

SURFACE WATER

HUNTINGTON RESERVOIR			
Reservoir level	Altitude (feet)	Capacity (acre-feet)	Area (acres)
Minimum pool	737	4,100	500
Seasonal pool	749	12,500	900
Maximum pool	798	153,100	7,900

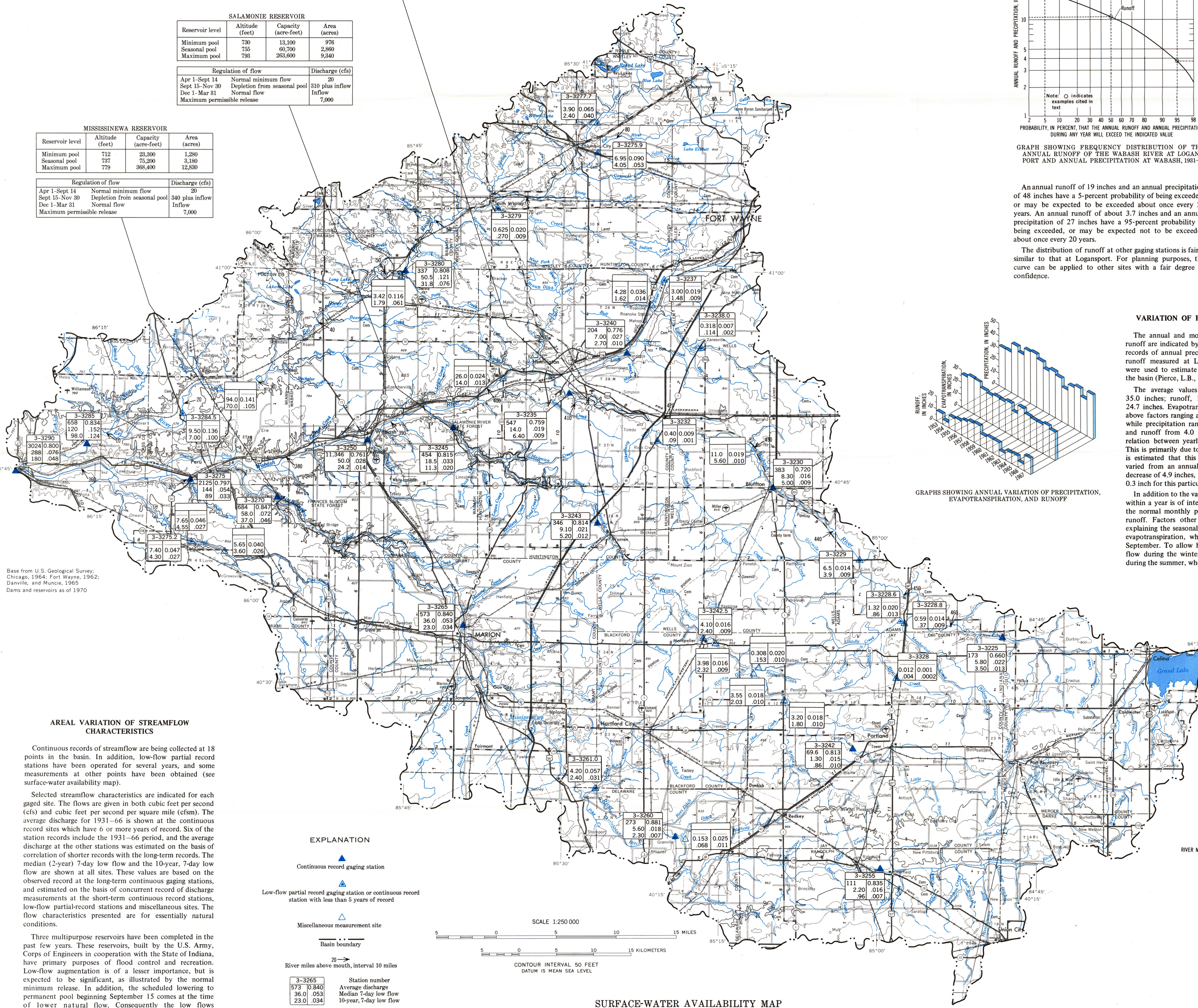
Regulation of flow		Discharge (cfs)
Apr 15 - Sept 14	Normal minimum flow	20
Sept 15 - Nov 30	Depletion from seasonal pool	55 plus inflow
Dec 1 - Apr 14	Normal flow	Inflow
Maximum permissible release		5,900

