

EXERCISE: INTRODUCTION TO ACCESSING AND USING THE ENVIRONMENT AGENCY'S WATER QUALITY ARCHIVE

Questions to answer

- What is the Water Quality Archive (Open WIMS)?
- How can I find out what's there?
- How can I download some data?
- What does the data look like when I plot it against time?
- What does the data look like when I plot it on a map?
- How can I provide feedback to the EA about Open WIMS?

1. What is the Water Quality Archive (Open WIMS)?

In 2016 the Environment Agency made tens of thousands of their water quality measurements available as Open Linked Data via the trial (alpha version) Water Quality Archive website. This is also known as the Open WIMS website - WIMS is the Environment Agency's Water Information Management System.

You can access this via this website: <http://environment.data.gov.uk/water-quality/view/landing>

Or type "Open WIMS" or "Water Quality Archive" into Google.

The screenshot shows the top navigation bar of the Environment Agency Water Quality Archive website. It includes the Environment Agency logo, the title 'Water Quality Archive', and navigation links for 'Home', 'Download', 'Documentation', and 'Explore'. There is also a link for 'EA open datasets'. Below the navigation bar, a pink banner indicates 'ALPHA' status and states 'This is a trial service - your feedback will help us to improve it.' The main heading is 'Water quality data archive'. Below this, a paragraph explains that the archive provides data on water quality measurements from 2000 to December 2015, covering various locations like agricultural, coastal, estuary, rivers, lakes, ponds, canals, sewage discharges, trade discharges, pollution investigation points, and waste sites. It notes that the data does not include groundwater data or externally supplied data and may be subject to change after publication. Three main action boxes are presented: 'Download' (with a 'download' button), 'Understand' (with an 'understand' button), and 'Explore' (with an 'explore' button).

Environment Agency Water Quality Archive

Home Download Documentation Explore EA open datasets

ALPHA This is a trial service - your feedback will help us to improve it.

Water quality data archive

The Water Quality Archive provides data on water quality measurements. Samples are taken from sampling points round the country, including: agricultural, coastal, estuary, rivers, lakes, ponds, canals, sewage discharges, trade discharges, pollution investigation points and waste sites. The archive provides data on these measurements and samples dating from 2000 to December 2015. When we update the data, we will update this home page. Currently, the data does not include groundwater data or externally supplied data. Data may be subject to change after publication. Please contact us if you require more information.

Download
Download water quality archive datasets to your computer.
download

Understand
Documentation on the structure of data in this archive, and the meanings of the terms used.
understand

Explore
Explore the data to find water sampling points at a particular location and their associated data.
explore

2. How can I find out what's there?

Click on the Explore button (see above) which takes you to the screen shown below. Click on a place, e.g. Manchester

Search sampling points

Look up sampling points in the archive by providing one or more of the search criteria below.

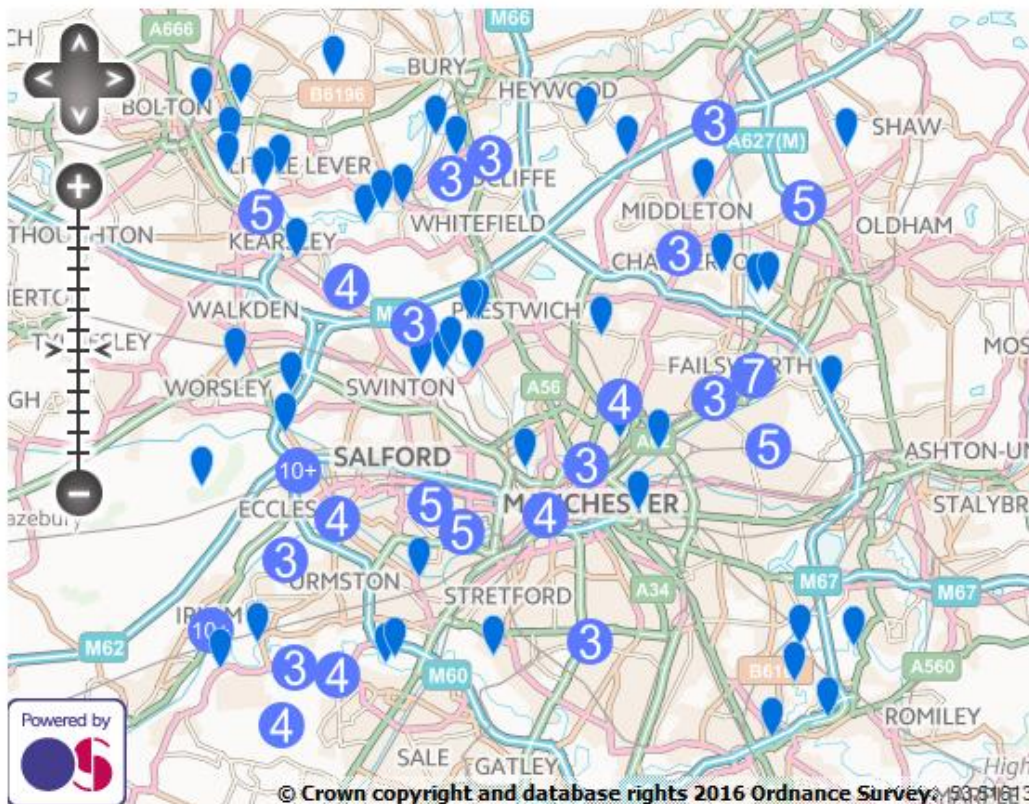
Search criteria form with fields for:

