



# The Big Windermere Survey

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Cumbrian Lakes Research Forum, 8<sup>th</sup> November 2022



National Trust



Lake District National Park



## Background

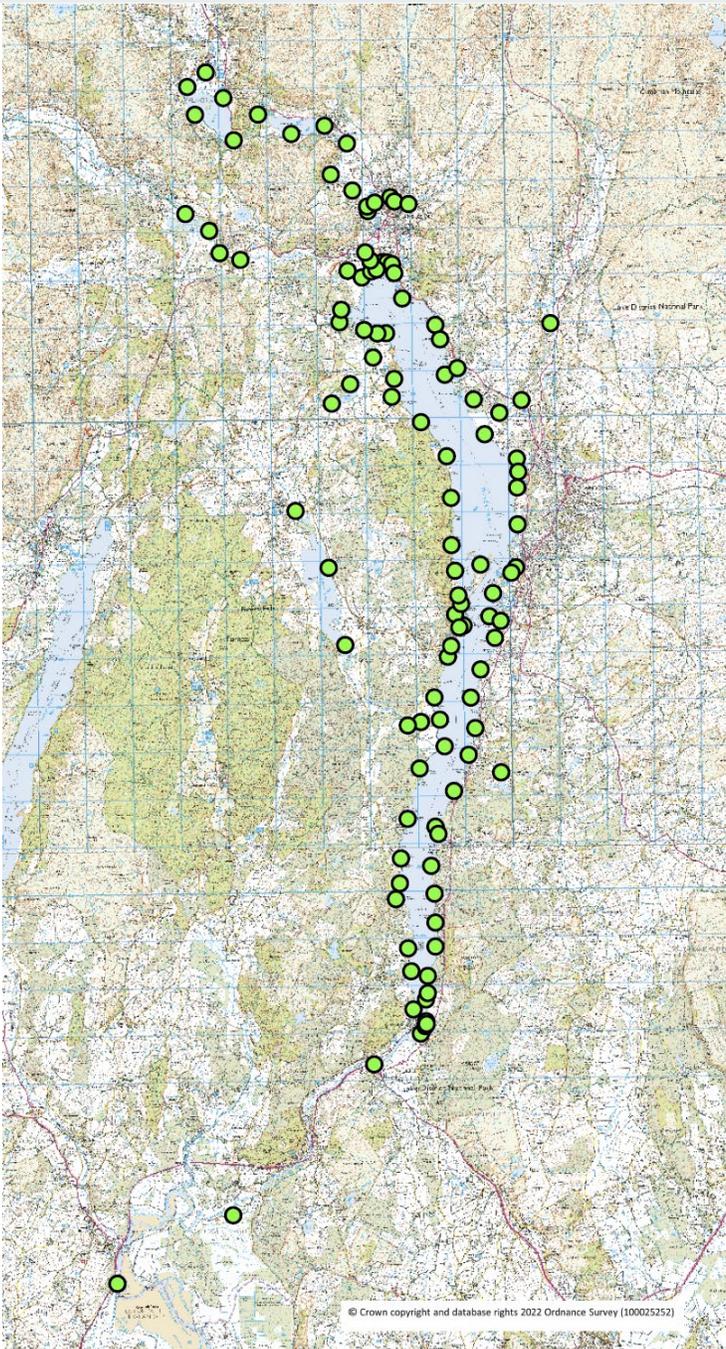
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- A citizen-science led, participatory approach to monitoring water quality in Windermere and the wider Leven catchment
- Initial funding from Lancaster University Vice Chancellor's Prize for participatory research 2022, match funding from United Utilities
- Objectives:
  - Build a network of community partners to support water quality monitoring activities
  - Design and run the first Big Windermere Survey in summer 2022
  - Progress a strategy for long term, community-led surveys at Windermere, including securing funding for this work.

