HULBURT CREEK HYDROLOGY, SOUTHWESTERN WISCONSIN

By

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GEOLOGICAL SURVEY OPEN-FILE REPORT

Prepared in Cooperation with

The Wisconsin Department of Natural Resources

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The purpose of this study was to determine the hydrologic characteristics of Hulburt Creek, Sauk County, Wis., in order to evaluate a proposed reservoir. The streamflow characteristics estimated are the low flow, monthly flow, and inflow flood. The study was done by the U.S. Geological Survey in cooperation with the Wisconsin Department of Natural Resources.

The following estimates are for the point on Hulburt Creek at the proposed Dell Lake damsite near Wisconsin Dells. The drainage area is 11.2 square miles.

Low Flow

The low-flow characteristics determined are the annual minimum 7-day mean flow that occurs on the average of once in 2 years (7-day Q_2), and the annual minimum 7-day mean flow that occurs on the average of once in 10 years (7-day Q_{10}). The values determined for Hulburt Creek are:

7-day Q_2 = 2.6 cfs (cubic feet per second)

7-day Q_{10}= 2.1 cfs

These values are based on a relationship developed from measured discharges on Hulburt Creek and Dell Creek. The Dell Creek drainage basin is located just south of Hulburt Creek, and

streamflow records were collected from 1958 to 1965 at the Dell Creek gaging station near Lake Delton. The drainage area of this station is 44.9 square miles.

Monthly Flow

The monthly discharges for the Hulburt Creek site were based on relationships developed between the recorded monthly mean discharges and drainage areas for Dell Creek and the Baraboo River along with the measured discharges for Dell Creek and Hulburt Creek. The estimated monthly discharges for the 1958-65 period are shown in table 1.

The amount of time required to fill the proposed Dell Lake was estimated from the monthly flows of Hulburt Creek determined for the 1958-65 period. A release from the reservoir of 25 percent of the natural low flow (7-day Q_2), 0.65 cfs, was used in the computation, with an average annual evaporation loss of 31 inches. Using these criteria, it would take 30 months to fill the 8,070 acre-foot capacity reservoir, assuming the reservoir was empty in October 1957. No allowance was made for seepage losses from the reservoir.

If the mean monthly flows were used for the period, the filling time would be 24 months. This estimate is based on passing the same release of 0.65 cfs and the same evaporation loss of 31 inches.

The average flow for the 1958-65 period is close to the long-term average, even though 1958 and 1959 were exceptionally dry years.

9-220 c
(Oct. 1951)

TABLE 1

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

Sheet _____ of _____ Sheets

ESTIMATED

Monthly and annual discharge, in CFS, of HULBURT CREEK ~~River~~ at DELL CREEK DAMSITE

[Drainage area, 11.2 square miles]

16—26189-6 U.S. GOVERNMENT PRINTING OFFICE

Water Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Annual
1958	4.5	6.1	5.9	4.9	5.9	4.4	5.8	3.8	5.0	4.9	4.2	4.1	59.5
1959	4.2	4.1	3.6	3.7	4.0	6.3	16.4	10.0	5.8	5.4	5.6	5.8	74.9
1960	10.6	9.4	8.4	8.0	5.7	9.6	8.8	15.4	11.4	9.6	9.2	9.7	115.8
1961	7.7	7.9	6.4	5.8	9.1	12.9	7.9	6.6	6.8	5.6	5.7	9.1	91.5
1962	10.6	13.5	8.8	8.0	7.4	12.2	11.3	10.3	10.1	8.9	7.3	7.1	115.5
1963	8.9	6.4	6.4	6.0	5.9	15.8	6.8	6.2	6.5	5.4	5.9	6.4	86.6
1964	5.6	6.4	5.3	5.5	4.8	4.3	6.1	7.5	6.0	7.5	5.2	5.0	69.5
1965	4.2	4.4	4.2	4.8	9.4	17.1	14.3	6.0	6.2	4.8	7.1	20.5	103.0
Total	56.3	58.2	49.0	46.7	52.2	82.6	77.4	65.8	57.8	52.1	50.2	67.7	716.0
Mean	7.0	7.3	6.1	5.8	6.5	10.3	9.7	8.2	7.2	6.5	6.3	8.5	89.5

Inflow Flood

The criteria to determine what type of flood to consider for the spillway design are open to considerable debate and judgment. The selection of the inflow flood should be based on hydrologic studies and the standards adopted by the appropriate authorities.

