WESTCOUNTRY RIVERS TRUST CITIZEN SCIENCE

MONITORING OF THE PAR RIVER AND ITS TRIBUTARIES

APRIL 2022

Riverfly monitoring near Lady Rashleigh Mine **Photo: Dave Burrell**

CONTENTS & PAGES

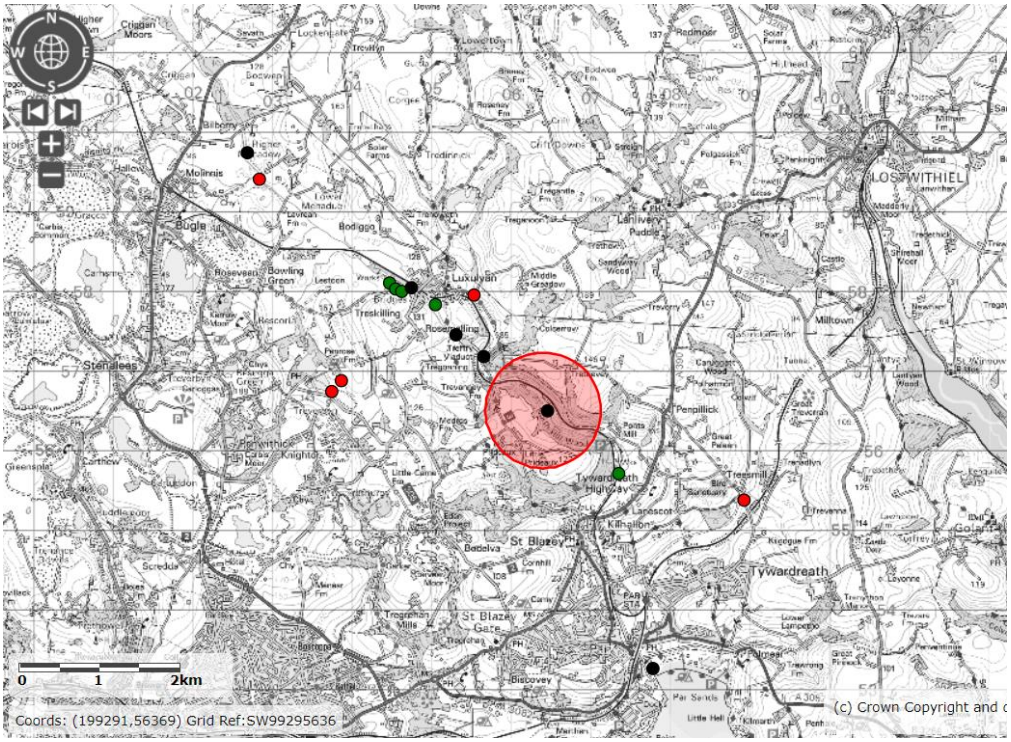
A. KEY POINTS FROM WRT CSI MONITORING IN APRIL 2022

1. Levels of E.coli and phosphates downstream from Luxulyan Sewage Treatment Works are very worrying. It appears likely that the treatment works is responsible.
2. The riverfly trigger target was exceeded for the second time.
3. Otter spraint provides evidence not only for otters but also fish.
4. One of the thermometers has been giving inaccurate readings for Treesmill and Par Beach so has been replaced. Readings for Total Coliforms have been reviewed.
5. Comments about a sewage leak at the SWW pumping station in Luxulyan in 2021 are in circulation. Our group has not reported this but did note that it had been the location of such pollution years ago. It may be that someone has misunderstood what we said.

A. OUR GROUP

Monitoring is part of the Citizen Science programme run by the West Country Rivers Trust (WCRT) and is carried out monthly by volunteers from the Friends of Luxulyan Valley. The team comprises: Dave Burrell; Mandy Case; Joan Farmer; Veronica Jones; Sue Perry; Linda and Roger Smith; Dave Stillings. They have received training from Lydia Deacon, Junior Evidence and Engagement Officer of the West Country Rivers Trust (https://wrt.org.uk/project/become-a-citizen-scientist/). Results are logged on the Cartographer website. The support and advice given by Ross Tonkin, Claire and Gary Phillips, David Edwards, Nick Taylor, Jeremy Roberts, Mat Bateman, Matt Healey, Simon Browning and Lydia Deacon is greatly appreciated. The interest and encouragement offered by Environment Agency officers, especially Lisa Best and Lisa Goodall, has been invaluable.

B. APRIL 2022 MONITORING POINTS



This month we monitored at 11 locations. Monitoring points along the main Par River are shown in **black**. Those in **red** are on tributaries. Those in green where show where there were visual checks. The red circle highlights Lady Rashleigh Mine, where riverfly and bacteria monitoring also took place.

Source: https://magic.defra.gov.uk/MagicMap.aspx

LOCATION	TYPE OF CHECK	MONITORED BY
Criggan Moors, Par River, SX 01882 61133	Visual. Not on Cartographer.	Roger Smith
South of Minorca Lane, Par River, SX 02657 59788	CSI sampling	Roger Smith
Carbis Stream SX 02834 59401	CSI sampling	Roger Smith
Treverbyn Stream, East of Innis Fishery (Point B) SX 03770 56781*	CSI sampling	Roger Smith
Treverbyn Stream, East of Innis Fishery (Point C) SX 03857 56884*	CSI sampling	Roger Smith
Luxulyan sewage treatment works, Par River, (SX 0455 58114 before Nov 2021)	Visual check Bacteria sampling upstream and downstream of STW.	Joan Farmer, Roger Smith
Treverbyn Stream, SX 04532 58033	Visual check	Joan Farmer, Roger Smith
Rosemullion, Tregarrick Stream, SX 04623 57990	Visual check	Joan Farmer, Roger Smith
Luxulyan allotments, Par River, SX 04732 58045	CSI sampling	Joan Farmer, Roger Smith
Luxulyan SWW pumping station, Par River, SX 05033 57849	Visual check	Joan Farmer, Roger Smith
Cam Bridges, Par River, SX 05292 57454	CSI sampling	Joan Farmer, Roger Smith
Gatty's Bridge, Bokiddick Stream SX 05531 57953	CSI sampling	Joan Farmer
Treffry Viaduct, Par River, SX 05650 57179	CSI sampling	Joan Farmer, Roger Smith
Lady Rashleigh Mine, Par River, SX 06451 56509	CSI sampling, Riverfly, E.coli, Total Coliform	Joan Farmer, Roger Smith, Veronica Jones, Sue Perry, Dave Burrell, Mat Bateman
Ponts Mill, Par River, SX 07354 55875	Visual check	Joan Farmer, Roger Smith, Mat Bateman
Treesmill, Tywardreath Stream, SX 08873 55385	CSI sampling	Veronica Jones
Par Beach slipway, SX 0776 53261	CSI sampling	Veronica Jones

*By special request. No untoward results at either location so no further comment is made in this report but the results are on Cartographer.

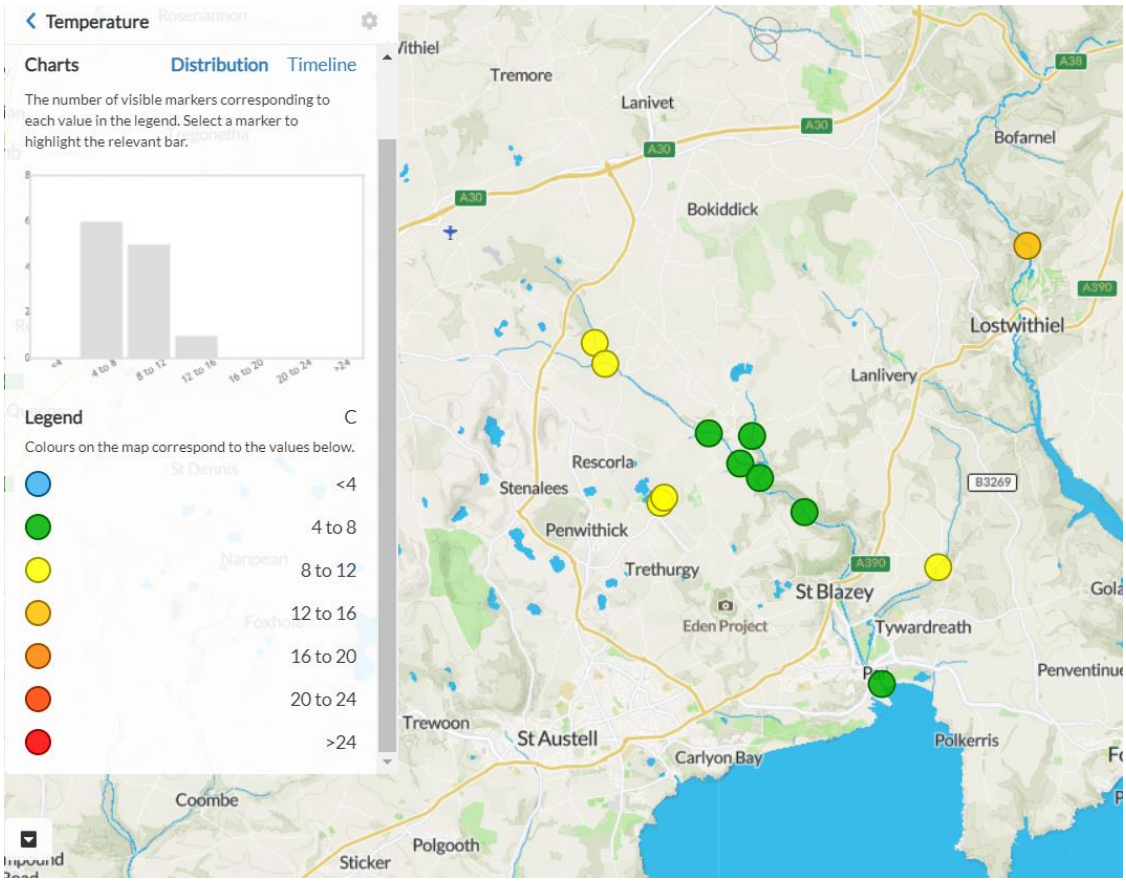
Surveys conducted on these dates, each of which is colour-coded:
7th April 2022 (CSI) **&** 16th April 2022 (riverfly & bacteria)
10th April 2022
11h April 2022

