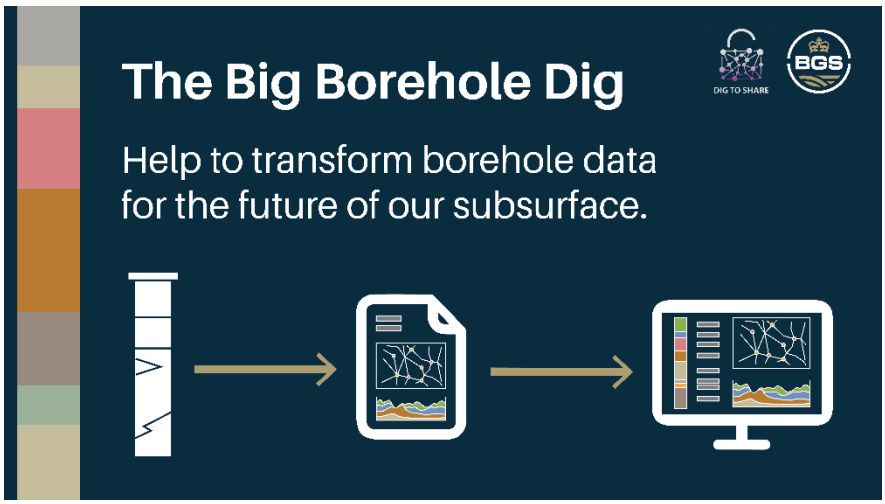
British Geological Survey

Big Borehole Dig Training Document

Digital Programme

Open Report OR/21/058



BRITISH GEOLOGICAL SURVEY

DIGITAL PROGRAMME

OPEN REPORT OR/21/058

Big Borehole Dig Training Document

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BRITISH GEOLOGICAL SURVEY

The full range of our publications is available from BGS shops at Nottingham, Edinburgh, London and Cardiff (Welsh publications only) see contact details below or shop online at www.geologyshop.com

The London Information Office also maintains a reference collection of BGS publications, including maps, for consultation.

We publish an annual catalogue of our maps and other publications; this catalogue is available online or from any of the BGS shops.

The British Geological Survey carries out the geological survey of Great Britain and Northern Ireland (the latter as an agency service for the government of Northern Ireland), and of the surrounding continental shelf, as well as basic research projects. It also undertakes programmes of technical aid in geology in developing countries.

The British Geological Survey is a component body of UK Research and Innovation.

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The Idea

The British Geological Survey (BGS) holds a database of over 1.4 million borehole records, each containing a range of information.

You can access digital scans of open data in the BGS archive via our GeoIndex viewer. Despite being held in digital format (usually PDF), the data within these documents is not yet in a useable format.

We believe it is essential that future generations have access to historical borehole data as Association of Geotechnical and Geoenvironmental Specialists (AGS) file format. By converting this data to AGS format, we can improve the availability and accessibility of borehole information to a wider audience and enable users to build better models, save costs on construction projects and reduce the amount of time lost due to unforeseen ground conditions.

After converting the data, we estimate that over 800 000 more downhole geology logs will be available for everyone to use. This information can feed directly into site investigations, conceptual ground models and academic projects, as well as provide the data necessary to perform even greater analyses on our subsurface in future.

The Big Borehole Dig aims to give people around the country the tools they need to:

- digitise downhole information
- create an AGS file
- send it back to BGS to store

This way everyone can benefit. By helping us to standardise data, your contribution will help the UK take steps towards becoming a major subsurface information manager.

This document

This document aims to give you all the information you need to install and use the software, access the information, create the borehole geological logs, export the data in the right format, and submit the data to BGS. Further help is available via the two authors should you need it, but other resources are available (such as training videos for the Groundhog software) on YouTube. The Appendix also lists some useful notes on what information to look out for, and problems regularly encountered when working with borehole logs.

User requirements

Everyone reading this document and thinking about taking part in the Big Borehole Dig should ideally:

- Be working/studying in a “geological” context
- Understand a little about what information is held in a borehole log, and a borehole scan
- Be able to install the Groundhog Desktop software on their own computer, or have access to Holebase
- If you also know a bit about the AGS standard then that would help

What next?

We invite you to read through this document, which has lots of information and guidance on coding your first boreholes. To avoid too many boreholes being coded incorrectly, we ask that submit your first few (up to 10) initially, then wait a few days to check that your first submission is accepted before proceeding.

If we notice any problems with your data submission, then we'll get in touch. If you don't hear from us within five days, you can assume that your submission has been accepted and you can proceed to code as many boreholes as you can. If you need any help at any point, please email the authors (sthorpe@bgs.ac.uk or adam.dargan@atkinsglobal.com) and they will respond as quickly as possible.

You can also check your own file by using the BGS online AGS Validation Tool:

https://agsapi.bgs.ac.uk/

STEP 1: INSTALLING GROUNDHOG DESKTOP SOFTWARE

Groundhog Desktop is a piece of software that BGS have developed over the last 6 years, to help visualise boreholes, create tools for constructing cross-sections and drawing your own conceptual geology into those cross-sections. It allows you to use maps as backdrops to your project and quickly gives you access to BGS' main data holdings. We will use Groundhog to access the borehole data for the Big Borehole Dig, and use the borehole logging tools to code the geology into your boreholes.

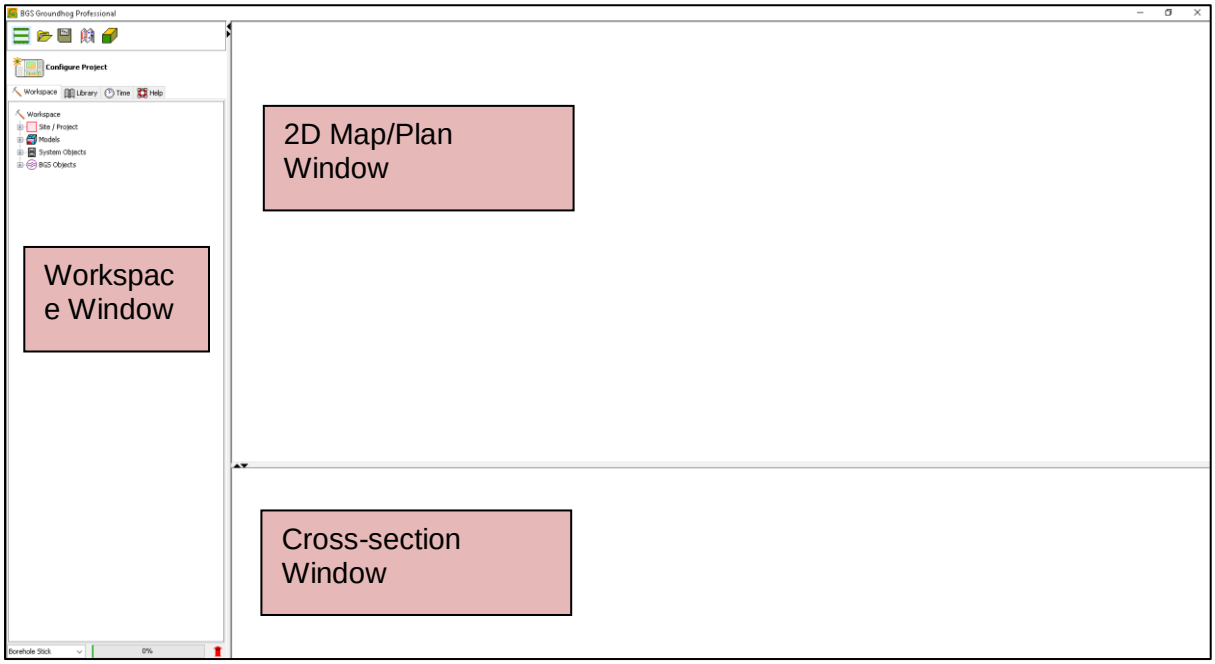
To download the latest version of the software please visit: www.bgs.ac.uk/groundhog

Once installed you should see the Groundhog Desktop icon on your own desktop:

Double-click this to open the software.

