

**Hydrologic Frequency Analysis Work Group (HFAWG) Meeting**  
**May 7, 2015**  
**Michael Baker International, 3601 Eisenhower Ave., Alexandria, VA**

The Hydrologic Frequency Analysis Work Group (HFAWG) met at the office of Michael Baker International, 3601 Eisenhower Ave., Alexandria, Virginia on Thursday, May 7, 2015. The agenda for the meeting is given in **Attachment 1**. Twelve people attended the May 7 meeting in person and seven people attended by conference call and webex. The attendees at the May 7 meeting are given in **Attachment 2**.

**1. Plans For Bulletin 17C – Overview – Will Thomas**

Will Thomas gave a powerpoint presentation that briefly outlined the progress of the HFAWG since the last meeting in June 2013. He described the purpose of the current meeting was to:

- Provide an overview of the Bulletin 17C draft report dated April 20, 2015,
- Discuss any review comments from the HFAWG members,
- Discuss the new information in Bulletin 17C and what is similar to Bulletin 17B,
- Decide on the changes needed in Bulletin 17C before forwarding to the Subcommittee on Hydrology (SOH) for their review, and
- Vote, if necessary, to forward Bulletin 17C to the SOH.

Will also described the plans for Bulletin 17C after the May 7 meeting that included:

- Forward Bulletin 17C to the SOH in June (by the end of June as described later) for their review,
- Discuss Bulletin 17C at the July 23, 2015 meeting of the SOH and get their approval to forward to ACWI,
- Present an overview of Bulletin 17C to the ACWI at their planned August 2015 meeting and get their approval to hold a public comment period,
- The USGS Office of Water Information will post Bulletin 17C on a public web site for comment and announce the review period through the Federal Register (September 2015),
- HFAWG will revise Bulletin 17C based on public comments and inform SOH of the revisions,
- Obtain approval from SOH and ACWI for publication, and
- USGS will publish Bulletin 17C in their “Techniques and Methods” series.

The powerpoint presentation by Will Thomas will be posted on the HFAWG web site at <http://acwi.gov/hydrology/Frequency/>.

**2. Bulletin 17C Draft Document – John England**

John England gave a powerpoint presentation on the Bulletin 17C draft document that included the following major points:

- What is familiar with Bulletin 17B and what sections have essentially been retained,
- What is new in Bulletin 17C with respect to improvements in data and methods,
- What is new in Bulletin 17C with respect to improvements in content and presentation,
- What materials are no longer need in Bulletin 17C, and
- A general overview of the organization of the Bulletin 17C draft document.

There were discussion and comments throughout John’s presentation. His powerpoint presentation will be posted on the HFAWG web site at <http://acwi.gov/hydrology/Frequency/>.

John also handed out a Crosswalk document that listed sections in Bulletin 17C that were consistent with the existing sections in Bulletin 17B. The Crosswalk document is included in **Attachment 3** for easy reference and will be posted on the HFAWG web site as a separate document.

### **3. Flood Frequency Examples (Appendix 8) Demonstration – John England and Andrea Veilleux**

John England and Andrea Veilleux discussed two examples in Appendix 8 of Bulletin 17C – the Crest Stage Gage Example and the Historical and PILF Example – and demonstrated the USGS PeakFQ program Version 7 that implements the Bulletin 17C methodology.

Bear Creek at Ottumwa, IA was the crest state gage example where the base of the crest stage gage changed numerous times over the period of record. This means the lowest stage and associated discharge that could be measured in any year changed with time. Andrea illustrated how multiple low thresholds could be used in the Bulletin 17C frequency analysis.

Santa Cruz River near Lochiel, AZ was the Historical and PILF Example where two large floods that occurred in the systematic record (1949-2013) were known to be the largest since 1927. The historical information was used to establish a perception threshold for the missing period of record prior to 1949. Using the Multiple Grubbs-Beck test, eight PILFs (Potentially Influential Low Floods) were identified. John used this example to illustrate the use of perception thresholds for high and low floods.

