



MILLFIELD

DISCOVER BRILLIANCE

River Exe Case Study

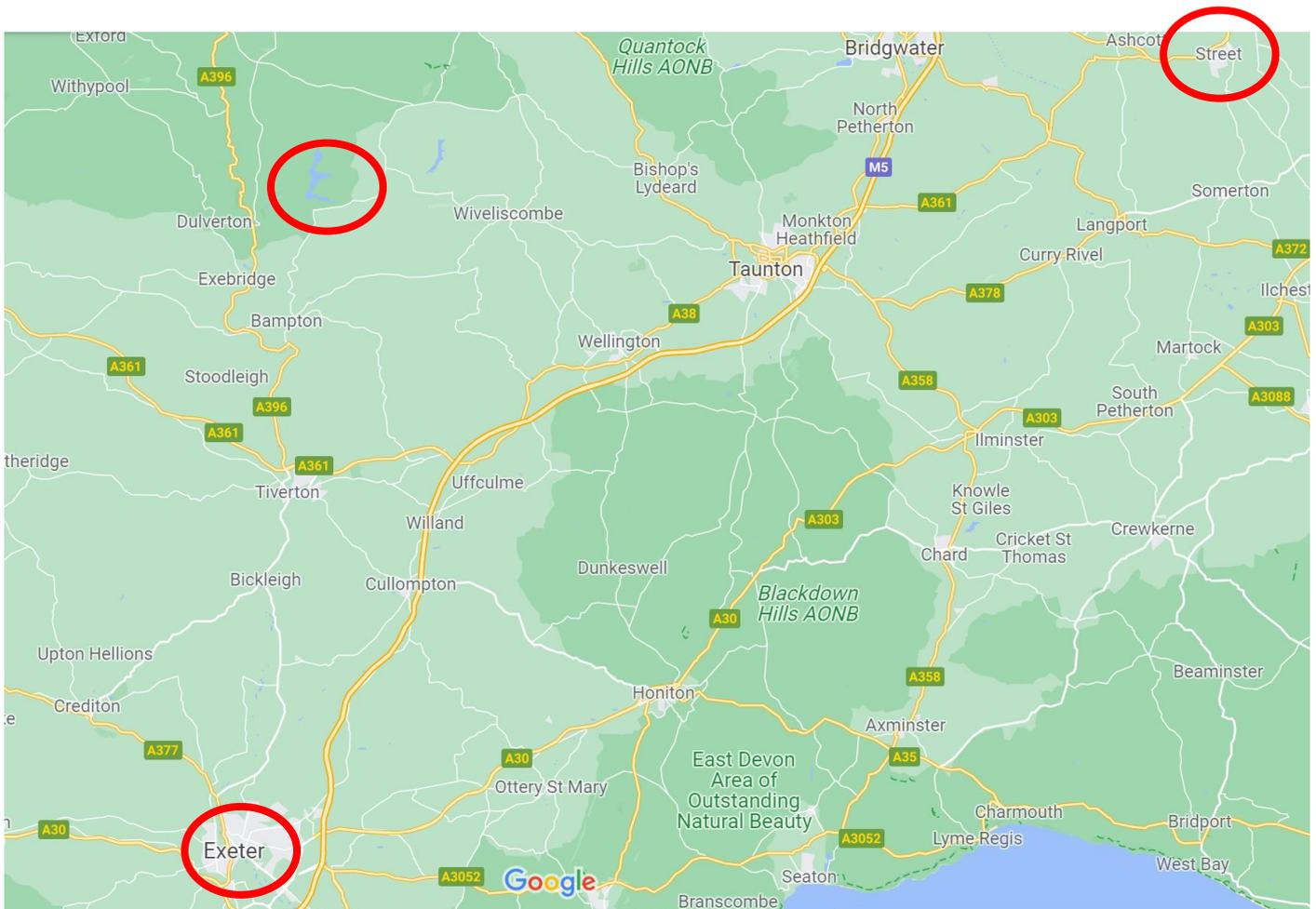
L6 Geography Field Visit

Staff Notes



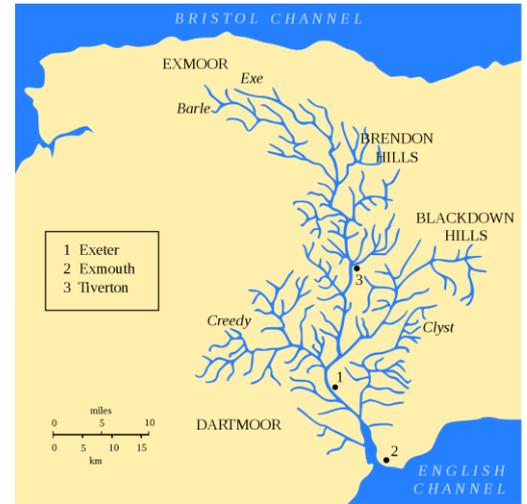
Itinerary

08.30	Briefing in the Science Lecture Theatre	<i>Remember to pick up lunches!</i>
09.00	Depart	<i>Four minibuses – see seating plan</i>
10.30	Arrive Wimbleball Lake (TA22 9NU) Discuss the catchment area of the upper course Walk to the dam Lunch	<i>Coffee available here!</i>
12.30	Drive to Exeter (EX4 2AB and EX2 8BY)	
13.30	Flood Defences Look-see flood defences at top of flood relief channel – from Station Road car park Look-see flood defences at bottom of flood relief channel – from Tenpin Bowling car park Start of ship canal to look at levées if time	
16.00	Depart for school	



