Dam and Levee Breach
Workshop

1 Objective

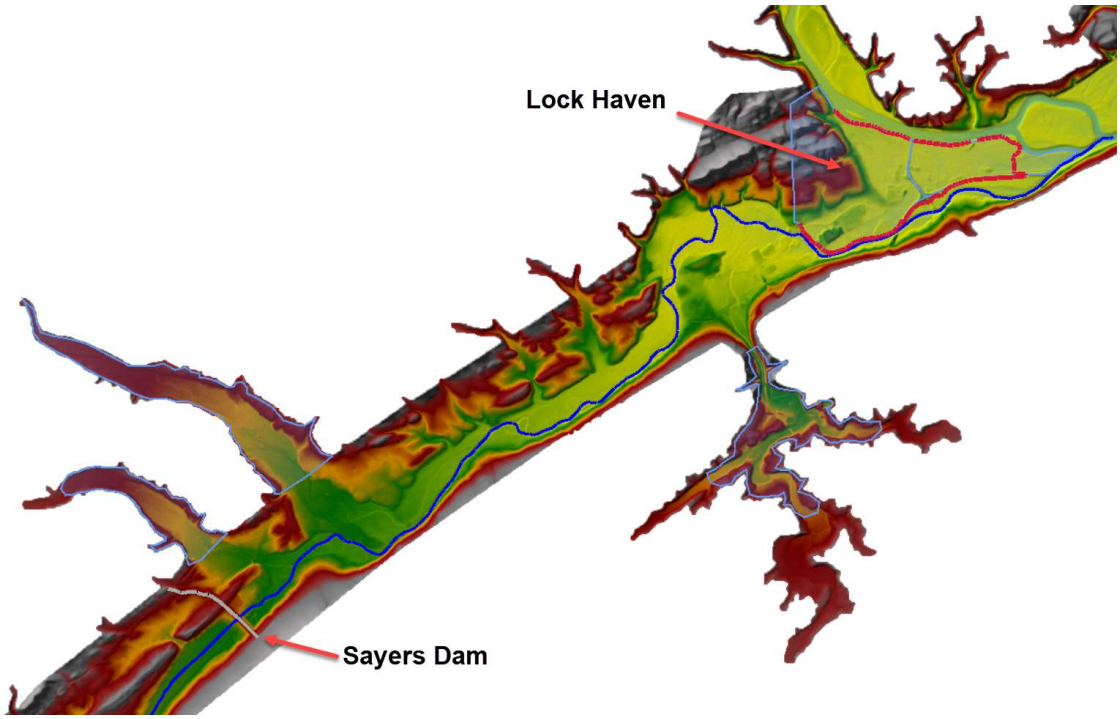
In this workshop, you will learn how to:

- Enter and edit dam and levee breach data
- Perform unsteady breach simulations
- Perform sensitivity analyses on timestep and breach parameters
- Review and interpret pertinent dam and levee breach output

2 Background

You will be working with a dataset for Sayers Dam on Bald Eagle Creek in central Pennsylvania. Sayers Dam is approximately 15 miles upstream of the town of Lock Haven. See the figure below to become acquainted with the dataset.

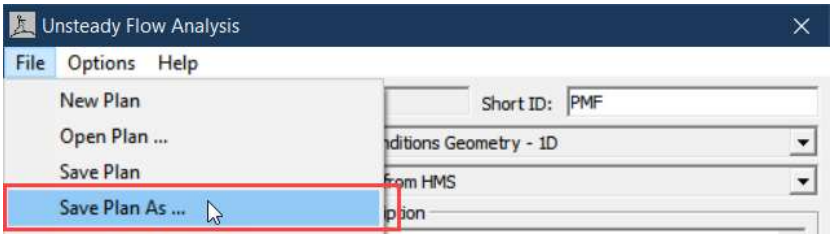
In this workshop, you will add a piping breach to the inline structure representing Sayers Dam and analyze the impact of the breach on the town lock Lock Haven downstream. Additionally, you will add an overtopping breach to one of the levees protecting Lock Haven.



