



# Training Session

- 10.00**      **Arrival & Introductions**  
**Why did you get involved in becoming a water quality citizen scientist?**  
**What do you want to achieve with your Citizen Science?**  
**Download Survey 1-2-3 and WQT App**
- 10.20**      **Training Presentation**  
**Catchment –based Approach, Wensum Catchment Partnerships and the**  
**Catchment Thinking Systems Cooperative (CaSTCo)**
- 10.40**      **The Science of Water quality testing**
- 11.20**      **Water Quality Feasibility Study**
- 11.40**      **Kit distribution and Agreements**
- 12.00**      **Lunch outside & Field training and App use**
- 2.00**        **Close**



## Who's who

Sarah Gelpke (NRT Project Coordinator)

Steve Lane (Environment Consultancy) Feasibility Study and CS  
Mentor

Rory Sanderson (Environment Agency) Water Quality and The  
Science

Jonah Tosney (NRT Technical Advisor)

Elle Clairborn (UEA) Benefits, SWOT of CS WQT

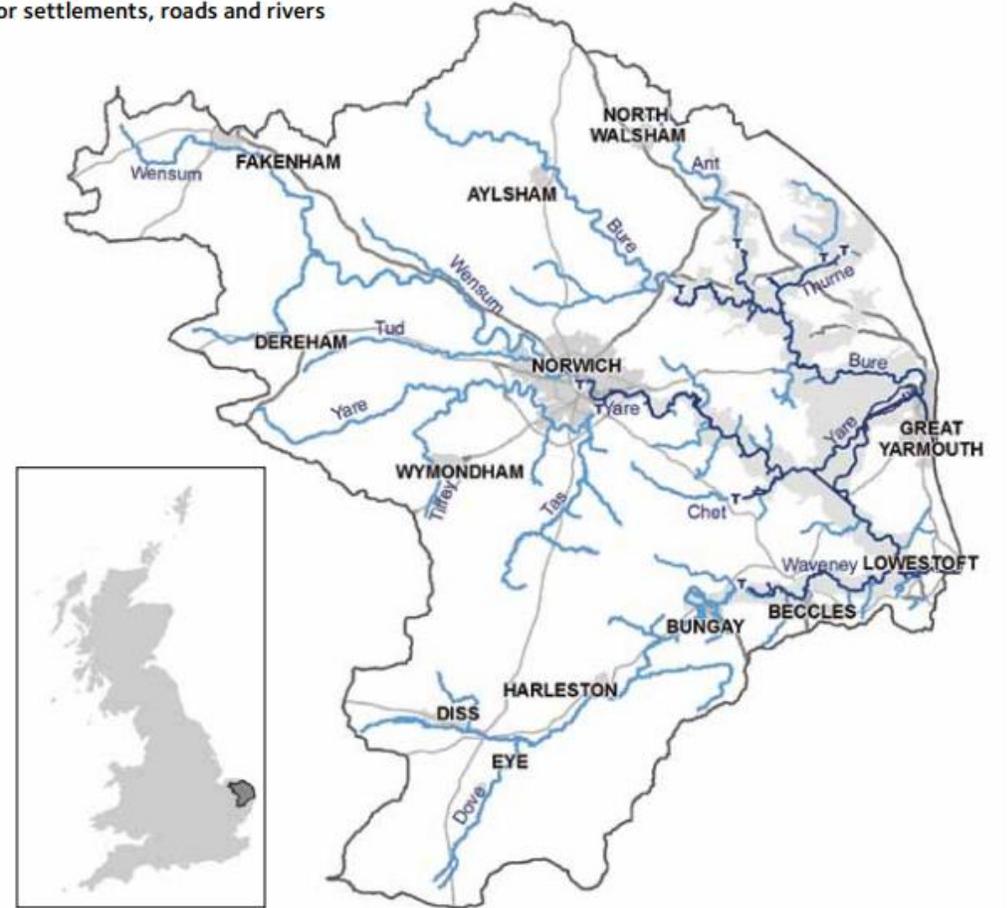
Sarah Taigel (East Point Geo) Data Management and Dissemination

# The Catchment Based Approach (CaBA)



100+ river catchments across England  
Each with a Catchment Partnership including Government, Local Authorities, Water Companies, businesses and local people  
Collaborating to improve and protect our precious water environments

Map 1 Location of the catchment, tidal limits, major settlements, roads and rivers



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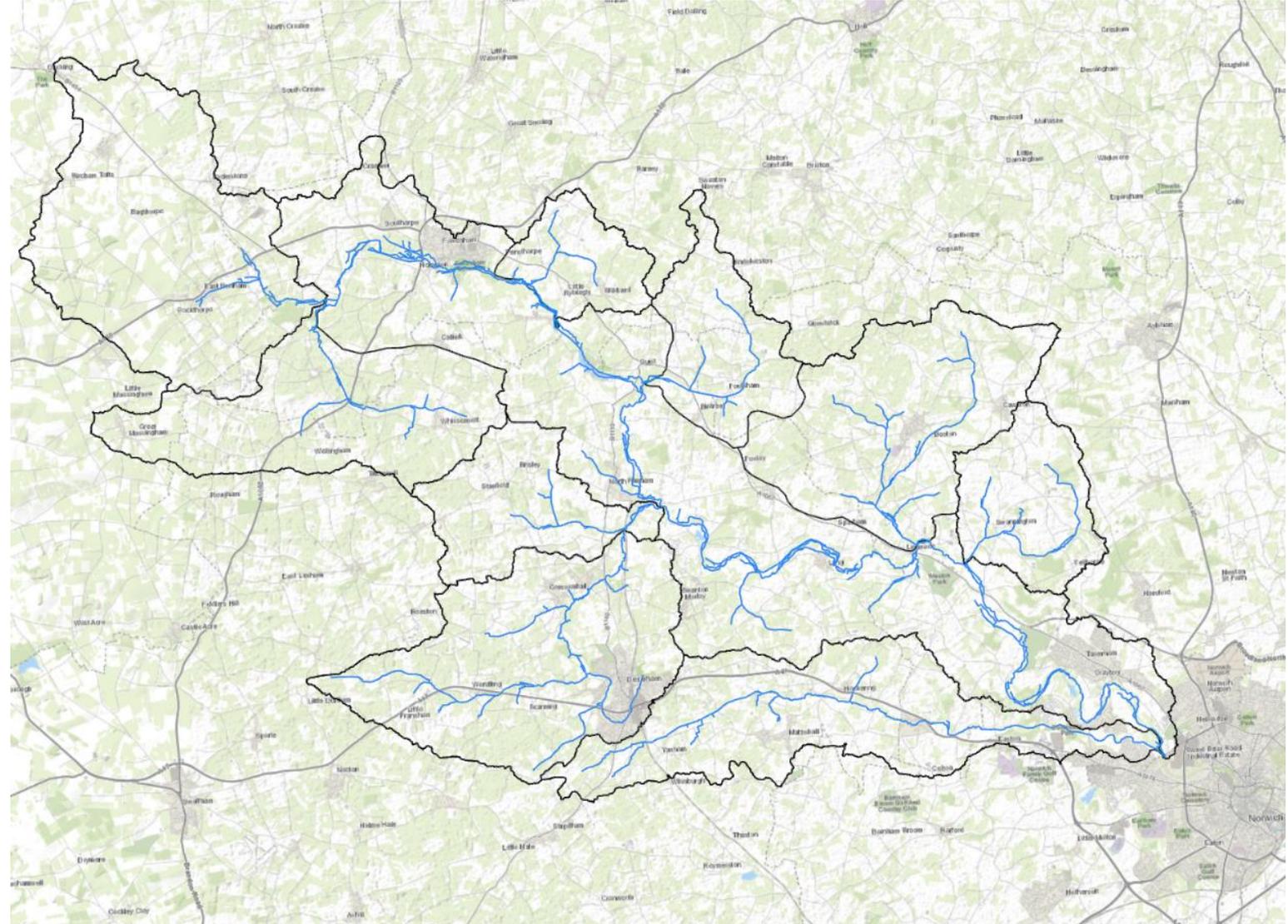
The Wensum is part of the Broadland Catchment

