ADVANCES
in Hydrologic Engineering
Winter 2008/2009

Director's Comments

By Christopher N. Dunn, P.E.

Welcome to the Winter 2008/2009 edition of the HEC Newsletter. It seems like just yesterday I was compiling the Director's Notes for our Spring 2008 Newsletter. I suppose that is a good sign in that we are actively engaged in many interesting projects; a number of which are described in this Newsletter and I encourage you to take a look.

As FY 2008 came to a close, HEC finished with another strong year both technically and financially. We performed work for many District and Division offices as well as offices outside the Corps. We recently completed MOA's with the Sonoma County Water Agency and the South Florida Water Management District. We also have a current MOA with the National Weather Service that has been keeping us busy and are performing work for FEMA as well. We have remained active with a number of National efforts and have been called on to participate in a few International activities too. This Newsletter has an entire section dedicated to our recent International efforts. These activities help us maintain our mission of advancing the state-of-the-art in hydrologic engineering and water resources planning.

National Activities:

HEC has long enjoyed a diverse client base and this year has been no exception. We are fortunate to

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HEC-ResSim Modeling in the ACT-ACF Basins

By Matthew McPherson, P.E., D WRE

For the last twenty years, the Corps of Engineers has played a central role in the comprehensive and controversial tri-state water resources study of the Alabama-Coosa-Tallapoosa (ACT) and Apalachicola-Chattahoochee-Flint (ACF) River basins. The appropriate allocation of the water from these two basins has been a major point of discussion and study by the states of Florida, Georgia and Alabama for the last two decades. Over this period, the Mobile District, the Hydrologic Engineering Center (HEC) and other major stakeholders performed reservoir system modeling for the 18-project ACT system and 10-project ACF system using HEC-5, reservoir simulation software that was developed by HEC.

As part of HEC's effort to modernize our software, guidelines have been established that will produce more consistent results when using HEC software in water resources studies. Also, the guidelines facilitate a common graphical user interface and look and feel for HEC software in the PC environment. Under these guidelines, HEC has developed a new and improved version of reservoir simulation software called HEC-ResSim. In recognition of HEC-ResSim's sophisticated computational abilities and maturity as a generalized model, the Mobile District recently began working with HEC to modernize its ACT and ACF reservoir modeling applications using HEC-ResSim. The more powerful system modeling functions and ability to incorporate custom logic into water management decisions provide improved capability to actual operations and allow greater flexibility for evaluating alternatives.

ACT/ACF HEC-ResSim Modeling Workshop

In the interests of transparency and cooperation, the Mobile District and HEC hosted a Stakeholder's Workshop to share the new tools and data with all the stakeholder groups involved with the contentious water management issues in the basins. The workshop took place at Jim Woodruff Lock & Dam from 30 September – 2 October 2008, and focused entirely on technical topics. A total of twenty-eight modelers attended the

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be involved with a number of very exciting and at times precedent setting efforts. The work with the Alabama-Coosa-Tallapoosa (ACT) and Apalachicola-Chattahoochee-Flint (ACF) River basins in the Southeastern part of the country is just one example. The cover story is about this project. If you are wondering where the new Levee Certification EC is (see page 4), we are in the process of responding to ITR comments so it will not be released until the beginning of the new year. We are also assisting the Corps' Engineering Risk and Reliability Directory of Expertise with a number of Dam and Levee safety studies and efforts. One of these efforts is the H&H and consequence training for the Corps' Issue Evaluation Studies team (see page 5). The training covered hydraulic model development using HEC-RAS/GeoRAS and an application of HEC-FIA to compute economic damages and loss-of-life for potential dam failure scenarios. Another project we are excited about is the work with the Sacramento District and the San Francisco Division where we are performing a risk analysis of the Sacramento River from a systems context. We are using existing tools, i.e. HEC-RAS and HEC-FDA, to perform the levee evaluation study. It will conclude at the end of December with a report documenting the steps required to perform a system-wide risk analysis. This process on this scale has not been documented before.

International Activities:

Within this Newsletter, you will find a section dedicated to some of our recent International activities. Just to highlight a few, Mr. John Hickey and Mr. Fauwaz Hanbali traveled to IHE-Delft where they provided water management and environmental modeling training to Iraq Ministry of Water officials. John also traveled to China where he participated in the Yangtze River Environmental Flows Workshop where they studied the possibility of re-operating the reservoirs on the Yangtze to better manage downstream fisheries and ecosystems. Finally John headed to Mexico City in December to present training on how to evaluate environmental flows to the Mexico Institute of Water Technology. The International requests for John's involvement are certainly encouraging as they indicate an interest in a more environmentally conscience society.

Others at HEC have also traveled internationally. Stan Gibson, Matt Fleming and Jon Fenske performed H&H training in Kenya and Ethiopia under the Combined Joint Task Force – Horn of Africa effort. Fauwaz Hanbali, Dan Barcellos, Mike Perryman and Darren Nezamfar provided data collection and water management training to the Iraq Ministry of Water and Jeff Harris participated in the "National Guidelines for Urban Flooding Disaster Management: Scientific, Technological, and Administrative Challenges", workshop held 7-9 January 2009 in Hyderabad, India. Finally, both Matt McPherson and I have travelled to Canada recently. Matt to work on studies along with the Detroit District and International Joint Commission and I presented a keynote presentation at the International Symposium on Uncertainties in Hydrologic and Hydraulic Modeling.

It is clear from the list of activities that HEC and the Corps are active in the International Water Resources Community. By doing so we stay informed of the latest developments throughout the profession and then pass this information on to the Corps and others in the community.

CWMS:

We are on the cusp of providing the latest version of the Corps Water Management System (CWMS) to our USACE water control management offices. Before we release Version 2.0, we are proceeding through a well defined testing plan. The testing plan includes detailed testing at HEC and also at a few of our water management offices. When the testing sites are comfortable with this version of the software, further distribution of CWMS will occur. The goal is to have CWMS Version 2.0 at every USACE water management office by the end of the second quarter of FY 2009. Version 2.0 includes major revisions to the basic database structures, allowing water control users more direct access to their data and enabling them to make more effective use of the features inherent in the database that is at the center of CWMS. It also includes the incorporation of RiverWare from CADSWES in Boulder, Colorado, the latest versions of the modeling programs and numerous enhancements. It should be noted that the Corps and the Regents of the University of Colorado have formally entered into an agreement that grants the Corps a license for the RiverWare software. The expiration date for this agreement is 30 June 2011. Information about CWMS is found on the CWMS web page www.hec.usace.army.mil/cwms/.

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US Army Corps of Engineers
Hydrologic Engineering Center
http://www.hec.usace.army.mil

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Director: Christopher N. Dunn, P.E.

Water Resource Systems Chief: Michael K. Deering, P.E

Director's Comments (continued)

A public release of the modeling component of CWMS, named HEC-RTS (Real-Time Simulation) is scheduled for release shortly after the release of Version 2.0 of CWMS. Mr. William Charley will be presenting a status report on HEC-RTS at the upcoming National Hydrologic Warning Council conference in Vail, Colorado 18-21 May 2009.

The Corps' Water Management Systems Users Representative Group, CURG, met via the telephone on 30 October 2008 to discuss CWMS Version 2.0, the national water management web presence, the CWMS COOP and ACE-IT's transition into the water management community. It was a lively call as offices from around the Corps participated. A meeting was held at HEC the first week of December where the WMeA stack configuration was discussed and initial design begun. Again it was a lively discussion.

HEC Software:

HEC continues to enhance and introduce new products, so please review our website (www.hec.usace.army.mil) to see the latest activities. Released since the last newsletter were:

- HEC-HMS, Hydrologic Modeling Systems, Version 3.3. Two new simulation features were added to the HMS Version 3.2 software. They include: a new option in the SCS Unit Hydrograph transform method and a simple reservoir evaporation option. In addition, as with any new release, the identification and repair of a number of bugs also took place.

