iCASP
Integrated Catchment Solutions Programme

Photography, overland flow and water quality 12th February 2019

www.icasp.org.uk
@YorkshireiCASP

NERC SCIENCE OF THE ENVIRONMENT

Fixed point photography

A key techniques for addressing a number of the monitoring objectives

FR1	Understand the distribution of and the type and extent of measures
FR2	Understand flood storage and flow interception
FR3	Understand how the measures affect flow, particularly high flows
FR4	Understand the operational maintenance requirements of the NFM measures
HB1	Quantify habitat directly created, restored and/or changed
HB2	Estimate the contribution of the habitat created or improved to the improved ecological functioning of the wider environment
ES1	Sort and qualify the multiple benefits achieved in a nationally consistent way
RES2	Measurements to establish changes to soil infiltration and storage
RES3	Measurements to establish effect on sediment and water quality
RES4	Measurements to establish effect on low flows

Fixed point photography

A number of different approaches can be employed:

Regular

- Photos of streams, interventions, overland flow etc at set intervals
- Monthly, weekly?
- Might not capture a range of flow events so might have to be responsive and react to forecasts

Time Lapse

- Automation of above

Ad-hoc

- During site visits, high and low flow events etc

Citizen science

- Incorporate in to peoples regular routines

Identify a fixed point to take photos from – a post may ensure you capture the same point
Install stage boards/reference markers to allow comparisons

Time Lapse Photography

Can provide valuable information on:

- Behaviour of features during storm events
- Water storage during storm events
- Impacts on timing
- Overland flow

Care is required to ensure that data is comparable through time

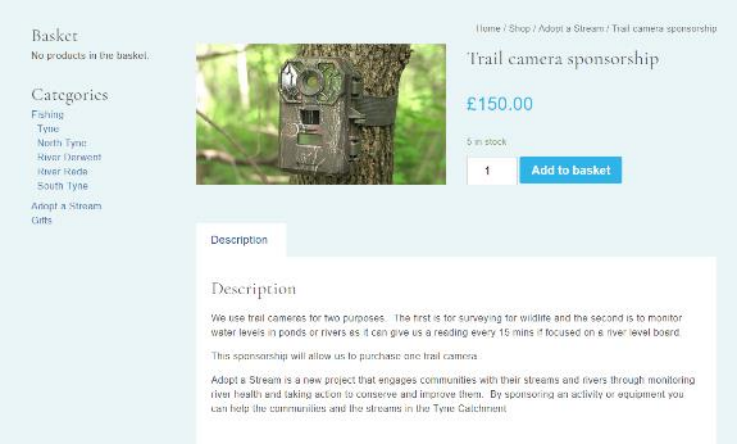
Essential elements:

- Stage board or some scale reference

Key questions

- How frequently should photos be taken – 5 minutes adequate
- Battery life
- SD card capacity – adjust photo resolution to maximise capacity without affecting quality

Tyne Rivers Trust



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Date:
Reel:
Shot:
TLC200 PRO 2018/01/15 12:50:06
SRC TC: 00:00:19:00
REC TC: 01:00:19:00
SLOW THE FLOW


TLC200 2018/11/19 07:19:08

Time lapse photography: Common problems

Camera too far away to pick out detail: Don't try an capture everything, make sure camera is located close to the feature and can see the stage board

Rain on lenses: Difficult to prevent but can tilt cameras, apply water repellent coatings to lens (make sure suitable for glass), create a shelter

Camera moves through time: Ensure camera points in the same direction after swapping batteries and SD cards. Have a fixed reference point or stage board

Theft/vandalism: Difficult to prevent but can camouflage camera, hide in bird box, avoid highly trafficked locations

No images during the night: Cameras are available with low glow/no glow IR flash

Battery Life: Select settings to maximize battery life. Some cameras can be powered externally. There is the potential to link to a float switch so only activated as levels start to rise

Fixed point photography

Citizen Science

There are opportunities to use citizen science to capture images through time and during storm events

Needs to be carefully thought out if relying on the general public

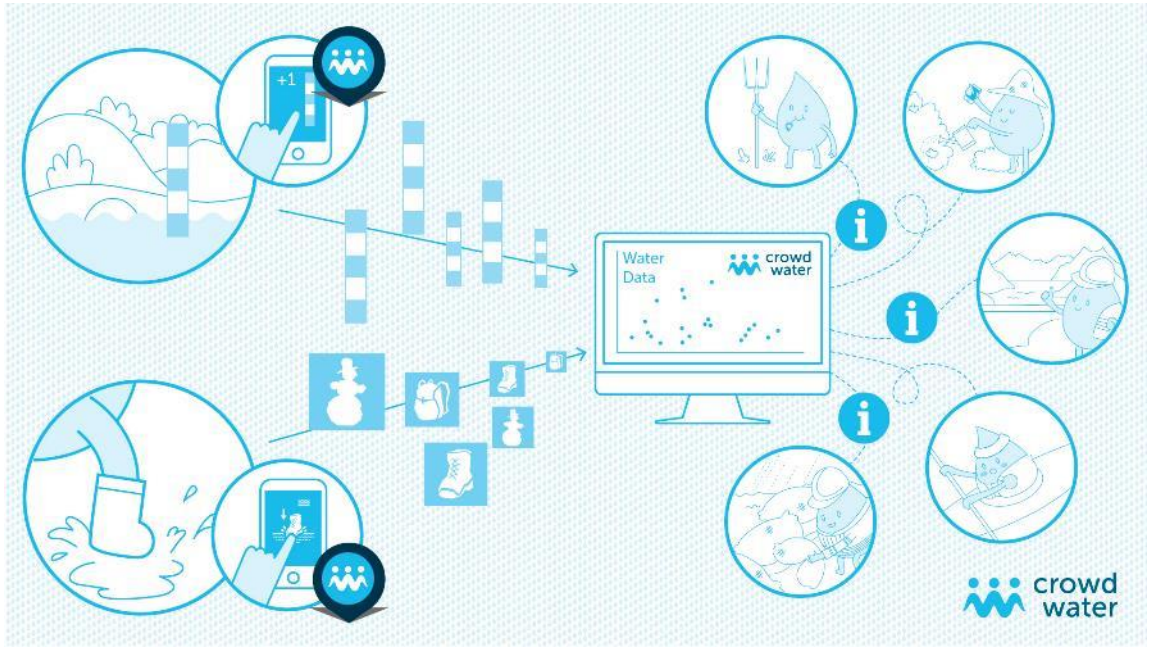
If volunteers provide a guidance document