- Sampling point name (text input)
- EA Area (dropdown menu)
- Sampling point type (dropdown menu)
- Status: open closed
- Near-to, or within bounding box:
- Maximum number of results:



Find sampling points

Then click "Find sampling points" to see all the sampling points in that area.



You can then zoom in and click on an individual sampling point (blue balloon) to see its name.



And right-clicking on the sampling point name, takes you to the sampling point web page for the that sampling point, e.g. River Medlock at Potato Wharf.

SAMPLING POINT

River Medlock At Potato Wharf

Description	RIVER MEDLOCK AT POTATO WHARF
Sampling point ID	NW-88002415
Type	Freshwater – Non Classified River Points
Status	open
Location	easting northing: 382900 397700 lat lon: 53.475735, -2.259098
Area	Greater Manchester Merseyside And Cheshire
Sub-Area	Manchester
Summary	136 samples taken between 2015 and 2000



Q1: What information is available here? Fill in the gaps.



- The sampling point identification number is NW-
- The sampling point type is Freshwater –
- The grid reference is easting: northing:
- How many samples were taken between 2000 and 2015?

The EA advises that the majority of freshwater monitoring sites have been set up as either “Freshwater - Non Classified River Points” or “Freshwater – unspecified” sample point types.

All the various types of sampling point are gathered into several groups (agriculture, freshwater, groundwater, sewage etc.) - see this link (<http://environment.data.gov.uk/water-quality/def/sampling-point-type-groups.html? sort=label>)

Further down on the sampling point web page for the River Medlock at Potato Wharf, the measurements that have been taken are listed (see screenshot below).

Determinands

Determinands identify a property which can be measured on a sample or the sampling environment, together with the units in which the result of that measurement will be expressed.

52 determinands have been measured at this site

Sampling results

Displaying the twenty most recent samples. You can [see all 136 sample results](#) (note that in some cases this may take a considerable time, and use significant data bandwidth).

Samples from 6 Nov 2007 to 21 Aug 2015

	Determinand	Units	6 Nov 2007 15:10	7 Dec 2007 10:10	4 Jan 2008 11:20	8 Feb 2008 15:00	25 Mar 2008 14:45	16 Apr 2008 12:40	9 May 2008 15:15	10 Jun 2008 12:55	8 Jul 2008 10:30	21 Aug 2015 12:45
0050	Lead	µg/l	2.8	13.8	5.7	< 2	2.2	2.6	< 2	< 2	3.6	
0061	pH		8	7.4	7.7	8.1	8	7.9	8.1	7.8	7.3	7.68
0076	Temperature of Water	°C	9.2	8.4	4.7	8.2	4.7	6.7	15.7	16.7	14.4	
0077	Conductivity at 25 C	µs/cm	543	297	589	512	526	499	567	626	399	537
0085	BOD : 5 Day ATU	mg/l	< 1	4.4	> 9.2	2.2	3.9	4.7	2.7	2.1	3.3	23.5
0092	Chemical Oxygen Demand :- {COD}	mg/l										47
0105	Mercury	µg/l	0.012	0.032	0.104		< 0.01	< 0.01	< 0.01	0.058	0.02	
0108	Cadmium	µg/l	< 0.1	0.18	0.11	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	
0111	Ammoniacal Nitrogen as N	mg/l	0.076	0.365	2.31	0.778	0.872	0.548	0.098	0.132	0.244	0.826
0116	Nitrogen, Total Oxidised as N	mg/l	5.12	2.36	3.45	3.12	2.64	3.49	6.01	6.78	2.81	3.04
0117	Nitrate as N	mg/l	5.07	2.33	3.29	3.02	2.57	3.42	5.91	6.66	2.69	2.84
0118	Nitrite as N	mg/l	0.0457	0.0304	0.157	0.0966	0.0672	0.0719	0.0961	0.125	0.117	0.196
0119	Ammonia un-ionised as N	mg/l	0.00131	0.00151	0.0144	0.0124	0.0108	0.00625	0.00271	0.0025	0.00125	
0135	Solids, Suspended at 105 C	mg/l	5.7	99.6	32.4	9.1	10.1	9.9	6.5	6.6	10.2	8.6
0143	Solids, non-volatile at 500 C	mg/l	< 20	86	< 20	< 20	< 20	< 20	< 20	< 20	< 20	
0162	Alkalinity to pH 4.5 as CaCO ₃	mg/l	128	84	135	136	129	118	116	137	108	151
0172	Chloride	mg/l	32	18	53.5	31.9	43.7	41.4	39.8	39.9	24	32.5
0180	Orthophosphate, reactive as P	mg/l	0.791	0.308	0.379	0.264	0.194	0.266	0.787	1.05	0.461	0.876

Q2: How many determinands have been measured at this site?