STEP 2: GETTING TO KNOW GROUNDHOG

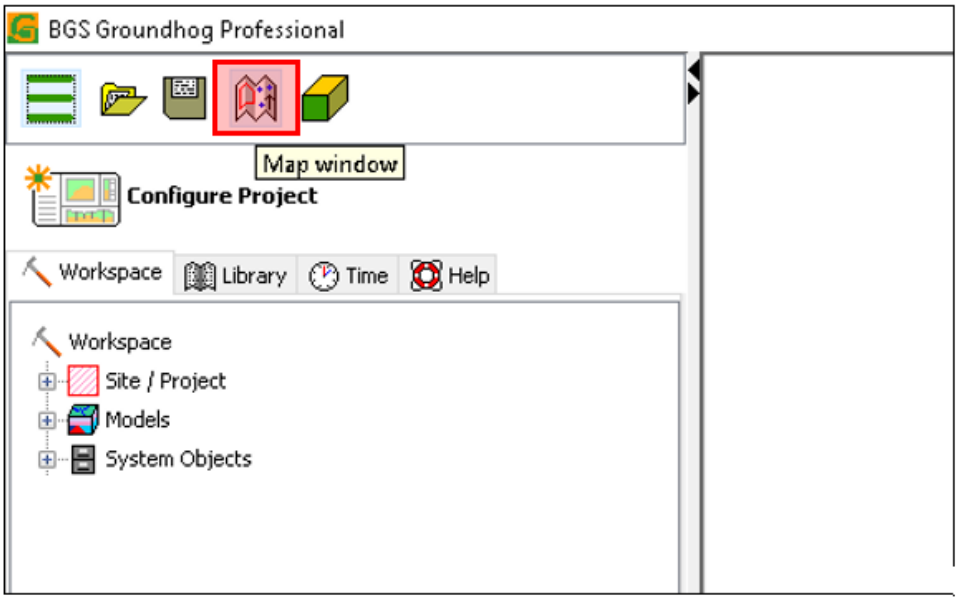
This is the Groundhog layout. Each of the different panes below deal with different areas of the drawing process:



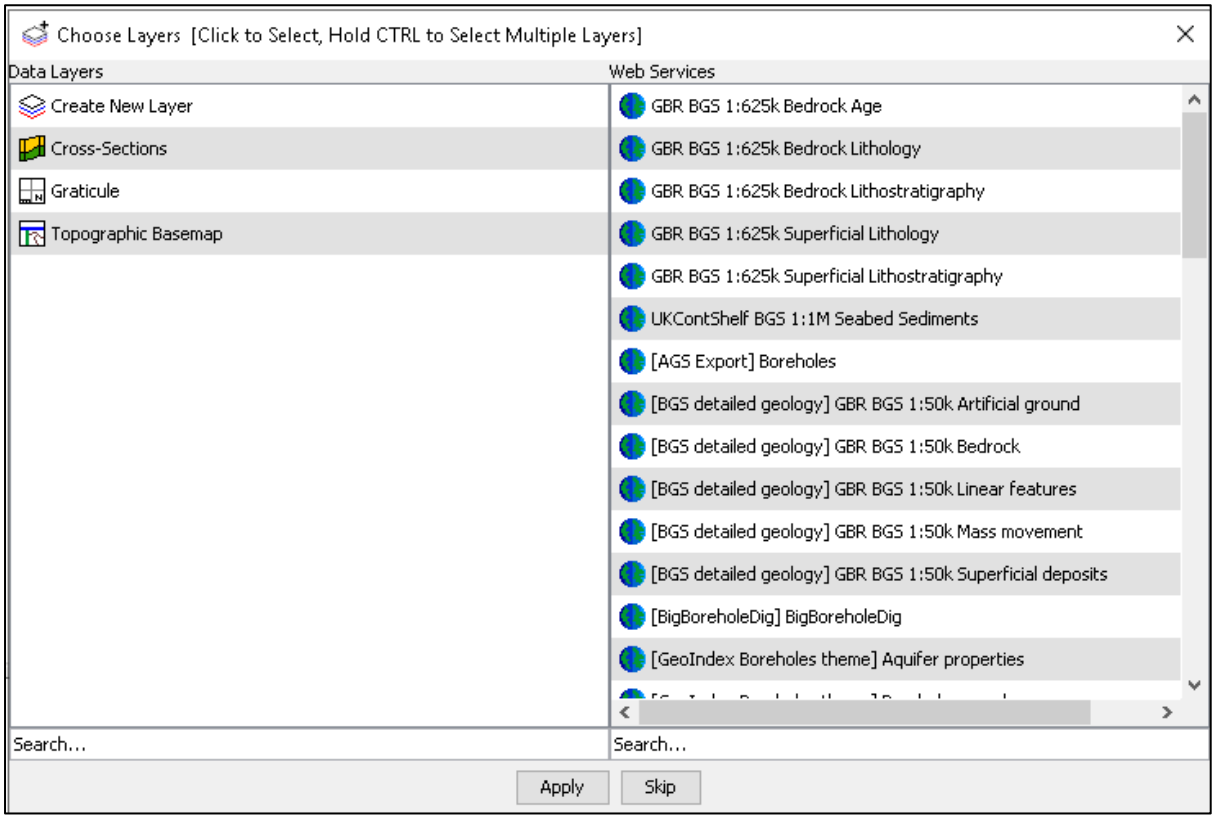
For the Big Borehole Dig project we will not be using the Cross-section window (but feel free to play with it, of course!)

STEP 3: OPEN A NEW MAP WINDOW

Click on the "Map window" button from the top left menu bar (highlighted in the red box):



This should open a dialogue box which allows you to choose various datasets, such as:



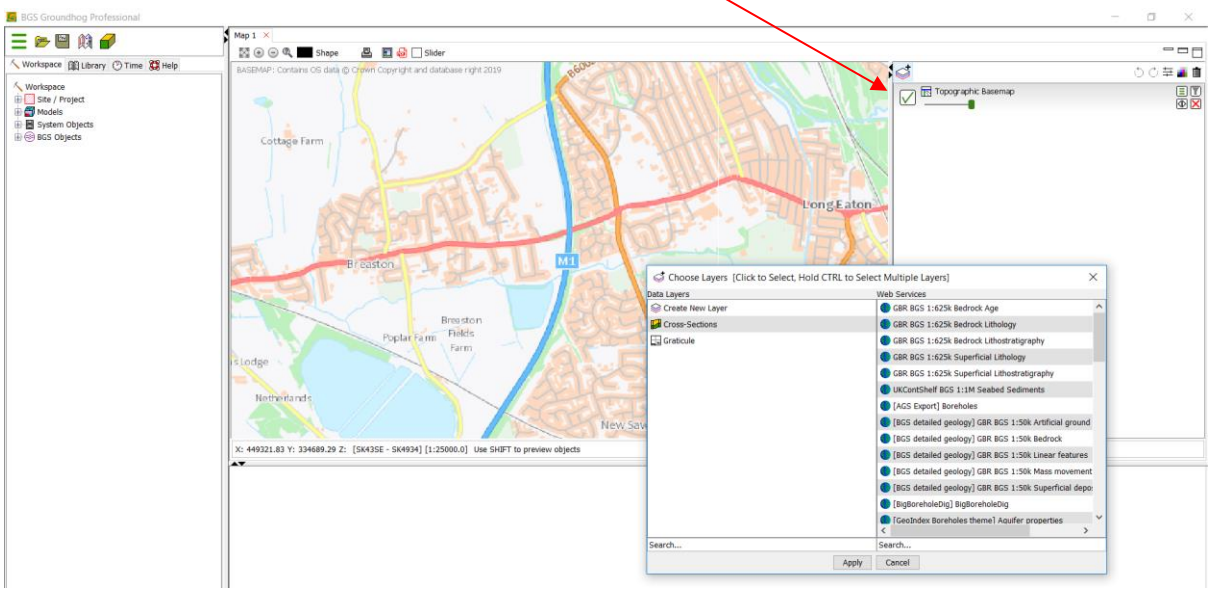
Left-click on “Topographic Basemap” (on the left-hand window pane) and click Apply.

This will open a map window and load a map of the UK (depending on the speed of your internet connection). You can zoom in and out using the scroll wheel of your mouse, and left-click + drag to move the map around.

There is a Gazetteer to find places of interest. Search for your home town, or maybe a project area you know well, to start your Big Borehole Dig project.

STEP 4: ADD THE "BIG BOREHOLE DIG" TO THE MAP

The Big Borehole Dig has a very specific set of borehole data that we need to use. To add the Big Borehole Dig data to our map, click on the Add Map Contents button above the map data on the right hand panel. This will open the dialog box shown. Click on "BigBoreholeDig" in the Web Services panel on the right to select it, then click Apply.



This map shows you every borehole that needs coding for the Big Borehole Dig Project. The idea is that once you have submitted your data and it has been successfully received and allocated to our borehole records, the WMS will remove the borehole and you won't see it in the layer any more. There is a slight delay in the process however, with boreholes taking a few days to be allocated and matched to the BGS records, so as you progress through the project you will need to ensure that you don't duplicate your own work!

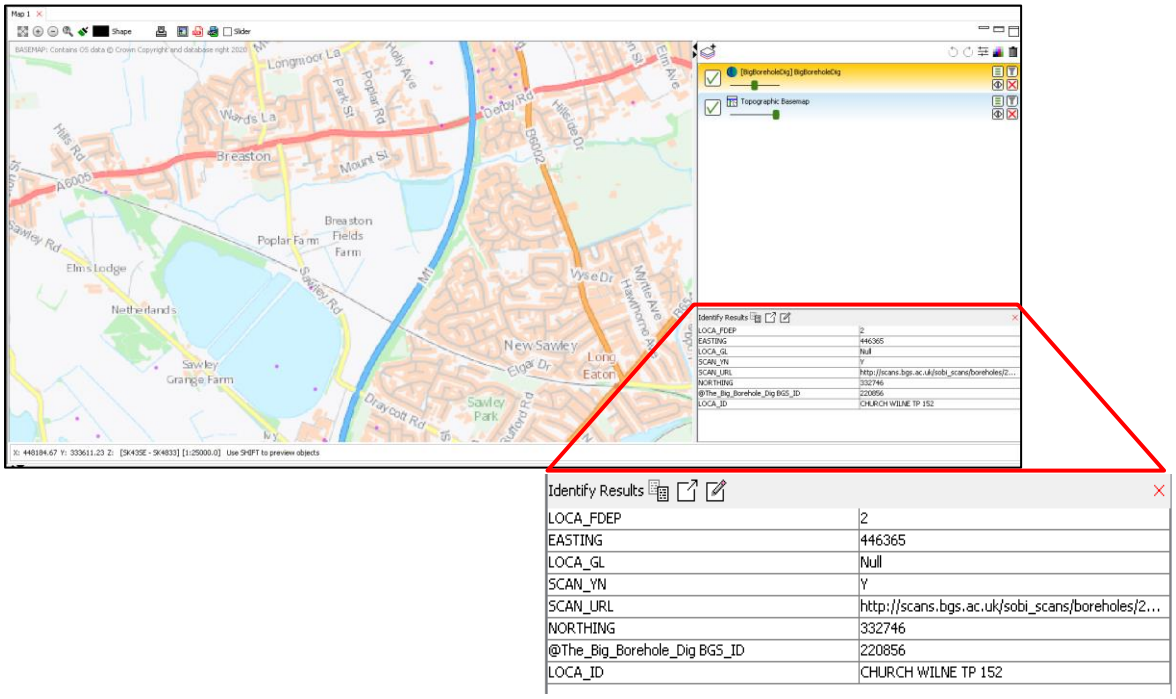
STEP 5: SAVING YOUR PROJECT

Now is a good point to save your work. Click on the Save icon from the top icon menu. Give your Groundhog project a name (BigBoreholeDig, for example) and save it somewhere memorable on your computer. Throughout your use of Groundhog it is recommended to