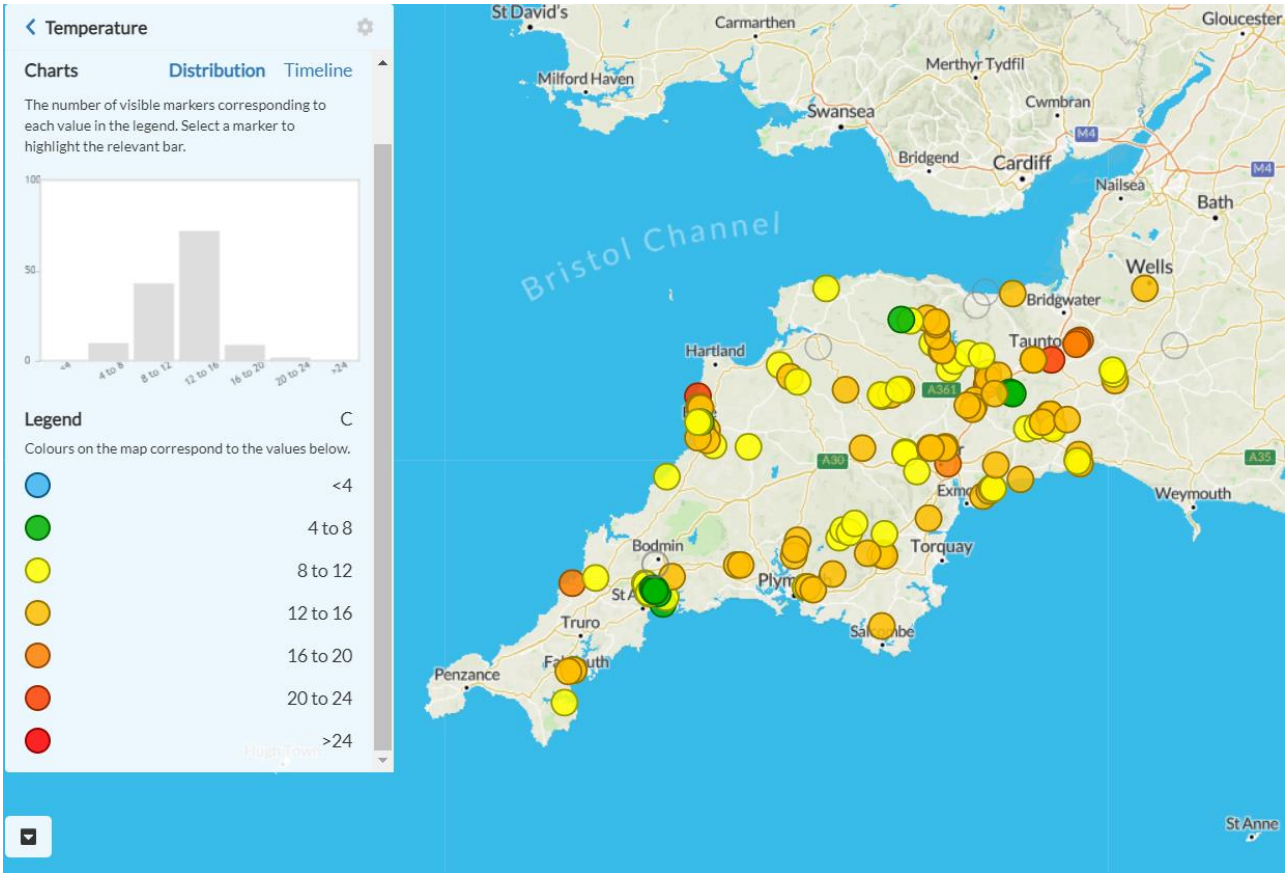
C. TEMPERATURE

1. This is the WRT's explanation of why this is monitored:

Temperature is a vital parameter within the river ecosystem. It controls many of the aquatic species life cycles. Temperature fluctuates with the seasons; however, you do get variation within that, particularly in small rivers and streams. Another important reason to measure temperature is to track the impact of our warming climate on our waterbodies.

2. **Geographical comparison.** Source: Cartographer.





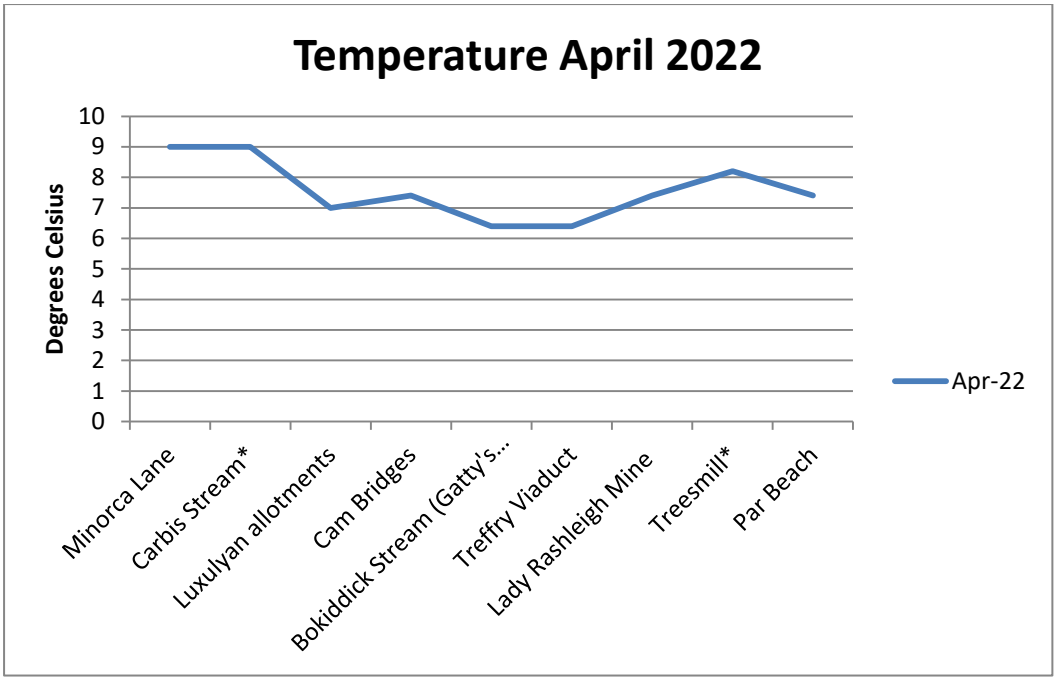
PAR RIVER/TRIBUTARY	LOCATION	Temperature ˚Celsius
Par	South of Minorca Lane, Par River, SX 02657 59788	9
Tributary	Carbis Stream SX 02834 59401	9
Par	Luxulyan allotments, Par River, SX 04732 58045	7
Par	Cam Bridges, Par River, SX 05292 57454	7.4
Tributary	Gatty's Bridge, Bokiddick Stream SX 05531 57953	6.4
Par	Treffry Viaduct, Par River, SX 05650 57179	6.4
Par	Lady Rashleigh Mine, Par River, SX 06451 56509	7.4
Tributary	Treesmill, Tywardreath Stream, SX 08873 55385	8.2
Par	Par Beach slipway, SX 0776 53261	7.4

CSI Surveys conducted on these dates, each of which is colour-coded:

7th April 2022

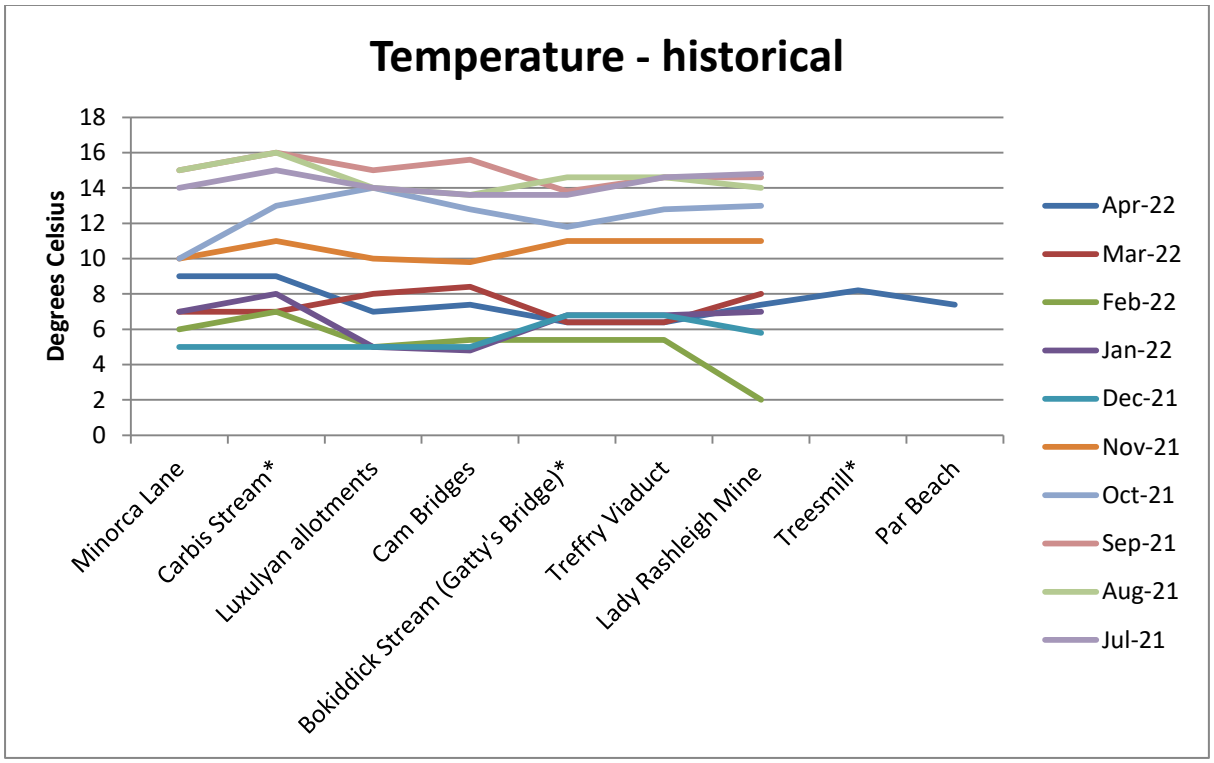
10th April 2022

11h April 2022



*indicates a tributary of the Par River.

