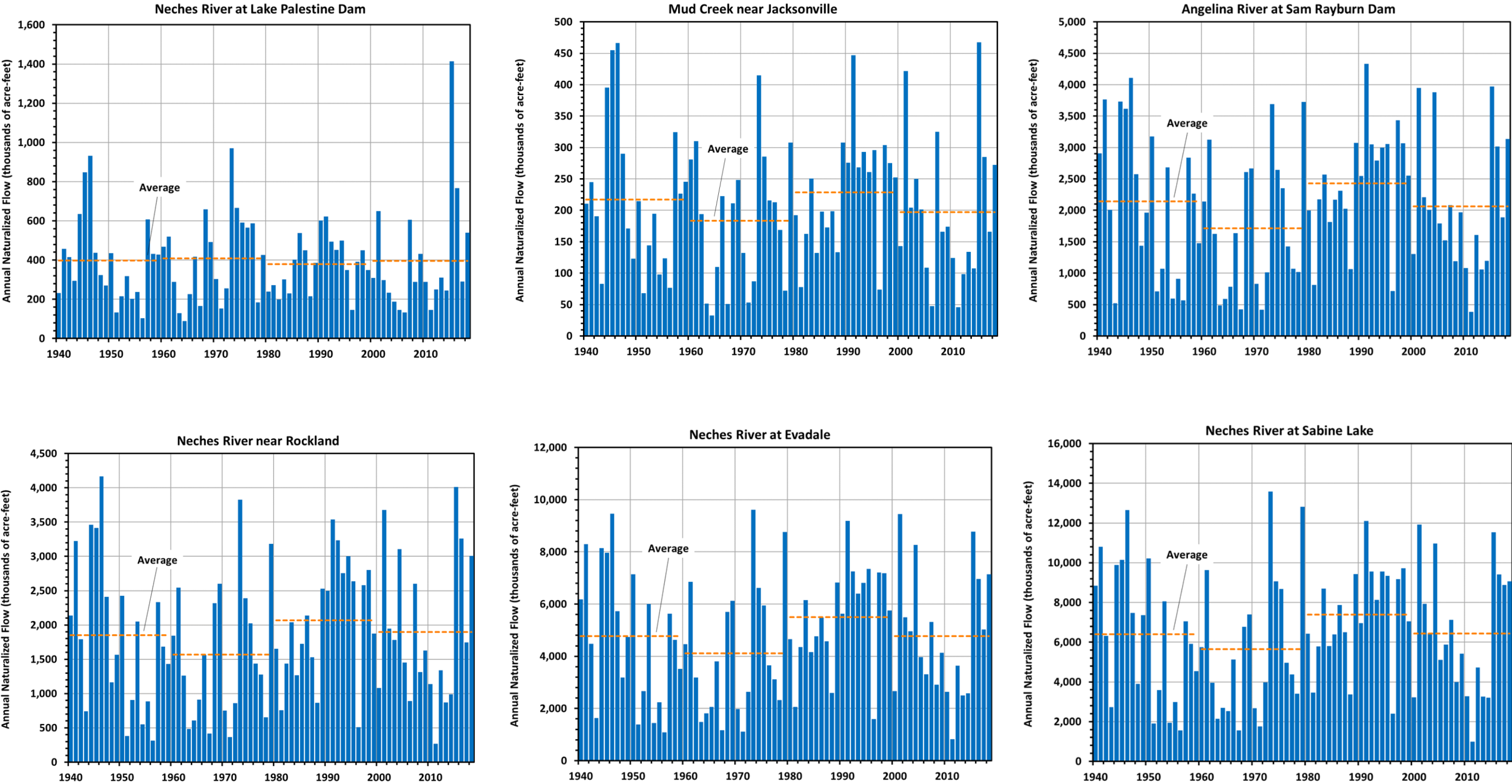


Figure 9. Annual Naturalized Streamflow at Selected Primary Control Points

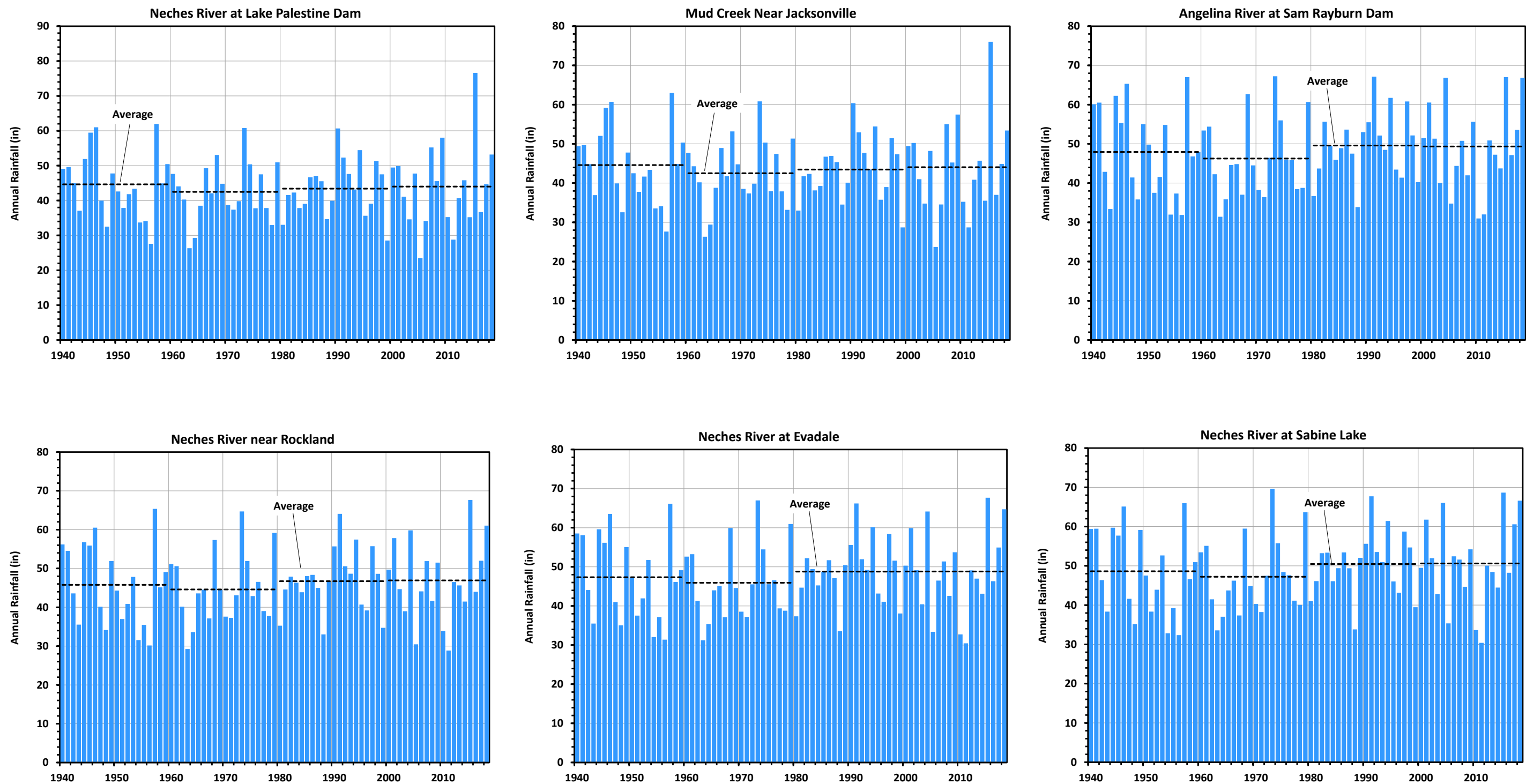


Figure 10. Annual Rainfall in Contributing Watersheds of Selected Primary Control Points

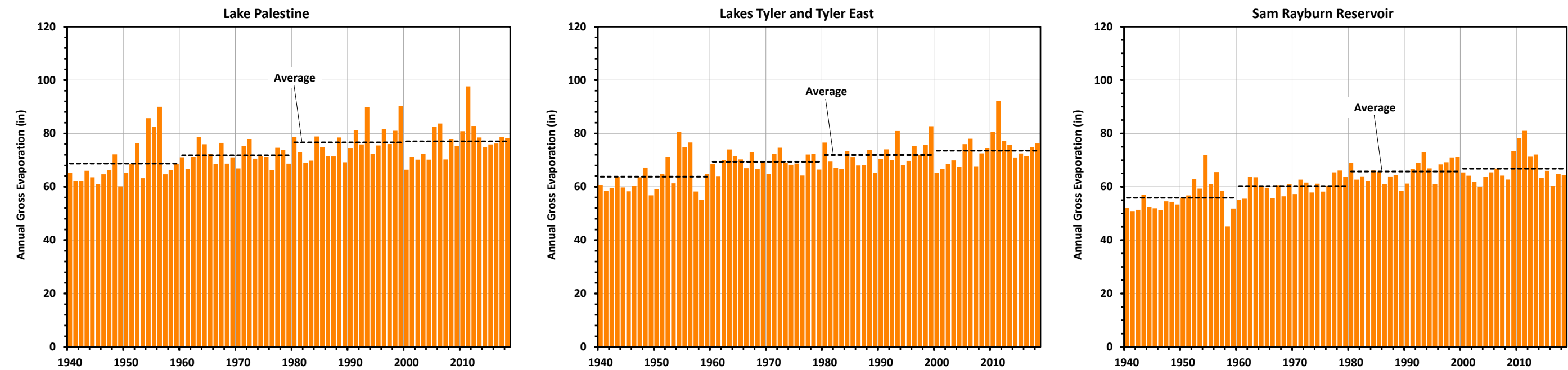


Figure 11. Annual Gross Evaporation at Selected Reservoirs

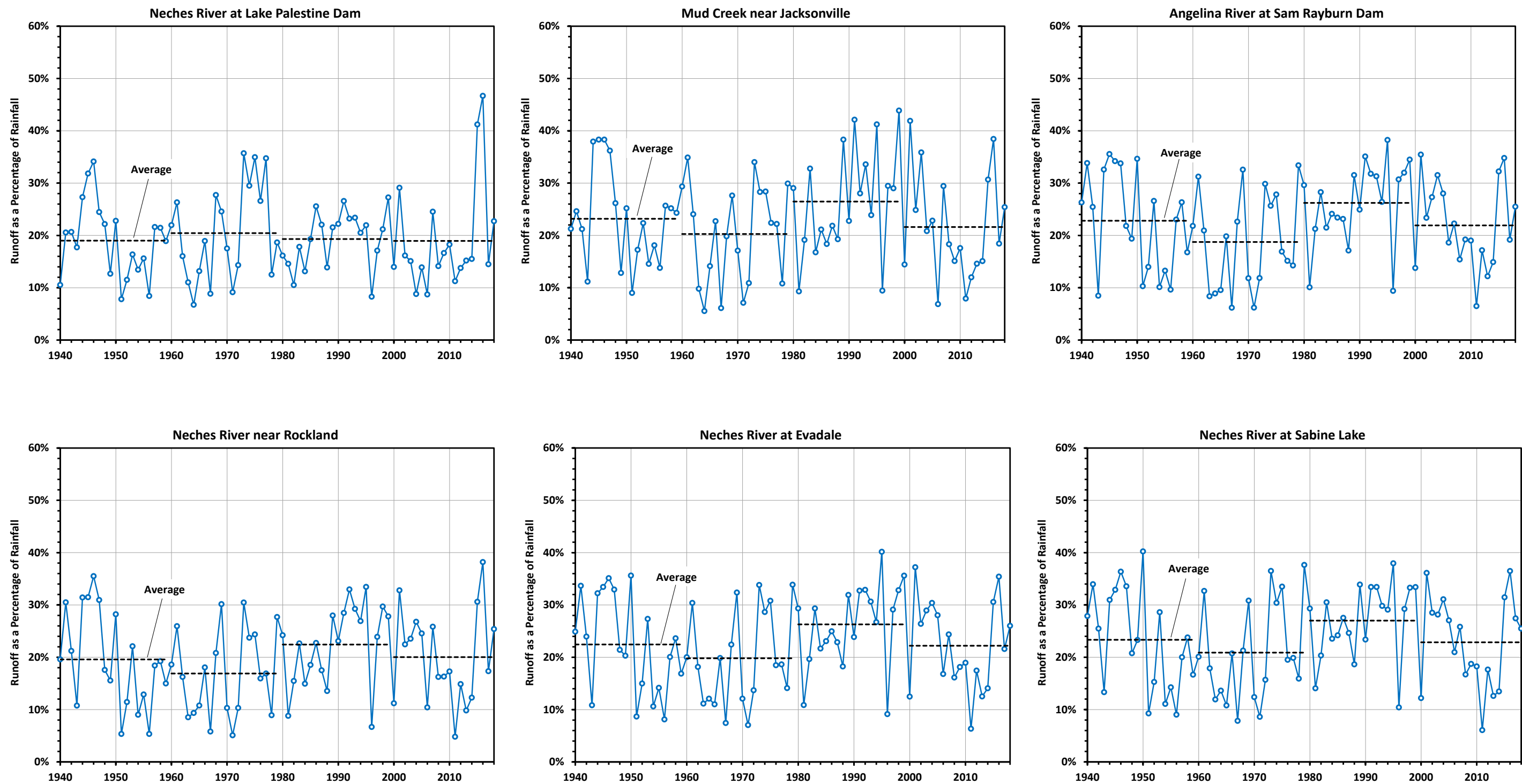


Figure 12. Annual Runoff as a Percentage of Rainfall at Selected Primary Control Points

12 Independent Peer Review

An independent review of the Neches WAM update was completed by Robert J. Brandes Consulting (RJBC) and Kennedy Resource Company (KRC). The independent review focused on quality control of the data collection effort and filling of missing data, calculations included in the naturalized flow workbooks, final datasets, and the draft report. The following four independent peer reviews were completed as part of the project.

1. **Draft Work Plan Review** – A review was completed of the work plan to verify the proposed methodologies to update the naturalized flow and evaporation datasets are correct and the most appropriate.
2. **Naturalized Flow Calculations** – A review of the naturalized flow workbooks was completed to verify naturalized flow and evaporation calculations are correct and methodologies outlined in the work plan were applied appropriately to fill missing data, address negative naturalized flows, and develop statistical relationships in the naturalized flow datasets.
3. **Evaporation Memo dated March 11, 2021** - The memo was reviewed, comments were submitted to HDR, and issues and comments were discussed during a conference call with the peer reviewers and HDR personnel.
4. **Draft Report Review** – A review of the draft report was completed to verify that deliverables and supporting documentation are complete, understandable, and meet TCEQ requirements before submittal of the draft report, naturalized flow workbooks, and updated WAM files. Issues and comments were discussed during a conference call with the peer reviewers and HDR personnel.

Comments from the independent peer review are summarized in the RJBC and KRC 30 June 2021 technical memorandum included in **Appendix H**. The independent peer review comments are addressed in the HDR 13 July 2021 technical memorandum also included in **Appendix H**. The only change made to the naturalized flow dataset following the independent review was to correct the formula error in the January 1965 content change for Sam Rayburn Reservoir. This correction did not result in significant changes to naturalized flow or net evaporation values at the Sam Rayburn Reservoir control point or downstream control points.

A decorative graphic on the left side of the page, consisting of a large blue rectangle and a smaller grey rectangle stacked vertically. To the right of these rectangles is a large grey rectangle, and below the grey rectangle is a black rectangle.

APPENDIX A – Updated Naturalized Flow Dataset

KICKAPOO CREEK NEAR BROWNSBORO (KIBR)
NATURALIZED FLOW
UNITS: ACRE-FEET

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
1940	1,386	2,981	1,715	4,605	3,352	2,281	3,697	603	771	339	20,521	27,709	69,960
1941	23,036	11,949	20,447	13,214	8,665	29,148	7,851	917	986	4,381	5,439	11,960	137,993
1942	8,508	10,182	9,174	41,896	20,717	16,966	1,790	1,663	5,111	1,614	3,167	4,845	125,633
1943	15,233	4,777	6,611	8,932	15,118	20,804	1,684	174	260	8,111	2,025	5,071	88,800
1944	22,975	28,777	34,142	10,929	65,925	10,192	965	418	883	485	2,468	13,547	191,706
1945	31,401	17,550	52,676	90,590	7,073	7,221	15,963	1,551	1,308	12,788	6,293	11,563	255,977
1946	34,615	28,542	31,770	17,276	36,492	35,979	4,130	5,652	11,484	5,549	47,475	22,603	281,567
1947	24,888	12,378	26,498	30,726	11,677	6,240	1,660	490	1,007	783	2,858	13,010	132,215
1948	11,448	26,112	23,702	8,117	20,303	2,302	1,373	198	186	296	1,366	2,108	97,511
1949	7,385	11,785	16,884	19,227	4,624	2,607	922	790	660	6,510	6,244	4,289	81,927
1950	21,830	43,401	9,976	11,742	22,758	12,745	2,032	909	1,265	874	1,771	1,981	131,284
1951	3,199	7,569	8,989	6,341	4,788	3,657	875	98	295	320	1,193	2,674	39,998
1952	3,704	8,873	10,602	19,921	10,417	4,957	380	0	0	2	796	5,447	65,099
1953	8,299	4,532	20,097	5,275	45,493	1,533	1,377	428	441	236	1,403	6,804	95,918
1954	5,660	4,517	4,461	5,002	19,294	1,033	40	0	0	1,621	12,254	7,386	61,268
1955	7,876	13,322	17,997	17,419	7,448	2,928	1,041	366	1,077	734	411	1,377	71,996
1956	2,504	7,000	2,578	1,494	16,840	319	10	0	0	0	212	458	31,415
1957	884	3,611	4,982	46,782	46,897	31,714	920	579	528	8,927	25,679	12,146	183,649
1958	16,766	11,904	10,039	11,141	54,825	3,456	8,388	646	2,745	2,785	3,170	4,339	130,204
1959	4,339	11,412	11,265	20,106	44,020	10,492	4,940	2,285	974	2,702	3,438	13,100	129,073
1960	28,345	15,745	21,651	6,518	3,783	2,534	4,196	905	926	3,496	6,130	47,262	141,491
1961	42,294	31,030	29,952	13,511	4,520	6,278	3,991	1,091	1,436	1,331	3,315	17,999	156,748
1962	16,146	12,680	15,245	10,026	5,018	936	1,160	1,625	180	588	1,223	2,146	66,973
1963	2,753	2,132	3,533	12,599	10,816	342	21	9	7	5	4	158	32,379
1964	687	1,855	4,746	1,448	2,059	937	10	13	13	12	235	102	12,117
1965	1,804	11,879	3,981	3,630	22,639	1,068	52	7	108	2	0	268	45,438
1966	646	3,602	2,243	77,476	31,158	878	257	1,546	4,727	887	1,543	2,253	127,216
1967	3,537	2,321	3,055	10,118	6,276	14,517	183	0	390	1,632	7,966	15,269	65,264
1968	20,896	15,560	23,903	34,742	84,897	10,707	5,665	356	972	749	2,979	10,935	212,361
1969	5,659	20,071	38,220	22,633	39,231	2,638	62	7	7	14	2,418	9,848	140,808
1970	11,330	18,389	28,800	9,981	3,336	2,483	63	8	631	25,384	8,210	3,521	112,136
1971	3,344	4,927	4,526	2,041	1,196	127	18	1,200	243	2,015	6,712	42,603	68,952
1972	26,848	8,680	3,598	1,767	1,025	1,172	158	454	12	1,667	10,132	10,052	65,565
1973	12,540	13,160	36,432	43,809	7,738	65,534	1,327	862	3,414	10,034	11,135	17,909	223,894
1974	19,390	11,266	12,073	8,678	14,097	2,315	69	87	4,407	2,400	35,889	19,396	130,067
1975	14,878	23,189	15,447	18,155	28,209	8,168	639	85	148	145	578	1,412	111,053
1976	3,045	3,937	9,562	12,452	16,344	26,660	11,113	274	18,565	9,568	6,569	22,596	140,685
1977	10,675	37,811	29,316	34,495	2,759	10,647	122	3	398	7	582	1,642	128,457
1978	3,217	8,269	19,573	3,195	5,076	808	0	9	4	0	247	531	40,929
1979	4,013	4,637	9,269	25,315	22,122	4,683	398	2,656	1,642	119	732	6,579	82,165
1980	17,742	11,827	5,974	13,912	8,311	236	0	2	4	2	2	45	58,057
1981	334	928	2,223	1,133	15,937	39,921	443	6	12	3,062	2,721	3,285	70,005
1982	2,971	3,511	5,381	2,454	4,352	2,674	2,196	0	10	31	2,279	27,685	53,544
1983	6,766	25,456	15,066	5,373	11,050	9,015	5,425	298	63	1	836	2,467	81,816
1984	2,745	15,870	29,522	4,130	815	177	0	0	0	32	1,894	6,452	61,637
1985	4,403	23,351	15,364	8,763	8,662	320	51	0	0	985	9,515	29,663	101,077
1986	3,598	21,939	2,759	46,629	46,895	18,307	1,185	1	5	838	8,061	24,305	174,522
1987	10,834	17,078	35,260	3,162	2,479	13,430	684	0	50	360	5,149	42,514	131,000
1988	17,998	16,548	24,294	10,856	1,538	1,213	80	0	0	15	2,402	3,104	78,048
1989	3,449	11,484	8,660	8,194	69,017	8,588	442	798	46	1,524	1,548	1,828	115,578
1990	9,259	9,462	33,757	25,169	32,659	12,459	2,713	3,580	3,325	7,386	9,897	12,466	162,132
1991	28,047	24,378	14,066	22,925	12,816	5,710	3,513	5,089	3,548	3,509	8,962	34,805	167,368
1992	25,426	34,969	24,358	4,782	3,184	2,601	2,677	430	2,288	3,628	7,542	21,197	133,082
1993	35,839	17,225	18,133	9,448	5,224	4,195	2,887	3,188	3,595	13,898	3,801	4,046	121,479
1994	4,432	27,743	12,411	2,847	18,201	1,191	1,477	1,234	86	18,923	11,826	34,112	134,483
1995	22,092	8,598	11,068	17,573	25,291	1,825	1,370	548	1,784	0	1,628	2,374	94,151
1996	2,616	2,450	1,880	5,216	3,515	1,727	1,678	4,143	2,795	2,632	3,590	6,827	39,069
1997	5,911	28,399	16,187	24,785	1,490	6,549	2,156	1,905	952	3,763	3,318	10,062	105,477
1998	35,375	13,253	12,944	2,225	1,436	2,167	1,262	230	5,080	9,280	19,635	18,224	121,111
1999	21,174	13,819	6,804	11,608	11,128	12,572	6,090	2,710	1,926	1,844	1,163	2,993	93,831
2000	2,032	3,755	3,720	5,081	20,289	5,858	2,633	1,430	0	1,943	11,973	24,596	83,310
2001	27,547	34,651	51,699	5,017	6,757	5,321	3,208	4,183	4,027	3,038	4,355	25,023	174,826
2002	5,182	8,664	19,465	11,876	4,221	2,984	5,172	3,482	3,122	3,189	3,205	9,446	80,008
2003	5,772	17,611	7,129	2,929	6,388	4,733	2,720	3,729	2,969	4,086	1,160	3,668	62,894
2004	3,439	8,417	3,466	4,404	8,865	3,962	3,502	2,753	777	2,958	1,052	6,981	50,576
2005	5,434	10,681	5,652	2,320	1,769	3,052	2,967	1,662	2,556	1,108	737	1,343	39,281
2006	2,662	3,814	8,148	1,939	3,038	1,452	1,150	2,840	1,591	1,754	2,731	4,697	35,816
2007	41,236	3,271	8,293	6,965	18,192	21,822	48,004	3,389	2,871	802	2,157	6,155	163,157
2008	4,103	8,480	14,543	5,527	9,010	3,455	3,059	7,291	8,190	3,575	7,138	3,178	77,549
2009	2,817	4,391	17,973	11,214	4,501	2,922	3,225	4,575	5,209	42,793	6,604	10,027	116,251
2010	8,004	20,405	16,785	1,045	2,530	16,904	1,980	2,924	1,128	2,161	1,457	2,178	77,501
2011	7,826	3,158	3,175	3,002	1,484	2,689	2,728	3,413	2,580	2,354	1,708	4,916	39,033
2012	7,661	10,414	27,552	1,561	3,274	2,969	1,806	3,744	3,500	1,340	1,177	2,485	67,483
2013	4,826	3,330	3,177	3,653	3,470	861	3,290	2,293	6,244	9,058	18,417	25,132	83,751
2014	9,235	9,395	9,628	11,292	5,337	4,511	3,649	2,326	1,885	3,948	2,481	2,111	65,798
2015	10,559	9,505	45,039	56,954	67,242	13,900	2,928	2,835	2,333	20,943	41,487	106,526	380,251
2016	28,979	17,140	68,410	34,074	23,453	16,475	3,036	3,818	1,953	2,778	2,068	4,068	206,252
2017	14,333	8,734	6,660	3,616	5,788	11,756	4,349	8,768	2,584	1,550	1,944	7,890	77,972
2018	6,552	29,353	21,856	6,459	2,796	2,195	2,438	2,162	2,196	14,847	21,726	32,849	145,429
MIN	334	928	1,715	1,045	815	127	0	0	0	0	0	45	12,117
MAX	42,294	43,401	68,410	90,590	84,897	65,534	48,004	8,768	18,565	42,793	47,475	106,526	380,251
AVG	11,990	13,491	16,180	14,600	15,967	8,135	2,882	1,528	1,892	3,988	6,255	12,362	109,272

LAKE PALESTINE DAM (NEPA)
NATURALIZED FLOW
UNITS: ACRE-FEET

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
1940	4,586	9,862	5,674	15,236	11,091	7,546	12,231	1,995	2,551	1,122	67,896	91,676	231,466
1941	76,217	39,536	67,651	43,718	28,668	96,438	25,976	3,036	3,262	14,495	17,995	39,570	456,562
1942	28,151	33,687	30,353	138,617	68,543	56,134	5,923	5,502	16,911	5,340	10,478	16,031	415,670
1943	50,401	15,805	21,874	29,551	50,019	68,831	5,572	575	859	26,837	6,700	16,777	293,801
1944	76,015	95,211	112,963	36,159	218,118	33,721	3,193	1,383	2,922	1,605	8,167	44,822	634,279
1945	103,892	58,064	174,281	299,724	23,402	23,892	52,813	5,130	4,327	42,311	20,820	38,256	846,912
1946	114,525	94,434	105,114	57,158	120,737	119,040	13,664	18,699	37,995	18,358	157,073	74,782	931,579
1947	82,345	40,953	87,669	101,658	38,634	20,644	5,494	1,621	3,332	2,590	9,457	43,045	437,442
1948	37,875	86,394	78,419	26,855	67,174	7,617	4,543	655	617	978	4,518	6,974	322,619
1949	24,433	38,990	55,861	63,612	15,297	8,626	3,049	2,615	2,182	21,537	20,658	14,190	271,050
1950	72,227	143,596	33,006	38,850	75,296	42,168	6,721	3,007	4,184	2,892	5,858	6,555	434,360
1951	10,582	25,041	29,740	20,979	15,843	12,098	2,894	324	975	1,060	3,947	8,847	132,330
1952	12,256	29,356	35,078	65,912	34,467	16,401	1,256	0	0	6	2,634	18,022	215,388
1953	27,458	14,995	66,494	17,453	150,516	5,071	4,556	1,417	1,458	781	4,641	22,512	317,352
1954	18,727	14,944	14,761	16,551	63,835	3,417	133	0	0	5,364	40,542	24,438	202,712
1955	26,059	44,077	59,544	57,632	24,644	9,687	3,443	1,210	3,564	2,428	1,361	4,556	238,205
1956	8,283	23,161	8,528	4,942	55,715	1,054	34	0	0	0	700	1,515	103,932
1957	2,926	11,948	16,483	154,781	155,161	104,927	3,045	1,916	1,745	29,535	84,959	40,185	607,611
1958	55,472	39,385	33,216	36,861	181,394	11,433	27,751	2,137	9,082	9,215	10,487	14,355	430,788
1959	14,357	37,758	37,270	66,521	145,645	34,714	16,343	7,562	3,222	8,941	11,375	43,343	427,051
1960	93,781	52,095	71,633	21,565	12,517	8,383	13,884	2,995	3,063	11,566	20,283	156,368	468,133
1961	139,933	102,666	99,099	44,701	14,956	20,772	13,203	3,608	4,752	4,405	10,969	59,551	518,615
1962	53,419	41,953	50,440	33,171	32,572	15,224	14,148	6,937	7,013	8,875	8,487	16,822	289,061
1963	17,586	14,732	20,193	12,599	40,215	6,073	2,883	2,728	2,441	2,123	2,583	5,622	129,778
1964	7,509	11,630	21,976	12,602	8,316	6,860	2,337	2,441	2,495	2,329	4,276	5,614	88,385
1965	13,361	38,171	25,128	25,164	86,785	23,083	2,637	1,907	2,109	1,724	2,355	4,436	226,860
1966	5,744	14,045	12,778	204,113	126,404	5,403	3,016	7,030	13,627	5,633	8,724	10,897	417,414
1967	15,375	10,710	13,025	27,775	18,409	30,284	2,192	2,104	4,429	2,184	15,447	24,719	166,653
1968	61,347	50,650	69,702	87,387	230,929	43,601	20,285	4,843	12,555	6,505	18,454	51,949	658,207
1969	26,243	57,122	110,552	119,770	89,040	14,609	3,186	2,162	3,408	2,441	24,591	39,372	492,496
1970	40,667	37,942	86,452	40,067	17,187	6,098	2,635	1,197	3,291	25,384	26,634	15,516	303,070
1971	15,081	18,265	16,952	9,337	6,043	2,120	1,267	3,472	2,242	3,555	12,426	62,167	152,927
1972	65,776	26,154	17,560	8,918	6,841	6,856	4,760	6,593	8,118	21,351	39,233	42,891	255,051
1973	54,645	38,477	132,176	145,109	28,359	180,855	33,666	19,862	75,648	82,071	92,290	87,669	970,827
1974	94,262	66,348	55,830	43,657	60,224	26,828	12,665	12,151	62,808	42,851	110,247	77,427	665,298
1975	70,580	108,889	61,726	81,733	118,193	69,949	20,114	9,057	10,487	17,238	10,616	12,632	591,214
1976	22,942	22,229	52,571	33,003	61,376	96,370	53,632	11,470	79,030	32,816	22,812	77,120	565,371
1977	45,519	127,447	144,785	171,306	28,215	22,688	7,134	6,798	2,647	4,605	10,435	16,534	588,113
1978	21,717	28,830	51,110	10,810	14,355	5,955	3,828	10,020	7,482	7,271	11,818	11,087	184,283
1979	35,624	20,756	47,248	94,590	70,207	52,072	27,937	8,231	32,128	6,711	4,767	25,164	425,435
1980	53,116	38,209	17,962	40,865	28,348	10,482	9,779	8,773	11,177	3,371	6,711	9,755	238,548
1981	9,914	14,044	17,419	14,179	49,210	98,901	6,410	6,742	7,910	12,986	16,185	17,363	271,263
1982	14,353	11,055	19,059	15,079	19,836	11,837	8,613	5,482	7,067	6,978	16,490	63,293	199,142
1983	12,555	66,809	55,736	18,378	52,089	44,607	19,400	9,082	4,930	5,717	4,825	7,490	301,618
1984	14,979	44,519	65,846	11,458	4,574	9,198	3,764	6,371	5,817	10,051	15,157	37,761	229,495
1985	19,194	64,866	47,876	29,439	23,679	1,417	8,816	9,623	7,630	40,449	58,913	91,129	403,031
1986	12,469	87,036	14,558	135,573	157,096	54,044	9,278	979	726	13,836	22,539	30,564	538,698
1987	27,069	62,448	143,288	10,417	12,523	24,151	5,089	4,092	10,439	2,975	29,250	117,623	449,364
1988	17,998	37,402	54,390	23,853	6,803	10,389	8,390	7,023	5,751	9,369	10,778	23,020	215,166
1989	17,111	35,948	35,958	23,409	216,252	23,618	4,139	10,129	61	5,663	5,752	6,794	384,834
1990	34,409	35,160	125,445	93,531	121,363	46,298	10,081	13,304	12,357	27,447	36,780	46,324	602,499
1991	104,227	90,590	52,270	85,193	47,625	21,220	13,056	18,913	13,184	13,040	33,305	129,340	621,963
1992	94,486	129,947	90,518	17,769	11,833	9,665	9,948	1,597	8,503	13,482	28,028	78,771	494,547
1993	133,182	64,008	67,384	35,110	19,413	15,588	10,730	11,846	13,361	51,645	14,125	15,036	451,428
1994	16,468	103,097	46,120	10,579	67,635	4,427	5,490	4,584	319	70,320	43,948	126,763	499,750
1995	82,095	31,950	41,128	65,304	93,985	6,783	5,092	2,036	6,630	0	6,051	8,823	349,877
1996	9,721	9,104	6,986	19,384	13,062	6,416	6,236	15,397	10,385	9,780	13,341	25,371	145,183
1997	21,965	105,533	60,153	92,105	5,536	24,336	8,011	7,080	3,538	13,984	12,329	37,391	391,961
1998	131,455	49,250	48,102	8,267	5,337	8,052	4,689	854	18,876	34,484	72,966	67,721	450,053
1999	78,684	51,351	25,284	43,135	41,352	46,718	22,632	10,070	7,157	6,854	4,322	11,123	348,682
2000	7,551	13,953	13,824	18,881	75,394	21,768	9,786	5,314	0	7,219	44,491	91,400	309,581
2001	102,366	128,766	192,118	18,642	25,110	19,774	11,920	15,543	14,963	11,290	16,183	92,988	649,663
2002	19,257	32,196	72,332	44,132	15,685	11,089	19,218	12,940	11,600	11,850	11,909	35,103	297,311
2003	21,449	65,445	26,493	10,883	23,738	17,589	10,107	13,858	11,033	15,183	4,311	13,629	233,718
2004	12,778	31,280	12,881	16,366	32,945	14,725	13,013	10,231	2,889	10,992	3,908	25,942	187,950
2005	20,193	39,692	21,005	8,623	6,572	11,342	11,024	6,176	9,500	4,116	2,740	4,992	145,975
2006	9,894	14,173	30,280	7,207	11,290	5,394	4,274	10,552	5,911	6,518	10,147	17,454	133,094
2007	153,236	12,154	30,816	25,884	67,602	81,094	178,386	12,594	10,670	2,980	8,017	22,873	606,306
2008	15,247	31,511	54,043	20,537	33,481	12,838	11,366	27,093	30,435	13,286	26,527	11,810	288,174
2009	10,470	16,318	66,788	41,674	16,726	10,858	11,986	17,002	19,356	159,021	24,542	37,262	432,003
2010	29,744	75,825	62,375	3,882	9,402	62,818	7,357	10,867	4,190	8,032	5,416	8,092	288,000
2011	29,082	11,734	11,800	11,157	5,513	9,994	10,137	12,682	9,588	8,746	6,348	18,270	145,051
2012	28,469	38,700	102,384	5,800	12,168	11,032	6,712	13,914	13,006	4,981	4,374	9,235	250,775
2013	17,935	12,375	11,806	13,575	12,896	3,201	12,227	8,522	23,204	33,661	68,438	93,394	311,234
2014	34,318	34,912	35,780	41,961	19,832	16,763	13,560	8,643	7,005	14,671	9,221	7,845	244,511
2015	39,238	35,322	167,369	211,648	249,879	51,654	10,879	10,534	8,668	77,825	154,168	395,860	1,413,044
2016	107,689	63,695	254,218	126,621	87,153	61,223	11,282	14,189	7,259	10,323	7,686	15,117	766,455
2017	53,264	32,458	24,749	13,439	21,510	43,688	16,163	32,583	9,604	5,760	7,224	29,320	289,762
2018	24,347	109,080	81,218	24,003	10,389	8,155	9,060	8,034	8,161	55,173	80,735	122,069	540,424
MIN	2,926	9,104	5,674	3,882	4,574	1,054	34	0	0	0	700	1,515	

NECHES RIVER AT NECHES (NENE)
NATURALIZED FLOW
UNITS: ACRE-FEET

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
1940	6,601	14,194	8,167	21,929	15,963	10,860	17,604	2,871	3,671	1,615	97,720	131,946	333,141
1941	109,697	56,902	97,368	62,922	41,261	138,799	37,386	4,369	4,695	20,862	25,900	56,951	657,112
1942	40,516	48,485	43,686	199,507	98,651	80,792	8,525	7,919	24,340	7,685	15,081	23,073	598,260
1943	72,540	22,748	31,483	42,531	71,990	99,066	8,020	828	1,237	38,626	9,643	24,147	422,859
1944	109,405	137,033	162,583	52,043	313,929	48,534	4,595	1,991	4,206	2,310	11,754	64,510	912,893
1945	149,528	83,570	250,836	431,382	33,682	34,387	76,012	7,384	6,228	60,896	29,966	55,061	1,218,932
1946	164,832	135,915	151,287	82,265	173,772	171,330	19,666	26,913	54,685	26,422	226,070	107,631	1,340,788
1947	118,516	58,942	126,179	146,313	55,605	29,712	7,907	2,333	4,796	3,728	13,611	61,953	629,595
1948	54,512	124,344	112,866	38,652	96,681	10,963	6,539	943	888	1,408	6,503	10,037	464,336
1949	35,166	56,117	80,399	91,555	22,017	12,415	4,389	3,763	3,141	30,998	29,733	20,423	390,116
1950	103,953	206,672	47,504	55,916	108,371	60,691	9,674	4,328	6,022	4,163	8,431	9,434	625,159
1951	15,231	36,041	42,803	30,194	22,802	17,412	4,165	467	1,404	1,526	5,681	12,733	190,459
1952	17,640	42,251	50,486	94,864	49,607	23,605	1,808	0	0	8	3,791	25,939	309,999
1953	39,520	21,582	95,702	25,119	216,632	7,299	6,558	2,040	2,099	1,124	6,679	32,400	456,754
1954	26,953	21,508	21,245	23,821	91,876	4,918	191	0	0	7,720	58,350	35,172	291,754
1955	37,506	63,439	85,699	82,947	35,469	13,942	4,956	1,742	5,130	3,495	1,959	6,558	342,842
1956	11,922	33,335	12,274	7,113	80,189	1,517	49	0	0	0	1,008	2,180	149,587
1957	4,211	17,196	23,723	222,770	223,317	151,017	4,382	2,757	2,512	42,508	122,279	57,837	874,509
1958	79,839	56,685	47,807	53,053	261,073	16,455	39,941	3,076	13,071	13,263	15,094	20,660	620,017
1959	20,663	54,343	53,642	95,741	209,621	49,962	23,522	10,883	4,638	12,869	16,371	62,382	614,637
1960	134,976	74,978	103,099	31,038	18,015	12,066	19,983	4,311	4,408	16,647	29,192	225,055	673,768
1961	201,400	147,763	142,629	64,337	21,525	29,897	19,003	5,193	6,839	6,340	15,787	85,710	746,423
1962	76,884	60,382	72,597	47,742	46,879	21,912	20,363	9,984	10,093	12,773	12,215	24,212	416,036
1963	25,311	21,203	29,063	18,055	57,957	8,740	4,149	3,926	3,513	3,055	3,717	8,092	186,781
1964	10,808	16,739	31,629	18,137	11,969	9,874	3,363	3,513	3,591	3,352	6,155	8,080	127,210
1965	19,230	54,938	36,166	36,217	124,907	33,222	3,796	2,745	3,036	2,481	3,390	6,384	326,512
1966	8,267	20,214	18,391	293,772	181,928	7,776	4,341	10,118	19,613	8,107	12,556	15,683	600,766
1967	22,129	15,415	18,747	39,975	26,495	43,586	3,155	3,028	6,374	3,144	22,233	35,577	239,858
1968	88,294	72,898	100,319	125,773	332,367	62,754	29,195	6,970	18,070	9,363	26,560	74,768	947,331
1969	37,771	82,214	159,113	172,381	128,152	21,026	4,586	3,111	4,905	3,513	35,393	56,667	708,832
1970	58,531	54,608	124,427	57,667	24,736	8,776	3,792	1,723	4,736	29,004	45,863	22,332	436,195
1971	21,706	26,288	24,398	13,439	8,698	3,051	1,823	4,997	3,227	5,116	17,884	89,474	220,101
1972	94,669	37,642	25,274	12,835	9,846	9,868	6,851	9,489	11,684	30,730	56,467	61,731	367,086
1973	70,952	59,314	163,062	233,619	74,439	256,840	48,440	23,951	93,334	125,558	111,203	127,643	1,388,355
1974	128,374	97,238	72,385	52,549	63,555	32,233	14,124	12,527	75,828	57,131	151,595	106,242	863,781
1975	85,267	141,464	70,454	86,716	118,193	70,851	24,614	10,603	12,442	22,224	15,516	19,913	678,257
1976	32,798	29,054	62,594	37,956	70,116	112,056	63,219	13,253	79,030	32,816	22,812	90,759	646,463
1977	50,998	152,058	144,785	195,827	33,064	35,143	9,928	7,136	3,491	5,336	14,518	20,385	672,669
1978	31,068	44,901	92,870	24,803	25,490	8,548	3,942	10,979	8,852	8,673	16,369	15,682	292,177
1979	57,884	43,883	93,189	143,707	99,373	88,718	51,595	31,850	54,782	16,873	18,906	51,424	752,184
1980	94,827	86,330	38,654	74,968	57,646	13,063	10,676	8,773	11,177	3,371	6,711	9,755	415,951
1981	11,343	20,735	23,440	17,342	59,365	144,550	14,952	6,742	7,910	14,250	18,130	20,226	358,985
1982	21,589	24,104	36,546	42,674	45,910	20,162	16,579	5,618	7,067	8,296	24,441	88,252	341,238
1983	31,458	94,132	112,050	39,519	65,763	63,056	29,426	10,769	5,711	7,051	8,508	14,642	482,085
1984	22,323	64,006	102,979	29,992	8,689	11,490	4,870	7,564	6,066	12,730	18,288	44,568	333,565
1985	28,585	73,906	85,800	44,404	35,998	3,802	9,805	9,882	7,867	44,211	81,801	140,131	566,192
1986	27,835	127,168	26,790	146,899	195,096	89,720	19,895	6,024	2,931	19,086	30,764	98,331	790,539
1987	55,048	84,737	161,714	29,456	24,801	44,889	12,270	6,557	12,444	4,569	38,605	154,762	629,852
1988	78,100	64,182	86,455	51,274	14,123	14,901	12,775	9,502	7,875	12,464	16,749	30,953	399,353
1989	26,371	63,832	55,086	47,295	305,390	64,243	12,946	11,035	2,024	7,983	7,957	8,152	612,314
1990	50,040	56,223	156,687	119,105	190,067	110,455	15,478	17,748	19,433	53,036	76,935	71,699	936,906
1991	182,493	142,116	89,543	147,790	90,849	43,285	21,591	39,443	24,276	19,674	59,868	220,735	1,081,663
1992	142,050	184,192	147,582	42,725	30,577	22,172	16,909	11,200	22,408	22,649	43,601	117,269	803,334
1993	181,035	96,560	120,610	73,230	51,438	65,787	23,709	17,683	17,855	59,388	25,601	31,218	764,114
1994	32,415	142,177	117,287	45,586	80,287	27,492	13,307	14,271	10,023	114,450	94,431	199,465	891,191
1995	149,663	73,808	94,058	112,316	155,038	31,850	14,431	10,552	19,365	3,289	12,536	18,573	695,479
1996	18,928	16,174	13,194	25,117	16,844	7,391	6,236	17,837	13,943	12,663	18,827	36,103	203,257
1997	33,602	144,390	133,659	118,074	75,094	73,269	19,183	12,321	6,212	18,585	19,289	63,170	716,848
1998	270,807	96,013	100,043	35,827	11,515	9,981	5,554	1,019	21,053	45,352	99,329	93,794	790,287
1999	125,110	94,540	44,946	70,606	53,821	56,247	31,752	13,874	10,184	9,792	8,359	19,166	538,397
2000	15,479	20,949	23,033	31,736	122,972	48,428	9,786	5,314	828	9,125	62,894	116,336	466,880
2001	156,340	147,217	318,000	47,787	45,443	65,259	26,573	17,832	27,300	21,267	24,727	139,931	1,037,676
2002	50,179	58,165	102,211	81,359	25,015	12,711	19,218	12,940	11,600	11,850	15,987	56,638	457,873
2003	48,069	120,374	84,477	31,888	30,080	39,775	12,034	13,858	11,033	15,183	7,313	20,125	434,209
2004	21,287	54,415	47,848	44,051	96,941	38,529	37,449	17,376	7,694	16,226	18,302	54,296	454,414
2005	46,130	77,758	51,758	28,368	11,721	14,760	13,472	9,231	10,862	5,226	4,295	7,487	281,068
2006	14,242	19,939	38,835	11,348	16,055	6,956	5,257	10,552	5,911	6,558	12,091	23,432	171,176
2007	192,084	35,368	55,024	54,924	121,096	118,329	360,409	43,106	13,673	4,834	11,461	30,016	1,040,324
2008	23,366	51,527	121,113	73,789	84,038	29,188	19,636	40,668	61,484	37,749	48,180	35,169	625,907
2009	25,857	28,332	105,850	93,099	48,671	14,574	13,925	20,214	22,825	215,001	86,540	85,379	760,267
2010	64,538	127,777	113,056	36,518	12,870	111,202	20,504	12,431	6,178	10,557	8,475	11,498	535,604
2011	37,456	17,139	16,350	14,406	6,806	10,251	10,501	13,420	10,133	9,148	7,361	24,482	177,453
2012	37,140	53,165	128,383	30,610	19,251	17,396	8,389	15,203	14,217	6,589	4,673	11,096	346,112
2013	25,276	21,874	17,309	20,005	21,558	6,236	13,022	8,912	23,745	37,481	97,959	104,988	398,365
2014	40,927	38,988	39,594	42,991	33,793	30,498	16,849	11,661	7,862	16,778	12,674	11,689	304,304
2015	48,139	37,577	190,634	211,648	249,879	98,427	19,734	11,869	9,217	79,443	170,375	395,860	1,522,802
2016	111,089	63,695	289,156	140,563	117,576	89,672	12,900	17,403	8,354	11,648	10,246	21,117	893,419
2017	74,697	43,883	33,573	22,110	46,454	77,843	25,338	55,687	13,529	7,941	9,413	35,784	446,252
2018	24,347	109,080	101,855	48,613	16,677								

NECHES RIVER NEAR ALTO (NEAL)
NATURALIZED FLOW
UNITS: ACRE-FEET

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
1940	14,486	78,746	18,332	39,131	50,854	45,062	43,839	4,784	6,464	2,499	169,983	304,354	778,534
1941	220,267	127,504	198,986	98,188	87,868	175,684	95,885	8,421	10,491	34,783	128,221	100,302	1,286,600
1942	80,681	77,300	76,720	255,346	186,781	122,857	30,136	11,909	34,636	10,625	19,042	29,868	935,901
1943	99,717	37,571	39,173	53,781	73,363	110,027	13,530	2,673	1,575	38,626	12,895	31,805	514,736
1944	150,069	198,109	252,323	143,618	624,597	104,356	12,601	5,670	11,271	5,569	32,251	109,305	1,649,739
1945	308,394	129,755	300,532	619,876	84,115	47,659	141,049	20,417	13,384	114,822	52,590	94,673	1,927,266
1946	231,450	252,723	245,367	158,945	242,868	202,103	49,280	26,913	65,320	40,793	286,055	178,861	1,980,678
1947	183,022	109,379	256,170	200,776	184,026	80,660	21,975	7,071	8,446	7,010	20,454	71,295	1,150,284
1948	85,208	165,493	144,928	78,337	115,496	22,094	12,747	2,194	2,004	2,379	10,262	20,622	661,764
1949	62,887	94,509	97,852	136,018	37,625	19,302	8,716	8,734	5,757	43,153	44,559	36,770	595,882
1950	137,721	254,666	89,029	72,999	188,640	113,801	20,841	8,537	9,155	7,190	11,146	15,109	928,834
1951	23,791	41,784	64,486	51,414	30,066	22,920	6,782	775	3,061	2,692	8,117	20,645	276,533
1952	24,014	63,005	91,494	113,658	118,783	46,826	5,073	896	0	81	4,019	28,059	495,908
1953	51,605	37,080	177,746	48,684	394,665	31,855	8,458	4,708	3,905	1,798	8,563	48,550	817,617
1954	40,508	36,601	32,176	32,676	99,485	14,000	1,008	0	0	7,720	58,350	36,727	359,251
1955	53,341	99,552	85,699	127,561	52,342	30,572	7,144	5,316	5,130	5,437	2,452	8,415	482,961
1956	13,919	42,364	22,573	18,682	97,439	4,753	580	0	0	0	1,008	2,180	203,498
1957	5,529	20,734	29,787	237,960	411,041	214,927	11,400	13,235	4,050	114,637	183,116	106,397	1,352,813
1958	135,638	123,542	82,898	74,738	298,373	28,516	45,551	7,606	55,788	30,593	22,701	32,656	938,600
1959	31,417	78,568	82,518	134,099	304,969	118,231	39,605	25,463	10,017	19,091	33,612	100,669	978,259
1960	207,179	128,959	169,168	56,535	34,098	25,740	24,331	9,689	9,201	27,404	61,112	356,739	1,110,155
1961	350,613	235,938	274,696	157,494	38,944	96,986	48,383	12,960	19,792	13,171	28,526	144,576	1,422,079
1962	128,680	111,578	117,508	83,665	119,689	60,836	37,683	10,508	18,349	17,489	17,837	35,765	759,587
1963	41,470	37,237	44,220	27,128	57,957	17,773	10,015	5,111	4,413	4,195	5,812	11,778	267,109
1964	16,421	23,091	45,567	29,647	24,999	20,002	4,082	4,148	4,725	4,510	7,359	10,949	195,500
1965	20,775	59,806	59,231	83,187	266,165	71,870	8,606	6,632	6,932	6,395	9,525	29,464	628,588
1966	32,702	54,346	44,435	293,772	418,673	32,892	8,980	18,433	25,628	12,568	15,687	18,871	976,987
1967	31,287	21,956	25,630	52,828	39,269	49,833	7,815	4,363	8,742	4,094	22,959	35,577	304,353
1968	124,167	89,235	138,747	214,945	349,110	122,807	64,488	12,884	35,230	17,405	46,171	149,692	1,364,881
1969	73,344	124,428	299,851	339,967	259,232	32,958	10,868	3,622	6,904	5,945	43,049	75,701	1,275,869
1970	84,385	75,690	174,980	112,150	44,570	12,567	5,346	2,169	6,960	29,004	45,863	25,360	619,044
1971	26,033	31,453	35,679	21,273	30,705	5,488	2,176	6,734	4,567	6,778	19,995	104,110	294,991
1972	120,969	52,888	37,512	20,026	13,177	12,786	11,532	10,595	11,684	33,390	71,729	77,696	473,984
1973	101,421	84,711	183,812	275,114	159,872	256,840	56,388	27,605	97,338	205,345	126,742	209,686	1,784,874
1974	236,362	172,155	115,898	71,120	78,631	39,208	17,081	14,901	87,373	60,060	170,546	145,774	1,209,109
1975	123,891	211,647	100,723	119,278	181,825	104,919	48,709	15,210	14,295	26,200	22,264	27,680	996,641
1976	43,109	36,344	98,049	63,633	136,706	141,866	124,430	22,156	79,030	33,458	37,050	117,158	932,989
1977	78,727	182,299	175,050	252,175	71,463	40,815	14,161	8,661	6,683	7,145	16,915	29,269	883,363
1978	47,941	67,084	95,258	44,217	32,888	12,507	3,942	10,979	9,480	8,711	21,228	22,933	377,168
1979	107,789	107,527	165,749	271,094	164,195	155,891	67,774	55,805	79,356	34,900	45,284	89,790	1,345,154
1980	151,713	147,503	87,001	120,260	140,866	26,316	14,450	8,773	11,177	3,371	8,356	14,296	734,082
1981	15,973	26,741	33,011	23,151	68,358	160,271	37,163	7,801	12,429	36,808	34,427	27,144	483,277
1982	30,364	40,136	51,748	109,178	116,691	35,709	28,839	7,020	7,697	9,807	39,349	141,882	618,420
1983	69,794	177,018	185,365	74,192	119,513	120,423	45,040	25,625	8,840	8,240	11,566	50,474	896,090
1984	38,212	89,741	170,271	52,766	15,026	14,493	7,842	8,870	6,866	44,356	54,323	73,260	576,026
1985	73,685	129,156	151,728	72,986	52,572	8,092	12,741	11,193	8,510	56,901	106,639	209,831	894,034
1986	51,320	155,833	41,598	157,651	244,309	182,208	37,610	7,399	7,381	24,572	80,766	159,389	1,150,036
1987	92,888	121,092	233,543	51,620	31,950	57,668	19,069	7,809	16,269	5,178	55,744	188,916	881,746
1988	116,218	81,317	120,002	74,727	20,300	17,577	16,321	11,368	8,793	13,770	19,258	38,750	538,401
1989	55,690	107,772	82,631	101,808	364,762	150,646	150,712	16,228	3,399	9,654	10,035	13,480	1,066,817
1990	91,408	105,712	195,426	194,726	241,229	222,260	20,959	20,897	22,760	62,446	91,176	86,994	1,355,993
1991	319,938	225,949	155,098	218,829	194,231	70,209	33,539	72,071	38,691	23,762	74,655	270,702	1,697,674
1992	269,208	330,044	299,994	83,750	53,088	44,589	22,835	14,161	27,100	25,559	52,969	159,250	1,382,547
1993	275,593	131,366	202,295	146,600	108,833	115,357	77,020	21,218	20,848	69,412	33,897	48,587	1,251,026
1994	49,708	201,306	192,737	71,117	123,454	56,099	17,485	21,791	17,977	246,652	121,698	296,252	1,416,276
1995	297,471	132,533	188,791	178,157	191,232	54,089	19,678	16,360	24,458	6,512	15,738	39,564	1,164,583
1996	27,347	21,721	17,471	32,317	20,971	9,119	7,607	25,610	25,032	18,560	24,104	57,970	287,829
1997	62,716	228,950	247,594	190,640	116,664	106,161	30,575	21,572	9,026	23,745	29,173	105,898	1,172,714
1998	409,763	154,791	173,621	55,736	17,091	12,291	6,626	2,561	28,689	68,304	188,267	165,661	1,283,401
1999	183,411	212,838	90,896	105,241	72,811	83,999	45,576	16,153	11,397	11,892	9,846	23,269	867,329
2000	18,530	24,883	30,985	49,122	147,884	69,999	11,011	5,314	1,016	10,615	105,490	168,089	642,938
2001	244,717	199,219	485,800	93,900	58,024	184,474	38,661	21,376	45,889	47,715	33,480	232,300	1,685,555
2002	98,484	88,210	127,968	146,485	34,964	18,790	27,420	12,940	11,992	28,577	83,769	129,090	808,689
2003	113,365	174,251	194,258	51,711	36,983	53,218	24,052	15,870	21,917	18,893	18,596	30,559	753,673
2004	52,285	151,750	108,715	66,312	176,156	70,602	84,576	24,570	14,094	30,563	122,239	137,264	1,039,126
2005	80,400	181,066	120,396	59,639	18,440	19,075	17,359	12,562	15,964	7,090	5,842	10,059	547,892
2006	20,705	44,210	55,208	20,550	20,920	8,628	9,585	12,435	6,478	60,058	34,464	41,743	334,984
2007	315,860	82,166	75,575	72,300	154,347	145,368	458,066	80,651	18,494	6,819	15,962	45,647	1,471,255
2008	35,782	114,932	162,348	106,697	95,719	38,874	22,305	48,469	66,906	44,999	53,819	43,619	834,469
2009	33,729	35,080	124,530	150,040	80,262	19,290	16,433	24,173	26,688	230,348	159,260	120,856	1,020,689
2010	87,771	182,004	168,084	54,126	17,399	116,947	33,724	14,442	7,506	11,572	9,944	13,373	716,892
2011	44,960	23,347	19,917	16,653	11,125	11,616	11,595	14,654	11,254	10,161	8,407	32,246	215,935
2012	60,643	103,388	229,024	63,004	24,612	22,796	14,706	17,088	16,531	12,489	6,062	14,698	585,041
2013	41,456	34,844	24,216	28,239	27,550	18,616	15,018	9,902	28,120	45,169	128,485	136,475	538,090
2014	60,145	52,199	60,924	61,431	63,614	55,102	33,242	16,359	10,637	23,681	25,565	22,199	485,098
2015	124,145	62,549	305,336	243,311	512,952	219,852	34,248	14,311	10,549	81,458	181,970	409,191	2,199,872
2016	242,836	81,888	385,331	192,807	273,606	185,051	22,006	29,259	16,457	16,094	14,		

NECHES RIVER NEAR DIBOLL (NEDI)
NATURALIZED FLOW
UNITS: ACRE-FEET

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
1940	24,936	171,928	31,869	60,483	99,630	93,793	79,441	7,076	9,910	3,504	258,611	535,206	1,376,387
1941	363,512	221,489	331,293	138,520	149,202	203,876	175,629	13,603	18,203	51,466	275,273	153,792	2,095,858
1942	132,586	110,816	117,424	300,061	298,804	169,866	60,608	16,320	45,268	13,520	22,036	35,540	1,322,849
1943	126,189	55,232	41,365	53,781	73,363	110,027	17,473	5,256	1,841	38,626	13,360	33,669	570,182
1944	198,736	263,767	356,794	198,295	1,042,078	198,567	15,343	5,670	24,389	6,928	36,845	199,830	2,547,242
1945	541,300	208,539	376,363	784,851	141,165	52,832	141,049	32,934	13,384	114,822	60,811	106,821	2,574,871
1946	351,497	478,615	444,192	256,142	348,229	334,950	70,457	26,913	69,681	43,067	372,869	255,494	3,052,106
1947	359,179	178,037	356,156	217,124	246,091	126,018	32,514	8,436	8,446	7,576	20,454	75,387	1,635,418
1948	100,503	252,425	225,178	144,039	116,458	55,310	14,488	2,705	2,156	2,379	10,697	20,622	946,960
1949	77,663	129,615	158,476	174,476	74,101	21,657	9,593	13,230	11,597	83,881	62,266	86,726	903,281
1950	244,189	389,773	172,687	89,835	261,115	256,621	30,144	10,683	9,949	8,349	11,146	17,372	1,501,863
1951	27,262	43,307	80,531	66,546	31,279	22,920	8,463	1,190	3,061	3,324	8,117	22,190	318,190
1952	26,518	68,944	138,145	145,445	183,625	67,739	7,310	1,775	0	81	6,222	33,130	678,934
1953	58,232	66,399	228,897	116,410	615,043	98,665	25,197	8,345	7,310	1,798	8,563	54,742	1,289,601
1954	49,565	45,587	36,097	35,142	123,111	48,697	1,064	75	0	7,720	58,350	36,727	442,135
1955	53,341	112,495	100,227	171,806	89,705	53,196	8,009	8,369	5,130	6,345	2,452	8,415	619,490
1956	13,919	60,141	24,292	39,171	104,291	8,538	580	0	0	0	1,008	2,180	254,120
1957	5,529	20,734	29,787	237,960	536,867	234,797	22,887	16,372	4,723	165,090	300,683	183,227	1,758,656
1958	235,641	150,656	120,088	76,156	373,821	31,272	45,809	8,216	99,531	57,528	22,701	32,656	1,254,075
1959	31,854	92,656	112,663	167,068	304,969	153,987	55,508	38,210	11,627	21,390	50,563	100,669	1,141,164
1960	213,901	204,248	220,732	75,637	61,202	34,045	35,514	19,607	10,388	27,731	72,036	469,251	1,444,292
1961	482,496	303,613	306,940	243,523	52,554	96,986	57,075	15,918	29,781	14,256	29,124	183,174	1,815,440
1962	154,229	144,141	125,214	92,068	235,228	60,836	39,104	10,670	18,349	17,489	17,837	39,914	955,079
1963	56,978	51,588	62,508	40,279	57,957	21,972	10,648	5,428	4,413	4,195	5,812	11,778	333,556
1964	18,419	24,752	64,738	85,112	51,061	27,575	4,527	4,148	4,725	4,510	7,359	11,068	307,994
1965	20,775	63,251	63,165	129,523	266,165	72,658	12,788	8,009	11,745	7,939	11,657	83,475	751,150
1966	69,400	116,115	59,339	293,772	463,060	54,856	10,378	25,024	25,628	14,110	15,687	18,871	1,166,240
1967	31,287	23,023	27,661	64,666	49,518	59,680	13,169	4,363	8,742	4,094	22,959	35,577	344,739
1968	131,763	99,145	152,131	338,267	349,110	208,743	110,347	19,053	48,697	21,083	46,171	194,150	1,718,660
1969	111,533	184,944	412,699	470,945	386,003	47,250	14,461	3,622	6,904	5,945	43,049	75,701	1,763,056
1970	84,385	75,690	174,980	112,150	58,272	14,933	5,679	2,280	6,960	30,175	45,863	25,360	636,727
1971	30,303	32,223	41,320	24,287	31,130	7,171	2,818	7,218	4,802	7,674	21,258	111,233	321,437
1972	133,463	72,468	52,261	30,535	31,437	17,284	17,079	11,594	11,684	36,550	99,354	118,210	631,919
1973	194,967	120,250	238,696	319,580	259,094	347,336	99,713	31,735	109,298	251,282	216,243	297,600	2,485,794
1974	402,969	252,186	141,383	87,187	82,022	49,093	21,091	16,461	90,598	79,348	196,454	195,609	1,614,401
1975	186,630	313,229	148,502	147,958	240,057	141,440	82,948	19,803	15,251	26,784	32,327	29,387	1,384,316
1976	55,071	57,299	101,708	87,186	194,554	141,866	164,446	30,926	79,030	33,458	37,050	126,894	1,109,488
1977	121,955	182,299	220,308	252,175	121,701	45,032	17,902	11,504	10,067	7,674	17,228	33,775	1,041,620
1978	83,566	98,840	96,552	58,759	34,817	20,238	4,236	11,214	10,450	8,711	21,228	28,696	477,307
1979	170,835	193,670	255,687	432,804	241,452	238,682	81,920	85,289	105,364	58,449	80,850	136,931	2,081,933
1980	218,049	221,839	151,420	173,179	253,455	43,502	15,992	9,274	11,177	3,660	10,550	16,842	1,128,939
1981	18,731	31,689	42,736	28,458	70,338	160,271	62,237	8,788	17,966	67,251	55,165	33,546	597,176
1982	39,262	59,335	67,327	199,801	213,048	54,943	43,875	8,025	7,697	10,043	56,812	204,641	964,809
1983	120,719	282,117	272,810	118,129	186,762	193,564	62,596	45,633	12,395	8,654	14,479	100,903	1,418,761
1984	57,538	115,705	250,505	80,853	22,776	16,752	11,323	9,360	6,892	88,902	104,355	107,343	872,304
1985	135,209	197,073	233,228	106,938	70,294	13,737	15,224	11,247	8,510	65,620	126,116	289,585	1,272,781
1986	83,633	169,113	59,380	157,651	250,761	315,051	62,293	8,057	14,161	28,588	157,566	236,111	1,542,365
1987	142,091	159,422	310,876	81,221	37,203	66,901	27,241	8,108	19,310	5,178	73,949	203,828	1,135,328
1988	159,425	92,578	153,053	100,406	26,890	17,966	18,670	11,368	8,793	13,770	19,258	41,702	663,879
1989	98,383	164,930	114,232	181,674	380,477	280,243	382,471	22,004	5,179	10,268	11,352	20,295	1,671,508
1990	148,045	174,489	217,631	290,502	275,291	382,288	25,979	21,295	22,989	63,636	93,911	93,000	1,809,056
1991	503,553	329,295	241,972	298,721	345,372	104,061	47,893	116,747	56,506	25,224	83,116	294,113	2,446,573
1992	446,599	527,547	518,984	141,853	82,968	76,667	28,214	16,078	28,827	25,559	55,349	198,060	2,146,705
1993	386,338	163,730	308,008	251,405	192,462	181,586	161,453	22,294	20,951	69,869	40,886	69,502	1,868,484
1994	70,155	262,424	288,730	101,943	174,673	97,261	20,887	30,634	28,755	440,411	141,778	405,631	2,063,282
1995	508,010	212,154	324,251	259,127	209,552	83,148	24,592	23,322	27,725	11,096	17,691	70,216	1,770,884
1996	36,418	26,657	21,075	37,569	23,293	9,997	8,330	33,754	40,064	25,081	27,837	85,199	375,274
1997	103,028	332,899	404,748	281,483	166,613	141,794	44,655	33,921	12,090	27,343	40,647	161,172	1,750,393
1998	571,170	228,268	271,255	79,697	23,385	13,435	6,898	4,911	35,827	94,790	312,346	262,128	1,904,110
1999	247,905	388,429	156,792	144,600	90,149	115,629	60,284	16,154	11,397	11,944	10,041	24,900	1,278,224
2000	19,397	25,725	38,107	69,918	155,928	86,767	15,357	5,314	1,104	10,615	160,598	223,858	812,688
2001	351,833	246,744	683,241	159,277	66,764	369,851	51,854	22,427	69,988	86,936	41,493	350,844	2,501,252
2002	166,935	123,219	143,285	234,924	44,941	24,006	32,816	13,662	13,937	51,904	192,961	236,985	1,279,575
2003	211,438	232,517	358,121	76,629	40,333	65,022	38,227	18,400	38,768	22,030	33,410	42,737	1,177,632
2004	99,274	302,785	199,283	91,983	284,292	114,588	154,588	31,985	22,870	50,506	294,693	263,784	1,910,631
2005	126,006	335,755	223,146	105,106	26,631	22,303	20,217	15,663	21,632	8,807	7,279	12,351	924,896
2006	27,750	80,084	72,282	33,086	24,726	9,532	15,227	12,435	6,478	149,473	69,299	66,453	566,825
2007	473,428	152,199	95,244	86,570	177,166	158,351	523,752	132,700	22,892	8,854	20,434	63,927	1,915,517
2008	50,438	208,804	198,805	142,212	95,719	43,599	22,305	49,427	66,906	44,999	53,819	44,293	1,021,326
2009	33,729	38,644	126,732	221,197	120,577	23,256	16,810	25,264	26,882	230,348	225,085	157,507	1,246,031
2010	109,350	238,788	230,372	73,515	17,399	116,947	33,724	14,442	7,987	11,572	9,944	13,373	877,413
2011	46,143	29,143	21,218	16,653	13,311	11,616	11,595	14,654	11,254	10,161	8,407	36,594	230,749
2012	90,375	174,277	364,945	109,762	28,369	27,139	22,097	17,088	16,531	20,683	7,124	17,739	896,129
2013	62,006	50,863	31,158	36,691	31,737	37,772	15,018	9,902	28,120	47,782	153,144	160,803	664,996
2014	81,494	63,828	86,256	80,871	105,080	88,581	56,521	21,114	13,171	30,721	42,288	35,573	705,498
2015	227,837	92,447	439,203	305,828	808,105	373,127	52,029	15,664	10,762	81,458	181,970	409,191	2,