save this file so you don't lose any work – there is no autosave. When you click on the Save icon, Groundhog will always ask you to save to a location. You can overwrite your file.

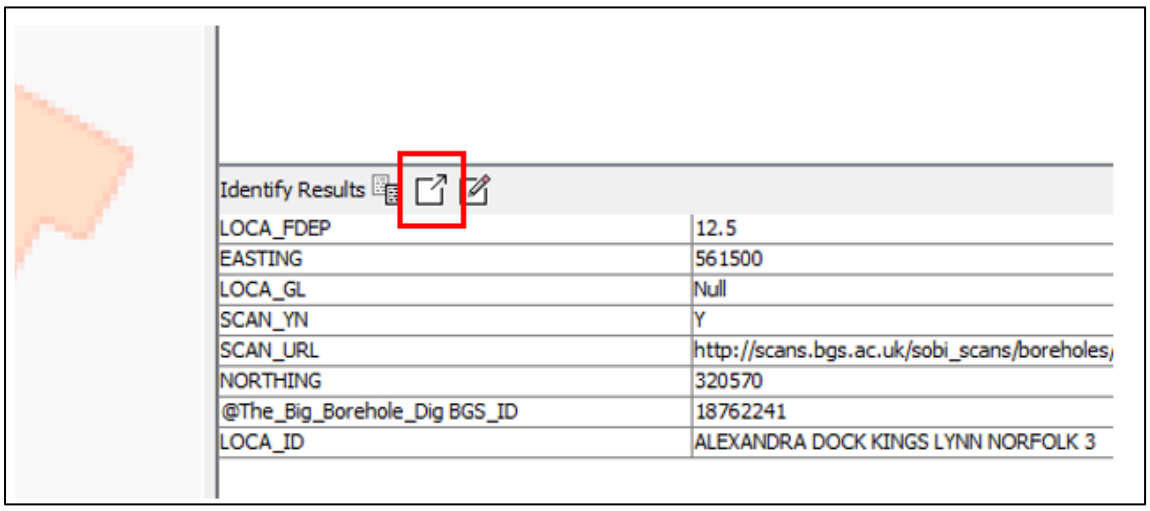
STEP 6: VIEWING BOREHOLE INFORMATION

The Big Borehole Dig layer shows us metadata relating to each borehole. We need to access this metadata to help us convert the WMS into an actual Groundhog borehole. To do this we first have to make the Big Borehole Dig layer active by left-clicking in the Layer Control Tab (it will turn orange). Left click a borehole in the map window to display its metadata.



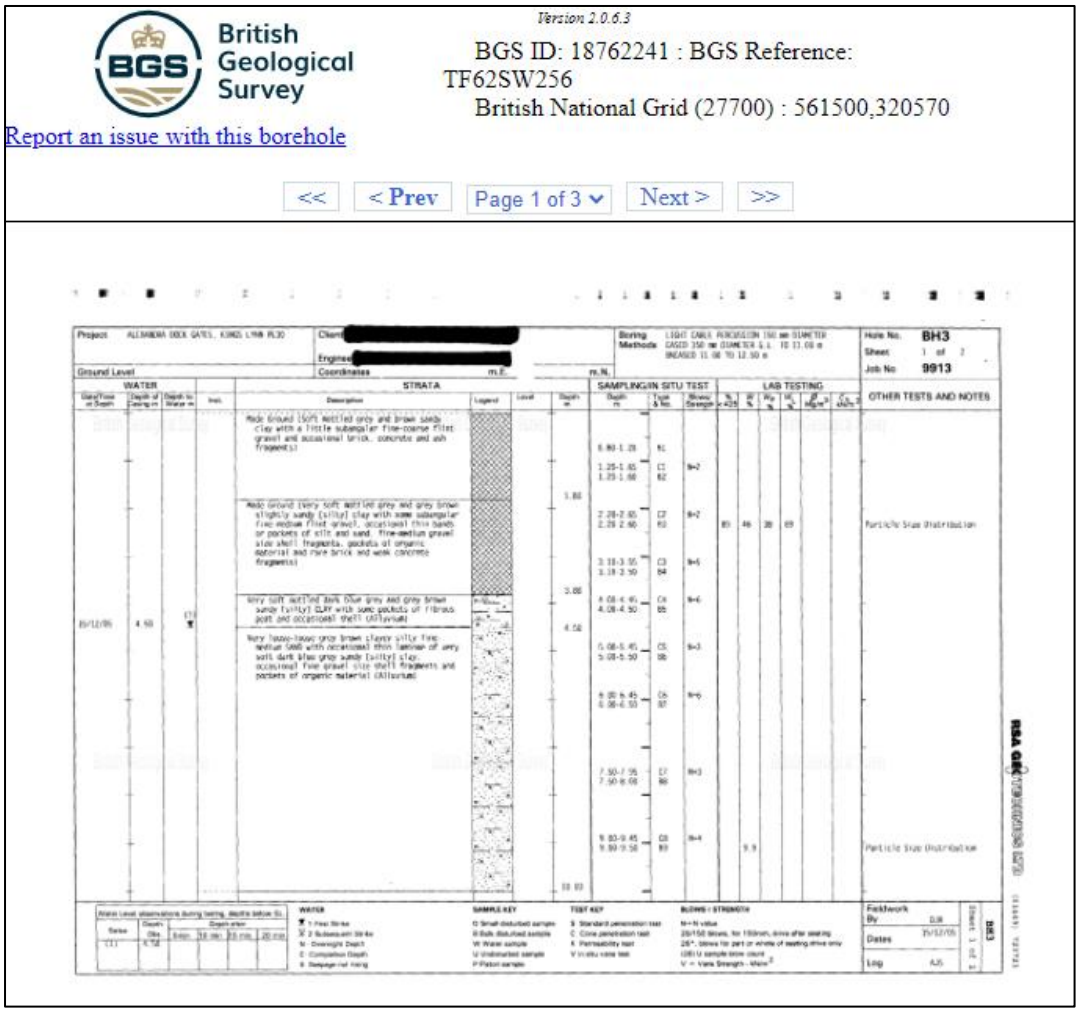
STEP 7 VIEWING BOREHOLE INFORMATION

In the identify panel, use this button to open the PDF scan of the original driller's log.

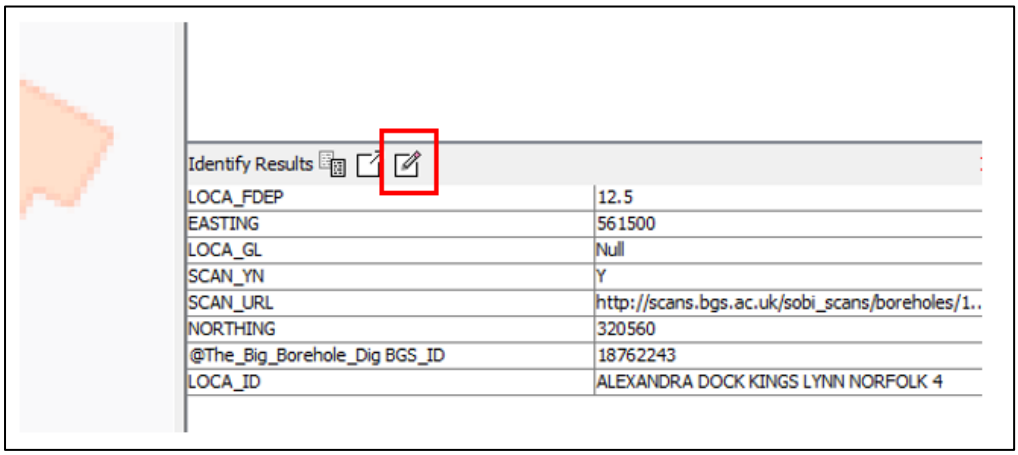


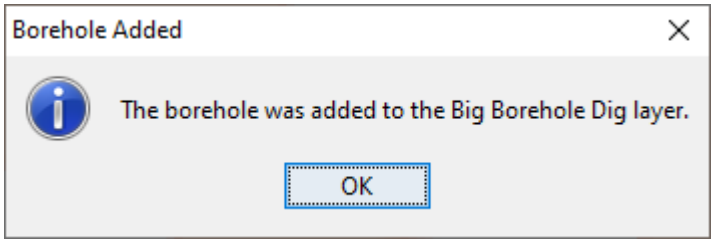
The driller's log contains information about who, where and when the borehole was drilled, together with the geology encountered by the driller. You can use the information to decide whether you wish to proceed with digitizing this location. Your decision will be based on:

1. Whether you can read the log (sometimes they are blurry, or the handwriting is illegible)
2. Whether the log actually contains geological info. Sometimes there is just information on water for example, or there is simply no geology at all.

