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NATURAL ENVIRONMENT RESEARCH COUNCIL

Geological Indicators of Flooding. User Guidance Notes

Information Products Programme
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Geological Indicators of Flooding: User Guidance Notes

Contributor/editor

K Booth, G Wildman.

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British Geological Survey offices

BGS Central Enquiries Desk

Tel 0115 936 3143 Fax 0115 936 3276

email enquiries@bgs.ac.uk

Kingsley Dunham Centre, Keyworth, Nottingham NG12 5GG

Tel 0115 936 3241 Fax 0115 936 3488

email sales@bgs.ac.uk

Murchison House, West Mains Road, Edinburgh EH9 3LA

Tel 0131 667 1000 Fax 0131 668 2683

email scotsales@bgs.ac.uk

Natural History Museum, Cromwell Road, London SW7 5BD

Tel 020 7589 4090 Fax 020 7584 8270

Tel 020 7942 5344/45 email bgslondon@bgs.ac.uk

Columbus House, Greenmeadow Springs, Tongwynlais, Cardiff CF15 7NE

Tel 029 2052 1962 Fax 029 2052 1963

Forde House, Park Five Business Centre, Harrier Way, Sowton EX2 7HU

Tel 01392 445271 Fax 01392 445371

Maclean Building, Crowmarsh Gifford, Wallingford OX10 8BB

Tel 01491 838800 Fax 01491 692345

Geological Survey of Northern Ireland, Colby House, Stranmillis Court, Belfast BT9 5BF

Tel 028 9038 8462 Fax 028 9038 8461

www.bgs.ac.uk/gsni/

Parent Body

Natural Environment Research Council, Polaris House, North Star Avenue, Swindon SN2 1EU

Tel 01793 411500 Fax 01793 411501

www.nerc.ac.uk

Website www.bgs.ac.uk

Shop online at www.geologyshop.com

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Contents

ACKNOWLEDGEMENTS ..... **I**

CONTENTS ..... **I**

SUMMARY ..... **II**

1 INTRODUCTION **1**

2 ABOUT THE GEOLOGICAL INDICATORS OF FLOODING DATASET **1**

2.1 BACKGROUND 1

3 WHAT THE DATASET SHOWS **2**

3.1 TYPES OF FLOODING 2
3.2 FLOOD CATEGORIES IN THE GIF 3
3.3 WHO NEEDS GIF INFORMATION? 3

4 USING THE GEOLOGICAL INDICATORS OF FLOODING DATASET **4**

4.1 FORMAT AND CONTENT 4
4.2 DATA HISTORY 4
4.3 POINTS TO CONSIDER WHEN USING THE DATASET 5
4.3.1 Using the GIF dataset 5

5 REFERENCES **7**

Appendix 1: Mapping scales used in the GIF data

Appendix 2 Rationale for the creation of the Geological Indicators of Flooding dataset.

Summary

This report provides guidance notes for all users of the Geological Indicators of Flooding V6 dataset. It provides a description of the history, details of the data content and data format and notes on the recommended scale of use/search criteria.

1 Introduction

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.

The GeoSure dataset comprises six different Geographical Information System (GIS) layers, with each layer representing a different natural ground stability hazard that occurs in Great Britain. The GeoSure datasets are polygon (area) layers, which are described using a straightforward A to E potential hazard classification.

This document provides information for users on the six ground stability hazard layers, together forming the GeoSure Natural Ground Stability dataset.

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:

Central Enquiries

British Geological Survey

Kingsley Dunham Centre

Keyworth

Nottingham

NG12 5GG

Direct tel. +44(0)115 936 3143

Fax. +44(0)115 9363150

email **enquiries@bgs.ac.uk**

2 About the Geological Indicators of Flooding Dataset

2.1 BACKGROUND

The BGS Geological Indicators of Flooding (GIF) dataset is a digital map based on the BGS Digital Geological Map of Great Britain at the 1:50,000 scale (DiGMapGB-50, BGS, 2010). Current coverage includes England, Wales and Scotland. It characterises superficial deposits on DiGMapGB-50 in terms of their likely susceptibility to flooding, either from coastal inundation or fluvial (inland) water flow. These superficial deposits are considered ‘recent’ in geological terms, most having been formed within the last few tens of thousands of years. Typically they have been laid down by processes of erosion and deposition and they have produced subtle topographical features, resulting in low-lying landforms we call floodplains and coastal plains. The mapping of these landforms, in conjunction with characterisation of deposits that underlie

them allows us to determine the extent of the coastal and inland flooding that created them. Observations made during recent major inland and coastal flooding events have demonstrated that the current floodplains and coastal plains continue to play a role in controlling where and how flooding occurs.