Criteria listed by Snyder (1964), Koelzer and Bitoun (1964), Ogrosky (1964), Chow (1964), and the U.S. Bureau of Reclamation (1960), emphasize the importance of adequate spillway capacity. If the proposed dam on Hulburt Creek failed, it could cause loss of life and/or considerable damage to public and private property, including an interstate highway.

The 50-year flood was estimated for Hulburt Creek. This along with a plot of recorded and estimated flood peaks versus drainage area for streams in the area are presented as guides to select inflow flood design criteria.

50-year flood.--Regional multiple-regression equations for estimating floods for small drainage areas were developed in a study conducted by the U.S. Geological Survey in cooperation with the Wisconsin Department of Transportation (D. H. Conger, written commun.). Based on these equations, the 50-year flood for Hulburt Creek would have a peak discharge of about 1,500 cfs.

Recorded and estimated flood peaks in southwestern Wisconsin.-- A major storm occurred in southwestern Wisconsin on June 30, 1969. A "bucket survey" by the U.S. Army Corps of Engineers (written commun., 1969) established the distribution of the storm. The

unofficial results show a maximum rainfall in a 10-square mile area of 7 inches in 3 hours. This storm along with preceding heavy rains in June had produced large flood peaks on many small streams in the area. The flood peaks ranged from about 300 cfs per square mile to about 1,500 cfs per square mile. These peaks and other recorded and estimated flood peaks are shown in figure 3 and are listed in table 2.

Probable maximum flood.--The probable maximum flood (PMF) is defined by Chow (1964, p. 25-26) as the most severe flood considered reasonably possible in a region. It is often used as the design flood when failure of the structure could lead to great damage and loss of life. Procedures for computation as described by the U.S. Bureau of Reclamation (1960, p. 23) were used to compute the PMF for Hulburt Creek.

Based on data in U.S. Weather Bureau Technical Paper 40 (1961, p. 107), the probable maximum precipitation of 24 inches in 6 hours would cause the PMF in the Hulburt Creek area. Rainfall was arranged in critical increments to produce the largest peak and was distributed into hourly values not to exceed those indicated by the regional depth-duration curves shown in figure 4 of the report by the U.S. Bureau of Reclamation (1960, p. 32). An infiltration rate of 0.75 inch per hour, determined from hydrograph analysis of a flood peak on Dell Creek, was subtracted from the hourly increments. The unit-hydrograph method of analysis was used to develop a hydrograph of the inflow flood into the proposed