NECHES RIVER NEAR ROCKLAND (NERO)
NATURALIZED FLOW
UNITS: ACRE-FEET

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
1940	80,392	303,996	44,835	131,975	130,833	153,701	94,640	13,530	14,060	5,053	267,820	894,782	2,135,617
1941	510,367	312,583	480,655	210,462	286,775	320,527	217,325	22,957	44,234	110,176	498,534	209,172	3,223,767
1942	170,026	155,163	199,187	378,015	360,590	217,231	82,474	84,340	53,364	18,638	32,050	41,606	1,792,684
1943	201,447	74,897	66,489	65,927	73,363	110,465	39,927	16,688	3,175	38,626	13,360	37,454	741,818
1944	237,448	341,108	424,532	296,474	1,470,738	297,159	23,035	7,798	38,241	8,353	40,045	273,382	3,458,313
1945	687,987	391,823	431,464	1,093,079	219,095	62,102	141,049	33,745	16,701	115,973	83,397	135,386	3,411,801
1946	442,278	782,327	531,576	336,558	420,787	458,633	116,818	26,913	80,836	59,302	564,492	344,318	4,164,838
1947	648,192	225,122	516,041	242,128	374,973	212,157	47,006	9,730	8,446	8,152	25,327	91,493	2,408,767
1948	106,405	320,192	264,913	203,249	125,132	77,827	17,744	3,831	3,444	2,379	15,916	22,812	1,163,844
1949	114,567	197,773	326,743	259,337	139,932	48,540	13,223	16,201	12,687	140,449	89,669	207,756	1,566,877
1950	510,191	545,266	319,812	105,384	341,708	497,075	39,245	13,563	11,094	11,281	11,499	18,645	2,424,763
1951	29,198	46,154	94,175	98,072	37,855	23,716	12,409	1,895	4,029	4,424	8,117	22,190	382,234
1952	28,676	80,057	160,812	198,527	283,097	91,016	8,607	2,767	278	81	6,867	46,255	907,040
1953	81,119	115,291	264,860	181,662	1,079,334	192,019	38,509	11,889	9,130	2,496	8,563	64,605	2,049,477
1954	77,246	51,510	39,319	55,198	168,994	59,208	2,908	783	0	7,720	58,350	36,727	557,963
1955	58,859	181,617	119,192	316,691	93,466	66,431	9,724	10,135	5,130	7,817	2,452	8,415	879,929
1956	14,376	78,230	36,405	63,900	104,291	8,538	2,292	46	0	0	1,008	2,369	311,455
1957	5,701	20,734	63,903	237,960	771,971	239,134	39,011	18,799	7,006	165,090	455,463	305,702	2,330,474
1958	396,590	221,246	163,937	101,715	429,419	44,262	53,934	12,057	99,531	91,435	28,134	39,495	1,681,755
1959	35,444	128,939	125,343	286,297	304,969	178,715	72,218	57,669	13,277	30,022	57,741	139,398	1,430,032
1960	273,185	287,991	316,070	91,440	78,035	52,396	49,902	26,882	12,369	32,863	87,164	537,156	1,845,453
1961	756,047	399,424	437,729	320,573	60,759	96,986	78,673	22,989	84,091	20,020	33,167	234,082	2,544,540
1962	205,504	190,561	150,542	116,489	344,299	69,852	47,887	12,243	20,708	17,489	18,021	70,446	1,264,041
1963	95,516	87,859	92,093	69,427	57,957	21,972	15,642	5,970	7,057	4,251	6,812	18,529	483,085
1964	33,868	38,889	154,588	156,843	143,663	36,727	6,963	4,789	5,398	4,730	7,359	14,157	607,974
1965	21,372	88,955	80,040	147,321	266,165	74,045	14,371	8,009	23,805	8,793	12,348	166,382	911,606
1966	123,965	292,920	87,183	293,772	560,769	75,166	13,326	31,454	25,906	21,391	15,687	18,872	1,560,411
1967	35,611	29,950	33,226	86,944	76,657	70,838	15,774	4,426	8,742	4,094	22,959	35,577	424,798
1968	150,013	115,238	181,357	553,599	387,375	322,871	210,462	28,647	51,515	21,642	46,171	239,658	2,308,548
1969	140,354	224,254	605,464	613,248	777,585	99,781	20,491	4,639	7,140	5,945	43,049	75,701	2,617,651
1970	84,385	75,690	188,836	143,296	101,122	18,972	7,464	2,917	6,960	30,175	45,863	28,974	734,654
1971	30,537	32,223	41,320	24,287	31,631	7,861	3,025	7,585	5,418	13,803	21,400	147,058	366,148
1972	168,012	106,383	95,193	55,769	89,690	18,967	17,994	13,427	14,233	36,550	103,474	140,253	859,945
1973	295,289	182,243	327,565	546,121	356,880	621,603	155,290	43,293	143,315	296,009	384,758	472,800	3,825,166
1974	710,605	406,897	167,982	113,121	89,486	55,462	22,152	17,191	101,497	87,831	304,632	310,968	2,387,824
1975	323,033	435,034	189,341	198,100	375,707	172,521	116,392	39,534	18,667	40,821	56,534	58,800	2,024,484
1976	84,716	84,102	134,802	110,264	290,554	163,339	199,403	40,909	79,030	37,039	45,412	168,186	1,437,756
1977	175,052	194,060	278,544	271,521	184,849	53,509	21,262	15,056	13,294	8,089	17,671	44,214	1,277,121
1978	142,846	173,736	104,268	70,053	35,711	25,967	4,708	11,530	11,929	8,711	21,228	41,120	651,807
1979	261,955	311,250	409,466	704,461	355,859	335,835	81,920	119,848	199,357	78,494	105,851	217,742	3,182,038
1980	249,943	325,614	225,979	276,121	445,177	59,779	17,093	10,390	11,370	4,144	10,550	18,677	1,654,837
1981	22,033	34,754	49,370	29,608	79,200	220,254	116,114	11,073	26,985	69,564	63,892	36,638	759,485
1982	45,585	77,710	83,899	304,842	343,878	77,170	71,057	11,218	7,697	12,698	72,552	327,239	1,435,545
1983	237,054	366,434	342,529	171,972	338,315	242,279	68,961	63,062	21,390	11,370	22,040	151,378	2,036,784
1984	106,722	203,767	309,235	104,559	69,955	27,854	14,185	12,827	7,392	120,278	158,032	134,083	1,268,889
1985	190,367	279,106	334,088	136,333	82,860	16,379	16,777	11,705	8,600	82,494	159,396	408,092	1,726,197
1986	129,008	198,315	85,396	157,651	290,506	499,336	96,829	9,478	23,417	35,652	262,182	346,786	2,134,556
1987	212,337	217,962	428,142	123,148	46,428	83,235	39,193	9,103	24,477	5,178	102,019	237,710	1,528,932
1988	223,824	113,359	204,751	139,124	36,914	19,841	23,235	12,668	8,793	13,770	19,258	51,103	866,640
1989	157,383	246,523	161,148	291,862	429,163	457,902	690,883	30,667	7,724	11,810	13,824	30,073	2,528,962
1990	227,689	270,791	261,357	428,328	337,779	604,503	34,045	23,441	25,065	70,050	104,553	107,501	2,495,102
1991	763,605	479,257	365,302	418,108	554,016	152,885	68,890	179,570	82,336	28,956	99,791	345,279	3,537,995
1992	694,712	806,164	822,747	222,773	125,367	121,214	36,887	19,639	33,160	25,559	64,548	260,204	3,232,974
1993	549,658	215,440	459,145	397,019	308,015	275,383	275,545	25,334	22,715	75,890	52,485	100,075	2,756,704
1994	100,218	356,412	426,680	146,965	249,894	154,335	26,611	43,659	43,956	707,704	177,009	568,822	3,002,265
1995	800,759	324,434	512,402	376,708	247,977	124,574	32,422	33,514	33,821	17,472	21,422	112,544	2,638,049
1996	50,170	34,677	27,056	46,821	27,908	11,834	9,851	46,182	61,263	34,881	34,501	124,587	509,731
1997	159,532	483,867	625,268	412,677	239,675	195,713	65,070	51,414	16,719	33,809	57,616	240,207	2,581,567
1998	809,835	334,429	409,808	114,728	32,780	15,862	7,765	8,118	47,210	134,037	485,890	398,562	2,799,024
1999	344,811	629,822	248,245	203,216	118,042	162,688	82,676	17,419	11,397	13,836	11,061	28,810	1,872,023
2000	21,959	28,751	49,648	100,382	177,808	113,711	22,384	5,314	1,111	11,409	239,428	308,399	1,080,304
2001	508,090	323,172	973,980	250,301	82,494	621,547	71,768	25,445	104,425	140,869	54,372	520,753	3,677,216
2002	262,253	174,932	172,911	359,582	60,448	32,154	41,869	15,809	17,157	83,997	339,268	385,182	1,945,562
2003	345,833	320,735	583,050	112,571	47,517	84,298	58,252	22,880	62,052	27,525	53,825	60,717	1,779,255
2004	163,507	507,967	323,708	130,031	436,484	176,411	250,814	43,399	35,206	78,423	524,976	436,458	3,107,384
2005	190,671	547,909	364,076	167,966	38,558	27,929	25,236	20,615	30,137	11,561	9,576	16,072	1,450,306
2006	38,388	129,458	98,457	50,740	31,235	11,365	23,832	12,775	6,901	268,695	116,579	101,347	889,772
2007	699,826	248,264	126,336	110,497	218,461	186,353	643,698	205,631	29,970	11,992	27,409	90,899	2,599,336
2008	71,997	337,945	258,180	196,022	95,719	60,187	22,305	56,199	66,906	44,999	53,819	47,408	1,311,686
2009	50,487	45,984	139,305	324,017	178,460	29,843	18,580	28,554	29,220	230,348	339,848	213,879	1,628,525
2010	143,843	325,718	323,253	103,582	28,167	116,947	35,110	15,453	9,312	11,572	9,944	13,544	1,136,445
2011	53,741	38,390	24,909	17,492	22,580	11,616	11,595	14,654	11,254	10,161	8,429	44,364	269,185
2012	133,176	273,099	556,837	174,537	35,104	34,483	35,097	17,088	16,690	32,234	8,958	22,781	1,340,084
2013	91,553	74,095	41,940	49,721	39,253	64,306	15,636	9,902	31,095	54,669	194,768	202,629	869,567
2014	113,527	82,800	123,447	110,561	163,132	135,743	88,918	28,480	17,247	36,550	42,288	44,859	987,552
2015	360,446	136,829</											

LAKES TYLER AND TYLER EAST DAMS (MUTY)
NATURALIZED FLOW
UNITS: ACRE-FEET

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
1940	802	1,918	991	1,490	1,042	1,225	1,553	3,789	1,866	152	30,879	23,307	69,014
1941	11,141	10,227	12,093	7,757	3,986	4,725	2,757	726	1,679	4,723	9,054	11,463	80,331
1942	6,651	5,822	6,008	18,502	8,058	6,686	828	1,284	1,601	775	2,176	4,055	62,446
1943	6,396	3,164	4,059	2,716	1,947	3,712	247	41	6	964	978	2,869	27,099
1944	12,787	19,965	14,619	9,335	46,863	5,468	448	121	534	248	2,089	17,180	129,657
1945	23,082	10,127	27,943	23,893	4,152	5,717	19,570	1,007	864	17,047	5,184	10,431	149,017
1946	23,278	19,606	15,886	6,437	21,862	15,619	2,837	2,867	2,764	2,608	28,019	11,106	152,889
1947	15,212	8,138	16,899	16,667	17,777	6,989	1,056	355	960	628	1,865	8,456	95,002
1948	8,414	15,949	10,603	5,663	10,586	1,003	564	67	156	223	1,242	1,536	56,006
1949	4,872	5,967	7,397	5,671	3,859	1,032	1,167	535	1,167	3,379	1,617	2,211	38,874
1950	9,834	16,209	5,700	3,949	16,247	6,211	1,836	1,957	1,453	735	1,118	1,488	66,737
1951	2,623	5,550	5,590	1,864	0	1,555	464	870	606	1,348	1,258	1,424	23,152
1952	4,606	16,787	8,275	11,908	4,817	2,723	1,365	1,472	525	1,550	1,964	4,142	60,134
1953	3,441	3,881	9,069	6,468	18,787	1,317	2,088	2,834	1,515	675	3,842	5,110	59,027
1954	4,729	4,758	3,705	4,028	12,586	2,518	913	1,610	528	2,394	3,462	4,052	45,283
1955	3,873	6,762	12,750	10,312	6,689	1,270	2,882	1,940	2,711	1,077	968	1,793	53,027
1956	1,936	5,046	2,276	944	8,912	1,460	1,360	1,933	578	174	592	951	26,162
1957	388	2,411	3,557	37,602	13,984	16,575	2,887	1,969	1,146	12,500	26,805	10,821	130,645
1958	12,488	8,379	8,515	19,105	10,265	4,216	4,784	9,397	1,610	4,882	1,774	2,199	87,614
1959	2,390	7,773	8,981	7,797	24,615	5,771	5,447	2,737	2,818	1,988	2,299	9,223	81,839
1960	11,354	9,659	13,140	4,601	2,314	4,320	3,712	2,071	3,281	2,442	4,637	21,381	82,912
1961	17,431	17,781	22,482	11,242	5,022	5,923	2,646	3,198	4,882	2,268	7,542	10,129	110,546
1962	11,703	9,989	10,895	16,416	6,230	4,382	4,232	2,775	3,434	2,525	2,889	3,220	78,690
1963	3,329	3,907	5,873	2,104	2,725	1,936	2,423	3,464	1,555	1,538	668	1,615	31,137
1964	1,936	2,299	4,698	1,441	1,360	2,121	1,607	1,146	1,484	1,474	1,821	2,951	24,338
1965	5,595	8,539	4,323	4,221	13,282	2,594	1,945	2,057	1,141	1,091	1,172	813	46,773
1966	1,676	3,148	2,597	49,491	20,487	3,193	2,516	2,535	2,687	1,878	2,582	1,912	94,702
1967	2,998	1,370	2,792	7,889	3,728	1,795	2,753	1,874	785	602	1,046	2,563	30,195
1968	8,655	6,185	7,048	4,715	5,182	5,896	1,803	2,283	3,109	1,788	3,487	2,641	52,792
1969	1,345	6,505	12,479	19,139	10,123	1,623	1,056	1,306	1,567	1,063	6,015	7,852	70,073
1970	3,516	4,561	7,565	4,773	941	1,639	676	695	1,162	6,275	2,068	3,527	37,398
1971	1,881	3,757	2,607	2,904	1,742	1,404	0	760	2,117	105	838	3,617	21,732
1972	6,865	3,253	3,372	1,316	1,101	709	1,148	1,908	1,735	3,880	2,966	5,449	33,702
1973	6,414	5,361	11,867	24,160	5,965	22,788	5,252	2,471	3,967	8,179	7,211	10,437	114,072
1974	14,316	8,810	5,354	3,482	4,099	3,272	2,335	630	10,563	10,315	5,632	6,809	75,617
1975	8,055	17,848	5,563	6,615	8,995	3,812	2,309	2,431	1,177	2,057	2,273	3,000	64,135
1976	5,509	3,454	12,300	4,468	7,867	5,800	5,327	2,349	3,575	2,670	1,594	4,039	58,952
1977	4,357	11,785	12,102	12,700	3,574	1,810	849	1,003	1,024	1,076	2,067	1,819	54,166
1978	3,975	4,097	6,565	2,698	3,064	636	1,388	1,123	936	831	2,521	1,905	29,739
1979	8,603	5,175	16,344	14,007	15,610	4,882	5,733	1,313	5,472	1,929	2,725	7,897	89,690
1980	5,872	9,873	5,644	7,728	8,218	1,792	1,756	1,533	1,496	870	1,293	1,449	47,524
1981	1,569	2,872	2,489	2,224	7,758	6,145	3,014	898	717	0	725	1,412	29,823
1982	2,872	2,622	3,665	4,250	3,900	1,455	3,130	549	432	1,644	3,104	6,046	33,669
1983	3,325	10,985	14,336	3,260	7,070	6,754	2,344	842	513	782	970	1,227	52,408
1984	2,159	5,205	5,040	2,475	1,338	1,586	1,462	629	514	2,325	1,946	4,360	29,039
1985	2,442	4,301	7,460	5,241	2,759	1,350	331	1,063	766	3,556	11,440	12,737	53,446
1986	3,902	20,406	4,809	12,061	15,597	7,335	1,340	1,070	1,236	3,744	2,332	2,887	76,719
1987	6,161	10,449	9,454	2,263	2,866	3,852	1,663	2,160	2,977	1,920	7,472	40,657	91,894
1988	17,094	14,139	15,435	4,094	1,021	2,159	1,897	1,977	1,225	1,606	3,617	3,529	67,793
1989	2,539	7,851	34,532	20,287	15,682	3,797	1,643	1,331	1,209	326	513	558	90,268
1990	4,228	2,941	11,172	12,278	10,415	4,144	404	488	671	896	4,905	30,036	82,578
1991	39,034	25,282	21,502	24,671	17,547	5,305	1,620	3,960	2,884	2,777	15,513	32,194	192,289
1992	21,967	16,873	16,797	3,099	1,457	1,600	2,005	3,551	2,187	1,335	4,776	13,577	89,224
1993	25,073	16,412	13,122	9,459	4,519	6,938	2,561	2,431	2,407	2,554	2,662	2,841	90,979
1994	2,134	12,659	8,623	2,538	4,907	1,008	2,028	1,864	2,703	8,842	6,942	28,556	82,804
1995	29,868	15,853	13,080	14,568	12,672	1,815	2,790	1,665	1,453	1,915	1,007	1,942	98,628
1996	2,291	1,899	1,782	4,458	1,939	867	2,091	1,896	3,382	3,660	3,091	4,282	31,638
1997	5,878	16,696	18,517	19,434	9,227	5,235	3,606	2,799	626	2,283	2,200	14,876	101,377
1998	23,827	15,317	13,854	2,869	934	1,848	2,475	1,403	2,622	10,129	7,968	14,478	97,724
1999	19,458	4,059	5,565	5,944	3,772	3,276	2,394	2,116	1,033	1,073	0	2,301	50,991
2000	1,868	2,734	2,668	4,640	8,023	4,369	562	0	0	702	9,053	12,634	47,253
2001	14,799	17,938	26,141	4,486	4,673	3,243	4,516	3,799	2,321	2,481	2,859	7,955	95,211
2002	8,350	11,311	18,439	23,128	12,015	1,773	3,785	4,495	3,796	1,308	1,679	4,540	94,619
2003	2,303	7,112	10,777	5,987	1,872	3,424	1,772	830	2,841	1,552	146	1,737	40,353
2004	2,387	5,032	5,987	4,811	9,550	4,788	1,568	2,162	774	3,008	4,107	8,582	52,756
2005	10,458	17,503	8,404	5,353	1,187	1,181	1,037	1,567	1,322	619	879	816	50,326
2006	2,865	2,659	4,315	2,037	1,020	467	310	828	566	859	1,137	1,868	18,931
2007	13,259	3,015	3,164	4,680	10,004	20,168	45,672	13,718	1,865	833	1,631	3,061	121,070
2008	2,631	6,204	17,094	9,852	16,282	6,631	1,797	5,271	3,822	4,400	8,090	8,112	90,186
2009	5,448	6,772	14,121	8,347	5,607	2,736	383	2,659	1,193	13,940	20,101	17,572	98,879
2010	12,241	17,328	22,719	10,024	1,739	7,439	3,881	3,016	980	2,066	1,126	1,376	83,935
2011	4,101	2,591	2,054	1,734	441	559	2,324	1,819	935	897	1,435	3,194	22,084
2012	3,787	4,503	9,482	1,869	1,917	2,173	977	3,048	2,461	1,245	1,104	1,227	33,793
2013	3,385	5,609	2,209	2,208	3,050	459	1,413	1,151	1,688	4,022	6,678	7,817	39,689
2014	2,341	3,470	3,903	11,616	9,042	6,709	1,910	1,384	2,442	3,663	1,608	2,034	50,122
2015	14,084	11,462	39,335	26,892	34,125	12,560	2,518	1,626	1,319	6,698	25,045	53,615	229,279
2016	18,922	14,059	37,260	40,432	15,596	5,085	1,898	3,003	2,502	2,210	1,585	4,047	146,599
2017	14,038	8,815	8,111	6,637	5,550	16,088	3,030	7,873	2,152	1,652	1,917	9,123	84,986
2018	6,774	24,869	18,984	11,129	4,573	1,583	1,236	1,778	1,549	7,137	20,942	23,523	124,077
MIN	388	1,370	991	944	0	459	0	0	0	0	0	558	18,931
MAX	39,034	25,282	39,335	49,491	46,863	22,788	45,672	13,718	10,563	17,047	30,879	53,615	229,279
AVG	8,281	8,932	10,594	9,488	8,105	4,380	2,860	2,141	1,852	2,830	4,842	7,977	72,282

MUD CREEK NEAR JACKSONVILLE (MUJA)
NATURALIZED FLOW
UNITS: ACRE-FEET

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
1940	2,446	5,853	3,025	4,546	3,180	3,739	4,739	11,562	5,693	464	94,231	71,123	210,601
1941	33,999	31,208	36,902	23,671	12,165	14,418	8,414	2,216	5,123	14,414	27,628	34,979	245,137
1942	20,295	17,766	18,335	56,461	24,591	20,402	2,527	3,917	4,887	2,366	6,641	12,373	190,561
1943	19,519	9,656	12,385	8,289	5,940	11,328	755	124	19	2,941	2,985	8,755	82,696
1944	39,021	60,926	44,610	28,487	143,006	16,685	1,367	370	1,629	756	6,375	52,427	395,659
1945	70,437	30,904	85,269	72,910	12,670	17,445	59,720	3,072	2,638	52,020	15,818	31,831	454,734
1946	71,034	59,829	48,476	19,642	66,714	47,663	8,658	8,749	8,436	7,960	85,503	33,892	466,556
1947	46,421	24,835	51,570	50,862	54,248	21,326	3,223	1,083	2,928	1,916	5,691	25,805	289,908
1948	25,676	48,668	32,356	17,282	32,303	3,062	1,720	205	477	682	3,790	4,687	170,908
1949	14,868	18,209	25,901	25,157	7,034	5,210	2,221	1,170	1,167	10,002	4,391	7,608	122,938
1950	46,941	51,804	14,560	14,932	42,411	29,958	3,624	1,957	1,824	1,382	2,426	2,931	214,750
1951	6,496	14,505	15,476	11,561	5,902	4,984	816	870	606	1,348	1,258	4,425	68,247
1952	8,467	46,895	26,506	36,061	10,154	5,351	1,365	1,472	525	1,550	1,964	4,964	145,274
1953	7,469	8,747	46,224	13,735	89,258	1,908	3,789	2,834	1,872	675	3,842	12,933	193,286
1954	10,697	8,035	7,314	6,383	39,822	2,518	913	1,610	528	2,748	6,636	10,737	97,941
1955	13,205	27,215	31,140	27,050	11,852	1,907	2,882	1,940	2,711	1,077	968	1,866	123,813
1956	3,150	13,390	5,051	2,479	46,396	1,460	1,360	1,933	578	174	592	951	77,514
1957	631	2,768	6,302	79,741	55,548	56,733	2,887	1,969	1,146	18,931	78,991	17,527	323,174
1958	31,473	22,639	16,385	33,223	70,712	9,539	5,328	9,397	5,876	8,686	5,527	7,677	226,462
1959	8,141	21,319	13,923	26,967	109,065	14,553	7,530	3,839	2,818	2,614	5,645	28,948	245,362
1960	41,106	45,809	46,233	10,773	4,237	5,882	4,302	2,151	6,480	6,086	14,089	93,882	281,030
1961	79,239	50,915	62,475	26,931	11,802	16,660	7,307	3,198	8,464	3,640	11,427	27,824	309,882
1962	36,611	25,261	22,313	26,326	24,086	17,635	13,430	2,775	4,002	5,543	6,184	9,793	193,959
1963	10,672	9,588	12,714	3,074	3,528	1,936	2,423	3,464	1,555	1,538	668	1,645	52,805
1964	2,047	4,177	9,533	3,177	2,211	2,121	1,607	1,146	1,484	1,474	1,821	2,951	33,749
1965	8,329	21,001	14,702	13,334	36,476	6,398	1,945	2,057	1,141	1,091	1,172	813	108,459
1966	2,613	6,544	5,585	131,169	53,827	3,193	2,516	3,248	3,807	2,136	3,155	4,494	222,287
1967	6,043	3,757	5,200	15,292	6,188	4,386	2,753	1,874	785	602	1,046	3,283	51,209
1968	18,973	17,028	20,327	29,751	60,047	12,486	8,568	2,937	5,419	2,886	8,854	24,124	211,400
1969	10,517	23,013	70,242	61,001	37,380	4,098	1,056	1,306	1,595	1,339	16,972	19,578	248,097
1970	17,918	17,426	41,442	21,067	4,754	2,540	757	695	1,644	9,646	5,715	8,482	132,086
1971	5,919	10,814	6,845	5,771	8,398	1,404	0	802	2,187	182	1,407	9,663	53,392
1972	24,659	10,682	8,199	2,672	1,652	1,159	1,148	1,908	2,247	7,018	11,011	14,714	87,069
1973	20,161	20,771	38,315	76,136	13,892	76,476	21,313	10,304	26,152	39,732	27,354	44,325	414,931
1974	54,677	35,749	24,036	12,266	13,401	9,106	3,080	964	29,317	17,238	55,905	29,905	285,644
1975	26,997	65,997	24,147	20,250	30,272	21,548	7,126	3,797	1,837	3,312	4,263	6,407	215,953
1976	11,728	8,238	33,899	15,286	25,561	42,815	29,483	3,572	7,059	6,763	6,245	22,390	213,039
1977	19,914	45,252	34,096	41,158	8,999	4,229	1,424	1,601	1,816	1,802	3,336	4,930	168,557
1978	10,586	12,345	21,021	6,674	7,115	1,173	1,536	1,272	1,245	1,102	4,060	3,822	71,951
1979	28,139	22,098	51,619	61,398	30,978	34,257	14,211	6,039	21,317	5,097	11,739	21,209	308,101
1980	36,009	38,238	14,966	49,942	37,224	4,732	2,253	1,747	1,680	1,168	1,816	2,390	192,165
1981	2,887	6,683	8,682	5,088	13,943	19,586	3,674	898	767	5,937	6,134	3,601	77,880
1982	6,326	10,878	11,176	39,738	32,337	5,699	7,212	1,139	432	1,644	10,142	35,815	162,538
1983	26,248	77,064	41,728	18,299	34,488	23,949	6,373	3,064	1,351	1,688	3,627	12,750	250,629
1984	8,810	20,628	43,631	8,864	3,131	1,586	1,462	629	647	11,228	12,518	18,957	132,091
1985	18,024	24,269	25,284	10,950	16,262	1,868	932	1,063	766	6,559	40,363	51,583	197,923
1986	12,409	21,948	7,314	12,061	22,645	41,204	2,969	1,175	1,284	5,153	11,694	32,884	172,740
1987	22,153	30,909	49,838	8,910	7,765	19,538	3,633	2,160	2,977	1,920	7,635	41,141	198,579
1988	43,054	18,694	22,537	13,754	2,487	2,159	1,897	7,961	1,279	1,718	5,940	11,943	133,423
1989	21,781	52,491	57,550	62,879	53,336	32,293	13,557	3,575	2,089	1,992	3,323	3,150	308,016
1990	24,986	35,339	22,843	26,485	61,908	35,342	2,243	1,309	3,831	15,230	26,822	30,036	286,374
1991	77,702	43,081	35,533	67,748	73,821	24,450	8,905	9,916	7,515	3,308	23,066	61,287	436,332
1992	52,033	73,436	61,582	15,816	9,542	6,411	4,406	3,551	2,576	1,528	8,255	29,015	268,151
1993	36,055	22,128	59,476	30,584	22,083	75,821	19,253	2,612	2,407	4,277	10,386	7,619	292,701
1994	9,940	39,357	38,071	14,056	17,569	6,670	3,933	4,767	7,559	38,158	16,170	64,460	260,710
1995	70,338	33,265	64,208	51,742	47,649	8,707	4,512	2,536	1,798	2,145	2,148	6,500	295,548
1996	6,997	4,643	3,949	6,413	3,163	1,319	2,091	3,122	8,581	8,371	7,094	18,207	73,950
1997	23,023	64,456	70,314	34,195	31,014	11,401	4,730	21,622	3,395	7,653	8,285	23,576	303,664
1998	56,546	35,957	47,930	14,694	3,273	1,848	2,475	1,403	2,622	20,206	33,926	54,622	275,502
1999	60,711	71,984	30,900	37,384	13,085	17,531	9,939	2,170	1,698	1,289	1,264	4,424	252,379
2000	4,858	4,794	8,380	21,436	35,249	12,174	2,368	133	0	702	18,547	34,603	143,244
2001	73,054	44,088	121,370	21,859	12,736	65,950	9,371	4,659	8,066	10,337	8,507	41,932	421,929
2002	16,424	22,678	33,343	37,652	12,015	5,271	7,640	5,903	5,552	5,675	8,303	43,937	204,393
2003	27,173	81,629	38,925	19,381	5,847	53,024	4,485	2,079	5,042	4,023	2,694	5,715	250,017
2004	10,800	26,266	28,707	24,757	54,633	10,078	4,797	4,211	1,262	5,592	14,908	15,220	201,231
2005	17,776	44,309	18,118	11,452	3,491	2,213	2,965	2,154	1,735	778	1,698	1,887	108,576
2006	5,631	8,058	13,431	4,539	3,704	832	595	907	717	1,456	2,282	5,419	47,571
2007	41,632	8,150	9,035	15,995	30,232	36,917	151,597	15,373	3,381	2,003	3,427	7,075	324,817
2008	6,423	16,203	38,035	22,287	19,931	6,631	1,797	13,103	9,116	9,158	11,444	12,061	166,189
2009	9,230	9,470	35,362	21,047	11,257	4,407	3,102	5,878	4,757	32,039	20,101	17,572	174,222
2010	18,229	26,929	28,053	10,024	1,739	13,010	6,811	4,014	2,605	4,582	4,336	3,908	124,240
2011	11,001	6,473	4,328	4,043	1,433	786	2,396	1,819	935	1,089	2,755	8,516	45,574
2012	9,538	14,734	29,855	7,861	6,050	4,791	2,479	4,051	3,737	5,446	2,987	6,746	98,275
2013	11,801	19,992	7,220	6,909	8,691	1,752	2,982	1,328	2,552	6,713	36,687	27,125	133,752
2014	7,023	10,441	11,335	19,705	20,422	11,264	3,459	3,469	3,124	7,568	4,890	4,770	107,470
2015	23,611	12,072	81,510	68,570	78,740	22,262	4,209	2,411	1,608	11,679	43,671	117,277	467,620
2016	32,159	15,121	75,578	56,859	59,342	14,375	3,203	7,172	4,625	3,405	3,352	10,016	285,207
2017	31,390	14,956	11,718	10,068	16,755	29,705	7,954	16,589	3,281	2,476	3,762	17,277	165,931
2018	10,515	43,064	37,237	22,773	6,312	2,432	3,455	3,018	4,573	19,194	59,187	60,345	272,105
MIN	631	2,768	3,025	2,479	1,433	786	0	124	0	174	592	813	33,749
MAX	79,239	81,629	121,370	131,169	143,006	76,476	151,597	21,622	29,317	52,020	94,231	117,277	467,620
AVG	24,070	27,044	30,933	26,326	26,874	15,186	7,366	3,672	3,835	6,658	13,310	21,342	206,6

EAST FORK ANGELINA NEAR CUSHING (EFACU)
NATURALIZED FLOW
UNITS: ACRE-FEET

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
1940	832	1,991	1,029	1,546	1,082	1,272	1,612	3,932	1,936	226	32,048	24,189	71,695
1941	11,563	10,614	12,550	8,051	4,137	6,036	5,160	1,315	1,171	4,902	9,396	11,896	86,791
1942	6,902	5,796	7,868	19,202	8,363	6,939	2,310	2,753	5,621	1,309	2,195	1,816	71,074
1943	7,246	4,051	2,750	3,807	1,248	1,373	836	225	130	294	1,396	2,236	25,592
1944	13,271	20,721	15,172	9,688	48,636	5,675	837	543	1,964	574	2,477	17,830	137,388
1945	23,956	10,510	29,000	24,797	4,309	4,598	20,311	1,492	948	17,692	5,057	10,826	153,496
1946	24,159	20,348	16,487	6,680	22,689	16,210	3,644	235	4,984	2,663	29,080	11,527	158,706
1947	15,788	8,446	17,539	17,298	18,450	4,540	1,547	615	773	559	1,823	5,078	92,456
1948	5,992	16,552	11,004	6,865	10,986	1,348	859	196	180	178	1,321	2,878	58,359
1949	5,057	6,193	7,261	9,058	3,755	1,302	1,101	1,209	966	4,734	3,679	3,873	48,188
1950	16,881	22,816	8,707	5,923	16,742	15,285	3,002	826	1,071	830	1,110	1,676	94,869
1951	2,842	4,285	4,784	7,132	1,968	1,094	342	113	188	237	402	1,677	25,064
1952	1,537	4,652	13,114	8,491	6,375	2,152	399	126	6	4	114	1,314	38,284
1953	2,156	5,628	23,622	5,140	48,109	3,045	2,571	992	849	228	609	3,491	96,440
1954	4,307	3,928	3,039	2,564	6,567	1,309	134	19	0	0	965	1,760	24,592
1955	3,744	6,625	4,504	11,274	6,254	3,578	1,201	1,467	293	306	136	565	39,947
1956	949	4,223	2,342	3,752	12,216	569	124	16	1	0	64	195	24,451
1957	362	1,142	2,277	10,376	36,029	13,528	2,242	1,120	504	16,072	27,001	14,183	124,836
1958	15,046	11,514	9,993	3,910	21,518	3,507	1,674	719	9,980	9,935	1,865	1,985	91,646
1959	1,981	7,099	5,279	10,255	17,902	5,246	2,101	1,971	835	1,233	3,062	7,872	64,836
1960	13,255	7,364	16,027	5,616	2,855	2,733	2,898	1,020	888	3,774	5,020	32,666	94,116
1961	30,720	16,669	22,170	16,292	4,704	11,841	6,567	1,302	4,402	1,660	4,502	22,057	142,886
1962	13,265	13,145	10,956	4,893	13,284	5,350	2,301	2,486	1,483	1,658	1,814	3,122	73,757
1963	4,446	3,692	4,012	3,273	1,265	1,040	186	0	319	0	454	1,230	19,917
1964	2,872	2,753	7,468	5,127	2,104	1,226	222	239	441	376	675	1,188	24,691
1965	1,728	6,841	18,756	7,995	9,848	2,406	487	427	1,085	541	871	4,048	55,033
1966	3,818	6,411	3,092	25,341	21,826	2,015	910	2,196	1,133	858	928	1,801	70,329
1967	1,803	1,700	2,017	2,822	1,658	2,287	769	185	223	212	489	1,317	15,482
1968	11,794	3,255	5,032	25,002	20,085	4,128	14,573	1,832	5,270	3,348	5,508	20,182	120,009
1969	6,722	15,271	34,760	26,412	19,345	2,350	846	436	733	877	2,620	3,822	114,194
1970	5,659	6,543	9,773	5,405	1,845	900	558	489	635	1,561	2,021	1,615	37,004
1971	1,791	2,733	2,763	3,189	12,286	879	510	637	573	605	947	4,356	31,269
1972	9,041	4,253	3,110	1,946	991	787	777	426	494	2,214	6,012	9,679	39,730
1973	18,920	8,947	14,783	22,255	5,786	11,115	9,229	3,211	13,428	13,692	9,035	21,804	152,205
1974	37,801	11,423	8,003	4,508	4,136	1,956	1,140	792	6,000	5,391	14,382	10,762	106,294
1975	13,704	24,002	9,114	8,670	18,397	11,774	4,003	2,297	1,323	1,866	3,838	4,110	103,098
1976	4,873	6,155	12,718	6,722	9,427	12,359	9,614	1,571	1,244	1,434	2,134	8,515	76,766
1977	6,984	10,965	9,507	4,173	3,235	2,267	523	957	655	528	1,055	1,545	42,394
1978	5,230	6,179	3,965	3,608	3,064	904	404	263	6,081	932	8,801	7,672	47,103
1979	29,460	20,537	18,635	15,390	25,301	24,795	6,434	4,207	6,188	2,650	11,203	11,250	176,050
1980	18,087	15,669	7,912	40,483	23,480	3,350	1,254	797	885	1,107	1,950	2,210	117,184
1981	2,402	3,154	5,336	2,382	3,658	4,975	1,044	515	5,312	10,635	5,827	2,783	48,023
1982	4,869	7,208	4,969	24,351	13,892	6,000	5,794	1,277	716	1,792	6,766	28,860	106,494
1983	10,528	37,952	13,946	6,190	26,100	10,457	2,819	4,360	1,745	1,624	3,128	11,149	129,998
1984	6,177	18,619	24,278	5,754	2,412	1,408	896	795	702	9,342	8,216	8,097	86,696
1985	9,146	18,399	11,736	11,865	8,116	1,490	1,010	543	447	4,620	25,571	15,604	108,547
1986	5,101	5,772	2,920	3,469	9,721	27,989	2,220	1,353	1,620	3,513	12,817	21,102	97,597
1987	9,868	24,871	12,563	4,209	3,864	4,425	2,130	844	2,093	1,545	7,361	16,566	90,339
1988	9,513	5,907	8,154	4,308	1,642	827	703	22,149	1,091	1,638	3,271	4,681	63,884
1989	16,391	14,007	32,237	7,797	25,851	9,402	12,639	1,966	1,785	833	1,390	1,317	125,615
1990	10,449	14,778	9,552	11,076	25,889	14,780	938	548	1,602	6,369	11,217	8,096	115,294
1991	36,958	18,016	14,859	28,331	30,871	10,225	3,724	4,147	3,143	1,383	9,646	25,629	186,932
1992	21,759	30,710	25,752	6,614	3,990	2,681	1,842	1,266	1,296	639	3,452	12,134	112,135
1993	15,078	9,254	24,872	12,790	9,235	31,707	8,051	1,092	940	1,855	4,343	3,186	122,403
1994	4,157	16,458	15,920	5,878	7,347	2,789	1,645	1,993	3,161	15,957	6,762	26,956	109,023
1995	29,414	13,911	26,851	21,638	19,926	3,641	1,887	1,061	752	897	898	2,718	123,594
1996	2,926	1,942	1,651	2,682	1,323	552	800	1,379	3,588	3,500	2,966	7,614	30,923
1997	9,628	26,955	29,404	14,300	12,969	4,768	1,978	9,042	1,420	3,200	3,465	9,859	126,988
1998	23,646	15,037	20,043	6,145	1,476	665	303	285	2,063	8,519	14,187	22,842	115,211
1999	25,388	30,103	12,922	15,633	5,472	7,331	4,156	908	710	539	529	1,850	105,541
2000	2,032	2,005	3,505	8,964	14,740	5,091	990	56	0	257	7,792	14,470	59,902
2001	30,550	18,437	50,755	9,141	5,326	27,579	3,919	1,049	4,555	5,830	2,980	29,556	189,677
2002	8,085	9,632	9,683	16,816	3,188	2,402	2,814	1,133	1,211	1,735	3,638	13,908	74,245
2003	13,175	22,257	17,898	8,347	1,937	10,886	3,344	907	1,358	1,362	1,652	2,691	85,814
2004	6,805	16,342	15,962	7,623	25,981	4,081	2,576	2,426	3,921	9,819	20,545	16,603	132,684
2005	11,327	23,143	13,271	8,862	2,110	1,423	1,500	756	620	460	597	935	65,004
2006	2,275	4,209	7,299	3,315	3,420	500	458	221	233	646	937	1,697	25,210
2007	19,511	4,335	3,747	3,758	9,801	7,575	50,571	5,580	1,049	719	901	2,470	110,017
2008	2,458	7,049	14,514	8,583	5,248	1,471	492	3,239	2,167	1,680	2,173	3,947	53,021
2009	3,365	2,928	10,277	11,383	4,314	1,176	489	835	612	7,225	6,411	5,392	54,407
2010	6,377	12,161	12,184	3,663	1,035	2,046	1,636	720	308	475	657	684	41,946
2011	2,608	1,730	1,395	697	766	132	356	250	117	161	320	1,817	10,349
2012	2,418	5,310	11,534	2,615	1,437	1,006	608	575	702	1,854	422	1,541	30,022
2013	5,938	7,061	2,899	2,441	1,432	621	750	166	571	1,269	9,731	11,616	44,495
2014	4,031	3,786	4,894	5,214	11,812	7,201	3,342	1,590	835	2,057	3,613	2,463	50,838
2015	16,783	6,178	36,336	27,728	32,243	15,581	2,148	559	373	873	13,917	18,971	171,690
2016	8,895	4,243	25,633	25,422	14,248	7,492	1,199	4,069	1,300	1,054	1,691	3,518	98,764
2017	4,575	3,379	3,004	3,531	6,337	2,377	1,373	1,430	884	537	1,050	2,633	31,110
2018	2,117	4,670	10,983	7,486	1,831	520	729	375	1,118	9,098	23,429	47,738	110,094
MIN	362	1,142	1,029	697	766	132	124	0	0	0	64	195	10,349
MAX	37,801	37,952	50,755	40,483	48,636	31,707	50,571	22,149	13,428	17,692	32,048	47,738	189,677
AVG	10,295	10,678	12,362	9,822	10,927	5,701	3,166	1,609	1,798	2,946	5,599	9,057	83,959

ANGELINA RIVER NEAR ALTO (ANAL)
NATURALIZED FLOW
UNITS: ACRE-FEET

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
1940	27,671	103,334	30,459	36,420	43,556	51,934	21,839	15,494	22,562	1,871	232,498	288,776	876,414
1941	202,014	108,659	166,769	82,654	68,764	52,073	40,606	10,420	12,431	67,360	136,638	118,328	1,066,716
1942	79,902	53,921	67,418	127,035	111,406	92,517	16,939	21,089	39,955	10,535	20,332	23,701	664,750
1943	64,721	34,925	29,541	32,037	13,725	19,891	5,968	1,530	831	4,778	11,692	22,701	242,340
1944	128,585	152,548	169,454	116,066	487,750	111,660	6,586	3,760	13,881	4,335	21,825	111,349	1,327,799
1945	322,081	108,700	209,402	265,721	66,026	46,129	123,851	12,380	8,553	100,607	47,362	71,105	1,381,917
1946	213,023	244,271	175,530	89,058	155,274	139,433	31,390	10,216	39,525	24,575	164,643	137,452	1,424,390
1947	171,675	116,810	200,008	159,975	161,728	49,651	12,874	4,918	7,753	5,405	17,063	57,480	965,340
1948	63,053	175,579	107,193	60,106	68,039	11,474	7,080	1,430	1,598	1,795	12,031	22,638	532,016
1949	56,313	84,472	71,196	81,734	31,280	12,972	9,295	9,232	7,339	40,517	28,732	32,532	465,614
1950	152,365	197,019	71,193	52,279	147,939	128,349	23,475	7,063	8,920	6,785	9,513	13,802	818,702
1951	24,573	40,658	44,844	58,037	18,094	11,362	3,319	1,111	1,710	2,272	4,152	14,986	225,118
1952	17,086	68,004	110,734	86,174	51,737	18,985	3,206	1,598	531	1,554	2,078	12,669	374,356
1953	21,512	45,507	198,299	45,964	400,123	22,456	21,175	8,473	7,291	1,938	7,220	34,053	814,011
1954	37,896	33,239	26,559	22,568	76,154	10,184	1,047	1,629	528	2,748	10,565	20,364	243,481
1955	35,930	66,536	54,911	98,465	52,204	27,067	10,365	11,294	3,593	2,830	1,600	5,510	370,305
1956	8,960	39,377	20,019	27,770	121,978	3,279	1,484	1,949	579	174	656	1,146	227,371
1957	2,917	10,689	20,531	132,636	290,996	137,098	17,316	8,670	4,068	126,179	246,706	111,227	1,109,033
1958	127,866	96,742	81,463	52,414	202,551	31,487	15,626	10,116	75,367	75,161	17,094	19,568	805,455
1959	19,896	65,287	46,852	90,940	220,745	47,281	20,637	16,136	7,734	10,596	24,747	78,055	648,906
1960	123,797	91,745	146,216	45,809	22,046	22,934	22,378	8,517	12,020	29,629	45,407	297,663	868,161
1961	270,882	154,904	200,780	128,566	41,150	90,526	48,277	11,102	36,142	13,995	39,510	165,425	1,201,259
1962	119,359	107,264	90,658	56,848	106,957	51,012	27,782	18,119	13,415	15,887	17,500	29,270	654,071
1963	38,406	32,619	37,742	26,230	11,534	6,795	2,609	3,464	1,874	1,538	2,137	10,186	175,134
1964	14,887	17,723	39,584	20,400	11,989	9,565	2,512	1,954	2,255	2,556	3,027	5,996	132,448
1965	12,836	37,301	38,060	101,779	93,225	37,926	5,554	4,033	3,819	2,622	5,520	17,828	360,503
1966	21,571	42,225	26,634	236,876	275,719	22,485	7,599	8,695	9,954	5,011	6,769	9,620	673,158
1967	13,740	9,801	14,208	35,146	16,212	22,081	6,854	3,022	1,368	814	1,571	8,335	133,152
1968	65,517	34,548	57,108	147,312	172,918	38,666	59,232	9,270	32,847	17,718	32,808	161,025	828,969
1969	58,697	84,419	286,077	257,286	177,777	18,950	3,132	1,837	4,103	4,051	61,710	49,074	1,007,113
1970	68,614	47,337	122,123	78,402	26,173	7,680	3,302	1,184	3,333	20,253	19,559	19,281	417,241
1971	17,273	24,899	22,991	17,496	44,332	3,504	510	2,333	3,088	1,852	3,537	27,373	169,188
1972	75,102	34,878	26,729	10,760	9,528	11,243	3,212	3,797	4,251	14,761	52,098	55,271	301,630
1973	86,902	77,586	113,361	192,428	80,067	126,764	47,979	25,757	59,618	145,951	71,201	185,214	1,212,828
1974	220,434	144,149	87,631	43,935	43,599	18,910	6,981	3,437	51,108	27,072	104,924	92,893	845,073
1975	95,491	197,551	70,005	67,732	137,908	68,351	27,161	11,919	4,671	10,806	19,082	20,112	730,789
1976	34,577	38,366	115,361	67,333	119,785	127,382	107,305	12,687	16,500	14,070	18,584	64,438	736,388
1977	58,735	111,879	87,991	98,555	30,116	13,875	4,589	4,420	5,403	3,685	5,643	14,120	439,011
1978	31,656	45,528	43,645	24,477	18,797	6,061	1,940	1,615	7,326	2,034	12,861	28,321	224,261
1979	143,949	103,955	156,929	193,365	105,510	157,891	24,338	32,563	49,962	17,160	39,524	71,412	1,096,558
1980	121,244	128,747	50,390	168,154	125,335	15,932	7,585	5,882	5,655	3,932	6,116	8,047	647,019
1981	9,722	22,501	29,234	17,130	46,945	65,947	11,607	1,413	6,079	18,867	20,652	12,125	262,222
1982	21,299	36,626	37,628	133,798	108,878	19,188	24,282	5,290	1,148	3,436	35,101	120,590	547,264
1983	88,376	259,474	140,499	61,614	116,121	80,636	21,459	10,316	4,549	5,683	12,211	42,929	843,867
1984	29,664	69,456	146,907	29,846	11,226	6,479	3,100	2,012	2,282	37,806	42,147	63,829	444,754
1985	60,686	81,715	85,132	36,870	54,755	6,288	3,958	2,756	1,213	23,452	135,903	173,681	666,409
1986	41,780	73,900	24,626	34,976	81,880	138,733	9,995	3,957	4,322	17,351	39,374	110,719	581,613
1987	74,588	104,072	167,805	29,999	26,146	65,784	16,445	3,061	9,527	5,549	27,117	138,523	668,616
1988	144,962	62,942	75,881	46,311	9,757	5,886	5,017	30,110	2,370	5,783	20,000	40,211	449,230
1989	73,336	176,739	193,772	211,715	179,582	108,729	45,646	12,038	7,033	6,707	11,188	10,606	1,037,091
1990	84,129	118,986	76,911	89,176	208,445	118,998	7,551	4,409	12,900	51,280	90,310	65,189	928,284
1991	297,565	145,053	119,639	228,107	248,557	82,324	29,982	33,386	25,303	11,139	77,663	206,352	1,505,070
1992	175,196	247,259	207,347	53,252	32,128	21,585	14,834	10,196	10,433	5,145	27,793	97,695	902,863
1993	121,398	74,505	200,255	102,978	74,353	255,288	64,825	8,793	7,572	14,933	34,971	25,653	985,524
1994	33,468	132,516	128,184	47,327	59,155	22,459	13,244	16,049	25,450	128,479	54,446	217,037	877,814
1995	236,829	112,005	216,188	174,217	160,435	29,316	15,191	8,540	6,053	7,223	7,234	21,884	995,115
1996	23,560	15,633	13,296	21,593	10,650	4,442	6,445	11,107	28,892	28,184	23,884	61,304	248,990
1997	77,518	217,025	236,746	115,133	104,424	38,387	15,925	72,803	11,432	25,766	27,895	79,379	1,022,433
1998	190,390	121,068	161,380	49,476	11,886	5,357	2,778	1,949	16,607	68,590	114,230	183,912	927,623
1999	204,413	242,372	104,042	125,872	44,058	59,026	33,466	7,308	5,717	4,341	4,256	14,897	849,768
2000	16,358	16,140	28,217	72,176	118,683	40,990	7,972	448	0	2,073	62,738	116,509	482,304
2001	245,974	148,445	408,652	73,601	42,881	222,054	31,551	8,448	36,677	46,941	23,997	237,967	1,527,188
2002	65,098	77,556	77,961	135,397	25,666	19,342	22,659	9,123	9,750	13,967	29,294	111,981	597,794
2003	106,075	179,205	144,103	67,207	15,598	87,645	26,922	7,306	10,938	10,964	13,304	21,667	690,934
2004	54,793	131,578	128,520	61,379	209,190	32,861	20,743	19,537	31,572	79,059	165,422	133,679	1,068,333
2005	91,200	186,340	106,854	71,352	16,986	11,461	12,080	6,087	4,989	3,702	4,803	7,528	523,382
2006	18,315	33,888	58,766	26,687	27,540	4,028	3,684	1,781	1,878	5,201	7,543	13,662	202,973
2007	157,095	34,904	30,170	30,258	78,911	60,991	407,170	44,931	8,445	5,787	7,251	19,890	885,803
2008	19,794	56,757	116,858	69,106	42,257	11,844	3,962	26,082	17,445	13,526	17,498	31,777	426,906
2009	27,090	23,571	82,744	91,651	34,731	9,471	3,938	6,722	5,369	57,732	51,615	43,412	438,046
2010	51,341	97,916	98,097	29,492	8,330	16,477	13,173	5,346	2,913	5,057	4,993	4,592	337,727
2011	20,997	13,927	11,228	5,615	6,164	1,061	2,809	2,069	1,052	1,250	3,075	14,082	83,329
2012	19,472	42,756	92,869	21,052	11,570	8,099	4,897	4,629	5,653	14,930	3,409	12,396	241,732
2013	47,808	56,853	23,342	19,651	11,527	4,999	6,039	1,494	4,436	10,221	78,351	93,530	358,251
2014	32,453	30,485	39,404	41,979	95,108	57,977	26,905	12,804	6,724	16,566	29,089	19,828	409,322
2015	135,127	49,739	292,564	223,249	259,605	125,449	17,291	4,502	3,005	12,552	72,744	187,006	1,382,833
2016	149,846	35,568	276,887	121,078	248,190	117,030	8,529	23,122	13,844	7,740	10,358	28,294	1,040,486
2017	62,084	48,344	35,380	43,879	65,342	60,594	20,906	21,507	7,637	3,613	7,720	51,869	428

ANGELINA RIVER NEAR LUFKIN (ANLU)
NATURALIZED FLOW
UNITS: ACRE-FEET

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
1940	36,119	134,883	39,758	47,539	56,854	67,790	28,507	16,349	33,326	3,369	303,482	376,943	1,144,919
1941	263,691	141,834	217,686	107,889	89,758	75,909	60,536	14,036	17,110	87,926	178,355	154,455	1,409,185
1942	104,297	75,068	94,046	165,820	145,420	120,763	24,958	21,089	45,186	11,683	20,546	30,581	859,457
1943	74,124	41,167	33,651	36,357	14,900	20,217	6,967	1,850	831	4,778	11,692	22,701	269,235
1944	167,599	199,123	221,191	151,503	636,666	145,751	10,871	4,523	18,579	5,647	24,576	145,345	1,731,374
1945	420,417	141,887	273,335	346,849	86,184	46,129	161,178	16,833	9,674	131,323	62,185	92,814	1,788,808
1946	278,061	318,850	229,121	116,249	202,681	182,004	46,109	10,369	39,525	25,255	214,910	179,418	1,842,552
1947	224,089	152,474	261,073	208,817	211,105	75,179	18,317	6,021	7,753	5,428	17,063	72,867	1,260,186
1948	72,208	229,185	139,921	95,092	88,812	16,494	8,703	1,779	1,921	1,795	12,031	24,467	692,408
1949	73,506	110,262	102,934	106,689	40,830	16,932	12,133	12,051	9,580	52,888	37,504	42,465	617,774
1950	198,884	257,171	92,929	68,241	193,106	167,535	30,642	9,219	11,644	8,857	12,417	18,016	1,068,661
1951	32,076	53,072	58,536	75,757	23,618	14,831	4,332	1,450	2,232	2,966	5,420	19,562	293,852
1952	22,302	88,767	144,543	112,484	67,533	24,782	3,679	1,598	531	1,554	2,078	17,645	487,496
1953	28,080	59,401	258,842	59,997	522,285	29,312	27,640	11,060	9,517	2,530	9,425	44,450	1,062,539
1954	49,466	43,387	34,668	29,458	99,405	14,111	1,047	1,629	528	2,748	14,791	26,582	317,820
1955	46,900	86,850	71,676	128,527	68,142	35,331	13,529	14,742	4,690	3,694	2,089	7,192	483,362
1956	11,695	51,399	26,131	36,248	159,220	5,328	1,484	1,949	579	174	656	1,670	296,533
1957	4,064	13,953	26,799	173,131	379,841	178,956	22,603	11,317	5,310	164,703	322,028	145,186	1,447,891
1958	166,905	126,279	106,335	68,417	264,393	41,101	20,397	11,808	99,774	98,108	22,313	25,542	1,051,372
1959	25,970	85,220	54,855	96,032	220,745	48,017	24,967	22,548	8,738	12,118	34,208	87,377	720,795
1960	144,227	115,624	179,502	58,632	31,102	22,934	26,933	9,893	12,020	29,980	58,559	350,753	1,040,159
1961	320,290	226,983	273,236	182,919	60,350	90,526	56,522	14,599	48,489	18,398	39,510	206,205	1,538,027
1962	132,300	155,020	119,433	69,173	150,855	57,083	27,782	20,449	15,577	16,557	17,809	31,476	813,514
1963	45,023	38,002	47,388	40,985	12,923	8,782	2,609	3,464	2,353	1,538	2,137	10,526	215,730
1964	16,930	19,803	48,746	48,881	21,932	12,128	2,517	2,687	2,394	2,556	3,336	7,220	189,130
1965	16,603	42,182	44,758	132,364	111,290	59,228	6,331	5,197	5,077	2,642	8,025	25,629	459,326
1966	37,012	61,020	38,000	236,876	343,275	45,281	8,644	12,676	11,658	6,013	7,637	12,605	820,697
1967	15,931	14,412	18,167	38,099	24,142	32,810	8,413	3,466	1,368	814	1,571	8,560	167,753
1968	89,608	42,872	82,608	217,511	202,610	77,538	70,232	20,012	47,241	21,467	41,075	203,709	1,116,483
1969	99,828	124,553	359,088	328,929	235,044	24,728	3,596	2,055	4,529	4,051	61,710	49,074	1,297,185
1970	70,398	51,387	149,178	86,677	38,536	8,621	3,302	1,184	3,333	20,253	19,559	19,281	471,709
1971	17,844	24,899	24,074	18,438	44,332	3,590	510	2,689	3,289	2,459	4,663	35,922	182,709
1972	81,416	44,504	35,369	16,601	12,709	11,243	7,788	4,202	4,294	15,826	77,926	90,402	402,280
1973	154,066	109,278	142,367	206,867	129,084	144,151	60,534	30,896	64,501	189,954	110,369	230,338	1,572,405
1974	270,219	222,397	116,387	53,063	47,096	24,315	7,865	3,679	52,478	33,154	143,556	136,400	1,110,609
1975	138,723	294,344	102,915	91,339	173,114	93,380	37,301	15,394	5,653	10,806	26,699	24,414	1,014,082
1976	43,059	54,440	118,088	96,526	146,066	127,382	125,418	24,293	18,397	16,671	24,313	81,635	876,288
1977	75,444	140,684	114,277	115,417	42,565	16,559	5,932	5,444	7,328	4,282	6,731	15,976	550,639
1978	43,652	65,292	55,129	36,579	23,864	7,508	1,940	2,071	7,326	2,034	16,476	40,289	302,160
1979	203,976	185,570	214,355	272,532	175,949	241,501	39,346	45,268	51,921	23,828	54,391	94,864	1,603,501
1980	150,093	166,537	82,415	217,002	185,780	22,586	8,912	6,902	5,668	3,932	6,116	8,202	864,145
1981	12,065	26,789	37,585	20,132	55,050	86,758	17,946	2,255	23,817	26,340	28,049	13,651	350,437
1982	27,646	47,429	51,438	205,888	143,431	28,138	30,408	7,511	1,148	7,541	52,217	193,001	795,796
1983	115,095	315,935	180,607	75,494	170,543	105,512	28,837	17,493	7,256	6,709	17,644	81,143	1,122,268
1984	53,628	117,388	196,062	43,234	24,204	12,314	4,747	5,151	3,624	55,617	57,340	79,939	653,248
1985	80,966	125,409	123,653	52,904	69,737	8,533	7,979	5,440	5,031	39,146	165,474	220,958	905,230
1986	51,260	99,345	32,421	44,575	107,112	199,133	22,472	10,614	9,541	21,939	91,471	155,811	845,694
1987	100,648	148,998	206,229	40,465	34,858	76,019	22,916	7,661	15,313	6,760	52,131	175,400	887,398
1988	177,367	76,727	105,851	62,952	13,658	7,530	8,195	30,110	2,421	5,934	21,066	45,205	557,016
1989	113,943	213,767	216,353	261,967	227,479	169,282	98,507	19,419	9,460	9,667	11,558	16,412	1,367,814
1990	128,964	164,041	106,212	113,915	267,991	159,335	9,934	7,475	14,360	51,280	96,710	76,626	1,196,843
1991	391,050	199,039	154,066	309,032	310,929	111,468	42,616	57,672	39,745	16,411	90,267	245,755	1,968,050
1992	232,905	346,287	282,333	84,370	44,243	31,325	18,470	15,308	14,172	6,322	32,450	132,508	1,240,693
1993	169,674	91,098	262,505	147,524	106,912	288,457	88,357	15,096	12,080	19,171	42,200	39,292	1,282,366
1994	50,349	183,905	170,292	68,584	79,249	32,472	16,357	25,929	34,381	198,443	70,935	279,921	1,210,817
1995	325,483	144,605	291,792	233,456	201,162	36,602	21,337	12,346	7,723	7,223	7,711	37,275	1,326,715
1996	29,823	21,303	15,908	29,046	14,889	7,243	6,603	15,996	39,421	32,833	30,590	81,685	325,340
1997	101,523	288,822	310,885	171,655	130,963	49,717	23,556	114,825	13,065	34,599	46,074	117,087	1,402,771
1998	287,181	173,349	202,920	62,505	18,026	10,099	5,710	5,353	28,017	79,232	159,347	234,622	1,266,361
1999	303,366	290,835	145,444	153,297	55,617	77,002	44,018	11,490	10,742	8,819	5,202	19,672	1,125,504
2000	18,166	20,212	39,614	93,643	148,572	51,038	9,513	2,368	249	3,357	81,984	150,532	619,248
2001	302,726	181,067	521,464	99,637	54,152	277,091	42,599	12,069	44,757	58,079	32,236	310,772	1,936,649
2002	92,193	97,509	101,681	179,918	30,728	22,231	25,527	12,031	12,438	26,840	70,349	175,233	846,678
2003	138,136	233,737	195,888	87,081	20,985	98,578	38,486	9,477	15,527	12,132	24,856	31,446	906,329
2004	80,748	210,457	184,566	79,988	264,736	61,660	38,226	24,448	37,373	92,699	247,645	181,805	1,504,351
2005	121,778	252,833	147,000	92,469	22,908	16,577	16,043	7,316	24,526	6,215	4,850	10,048	722,563
2006	26,994	63,178	74,425	41,986	35,562	5,338	10,003	5,316	2,582	62,971	14,960	47,511	390,826
2007	235,872	58,268	45,851	38,500	89,910	75,902	433,241	57,979	10,696	7,337	10,851	30,820	1,095,227
2008	24,053	94,379	144,512	96,959	50,822	16,948	6,367	28,141	17,445	13,566	20,492	39,206	552,890
2009	34,124	33,174	103,644	131,616	45,517	15,067	8,798	14,362	7,629	112,878	80,009	80,604	667,422
2010	69,011	134,616	126,598	39,453	11,881	22,217	15,302	8,769	7,417	5,949	8,118	7,233	456,564
2011	24,443	21,377	16,502	6,526	11,666	7,309	3,371	5,403	2,108	1,250	3,075	25,027	128,057
2012	43,198	77,294	159,262	44,297	16,616	11,145	17,067	6,761	16,257	25,394	3,719	17,084	438,094
2013	69,122	71,745	31,517	30,856	14,931	9,776	6,377	1,695	11,199	19,895	92,890	112,245	472,248
2014	41,513	40,946	53,513	57,296	116,760	76,722	48,523	17,565	9,186	19,690	29,089	27,109	537,912
2015	191,294	61,698	372,179	283,579	349,702	172,419	36,943	9,139	5,149	12,552	96,169	216,154	1,806,977
2016	195,364	47,792	370,582	155,101	314,058	151,334	12,565	35,240	20,293	9,589	12,457	39,124	1,363,499