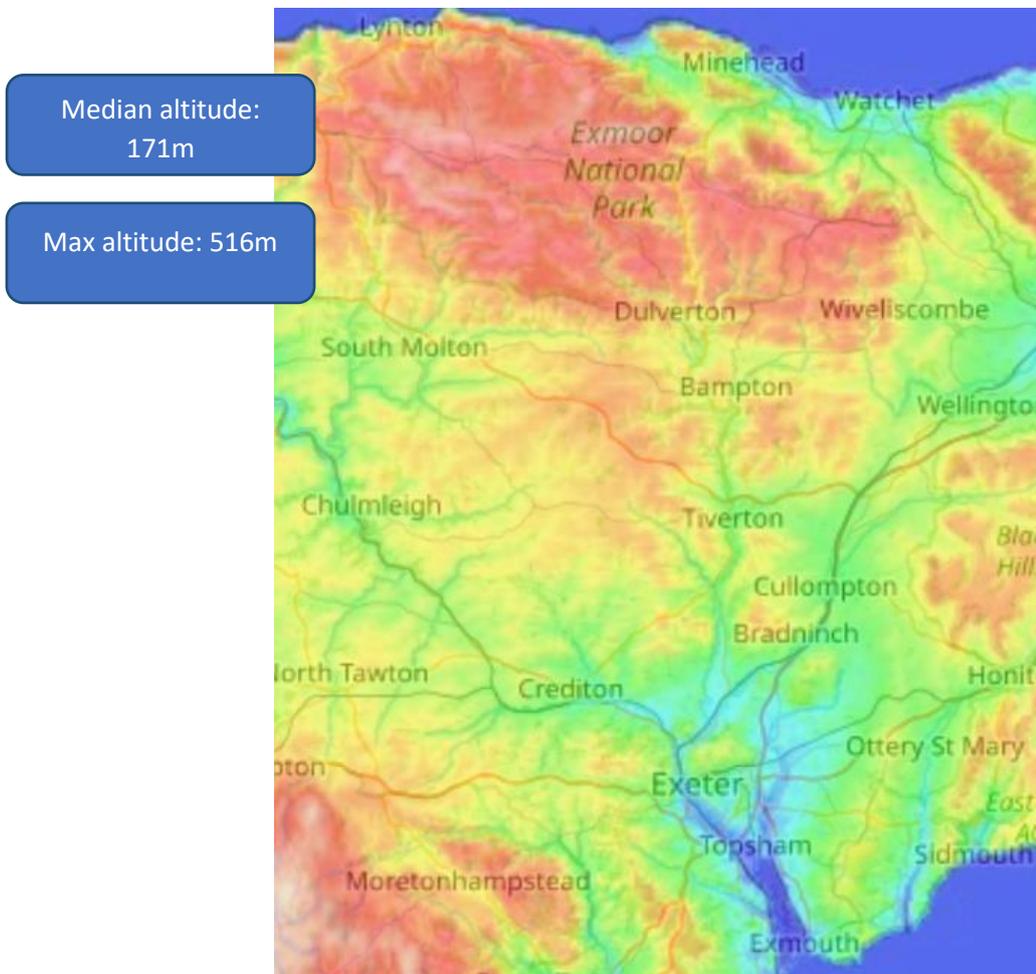
Teaching Notes: Context and Background

The source of the River Exe in Simonsbath is just 8km from the Bristol Channel high in the hills of Exmoor. The river flows south for 82.7km