ANNUAL

OPERATING

PLAN

Kansas River Projects

1960 Operations

1961 Outlook

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
REGION 7
DENVER, COLORADO

February 1961

UNITED STATES DEPARTMENT OF THE INTERIOR
Stewart L. Udall, Secretary

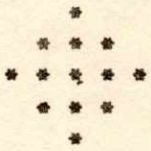
BUREAU OF RECLAMATION
Floyd E. Dominy, Commissioner

Region 7 - Denver, Colorado
John N. Spencer, Regional Director

ANNUAL OPERATING PLAN

KANSAS RIVER PROJECTS

1960 OPERATIONS
1961 OUTLOOK



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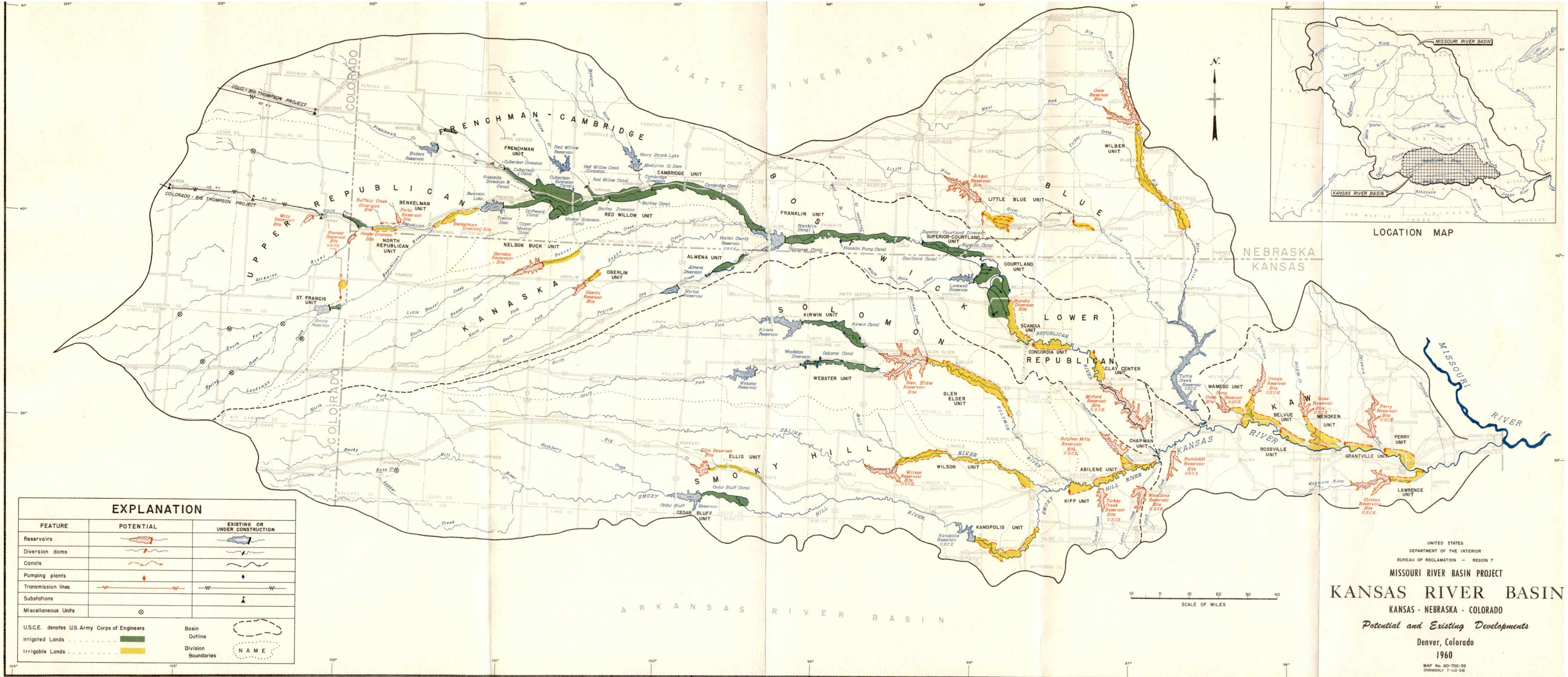

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION — REGION 7
MISSOURI RIVER BASIN PROJECT
KANSAS RIVER BASIN
KANSAS - NEBRASKA - COLORADO
Potential and Existing Developments
Denver, Colorado
1960
MAP No. 60-700-39
(FORMERLY 7-110-39)
EXPLANATION
FEATURE
POTENTIAL
EXISTING OR UNDER CONSTRUCTION
Reservoirs
Diversion dams
Canals
Pumping plants
Transmission lines
Substations
Miscellaneous Units
U.S.C.E. denotes U.S. Army Corps of Engineers
Irrigated Lands
Irrigable Lands
Basin Outline
Division Boundaries
NAME
SCALE OF MILES
10 0 10 20 30 40
LOCATION MAP
MISSOURI RIVER BASIN
KANSAS RIVER BASIN
N
PLATTE RIVER BASIN
ARKANSAS RIVER BASIN
NEBRASKA
KANSAS
COLORADO
MISSOURI RIVER
COLO.-BIG THOMPSON PROJECT
COLORADO-BIG THOMPSON PROJECT
FRENCHMAN-CAMBRIDGE
UPPER REPUBLICAN
KANASKA
BOSTWICK
SOLOMON
LOWER REPUBLICAN
BLUE
KAW
SMOKY HILL
FRENCHMAN UNIT
CAMBRIDGE UNIT
RED WILLOW UNIT
BENKELMAN UNIT
NORTH REPUBLICAN UNIT
NELSON BUCK UNIT
ST. FRANCIS UNIT
OBERLIN UNIT
ALMENA UNIT
FRANKLIN UNIT
SUPERIOR-COURTLAND UNIT
COURTLAND UNIT
LITTLE BLUE UNIT
WILBER UNIT
KIRWIN UNIT
WEBSTER UNIT
GLEN ELDER UNIT
SCANDIA UNIT
CONCORDIA UNIT
CLAY CENTER UNIT
WAMEGO UNIT
BELVUE UNIT
MENOKEN UNIT
PERRY UNIT
ROSSVILLE UNIT
GRANTVILLE UNIT
LAWRENCE UNIT
CHAPMAN UNIT
ABILENE UNIT
KIPP UNIT
WILSON UNIT
KANOPOLIS UNIT
ELLIS UNIT
CEDAR BLUFF UNIT
Harry Strunk Lake
Enders Reservoir
Swanson Lake
Bonny Reservoir
Norton Reservoir
Harlan County Reservoir U.S.C.E.
Lovewell Reservoir
Kirwin Reservoir
Webster Reservoir
Tuttle Creek Reservoir U.S.C.E.
Kanopolis Reservoir U.S.C.E.
Cedar Bluff Reservoir
Glen Elder Reservoir Site
Milford Reservoir Site U.S.C.E.
Wilson Reservoir Site U.S.C.E.
Perry Reservoir Site U.S.C.E.
Clinton Reservoir Site U.S.C.E.

SYNOPSIS

Annual Operating Plan - Kansas River Projects
Missouri River Basin
1960 Operations
1961 Outlook

This is the eighth Annual Operating Plan for irrigation units in the Kansas River Projects area. The prime purpose of this report is to describe the irrigation operations and define the responsibilities of the Bureau of Reclamation in relation to the Federally constructed and rehabilitated irrigation facilities in the Republican, Solomon, and Smoky Hill River drainage areas. Harlan County Reservoir on the Republican River is operated by the Corps of Engineers. Bonny, Enders and Lovewell Reservoirs, Swanson and Harry Strunk Lakes in the Republican River Basin, Webster and Kirwin Reservoirs in the Solomon River Basin, and Cedar Bluff Reservoir in the Smoky Hill River Basin are operated by the Bureau of Reclamation. Red Willow Dam presently is scheduled for completion by the end of 1961, hence is not included in this report. As there are no irrigation facilities constructed below Kanopolis Reservoir on the Smoky Hill River, and below Tuttle Creek Reservoir on the Blue River, they are not included in this report.

Chapter I, the introduction of the report, gives a brief description of the irrigation units in the Kansas River Projects area. Chapter II summarizes the 1960 operations, and the plan of operation for 1961 is presented in Chapter III.

1960 OPERATIONS

The water supply was more than adequate to meet the 1960 irrigation requirements of 89,622 acres under Kansas River Projects units. The diversion for all the Kansas River Projects averaged 2.31 acre-feet per acre. Precipitation was generally near normal in the Republican River Basin. The inflows to all the reservoirs excepting Bonny Reservoir and Swanson Lake were above normal. All of the reservoirs spilled because of the unusually heavy snowmelt runoff in the spring of 1960.

1961 OUTLOOK

The carryover storage at all of the reservoirs is more than adequate to meet the irrigation requirements of 134,600 acres of project lands with service available in 1961. Of this, 114,435 acres are expected to be irrigated. The carryover storage is also adequate to meet the demands of supplemental water under Warren Act Contracts to approximately 5,000 acres of land in private irrigation systems in Nebraska and Colorado.

KANSAS RIVER PROJECTS
1960 OPERATIONS
1961 OUTLOOK

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ANNUAL OPERATING PLAN - KANSAS RIVER PROJECTS

1960 OPERATIONS - 1961 OUTLOOK

CHAPTER I - INTRODUCTION

PURPOSE OF THE REPORT

The purpose of this eighth Annual Operating Plan is to advise water users, cooperating agencies, and other interested groups or persons of the irrigation operations during 1960 and of the plan of operations for 1961 in the Kansas River Projects area. Flood control operations are the responsibility of the Corps of Engineers and are not included in this report.

LOCATION AND MAJOR FEATURES

The Kansas River Projects consist of the irrigation units of the Kansas. River Basin, which are a part of the Missouri River Basin Project. This includes multi-purpose reservoirs which provide storage for irrigation, flood control, municipal water supply, recreational purposes, stream pollution abatement, and other uses. These dams and reservoirs, constructed and operated by the Bureau of Reclamation or Corps of Engineers, serve the irrigation systems for these units. The canals and diversion dams have been constructed or rehabilitated by the Bureau of Reclamation and, for the most part, are operated by Irrigation Districts.

Eleven reservoirs, thirteen canal systems, and five diversion dams are in operation. Two canal systems and Red Willow Dam are presently under construction. Contracts for the railroad and highway relocations in the initial construction phases of Norton Dam will be initiated this fiscal year. As Tuttle Creek and Kanopolis Reservoirs are operated by the Corps of Engineers and do not serve irrigation systems at the present time, they are not included in this report. Storage allocations for the nine reservoirs presented in this report are shown in Table 1. The reservoirs and main irrigation canals are schematically shown in Exhibit 1.

IRRIGATION DISTRICTS

Nine Irrigation Districts in the Kansas River Projects have contracted with the Bureau of Reclamation for construction of irrigation facilities. These districts are described in the following paragraphs.

Table No. 2 shows the status of the repayment and water service contracts with the development periods where appropriate.

The Normal irrigation season for Frenchman Valley, H&RW, and Frenchman-Cambridge Irrigation Districts is from May 1 to October 15, for all other districts, the irrigation season is May 1 to September 30.

Frenchman Valley Irrigation District

Enders Reservoir and Culbertson Canal are used to serve 9,600 acres. The Culbertson Diversion Dam and the Culbertson Canal have been reconstructed. Water was delivered under repayment contract for the first time in 1958 with Enders Reservoir firming up a previously inadequate water supply. These lands have been irrigated since the 1890's.

H & RW Irrigation District

The Culbertson Extension Canal, a continuation of the Culbertson Canal, is under construction to serve 11,490 acres generally in the tablelands north of the Republican River, between Culbertson and McCook, Nebraska. The construction on the first 17½ miles of the canal will be completed by May of this year, with service available to approximately 7,000 acres. All construction will be complete by the Fall of 1961. Enders Reservoir provides the storage water for this district as well as the Frenchman Valley Irrigation District.

Frenchman-Cambridge Irrigation District

43,150 acres of land in this irrigation district will ultimately be irrigated in this district. Swanson and Harry Strunk Lakes provide storage for 38,632 acres of land under the Meeker-Driftwood, Bartley and Cambridge Canals. Red Willow Dam (Hugh Butler Lake) is under construction and storage will commence sometime this fall. Red Willow Diversion Dam and canal construction is scheduled for completion by 1963.

Bostwick Irrigation District in Nebraska

Harlan County Reservoir provides irrigation storage for this district. The Franklin, Naponee, Franklin Pump, Superior and Courtland (Nebraska) Canals have been constructed to serve 24,240 acres.

Kansas-Bostwick Irrigation District No. 2

Storage water for the 46,300 acres in this district will be provided by Harlan County and Lovewell Reservoirs. All of the major construction work to serve district lands will be completed by the start of the 1961 irrigation season. Lovewell Reservoir serves as a regulating and storage reservoir. The upper Courtland Canal system was constructed to serve 15,270 acres of land and to transport Republican River flows and Harlan County storage releases as required to Lovewell Reservoir. The lower Courtland Canal system serves 31,030 acres of land below Lovewell Reservoir.

Kirwin Irrigation District No. 1

Kirwin Reservoir provides storage for 11,500 acres of land served by the Kirwin Main, North and South Canals.

Webster Irrigation District No. 4

Webster Reservoir provides storage for the 8,500 acres served by the Osborne Canal. All construction work is expected to be completed by May of 1961.

Almena Irrigation District No. 5

Norton Reservoir will provide storage for the irrigation of 5,350 acres of land in the Almena Irrigation District. The initial construction will be started on Norton Dam this year. Construction of the Almena Diversion Dam and irrigation facilities is scheduled to begin in 1963.

Cedar Bluff Irrigation District No. 6

Cedar Bluff Reservoir will provide storage water for 6,500 acres served by the Cedar Bluff Canal. This Canal is under construction and will be completed early in 1963.

MUNICIPAL WATER

City of Norton, Kansas

Norton Reservoir will provide storage for the municipal water supply of Norton, Kansas. A long term contract has been negotiated with the City.

City of Russell, Kansas

The Bureau of Reclamation and the City of Russell are negotiating a long term contract for a municipal water supply from Cedar Bluff Reservoir.

FISH HATCHERY

A warm-water fish hatchery is in operation below Cedar Bluff Reservoir. A maximum of 4,000 acre-feet of reservoir storage per year is allocated for hatchery use.

CHAPTER II-SUMMARY OF 1960 OPERATIONS

PRECIPITATION

The annual precipitation was above normal in the Kansas River Projects except in the Frenchman-Cambridge Division where it was about 91% of normal. The distribution greatly affected the Frenchman-Cambridge Division in that the July, August and September precipitation was generally much below normal.

RESERVOIR INFLOW

Heavy snowmelt run-off caused all reservoirs to spill early in the season. The annual inflows to Bonny Reservoir and Swanson Lake were below normal. Annual inflows to the other reservoirs were much above normal. Table 4 shows the 1960 inflows compared to the historical average. Exhibits 27 and 35 graphically present the 1960 inflows as compared to the historical inflows for the period of record.

RESERVOIR OPERATIONS

All of the operations in the Kansas River Projects were well within the plan of operation; consequently, there were no irrigation shortages in 1960. All of the irrigation pools were full at the start of the heavy demand period in early July. Tables 5 through 7 show the 1960 reservoir operations by months. The 1960 inflows, outflows, reservoir contents, and the 1961 estimates are plotted on exhibits 2 through 19.

Ample flood protection was provided at all times even though record maximum water surface elevations were reached at Swanson and Harry Strunk Lakes and Enders, Harlan County, Lovewell, and Kirwin Reservoirs. Controlled spills were made under the direction of the Corps of Engineers, who has estimated the flood protection provided by the nine reservoirs in this report to be $9,800,000.00 during 1960.

The details of operations for each reservoir are described in the following paragraphs:

Bonny Reservoir

As planned, no releases were made during the winter of 1959-1960. Above normal inflows caused controlled spills from April through July.

The reservoir water surface remained above the desired operating level of two feet below the top at the irrigation pool until late June. Natural flow bypasses as required for irrigation were made to Hale Ditch from May through October. 285 acre-feet of storage water was sold under Warren Act Contracts as a supplemental water supply for 590 acres served by Hale Ditch. The releases of natural flow and supplemental storage water to Hale Ditch lowered the reservoir level to about 4½ feet below the top of the irrigation pool.

Swanson Lake

The reservoir level reached a depth of about five feet in the flood control pool which was the maximum water surface level since initial storage in 1953. For this reason, controlled spills were made from April 1 to July 18, when the reservoir level was lowered to the top of the irrigation pool.

The lands under the Bartley and Meeker-Driftwood Canals were provided a full water supply. Additional releases amounting to 168 acre-feet were delivered under Warren Act Contracts to serve 789 acres. This resulted in a drawdown of $10\frac{1}{2}$ feet in the irrigation pool at the end of the season.

Enders Reservoir

Controlled spills were made from March to July. The reservoir in 1960 reached a level 5.90 feet in the flood control pool. This is the highest reservoir level since initial storage in 1950. The storage was more than adequate to meet the irrigation demand of 9,400 acres in the Frenchman Valley Irrigation District and to furnish 731 acre-feet of water to 2,572 acres of Warren Act Contractors.

A special release was made during September to facilitate a study under the direction of the Nebraska Department of Water Resources to determine the effect of Enders Reservoir on the flows of Frenchman Creek.

Harry Strunk Lake

Releases made for diversion by the Cambridge Canal resulted in a drawdown of 12.85 feet in the irrigation pool (18,670 acre-feet). 196 acre-feet of water was provided for 994 acres under Warren Act Contract. The highest water surface elevation since initial storage in August of 1949 was reached on March 23, 1960. This was 8 feet in the flood control pool. Controlled spills occurred from March to July.

Harlan County Reservoir

The precipitation and inflow were above normal and the reservoir pool level was lowered only 3.77 feet in the irrigation pool during the irrigation season. Releases were made during July, August and September to meet the demands of Nebraska and Kansas Bostwick Irrigation Districts. Releases were made throughout the year to maintain the desired minimum sanitation flows as stated in the Harlan County Reservoir Statement of Operational Objectives. On April 5, 1960 the reservoir level reached the highest water surface elevation since initial storage in November of 1952. This was elevation 1955.66, or 9.66 feet in the flood control pool. Controlled spills were made from April to July.

Lovewell Reservoir

The inflows from White Rock Creek raised the pool level to an elevation of 1586.34 on June 24, 1960, which was the highest since initial storage

in the spring of 1957. This was, however, only 3.75 feet in the flood control pool. Controlled spills were made during the spring months. The operations were regulated so as to meet the demand of lower Courtland Canal and to have the reservoir level at elevation 1577 by September 1 to facilitate construction of a boat ramp in the recreation area. The inflow to Lovewell Reservoir from the Republican River flows and Harlan County Reservoir releases transported through the Courtland Canal amounted to 12,700 acre-feet.

Kirwin Reservoir

The maximum reservoir level in 1960 was 3.25 feet in the flood control pool. This was the highest reservoir level since initial storage in March of 1955. The flood storage was released during the spring months. Due to a delay in completion of a canal lining contract, no releases were made to Kirwin Canal until late June. Releases were made to Kirwin Main Canal at the end of the irrigation season during October and November to facilitate a special loss study on the Kirwin Main, North and South Canals.

Webster Reservoir

Controlled spills were made during the spring months. Small irrigation releases were made during July, August and September for diversion to the Osborne Canal. During the fall months, a study was made by the Geological Survey, Corps of Engineers, and the Kansas State Board of Water Resources to determine the base flows of the South Fork of the Solomon River at various points from Webster Dam to Osborne, Kansas.

Cedar Bluff Reservoir

Controlled spills occurred at Cedar Bluff Reservoir during the spring and again from August throughout the balance of the year. The municipal water demands of the City of Russell, Kansas were met by these spills. Therefore, a temporary supply contract was not required in 1960.

The fish hatchery operated by the Bureau of Sport Fisheries and Wildlife diverted 2,103 acre-feet with 1,228 acre-feet passing back to the river below Cedar Bluff Dam.

CANAL OPERATIONS

A total of 207,043 acre-feet of water was diverted into thirteen canal systems that served 89,622 acres of land in the Kansas River Projects. This is 78% of the area that had service available for 1960. The following table presents the irrigable acreage and diversion and farm delivery data for each of the irrigation districts.

Irrigation District	Acres Irrigated	Acre-feet Diverted	Diversion Rate Acre-foot/Acre	Farm Delivery Acre-foot/Acre
Frenchman Valley	9,400	22,094	2.35	(no records)
Frenchman-Cambridge	32,698	72,890	2.23	1.50
Bostwick in Nebraska	18,194	45,919	2.52	1.17
Kansas-Bostwick	19,955	45,121	2.26	1.36
Kirwin	8,216	16,834	2.05	1.13
Webster	1,159	4,185	3.62	1.00
TOTAL Kansas River Projects	89,622	207,043	2.31	1.35 for 80,222 acres

1,095 acre-feet of storage water was released to Warren Act Contractors as supplemental water supply for 4,355 acres of non-project land in the Frenchman-Cambridge Division in Nebraska. 2,855 acre-feet of water was released to Hale Ditch, of which 385 acre-feet was sold under Warren Act Contract.

Table 8 presents the monthly diversions and acres irrigated for each canal system. Table 9 tabulates the irrigation development by canal systems and the estimates for 1961. The acres irrigated in 1960 and estimated for 1961 are compared to the planned acreage on table 10. A graphic representation of development by irrigation districts is presented in Exhibits 20 through 26.

OTHER USES

A wet spring followed by drouth during the summer months caused considerable fluctuations of the reservoir levels in the flood and irrigation pools. Although fishermen reported excellent success during late March and April, these fluctuations diminished the fishing success and recreational activities during the remainder of the season.

With the exception of Enders Reservoir, all of the other reservoir areas had a recorded visitation less than that reported in 1959. Even with the slight decrease in visitation, a total of 1,435,029 visitor days were recorded in 1960. Table 11 presents the recreational usage at each reservoir.

CHAPTER III - ANNUAL OPERATING PLAN FOR 1961

WATER SUPPLY

The water supply outlook for 1961 is excellent at all reservoirs except Swanson Lake, which has a good outlook. Even under extremely dry conditions, no shortages are expected in meeting the demands of 114,435 acres of Kansas River Project lands which are expected to be irrigated, and any demand for municipal water of Russell, Kansas. Carryover storage in Bonny and Enders Reservoirs and Swanson and Harry Strunk Lakes will also meet the demands for supplemental water on approximately 5,000 acres of non-project lands in Colorado and Nebraska. No requests of water under Warren Act Contracts are anticipated in Kansas.

The total available water supply of each reservoir is equal to the carryover storage from the previous year plus the inflow of the current year. While the carryover storage is readily known, it is nearly impossible to forecast reservoir inflows for an area where the major source of water is flood run-off. For forecasting purposes, values of annual inflows that will be statistically equaled or exceeded 10, 50, and 90 percent of the time were selected from the probability curve to be "reasonable maximum," "most probable," and "reasonable minimum" inflow conditions. The estimates for 1961 are shown in Table 4 and are graphically compared with the historical inflow records on exhibits 27 through 35.

RESERVOIR OPERATIONS

The normal storage limitations at each of the reservoirs for irrigation and municipal purposes will be at the top of the irrigation storage pool as shown in Table 1. Administration of the use of water in accordance with state laws will affect the amount and time of storing streamflows.

Each fall after the demand period, the storage in each reservoir is evaluated and when it is apparent that a reservoir will spill under all inflow conditions before the start of next irrigation season, controlled releases will be made to store only that portion of the inflow required to fill the irrigation pool by the first of April. This plan is not used for Bonny Reservoir, as winter releases are undesirable.

Exhibits 2, 4, 6, 8, 10, 12, 14, 16 and 18 show the probable effects on each reservoir for 1961 under "most probable," "reasonable minimum," and "reasonable maximum" inflow conditions.

Bonny Reservoir

The only expected demand on Bonny Reservoir is for supplemental water to irrigate 590 acres of non-project land served by Hale Ditch. Continuous winter releases are undesirable because of the exposed Hale Ditch outlet pipe.

Releases in extremely cold weather are not necessary if the pool level is at least three feet below the top of the irrigation pool in the fall. To reduce the chances of a large fall drawdown, the reservoir pool is lowered two feet by early April and maintained there throughout the spring and summer months. During dry years, the supplemental water demand and normal reservoir losses will lower the pool another two to three feet by September. During other years, it will be necessary to make special releases during September to draw the pool level down another foot.

Swanson Lake

Irrigation demands will be made by irrigators under the Meeker-Driftwood and Bartley Canal systems for 20,992 acres. The carryover storage and available inflow will be more than adequate to meet this demand. The maximum expected drawdown even under dry year conditions will be about 19 feet below the top of the irrigation pool. If other than reasonable minimum inflow conditions prevail this spring, the reservoir will spill.

Enders Reservoir

Enders Reservoir will be spilling by early spring. The storage and available inflow will be more than adequate to meet the irrigation demands of 9,600 acres in the Frenchman Valley Irrigation District and 7,000 acres in the H&RW Irrigation District. A continuation of the study of the effects of Enders Reservoir on Frenchman Creek will be made in the spring of 1961 with the reservoir level at the top of the irrigation pool.

Harry Strunk Lake

The irrigation pool is expected to be filled by the start of the 1961 irrigation season. The storage and available inflow will more than meet the irrigation demands of 15,626 acres served by Cambridge Canal. The maximum expected drawdown under reasonable minimum inflow conditions will be about 23 feet below the top of the irrigation pool. A re-survey of the sedimentation conditions in the reservoir is planned for F.Y. 1962.

Harlan County Reservoir

The irrigation pool will be filled by spring. Therefore, an ample water supply is available to irrigate 19,500 acres in the Bostwick Irrigation District in Nebraska, and 28,400 acres in Kansas Bostwick Irrigation District. Of the 28,400 acres in Kansas, 17,500 acres are served by Courtland Canal system below Lovewell Reservoir.

Under dry and normal year inflow conditions, a transfer of storage from Harlan County Reservoir to Lovewell Reservoir is required to meet the irrigation demands of the Courtland system below Lovewell Reservoir. If conditions permit, the transfers of storage from Harlan County Reservoir to Lovewell Reservoir will be made during the irrigation season, but unusual conditions may occasionally require transfer operations during the non-irrigation season. The transfer of storage during the winter months will be held to a minimum as the maintenance costs are higher and the irrigation districts are normally preparing their canals for the next year's operation.

As soon as hydrologic conditions permit, the Corps of Engineers plan to temporarily store about 35,000 acre-feet of water in the flood control pool. This water will be released in varying rates to facilitate a study of channel flow conditions, including the determinations of channel roughness coefficients at several points on the Republican River. In the event of a dry year with no surplus inflow, the tests will be deferred to another year.