# The Wensum Catchment



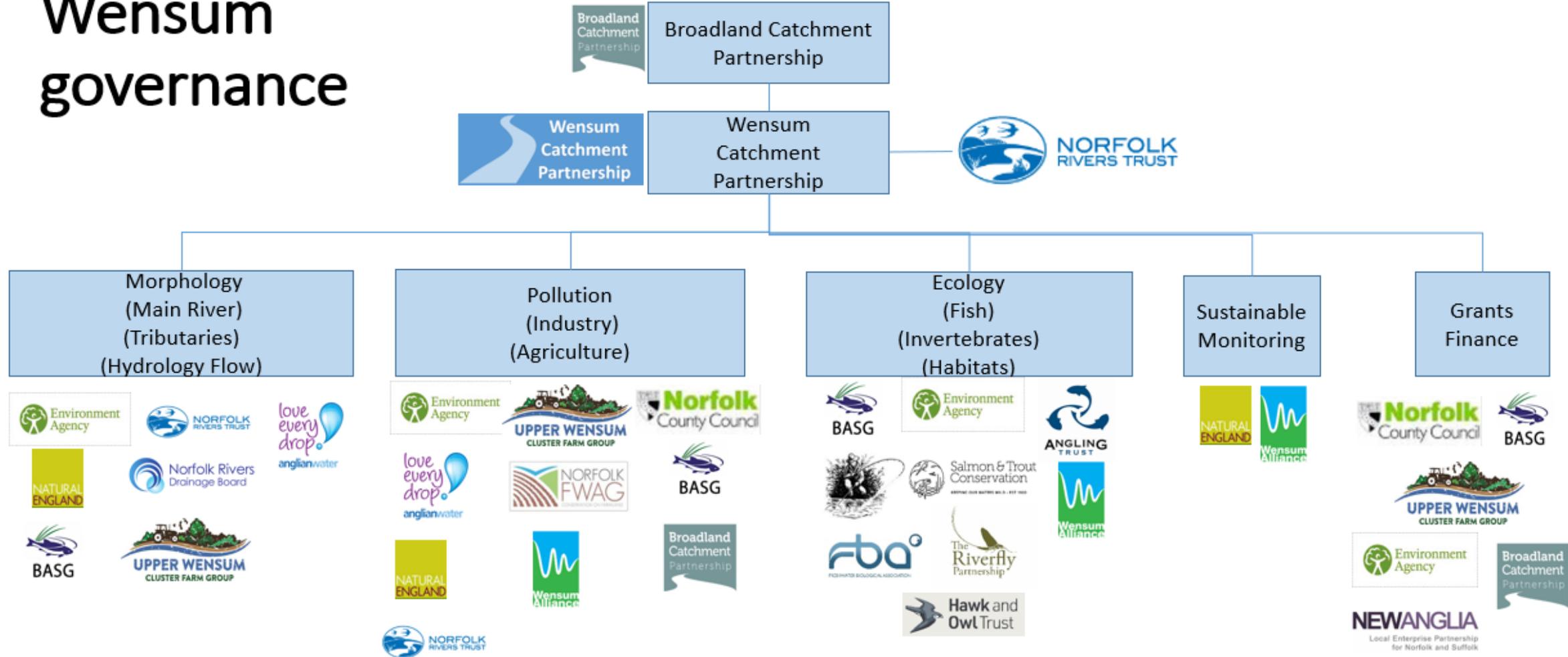
Largest chalk-fed river in Norfolk: 73 km long with a catchment area of 686 km<sup>2</sup>.  
10 sub-catchments with 12 water bodies:  
Two Natural, one Artificial and nine are heavily modified

Most protected river in Europe. One of 31 English rivers designated as a SSSI. A Special Area of Conservation (SAC), Natura 2000 Protected Area (WFD). Priority Habitat - UK Biodiversity Action Plan (BAP).



# The Wensum Catchment Partnership

## Wensum governance

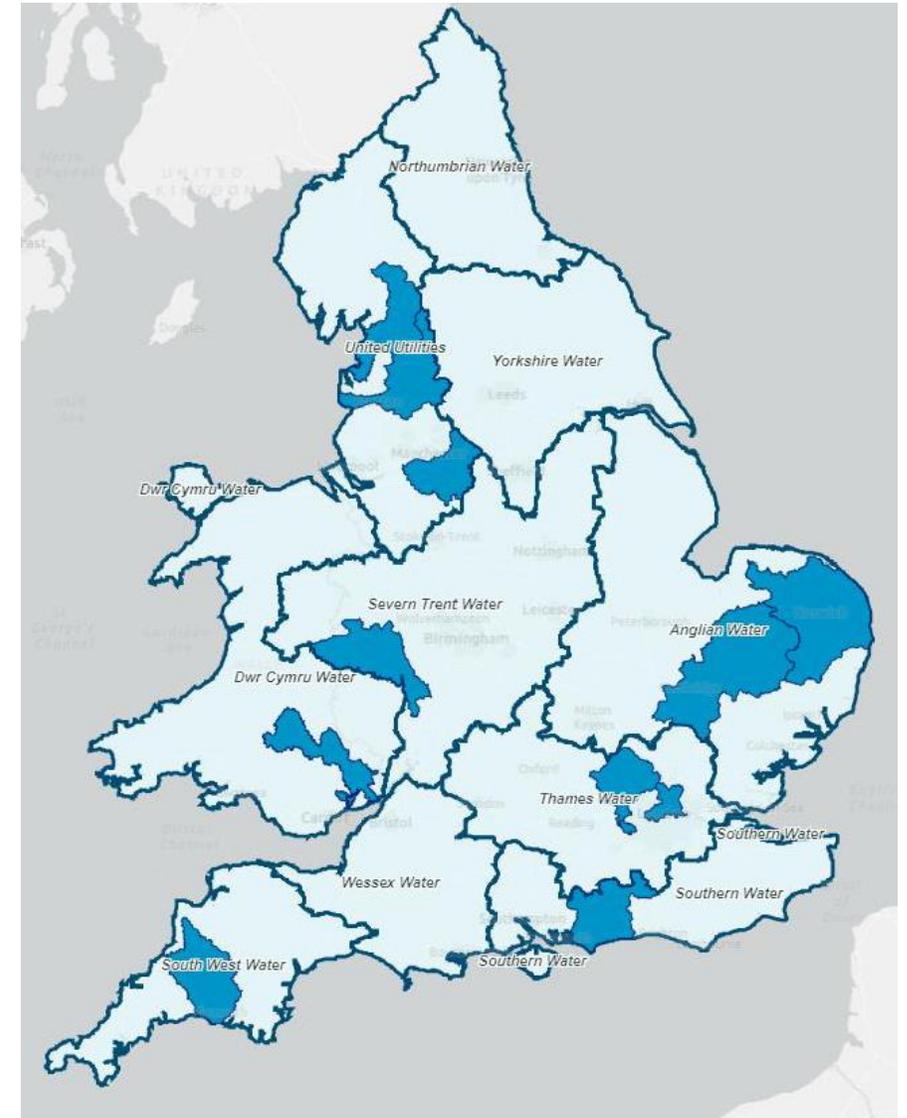


# The Catchment Systems Thinking Cooperative (CaSTCo)

**What is it?** A national programme run by the Rivers Trust and partners to develop national standard methods to measure river health

**Why?** To develop a catchment-based approach to data collection, analysis and dissemination to catchment partners, citizen scientists and others

**Where?** The Wensum pilot project is one of 8 Demonstrator Projects across England Co-Design Standardised Methods for river data monitoring

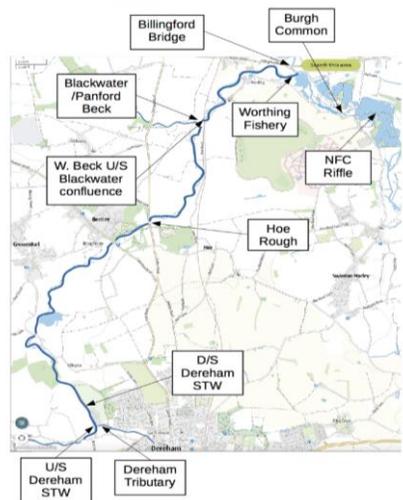


# So where does Citizen Science fit in?

- Budget cuts, limited resources and the scale of the river and its tributaries means that water quality data and evidence is limited.
- Citizen Scientists need affordable and accurate equipment and methods to become empowered to gather and share water quality data
- Data will help build understanding of the state of the river and help the Wensum Catchment Partnership and communities to develop a catchment management plan and target restoration efforts.