3 Enter Dam Breach Parameters

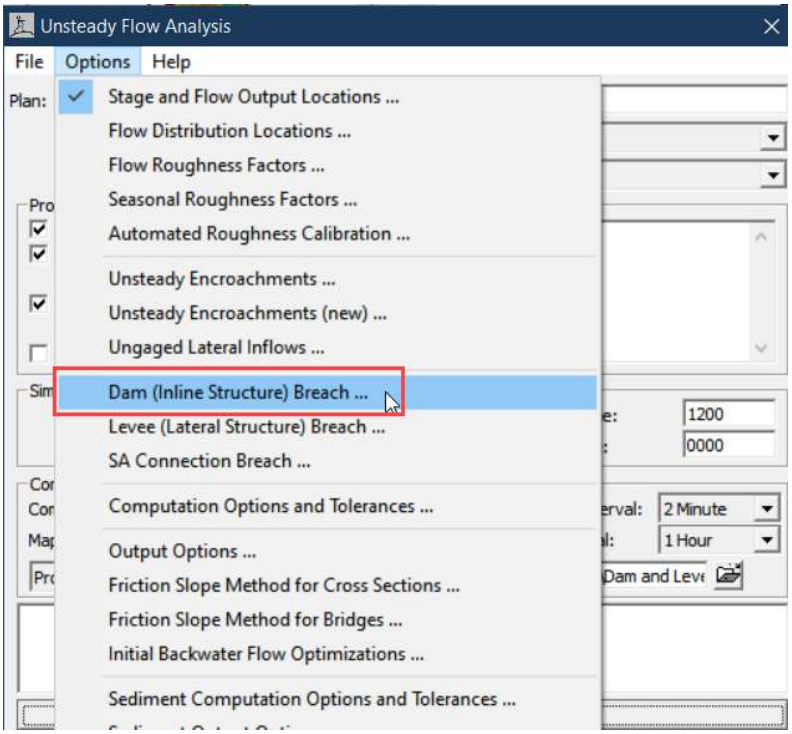
1. Start HEC-RAS and **open** the "**Bald Eagle Creek Example Dam Break Study**" project.

2. **Open** the **Unsteady Flow Analysis** window and **create** a new **plan** using **Save Plan As Option** from the file menu.