Lovewell Reservoir

Lovewell Reservoir was planned for regulation of Courtland Canal as well as the storage of natural flows on White Rock Creek. The demands of 17,500 acres under the Courtland Canal below Lovewell Reservoir will be met with water stored from White Rock Creek flows and transfers of Republican River flows and storage releases, if required, from Harlan County Reservoir through the upper Courtland Canal. During periods of low water supply in Harlan County and Lovewell Reservoirs, all Republican River flows not required by Superior and Courtland Canals, and downstream water rights will be diverted into Lovewell Reservoir. Under continued severe drouth conditions, diversions could continue through all of the non-irrigation season except January and February.

During the winter months, it is desirable that the pool level in Lovewell Reservoir be at elevation 1,577 or above to reduce the possibilities of erosion to the upstream face of the dam. Under dry year conditions, it is planned to operate the entire season at about this pool level. If Republican River flows or surplus storage are available in Harlan County Reservoir, the irrigation pool will be filled during May and June.

The hoisting mechanism of the spillway gates will be modified to permit manual override of automatic float controlled system.

Kirwin Reservoir

The project area of 11,500 acres is 1,500 acres larger than the area planned for irrigation with the available water supply, and successful operation will at times be dependent upon several years of carry-over reservoir storage. An extensive canal lining program is planned to minimize the seepage losses in the canal system. The carryover storage and available inflow are more than adequate to meet the irrigation demand of 9,000 acres in 1961.

Webster Reservoir

The irrigation pool will be filled by the end of February. The storage and available inflow will be more than adequate to meet the irrigation demand of 4,000 acres to be served by the Osborne Canal

The pool level will be lowered to elevation 1884.6 by September 1, 1961 to facilitate the replacement of the seals on the radial gates in the spillway. It is also planned under the same contract to modify the spillway gate hoists to allow manual override of the automatic float controlled system.

Cedar Bluff Reservoir

Cedar Bluff Reservoir was spilling at the end of 1960. The only 1961 demands on this reservoir are to supply the Fish Cultural Station requirements and to supplement the municipal water supply of the City of Russell, Kansas. The Cedar Bluff Canal is under construction but will not be operated in 1961.

CANAL OPERATIONS

We estimate that 114,435 acres under Kansas River Projects will be irrigated in 1961. Of this, 73,035 acres are in Nebraska and 41,400 acres in Kansas. The acres expected to be irrigated in 1961 are shown by canals in Table 9. The irrigable acres and probable canal diversions for 1961 under the "most probable," "reasonable driest year," and "reasonable wettest year" are shown graphically on exhibits 20 through 26.

The expected canal operations for 1961 are discussed in the following paragraphs for each irrigation district.

Frenchman Valley Irrigation District

The district will operate and maintain the Culbertson Diversion Dam and Culbertson canal to irrigate 9,600 acres. The seepage losses on the Culbertson Canal will be shared with the H & RW Irrigation District.

H & RW Irrigation District

The first 17½ miles of the Culbertson Extension Canal will be ready by May 1 to serve about 7,000 acres. This will be the first year of operation for this part of the system. The operation and maintenance work will be performed by the Bureau of Reclamation.

Frenchman-Cambridge Irrigation District

The irrigation district will operate and maintain the Bartley, Cambridge, and Meeker-Driftwood Canal systems. We estimate 36,618 acres will be irrigated by these three systems in 1961.

Bostwick Irrigation District in Nebraska

Franklin, Naponee, Franklin Pump and Superior Canals will be operated and maintained by the irrigation district. We estimate that 19,810 acres will be irrigated in 1961. The Kansas-Bostwick Irrigation District will operate and maintain the Superior-Courtland Diversion Dam and Courtland Canal in Nebraska and the Bostwick Irrigation District in Nebraska will operate and maintain the Courtland Lateral System in Nebraska.

Kansas-Bostwick Irrigation District No. 2

28,400 acres are expected to be irrigated in 1961. The district will operate and maintain the entire system, with the exception of Pump No. 1 and White Rock Extension, which will be maintained by the Bureau of Reclamation.

The start of the irrigation season on the facilities below Lovewell Reservoir will be delayed until May 20, 1961 to allow completion of canal lining contracts.

Kirwin Irrigation District No. 1

The district will operate and maintain the Kirwin Canal system. The start of the irrigation season will be delayed until May 20, 1961 to allow completion of a canal lining contract. We estimate that 9,000 acres will be irrigated during the 1961 irrigation season.

Webster Irrigation District No. 4

Of the 8,500 acres available for service in the Osborne Canal System, 4,000 acres are expected to be irrigated this year. The Bureau of Reclamation will operate and maintain this system during 1961. The operation and maintenance will be transferred to the district on January 1, 1962.

TABLE 1
RESERVOIR DATA - KANSAS RIVER PROJECTS

RESERVOIR	STORAGE ALLOCATIONS			CONDITIONS EXPECTED BY MAY 1, 1961
	DEAD AND INACTIVE 1/	IRRIGATION 1/	FLOOD CONTROL	
Bonny				
Elevation (Ft.)	3635.5	3672.0	3710.0	3670.0
Total Acre Feet	1,420	41,340	170,160	37,390
Net Acre Feet	1,420	39,920	128,820	35,970
Swanson Lake				
Elevation (Ft.)	2710.0	2752.0	2773.0	2750.2
Total Acre Feet	4,100	120,160	253,950	111,400
Net Acre Feet	4,100	116,060	133,790	107,300
Enders				
Elevation (Ft.)	3080.0	3112.3	3127.0	3112.3
Total Acre Feet	8,470	44,480	74,520	44,480
Net Acre Feet	8,470	36,010	30,040	36,010
Harry Strunk				
Elevation (Ft.)	2335.0	2366.1	2386.2	2366.1
Total Acre Feet	5,370	39,230	90,920	39,230
Net Acre Feet	5,370	33,860	51,690	33,860
Harlan County				
Elevation (Ft.)	1920.0 2/	1946.0	1973.5	1946.0
Total Acre Feet	97,200 3/	350,120	850,000	350,120
Net Acre Feet	97,200 3/	252,920	499,880	252,920
Lovewell				
Elevation (Ft.)	1562.07 4/	1582.6	1595.3	1578.1
Total Acre Feet	5,050 5/	41,690	92,150	29,720
Net Acre Feet	5,050 5/	36,640	50,460	24,670
Kirwin				
Elevation (Ft.)	1693.0	1728.4	1757.3	1728.4
Total Acre Feet	6,380	95,180	314,550	95,180
Net Acre Feet	6,380	88,800	219,370	88,800
Webster				
Elevation (Ft.)	1855.5	1889.6	1923.7	1889.6
Total Acre Feet	2,180	67,100	260,740	67,100
Net Acre Feet	2,180	64,920	193,640	64,920
Cedar Bluff				
Elevation (Ft.)	2100.4 4/	2144.0	2166.0	2144.0
Total Acre Feet	21,580 6/	185,090	376,950	185,090
Net Acre Feet	21,580 6/	163,510	191,860	176,830
Total Storage (A.F.)	151,750	984,390	2,483,940	959,710
Total Net Acre Feet	151,750	832,640	1,499,550	821,280

1/ Includes space for sediment storage.
2/ Controlling elevation to Franklin Canal.
3/ Could release 95,900 A.F. to river.
4/ Controlling elevation to canal.
5/ Could release 690 A.F. to river.
6/ Could release 13,320 A.F. to river and fish hatchery.

Note: Reservoir storage data based on latest reservoir surveys.

TABLE 2

STATUS OF REPAYMENT / WATER SERVICE CONTRACTS
KANSAS RIVER PROJECTS

Contracting Organization	Contract Number	Date of Contract	Date Contract Approved by Court	Development Period Start	Development Period End
Frenchman-Cambridge Irrigation District	Ilr-1500 Amendatory No.1 Amendatory No.2 Amendatory No.3	May 29,1947 July 19,1951 Jan.4,1956 Nov.1,1957	July 19,1950 (Rej.) Feb. 11,1956 (Appr.)	Jan.1,1957(Blk I) Jan.1,1960(Blk II)	Dec.31,1961 (Blk I) Dec.31,1964 (Blk II)
Frenchman Valley Irrigation District	14-06-700-1241	Nov.7,1956	Oct.20,1958	No development period Pay only water service charges	
H. & R. W. Irrigation District	14-06-700-1242 Amendment No.1	Nov.7,1956 Aug.12,1958	July 19,1957		
Nebraska-Bostwick Irrigation District	I 1 r-1079 Amended	Feb.21,1949 Nov.10,1954	Feb.28,1955	Jan.1,1957	Dec.31,1961
Kansas-Bostwick Irrig.Dist.No. 2	I 1r-1584 Amendment No.2	Apr.20,1951 Apr.24,1957	Mar.9,1953 Dec.20,1957	Jan.1,1957(Blk I) Jan.1,1960(Blk II) Jan.1,1961(Blk III)	Dec.31,1961 (Blk I) Dec.31,1964 (Blk II) Dec.31,1965(Blk III)
Almena Irrigation District No. 5	14-06-700-1579	Mar.7,1958	Nov.20,1958		
Kirwin Irrigation District No. 1	14-06-W55 Amendatory Amendatory No.2	June 9,1953 Oct.18,1955 Feb.12,1959	May 26,1954	Jan.1,1960	Dec.31,1964
Webster Irrigation District No. 4	14-06-700-1375	Apr.24,1957	Oct.22,1957		
Cedar Bluff Irrigation District No.6	14-06-700-2118	Sept.3,1959	March 17,1960		
City of Norton, Kansas	14-06-700-1573	Mar.7,1958			

Table 3

PRECIPITATION DATA

Month	BONNY DAM				TRENTON DAM				ENDERS DAM				McCOOK, NEBR.				MEDICINE CREEK DAM				HARLAN CO. DAM			
	Norm.	1958	1959	1960	Norm.	1958	1959	1960	Norm.	1958	1959	1960	Norm.	1958	1959	1960	Norm.	1958	1959	1960	Norm.	1958	1959	1960
Jan.	0.35	0.13	0.49	0.94	0.44	0.17	0.61	0.61	0.42	0.14	0.69	1.70	0.50	0.11	0.96	1.49	0.40	0.06	0.51	1.38	0.41	0.22	0.48	0.95
Feb.	0.41	0.48	0.22	2.94	0.52	0.77	0.14	2.19	0.46	0.47	0.54	2.09	0.59	1.32	0.29	2.63	0.64	1.50	0.26	1.39	0.58	1.46	0.29	0.80
Mar.	0.91	1.55	0.87	0.48	1.21	1.41	1.14	0.72	1.06	1.76	1.34	0.67	1.35	2.14	2.32	1.07	0.99	1.43	1.70	0.63	0.95	1.82	1.67	0.72
Apr.	1.59	1.41	0.76	1.08	1.94	1.94	0.85	1.07	1.94	2.13	0.50	1.37	2.06	2.05	1.65	1.40	2.31	1.87	1.61	1.69	2.27	2.76	2.49	2.23
May	2.40	5.90	2.61	2.66	3.20	4.94	2.31	3.12	3.38	2.65	3.62	4.74	3.12	3.09	2.28	1.73	3.22	3.27	2.79	3.08	3.21	3.04	3.76	4.48
June	2.57	3.79	0.82	2.51	3.19	2.21	2.38	3.20	3.36	3.63	1.73	2.55	3.17	2.49	4.21	3.94	3.52	3.17	2.12	6.86	3.66	1.29	3.29	5.64
July	2.32	3.70	2.61	3.90	2.61	2.75	2.45	2.64	2.19	9.08	0.88	1.88	2.80	4.90	2.36	0.79	2.79	3.29	1.34	1.04	2.86	5.76	1.10	1.47
Aug.	2.27	2.58	1.56	0.03	2.50	2.47	2.23	0.49	2.23	2.20	0.76	1.16	2.30	2.31	3.32	1.47	2.61	0.85	2.94	1.11	2.48	4.29	1.83	2.58
Sept.	1.28	0.89	1.30	0.93	1.68	1.77	1.64	1.04	1.79	1.35	1.68	0.65	1.70	0.98	2.17	0.57	2.02	0.66	1.76	0.88	2.19	1.47	2.46	1.03
Oct.	0.74	0.66	1.75	2.09	0.87	0.30	2.67	1.71	0.80	0.48	2.78	1.66	0.87	0.42	2.63	1.63	1.12	0.17	2.87	1.46	1.03	0.03	2.15	1.17
Nov.	0.41	0.23	0.01	0.15	0.68	0.16	0.08	0.06	0.54	0.07	0.21	0.07	0.76	0.63	0.12	0.19	0.84	0.76	T	0.23	0.77	0.65	T	0.36
Dec.	0.39	0.44	0.36	1.07	0.45	0.58	0.93	0.71	0.45	0.88	0.10	0.77	0.53	0.56	0.54	1.06	0.57	0.14	0.00	0.58	0.49	0.03	0.03	0.34
Total	15.64	21.76	13.36	18.78	19.29	19.47	17.43	17.56	18.62	24.84	14.83	19.31	19.75	21.00	22.85	17.97	21.03	17.17	17.90	20.33	20.90	22.82	19.55	21.77

Month	LOVEWELL DAM				KIRWIN DAM				WEBSTER DAM				CEDAR BLUFF DAM				KANOPOLIS DAM			
	Norm.	1958	1959	1960	Norm.	1958	1959	1960	Norm.	1958	1959	1960	Norm.	1958	1959	1960	Norm.	1958	1959	1960
Jan.	0.60	0.21	0.48	1.42	0.47	0.25	0.36	1.19	0.40	0.49	0.51	1.37	0.48	0.07	0.19	0.59	0.77	0.28	0.21	0.91
Feb.	0.85	1.47	0.38	1.80	0.70	1.16	0.19	1.01	0.78	1.12	0.38	2.29	0.62	0.26	0.05	1.35	1.08	0.89	0.39	1.88
Mar.	1.26	2.68	2.27	2.02	1.18	2.97	1.41	0.84	1.00	3.72	1.62	1.01	1.26	3.28	0.86	0.47	1.71	3.02	2.21	1.47
Apr.	2.21	2.08	1.56	2.70	2.40	1.12	1.15	2.13	2.20	1.00	1.67	2.45	2.11	2.06	0.52	3.55	2.65	1.33	1.29	1.52
May	3.60	2.95	8.11	3.13	2.90	2.27	5.25	6.18	2.90	3.77	4.23	4.18	3.62	4.29	4.43	1.08	4.02	3.23	6.45	1.85
June	4.82	3.50	2.59	6.50	3.75	1.87	2.48	4.23	3.70	1.48	2.75	4.55	3.92	1.84	3.07	2.66	4.01	3.38	3.55	4.57
July	2.81	7.99	1.15	1.34	2.87	5.68	3.45	1.77	2.70	7.26	4.16	0.14	2.33	8.51	2.97	0.14	3.31	4.88	4.39	1.79
Aug.	2.68	3.20	1.07	3.62	2.85	3.56	1.04	3.32	2.75	3.41	1.88	4.94	2.43	3.70	1.39	2.89	3.45	2.04	3.14	6.55
Sept.	2.69	8.02	3.10	2.53	2.27	1.35	4.48	3.26	2.50	1.63	3.24	1.83	2.06	2.14	4.38	2.40	3.02	4.71	4.55	3.81
Oct.	1.45	0.54	5.64	2.05	1.26	0.11	4.53	1.81	1.40	0.67	4.25	1.78	1.16	0.09	3.17	1.95	2.29	0.09	4.19	3.32
Nov.	1.03	0.68	0.03	0.32	0.84	0.47	T	0.19	0.99	0.56	T	T	0.86	0.43	T	0.31	1.30	0.79	0.01	0.28
Dec.	0.77	0.10	0.18	0.29	0.57	0.13	T	0.41	0.70	0.46	0.06	0.49	0.55	0.10	0.10	0.32	0.90	0.17	0.37	1.76
Total	24.77	33.42	26.56	27.72	22.06	20.94	24.34	26.34	22.02	25.57	24.75	25.03	21.40	26.77	21.13	17.71	28.51	24.81	30.75	29.71

The records on this table were taken from U.S. Weather Bureau records

TABLE 4
INFLOW INTO RESERVOIRS - 1960 RECORDS, 1961 ESTIMATES

1	2	3	4	5	6	7	8
	1,000 Acre-Feet (Except Column 4)						
	1960 Records			Average	1961 Estimates 1/		
Reservoir	Actual	Adjusted	Percent of Average	for Period of Record	Reasonable Minimum	Most Probable	Reasonable Maximum
Bonny	25.0		75%	33.5	18.5	26.2	42.0
Swanson Lake	119.3	124.9 3/	91% 3/	136.6 3/	68.0	119.0	205.0
Enders	62.8		119%	52.8	42.8	49.3	57.2
Harry Strunk Lake	74.2		129%	57.7	33.0	51.7	82.0
Harlan County	501.3	526.7 3/	109% 3/	484.3 3/	260.0	455.6	780.0
Lovewell	42.7 4/	30.0 5/	110% 5/	27.3 5/	3.4	17.9	64.0
Kirwin	70.9		130%	54.4	17.0	38.1	115.0
Webster	66.8		130%	51.5	12.5	33.9	98.0
Cedar Bluff	99.4		155%	64.1	12.4	36.9	138.0

1/ Values determined from inflow frequency curves. A value of 90% on curve = reasonable minimum conditions, 50% = most probable conditions, and 10% = reasonable maximum conditions.

2/ Average computed for period of record up to and including 1959.

3/ Actual records plus upstream depletions caused by reservoirs and canals in Missouri Basin Projects.

4/ Includes total of White Rock Creek and inflow from Courtland Canal.

5/ Natural inflow from White Rock Creek.

RESERVOIR OPERATIONS
BONNY, SWANSON LAKE, AND ENDERS RESERVOIRS
(Units in 1,000 Acre-Feet)

Month	TOTAL STORAGE END OF MONTH 1959	TOTAL STORAGE END OF MONTH 1960	1960 OUTFLOW	INFLOW 1960 ACTUAL	INFLOW 1960 ADJ.	INFLOW HIST. AVG.	DAM AND RESERVOIR INFORMATION
Jan.	41.2	88.8	0.4	1.7		2.3	DAM: BONNY
Feby.	42.9	41.3	0.4	1.9		2.3	
Mar.	43.9	46.4	0.5	4.9		2.9	RESERVOIR: BONNY
Apr.	39.4	45.1	3.2	2.6		2.6	
May	37.7	42.2	5.5	3.0		6.3	STORAGE CAPACITY
June	36.2	37.3	6.4	2.6		4.7	
July	36.4	36.4	1.9	1.9		2.9	
Aug.	34.8	34.5	0.6	0.0		2.2	DEAD 1.4
Sept.	33.6	33.2	0.4	0.1		1.6	IRRIGATION 39.9
Oct.	33.9	33.2	1.0*	1.6*		1.7	SUB-TOTAL 41.3
Nov.	35.4	34.6	0.4*	2.2*		1.9	FLOOD 128.8
Dec.	37.0	36.4	0.4*	2.5*		2.1	TOTAL 170.1
Total			21.1	25.0		33.5	

Average inflow based on CY 1929-1959

Jan.	116.6	82.8	0.1	5.1	6.4	9.7	DAM: TRENTON
Feb.	119.3	94.7	0.1	10.3	11.8	11.8	
Mar.	122.1	140.9	0.1	48.4	52.8	14.7	RESERVOIR: SWANSON LAKE
Apr.	119.4	146.0	6.9	13.4	12.8	12.2	
May	121.9	123.0	37.9	15.6	13.1	20.7	STORAGE CAPACITY
June	116.3	122.8	9.1	11.5	7.7	20.2	
July	95.2	107.4	18.8	5.9	5.9	11.3	
Aug.	75.1	83.6	21.2	0	0.0	9.3	
Sept.	67.3	75.4	6.4	0	0.2	6.5	DEAD 4.1
Oct.	68.4	74.1	0.3*	0.6*	1.6*	4.8	IRRIGATION 116.1
Nov.	72.4	76.6	0.0*	3.3*	5.3*	7.3	SUB-TOTAL 120.2
Dec.	78.4	81.4	0.0*	5.2*	7.3*	8.1	FLOOD 133.8
Total			100.9	119.3 a/	124.9b/	136.6	TOTAL 254.0

Average inflow based on CY 1922, 1924-59 with records adjusted to correct for effect of operation of Bonny Reservoir

a/ Recorded inflow

b/ Recorded inflow adjusted to correct for effect of operation of Bonny Reservoir

Jan.	43.3	42.6	2.2	5.3		5.0	DAM: ENDERS
Feb.	44.1	45.7	1.4	5.0		4.5	RESERVOIR: ENDERS
Mar.	45.9	52.0	1.2	18.6		4.7	
Apr.	46.0	48.0	9.1	4.5		4.3	
May	44.6	45.4	5.6	3.8		4.7	STORAGE CAPACITY
June	42.7	45.2	4.2	3.7		4.9	
July	38.5	41.2	6.6	3.1		3.9	
Aug.	33.5	36.3	7.9	3.2		3.8	DEAD 8.5
Sept.	33.1	34.6	4.6	2.9		4.0	IRRIGATION 36.0
Oct.	34.9	34.7	2.0*	3.7*		4.1	SUB-TOTAL 44.5
Nov.	37.5	36.6	1.9*	4.1*		4.3	FLOOD 30.0
Dec.	39.9	39.4	3.0*	4.9*		4.6	TOTAL 74.5
			49.7	62.8		52.8	

Average inflow based on CY 1924-59

* Not U.S.G.S. record. Computed from reservoir operation data.

Table 6

RESERVOIR OPERATIONS
MEDICINE CREEK, HARLAN COUNTY & LOVEWELL RESERVOIRS
(Units in 1,000 Acre-Feet)

Month	TOTAL STORAGE END OF MONTH 1959	1960	1960 OUTFLOW	INFLOW 1960 ACTUAL	1960 ADJ.	HIST. AVG.	DAM AND RESERVOIR INFORMATION
Jan.	39.1	34.0	0.3	3.6		3.6	DAM: MEDICINE CREEK
Feb.	40.3	41.2	3.7	12.2		3.8	
Mar.	41.1	48.4	20.7	25.3		4.7	RESERVOIR:
Apr.	39.6	41.9	11.0	4.3		5.3	HARRY STRUNK
May	39.2	40.1	8.2	6.7		6.6	LAKE
June	38.2	39.7	8.3	6.6		10.1	STORAGE
July	28.9	32.6	9.5	2.7		5.6	CAPACITY
Aug.	22.8.	22.9	10.8	1.8		3.8	DEAD 5.4
Sept.	23.2	21.4	2.5	1.8		3.7	IRRIGATION 33.8
Oct.	25.7	23.6	0.4*	2.9*		3.6	SUB-TOTAL 39.2
Nov.	28.2	26.3	0.2*	3.0*		3.2	FLOOD 51.7
Dec.	30.9	29.2	0.2*	3.3*		3.7	TOTAL 90.9
Total			75.8	74.2		57.7	

Average inflow based on CY 1925-59

Jan.	317.1	289.3	0.8	7.1	20.1	21.6	DAM: HARLAN COUNTY
Feb.	325.3	318.4	0.9	30.7	46.1	29.6	
Mar.	345.4	477.5	2.2	151.3	195.4	40.2	RESERVOIR:
Apr.	352.2	404.0	142.8	60.4	55.0	40.3	HARLAN COUNTY
May	361.9	356.2	128.4	80.8	56.3	59.6	
June	345.3	384.8	90.0	113.4	109.1	112.9	STORAGE
July	313.6	340.5	65.9	22.4	25.3	51.8	CAPACITY
Aug.	274.3	312.3	31.0	8.1	7.4	31.7	DEAD 1.3
Sept.	262.8	302.9	7.8	3.9	5.3	29.9	INACTIVE 95.9
Oct.	268.5	305.2	0.6*	6.6*	14.5*	24.1	IRRIGATION 252.9
Nov.	273.5	310.3	0.6*	7.2*	18.5*	20.4	SUB-TOTAL 350.1
Dec.	281.8	318.3	0.6*	9.4*	23.7*	21.9	FLOOD 499.9
Total			471.6	501.3a/	526.7b/	484.3	TOTAL 850.0

Average inflow based on CY 1929-59 with records adjusted to correct for effect of upstream reservoirs and canals.
a/ Recorded inflow
b/ Recorded inflow adjusted to correct for effect of upstream reservoirs & canals.

Jan.	39.8	28.1	0	0	0	0.2	DAM: LOVEWELL
Feb.	39.9	27.5	1.7	0.3	0.3	1.1	RESERVOIR: LOVEWELL
Mar.	40.6	40.4	1.8	7.5	7.5	1.0	
Apr.	41.1	41.4	9.1	4.2	4.2	1.2	STORAGE
May	44.5	43.2	3.6	3.8	3.8	4.2	CAPACITY
June	40.6	50.8	5.9	10.6	10.6	8.3	DEAD 4.4
July	33.3	33.7	19.6	3.5	0.4	5.1	INACTIVE 0.7
Aug.	20.5	30.5	12.8	9.2	2.4	1.6	IRRIGATION 36.6
Sept.	21.7	28.2	3.8	2.7	0.1	2.2	SUB-TOTAL 41.7
Oct.	28.1	28.3	0.1*	0.7*	0.5*	1.6	FLOOD 50.5
Nov.	27.6	28.1	0*	0*	0*	0.5	TOTAL 92.2
Dec.	27.7	28.2	0*	0.2*	0.2*	0.3	
Total			58.4	42.7a/	30.0b/	27.3	

Average inflow based on CY 1929-59 (excluding deliveries from Upper Courtland Canal)
a/ Total inflow from White Rock Creek and deliveries from Upper Courtland Canal
b/ Natural flow from White Rock Creek
*Not U.S.G.S. record. Computed from reservoir operation data.

