



ICE WaRM

International Centre of Excellence
in Water Resources Management

BEGINNING SOON: 2pm Sydney Time

WEBINAR:

Water Modelling using HEC-RAS: 1D and 2D

Presented by Krey Price, Mark Forest, Robert Keller



Australian Government



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CHAIR



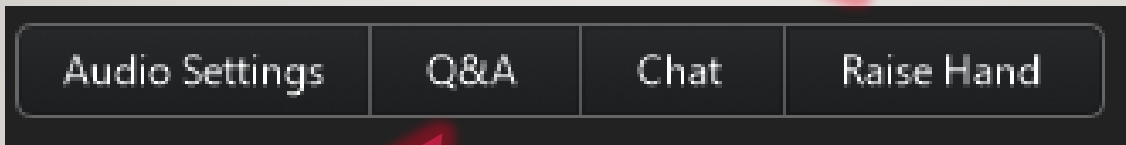
Trevor Pillar,

National Partnerships Manager,



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TEST



Please click on Q&A and start writing questions as they come to mind.

UP COMING HEC-RAS TRAINING COURSES:

- **Date:** Monday 11th - Friday 15th September, 2017
 - *Attend any or all days*
- **Location:** Brisbane
- **Presenters:** Robert Keller, Krey Price, Mark Forest
- **Register:** <http://www.icewarm.com.au/australian-water-school/short-courses/course/5th-hec-ras-water-modelling/>

AGENDA

- **Format:**
 - 25 mins: **Presentations:**
 - RAS Mapper and GIS Interfacing (Krey Price)
 - Subgrid Terrain Detail (Mark Forest)
 - Hydraulic Structures (Bob Keller)
 - 25 mins: **Q&A** open to all
- **Recording-** will be sent to all
- **Feedback**
 - 1 minute after Webinar
 - All comments welcome- helps shape future webinars

Today's Attendees:



Today's Presenters



Mark Forest

Global Practice
Leader

HDR Inc.



Dr. Robert Keller

Honorary
Associate
Professor
Monash
University



Krey Price

Director

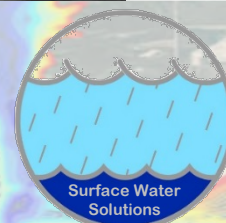
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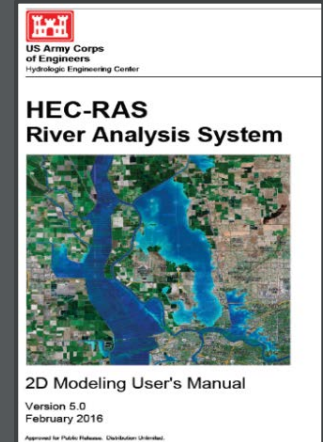
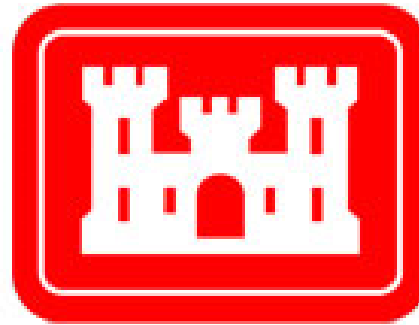
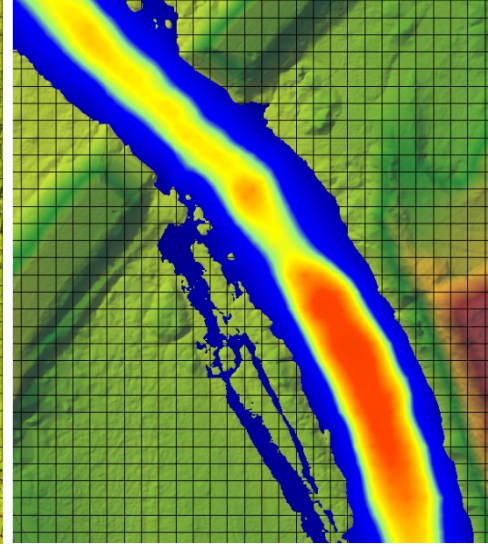
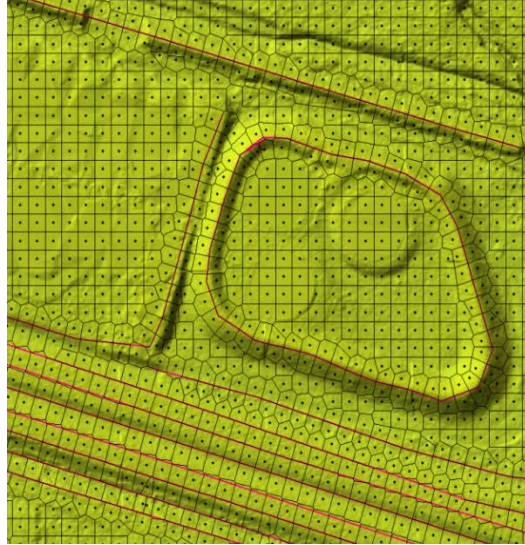


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What is HEC-RAS 5.0?

- 2-dimensional Hydrodynamic Flow Routing
- Similar to the use of a Storage Area
- Linked 1D/2D Capability
- Independent 2D Domain for Overbank or Channel
- Full Saint Venant or Diffusion Wave Equation Solution Options
- Implicit Finite Volume Solution Algorithm
- 1D and 2D Coupled Solution Algorithm
- Unstructured or Structured Computational Meshes with Variable Sizes in Domain
- Detailed Hydraulic Table Properties for Computational Cells and Cell Faces
- Multi-Processor Based Solution Algorithm
- 64 Bit and 32 Bit Computational Engines