### **4. HFAWG Review Comments on Bulletin 17C Draft Document – HFAWG members**

John England led a discussion of the Bulletin 17C draft document and several possible revisions were discussed. The discussions centered on the format of the document and how certain information should be presented. There was no discussion related to changing the methodology.

Many editorial suggestions were made but the following major revisions are noted:

- The first six paragraphs under “Applicability of These Guidelines” will be moved forward under “Purpose and Scope”. The six paragraphs describe what is new about Bulletin 17C and it was agreed this information should be at the beginning of the report.
- Equations 3-7 and the associated discussion for the new plotting positions beginning on page 18 will be put in an appendix to reduce the length of the main text and increase the readability.

- Equations 19-23 and the associated discussion under “Zeros and Identifying Potentially-Influential Low Floods” that begin on page 21 will be moved to Appendix 4 to reduce the length of the main text and increase the readability.
- Equations 29-37 and the associated discussion under “Expected Moments Algorithm” will be moved to Appendix 5 to reduce the length of the main text and increase the readability.
- Under “Record Extension with Nearby Sites”, the text starting with the fourth paragraph on page 25 will be moved to Appendix 6 to reduce the length of the main text and increase the readability.

As noted above, a major objective is to reduce the length of the main text and make it more comprehensible. The objective is to put most of the equations in an appendix to document the procedures. Interested readers can refer to the appendices for the details.

HFAWG members have until May 22 to provide any additional comments to John England. These comments will be made on the April 20, 2015 version of Bulletin 17C knowing that the changes noted above will be made. John England will develop a revised version of Bulletin 17C by June 23 and this version of Bulletin 17C will be provided to the Chair and Vice Chair of the SOH for distribution to all SOH members for their review.

#### **5. Discussion and Vote on Forwarding Bulletin 17C draft document to the SOH – HFAWG members**

The motion was to forward the proposed version of Bulletin 17C, to be revised by June 23, to the SOH for their review. This version would include all comments recorded at the May 7 meeting (some noted above) plus any additional comments from the HFAWG that are sent to John England by May 22.

The vote on the motion to forward the proposed version of Bulletin 17C to the SOH was:

Robert Mason, U.S. Geological Survey - Yes  
 Bill Merkel, Natural Resources Conservation Service – Yes  
 Sanja Perica, National Weather Service – Yes  
 Sam Lin, Federal Energy Regulatory Commission – Yes  
 Curt Jawdy, Tennessee Valley Authority – Yes  
 Joe Kanney, Nuclear Regulatory Commission – Yes  
 Zhida Song-James, Consulting Hydrologist – Yes  
 John England, Bureau of Reclamation – Yes  
 Jerry Stedinger, Cornell University – Yes  
 Beth Faber, U.S. Army Corps of Engineers – Yes  
 Martin Becker, BECKER – Yes  
 Jerry Coffey, Mathematical Statistician – No

Representatives and voting members from the Federal Emergency Management Agency and Federal Highway Administration were not able to attend the meeting.

So the final vote was 11-1 in favor of forwarding the proposed version of Bulletin 17C, that will be revised by June 23, 2015, to the Subcommittee on Hydrology for their review.

## 6. Outreach, Training, and Next Steps for Bulletin 17C and Future Work

Several presentations have taken place at conferences over the last few years describing the changes needed in Bulletin 17B and the changes to be included in Bulletin 17C. A listing of presentations and outreach at major conferences and meetings from 1995 to 2013 is included on John England's web site at <https://sites.google.com/a/alumni.colostate.edu/jengland/bulletin-17c#Refs>.

Flood frequency concepts that are included in Bulletin 17C (EMA, interval data, MGBT, and confidence intervals) are currently part of USGS Flood Frequency training classes and classes from other Federal agencies. In the future, webinars on Bulletin 17C will be developed to reach a wider audience.

Bulletin 17C supporting information that is now on John England's web site will be moved to the HFAWG web site as part of the Bulletin 17C public review phase. Frequently Asked Questions (FAQs) on the Bulletin 17C methodology (EMA, MGBT, interval data, etc.) that are currently on the HFAWG web site ([http://acwi.gov/hydrology/Frequency/b17\\_swfaq/EMAFQAQ.html](http://acwi.gov/hydrology/Frequency/b17_swfaq/EMAFQAQ.html)) will be expanded in the future. The powerpoint presentations by Will Thomas and John England, the Crosswalk document, and a document describing the differences in Bulletin 17C and Bulletin 17B will also be posted on the HFAWG web site.