ATTOYAC BAYOU NEAR CHIRENO (ATCH)
NATURALIZED FLOW
UNITS: ACRE-FEET

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
1940	25,549	115,188	24,972	31,987	46,612	29,302	8,896	8,398	9,110	2,460	176,017	153,963	632,454
1941	68,854	61,888	76,346	23,516	77,226	88,243	23,145	11,064	14,910	41,708	151,146	57,287	695,333
1942	37,926	33,894	49,942	54,530	31,474	48,900	8,269	31,275	18,960	5,635	9,715	13,605	344,125
1943	22,881	17,173	18,155	9,255	4,925	3,306	2,561	2,114	2,543	3,273	4,540	11,050	101,776
1944	56,170	53,155	69,037	46,477	199,012	29,236	5,734	5,708	10,358	3,481	17,482	60,032	555,882
1945	143,857	42,877	50,971	79,240	21,939	9,382	10,433	4,316	3,620	20,297	11,764	28,364	427,060
1946	110,644	109,125	73,615	27,513	59,677	30,728	9,979	7,478	7,458	8,463	46,358	30,980	522,018
1947	94,854	32,571	82,768	69,652	32,858	11,812	4,282	2,398	2,269	2,666	13,585	21,665	371,380
1948	23,714	84,540	34,157	33,201	26,061	4,679	4,005	1,428	1,394	1,511	5,568	9,211	229,469
1949	38,491	35,244	51,150	36,171	22,284	8,672	7,317	4,798	3,866	47,746	16,086	39,074	310,899
1950	97,162	48,303	47,252	22,542	71,564	87,679	15,606	5,351	6,373	4,758	5,950	9,535	422,075
1951	14,828	23,385	27,249	21,459	6,847	3,527	2,071	1,101	3,838	1,702	3,469	17,437	126,913
1952	12,432	25,119	29,343	42,758	30,528	9,168	2,926	1,252	712	728	3,725	8,380	167,071
1953	12,607	37,204	128,259	48,182	228,359	7,503	10,485	6,458	3,622	2,390	4,556	12,986	502,611
1954	16,419	13,323	8,749	9,195	22,380	2,134	692	468	521	1,814	0	794	76,489
1955	7,060	28,675	8,960	38,189	8,907	11,615	2,993	6,257	2,133	1,686	2,122	4,054	122,651
1956	6,058	22,138	11,746	30,817	19,256	2,249	622	373	613	263	1,380	2,138	97,653
1957	3,975	12,147	16,806	94,538	89,534	40,276	4,951	1,644	2,858	19,843	114,159	38,055	438,786
1958	65,447	26,602	29,615	15,894	61,045	18,311	6,038	18,740	118,701	22,227	13,882	11,641	408,143
1959	10,852	40,590	18,976	46,982	12,169	10,637	12,093	6,020	2,908	6,474	12,494	41,274	221,469
1960	38,079	49,515	50,053	15,463	15,489	10,211	5,379	7,420	9,465	13,228	37,745	87,564	339,611
1961	114,270	59,645	95,224	43,031	12,684	17,066	10,288	5,462	21,435	5,901	15,485	101,768	502,259
1962	45,812	31,010	27,993	26,914	35,512	9,429	4,485	2,100	6,895	3,552	6,109	10,723	210,534
1963	11,605	14,227	13,525	24,301	3,995	3,529	2,255	1,200	1,210	1,357	2,694	5,508	85,406
1964	8,936	7,765	27,394	28,629	9,907	5,562	721	591	770	788	1,805	4,314	97,182
1965	6,407	16,959	10,885	33,790	46,584	20,116	1,135	846	6,411	1,815	2,878	20,844	168,670
1966	23,706	49,377	12,609	48,666	82,504	5,050	1,769	5,782	3,316	2,817	2,547	5,587	243,730
1967	5,849	11,389	8,360	6,333	4,919	23,187	2,293	972	741	324	1,081	4,017	69,465
1968	47,744	10,064	23,984	108,159	59,242	25,718	28,566	6,268	29,869	11,258	18,151	87,257	456,280
1969	24,042	63,245	126,056	89,506	72,046	9,195	2,690	1,866	2,031	1,910	4,784	7,438	404,809
1970	11,939	14,569	40,719	17,411	12,512	3,765	1,743	1,206	1,983	5,954	6,750	4,332	122,883
1971	5,653	7,180	6,549	4,022	11,343	1,553	2,261	4,189	1,256	2,241	3,491	17,474	67,212
1972	22,836	16,193	8,289	6,807	12,270	3,174	3,491	1,831	1,588	5,744	25,367	39,356	146,946
1973	79,476	32,138	65,732	84,978	24,307	43,662	17,699	10,332	15,961	36,415	42,165	88,249	541,114
1974	132,434	51,971	27,059	14,634	15,733	8,890	5,794	3,427	17,024	6,069	69,423	57,838	410,296
1975	65,532	117,287	41,657	33,824	69,489	26,458	14,759	7,484	6,167	6,355	12,434	11,107	412,553
1976	16,050	22,921	25,063	13,400	17,248	28,407	42,228	3,767	3,909	3,969	6,234	26,896	210,092
1977	26,768	38,703	36,269	27,560	8,844	10,065	2,831	15,434	5,422	2,730	4,651	10,538	189,815
1978	39,402	34,166	25,597	18,517	21,373	3,295	1,267	1,504	31,341	4,428	10,638	31,117	222,645
1979	125,111	86,967	80,678	79,629	68,175	141,851	10,653	12,399	13,467	7,513	43,692	39,747	709,882
1980	51,650	55,337	42,021	142,757	87,981	9,985	3,399	2,498	2,278	3,190	5,191	6,337	412,624
1981	7,312	13,152	13,239	6,003	11,452	36,437	4,825	2,079	108,521	23,429	17,630	8,467	252,546
1982	16,356	30,768	24,308	121,931	45,425	10,203	19,710	10,225	3,004	7,919	24,357	125,499	439,705
1983	51,914	106,640	61,267	25,655	96,993	46,764	24,160	15,558	7,052	5,616	12,243	110,561	564,423
1984	41,355	72,801	77,275	19,340	16,789	7,177	4,400	3,578	3,446	42,454	34,145	25,733	348,493
1985	44,492	63,350	58,686	38,076	48,740	4,605	4,580	2,119	2,346	24,542	39,647	67,748	398,931
1986	12,890	38,422	11,571	13,785	37,240	94,874	21,465	11,590	8,966	6,526	89,866	70,113	417,308
1987	39,461	70,480	52,396	15,844	13,070	11,846	10,006	7,976	9,466	1,625	42,327	52,540	327,037
1988	43,844	18,524	46,371	25,329	6,047	2,371	3,230	0	0	0	0	4,969	150,685
1989	65,779	48,988	21,270	69,299	68,274	98,152	90,613	12,085	3,666	4,659	0	9,394	492,179
1990	72,311	69,220	45,064	35,622	86,361	60,723	3,535	5,079	1,338	0	2,586	14,070	395,909
1991	138,555	82,693	50,018	122,889	87,436	44,239	19,749	40,389	23,472	8,377	14,925	50,301	683,043
1992	86,381	153,570	114,273	50,703	18,599	15,378	5,062	8,184	5,689	1,605	5,604	52,909	517,957
1993	74,779	22,422	92,050	69,906	51,186	34,180	35,885	10,470	7,359	6,137	9,517	21,991	435,882
1994	27,047	79,272	62,993	33,540	30,262	15,782	4,281	16,184	13,535	113,121	24,242	91,513	511,772
1995	135,934	47,492	114,500	89,234	57,281	10,186	9,546	5,998	2,402	0	296	25,523	498,392
1996	8,920	8,645	3,374	11,259	6,568	4,599	0	7,692	16,067	5,551	9,686	30,565	112,926
1997	35,467	107,562	109,806	90,252	37,338	16,560	12,147	68,379	1,797	13,327	29,942	59,954	582,531
1998	155,230	82,023	58,649	18,510	9,866	8,003	5,652	5,284	18,883	12,298	69,807	72,906	517,111
1999	157,721	63,010	64,137	36,787	16,406	26,461	15,652	6,799	8,475	7,629	1,278	7,107	411,462
2000	1,619	5,717	17,698	31,431	41,943	13,990	1,977	3,412	448	2,105	28,377	49,604	198,321
2001	77,576	43,885	162,239	39,515	16,004	76,881	16,736	5,674	10,879	15,357	12,434	107,282	584,462
2002	42,274	28,168	34,910	66,617	6,546	3,266	2,898	4,324	3,865	21,782	70,992	102,686	388,328
2003	47,115	80,259	78,826	29,059	8,139	10,917	18,128	3,177	7,169	1,006	19,469	15,440	318,704
2004	41,251	128,863	88,057	27,365	79,084	48,566	29,405	6,888	7,286	16,650	131,497	73,279	678,191
2005	45,934	101,082	61,595	30,884	8,963	8,064	5,928	1,605	34,678	4,155	0	3,784	306,672
2006	13,795	49,349	22,316	24,878	11,689	1,955	11,009	6,187	1,080	103,500	12,601	59,581	317,940
2007	126,127	38,577	25,216	11,813	11,908	20,746	6,202	18,998	3,209	2,212	5,756	17,690	288,454
2008	5,688	62,063	38,100	43,237	11,193	8,005	3,934	1,097	0	0	5,560	10,198	189,075
2009	9,954	14,932	29,354	62,790	15,945	9,128	8,357	13,084	4,374	92,677	45,962	62,624	369,181
2010	26,679	56,284	41,504	14,985	5,560	8,686	2,516	4,768	8,637	3,446	4,564	2,554	180,183
2011	4,104	12,020	8,374	1,079	9,290	11,144	629	5,900	2,091	0	615	17,269	72,515
2012	40,772	57,910	110,254	39,748	7,928	4,674	21,424	3,375	18,529	17,347	237	7,181	329,379
2013	33,595	21,127	12,385	18,210	4,975	8,102	4	514	11,431	16,397	18,340	24,340	169,420
2014	13,066	15,785	21,462	23,379	29,470	27,951	36,232	7,291	3,760	3,968	0	12,280	194,644
2015	87,613	16,557	114,080	86,292	136,252	72,022	33,655	7,898	3,560	470	33,175	33,772	625,346
2016	66,966	18,451	141,001	49,147	93,767	50,058	6,413	19,506	10,226	2,556	2,743	16,669	477,503
2017	41,376	18,273	21,264	17,456	30,662	46,834	15,554	89,305	61,390	3,122	6,172	1,014	352,422
2018	13,734	101,697	82,371	68,095	3,646	2,479	11,657	0	8,914	39,602	68,740	131,074	532,009
MIN	1,619	5,717	3,374	1,079	3,646	1,553	0	0	0	0	0	794	67,212
MAX	157,721	153,570	162,239	142,757	228,359	141,851	90,613	89,305	118,701	11			

AYISH BAYOU NEAR SAN AUGUSTINE (AYSA)
NATURALIZED FLOW
UNITS: ACRE-FEET

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
1940	5,217	23,521	5,099	6,532	9,518	5,983	1,817	1,715	1,860	502	35,943	31,439	129,146
1941	14,060	12,638	15,590	4,802	15,770	18,019	4,726	2,259	3,045	8,517	30,864	11,698	141,988
1942	7,744	6,921	10,198	11,135	6,427	9,985	1,689	6,386	3,872	1,151	1,984	2,778	70,270
1943	4,672	3,507	3,707	1,890	1,006	675	523	432	519	668	927	2,256	20,782
1944	11,470	10,854	14,097	9,491	40,638	5,970	1,171	1,166	2,115	711	3,570	12,259	113,512
1945	29,376	8,755	10,408	16,181	4,480	1,916	2,130	881	739	4,145	2,402	5,792	87,205
1946	22,594	22,283	15,032	5,618	12,186	6,275	2,038	1,527	1,523	1,728	9,466	6,326	106,596
1947	19,369	6,651	16,901	14,223	6,710	2,412	874	490	463	544	2,774	4,424	75,835
1948	4,842	17,263	6,975	6,780	5,322	955	818	292	285	309	1,137	1,881	46,859
1949	7,860	7,197	10,445	7,386	4,550	1,771	1,494	980	789	9,750	3,285	7,979	63,486
1950	19,840	9,863	9,649	4,603	14,613	17,904	3,187	1,093	1,301	972	1,215	1,947	86,187
1951	3,028	4,775	5,564	5,935	2,767	1,009	715	473	1,179	429	409	1,439	27,722
1952	1,432	4,254	6,294	11,103	13,688	3,997	1,437	802	281	227	615	2,192	46,322
1953	6,071	9,966	16,595	10,396	64,732	11,951	4,022	3,026	1,279	615	594	2,020	131,267
1954	4,312	2,139	1,058	4,372	8,272	2,766	784	363	127	644	0	201	25,038
1955	1,788	7,262	2,269	9,671	2,256	2,942	758	1,585	540	369	426	504	30,370
1956	825	5,785	2,270	4,247	1,546	774	797	374	293	137	383	312	17,743
1957	405	1,123	5,380	3,693	32,064	4,012	1,792	837	888	0	14,431	17,904	82,529
1958	16,429	9,591	5,766	3,865	8,115	1,210	645	1,428	7,656	11,551	2,675	1,728	70,659
1959	1,718	8,895	3,737	16,499	2,434	833	5,974	1,371	347	1,677	1,424	8,685	53,594
1960	10,579	13,180	6,557	2,972	1,491	1,843	1,892	1,098	1,183	904	7,446	16,722	65,867
1961	27,878	12,140	27,278	9,890	1,820	1,845	1,121	675	5,540	728	2,172	18,695	109,782
1962	7,576	4,142	4,415	3,648	6,979	797	175	60	700	159	580	4,335	33,566
1963	3,176	4,474	3,871	4,062	911	1,283	296	204	37	25	317	834	19,490
1964	2,693	2,280	13,674	17,188	1,821	403	54	147	111	88	219	748	39,426
1965	669	7,511	3,980	2,221	1,440	301	69	34	1,078	95	371	5,305	23,074
1966	6,473	21,146	3,113	13,449	4,211	249	75	280	801	730	330	1,137	51,994
1967	1,504	1,980	1,945	1,409	1,339	2,247	215	39	33	33	87	522	11,353
1968	6,999	2,376	7,811	34,466	6,357	6,996	4,953	820	11,184	905	6,958	18,918	108,743
1969	5,810	13,253	25,141	16,015	14,399	1,286	140	77	145	143	330	596	77,335
1970	1,214	1,990	7,142	2,381	5,939	502	135	89	137	407	359	367	20,662
1971	440	619	692	288	531	108	352	616	286	287	775	7,166	12,160
1972	7,937	3,483	3,212	2,283	3,481	164	263	140	277	1,261	2,144	9,798	34,443
1973	20,218	9,107	17,847	18,514	6,697	16,585	2,106	1,210	2,513	6,949	13,162	22,872	137,780
1974	46,428	11,178	6,057	6,963	2,033	1,903	271	321	1,960	947	14,766	19,514	112,341
1975	17,029	16,673	9,637	5,045	29,539	4,662	4,964	1,516	813	1,143	2,221	2,320	95,562
1976	3,998	6,240	7,889	2,723	2,528	2,764	3,821	244	327	284	656	3,056	34,530
1977	5,180	7,847	6,111	4,791	1,886	303	146	611	391	299	703	3,439	31,707
1978	14,166	11,541	3,830	1,452	454	200	113	135	18,208	340	1,651	7,105	59,195
1979	34,705	33,020	21,984	18,758	10,450	7,566	1,348	545	1,191	363	1,342	2,964	134,236
1980	5,478	8,507	11,046	11,833	20,095	1,108	222	120	107	209	372	427	59,524
1981	485	989	1,452	852	2,608	7,020	1,967	517	1,234	559	648	629	18,960
1982	2,393	3,682	3,022	20,402	5,479	924	1,021	306	203	4,012	9,261	32,090	82,795
1983	11,289	20,545	14,359	3,624	19,614	4,971	1,166	3,032	761	402	1,221	21,051	102,035
1984	9,647	16,994	14,318	2,609	9,661	1,040	302	350	305	2,501	1,749	2,396	61,872
1985	5,034	15,209	12,928	3,793	2,516	356	318	103	180	5,447	8,800	15,037	69,721
1986	2,861	8,528	2,568	3,059	8,265	21,057	4,764	2,572	1,990	1,448	19,945	15,561	92,618
1987	8,758	15,643	11,629	3,516	2,901	2,629	2,221	1,770	2,101	361	9,394	11,661	72,584
1988	9,731	4,111	10,292	5,622	1,342	526	717	0	0	0	0	1,103	33,444
1989	14,599	10,873	4,721	15,381	15,153	21,784	20,111	2,682	814	1,034	0	2,085	109,237
1990	16,049	15,363	10,002	7,906	19,168	13,477	785	1,127	297	0	574	3,123	87,871
1991	30,752	18,353	11,101	27,275	19,406	9,819	4,383	8,964	5,209	1,859	3,312	11,164	151,597
1992	19,172	34,084	25,362	11,253	4,128	3,413	1,123	1,816	1,263	356	1,244	11,743	114,957
1993	16,597	4,976	20,430	15,515	11,361	7,586	7,964	2,324	1,633	1,362	2,112	4,881	96,741
1994	6,003	17,594	13,981	7,444	6,717	3,503	950	3,592	3,004	25,107	5,380	20,311	113,586
1995	30,170	10,541	25,413	19,805	12,713	2,261	2,119	1,331	533	0	66	5,665	110,617
1996	1,980	1,919	749	2,499	1,458	1,021	0	1,707	3,566	1,232	2,150	6,784	25,065
1997	7,872	23,873	24,371	20,031	8,287	3,675	2,696	15,176	399	2,958	6,646	13,307	129,291
1998	34,453	18,205	13,017	4,108	2,190	1,776	1,254	1,173	4,191	2,730	15,493	16,181	114,771
1999	35,006	13,985	14,235	8,165	3,641	5,873	3,474	1,509	1,881	1,693	284	1,577	91,323
2000	359	1,269	3,928	6,976	9,309	3,105	439	757	100	467	6,298	11,009	44,016
2001	17,218	9,740	36,008	8,770	3,552	17,064	3,714	1,259	2,415	3,409	2,760	23,811	129,720
2002	9,382	6,252	7,748	14,785	1,453	725	643	960	858	4,834	15,756	22,791	86,187
2003	10,457	17,813	17,495	6,450	1,806	2,423	4,023	705	1,591	223	4,321	3,427	70,734
2004	9,156	28,601	19,544	6,074	17,552	10,779	6,526	1,529	1,617	3,695	29,185	16,264	150,522
2005	10,195	22,435	13,671	6,855	1,989	1,790	1,316	356	7,697	922	0	840	68,066
2006	3,062	10,953	4,953	5,521	2,594	434	2,443	1,373	240	22,971	2,797	13,224	70,565
2007	27,993	8,562	5,597	2,622	2,643	4,605	1,377	4,217	712	491	1,278	3,926	64,023
2008	1,262	13,775	8,456	9,596	2,484	1,777	873	244	0	0	1,234	2,263	41,964
2009	2,209	3,314	6,515	13,936	3,539	2,026	1,855	2,904	971	20,569	10,201	13,899	81,938
2010	5,921	12,492	9,212	3,326	1,234	1,928	558	1,058	1,917	765	1,013	567	39,991
2011	911	2,668	1,858	239	2,062	2,473	140	1,309	464	0	136	3,833	16,093
2012	9,049	12,853	24,470	8,822	1,760	1,037	4,755	749	4,112	3,850	53	1,594	73,104
2013	7,456	4,689	2,749	4,042	1,104	1,798	1	114	2,537	3,639	4,070	5,402	37,601
2014	2,900	3,503	4,763	5,189	6,541	6,204	8,042	1,618	834	881	0	2,726	43,201
2015	19,445	3,675	25,320	19,152	30,241	15,985	7,470	1,753	790	104	7,363	7,496	138,794
2016	14,863	4,095	31,295	10,908	20,811	11,110	1,423	4,329	2,270	567	609	3,700	105,980
2017	9,183	4,056	4,719	3,874	6,805	10,395	3,452	19,821	13,625	693	1,370	225	78,218
2018	3,048	22,571	18,282	15,113	809	550	2,587	0	1,978	8,789	15,257	29,091	118,075
MIN	359	619	692	239	454	108	0	0	0	0	0	201	11,353
MAX	46,428	34,084	36,008	34,466	64,732	21,784	20,111	19,821	18,208	25,107	35,943	32,090	151,597
AVG	10,634	10,439	10,643	8,530	8,309	4,600	2,140	1,665	1,904	2,416	4,601	8,013	73,896

VILLAGE CREEK NEAR KOUNTZE (VIKO)
NATURALIZED FLOW
UNITS: ACRE-FEET

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
1940	16,624	38,799	12,673	37,238	34,024	30,265	66,058	36,402	6,156	4,460	382,189	358,393	1,023,281
1941	98,761	81,767	118,255	46,892	104,065	151,629	53,862	13,026	34,074	46,197	169,988	41,905	960,421
1942	58,951	56,051	73,624	178,469	56,350	45,646	43,247	81,608	51,887	11,972	17,113	30,052	704,970
1943	84,562	27,958	40,430	35,630	49,525	21,025	48,238	38,323	15,308	10,481	13,141	36,955	421,576
1944	124,715	84,881	71,772	27,954	195,262	27,782	8,338	7,129	15,312	7,152	18,241	77,543	666,081
1945	164,294	106,876	72,376	190,766	52,144	31,879	24,717	18,148	22,145	32,267	17,500	103,524	836,636
1946	199,492	199,147	116,021	48,293	103,147	121,418	78,508	16,953	13,074	28,650	216,678	81,054	1,222,435
1947	226,190	54,582	149,194	33,080	70,428	32,378	13,402	8,943	6,873	5,435	13,854	51,128	665,487
1948	45,813	83,149	53,466	30,855	16,834	7,228	9,813	3,741	3,755	3,053	8,858	9,017	275,582
1949	50,863	87,468	157,531	143,074	31,451	27,489	15,885	9,987	11,469	254,235	23,922	191,280	1,004,654
1950	218,721	165,301	135,036	53,533	127,393	396,295	35,249	12,101	12,218	8,022	8,967	10,356	1,183,192
1951	24,020	22,197	27,161	38,345	12,919	6,742	5,195	3,396	24,512	7,368	6,577	19,726	198,158
1952	11,736	25,378	26,170	99,908	110,111	20,257	21,274	5,157	2,740	2,272	5,587	20,852	351,442
1953	45,708	79,092	61,947	47,992	425,759	19,633	30,833	13,599	11,865	5,699	9,095	36,721	787,943
1954	42,989	20,707	15,840	32,608	39,485	6,382	3,877	7,071	2,778	5,072	8,206	7,083	192,098
1955	22,987	84,499	16,220	99,526	12,153	5,351	9,895	11,428	8,192	5,274	4,202	8,521	288,248
1956	20,590	73,558	41,006	17,185	6,708	4,129	2,357	1,771	1,577	1,613	3,648	8,955	183,097
1957	6,934	13,292	49,070	55,174	114,131	37,666	13,239	5,498	22,145	39,385	123,122	68,776	548,432
1958	203,795	107,597	60,598	34,918	19,861	7,389	7,077	4,339	22,467	12,244	8,775	8,042	497,102
1959	9,783	67,299	28,212	85,143	23,554	10,090	33,787	28,630	7,405	18,021	16,186	63,895	392,005
1960	66,603	81,334	43,770	12,774	16,267	24,303	22,946	7,528	6,098	22,139	94,779	91,477	490,018
1961	295,828	142,529	92,941	36,713	17,775	64,798	120,990	23,318	125,481	14,968	48,984	75,452	1,059,777
1962	58,726	37,610	30,706	24,800	50,758	20,838	11,162	4,081	5,725	5,814	10,697	39,348	300,265
1963	42,839	40,777	27,800	14,206	5,496	7,389	11,724	4,184	35,185	4,788	15,080	44,816	254,284
1964	50,623	54,674	104,100	48,474	26,704	12,991	3,735	5,550	4,105	3,493	5,244	18,916	338,609
1965	12,157	24,554	29,083	33,258	12,889	8,690	3,618	3,179	3,757	2,736	8,370	37,709	180,000
1966	52,120	245,164	38,444	38,694	53,402	12,375	5,612	10,465	6,910	13,379	14,854	16,852	508,271
1967	23,474	23,080	20,707	43,924	12,194	8,364	4,366	2,168	2,099	1,402	2,079	7,692	151,549
1968	16,788	9,729	24,163	62,055	76,126	114,738	40,506	8,604	11,742	8,047	14,396	41,254	428,148
1969	23,078	76,088	96,710	49,498	221,060	25,995	7,129	3,614	3,531	2,828	5,585	18,060	533,176
1970	20,688	19,111	28,943	29,647	65,185	18,058	3,654	2,390	3,455	25,299	15,866	9,707	242,003
1971	15,348	9,717	18,250	6,190	17,820	4,286	1,914	7,710	5,336	12,938	11,455	150,609	261,573
1972	91,496	52,159	68,259	41,649	141,457	8,989	14,342	6,038	5,546	9,632	34,614	57,057	531,238
1973	107,024	167,615	149,082	247,190	140,947	159,068	76,909	61,226	85,394	106,746	104,705	158,711	1,564,617
1974	350,063	99,098	64,481	112,126	35,639	24,863	10,193	10,945	29,361	14,777	113,673	152,838	1,018,057
1975	179,504	125,068	100,842	81,483	139,488	126,173	67,501	97,129	21,243	39,830	46,651	44,723	1,069,635
1976	66,668	31,323	52,606	42,625	96,789	77,693	43,980	9,076	7,913	13,708	19,958	86,380	548,719
1977	71,451	55,117	69,404	82,169	35,532	29,121	8,715	10,979	11,952	6,803	14,929	52,867	449,039
1978	111,320	115,878	37,843	13,979	7,625	9,764	5,742	5,453	12,125	4,303	49,978	79,220	453,230
1979	228,298	177,481	149,455	400,625	60,948	85,097	79,475	35,411	106,739	23,750	86,166	68,198	1,501,643
1980	106,282	108,883	97,968	124,937	117,253	17,054	6,865	4,919	7,519	11,080	12,436	16,187	631,383
1981	16,836	19,398	32,507	15,464	18,246	258,745	74,705	7,490	15,180	12,930	13,860	17,940	503,301
1982	20,841	36,618	30,490	74,981	83,544	13,159	14,661	10,060	3,920	5,544	19,560	192,243	505,621
1983	96,086	133,912	76,683	38,148	270,357	35,048	24,533	59,116	72,805	15,953	28,414	107,855	958,910
1984	101,796	178,714	109,120	44,531	76,188	21,547	10,169	8,876	7,368	41,200	39,288	52,607	691,404
1985	49,125	114,077	133,500	42,500	24,001	15,219	8,625	6,491	5,595	22,103	65,756	121,285	608,277
1986	29,595	80,919	25,803	22,933	65,280	203,515	61,727	13,901	21,087	28,426	128,968	191,584	873,738
1987	108,464	80,191	105,961	21,178	72,331	125,797	75,498	15,617	11,543	5,927	30,306	108,444	761,257
1988	98,917	57,694	92,246	35,378	14,309	8,065	8,106	6,697	4,332	3,960	4,139	14,213	348,056
1989	48,614	47,182	56,335	51,211	270,873	118,672	305,096	15,559	8,104	13,167	13,648	10,709	959,170
1990	89,500	93,636	97,958	128,280	95,262	26,863	13,410	5,939	7,668	7,121	8,543	16,322	590,502
1991	176,833	143,937	96,207	157,940	127,742	79,509	50,428	61,156	63,546	12,212	59,599	117,516	1,146,625
1992	175,789	246,599	203,599	65,999	30,033	42,313	22,874	17,108	9,489	6,734	29,193	94,624	944,354
1993	137,637	45,895	123,388	99,622	41,842	62,583	19,238	7,589	7,142	9,519	36,849	33,652	624,956
1994	46,011	128,242	108,131	30,799	118,581	55,635	14,616	13,075	8,544	291,567	30,095	59,811	905,107
1995	217,517	65,583	160,554	131,499	26,284	37,426	18,807	28,044	10,623	13,733	16,142	66,598	792,810
1996	36,730	17,647	13,189	15,282	8,726	10,915	7,919	11,481	90,073	49,100	18,163	54,712	333,937
1997	58,195	155,972	172,331	100,526	58,121	75,621	14,765	17,049	8,337	18,032	21,539	156,438	856,926
1998	258,057	103,012	107,388	23,437	10,271	7,033	4,797	6,000	37,262	67,726	177,365	166,655	969,003
1999	124,220	56,877	101,760	189,147	42,684	68,165	35,712	8,858	6,226	9,173	8,366	17,936	669,124
2000	10,895	10,724	14,388	29,576	37,360	9,380	3,666	2,253	2,397	2,791	39,625	30,672	193,727
2001	73,242	32,191	121,160	25,194	9,070	112,161	25,855	5,566	40,526	68,004	32,940	251,447	797,356
2002	51,725	44,664	29,314	49,193	7,416	7,037	18,187	8,682	14,465	110,441	355,538	147,273	843,935
2003	104,140	104,600	66,387	19,560	8,711	20,490	13,566	8,565	21,358	17,196	102,250	42,480	529,303
2004	100,126	258,263	83,278	80,939	138,264	81,161	63,847	11,092	9,835	16,033	142,876	99,595	1,085,309
2005	59,508	162,967	88,362	30,922	12,383	8,409	8,581	8,281	59,215	19,303	13,174	34,987	506,092
2006	25,065	49,034	30,550	17,116	34,366	29,129	69,917	39,090	9,057	532,145	76,910	79,347	991,726
2007	223,009	106,161	53,770	72,744	36,226	42,570	79,159	43,094	16,037	11,206	18,532	25,917	728,425
2008	43,546	95,618	44,330	22,926	16,724	8,468	5,779	9,854	29,819	12,114	46,516	44,569	380,263
2009	28,117	29,551	89,455	121,785	106,892	12,067	5,413	14,924	7,904	35,553	52,473	54,833	558,967
2010	46,486	96,334	46,908	13,885	6,927	6,460	11,860	4,330	5,089	2,942	5,930	5,925	253,076
2011	11,800	11,285	7,900	4,350	4,891	1,679	1,232	824	1,056	728	4,387	24,367	74,499
2012	55,874	131,732	109,385	37,561	11,294	9,002	58,040	7,722	5,114	5,232	3,600	6,675	441,231
2013	26,967	27,802	12,576	27,128	33,351	18,995	4,400	1,951	4,259	16,993	115,382	41,520	331,324
2014	20,467	39,151	37,790	24,462	22,181	38,120	30,871	7,299	10,375	8,382	8,904	21,182	269,184
2015	104,409	19,210	164,104	75,266	191,458	140,587	18,333	5,705	4,962	16,524	132,420	83,035	956,013
2016	97,253	33,261	203,366	113,642	215,846	217,127	14,437	29,307	23,021	8,449	9,474	27,132	992,315
2017	75,026	30,887	25,344	55,438	85,997	96,805	38,576	720,265	349,355	17,160	14,444	16,656	1,52

PINE ISLAND BAYOU NEAR SOUR LAKE (PISL)
NATURALIZED FLOW
UNITS: ACRE-FEET

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
1940	8,566	19,993	6,530	19,189	17,533	15,596	34,040	18,758	3,172	2,298	196,942	184,680	527,297
1941	50,892	42,135	60,937	24,163	53,625	78,134	27,755	6,712	17,558	23,805	87,595	21,594	494,905
1942	30,377	28,883	37,938	91,965	29,037	23,521	22,285	42,053	26,737	6,169	8,818	15,486	363,269
1943	43,575	14,407	20,834	18,360	25,520	10,834	24,857	19,748	7,888	5,401	6,772	19,043	217,239
1944	64,266	43,739	36,984	14,405	100,619	14,316	4,297	3,674	7,890	3,685	9,400	39,958	343,233
1945	84,661	55,073	37,295	98,302	26,870	16,427	12,737	9,352	11,411	16,627	9,018	53,346	431,119
1946	102,798	102,620	59,786	24,885	53,152	62,567	40,455	8,736	6,737	14,763	111,654	41,767	629,920
1947	116,556	28,126	76,880	17,046	36,292	16,684	6,906	4,608	3,542	2,801	7,139	26,346	342,926
1948	23,607	42,847	27,551	15,900	8,675	3,725	5,057	1,928	1,935	1,573	4,565	4,646	142,009
1949	26,210	45,072	81,176	73,726	16,207	14,165	8,186	5,146	5,910	131,007	12,327	98,567	517,699
1950	112,707	85,180	69,584	27,586	65,646	204,211	18,164	6,236	6,296	4,134	4,621	5,336	609,701
1951	12,378	11,438	13,996	19,759	6,657	3,474	2,677	1,750	12,631	3,797	3,389	10,165	102,111
1952	6,048	13,077	13,485	51,483	56,740	10,438	10,962	2,657	1,412	1,171	2,879	10,745	181,097
1953	23,553	40,756	31,921	24,730	219,394	10,117	15,888	7,008	6,114	2,937	4,687	18,922	406,027
1954	22,152	10,670	8,162	16,803	20,347	3,289	1,998	3,644	1,432	2,614	4,229	3,650	98,990
1955	11,845	43,542	8,358	51,286	6,262	2,757	5,099	5,889	4,221	2,718	2,165	4,391	148,533
1956	10,610	37,904	21,130	8,855	3,457	2,128	1,215	913	813	831	1,880	4,615	94,351
1957	3,573	6,849	25,286	28,431	58,812	19,409	6,822	2,833	11,411	20,295	63,445	35,440	282,606
1958	105,016	55,445	31,226	17,993	10,234	3,808	3,647	2,236	11,577	6,309	4,522	4,144	256,157
1959	5,041	34,679	14,538	43,874	12,137	5,199	17,410	14,753	3,816	9,286	8,341	32,925	201,999
1960	34,321	41,911	22,555	6,582	8,382	12,523	11,824	3,879	3,142	11,408	48,840	47,138	252,505
1961	152,440	73,445	47,892	18,918	9,159	33,390	62,346	12,016	64,660	7,713	25,241	38,880	546,100
1962	30,262	19,380	15,823	12,779	26,156	10,738	5,752	2,103	2,950	2,996	5,512	20,276	154,727
1963	22,075	21,012	14,325	7,320	2,832	3,808	6,041	2,156	18,131	2,467	7,771	23,094	131,032
1964	26,086	28,174	53,643	24,979	13,761	6,694	1,925	2,860	2,115	1,800	2,702	9,747	174,486
1965	6,265	12,653	14,986	17,138	6,642	4,478	1,864	1,638	1,936	1,410	4,313	19,431	92,754
1966	26,857	126,333	19,810	19,939	27,518	6,377	2,892	5,393	3,561	6,894	7,654	8,684	261,912
1967	12,096	11,893	10,670	22,634	6,284	4,310	2,250	1,117	1,082	181	152	3,933	76,602
1968	11,901	2,152	8,368	37,518	33,908	52,471	23,842	2,150	6,077	6,704	1,005	7,109	193,205
1969	1,637	40,387	57,209	28,939	48,225	8,419	5,535	2,218	1,127	178	381	9,043	203,298
1970	2,287	3,485	15,600	9,077	26,205	19,290	3,677	2,469	4,772	39,562	31,432	786	158,642
1971	292	1,963	6,662	4,386	9,008	2,476	3,360	10,286	2,390	2,874	2,017	69,701	115,415
1972	29,857	35,205	23,748	10,210	57,162	3,309	5,780	2,073	4,646	1,260	36,599	35,681	245,530
1973	51,503	52,159	63,907	127,012	44,710	120,955	26,906	28,424	68,936	71,576	52,195	37,305	745,588
1974	135,688	23,508	11,475	27,422	12,313	9,265	4,510	4,776	8,218	4,415	90,883	68,079	400,552
1975	83,468	23,909	16,433	52,376	39,350	141,263	15,764	58,080	4,431	18,244	29,649	27,336	510,303
1976	17,334	3,090	17,893	14,033	23,205	27,562	8,426	1,843	1,297	2,198	11,889	85,367	214,137
1977	40,153	28,024	7,868	44,223	8,571	20,795	3,465	754	3,265	702	72,641	51,057	281,518
1978	66,417	48,645	5,480	3,072	1,789	14,577	5,939	1,061	2,017	233	6,545	20,908	176,683
1979	82,848	73,702	77,542	295,845	16,967	23,036	116,440	42,424	88,495	4,262	20,372	9,870	851,803
1980	79,712	47,334	42,091	48,710	83,663	2,690	2,051	891	35,762	49,718	1,845	7,617	402,084
1981	3,745	23,907	11,038	4,130	8,444	166,326	48,190	1,259	1,723	22,667	12,992	11,179	315,600
1982	15,332	29,090	18,807	40,945	58,618	3,261	4,917	4,858	1,575	1,456	19,335	127,656	325,850
1983	49,035	67,458	23,086	8,402	82,064	6,791	27,854	102,085	69,332	9,410	5,161	70,784	521,462
1984	47,316	53,018	21,937	7,561	29,076	2,249	2,059	5,827	600	57,376	19,450	13,680	260,149
1985	15,840	65,451	92,943	4,483	2,491	4,925	2,896	1,886	940	25,644	69,191	43,583	330,273
1986	1,573	17,385	8,632	1,886	15,271	110,152	49,632	6,212	15,267	30,722	124,669	132,728	514,129
1987	65,109	22,990	40,520	1,275	6,659	115,047	70,286	1,726	1,268	404	2,803	34,804	362,891
1988	31,152	14,190	35,092	6,920	1,807	2,840	2,392	3,943	2,176	320	148	827	101,807
1989	3,531	749	5,796	3,410	220,677	99,663	202,374	5,702	881	5,260	3,618	762	552,423
1990	50,696	41,502	31,226	28,871	14,527	2,315	2,370	1,615	2,210	986	1,574	3,156	181,048
1991	116,184	81,544	31,214	129,388	59,818	39,790	26,517	2,586	3,979	1,109	9,786	41,550	543,465
1992	100,604	106,435	106,401	22,292	2,646	9,933	7,668	3,312	1,977	861	3,844	36,607	402,580
1993	68,830	20,491	106,076	54,521	14,711	77,502	16,754	3,086	1,166	1,037	5,673	8,081	377,928
1994	17,256	37,299	36,250	3,527	38,822	15,975	9,013	4,300	2,975	496,794	6,222	16,056	684,489
1995	58,262	37,137	85,573	36,950	8,763	23,601	20,436	21,759	2,297	6,367	11,028	46,780	358,953
1996	16,227	3,380	906	1,346	1,498	17,855	3,999	7,577	26,168	40,431	3,822	11,794	135,003
1997	15,707	65,933	97,198	38,569	19,628	3,283	3,174	3,485	838	1,040	1,315	33,183	283,353
1998	138,051	39,189	28,157	2,045	1,400	1,494	2,580	3,052	102,072	50,049	72,558	71,635	512,282
1999	27,907	3,603	7,951	8,709	2,389	20,148	12,350	1,171	331	324	506	884	86,273
2000	368	338	437	4,708	38,868	2,395	967	276	59	14,995	52,620	17,023	133,054
2001	58,524	8,521	63,015	19,861	1,270	216,647	5,507	3,343	32,383	52,719	28,597	148,629	639,016
2002	12,443	7,171	2,173	47,988	833	3,903	7,148	17,102	28,204	128,615	189,606	117,786	562,972
2003	28,262	69,160	24,328	689	598	1,802	3,454	1,634	36,456	56,922	84,023	26,254	333,582
2004	64,667	112,128	16,392	8,635	68,729	84,506	55,115	4,323	710	467	37,634	30,946	484,252
2005	9,499	81,148	15,869	1,047	1,339	2,873	3,617	1,934	5,974	972	5,266	25,763	155,301
2006	4,913	9,923	1,559	660	16,997	47,929	85,735	57,097	879	210,417	48,032	12,521	496,662
2007	91,408	61,051	22,392	35,136	14,688	19,272	66,746	4,555	5,737	413	1,850	1,413	324,661
2008	32,676	43,837	17,146	3,569	2,594	3,003	2,332	11,324	41,066	7,695	65,482	14,419	245,143
2009	5,886	12,024	23,994	68,224	32,632	2,020	1,173	1,043	623	8,337	5,127	28,674	189,757
2010	19,146	76,859	10,098	890	1,123	1,488	7,602	2,258	2,597	343	451	582	123,437
2011	5,243	3,750	3,240	623	812	1,121	2,796	1,055	769	307	137	3,602	23,455
2012	18,652	69,525	42,904	2,893	461	1,196	47,095	1,489	1,583	1,450	148	871	188,267
2013	16,382	4,082	387	7,410	12,310	1,689	2,004	1,511	3,651	9,676	51,158	7,370	117,630
2014	418	10,360	19,001	2,773	5,092	13,906	7,126	1,671	6,995	1,681	3,958	20,631	93,612
2015	54,694	4,094	98,717	66,897	74,383	100,060	4,817	982	1,176	20,736	186,274	40,450	653,280
2016	42,754	4,132	68,312	62,980	62,954	151,666	700	6,869	1,322	271	508	28,434	430,902
2017	35,892	5,652	11,911	15,336	1,652	12,697	4,155	326,655	297,330	928	448	1,390	714,046
2018	19,436	59,988	22,426	26,741	606	6,173	5,902	642	5,301	5,626	55,145	69,406	277,392
MIN	292	338	387	623	461	1,121	700	276	59	178	137	582	23,455
MAX	152,440	126,333	106,401	295,845	220,677	216,647	202,374	326,655	297,330	496,794	196,942	184,680	851,803
AVG	39,766	36,143	31,528	29,166	2								

The page features a large, light blue rectangular area on the left side. To its right, there is a dark gray rectangular area at the top and a black rectangular area at the bottom. The title 'APPENDIX B – Updated Net Evaporation Dataset' is positioned to the right of the blue area, between the gray and black areas.

APPENDIX B – Updated Net Evaporation Dataset

LAKE ATHENS
NET EVAPORATION DEPTHS
UNITS: FEET

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
1940	0.07	0.00	0.22	-0.01	0.20	0.20	0.52	0.54	0.54	0.35	-0.43	-0.03	2.17
1941	0.18	0.05	0.14	0.12	0.29	0.00	0.52	0.55	0.37	0.07	0.12	0.00	2.41
1942	0.16	0.27	0.27	-0.20	0.29	0.30	0.68	0.38	0.28	0.26	0.14	-0.13	2.70
1943	0.19	0.38	0.08	0.32	0.02	0.48	0.63	0.87	0.34	0.22	0.21	-0.10	3.64
1944	-0.07	0.01	0.21	0.09	0.03	0.61	0.72	0.54	0.55	0.53	-0.24	-0.17	2.81
1945	0.16	-0.02	-0.30	0.58	0.38	0.11	0.26	0.44	0.50	0.12	0.17	0.10	2.50
1946	-0.07	0.16	0.15	0.20	-0.07	0.61	0.74	0.48	0.52	0.42	-0.26	0.20	3.08
1947	0.07	0.32	0.15	0.19	0.14	0.47	0.82	0.66	0.55	0.48	-0.02	-0.15	3.68
1948	-0.02	0.05	0.17	0.32	0.22	0.60	0.72	0.91	0.75	0.50	0.07	0.09	4.38
1949	-0.40	0.01	0.11	0.10	0.29	0.42	0.47	0.56	0.51	-0.26	0.35	-0.01	2.15
1950	-0.07	0.11	0.32	0.05	0.10	0.54	0.38	0.67	0.24	0.44	0.29	0.25	3.32
1951	0.06	-0.02	0.28	0.34	0.32	0.32	0.77	1.07	0.17	0.35	0.10	0.12	3.88
1952	0.08	0.13	0.09	-0.04	0.14	0.62	0.62	1.10	0.90	0.79	-0.24	-0.17	4.02
1953	0.16	0.13	0.04	-0.03	0.13	0.73	0.34	0.54	0.46	0.40	0.08	-0.10	2.88
1954	-0.04	0.36	0.40	0.24	0.16	0.85	1.03	1.16	0.85	-0.03	0.21	0.17	5.36
1955	0.05	0.02	0.27	0.26	0.29	0.56	0.76	0.46	0.64	0.68	0.53	0.21	4.73
1956	0.02	-0.07	0.41	0.32	0.39	0.73	1.17	1.11	1.01	0.56	0.08	0.16	5.89
1957	-0.04	-0.05	-0.08	-0.50	0.14	0.47	0.88	0.73	0.30	-0.17	-0.13	0.17	1.72
1958	0.06	0.15	0.08	-0.19	0.56	0.43	0.78	0.68	0.04	0.26	0.14	0.12	3.11
1959	0.13	-0.08	0.39	0.09	0.23	0.28	0.38	0.66	0.52	0.12	0.21	-0.14	2.79
1960	0.00	0.05	0.26	0.36	0.45	0.33	0.72	0.50	0.46	0.18	0.14	-0.22	3.23
1961	0.03	0.09	0.18	0.48	0.41	-0.03	0.49	0.70	0.48	0.43	-0.05	-0.07	3.14
1962	-0.04	0.13	0.30	0.06	0.56	0.11	0.64	0.95	0.23	0.26	0.01	0.08	3.29
1963	0.10	0.17	0.33	0.11	0.38	0.50	0.77	0.96	0.65	0.74	0.16	0.01	4.88
1964	0.05	0.05	0.08	0.08	0.29	0.62	1.02	0.73	0.34	0.53	0.06	0.17	4.02
1965	-0.02	-0.15	0.08	0.34	-0.24	0.47	0.95	0.86	0.41	0.40	0.11	-0.05	3.16
1966	-0.09	-0.11	0.28	-0.10	0.29	0.63	0.75	0.27	0.26	0.42	0.39	0.04	3.03
1967	0.23	0.15	0.36	0.10	0.09	0.75	0.61	0.94	0.12	0.17	0.23	-0.05	3.70
1968	-0.14	0.09	0.16	0.16	0.34	0.20	0.62	0.86	0.28	0.45	-0.07	0.10	3.05
1969	0.15	0.01	0.06	0.11	0.15	0.68	0.95	0.75	0.53	0.15	0.08	-0.10	3.52
1970	0.14	-0.09	0.14	0.08	0.29	0.57	0.76	0.81	0.17	0.10	0.34	0.21	3.52
1971	0.28	0.14	0.44	0.37	0.29	0.71	0.51	0.46	0.48	0.09	0.17	-0.05	3.89
1972	0.01	0.30	0.39	0.36	0.43	0.45	0.65	0.81	0.46	0.06	0.05	0.04	4.01
1973	-0.06	0.12	0.11	-0.03	0.41	0.35	0.56	0.84	0.01	-0.15	0.21	0.18	2.55
1974	-0.09	0.28	0.38	0.31	0.33	0.48	0.91	0.33	-0.11	0.15	-0.03	0.11	3.05
1975	0.17	0.02	0.14	0.12	0.13	0.36	0.64	0.69	0.58	0.49	0.30	0.08	3.72
1976	0.20	0.23	0.04	-0.10	0.03	0.42	0.39	0.77	0.31	0.13	0.23	0.10	2.75
1977	0.02	0.25	0.17	0.25	0.44	0.46	0.86	0.57	0.54	0.48	0.04	0.25	4.33
1978	-0.13	-0.02	0.24	0.37	0.25	0.59	0.87	0.80	0.42	0.59	-0.11	0.04	3.91
1979	-0.15	-0.08	0.00	0.21	-0.06	0.53	0.33	0.52	0.25	0.46	0.19	-0.04	2.16
1980	0.01	0.20	0.18	0.23	0.14	0.63	0.99	1.03	0.55	0.47	0.13	0.12	4.68
1981	0.13	0.08	0.13	0.28	-0.04	0.23	0.61	0.77	0.48	-0.14	0.22	0.27	3.02
1982	0.07	0.08	0.17	0.07	0.07	0.19	0.66	0.80	0.74	0.26	-0.09	-0.06	2.96
1983	0.18	-0.04	0.11	0.43	0.03	0.29	0.69	0.50	0.63	0.40	0.12	0.00	3.34
1984	0.04	0.14	0.22	0.45	0.41	0.52	0.80	0.81	0.69	-0.26	0.12	0.03	3.97
1985	0.07	-0.01	0.14	0.23	0.36	0.55	0.59	1.03	0.61	-0.16	-0.16	0.08	3.33
1986	0.28	0.09	0.41	0.27	0.26	0.26	0.86	0.73	0.36	0.05	-0.10	0.00	3.47
1987	0.17	-0.06	0.36	0.50	0.07	0.25	0.61	0.87	0.42	0.50	-0.08	-0.06	3.55
1988	0.31	0.15	0.18	0.36	0.53	0.58	0.64	0.89	0.62	0.30	0.05	-0.03	4.58
1989	-0.07	-0.01	0.05	0.34	0.23	0.06	0.46	0.72	0.59	0.46	0.34	0.25	3.42
1990	-0.25	0.08	0.01	0.35	0.17	0.63	0.65	0.80	0.40	0.29	0.10	0.07	3.30
1991	-0.02	0.11	0.36	0.05	0.34	0.41	0.80	0.55	0.48	0.32	0.25	-0.06	3.59
1992	0.04	0.06	0.30	0.31	0.12	0.33	0.74	0.67	0.53	0.40	0.11	0.06	3.67
1993	0.25	0.11	0.14	0.18	0.38	0.20	1.15	1.21	0.77	0.25	0.22	0.26	5.12
1994	0.15	0.06	0.27	0.31	0.02	0.50	0.72	0.58	0.56	-0.23	0.24	-0.04	3.14
1995	0.31	0.13	0.12	0.17	0.23	0.48	0.62	0.66	0.43	0.65	0.37	0.11	4.28
1996	0.23	0.40	0.34	0.32	0.58	0.50	0.67	0.34	0.39	0.39	-0.01	0.10	4.25
1997	0.09	-0.10	0.34	0.13	0.38	0.32	0.84	0.63	0.71	0.21	0.11	0.00	3.66
1998	-0.04	0.05	0.27	0.43	0.58	0.82	1.10	0.74	0.32	-0.10	-0.13	0.05	4.09
1999	0.09	0.43	0.26	0.36	0.27	0.49	0.77	1.15	0.83	0.57	0.41	0.22	5.85
2000	0.14	0.13	0.04	0.12	-0.07	0.10	0.77	0.89	0.64	0.28	-0.32	0.00	2.72
2001	0.19	0.05	0.23	0.42	0.26	0.23	0.93	0.70	0.25	0.35	0.15	0.08	3.84
2002	0.18	0.17	0.24	0.43	0.32	0.41	0.53	0.79	0.63	-0.02	0.21	-0.23	3.66
2003	0.28	-0.21	0.28	0.38	0.32	0.17	0.72	0.80	0.38	0.34	0.22	0.18	3.86
2004	0.05	-0.11	0.24	0.07	0.35	-0.02	0.63	0.55	0.70	0.06	-0.28	0.19	2.43
2005	0.00	0.00	0.24	0.37	0.33	0.70	0.63	0.74	0.79	0.64	0.43	0.30	5.17
2006	0.11	-0.01	0.09	0.29	0.44	0.61	0.79	1.07	0.72	0.26	0.18	-0.12	4.43
2007	-0.10	0.25	-0.06	0.25	-0.18	0.19	0.28	0.67	0.49	0.45	0.26	0.09	2.59
2008	0.16	0.22	0.41	0.26	0.27	0.59	0.97	0.34	0.36	0.45	0.18	0.21	4.42
2009	0.20	0.28	0.08	0.24	0.76	0.70	0.55	0.85	0.09	-0.06	0.37	0.15	4.21
2010	0.06	0.15	0.27	0.41	0.54	0.38	0.52	1.01	0.48	0.57	0.21	0.27	4.87
2011	-0.04	0.11	0.42	0.40	0.39	0.81	1.12	1.32	1.05	0.61	0.25	-0.22	6.22
2012	0.01	0.08	0.07	0.35	0.41	0.45	0.74	0.80	0.42	0.44	0.39	0.12	4.28
2013	-0.11	0.12	0.27	0.23	0.23	0.60	0.59	0.99	0.49	-0.07	0.06	0.07	3.47
2014	0.28	0.15	0.21	0.30	0.15	0.26	0.62	0.82	0.61	0.30	0.11	0.11	3.92
2015	-0.07	0.03	0.00	-0.09	-0.24	0.45	0.96	0.82	0.83	-0.11	-0.15	0.54	2.97
2016	0.34	0.29	0.41	-0.01	0.39	0.43	0.94	0.43	0.66	0.57	0.20	0.12	4.77
2017	-0.01	0.15	0.24	0.09	0.21	0.35	0.66	0.28	0.82	0.51	0.22	-0.03	3.49
2018	0.15	-0.19	0.24	0.31	0.45	0.69	0.74	0.80	0.00	-0.28	0.08	-0.04	2.95
MIN	-0.40	-0.21	-0.30	-0.50	-0.24	-0.03	0.26	0.27	-0.11	-0.28	-0.43	-0.23	1.72
MAX	0.34	0.43	0.44	0.58	0.76	0.85	1.17	1.32	1.05	0.79	0.53	0.54	6.22
AVG	0.07	0.09	0.20	0.21	0.25	0.44	0.71	0.74	0.49	0.28	0.11	0.06	3.64

LAKE PALESTINE
NET EVAPORATION DEPTHS
UNITS: FEET

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
1940	0.06	-0.03	0.18	-0.03	0.18	0.14	0.49	0.44	0.46	0.29	-0.49	-0.08	1.61
1941	0.15	0.05	0.11	0.10	0.27	-0.06	0.47	0.52	0.26	0.02	0.06	-0.02	1.93
1942	0.14	0.24	0.22	-0.18	0.27	0.24	0.63	0.30	0.27	0.28	0.14	-0.19	2.36
1943	0.15	0.36	0.06	0.29	-0.05	0.45	0.55	0.80	0.29	0.17	0.16	-0.14	3.09
1944	-0.12	-0.04	0.16	0.01	-0.01	0.54	0.67	0.44	0.48	0.51	-0.29	-0.22	2.13
1945	0.13	-0.04	-0.38	0.57	0.32	0.07	0.19	0.45	0.41	0.04	0.13	0.08	1.97
1946	-0.16	0.12	0.10	0.15	-0.13	0.53	0.68	0.42	0.46	0.37	-0.39	0.16	2.31
1947	0.05	0.27	0.10	0.17	0.05	0.42	0.74	0.62	0.50	0.44	-0.10	-0.20	3.06
1948	-0.04	0.01	0.14	0.29	0.19	0.55	0.72	0.85	0.72	0.45	-0.01	0.03	3.90
1949	-0.45	0.00	0.08	0.06	0.30	0.40	0.37	0.51	0.42	-0.39	0.31	-0.05	1.56
1950	-0.13	0.07	0.28	0.01	0.02	0.52	0.34	0.63	0.17	0.39	0.25	0.23	2.78
1951	0.00	-0.09	0.19	0.30	0.25	0.29	0.63	0.93	0.02	0.31	0.02	0.04	2.89
1952	0.03	0.08	0.04	-0.10	0.10	0.55	0.55	1.04	0.84	0.74	-0.26	-0.19	3.42
1953	0.13	0.10	-0.01	-0.07	0.02	0.67	0.25	0.47	0.41	0.39	0.04	-0.14	2.26
1954	-0.05	0.34	0.38	0.22	0.11	0.82	0.96	1.10	0.82	-0.15	0.18	0.13	4.86
1955	0.03	0.00	0.25	0.23	0.30	0.59	0.71	0.40	0.64	0.68	0.51	0.19	4.53
1956	0.01	-0.10	0.35	0.29	0.34	0.69	1.09	1.00	0.95	0.54	0.06	0.15	5.37
1957	-0.06	-0.08	-0.10	-0.50	0.23	0.38	0.81	0.60	0.25	-0.24	-0.16	0.14	1.27
1958	0.02	0.14	0.07	-0.23	0.55	0.36	0.72	0.64	-0.06	0.24	0.09	0.11	2.65
1959	0.12	-0.10	0.35	0.04	0.19	0.31	0.31	0.58	0.48	0.17	0.18	-0.18	2.45
1960	-0.02	0.00	0.24	0.35	0.46	0.28	0.70	0.46	0.33	0.17	0.08	-0.25	2.80
1961	0.02	0.06	0.12	0.47	0.41	-0.10	0.42	0.64	0.44	0.44	-0.08	-0.13	2.71
1962	-0.07	0.11	0.27	0.05	0.53	0.08	0.63	0.91	0.20	0.27	-0.03	0.07	3.02
1963	0.09	0.15	0.30	0.09	0.39	0.45	0.71	0.92	0.63	0.71	0.13	-0.01	4.56
1964	0.07	0.03	0.07	0.05	0.29	0.59	0.97	0.67	0.37	0.53	0.08	0.15	3.87
1965	-0.03	-0.17	0.06	0.33	-0.24	0.43	0.92	0.83	0.38	0.38	0.13	-0.08	2.94
1966	-0.11	-0.12	0.27	-0.13	0.27	0.64	0.71	0.23	0.23	0.37	0.34	0.00	2.70
1967	0.20	0.13	0.33	0.05	0.05	0.74	0.57	0.91	0.15	0.21	0.25	-0.07	3.52
1968	-0.16	0.08	0.17	0.10	0.30	0.17	0.59	0.85	0.21	0.42	-0.12	0.07	2.68
1969	0.11	-0.03	0.01	0.06	0.18	0.66	0.87	0.73	0.53	0.12	0.01	-0.12	3.13
1970	0.13	-0.09	0.15	0.06	0.29	0.52	0.68	0.72	0.20	0.06	0.29	0.18	3.19
1971	0.25	0.12	0.40	0.35	0.23	0.67	0.50	0.45	0.46	0.14	0.12	-0.06	3.63
1972	-0.03	0.29	0.35	0.34	0.44	0.39	0.58	0.78	0.41	0.03	0.02	0.00	3.60
1973	-0.06	0.12	0.05	-0.04	0.41	0.34	0.57	0.80	-0.07	-0.15	0.17	0.13	2.27
1974	-0.14	0.26	0.35	0.28	0.31	0.43	0.85	0.29	-0.16	0.18	-0.07	0.10	2.68
1975	0.16	0.00	0.11	0.12	0.17	0.30	0.64	0.64	0.53	0.43	0.25	0.08	3.43
1976	0.15	0.20	0.00	-0.03	0.04	0.36	0.36	0.71	0.31	0.15	0.22	0.08	2.55
1977	0.02	0.24	0.16	0.24	0.45	0.40	0.77	0.52	0.46	0.44	0.00	0.20	3.90
1978	-0.18	-0.01	0.22	0.35	0.26	0.54	0.79	0.75	0.38	0.55	-0.14	0.01	3.52
1979	-0.21	-0.11	0.01	0.16	0.00	0.49	0.26	0.52	0.15	0.41	0.14	-0.06	1.76
1980	-0.03	0.19	0.14	0.22	0.13	0.57	0.91	0.95	0.50	0.41	0.08	0.14	4.21
1981	0.12	0.08	0.14	0.27	-0.05	0.31	0.57	0.75	0.47	-0.12	0.19	0.26	2.99
1982	0.05	0.05	0.16	0.03	0.09	0.14	0.61	0.75	0.68	0.22	-0.11	-0.11	2.56
1983	0.17	-0.04	0.08	0.40	0.02	0.23	0.67	0.48	0.60	0.38	0.09	-0.05	3.03
1984	0.01	0.09	0.20	0.44	0.37	0.49	0.74	0.73	0.62	-0.27	0.10	0.07	3.59
1985	0.05	-0.02	0.13	0.23	0.35	0.54	0.52	0.97	0.56	-0.18	-0.22	0.08	3.01
1986	0.25	0.12	0.40	0.23	0.28	0.25	0.84	0.71	0.32	0.06	-0.12	-0.02	3.32
1987	0.16	-0.09	0.34	0.49	0.11	0.23	0.55	0.79	0.36	0.45	-0.10	-0.13	3.16
1988	0.29	0.14	0.15	0.33	0.55	0.60	0.60	0.82	0.61	0.23	-0.01	-0.06	4.25
1989	-0.12	-0.02	-0.01	0.32	0.24	0.03	0.44	0.74	0.56	0.41	0.31	0.21	3.11
1990	-0.30	0.10	0.01	0.37	0.15	0.55	0.57	0.78	0.36	0.22	0.08	0.03	2.92
1991	-0.05	0.09	0.34	-0.02	0.31	0.38	0.77	0.55	0.48	0.38	0.21	-0.02	3.42
1992	0.05	0.07	0.31	0.31	0.19	0.36	0.69	0.65	0.53	0.36	0.12	0.04	3.68
1993	0.21	0.13	0.12	0.18	0.38	0.11	1.15	1.18	0.77	0.30	0.21	0.26	5.00
1994	0.12	0.05	0.26	0.33	0.00	0.51	0.65	0.51	0.56	-0.31	0.26	-0.07	2.87
1995	0.31	0.13	0.15	0.17	0.26	0.48	0.61	0.65	0.40	0.61	0.36	0.07	4.20
1996	0.21	0.38	0.33	0.30	0.55	0.47	0.61	0.34	0.38	0.36	0.01	0.08	4.02
1997	0.05	-0.13	0.34	0.16	0.37	0.31	0.80	0.58	0.63	0.20	0.09	0.04	3.44
1998	-0.05	0.04	0.26	0.41	0.56	0.78	1.06	0.71	0.32	-0.10	-0.14	0.07	3.92
1999	0.07	0.43	0.29	0.37	0.30	0.45	0.73	1.09	0.81	0.55	0.38	0.21	5.68
2000	0.10	0.11	-0.01	0.07	-0.15	0.14	0.68	0.79	0.59	0.27	-0.37	-0.08	2.14
2001	0.16	0.02	0.21	0.41	0.24	0.06	0.88	0.66	0.17	0.32	0.14	0.07	3.34
2002	0.15	0.15	0.22	0.42	0.32	0.35	0.52	0.75	0.59	0.02	0.17	-0.23	3.43
2003	0.27	-0.27	0.27	0.37	0.32	0.14	0.65	0.77	0.40	0.34	0.18	0.13	3.57
2004	0.03	-0.15	0.21	0.08	0.35	0.03	0.64	0.54	0.68	0.03	-0.31	0.16	2.29
2005	0.01	-0.03	0.24	0.36	0.35	0.70	0.60	0.77	0.76	0.62	0.40	0.28	5.06
2006	0.05	-0.04	0.07	0.27	0.44	0.57	0.73	1.06	0.73	0.20	0.14	-0.16	4.06
2007	-0.16	0.23	0.05	0.23	-0.13	0.25	0.18	0.63	0.53	0.44	0.24	0.06	2.55
2008	0.14	0.21	0.41	0.28	0.25	0.52	0.96	0.27	0.27	0.39	0.12	0.18	4.00
2009	0.17	0.27	0.06	0.26	0.74	0.70	0.49	0.78	0.08	-0.09	0.36	0.10	3.92
2010	0.08	0.10	0.26	0.43	0.55	0.31	0.49	0.98	0.55	0.53	0.18	0.24	4.70
2011	-0.08	0.11	0.41	0.38	0.40	0.84	1.11	1.28	1.03	0.62	0.19	-0.24	6.05
2012	0.02	0.06	0.04	0.34	0.41	0.39	0.71	0.76	0.34	0.41	0.35	0.08	3.91
2013	-0.13	0.08	0.25	0.22	0.22	0.56	0.53	0.96	0.47	-0.03	0.03	0.04	3.20
2014	0.27	0.10	0.16	0.27	0.14	0.25	0.55	0.76	0.56	0.26	0.05	0.09	3.46
2015	-0.12	-0.01	-0.07	-0.16	-0.20	0.44	0.94	0.76	0.79	-0.09	-0.20	0.45	2.53
2016	0.32	0.29	0.37	-0.04	0.39	0.43	0.92	0.41	0.67	0.57	0.21	0.07	4.61
2017	-0.05	0.14	0.23	0.12	0.15	0.38	0.64	0.18	0.80	0.49	0.23	-0.07	3.24
2018	0.14	-0.22	0.22	0.29	0.47	0.71	0.72	0.82	0.02	-0.23	0.04	-0.07	2.91
MIN	-0.45	-0.27	-0.38	-0.50	-0.24	-0.10	0.18	0.18	-0.16	-0.39	-0.49	-0.25	1.27
MAX	0.32	0.43	0.41	0.57	0.74	0.84	1.15	1.28	1.03	0.74	0.51	0.45	6.05
AVG	0.04	0.07	0.18	0.19	0.24	0.41	0.66	0.69	0.45	0.26	0.08	0.03	3.29