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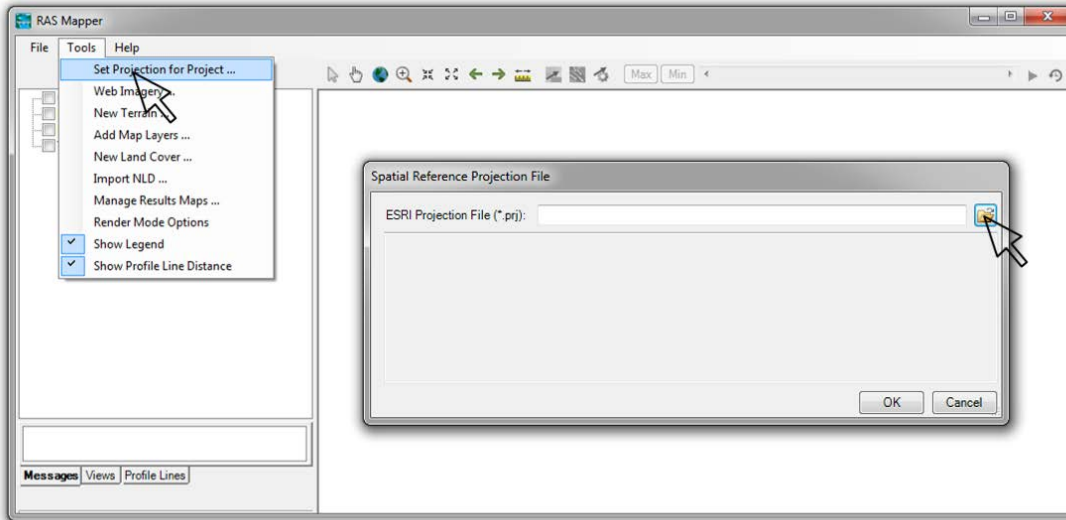
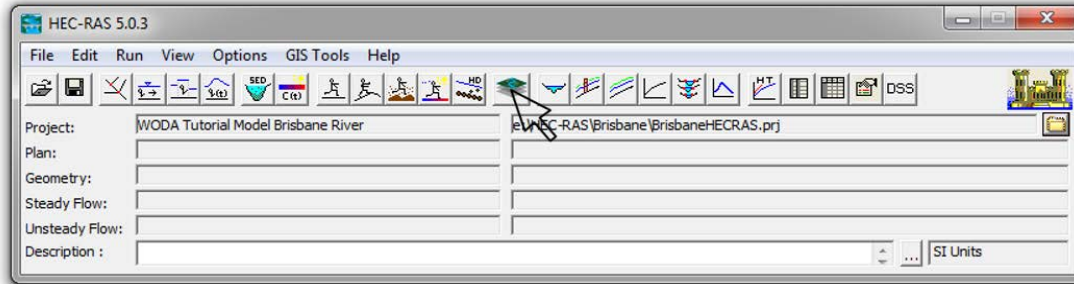


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RAS Mapper





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The screenshot shows a web browser window at <http://spatialreference.org/ref/epsg/gda94-mga-zone-56/>. The page title is "Spatial Reference epsg projection 28356 - gda94 / mga zone 56". The main heading is "EPSG:28356".

Navigation links include: Home | Upload Your Own | List user-contributed references | List all references | Search

Previous: [EPSG:28355: GDA94 / MGA zone 55](#) | Next: [EPSG:28357: GDA94 / MGA zone 57](#) | [Link to this Page](#)

Input Coordinates: 153, -29.75 Output Coordinates: 500000, 6708916.14734

EPSG:28356

GDA94 / MGA zone 56 ([Google it](#))

- **WGS84 Bounds:** 150.0000, -37.8000, 156.0000, -21.7000
- **Projected Bounds:** 189586.6272, 5812134.5296, 810413.3728, 7597371.5494
- **Scope:** Large and medium scale topographic mapping and engineering survey.
- **Last Revised:** June 2, 1995
- **Area:** Australia - 150°E to 156°E

A map of Australia is shown with a red location pin in the southeast. A dropdown menu is open at the bottom right, showing options: Save, Save as, Save and open. A yellow bar at the bottom of the page asks: "Do you want to open or save 28356.prj (388 bytes) from spatialreference.org?".



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Applying geoscience to Australia's most important challenges

Australian Government
Geoscience Australia



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[National Elevation Data Framework](#)

[National Elevation Data Framework \(NEDF\) and Urban Digital Elevation Model \(DEM\) Project Data Contributors](#)

[Built Environment and Exposure](#)

[National Surface Water Information](#)

[Topographic Information](#)

[Dimensions](#)

[Landforms](#)

Digital Elevation Data

Contents

- [National Elevation Data Framework \(NEDF\)](#)
- [Online data](#)
- [Packaged data](#)
- [Related Information](#)

Australia's future safety, prosperity and sustainability depends on making informed policy and investment decisions that meet the needs of today, and the decades ahead. Digital elevation data which describes Australia's landforms and seabed is crucial for addressing issues relating to the impacts of climate change, disaster management, water security, environmental management, urban planning and infrastructure design. Geoscience Australia is working collaboratively across all levels of government, industry and academia to ensure decision makers, investors and communities have access to the best available elevation data to meet local, regional and national needs.

National Elevation Data Framework (NEDF)



ELVIS (Elevation Information System)

Ensuring decision makers, investors and the community have access to the best available elevation data describing Australia's landforms and sea bed to address the needs of today and the decades ahead.



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A screenshot of the ELVIS - Elevation Information System web application. The interface shows a map of Australia with state and territory labels: Northern Territory, Queensland, Western Australia, South Australia, New South Wales, Victoria, ACT, and Tasmania. The map is overlaid on a satellite-style background. On the right side, there is a panel titled "Available datasets" with a list of data layers and their descriptions. A hand cursor is pointing at the "5 metre Digital Elevation Model (DEM)" option. The top of the page has the Australian Government logo and the text "ELVIS - Elevation Information System". The bottom of the page shows a Google logo and a scale bar for 300 km.



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ELVIS - Elevation Information System

Enter a location

Download wizard

5 metre Digital Elevation Model (DEM)

Output Format:

Coordinate System:

Data representation. Select how you want your data presented.
Output format is the structure of the data and you should choose a format compatible with the tools that you will use to manipulate the data.