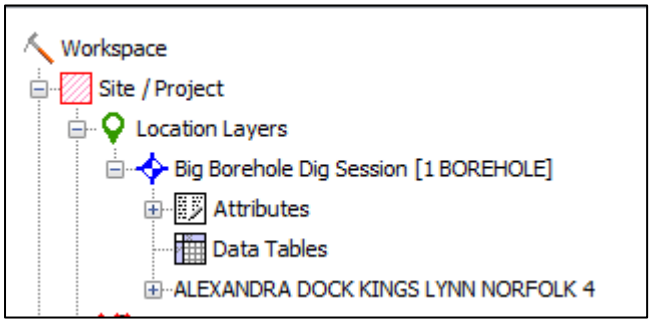


If you decide to work on this record, click this button in the identify panel (highlighted in red below) to pull the record into your Groundhog project.



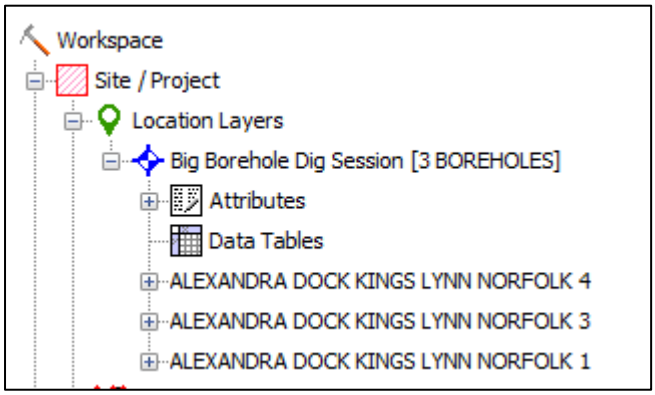


The location will be added as a “borehole” object in the Location Layer of the data tree on the left-hand side, in a special dataset folder called ***Big Borehole Dig Session***.



Continue exploring the map, clicking on points and trying to find a pattern of boreholes that belong to the same Ground Investigation. **It’s important that you digitise all the boreholes relating to one ground investigation project, and not mix and match boreholes from different projects or companies.**

Once you have chosen all your locations to digitise and added them to your project you should have something like this. Here we have added a total of 3 locations to the BBD Session.



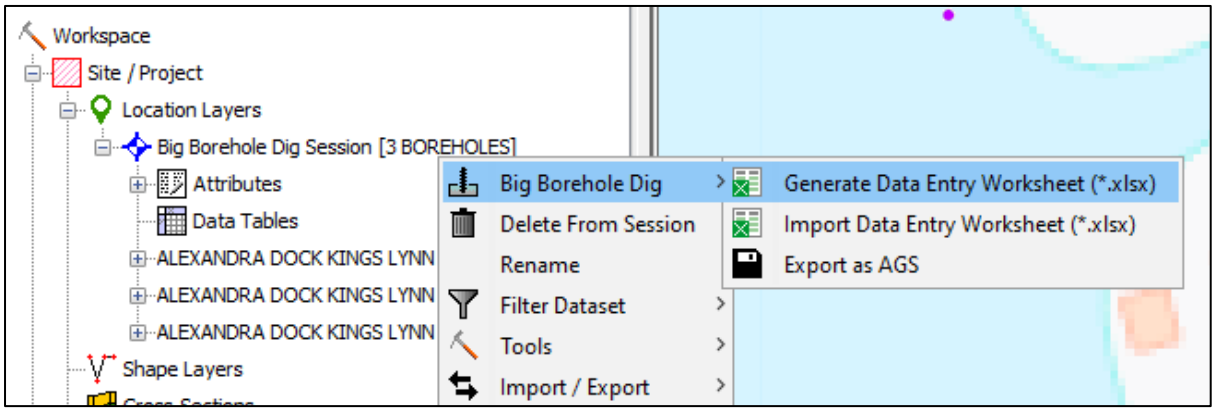
IMPORTANT: Please only work on locations that belong to the same engineering project at a time. Do not mix locations from multiple projects. Instead, work on one project at a time, starting a new Groundhog session each time. This is because AGS rules only permit data from one project in an AGS data file, but Groundhog does not have the necessary information at this point to enforce this rule, so you will need to manage this yourself. The information in the driller’s logs and the IDs of the locations should give you enough to go on in this respect, so just use your own judgement here.

Before proceeding, it is a good idea to save your Groundhog project.

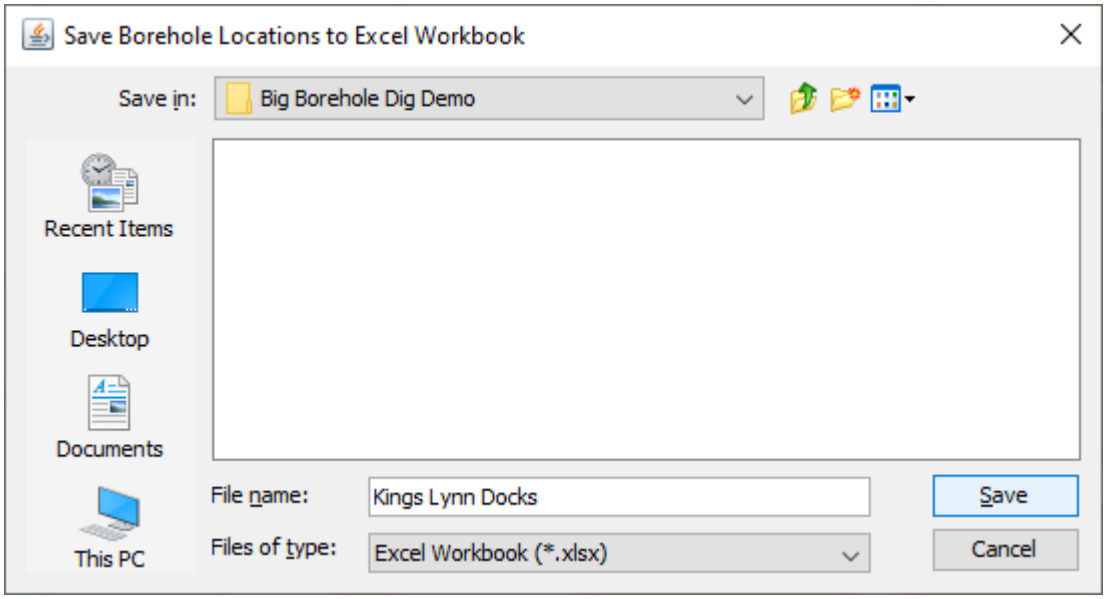
STEP 8: PREPARING BOREHOLES FOR EXCEL WORKBOOK

These boreholes can now be exported to an Excel workbook.

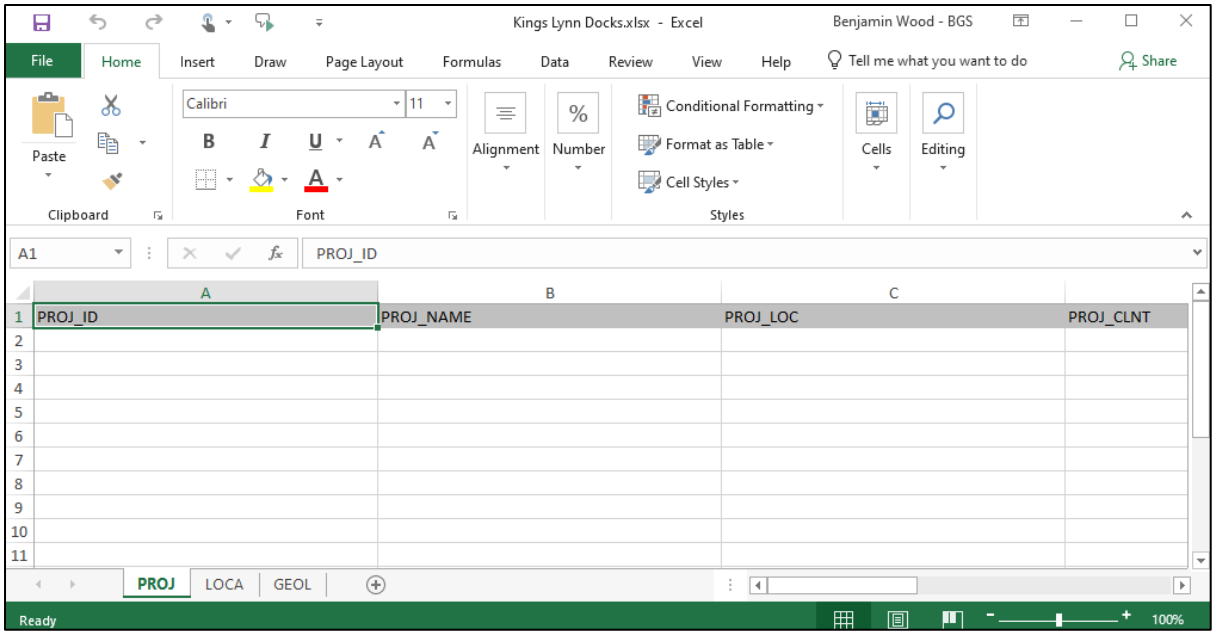
Right-click on the Big Borehole Dig Session layer in the data tree and choose Big Borehole Dig > Generate Data Entry Worksheet (*.xlsx)



Choose a folder location and enter a name to save the Excel file to.