LAKE JACKSONVILLE
NET EVAPORATION DEPTHS
UNITS: FEET

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
1940	0.03	-0.11	0.17	-0.11	0.14	0.07	0.43	0.36	0.45	0.31	-0.40	-0.08	1.26
1941	0.09	0.05	0.10	0.11	0.10	-0.12	0.34	0.49	0.19	-0.13	0.09	0.04	1.35
1942	0.15	0.22	0.19	-0.10	0.17	0.18	0.55	0.21	0.26	0.31	0.16	-0.12	2.18
1943	0.07	0.32	0.06	0.27	0.01	0.40	0.47	0.74	0.29	0.22	0.10	-0.17	2.78
1944	-0.19	0.00	0.06	-0.03	-0.01	0.48	0.64	0.37	0.41	0.49	-0.30	-0.18	1.74
1945	0.14	-0.04	-0.16	0.20	0.26	0.17	0.36	0.42	0.39	0.13	0.15	0.09	2.11
1946	-0.16	0.09	0.06	0.12	-0.07	0.44	0.57	0.41	0.39	0.33	-0.34	0.11	1.95
1947	-0.02	0.26	0.08	0.21	0.10	0.43	0.69	0.64	0.53	0.45	-0.10	-0.13	3.14
1948	-0.03	-0.01	0.12	0.26	0.17	0.52	0.67	0.75	0.64	0.42	-0.10	-0.01	3.40
1949	-0.43	0.00	0.01	0.06	0.27	0.31	0.29	0.43	0.35	-0.42	0.29	-0.13	1.03
1950	-0.17	0.04	0.22	0.03	-0.04	0.38	0.32	0.56	0.08	0.35	0.22	0.16	2.15
1951	-0.04	-0.08	0.11	0.28	0.31	0.27	0.59	0.86	-0.01	0.34	0.02	-0.05	2.60
1952	-0.01	0.02	0.02	-0.06	0.08	0.53	0.46	0.90	0.75	0.70	-0.23	-0.12	3.04
1953	0.06	0.02	-0.08	-0.15	-0.07	0.56	0.20	0.46	0.42	0.39	0.05	-0.13	1.73
1954	-0.06	0.31	0.33	0.20	0.06	0.76	0.85	0.91	0.77	-0.03	0.16	0.12	4.38
1955	-0.03	-0.06	0.26	0.16	0.22	0.54	0.54	0.29	0.54	0.59	0.40	0.15	3.60
1956	-0.02	-0.12	0.22	0.16	0.29	0.51	0.87	0.80	0.78	0.44	0.05	0.10	4.08
1957	-0.11	-0.10	-0.12	-0.44	0.34	0.23	0.64	0.51	0.19	-0.32	-0.27	0.11	0.66
1958	-0.06	0.08	0.08	-0.14	0.47	0.22	0.59	0.41	-0.31	0.24	0.05	0.09	1.72
1959	0.10	-0.12	0.30	-0.03	0.26	0.33	0.23	0.50	0.42	0.15	0.10	-0.17	2.07
1960	-0.02	-0.05	0.21	0.27	0.48	0.23	0.71	0.31	0.28	0.12	-0.03	-0.24	2.27
1961	-0.01	0.05	0.05	0.43	0.39	-0.13	0.29	0.57	0.30	0.39	-0.08	-0.21	2.04
1962	-0.12	0.13	0.27	0.04	0.45	0.10	0.67	0.87	0.21	0.27	-0.04	0.00	2.85
1963	0.06	0.10	0.30	0.14	0.41	0.40	0.60	0.83	0.52	0.65	0.07	-0.05	4.03
1964	0.01	0.02	0.03	-0.03	0.27	0.57	0.83	0.55	0.35	0.50	0.09	0.04	3.23
1965	-0.05	-0.18	0.00	0.34	-0.19	0.38	0.84	0.71	0.33	0.40	0.12	-0.22	2.48
1966	-0.17	-0.13	0.27	0.00	0.29	0.64	0.68	0.24	0.30	0.30	0.30	-0.04	2.68
1967	0.17	0.09	0.31	0.06	0.00	0.63	0.50	0.80	0.27	0.35	0.27	-0.10	3.35
1968	-0.22	0.08	0.19	-0.01	0.40	0.09	0.49	0.74	0.12	0.38	-0.13	-0.01	2.12
1969	0.10	-0.05	-0.03	0.01	0.18	0.61	0.75	0.72	0.51	0.15	-0.01	-0.10	2.84
1970	0.11	-0.05	0.15	0.06	0.25	0.47	0.53	0.56	0.21	0.04	0.25	0.13	2.71
1971	0.23	0.10	0.36	0.33	0.17	0.57	0.51	0.39	0.41	0.20	0.14	0.02	3.43
1972	-0.04	0.27	0.25	0.26	0.40	0.35	0.45	0.68	0.34	0.01	0.01	-0.04	2.94
1973	-0.12	0.11	0.02	-0.01	0.38	0.31	0.46	0.67	-0.07	-0.10	0.15	0.03	1.83
1974	-0.28	0.22	0.33	0.28	0.30	0.39	0.70	0.26	-0.17	0.17	-0.07	0.07	2.20
1975	0.10	-0.08	0.10	0.11	0.13	0.25	0.54	0.61	0.50	0.31	0.18	0.06	2.81
1976	0.11	0.17	-0.06	0.08	0.05	0.33	0.32	0.66	0.34	0.18	0.16	0.03	2.37
1977	-0.01	0.27	0.15	0.28	0.42	0.40	0.68	0.42	0.39	0.43	0.01	0.15	3.59
1978	-0.25	0.01	0.24	0.32	0.27	0.51	0.75	0.71	0.28	0.49	-0.17	-0.05	3.11
1979	-0.34	-0.19	-0.05	0.08	0.01	0.43	0.20	0.50	0.12	0.36	0.05	-0.06	1.11
1980	-0.02	0.17	0.05	0.17	0.02	0.55	0.85	0.89	0.49	0.38	0.06	0.15	3.76
1981	0.09	0.03	0.12	0.25	-0.03	0.28	0.47	0.66	0.35	-0.08	0.15	0.22	2.51
1982	0.01	0.04	0.12	-0.10	0.08	0.12	0.57	0.70	0.60	0.13	-0.14	-0.17	1.96
1983	0.13	-0.10	0.06	0.36	-0.06	0.21	0.61	0.39	0.51	0.37	0.03	-0.16	2.35
1984	0.00	0.03	0.21	0.41	0.31	0.44	0.64	0.63	0.51	-0.46	0.04	0.04	2.80
1985	-0.01	0.01	0.11	0.24	0.33	0.55	0.45	0.89	0.49	-0.28	-0.25	0.11	2.64
1986	0.23	0.16	0.38	0.28	0.25	0.11	0.78	0.62	0.25	0.00	-0.24	-0.06	2.76
1987	0.15	-0.16	0.37	0.45	0.10	0.21	0.47	0.70	0.30	0.42	-0.22	-0.13	2.66
1988	0.27	0.13	0.13	0.31	0.54	0.57	0.52	0.65	0.59	0.21	0.03	-0.10	3.85
1989	-0.26	-0.02	-0.13	0.32	0.30	-0.20	0.35	0.64	0.47	0.36	0.25	0.13	2.21
1990	-0.29	0.03	0.08	0.40	0.14	0.50	0.50	0.72	0.34	0.17	0.05	0.01	2.65
1991	-0.20	0.02	0.29	-0.23	0.17	0.30	0.64	0.47	0.41	0.41	0.15	-0.04	2.39
1992	-0.01	-0.01	0.23	0.26	0.15	0.38	0.71	0.60	0.48	0.32	0.05	-0.05	3.11
1993	0.21	0.14	0.03	0.14	0.25	-0.08	1.04	0.99	0.75	0.31	0.13	0.19	4.10
1994	0.06	-0.01	0.25	0.25	-0.03	0.42	0.66	0.42	0.48	-0.43	0.35	-0.07	2.35
1995	0.31	0.13	0.08	0.09	0.30	0.45	0.50	0.53	0.29	0.51	0.28	-0.06	3.41
1996	0.18	0.33	0.28	0.26	0.54	0.36	0.51	0.27	0.24	0.32	0.02	0.04	3.35
1997	0.03	-0.12	0.25	0.13	0.28	0.27	0.71	0.55	0.54	0.12	0.04	0.01	2.81
1998	-0.08	-0.04	0.25	0.36	0.53	0.74	0.98	0.57	0.20	-0.07	-0.18	0.01	3.27
1999	-0.13	0.37	0.17	0.32	0.28	0.36	0.63	1.02	0.71	0.45	0.37	0.17	4.72
2000	0.11	0.14	-0.08	0.05	-0.12	0.18	0.71	0.79	0.55	0.29	-0.54	-0.08	2.00
2001	0.06	0.08	0.19	0.41	0.26	-0.16	0.75	0.55	0.08	0.23	0.09	0.04	2.58
2002	0.13	0.15	0.21	0.39	0.37	0.37	0.46	0.70	0.55	-0.05	0.03	-0.32	2.99
2003	0.25	-0.29	0.24	0.33	0.36	0.15	0.54	0.66	0.36	0.32	0.10	0.15	3.17
2004	-0.06	-0.20	0.14	0.08	0.28	-0.08	0.61	0.49	0.59	-0.03	-0.49	0.08	1.41
2005	-0.01	-0.12	0.20	0.30	0.34	0.63	0.51	0.59	0.53	0.56	0.32	0.25	4.10
2006	0.04	-0.08	0.07	0.26	0.42	0.47	0.55	0.87	0.60	0.00	0.16	-0.19	3.17
2007	-0.20	0.17	0.09	0.20	-0.06	0.30	0.12	0.60	0.63	0.39	0.22	0.04	2.50
2008	0.12	0.08	0.40	0.31	0.24	0.53	0.86	0.20	0.28	0.36	0.09	0.13	3.60
2009	0.19	0.24	0.07	0.22	0.81	0.70	0.48	0.72	0.18	-0.12	0.37	0.05	3.91
2010	0.11	0.14	0.31	0.43	0.54	0.40	0.42	0.93	0.57	0.58	0.17	0.28	4.88
2011	-0.10	0.12	0.40	0.39	0.38	0.80	0.98	1.19	0.83	0.58	0.15	-0.24	5.48
2012	0.04	0.02	0.01	0.27	0.40	0.38	0.52	0.75	0.17	0.39	0.31	0.00	3.26
2013	-0.18	0.02	0.24	0.19	0.21	0.47	0.56	0.84	0.46	-0.03	0.09	0.06	2.93
2014	0.28	0.10	0.09	0.20	0.05	0.19	0.49	0.67	0.48	0.21	0.00	0.05	2.81
2015	-0.18	0.00	-0.08	-0.15	-0.10	0.40	0.85	0.69	0.71	0.06	-0.30	-0.20	1.70
2016	0.16	0.19	0.02	-0.06	0.18	0.38	0.78	0.22	0.62	0.54	0.16	0.01	3.20
2017	-0.06	0.15	0.17	0.04	0.04	0.31	0.58	-0.03	0.73	0.47	0.21	-0.12	2.49
2018	0.07	-0.36	0.04	0.23	0.43	0.65	0.61	0.72	-0.04	-0.09	0.16	0.02	2.44
MIN	-0.43	-0.36	-0.16	-0.44	-0.19	-0.20	0.12	-0.03	-0.31	-0.46	-0.54	-0.32	0.66
MAX	0.31	0.37	0.40	0.45	0.81	0.80	1.04	1.19	0.83	0.70	0.40	0.28	5.48
AVG	0.00	0.04	0.14	0.16	0.22	0.36	0.58	0.61	0.39	0.23	0.05	-0.01	2.78

LAKES TYLER AND TYLER EAST
NET EVAPORATION DEPTHS
UNITS: FEET

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
1940	0.04	-0.09	0.14	-0.08	0.15	0.09	0.43	0.37	0.47	0.29	-0.32	-0.06	1.43
1941	0.11	0.06	0.09	0.09	0.13	-0.19	0.36	0.48	0.20	-0.06	0.08	0.03	1.38
1942	0.15	0.23	0.17	-0.14	0.21	0.18	0.58	0.18	0.26	0.30	0.16	-0.14	2.14
1943	0.08	0.33	0.07	0.26	-0.02	0.39	0.51	0.75	0.29	0.16	0.12	-0.16	2.78
1944	-0.17	-0.01	0.06	-0.02	0.00	0.50	0.65	0.35	0.42	0.49	-0.29	-0.21	1.77
1945	0.16	-0.03	-0.25	0.24	0.28	0.14	0.35	0.44	0.39	0.13	0.14	0.10	2.09
1946	-0.17	0.11	0.07	0.10	-0.11	0.43	0.60	0.38	0.37	0.32	-0.32	0.12	1.90
1947	-0.01	0.25	0.09	0.19	0.17	0.45	0.70	0.62	0.49	0.42	-0.10	-0.14	3.13
1948	-0.04	0.01	0.13	0.27	0.15	0.53	0.67	0.76	0.65	0.41	-0.10	0.02	3.46
1949	-0.35	0.01	-0.01	0.04	0.31	0.34	0.29	0.46	0.39	-0.29	0.31	-0.08	1.42
1950	-0.07	0.10	0.24	0.03	0.16	0.40	0.36	0.59	0.08	0.35	0.22	0.19	2.65
1951	-0.01	0.05	0.13	0.28	0.32	0.28	0.57	0.86	0.00	0.35	0.03	-0.04	2.82
1952	0.00	0.03	0.03	0.04	0.10	0.55	0.47	0.93	0.77	0.70	-0.21	-0.10	3.31
1953	0.08	0.06	-0.11	-0.09	0.06	0.59	0.21	0.48	0.44	0.41	0.06	-0.11	2.08
1954	-0.02	0.34	0.34	0.19	-0.02	0.79	0.89	0.97	0.78	-0.07	0.09	0.09	4.37
1955	-0.04	-0.09	0.23	0.14	0.20	0.54	0.56	0.31	0.57	0.59	0.42	0.16	3.59
1956	-0.01	-0.12	0.24	0.19	0.19	0.53	0.88	0.83	0.79	0.43	0.04	0.10	4.09
1957	-0.10	-0.09	-0.10	-0.37	0.22	0.20	0.65	0.56	0.19	-0.24	-0.23	0.12	0.81
1958	0.00	0.09	0.12	0.12	0.40	0.27	0.55	0.41	-0.21	0.23	0.09	0.12	2.19
1959	0.11	-0.07	0.35	0.07	0.03	0.29	0.23	0.56	0.47	0.18	0.14	-0.12	2.24
1960	0.07	-0.03	0.19	0.32	0.49	0.27	0.71	0.39	0.26	0.16	0.01	-0.32	2.52
1961	-0.11	0.00	0.04	0.47	0.42	-0.13	0.35	0.61	0.36	0.39	-0.06	-0.10	2.24
1962	-0.08	0.15	0.29	0.08	0.52	0.15	0.67	0.88	0.25	0.27	-0.03	0.05	3.20
1963	0.09	0.13	0.32	0.07	0.40	0.42	0.59	0.84	0.55	0.67	0.08	-0.03	4.13
1964	0.04	0.04	0.07	0.01	0.29	0.57	0.84	0.55	0.36	0.51	0.11	0.05	3.44
1965	-0.02	-0.13	0.08	0.38	-0.14	0.42	0.87	0.75	0.34	0.42	0.14	-0.15	2.96
1966	-0.13	-0.12	0.29	0.12	0.26	0.66	0.69	0.26	0.26	0.31	0.29	-0.04	2.85
1967	0.16	0.10	0.32	0.06	-0.05	0.60	0.51	0.84	0.26	0.32	0.21	-0.20	3.13
1968	-0.27	0.03	0.09	-0.09	0.05	0.16	0.49	0.76	0.15	0.38	-0.09	0.07	1.73
1969	0.13	-0.08	-0.02	0.13	0.07	0.64	0.81	0.75	0.52	0.18	0.04	-0.07	3.10
1970	0.11	-0.09	0.09	0.08	0.28	0.47	0.61	0.65	0.27	0.06	0.25	0.18	2.96
1971	0.24	0.12	0.36	0.34	0.23	0.62	0.45	0.40	0.43	0.18	0.10	-0.24	3.23
1972	-0.13	0.25	0.28	0.28	0.41	0.37	0.51	0.72	0.37	0.10	-0.02	0.00	3.14
1973	-0.10	0.14	0.01	0.03	0.40	0.16	0.51	0.74	0.01	-0.05	0.19	0.12	2.16
1974	-0.13	0.28	0.38	0.27	0.27	0.38	0.72	0.27	-0.09	0.21	-0.11	0.05	2.50
1975	0.13	0.09	0.08	0.08	0.11	0.27	0.61	0.64	0.53	0.37	0.21	0.09	3.21
1976	0.14	0.18	-0.02	0.04	0.06	0.23	0.35	0.69	0.23	0.15	0.17	-0.02	2.20
1977	0.00	0.18	0.14	0.30	0.45	0.36	0.70	0.45	0.44	0.45	0.02	0.18	3.67
1978	-0.21	0.01	0.18	0.35	0.28	0.56	0.76	0.73	0.34	0.51	-0.15	-0.03	3.33
1979	-0.30	-0.14	0.02	0.10	0.11	0.54	0.33	0.56	0.25	0.40	0.14	-0.01	2.00
1980	0.05	0.25	0.14	0.24	0.21	0.57	0.89	0.91	0.51	0.40	0.10	0.17	4.44
1981	0.13	0.07	0.17	0.27	-0.03	0.25	0.56	0.66	0.40	-0.05	0.19	0.25	2.87
1982	0.02	0.05	0.16	0.00	0.11	0.12	0.61	0.72	0.63	0.14	-0.14	-0.05	2.37
1983	0.16	-0.12	0.13	0.38	-0.06	0.19	0.67	0.44	0.55	0.38	0.04	-0.14	2.62
1984	0.01	-0.03	0.08	0.42	0.33	0.48	0.66	0.65	0.54	-0.36	0.06	0.13	2.97
1985	0.02	0.00	0.17	0.28	0.46	0.61	0.49	0.92	0.52	-0.23	-0.25	0.01	3.00
1986	0.24	0.16	0.40	0.00	-0.01	0.09	0.79	0.65	0.29	0.02	-0.25	-0.13	2.25
1987	0.14	-0.20	0.39	0.48	0.12	0.16	0.50	0.75	0.35	0.41	-0.21	-0.10	2.79
1988	0.29	0.13	0.11	0.32	0.56	0.60	0.55	0.68	0.59	0.21	0.00	-0.05	3.99
1989	-0.17	0.01	-0.08	0.42	0.11	-0.10	0.39	0.64	0.50	0.37	0.27	0.15	2.51
1990	-0.32	0.05	0.05	0.38	0.11	0.52	0.49	0.71	0.35	0.19	0.03	0.01	2.57
1991	-0.14	0.02	0.27	-0.25	0.17	0.29	0.65	0.50	0.43	0.36	0.14	-0.08	2.36
1992	-0.03	0.00	0.23	0.27	0.17	0.32	0.70	0.61	0.44	0.31	0.04	-0.03	3.03
1993	0.18	0.12	0.06	0.14	0.28	-0.03	1.04	0.99	0.73	0.27	0.14	0.20	4.12
1994	0.05	-0.02	0.23	0.26	-0.04	0.43	0.59	0.45	0.52	-0.41	0.31	-0.08	2.29
1995	0.31	0.13	0.09	0.06	0.26	0.47	0.54	0.60	0.32	0.53	0.30	-0.04	3.57
1996	0.17	0.33	0.28	0.26	0.52	0.35	0.51	0.28	0.22	0.30	0.00	0.04	3.26
1997	0.02	-0.13	0.24	0.08	0.30	0.28	0.70	0.54	0.58	0.11	0.04	-0.01	2.75
1998	-0.09	-0.03	0.23	0.36	0.51	0.73	0.99	0.62	0.18	-0.08	-0.17	0.02	3.27
1999	-0.09	0.37	0.19	0.31	0.25	0.37	0.65	1.02	0.71	0.45	0.35	0.16	4.74
2000	0.11	0.15	-0.06	0.05	-0.13	0.16	0.70	0.80	0.58	0.30	-0.47	-0.10	2.09
2001	0.07	0.02	0.18	0.41	0.23	-0.03	0.78	0.56	0.09	0.24	0.09	0.04	2.68
2002	0.13	0.14	0.18	0.38	0.36	0.38	0.47	0.71	0.54	-0.02	0.07	-0.34	3.00
2003	0.25	-0.28	0.25	0.33	0.35	0.10	0.59	0.66	0.39	0.34	0.13	0.13	3.24
2004	-0.03	-0.18	0.14	0.09	0.29	-0.08	0.62	0.49	0.61	0.00	-0.43	0.10	1.62
2005	-0.01	-0.10	0.21	0.29	0.35	0.63	0.51	0.64	0.56	0.56	0.33	0.25	4.22
2006	0.05	-0.09	0.06	0.27	0.42	0.51	0.60	0.89	0.62	0.10	0.14	-0.19	3.38
2007	-0.23	0.17	0.10	0.20	-0.06	0.26	0.13	0.62	0.58	0.40	0.22	0.03	2.42
2008	0.12	0.09	0.38	0.28	0.20	0.49	0.87	0.21	0.28	0.36	0.07	0.12	3.47
2009	0.17	0.24	0.05	0.24	0.74	0.69	0.40	0.71	0.12	-0.18	0.35	0.05	3.58
2010	0.08	0.13	0.30	0.43	0.53	0.41	0.42	0.96	0.58	0.55	0.15	0.27	4.81
2011	-0.10	0.10	0.40	0.37	0.38	0.81	1.04	1.20	0.85	0.57	0.14	-0.29	5.47
2012	0.02	0.01	0.02	0.26	0.39	0.40	0.55	0.73	0.22	0.37	0.31	0.01	3.29
2013	-0.18	0.02	0.24	0.19	0.21	0.48	0.55	0.86	0.42	-0.04	0.07	0.01	2.83
2014	0.28	0.08	0.10	0.20	0.06	0.22	0.51	0.68	0.51	0.22	0.02	0.04	2.92
2015	-0.17	-0.03	-0.09	-0.15	-0.11	0.41	0.87	0.71	0.73	0.02	-0.29	0.56	2.46
2016	0.28	0.27	0.23	-0.11	0.36	0.40	0.80	0.26	0.63	0.54	0.16	0.00	3.82
2017	-0.03	0.16	0.19	0.11	0.08	0.33	0.60	0.03	0.74	0.48	0.21	-0.10	2.80
2018	0.08	-0.27	0.15	0.22	0.45	0.67	0.63	0.74	-0.01	-0.11	0.03	-0.21	2.37
MIN	-0.35	-0.28	-0.25	-0.37	-0.14	-0.19	0.13	0.03	-0.21	-0.41	-0.47	-0.34	0.81
MAX	0.31	0.37	0.40	0.48	0.74	0.81	1.04	1.20	0.85	0.70	0.42	0.56	5.47
AVG	0.02	0.05	0.15	0.17	0.22	0.37	0.60	0.63	0.41	0.24	0.05	0.00	2.91

LAKE COLUMBIA
NET EVAPORATION DEPTHS
UNITS: FEET

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
1940	0.03	-0.10	0.15	-0.09	0.14	0.08	0.43	0.36	0.46	0.29	-0.36	-0.07	1.32
1941	0.11	0.06	0.09	0.10	0.11	-0.17	0.34	0.48	0.19	-0.10	0.08	0.03	1.32
1942	0.15	0.22	0.17	-0.12	0.19	0.18	0.56	0.18	0.26	0.31	0.16	-0.13	2.13
1943	0.07	0.33	0.07	0.26	0.00	0.39	0.49	0.74	0.29	0.19	0.11	-0.16	2.78
1944	-0.18	-0.01	0.06	-0.03	-0.02	0.49	0.64	0.35	0.42	0.49	-0.29	-0.21	1.71
1945	0.15	-0.03	-0.21	0.22	0.27	0.15	0.36	0.43	0.39	0.13	0.14	0.10	2.10
1946	-0.17	0.10	0.07	0.10	-0.10	0.43	0.58	0.39	0.37	0.32	-0.32	0.11	1.88
1947	-0.02	0.25	0.09	0.20	0.14	0.44	0.69	0.63	0.50	0.43	-0.10	-0.14	3.11
1948	-0.04	0.00	0.13	0.26	0.15	0.53	0.66	0.75	0.64	0.41	-0.11	0.01	3.39
1949	-0.35	0.01	-0.01	0.05	0.31	0.33	0.29	0.45	0.38	-0.29	0.30	-0.10	1.37
1950	-0.07	0.10	0.24	0.03	0.16	0.38	0.36	0.59	0.08	0.35	0.22	0.18	2.62
1951	-0.01	0.05	0.12	0.28	0.33	0.28	0.57	0.86	-0.01	0.35	0.03	-0.04	2.81
1952	0.00	0.02	0.03	0.05	0.10	0.55	0.47	0.91	0.76	0.70	-0.21	-0.09	3.29
1953	0.07	0.05	-0.12	-0.10	0.05	0.57	0.21	0.47	0.44	0.41	0.06	-0.10	2.01
1954	-0.01	0.33	0.34	0.19	-0.01	0.79	0.87	0.95	0.78	-0.05	0.10	0.09	4.37
1955	-0.04	-0.10	0.24	0.13	0.19	0.54	0.54	0.30	0.56	0.59	0.41	0.15	3.51
1956	-0.01	-0.11	0.23	0.17	0.19	0.52	0.86	0.81	0.77	0.43	0.04	0.10	4.00
1957	-0.11	-0.08	-0.09	-0.36	0.24	0.19	0.64	0.55	0.19	-0.25	-0.23	0.12	0.81
1958	0.00	0.08	0.13	0.15	0.39	0.27	0.55	0.40	-0.25	0.24	0.09	0.12	2.17
1959	0.10	-0.07	0.34	0.06	0.04	0.29	0.22	0.54	0.46	0.17	0.12	-0.11	2.16
1960	0.07	-0.04	0.19	0.30	0.49	0.26	0.71	0.36	0.27	0.14	-0.01	-0.32	2.42
1961	-0.12	0.00	0.04	0.46	0.41	-0.12	0.34	0.60	0.33	0.39	-0.06	-0.11	2.16
1962	-0.08	0.16	0.29	0.08	0.51	0.14	0.67	0.87	0.24	0.28	-0.03	0.04	3.17
1963	0.09	0.13	0.32	0.09	0.40	0.42	0.58	0.83	0.53	0.66	0.07	-0.03	4.09
1964	0.03	0.04	0.06	0.00	0.28	0.57	0.83	0.54	0.35	0.51	0.10	0.04	3.35
1965	-0.02	-0.13	0.08	0.37	-0.14	0.42	0.86	0.73	0.34	0.42	0.14	-0.17	2.90
1966	-0.14	-0.12	0.29	0.15	0.26	0.66	0.69	0.25	0.27	0.30	0.29	-0.04	2.86
1967	0.16	0.09	0.31	0.06	-0.04	0.58	0.50	0.82	0.27	0.33	0.22	-0.19	3.11
1968	-0.28	0.03	0.09	-0.10	0.07	0.14	0.48	0.75	0.15	0.38	-0.09	0.06	1.68
1969	0.12	-0.08	-0.02	0.13	0.07	0.63	0.79	0.74	0.52	0.18	0.04	-0.07	3.05
1970	0.11	-0.09	0.09	0.08	0.27	0.47	0.59	0.62	0.26	0.06	0.24	0.17	2.87
1971	0.24	0.12	0.36	0.34	0.21	0.60	0.47	0.39	0.42	0.19	0.10	-0.23	3.21
1972	-0.13	0.25	0.27	0.27	0.40	0.38	0.48	0.70	0.36	0.11	-0.01	-0.01	3.07
1973	-0.11	0.13	0.01	0.04	0.39	0.16	0.50	0.72	0.01	-0.05	0.19	0.11	2.10
1974	-0.14	0.28	0.38	0.27	0.27	0.39	0.71	0.27	-0.08	0.21	-0.11	0.05	2.50
1975	0.13	0.09	0.08	0.08	0.11	0.27	0.59	0.63	0.52	0.35	0.20	0.08	3.13
1976	0.14	0.17	-0.02	0.05	0.06	0.23	0.34	0.68	0.24	0.15	0.16	-0.03	2.17
1977	0.00	0.19	0.14	0.30	0.44	0.36	0.69	0.44	0.43	0.45	0.02	0.17	3.63
1978	-0.22	0.01	0.19	0.34	0.28	0.54	0.76	0.73	0.32	0.50	-0.16	-0.04	3.25
1979	-0.30	-0.15	0.01	0.09	0.11	0.53	0.32	0.56	0.25	0.39	0.12	0.00	1.93
1980	0.06	0.25	0.13	0.24	0.20	0.57	0.87	0.90	0.51	0.40	0.09	0.18	4.40
1981	0.13	0.07	0.17	0.27	-0.02	0.24	0.54	0.66	0.38	-0.05	0.19	0.25	2.83
1982	0.02	0.06	0.16	-0.03	0.11	0.12	0.61	0.71	0.62	0.13	-0.14	-0.05	2.32
1983	0.15	-0.12	0.12	0.37	-0.08	0.19	0.66	0.42	0.54	0.38	0.03	-0.15	2.51
1984	0.01	-0.03	0.08	0.42	0.32	0.47	0.65	0.64	0.53	-0.39	0.06	0.12	2.88
1985	0.01	0.01	0.17	0.28	0.45	0.61	0.48	0.91	0.51	-0.25	-0.25	0.02	2.95
1986	0.24	0.17	0.40	0.01	-0.01	0.08	0.78	0.64	0.27	0.01	-0.26	-0.14	2.19
1987	0.14	-0.20	0.40	0.48	0.12	0.16	0.49	0.73	0.33	0.42	-0.21	-0.09	2.77
1988	0.29	0.14	0.12	0.31	0.55	0.59	0.54	0.66	0.58	0.21	0.02	-0.06	3.95
1989	-0.19	0.02	-0.09	0.42	0.12	-0.12	0.38	0.63	0.49	0.36	0.26	0.13	2.41
1990	-0.31	0.04	0.07	0.39	0.12	0.51	0.49	0.71	0.35	0.18	0.04	0.01	2.60
1991	-0.17	0.02	0.27	-0.26	0.16	0.28	0.64	0.49	0.42	0.37	0.14	-0.07	2.29
1992	-0.03	-0.01	0.22	0.27	0.16	0.34	0.70	0.60	0.45	0.31	0.04	-0.04	3.01
1993	0.19	0.13	0.05	0.14	0.26	-0.05	1.03	0.97	0.73	0.28	0.13	0.19	4.05
1994	0.05	-0.02	0.23	0.25	-0.04	0.42	0.61	0.44	0.50	-0.42	0.32	-0.07	2.27
1995	0.31	0.13	0.08	0.06	0.27	0.46	0.52	0.57	0.31	0.52	0.29	-0.05	3.47
1996	0.17	0.33	0.28	0.25	0.53	0.34	0.50	0.27	0.21	0.31	0.00	0.04	3.23
1997	0.02	-0.13	0.23	0.10	0.29	0.27	0.69	0.54	0.56	0.11	0.04	-0.01	2.71
1998	-0.09	-0.04	0.23	0.36	0.51	0.73	0.98	0.60	0.18	-0.08	-0.18	0.01	3.21
1999	-0.12	0.37	0.17	0.31	0.25	0.36	0.63	1.01	0.70	0.44	0.35	0.16	4.63
2000	0.11	0.15	-0.07	0.04	-0.13	0.17	0.71	0.79	0.57	0.30	-0.50	-0.09	2.05
2001	0.06	0.04	0.18	0.41	0.24	-0.08	0.77	0.55	0.08	0.23	0.09	0.04	2.61
2002	0.13	0.14	0.19	0.38	0.37	0.38	0.46	0.70	0.54	-0.04	0.05	-0.34	2.96
2003	0.24	-0.29	0.24	0.33	0.36	0.11	0.57	0.65	0.38	0.34	0.12	0.14	3.19
2004	-0.04	-0.19	0.13	0.09	0.28	-0.09	0.61	0.49	0.60	-0.01	-0.46	0.09	1.50
2005	-0.01	-0.11	0.21	0.29	0.35	0.63	0.51	0.62	0.54	0.55	0.32	0.25	4.15
2006	0.04	-0.09	0.07	0.26	0.42	0.49	0.57	0.87	0.61	0.06	0.14	-0.19	3.25
2007	-0.22	0.17	0.10	0.20	-0.05	0.28	0.12	0.61	0.60	0.39	0.22	0.03	2.45
2008	0.12	0.08	0.38	0.29	0.21	0.50	0.86	0.20	0.28	0.36	0.07	0.12	3.47
2009	0.18	0.24	0.06	0.23	0.76	0.69	0.42	0.71	0.14	-0.17	0.36	0.05	3.67
2010	0.09	0.14	0.30	0.43	0.53	0.41	0.42	0.95	0.58	0.56	0.15	0.27	4.83
2011	-0.10	0.10	0.40	0.37	0.38	0.80	1.01	1.19	0.83	0.57	0.14	-0.28	5.41
2012	0.02	0.01	0.02	0.26	0.39	0.39	0.53	0.73	0.19	0.37	0.31	0.01	3.23
2013	-0.18	0.02	0.24	0.19	0.21	0.47	0.56	0.85	0.44	-0.03	0.08	0.03	2.88
2014	0.28	0.09	0.10	0.20	0.05	0.21	0.50	0.67	0.49	0.21	0.01	0.04	2.85
2015	-0.18	-0.02	-0.09	-0.15	-0.10	0.41	0.86	0.70	0.72	0.05	-0.29	0.57	2.48
2016	0.27	0.27	0.24	-0.11	0.34	0.39	0.79	0.23	0.63	0.54	0.16	0.00	3.75
2017	-0.02	0.16	0.19	0.11	0.06	0.33	0.59	0.01	0.73	0.48	0.21	-0.10	2.75
2018	0.07	-0.26	0.14	0.22	0.44	0.66	0.61	0.73	-0.02	-0.10	0.05	-0.24	2.30
MIN	-0.35	-0.29	-0.21	-0.36	-0.14	-0.17	0.12	0.01	-0.25	-0.42	-0.50	-0.34	0.81
MAX	0.31	0.37	0.40	0.48	0.76	0.80	1.03	1.19	0.83	0.70	0.41	0.57	5.41
AVG	0.01	0.05	0.15	0.17	0.22	0.36	0.59	0.62	0.40	0.24	0.05	0.00	2.86

LAKE STRIKER
NET EVAPORATION DEPTHS
UNITS: FEET

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
1940	0.03	-0.12	0.15	-0.11	0.14	0.07	0.42	0.33	0.45	0.30	-0.27	-0.06	1.33
1941	0.14	0.07	0.10	0.16	0.12	-0.16	0.34	0.49	0.24	0.01	0.24	0.06	1.81
1942	0.15	0.24	0.18	-0.10	0.15	0.27	0.56	0.26	0.36	0.34	0.19	-0.07	2.53
1943	0.07	0.33	0.07	0.29	0.02	0.37	0.48	0.73	0.29	0.23	0.11	-0.14	2.85
1944	-0.12	0.08	0.11	-0.03	0.03	0.48	0.64	0.34	0.43	0.49	-0.23	-0.16	2.06
1945	0.18	-0.01	-0.15	0.22	0.29	0.27	0.50	0.42	0.39	0.21	0.12	0.06	2.50
1946	-0.17	0.15	0.09	0.11	0.04	0.48	0.55	0.44	0.38	0.31	-0.33	0.10	2.15
1947	0.00	0.25	0.10	0.23	0.15	0.39	0.68	0.63	0.52	0.44	-0.09	-0.09	3.21
1948	0.01	0.04	0.14	0.28	0.16	0.52	0.65	0.73	0.62	0.41	-0.11	0.02	3.47
1949	-0.34	0.01	-0.03	0.05	0.30	0.31	0.28	0.44	0.37	-0.30	0.30	-0.12	1.27
1950	-0.08	0.09	0.23	0.04	0.15	0.35	0.36	0.58	0.07	0.34	0.22	0.16	2.51
1951	-0.01	0.05	0.11	0.28	0.34	0.27	0.56	0.85	-0.01	0.36	0.03	-0.06	2.77
1952	-0.01	0.01	0.02	0.05	0.09	0.54	0.44	0.88	0.74	0.70	-0.20	-0.07	3.19
1953	0.06	0.03	-0.14	-0.13	0.02	0.54	0.21	0.47	0.44	0.40	0.06	-0.10	1.86
1954	-0.01	0.33	0.33	0.19	-0.02	0.77	0.84	0.90	0.76	-0.03	0.09	0.09	4.24
1955	-0.05	-0.11	0.25	0.11	0.17	0.53	0.50	0.27	0.54	0.57	0.38	0.14	3.30
1956	-0.02	-0.12	0.20	0.14	0.19	0.48	0.82	0.77	0.74	0.42	0.04	0.09	3.75
1957	-0.12	-0.08	-0.09	-0.34	0.27	0.16	0.61	0.53	0.18	-0.26	-0.26	0.11	0.71
1958	-0.02	0.06	0.13	0.18	0.38	0.24	0.53	0.35	-0.31	0.24	0.08	0.11	1.97
1959	0.10	-0.08	0.34	0.04	0.06	0.29	0.20	0.51	0.44	0.16	0.10	-0.11	2.05
1960	0.08	-0.05	0.19	0.28	0.50	0.24	0.71	0.31	0.26	0.12	-0.03	-0.31	2.30
1961	-0.13	0.00	0.02	0.45	0.40	-0.12	0.30	0.58	0.29	0.38	-0.06	-0.13	1.98
1962	-0.09	0.17	0.29	0.08	0.49	0.14	0.68	0.86	0.24	0.28	-0.03	0.02	3.13
1963	0.08	0.11	0.32	0.11	0.41	0.40	0.56	0.81	0.51	0.65	0.06	-0.04	3.98
1964	0.03	0.04	0.07	0.00	0.27	0.57	0.79	0.52	0.35	0.50	0.11	0.02	3.27
1965	-0.05	-0.21	0.15	0.40	-0.23	0.39	0.83	0.71	0.32	0.42	0.13	-0.18	2.68
1966	-0.14	-0.10	0.28	-0.29	0.29	0.66	0.68	0.26	0.28	0.28	0.28	-0.06	2.42
1967	0.15	0.08	0.31	0.02	-0.06	0.54	0.49	0.79	0.30	0.36	0.22	-0.20	3.00
1968	-0.25	0.00	0.08	-0.02	0.02	0.06	0.58	0.73	0.15	0.39	-0.09	0.11	1.76
1969	0.13	-0.04	0.05	0.11	0.11	0.62	0.76	0.74	0.51	0.18	-0.02	-0.13	3.02
1970	0.09	-0.11	0.05	0.06	0.24	0.45	0.52	0.57	0.25	-0.12	0.21	0.12	2.33
1971	0.22	0.09	0.34	0.35	0.29	0.58	0.48	0.38	0.41	0.20	0.10	-0.23	3.21
1972	-0.15	0.25	0.23	0.25	0.39	0.34	0.45	0.67	0.34	0.01	-0.01	-0.03	2.74
1973	-0.03	0.11	-0.08	-0.10	0.38	-0.04	0.53	0.69	0.04	-0.02	0.16	0.10	1.74
1974	-0.07	0.25	0.32	0.25	0.23	0.36	0.67	0.27	-0.15	0.20	-0.17	0.03	2.19
1975	0.12	-0.02	0.08	0.07	0.11	0.30	0.57	0.63	0.52	0.33	0.20	0.09	3.00
1976	0.12	0.19	-0.02	0.09	0.04	0.26	0.32	0.66	0.23	0.14	0.14	-0.04	2.13
1977	-0.02	0.12	0.04	0.11	0.43	0.36	0.66	0.41	0.40	0.44	0.01	0.14	3.10
1978	-0.24	0.02	0.14	0.34	0.27	0.53	0.74	0.71	0.34	0.49	-0.08	0.01	3.27
1979	-0.12	-0.03	0.06	0.05	0.11	0.64	0.28	0.53	0.17	0.37	0.15	0.00	2.21
1980	0.03	0.23	0.07	0.45	0.18	0.57	0.86	0.89	0.50	0.39	0.09	0.18	4.44
1981	0.11	0.04	0.15	0.27	-0.11	0.07	0.48	0.63	0.39	0.03	0.18	0.23	2.47
1982	0.02	0.08	0.13	0.11	0.19	0.15	0.61	0.71	0.60	0.12	-0.10	-0.11	2.51
1983	0.17	0.09	0.10	0.38	0.11	0.24	0.61	0.44	0.52	0.38	0.04	-0.09	2.99
1984	0.03	0.08	0.24	0.43	0.32	0.46	0.64	0.63	0.50	-0.36	0.08	0.08	3.13
1985	0.03	0.02	0.12	0.27	0.34	0.56	0.46	0.89	0.49	-0.25	-0.05	0.06	2.94
1986	0.25	0.06	0.39	0.00	0.00	0.22	0.78	0.62	0.26	0.02	-0.20	-0.02	2.38
1987	0.17	-0.06	0.26	0.47	0.13	0.15	0.48	0.71	0.33	0.42	-0.23	-0.28	2.55
1988	0.23	0.07	0.03	0.28	0.55	0.58	0.50	0.83	0.58	0.21	0.03	-0.08	3.81
1989	-0.13	0.02	0.11	0.34	0.07	-0.21	0.45	0.62	0.47	0.35	0.24	0.11	2.44
1990	-0.31	0.03	0.08	0.40	0.11	0.50	0.47	0.70	0.35	0.18	0.03	0.00	2.54
1991	-0.21	0.00	0.26	-0.29	0.14	0.27	0.61	0.48	0.41	0.38	0.12	-0.07	2.10
1992	-0.04	-0.02	0.21	0.25	0.15	0.35	0.71	0.59	0.44	0.30	0.03	-0.06	2.91
1993	0.19	0.13	0.03	0.13	0.23	-0.08	1.01	0.94	0.74	0.28	0.12	0.17	3.89
1994	0.04	-0.03	0.23	0.23	-0.04	0.40	0.62	0.42	0.48	-0.45	0.34	-0.07	2.17
1995	0.30	0.13	0.06	0.05	0.28	0.45	0.49	0.53	0.28	0.50	0.27	-0.08	3.26
1996	0.17	0.32	0.27	0.24	0.52	0.32	0.49	0.26	0.19	0.30	0.01	0.03	3.12
1997	0.02	-0.12	0.21	0.10	0.27	0.26	0.68	0.54	0.54	0.09	0.03	-0.02	2.60
1998	-0.10	-0.05	0.24	0.35	0.51	0.72	0.97	0.56	0.16	-0.07	-0.19	0.00	3.10
1999	-0.16	0.36	0.15	0.30	0.25	0.34	0.61	1.00	0.68	0.42	0.35	0.15	4.45
2000	0.11	0.15	-0.09	0.04	-0.12	0.17	0.71	0.79	0.55	0.30	-0.55	-0.09	1.97
2001	0.04	0.06	0.17	0.41	0.25	-0.14	0.74	0.53	0.07	0.22	0.08	0.03	2.46
2002	0.12	0.14	0.19	0.38	0.38	0.37	0.45	0.69	0.53	-0.06	0.01	-0.36	2.84
2003	0.24	-0.29	0.24	0.32	0.36	0.12	0.54	0.63	0.37	0.33	0.09	0.14	3.09
2004	-0.07	-0.21	0.12	0.09	0.26	-0.11	0.60	0.48	0.58	-0.02	-0.50	0.07	1.29
2005	-0.01	-0.13	0.20	0.28	0.34	0.61	0.49	0.58	0.48	0.54	0.30	0.24	3.92
2006	0.04	-0.10	0.07	0.26	0.41	0.47	0.53	0.84	0.58	0.00	0.15	-0.20	3.05
2007	-0.23	0.15	0.11	0.19	-0.04	0.29	0.12	0.61	0.62	0.38	0.21	0.03	2.44
2008	0.11	0.05	0.38	0.30	0.22	0.50	0.84	0.19	0.28	0.35	0.07	0.11	3.40
2009	0.18	0.24	0.06	0.22	0.78	0.70	0.44	0.71	0.18	-0.17	0.36	0.04	3.74
2010	0.11	0.15	0.32	0.43	0.53	0.44	0.40	0.94	0.59	0.58	0.16	0.28	4.93
2011	-0.11	0.11	0.40	0.38	0.37	0.79	0.98	1.17	0.79	0.56	0.12	-0.28	5.28
2012	0.03	0.00	0.00	0.25	0.39	0.39	0.48	0.73	0.15	0.37	0.30	-0.01	3.08
2013	-0.19	0.01	0.24	0.18	0.21	0.45	0.56	0.82	0.44	-0.03	0.10	0.04	2.83
2014	0.28	0.09	0.08	0.18	0.04	0.19	0.48	0.65	0.47	0.20	0.00	0.03	2.69
2015	-0.19	-0.02	-0.09	-0.15	-0.07	0.39	0.84	0.68	0.70	0.05	-0.34	-0.17	1.63
2016	0.14	0.18	-0.03	-0.07	0.19	0.37	0.76	0.20	0.61	0.53	0.15	-0.01	3.02
2017	-0.06	0.15	0.17	0.04	0.05	0.29	0.57	-0.08	0.72	0.47	0.21	-0.12	2.41
2018	0.05	-0.40	0.03	0.21	0.43	0.65	0.58	0.71	-0.05	-0.05	0.15	0.00	2.31
MIN	-0.34	-0.40	-0.15	-0.34	-0.23	-0.21	0.12	-0.08	-0.31	-0.45	-0.55	-0.36	0.71
MAX	0.30	0.36	0.40	0.47	0.78	0.79	1.01	1.17	0.79	0.70	0.38	0.28	5.28
AVG	0.01	0.05	0.14	0.16	0.21	0.35	0.57	0.60	0.39	0.24	0.05	-0.01	2.77

LAKE NACOGDOCHES
NET EVAPORATION DEPTHS
UNITS: FEET

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
1940	0.08	0.14	0.22	-0.07	0.25	0.13	0.40	0.24	0.43	0.32	-0.37	0.03	1.80
1941	0.15	0.07	0.16	0.11	0.18	0.06	0.28	0.49	0.12	-0.20	0.41	0.09	1.92
1942	0.17	0.22	0.22	-0.12	0.14	0.19	0.51	0.23	0.32	0.34	0.16	-0.12	2.26
1943	0.02	0.31	0.07	0.27	0.06	0.35	0.43	0.70	0.29	0.27	0.06	-0.18	2.65
1944	-0.23	-0.08	0.05	-0.04	-0.12	0.46	0.63	0.35	0.41	0.49	-0.30	-0.26	1.36
1945	0.25	-0.05	-0.25	0.11	0.21	0.16	0.15	0.38	0.33	-0.06	0.10	0.01	1.34
1946	-0.18	0.09	0.06	0.13	-0.16	0.27	0.48	0.35	0.32	0.28	-0.53	0.02	1.13
1947	0.02	0.22	0.10	0.22	-0.06	0.34	0.64	0.64	0.55	0.43	-0.10	-0.16	2.84
1948	-0.07	0.03	0.12	0.24	0.12	0.51	0.60	0.69	0.57	0.40	-0.18	-0.01	3.02
1949	-0.34	0.00	0.01	0.02	0.29	0.26	0.28	0.40	0.34	-0.38	0.29	-0.11	1.06
1950	-0.04	-0.14	0.26	0.01	-0.02	0.46	0.34	0.53	0.06	0.33	0.19	0.12	2.10
1951	-0.03	-0.05	0.09	0.30	0.31	0.24	0.53	0.83	-0.02	0.37	0.03	-0.06	2.54
1952	0.00	0.00	0.04	-0.07	0.06	0.50	0.38	0.81	0.70	0.69	-0.22	-0.08	2.81
1953	0.01	0.05	0.13	-0.13	0.27	0.47	0.18	0.45	0.42	0.39	0.07	-0.11	2.20
1954	-0.05	0.31	0.30	0.17	0.00	0.72	0.78	0.82	0.74	0.02	0.08	0.07	3.96
1955	-0.10	-0.10	0.24	0.19	0.18	0.51	0.45	0.25	0.51	0.53	0.33	0.12	3.11
1956	-0.04	-0.11	0.18	0.18	0.24	0.43	0.79	0.71	0.73	0.41	0.05	0.08	3.65
1957	-0.14	-0.08	-0.11	-0.42	0.38	0.09	0.60	0.52	0.15	-0.28	-0.16	0.13	0.68
1958	-0.01	0.05	0.12	-0.11	0.28	0.17	0.47	0.29	-0.08	0.31	0.05	0.09	1.63
1959	0.09	-0.08	0.23	-0.18	0.07	0.27	0.16	0.44	0.37	0.09	0.09	-0.23	1.32
1960	-0.11	-0.07	0.22	0.23	0.52	0.17	0.69	0.17	0.25	0.06	-0.06	-0.28	1.79
1961	-0.10	0.19	0.17	0.57	0.44	-0.15	0.22	0.54	0.23	0.39	-0.10	-0.14	2.26
1962	-0.13	0.30	0.30	0.02	0.57	0.10	0.65	0.82	0.20	0.29	-0.07	-0.06	2.99
1963	0.06	0.07	0.32	0.16	0.34	0.34	0.51	0.78	0.44	0.60	0.00	-0.07	3.55
1964	-0.04	0.02	0.01	0.03	0.28	0.55	0.73	0.49	0.32	0.48	0.10	-0.02	2.95
1965	-0.01	-0.20	0.12	0.37	-0.07	0.41	0.76	0.62	0.28	0.40	0.10	-0.24	2.54
1966	-0.03	-0.05	0.29	-0.12	0.35	0.62	0.63	0.23	0.30	0.20	0.26	-0.08	2.60
1967	0.12	0.06	0.28	0.02	-0.04	0.51	0.44	0.72	0.33	0.38	0.22	-0.23	2.81
1968	-0.17	0.03	0.14	0.18	0.16	0.04	0.56	0.68	0.14	0.35	-0.07	0.16	2.20
1969	0.16	0.12	0.16	0.27	0.19	0.58	0.68	0.70	0.50	0.19	0.01	-0.15	3.41
1970	0.04	-0.10	0.07	0.08	0.18	0.43	0.47	0.45	0.22	-0.15	0.19	0.11	1.99
1971	0.19	0.08	0.31	0.33	0.13	0.51	0.49	0.36	0.36	0.20	0.11	-0.21	2.86
1972	-0.11	0.26	0.18	0.22	0.36	0.35	0.44	0.59	0.30	0.06	0.13	0.12	2.90
1973	0.20	0.14	0.07	0.11	0.37	0.04	0.43	0.56	-0.03	-0.04	0.34	0.07	2.26
1974	-0.06	0.30	0.29	0.23	0.20	0.40	0.61	0.26	-0.12	0.20	-0.07	0.03	2.27
1975	0.21	0.41	0.12	0.08	0.04	0.34	0.49	0.60	0.48	0.26	0.16	0.06	3.25
1976	0.10	0.18	-0.06	0.12	0.03	0.24	0.28	0.64	0.24	0.15	0.10	-0.02	2.00
1977	0.00	0.20	0.12	0.14	0.40	0.34	0.62	0.37	0.38	0.43	0.02	0.11	3.13
1978	-0.23	0.07	0.23	0.37	0.29	0.50	0.71	0.67	0.21	0.47	-0.10	-0.03	3.16
1979	0.04	0.09	0.24	0.15	0.57	1.26	0.27	0.48	0.15	0.34	0.21	0.03	3.83
1980	0.07	0.23	0.06	0.23	0.13	0.56	0.78	0.85	0.50	0.36	0.06	0.16	3.99
1981	0.08	0.01	0.11	0.25	-0.07	0.05	0.46	0.60	0.37	0.07	0.19	0.19	2.31
1982	0.02	0.12	0.11	0.30	0.16	0.09	0.54	0.68	0.56	0.07	0.05	0.10	2.80
1983	0.18	0.03	0.12	0.37	0.12	0.27	0.56	0.34	0.44	0.37	0.01	0.01	2.82
1984	0.05	0.11	0.23	0.40	0.27	0.43	0.64	0.59	0.46	-0.33	0.11	0.10	3.06
1985	0.03	0.04	0.17	0.34	0.37	0.56	0.44	0.84	0.45	-0.18	0.08	0.09	3.23
1986	0.22	0.07	0.36	0.01	-0.02	0.47	0.77	0.57	0.23	0.00	-0.28	-0.02	2.38
1987	0.17	-0.07	0.26	0.45	0.11	0.15	0.45	0.68	0.30	0.43	-0.24	-0.22	2.47
1988	0.23	0.08	0.02	0.27	0.53	0.55	0.42	0.58	0.53	0.21	0.07	-0.12	3.37
1989	-0.18	0.05	0.10	0.34	0.09	-0.23	0.51	0.57	0.40	0.32	0.19	0.05	2.21
1990	-0.35	0.18	-0.04	0.13	0.27	0.50	0.44	0.67	0.35	0.18	-0.09	-0.11	2.13
1991	-0.18	0.08	0.22	-0.03	0.17	0.23	0.57	0.52	0.38	0.40	0.03	-0.06	2.33
1992	0.04	0.05	0.21	0.23	0.13	0.36	0.55	0.54	0.43	0.30	-0.07	-0.22	2.55
1993	0.09	0.08	0.15	0.16	0.17	0.07	0.97	0.89	0.75	0.13	0.13	0.12	3.71
1994	0.22	-0.08	0.26	0.22	0.03	0.43	0.51	0.43	0.44	-0.34	0.18	-0.21	2.09
1995	0.43	0.13	0.07	0.19	0.20	0.45	0.47	0.46	0.23	0.48	0.25	-0.05	3.31
1996	0.21	0.33	0.28	0.24	0.53	0.32	0.48	0.27	0.25	0.33	0.04	0.02	3.30
1997	0.02	-0.10	0.07	0.00	0.21	0.23	0.64	0.55	0.51	0.10	0.05	0.10	2.38
1998	-0.03	-0.06	0.25	0.33	0.54	0.71	0.96	0.52	0.48	-0.03	0.04	0.12	3.83
1999	-0.03	0.37	0.28	0.51	0.30	0.35	0.66	1.01	0.66	0.43	0.38	0.18	5.10
2000	0.13	0.17	-0.09	0.01	-0.10	0.09	0.64	0.78	0.50	0.33	-0.62	-0.20	1.64
2001	-0.08	-0.16	-0.09	0.35	0.27	-0.07	0.70	0.53	0.08	0.21	0.14	-0.03	1.85
2002	0.12	0.13	0.03	0.26	0.33	0.36	0.38	0.66	0.53	0.00	0.31	-0.17	2.94
2003	0.28	-0.24	0.26	0.32	0.38	0.16	0.49	0.62	0.38	0.36	0.12	0.21	3.34
2004	-0.02	0.02	0.12	0.18	0.40	-0.01	0.67	0.53	0.67	0.01	-0.29	0.19	2.47
2005	0.02	0.03	0.26	0.33	0.37	0.61	0.52	0.56	0.53	0.55	0.30	0.27	4.35
2006	0.07	-0.01	0.10	0.32	0.44	0.46	0.46	0.80	0.58	0.99	0.24	0.10	4.55
2007	-0.25	0.20	0.20	0.29	-0.02	0.16	-0.08	0.60	0.65	0.38	0.23	0.01	2.37
2008	0.15	0.04	-0.03	0.24	0.21	0.46	0.81	0.18	0.32	0.37	0.11	0.18	3.04
2009	0.23	0.28	0.06	0.28	0.37	0.72	0.52	0.67	0.17	-0.52	0.27	-0.04	3.01
2010	0.11	0.01	0.19	0.40	0.54	0.48	0.39	0.96	0.60	0.60	0.20	0.32	4.80
2011	-0.13	0.13	0.40	0.40	0.35	0.74	0.88	1.13	0.73	0.54	0.10	-0.28	4.99
2012	0.03	0.26	0.09	0.30	0.39	0.39	0.49	0.76	0.06	0.38	0.30	-0.02	3.43
2013	-0.14	0.05	0.24	0.25	0.26	0.42	0.59	0.79	0.46	0.06	0.29	0.01	3.28
2014	0.27	0.12	0.09	0.18	0.01	0.16	0.46	0.63	0.44	0.20	0.01	0.06	2.63
2015	-0.17	-0.01	-0.21	-0.20	-0.17	0.33	0.80	0.67	0.66	0.12	-0.35	-0.13	1.34
2016	0.11	0.16	-0.02	-0.06	0.13	0.35	0.72	0.14	0.59	0.52	0.14	-0.04	2.74
2017	-0.04	0.18	0.16	0.05	0.03	0.26	0.54	-0.23	0.68	0.46	0.21	-0.09	2.21
2018	0.02	-0.38	0.01	0.19	0.41	0.64	0.52	0.67	-0.09	0.01	0.19	-0.07	2.12
MIN	-0.35	-0.38	-0.25	-0.42	-0.17	-0.23	-0.08	-0.23	-0.12	-0.52	-0.62	-0.28	0.68
MAX	0.43	0.41	0.40	0.57	0.57	1.26	0.97	1.13	0.75	0.99	0.41	0.32	5.10
AVG	0.02	0.07	0.14	0.17	0.21	0.35	0.53	0.56	0.38	0.24	0.06	-0.01	2.72

LAKE NACONICHE
NET EVAPORATION DEPTHS
UNITS: FEET

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
1940	0.08	0.15	0.21	-0.06	0.25	0.13	0.40	0.24	0.43	0.32	-0.36	0.02	1.81
1941	0.16	0.07	0.16	0.10	0.18	0.04	0.27	0.49	0.12	-0.19	0.41	0.08	1.89
1942	0.17	0.22	0.21	-0.13	0.15	0.19	0.52	0.21	0.32	0.34	0.16	-0.13	2.23
1943	0.02	0.31	0.07	0.26	0.06	0.35	0.44	0.70	0.29	0.25	0.06	-0.18	2.63
1944	-0.23	-0.08	0.05	-0.05	-0.13	0.46	0.63	0.34	0.40	0.49	-0.30	-0.27	1.31
1945	0.25	-0.04	-0.26	0.12	0.21	0.16	0.15	0.38	0.33	-0.06	0.10	0.01	1.35
1946	-0.19	0.10	0.06	0.12	-0.17	0.26	0.48	0.34	0.31	0.28	-0.52	0.02	1.09
1947	0.01	0.22	0.10	0.22	-0.05	0.35	0.64	0.64	0.54	0.43	-0.11	-0.16	2.83
1948	-0.07	0.03	0.12	0.24	0.11	0.51	0.59	0.69	0.57	0.40	-0.19	0.00	3.00
1949	-0.35	0.00	0.01	0.02	0.29	0.26	0.26	0.39	0.34	-0.38	0.29	-0.11	1.02
1950	-0.05	-0.14	0.25	0.00	-0.03	0.46	0.32	0.52	0.04	0.32	0.18	0.12	1.99
1951	-0.04	-0.05	0.09	0.30	0.31	0.24	0.52	0.82	-0.02	0.37	0.03	-0.07	2.50
1952	-0.01	0.00	0.04	-0.07	0.06	0.50	0.38	0.81	0.69	0.68	-0.21	-0.08	2.79
1953	0.01	0.05	0.13	-0.13	0.27	0.47	0.17	0.45	0.42	0.39	0.07	-0.11	2.19
1954	-0.05	0.30	0.30	0.17	-0.01	0.72	0.79	0.83	0.74	0.01	0.07	0.07	3.94
1955	-0.09	-0.10	0.23	0.19	0.17	0.52	0.44	0.24	0.51	0.53	0.33	0.11	3.08
1956	-0.04	-0.12	0.18	0.18	0.23	0.42	0.78	0.70	0.72	0.40	0.05	0.08	3.58
1957	-0.15	-0.09	-0.11	-0.42	0.37	0.08	0.58	0.53	0.13	-0.28	-0.17	0.13	0.60
1958	-0.01	0.05	0.11	-0.14	0.27	0.15	0.44	0.28	-0.08	0.30	0.05	0.09	1.51
1959	0.09	-0.08	0.23	-0.18	0.07	0.27	0.15	0.45	0.38	0.10	0.09	-0.23	1.34
1960	-0.11	-0.08	0.22	0.24	0.52	0.18	0.69	0.18	0.24	0.07	-0.05	-0.29	1.81
1961	-0.10	0.19	0.16	0.57	0.44	-0.16	0.22	0.55	0.23	0.39	-0.11	-0.14	2.24
1962	-0.13	0.29	0.29	0.02	0.57	0.11	0.65	0.82	0.21	0.28	-0.07	-0.06	2.98
1963	0.06	0.07	0.32	0.14	0.34	0.34	0.50	0.77	0.44	0.60	0.00	-0.07	3.51
1964	-0.03	0.02	0.02	0.03	0.28	0.55	0.72	0.48	0.32	0.49	0.10	-0.03	2.95
1965	-0.02	-0.21	0.12	0.37	-0.07	0.41	0.77	0.63	0.28	0.41	0.11	-0.24	2.56
1966	-0.03	-0.05	0.30	-0.15	0.35	0.63	0.63	0.23	0.30	0.20	0.25	-0.08	2.58
1967	0.12	0.06	0.28	0.02	-0.06	0.51	0.44	0.72	0.33	0.38	0.22	-0.23	2.79
1968	-0.17	0.03	0.14	0.18	0.15	0.05	0.56	0.67	0.13	0.35	-0.08	0.17	2.18
1969	0.16	0.12	0.15	0.26	0.20	0.59	0.69	0.71	0.50	0.20	0.00	-0.15	3.43
1970	0.04	-0.10	0.07	0.08	0.19	0.43	0.47	0.47	0.24	-0.15	0.19	0.11	2.04
1971	0.19	0.08	0.30	0.32	0.14	0.52	0.47	0.36	0.36	0.20	0.11	-0.21	2.84
1972	-0.12	0.26	0.18	0.22	0.36	0.34	0.45	0.59	0.30	0.06	0.12	0.11	2.87
1973	0.20	0.14	0.07	0.09	0.37	0.03	0.43	0.57	-0.03	-0.03	0.34	0.06	2.24
1974	-0.06	0.29	0.29	0.23	0.19	0.38	0.60	0.26	-0.12	0.19	-0.07	0.02	2.20
1975	0.20	0.40	0.12	0.08	0.03	0.34	0.50	0.60	0.49	0.27	0.16	0.06	3.25
1976	0.10	0.18	-0.07	0.12	0.03	0.23	0.27	0.64	0.24	0.15	0.10	-0.01	1.98
1977	0.00	0.19	0.12	0.15	0.40	0.35	0.62	0.36	0.38	0.44	0.02	0.11	3.14
1978	-0.23	0.07	0.22	0.37	0.29	0.51	0.71	0.67	0.22	0.47	-0.10	-0.03	3.17
1979	0.03	0.09	0.24	0.15	0.57	1.26	0.28	0.48	0.15	0.34	0.21	0.03	3.83
1980	0.06	0.23	0.06	0.22	0.13	0.56	0.78	0.85	0.51	0.37	0.07	0.16	4.00
1981	0.08	0.01	0.11	0.25	-0.07	0.06	0.47	0.59	0.38	0.08	0.18	0.19	2.33
1982	0.02	0.11	0.11	0.30	0.16	0.09	0.54	0.68	0.57	0.07	0.05	0.08	2.78
1983	0.17	0.02	0.12	0.37	0.12	0.26	0.57	0.35	0.45	0.37	0.01	0.00	2.81
1984	0.05	0.10	0.23	0.40	0.27	0.44	0.64	0.59	0.45	-0.31	0.10	0.10	3.06
1985	0.03	0.03	0.17	0.33	0.36	0.56	0.44	0.85	0.45	-0.17	0.09	0.08	3.22
1986	0.22	0.06	0.36	0.01	-0.02	0.46	0.77	0.57	0.23	0.00	-0.29	-0.03	2.34
1987	0.16	-0.08	0.25	0.45	0.11	0.14	0.45	0.69	0.31	0.41	-0.26	-0.24	2.39
1988	0.22	0.07	0.02	0.27	0.53	0.56	0.42	0.57	0.53	0.21	0.06	-0.12	3.34
1989	-0.17	0.04	0.09	0.34	0.08	-0.23	0.50	0.56	0.40	0.32	0.19	0.05	2.17
1990	-0.36	0.19	-0.04	0.13	0.27	0.51	0.43	0.66	0.35	0.19	-0.10	-0.11	2.12
1991	-0.17	0.08	0.21	-0.06	0.16	0.23	0.56	0.52	0.38	0.39	0.03	-0.07	2.26
1992	0.03	0.05	0.20	0.23	0.14	0.34	0.55	0.54	0.41	0.29	-0.08	-0.23	2.47
1993	0.08	0.08	0.16	0.15	0.17	0.07	0.96	0.87	0.74	0.12	0.13	0.12	3.65
1994	0.21	-0.08	0.25	0.22	0.03	0.42	0.49	0.44	0.45	-0.34	0.18	-0.21	2.06
1995	0.43	0.13	0.07	0.17	0.19	0.46	0.48	0.48	0.23	0.48	0.26	-0.06	3.32
1996	0.21	0.32	0.27	0.23	0.52	0.31	0.48	0.27	0.24	0.32	0.03	0.01	3.21
1997	0.02	-0.10	0.06	-0.02	0.21	0.23	0.63	0.54	0.52	0.09	0.05	0.09	2.32
1998	-0.04	-0.07	0.24	0.33	0.53	0.71	0.96	0.53	0.46	-0.03	0.04	0.11	3.77
1999	-0.04	0.37	0.28	0.50	0.29	0.35	0.66	1.00	0.65	0.42	0.37	0.18	5.03
2000	0.13	0.17	-0.09	0.01	-0.10	0.09	0.64	0.79	0.51	0.33	-0.61	-0.21	1.66
2001	-0.09	-0.17	-0.09	0.35	0.26	-0.05	0.70	0.52	0.07	0.21	0.13	-0.03	1.81
2002	0.12	0.13	0.02	0.26	0.33	0.37	0.38	0.66	0.53	0.01	0.31	-0.18	2.94
2003	0.28	-0.24	0.26	0.32	0.38	0.14	0.50	0.61	0.39	0.36	0.13	0.21	3.34
2004	-0.01	0.02	0.12	0.18	0.40	-0.02	0.67	0.53	0.67	0.02	-0.29	0.19	2.48
2005	0.02	0.03	0.26	0.32	0.37	0.61	0.51	0.56	0.52	0.55	0.30	0.26	4.31
2006	0.08	-0.02	0.10	0.32	0.44	0.47	0.46	0.80	0.58	1.01	0.24	0.10	4.58
2007	-0.26	0.20	0.20	0.28	-0.02	0.15	-0.08	0.60	0.64	0.38	0.23	0.01	2.33
2008	0.15	0.03	-0.04	0.23	0.20	0.44	0.80	0.18	0.32	0.37	0.10	0.17	2.95
2009	0.23	0.27	0.05	0.29	0.35	0.72	0.49	0.67	0.16	-0.54	0.26	-0.04	2.91
2010	0.10	0.01	0.18	0.40	0.53	0.49	0.39	0.97	0.60	0.60	0.19	0.32	4.78
2011	-0.13	0.12	0.40	0.39	0.35	0.74	0.89	1.12	0.72	0.53	0.09	-0.30	4.92
2012	0.02	0.25	0.09	0.29	0.39	0.39	0.49	0.75	0.07	0.37	0.29	-0.02	3.38
2013	-0.15	0.05	0.24	0.24	0.26	0.41	0.59	0.79	0.45	0.05	0.29	0.00	3.22
2014	0.27	0.12	0.09	0.17	0.01	0.17	0.46	0.63	0.44	0.19	0.01	0.05	2.61
2015	-0.17	-0.02	-0.22	-0.20	-0.17	0.33	0.81	0.67	0.66	0.10	-0.36	-0.13	1.30
2016	0.11	0.16	-0.04	-0.06	0.14	0.35	0.71	0.14	0.59	0.52	0.14	-0.04	2.72
2017	-0.05	0.18	0.16	0.05	0.03	0.26	0.54	-0.24	0.68	0.46	0.21	-0.10	2.18
2018	0.01	-0.40	0.01	0.19	0.41	0.64	0.52	0.67	-0.09	0.02	0.18	-0.07	2.09
MIN	-0.36	-0.40	-0.26	-0.42	-0.17	-0.23	-0.08	-0.24	-0.12	-0.54	-0.61	-0.30	0.60
MAX	0.43	0.40	0.40	0.57	0.57	1.26	0.96	1.12	0.74	1.01	0.41	0.32	5.03
AVG	0.02	0.07	0.13	0.17	0.21	0.35	0.53	0.56	0.37	0.24	0.06	-0.02	2.69

