



URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

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MEMORANDUM

FROM: Ken A. MacKenzie, PE, CFM
Manager, Master Planning Program

SUBJECT: UDFCD Position on the *NOAA Atlas 14 Precipitation-Frequency Atlas, Volume 8*

DATE: September 11, 2013

Since 1981, UDFCD has been using the 1973 *NOAA Atlas 2 Precipitation-Frequency Atlas of the Western United States (Volume III-Colorado)* as the hydrologic basis for all flood hazard area delineation studies and all watershed/drainageway planning studies, and in turn, as the basis for nearly all the drainage and flood control infrastructure constructed since that time. In mid-2013, the new 2013 *NOAA Atlas 14 Precipitation-Frequency Atlas of the United States, Volume 8-Midwestern States* was published. The data and analyses that serve as the basis of this new atlas were released to UDFCD for peer review in October 2012, and we undertook considerable effort to evaluate NOAA's work—particularly to determine if any changes as compared to the 1973 atlas were justified.

NOAA's new one-hour values are generally 5% to 15% lower than their 1973 counterparts for the 100-year return period; and 10% to 25% lower for the 2-year return period in our region. As part of our review we noted that in almost all cases the statistical 90% confidence intervals associated with the new estimates overlapped those same confidence intervals applied to the estimated values in the 1973 atlas. When the lower 90% confidence bound of one median value overlaps the upper 90% confidence bound of another median value, they are said to be "not statistically significantly different," meaning that neither value is more correct.

Nearly all the infrastructure built and floodplains delineated in the past 40 years within the UDFCD boundary are based on the 1973 precipitation values and from our forensic reviews of major flooding events and drainage infrastructure performance, our rainfall-runoff estimates are very reliable.

For these two reasons, the UDFCD position is that a change in precipitation values is not warranted at this time, nor is it in the best interests of the health, safety, and welfare of the citizens of the UDFCD region. For a copy of the full presentation on this subject from the UDFCD 2013 annual seminar, please go to:

http://www.udfcd.org/resources/pdf/conferences/conf2013/3_The_New_NOAA%20Atlas_Whats_Changed.pdf

UDFCD comment letters to NOAA are attached for reference.



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March 5, 2013

DELIVERED VIA EMAIL

Sanja Perica
National Weather Service
Office of Hydrology
1325 East-West Highway
Silver Spring, MD 20910

RE: Comments on draft NOAA Atlas 14, Volume 8 Version 1

Dear Sanja,

A meeting was held at the offices of the Urban Drainage and Flood Control District (UDFCD) in Denver, Colorado on February 25, 2013 which NOAA staff participated via a conference call link. At this meeting, we discussed the draft of the *NOAA Atlas 14: Precipitation-Frequency Atlas of the United States, Volume 8 Version 1: Midwestern States, Colorado*, (draft Atlas) prepared by your office. Also at this meeting we examined comparisons between the precipitation frequency estimates provided in the *1973 NOAA Atlas 2: Precipitation-Frequency Atlas of the Western United States, Volume III – Colorado* (1973 Atlas) to those shown in the new draft Atlas. We contracted with Wright Water Engineers, Inc. (WWE) to review the draft Atlas and to assist us with identifying and addressing issues that may affect UDFCD policies and procedures. WWE was also asked to provide recommendations to us on how we may go about evaluating and what changes may be incorporated from the new Atlas into our Urban Storm Drainage Criteria Manual (Manual), a document used by over 30 local governments in the Denver region.

Any changes made to point rainfall information by UDFCD in this Manual will affect the design of all stormwater management facilities within these local jurisdictions and the regulation of all future floodplain delineation and watershed master planning projects. After reviewing approximately 20 precipitation stations located within the UDFCD boundary, we found that the 2-year, 1-hour point precipitation depths in the new draft Atlas were 2% to 27% lower than were developed using the 1973 Atlas. The 100-year, 1-hour point precipitation depths in the new draft were from 4% higher to 24% lower than those obtained from the 1973 Atlas.

The precipitation depths for the “minor” (i.e., up to 5-year return period) storm events are used in the Denver region to size the “minor” storm management system, including storm sewers. Any changes in the official NOAA point rainfall depths could have a very significant effect on how these systems are sized in the future and the new information could result in facilities that provide less protection to the public. At the same time, using the new precipitation depths for the “major” (i.e., 50-, 100-, and 500-year) events that are used to delineate flood hazard zones and to manage FEMA-designated floodplains could result in less adequate safeguards against

flood damages. As a result, any significant changes to the point rainfall values have to be fully defensible for UDFCD to adopt the draft Atlas values. Having these considerations in mind, we offer the following comments:

1. After looking at published 90% confidence limits for point rainfall depths for NOAA Atlas studies for other states, we ask you to consider showing changes in the point rainfall information in the draft Atlas only if the 90% confidence intervals for the point rainfall depths from the 1973 Atlas and the draft Atlas do not overlap. We realize that the 1973 Atlas does not have documented confidence values; however we suggest that similar confidence percentiles found in the draft Atlas be assigned to them. If anything, because of the shorter data periods used to develop the 1973 Atlas, this approach would understate the range in confidence bands of the point rainfall depths presented in the 1973 Atlas and, if the 1973 Atlas and the draft Atlas 90% confidence values do not overlap, a shift in the reported values would be defensible for us when we deal with local jurisdiction as well as for NOAA. Otherwise, a shift in values may not be statistically defensible. If the point rainfall depths in the draft Atlas had been higher than the 1973 Atlas, we would have made this same recommendation.
2. We do understand that the results for the 90% confidence limits for Colorado, which we alluded to above, are currently being analyzed by your office and are provisional in nature. We do, however, respectfully request this provisional information be provided to us so that we can test our premise and report to you what we find. This may help you in your own evaluation of the information that will be published for our state and especially for our region.
3. Upon examination of the 1-hour rainfall data available from the National Climatic Data Center at the Denver Stapleton gage, we discovered that in 1995 the minimum reporting depth changed from 0.01 inch to 0.10 inch. We found that change in the data very significantly decrease individual storm event depths, durations and duration of dry periods between storms. As a result, we are wondering if this change in the reported minimum depth may also have an effect on the analysis that resulted in the point rainfall depths shown in the draft Atlas.
4. Another topic we identified is that the current study used ratios to convert 24-hour station data to shorter duration depths, such as a 1-hour depth, for filling in the gaps between stations where short duration data were available. Although we do not have your information on the ratios used in the draft Atlas, we are currently examining ALERT data collected throughout the UDFCD boundary. Some of these data go as far back as the 1980s. These ALERT data have a time stamp whenever a total of one millimeter of rainfall occurred and tipped the rain gage bucket. As a result, we can extract the maximum precipitation depths for any year for any time increment. We are currently working on determining the ratios between the 1-hour clock depths and the maximum depths recorded within 60 minutes (not hourly clock dependent), as well as the ratios between 24-hour

depths and the maximum 60 minute depths. We will provide you this information as soon as possible to determine if these local ratios differ from the ones used for the draft Atlas, but we do suspect that the semi-arid nature of Denver's meteorology may warrant the use of ratios that are different than those developed using Eastern or Midwestern precipitation data.

I appreciate the opportunity to provide comments to you. If you have any questions, please either call me (303-455-6277) or e-mail me (kmackenzie@udfcd.org). We are prepared to work with you and to help in any way we can.

Sincerely,



Ken A MacKenzie, PE, CFM
Master Planning Program Manager Manager, Master Planning Program



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March 21, 2013

DELIVERED VIA EMAIL

Sanja Perica
National Weather Service
Office of Hydrology
1325 East-West Highway
Silver Spring, MD 20910

Re: Additional Comments on draft NOAA Atlas 14, Volume 8 Version 1

Dear Sanja,

Per our comment letter sent to you on March 5, 2013, we were examining Urban Drainage and Flood Control District (UDFCD) ALERT data collected throughout the UDFCD boundary. These ALERT data have a time stamp whenever a total of one millimeter of rainfall occurred and tipped the rain gage bucket. As a result, we are able to extract the maximum precipitation depths for any year for any time increment and conducted an analysis to determine the difference between the 1-hour clock depths and the maximum depths recorded within 60 minutes (not hourly clock dependent).

Annual 1-hour maximum depths recorded from eleven different ALERT gages, all located within a two-mile radius of the NCDC reported gage site, were compared to the annual maximum hourly clock depths of the nearest NOAA precipitation gage. Table 1 (below) provides a summary of this comparison.

Table 1. Comparison of ALERT Gage Arithmetic Mean of Annual Maximum 1-hour Precipitation Depths (not hourly clock dependent) to NOAA Gage Arithmetic Mean of Annual Maximum Hourly Clock Precipitation Depths.

| ALERT Gage | NCDC Gage | Years of Coincident Gage Operation | ALERT Gage (inch) | NCDC Gage (inch) | Difference (%) |
|---|----------------------------|---|--------------------------|-------------------------|-----------------------|
| Justice Center (4360) | Boulder 2 (05-0843) | 22 | 0.70 | 0.61 | 14.1% |
| Heritage Square (1060) | Golden 3 S (05-3386) | 24 | 0.66 | 0.57 | 16.2% |
| Montview Park (400) | Denver-Stapleton (05-2220) | 23 | 0.97 | 0.94 | 3.3% |
| Lena @ US Hwy 6 (1040) | Golden 3 S (05-3386) | 24 | 0.72 | 0.57 | 26.6% |
| Urban Farm (1460) | Denver-Stapleton (05-2220) | 7 | 1.05 | 0.77 | 36.9% |
| Bear Creek below Cub (2230) | Evergreen (05-2790) | 17 | 0.62 | 0.61 | 2.7% |
| Bear Creek at Morrison (2330) | Morrison 1 SW (05-5765) | 17 | 0.76 | 0.61 | 25.9% |
| Idledale (2350) | Morrison 1 SW (05-5765) | 17 | 0.64 | 0.61 | 6.0% |
| Indian Hills (2360) | Morrison 1 SW (05-5765) | 17 | 0.56 | 0.61 | -7.7% |
| Red Rocks Park (2370) | Morrison 1 SW (05-5765) | 17 | 0.76 | 0.61 | 26.2% |
| East Plum Creek at Haskins Gulch (2820) | Castle Rock (05-1401) | 8 | 1.07 | 0.78 | 38.2% |

Based on the results of Table 1, in every case except for ALERT gage Indian Hills (2360), the NOAA hourly clock-dependent annual maximum depths underestimate the actual 1-hour intensity (not clock dependent) by approximately 3% to 38%. This analysis may, at least in part, explain why the draft NOAA Atlas 14 1-hour depths have decreased within the UDFCD boundary.

I appreciate the opportunity to provide these additional comments to you. If you have any questions, please either call me (303-455-6277) or e-mail me (kmackenzie@udfcd.org). We are prepared to work with you and help you in any way that we can.

Sincerely,



Ken A. MacKenzie, PE, CFM
Master Planning Program Manager

Postscript:

NOAA Atlas 14 Precipitation-Frequency Atlas of the United States, Volume 8-Midwestern States was published in mid-2013. NOAA responded to many of the comments in this letter and in my letter dated 3/5/2013. The responses to our comments can be found in the Atlas Appendix A.4, items 1.16, 2.6, 2.7, and 3.32. NOAA's responses did not, however, alleviate our concerns.

-Ken MacKenzie.