Unit 05:
Tips and Tricks/Advanced Techniques

WEB-BASED FLOOD INUNDATION MODELING WITH DSS-WISE WEB: A SHORT COURSE ON RECENT UPDATES WITH HANDS-ON TRAINING

For
FEDERAL EMERGENCY MANAGEMENT AGENCY
FEMA

Technical Workshop

September 26th, 2024

Colorado Convention Center, Meeting Room 403
700 14th St, Denver, CO 80202

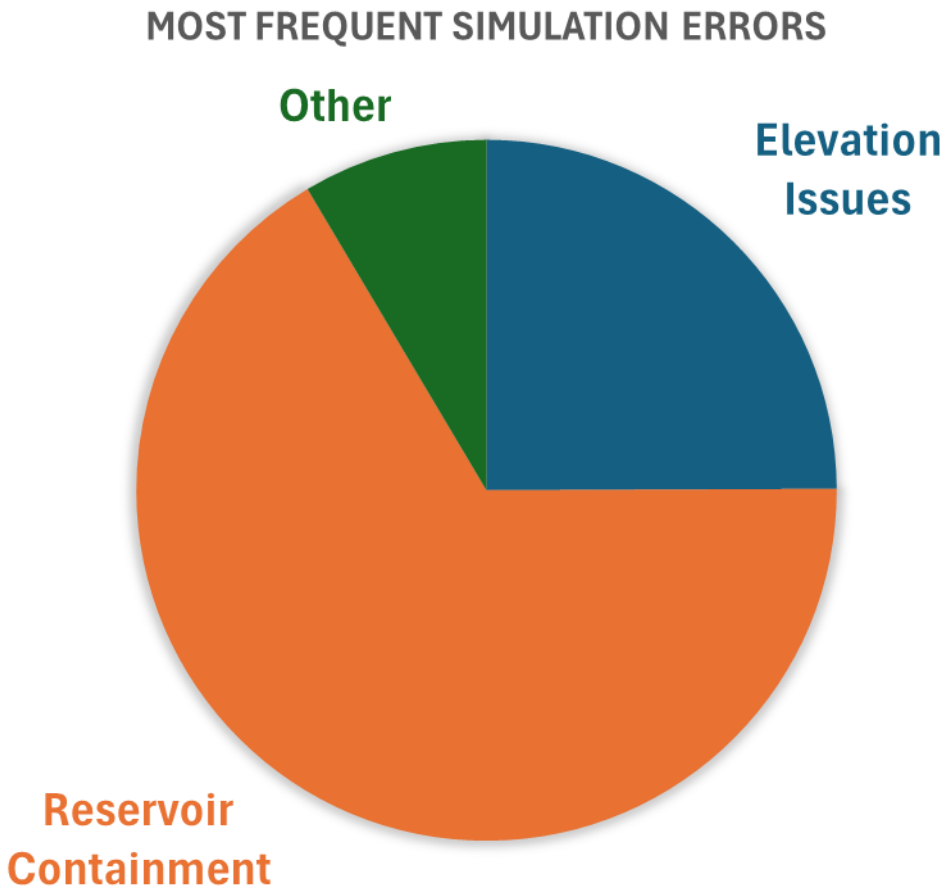
Developed by

NATIONAL CENTER FOR COMPUTATIONAL HYDROSCIENCE AND ENGINEERING
THE UNIVERSITY OF MISSISSIPPI

Statistics of User Errors

5.1

Sources of User Errors

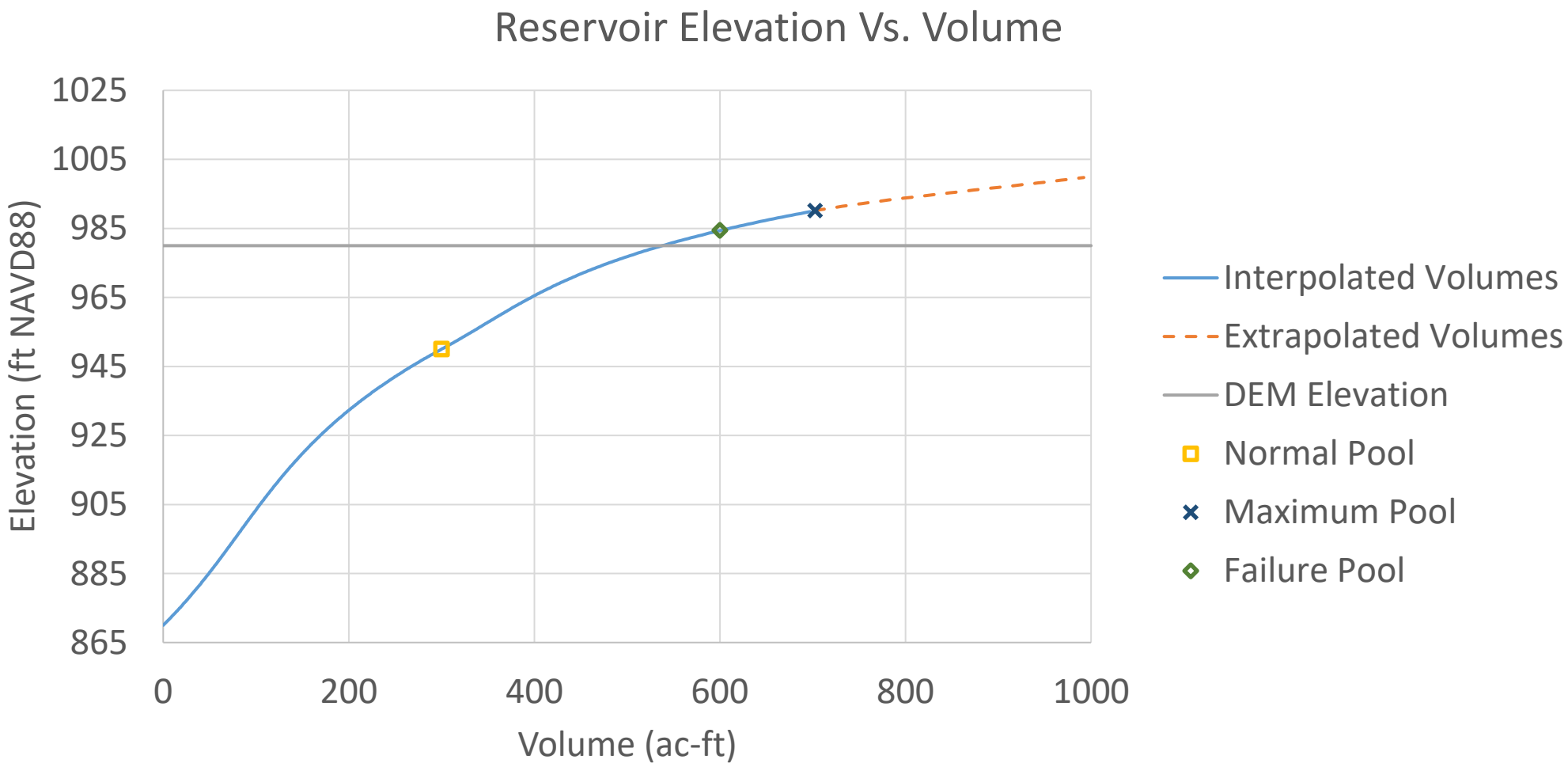


- The most common issues are caused by errors in elevation data entered by the user or a mismatch with the DEM data. In reservoir type simulations the user is asked to provide the crests elevations of all impounding structures, maximum storage elevation of the reservoir, normal pool elevation of the reservoir, the failure elevation of the reservoir, and the breach invert elevation.
- The National Inventory of Dams (NID) does not contain any elevation information. Often, the users do not have the elevation data for the dam they are simulating. They try enter guessed values, which are often wrong.