# Gather Data Evidence



# Share Data Evidence

Wendling Beck & River Wensum sites sampled on 16 February 2022:

Location	P (as PO4 <sup>-3</sup> )	P (as PO4 <sup>*</sup> )	NH3-N	NO3-N	NO2-N	°C	DO %	TDS	EC	pH
W. Beck U/S Dereham STW	0.21	0.0685	0.00	5	0	10.1	93.5	278	552	7.95
Dereham Trib.	0.09	0.0293	0	2	0		85.1	288	584	7.74
D/S Dereham STW	0.91	0.2968	0.00	5	0	10.3	89.0	270	556	7.89
Hoe Rough	0.28	0.0913	0.01	5	0	10.9	88.4	273	536	7.87
W. Beck U/S Blackwater conf.	0.30	0.0978	0.05	5	0	10.8	87.5	274	544	7.98
Blackwater U/S W. Beck conf.	0.23	0.0750	0.00	2	0	11.9	88.0	272	548	7.95
Worthing Fishery	0.35	0.1141	0.00	-	-	8.6	87.3	248	496	7.83
Billingford Bridge (Wensum U/S conf.)	0.13	0.0424	0.03	2	0	9.9	87.8	252	516	7.86
Burgh Common (Wensum D/S conf.)	0.22	0.0717	0.02	0.5	0	9.1	85.0	248	504	7.85

# Catchment Plans and Targeted Restoration



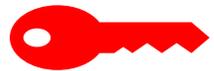
# Implement Solutions



# Aspects of a Healthy River: Morphology, Ecology and Water Quality



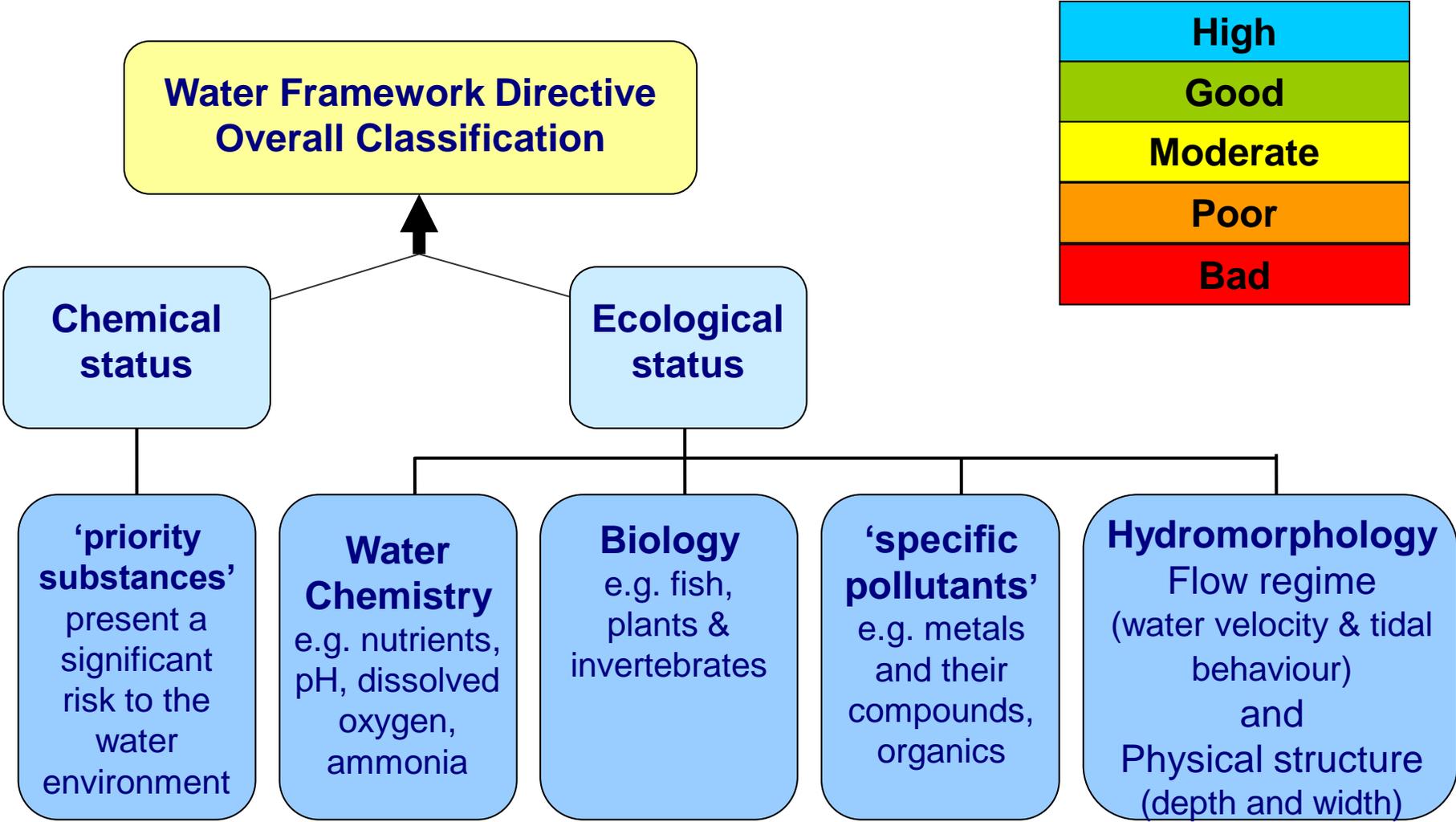
# What factors affect a rivers health?



**Key Wensum water quality issues : Phosphate and nitrate pollution, sediment run-off, changes to a rivers natural course, invasive species, other chemical pollution.**

# Background – River Basin Planning

## New Classification System



**'One Out, All Out'**

# Water body – default objective



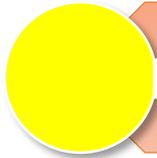
H

High – no or very minor disturbance from natural conditions



G

Good – slight variation from natural conditions



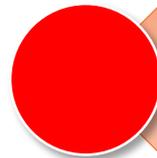
M

Moderate – significantly disturbed from natural conditions



P

Poor – showing major disturbance to the biology



B

Bad – severe disturbance to the biology

# What does good look like?

**Table 2:** Water Framework Directive physico-chemical water quality boundary standards that apply to waterbodies in the River Wensum operational catchment according to river typology.\*

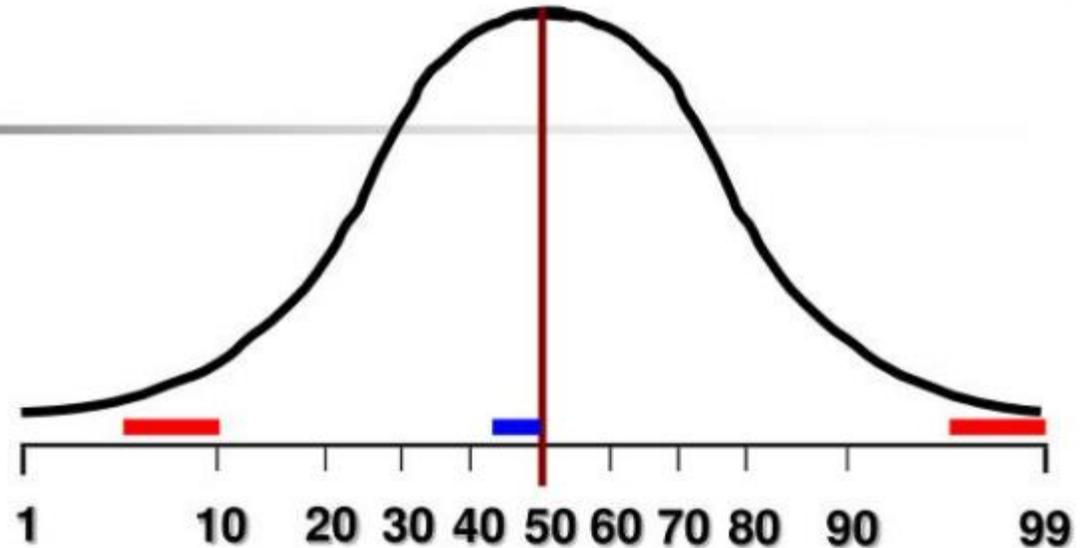
			← PASS		FAIL →	
Element	Statistic	River typology	HIGH	GOOD	MODERATE	POOR
BOD (mg/l O)	90 %ile	Salmonid	3	4	6	7.5
		Lowland high alkalinity (non salmonid)	4	5	6.5	9
Ammonia (mg/l N)	90 %ile	Lowland high alkalinity (non salmonid)	0.3	0.6	1.1	2.5
Dissolved Oxygen (% sat)	10 %ile	Salmonid	80	75	64	50
		Lowland high alkalinity (non salmonid)	70	60	54	45
Phosphate** (mg/l P)	Annual Average	Site specific standards based on a site's altitude and alkalinity.	Site specific standards are shown appendix A			
pH	High-Good: 5 & 95%ile; Mod-Poor 10%ile	n/a	> 6 & < 9	> 6 & < 9	4.7	4.2
Temperature (°C)	98%ile	Salmonid	20	23	28	30
		Rivers not in salmonid water bodies and canals	25	28	30	32

Sculthorpe Mill (2012-2022)		
Mean	Min	Max
1.1	1.0	3.7
0.032	0.030	0.120
88.6	13.2	140.3
0.045	0.010	0.120
7.82	7.36	8.29
10.52	2.06	19.8

What does good look like?

