Improving the River Petteril

Online Story Map featuring a case study in catchment management

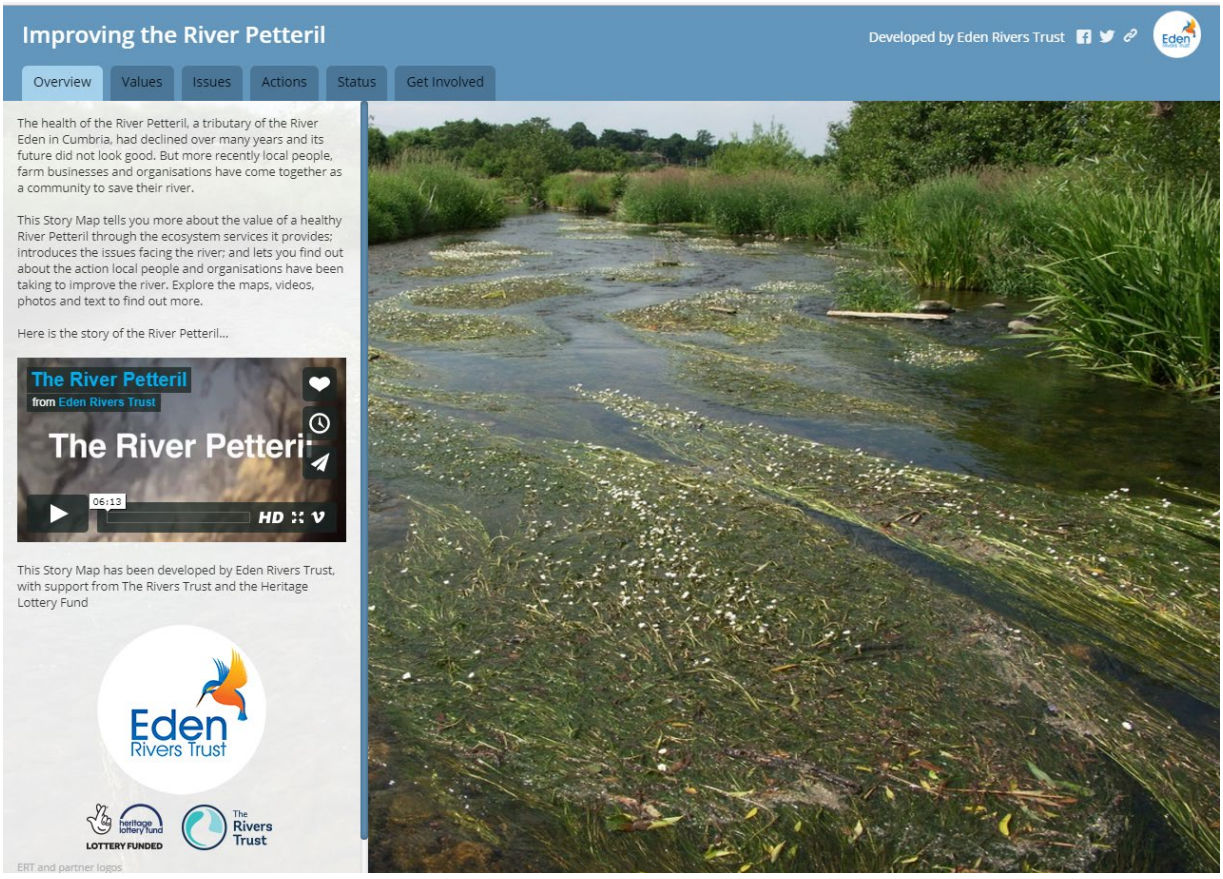
Summary

The **Improving the River Petteril** story map presents a catchment management case study for the River Petteril, a tributary of the River Eden in Cumbria.

Students can learn about: ecosystem services, water quality and pollution pressures, using data and evidence to manage catchments, and the Water Framework Directive.

