DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

HYDROLOGIC INVESTIGATIONS
ATLAS HA-326

Table 1.—Bench and reference marks.

Designation	Description	Location	Established by	Elevation above mean sea level (feet)
TT STA NO 29T 1927 Reset 1962	Bronze disk	1.9 miles NE along State Highway 615 from Craig County Courthouse at New Castle, 40 feet SE of centerline of Highway 311 at the SW intersection of Highway 696 (0.35 mile length of old Highway 42 paralleling Highway 615); set in top of a concrete post set flush in the ground along the NW side of a fence.	USGS	1247.74
RM – 1	Chiseled square	At New Castle, at Highway 616 bridge over Craig Creek, on top of the left downstream abutment, on a flat part 3 feet lower than the top of the bridge floor (directions for facing downstream).	USGS	1261.9
RM – 2	Chiseled square	At New Castle, at Highway 616 bridge over Craig Creek, on top of the right downstream abutment, on a flat part 3 1/2 feet lower than the top of the bridge floor (directions for facing downstream).	USGS	1261.0
K 45 1926	Bronze disk	At New Castle, at the Craig County Courthouse, in the door sill of the front entrance.	USGS	1310.365
H 75 1936	Bronze disk	At New Castle, in the southwest corner of the public school yard, 39 feet east of the centerline of State Highway 311, 33 feet north of the centerline of a side street, and 1 foot east of the east edge of a sidewalk, in top of a concrete post set flush with the ground.	U.S. Coast and Geodetic Survey	1325.191
RM – MC	Chiseled square	0.3 mile south along State Highway 311 from the public school at New Castle, on the highway bridge over Meadow Creek, on top of the downstream curb, right end (facing downstream).	USGS	1316.2
RM – CB	Chiseled square	1.0 mile south along State Highway 311 from the public school at New Castle, at the foot bridge across Craig Creek, on the top of the right concrete abutment; downstream, instream corner (facing downstream).	USGS	1275.4
RM – E	Chiseled square	1.5 miles south along State Highway 311 from the public school at New Castle, on a box culvert, on top of the left downstream wingwall (facing downstream).	USGS	1304.0
G 75 1935	Bronze disk	1.9 miles south along State Highway 311 from the public school at New Castle, 102 feet south of the centerline of a 4-by-4 foot box culvert, 47 feet east of utility pole N 470, and 25 feet east of the centerline of the highway, and set in the top of a concrete post projecting 5 inches above ground.	U.S. Coast and Geodetic Survey	1306.1*
RM – G	Chiseled square	1.9 miles south along State Highway 311 from the public school at New Castle, on a 4-by-4 foot box culvert, 102 feet north of Bench Mark G 75 1935 (described above), on the top of the right upstream wingwall (facing downstream).	USGS	1305.7
GAGING STATION RM 3	Machine bolt head	At New Castle, at the Johns Creek gaging station at the Highway 615 bridge, located 10.3 feet inshore and 1 foot upstream from the upstream, inshore corner of the gage house, in top of a concrete post set flush with the ground.	State of Va.	1263.38

* Found post broken off at ground on March 8, 1967. Set top of post back on base and checked the elevation. Found it correct to the nearest tenth of a foot (as shown) from line of levels starting at BM 1936. Elevation can be checked with RM – G.

FLOODS ON JOHNS AND CRAIG CREEKS IN CRAIG COUNTY, VIRGINIA

This report was prepared by the U.S. Geological Survey to further the objectives of the Appalachian Regional Commission. It provides technical guidance for those who plan the economic uses of flood-plain lands.

The report presents the results of a study of the occurrence and magnitude of flooding along a 6-mile reach of Craig Creek and a 1½-mile reach of Johns Creek in the vicinity of New Castle, Craig County, Virginia. The areas inundated by a hypothetical 50-year flood along Johns and Craig Creeks are delineated on a topographic map. The report will be useful for preparing building and zoning regulations, locating waste disposal facilities, developing recreational areas, and managing surface water.

Flood history.—According to reports of local residents, some of whom could remember as far back as 45 years, the flood of January 23, 1935, was the highest observed on Johns and Craig Creeks at New Castle. This flood reached a stage of 1,265.10 feet above mean sea level at the Johns Creek gaging station at New Castle.

Streamflow records obtained at the Virginia Division of Water Resources gaging stations on Craig Creek at Parr, Va., and Johns Creek at New Castle, Va., are the primary sources of flood data used. The records are published in water-supply papers of the U.S. Geological Survey and in the Surface Water Supply of Virginia Bulletins of the Division of Water Resources of the Virginia Department of Conservation and Economic Development.

