ADVANCES in Hydrologic Engineering

Spring 2010

Director's Comments

By Christopher N. Dunn, P.E., D.WRE

At the request of the government, I recently completed an on-line survey about my job satisfaction. The survey asked the usual questions about health benefits, etc., but they also asked the question, "What is the primary reason why I like my job?" There were five possible reasons I could choose from: "Is it the people I work with, the way I get to use my skills, the interesting and varied work, the pay, or the job security?" The answer had to be all of the above but that wasn't a choice. I do get to work with some of the best people on some of the most interesting water resources projects throughout the nation, and in this economy, I'm not going to suggest the pay and the job security are not important. Let's just say I'm blessed to be in the situation I'm in.

The Hydrologic Engineering Center is likewise experiencing another busy and productive year. We continue to be involved in two American Recovery and Reinvestment Act (ARRA - Stimulus) activities, a myriad of reimbursable projects, research and development activities, training through the Corps' PROSPECT program and through reimbursable efforts at home and abroad. Some of these activities are described in this edition of the HEC newsletter. They include HEC-RAS' adoption by the National Weather Service and also by the country of Hungary as their one-dimensional water surface

continued on page 2

HEC's Accelerated CWMS Deployment Campaign

By Thomas A. Evans, Ph.D. & William J. Charley, M.S., P.E.

HEC is participating in the American Recovery and Reinvestment Act (ARRA) by working with three engineering consulting firms to deliver fully functional Corps Water Management System (CWMS) model watersheds to 11 Corps offices. The project, called Accelerated CWMS Deployment Campaign (ACDC) will enhance the Corps' capability to make well-informed, operational decisions about reservoirs and water control systems. The final product will be operational CWMS watersheds and any technology transfer needed for the Corps office to effectively use CWMS for the chosen basin. The intent is not to develop only models, but a complete CWMS implementation that includes the models.

The project expands, at an accelerated pace, the availability of advanced information technology resources for hydrometeorological data management, display, and dissemination; watershed runoff forecasting; flood stage prediction; reservoir operation analysis; and flood impact and consequence analysis, typically including HEC-HMS, HEC-RAS, HEC-ResSim, and HEC-FIA models as well as data collection and visualization programs.

In keeping with the intent of the ARRA, the work is being done by US contractors. HEC has used existing blanket purchase agreement (BPA) contracts with David Ford Consulting Engineers, Riverside Technology Inc., and WEST Consultants to carry out the work. The BPA contractors rely upon their own staff and staff of district water management or hydrology & hydraulics IDIQ contractors to complete the technical work. Ford is serving as the overall project coordinator, with HEC managing the contracts, providing oversight, and providing technical support to the contractors.

Substantial work on ACDC started in late summer 2009 with the selection of eight watersheds for deployment: the Puyallup River (Seattle district); the Santa Ana River (Los Angeles district); the Red River (St. Paul district); the Missouri River (Northwest division); Buffalo Bayou (Galveston district); the Cumberland, Tennessee and lower Ohio Rivers (Great Lakes and Ohio River division); the Apalachicola,

continued on page 4

In This Issue:

Director's Comments (continued)

continued from page 1

profile program (kudos to the HEC-RAS team), our work internationally with activities in Korea, Guyana, Switzerland and Hungary, the accelerated CWMS deployment campaign, and the extensive collaboration with our Northwest Division on their Columbia River Treaty study. Also discussed in this newsletter is the release of two new pieces of software and a description of our FY10 and FY11 PROSPECT programs. As you read, you will see that our program is an exciting and varied one.

While the description of the accelerated CWMS deployment campaign is our cover story, the other ARRA project is not addressed. Our second ARRA activity is the reservoir and water quality modeling for the Mobile District. It is in support of the Alabama-Coosa-Tallapoosa (ACT) and Apalachicola-Chattahoochee-Flint (ACF) River basins study in the Southeastern part of the country. This highly sophisticated study has been ongoing for years and we are helping them use HEC-5Q to perform the reservoir water quality modeling.

International Activities:

Many of our recent international activities are discussed in this newsletter. However, two other noteworthy activities are not mentioned. They are the hydrologic modeling for the Ogaden Basin in Ethiopia and the watershed assessments in Afghanistan. The hydrologic modeling in Ethiopia began with H&H training, which then led to the hydrologic model development. Our engineers presented hydrologic modeling training in Addis Ababa, Ethiopia as part of a continuing capacity building effort. Funded by the Naval Facilities (NAVFAC) program, the participants acquired practical skills with GIS technology and hydrologic software to develop a hydrologic model for the Genale watershed of the Ogaden Basin. We have since been working with Ethiopian engineers to complete the Ogaden Basin modeling.

HEC has also resumed our watershed assessment study of the Helmand Province of Afghanistan. This effort is being led by the Corps' Transatlantic North office and is a multi-district effort. The goal is to identify possible small dam sites (5- to 10-m high) for impoundment of water for seasonal irrigation and micro-hydro power generation. The location of the sites is being made based on snowmelt and precipitation records, and terrain, soils and land use data. The identification of the sites is preliminary, as a full geotechnical evaluation for proper site selection is not being performed at this time. The focus on the smaller basins is so that local communities can operate and maintain these structures. There is no intention of providing flood protection. Instead the idea is to retain a portion of the seasonal runoff that can then be metered out over a longer growing season for the production of more and better crops. The results are due in FY11.

CWMS and RTS:

The long awaited deployment of version 2.0 of the Corps Water Management System (CWMS) has begun. Following a schedule approved by the CMWS Advisory Group, HEC has begun to push version 2.0 to approximately 40 offices within the Corps that have a water management mission. The goal of our Water Management Division is to have CWMS version 2.0 at every USACE water management office by the end of the calendar year. Before we released version 2.0, we went through a well defined testing plan including full field testing at a number of our Corps sites. 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 commercial Oracle database at the center of CWMS. It also includes the incorporation of RiverWare from CADSWES in Boulder, Co, the latest versions of the modeling programs and numerous enhancements. You can find more information about CWMS and other HEC software on the HEC website at www.hec.usace.army.mil/software/.

We are also excited about another product called HEC-RTS or Realtime Simulation. It will be a public release of the modeling components of CWMS and is scheduled for release shortly after the release of version 2.0 of CWMS. It was recently demonstrated in Tulsa for the members of the Corps' Southwestern Division water management/forecasting team and the response was very positive. Instead of having an Oracle database requirement like CWMS, HEC-RTS will let the user employ their own database along with the DSS (Data Storage System) that stores the time series data for the models implemented in HEC-RTS.

continued on page 3

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: Matthew M. McPherson, P.E., D.WRE

Director's Comments (continued)

continued from page 2

NEXGEN Software:

We released a number of new pieces of software since the last newsletter. These include: HEC-FDA 1.2.5, DSSVue 2.0.1, HEC-RAS 4.1, HEC-EFM 2.0 and HEC-HMS 3.4. While a more complete description of these tools and their enhancements can be found on our website, www.hec.usace.army.mil, I have included a short description of some of them here.