Requires risk assessments as could be taking photos during high flow events

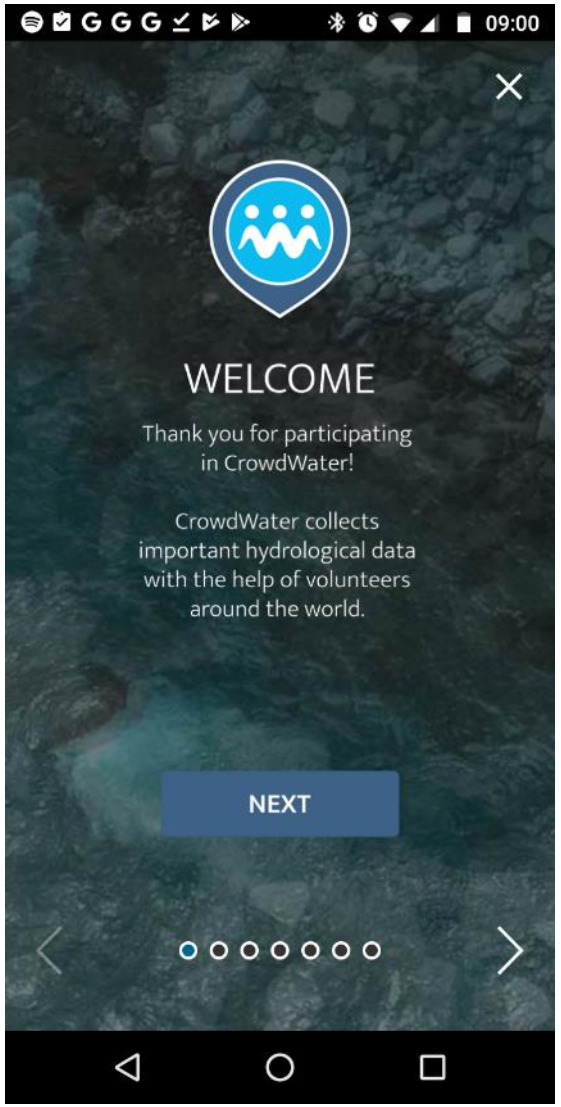
River Levels - Citizen Science

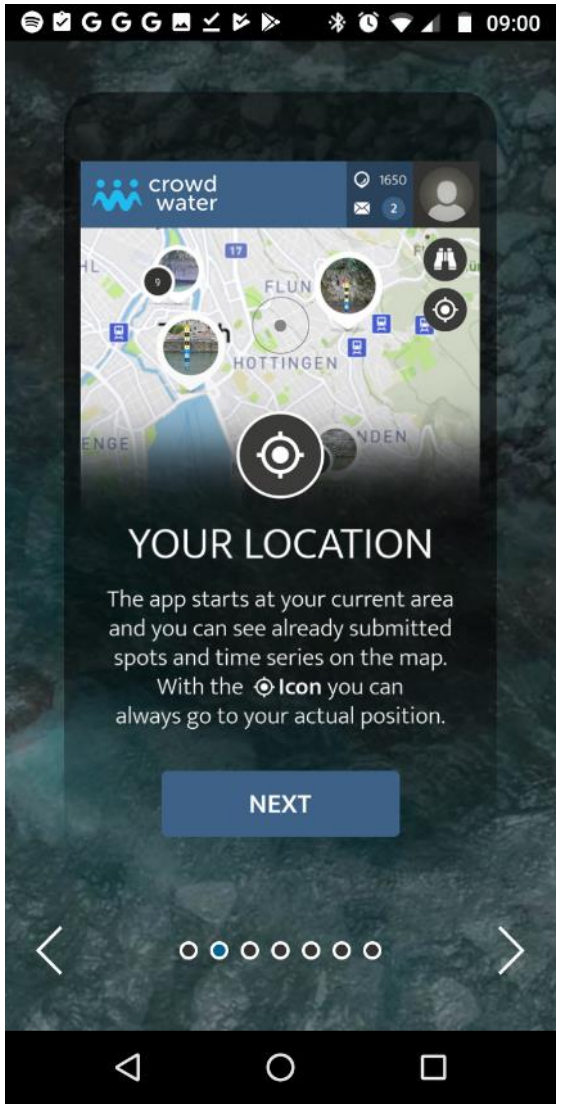
CrowdWater https://www.crowdwater.ch/en/welcome-to-crowdwater/

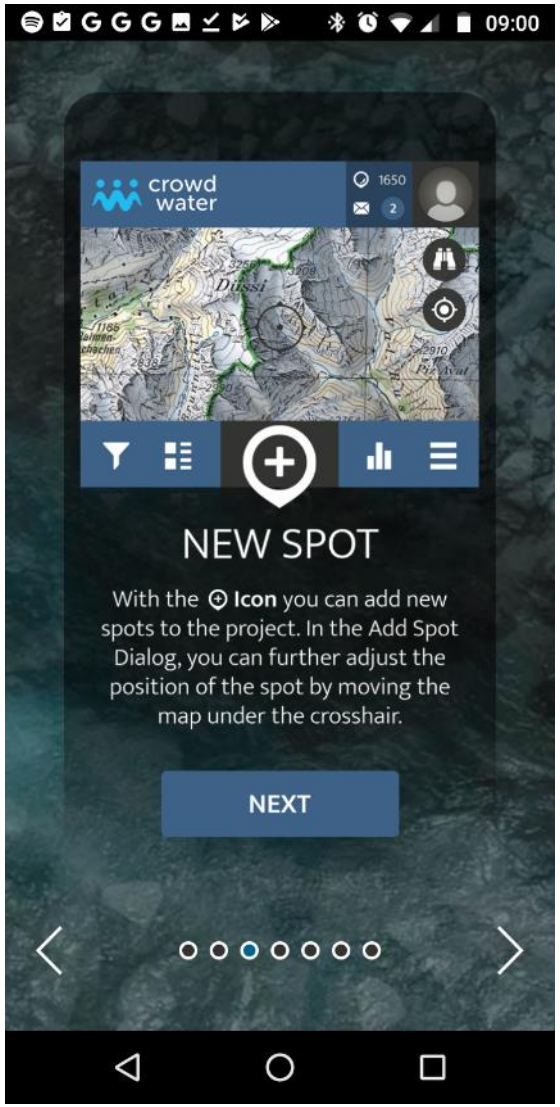
1. Water level and streamflow
2. Soil moisture
3. Flow condition of a temporary stream



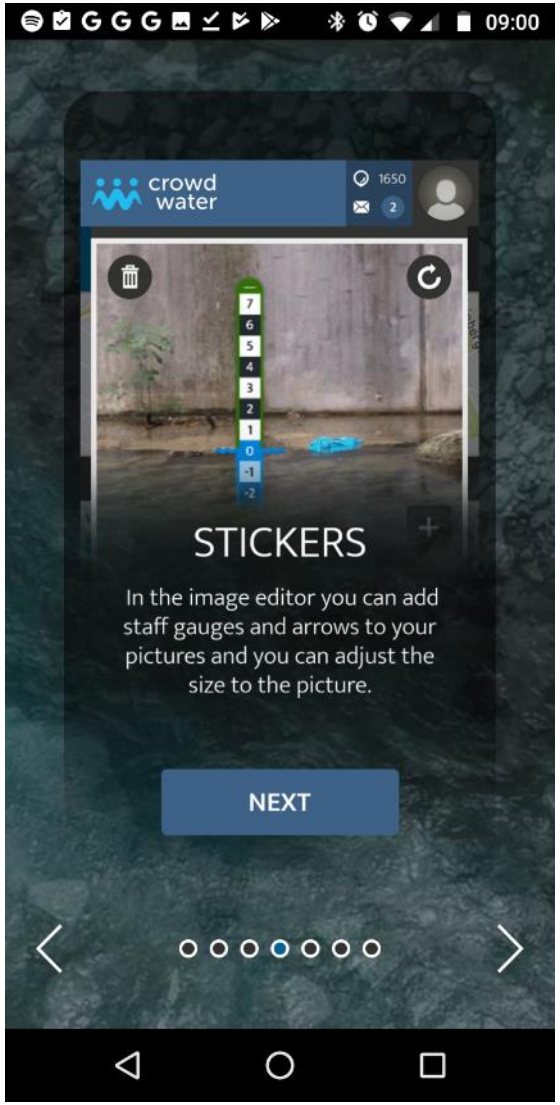
River Levels - Citizen Science: CrowdWater app

