New Jersey Turnpike Authority
P.O. Box 5042, Woodbridge, NJ 07095

January 27, 2026

Document Change Announcement

Design Manual
Drainage Resiliency Updates
DCA2026DM-01

Subject: Revisions to
Section 5 Drainage Design, Subsection 5.4 Hydrology

Description of Change:
This DCA revises the Authority's roadway drainage system design standards to account for projected increases in rainfall due to climate change in conformance with the NJDEP's Protecting Against Climate Threats (NJPACT) program.

Notice to New Jersey Turnpike Authority Staff and Design Consultants
This DCA should be applied to all projects that have not yet initiated Phase B. During Phase B, the drainage systems are being laid out and detailed calculations prepared, so having projects that have graduated through Phase B implement these changes could result in rework of various drainage and associated tasks. The updated section of the design manual only applies to roadway drainage systems and small culverts, not regulated by NJDEP, that use Rational Method hydrologic calculations.

These design items are mostly limited to include gutter spread, inlet/scupper design, roadway drainage pipes, and roadside swales/ditches. All stormwater management and/or flood hazard area calculations that are regulated by NJDEP, DRCC, or NJ Pinelands Commission through a project-specific individual permit, project-specific general permit, the Authority's NJDEP Statewide Blanket Permit, or through the Authority's NJDEP Highway Agency Stormwater General Permit will continue to be regulated per the applicable review agency's regulations.

Contact your New Jersey Turnpike Authority Project Manager for instruction.

The revisions may be accessed on the Authority's webpage: https://www.njta.gov/business-hub/professional-services/document-change-announcements/

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NOTE: All text herein are REVISIONS, as indicated by the tracked changes, to the latest version of the Design Manual.

SECTION 5 – DRAINAGE DESIGN

5.4. HYDROLOGY

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5.4.2. Rational Method

The Rational Method consists of an empirical formula relating runoff to rainfall intensity. The Rational Method can only be used to compute estimated peak flow rates but cannot provide runoff volumes or hydrographs. It is expressed in the following form:

$$Q = C \times I \times Rf \times A$~~CIA~~$$

Where:

Q	=	peak flow in cubic feet per second, cfs
C	=	runoff coefficient (weighted)
I	=	rainfall intensity in inches (in) per hour
Rf	=	Resiliency Factor derived from NJAC 7:8 Table 5-6
A	=	drainage area in acres

1. Basic Assumptions
   a. The peak rate of runoff (Q) at any point is a direct function of the average rainfall intensity (I) for the Time of Concentration (Tc) to that point.

   b. The recurrence interval of the peak discharge is the same as the recurrence interval of the average rainfall intensity.

   c. The Time of Concentration is the time required for the runoff to become established and flow from the most distant point of the drainage area to the point of discharge.

The Rational Method is limited to small watersheds due to the assumption that rainfall is constant throughout the entire watershed. Severe storms, say of a 100-year return period, generally cover a very small area. Applying the high intensity corresponding to a 100-year storm to the entire watershed could produce greatly exaggerated flows, as only a fraction of the area may be experiencing such an intensity at any given time.

The variability of the runoff coefficient also favors the application of the rational method to small, developed watersheds. Although the coefficient is assumed to remain constant, it actually changes during a storm event. The greatest fluctuations take place on unpaved surfaces, as in rural settings. In addition, runoff coefficient values are much more difficult to determine and may not be as accurate for surfaces that are not smooth, uniform and impervious.

The Rational Method provides the most reliable results when applied to small, developed watersheds and particularly to roadway drainage design. The validity of each assumption should be verified for the site before proceeding.

2. Procedure

   a. Obtain the following information for each site:

      - Drainage area
      - Land use (% of impervious area such as pavement, sidewalks or roofs)
      - Soil types (highly permeable or impermeable soils)
      - Distance from the farthest point of the drainage area to the point of discharge
      - Difference in elevation from the farthest point of the drainage area to the point of discharge

   b. Determine the Time of Concentration (Tc). See Subsection **Error! Reference source not found.**.

   c. Determine the rainfall intensity rate (I) for the selected recurrence intervals.

   d. Select the appropriate C value.

   e. Calculate Rf for the selected recurrence intervals based on NJDEP Precipitation Adjustment Factors for the project area. Determine the factor using the NJDEP Stormwater Management Regulations (NJAC 7:8); Table 5-6. Rf = "Future Precipitation Change Factors."