HEC-HMS, Hydrologic Modeling System, Version 3.4.
New simulation features were added to the HEC-HMS Version 3.3 software. These features include: a new option in the Snyder Unit Hydrograph transform method for specialized use in the Ft. Worth and Tulsa Districts, hydrologic order sorting for watershed elements, and improved results visualization. Parameter editors were upgraded to give visual identification of required data as compared to optional data. In addition, as with any new release, the identification and repair of a number of bugs also took place. Finally, a Validation Guide was published that describes the numerical tests used to verify that computed results are accurate and precise.

HEC-FDA, Flood Damage Reduction Analysis, Version 1.2.5.
About 18 months ago, HEC released HEC-FDA Version 1.2.4. We hadn't released a new version of FDA in nearly a decade so there was bound to be a few bugs. Version 1.2.5 addresses those bugs. These fixes include: several modifications to improve the speed of the software when a study includes a large number of damage reaches and plans, improvements in the speed of deleting records, and the trace output from the EAD calculations are now easier to read and understand. Additionally, changes were made to reduce the amount of trace output, the format was redone to make the trace output more understandable, there is improved speed when importing ASCII tab-delimited files, and modifications were made to the stage-probability graphical curves when the stage is negative or zero and for adjusting the uncertainty about graphical frequency curves.

Meanwhile, work continues in parallel with versions 1.4 and 2.0 of FDA. Version 1.4 will be the last release of FDA in its current incarnation. Version 2.0 implements the computational engine of version 1.4 in a contemporary Java-based environment, and permits integration with HEC-WAT. We are still hopeful that both of these versions could be released this fiscal year.

HEC-EFM, Ecosystem Functions Model, Version 2.0.
HEC-EFM version 2.0 is described in depth on page 6 in this newsletter.

HEC-DSSVue, Data Storage System Visual Utility Engine, Version 2.0.
HEC-DSSVue version 2.0 is described in depth on page 9 in this newsletter.

HEC-RAS, River Analysis Systems, Version 4.1.
Several new simulation features have been added to the program. Version 4.1 includes the following new features: RAS Mapper floodplain delineation capabilities, groundwater leakage capabilities for storage areas, water quality modeling enhancements, sediment transport modeling enhancements and accompanying additions to the User's Manuals and Help System. In addition, many improvements were made to the Unsteady Modeling capabilities, including the ability to use hydrologic routing reaches, a new flow data and boundary conditions editor, the use of contraction/ expansion losses, minor losses, and a new junction hydraulics option.

Other minor enhancements were also added to the RAS software. The development team has continued careful and systematic testing of the program. The results of that testing in combination with reports from users has allowed the identification and repair of various problems. Some minor glitches that did not affect results but caused problems in the program interface have been repaired without being specifically documented.

Other noteworthy software efforts include HEC's collaboration with ERDC on the continued integration of HEC-ResSim and CE-QUAL-W2 for modeling of water-quality constraints on the operations of one or more reservoirs. And, HEC and the USGS, in association with IHE-Deltares, are working to integrate HEC-RAS and the USGS MODFLOW software for a direct surface water to groundwater connection. After careful consideration, it was decided to use a method developed in Europe, called OpenMI, to facilitate this combination.

Closing thoughts:

While we currently have a heavy workload, the economic downturn proved things can change very quickly. The Corps projected budget picture does not look bright and therefore, it behooves us to continue looking for new and exciting projects. If you are interested in talking with us, please let us know.

Chris Dunn, P.E., D.WRE
Director

HEC Training Program: PROSPECT Course Schedule

By Matthew McPherson, P.E., D.WRE

FY 2010 PROSPECT Training Program

Course Number	Course Title (all classes located in Davis, CA)	Dates
123	Flood Frequency Analysis	17-21 May 2010
219	Hydrologic Engineering Applications for GIS	21-25 Jun 2010
188	Unsteady Flow Analysis with HEC-RAS	26-30 Jul 2010
178	Hydrologic Modeling with HEC-HMS – **Session 1**	16-20 Aug 2010
178	Hydrologic Modeling with HEC-HMS – **Session 2**	9-13 Aug 2010

This schedule is current as of April 2010. Please be sure to access the PDSC site for updated and correct training schedule information at http://ulc.usace.army.mil/Default.aspx.

The PROSPECT training program for FY 2010 started in October 2010 with the Steady Flow with HEC-RAS class and continued through four subsequent classes. There are four more classes remaining on the 2010 schedule. However, the only course that has room for additional students is the Hydrologic Modeling with HEC-HMS, which is separated into two sessions as noted in the course schedule above. A survey conducted in the summer of 2009 indicated sufficient interest to conduct two back-to-back sessions of this basic HMS course, and only a few seats remain available.

To register for our classes, please contact the appropriate section 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. A short description along with course agendas is also provided on HEC's web site under the Training tab (http://www.hec.usace.army.mil/training/course_sch.html). To obtain enrollment information, please contact the PDSC in Huntsville. When doing so, please note the course number, name, data, and location, and then contact:

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

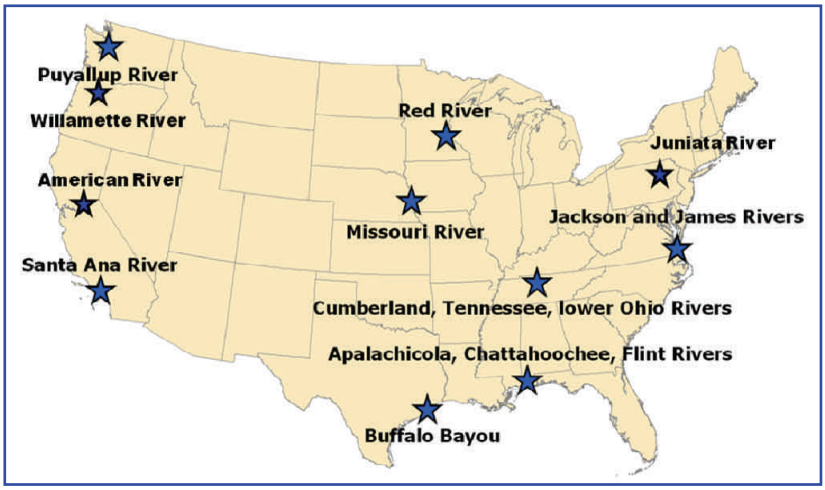
continued on page 5

HEC's Accelerated CWMS Deployment Campaign *(continued)*

continued from page 1

Chattahoochee and Flint Rivers (Mobile district); and the Jackson and James Rivers (Norfolk district). As these sites were planned, it became clear that available funding allowed for more work, so selected models for three additional watersheds were added in fall 2009: the American River (Sacramento district), the Willamette River (Portland district), and the Juniata River (Baltimore district).

The project is now well under way, with models and data collection processes partially completed at all 11 sites. Enough progress was made at the Red River site to provide assistance to the St. Paul district during the recent winter floods.



Above is a map showing the eleven sites where HEC is working on the Accelerated CWMS Deployment Campaign for the American Recovery and Reinvestment Act.