(Only 18 are shown in the table below).

(There is some reference information about determinands in Appendix A at the end of this worksheet.)

Q3: Look at the measurements for the determinand Ammoniacal Nitrogen as N between 2007 and 2015. The lowest concentration is 0.076 mg/l. What date and time was this measurement taken?



Q4: According to Environment Agency's WFD classification¹ for a lowland river (altitude below 80 mAOD), 90% of the ammonia measurements need to be 0.6 mg/l or lower for a river to be Good status. So ammonia measurements that are regularly higher than 0.6 mg/l indicate that the river is failing the WFD standard (i.e. less than Good status) at that sampling point.

How many samples between 6 Nov 2007 and 21 Aug 2015 have concentrations for Ammoniacal Nitrogen as N (determinand 0111) that are higher than this 0.6 mg/l threshold?



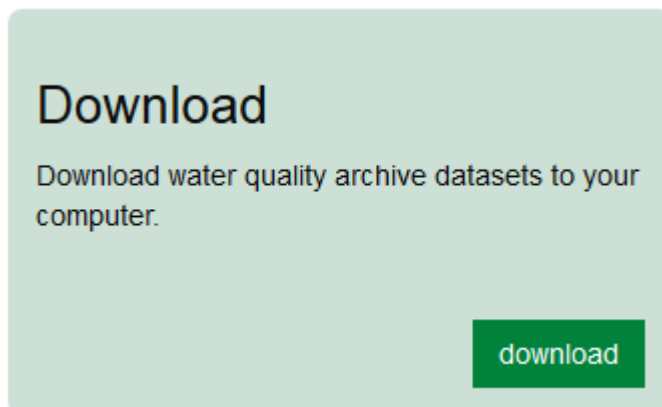
3. How can I download some data?

There are two ways to download data:

- Click Home then click the Download button.
- Use the API² (Application Program Interface). For Open WIMS the API allows you to use URL³ lines (web addresses) to query the data. It's easier to explain this by example, so see below.

At present, it's not possible to download directly the data you can see on the webpage for a sampling point (such as that for the River Medlock at Potato Wharf above). If this is an improvement that you would like to see, you can contact the Environment Agency directly and provide feedback (see Section 6).

Using the Download button



Clicking Download from the Home page takes you to a page (see screenshot below) where you can download the data for the sampling points in a whole Region (e.g. Greater Manchester Merseyside and Cheshire) for one year at a time. Each year's data is provided in a file about 25Mb in size (about 75,000 lines of data). So if you want to download all 16 files for all the years 2000 - 2015, that's a lot of data.

Download open water quality archive datasets

Select an open water quality archive dataset to download using the options below, or choose from the [list of available datasets](#)

Area	Greater Manchester Merseyside and Cheshire
Year	2015
Purpose	both compliance and monitoring
<input type="button" value="Download dataset"/>	

¹ See Appendix A and References section

² An Application Program Interface is a set of routines, protocols, and tools for building software applications to interact with the webpages.

³ A URL (Uniform Resource Identifier) is simply an internet "web address".

Using the API

On the other hand, by writing a web address instruction (a URL), the API lets us be more selective about the data we can download. The URL (web address) in the box below will interrogate the Open WIMS webpages and download all the data at the River Medlock at Potato Wharf sampling point for the determinand Ammoniacal Nitrogen as N. The way this URL is constructed is explained in the next section.

http://environment.data.gov.uk/water-quality/data/measurement.csv?samplingPoint=NW-88002415&determinand=0111&_limit=10000

This URL will download the data as a comma separated variable (.csv) file, which can be opened in Excel so we can view the data (see screenshot below).

Q5: Does the measurement in the row 124 of the .csv file below (for 6 Nov 2007 at 1510) match the measurement in the table in Section 2 above?