Reservoir Volume Interpolation

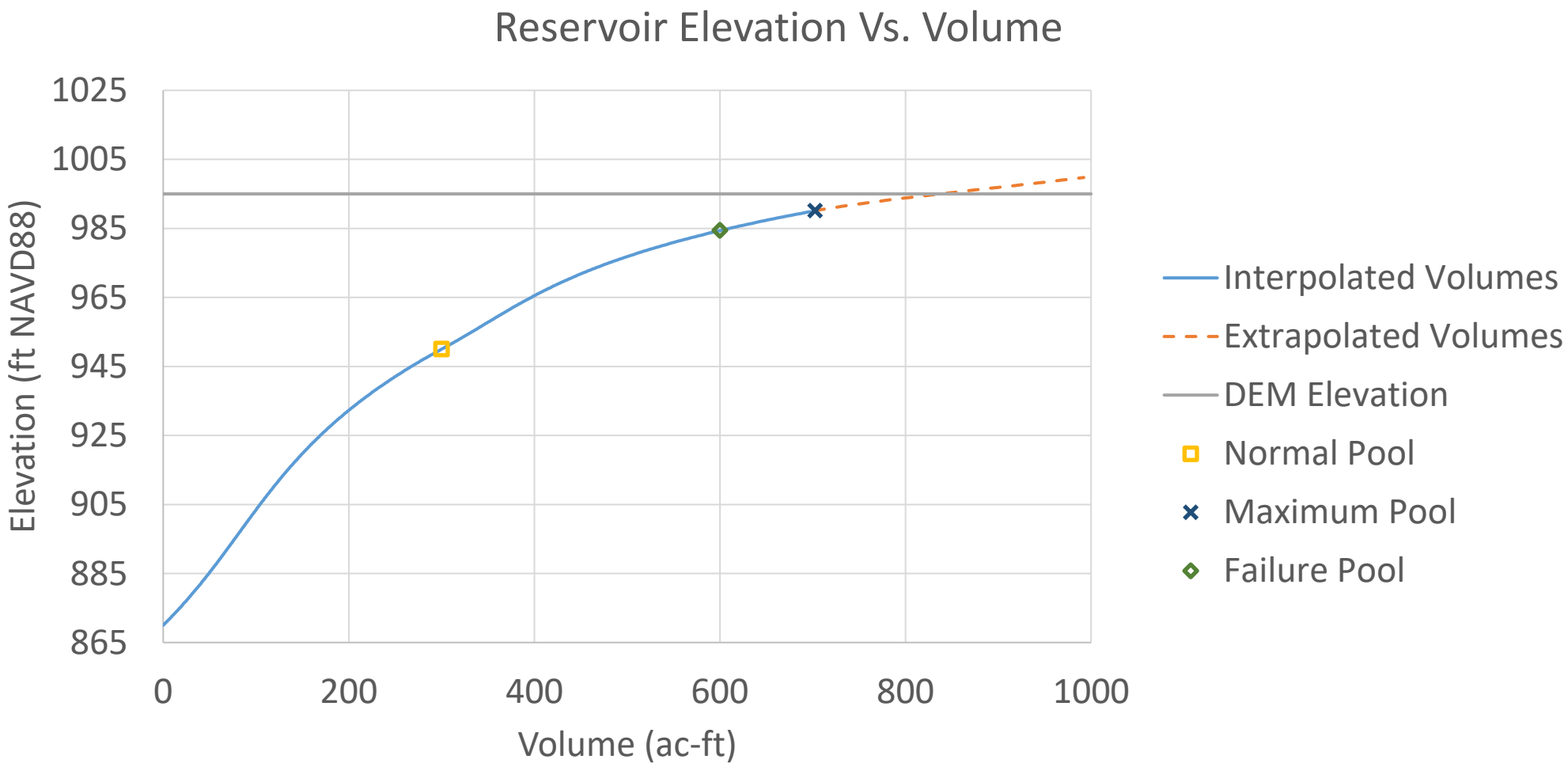
5.2

Reservoir Volume Interpolation/Extrapolation



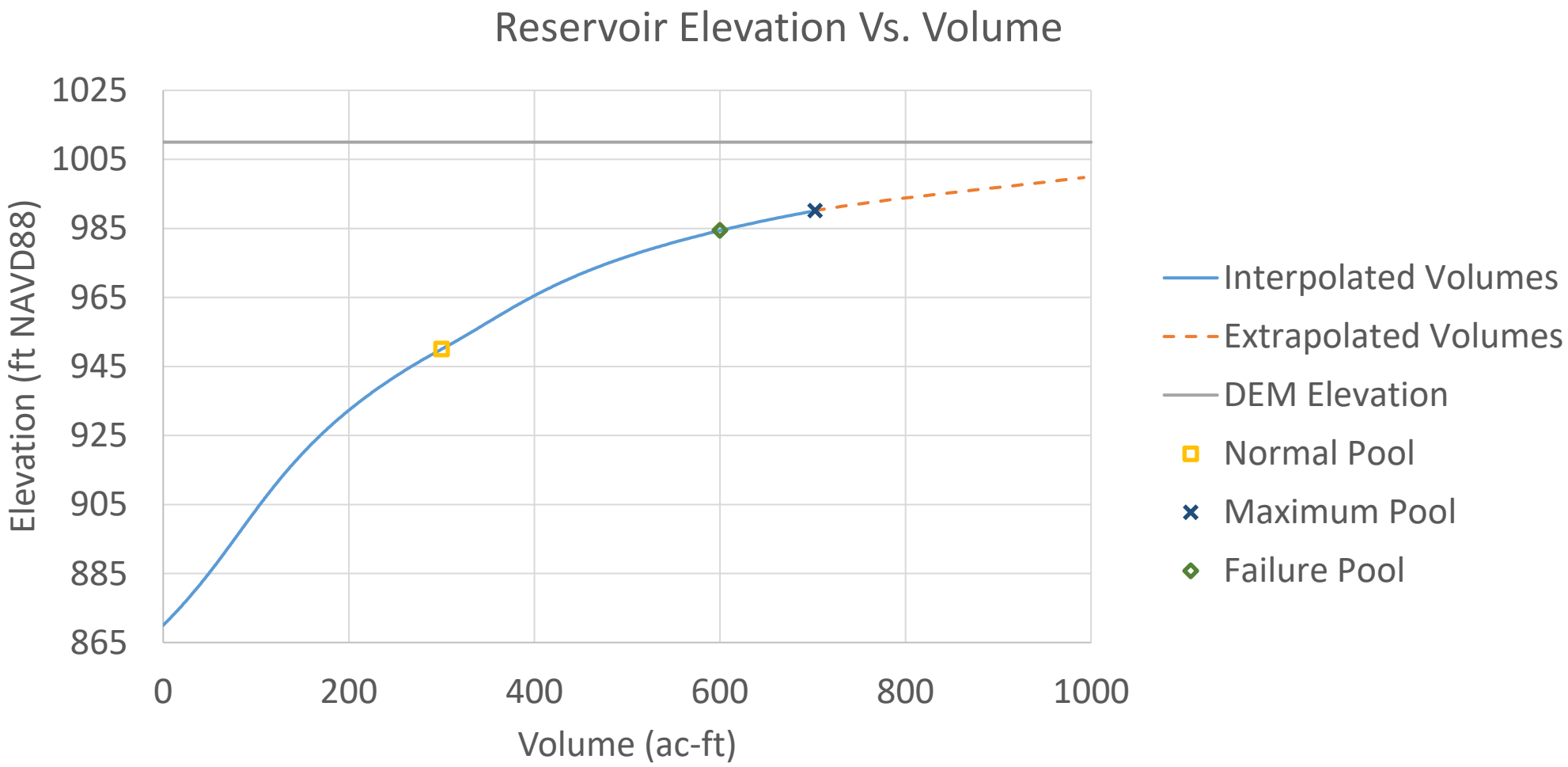
Elevation in DEM at Reservoir Point is within the given elevations given for the reservoir. The volume at this point can be interpolated.

Reservoir Volume Interpolation/Extrapolation



Elevation in DEM at Reservoir Point is outside the elevations given for the reservoir, but can still be successfully extrapolated.

Reservoir Volume Interpolation/Extrapolation



Elevation in DEM at Reservoir Point is outside the elevations given for the reservoir, and is also too high to be extrapolated. This will result in an error.

Examples of Simulations with User Errors

5.3

ERROR CODE: 1

Footprint of the impounding structure

Reservoir Point.
Too close to the structure footprint!

Job Status	User Error
Error	ELEVATION FOUND IN DEM IS TOO HIGH RELATIVE TO THE GIVEN RESERVOIR INFORMATION: The reservoir volume at elevation 3,382.1 ft is required in order to estimate its bathymetry. The system tries to estimate the volume at this elevation using the given maximum, normal, and failure pool data. None of the given reservoir pool elevations were high enough to properly estimate the required volume, so the system was unable to estimate reservoir bathymetry and had to abort. Please review input data.

Breach Center

Reservoir point placed too close to the impounding structure, which may cause issues.

ERROR CODE: 1

Footprint of the impounding structure

Reservoir Point.
Note that it is not correctly located!