HEC Training Program: PROSPECT Course Schedule *(cont.)*

FY 2011 PROSPECT Training Program - Proposed

Course Number	Course Title (all classes located in Davis, CA)	Dates
209	Risk-Based Analysis for Flood Reduction Projects	18-22 Oct 2010
164	Water and the Watershed	15-19 Nov 2010
369	Advanced Applications of HEC-HMS	6-10 Dec 2010
122	Sediment Transport Analysis with HEC-RAS	10-14 Jan 2011
98	Reservoir Systems Analysis with HEC-ResSim	24-28 Jan 2011
58	Statistical Methods in Hydrology	7-11 Feb 2011
320	H&H for Dam Safety Studies	7-11 Mar 2011
161	Hydrologic Analysis for Ecosystem Restoration	11-15 Apr 2011
	Water Quality Modeling with HEC-RAS	2-6 May 2011
219	Hydrologic Engineering Applications for GIS	16-20 May 2011
155	CWMS Modeling for Real-Time Water Management	13-17 Jun 2011
67	Advanced Steady Flow Analysis with HEC-RAS	11-15 July 2011
152	Water Data Management with HEC-DSSVue	1-5 Aug 2011
57	Hydrologic Engineering for Planning	15-19 Aug 2011

This schedule is current as of April 2010. Please be sure to access the PDSC site for updated and correct training schedule information at http://ulc.usace.army.mil/Default.aspx.

HEC has submitted our proposed FY 2011 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 June 2010 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 2011 class list (above). If you are interested in one or more of the classes, please let the training program in your District/ Division know so that they can report your interest to the PDSC.

HEC is offering the traditional classes such as Water and the Watershed, Hydrologic Analysis for Ecosystem Restoration, and Risk-Based Analysis for Flood Reduction Projects, along with a class that has not been presented in a long time: Hydrologic Engineering for Planning, and a new course: Sediment Transport Analysis with HEC-RAS. To help ensure that all these classes will be taught, please sign up early if you are interested.

The registration process is the same for our FY 2010 and 2011 classes, so please view the FY 2010 PROSPECT Training Program section of this article (page 4) for registration information..

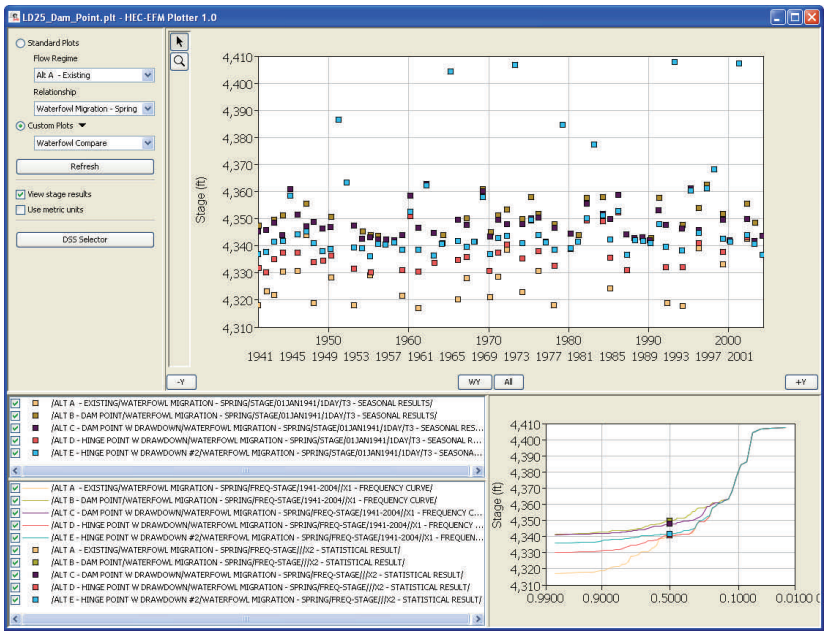
The above photo was taken during our Reservoir System Analysis with HEC-ResSim course offered on 11-15 January 2010.

The Ecosystem Functions Model—Version 2.0

By John T. Hickey, P.E.

Version 2.0 of the Ecosystem Functions Model (HEC-EFM) was released in November 2009. It has several new features, including expanded statistical capabilities, metric units, format options for model output, and an updated user guide. Also, this is the first version of EFM accompanied by its new software accessory, which is known as HEC-EFM Plotter.

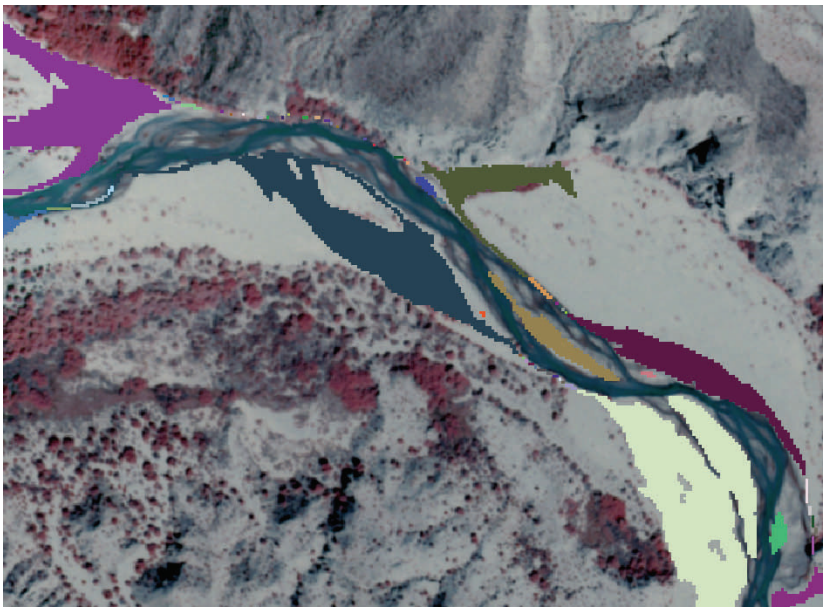
EFM Plotter is designed to help users view output and compare results for different water management scenarios and aspects of the ecosystem. Additionally, by displaying all of the computations that EFM performs, Plotter provides a way for teams to interactively explore and refine the parameters they are using to analyze connections between hydrology and ecology.



Use of Plotter to compare the seasonal pool stages that support waterfowl migration for five different reservoir management scenarios, Mississippi River, Pool 25. Data prepared by Andy Richter, MVS.

Work also continues on HEC-GeoEFM. HEC and the Environmental Systems Research Institute (ESRI) are partnering to develop GeoEFM as the spatial component of EFM. GeoEFM is being programmed as an extension for ArcGIS and packages several GIS functions that are commonly used in EFM applications, including management of spatial data sets, comparisons of spatial result areas for different flow regimes and relationships, and calculators for performing geographical queries. GeoEFM will also have a patch tool that analyzes habitat connectivity.

This is an exciting time for EFM. It is being used or considered for use by several organizations, within and outside of the Corps, for a wide range of projects, including dam removal, reservoir reallocations, river restoration, endangered species management, levee setbacks, and watershed assessments of ecosystem functions.



Use of GeoEFM to analyze the connectivity of simulated cottonwood seedlings produced during an experimental flood on the Bill Williams River, Arizona.