- **Esri ASCII Grid** - An Esri ASCII grid is a raster GIS file format developed by Esri. The grid defines geographic space as an array of equally sized squares grid points arranged in rows and columns. Each grid point stores a numeric value that represents elevation or surface slope for that unit of space. Each grid cell is referenced by its x,y coordinate location.
- **Geo TIFF (Geo-referenced Tagged Image File Format)** - GeoTIFF is a public domain metadata standard which allows georeferencing information to be embedded within a TIFF file.
- **MapInfo Vertical Mapper Grid (NGrid)** - NGrid is a binary raster format with header information. For each raster, there is only a single feature returned, since this feature will contain the entire raster. A single feature is stored in a single file, with header information in an associated MapInfo TAB file.

Select what coordinate system or projection you would like. If in doubt select WGS84.
Not all projections cover all of Australia. If the area you select is not covered by a particular projection then the option to download in that projection will not be available.



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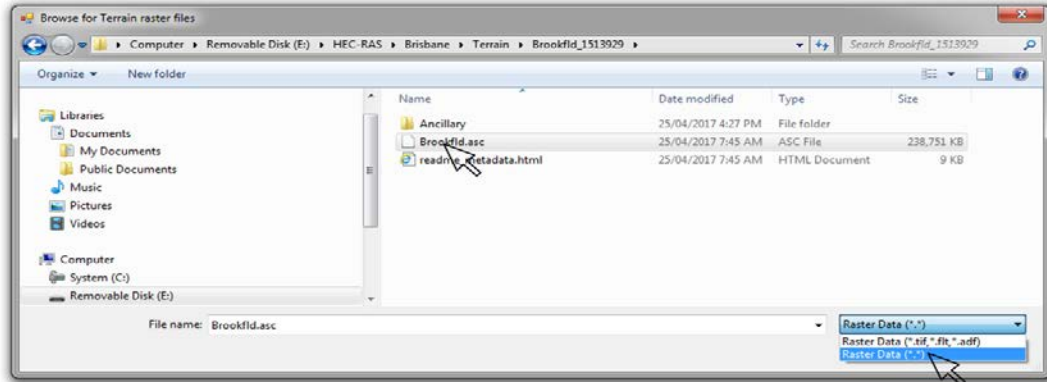
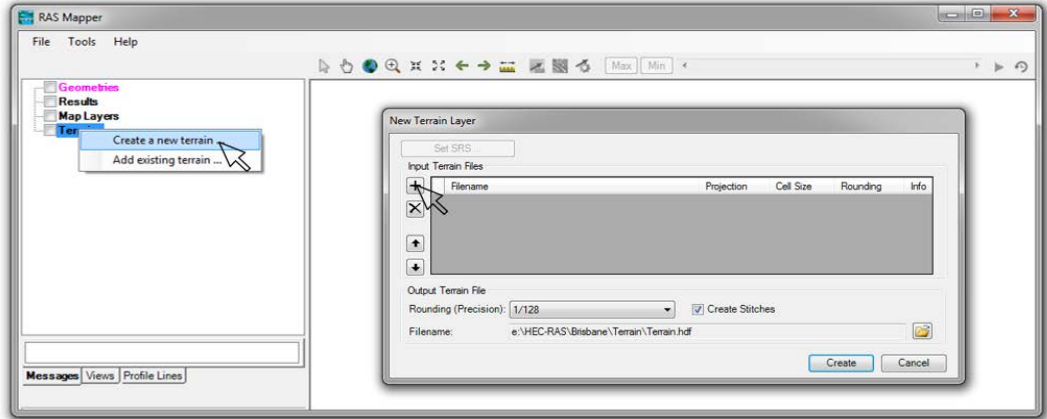
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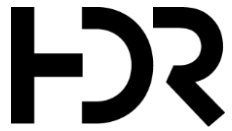
RAS Mapper



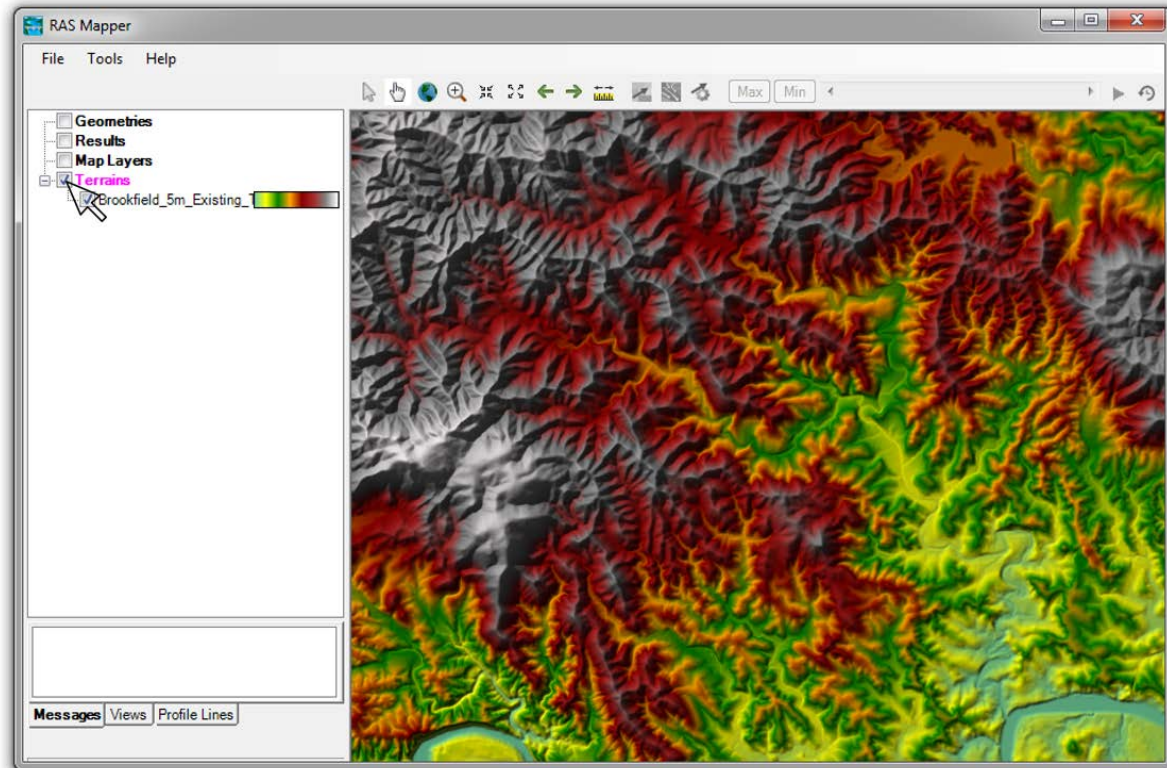
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The image shows a screenshot of the RAS Mapper software interface. The main window displays a map with a topographic relief overlay. A context menu is open over the map, listing options: "Add map data layers ...", "Add Web Imagery layer ...", "Add new Land Cover layer ...", and "Add existing Land Cover layer ...". The "Add Web Imagery layer ..." option is highlighted. In the foreground, the "GDALWMS" dialog box is open, titled "Select WMS image server". It contains a list of WMS servers, with "Google Satellite" selected. The list includes: ArcGIS Ocean Basemap, ArcGIS USA Topo Maps, ArcGIS World Imagery, ArcGIS World Physical Map, ArcGIS World Shaded Relief, ArcGIS World Street Map, ArcGIS World Terrain Base, ArcGIS World Topo Map, Bing Satellite, Google Hybrid, Google Map, Google Satellite, Google Terrain Streets Water, Google Terrain, MapQuestOpenAerial, MapQuestOpenStreets, NASA USDA NAIP Infrared, OpenStreetMaps, Quadshhets, and USGS Orthoimagery. At the bottom of the dialog, the "Reprojection Resample Method" is set to "near", and the "OK" button is highlighted with a mouse cursor.