3. **Historical data** on temperature:



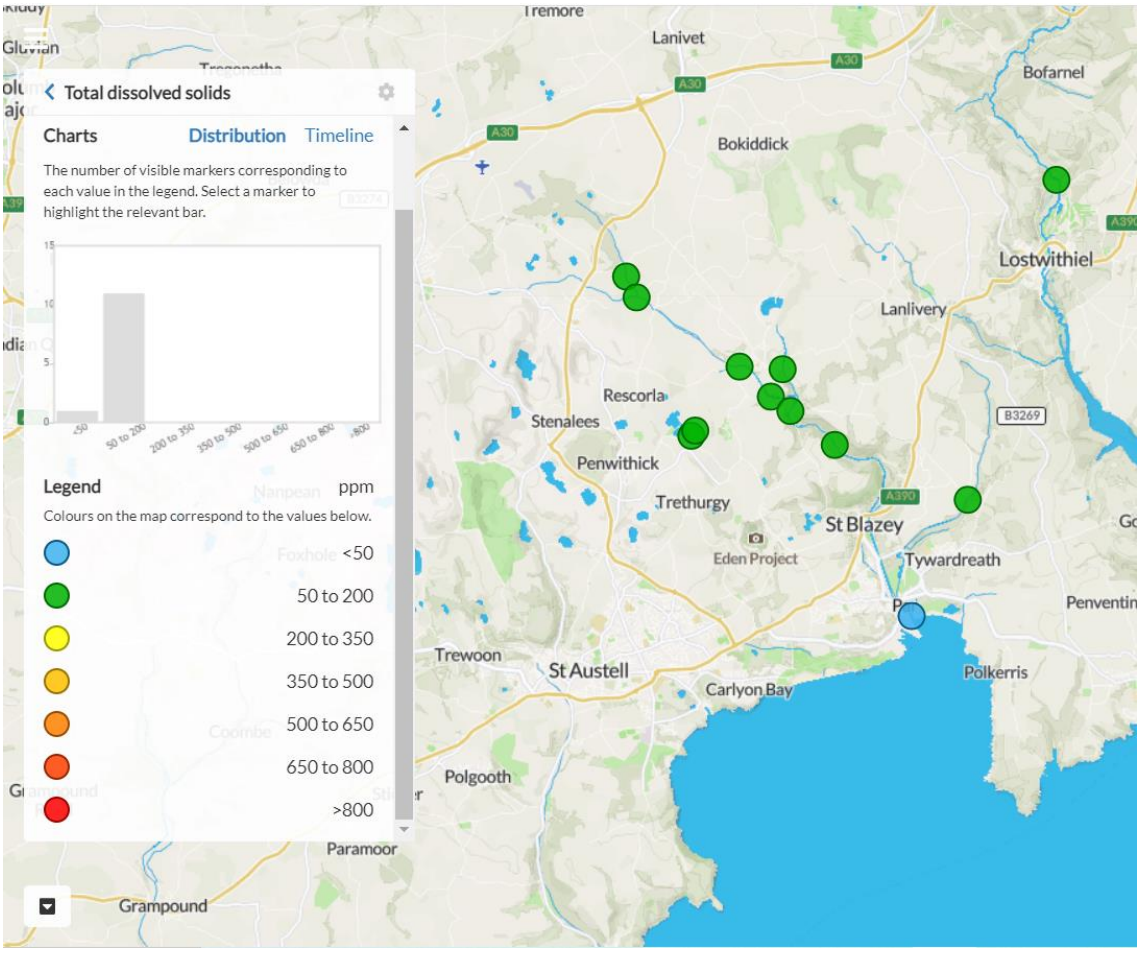
The thermometer used at Treesmill and Par Beach was giving inaccurate readings. These have been deleted and the new reading is in line with other readings.

D. TOTAL DISSOLVED SOLIDS

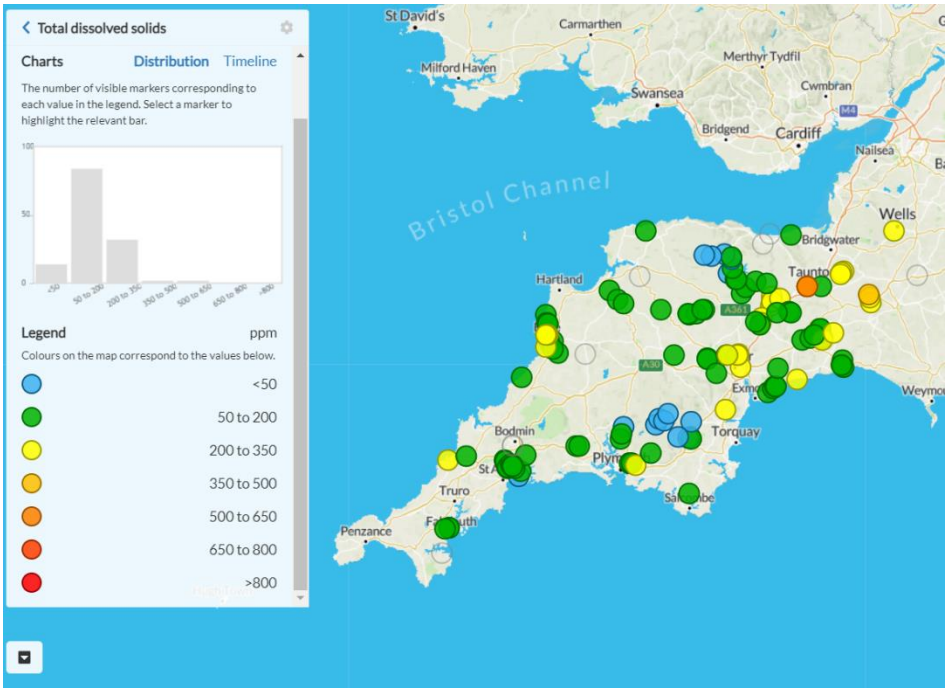
1. We measure these in ppm (parts per million). This is the WRT's explanation:

Total Dissolved Solids (TDS) is directly related to the conductivity of the water. The more minerals, salts and metals that are dissolved in the water the more conductive it gets. Low levels of dissolved solids in waters such as those on Dartmoor near to the source of the river are a result of very low levels of input from the surrounding landscape. As the river runs down to the sea it collects material from many different inputs, some natural and some man-made such as farms, sewage plants, factories and residential areas. This typically increases the amount of solids dissolved in the water leading to a higher reading. Harmful pollution from things like sewage, slurry and factory discharge will usually elevate your TDS reading. However, some pollutants such as oil can lower conductivity; therefore it should be used as a general indicator of water quality not a specific measure of toxicity. Geology will influence the normal level of conductivity in a watercourse (e.g. Areas dominated by granite generally give a lower conductivity than those with limestone). Regular monitoring will allow the detection of changes in conductivity which can indicate pollution.

2. **Geographical comparison.** Source: Cartographer.



The reading of zero ppm at Par Beach is a surprise but is not the only such result in the region as this map shows:



PAR RIVER/TRIBUTARY	LOCATION	Total Dissolved Solids ppm
Par	South of Minorca Lane, Par River, SX 02657 59788	64
Tributary	Carbis Stream SX 02834 59401	197
Par	Luxulyan allotments, Par River, SX 04732 58045	150
Par	Cam Bridges, Par River, SX 05292 57454	148
Tributary	Gatty's Bridge, Bokiddick Stream SX 05531 57953	74
Par	Treffry Viaduct, Par River, SX 05650 57179	137
Par	Lady Rashleigh Mine, Par River, SX 06451 56509	106
Tributary	Treesmill, Tywardreath Stream, SX 08873 55385	144
Par	Par Beach slipway, SX 0776 53261	0

CSI Surveys conducted on these dates, each of which is colour-coded:

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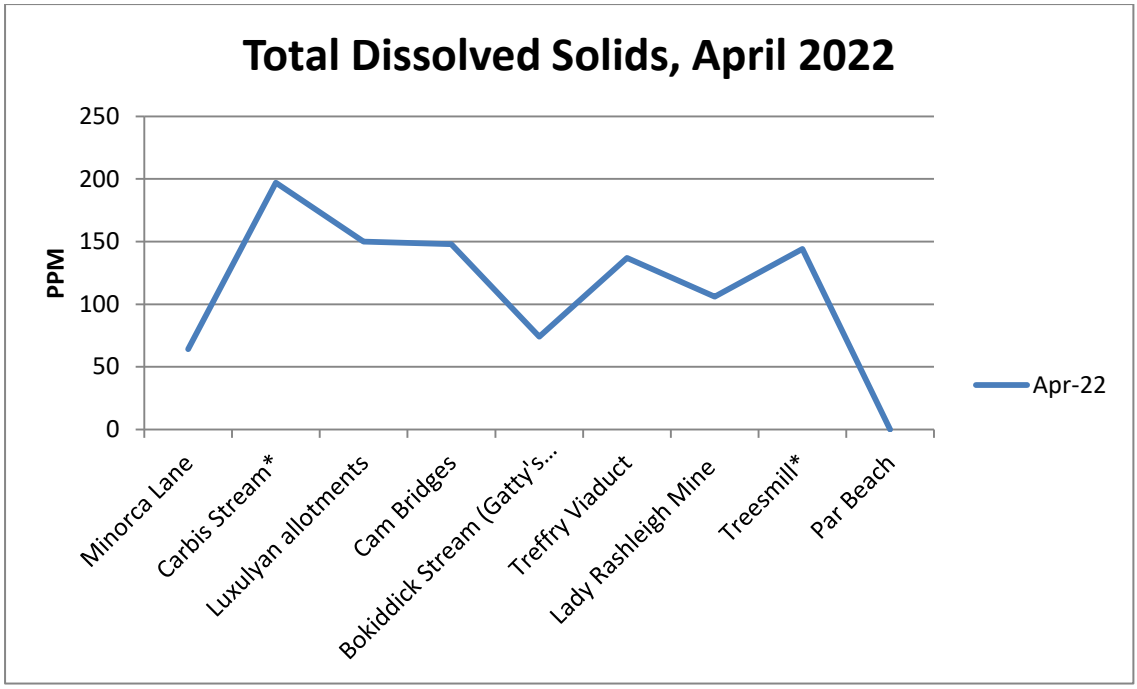
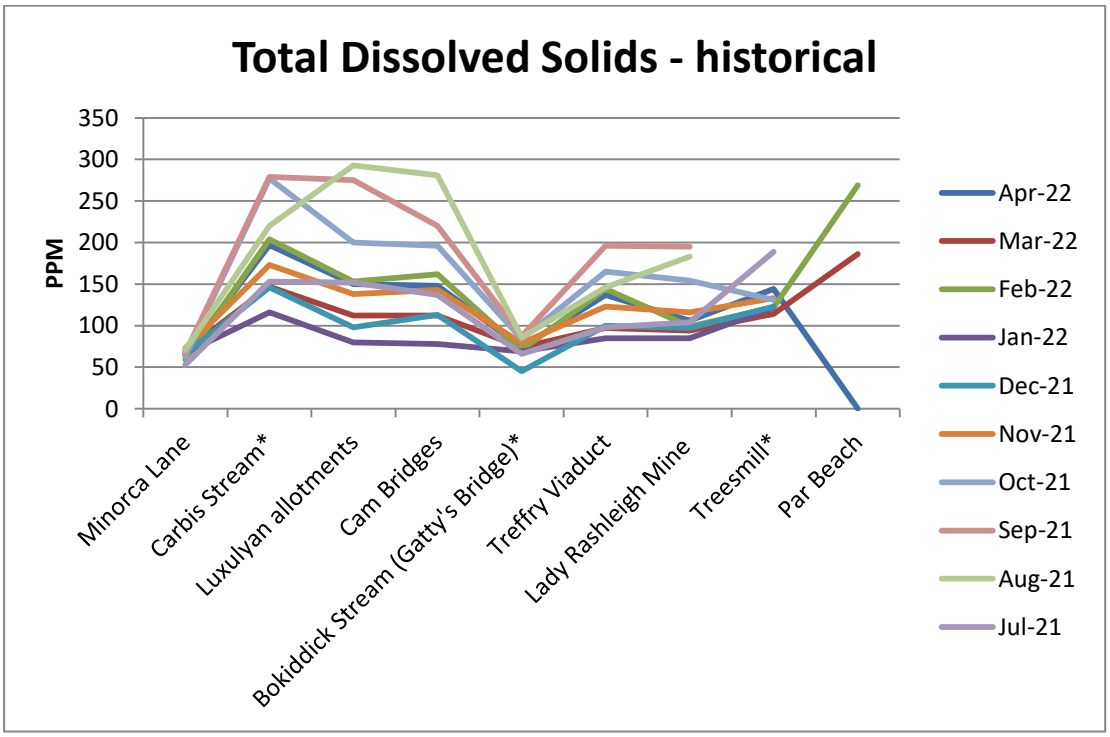
11h April 2022

N.B. The reading for Par Beach is surprising.