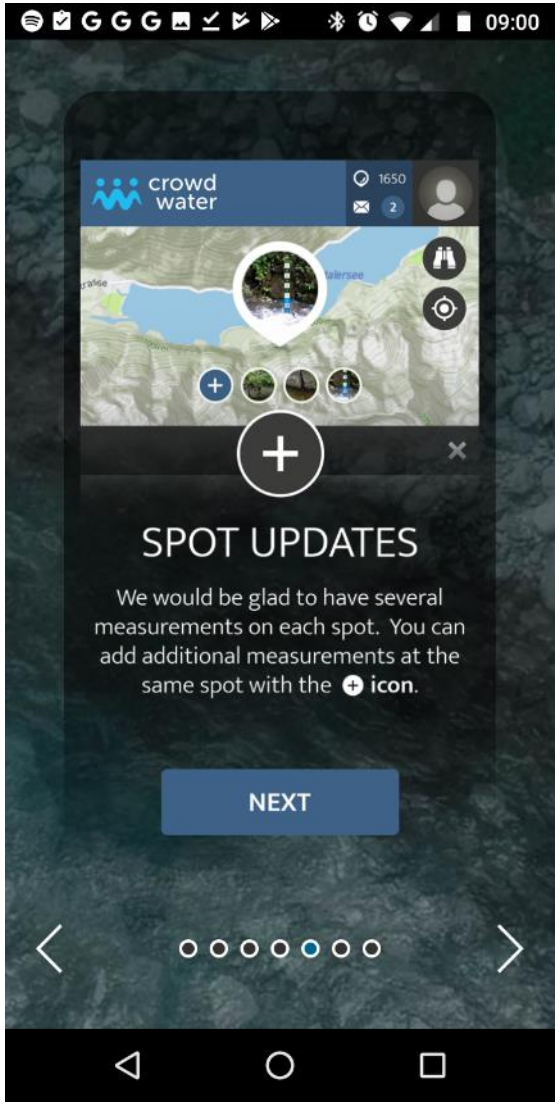


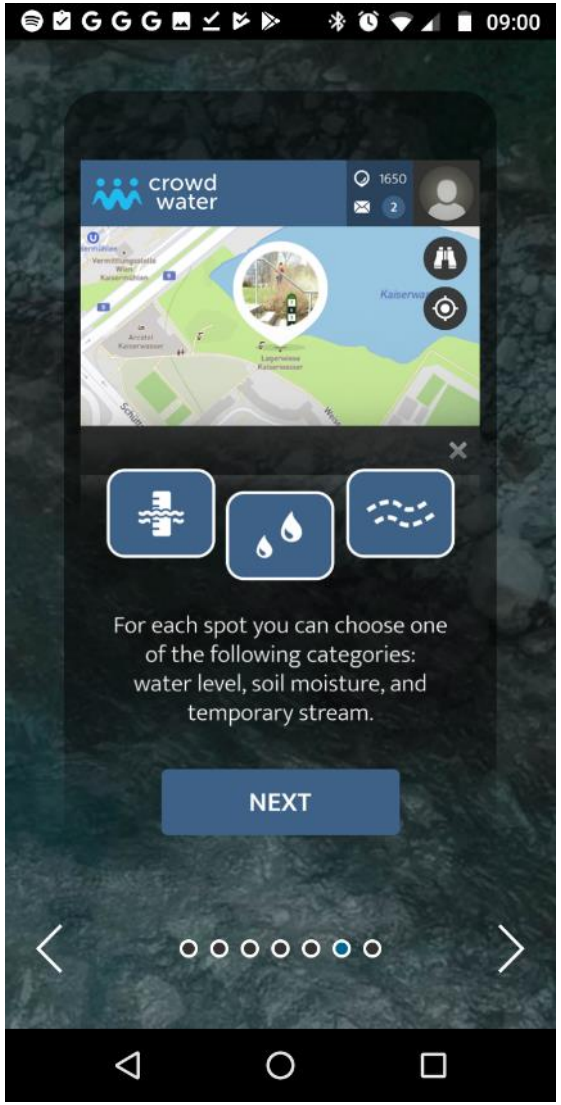




River Levels - Citizen Science: CrowdWater app







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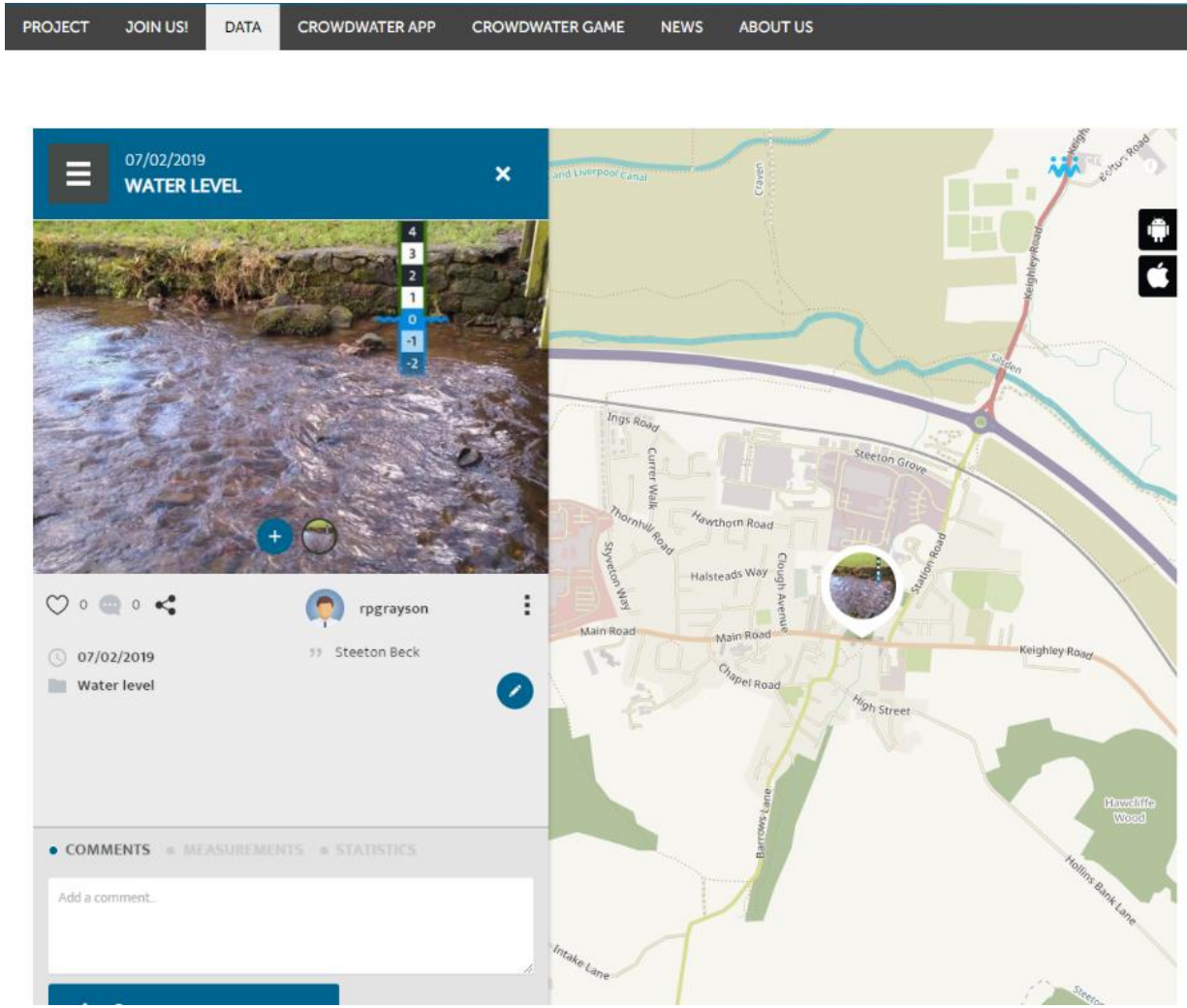