The Excel workbook should open automatically. If it does not, simply open from the Windows folder you saved to.



IMPORTANT: Do not change the column order, column names, column data types or add your own columns to the workbook as this will invalidate the data when you come to re-import to Groundhog in the next step.

STEP 9: ADDING GEOLOGY AND BOREHOLE DETAILS

The workbook has three worksheets.

1. PROJ – for the project information
2. LOCA – for the location information
3. GEOL – for the geological log information

PROJ

In this sheet you should only complete row 2. Use the information on the driller's logs to complete as many fields as you can.

1. PROJ_ID – a unique ID for the project. If this is not clear, use the name of the project instead.
2. PROJ_NAME – the name of the project.
3. PROJ_LOC – a general description of the locality of the project e.g. "King's Lynn Docks".
4. PROJ_CLNT – the client for the project.
5. PROJ_CONT – the contractor for the project.
6. PROJ_ENG – the consultant/engineer for the project.

A completed PROJ sheet might look like this.

	A	B	C	D	E	F
1	PROJ_ID	PROJ_NAME	PROJ_LOC	PROJ_CLNT	PROJ_CONT	PROJ_ENG
2	ABC 123	KL Docks	King's Lynn Docks	Port Authority	KL Drillers	Norfolk Engineering Ltd

LOCA

You will see that the LOCA sheet is already partially populated with the information from the Big Borehole Dig web service.

	A	B	C	D	E	F	G	H
1	LOCA_ID	LOCA_TYPE	LOCA_NATE	LOCA_NATN	LOCA_GREF	LOCA_GL	LOCA_REM	LOCA_FDEP
2	ALEXANDRA DOCK KINGS LYNN NORFOLK 4		561500	320560	OSGB		http://scans.bgs.ac.uk/sobi_	12.5
3	ALEXANDRA DOCK KINGS LYNN NORFOLK 3		561500	320570	OSGB		http://scans.bgs.ac.uk/sobi_	12.5
4	ALEXANDRA DOCK KINGS LYNN NORFOLK 1		561490	320570	OSGB		http://scans.bgs.ac.uk/sobi_	20
5								

You should edit this sheet by entering values for LOCA_TYPE and LOCA_GL.

- LOCA_TYPE is the drilling type/method recorded on the driller's log, e.g. CP (Cable percussion), RC (Rotary cored), or in most cases use BH (Borehole, if nothing is recorded or obvious then use this code).
- LOCA_GL is the ground level recorded on the driller's log. Beware ground levels recorded in feet rather than metres (please convert it before entering in the spreadsheet). Below is an example of a completed LOCA sheet.

	A	B	C	D	E	F	G	H
1	LOCA_ID	LOCA_TYPE	LOCA_NATE	LOCA_NATN	LOCA_GREF	LOCA_GL	LOCA_REM	LOCA_FDEP
2	ALEXANDRA DOCK KINGS LYNN NORFOLK 4	CP	561500	320560	OSGB	2.5	http://scans.bgs.ac.uk/sobi_	12.5
3	ALEXANDRA DOCK KINGS LYNN NORFOLK 3	CP	561500	320570	OSGB	2.7	http://scans.bgs.ac.uk/sobi_	12.5
4	ALEXANDRA DOCK KINGS LYNN NORFOLK 1	CP	561490	320570	OSGB	3.1	http://scans.bgs.ac.uk/sobi_	20
5								

GEOL

This is where most of the work is done. In this sheet the geology information from the driller's log is entered. Work one location at a time, creating a new row for each interval of geology in the log. Make sure to accurately copy-paste the LOCA_ID from the LOCA sheet into each row to ensure the ID can be used to link locations with the corresponding intervals of geology.

Here is an example of a completed GEOL sheet for 3 shallow boreholes. The rows for each location are highlighted here in different colours for demo purposes. Note that each location can have as many rows of data as necessary to digitize the intervals of geology described in the geology log.

	A	B	C	D	E	F
1	LOCA_ID	GEOL_TOP	GEOL_BASE	GEOL_DESC	GEOL_LEG	GEOL_GEOL
2	ALEXANDRA DOCK KINGS LYNN NORFOLK 4	0	3.5	Silty Clay	221	KL clay
3	ALEXANDRA DOCK KINGS LYNN NORFOLK 4	3.5	5.2	Silt	301	KL silt
4	ALEXANDRA DOCK KINGS LYNN NORFOLK 3	0	1.2	Silty Clay	221	KL clay
5	ALEXANDRA DOCK KINGS LYNN NORFOLK 1	0	0.8	Made Ground	102	Made Ground
6	ALEXANDRA DOCK KINGS LYNN NORFOLK 1	0.8	4.2	Clay	201	KL clay
7						

Column meanings;

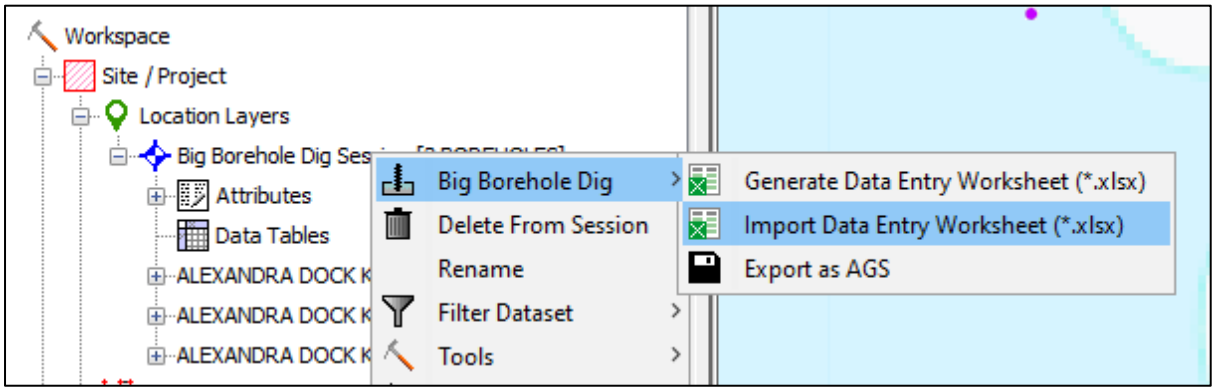
1. GEOL_TOP – the depth to the top of the interval. Always starts at 0 (m) at the top of the log and increases downwards
2. GEOL_BASE – the depth from the surface to the base of the interval.
3. GEOL_DESC – a description of the lithological layer, as recorded on the log.
4. GEOL_LEG – the 3-digit AGS legend code for the recorded lithology.
5. GEOL_GEOL – the geological unit name, if recorded.

Once you have entered all of the data, save the workbook and return to your Groundhog project.

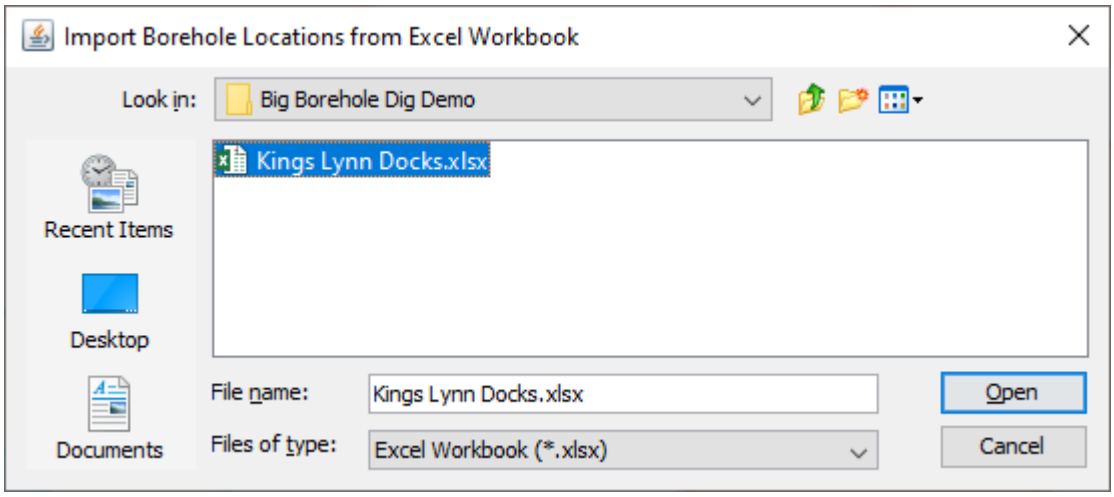
STEP 10: IMPORTING YOUR BOREHOLE DATA BACK TO YOUR GROUNDHOG PROJECT

The borehole geology information can now be imported back into your Groundhog project.