## Interpretation of Percentile Ranks

**In a normal distribution, there is a piling up of scores between the 25th and the 75th percentile ranks and a tailing off at either end.**



# Good phosphorus and nitrogen?

**Table A Site specific WFD phosphate standards, SAC phosphate standards and salmonid typology for all waterbodies in the Wensum operational catchment**

SITE_ID	SITE_NAME	WATER BODY_ID	WATER BODY_NAME	WFD Phosphate class (mg/l P) annual average				SAC phosphate target applicable to each site (mg/l P)	Salmonid water body
				PASS ←		FAIL →			
				High	Good	Moderate	Poor		
WEN010	R.TAT TATTERFORD COMMON (R.WENSUM)	GB105034055870	Tat	0.047	0.086	0.206	1.079	0.02	Yes
WEN020	R.WENSUM HELHOUGHTON BRIDGE	GB105034051111	Wensum (to Tatterford)	0.048	0.088	0.209	1.086	0.02	Yes
WEN040	R.WENSUM SCULTHORPE MILL	GB105034055881	Wensum US Norwich	0.049	0.089	0.212	1.091	0.03	Yes
WEN060	KETTLESTONE STR.LANGER BR. (R.WENSUM)	GB105034055860	Little Ryburgh Tributary	0.05	0.09	0.213	1.094	0.03	Yes
WEN090	FOULSHAM STR.TWYFORD BRIDGE (R.WENSUM)	GB105034055850	Foulsham Tributary	0.051	0.092	0.217	1.102	n/a	No
WEN111	BLACK WATER D/S SPONG BRIDGE	GB105034051050	Blackwater (Wendling Beck)	0.052	0.093	0.219	1.106	n/a	Yes
WEN140	WENDLING BECK GRESSENHALL BR (R.WENSUM)	GB105034051020	Wendling Beck	0.05	0.091	0.215	1.098	n/a	Yes
WEN180	R.WENSUM SWANTON MORLEY BRIDGE	GB105034055881	Wensum US Norwich	0.052	0.094	0.22	1.109	0.03	Yes
WEN210	BLACKWATER DRN.GT.WITCHNGHAM (R.WENSUM)	GB105034051120	Blackwater Drain (Wensum)	0.053	0.096	0.223	1.115	n/a	Yes
WEN223	OLD RAIL BR.ALDERFORD	GB105034051070	Swannington Beck	0.054	0.096	0.224	1.117	0.03	Yes
WEN235	R.WENSUM TAVERHAM BRIDGE	GB105034055881	Wensum US Norwich	0.055	0.098	0.228	1.124	0.03	Yes

**Table 4: Nitrate standards for all rivers**

Element	statistic	PASS	FAIL
Nitrate (mg/l N)	average	≤11.3	>11.3

The Nitrate Directive directions (England and Wales) 2015  
[http://www.legislation.gov.uk/ukxi/2015/668/pdfs/ukxiem\\_20150668\\_en.pdf](http://www.legislation.gov.uk/ukxi/2015/668/pdfs/ukxiem_20150668_en.pdf)

# Wensum Headwaters Citizen Science WQ Monitoring



**Nitrate - mg/l , Ammonia - mg/l, Phosphate - ppm (mg/l) or ppb ( $\mu\text{g/l}$ ),  
Dissolved oxygen - mg/l & % saturation,  
Water temperature C, Turbidity, PH, Total Dissolved Solids, Conductivity  
Rainfall, water level and flow**



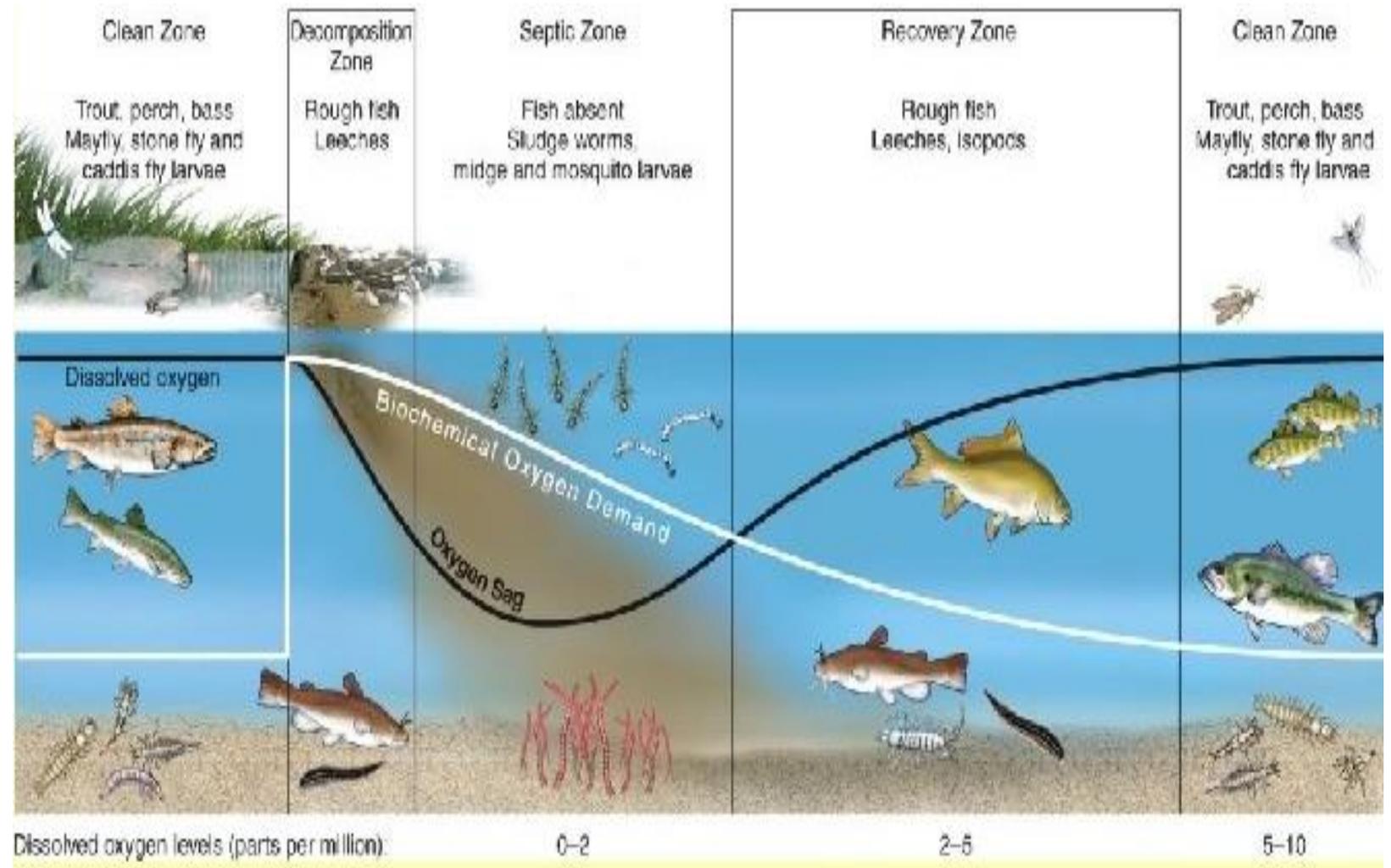
**Signs of Pollution, algal blooms, dead animals, invasive species**

# The Science



# Dissolved Oxygen and the Oxygen Curve

- By far the most important characteristic determining the quality of a river or stream is its dissolved oxygen, DO (measured in mg/L).
- A river can be considered healthy as long as its dissolved oxygen DO exceeds 5 mg/L. Below this, most fish can't survive, and some embryonic and larval stages require at least 8 mg/L to survive.



# Phosphate or Orthophosphate ( $\text{PO}_4^{3-}$ )

Phosphate ( $\text{PO}_4^{3-}$ ), also referred to as orthophosphate, is the bioavailable form of phosphorus, and essential for plant growth. It is found dissolved in water and attached to soil particles.

High concentrations in rivers can cause serious damage to aquatic ecosystems.