LAKE KURTH
NET EVAPORATION DEPTHS
UNITS: FEET

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
1940	0.06	0.06	0.22	-0.12	0.24	0.11	0.38	0.16	0.39	0.35	-0.54	-0.04	1.27
1941	0.14	0.03	0.16	0.15	0.09	0.07	0.18	0.48	0.04	-0.37	0.40	0.11	1.48
1942	0.16	0.19	0.19	-0.07	0.09	0.14	0.46	0.21	0.34	0.37	0.15	-0.11	2.12
1943	-0.02	0.29	0.07	0.28	0.12	0.33	0.37	0.67	0.29	0.34	0.02	-0.18	2.58
1944	-0.28	-0.05	0.03	-0.07	-0.23	0.42	0.62	0.35	0.38	0.49	-0.34	-0.26	1.06
1945	0.21	-0.06	-0.11	0.07	0.14	0.21	0.16	0.33	0.26	-0.08	0.10	-0.02	1.21
1946	-0.23	0.01	0.04	0.15	-0.13	0.22	0.40	0.33	0.27	0.26	-0.53	-0.02	0.77
1947	-0.04	0.21	0.09	0.24	-0.14	0.30	0.58	0.65	0.61	0.44	-0.12	-0.16	2.66
1948	-0.06	0.00	0.14	0.20	0.14	0.50	0.53	0.65	0.51	0.40	-0.24	-0.03	2.74
1949	-0.31	-0.01	-0.03	0.02	0.27	0.21	0.29	0.37	0.31	-0.43	0.28	-0.18	0.79
1950	-0.06	-0.17	0.23	0.00	-0.05	0.36	0.35	0.52	0.07	0.33	0.17	0.07	1.82
1951	-0.02	-0.05	0.06	0.31	0.33	0.24	0.50	0.82	-0.03	0.39	0.03	-0.10	2.48
1952	-0.01	-0.03	0.03	-0.07	0.03	0.48	0.31	0.74	0.65	0.68	-0.21	-0.03	2.57
1953	-0.01	-0.01	0.07	-0.21	0.20	0.36	0.18	0.42	0.41	0.38	0.09	-0.07	1.81
1954	-0.04	0.30	0.28	0.16	0.02	0.70	0.71	0.72	0.72	0.08	0.08	0.09	3.82
1955	-0.12	-0.12	0.27	0.15	0.16	0.51	0.39	0.21	0.49	0.50	0.26	0.08	2.78
1956	-0.07	-0.11	0.15	0.13	0.26	0.36	0.76	0.64	0.71	0.41	0.07	0.07	3.38
1957	-0.17	-0.06	-0.10	-0.36	0.47	0.07	0.59	0.52	0.12	-0.25	-0.21	0.13	0.75
1958	-0.05	0.02	0.14	0.00	0.29	0.14	0.44	0.18	-0.21	0.34	0.04	0.08	1.41
1959	0.08	-0.09	0.22	-0.22	0.16	0.28	0.11	0.33	0.32	0.02	0.04	-0.23	1.02
1960	-0.10	-0.11	0.22	0.14	0.54	0.11	0.66	-0.01	0.27	0.00	-0.13	-0.25	1.34
1961	-0.16	0.19	0.14	0.54	0.41	-0.09	0.13	0.50	0.11	0.40	-0.09	-0.19	1.89
1962	-0.14	0.33	0.31	0.00	0.52	0.05	0.65	0.77	0.16	0.32	-0.08	-0.13	2.76
1963	0.05	0.02	0.33	0.22	0.35	0.26	0.46	0.74	0.38	0.54	-0.06	-0.09	3.20
1964	-0.10	0.01	-0.02	-0.04	0.24	0.52	0.66	0.46	0.30	0.47	0.10	-0.06	2.54
1965	0.02	-0.20	0.11	0.35	-0.05	0.41	0.67	0.53	0.23	0.39	0.07	-0.35	2.18
1966	-0.08	-0.10	0.27	0.05	0.32	0.57	0.57	0.18	0.32	0.11	0.24	-0.09	2.36
1967	0.10	0.03	0.24	0.02	0.00	0.43	0.38	0.63	0.37	0.41	0.23	-0.24	2.60
1968	-0.17	0.03	0.14	0.08	0.22	-0.08	0.47	0.61	0.13	0.34	-0.06	0.10	1.81
1969	0.14	0.10	0.17	0.27	0.12	0.55	0.59	0.66	0.48	0.20	0.08	-0.14	3.22
1970	0.02	-0.08	0.05	0.09	0.09	0.40	0.43	0.31	0.19	-0.17	0.18	0.10	1.61
1971	0.18	0.09	0.29	0.33	0.06	0.43	0.52	0.34	0.30	0.20	0.13	-0.21	2.66
1972	-0.09	0.25	0.11	0.18	0.32	0.35	0.35	0.48	0.25	0.09	0.17	0.11	2.57
1973	0.16	0.14	0.06	0.16	0.33	0.00	0.41	0.42	-0.04	-0.01	0.35	0.04	2.02
1974	-0.14	0.30	0.28	0.24	0.18	0.48	0.53	0.26	-0.09	0.20	-0.10	-0.01	2.13
1975	0.19	0.39	0.12	0.08	0.01	0.33	0.40	0.57	0.44	0.18	0.13	0.06	2.90
1976	0.11	0.15	-0.04	0.16	0.02	0.24	0.26	0.64	0.27	0.17	0.06	-0.04	2.00
1977	0.00	0.24	0.13	0.15	0.37	0.33	0.58	0.32	0.35	0.42	0.04	0.08	3.01
1978	-0.27	0.08	0.26	0.36	0.31	0.46	0.67	0.62	0.11	0.44	-0.08	-0.06	2.90
1979	0.01	0.04	0.22	0.17	0.57	1.26	0.28	0.45	0.14	0.31	0.19	0.03	3.67
1980	0.09	0.22	0.01	0.23	0.07	0.57	0.68	0.79	0.49	0.34	0.04	0.16	3.69
1981	0.05	-0.01	0.09	0.25	-0.01	0.01	0.39	0.56	0.26	0.12	0.17	0.16	2.04
1982	-0.01	0.13	0.06	0.18	0.15	0.05	0.49	0.64	0.51	0.01	0.07	0.07	2.35
1983	0.16	0.04	0.10	0.36	0.05	0.24	0.52	0.26	0.35	0.38	0.00	-0.05	2.41
1984	0.02	0.10	0.23	0.38	0.22	0.39	0.61	0.56	0.40	-0.38	0.12	0.09	2.74
1985	-0.02	0.04	0.15	0.34	0.35	0.57	0.42	0.78	0.39	-0.24	0.08	0.12	2.98
1986	0.20	0.10	0.35	0.04	-0.08	0.44	0.72	0.50	0.19	-0.02	-0.38	-0.02	2.04
1987	0.16	-0.08	0.26	0.42	0.09	0.14	0.41	0.64	0.26	0.44	-0.26	-0.14	2.34
1988	0.23	0.10	0.02	0.26	0.51	0.53	0.32	0.50	0.48	0.23	0.15	-0.14	3.19
1989	-0.28	0.08	0.12	0.36	0.13	-0.36	0.47	0.52	0.30	0.28	0.14	-0.02	1.74
1990	-0.35	0.15	-0.01	0.16	0.23	0.47	0.41	0.65	0.36	0.21	-0.08	-0.12	2.08
1991	-0.29	0.03	0.22	-0.05	0.15	0.20	0.52	0.54	0.36	0.43	0.00	-0.05	2.06
1992	0.01	0.00	0.19	0.20	0.13	0.44	0.56	0.51	0.45	0.33	-0.09	-0.27	2.46
1993	0.11	0.10	0.12	0.11	0.09	0.07	0.91	0.85	0.80	0.14	0.13	0.05	3.48
1994	0.20	-0.12	0.28	0.17	0.03	0.37	0.55	0.41	0.36	-0.41	0.23	-0.16	1.91
1995	0.42	0.13	-0.01	0.16	0.21	0.42	0.40	0.33	0.15	0.43	0.20	-0.12	2.72
1996	0.20	0.31	0.27	0.21	0.52	0.29	0.47	0.23	0.24	0.34	0.08	-0.01	3.15
1997	0.03	-0.09	0.03	0.04	0.17	0.22	0.61	0.54	0.44	0.08	0.03	0.07	2.17
1998	-0.07	-0.09	0.27	0.30	0.55	0.68	0.93	0.43	0.46	-0.01	-0.02	0.09	3.52
1999	-0.13	0.35	0.22	0.53	0.27	0.28	0.59	0.96	0.58	0.38	0.37	0.16	4.56
2000	0.13	0.16	-0.13	-0.03	-0.11	0.09	0.64	0.75	0.41	0.34	-0.77	-0.20	1.28
2001	-0.11	-0.10	-0.10	0.34	0.31	-0.24	0.64	0.50	0.08	0.18	0.10	-0.06	1.54
2002	0.09	0.13	0.05	0.27	0.35	0.34	0.32	0.60	0.50	-0.12	0.20	-0.23	2.50
2003	0.26	-0.25	0.23	0.29	0.40	0.20	0.38	0.57	0.34	0.36	0.05	0.22	3.05
2004	-0.09	-0.04	0.08	0.18	0.33	-0.03	0.65	0.53	0.65	-0.02	-0.43	0.15	1.96
2005	0.02	-0.02	0.24	0.33	0.35	0.57	0.50	0.48	0.40	0.54	0.26	0.23	3.90
2006	0.05	-0.05	0.13	0.31	0.43	0.43	0.35	0.73	0.54	0.81	0.27	0.09	4.09
2007	-0.26	0.17	0.23	0.27	0.01	0.20	-0.06	0.57	0.69	0.36	0.23	0.01	2.42
2008	0.16	-0.03	-0.01	0.25	0.28	0.45	0.75	0.17	0.35	0.37	0.11	0.15	3.00
2009	0.27	0.30	0.10	0.25	0.45	0.76	0.65	0.69	0.29	-0.52	0.28	-0.08	3.44
2010	0.15	0.02	0.24	0.41	0.55	0.57	0.40	0.98	0.60	0.64	0.24	0.35	5.15
2011	-0.14	0.15	0.40	0.43	0.34	0.68	0.76	1.07	0.65	0.51	0.07	-0.30	4.62
2012	0.02	0.23	0.02	0.26	0.38	0.38	0.36	0.79	-0.06	0.39	0.29	-0.04	3.02
2013	-0.16	0.05	0.24	0.24	0.24	0.35	0.60	0.75	0.51	0.08	0.35	0.06	3.31
2014	0.27	0.13	0.08	0.16	0.01	0.10	0.39	0.58	0.38	0.18	0.00	0.05	2.33
2015	-0.22	0.02	-0.22	-0.20	-0.11	0.27	0.75	0.65	0.60	0.20	-0.36	-0.08	1.30
2016	0.07	0.14	0.00	-0.03	0.04	0.31	0.68	0.06	0.56	0.51	0.13	-0.07	2.40
2017	-0.02	0.21	0.14	0.06	0.00	0.22	0.50	-0.43	0.64	0.44	0.21	-0.06	1.91
2018	-0.01	-0.34	-0.01	0.17	0.39	0.63	0.44	0.63	-0.15	0.07	0.25	-0.17	1.90
MIN	-0.35	-0.34	-0.22	-0.36	-0.23	-0.36	-0.06	-0.43	-0.21	-0.52	-0.77	-0.35	0.75
MAX	0.42	0.39	0.40	0.54	0.57	1.26	0.93	1.07	0.80	0.81	0.40	0.35	5.15
AVG	0.00	0.06	0.13	0.16	0.20	0.32	0.49	0.51	0.34	0.23	0.04	-0.03	2.46

LAKE PINKSTON
NET EVAPORATION DEPTHS
UNITS: FEET

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
1940	0.04	0.08	0.18	-0.12	0.26	0.08	0.30	0.07	0.44	0.30	-0.38	-0.06	1.19
1941	0.13	0.05	0.13	0.11	0.05	0.05	0.16	0.44	0.08	-0.26	0.38	0.09	1.41
1942	0.14	0.16	0.13	-0.09	0.12	0.15	0.47	0.16	0.34	0.37	0.16	-0.12	1.99
1943	0.00	0.28	0.03	0.23	0.15	0.34	0.43	0.66	0.29	0.28	0.06	-0.18	2.57
1944	-0.27	-0.12	0.00	-0.07	-0.14	0.44	0.60	0.26	0.35	0.47	-0.30	-0.38	0.84
1945	0.22	-0.07	-0.21	0.04	0.16	0.14	0.09	0.36	0.27	-0.10	0.06	-0.01	0.95
1946	-0.30	0.02	0.02	0.08	-0.23	0.21	0.37	0.30	0.27	0.23	-0.45	-0.04	0.48
1947	-0.08	0.18	0.07	0.16	0.02	0.34	0.60	0.63	0.50	0.38	-0.14	-0.17	2.49
1948	-0.12	-0.01	0.12	0.19	0.09	0.50	0.51	0.63	0.47	0.37	-0.33	-0.02	2.40
1949	-0.37	-0.05	-0.04	0.00	0.30	0.19	0.17	0.38	0.31	-0.43	0.28	-0.19	0.55
1950	-0.10	-0.18	0.19	-0.02	-0.07	0.30	0.24	0.42	-0.02	0.24	0.12	0.08	1.20
1951	-0.16	-0.03	0.03	0.27	0.31	0.24	0.43	0.78	-0.05	0.41	0.03	-0.15	2.11
1952	-0.04	-0.05	0.03	-0.11	0.04	0.48	0.26	0.67	0.62	0.66	-0.17	-0.06	2.33
1953	-0.04	-0.06	0.07	-0.29	0.11	0.41	0.13	0.43	0.42	0.41	0.06	-0.11	1.54
1954	-0.09	0.28	0.25	0.12	-0.09	0.67	0.73	0.72	0.69	0.14	0.07	0.05	3.54
1955	-0.16	-0.15	0.22	0.12	0.08	0.45	0.23	0.10	0.45	0.45	0.21	0.07	2.07
1956	-0.07	-0.17	0.07	0.10	0.21	0.28	0.64	0.59	0.60	0.32	0.00	-0.01	2.56
1957	-0.21	-0.11	-0.14	-0.34	0.38	-0.03	0.49	0.55	0.06	-0.23	-0.30	0.09	0.21
1958	-0.05	0.02	0.06	-0.17	0.20	-0.01	0.26	0.08	-0.22	0.30	0.01	0.09	0.57
1959	0.05	-0.10	0.18	-0.08	0.13	0.30	0.16	0.39	0.37	0.11	0.07	-0.15	1.43
1960	-0.10	-0.09	0.18	0.22	0.51	0.22	0.67	0.12	0.26	0.10	-0.02	-0.27	1.80
1961	-0.01	-0.01	0.02	0.42	0.37	-0.14	0.13	0.48	0.15	0.34	-0.11	-0.13	1.51
1962	-0.09	0.15	0.21	0.02	0.38	0.13	0.66	0.73	0.26	0.30	-0.06	-0.07	2.62
1963	0.05	0.06	0.30	0.13	0.34	0.31	0.36	0.68	0.38	0.56	-0.06	-0.08	3.03
1964	-0.07	0.02	0.01	-0.11	0.25	0.53	0.61	0.35	0.31	0.47	0.09	-0.12	2.34
1965	-0.03	-0.26	-0.07	0.43	-0.06	0.39	0.68	0.53	0.21	0.43	0.10	-0.28	2.07
1966	-0.18	-0.18	0.27	-0.14	0.31	0.58	0.57	0.25	0.33	0.11	0.21	-0.14	1.99
1967	0.09	-0.01	0.26	0.01	-0.15	0.43	0.31	0.64	0.40	0.41	0.24	-0.31	2.32
1968	-0.26	-0.04	0.08	-0.13	0.02	0.04	0.35	0.53	0.10	0.35	-0.10	0.10	1.04
1969	0.16	-0.02	0.10	0.14	0.08	0.57	0.60	0.72	0.50	0.25	0.00	-0.18	2.92
1970	0.06	-0.09	0.03	0.11	0.12	0.38	0.39	0.43	0.30	-0.16	0.17	0.08	1.82
1971	0.18	0.05	0.25	0.34	0.12	0.49	0.33	0.32	0.33	0.25	0.10	-0.23	2.53
1972	-0.23	0.23	0.06	0.19	0.33	0.32	0.26	0.52	0.26	0.00	0.00	-0.07	1.87
1973	-0.07	0.09	-0.07	-0.03	0.31	-0.03	0.36	0.52	-0.04	0.04	0.19	0.05	1.32
1974	-0.27	0.23	0.27	0.17	0.17	0.38	0.46	0.29	-0.14	0.13	-0.10	-0.03	1.56
1975	0.12	0.00	0.04	0.07	-0.05	0.16	0.41	0.58	0.46	0.19	0.14	0.07	2.19
1976	0.08	0.14	-0.12	0.21	0.01	0.18	0.31	0.61	0.28	0.21	0.08	-0.09	1.90
1977	-0.05	0.14	0.02	0.20	0.40	0.39	0.54	0.31	0.39	0.42	-0.01	0.09	2.84
1978	-0.24	0.08	0.20	0.38	0.28	0.50	0.64	0.58	0.27	0.44	-0.11	-0.03	2.99
1979	-0.24	-0.07	0.08	0.10	0.09	0.82	0.23	0.51	0.17	0.31	0.14	0.01	2.15
1980	0.01	0.20	-0.04	0.38	0.12	0.55	0.75	0.82	0.50	0.31	0.07	0.18	3.85
1981	0.08	0.00	0.08	0.26	-0.06	0.09	0.41	0.53	0.54	0.09	0.15	0.17	2.34
1982	-0.06	0.02	0.09	0.08	0.27	0.11	0.55	0.63	0.51	-0.04	-0.15	-0.22	1.79
1983	0.18	-0.06	0.13	0.31	0.01	0.25	0.61	0.37	0.41	0.39	-0.08	-0.04	2.48
1984	0.04	0.02	0.22	0.35	0.23	0.40	0.53	0.52	0.38	-0.40	0.01	0.08	2.38
1985	0.00	-0.03	0.12	0.25	0.36	0.55	0.42	0.76	0.36	-0.24	0.18	0.06	2.79
1986	0.20	0.04	0.31	0.03	-0.02	0.31	0.71	0.48	0.23	-0.06	-0.43	-0.03	1.77
1987	0.11	-0.21	0.25	0.44	0.11	0.16	0.41	0.63	0.34	0.37	-0.40	-0.25	1.96
1988	0.14	0.04	-0.07	0.23	0.52	0.56	0.32	0.42	0.45	0.15	0.05	-0.18	2.63
1989	-0.29	0.03	0.06	0.34	-0.03	-0.44	0.35	0.46	0.35	0.27	0.16	-0.05	1.21
1990	-0.48	0.10	-0.04	0.10	0.25	0.40	0.39	0.60	0.39	0.20	-0.15	-0.17	1.59
1991	-0.21	0.00	0.14	-0.32	0.03	0.20	0.47	0.43	0.35	0.35	0.05	-0.09	1.40
1992	-0.02	0.00	0.16	0.19	0.15	0.24	0.53	0.56	0.39	0.26	-0.09	-0.22	2.15
1993	0.02	0.06	0.11	0.12	0.13	0.06	0.86	0.80	0.70	0.12	0.09	0.08	3.15
1994	0.13	-0.13	0.23	0.18	0.00	0.39	0.45	0.39	0.47	-0.34	0.18	-0.17	1.78
1995	0.42	0.13	-0.03	0.01	0.17	0.50	0.44	0.49	0.22	0.42	0.20	-0.10	2.87
1996	0.16	0.30	0.24	0.18	0.48	0.18	0.35	0.23	0.17	0.30	0.00	0.01	2.60
1997	0.00	-0.11	-0.03	-0.10	0.16	0.25	0.60	0.46	0.49	0.04	0.02	0.01	1.79
1998	-0.10	-0.09	0.23	0.31	0.53	0.70	0.87	0.50	0.32	0.07	0.01	0.07	3.42
1999	-0.28	0.32	0.17	0.38	0.26	0.26	0.58	0.92	0.51	0.33	0.34	0.10	3.89
2000	0.13	0.19	-0.16	-0.05	-0.11	0.16	0.67	0.83	0.51	0.38	-0.63	-0.21	1.71
2001	-0.13	-0.13	-0.12	0.33	0.33	0.02	0.64	0.46	0.03	0.17	0.07	-0.07	1.60
2002	0.08	0.12	-0.02	0.23	0.36	0.40	0.37	0.61	0.46	-0.06	0.23	-0.27	2.51
2003	0.24	-0.27	0.23	0.25	0.36	0.11	0.44	0.52	0.33	0.37	0.05	0.17	2.80
2004	-0.07	-0.07	0.09	0.20	0.31	-0.11	0.62	0.49	0.64	0.01	-0.33	0.13	1.91
2005	0.01	-0.02	0.24	0.24	0.38	0.53	0.41	0.49	0.38	0.49	0.21	0.20	3.56
2006	0.03	-0.09	0.09	0.27	0.42	0.43	0.41	0.68	0.51	0.86	0.21	-0.02	3.80
2007	-0.27	0.16	0.27	0.24	0.09	0.15	-0.09	0.62	0.61	0.37	0.18	-0.03	2.30
2008	0.12	-0.06	-0.07	0.22	0.18	0.38	0.73	0.18	0.26	0.35	0.02	0.05	2.36
2009	0.21	0.24	-0.02	0.27	0.29	0.69	0.36	0.59	0.17	-0.66	0.24	-0.11	2.27
2010	0.08	0.02	0.22	0.39	0.49	0.58	0.34	0.93	0.61	0.65	0.13	0.31	4.75
2011	-0.11	0.11	0.42	0.42	0.37	0.70	0.78	1.07	0.57	0.52	0.07	-0.34	4.58
2012	-0.03	0.15	-0.04	0.18	0.41	0.43	0.35	0.67	0.01	0.35	0.27	-0.10	2.65
2013	-0.25	-0.01	0.25	0.15	0.27	0.32	0.55	0.78	0.38	0.01	0.26	-0.02	2.69
2014	0.24	0.06	0.04	0.12	-0.01	0.17	0.44	0.55	0.41	0.15	0.02	-0.03	2.16
2015	-0.23	-0.05	-0.21	-0.13	-0.18	0.32	0.76	0.69	0.60	0.06	-0.42	-0.02	1.19
2016	0.04	0.12	-0.29	-0.07	0.12	0.28	0.57	-0.03	0.55	0.47	0.09	-0.11	1.74
2017	-0.08	0.17	0.14	0.00	-0.12	0.11	0.43	-0.50	0.58	0.45	0.19	-0.11	1.26
2018	-0.06	-0.58	-0.08	0.10	0.39	0.55	0.41	0.58	-0.14	0.02	0.06	-0.13	1.12
MIN	-0.48	-0.58	-0.29	-0.34	-0.23	-0.44	-0.09	-0.50	-0.22	-0.66	-0.63	-0.38	0.21
MAX	0.42	0.32	0.42	0.44	0.53	0.82	0.87	1.07	0.70	0.86	0.38	0.31	4.75
AVG	-0.03	0.01	0.09	0.13	0.18	0.31	0.45	0.50	0.34	0.22	0.02	-0.05	2.15

LAKE SAM RAYBURN
NET EVAPORATION DEPTHS
UNITS: FEET

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
1940	0.05	0.09	0.18	-0.15	0.31	0.01	0.26	-0.10	0.41	0.23	-0.40	-0.07	0.82
1941	0.16	0.07	0.10	0.12	-0.13	0.06	0.03	0.44	-0.05	-0.33	0.44	0.11	1.02
1942	0.13	0.10	0.10	-0.15	0.17	0.07	0.24	0.08	0.28	0.36	0.12	-0.11	1.39
1943	-0.05	0.24	0.00	0.21	0.08	0.27	0.11	0.55	0.18	0.36	-0.01	-0.14	1.80
1944	-0.28	0.03	0.02	-0.03	-0.13	0.43	0.55	0.16	0.26	0.43	-0.31	-0.27	0.86
1945	0.26	-0.07	-0.04	-0.05	0.10	0.11	0.10	0.21	0.23	-0.06	0.08	-0.13	0.74
1946	-0.24	0.01	0.06	0.14	-0.26	0.08	0.23	0.32	0.21	0.16	-0.46	-0.05	0.20
1947	-0.15	0.21	0.06	0.23	-0.06	0.25	0.48	0.48	0.51	0.36	-0.19	-0.20	1.98
1948	-0.11	0.04	0.14	0.16	0.18	0.50	0.35	0.51	0.35	0.38	-0.43	0.00	2.07
1949	-0.31	-0.11	-0.13	-0.06	0.31	0.14	0.14	0.41	0.30	-0.55	0.30	-0.30	0.14
1950	0.04	-0.20	0.17	-0.05	0.04	0.18	0.28	0.47	0.10	0.31	0.12	0.06	1.52
1951	-0.21	-0.02	-0.01	0.24	0.26	0.23	0.35	0.69	-0.12	0.41	0.07	-0.13	1.76
1952	-0.01	-0.11	0.07	-0.24	-0.05	0.43	0.05	0.59	0.58	0.69	-0.20	0.03	1.83
1953	0.02	-0.11	0.16	-0.32	0.14	0.26	0.14	0.34	0.43	0.42	0.09	-0.02	1.55
1954	-0.06	0.30	0.25	0.08	-0.04	0.65	0.59	0.66	0.66	0.15	0.12	0.10	3.46
1955	-0.22	-0.23	0.33	0.04	0.16	0.42	0.16	-0.03	0.40	0.47	0.16	0.03	1.69
1956	-0.10	-0.15	0.07	0.18	0.30	0.30	0.72	0.58	0.66	0.34	0.02	-0.14	2.78
1957	-0.13	-0.03	-0.17	-0.20	0.54	-0.01	0.54	0.52	-0.03	-0.08	-0.25	0.08	0.78
1958	-0.07	-0.04	0.11	-0.05	0.27	0.17	0.28	0.14	-0.32	0.30	0.02	0.06	0.87
1959	-0.01	-0.21	0.22	0.03	0.18	0.31	0.06	0.20	0.28	0.02	0.06	-0.14	1.00
1960	-0.03	-0.04	0.18	0.11	0.50	0.13	0.53	-0.09	0.31	-0.11	-0.04	-0.21	1.24
1961	0.07	-0.05	0.29	0.41	0.31	-0.09	0.00	0.38	0.06	0.40	-0.17	-0.04	1.57
1962	-0.07	0.16	0.24	0.01	0.40	0.01	0.63	0.63	0.22	0.31	-0.08	-0.11	2.35
1963	0.03	0.03	0.33	0.28	0.37	0.23	0.33	0.66	0.16	0.49	-0.19	-0.11	2.61
1964	-0.13	0.01	0.15	0.15	0.18	0.47	0.50	0.34	0.23	0.47	0.05	-0.17	2.25
1965	0.02	-0.11	-0.02	0.34	-0.09	0.37	0.56	0.39	0.19	0.39	0.03	-0.34	1.73
1966	-0.21	-0.06	0.25	0.11	0.05	0.45	0.50	0.14	0.33	0.01	0.15	-0.13	1.59
1967	0.06	-0.03	0.23	-0.08	-0.03	0.40	0.29	0.54	0.40	0.34	0.26	-0.44	1.94
1968	-0.19	-0.02	0.13	0.21	-0.01	-0.08	0.31	0.47	0.28	0.28	-0.01	0.10	1.47
1969	0.17	-0.04	0.25	0.17	0.03	0.48	0.37	0.63	0.47	0.27	0.12	-0.25	2.67
1970	0.03	-0.03	0.03	0.15	0.05	0.38	0.40	0.43	0.21	-0.34	0.17	0.10	1.58
1971	0.14	0.04	0.22	0.34	0.03	0.42	0.40	0.28	0.22	0.20	0.10	-0.34	2.05
1972	-0.14	0.21	0.01	0.16	0.23	0.34	0.14	0.38	0.13	0.07	-0.05	-0.04	1.44
1973	0.02	0.07	0.00	0.02	0.25	-0.03	0.22	0.32	-0.12	-0.01	0.35	0.20	1.29
1974	0.08	0.28	0.22	0.21	0.11	0.45	0.40	0.23	-0.02	0.10	-0.13	0.09	2.02
1975	0.19	0.07	0.12	-0.01	0.18	0.09	0.26	0.40	0.37	0.06	0.12	0.03	1.88
1976	0.11	0.21	-0.03	0.21	0.00	0.05	0.21	0.55	0.30	0.16	0.00	-0.20	1.57
1977	-0.07	0.22	0.01	0.11	0.38	0.32	0.52	0.23	0.34	0.37	-0.19	0.04	2.28
1978	-0.18	0.16	0.24	0.36	0.28	0.28	0.53	0.44	0.43	0.48	-0.14	0.08	2.96
1979	0.04	0.22	0.23	0.04	0.11	0.54	0.06	0.42	0.06	0.29	0.10	-0.07	2.04
1980	-0.08	0.16	-0.12	0.16	0.11	0.58	0.65	0.75	0.36	0.22	0.05	0.14	2.98
1981	0.05	-0.06	0.10	0.25	0.09	-0.11	0.29	0.54	0.22	0.09	0.12	0.06	1.64
1982	-0.03	-0.06	0.06	0.04	0.20	0.14	0.44	0.53	0.49	0.12	-0.07	-0.12	1.74
1983	0.19	0.03	0.23	0.26	0.00	0.20	0.46	0.17	0.23	0.38	-0.03	0.03	2.15
1984	0.03	0.10	0.30	0.34	0.26	0.35	0.51	0.48	0.37	-0.38	0.02	0.04	2.42
1985	-0.06	0.01	0.17	0.24	0.29	0.50	0.40	0.64	0.33	-0.25	-0.02	0.12	2.37
1986	0.20	0.13	0.34	0.15	-0.10	-0.09	0.64	0.47	0.20	0.05	-0.25	-0.05	1.69
1987	0.05	-0.19	0.27	0.47	0.12	0.10	0.40	0.58	0.32	0.48	-0.24	-0.01	2.35
1988	0.20	0.07	0.06	0.28	0.53	0.49	0.32	0.38	0.40	0.27	0.24	-0.18	3.06
1989	-0.38	0.07	-0.02	0.33	-0.04	-0.47	0.43	0.52	0.43	0.33	0.15	-0.02	1.33
1990	-0.34	-0.01	0.04	0.22	0.05	0.29	0.40	0.67	0.36	0.26	-0.03	-0.14	1.77
1991	-0.42	-0.13	0.20	-0.32	0.03	0.21	0.48	0.48	0.43	0.47	0.13	-0.15	1.41
1992	-0.10	0.01	0.11	0.16	0.24	0.38	0.51	0.57	0.50	0.36	-0.01	-0.15	2.58
1993	-0.06	0.06	-0.02	0.07	0.10	0.18	0.83	0.89	0.78	0.17	0.05	0.05	3.10
1994	0.08	-0.06	0.28	0.18	0.02	0.35	0.50	0.34	0.43	-0.46	0.23	-0.08	1.81
1995	0.42	0.13	-0.09	0.04	0.12	0.42	0.28	0.32	0.26	0.35	0.08	-0.17	2.16
1996	0.10	0.28	0.25	0.18	0.47	0.18	0.40	0.15	0.12	0.27	0.09	0.06	2.55
1997	0.02	-0.10	0.01	0.03	0.15	0.28	0.58	0.49	0.44	0.14	0.04	0.00	2.08
1998	-0.17	-0.06	0.26	0.32	0.57	0.64	0.81	0.37	0.11	0.00	-0.06	0.07	2.86
1999	-0.09	0.31	0.16	0.43	0.24	0.22	0.47	0.89	0.53	0.36	0.36	0.07	3.95
2000	0.18	0.20	-0.02	-0.01	-0.07	0.18	0.64	0.77	0.43	0.37	-0.66	-0.06	1.95
2001	-0.10	0.05	-0.14	0.33	0.38	-0.23	0.58	0.38	0.02	0.13	-0.05	-0.04	1.31
2002	0.09	0.12	0.09	0.24	0.39	0.27	0.26	0.42	0.34	-0.35	0.16	-0.31	1.72
2003	0.22	-0.23	0.20	0.24	0.40	0.07	0.33	0.40	0.17	0.31	-0.08	0.13	2.16
2004	-0.16	-0.10	0.15	0.16	0.11	-0.13	0.57	0.53	0.59	0.12	-0.41	0.11	1.54
2005	0.04	-0.11	0.21	0.30	0.32	0.52	0.33	0.41	0.32	0.55	0.15	0.09	3.13
2006	0.06	-0.02	0.17	0.19	0.31	0.29	0.14	0.56	0.44	0.43	0.25	-0.06	2.76
2007	-0.19	0.12	0.24	0.15	0.13	0.20	-0.09	0.53	0.49	0.37	0.09	0.03	2.07
2008	0.02	-0.05	0.03	0.23	0.23	0.33	0.61	0.14	0.17	0.30	0.03	0.01	2.05
2009	0.23	0.20	-0.02	0.16	0.35	0.69	0.43	0.54	0.24	-0.54	0.25	-0.14	2.39
2010	0.09	-0.04	0.25	0.40	0.46	0.51	0.24	0.83	0.54	0.64	0.11	0.23	4.26
2011	-0.08	0.14	0.37	0.46	0.41	0.62	0.57	0.98	0.54	0.52	0.06	-0.26	4.33
2012	-0.08	0.03	-0.06	0.18	0.40	0.38	0.14	0.65	0.14	0.45	0.29	-0.10	2.42
2013	-0.27	-0.01	0.30	0.11	0.20	0.30	0.53	0.71	0.26	0.00	0.24	0.10	2.47
2014	0.19	0.01	0.07	0.20	0.03	0.04	0.39	0.44	0.31	0.18	-0.01	-0.08	1.77
2015	-0.21	0.04	-0.22	-0.18	-0.17	0.23	0.71	0.61	0.44	-0.02	-0.26	-0.05	0.92
2016	0.03	0.13	0.09	-0.13	-0.04	0.31	0.55	0.02	0.52	0.49	0.15	-0.13	1.99
2017	0.00	0.19	0.09	0.12	-0.11	0.05	0.45	-0.06	0.68	0.49	0.24	-0.04	2.10
2018	-0.06	-0.23	0.17	0.23	0.41	0.39	0.35	0.49	-0.21	0.00	-0.04	-0.32	1.18
MIN	-0.42	-0.23	-0.22	-0.32	-0.26	-0.47	-0.09	-0.10	-0.32	-0.55	-0.66	-0.44	0.14
MAX	0.42	0.31	0.37	0.47	0.57	0.69	0.83	0.98	0.78	0.69	0.44	0.23	4.33
AVG	-0.02	0.03	0.12	0.13	0.17	0.25	0.38	0.44	0.30	0.21	0.01	-0.06	1.97

LAKE STEINHAGEN
NET EVAPORATION DEPTHS
UNITS: FEET

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
1940	0.01	-0.16	0.13	-0.19	0.26	-0.05	0.33	-0.11	0.41	0.20	-0.20	0.12	0.75
1941	0.13	0.06	0.06	0.13	-0.24	0.08	0.03	0.43	-0.06	-0.35	0.31	0.01	0.59
1942	0.11	0.08	0.07	-0.03	0.20	-0.01	0.21	0.09	0.28	0.35	0.12	-0.08	1.39
1943	0.03	0.23	-0.01	0.23	0.13	0.28	0.08	0.59	0.16	0.38	-0.01	-0.10	1.99
1944	-0.21	0.05	-0.07	-0.10	-0.34	0.41	0.54	0.11	0.23	0.41	-0.32	-0.30	0.41
1945	0.14	0.00	-0.04	0.01	0.14	0.13	0.10	0.19	0.26	-0.04	0.08	-0.07	0.90
1946	-0.19	0.07	0.06	0.15	-0.28	0.18	0.29	0.34	0.20	0.16	-0.20	0.01	0.79
1947	-0.05	0.22	0.07	0.09	-0.02	0.25	0.47	0.43	0.50	0.35	-0.21	-0.19	1.91
1948	-0.10	-0.04	0.13	0.12	0.15	0.51	0.32	0.48	0.33	0.39	-0.47	0.01	1.83
1949	-0.33	-0.08	-0.02	0.08	0.32	0.16	0.12	0.44	0.31	-0.28	0.30	-0.09	0.93
1950	0.20	-0.04	0.27	-0.03	0.12	0.62	0.29	0.48	0.13	0.32	0.13	0.06	2.55
1951	-0.24	-0.05	-0.05	0.23	0.25	0.24	0.33	0.67	-0.12	0.42	0.09	-0.14	1.63
1952	-0.02	-0.17	0.04	-0.24	0.04	0.43	0.02	0.57	0.58	0.70	-0.21	0.06	1.80
1953	0.08	-0.10	-0.06	-0.37	0.25	0.25	0.16	0.33	0.45	0.44	0.09	0.02	1.54
1954	-0.03	0.30	0.25	0.10	-0.03	0.64	0.56	0.67	0.65	0.16	0.14	0.11	3.52
1955	-0.22	-0.19	0.31	0.01	0.15	0.40	0.14	-0.09	0.38	0.48	0.15	0.02	1.54
1956	-0.09	-0.09	0.10	0.15	0.26	0.30	0.72	0.58	0.65	0.34	0.02	-0.19	2.75
1957	-0.10	-0.04	-0.15	-0.35	0.49	-0.07	0.54	0.50	-0.04	-0.04	-0.35	0.08	0.47
1958	0.10	0.06	0.13	-0.04	0.13	0.18	0.26	0.15	-0.67	0.24	-0.01	0.03	0.56
1959	-0.06	-0.26	0.21	-0.10	0.16	0.32	-0.03	0.19	0.28	0.02	0.07	-0.17	0.63
1960	-0.09	-0.12	0.16	0.08	0.49	0.14	0.49	-0.10	0.32	-0.14	0.02	-0.33	0.92
1961	0.13	-0.04	0.02	0.30	0.31	-0.02	0.17	0.38	0.18	0.42	-0.16	-0.20	1.49
1962	-0.08	0.16	0.22	0.01	0.38	0.02	0.64	0.61	0.24	0.31	-0.08	-0.12	2.31
1963	0.03	0.02	0.31	0.27	0.38	0.22	0.33	0.65	0.15	0.49	-0.20	-0.06	2.59
1964	-0.10	0.06	0.10	-0.03	0.18	0.48	0.48	0.34	0.21	0.48	0.04	-0.17	2.07
1965	0.04	-0.17	-0.03	0.36	-0.04	0.39	0.54	0.37	0.19	0.39	0.02	-0.36	1.70
1966	-0.24	-0.01	0.26	-0.03	0.05	0.45	0.49	0.14	0.32	0.01	0.14	-0.12	1.46
1967	0.07	-0.03	0.23	-0.06	-0.02	0.40	0.29	0.53	0.41	0.33	0.27	-0.48	1.94
1968	-0.26	-0.04	0.04	-0.22	0.01	-0.01	0.30	0.45	0.12	0.25	-0.10	-0.16	0.38
1969	0.11	-0.15	0.01	-0.02	0.18	0.48	0.31	0.62	0.46	0.28	0.13	-0.25	2.16
1970	0.04	0.00	-0.04	0.17	0.04	0.41	0.41	0.48	0.20	-0.36	0.19	0.11	1.65
1971	0.15	0.03	0.22	0.35	0.04	0.43	0.40	0.26	0.20	0.21	0.10	-0.25	2.14
1972	-0.12	0.23	0.06	0.19	0.38	0.36	0.13	0.38	0.10	0.07	-0.05	-0.13	1.60
1973	-0.14	0.17	-0.05	0.12	0.36	-0.07	0.26	0.38	-0.04	0.04	0.32	0.09	1.44
1974	-0.11	0.25	0.20	0.27	0.12	0.43	0.40	0.21	0.03	0.10	-0.21	0.01	1.70
1975	0.20	0.05	0.13	0.03	-0.11	0.21	0.24	0.47	0.37	0.08	0.15	0.05	1.87
1976	0.15	0.17	-0.08	0.23	0.14	0.11	0.22	0.54	0.31	0.16	0.01	-0.13	1.83
1977	-0.04	0.19	0.02	0.15	0.40	0.36	0.52	0.23	0.34	0.36	-0.25	0.04	2.32
1978	-0.24	0.16	0.25	0.37	0.29	0.22	0.50	0.40	0.15	0.49	-0.11	0.13	2.61
1979	-0.16	-0.04	0.13	0.36	0.05	0.56	0.09	0.45	0.19	0.33	0.25	0.01	2.22
1980	0.00	0.21	-0.19	0.17	-0.05	0.60	0.65	0.74	0.31	0.20	0.06	0.15	2.85
1981	0.07	-0.06	0.14	0.26	0.11	0.16	0.36	0.53	0.26	0.09	0.14	0.05	2.11
1982	-0.01	-0.10	0.07	-0.14	0.26	0.18	0.44	0.51	0.49	0.12	-0.22	-0.37	1.23
1983	0.15	-0.10	0.13	0.24	0.14	0.19	0.45	0.17	0.31	0.39	0.01	-0.13	1.95
1984	0.03	0.13	0.27	0.38	0.20	0.36	0.51	0.47	0.38	-0.30	0.07	0.09	2.59
1985	-0.05	-0.07	0.19	0.26	0.31	0.50	0.40	0.61	0.30	-0.37	0.02	0.14	2.24
1986	0.20	0.16	0.30	0.14	-0.02	0.11	0.71	0.44	0.16	0.04	-0.33	0.03	1.94
1987	0.07	-0.22	0.34	0.46	0.09	0.04	0.39	0.54	0.29	0.45	-0.35	-0.11	1.99
1988	0.19	0.03	0.01	0.25	0.50	0.43	0.30	0.32	0.35	0.27	0.25	-0.24	2.66
1989	-0.37	0.10	-0.12	0.34	0.15	-0.58	0.65	0.50	0.44	0.32	0.13	-0.03	1.53
1990	-0.45	0.02	-0.08	0.28	0.06	0.28	0.38	0.66	0.31	0.23	-0.04	-0.17	1.48
1991	-0.42	-0.05	0.22	-0.26	-0.07	0.17	0.49	0.43	0.41	0.43	0.16	-0.09	1.42
1992	-0.04	0.14	0.24	0.13	0.20	0.31	0.46	0.55	0.48	0.34	-0.05	-0.14	2.62
1993	-0.02	0.07	-0.05	0.07	0.04	-0.03	0.78	0.86	0.73	0.15	0.01	0.04	2.65
1994	-0.13	0.03	0.29	0.16	0.07	0.34	0.48	0.30	0.43	-0.17	0.23	-0.07	1.96
1995	0.45	0.15	0.00	-0.05	0.07	0.41	0.21	0.31	0.29	0.32	0.04	-0.17	2.03
1996	0.05	0.26	0.24	0.16	0.45	0.14	0.38	0.07	0.14	0.30	0.08	0.09	2.36
1997	0.05	-0.15	0.16	0.07	0.15	0.39	0.56	0.46	0.41	0.15	0.00	-0.01	2.24
1998	-0.08	-0.04	0.31	0.32	0.56	0.61	0.77	0.33	-0.27	0.00	-0.10	0.05	2.46
1999	-0.12	0.28	0.08	0.46	0.18	0.17	0.38	0.85	0.52	0.34	0.34	0.01	3.49
2000	0.17	0.19	0.00	-0.02	-0.07	0.20	0.63	0.74	0.43	0.34	-0.68	-0.01	1.92
2001	-0.12	0.09	-0.18	0.34	0.39	-0.28	0.58	0.32	0.01	0.15	-0.15	0.13	1.28
2002	0.11	0.10	0.08	0.23	0.38	0.22	0.23	0.34	0.28	-0.41	0.41	-0.35	1.62
2003	0.26	-0.21	0.17	0.23	0.38	0.02	0.29	0.32	0.09	0.27	-0.03	0.09	1.88
2004	-0.14	-0.04	0.19	0.15	-0.01	-0.25	0.56	0.49	0.47	0.11	-0.50	0.09	1.12
2005	0.05	-0.10	0.23	0.28	0.27	0.50	0.25	0.36	0.28	0.56	0.10	0.05	2.83
2006	0.04	-0.04	0.16	0.12	0.27	0.26	0.15	0.57	0.40	0.15	0.31	-0.26	2.13
2007	0.02	0.18	0.24	0.09	0.16	0.18	-0.07	0.51	0.42	0.37	0.04	0.04	2.18
2008	-0.03	-0.04	0.05	0.23	0.21	0.31	0.55	0.12	0.12	0.26	0.04	-0.04	1.78
2009	0.22	0.18	-0.02	0.11	0.40	0.67	0.35	0.50	0.20	-0.64	0.28	-0.18	2.07
2010	0.06	-0.03	0.25	0.38	0.43	0.43	0.18	0.74	0.50	0.62	0.05	0.16	3.77
2011	-0.08	0.13	0.34	0.45	0.43	0.61	0.52	0.95	0.53	0.53	0.05	-0.25	4.21
2012	-0.07	-0.14	-0.22	0.12	0.39	0.36	0.07	0.60	0.23	0.46	0.29	-0.13	1.96
2013	-0.34	-0.05	0.32	0.02	0.16	0.31	0.50	0.69	0.15	-0.09	0.21	0.13	2.01
2014	0.17	-0.03	0.06	0.22	0.05	0.06	0.41	0.39	0.29	0.18	-0.03	-0.12	1.65
2015	-0.13	0.07	-0.11	-0.14	0.03	0.36	0.71	0.58	0.38	-0.09	-0.22	-0.01	1.43
2016	0.10	0.16	0.01	-0.11	0.16	0.43	0.50	0.02	0.51	0.48	0.15	-0.17	2.24
2017	-0.07	0.17	0.04	0.06	-0.19	-0.04	0.46	-0.11	1.13	0.46	0.21	-0.08	2.04
2018	-0.13	-0.33	0.11	0.31	0.38	0.30	0.32	0.42	-0.29	-0.03	-0.12	-0.27	0.67
MIN	-0.45	-0.33	-0.22	-0.37	-0.34	-0.58	-0.07	-0.11	-0.67	-0.64	-0.68	-0.48	0.38
MAX	0.45	0.30	0.34	0.46	0.56	0.67	0.78	0.95	1.13	0.70	0.41	0.16	4.21
AVG	-0.02	0.02	0.10	0.12	0.17	0.26	0.38	0.42	0.28	0.20	0.01	-0.07	1.87

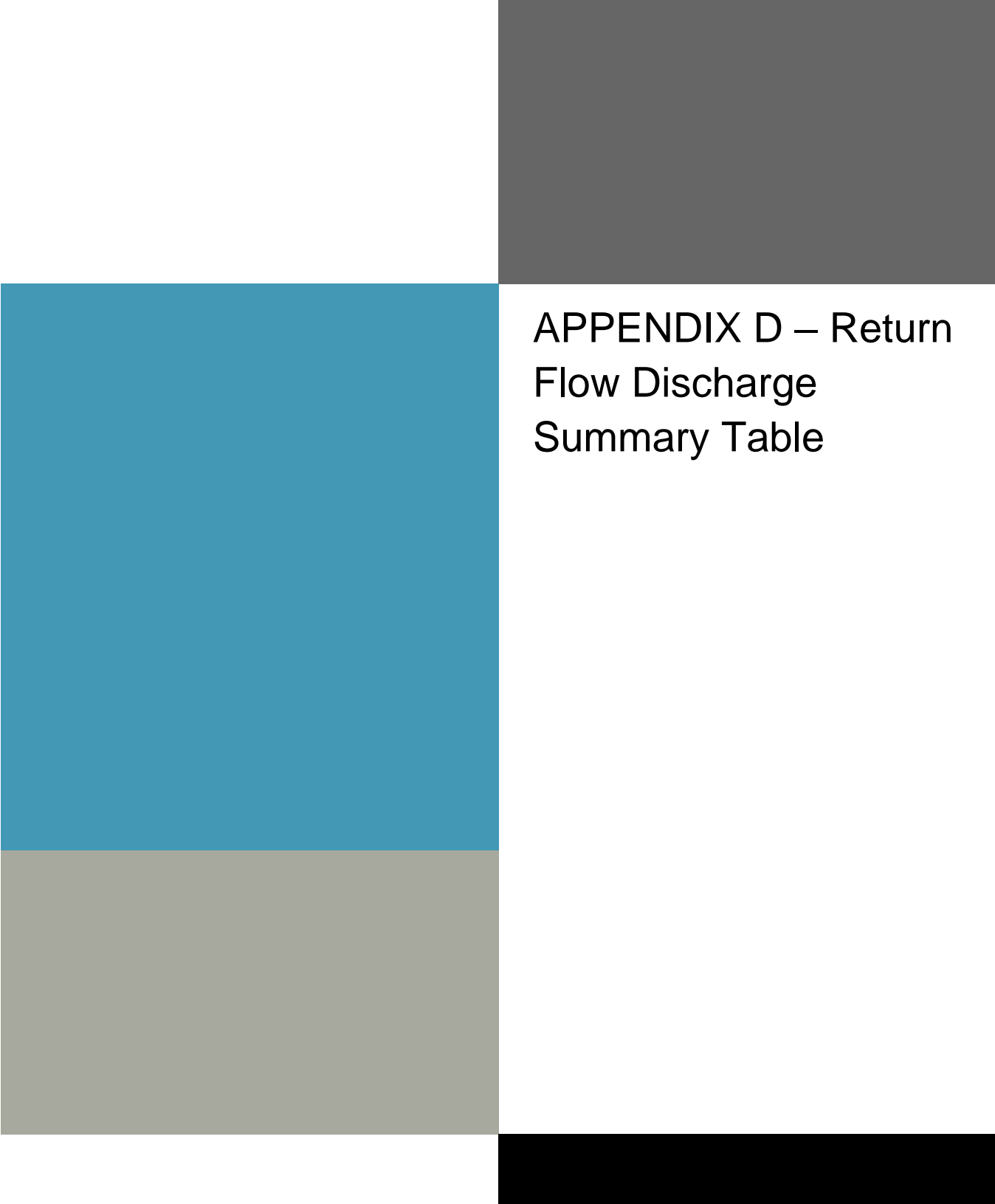


APPENDIX C – Water Rights Summary Table

Subbasin	Water Right ID	Owner	Type	2014-2018 Avg Annual Reported Diversion	Notes
ANAL	C 4080	ALFORD, E LANDON; ALFORD, JOHN R JR	IRR	0	
ANAL	C 4839	Estate of C R Kelley	IND	0	
ANAL	C 4841	RICHARDSON, CHARLES H	IRR	0	
ANAL	C 4846	BREWER, FOSTER L	IRR	0	
ANAL	C 4847	ANCWCID#1	IND	134.6	Stryker Creek SES (Stream Electric Station)
ANAL	C 4857	WELLBORN, BOBBY J	IRR	0	
ANAL	C 4858	B R DARBY JR	IRR	0	
ANAL	C 4859	CHRISTOPHER, LUTHER DEAN	IRR	0	
ANAL	C 4860	SIMPSON, BOBBIE JEAN THOMAS	IRR	0	
ANAL	C 4861	CHRISTOPHER, LUTHER DEAN	IRR	0	
ANAL	C 4862	KELLERMAN, CARRIE; KELLERMAN, R M	IRR	0	
ANAL	Claim 2836	WILLIAM CLOYD WALDRUP	IRR	0	
ANAL	Claim 3082	WILLIAM CLOYD WALDRUP	IRR	0	
ANAL	P 4055	Margot Hill; Smith Hill, Jr.	IRR	0	
ANAL	P 4228	Angelina & Neches River Authority	MUN, DOM	0	
ANLU	C 3824	Goodman Et. Al	IRR	0	
ANLU	C 4448	CLARENCE M FORE	IRR	0	
ANLU	C 4864	CITY OF NACOGDOCHES	MUN	6931.25	
ANLU	C 4865	Mast Cattle & Timber	IRR	0	
ANLU	C 4866	STRIPLING, W B JR	IRR	0	
ANLU	C 4867	Mast Cattle & Timber	IRR	0	
ANLU	C 5134	S B HAYTER TRUST	IRR	0	
ANLU	C 5555	TPWD	AGR	90.75	
ANLU	Claim 5279	HOMER STONE	IRR	0	
ANLU	P 4134	MIG Blueberry Farms, LLC	IRR	0	
ANLU	P 5486	NORMAN, BETTYE V; NORMAN, CHARLES A	IRR	1.64	
ANSR	C 4395	Frank Sharp Tucker; TUCKER, STEPHEN B JR	IRR	0	
ANSR	C 4396	ALDERS, NOLAN BAILEY	IRR	0	
ANSR	C 4397	GILCREASE, GRACE F	IRR	0	
ANSR	C 4410	Georgia-Pacific Wood Products LLC	IND	25.26	
ANSR	C 4869	ROBERT W MURPHEY	IRR	0	
ANSR	C 4872	Mast Cattle & Timber	IRR	0	
ANSR	C 4873	Mast Cattle & Timber	IRR	0	
ANSR	Claim 3509	NACOGDOCHES LUMBER COMPANY	IND	0	
ANSR	P 3943	IRWIN, BELINDA; IRWIN, DON	IRR	0	
ANSR	P 4393	City of Lufkin	IND	583.26	Water right purchased by City of Lufkin from Lufkin Paper Mill.
ATCH	C 4399	Shelby County Fresh Water Supply District 1	MUN	0	
ATCH	C 4401	FREDERICK, CHARLES; FREDERICK, GEORGE B	IND	0	
ATCH	C 4402	Frank Sharp Tucker; TUCKER, STEPHEN B JR	DOM, LIV	0	
ATCH	C 4403	Mast Cattle & Timber	IRR	0	
ATCH	C 4404	CITY OF CENTER	MUN	3421.51	
ATCH	C 4406	SCOGGINS, PAT	IRR	0	
ATCH	C 5147	B A THRUSTON	IRR	0	
ATCH	P 3966	FEARS, FRANCES E; FEARS, LOUIS G	IRR	0	
AYSA	C 4409	CITY OF SAN AUGUSTINE	MUN	707.17	
EFACU	C 4849	STEPHEN F AUSTIN UNIVERSITY	AGR	0	
EFACU	P 5314	HAM, C D JOSH	AGR, AGU, IND	0	
EFACU	P 5629	MARK WILLIAM VANHAM	IRR	0	
KIBR	C 3244	EASLEY, CHARLES R EASLEY, MARGARET	IRR	0	
KIBR	C 3245	BEASLEY, ARCH A JR	IRR	0	
KIBR	C 3247	MEWBOURN, JACK Kathie Mewbourn	IRR	0	
KIBR	C 3248	Forked Lake LLC	IRR	0	
KIBR	C 3250	Eagles Nest Preserve, LLC THURSTON, DAVID L; Eagles Nest Preserve, LLC	IRR	0	
KIBR	C 3251	DUNCAN, W L	IRR	0	
KIBR	C 3252	COLLINS, ANN H; COLLINS, DWAYNE	IRR	0	
KIBR	C 3253	TED L HAND	IRR	11.29	

Subbasin	Water Right ID	Owner	Type	2014-2018 Avg Annual Reported Diversion	Notes
KIBR	P 5746	Dekker, Andre Et. Al.	IRR	0	Permittee may not impound or divert State water. Ponds must be kept full with groundwater.
MUJA	Claim 3078	CLOYD WALDRUP	IRR	0	
MUJA	Claim 6217	JOE W BLACKMON	MUN	0	
MUJA	P 13356	BTS ENTERPRISES	IRR	0	
MUTY	C 4850	REYNOLDS, ARCHIE E	IRR	0	Pinkerton Lake. Originally Claim 4030.
MUTY	C 4853	CITY OF TYLER	MUN, IND, DOM	12485.82	
MUTY	P 13356	Bts Enterprises, Inc.	IRR	0	
MUTY	P 3733 (Claim 4030)	LCJ Land Investments; LP Connie Pinkerton; Jeff Pinkerton	IRR	0	
NEAL	C 3254	UPPER NECHES RIVER MUNICIPAL WATER AUTHORITY	MUN	3363.27	Data provided by UNRMWA for 1997-2018 period.
NEAL	C 3266	WALKER, ALEEN TAYLOR	IRR	0	
NEAL	C 3269	EZELL, EVELYN	IRR	0	
NEAL	C 3274	CITY OF JACKSONVILLE	MUN	730.14	
NEAL	C 3275	CRAIG BARBER; JEREMY BARBER	IRR	0	
NEAL	C 3276	KOLB, JOSEPH WALLACE; DON WALKER; LESNIEWSKI, LINDA KOLB; KOLB, NANCY MARIE; JOSEPH WALLACE KOLB, Et. Al.	IRR	0	
NEAL	C 3277	LENNON W BOLTON, Et. Al.	IRR	0	
NEAL	C 3278	EZELL, EVELYN	IRR	0	
NEAL	C 3279	EZELL, EVELYN	IRR	0	
NEAL	C 3280	WALLACE, GILBERT B III	IRR	0	
NEAL	C 3282	Charles R. Milford; Vernetta F. Walker	IRR	0	
NEAL	C 3283	Donna Moore; Gary Moore; Bettye S Carvell; Robert Carvell Jr	IRR	0	
NEAL	C 3284	BROWN, MARIE F	IRR	17.98	
NEAL	C 3285	Jeanine Murphy Sawyer	IRR	0	
NEAL	C 3287	Pernie Bailey Drilling Company	IRR	0	
NEAL	C 3288	James E. Tucker	IRR	0	
NEAL	C 3289	Aaron Clifton Henicke; Michael Thomas Henicke	IRR	0	
NEAL	C 3290	BRIMBERRY, E HUBERT	IRR	0	
NEAL	C 3291	CHESTER CUNNINGHAM	IRR	0	
NEAL	C 3293	BROWN, W A	IRR	0	
NEAL	C 3294	GRADY EDGE ET AL	IRR	0	
NEAL	C 3296	BLOUNT, JAMES ROBERT; CABANISS, ALLEN DWIGHT; CABANISS, HAROLD BRUCE	IRR	0	
NEAL	C 3297	MARTIN, E W	IRR	0	
NEAL	C 3298	James Bryan Lake GST Trust	IRR	0	
NEAL	C 3299	ADLONG, SADIE WILKINS; BOWLEY, BERNICE; DICKEY, MILDRED; LIVELY, JEAN	IRR	1.49	
NEAL	C 3301	REMINGTON SPRINGLAKE RANCH, INC.	IRR	0	
NEAL	C 3303	G S Farms, INC.	IRR	0	
NEAL	C 4219	CITY OF RUSK	IRR	0	
NEAL	C 4543	BILLY J & CAROL E BRADSHAW	IRR	0	
NEAL	Claim 1853	H H MURPHY ET UX	IRR	0	
NEAL	Claim 2293	HAROLD & ANNIE MAE CARNES	IRR	0	
NEAL	Claim 3987	W P BUCKTHAL	IRR	0	
NEAL	Claim 5121	ROBERT L TARRANT ET AL	IRR	0	
NEAL	P 3292	CUNNINGHAM, BOBBY; CUNNINGHAM, DONALD	IRR	0	
NEAL	P 3295	CUNNINGHAM, BOBBY; CUNNINGHAM, JUANICE	IRR	0	
NEAL	P 3921	City of Rusk	MUN	0	
NEAL	P 4094	Texas A & M University	IRR	0	
NEAL	P 4220	BRADSHAW, BILLY J; BRADSHAW, CAROL E	IRR	0	
NEAL	P 4272	TOSH, HARRY R; TOSH, HAZEL M	IRR	0	
NEBA	App. 2298	LNVA	IRR, IND, MUN	0	
NEBA	C 4411 M	LNVA	RR, IND, MUN, MII	245139	
NEBA	C 4415 IN	CITY OF BEAUMONT	IND, MUN	18711.84	
NEBA	C 4432	IDYLVILD GOLF CLUB, INC.	IRR	86.6	
NEBA	Certified Filing 134	LNVA	IRR	0	
NEBA	Certified Filing 869	LNVA	MUN	0	
NEBA	Certified Filing 869	LNVA	MUN	0	
NEDI	C 4382	Texas A & M University	IRR, AGR	0	
NEDI	C 4383	CROWN COLONY COUNTRY CLUB INC	IRR	127.25	

Subbasin	Water Right ID	Owner	Type	2014-2018 Avg Annual Reported Diversion	Notes
NEDI	C 4384	Georgia-Pacific Panel Products LLC	IND	1526.32	Originally Claim 2710 and App 2482
NEDI	C 5389	DIBOLL, CITY OF	IRR	14.89	
NEDI	P 4380	TEMPLE-INLAND FOREST PROD CORP	IRR	81.87	
NEEV	C 4414	TEXAS FOREST SERVICE	IRR	0	
NENE	C 3261	LEWIS, LOWELL V JR	IRR	0.78	Water right included in WAM but not WR Active database
NENE	P 3878	Arborgen Inc.	IRR	0	
NENE	P 5228	James Robet Galapsie	IRR	0	
NEPA	C 3221	LOVE, A C LOVE, LOUISE R	AGR, IRR	0	
NEPA	C 3222	Rhines Lake Association Inc.	MIN	0	
NEPA	C 3223	Anne H. Hamm; HAMM, TZ; Baker Lucas	AGR, IRR	0	
NEPA	C 3225	OTAKA INC	IRR	0	
NEPA	C 3226	DAVID LAWRENCE PAYNE	AGR, IRR	0	
NEPA	C 3230	Bell Sand Company Inc.	MIN	3.21	
NEPA	C 3231	BELL SAND CO.	MIN	3.21	
NEPA	C 3233	LARRY JOE BURKS ET UX	IRR	0	
NEPA	C 3235	EIKNER, HOMER W	AGR, IRR	0	
NEPA	C 3236	City of Tyler & Genecov Investments, LTD.; Genecov Investments, LTD.	AGR, IRR	0	
NEPA	C 3237	CITY OF TYLER	MUN	0	
NEPA	C 3237	CITY OF TYLER	IRR	284.86	
NEPA	C 3237	CITY OF TYLER	IND	0	
NEPA	C 3238	GREENBRIER LAKE CLUB	IND	0	
NEPA	C 3254	UPPER NECHES RIVER MUNI W A	MUN	16120.49	
NEPA	C 3254	UPPER NECHES RIVER MUNI W A	IRR	285.55	
NEPA	C 3256	ATHENS MUNC WATER AUTH	MUN	1610.3	
NEPA	C 3256	ATHENS MUNC WATER AUTH	IND	2492.66	
NEPA	C 3259	TEX IRON INC	MIN	0	
NEPA	C 3438	GARDEN VALLEY SPORTS RESORT IN	IRR	0	
NEPA	C 5041	TEXAS EASTMAN COMPANY	IND	1.65	
NEPA	P 3224	Garden Valley Golf Reseort	IRR	44.77	
NEPA	P 5232	Debbie Waldrop; Robert R. Waldrop	AGR, AQU, IND	8	
NERO	C 4386	FLOURNOY, DON MICHAEL; FLOURNOY, M M; FLOURNOY, MORGAN PITRE; FLOURNOY, ROBERT L; FLOURNOY, THOMAS GIBBS; JOHNSON, JULIANNE FLOURNOY	IRR	0	
NERO	C 4387	CREWS, EVELYN; CREWS, W C III; CREWS, W C JR	IRR	0	
NERO	P 5484	BOYKIN, EUGENE LINDSEY	IRR	0	
NETB	C 4412	TEXAS PARKS & WILDLIFE	IND	525.4	Sheet says canceled 1986, but data continues.
NETB	C 4413	Tin LLC; Crown Pine Timber 1, L.P.	IND	90.58	Formerly owned by Temple Inland
NETB	Certified Filing 381	CITY OF HENDERSON	IND	0	Water right included in WAM but not WR Active database
NETB	P 5027	LOUISIANA-PACIFIC CORPORATION	IND	0	
PISL	C 4431	JIM BEST	IRR	0	
PISL	P 5508	HENDERSON PARTNERS LTD	IRR	0	
VIKO	C 4426	B F BOYKIN	IRR	0	Birdwell Lake
VIKO	C 4429	SHIRLEY PRUNTY	IRR	0	
VIKO	C 4430	STANTON, LOIS ANNE; STANTON, ROBERT E	IRR	0	