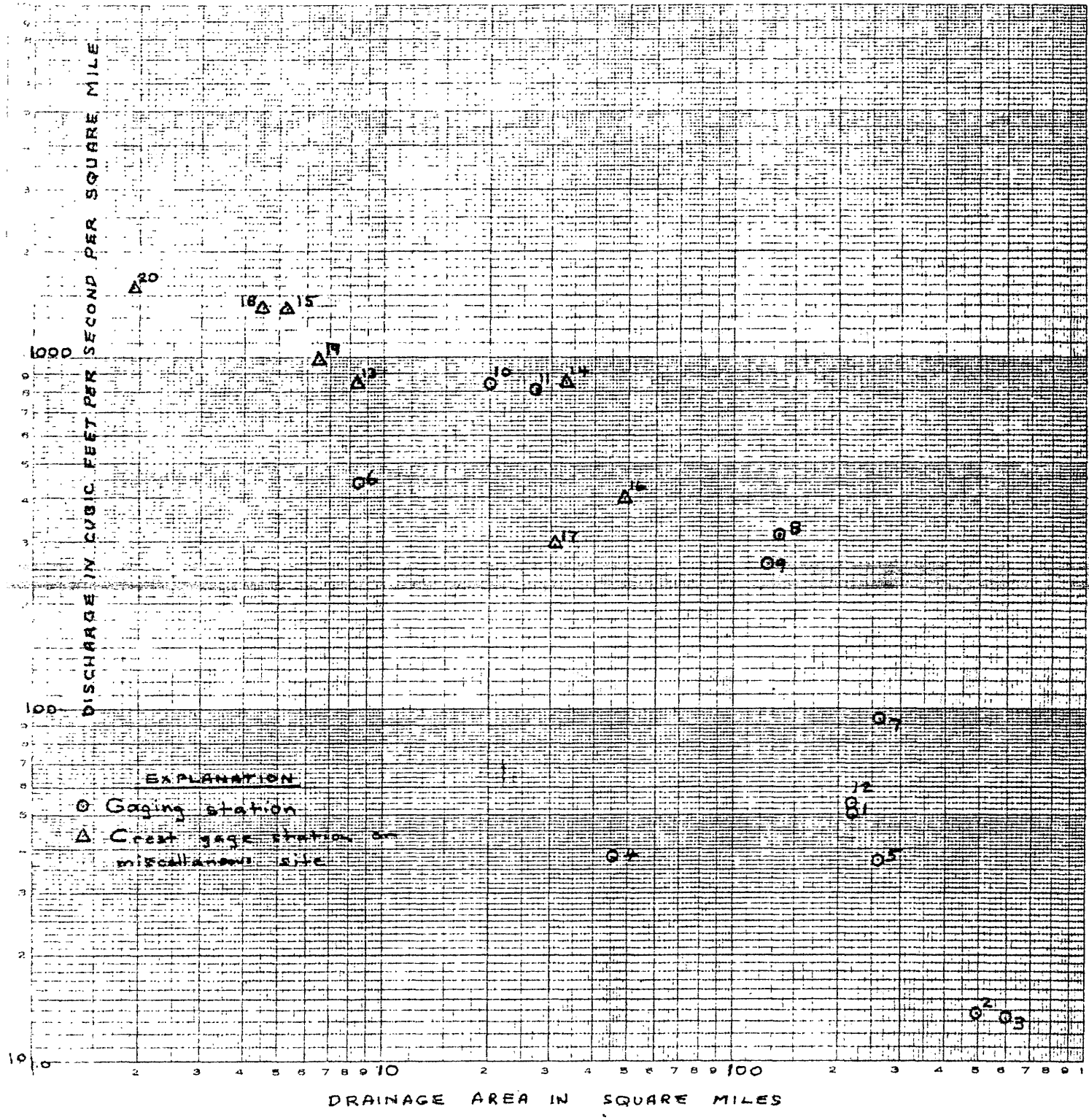

Figure 1. — Recorded and estimated flood peaks for streams in Southwestern Wisconsin

Table 2.--Flood peaks for southwestern Wisconsin streams.

Site number [1]	Location	Drainage area (sq mi)	Flood peak (cfs)	Flood peak (cfs per sq mi
	Gaging stations:			
1	Yellow River at Babcock- - - - - - - - -	223	11,600	50
2	Lemonweir River at New Lisbon- - - - - -	500	6,800	13
3	Baraboo River near Baraboo - - - - - - -	600	7,900	13
4	Black Earth Creek at Black Earth - - - -	46.4	1,750	37
5.	Kickapoo River at La Farge - - - - - - -	266	9,910	37
6	Knapp Creek near Bloomingdale- - - - - -	8.47	3,710	430
7	Grant River at Burton- - - - - - - - - -	267	25,000	93
8	Platte River near Rockville- - - - - - -	139	43,500	313
9	Galena River at Buncombe - - - - - - - -	128	32,700	258
10	E. Fork Galena R. at Council Hill, Ill.-	20.1	16,600	830
11	Pecatonica River at Darlington - - - - -	274	22,000	80
12	E. Branch Pecatonica R. near Blanchardville	221	11,700	53
	Crest-gage stations and miscellaneous sites:			
13	Pats Creek near Elk Grove- - - - - - - -	8.49	7,040	830
14	Ames Branch near Darlington- - - - - - -	33.7	28,700	852
15	N. Fork Ames Branch near Shullsburg- - -	5.27	7,200	1,360
16	Otter Creek near Darlington- - - - - - -	49.2	19,200	390
17	Shullsburg Branch near Leed Mine - - - -	31.2	9,270	295
18	Madden Branch near New Diggings- - - - -	4.51	6,220	1,380
19	Madden Branch near Belmont - - - - - - -	6.49	6,260	965
20	Wood Branch tributary near Truman- - - -	1.97	3,100	1,570

[1] Numbers correspond to points shown on figure 3.