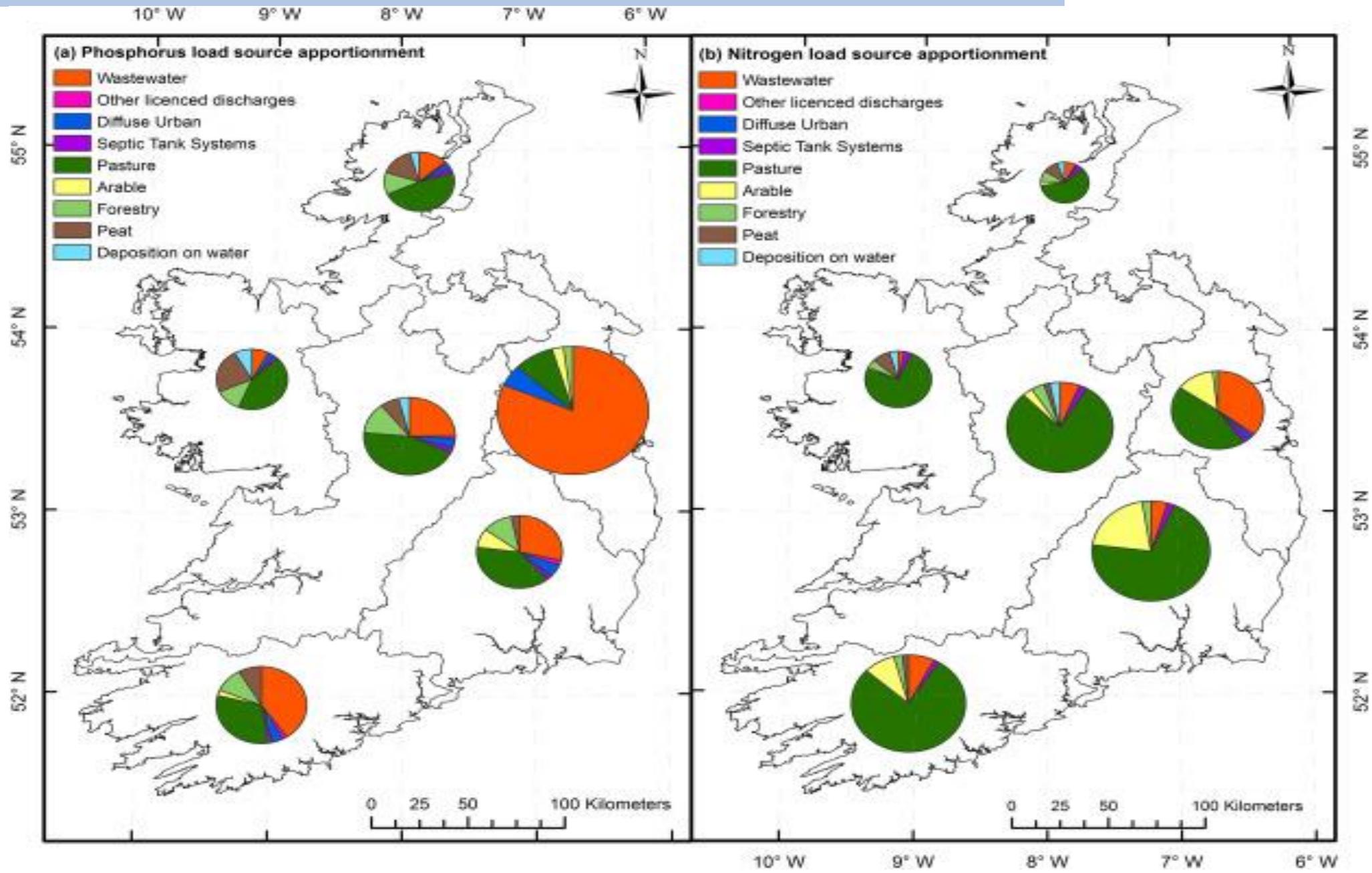
Phosphate can be concentrated in ground water which in turn can affect surface water quality

Its concentration is commonly measured in ppm (mg/l) or ppb ( $\mu\text{g/l}$ )



Edward Burtynsky: Anthropocene Phosphorus Tailings

# Source Apportionment Nitrogen and Phosphorus



# Nitrogen Cycle – Nitrate and Ammonium

Nitrate ( $\text{NO}_3$ ) is the oxidized form of nitrogen found dissolved in water.

Ammonia ( $\text{NH}_3$ ) and ammonium ( $\text{NH}_4$ ) are formed by bacteria decomposing nitrogen in organic material.

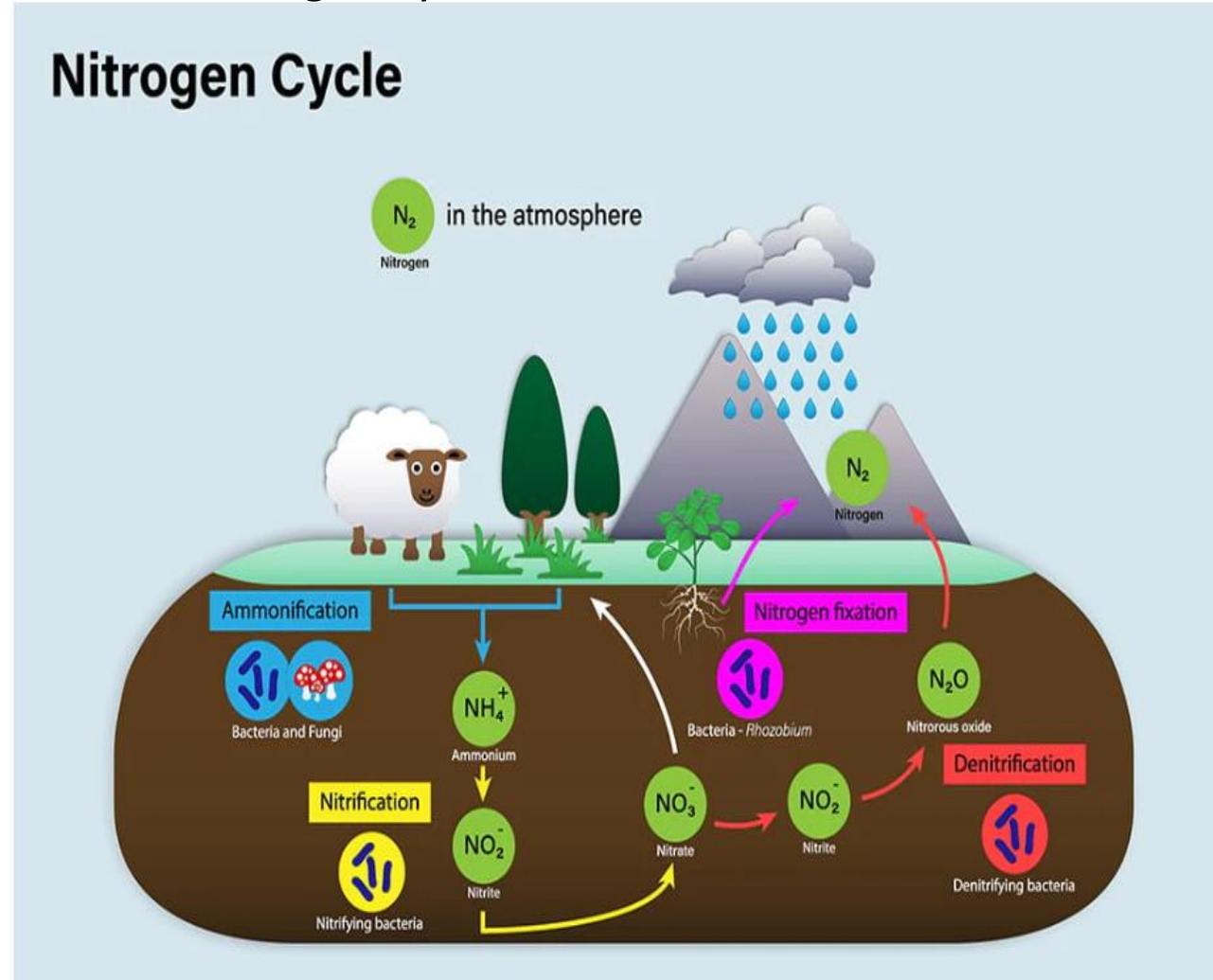
Nitrate comes from natural decay and is also added as a fertilizer to arable land.

Ammonia is excreted by animals and produced during decomposition of plants and animals.

High concentrations of nitrate and ammonia in rivers can cause serious damage to aquatic ecosystems.

Both concentrations are commonly measured in ppm (mg/l) or ppb ( $\mu\text{g/l}$ )

Nitrogen is an essential nutrient for life. It can be found in various forms in nature as part of the Nitrogen Cycle.