The Story Map can be accessed at: https://arcg.is/151DCr

It includes a variety of interactive maps, data and videos which students can use to support independent investigative enquiry.



How to use the Story Map:

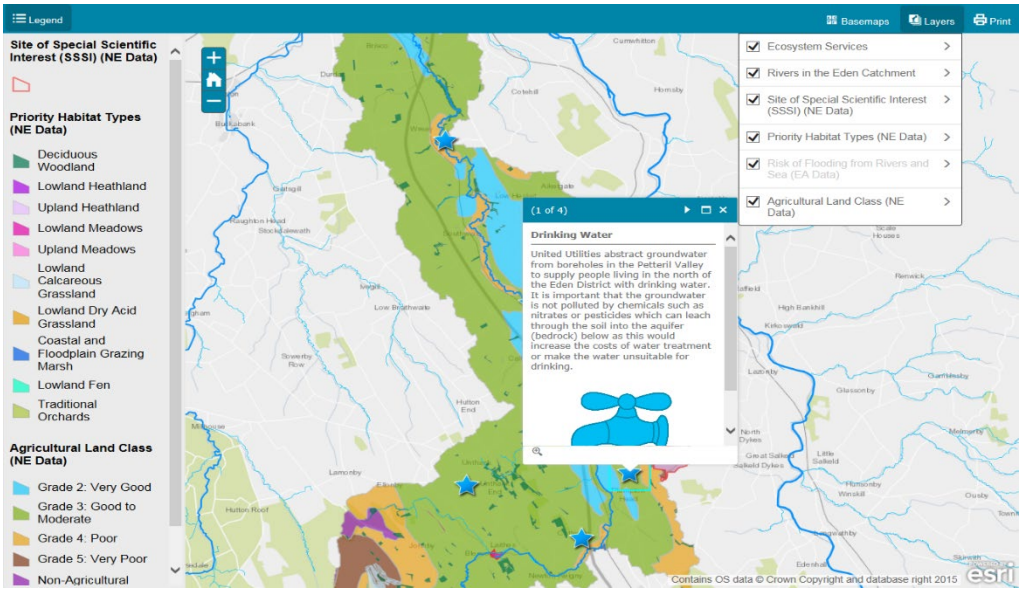
The Story Map is split into a number of different tabs (found across the top). Here is a short summary of the information and a description of the mapped data included in each tab, together with some suggested discussion topics.
Click on **data** within the maps to bring up pop-ups with more information.

1. Overview tab

To introduce the case study, watch the River Petteril video to gain an overview of the whole project.

2. Values tab

This section introduces the concept of ecosystem services and the benefits that a healthy river system can provide to society through a series of videos and interactive maps.



Guide to viewing data layers

Blue stars: Click on the blue stars around the catchment to bring up more information about the ecosystem services provided, e.g. drinking water, farming and food production, nature and biodiversity, flood risk, recreation, and fisheries.

Risk of Flooding from Rivers and Sea: This layer, provided by the Environment Agency, identifies where flooding from the river is most likely to occur and the level of risk (e.g. chance of flooding in any given year). *NOTE*: *you need to zoom in to see this more detailed layer – you will see this is 'greyed out' in the layers list, until you zoom in and the layer appears on the map.*

Sites of Special Scientific Interest (SSSI): Sites that are legally protected under UK law for their scientific or conservation value.

Agricultural land class: This layer provided by Natural England shows the grade of agricultural land based on climate, site and the type of soil as well as the interaction between these factors. There are five grades of land, with Grade 1 land being the most valuable and having the maximum potential to grow crops.

Priority habitat types: This layer highlights priority (Biodiversity Action Plan – BAP) habitats that should be enhanced and protected wherever possible due to their biodiversity value.