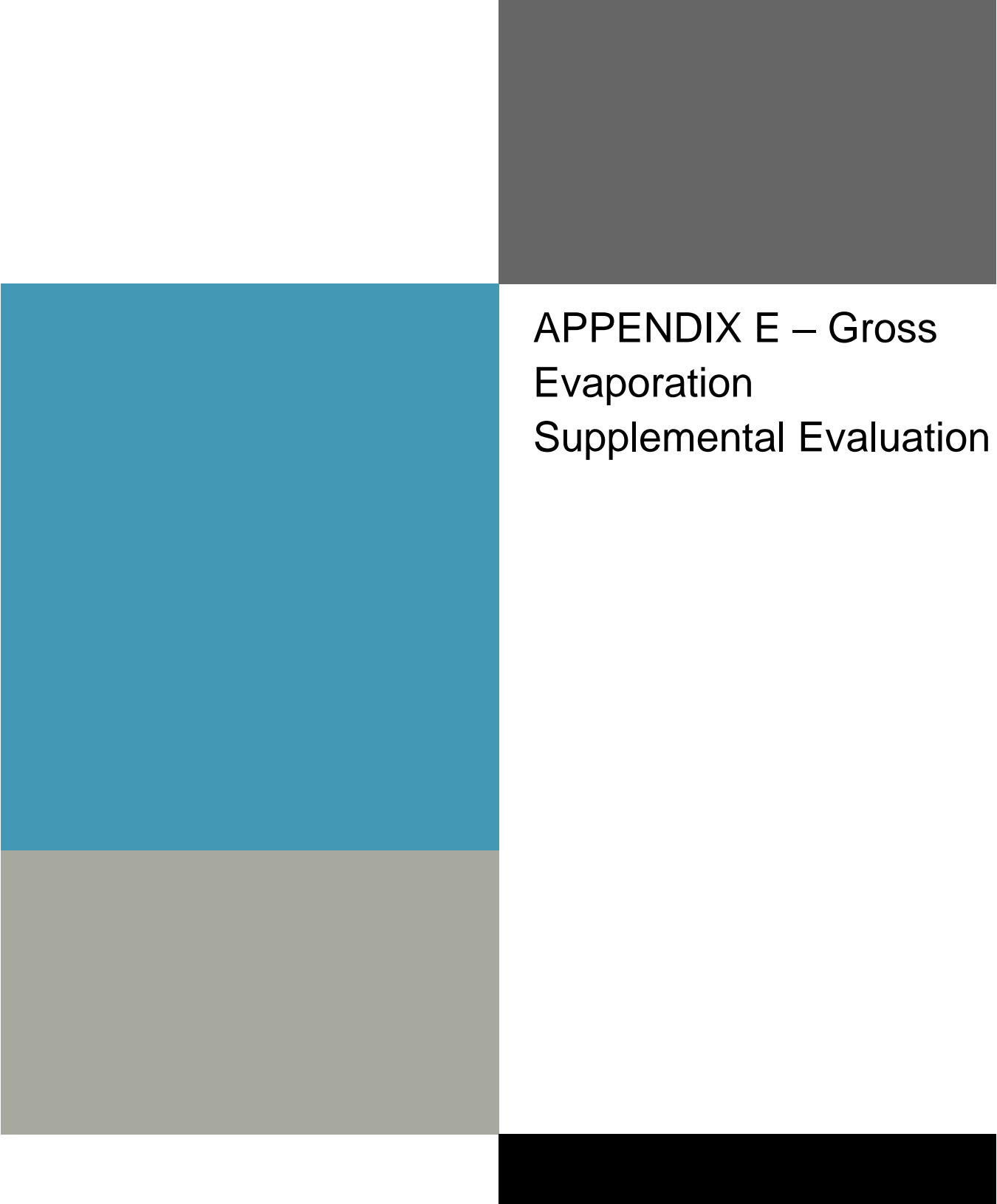
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APPENDIX D – Return Flow Discharge Summary Table

Subbasin	PNUM	NPDES No.	Owner	Facility Name	Permitted Discharge (mgd)	2014-2018 Average Annual Discharge (mgd)	Included in Original Flow Naturalization	Included in Updated Flow Naturalization	Notes
ANAL	00946-000	TX0001066	LUMINANT GENERATION CO LLC	Stryker Creek Electric Station	575.0	0	no	yes	Return flow is accounted for in water use. Only consumed amount (not diverted amount) is reported in water use.
ANAL	02973-000	TX0104175	Covia Holdings Corp. (prev. UNIMIN CORP)	Unimin Corp Troup Facility	Variable		no	no	Name changed to Covia in 2018.
ANAL	04414-000	TX0124842	City of Austin (prev. NACOGDOCHES POWER LLC)	Nacogdoches Power Electric Generating Plant	1.8	0.07	no	yes	Power generation operations began in 2012. Ownership transferred from Nacogdoches Power LLC to City of Austin in 2019.
ANAL	05154-000	TX0136093	CLEAR WATER SOLUTIONS LLC	Clear Water Solutions WWTP	0.0		no	no	
ANAL	10187-001	TX0052779	CITY OF HENDERSON	Southside WWTP	3.0	1.72	yes	yes	
ANAL	10187-002	TX0091910	CITY OF HENDERSON	Northside WWTF	1.0		no	no	
ANAL	10693-001	TX0024392	CITY OF JACKSONVILLE	Canada Street WWTP	--	--	no	yes	Operations terminated in 2014.
ANAL	10693-003	TX0100587	CITY OF JACKSONVILLE	Double Creek WWTF	2.9	2.54	yes	yes	
ANAL	12376-001	TX0087360	CITY OF NEW LONDON	City of New London South WWTF	0.1		no	no	
ANAL	14292-001	TX0124371	CARLISLE ISD	Carlisle ISD WWTF	0.0		no	no	
ANLU	04198-000	TX0121053	CAL-TEX LUMBER CO INC	Cal-Tex Lumber Co. Inc.	Variable		no	no	
ANSR	00368-000	TX0001643	VERDANT INDUSTRIES LLC	Lufkin Facility (Paper Mill)	Variable		no	no	
ANSR	00368-001	TX0001643	VERDANT INDUSTRIES LLC	Lufkin Mill	--	0	yes	yes	No current permit. Mill has ceased opertions.
ANSR	01737-000	TX0082261	GEORGIA-PACIFIC CHEMICALS LLC	Port Neches Operations	--		no	no	
ANSR	01820-000	TX0046892	GEORGIA-PACIFIC WOOD PRODUCTS LLC	Pineland Lumber Operations	Variable		no	no	
ANSR	05195-000	TX0136964	BAILEY BARK MATERIALS INC	Bailey Bark Materials	Variable		no	no	
ANSR	10249-001	TX0027154	CITY OF PINELAND	City of Pineland WWTF	0.2		no	no	
ANSR	10342-004	TX0055123	CITY OF NACOGDOCHES	Nacogdoches Plant 2A WWTF	12.9	6.62	yes	yes	
ANSR	10788-001	TX0023701	RAYBURN COUNTRY MUD	Rayburn Country WWTF	0.3		no	no	
ANSR	10998-001	TX0031283	BROOKELAND FWSD	Forest Hills WWTF	0.1		no	no	
ANSR	11337-001	TX0031275	WESTWOOD WSC	Westwood WSC WWTF	0.0		no	no	
ANSR	11588-001	TX0054127	OREAL INC	Twin Oaks MHP Oak Haven Subdivision	0.0		no	no	
ANSR	11620-001	TX0056154	ANGELINA & NECHES RIVER AUTHORITY	North Angelina County Regional WWTF	0.4		no	no	
ANSR	11772-001	TX0057673	CITY OF BROADDUS	City of Broaddus WWTF	0.1		no	no	
ANSR	11895-001	TX0068039	TEXAS AIRSTREAM HARBOR INC	Texas Airstream Harbor WWTF	0.0		no	no	
ANSR	13092-001	TX0099082	BROOKELAND ISD	Brookeland ISD WWTF	0.0		no	no	
ANSR	13161-001	TX0098744	STEPHEN F AUSTIN STATE UNIVERSITY	Piney Woods Conservation Center WWTF	0.0		no	no	
ANSR	13917-002	TX0137537	CHIRENO ISD	Chireno ISD WWTF	0.0		no	no	
ANSR	14345-001	TX0134449	WODEN ISD	Woden ISD WWTF	0.0		no	no	
ANSR	15021-001	TX0133329	ANGELINA COUNTY WCID NO 3	Angelina County WCID WWTF	0.1		no	no	
ANSR	15207-001	TX0135089	SHERRY SMITH MILNER (now WTIG)	Lakeview RV Park & Motel WWTF	0.0		no	no	
ANSR	15357-001	TX0136328	NEW WSC	New WSC WWTF	0.1		no	no	
ATCH	11304-001	TX0076503	CITY OF GARRISON	City of Garrison WWTF	0.1		no	no	
ATCH	14027-001	TX0118354	MARTINSVILLE ISD	Martinsville ISD WWTF	0.0		no	no	
ATCH	14352-002	TX0133311	CITY OF CENTER	Aiken SWTF	0.2		no	no	
AYSA	10268-001	TX0022349	CITY OF SAN AUGUSTINE	San Augustine WTF	0.9		no	no	
AYSA	10268-002	TX0122351	CITY OF SAN AUGUSTINE	San Augustine WTF	0.1		no	no	
AYSA	15339-001	TX0136182	NEW WATER SUPPLY CORPORATION	Plant 1 WTF	0.1		no	no	
EFACU	10437-001	TX0053937	CITY OF CUSHING	City of Cushing WWTF	0.1		no	no	
EFACU	14283-001	TX0122173	CITY OF MOUNT ENTERPRISE	City of Mt Enterprise WWTF	0.1		no	no	
KIBR	10540-001	TX0062707	CITY OF BROWNSBORO	City of Brownsboro WWTF	0.2		no	no	
KIBR	13972-001	TX0072087	CITY OF MURCHISON	Murchison WWTF	0.1		no	no	
KIBR	15423-001	TX0136743	SUNDOWN RANCH INC	Sundown Ranch WWTF	0.0		no	no	
KIBR	15651-001	TX0138240	CORNELIUS ERIKS AND SUSAN CHARLOTTE ERIKS	Staway Ranch RV Park WWTF	0.0		no	no	
MUJA	10304-001	TX0033529	CITY OF TROUP	City of Troup WWTF	0.3		no	no	
MUJA	10511-001	TX0054194	CITY OF ARP	City of Arp WWTF	0.2		no	no	
MUJA	10653-002	TX0047988	CITY OF TYLER	Southside WWTF	9.0	6.07	yes	yes	
MUJA	11222-001	TX0072770	CITY OF WHITEHOUSE	City of Whitehouse WWTF	1.5	0.66	no	yes	
MUJA	13000-001	TX0101010	TALL TIMBERS UTILITY CO INC	Tall Timbers WWTF	0.4		no	no	
MUJA	13168-001	TX0098795	LIBERTY UTILITIES WOODMARK SEWER CORP	Woodmark WWTF	0.4		no	no	
MUJA	13585-001	TX0107875	CITY OF NEW SUMMERFIELD	City of New Summerfiled WWTF	0.1		no	no	
MUTY	01590-002	TX0001449	--	Delek Refining LTD (formerly La Gloria Oil & Gas Co.)	--	0	yes	no	Stormwater discharge permit and outfalls are in NEPA watershed. Removed from calculations. No current permit.
NEAL	05269-000	TX0139114	NGO INDUSTRIAL HOLDINGS LLC	Palestine Power Peaking Facility	0.3		no	no	
NEAL	10181-002	TX0055239	CITY OF GRAPELAND	City of Grapeland WWTF	0.3		no	no	
NEAL	10214-002	N/A	--	City of Palestine - Wells Creek	--	0	yes	yes	Plant phased out in April 1999. No current permit
NEAL	10447-001	TX0054399	CITY OF RUSK	City of Rusk WWTF	1.8	0.95	yes	yes	
NEAL	15094-001	TX0134571	CRAFT-TURNEY WSC	Batton Loop Water Treatment	0.0		no	no	
NEBA	00493-000	TX0003891	WESTROCK TEXAS LP	Evadale Paper Mill	Variable	41.03	no	yes	
NEBA	00493-001	N/A	WESTROCK TEXAS LP	Evadale Paper Mill	--		yes	no	No current permit.
NEBA	00745-000	TX0002941	BNSF RAILWAY CO & TIMBER ROCK RAILROAD LLC	Timber Rock Railroad Silsbee Yard	Variable		no	no	
NEBA	01403-000	TX0003204	SOUTH HAMPTON RESOURCES INC	Bulk org chemicals manufacturing plant	Variable		no	no	
NEBA	10203-003	TX0095478	CITY OF KOUNTZE	City of Kountze WWTF	0.4	0.28	yes	yes	
NEBA	10282-001	TX0023736	CITY OF SILSBEE	South Plant WWTP	1.6	0.82	yes	yes	
NEBA	10282-002	TX0023728	CITY OF SILSBEE	North Plant WWTP	0.3	0.13	yes	yes	
NEBA	10678-001	TX0027693	HARDIN COUNTY WCID 1	Pinewood WWTF	0.3		no	no	
NEBA	10703-001	TX0023876	CITY OF SOUR LAKE	City of Sour Lake WWTF	0.6		no	no	
NEBA	11551-001	TX0054551	CITY OF BEVIL OAKS	City of Bevel Oaks WWTF	0.2		no	no	
NEBA	11709-001	N/A	LUMBERTON MUD	Permit inactive	--		yes	no	No current permit.

Subbasin	PNUM	NPDES No.	Owner	Facility Name	Permitted Discharge (mgd)	2014-2018 Average Annual Discharge (mgd)	Included in Original Flow Naturalization	Included in Updated Flow Naturalization	Notes
NEBA	11709-002	TX0092801	LUMBERTON MUD	Lumberton MUD WWTF	3.3	1.73	yes	yes	
NEBA	14183-001	TX0122564	EVADALE WCID 1	Evadale WCID WWTF	0.2		no	no	
NEBA	336-00576	N/A	--	--	--		yes	no	No current permit.
NEDI	01153-003	TX0001201	GEORGIA-PACIFIC PANEL PRODUCTS & GEORGIA-PACIFIC WOOD PRODUCTS SOUTH	Diboll Plant	Variable	1.14	yes	yes	
NEDI	03492-001	N/A	--	Northern Chipmill	--	0	yes	yes	No current permit. Mill has ceased opertions.
NEDI	10214-001	TX0024309	CITY OF LUFKIN	City of Lufkin - Hurricane Creek WWTF	11.3	5.48	yes	yes	
NEDI	10288-001	TX0024872	CITY OF DIBOLL	Diboll WWTF	2.0	0.68	yes	yes	
NEDI	10546-001	TX0025020	CITY OF ALTO	City of Alto WWTF	0.4		no	no	
NEDI	11196-001	TX0071021	CITY OF WELLS	City of Wells WWTF	0.2		no	no	
NEDI	11474-001	TX0056596	CITY OF KENNARD	City of Kennard WWTF	0.1		no	no	
NEDI	11826-001	TX0068985	CITY OF HUDSON	City of Hudson WWTF	0.6	0.45	yes	yes	Previous owner City of San Augustine.
NEDI	11826-001	TX0068985	CITY OF HUDSON	City of Hudson WWTF	0.6		yes	yes	Moved from AYSA to NEDI. Previous owner City of San Augustine.
NEDI	14086-001	TX0118966	APPLE SPRINGS ISD	Apple Springs ISD Wetlands WWTF	0.0		no	no	
NEDI	15234-001	TX0135267	FOREST WSC	Water Plant 2 WTF	0.0		no	no	
NEEV	01766-000	TX0006351	TEXAS ELECTRIC COOPERATIVES INC	Texas Electric Cooperatives Treating	Variable		no	no	
NENE	05144-000	TX0135861	APEX TEXAS POWER LLC	NECHES STATION PROJECT	1.5	0	no	yes	Facility to be constructed.
NENE	10441-001	TX0033456	CITY OF FRANKSTON	City of Frankston WWTF	0.2		no	no	
NENE	11787-001	TX0071188	CITY OF BULLARD	Bullard WWTF	0.4		no	no	
NENE	13538-001	TX0105902	LA POYNOR ISD	LaPoyner ISD WWTF	0.0		no	no	
NENE	13728-002	TX0112593	CITY OF CUNEY	City of Cuney WWTF	0.1		no	no	
NEPA	10376-001	TX0054071	CITY OF VAN	City of Van WWTF	0.6		no	no	
NEPA	10412-002	TX0105066	CITY OF LINDALE	Lindale Southside WWTF	0.1		no	no	
NEPA	10653-001	TX0047996	CITY OF TYLER	Westside WWTF	13.0	9.55	yes	yes	
NEPA	11012-001	TX0033499	CITY OF CHANDLER	City of Chandler WWTF	0.5		no	no	
NEPA	13849-002	TX0137995	LIBERTY UTILITIES SILVERLEAF WATER LLC	Big Eddy WWTF	0.1		no	no	
NEPA	13905-001	TX0118591	BEN WHEELER WSC	Water Well 4 WTF	0.0		no	no	
NEPA	13974-001	TX0065650	BEN WHEELER WSC	Water Well 1 WTF	0.0		no	no	Permit cancelled.
NEPA	14079-001	TX0118273	SOUTHERN UTILITIES CO	Teaselville Well 1 WTF	0.0		no	no	
NEPA	14080-001	TX0118362	SOUTHERN UTILITIES CO	Noonday Water Well 2 WTF	0.0		no	no	
NEPA	15007-001	TX0133086	RPM WSC	Akin Hill WTF	0.0		no	no	
NEPA	15074-001	TX0134287	HELMS, TONDA JOLANE	Spring Lake Mobile Home Park WWTF	0.0		no	no	
NEPA	15715-001	TX0138681	LKW SALINE CREEK SENIOR VILLAGE LTD	Saline Creek Senior Village WWTF	0.0		no	no	
NERO	01598-000	TX0006076	GEORGIA-PACIFIC WOOD PRODUCTS LLC	Camden Plywood and Lumber Complex	Variable		no	no	
NERO	01902-000	TX0064491	GEORGIA-PACIFIC WOOD PRODUCTS WOUTH LLC	Corrigan Plant	Variable		no	no	
NERO	10191-001	TX0053422	CITY OF HUNTINGTON	City of Huntington WWTF	0.4		no	no	
NERO	11139-001	TX0075701	MOSCOW WSC	Moscow WSC	0.0		no	no	
NERO	11295-001	TX0100692	CITY OF COLMESNEIL	City of Colmesneil WWTF	0.2		no	no	
NERO	13871-001	TX0118991	CITY OF ZAVALLA	City of Zavalla WWTF	0.1		no	no	
NERO	14128-001	TX0119679	ANGELINA WSC	Water Plant 4 WTF	0.0		no	no	
NERO	15057-001	TX0133787	CITY OF CORRIGAN	City of Corrigan WWTF	0.3		no	no	
NESL	00316-000	TX0002909	PHILLIPS 66 GULF COAST PROPERTIES LLC	Beaumont Terminal	Variable		no	no	
NESL	00336-000	TX0006696	ENTERGY TEXAS INC	Sabine Plant	1306.0		no	no	
NESL	00462-000	TX0004227	EXXONMOBIL OIL CORP	ExxonMobil Oil Corp. Beaumont Chemical Plant	Variable		no	no	
NESL	00473-000	TX0004669	LUCITE INTERNATIONAL INC	Lucite Beaumont Facility	Variable		no	no	
NESL	00491-000	TX0004201	TOTAL PETROCHEMICALS & REFINING USA INC	Port Arthur Refinery	Variable		no	no	
NESL	00511-000	TX0005070	Indorama Ventures LLC	Joint WWTP	Variable		no	no	Transferred from Huntsman Petrochem to Indorama 2020.
NESL	00647-000	TX0006726	CHEMTRADE REFINERY SERVICES INC	--	--		no	no	No current permit.
NESL	01151-000	TX0005746	SUNOCO PARTNERS MARKETING & TERMINAL LP	Sunoco Partners Nederland Terminal	5.0		no	no	
NESL	01202-000	TX0003662	MARTIN OPERATING PARTNERSHIP LP	Neches Terminal	Variable		no	no	
NESL	01595-000	TX0007277	AIR LIQUIDE LARGE INDUSTRIES US LP	Air Liquide - Nederland ASU Facility	0.2		no	no	
NESL	01674-000	TX0064718	INTEGRITY GOLDEN TRIANGLE MARINE SERVICES LLC	Carotex Facility	Variable		no	no	
NESL	01727-000	TX0062677	NECHES RIVER TREATMENT CORP AND LOWER NECHES VALLEY AUTHORITY	LNVA North Regional Treatment Plant	21.0		no	no	
NESL	01872-000	TX0052825	ARKEMA INC	Arkema Beaumont Plant	Variable		no	no	
NESL	01971-000	TX0067695	OPTIMUS STEEL LLC	Optimus Steel beaumont Mill	Variable		no	no	
NESL	02487-000	TX0087602	LION ELASTOMERS LLC	Lion Elastomers	0.3		no	no	
NESL	03426-000	TX0118737	EXXONMOBIL OIL CORP	ExxonMobil Beaumont Oil Refinery	Variable		no	no	
NESL	04025-000	TX0118231	MARINE FUELING SERVICE INC	Barge cleaning facility	0.0		no	no	
NESL	04074-000	TX0116921	MARTIN OPERATING PARTNERSHIP LP	Stanolind Cut Terminal	Variable		no	no	
NESL	04135-000	TX0119369	BASF TOTAL PETROCHEMICALS LLC	Basf Total Nafta Region Olefins Complex	Variable		no	no	
NESL	04731-000	TX0062448	INEOS CALABRIAN CORP	Inorganic chemical plant	0.3		no	no	
NESL	04840-000	TX0129887	TPC GROUP LLC	Couldn't find permit	--		no	no	
NESL	04874-000	TX0131598	KINDER MORGAN PETCOKE LP	Rainbow Terminal Petcoke Handling Facility	Variable		no	no	
NESL	05143-000	TX0135836	NATGASOLINE LLC	Beaumont Gas to Gasoline Plant	Variable		no	no	
NESL	05188-000	TX0136824	JEFFERSON RAILPORT TERMINAL I (TEXAS) LLC	Jefferson Railport Terminal I	Variable		no	no	
NESL	05236-000	TX0137855	Bayport Polymers (prev. TOTAL PETROCHEMICALS & REFINING USA INC)	Ethane Cracker facility	0.8		no	no	
NESL	10477-004	TX0022926	CITY OF PORT NECHES	Main WWTF	5.0		no	no	

Subbasin	PNUM	NPDES No.	Owner	Facility Name	Permitted Discharge (mgd)	2014-2018 Average Annual Discharge (mgd)	Included in Original Flow Naturalization	Included in Updated Flow Naturalization	Notes
NESL	10875-001	TX0023795	ORANGE COUNTY WCID 1	Oak lane WWTF	3.0		no	no	
NESL	14049-001	TX0117277	BOGGS SUGAR PINES LLC	Sugar Pines Mobile Home WWTF	0.0		no	no	
NESL	15455-001	TX0136956	CITY OF ROSE CITY	City of Rose City WWTF	0.1		no	no	
NETB	10197-001	TX0024368	CITY OF JASPER	City of Jasper WWTF	3.3	1.14	yes	yes	
NETB	11718-001	TX0068276	TEXAS PARKS & WILDLIFE DEPT	Martin Dies, Jr State Park WWTF	0.0		no	no	
PISL	10736-002	TX0126837	CITY OF DAISSETTA	City of Daisetta WWTF	0.2		no	no	
PISL	11274-001	TX0030813	WEST HARDIN CISD	West Hardin County CISD WWTF	0.0		no	no	
PISL	11564-001	TX0054178	CITY OF NOME	City of Nome WWTF	0.3		no	no	
PISL	13544-002	TX0106836	HULL FWSD	Hull FWSD WWTF	0.2		no	no	
VIKO	04949-000	TX0132918	EAST TEXAS ELECTRIC COOPERATIVE INC	Woodville Renewable Power Project	0.2		no	no	
VIKO	10322-001	TX0025828	CITY OF WOODVILLE	City of Woodville South WWTF	1.6	1.08	yes	yes	
VIKO	11184-001	TX0103641	WILDWOOD PROPERTY OWNERS ASSN	Wildwood WWTF	0.0		no	no	
VIKO	11307-001	TX0076015	WARREN ISD	Warren ISD High School WWTF	0.0		no	no	

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APPENDIX E – Gross Evaporation Supplemental Evaluation

Memo

Date: 11 March 2021

Project: Water Availability Model (WAM) Update – Phase 1 – Neches River Basin
TCEQ Contract 582-20-13328

To: Kathy Alexander, Ph.D., TCEQ
Steven Mahr, TCEQ

From: Zach Stein, PE
Sam Vaughn, PE

Subject: Neches River Basin Work Plan - Revision

1. Background

The Texas Commission on Environmental Quality (TCEQ) has retained the professional services of a team led by HDR Engineering, Inc. (HDR)¹ to extend the naturalized flow and net evaporation datasets of the Neches Water Availability Model (WAM). HDR submitted a Work Plan to TCEQ staff on 3 August 2020 which provides a detailed technical approach to update the existing datasets for the 1940-1996 period and to extend these datasets through 2018. TCEQ staff approved the work plan on 14 August 2020.

In accordance with the Task 2, part 13 of the scope of work, the approved Work Plan includes the review of hydropower releases in the Neches River Basin to verify the method used in the existing dataset development minimizes the occurrence of negative flows. The existing naturalized flow dataset includes the frequent occurrence of negative naturalized flows for the July through November months at primary control points throughout the basin. These negative flows become prevalent at primary control points following the construction of a major reservoir upstream of the control point location. During the review, HDR found the apparent cause of the negative naturalized flows in the dataset to be inaccurate estimates of gross evaporation and not inaccuracies in hydropower releases.²

HDR participated in a 7 January 2021 meeting with Dr. Kathy Alexander and Steven Mahr to present findings from the review. During the meeting, Dr. Alexander indicated she would like for HDR to correct the inaccurate evaporation data throughout the entire river basin as the

¹ Additional members of the team led by HDR include Freese & Nichols, Inc. (FNI), Baer Engineering & Environmental Consulting, Inc. (Baer), Susan Roth Consulting, LLC (SRC), Robert J. Brandes Consulting (RJBC), and Kennedy Resource Company (KRC).

² Comparison of hydropower releases from Sam Rayburn Reservoir reported by the USACE to available USGS gaged streamflow records downstream of the dam tends to validate the accuracy of the reported releases. This comparison will be documented in HDR's report summarizing Neches WAM updates.

review of negative naturalized flows at multiple locations suggests the same issue with inaccurate estimates of gross evaporation.

This technical memorandum summarizes findings of a supplemental evaluation of gross evaporation estimates used in the development of the existing naturalized flow and net evaporation datasets and provides an approach to correct the inaccurate gross evaporation estimates.

2. Supplemental Evaporation Evaluation

Monthly gross evaporation rates for the development of the existing naturalized flow and net evaporation datasets were obtained from the Texas Water Development Board (TWDB). The TWDB data is available by one-degree quadrangle of latitude and longitude for the 1940-2018 period and gross evaporation rates are estimated at the major reservoirs in the Neches River Basin using an inverse distance ratio weighting procedure based on distances from the reservoir centroid to the centroid of the surrounding quadrangles.

For the 1940-1953 period, the currently available TWDB quadrangle gross evaporation data was obtained from the TWDB Report 64, published in October 1967. The report provides quadrangle gross evaporation estimates for the 1940-1965 period. The estimates were derived using available pan evaporation data throughout Texas and surrounding states. **Table 1** provides a summary of the available pan data in the Neches River Basin used to develop the 1940-1965 quadrangle evaporation estimates, including the type of pan and available period of record.

Table 1. Available Pan Evaporation Data in the Neches Basin

Name of Station	County	Pan Type	Available Records
Alto	Cherokee	Young	1955-1957
Beaumont Experiment Station	Jefferson	BPI	1917-1957
		Young	1950-1965
Nacogdoches Experiment Station	Nacogdoches	BPI	1915-1957
Spurger Dam B	Tyler	Class A	1953-1965
Tyler Experiment Station	Smith	BPI	1933-1957
		Young	1951-1965

The pan data was adjusted using monthly pan coefficients specific to the type of pan to estimate lake evaporation. **Table 2** provides a summary of the pan coefficients used in the study to estimate gross lake evaporation from the available pan data.

Table 2. Summary of Monthly Pan Coefficients used in the Development of TWDB Gross Evaporation for 1940-1965 Period

Month	Pan Type		
	National Weather Service Class A	Bureau of Plant Industry	Young Screened
JAN	0.77	1.03	0.97
FEB	0.67	0.91	0.87
MAR	0.64	0.78	0.81
APR	0.64	0.76	0.79
MAY	0.68	0.78	0.81
JUN	0.73	0.85	0.91
JUL	0.79	0.94	1.03
AUG	0.84	1.03	1.12
SEP	0.88	1.11	1.19
OCT	0.91	1.16	1.21
NOV	0.92	1.17	1.19
DEC	0.89	1.12	1.10
ANNUAL	0.78	0.97	1.00

Source: Texas Water Development Board Report 64, Table 3.³

For the 1954-2018 period, the TWDB currently available quadrangle gross evaporation data was developed using only Class A pan data throughout Texas and surrounding states⁴. The gross lake evaporation is estimated by applying “new” quadrangle specific pan coefficients developed by the TWDB using GIS methods⁵. As shown in **Figure 1**, the new pan coefficients for Sam Rayburn Reservoir (weighted average of quadrangles 613, 713, 614 and 714) have very little monthly or seasonal variability. In contrast, the monthly pan coefficients for Young Screened pans, Bureau of Plant Industry (BPI), and National Weather Service Class A pans have a more pronounced seasonal pattern, especially in the July through November months when the occurrence of negative naturalized flows is prevalent in the existing naturalized flow dataset.

³Report 64 references the original source of pan coefficients as Bulletin 787 of the Texas Agricultural Experiment Station published in December 1954.

⁴ HDR participated in a 11 January 2021 meeting with TWDB staff to discuss the data and methods used to develop the TWDB quadrangle gross evaporation data for the 1954-2018 period. TWDB staff provided historical pan evaporation depths used in the quadrangle gross evaporation calculations and informed HDR that only Class A pan data is used in the TWDB calculations for the 1954-2018 period.

⁵ Tschirhart, W., and Rodriguez, D. A., 1998. ThEvap 1.0: Monthly Reservoir Evaporation Rates for Texas Using GIS, Texas Water Development Board User’s Manual Series No UM-50

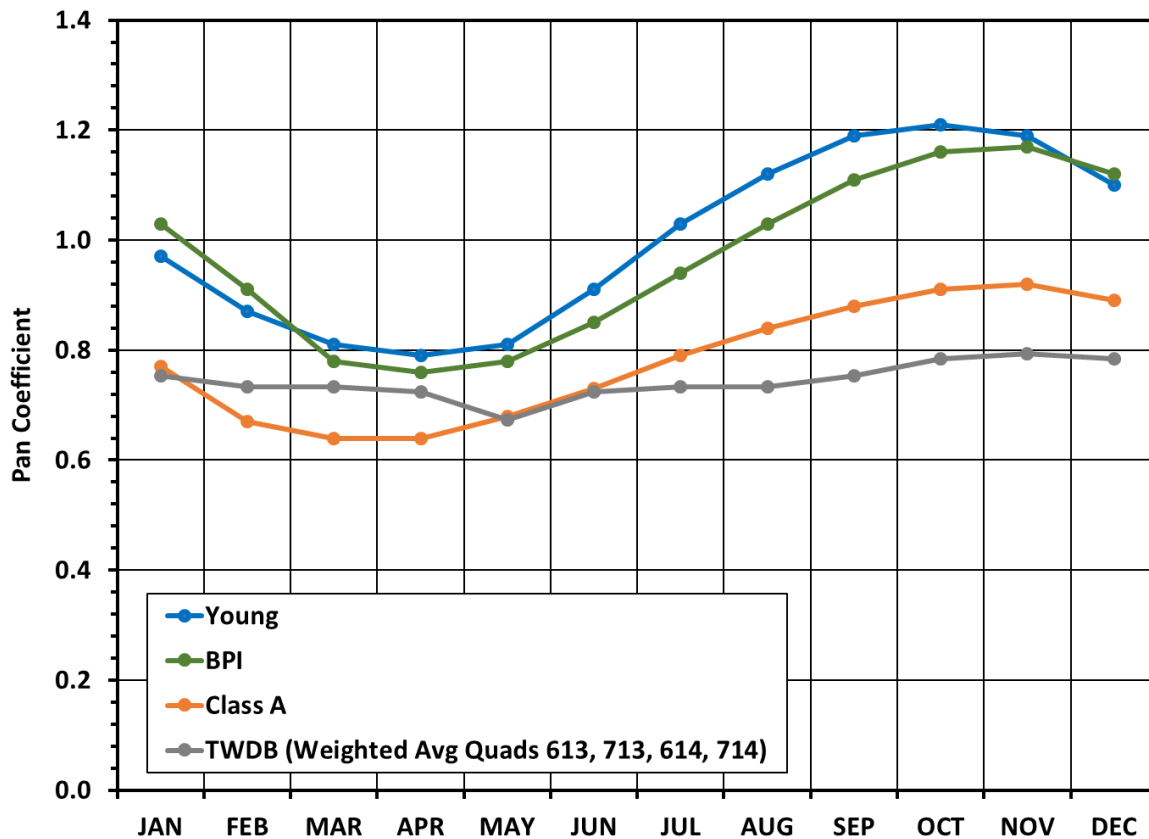


Figure 1. Comparison of Monthly Pan to Lake Coefficients

HDR performed a monthly time-step water balance evaluation of Sam Rayburn Reservoir to back-calculate monthly pan coefficient values. Results of the evaluation are used to identify the set of pan coefficients that will provide the most accurate estimate of gross lake evaporation in the Neches River Basin. Sam Rayburn Reservoir was selected for the evaluation for the following reasons: 1) approximately 64% of the watershed is gaged during the period of April 1965 (when significant filling of Sam Rayburn had occurred) through September 1979 (after which gaged inflows from the Angelina River are no longer available); 2) reservoir outflow data is readily available from the U.S. Army Corps of Engineers (USACE); and 3) limited diversions and return flows occurred during the period of 1965-1979. No other reservoirs in the Neches River Basin are identified with available gaged inflows for a substantial portion of the watershed. The following data were applied in the water balance evaluation to calculate monthly pan coefficients:

- Reservoir inflows were estimated using U.S. Geological Survey (USGS) streamflow gage data recorded at the Angelina River near Lufkin (USGS 08037000), Attoyac Bayou near Chireno (USGS 08038000), and Ayish Bayou near San Augustine (USGS 08039100). Historical inflows from the ungaged portion of the Sam Rayburn Reservoir watershed were estimated by adjusting gaged inflows for differences in drainage areas between the USGS gages and Sam Rayburn Dam.

- Reservoir outflow (gated and hydropower releases) data was obtained from the USACE.
- Monthly return flows associated with the Lufkin Paper Mill operations and treated wastewater discharges from the City of Nacogdoches wastewater treatment facility are included in the water balance as they are located downstream of the USGS gages measuring inflows. Return flows for the evaluation period average 2,286 acre-feet per month.
- Monthly diversions from the Angelina River associated with the Lufkin Paper Mill (Water Use Permit 4393) are included in the water balance as they are located downstream of the USGS gage measuring inflows located on the Angelina River near Lufkin. Diversions for the evaluation period average 485 acre-feet per month.
- Pan evaporation depths included in the evaluation were back-calculated from the TWDB quadrangle gross lake evaporation data using the new TWDB coefficients for quadrangles surrounding Sam Rayburn Reservoir. Pan evaporation depths for Sam Rayburn Reservoir were estimated using a weighted average of the back-calculated pan evaporation depths of the surrounding quadrangles.
- TWDB quadrangle precipitation data was used in the water balance calculations. Rainfall depths for Sam Rayburn Reservoir were estimated using a weighted average of the surrounding quadrangles.
- Recorded streamflow at the nearby USGS Ayish Bayou near San Augustine gage were used to estimate effective precipitation in the water balance calculations in order to account for the runoff from rainfall that would have resulted in the absence of the reservoir.

Figure 2 presents the monthly back-calculated pan coefficient values (grey circles) for all months during the evaluation period of April 1965 through September 1979. The median (bold red dashes) and the 25th and 75th percentiles (black dashed lines) of the calculated pan coefficients are included in the figure for comparison to the alternative sets of pan coefficients. The figure shows the median values correspond more closely to the Young and BPI coefficients and indicate these coefficients provide a more accurate estimate of gross reservoir evaporation than the Class A and new TWDB coefficients.

Review of the calculations found that months with higher rainfall amounts tended to produce outlier pan coefficient values. This tendency is reflected in the figure by the divergence of the 25th and 75th percentiles during the non-summer months when rainfall amounts are generally higher. **Figure 3** presents the calculated pan coefficients for only the months with less than 4 inches of rainfall during the evaluation period. The figure shows the convergence of the 25th and 75th percentiles during the non-summer months from the removal of outlier values occurring in the higher rainfall months. The median values remain closely correlated with the Young and BPI coefficients, further indicating these coefficients provide a more accurate estimates of gross reservoir evaporation than the Class A and new TWDB coefficients.

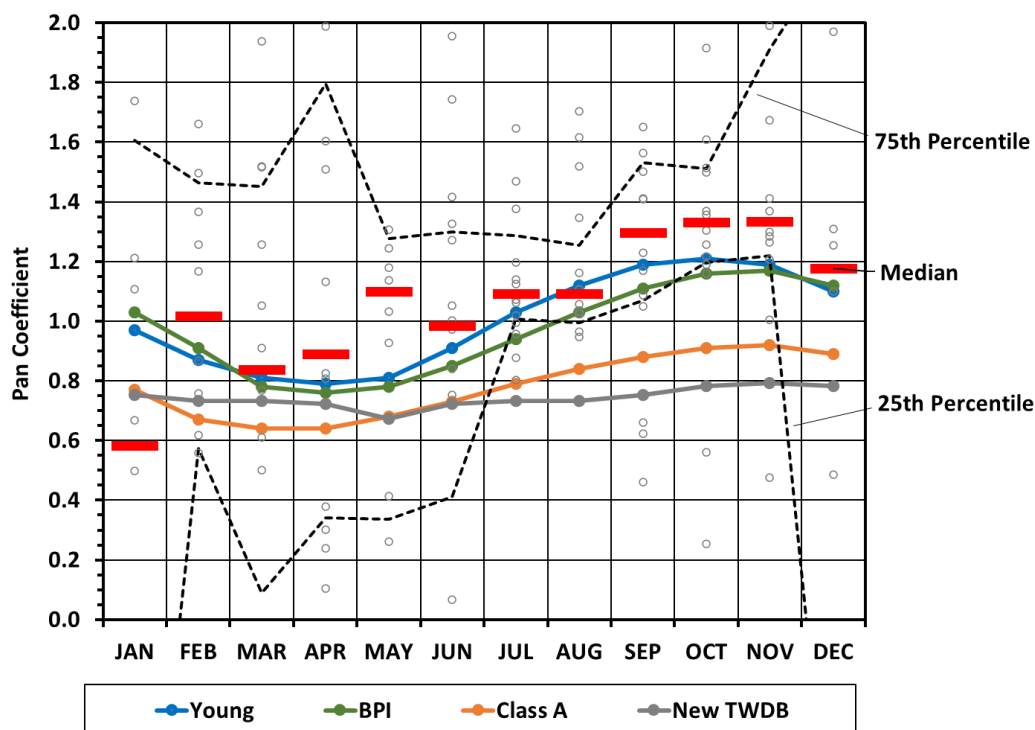


Figure 2. Calculated Monthly Pan Coefficients for Sam Rayburn Reservoir for April 1965 to September 1979 (All Months)

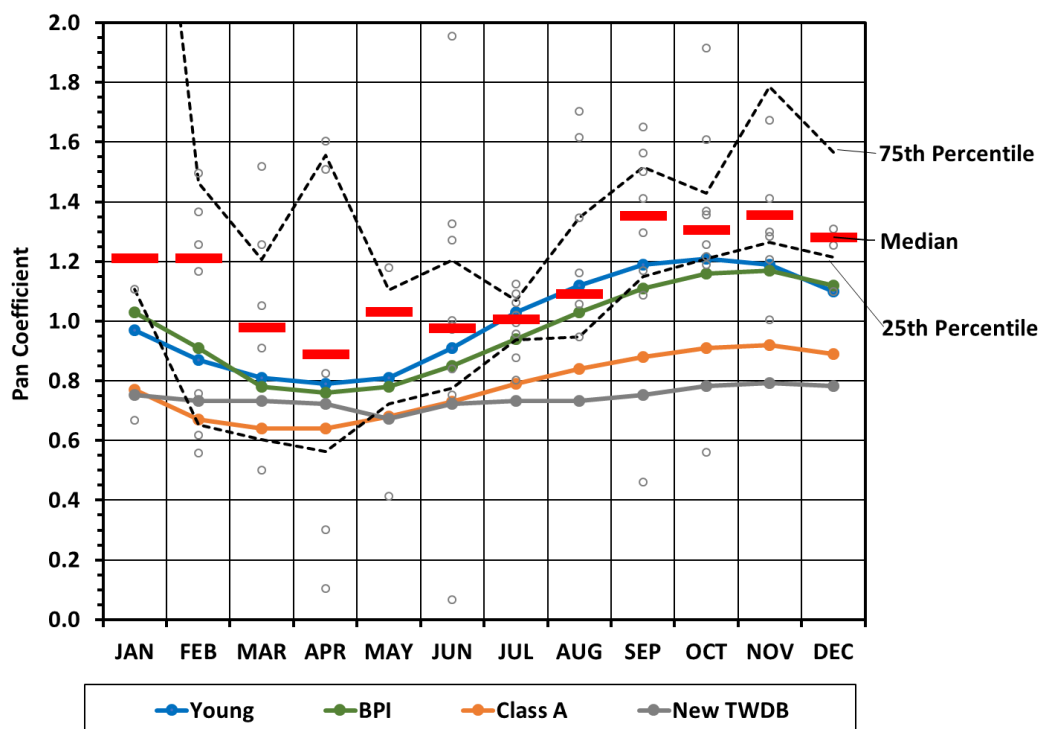


Figure 3. Calculated Monthly Pan Coefficients for Sam Rayburn Reservoir for April 1965 to September 1979 (Months with Less Than 4 Inches of Rainfall)

Figure 4 compares Sam Rayburn Reservoir monthly inflows calculated by water balance using the alternative pan coefficient sets and gaged inflows for the evaluation period. The comparisons shown in **Figure 4** are for the months of July through November when negative naturalized flows are more prevalent in the existing dataset. The comparisons show the Young coefficients provide the best correlation with gaged inflows for the lower inflow months and eliminate almost all of the calculated negative inflows.

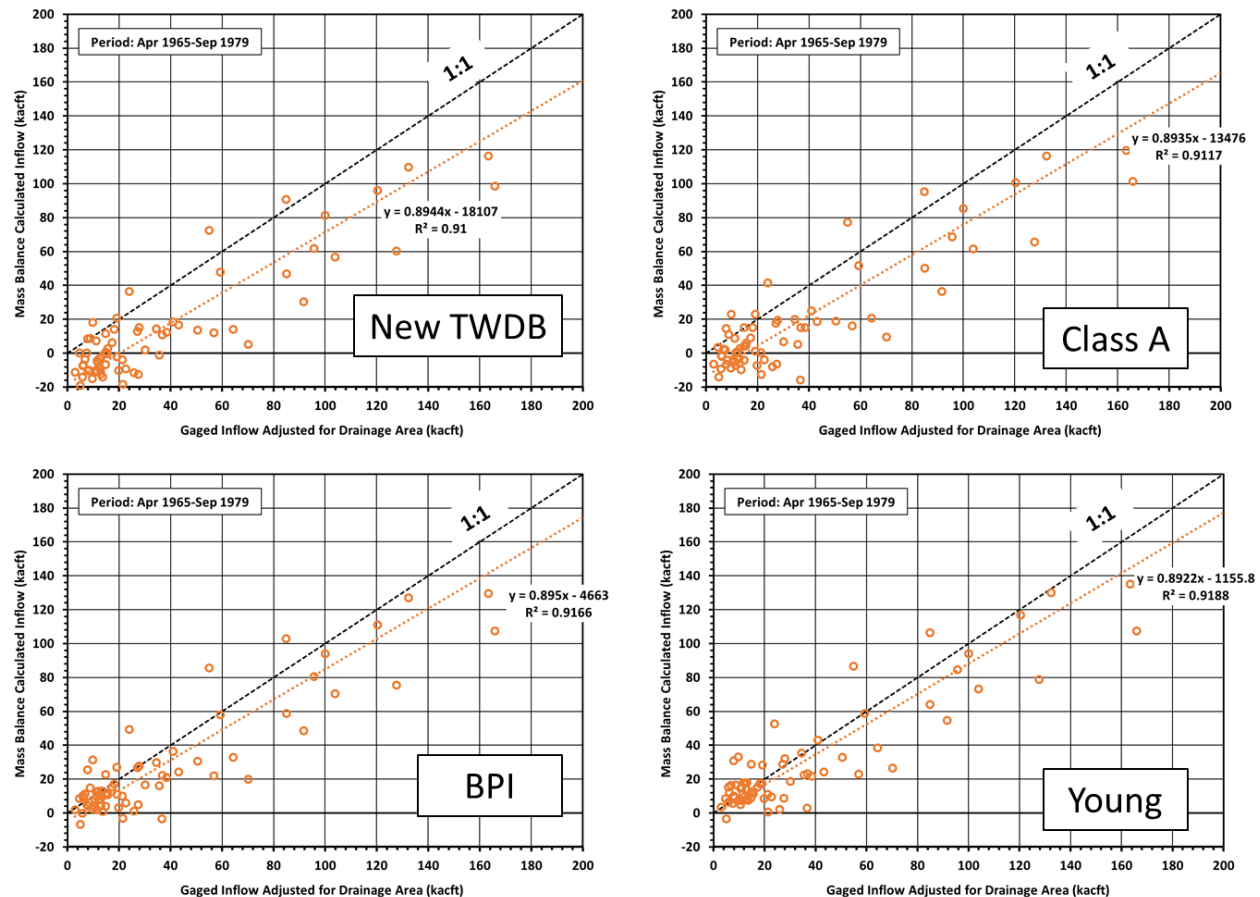


Figure 4. Comparison of Sam Rayburn Reservoir Mass Balance Calculated Inflows and Gaged Inflows for Alternative Pan Coefficient Sets (July-November)

Figure 5 provides the same comparisons for the months of December through June. The comparisons show slightly improved estimates of inflow using the BPI and Young coefficients in the lower flow months and no substantial difference in inflow estimates among the alternative coefficient sets for the higher flow months.

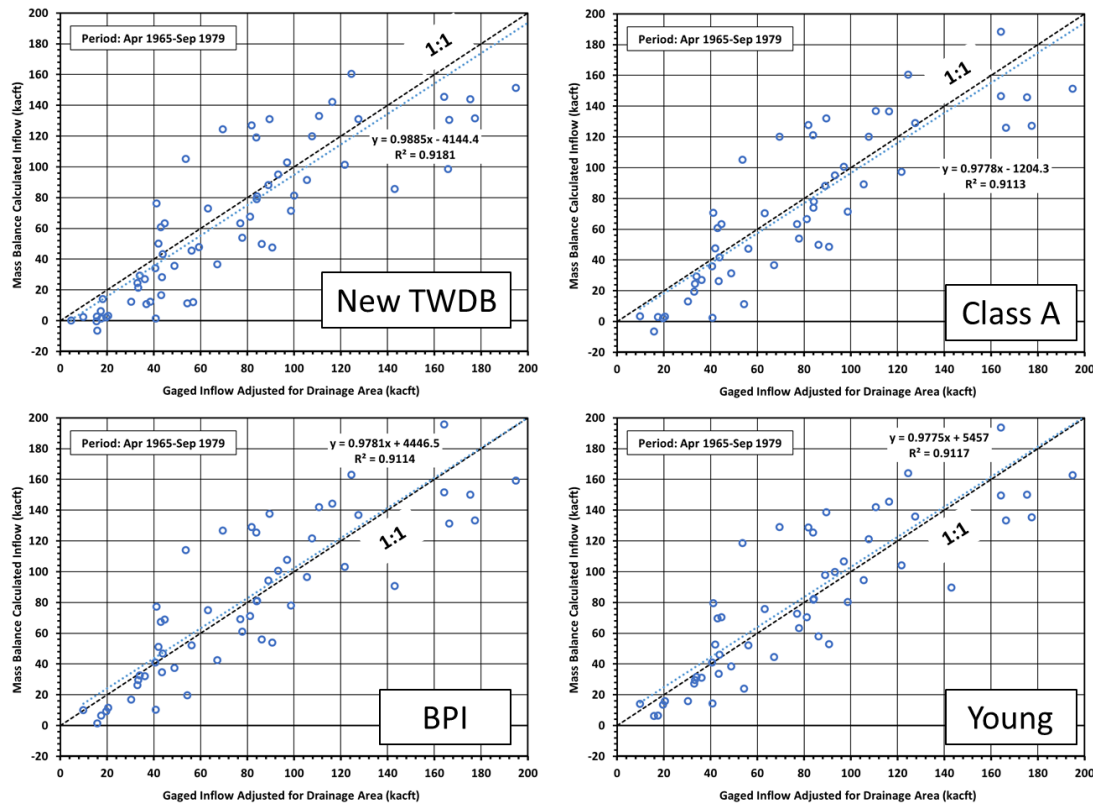


Figure 5. Comparison of Sam Rayburn Reservoir Mass Balance Calculated Inflows and Gaged Inflows for Alternative Pan Coefficient Sets (December-June)

HDR recommends application of the Young coefficients to the TWDB quadrangle back-calculated pan evaporation data to estimate gross lake evaporation for use in updating the naturalized flow and net evaporation datasets. HDR acknowledges that only Class A pan data is used in the TWDB quadrangle data for the 1954-2018 period; however, it is HDR's opinion based on results of the Sam Rayburn Reservoir water balance evaluation that the Young coefficients applied to the Class A pan data provide the best estimate of gross lake evaporation in the Neches River Basin.

HDR also recommends adjusting the TWDB quadrangle data for the 1940-1953 period to be consistent with the recommendation of applying the Young coefficients to Class A pan data for the 1954-2018 period. Adjustment of the 1940-1953 data will provide consistency in the evaporation data throughout the Neches WAM simulation period.

3. Approach for Adjusting Gross Evaporation Estimates

The following approach is proposed for improving gross evaporation estimates used in the development of the naturalized flow and net evaporation datasets.

- For the 1940-1953 period, TWDB quadrangle evaporation estimates in the Neches River Basin were developed using BPI and Young coefficients applied to pan evaporation data from these types of pans. The equivalent pan evaporation from a Class A pan will be estimated from the TWDB quadrangle evaporation data by applying the monthly pan

conversion factors published in the USGS Circular 229⁶ and shown in **Table 3**. Because both BPI and Young pans were used by the TWDB to develop the quadrangle lake evaporation data for the 1940-1953 period and detailed calculations providing the weights of the individual pans in the quadrangle calculations are unavailable, the monthly average of the pan conversion factors for the two pan types will be applied to the TWDB data to estimate the equivalent evaporation from a Class A pan. The resulting quadrangle lake evaporation estimates are essentially Class A pan data with the application of BPI and Young coefficients to estimate lake evaporation. Because the weighting of the individual pans in the development of the TWDB quadrangle data for the 1940-1953 period is unknown, the combination of the BPI and Young coefficients applied by the TWDB are not proposed to be adjusted to estimate evaporation using only the Young coefficients applied to Class A pan data.

Table 3. Monthly Conversion Factors for Estimating Class A Pan Data from BPI and Young Screened Pans

Month	Bureau of Plant Industry	Young Screened	Average
JAN	1.28	1.06	1.17
FEB	1.67	1.46	1.57
MAR	1.29	1.17	1.23
APR	1.35	1.27	1.31
MAY	1.35	1.48	1.42
JUN	1.33	1.51	1.42
JUL	1.34	1.46	1.40
AUG	1.31	1.47	1.39
SEP	1.25	1.38	1.32
OCT	1.36	1.33	1.35
NOV	1.19	0.99	1.09
DEC	1.30	0.96	1.13
ANNUAL	1.34	1.32	1.33

Source: USGS Circular 229, Table 25.

- For the 1954-2018 period, TWDB quadrangle Class A pan evaporation depths will be back-calculated using the new TWDB coefficients. The Young monthly pan coefficients shown in **Table 2** will be applied to the back-calculated TWDB quadrangle Class A pan evaporation depths to estimate gross lake evaporation.

Figure 6 compares the calculated annual lake evaporation for Sam Rayburn Reservoir using the existing TWDB quadrangle data and the proposed adjustments to the TWDB data. The figure shows that the proposed adjustments to the 1940-1953 and 1954-2018 periods are similar in magnitude and result in a reasonably consistent dataset throughout the updated WAM simulation period of 1940-2018. The figure also shows an apparent increasing trend in gross evaporation throughout the 1940-2018 period for both

⁶U.S. Dept. of the Interior, Geological Survey. *Water-Loss Investigations: Volume 1--Lake Hefner Studies Technical Report*. Circular, 229, 1952, <http://pubs.er.usgs.gov/publication/cir229>.

the existing TWDB data and the adjusted data, indicating that the proposed adjustments to the dataset will provide a more accurate estimate of current evaporative losses for use in WAM simulations than the existing TWDB data.

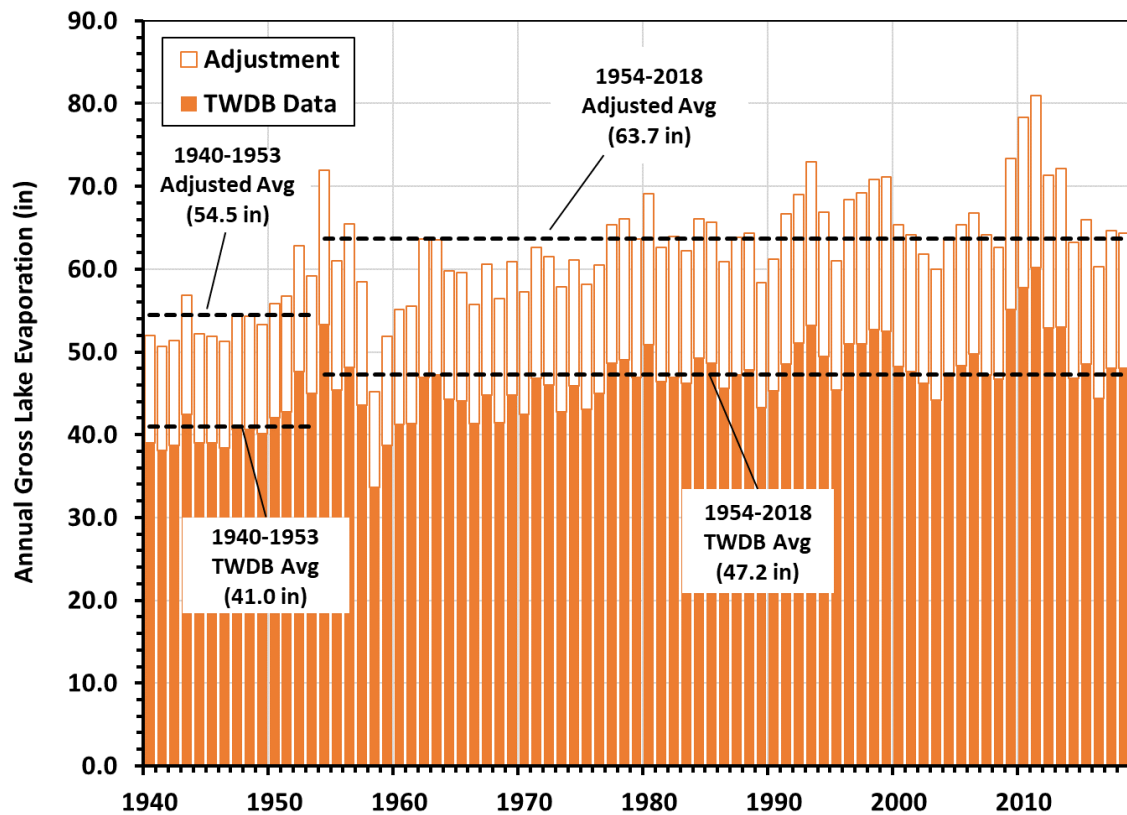
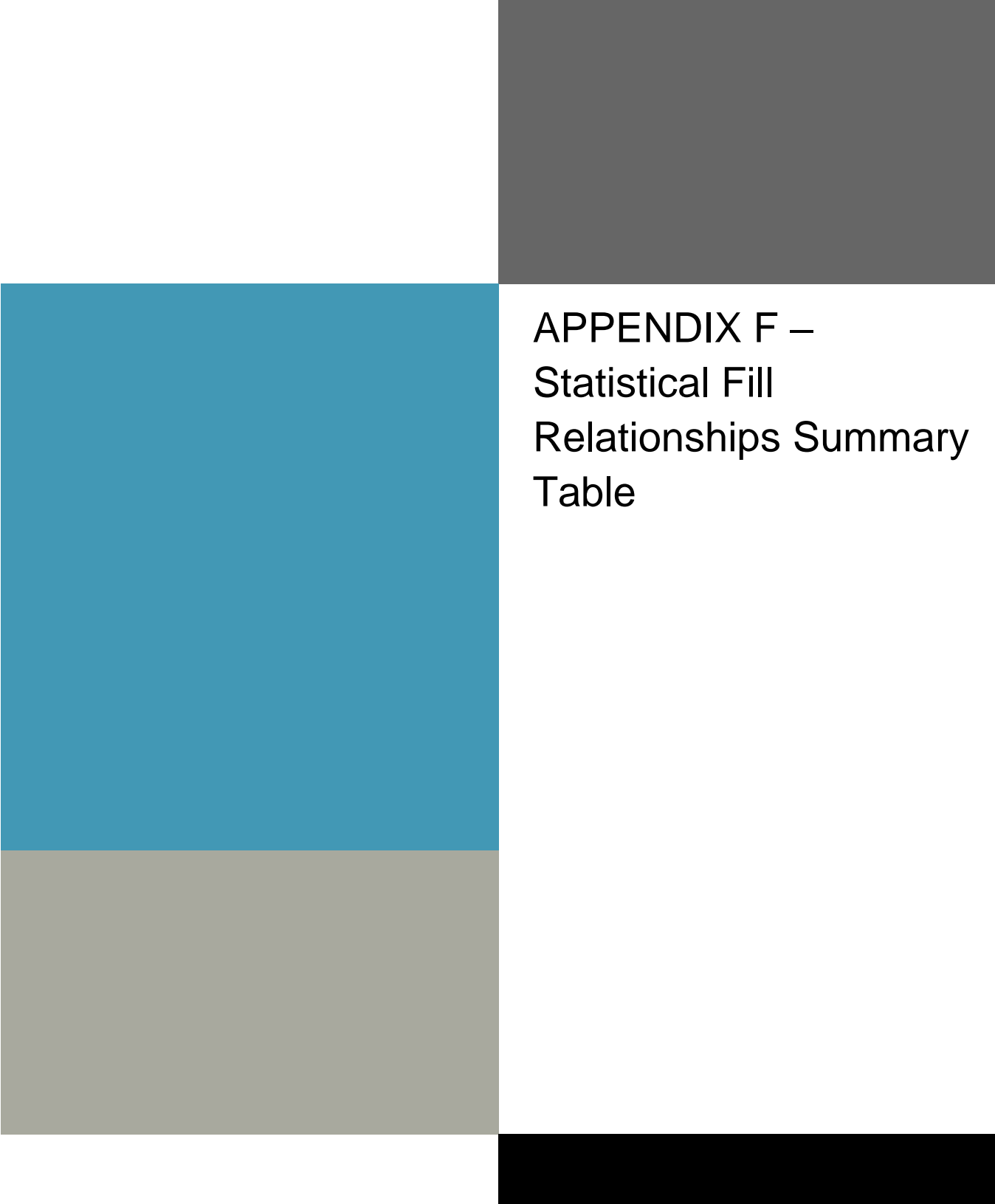


Figure 6. Comparison of Existing TWDB and Adjusted Annual Lake Evaporation for Sam Rayburn Reservoir



APPENDIX F – Statistical Fill Relationships Summary Table

APPENDIX F: SUMMARY OF FILLED NATURALIZED FLOW CALCULATIONS

CONTROL POINT	MISSING DATA	POSSIBLE SOURCES	CHART TYPE	2020 FILL RELATIONSHIP EQUATION	R2	CHART TYPE	ORIGINAL FILL RELATIONSHIP EQUATION	R2	DRAINAGE AREA RATIO	CHOICE	OVERLAP PERIOD
KI_BR	1/40-4/62	NE_NE	DOUBLE MASS	Y = 0.1941X		DOUBLE MASS	Y = 0.1953X		0.20262009	HIGH R ² VALUE & SLOPE CLOSE TO DOUBLE MASS RESULTS	5/62-9/89
	10/89-12/2018	NE_PA	LINEAR	Y = 0.229X ¹ - 1982.8	0.881	LINEAR	Y = 0.2278X ¹ - 1349.1	0.882			
			LINEAR 0	Y = 0.210X	0.906	LINEAR 0	Y = 0.215X	0.875			
			POLY 2	Y = (2E-7)X ² + 0.1905X ¹ - 1126	0.886	POLY 2	Y = (2E-7)X ² + 0.1872X ¹ - 544.79	0.889			
			POLY 3	Y = (2E-13)X ³ + (1E-7)X ² + 0.19747X ¹ - 1219.3	0.886	POLY 3	Y = (1E-13)X ³ + (1E-7)X ² + 0.1917X ¹ - 594.46	0.889			
			LOG-LOG	Y = 8051.1Ln(X) - 73108	0.559	LOG-LOG	Y = 6490.6Ln(X) - 56106	0.487			
			DOUBLE MASS	Y = 0.2301X		DOUBLE MASS	Y = 0.2734X				
			LINEAR	Y = 0.2883X ¹ - 1488	0.854	LINEAR	Y = 0.2851X ¹ - 377.83	0.859		0.27651967	1/73-9/89
			LINEAR 0	Y = 0.2691X	0.900	LINEAR 0	Y = 0.2804X	0.858			
			POLY 2	Y = (3E-7)X ² + 0.2439X ¹ - 749.46	0.857	POLY 2	Y = (4E-7)X ² + 0.2354X ¹ + 276.21	0.864			
			POLY 3	Y = (3E-12)X ³ - (6E-6)X ² + 0.301X ¹ - 1346.9	0.859	POLY 3	Y = (4E-12)X ³ - (6E-7)X ² + 0.2861X ¹ - 70.581	0.865			
			LOG-LOG	Y = 7890.3Ln(X) - 69524	0.561	LOG-LOG	Y = 6345.7Ln(X) - 52262	0.497			
			DOUBLE MASS	Y = 0.7059X		DOUBLE MASS	Y = 0.6416X				
			LINEAR	Y = 0.7191X ¹ - 2705.7	0.895	LINEAR	Y = 0.6999X ¹ - 2946.9	0.925			
			LINEAR 0	Y = 0.6948X	0.936	LINEAR 0	Y = 0.6724X	0.922			
			POLY 2	Y = (5E-7)X ² + 0.614X ¹ + 34.24	0.899	POLY 2	Y = (2E-7)X ² + 0.6623X ¹ - 2179.4	0.925			
			POLY 3	Y = (-3E-12)X ³ + (2E-6)X ² + 0.4964X ¹ + 1947.4	0.900	POLY 3	Y = (-4E-12)X ³ + (2E-6)X ² + 0.5438X ¹ - 801.13	0.927			
			LOG-LOG	Y = 31299Ln(X) - 289099	0.605	LOG-LOG	Y = 26956Ln(X) - 244124	0.626			
NE_PA	1/40-12/72	NE_NE	DOUBLE MASS	Y = 0.7059X		DOUBLE MASS	Y = 0.6416X		0.73275109	HIGH R ² VALUE & SLOPE CLOSE TO DOUBLE MASS RESULTS	1/73-12/18
	1/40-12/43	NE_DI	LINEAR	Y = 0.7191X ¹ - 2705.7	0.895	LINEAR	Y = 0.6999X ¹ - 2946.9	0.925			
			LINEAR 0	Y = 0.6948X	0.936	LINEAR 0	Y = 0.6724X	0.922			
			POLY 2	Y = (5E-7)X ² + 0.614X ¹ + 34.24	0.899	POLY 2	Y = (2E-7)X ² + 0.6623X ¹ - 2179.4	0.925			
			POLY 3	Y = (-3E-12)X ³ + (2E-6)X ² + 0.4964X ¹ + 1947.4	0.900	POLY 3	Y = (-4E-12)X ³ + (2E-6)X ² + 0.5438X ¹ - 801.13	0.927			
			LOG-LOG	Y = 31299Ln(X) - 289099	0.605	LOG-LOG	Y = 26956Ln(X) - 244124	0.626			
			DOUBLE MASS	Y = 0.7234X		DOUBLE MASS	Y = 0.7414X			0.71402349	1/44-12/78
			LINEAR	Y = 0.6851X ¹ + 5808	0.934	LINEAR	Y = 0.6853X ¹ + 5451.5	0.935			
			LINEAR 0	Y = 0.7073X	0.959	LINEAR 0	Y = 0.7061X	0.933			
			POLY 2	Y = (-1E-7)X ² + 0.7543X ¹ + 2335.8	0.937	POLY 2	Y = (-1E-7)X ² + 0.754X ¹ + 2065.3	0.938			
			POLY 3	Y = (6E-14)X ³ - (2E-7)X ² + 0.7714X ¹ + 1806.1	0.937	POLY 3	Y = (6E-14)X ³ - (2E-7)X ² + 0.7712X ¹ + 1548	0.938			
			LOG-LOG	Y = 47973Ln(X) - 439155	0.595	LOG-LOG	Y = 47350Ln(X) - 431451	0.598			
			DOUBLE MASS	Y = 1.58X		DOUBLE MASS	Y = 1.5449X				
			LINEAR	Y = 1.4232 + 5384.3	0.908	LINEAR	Y = 1.4238X ¹ + 5648.7	0.910			
			LINEAR 0	Y = 1.4668X	0.944	LINEAR 0	Y = 1.4692X	0.907			
			POLY 2	Y = (-7E-7)X ² + 1.5843X ¹ + 1736.6	0.912	POLY 2	Y = (-7E-7)X ² + 1.5827X ¹ + 2174.7	0.912			
			POLY 3	Y = (3E-12)X ³ - (2E-6)X ² + 1.7609X ¹ - 757.79	0.912	POLY 3	Y = (3E-12)X ³ - (2E-6)X ² + 1.7577X ¹ - 168.56	0.913			
			LOG-LOG	Y = 47313Ln(X) - 398670	0.576	LOG-LOG	Y = 46056Ln(X) - 383389	0.581			
NE_AL	1/40-12/72	NE_NE	DOUBLE MASS	Y = 0.7059X		DOUBLE MASS	Y = 0.6416X		0.73275109	HIGH R ² VALUE & SLOPE CLOSE TO DOUBLE MASS RESULTS	1/73-12/18
	1/40-12/43	NE_DI	LINEAR	Y = 0.7191X ¹ - 2705.7	0.895	LINEAR	Y = 0.6999X ¹ - 2946.9	0.925			
			LINEAR 0	Y = 0.6948X	0.936	LINEAR 0	Y = 0.6724X	0.922			
			POLY 2	Y = (5E-7)X ² + 0.614X ¹ + 34.24	0.899	POLY 2	Y = (2E-7)X ² + 0.6623X ¹ - 2179.4	0.925			
			POLY 3	Y = (-3E-12)X ³ + (2E-6)X ² + 0.4964X ¹ + 1947.4	0.900	POLY 3	Y = (-4E-12)X ³ + (2E-6)X ² + 0.5438X ¹ - 801.13	0.927			
			LOG-LOG	Y = 31299Ln(X) - 289099	0.605	LOG-LOG	Y = 26956Ln(X) - 244124	0.626			
			DOUBLE MASS	Y = 0.7234X		DOUBLE MASS	Y = 0.7414X				
			LINEAR	Y = 0.6851X ¹ + 5808	0.934	LINEAR	Y = 0.6853X ¹ + 5451.5	0.935			
			LINEAR 0	Y = 0.7073X	0.959	LINEAR 0	Y = 0.7061X	0.933			
			POLY 2	Y = (-1E-7)X ² + 0.7543X ¹ + 2335.8	0.937	POLY 2	Y = (-1E-7)X ² + 0.754X ¹ + 2065.3	0.938			
			POLY 3	Y = (6E-14)X ³ - (2E-7)X ² + 0.7714X ¹ + 1806.1	0.937	POLY 3	Y = (6E-14)X ³ - (2E-7)X ² + 0.7712X ¹ + 1548	0.938			
			LOG-LOG	Y = 47973Ln(X) - 439155	0.595	LOG-LOG	Y = 47350Ln(X) - 431451	0.598			
			DOUBLE MASS	Y = 1.58X		DOUBLE MASS	Y = 1.5449X				
NE_PA	1/40-12/72	NE_NE	DOUBLE MASS	Y = 0.7059X		DOUBLE MASS	Y = 0.6416X		0.73275109	HIGH R ² VALUE & SLOPE CLOSE TO DOUBLE MASS RESULTS	1/73-12/18
	1/40-12/43	NE_DI	LINEAR	Y = 0.7191X ¹ - 2705.7	0.895	LINEAR	Y = 0.6999X ¹ - 2946.9	0.925			
			LINEAR 0	Y = 0.6948X	0.936	LINEAR 0	Y = 0.6724X	0.922			
			POLY 2	Y = (5E-7)X ² + 0.614X ¹ + 34.24	0.899	POLY 2	Y = (2E-7)X ² + 0.6623X ¹ - 2179.4	0.925			
			POLY 3	Y = (-3E-12)X ³ + (2E-6)X ² + 0.4964X ¹ + 1947.4	0.900	POLY 3	Y = (-4E-12)X ³ + (2E-6)X ² + 0.5438X ¹ - 801.13	0.927			
			LOG-LOG	Y = 31299Ln(X) - 289099	0.605	LOG-LOG	Y = 26956Ln(X) - 244124	0.626			
			DOUBLE MASS	Y = 0.7234X		DOUBLE MASS	Y = 0.7414X				
			LINEAR	Y = 0.6851X ¹ + 5808	0.934	LINEAR	Y = 0.6853X ¹ + 5451.5	0.935			
			LINEAR 0	Y = 0.7073X	0.959	LINEAR 0	Y = 0.7061X	0.933			
			POLY 2	Y = (-1E-7)X ² + 0.7543X ¹ + 2335.8	0.937	POLY 2	Y = (-1E-7)X ² + 0.754X ¹ + 2065.3	0.938			
			POLY 3	Y = (6E-14)X ³ - (2E-7)X ² + 0.7714X ¹ + 1806.1	0.937	POLY 3	Y = (6E-14)X ³ - (2E-7)X ² + 0.7712X ¹ + 1548	0.938			
			LOG-LOG	Y = 47973Ln(X) - 439155	0.595	LOG-LOG	Y = 47350Ln(X) - 431451	0.598			
			DOUBLE MASS	Y = 1.58X		DOUBLE MASS	Y = 1.5449X				
NE_AL	1/40-12/72	NE_NE	DOUBLE MASS	Y = 0.7059X		DOUBLE MASS	Y = 0.6416X		0.73275109	HIGH R ² VALUE & SLOPE CLOSE TO DOUBLE MASS RESULTS	1/73-12/18
	1/40-12/43	NE_DI	LINEAR	Y = 0.7191X ¹ - 2705.7	0.895	LINEAR	Y = 0.6999X ¹ - 2946.9	0.925			
			LINEAR 0	Y = 0.6948X	0.936	LINEAR 0	Y = 0.6724X	0.922			
			POLY 2	Y = (5E-7)X ² + 0.614X ¹ + 34.24	0.899	POLY 2	Y = (2E-7)X ² + 0.6623X ¹ - 2179.4	0.925			
			POLY 3	Y = (-3E-12)X ³ + (2E-6)X ² + 0.4964X ¹ + 1947.4	0.900	POLY 3	Y = (-4E-12)X ³ + (2E-6)X ² + 0.5438X ¹ - 801.13	0.927			
			LOG-LOG	Y = 31299Ln(X) - 289099	0.605	LOG-LOG	Y = 26956Ln(X) - 244124	0.626			
			DOUBLE MASS	Y = 0.7234X		DOUBLE MASS	Y = 0.7414X				
			LINEAR	Y = 0.6851X ¹ + 5808	0.934	LINEAR	Y = 0.6853X ¹ + 5451.5	0.935			
			LINEAR 0	Y = 0.7073X	0.959	LINEAR 0	Y = 0.7061X	0.933			
			POLY 2	Y = (-1E-7)X ² + 0.7543X ¹ + 2335.8	0.937	POLY 2	Y = (-1E-7)X ² + 0.754X ¹ + 2065.3	0.938			
			POLY 3	Y = (6E-14)X ³ - (2E-7)X ² + 0.7714X ¹ + 1806.1	0.937	POLY 3	Y = (6E-14)X ³ - (2E-7)X ² + 0.7712X ¹ + 1548	0.938			
			LOG-LOG	Y = 47973Ln(X) - 439155	0.595	LOG-LOG	Y = 47350Ln(X) - 431451	0.598			
			DOUBLE MASS	Y = 1.58X		DOUBLE MASS	Y = 1.5449X				
NE_PA	1/40-12/72	NE_NE	DOUBLE MASS	Y = 0.7059X		DOUBLE MASS	Y = 0.6416X		0.73275109	HIGH R ² VALUE & SLOPE CLOSE TO DOUBLE MASS RESULTS	1/73-12/18
	1/40-12/43	NE_DI	LINEAR	Y = 0.7191X ¹ - 2705.7	0.895	LINEAR	Y = 0.6999X ¹ - 2946.9	0.925			
			LINEAR 0	Y = 0.6948X	0.936	LINEAR 0	Y = 0.6724X	0.922			
			POLY 2	Y = (5E-7)X ² + 0.614X							