	A	C	D	E	F	I
1	Unique identified for each measurement	Determinand	Determinand id	Units	The measurement result	Date & time of sample
2	@id	determinand.definition	determinand.notation	determinand.unit.label	result	sample.sampleDateTime
124	t/NW-1743109-0111	Ammoniacal Nitrogen as N		111 mg/l	0.076	2007-11-06T15:10:00
125	t/NW-1746135-0111	Ammoniacal Nitrogen as N		111 mg/l	0.365	2007-12-07T10:10:00
126	t/NW-1734853-0111	Ammoniacal Nitrogen as N		111 mg/l	0.082	2007-07-30T11:20:00
127	t/NW-1719659-0111	Ammoniacal Nitrogen as N		111 mg/l	0.603	2007-02-05T10:40:00
128	t/NW-1725182-0111	Ammoniacal Nitrogen as N		111 mg/l	0.167	2007-04-16T11:15:00
129	t/NW-1723142-0111	Ammoniacal Nitrogen as N		111 mg/l	0.332	2007-03-21T11:40:00

Explanation of the URL

The URL above says:

- Get measurements from the Open WIMS website (<http://environment.data.gov.uk/water-quality/data/measurement>)
- Get the data as a csv file (.csv?)
- Filter the measurements for specific sampling point ([samplingPoint=NW-88002415](#))
Note that "Sampling Point=" will not work, it must be "samplingPoint="
- Filter the measurements for specific determinands ([&determinand=0111](#))
Ammoniacal Nitrogen as N is determinand=0111. The determinand id is shown in the table under "Sampling results" on the sampling point page for River Medlock at Potato Wharf.
- Limit the number of total data points to be collected to 10,000 ([&_limit=10000](#))
Note that there is an underscore between the & symbol and "limit". It won't work if you miss this out.

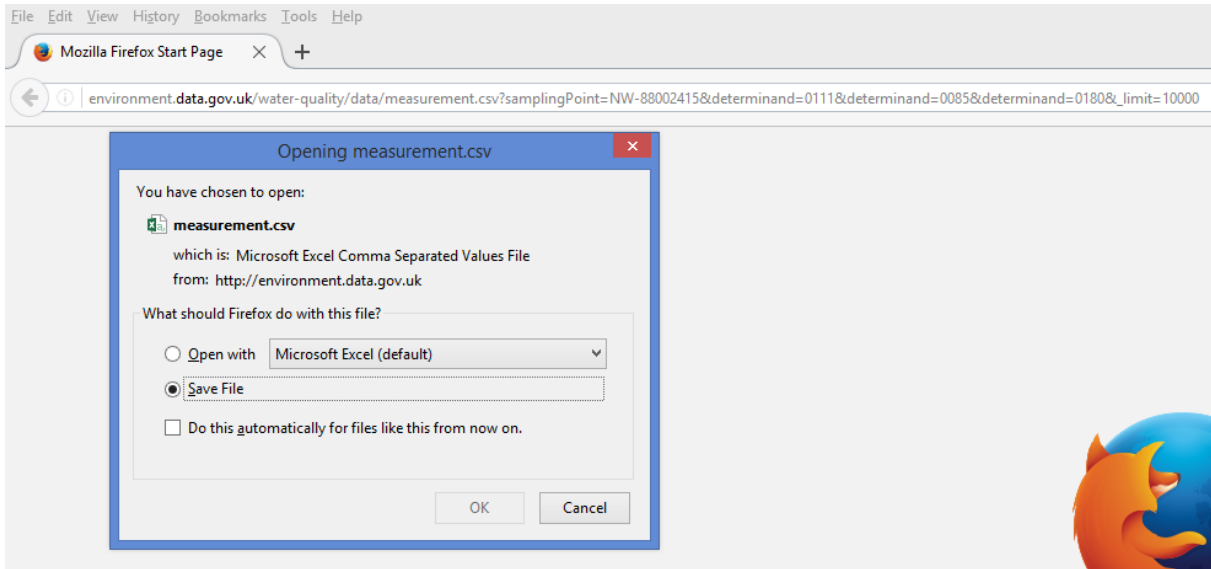
Q6: Now write your own URL for the same sampling points but to download three determinands: Ammoniacal Nitrogen as N, BOD and Orthophosphate.



http://environment.data.gov.uk/water-quality/data/measurement.csv?samplingPoint=NW-88002415&determinand=0111&determinand=0085&determinand=0180&_limit=10000

Hint: The determinand id numbers for BOD and Orthophosphate are shown in the table under "Sampling results" on the sampling point page for the River Medlock at Potato Wharf (in Section 2 above).