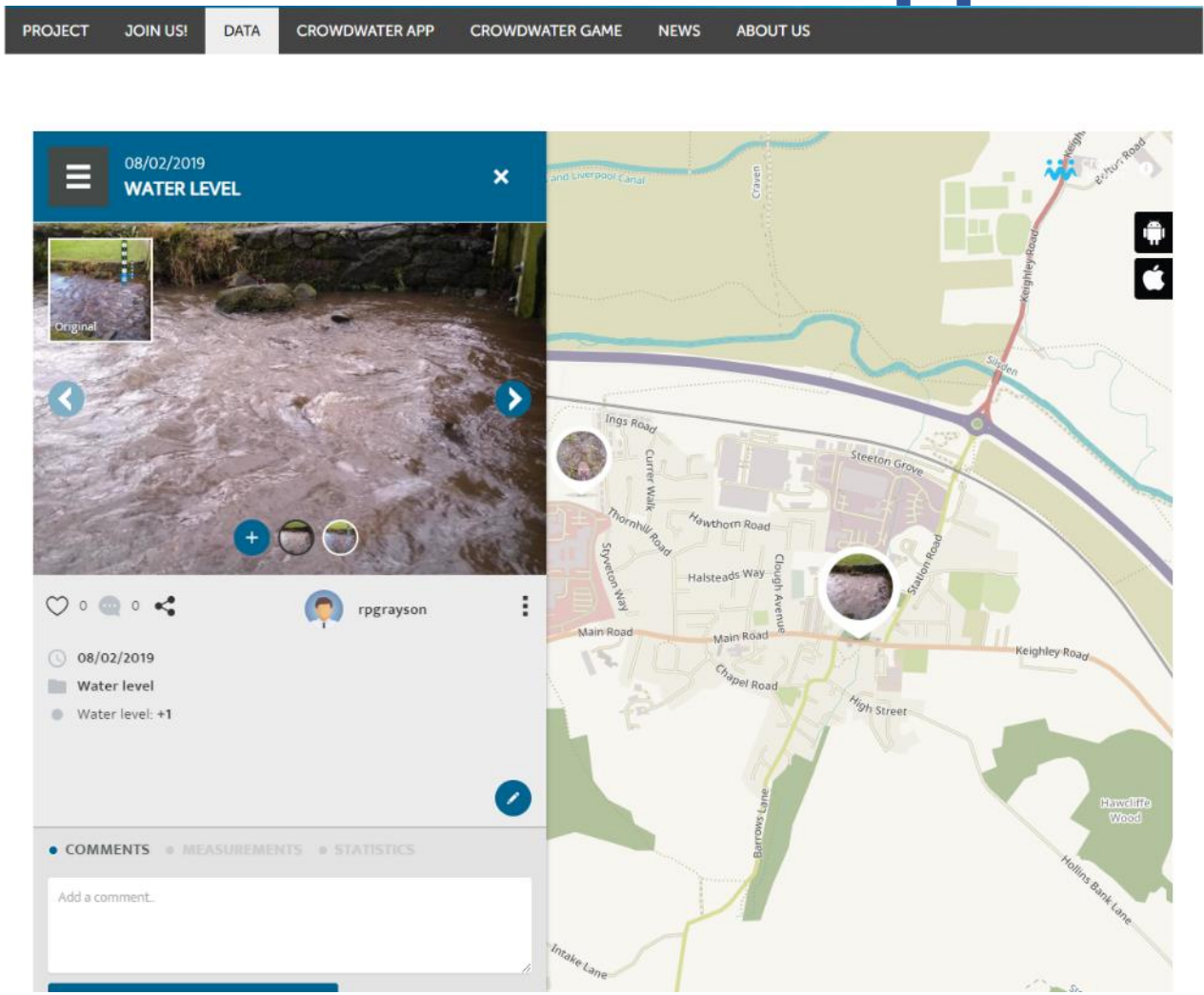

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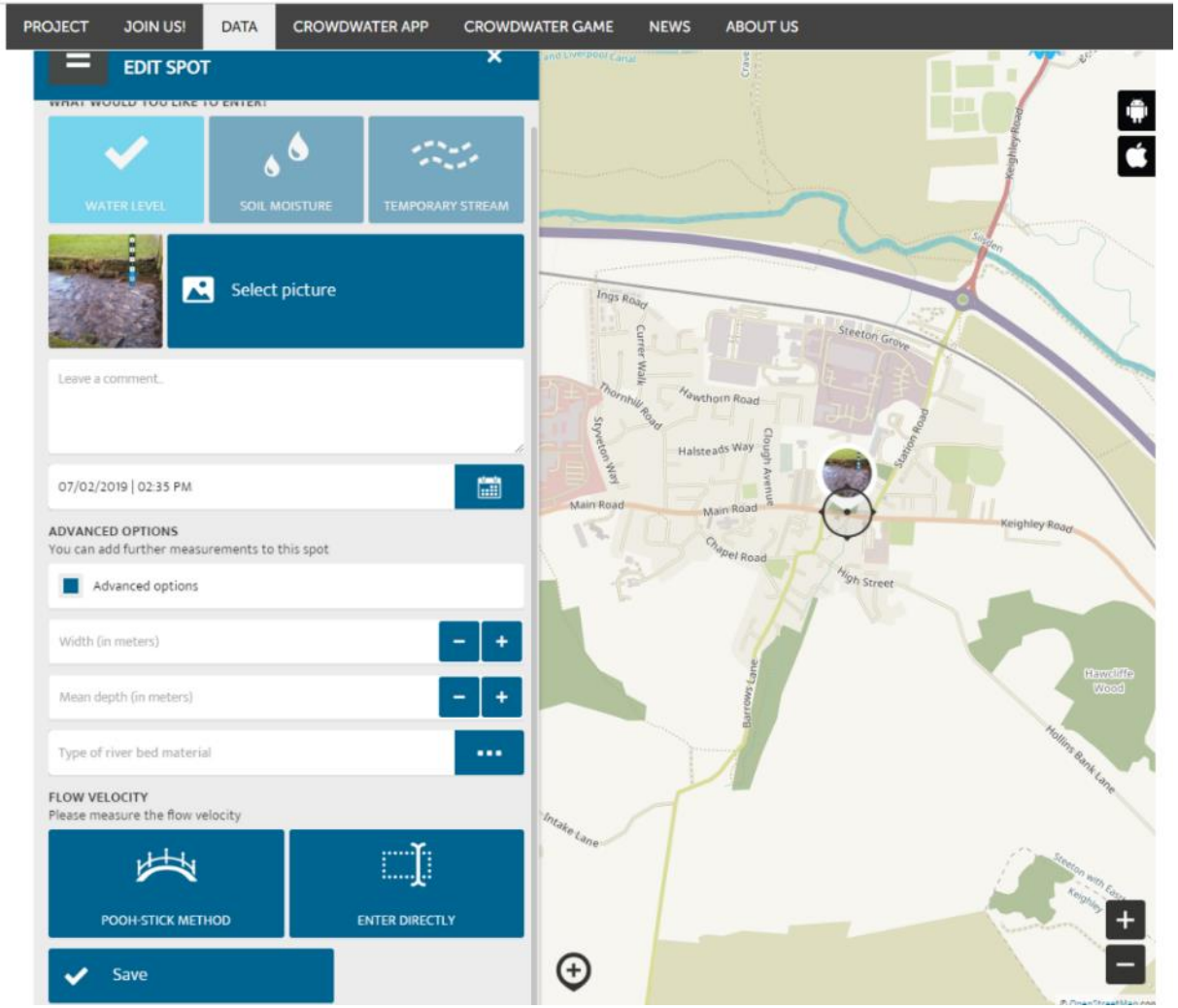
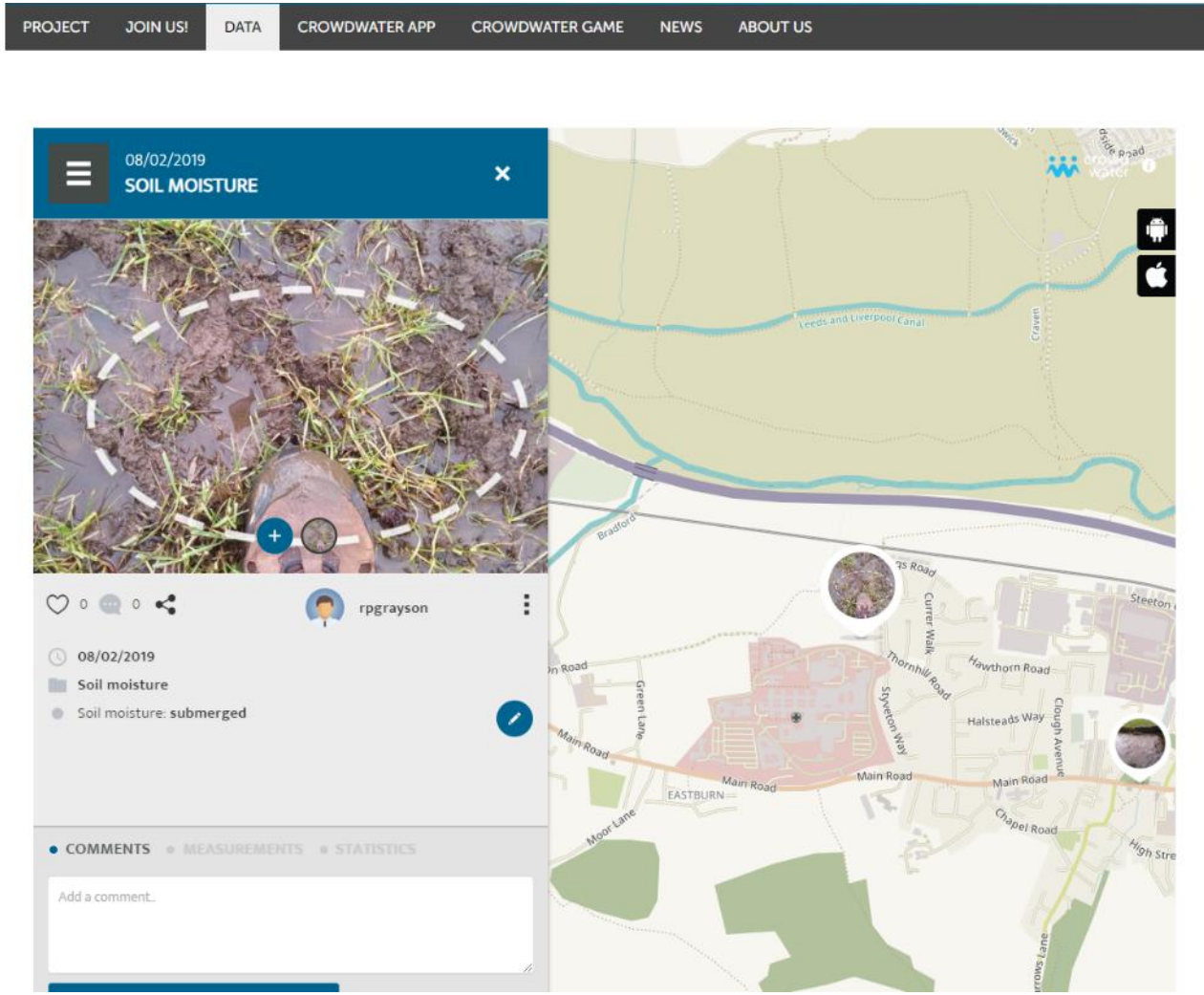




Overland flow

Timelapse cameras with stage board would be highly effective

Low cost crest stage gauges:

- Record the maximum water level achieved over a period of time
- Can place away from a channel
- Could also be used in a channel to record maximum flow height

