

**SUMMARY OF THE MEETING OF THE
ADVISORY COMMITTEE ON WATER INFORMATION'S (ACWI)
SUBCOMMITTEE ON HYDROLOGY (SOH)
12:30 pm – 3:30 pm, Eastern Daylight Savings Time
October 18, 2018**

1. Welcome and roll call

Chair Siamak Esfandiary, FEMA welcomed everyone to the SOH meeting. The meeting began with a roll call, included as Attachment 1. Fifteen SOH members were present at the start of the call, which is a quorum of 22 members, with a sixteenth member joining later.

Members that were not represented at the meeting include USDA-NRCS, TVA, USDA-ARS, GEC, OSMRE, and NSF.

2. Approval of the draft agenda

Tom Nicholson, U.S. NRC motioned to approve the agenda and Victor Hom, NOAA/NWS seconded the motion. There were no objections and the motion passed.

3. Approval of the July 19, 2018 meeting summary

Brian Beucler, FHWA motioned to approve the July 19, 2018 SOH meeting minutes and Siamak seconded the motion. There were no objections and the motion passed.

4. Status of Action Items from July 19, 2018 Meeting

ESEWG Proposal

Regarding the Extreme Storm Events Work Group's (ESEWG) Extreme Rainfall Product Needs proposal which was the topic of the ESEWG/SOH briefing meeting on August 20, 2018, meeting minutes were circulated to the SOH members and posted on the SOH/ESEWG Website (<https://acwi.gov/hydrology/extreme-storm/>). A vote on the ESEWG Proposal is on the agenda under "New Business".

Tom Nicholson, Chair of ESEWG asked the SOH Chair if the Proposal could be discussed now as he wanted to hear from James Demby, FEMA's National Dam Safety Program Director who had limited time to address the Proposal's recommendation to develop a national guidance document for review of State-wide/regional and site specific Probable Maximum Precipitation (PMP) studies.

James said that he had been following the development of this project. Colorado and New Mexico are providing guidance. They are looking at adopting it as a federal guideline to review other PMP studies. He supports the Proposal's recommendation.

Tom summarized the key points from the August 20th meeting. NOAA Atlas 14 needs to be completed, and Dr. Sanja Perica, NOAA/NWS provided an update. The USACE has developed an extreme precipitation database related to significant floods and discussed its completion and possible archiving of data at the NCEI. John Onderdonk, FERC and Mark Perry, State of Colorado spoke on updating HMRs. The states have gone and are continuing to go to the private sector for updated probable maximum precipitation (PMP) estimates, so the Proposal is recommending publication of a national guidelines

document for technically reviewing such studies. Also the Proposal recommends the federal government reconstitute a program for updating and maintaining PMP on a national level."

Victor Hom asked if the final version of the Proposal is on the SOH/ESEWG website? Tom said yes.

Victor said there are comments from NOAA leadership. Overall it is a great report, NOAA provided comments and appreciates the work. The NWS is 100 percent behind this effort.

Martin Becker asked if there were a number of comments at the meeting. Tom responded that the minutes have the comments included. It was a public meeting. All comments from all people were posted in the meeting minutes which are posted on the SOH/ESEWG Website.

Tom indicated that the ESEWG unanimously approved the Proposal and recommended that it be sent to SOH for their review and approval. Tom would like to move the Proposal forward to ACWI.

Victor asked if all member organizations have read the Proposal. Victor motioned that we take a poll of the member organizations present at the meeting to ask if they have reviewed it. Siamak seconded the motion. The member organizations were polled, and ten out of the 16 organizations present had reviewed the proposal.

Martin would like to take a closer look at the comments.

Victor made a motion for two more weeks for those organizations to review the Proposal and then conduct an electronic vote. Candice Hopkins, USGS coordinator for SOH and ACWI, mentioned that there are no ACWI meetings scheduled right now since ACWI is being reconstituted.

Siamak asked all member organizations to please review the Proposal in the next month.

Regarding state representatives, Melissa Collard, State of California, said she would like the opportunity to review it. She used to call in to SOH meetings but stopped getting meeting requests. Mark Perry, State of Colorado is a co-author of the Proposal and has been involved in the effort.

Siamak said that one month should be sufficient for everyone to review the Proposal. The SOH will follow up with an e-mail and request for votes in about one month to accept the Proposal and send it to ACWI.

Victor asked what were the plans going forward with this report. Tom commented that the plans were to engage FEMA and the national dam safety program to move forward with the recommendation to develop a national guidance document to review PMP studies.