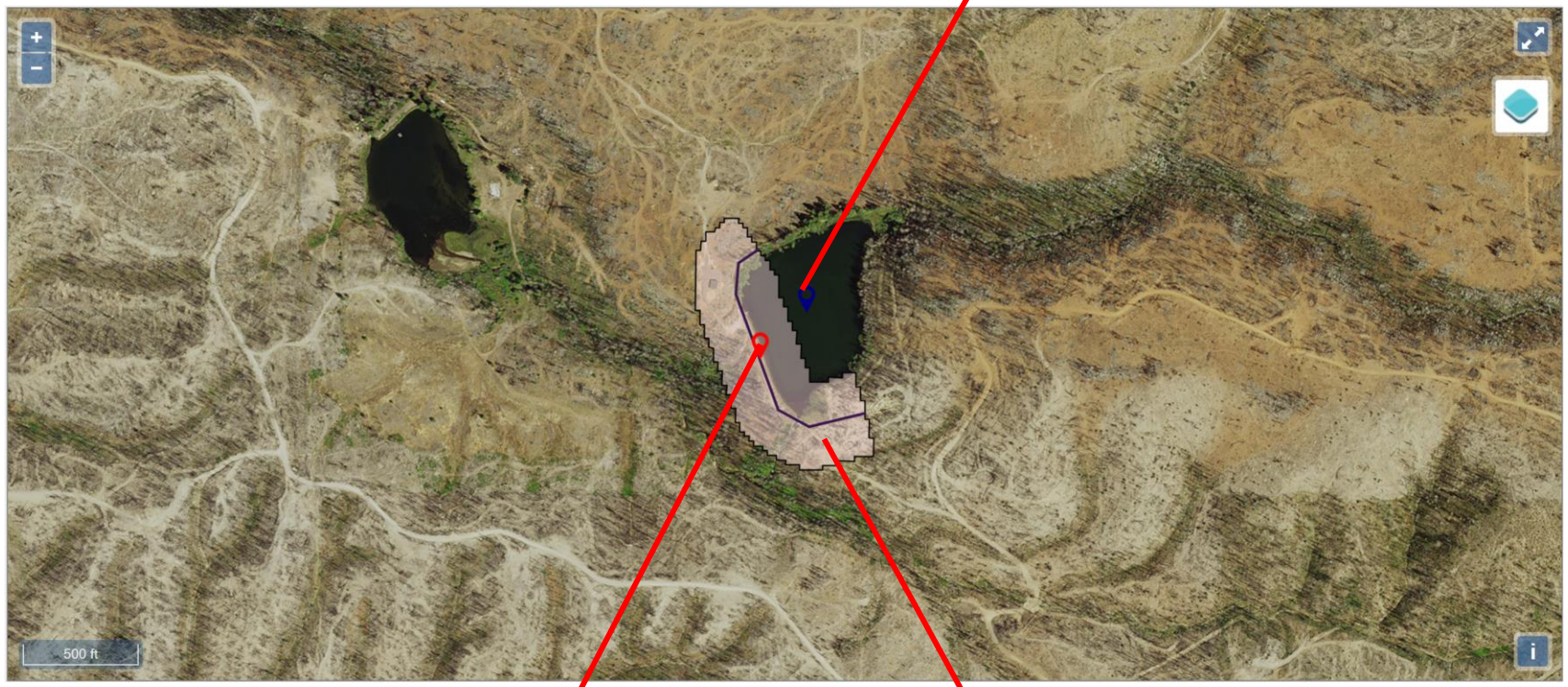
Job Status	User Error
Error	ELEVATION FOUND IN DEM IS TOO HIGH RELATIVE TO THE GIVEN RESERVOIR INFORMATION: The reservoir volume at elevation 793.99 ft is required in order to estimate its bathymetry. The system tries to estimate the volume at this elevation using the given maximum, normal, and failure pool data. None of the given reservoir pool elevations were high enough to properly estimate the required volume, so the system was unable to estimate reservoir bathymetry and had to abort. Please review input data.

Breach Center

Very narrow reservoir, with the reservoir point too close to the structure. The system will try to move it away, but it is not always successful in preventing the error.

ERROR CODE: 1

Reservoir Point.



Job Status	User Error
Error	ELEVATION FOUND IN DEM IS TOO HIGH RELATIVE TO THE GIVEN RESERVOIR INFORMATION: The reservoir volume at elevation 3,362.1 ft is required in order to estimate its bathymetry. The system tries to estimate the volume at this elevation using the given maximum, normal, and failure pool data. None of the given reservoir pool elevations were high enough to properly estimate the required volume, so the system was unable to estimate reservoir bathymetry and had to abort. Please review input data.

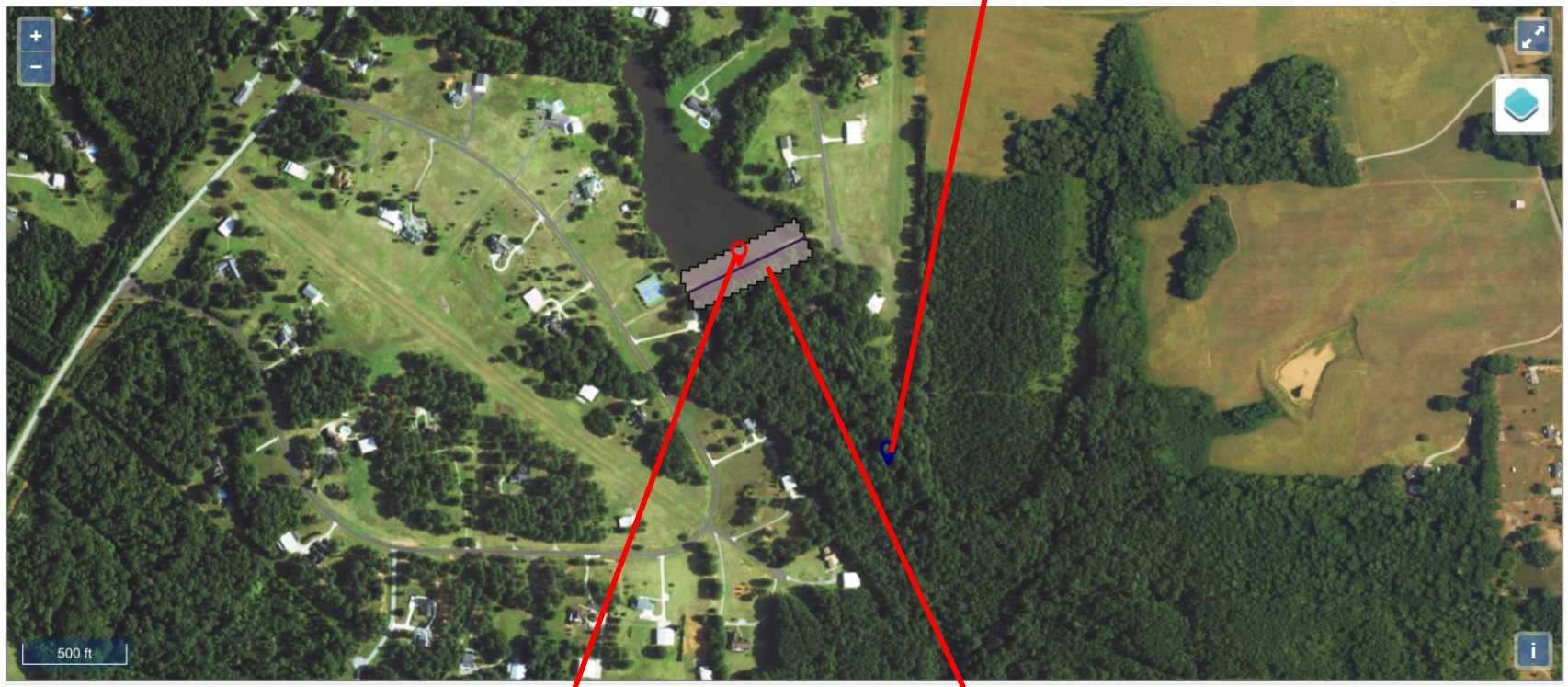
Breach Center

Footprint of the impounding structure

Very small reservoir, which may not be accurately represented in the DEM.

ERROR CODE: 1

Reservoir Point.
Mistakenly located on the d/s side of the dam



Job Status	User Error
Error	ELEVATION FOUND IN DEM IS TOO HIGH RELATIVE TO THE GIVEN RESERVOIR INFORMATION: The reservoir volume at elevation 838.84 ft is required in order to estimate its bathymetry. The system tries to estimate the volume at this elevation using the given maximum, normal, and failure pool data. None of the given reservoir pool elevations were high enough to properly estimate the required volume, so the system was unable to estimate reservoir bathymetry and had to abort. Please review input data.