through Dulverton, Tiverton and Exeter to the sea at Exmouth on the south coast of Devon. It has an extensive network of tributaries and a high drainage basin.



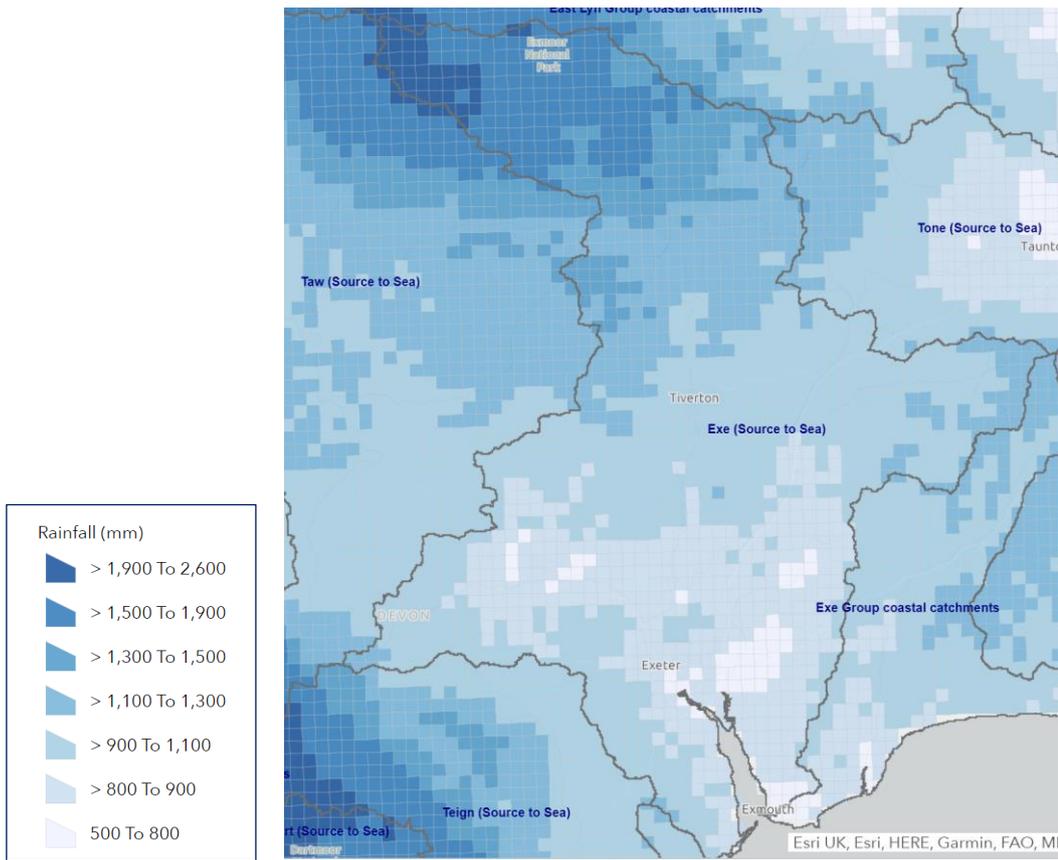
[Source](#)