James will take it up with the National Dam Safety Review Board (NDSRB) (see: <https://www.fema.gov/national-dam-safety-review-board>). Tom said NDSRB should consider putting together a panel with the USACE and the States to begin work on the national guidance document. Karen Metchis mentioned that there is a meeting of the Federal Committee on Water Availability today, and it was mentioned that ACWI may be considering such a report.

Martin did not see comments included in the documents. Tom said the comments are worked into the August 20th meeting minutes.

Martin appreciates the need for information. Tom noted that this a Proposal, not a final product of technical procedures. The subcommittee needs to get the Proposal to ACWI and have ACWI discuss it.

Siamak said there is a major need in this arena.

Data gaps group

Dalia Kirschbaum reported that this is on hold. The goal is to reform it to where it makes more sense for the general group. She will take an action item to discuss it with Sujay.

Low flow proposal

Mark Landers provided the update. The revised low flow proposal was circulated; it is included as Attachment 3. It was modified to highlight that the group will be reaching out to people in this process. Another change is that Julie Kiang will serve as vice chair and Will Thomas will serve as chair. Robert Mason has asked that the SOH make a motion to approve the proposal even though there is not an ACWI meeting scheduled.

Candice Hopkins said that right now the SOH cannot form any new workgroups as ACWI is not officially active. However, the SOH can bring the proposal forward to ACWI for when they meet again. So, the SOH can agree to move it up to ACWI but cannot start any work on it.

Mark is asking that SOH move to advance the proposal to ACWI. Siamak asked how many have read the proposal.

Martin said that ACWI may make requests that would require additions and subtractions to this proposal. He suggests postponing a vote until ACWI is empowered again.

Will said that the white paper was presented back in April. Everyone should review it by the next meeting.

Martin agrees it should be reviewed.

Candice thinks it is fine that once ACWI resumes we approach them with a list of proposals.

Victor said the entire group should take an action item to review with the next two weeks or one month.

Victor put a motion on the floor for a one-month review of the two-page document and to send all responses back to Will Thomas and Julie Kiang. Will seconded the motion. There were no objections.

The agenda was altered at this point in order to have the feature presentation at the scheduled time. The last two items under "status of action items" were discussed after the presentation.

5. Feature presentation

Roger Kilgore of KCM presented "Adapting Global Climate Model Precipitation Projections to Hydrologic Design."

This effort was conducted by collaborative teams of climate scientists, hydrologists, and engineers such as Will Thomas and others. The objective is to develop a design guide that can be applied nationally to provide the tools needed to amend transportation design practices to account for climate change.

The basic questions for this study are:

- 1) Which projected datasets for precipitation and temperature should be used?

- 2) What is an actionable approach?
- 3) What is an actionable approach for estimating projected sub-daily precipitation?

The study did address identifying and projecting trends, regression equations for estimating future discharges, temperature and precipitation for continuous simulation modeling and coastal issues/sea level rise.

For question one, the study concluded that it should focus on Group 1 General Circulation Models (GCMs), which are third to fifth generation models, long-established from climate modeling groups with decades of experience. There are issues with downscaling. A comparison of five high-resolution datasets was performed with different scenarios, time frequencies and spatial resolutions.

For question two, the approach should focus on estimating extremes. Engineers are interested in distribution tails. However, the models have biases, and there are concerns about generating 100-year events from these models.

There are several possible solutions to this problem. One solution is to wait for better datasets, but we are spending money on infrastructure now. A second solution is to wait for programmatic tools. The third solution, which is the proposed solution, is to estimate a moderately extreme event, such as the 10-year event, and assume a stationary rainfall frequency curve to compute greater extremes.

The recommended procedure is to use the lower and higher scenarios, using multiple GCM indexes to the 10-year event to estimate the more extreme, 100-year event. The procedures assume the 100-yr to 10-year ratio is stationary. This index approach is used as the extremes are very sensitive and high-resolution datasets are limited.

The third question is how to estimate sub-daily precipitation. Possible solutions are to wait for better data or to estimate the sub-daily precipitation assuming stationary relations to the 24-hour estimate. These stationary relationships would be updated and tied to NOAA updates of the precipitation frequency studies. Bottomline, there is a choice of doing something reasonable or nothing at all.

For a particular project, there are several levels of analysis; not all projects require the same attention. Projects may use:

- Historical discharges (for low risk projects)
- Historical discharges with confidence limits
- Historical discharges/confidence limits with precipitation projections
- Projected discharges
- Projected discharges with expanded evaluation (highest risk)

In summary, the objective is to recommend practical methods.