3. **Historical data** on total dissolved solids:

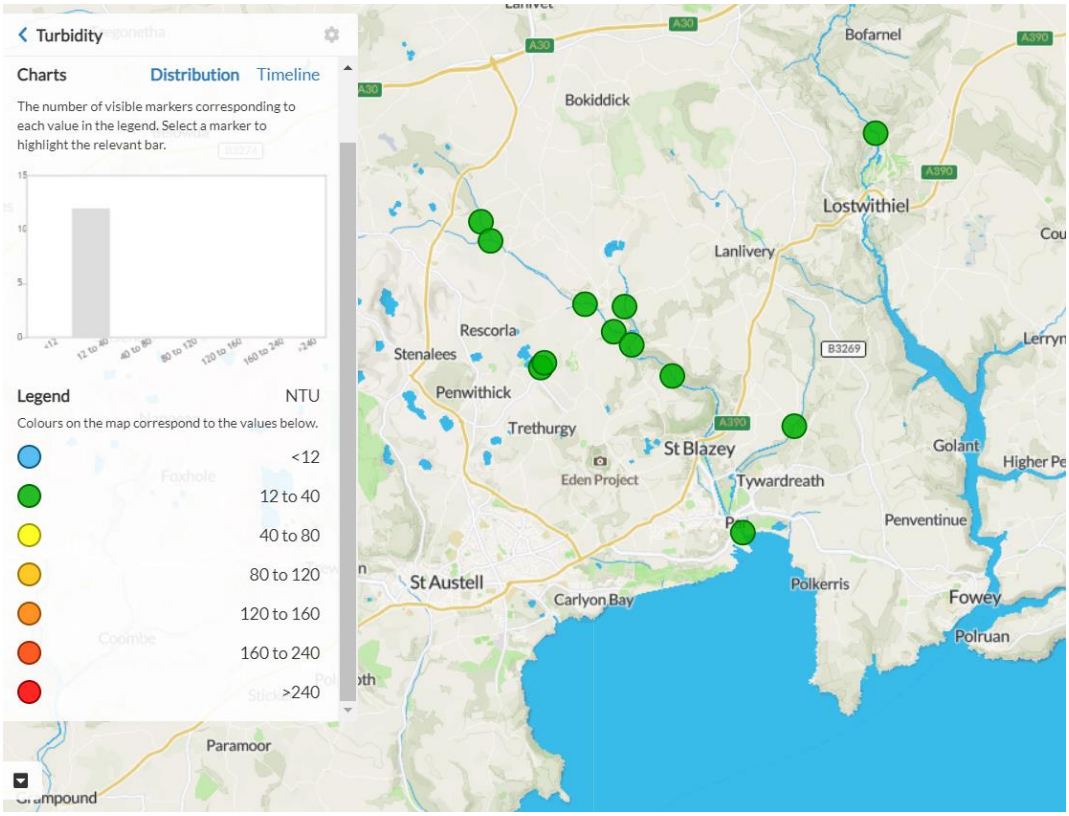


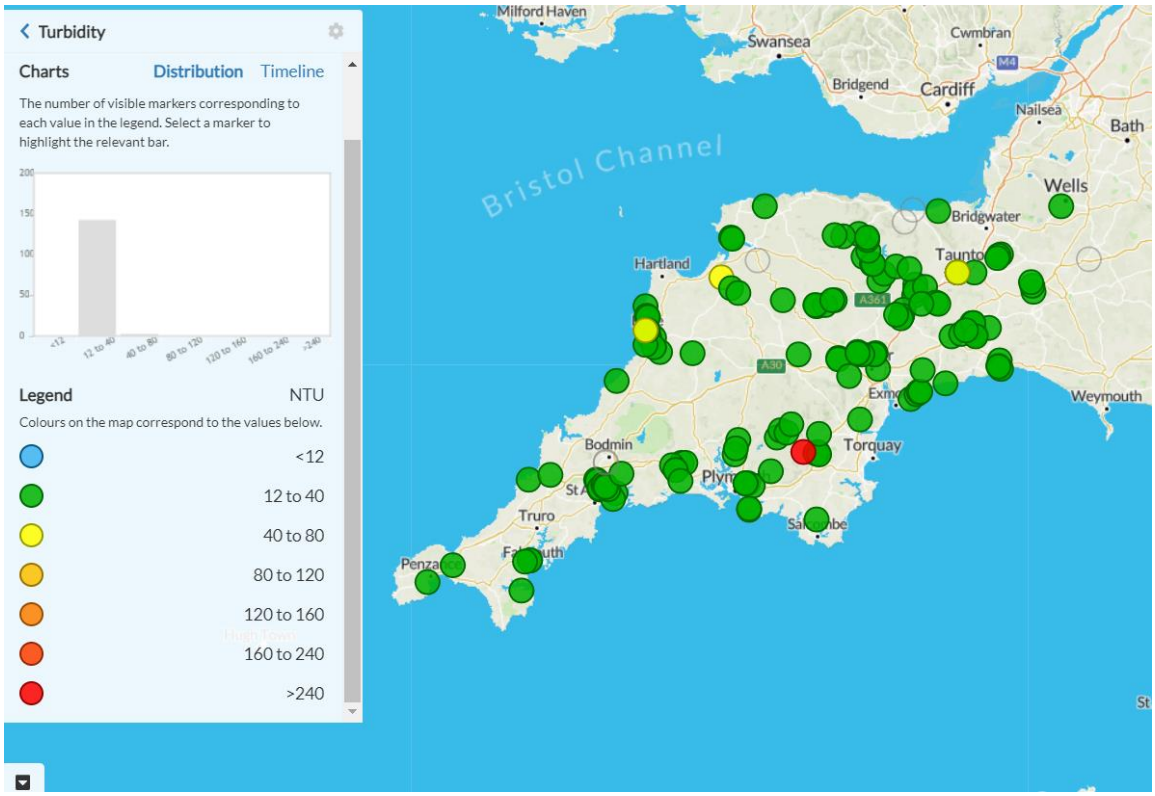
E. TURBIDITY

1. This is the WRT explanation of this measure:

Turbidity tube is a measure of the optical clarity of the water. The more suspended particles in the water the lower the clarity and the higher the turbidity. You will often find your waterbody gets more turbid after heavy rainfall due to soil running off the fields and sediment being mixed into the water column. This loss of topsoil is both a problem for farmer and river. It can often contain chemicals from the fertiliser and pesticides used on the land. An increase in sediment level on the substrate of the river can cause smothering of habitat by removing light and oxygen. Aquatic wildlife such as the less mobile invertebrates and fish eggs struggle to survive in low oxygen conditions and without light, plants are unable to grow. It is a good idea to sample your river after different weather conditions to understand how it responds to rainfall or drought.

2. **Geographical comparison.** Where scores are shown as 0, it means that the reading using the Secchi tube was <12. Source: Cartographer.





3 April data

PAR RIVER/TRIBUTARY	LOCATION	Turbidity
Par	South of Minorca Lane, Par River, SX 02657 59788	0
Tributary	Carbis Stream SX 02834 59401	22
Par	Luxulyan allotments, Par River, SX 04732 58045	0
Par	Cam Bridges, Par River, SX 05292 57454	0
Tributary	Gatty's Bridge, Bokiddick Stream SX 05531 57953	0
Par	Treffry Viaduct, Par River, SX 05650 57179	0
Par	Lady Rashleigh Mine, Par River, SX 06451 56509	18
Tributary	Treesmill, Tywardreath Stream, SX 08873 55385	0
Par	Par Beach slipway, SX 0776 53261	0

CSI Surveys conducted on these dates, each of which is colour-coded:

7th April 2022

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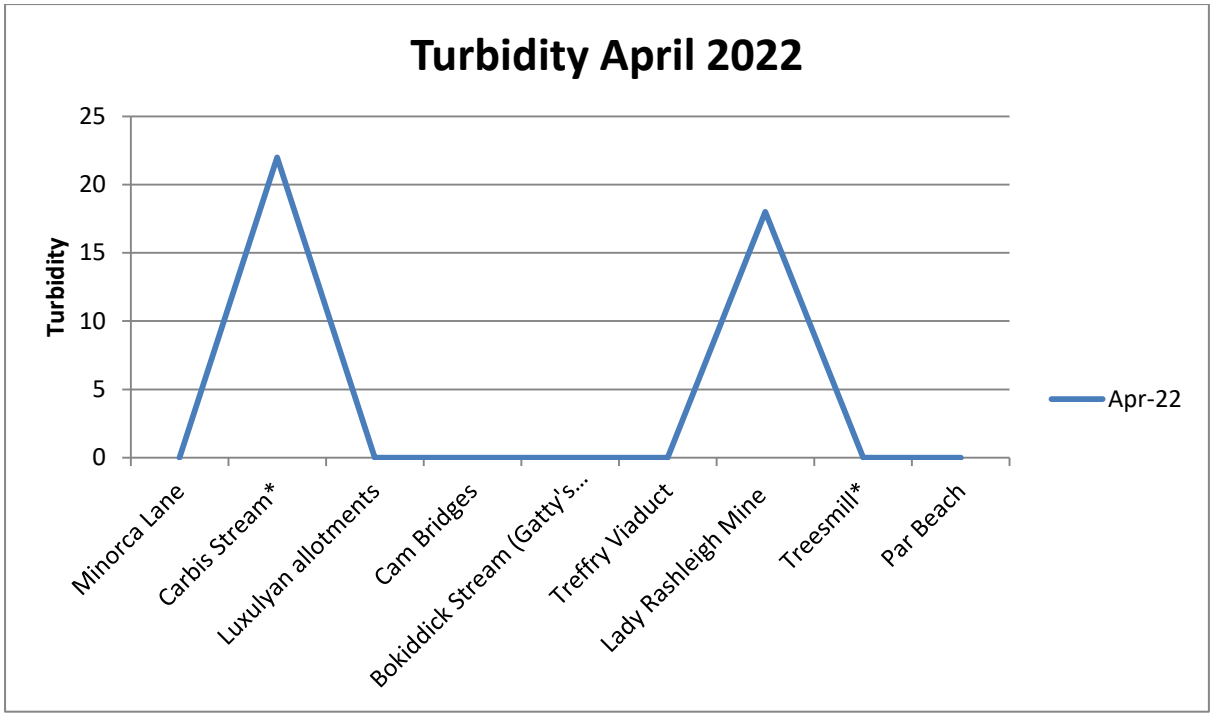
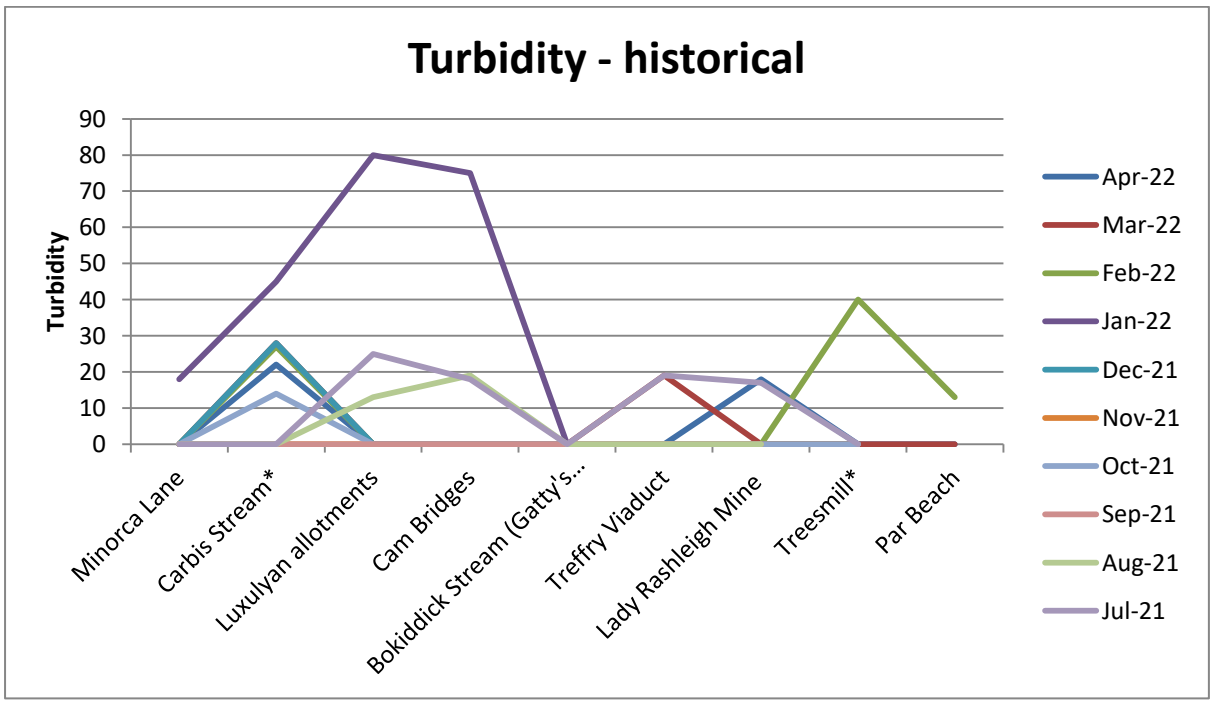
11h April 2022



4. Historical data on turbidity:



F. PHOSPHATES

1. This is the WRT's explanation of this measure.

Phosphate occurs naturally within the river ecosystem, but in very low levels under 0.05 mg/l. Therefore, higher levels may indicate anthropogenic input. Phosphate is found in animal and human waste, cleaning chemicals, industrial runoff and fertiliser so this can be a good indicator of pollution. Having raised levels of phosphate can lead to increases in plant growth within the watercourse. This leads to a depletion of oxygen due to the plant's aerobic respiration during the night. Without oxygen aquatic species cannot survive and the river ecosystem collapses. (It is important to note that phosphate is taken up by plants. You may get a low reading but high plant growth, indicating eutrophication.)

Ranges on phosphate diagnostic colour chart:

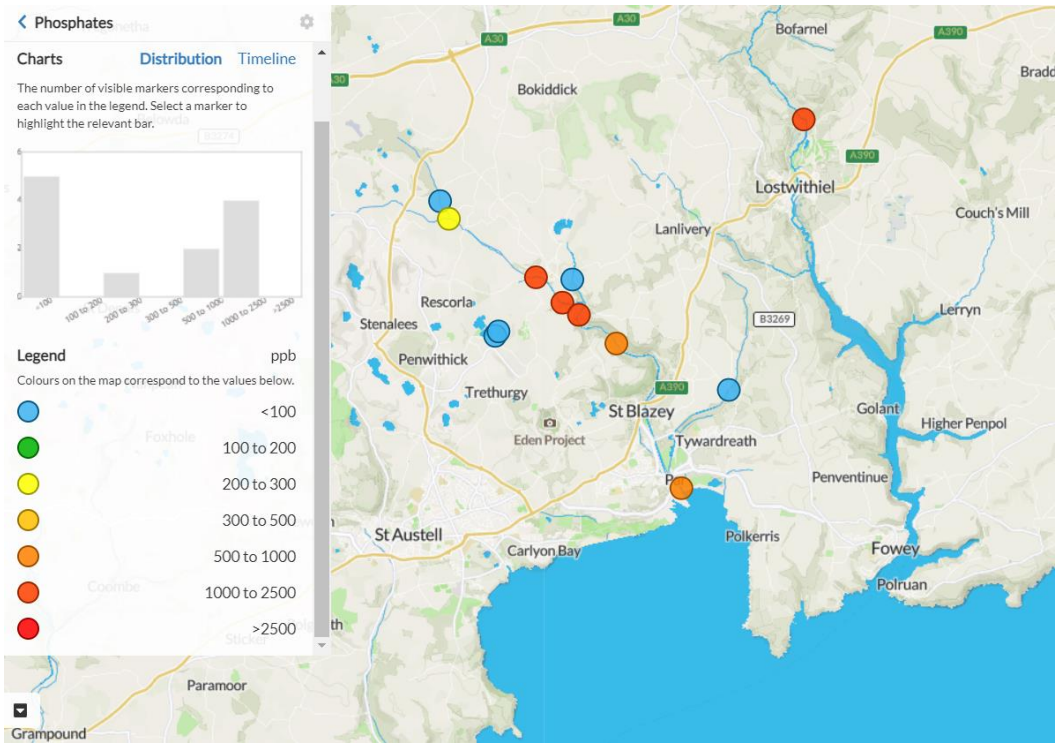
0 – 100 OK

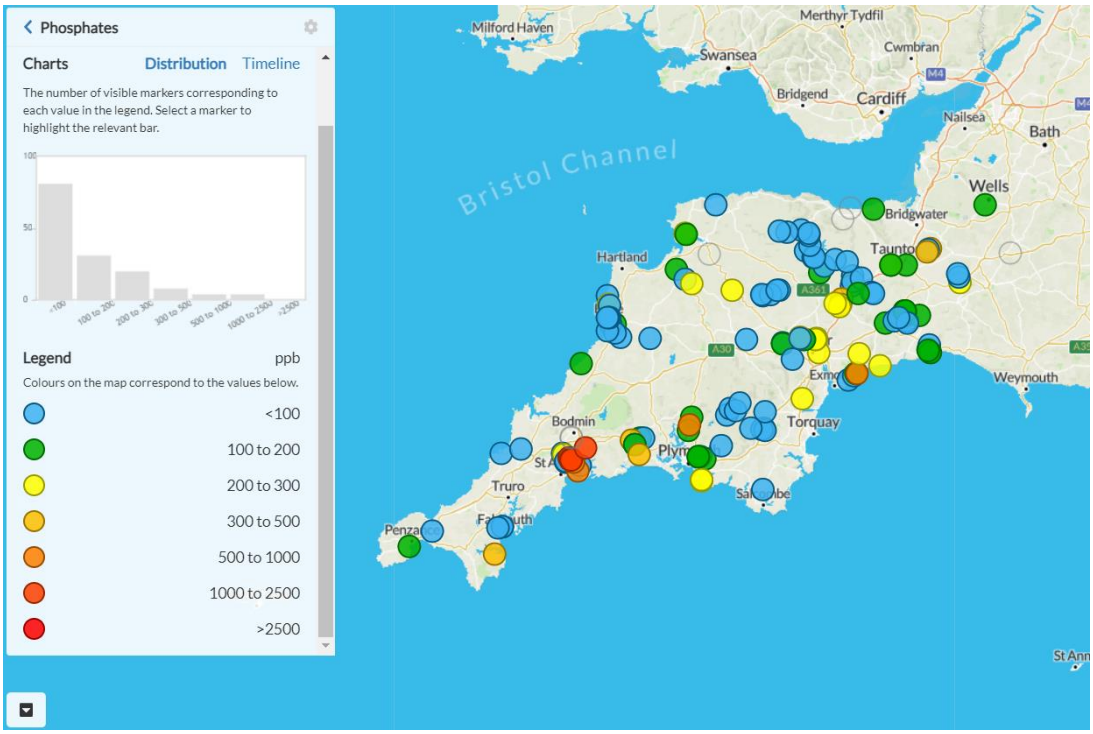
200 – 300 HIGH

500 – 2500 – TOO HIGH

Phosphate levels were relatively low for the second month running. Levels at all sites monitored were OK according to the WRT guidance. Maximum scores of 2500 PPB have been recorded at some sites but these precede the date range in the historical graphs. They have been recorded on Cartographer.

2. **Geographical comparison.** Source: Cartographer





3 April data

PAR RIVER/TRIBUTARY	LOCATION	Phosphates ppb
Par	South of Minorca Lane, Par River, SX 02657 59788	0
Tributary	Carbis Stream SX 02834 59401	200
Par	Luxulyan allotments, Par River, SX 04732 58045	1000
Par	Cam Bridges, Par River, SX 05292 57454	1000
Tributary	Gatty's Bridge, Bokiddick Stream SX 05531 57953	0
Par	Treffry Viaduct, Par River, SX 05650 57179	1000
Par	Lady Rashleigh Mine, Par River, SX 06451 56509	500
Tributary	Treesmill, Tywardreath Stream, SX 08873 55385	0
Par	Par Beach slipway, SX 0776 53261	500

CSI Surveys conducted on these dates, each of which is colour-coded:

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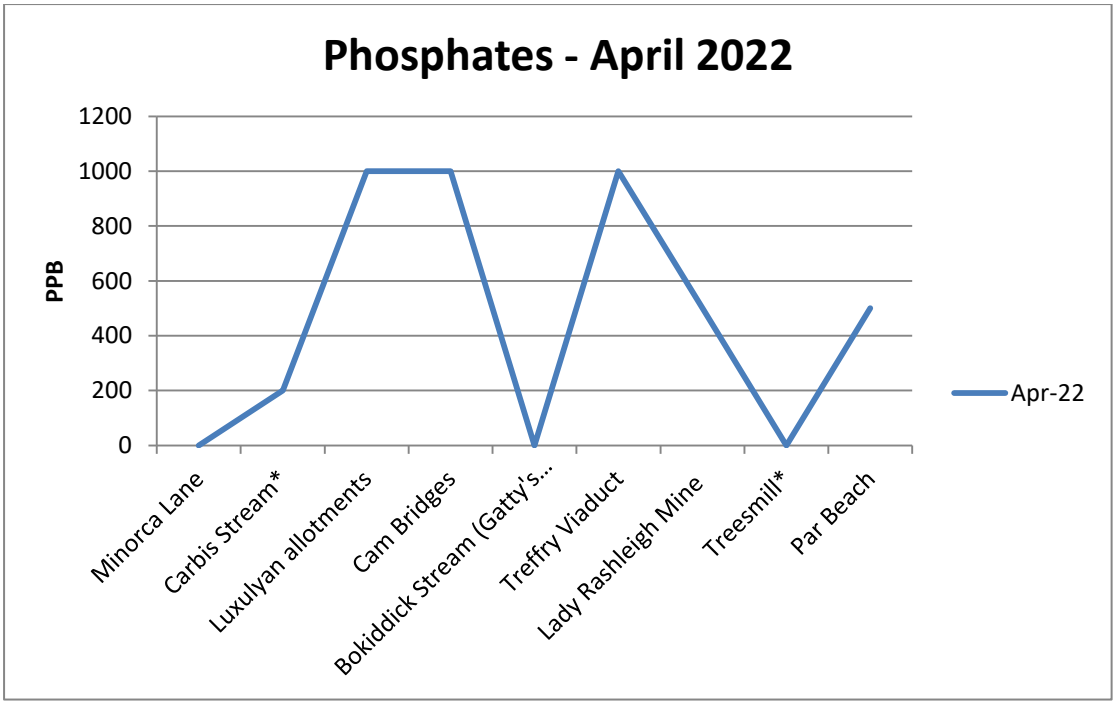
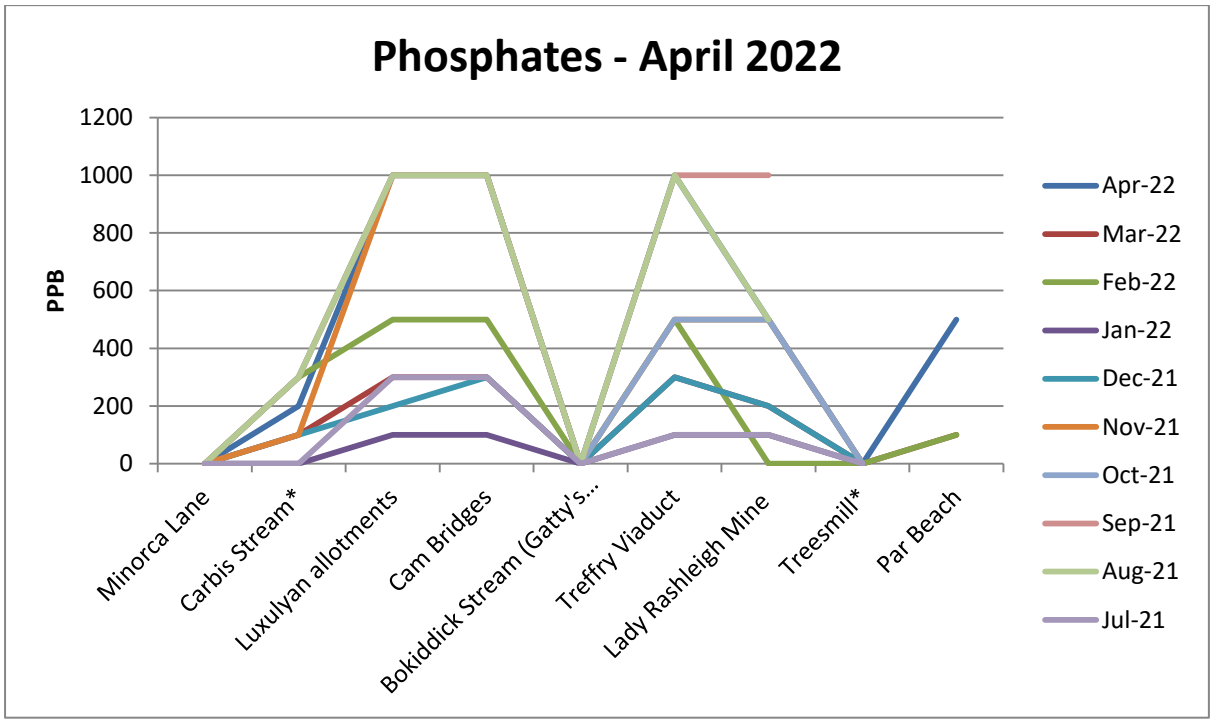
11h April 2022



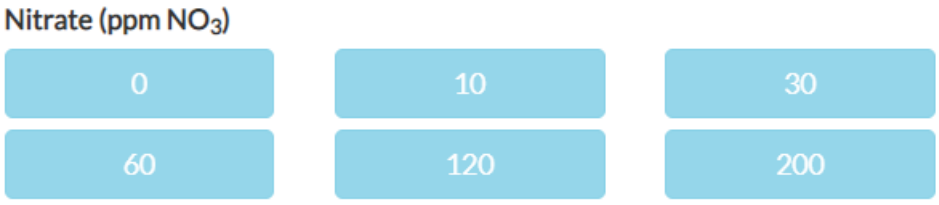
*indicates a tributary of the Par River.

5. **Historical data on phosphates:**



G. NITRATES

1. The WRT kit has these ranges for nitrates:



2. We have concerns about the sensitivity of the testing strips so did not carry out any tests this month.

H. OTHER OBSERVATIONS

1. **E.coli (EC) and Total Coliform(TC)**

(a) On 10th April2022 testing took place on the Par River near Luxulyan STW and on 13th April at Lady Rashleigh Mine (SX 06451 56509) using the Aquagenx CBT EC+TC MPN Kit which 'simultaneously detects and quantifies E. coli (EC) and Total Coliform (TC) bacteria in a 100 mL sample'.

(b) Key information:

What is the difference between total coliform and E. coli?

Total coliform is a large collection of different kinds of bacteria. Faecal coliform are types of total coliform that exist in faeces. E. coli is a subgroup of faecal coliform.
https://doh.wa.gov/sites/default/files/legacy/Documents/Pubs//331-181.pdf

Why is E. coli in river water a concern?

The presence of E. coli **indicates faecal contamination of the drinking water** and as a result, there is an increased risk that enteric pathogens may be present.
https://www.canada.ca/en/health-canada/programs/consultation-e-coli-drinking-water/document.html

Particular thanks are due to Joan Farmer for allowing the use of her home for the unpleasant process of incubating the samples and also for contacting the manufacturers of the kit in North Carolina, USA, for guidance on the results. Thanks too to Ross Tonkin for sharing his professional expertise.

(c) Report from Joan Farmer:

Samples taken upstream and downstream of the Sewage Treatment Works Luxulyan

10/04/2022

Results 13/04/2022 48 hours at 25-30 degrees centigrade.

Aquagenx Test for Surface and Recreational Waters (USA)

MPN= most probable number

E coli	**Upstream of STW** **SX0430 5821**	**Downstream of STW** **SX0448 5810**
Result	34 MPN/100ml	136 MPN/100ml
Health Risk	Low Risk probably safe	High Risk Unsafe

The results for total coliforms are inconclusive. Both samples glowed under UV light but looked white rather than blue, so until we have clarification, the possible range is as follows

Total Coliforms under uv light	**Upstream of STW** **SX 0430 5821**	**Downstream of SWT** **SX 0448 5810**
Result	Between 34 MPN/100ml and >1000 MPN/100ml	Between 136MPN/100ml and >1000 MPN/100ml
Health Risk	Low risk or Very unsafe	High Risk or Very Unsafe

Discussion

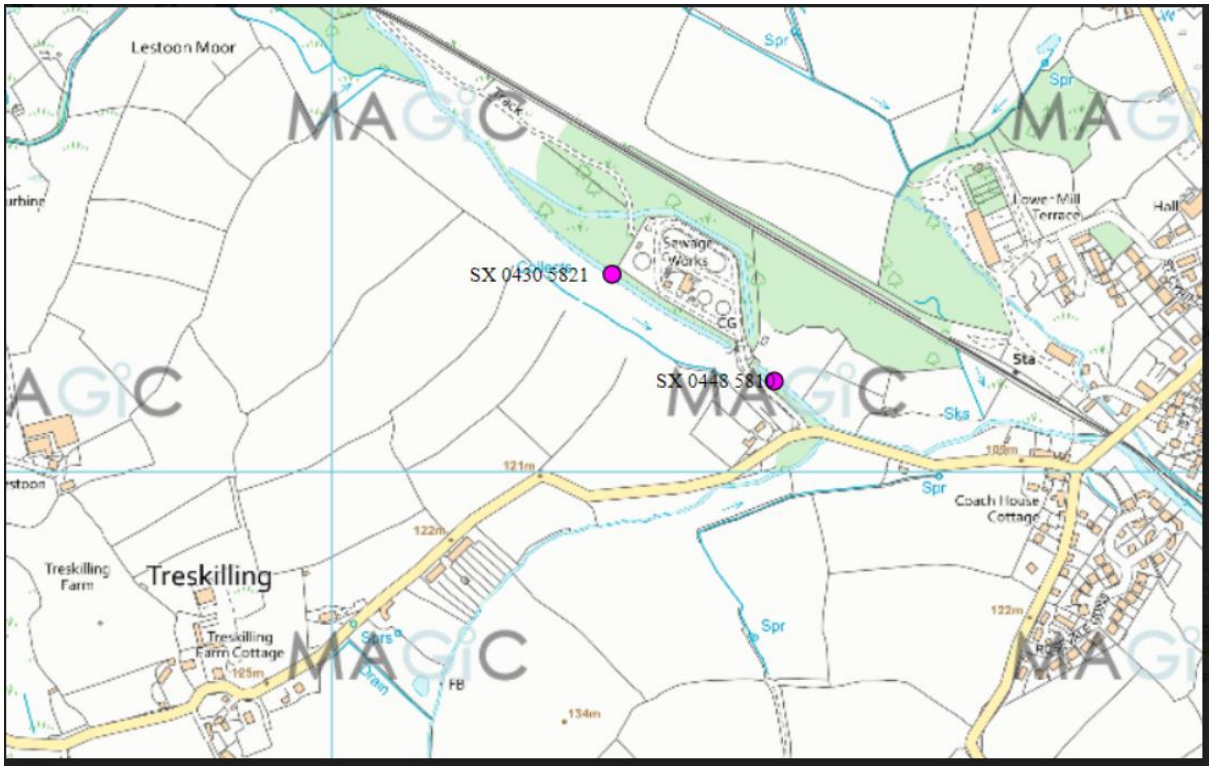
There appears to be a significant increase in e coli just downstream of the Sewage Treatment Works. The result of 136 MPN/100 ml is the same as the reading we got at Lady Rashleigh mine in March.

The February result at Lady Rashleigh of >1000/ 100 ml for e coli, (very unsafe), may have been due to the fact that we took the sample on the Monday following the weekend of Storm Eunice and Storm Franklin so sewage may have been pumped into the river for that reason.