## Sampling design

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- 109 sampling sites initially identified, combination of stream/river and lake shoreline
- Sampling packs provided for citizen scientists, based on research approaches and equipment
- Training video produced to support citizen scientists in sampling, plus online Q&A prior to event
- Temperature measurements made by citizen scientists, plus site photographs taken
- Citizen scientists return samples to one of four 'science hubs' around Windermere after collection for further processing



## Sample analysis

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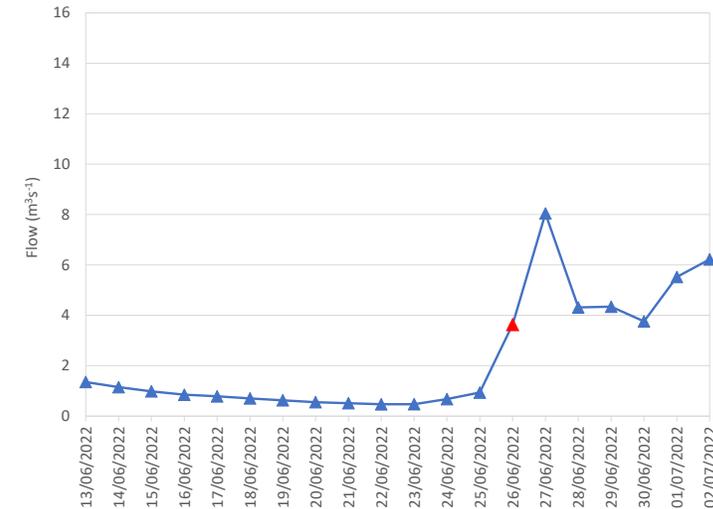


- Sample pH and EC measured immediately at science hubs
- Bacterial analysis (*E. coli*, intestinal enterococci, total coliforms) analysed at external, accredited laboratory (Simplex Health)
- Nutrients (total phosphorus, total dissolved phosphorus, soluble reactive phosphorus, nitrate, nitrite, total ammonia, dissolved silica) analysed in Lancaster Environment Centre research laboratories

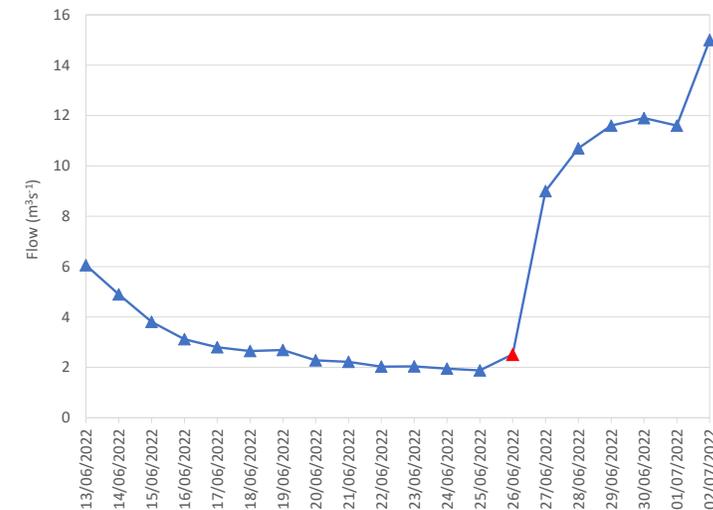
## June 2022 survey

- 93 of the 109 sites were sampled
- Weather had been dry leading up to the date of the survey and river discharge had been relatively low
- Rainfall on the day of the survey, but mostly after sample collection
- Samples broadly captured summer low flow conditions