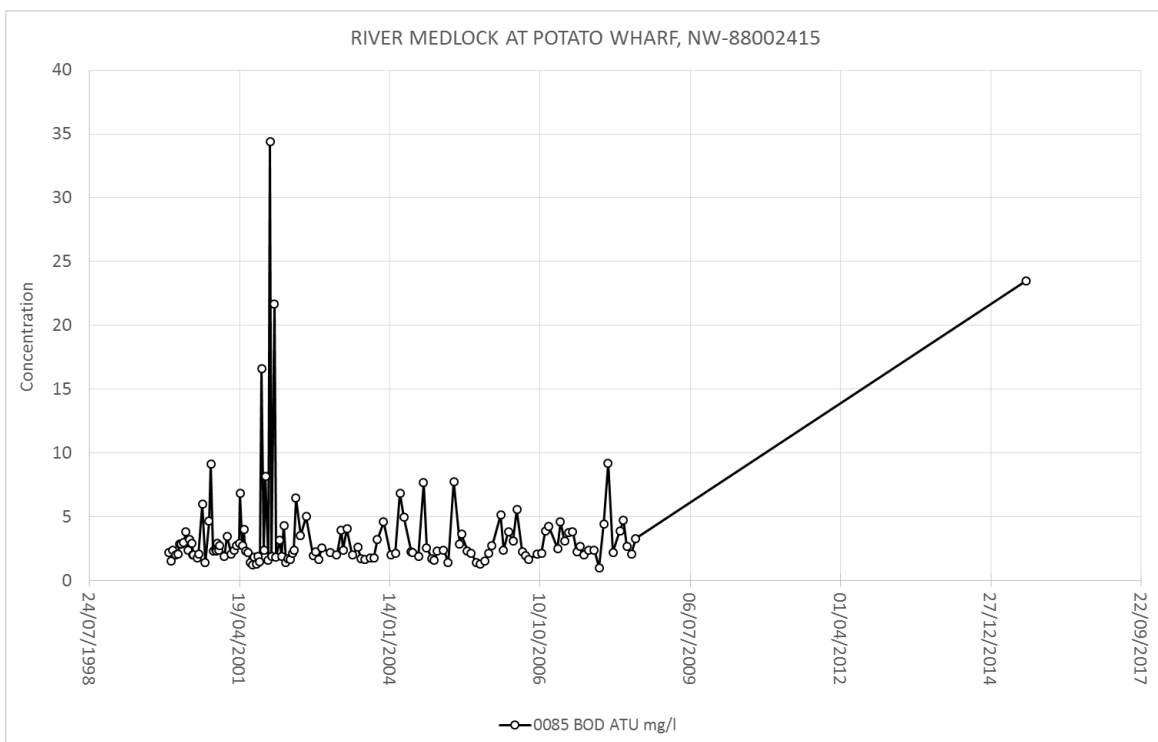
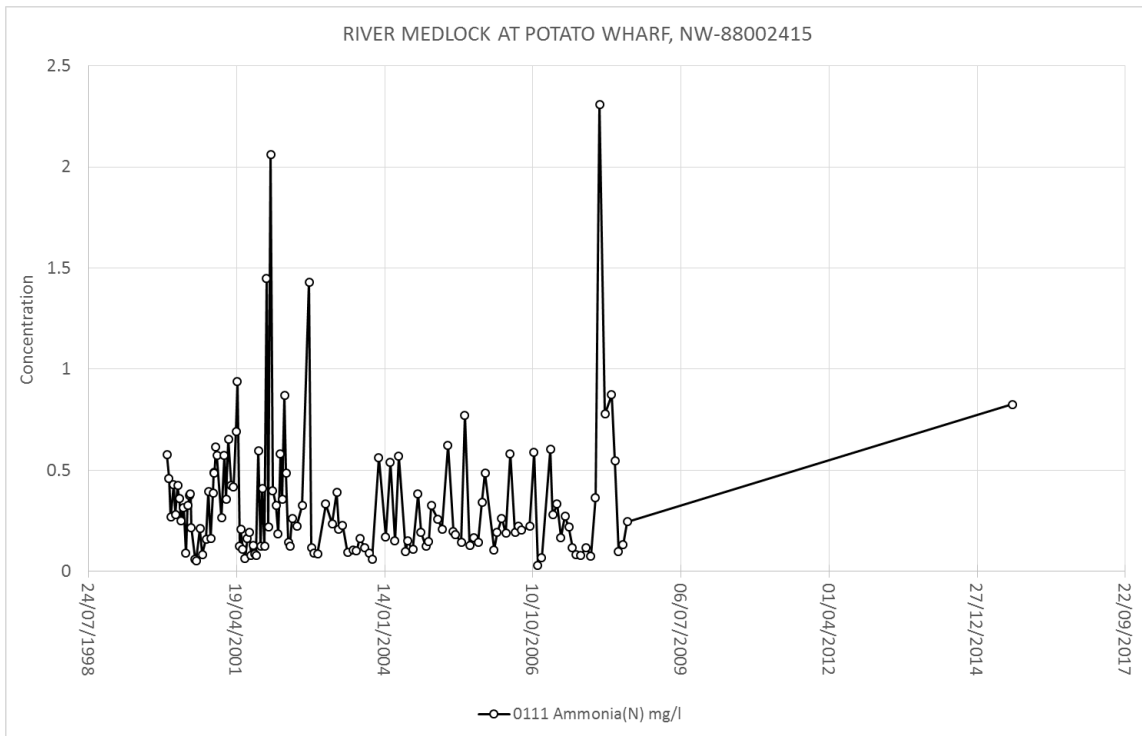
You can copy this URL into a web browser, such as Internet Explorer or Firefox, and it should download the .csv file of data (measurement.csv) - see screenshot below.