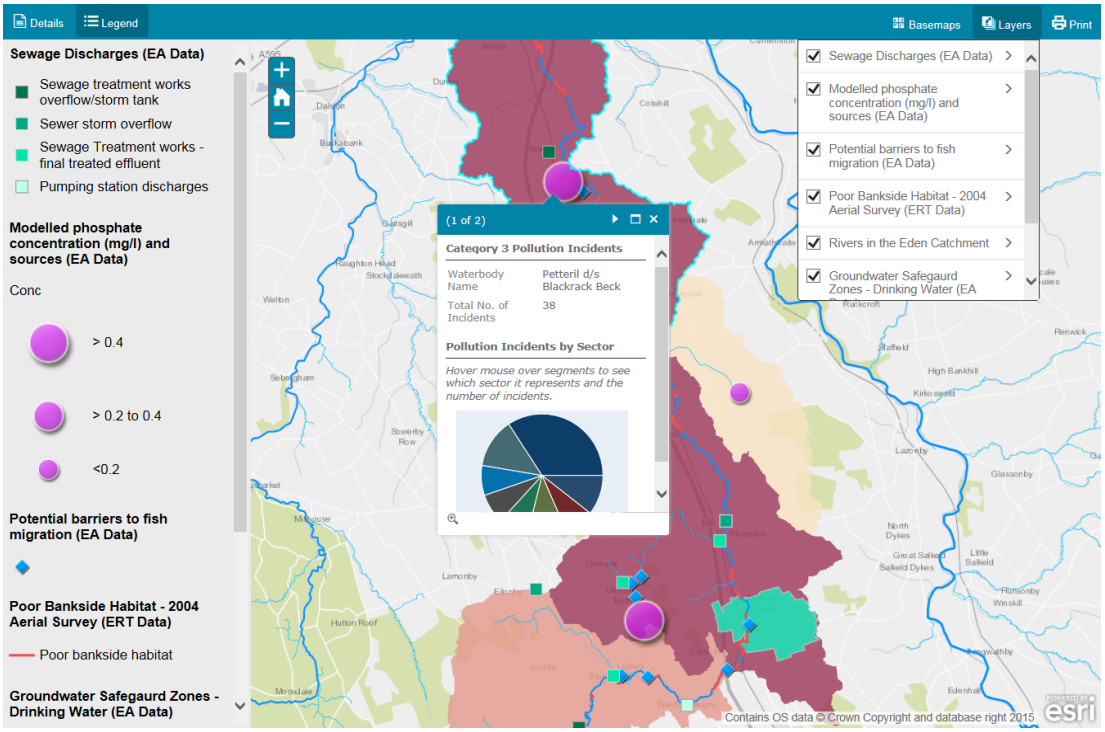
Question suggestions in relation to the Values tab:

Q1. What services does the River Petteril and its catchment provide?

Q2. Can you think of any conflicts that might occur between people when trying to manage the catchment?

3. Issues tab

This section presents a range of data and evidence that students can use to investigate pressures affecting the River Petteril.



Guide to viewing data layers

Consented sewage discharges: These are the discharges to rivers that the Environment Agency regulates. This layer highlights storm overflows from the sewage network.

These discharges are designed to overflow during very wet periods when dilution in the river will be significant enough to avoid ecological impact. However, it is not un-common for these type of discharges to malfunction due to blockages, which means they can cause pollution during low flow periods.

Blockages can often be caused by people flushing the wrong things down their toilets and drains e.g. sanitary products, baby wipes, fats and oils.

Modelled phosphate concentration and sources: This layer identifies the computer-modelled phosphorus concentration in each river waterbody in mg/l and the percentage contribution of phosphate from: sewage treatment works, septic tanks, and diffuse pollution (from urban and agricultural sources).
Hover over the pie chart to see the predicted contribution from each source.

High concentrations of phosphate can lead to **EUTROPHICATION** (nutrient enrichment) of waters. This encourages aquatic plants such as algae to bloom, choking the river bed and reducing dissolved oxygen concentrations, impacting on wildlife.

The data shows that in the River Petteril agriculture is a major source of phosphate. The soils video included in the Story Map gives an excellent introduction to agricultural sources of nutrients such as phosphate and their pathways to the river.