- HEC-FDA, Flood Damage Reduction Analysis, Version 1.2.4. This long awaited product has many new and improved features which are discussed in the "What's New" section of the HEC-FDA web page site (http://www.hec.usace.army.mil/software/hec-fda). Since it has been a while since we have had a new release of HEC-FDA, I offer this short summary of the tool. HEC-FDA provides the capability to perform an integrated hydrologic engineering and economic analysis during the formulation and evaluation of flood risk management plans. HEC-FDA is designed to assist study members in using risk analysis procedures for formulating and evaluating flood risk management measures and analyzing the economics of flood risk management projects. It computes expected annual damage (EAD) and equivalent annual damage and provides the annual exceedance probability (AEP) and conditional non-exceedance probability as required for levee certification.

- HEC-SSP, Statistical Software Package, Version 1.0. This initial release of the HEC-SSP software begins to replace the multiple DOS based statistical applications that HEC has supported for years. Version 1.0 can perform flood flow frequency analysis based on Bulletin 17B, "Guidelines for Determining Flood Flow Frequency" (1982).

- HEC-EFM, Ecosystem Functions Model, Version 1.0. The inaugural release of this long anticipated software is designed to help determine ecosystem responses to changes in flow regime of a river or connected wetlands. It allows the study team to visualize and define existing ecologic conditions, highlight promising restoration sites, and assess and rank alternatives according to predicted changes in different aspects of the ecosystem.

While the latest version of HEC-ResSim, the Reservoir Simulation model, has not yet been released, it is expected late January 2009. An article about Version 3.1, the impending release, is included with this Newsletter (see page 15) and it details the new and enhanced capabilities. Other software that is expected to be released in FY 2009 includes HEC-FIA, Flood Impact Analysis, with its loss-of-life capabilities and the new Watershed Analysis Tool, HEC-WAT, (which includes HMS, RAS, SSP, ResSim, EFM and FIA software). A beta version of the HEC-WAT was released in FY 2008 and is still available to you for use and testing if you contact HEC.

Summary:

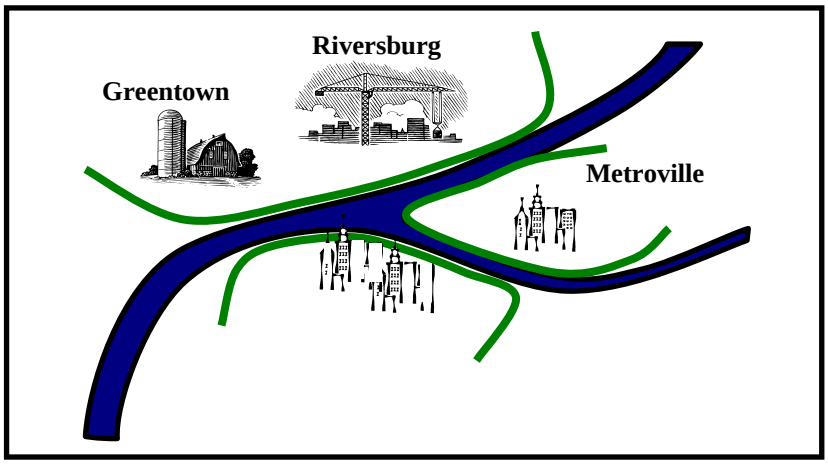
With a new administration coming in and an uncertain budget, a lengthy Continuing Resolution Authority (CRA) appears likely. In spite of that, there are still significant expectations for HEC. We will continue to support the Districts, Divisions, HQ and those outside the Corps to promote good water resources management and engineering. We continue to do this through a balance program of research and software development, training, technology transfer, software maintenance, and providing technical assistance and performing special projects.

As always, if we can help you in any way, please let us know.

New Guidance for Certification of Levee Systems

By Michael Deering, P.E.

An Engineer Technical Letter (ETL) for levee system assessments was developed and released for review and field use in September of 2007. Levee systems risk assessments are being performed in association with the FEMA Map Modernization and National Flood Insurance Program (NFIP) efforts. The ETL provides technical guidance for USACE levee system certifications. A levee system comprises of one or more components which collectively provide flood damage reduction to a defined area. Failure of one component within a system constitutes failure of the entire system. The levee system is inclusive of all components that are interconnected and necessary to ensure protection of the associated separable floodplain – levee and floodwall sections, closure structures, pumping stations, culverts, and interior drainage works (see figure). The ETL describes documentation policy, study process and outreach, coordination, technical criteria and guidance for complete engineering evaluation, and ITR and staffing/ signature requirements. As the ETL evolved, it began to capture more and more policy topics than typically contained in an ETL as defined by OM 25-1-51, "Guidance for Preparation and Processing of



Three levee "systems" each protecting a separable floodplain. Ownership boundaries and construction sequence and authorization limits are not relevant.

USACE Command Publications within HQUSACE". Because of these distinctions, the final release of the guidance will be in the form of an Engineer Circular (EC 1110-2-6067) of the same title, in lieu of an ETL.

Application of a risk assessment for the various engineering components is being addressed with a multi-disciplinary USACE engineering team preparing the EC and applies to existing and new levee systems. The assessment is to determine whether a levee system meets FEMA and USACE requirements for certifying that the system can be reasonably expected to provide flood protection from the 1% annual chance of exceedance flood.

Initially, the risk framework is applicable for only the flow and stage-chance exceedance (still-water-level-frequency) aspect of risk assessment, and to a lesser degree other components. Risk analysis methodologies are under development and emerging for structural and geotechnical engineering elements, but are not yet sufficiently mature for direct application in certification determinations. As methodologies for these and the remaining engineering assessment elements mature, they will be incorporated into future versions of this EC. The release of the final EC is anticipated in the first quarter of CY 2009.

HEC-ResSim Modeling in the ACT-ACF Basins (continued)

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workshop representing three federal agencies, three state agencies, one university, and five private consultants representing the stakeholders.

The session proved very successful regarding its objectives:

- Introduce the participants to the HEC-ResSim software.
- Initiate technology transfer by providing the participants with a copy of the software and ACT/ACF Models; walk the participants through the model; and, answer questions.
- Foster relationships by continuing long standing technical working relationships with stakeholders.

Mobile District and HEC continue to refine the HEC-ResSim models of the ACT and ACF systems, with an awareness and informed participation by the stakeholders. The models will be the primary tools for the extensive water management studies to be performed in FY 2009. The improved comfort and "buy-in" from the stakeholders regarding the HEC-ResSim models eliminates one potential source of dispute and provides an excellent foundation for reaching agreement on difficult issues.

Dam Failure Analysis and Consequence Estimation Using HEC Tools

By Jason Needham, P.E.; David Margo, P.E., CELRP

The portfolio risk management approach used by the United States Army Corps of Engineers (USACE) incorporates various types and levels of risk assessment ranging from preliminary screening to detailed risk assessments in support of dam safety decisions. Risk assessments can have a variety of purposes which include determining the dam safety action classification (DSAC), identifying and characterizing dam safety issues and their associated risks, justifying and prioritizing additional studies and investigations to confirm issues and reduce uncertainty, and justifying and prioritizing interim and permanent risk reduction actions. The process is decision driven meaning that the level of detail and accuracy required must be appropriate to support the decision being made with a reasonable level of confidence. For example, a screening risk assessment used to establish the initial DSAC classification for a dam and set priorities for more detailed studies should require significantly less effort and rigor than a detailed risk assessment used to determine what risk reduction actions are needed to satisfy tolerable risk guidelines.

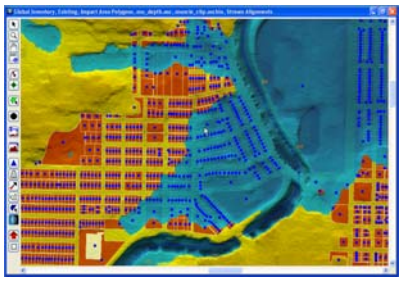
Within the risk informed framework, an accurate estimate of the incremental consequences due to dam failure including life safety and economic impacts is critical to success of the portfolio risk management effort. These consequence estimates are primarily determined by the temporal and spatial distribution of flooding due to dam failure, the initial distribution of people and property within the dam failure floodplain, and the redistribution of people and property as a result of warnings and evacuations. As a result, standard and scalable hydraulic modeling and consequence estimation procedures for evaluating the effects of dam failure are needed in order to estimate and compare the consequences of dam failure and the associated risk across the entire portfolio of more than six hundred dams that are owned, operated, and maintained by the USACE. Given the interdependence of the dam failure and consequence estimation models, additional tools are needed to efficiently extract, transfer, and update model results. Tools to achieve this are readily available due to advancements in the use of Geographic Information Systems (GIS).