- Use high-resolution climate datasets for two scenarios: Representative Concentration Pathways (RCP) 4.5 and 8.5 from the Localized Constructed Analogs (LOCA) dataset
- Estimate moderately extreme 24-hour, 10-year events from high-resolution climate datasets and assume stationarity in the relationship with more extreme events
- Estimate sub-daily precipitation from 24-hour values and assume stationarity in sub-daily relations

- Use more complex methods for higher levels of risk

Siamak thanked Roger for the presentation.

LySanias Broyles asked if the team has had to change any language when communicating this work, in certain contexts? Roger said that there are political constraints in some areas. They often talk about resilience and extreme events rather than climate change.

LySanias asked how well can you communicate when using alternative language? Roger said that engineers are used to dealing with changes, so it is put in that context. Sometimes it is awkward, but the message still gets through.

Karen Metchis asked if this information is available as a paper. Some of this work relies upon relationships derived from NOAA Atlas 14. There was just recently a presentation from Sanja Perica at NOAA about the statistical error. Roger answered that the projections are not tied to NOAA Atlas 14. Indexing may use Atlas 14. Regarding the paper, these are the last months of a three-year project. The final report and a design guide are in review. These will be available through the Transportation Research Board (TRB). Brian Beucler said that there is a TRB panel meeting on October 30 that will be discussing this report. AASHTO will look at this and may revise their drainage manual, and state DOTs may modify their own drainage manuals in response.

Brian asked for the opinion of the hydrologists in the room if either of the two stationarity assumptions are major problems.

Siamak asked that instead of pushing design guides, why as a profession do we not switch to stochastic modeling? Is the issue that this is political and, in some projects, might be costly?

Victor said that there is a top down approach and a bottom up approach. Roger does have those concepts in the report.

Roger said that with the bottom up approach, they are approaching infrastructure from a vulnerability standpoint. It will be part of the recommendations.

Siamak said that generally if the industry moves toward a stochastic approach rather than a design frequency approach it will avoid this.

Will said that they use an average of an ensemble of models. There are fifteen to eighteen models in this category. The uncertainty comes in with the variability of the different models.

Siamak said that we could just design at 95% confidence level.

Siamak asked if you would use this for a project that has a life span of 50 years. Would this method still be used? Roger said that the recommended confidence limits are time-based. Whether to account for climate for a project with a lifespan of 50 years depends on the risks of that project.

Siamak asked if the SOH can get a copy of the presentation. Roger said probably yes. He asked Brian (FHWA) if the SOH can have a copy of the paper. Brian said no, they (TRB/FHWA) are not allowed to release at this time.

Siamak said that this is the first document the SOH has seen that deals with actionable items for the future conditions.

Will said that the report could avoid using the word stationarity; there are ways to use different words to describe the same thing.

Siamak said that if we get a presentation from Roger, we will it post online.

At this point, the group took a short break. When the meeting resumed, the group returned to where it left off with the status of action items.

6. Status of action items (part II)

E-mail lists and roster

Candice Hopkins has set up the list serve. Laura Chap noted that some of the emails have been caught in spam filters during a test, so we will need a transition period where we use both regular email and the list serve.

Private members

Siamak reiterated that Dewberry, a private organization, is now a voting member of SOH. He asked if there are any further concerns or interpretations of the terms of reference for membership in SOH? We will keep a record of the discussion of this for future reference.

Candice is concerned that it does not look procedurally correct, since the vote should have not happened given the terms of reference. If the SOH wants to revisit how to determine membership, they would have to bring the question to ACWI and have it provide approved procedures. The group should make sure they are following the terms of reference. The minutes should reflect membership issues not opinions from multiple people.

Martin suggested that the minutes have an asterisk indicating that there is clarification in the next meeting's minutes.

7. New Business

ESEWG proposal

This was already discussed under agenda item four, status of action items.

In four weeks, the SOH will solicit ask for a vote by email. There will also be a vote on the low flow work group at the same time.

8. Work group reports

HFAWG

Will Thomas submitted a written report for the minutes, included as Attachment 4. Bulletin 17C was published, and since then the co-authors have been presenting workshops. They recently gave a workshop at the FHWA conference in Columbus, OH. There is a three-hour workshop planned for at TRB annual conference scheduled in January 2019.

Siamak asked if HFAWG will sunset. Will said 17C is finished. There were three objectives in the charge: Frequently Asked Questions on 17B (done); paper on ungaged watersheds (done), and paper on analysis

for gaged watersheds where upstream flows are regulated by dams (not done and no plans to complete). HFAWG is inactive except for workshops.

Siamak asked if this workgroup can sunset.

Victor said that there is the possibility of expanding the workgroup. He asked Candice could work move forward if the low flow group is folded into the existing HFAWG workgroup.

