

Hydrological Report on River Ilston
Physical Landscape and the Geosphere
ACNA 4007
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1. Introduction

This report aims to analyse the features of the river Ilston, located in the Gower area, from its source to where it meets the sea. Using data collected, a number of hypotheses shall be examined to determine the ways in which the river's qualities change based on the section of the river. The data shall be analysed in accordance with key literature to address these hypotheses and situate them in the wider field of hydrology.

1.1 Context and Background

Hydrology, the scientific study of water and its properties and impacts, has a long history. The movement of water and the effects that it can have on the world around it are often very visible, and even before it could be studied using what would be considered a scientific approach today, people tried to explain and understand it (Rosbjerg & Rodda, 2019). In the field of hydrology, the movement of water on the Earth's surface and below it is studied, and the way water interacts with other aspects of the natural world (Huggett, 2009). The way that human societies and actions impact on water quality and water availability are also focuses of hydrologists, and this science is vital to determining the best ways to undertake water management (National Geographic Society, 2022). Rivers are the main avenues by which runoff water returns to the oceans from the land, with the water tending to take residence in the water for roughly 15 days (Dingman, 2015, p.77).

Gower, where this study took place, is an area that was created by the Normans as a lordship out of the area previously called Gwyr, which is still the Welsh name today. It includes the Gower Peninsula, and is the site of the first Site of Outstanding Natural Beauty created in the UK (The Gower Society, 2022). The oldest rocks in Gower date from the Devonian period, but the majority of the area is limestone, which would have formed in the Carboniferous period. Fern and moss forests would have formed and then rotted, which would later become the coal that Wales was famous for (The Geological Society, 2012).

The Ilston river (see figure 1, as shown right), has its source near the Swansea Airfield, and meets the sea at Three Cliffs Bay. It cuts through the village Ilston, and passes in front of Pennard Castle as the Pennard Pill. The river water is able to erode the soft limestone that Gower is largely composed of, meaning there are points at which the river or large amounts of the river's flow disappear underground, such as at Ilston Cwm, a valley with many caves and sinks along its course (Caves of South Wales, 2018).

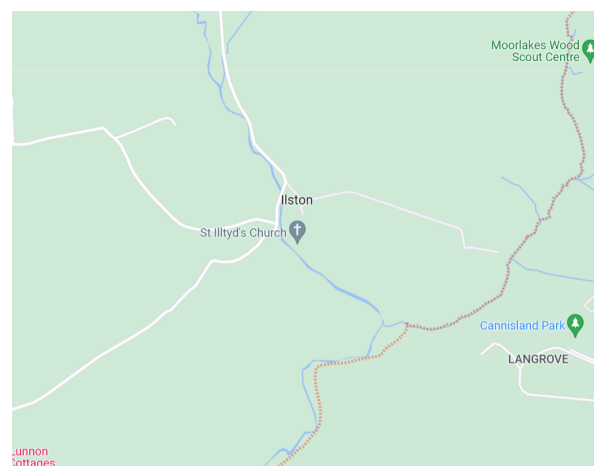


Figure 1: Ilston river intersecting with Ilston village. (Google Maps, 2022.)

1.2 Experiment Rationale

In this experiment, eight hypotheses about the changing characteristics of the river Ilston were examined. They were:

1. Downstream, the river becomes wider and deeper.
2. The cross-sectional area of the river increases downstream.
3. The river velocity increases on the outside of a meander.
4. The highest water velocity is in the centre of the river.
5. The river velocity increases downstream.
6. The size of the bed load gets smaller downstream.
7. The shape of the bed load becomes more rounded downstream.
8. The discharge of water in the river increases downstream.

A variety of different tests were planned to investigate each of these hypotheses. For 1 and 2, measuring tapes and depth measures would be used to record the width and depth of the river at different points along it. For 3, 4, and 5, the water velocity would be tested in different parts of the river using oranges floated between distance markers. 6 and 7 would require visual observation, and 8 could be calculated using data gathered for previous hypotheses.