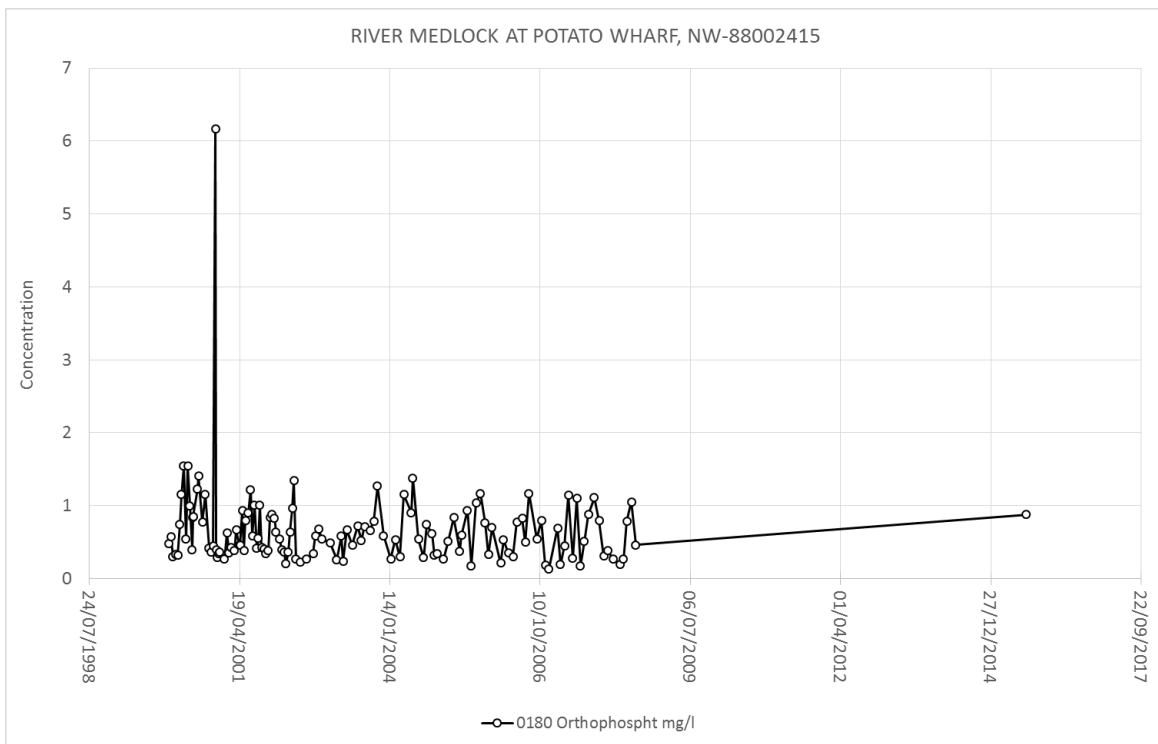


4. What does the data look like when I plot it against time?

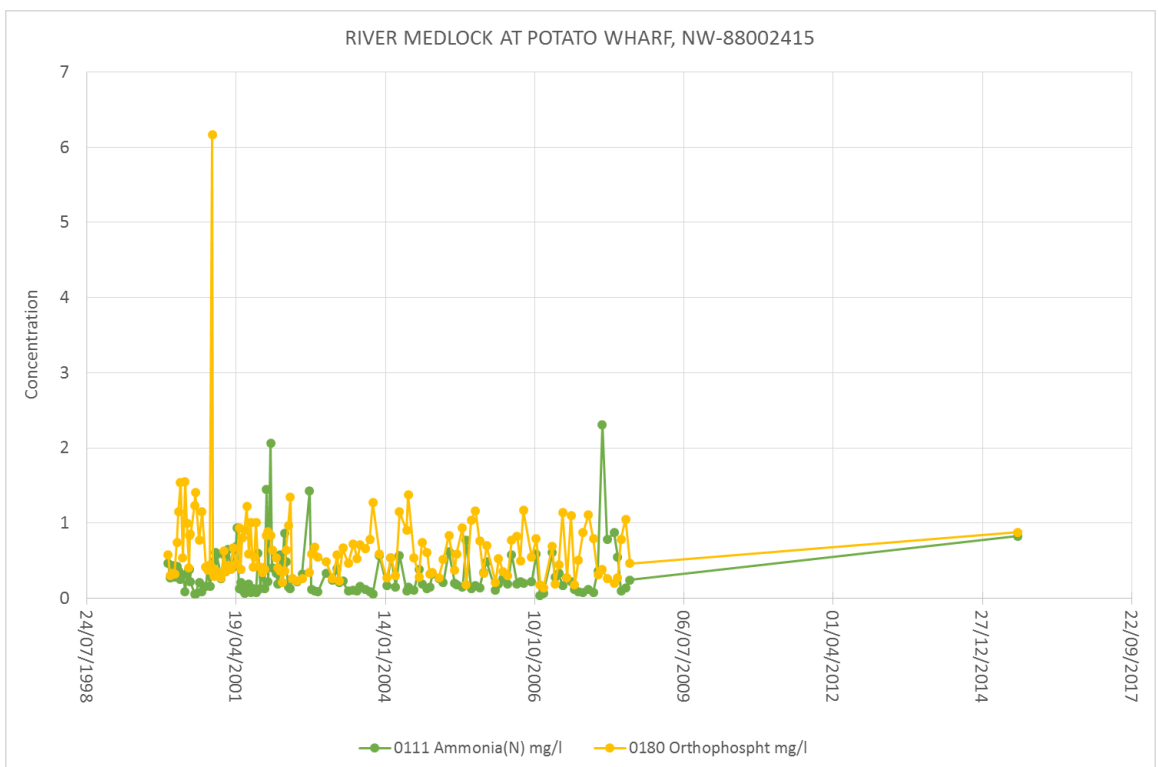
The RT has developed a spreadsheet for plotting the data that Open WIMS provides. This gives you a first look of what the data looks like as a series of measurements in time. This spreadsheet is a bit rough and ready but it may help you get started. See the files "RMedlock_atPotatoWharf.xlsx" and "OpenWIMS_BlankTemplate_V1.xlsx", on the CaBA website with the course materials.