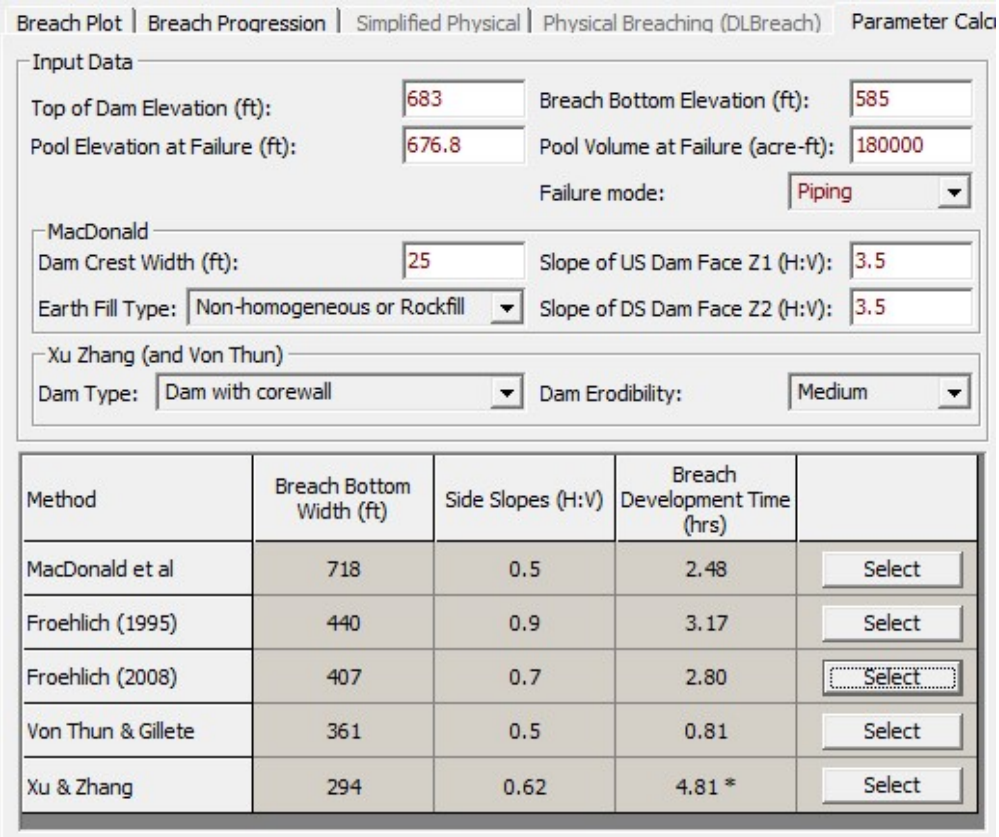


3. Name the new plan (and short ID) "**Froehlich"**.

4. **Open** the **Dam Breach Data** editor from the Unsteady Flow Analysis window as shown below.



5. Select the **Parameter Calculator** tab and **enter the input data** as shown below:

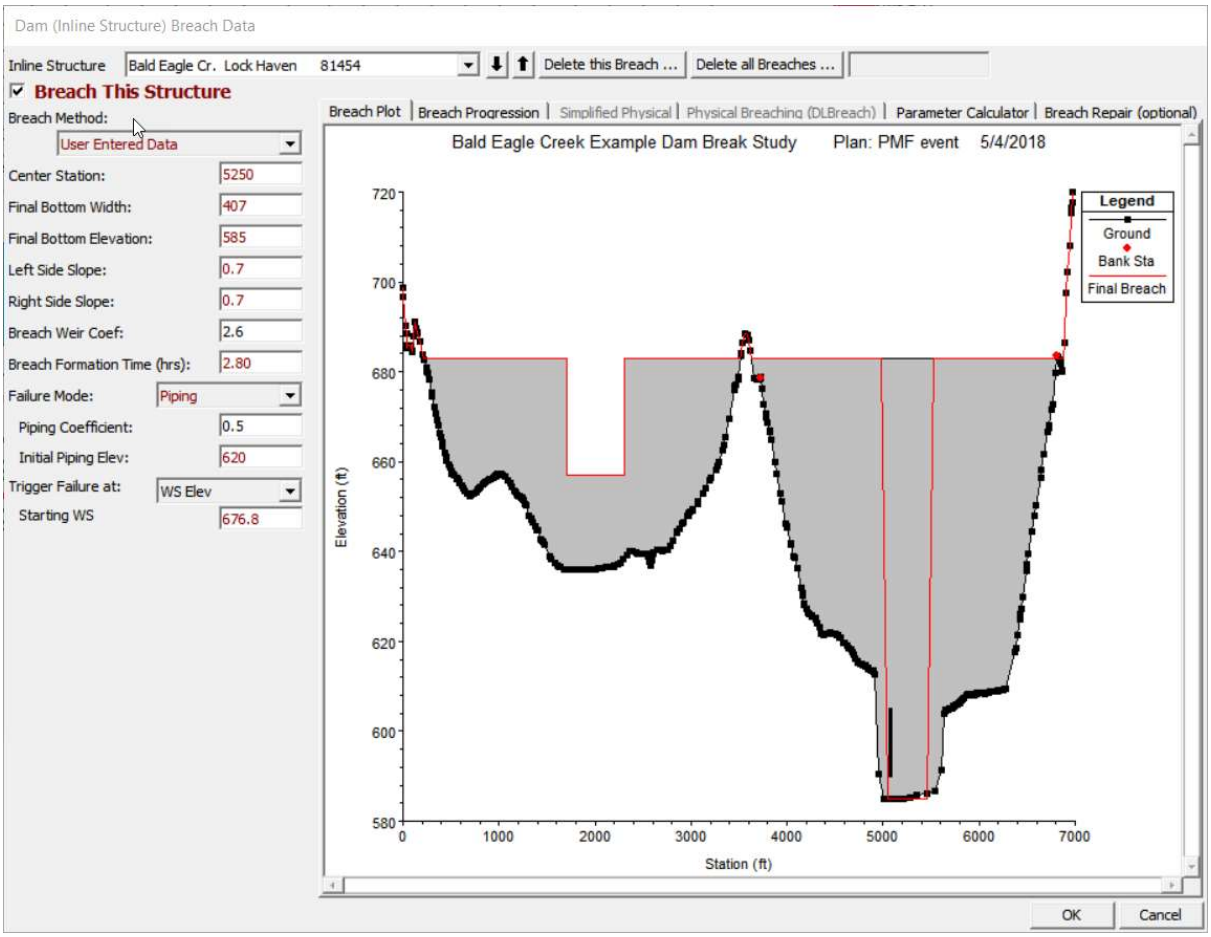


6. In the table of breach methods at the bottom, press **Select** the **Froehlich (2008)** method. This will copy the calculated parameters to the pane on the left.