Candice said that the entire subcommittee is not supposed to work on anything unless ACWI has specifically told them to work on it.

Will said that the low flow guidance will be a new task. Candice said no, the group can't start a new task.

Siamak said it is in the Terms of Reference. Will said that low flow would be within the ACWI scope.

Candice said the intention is to get ACWI back on track to provide advice to DOI. The committee needs to make sure all tasks are providing advice to DOI. A lot of scrutiny is on ACWI regarding what ACWI is doing and producing. It needs to be documented that ACWI asked a group to do a task that will result in providing advice to the DOI. A more transparent process is needed. This effort is to make sure ACWI is doing what it is charged to do and is using its meeting time for this purpose. For low flow, Candice advises that the SOH wait on the low flow group and present it to ACWI.

Siamak thought there were internal discussions between the USGS and ACWI.

Siamak asked if Will wanted to terminate HFAWG as the chair? Will said he wants to take on low flow within HFAWG as a new task. He would still like to move the low flow proposal forward so when ACWI is ready, we will be ready.

Candice thinks it will be several months before ACWI meets.

ESEWG

Tom said that the Extreme Rainfall Product Needs Proposal was completed and discussed with SOH members at the August 20th meeting, and again today. In addition, last spring an ESEWG meeting was proposed to focus on QA/QC of rainfall data but was postponed until the Proposal was completed and approved and sent on to SOH. This postponed meeting topic, QA/QC of rainfall data will be discussed at their next meeting.

STIWG

LySanias provided the report. The GOES-17 spacecraft was launched this year to replace the GOES East. They will have to reposition dishes.

LySanias was in Amsterdam last week at the SATCOM forum on issue of hydrometeorological data and preservation of the spectrum. They are hoping to continue working to preserve the spectrum. They want to continue to utilize all of their current capabilities.

Siamak asked if LySanias is willing to do short presentation for group. It could be a 15-20-minute presentation at the next meeting, or possibly a feature presentation.

Streamflow information collaborative

Mark provided the report for Mike Woodside. The group has had several webinar presentations on portals. The November presentation was about the USGS response to Hurricane Florence. Mike has been acting director for the USGS groundwater and streamflow information program. The new director is Chad Wagner.

The question was raised as to whether this work is in response to an existing request, as it is extremely strategic for DOI. Siamak believes this was requested by ACWI, but the group can get clarification from Robert.

Candice said that the streamflow information collaborative will likely fall under the USGS charter on the internet of water. A lot of products might move over to the acwi.gov URL.

The ACWI minutes were checked, and streamflow information group had been presented to and was approved by ACWI.

Data gaps

Dalia provided the report. She said this is reforming a remote-sensing focused group. They need to look at what would be the interest of the group. Siamak said for this particular work group, the SOH was not asked to form it. The SOH will need to talk to ACWI and see if there is a need to pursue.

HMWG

No one was available to provide a report.

9. Member business reports

In the interests of time, these are not discussed at the meeting but are included in the minutes. The NOAA business report is included in Attachment 5.

10. Review of action items for next meeting

- Votes on the low flow group and ESEWG proposal will be solicited by email in approximately one month
- Siamak will discuss a presentation from STIWG by LySanias
- The next meeting will be January 17, host to be determined.
- Dalia will revisit the data gaps group proposal that was already put together and may recirculate with the group as appropriate

11. Adjourn

Victor motioned to adjourn the meeting, Siamak seconded the motion.

Attachment 1. Roll call and represented member organizations

Roll Call

Name	Agency/Group	On phone/in person
Ben Pratt*	NHWC	On phone
Brian Beucler*	FHWA	In person
Chandra Pathak*	USACE	On person
Karen Metchis	USEPA	On phone
David Raff*	USBR	On phone
Martin Becker*	BECKER	On phone
Paul (Doug) Curtis*	BLM	On phone
Mark Landers	USGS	On phone
John Onderdonk	FERC	On phone
Siamak Esfandiary*	FEMA	In person
Steven Yochum*	USFS	On phone
Dalia Kirschbaum*	NASA	On phone
Thomas Nicholson*	U.S. NRC	On phone
Victor Hom*	NWS	In person
Will Thomas*	ASFPM	On phone
Jason Giovannettone*	Dewberry	In person
Joe Kanney	NRC	On phone
Elena Yegorova	NRC	On phone
Meredith Carr	NRC	On phone
James Demby	FEMA	On phone
Candice Hopkins	ACWI	On phone
Victoria Bahls	MetStat	On phone
Gwen Chen	NWS	On phone
Melissa Collard	CaDWR Dam Safety	On phone
Mark Perry	Colorado Dam Safety	On phone
Bill McCormick	Colorado Dam Safety	On phone
Maryanne Baker	NWS	On phone
Laura Chap	STARR II	In person
Kornel Kerenyi	FHWA	In person
Chao Huang	FHWA	In person