Dam Failure Analysis

The initial approach used by USACE for risk assessments will be to develop new dam failure models using HEC-GeoRAS and HEC-RAS. Once a current GIS based model is available for each dam in the portfolio, the model will be updated every ten years to support periodic assessment of the dam. The link between these hydraulic tools and GIS facilitates the use of readily available and existing data sets, efficient model development, and processing of results. New data and information can be readily incorporated into existing models when improved accuracy is needed.

Consequence Estimation

Initially, new GIS-based consequence models and resultant consequence estimates will be developed using HEC-FIA (Flood Impact Analysis) for most USACE risk assessments. Then, after an HEC-FIA consequence model is available for each dam in the portfolio, it will be updated every ten years to support periodic assessment of the dam. HEC-FIA is a stand-alone, GIS enabled model for estimating flood impacts due to a specific flood event. The software can generate required economic and population data for a study area from readily available data sets and use those data to compute urban and agricultural flood damage, area inundated, number of structures inundated, population at risk and loss of life. The loss of life computations in HEC-FIA are based on a modified LifeSim approach. The full version of LifeSim was developed for the USACE and the Australian National Committee on Large Dams (ANCOLD) by Utah State University's Institute for Dam Safety Risk Management, and is applied in support of risk assessments when the goals and characteristics of the study require a more sophisticated approach. GIS facilitates the use of readily available and existing data sets, efficient model development, and processing of results. New data and information can be readily incorporated into existing models when improved accuracy is needed.



Consequence estimation software, HEC-FIA (Version 2.0).

A training course on developing hydraulic and consequence models in support of USACE risk assessments was presented at HEC from 1-5 December 2008. For more information on this subject and future training activities, contact Jason Needham at jason.t.needham@usace.army.mil.

Training Program

FY 2010 PROSPECT Training Program - Proposed

By Matthew McPherson, P.E., D WRE

HEC has submitted our proposed FY 2010 PROSPECT training schedule to the Corps' Professional Development Support Center (PDSC). The PDSC, located in Huntsville, AL, will conduct the training survey which will begin in May 2009 and will help decide which classes will actually be taught. Only the classes that have enough subscriptions will be taught. Therefore, it is very important that you complete the survey for each class you wish to attend. For your review and use, HEC has provided the proposed FY 2010 class list (above). If you are interested in one or more of the classes make sure you let the training program in your District/Division know so that they can report your interest to the

HEC is offering the traditional classes such as Water and the Watershed, Hydrologic Analysis for Ecosystem Restoration, and Risk Analysis for Flood Damage Reduction Projects, along with a few classes that have not been presented in awhile, Flood Frequency Analysis and Hydrologic Engineer Role in Planning. To help ensure that all these classes will be taught, please sign up early if you are interested.

To register for our classes, please contact the appropriate part in your office or contact PDSC, http://pdsc.usace.army.mil. Registration is handled by Training and

Course descriptions are provided in the "Purple Book" at the PDSC site (http://pdsc.usace.army.mil/downloads/PurpleBook2009.pdf). A short description along with course agendas is also provided on HEC's web site (http://www.hec.usace.army.mil/training/course_list.html). To obtain enrollment information, please contact the Huntsville District. When doing so, please note the course number, name, data, and location, and contact the address listed below:

Course Number	Course Title (all classes located in Davis, CA)	Dates
114	Steady Flow with HEC-RAS	26-30 October 2009
164	Water and the Watershed	16-20 November 2009
209	Risk Analysis for Flood Damage Reduction Projects	7-11 December 2009
98	Reservoir System Analysis with HEC-ResSim	11-15 January 2010
320	H&H for Dam Safety Studies	25-29 January 2010
161	Hydrologic Analysis for Ecosystem Restoration	22-26 March 2010
152	Water Data Management with HEC-DSSVue	12-16 April 2010
123	Flood Frequency Analysis	17-21 May 2010
219	Hydrologic Engineering Applications for GIS	21-25 June 2010
176	Hydrologic Engineer Role in Planning	12-16 July 2010
188	Unsteady Flow Analysis with HEC-RAS	26-30 July 2010
178	Hydrologic Modeling with HEC-HMS	16-20 August 2010
300	Advanced ResSim	13-17 September 2010

HEC's FY 2010 Proposed PROSPECT Training Program

CEHR-P-RG
USACE Professional Development Support Center (PDSC)
550 Sparkman Drive
Huntsville, AL 35817
Phone: (256) 895-7421
FAX: (256) 895-7465

FY 2009 PROSPECT Training Program

By Matthew McPherson, P.E., D WRE

The PROSPECT training program for FY 2009 started in November 2008 with the Water and the Watershed and the Advanced Applications of HEC-HMS classes being given.

HEC has eleven more classes on the schedule, but only eight of those classes have student registration numbers that will allow the classes to be given. The other three classes are in jeopardy of being cancelled because of low registration numbers. In the FY 2009 PROSPECT Training Schedule (shown on page 7), the classes with asterisks by the course number, as of this newsletter, do not have sufficient registration numbers to guarantee that the class will be given. To help ensure that all these classes will be taught, register as soon as possible. Out of the other eight classes, only the Risk Analysis for Flood Damage Reduction Projects class (209) has full registration, so if you are interested in the other classes please be sure to register.

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Training Program (continued)

FY 2009 PROSPECT Training Program (continued)

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Course Number	Course Title (all classes located in Davis, CA)	Dates
320	H&H for Dam Safety Studies	12-16 January 2009
155	CWMS Modeling for Real-Time Water Management	2-6 February 2009
219	Hydrologic Engineering Applications for GIS	23-27 February 2009
345	Nonstructural Measures for Flood Risk Management	30 Mar – 3 Apr 2009
161	Hydrologic Analysis for Ecosystem Restoration	6-10 April 2009
124*	Groundwater Hydrology	20-24 April 2009
67	Advanced Steady Flow Analysis with HEC-RAS	4-8 May 2009
209	Risk Analysis for Flood Damage Reduction Projects	15-19 June 2009
58*	Statistical Methods for Water Resources	13-17 July 2009
122	Sediment Transport Analysis with HEC-RAS	17-21 August 2009
300*	Advanced Reservoir Modeling with HEC-ResSim	14-18 September 2009

HEC's FY 2009 PROSPECT Training Program

The procedure for registration is the same stated in the article on the proposed FY 2010 PROSPECT training program, and will be reiterated here. To register for our classes, please contact the appropriate part in your office or contact PDSC, http://pdsc.usace.army.mil. Registration is handled by Training and Operations (CEHR-P-RG). Course descriptions are provided in the "Purple Book" at the PDSC site (http://pdsc.usace.army.mil/downloadsPurpleBook2009.pdf). A short description along with course agendas is also provided on HEC's web site (http://www.hec.usace.army.mil/training/course_list.html). To obtain enrollment information, please contact the Huntsville District. When doing so, please note the course number, name, data, and location, and contact:

CEHR-P-RG
USACE Professional Development Support Center (PDSC)
550 Sparkman Drive
Huntsville, AL 35817

HEC Publications

HEC publications are available electronically through the HEC web site (www.hec.usace.army.mil). Work continues on adding computer program documentation to the webpage, and updates to the following documentation was posted to the web site: HEC-FDA, Flood Damage Reduction User's Manual (CPD-72); HEC-HMS, Hydrologic Modeling System (CPD-74A, CPD-74C, CPD-74D); HEC-RAS, River Analysis Systems User's Manual (CPD-68); HEC-RAS, River Analysis System, Hydraulic Reference Manual (CPD-69); HEC-RAS, River Analysis System, Applications Guide (CPD-70); HEC-SSP, Statistical Software Package User's Manual (CPD-86).