# Eutrophication

An excess of phosphorus or nitrogen in a river can cause a reduction in dissolved oxygen in water bodies due to an increase of mineral and organic nutrients.

This can result in algal blooms. When the algae dies bacteria breaks it down, a process which consumes oxygen and results in 'dead zones' – low oxygen areas where fish can't survive.

If ingested algae can cause flu-like symptoms and death in animals



Toxic algal bloom in Lake Erie 2011)



Dead fish in algal bloom

# Temperature (°C)

- Water temperature controls the rate of many chemical, physical and biological processes in a river
- Water temperature determines whether a river habitat is suitable for different aquatic species to survive
- Warm water can hold less dissolved oxygen than cold water

Every morning I feel like a mad scientist



Getting the perfect balance of hot and cold water

Arun

[iamwalrus.blogspot.com](http://iamwalrus.blogspot.com)

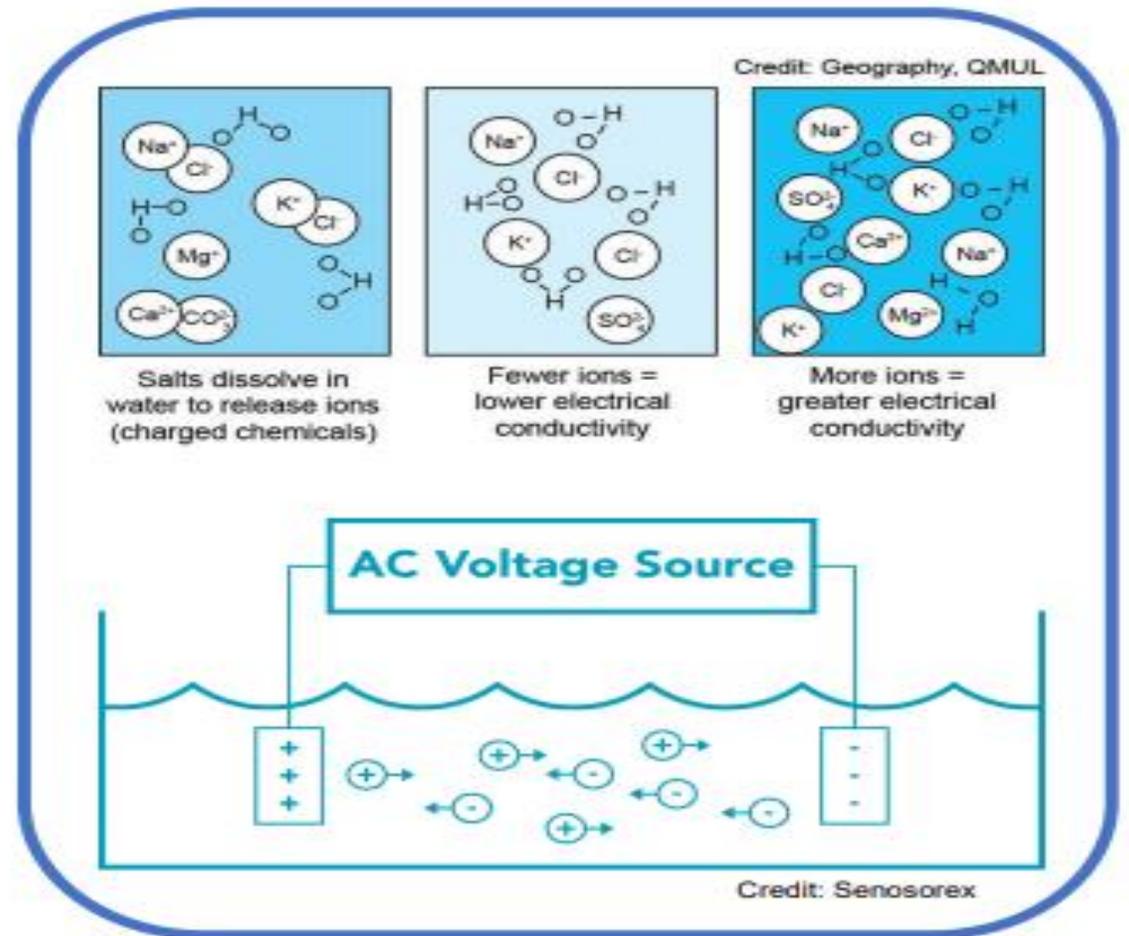


## Electrical Conductivity (EC) and Total Dissolved Solids (TDS)

Water containing dissolved salts (ions) conducts electricity. This is measured in  $\mu\text{S}/\text{cm}$  and indicates the total amount of total dissolved solids (TDS) in water.

EC in water typically varies between  $<100 \mu\text{S}/\text{cm}$  to  $>1000 \mu\text{S}/\text{cm}$  in rivers, and is affected by temperature and discharge rates

If EC readings vary from normal baseline conditions (i.e. high  $\mu\text{S}/\text{cm}$ ) it may indicate a contamination event has occurred



# Turbidity

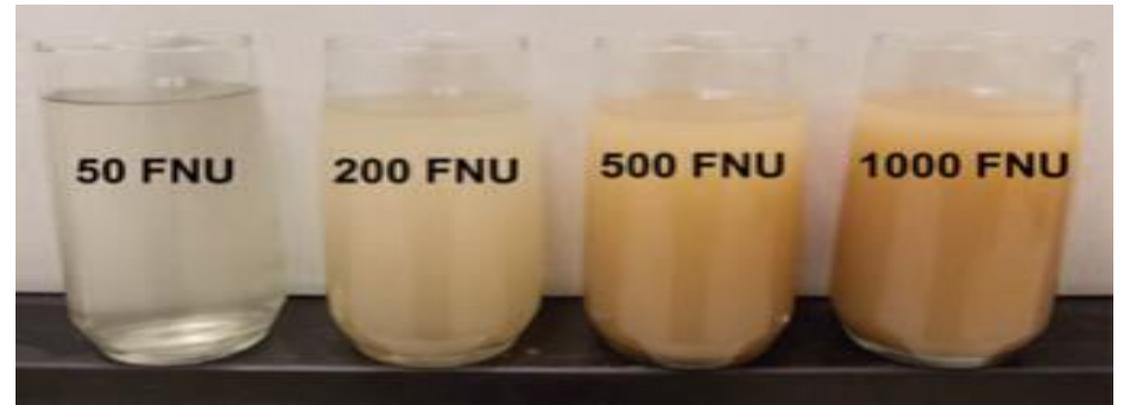
Turbidity is a measure of how many particles or suspended solids (SS) are dissolved or suspended in water- how murky or clear water is.

Turbidity can come from natural processes like increased erosion due to rainfall, or churning up of sediment at high flow

Or be human-induced such as chemical pollution and eutrophication, storm water and agricultural runoff from soil erosion

High turbidity can reduce light in a river and growth of water plants (macrophytes) and affect chemical, biological and physical properties of a stream

