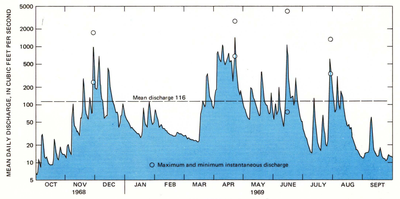
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH THE
COMMONWEALTH OF MASSACHUSETTS
WATER RESOURCES COMMISSION
AND BERKSHIRE COUNTY

HYDROLOGIC INVESTIGATIONS
ATLAS HA-481 (SHEET 2 OF 2)

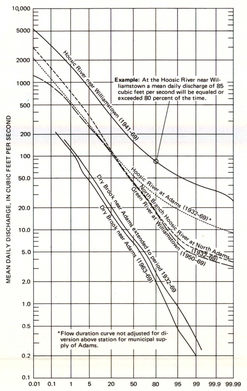
SURFACE WATER AVAILABILITY

STREAMFLOW VARIABILITY



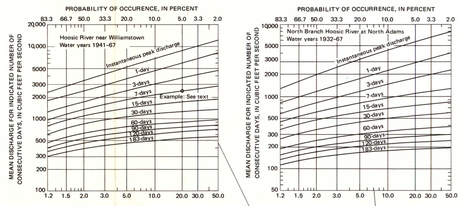
THE VARIABILITY OF MEAN DAILY DISCHARGE FOR THE NORTH BRANCH HOOSIC RIVER IS TYPICAL OF MANY STREAMS IN THE BASIN.–Maximum and minimum instantaneous discharge indicate the rapid change in streamflow that may occur daily.

FLOW DURATION

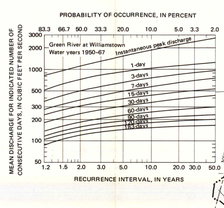


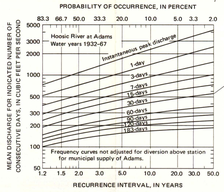
THE GEOHYDROLOGIC CHARACTERISTICS OF A DRAINAGE BASIN MAY BE INFERRED FROM THE SHAPE OF THE DURATION CURVE.–A steep slope at the upper end of the duration curve indicates flood flows run off rapidly. At the lower end, a steep slope (low base flow) indicates negligible ground-water storage, whereas a more gentle or flat slope (high base flow) indicates more ground-water storage. If conditions that govern runoff do not change from the period of record, the curves can be used to predict the percentage of time future flows will be equaled or exceeded.

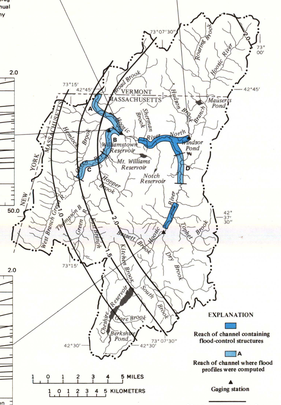
REGIONAL FLOOD FREQUENCY



EXAMPLE: The annual maximum 7-day mean flow will exceed 2400 cubic feet per second (cfs) at intervals averaging 20 years in length, and the probability of the annual maximum 7-day mean flow exceeding 2400 cfs in any 1 year is 5 percent.







THE MAGNITUDE OF A FLOOD AT SELECTED FREQUENCIES CAN BE ESTIMATED FROM REGIONAL FLOOD-FREQUENCY FORMULAS.–Flow data at long-term gaging stations provide information for flood-frequency curves drawn above. Similar data from many stations were used (Knox and Johnson, 1965) to estimate flood flows at ungaged sites where the drainage area is greater than 10 square miles or to streams where flood peaks are not affected materially by manmade regulation.