SALAMONIE RESERVOIR			
Reservoir level	Altitude (feet)	Capacity (acre-feet)	Area (acres)
Minimum pool	730	13,100	976
Seasonal pool	755	60,700	2,860
Maximum pool	798	285,000	9,340

Regulation of flow		Discharge (cfs)
Apr 1 - Sept 14	Normal minimum flow	20
Sept 15 - Nov 30	Depletion from seasonal pool	310 plus inflow
Dec 1 - Mar 31	Normal flow	Inflow
Maximum permissible release		7,000

MISSISSINNEWA RESERVOIR			
Reservoir level	Altitude (feet)	Capacity (acre-feet)	Area (acres)
Minimum pool	712	23,300	1,280
Seasonal pool	737	75,900	3,180
Maximum pool	779	388,400	12,830

Regulation of flow		Discharge (cfs)
Apr 1 - Sept 14	Normal minimum flow	20
Sept 15 - Nov 30	Depletion from seasonal pool	340 plus inflow
Dec 1 - Mar 31	Normal flow	Inflow
Maximum permissible release		7,000



AREAL VARIATION OF STREAMFLOW CHARACTERISTICS

Continuous records of streamflow are being collected at 18 points in the basin. In addition, low-flow partial record stations have been operated for several years, and some measurements at other points have been obtained (see surface-water availability map).

Selected streamflow characteristics are indicated for each gaged site. The flows are given in both cubic feet per second (cfs) and cubic feet per second per square mile (cfs/mi). The average discharge for 1931-66 is shown at the continuous record sites which have 6 or more years of record. Six of the station records include the 1931-66 period, and the average discharge at the other stations was estimated on the basis of correlation of shorter records with the long-term records. The median (2-year) 7-day low flow and the 10-year, 7-day low flow are shown at all sites. These values are based on the observed record at the long-term continuous gaging stations, and estimated on the basis of concurrent record of discharge measurements at the short-term continuous record stations, low-flow partial-record stations and miscellaneous sites. The flow characteristics presented are for essentially natural conditions.

Three multipurpose reservoirs have been completed in the past few years. These reservoirs, built by the U.S. Army, Corps of Engineers in cooperation with the State of Indiana, have primary purposes of flood control and recreation. Low-flow augmentation is of a lesser importance, but is expected to be significant, as illustrated by the normal minimum release. In addition, the scheduled lowering to permanent pool beginning September 15 comes at the time of lower natural flow. Consequently the low flows downstream from these reservoirs will be substantially increased.

EXPLANATION

- Continuous record gaging station
- Low-flow partial record gaging station or continuous record station with less than 5 years of record
- Miscellaneous measurement site
- Basin boundary
- River miles above mouth, interval 10 miles

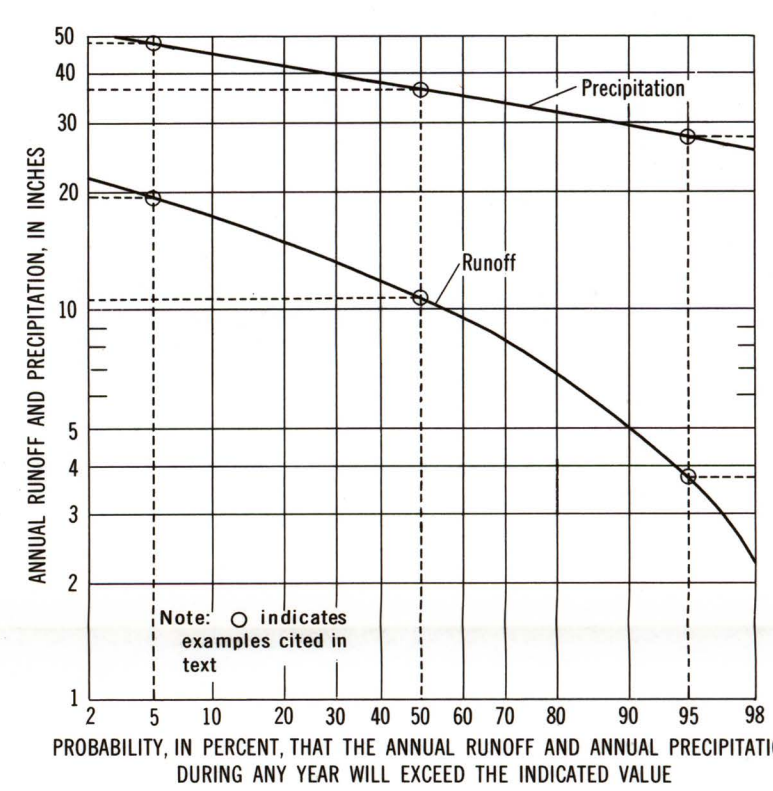
Station number	Average discharge	Median 7-day low flow	10-year, 7-day low flow
3-3265	573 0.840	36.0 0.053	23.0 0.034