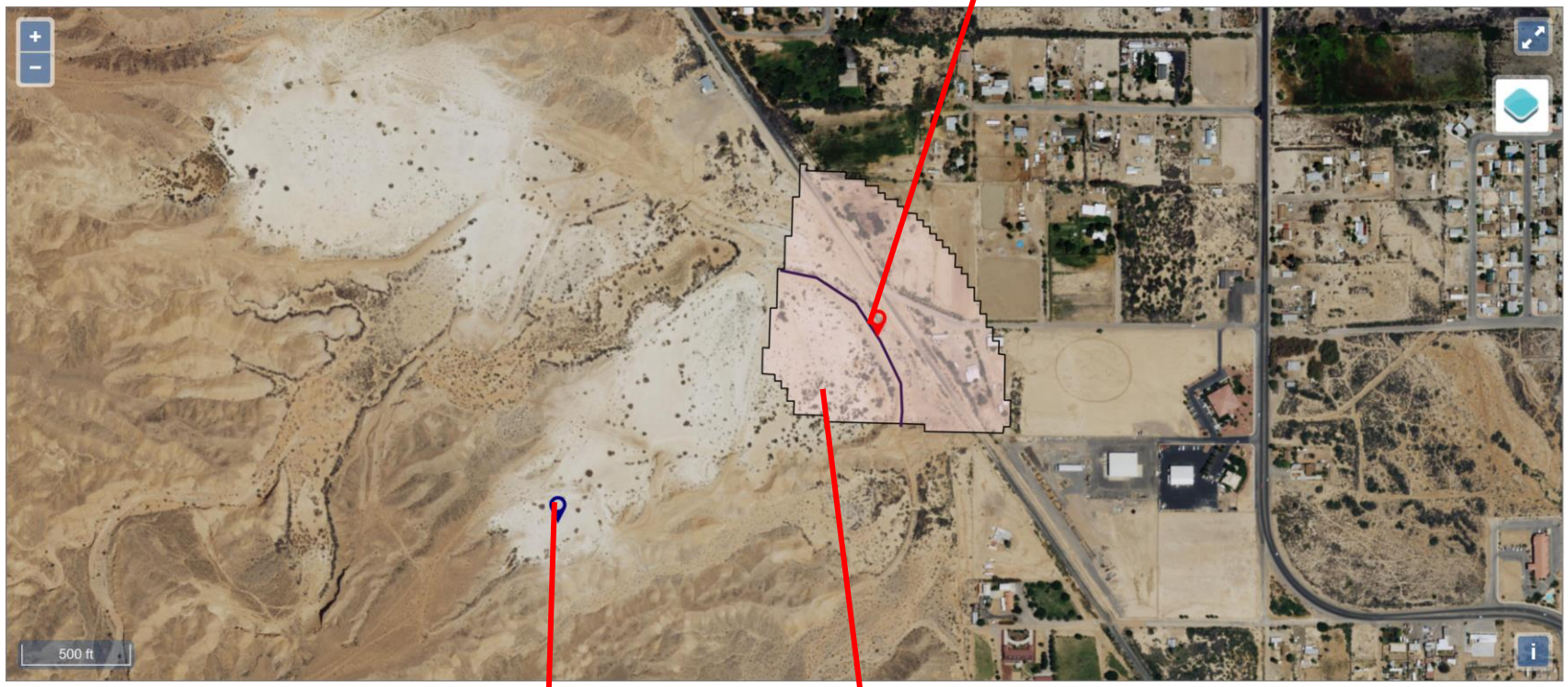
Breach Center

Footprint of the impounding structure

Reservoir mistakenly placed on wrong side of impounding structure.

ERROR CODE: 1

Breach Center



Job Status	User Error
Error	ELEVATION FOUND IN DEM IS TOO HIGH RELATIVE TO THE GIVEN RESERVOIR INFORMATION: The reservoir volume at elevation 1,348.5 ft is required in order to estimate its bathymetry. The system tries to estimate the volume at this elevation using the given maximum, normal, and failure pool data. None of the given reservoir pool elevations were high enough to properly estimate the required volume, so the system was unable to estimate reservoir bathymetry and had to abort. Please review input data.

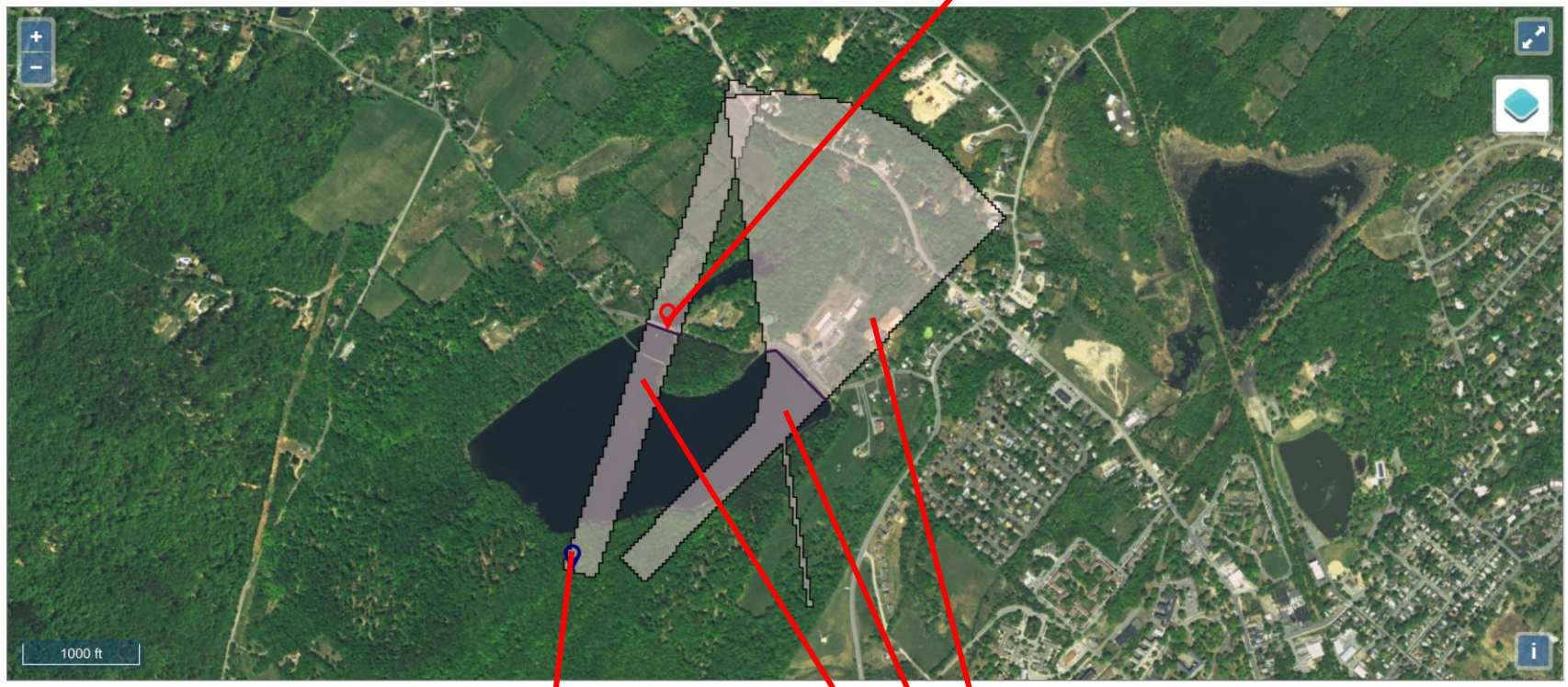
Reservoir Point

Footprint of the impounding structure

Flood control reservoir, which is normally dry. Either the user provided incorrect elevations, or the DEM may have issues in this area.

ERROR CODE: 1

Breach Center



Job Status	User Error
Error	ELEVATION FOUND IN DEM IS TOO HIGH RELATIVE TO THE GIVEN RESERVOIR INFORMATION: The reservoir volume at elevation 808.63 ft is required in order to estimate its bathymetry. The system tries to estimate the volume at this elevation using the given maximum, normal, and failure pool data. None of the given reservoir pool elevations were high enough to properly estimate the required volume, so the system was unable to estimate reservoir bathymetry and had to abort. Please review input data.

Reservoir Point
Apparently misplaced

Footprint of the multiple impounding structures defined by the user

An obvious case of invalid hydraulic height causing the impounding structures to be extremely wide, which interferes with the reservoir point.

ERROR CODE: 1

Breach Center

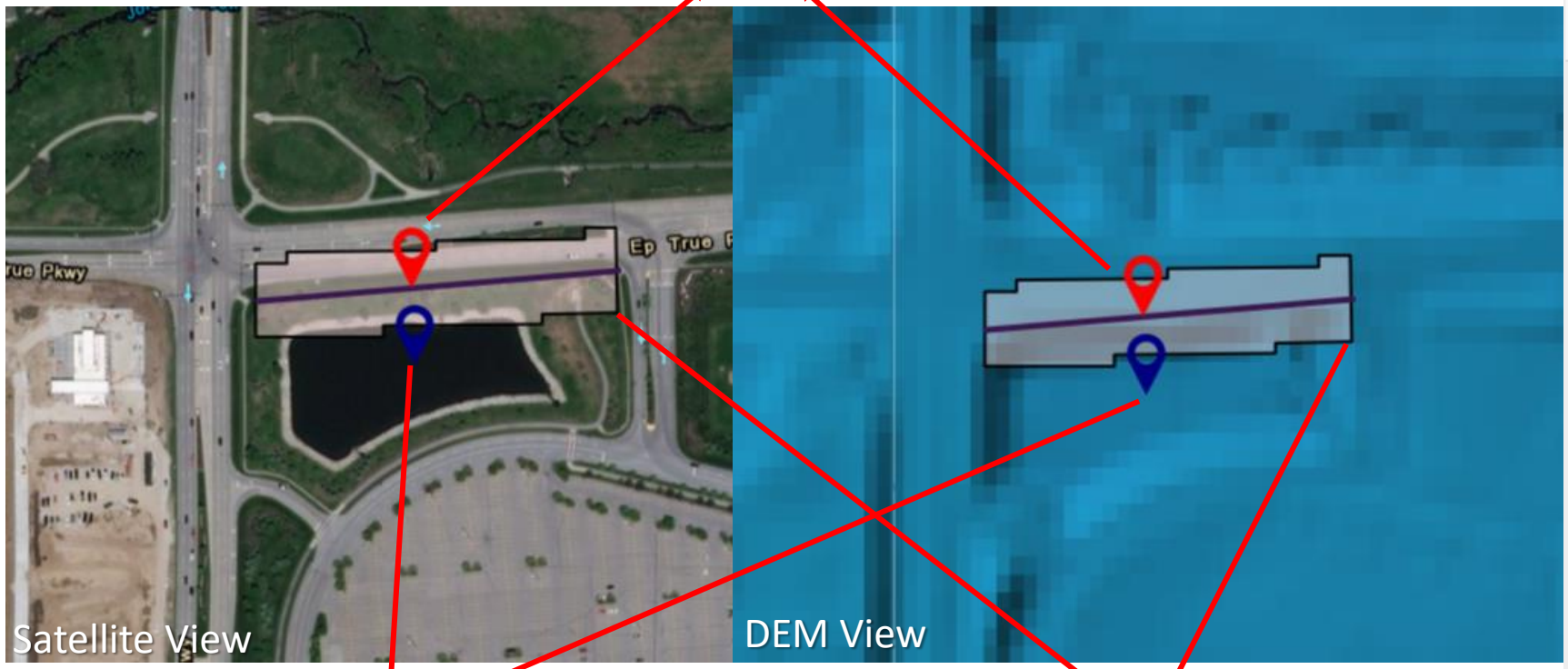
Job Status	User Error
Error	ELEVATION FOUND IN DEM IS TOO HIGH RELATIVE TO THE GIVEN RESERVOIR INFORMATION: The reservoir volume at elevation 369.59 ft is required in order to estimate its bathymetry. The system tries to estimate the volume at this elevation using the given maximum, normal, and failure pool data. None of the given reservoir pool elevations were high enough to properly estimate the required volume, so the system was unable to estimate reservoir bathymetry and had to abort. Please review input data.