*Indicates designated SOH representative or alternate

Member Organizations Present

ASFPM	Yes
USBR	Yes
BECKER	Yes
FEMA	Yes
FERC	Yes
NSF	No
FHWA	Yes
GEC	No

NASA	Yes
NHWC	Yes
USDA - NRCS	No
NWS	Yes
USACE	Yes
USDA - ARS	No
USDA - USFS	Yes
DOI - BLM	Yes
DOI - OSMRE	No
DOI - USGS	Yes
EPA	Yes
NRC	Yes
TVA	No
Dewberry	Yes

Attachment 2. Agenda

**MEETING OF THE
ADVISORY COMMITTEE ON WATER INFORMATION'S (ACWI)
SUBCOMMITTEE ON HYDROLOGY (SOH)
12:30 p.m. – 3:30 pm, Eastern Time
Thursday, October 18, 2018**

Location: In-person meeting at Turner-Fairbank Highway Research Center - 6300
Georgetown Pike, McLean VA 22101

Problems? Ashley Roby, Office: (240) 616-3746; Siamak Esfandiary, cell: (202) 701-3606

Meeting Instructions and Resources:

In the interest of time, we will be using the doodle poll to do our roll-call and provide a guest list for security. Please register before COB on October 16 at

<https://doodle.com/poll/nntvs33mza5x4434>

[There will be an optional lab tour from 11 am – noon. Please bring a bag lunch if planning to attend the lab tour as there is no lunch available on site.](#)

Call-in and meeting link:

JOIN WEBEX MEETING

<https://doilearn2.webex.com/doilearn2/j.php?MTID=m506b933e5556e01e451acf78c6cf951a>

Meeting number (access code): 903 094 577 Meeting password: hydrology

JOIN BY PHONE

+1-415-527-5035 US Toll

Can't join the meeting?

<https://collaborationhelp.cisco.com/article/WBX000029055>

Agenda

- | | |
|---|--------------------------|
| 1. Welcome (5 mins) | Siamak Esfandiary |
| 2. Roll Call (5 mins) | Laura Chap |
| • SOH member organizations | |
| • Other attendees and guests (via doodle poll) | |
| 3. Approval of the Draft Agenda | Siamak Esfandiary |
| 4. Approval of the July 19, 2018 Meeting Summary (5 mins) | Laura Chap |
| 5. Status of Action Items from July 19, 2018 Meeting (10 mins) | Laura Chap |
| • ESEWG proposal - August 20 th meeting was held, summary circulated | |

- Data gaps group - Dalia Kirschbaum to provide update
- Low flow group – Mark Landers to provide update
- Private members –Siamak Esfandiary to provide wrap-up of this issue
- Email lists and roster – Candice Hopkins has set up a list serve, an initial test showed that it was caught in spam filters, so we will need a transition period.

6. Featured presentation (1 – 2 pm) “Applying Climate Change Information to Hydrologic and Hydraulic Design of Transportation Infrastructure”

Roger Kilgore, KCM

7. Break (10 min)

8. New Business/Announcements (45 mins)

Siamak Esfandiary

- Vote on ESEWG proposal

9. SOH Workgroups (30 mins)

Siamak Esfandiary

- [HFAWG](#)
- *ESEWG*
- [STIWG](#)
- *Streamflow Info Consortium*
- *Data Gaps*
- [HMWG](#)

Will Thomas
Tom Nicholson
LySanias Broyles
Mark Landers
Dalia Kirschbaum
Claudia Hoeft

10. Review Actions and Plans for next SOH meeting (5 mins)

Siamak Esfandiary

11. Next Meeting

All

11. Meeting Adjourn (Around 3:30 pm)

Subcommittee on Hydrology Work Group Proposal

Low Flow Analysis – Literature review and Inventory of methods

(Revision – final version will remove highlighting.)

7/16/2018

- **Problem Statement:** *Please describe in detail the need this work group will address. Provide a clear description of the problem, its scale, and why it is important to federal government. Please do not include the solution.*

Low flow frequency analysis is commonly used for water resources planning, design, management and regulation (permit writing), yet methods have not been updated for decades, and uniform guidelines do not exist as they do for flood frequency analysis. A number of advances made for flood frequency analysis have not been tested for low flow frequency. There is currently no process for efficiently identifying or evaluating methodological improvements, yet federal consensus on what updates are needed to ensure consistency in the future.

