# Agenda

**Hydrologic Engineering Center**

Training Course on

# Consequence Estimation with HEC-FIA
**Course Control Number #060**

Davis, California

Purpose: The primary objective of the course is to provide participants with an understanding of 1) the features of HEC-FIA and 2) the methodologies necessary to conduct after damage reports, life loss calculation, and supporting damage estimates for a feasibility report.

## Monday

8:00 – 8:45 a.m. **Welcome, Introductions, and Course Preliminaries**

8:45 – 9:00 a.m. Break

9:00 – 10:00 a.m. 1.1 Lecture **Existing Policy Overview**
This lecture will go over existing policy governing the Corps for evaluating damages for single events, and consequences from breaches. Additionally, the concepts of life loss estimation and policy will be addressed.

10:00 – 10:15 a.m. Break

10:15 – 10:45 a.m. 1.2 Lecture **Introduction to Consequence Calculations**
This lecture covers the general concepts within HEC-FIA and how they can be used to calculate meaningful numbers to assist the various functions within the Corps. This presentation will explain why the basics of damage driving parameters and how consequences are calculated in a general overview of HEC-FIA.

10:45 – 11:00 a.m. Break

11:00 – 12:00 p.m. 1.3 Lecture **Structure Inventories 101**
This lecture will discuss the required data fields for evaluating consequences at a structure. It will discuss ways of representing those structures and various auxiliary data files required to fully describe the consequences at a structure. Common issues and ways to rapidly develop inventories will be discussed. This Lecture will also discuss further detail on the methods to calculate direct economic damages. The students will learn how HEC-FIA computes damages, how to review results, and what features can help to QA/QC results.

12:00 – 1:00 p.m. Lunch

1:00 – 1:45 p.m. 1.4 Lecture **Case Histories**
This presentation will describe some case history of life loss due to dam breaching, and form the foundation of terminology for our Life loss Calculations and estimation process

2:45 – 3:00 p.m. Break

2:00 – 3:00 p.m. 1.5 Lecture **Life Loss Estimation Process**
This lecture will focus on the methodology in HEC-FIA to distribute people into structures based on occupancy type and demographic information available from the web. This lecture will explain how population is distributed, and common issues with populating parcel based structure inventories. The lecture will go on to explain the re-distribution process and how people are warned, mobilized and evacuated during an event simulation in HEC-FIA. Additionally, the full LifeSim methodology for evacuation will be discussed. This lecture will discuss the methodology developed by Dr. Bowles and Dr. Mclelland to estimate life loss in individual structures given their evacuation outcome category. The students will learn about the simplified LIFESim method that HEC-FIA has adopted, and discuss the merits and shortcomings of the simplifications.

3:15 – 4:45 p.m. 1.6 Workshop 1 **Consequence Calculation Exercise**
In this workshop, the participants will be provided with information on a dam breach scenario including inundation extents, depths and velocities throughout the impacted areas. Participants estimate potential loss of life by hand (calculators or Excel) to reinforce the concepts presented in the previous lectures.

4:45 – 5:00 p.m. REVIEW **Review of workshop**

## Tuesday

8:00 – 9:15 a.m. 2.1 Lecture **Common Issues with Hydraulic Modeling for Consequences**
This lecture will cover some of the common pitfalls for developing meaningful hydrographs for consequence estimation. It will stress the importance of hydraulic, geotechnical, and structural parameters on the consequence estimation process.

9:15 – 9:30 a.m. Break

9:30 – 10:30 a.m. 2.2 Lecture **Common Mapping Issues with Hydraulic Data**
This lecture will cover some of the common pitfalls for converting hydrographs into gridded data with HEC-RAS, sensitivity of breach characteristic parameters, and other common issues that impact the evaluation of consequences from dam breach scenarios.

10:30 – 10:45 a.m. Break

10:45 – 12:00 a.m. 2.3 Workshop 2 **GIS Pre Processing for HEC-FIA**
Geospatial analysis requires that the users be familiar with many different tools in ESRI products, specifically ARC-MAP. This workshop will go over the basics of creating data for input into typical consequence estimation software. The users will build/modify the data for creating a structure inventory and other necessary geospatial elements to describe a study area in HEC-FIA, and methods for preparing agriculture data for HEC-FIA

12:00 – 1:00 p.m. Lunch

1:00 – 1:30 p.m. REVIEW **REVIEW of GIS Pre Processing for HEC-FIA**

1:30 – 2:15 p.m. 2.4 Lecture **Level of Detail. Recon vs. Feasibility Level analysis with HEC-FIA**
The concept of HEC-FIA is to allow users to quickly scale the model from a quick estimate of damage to a very detailed estimate of risk without having to create a new instance of their study region in HEC-FIA. This lecture will discuss the difference of detail that parcel data can bring to a study area. Topics of concern will be geospatial placement, value assessment, occupancy type assessment, and population estimation.

2:15 – 2:30 p.m. Break

2:30 – 3:00 p.m. 2.5 Demo **Familiarization with HEC-FIA interface**
This lecture will focus on the methodology in HEC-FIA to distribute people into structures based on occupancy type and demographic information stored in the HAZUS database. This lecture will explain how population is distributed, and common issues with populating parcel based structure inventories. The lecture will go on to explain the re-distribution process and how people are warned, mobilized and evacuated during an event simulation in HEC-FIA.