Reservoir Point

Footprint of the impounding structure

Upstream reservoirs/impounding structures may interfere with the chosen reservoir point.

ERROR CODE: 13



Job Status	User Error
Error	REMOVING DAM STRUCTURE(S) DOES NOT RELEASE WATER: The system has determined that even if all the structures associated with reservoir 1 are removed, the water would not flood a significant area. This is usually caused by incorrect reservoir elevations or impounding structure elevations, incorrect structure placement, or high topography downstream of the breached structure(s). Please review input data.

The road embankment just downstream of the breach prevents the water from escaping.

Result of Simulation is “No Results”

5.4

“No Results”

The simulation setup process does not find any errors, the simulation runs, but the water does not go beyond the initial filled reservoir (or the cells making up the impounding structure or the breach itself).

Since no cells outside the reservoir or impounding structure are filled, there are no “downstream cells”, and nothing to show as a result.

This could be caused by:

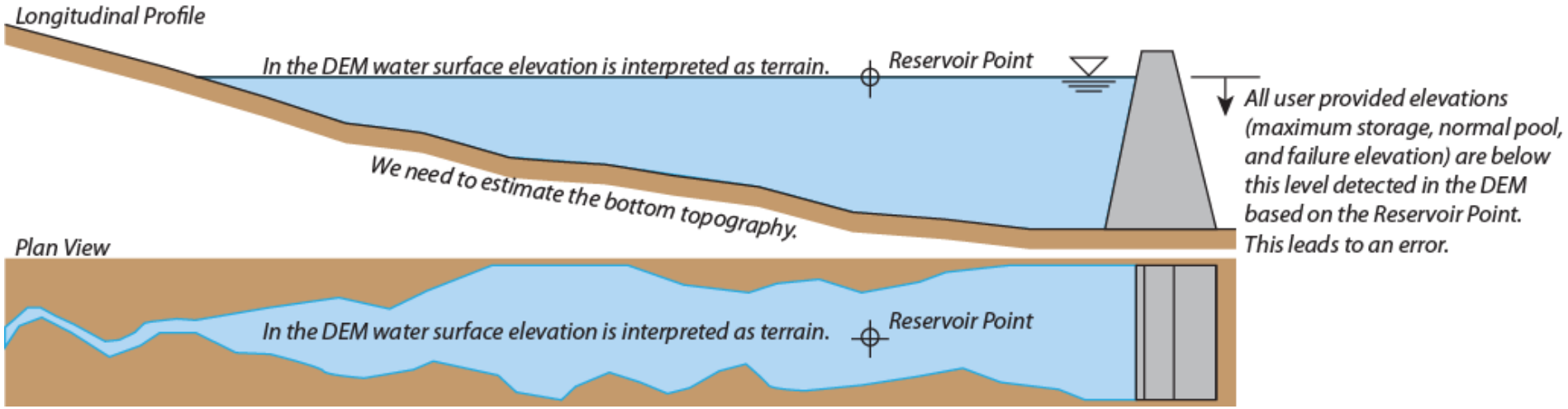
- A blockage just downstream of the breach
- Elevation/volume/breach information is valid, but doesn’t match the DEM, or DEM is wrong
- Breach placed near valley wall, where elevations are higher and block the water from flowing downstream
- Usually either a problem with the user-provided reservoir elevation values, or a problem with the DEM.

Explanations of Error Codes

5.5

ERROR CODE: 1
ELEVATION FOUND IN DEM IS TOO HIGH RELATIVE TO THE GIVEN RESERVOIR INFORMATION

The user specified a reservoir point which was found to be at elevation X.Xm (Y.Yft) in the DEM. At least one of the following pool elevations: either the maximum, normal, or failure must be above this value. All of the given reservoir pool elevations were below this, so the system was unable to estimate the reservoir bathymetry and had to abort.



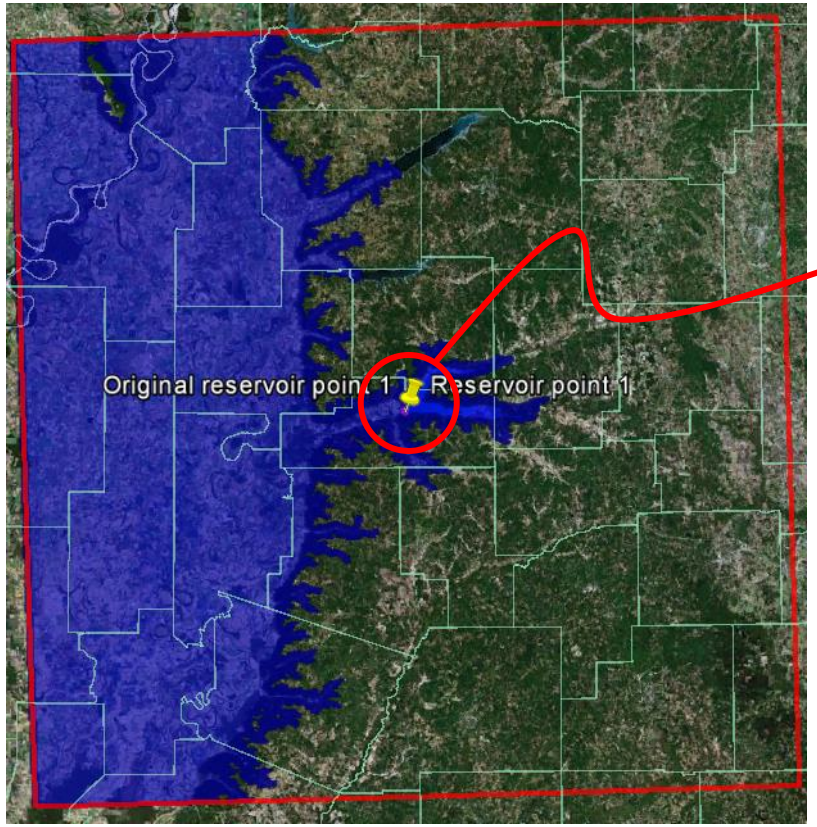
ERROR CODE: 4
RESERVOIR COULD NOT BE CONTAINED BY GIVEN IMPOUNDING STRUCTURE(S)

Reservoir bathymetry estimation requires the delineation of the reservoir boundaries by structures or higher topographic elevations. The system was unable to find this boundary either because the impounding structure(s) or reservoir were not defined correctly. A structure is missing from the setup or there is a problem with the DEM.

This error may result from different situations:

1. Incorrectly defined dam.
2. Missing structure(s).
3. Misplaced reservoir point (reservoir point mistakenly placed on the downstream).
4. Problems with the DEM (DEM elevations are not correct).

