

# Hydrology of the Eden - create your own map

## GIS lesson focused on the Eden Catchment

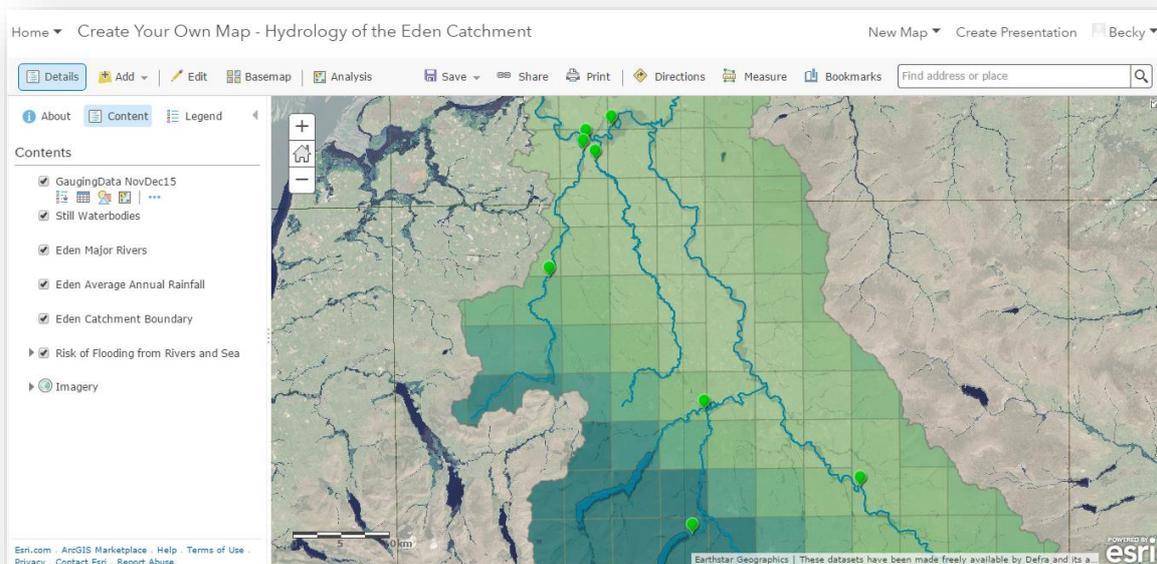
### Summary

Follow the step by step video tutorial to create your own web map about the hydrology of the Eden Catchment. The map can then be used to answer a range of questions such as:

- How did the storm hydrograph for the December 2015, Storm Desmond Floods vary across the Eden catchment?
- What was the peak flood level at Eamont Bridge during Storm Desmond?
- Where is the highest average annual rainfall in the Eden Catchment?
- Name some areas of Carlisle at high risk of flooding.

By completing this lesson, students will become familiar with the following GIS skills:

- Adding data to ArcGIS Online (from zipped shapefiles, csv Excel file, Internet),
- Symbolising data in ArcGIS Online,
- Creating a choropleth map of average annual rainfall,
- Customising pop-up information including adding simple storm hydrographs to a map, and
- Querying map data.



## Resources Required

- Internet access,
- An ArcGIS Online Account. You can use a free public account which you can register for at <https://www.arcgis.com/home/signin.html> (an e-mail address is required). Or your school can sign up for free to the ESRI UK Schools ArcGIS Online programme: <https://schools.esriuk.com/>,
- Hydrology data, to enable the creation of the map. Email our Learning Co-ordinator at [learning@edenrt.org](mailto:learning@edenrt.org) for your copy.

## Create your own map

A step-by-step video tutorial is provided to guide you through the creation of the map: <https://vimeo.com/233496094>

You may want to pause the video after each step, so that students can more easily follow and reproduce each step on their computer.

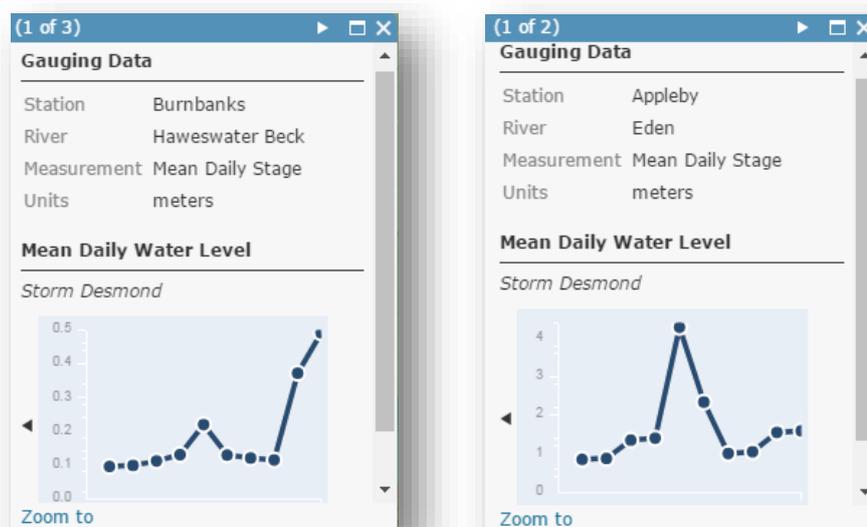
An example version of the finished map can be found at: <http://arcg.is/111B1A3>

