
CUMBERLAND RIVER BASIN

VOLUME III
BARKLEY
WATER CONTROL MANUAL

U.S. ARMY CORPS OF ENGINEERS

Nashville District

CUMBERLAND RIVER BASIN

VOLUME III

BARKLEY
WATER CONTROL MANUAL

Prepared by

SVERDRUP CORPORATION

For

U.S. ARMY CORPS OF ENGINEERS

Nashville District

December 1998

**CUMBERLAND RIVER BASIN
VOLUME III
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BARKLEY DAM & LAKE BARKLEY

PERTINENT DATA

DAM LOCATION

- Dam Location
 - State: Kentucky
 - County: Lyon and Livingston
 - Nearest Community: City of Grand Rivers
located 2 miles east of the project
via US 62 East & SR 453 South
 - River: Cumberland
 - Mile: 30.6
 - Latitude: North 37°01'18"
 - Longitude: West 88°13'16"

- Adjacent Water Control Facilities
 - Upstream
 - Cheatham Dam - Cumberland River, Mile 148.7
 - Downstream
 - Lock and Dam 52 - Ohio River, Mile 938.9

ORIGINAL AUTHORIZATION AND HISTORY

- Primary Project Purposes
 - Flood Control
 - Navigation
 - Hydropower
- Authorizing Legislation
 - PL 83-780, River and Harbor Act of 1954
 - PL 79-525, River and Harbor Act of 1946
 - PL 79-525, River and Harbor Act of 1946

Note: PL79-525 authorized Eureka and Dover projects.
 PL83-780 authorized Barkey in lieu of Eureka and Dover.

- Additional Operating Purposes
 - Recreation PL 78-534, Flood Control Act of 1944
 - Fish and Wildlife PL 85-624, Fish and Wildlife Coordination
Act of 1958
 - Water Quality PL 92-500, Federal Water Pollution Control
Act Amendments of 1972
 - Water Supply Although storage space is not allocated for water supply on
either a permanent (PL 85-500) or temporary (PL 78-534) basis,
water is being withdrawn for municipal and industrial pur-
poses. Consequently, during drought, consideration is given to
keeping the lake level above the supply pipe intakes.

- Construction Dates
 - Began - 7 June 1957
 - Closure - 1 July 1964
 - Impoundment - 16 February 1966
 - Inservice
 - Lock - 18 July 1961
 - Power
 - Unit 1 - 20 January 1966
 - Unit 2 - 4 February 1966
 - Unit 3 - 7 March 1966
 - Unit 4 - 30 March 1966
 - Canal - 14 July 1966

PHYSICAL COMPONENTS OF DAM

- Type of Structure
Combination concrete gravity and rolled earthfill embankment

- Dam Section Lengths

| | | | |
|--------------------|---|-------------|----------|
| Spillway Section | - | 804 feet | 245.0 m |
| Power Section | - | 430 feet | 131.1 m |
| Lock Section | - | 221 feet | 67.4 m |
| Embankment Section | - | 8,725 feet | 2659.3 m |
| Total Dam Length | - | 10,180 feet | 3102.7 m |

- Structure Elevations

| | | | |
|----------------|---|----------|---------|
| Embankment | - | 388 NGVD | 118.3 m |
| Top of Gates | - | 375 NGVD | 114.3 m |
| Spillway Crest | - | 325 NGVD | 99.1 m |

- Outlet Works

| | | | |
|-----------------------|---|----------|---------|
| Spillway | | | |
| Total Effective Width | - | 660 feet | 201.2 m |
| Tainter Gates | | | |
| Number | - | 12 | |
| Width | - | 55 feet | 16.8 m |
| Height | - | 50 feet | 15.2 m |
| Pier width | - | 12 feet | 3.7 m |

- Power Plant

| | | | |
|---|---|--------------------------------|---|
| Type — 4 Kaplan adjustable blade propeller turbines | | | |
| Operating Heads | | | |
| Minimum net for power | - | 18 feet | 5.5 m |
| Nominal (normal for design) | - | 44 feet | 13.4 m |
| Maximum static | - | 72 feet | 21.9 m |
| Penstock | | | |
| Intake Width | - | 77 feet | 23.5 m |
| Intake Height | - | 61.25 feet | 18.7 m |
| Nominal Discharge (normal at 130 MW) | - | 39,000 cfs (9,750 cfs each) | 1100 cu. m/sec. (276 cu. m/sec. ea.) |
| Nameplate Power Rating | - | 130 MW (32.5 MW each) | |
| Estimated average annual generation | - | 582,000 MWh | |

PHYSICAL COMPONENTS OF DAM
(continued)

| | | | |
|-----------------------------|---|------------|---------|
| • Navigation Lock Chamber | | | |
| Length | - | 800 feet | 244.0 m |
| Width | - | 110 feet | 33.5 m |
| Top of Structure Elevations | | | |
| Chamber | - | 382 NGVD | 116.4 m |
| Guide Walls | | | |
| Upper | - | 382 NGVD | 116.4 m |
| Lower | - | 352 NGVD | 107.3 m |
| Sills | | | |
| Upper | - | 335 NGVD | 102.1 m |
| Lower | - | 289 NGVD | 88.1 m |
| Water Surface Elevations | | | |
| Tailwater | | | |
| Minimum | - | 302 NGVD | 92.0 m |
| Normal | - | 302 NGVD | 92.0 m |
| Headwater | | | |
| Minimum | - | 346 NGVD | 105.5 m |
| Normal (summer) | - | 359 NGVD | 109.4 m |
| Normal (winter) | - | 354 NGVD | |
| Lift | | | |
| Normal | - | 57 feet | 17.4 m |
| Maximum | - | 73 feet | 22.2 m |
| Average Single Lockage Time | - | 30 minutes | |

REAL ESTATE

| | | | |
|---------------------------------|---|--|-----------------|
| • Acquisition | | | |
| Fee Holdings | - | 71,879 acres | 29,099 hectares |
| Easement Holdings | - | 5,842 acres | 2,365 hectares |
| • Elevation of Acquisition Line | | | |
| At Dam | - | Elevation 378 | |
| At Upper End | - | Elevation 378 | |
| Intermediate Areas | - | All land from the dam upstream to mile 102 which is below the five-year frequency flow line (elevation 367 at the dam) was acquired in fee, and flowage easements were obtained on all other lands acquired for project operation. | |

HYDRAULICS AND HYDROLOGY
(continued)

- Average Outflows (cfs) (1967 - 1996)

| <u>Month</u> | <u>Generation</u> | <u>Spill</u> | <u>Total</u> | <u>Total Cubic Meters/Sec</u> |
|--------------|-------------------|--------------|--------------|-----------------------------------|
| Jan | 41,976 | 9,807 | 51,783 | 1,466 |
| Feb | 40,962 | 11,374 | 52,336 | 1,482 |
| Mar | 37,507 | 13,946 | 51,453 | 1,457 |
| Apr | 28,674 | 9,648 | 38,322 | 1,085 |
| May | 29,782 | 6,139 | 35,922 | 1,017 |
| Jun | 25,225 | 1,611 | 26,836 | 760 |
| Jul | 23,049 | 342 | 23,391 | 662 |
| Aug | 23,185 | 24 | 23,209 | 657 |
| Sep | 19,902 | 119 | 20,021 | 567 |
| Oct | 21,055 | 218 | 21,273 | 602 |
| Nov | 29,053 | 798 | 29,851 | 845 |
| Dec | 39,502 | 7,295 | 46,796 | 1,325 |
| Annual | 29,950 | 5,085 | 35,035 | 992 |

- Maximum Pool Frequencies

| | |
|------------------|-------------------------|
| Period of Record | - |
| 2 Year | - |
| 5 Year | - |
| 10 Year | - |
| 25 Year | - |
| 50 Year | - |
| 100 Year | - |
| 200 Year | - |
| Maximum Observed | - 370.04 on 13 May 1984 |

Note - Theoretical pool elevations based on statistical evaluations.
Proper regulation procedures preclude a pool elevation exceeding 375.00.

- Maximum Observed Discharge - 209,000 cfs on 16 March 1975.
- Maximum Daily Average Discharge - 202,000 cfs on 16 March 1975.

ACCESS LOCATIONS

- Barkley Canal

| | |
|------------------|----------------------------|
| Length | 1.75 Miles |
| Entrances | 32.8 Cumberland River Mile |
| | 25.3 Tennessee River Mile |
| Bottom Elevation | 335 NGVD |
| Width | 400 Feet |

| | River Mile | Horizontal | Clearance (feet) | | | |
|---|------------|------------|-----------------------|-------|----------------------|-------|
| | | | Vertical | | Regulated High Water | |
| | | | Pool Elev 359 Left | Right | Left | Right |
| • Bridge Crossing | | | | | | |
| Eureka Highway (U.S. Highway 62) | 29.9 | 270 | 90 | 90 | 35 | 35 |
| Henry R. Lawrence Memorial Highway Bridge (U.S. Highway 68) | 63.1 | 300 | 57 | 52 | 41 | 36 |
| Sidney C. Lewis Highway (U.S. Highway 79) | 88.8 | 428 | 60.9 | 60.9 | 42.9 | 42.9 |
| Seaboard Systems R.R. John T Cunningham Highway (State Highway 48) | 126.5 | 118 | 50 | 50 | 19 | 19 |
| State Highway 13 | 128.2 | 269 | 73 | 73 | 40 | 40 |
| | 129.9 | 310 | 72 | 72 | 40 | 40 |

- | | River Mile |
|--|------------|
| • Former Project Locations in Pool | |
| Lock & Dam F (Inundated) | 43.6 |
| Lock & Dam E (Inundated) | 66.3 |
| Lock & Dam D (River Lock Wall Removed) | 88.0 |
| Lock & Dam C (Removed Dam and River Lock Wall) | 108.5 |
| Lock & Dam B (River Lock Wall and Dam Removed) | 140.3 |
| • Recreational Areas | |
| Corps of Engineers | |
| Damsite | 30.0 R |
| Eureka | 30.4 L |
| Grand Rivers | 31.0 L |
| Canal | 31.8 L |
| Boyd's Landing | 35.6 R |
| Buzzard Rock | 39.4 R |
| Poplar Creek | 39.6 R |
| Kuttawa | 40.8 R |
| Eddyville | 43.8 R |

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**CHAPTER I
INTRODUCTION**

1.1. Authorization. This manual was prepared for the U.S. Army Corps of Engineers, Nashville District, by the Sverdrup Corporation under contract DACW62-87-C-0068, modification P00011 in accordance with ER 1110-2-240, ETL 1110-2-251, and EC 1110-2-256.

1.2. Purpose. The purpose of this manual is to serve as a guide for the day to day and emergency regulation of the Barkley project, and to provide background information on the project.

1.3. Scope. This manual presents the plan of regulation for the Barkley project and furnishes information pertinent to its operation.

1.4. Emergency Regulation Assistance Procedures. In the event that unusual conditions arise, contact can be made by telephone to the CELRN-EP-H, Water Management Section at the phone number listed in Appendix E. During nonduty hours, assistance can be obtained by contacting one of the officials also listed in Appendix E.

1.5. Update Procedure. Regulations specify that this Water Control Manual be published in loose leaf form, and only those sections, or parts thereof, requiring changes will be revised and printed. Therefore, this copy should be preserved in good condition so that inserts can be made to keep the manual current.

1.6. Responsible Agencies.

- | | |
|---------------------------------|---|
| ▪ Project Owner: | U.S. Army Corps of Engineers |
| ▪ Operating Agency: | U.S. Army Corps of Engineers |
| ▪ Regulating Agency: | |
| - Normal and Drought Conditions | U.S.A. Corps of Eng. - Nashville District |
| - Flood Conditions | U.S.A. Corps of Eng. - Lakes and River Division (LRD) |
| ▪ Hydropower Marketing Agency: | Southeastern Power Administration (SEPA) |
| ▪ Hydropower Scheduling: | Tennessee Valley Authority (TVA) |

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| - Flood Conditions | U.S.A. Corps of Eng. - Lakes and River Division (LRD) |
| ■ Hydropower Marketing Agency: | Southeastern Power Administration (SEPA) |
| ■ Hydropower Scheduling: | Tennessee Valley Authority (TVA) |

1.7. Related Manuals and Reports.

1.7.1. Original Water Control Manuals.

| Master Regulation Manual for Reservoirs in the Cumberland River Basin Revised March, 1954 | | |
|--|---|---------------------|
| | <u>Appendices</u> | <u>Date</u> |
| A: | Regulation Manual for Wolf Creek | Revised March, 1954 |
| B: | Regulation Manual for Dale Hollow | Revised March, 1954 |
| C: | Regulation Manual for Center Hill | Revised March, 1954 |
| D: | Regulation Manual for Old Hickory | November, 1959 |
| E: | Regulation Manual for Cheatham | November, 1959 |
| F: | Regulation Manual for Barkley Reservoir | April, 1969 |
| G: | Regulation Manual for J. Percy Priest Reservoir | April, 1977 |

1.7.2. Revised Water Control Manuals.

| <u>Cumberland River Basin Water Control Manuals</u> | | <u>Published</u> |
|---|---------------------------------------|------------------|
| Volume I | Master Water Control Reference Manual | April, 1990 |
| Volume II | Master Water Control Plan | December, 1998 |
| Volume III | Barkley Water Control Manual | December, 1998 |
| Volume IV | Cheatham Water Control Manual | December, 1998 |
| Volume V | Old Hickory Water Control Manual | December, 1998 |
| Volume VI | Cordell Hull Water Control Manual | December, 1998 |
| Volume VII | J. Percy Priest Water Control Manual | December, 1998 |
| Volume VIII | Center Hill Water Control Manual | December, 1998 |
| Volume IX | Dale Hollow Water Control Manual | December, 1998 |
| Volume X | Wolf Creek Water Control Manual | December, 1998 |
| Volume XI | Laurel Water Control Manual | December, 1998 |
| Volume XII | Martins Fork Water Control Manual | December, 1998 |

1.7.3. Related Manuals.

1. Barkley Dam Instructions for Reservoir Regulation - Revised December, 1998.
2. Cumberland River Basin Drought Contingency Plan - November, 1994.

CHAPTER II WATER CONTROL PLAN

2.1. Primary Objectives. The water control plan for the Barkley project has four primary objectives. These are:

1. To provide flood protection to the lower Ohio and Mississippi Rivers.
2. To provide a nine foot slackwater pool to permit commercial navigation from the dam upstream to Cheatham Dam.
3. To generate hydropower.
4. To provide a relatively stable pool during the summer months for the enjoyment of the recreating public.

2.2 Regulation Curve

2.2.1. The regulation curve, or guide curve, represents the primary guidance for operating the Barkley project. It defines operating limits of reservoir elevations as a function of time of year and is presented graphically on Plate A-1. The guide curve at Barkley is a single line representing the desired elevation of the pool for each day of the year. A tolerance of one foot on either side of the desired elevation is permitted. The guide curve is at elevation 354 from December 1st until April 1st. It then climbs to elevation 357 by April 15 and continues climbing to elevation 359 by May 1st. It remains at elevation 359 until July 1st, begins to decline to elevation 355 by October 1st, and then returns to elevation 354 by December 1st. The single line regulation curve divides the storage volume into two distinct zones as described below. Prior to 1980 the officially approved guide curve stipulated that the drawdown from summer to winter pool started on 15 June. In 1980, at the request of the recreation industry, consideration was given to delaying the start of the drawdown until 1 July. This lake level operation was implemented on a trial basis from 1980 to 1982. Studies showed that maintaining full summer pool for this additional fifteen days improved water related recreation without impacting flood control, navigation, hydropower, water quality, environmental considerations, or other operating goals of the project. In 1983 the guide curve was officially changed to incorporate delaying the drawdown until 1 July. 22

2.2.2. Inactive Pool. The inactive pool at Barkley extends from the bottom of the reservoir up to the regulation curve. Water is not released if it would bring the surface of the water more than one foot below the top of this zone, which is the maximum tolerance allowed. Inactive storage is provided primarily to offset lake sedimentation. Other benefits of this permanent pool include navigation, head for power generation, depth for water intake installation, permanent habitat for fish and other aquatic life, and insurance water for drought emergencies.

2.2.3. Flood Control Pool. The flood control pool at Barkley extends from elevation 354 to elevation 375 during the winter and from elevation 359 to elevation 375 during the summer. The normal condition is for this pool to remain empty so that the space is available to store water during flood events and thus reduce the downstream damages due to flooding. Following a flood event, water is released from this pool as quickly as possible in order to restore the capability to provide protection from future flood events.

2.3. Normal Regulation

2.3.1. As a result of a daily analysis of current hydrologic conditions, the Water Management Section advises TVA of the amount of water available for energy production for the following day at Barkley and, if needed, modifies the generating schedule for the current day. TVA accepts this daily total generation and then schedules the energy on an hourly basis to best meet power demands. To help navigation anticipate conditions on the lower Cumberland River, TVA has agreed not to change the generation schedule unless flooding or emergency conditions occur. Once the hourly generating schedule is developed for Barkley and relayed to the powerhouse, it is considered firm.

2.3.2. The Barkley powerhouse is manned twenty-four hours a day, seven days a week. The TVA load coordinator in Chattanooga communicates the hourly generation schedule directly to the Barkley operators who, in turn, control all turbine and spillway releases from the dam. The attending personnel are supervised by the Construction and Operations Division but it is the responsibility of the Water Management Section of the Engineering-Planning Division to issue specific project release instructions.

2.3.3. During periods of normal regulation, the water surface elevation behind the dam is maintained as close as possible to that indicated from the regulation curve and all releases are made through the turbines in the interest of hydropower production. Because the desired pool elevation is represented on the guide curve as a single line, as opposed to a zone bounded by upper and lower limits as in a typical storage reservoir, there is not much flexibility in operating the Barkley project on a week to week or a month to month basis. Deviation from the guide curve is limited to one foot above or below the desired pool elevation for "normal" regulation. This one foot allowance does, however, allow the project to be operated for daily hydropower peaking.

2.3.4. Canal Flow Limitation. Since Lake Barkley and Kentucky Lake are connected by an uncontrolled canal, the two projects must be operated as one unit. It is estimated that water velocities in the canal in excess of five miles per hour (8.1

kilometers per hour) will cause the suspension of commercial navigation. It is therefore desirable to limit flow velocities in the canal to four mph (6.4 kph). To accomplish this, every effort is made to keep the lake levels within one foot of each other. Under normal operating conditions this can be achieved with little or no difficulty. On occasion, usually when project releases are being curtailed for flood control operations or when there is a large difference in the inflow of the two reservoirs, excessive lake level differences and canal velocities have occurred.

2.3.5. Minimum Release Rates. The minimum release rate from the Barkley project is 6,000 cfs, or roughly the equivalent of operating one hydropower unit at the lowest allowed generation rate. This was originally intended to assure navigation flows on the lower Ohio and Mississippi Rivers. It also ensures sufficient tailwater depth for commercial navigation in the Cumberland River below the dam while also improving water quality conditions in the lower portion of the river. A 302 tailwater elevation is required for commercial navigation and normally, this is provided by the 6,000 cfs minimum release. However, when the Ohio River is low, 6,000 cfs will not maintain a 302 tailwater elevation. The requirement to maintain a 302 tailwater elevation takes precedence and will be maintained at all times, even when higher discharges are needed.

2.3.6. Rates of Change in Hydropower Generation. Large surges in releases, such as those resulting from hydropower peaking operations, can make commercial navigation much more difficult in the lower portion of the Cumberland River below Barkley Dam. However, the Barkley hydropower plant is operated to help satisfy peak periods of energy demand and is an integral part of the overall power supply network in the region. In order to accommodate both interests as much as possible, changes in hydropower generation are limited to one unit per hour, up or down.

2.4. Flood Regulation

2.4.1. Authority for Flood Regulation. During flood events Barkley Dam is operated in tandem with Kentucky Dam in consideration of the objectives and primary control points as described below. All of these primary control points are located downstream of the confluence of the Cumberland and Ohio Rivers, outside of the Nashville District boundaries. The Cumberland River below Barkley Dam is considered a secondary control point which is discussed later in this chapter.

2.4.2. Storage Limits. Acquisition of land within the Kentucky reservoir was based on a) purchase in fee of lands lying below a profile corresponding to a flow of 200,000 cfs and an elevation of 365 at the dam and b) flowage easements between the fee purchase land and a profile corresponding to a flow of 300,000 cfs and an elevation of 375 at the dam. The easements are confined to the six month period between December 1 and May 31 because floods are most likely to occur during this

part of the year. At Lake Barkley, the land acquisition was based upon elevation 378 through out the length of the reservoir. Some of this land was purchased in fee and some obtained via easements, but there are no restrictions on the time, depth or duration of flooding permitted in the easement areas.

2.4.3. As flood conditions arise, the Nashville District will maintain frequent communication with the Great Lakes and Ohio River Division (LRD) and the TVA. For minor floods and for floods centered in the Cumberland and Tennessee River Basins, the Nashville District will maintain control of the Barkley Project, and the Water Management Section will maintain responsibility for insuring that the proper releases are being made at the dam. However, the Nashville District will relinquish this responsibility to the LRD during periods when major flooding is expected on the lower Ohio or Mississippi Rivers. This authority by LRD will also apply to TVA with regard to the operation of Kentucky Dam, and will allow LRD to manage the overall flood control effort within the Ohio River Basin.

2.4.4. Authority for the Corps to take over operational control of Kentucky Dam is contained in Section 7 of the 1944 Flood Control Act. This act authorizes the Corps to direct releases from Kentucky Dam if there is a threat of flooding on the Ohio and Mississippi Rivers. As a result of several meetings and operational experience gained between 1945 and 1962, it has been agreed that the Corps will assume operational control of Kentucky Dam when the Cairo gage reaches a stage of 35 feet and is forecasted to exceed 40 feet.

2.4.5. The June 1974 flood raised the issue as to whether the Corps could direct TVA to store water in Kentucky Lake above its seasonal easements. In September 1984 the Corps and TVA signed an MOU which outlines under which specific flood condition the Corps may direct TVA to store water above the seasonal easements. A copy of this MOU is presented as Appendix F.

2.4.6. Primary Objectives. The primary objectives of flood control operations at the Barkley and Kentucky projects are:

1. To safeguard the Mississippi River levee system,
2. To reduce the frequency of use of the Birds Point-New Madrid Floodway, and
3. To reduce the frequency and magnitude of flooding of unprotected lands along the lower Ohio and Mississippi Rivers.

2.4.7. As with operations for other project purposes, operations for flood control at Barkley and Kentucky must be coordinated. The uncontrolled canal between the two projects mandates such cooperation.

2.4.8. Primary Control Points. There is more than one control point upon which the regulation of Kentucky and Barkley is based. The primary location however is the gage on the Ohio River at Cairo, Illinois. This gage is located 2.2 miles upstream of the Ohio's confluence with the Mississippi River and thus represents the conditions on the Mississippi as well as the Ohio River. For flood control operations, the forecast stage at Cairo is classified into one of three categories: major, intermediate or minor floods.

1. Ohio River at Paducah

Flood stage at Paducah, Kentucky is 39 feet. The city is protected by a levee and floodwall system to a stage of 63.8 feet, which is about three feet above the flood of record in January and February of 1937. Operation of the flood protection works begins with some pumping at a stage of 27.5 feet, and more than 21 closures are made at a stage of approximately 48 feet. All closures must be in place at a stage of 49.5 feet.

2. Ohio River at Cairo

A. Official flood stage at Cairo is 40 feet, however some damages to unprotected agricultural lands start to occur at about a 37 foot stage. The city of Cairo is protected by a levee system to a stage of 63.2 feet.

B. A major flood is defined as one which produces a stage at Cairo above 54 feet between January 1st and April 1st, above 44 feet between May 1st and December 1st, or a uniformly varying elevation during periods between these dates. An intermediate flood is defined as one which falls within a zone four feet below that just defined for major floods. In other words, an intermediate flood produces a stage at Cairo between 50 and 54 feet from January 1st to April 1st, between 40 and 44 feet from May 1st to December 1st, or a uniformly varying elevation range during periods between these dates. A minor flood is one which produces a stage at Cairo above 40 feet but below the intermediate level. This is between stage 40 and 50 from January 1st to April 1st, and transitions from between stage 40 and 50 to zero height at a stage of 40 feet during April and December. There is no minor flood zone from May 1st to December 1st. This information is presented graphically on Plate A-2.

3. Mississippi River at Birds Point-New Madrid Floodway

A. The floodway consists of two relatively parallel lines of levees running from Birds Point, Missouri at Upper Mississippi River Mile 2, to New Madrid, Missouri at Lower Mississippi River Mile 889. It is approximately

35 miles long and varies in width from 4 to 12 miles. The riverward or "frontline" levee provides normal protection from Mississippi River floodwaters to 205 square miles of farmland in the floodway in the southeast corner of the state of Missouri. The landward or "setback" levee delineates the backside of the floodway.

B. There are two fuse plug areas, which are areas of slightly lower levee and three crevasse areas, which are areas which have been prepared for the potential use of explosive charges to excavate an opening. These are the areas where excess flood waters would enter and leave the floodway area. The upper fuse plug and crevasse area, or "Inflow" area, is about eight and one half miles in length, just below the confluence of the Ohio and Mississippi Rivers. The lower fuse plug and crevasse area, or "Inflow/Outflow No.2" area is about three and one half miles in length and is located at the downstream end of the floodway. There is a third crevasse area known as "Inflow/Outflow No.1" at a point where the floodway narrows significantly, located about 3/4 of the distance down the floodway. The lowermost area of the floodway, about 1500 feet in length and below the lower fuse plug area, is always open to flood backwaters. This opening provides for drainage of interior rainwater.

C. The frontline levee is constructed to a stage on the Cairo gage of generally 62.5, although some areas have been overbuilt to account for potential settling. The fuse plug areas are at an elevation corresponding generally to 60.5. The set back levee is constructed to a stage of 65.5.

D. The operation of the floodway involves breaching the frontline levee at the crevasse locations and allowing the area between the frontline and setback levees to be flooded. This action diverts large volumes of water from the Mississippi River to lower flood stages upstream and adjacent to the floodway. The setback levee then provides protection to the lands behind it. The impact on Mississippi and Ohio River stages would depend on the size and location of the crevasses created by the specific operation. For the Project Design Flood, up to four and one half feet of stage reduction is possible at Cairo. Reduced stages could potentially reach up the Ohio and Mississippi Rivers as much as 40 miles until its impact was no longer discernable.

E. The size of the crevasses created can be controlled by the quantity and placing of explosives, but in general, crevasse depths of up to 11 feet can be created in 1000 foot increments. Initial preparation of the floodway is required when the stage at the Cairo gage is approximately 59 feet, and completion of preparation at the inflow crevasse is required at 60 feet.

Operation of the floodway begins on order of the President of the Mississippi River Commission. The floodway has been operated only once, in 1937.

F. The Birds Point-New Madrid Floodway is one of four floodways within the Mississippi River and Tributaries Project. The other three are the Morganza, the West Atchafalaya, and the Bonnet Carre Spillway. The Birds Point-New Madrid floodway is the only one of the four which returns its flow back to the Mississippi River. The other three all direct their flows to the Gulf of Mexico via alternate routes.

4. Mississippi River Levee System

A. The Mississippi River Levee System is composed of 2,203 miles of levees of which 1,607 miles lie along the mainstem of the Mississippi River. The longest unbroken reach extends 650 miles along the west bank of the river from the Arkansas River to Venice, Louisiana.

B. The levees are typically 20 to 35 feet high and 215 to 375 feet wide at the bottom. The design top width is 25 feet. The levee system protects 23,620 square miles, with partial protection provided to an additional 3,780 square miles.

2.4.9. Storage Commitments. The use of storage in the Kentucky/Barkley flood control pool is committed based on the forecast stage at Cairo within the zones described above. For minor floods it is considered reasonable to limit the planned commitment of reservoir storage to a maximum headwater elevation of about 360, which corresponds to about 22 percent of the flat pool storage capacity above elevation 354. For intermediate floods, the maximum planned headwater level is 365, corresponding to 44 percent of storage. Major floods, not exceeding a stage of 57 feet at Cairo would be limited to a maximum headwater elevation of about 370, or about 70 percent of storage. The full storage volume of the flood control pool can be committed to floods which are forecast to exceed 57 feet at Cairo.

2.4.10. Target Stages. For minor and intermediate floods, as defined above, target stages at Cairo will generally be the anticipated crest which will result with turbine capacity releases. Lower releases can be made if the system demand for hydropower permits. During major floods, turbine releases may reduced or eliminated during the crest period at Cairo.

2.4.11. Release Limits.

1. Release Rates

No specific limits have been placed on the maximum release rate from Kentucky or Barkley. With respect to the lower Tennessee and Cumberland Rivers, releases are limited to keep downstream stages from exceeding the peak stage which would have occurred under natural conditions. Barkley releases are restricted to keep the tailwater stage from exceeding that which would have occurred had Barkley Dam not been built. During evacuation of flood waters from the reservoirs, discharges are not to be increased if this action would create a secondary crest on the lower Cumberland which would be higher than the initial crest experienced during flood control operations.

2. Rate of Change of Release

A. The rate of change of spillway discharge from Barkley Dam is limited to 40,000 cfs in 24 hours. This corresponds to a rate of rise in the tailwater of about 12 feet in 24 hours, which is approximately equal to the maximum observed rate under natural conditions. In addition, the rate of change of spillway release is also limited to increases of 5,000 cfs per hour, and decreases of 10,000 cfs per hour.

B. The rate of change of spillway discharge from Kentucky Dam fluctuates, and is based on the stage at Paducah. This and other discharge regulations which TVA follows at Kentucky Dam is presented as Plate A-27.

2.4.12. Secondary Objectives. If deemed advisable by water control managers, up to 15 percent of the available flood storage capacity can be used to provide flood protection to secondary objective locations. This corresponds to maximum headwater elevations of three to four feet above the guide curve. Specific control stages have not been established at these locations since this may imply that the reservoirs will be used to prevent all floods from exceeding these stages. This is not the case. Regulation of the reservoirs for secondary locations could potentially require use of large volumes of storage which would reduce the level of protection for the primary objectives. Protection will be provided for secondary locations only if a reasonable impact on flood stages can be accomplished within the 15 percent of storage limitation.

2.4.13. Secondary Control Points.

1. Cumberland River below Barkley Dam

Based on the physical characteristics of the riverbank, the "ordinary high water line" below Barkley Dam extends from elevation 315 at the mouth of the river to elevation 320 at the dam tailwater. This profile also closely

approximates the flow line resulting from maximum turbine releases from Barkley with the Ohio River at elevation 315. Lands adjacent to the lower Cumberland River below Barkley Dam remain mostly agricultural. Commercial businesses catering mostly to tourists are developing immediately below the dam at Lake City, Kentucky. The communities of Iuka, Dycusburg, and Pinckneyville, Kentucky, are located along the lower 30.6 miles of the Cumberland. The city of Smithland, Kentucky, sits at the confluence of the Cumberland and Ohio Rivers and is affected by the operation of Barkley and Smithland Dams. A levee system has been constructed at Smithland to afford flood protection of the "Old Town" part of the city to elevation 336 msl (stage of 46 feet on Smithland L&D lower). Official flood stage immediately below Barkley Dam has been established as elevation 335 msl (NGVD), and the National Weather Service has set 40 feet as flood stage at the Smithland, Kentucky, gage. During the crop season, a Barkley tailwater elevation of 325 msl (NGVD) has been identified as the initial point of agricultural damage.

2. Tennessee River at Calvert City, Kentucky

Agricultural damages begin in this area at a Kentucky tailwater elevation of 320 in the cropping season and at about 325 in the winter months. Some industrial facilities have been constructed in this reach, but TVA and the Corps of Engineers have agreed that the flood situation in the vicinity of Calvert City does not necessarily constitute a restriction on releases from Kentucky Dam, since the developments in the flood plain have been constructed with full knowledge of the hazards involved.

3. Ohio River at Smithland, Kentucky

Smithland is protected by a small levee from river stages up to about 40 feet on the Smithland gage. The pumping station for the water supply plant is subject to flooding at a stage of about 43 feet (Smithland L&D lower). Depending on river slope, this corresponds to a stage at Paducah of between 50 and 54 feet.

4. Ohio River at Paducah, Kentucky

Temporary efforts to slow the stage rise while flood wall closure structures are installed may be considered.

5. Ohio River at Metropolis, Illinois

Official flood stage is 39 feet on the pass sill gage at Lock and Dam 52.

However, damages do not become serious until a stage of 48 feet is reached. This corresponds to about 46 feet on the Paducah gage.

6. Mississippi River at Arkansas City, Arkansas

2.4.14. Pre-Project Conditions. Under all circumstances, flood levels at all downstream locations will be held to stages no higher than they would have under natural conditions (no dams), and no higher than they would have had Barkley Dam not been built.

2.5. Drought Regulation

2.5.1. Priorities. As specified in the Cumberland River Basin Drought Contingency Plan, the system wide priorities for drought regulation in the basin are:

1. Water Supply*
2. Water Quality*
3. Navigation
4. Hydropower
5. Recreation

* For Public Health and Safety

2.5.2. Authorization. Of these purposes, only Navigation and Hydropower were specifically mentioned in the authorizing legislation. Flood Control is the other specifically authorized purpose, but it is not a factor during a drought. Barkley Dam is also operated for water quality and fish and wildlife under the general authorities of the Federal Water Pollution Control Act Amendments and the Fish and Wildlife Coordination Act respectively. While there is no general authority at Barkley for storage allocated for water supply on either a permanent (PL 85-500) or temporary (PL 78-534) basis, water is being withdrawn for municipal and industrial purposes. Consequently, in the interest of public health and safety, high priority is given to maintaining the lake level above the minimum operating elevations of all water supply intakes.

2.5.3. Municipal Water Supply. As discussed later under Effects of the Water Control Plan, Lake Barkley serves as the water supply source for approximately 120,000 people via eight municipal water systems. The minimum pool level at which all eight systems which withdraw water can function is elevation 354. This corresponds to the top of the lowest level of the inactive pool. Normal operation allows a one foot variation from this level which has not been a problem in the past. Thus no deviation from the normal operating plan is required to meet this goal.

2.5.4. Water Quality for Public Health and Safety. No special operations have been required at Barkley Dam for the purpose of water quality during a drought, nor are they anticipated. Water Quality needs are generally satisfied by providing the minimum release rate of 6,000 cfs as described under normal regulation procedures.

2.5.5. Navigation. During the 1988 drought the Lake Barkley pool was held at elevation 359 beyond the normal drawdown date of July 1st. This served navigation in two manners. First, the higher combined Kentucky/Barkley pool provided adequate depth for navigation in the Pickwick Landing Dam tailwater area at the headwaters of Kentucky Lake. Second, the additional volume of water was held to insure adequate release water was available to maintain a minimum nine foot navigation depth in the Lower Mississippi River below Cairo, Illinois.

2.5.6. In addition, peaking power operations were foregone in favor of steady power releases to provide a more constant flow in the Mississippi River in the Memphis area. A river with steady flows will better maintain an open channel, while one with fluctuating flows has more of a tendency to produce shoaling, which in turn needs to be resolved by dredging.

2.5.7. In the Cumberland River downstream of the project the normal minimum required tailwater elevation of 302 should be adequate to maintain navigation even during a drought.

2.5.8. Hydropower. As discussed above, hydropower peaking operations may need to be curtailed in favor of more steady power generation in order to assist the navigation needs of the lower Ohio and Mississippi Rivers.

2.5.9. Recreation. No specific operations are anticipated for recreation during drought conditions. The modifications described above under Navigation will have no significant impact on recreation facilities. These facilities can fully function under the prescribed range of pool elevations which are within the normal range experienced every year.

2.6. Special Regulation.

2.6.1 Stabilization for Spawning. Usually in late April or early May, the largemouth bass and crappie spawn occurs. For a two to three week period during this occurrence it is critical to keep a relatively stable pool for good spawning conditions. If however, the water should rise in the flood control pool and evacuation of this storage is necessary, it should be evacuated as rapidly as practical to attempt to delay the spawn. Stabilization efforts are initiated when the Nashville District determines that the spawn is occurring, based on criteria established by the Kentucky Department of Fish and Wildlife Resources. The state agency's criteria to

predict the beginning of the spawn period for all lakes in Kentucky is triggered when surface water temperature reaches 65 degrees Fahrenheit for three consecutive days. Lake level stabilization to enhance fish spawn is a cooperative effort between the Corps, State of Kentucky, SEPA, and TVA.

2.6.2. In addition to the functional goals discussed in this chapter, there are often other miscellaneous requirements of reservoir regulation for special purposes or circumstances. These include such things as providing specific water levels or discharges for construction activities, project maintenance, inspections, and response to emergency situations such as drownings and oil and chemical spills. Normally special operations can be accomplished within the frame work of the approved reservoir operating plan and therefore do not require approval of higher authority. In rare circumstances when deviating from the approved plan is necessary, prior approval of the Great Lakes and Ohio River Division Office is required.

2.7. Safety. Maintaining the integrity of the structure under all conditions of streamflow, and assuring the safety of the general public both at the project and in the river system below the project takes precedence over all functional requirements. The project design and this water control plan are intended to result in safe conditions for all anticipated circumstances. If however, conditions arise where adherence to this plan would jeopardize structural integrity or the general public, safety conditions should prevail.

2.8. Specific Regulating Rules.

2.8.1. Normal and Drought Conditions.

- (1) Maintain the headwater elevation within one foot above or below that specified on the guide curve (Plate A-1) and release all water through the turbines in the interest of hydropower production.
- (2) Maintain the headwater elevation within one foot of the headwater elevation at Kentucky Dam.
- (3) Maintain a continuous minimum release of 6,000 cfs.
- (4) Maintain a minimum tailwater elevation of 302.
- (5) Limit the change in hydropower generation to one unit per hour, up or down.

2.8.2. Flood Conditions.

- (1) Limit the rate of increase in spillway releases to 5,000 cfs per hour.
- (2) Limit the rate of change in spillway releases to 40,000 cfs per 24 hours.
- (3) Limit the rates of decrease in spillway releases to 10,000 cfs per hour.

2.9. Instructions to Operators. Additional instructions regarding normal and emergency operations and specific instructions on operators data collection and reporting duties can be found in the separate "Barkley Project Instructions for Reservoir Regulation" document.

2.10. Deviations from Water Control Plan. Permission to deviate from this plan must be obtained from the Great Lakes and Ohio River Division, Water Management Branch.

2.11. Standing Instructions. See next page.

STANDING INSTRUCTIONS

In the unlikely event that contact cannot be established between the Barkley Project and the Nashville District Water Management Section, the following instructions should be followed by the operators .

1. Follow schedule given by the dispatcher for the Tennessee Valley Authority (TVA).
2. If headwater elevation exceeds that designated by the guide curve, increase project releases as required to maintain headwater level to within one foot of that designated by the guide curve, but do not increase spillway releases by more than 5,000 cfs per hour, or 40,000 cfs per day.
3. Do not allow the pool elevation to exceed 375 under any circumstances.
4. After the pool peaks, limit decrease in spillway releases to 10,000 cfs per hour.
5. Do not allow the pool elevation to fall below 353 under any circumstances.

CHAPTER III EFFECT OF WATER CONTROL PLAN

3.1. Pool Elevation.

3.1.1. Plate III-1 shows the annual peak headwater elevation of Lake Barkley for 30 years of history arranged in descending order. The pool elevation frequency curve displayed as Plate III-2, shows the percent of time that the pool has been at or below various elevations. During the history of the project, the pool has been between the winter and summer guide curve elevations approximately 80 percent of the time. The pool has been above the summer elevation of 359 a little over 15 percent of the time and below winter elevation less than 5 percent of the time. The pool has been within the range between one foot above summer elevation and one foot below winter elevation over 95 percent of its history.

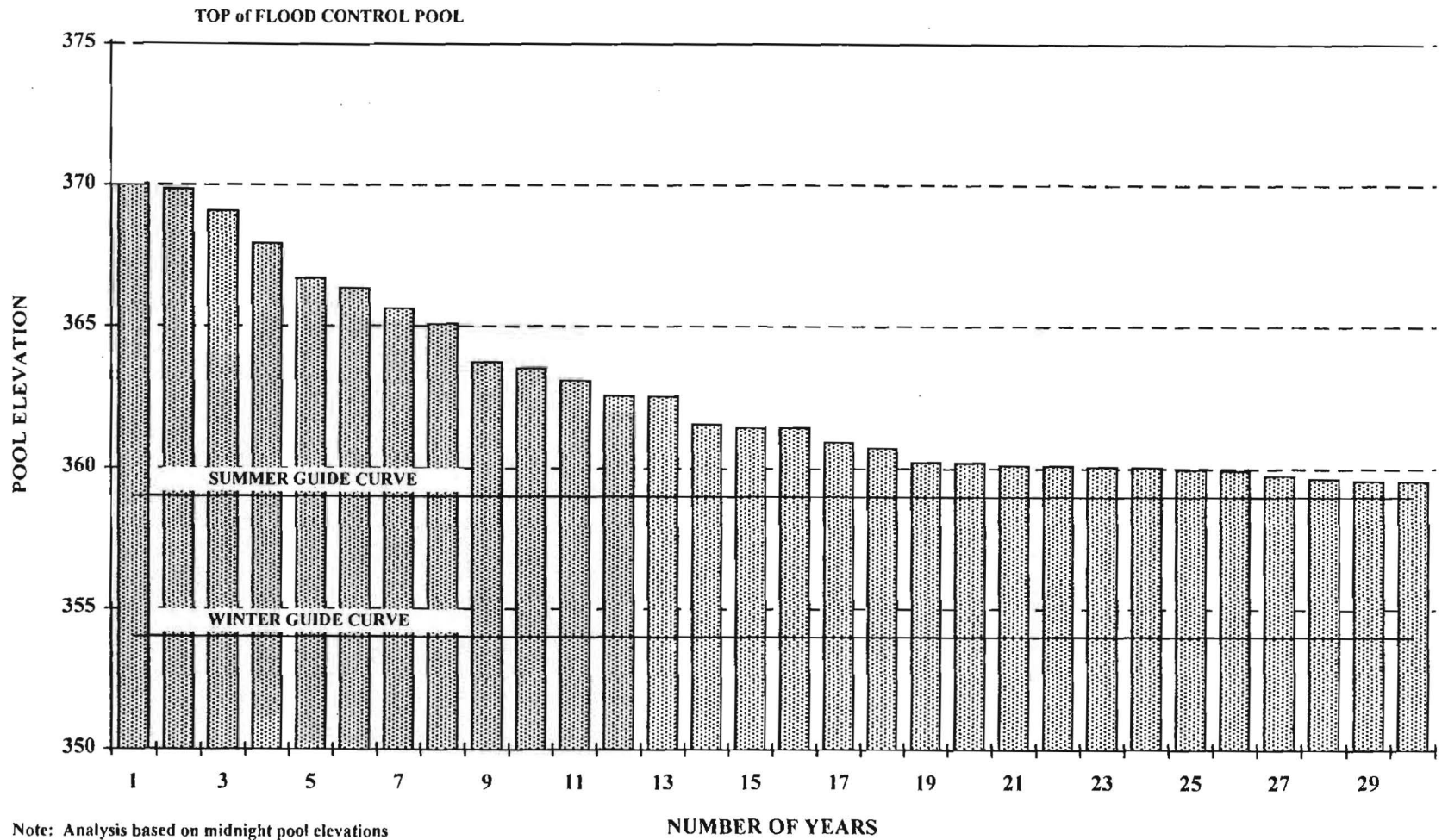
3.1.2. Plate III-3 shows the range of pool elevation used during each year between 1966 and 1996. This chart shows that the pool remains within one foot of the normal annual range during many years, but also extends up into the flood control pool fairly often. It has been above elevation 365 during eight different years and above 370 only one time and then just barely. Thus, the water surface has essentially never been closer than five feet to the top of the flood control pool.

3.2. Project Discharge and Canal Flows.

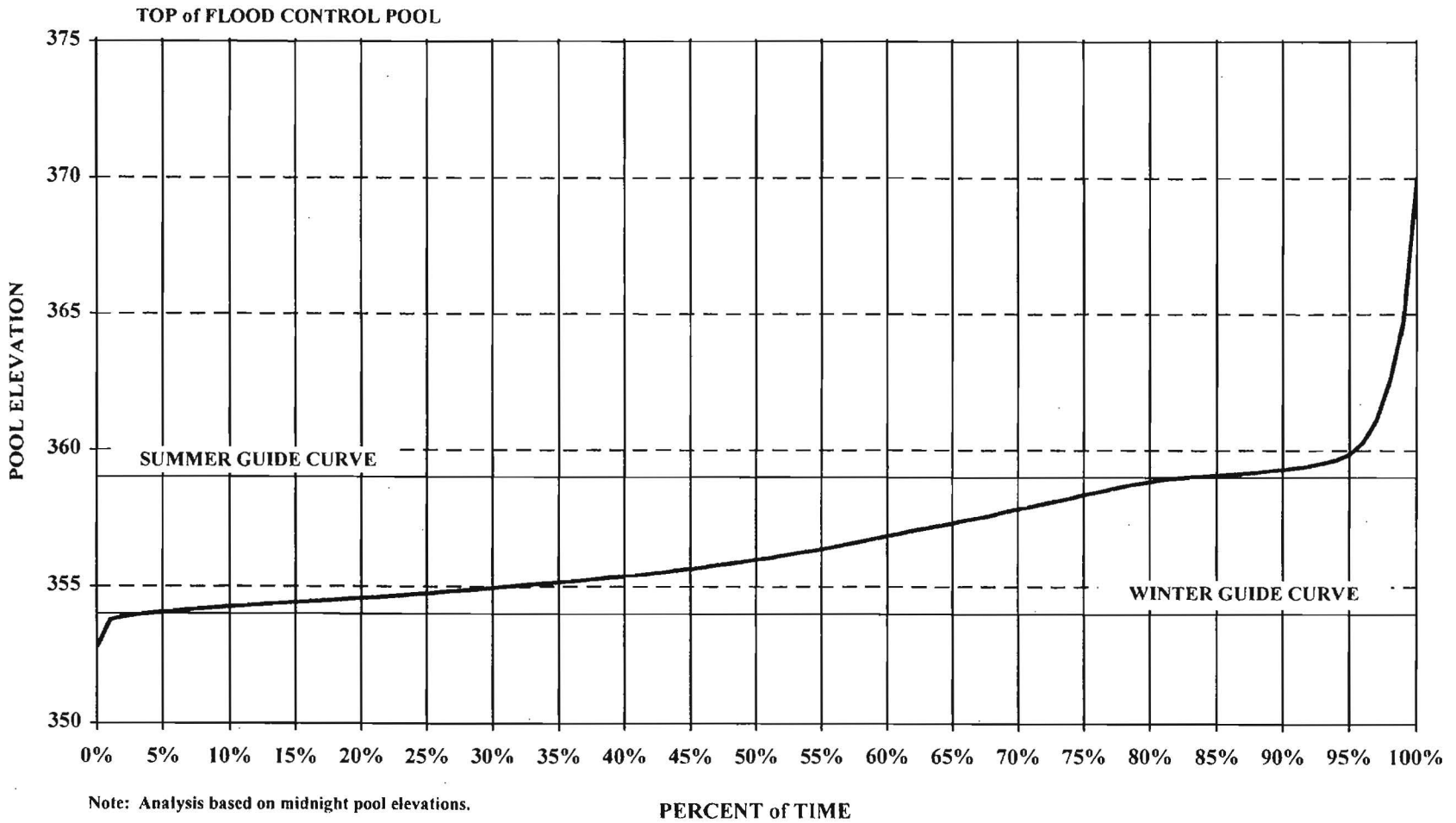
3.2.1. The project history discharges are depicted in Plates III-4 and III-5. Plate III-4 shows the average turbine and spill discharges for each month of the year. This project has almost no spill in the late summer and early fall months of the year, whereas during the early spring it is typically about 25% of the dam discharge. The largest average spill occurs in March when it is about 14,000 cfs. The smallest amount occurs in August when it is only 24 cfs. Total average outflow peaks in February at over 52,000 cfs, while the minimum total average flow is in September when it is just over 20,000 cfs. Variations between the years are as great as the annual variations within the year. The maximum spill occurred in 1975 when it averaged over 17,000 cfs. There has never been a whole year when there was no spill, but in 1985 spill occurred on only three days. When averaged out over that year this spill amounted to only 80 cfs. The highest total flow was in 1979 when the annual average was over 54,000 cfs. The year 1975 was a very close second. The lowest annual flow since regular operation began was in 1988 when the average annual flow was only 17,700 cfs.

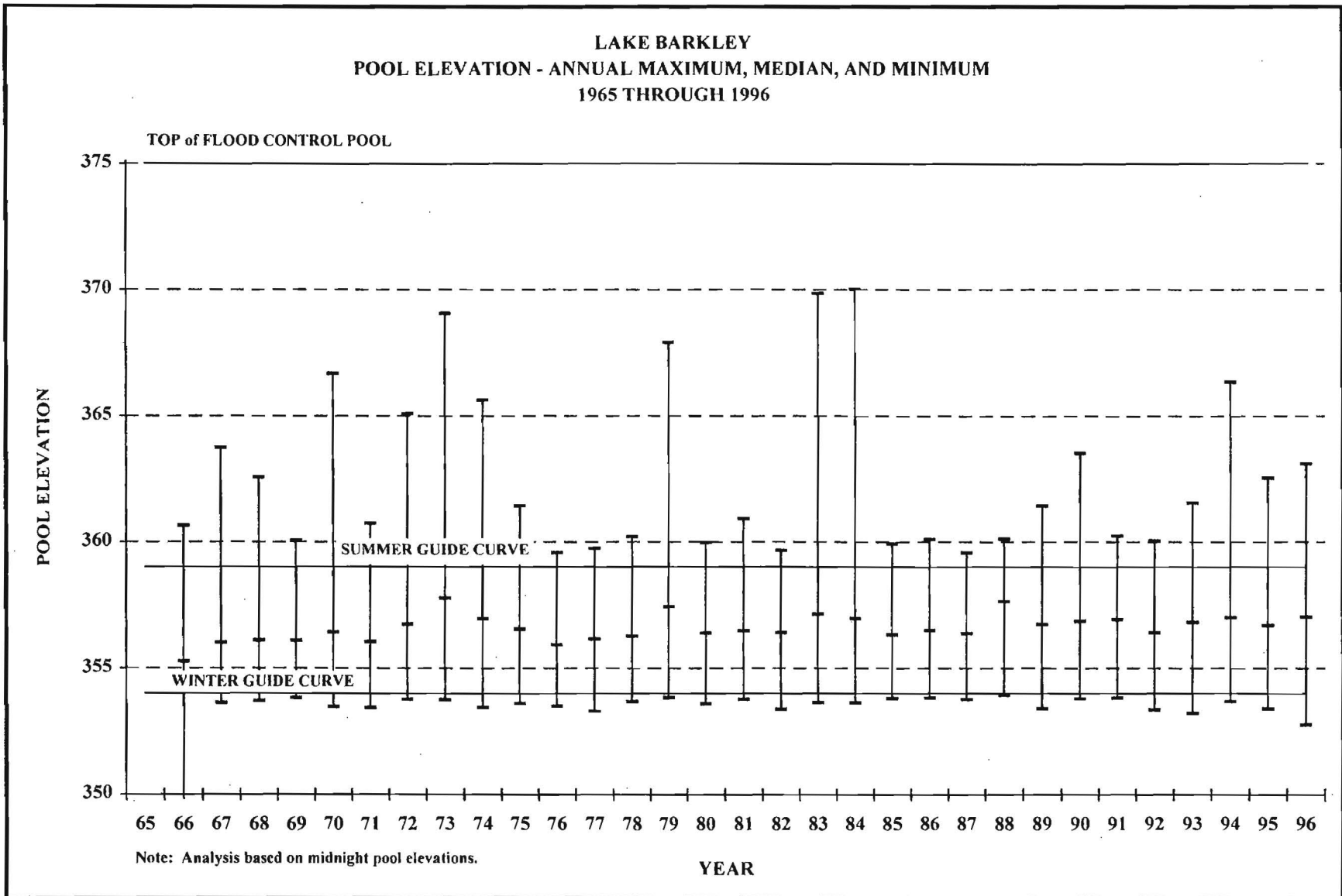
3.2.2. The Barkley Canal historical flows are depicted in Plates III-6 and III-7. Plate III-6 shows the average daily flow and the extremes in each direction for each day of the year. There is little or no recognizable seasonal variation in either the average or the extremes. It is interesting to note that the average flow is regularly from Kentucky to Barkley, while the largest extremes of flows have been from Barkley to Kentucky. Plate III-7 shows the annual average and the extreme daily flow in each direction for each year from 1967 through 1990. The average flow has been from Kentucky to Barkley for every year except 1984 through 1986.