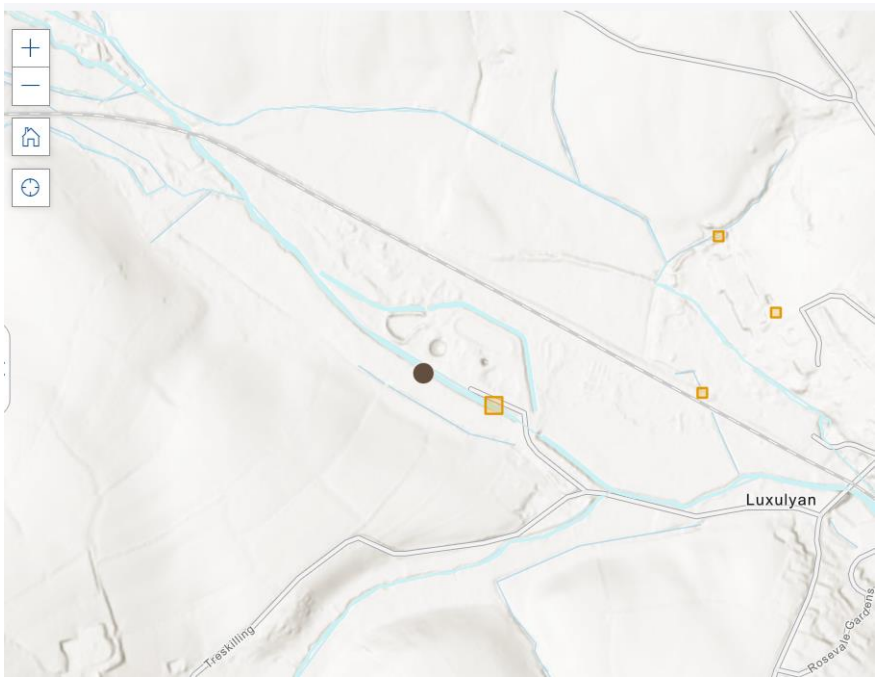
However, Total coliform results are unclear. There may be another source, or perhaps the area tested was still affected by the STW. E coli is a coliform, and was present at both sites but the test under UV light picks up other coliforms.

I suggest that we seek expert advice, test where we have access about a mile upstream and downstream at our testing site in the allotments, next time.

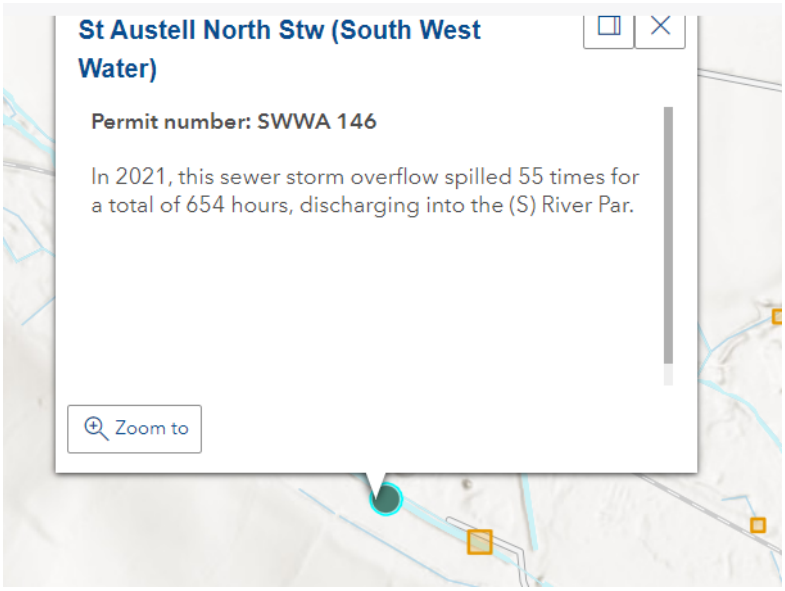
Roger has pointed out that unsafe results according to our American tests are deemed safe in the UK.



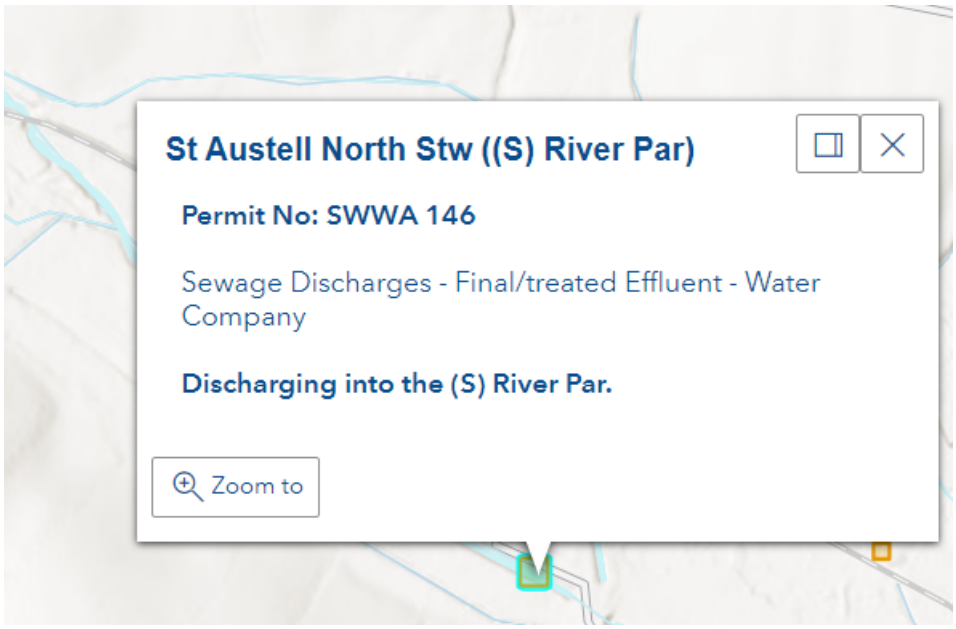
The new Rivers Trust Sewage Map (https://theriverstrust.org/key-issues/sewage-in-rivers) shows the 2 outfalls from this facility. Samples were taken upstream and downstream of the works.



The outfall marked by the brown circle was inactive when the samples were taken. This is what The Rivers Trust has to say about it:



The outfall marked with a square was operating when the samples were taken. Small clusters of foam and a very slight smell were noticeable.



Par River near Lady Rashleigh Mine SX 06451 56509

Results are shown in MPN/100ml (Most Probable Number)

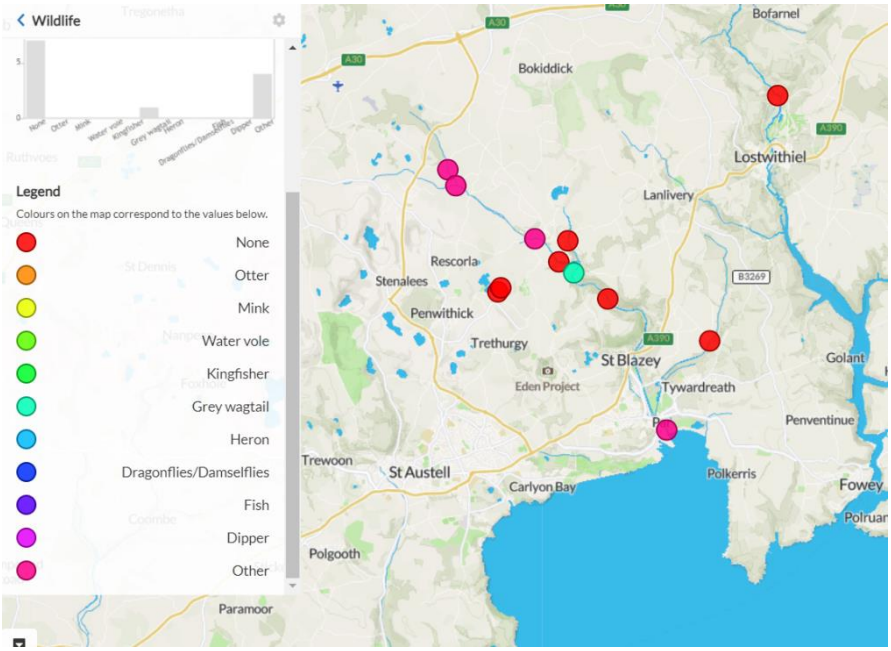
>1000 is the highest reading on the 32 row chart. 483 is the second highest number.

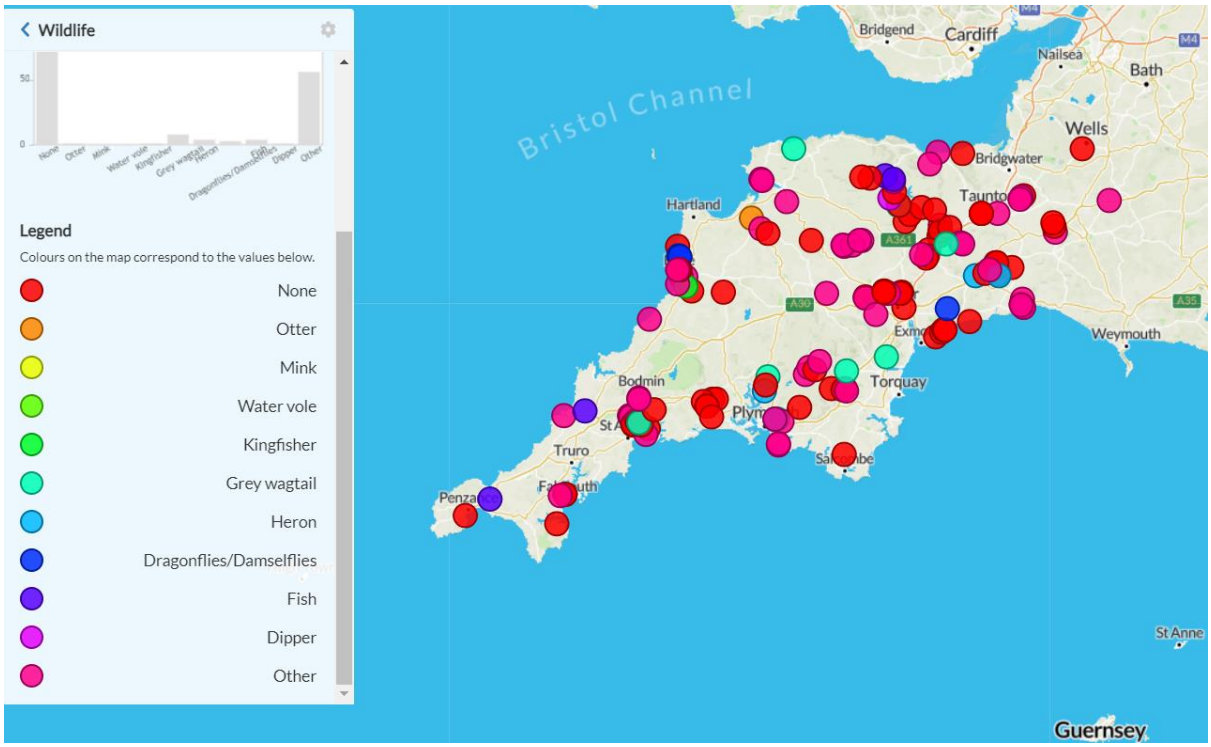
Sample Date	Rain? Notes	Result Date	Results E coli	Health Risk	Results Coliforms	Health Risk
21/02/22	Rain prev. 24hrs.	23/02/22 24/02/22	483 [1] >1000	Very High Unsafe Very Unsafe	>1000 >1000	V. Unsafe V. Unsafe
21/03/22	dry	24/03/22	136	High risk Prob. Unsafe	>1000 [2]	V. Unsafe
16/04/22	Dry and sunny. Rain previous day	18/04/22 Temp over 30 C	326	Very High Risk/ Unsafe	>1000 Def. blue In comp 4 and 5	V. unsafe

[1] Readings taken twice on the 1st sample as it took 12 hours to reach the minimum temperature of 25 degrees
[2] Compartments 4 and 5 had only very pale blue fluorescence in UV light, but definitely glowed with no trace of yellow. Aquagenx company confirmed that fluorescence under UV light indicates positive for total coliforms.