Flood height at a gaging station—the elevation reached by the water surface above an arbitrarily selected datum plane—usually is stated in terms of gage height or stage. Flood heights shown in this report are elevations above mean sea level, datum of 1929, supplementary adjustment of 1936. Gage heights or stages at gaging stations on Johns and Craig Creeks can be converted to elevations above mean sea level by adding the gage height to the appropriate datum of the gage listed below. Location of gaging station and period of record also are shown.

Gaging station	Miles along channel, upstream from mouth	Datum of gage above mean sea level (feet)	Period of record
Craig Creek at Parr	12.0	992.50	April 1925–to date
Johns Creek at New Castle . .	0.30	1,254.30	April 1926–to date

Flood occurrence.—The irregular distribution of flood events is illustrated by the pattern of annual peak stages at the gaging station on Johns Creek at New Castle during the period 1926 to 1966 shown in figure 1. Records for other gaging stations as well as for other time periods also show an erratic distribution of flood occurrences.

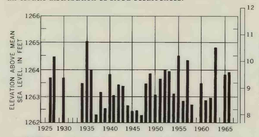


FIGURE 1.—*Annual peak stages above 1262-foot elevation, 1926–66, Johns Creek at New Castle, Va.*

Flood discharge.—The rate of discharge of a stream is the volume of flow that passes a particular location in a given period of time. Discharge rates usually are expressed in units of cubic feet per second (cfs). Peak discharge, the maximum discharge attained by a flood, generally occurs at the time of the maximum height (stage) of the flood, but if a stream is affected by variable backwater, the time of the peak discharge may not coincide with that of the maximum stage. Also, backwater from debris or an ice jam may cause a high stage during a period of relatively low discharge.

Recurrence intervals.—Although the distribution of flood occurrences is recognized as erratic, the concept of "recurrence intervals" is used in evaluating the probable frequency of future flooding. As applied to flood events, recurrence interval is the average interval of time within which a given flood will be equaled or exceeded once. For example, 50 floods of at least the magnitude of a 2-year flood may be expected to occur in a 100-year period, and 4 floods of at least the magnitude of a 25-year flood may be expected to occur in a 100-year period. Because of the irregular nature of flood events, recurrence intervals cannot be used to predict the time of flood occurrence. They can, however, be used to evaluate the probability of occurrence in any future year. A 25-year flood has 1 chance in 25 of being equaled or exceeded in any one year, and the 50-year flood shown on the map has 1 chance in 50 of being equaled or exceeded in any one year.

Flood frequency.—Frequency of floods at the Virginia Division of Water Resources stations on Johns Creek at New Castle and on Craig Creek at Parr was determined from the regional flood-frequency relation for streams in the western part of Virginia (Speer and Gamble, 1964).

The general relation between discharge and frequency is shown in figures 2 and 3 and the general relation between stage and frequency is shown in figures 4 and 5. The relation between stage and frequency is dependent on the relation of stage to discharge which is affected by changes in the physical conditions of stream channels and bridge openings. The frequency curves are based on channel conditions existing in 1967. Longer streamflow records and future changes in channel conditions may define somewhat different stage-frequency curves. Extrapolation of the frequency curves beyond the limits shown is not recommended.

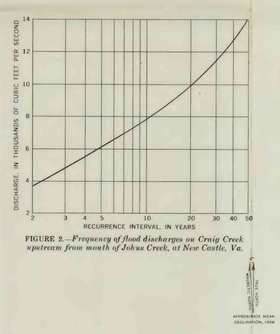


FIGURE 2.—*Frequency of flood discharges on Craig Creek upstream from mouth of Johns Creek, at New Castle, Va.*

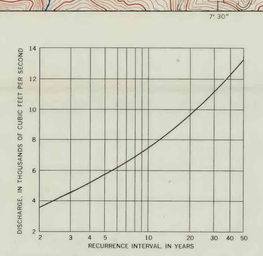


FIGURE 3.—*Frequency of flood discharges on Johns Creek at New Castle, Va.*

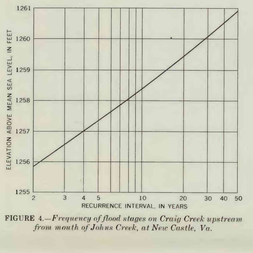


FIGURE 4.—*Frequency of flood stages on Craig Creek upstream from mouth of Johns Creek, at New Castle, Va.*