LAKE BARKLEY POOL ELEVATION - NUMBER OF YEARS EQUALED OR EXCEEDED 1967 THROUGH 1996



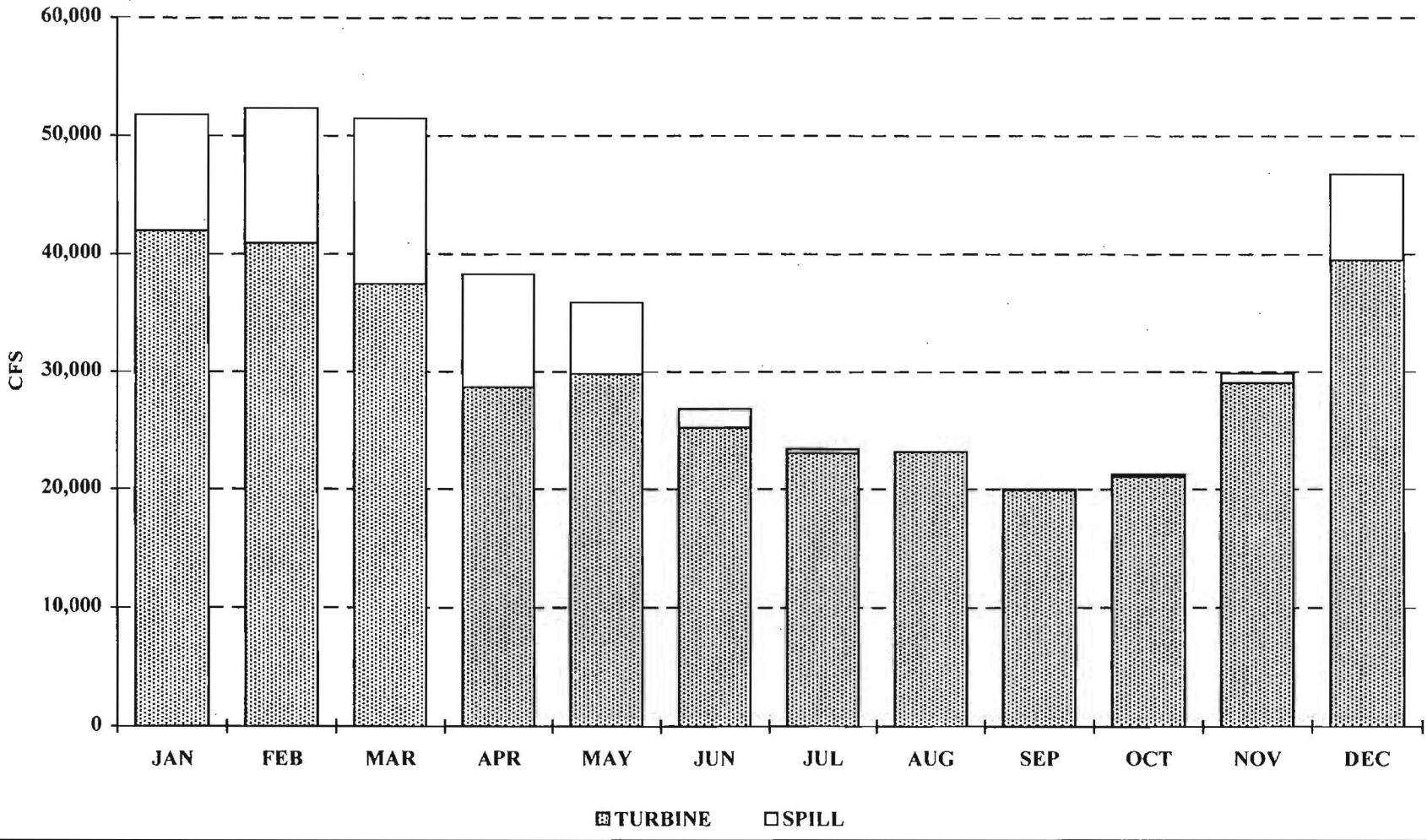
LAKE BARKLEY
POOL ELEVATION - PERCENT OF TIME AT OR BELOW
1967 THROUGH 1996

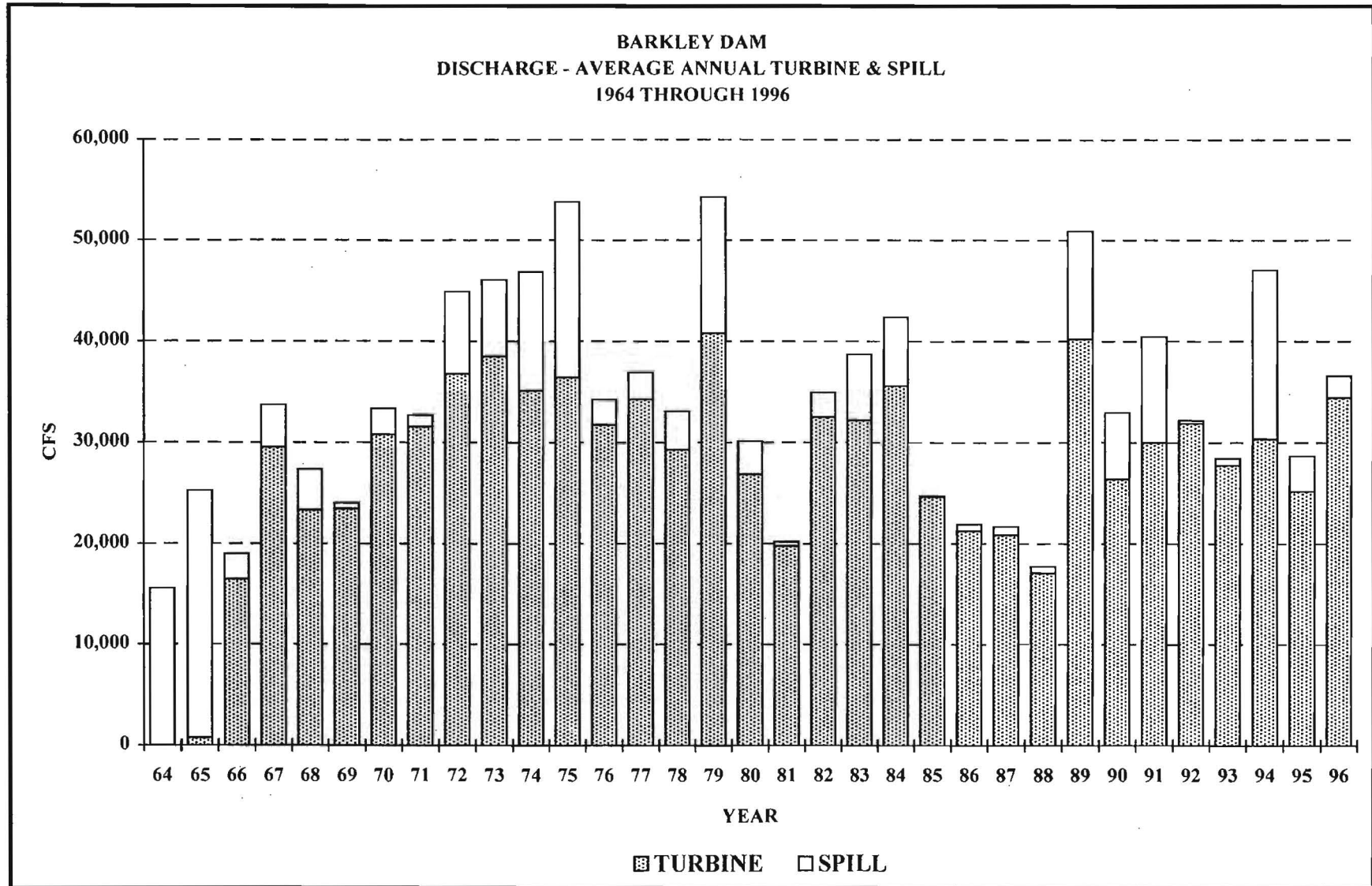




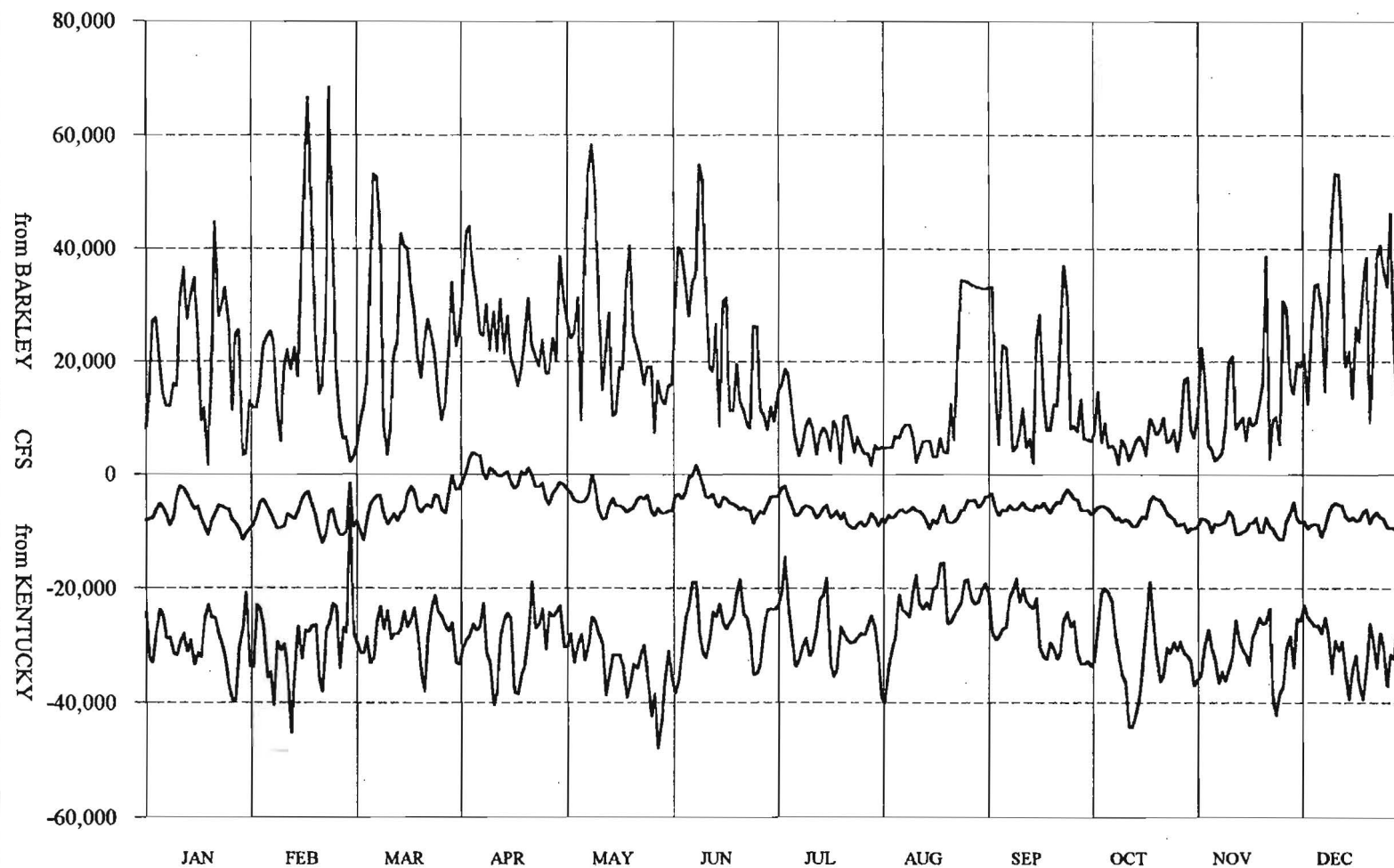
S - III

BARKLEY DAM
AVERAGE MONTHLY TURBINE & SPILL RELEASE
1967 THROUGH 1996



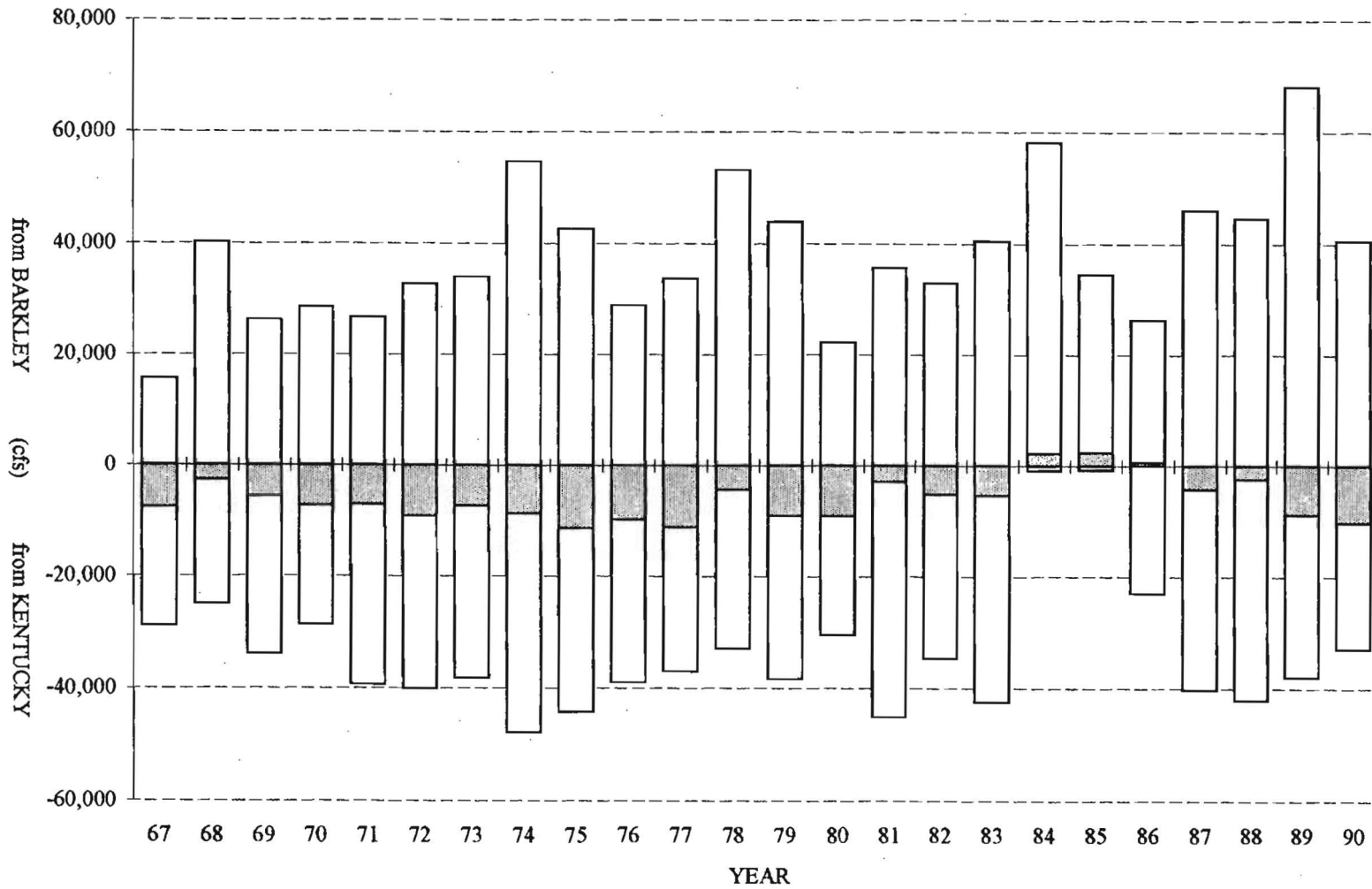


BARKLEY CANAL
FLOW - DAILY AVERAGE & EXTREMES
1967 THROUGH 1990



III - 7

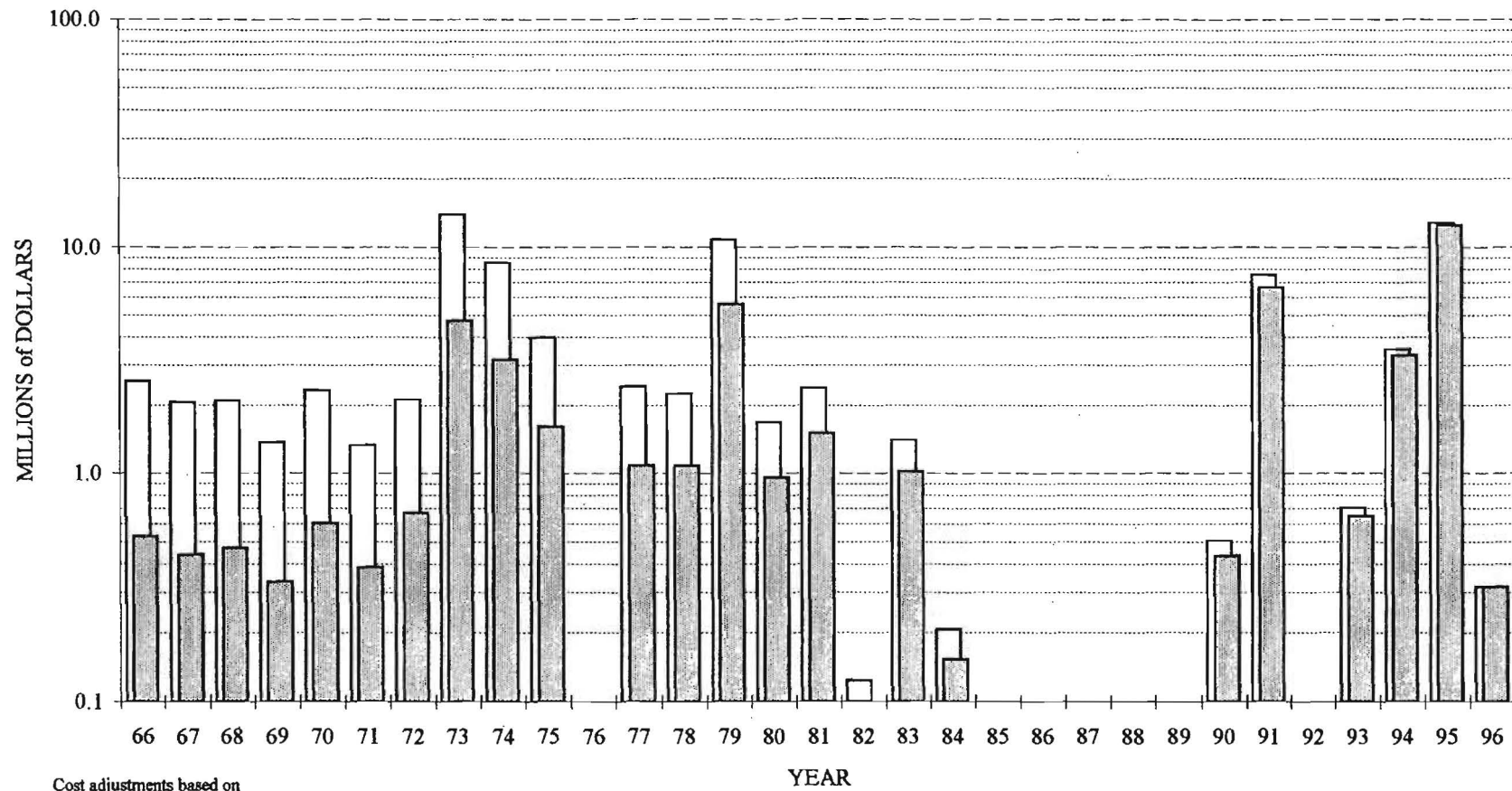
BARKLEY CANAL FLOW - ANNUAL AVERAGE & EXTREME DAILY



□ + Max daily flow from Barkley to Kentucky □ - Max daily flow from Kentucky to Barkley ■ Average annual flow between lakes

3.3. Flood Control. Barkley Dam has provided flood control benefits almost every year since it became operational. It has prevented a total of over 50 million dollars in damage, or about 100 million dollars if converted into 1996 dollars. Flood damages prevented for all years between 1966 and 1996 are shown graphically in Plate III-8. Pool elevations and discharges for the March, 1975 and May, 1984 flood events are shown on Plates III-9 and III-10.

BARKLEY DAM FLOOD DAMAGES PREVENTED

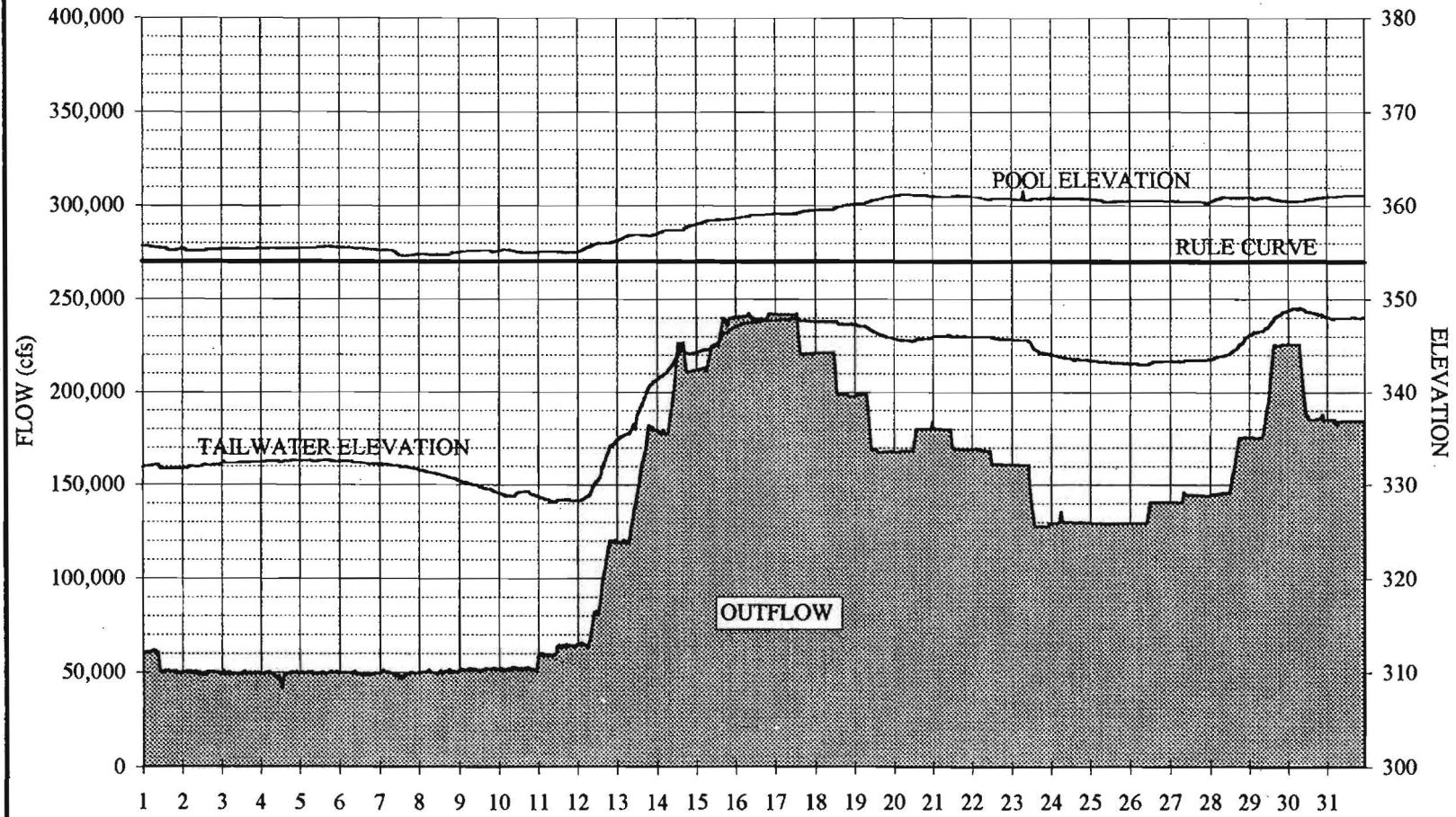


Cost adjustments based on
Means Historical Cost Index

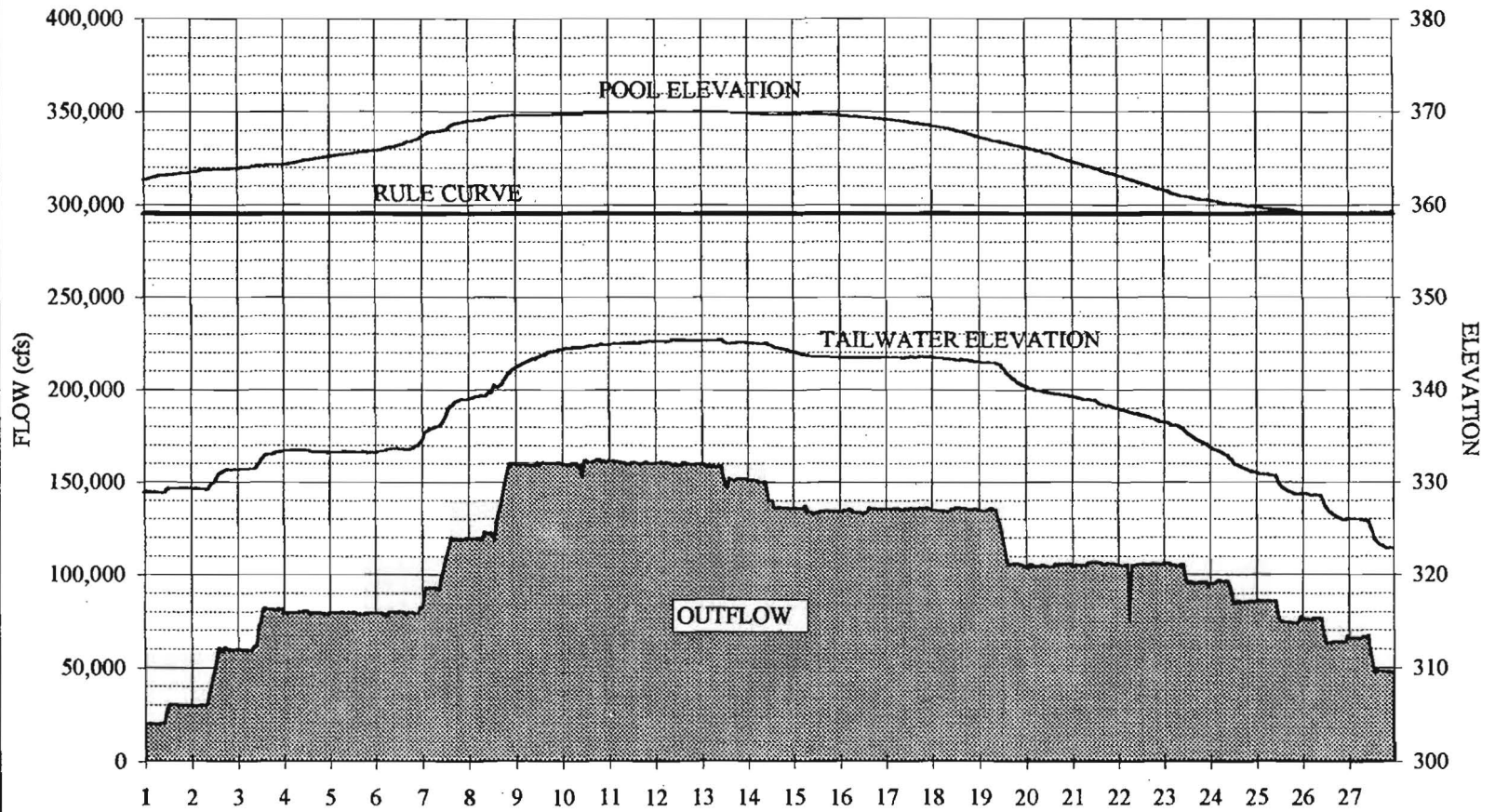
□ 1996 DOLLARS ■ EVENT YEAR DOLLARS

BARKLEY DAM
FLOOD CONTROL STORAGE USE
MARCH 1975

III - III



BARKLEY DAM
FLOOD CONTROL STORAGE USE
MAY 1984

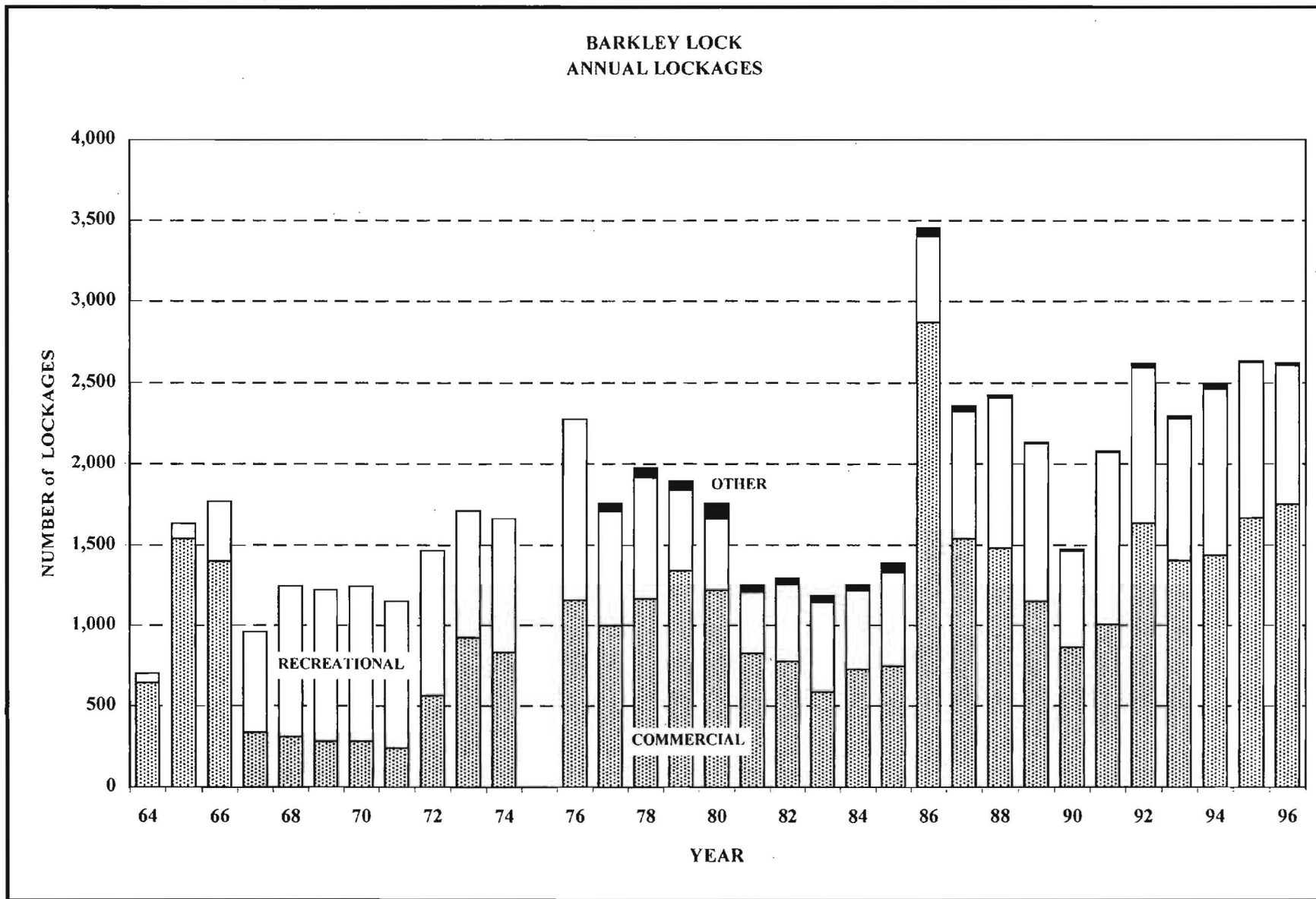


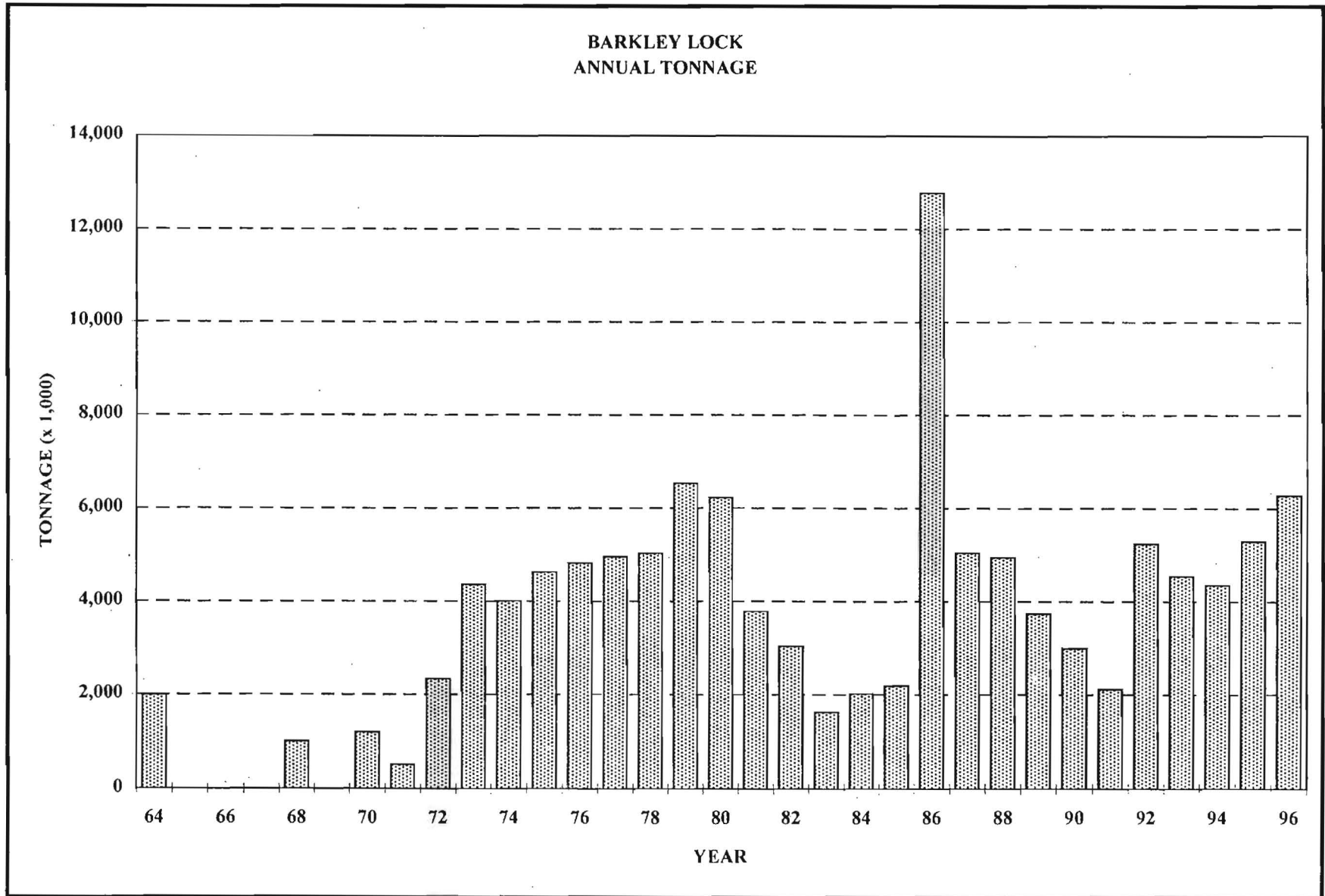
III - 12

3.4. Navigation.

3.4.1. Barkley and Cheatham Locks are by far the two busiest of the four locks on the Cumberland River. Even though the lock is 200 feet longer than Kentucky Lock, many shippers tend to bypass Barkley and use Kentucky if possible. By using Kentucky Lock and the Barkley Canal, shippers can avoid the lower 30.6 miles of the Cumberland River, which has many sharp bends and a stronger current than the generally parallel lower Tennessee River. Over the history of the project, the number of lockages at Barkley has generally increased, but it is not unusual for annual figures to decline from year to year. Commercial lockages generally outnumber recreational lockages with the exception of 1968 through 1972 and also during 1991. The annual number of lockages is shown graphically in Plate III-11 for each year between 1964 and 1996, except for 1975. The figures for this year were not available.

3.4.2. Commercial tonnage through the lock has varied over the years. Since 1972 it has generally averaged around four to five million tons per year. A notable exception was 1986 when almost 13 million tons of cargo passed through Barkley lock. The primary reason for this sharp increase in tonnage was attributed to the outage of Kentucky Lock for several months that year for major repairs. The annual tonnage through the lock is shown graphically in Plate III-12 for years 1964 through 1996, except for missing data in 1965, 1966, 1967 and 1969.



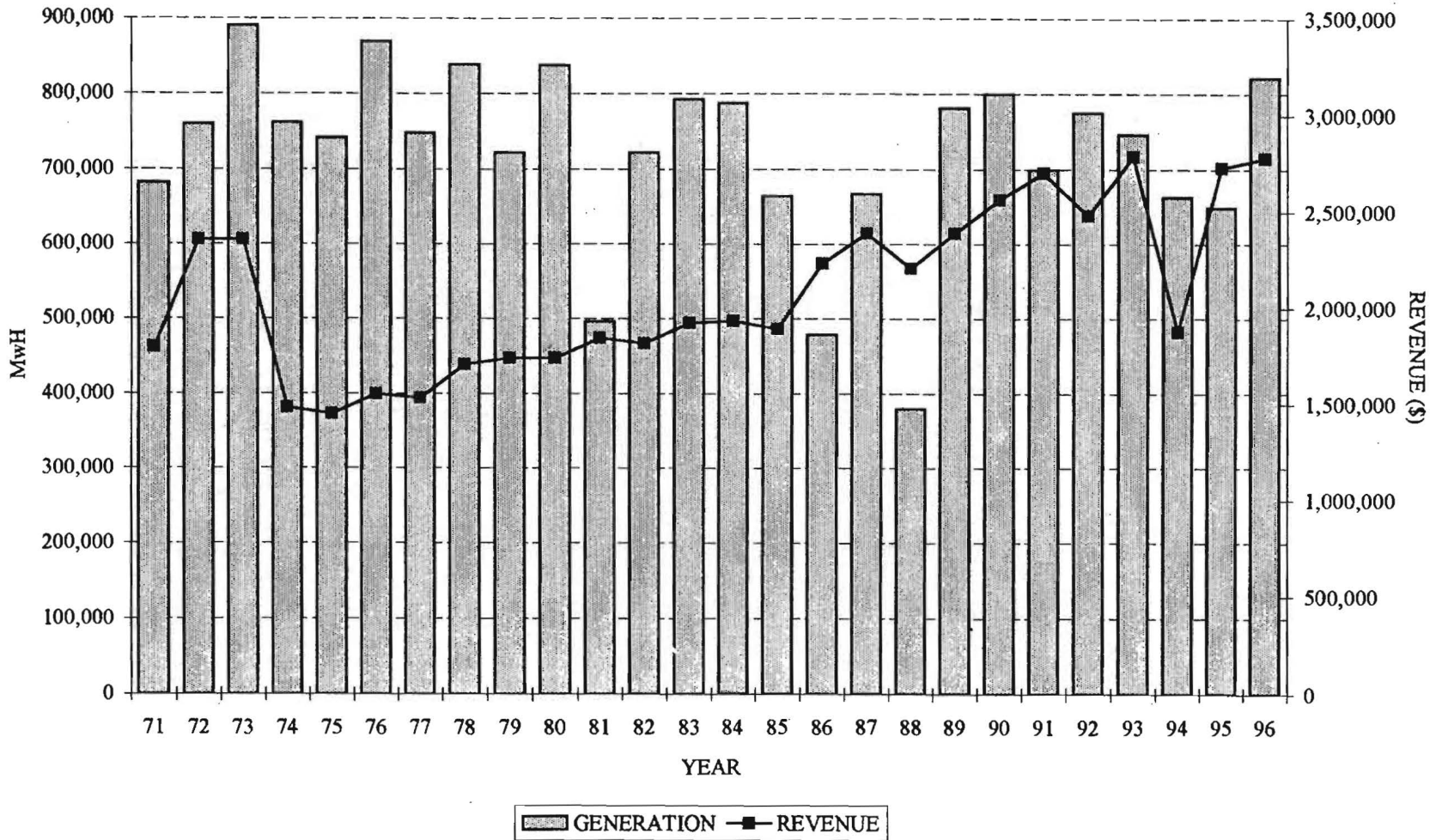


3.5. Hydropower.

3.5.1. Hydropower generation at Barkley, as at most hydropower projects, is generally a function of streamflow conditions for that year. From 1971 through 1996, the Barkley project generated over 18,000 gigawatt hours of electricity and produced revenues of more than 54 million dollars. Annually, it generally produces between 600 and 800 gigawatt hours of electricity. The net power generation and revenue for each year from 1971 through 1996 is shown graphically in Plate III-13, while Plate III-14 shows similar information in tabular form.

3.5.2. Fluctuations in revenue do not necessarily follow the same annual fluctuation pattern as generation. Hydropower revenue attributed to individual projects tends to be more a function of accounting, as total revenue is divided among the Cumberland Basin hydropower projects. In addition, only about one third of a project's hydropower revenue comes from the actual generation of power, while the remainder comes from selling power "capacity". Barkley, like other hydro projects in the basin, offers a guaranteed amount of capacity to the overall power "network", such as the TVA network, which is made up of hydropower, coal, nuclear, and gas-fired facilities. This hydropower capacity adds a great deal of value to the power network by delaying the time at which additional capacity, such as a new coal or nuclear facility, will need to be added.

BARKLEY
HYDROPOWER - ANNUAL GENERATION and REVENUE



SUMMARY OF BARKLEY DAM HYDROPOWER OUTPUT

| FISCAL YEAR | ESTIMATED ANNUAL GENERATION (million kwh) | GROSS GENERATION (million kwh) | % ABOVE/BELOW ESTIMATED ANNUAL GENERATION | STATION USE (million kwh) | NET ① GENERATION (million kwh) | REVENUE (\$ million) | REVENUE (¢ / kwh sold) |
|-------------|---|--------------------------------|---|---------------------------|--------------------------------|----------------------|------------------------|
| 1971 | 582 | 684.8 | 18 | 3.3 | 681.5 | 1.79 | .27 |
| 1972 | 582 | 762.5 | 31 | 3.3 | 759.2 | 2.36 | .31 |
| 1973 | 582 | 893.3 | 53 | 3.4 | 889.9 | 2.35 | .27 |
| 1974 | 582 | 764.7 | 31 | 3.2 | 761.6 | 1.48 | .19 |
| 1975 | 582 | 744.2 | 28 | 2.8 | 741.4 | 1.45 | .20 |
| 1976 | 582 | 866.5 | 49 | 2.4 | 864.1 | 1.55 | .18 |
| 1977 | 582 | 750.2 | 29 | 2.7 | 747.5 | 1.53 | .21 |
| 1978 | 582 | 841.5 | 45 | 2.7 | 838.8 | 1.71 | .20 |
| 1979 | 582 | 724.4 | 24 | 2.9 | 721.6 | 1.74 | .24 |
| 1980 | 582 | 840.2 | 44 | 2.8 | 837.3 | 1.74 | .21 |
| 1981 | 582 | 498.5 | -14 | 2.6 | 495.9 | 1.84 | .37 |
| 1982 | 582 | 724.4 | 24 | 2.6 | 721.9 | 1.81 | .25 |
| 1983 | 582 | 795.4 | 37 | 2.6 | 792.8 | 1.92 | .24 |
| 1984 | 582 | 790.4 | 36 | 2.5 | 787.9 | 1.93 | .25 |
| 1985 | 582 | 666.3 | 14 | 2.6 | 663.7 | 1.89 | .29 |
| 1986 | 582 | 480.9 | -17 | 2.5 | 478.3 | 2.23 | .47 |
| 1987 | 582 | 669.4 | 15 | 2.4 | 667.0 | 2.39 | .36 |
| 1988 | 582 | 382.2 | -34 | 2.5 | 379.7 | 2.21 | .58 |
| 1989 | 582 | 783.5 | 35 | 2.6 | 781.0 | 2.39 | .31 |
| 1990 | 582 | 803.1 | 38 | 2.5 | 800.5 | 2.56 | .32 |
| 1991 | 582 | 701.5 | 21 | 2.3 | 699.2 | 2.70 | .39 |
| 1992 | 582 | 776.9 | 33 | 3.3 | 774.7 | 2.48 | .32 |
| 1993 | 582 | 748.4 | 29 | 3.6 | 746.1 | 2.79 | .37 |
| 1994 | 582 | 664.7 | 14 | 3.8 | 662.7 | 1.87 | .28 |
| 1995 | 582 | 650.7 | 12 | 3.7 | 648.3 | 2.73 | .42 |
| 1996 | 582 | 823.9 | 42 | 3.8 | 821.5 | 2.78 | .34 |

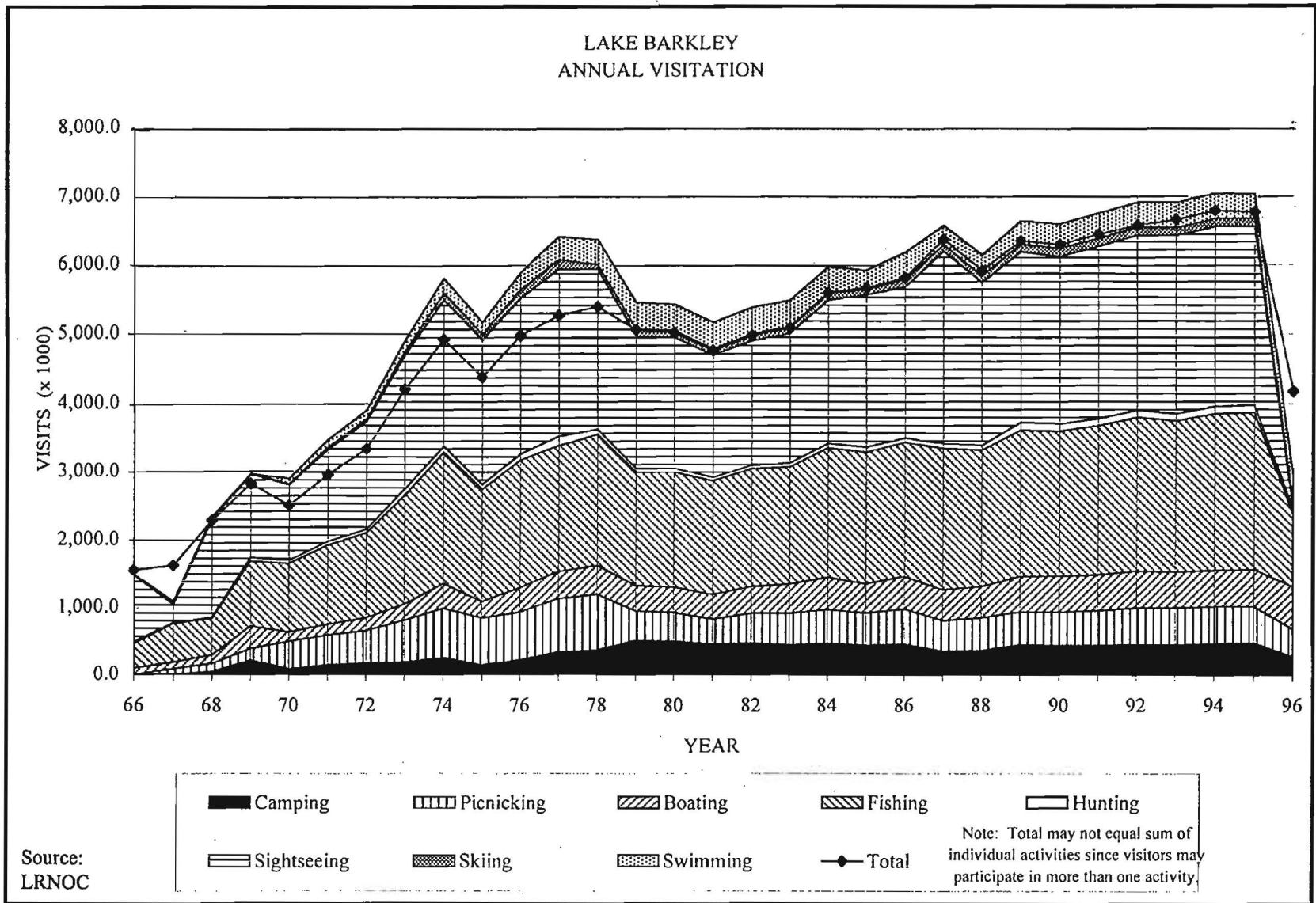
① Net generation plus station use may not equal gross generation due to rounding

3.6. Recreation.

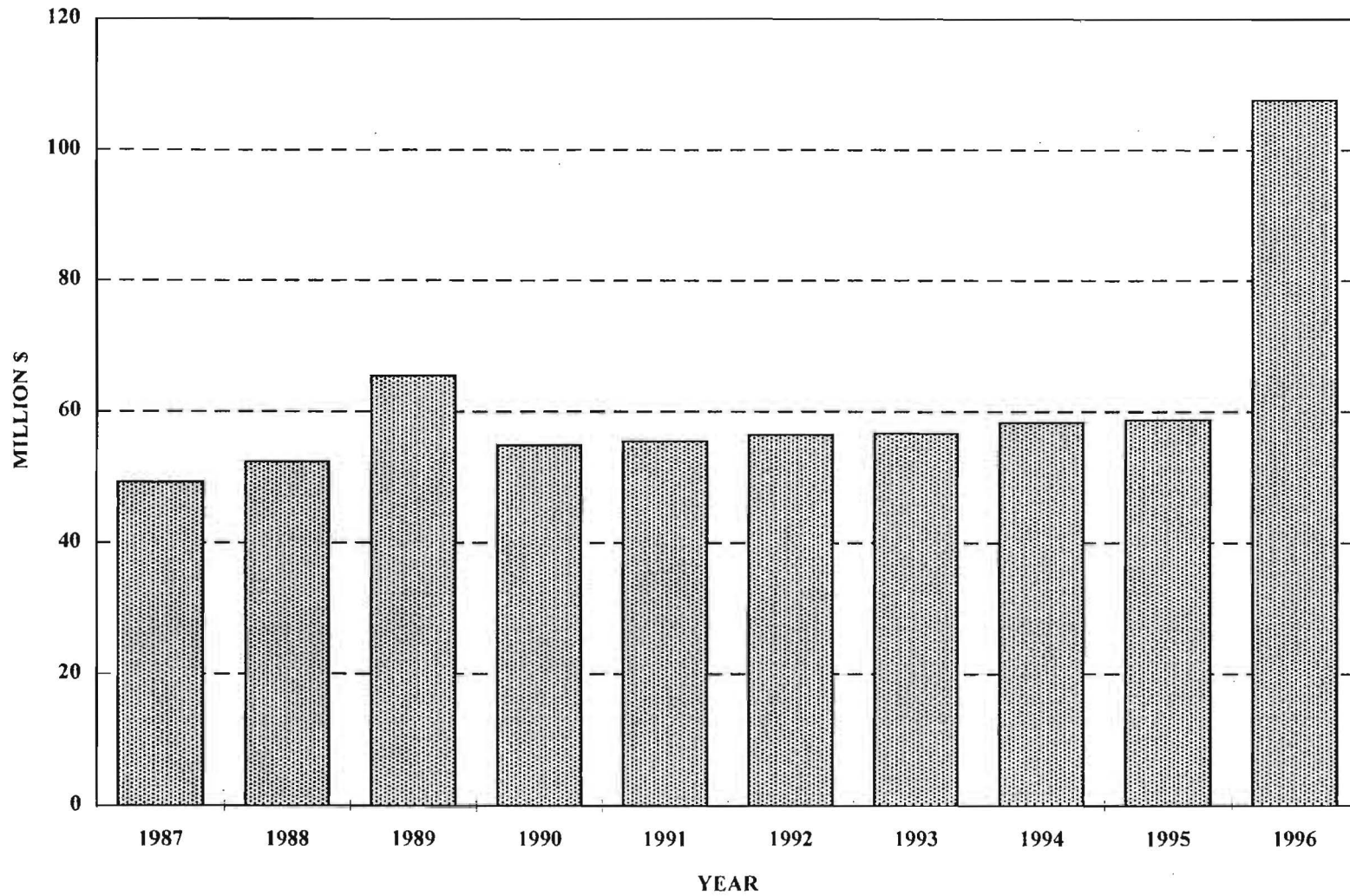
3.6.1. Recreation usage of Lake Barkley grew very quickly during the first ten years after the reservoir was filled. Usage then stabilized and even dropped for a few years, but has again shown slow but steady growth since 1981. Lake Barkley is the fourth most visited reservoir of the ten managed by the Nashville District, behind Old Hickory, J. Percy Priest, and Wolf Creek. The most popular recreational activity at Lake Barkley is sightseeing. While fishing remains a very close second, sightseeing has been the most popular activity since the project was filled. These two activities together account for the vast majority of visitor hours at the lake. Plate III-15 shows annual visitation to Lake Barkley by category of recreational use.