REGIONAL FLOOD-FREQUENCY FORMULAS

$Q1.2 = 1.91AS^{0.5}O^{1.2}$

$Q2.33 = 3.19AS^{0.5}O^{1.2}$

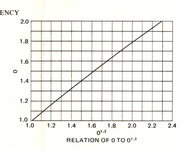
$Q5 = 4.51AS^{0.5}O^{1.2}$

$Q10 = 6.11AS^{0.5}O^{1.2}$

$Q25 = 9.53AS^{0.5}O^{1.2}$

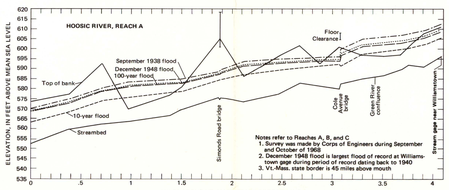
$Q50 = 12.6AS^{0.5}O^{1.2}$

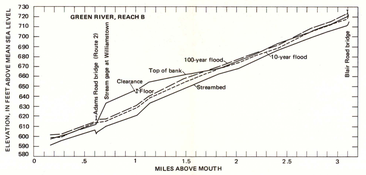
$Q100 = 16.3AS^{0.5}O^{1.2}$

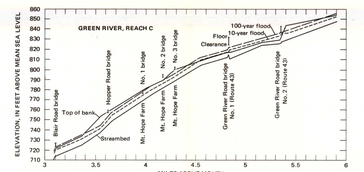


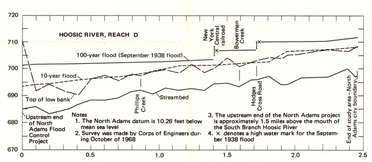
Q50 = Peak-flood discharge for 50-year frequency, or recurrence interval, in cubic feet per second.
A = Drainage area, in square miles.
S = Slope factor, in feet per mile, as determined by extending the main channel of the stream to the drainage-basin divide on the topographic map, picking off the elevations of the points 85 and 10 percent of the total length above the site, dividing the difference in elevation, in feet, by the length, in miles, between the 2 points and obtaining feet per mile.
O = Orographic factor from map above.

FLOOD PROFILES



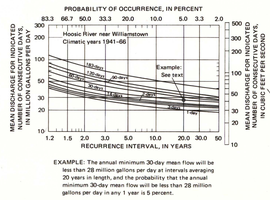




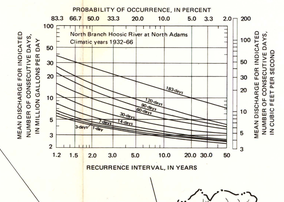


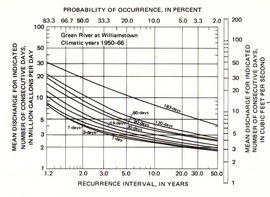
WATER-SURFACE PROFILES FOR VARIOUS FLOODS ALONG STREAM CHANNELS ARE USEFUL FOR FLOOD-PLAIN ZONING.–Areas where flood profiles were computed (U.S. Army Corps of Engineers, 1970), as well as areas where extensive flood-control structures have been installed, are shown on the flood-frequency map.

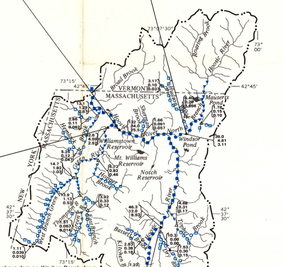
LOW-FLOW FREQUENCY



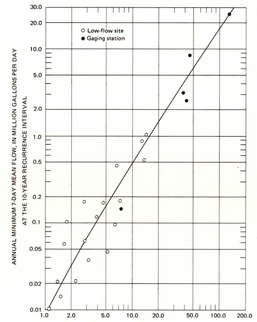
EXAMPLE: The annual minimum 30-day mean flow will be less than 28 million gallons per day at intervals averaging 20 years in length, and the probability that the annual minimum 30-day mean flow will be less than 28 million gallons per day in any 1 year is 5 percent.



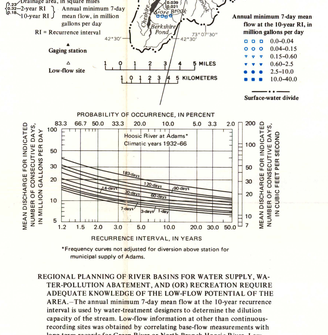




Excludes 2.52 square miles above dam on Kitchen Brook, from which flow is diverted for municipal supply of Cheshire.