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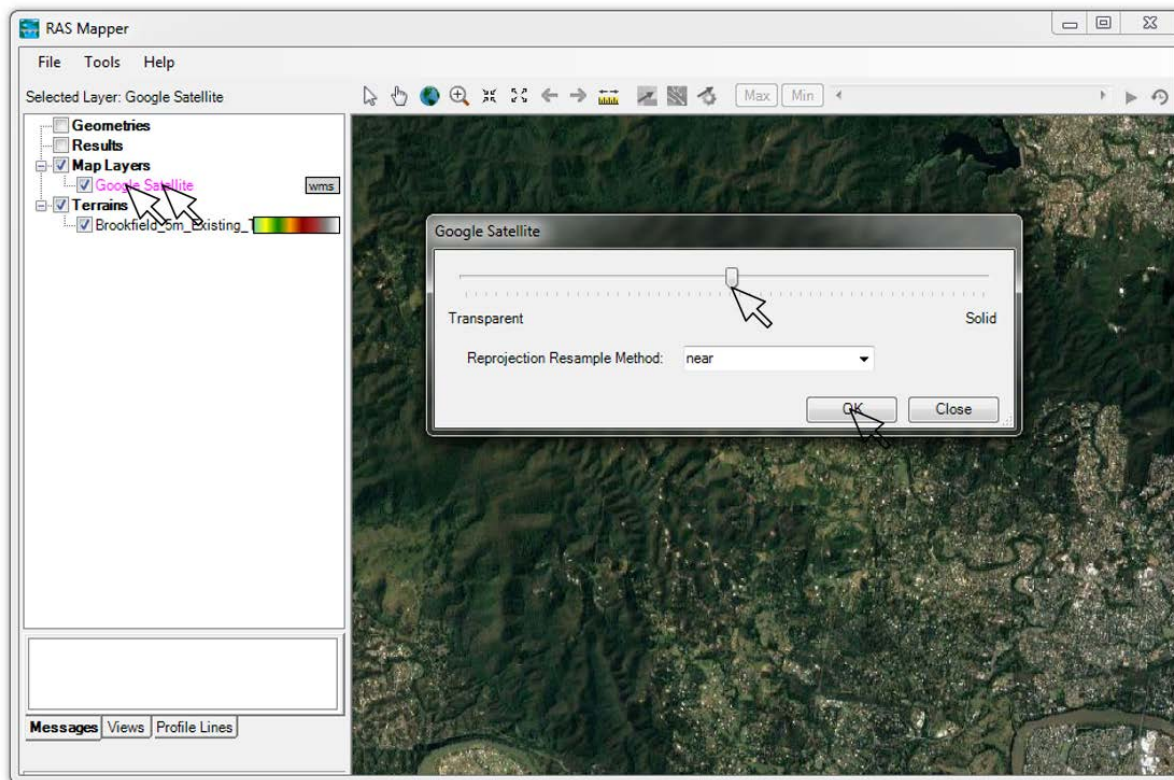
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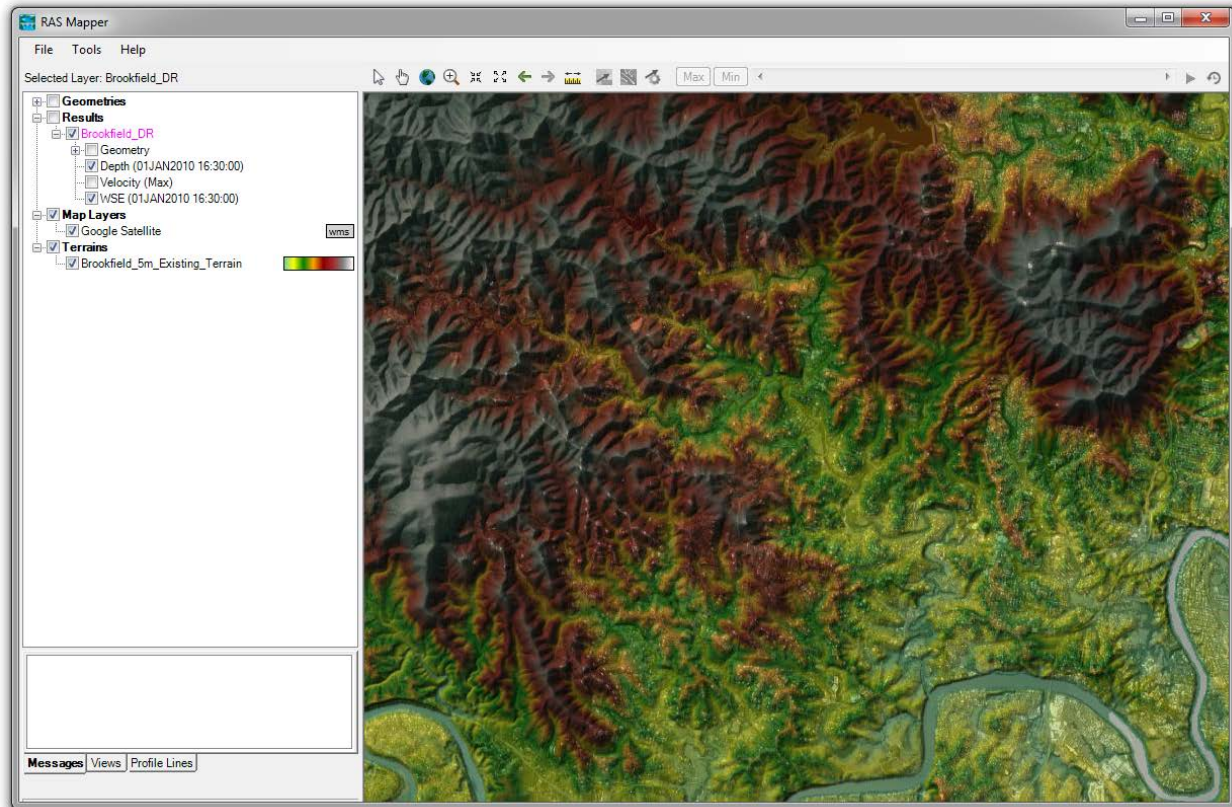
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