1.3 Study Location

The tests were conducted at ten different points along the river Ilston between the source and where it meets the sea. Each of these points is highlighted red on figure 2, pictured left. Beginning at Site 1, closest to the airfield, the studies would take place in order down the river, ending at Site 10, at Three Cliffs bay. This selection of sites ensures a complete picture of the river's characteristics at all points would be obtained.



Figure 2: House, C. (2015), Ilston Valley Field Survey map.

2. Methodology

A variety of different techniques were used to address each of the hypotheses for this study.

2.1 Hypotheses 1 and 2.

To measure the width, depth and cross sectional area of the river a measuring tape and measuring sticks were used. Measuring from where the water reaches up to on both sides of the river, depth measures were taken every 25cm. This was accomplished using waders. It is expected that the river shall get wider downstream, and that the cross sectional area shall increase further downstream.

2.2 Hypotheses 3, 4 and 5.

A current meter tool is used to measure river velocity at different points. The more points measured, the more accurate collected data becomes. To measure the river velocity and if it increases downstream for hypothesis 5, a measurement using an orange was taken. This involved marking out a 5m long stretch of uninterrupted river at each test site, such as pictured left in Figure 3, and placing an orange on the surface of the water and seeing how long it took to reach the opposite end of the 5m stretch. This test was conducted 5 times per site, and all results recorded using a digital timer. The orange was placed rather than dropped into the river at the centre of the flow. The same orange was used for each test, with the same people conducting the tests.



Figure 3: Site 3, where an orange test took place.

Expected results include the river velocity being faster where the river is narrower, and the middle part of the river having the highest velocity as it is experiencing least friction from the riverbed below and the wind above.

2.3 Hypotheses 6 and 7

5 samples of the material at the bottom of the river were taken each at 5 of the 10 testing locations. They were then assessed according to their roundness class, as described by Bates & Jackson in 1987. It was expected that further downstream the bed load would become rounder as it has had more time to be abraded in the current.

2.4 Hypothesis 8

This can be calculated using the results of the velocity test and the cross sectional area measurements.

3. Results and Discussion

At nine of the ten sites, the average width of the river was recorded. This data has been plotted onto a line graph (pictured below, figure 2). At the sixth site, no data was recorded, hence the anomaly visible below.

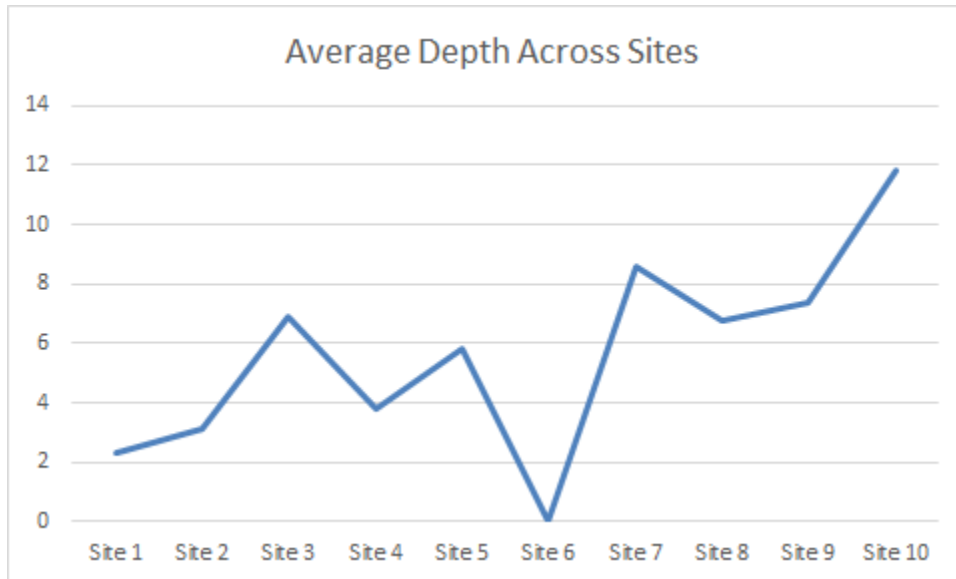


Figure 4: Line graph showing data across locations.