Numbers on left are in cubic feet per second and on right are in cubic feet per second per square mile

SURFACE-WATER AVAILABILITY MAP

FREQUENCY DISTRIBUTION OF PRECIPITATION AND RUNOFF

The frequency distribution of yearly flows of the Wabash River at Logansport as shown on the graph below indicates that there is a 50-percent probability that the annual runoff will exceed 10.6 inches. This runoff will be exceeded on an average of once every 2 years. The frequency distribution of annual precipitation at Wabash, Indiana shows a 50-percent probability that the annual precipitation any year will exceed 37 inches.



GRAPH SHOWING FREQUENCY DISTRIBUTION OF THE ANNUAL RUNOFF OF THE WABASH RIVER AT LOGANS-PORT AND ANNUAL PRECIPITATION AT WABASH, 1931-67

An annual runoff of 19 inches and an annual precipitation of 48 inches have a 5-percent probability of being exceeded, or may be expected to be exceeded about once every 20 years. An annual runoff of about 3.7 inches and an annual precipitation of 27 inches have a 95-percent probability of being exceeded, or may be expected not to be exceeded about once every 20 years.

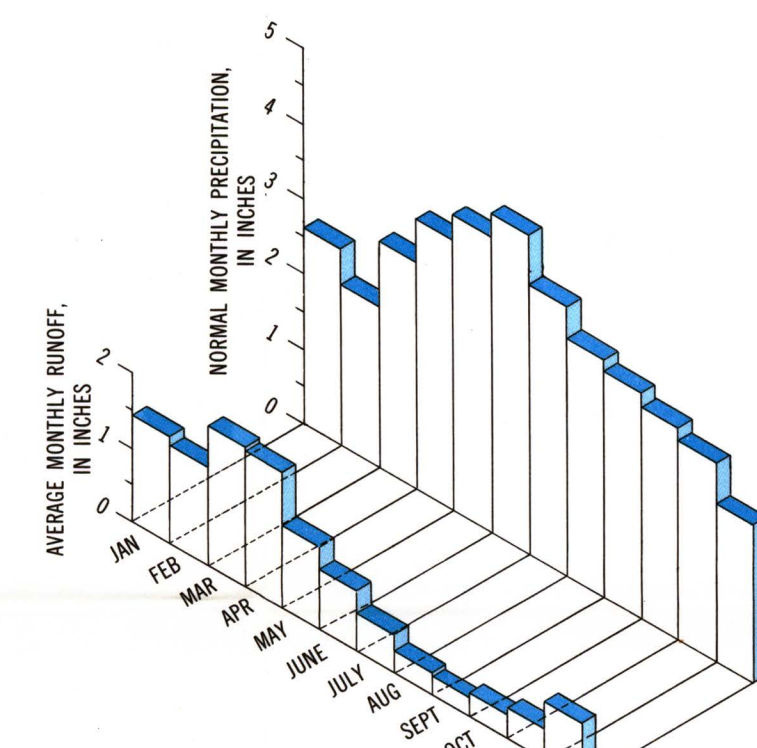
The distribution of runoff at other gaging stations is fairly similar to that at Logansport. For planning purposes, the curve can be applied to other sites with a fair degree of confidence.