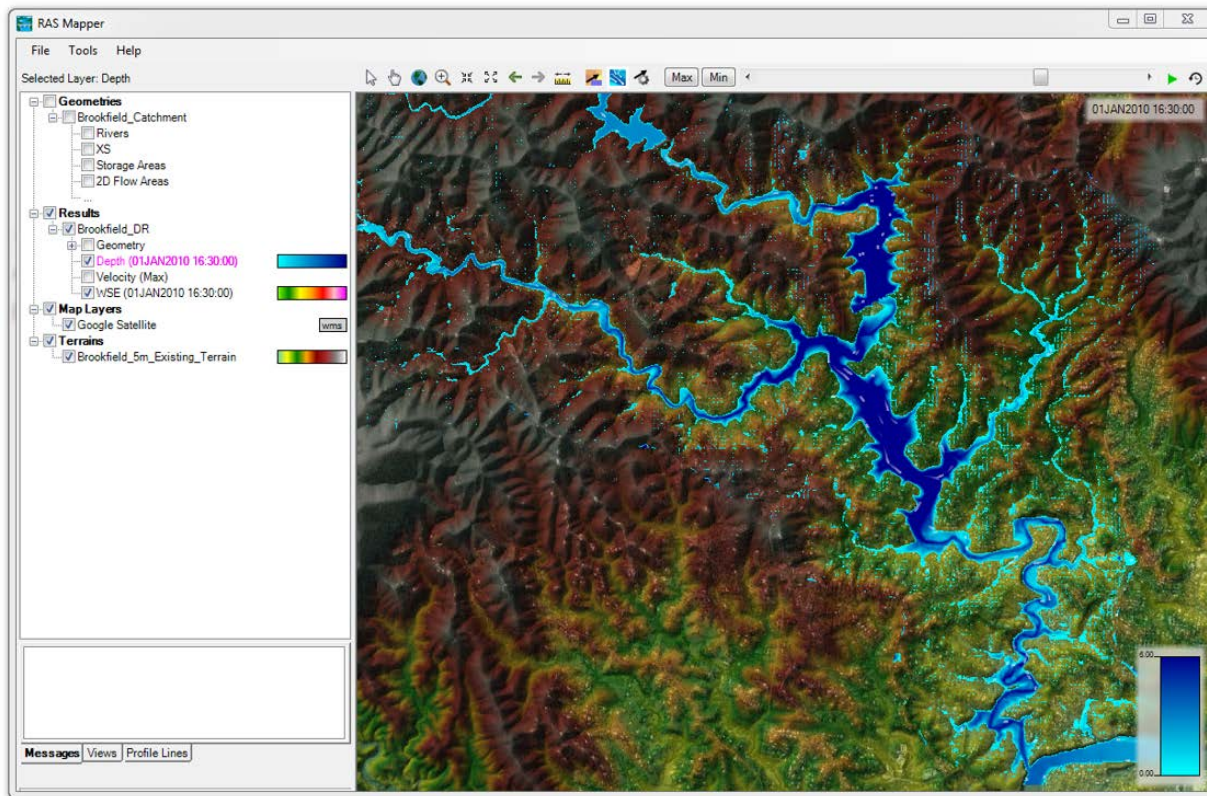
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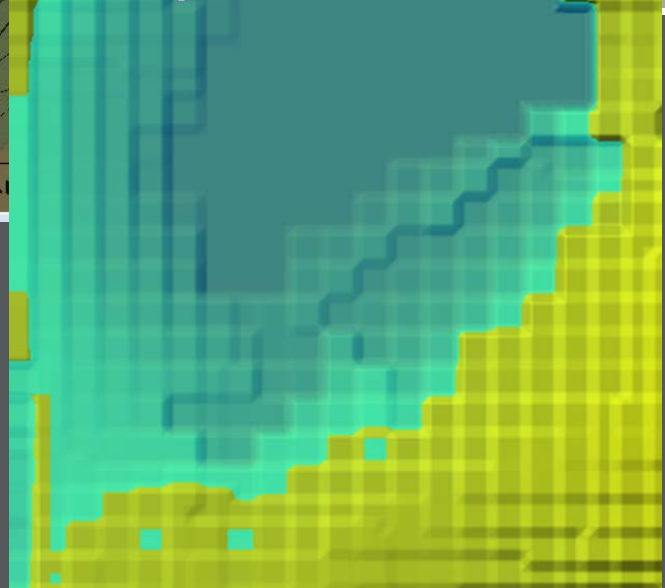
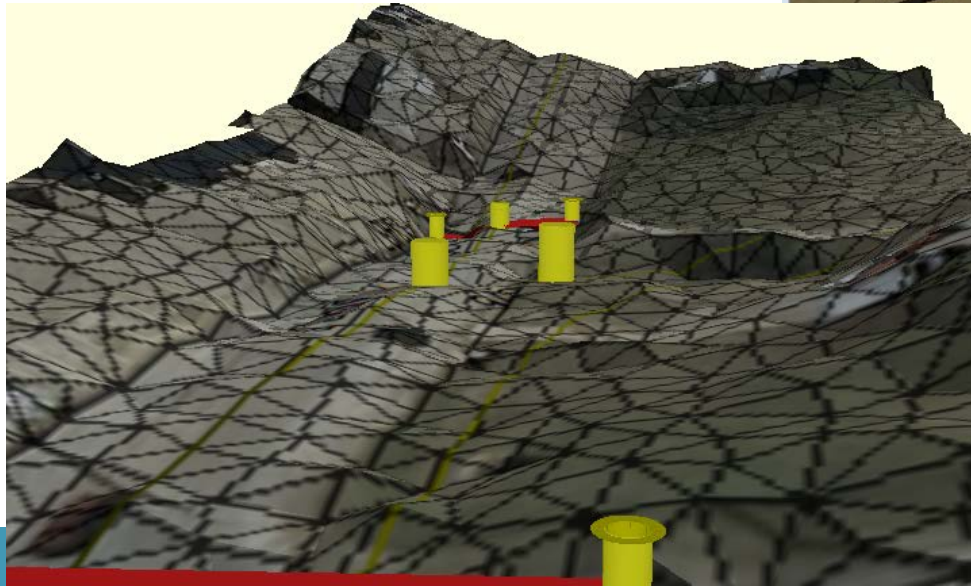
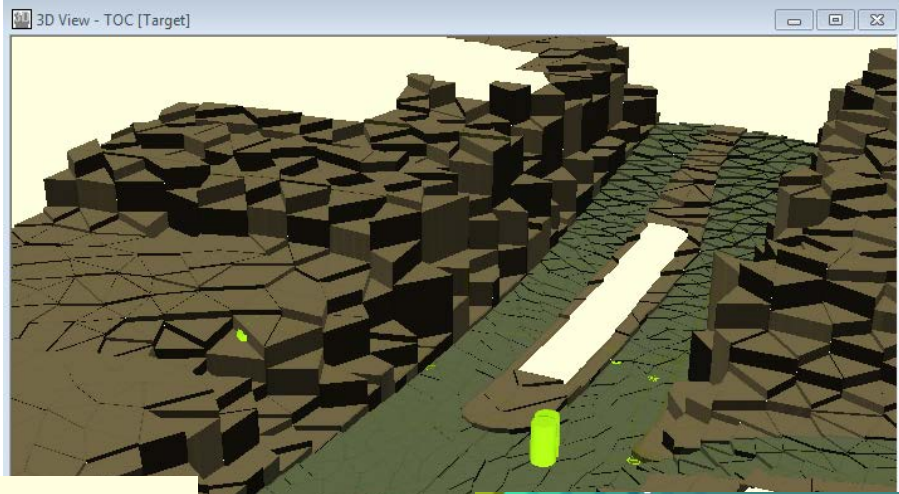