2. Wildlife

Source: Cartographer.





3. Otter survey:

A. SURVEY CONDITIONS

Date & time	7/4/2022, 10/4/2022
Surveyors	Roger Smith, Joan Farmer, Mat Bateman
Areas surveyed	Par River from STW to Cam Bridges; Par River from Treffry Viaduct to Ponts Mill; Upper Par (Criggan Moors and Minorca Lane)
Weather	Dry.
River level	Average- high
River flow	Steady
Water quality	Too High phosphate levels from Luxulyan allotments downstream (100 ppb); at Lady Rashleigh Mine 500 ppb. There are also concerns about levels of E.coli and Total Coliforms.
Other wildlife	Grey wagtails seen on 10/4/2022.

B. EVIDENCE FOR OTTERS ✓

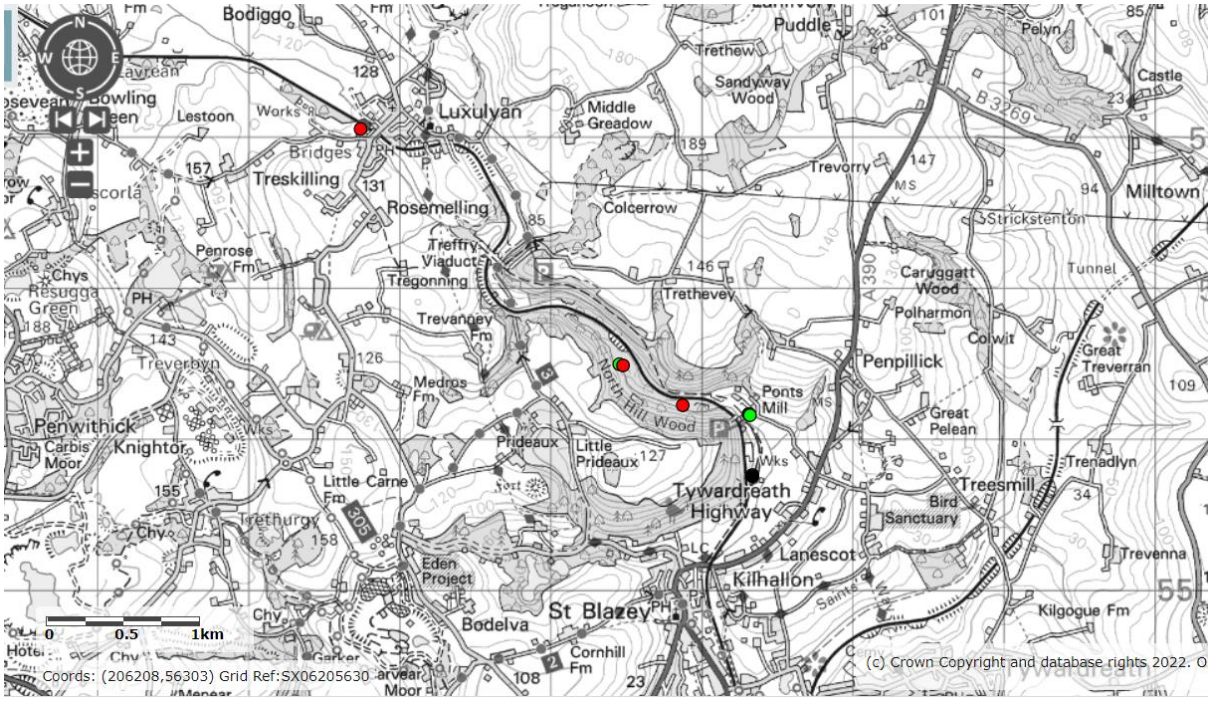
EVIDENCE	SEEN/ ORKS*	LOCATION	NOTES
Spraint - fresh	✓* ✓*	SX 04747 58056 – LA – boulder in river SX 0687 5622 LTSCW- upriver from Carmears Wood stream crossing Lower Tramway	This site hasn't had spraint for a very long time.
Spraint – recent	✓*	SX 06471 56497 DLRM - boulder in river	
Spraint - old	✓ ✓ ✓* ✓*	SX 06456 56498 Lady Rashleigh Mine – boulder in river SX 07312 56164 under canal bridge at Ponts Mill SX 0733 5577 Downstream from Ponts Mill sluice SX 04747 58056 – LA – boulder in river	
Anal jelly			
Sign heap			
Staining			
Tracks	✓	SX 07312 56164 under canal bridge at Ponts Mill	Indistinct
Path			
Slide	✓	SX 0733 5577 Downstream from Ponts Mill sluice	On river bank next to log on which there was spraint. Likely but not certain.
Holt			
Hover			
Couch			
Live sighting			
Corpse			

***Report sent to ORKS: https://erccis.org.uk/**

C. MAP

Source: https://magic.defra.gov.uk/MagicMap.aspx

Red dots – definite evidence. Recorded on ORKS.
Black dots – possible evidence. Not recorded on ORKS.
Green dots – definite evidence but may have been recorded in the previous month, e.g. old spraint.



D. **PHOTOGRAPHS**

1. Old spraint (from March?) under canal bridge at Ponts Mill (SX 07312 56164).

2. Indistinct footprints under canal bridge at Ponts Mill (SX 07312 56164).

3. Old spraint on log downstream from Ponts Mill sluice (SX 0733 5577).

4. Upriver from point where Carmears Wood stream crosses Lower Tramway and joins Par River. Fresh spraint with fish bones and scales (SX 0687 5622).

5. The stream from Carmears enters on the left. This is a fast flowing, boulder-strewn section (SX 0687 5622).

6. Old spraint on boulder at Lady Rashleigh Mine (SX 06456 56498) may be from last month so has not been recorded on ORKS.

7. Recent spraint on boulder downstream from bridge at Lady Rashleigh Mine (SX 06471 56497).

8. Unidentified, odourless dropping containing fur on boulder downstream from bridge at Lady Rashleigh Mine (SX 06471 56497).

9. Fresh and old spraint on boulder on far side of river from Luxulyan allotments (SX 04747 58056). Old spraint not seen in March survey so can be recorded on ORKS.

10. Looking upstream from sprainting spot near Luxulyan allotments (SX 04747 58056).

4. ARMI Riverfly Survey

Three of the group (Joan Farmer, Veronica Jones and Roger Smith) have undertaken the training to carry out Riverfly Surveys under the Anglers' Riverfly Monitoring Initiative (https://www.riverflies.org/rp-riverfly-monitoring-initiative). In short, sampling for 8 riverfly groups is carried out using standardised methods with scores calculated for their abundance. Information is passed to ARMI and the ORKS database. If the score does not reach a trigger level (in our case we have a temporary trigger level of 5), the Environment Agency must be informed immediately since it is highly likely to indicate that the water is polluted. Our group received approval to sample at two sites: Luxulyan allotments (SX 04743 58054) and Lady Rashleigh Mine (SX 06453 56500). We have decided, for the time being, to concentrate on the latter.

It is impossible to count every invertebrate so this counting method is used:

Abundance	Score	Estimated Number
1-9	1	Quick count
10-99	2	Nearest 10
100-999	3	Nearest 100
>1000	4	Nearest 1000

Results, 16th April 2022

	SPECIES	NUMBER	CATEGORY
Trichoptera			
1	**Cased Caddisfly**	**10**	**2**
2	**Caseless Caddisfly**	**15**	**2**
Ephemeroptera 3 tails			
3	**Mayfly (Ephemeridae)**	**0**	**0**
4	**Blue-winged olive (Ephemerellidae)**	**0**	**0**
5	**Flat-bodied up-wings (Heptageniidae)**	**50**	**2**
6	**Olives (Baetidae)**	**60**	**2**
Plecoptera 2 tails			
7	**Stoneflies**	**13**	**2**
Gammaridae			
8	**Freshwater Shrimp**	**40**	**2**
			12

CATEGORY TOTAL	**12**
TRIGGER LEVEL	**5**

I. DISCUSSION

1. Positive observations.

The Riverfly trigger level was exceeded. Otters and fish are present. There were observations too of other wildlife, including grey wagtails and pond skaters. E.coli levels upstream from Luxulyan STW were deemed 'Low risk; probably safe'. The tributaries (Treverbyn, Bokiddick and Tywardreath Marsh Stream) seem to be relatively healthy. Habitat improvement work was noted upstream from Lavrean.

2. Points of concern.

Phosphate levels from Luxulyan allotments downstream were back to levels considered 'Too High' by the Westcountry Rivers Trust. E.coli levels downstream from Luxulyan STW and at Lady Rashleigh Mine appear to be 'High Risk/Unsafe'. Total Coliform levels downstream from Luxulyan STW and at Lady Rashleigh Mine are 'Very Unsafe'. The Carbis Stream is still polluted with china clay and this is noticeable for a significant stretch between the monitoring point and Lavrean Bridge. Although the Riverfly trigger score was exceeded, two species were absent. The absence of Blue-winged olive may be due to seasonal factors, however not a single Mayfly larva was found. It could be that only riverflies that are most tolerant of impure water are present, with none that require clean water being present.

3. Areas of doubt

There is doubt about the responsiveness of the nitrate strips. Previously we have recorded scores of 10 ppm at most of the sites where this testing has occurred; however, the colour on the strip after testing appears identical to that when it is taken from the canister.

The bacteria testing is being carried out with increased confidence and expertise, thanks to Joan Farmer. Many of the results are very concerning but we do not know what can be done to highlight and address this problem. While the results for E.coli seemed to support the idea that the source was Luxulyan STW, it was surprising to discover that Total Coliform levels were also high upstream of that facility.

Roger Smith and Joan Farmer on behalf of the Par River Monitoring Group, 28th April 2022