All HFAWG members who have not provided review comments on Bulletin 17C should do so by May 22, 2015. Additional comments can be provided in the future during the SOH review period and the public comment period. The plans for obtaining approval to publish Bulletin 17C from the SOH and ACWI (as identified in #1 above) will be pursued.

Will Thomas  
Michael Baker International  
Chair of the HFAWG  
May 14, 2015 – Revised May 18, 2015

**Attachment 1. Agenda for the May 7, 2015 meeting**

**Subcommittee on Hydrology of the Advisory Committee on Water  
Information  
Hydrologic Frequency Analysis Work Group (HFAWG) Meeting**

May 7, 2015  
Michael Baker International, 3601 Eisenhower Ave., Alexandria, VA

**Detailed Agenda**

Meeting Activities:

1. Discuss the draft Bulletin 17C:
  - a. report (main text);
  - b. appendices – data analysis, MOVE, flood frequency examples;
  - c. software (PeakFQ and peakfqSA).
2. Vote on a motion to approve draft Bulletin 17C and submit to SOH.
3. Outreach, Training, and Next Steps.

<i>Time</i>	<i>Topic, Presentation and Relevant Documents</i>	<i>Presenters/ Discussion Leads</i>
10:00 am - 10:15 am	Introductions, Member Agencies, Call to Order, Voting Procedures, Motion to Approve Agenda	Will Thomas, HFAWG Chair
10:15 am - 10:45 am	Plans for Bulletin 17C - Overview (document, supporting materials, software, outreach, future review) <ul style="list-style-type: none"> <li>• <i>Presentation</i> – Will Thomas</li> </ul>	Will Thomas, HFAWG Chair
10:45 am – 11:45 am	Bulletin 17C Draft document <ul style="list-style-type: none"> <li>• <i>Presentation of document and appendices (slides)</i> – John England</li> </ul>	John England, Tim Cohn, Beth Faber
11:45 am – 12:45 pm	Flood Frequency Examples (Appendix 8) Demonstration <ul style="list-style-type: none"> <li>• <i>Examples files from website (sent via email)</i></li> </ul> <i>Working Lunch (provided)</i>	John England, Andrea Veilleux
12:45 pm – 2:30 pm	HFAWG Review Comments on Bulletin 17C Draft document <ul style="list-style-type: none"> <li>• <i>Discussion comments and potential responses</i></li> </ul>	Group Discussion
2:30 pm- 3:00 pm	Discussion and Vote on forwarding Bulletin 17C Draft document to SOH	HFAWG Members
3:00 pm – 4:00 pm	Outreach, Training, and Next Steps for Bulletin 17C and future work	Will Thomas, HFAWG

**Attachment 2. Attendees at the May 7, 2015 meeting**

<b>Name</b>	<b>Company/Agency</b>	<b>Telephone</b>
Robert Mason	USGS	703-648-5305
John England	USBR	303-445-2541
Tim Cohn	USGS	703-395-0204
Will Thomas	Michael Baker International	703-334-4935
Zhida Song-James	Consulting Hydrologist	
Beth Faber	HEC-USACE	530-756-1104 x335
Julie Kiang	USGS	
Joe Kanney	NRC	
Jery Stedinger	Cornell University	607-257-8016
Sanja Perica	NWS/OHD	301-713-1669
William Merkel	NRCS	301-504-3936
Sam Lin	FERC	202-502-6015
<b>By phone/webex</b>		
Curt Jawdy	TVA	
Mike Anderson	CA/DWR	
Mark Bandurraga	Ventura County	
Martin Becker	BECKER	
Andrea Vellieux	USGS	
Jerry Coffey	Mathematical Statistician	
John Onderdonk	FERC	