- **Objective and Approach:** *Please describe the solution in detail and how it will be achieved.*

We propose to address this problem in three stages:

Stage 1: Literature review: inventory of methods and low flow statistics used in the U.S. and elsewhere, possible improvements including transfer of innovations from flood frequency analysis, and needs for future research

Stage 2: Investigation of high priority questions about methods identified in stage 1

Stage 3: Publication of best practices (guidelines) for low flow analysis

Only the first stage of work will be addressed by this proposed workgroup.

Specifically, the stage 1 workgroup will produce a document that provides:

I. A general literature review of advancements and current practices in low flow science. Relevant advances in flood flow frequency analysis may be included, where an analogous application to low flow frequency analysis could be investigated.

II. An inventory of what statistics U.S. state and federal agencies are using as low flow metrics currently, why they are used and how they are estimated:

a. Low flow Statistics

1. Annual low flow series, i.e. 7Q10, 7Q2, 30Q10, 30Q2

a. Any variants?

b. What software?

2. Biologically-based flows
 3. Flow duration curves, i.e. Q90, Q95, Q99
 4. Flows needed for aquatic organism (fish) passage (AOP)
 5. Frequency of zero flows
 6. Etc.
- ii. Identify additional needs and questions for selection of the flow statistic
- b. Methods
- i. Gaged locations
 1. Probability distribution selection
 2. Parameter Estimation methods
 3. Outlier detection methods
 4. Managed Rivers
 - ii. Ungaged locations
 1. Regression modeling
 - a. USGS StreamStats
 - b. USGS NSS
 - c. Other?
 2. Machine learning
 - a. Many variants can be explored
 3. Deterministic models
 4. Managed rivers
 5. Other?
 - iii. Identify additional needs and questions for methods improvement

III. An overview of low flow metrics and estimation methods used internationally

In conducting this literature review and inventory, workgroup members will reach out to other researchers and organizations for input and potential participation in future phases of the work. In particular, we see a need to expand beyond the initial membership to include representatives with experience working in western states and arid areas. As part of the report for this phase of work, the workgroup will identify major alternatives for improving low flow frequency analysis that can be considered for future work.

- **Related Information:** *Please list all the existing related references, tools and documents (if any) that will be used in this effort.*

The white paper written by Richard Vogel and Chuck Kroll and presented to SOH at its April 2018 meeting will be one of the primary references as this effort begins. It includes a partial literature review as a starting point. In addition, we have information from EPA on what state and other agencies use for critical low flow analysis. This information is incomplete and will need to be supplemented. USGS WSCs have information on metrics and methods used by cooperating agencies in their area and will be contacted for assistance as well.

- **Improvements to availability of information:** *Please describe how the work group will improve the availability and reliability of information in any of the following fields:*
 1. hazard mitigation: Better understanding and characterization of low flows and droughts will help to mitigate the risk of over-allocating or underutilizing water supplies, running short of water supplies, or inadequately protecting water supplies or ecosystems
 2. water supply and water use management: Water managers need accurate estimates of low flow probabilities, particularly for determining reservoir and on and off stream release rules, and this project will lead to a set of best practices that can be applied nationally.
 3. environmental protection: Improved estimates of low flow metrics will assist in ensuring any water management or permitting activities appropriately safeguard aquatic life and address other environmental concerns.

- **Improvements to existing Practices:** *Will the work group activities support or improve existing practices in any of the fields below? Please provide detail explanation.*
 1. precipitation information: n/a
 2. stream flow information: This workgroup's products will lead to more consistent, reliable, and improved information on low streamflow across all federal, state, and local agencies.
 3. water supply planning: Improved information on low streamflow can be expected to improve water supply planning, especially for drought conditions.
 4. water allocation: Where water allocation relies on these low flow metrics, better information for these decisions will be made available.
 5. flood control operations: n/a
 6. water quality management: Where water quality is affected by low streamflows, better estimates will aid in making informed management decisions, such as in the determination of total maximum daily loads from watersheds and in the determination of discharge permits from wastewater treatment plants, reservoirs and other settings
 7. Navigation: Low streamflow conditions can have significant impacts on navigation, thus better information concerning low flow conditions will lead to better management of navigation facilities
 8. Recreation: Recreation activities can be significantly impacted by water levels under drought conditions, thus improved information on low streamflows can lead to significant improvements in planning for recreation activities such as recreation releases from dams.
 9. flood forecasting: n/a
 10. emergency management operation: drought preparedness plans are available for most water resource systems and improved information on low flow conditions will lead to improved drought preparedness planning activities
 11. other water related decision making tools: improved information on low flow conditions will lead to improvements in decision support systems which attempt to balance tradeoffs among water resources during times of drought.