The size and shape of the particulate material found in the bed load was tested at the 10 different locations. 5 samples of stones in the bed load were taken per location. The results have been collected into bar charts, and 3 were selected for analysis. Site 1 can be seen below, figure 5.

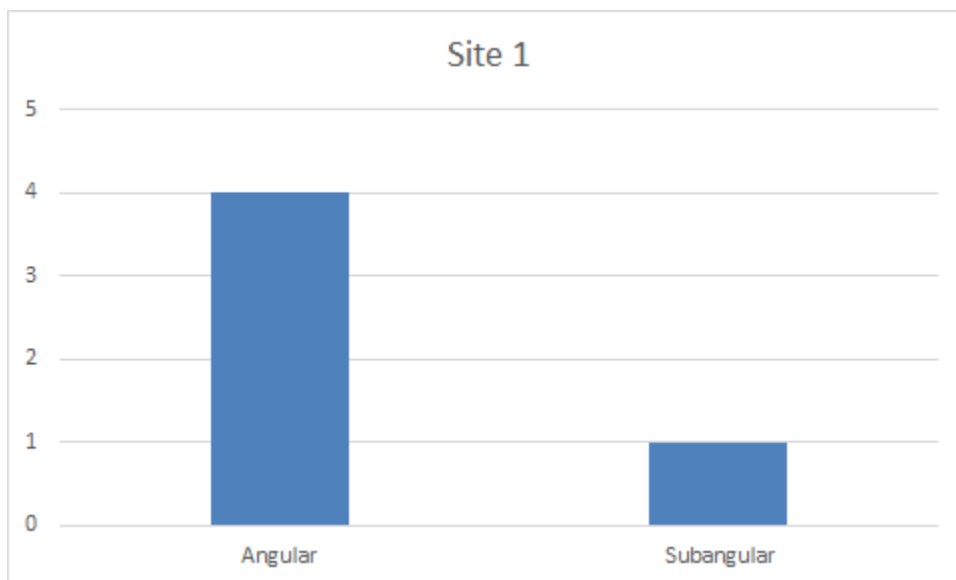


Figure 5. Bar chart depicting the bed load samples of site 1.

It can be seen that 4 of the five stones were identified as angular, and only 1 was described as subangular. At site 4, however, see figure 6 below, there is no angular material. Instead, it is shown that there were 2 subrounded and 3 subangular stones identified.

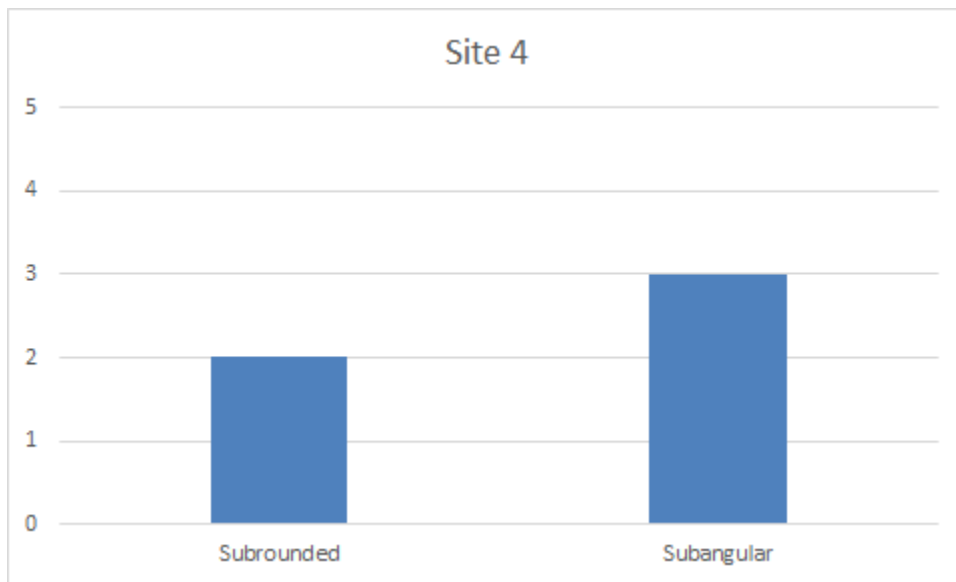


Figure 6. Bar chart depicting the bed load samples of site 6.