During FY 2009, HEC will be revising the Publications page of the HEC web site. Hopefully, this work will be completed by mid-FY 2009, providing users with a better layout and up-to-date information.

All documents are in Adobe® format (7.0 and later) and are set for printing only. However, HEC is working on creating documents that will allow highlighting and searching in our publications. To download and view the documents, a user will need to the latest version of Adobe® Reader (8.1.3) from Adobe® (www.adobe.com). If you have any questions regarding HEC publications or this issue of the newsletter, please contact Ms. Penni Baker (email: penni.r.baker@usace.army.mil) of our office.

International Activities

UNESCO-IHE Short Course

By Fauwaz Hanbali & John Hickey, P.E.

In July 2008, HEC staff contributed to a short course on Integrated Water Resources Management (IWRM) that was organized and hosted by UNESCO-IHE, Delft, The Netherlands. The course was a collaborative activity between UNESCO-IHE and USACE Institute for Water Resources (IWR), and was tailor-made for engineers from the Iraq Ministry of Water Resources (MoWR). Iraqi participants included mid-career and senior professionals with diverse specializations that included irrigation, water management planning, mechanical, and electrical engineering. The course spanned a period of three weeks and targeted key water management issues that are especially pertinent to Iraq. The first week's program covered international IWRM concepts and case studies and was given by experts from UNESCO-IHE, IWR, and Johns Hopkins University. The first week also included lectures on urban water supply and sanitation and management of irrigation systems. The second week consisted of a technical tour where course participants visited an assortment of water resources projects and institutions in the Netherlands, Germany, and Belgium. UNESCO-IHE and HEC instructors conducted the third and final week of the course to present examples of reservoir system management and IWRM in the United States (U.S.), Netherlands, Syria, and Iraq.

UNESCO-IHE Short Course

HEC presentations introduced course participants to the Corps of Engineers, HEC, and reservoir operations and environmental analysis tools. The participants received an introduction to the various mission areas of the Corps of Engineers, in particular water resources. In addition, three different river basins (Savannah, Ohio, and Willamette) were highlighted for their multi-purpose and integrated water management, as well as their unique basin and project characteristics. The participants also received an overview of HEC and its array of hydrologic and hydraulic computer programs, including the software integration systems of the Corps Water Management System (CWMS) for real-time water control and the Watershed Analysis Tool (HEC-WAT) for water resources management and planning analyses. Other lectures covered the concepts of reservoir system simulation, an introduction to the Reservoir System Simulation program (HEC-ResSim), and an overview of the Tigris-Euphrates application developed during previous HEC support activities for the MoWR and its international partners. As a conclusion for the HEC portion, Iraqi participants were given a role-play exercise where they were asked to develop flow requirements for the rehabilitation of the Mesopotamian Marshlands. In this exercise, participants assumed the duties and perspectives of different disciplines (biology, ecology, hydrology, water management, and socio-economic planning) while HEC staff acted as facilitators using HEC-RPT (Regime Prescription Tool), a tool that helps groups of people reach agreements on managing water by plotting historical flows and building desired management scenarios.

It was a valuable experience for the HEC staff to be involved in such an international activity, especially the collaborations and interactions with the Dutch hosts and Iraqi participants. Corps involvement in this training course was led through IWR's International Center for Integrated Water Resources Management (ICIWaRM), which had recently been endorsed as a global water center within the hydrologic program of UNESCO.

South Korean Workshop

By Jay Pak, Ph. D., P.E.

The purpose of this article is to share my great experiences gained from a recent trip to my native South Korea. Between late August and early September, I spent three weeks in South Korea on a trip arranged and sponsored by the Korean Water Resources Association (KWRA) and Inha University. This was my first trip back to South Korea since 2001. In cooperation with KWRA and Inha University I led seminars and workshops. In Seoul, I was able to stay near the Seoul Education & Culture Center. This is very close to the Yangjae-cheon (stream) restoration project site, one of the major river restoration projects in Seoul (see figure on page 9). Yangjae-cheon is a river that flows through the city of Seoul and through Gangnam, which is the lower half of the city. The river has an associated greenway stretching five and a half kilometers from Gwanaksan in Gyeonggi-do into Seoul through Seocho-gu, Gangnam-gu, Songpa-gu until it runs into the Tancheon. The river has major bridge crossings and multiple bike and pedestrian trails flanking it on tiered ledges. Public

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International Activities (continued)

South Korean Workshop (continued)

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Yangjae-cheon (stream) Restoration Project Site, Seoul, South Korea

exercise equipment is provided along the stream as well as benches and a variety of flowers. I walked around this beautiful project almost every morning.

The first seminar was for a research group who is undertaking a project entitled “Development of Assessment Techniques for Abnormal Climate Analysis” at the Department of Civil Engineering, Inha University. The title of the seminar was "Estimation/Managing Debris Yield after Wildfires and Subsequent Storm Events." I made a presentation based on my previous research ("A Statistical Sediment Yield Prediction Model Incorporation the Effect of Fire and Subsequent Storm Events") published in Journal of the American Water Resources Association (44(3):689-699). After my presentation, there were lengthy discussions with at least thirty researchers, engineers, and students that study debris issues and are active in developing future research study plans for debris solutions in South Korea.

The second seminar was for the National Institute for Disaster Prevention (NIDP), Korean National Emergency Management Agency (NEMA). I made two presentations - "Estimation/ Managing Debris Yield after Wildfires and Subsequent Storm Events"; and, " Sediment Transport Module of Hydrologic Modeling System (HEC-HMS: STM)". After my presentation, we discussed debris flow and landslide disaster prevention plans from mountain watersheds in US and South Korea.

Debris Flow and Landslide Disaster Prevention Seminar at NEMA

I visited the Far East District (FED) office located in Seoul. Mr. Michel Wong, Hydraulic Engineer of Honolulu District (POH), arranged this visit. I met with Mr. Samuel Hong, Chief of Korea Relocation Technical Support Branch Engineering Division, Far East District (FED). Mr. Hong briefly presented the Camp Humphreys expansion project with plans and engineering reports and introduced engineers in his branch. It turns out that, for this project, HEC conducted the technical review. After that, I also visited the Design Branch, Engineering Division, FED and met many engineers. A flyover video of Camp Humphreys expansion project is available at http://www.pof.usace.army.mil/video/video%20hump.html. The construction of the Humphreys expansion will proceed in three stages; Parcel 1 and Parcel 2 is headed by the U. S. and Parcel K is headed by South Korea. About 600 buildings with a total 2328 acres of capacity will be built to accommodate the transformation, including a headquarters, administrative complex, maintenance and logistics facilities, residential housing, dining facilities, a recreational center and hospitals.

I also had the opportunity to lead the 19th KWRA workshop for 186 engineers and students who work in the water resources engineering area. The workshop included four lectures and two demonstration workshops using HEC-HMS:

1. HEC Model Development Plan
2. Sediment Transport Module (STM) of HEC-HMS
3. Continuous Simulation Methodologies
4. Evapotranspiration
5. Demonstration Workshop -1: Working with Soil Moisture Accounting
6. Demonstration Workshop - 2: Continuous Simulation.

Many of the engineers at the workshop were already familiar with the HEC-HMS software. Many engineers expressed interested in new software tools and future HEC software including HEC-WAT, HEC-RAS Sediment Temperature and Nutrient Module, and HEC-HMS Sediment Transport Module.

The 19th KWRA Workshop at KyungHee University

Additionally, I was able to visit six universities and two institutes including Korea University, KangWon University, ChungNam University, KyungHee University, InJe University, KookMin University, Korea Institute of Water and Environment, and Korea

continued on page 10

International Activities (continued)

South Korean Workshop (continued)

continued from page 9

Institute of Construction Technology. I led additional seminars on the topics mentioned above. Through these seminars and workshops I was pleased to provide representation from the USACE to the South Korean water resources community by offering technical assistance and training. This work contributed to the IWR goals of strengthening international technical exchange and maintaining the professional reputation and credibility for USACE with our international partners.