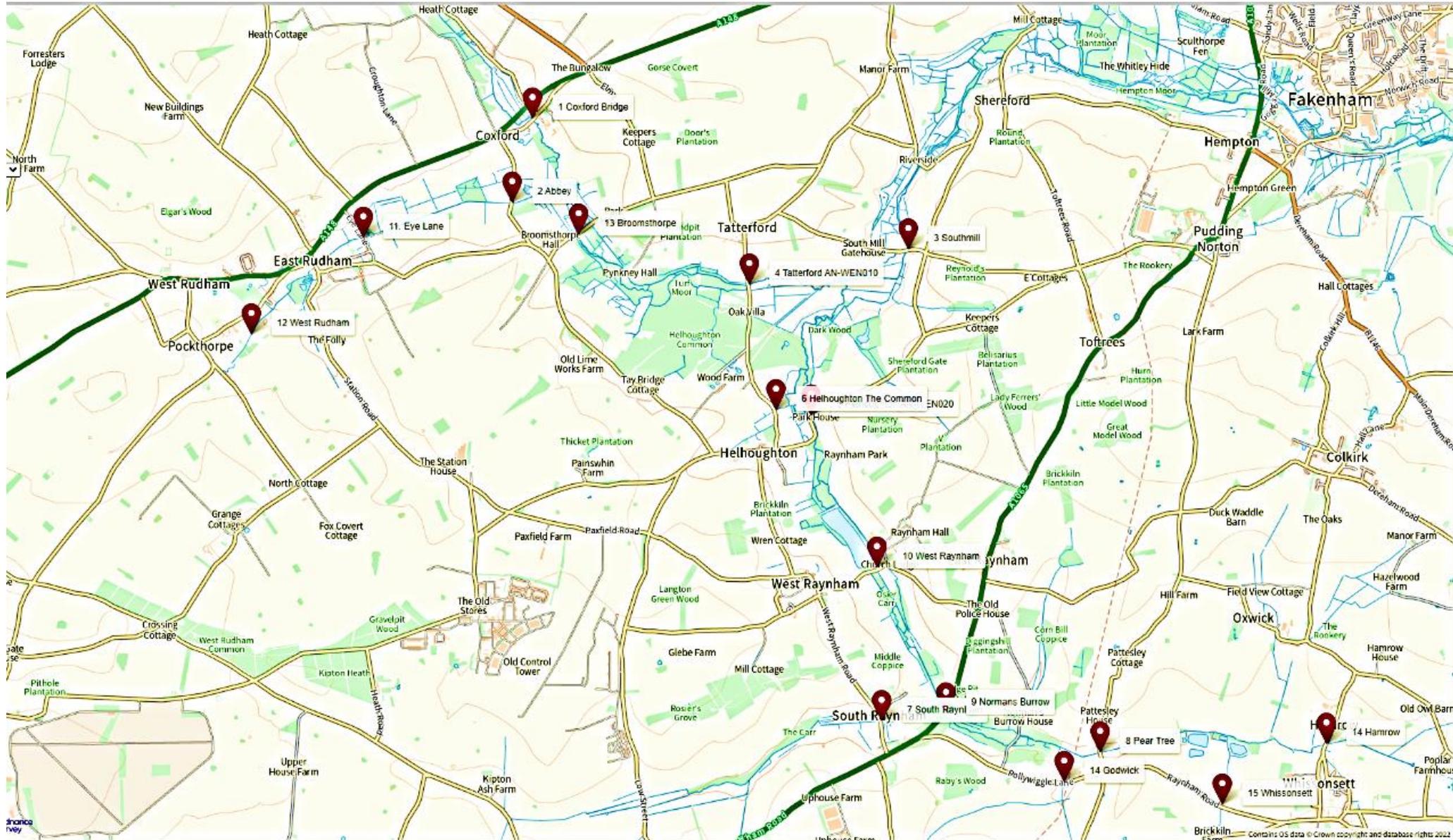
Turbidity is measured in Nephelometric Turbidity Units (NTU) using a Secchi Tube



Getting out in the field



# Monitoring Point Locations



/// campus.copy.reunion

Share    Navigate    Save

Fakenham Rd    Great Ryburg    Bridge Rd

Google    Keyboard shortcuts    Map data ©2022    Terms of Use    Report a map error

The map interface includes a search bar at the top with the URL '/// campus.copy.reunion'. Below it are three buttons: 'Share', 'Navigate', and 'Save'. The map itself shows a location in Great Ryburg, with a red pin and a blue square icon. The map is surrounded by various navigation controls, including zoom in (+) and zoom out (-) buttons, a compass, a street view icon, and a globe icon. At the bottom, there are links for 'Keyboard shortcuts', 'Map data ©2022', 'Terms of Use', and 'Report a map error'.

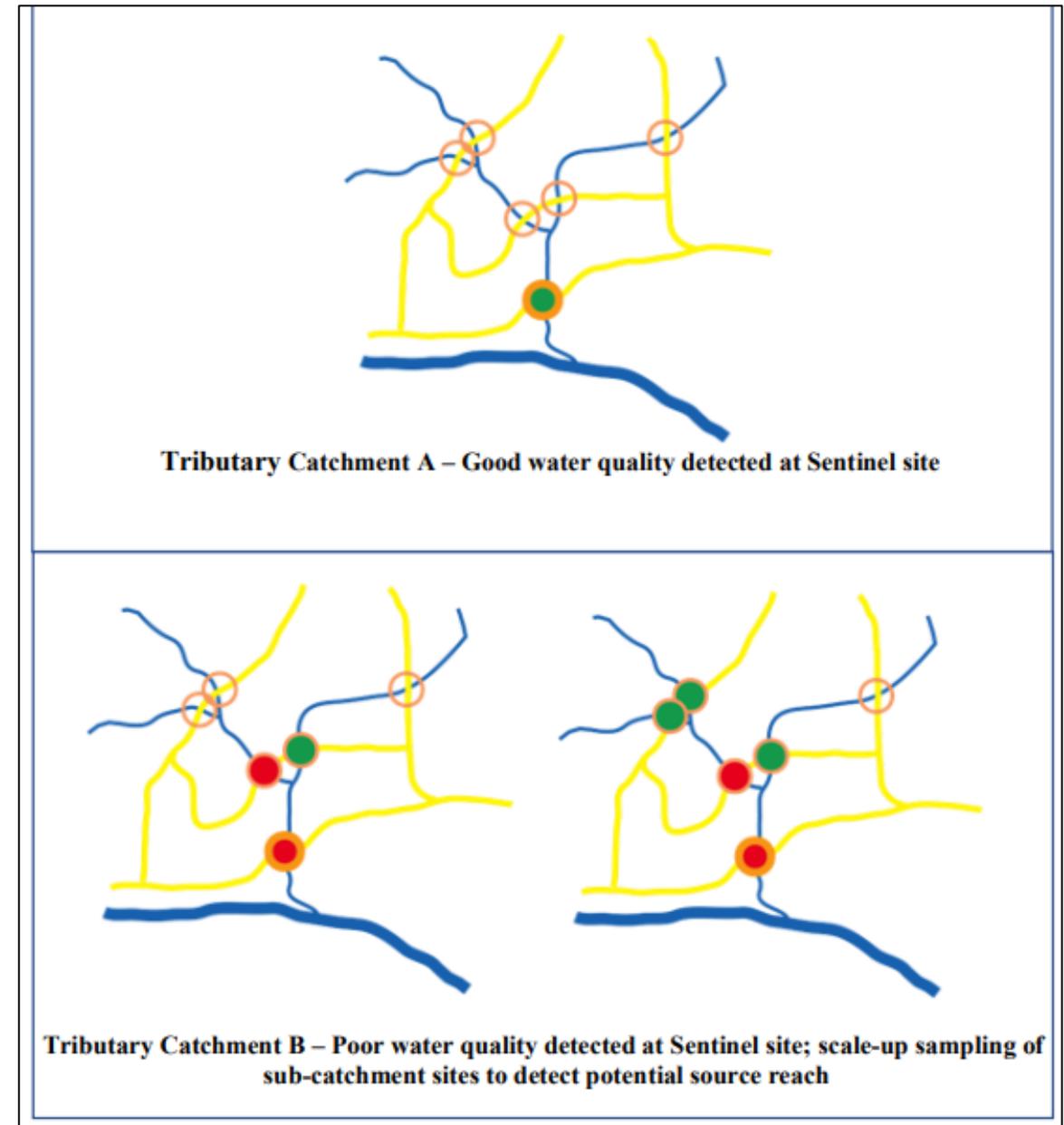


# Water Quality Detectives!

After a month or so of Sentinel and selected point monitoring we may be in a position to explore upstream to find source of pollution from different tributaries – Water Blitz!

## Biosecurity

Remember if you are monitoring more than one point on the same tributary always work downstream to avoid biological contamination.



# What to take to the field

Kit	Use
Sampling bucket and cord	To collect sample
Waterproof gloves	Keep contamination low and safety
Waste bottles and plastic bag	To store waste reagents and rubbish
Phone to record on Survey 123	To record data and take photos
Notebook and pen	In case phone fails and for observations
Syringe	For transferring water into test bottles
Hanna Phosphate Checker	Orthophosphate ( $\text{PO}_4^{-3}$ ) & Orthophosphate as P ( $\text{PO}_4\text{-P}$ )
Hanna Ammonia Checker	Ammonia-N ( $\text{NH}_3\text{-N}$ )
Hach nitrate nitrite strips	Nitrate ( $\text{NO}_3$ )
AZ Instruments 8403 Dissolved Oxygen Meter	Dissolved Oxygen (mg/l and % saturation) + water temperature ( $^{\circ}\text{C}$ )
Graduated Secchi tube	Turbidity
pH Pen Tester	pH
TDS & EC Pen Tester	Total Dissolved Solids & Conductivity (EC)
Manual	Health and safety guidance and reminders on kit use
PPE and Supplies and scissors	HiVis vest to stand out, suncream, water to drink, medication



Remember to let someone know where you will be doing your testing.