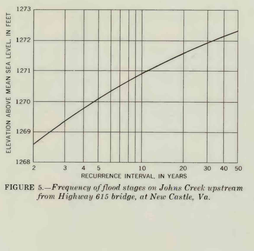
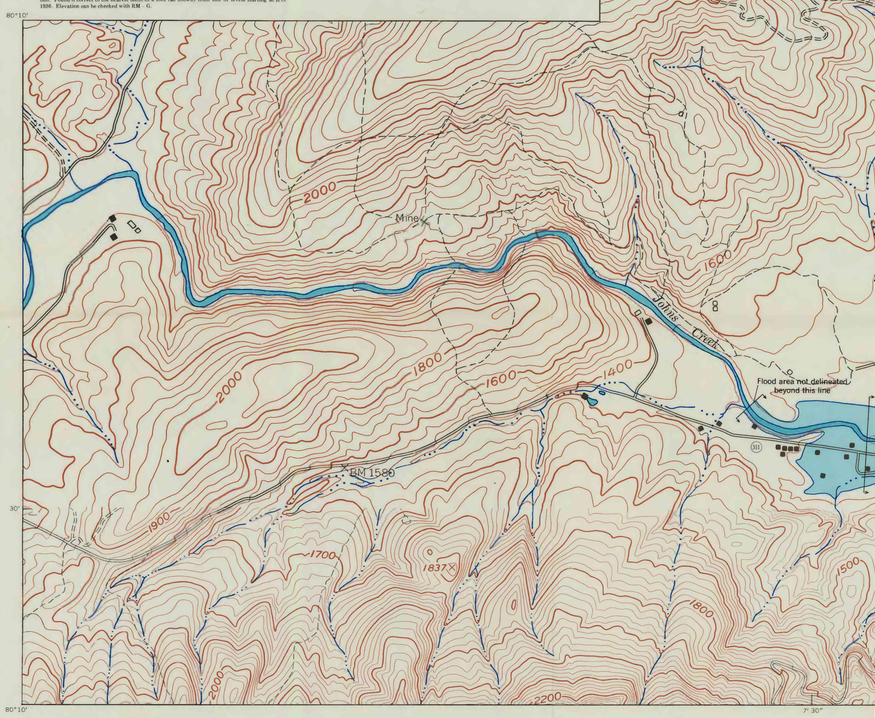


FIGURE 5.—*Frequency of flood stages on Johns Creek upstream from Highway 615 bridge, at New Castle, Va.*



Base from U.S. Geological Survey 1:24 000, Catawba, and Looney, 1963, and New Castle SE and SW advance sheets, 1966

SCALE 1:12 000
0 ½ 1 MILE
0 .5 1 KILOMETER
CONTOUR INTERVAL 20 AND 40 FEET
DATUM IS MEAN SEA LEVEL

It is emphasized that recurrence intervals are average figures—the average number of years between occurrences of floods that equal or exceed a given magnitude (stage or discharge). The fact that a major flood occurs in a given year does not reduce the probability of that flood being exceeded in the next year or even in the next week.

Flood profiles.—The flood-frequency relations (figs. 2–5) evaluate the flood likelihood at only one site each on Craig and Johns Creeks. The profiles of the floodwater surface shown in figures 6 and 7 extend this information to all sites along Johns and Craig Creeks in the study area. These profiles are for hypothetical floods of 5-, 25-, and 50-year recurrence intervals, which are based on computations of field data using the step-backwater method. The river mile distances of the profiles correspond to those marked along the streams on the topographic map. The three profiles are based on channel conditions existing in 1967 and could be altered by changes in the physical conditions of the stream channels and bridge openings.

Extent of flooding.—The elevation reached by the 50-year flood was determined at each cross section shown on the map. Boundaries of inundation by the 50-year flood were drawn by connecting the points on the cross sections corresponding to the 50-year flood elevations, and interpolating between contours. Owing to the nature of the topography, and the small scale and large contour interval of the map used, it was not practicable to distinguish differences in areal extent between the 5-, 25-, and 50-year floods. Only the 50-year flood is shown on the map.

Along tributary streams, the areas shown on the topographic map as being subject to inundation are those that would be flooded by backwater from Johns and Craig Creeks. The areas along tributaries subject to inundation by tributary flow may be greater than the areas inundated by backwater from Johns and Craig Creeks.

Depth of flooding.—The depth of flooding at any point can be estimated by subtracting the ground elevation from the water-surface elevation at the same point, indicated by the profiles in figures 6 and 7. The approximate ground elevation can be determined from contours on the map, although more accurate elevations can be obtained by leveling from nearby bench and reference marks shown on the map and listed in table 1. Depth of flooding is also shown on the cross sections in figures 8 and 9.