Potential barriers to fish migration: The Environment Agency has identified a number of potential barriers to fish migration. Assessment is required as not all will be barriers at all flow levels. Weirs, culverts, fords, pipe bridges and waterfalls can all cause a barrier to fish passage. This is a particularly important issue for migratory species such as wild Atlantic salmon, trout and eel.

Poor bankside habitat: In 2004, Eden Rivers Trust commissioned an aerial photography survey of the River Eden and its tributaries. The images collected were used to identify areas of poor bankside (riparian) habitat, for example, where livestock were trampling banks, causing erosion, or where there was little cover from bankside trees. The areas highlighted in red show those reaches which were classified as severely degraded.

Groundwater Safeguard Zones: have been designated by the Environment Agency around water abstraction sites which have seen, or are at risk of seeing, a deterioration in water quality, and where additional measures are required to ensure that abstraction waters meet the required standard under Article 7.3 of the Water Framework Directive.

United Utilities abstract groundwater from the aquifer at Bowscar to supply drinking water to villages in the north of the Eden District. A Safeguard Zone has been designated here as **Nitrate concentrations** in the groundwater have been increasing over recent years.

Category 3 pollution incidents to water: This dataset presents Category 3 (low level) pollution incidents to water that have been reported to, and recorded by the Environment Agency in their National Pollution Incidents Database (2001-2014).

The number of incidents per waterbody are shown. If you hover over the pie chart in the pop-up window, you can see the number of incidents from each source e.g. agriculture, domestic, water industry etc.

Question suggestions in relation to the Issues tab:

Q1. What problems did the River Petteril have? Provide evidence to support your answer.

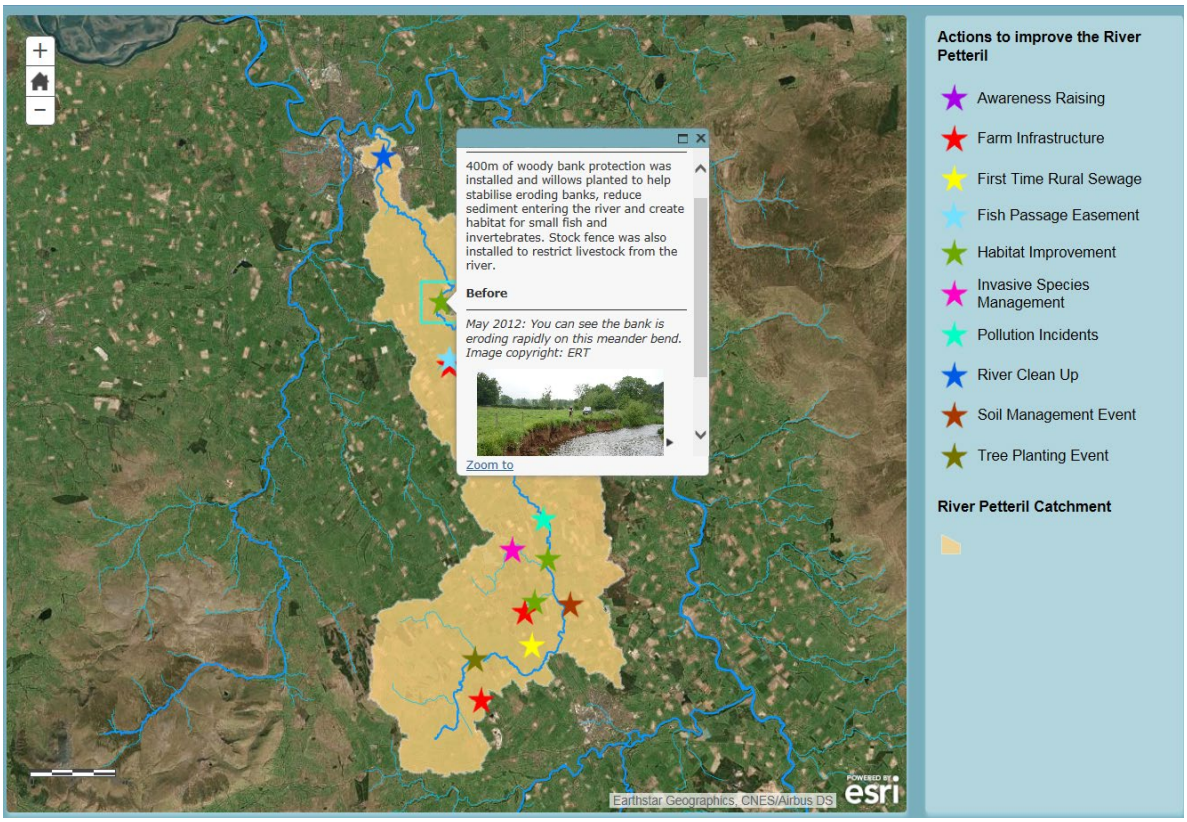
Q2. How might these issues affect the river, people and wildlife? Think about ecosystem services.