3.6.2. The visitation dollar benefit attributed to Lake Barkley is shown on Plate III-16. Prior to 1996, this was a very conservative rough estimate based on an average expenditure rate of \$1.96 per visitor hour for all the various user groups, such as boaters, campers, hunters, etc. In addition, it was intended to reflect only those expenditures made in the vicinity of the lake and did not attempt to account for major expenditures prior to the visit, such as the purchase of camping gear or a boat. Plate III-17 shows the impacts of low lake levels on water based recreational facilities and water supply intakes.

3.6.3. For 1996, a distinct decrease in the visitation chart and increase in the dollar benefit chart can easily be detected. This is due to a change in methodology of how the District determines these recreational values. The Nashville District now uses the Visitor Information and Reporting System (VIRS) which was developed by the Waterways Experiment Station (WES). This system counts each "visitor" on Corps' property for recreation as "one", even if that visitor stayed a full week on the property. The previous method used by the District would have counted a full week stay as seven recreation use-days. This different methodology would account for the decrease in the visitation chart. The sharp increase in the dollar benefit is also attributed to the new VIRS system. It reflects a much greater average expenditure rate which varies depending on the recreational activity. However, similar to the previous technique, this new accounting method still does not attempt to account for major expenditures of durable goods.



LAKE BARKLEY
VISITATION DOLLAR BENEFIT



III - 21

LAKE BARKLEY

IMPACTS OF LAKE LEVELS ON RECREATION AND NATURAL RESOURCES

| SUMMER POOL - ELEVATION 359.0 | | | | | | | | | | |
|-------------------------------|--------|---|----------------------|-------------------|---|----------------------|-------------------|--|----------------------|-------------------|
| WATER BASED FACILITIES | | INITIAL IMPACT (A) ELEVATION 355.0 (4.0 feet below summer pool) | | | MAJOR IMPACT (B) ELEVATION 352.5 (6.5 feet below summer pool) | | | SEVERE IMPACT (C) ELEVATION 350.0 (9.0 feet below summer pool) | | |
| Type | Number | Usable | Marginal or Unusable | Percent Reduction | Usable | Marginal or Unusable | Percent Reduction | Usable | Marginal or Unusable | Percent Reduction |
| Beaches | 13 | 0 | 13 | 100% | 0 | 13 | 100% | 0 | 13 | 100% |
| Boat Ramps | 65 | 65 | 0 | 0% | 28 | 37 | 57% | 0 | 65 | 100% |
| Marinas | 7 | 7 | 0 | 0% | 5 | 2 (D) | 29% | 3 | 4 (E) | 57% |
| Wet Moorage at Marinas | 919 | 919 | 0 | 0% | 769 | 150 | 16% | 229 | 690 | 75% |
| Private Docks | 350 | 325 | 25 | 7% | 22 | 328 | 94% | 5 | 345 | 99% |
| Public Water Intakes | 8 | 8 | 0 | 0% | 8 | 0 | 0% | 7 | 1 (F) | 13% |
| Industrial Water Intakes | 1 | 1 | 0 | 0% | 1 | 0 | 0% | 0 | 1(F) | 100% |
| Water Surface Acreage | 57,920 | 52,400 | 5,520 | 10% | 45,250 | 12,670 | 22% | 40,000 | 17,920 | 31% |

III - 22

LAKE BARKLEY
IMPACTS OF LAKE LEVELS ON RECREATION AND NATURAL RESOURCES

FOOTNOTES:

- A. Initial Impacts - The level where recreation and natural resources management impacts are first observed: some ramps are unusable, most beaches are unusable or minimally usable, and/or navigation hazards begin to surface.
- B. Major Impacts - The level where significant impact would occur: water or boating access would be significantly limited, a significant number of boat ramps would be unusable, major navigation hazards occur, channels to marinas would become impassable and/or slips would have to be relocated, exposed mud or rock bottom surfaces would make water access from recreation areas inaccessible, a majority of privately permitted boat docks would be unusable or relocated, and all swimming beaches are unusable.
- C. Severe Impacts - The level where a majority of recreation facilities are virtually out of business: all or almost all boat ramps are closed, all swimming beaches are closed, major navigation hazards severely limit lake use, channels to marinas are impassable, and slips are unusable, and a majority of the privately permitted boat docks are unusable.
- D. N/A
- E. Kuttawa Marina, Bumpus Mills Marina, Green Turtle Bay Marina, and Prisor Point Marina
- F. Eddyville and Tennessee Valley Authority (Cumberland)

3.7 Water Quality.

3.7.1. Lake Barkley is a main stem, near run-of-the-river impoundment. The mean depth at the power pool elevation (359.0) is 15 feet. The average annual discharge from the dam is 33,912 cfs, resulting in a theoretical detention time of about six days. Typical of run-of-the-river impoundments, the upstream zone of Lake Barkley is essentially riverine. The main channel is usually well mixed, with no stratification evident. A gradual transition is made to more lacustrine conditions, as the lake spreads out over a widening flood plain and forms more extensive embayments.

3.7.2. Discharges from Cheatham Dam provide the primary inflow to Lake Barkley. Local inflow streams include Red River, Little River, and numerous smaller tributaries. Tributary embayments have a longer hydraulic detention time and are relatively isolated from the main channel. Therefore, most embayments exhibit water quality that is markedly different from that found in the main channel.

3.7.3. Inflows from Cheatham are generally nutrient rich, having received substantial waste loadings from Nashville and areas upstream. Most local inflows drain relatively fertile, predominantly agricultural areas which contribute large quantities of nutrients and sediment to Lake Barkley. As a result, primary productivity is generally high, but especially so in enriched embayments. Thermal and dissolved oxygen (DO) stratification are evident to a much greater degree in embayments than in the main channel. Low flow conditions occasionally favor weak, temporary stratification with concomitant reductions in hypolimnetic DO in the downstream, more lacustrine portion of Lake Barkley. Distinct slugs of low DO water have occasionally been noted moving through Lake Barkley.

3.7.4. A navigation canal connects Lake Barkley on the Cumberland River with Kentucky Lake on the Tennessee River. The Barkley Canal enters the Lake Barkley pool at Cumberland River Mile 32.8. At pool elevation 354.0 feet the canal has a minimum depth of 11 feet. As a consequence of the canal connection, Lake Barkley and Kentucky Lake operate in a unified fashion. Direction of flow movement through the canal is dependent upon the individual operation of the Barkley and Kentucky projects. The preference is to route water from Kentucky to Barkley to take advantage of the newer, more efficient hydropower units in Barkley Dam. The canal acts to skim higher quality water from the upper layers of the Kentucky pool when net flows enter Barkley. This usually enhances mixing in the Barkley forebay producing slight increases in hypolimnetic and outflow dissolved oxygen concentrations.

3.7.5. The Tennessee Valley Authority (TVA) operates the Cumberland Fossil

Plant which withdraws cooling water from Lake Barkley at Cumberland River Mile 103.5. The Cumberland Fossil Plant is a two unit, 2600 megawatt, coal-fired, electrical generating facility. Cooling water is withdrawn from Lake Barkley, circulated once through the plant and discharged into a canal to reenter the Cumberland River. The plant can use up to 4,320 cfs for circulating cooling water and discharge water can be warmed as much as 6.6°C.

3.8 Fish and Wildlife.

3.8.1. The primary concern for regulating this reservoir project for the fishery is during the fish spawning period as discussed earlier in paragraph 2.6.1. Both Lake Barkley and the tailwater support an excellent fishery. Commercial species include the buffaloes, paddle fish, carp and catfish. The primary game fish in the lake include largemouth bass, smallmouth bass, Kentucky or spotted bass, white and black crappie, bluegill, white bass, striped bass (rockfish), and catfish. The tailwater area provides excellent conditions for crappie, white bass, striped bass (rock fish) and catfish. Catfish are also numerous in the navigation canal. Even though fishing is the number two recreational activity at the lake, studies indicate that the fishing pressure does not seem to be too great and annual fishery growth rates are relatively good. Lake Barkley has a reputation for producing exceptionally large size and numbers of crappie.

3.8.2. Lake Barkley supports a substantial and growing commercial mussel fishery, particularly in the Kentucky portion of the impoundment. The abundance of shallow habitat and high primary productivity results in Lake Barkley's very productive fin fishery. The Kentucky Department of Fish and Wildlife Resources has placed numerous fish attractors in the portion of Lake Barkley within their jurisdiction. Beds of aquatic macrophytes, principally Eurasian watermilfoil and *Potamogeton spp.*, appeared during the late 1980's and still persist, but have not reached nuisance levels. Significant federally owned wildlife and/or recreational areas adjacent to Lake Barkley include Cross Creeks National Wildlife Refuge (US Fish and Wildlife Service), Land Between the Lakes National Recreation Area and International Biosphere Reserve (Tennessee Valley Authority), and Fort Donelson National Military Park (National Park Service).

3.9. Water Supply. Although water supply is not an authorized project purpose at any Nashville District project, all but one of them are used by municipalities for this purpose. Of these, Lake Barkley is the third most intensively used for water supply. In 1990 it was estimated that this project serves as the water supply source for almost

120,000 people through eight water systems which directly access the lake and through 11 additional systems which purchase water from those systems with direct access. The eight direct access systems withdraw approximately 21 cfs from Lake Barkley. A significant portion of this amount is returned to the Cumberland River via sewage treatment plant discharges. Pertinent information on these eight municipal systems is presented on Plate III-18.

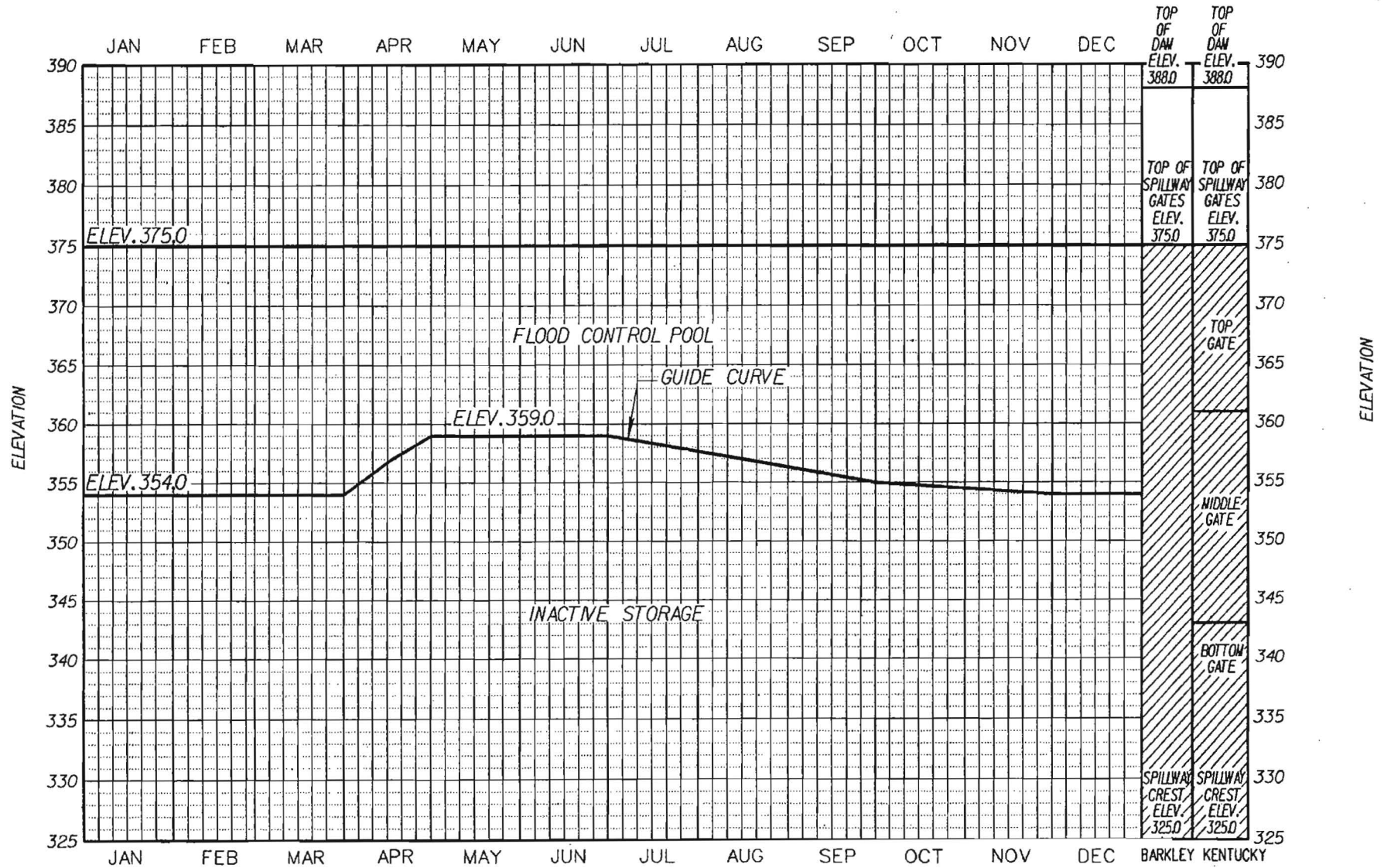
LAKE BARKLEY WATER SUPPLY INTAKES

| SYSTEM | STATE | | RIVER | | EMBAYMENT | | INLET | | | SERVICES | |
|-------------------------|-------|------------|------------|--------------|-------------------|--------------|----------------|--------------|----------------|----------|--------|
| | | COUNTY | NAME | BANK MILE | NAME | BANK MILE | (ins.) DIA. | TOP ELEV. | OPER. ELEV. | NUM. | POP. |
| Kuttawa | KY | Lyon | Cumberland | [REDACTED] | | | 3@12 | [REDACTED] | [REDACTED] | 360 | 550 |
| Eddyville | KY | Lyon | Cumberland | [REDACTED] | Knob Creek Branch | 0.6 | 6 | [REDACTED] | [REDACTED] | 788 | 2,360 |
| Princeton | KY | Lyon | Cumberland | [REDACTED] | | | 16 | [REDACTED] | [REDACTED] | 3,300 | 8,500 |
| Barkley Lake WD | KY | Trigg | Cumberland | [REDACTED] | Hopson Creek | 1 | 8 | [REDACTED] | [REDACTED] | 3,000 | 9,000 |
| Dover | TN | Stewart | Cumberland | [REDACTED] | | | 4 | [REDACTED] | [REDACTED] | 800 | 2,079 |
| Erin | TN | Houston | Cumberland | [REDACTED] | | | 8 | [REDACTED] | [REDACTED] | 1,300 | 3,679 |
| Clarksville | TN | Montgomery | Cumberland | [REDACTED] | | | 36 | [REDACTED] | [REDACTED] | 23,720 | 70,000 |
| Cunningham-East Montgom | TN | Montgomery | Cumberland | [REDACTED] | | | 20 | [REDACTED] | [REDACTED] | | |

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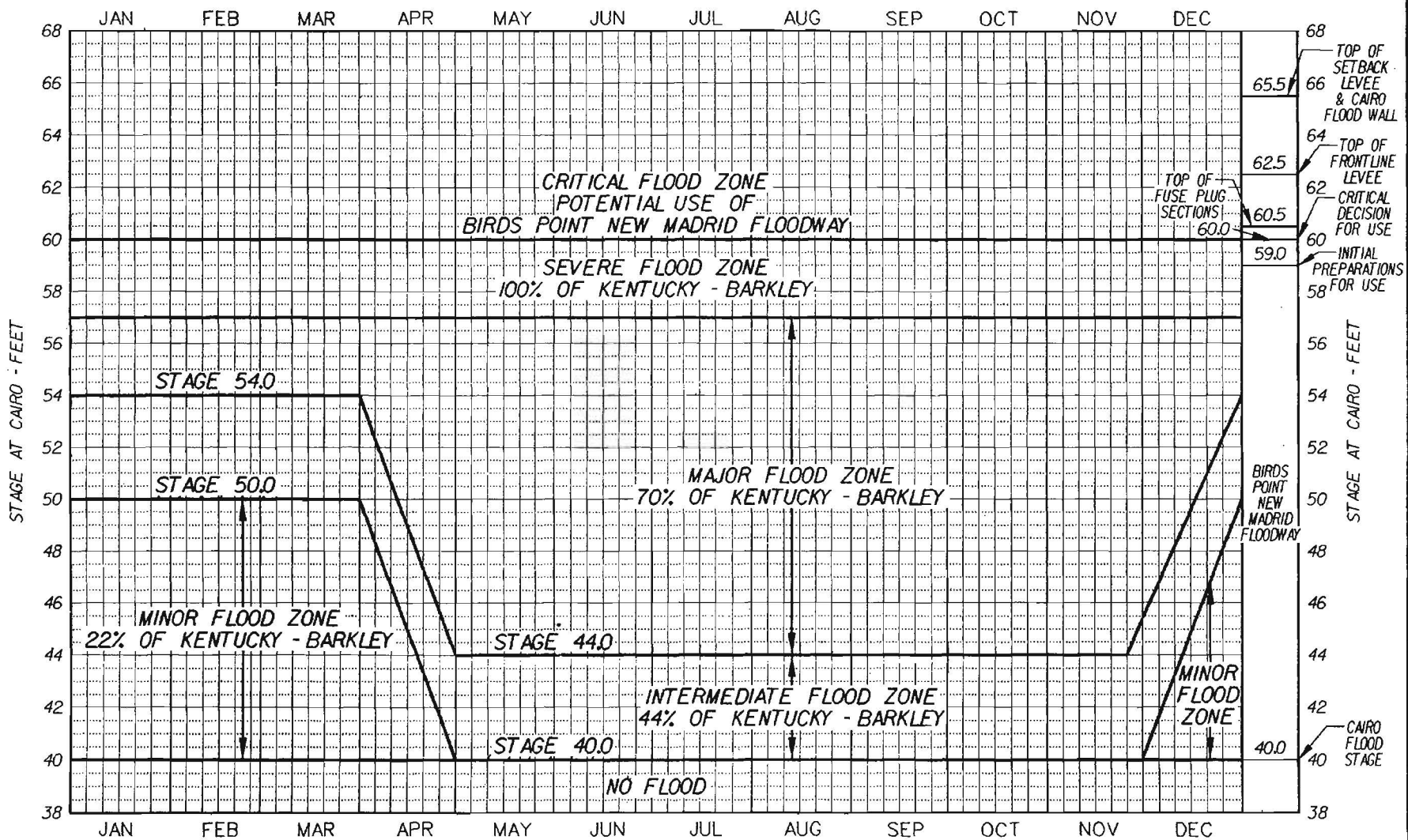
| SYSTEM | PRODUCTION (gpd) | | SURVEY DATE | PLANT PHONE NUMBER | PHONE NUMBER | OFFICE | |
|-------------------------|------------------|--------------------|----------------|--------------------------|-----------------|------------|-------------------------|
| | AVERAGE DAILY | DESIGN CAPACITY | | | | NAME | TITLE |
| Kuttawa | 200,000 | | 5/07/90 | [REDACTED] | [REDACTED] | [REDACTED] | City Clerk |
| Eddyville | 280,000 | 357,000 | 5/07/90 | [REDACTED] | [REDACTED] | [REDACTED] | Water Superintendent |
| Princeton | 850,000 | 2,000,000 | 5/07/90 | [REDACTED] | [REDACTED] | [REDACTED] | Water Superintendent |
| Barkley Lake WD | 1,000,000 | 2,000,000 | 5/07/90 | [REDACTED] | [REDACTED] | [REDACTED] | |
| Dover | 200,000 | 280,000 | 5/07/90 | [REDACTED] | [REDACTED] | [REDACTED] | City Manager |
| Erin | 500,000 | 748,800 | 5/07/90 | [REDACTED] | [REDACTED] | [REDACTED] | Supervisor of Utilities |
| Clarksville | 10,800,000 | 16,000,000 | 5/07/90 | [REDACTED] | [REDACTED] | [REDACTED] | City Engineer |
| Cunningham-East Montgom | U.C. | 4,000,000 | 6/15/90 | [REDACTED] | [REDACTED] | [REDACTED] | |

BARKLEY PROJECT GUIDE CURVE



U.S. ARMY CORPS OF ENGINEERS
NASHVILLE DISTRICT

BARKLEY DAM GUIDE FOR FLOOD STORAGE COMMITMENT (BASED ON CAIRO GAGE)



U.S. ARMY CORPS OF ENGINEERS
NASHVILLE DISTRICT

LAKE BARKLEY
CUMBERLAND RIVER, KENTUCKY AND TENNESSEE
AREA AND VOLUME TABLE
(Mile 30.6 to Mile 148.7)

| ELEV. M.S.L. | AREA Acres | VOLUME Acre Feet | VOLUME DSF | ELEV. M.S.L. | AREA Acres | VOLUME Acre Feet | VOLUME DSF | ELEV. M.S.L. | AREA Acres | VOLUME Acre Feet | VOLUME DSF |
|-----------------|---------------|---------------------|---------------|-----------------|---------------|---------------------|---------------|-----------------|---------------|---------------------|---------------|
| 230 | 0 | 0 | 0 | 235 | 16 | 237 | 119 | 240 | 1,690 | 15,100 | 7,510 |
| 1 | * | * | * | 6 | 17 | 253 | 128 | 1 | 1,820 | 16,900 | 8,520 |
| 2 | * | * | * | 7 | 18 | 270 | 136 | 2 | 1,960 | 18,800 | 9,480 |
| 3 | * | 1 | 1 | 8 | 19 | 289 | 146 | 3 | 2,100 | 20,800 | 10,500 |
| 4 | 1 | 2 | 1 | 9 | 20 | 308 | 155 | 4 | 2,240 | 23,000 | 11,600 |
| 235 | 1 | 4 | 2 | 270 | 21 | 328 | 165 | 505 | 2,380 | 25,300 | 12,800 |
| 6 | 2 | 5 | 3 | 1 | 24 | 350 | 176 | 6 | 2,510 | 27,700 | 14,000 |
| 7 | 2 | 7 | 4 | 2 | 27 | 376 | 190 | 7 | 2,640 | 30,300 | 15,300 |
| 8 | 2 | 9 | 5 | 3 | 31 | 404 | 204 | 8 | 2,760 | 33,000 | 16,600 |
| 9 | 2 | 11 | 6 | 4 | 35 | 437 | 220 | 9 | 2,890 | 35,800 | 18,000 |
| 240 | 2 | 13 | 7 | 275 | 41 | 475 | 239 | 310 | 3,010 | 38,800 | 19,600 |
| 1 | 3 | 16 | 8 | 6 | 47 | 519 | 262 | 1 | 3,130 | 41,800 | 21,100 |
| 2 | 4 | 19 | 10 | 7 | 54 | 570 | 287 | 2 | 3,250 | 45,000 | 22,700 |
| 3 | 4 | 23 | 12 | 8 | 62 | 628 | 317 | 3 | 3,380 | 48,400 | 24,400 |
| 4 | 5 | 28 | 14 | 9 | 74 | 696 | 351 | 4 | 3,510 | 51,800 | 26,100 |
| 245 | 5 | 33 | 17 | 280 | 87 | 777 | 392 | 315 | 3,650 | 55,400 | 27,900 |
| 6 | 6 | 38 | 19 | 1 | 109 | 875 | 441 | 6 | 3,790 | 59,100 | 29,800 |
| 7 | 6 | 44 | 22 | 2 | 135 | 997 | 503 | 7 | 3,930 | 63,000 | 31,800 |
| 8 | 7 | 51 | 26 | 3 | 166 | 1,150 | 580 | 8 | 4,070 | 67,000 | 33,800 |
| 9 | 7 | 57 | 29 | 4 | 210 | 1,340 | 676 | 9 | 4,230 | 71,100 | 35,800 |
| 250 | 8 | 65 | 33 | 285 | 264 | 1,570 | 792 | 320 | 4,390 | 75,400 | 38,000 |
| 1 | 8 | 72 | 36 | 6 | 336 | 1,870 | 943 | 1 | 4,590 | 79,900 | 40,300 |
| 2 | 8 | 80 | 40 | 7 | 417 | 2,250 | 1,130 | 2 | 4,820 | 84,600 | 42,700 |
| 3 | 9 | 89 | 45 | 8 | 507 | 2,710 | 1,370 | 3 | 5,060 | 89,600 | 45,200 |
| 4 | 9 | 98 | 49 | 9 | 594 | 3,260 | 1,640 | 4 | 5,320 | 94,700 | 47,700 |
| 255 | 10 | 108 | 54 | 290 | 678 | 3,900 | 1,970 | 325 | 5,580 | 100,200 | 50,500 |
| 6 | 10 | 118 | 59 | 1 | 754 | 4,610 | 2,320 | 6 | 5,850 | 105,900 | 53,400 |
| 7 | 11 | 129 | 65 | 2 | 831 | 5,400 | 2,720 | 7 | 6,140 | 111,900 | 56,400 |
| 8 | 12 | 140 | 71 | 3 | 911 | 6,280 | 3,170 | 8 | 6,450 | 118,200 | 59,600 |
| 9 | 12 | 152 | 77 | 4 | 994 | 7,230 | 3,650 | 9 | 6,780 | 124,800 | 62,900 |
| 260 | 13 | 165 | 83 | 295 | 1,080 | 8,270 | 4,170 | 330 | 7,130 | 131,800 | 66,400 |
| 1 | 14 | 178 | 90 | 6 | 1,180 | 9,400 | 4,740 | 1 | 7,510 | 139,100 | 70,100 |
| 2 | 14 | 192 | 97 | 7 | 1,300 | 10,600 | 5,340 | 2 | 7,950 | 146,800 | 74,000 |
| 3 | 15 | 207 | 104 | 8 | 1,430 | 12,000 | 6,050 | 3 | 8,420 | 155,000 | 78,100 |
| 4 | 15 | 221 | 111 | 9 | 1,560 | 13,500 | 6,810 | 4 | 8,940 | 163,700 | 82,500 |
| 265 | 16 | 237 | 119 | 300 | 1,690 | 15,100 | 7,510 | 335 | 9,530 | 172,900 | 87,200 |

* Less than 1

LAKE BARKLEY
CUMBERLAND RIVER, KENTUCKY AND TENNESSEE
AREA AND VOLUME TABLE
(Mile 30.6 to Mile 148.7)

| ELEV. M.S.L. | AREA Areas | VOLUME Acre Feet | VOLUME DSF | ELEV. M.S.L. | AREA Areas | VOLUME Acre Feet | VOLUME DSF | ELEV. M.S.L. | AREA Areas | VOLUME Acre Feet | VOLUME DSF |
|-----------------|---------------|---------------------|---------------|-----------------|---------------|---------------------|---------------|-----------------|---------------|---------------------|---------------|
| 335 | 9,590 | 172,000 | 87,500 | 350 | 43,500 | 453,000 | 228,400 | 365 | 71,320 | 1,257,100 | 633,800 |
| 6 | 10,180 | 182,800 | 92,200 | 1 | 36,300 | 487,900 | 246,000 | 6 | 73,520 | 1,329,500 | 670,300 |
| 7 | 10,910 | 193,300 | 97,500 | 2 | 39,240 | 525,600 | 265,000 | 7 | 75,750 | 1,404,200 | 708,000 |
| 8 | 11,710 | 204,600 | 103,200 | 3 | 42,280 | 566,400 | 285,600 | 8 | 78,020 | 1,481,000 | 746,700 |
| 9 | 12,630 | 216,800 | 109,300 | 4 | 45,210 | 610,100 | 307,600 | 9 | 80,320 | 1,560,200 | 786,600 |
| 340 | 13,680 | 230,000 | 116,000 | 355 | 48,010 | 656,800 | 331,100 | 370 | 82,580 | 1,641,600 | 827,600 |
| 1 | 14,950 | 244,300 | 123,200 | 6 | 50,560 | 706,000 | 355,900 | 1 | 84,770 | 1,725,300 | 869,800 |
| 2 | 16,380 | 259,900 | 131,000 | 7 | 53,070 | 757,900 | 382,100 | 2 | 86,970 | 1,811,200 | 913,100 |
| 3 | 17,980 | 277,100 | 139,700 | 8 | 55,530 | 812,200 | 409,500 | 3 | 89,190 | 1,899,300 | 957,600 |
| 4 | 19,700 | 296,000 | 149,200 | 9 | 57,920 | 868,900 | 438,100 | 4 | 91,340 | 1,989,500 | 1,003,000 |
| 345 | 21,560 | 316,600 | 159,600 | 360 | 60,270 | 928,000 | 467,900 | 375 | 93,430 | 2,081,900 | 1,049,600 |
| 6 | 23,660 | 339,200 | 171,000 | 1 | 62,510 | 989,400 | 498,800 | | | | |
| 7 | 25,930 | 364,000 | 183,500 | 2 | 64,740 | 1,053,000 | 530,900 | | | | |
| 8 | 28,370 | 391,100 | 197,200 | 3 | 66,940 | 1,118,800 | 564,100 | | | | |
| 9 | 30,890 | 420,800 | 212,200 | 4 | 69,140 | 1,186,900 | 598,400 | | | | |
| 350 | 33,500 | 453,000 | 228,400 | 365 | 71,320 | 1,257,100 | 633,800 | | | | |

Note: Areas and volumes determined by Nashville District Corps of Engineers in 1957 from Lake Barkley maps using stereophotogrammetric plotting instruments; flown in 1957; scale 1:6000; contour interval 5 feet; datum, MSL 1929 Gen. Adj. Areas below normal navigation pools, B, C, D, E, F and Ohio River 52, were determined from 1930 Cumberland River Survey cross sections. Capacity determined by arithmetical integration of level pool areas at one-foot increments. Area and capacity data are available for one-mile reaches.

DISCHARGE RATING TABLE

| Cumberland River near Grand Rivers, KY 03438220 Rating No. 9.0 (10/1/93) | | | |
|---|-----------------|--------------------|-----------------|
| Gage Height (feet) | Discharge (cfs) | Gage Height (feet) | Discharge (cfs) |
| 1.5 | 100.0 * | 27.0 | 91,660 |
| 1.6 | 222.1 | 28.0 | 96,060 |
| 1.7 | 470.0 * | 29.0 | 100,500 |
| 1.8 | 867.8 | 30.0 | 105,000 * |
| 1.9 | 1,550 • | 31.0 | 109,500 |
| 2.0 | 2,500 * | 32.0 | 114,100 |
| 2.1 | 3,637 | 33.0 | 118,700 |
| 2.2 | 5,200 • | 34.0 | 123,300 |
| 2.3 | 6,400 * | 35.0 | 128,000 * |
| 2.4 | 7,200 * | 36.0 | 133,300 |
| 2.5 | 7,850 * | 37.0 | 138,600 |
| 2.6 | 8,400 * | 38.0 | 144,000 |
| 2.7 | 8,823 | 39.0 | 149,500 |
| 2.8 | 9,250 * | 40.0 | 155,000 * |
| 2.9 | 9,624 | 41.0 | 160,300 |
| 3.0 | 10,000 * | 42.0 | 165,700 |
| 3.5 | 11,500 * | 43.0 | 171,100 |
| 4.0 | 13,000 • | 44.0 | 176,500 |
| 5.0 | 15,300 * | 45.0 | 182,000 * |
| 6.0 | 17,800 * | 46.0 | 187,500 |
| 7.0 | 20,400 * | 47.0 | 193,100 |
| 8.0 | 23,000 * | 48.0 | 198,700 |
| 9.0 | 26,000 * | 49.0 | 204,300 |
| 10.0 | 29,200 * | 50.0 | 210,000 * |
| 11.0 | 32,340 | | |
| 12.0 | 35,500 * | | |
| 13.0 | 38,960 | | |
| 14.0 | 42,460 | | |
| 15.0 | 46,000 * | | |
| 16.0 | 49,470 | | |
| 17.0 | 52,970 | | |
| 18.0 | 56,500 * | | |
| 19.0 | 60,290 | | |
| 20.0 | 64,130 | | |
| 21.0 | 68,000 * | | |
| 22.0 | 71,710 | | |
| 23.0 | 75,450 | | |
| 24.0 | 79,220 | | |
| 25.0 | 83,000 * | | |
| 26.0 | 87,310 | | |

* Values which were included in USGS rating table. All other values were interpolated.

RATING TABLE

| Barkley-Kentucky Canal near Grand Rivers, KY 03438190 Rating No. 5.0 (10/1/89) | |
|---|----------------|
| Deflection | Velocity (fps) |
| 0.0 | -8.000 * |
| 0.5 | -8.000 |
| 1.0 | -8.000 |
| 1.5 | -8.000 |
| 2.0 | -8.000 |
| 2.5 | -7.228 |
| 3.0 | -5.850 * |
| 3.5 | -4.460 |
| 4.0 | -3.070 * |
| 4.5 | -1.680 * |
| 4.8 | -0.880 * |
| 4.9 | -0.580 * |
| 5.0 | 0.000 * |
| 5.1 | 0.600 * |
| 5.2 | 0.840 * |
| 5.4 | 1.270 * |
| 5.5 | 1.485 |
| 5.6 | 1.700 * |
| 5.8 | 2.170 * |
| 6.0 | 2.680 * |
| 6.5 | 4.000 * |
| 7.0 | 5.500 * |
| 7.5 | 6.874 |
| 8.0 | 8.000 |
| 8.5 | 8.000 |
| 9.0 | 8.000 |
| 9.5 | 8.000 |
| 10.0 | 8.000 * |
| + = Barkley to Kentucky - = Kentucky to Barkley | |
| * Values which were included in USGS rating table. All other values were interpolated. | |

DISCHARGE RATING TABLE

| Little River near Cadiz, KY 03438000 Rating No. 18.0 (10/1/93) | |
|---|-----------------|
| Gage Height (feet) | Discharge (cfs) |
| 2.2 | 5.30 * |
| 2.3 | 11.00 |
| 2.4 | 18.45 |
| 2.5 | 27.57 |
| 2.6 | 38.28 |
| 2.7 | 50.52 |
| 2.8 | 64.25 |
| 2.9 | 79.42 |
| 3.0 | 96 * |
| 3.5 | 198 * |
| 4.0 | 330 * |
| 4.5 | 490 * |
| 5.0 | 670 * |
| 6.0 | 1,090 * |
| 7.0 | 1,518 |
| 8.0 | 1,990 * |
| 9.0 | 2,502 |
| 10.0 | 3,050 * |
| 11.0 | 3,656 |
| 12.0 | 4,300 * |
| 13.0 | 4,900 * |
| 14.0 | 5,631 |
| 15.0 | 6,400 * |
| 16.0 | 7,276 |
| 17.0 | 8,200 * |
| 18.0 | 9,541 |
| 19.0 | 11,000 * |
| 20.0 | 12,500 * |
| 21.0 | 14,500 * |
| 22.0 | 18,100 * |
| 22.5 | 20,400 * |

* Values which were included in USGS rating table.
All other values were interpolated.

DISCHARGE RATING TABLE

| Yellow Creek at Ellis Mills, TN 03436690 Rating No. 20 (5/6/84) | | | |
|--|-----------------|--------------------|-----------------|
| Gage Height (feet) | Discharge (cfs) | Gage Height (feet) | Discharge (cfs) |
| 3.2 | 2.7 * | 16.0 | 9,800 * |
| 3.3 | 6.0 * | 16.5 | 10,650 |
| 3.4 | 11.0 * | 17.0 | 11,550 |
| 3.5 | 17.5 * | 17.5 | 12,500 * |
| 3.6 | 25 * | 18.0 | 13,400 * |
| 3.7 | 35 * | 18.5 | 14,500 * |
| 3.8 | 45 * | | |
| 3.9 | 55 * | | |
| 4.0 | 70 * | | |
| 4.1 | 85 * | | |
| 4.2 | 100 * | | |
| 4.3 | 120 * | | |
| 4.4 | 140 * | | |
| 4.5 | 160 * | | |
| 4.6 | 180 * | | |
| 4.7 | 210 * | | |
| 4.8 | 240 * | | |
| 4.9 | 270 * | | |
| 5.0 | 300 * | | |
| 5.5 | 450 * | | |
| 6.0 | 650 * | | |
| 6.5 | 875 * | | |
| 7.0 | 1,150 * | | |
| 7.5 | 1,425 * | | |
| 8.0 | 1,700 * | | |
| 8.5 | 1,975 * | | |
| 9.0 | 2,250 * | | |
| 9.5 | 2,550 * | | |
| 10.0 | 2,900 * | | |
| 10.5 | 3,308 | | |
| 11.0 | 3,750 * | | |
| 11.5 | 4,209 | | |
| 12.0 | 4,700 * | | |
| 12.5 | 5,186 | | |
| 13.0 | 5,700 * | | |
| 13.5 | 6,250 * | | |
| 14.0 | 6,881 | | |
| 14.5 | 7,550 * | | |
| 15.0 | 8,250 * | | |
| 15.5 | 9,000 * | | |

* Values which were included in USGS rating table. All other values were interpolated.

DISCHARGE RATING TABLE

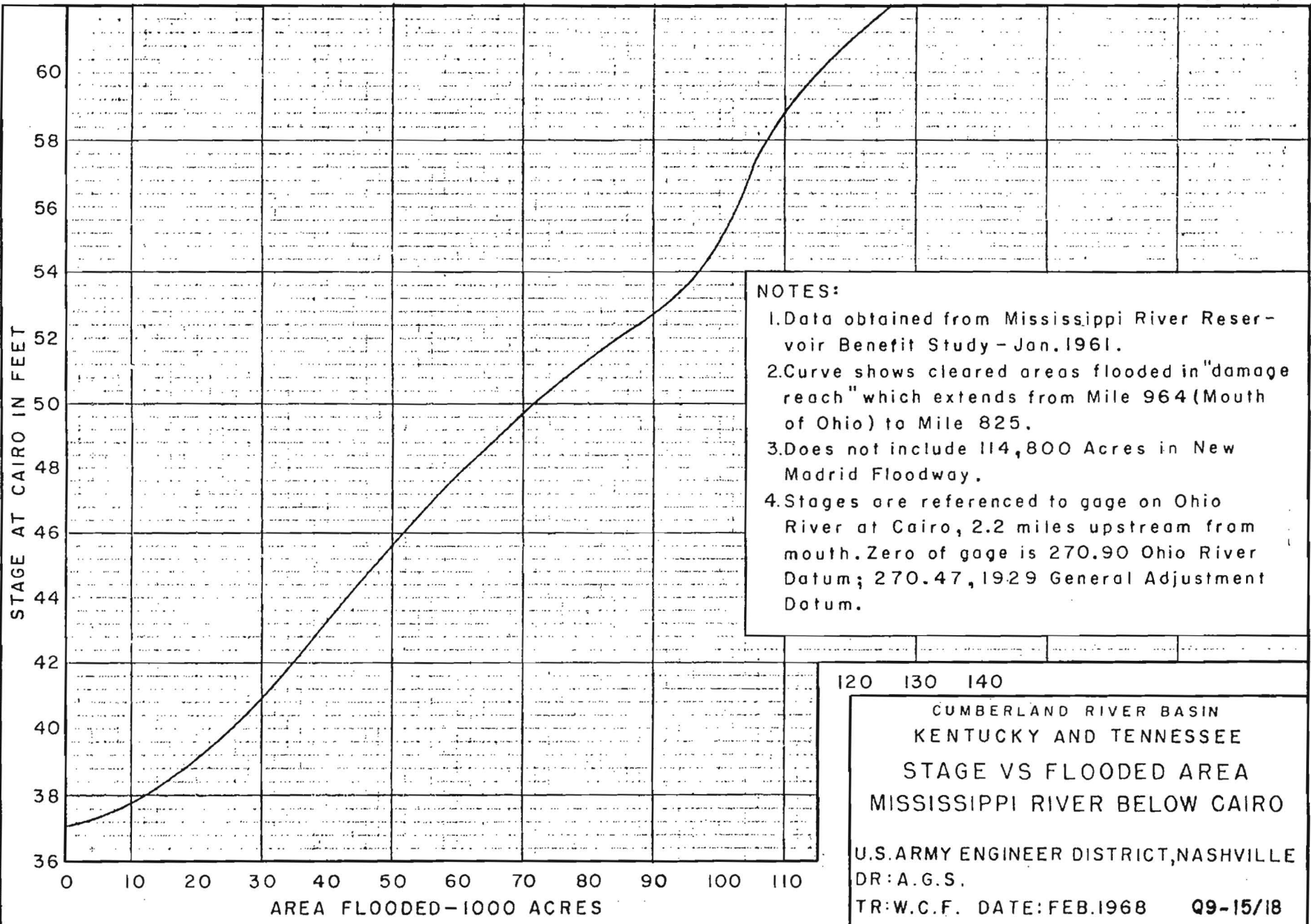
| Red River at Port Royal, TN 03436100 Rating No. 13 (10/1/89) | | | | | |
|---|-----------------|-----------------------|-----------------|-----------------------|-----------------|
| Gage Height (feet) | Discharge (cfs) | Gage Height (feet) | Discharge (cfs) | Gage Height (feet) | Discharge (cfs) |
| 3.9 | 27.00 * | 14.5 | 5,290 | 34.0 | 23,810 |
| 4.0 | 40.06 | 15.0 | 5,554 | 34.5 | 24,710 |
| 4.1 | 57.24 | 15.5 | 5,820 | 35.0 | 25,640 |
| 4.2 | 79.29 | 16.0 | 6,088 | 35.5 | 26,580 |
| 4.3 | 107.0 * | 16.5 | 6,357 | 36.0 | 27,550 |
| 4.4 | 136.0 | 17.0 | 6,627 | 36.5 | 28,530 |
| 4.5 | 170.0 * | 17.5 | 6,899 | 37.0 | 29,540 |
| 4.6 | 210.0 * | 18.0 | 7,172 | 37.5 | 30,560 |
| 4.7 | 252.3 | 18.5 | 7,447 | 38.0 | 31,610 |
| 4.8 | 300.0 * | 19.0 | 7,723 | 38.5 | 32,670 |
| 4.9 | 347.7 | 19.5 | 8,000 * | 39.0 | 33,760 |
| 5.0 | 400.0 * | 20.0 | 8,315 | 39.5 | 34,860 |
| 5.1 | 445.0 * | 20.5 | 8,632 | 40.0 | 35,990 |
| 5.2 | 495.0 * | 21.0 | 8,952 | 40.5 | 37,130 |
| 5.3 | 555.0 * | 21.5 | 9,275 | 41.0 | 38,300 * |
| 5.4 | 610.0 * | 22.0 | 9,600 * | 41.5 | 39,620 |
| 5.5 | 670.0 * | 22.5 | 10,020 | 42.0 | 40,970 |
| 5.6 | 730.0 * | 23.0 | 10,440 | 42.5 | 42,350 |
| 5.7 | 780.0 * | 23.5 | 10,870 | 43.0 | 43,760 |
| 5.8 | 829.4 | 24.0 | 11,310 | 43.5 | 45,190 |
| 5.9 | 880.0 * | 24.5 | 11,750 | 44.0 | 46,660 |
| 6.0 | 940.0 * | 25.0 | 12,200 * | 44.5 | 48,150 |
| 6.5 | 1,170 * | 25.5 | 12,640 | 45.0 | 49,670 |
| 7.0 | 1,430 * | 26.0 | 13,090 | 45.5 | 51,220 |
| 7.5 | 1,640 | 26.5 | 13,540 | 46.0 | 52,800 * |
| 7.7 | 1,725 * | 27.0 | 14,000 * | 46.5 | 54,420 |
| 8.0 | 1,920 * | 27.5 | 14,560 | 47.0 | 56,080 |
| 8.5 | 2,160 * | 28.0 | 15,130 | 47.5 | 57,760 |
| 9.0 | 2,408 | 28.5 | 15,710 | 48.0 | 59,480 |
| 9.5 | 2,662 | 29.0 | 16,300 * | 48.5 | 61,220 |
| 10.0 | 2,921 | 29.5 | 16,980 | 49.0 | 63,000 * |
| 10.5 | 3,184 | 30.0 | 17,670 | | |
| 11.0 | 3,452 | 30.5 | 18,370 | | |
| 11.5 | 3,724 | 31.0 | 19,090 | | |
| 12.0 | 4,000 * | 31.5 | 19,830 | | |
| 12.5 | 4,250 * | 32.0 | 20,580 | | |
| 13.0 | 4,507 | 32.5 | 21,350 | | |
| 13.5 | 4,766 | 33.0 | 22,130 | | |
| 14.0 | 5,027 | 33.5 | 22,920 * | | |

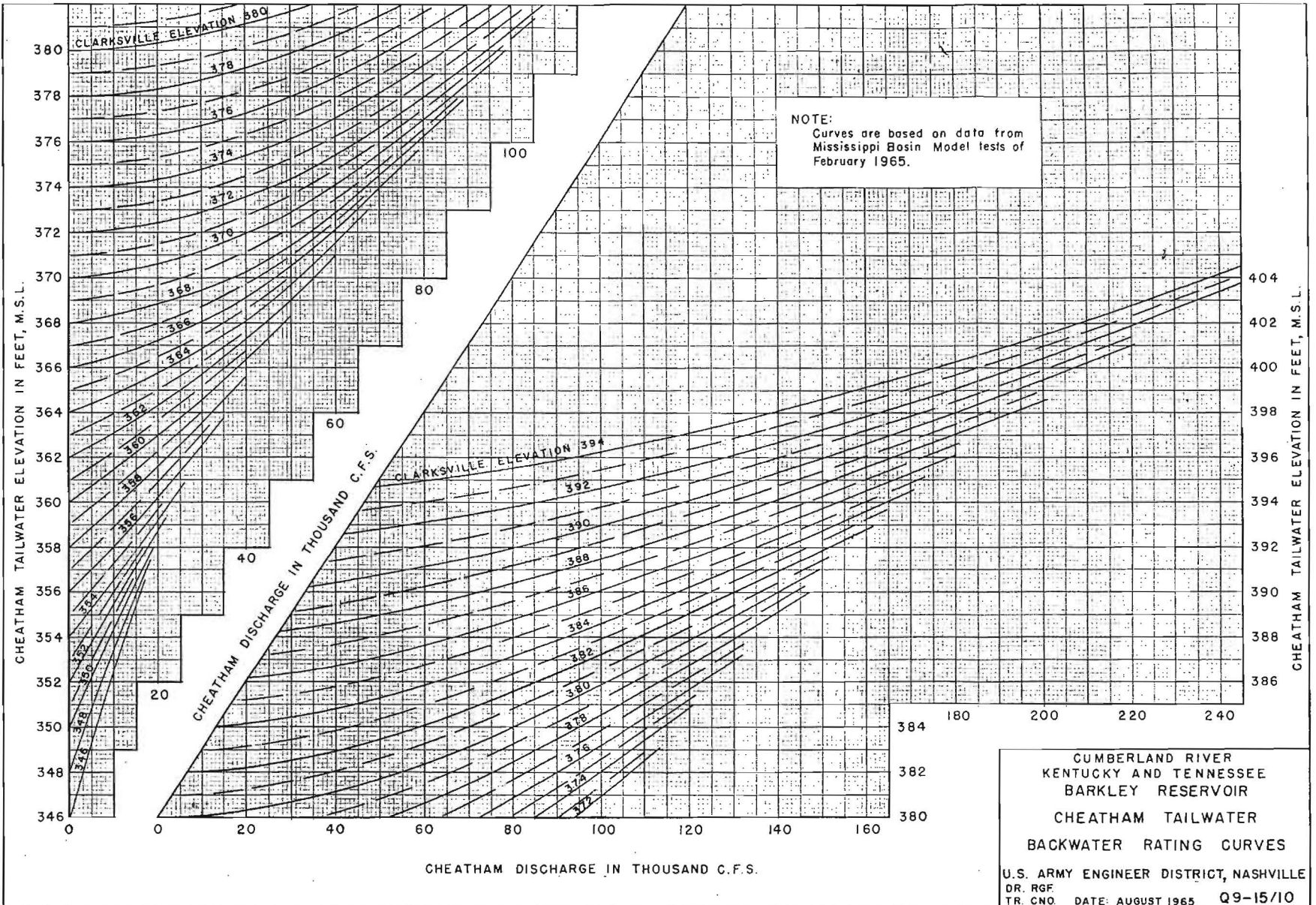
* Values which were included in USGS rating table. All other values were interpolated.