Capacity Development in Ethiopia

By Jon Fenske, P.E.

In May-June 2007, staff from the Hydrologic Engineering Center (HEC) presented two hydrologic modeling courses in Kenya and Ethiopia. In July 2008, staff from HEC, in collaboration with the U.S. Geological Survey (USGS), presented a two-week groundwater modeling course at the University of Addis Ababa, Ethiopia. Funding for this training was provided by the Department of Defense Combined Joint Command Task Force, Horn of Africa. The course was a capacity development activity supported by the UNESCO International Center for Integrated Water Resource Management (ICIWaRM). ICIWaRM is hosted by the Institute for Water Resources (IWR), working in collaboration with the Corps, other Federal agencies, academia and professional societies, and non-governmental organizations, who have agreed to serve as organizational nodes.

The ten-day training focused on the use of groundwater models for water resource management. The course had twenty attendees consisting of a mix of graduate students, professors, and professional engineers. The first five days of the course focused on the theory and structure of the USGS groundwater flow model MODFLOW. The second five day session focused on project applications in which students were encouraged to develop models that address potential water management issues that would occur within Ethiopia.

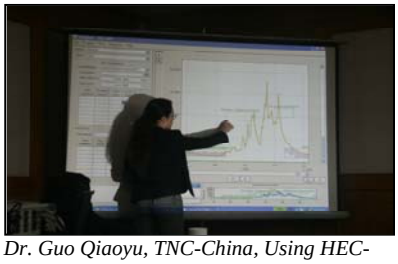
Environmental Flows Workshop - Yangtze River Basin, China

By John Hickey, P.E.

In October 2008, HEC staff participated in a field trip, symposium, and workshop that focused on water management challenges in the Yangtze River Basin, China. The field trip included visits to the Xiangjaba Dam construction site, the Upper Yangtze Native Fish Reserve, and a flood retention basin near Jingzhou, China.

The symposium was entitled Three Gorges Project and Yangtze River Water Resources Development, Utilization and Protection. It was sponsored by the China Three Gorges Project Corporation, the Chiangjiang Water Resources Commission, International Hydropower Association, the Nature Conservancy, and World Wildlife Fund. Topics focused on river basin management with an emphasis on the sustainable generation of hydropower.

The purpose of the workshop was to define the managed river flows needed to sustain the ecosystems of the Upper Yangtze River's Native Fish Reserve. The Native Fish Reserve, which includes more than 350 kilometers of the mainstem Yangtze, is located upstream of the Three Gorges Dam reservoir and downstream of a cascade of dams currently under construction (Xiangjaba is the lowermost of these projects).



Dr. Guo Qiaoyu, TNC-China, Using HEC-RPT to Develop Environmental Requirements

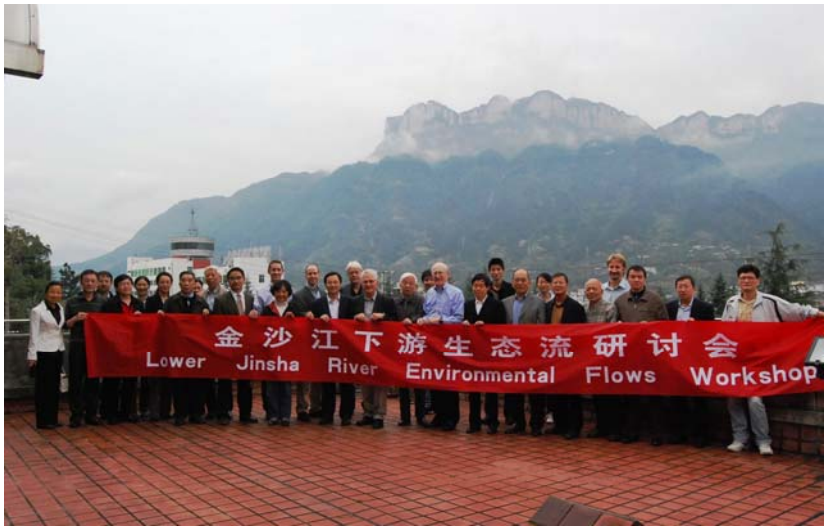
continued on page 11

International Activities (continued)

Environmental Flows Workshop - Yangtze River Basin, China (continued

continued from page 10

This environmental flow workshop was co-organized by the China Three Gorges Project Corporation and the Nature Conservancy and attended by approximately thirty biologists, hydrologists, and engineers. During the two-day workshop, participants reached an initial consensus on the flow and water temperature conditions needed to support key native fishes in the Reserve. These recommendations will be considered from an operational perspective for the four large reservoirs that are planned for construction on the Upper Yangtze River above the Reserve.



Lower Jinsha River Environmental Flows Workshop Attendees

HEC Software

Several recent releases of HEC software are detailed in the Director's Comments (see page 2) of this newsletter. Releases include:

- HEC-HMS, Version 3.3
- HEC-FDA, Version 1.2.4
- HEC-SSP, Version 1.0
- HEC-EFM, Version 1.0

HEC software is available electronically through the HEC web site (www.hec.usace.army.mil). Although our software is developed to meet the needs of the U.S. Army Corps of Engineers' planning and engineering communities, we do make our software available to the public whenever appropriate. HEC software that we make available for download on our web site may be used by individuals outside of the Corps of Engineers without charge, subject to the Terms and Conditions for use of HEC Software. Note that HEC cannot provide direct user assistance or support for its software to non-Corps users.

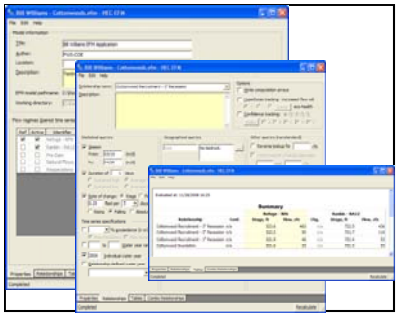
If you have any questions regarding HEC software or this issue of the newsletter, please contact Ms. Penni Baker (email: penni.r.baker@usace.army.mil) of our office.

Introducing the Ecosystem Functions Model (HEC-EFM)

By John T. Hickey, P.E.

The Ecosystem Functions Model (HEC-EFM) is now available for download at HEC's website. EFM is designed to help study teams determine ecosystem responses to changes in the flow regime of a river or connected wetland.

HEC-EFM analyses involve: 1) statistical analyses of relationships between hydrology and ecology, 2) hydraulic modeling, and 3) use of Geographic Information Systems to display results and other relevant spatial data. Through this process, study teams are able to visualize and define existing ecologic conditions, highlight promising restoration sites, and assess and rank alternatives according to predicted changes in different aspects of the ecosystem.



Primary user interface of HEC-EFM , including an output table display statistical results for Cottonwood recruitment on the Bill Williams River

Though initially released to the web in July 2008, earlier versions have already been applied to a diverse group of rivers, including the Sacramento, San Joaquin, Mississippi (Pool 25), Truckee, and Savannah Rivers. The latest application is for the Bill Williams River in Arizona where EFM is being used to investigate the establishment of riparian tree seedlings and the removal (via high flows) of existing vegetation.