In support of these and other applications, HEC is working to prepare an EFM certification package for consideration by the Corps' Ecosystem Planning Center of Expertise (EFM is already listed as "approved for use" by the Corps' Engineering Community of Practice) and continues to pursue software development opportunities through Corps research and development programs.

If you have questions about EFM or ideas for its development or application, please contact John Hickey via email at john.t.hickey@usace.army.mil.

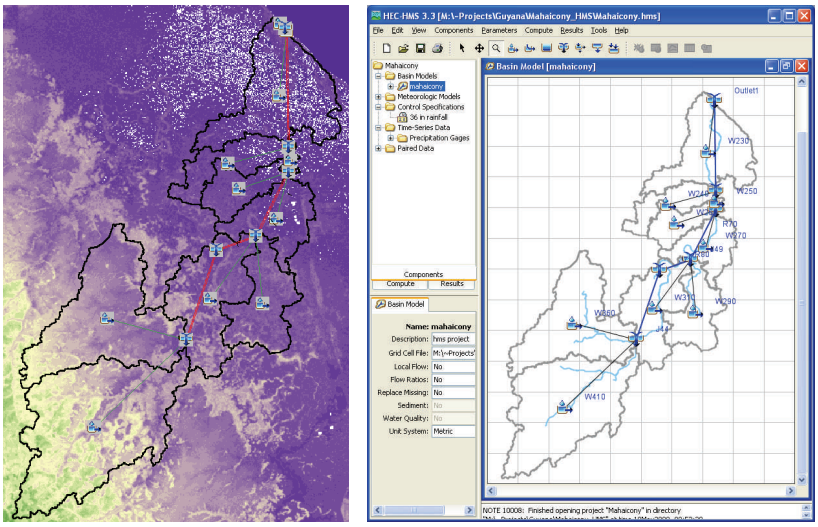
HEC would like to thank the Corps' Ecosystem Management and Restoration Research Program (EMRRP) and Corps Headquarters for supporting completion of version 2.0 of EFM and version 1.0 of Plotter.

Emergency Management Exercise in Guyana

By Stanford Gibson, Ph.D.

In 2005, the highlands of Guyana got 36 inches of rain in 8 hours. The subsequent flooding left 34 dead and 275,000 (over a third of the country's population) displaced. As a result, the U.S. Army Southern Command (SOUTHCOM) partnered with Guyana's Civil Defense Commission to conduct an emergency management exercise. Mark Jensen and Stanford Gibson were asked to participate from HEC.

Mr. Jensen and Mr. Gibson visited the Mahaicony River, cooperated with local scientists and engineers to collect, or estimate, the necessary data, and constructed hydrologic and hydraulic models of the system using HEC-GeoHMS, HEC-HMS, HEC-RAS, and HEC-GeoRAS. After the models were completed, HEC conducted a week-long modeling workshop for University of Guyana professors and government water scientists that represented at least seven separate organizations. The workshop introduced HEC's hydrologic and hydraulic software and several of the exercises were designed to give the students experience with the local model.



Model of the Mahaicony River in HEC-geoHMS (left) and HEC-HMS (right).

Photograph of the Mahaicony River in Guyana, South America.

After the class, SOUTHCOM and the Civil Military Emergency Preparedness (CMEP) conducted the exercise. A hypothetical storm event was specified and the various Guyanese agencies with emergency management responsibilities had to respond to the flooding. HEC representatives worked with local agency scientists as they used the model to predict the flooding extent, which informed those who dispatched emergency supplies and personnel.

HEC's involvement was well received by SOUTHCOM partners and the Guyanese agencies. Mr. Jensen and Mr. Gibson were even interviewed by local media and highlighted on the evening news. Professors at the University of Guyana plan to teach the HEC software as part of their water and environmental sciences curriculum. There are also plans to form an inter-agency Guyanese modeling team to replicate HEC's work on the Mahaicony and set up predictive, quantitative flood warning systems on other flood-prone rivers.

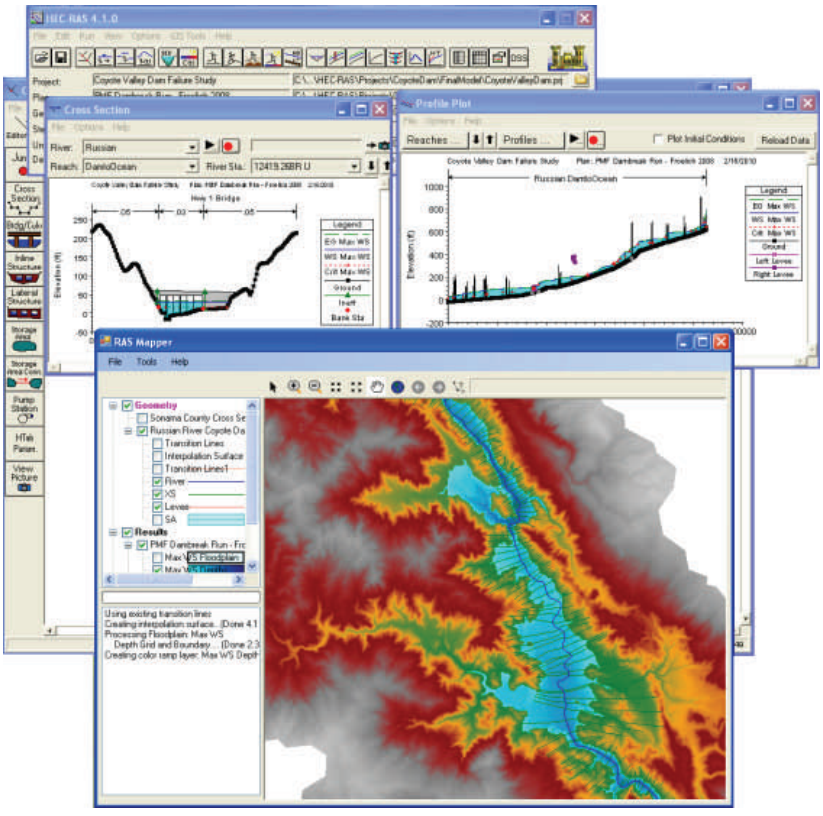
National Weather Service Adopts HEC-RAS

By Gary W. Brunner, P.E., D.WRE

The National Weather Service (NWS) has adopted HEC-RAS as its Unsteady Flow hydraulics model for Real Time River Forecasting. The NWS evaluated and tested several pieces of software for inclusion in their new real time forecasting system CHPS (Community Hydrologic Prediction System). The software they tested and compared were HEC-RAS (U.S. Army Corps of Engineers, Hydrologic Engineering Center), FLDWAV (National Weather Service), MIKE11 (Danish Hydraulics Institute, DHI), and SOBEK (Delft Hydraulics).

The NWS objectives for this hydraulic model review, as stated in their final report, were "to identify "state-of-the art" hydraulic models; to evaluate their capabilities and limitations in relevance to NWS operations; and to recommend the "best" model(s) that will be used instead of, or in addition to, the FLDWAV model. The ideal hydraulic model should be capable of simulating a range of complex water resources scenarios relevant to NWS operations using the most advanced methodologies through an easy to use interface." (Evaluation of Hydraulic Models in Support of NWS Operations, Final Report, NWS November 2007). The NWS model evaluation team concluded that HEC-RAS was the model they wanted to go forward with in the development of their new real time forecasting system.