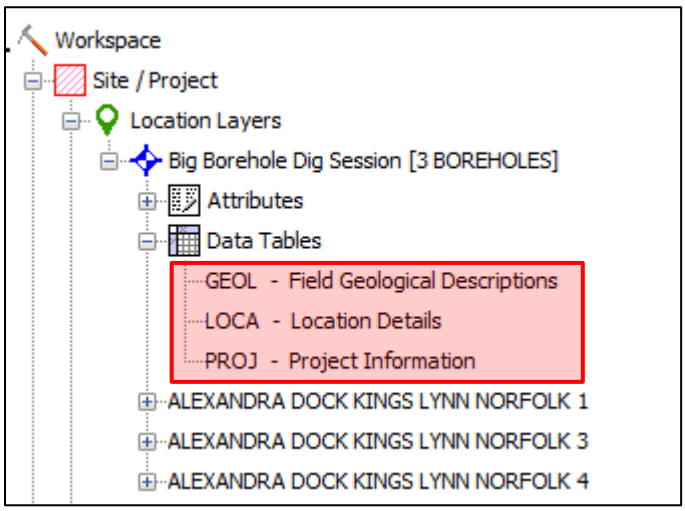
Right-click on the Big Borehole Dig Session layer in the data tree and choose: Big Borehole Dig > Import Data Entry Worksheet (*.xlsx) to import the digitized data.



Navigate to your spreadsheet and click Open



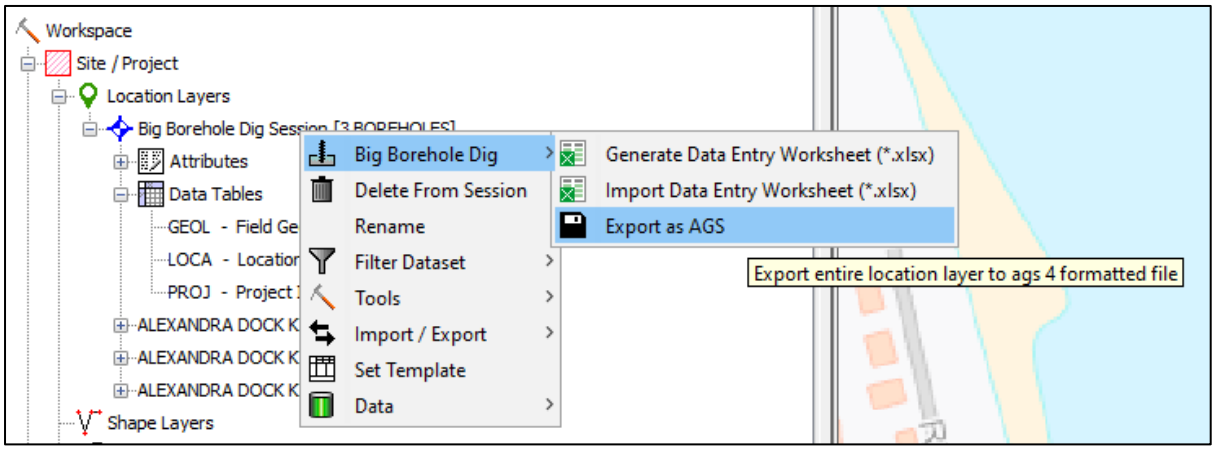
The data will be added to the Data Tables folder within the existing dataset.



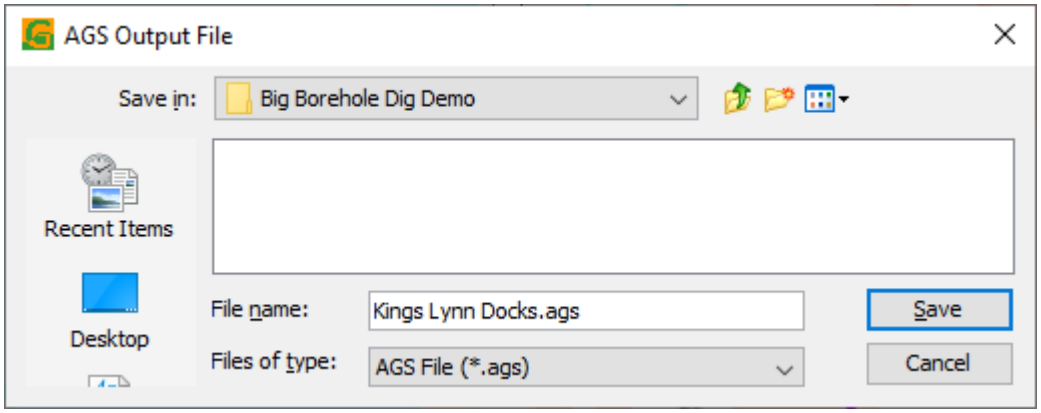
STEP 11: EXPORT YOUR BOREHOLES AS AGS FILE FORMAT

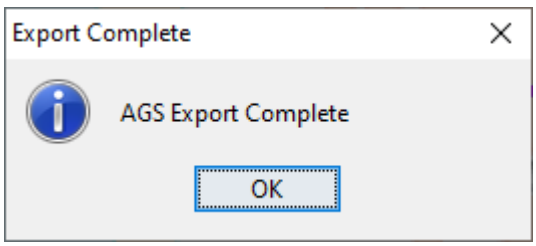
Finally, export this dataset to AGS format.

Right-click on the Big Borehole Dig Session layer in the data tree and choose: Big Borehole Dig > Export as AGS.



Chose a location for the AGS file.





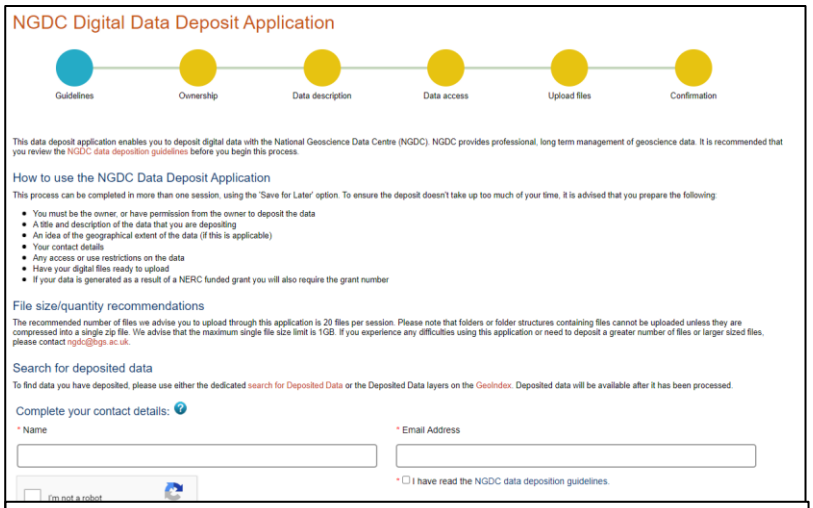
If you wish you can check your file by using the BGS Validator https://agsapi.bgs.ac.uk/

STEP 12: SENDING YOUR DATA TO BGS

To send your AGS files to the BGS for storage in the national archives we will use the Ingestion Portal.

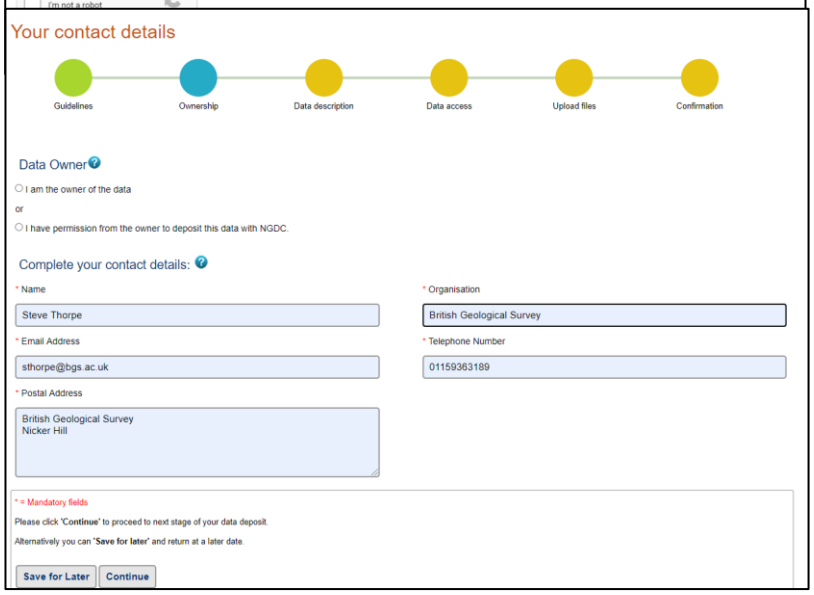
The Ingestion Portal (http://transfer.bgs.ac.uk/ingestion?) has a few stages for you to provide some metadata for your deposit. The following stages should be followed:

Stage One: Enter name and email address



Stage two: Enter your organisation (this can be your work, or personal address).

Ensure to tick “I am the owner of this data” as it is you that generated the AGS file.