VARIATION OF PRECIPITATION AND RUNOFF

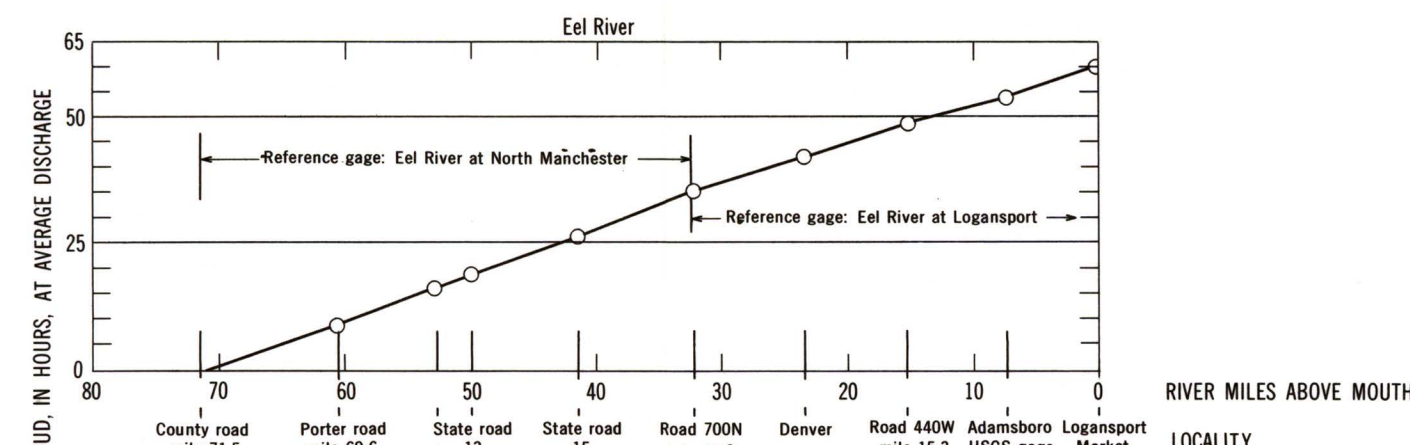
The annual and monthly variation of precipitation and runoff are indicated by the graphs at the left and right. The records of annual precipitation in the basin and the annual runoff measured at Logansport for water years 1953-67 were used to estimate the annual evapotranspiration from the basin (Pierce, L.B., 1955).

The average values for the period are: precipitation, 35.0 inches; runoff, 10.3 inches; and evapotranspiration, 24.7 inches. Evapotranspiration is the most uniform of the above factors ranging annually from 21 inches to 29 inches, while precipitation ranged from 27.6 inches to 41.9 inches, and runoff from 4.0 to 16.2 inches. There is not a good relation between yearly values of precipitation and runoff. This is primarily due to the annual change in basin storage. It is estimated that this factor, largely ground-water storage, varied from an annual increase of 4.5 inches to an annual decrease of 4.9 inches, the annual average being a decrease of 0.3 inch for this particular 15-year period.

In addition to the variation between years, the distribution within a year is of interest. The monthly graphs are based on the normal monthly precipitation and the average monthly runoff. Factors other than precipitation are important in explaining the seasonal pattern of runoff. The major factor is evapotranspiration, which is greatest from May through September. To allow higher utility of the water, the excess flow during the winter months could be stored for release during the summer, when the demand is high.



GRAPHS SHOWING MONTHLY VARIATION IN PRECIPITATION AND RUNOFF (1953-67)



