**TRANSPORTATION POOLED FUND PROGRAM**

**QUARTERLY PROGRESS REPORT**

Lead Agency (FHWA or State DOT): \_\_\_**FHWA**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**INSTRUCTIONS:**

*Project Managers and/or research project investigators should complete a quarterly progress report for each calendar quarter during which the projects are active. Please provide a project schedule status of the research activities tied to each task that is defined in the proposal; a percentage completion of each task; a concise discussion (2 or 3 sentences) of the current status, including accomplishments and problems encountered, if any. List all tasks, even if no work was done during this period.*

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| **Transportation Pooled Fund Program Project #**  TPF-5(475) | | **Transportation Pooled Fund Program - Report Period:**  □ Quarter 1 (January 1 – March 31)  □ Quarter 2 (April 1 – June 30)  □ Quarter 3 (July 1 – September 30)  X Quarter 4 (October 1 – December 31) | |
| **Project Title:**  Update Precipitation Frequency Estimates for Delaware, Maryland, North Carolina, Virginia, Pennsylvania, and South Carolina (NOAA Atlas 14, Vol. 13) | | | |
| **Name of Project Manager(s):**  Megan Frye | **Phone Number:**  (303) 396-9847 | | **E-Mail**  megan.frye@dot.gov |
| **Lead Agency Project ID:**  FHWA | **Other Project ID (i.e., contract #):** | | **Project Start Date:**  March 19, 2021 |
| **Original Project End Date:**  June 2024 | **Current Project End Date:**  December 2025 | | **Number of Extensions:** |

Project schedule status:

□ On schedule □ On revised schedule □ Ahead of schedule X Behind schedule

Overall Project Statistics:

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| **Total Project Budget** | **Total Cost to Date for Project** | **Percentage of Work**  **Completed to Date** |
| $1,802,000 | $433,870 | 24% |

***Quarterly*** Project Statistics:

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| **Total Project Expenses**  **and Percentage This Quarter** | **Total Amount of Funds**  **Expended This Quarter** | **Total Percentage of**  **Time Used to Date** |
| $54,600 / 3% | $54,600 | 55% |

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| **Project Description**:  The purpose of this project is to update precipitation frequency estimates for Delaware, Maryland, North Carolina, Virginia, Pennsylvania, and South Carolina published in NOAA Atlas 14 Volume 2. Like previous NOAA Atlas 14 volumes, the estimates and associated bounds of 90% confidence intervals will be provided at 30 arc-sec resolution for durations of 5-minute through 60-day at average recurrence intervals (ARIs) of 1-year through 1,000-year.  The study results will be published as NOAA Atlas 14 Volume 13, a wholly web-based publication available at Precipitation Frequency Data Server (PFDS). The publication will include the artifacts provided in previous NOAA Atlas 14 Volumes, including access through the PFDS, base grids in standard formats together with error estimates, electronic copies of maps, charts of seasonal distributions and probabilistic temporal distributions of heavy precipitation, and detailed documentation.  Updated areal reduction factors, which are needed to calculate analogous areal precipitation frequency estimates, will not be developed as a part of this project. |

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| **Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):**  NOAA continue to format and quality control the identified precipitation networks that are considered for the development of the Atlas 14 Volume 13 estimates. As with all NOAA Atlas 14 Volumes, the primary source of data is the NOAA’s National Centers for Environmental Information (NCEI). The NCEI is the most reliable data source network in the United States. The NCEI’s precipitation data alone may not be sufficient to support the objectives of NOAA Atlas 14. Since the NOAA Atlas 14 estimates are based on the statistical analysis of the historical record of the observed precipitation data, denser spatial coverage may be needed to compute the robust and reliable precipitation frequency estimates. Therefore, for each project area, NOAA also collect digitized data measured at 1-day or shorter reporting intervals from other Federal, State and local agencies.  NOAA also continue screening stations’ metadata for errors. A total of 117 station locations were manually checked, and 101 adjustments were made in this project area thus far.  This quarter, the AMS quality control task for the 1-day duration of all NCEI GHCN-DAILY data has been completed, and the AMS quality control task on all hourly durations for the NCEI COOP stations has been initiated.  Additional information on the status of the Atlas 14, Volume 13 work is available at:  https://www.weather.gov/owp/hdsc\_current\_projects |
| **Anticipated work next quarter**:  NOAA will continue with data collection, reformatting, and station metadata checks for NCEI stations. All collected data will be examined and formatted into a common format, where appropriate. In parallel, NOAA will continue to evaluate the spatial covariates for this project area.  The AMS quality control task on all hourly durations for the NCEI COOP stations is anticipated to be completed by the end of the next reporting period. |

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| **Significant Results:**  During this reporting period, NOAA’s focus remains on exploring spatial covariates within this project area. They are interested in identifying and incorporating spatial-varying covariates into the parameterization process, allowing parameters to vary in space at each grid point. For example, the spatial covariate, PRISM mean annual precipitation (MAP), can be incorporated into the parameter optimization process, allowing grid points to account for the effects of terrain.  NOAA has identified several different spatial covariates, including slope, latitude, effective terrain height, coastal proximity, PRISM MAP, elevation, etc. Using stepwise multiple regression, they are attempting to determine the most critical covariates in this project area based on mean squared error and R². Their continuing analysis has demonstrated the ability to consistently achieve favorable results in this project area, even when excluding PRISM MAP as a covariate. Consequently, they are continuing investigation in this direction. |
| **Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that**  **might affect the completion of the project within the time, scope and fiscal constraints set forth in the**  **agreement, along with recommended solutions to those problems).**  Delay in finalizing the IAA with NOAA. Estimated timeline to complete the work is late 2025 now.  Current schedule:   * **Data collection, formatting, and initial quality control [Revised to Q2 2024; In Progress]** * **Extraction of annual maximum series (AMS); additional quality control and data reliability tests (e.g., outliers, independence, consistency across durations, duplicate stations, candidates for merging)] [Q2 2024; In Progress]** * Regionalization and frequency analysis [Q3 2024] * Initial spatial interpolation of precipitation frequency (PF) estimates and consistency checks across durations [Q3 2024] * Peer review [Q4 2024] * Revision of PF estimates [Q3 2025] * Remaining tasks (e.g., development of precipitation frequency estimates for partial duration series, seasonality, temporal distributions, documentation) [Q4 2025] * Web publication [Q4 2025] |

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| **Potential Implementation:**  All deliverables will be accessible through the Precipitation Frequency Data Server (PFDS). That includes:   * Interactive map of the United States. Via this map, IDF/DDF tables and curves will be available for any location in the project area. * Precipitation frequency grids in GIS compatible formats. * Metadata in Federal Geographic Data Transfer Standard format. * Cartographic maps of precipitation frequency estimates. * Charts of the seasonal distribution of annual maxima * Probabilistic temporal distributions for 6-hour, 12-hour, 24-hour, and 96-hour durations in both chart and digital form * Rainfall frequency estimates with corresponding upper and lower bounds of 90% confidence intervals will be available at 30-arc sec grid for durations of 1, 2, 3, 6, 12 and 24 hours. |