Q3. What could be done to reduce pollution from different sources e.g. agriculture, domestic, water industry?

4. Action tab

Find out more information about the type of catchment management actions which have been/ are being used to try and improve the River Petteril by organisations such as Eden Rivers Trust, the Environment Agency, United Utilities and local people.

Click on each of the stars to bring up more information about each action and see before and after photographs.



Question suggestions in relation to the Action tab:

Q1. Do you think these actions will address all of the issues you have identified?

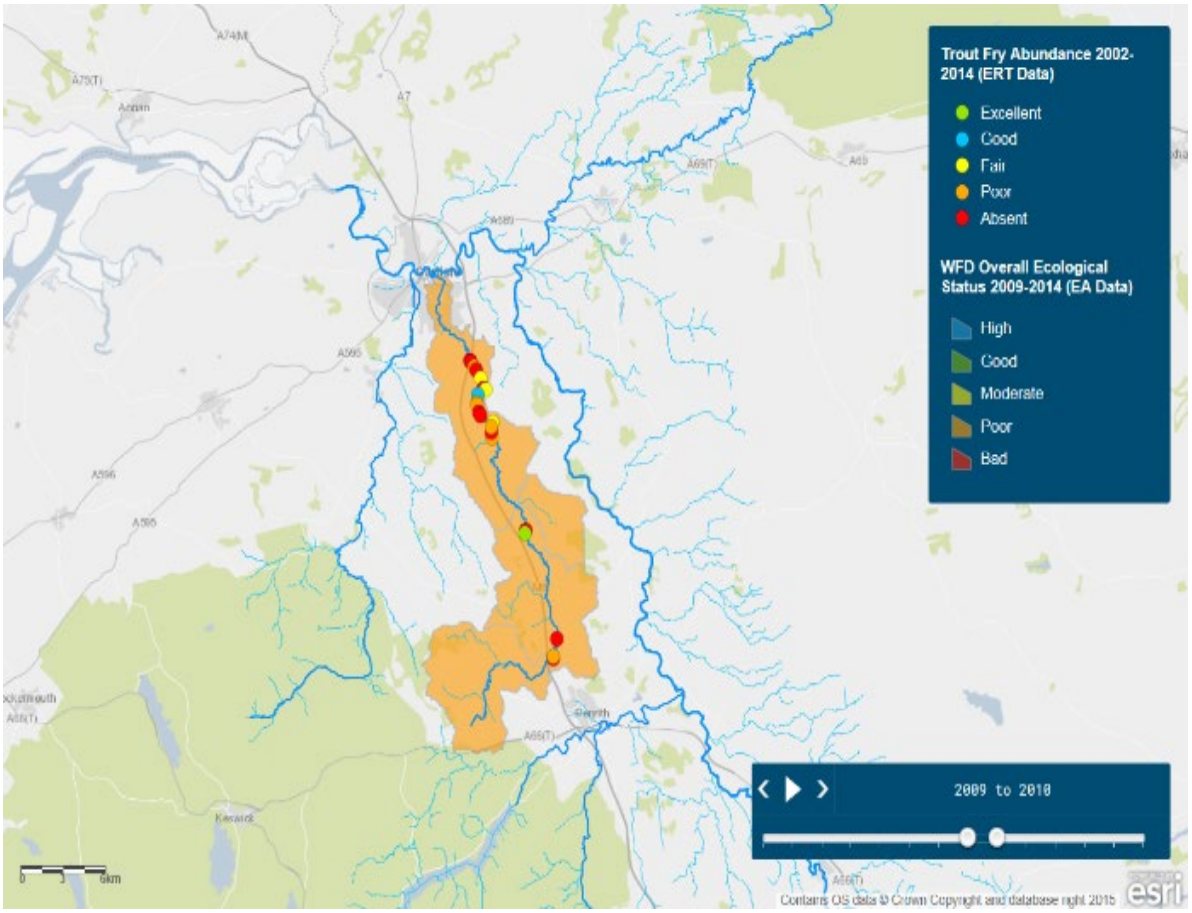
Q2. What else could be done to improve the River Petteril?