The data can be processed and plotted in Excel, as in the plots below for Ammonia, BOD and Phosphate. Notice that there is a big gap in the data between 2007 and 2015.





Or you can plot two or more determinands on the same graph for comparison.

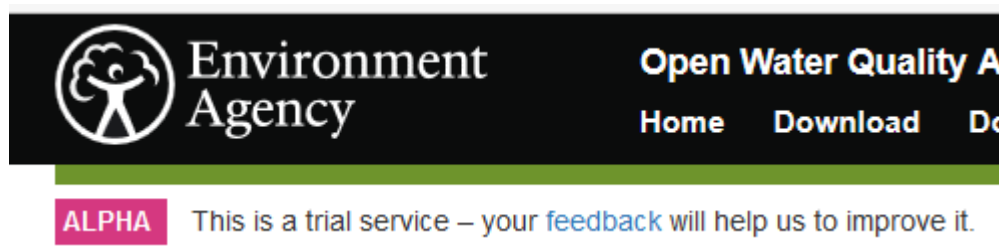


5. What does the data look like when I plot it on a map?

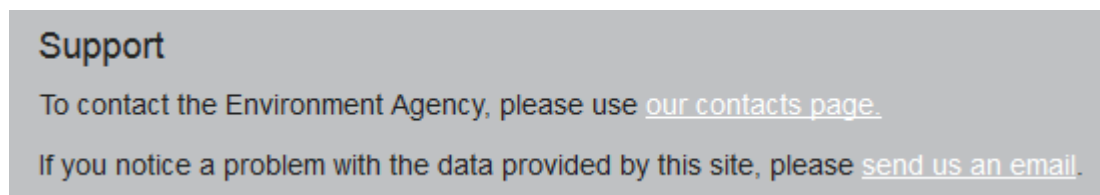
Separate sheet (MW).

6. How can I provide feedback to the EA about Open WIMS?

At the top of the webpage, the Environment Agency invites feedback from users of the Open WIMS website but there is no valid email address.



Nevertheless, you can send your feedback to the support email address at the bottom of the webpages: data.info@environment-agency.gov.uk



There are some suggested changes to the Open WIMS website listed on your feedback sheets. Q7: Can you vote for the ones you think would be useful.

One of the suggestions: Extract in a format which can go straight into an Excel spreadsheet in a tabular format rather than database format, refers to the two data formats below.



Database format - at the moment the WIMS downloads come in database format like this:

Date. Time	Determinand	Units	Result
2000-04-10T11:30:00	Ammonia(N)	mg/l	0.25
2000-04-10T11:30:00	Orthophosphat	mg/l	1.54
2000-05-10T11:15:00	Orthophosphat	mg/l	1.55
2000-05-10T11:15:00	Ammonia(N)	mg/l	0.089
2000-05-10T11:15:00	BOD ATU	mg/l	2.38
2000-03-27T11:50:00	Ammonia(N)	mg/l	0.359
2000-03-27T11:50:00	Orthophosphat	mg/l	1.15

Tabular format - but it would be more useful if it came in tabular format like that below, i.e. in a way that can be easily graphed in Excel.