ERROR CODE: 4

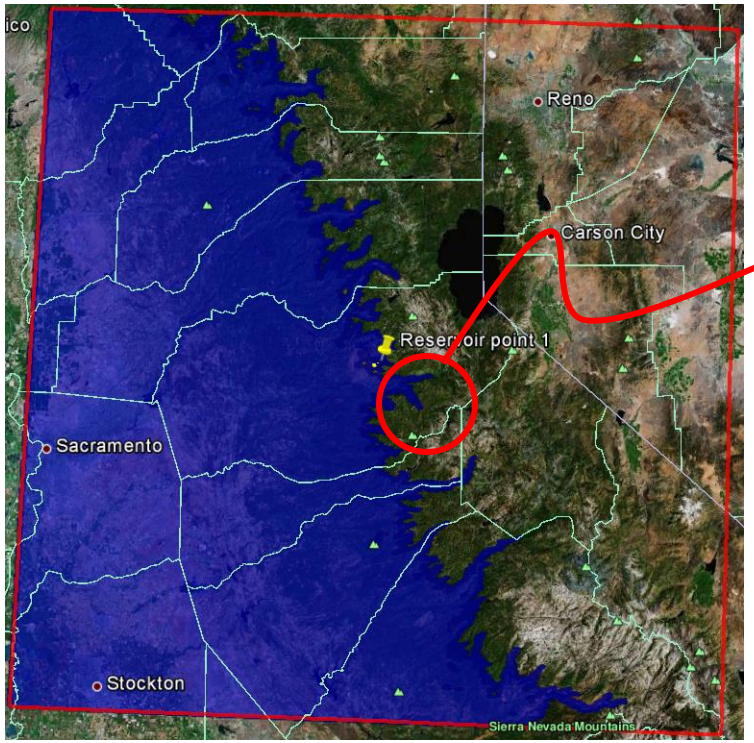


When DSS-WISE™ Lite attempts to fill the reservoir at the specified failure level the water leaks and fills the area downstream.

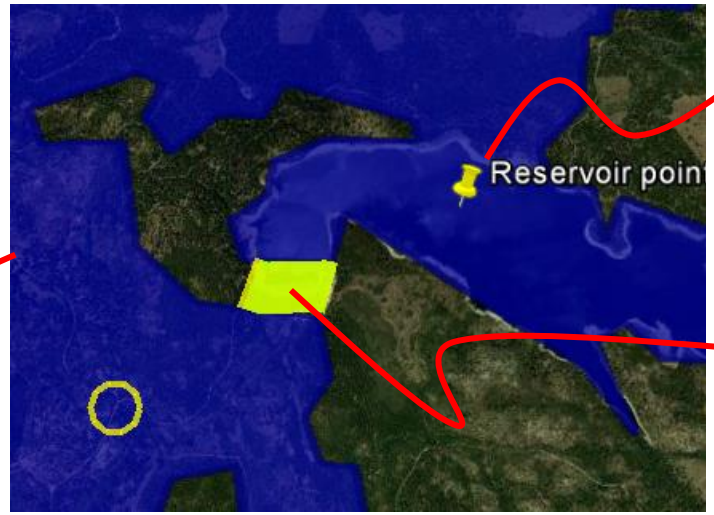
The dam is defined too short. The water leaks over the undefined part of the crest.

This close-up view clearly shows from where the water is leaking downstream.

ERROR CODE: 4



When DSS-WISE™ Lite attempts to fill the reservoir at the specified failure level the water leaks and fills the area downstream.



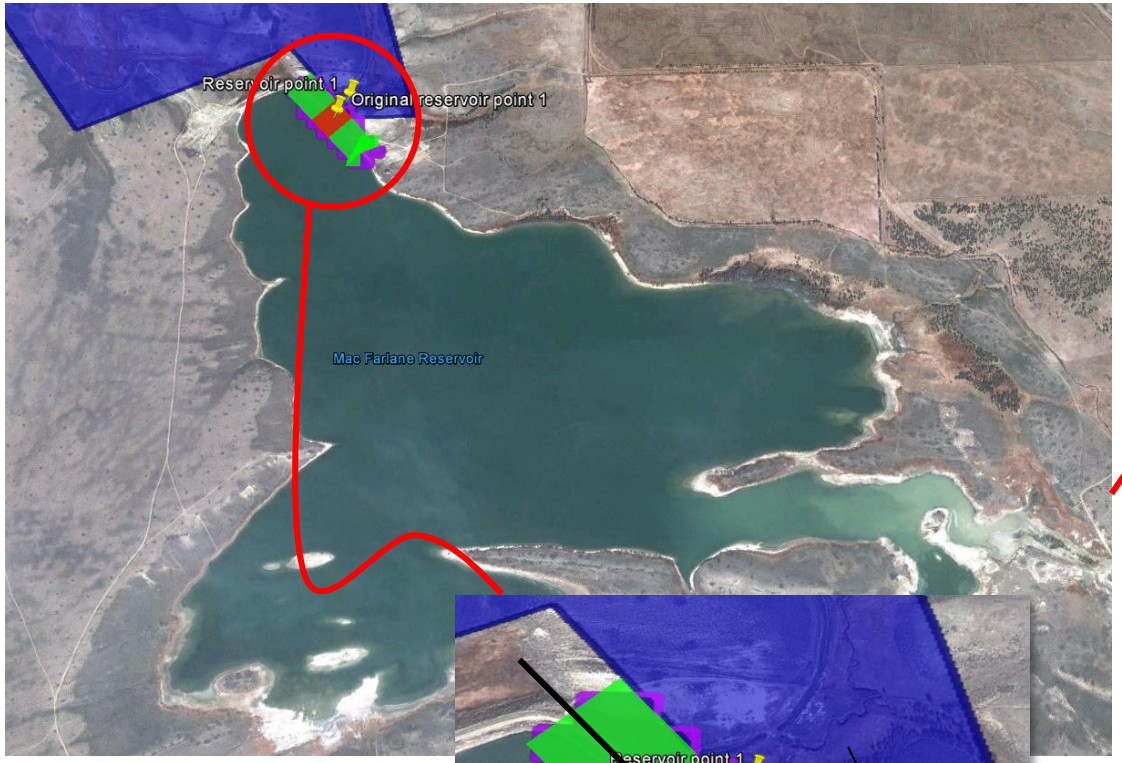
The water leaks from this area.

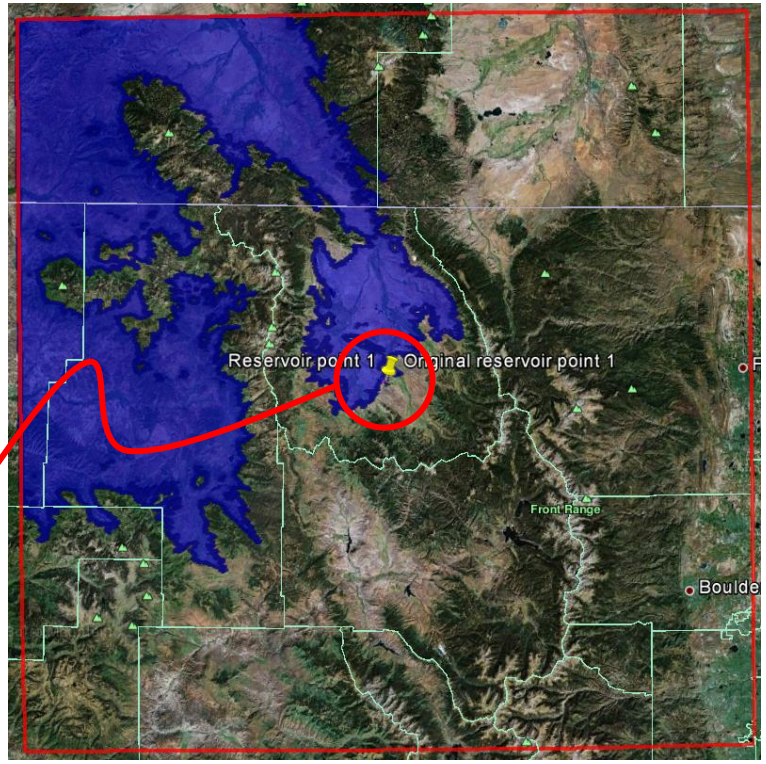
This dam holds the water.

The user forgot to define these additional structures that impound the reservoir.

This dam is correctly defined.

ERROR CODE: 4





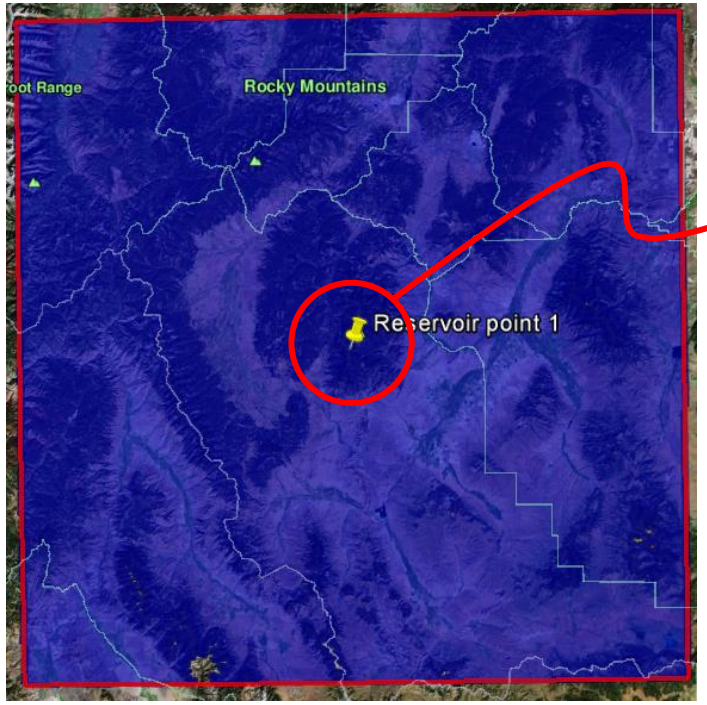
The user mistakenly placed the reservoir point on the wrong side of the dam axis.