Since its initial web release, there have already been more than 1,000 downloads of EFM. Future versions will include

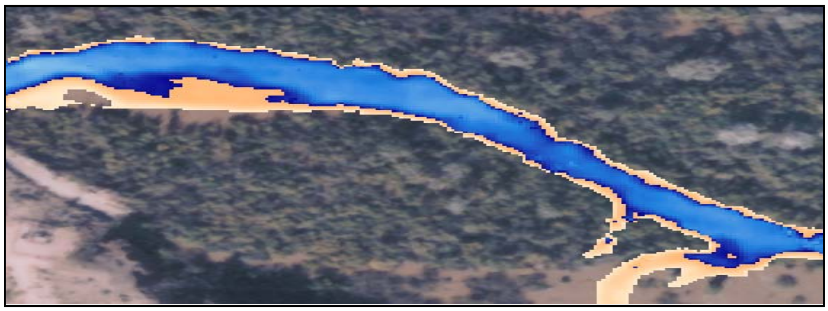
continued on page 12

HEC Software (continued)

Introducing the Ecosystem Functions Model (HEC-EFM) (continued)

continued from page 11

enhanced user controls for managing output, units systems, and statistical queries. New accessories are being developed for viewing computational output (EFM Plotter) and performing spatial calculations (GeoEFM). If you have questions regarding the EFM software please contact Mr. John Hickey (email: john.t.hickey@usace.army.mil) of our office.

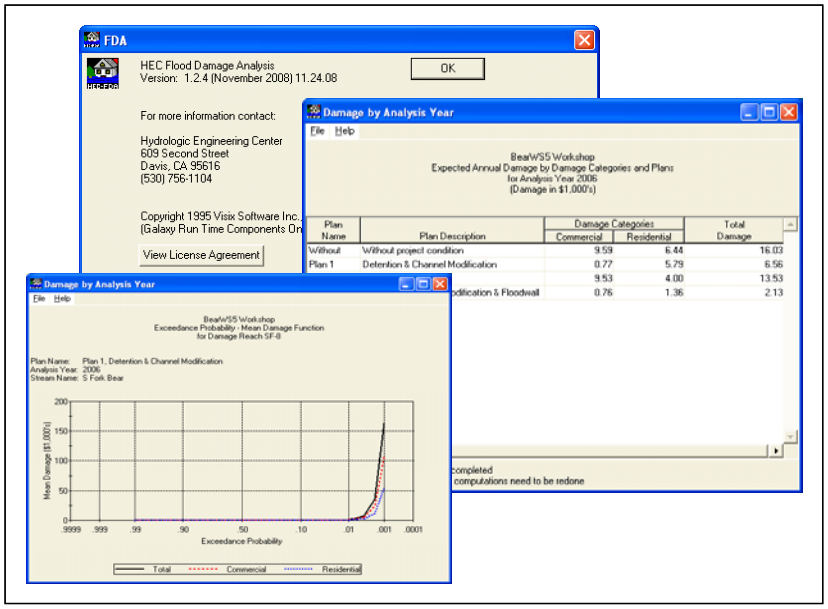


GIS Output from HEC-EFM Analysis (Bill Williams River)

HEC-FDA Version 1.2.4

By Penni R. Baker

The HEC-FDA software provides the capability to perform an integrated hydrologic engineering and economic analysis during the formulation and evaluation of flood risk management plans. The software follows functional elements of a study involving coordinated study layout and configuration, hydrologic engineering analyses, economic analyses, and plan formulation and evaluation. The model will be used continuously throughout the planning process as the study evolves from the base year without-project condition analysis through the analyses of alternative plans over their project life. Hydrologic engineering and economics (flood inundation damage analyses) are performed separately, in a coordinated manner after specifying the study configuration and layout, and merged for the formulation and evaluation of the potential flood risk management plans.



HEC-FDA Version 1.2.4

Version 1.2.4 of the Flood Damage Reduction Analysis (HEC-FDA) software is now available. This version is an update to Version 1.2, which was released to the general public in March of 2000. Several fixes have been made in Version 1.2.4 which are listed:

- Greater accuracy in the calculation of the median and mean annual exceedance probabilities for the project performance reports.
- A damage reach may contain both a geotechnical failure function as well an interior-exterior stage function; previously, a damage reach could contain either but not both.
- A change has been made in the calculation methodology for "average" probability functions; although these are not used in the calculation of expect annual damage (EAD), they do indicate an "average" curve based on those generated during the Monte Carlo simulations.
- The algorithm for computing EAD and project performance when there is a geotechnical failure has been changed. The calculations give greater accuracy in the results within the failure zone when the difference in elevation is small between the probability of failure (PFP) and probability of non-failure points (PNP). However, if the difference in elevation between the PFP and PNP points is large, the user must enter enough points in the geotechnical failure curve to adequately define the probability function in that range. Version 1.2.4 uses the points from the geotechnical failure curve in the geotechnical failure range as the calculation

continued on page 13

HEC Software (continued)

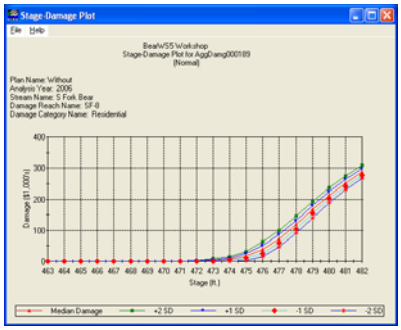
HEC-FDA Version 1.2.4 (continued)

continued from page 12

points rather than the possibly more detailed internal calculation points that otherwise would be used.

- When computing stage-damage for structures that have a depth-direct dollar damage function, the price index is now applied to the dollar amounts; previously, the direct dollar values were not adjusted by the price index.
- Graphical discharge-probability and stage-probability functions are stored both in binary fields and in a memo field in tab-delimited format. Likewise, the transform flow function is stored in a memo field as tab-delimited data. The data in the tab-delimited memo field is used in calculations and can be edited using dBASE or MS Access.
- The mean and median annual exceedance probabilities (AEPs) are stored in the database with five rather than three digits to the right of the decimal point.
- For Log Pearson Type III discharge-probability functions, calculations are carried out to an exceedance probability of 0.0001 for greater accuracy in the project performance calculations.
- When water surface profiles are imported as a delimited text file, you can now import a large number of cross-sections. Previously, you could correctly import a maximum of ~1,000 cross-sections from a delimited file. HEC-FDA has been tested for importing a stage-probability water surface profile set with 100,000 cross-sections. However, it is very slow to display the profile input dialog.
- It is now allowable to have negative stages in input stage-probability functions.
- For Log Pearson Type III discharge-probability functions, the confidence limits are now computed for the 25% and 75% limits. They previously computed at +1 and -1 standard deviations but were labeled as 25% and 75%.
- The equivalent annual damage is calculated properly when the most likely future year is beyond the period of analysis.
- A fix for the importing of water surface profiles and all water surface profile assignments has been included.
- For stage-probability functions which have a steep slope followed by a very flat slope for rare exceedance probabilities, HEC-FDA Version 1.2.4 will use the calculated uncertainty about the flat portion of the function in the expected annual damage (EAD) and project performance computations.

Not all of the fixes are covered in this article, for further details please see the HEC-FDA web page on the HEC web site (http://www.hec.usace.army.mil/software/hec-fda). For further information regarding HEC-FDA contact hec.fda@usace.army.mil) or Penni Baker (penni.r.baker@usace.army.mil) at HEC.



Stage-Damage Plot - HEC-FDA

HEC-SSP Version 1.0

By Matthew Fleming

Version 1.0 of the Hydrologic Engineering Center's Statistical Software Package, HEC-SSP, was officially released on August, 2008. The HEC-SSP program can be used to perform a frequency analysis of hydrologic data. Four main steps are followed when using HEC-SSP to perform a frequency analysis: add background maps, import hydrologic data, perform the analysis, and view results.

Currently, the HEC-SSP software can load the following types of map layers: USGS DLG, AutoCAD DXF, shapefile, Raster Image, USGS DEM, Arc Info DEM, ASCII NetTIN, and Mr Sid. Background map layers of rivers, watershed boundaries, and urban areas can be useful for visualizing the study area and identifying data locations.