3:00 – 5:00 p.m. 2.6 Workshop 3 **Consequence Calculations with HEC-FIA**
Students will take the data files from workshop 2 and input them in HEC-FIA to conduct an analysis of the potential consequences from a dam breach scenario. A comparison of Gridded results to Cross section results will be analyzed, and methods to improve consequence results will be proposed.

## Wednesday

8:00 – 8:15 a.m. REVIEW **Review of previous workshop**

8:15 – 9:30 a.m. 3.1 Workshop 4 **Using FIA to calculate dam fail consequences.**
HEC-FIA can be used to address issues identified in the workshop 3 review. These issues will be fixed and new results will be generated.

9:30 – 9:45 a.m. REVIEW **Workshop 4**

9:45 – 10:00 a.m. Break

10:00 – 10:45 a.m. 3.2 Lecture **Alternative Analysis and Comparison with HEC-FIA**
This lecture will focus on the methodology in HEC-FIA to run several scenarios and conduct an alternative analysis with HEC-FIA for a single event. This lecture will explain how various structural and non-Structural alternatives can be modeled and how to combine them into an alternative report to view the results.

10:45 – 12:00 a.m. 3.3 Lecture **Overview of the Dam and Levee Safety Programs**
One of the benefits of HEC-FIA using the unsteady hydraulics data for a single event is the ability to calculate damages following a large catastrophic failure of a dam. HEC-FIA is used to estimate these types of events on a fairly regular basis, and this lecture will present the way HEC-FIA facilitates the MMC in their work.

12:00 – 1:00 p.m. Lunch

1:00 – 1:45 p.m. 3.4 Lecture **Things to Consider when using HEC-FIA for Dam Safety**
This lecture will discuss how HEC-FIA should be used to tie consequences to the failure mode, and common issues with modeling HEC-FIA results for input into DamRae.

1:45 - 2:00 p.m. Break

2:00 – 3:00 p.m. 3.5 Lecture **Using HEC-FIA for a Dam Safety application**
This lecture will build on the lecture of how HEC-FIA is intended to be used for Dam Safety applications by going through a study where HEC-FIA was used to estimate the consequences that were associated with the failure of a large dam. This example will show how the user developed the HEC-FIA model, tested it for sensitivity, found credible estimations for warning, evacuations, and failure modes, and how he modeled a dam break and its consequences with HEC-FIA.

3:00 – 3:15 p.m. Break

3:15 – 5:00 p.m. 3.6 Workshop 5 **Alternative Analysis Workshop**
HEC-FIA can be used to address structural and non structural measures, this workshop will be used to illustrate some different methods to create alternatives and compare them in HEC-FIA.

## Thursday

8:00 – 8:30 a.m. REVIEW **Review of previous workshop**

8:30 – 9:45 p.m. 4.1 Lecture **HEC-FIA with Uncertainty**
This lecture will discuss how HEC-FIA can be used to estimate single events with uncertainty.

9:45 – 10:00 a.m. Break

10:00 – 11:45 p.m. 4.2 Workshop 6 **HEC-FIA and Monte Carlo Iterations**
Students will take the information from workshop 1 and workshop 4 and combine them in HEC-FIA to conduct a feasibility level analysis of their study area to evaluate the base condition of a study area.

11:45 – 12:45 p.m. Lunch

12:45 – 1:15 p.m. REVIEW **REVIEW of Workshop 6**

1:15 – 2:00 p.m. **Question and Answer Session**
This time is set aside for the class participants to be able to ask the people in the room questions pertaining to Life Loss estimation, Dam Safety, CWMS, Agriculture, WAT.

2:00 – 2:15 p.m. Break

2:15 – 3:45 p.m. 4.3 Lecture **Calculating Indirect Economic Damages using a CGE model**
This Lecture will discuss the concepts behind Computable General Equilibrium modeling, and how it can be used to estimate the indirect losses associated with a single flood event. This will be an economic intensive lecture that attempts to explain the basics of how an economy works and the relationships that can be used to describe that mathematically. This lecture will focus on the methodology in HEC-FIA to estimate reductions in Labor and Capital on a county by county basis, and how that can be used to give ECAM information to estimate the lost business after a flood event. The lecture will go on to explain the meaning of the loss values, and how they can be used to help determine the regional impacts a flood might have on the study area.

3:45 – 5:00 p.m. 4.4 WORKSHOP 7 **HEC-FIA Calculating Indirect Economics**
This workshop will use the study area and structure inventory that has been created in HEC-FIA to create an HEC-FIA model that can be used in conjunction with ECAM to calculate indirect economics.

## Friday

8:00 – 8:30 a.m. Review of workshop 7

8:30 – 9:45 p.m. 5.1 Lecture **Using HEC-FIA in HEC-WAT with the FRA compute option**
This is a lecture to discuss how HEC is preparing a tool that can be used to estimate the consequences of a watershed with full uncertainty through event sampling, and how HEC-FIA is going to be used as a component of HEC-WAT.

9:45 – 10:00 a.m. Break

10:00 – 11:00 a.m. 5.2 Lecture **HEC-LifeSim Case Study Presentation**
This lecture will discuss how HEC-Lifesm can be used to estimate single events with uncertainty in evacuation and demo the evacuation logic for a few test cases.

11:00 – 11:30 a.m. Course review and critique