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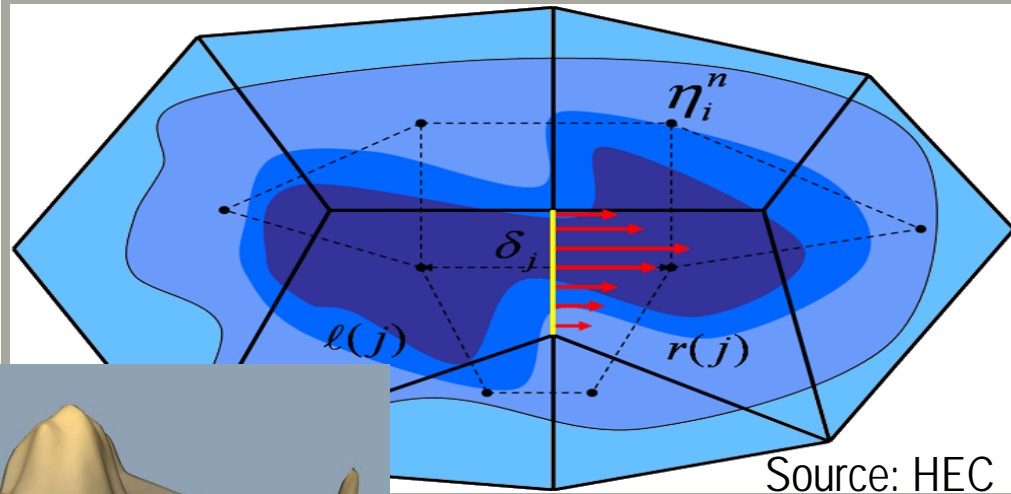
Sub-Grid Level Detail is Important

