BGS Data Products

Susceptibility to groundwater flooding

Explanatory notes for users

Background to BGS digital data in the UK
Founded in 1835, the British Geological Survey (BGS) is the world's oldest national geological survey and the United Kingdom's premier centre for earth science information and expertise. The BGS provides expert services and impartial advice in all areas of geoscience. Our client base is drawn from the public and private sectors both in the UK and internationally.

Our innovative digital data products aim to help describe the ground surface and what's beneath across the whole of Great Britain. These digital products are based on the outputs of the BGS survey and research programmes and our substantial national data holdings. This data coupled with our in-house Geoscientific knowledge are combined to provide products relevant to a wide range of users in central and local government, insurance and housing industry, engineering and environmental business, and the British public.

Further information on all the digital data provided by the BGS can be found on our website at http://www.bgs.ac.uk/data/digitaldata/digitaldata.cfm or by contacting:

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Background to BGS susceptibility to groundwater flooding dataset
Groundwater flooding (defined as the emergence of groundwater at the ground surface or the rising of groundwater into man-made ground under conditions where the normal range of groundwater levels is exceeded) is increasingly being recognised as a hazard. However, until the wet winter of 2000/2001 it had received little attention from the research community in the UK. Local knowledge of historic groundwater flooding events had generally been the only guide to an area's susceptibility to flooding. Unfortunately, local knowledge is patchy and can be unreliable and often groundwater flooding is not recognised as a distinct event, being masked by surface water floods.

In response to the need for more information on groundwater flooding, BGS has produced the first national dataset on the susceptibility of groundwater flooding, covering England, Wales and Scotland. This note describes how the susceptibility dataset was prepared and how it should be used. Based on geological and hydrogeological information, the digital data can be used to identify areas where geological conditions could enable groundwater flooding to occur and where groundwater may come close to the ground surface. Note, it is a susceptibility set, it does not indicate hazard or risk, i.e. it does not provide any information on the depth to which

groundwater flooding occurs or the likelihood of the occurrence of an event of a particular magnitude.

How the data were prepared
The datasets have been produced with digital mapping software (ArcGIS) using a 'rule-based' approach. The first step was to apply 'rules' to identify areas, based on geological considerations, where groundwater flooding could not occur, *i.e*. areas where non-aquifers are present at the ground surface (this was done using the BGS' DiGMapGB-50 data that has been attributed with a permeability classification). These areas have been denoted as not susceptible to groundwater flooding. For all areas that were geologically susceptible, a second suite of rules was used to produce a national groundwater level surface using data taken from published BGS groundwater level contours, groundwater levels in BGS' WellMaster database and modelled using river base levels.

A further suite of rules was then developed to modify this groundwater level surface so that it was representative of conditions of high groundwater level. Finally, this modified groundwater surface was compared with a digital terrain model of the ground surface elevation and a set of rules used to zone the degree of susceptibility depending on the modelled depth of the groundwater surface below the land surface.

The susceptibility to groundwater flooding dataset includes a complementary dataset which indicates the confidence in the susceptibility classification. Using the understanding of the mechanisms by which groundwater flooding occurs and the locations of reported incidents, degrees of confidence in the susceptibility dataset are provided based on the hydrogeological setting.

How the data should be used
The susceptibility data is suitable for use for regional or national planning purposes where the groundwater flooding information will be used along with a range of other relevant information to inform land-use planning decisions. It might also be used in conjunction with a large number of other factors, *e.g.* records of previous incidence of groundwater flooding, rainfall, property type, and land drainage information, to establish relative, but not absolute, risk of groundwater flooding at a resolution of greater than a few hundred metres. The confidence dataset will help in this assessment. The susceptibility data should not be used on its own to make planning decisions at any scale, and, in particular, should not be used to inform planning decisions at the site scale. The susceptibility data cannot be used on its own to indicate risk of groundwater flooding.

Groundwater flooding data format
The dataset has been generated using ESRI ArcMap software creating a GIS layer comprised of vector polygons that are attributed with a class value indicating the susceptibility to groundwater flooding. The polygon data is generated through interpolation of the digital hydrogeology (point and polygon data) to a gridded structure, with grid squares of 50m by 50m cells. The grids were then converted to polygons and modelled depth to groundwater was then converted to groundwater flooding classes. The result is three classes (A, B and C) of susceptibility to groundwater flooding. Outside of these areas and onshore, the rock types are not considered to be prone to groundwater flooding.

Classification	Description
A	**Limited potential for groundwater flooding to occur:** based

	on rock type and estimated groundwater level during periods of extended intense rainfall.
B	**Potential for groundwater flooding of property situated below ground level:** based on rock type and estimated groundwater level during periods of extended intense rainfall. Where this may have an impact, you are advised to check that this has not been a problem in the past at this location and/or that measures are in place to sufficiently reduce the impact of the flooding.
C	**Potential for groundwater flooding to occur at surface:** based on rock type and estimated groundwater level during periods of extended intense rainfall. You are advised to check that this has not been a problem in the past at this location and/or that measures are in place to sufficiently reduce the impact of the flooding.
Elsewhere (onshore)	**Not considered to be prone to groundwater flooding**: based on rock type.

The confidence dataset has three classes: low, moderate and high. The confidence class is determined by different combinations of flooding mechanism and groundwater flooding susceptibility class.

Both the susceptibility to groundwater flooding and confidence datasets can be provided in ESRI shapefiles or MapInfo tab files. The layers of national extent have been split up into 10 smaller areas for ease of use. Figure 1 shows the areas used.

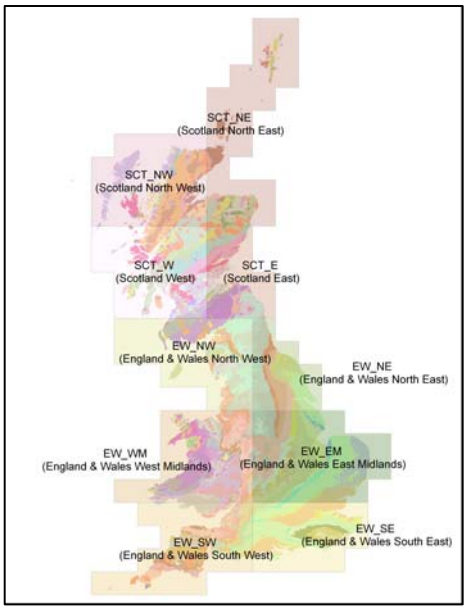

Figure 1. Illustrating how the data has been split into regions within the UK.

Differences between datasets in Scotland and England & Wales

There are two methodologies used to develop the national dataset. There are slight differences between the methodologies for Scotland and for England & Wales. In Scotland the paucity of groundwater level data means the groundwater level surface has been produced using only river base levels. In addition, in Scotland geological settings are included within the methodology that are not in that used in England & Wales. The change to the methodology in

Scotland has been made to incorporate within the susceptibility dataset, locations of known groundwater flooding. As a result of the slight differences between the two methodologies, the datasets at the Scottish/English border do not match.

Changes from previous version of the dataset

1. The susceptibility classification has been simplified and, in the table above, provides advice on what action to take based on the classification.
2. Susceptibility to groundwater flooding uses as a component the Permeability Indices dataset. Changes to this dataset in Version 6 can be found in 'Information Note, 2010: Permeability Index - Version 6.0'.
3. The inclusion of the confidence dataset along with the susceptibility to groundwater flooding dataset is new in Version 6.
4. The dataset now covers Scotland.