APPENDIX F: SUMMARY OF FILLED NATURALIZED FLOW CALCULATIONS

CONTROL POINT	MISSING DATA	POSSIBLE SOURCES	CHART TYPE	2020 FILL RELATIONSHIP EQUATION		R2	CHART TYPE	ORIGINAL FILL RELATIONSHIP EQUATION		R2	DRAINAGE AREA RATIO	CHOICE	OVERLAP PERIOD	
AN_LU	10/79-12/2018	AN_SR	DOUBLE MASS	Y = 0.4611X			DOUBLE MASS	Y = 0.4818X			0.46390258	HIGH R ² VALUE	1/65-9/79	
			LINEAR	Y = 0.4054X + 7221.9	0.863	LINEAR	Y = 0.4035X + 10690	0.869						
			LINEAR 0	Y = 0.4251X	0.917	LINEAR 0	Y = 0.4318X	0.857						
			POLY 2	Y = (-1E-7)X ² + 0.4916X + 2182.8	0.868	POLY 2	Y = (-1E-7)X ² + 0.4886X + 6399.1	0.875						
			POLY 3	Y = (-2E-13)X ³ + (6E-8)X ² + 0.4432X + 3800	0.868	POLY 3	Y = (-1E-13)X ³ + (1E-8)X ² + 0.4521X + 7346.5	0.875						
			LOG-LOG	Y = 44278Ln(X) - 423786	0.637	LOG-LOG	Y = 38726Ln(X) - 355084	0.539						
		AN_AL	DOUBLE MASS	Y = 1.2554X		DOUBLE MASS	Y = 1.2809X		0.46390258					
			LINEAR	Y = 1.2621X + 719.28	0.953	LINEAR	Y = 1.2626X + 834.4	0.954						
			LINEAR 0	Y = 1.2684X	0.972	LINEAR 0	Y = 1.2698X	0.954						
			POLY 2	Y = (-5E-7)X ² + 1.3588X - 1284	0.954	POLY 2	Y = (-5E-7)X ² + 1.356X - 1048.9	0.955						
POLY 3	Y = (1E-12)X ³ - (9E-7)X ² + 1.3981X - 1763.9		0.954	POLY 3	Y = (1E-12)X ³ - (9E-7)X ² + 1.3896X - 1441.9	0.955								
LOG-LOG	Y = 41210Ln(X) - 352279		0.613	LOG-LOG	Y = 39967Ln(X) - 338402	0.608								
MULT. REG AN_SR & AN_AL	NORMAL	Y = 0.1341AN_SR + 0.9214AN_AL	0.963	NORMAL REG	Y = 0.1334AN_SR + 0.9276AN_AL	0.963								
	LOG REG	Y = (0.1106*Ln(AN_SR)) + (0.9022*Ln(AN_AL))	0.9938	LOG REG	Y = 0.1090Ln(AN_SR) + 0.9068Ln(AN_AL)	0.974								
AT_CH	10/54-9/55	NE_TB - NE_RO - AN_LU	DOUBLE MASS	Y = 0.2124X			DOUBLE MASS	Y = 0.2168X			0.21514115	REASONABLE R ² VALUE & SLOPE CLOSE TO DOUBLE MASS	5/51-10/54 & 10/55-9/79	
			LINEAR	Y = 0.1829X + 2821.1	0.766	LINEAR	Y = 0.1833X + 3384.4	0.769						
			LINEAR 0	Y = 0.1923X	0.848	LINEAR 0	Y = 0.1946X	0.760						
			POLY 2	Y = (-3E-8)X ² + 0.2016X + 1677	0.769	POLY 2	Y = (-3E-8)X ² + 0.202X + 2352.3	0.772						
			POLY 3	Y = (4E-14)X ³ + (-1E-7)X ² + 0.2233X + 845.52	0.770	POLY 3	Y = (4E-14)X ³ - (1E-7)X ² + 0.2226X + 1664.7	0.773						
			LOG-LOG	Y = 17147Ln(X) - 164153	0.524	LOG-LOG	Y = 15174Ln(X) - 139896	0.493						
		Big Cow Creek near Newton	DOUBLE MASS	Y = 3.5099X		Not included in original equations								
			LINEAR	Y = 3.2737X + 2223.2	0.479									
			LINEAR 0	Y = 3.4408X	0.668									
			POLY 2	Y = (-2E-5)X ² + 3.7842X - 214.65	0.483									
10/85-12/2018	AN_SR - AN_AL	POLY 3	Y = (3E-9)X ³ - 0.0002X ² + 6.2744X - 6268.7	0.496										
		LOG-LOG	Y = 24869Ln(X) - 186394	0.419										
		DOUBLE MASS	Y = 0.2609X		DOUBLE MASS	Y = 0.3010X		0.23147722						
		LINEAR	Y = 0.2243X + 4498.3	0.837	LINEAR	Y = 0.2223X + 6981.6	0.837							
		LINEAR 0	Y = 0.2415X	0.899	LINEAR 0	Y = 0.2481X	0.802							
		POLY 2	Y = (-7E-8)X ² + 0.2518X + 3453.6	0.839	POLY 2	Y = (-1E-7)X ² + 0.2657X + 5644.3	0.842							
	AN_AL	POLY 3	Y = (-5E-13)X ³ + (3E-7)X ² + 0.1799X + 4961.4	0.844	POLY 3	Y = (-2E-13)X ³ + (7E-8)X ² + 0.2349X + 6124.8	0.843							
		LOG-LOG	Y = 15668Ln(X) - 139700	0.574	LOG-LOG	Y = 18259Ln(X) - 166111	0.571							
		DOUBLE MASS	Y = 0.4639X		DOUBLE MASS	Y = 0.5240X		0.39420063						
		LINEAR	Y = 0.422X + 4134.7	0.670	LINEAR	Y = 0.4295X + 4576.7	0.699							
10/85-12/2018	Big Cow Creek near Newton	LINEAR 0	Y = 0.4587X	0.796	LINEAR 0	Y = 0.4681X	0.685							
		POLY 2	Y = (-8E-7)X ² + 0.5783X + 924.62	0.685	POLY 2	Y = (-7E-7)X ² + 0.5642X + 1832.5	0.710							
		POLY 3	Y = (-5E-12)X ³ + (1E-6)X ² + 0.4301X + 2707.7	0.689	POLY 3	Y = (-7E-12)X ³ + (2E-6)X ² + 0.3578X + 4180.1	0.717							
		LOG-LOG	Y = 14227Ln(X) - 118472	0.476	LOG-LOG	Y = 13944Ln(X) - 113368	0.476							
		DOUBLE MASS	Y = 3.5099X		Not included in original equations									
		LINEAR	Y = 3.2737X + 2223.2	0.479										
	LINEAR 0	Y = 3.4408X	0.668											
	POLY 2	Y = (-2E-5)X ² + 3.7842X - 214.65	0.483											
	Big Cow Creek near Newton	POLY 3	Y = (3E-9)X ³ - 0.0002X ² + 6.2744X - 6268.7	0.496										
		LOG-LOG	Y = 24869Ln(X) - 186394	0.419										
AY_SA	1/40-3/51	AT_CH	DOUBLE MASS	Y = 0.2114X			DOUBLE MASS	Y = 0.1998X			0.17693837	REASONABLE R ² VALUE & SLOPE CLOSE TO DOUBLE MASS	3/59-9/85	
			LINEAR	Y = 0.2065X - 136.87	0.729	LINEAR	Y = 0.236X - 649.21	0.824						
			LINEAR 0	Y = 0.2042X	0.819	LINEAR 0	Y = 0.2245X	0.819						
			POLY 2	Y = (-5E-7)X ² + 0.2563X - 674.79	0.735	POLY 2	Y = (4E-7)X ² + 0.1974X - 249.66	0.827						
			POLY 3	Y = (-2E-11)X ³ + (3E-6)X ² + 0.1225X + 169.23	0.746	POLY 3	Y = (2E-12)X ³ + (3E-8)X ² + 0.2114X - 333.67	0.827						
			LOG-LOG	Y = 4116.7Ln(X) - 33768	0.530	LOG-LOG	Y = 4272.3Ln(X) - 35187	0.547						
		4/51-9/54	AT_CH	DOUBLE MASS	Y = 0.2114X		DOUBLE MASS	Y = 0.1998X		0.17693837				
				LINEAR	Y = 0.2065X - 136.87	0.729	LINEAR	Y = 0.236X - 649.21	0.824					
				LINEAR 0	Y = 0.2042X	0.819	LINEAR 0	Y = 0.2245X	0.819					
				POLY 2	Y = (-5E-7)X ² + 0.2563X - 674.79	0.735	POLY 2	Y = (4E-7)X ² + 0.1974X - 249.66	0.827					
10/54-9/55	NE_TB - NE_RO - AN_LU	POLY 3	Y = (-2E-11)X ³ + (3E-6)X ² + 0.1225X + 169.23	0.746	POLY 3	Y = (2E-12)X ³ + (3E-8)X ² + 0.2114X - 333.67	0.827							
		LOG-LOG	Y = 4116.7Ln(X) - 33768	0.530	LOG-LOG	Y = 4272.3Ln(X) - 35187	0.547							
		DOUBLE MASS	Y = 0.0453X		DOUBLE MASS	Y = 0.0483X		0.03806672						
		LINEAR	Y = 0.0513X - 691.66	0.844	LINEAR	Y = 0.0512X - 307.35	0.855							
		LINEAR 0	Y = 0.0487X	0.891	LINEAR 0	Y = 0.0501X	0.854							
		POLY 2	Y = (2E-8)X ² + 0.0408X - 163.78	0.849	POLY 2	Y = (2E-8)X ² + 0.0417X + 107.38	0.861							
	10/54-9/55	NE_TB - NE_RO - AN_LU	POLY 3	Y = (5E-14)X ³ + (-2E-8)X ² + 0.0496X - 442.94	0.850	POLY 3	Y = (2E-14)X ³ + (5E-9)X ² + 0.0448X + 27.751	0.861						
			LOG-LOG	Y = 4402.4Ln(X) - 43283	0.539	LOG-LOG	Y = 4034.5Ln(X) - 38618	0.520						
			DOUBLE MASS	Y = 0.0453X		DOUBLE MASS	Y = 0.0483X		0.03806672					
			LINEAR	Y = 0.0513X - 691.66	0.844	LINEAR	Y = 0.0512X - 307.35	0.855						
10/55-2/59	AT_CH	LINEAR 0	Y = 0.0487X	0.891	LINEAR 0	Y = 0.0501X	0.854							
		POLY 2	Y = (2E-8)X ² + 0.0408X - 163.78	0.849	POLY 2	Y = (2E-8)X ² + 0.0417X + 107.38	0.861							
		POLY 3	Y = (5E-14)X ³ + (-2E-8)X ² + 0.0496X - 442.94	0.850	POLY 3	Y = (2E-14)X ³ + (5E-9)X ² + 0.0448X + 27.751	0.861							
		LOG-LOG	Y = 4402.4Ln(X) - 43283	0.539	LOG-LOG	Y = 4034.5Ln(X) - 38618	0.520							
		DOUBLE MASS	Y = 0.0453X		DOUBLE MASS	Y = 0.0483X		0.17693837						
		LINEAR	Y = 0.2065X - 136.87	0.729	LINEAR	Y = 0.236X - 649.21	0.824							
	10/55-2/59	NE_TB - NE_RO - AN_LU	LINEAR 0	Y = 0.2042X	0.819	LINEAR 0	Y = 0.2245X	0.819						
			POLY 2	Y = (-5E-7)X ² + 0.2563X - 674.79	0.735	POLY 2	Y = (4E-7)X ² + 0.1974X - 249.66	0.827						
			POLY 3	Y = (-2E-11)X ³ + (3E-6)X ² + 0.1225X + 169.23	0.746	POLY 3	Y = (2E-12)X ³ + (3E-8)X ² + 0.2114X - 333.67	0.827						
			LOG-LOG	Y = 4116.7Ln(X) - 33768	0.530	LOG-LOG	Y = 4272.3Ln(X) - 35187	0.547						
10/85-12/2018	AN_SR - AN_AL	DOUBLE MASS	Y = 0.2114X		DOUBLE MASS	Y = 0.1998X		0.03806672						
		LINEAR	Y = 0.0513X - 691.66	0.844	LINEAR	Y = 0.0512X - 307.35	0.855							
		LINEAR 0	Y = 0.0487X	0.891	LINEAR 0	Y = 0.0501X	0.854							
		POLY 2	Y = (2E-8)X ² + 0.0408X - 163.78	0.849	POLY 2	Y = (2E-8)X ² + 0.0417X + 107.38	0.861							
		POLY 3	Y = (5E-14)X ³ + (-2E-8)X ² + 0.0496X - 442.94	0.850	POLY 3	Y = (2E-14)X ³ + (5E-9)X ² + 0.0448X + 27.751	0.861							
		LOG-LOG	Y = 4402.4Ln(X) - 43283	0.539	LOG-LOG	Y = 4034.5Ln(X) - 38618	0.520							
	10/85-12/2018	AN_SR - AN_AL	DOUBLE MASS	Y = 0.0542		DOUBLE MASS	Y = 0.0586X		0.0409572					
			LINEAR	Y = 0.054X - 95.531	0.835	LINEAR	Y = 0.0542X + 394	0.847						
			LINEAR 0	Y = 0.0536X	0.890	LINEAR 0	Y = 0.0557X	0.845						
			POLY 2	Y = (3E-8)X ² + 0.0393X + 463.26	0.845	POLY 2	Y = (2E-8)X ² + 0.044X + 713.58	0.852						
10/85-12/2018	AN_AL	POLY 3	Y = (1E-14)X ³ + (3E-8)X ² + 0.0407X + 432.71	0.845	POLY 3	Y = (8E-14)X ³ - (4E-8)X ² + 0.0555X + 530.19	0.854							
		LOG-LOG	Y = 3586.6Ln(X) - 32876	0.515	LOG-LOG	Y = 4100.9Ln(X) - 38093	0.502							
		DOUBLE MASS	Y = 0.0962X		DOUBLE MASS	Y = 0.1040X		0.06888715						
		LINEAR	Y = 0.0882X + 701.54	0.510	LINEAR	Y = 0.0906X + 674.4	0.530							
		LINEAR 0	Y = 0.0941X	0.669	LINEAR 0	Y = 0.096X	0.526							
		POLY 2	Y = (-2E-7)X ² + 0.1301X - 189.17	0.529	POLY 2	Y = (-2E-7)X ² + 0.127X - 93.21	0.545							
	Big Cow Creek near Newton	POLY 3	Y = (-1E-12)X ³ + (4E-7)X ² + 0.0823X + 394.81	0.534	POLY 3	Y = (-2E-12)X ³ + (5E-7)X ² + 0.0691X + 565.91	0.553							
		LOG-LOG	Y = 3140Ln(X) - 26461	0.376	LOG-LOG	Y = 2982.9Ln(X) - 24636	0.369							
		DOUBLE MASS	Y = 0.7307X		Not included in original equations									
		LINEAR	Y = 0.8749X - 1098.2	0.616										
	LINEAR 0	Y = 0.7904X	0.736											
	POLY 2	Y = (-7E-6)X ² + 1.0614X - 1809.8	0.621											
	POLY 3	Y = (-8E-10)X ³ + (4E-5)X ² + 0.4989X - 402.14	0.631											
	LOG-LOG	Y = 6292.7Ln(X) - 48557	0.506											
AN_SR	4/51-12/64	NE_TB - NE_RO	DOUBLE MASS	Y = 0.8067X			DOUBLE MASS	Y = 0.7992X			0.87582529	HIGH R ² VALUE & SLOPE CLOSE TO DOUBLE MASS RESULTS	1/65-12/18	
			LINEAR	Y = 0.8966X - 17837	0.977	LINEAR	Y = 0.8884X - 17676	0.979						
			LINEAR 0	Y = 0.8553X	0.985	LINEAR 0	Y = .8477X	0.975						
			POLY 2	Y = (7E-8)X ² + 0.842X - 12684	0.977	POLY 2	Y = (1E-7)X ² + 0.7955X - 10913	0.981						
			POLY 3	Y = (-9E-14)X ³ + (2E-7)X ² + 0.7994X - 10432	0.977	POLY 3	Y = (-2E-13)X ³ + (3E-7)X ² + 0.7353X - 8408.5	0.981						
			LOG-LOG	Y = 155127Ln(X) - (2E+6)	0.742	LOG-LOG	Y = 160606Ln(X) - (2E6)	0.745						
		NE_TB	NE_EV	DOUBLE MASS	Y = 0.9122X			DOUBLE MASS	Y = 0.9082X					0.95258458
				LINEAR	Y = 0.9358X - 8135	0.988	LINEAR	Y = 0.9386X - 10697	0.990					
				LINEAR 0	Y = 0.9259X	0.993	LINEAR 0	Y = 0.9254X	0.989					
				POLY 2	Y = (3E-8)X ² + 0.8955X - 1321.6	0.988	POLY 2	Y = (3E-8)X ² + 0.895X - 3957.8	0.990					
PI_SL	1/40-9/67	VI_KO	POLY 3	Y = (2E-14)X ³ - (2E-8)X ² + 0.9327X - 5486.5	0.989	POLY 3	Y = (2E-14)X ³ - (4E-8)X ² + 0.9424X - 8595.7	0.991						
			LOG-LOG	Y = 278659Ln(X) - (3E+6)	0.716	LOG-LOG	Y = 243169Ln(X) - (3E6)	0.678						
			DOUBLE MASS											



APPENDIX G – Drought Comparison Figures

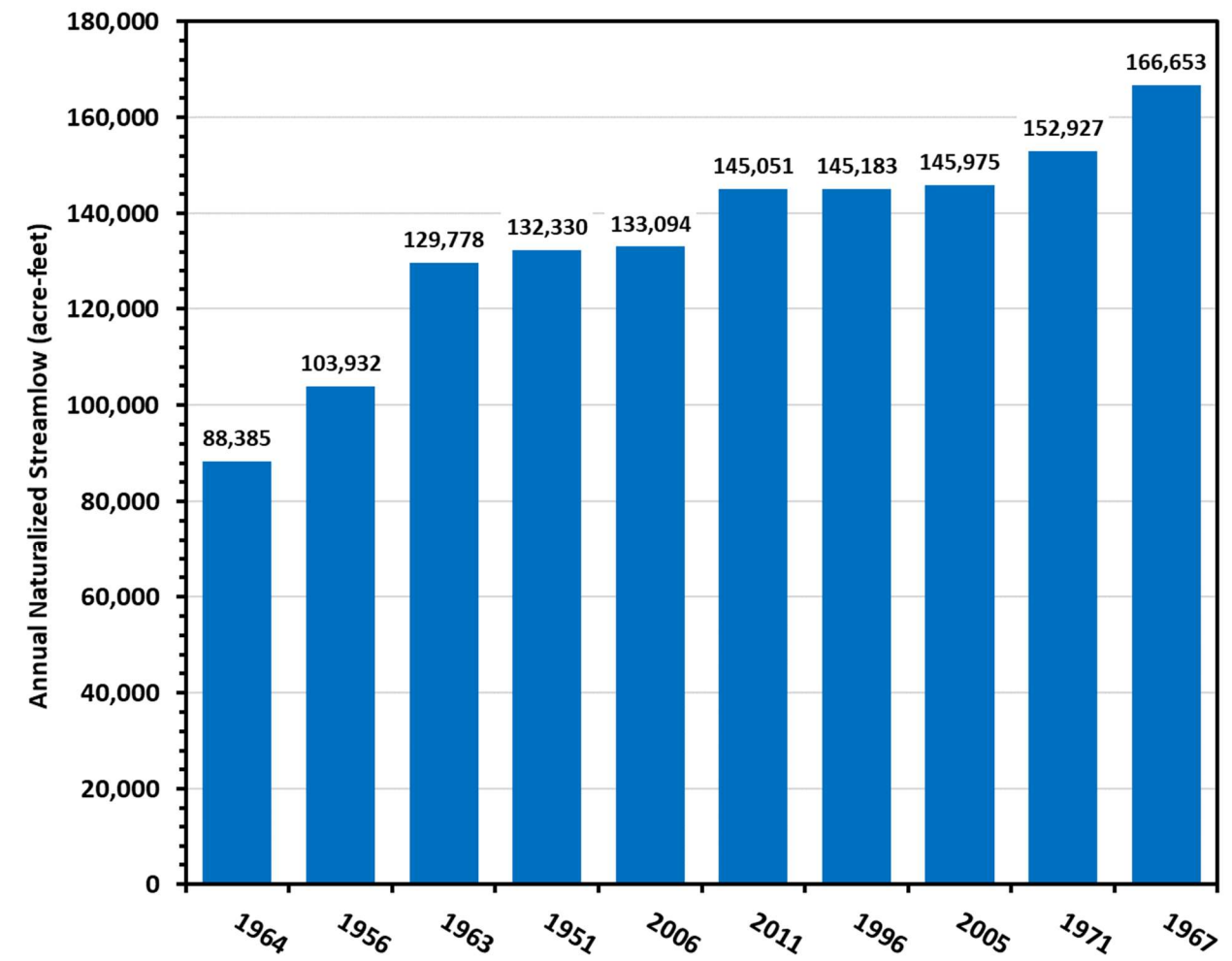
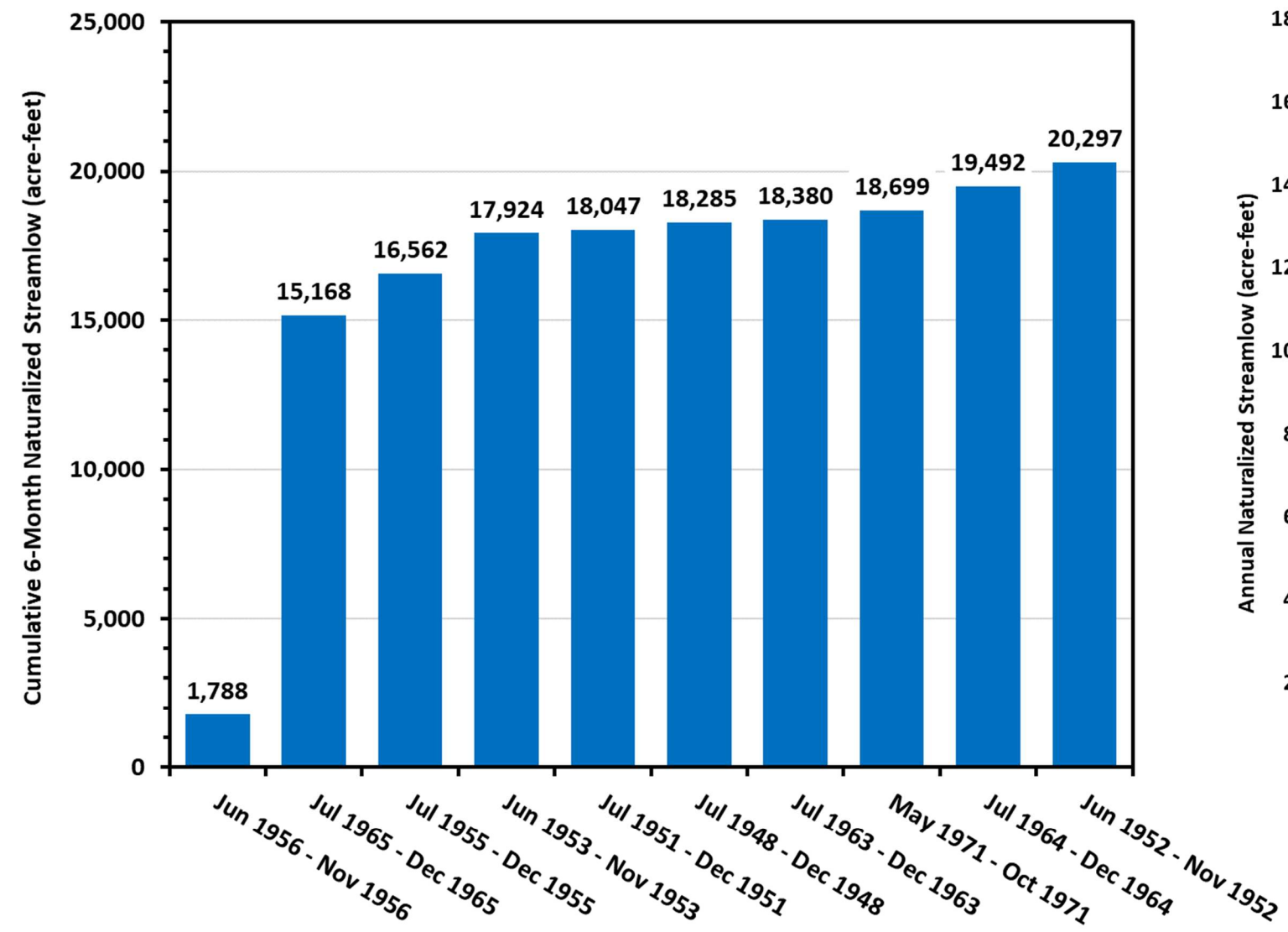


Figure G-1. Comparison of 10 Lowest 6-month and Annual Naturalized Streamflow Amounts at Lake Palestine Dam (NEPA)

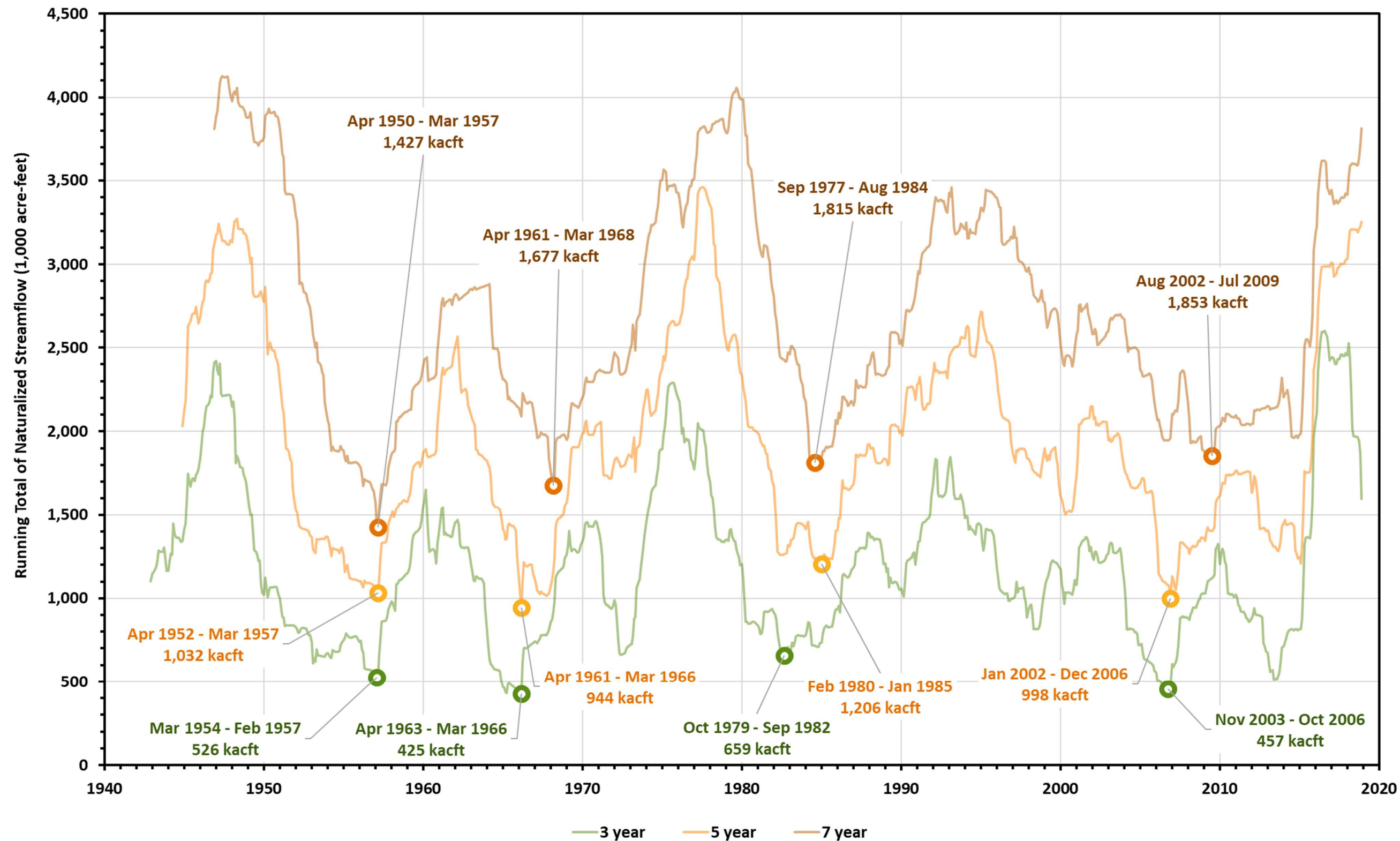


Figure G-2. Comparison of 3-, 5-, and 7-year Running Totals of Naturalized Streamflow at Lake Palestine Dam (NEPA)

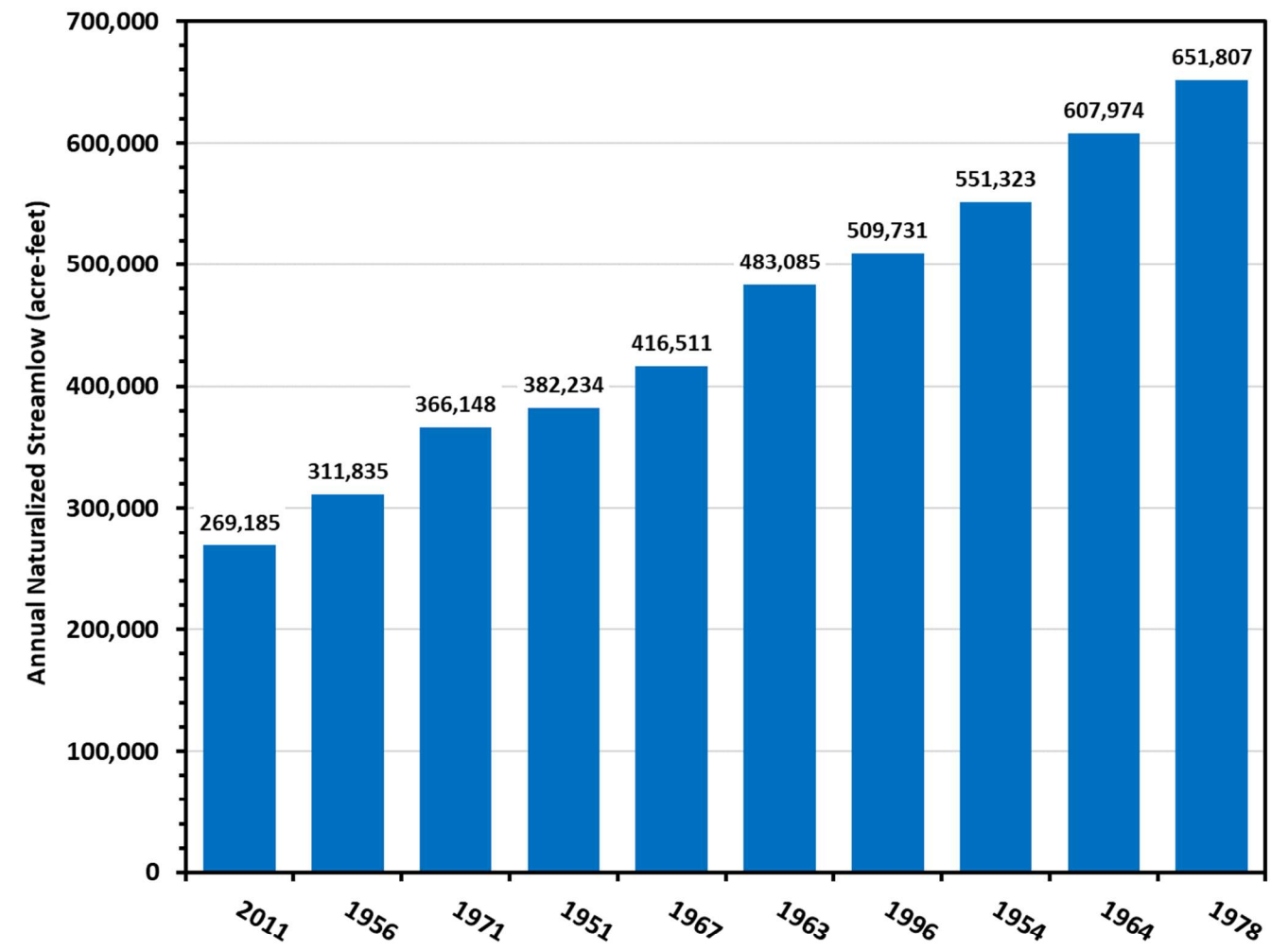
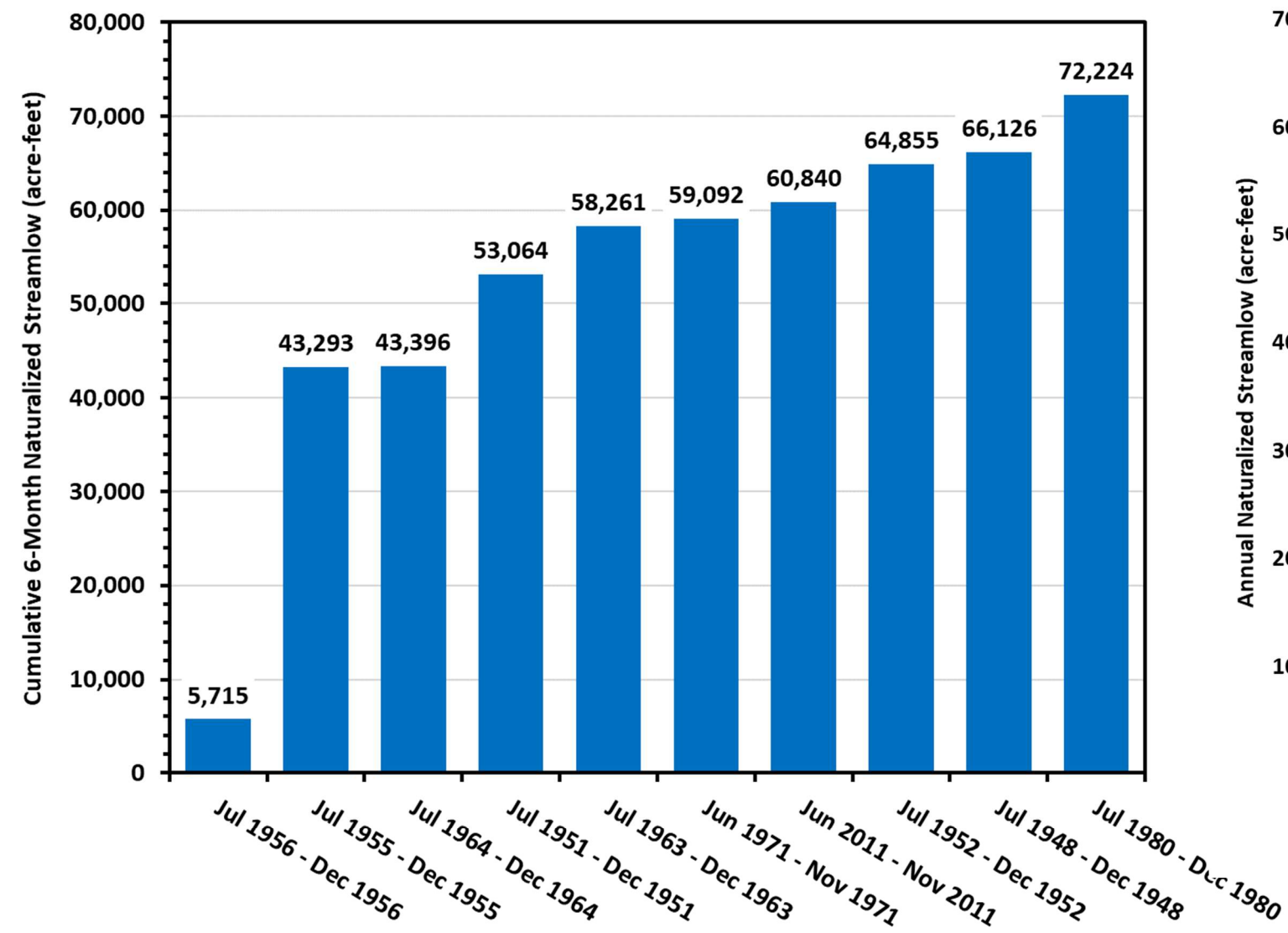


Figure G-3. Comparison of 10 Lowest 6-month and Annual Naturalized Streamflow Amounts at Neches River near Rockland (NERO)

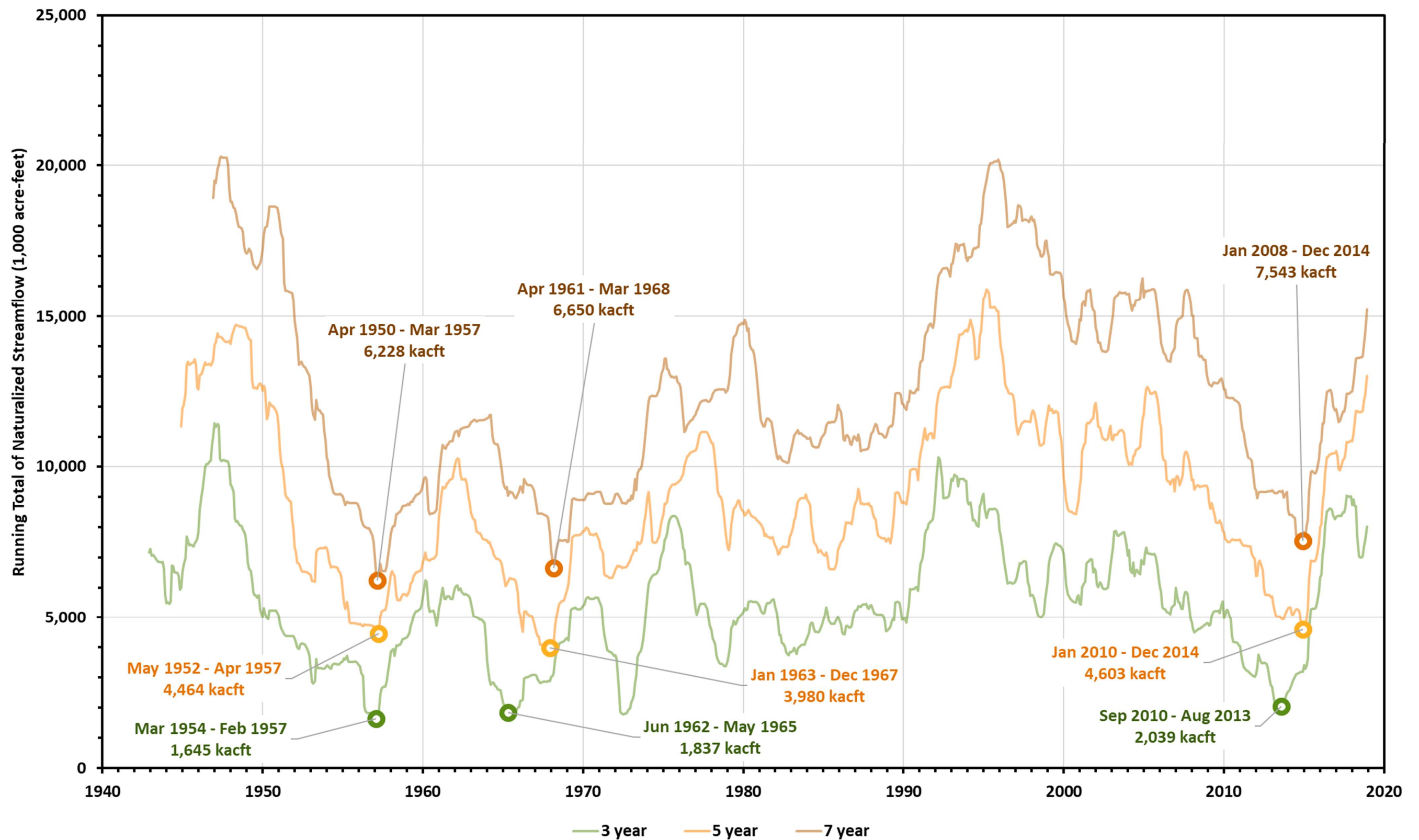


Figure G-4. Comparison of 3-, 5-, and 7-year Running Totals of Naturalized Streamflow at Neches River near Rockland (NERO)

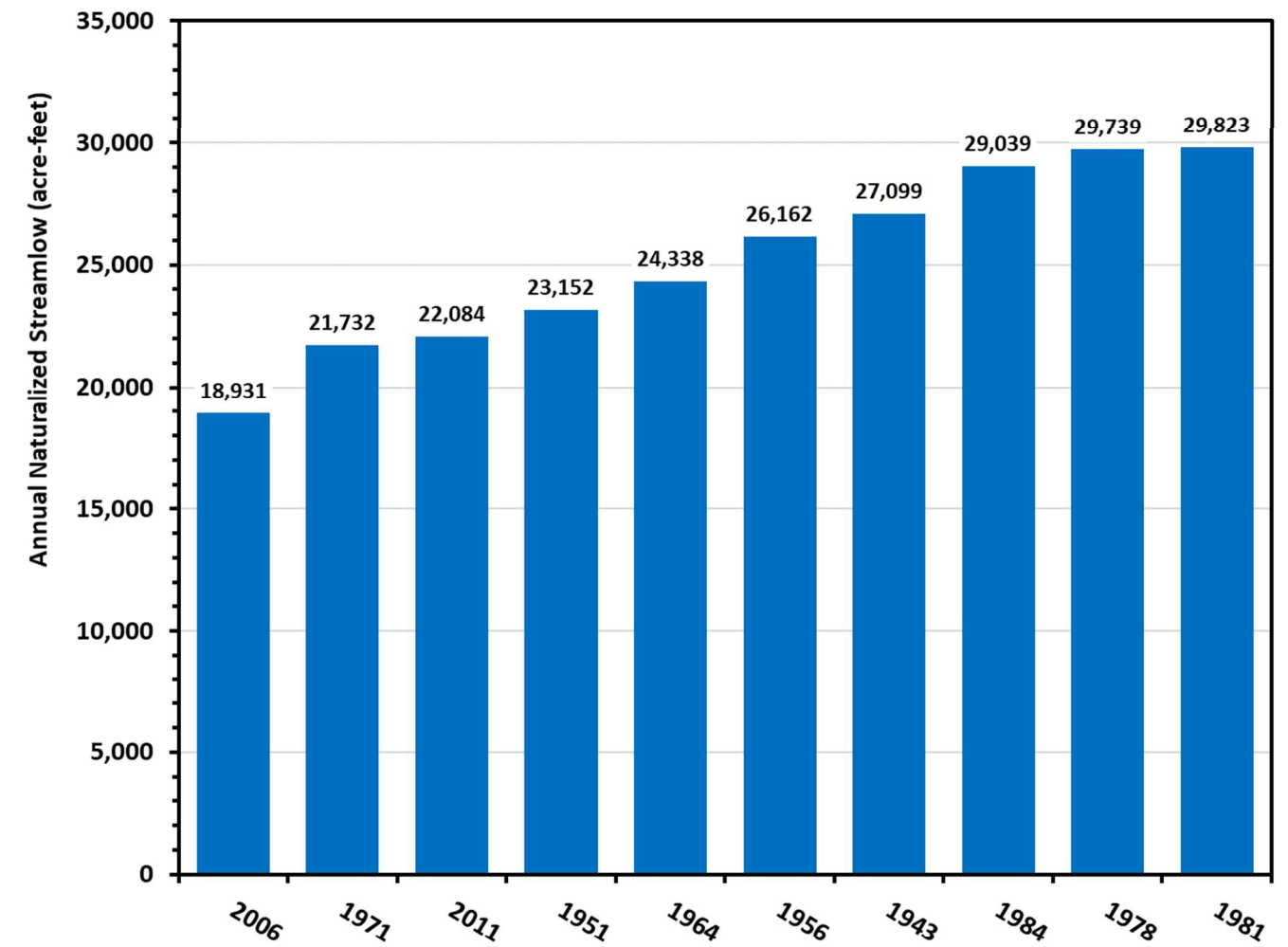
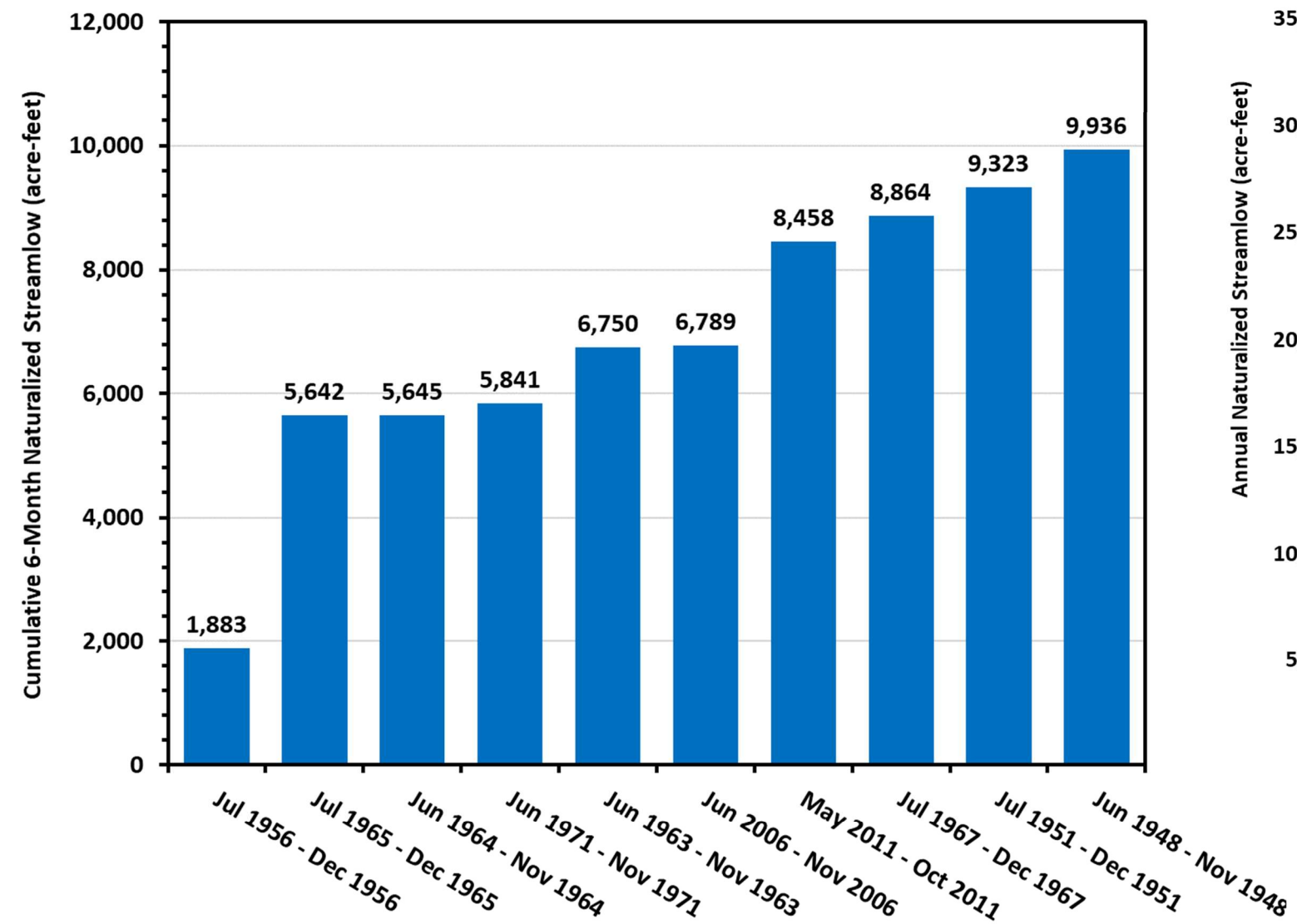


Figure G-5. Comparison of 10 Lowest 6-month and Annual Naturalized Streamflow Amounts at Mud Creek near Jacksonville (MUJA)

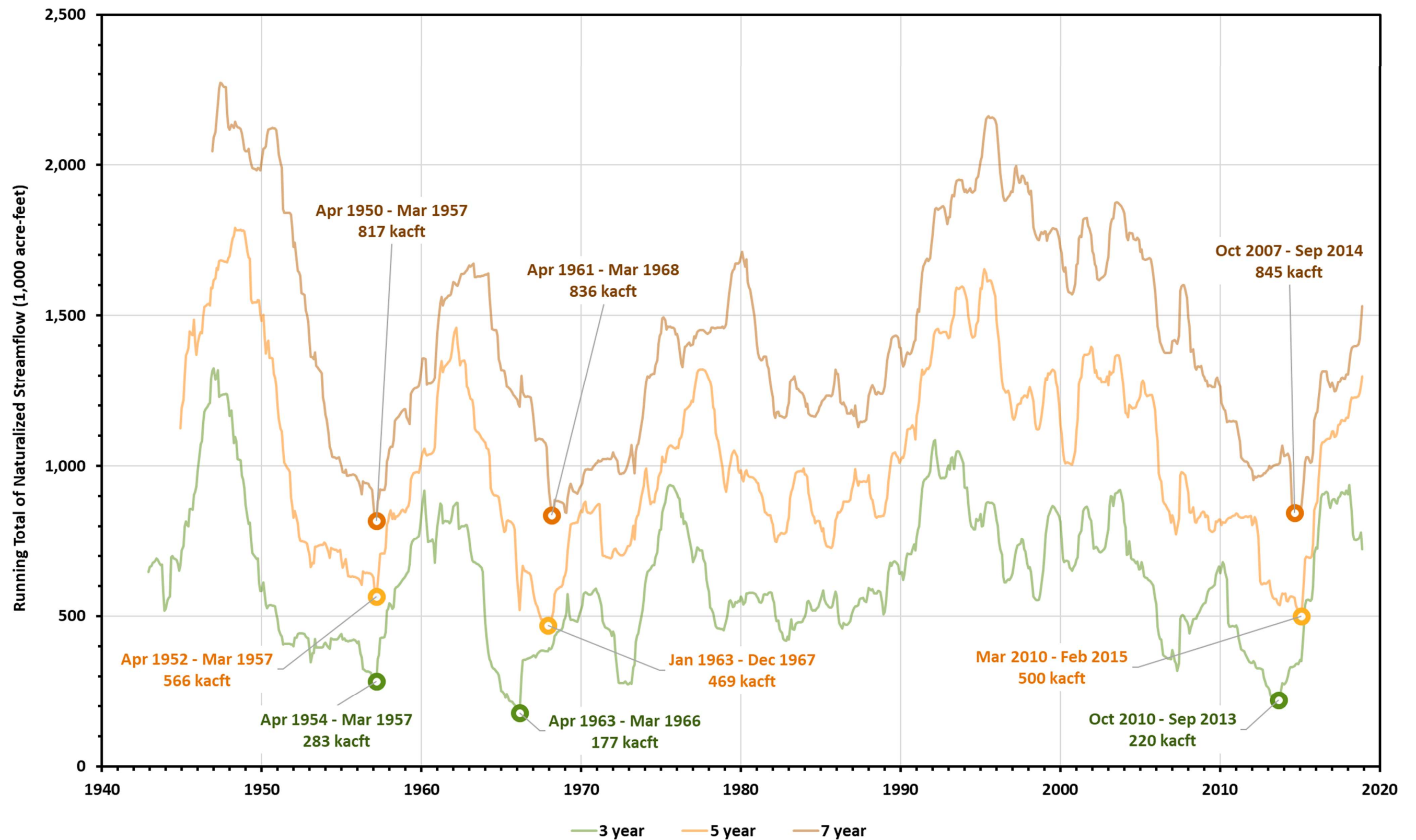


Figure G-6. Comparison of 3-, 5-, and 7-year Running Totals of Naturalized Streamflow at Mud Creek near Jacksonville (MUJA)

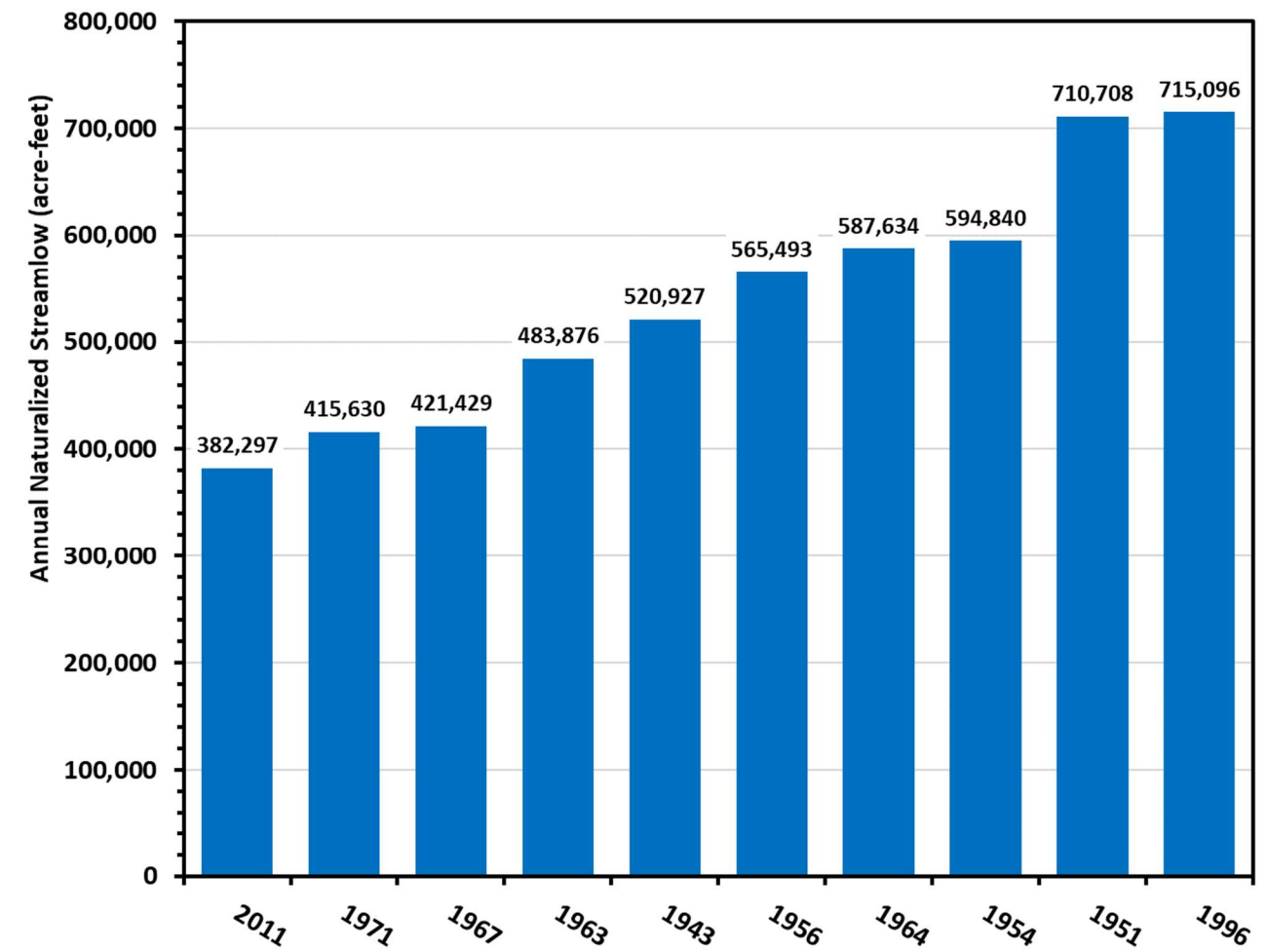
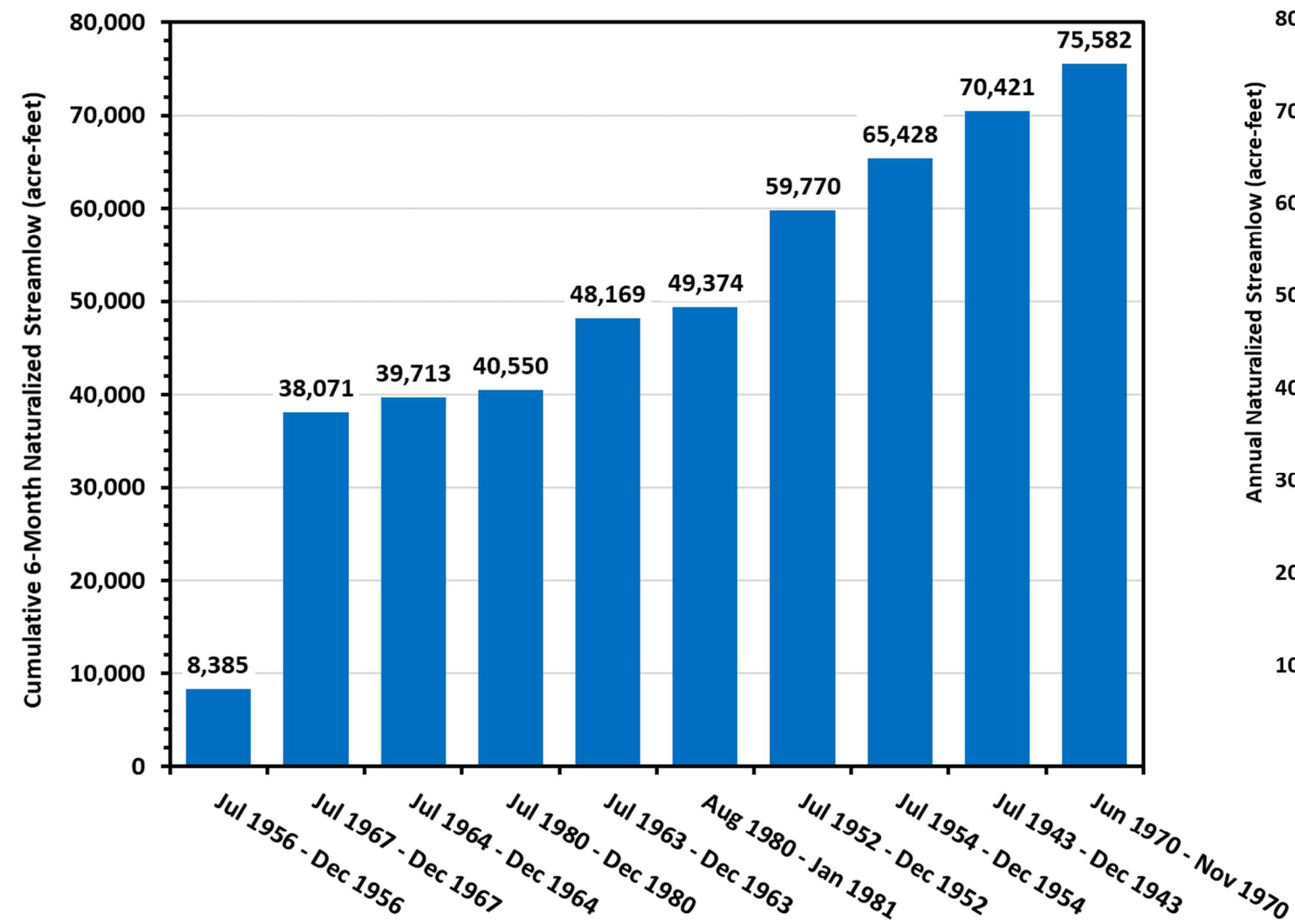