- Most 2D Software Packages Simplify the Terrain
- Simplified terrain requires smaller grids



How is RAS Different?

- Computational Mesh with Sub-Grid Terrain Data (Full Terrain Detail is Utilised)
- Gridding Process Defines Hydraulic Property Tables
 - Elev-Wetted Perimeter (Face)
 - Elev-Area (Face)
 - Roughness (Face)
 - Elev-Volume (Cell)
- Cell Face is a Detailed Cross Section
- Able to Capture Complex Hydrodynamics



Source: HEC

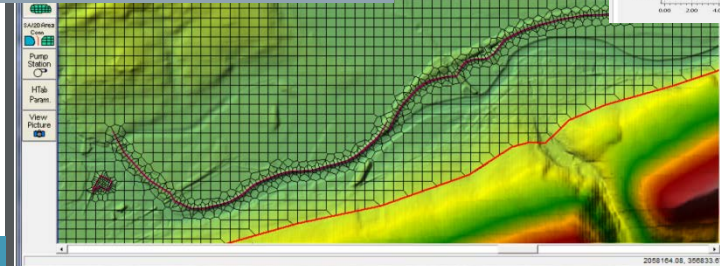
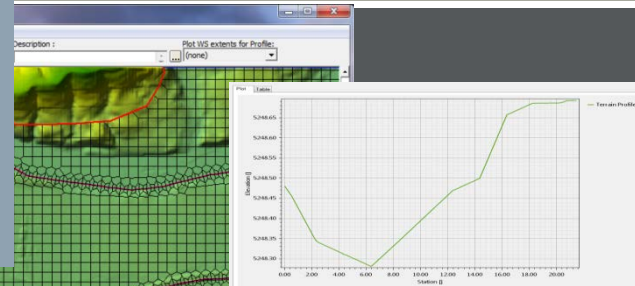
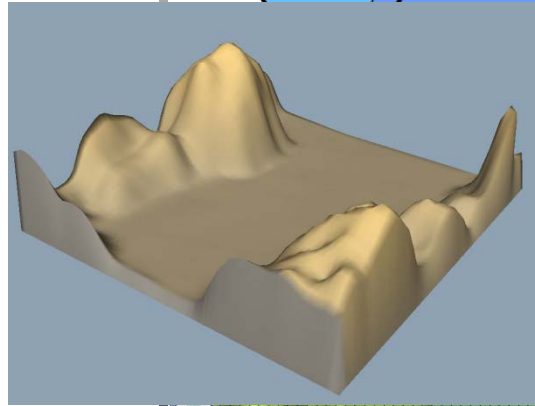
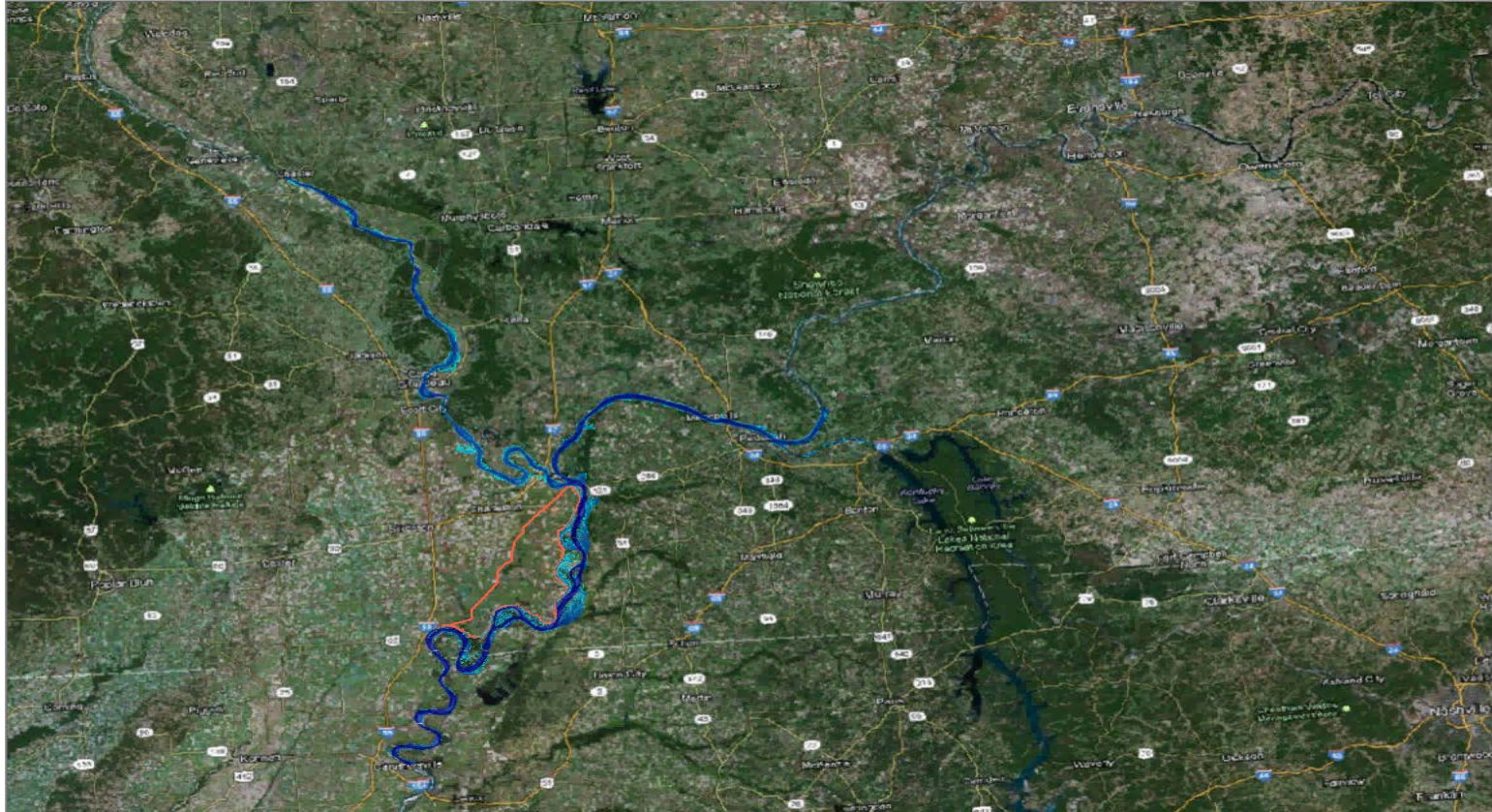


Figure 3-6. Example 2D computational mesh for a levee protected area.

