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# Overview of HEC-RAS 2D Modeling and How It Can Be Used to Evaluate and Reduce Flood Hazards

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# Hydrologic Engineering Center - River Analysis System



#### How did HEC-RAS come to be?



### 1824: U.S. Army Corps of Engineers (USACE) starts their first Civil Works project - to promote safety on the Ohio and Mississippi River.





# **1936: Flood Control Act gives USACE authority to provide flood protection across entire country.**





### 1966: USACE releases the computer program "Backwater Any Cross Section"





# **1968: HEC releases the software HEC-2 to estimate water levels on a river**





#### 1984: HEC-2 can be run on a personal computer





**IBM personal computer in 1981** 

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<u>F</u> ile <u>E</u> d	it <u>S</u> imulate <u>V</u> iew <u>O</u> ptions	<u>H</u> elp		
English Units English Units				
Project	Trapezoidal Bridge	c:\vbasic\ras\new\trapbrdg.prj		
Plan	Test of trapezoidal bridge opening	c:\vbasic\ras\new\trapbrdg.p01		
Geometry	trapezoidal sections and bridge	c:\vbasic\ras\new\trapbrdg.g01		
Flow	Five profiles	c:\vbasic\ras\new\trapbrdg.f01		

**HEC-RAS version 1.0** 



### 1995-2015: HEC-RAS is limited to 1-dimensional modeling



**HEC-RAS Cross Sections** 



#### 2016: HEC-RAS 5.0 is released with 2-dimensional modeling



**HEC-RAS 2-D Flow Area** 



#### How do you set up and run a HEC-RAS 2D model?





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#### **Field Work**



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#### **Field Work**





Connection Data Editor - IndianRiverGeometry Proposed				
File View Help				
Image: Connection:   Image: Connet:   Image: Connection:   Image: Connec				
Connections				
From: 2D flow area: IndianRiver Set SA/2D Weir Length: 93.93				
To: 2D flow area: IndianRiver Set SA/2D Centerline Length: 93.93				
Overflow Computation Method Overflow Computation Domain C Use Weir Equation Centerline GIS Coords				
Structure Type Weir and Cullverte 👻 No Flan Cates 👻 Terrain Profile				
	AND			
Param. 10 Soillway				
9 HW Cell Min Elev				
E 8 TW Cell Min Elev				
E T				
	XIH X X I			
0 20 40 60 80 100	XTHINXA			
Station (ft)				
Select connection to Edit				
	bridges/cuiverts/dams			

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# **Simulation Duration:**

1.5 days

# Time Step: 5 seconds

HEC-RAS Computations				
Write Geometry Information				
Layer: Complete				
Geometry Processor				
River:	IS:			
Reach:	lode Type:			
IB Curve:				
- Unstandy Flow Cimulation				
Simulation:				
Time: 0.1236 01JAN2000 00:07:25	Iteration (1D): Iteration (2D): 10			
Unsteady Flow Computations				
Computation Messages				
Plan: 'IRInflow100yrPlan Proposed' (Indian Simulation started at: 19Oct2017 01:43:54 PM Using 64 Bit Computation Engines	River.p18)			
Writing Geometry IndianRiver: Mesh property tables are current. Completed Writing Geometry				
Geometric Preprocessor HEC-RAS 5.0.3 September 2016				
Finished Processing Geometry				
Writing Event Conditions Event Conditions Complete				
Derforming Unstandy Flow Simulation, HEC-DAS 5.0.3 Sentember 2016				
renorming onsteady now owneddon mee				
Pause Take Snapshot of Results		Stop		





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9 250 8 Peak flow through Green Farms Culvert about 200 cfs. 7 150 Flow (cfs) 6 - 100 5 -50 3 2400 +0 1200 2400 0600 1200 01Jan2000 1800 0600 02Jan2000 Time

SA Connection: IR Green Road

Legend Stage HW Stage TW Flow



Stage (ft)

#### **Calibrate the Model**

Just compare results

OR

Simulate historic storm





#### **Identify Locations with Significant Flooding**





#### **Identify Locations with Significant Flooding**





#### **Perform Simulations with Proposed Changes**





#### **Perform Simulations with Proposed Changes**



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#### **Perform Simulations with Proposed Changes**





Once you have a model, the possibilities are endless.

Thank you!



#### Feel free to contact me at Christine.Suhonen@gza.com





# https://www.civilgeo.com/the-road-to-hec-ras/