Topography of the drainage basin



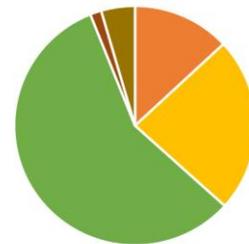
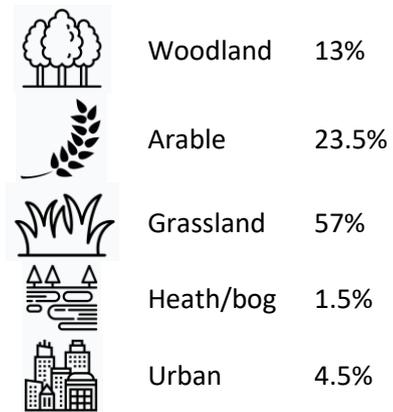
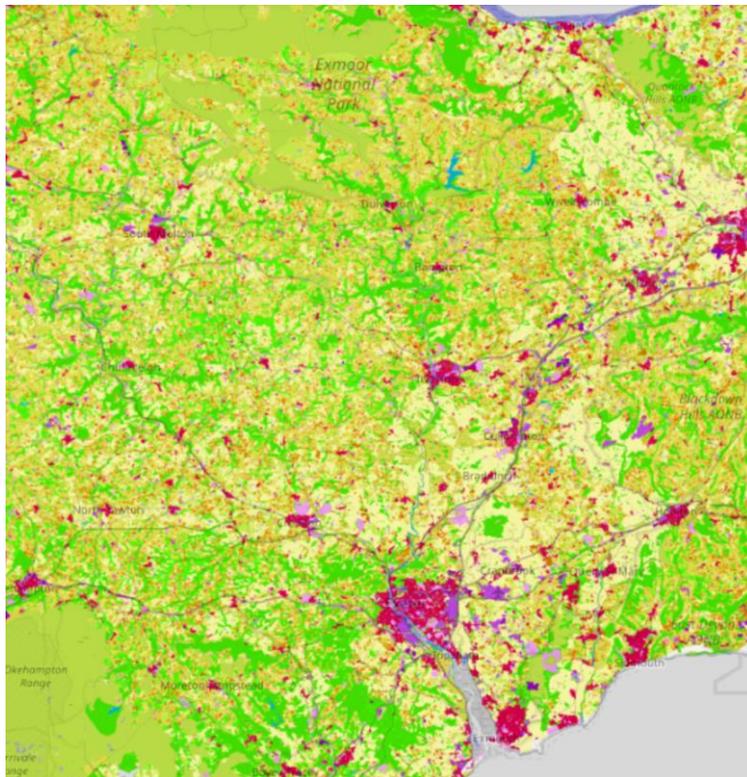
[Source](#)

Average Annual Rainfall



[Source](#)

Landuse



Woodland Arable Grassland Heath/bog Urban

[Map source](#)

Teaching Notes: The Upper Course

The upper course/catchment area includes everything upstream of Thorverton, 13km north of Exeter.

Physical

The area of the upper catchment is 601km². Its maximum elevation is 516m; the lowest elevation is 26m.

Geology

An estimated 84.4% of the catchment is underlain by impermeable rocks, which accounts for the extensive drainage network.

Landuse

Most of the land is agricultural grassland (67%) with some woodland (15%) and arable farmland (13%). On the high ground of Exmoor, there are moors and peat bogs (3%). Just 2% is considered urban.