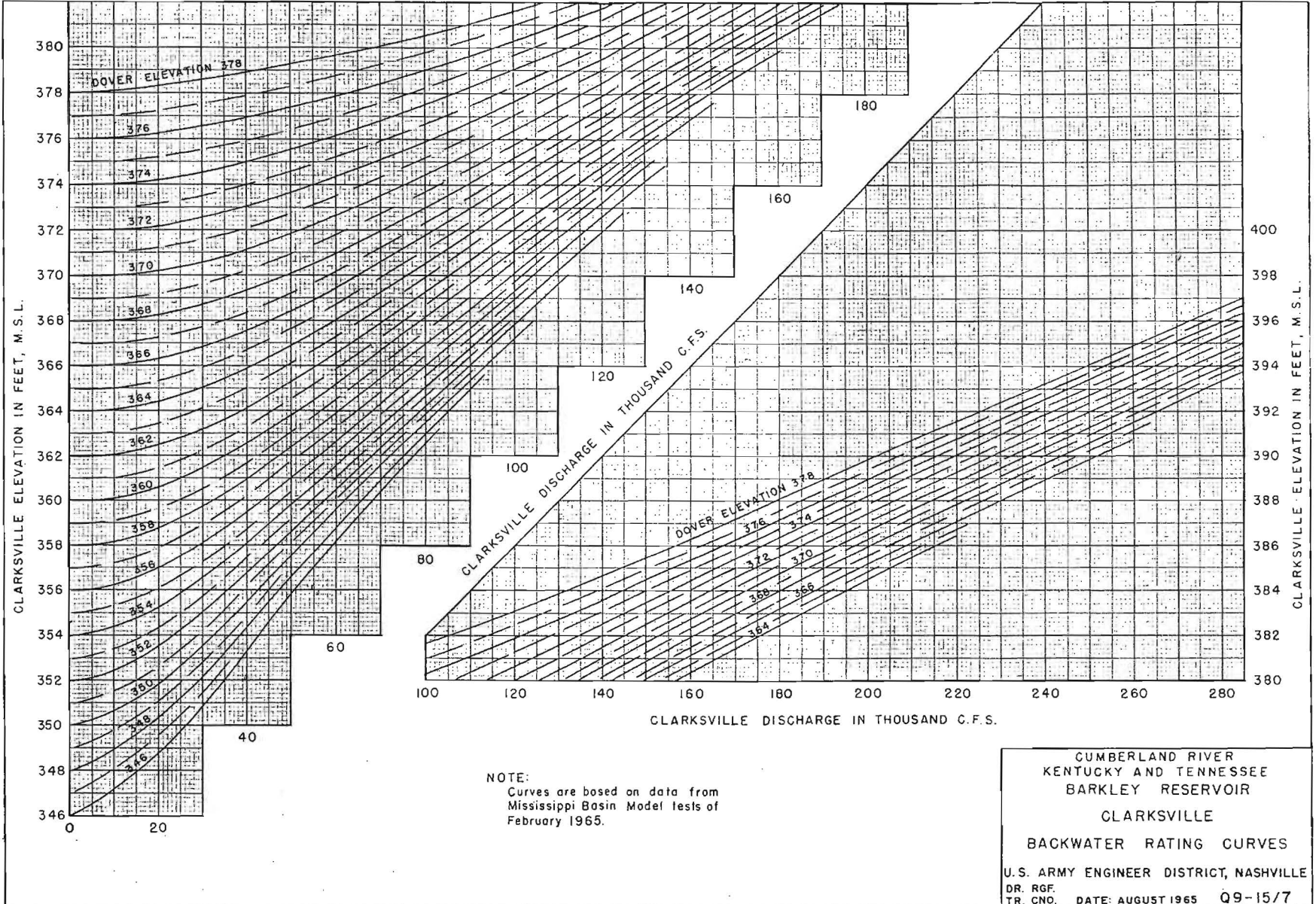
DISCHARGE RATING TABLE

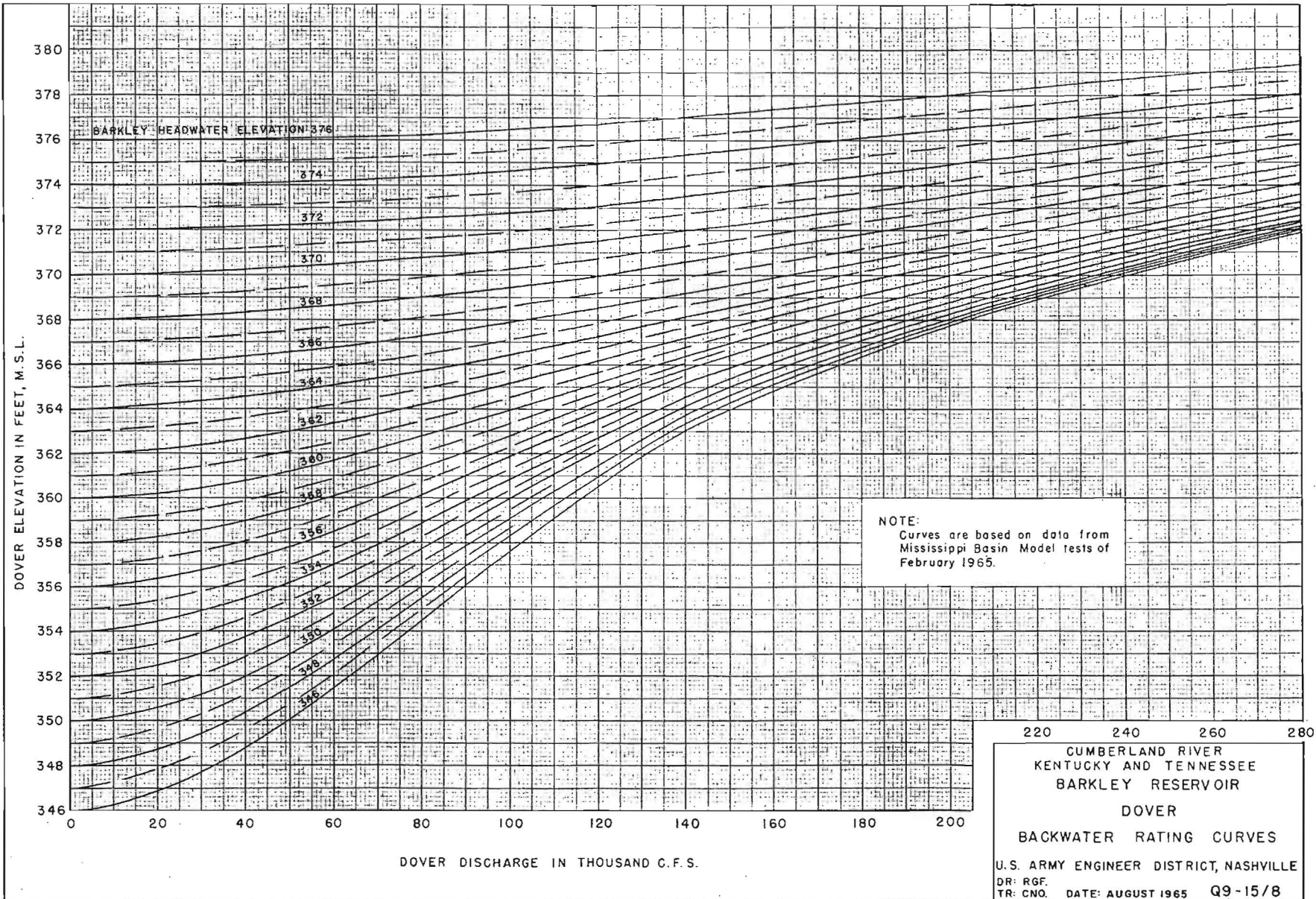
| Cumberland River below Cheatham Dam, TN 03435000 Rating No. 6 (10/1/84) | | | | | |
|--|-----------------|--------------------|-----------------|--------------------|-----------------|
| Gage Height (feet) | Discharge (cfs) | Gage Height (feet) | Discharge (cfs) | Gage Height (feet) | Discharge (cfs) |
| 2.0 | 4,800 * | 22.0 | 27,000 | 40.0 | 59,800 * |
| 2.5 | 5,325 | 22.5 | 27,570 | 40.5 | 61,050 |
| 3.0 | 5,850 * | 23.0 | 28,150 | 41.0 | 62,300 * |
| 3.5 | 6,375 | 23.5 | 28,720 | 41.5 | 63,550 |
| 4.0 | 6,900 * | 24.0 | 29,300 | 42.0 | 64,800 |
| 4.5 | 7,450 | 24.5 | 29,870 | 42.5 | 66,050 |
| 5.0 | 8,000 | 25.0 | 30,450 | 43.0 | 67,300 |
| 5.5 | 8,550 | 25.5 | 31,020 | 43.5 | 68,550 |
| 6.0 | 9,100 | 26.0 | 31,600 * | 44.0 | 69,800 |
| 6.5 | 9,650 | 26.5 | 32,200 | 44.5 | 71,050 |
| 7.0 | 10,200 | 27.0 | 32,800 * | 45.0 | 72,300 |
| 7.5 | 10,750 | 27.5 | 33,450 | 45.5 | 73,550 |
| 8.0 | 11,300 | 28.0 | 34,100 * | 46.0 | 74,800 |
| 8.5 | 11,850 | 28.5 | 34,800 | 46.5 | 76,050 |
| 9.0 | 12,400 | 29.0 | 35,500 * | 47.0 | 77,300 |
| 9.5 | 12,950 | 29.5 | 36,250 | 47.5 | 78,550 |
| 10.0 | 13,500 | 30.0 | 37,000 * | 48.0 | 79,800 * |
| 10.5 | 14,050 | 30.5 | 37,800 * | 48.5 | 81,100 |
| 11.0 | 14,600 | 31.0 | 38,650 * | 49.0 | 82,400 * |
| 11.5 | 15,150 | 31.5 | 39,550 * | 49.5 | 83,700 |
| 12.0 | 15,700 | 31.6 | 39,740 * | 50 | 85,000 * |
| 12.5 | 16,250 | 31.7 | 39,940 * | | |
| 13.0 | 16,800 | 31.8 | 40,150 * | | |
| 13.5 | 17,350 | 31.9 | 40,370 * | | |
| 14.0 | 17,900 | 32.0 | 40,600 * | | |
| 14.5 | 18,450 | 32.5 | 41,800 | | |
| 15.0 | 19,000 * | 33.0 | 43,000 | | |
| 15.5 | 19,550 | 33.5 | 44,200 | | |
| 16.0 | 20,100 * | 34.0 | 45,400 | | |
| 16.5 | 20,670 | 34.5 | 46,600 | | |
| 17.0 | 21,250 | 35.0 | 47,800 | | |
| 17.5 | 21,820 | 35.5 | 49,000 | | |
| 18.0 | 22,400 | 36.0 | 50,200 | | |
| 18.5 | 22,970 | 36.5 | 51,400 | | |
| 19.0 | 23,550 | 37.0 | 52,600 | | |
| 19.5 | 24,120 | 37.5 | 53,800 | | |
| 20.0 | 24,700 | 38.0 | 55,000 | | |
| 20.5 | 25,270 | 38.5 | 56,200 | | |
| 21.0 | 25,850 | 39.0 | 57,400 | | |
| 21.5 | 26,420 | 39.5 | 58,600 | | |

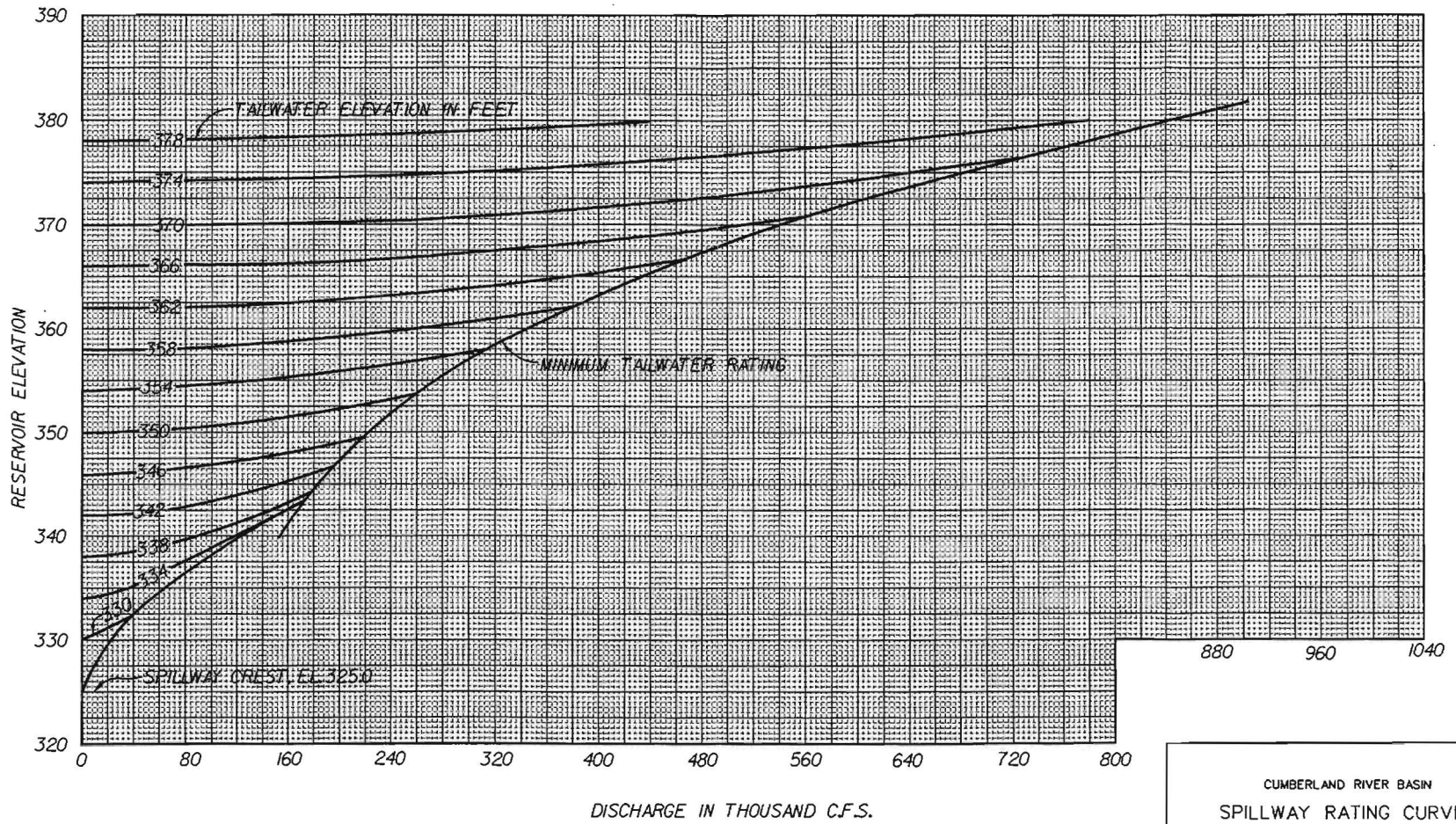
* Values which were included in USGS rating table. All other values were interpolated.



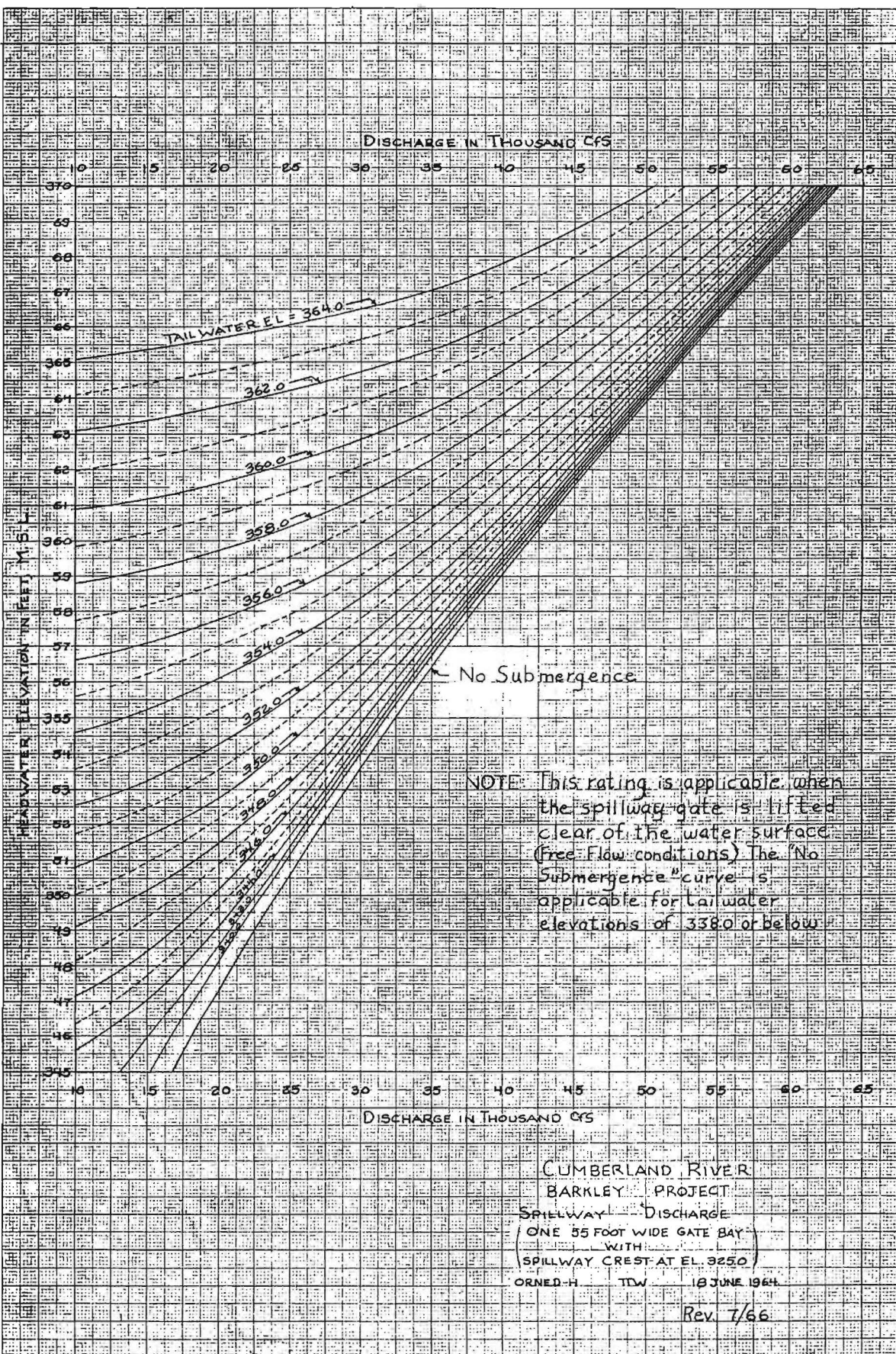


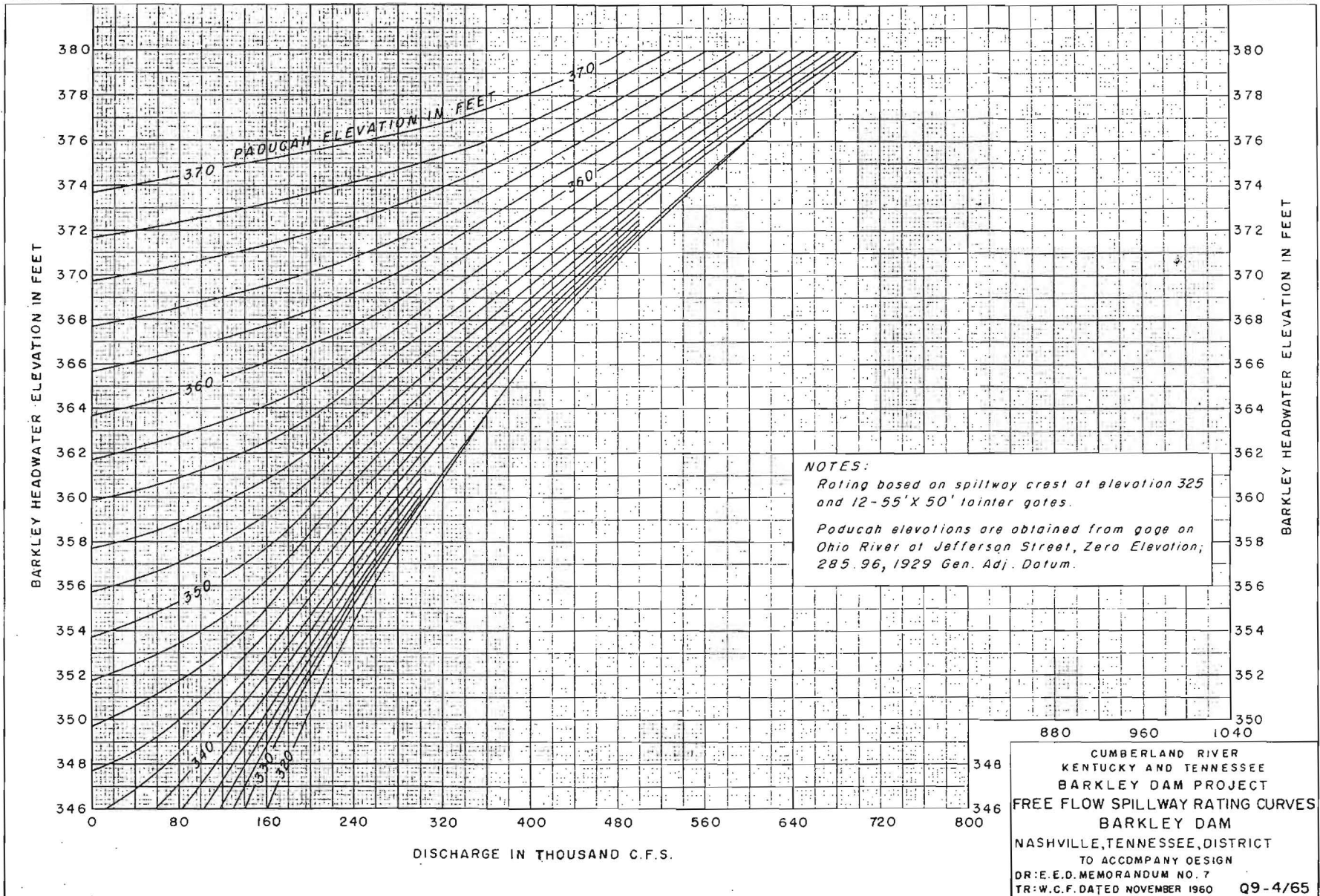






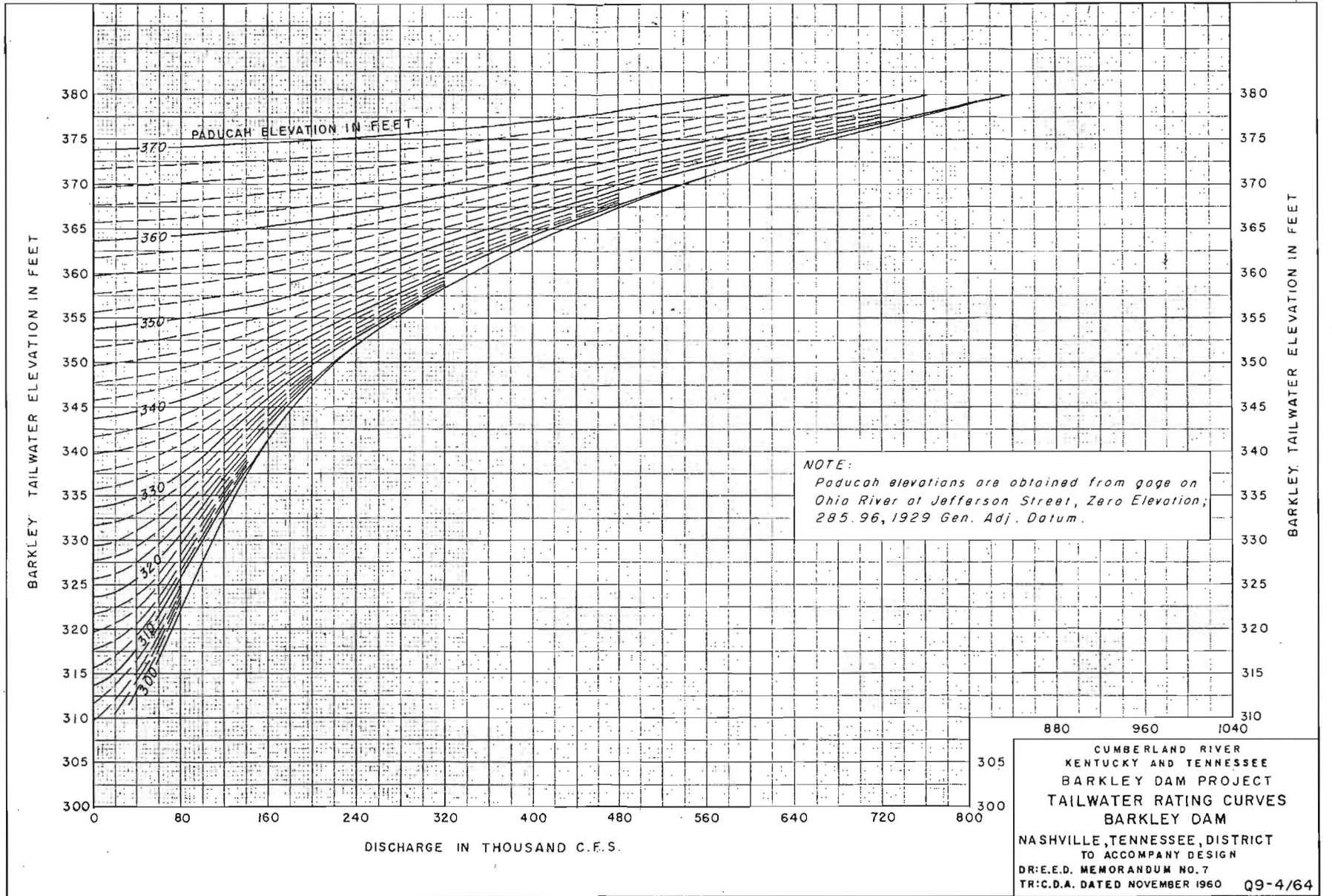
CUMBERLAND RIVER BASIN
SPILLWAY RATING CURVES
BARKLEY DAM
NASHVILLE DISTRICT





880 960 1040

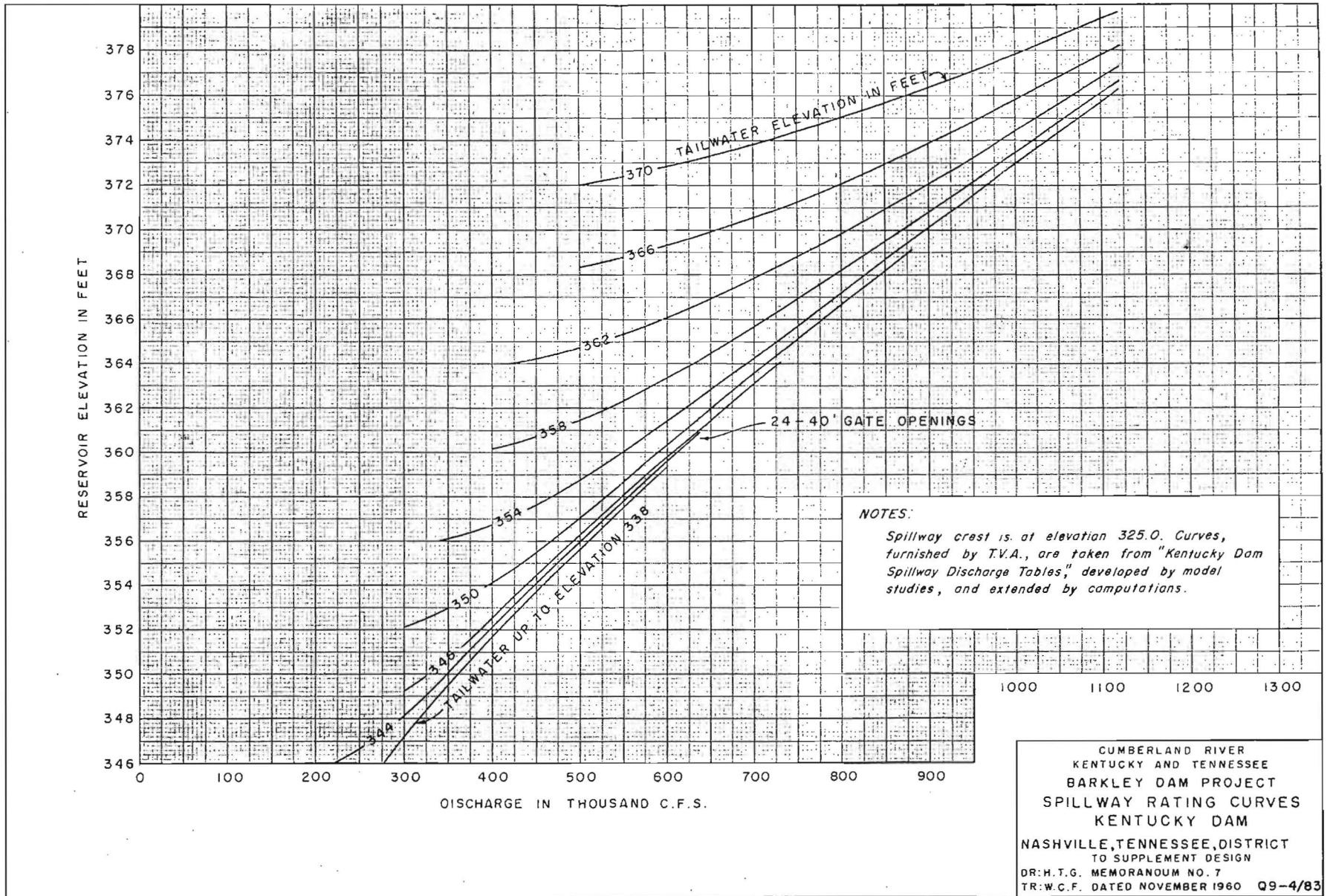
CUMBERLAND RIVER
 KENTUCKY AND TENNESSEE
 BARKLEY DAM PROJECT
 FREE FLOW SPILLWAY RATING CURVES
 BARKLEY DAM
 NASHVILLE, TENNESSEE, DISTRICT
 TO ACCOMPANY DESIGN
 DR: E. E. D. MEMORANDUM NO. 7
 TR: W. C. F. DATED NOVEMBER 1960 Q9-4/65

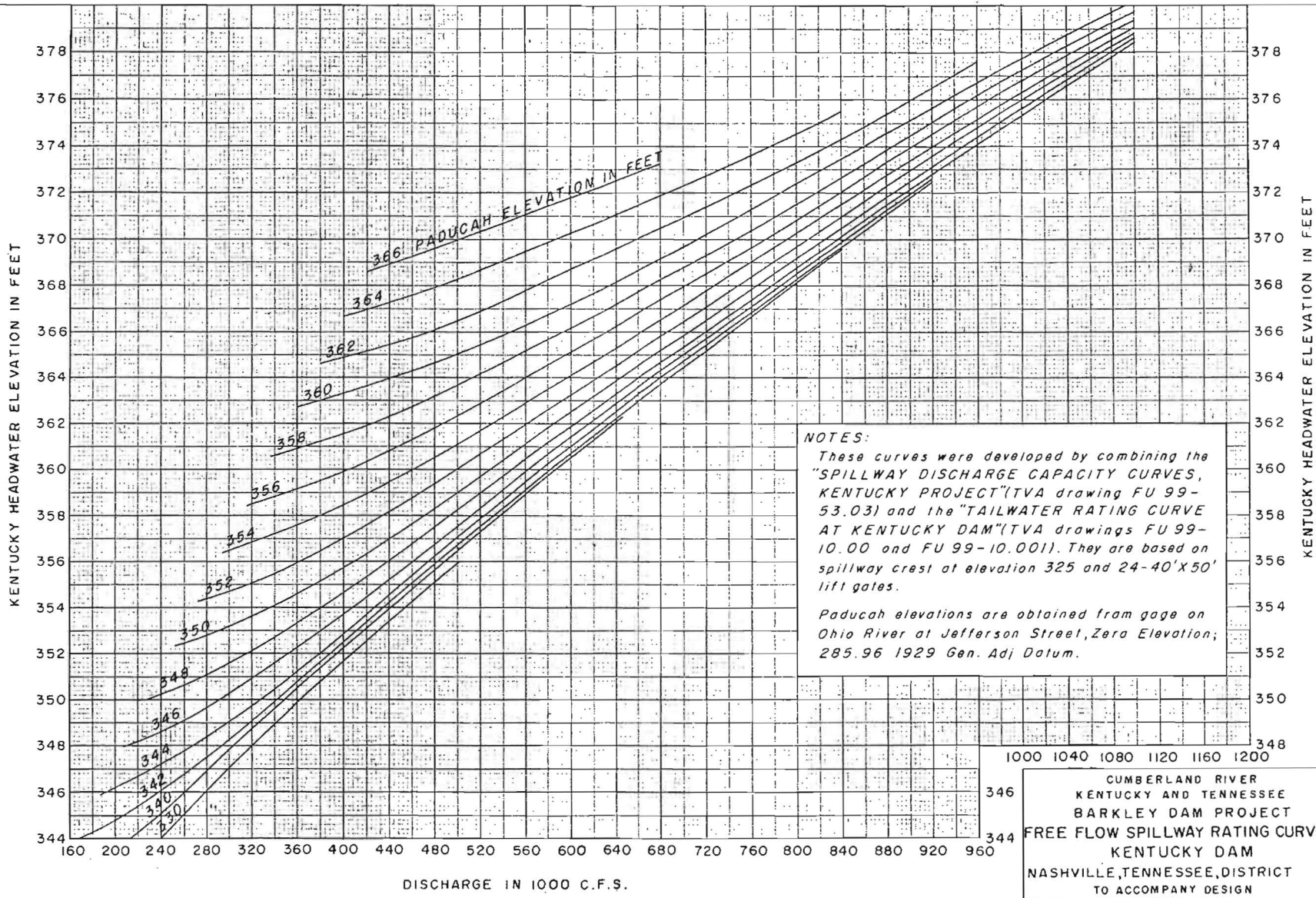


880 960 1040

CUMBERLAND RIVER
KENTUCKY AND TENNESSEE
BARKLEY DAM PROJECT
TAILWATER RATING CURVES
BARKLEY DAM

NASHVILLE, TENNESSEE, DISTRICT
TO ACCOMPANY DESIGN
DR: E.E.D. MEMORANDUM NO. 7
TR: C.D.A. DATED NOVEMBER 1960



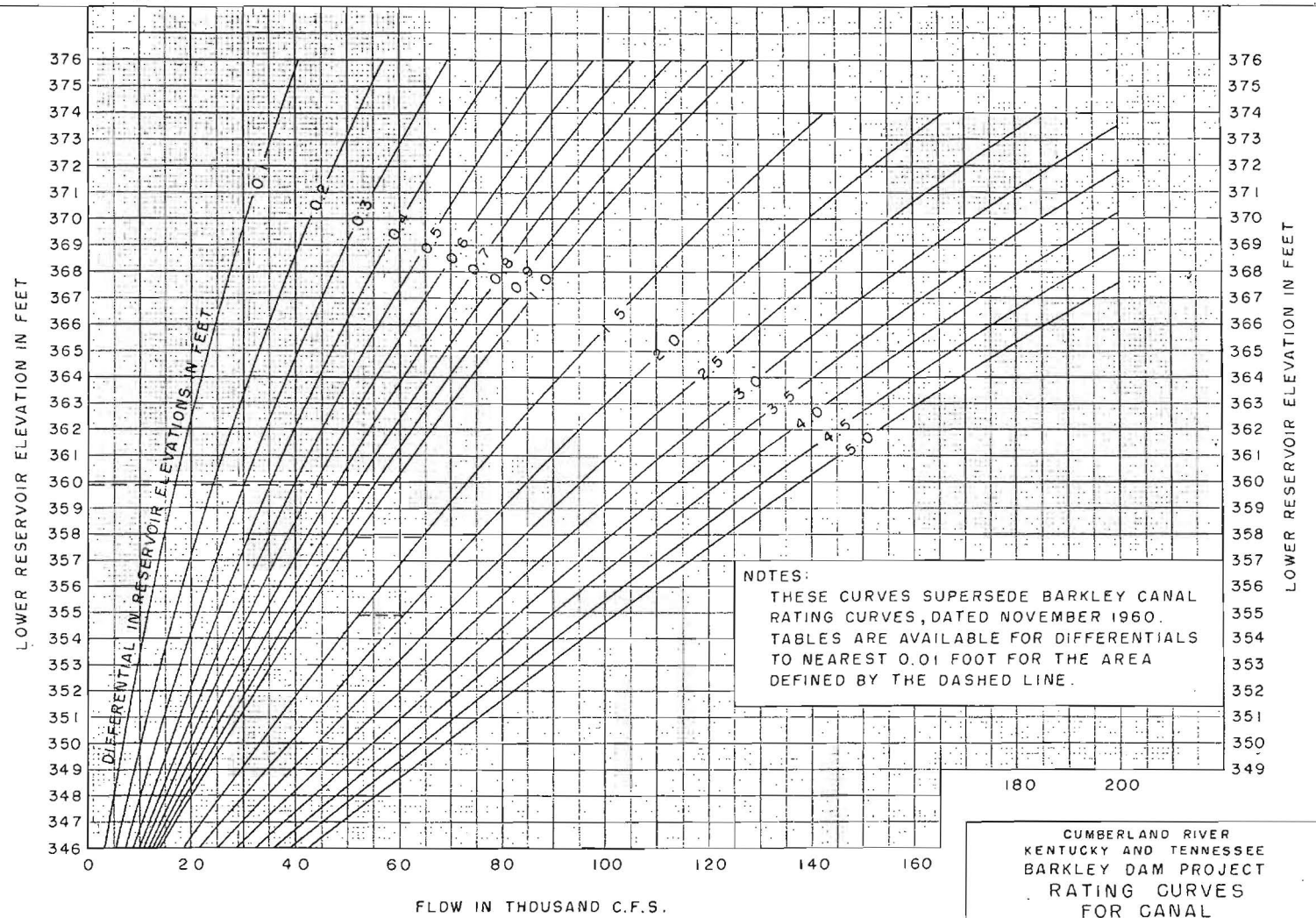


1000 1040 1080 1120 1160 1200

346

344

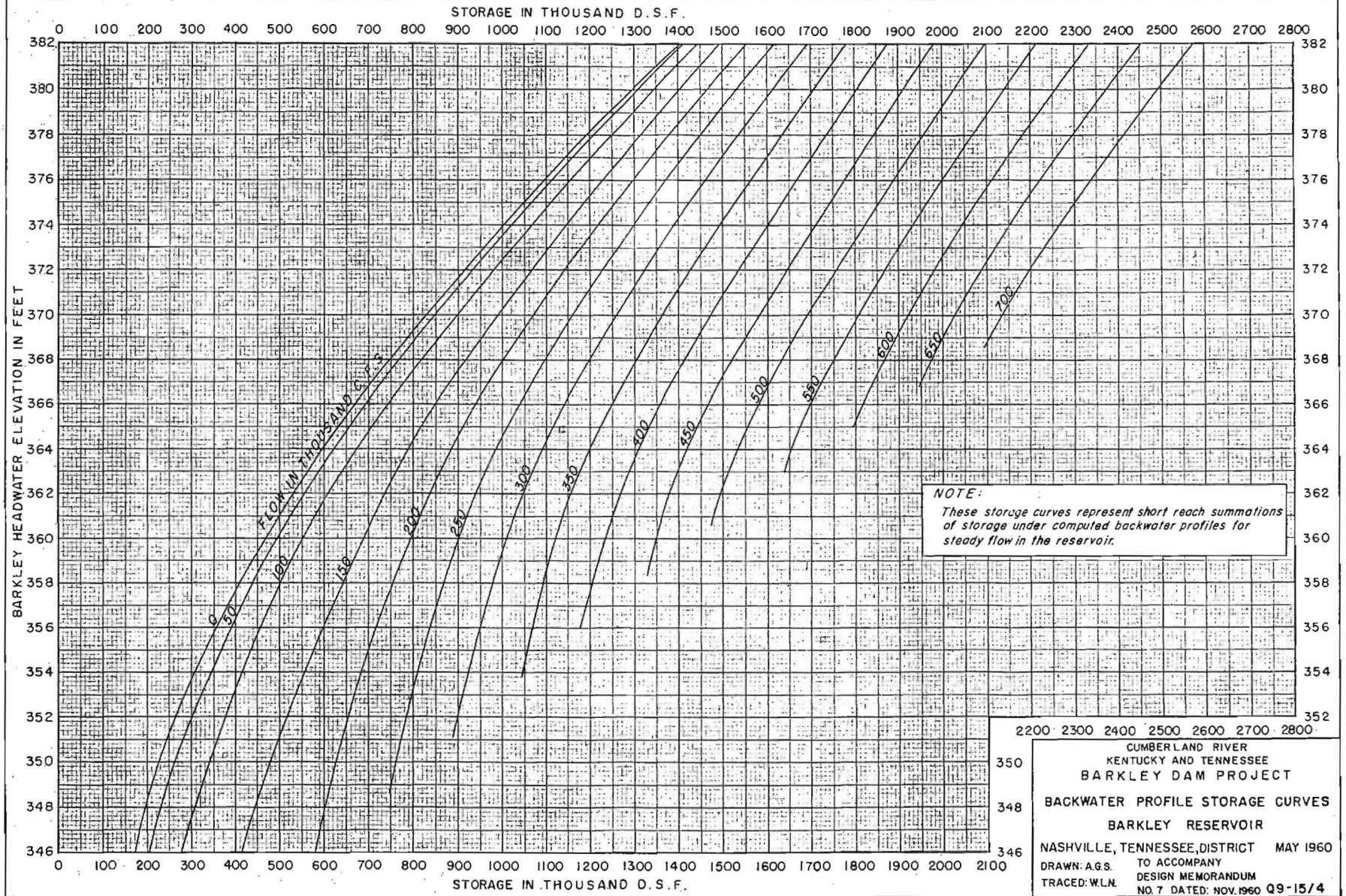
CUMBERLAND RIVER
 KENTUCKY AND TENNESSEE
 BARKLEY DAM PROJECT
 FREE FLOW SPILLWAY RATING CURVES
 KENTUCKY DAM
 NASHVILLE, TENNESSEE, DISTRICT
 TO ACCOMPANY DESIGN
 DR: E.E.D. MEMORANDUM NO. 7
 TR: W.C.F. DATED NOVEMBER 1960 Q9 - 4/71

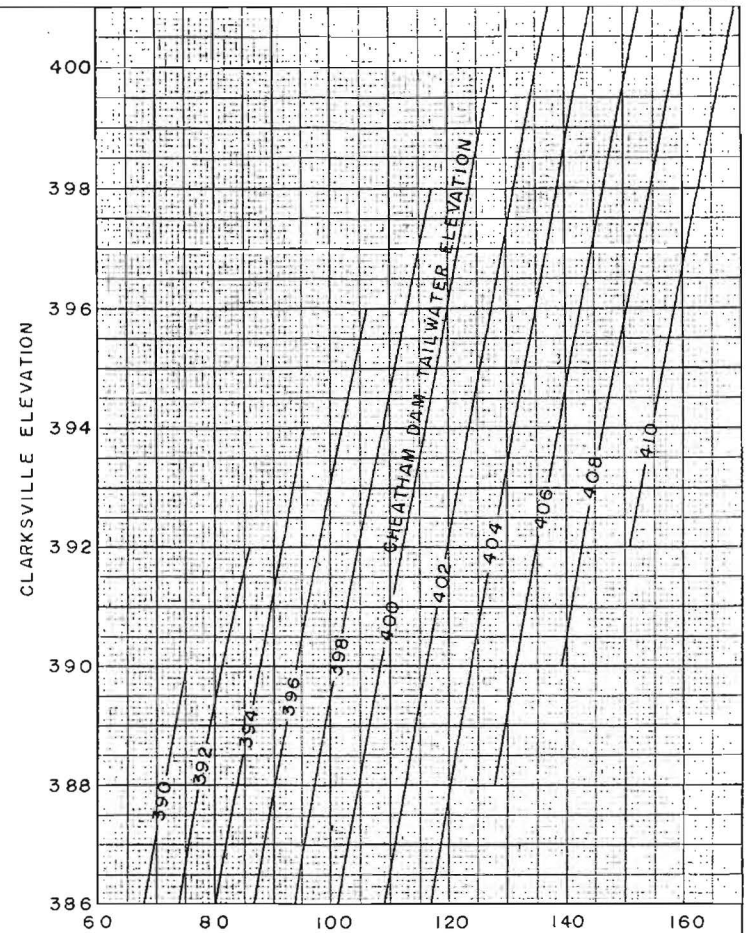
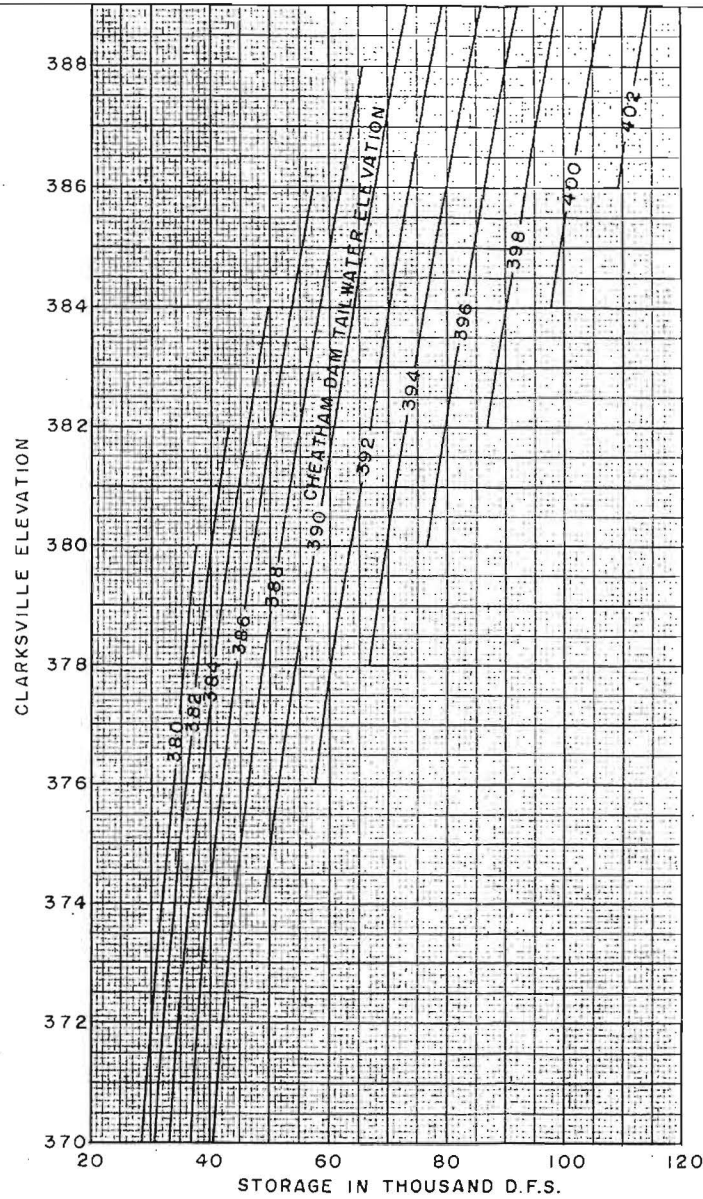
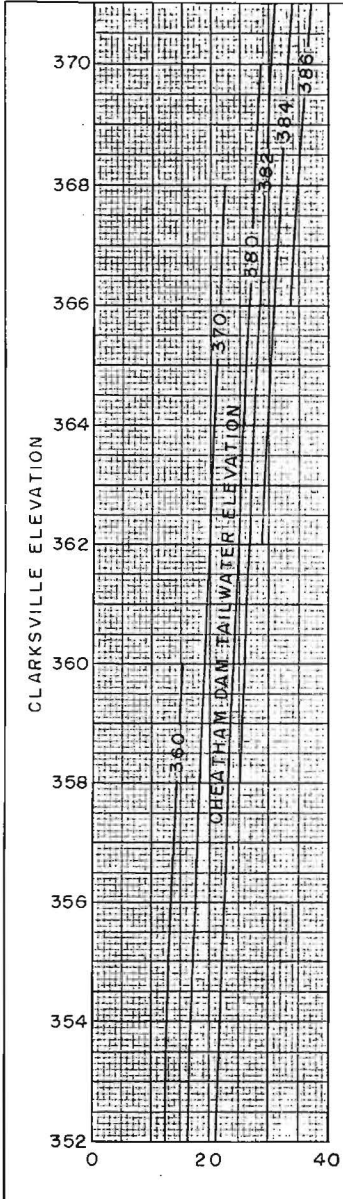


NOTES:
 THESE CURVES SUPERSEDE BARKLEY CANAL
 RATING CURVES, DATED NOVEMBER 1960.
 TABLES ARE AVAILABLE FOR DIFFERENTIALS
 TO NEAREST 0.01 FOOT FOR THE AREA
 DEFINED BY THE DASHED LINE.

CUMBERLAND RIVER
 KENTUCKY AND TENNESSEE
 BARKLEY DAM PROJECT
 RATING CURVES
 FOR CANAL
 NASHVILLE, TENNESSEE, DISTRICT
 DR: C.H.B.
 TR: W.C.F. DATED: OCTOBER 1965

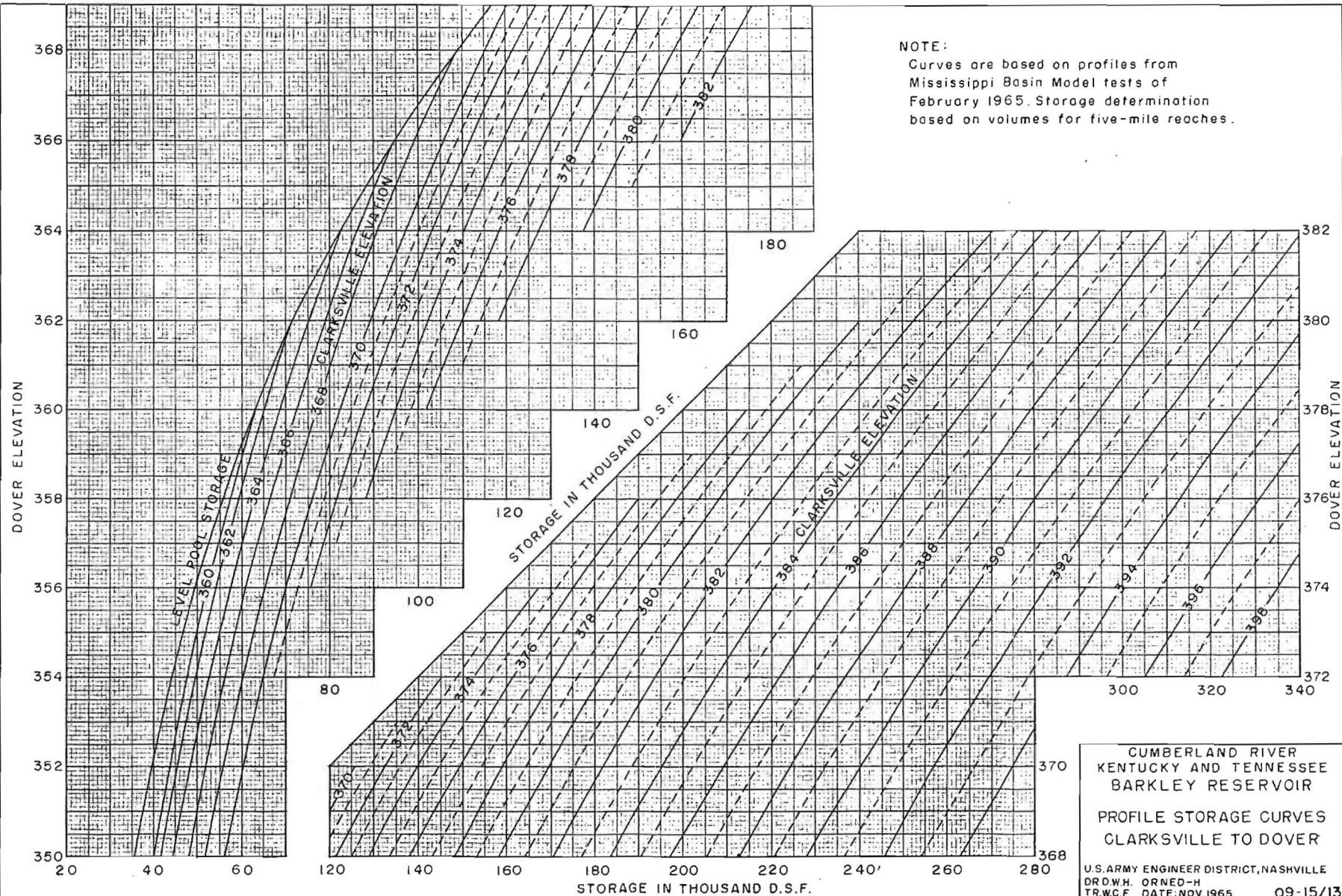
Q 9-15/11

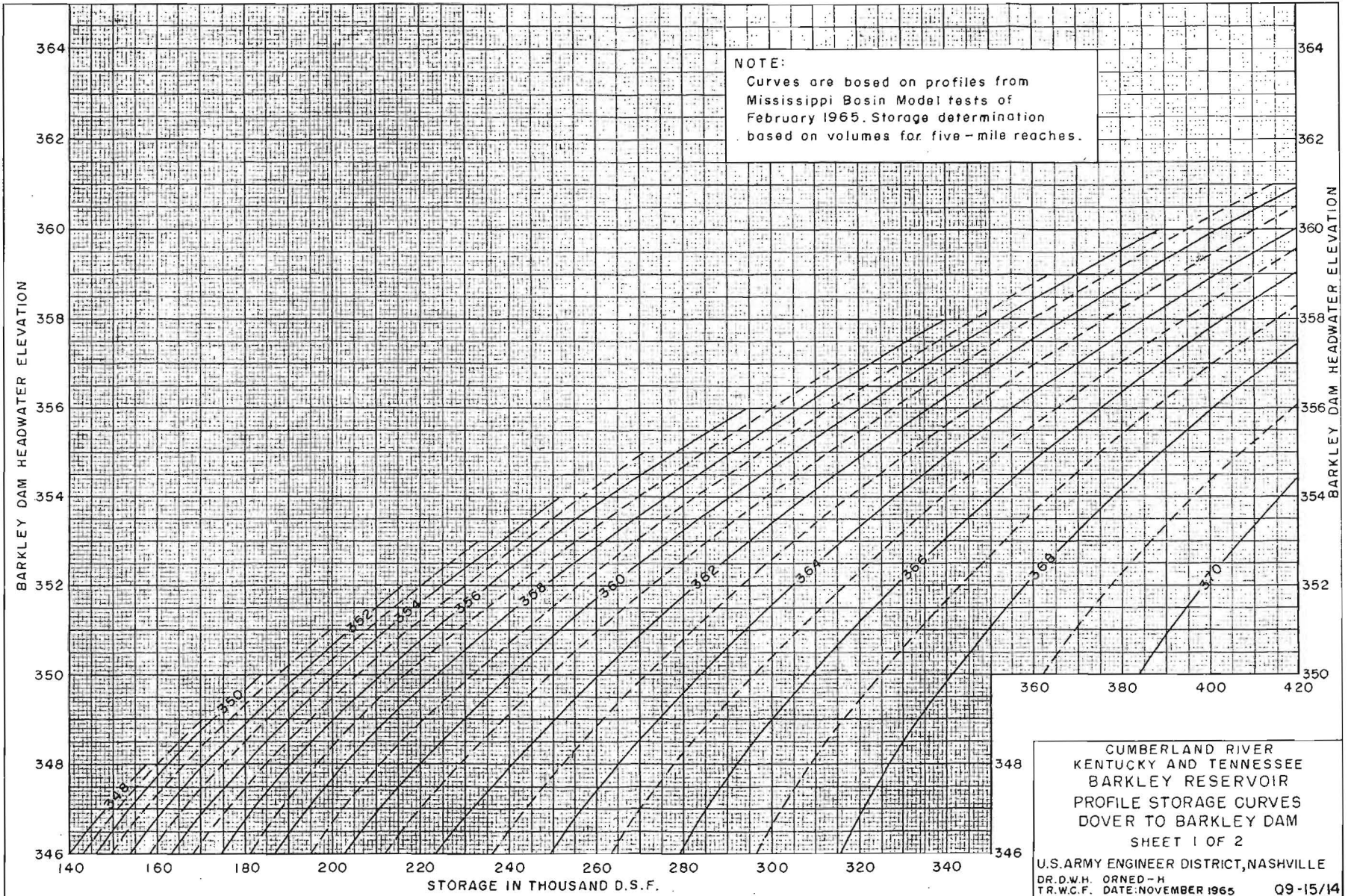


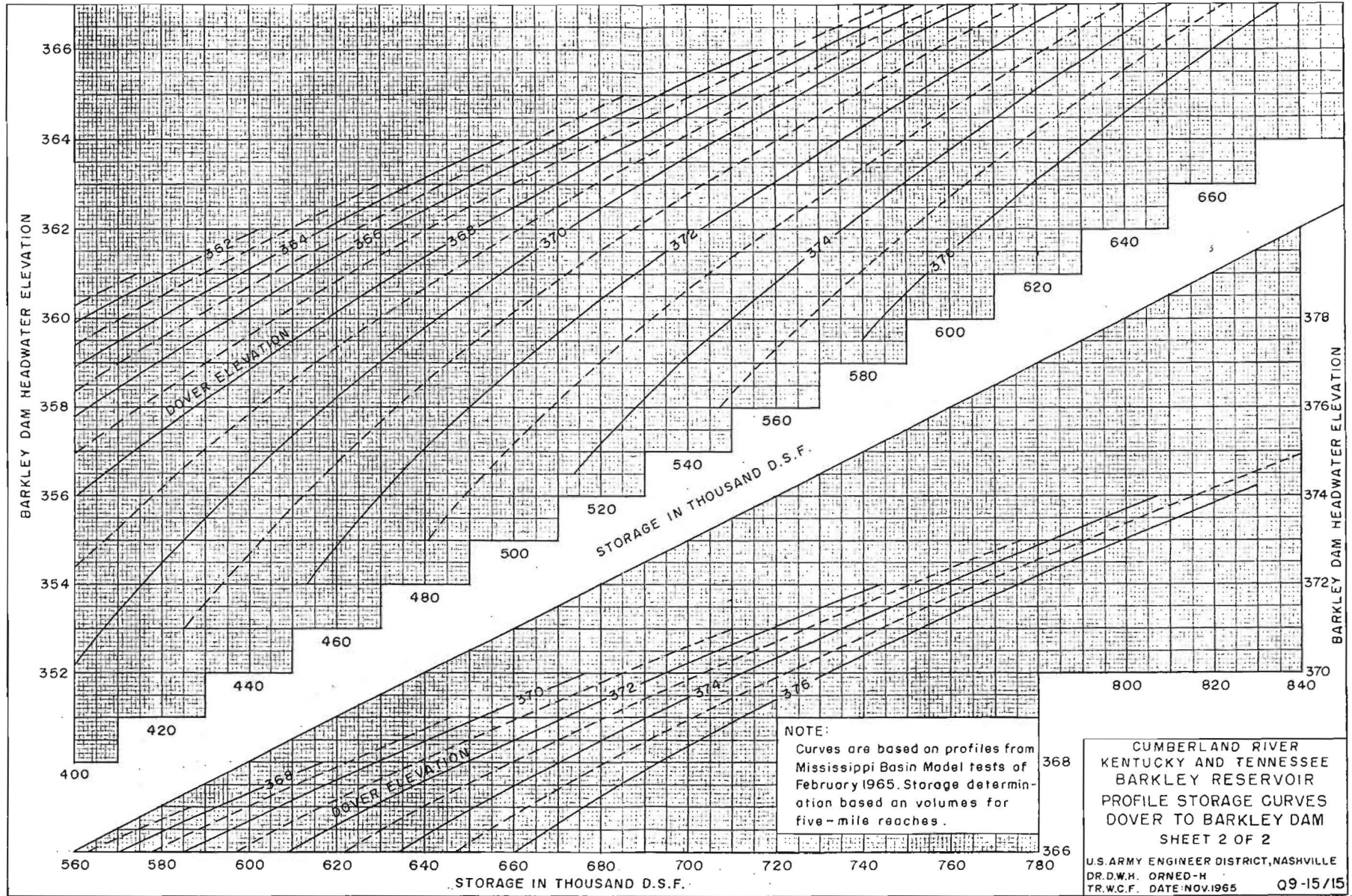


NOTE:
 Curves are based on profiles
 from Mississippi Basin Model
 tests of February 1965. Storage
 determination based on volumes
 for five-mile reaches.