At sites 9 and 10, no data could be gathered as there was only silty sand or sand present, respectively. However, the data for site 8, the last site with rocks of a size to be assessed for their roundness class, is shown below, figure 7. It is shown that there are no angular stones at all, just one subangular. There are also two subrounded, and two rounded.

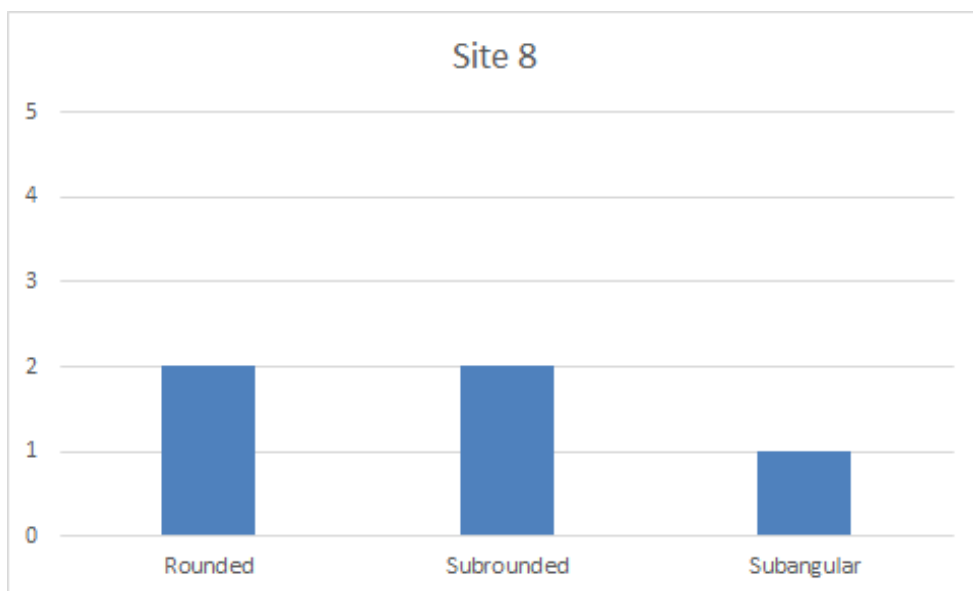


Figure 7. Bar chart depicting the bed load samples of site 8.

It can be observed in the graphs that the river appears to on average get wider further downstream, and that the bed load appears to get more rounded downstream, based on the data collected on this trip.

4. Conclusion

4.1 Hypotheses

From the data collected on this particular research trip, certain trends in the river's changing characteristics can be seen that address the questions asked. The river appears to become wider and have a larger cross sectional area downstream, and the highest velocity appears to be in the middle of the river. The cross sectional area of the river is likely to vary over time, and a continuous measurement of this would produce a series of information called a hydrograph (Davie, T., 2019). The size of the bed load becomes smaller downstream, and it also becomes more rounded. The features of the river Ilston seem to change at different positions along its length.

4.2 Limitations of Study

There were a number of limitations to the tests conducted and the study overall. Tests were conducted by several different groups, meaning that the datasets were not all recorded in a consistent style, and some had information missing. Standardising the method of recording helps ensure that results are accurate and can be reliably used in further analysis. Using checklists and making sure everyone conducting tests has been thoroughly briefed before beginning the experiments are ways of improving consistency (BetterEvaluation, 2022)

The testing was also only conducted on one day, in one season. Multiple testing rounds throughout the year would provide a more complete picture. Farjad, Gupta and Marceau (2016), for example, conducted their study into the Elbow River Watershed in Canada and the way it is being affected by climate change with a focus on both seasonal and annual variations of the watershed. This gave them a more complete picture of the characteristics of their study site.

4.3 Future Studies

There is a lot of potential for more studies to take place in the river Ilston site, pictured right in figure 8. These could include measuring the pH of the river at different points along its length, noting what infrastructure has been built around the river such as farms or roads and tracking the connection between different surroundings and any contaminants detected in the water.



Figure 8: River Ilston outside Pennard Castle.

5. Reference List

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