Rothay at Miller Bridge House

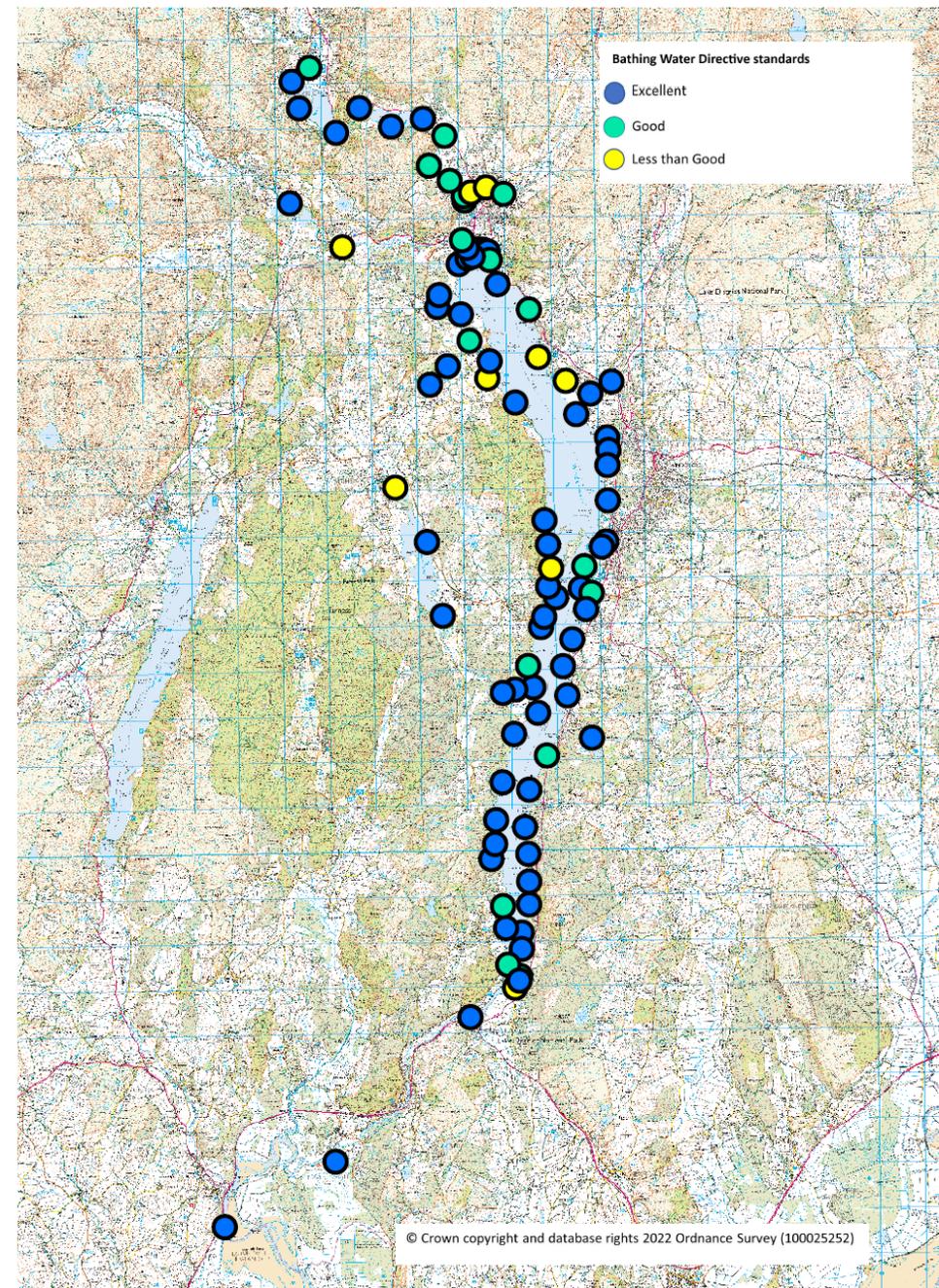


Leven at Newby Bridge



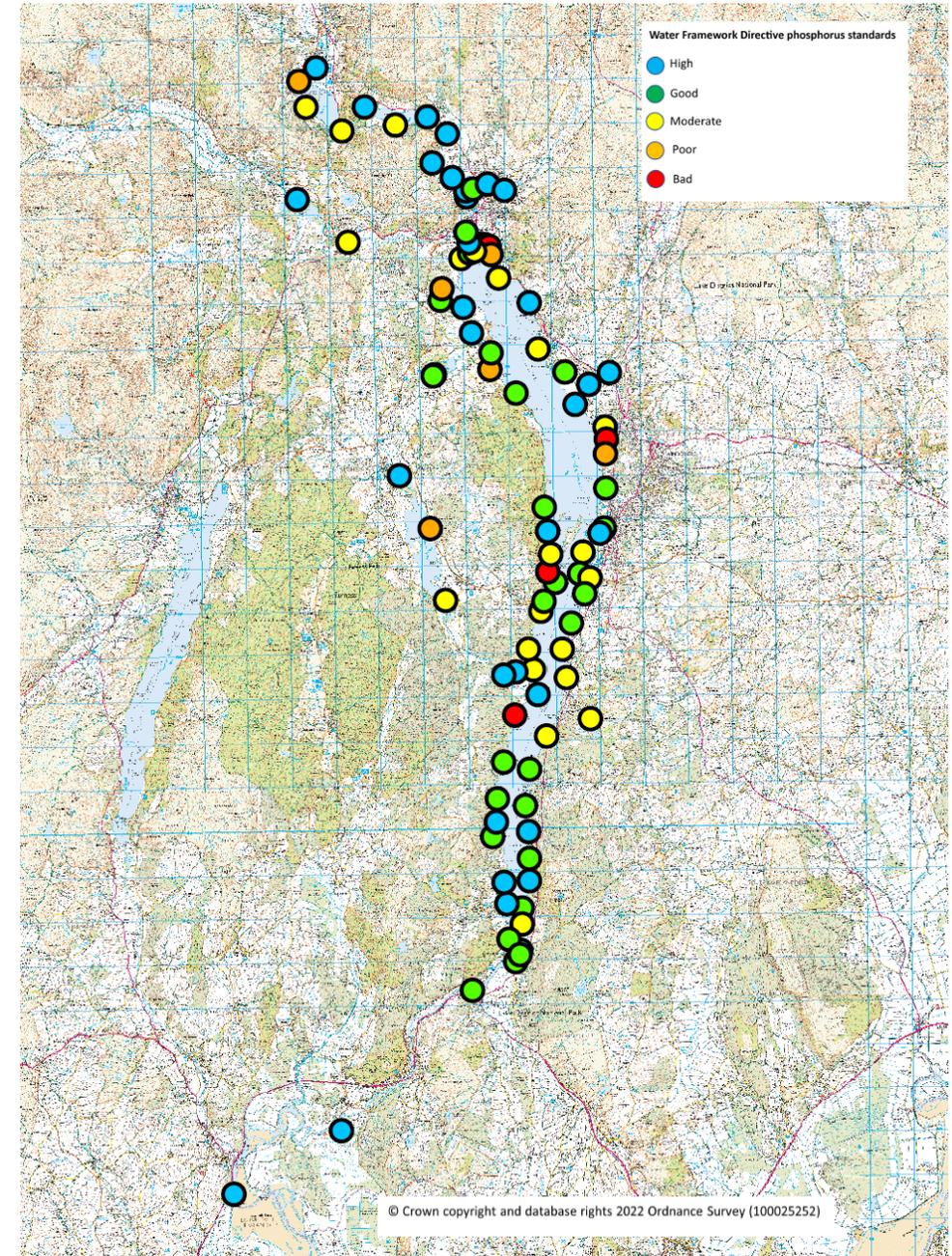
## Initial data: Bacteria

- 90% of all sites in the survey consistent with standards for Excellent (E) or Good (G) bathing water quality
- 92% of Windermere shoreline sites consistent with standards for E or G, including Lakeside YMCA, Millerground Landing and Rayrigg Meadow
- Fell Foot had elevated *E. coli*, dropping below the standard for G
- Stock Ghyll through Ambleside (*E. coli* and intestinal enterococci), Black Beck at Hawkshead (*E. coli*) and Brathay at Skelwith Bridge (intestinal enterococci) dropped below standard for G