Future conditions.—Greater floods than the hypothetical flood whose boundary is shown on the topographic map are possible. The flood boundary shown reflects 1967 channel conditions existing when the channel survey was conducted. Changes in channel conditions, in waterway openings at highways, in runoff characteristics of the streams caused by increased urbanization, or in farming practices that may take place could affect the height reached by a future flood of comparable discharge. Protective works built in the future may reduce the frequency of flooding in the area but will not necessarily eliminate all future flooding.

Acknowledgments.—The selection of the site for this project was made in collaboration with the Appalachian Regional Commission and the Virginia Department of Conservation and Economic Development, Division of Water Resources. Coordination of planning with the district office of the Corps of Engineers was accomplished through the Office of Appalachian Studies, Corps of Engineers. Cross sections on Johns Creek were furnished by the Soil Conservation Service, U.S. Department of Agriculture.

The report was prepared under the administrative direction of J. W. Gambrell, district chief, Water Resources Division, U.S. Geological Survey, Richmond, Va., and with the assistance of J. F. Bailey, hydraulic specialist, Water Resources Division, U.S. Geological Survey, Arlington, Va.

Additional information.—Other information pertaining to Johns and Craig Creeks can be obtained at the office of the U.S. Geological Survey, Water Resources Division, 200 West Grace Street, Richmond, Va., 23220, and from the following reports:

Grover, N. C., 1937, The Floods of March 1936, Part 3, Potomac, James, and Upper Ohio Rivers: U.S. Geol. Survey Water-Supply Paper 800, p. 144–145.

_____1949, Floods of August 1940 in the southeastern states: U.S. Geol. Survey Water-Supply Paper 1066, p. 95, 97.

Speer, P. R., and Gamble, C. R., 1964, Magnitude and frequency of floods in the United States, Part 2-A, South Atlantic slope basins, James River to Savannah River: U.S. Geol. Survey Water-Supply Paper 1673, p. 12, 49–51.

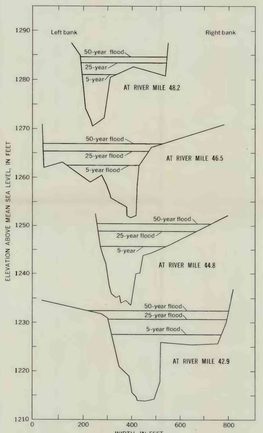


FIGURE 8.—*Cross sections of Craig Creek and flood plain*

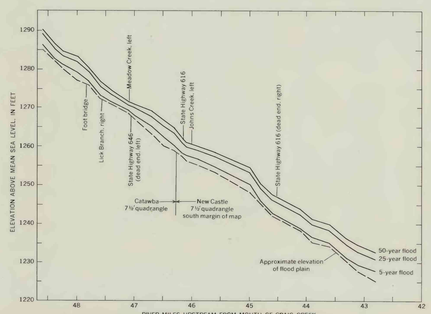
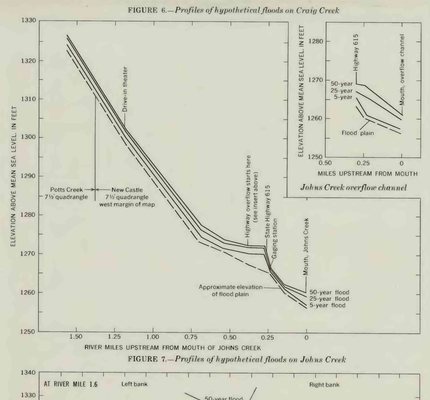


FIGURE 6.—*Profiles of hypothetical floods on Craig Creek*



Johns Creek overflow channel

FIGURE 7.—*Profiles of hypothetical floods on Johns Creek*

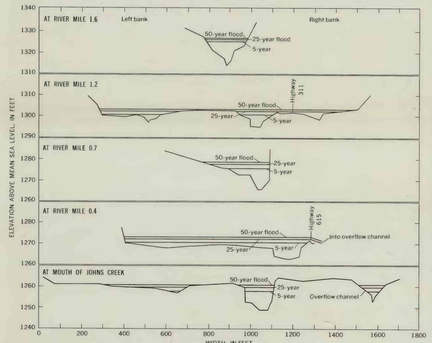


FIGURE 9.—*Cross sections of Johns Creek and flood plain*

EXPLANATION

Estimated area inundated by hypothetical 50-year flood

Boundary of 50-year flood

Cross section location

Distance along channel measured in miles upstream from mouth (45)

Area of this report

FLOODS ON JOHNS AND CRAIG CREEKS IN CRAIG COUNTY, VIRGINIA

By
Donald H. Rapp

1968

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D.C.—1968—W68334

For sale by U. S. Geological Survey, price 75 cents