7. Next, enter a **Center Station of 5250 ft,** and **Initial Piping Elev of 620 ft**. **Check** the **Breach This Structure** box.

8. Don't forget to click **Breach This Structure** 

9. Switch to the **Breach Plot** tab to visualize the final breach dimensions:



10. **Select OK to** close the editor. **Save** the **Plan**.

4 Compute and Review Results

11. **Compute** the plan with the dam breach and answer the questions below.

<u>Question</u>: What time does the breach begin? How did you determine that?

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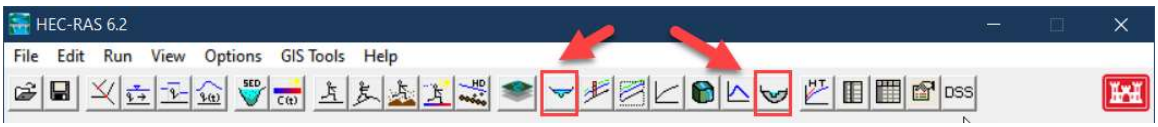
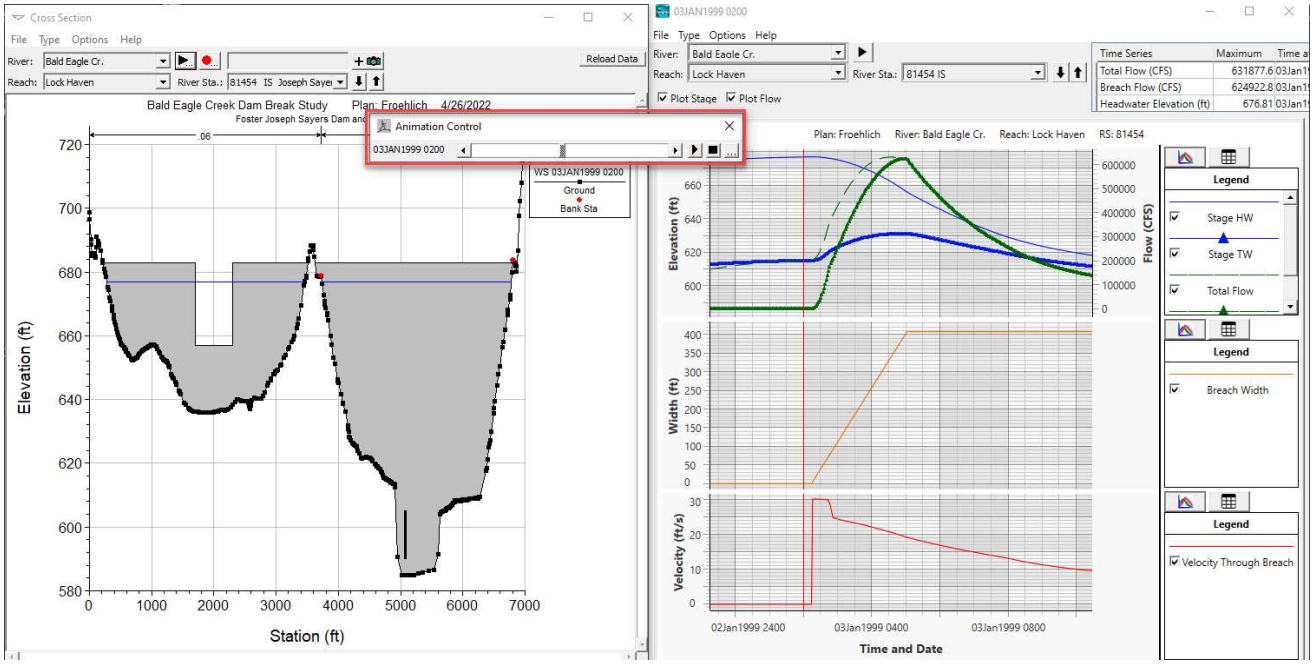
12. **Open** the **Breach Time Series Plot** from the main window. Then open the **Cross Section Plot** and **animate** them together.