The integration of HEC-RAS into the NWS CHPS system is now complete and is currently in the testing phase. Several of the existing FLDWAV models have been converted to HEC-RAS models and have been found to give as good or better results. The National Weather Service put together a set of software (fld2ras program) and guidelines for converting FLDWAV and DWOPER models to HEC-RAS. Many FLDWAV models are currently being converted to HEC-RAS, and some completely new models are being developed by the NWS river forecast centers across the country.



Above are some images of HEC-RAS capabilities. HEC-RAS allows you to perform one-dimensional steady flow, unsteady flow, sediment transport/mobile bed computations, and water temperature modeling.

Above is a map of the Ohio River outlined in red with some major tributaries outlined in blue.

A new model for the Ohio River system is jointly being developed between the National Weather Service, Ohio River Forecast Center and the U.S. Army Corps of Engineers, Ohio River Division. This model consists of the entire Ohio River (1100 miles), and its major tributaries, as well as 200 miles of the Mississippi river (100 miles downstream and 100 miles upstream of the junction with the Ohio River).

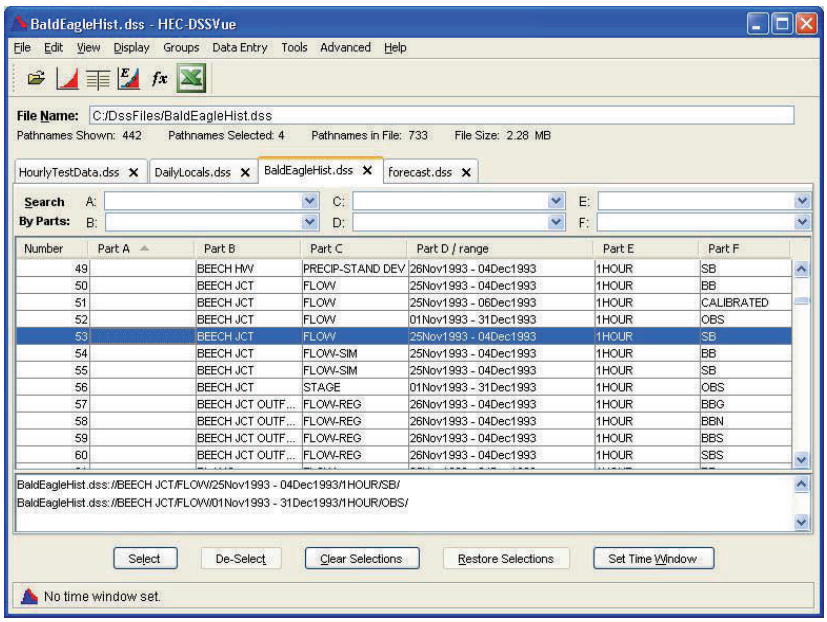
Above is the junction of the Ohio River, coming from the left, with the Mississippi River on the right.

This model also includes 20 locks and dams, levee systems, and many bridge crossings. The model will be used both by the National Weather Service and the Corps of Engineers for Real Time River Forecasting and operations of the dams contained on the tributaries.

HEC Releases HEC-DSSVue Version 2.0

By William J. Charley, M.S., P.E.

Last Fall, HEC released version 2.0 of HEC-DSSVue. This version has many significant improvements, including larger DSS file support, where files up to 8 GB can be used, and with significantly faster cataloging of DSS files. The main window of HEC-DSSVue has changed too; now several DSS files can be accessed at the same time via tabbed panes as shown in the image to the right.



HEC-DSSVue 2.0 Main Screen with Tabbed DSS Files

HEC-DSSVue Version 2.0 now supports additional data types as well, including the capability of storing and displaying .jpg, .pdf, .mp3, etc. files. By selecting one of these data sets from a DSS file, the native function can be applied. For example, a .pdf data set will be displayed in Adobe Reader, .jpg files in either a native viewer or HEC-DSSVue's picture viewer, and an .mp3 will play music through Media Player.

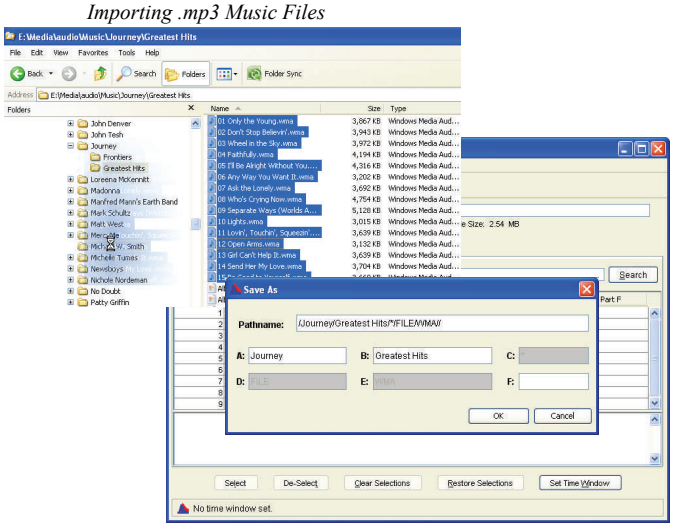
This updated version also supports "drag and drop." You can now drag a pathname onto an open plot or table to add that data set. You can drag pathnames from one DSS file to another to copy them or drag an entire DSS file into another DSS file. You can also drag files from Windows Explorer onto the main screen to import that data into DSS. When used in combination with opening multiple DSS files, this feature makes movement of records between files much faster and less error-prone than typing pathname parts and file names.

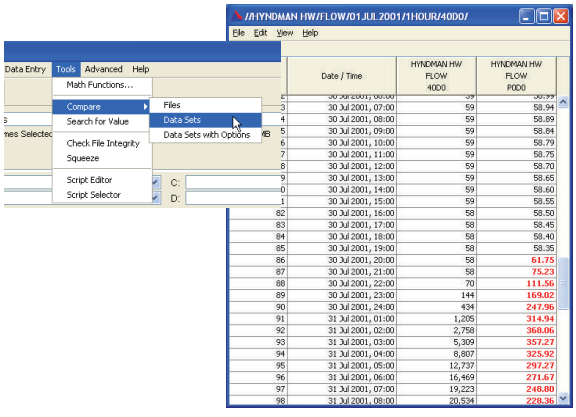
In addition, we added several data formats for importing data into DSS. These include SHEF (Standard Hyrdrometerologic Exchange Format), NCDC precipitation, temperature, etc., data from Microsoft Excel, DSSUTL Write Data files, WaterML, and an alpha version of a generalized time series import wizard.

Several math functions have also been added, including Duration Analysis, Frequency Plot, and functions to set and manipulate paired data and time series data sets.

Another notable improvement is the development of the tools and utilities feature. This includes "groups," which allow you to save a set of pathnames and use them later. This is useful for data that arrives on a daily basis, where you can plot, do math functions, etc., on data sets where only the time window has changed. Other important tool additions include Check File Integrity, Compare data sets, and Compare DSS files.