CUMBERLAND RIVER
 KENTUCKY AND TENNESSEE
 BARKLEY RESERVOIR
 PROFILE STORAGE CURVES
 CHEATHAM TO CLARKSVILLE
 U.S. ARMY ENGINEER DISTRICT, NASHVILLE
 DR. D.W.H. ORNED - H
 TR. W.C.F. DATE: NOVEMBER 1965 09-15/12

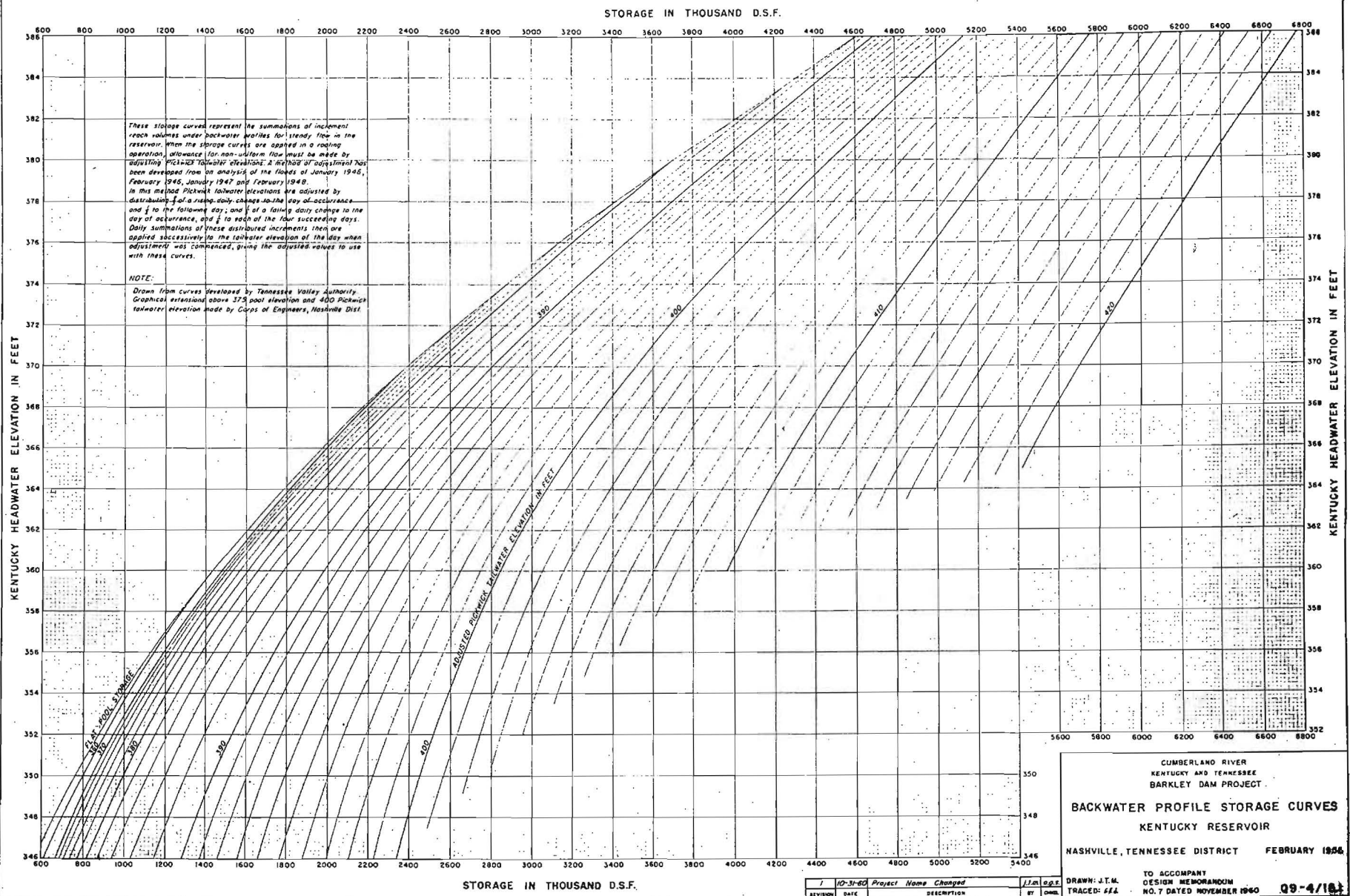






NOTE:
 Curves are based on profiles from
 Mississippi Basin Model tests of
 February 1965. Storage determin-
 ation based on volumes for
 five-mile reaches.

CUMBERLAND RIVER
 KENTUCKY AND TENNESSEE
 BARKLEY RESERVOIR
 PROFILE STORAGE CURVES
 DOVER TO BARKLEY DAM
 SHEET 2 OF 2
 U.S. ARMY ENGINEER DISTRICT, NASHVILLE
 DR. D.W.H. ORNED-H
 TR. W.C.F. DATE: NOV. 1965 09-15/15



CUMBERLAND RIVER
KENTUCKY AND TENNESSEE
BARKLEY DAM PROJECT

BACKWATER PROFILE STORAGE CURVES

KENTUCKY RESERVOIR

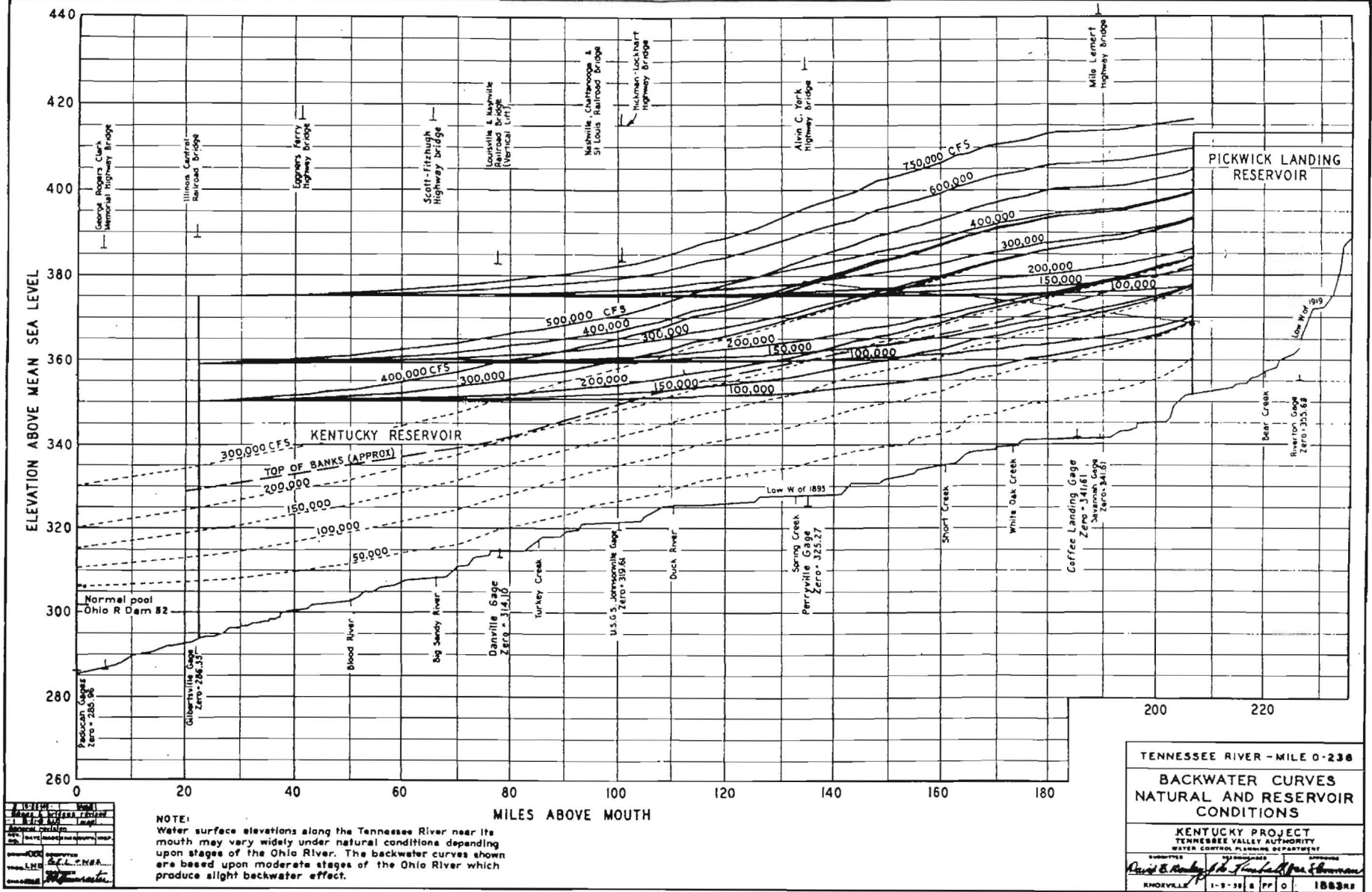
NASHVILLE, TENNESSEE DISTRICT FEBRUARY 1956

| | | | |
|----------|----------|----------------------|-----------|
| 1 | 10-31-60 | Project Name Changed | J.M. G.P. |
| REVISION | DATE | DESCRIPTION | BY |

TO ACCOMPANY
DESIGN MEMORANDUM
NO. 7 DATED NOVEMBER 1960

DRAWN: J.T.M.
TRACED: 644

99-4/181



NOTE:
 Water surface elevations along the Tennessee River near its mouth may vary widely under natural conditions depending upon stages of the Ohio River. The backwater curves shown are based upon moderate stages of the Ohio River which produce slight backwater effect.

TENNESSEE RIVER - MILE 0-236

**BACKWATER CURVES
 NATURAL AND RESERVOIR
 CONDITIONS**

KENTUCKY PROJECT
 TENNESSEE VALLEY AUTHORITY
 WATER CONTROL PLANNING DEPARTMENT

APPROVED: *David B. Kinney*
 1-9-38 8 PP 0 1883R2

PLATE A-27

KENTUCKY DISCHARGE REGULATIONS (provided by TVA)

| | |
|------------------------------------|------------|
| June - August biweekly average | 18,000 cfs |
| May and September biweekly average | 15,000 cfs |
| October - April daily average | 12,000 cfs |

Minimum Kentucky tailwater elevation 300.00 NGVD

Paducah greater than 16 feet

Maximum variation of Kentucky Tailwater - 1 ½ feet/day

Maximum hourly change - 12,000 cfs

Maximum Paducah fluctuation - 1 foot/day

Minimum daily discharge for navigation is zero cfs

Paducah less than 16 feet but greater than 14 feet

Maximum variation - 30,000 cfs/day if not spilling

Maximum hourly change - 12,000 cfs

Minimum daily discharge for navigation - 15,000 cfs

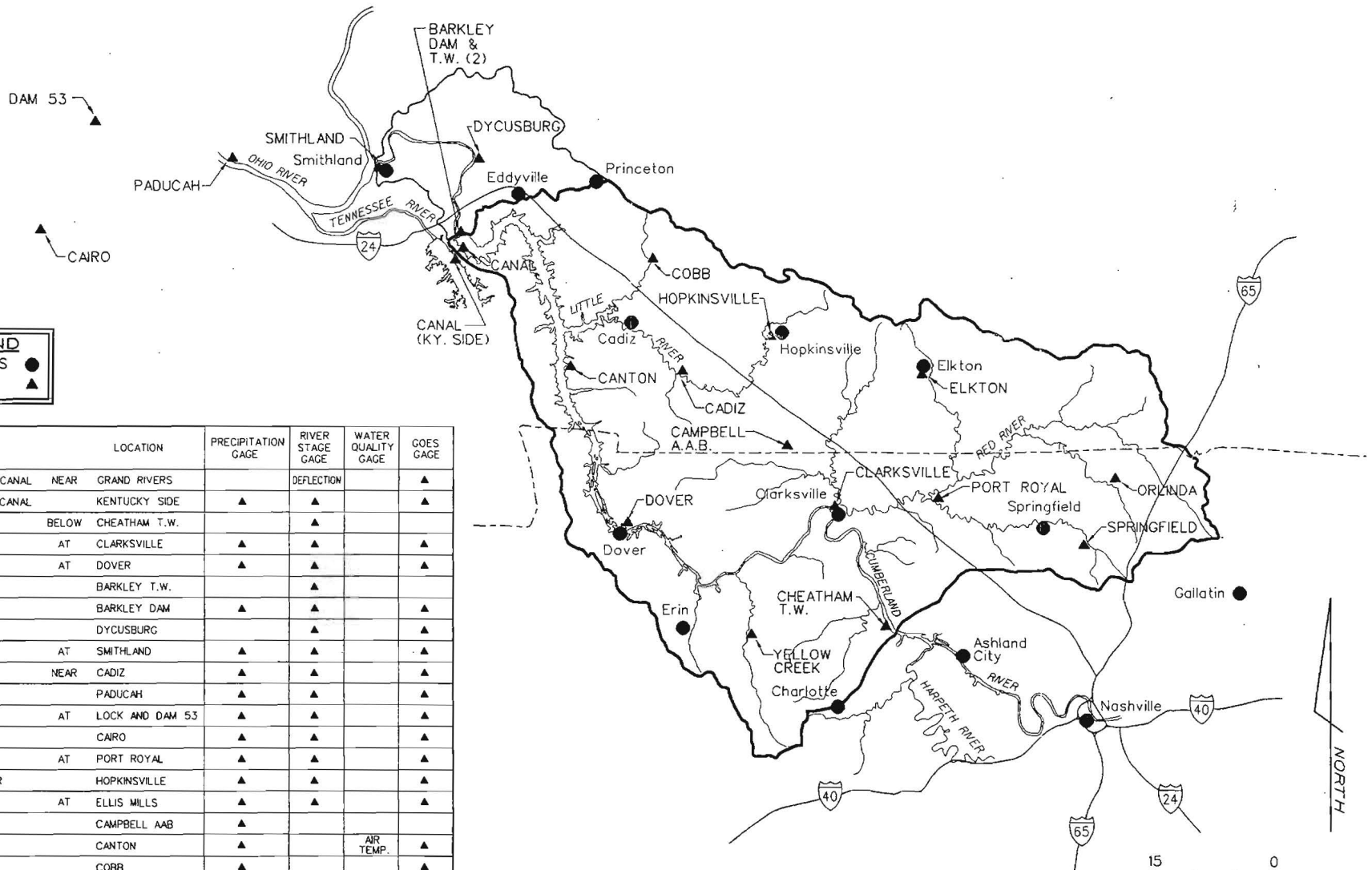
Paducah less than 14 feet

Minimum discharge for navigation - 20,000 cfs steady daily average

Discharge permits for water quality below the dam are based on 5,000 cfs daily average - Kentucky in the recent past has not gone below this

Call Kentucky Water Quality anytime flow less than 10,000 cfs instantaneous is scheduled

BARKLEY SUBBASIN MAP



LEGEND

COMMUNITIES ●

GAGES ▲

| STREAM | LOCATION | PRECIPITATION GAGE | RIVER STAGE GAGE | WATER QUALITY GAGE | GOES GAGE |
|------------------------|---------------------|--------------------|------------------|--------------------|-----------|
| BARKLEY-KENTUCKY CANAL | NEAR GRAND RIVERS | | DEFLECTION | | ▲ |
| BARKLEY-KENTUCKY CANAL | KENTUCKY SIDE | ▲ | ▲ | | ▲ |
| CUMBERLAND RIVER | BELOW CHEATHAM T.W. | | ▲ | | |
| CUMBERLAND RIVER | AT CLARKSVILLE | ▲ | ▲ | | ▲ |
| CUMBERLAND RIVER | AT DOVER | ▲ | ▲ | | ▲ |
| CUMBERLAND RIVER | BARKLEY T.W. | | ▲ | | |
| CUMBERLAND RIVER | BARKLEY DAM | ▲ | ▲ | | ▲ |
| CUMBERLAND RIVER | DYCUSBURG | ▲ | ▲ | | ▲ |
| CUMBERLAND RIVER | AT SMITHLAND | ▲ | ▲ | | ▲ |
| LITTLE RIVER | NEAR CADIZ | ▲ | ▲ | | ▲ |
| OHIO RIVER | PADUCAH | ▲ | ▲ | | ▲ |
| OHIO RIVER | AT LOCK AND DAM 53 | ▲ | ▲ | | ▲ |
| OHIO RIVER | CAIRO | ▲ | ▲ | | ▲ |
| RED RIVER | AT PORT ROYAL | ▲ | ▲ | | ▲ |
| S. FORK LITTLE RIVER | HOPKINSVILLE | ▲ | ▲ | | ▲ |
| YELLOW CREEK | AT ELLIS MILLS | ▲ | ▲ | | ▲ |
| | CAMPBELL AAB | ▲ | | | |
| | CANTON | ▲ | | AIR TEMP. | ▲ |
| | COBB | ▲ | | | ▲ |
| | ELKTON | ▲ | | | ▲ |
| | ORLINDA | ▲ | | | ▲ |
| | SPRINGFIELD | ▲ | | | ▲ |

BARKLEY SUBBASIN DATA COLLECTION NETWORK

| STREAM | LOCATION | DRAINAGE | | | HYDROLOGIC | | | |
|------------------------|-------------------|----------|----------------|---------------|------------|--------------|-------------------|-------------------|
| | | DATUM | AREA sq.mi. | RIVER MILE | COUNTY | UNIT CODE | NORTH LATITUDE | WEST LONGITUDE |
| Barkley-Kentucky Canal | near Grand Rivers | 299.69 | █ | █ | Lyon | 05130205 | █ | █ |
| Barkley-Kentucky Canal | near Grand Rivers | 299.69 | █ | █ | Lyon | 06040005 | █ | █ |
| Cumberland River | below Cheatham TW | 350.00 | 14163 | █ | Cheatham | 05130205 | █ | █ |
| Cumberland River | at Clarksville | 300.00 | 15897 | █ | Montgomery | 05130205 | █ | █ |
| Cumberland River | at Dover | 300.00 S | 16530 | █ | Stewart | 05130205 | █ | █ |
| Cumberland River | Barkley TW | 300.00 | 17598 | █ | Lyon | 05130205 | █ | █ |
| Cumberland River | near Grand Rivers | 300.00 | 17598 | █ | Lyon | 05130205 | █ | █ |
| Cumberland River | Dycusburg | 299.54 | 17700 | █ | Crittenden | 05130205 | █ | █ |
| Cumberland River | at Smithland | 300.00 S | 17913 | █ | Livingston | 05130205 | █ | █ |
| Little River | near Cadiz | 391.45 | 244 | █ | Trigg | 05130205 | █ | █ |
| Ohio River | Paducah | 286.30 | 202800 | █ | McCracken | 05140206 | █ | █ |
| Ohio River | at L & D 53 | 273.10 | 203100 | █ | Pulaski | 05140206 | █ | █ |
| Ohio River | Cairo | 270.90 | 203940 | █ | Alexander | 05140206 | █ | █ |
| Red River | at Port Royal | 376.25 | 935 | █ | Montgomery | 05130206 | █ | █ |
| S Frk Little River | Hopkinsville | 499.71 | 46.5 | █ | Christian | 05130205 | █ | █ |
| Yellow Creek | at Ellis Mills | 417.00 | 103 | █ | Houston | 05130205 | █ | █ |
| | Campbell AAB | | | █ | Christian | 05130103 | █ | █ |
| | Canton | | | █ | Trigg | 05130205 | █ | █ |
| | Cobb | | | █ | Caldwell | 05130205 | █ | █ |
| | Elkton | | | █ | Todd | 05130206 | █ | █ |
| | Orlinda | | | █ | Robertson | 05130206 | █ | █ |
| | Springfield | | | █ | Robertson | 05130206 | █ | █ |

BARKLEY SUBBASIN DATA COLLECTION NETWORK

| STREAM | LOCATION | USGS ID | TELEPHONE ACCESS | | DSS PATHNAME PART B | PRECIP | | W Q |
|------------------------|-------------------|-------------|------------------|---|---------------------|--------|---|--------|
| | | | GOES ID | | | STAGE | | |
| | | | | | | | | |
| Barkley-Kentucky Canal | near Grand Rivers | KY 03438190 | | | CANAL | * | | |
| Barkley-Kentucky Canal | near Grand Rivers | KY 03438191 | | | CANAL-KENTUCKY SID | S | P | |
| Cumberland River | below Cheatham TW | TN 03435000 | | | CHEATHAM DAM | S | | |
| Cumberland River | at Clarksville | TN 03436500 | | T | CLARKSVILLE | S | P | |
| Cumberland River | at Dover | TN 03437000 | | T | DOVER | S | P | |
| Cumberland River | Barkley TW | KY | | | BARKLEY DAM | S | | |
| Cumberland River | near Grand Rivers | KY 03438220 | | | BARKLEY DAM | S | P | |
| Cumberland River | Dycusburg | KY 03430200 | | | DYCUSBURG KY. | S | | |
| Cumberland River | at Smithland | KY 03438500 | | | SMITHLAND GOES KY | S | P | |
| Little River | near Cadiz | KY 03438000 | | | CADIZ | S | P | |
| Ohio River | Paducah | KY | | | PADUCAH KY | S | P | |
| Ohio River | at L & D 53 | IL 03612500 | | | DAM 53 | S | P | |
| Ohio River | Cairo | IL | | | CAIRO IL | S | P | |
| Red River | at Port Royal | TN 03436100 | | T | PORT ROYAL | S | P | |
| S Frk Little River | Hopkinsville | KY 03437500 | | | HOPKINSVILLE | S | P | |
| Yellow Creek | at Ellis Mills | TN 03436690 | | | YELLOW CRK. TN. | S | P | |
| | Campbell AAB | KY | | | CAMPBELL AAB | | P | |
| | Canton | KY | | | CANTON | | P | A |
| | Cobb | KY | | | COBB | | P | |
| | Elkton | KY | | | ELKTON | | P | |
| | Orlinda | TN | | | ORLINDA | | P | |
| | Springfield | TN | | | SPRINGFIELD | | P | |

WATER QUALITY LEGEND
A - air temperature

CLIMATOGRAPHY OF THE UNITED STATES NO. 20
CLARKESVILLE, TN

CLIMATOLOGICAL SUMMARY

PERIOD: 1951-80
ELEVATION: 382 FT

| YEAR | MEANS | | | TEMPERATURE (F) | | | | | | | | | PRECIPITATION TOTALS (INCHES) | | | | | | | | | | | | | | |
|------|-----------------|-----------------|-----------|-----------------|--------|--------|---------------------|--------|--------|--------------|--------------|--------------|-------------------------------|--------------------|-------------|-----------------|-----------------|---------------------|----------------|--------|--------|------|-----------------|--------|------------|------------|-------------|
| | * DAILY MAXIMUM | * DAILY MINIMUM | * MONTHLY | EXTREMES | | | MEAN NUMBER OF DAYS | | | DEGREE DAYS | | | * MEAN | * GREATEST MONTHLY | SNOW | | | MEAN NUMBER OF DAYS | | | | | | | | | |
| | | | | RECORD HIGHEST | YEAR | DAY | RECORD LOWEST | YEAR | DAY | 90 AND ABOVE | 32 AND BELOW | 32 AND BELOW | | | C AND BELOW | HEATING BASE 65 | COOLING BASE 65 | YEAR | GREATEST DAILY | YEAR | DAY | YEAR | MAXIMUM MONTHLY | YEAR | 10 OR MORE | 50 OR MORE | 100 OR MORE |
| JAN | 45.9 | 25.4 | 35.7 | 80 | 72 | 24 | -17+ | 63 | 24 | 0 | 5 | 23 | 1 | 908 | 0 | 4.52 | 11.30 | 57 | 4.24 | 56 | 30 | 3.7 | 16.0 | 78 | 8 | 3 | 1 |
| FEB | 50.3 | 27.7 | 39.0 | 82 | 62 | 13 | -11 | 51 | 2 | 0 | 2 | 19 | 1 | 728 | 0 | 4.26 | 10.31 | 62 | 2.69 | 62 | 27 | 3.4 | 16.9 | 78 | 7 | 3 | 1 |
| MAR | 59.5 | 36.2 | 47.9 | 87+ | 67 | 14 | 0 | 80 | 3 | 0 | 0 | 13 | 0 | 541 | 11 | 5.92 | 17.28 | 75 | 6.08 | 75 | 12 | 1.8 | 21.6 | 60 | 8 | 4 | 2 |
| APR | 71.9 | 46.1 | 59.0 | 92+ | 55 | 16 | 24+ | 73 | 11 | 0 | 0 | 2 | 0 | 201 | 21 | 4.46 | 8.44 | 79 | 3.50 | 79 | 02 | .0 | .8 | 51 | 7 | 3 | 1 |
| MAY | 79.5 | 54.3 | 66.9 | 95+ | 53 | 29 | 32+ | 80 | 9 | 3 | 0 | 0 | 0 | 75 | 134 | 4.14 | 8.55 | 57 | 3.07 | 57 | 19 | .0 | .0 | | 7 | 3 | 1 |
| JUN | 86.9 | 62.7 | 74.8 | 108+ | 52 | 30 | 42+ | 66 | 1 | 11 | 0 | 0 | 0 | 8 | 302 | 3.74 | 7.40 | 77 | 4.13 | 60 | 28 | .0 | .0 | | 6 | 3 | 1 |
| JUL | 90.7 | 66.6 | 78.7 | 110+ | 52 | 28 | 47+ | 68 | 5 | 19 | 0 | 0 | 0 | 0 | 425 | 3.81 | 7.16 | 74 | 3.05 | 72 | 28 | .0 | .0 | | 6 | 2 | 1 |
| AUG | 89.5 | 65.2 | 77.4 | 107+ | 54 | 16 | 48+ | 68 | 28 | 16 | 0 | 0 | 0 | 0 | 384 | 3.79 | 9.42 | 74 | 3.87 | 63 | 29 | .0 | .0 | | 6 | 3 | 1 |
| SEP | 83.5 | 58.5 | 71.0 | 106+ | 54 | 5 | 34+ | 67 | 29 | 7 | 0 | 0 | 0 | 22 | 202 | 3.31 | 12.55 | 79 | 5.80 | 79 | 14 | .0 | .0 | | 5 | 2 | 1 |
| OCT | 72.5 | 45.2 | 58.9 | 97 | 53 | 1 | 21+ | 76 | 29 | 1 | 0 | 3 | 0 | 224 | 35 | 2.83 | 7.39 | 70 | 2.25 | 62 | 02 | .0 | .0 | | 5 | 2 | 1 |
| NOV | 59.8 | 35.9 | 47.8 | 86+ | 71 | 2 | 11+ | 76 | 30 | 0 | 0 | 13 | 0 | 516 | 0 | 4.22 | 10.97 | 57 | 3.83 | 68 | 28 | .4 | 3.0 | 66 | 6 | 3 | 1 |
| DEC | 49.9 | 29.1 | 39.5 | 80+ | 51 | 31 | -6+ | 62 | 13 | 0 | 2 | 20 | 0 | 791 | 0 | 4.64 | 12.09 | 78 | 3.80 | 64 | 04 | 1.3 | 7.5 | 69 | 7 | 3 | 1 |
| YEAR | 70.0 | 46.1 | 58.1 | 110 | JUL 52 | JAN 28 | -17 | JAN 63 | JAN 24 | 57 | 9 | 93 | 2 | 4014 | 1514 | 49.64 | MAR 17.28 | MAR 75 | MAR 6.08 | MAR 75 | MAR 12 | 10.6 | MAR 21.6 | MAR 60 | 78 | 34 | 13 |

*FROM 1951-80 NORMALS

ESTIMATED VALUE BASED ON DATA FROM SURROUNDING STATIONS

+ ALSO ON EARLIER DATES.

DEGREE DAYS TO SELECTED BASE TEMPERATURES (F)

| BASE | HEATING DEGREE DAYS | | | | | | | | | | | | ANN |
|----------|---------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | |
| BELOW 65 | 908 | 728 | 541 | 201 | 75 | 8 | 0 | 0 | 22 | 224 | 516 | 791 | 4014 |
| 60 | 761 | 600 | 401 | 103 | 25 | 0 | 0 | 0 | 5 | 128 | 370 | 636 | 3029 |
| 57 | 672 | 523 | 325 | 60 | 12 | 0 | 0 | 0 | 0 | 82 | 286 | 549 | 2509 |
| 55 | 614 | 473 | 279 | 37 | 7 | 0 | 0 | 0 | 0 | 56 | 233 | 490 | 2189 |
| 50 | 476 | 357 | 185 | 9 | 0 | 0 | 0 | 0 | 0 | 19 | 127 | 351 | 1524 |
| BASE | COOLING DEGREE DAYS | | | | | | | | | | | | ANN |
| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | |
| ABOVE 55 | 16 | 25 | 59 | 157 | 376 | 594 | 735 | 694 | 480 | 177 | 17 | 10 | 3340 |
| 57 | 12 | 19 | 43 | 120 | 319 | 534 | 673 | 632 | 420 | 141 | 10 | 7 | 2930 |
| 60 | 8 | 12 | 26 | 73 | 239 | 444 | 580 | 539 | 335 | 94 | 0 | 0 | 2350 |
| 65 | 0 | 0 | 11 | 21 | 134 | 302 | 475 | 384 | 202 | 35 | 0 | 0 | 1514 |
| 70 | 0 | 0 | 0 | 5 | 59 | 175 | 276 | 237 | 104 | 11 | 0 | 0 | 867 |

PROBABILITY THAT THE MONTHLY PRECIPITATION WILL BE EQUAL TO OR LESS THAN THE INDICATED PRECIPITATION AMOUNT

| PROBABILITY LEVELS | MONTHLY PRECIPITATION (INCHES) | | | | | | | | | | | |
|--------------------|--------------------------------|------|-------|------|------|------|------|------|------|------|------|-------|
| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
| .05 | 1.01 | 1.35 | 2.10 | 1.91 | 1.11 | 1.05 | 1.12 | .98 | .63 | .50 | 1.13 | 1.09 |
| .10 | 1.43 | 1.76 | 2.66 | 2.31 | 1.50 | 1.40 | 1.49 | 1.34 | .92 | .75 | 1.53 | 1.53 |
| .20 | 2.09 | 2.36 | 3.47 | 2.88 | 2.10 | 1.94 | 2.03 | 1.89 | 1.41 | 1.16 | 2.14 | 2.20 |
| .30 | 2.69 | 2.87 | 4.15 | 3.34 | 2.63 | 2.41 | 2.50 | 2.37 | 1.86 | 1.55 | 2.68 | 2.81 |
| .40 | 3.29 | 3.36 | 4.80 | 3.77 | 3.14 | 2.87 | 2.96 | 2.85 | 2.31 | 1.94 | 3.21 | 3.41 |
| .50 | 3.92 | 3.87 | 5.46 | 4.21 | 3.68 | 3.35 | 3.43 | 3.36 | 2.80 | 2.37 | 3.76 | 4.05 |
| .60 | 4.63 | 4.43 | 6.19 | 4.67 | 4.28 | 3.87 | 3.96 | 3.92 | 3.36 | 2.86 | 4.37 | 4.76 |
| .70 | 5.49 | 5.09 | 7.03 | 5.21 | 4.99 | 4.50 | 4.58 | 4.58 | 4.04 | 3.45 | 5.09 | 5.62 |
| .80 | 6.61 | 5.94 | 8.11 | 5.89 | 5.92 | 5.31 | 5.38 | 5.45 | 4.93 | 4.24 | 6.04 | 6.73 |
| .90 | 8.39 | 7.26 | 9.78 | 6.93 | 7.37 | 6.58 | 6.63 | 6.82 | 6.36 | 5.51 | 7.52 | 8.51 |
| .95 | 10.08 | 8.48 | 11.31 | 7.87 | 8.73 | 7.77 | 7.79 | 8.10 | 7.73 | 6.72 | 8.90 | 10.17 |

THESE VALUES WERE DETERMINED FROM THE INCOMPLETE GAMMA DISTRIBUTION.

DERIVED FROM THE 1951-80 MONTHLY NORMALS

SOURCE: NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

401790 CLARKESVILLE, TN

DEG MIN DEG MIN
LAT: 36 33N LONG: 87 22W

PERIOD: 1951-80

FREEZE DATA

PROBABILITY OF LATER DATE IN SPRING (THRU JULY 31) THAN INDICATED(*)

| TEMP (F) | SPRING FREEZE DATES (MO/DAY) | | | | | | | | |
|----------|------------------------------|------|------|------|------|------|------|------|------|
| | 90 | 80 | 70 | 60 | 50 | 40 | 30 | 20 | 10 |
| 36 | 4/12 | 4/17 | 4/21 | 4/24 | 4/27 | 4/30 | 5/03 | 5/07 | 5/12 |
| 32 | 3/29 | 4/03 | 4/07 | 4/10 | 4/12 | 4/15 | 4/18 | 4/22 | 4/27 |
| 28 | 3/12 | 3/17 | 3/21 | 3/24 | 3/27 | 3/30 | 4/03 | 4/07 | 4/12 |
| 24 | 2/17 | 2/25 | 3/03 | 3/08 | 3/13 | 3/18 | 3/23 | 3/28 | 4/05 |
| 20 | 1/29 | 2/08 | 2/15 | 2/21 | 2/27 | 3/05 | 3/11 | 3/18 | 3/28 |
| 16 | 1/17 | 1/29 | 2/06 | 2/13 | 2/19 | 2/25 | 3/03 | 3/11 | 3/21 |

PROBABILITY OF EARLIER DATE IN FALL (BEGINNING AUG 1) THAN INDICATED(*)

| TEMP (F) | FALL FREEZE DATES (MO/DAY) | | | | | | | | |
|----------|----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 |
| 36 | 10/02 | 10/06 | 10/09 | 10/11 | 10/14 | 10/16 | 10/18 | 10/21 | 10/25 |
| 32 | 10/08 | 10/13 | 10/16 | 10/19 | 10/22 | 10/25 | 10/27 | 10/31 | 11/05 |
| 28 | 10/20 | 10/25 | 10/28 | 10/31 | 11/02 | 11/04 | 11/07 | 11/10 | 11/15 |
| 24 | 10/31 | 11/04 | 11/07 | 11/10 | 11/13 | 11/15 | 11/18 | 11/21 | 11/26 |
| 20 | 11/05 | 11/11 | 11/15 | 11/18 | 11/22 | 11/25 | 11/29 | 12/03 | 12/08 |
| 16 | 11/17 | 11/25 | 11/30 | 12/05 | 12/09 | 12/14 | 12/19 | 12/25 | 1/03 |

PROBABILITY OF LONGER THAN INDICATED FREEZE FREE PERIOD (DAYS)

| TEMP (F) | FREEZE FREE PERIOD | | | | | | | | |
|----------|--------------------|-----|-----|-----|-----|-----|-----|-----|-----|
| | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 |
| 36 | 190 | 182 | 177 | 173 | 169 | 165 | 160 | 155 | 148 |
| 32 | 212 | 205 | 200 | 196 | 192 | 188 | 183 | 178 | 171 |
| 28 | 238 | 231 | 227 | 223 | 219 | 215 | 211 | 207 | 200 |
| 24 | 272 | 262 | 255 | 250 | 244 | 239 | 233 | 226 | 217 |
| 20 | 300 | 289 | 281 | 273 | 267 | 260 | 253 | 245 | 234 |
| 16 | >365 | 314 | 302 | 294 | 287 | 281 | 274 | 267 | 257 |

(*)PROBABILITY OF OBSERVING A TEMPERATURE AS COLD, OR COLDER, LATER IN THE SPRING OR EARLIER IN THE FALL THAN THE INDICATED DATE.
0/00 INDICATES THAT THE PROBABILITY OF OCCURRENCE OF THRESHOLD TEMPERATURE IS LESS THAN INDICATED PROBABILITY.

GROWING DEGREE UNITS TO SELECTED BASE TEMPERATURES (F)

| BASE | GROWING DEGREE UNITS | | | | | | | | | | | | | |
|------|----------------------|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|
| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | ANN | |
| 40 | M | 92 | 119 | 295 | 576 | 843 | 1052 | 1204 | 1167 | 936 | 592 | 277 | 125 | 7278 |
| | S | 92 | 211 | 506 | 1082 | 1925 | 2977 | 4181 | 5348 | 6284 | 6876 | 7153 | 7278 | |
| 45 | M | 48 | 63 | 188 | 432 | 688 | 902 | 1049 | 1012 | 786 | 441 | 173 | 65 | 5847 |
| | S | 48 | 111 | 299 | 731 | 1419 | 2321 | 3370 | 4382 | 5168 | 5609 | 5782 | 5847 | |
| 50 | M | 23 | 30 | 108 | 298 | 533 | 752 | 894 | 857 | 637 | 301 | 95 | 29 | 4557 |
| | S | 23 | 53 | 161 | 459 | 992 | 1744 | 2638 | 3495 | 4132 | 4433 | 4528 | 4557 | |
| 55 | M | 9 | 11 | 54 | 188 | 384 | 602 | 739 | 702 | 488 | 184 | 44 | 10 | 3415 |
| | S | 9 | 20 | 74 | 262 | 646 | 1248 | 1987 | 2689 | 3177 | 3361 | 3405 | 3415 | |
| 60 | M | 2 | 3 | 22 | 104 | 249 | 452 | 584 | 547 | 343 | 96 | 16 | 2 | 2420 |
| | S | 2 | 5 | 27 | 131 | 380 | 832 | 1416 | 1963 | 2306 | 2402 | 2418 | 2420 | |

M = MONTHLY DATA S = SUM OF MONTHLY DATA

GROWING DEGREE UNITS FOR CORN

| CORN | GROWING DEGREE UNITS FOR CORN | | | | | | | | | | | | |
|------|-------------------------------|-----|-----|-----|------|------|------|------|------|------|------|------|------|
| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | ANN |
| M | 60 | 80 | 190 | 371 | 548 | 705 | 811 | 787 | 615 | 386 | 181 | 78 | 4812 |
| S | 60 | 140 | 330 | 701 | 1249 | 1954 | 2765 | 3552 | 4167 | 4553 | 4734 | 4812 | |

NOTE: FOR CORN THE BASE IS 50, AND THE DEGREE UNITS ARE ADJUSTED FOR TEMPERATURES BELOW 50 AND ABOVE 86

OTHER CLIMATOLOGICAL DATA ARE AVAILABLE IN A VARIETY OF SUMMARIES AND FORMATS, SUCH AS THE CLIMATOGRAPHY OF THE UNITED STATES; NO. 60 - CLIMATE OF STATES; NO. 81 - MONTHLY NORMALS (AND SUPPLEMENTS: ANNUAL DEGREE DAYS TO SELECTED BASES DERIVED FROM THE 1951-80 NORMALS; AND MONTHLY PRECIPITATION PROBABILITIES, SELECTED PROBABILITY LEVELS DERIVED FROM THE 1951-80 NORMALS); NO. 84 - DAILY NORMALS; NO. 85 - DIVISIONAL NORMALS. A VARIETY OF DATA IS AVAILABLE EITHER ON MAGNETIC TAPE, MICROFICHE, OR PAPER COPY.

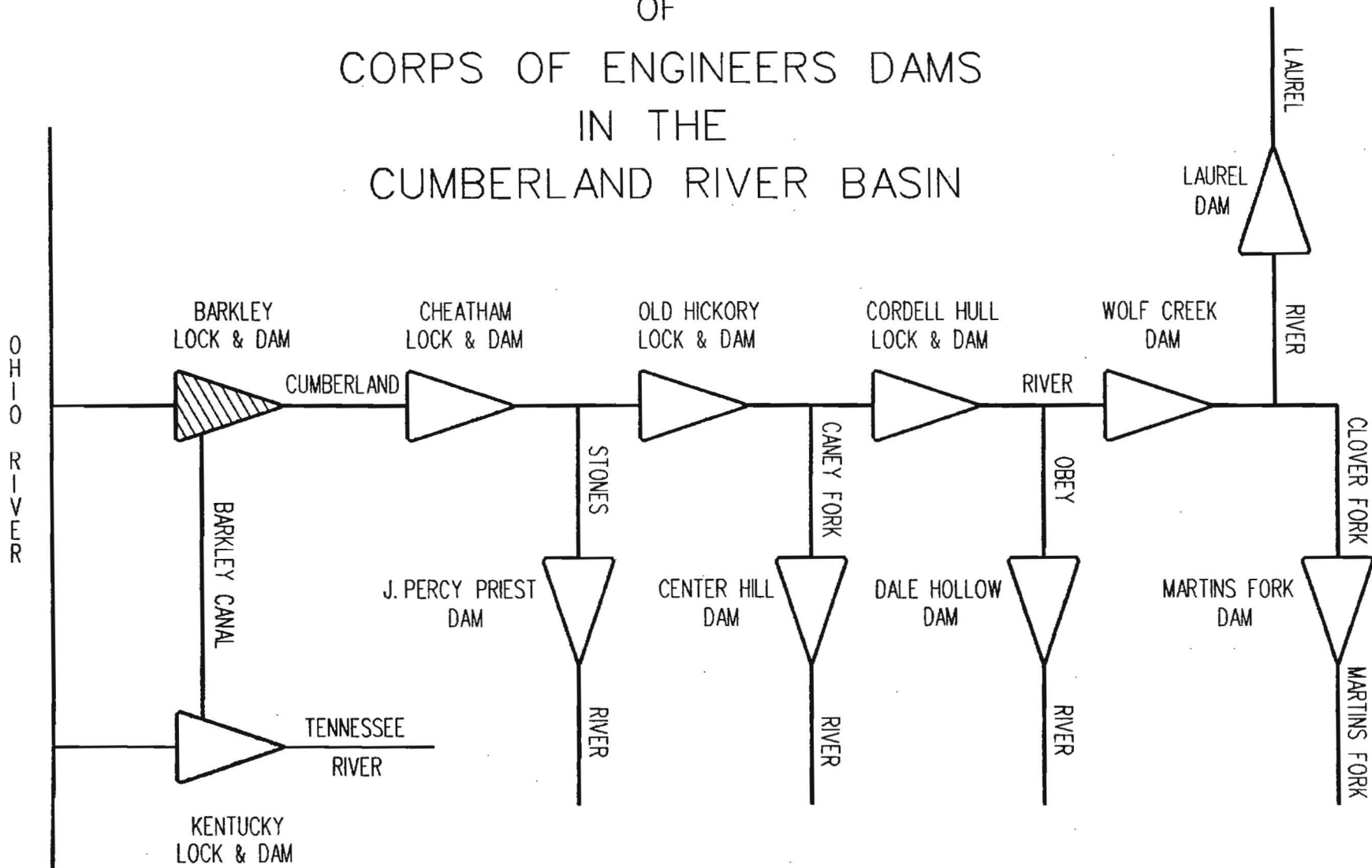
TO OBTAIN INFORMATION ABOUT CLIMATOLOGICAL DATA AND RELATED PUBLICATIONS, CONTACT:

DIRECTOR
NATIONAL CLIMATIC DATA CENTER
FEDERAL BUILDING
ASHEVILLE, NC 28801-2696
(OR TELEPHONE: (704) 259-0682)

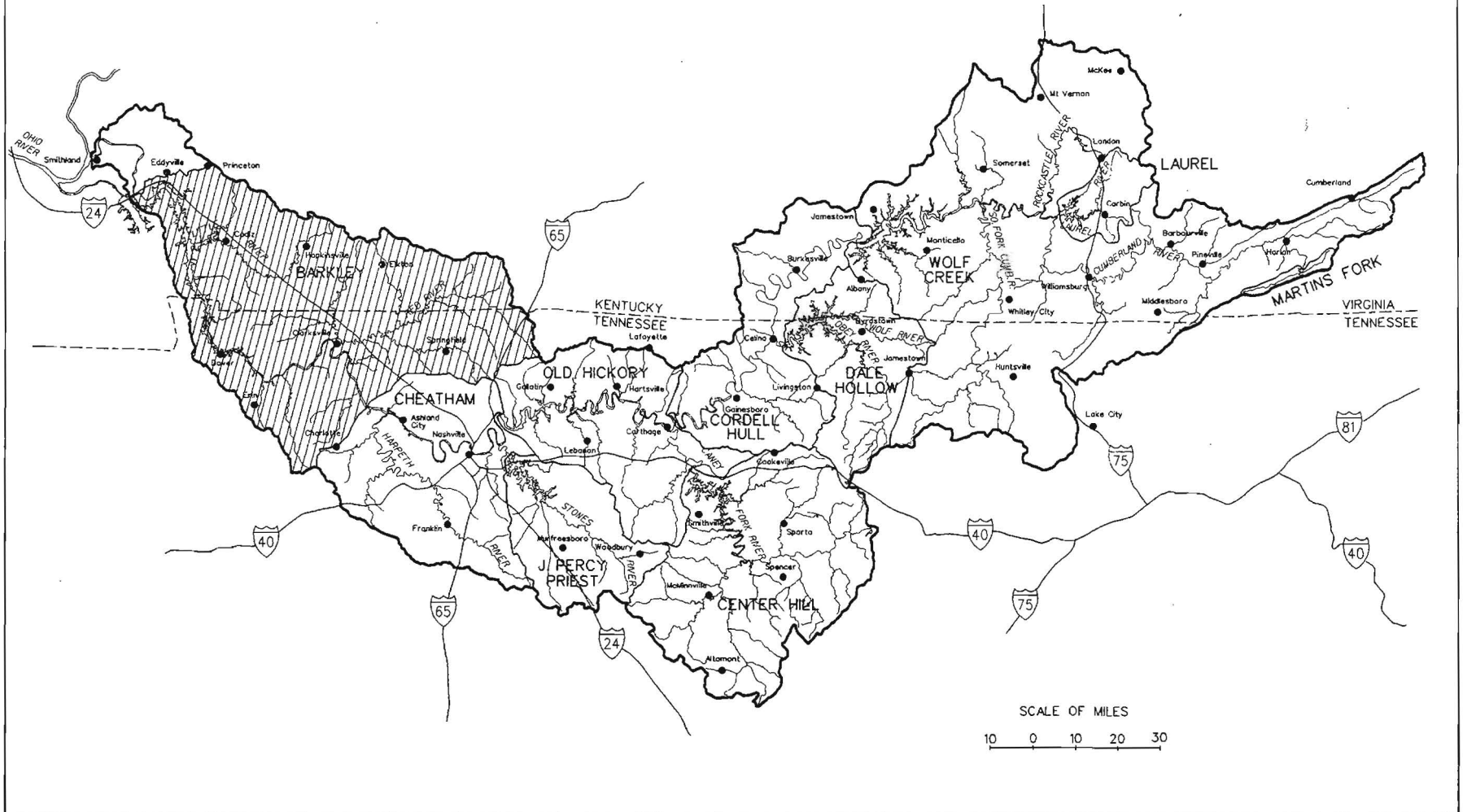
DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL ENVIRONMENTAL SATELLITE, DATA, AND INFORMATION SERVICE
NATIONAL CLIMATIC DATA CENTER
ASHEVILLE, NC



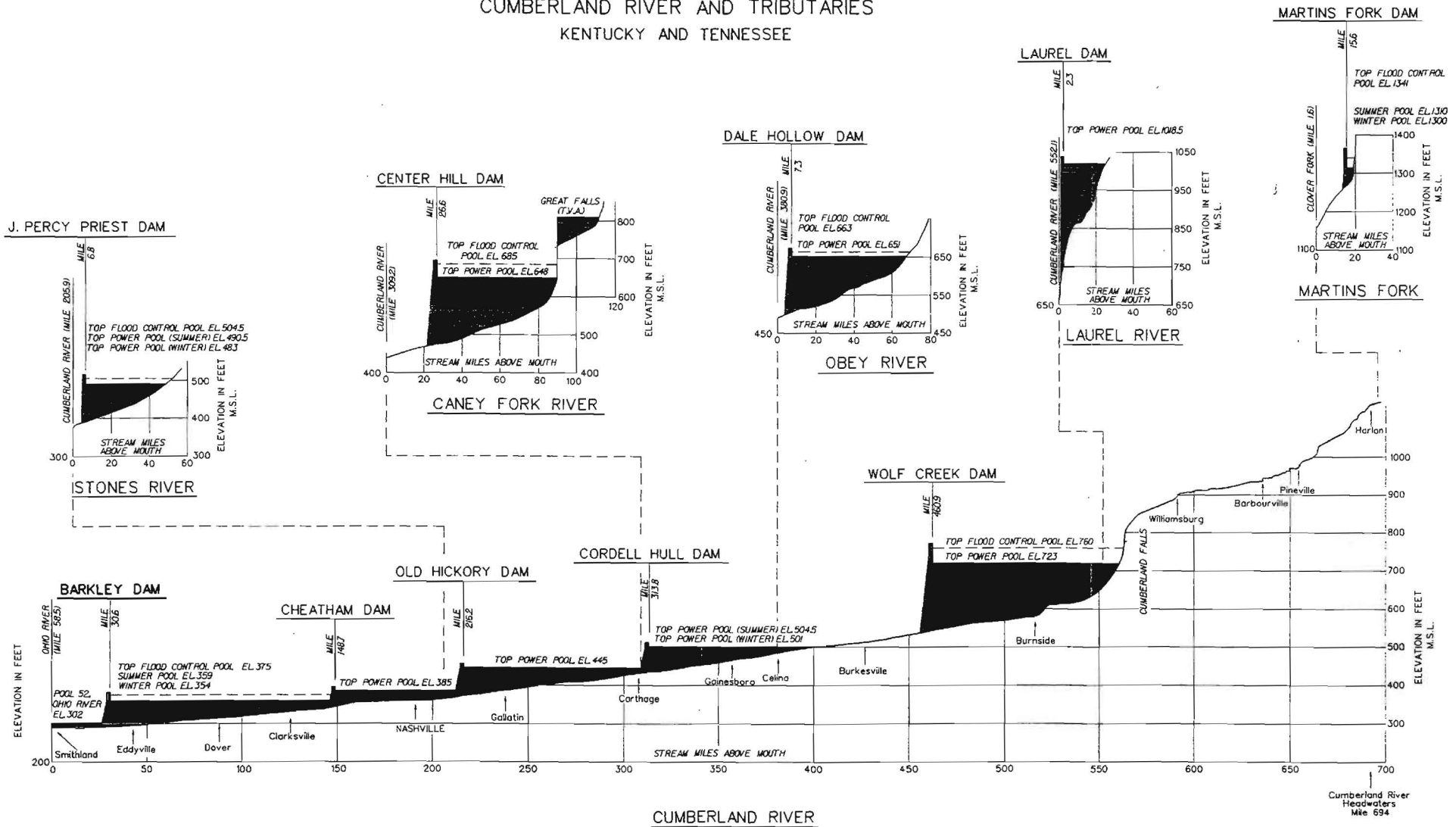
SCHEMATIC
OF
CORPS OF ENGINEERS DAMS
IN THE
CUMBERLAND RIVER BASIN



CUMBERLAND RIVER BASIN MAP



PROFILE OF
CUMBERLAND RIVER AND TRIBUTARIES
KENTUCKY AND TENNESSEE



Redacted

Ex. 7

| | | | |
|----------|----------|--|--------|
| 3 | 9-21-61 | Transitioned Railroad | C.D.A. |
| 4 | 6-27-61 | Added Water Line, Detail A, Section D and Section E. E. | C.D.A. |
| 5 | 6-18-61 | Revised Stationing, Details of Top of Dam, Access | C.D.A. |
| 2 | 2-1-61 | Revised Silt A-A and Added Slope Information on Silt C. C. | C.D.A. |
| 1 | 12-28-60 | GENERAL REVISION | C.D.A. |
| REVISION | DATE | DESCRIPTION | BY |