The Water Balance

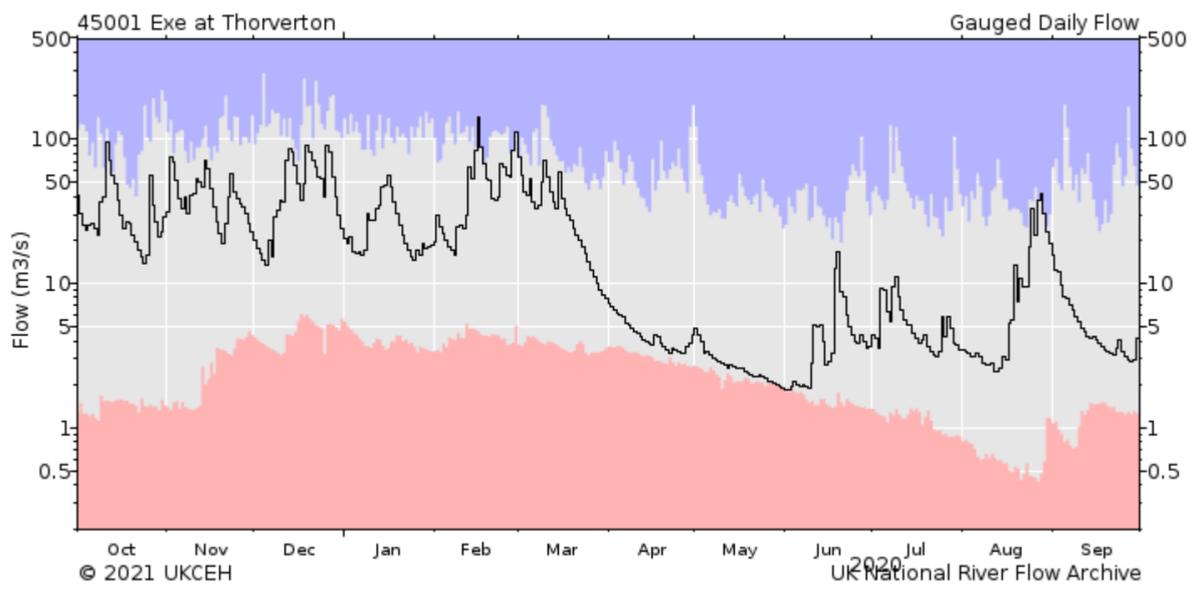
Precipitation (1295mm) = evaporation +/- soil water storage (451mm) + runoff (844mm)

Runoff is high, particularly over Exmoor. Some is absorbed by the peaty moorland soils, however, if saturated or where drainage ditches have been dug, water can flow off the hills rapidly.

Runoff accounts for 65% of the water balance, which is quite high compared with other UK rivers. This is because:

- The impermeable nature of most of the bedrock (93% is considered moderate/low permeability) which reduces percolation and baseflow.
- Drainage ditches on Exmoor reduce the amount of soil water storage
- There is very little woodland in the catchment reducing interception, transpiration and less binding of the soil
- The grassland is mostly agricultural: sheep and cattle compact the soils, further reducing infiltration and increasing runoff

