Lesson Plan: Flood Management Geography Fieldwork

Activity Details Summary
Location: *Pickering and Pickering Catchment at Lockton*
Duration: *Full day, timings and order of activities will depend on conditions.*
Age Range: *GCSE and A-level students*
Max group size: *30 students per Activity Leader*
Subject: *Geography*
Activity Type: *Flood and Catchment Management Fieldwork*
Risk assessment: *Pickering/Lockton Risk Assessment*

Main Curriculum Links
Hydrological processes (such as infiltration and stream dynamics), how these are managed and assessing associated flood risk.

Learning Objectives
Knowledge and Understanding
- *Gain a greater understanding of hydrological Processes (in particular infiltration, stream measurements, and storm hydrograph dynamics).*
- *Consider how flooding risk can be assessed and managed, including carrying out fieldwork to assess flood risk and evaluating different catchment flood management strategies.*
- *Gain a greater understanding of fieldwork techniques and how a river and flooding fieldwork investigation can be undertaken.*

Skills and Personal & Social Development
- *Independent learning, through research pre and post visit and during small group tasks in the field.*
- *Co-operation and problem solving skills during practical fieldwork tasks.*

Learning Styles
For aural learners: *Instructions and background information on the river management and river processes around the Pickering Catchment delivered orally. AFL discussions and questioning used by activity leader to engage students and check understanding.*
For visual learners: *Maps, flooding photos and seeing 'real world' casebook examples embedded into the day.*
For kinetic learners: *Practical fieldwork tasks throughout the day and carefully selected route around catchment to ensure students are regularly moving and to take into account weather conditions.*

Equipment Required:

Pickering flood risk:
- *Pickering flood photos*
- *GPS Unit (1 per each small group)*
- *Recoding sheet (1 per each small group)*
- *Maps of flood zones (x1 per each small group)*
- *Compasses for field sketches*

Infiltration:
- *Recording sheets*
- *Mallet (x1 per pair/group of 3)*
- *Plastic drain pipe (x1 per pair/group of 3)*
- *Ruler and stopwatch (x1 per pair/group of 3)*
- *Wood for bashing (x1 per pair/group of 3)*
- *Water container and water*
- *2 tape measures*
- *Random numbers tables*

Safety equipment including:
- *Mobile phone*
- *Throwline*
- *First aid kit*

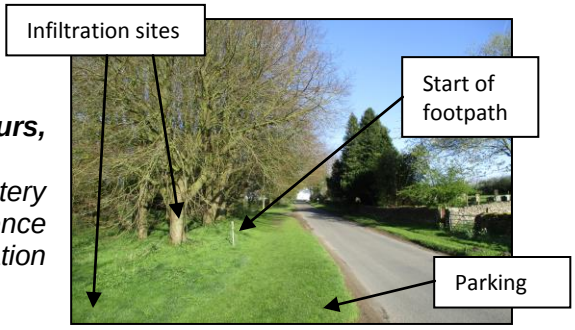
River survey material:
- *Stop watch (x1 per small group)*
- *Clinometers (x1 per small group)*
- *Metre rulers (x2 per small group)*
- *Tape measures (x1 per small group)*
- *Chain*
- *Flow meter*
- *Floats for velocity (x1 per small group)*
- *GPS device (x1 per small group)*
- *River recording sheet (x1 per small group)*
- *Bi-polar & field sketch sheets (x1 per student)*
- *Map showing photos and locations of 8 Dams near stream confluence*

Activity Outline:
Half the day is spent near Lockton carrying out measurements above and below leaky (large woody debris – LWD) dams to assess whether they do increase storage capacity of the river, and then an infiltration investigation to help assess the impact of land use on flood risk. The second part of the investigation is in Pickering assessing flood risk.

Introduction:
- *Introduce Pickering Catchment, and locate it and NYMNP on the map of the north east of England.*
- *H&S information (stay in groups; avoid deep water and steep banks, hazard of roads and weather).*
- *Brief outline of day and objectives for the day.*
- *Set up the day's investigation aim, history of flooding in Pickering and consider hypotheses.*
- *Toilet stops and when lunch is likely to be.*

The Activities:

River measurements above and below small dams (1¾ hours, including walk to site):
Park on B-road heading into Lockton (form A169, opposite the Cemetery (GR: SE 847 899) and then walk down the footpath to stream confluence near St Robert's Well (GR: SE 842 903). Parking, footpath and infiltration site are shown in the photo)



*Each group head to an allocated dam. At the site students record the exact location utilizing their GPS device and take a photo of the site. The each group collect information about the stream following the recording sheet, including: width, 5-11 depths, velocity, gradient and wetted perimeter above **and** below the dam. The students can begin to calculate the Cross sectional area of the river and discharge. The group can then eyeball the data to see if there is general fall in stream capacity below the dam compared to above the dam.*

Infiltration fieldwork (1hour):
Undertaken at the small area of woodland and open grassland by the parking outlined above for river access.