SCALE: 1" = 400 FEET

CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER
NASHVILLE, TENNESSEE DISTRICT

CUMBERLAND RIVER
KENTUCKY AND TENNESSEE
BARKLEY DAM PROJECT
SITE MAP

| POINT | Y | X |
|-------|---------|-----------|
| A | 258,894 | 1,878,577 |
| B | 259,503 | 1,877,495 |
| C | 263,037 | 1,876,288 |
| D | 255,734 | 1,878,261 |
| R.L. | 241,236 | 1,883,213 |

APPROVED: *[Signature]*
DISTRICT ENGINEER

DATE: APR. 1961

09-4/31.5

Redacted
Ex. 7

| | | | |
|--|------------------------------------|------------------------------|----------|
| MAIN DAM WORKS | | | |
| GENERAL PLAN ELEVATION & SECTIONS | | | |
| KENTUCKY PROJECT TENNESSEE VALLEY AUTHORITY DIVISION OF DESIGN | | | |
| DESIGNED BY <i>E. W. ...</i> | RECOMMENDED BY <i>A. L. ...</i> | APPROVED BY <i>R. ...</i> | |
| INDYVILLE | 8-24-28 | B C 4 | 10W2204- |
| MADE UNDER A CONTRACT <i>R. ...</i> 8-18-28 | | | |

Redacted
Ex. 7

| | | | |
|--|----------------------------|--------------|-----------------------|
| CUMBERLAND RIVER KENTUCKY AND TENNESSEE BARKLEY DAM PROJECT CANAL GENERAL PLAN | | | |
| NO. 1 SHEET | 100' | SCALE | 300' 600' SHEET NO. 1 |
| U. S. ARMY ENGINEER DISTRICT, NASHVILLE NOVEMBER 1940 | | | |
| SUBMITTED | APPROVED | RECOMMENDED | APPROVED |
| CHIEF DESIGN BRANCH | CHIEF ENGINEERING DIVISION | COL. COMPTON | DISTRICT ENGINEER |
| 99-4/59 | 99-4/59 | | |

Redacted

Ex. 7

CUMBERLAND RIVER
TENNESSEE AND KENTUCKY
BARKLEY DAM & LAKE BARKLEY

SCALE IN FEET
0 600 1200

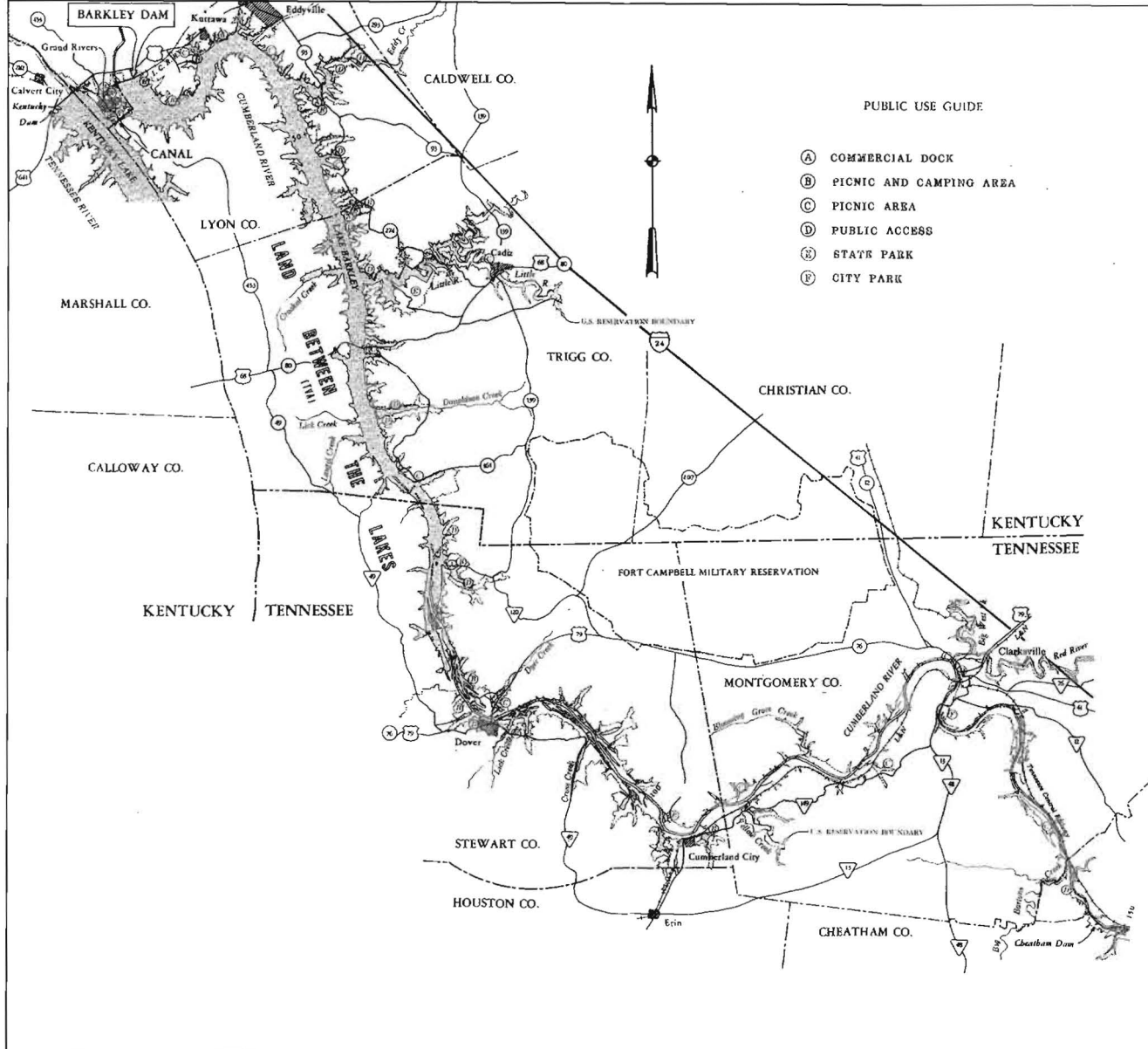
U.S. ARMY ENGINEER DISTRICT, NASHVILLE

30 JUNE 1971

PLATE C-9

CORPS OF ENGINEERS

U.S. ARMY



PUBLIC USE GUIDE

- (A) COMMERCIAL DOCK
- (B) PICNIC AND CAMPING AREA
- (C) PICNIC AREA
- (D) PUBLIC ACCESS
- (E) STATE PARK
- (F) CITY PARK



VICINITY MAP
Scale in Miles
0 10

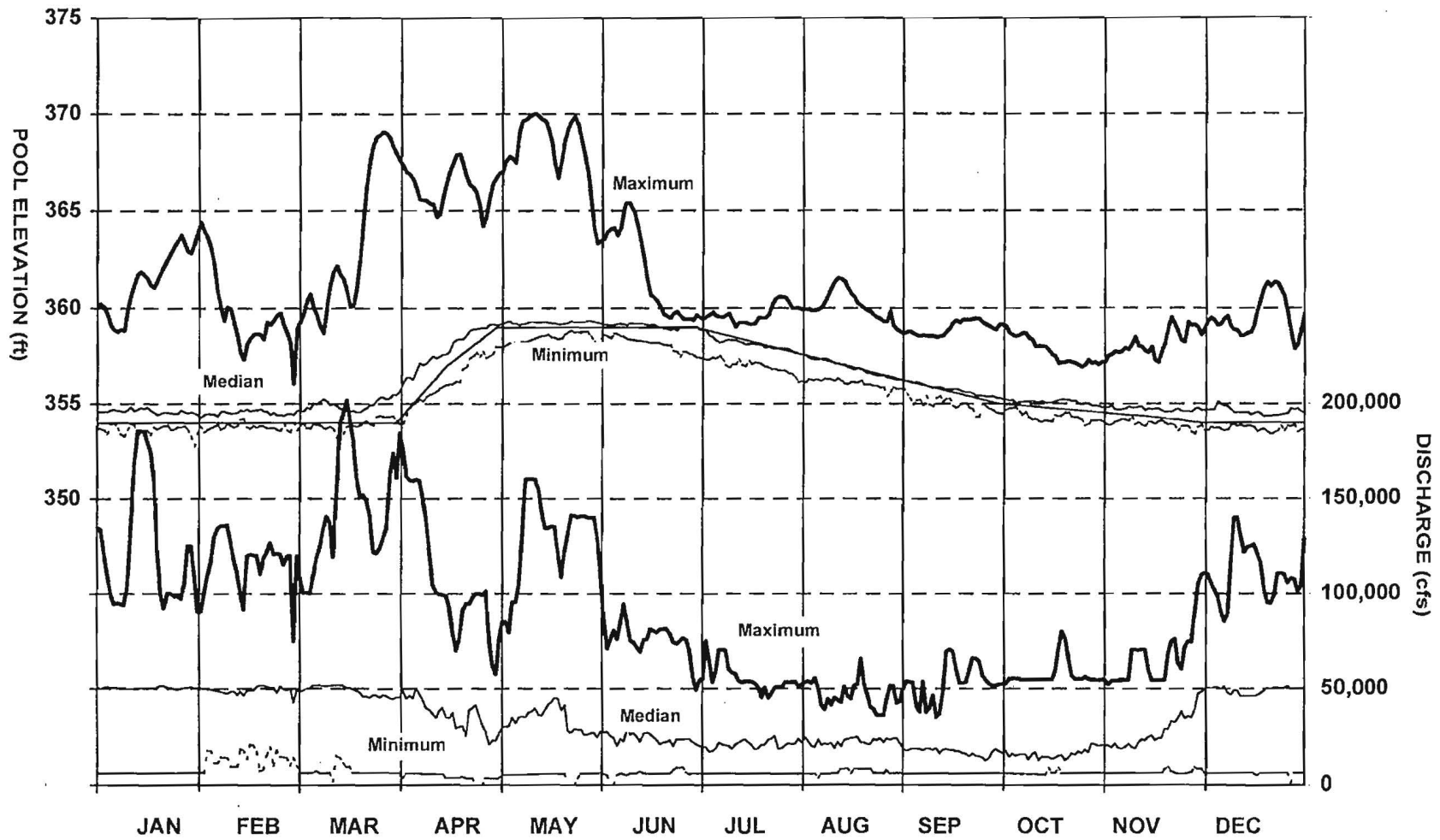
PROJECT STATUS:
Completed

CUMBERLAND RIVER
LAKE BARKLEY
TENNESSEE AND KENTUCKY

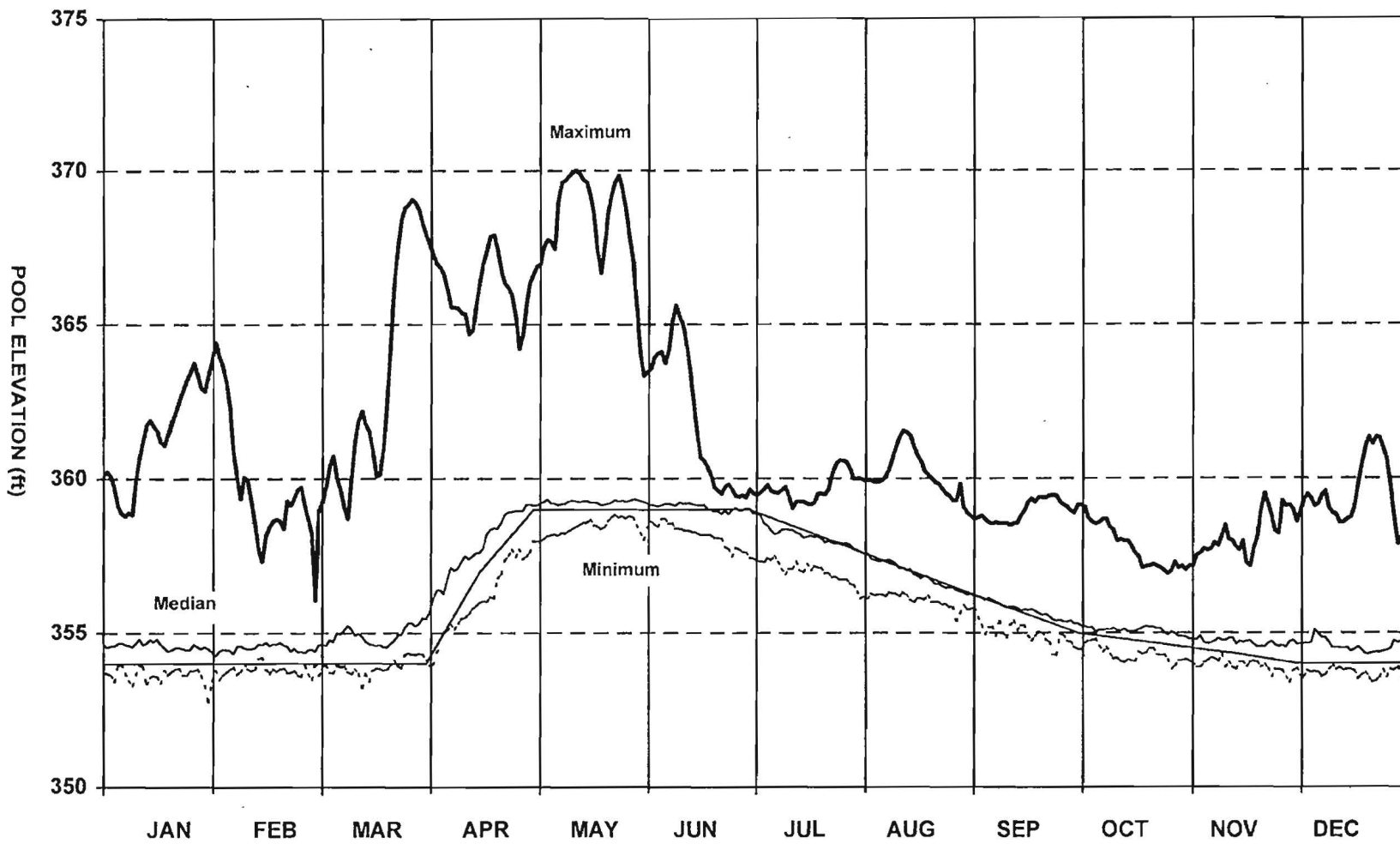
SCALE IN MILES
0 5 6

U.S. ARMY ENGINEER DISTRICT, NASHVILLE
10 JUNE 1973

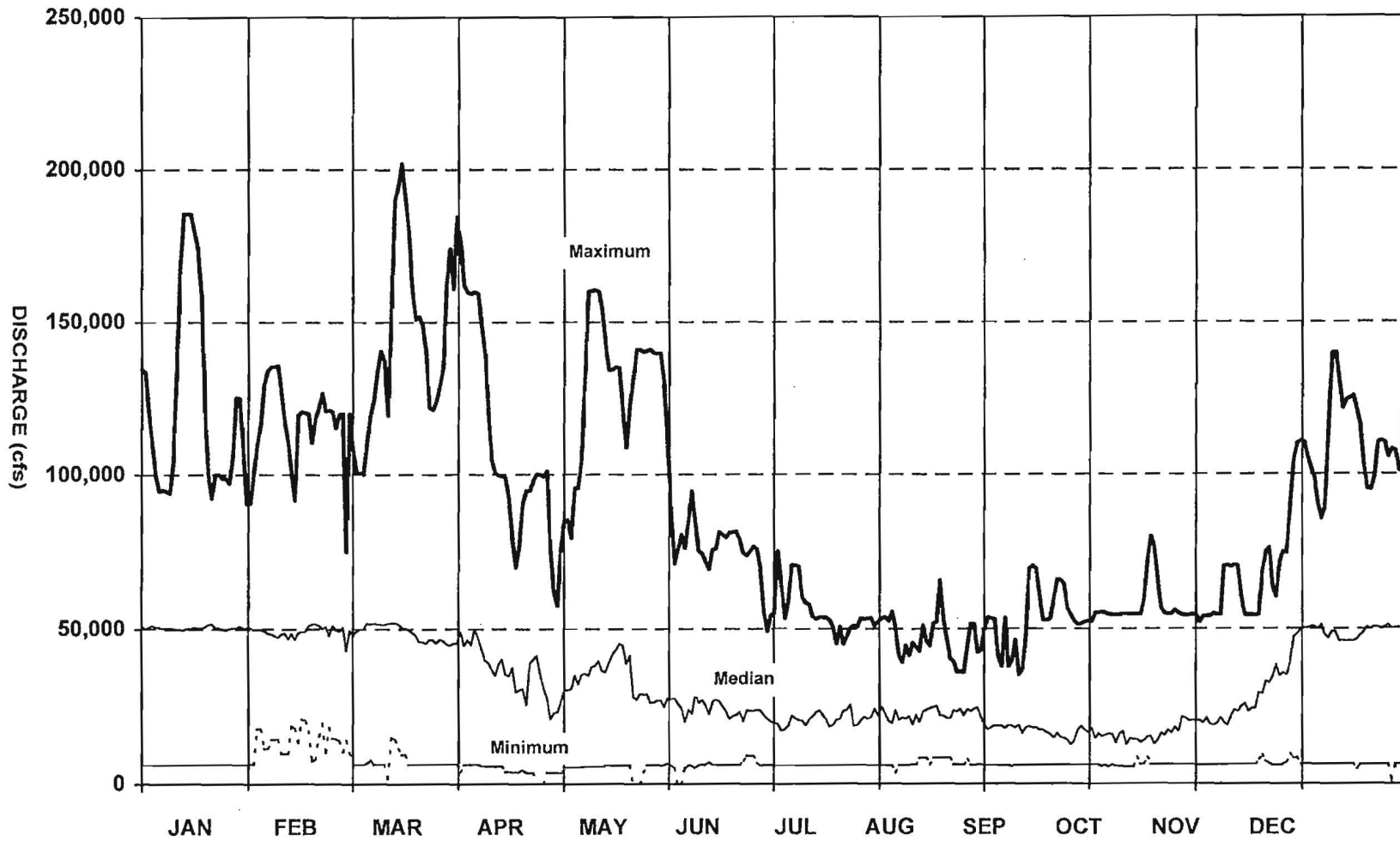
BARKLEY
DAILY MAXIMUM, MEDIAN & MINIMUM AVERAGE DISCHARGE & MIDNIGHT POOL ELEVATION
1967 THROUGH 1996



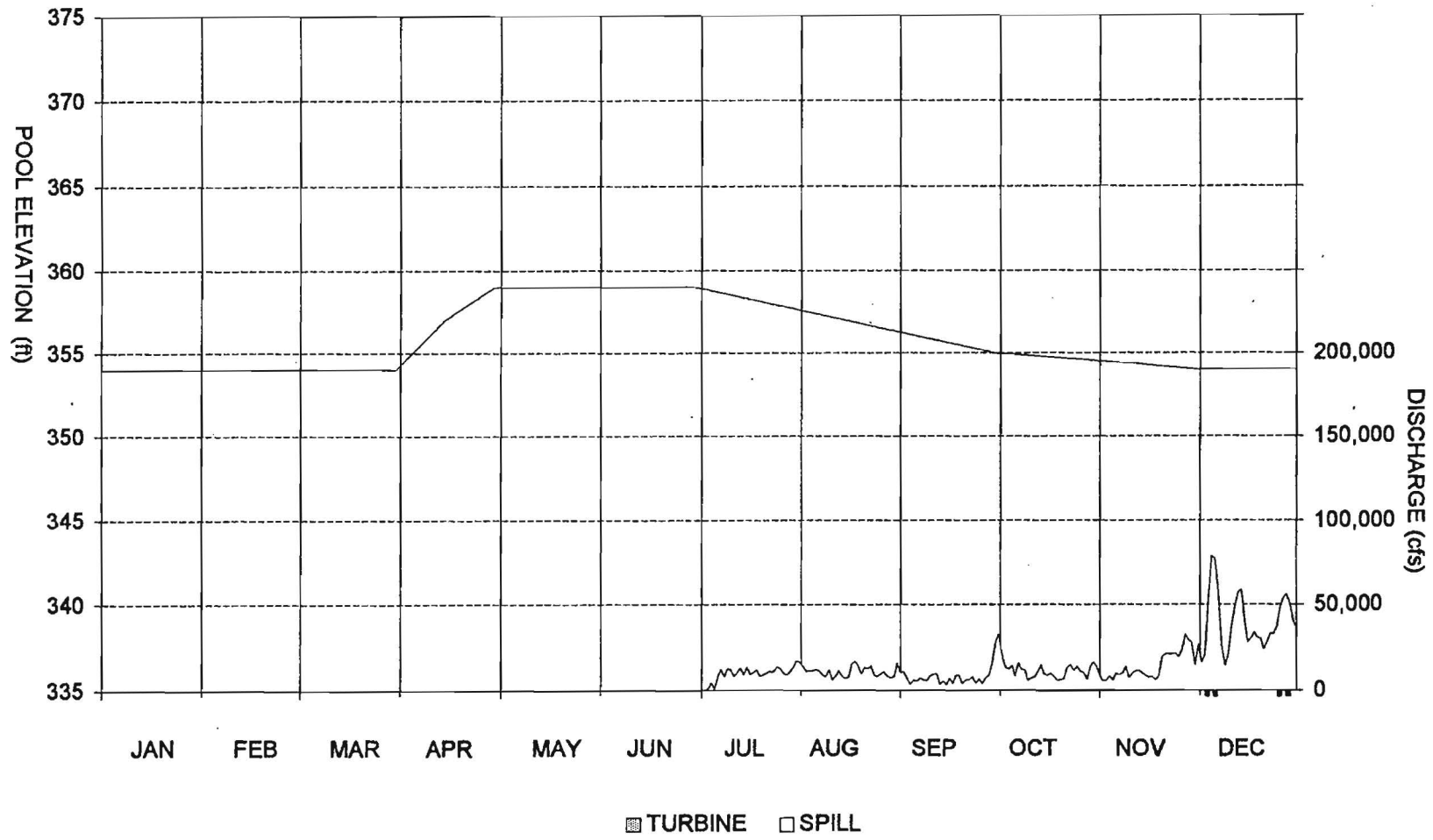
BARKLEY
DAILY MAXIMUM, MEDIAN & MINIMUM MIDNIGHT POOL ELEVATION
1967 THROUGH 1996



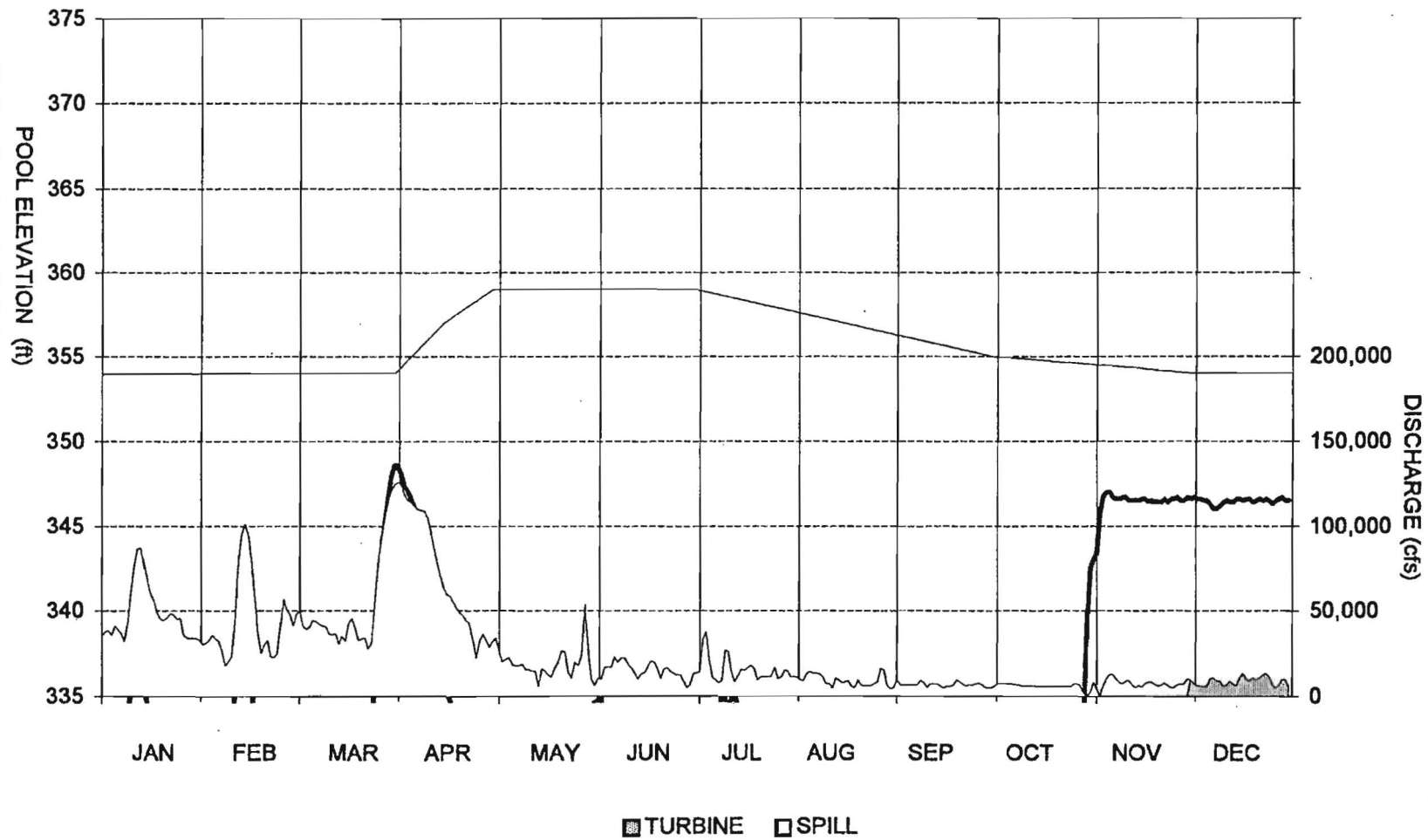
BARKLEY
DAILY MAXIMUM, MEDIAN & MINIMUM AVERAGE DISCHARGE
1967 THROUGH 1996



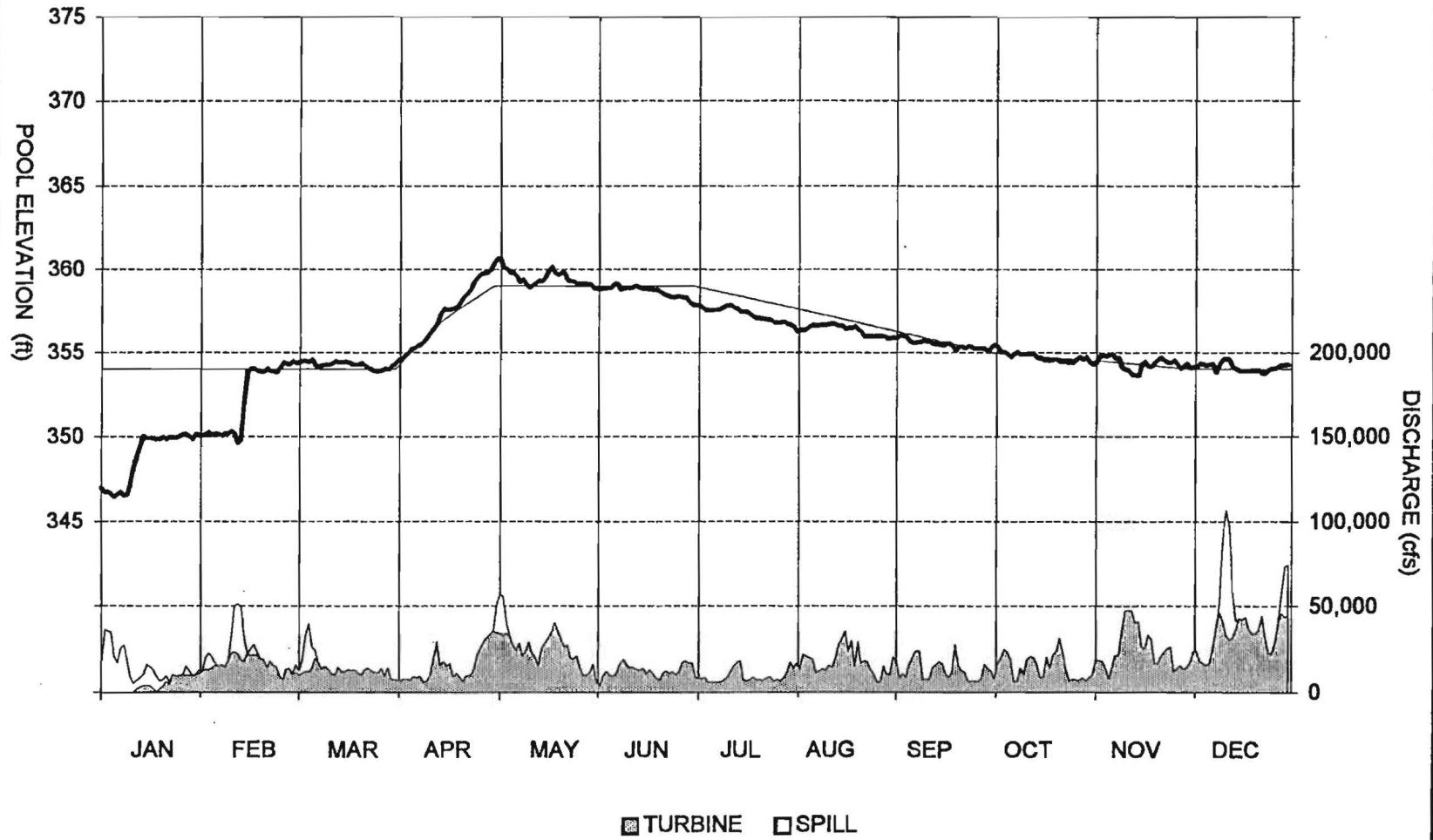
BARKLEY
DAILY POOL ELEVATION & AVERAGE DISCHARGE
1964



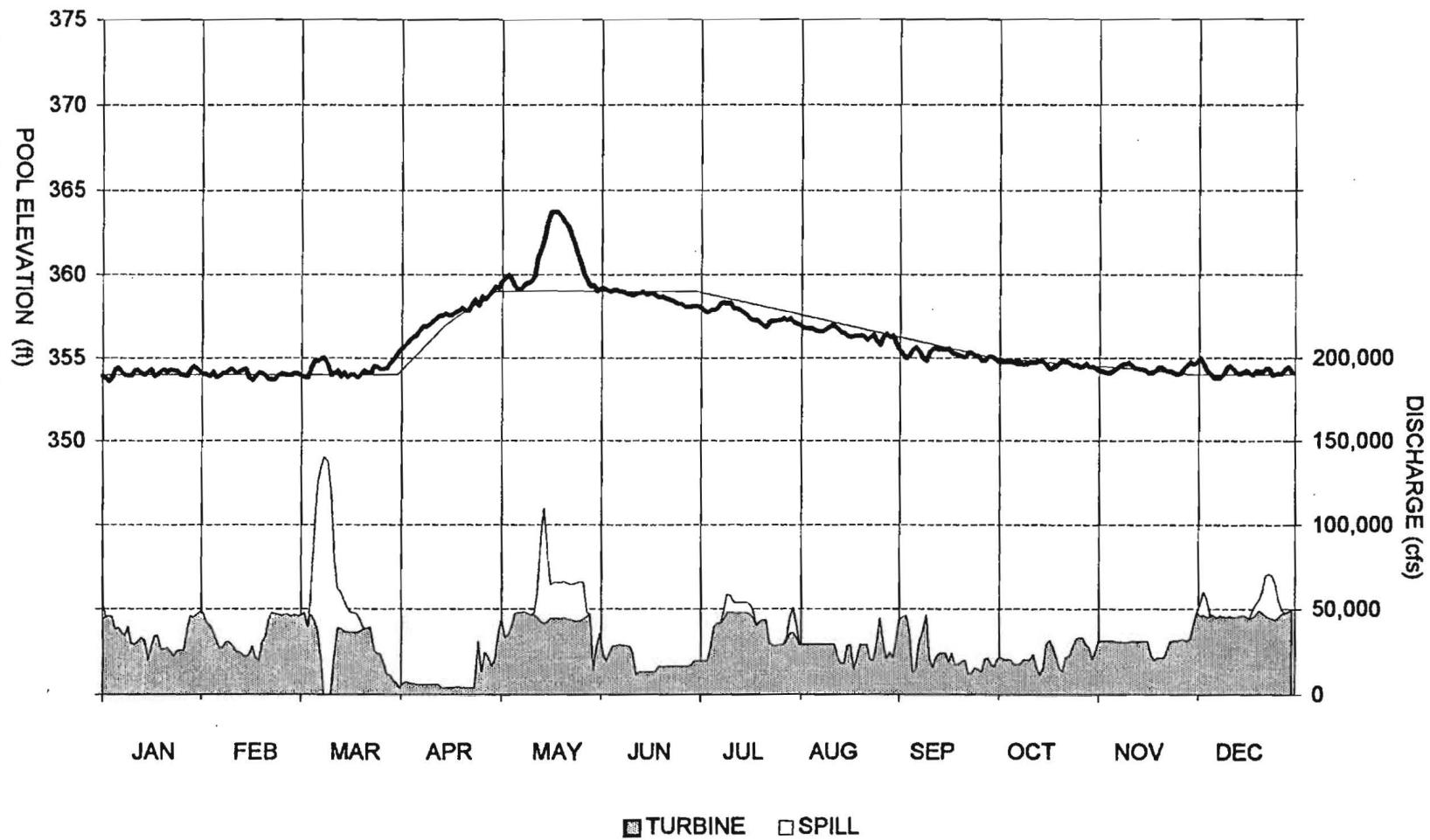
BARKLEY
DAILY POOL ELEVATION & AVERAGE DISCHARGE
1965



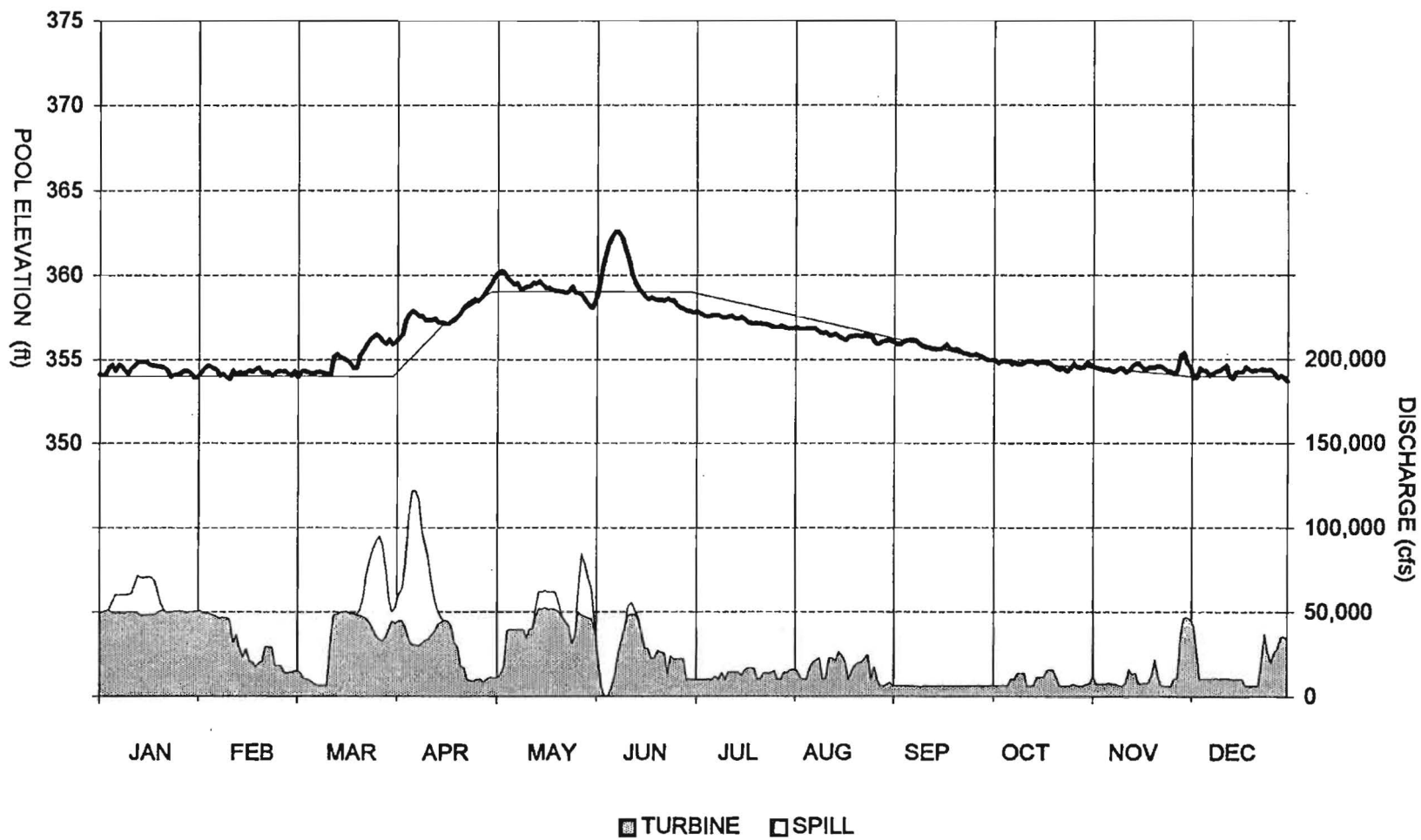
BARKLEY
DAILY POOL ELEVATION & AVERAGE DISCHARGE
1966



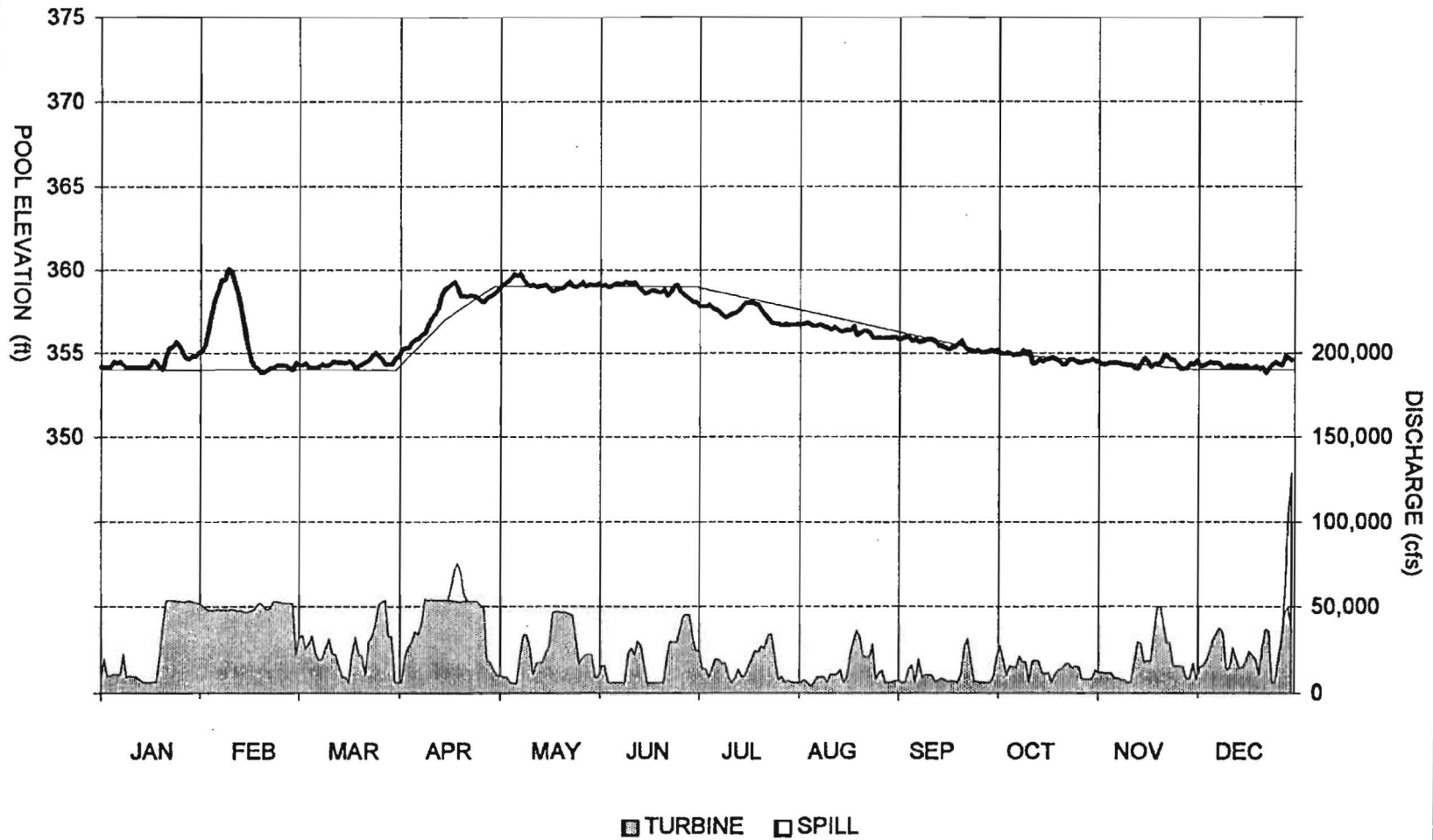
BARKLEY
DAILY POOL ELEVATION & AVERAGE DISCHARGE
1967



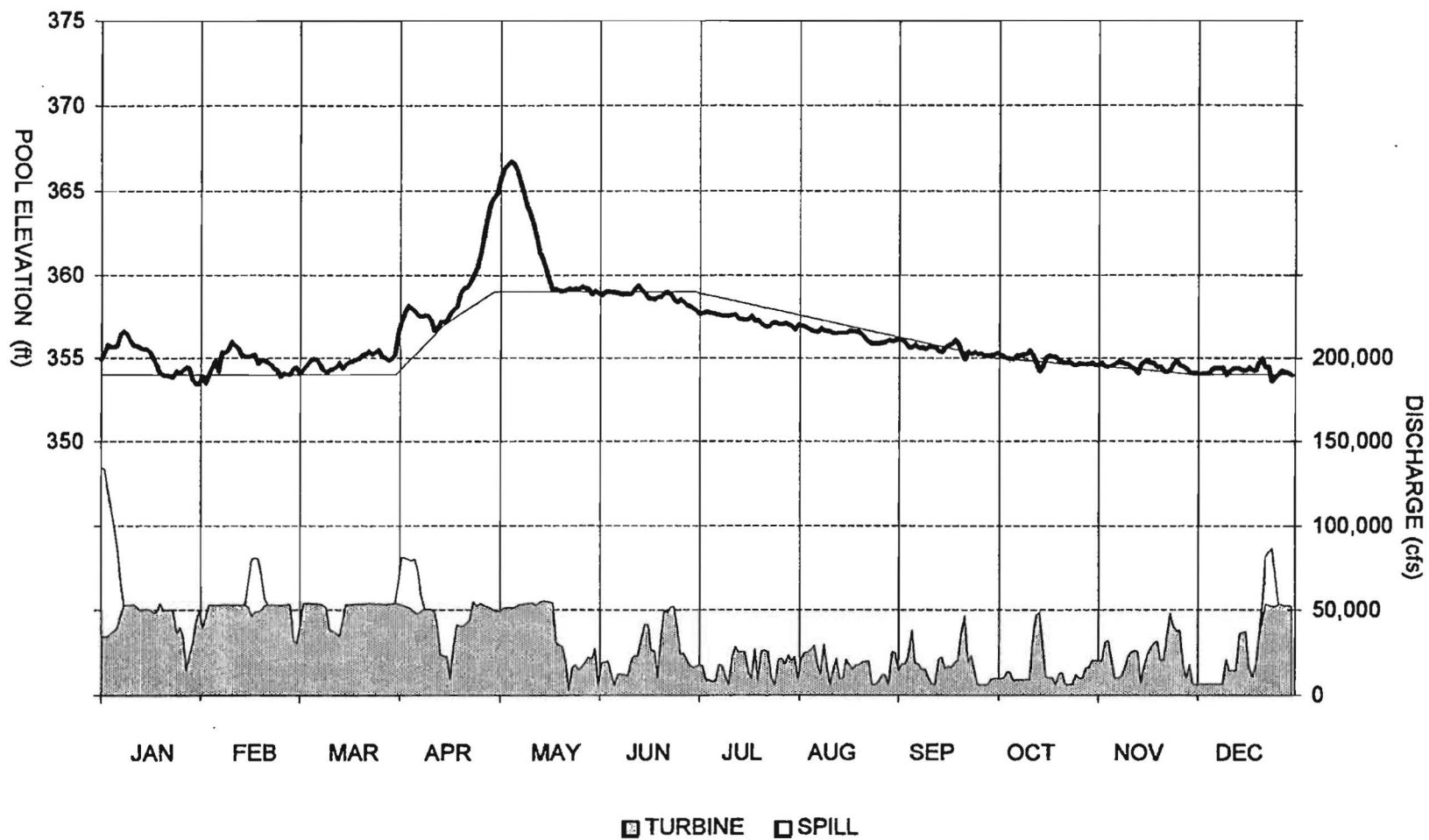
BARKLEY
DAILY POOL ELEVATION & AVERAGE DISCHARGE
1968



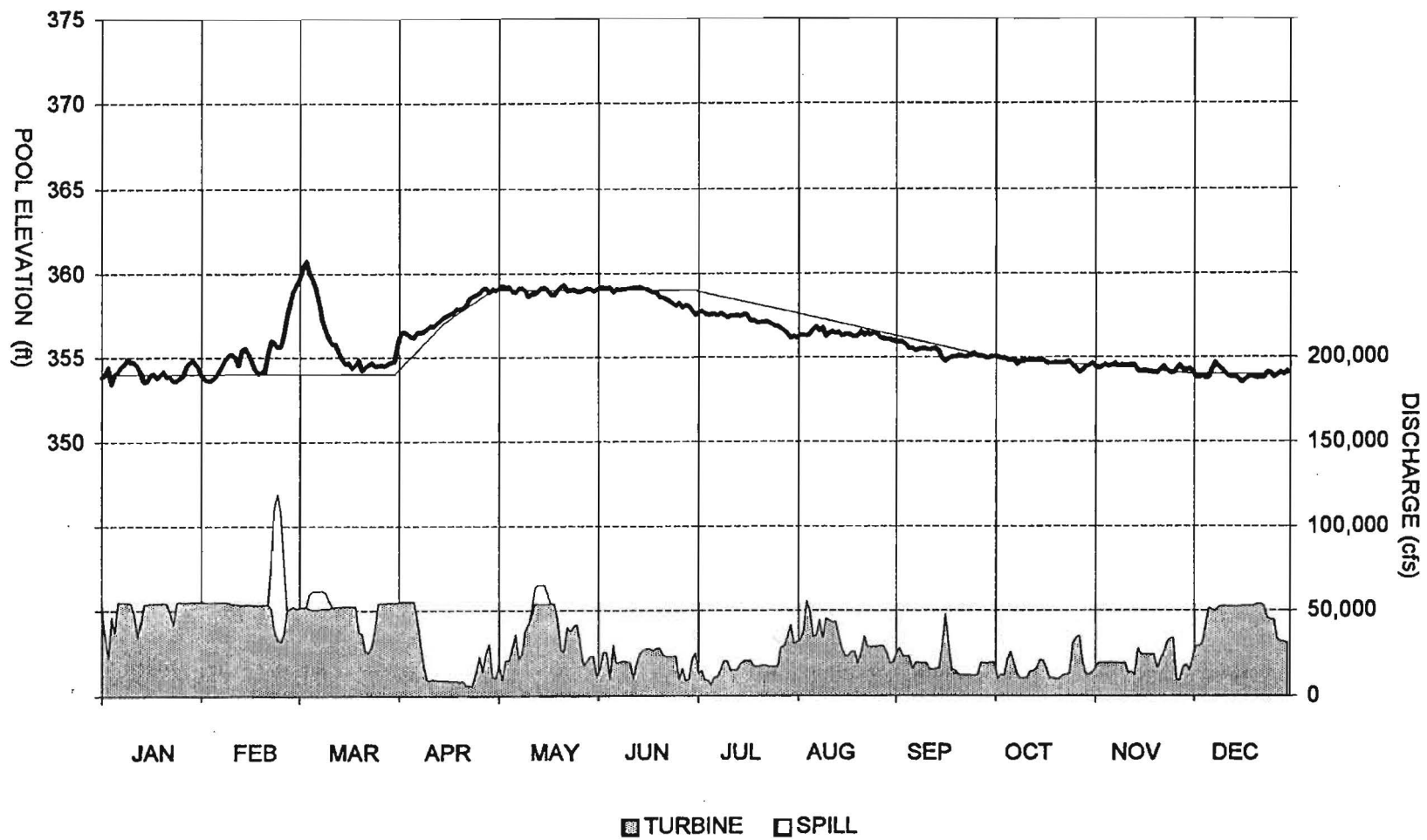
BARKLEY
DAILY POOL ELEVATION & AVERAGE DISCHARGE
1969



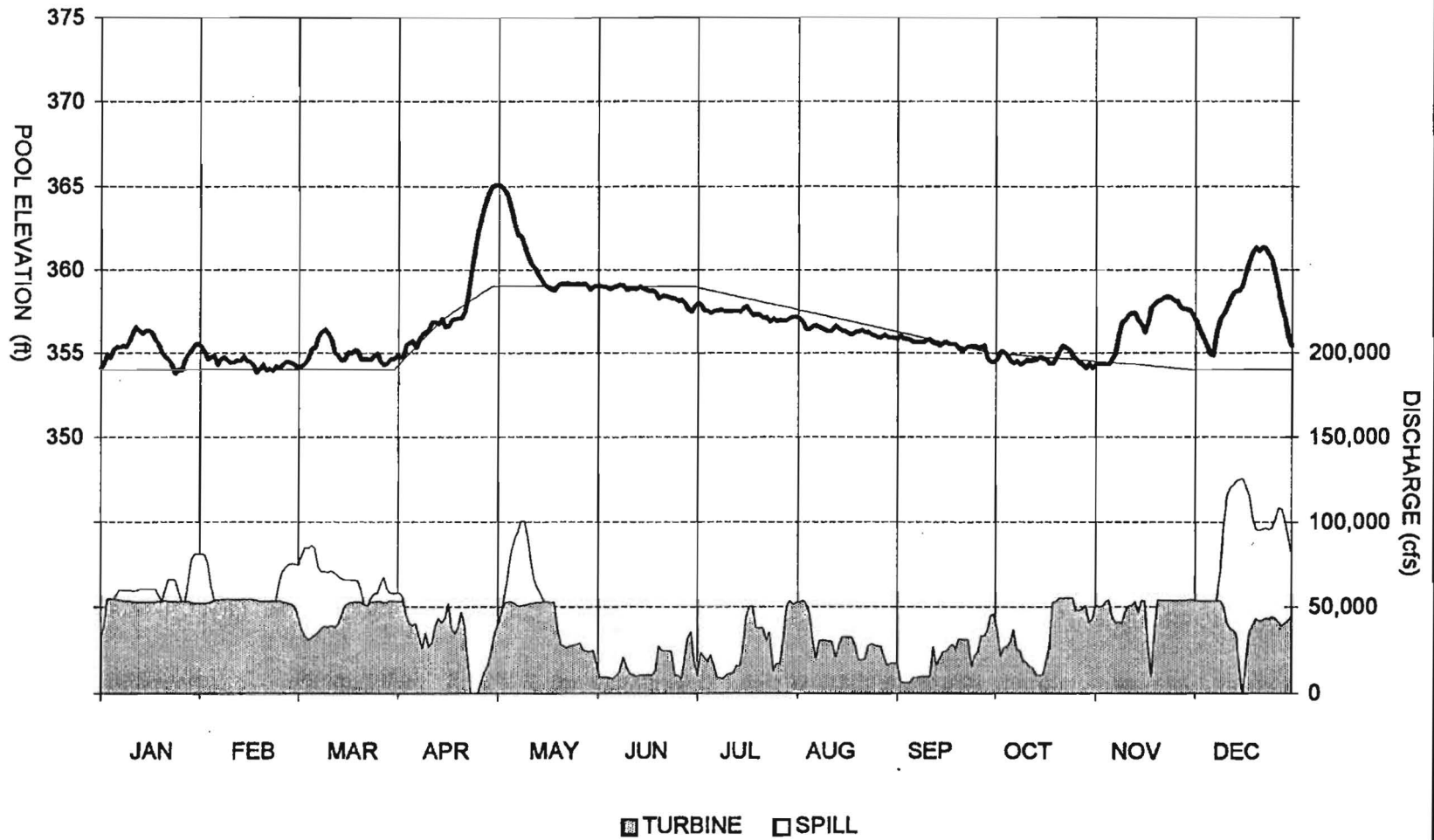
BARKLEY
DAILY POOL ELEVATION & AVERAGE DISCHARGE
1970



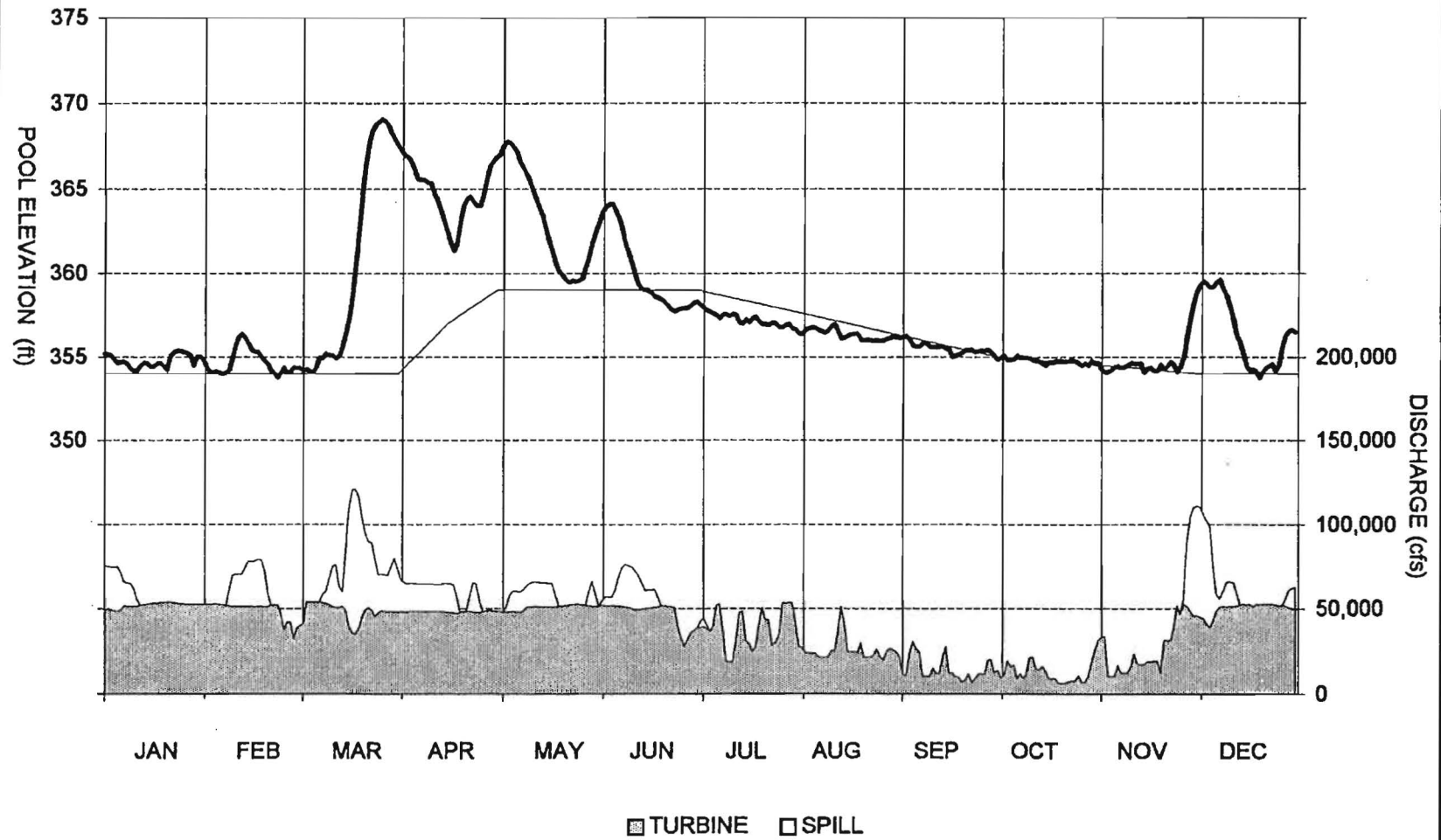
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DAILY POOL ELEVATION & AVERAGE DISCHARGE
1971