Stage three: *please enter the information in the boxes as follows:*

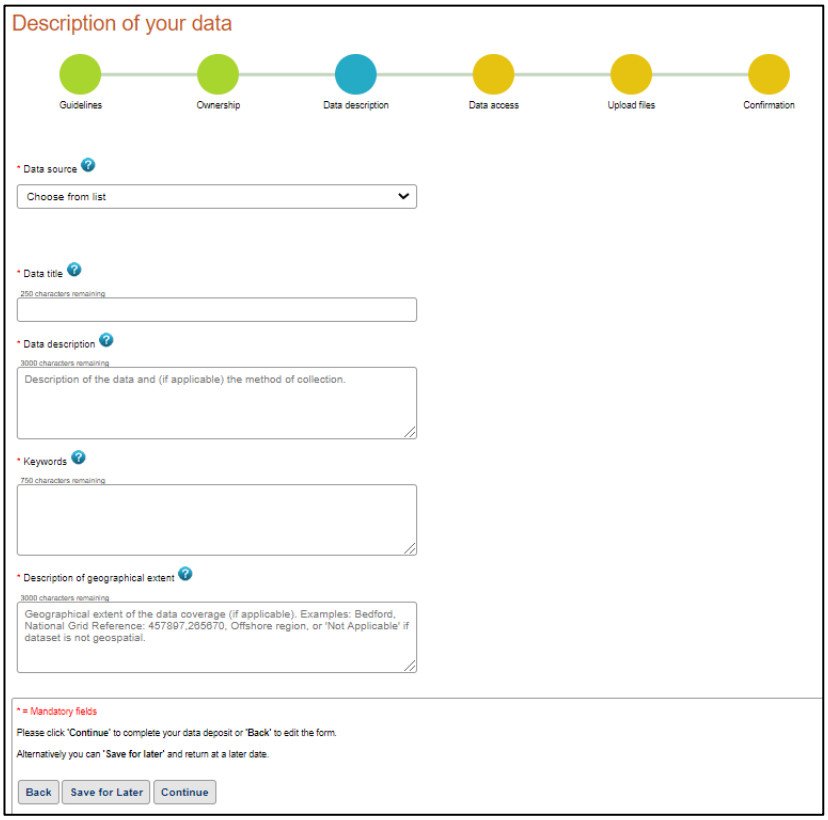
Data Source = Volunteer;

Data Title = name of the project layer containing the boreholes;

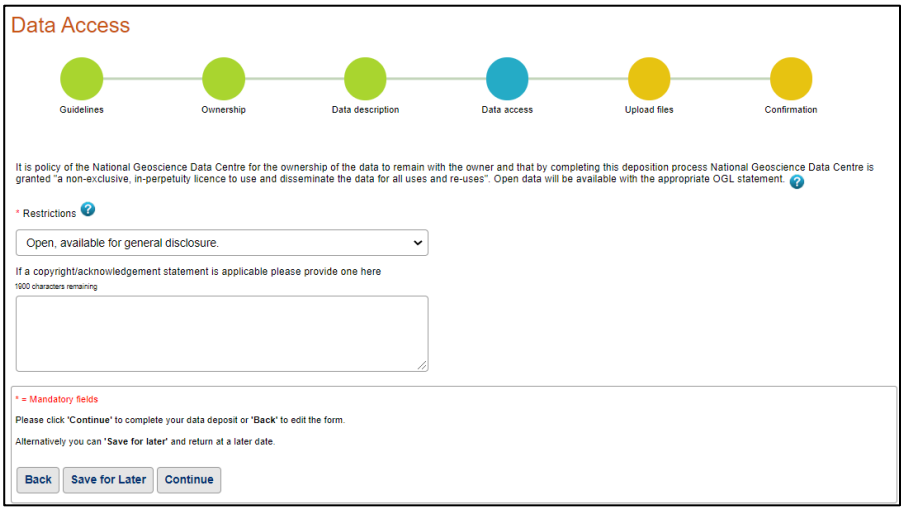
Data description = Please ensure that you enter this exact phrase: “(Number of boreholes in the AGS file) generated by Groundhog V2.0 for the Big Borehole Dig project 2020. AGS file contains only geology table”;

Keywords = AGS, Boreholes, Geology;

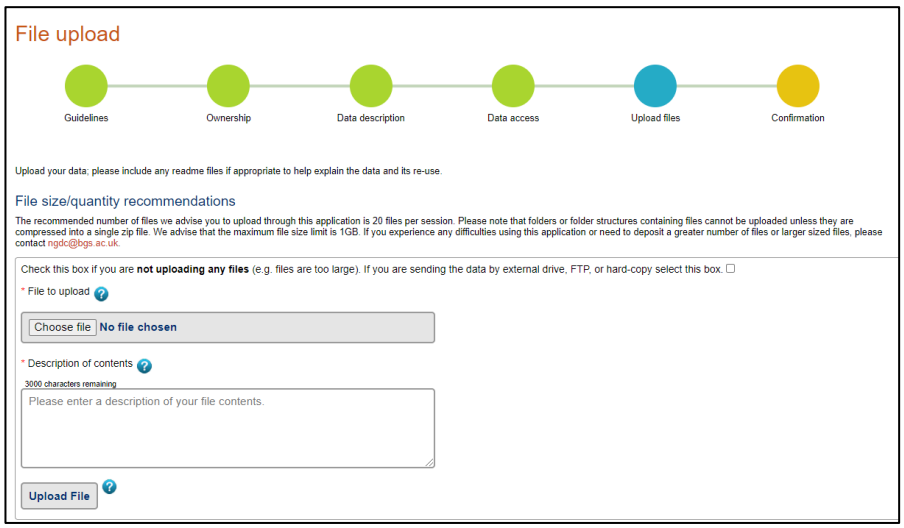
Geographical extent = nearest town or grid reference for the borehole/middle of the project



Stage four: Data Access – leave this as Open - all data generated has come from openly available boreholes.