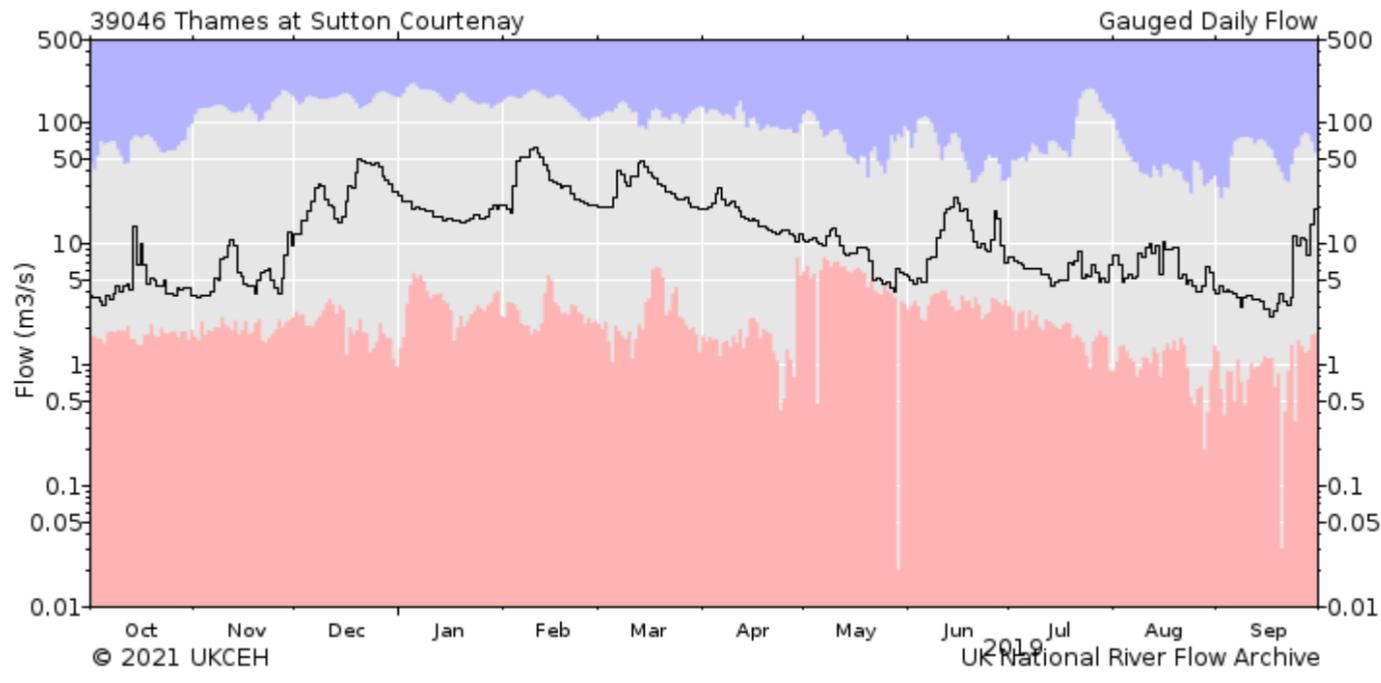
Thus the annual hydrograph, shown below for October 2019-September 2020, measured at Thorverton, shows that the river is quite 'flashy' responding to rainfall events.



Key: Red and blue envelopes represent lowest and highest flows on each day over the period of record. Underlying data supplied by the Environment Agency

[Source](#)

By contrast, the River Thames at Sutton Courtney in Oxfordshire has a more steady annual hydrograph for the same period:



Key: Red and blue envelopes represent lowest and highest flows on each day over the period of record. Underlying data supplied by the Environment Agency

[Source](#)

Wimbleball Reservoir

In 1979 the River Haddeo, an upland tributary of the River Exe, was dammed to create Wimbleball Reservoir. The reservoir has a surface area of 150ha. The reservoir supplies water to Exeter and parts of East Devon. It has a crucial impact on this part of the catchment as it regulates the flow and thus reduces the likelihood of flooding.

Fieldwork tasks:

1. Walk from car park at A along green footpath to the dam. Notice how small the river is downstream of the dam!
2. Fieldsketch at an appropriate place – possibly near hire and launch hut. Ask students to annotate their sketches with information about the catchment area.



Extension note:

The Mires-on-the-Moors project is an attempt to reverse the damage done to the peat bogs on Exmoor in the 19th and 20th centuries. By blocking the drainage ditches, the aim is to enhance water storage, improve water quality and facilitate a rise in water table levels. More information can be found [here](#).