Date.Time	Ammonia (N) (mg/l)	BOD ATU (mg/l)	Orthophosphate (mg/l)
2000-04-10T11:30:00	0.25		1.54
2000-05-10T11:15:00	0.089	2.38	1.55
2000-03-27T11:50:00	0.359		1.15

Appendix A: Further information about determinands

Determinands in Open WIMS

On the Open WIMS website there are currently about 7,600 determinands. The full list can be downloaded via this URL:

<http://environment.data.gov.uk/water-quality/def/determinands.csv? limit=10000& sort=label>

If you want to see the information that Open WIMS gives about a determinand, try searching for it in Google. E.g. if you search for...

open wims nitrate

Then click on the first entry and you get this

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Measurement: aN 1799668 0117

<http://environment.data.gov.uk/water-quality/data/measurement/AN-1799668-0117>

determinand	Nitrate-N mg/l
result	7.26
sample	Sample on 8 Jun 2015 11:41:00.000 at R. OUSE WATER STRATFORD RD. BR.
type	Measurement

Then click on Nitrate-N and you will get this description. Note that the determinand notation (determinand id No.) is 0117 and the measurement units are mg/l.

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nitrate n

<http://environment.data.gov.uk/water-quality/def/determinands/0117>

definition	Nitrate as N
determinand notation	0117
in scheme	scheme
label	Nitrate-N
notation	0117
pref label	Nitrate-N
top concept of	scheme
type	Concept Determinand
unit	mg/l

The table on the next page give a little information on some useful determinands from Open WIMS.

Some useful determinands from Open WIMS are shown in the table below.

Would a more comprehensive version of this table be useful (e.g. Michelle's example page on P)?

Determinand notation (id number)	Name	Comments	Useful links (from the USEPA, CADDIS website)
0061	pH		https://www3.epa.gov/caddis/ssr_ph_wtl.html
0076	Temperature of Water		https://www3.epa.gov/caddis/ssr_temp_wtl.html
0077	Conductivity at 25 C	Most streams have a fairly constant range of conductivity under normal circumstances. So significant changes in conductivity can be an indicator that a discharge or some other source of pollution has entered the water.	
0085	BOD : 5 Day ATU	Biochemical Oxygen Demand (BOD) is a test which measures the dissolved oxygen (DO) content of a sample of water, the sample is then incubated under controlled conditions (20°C) for 5 days and the DO content re-measured. The drop in DO is the BOD. ATU means that allyl thiourea (ATU) has been added to suppress nitrification during the course of the test.	
0111	Ammoniacal Nitrogen as N	Sources: sewage, manures, landfill leachate	https://www3.epa.gov/caddis/ssr_amm_wtl.html
0117	Nitrate as N	Needs converting to nitrate if compared to 50mg/l drinking water standard	
0119	Ammonia un-ionised as N	Unionised ammonia is very toxic to aquatic animals.	
0135	Solids, Suspended at 105 C	Sources: livestock, bank erosion, land cultivation, storm runoff, dredging...	https://www3.epa.gov/caddis/ssr_sed_wtl.html
0162	Alkalinity to pH 4.5 as CaCO3	Used in setting ammonia and phosphate WFD thresholds.	
0180	Orthophosphate, reactive as P	There are several types of P but this is the bio-available one. Sources: sewage, manures...	
9901	Oxygen, Dissolved, % Saturation	DO is complex and not easy to interpret	

WFD class thresholds

Thresholds for ammonia and dissolved oxygen are given in the document on WFD standards (Defra 2015 - see References). The phosphate thresholds are site-specific and may be derived from the UKTAG River Phosphorus Calculator (UKTAG website - see References).

The current WFD class thresholds for ammonia (N) for rivers at an altitude lower than 80 mAOD are given in the table below (taken from Defra 2015).

Class	Total ammonia as nitrogen (N) (mg/l) 90 percentile
High	<0.3
Good	0.3 - 0.6
Moderate	0.6 - 1.1
Poor	1.1 - 2.5
Bad	>2.5

Table - WFD class thresholds for ammonia (N) for rivers at an altitude lower than 80 mAOD.

This means that if 90% of the measurements are within the range 0.3 - 0.6 mg/l the river will be classed as Good status at that sampling point. Or putting it another way, up to 10% of the measurements can be worse than the threshold (>0.6 mg/l) and the sampling point will still be classed as Good status.

So ammonia measurements that are regularly higher than 0.6 mg/l will indicate that the river is failing the WFD standard at that sampling point and measurements that are regularly higher than 2.5 mg/l indicate that the river is Bad at that location.

References

Defra 2015. The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015. (<http://www.legislation.gov.uk/uksi/2015/1623/resources> and http://www.legislation.gov.uk/uksi/2015/1623/pdfs/ukiod_20151623_en_auto.pdf).

UKTAK. Phosphorus Standards (<http://www.wfduk.org/resources/rivers-phosphorus-standards>).

USEPA. CADDIS website (<https://www3.epa.gov/caddis>).