- **Workgroup membership and other details**
 1. Names, affiliations, and qualifications of key members, and their responsibilities in the work group. At least 3 key members are required (either the Chair or Vice Chair needs to be an SOH member):
 - a. Work group Chair: Julie Kiang, USGS
 - i. Initiates and ends the work group

- ii. Selects independently the members of the work group at least one of which is a member of a federal agency, subject to endorsement of the SOH
 - iii. Is responsible for delivering the final product on schedule
 - iv. Provides updates
 - b. Work Group Vice Chair: Wilbert Thomas, representing ASFPM
 - i. Assists the Chair in her/his responsibilities
 - c. Work Group Technical Lead: Richard Vogel
 - i. Assists the Chair in delivering a technically credible products
 - ii. Provides technical support
 - iii. QA
 - d. After workgroup membership is finalized, the group may choose to elect a new chair or vice-chair.
 - 2. Other members that will work with the work group:
 - a. Names, affiliations, qualifications, and their responsibilities in the work group: Thus far, the following individuals have indicated a willingness to serve on the workgroup, and all have experience working on questions related to low flows. In addition, we will seek membership from other agencies and scientists.
 - i. Chuck Kroll, State University of New York
 - ii. Jonathan Lamontagne, Tufts University
 - iii. William Farmer, USGS
 - iv. Robert Mason, USGS
 - v. Ben Pratt, Susquehanna River Basin
 - vi. Jason Giovannettone, Dewberry
 - vii. Robin Johnson, EPA
 - viii. John England, USACE (possible)
 - 3. Any other resources that will be used
 - a. NIWR grant proposal – a previously prepared proposal to the USGS NIWR program contains information relevant to the literature review.
 - b. USGS-EPA work on low flows will be shared with the workgroup.
 - c. An ASCE-EWRI task committee on extreme events, including low flows, is also conducting a literature review which may be useful to this effort.
 - 4. Schedule and milestones.
 - a. 18 months from inception of the workgroup, a report will be submitted to SOH.
 - 5. A QA/QC plan that is endorsed by the subcommittee
 - a. The report will be circulated to obtain at least one colleague review from each agency that is participating in this workgroup. In addition, university participants may choose one or more additional reviewers. At least 3 reviewers will be asked to review and comment on the report before it is submitted to SOH.
 - b. The workgroup will consult with SOH about whether to put the literature review out for public comment.
 - 6. Description of the final product that is endorsed by the subcommittee
 - a. The final product will be a report, as described above. A version of this report may also be submitted to a journal for publication and/or published by USGS.
- **Other requirements:**
 - 1. SOH endorsement is required prior to establishing the work group and for the final product prior to presentation to the ACWI

2. Provide regular updates to the members at SOH quarterly meetings
3. Provide brief updates (emails) to the SOH Chair and Vice Chair *on a quarterly basis*.
4. Present the final product to the ACWI for deliberation and approval as advice to the Federal Government

Attachment 4 – HFAWG report

Hydrologic Frequency Analysis Work Group (HFAWG) Report for the Subcommittee on Hydrology Meeting on October 18, 2018

Since publication of Bulletin 17C by the U.S. Geological Survey (USGS) in March 2018, the co-authors of Bulletin 17C have been giving workshops at national conferences to spread the word about the new procedures and associated software.

Will Thomas gave a 2-hour workshop on Bulletin 17C at the Federal Highway Administration's (FHWA) National Hydraulic Engineering Conference in Columbus, Ohio on August 30, 2018 (<https://www.ohio.edu/engineering/nhec/index.cfm>).

Robert Mason, Julie Kiang and Will Thomas will be giving a 3-hour workshop on Bulletin 17C at the Transportation Research Board (TRB) annual conference in Washington, DC on January 13, 2019 (<https://annualmeeting.mytrb.org/Workshop/Date>). The workshop is sponsored by the TRB Standing Committee on Hydrology and Hydraulics and the Standing Committee on Stormwater and Brian Beucler, FHWA, will preside over the workshop. The abstract for the TRB workshop in January 2019 is given below.