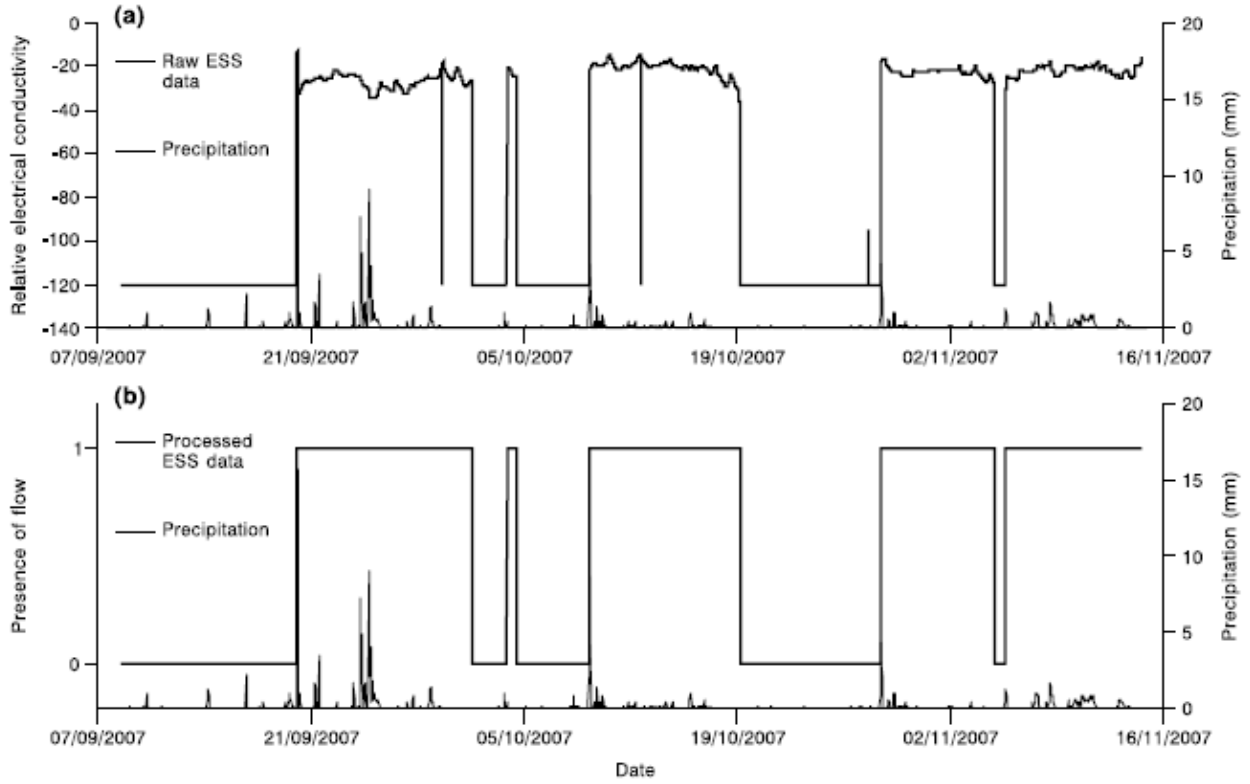
Even cheaper crest stage tubes:

- Installed with holes at the surface and record the presence or absence (i.e. empty = absence, full = presence) of overland flow over a set period of time.
- Can get an idea of depth of flow by installing several tubes each with holes at different set distances above surface

Overland flow

Cheap temperature loggers can be modified to measure electrical resistance:

- Low resistance when wet
- Allows continuous logged presence or absence of flow



Wrack Marks

Use debris/trash lines to identify maximum flow during storm events

Can also be used to identify where water flows when out of channel

Sediment and water quality

simple

- Desktop study / historical research of downstream sedimentation or dredging records.
- Fixed point photography
- Summary information recorded whether sedimentation is affecting ecology

intermediate

- Accurate survey of ground surface levels behind dam or RAF/pond bed levels to measure silt depths at certain locations throughout the year and after a flood event.
- Assessed during high flows with the measurement of sediment load and nutrient load at the downstream flow gauging station.

complex

- Sediment fingerprinting surveys
- Real time and online monitoring of sediment flux (e.g. via turbidity, total suspended solids for fine sediments) and nutrient flux (e.g. auto-analysers, auto-samplers)

Sediment

Suspended Sediment Concentration (SSC): relatively easy to measure in the lab but difficult to quantify total loads based on a single sample

90% of the total suspended sediment transport in Devon rivers takes place in **10% (or less) of the time** (Webb and Walling, 1982) – so very difficult to capture representative data using spot sampling

Volumetric method is slightly less accurate than gravimetric

Both require access to lab equipment

Sediment

What are the alternatives to spot sampling?

Pump samplers:

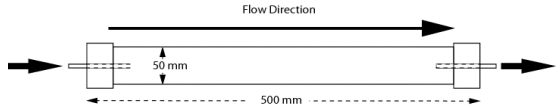
- Expensive to buy
- Samples need analysing in the lab

Turbidity probes:

- Expensive
- Require calibrating using samples measured in the lab

Time integrated samplers:

- Cheap
- Difficult to quantify properly as there is no way to tell whether they capture a representative load
- Good for fingerprinting



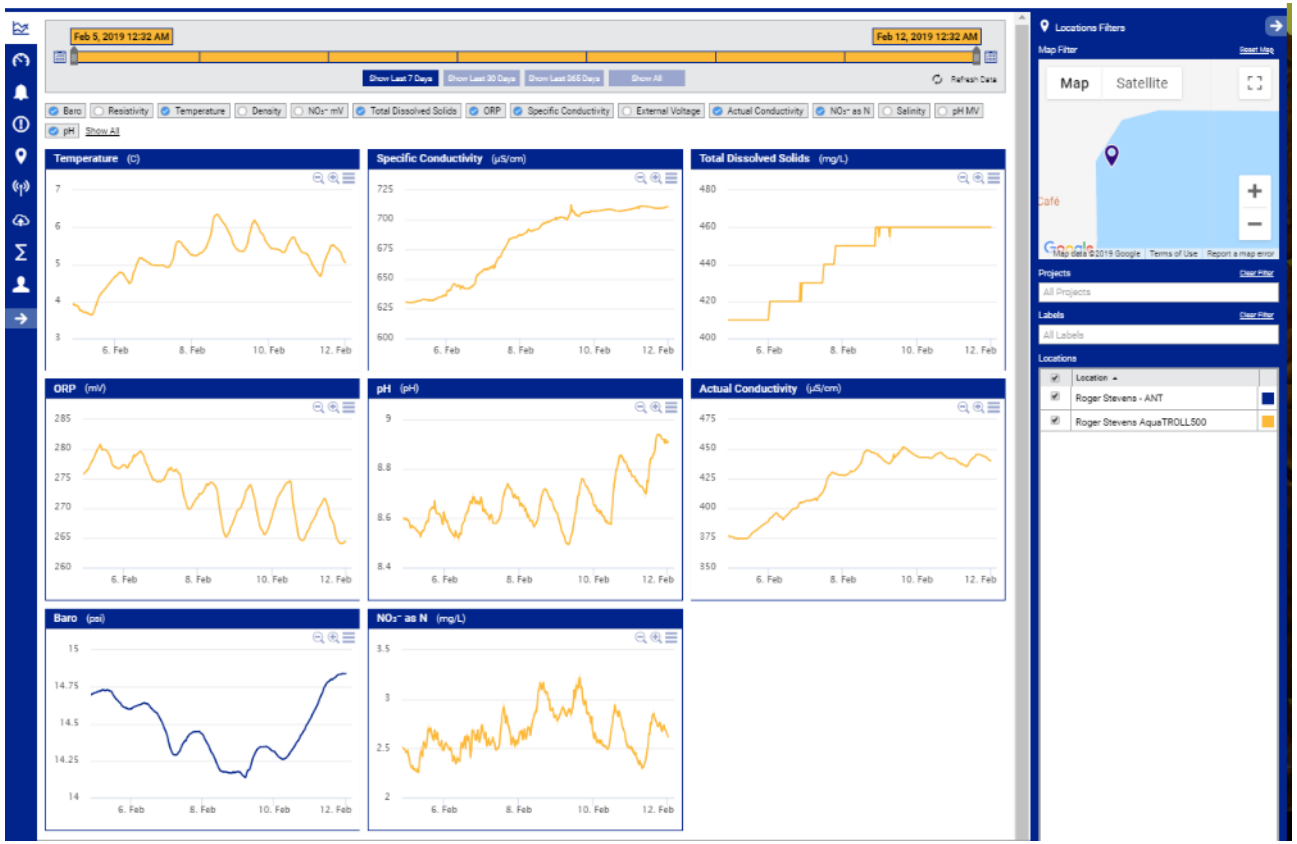
Water Quality

Spot sampling – again questions of how representative these are

Water Quality sondes:

- Continuous WQ data
- Expensive to buy and run as require regular calibration and maintenance

Lab based analysis is very expensive depending on what you want to measure



Riverfly

The Riverfly Partnership Angler's Riverfly Monitoring Initiative (ARMI) uses 8 groups of commonly occurring freshwater invertebrates to monitor the biological condition of rivers across the UK

Riverfly Extended Scheme uses an extended list of 20 groups

Training required

Great engagement tool

However, to be effective a big change in sediment load is required

Has been successful in the East of England but maybe less successful in Yorkshire Rivers where pools and riffles are more dominant and flows are faster

Aire Rivers Trust are organising a training course for the Riverfly monitoring scheme in March (likely to be in Pudsey). For more information please contact Nick Milsom nick.milsom@aireriverstrust.org.uk

Water Quality Testing Kits

Cheaper alternative to expensive equipment

Great for citizen science

Westcountry CSI: Citizen Science Investigations

http://wrt.org.uk/project/become-a-citizen-scientist/

kit includes:

- Turbidity tube
- Total Dissolved Solids probe
- Phosphate test kit

Westcountry C.S.I.
Citizen Science Investigations

Westcountry CSI is an initiative by
Westcountry Rivers Trust

Survey Details

Survey location: _____ Grid Reference: _____

Name of river/stream: _____

Date: _____ Time: _____ Observer name: _____

FreshWaterWatch

Your FreshWater Watch kit contains everything you need to begin collecting data, including:

- A pack of 5 nitrate water quality testing tubes.
- A pack of 5 phosphate water quality testing tubes.
- Colour charts for nitrate and phosphate tests.
- Sample cup for use with testing tubes.
- Secchi tube.

£70.00

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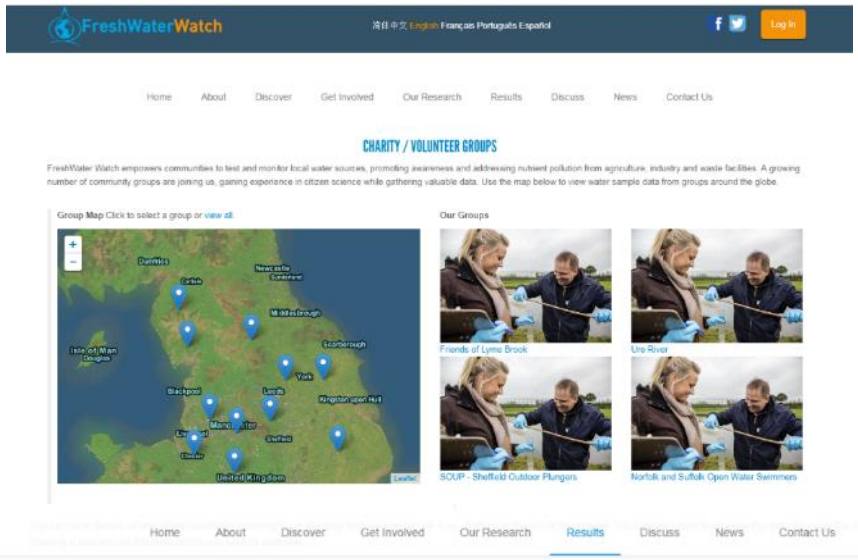
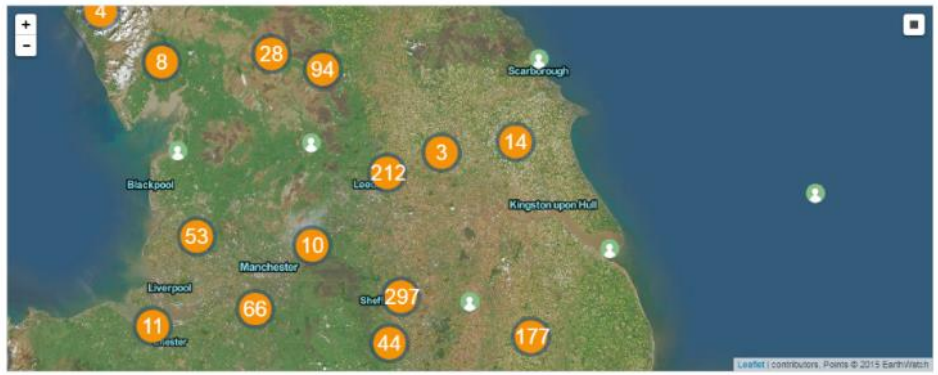
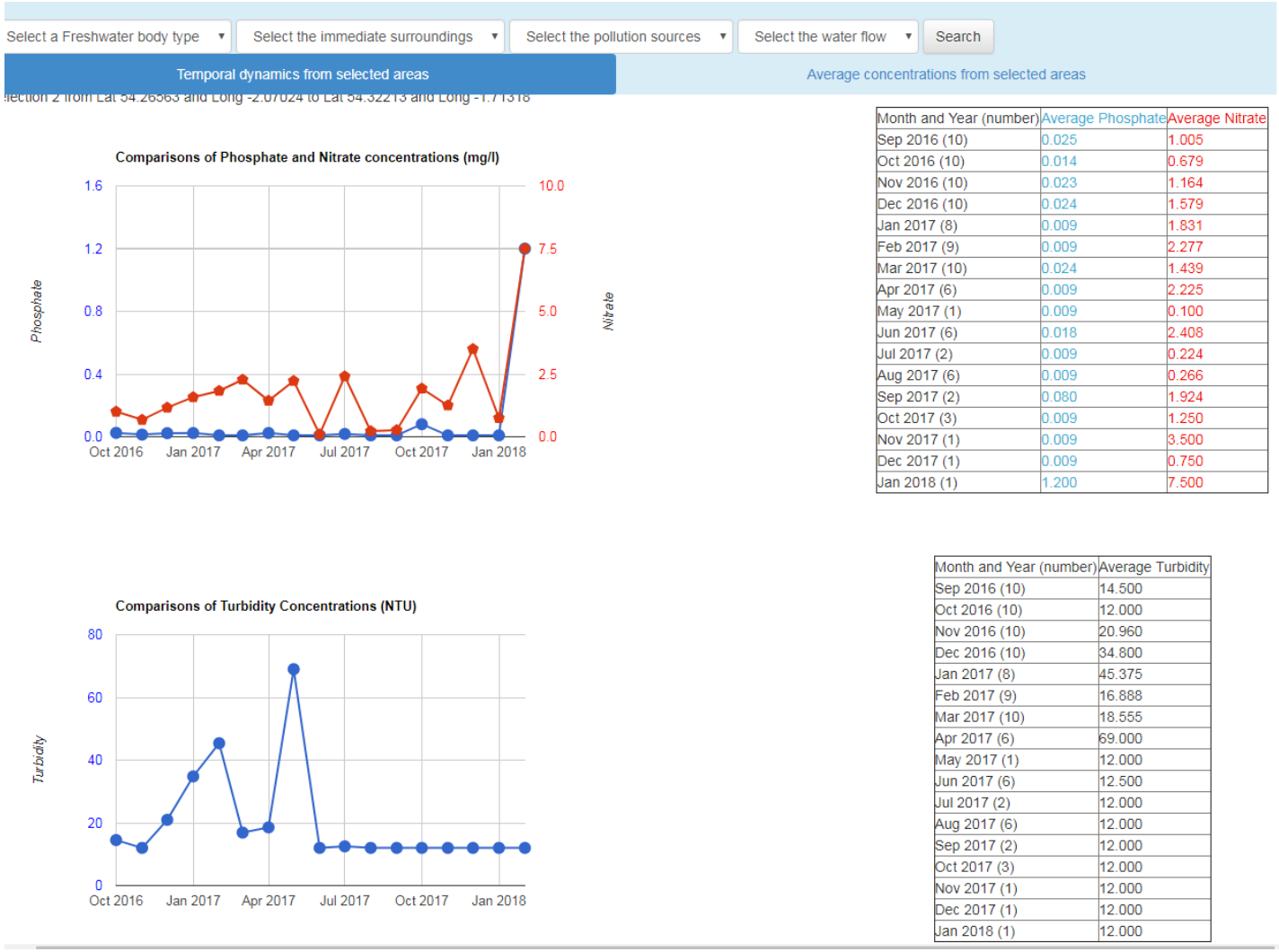
Water Quality Testing Kits