## Questions

Use the finished map to answer questions on the hydrology of Eden and December 2015 floods:

Q1. How did the storm hydrograph for the December 2015, Storm Desmond, floods vary across the Eden catchment?

Click on the different gauging stations in the catchment to view the pop-up storm hydrographs. Ask students to consider why the storm hydrographs for the river draining from Haweswater Reservoir may be different to those on the main River Eden.



Q2. What was the peak flood level at Eamont Bridge in December 2015? Compare this to the current river level at Eamont Bridge today which you can find on Gauge Map at <http://www.gaugemap.co.uk/>

Q3. Where and what is the highest and lowest average annual rainfall in the Eden Catchment?

You can query the rainfall data by following the instructions below:

1. Click on the table tool, found below the average annual rainfall layer in the table of contents to bring up rainfall data for the catchment.

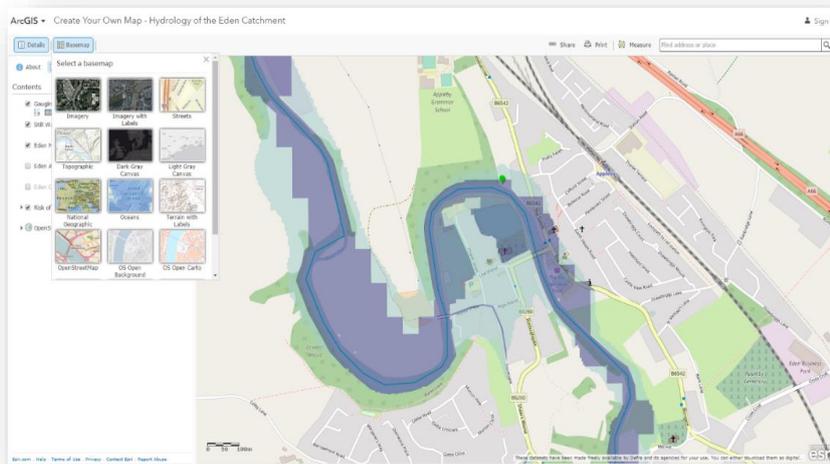
2. Click on the rainfall column heading and sort the data in the table in ascending or descending order to find the highest and lowest average annual rainfall in mm.

3. Click to highlight the lowest or highest rainfall record. The 5km grid cell which it relates to will then be highlighted on your map.

Rainfall (mm)
827
836
837
841
843

Q4. Using the 'Risk of flooding from Rivers and Sea' layer, describe the flood risk from rivers in Appleby. Are there any areas of the town at high risk of flooding? Name some streets, buildings or places at risk of flooding.

You can change the basemap from the **aerial imagery** to the **Open Street Map** so that you can see place names. Turn off the Eden catchment boundary and average annual rainfall layers to have a clearer view of the flood risk layer.



## Task

Print out your map.

Use the print function available in ArcGIS Online to print out your finished map. Alternatively, you could use the print screen function or Microsoft's Snipping Tool to copy the image and paste into a Word document.

## Advanced Study – Suggestions for further work

1. Search ArcGIS Online for other relevant datasets about the Eden catchment and add them to your map. For example, datasets on land cover and environmental designations can all be found online.
2. Collect your own hydrological field data on rainfall or flow rates. Record this in an Excel spreadsheet and save as a .csv file which you can then upload to your map. Please note that grid references must be provided in longitude and latitude format as per the csv file used in this tutorial.

**Further lesson ideas and resources for using ArcGIS Online  
in the classroom can be found at:**

**<http://www.esriuk.com/software/arcgis/arcgis-for-schools> and at  
[www.edenriverstrust.org.uk/arcgis-resources-secondary-schools](http://www.edenriverstrust.org.uk/arcgis-resources-secondary-schools)**



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Thank you to all of the teachers who helped with the development of these resources.