The reservoir point was in the footprint of the dam. The system displaced the reservoir away from the dam axis.

When DSS-WISE™ Lite attempts to fill the reservoir at the specified failure level the water leaks and fills the area downstream.

Since the reservoir point was originally placed on the wrong side of the dam axis, when DSS-WISE™ Lite tries to fill the reservoir, it fills the downstream side.

ERROR CODE: 4



When DSS-WISE™ Lite attempts to fill the reservoir at the specified failure level the water leaks and fills the area downstream.

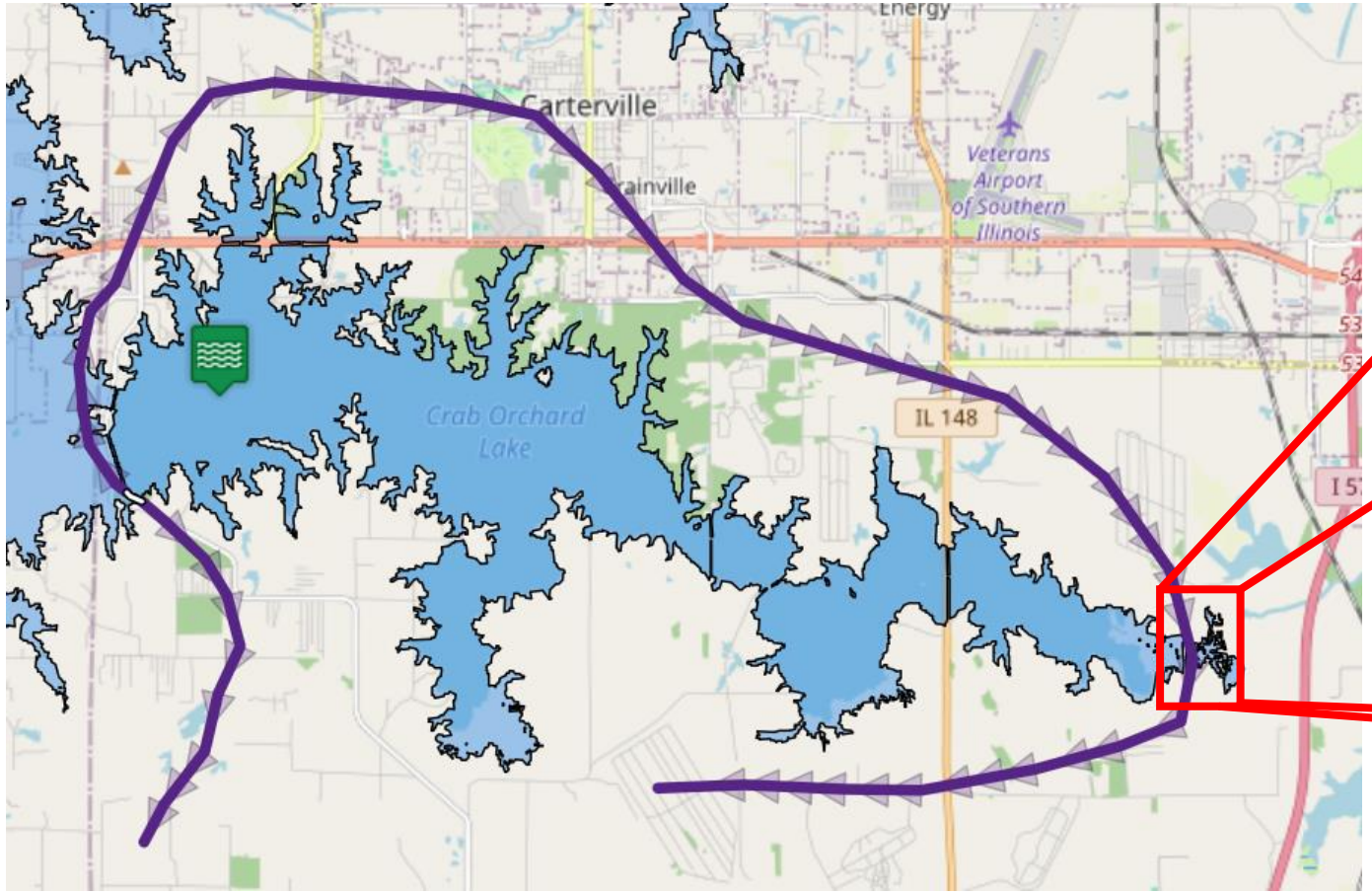
Enlarged view of the dam area.

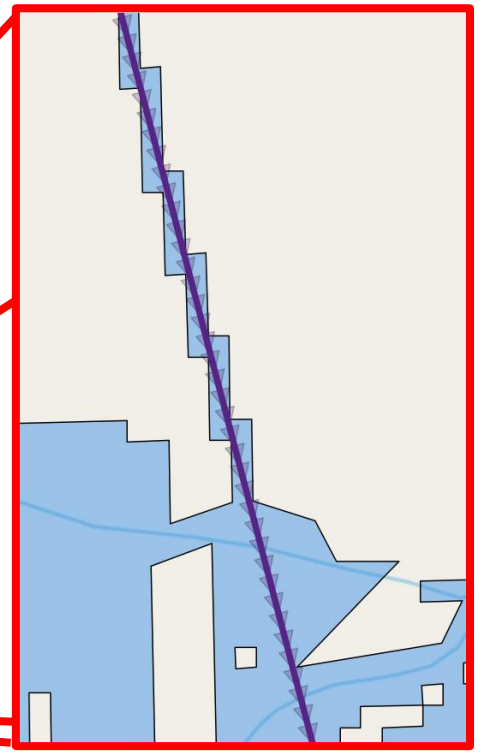
User defined dam shown in green.

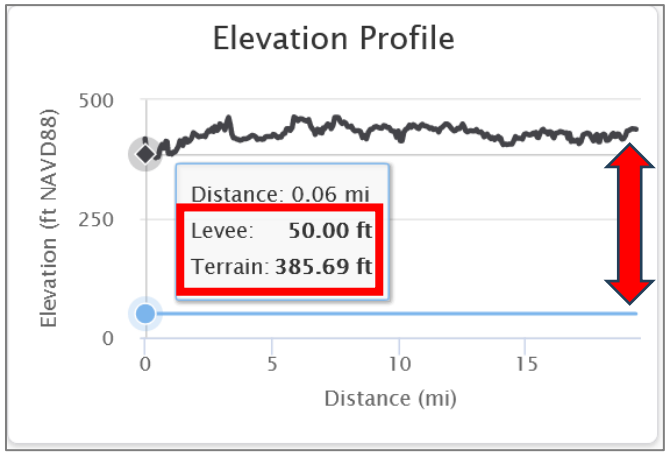
Since the user defined dam was not properly anchored DSS-WISE™ Lite extended the end points.

Due to a disagreement with the DEM, the water leaks from the upstream boundaries of the reservoir at the specified failure elevation.

ERROR: Code 4, Levee Digging Trench to Downstream



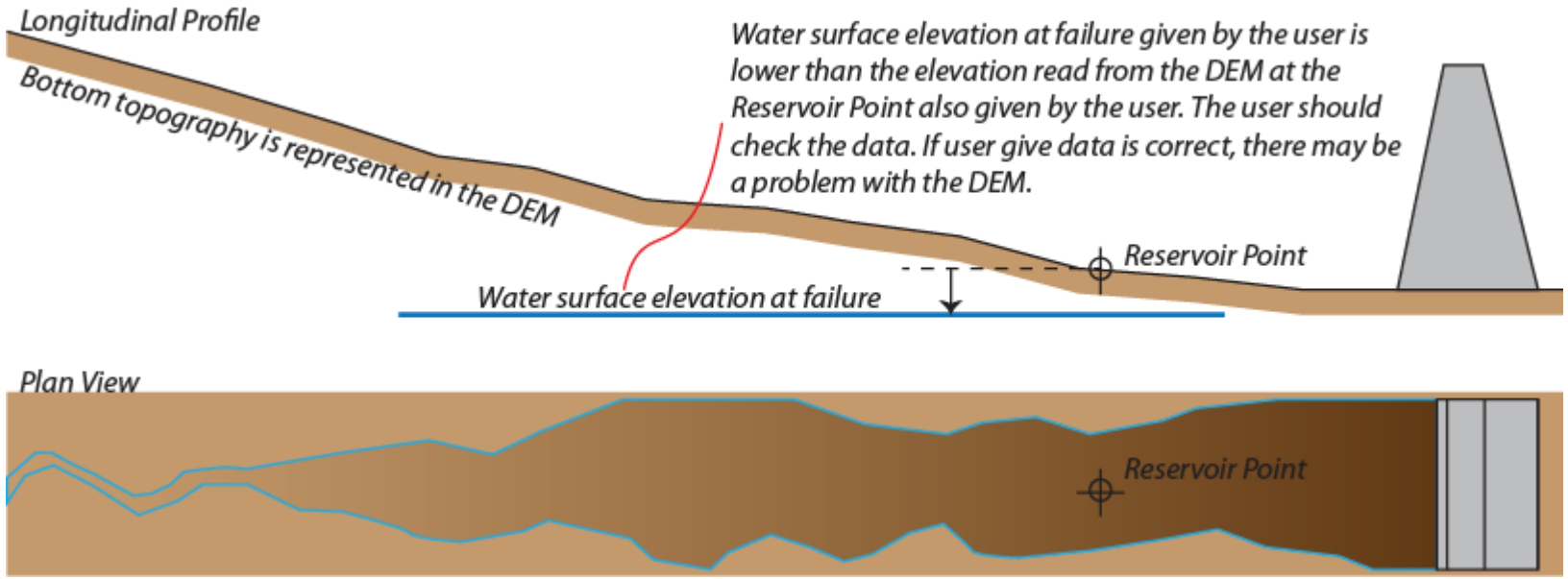




- The user tried to remedy error 4 by drawing a levee all the way around the reservoir to act as a barrier
- They mistook elevation for height, which ended up digging a deep trench where the levee was added
- The water escaped downstream through this trench, so the reservoir was not contained