Stage five: Upload your AGS file

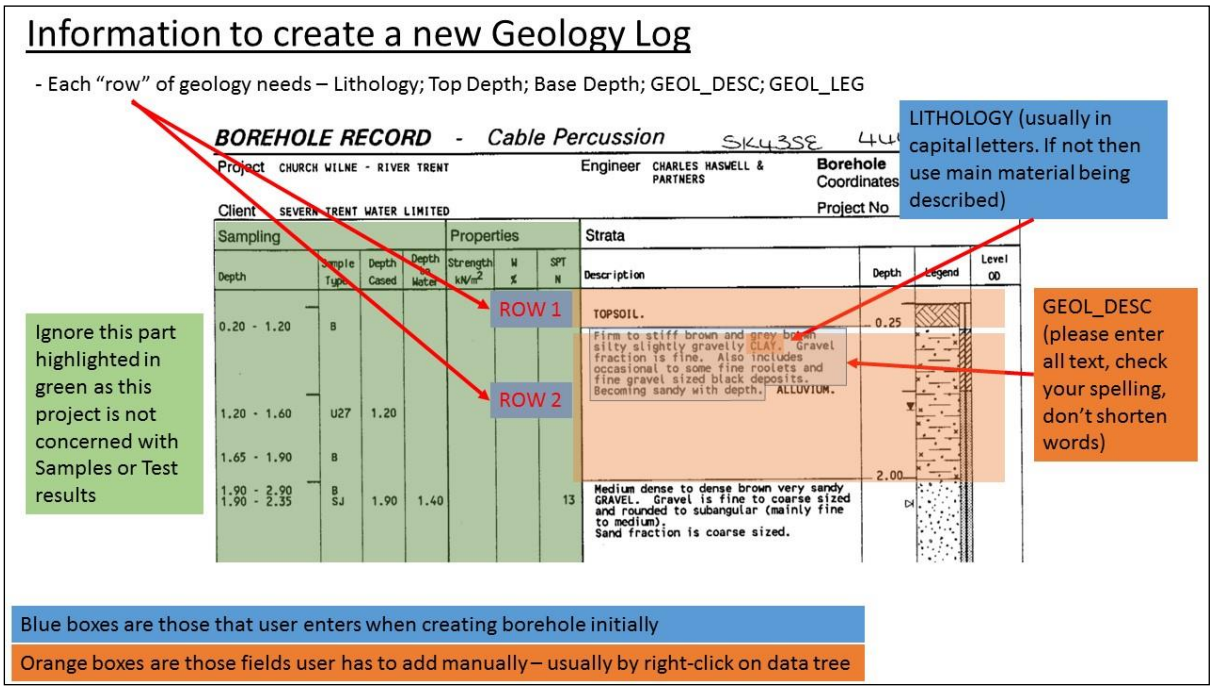


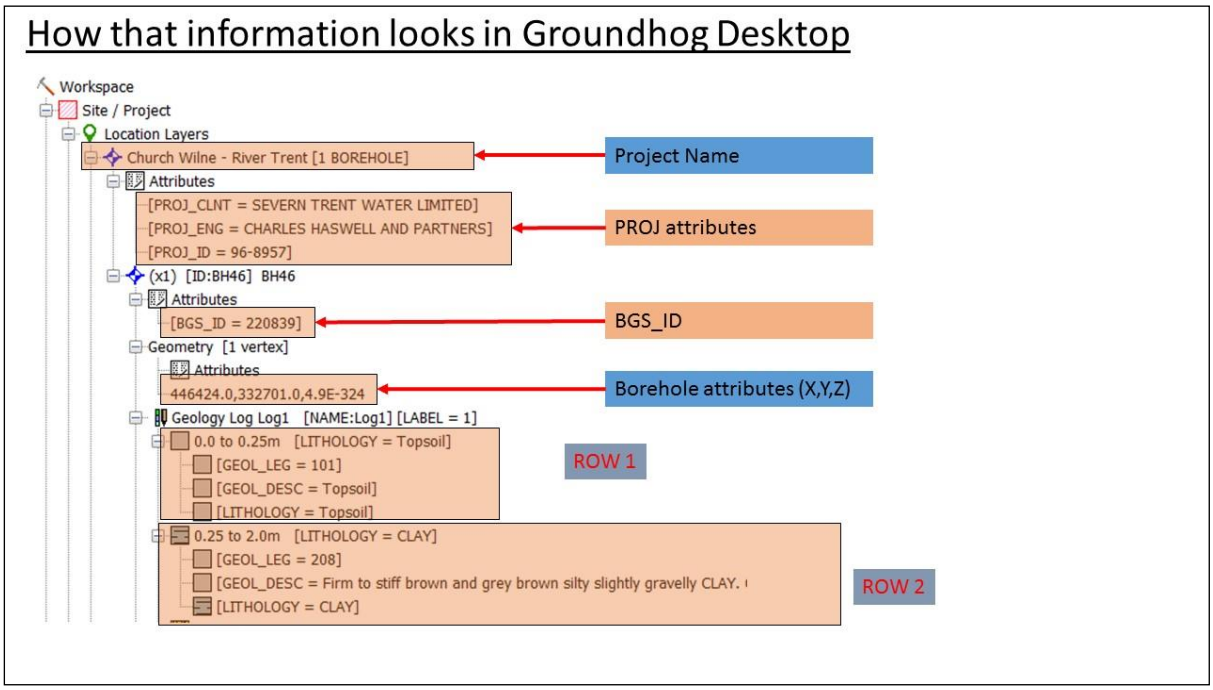
Stage six: Confirmation

You should receive an email letting you know that your deposit has been submitted successfully. BGS don't follow up with a success of ingestion, so you need to keep your own record of progress. However, after a few days you should see that the Big Borehole DIG WMS layer will no longer show your boreholes, and after 2 weeks the boreholes should appear on the AGS layer in the GeoIndex.

Appendix

HOW TO FIND THE BOREHOLE INFORMATION FROM SCAN





AGS FIELDS TO INCLUDE

Some AGS fields need to be included with each borehole (where info allows). Right-click on the Project Name and select TOOLS -> ADD ATTRIBUTE and add these 5 new attributes to each of your projects:

PROJ_ID – Project ID

PROJ_NAME – Project Name

PROJ_LOC – Project Location

PROJ_CLNT = Project Client

PROJ_CONT – Project Contractor

PROJ_ENG – Project Engineer

GEOL_LEG CODES

Code	Description
101	TOPSOIL
102	MADE GROUND
103	Bituminous Material
105	Undefined
201	CLAY
202	Silty CLAY
203	Sandy CLAY
204	Gravelly CLAY
205	Cobbly CLAY
206	Bouldery CLAY
207	Silty sandy CLAY
208	Silty gravelly CLAY
209	Silty cobbly CLAY
210	Silty bouldery CLAY
211	Silty sandy gravelly CLAY
212	Silty sand cobbly CLAY
213	Silty sandy bouldery CLAY
214	Silty sandy gravelly cobbly CLAY
215	Silty sandy gravelly bouldery CLAY
216	Silty sandy gravelly cobbly bouldery CLAY
217	Silty sandy organic CLAY
218	Silty sandy gravelly organic CLAY
219	Silty organic CLAY
220	Sandy gravelly CLAY
221	SILT/CLAY
222	Sandy cobbly CLAY
223	Sandy bouldery CLAY
224	Sandy gravelly cobbly CLAY
225	Sandy gravelly bouldery CLAY
226	Sandy gravelly cobbly bouldery CLAY
227	Sandy organic CLAY
228	Sandy gravelly organic CLAY
229	Organic CLAY
230	Sandy gravelly cobbly SILT/CLAY
231	Sandy gravelly bouldery SILT/CLAY
232	Sandy gravelly cobbly bouldery SILT/CLAY
233	Sandy peaty SILT/CLAY
234	Sandy gravelly peaty SILT/CLAY
235	Peaty SILT/CLAY
301	SILT
302	Clay/Silt
303	Sandy SILT
304	Gravelly SILT
305	Organic SILT
306	Peaty SILT
307	Gravelly SILT
308	Sandy gravelly SILT
309	Bouldery SILT
310/312	Sandy gravelly SILT
314	Clayey sandy gravelly organic cobbly SILT
316	Sandy cobbly SILT
317	Sandy bouldery SILT
318	Sandy organic SILT
319	Sandy gravelly organic SILT
320	Sandy gravelly cobbly SILT
321	Sandy gravelly organic cobbly SILT
322	Gravelly cobbly SILT
323	Gravelly bouldery SILT
324	Gravelly organic SILT
325	Gravelly organic cobbly SILT
326	Cobbly SILT
327	Cobbly bouldery SILT
328	Organic cobbly SILT
330	Peaty SILT
331	Bouldery SILT
332	Peaty CLAY/SILT
333	Gravelly CLAY/SILT
334	Sandy gravelly CLAY/SILT
335	Bouldery CLAY/SILT
336	Sandy gravelly CLAY/SILT
337	Sandy gravelly peaty CLAY/SILT
338	Cobbly CLAY/SILT

339	Peaty CLAY/SILT
401	SAND
402	Clayey SAND
403	Silty SAND
404	Gravelly SAND
405	Cobbly SAND
406	Bouldery SAND
407	Clayey silty SAND
408	Clayey silty gravelly SAND
409	Clayey silty gravelly cobbly SAND
410	Clayey gravelly SAND
411	Clayey gravelly cobbly SAND
412	Silty gravelly SAND
413	Silty gravelly cobbly SAND
414	Silty gravelly cobbly bouldery SAND
415	Gravelly cobbly SAND
416	Gravelly cobbly bouldery SAND
417	Gravelly bouldery SAND
418	Cobbly bouldery SAND
430	SAND and GRAVEL
431	Organic SAND
432	Clayey peaty SAND
433	Silty organic SAND
434	Gravelly organic SAND
435	Cobbly organic SAND
436	Bouldery organic SAND
437	Clayey silty peaty SAND
438	Clayey silty gravelly peaty SAND
501	GRAVEL
502	Clayey GRAVEL
503	Silty GRAVEL
504	Sandy GRAVEL
505	Organic GRAVEL
506	Cobbly GRAVEL
507	Bouldery GRAVEL
508	Clayey silty GRAVEL
509	Clayey sandy GRAVEL
510	Clayey cobbly GRAVEL
511	Clayey bouldery GRAVEL
512	Clayey organic GRAVEL
513	Clayey silty sandy GRAVEL
514	Clayey silty cobbly GRAVEL
515	Clayey silty bouldery GRAVEL
516	Clayey silty peaty GRAVEL
517	Clayey sandy organic GRAVEL
518	Clayey silty sandy bouldery GRAVEL
519	Clayey silty sandy peaty GRAVEL
520	Silty sandy GRAVEL
521	Silty cobbly GRAVEL
522	Silty bouldery GRAVEL
523	Silty organic GRAVEL
524	Silty organic sandy GRAVEL
525	Sandy cobbly GRAVEL
526	Sandy bouldery GRAVEL
527	Sandy organic GRAVEL
528	Silty sandy cobbly GRAVEL
601	PEAT
602	Clayey PEAT
603	Silty PEAT
604	Sandy PEAT
605	Gravelly PEAT
606	Cobbly PEAT
607	Clayey silty PEAT
608	Clayey sandy PEAT
609	Clayey gravelly PEAT
610	Clayey silty sandy PEAT
611	Clayey silty sandy gravelly PEAT
612	Silty sandy PEAT
613	Silty sandy gravelly PEAT
614	Sandy gravelly PEAT
701	COBBLES
702	Clayey COBBLES
703	Silty COBBLES
704	Sandy COBBLES
705	Gravelly COBBLES
706	Organic COBBLES
707	Clayey silty COBBLES
708	Clayey sandy COBBLES
709	Clayey gravelly COBBLES
710	Clayey silty sandy COBBLES
711	Clayey silty gravelly COBBLES
712	Clayey silty gravelly sandy COBBLES
713	Silty sandy COBBLES
714	Silty gravelly COBBLES
715	Silty organic COBBLES
716	Silty gravelly sandy COBBLES
717	Silty sandy organic COBBLES
718	Silty sandy gravelly organic COBBLES
719	Sandy gravelly COBBLES
720	Sandy organic COBBLES
721	Gravelly organic COBBLES
725	COBBLES and BOULDERS
730	BOULDERS
731	Gravelly cobbly BOULDERS

801	MUDSTONE
802	SILTSTONE
803	SANDSTONE
804	LIMESTONE
805	CHALK
806	COAL
807	BRECCIA
808	CONGLOMERATE
809	Fine grained IGNEOUS
810	Medium grained IGNEOUS
811	Coarse grained IGNEOUS
812	Fine grained METAMORPHIC
815	Pyroclastic (Volcanic Ash)

816	Gypsum, Rocksalt
817	Shale
901	Sand Backfill
902	Gravel Backfill
903	Bentonite
904	Grout
905	Arisings
906	Concrete
988	Bentonite or Grout
997	Undefined
999	Void