Importing .mp3 Music Files





Comparing DSS Data Sets

HEC Director Speaks in Seoul, South Korea

By Christopher N. Dunn, P.E., D.WRE and Brandee Robbins

This past November, HEC Director Mr. Chris Dunn got the opportunity to make a keynote presentation at the 1st International Conference on Policy and Research for Global Disaster Management (PR4GDM) in Seoul, South Korea. It was a three-day conference from 11-13 November 2009 and was hosted by NEMA (the Korean National Emergency Management Agency). The conference aimed to strengthen disaster response through disaster management technology and International R&D sharing and to discuss the feasibility of a collaborative International R&D program for global disaster management.

Above are some of the Keynote speakers from the 1st International Conference on Policy and Research for Global Disaster Management in Seoul, South Korea. HEC Director Christopher N. Dunn is all the way to the left in the front row.

Ten countries were represented as well as one member of the United Nations. The countries represented were Belarus, Canada, China, Hong Kong, Japan, Mongolia, Norway, Thailand, the United States and Korea. Topics ranged from Green Growth and Climate Change Adaptation, Typhoons, Fire Protection and Rescue/First Aid, Education and Training, Natural Disaster Management, Water Resources, IT and Spatial Information, and Institutional Approaches to Emergency Management. More than 400 people attended the conference, most of the participants being from Korea. One of the first keynote speakers was Mr. Phil Waters, Director of the U.S. Department of Homeland Security, Science and Technology Directorate, who made an interesting presentation on the activities of the Department.

Mr. Dunn spoke specifically on the Corps Water Management Systems (CWMS) software program for real-time water management. HEC has been developing and deploying this software for over a decade and is now releasing Version 2.0 to the Corps field offices. Mr. Dunn spent a majority of the presentation introducing the audience to CWMS. He also discussed the overall water management mission of the Corps and the purpose, development and deployment of the integrated water management system. He demonstrated how the Corps is proactively reducing threats to our population and property by forecasting floods and reservoir operations and, in turn, alerting emergency operation managers so they can take the appropriate steps to reduce damage and loss-of-life. Hard copies of all presentations were made available to all participants in one large bound publication. In addition, the presentations are going to be posted on the conference website: www.pr4gdm.org.

While in Korea, Mr. Dunn and Dr. Jay Pak (former HEC Hydraulic Engineer now working for the Corps' Korean office) met with representatives of the Korea Institute of Construction Technology (KICT), NEMA's National Institute for Disaster Prevention (NIDP) and K-water, formerly known as KOWACO, to continue investigating how the Corps could officially work with them. Both KICT and K-water already approached the Corps at the World Water Forum (WWF) in Istanbul in March 2009 about entering into such an agreement.

The Korean people and those who hosted the conference were extremely gracious, accommodating and friendly. They went out of their way to make sure all needs were met. The Koreans also asked HEC to participate in the 8th International Conference on EcoHydraulics in September 2010 in Seoul, South Korea. Dr. Hyo Seop Woo is the Conference Chair. Mr. Dunn talked with Dr. Woo while visiting KICT. HEC agreed to present a one-day workshop addressing ecosystem planning and the hydraulic analysis to support ecosystem planning. HEC will present tools such as HEC -EFM, HEC-RAS and HEC-GeoRAS and will also include workshops during the training.

The PR4GDM Conference will be held every other year in the November time frame. The next conference is planned for November 2011 in Seoul, South Korea.

HEC Support of the Columbia River Treaty Review Studies

By Michael Deering, P.E., D.WRE

The Columbia River Treaty was ratified in 1961 and affected in 1964. The treaty is an agreement between the United States and Canada to provide flood control and power benefits within regions of both countries. As a direct result of the treaty, four storage dams were built: Mica, Arrow, and Duncan Dams in British Columbia, Canada; and Libby Dam in Montana. These four projects doubled the storage capacity of the entire Columbia River system, increased control of the river flow, thereby decreasing the risk of major flooding events downstream, and provided an abundance of water for power generation.

The Columbia River is a shared resource, providing power and revenues to both the Pacific Northwest and British Columbia. While its headwaters are situated in British Columbia, only about 15 percent of the total Columbia River Drainage Basin is actually in Canada. However, 35 percent of the total annual volume and 50 percent of peak flood flows come from the Canadian portion of the basin.

Under the treaty, Canada is entitled to half of the downstream power benefits calculated based upon treaty procedures that do not reflect the current system operations (referred to as the Canadian Entitlement). Initially, Canada sold these rights to private interests in the United States, but since 2003, all of the Canadian Entitlement has gone to British Columbia Hydro and Power Authority (BC Hydro) for their use and/or resale.

The U. S. Army Corps of Engineers, Northwestern Division (CENWD), along with their regional partner, Bonneville Power Administration (BPA), is undertaking a series of studies to collect critical information to support a pending decision by the United States pertaining to the future of the treaty with Canada. Collectively called the "Columbia River Treaty 2014/2024 Review" (CRT 2014), the program is a regional effort within CENWD, requiring close coordination amongst the division headquarters and the three districts with geographic responsibilities within the Columbia River Basin, Portland, Seattle and Walla Walla districts. CEIWR-HEC is assisting the study team in preparing the overall HEC-WAT (Watershed Analysis Tool) watershed (with the flood risk management option), the generation of an HEC-ResSim model(s), the HEC-RAS model from Portland to the mouth, and the creation and application of an HEC-FIA model.

Columbia River Basin

The purpose of the technical studies is to document the base condition for the CRT 2014 review. The base condition will include an evaluation of the current treaty flood control operations (until 2024), and an evaluation of the base condition from 2025 to 2075. The base condition will be evaluated using the Flood Risk Management (FRM) compute option of HEC-WAT.

Risk Assessment with HEC-FRM

The major thrust of the CRT studies is to understand the flood risk management details of the current and potential future treaty operating scenarios as they relate to flood damages, hydropower, and system performance. These studies are currently performed using the tool Flood Damage Reduction Analysis (HEC-FDA). HEC-FDA provides the capabilities to evaluate the with and without treaty plans and compares the plans using expected damage and damage reduced benefits. The tool also develops project engineering performance metrics for comparison of alternatives in terms of Annual Exceedance Probabilities (AEP), Conditional Non-exceedance Probability (CNP) and long term risk. However, even with these capabilities, HEC-FDA still looks at a system of projects as a collection of independent projects. This issue and others raised by the National Research Council, current users of HEC-FDA and CEIWR-HEC have clearly shown that HEC-FDA needs to include explicit systems analysis capabilities. Other needs identified to improve HEC-FDA include: re-writing FDA's Monte Carlo sampling to address a combination of damage reaches; providing risk and uncertainty capabilities about non-structural measures, adding agricultural damage and project costs; providing correlated sampling of dependent relationships (e.g. rating curve versus the reservoir inflow/outflow curve); adding additional failure modes and features; analyzing impacts of project failure for residual risk requirements (e.g. loss-of-life); and addressing additional hydrology and hydraulic support of risk analysis (e.g. realistic physical limits on frequency analysis and update the equivalent record length