Question: What is the peak flow leaving the dam due to the breach, and what is the total peak flow leaving the dam. Why are they different?

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5 Timestep Sensitivity

13. Create a new plan using **Save Plan As**. Name the Plan "**Froehlich_10S**".
14. Set the **timestep** of the plan to **10 seconds**. **Save** and **compute.**
15. **Compare** hydrographs from the 10-second- and 2-minute plans.

Question: What differences in stage and flows did you find between the two plans? Which timestep do you think is more appropriate for this dam breach problem?

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6 Breach Parameter Sensitivity

16. Create a new plan by using **Save Plan As** and name the new plan "**VonThun"**

17. **Change** the breach parameters for Sayers Dam to reflect the **Von Thun breach method**. You can do this by selecting Von Then & Gillette method from the **Parameter Calculator**.

18. **Save** the plan and **compute.**

19. **Compare profiles and hydrographs** from the Froehlich and Von Thun plans.

<u>Question</u>: What differences do you see in the results when comparing the Von Thun and Froehlich plans? Where do you see the most differences?

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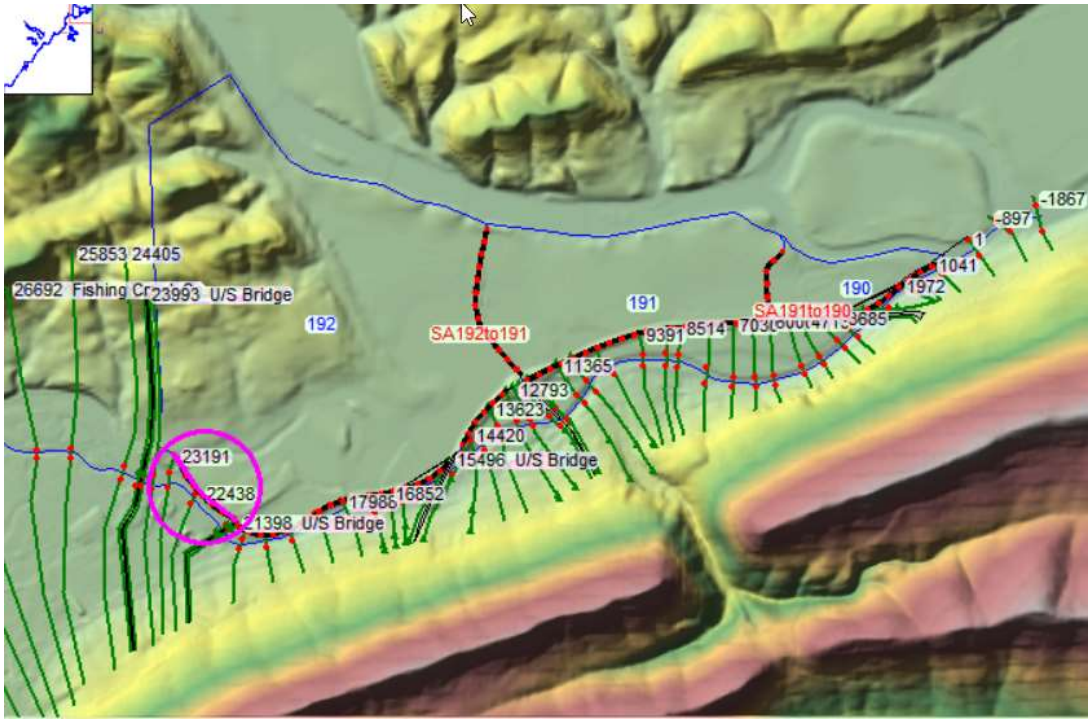
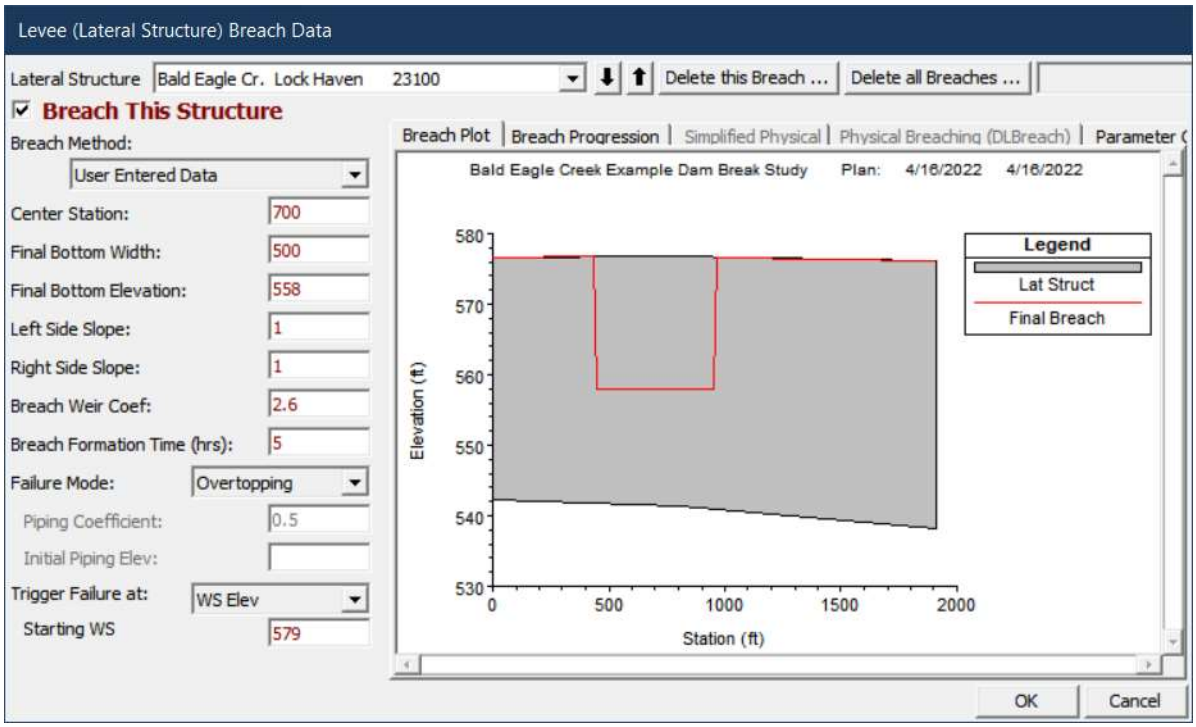
7 Add Levee Breach at Lock Haven

