

Technical Memorandum

To: Electronic Distribution Recipients

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Subject: Use of Atlas 14 Volume 8 Precipitation Frequency Estimates

Expiration

This Technical Memorandum supersedes Technical Memorandum 15-10-B-02 and will expire November 23, 2025, unless superseded prior to this date or placed into the MnDOT Drainage manual.

Implementation

The guidelines contained in this Memorandum continue the implementation of Atlas 14 precipitation depths and intensities for trunk highway projects that use rainfall-runoff based design flows. Implementation of this Technical Memorandum is immediate.

Local road authorities are encouraged to adopt these or similar guidelines.

Introduction

In 2013, a Technical Memorandum was issued to address using the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 precipitation depths. In 2015, an updated Technical Memorandum was issued to update design guidelines when using Natural Resources Conservation Service (NRCS) hydrology methodology. This Technical Memorandum adds clarification on use of alternate NRCS unit hydrograph and time of concentration methodology, and provides updated references to NRCS documentation.

Purpose

This Technical Memorandum continues the use of the Atlas 14 derived precipitation depths, intensities, and design rainfall distributions. The Atlas 14 derived precipitation data replaces the design precipitation data in the Drainage Manual (2000). The time of concentration methods referred to in this Technical Memorandum supplement the Drainage Manual (2000) time of concentration methods and do not replace them.

Guidelines

Use Atlas 14 Precipitation Frequency Estimates when using rainfall-runoff models to compute hydrology for the design of hydraulic infrastructure. The Atlas 14 data is obtained from NOAA's Precipitation Frequency Data Server (PFDS) at <https://hdsc.nws.noaa.gov/hdsc/pfds/>.

Rational Method

Use the precipitation intensities from Atlas 14 for the project location to develop a project Intensity- Duration-Frequency (IDF) curve, or use the Atlas 14 regionalized IDF values developed by MnDOT with the Rational Method to calculate flow. Continue to use time of concentration methods in the MnDOT Drainage Manual (2000).

Standard NRCS Method

Use the Atlas 14 precipitation depth for the project location or the Minnesota NRCS Atlas 14 county average depth when the 24 hour precipitation depth is used. Use the standard NRCS dimensionless unit hydrograph with the peak rate factor of 484. Use the rainfall distribution derived from Atlas 14 data or use the NRCS MSE 3 rainfall distribution with the NRCS rainfall/runoff hydrology method to calculate flow. Do not use the NRCS Type II rainfall distribution. Continue to use the time of concentration methods in the MnDOT Drainage Manual.

Alternative NRCS Rural Watershed Method

Where the standard NRCS method gives flow rates that don't match observed conditions, the alternative NRCS Rural Watershed method can be considered. For some rural drainage areas that are not steep, the Minnesota NRCS MSE 3 MN (MSE 3 Rainfall Distribution and dimensionless unit hydrograph with peak rate factor of 400) methodology and Minnesota NRCS time of concentration methodology recommendations may be used to determine flow. Before using this alternative method, review and follow the NRCS documentation provided below. This alternative uses the same Atlas 14 precipitation depth data as the standard method.

Minnesota NRCS Time of Concentration Methodology

For rural drainage areas where the alternative NRCS rural watershed methodology is being evaluated, the time of concentration can be calculated using the Minnesota NRCS recommended methods.

The Minnesota Hydrology Flowchart provides guidance to determine the appropriate time of concentration method to use for the watershed.

- The Folmar & Miller (F&M) time of concentration equation is described in the Minnesota NRCS Engineering Field Handbook Chapter 2 supplement, Estimating Runoff and Peak Discharges.
- The Watershed Lag method, also referred to as the EFH-2 in the NRCS flowchart, is described in the Engineering Field Handbook Chapter 2 (EFH-2).

Guidance on the NRCS methodology is available from the Minnesota NRCS Office. Links to relevant NRCS publications:

NRCS Minnesota Hydrology Flowchart

https://www.nrcs.usda.gov/wps/PA_NRCSConsumption/download?cid=stelprdb1270339&ext=pdf

Minnesota NRCS Estimating Runoff and Peak Discharges supplement: Estimating Runoff and Peak Discharges

https://www.nrcs.usda.gov/wps/PA_NRCSConsumption/download?cid=stelprdb1270686&ext=pdf

NRCS Engineering Field Handbook Chapter 2. Only use as a reference for the time of concentration formula.

<https://directives.sc.egov.usda.gov/17541.wba>

Questions

Any questions regarding the technical provisions of this Technical Memorandum can be addressed to the following:

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Any questions regarding publication of this Technical Memorandum should be referred to the Design Standards Unit, DesignStandards.DOT@state.mn.us. A link to all active and historical Technical Memoranda can be found at <http://techmemos.dot.state.mn.us/techmemo.aspx>.

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