## Initial data: Phosphorus

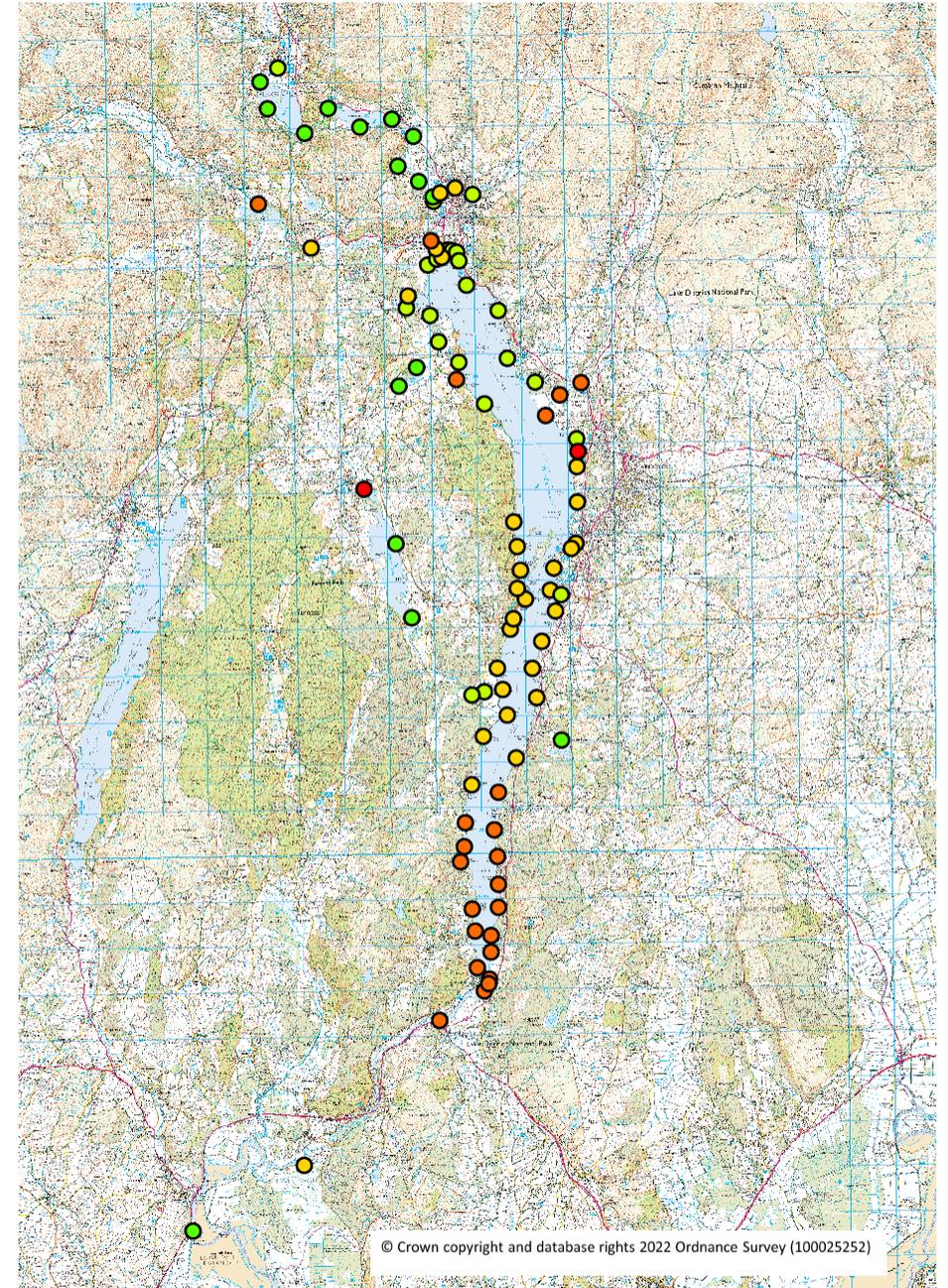
- 52% of all lake sites (58% for Windermere) consistent with at least 'Good' phosphorus standards based on TP
- Clusters of higher TP around Waterhead, Millerground, in Bowness-on-Windermere around the car ferry crossing, and in the area between Storrs and Tower Wood
- 24 out of 25 river sites consistent with at least 'Good' phosphorus standards based on SRP



## Initial data: Nitrate

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- Summer drawdown of nitrate concentrations to  $< 0.1$  mg N L<sup>-1</sup> in majority of lakes
- Contrasting pattern in Windermere – increasing from c.0.2 to c.0.5 mg N L<sup>-1</sup> across north to south basins
- Consider N and O stable isotope analysis in nitrate to separate source inputs versus nitrification explanations?



# Dissemination of findings

- Core principle: data are freely and openly available to all
- Freshwater Biological Association website hosts access to data, which can be viewed in Cartographer
- 'Explainer note' produced to accompany data release and support interpretation of results
- Online Q&A session in October 2022 for citizen scientists to discuss initial findings



## Big Windermere Survey - June 2022 Results

### BIG WINDEREMERE SURVEY

Summary results from June 2022 survey - full information and dataset available from [www.fba.org.uk/bws-june-2022](http://www.fba.org.uk/bws-june-2022)

#### Key findings



**Bacteria**  
• 90% of sites meet standards for Good or Excellent quality, based on *E. coli* and intestinal enterococci



**Phosphorus**  
• 90% of river sites meet standards for High or Good status  
• 52% of lake sites meet standards for High or Good status; 48% meet lower standards for Moderate, Poor or Bad status



**Nitrogen**  
• Nitrate concentrations were <math>< 1.1</math> mg N/L in all samples; substantially below the drinking water limit of 1.1 mg N/L  
• Total ammonia concentrations were very low, many being below the detection limit

  
93 sites sampled by >100 people in Windermere's largest ever spatial survey



## Next steps

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- Seasonal sample collection planned for Autumn (November 13<sup>th</sup>), Winter 2022/23 and Spring 2023.
- Consider additional parameters in these surveys, e.g. targeted molecular analysis for MST
- Working with partners to investigate areas of concerning water quality data
- Review data following Spring 2023 survey and consider scope for longer term continuation