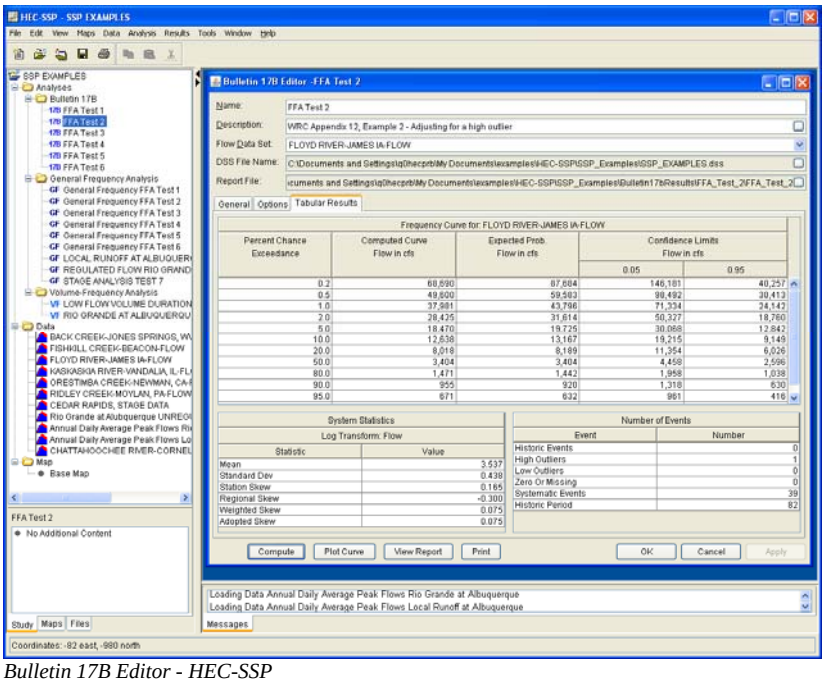
Hydrologic data can be imported into an HEC-SSP study from an existing HEC-DSS file, directly from the USGS, from an Microsoft Excel® file, or entered manually. Once data are brought into HEC-SSP, they can be plotted for visual inspection and metadata can be specified to document the data. Geographic locations can be specified as part of the metadata and HEC-SSP will plot the data along with other map layers.

HEC-SSP Version 1.0 supports three types of analysis: Bulletin 17B, General Frequency, and Volume-Duration Frequency. The Bulletin 17B analysis allows the user to perform annual peak flow frequency analyses. The software

continued on page 14

HEC Software (continued)

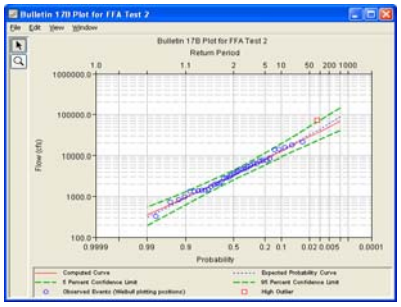
HEC-SSP Version 1.0 (continued)



Bulletin 17B Editor - HEC-SSP

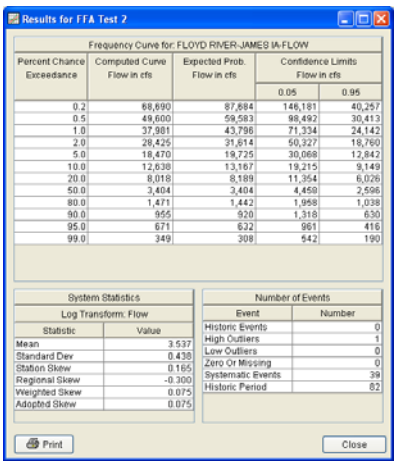
follows guidelines in Bulletin 17B, "Guidelines for Determining Flood Flow Frequency", by the Interagency Advisory Committee on Water Data. The General Frequency analysis allows the user to perform annual peak flow frequency analyses by various methods. Additionally the user can perform frequency analysis of variables other than peak flows, such as stage and precipitation data. The Volume-Duration Frequency analysis allows the user to perform volume-duration frequency analyses on daily flow data. The volume-duration frequency analysis can be used to help generate synthetic inflow hydrographs for a reservoir analysis or flow-duration information for an environmental study. All three analysis types provide methods for dealing with broken records, zero flood years, low and high outliers, and historic events. The program also provides options that let the user choose the plotting position method, frequency ordinates, and confidence limits. In the case of the General Frequency and Volume-Duration Frequency analyses, the user has the option of choosing whether to use log transform and the analytical distribution, and the option to manually enter the distribution statistics or to fit a curve graphically to the data. Additional options for a Volume-Duration Frequency analysis include choosing whether to analyze annual minimums or maximums and the date when the analysis year begins.

Output from an analysis includes graphs, summary tables, and report files. Result graphs include the systematic data plotted using the specified plotting position method, historic data, the computed and/or user-specified frequency curve, and confidence limits. The user can modify the plot properties, like line styles and axis names, in order to create a report quality graph.



Bulletin 17B Plot - HEC-SSP

Output in the summary tables includes ordinates of the frequency curve at user-defined frequencies, the computed and user-defined statistics, and the number of outliers, historical events, and zero flow or missing years. The report file is a comprehensive summary of the analysis, and it lists all of the input data, plotting positions of the data points, intermediate results, each of the various statistical tests performed (i.e. high and low outliers, historical data, etc…), and the final results. This file is useful for understanding how the software arrived at the final frequency curve.



Results for FFA Test 2

Frequency Curve for: FLOYD RIVER-JAMES IA-FLOW

Percent Chance Exceedance	Computed Curve Flow in cfs	Expected Prob. Flow in cfs	Confidence Limits Flow in cfs	
			0.05	0.95
0.2	68,690	87,684	146,181	40,257
0.5	49,600	59,583	98,492	30,413
1.0	37,981	43,796	71,334	24,142
2.0	28,425	31,614	50,327	18,760
5.0	18,470	19,725	30,068	12,842
10.0	12,638	13,167	19,215	9,149
20.0	8,018	8,189	11,354	6,026
50.0	3,404	3,404	4,458	2,596
80.0	1,471	1,442	1,958	1,038
90.0	955	920	1,318	630
95.0	671	622	961	416
99.0	349	308	542	190

System Statistics — Log Transform: Flow

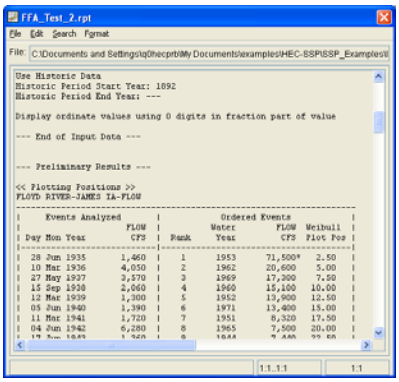
Statistic	Value
Mean	3.537
Standard Dev	0.438
Station Skew	0.165
Regional Skew	-0.300
Weighted Skew	0.075
Adopted Skew	0.075

Number of Events

Event	Number
Historic Events	0
High Outliers	1
Low Outliers	0
Zero Or Missing	0
Systematic Events	39
Historic Period	82

Print | Close

HEC-SSP Summary Table



FFA_Test_2.rpt

```
Use Historic Data
Historic Period Start Year: 1892
Historic Period End Year: ---

Display ordinate values using 0 digits in fraction part of value

--- End of Input Data ---

--- Preliminary Results ---

<< Plotting Positions >>
FLOYD RIVER-JAMES IA-FLOW
```

Knents Analyzed			Ordered Events			
Day Mon Year	FLOW CFS	Rank	Water Year	FLOW CFS	Weibull Plot Pos	
28 Jun 1935	1,460	1	1953	71,500*	2.50	
10 Mar 1936	4,050	2	1962	20,600	5.00	
27 May 1937	3,570	3	1969	17,300	7.50	
15 Sep 1938	2,060	4	1960	15,100	10.00	
12 Mar 1939	1,300	5	1952	13,900	12.50	
05 Jun 1940	1,390	6	1971	13,400	15.00	
11 Mar 1941	1,720	7	1951	8,320	17.50	
04 Jun 1942	6,280	8	1965	7,500	20.00	

HEC-SSP Report File

For further information regarding HEC-SSP, please contact Mr. Matthew Fleming (email: matthew.j.fleming@usace.army.mil) of our office.