## Attachment 3. Crosswalk comparing sections in Bulletin 17C with sections in Bulletin 17B (developed by John England)

### Bulletin 17C Draft Crosswalk with Bulletin 17B Hydrologic Frequency Analysis Work Group, Subcommittee on Hydrology based on Bulletin 17C draft report dated April 20, 2015

May 11, 2015

Bulletin 17C Section	Bulletin 17B
<b>Abstract</b>	
<b>Introduction</b>	<b>I. Introduction</b>
Background	
Purpose and Scope	
Risk Accumulates	VI. Reliability Application; Appendix 10. Risk
Acknowledgments	
<b>Flood Flow Frequency Information</b>	<b>III. Information to be Evaluated</b>
Use of Annual Maximum Series	V. A. Series Selection
Data Sources for a Site	
Systematic Records	III. A. Systematic Records
Historical Flood Information	III. B. Historic Data; Appendix 6
Paleoflood and Botanical Information	
Common Issues with At-Site Data Records	
Broken, Incomplete and Discontinued Records	V. B. 5. Broken Record; V. B. 6. Incomplete Record
Zero Flows and Potentially-Influential Low Floods	V. B. 7. Zero Flood Years; Appendix 5
Data Representation using Intervals and Thresholds	
Regional Information and Nearby Sites	III C. Comparisons with Similar Watersheds
Flood Estimates from Precipitation	III. D. Flood Estimates from Precipitation
<b>Data Assumptions and Specific Concerns</b>	<b>IV. Data Assumptions</b>
Flow Measurement Error	IV. E. Reliability of Flow Estimates
Randomness of Events	IV. B. Randomness of Events
Mixed Populations	IV. D. Mixed Populations
Watershed Changes	IV. C. Watershed Changes
Climate Variability and Change	IV. A. Climatic Trends
<b>Determination of the Flood Flow Frequency Curve</b>	<b>V. Determination of the Flood Flow Frequency Curve</b>
Plotting Positions	VIII. B. Plotting Positions
Flood Distribution	V. B. 1. The Distribution
Parameter Estimation: Simple Case	V. B. 2. Fitting the Distribution
Moments and Parameters	
Weighting the Skew Coefficient	V. B. 4. Weighting the Skew Coefficient
Zeros and Identifying Potentially-Influential Low Floods	
Expected Moments Algorithm	
Record Extension with Nearby Sites	
Confidence Intervals for Quantiles	VI. A. Confidence Limits
<b>Estimating Regional Skew</b>	V. B. 3. Estimating Generalized Skew
<b>Comparisons of Frequency Curves</b>	
Comparisons with Similar Watersheds	V. C. 1. Comparisons with Similar Watersheds
Comparisons with Flood Estimates from Precipitation	V. C. 2. Flood Estimates from Precipitation
Weighting of Independent Frequency Estimates	V. C. 1. Comparisons with Similar Watersheds
<b>Software and Examples</b>	Appendix 13 Software; Appendix 12 Examples
<b>Future Studies</b>	VIII. C. Future Studies
Ungaged Sites	
Regulated Flow Frequency	
Urbanization	
<b>Applicability of These Guidelines</b>	
<b>References</b>	<b>Appendix 1 References</b>
<b>Appendix 1—Subcommittee and Work Group Members</b>	Hydrology Subcommittee (after Foreword)
<b>Appendix 2—Data Sources</b>	
<b>Appendix 3—Initial Data Analysis</b>	
<b>Appendix 4—Potentially-Influential Low Floods (PILFs)</b>	<b>Appendix 5 Conditional Probability Adjustment (CPA)</b>
<b>Appendix 5—Expected Moments Algorithm (EMA)</b>	Appendix 5 CPA; Appendix 6 Historic Data; Appendix 9 Conf. Limits
<b>Appendix 6—Record Extension with Nearby Sites</b>	<b>Appendix 7 Two-Station Comparison</b>
<b>Appendix 7—Weighting of Independent Estimates</b>	Appendix 8 Weighting of Independent Estimates
<b>Appendix 8—Examples</b>	Appendix 12 Flow Diagram and Examples
<b>Glossary</b>	Appendix 2 Glossary and Notation