WATER SUPPLY REPORT
KIRWIN, WEBSTER & CEDAR BLUFF RESERVOIRS
(Units in 1,000 Acre-Feet)

Month	TOTAL STORAGE END OF MONTH 1959	TOTAL STORAGE END OF MONTH 1960	TOTAL 1960 OUTFLOW	INFLOW 1960 ACTUAL	INFLOW HISTORICAL AVERAGE	DAM & RESERVOIR INFORMATION
Jan.	86.4	80.4	0	.5	.9	DAM: KIRWIN
Feb.	88.8	83.1	0	2.6	1.6	RESERVOIR: KIRWIN
Mar.	90.7	101.7	0	18.9	1.8	
Apr.	91.4	97.2	9.6	5.5	3.1	STORAGE
May	92.2	106.2	10.8	30.4	5.7	CAPACITY
June	88.6	100.7	12.2	8.9	15.0	
July	86.6	92.0	9.8	2.4	10.0	DEAD 6.4
Aug.	77.9	85.5	5.8	.3	6.8	IRRIGATION 88.8
Sept.	76.0	82.9	1.4	.1	4.4	SUB-TOTAL 95.2
Oct.	79.9	81.6	.9	.7	2.8	FLOOD 219.4
Nov.	79.2	80.5	.7	0	1.3	TOTAL 314.6
Dec.	79.6	80.8	0	.6	1.0	
Total			51.2	70.9	54.4	

Average inflow for years 1920-59

Month	TOTAL STORAGE END OF MONTH 1959	TOTAL STORAGE END OF MONTH 1960	TOTAL 1960 OUTFLOW	INFLOW 1960 ACTUAL	INFLOW HISTORICAL AVERAGE	DAM & RESERVOIR INFORMATION
Jan.	82.8	65.8	1.8	1.2	.9	DAM: WEBSTER
Feb.	85.3	69.6	1.0	3.7	1.6	RESERVOIR: WEBSTER
Mar.	72.8	89.4	3.3	19.3	1.8	
Apr.	66.6	72.7	24.8	7.4	3.0	
May	69.2	74.3	20.5	19.8	6.1	STORAGE
June	66.1	70.0	16.8	9.8	13.4	CAPACITY
July	66.6	63.2	5.9	1.2	9.7	
Aug.	63.9	64.7	2.4	3.4	5.9	DEAD 2.2
Sept.	62.5	63.0	1.0	.6	4.2	IRRIGATION 64.9
Oct.	67.3	62.8	0	.3	2.7	SUB-TOTAL 67.1
Nov.	67.1	63.0	0	0	1.2	FLOOD 193.6
Dec.	66.2	64.4	0	.1	1.0	TOTAL 260.7
Total			77.5	66.8	51.5	

Average inflow for years 1920-59

Month	TOTAL STORAGE END OF MONTH 1959	TOTAL STORAGE END OF MONTH 1960	TOTAL 1960 OUTFLOW	INFLOW 1960 ACTUAL	INFLOW HISTORICAL AVERAGE	DAM & RESERVOIR INFORMATION
Jan.	182.7	182.7	.1	.3	.9	DAM: CEDAR BLUFF
Feb.	184.4	184.1	0	1.6	1.3	RESERVOIR: CEDAR BLUFF
Mar.	185.4	214.9	8.3	34.5	1.3	
Apr.	185.4	187.2	32.6	6.4	3.4	
May	189.6	189.2	25.3	20.7	8.6	STORAGE
June	187.5	186.1	8.0	5.3	19.6	CAPACITY
July	185.4	183.4	.4	.7	10.0	
Aug.	182.4	203.1	3.6	27.8	8.4	DEAD 8.3
Sept.	180.0	193.4	7.1	1.7	4.7	INACTIVE 13.3
Oct.	184.4	188.5	2.6	.3	3.7	IRRIGATION 163.5
Nov.	182.0	186.3	.9	0	1.3	SUB-TOTAL 185.1
Dec.	181.3	185.1	.5	.1	.9	FLOOD 191.9
Total			89.4 a/	99.4	64.1	TOTAL 377.0

Average inflow for years 1919-59

a/Cedar Bluff Outflow includes releases to the Fish Hatchery

Table 7

TABLE 8

ACRES IRRIGATED AND CANAL DIVERSIONS - 1960
KANSAS RIVER PROJECTS

State and Canal System	Acres Irrigated	Acre-Feet Diverted Apr.	May	June	July	Aug.	Sept.	Oct.	Total
COLORADO									
Hale Ditch (Non-Project) 1/	590	0	168	984	833	177	87	607	2,855 2856
NEBRASKA									
Warren Act (Non-Project) 2/	4,355	0	0	0	461	622	12	0	1,095
Culbertson (Frenchman Valley I.D.)	9,400	555	1,020	4,149	7,339	7,722	1,309	0	22,094
Meeker-Driftwood	13,538	0	1,610	1,860	11,710	13,310	4,610	860	33,960
Bartley	4,911	0	610	250	4,750	4,740	1,200	210	11,760
Cambridge	14,249	0	1,400	540	9,450	12,540	2,860	380	27,170
Total (Frenchman-Cambridge I.D.)	32,698	0	3,620	2,650	25,910	30,590	8,670	1,450	72,890
Franklin	8,424	0	1,162	1,087	7,311	9,719	3,317	0	22,596
Naponee	1,411	0	0	0	1,051	1,117	125	0	2,293
Franklin Pump	1,903	0	0	0	698	1,545	433	0	2,676
Superior	5,029	0	932	603	4,780	5,647	1,162	0	13,124
Courtland (Nebraska) 3/	1,427	0	0	947	2,072	2,168	43	0	5,230
Total (Nebraska-Bostwick I.D.)	18,194	0	2,094	2,637	15,912	20,196	5,080	0	45,919
KANSAS									
Courtland (Above Lovewell Res.) 4/	7,020	0	0	1,560	8,756	7,333	1,112	-169	18,592
Courtland (Below Lovewell Res.)	12,935	0	0	966	13,313	11,171	1,079	0	26,529
Total (Kansas-Bostwick I.D.)	19,955	0	0	2,526	22,069	18,504	2,191	-169	45,121
Kirwin (Kirwin I.D.)	8,216	0	0	226	9,400	5,812	1,396	0	16,834
Osborne (Webster I.D.)	1,159	0	0	159	2,031	1,291	704	0	4,185
TOTAL OF PROJECTS (Does not include non-project lands)	89,622	555	6,734	12,347	82,661	84,115	19,350	1,281	207,043

1/ Includes 285 acre-feet of surplus storage water supplied under Warren Act Contracts on 134 acres.
2/ Storage water supplied to non-project lands. No record of natural flow use.
3/ Headgate records less state line records.
4/ State line records less records at deliveries to Lovewell Reservoir.

TABLE 9

IRRIGATION UNDER CANAL SYSTEMS IN KANSAS RIVER PROJECTS

	Water Use During Year	COLORADO Hale Ditch 1/ (Non-Proj)	NEBRASKA Warren Act 2/ (Non-Proj)	Fr. Valley Irrig.Dist. Culbertson & Extension	H&RW Irrig.Dist.	Frenchman-Cambridge Irrigation District Meeker-Driftwood	Meeker	Bartley	Cambridge	Total Fr. Cambr.	Nebr.-Bostwick Irrig. Dist. Franklin	Naponee	
1961 Est.	Acres	590	5,000	9,600	7,007	14,400	4/	6,592	15,626	36,618	9,360	1,470	1961 Est.
	AF-Dry Yr.	5,200	3,100	27,600	20,200	39,000		17,100	39,400	95,500	31,400	4,900	
	AF-Med Yr.	3,800	900	19,200	14,000	27,400		11,900	26,600	65,900	20,900	3,300	
	AF-Wet Yr.	2,600	100	12,000	8,700	16,100		6,900	15,600	38,600	10,600	1,700	
1960	Acres	590	4,355	9,400		13,538	4/	4,911	14,249	32,698	8,424	1,411	1960
	AF Div.	2,855	1,095	22,094		33,960		11,760	27,170	72,890	22,596	2,293	
	AF/Ac.	4.83	0.25	2.40		2.51		2.39	1.90	2.23	2.68	1.62	
1959	Acres	590	4,499	9,400 5/		9,670	4/	4,815	13,485	27,970	9,687	1,474	1959
	AF Div.	2,571	1,039	22,076		30,141		10,457	30,807	71,405	25,847	3,223	
	AF/Ac.	4.36	0.23	2.35		3.12		2.17	2.29	2.55	2.67	2.19	
1958	Acres	575	3,350	9,400 5/		1,895	2,855	5,300	12,800	22,850	8,359	930	1958
	AF Div.	2,066	226	26,330 5/		8,710	9,558	8,550	20,380	47,198	13,810	407	
	AF/Ac.	3.59	0.07	2.80		4.60	3.35	1.61	1.59	2.07	1.65	0.44	
1957	Acres	880	4,187			739 5/	2,908	5,050	11,855	20,552	6,887	1,220	1957
	AF Div.	2,677	388			3,480	8,906	8,560	21,430	42,376	13,150	1,940	
	AF/Ac.	3.04	0.09			4.71	3.06	1.70	1.81	2.06	1.91	1.59	
1956	Acres	1,643	6,310				2,975	4,430	9,860	17,265	5,834	1,057	1956
	AF Div.	4,729	1,040				13,830	9,490	33,890	57,210	21,250	2,040	
	AF/Ac.	2.88	0.16				4.65	2.14	3.44	3.31	3.64	1.93	
1955	Acres	982	14,214 7/				3,048	3,502	9,104	15,654	2,743	548	1955
	AF Div.	5,267	2,574				11,626	11,430	32,540	55,596	11,490	1,700	
	AF/Ac.	5.36	0.18				3.81	3.26	3.57	3.55	4.19	3.10	
1954	Acres	1,541	14,573 7/				2,950	450 5/	5,938	9,338	1,165		1954
	AF Div.	5,493	2,572				11,330	1,520	22,860	35,710	7,930		
	AF/Ac.	3.56	0.18				3.84	3.38	3.85	3.82	6.81		

Note: Acres shown are based upon crop census unless indicated otherwise.

TABLE 9 (cont'd)

IRRIGATION UNDER CANAL SYSTEMS IN KANSAS RIVER PROJECTS

Water Use During Year	NEBRASKA (cont'd)				KANSAS					TOTAL FOR PROJECT SYSTEMS 3/	
	Nebr.Bost.Irrig.District				Kans-Bostwick Irrig.Dist.			Kirwin Irrig.Dist	Webster Irrig.Dist		
	Franklin Pump	Superior	Courtland	Total Nebr-Bost	Courtland Canal Upper	Courtland Canal Lower	Total	Kirwin	Osborne		
Acres	1,900	5,240	1,840	19,810	10,900	17,500	28,400	9,000	4,000	114,435	1961 Est
AF-Dry Yr.	6,400	15,600	4,700	63,000	28,100	45,200	73,300	24,000	12,400	316,000	
AF-Med Yr.	4,200	11,200	3,400	43,000	20,300	32,600	52,900	16,200	8,500	219,700	
AF-Wet Yr.	2,100	5,400	1,700	21,500	9,800	15,800	25,600	10,100	5,300	121,800	
Acres	1,903	5,029	1,427	18,194	7,020	12,935	19,955	8,216	1,159	89,622	1960
AF Div.	2,676	13,124	5,230	45,919	18,592	26,529	45,121	16,834	4,185	207,043	
AF/Ac.	1.41	2.61	3.66	2.52	2.65	2.05	2.26	2.04	3.61	2.31	
Acres	1,930	5,080	1,664	19,835	7,159	9,081	16,240	6,470		79,915	1959
AF Div.	3,110	17,449	5,133	54,762	23,343	26,388	49,731	21,005		218,979	
AF/Ac.	1.61	3.43	3.08	2.76	3.26	2.91	3.06	3.25		2.74	
Acres	1,391	3,978	489	15,147	5,829	2,878	8,707	4,127		60,230	1958
AF Div.	858	8,420	1,620	25,115	13,727	5,690	19,417	15,150		133,210	
AF/Ac.	0.62	2.12	3.31	1.66	2.35	1.98	2.23	3.67		2.21	
Acres	1,628	4,685	1,396	15,816	7,272		7,272	1,336		44,976	1957
AF Div.	1,800	10,490	2,180	29,560	18,240		18,240	5,530		95,706	
AF/Ac.	1.11	2.24	1.56	1.87	2.51		2.51	4.14		2.13	
Acres	1,596	4,681	1,399	14,567	5,347		5,347			37,179	1956
AF Div.	3,710	13,190	6,140	25,080	20,860		20,860			103,150	
AF/Ac.	2.32	2.82	4.39	1.72	3.90		3.90			2.77	
Acres	1,516	4,316	1,383	10,506	2,385		2,385			28,545	1955
AF Div.	3,830	15,100	6,600	38,720	14,370		14,370			108,686	
AF/Ac.	2.53	3.50	4.77	3.69	6.03		5.07			3.81	
Acres	1,460	3,812	1,079	7,516	30 5/		30			16,854	1954
AF Div.	2,540	9,610	9,690	29,770	3,910		3,910			69,390	
AF/Ac.	1.74	2.52	8.98	3.96	13.03		13.03			4.12	

TABLE 9 (Cont'd)

IRRIGATION UNDER CANAL SYSTEMS IN KANSAS RIVER PROJECTS

Water Use During Year		COLORADO				NEBRASKA				
		Hale Ditch 1/ (Non-Proj)	Warren Act 2/ (Non-Proj)	Fr. Valley Irrig.Dist. Culbertson	H&RW Irrig.Dist. & Extension	Frenchman-Cambridge Irrigation District Meeker-Driftwood	Meeker	Bartley	Cambridge	Total Fr. Cambr.	Nebr.-Bostwick Irrig. Dist. Franklin Naponee
1953	Acres	700	730			2,800		4,390		7,190	
	AF Div	3,870	469			9,980		16,340		26,320	
	AF/Ac	5.53	0.64			3.56		3.72		3.66	
1952	Acres	700	330			2,887		1,419		4,306	
	AF Div	3,463	84			10,460		6,510		16,970	
	AF/Ac	4.95	0.25			3.62		4.59		3.94	
1951	Acres	700				2,816		1,450		4,266	
	AF Div	2,821				7,390		8,900		16,290	
	AF/Ac	4.03				2.62		6.14		3.82	
1950	Acres					2,791				2,791	
	AF Div					7,660				7,660	
	AF/Ac					2.74				2.74	
1949	Acres					2,906				2,906	
	AF Div					5,290				5,290	
	AF/Ac					1.82				1.82	
1948	Acres					2,675				2,675	
	AF Div					5,180				5,180	
	AF/Ac					1.94				1.94	

TABLE 9 (Cont'd)
IRRIGATION UNDER CANAL SYSTEMS IN KANSAS RIVER PROJECTS

Water Use During Year	NEBRASKA (Cont'd.) Nebraska-Bostwick Irrigation District Franklin Pump	Superior	Nebr.-Courtland	Total Nebr-Bost.	KANSAS Kans-Bostwick Irrig. Dist. Courtland Canal Upper	Lower	Total	Kirwin Irrig.Dist Kirwin	Webster Irrig. Dist Osborne	TOTAL FOR PROJECT 3/ SYSTEMS	
1953	Acres	994	3,093	282	4,376					11,566	1953
	AF Div.	2,290	10,170	1,470	13,930					40,250	
	AF/Ac.	2.30	3.29	5.21	3.18					3.48	
1952	Acres		1,900	338	2,238					6,544	1952
	AF Div.		6,280	7,340	13,620					30,590	
	AF/Ac.		3.31	21.72	6.09					4.67	
1951	Acres		193		193					4,459	1951
	AF Div.		1,940		1,940					18,230	
	AF/Ac.		10.05		10.05					4.09	
1950	Acres									2,791	1950
	AF Div.									7,660	
	AF/Ac.									2.74	
1949	Acres									2,906	1949
	AF Div.									5,290	
	AF/Ac.									1.82	
1948	Acres									2,675	1948
	AF Div.									5,180	
	AF/Ac.									1.94	

1/ Hale Ditch is not a Bureau constructed or operated system. Acre feet diverted includes both natural flow and supplemental water delivered under Warren Act Contracts.
2/ Includes private pumps and irrigation systems not constructed or operated by Bureau of Reclamation. Storage use only.
3/ Totals for project systems only. Excludes Hale Ditch and deliveries under Warren Act contracts.
4/ Old Meeker lands now included under Meeker-Driftwood Canal System.
5/ Acreage based on water rental or acreage assessment data.
6/ First year operated as a project of the Bureau of Reclamation.
7/ Includes Culbertson Canal before it became a project area.

TABLE 10

IRRIGATION DEVELOPMENT AND OPERATION OF PROJECT CANAL SYSTEMS

State and Canal System	Acres: Planned in Definite Plan Reports	Acres: 1960 Irrigation Season: Service Available 1/	Acres: 1960 Irrigation Season: Actually Irrigated 2/	Acres: Available for Service Jan. 1, 1961 3/	Years (Inclusive) Canal was Operated: By Bureau of Reclamation	Years (Inclusive) Canal was Operated: By Irrigation District
NEBRASKA						
Culbertson (Fr.-Val. I.D.)	9,600	9,600 4/	9,400 4/	9,600	None	1958 - Present 5/
Culbertson Ext. (H. & R.W.)	11,490	0	0	7,007 6/	1960	
Meeker-Driftwood	16,440	16,278	13,538	16,440	1957-59 7/	Dist. in 1960
Bartley	7,000	6,592	4,911	6,592	1954-56	1957 - Present
Cambridge	15,600	15,626	14,249	15,600	1951-56	1957 - Present
Total (Fr.-Cam.I.D.)	39,040	38,496	32,698	38,632		
Franklin	11,510	11,285	8,424	11,267	1954-56	1957 - Present
Naponee	1,640	1,533	1,411	1,533	1955-56	1957 - Present
Franklin Pump	2,120	2,123	1,903	2,125	1953-56	1957 - Present
Superior	6,320	5,834	5,029	5,892	1951-56	1957 - Present
Courtland (Nebraska)	2,650	1,840	1,427	2,018	1952-58 8/	1959 - Present
Total (Nebr.-Bost. I.D.)	24,240	22,615	18,194	22,835		
KANSAS						
Courtland(Above Lov.Res.)	15,270	9,801	7,020	11,476 9/	1954-58 10/	1959 - Present
Courtland(Below Lov.Res.)	31,030	22,138	12,935	25,052 11/	1958	1959 - Present
Total (Kans.-Bost. I.D.)	46,300	31,939	19,955	36,528		
Kirwin (Kirwin I.D.)	10,000 12/	11,374	8,216	11,500	1957-59	1960 - Present
Webster (Webster I.D.)	8,500	0	1,159	8,500 13/	1960-61	
TOTAL OF PROJECTS	149,170	114,024	89,622	134,602		

(See attached sheet for footnotes.)

Footnotes for Table 10

1/ Acres used in crop census reports and official program documents.

2/ Determined by crop census.

3/ Based upon land classification reports.

4/ Acres paying water charges. Crop census includes only 984 acres under reconstructed canal.

5/ District operated since 1890, but 1958 was first year operated as part of Kansas River Projects.

6/ Service will be available for 7,007 acres by May 1961. Contractor estimates system completion by September 1, 1961, with service available to 11,490 acres.

7/ In 1948 Bureau took over operation of 2,912 acres of old Meeker Canal now included in Meeker-Driftwood system.

8/ Nebraska-Bostwick District took over lateral operation in 1957. Kansas-Bostwick District took over main canal operation in 1959, and operation of the Superior-Courtland Diversion Dam in 1960.

9/ Includes 1,100 acres under Pump No. 1 which will be completed by May 1961.

10/ Kansas-Bostwick District operated lateral systems in 1957.

11/ Includes 1,400 acres under White Rock Extension which will be completed by May 1961.

12/ The repayment contract states 11,500 acres.

13/ Only 4,000 acres will be irrigated in 1961.

RECREATION USES OF BUREAU OF RECLAMATION RESERVOIRS IN KANSAS RIVER PROJECTS DURING 1960

Annual Totals

Reservoirs	Visitors	Cars in area	Water Craft	Sport Fish Caught	Season Take Ducks	Season Take Geese
COLORADO						
BONNY	38,138	10,000	1,727	20,500	1,000	45
KANSAS						
CEDAR BLUFF	330,457	82,614	9,374	110,380	2,500	200
WEBSTER	236,851	59,213	5,469	155,000	1,250	153
KIRWIN	193,654	62,469	310	295,000	112	75
LOVEWELL	228,877	57,214	5,381	97,650	1,500	325
NEBRASKA						
ENDERS	114,992	28,748	1,501	70,608	925	11
SWANSON	201,720	52,680	1,997	71,984	2,706	25
HARRY STRUNK	81,340	20,335	2,301	104,140	1,120	3
TOTAL	1,426,029	373,273	28,060	925,262	11,113	837

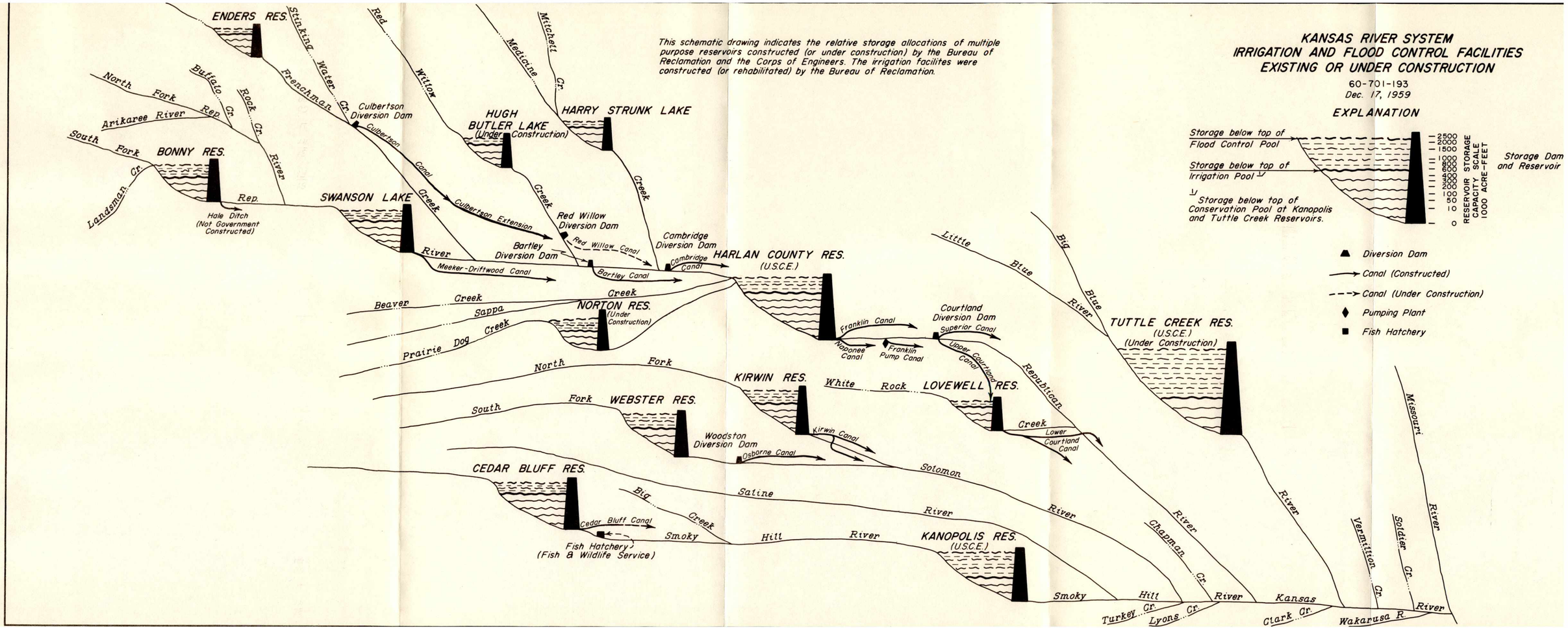
Visitors = Total visitor days which includes fishing, hunting, boating, skiing, camping, picnicking & sightseeing.

Water Craft = Boating days which includes rentals, inboards, outboards, rowboats & sailboats.

KANSAS RIVER SYSTEM
IRRIGATION AND FLOOD CONTROL FACILITIES
EXISTING OR UNDER CONSTRUCTION

60-701-193
Dec. 17, 1959

This schematic drawing indicates the relative storage allocations of multiple purpose reservoirs constructed (or under construction) by the Bureau of Reclamation and the Corps of Engineers. The irrigation facilites were constructed (or rehabilitated) by the Bureau of Reclamation.