ERROR CODE: 5
RESERVOIR'S FILLING ELEVATION IS BELOW DEM AT THAT POINT

The reservoir's bathymetry was detected to already be present in the DEM, but the given reservoir surface elevation at the failure scenario level is below the DEM's elevation. The reservoir cannot be filled to this underground elevation.



ERROR CODE: 8
NO IMPOUNDING STRUCTURES FOUND TOUCHING THE RESERVOIR

Reservoir 1 was associated with 0 impounding structure(s), but none of them were found to be properly positioned to touch any point of the reservoir when filled to the elevation found in the DEM.

This error occurs when the user digitizes the axis of a dam and clicks the reservoir point in a reservoir not connected with the digitized dam.

When DSS-WISE fills the reservoir up the elevation Z_{fail}, the water does not touch the dam cells. This situation is caught and the user is sent an error message.

ERROR CODE: 98
RESERVOIR IS TOO SMALL TO MODEL

A DSS-WISE™ Lite reservoir-type simulation must have at least 40 connected cells representing the reservoir area. This area is automatically determined from the DEM and the user-given reservoir point during a pre-processing step. Cells occupied by the footprint(s) of any impounding structures are excluded from the reservoir area. The footprint area is determined by the user-given crest line for the structure, the type of structure, and its hydraulic height. If any of these inputs are incorrect, or if the footprint(s) of impounding structures impinge too far into the reservoir, then the number of cells may fall below the threshold of 40. If this happens, the system will automatically reduce the cell size successively and attempt another pre-processing step until either the threshold number of cells is met, or the minimum cell size is reached. If the threshold number of reservoir cells still cannot be met, then the system will return this error. Check for proper placement of the reservoir point on the upstream side of the impounding structure(s), the placement and values given for the impounding structure(s), and the selected simulation cell size. Sometimes the reservoir surface is not properly represented as flat terrain of similar elevations in the DEM, in which case it may be possible to improve the situation by selecting the reservoir point to be on the highest part of the area representing the water surface in the DEM. Try turning on the DEM elevation base layer in the viewer to help determine if the reservoir surface is properly represented.

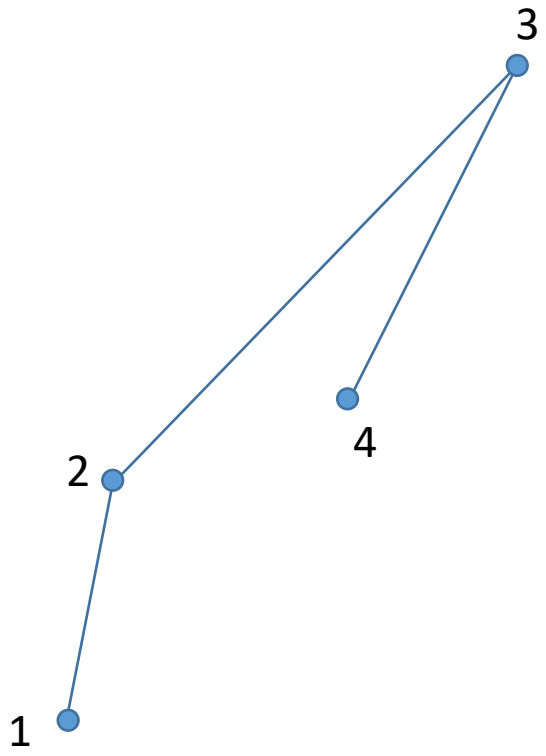
ERROR CODE: 100
UNEXPECTED FATAL ERROR

An unexpected fatal error has occurred. DSS-WISE™ Web is a complex automated system running continuously with minimal human operator intervention. We have made every effort to plan for and mitigate potential issues, but occasionally an unplanned problem arises which interferes with normal system operation (extended power outage, emergency system update, novel user behavior, etc.). The system administrators have been made aware of this error, and they will be looking into it. You can try resubmitting a DSS-WISE™ Lite simulation request or reading the Frequently Asked Questions or Known Issues list on the Help page.

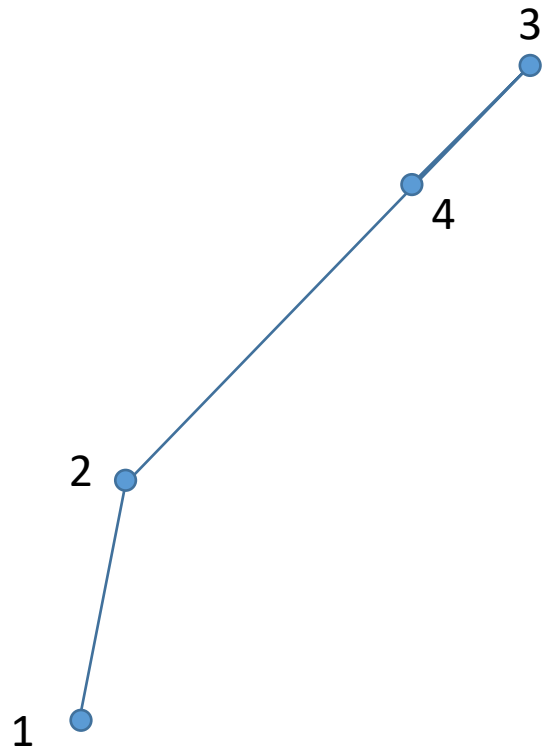
Errors In Defining a Dam Crest Line

5.6

Problems with User Defined Dam Crest Lines



Acute Angle!



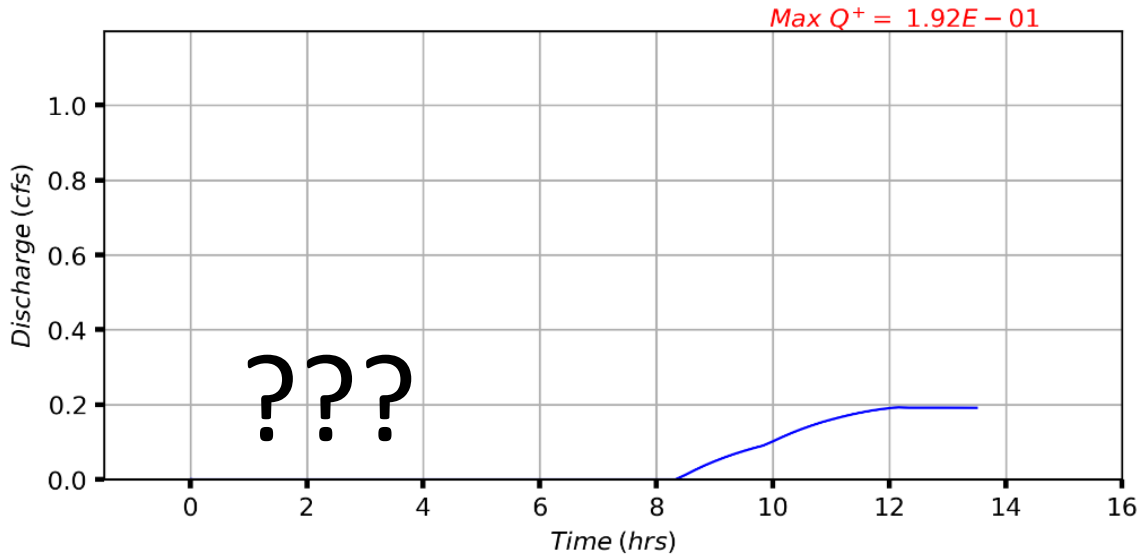
Super Acute Angle: Retracing Back!

This also defeats the system's attempts to extend the impounding structure if the reservoir is not contained.

General Tips

5.7

Negative Discharge



- Dam is defined with downstream direction on reservoir side
- Resulting breach discharge is reported as negative