HEC Software (continued)

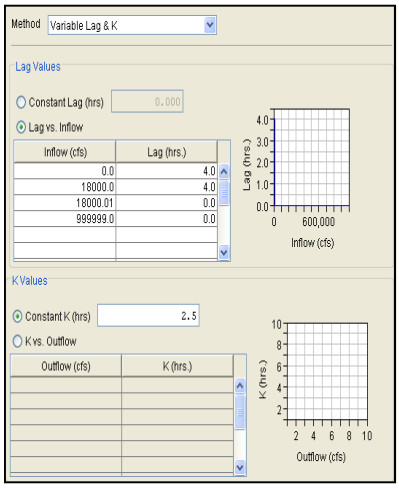
HEC-ResSim Version 3.1 Development

By Joan T. Klipsch, P.E.

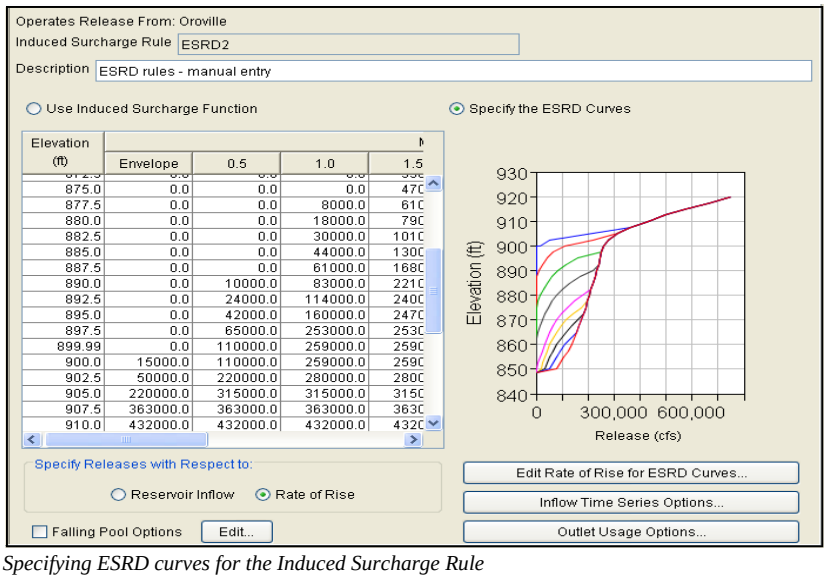
The next release of HEC-ResSim, Version 3.1, HEC's modeling program for reservoir simulation, has been in development for almost two years. Beta testing began this past summer and is almost complete, allowing HEC to project a release date for late January 2009. Included in this release are several new features as well as some great enhancements to existing features. Most of these developments have been made possible through some unique interagency projects and resource sharing. Here are some of the highlights:

ESRD Operations – modelers can now directly enter the family of curves represented on the "Emergency Spillway Release Diagram" found in most water control manuals for Corps-operated flood-control reservoirs. This was one of several enhancements supported by the "Forecast Coordinated Operations" team formed by the Yuba County Water Agency, California, and included members from the California Department of Water Resources, the California-Nevada River Forecast Center of the National Weather Service, the Sacramento District of the US Army Corps of Engineers, and the consulting firms of Bookman-Edmonston (a division of GEI Consultants, Inc.), David Ford Consulting Engineers, and MBK Engineers.

Variable Lag and K Routing – a standard routing method used by National Weather Service (NWS) River forecasters has been added in support of two NWS related projects: 1) a Flood Operations model for the Delaware River Basin Commission and 2) the integration of HEC-ResSim into the NWS River Forecasting System.

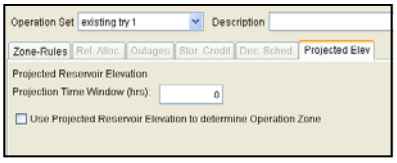


Lag & K Routing Editor



Specifying ESRD curves for the Induced Surcharge Rule

Operation for Projected Pool – a new feature to compute "where would the reservoir be in X hours if it continued to make the current release" with the option to use that projected pool elevation to select the operating zone rather than the current elevation. Resources for the addition of this feature were provided by the Lower Colorado River Authority (LCRA), Texas, to support one of their authorized flood control operating strategies. This feature has been implemented in a very generic way and, if applied to other river system models, could provide some interesting insights into alternative operating schemes



Projected Pool Elevation Tab - Reservoir Operations Editor

Be sure to carefully review the Release Notes that will be provided with the Version3.1 release. Brief descriptions of all the new or enhanced features will be there as well as instructions for migrating models developed in an older version of HEC-ResSim into the newest version.

For questions or comments regarding HEC-ResSim, please contact Ms. Joan Klipsch (email: joan.d.klipsch@usace.army.mil) of our office.

HEC Personnel

Retirement - Marilyn B. Hurst

By Penni Baker

Long-time HEC employee, Marilyn B. Hurst (a.k.a MBH) has decided to retire from federal service after 42 years on 2 February 2009. Marilyn started work at HEC in January 1971, but her federal service started in June 1967 at Ellington Air Force Base in Houston, Texas. Marilyn started out as a base locator (basically receiving telephone calls from people looking for someone on the base), moved to consolidated mailroom clerk, and then to personnel clerk where she maintained personnel records for the Reserve unit. During her stint as mailroom clerk she had the opportunity to chat with lots of people, and one of those people is her husband of almost forty years Phil, who eventually went to work for the US Postal Service.

In January of 1971 she joined HEC as a Computer Technician in the Special Assistance Branch and will finish her career at HEC as an IT Specialist in the Water Resources Systems Division. Her work has mainly focused on engineering work, with terrific mentors such as Herb Hereth, Bill Johnson and Harold Kubik, she learned to use the "tools of the day" - USGS Quad sheets, planimeters (compute the drainage area of a subbasin), and wheelies (compute the length of the streams) - to obtain hydrologic data. This data was then transferred to a data form, using a keypunch machine, a deck of computer cards was created for input to HEC software. The deck of cards was then sent to a mainframe computer via courier, and then the next day received the results back via the courier ("one run a day").

In the late 1970's, early 1980's she became involved with reservoir simulation modeling, using such HEC products as HEC-3, HEC-5C, POW-5, and finally HEC-5 which covered conservation, hydropower, and flood control, making it a very complex and powerful piece of software. In fact, some have coined HEC-5 to be "the free world's most powerful program". Marilyn applied HEC-5 to various studies, the most famous is the ACT/ACF (Alabama-Coosa-Tallapoosa/ Apalachicola-Chattahoochee-Flint). These two river systems extend through three states; Georgia, Florida, and Alabama.

During her involvement with HEC-5, she fell under the tutelage and guidance of Bill Eichert, Vern Bonner and Richard Hayes - reservoir simulation gurus. With their expertise, encouragement, and teamwork Marilyn became HEC's resident expert on reservoir simulation, especially after these gentlemen retired.

With the arrival of the PC, the software world changed, and for the past several years Marilyn's involvement has been with HEC-ResSim, which is even more complex and capable than HEC-5. She is teamed with Joan Klipsch on developing, maintaining, and teaching ResSim. The cover story (see page 1) is about the Mobile District modernizing its ACT/ACF models using HEC-ResSim. Once again Marilyn is very involved in this effort from collecting data to creating HEC-ResSim models for the study area.

Marilyn has felt very fortunate to have worked at HEC, and HEC as felt very lucky to have her as an employee. The author of this article has worked with Marilyn for over thirty-four years and will miss the intense attitude towards detail, the warmth and mother-den nature, and a sense of humor that lights a room and lightens your soul.

Marilyn's retirement party will be on 31 January 2009, at the Sterling Hotel (located in downtown

Sacramento), and will start at 3:00 p.m. There will be a buffet with a no-host bar. Ms. Penni Baker is in charge of the event and will be providing further details in a flyer. If you wish to attend you need to contact her for details (the same information will be posted on the HEC web site). Also, if you want to send a message to Marilyn, a "retirement book" is being put together that will include messages and pictures. Contact information for Ms. Baker is penni.r.baker@usace.army.mil, phone number is (530) 756-1104, and of course you can mail items to the HEC address in care of Ms. Baker.