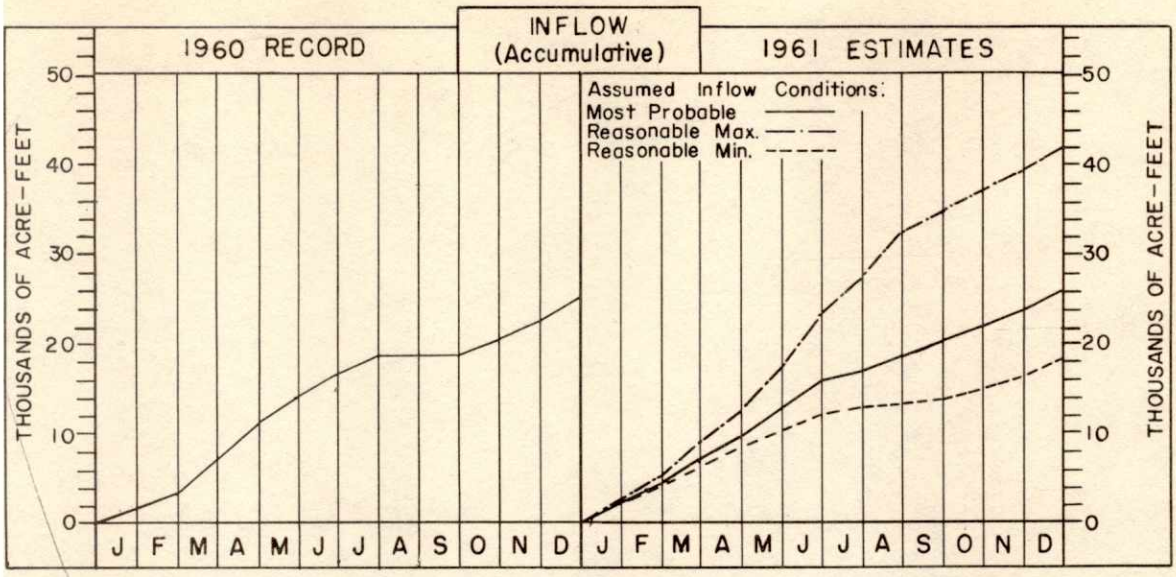


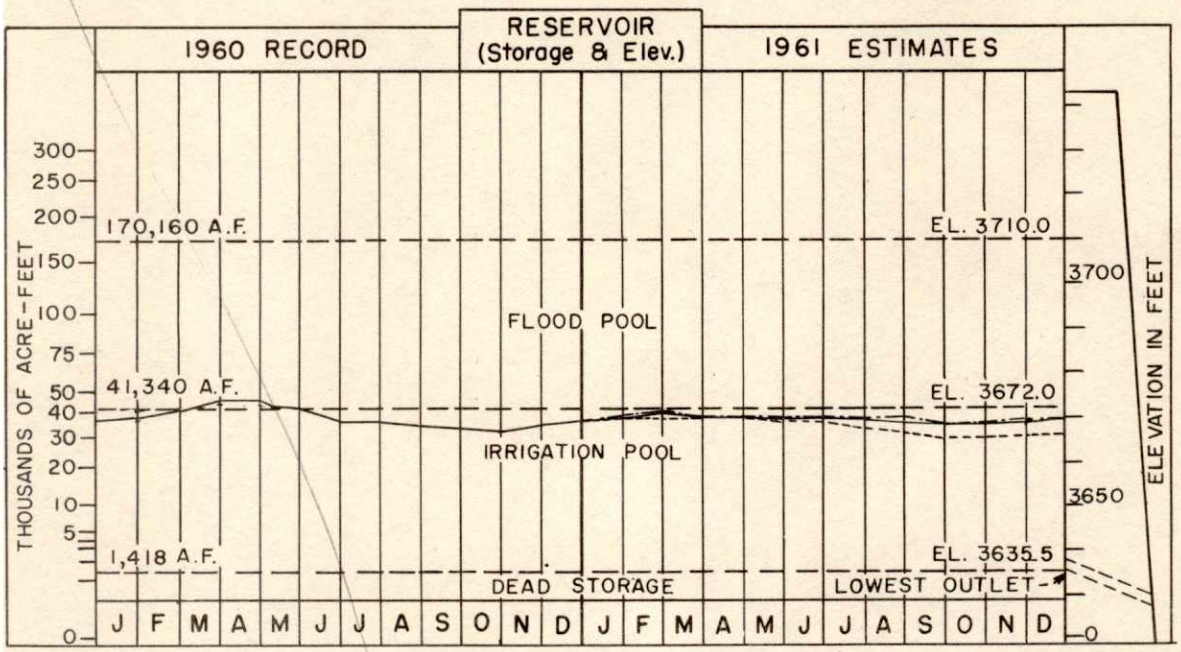
EXPLANATION

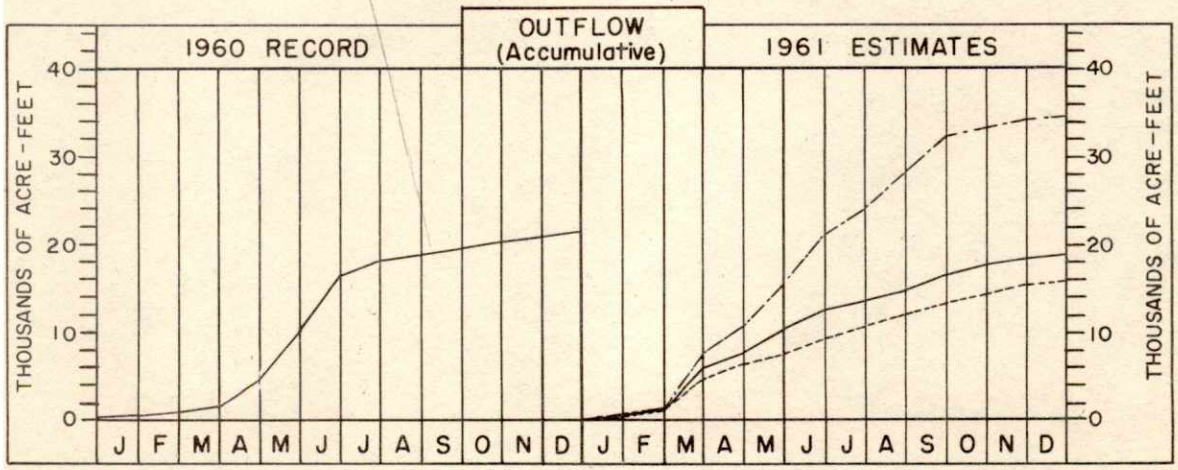
- Diversion Dam
- Canal (Constructed)
- Canal (Under Construction)
- Pumping Plant
- Fish Hatchery