Source: HEC

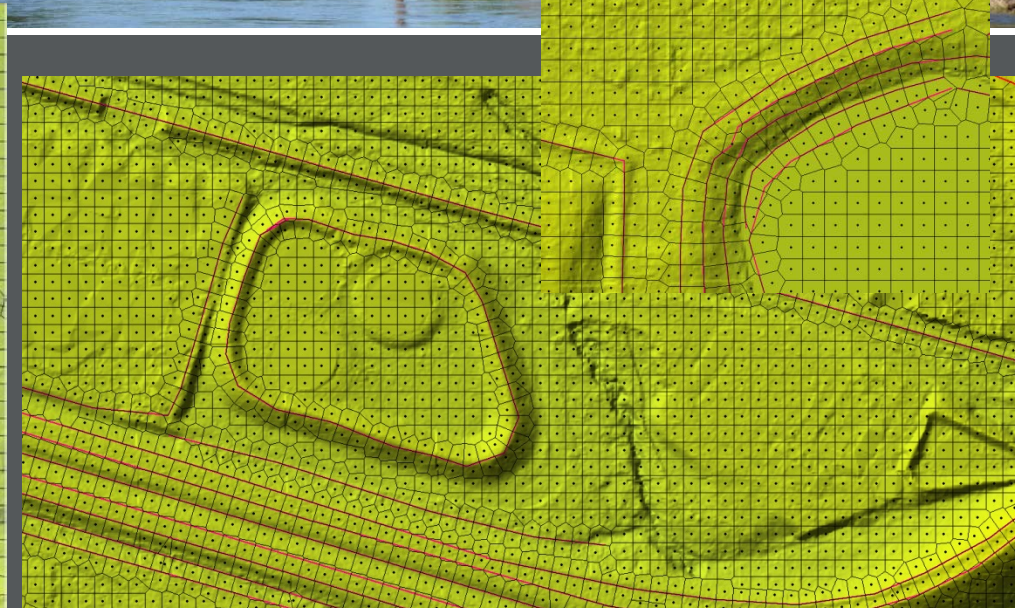
Mississippi/Ohio River Flooding May 2011 – Forced Levee Breach

- Installed over 100 Temporary Gages to Capture the Event
- Used as Model Validation



Adding Breaklines to Capture Linear Features

- Breaklines allow user defined grid boundaries to define linear features and gridding process



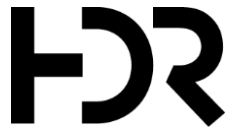
Hydraulic Structures



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Geometric Data - Brookfield_Catchment

Connection Data Editor - Brookfield_Catchment_Structure

24x7 Help

File Edit Opti

Tools River Reach

Editors

Junct.

Cross Section

Brdg/Culv

Inline Structure

Weir / Embankment

Lateral Structure

Storage Area

2D Flow Area

SA/2D Area Conn

Pump Station

HTab Param.

View Picture

File View Help

Connection: Roadway [Apply Data]

Description: 10-m roadway deck with 4-m diameter concrete pipe [Breach (plan data) ...]

Connections

From: 2D flow area: Brookfid_Ctchmnt [Set SA/2D ...]

To: 2D flow area: Brookfid_Ctchmnt [Set SA/2D ...]

Weir Length: 505.80

Centerline Length: 505.80

Overflow Computation Method

Normal 2D Equation Domain Use Weir Equation [Centerline GIS Coords ...]

Structure Type: Weir and Culverts [No Flap Gates] [Terrain Profile ...]

Legend

Spillway

Elevation (m)

Station (m)

Roadway

Centerline Stations

	Upstream	Downstream
5	220.	220.
6	225.	225.
7	230.	230.
8		

Cancel Help

66.42, 6959349.06



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Hydraulic Structures

- Modeling hydraulic structures in RAS 2D very limited
- Some options for adding a bridge
- Eg:
 - Simply modify the terrain to include the bridge embankments, piers, and abutments
 - Advantages:
 - Easy to set up for existing bridges that are included as part of the terrain
 - Disadvantages:
 - Requires manually editing your terrain if you want to model a proposed bridge.
 - Can only simulate low flow through a bridge (can't impact the bridge deck).
 - Can't simulate complex-shaped piers.



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Hydraulic Structures

- Alternatively:
 - Use a SA/2D Area Connection with a culvert (or culverts) - useful for wider bridges with relatively small openings when the bridge deck is impacted during the flood - spacing between box culverts simulates the piers.
 - Advantages:
 - Can simulate low flow and high flow conditions (i.e. bridge overtopping).
 - Disadvantages:
 - Uses culvert equations to model a bridge.
 - May not be able to get the culvert shape to perfectly match the bridge opening
 - Requires calibration
- NOTE BRIDGE SCOUR ISSUE



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Hydraulic Structures



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Hydraulic Structures

- If scour is an issue, must use 1-D modeling
- Other Structures
 - Irrigation controls
 - Pump stations
 - Many lateral structures
 - Etc etc
- Use 1-D modeling for proper structure simulation



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Logistics for Q&A

1. Please click **Q&A** and type your question:



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Audio Settings

Q&A

Chat

Raise Hand

2. Please click **raise hand** and ask a **live** question on screen.



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Thanks for participating

REMINDER:

- FEEDBACK: complete short survey as you close this window.
- RECORDING: link will be emailed
- BRISBANE COURSE: 11 - 15 September- *attend any or all days*
- FREE WEBINARS:
 - **25th May: Smart Water Grids**: *SA Water CEO Roch Cheroux*
 - **15th June: Hard-Rock Groundwater Recharge**: *Peter Dillon, Yogita Dashora*
 - **29th June: Next Generation Irrigation Management**: *Tim Hyde, Ivor Gaylard*
 - **20th July: Community Wastewater Reuse with HRAP**: *Howard Fallowfield*
- TWITTER: [@ICE_WaRM_](#) keep up-to-date with ICE WaRM



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