A. GRAPHS SHOWING CUMULATIVE TRAVEL TIME OF LEADING EDGE OF DYE CLOUD AT AVERAGE DISCHARGE

TIME-OF-TRAVEL OF WATER

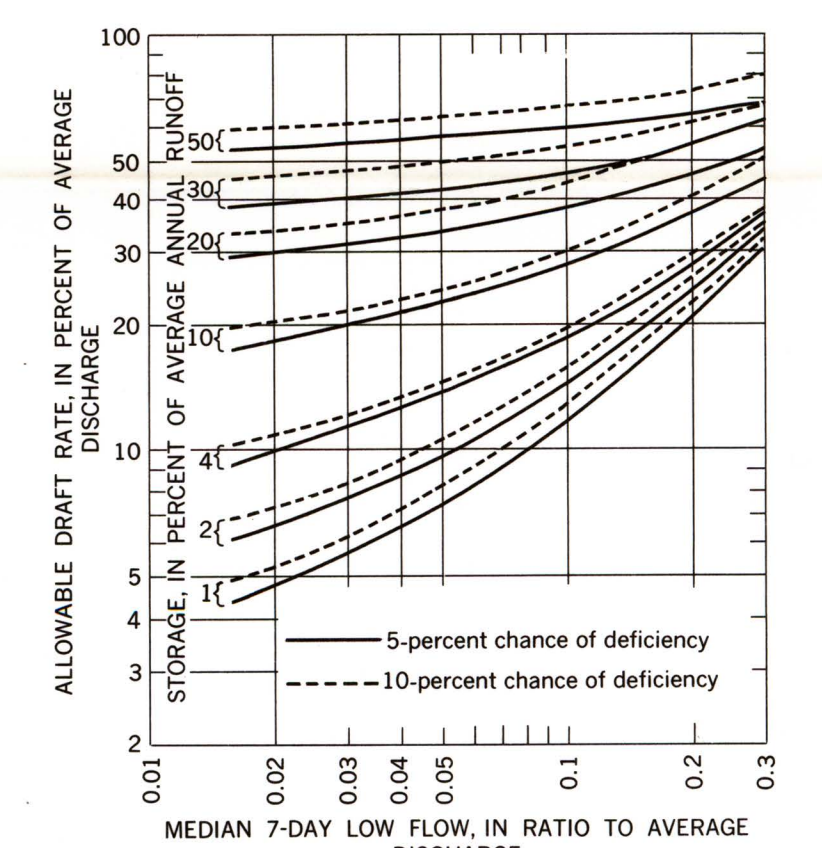
The rate of travel of water has been investigated for the main stem of the Wabash River below New Corydon, except from Bluffton to Huntington, and for the Eel River below South Whitley. The elapsed time for the leading edge of a dye cloud to travel between indicated points when the flow is equal to the average discharge is shown on graph A. A means of computing travel time for different rates of flow is shown on graph B. Using the time of travel for the leading edge, the time of travel of the peak concentration can be obtained from graph C.

These relations could serve as a means of planning for the operation of water intakes in case of a contamination of the

DRAFT-STORAGE FOR FLOW AUGMENTATION

The natural flow of streams is often insufficient to meet the demands for water during low-flow periods. Storage of water during periods of high flow for release during drier periods can increase the usefulness of the available water. An analysis of the streamflow records yields a general relationship from which the required amount of storage for various draft rates can be determined (Hardison, 1966 and Riggs, 1964). Parameters necessary to use the curve are the average flow, which can be estimated on the basis of the drainage area, and the median 7-day low flow. This low-flow value can be estimated by interpolation from data shown on the map. More reliable information would result from correlating low-flow measurements at the site with continuous gaging station records.

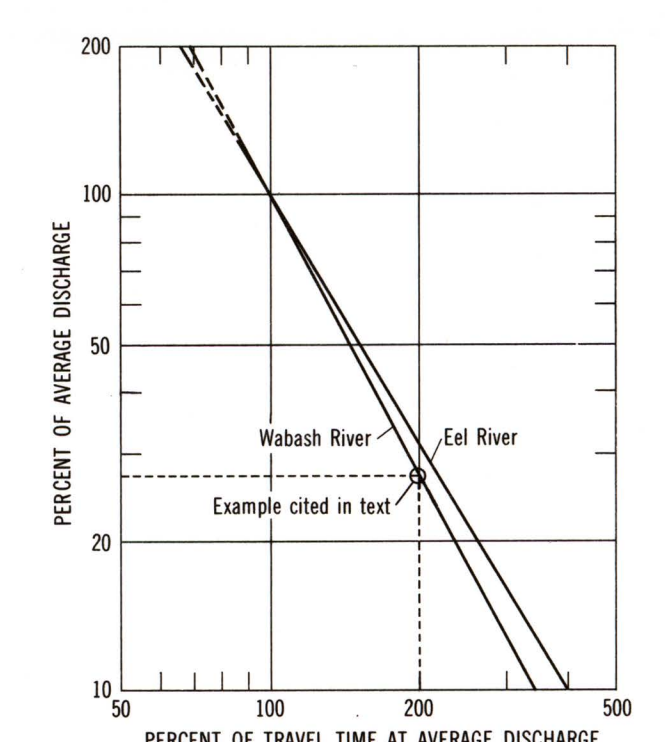
The draft storage relations are presented on the graph below. Given the mean discharge and the median 7-day low flow, the amount of storage required to maintain a desired draft rate can be estimated for either a 5-percent or a 10-percent chance of deficiency. Allowance for evaporation and seepage losses should be included in the draft rate, or added to the storage required.