Exhibit 2

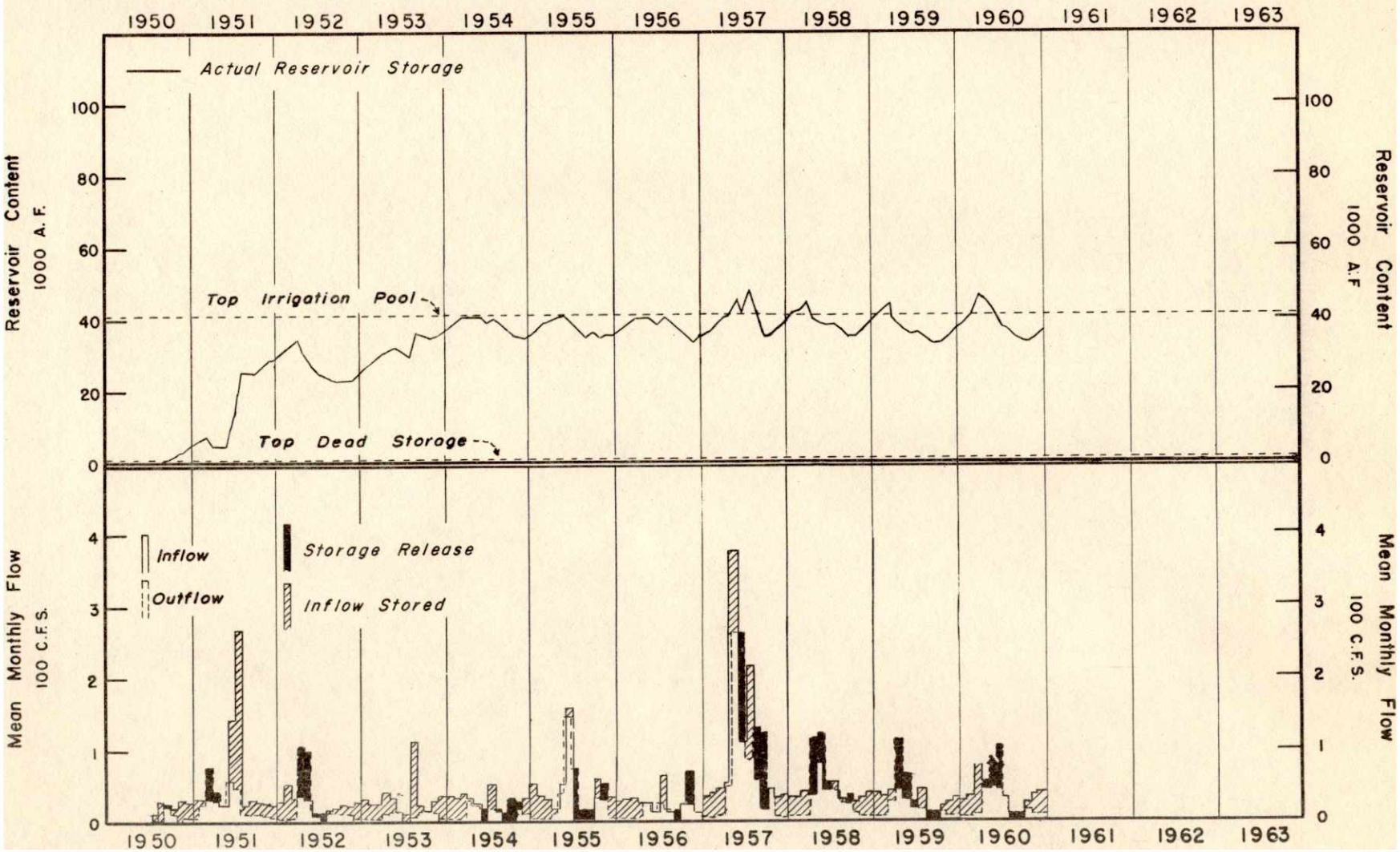
BONNY RESERVOIR OPERATION



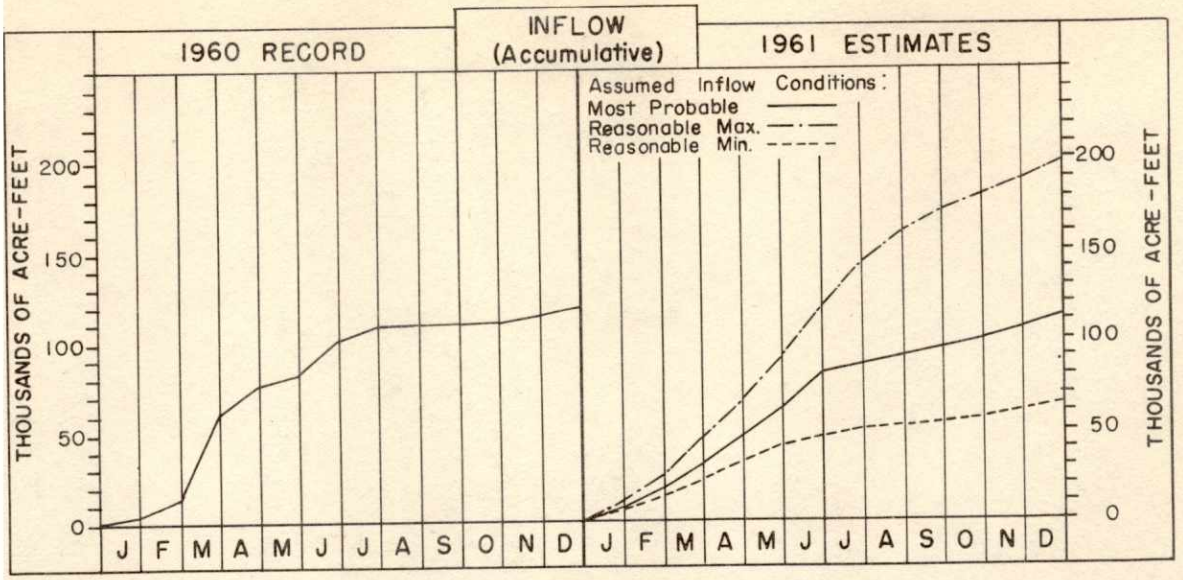


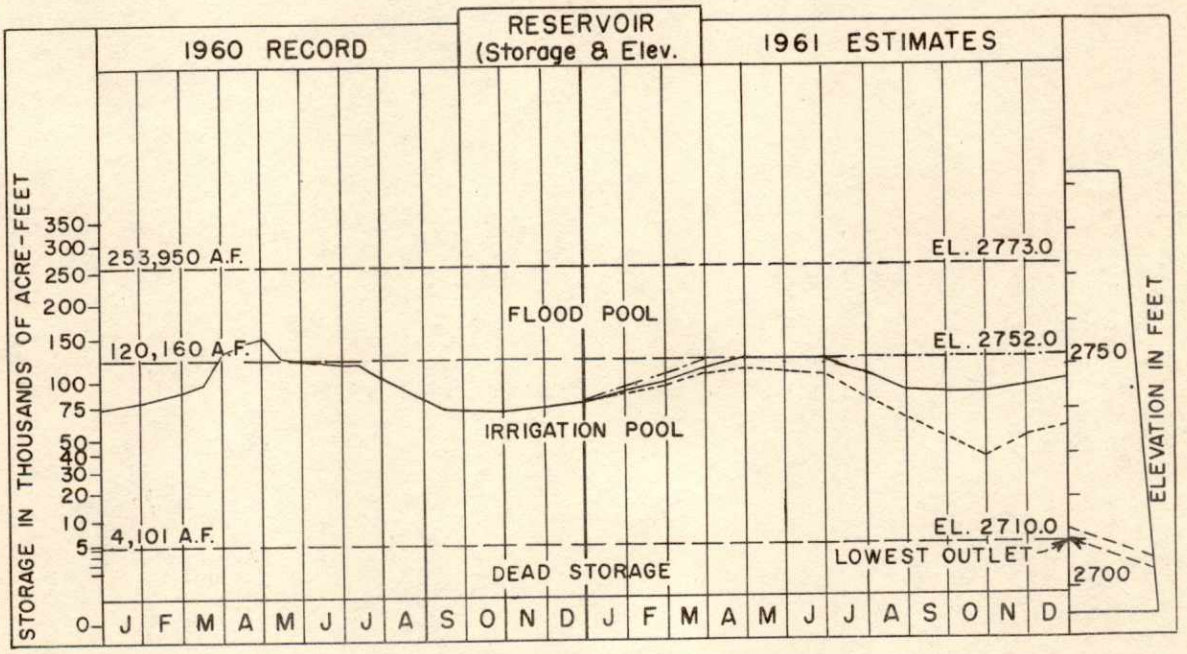


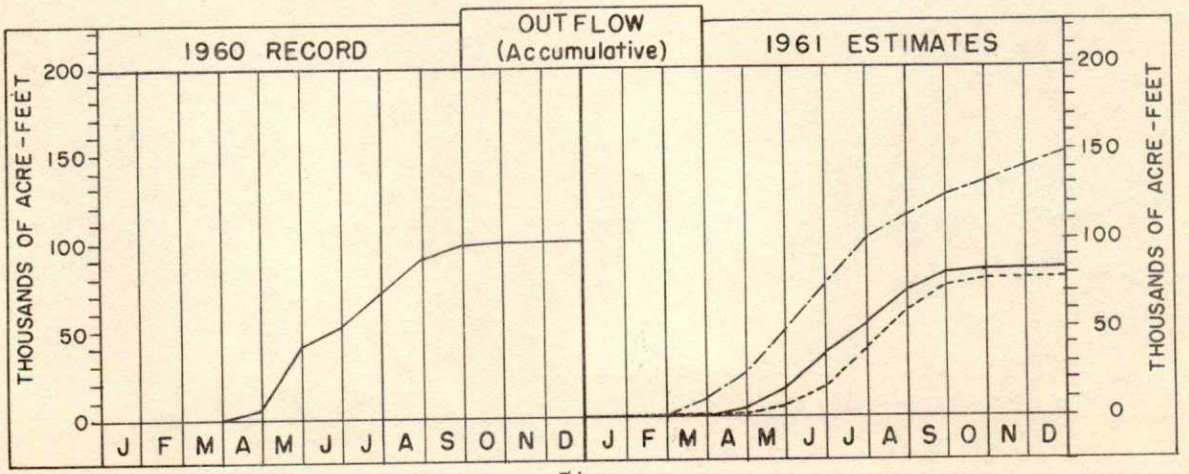
BONNY RESERVOIR
OPERATION HYDROGRAPHS



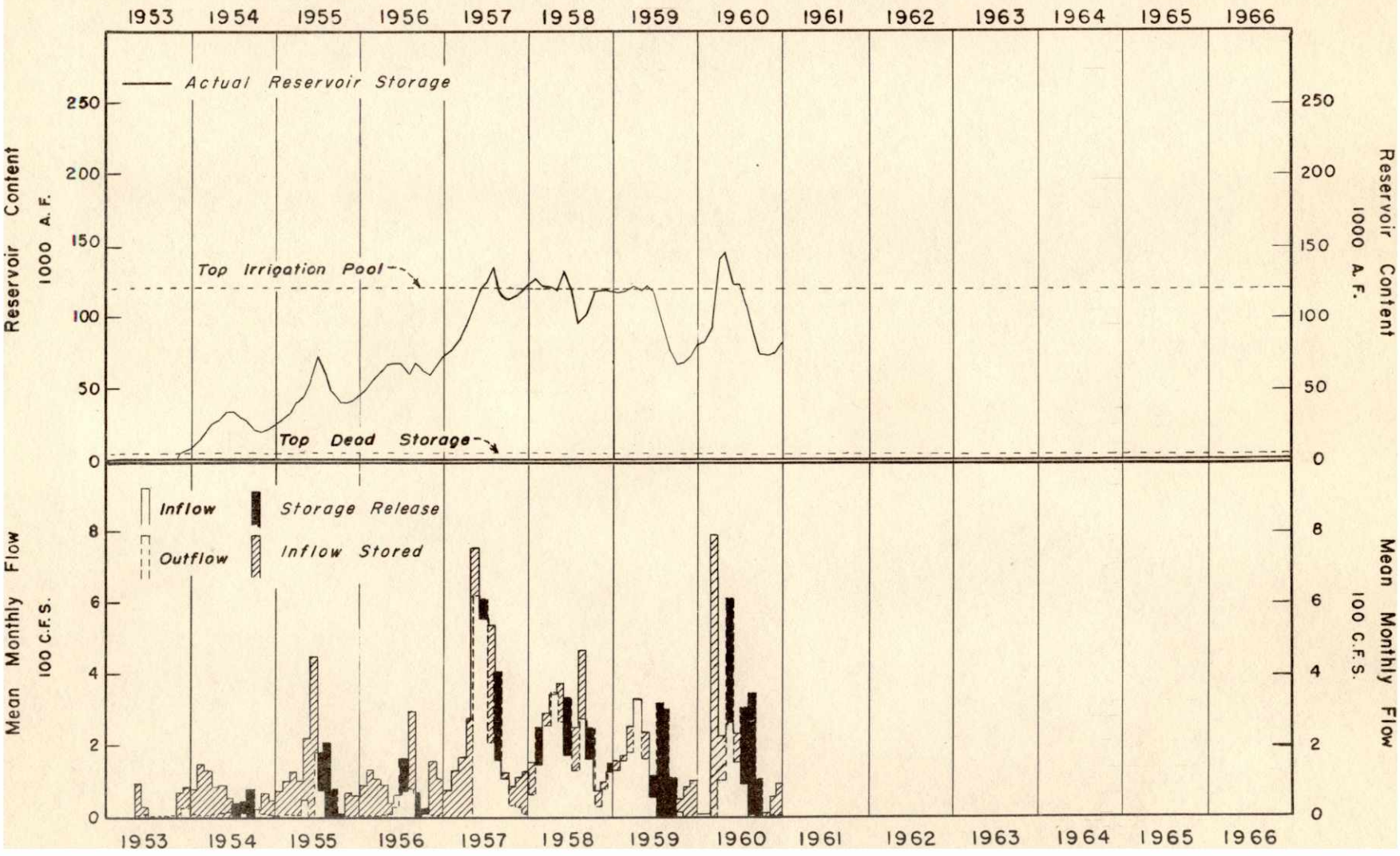
SWANSON LAKE OPERATION



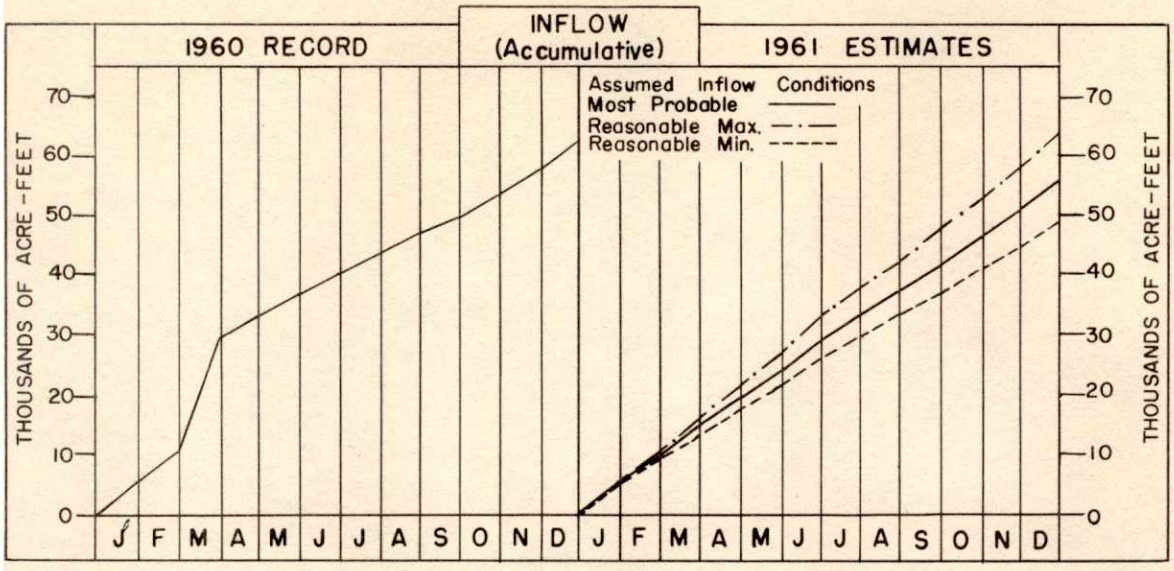


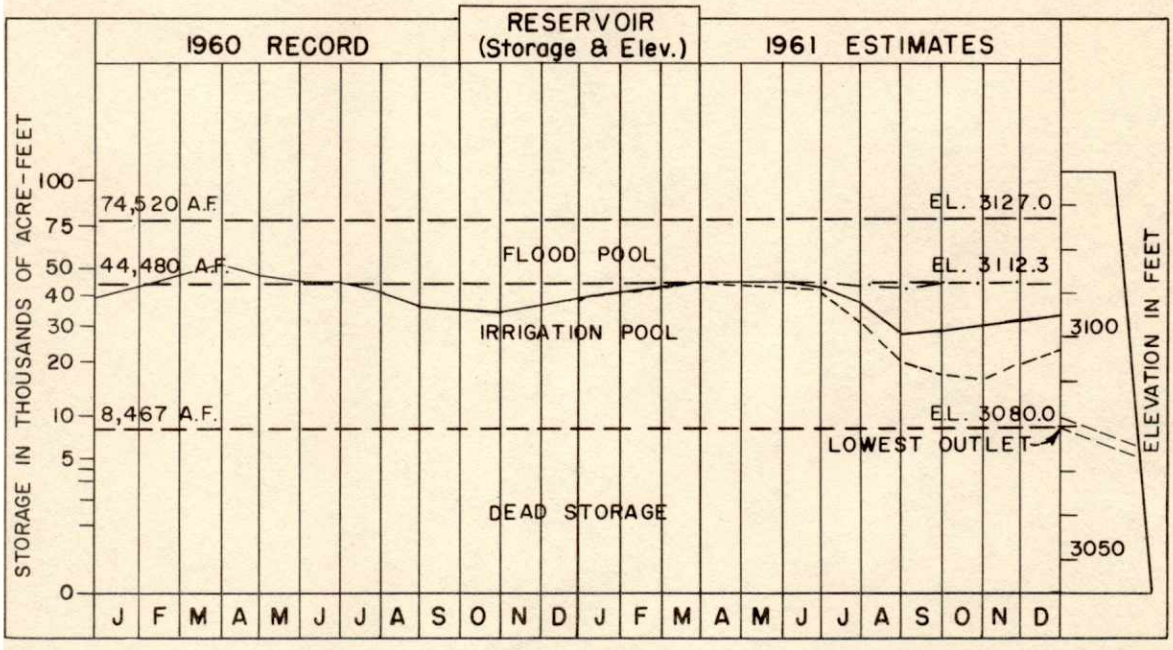


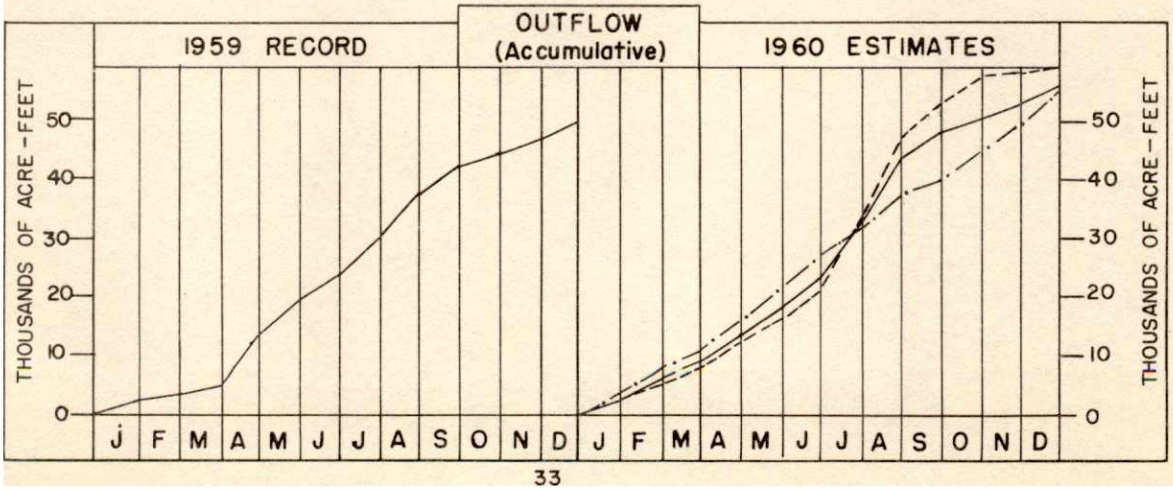
SWANSON LAKE
OPERATION HYDROGRAPHS



ENDERS RESERVOIR OPERATION







ENDERS RESERVOIR
OPERATION HYDROGRAPHS

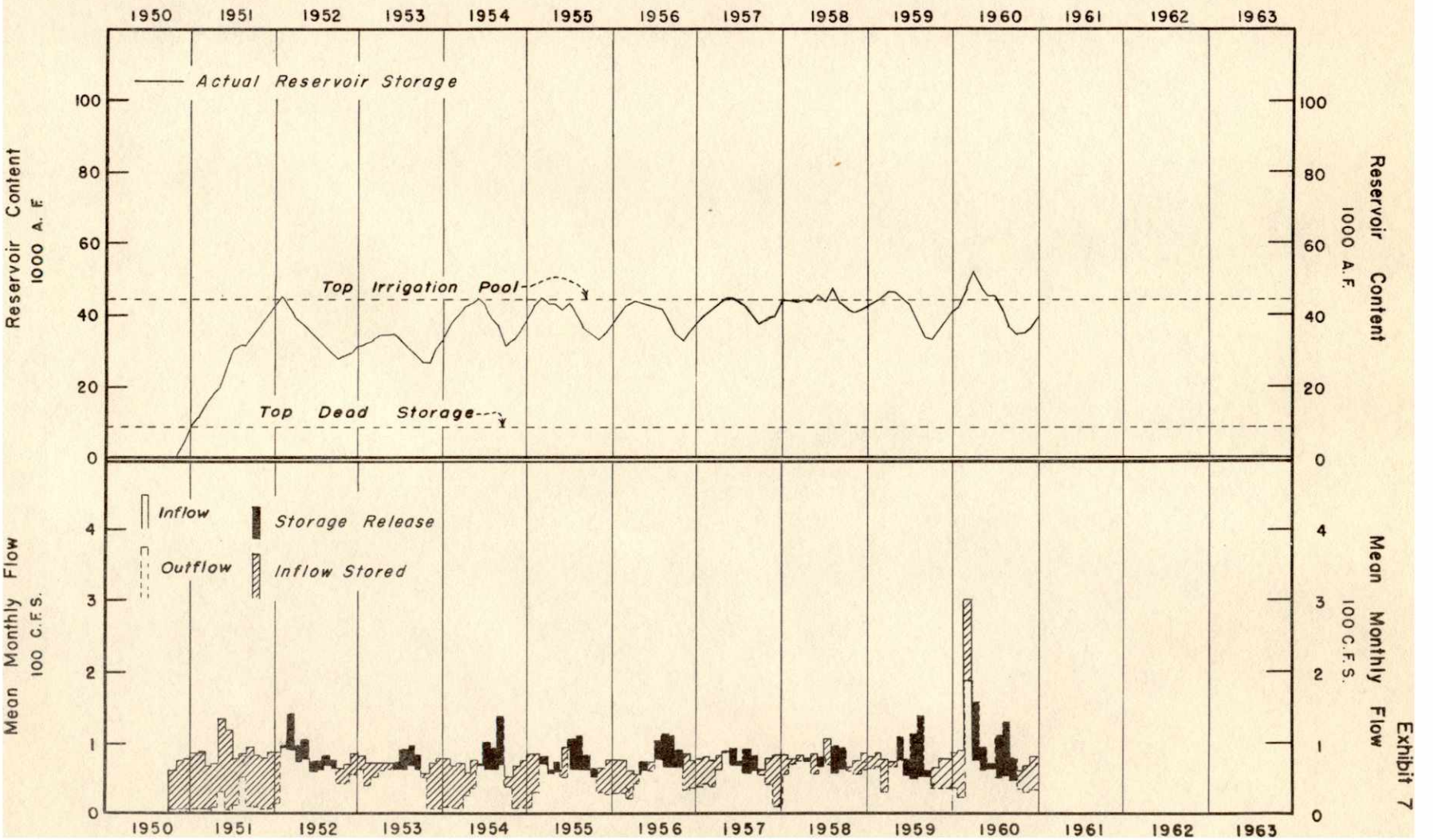
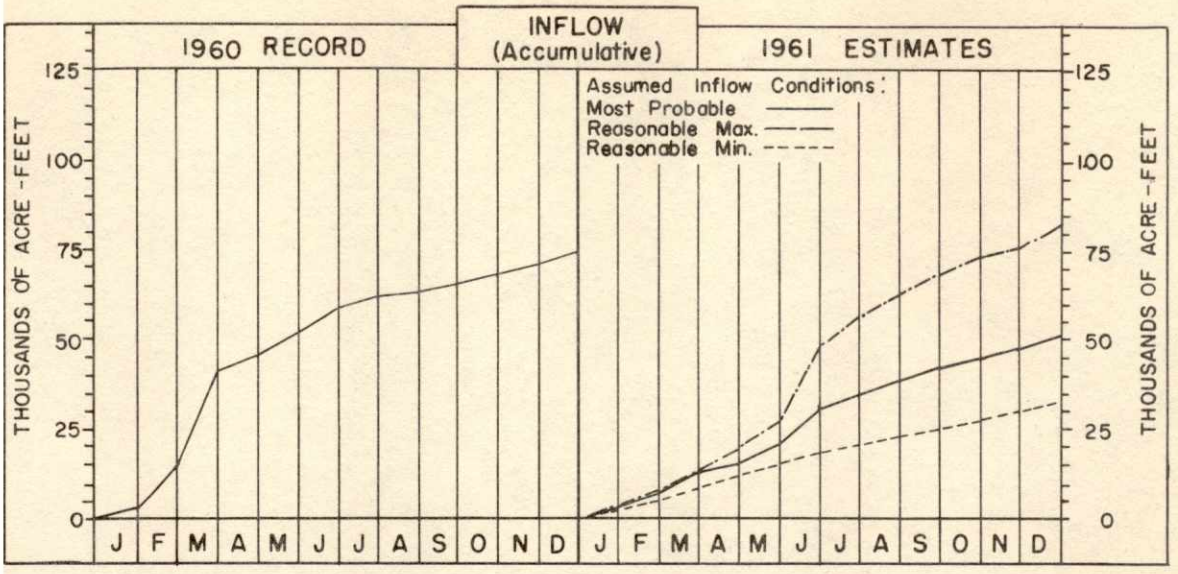
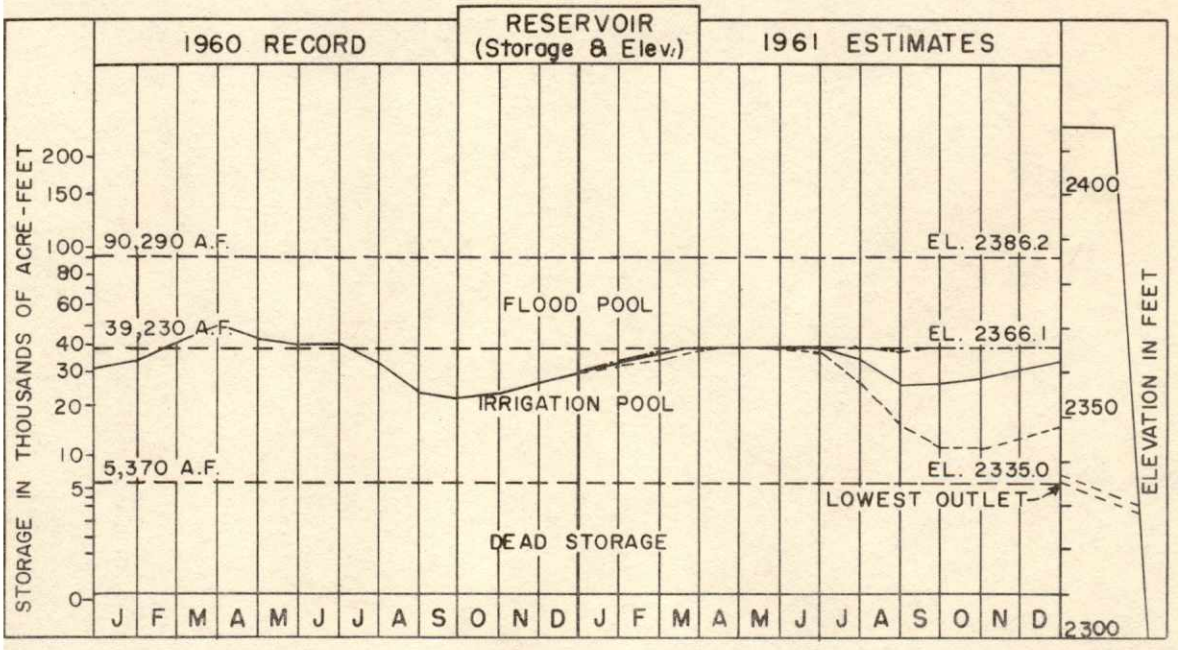


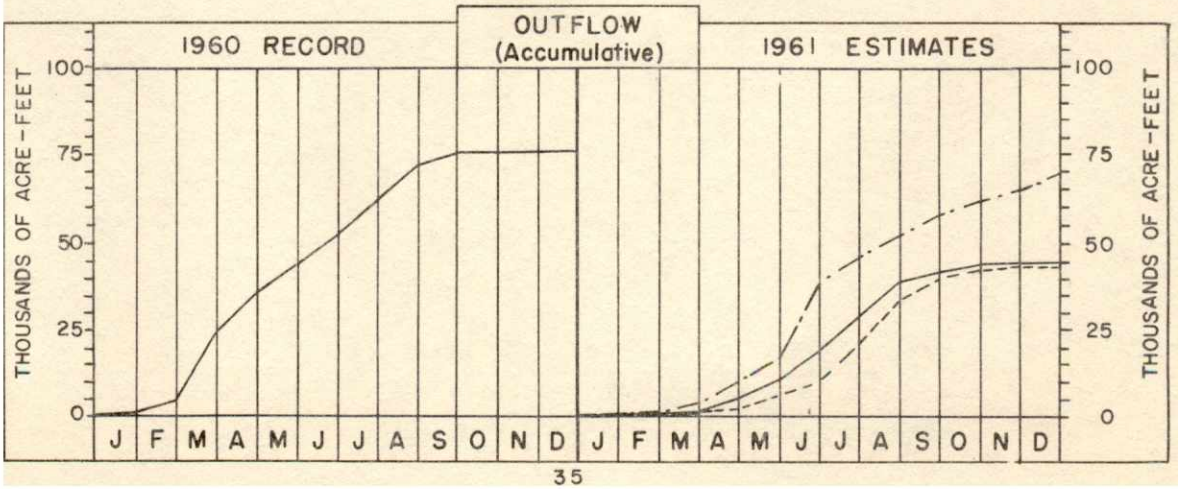
Exhibit 7

Exhibit 8

HARRY STRUNK RESERVOIR OPERATION







HARRY STRUNK LAKE
OPERATION HYDROGRAPHS

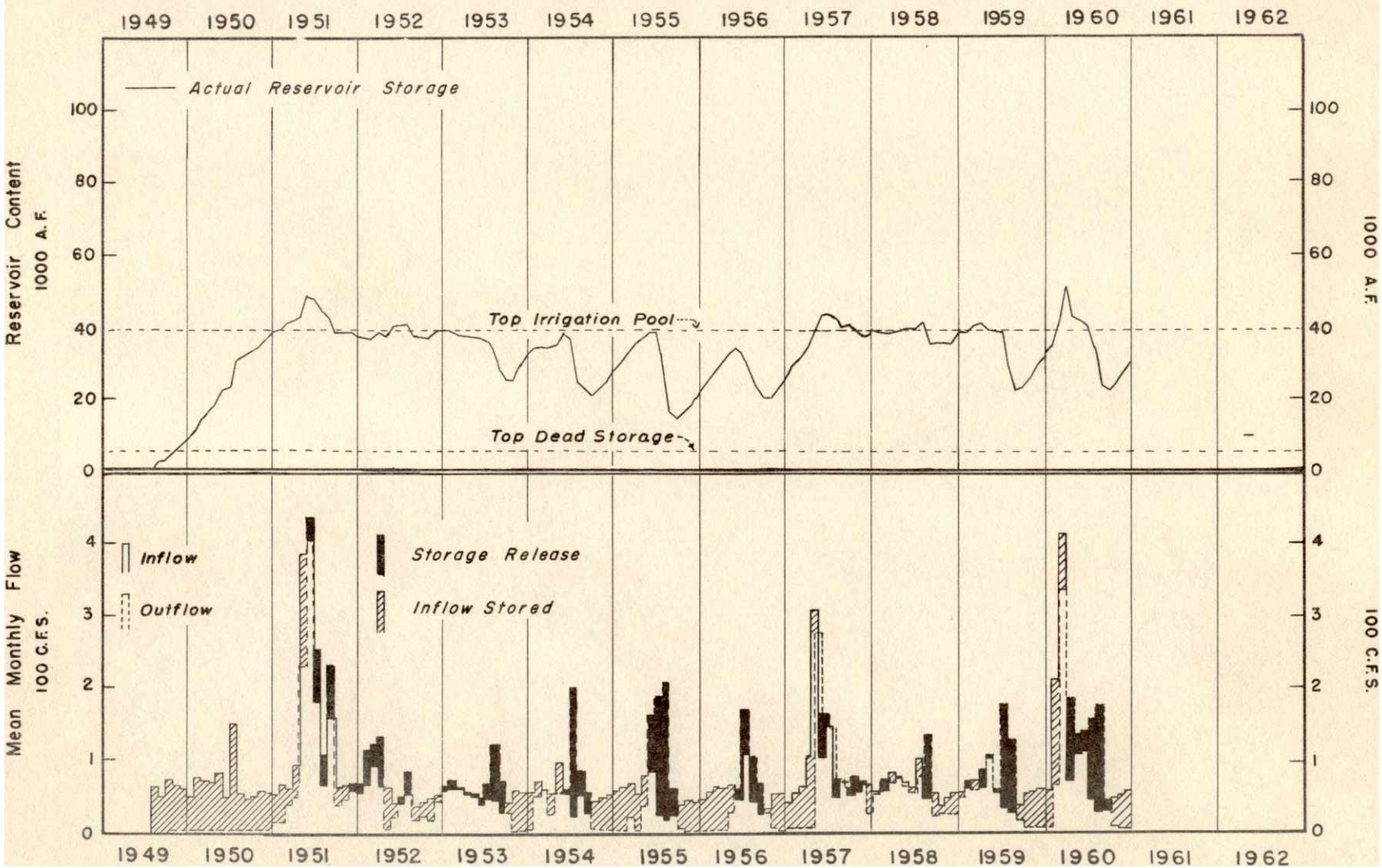
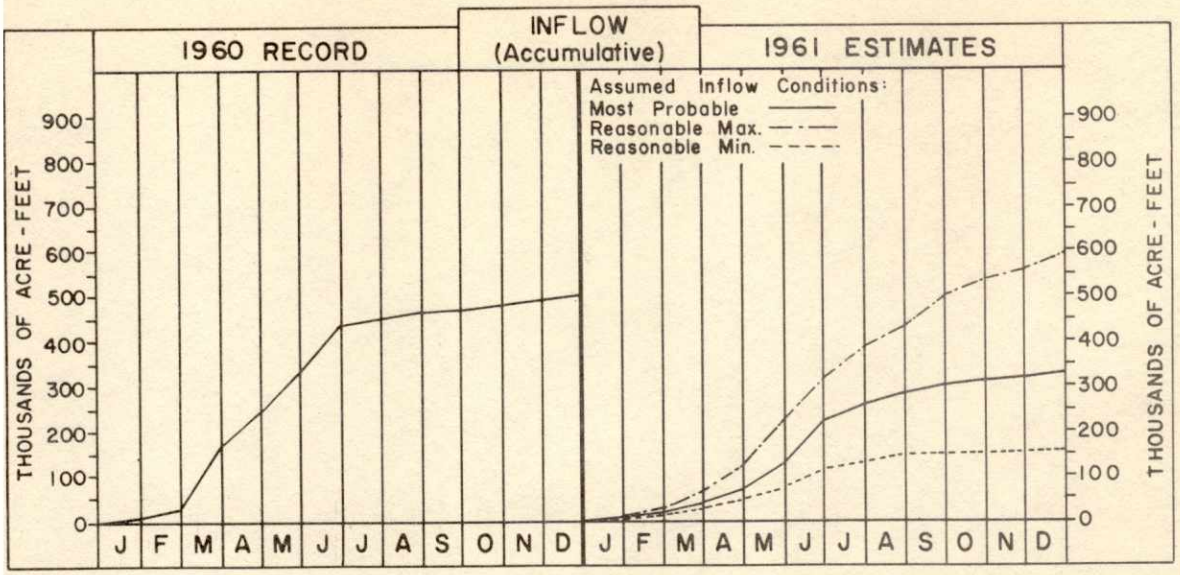
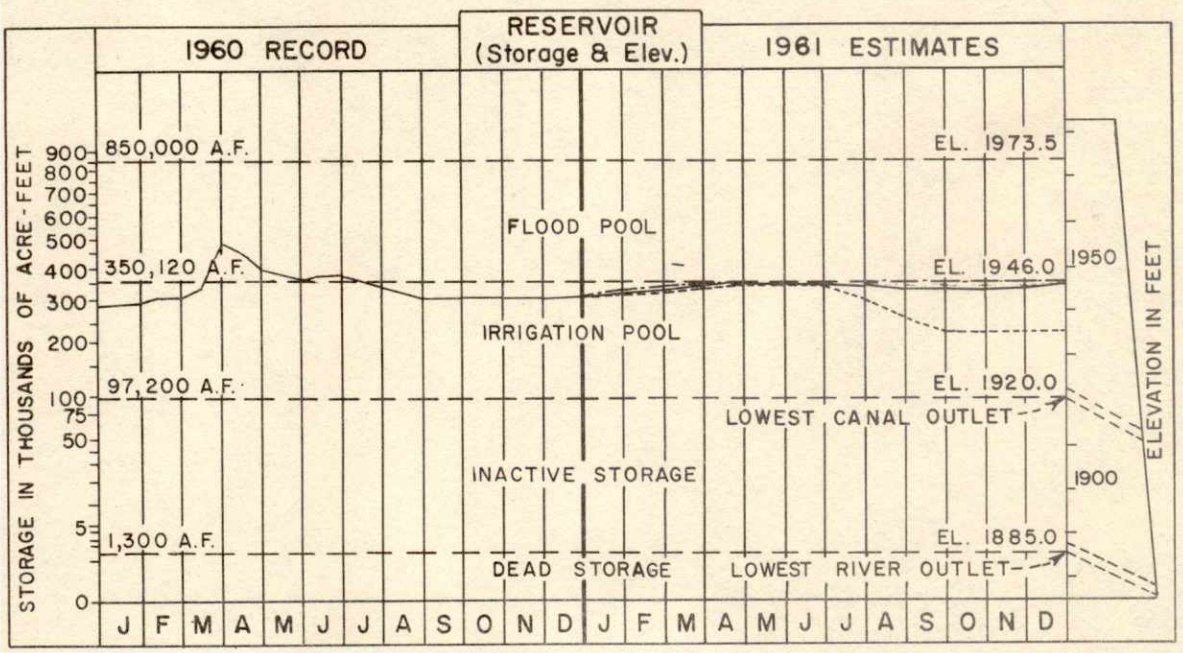
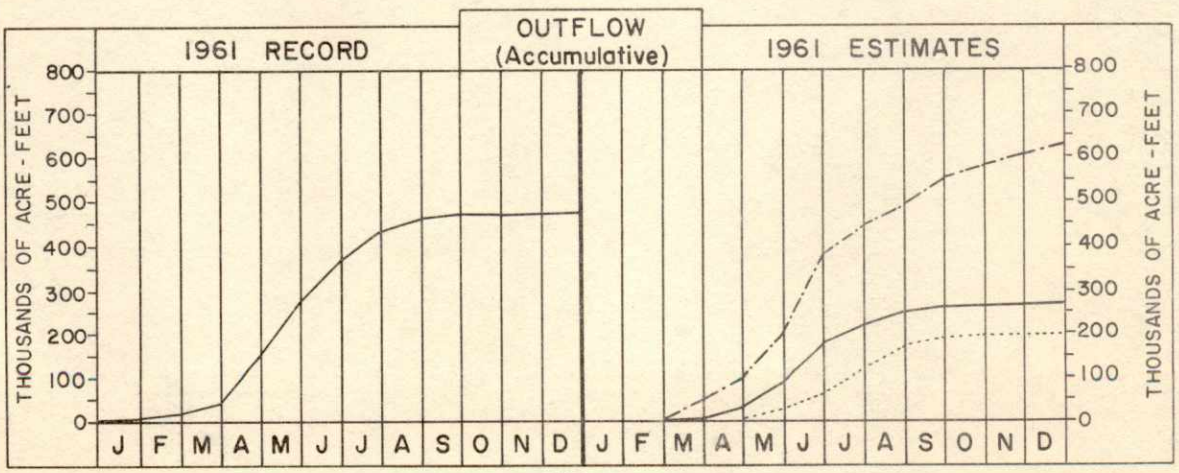