5. Status tab

This section includes data and information about how the health of the River Petteril has changed over time.

It introduces students to the Water Framework Directive and how the Environment Agency classify the health of rivers and catchments nationally.

It also includes fisheries monitoring data for juvenile trout populations collected by Eden Rivers Trust. Trout are an excellent indicator of river health as they require clean, well oxygenated water and a good habitat to survive and thrive. Play the mapped animation to see how the health of the River Petteril has changed over time.



6. Get Involved tab

The case study can also support the Citizenship Curriculum through the **Get Involved** tab which suggests ways in which we can all play our part in looking after our local rivers.

Contact Eden Rivers Trust if you are interested in finding out more about volunteering opportunities for your students.

Example Lesson Plan

An example lesson plan could include answering the following questions with supporting evidence, e.g. text, pictures and maps.

PAST:

1. What problems did the River Petteril have?

PRESENT:

2. What wildlife lives in the river?
3. What benefits does a healthy river system provide to society?
4. What is being done to improve the health of the River Petteril?

FUTURE:

5. What could be done to prevent pollution incidents in the future?

Support your answers with **EVIDENCE** e.g. text, pictures and maps

Example answer for Q1, to get students started could be:

POINT: The River Petteril has had many pollution incidents.

EVIDENCE: In.....a tanker overturned and spilled....., which was washed into the river.

EXPLAIN: This killed.....

MORE ADVANCED: Mapped data on pollution incidents shows that there have been.....number of pollution incidents in the Lower Petteril (downstream of Blackrack Beck) between 2001 and 2014. Of these.....% were from..... sources... Pollution incidents such as these could be reduced by .....

Advanced study and fieldwork opportunity

Organise a field visit with Eden Rivers Trust to learn about the management of the River Petteril Catchment in more detail and to see some examples of work undertaken to improve the river and reduce pollution.

As part of the visit, students could undertake water quality sampling and invertebrate kick sampling at a variety of locations to investigate and analyse the health of the river. Fisheries and riverfly monitoring data for the River Petteril could also be made available to students in spreadsheet form adding to the data resource available for analysis.

On returning to the classroom, students could analyse the data and produce their own report or presentation about the health of the River Petteril, including their field work results together with maps and images taken from the online Story Map.

Contact our Outdoor Learning Manager at **learning@edenrt.org** to arrange.

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 on the Eden Rivers Trust website.

This series of ArcGIS resources for Secondary Schools have been developed by Eden Rivers Trust in conjunction with The Rivers Trust with support from The National Lottery Heritage Fund.
Thank you to all of the teachers who helped with the development of these resources.

Made possible with Heritage Fund

The Rivers Trust

Eden Rivers Trust