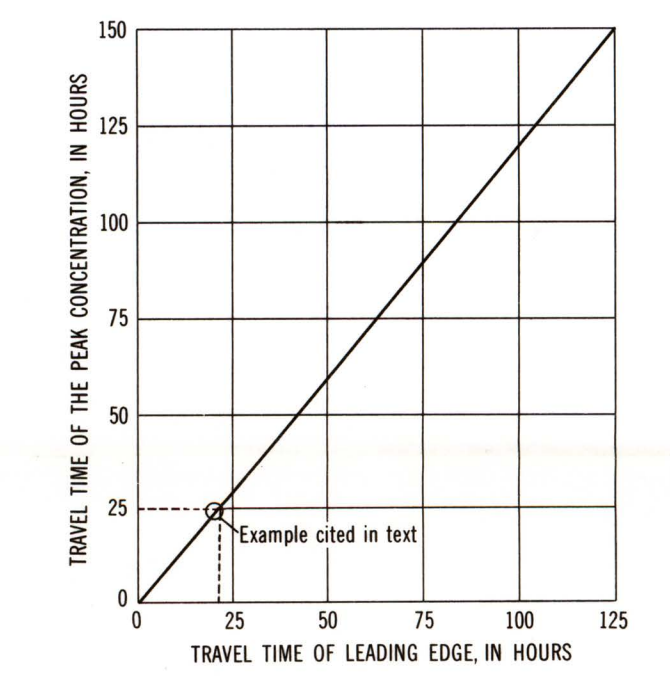
GRAPH SHOWING DRAFT-STORAGE CURVES

The curves are dimensionless ratios, therefore, any units of flow can be used as long as consistency is maintained. Suggested units are cubic feet per second (cfs) for discharge and cfs-days for storage. One cfs-day equals 0.646 million gallons.

If at a site, the mean discharge is estimated as 100 cfs and the median 7-day low flow is estimated as 5 cfs, and the desired dependable flow is 20 cfs, the required storage can be estimated. The desired draft is 20 percent of the mean flow, and the ratio of the median 7-day low flow to the average discharge is 0.05. The graph indicates that a storage of about 8 percent of the average annual runoff is required for a 5-percent chance of deficiency. The average runoff is 100 cfs x 365 days or 36,500 cfs-days, and 8 percent is about 2,900 cfs-days, or 1,900 million gallons. This is the storage capacity required without adjustment for seepage and evaporation losses. Adjustment for these can be made when the reservoir is designed.



B. GRAPH SHOWING RELATION OF TRAVEL TIME OF LEADING EDGE OF DYE CLOUD TO DISCHARGE EXPRESSED IN PERCENT OF AVERAGE



C. GRAPH SHOWING RELATION OF TRAVEL TIME OF LEADING EDGE AND PEAK CONCENTRATION OF A DYE CLOUD

stream. As an example, if a spill of a harmful contaminant into the Wabash River occurred at Wabash, when the discharge there was 340 cfs, when would the leading edge and peak concentration of the contaminant reach Peru? The average discharge at Wabash is 1,346 cfs. Three hundred forty cfs is approximately 25 percent of the average discharge. The elapsed time at average discharge is determined, from graph A, to be 10 hours. Graph B indicates that at 25 percent of average flow, the travel time is approximately 200 percent of the travel time at average flow, so the leading edge would reach Peru 20 hours (200 percent of 10 hours) after the spill. Based on this time for the leading edge and the relationship shown on graph C, the time for the peak concentration would be 25 hours.