Exhibit 10

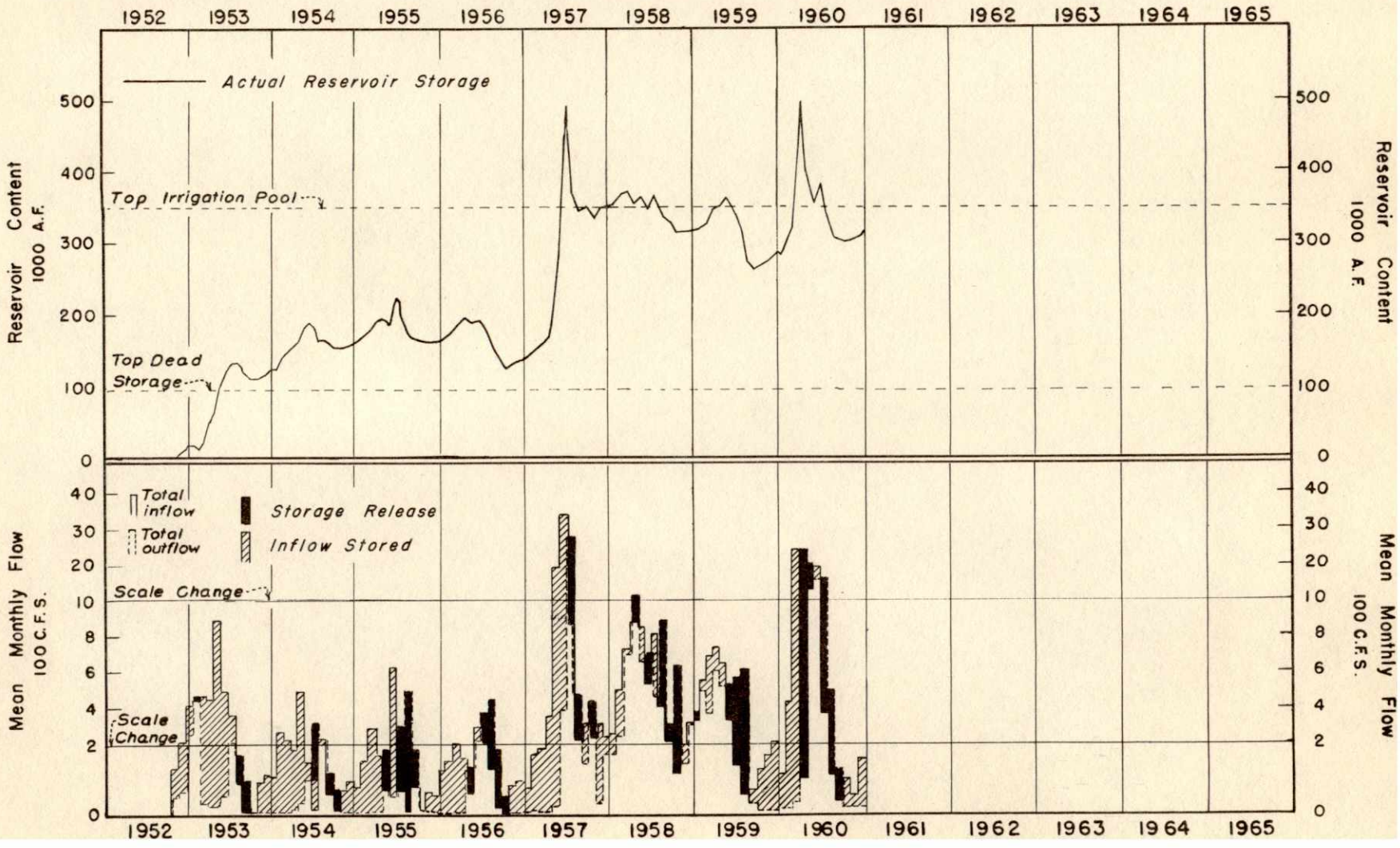
HARLAN COUNTY RESERVOIR OPERATION



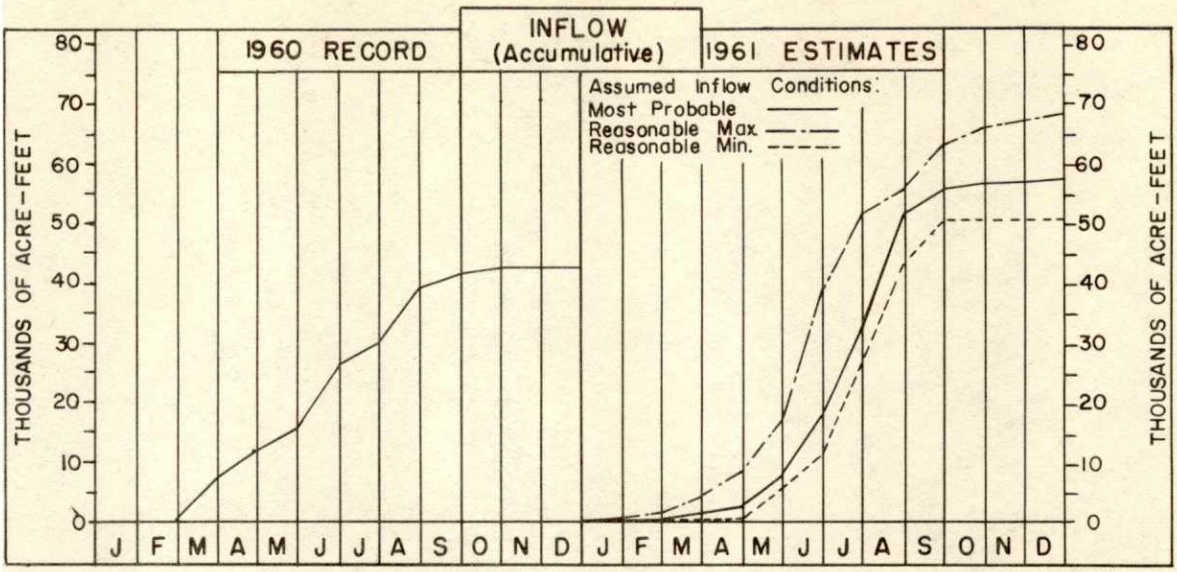


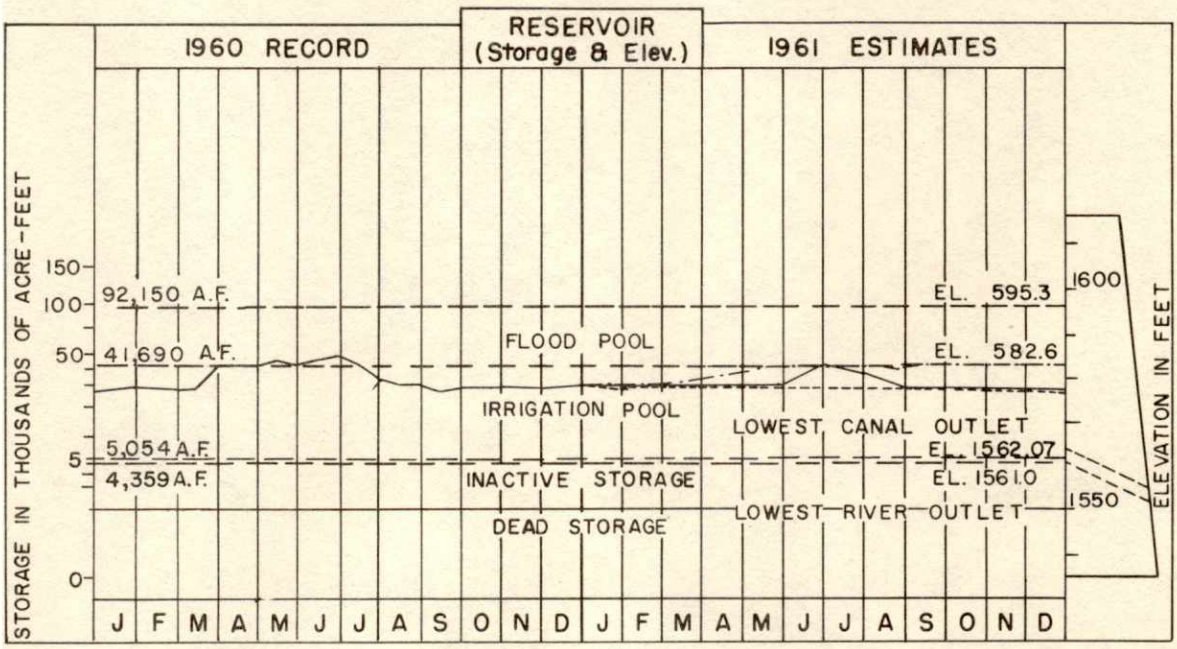


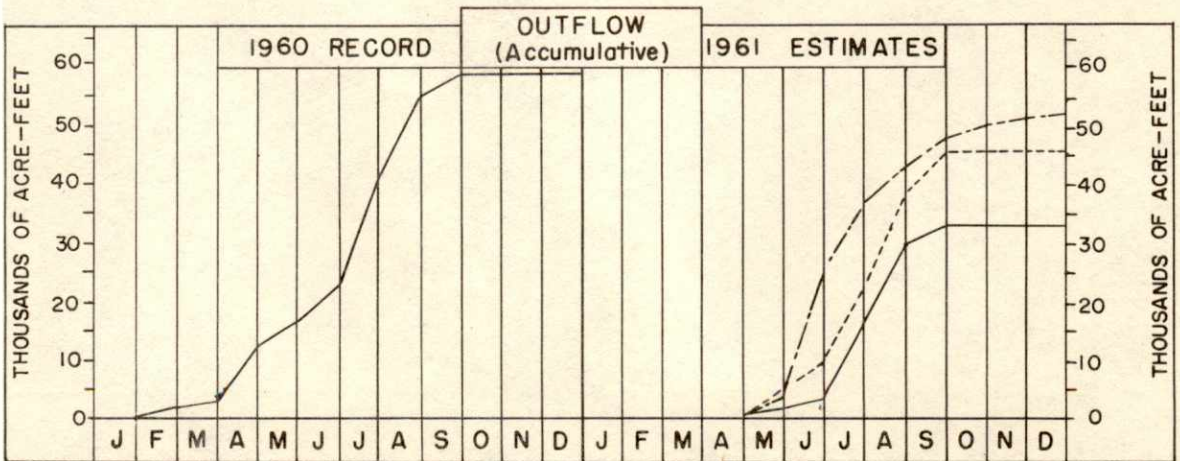
HARLAN COUNTY RESERVOIR
OPERATION HYDROGRAPHS



LOVEWELL RESERVOIR OPERATION







LOVEWELL RESERVOIR
OPERATION HYDROGRAPHS

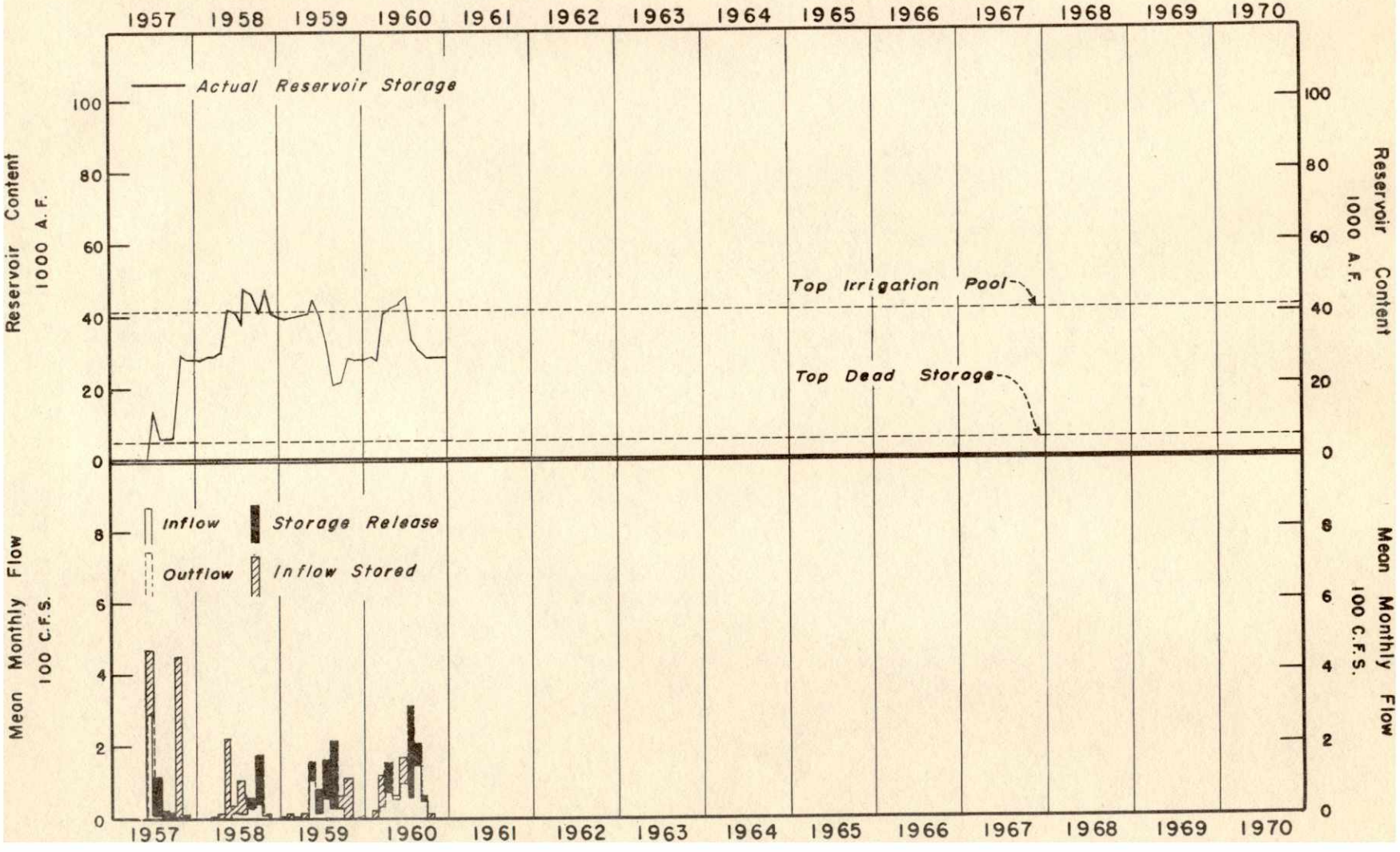
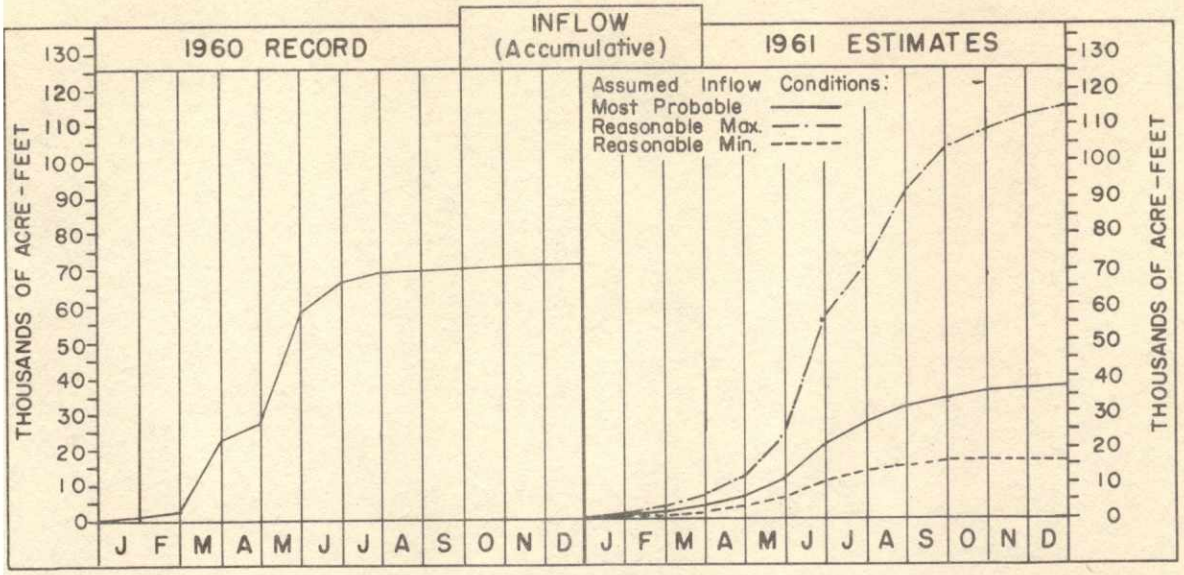
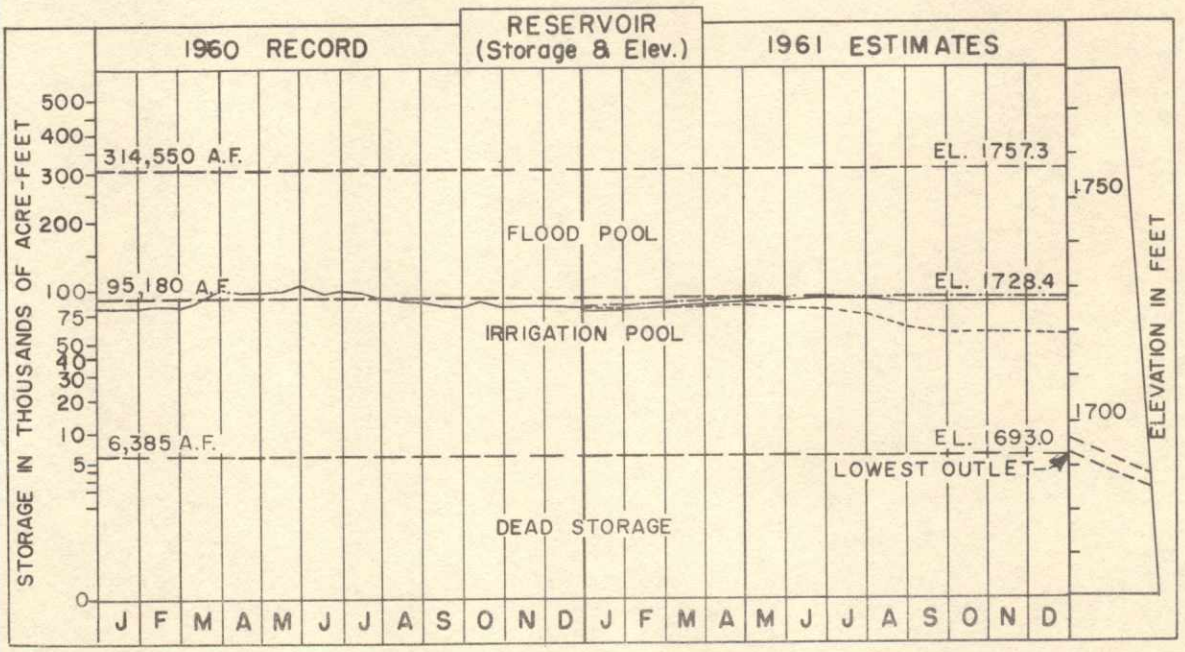
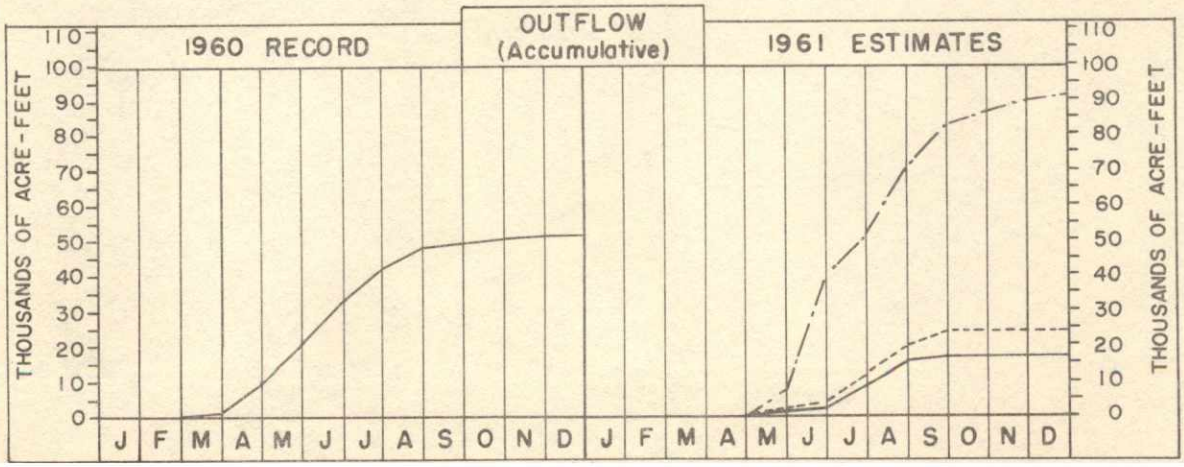