Make sure they have emergency contact details (in manual)

# Recording Data and other observations in the field

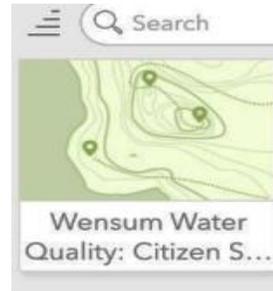


# Using Survey 123

Download the Survey  
1-2-3 App



Click on the Wensum  
Water Quality Citizen  
Science icon



Complete Survey  
form in the App



Submit Data



Date:            Time:            Surveyor name:            Sampling site: 1-17

<b>Has there been any rain in the area over the last 24 hours?</b>	<b>Yes          No</b>
<b>What is the flow of the river currently like?</b>	Dry   Still   Slow   Moderate   Fast
<b>Is the river bed visible?</b>	Yes    No(vegetation)    No (too turbid)
<b>What is the river water temperature (in degrees C)?</b>	
<b>What is your dissolved oxygen reading (in % saturation) (in mg/l)</b>	
<b>What is your phosphate reading (in mg/l)?*</b>	
<b>What is your nitrate reading (in mg/l)?*</b>	
<b>What is your ammonia reading in mg/l?*</b>	
<b>What is your pH reading?*</b>	
<b>What is your TDS reading in mg/l?*</b>	
<b>What is your conductivity (EC) reading in uS?*</b>	
<b>What is your turbidity reading in NTU?</b>	
<b>Have you seen anything unusual or important while visiting this site?</b>	
<b>Urgent pollution incident- steps taken</b>	
Please upload a picture of the river channel as you see it looking upstream*	



## Citizen Scientist Agreement



Follow Health and Safety Advice and Ask for help or support if needed!



Do little harm : Dispose of waste reagents safely  
Avoid disturbance of the river bed and banks  
Don't trespass on private land



Only monitor on agreed locations, once a week if possible.  
Please test for all parameters- ask if you aren't sure



Record and upload data on the Survey 123 App.  
Data may be sensitive- please respect confidentiality.  
Please do not upload or share data outside the App- i.e. on social media or public sites



Be a river guardian and WCP Ambassador. Champion positive actions to improve river health!  
Please don't accuse individuals of polluting- follow the guidance if you suspect pollution.  
Collaborate with WCP partners to identify issues and agree solutions.

# Health Safety and Risk Assessments



- Public liability insurance: As a NRT volunteer you are insured to carry out monitoring on the agreed sites only.
- Slips, trips and falls: Wear footwear with a good grip. Only survey in daylight and dry conditions. Look before you step and take your time.
- Bridge Safety: Keep both feet on the ground, do not lean over too far
- Road and personal safety: Wear your HiVis vest at all times. Park off the road to avoid obstructing traffic and turn off your vehicle. Carry out analysis at a place where you can see the road in both directions.
- Chemical poisoning: Rinse hands after using reagents
- Stings and sharp thorns: Inform team of any allergies or if you use an epipen. Check for bee and wasps nests before taking sample, check for plants with sharp thorns before entering location

# Health Safety and Risk Assessments



- Waterborne diseases: Leptospirosis (Weils Disease). Rodent urine, cattle and pigs can carry Weils disease which can cause flu-like symptoms. Always wear gloves, cover cuts with waterproof dressing. and avoid contact with skin, eyes and your mouth.
- Harmful Algal Blooms: Not all blue-green algae is toxic but some can cause illness. Always wear gloves and avoid contact with skin, eyes and your mouth. If paint-like, postpone surveying.
- Drowning, cold water shock: Never enter the river or ditch. Stay away from the bank in case it crumbles.
- Loosing your bucket- Don't enter water to retrieve it- use a stick!
- Water course obscured by vegetation: Don't try and clear it. Let the team know if you can't easy collect a sample.
- Always wash your hands or use disinfectant spray after surveying, and before eating or smoking.

# What to do if you suspect a pollution incident

Water pollution can be caused by blocked drains. If you see any of the following in or near a stream, waterway or river please let us know



Wet wipes & toilet paper



Human waste, sewage and smells



Foam or milky looking fluids



Sanitary products



Fatty oil greasy film on the surface of the water



Dead or gasping fish

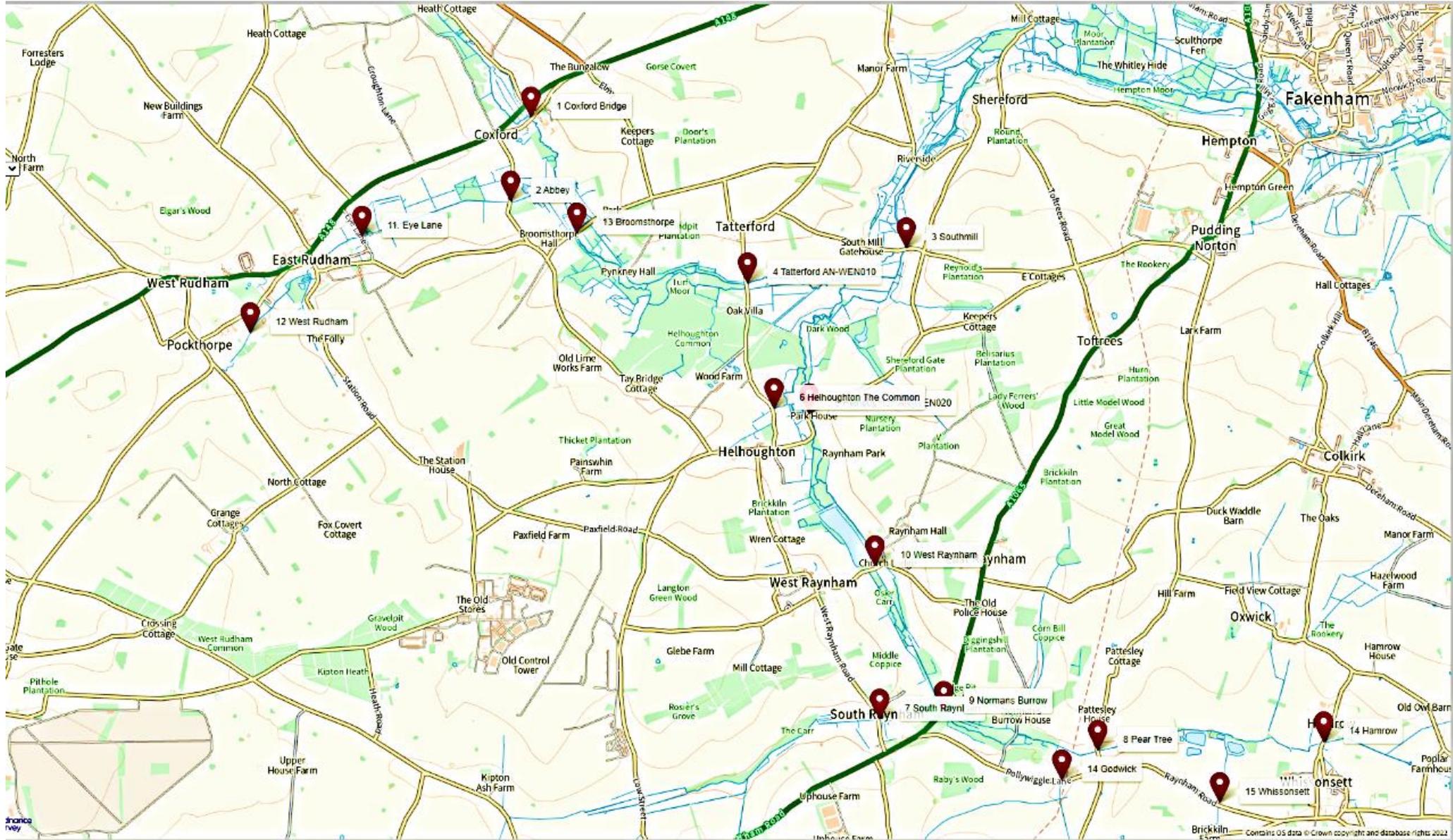
Call EA Hotline 0800 80 70 60  
Call Anglian Water 03457 145 145  
Details are in your Manual

# Q&A Session

FAQs :

- ❖ What other kit do I need to find myself and bring out to the field?
- ❖ What if the kit breaks/ I don't think its working properly ?
- ❖ What if I forget how to use the kit?
- ❖ What if I run out of supplies or loose kit?
- ❖ How do I look after the kit/ does it require maintenance?
- ❖ What do I do if someone asks me what I'm doing?
- ❖ Any other questions?

# Where do you want to monitor?



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“Never doubt that a small group of thoughtful, committed **citizens can change the world**; indeed, it’s the only thing that ever has.”

Margaret Mead

