MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

RESEARCH SUMMARY

Regression Equations for Estimating Flood Discharges for Coastal Plains of Maryland

WHAT WAS THE NEED?

Fixed region regression equations are used to estimate flood discharges for bridge and culvert design and floodplain mapping in Maryland by several state and local agencies. These empirical equations are developed based on relations between flood discharges at gaging stations and watershed characteristics that can be estimated from available digital data layers. For ungaged locations, the watershed characteristics are used in the regression equations to predict the flood discharges. The Maryland Department of Transportation State Highway Administration uses the regression equations to primarily evaluate the reasonableness of flood discharges estimated using the TR-20 watershed model.

WHAT WAS THE GOAL?

The objective of the current analysis is to update the Fixed Region regression equations for the Eastern and Western Coastal Plain Regions for estimating the 1.25-, 1.5-, 2-, 5-, 10-, 25-, 50-, 100-, 200-, and 500-year flood discharges using the following data:

- Annual peak flow data through the 2017 water year
- Flood frequency analyses using Bulletin 17C
- Watershed characteristics computed using GISHydroNXT
- SSURGO data downloaded from the Natural Resources Conservation Service (NRCS) Soil Survey web site in May 2018

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PRINCIPAL INVESTIGATOR:
Wilbert O. Thomas, Jr.
Michael Baker International
wthomas@mbakerintl.com

WHAT DID THE RESEARCH TEAM DO?

Flood frequency analyses were performed for 27 gaging stations in the Western Coastal Plain (WCP) Region: 15 rural stations; 12 urban stations (impervious area greater than 10 percent at the midpoint of the record). There were six active urban stations with significant upward trends in the annual peak flows due to increasing urbanization and these trends were accounted for using different approaches. Flood frequency analyses were performed for 41 rural gaging stations in the Eastern Coastal Plain (ECP) Region: 22 stations in Maryland; 19 stations in Delaware.

A regional skew analysis was performed using data for eight rural gaging stations in the WCP Region and 15 rural stations in the ECP Region. Only the rural stations with consistent land use over time were used. A mean skew of 0.38 with standard error of 0.38 was determined in this analysis. The regional skew was weighted with the station skew for all rural watersheds (less than 10 percent impervious area at the midpoint of the record) to produce final discharge estimates. For the urban gaging stations, station skew was used because the regional skew is not applicable due to changing land use conditions.

Watershed characteristics were compiled using GIS data for development of regional regression equations for estimating flood discharges.

WHAT WAS THE OUTCOME?

The regression equations for the WCP Region are based on drainage area, in square miles, impervious area, in percent, at the midpoint of the gaging station record, and percent A soils based on the May 2018 SSURGO data. The standard errors ranged from 33.3 to 49.5 percent across all recurrence intervals. The equations for the ECP Region are based on drainage area, in square miles, percent A soils based on the May 2018 SSURGO data, and land slope, in percent. The standard errors range from 38.9 to 47.4 percent across all recurrence intervals. The regression equations for both regions were compared to gaging station data and shown to be reasonably unbiased for the 10- and 100-year flood discharges.

HOW WILL MDOT SHA USE THE RESULTS?

The updated regression equations will be used by MDOT SHA in the design of bridges and culverts in Maryland. The updated regression equations will be included in the fifth edition of the Maryland Hydrology Panel report entitled “Application of Hydrologic Methods in Maryland” that will be published in 2020.

LEARN MORE

To view the Western Coastal Plain Region report, click here.
To view the Eastern Coastal Plain Region report, click here.