continued on page 12

Risk Assessment with HEC-FRM (continued)

continued from page 11

procedures). For these reasons, the U.S. Army Corps of Engineers, Institute for Water Resources (CEIWR) sponsored investigations into the development of a new tool to analyze complex riverine systems while implementing current flood risk analysis and systems requirements. FRM is a new compute option of the HEC-WAT software. FRM will use the HEC-WAT basic structure to assess risk in a life-cycle framework. The option's features include a systems approach, event-based sampling, the ability to do scenario analysis, and structure-by-structure, cost, non-structural, loss-of-life, and agricultural damage analysis. FRM is well suited to a large, complex system like the Columbia River Basin and is the preferred tool to describe the base condition and to evaluate the alternatives in the next phase of study. Given the current developmental state of FRM, the team will not rely exclusively on FRM's completion. All data and models developed in this phase will be appropriate inputs for either HEC-FDA or HEC-WAT with the FRM option. Alpha and Beta versions of HEC-WAT with FRM will be tested using the Columbia River Basin as a test study.

Reservoir Simulation Modeling with HEC-ResSim

Current reservoir projects contributing to flood control in the Columbia system include: Mica, Libby, Hungry Horse, Chelan, Dworshak, and Brownlee. These and other reservoirs on Columbia tributaries will be included in reservoir models to be developed using HEC-ResSim. The models will be used to simulate reservoir operations throughout the system during normal operations and flood emergencies in order to maintain a balance of flood control storage among the reservoirs, minimize flooding in high-flow periods, and return the system to a normal state as quickly as possible following a flood. The models will be used to determine storage requirements for flood control and conservation (including hydropower) for each reservoir in the system. The reservoir system models will be used to evaluate the effectiveness of future operating plans to be developed under the CRT studies.

Reservoir Optimization Modeling with HEC-ResPRM

Reservoir operations optimization will be conducted in conjunction with simulation modeling to support the refinement of operating rules and seek the ideal balance between system objectives. ResPRM will be used to determine best case scenarios for operating plans, and optimal operations will then be investigated for potential improvements to operating rules. These improvements might have otherwise been overlooked if only using the trial and error approach of simulation modeling. Trade-off relationships will also be developed between system objectives, particularly hydropower generation and flood control. This process will facilitate the selection and achievement of the desired system balance. Other objectives, including navigation, recreation, fish migration, habitat, cultural resources and water supply may be considered.

Consequence Modeling with HEC-FIA

Consequences will be computed using HEC-FIA including economic damages and loss-of-life estimates. Depth, duration, and velocity-gridded data would be passed from the spreading model to HEC-FIA for those computations. Currently, HEC-FIA is used to determine flood damage reduction benefits attributed to individual flood control projects (reservoirs, levees and diversions) and for real-time response activities. HEC-FIA is part of the Corps Water Management System (CWMS). For a specified event or for each fifty-year life cycle sequence, HEC-FIA can compute urban and agricultural flood damage, area inundated, number of structures inundated, and population at risk. Damage analysis of crops involves a complex series of factors and considerations. Among the parameters are the types of crop, season of the year, cropping patterns, duration and magnitude of flooding, and much more. Monetary damage values are determined from investment losses, mature-crop price values, harvest costs, and may include secondary business losses. The newest version of HEC-FIA includes a graphical user interface with GIS capabilities.

continued on page 13

HEC Support of the Columbia River Treaty Review Studies *(cont.)*

continued from page 12

Hydraulic Modeling with HEC-RAS

The current HEC-RAS model of the lower Columbia River (Bonneville Dam to the ocean) consists of an old UNET model that was converted to HEC-RAS. The current model has been used for a variety of activities by the District. For the Columbia River Treaty work, new topography is being collected. This topography includes aerial developed lidar that will be meshed with hydrographic surveys to form a complete terrain. HEC will be using this terrain to build a new HEC-RAS model for the Lower Columbia River. Work on the modeling is scheduled to begin in late June after receipt of the terrain data.

United Nations World Meteorological Organization

By William Scharffenberg, Ph.D.

The World Meteorological Organization (WMO) was established in 1950. It is a major agency of the United Nations and operates from a headquarters building in Geneva, Switzerland. WMO is the lead agency of the United Nations for issues with the Earth's atmosphere and weather, and the interaction of atmospheric processes with oceans and water resources. It is well known for establishing procedures for making meteorological measurements, establishing policies for trans-boundary issues such as aviation weather forecasts, and collecting data for use by the Intergovernmental Panel on Climate Change, among other activities. Nevertheless, hydrology forms an important, though small component, of WMO's work.

The United Nations World Meteorological Organization Headquarters

The United States participates in the WMO with exchanges coordinated by the National Weather Service International Activities Office at NOAA headquarters. The U.S. Geological Survey also participates and is a major source of knowledge on water resources. The U.S. Army Corps of Engineers recently began participating as well, providing focused knowledge on managing water resources, especially the management of flood flows. While other federal agencies have knowledge of water resources, the Corps contributes the experience that comes from operating 383 major dams and 8,500 miles of levees for flood management and other beneficial uses.

WMO recently established the Flood Forecasting Initiative, which aims to assist member nations, especially the developing nations, by improving their flood forecasting capabilities. The Initiative fits with WMO's mission because flood forecasting is tightly tied to short-term weather and climate forecasting. Much of the Initiative's work focuses on supporting the improvement of stream flow monitoring networks and promoting the establishment of new networks. There is also a focus on technology transfer and capacity building where countries with established flood forecasting centers provide guidance and training to countries still working to build an effective forecasting capability. All these efforts are carried out within the Integrated Water Resources Management framework that seeks to balance reducing the damaging effects of floods with the beneficial effects that periodic high flows bring to ecosystem health.

Dr. William Scharffenberg has participated in several efforts with the WMO. Most recently he represented the United States at a workshop of the Flood Forecasting Initiative in December 2009 at WMO headquarters. The workshop focused on developing a specific list of activities to achieve the goals of the Initiative. The group of experts made recommendations for research proposals, informative documents, training programs, and other capacity building efforts. When executed, the recommendations should lead to improvements in the abilities of member countries to forecast and manage floods. Using his experience as the lead developer of the Hydrologic Modeling System (HEC-HMS), Dr. Scharffenberg will be working with several other experts from the workshop to develop a proposal for a comparison of hydrologic forecasting models. The comparison will assist developing countries in selecting the best hydrologic forecasting model for their unique needs.

For more information, please contact William Scharffenberg (william.a.scharffenberg@usace.army.mil).