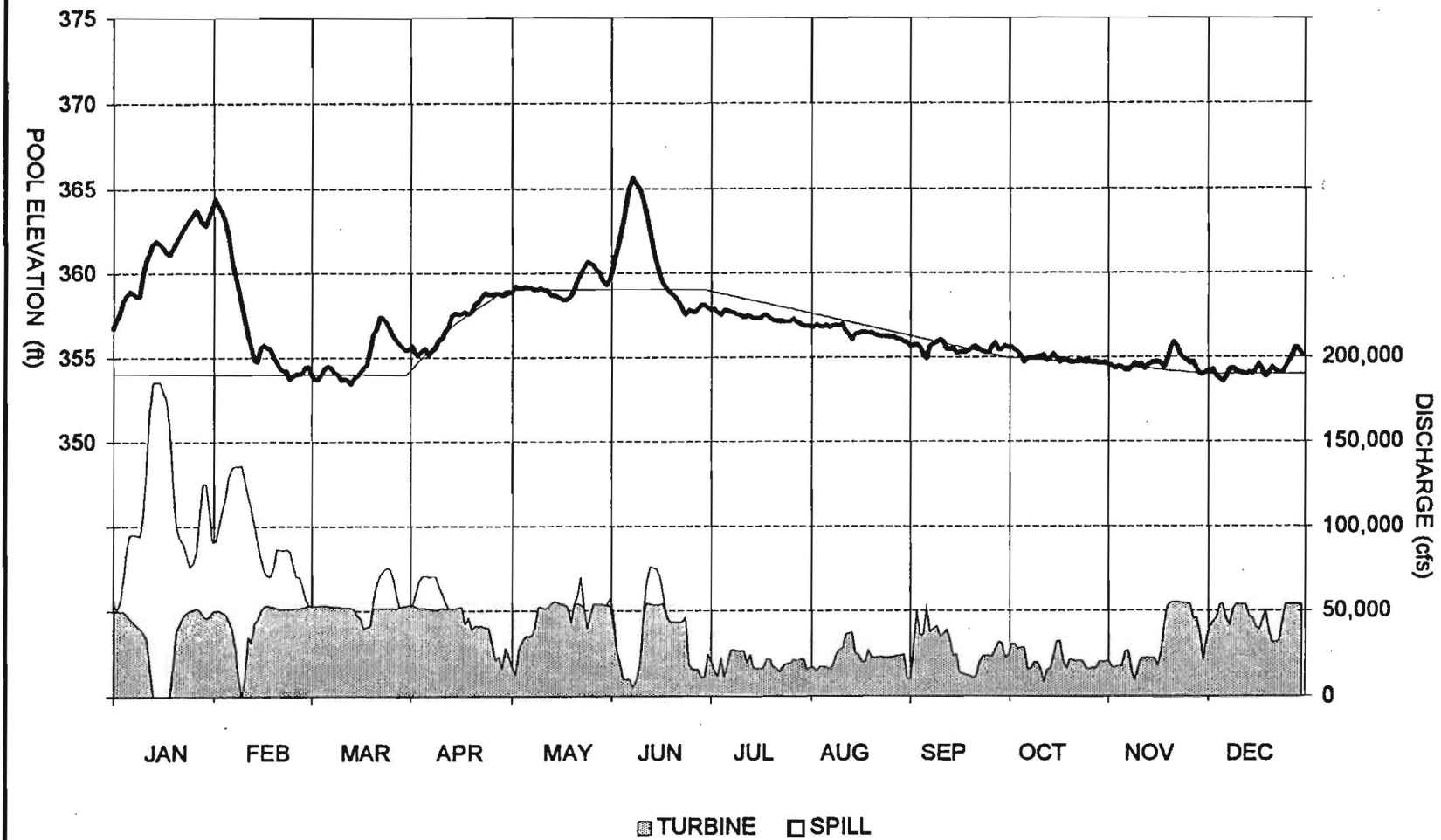
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DAILY POOL ELEVATION & AVERAGE DISCHARGE
1972



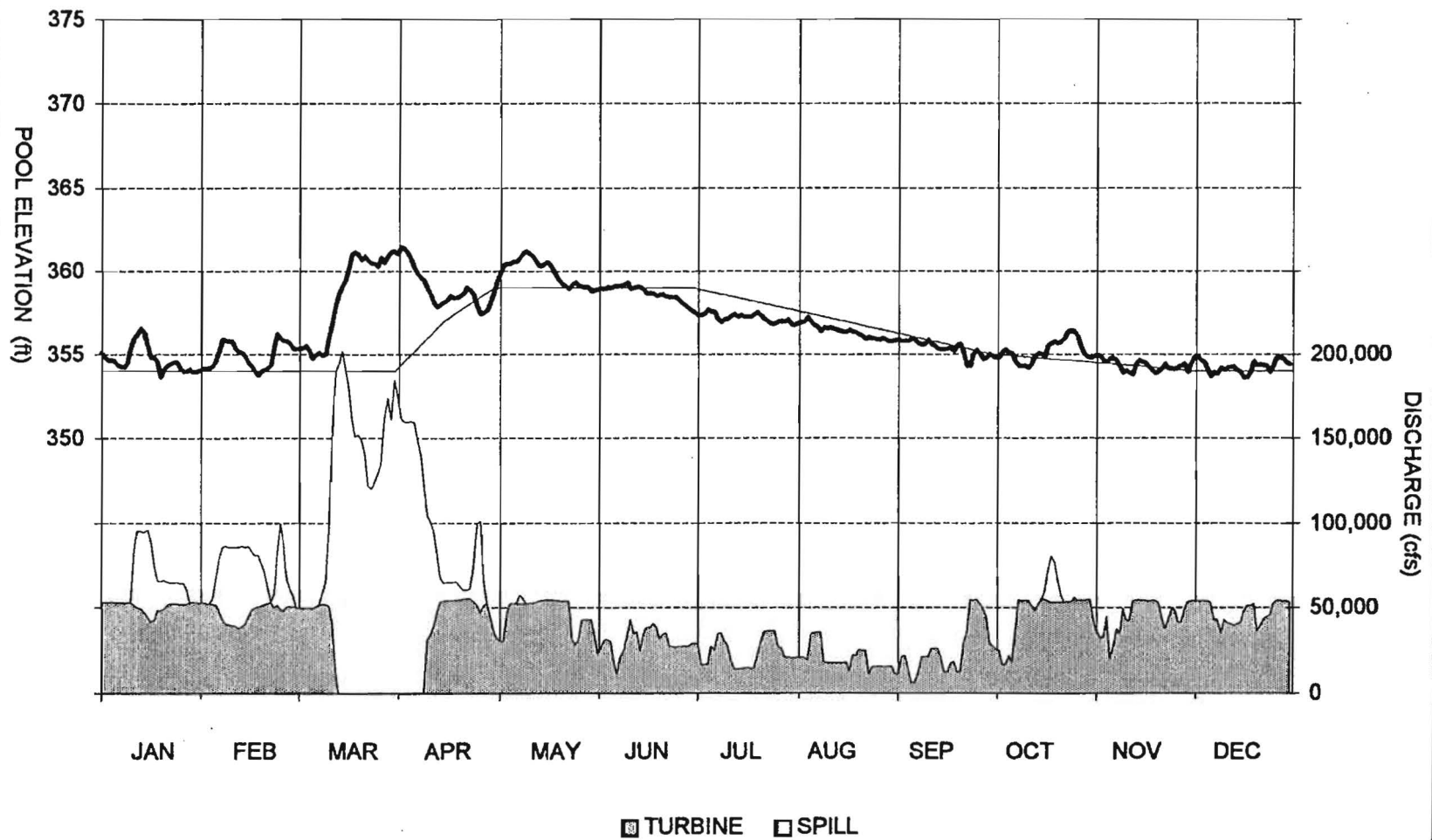
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DAILY POOL ELEVATION & AVERAGE DISCHARGE
1973



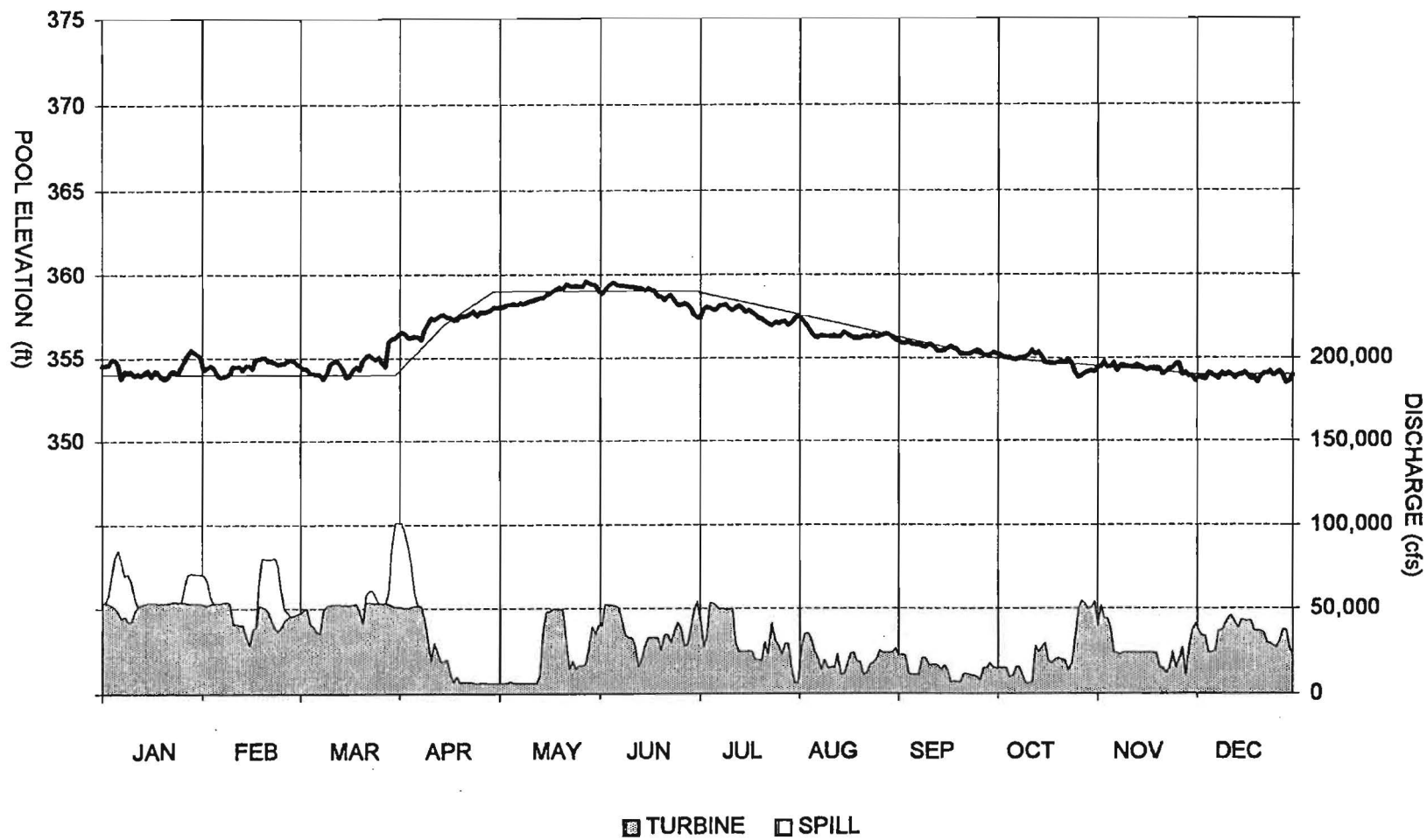
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DAILY POOL ELEVATION & AVERAGE DISCHARGE
1974



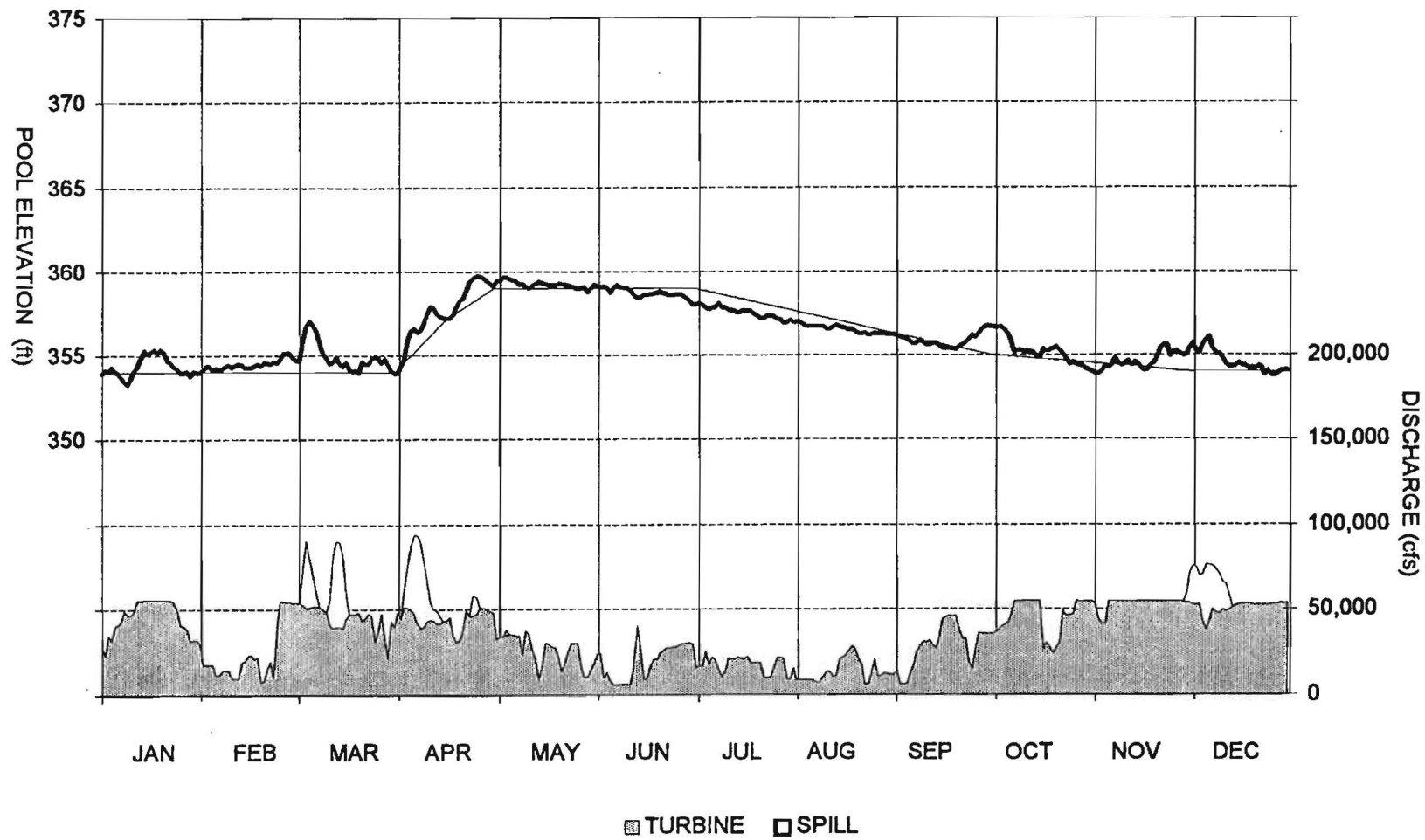
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DAILY POOL ELEVATION & AVERAGE DISCHARGE
1975



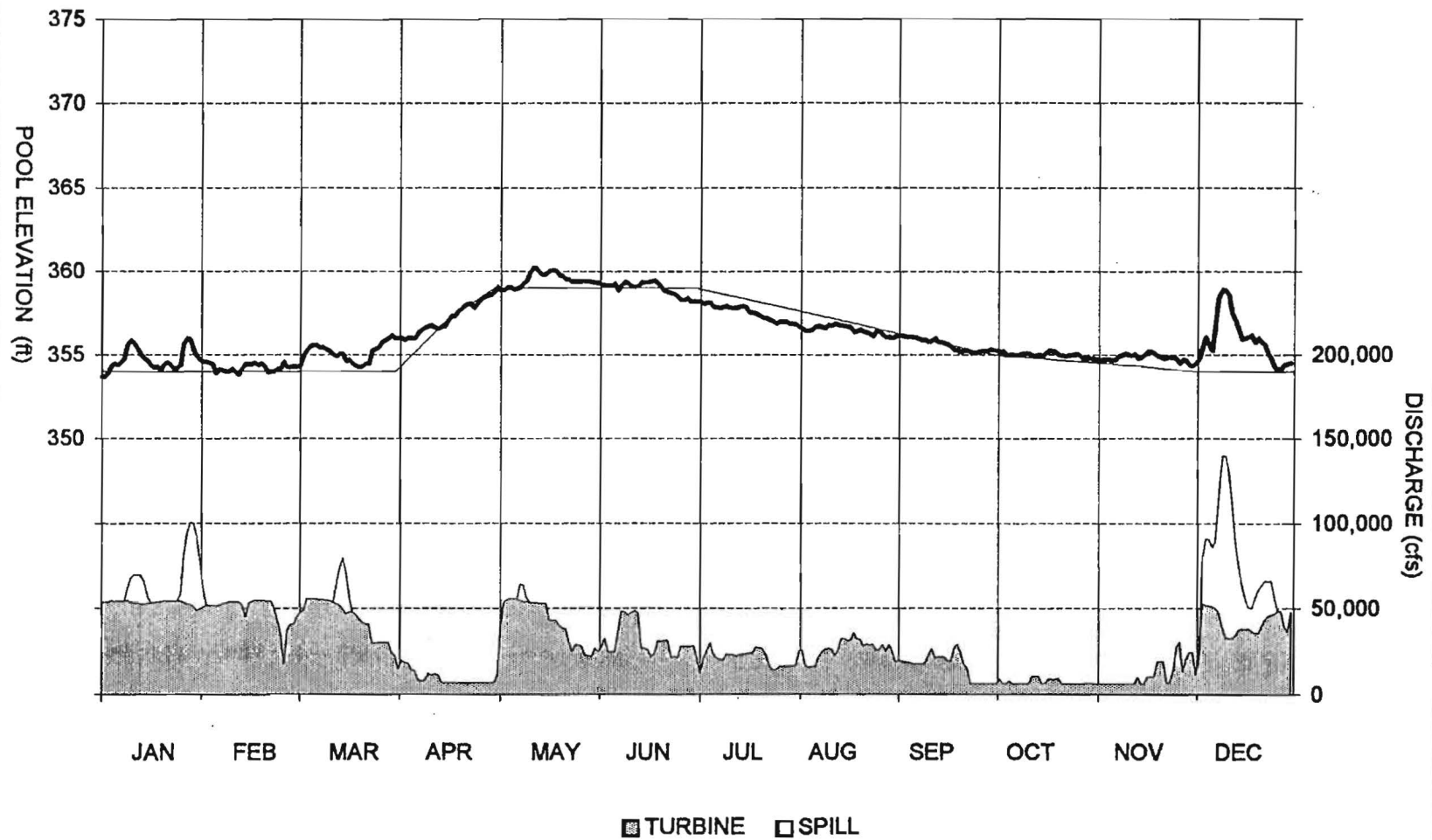
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DAILY POOL ELEVATION & AVERAGE DISCHARGE
1976



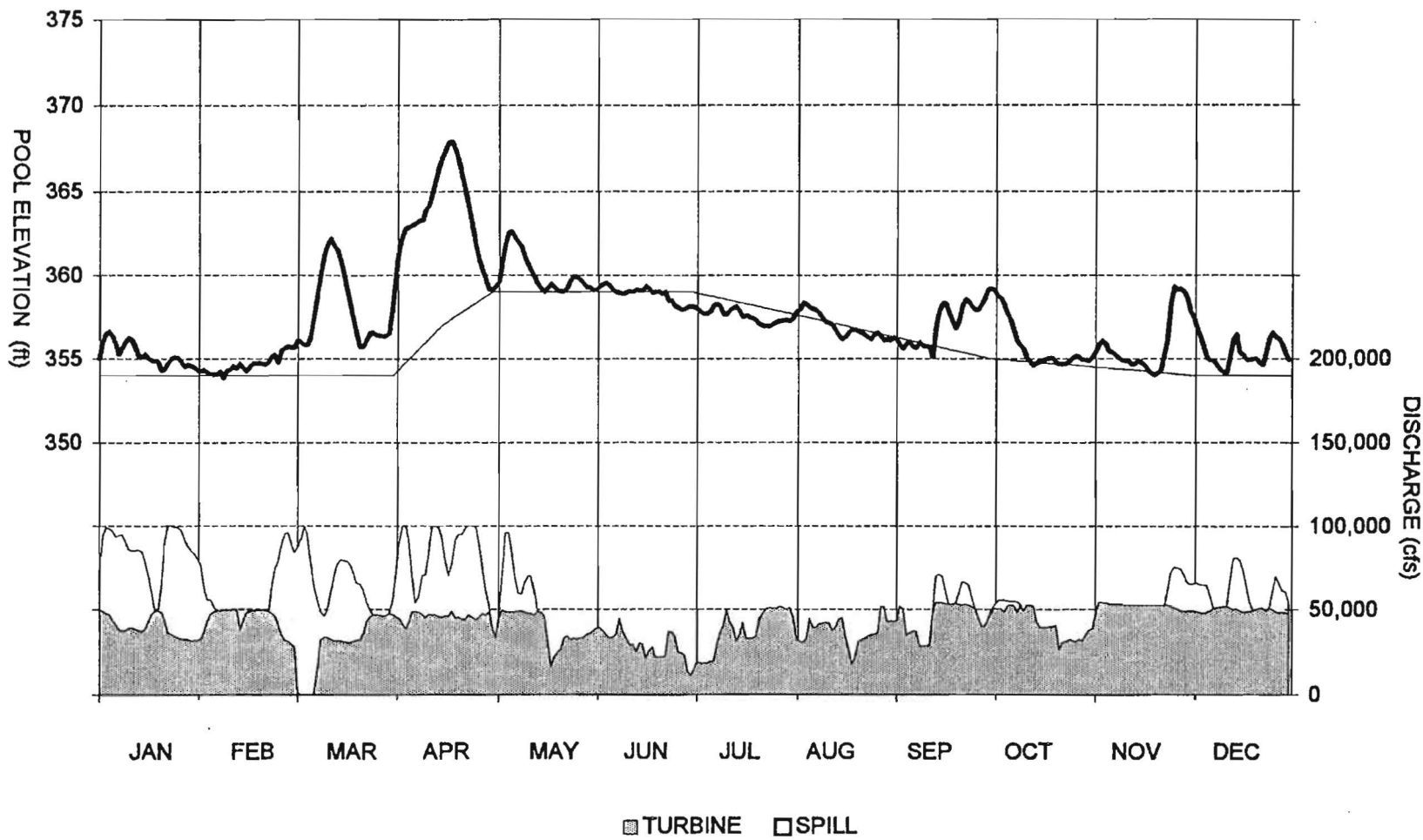
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DAILY POOL ELEVATION & AVERAGE DISCHARGE
1977



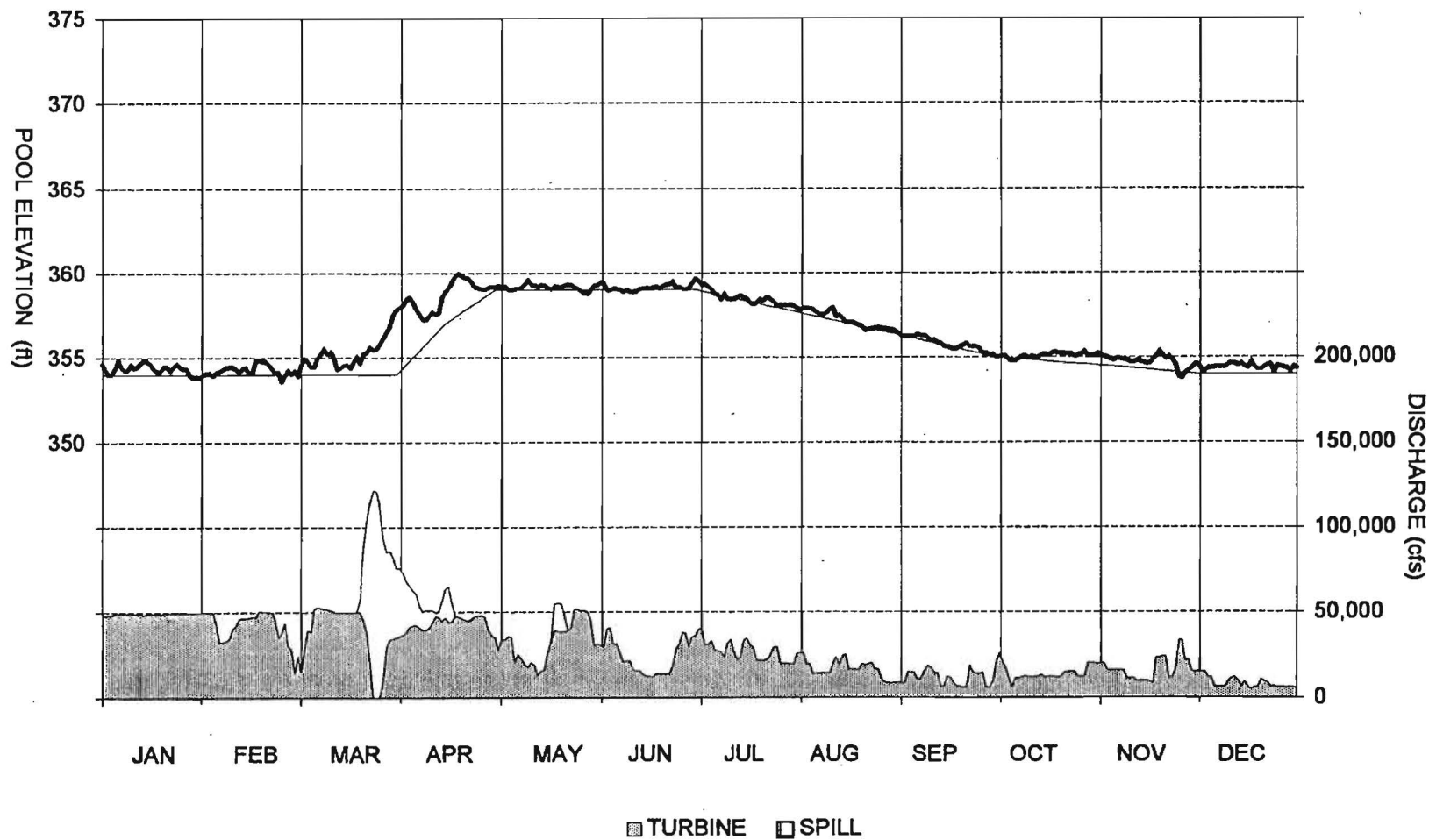
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DAILY POOL ELEVATION & AVERAGE DISCHARGE
1978



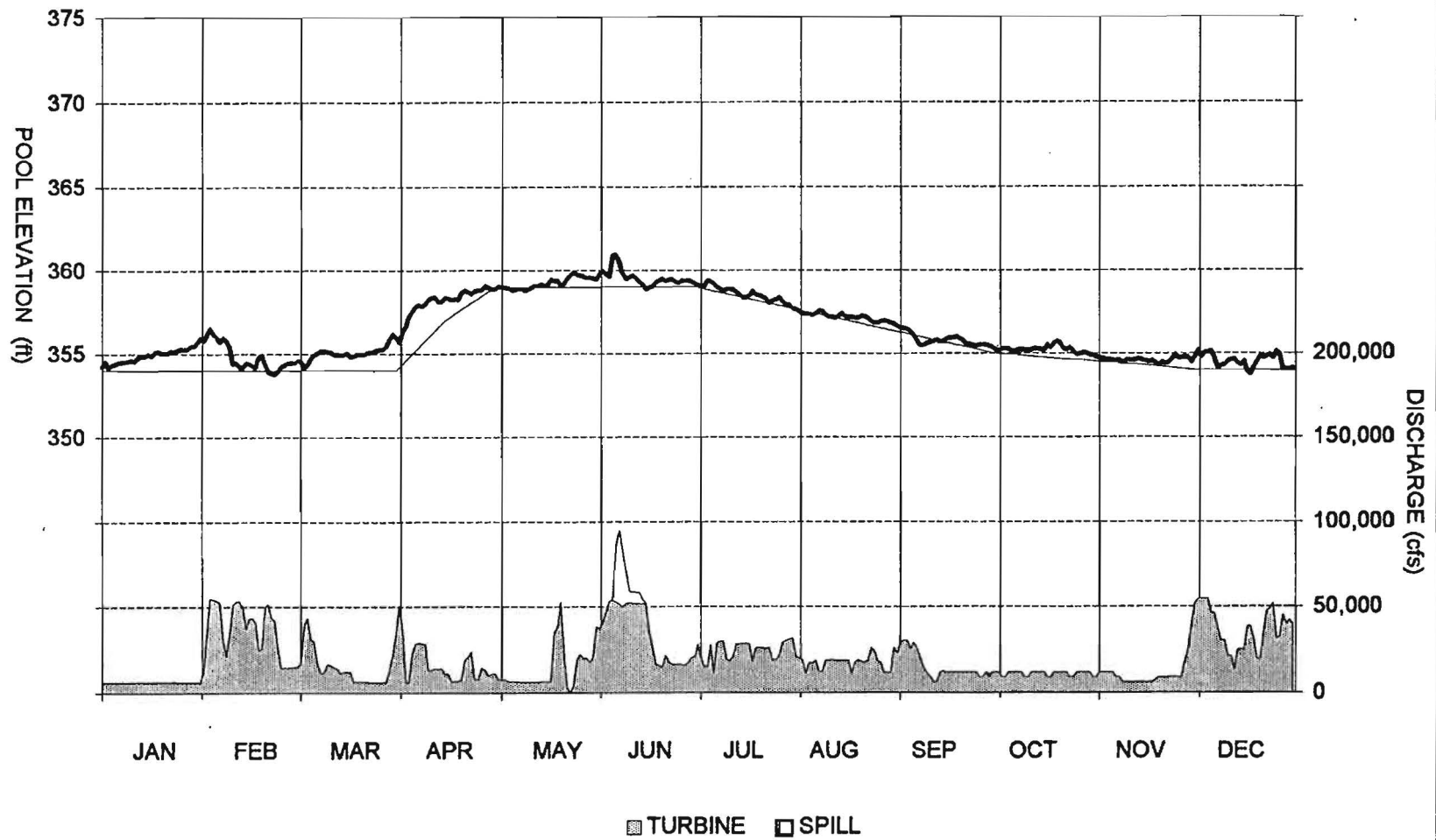
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DAILY POOL ELEVATION & AVERAGE DISCHARGE
1979



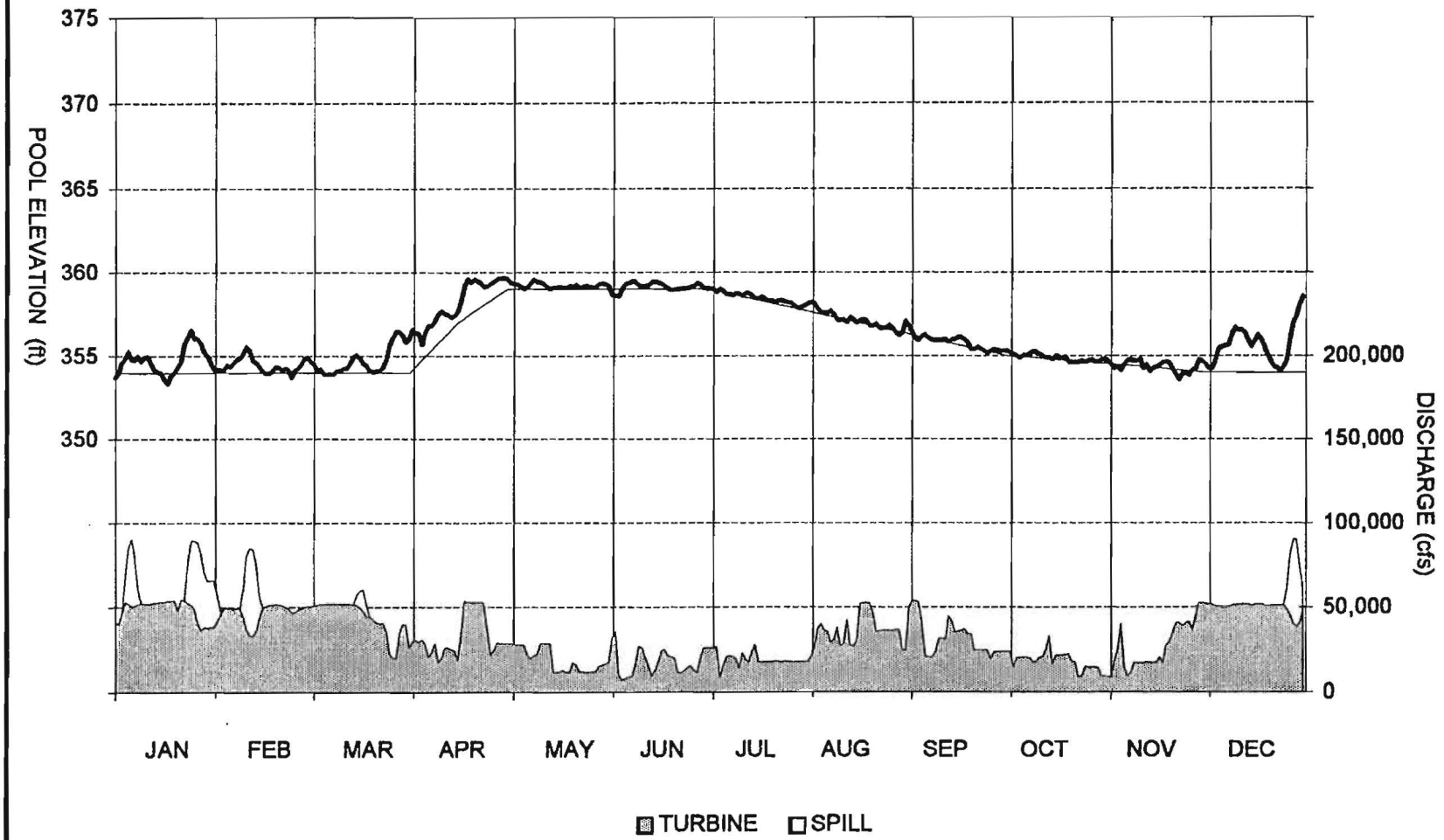
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DAILY POOL ELEVATION & AVERAGE DISCHARGE
1980



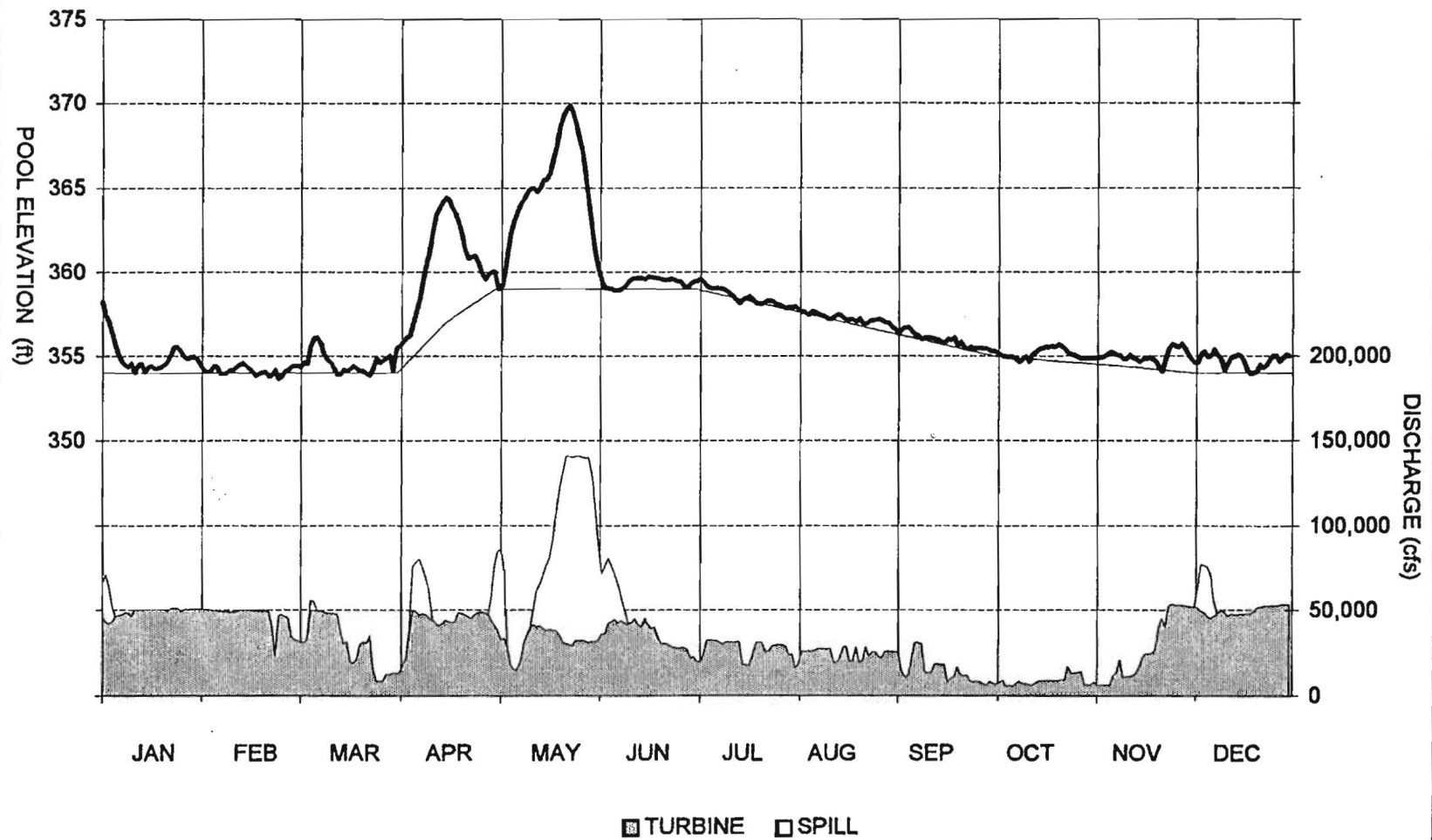
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DAILY POOL ELEVATION & AVERAGE DISCHARGE
1981



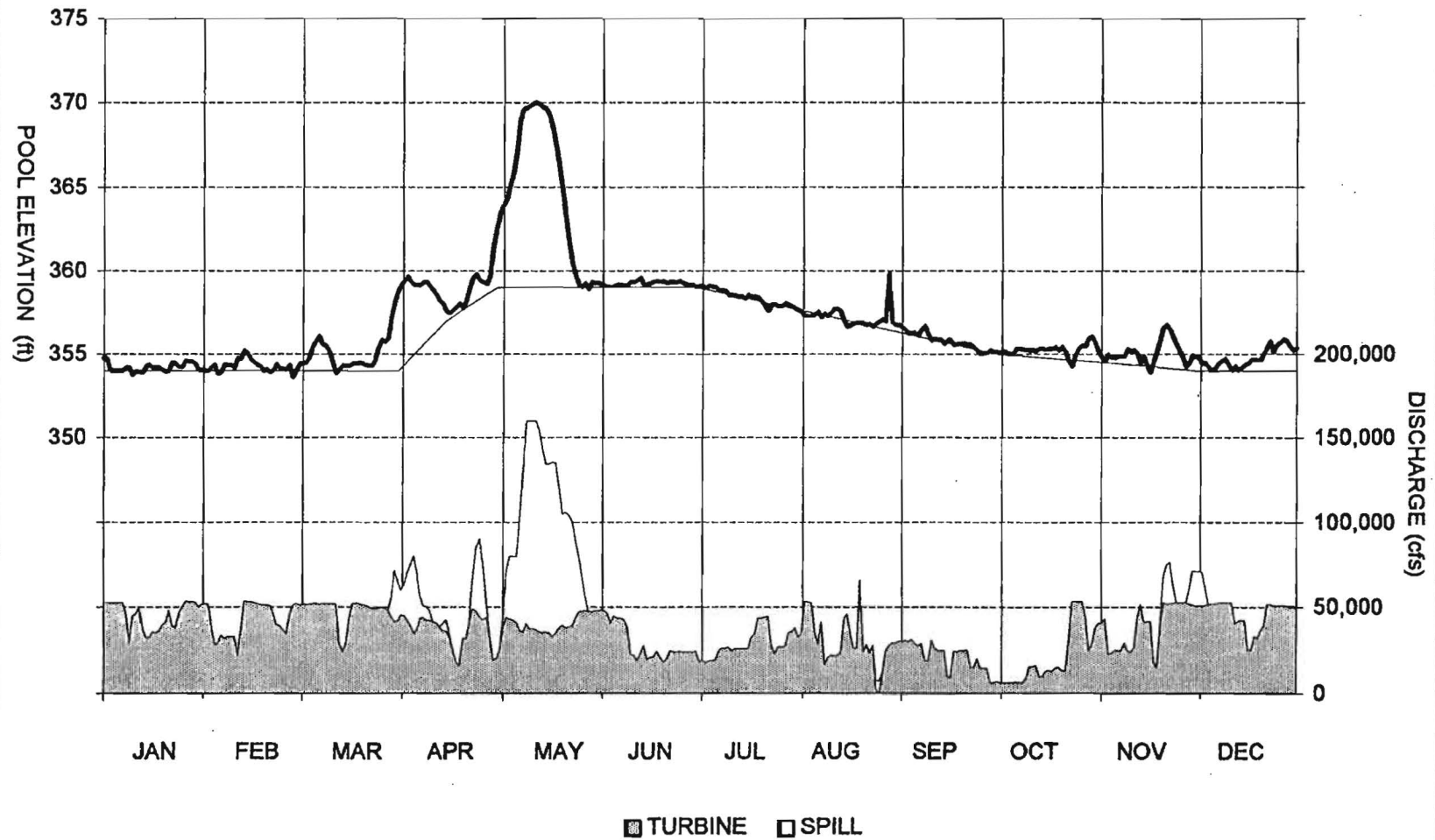
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DAILY POOL ELEVATION & AVERAGE DISCHARGE
1982



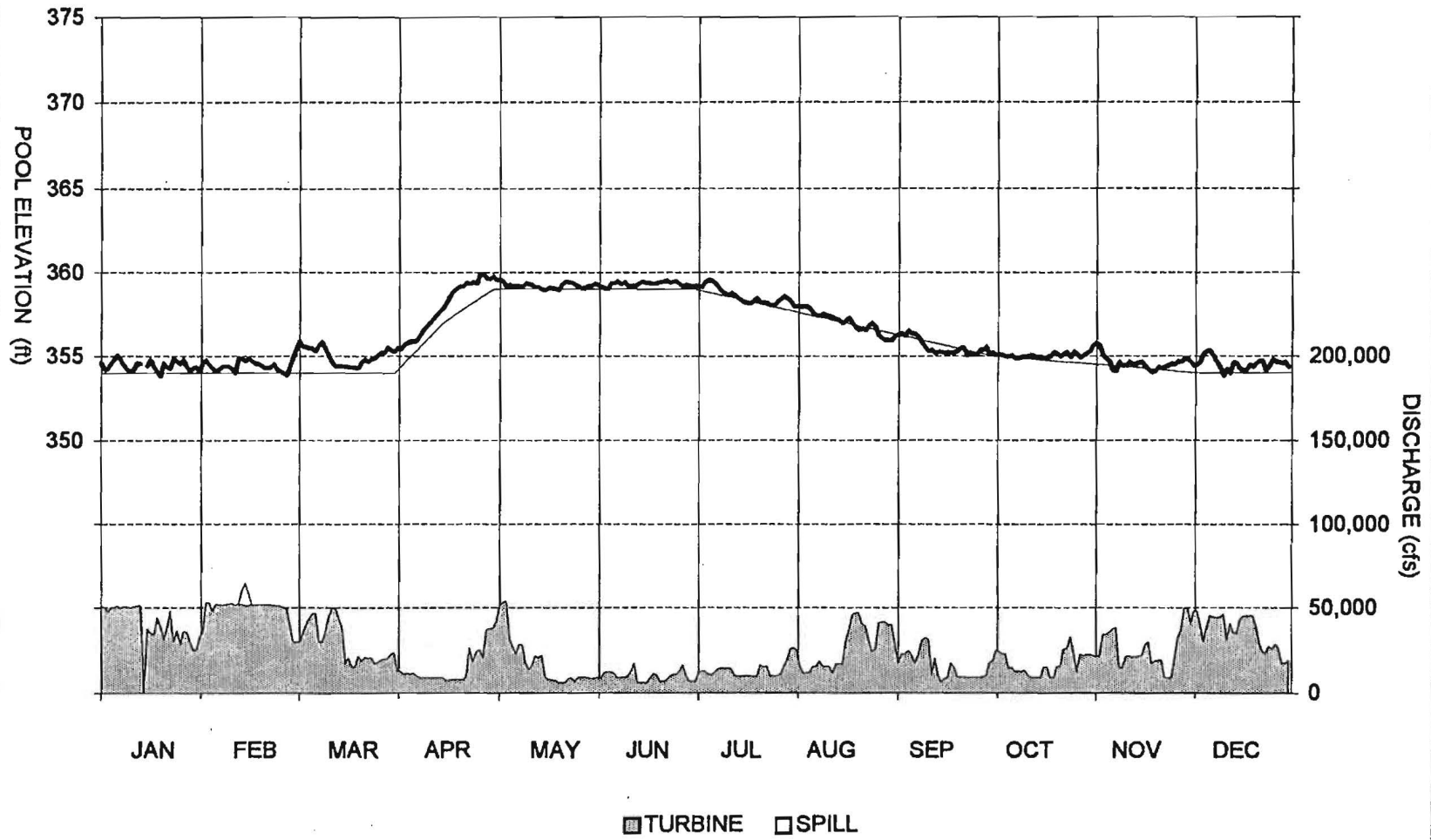
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DAILY POOL ELEVATION & AVERAGE DISCHARGE
1983