FreshWaterWatch







Month and Year (number)	Average Phosphate	Average Nitrate
Sep 2016 (10)	0.025	1.005
Oct 2016 (10)	0.014	0.679
Nov 2016 (10)	0.023	1.164
Dec 2016 (10)	0.024	1.579
Jan 2017 (8)	0.009	1.831
Feb 2017 (9)	0.009	2.277
Mar 2017 (10)	0.024	1.439
Apr 2017 (6)	0.009	2.225
May 2017 (1)	0.009	0.100
Jun 2017 (6)	0.018	2.408
Jul 2017 (2)	0.009	0.224
Aug 2017 (6)	0.009	0.266
Sep 2017 (2)	0.080	1.924
Oct 2017 (3)	0.009	1.250
Nov 2017 (1)	0.009	3.500
Dec 2017 (1)	0.009	0.750
Jan 2018 (1)	1.200	7.500

Month and Year (number)	Average Turbidity
Sep 2016 (10)	14.500
Oct 2016 (10)	12.000
Nov 2016 (10)	20.960
Dec 2016 (10)	34.800
Jan 2017 (8)	45.375
Feb 2017 (9)	16.888
Mar 2017 (10)	18.555
Apr 2017 (6)	69.000
May 2017 (1)	12.000
Jun 2017 (6)	12.500
Jul 2017 (2)	12.000
Aug 2017 (6)	12.000
Sep 2017 (2)	12.000
Oct 2017 (3)	12.000
Nov 2017 (1)	12.000
Dec 2017 (1)	12.000
Jan 2018 (1)	12.000

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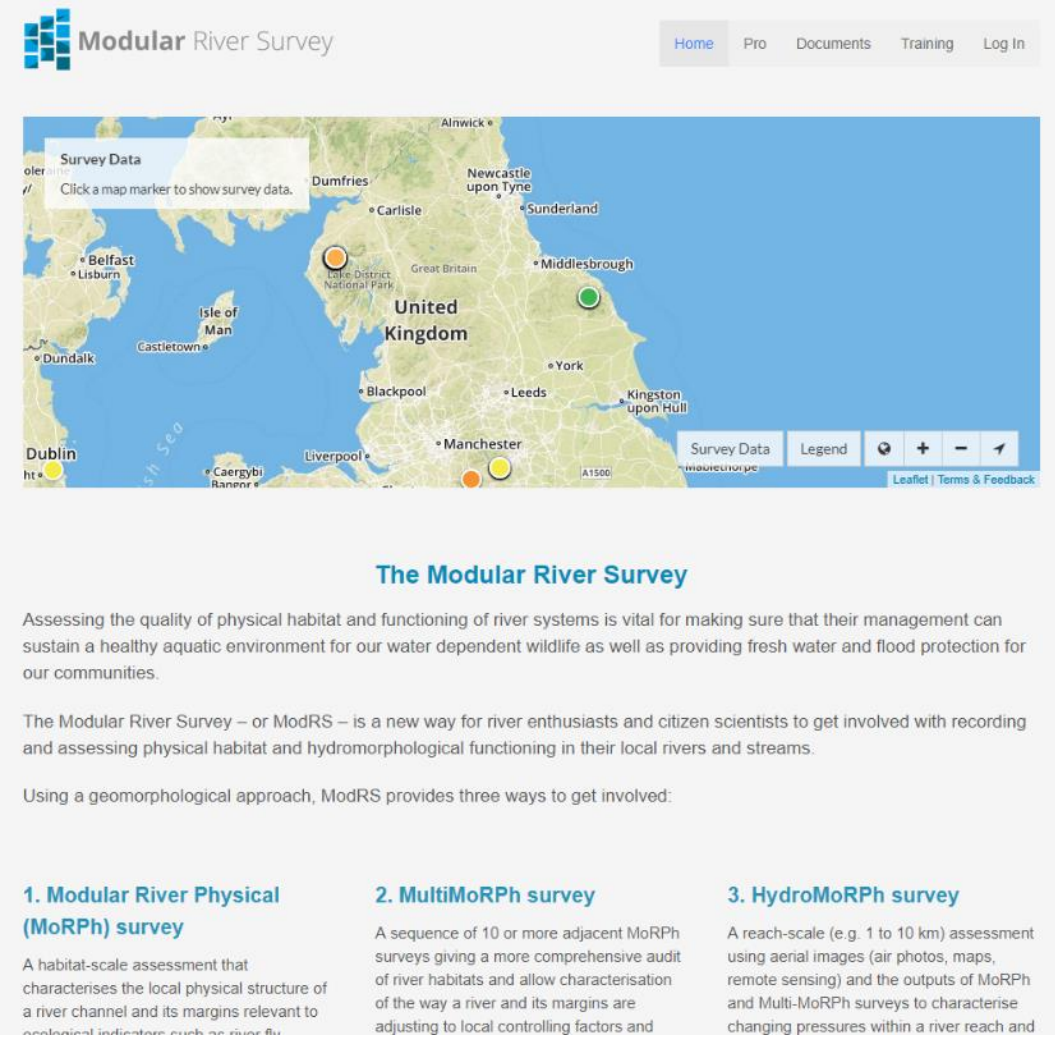
Modular River Physical (MoRPh) survey



One MoRPh survey: records physical habitat / features along a short length (module) of a river AT a river biological sampling site. Includes bank tops, bank faces and channel bed.

Three contiguous MoRPh surveys: records LOCAL physical habitat availability (3 surveys centred on biological sampling site).

10+ contiguous MoRPh surveys (= MultiMoRPh): records GENERAL physical habitat availability to highly mobile organisms and also typical morphological units, contemporary hydromorphological processes and pressures

Repeat surveys at same MoRPh survey site(s): physical habitat, and pressure MONITORING

Opportunities

EA Strategic monitoring review

Changes to compensation flows in reservoirs around Sheffield – potentially high level invertebrate sampling

Talk to catchment based ecologist