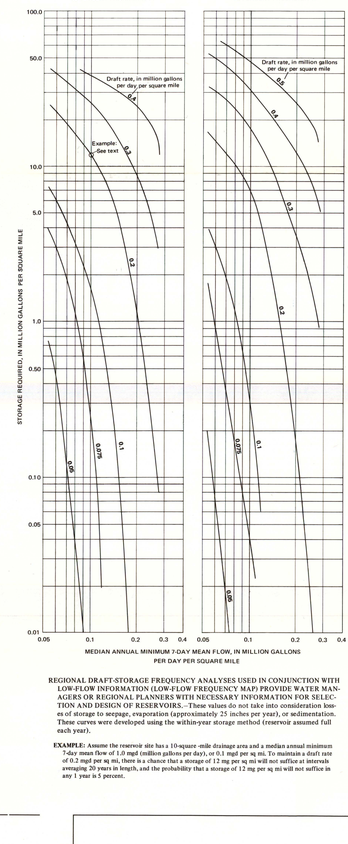
ANNUAL MINIMUM 7-DAY MEAN FLOW AT THE 10-YEAR RECURRENCE INTERVAL MAY BE ESTIMATED FROM THE SIZE OF THE DRAINAGE AREA.–The nonuniformity in the surficial material, water-table slope, precipitation, and evapotranspiration affects this relationship.



*Frequency curves not adjusted for diversion above station for municipal supply of Adams.

REGIONAL PLANNING OF RIVER BASINS FOR WATER SUPPLY, WATER-POLLUTION ABATEMENT, AND (OR) RECREATION REQUIRE ADEQUATE KNOWLEDGE OF THE LOW-FLOW POTENTIAL OF THE AREA.–The annual minimum 7-day mean flow at the 10-year recurrence interval is used by water-treatment designers to determine the dilution capacity of the stream. Low-flow information at other than continuous-recording sites was obtained by correlating base-flow measurements with long-term records for Green River or North Branch Hoosic River. Low-flow frequency analyses are based on the climatic year, which begins April 1st.

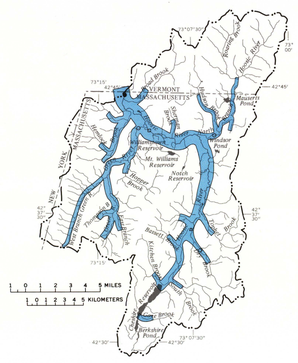
REGIONAL STORAGE ANALYSIS



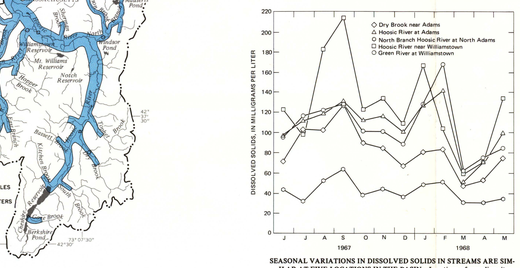
REGIONAL DRAFT-STORAGE FREQUENCY ANALYSES USED IN CONJUNCTION WITH LOW-FLOW INFORMATION (LOW-FLOW FREQUENCY MAP) PROVIDE WATER MANAGERS OR REGIONAL PLANNERS WITH NECESSARY INFORMATION FOR SELECTION AND DESIGN OF RESERVOIRS.–These values do not take into consideration losses of storage to seepage, evaporation (approximately 25 inches per year), or sedimentation. These curves were developed using the within-year storage method (reservoir assumed full each year).

EXAMPLE: Assume the reservoir site has a 10-square -mile drainage area and a median annual minimum 7-day mean flow of 1.0 mgd (million gallons per day), or 0.1 mgd per sq mi. To maintain a draft rate of 0.2 mgd per sq mi, there is a chance that a storage of 12 mg per sq mi will not suffice at intervals averaging 20 years in length, and the probability that a storage of 12 mg per sq mi will not suffice in any 1 year is 5 percent.

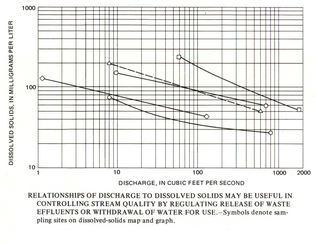
QUALITY



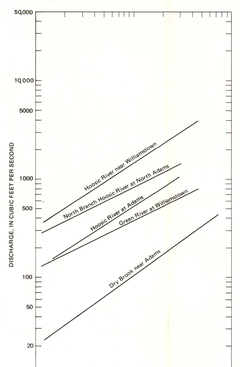
DISSOLVED-SOLIDS CONTENT IS LOWEST IN UPSTREAM TRIBUTARIES AND HIGHEST IN DOWNSTREAM REACHES OF THE HOOSIC RIVER.–The increase results from dissolution of soil and rocks and waste products of man's activities. The above map is based on measurements made August 1968 at about the 95-percent flow frequency.