Figure G-7. Comparison of 10 Lowest 6-month and Annual Naturalized Streamflow Amounts at Sam Rayburn Dam (ANSR)

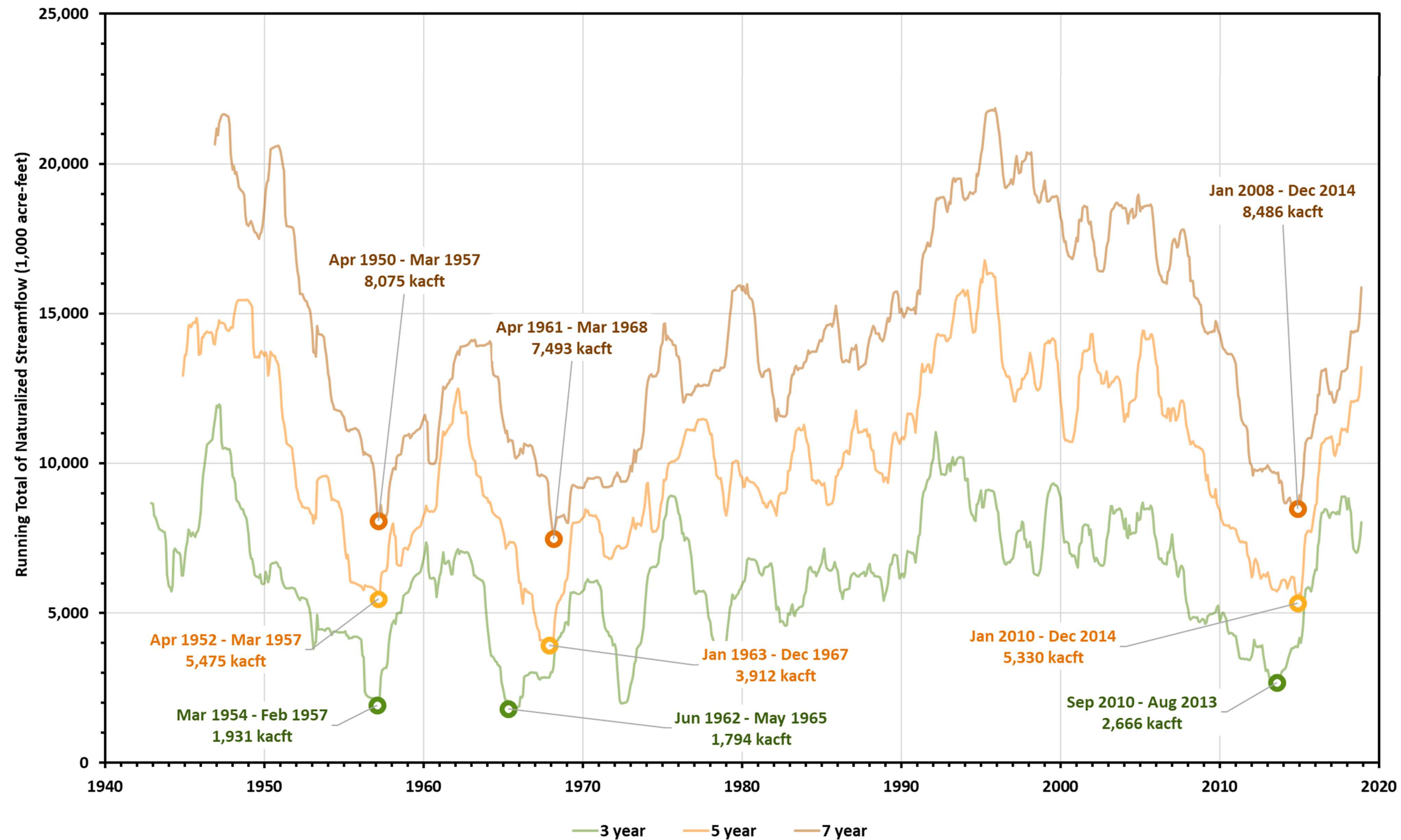


Figure G-8. Comparison of 3-, 5-, and 7-year Running Totals of Naturalized Streamflow at Sam Rayburn Dam (ANSR)

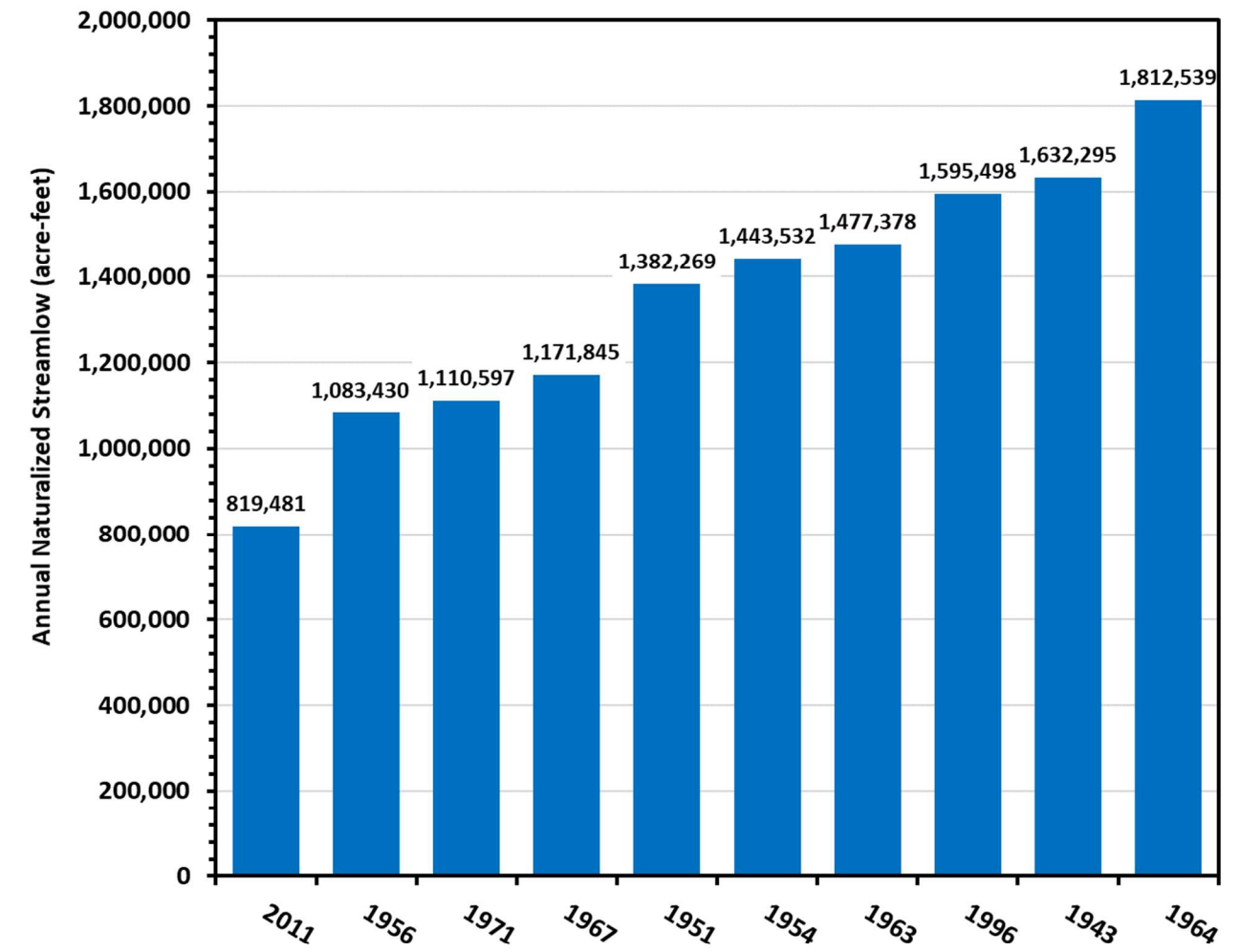
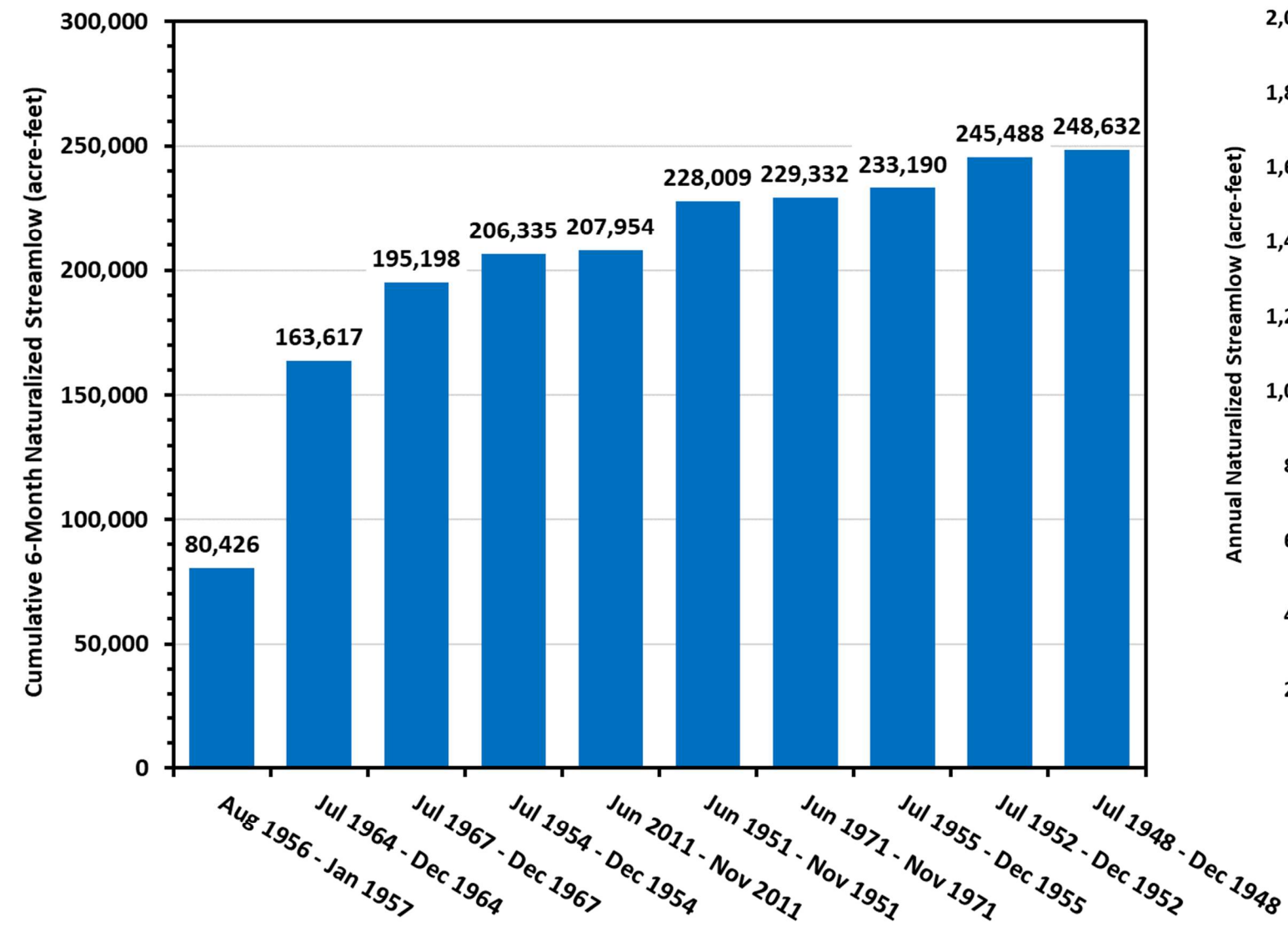


Figure G-9. Comparison of 10 Lowest 6-month and Annual Naturalized Streamflow Amounts at the Neches River at Evadale (NEEV)

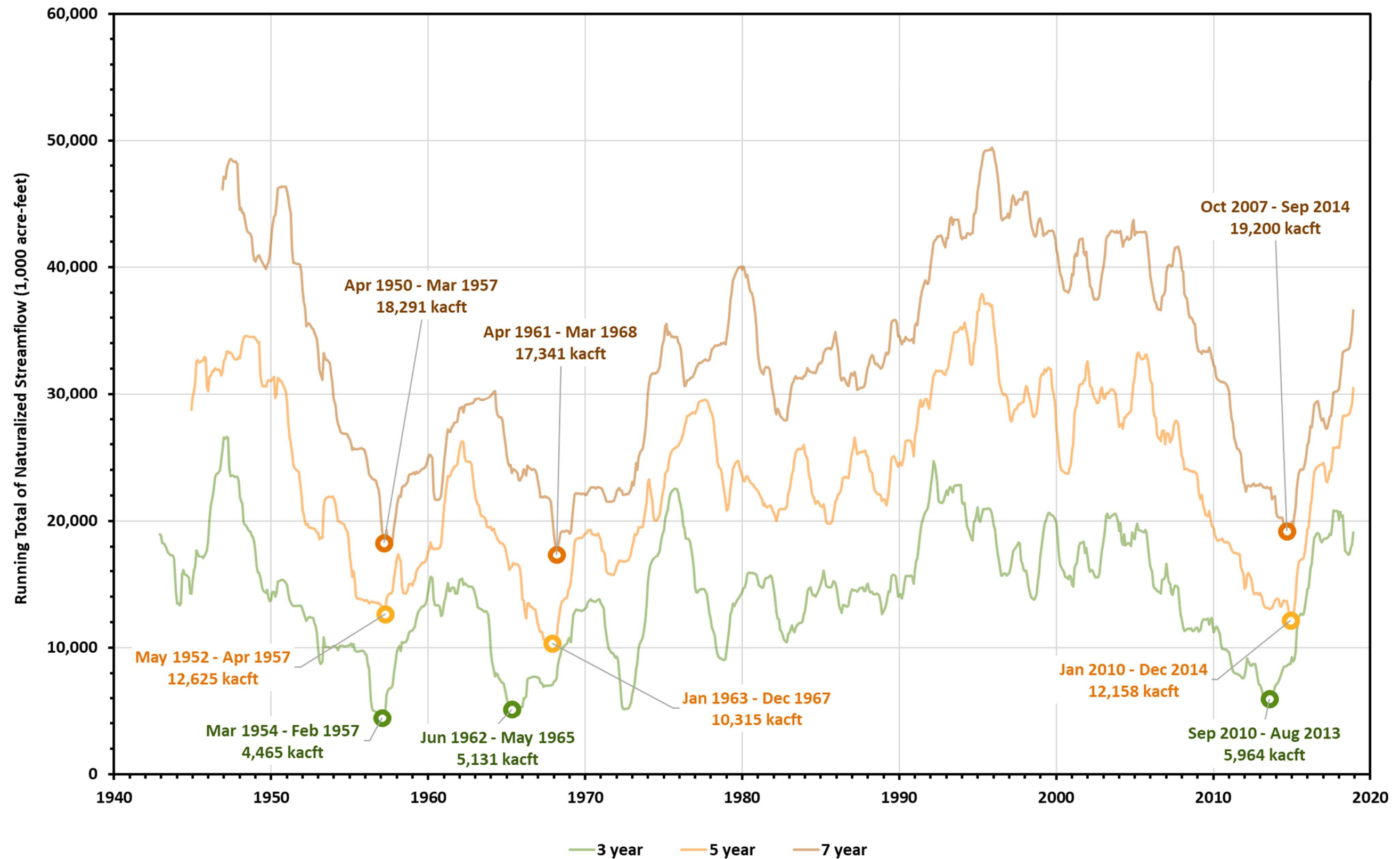


Figure G-10. Comparison of 3-, 5-, and 7-year Running Totals of Naturalized Streamflow at the Neches River at Evadale (NEEV)

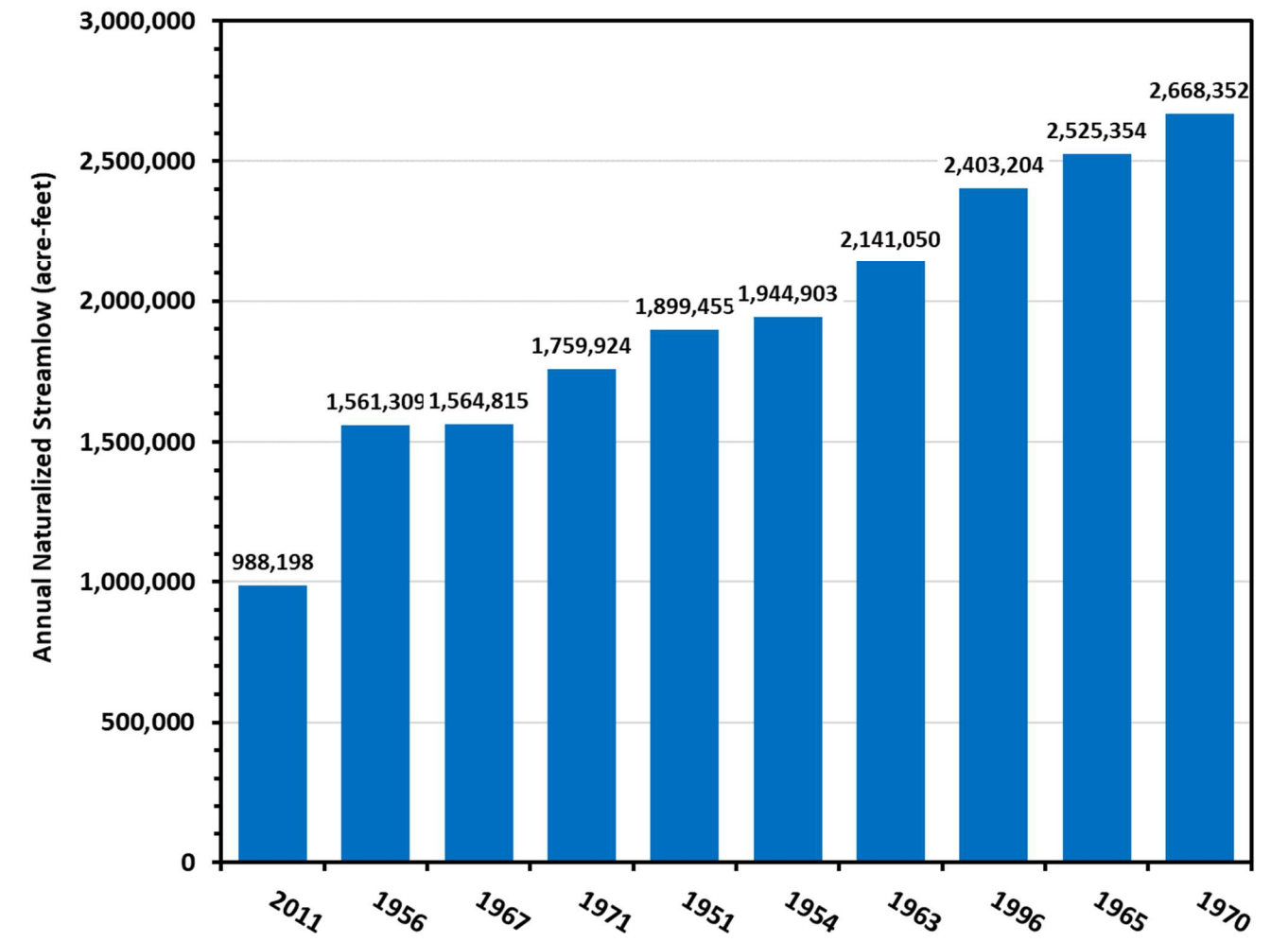
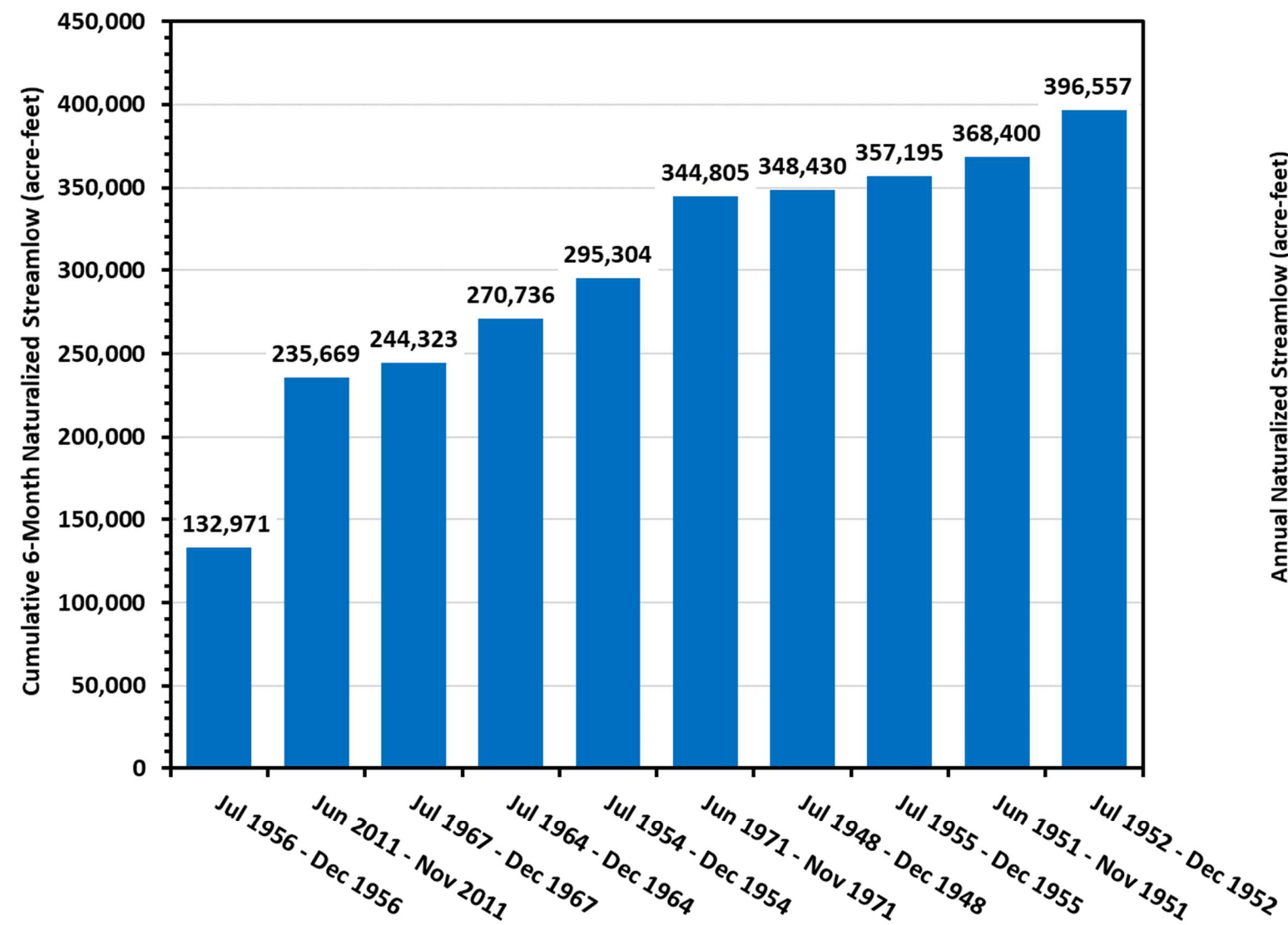


Figure G-11. Comparison of 10 Lowest 6-month and Annual Naturalized Streamflow Amounts at the Neches River at Sabine Lake (NESL)

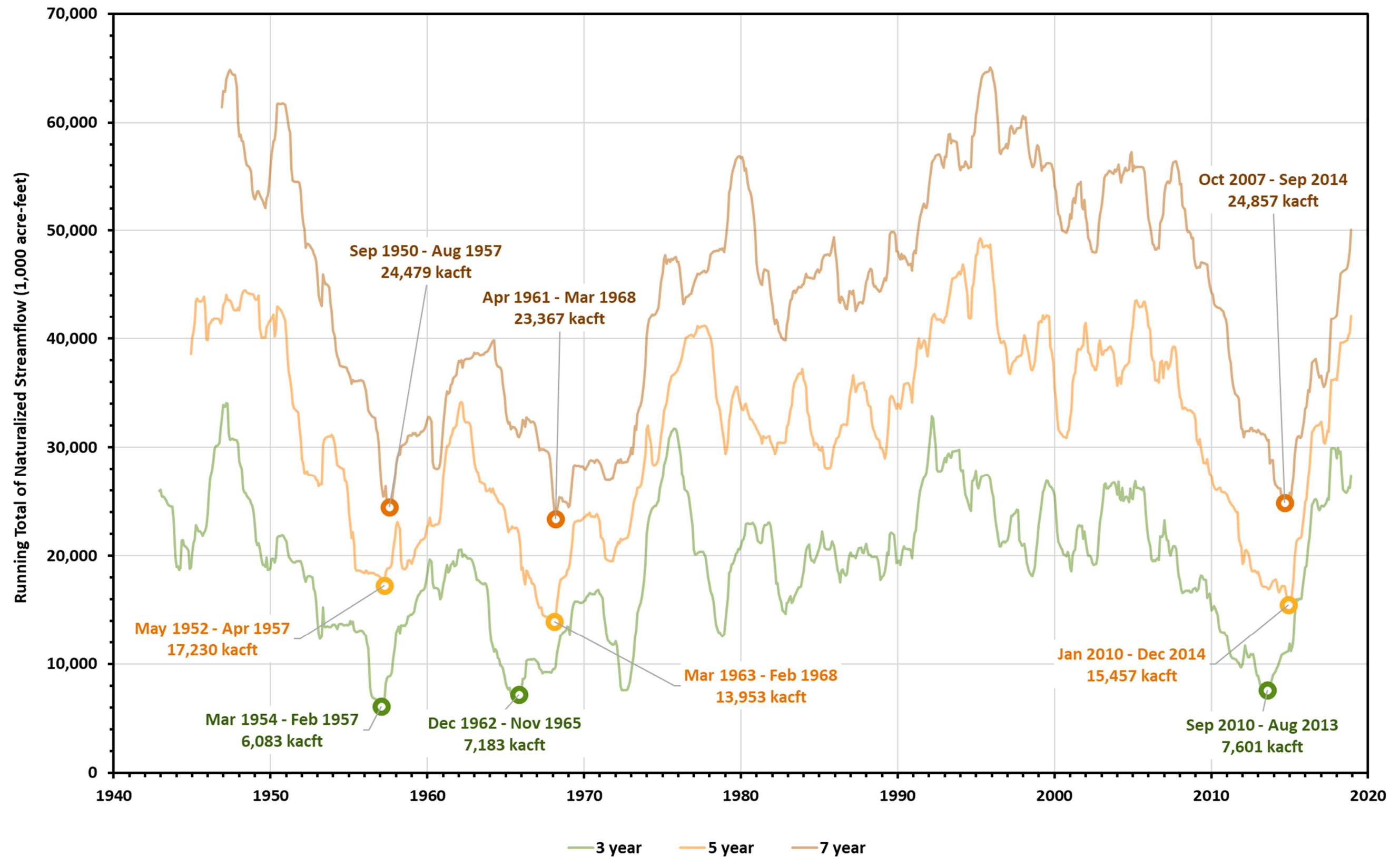


Figure G-12. Comparison of 3-, 5-, and 7-year Running Totals of Naturalized Streamflow at the Neches River at Sabine Lake (NESL)

The page features a large, abstract graphic on the left side composed of three overlapping rectangular blocks: a dark gray block at the top right, a blue block in the middle left, and a light gray block at the bottom left. A solid black horizontal bar is positioned at the bottom right of the page.

APPENDIX H – Independent Peer Review Comments

MEMO

From: Kirk Kennedy and Bob Brandes (Independent Peer Review Team)
To: Zach Stein, HDR
Subject: Independent Peer Review of Naturalized Flow Workbooks, Evaporation Memo, and Draft Report for Neches Basin WAM Update
Date: June 30, 2021

This memo presents a summary of our review of several products from the project currently being conducted by HDR under a contract with the TCEQ to update the naturalized flows and reservoir net evaporation data for the Neches Basin water availability model (WAM). The study products reviewed and discussed in this memo include: (1) a memo prepared by HDR describing problems with TWDB's reservoir evaporation data as used in the original development of naturalized flows and as subsequently revised by the TWDB and discussing HDR's proposed revisions of these data, (2) updated naturalized flow workbooks for the original 1940-1996 modeling period and for the updated 1997-2018 extension period, and (3) a draft report describing the overall work performed. Our review of these study products has been conducted as an independent peer review (IPR) team, without interaction with HDR and its subcontractors during their performance of the actual work. Results from our review of each of the study products are presented and discussed in the following individual sections.

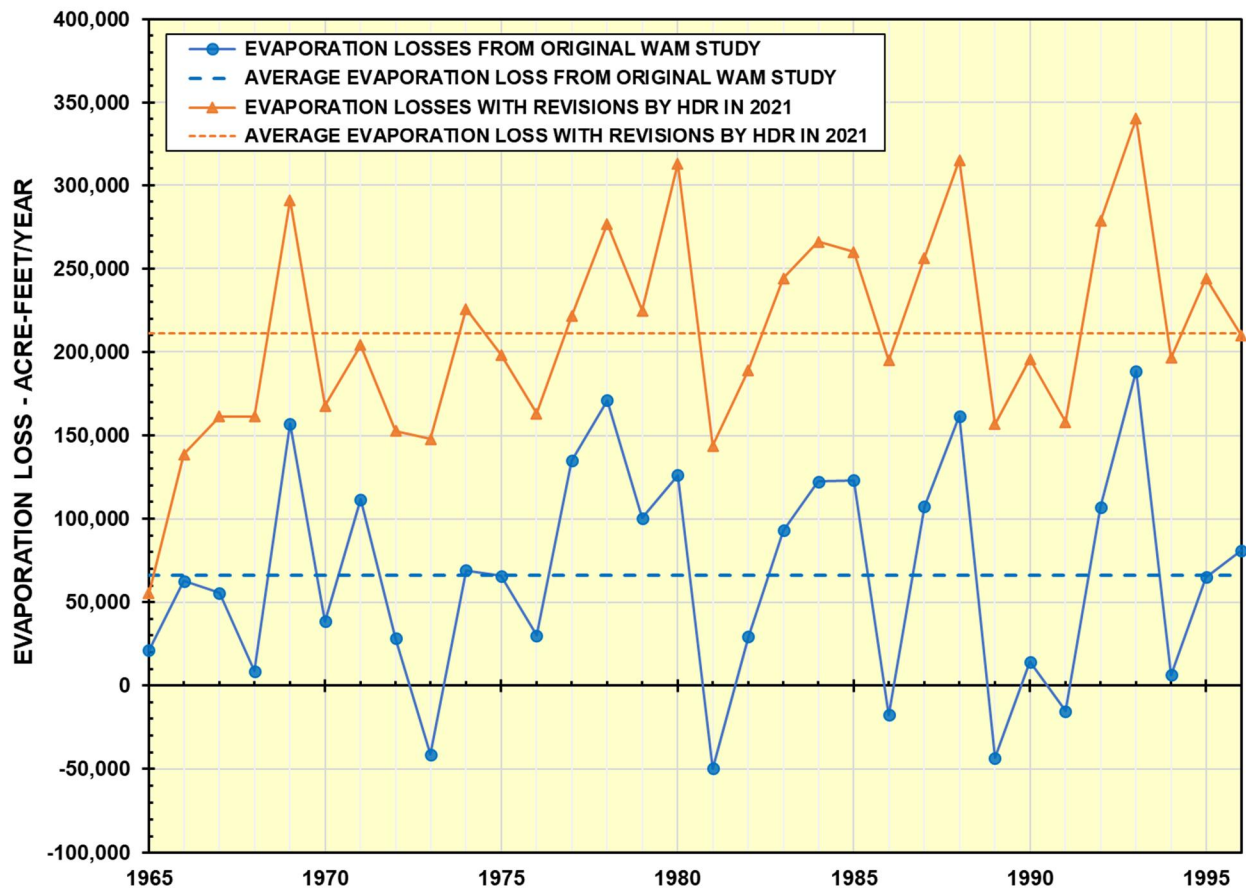
1.0 REVIEW OF EVAPORATION MEMO

During the course of compiling and analyzing data for the 1997-2018 extension period, it was determined by HDR that the 1940-1996 evaporation data used in the original Neches WAM study and the revisions of these evaporation data made by the TWDB since development of the original naturalized flows (referred to by HDR as "new" evaporation data) were unrealistic. It was decided jointly by HDR and TCEQ that the naturalized flows for the entire original period of record, 1940-1996, should be re-calculated using better and more realistic estimates of evaporation data for calculating reservoir evaporation losses and that these more realistic evaporation estimates also should be used for calculating the naturalized flows for the extended 1997-2018 period. Part of the reason for re-calculating the original naturalized flows using more realistic evaporation data was that it could result in eliminating many of the large negative incremental flows inherent in the original naturalized flow dataset. Although these corrections and revisions of the monthly lake evaporation data likely improved the accuracy of the updated naturalized flows, many large negative incremental flows still occur and have required adjustments using flows from adjacent months to offset the negative flows.

HDR produced a memo dated March 11, 2021 that describes the logic behind the conclusion that the TWDB “new” monthly evaporation values are flawed and also outlines procedures used in developing the revised lake evaporation values for the entire 1940-2018 period, and this memo has been reviewed and commented on by the IPRs. The procedures used in developing the revised lake evaporation values include: (1) comparison of the TWDB “new” pan coefficients used for the 1954-2018 period with other standard coefficients leading to the conclusion that the TWDB pan coefficients lack normal seasonal variation, (2) back-calculating actual monthly pan coefficients for Sam Rayburn Reservoir using a monthly mass balance approach applied to 1965-1979 data, (3) comparing these actual pan coefficients for Sam Rayburn Reservoir with standard coefficients and adopting the Young pan coefficients as the most appropriate for converting TWDB Class A pan evaporation data to gross lake evaporation for the 1954-2018 period, and (4) applying the Young pan coefficients to 1940-1953 pan evaporation data to re-calculate gross lake evaporation, after converting all of the original pan evaporation data to Class A pan values.

The resulting revised gross lake evaporation values have more seasonal variation and are significantly higher in all months, averaging about 35% higher. Based on calculations using 1965-1996 historical water levels, surface areas, and storage for Sam Rayburn Reservoir, the average increase in annual evaporation loss is over 200%, ranging from about 66,000 acre-feet/year with the original evaporation rates up to 211,000 acre-feet/year with HDR’s revised evaporation rates (see graph below).

COMPARISON OF ANNUAL EVAPORATION LOSSES FOR SAM RAYBURN RESERVOIR



In the naturalized flow process, this significant increase in the evaporation loss from reservoirs translates to more water being added to the adjustments of gaged flows, thereby producing reductions in the quantities of negative total and incremental naturalized flows.

Given the significant increase in reservoir evaporation losses that result from using the revised lake evaporation values, it would be good to somehow validate the approach used by HDR in this study. The reasonableness of this approach with regard to reservoir evaporation in the Neches Basin could be examined by comparing historical evaporation losses for Sam Rayburn Reservoir as calculated from actual onsite pan evaporation data with the associated coefficients (Class A pan with Class A coefficients) and surface area as measured by the Corps of Engineers with the corresponding estimated evaporation losses determined by HDR in this study. Such comparison could verify the validity of the evaporation approach used by HDR and lend credence to the overall evaporation loss values used in the naturalized flow process.

One point to note with regard to the revised naturalized flows as calculated in the updated workbooks is that the 2004 elevation-area-capacity (EAC) data for Sam Rayburn Reservoir are used for the entire 1940-2018 period, whereas the 1965 EAC data were used in the original development of naturalized flows for the 1940-1996 period. Even though the newer 2004 EAC data produce generally lower values of reservoir content and water surface area at the same elevation, the new calculated evaporation losses are still substantially higher than what was computed originally because of the increased evaporation rates used in the revised approach. It is not clear why HDR used the 2004 EAC data for the entire 1940-2018 period when the 1965 EAC data may have been more appropriate for some part of the early period.

Following are specific comments regarding the HDR evaporation memo:

- 1) With regard to HDR's use of mixed Class A evaporation pan data with Young evaporation pan coefficients, why are the 1940-1953 gross lake evaporation data from the TWDB considered to be inaccurate if they were derived using pan evaporation data adjusted with corresponding pan coefficients, e.g., Young pan data adjusted with Young pan coefficients? These TWDB 1940-1953 gross evap values are probably more accurate than the TWDB 1954-2018 gross evap data that were derived using the TWDB GIS-based pan coefficients.
- 2) With regard to Figures 2 and 3, the data points exhibit extreme scatter, which might question the validity of using the median values as a true representation of evaporation conditions. Also, it is not clear from this plot why HDR selected the Young pan coefficients, which are the highest, as opposed to the Class A pan coefficients which are a closer match to the TWDB pan coefficient. Also, why not use the median values of the pan coefficients since these are based on actual data. It is understood that the comparison of the gaged monthly inflows to Sam Rayburn Reservoir with the water-balance calculated reservoir inflows in Figure 4 indicates that the Young pan coefficients produce the least number of negative values of the water-balance calculated inflows.

2.0 REVIEW OF UPDATED NATURALIZED FLOW WORKBOOKS

The 1940-2018 extended versions of the naturalized flow workbooks for the Neches Basin were received from HDR on April 28, 2021 and subsequently were reviewed in detail. The naturalized flow approach utilized for the 1997-2018 extension period was the same as what was done in the original Neches WAM study. This approach is referred to as the “cumulative naturalized flow adjustment technique”, and it is structured so that all of the flow adjustments made at upstream control points are accumulated and also applied at all downstream control points. For the Neches Basin, there are 20 locations where naturalized flows were determined involving 11 major reservoirs (12 if Lake Kurth is included).

Following are general observations and notes made during the review of the updated naturalized flow workbooks for the Neches Basin. In general, the workbook for each site (primary control point) where naturalized flows are calculated is organized as follows with respect to the worksheets included (tab names):

- (1) INCREMENTAL ADJ. – Final naturalized flow after an additional check, and adjustment if applicable, is made to resolve negative incremental flows.
- (2) ADJ LIST – Back calculation showing extent of negative offsetting adjustments made to deal with negative incremental flows.
- (3) FILLED – Adjusted for the period the gage existed and filled naturalized flows outside of the gaged period, based on various relationships with nearby actual naturalized flows. Fills are based on correlations to a single source location (flow factor) or more than one source location (multi) and in the case of the two most downstream locations, the entire period of record is filled using a drainage area ratio relationship with a nearby location.
- (4) ADJUSTED – Naturalized flow after adjustments for total negative flows.
- (5) NATURAL – Naturalized flow (Gaged Flow + HIST ADJ.)
- (6) HISTORICAL – Gaged flow.
- (7) HIST. ADJ - Historical adjustments (div-rf+cis+el) for all activities in this watershed (local) plus the historical adjustments from all watersheds upstream, if applicable.
- (8) DIVERSIONS – Total diversions by water rights in the local watershed.
- (9) RET_FLOW – Total return flows by major dischargers in the local watershed.
- (10) CHANGE_CONT – Total change in storage for all major reservoirs in the local watershed.
- (11) EVAP_LOSS – Total evaporation loss for all major reservoirs in the local watershed.

In addition, there are usually some other worksheets that contain plots or other visual information.

Other observations regarding the workbooks:

- Formats among worksheets within a workbook are inconsistent with no usable print range specified.
- There are no average, maximum, or minimum values at the bottom of tables for comparison purposes, which often are useful for comparisons between primary control points.
- Some of the source workbooks use Office 365 functions. Note that some state agencies are not able to use Office 365 and thus these formulas cannot be recalculated.
- Sometimes the observed flow is linked to a source file; other times it is pasted in as values.
- Total negative naturalized flows are set to zero and are offset with adjacent flows as the total naturalized flows are calculated.
- Incremental negative flows are set to zero, as the last step, by calculating the difference between the total final naturalized flow for the subject location and all immediately-upstream locations. Note that this incremental flow adjustment is without regard to whether the upstream locations were filled or naturalized.
- A file called HDRTools.xlam is present in the directory as received, but it only appears to be a shortcut to the real file; thus, we were unable to recalculate some of the formulas.
- Evaporation loss is computed as: (average area for current and previous months) x (net evaporation for current month).
- The way reservoir area is interpolated from reservoir capacity is cumbersome and difficult to follow. Streamlining this calculation should be considered.
- There is no worksheet that computes the total adjustments for a given location without including all upstream adjustments. A new worksheet containing the sum of all local adjustments for a given location could be created in each naturalized flow workbook as a means to better understand where all of the adjustments for the total naturalized flow are coming from.

Review of the individual naturalized flow workbooks and associated files has been undertaken by segment of the Neches Basin as specified below. For each segment, shorthand notes/observations have been recorded, and common mistakes made in performing these types of calculations have been specifically reviewed for correctness. Overall, the only major shortcoming that has been identified is an error in the formula that computes evaporation loss from Sam Rayburn Reservoir. It is also noted that the description of the reservoir adjustments associated with Lakes Tyler and Tyler East are poorly documented.

NECHES ARM

KIBR – Headwaters. No ret, No res, few div.

Gage 5/62-9/89: Fill:

Flow factor with NENE for 1/40-4/62

Flow factor with NEPA 10/89-12/18.

Adjustments to total negative flow: None.

Adjustments to incremental negative flow: NA

NEPA – KIBR upstream. About 10kaf rf, about 22kaf div, Palestine and Athens within. A few negatives offset.

Gage 1/73-12/18.

Fill: flow factor with NENE for 1/40-12/72

Adjustments to total negative flow: None

Correct incremental calculated, adjustments to incremental negative flow: 3

Palestine: Began 11/61. Three EAC (original, 2003, 2012) used to interpolate area with storage – orig used until 12/96, 2003 on 1/97, 2012 on 7/12. Formulas for computing cis and evap loss are correct.

Athens: Began 11/62, Two EAC (original and 1998) used to interpolate area with storage – orig used until 12/96, storage 1/97-4/99 was missing and had to be simulated and used 1998 EAC. 10/00 thru 12/18 storage again was published and 1998 EAC was continued to interpolate area with storage. Formulas for computing cis and evap loss are correct.

NENE – NEPA upstream. No res, no ret, small div.

Gage POR.

Fill: None needed.

Adjustments to total negative flow: 6 months.

Correct incremental calculated, adjustments to incremental negative flow: approximately 50 months.

NEAL - NENE upstream. About 1KAF rf, about 2kaf div, Lake Jacksonville within.

Gage 1/44-12/78. Fill:

1/40-12/43 with Multi using NEDI and NENE

1/79-9/85 with Multi using NEDI and NENE

10/85-9/14 with Multi NENE and NERO

10/14-12/18 with Multi NEDI and NENE

Adjustments to total negative flow: 5 months.

Correct incremental calculated, adjustments to incremental negative flow: approximately 20 months.

Lake Jacksonville: Began 7/57. Two EAC, orig [1957] and 2006. Content provided by USGS beginning in 5/99, period before was simulated. Switch from orig to 2006 EAC 12/96. Formulas for computing cis and evap loss are correct.

NEDI – NEAL upstream. About 6kaf rf, about 3k div, then drops to near zero last 2 years, no res.

Gage 2/40-9/85

Fill: 10/85-12/18 with Multi using NERO and NENE

Adjustments to total negative flow: 6 months

Correct incremental calculated, adjustments to incremental negative flow: Many (50 to 100) months.

NERO – NEDI upstream. No rf, no div, no res.

Gage POR. However, similar 1 sm delta DA adjustment for 1/40-5/73.

Adjustments to total negative flow: 4 months.

Correct incremental calculated, adjustments to incremental negative flow: Many months (50 to 100).

ANGELINA ARM

MUTY - Headwaters. No rf, 13kaf div but used to be a lot more, res Tyler and Tyler East within.

Gage: 3/49-12/18, but not really gage, instead appears to be simulated spills from Tyler and Tyler East. Note that this workbook has an additional tab called “INTERMEDIATE ADJ” where after the spills from Tyler and Tyler East are computed, any negative total flows are adjusted and offset. Then the “ADJUSTMENT” tab is used to adjust the spills to reflect the gage location, by multiplying by a DAR of 2.378, apparently to represent the “flow” at the gage, which apparently does not exist.

Fill: 1/40-2/49 Flow factor with MUJA

Adjustments to total negative flow: 6 months

Adjustments to incremental negative flow: NA

Tyler: 1/49. Storage appears to be published thru 4/68 then a larger (about double) amount of storage appears to be published from 5/68-9/86 in a tab called Tyler and Tyler East. EAC for a single reservoir named Tyler is dated 2013 which goes to max AC of 4,868 acres and 78,805 af and was somehow extended to 5,268 acres and 91,738 af.

Tyler East: Must be included, somehow, in Tyler...not very well explained or documented.

MUJA – MUTY upstream. About 7.5 kaf rf, almost no div, un-understandable res adjustment for a few years in mid POR. Note says some initial fill details with Tyler East that were not accounted for in Tyler East adjustment. Need to better understand.

Gage 1/40-9/79, 8/01-12/18

Fill: 10/79-7/01 Flow factor with ANAL.

Adjustments to total negative flow: 2 months.

Correct incremental calculated, adjustments to incremental negative flow: Many months (on order of 50).

EFACU – Headwaters. No rf. No div, no res.

Gage 1/64-9/89, 10/15-12/18

Fill: 1/40-12/63 flow factor MUJA, multi with ANAL & MUJU, multi with ANLU & MUJA, and flow factor with ANAL (use of any one of the above fills varies due to availability of source info).

Fill: 10/89-9/15 flow factor with ANAL

Adjustments to total negative flow: None.

Adjustments to incremental negative flow: NA

ANAL – EFACU & MUJA upstream. About 5kaf rf, 100 af div recent, 4 times that 20 years ago, Stryker within.

Gage: spotty 40-49, solid 3/59-12/18

Adjustments to total negative flow: 3 months.

Adjustments to incremental negative flow: on order of 50 months.

Fill 40-49 with ANLU for spotty period as well as rest of solid period up to 2/59.

Stryker 5/57. Two EAC, original [1957] and 1996. Following summarizes observed elevation and simulated results:

5/57-1/60: Observed from USGS, used orig EAC

2/60-12/62: Simulated using Mud Creek at Jacksonville nat flow using orig EAC

1/63-12/63: Observed from USGS, used orig EAC

1/64-12/67: Simulated using East Fork Angelina at Cushing gaged flow using orig EAC

1/68-12/79: Observed from USGS, used orig EAC

1/80-12/80: Simulated from unknown source using orig EAC, then estimated last 4 months from adjacent months

1/81-12/96: Observed from used orig EAC.

1/97-12/18: Observed from ANWCID#1 and used 1996 EAC.

Formulas for computing cis and evap loss are correct.

ANLU – ANAL upstream. No rf, about 7kaf div, Lake Nacogdoches within.

Gage 1/40-9/79.

Adjustments to total negative flow: 3 months.

Adjustments to incremental negative flow: on order of 75 months.

Fill 10/70-12/18 Multi with ANAL and ANSR

Nacogdoches 7/76. Two EAC, original (date UK) and 1994 EAC. Observed content available 7/76 to 12/96, then obs elevation 1/97-12/18. EAC changed from orig to 1994 in 10/95. Formulas for computing cis and evap loss are correct.

ATCH – Headwaters. No rf, div about 3kay, Pinkston and Naconiche within.

Gage: 1/40-9/85 (msg 11/54-9/55) and 10/85-12/18

Adjustments to total negative flow: None

Adjustments to incremental negative flow: NA

Fill missing with flow factor with inc of NETB, NERO, ANLU.

Fill 10/85-12/19 with flow factor with inc of ANSR and ANAL.

Pinkston 9/87 No observed info, simulated using the following USGS gaged flow for various period:

Ayish Bayou near San Augusta

Bayou Lanana at Nacogdoches

Big Cow Creek near ?

East Fork Angelina near ?

What appeared to be historical demand was correctly represented in the reservoir simulation model and the formulas for computing cis and evap loss, although unique, are correct.

Naconiche 1/09 No observed info, simulated using the USGS gaged flow for Big Cow Creek near ?. There was no demand placed on the reservoir in the simulation and the formulas for computing cis and evap loss, although unique, are correct.

AYSA – Headwaters, No rf, about 800 afy div, no res.

Gage 3/59-8/85

Adjustments to total negative flow: None

Adjustments to incremental negative flow: NA

Fill 1/40-2/59 flow factor with ATCH

Fill 4/51-2/59 with flow factor using inc of NETB, NERO, ANLU.

Fill 10/89-12/18 with flow factor using inc of ANSR, ANAL.

ANSR – ANLU, ATCH, AYSA upstream. RET 7400 af/y late, was over 20KAF earlier in period. Div 36 af/y late and was over 10 kaf/y earlier in period. Sam Rayburn is within.

Gage 1/65-12/18.

Adjustments to total negative flow: 6 months.

Adjustments to incremental negative flows: over 100 months.

Fill 1/40-3/51 flow factor with ANHG.

Fill 4/51-9/51 flow factor with inc NETB, NERO

Fill 10/51012/64 flow factor with ANZAV? Note that this designation is not defined but does refer to a memo by written by Tom Gooch that could not be found in the files provided.

Rayburn Beginning 1/65 USACOE provided observed elevations for entire period. Had 2 EAC relationships, original (1965) and 2004. The original EAC was deemed inaccurate and the 2004 EAC was used to interpolate storage and area for the reservoir's entire period. **Note that the formula that computes evaporation loss is in error for January 1965 (the previous month's area was inadvertently specified as the cell with the year in it).** Formulas that calculate cis are correct.

Kurth 7/61 . Assumed full 7/61-6/79, 7/79-12/95 observed elevation interpolated with orig EAC, then 1996 ACE used thru old POR (ends in 12/1996). Although this reservoir was naturalized in original work, it is now deemed to be off-channel so no adjustments were computed for extended period.

NECHES BELOW NECHES/ANGELINA CONFLUENCE

NETB – NERO & ANSR upstream. Rt 1200 af/y, div 700 af/u, Steinhagen is within.

Gage 4/51 to 12/18. Note that gage apparently moved (4/51-10/89 with DA of 7574, then 11/89-12/18 with DA of 7573) this being addressed in the in ADJUSTED tab. Also, several “discrepancies” noted

for 8/89-9/90 and also 1/97-9/00 where apparently published electric values were over rode with paper USGS reports.

Fill 1/40-3/52 using flow factor with NEEV.

Adjustments to total negative flow: None

Correct incremental calculated for adjustments to incremental negative flow. Adjustments to incremental negative flow: magnitude of 75 months (some were almost 500 kaf/m).

Steinhagen 4/51. USACOE provided observed elevation for entire period. The only actual reservoir survey was by TWDB in 2011. FNI estimated the sedimentation rate from when Steinhagen was impounded to the date of the 2011 survey, then applied this sedimentation rate to the effective drainage area of Steinhagen, reducing the effective drainage area as major reservoirs were constructed upstream. FNI then created numerous estimated area and capacity relationships, using this information to interpolate storage and area for numerous time slots that correspond to other major upstream reservoirs development (Jacksonville, Palestine, Rayburn). These curves were used to interpolate area and capacity from observed elevation as follows:

1951 Est. EAC: 4/51-11/60

1960 Est. EAC: 12/60-4/66

1965 Est. EAC: 5/66-4/69

1970 Est. EAC: 5/69-5/79

1980 Est. EAC: 6/79-6/89

1990 Est. EAC: 7/89-1/99

2000 Est. EAC: 3/99-10/09

2011 Actual EAC: 11/09-12/18

The formulas that calculate evap loss and cis were correct.

NEEV – NETB upstream. No rf, small div late, more div earlier, No res.

Gage POR. Note that gage apparently moved (1/40-10/63 with DA of 7951, then 11/63-12/18 with DA of 7952, this being addressed in the in ADJUSTED tab.

Fill - None.

Adjustments to total negative flow: None

Correct incremental calculated for adjustments to incremental negative flow. Adjustments to incremental negative flow: over 100 months (some were almost 475 kaf/m).

VIKO – Headwaters. 1200 AF/Y RF, No div late and small amount earlier, no res within.

Gage POR. Note that gage apparently moved (1/40-9/66 with DA of 860, then 10/66-12/18 with DA of 861) this being addressed in the in ADJUSTED tab.

Fill - None.

Adjustments to total negative flow: None

Adjustments to incremental negative flow: NA.

PISL – Headwaters. No rf, no recent div (few 100 af in 1970's), no res.
Gage 10/67-12/18. Gage discrepancies noted and addressed in 1/93, 3/93-4/93.
Fill 1/40-9/67 with flow factor with VIKO (note strange note in top of FILLED tab).
Adjustments to total negative flow: None
Adjustments to incremental negative flow: NA.

NEBA – NEBA & PISL upstream. > 50KAFY rf, >275 KAFY div, no res.
Gage None.
Fill. Entire POR filled with NEEV + (1.525* VIKO + PISL) [1824/860+336].
Adjustments to total negative flow: None
Adjustments to incremental negative flow: NA, all filled.

NESL – NEBA upstream. No rf, no div, no res.
Gage None.
Fill. Entire POR filled with NEEV + (1.7224* VIKO + PISL) [2060/860+336].
Adjustments to total negative flow: None
Adjustments to incremental negative flow: NA, all filled.

3.0 REVIEW OF DRAFT REPORT

The draft report as produced by HDR has been reviewed in detail by the IPR team, and suggested revisions and marginal comments have been provided using the track changes and comment options in MS Word. These documents with suggested revisions and marginal comments have been provided to HDR, and they were discussed with HDR personnel in a video conference. Significant suggested changes include the following:

- 1) Section 5.6-Gross Reservoir Evaporation - Why not put the entire March 11, 2021 memo on evaporation in an Appendix and then simply state here that the gross reservoir evaporation values were adjusted as described in the memo, maybe with some very limited description of what was done. The following paragraphs could then be eliminated since they are addressed in the memo. Also, the inclusion of parts of the memo here and the remainder in Section 7.1 seems disjointed and difficult to comprehend.
- 2) Section 7-Procedures for Addressing Negative Naturalized Flows - Throughout this section, it needs to be made clear as to whether total naturalized flows or incremental naturalized flows are being discussed. Needs further clarification.
- 3) Section 7-Procedures for Addressing Negative Naturalized Flows - How do you get from a review of hydropower releases to verifying that occurrence of negative flows is minimized? Need some more explanation or maybe this sentence should be the first sentence of the next paragraph.

- 4) Section 7-Procedures for Addressing Negative Naturalized Flows - With regard to noting that the HDR evaporation adjustments “resulted in a significant reduction of the occurrence and magnitude negative naturalized flows in the dataset”, this statement is made before any results from the evaporation study are presented in the following Section 7.1. Seems like Table 10 should follow a discussion of the supplemental evaporation study, which should be in an appendix.
- 5) Section 8- Procedures for Addressing Negative Incremental Naturalized Flows - With regard to the causes of incremental naturalized flows, what about the effects of the evaporation data changes in the March 11, 2021 memo? Seems like this might be an important factor in this case. Also, would a table comparing negative naturalized flow statistics for the existing dataset and the updated dataset like Table 10 above be useful here? Seems like Table 10 for total flows requires a similar table for incremental flows. The updated naturalized flows still show significant monthly negative flow values.

Memo

Date: Tuesday, July 13, 2021

Project: Water Availability Model (WAM) Update – Phase 1 – Neches River Basin

To: Kathy Alexander, Ph.D., TCEQ
Steven Mahr, TCEQ

From: Zach Stein, PE
Sam Vaughn, PE

Subject: Responses to Independent Reviewer Comments

Background

An independent review of the Neches WAM update was performed by Robert J. Brandes Consulting (RJBC) and Kennedy Resource Company (KRC). The independent review focused on quality control of the data collection effort and filling of missing data, calculations included in the naturalized flow workbooks, final datasets, and the final report. The following four items were reviewed by the independent peer reviewers.

1. Draft Work Plan
2. Naturalized Flow and Net Evaporation Calculations
3. Evaporation Memo dated March 11, 2021
4. Draft Report

Comments from the independent peer review are summarized in the RJBC and KRC 30 June 2021 technical memorandum. This 13 July 2021 technical memorandum provides responses to substantive comments from the independent peer review. Substantive comments from the independent review are shown herein in bold and italic format followed by HDR responses.

The only change made to the naturalized flow dataset following the independent review was to correct the formula error in the January 1965 content change for Sam Rayburn Reservoir. This correction did not result in significant changes to naturalized flow or net evaporation values at the Sam Rayburn Reservoir control point or downstream control points. Additional notes and documentation clarifying procedures used in the calculations were also added to the naturalized flow workbooks in response to the independent peer review.

Draft Work Plan Review

A review was completed of the work plan to verify that the proposed methodologies to update the naturalized flow and net evaporation datasets are correct and the most appropriate. Reviewers found the draft work plan satisfactory and no substantive changes were made in finalizing the work plan.

Naturalized Flow and Net Evaporation Calculations

A review of the naturalized flow workbooks was completed to verify that naturalized flow and net evaporation calculations are correct and that methodologies outlined in the work plan were applied appropriately to fill missing data, address negative naturalized flows, and develop statistical relationships in the naturalized flow datasets.

Formats among worksheets within a workbook are inconsistent with no usable print range specified.

Formatting has been updated to provide additional consistency among the worksheets.

There are no average, maximum, or minimum values at the bottom of tables for comparison purposes, which often are useful for comparisons between primary control points.

Average, maximum, and minimum values have been added to the tables included in the naturalized flow workbooks.

Some of the source workbooks use Office 365 functions. Note that some state agencies are not able to use Office 365 and thus these formulas cannot be recalculated.

Noted. HDR will work with the TCEQ following its review to resolve any issues related to functions used in the workbooks.

Sometimes the observed flow is linked to a source file; other times it is pasted in as values.

All observed flows have been linked to source files (NECHESGAGEFLW.xlsm).

Total negative naturalized flows are set to zero and are offset with adjacent flows as the total naturalized flows are calculated.

This procedure is consistent with those included in the original development of naturalized flows in the Neches River Basin and is consistent with the approach included in the approved work plan.

Incremental negative flows are set to zero, as the last step, by calculating the difference between the total final naturalized flow for the subject location and all immediately-upstream locations. Note that this incremental flow adjustment is without regard to whether the upstream locations were filled or naturalized.

This procedure is consistent with those included in the original development of naturalized flows in the Neches River Basin and is consistent with the approach included in the approved work plan.

A file called HDRTTools.xlam is present in the directory as received, but it only appears to be a shortcut to the real file; thus, we were unable to recalculate some of the formulas.

The HDRTTools.xlam includes an interpolation function used in converting reservoir surface elevations to storage volumes in conjunction with available elevation-storage relationships. The interpolation function has been embedded within the workbooks to properly work without reference to the HDRTTools.xlam file.

Evaporation loss is computed as: (average area for current and previous months) x (net evaporation for current month).

Evaporation loss is computed as the average of the end of month areas of the previous and current months multiplied by the net evaporation depth of the current month.

The way reservoir area is interpolated from reservoir capacity is cumbersome and difficult to follow. Streamlining this calculation should be considered.

Embedment of the interpolation function within the workbooks has made this computation more transparent and easier to follow.

There is no worksheet that computes the total adjustments for a given location without including all upstream adjustments. A new worksheet containing the sum of all local adjustments for a given location could be created in each naturalized flow workbook as a means to better understand where all of the adjustments for the total naturalized flow are coming from.

The addition of a new worksheet for these computations is not necessary for calculation of naturalized flows. Should TCEQ wish to add this additional worksheet, HDR will proceed with the modifications.

Overall, the only major shortcoming that has been identified is an error in the formula that computes evaporation loss from Sam Rayburn Reservoir. It is also noted that the description of the reservoir adjustments associated with Lakes Tyler and Tyler East are poorly documented.

The evaporation loss formula error included in the calculations for Sam Rayburn Reservoir was applicable to only one month and has been corrected. Additional documentation of the procedures for adjusting Lakes Tyler and Tyler East has been added to the appropriate workbooks.

Evaporation Memo

Page 3. One point to note with regard to the revised naturalized flows as calculated in the updated workbooks is that the 2004 elevation-area-capacity (EAC) data for Sam Rayburn Reservoir are used for the entire 1940-2018 period, whereas the 1965 EAC data were used in the original development of naturalized flows for the 1940-1996 period. Even though the newer 2004 EAC data produce generally lower values of reservoir content and water surface area at the same elevation, the new calculated evaporation losses are still substantially higher than what was computed originally because of the increased evaporation rates used in the revised approach. It is not clear why HDR used the 2004 EAC data for the entire 1940-2018 period when the 1965 EAC data may have been more appropriate for some part of the early period.

Comparison of the 1965 and 2004 surveys show that less capacity and surface area are present at contours below elevation 150 ft-msl in the 1965 survey. This smaller storage capacity and surface area in the earlier survey is counter-intuitive when considering sediment deposition and suggests the 1965 survey reflects a lower degree of accuracy than the 2004 survey. As a result, HDR applied the 2004 survey for the full period to provide a consistent basis for content change and net evaporation calculations. Additional documentation has been added to the draft report and Sam Rayburn Reservoir content change workbook.

Page 3. With regard to HDR's use of mixed Class A evaporation pan data with Young evaporation pan coefficients, why are the 1940-1953 gross lake evaporation data from the TWDB considered to be inaccurate if they were derived using pan evaporation data adjusted with corresponding pan coefficients, e.g., Young pan data adjusted with Young pan coefficients? These TWDB 1940-1953 gross

evap values are probably more accurate than the TWDB 1954-2018 gross evap data that were derived using the TWDB GIS-based pan coefficients.

Based on the results of the supplemental multi-year monthly mass balance evaporation evaluation, HDR found the most accurate estimates of evaporation to be those derived using published Young pan coefficients applied to Class A pan data. Given the results of the evaluation and the clear discontinuity between the TWDB 1940-1953 data and the later evaporation rates estimated using Class A pan data with Young coefficients applied (a shift in annual average of 22.7 inches), adjustments to the earlier data for consistency was deemed necessary and appropriate.

Page 3. With regard to Figures 2 and 3, the data points exhibit extreme scatter, which might question the validity of using the median values as a true representation of evaporation conditions. Also, it is not clear from this plot why HDR selected the Young pan coefficients, which are the highest, as opposed to the Class A pan coefficients which are a closer match to the TWDB pan coefficient. Also, why not use the median values of the pan coefficients since these are based on actual data. It is understood that the comparison of the gaged monthly inflows to Sam Rayburn Reservoir with the water-balance calculated reservoir inflows in Figure 4 indicates that the Young pan coefficients produce the least number of negative values of the water-balance calculated inflows.

Figures 2 and 3 clearly show the Young coefficients most closely approximate the calculated monthly medians while the new TWDB and Class A coefficients do not even fall within the range including 75% of the data for 5 to 8 months of the year. HDR's selection is based on clear consistency with actual data for Sam Rayburn Reservoir. Selection of the Class A coefficients is clearly unsupported by the results of the analyses and is not deemed a defensible choice.

HDR acknowledges significant scatter occurs in the winter months; however, for the summer and fall months, the scatter is limited as shown by the convergence of the 25th and 75th percentile. During the summer and fall months, the median values closely correspond to the Young coefficients while the variance increases in the winter and spring months. For this reason, use of the Young coefficients is considered an accurate estimation for the summer and fall months and a more defensible choice for the winter and spring months compared to the median values.

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Section 5.6-Gross Reservoir Evaporation - Why not put the entire March 11, 2021 memo on evaporation in an Appendix and then simply state here that the gross reservoir evaporation values were adjusted as described in the memo, maybe with some very limited description of what was done. The following paragraphs could then be eliminated since they are addressed in the memo. Also, the inclusion of parts of the memo here and the remainder in Section 7.1 seems disjointed and difficult to comprehend.

The memo has been added as an appendix and text in the report has been revised accordingly.

Section 7-Procedures for Addressing Negative Naturalized Flows - Throughout this section, it needs to be made clear as to whether total naturalized flows or incremental naturalized flows are being discussed. Needs further clarification.

Additional text has been added to the report for clarification of discussions related to total negative naturalized flows and incremental negative naturalized flows.

Section 7-Procedures for Addressing Negative Naturalized Flows - How do you get from a review of hydropower releases to verifying that occurrence of negative flows is minimized? Need some more explanation or maybe this sentence should be the first sentence of the next paragraph.

Additional documentation of has been added to the report to describe the investigative process used to identify the cause of the total negative naturalized flows.

Section 7-Procedures for Addressing Negative Naturalized Flows - With regard to noting that the HDR evaporation adjustments “resulted in a significant reduction of the occurrence and magnitude negative naturalized flows in the dataset”, this statement is made before any results from the evaporation study are presented in the following Section 7.1. Seems like Table 10 should follow a discussion of the supplemental evaporation study, which should be in an appendix.

Additional discussion has been added to the text before Table 10.

Section 8- Procedures for Addressing Negative Incremental Naturalized Flows - With regard to the causes of incremental naturalized flows, what about the effects of the evaporation data changes in the March 11, 2021 memo? Seems like this might be an important factor in this case. Also, would a table comparing negative naturalized flow statistics for the existing dataset and the updated dataset like Table 10 above be useful here? Seems like Table 10 for total flows requires a similar table for incremental flows. The updated naturalized flows still show significant monthly negative flow values.

A comparison of incremental flows adjustments made in the original dataset calculations and those included in the update as part of this study shows no substantive differences in the frequency and magnitude of the incremental flow adjustments. Further investigation indicates negative incremental flows are largely the result of timing issues and not total negative flow issues. Additional discussion has been added to the report related to the occurrence of negative incremental flows.