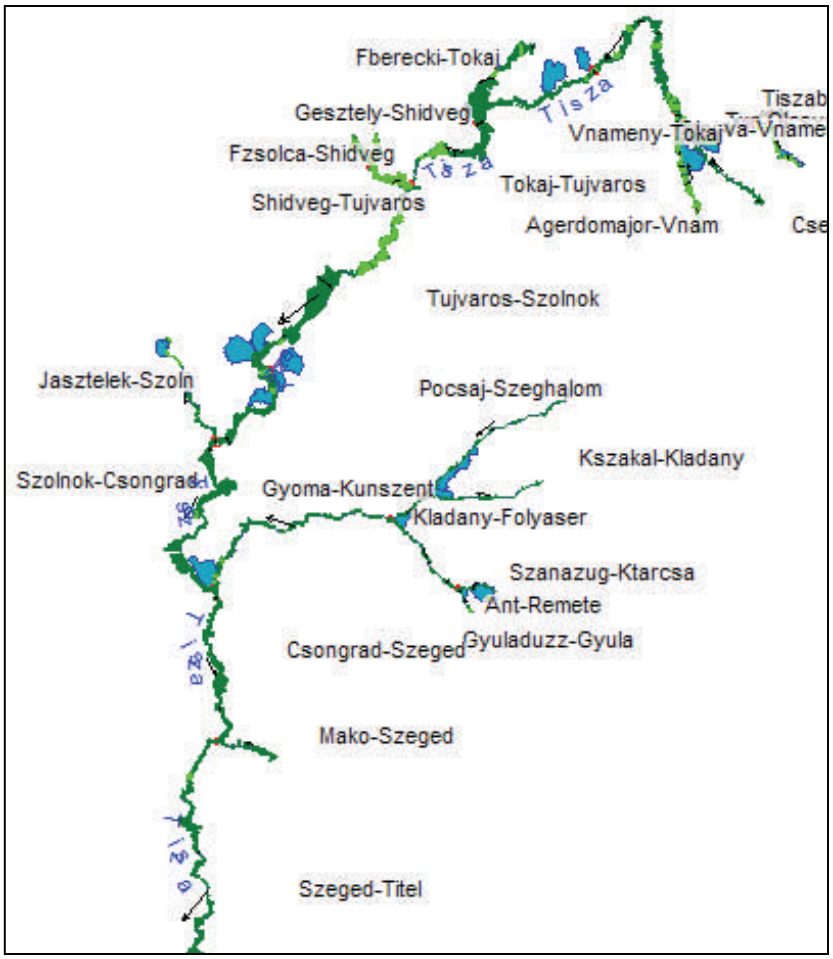
Hungary Adopts HEC-RAS

By Cameron Ackerman, P.E., D.WRE

Two HEC Senior Hydraulic Engineers, Cam Ackerman and Mark Jensen, were recently invited to Hungary by the Ministry of Environment and Water to conduct training on HEC's River Analysis System (HEC-RAS). The HEC-RAS modeling conference was held in Szolnok, Hungary and was used to raise public awareness of flooding issues and highlight the completion of an offline storage facility on the Tisza River near the town of Tiszaroff (note that "sz" in Hungarian is pronounced like an "s" and "s" is pronounced like "sh").

The modeling conference was organized by Dr. Sándor Kovács of the Middle Tisza District and Pal Hegedus of RBF Consulting. Opening presentations to more than 150 attendees were provided by László Kóthay, State Secretary for Water and Attila Lovas, Director of the Middle Tisza District. Cam gave the keynote presentation on the status of affairs of HEC, highlighting the latest software development activities and, specifically, the future plans for HEC-RAS. Local radio, television, and print journalists attended the beginning session where it was announced that the Hungary Ministry of Environment and Water has officially adopted the HEC-RAS program for performing all one-dimensional river modeling. It was very important for the Ministry management personnel to hear directly from HEC about the future of HEC-RAS, because they have made a five-year commitment to exclusively use RAS for river modeling. They were also very excited to hear that HEC is investigating the inclusion of a two-dimensional spreading model.

Approximately 40 Hungarian engineers from the various water Districts attended the latter portion of the conference for HEC-RAS training. Cam and Mark provided hands-on training on several specific HEC-RAS topics. The attendees enjoyed working with HEC-RAS and learning about new features and how to apply RAS to specific hydraulic issues to their current Tisza River RAS model which covers over 500 miles with more than 2000 cross sections and 100 structures.



HEC-RAS schematic for the Tisza River.

Following the HEC-RAS training, Cam and Mark were invited by Mr. Lovas to the Middle Tisza District office in Szolnok. The meeting consisted of a briefing of the District's responsibilities, water management activities, and, in large part, the seasonal flood-fighting efforts. There are two major rivers in Hungary, the Danube River and the Tisza River. Much of Hungary is extremely flat and the historic floodplain boundary is immense. Levees are the dominant flood protection measure and it appears that temporarily raising levees and repairing failed levees is standard practice during flood events. One interesting tool Hungarians use to prevent major levee failures are one -cubic-meter plastic blocks that are air-dropped into seepage and boil locations, and then filled on site with water.

A site visit to various projects on the Tisza River followed the briefing at the District office. Cam and Mark were taken along the upper Tisza River to look at flood management projects that are currently being completed by the

continued on page 15

Hungary Adopts HEC-RAS *(continued)*

continued from page 14

Ministry of Environment and Water. The ground surface around the Tisza River does not provide much relief (it is very similar to the Sacramento River valley); therefore, they have identified using lateral detention facilities to store flood waters as the best environmentally acceptable flood management alternative for reducing flood peaks. These storage areas are created using a ringed-levee approach that is tied back into the main river levees. The levees range from 1 to 6 meters high, but typically are just 2 or 3 meters high. The levees are constructed with a 5 meter crown with a 3 meter wide, paved access road and are extremely well maintained with only grasses allowed to grow on them. A superintendant lives on the river and is responsible for maintaining that stretch of the river. The impoundment is connected to the river using a gated structure with the intended operation to open the gates shortly before the peak arrives to store the peak flood waters, thereby reducing the flood peak. After the river stage has been lowered, the water is returned to the river. HEC-RAS is well-suited to model this operation technique using the "Rules" capability for gated structures.

Because the detention areas have been created on private agricultural land, economic consideration is be given to the land owners. Hungary has historically been referred to as the "bread basket of Europe" due to their production of grains and much of the prime farm land has been ringed-off into the detention facilities. If a farmer's crops are destroyed due to flooding in the impoundment areas, the Ministry will pay for the crops at market rate.

The Tisza River also has a major dam at the town of Kiskore. It creates a reservoir for recreation and low-head power generation and provides a lock and dam for river navigation. At the Kiskore field office Cam and Mark were treated to a detailed briefing on the dam construction and reservoir use. They provided valued insight on how to use RAS to properly model the structure and came away from the experience with ideas for important tools that could be added to the HEC-RAS program.

The trip concluded with a visit to the Budapest University of Technology and Economics where Cam and Mark met with Dr. János Józsa, Head of Department for Hydraulic and Water Resources Engineering. Cam and Mark participated in animated discussions regarding the field of water resources, physics, and the history of water resources and education in Hungary. They also listened to presentations from Professor János's most achieved Master's student and participated in an excellent technical discussion regarding their work. Cam and Mark provided insight on HEC activities and suggested software programs that they could use for research topics. Cam and Mark, along with everyone at HEC, were pleased to learn that the Budapest University uses HEC products in both their B.Sc. and M.Sc. programs as part of their standard curriculum.

The Tisza River at Szolnok (note the well manicured levee in the foreground).