*Discuss infiltration and factors which could affect the rate of infiltration; relate this back to flood risk in the catchment. Then look at the two land-uses (woodland/trees and grassland) and from this set up a hypothesis. Then set out a 10m x 10m grid with tape measures and use random numbers to find a co-ordinate in the box for each pair of (or 3) students (up to 10 groups). Brief students on safely banging in tubes, watching out for people behind them and fingers when using the mallet. Once the tube/infiltration ring is banged in fill with water and record the water from this point and every 30 seconds. If the tube needs refilling do this when taking a recording, so you will do two recordings at that time. Students can then calculate the amount of infiltration following the recording sheet. Repeat for the second land-use. **Mini review**: Human graphs, students represent a piece of data and stand in a line, and then separate out to show to 'range bars of data'. You can then discuss overlaps in data, the interquartile range, median, and return to the original hypothesis.*

Pickering Flood Risk Assessment (1hour)
Park in the Centre of Pickering (near the Co-op (no coach parking) or roundabout) (GR SE 798 838).

Direct groups to loos, meeting location and what to do if there is an issue (including how to contact Activity leader). Outline how to assess flood likelihood and flood impact, by running through the recording sheet. Then orientate everyone on the zone map and brief groups on which zone(s) they are going to. Set up a hypothesis on where high value land will be compared to flood likelihood. Groups head out and collate data, whilst Activity leader can brief school staff on how to collate data on a laptop.

Extension activities:

- Utilize the Environment Agency Flood Risk Maps for Pickering and compare how these relate to the scoring flood likelihood scores collected by students.
- Go through storm hydrographs and consider how this links to why Pickering, at the foot of the North York Moors Plateau, is at risk of flooding.
- Go through sources of information on the 2007 Pickering floods and consider the impact of these floods in more detail to form an in-depth case study of a UK Flood.

Summing up and review of learning:

- *Students compare notes and discuss where the highest flood risk seems to be and why.*
- *Briefly return to the day's original hypotheses, consider the evidence to accept/reject these.*
- *Outline what students could do post visit to follow up on the investigation.*

Possible Pre and post session activity suggestions include:

Before coming out on fieldwork visit:

- *Teach about key concepts related to flood management, such as those listed on coversheet.*
- *Introduce the study site using the online North York Moors National Park PowerPoint.*
- *Ask students to research the Pickering flood management scheme 'Slow the flow'. Possible source resources include:*
    - *https://www.forestry.gov.uk/fr/slowingtheflow (Summary of scheme with links to Phase 1 and Phase 2 reports on the scheme)*
    - *http://www.gazetteherald.co.uk/news/1502107.worst_floods_in_living_memory/ Local Paper article on 2007 Pickering floods.*
    - *http://www.northyorkmoors.org.uk/looking-after/our-projects/slowing-the-flow (Overview of scheme form the North York Moors National Park)*
    - *http://welcometopickering.co.uk/about-pickering/about-the-town/slowing-the-flow/ (Video by the University of Oxford on the Scheme)*
    - *https://www.youtube.com/watch?v=IGNMpb_G1PQ&feature=youtu.be (Video from Royal Society on the Scheme)*
    - *https://www.youtube.com/watch?v=g9lV_rEU9zQ (Flyover of flood defences constructed as part of the Slow the Flow scheme)*
    - *http://www.bbc.co.uk/programmes/p01x6982 BBC overview of catchment management strategies being employed near Pickering.*

Post visit:

- *Collate data on North York Moors National Park spreadsheets for flood risk; use this as a stimulus to consider different ways to present data including Google Earth Choropleth graphs. Use this geo-located data to consider which areas of Pickering might need more protection.*
- *With A-level groups consider statistical tests which could be done on the data (Mann Whitney can be used to analyze above and below dam discharge data and infiltration data on two land uses) (3) return to the investigation key questions/ hypotheses.*
- *Input the river dam data and infiltration into the provided spreadsheets and consider different data presentation techniques which could aid the investigation.*