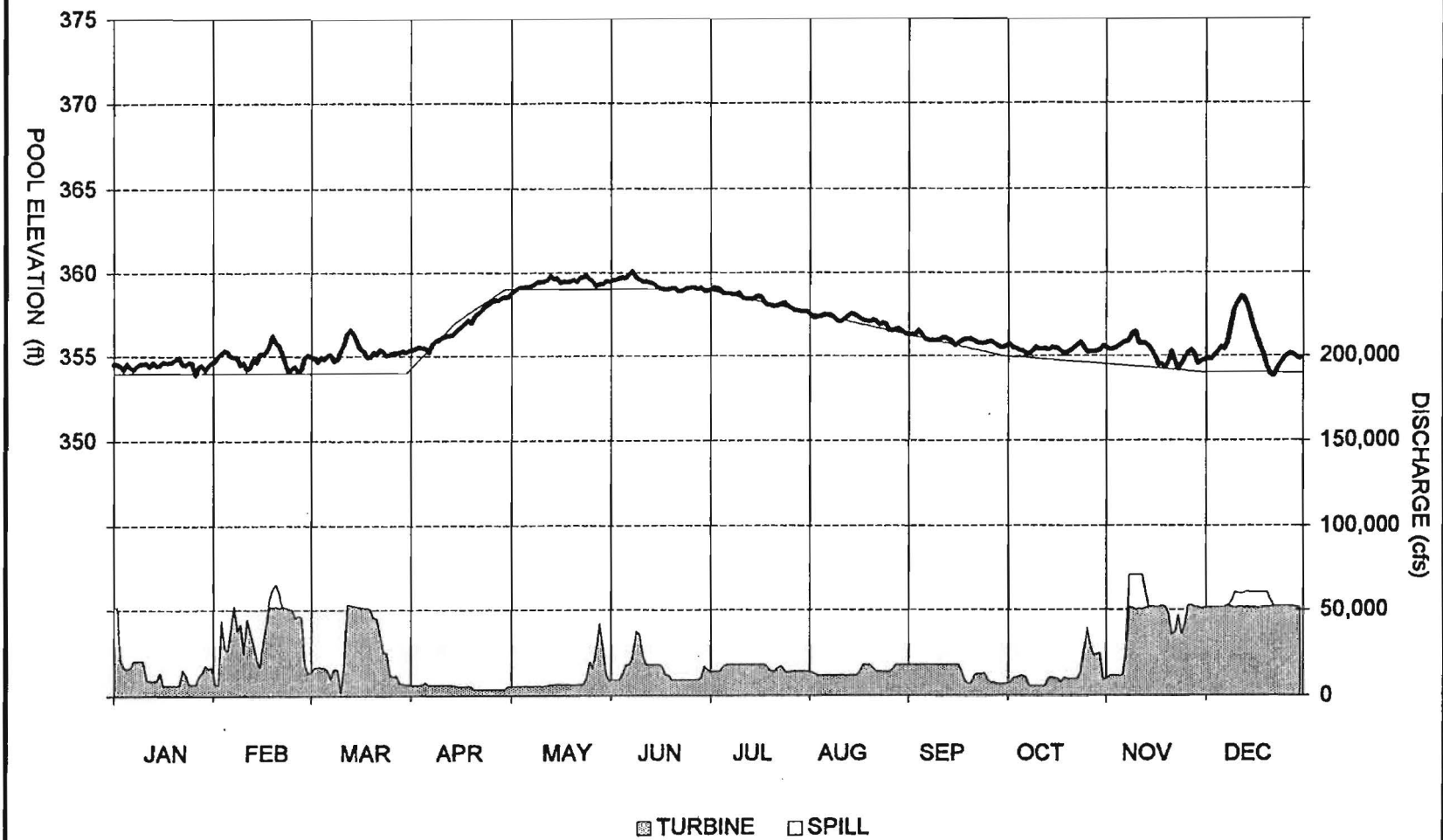
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DAILY POOL ELEVATION & AVERAGE DISCHARGE
1984



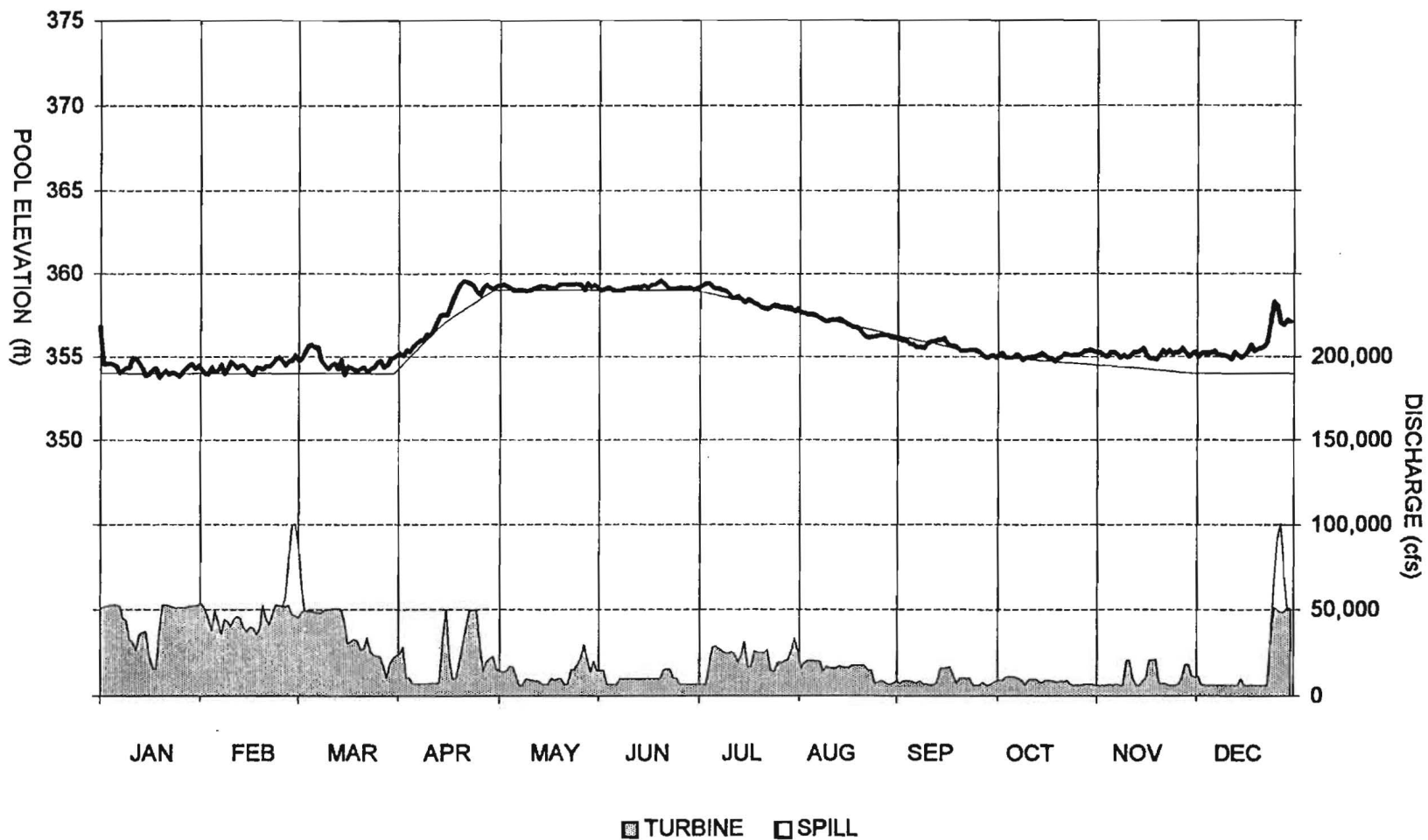
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DAILY POOL ELEVATION & AVERAGE DISCHARGE
1985



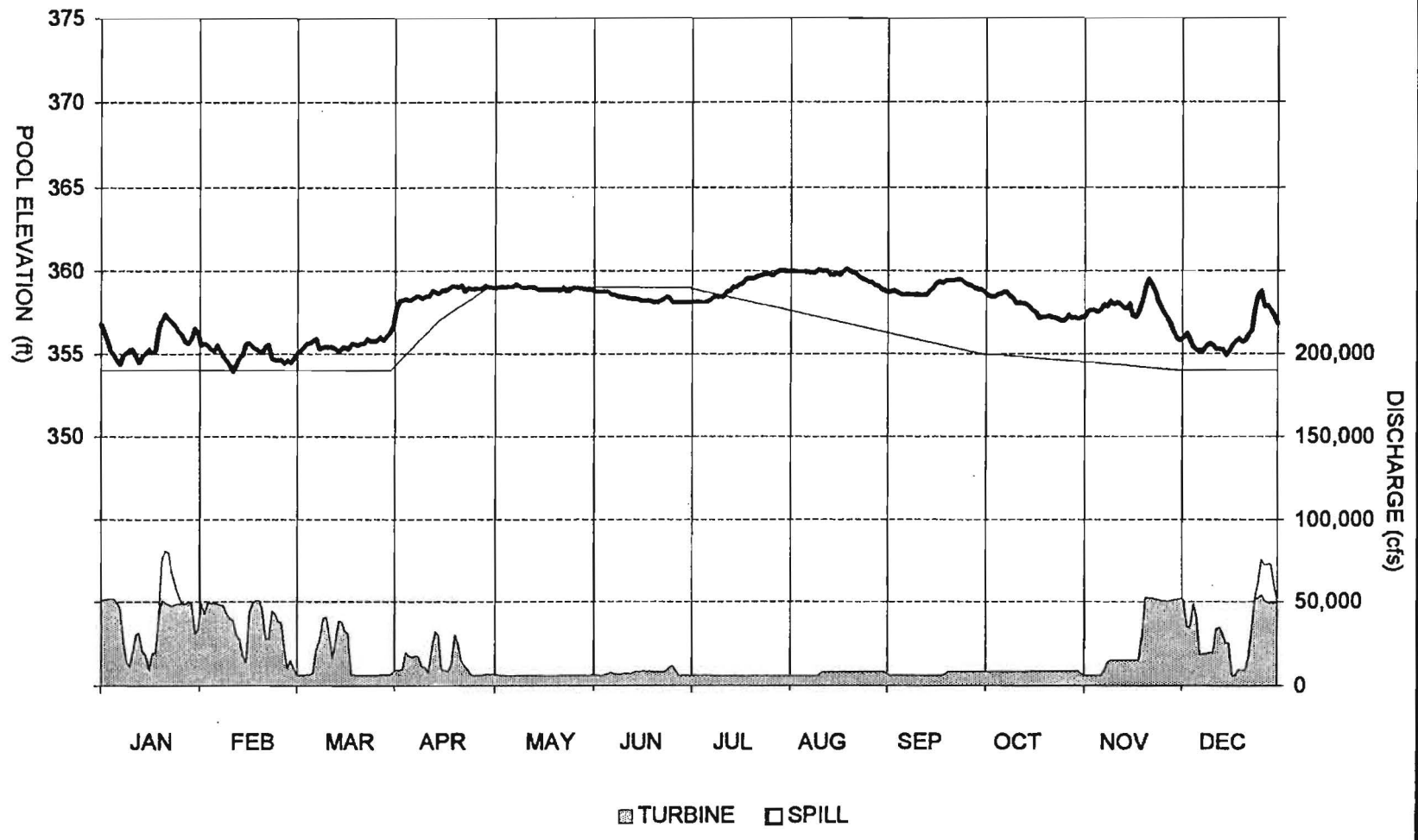
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DAILY POOL ELEVATION & AVERAGE DISCHARGE
1986



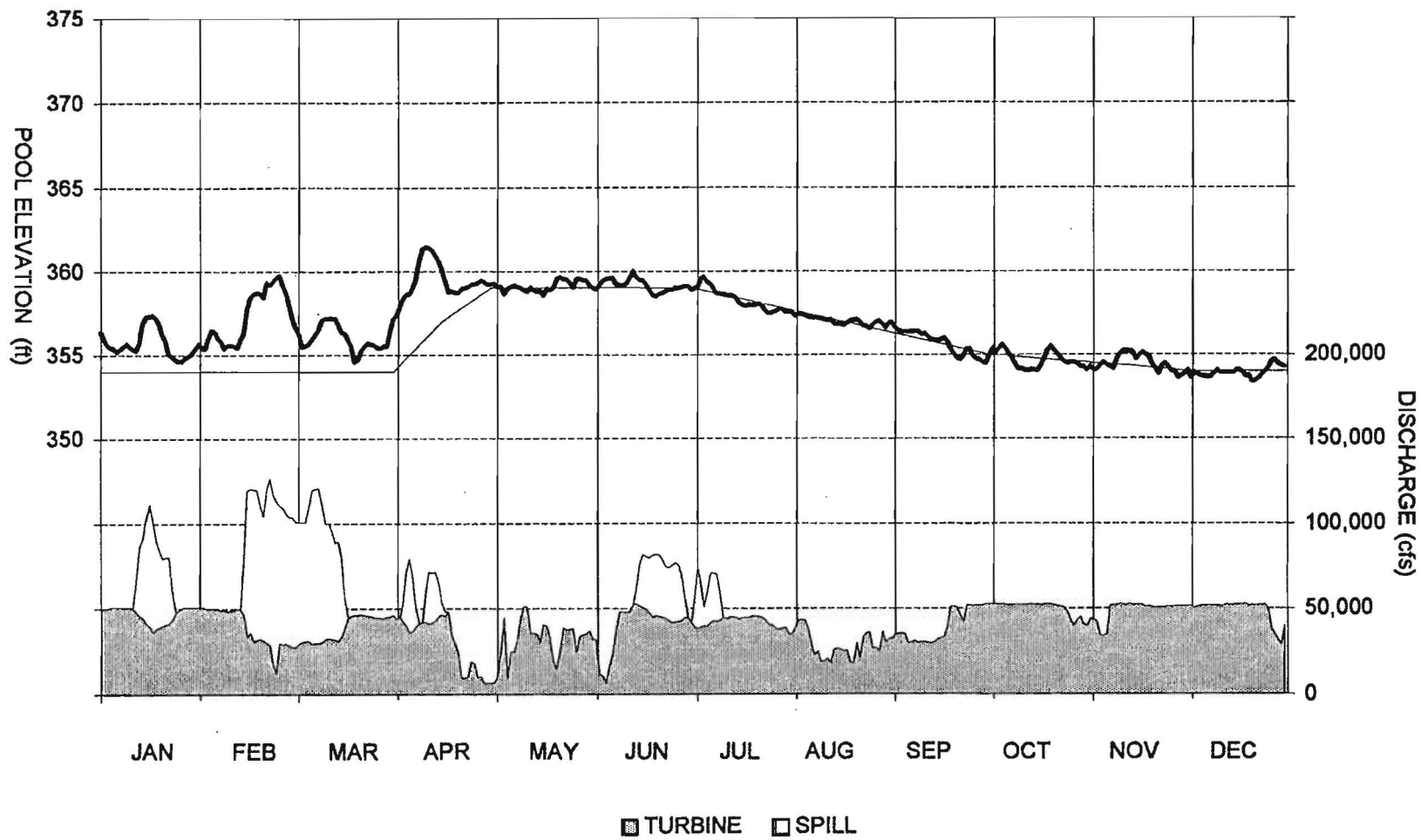
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DAILY POOL ELEVATION & AVERAGE DISCHARGE
1987



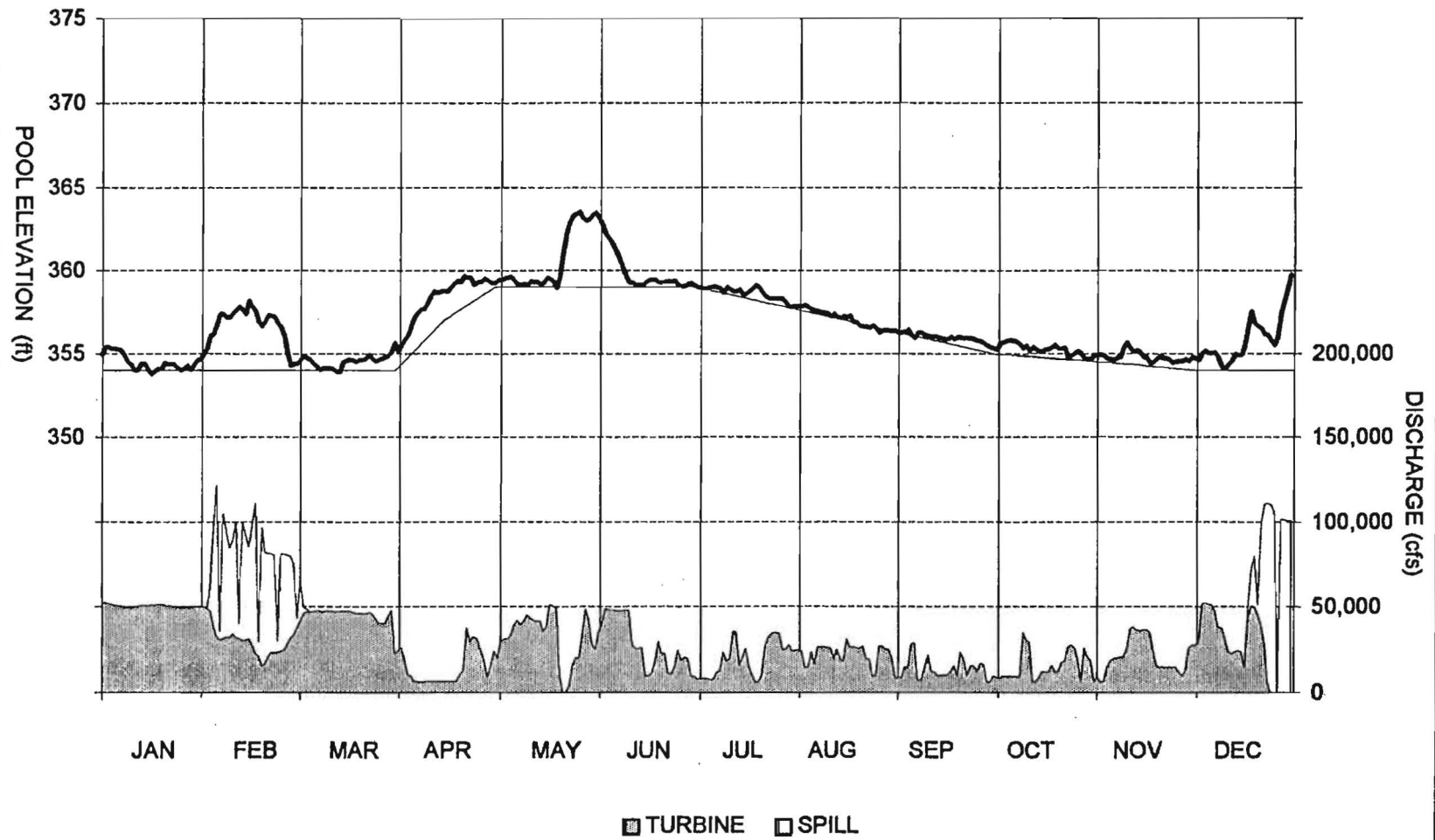
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DAILY POOL ELEVATION & AVERAGE DISCHARGE
1988



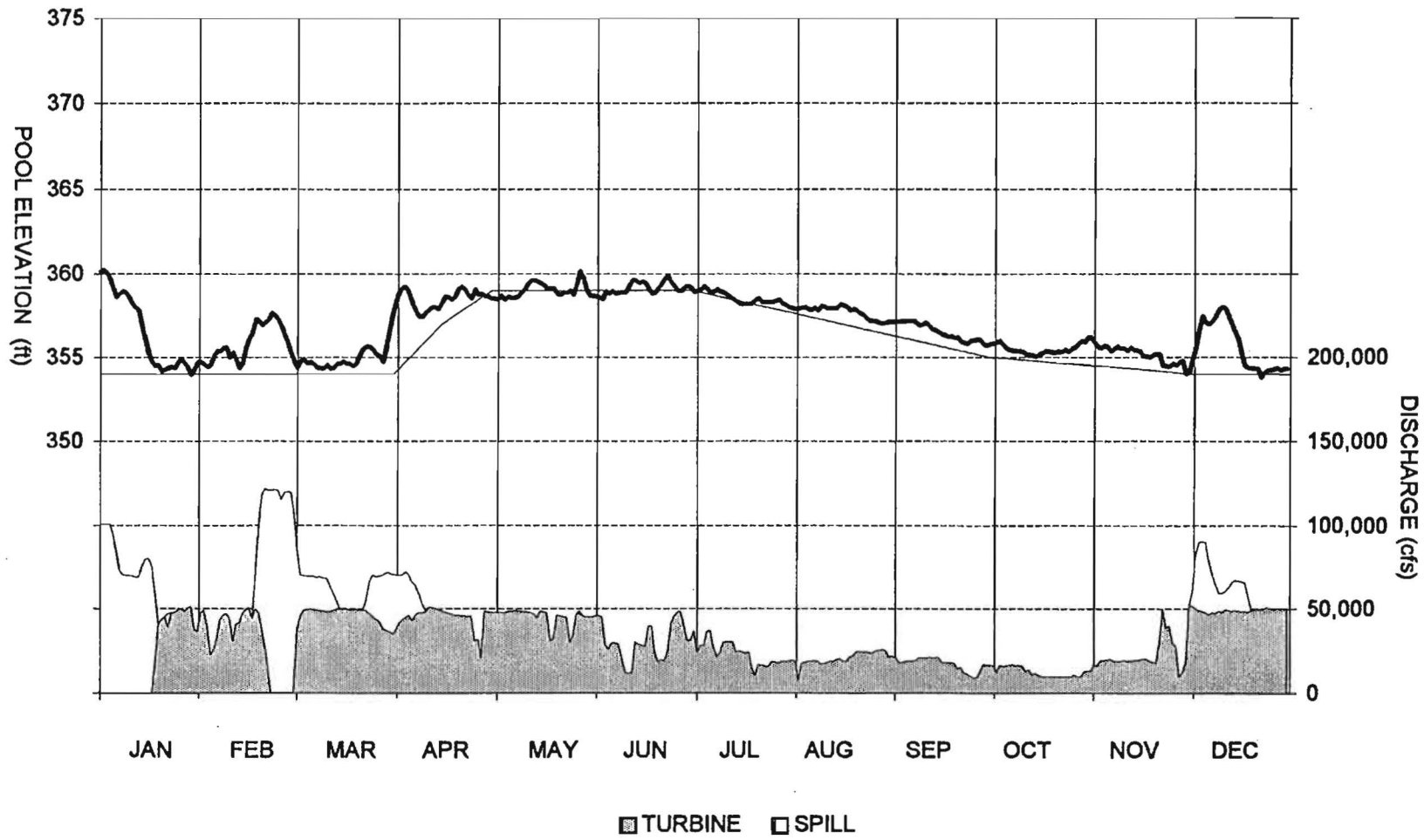
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DAILY POOL ELEVATION & AVERAGE DISCHARGE
1989



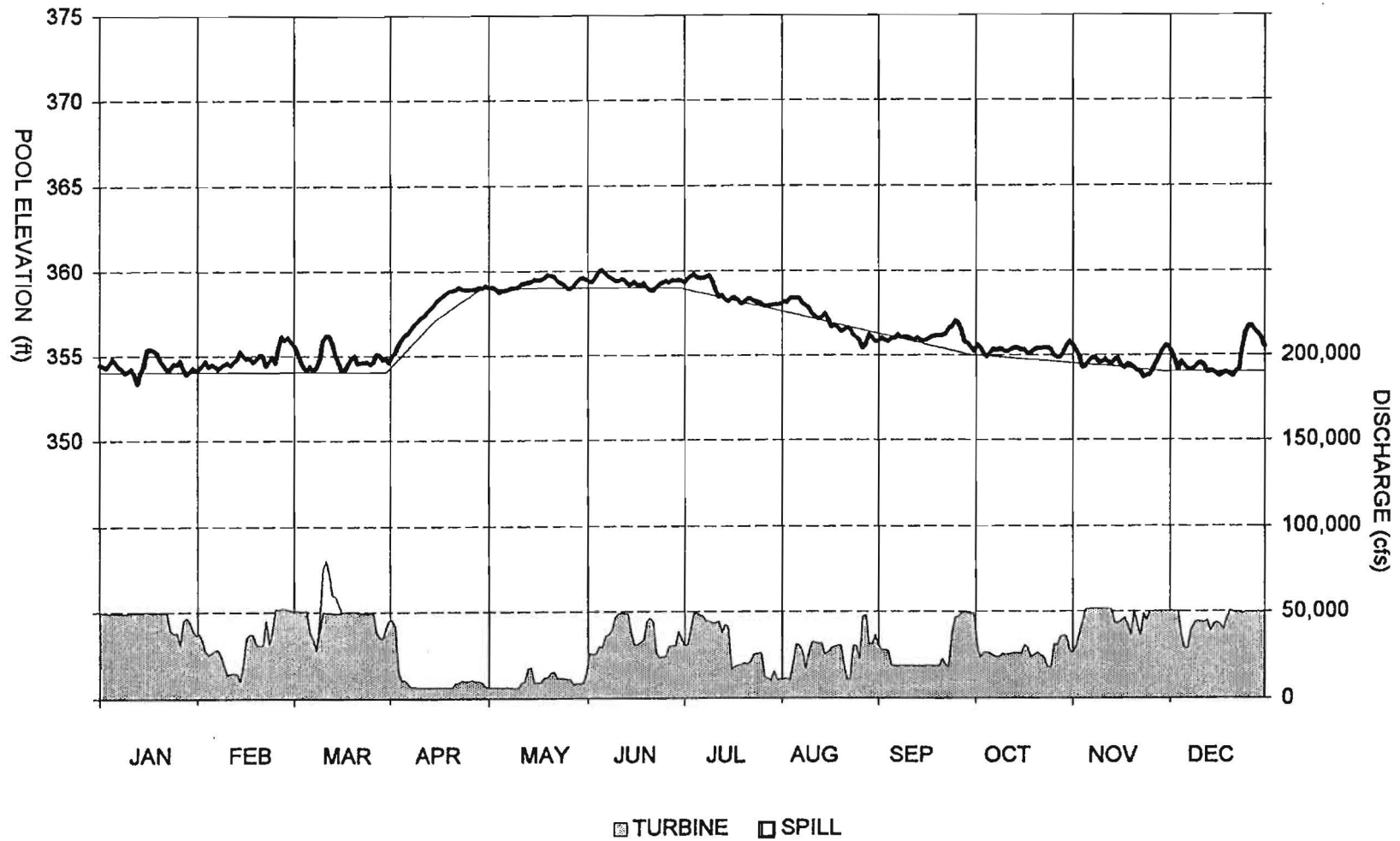
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DAILY POOL ELEVATION & AVERAGE DISCHARGE
1990



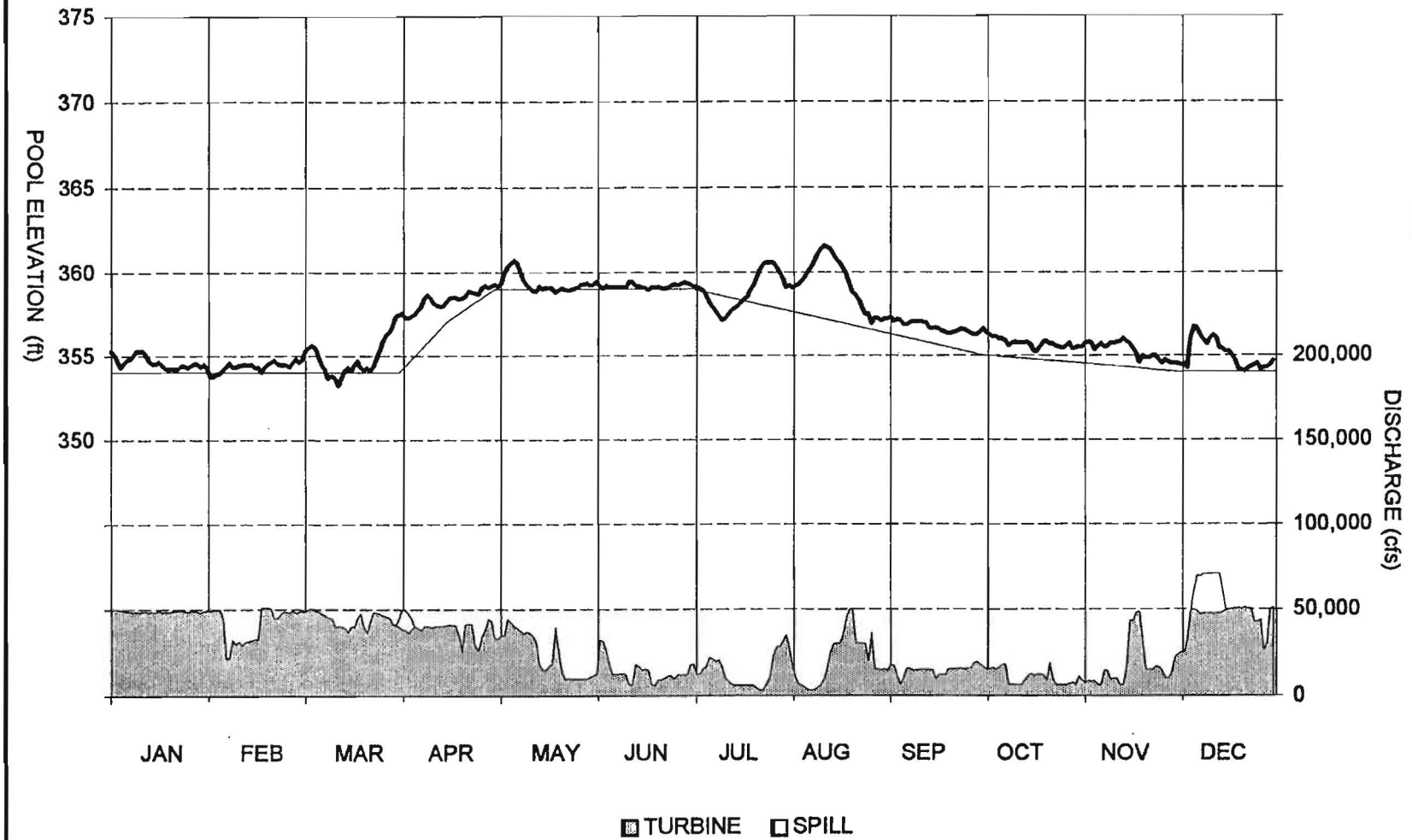
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DAILY POOL ELEVATION & AVERAGE DISCHARGE
1991



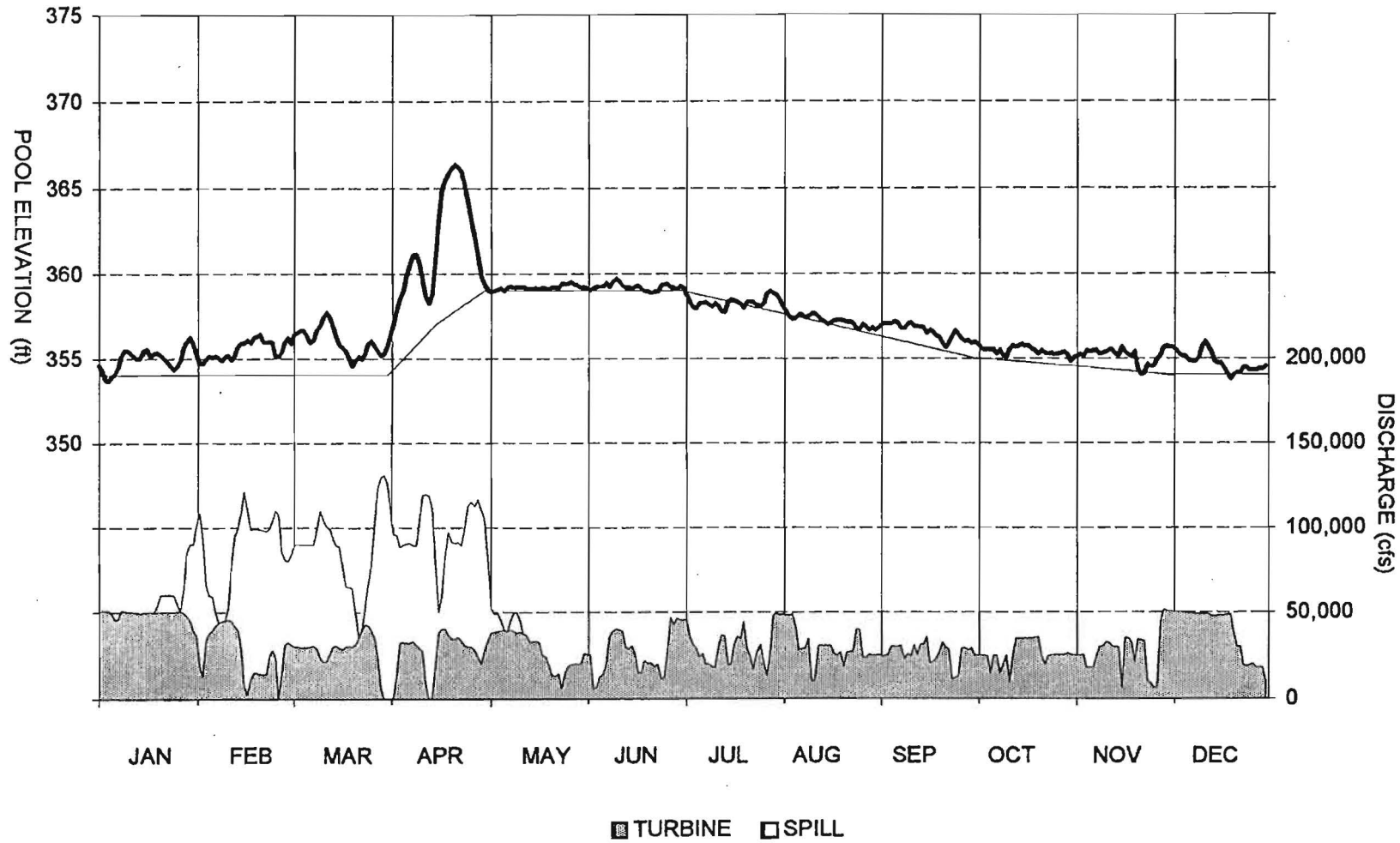
BARKLEY
DAILY AVERAGE DISCHARGE & MIDNIGHT POOL ELEVATION
1992



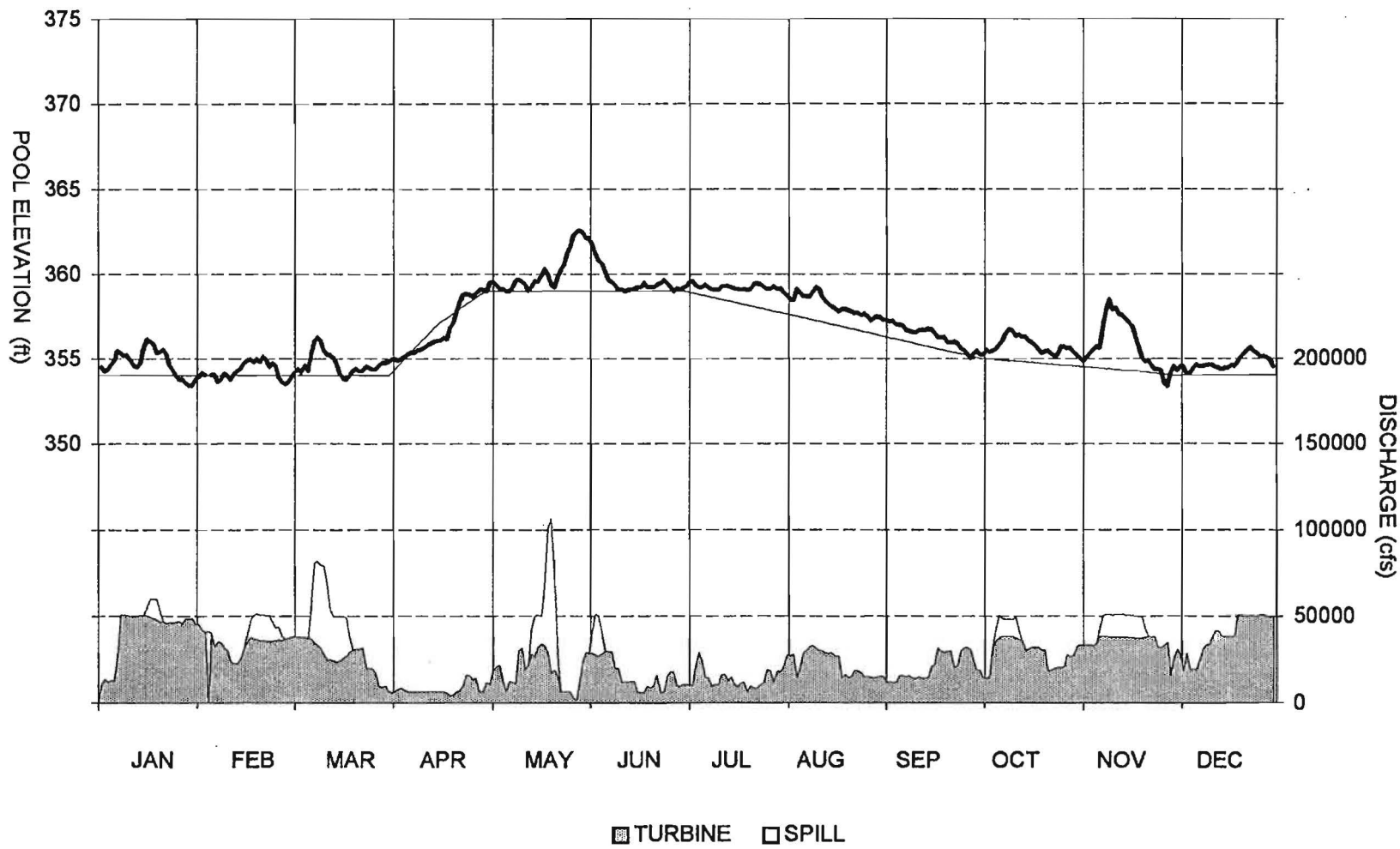
BARKLEY
DAILY AVERAGE DISCHARGE & MIDNIGHT POOL ELEVATION
1993



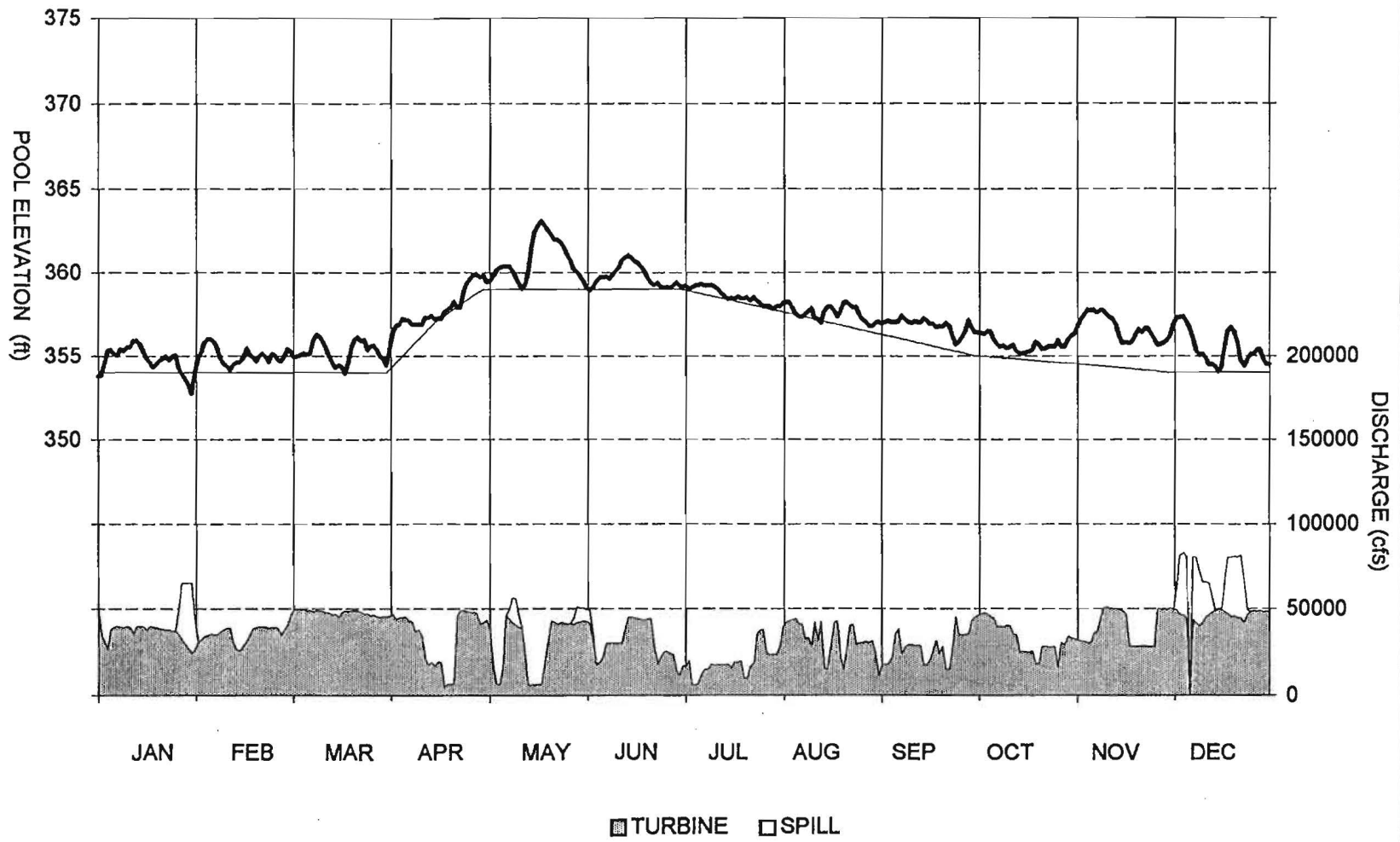
BARKLEY
DAILY AVERAGE DISCHARGE & MIDNIGHT POOL ELEVATION
1994



BARKLEY
DAILY AVERAGE DISCHARGE & MIDNIGHT POOL ELEVATION
1995



BARKLEY
DAILY AVERAGE DISCHARGE & MIDNIGHT POOL ELEVATION
1996



KEY CONTACT TELEPHONE LIST

| CONTACT | TELEPHONE | | |
|---|------------|------------|------------|
| | Office | Home | Restricted |
| ■ CORPS OF ENGINEERS | | | |
| ENGINEERING - PLANNING DIVISION | | | |
| Chief, [REDACTED] | [REDACTED] | | |
| Hydrology and Hydraulics Branch | | | |
| Chief, [REDACTED] (acting) | [REDACTED] | | |
| Water Management Section | | | |
| Chief, [REDACTED] branch | [REDACTED] | [REDACTED] | |
| [REDACTED] | [REDACTED] | [REDACTED] | |
| [REDACTED] | [REDACTED] | [REDACTED] | |
| CONSTRUCTION - OPERATIONS DIVISION | | | |
| Chief, [REDACTED] | [REDACTED] | | |
| Readiness Branch | | | |
| Chief, [REDACTED] | [REDACTED] | [REDACTED] | |
| [REDACTED] | [REDACTED] | [REDACTED] | |
| Technical Support Branch | | | |
| Chief, [REDACTED] | [REDACTED] | | |
| Hydropower Section | | | |
| Chief, [REDACTED] | [REDACTED] | | |
| Locks Section | | | |
| Chief, [REDACTED] | [REDACTED] | | |
| Natural Resource Section | | | |
| Chief, [REDACTED] | [REDACTED] | | |
| Hydropower Plants | | | |
| Barkley | [REDACTED] | | |
| Center Hill | [REDACTED] | | |
| Cheatham | [REDACTED] | | |
| Cordell Hull | [REDACTED] | | |
| Dale Hollow | [REDACTED] | | |
| J. Percy Priest | [REDACTED] | | |
| Laurel | [REDACTED] | | |
| Old Hickory | [REDACTED] | | |
| Wolf Creek | [REDACTED] | | |

Note: A space has been provided for Restricted telephone numbers for use by employees with access to such.

CONTACT

TELEPHONE

Office

Home

Restricted

Locks

Barkley
Cheatham
Old Hickory
Cordell Hull



Resource Managers

Center Hill
Cheatham
Cordell Hull
Dale Hollow
J. Percy Priest
Lake Barkley
Lake Cumberland (Wolf Creek)
Laurel
Martins Fork
Old Hickory



Public Affairs Office (PAO)

Chief, [Redacted]



FM Radio Call Letters

Emergency Operations Center (Base)
Center Hill
Cheatham
Cordell Hull
Dale Hollow
J. Percy Priest
Barkley
Wolf Creek (Lake Cumberland)
Laurel
Martins Fork
Old Hickory



■ **GREAT LAKES AND OHIO RIVER DIVISION (LRD)**

Water Management Branch

Chief, [Redacted]



River and Reservoir Control Section

Chief, D [Redacted]



Note: A space has been provided for Restricted telephone numbers for use by employees with access to such.

| CONTACT | TELEPHONE | | |
|---------|-----------|------|------------|
| | Office | Home | Restricted |

■ TENNESSEE VALLEY AUTHORITY (TVA)

Reservoir Operations (Knoxville)

Manager, [REDACTED]

[REDACTED]

Power Supply Operations (Chattanooga)

Load Coordinator

Manager, [REDACTED]

[REDACTED]

[REDACTED]

Data Collection

Supervisor, [REDACTED]

[REDACTED]

Daily Operations (Chattanooga)

Manager, [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

■ SOUTHEASTERN POWER ADMINISTRATION (SEPA)

Systems Engineering

Manager, [REDACTED]

[REDACTED]

Power Operations

Specialist, [REDACTED]

[REDACTED]

■ NATIONAL WEATHER SERVICE (NWS)

Nashville Office

Chief, [REDACTED]

[REDACTED]

Nashville Radar Site

[REDACTED]

Weather Forecast Office

Memphis

[REDACTED]

Service Hydrologist,

[REDACTED]

[REDACTED]

Louisville

[REDACTED]

River Forecast Center

Cincinnati (Wilmington, OH)

Kansas City

Slidell

[REDACTED]

Note: A space has been provided for Restricted telephone numbers for use by employees with access to such.

CONTACT**TELEPHONE****Office****Home****Restricted**

■ UNITED STATES GEOLOGIC SERVICE (USGS)

Tennessee Office
District Chief, [REDACTED]
Assist. Dist. Chief, [REDACTED]
Supervisor of Field Operations
[REDACTED]

Kentucky Office
District Chief, [REDACTED]
Assist. Dist. Chief, [REDACTED]
Supervisor of Field Operations
Upper Cumberland
[REDACTED]

West Kentucky
[REDACTED]

■ NATIONAL RESPONSE CENTER

800/424-8802

N.R.C. will call Coast Guard if it is determined to be the Coast Guard's responsibility or jurisdiction.

■ TENNESSEE EMERGENCY MANAGEMENT AGENCY
[REDACTED]

615/741-0001

Note: T.E.M.A. will notify the Tennessee Department of Water Pollution Control in case of a spill.

■ KENTUCKY DISASTER EMERGENCY RESPONSE

502/564-7815

800/255-2587


■ TENNESSEE DEPARTMENT OF WATER POLLUTION CONTROL
Spill Notification
[REDACTED]**■ KENTUCKY ENVIRONMENTAL RESPONSE EMERGENCY**
Spill Notification

502/564-2380

800/928-2380

Note: A space has been provided for Restricted telephone numbers for use by employees with access to such.

■ PERTINENT GAGES IN THE CUMBERLAND BASIN WITH TELEPHONE ACCESS

| Stream | Subbasin | Location | Restricted No. | Goes Station ID |
|---------------------|-----------------|---------------------|----------------|---|
| Cumberland River | Barkley | Clarksville | |  |
| Cumberland River | Barkley | Dover | | |
| Red River | Barkley | Port Royal | | |
| Cumberland River | Cheatham | Nashville | | |
| Harpeth River | Cheatham | Kingston Springs | | |
| Harpeth River | Cheatham | Franklin | | |
| Mill Creek | Cheatham | Antioch | | |
| Cumberland River | Old Hickory | Carthage | | |
| W Fork Stones River | J. Percy Priest | Smyrna | | |
| Cumberland River | Cordell Hull | Penitentiary Branch | | |
| Cumberland River | Cordell Hull | Celina | | |
| Roaring River | Cordell Hull | Gainsboro | | |
| Cumberland River | Wolf Creek | Pineville Pine St | | |

Note: A space has been provided for Restricted telephone numbers for use by employees with access to such.

MEMORANDUM OF UNDERSTANDING
BETWEEN
TENNESSEE VALLEY AUTHORITY
AND
UNITED STATES ARMY CORPS OF ENGINEERS

THIS MEMORANDUM OF UNDERSTANDING, made and entered into this 12th day of September, 1984 by and between the TENNESSEE VALLEY AUTHORITY, a corporate agency and instrumentality of the United States (hereinafter called "TVA"), and the UNITED STATES ARMY CORPS OF ENGINEERS (hereinafter called "Corps"),

W I T N E S S E T H

WHEREAS TVA is authorized by the Tennessee Valley Authority Act of 1933, as amended (hereinafter "TVA Act"), to improve navigation in the Tennessee River and to control the destructive floodwaters in the Tennessee and Mississippi River basins; and

WHEREAS in the operation of its dams and reservoirs, TVA is directed to regulate the streamflow primarily for the purposes of promoting navigation and controlling floods, and so far as may be consistent with such purposes, for the generation of electric energy; and

WHEREAS Section 7 of the Flood Control Act of 1944 (hereinafter "the 1944 Act") directs TVA, in the case of danger from floods on the lower Ohio and Mississippi Rivers, to regulate the release of water from the Tennessee River into the Ohio River in accordance with such instructions as may be issued by the Department of the Army; and

WHEREAS the Secretary of the Army has designated the Division Engineer, Ohio River Division, as the official responsible for carrying out the aforesaid provision of Section 7 of the 1944 Act; and

WHEREAS it is TVA's position that TVA is not required to operate Kentucky Reservoir during routine flood control operations by the Corps on the lower Ohio and Mississippi Rivers above the 365-foot elevation at the dam in the summer and fall (June 1 - November 30) and above the 375-foot elevation at the dam in the winter and spring (December 1 - May 31), these elevations being the limits of existing acquired flood easement rights; and

WHEREAS TVA recognizes that emergency flood conditions on the lower Ohio and Mississippi Rivers may arise which could result in the overtopping or failure of levees or floodwalls, loss of life, or other catastrophic circumstances; and

WHEREAS, in order to facilitate the proper response to such conditions, the parties desire to develop special criteria defining the emergency circumstances that would warrant extraordinary flood control operations on Kentucky Reservoir, and

WHEREAS it is the Corps' position that this memorandum of understanding does not define the full extent of authority that the Corps may exercise and the instructions that it may issue under Section 7 of the 1944 Act to require water storage at Kentucky Dam in case of danger from floods on the lower Ohio and Mississippi Rivers; including the utilization of the elevations above the 365-foot elevation at the dam in the summer and fall (June 1 - November 30) and above the 375-foot elevation at the dam in the winter and spring (December 1 - May 31).

NOW, THEREFORE, in consideration of the foregoing premises and of the mutual covenants hereinafter contained, the parties hereto agree as follows:

I

OPERATIONS

1. When the river stage at Paducah or at the Birds Point - New Madrid Floodway on the lower Ohio and Mississippi Rivers reaches the alert stage, as defined herein, the Corps and TVA will evaluate flooding conditions on a continuous basis to determine the potential need to raise the elevation of Kentucky Reservoir in the event of emergency circumstances that would warrant extraordinary flood control operations on Kentucky Reservoir.

Appendix F

2. When the river stage at Paducah or at the Birds Point - New Madrid Floodway on the lower Ohio and Mississippi Rivers reaches the critical stage, as defined herein, TVA will operate Kentucky Dam without regard to the aforesaid wintertime or summertime Kentucky Reservoir elevations at the direction of the Division Engineer, Ohio River Division, so long as the river stage at such locations is at critical stage or higher.

3. When overtopping or failure of the mainstem levees, floodwalls or frontline levees along the Mississippi River and Tributaries Project is imminent and when flood regulation by Kentucky Dam would significantly reduce the threat of overtopping or failure, both as determined by the President, Mississippi River Commission, and concurred in by the General Manager, TVA, TVA will operate Kentucky Dam without regard to the aforesaid wintertime or summertime Kentucky Reservoir elevations at the direction of the Division Engineer, Ohio River Division. When in the judgment of either TVA or the Corps either of the aforesaid conditions no longer exists, normal operations at Kentucky Dam shall be resumed.

II

CRITERIA

For the purposes of Section I.1 and I.2 herein, the locations at which stream level data will be measured and the alert stage and critical stage at such locations are as follows:

1. Paducah, KY - Ohio River Mile 934.4
1980 Population - 29,315
Federal Levee - Overtopping Stage - 63.8 ft.
- Critical Stage - 59.0 ft.
- Alert Stage - 55.0 ft.
- Zero Gage at Paducah, KY - 286.3 ft. NGVD
2. Birds Point - New Madrid Floodway - Ohio River Mile 981.5
- Mississippi River Mile 953.8

Appendix F

1980 Population - 1300+

- Federal Floodway - Overtopping Stage - 60.0 ft. (relative to the Cairo gage)
- Critical Stage - 55.0 ft.
- Alert Stage - 52.5 ft.
- Zero Gage at Cairo, IL - 270.5 ft NGVD

III

LIABILITY AND COMPENSATION

Any action taken by TVA to operate Kentucky Dam at the direction of the Division Engineer, Ohio River Division, that causes the water in the Kentucky Reservoir to rise above the 365-foot elevation in the summer and fall (June 1 - November 30) and above the 375-foot elevation in the winter and spring (December 1 - May 31) under Section 7 of the 1944 Act or pursuant to this memorandum shall be considered to be taken at the direction of the Corps and solely its action. The Corps will be responsible for handling, addressing, and defending any administrative claims against the TVA or the Corps arising out of the regulation of Kentucky Reservoir hereinunder or Section 7 of the 1944 Act, and subject to the appropriation of necessary funds, will be responsible for the payment of any costs or damages resulting therefrom. Should any litigation in which TVA is a party or otherwise involved arise out of the regulation of Kentucky Reservoir hereinunder or Section 7 of the 1944 Act, TVA will represent itself with attorneys of its choosing but the Corps will, subject to the appropriation of necessary funds, reimburse TVA for any litigation costs and expenses and judgements and settlements resulting therefrom.

IV

AMENDMENTS TO MEMORANDUM OF UNDERSTANDING

This memorandum of understanding shall be effective as of the date first written above and shall continue in effect unless it terminates by mutual agreement of the parties, or upon 30 days written notice by one party. This agreement may be amended in writing by mutual agreement of the parties.

Appendix F