   ~~e.~~f. Compute the design flow (Q = C × I × Rf × A~~CIA~~).

The runoff coefficient (C) accounts for the effects of infiltration, detention storage, evapo-transpiration, surface retention, flow routing and interception. The product of C and the average rainfall intensity (I) is the rainfall excess of runoff per acre.

The runoff coefficient should be weighted to reflect the different conditions that exist within a watershed

Example:

$$C_w = \frac{A_1C_1 + A_2C_2 \ldots A_NC_N}{A_1 + A_2 \ldots A_N}$$

NOTE: Calculations required for NJDEP stormwater management compliance must preclude the weighing of pervious and directly connected impervious surfaces unless the Tc values are identical. Refer to the NJDEP Stormwater Best Management Practices (BMP) Manual for additional guidance.

3. Value for C

Select the appropriate value for C from EXHIBIT 5-5:

EXHIBIT 5-1 RECOMMENDED COEFFICIENT OF RUNOFF VALUES FOR VARIOUS SELECTED LAND USES

Land Use	Description	Hydrologic Soils Group			
		A	B	C	D
Cultivated Land	without conservation treatment with conservation treatment	0.49 0.27	0.67 0.43	0.81 0.67	0.88 0.67
Pasture or Range Land Meadow	poor condition fair condition good condition	0.38 --- ---	0.63 0.25 ---	0.78 0.51 0.41	0.84 0.65 0.61
Wood or Forest Land	thin stand, poor cover, no mulch good cover	--- ---	0.34 ---	0.59 0.45	0.70 0.59
Land Use	Description	Hydrologic Soils Group			
Open Spaces, Lawns, Parks, Golf Courses, Cemeteries Good Condition Fair Condition	grass cover on 75% or more grass cover on 50% to 75%	--- ---	0.25 0.45	0.51 0.63	0.65 0.74
Commercial and Business Area	85% impervious	0.84	0.90	0.93	0.96
Industrial Districts	72% impervious	0.67	0.81	0.88	0.92
Residential Average Lot Size (acres) 1/8 1/4 1/3 1/2 1	 average % impervious 65 38 30 25 20	 0.59 0.29 --- --- ---	 0.76 0.55 0.49 0.45 0.41	 0.86 0.70 0.67 0.65 0.63	 0.90 0.80 0.78 0.76 0.74
Paved Areas	parking lots, roofs, driveways, etc.	0.99	0.99	0.99	0.99
Streets and Roads	paved with curbs & storm sewers gravel dirt	0.99 0.57 0.49	0.99 0.76 0.69	0.99 0.84 0.80	0.99 0.88 0.84

NOTE: Values are based on NRCS definitions and are average values.

Source: Technical Manual for Land Use Regulation Program, Bureau of Inland and Coastal Regulations, Flood Hazard Area Permits, NJDEP.

4. Determination of Rainfall Intensity Rate (I):
   Determine the Time of Concentration (Tc) in minutes for the drainage basin. Refer to Subsection **Error! Reference source not found.** for additional information.

   Determine the value for rainfall intensity for the selected recurrence interval with a duration equal to the Time of Concentration for the project location from NOAA's Precipitation Frequency (PF) Estimates available from NOAA's Precipitation Frequency Data Server at https://hdsc.nws.noaa.gov/hdsc/pfds/. Select the Precipitation Intensity Data Type and appropriate location using the interactive map. PF Estimates provide a table of precipitation intensities referenced to storm durations and recurrence intervals.

5. Determination of Resiliency Factor (Rf):
   Determine the value of the resiliency factor for the selected recurrence intervals using the methodology depicted in the NJDEP Stormwater Management Regulations (NJAC 7:8) Table 5-6 for the future conditions event(s). Interpolate the value of Rf for the appropriate design event, as necessary, from the available NJDEP values published in Table 5-6. Applying the resiliency factor to the rational flow calculations will incorporate future rainfall conditions into the design.

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