Exhibit 14

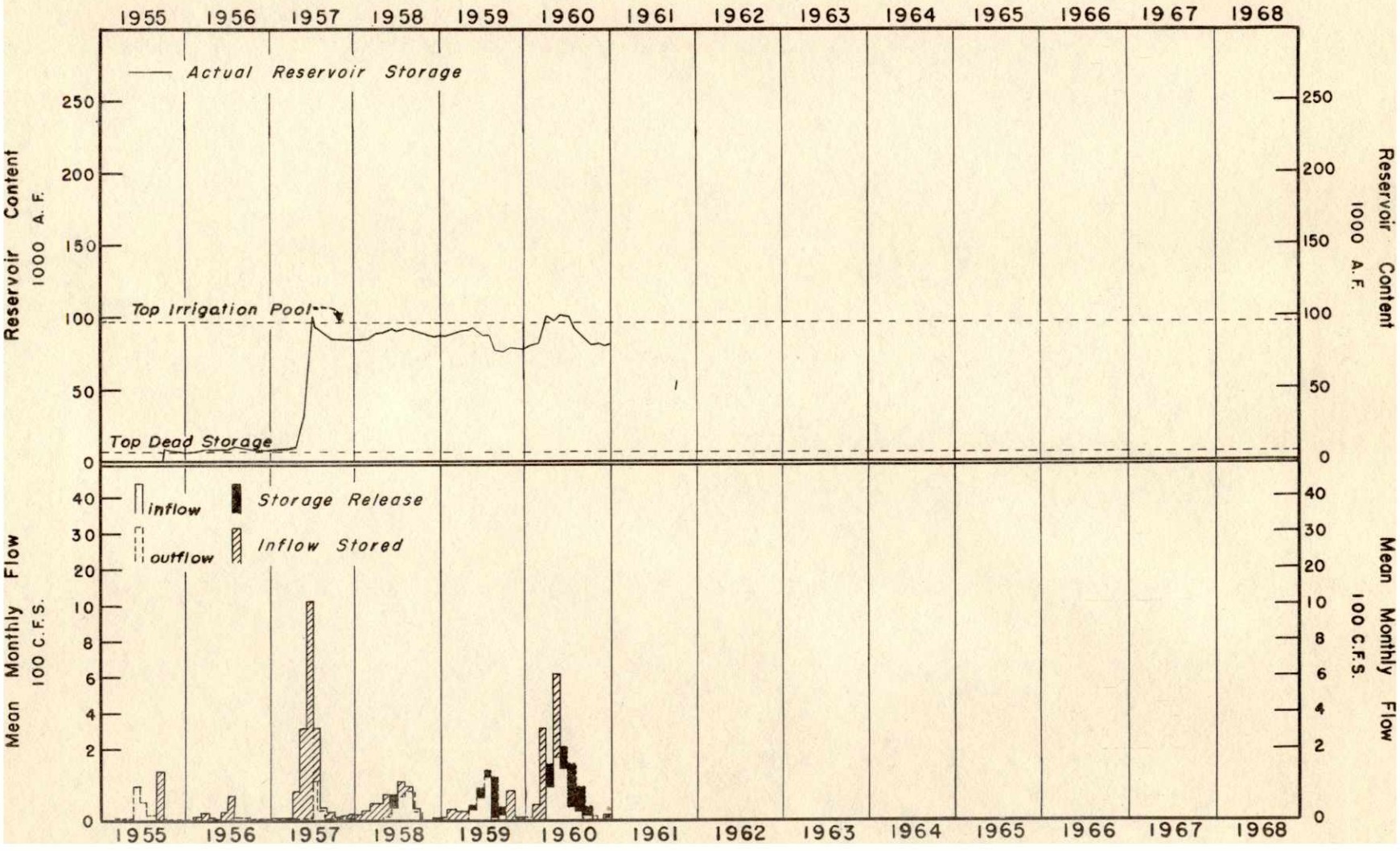
KIRWIN RESERVOIR OPERATION



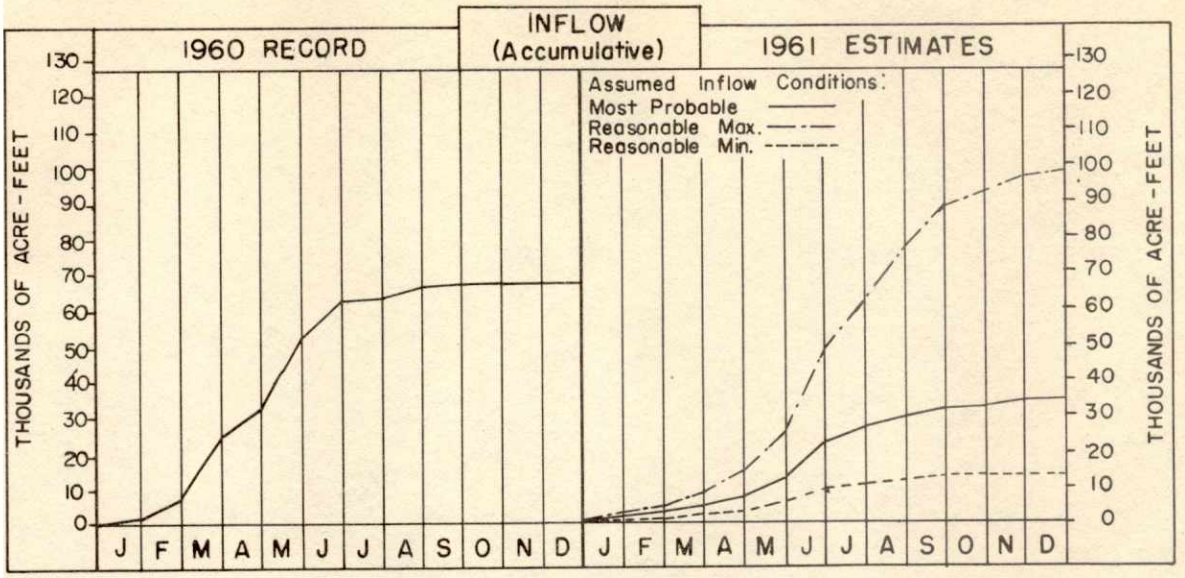


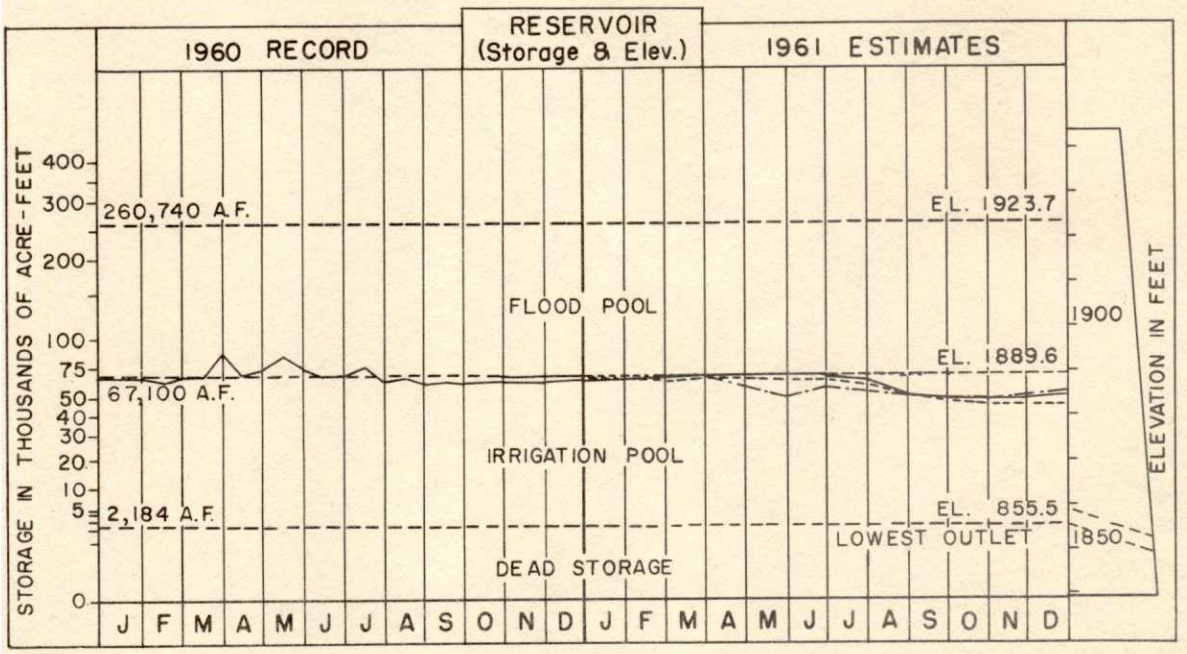


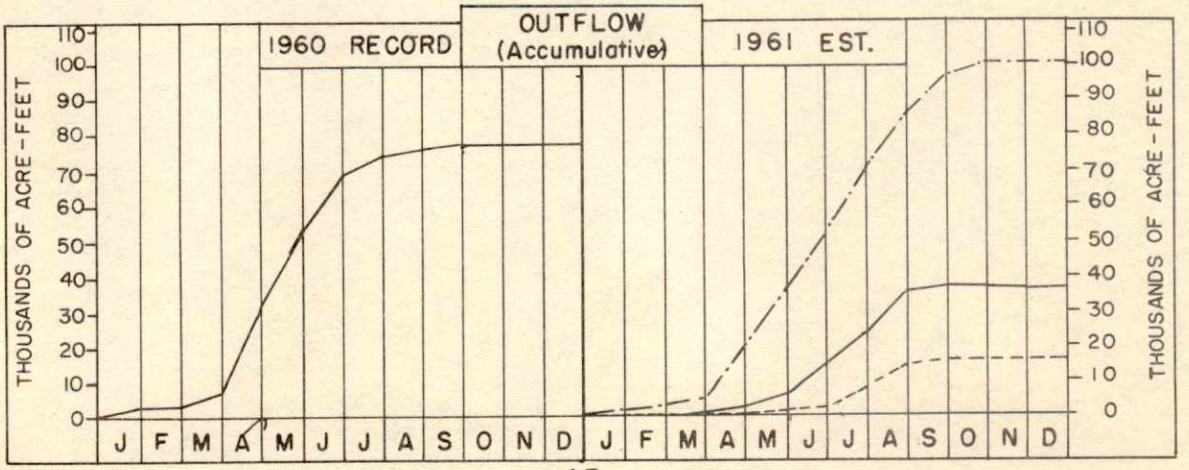
KIRWIN RESERVOIR
OPERATION HYDROGRAPHS



WEBSTER RESERVOIR OPERATION







WEBSTER RESERVOIR
OPERATION HYDROGRAPHS

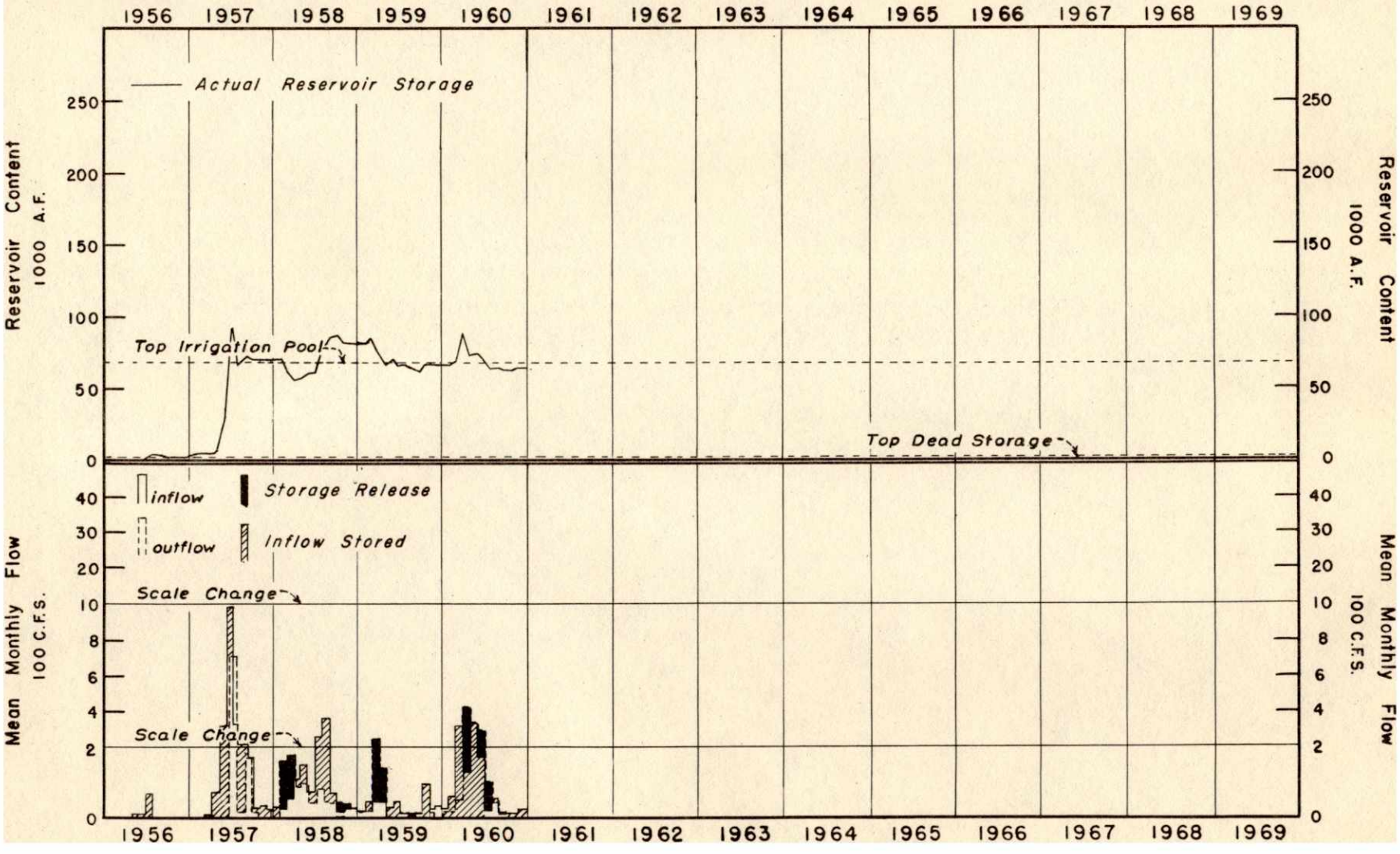
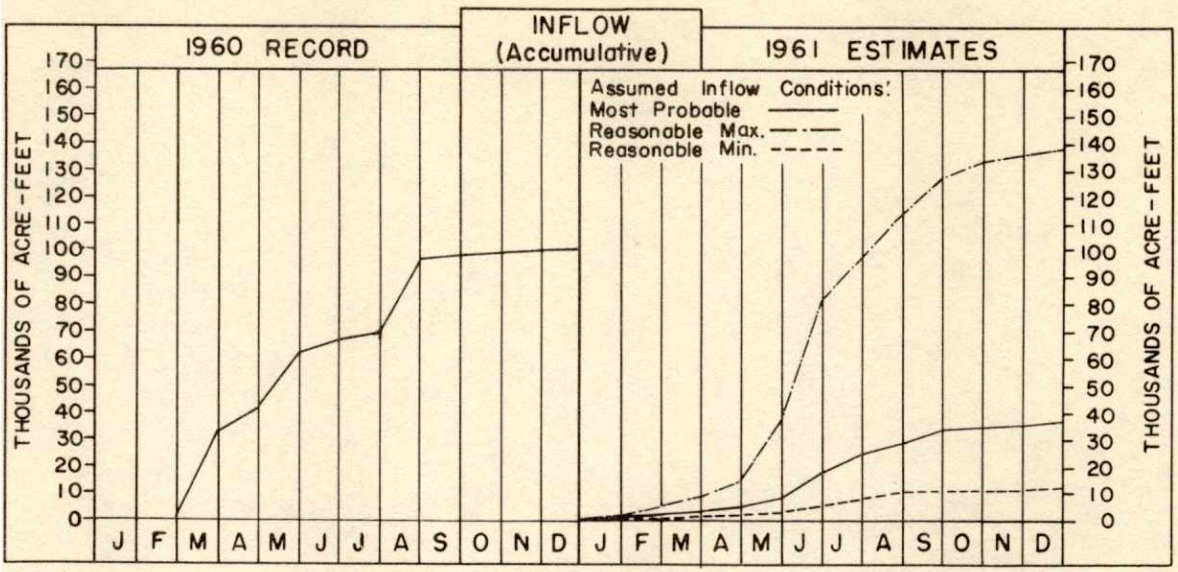
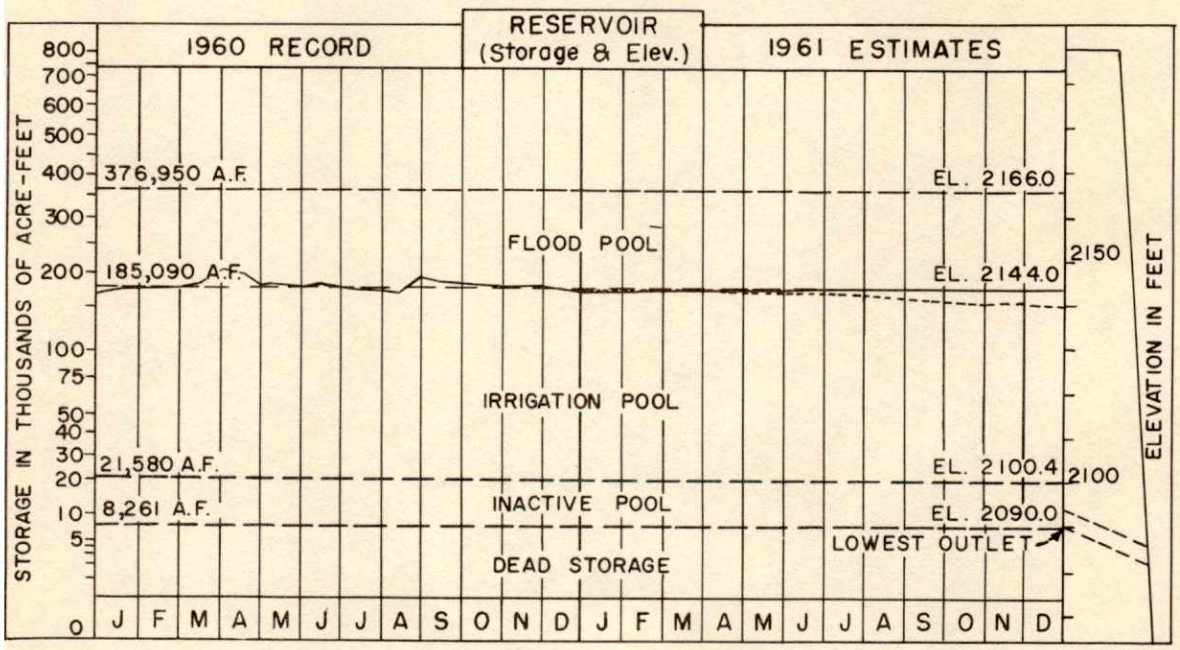
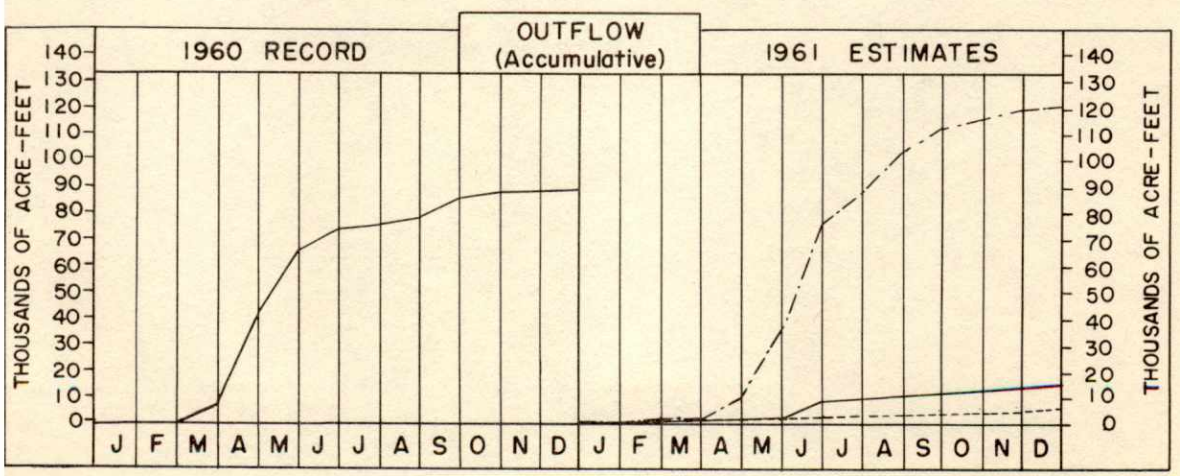


Exhibit 18

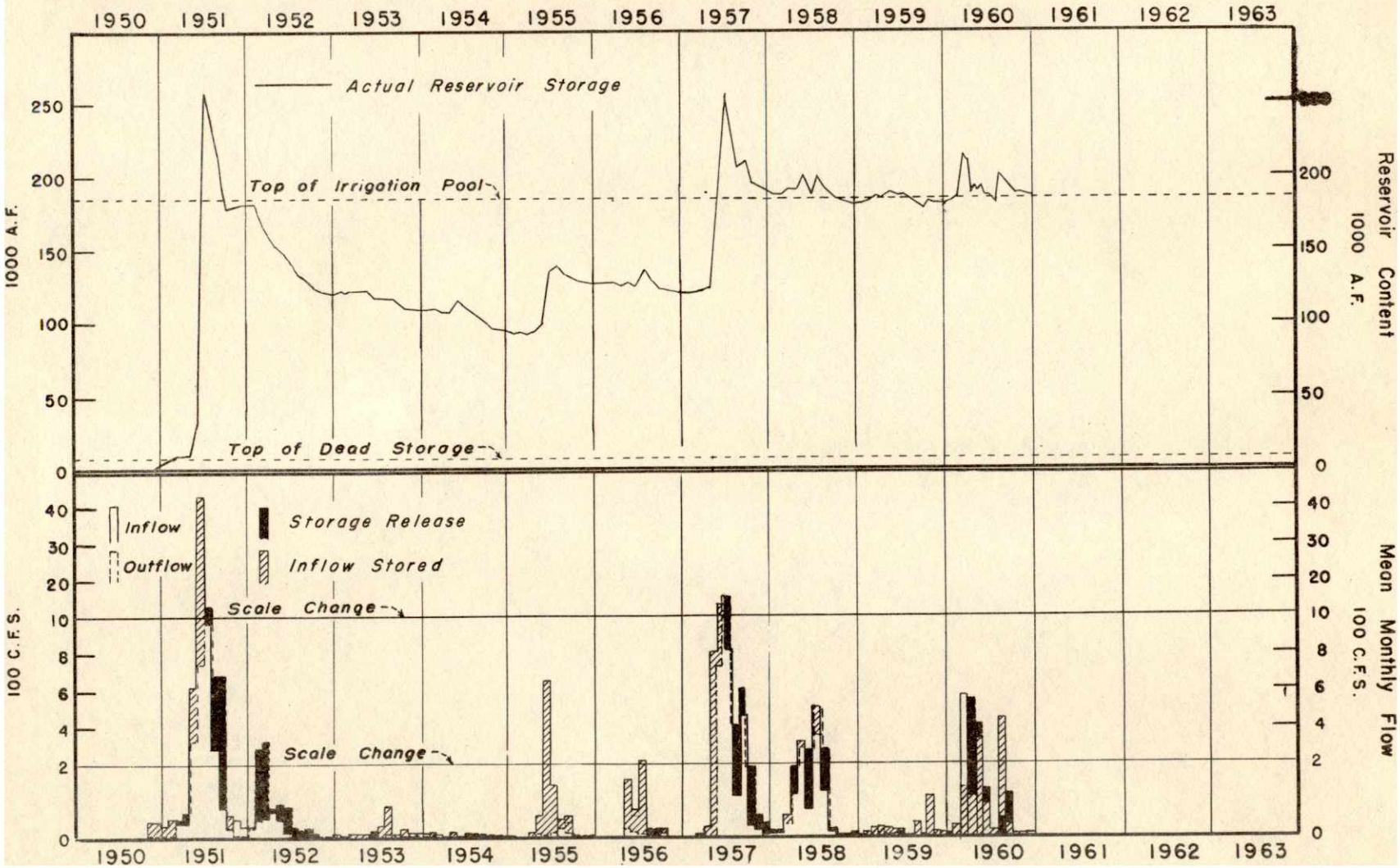
CEDAR BLUFF RESERVOIR OPERATION







CEDAR BLUFF RESERVOIR
OPERATION HYDROGRAPHS



Canals	First Year Operated
Meeker 1/	1948 2/
Cambridge	1951
Superior	1951
Courtland in Nebraska	1952
Franklin Pump	1953
Bartley Canal	1954
Franklin	1954
Courtland in Kansas above Lovewell Reservoir	1954
Naponee	1955
Meeken-Driftwood	1957
Kirwin	1957
Culbertson	1958 2/
Courtland in Kansas below Lovewell Reservoir	1958
Osborne	1960

1/ Operated as a lateral on Meeker-Driftwood Canal after 1958.
2/ First year operated as a part of Kansas River Projects.

D = Reasonably Driest Year.
P = Most Probable Year.
W = Reasonably Wettest Year.

ACRE FEET DIVERTED OR ACRES IRRIGATED (Thousands)

1948: 5,180 A.F. (1.94 A.F./Acre) 2,675 Acres
1949: 5,290 A.F. (1.82 A.F./Acre) 2,906 Acres
1950: 7,660 A.F. (2.74 A.F./Acre) 2,791 Acres
1951: 18,230 A.F. (4.09 A.F./Acre) 4,459 Acres
1952: 30,590 A.F. (4.67 A.F./Acre) 6,544 Acres
1953: 40,250 A.F. (3.48 A.F./Acre) 11,566 Acres
1954: 69,390 A.F. (4.12 A.F./Acre) 16,854 Acres
1955: 108,686 A.F. (3.81 A.F./Acre) 28,545 Acres
1956: 103,150 A.F. (2.77 A.F./Acre) 37,179 Acres
1957: 95,706 A.F. (2.13 A.F./Acre) 44,976 Acres
1958: 133,210 A.F. (2.21 A.F./Acre) 60,230 Acres
1959: 218,979 A.F. (2.74 A.F./Acre) 79,915 Acres
1960: 207,043 A.F. (2.31 A.F./Acre) 89,622 Acres
1961 Estimates: D 295,800 A.F.; P 205,700 A.F.; W 113,100; 130,102 Acres

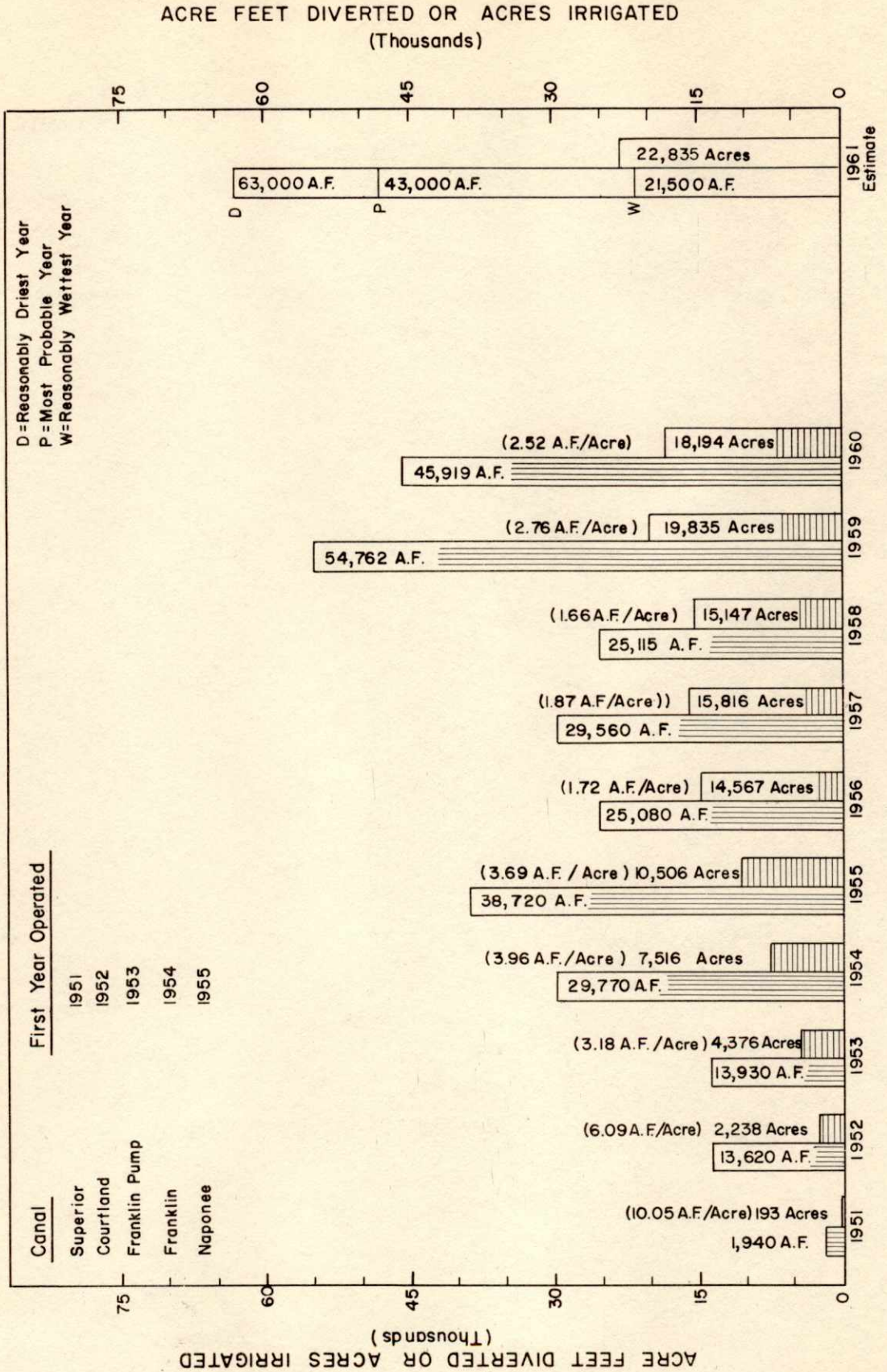
CANAL DIVERSIONS AND ACRES IRRIGATED
KANSAS RIVER PROJECTS

Exhibit 20

CANAL DIVERSIONS AND ACRES IRRIGATED
FRENCHMAN VALLEY IRRIGATION DISTRICT

CANAL DIVERSIONS AND ACRES IRRIGATED
FRENCHMAN-CAMBRIDGE IRRIGATION DISTRICT

Exhibit 22



CANAL DIVERSIONS AND ACRES IRRIGATED
BOSTWICK IRRIGATION DISTRICT IN NEBRASKA

CANAL DIVERSIONS AND ACRES IRRIGATED
KANSAS-BOSTWICK IRRIGATION DISTRICT

Canal

Kirwin

ESTIMATES

D = Reasonably Driest Year.

P = Most Probable Year.

W = Reasonably Wettest Year.

ACRE FEET DIVERTED OR ACRES IRRIGATED (Thousands)

0 5 10 15 20 25 30 35

1957: 5,530 A.F. (3.84 A.F./Acre) 1,440 Acres

1958: 15,150 A.F. (3.67 A.F./Acre) 4,127 Acres

1959: 21,005 A.F. (3.25 A.F./Acre) 6,470 Acres

1960: 16,834 A.F. (2.05 A.F./Acres) 8,216 Acres

1961 Estimates:

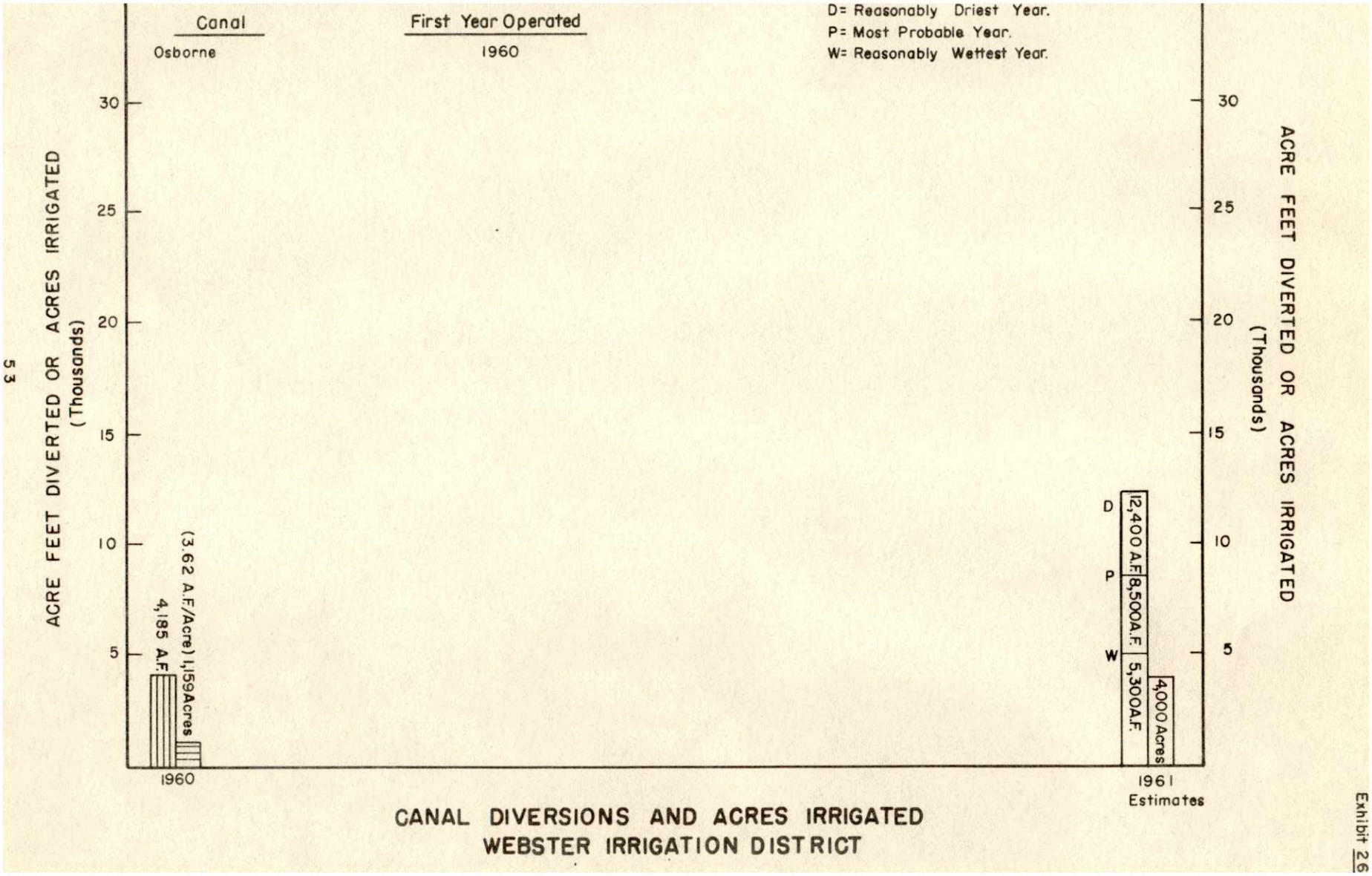
D: 24,000 A.F. | 11,500 Acres

P: 16,200 A.F.

W: 10,100 A.F.