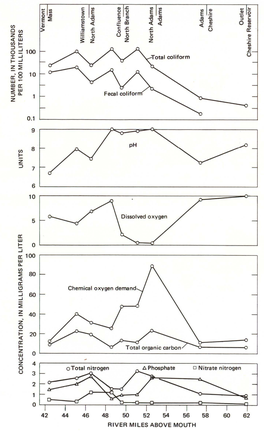
SEASONAL VARIATIONS IN DISSOLVED SOLIDS IN STREAMS ARE SIMILAR AT FIVE LOCATIONS IN THE BASIN.–Locations of sampling sites are shown on dissolved-solids map.



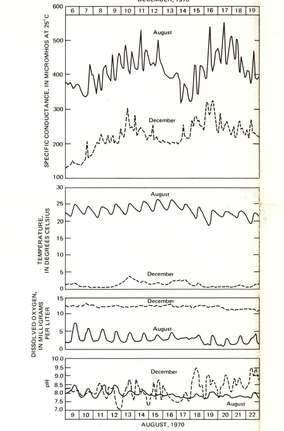
RELATIONSHIPS OF DISCHARGE TO DISSOLVED SOLIDS MAY BE USEFUL IN CONTROLLING STREAM QUALITY BY REGULATING RELEASE OF WASTE EFFLUENTS OR WITHDRAWAL OF WATER FOR USE.–Symbols denote sampling sites on dissolved-solids map and graph.



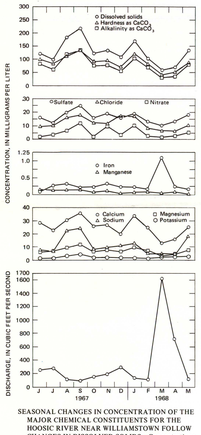
THE CONCENTRATION OF SUSPENDED SEDIMENT VARIES WITH DISCHARGE AND IS HIGHEST DURING PERIODS OF SPRING RUNOFF.–The above concentration-discharge curves were prepared from samples collected during the spring runoff period in 1968 and show the general range of concentrations to be expected with changes in discharge. The suspended sediment is derived from erosion of soils and stream banks.



SOME COMMON INDICES OF POLLUTION SHOW MARKED CHANGES IN CONCENTRATION ALONG THE MAIN STEM OF THE HOOSIC RIVER.–Municipal and industrial waste utilize the dissolved oxygen and add undesirable constituents to the stream. The measurements were made in August 1968 at about 95 percent flow frequency. (Data furnished by Environmental Protection Agency.)



DAILY AND WEEKLY CYCLES OF RECORDED WATER-QUALITY PARAMETERS ON THE HOOSIC RIVER BELOW WILLIAMSTOWN ILLUSTRATE SOME EFFECTS OF WASTE EFFLUENTS ON STREAMS.–Higher discharge during December dilutes the dissolved solids and causes lower specific conductance. Lower water temperature and less biochemical activity results in higher concentrations of dissolved oxygen and less diurnal variation in December.



SEASONAL CHANGES IN CONCENTRATION OF THE MAJOR CHEMICAL CONSTITUENTS FOR THE HOOSIC RIVER NEAR WILLIAMSTOWN FOLLOW CHANGES IN DISSOLVED SOLIDS.–Concentrations of these constituents are not excessive for most water uses. They are generally lower at upstream and tributary stations and follow the same general seasonal patterns.

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_____1964, Compilation of records of surface waters of the United States, October 1950 to September 1960, pt. 1-B, North Atlantic slope basins, New York to York River: U.S. Geol. Survey Water-Supply Paper 1722, 578 p.

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HYDROLOGY AND WATER RESOURCES OF THE HOOSIC RIVER BASIN, MASSACHUSETTS

By
Bruce P. Hansen, L. G. Toler, and Frederick B. Gay

1973

Interior–Geological Survey, Washington, D.C.–1973–W72319