Teaching Notes: Flood Management Scheme at Exeter

Historical flood events:

October 1960:

- devastating floods along the Exe as a result of half the annual average of rainfall (380mm), saturating the ground.
- 700cumecs flowed into Exeter, flooding parts of Exwick, St Thomas and Alphington.
- No deaths
- 2500 homes affected: Exmoor sandstone results in thick red sediment

December 1960

- Just five weeks later 80mm of rain fell one night and a second flood affected 1200 homes



Okehampton Street

[Source](#)

More information [here](#).

The response:

£8m was spent in the 1960s to prevent future flooding.

- **The Exwick Spillway**

The Exwick spillway is the largest and technically most complex of the channels – a huge radial gate was built just above St David's Station that is designed to close water from the river and divert into the spillway that runs from the gate down to the new Miller's Crossing footbridge, just above the Mill on the Exe pub. The radial gate is totally automatic and responds to changes in water level – a system of chambers fill with water and floats in the chamber rise with the water and lower a huge gate into the flow of the Exe, thus obstructing the flow of water downstream and causing it to spill over into the Exwick Spillway. The spillway is 1,600 metres long and has grass covered concrete banks and a concrete bottom. It is drained of water and cleaned every year and allowed to fill to a depth of 0.7 meters, allowing it to be used for model boating and canoeing. The River Exe and the Exwick Spillway can handle 708 cumecs between them. During the building of the channel in 1974, Station Road and the bridge crossing the Exe were swept away in another flood. It was a year later that the army lowered into place a new bridge. The Exwick Spillway was formally opened by John Silkin on 23 September 1977. [Source](#)

The start of the Exwick spillway



The end of the Exwick spillway, opposite the Mill on the Exe



- **Trew's Weir**

Another spillway was installed just above Trew's Weir, close to the entrance to the canal. In time of flood, Trew's Weir Relief Channel will allow water to spill over the concrete weir and flow along the grass covered channel to exit adjacent to St James' Weir. [Source](#)
[More information](#)