20. Create a new plan by using **Save Plan As** and name the new plan "**VonThun _Levee**". In this plan you will add a levee breach to the most upstream lateral structure (sta. 23100) protecting Lock Haven shown below.



21. **Open** the **Levee Breach Data Editor** from the Unsteady Flow Analysis window and enter a levee breach for **lateral structure 23100** as shown below.



22. For this plan, decrease the **Mapping Output Interval** to **5 Minutes**. This will help better visualize the inundation behind the levees later.

23. **Save** the plan and **compute**.

24. **Compare** the **profiles** and **hydrographs** results from the two Von Thun plans.

<u>Question</u>: How much did the lateral weir breach change the maximum water surface elevation at storage area 192? How did the breach impact water surface elevations in Bald Eagle Creek?

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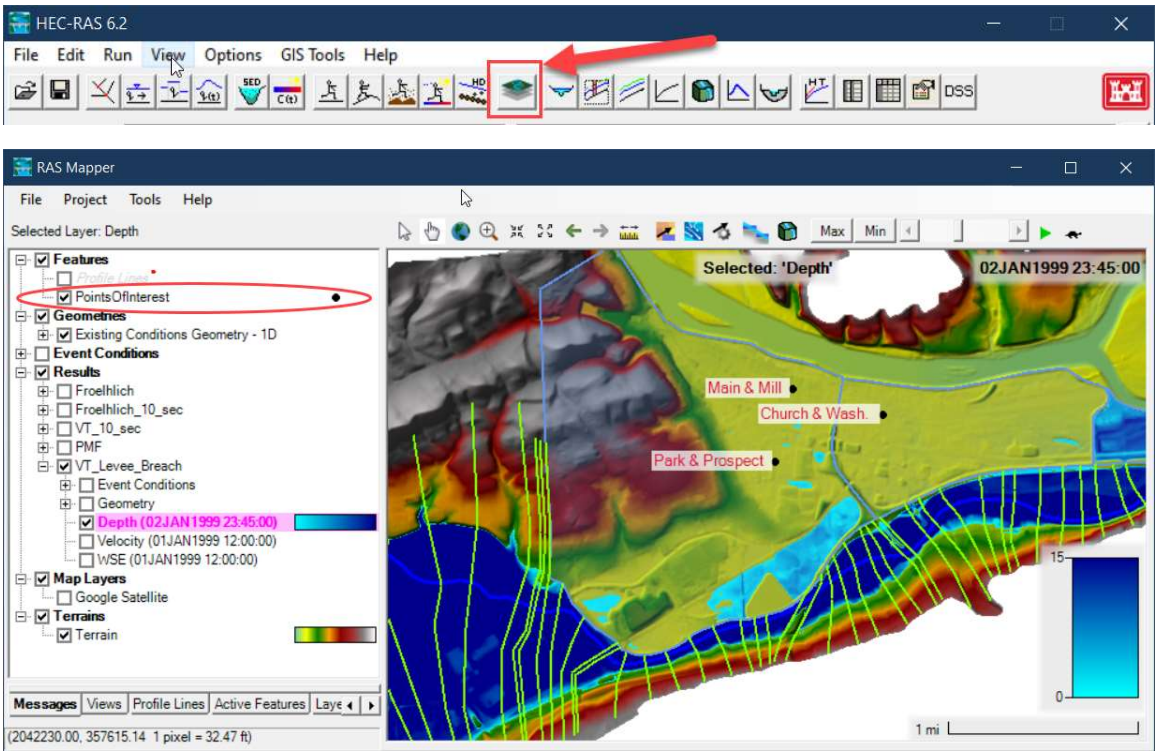
25. **Open RAS Mapper** and **zoom** to the Lock Haven area.

26. Turn on the "**PointsofInterest**" shapefile that shows locations of three road intersections in Lock Haven.



27. Turn on the **Depth** layer for the levee breach plan and **animate** the layer to visualize the inundation behind the levees.

<u>Question</u>: For the levee breach plan, what time does water first arrive at the Main & Mill location. What time is the water surface elevation at a maximum at Main & Mill?

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<u>Question</u>: For the levee breach plan, what time does water first arrive at the Church & Washington location. What time is the water surface elevation at a maximum at Church & Washington?

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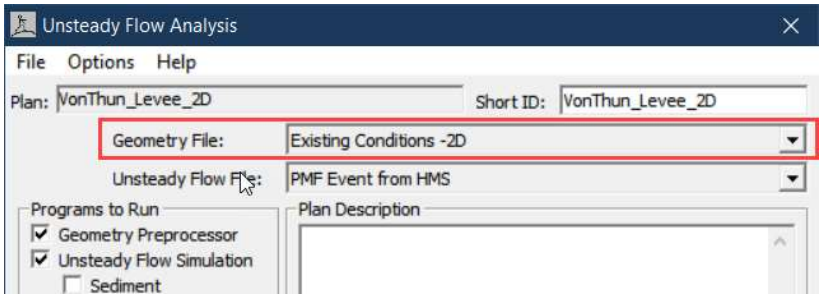
<u>Question</u>: Are the three storage areas (190, 191, and 192) an adequate approach to model the area behind the levee? Does the model output make "hydraulic sense?" (Hint: display the water surface elevations layer in RAS Mapper). What could be done to improve the results?

8 2D Area Sensitivity

28. In this section you will explore the differences between using 1D Storage Areas and 2D Areas for modeling the leveed area.

29. From the "**Von Thun_Levee"** plan, create a new plan with **Save Plan As**. Name the Plan "**VonThun_Levee_2D**"

30. This project included an existing 2D Geometry called "**Existing Conditions-2D**". **Change the Geometry** in the plan to the 2D geometry.



31. **Save** the plan and **compute**.

32. **Open RAS Mapper** and **zoom** to the Lock Haven area. **Animate** the **depth** layer.

<u>Question</u>: What differences do you see between the 2D and 1D inundations behind the levees?

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