CANAL DIVERSIONS AND ACRES IRRIGATED
KIRWIN IRRIGATION DISTRICT

Exhibit 25



CANAL DIVERSIONS AND ACRES IRRIGATED
WEBSTER IRRIGATION DISTRICT

Exhibit 26

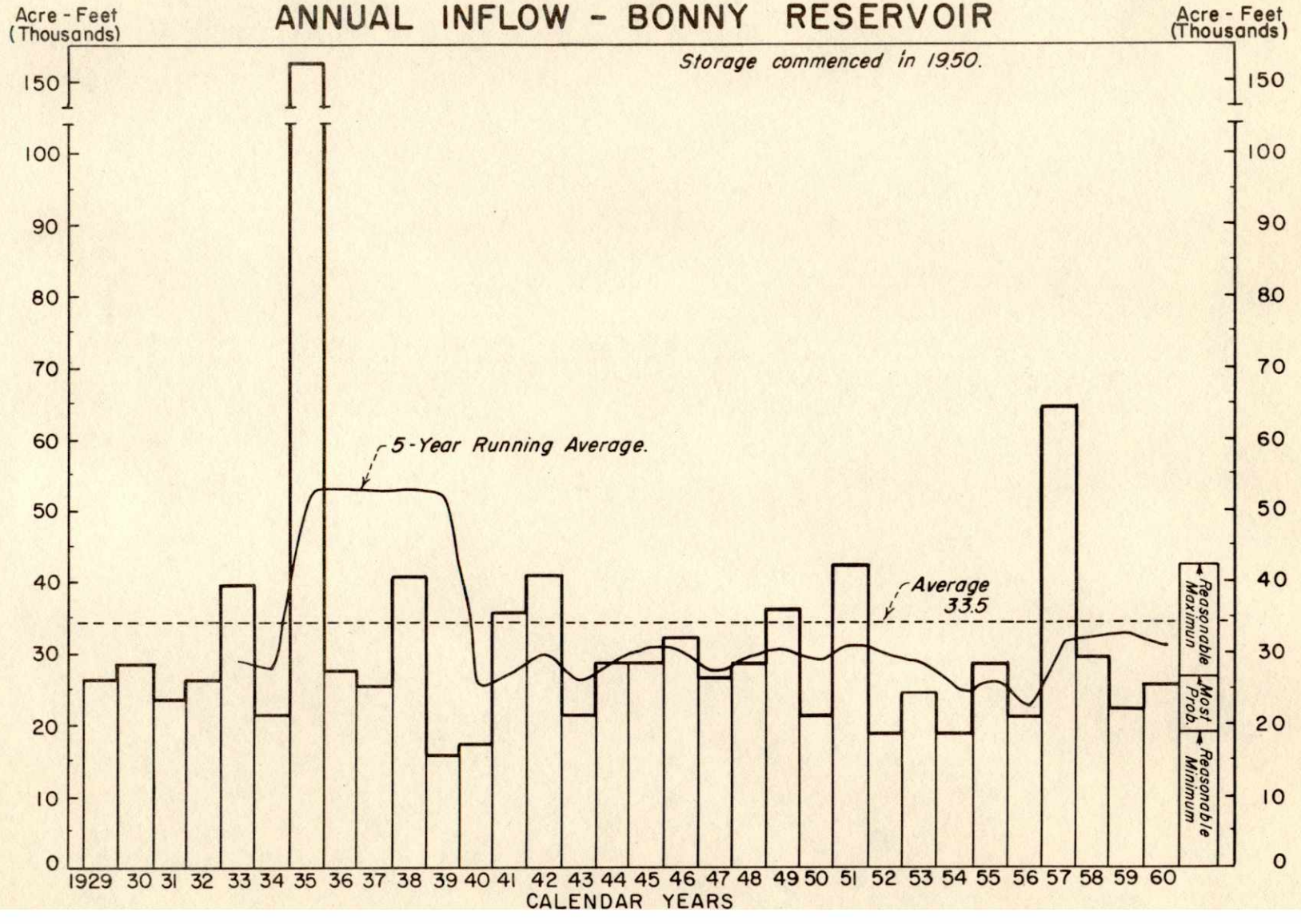
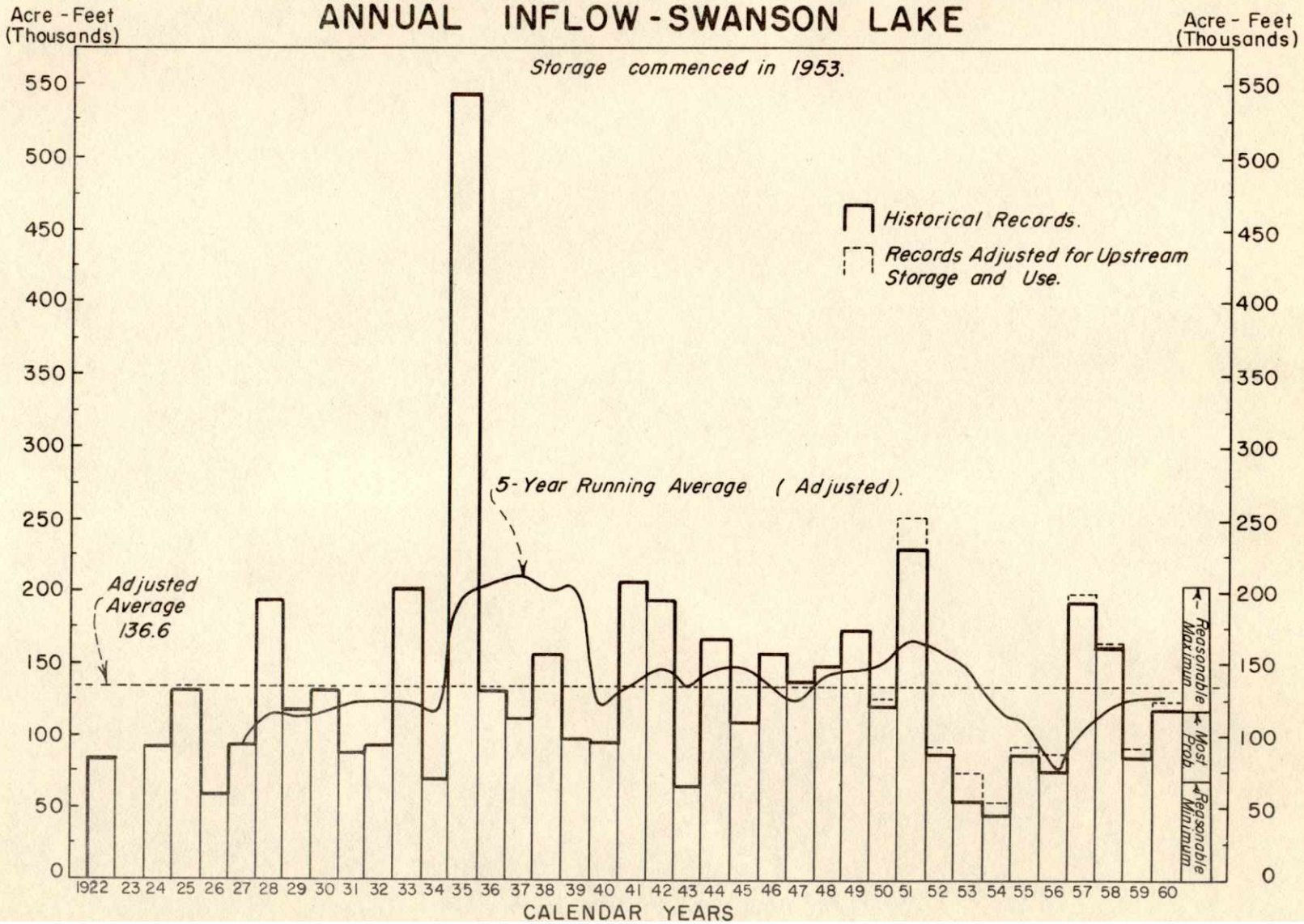
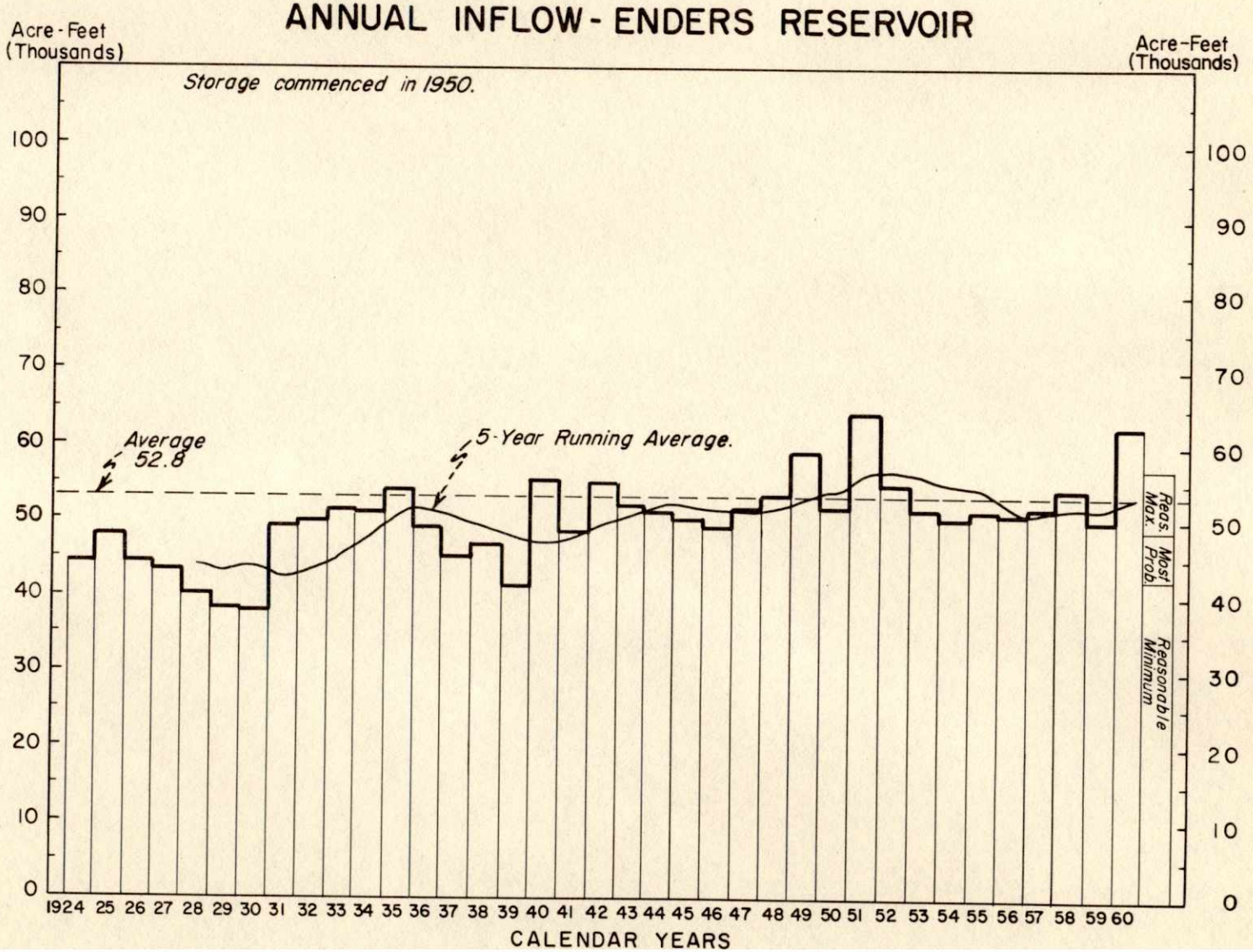

ANNUAL INFLOW - BONNY RESERVOIR
Acre - Feet (Thousands)
Acre - Feet (Thousands)
Storage commenced in 1950.
5-Year Running Average.
Average 33.5
Reasonable Maximum
Most Prob.
Reasonable Minimum
150
100
90
80
70
60
50
40
30
20
10
0
1929 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60
CALENDAR YEARS

Exhibit 27

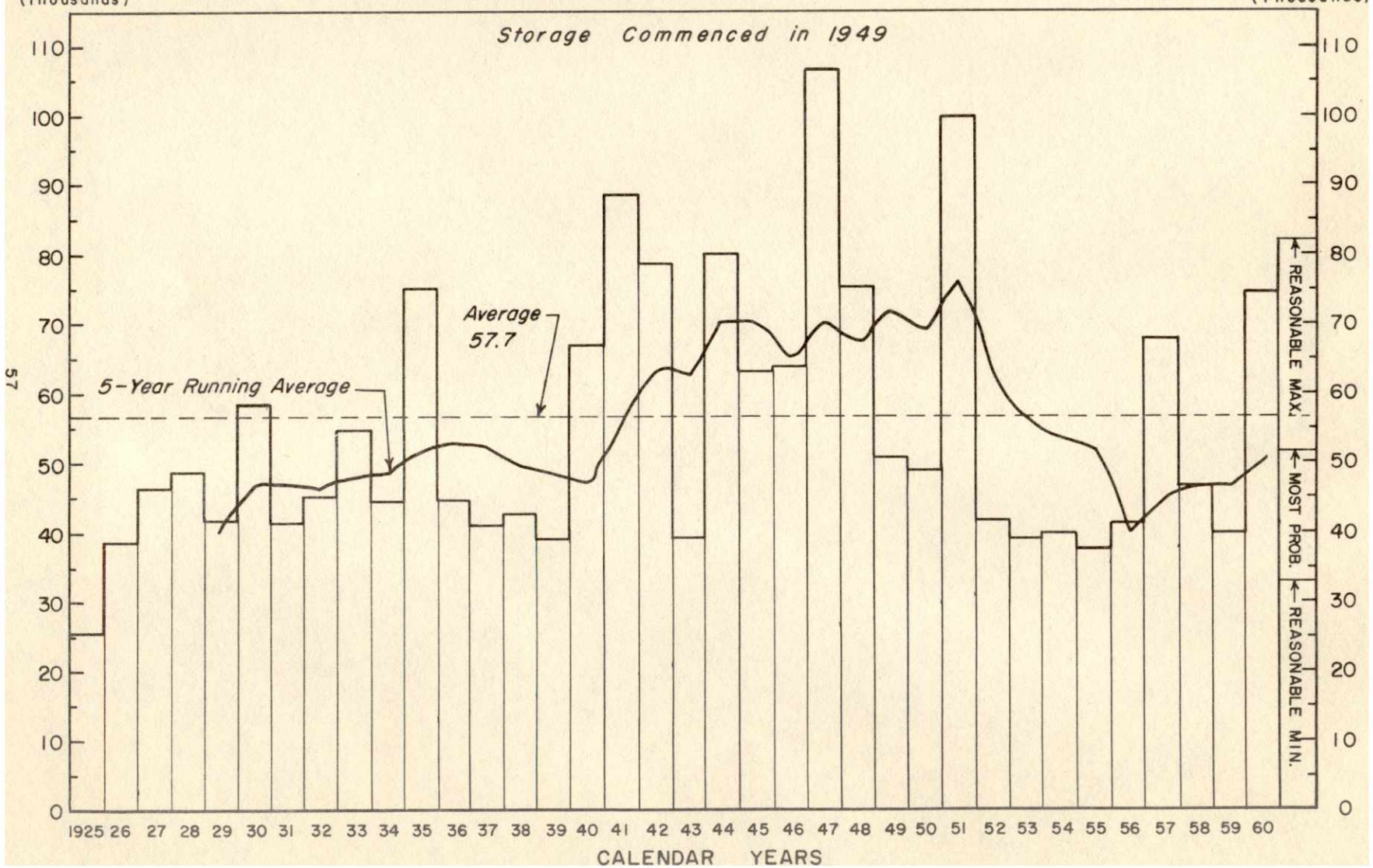
ANNUAL INFLOW - SWANSON LAKE



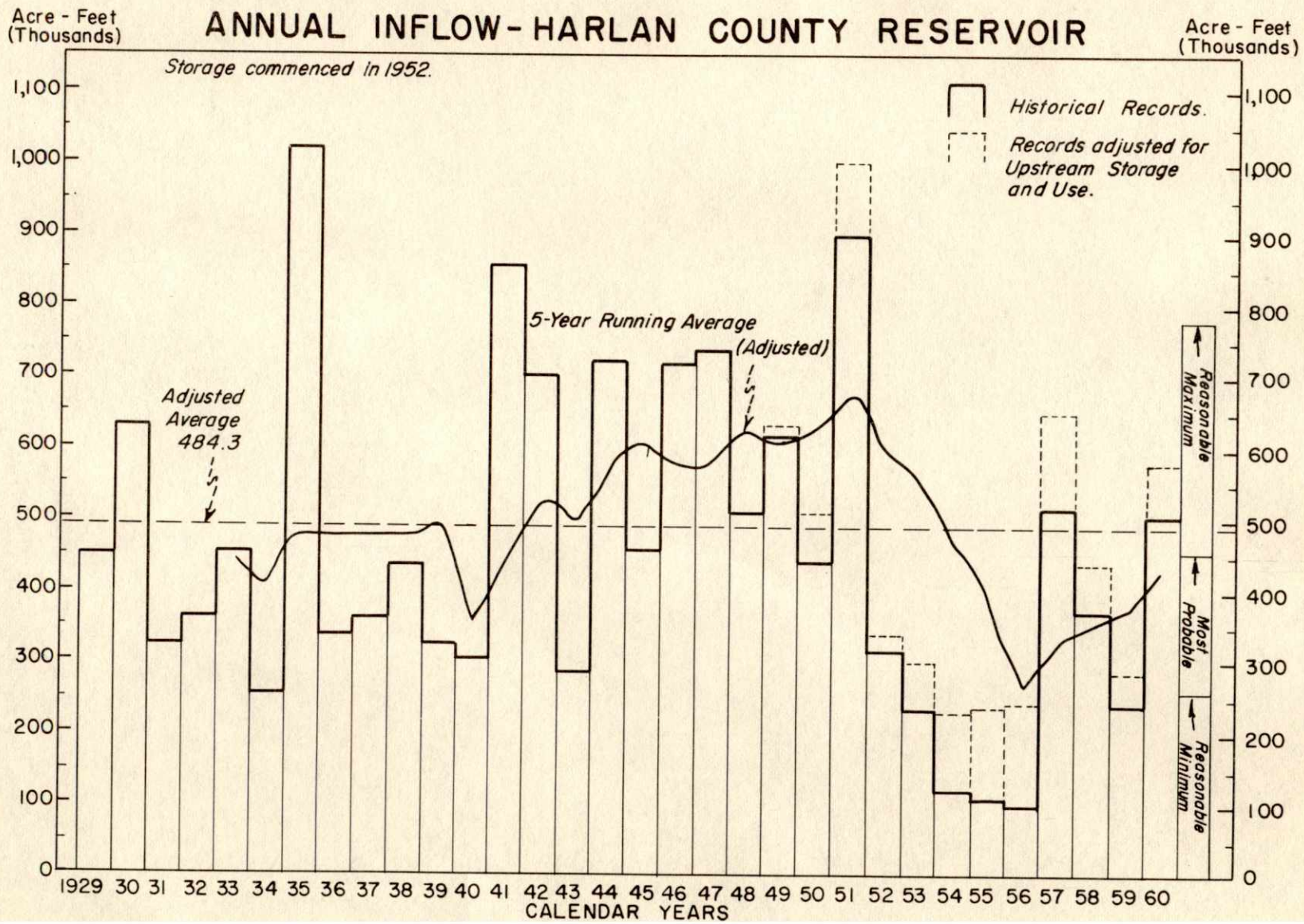
ANNUAL INFLOW - ENDERS RESERVOIR



ANNUAL INFLOW — HARRY STRUNK LAKE

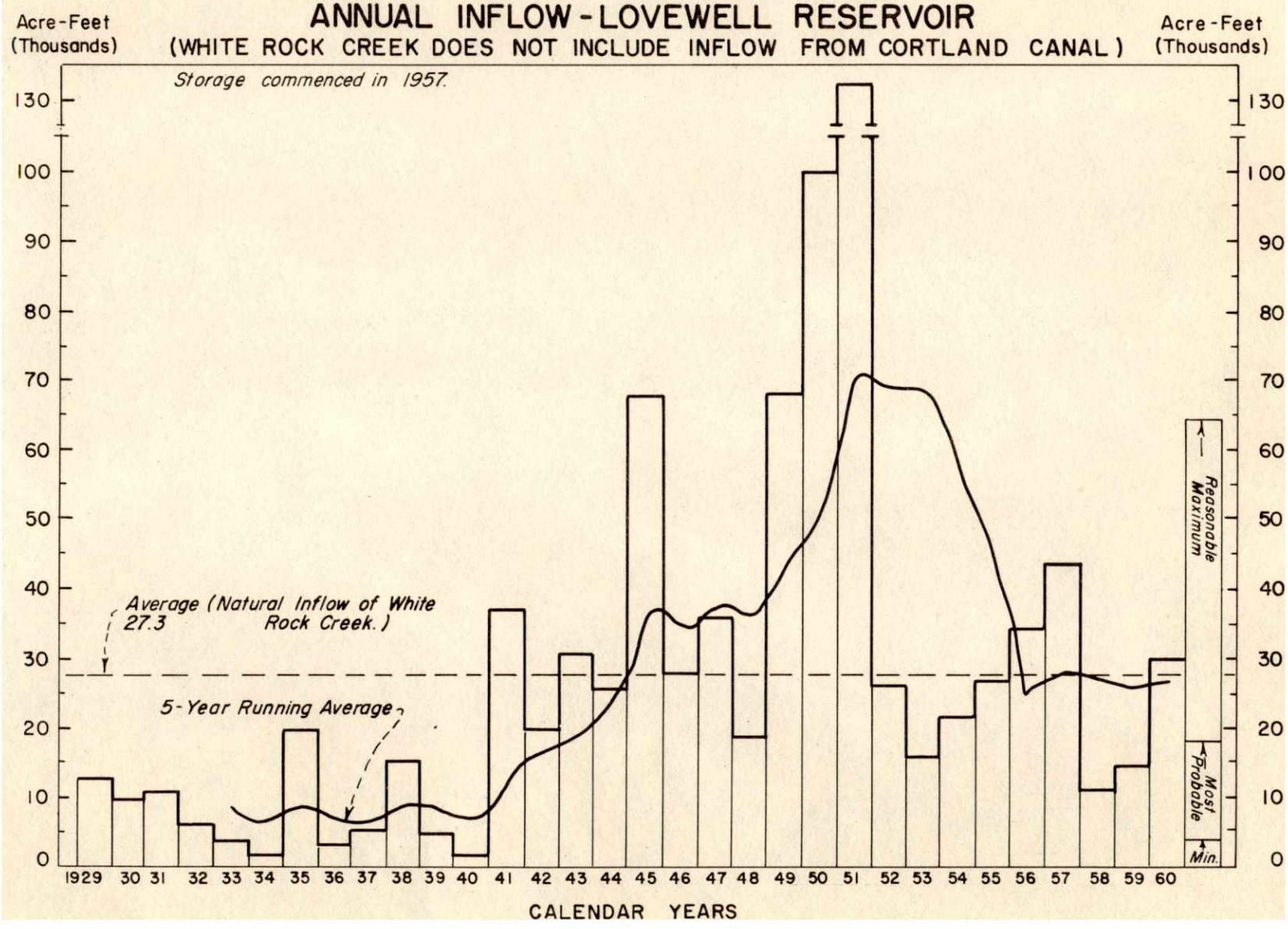


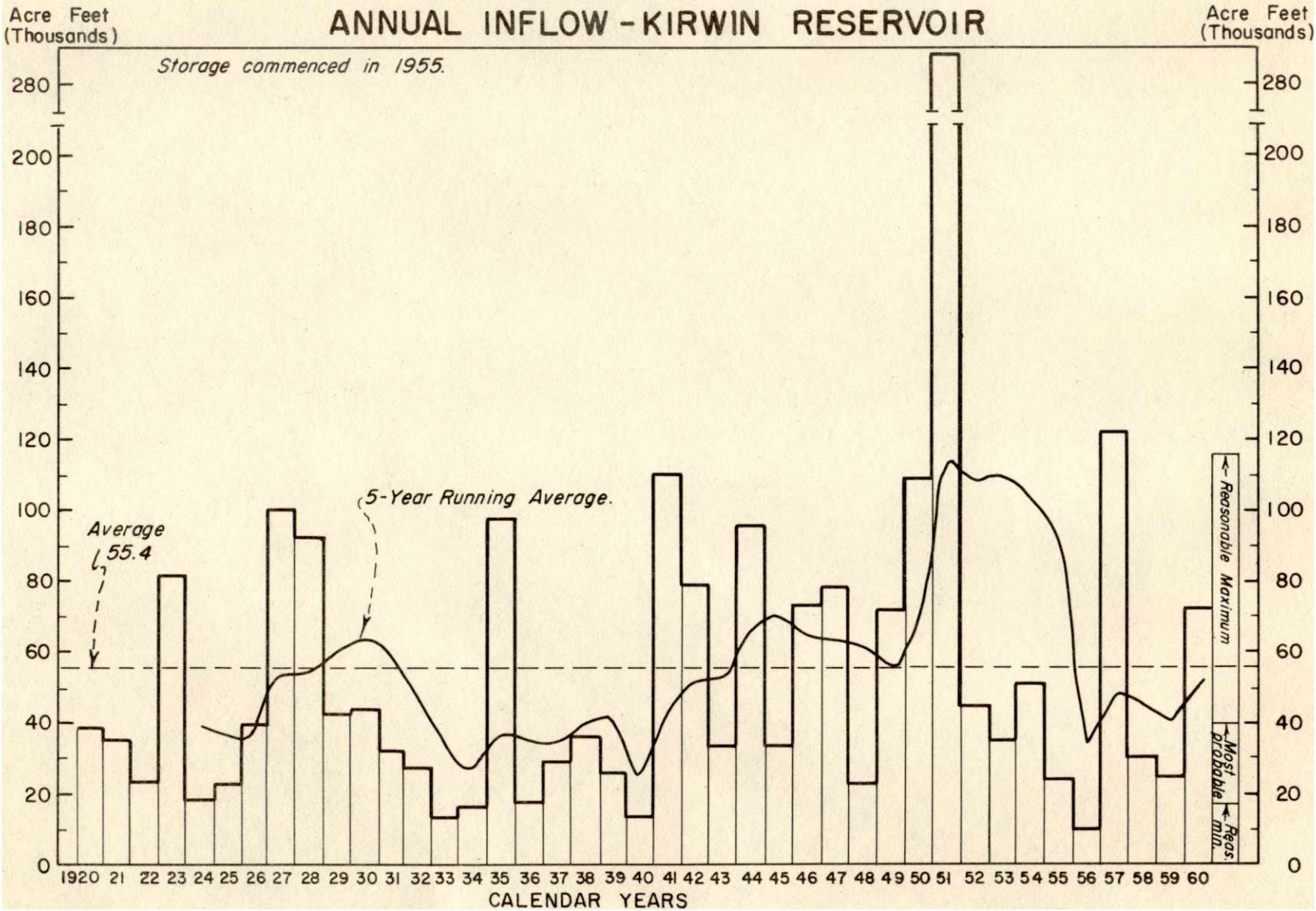
57


ANNUAL INFLOW - HARLAN COUNTY RESERVOIR
Acre - Feet (Thousands)
Acre - Feet (Thousands)
Storage commenced in 1952.
Historical Records.
Records adjusted for Upstream Storage and Use.
5-Year Running Average (Adjusted)
Adjusted Average 484.3
Reasonable Maximum
Most Probable
Reasonable Minimum
1,100
1,000
900
800
700
600
500
400
300
200
100
0
1929 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60
CALENDAR YEARS

ANNUAL INFLOW - LOVEWELL RESERVOIR

(WHITE ROCK CREEK DOES NOT INCLUDE INFLOW FROM CORTLAND CANAL)




ANNUAL INFLOW - KIRWIN RESERVOIR
Acre Feet (Thousands)
Acre Feet (Thousands)
Storage commenced in 1955.
5-Year Running Average.
Average 55.4
Reasonable Maximum
Most probable
Reas. min.
280
200
180
160
140
120
100
80
60
40
20
0
1920 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60
CALENDAR YEARS

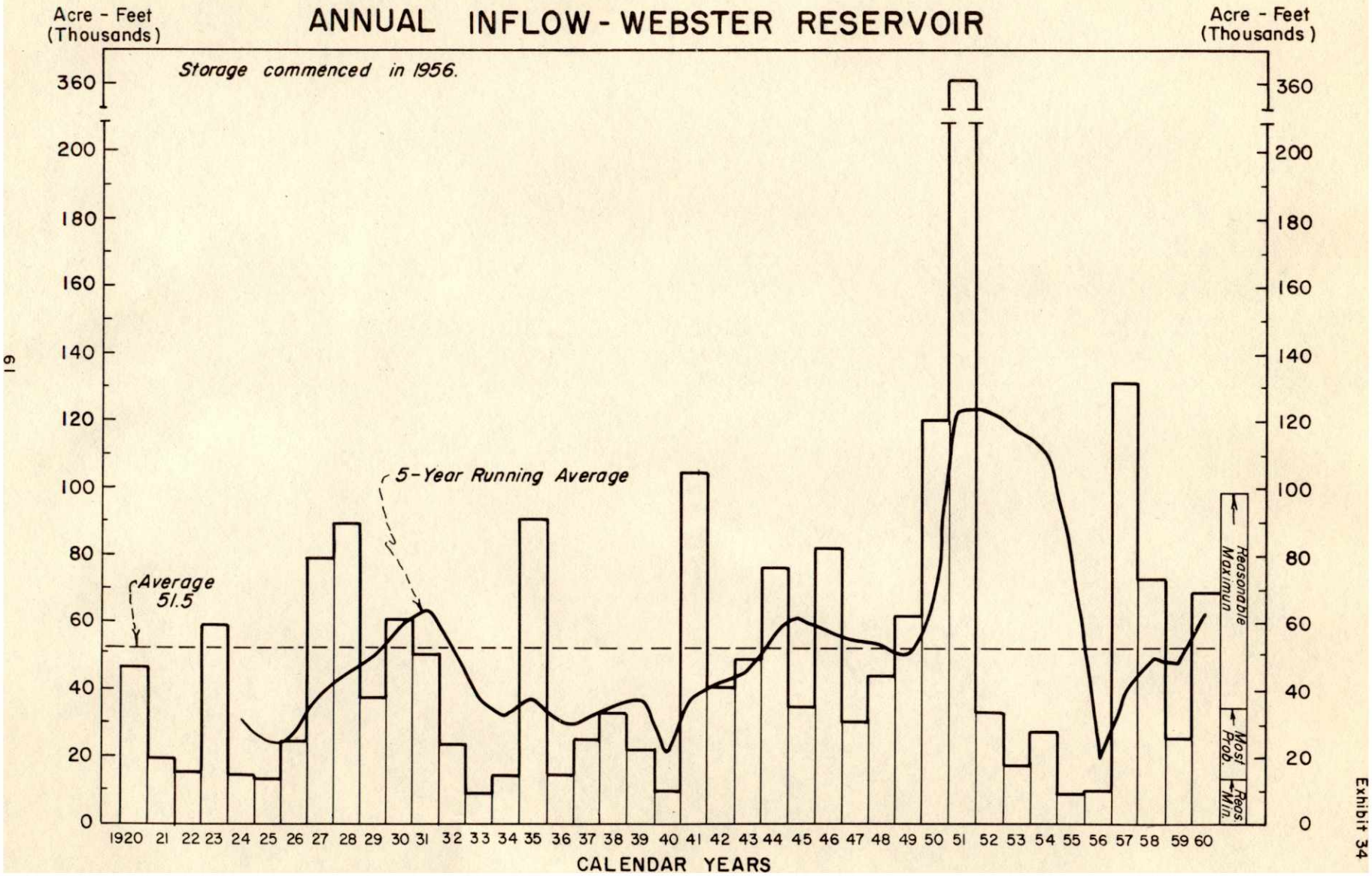

ANNUAL INFLOW - WEBSTER RESERVOIR
Acre - Feet (Thousands)
Acre - Feet (Thousands)
Storage commenced in 1956.
5-Year Running Average
Average 51.5
Reasonable Maximum
Most Prob.
Poss. Min.
360
200
180
160
140
120
100
80
60
40
20
0
1920 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60
CALENDAR YEARS

Exhibit 34

ANNUAL INFLOW - CEDAR BLUFF RESERVOIR