Dell Lake. The unit hydrograph (fig. 2) was developed from a dimensionless graph, which was determined from a recorded flood at the gaging station on Dell Creek near Lake Delton. The flood shown in figure 3 had a peak of 15,400 cfs and a 24-hour volume of 11,700 acre-feet.

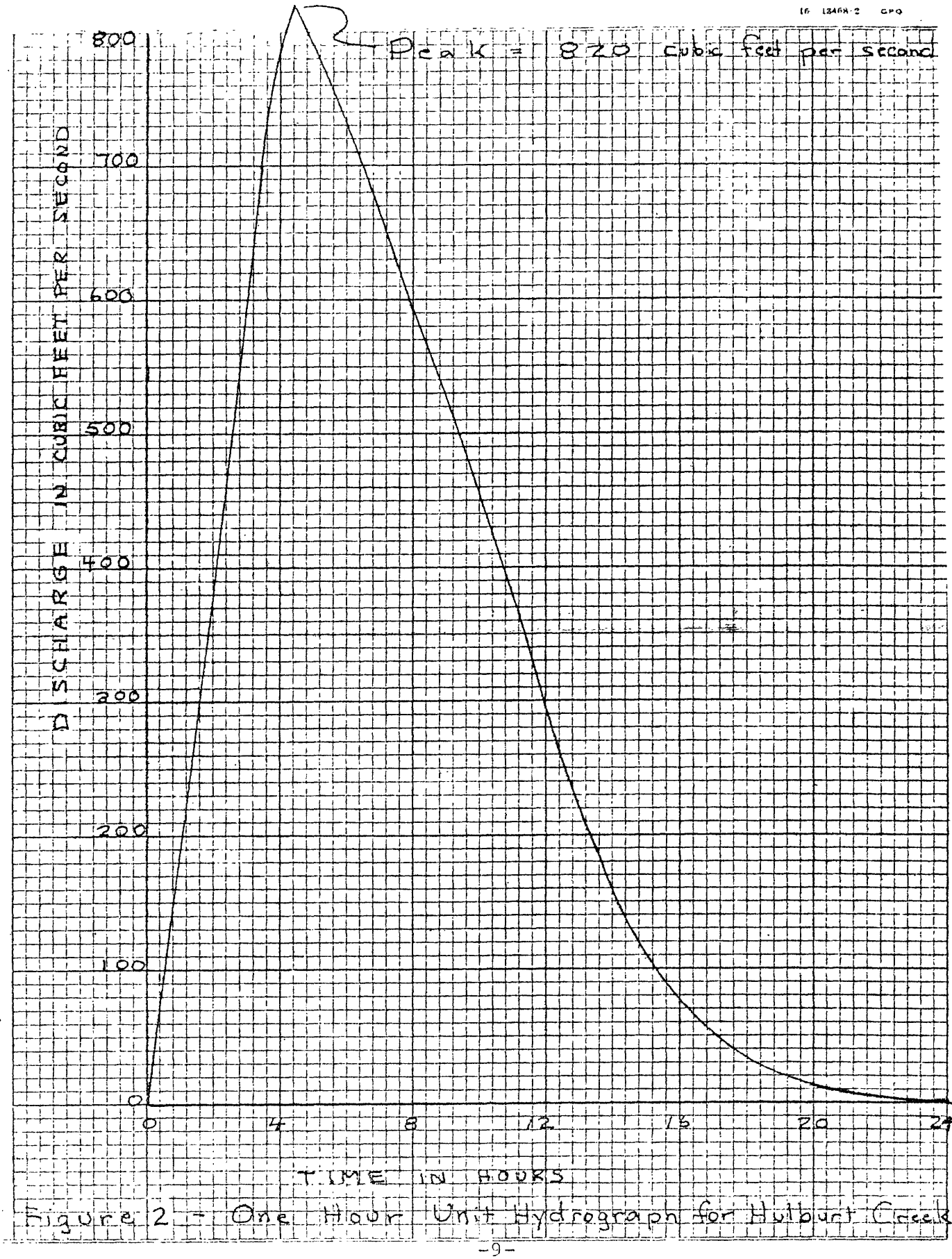

Figure 2 - One Hour Unit Hydrograph for Hulburt Creek

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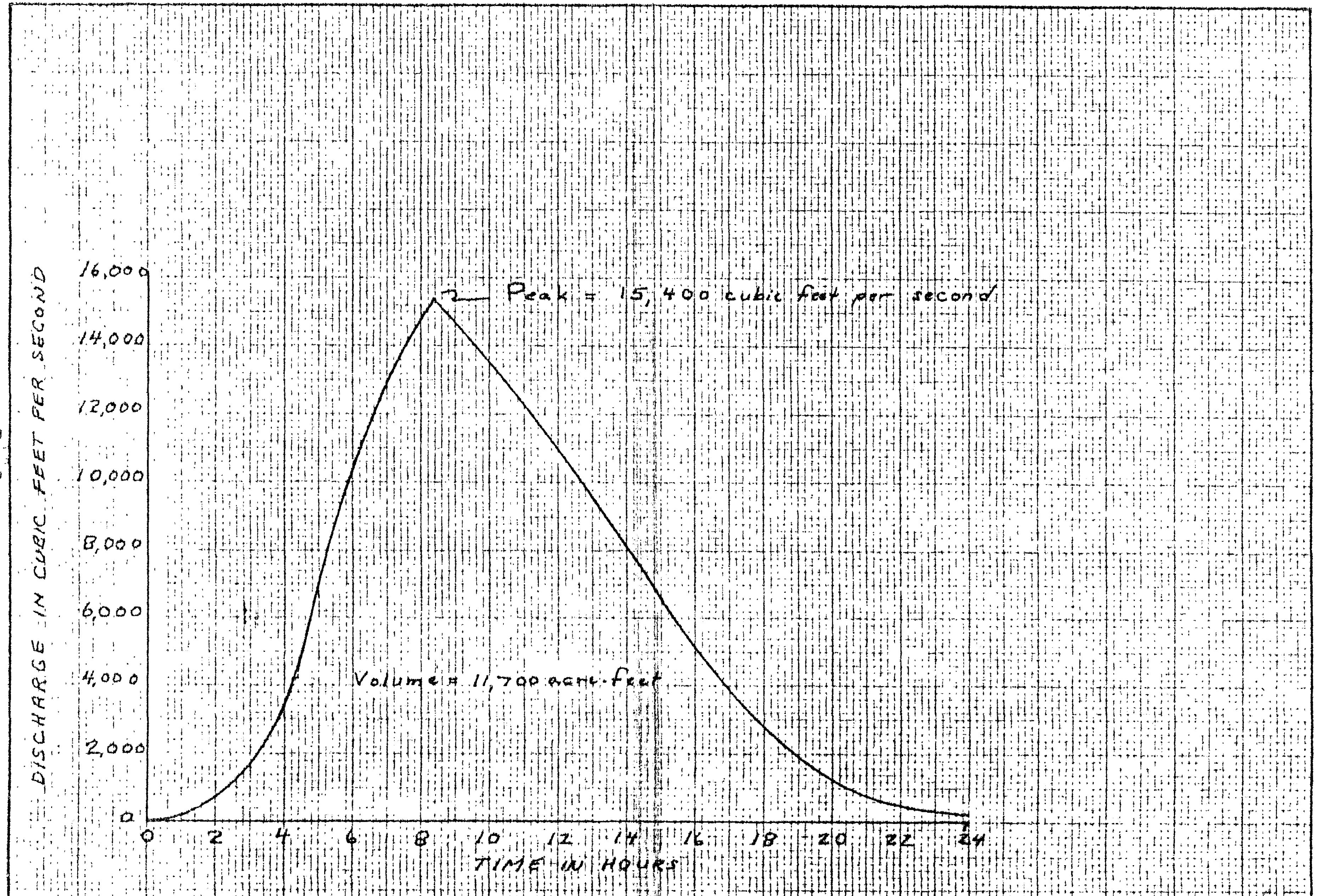

Figure 3 - [illegible]

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