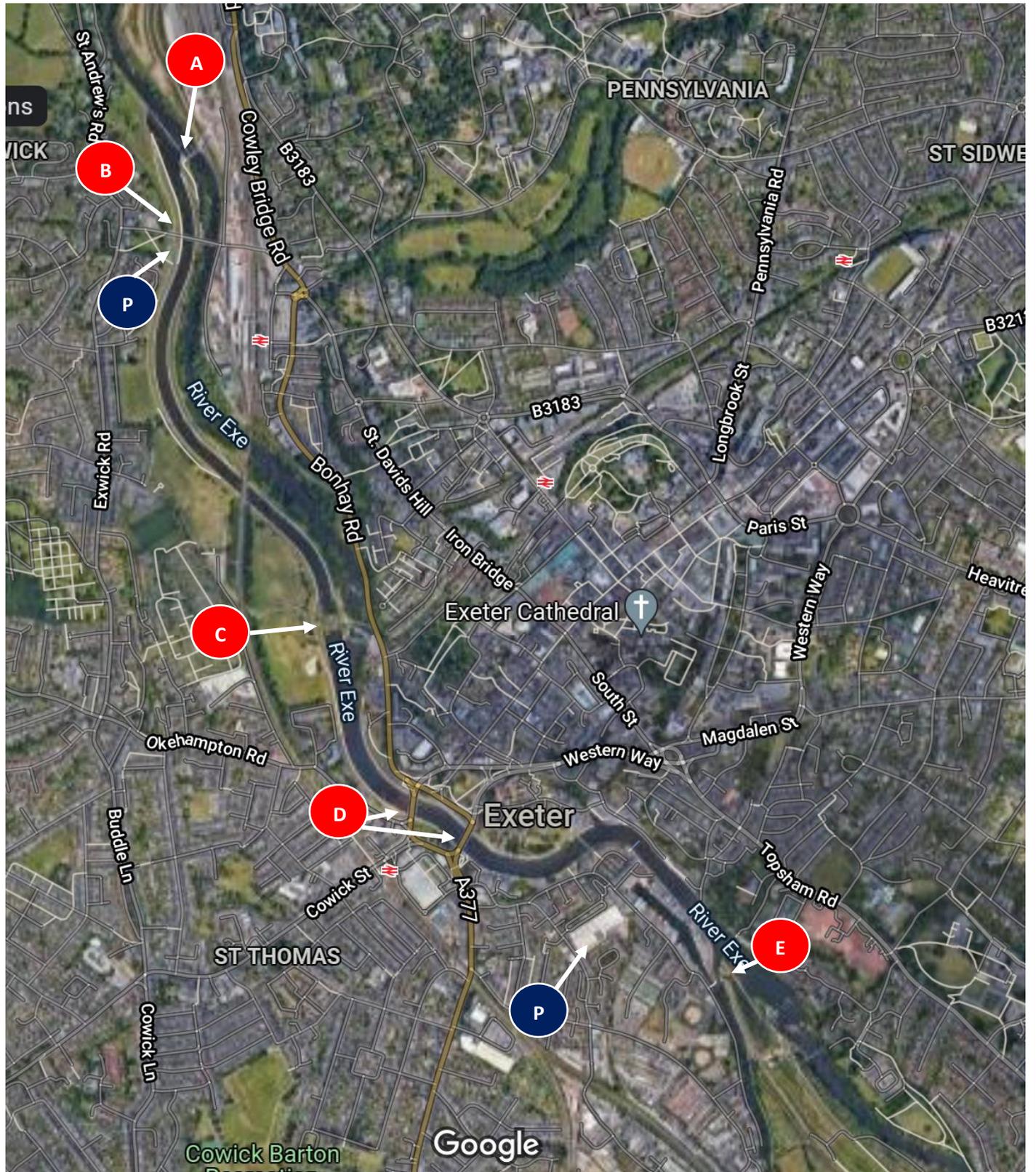
- In addition to the flood relief channels, something had to be done about the obstruction of the Exe Bridge. In 1969 and 1972 the two new concrete bridges were constructed and the old steel bridge dismantled. The two new bridges are utilitarian in design and have streamlined pillars and a flat underside to aid the flow of water at the time of flood. [Source](#)

More Recently

£32m' worth of updates to the flood management scheme:

- Deepening of Trews flood relief channel by 1m and lowering the side spill weir. This increased the flow capacity of the flood relief channel, which will help reduce flood risk to the quay area during high river flows.
- At the end of the relief channel a weir has been removed: this area is now wetter at high tide, improving the ecosystem

Fieldwork Overview



Sites A and B

Parking at Station Road EX4 2AB

Site A: Start of Exwick Spillway

- Walk up to the start of the Exwick spillway

Site B: Flood gates

- Show students the flood gates just to the left as you walk out of the car park

Sites C, D and E

Parking at the Tenpin Bowling car park EX2 8BY

Site C: End of Exwick Spillway

- Walk upstream on the Western riverbank all the way to the Flowerpot Park – reference floodplain and landuse zoning
- Walk across the bridge and look at the end of the Exwick spillway
- Reference the Mill on the Exe pub – flooded numerous times, including early 2000s
- Return the same way back (nasty bit of road by the Mill on the Exe, otherwise it would have been nice to walk a different way!)

Site D: Exe Bridges

- On return towards the quay, point out the ‘new’ Exe Bridges roundabout with the streamlined pillars and a flat underside to aid the flow of water during peak flow
- Notice the levées either side of the footpath which increases capacity at times of peak flow

Site E: Trews Weir

- Walk on back towards and beyond the quay towards the spillway at Trews Weir and the start of the ship canal
- Optional coffee/cake/ice cream/chips stop at the quay ★