Transportation Research Board (TRB) January 13-17, 2019 Annual Meeting

Sunday, January 13th

1:30 – 4:30 pm

Workshop on the New National Flood Frequency Guidelines, Bulletin 17C

Accurate and consistent techniques for estimating the magnitude and frequency of floods are needed for several purposes such as the economic design of bridges, culverts, roadways, dams and levees, and for developing consistent floodplain maps to inform long-term land use planning. Considerable resources and effort have been expended over the years by Federal agencies in the United States to develop uniform national guidelines for estimating flood flow frequency including Bulletin 15 in 1967, Bulletin 17 in 1972, Bulletin 17A in 1977 and Bulletin 17B in 1982. Recently a work group of the Subcommittee on Hydrology of the Advisory Committee on Water Information developed new flood frequency guidelines, Bulletin 17C, ***Guidelines for Determining Flood Flow Frequency***, an update of Bulletin 17B. The U.S. Geological Survey (USGS) published Bulletin 17C in March 2018 as USGS Techniques and Methods 4-B5 (URL: <https://pubs.er.usgs.gov/publication/tm4B5>). Although published by the USGS, Bulletin 17C is an interagency report and all Federal agencies are requested to use these guidelines in planning activities involving water and land related resources. State, local, and private organizations are encouraged to use these guidelines.

This workshop is intended to describe the new computational procedures in Bulletin 17C and demonstrate examples from the Bulletin using the USGS PeakFQ program (<https://water.usgs.gov/software/PeakFQ/>).

The workshop will include:

- A brief overview of at-site flood frequency analysis
- New computational procedures and concepts
- Examples of applying the new guidelines
- Discussion of future work on flood frequency

Instructors:

Robert Mason, U.S. Geological Survey, Reston, VA, rmason@usgs.gov

Julie Kiang, U.S. Geological Survey, Reston, VA, jkiang@usgs.gov

Wilbert O. Thomas, Jr., Michael Baker International, Cary, NC, wthomas@mbakerintl.com

Will Thomas
Chair of the HFAWG
October 15, 2018

Attachment 5 – NOAA business report

SOH Member Business Reports (October 2018) NOAA NWS

National Water Center Innovators Program 2018 Summer Institute

The NWS, in partnership with Consortium of Universities for the Advancement of Hydrologic Science, Inc. (CUAHSI), established the National Water Center (NWC) Innovators Program in 2015 to engage the academic community in research to advance the mission of the NWC. The Summer Institute is a residential program which brings graduate students, senior academic faculty, and federal scientists together with NWC staff and other senior scientists to conduct group projects which involve rapid prototyping of new ideas focused on the National Water Model (NWM) at the NWC. This 2018 Summer Institute was held June 11-July 27 and involved 23 graduate students from 18 universities. This year's themes included 1) ground and surface water interaction, 2) hyper-resolution modeling, and 3) computational aspects of the NWM and citizen science data. Please see the [report](#).

National Centers for Environmental Information Climate Report for September 2018

NOAA's National Centers for Environmental Information (NCEI) reported that the average September 2018 global temperature was 1.40 degrees F above the 20th-century average of 59 degrees. This was the fourth highest global September temperature (tied with 2017) since the 139-year record (1880-2018). September 2018 was also the 42nd consecutive September and the 405th consecutive month with temperatures above average. For more, please see [NCEI's monthly climate report and download related maps](#).

National Geodetic Survey's Aerial Images of Hurricane Michael

From October 11-14, 2018, the National Geodetic Survey (NGS) collected 9,580 aerial damage assessment images covering approximately 4,153 square miles in the aftermath of Hurricane Michael. Imagery was collected in specific areas identified by NOAA in coordination with FEMA and other state and federal partners. A team of NOAA aviators and sensor operators captured the images using specialized remote-sensing cameras aboard NOAA Office of Marine and Aviation Operations' King Air aircraft flying above the area at an altitude of 5,500 feet. Collected images are available to view online via the [NGS aerial imagery viewer](#). A preliminary assessment of [Hurricane Michael](#) is available from the NWS Weather Forecast Office Tallahassee, Florida.

National Geodetic Survey's Aerial Images of Hurricane Florence

From September 15-22, 2018, the National Geodetic Survey (NGS) collected damage assessment imagery in the aftermath of Hurricane Florence. Imagery was collected in specific areas identified by NOAA in coordination with FEMA and other state and federal partners. A team of NOAA aviators and sensor operators captured the images using specialized remote-sensing cameras aboard NOAA Office of Marine and Aviation Operations' King Air aircraft flying above the area between 500 - 1,500 meters. Collected images are available to view online via the [NGS aerial imagery viewer](#). Some preliminary information of [Hurricane Florence](#) is available from the NWS Weather Forecast Office Newport/Morehead City, North Carolina.

Local SKYWARN® Spotter Training

Become part of a national network of volunteer severe weather spotters. Spotters are trained by local National Weather Service Forecast Offices on how to spot severe thunderstorms, tornadoes, hail and flooding. In some parts of the country, spotters also report snowfall and ice accumulation. Here are [opportunities](#) in the Greater DC area.