On this basis, the floodplains and coastal plains constituting areas at greatest risk from flooding can be both visualised and defined by superficial deposits as depicted on geological maps. These include deposits such as river alluvium and lacustrine (lake) alluvium, classified in the GIF as zone 1 deposits, as well as the younger river terraces or 'floodplain terrace' (raised level areas adjacent to or within floodplains, which represent the level of the floodplain prior to the most recent episode of floodplain formation). These latter are classified in the GIF as zone 2 deposits as they are perceived to be susceptible to flooding in more extreme events such as very heavy and prolonged periods of rainfall and/or extreme high tides, wind speeds and storm surges. They are the areas where secondary flooding may occur. Older and higher river terraces have been excluded as they tend to lie outside the geologically defined floodplain and relate to generations of floodplains extending back over hundreds of thousands of years in some cases. Areas at risk from coastal inundation are similarly characterised by a range of estuarine or marine deposits that include, for example, tidal flats and low-lying raised beaches. Reclaimed marine deposits have also been included as it is uncertain that these will not flood in extreme storm events.

Observations made during recent major inland and coastal flooding events (Oxfordshire and Hull were some of the regions badly affected in 2007 and Cumbria in 2009) have demonstrated that these previous floodplains continue to play a role in controlling where and how flooding occurs. In response to the flood events of summer 2007, the Pitt Review was commissioned. This review resulted in 92 recommendations being made by Sir Michael Pitt and publication of his full report, the 'Pitt Review' (see Appendix 2).

3 What the dataset shows

3.1 TYPES OF FLOODING

The GIF dataset is designed to be relevant to most of the categories of flooding set out, for example, in the Government's Planning Policy Statement 25: *Development and Flood Risk* (PPS 25)**.** This recognises that flooding is a natural process and can happen at any time, with a wide variety of locations and geographical settings proving vulnerable.

- *Flooding from rivers* occurs when the amount of water in them exceeds the flow capacity of the river channel. Most rivers are surrounded by a floodplain, the natural function of which is to accommodate any excess water that spills over from the river. The geological deposits of the floodplains, as defined above, constitute large parts of the GIF; however, it is accepted that floodplains are commonly obstructed by barriers or development and the effects of such modifications cannot be taken into account in the GIF.
- *Flooding from land* happens when intense rainfall, often of short duration, either a) runs rapidly down slopes or b) is unable to soak into the ground or enter drainage systems before causing local flooding. The scenario envisaged by a) could occur in mountainous areas such as Wales and Scotland, however, scenario b) is the one most anticipated by the GIF dataset. It typically occurs in low-lying,

poorly drained areas and the flood can be of long duration, a classic example being the inundations of Hull, situated on a coastal plain, and subjected to severe floods in the summer of 2007.

- *Flooding from groundwater* cannot be anticipated by the GIF, except for the general case where groundwater flooding commonly accompanies surface flooding in permeable deposits that underlie floodplains and coastal plains. A separate dataset on groundwater flooding (the Susceptibility to Groundwater Flooding dataset) in areas of permeable bedrocks, such as the Chalk downlands, is available from BGS. Contact BGS enquiries for more details.
- *Flooding from reservoirs, canals* and other artificial sources cannot be anticipated by the GIF maps.
- *Flooding from the sea* typically results from a combination of high seasonal tides and weather patterns that generate storm surges. It results in the rapid inundation of low-lying areas, such as coastal plains and estuaries, the deposits of which form part of the GIF dataset.

3.2 FLOOD CATEGORIES IN THE GIF

In summary, GIF includes categorisation of deposits that may be susceptible to:-

Fluvial Zone 1 & Zone 2: Flooding from rivers where the capacity of the river channel is exceeded and water overflows. This is identified as "fluvial" in the GIF, and is subdivided into higher (zone 1) and lower (zone 2) susceptibility categories;

Coastal Zone 1 & Zone 2: Flooding from the sea as a result of high tides and storm surges is identified as "coastal" flooding in the GIF. This is similarly subdivided into higher (zone 1) and lower (zone 2) susceptibility categories.

Both classifications are also subject to an element of pluvial flooding from land as a result of and episode of heavy intense rainfall. We do not have a specific category to identify this type of event.

Typically, GIF does not currently identify the presence of permanent standing bodies of water such as lakes or canals.

3.3 WHO NEEDS GIF INFORMATION?

The Geological Indicators of Flooding dataset has been designed to meet the needs of a wide range of users wishing to assess flooding hazards across the UK. Its scale and coverage make it an ideal dataset for national, regional and local scales of assessment and so its user-base is envisaged to include:

- Non governmental organisations
- Local authorities
- Insurance companies
- Consultants
- Surveyors
- Planners (including development and incident)
- Environmental officers
- Developers
- Land owners
- Home owners

The BGS Geological Indicators of Flooding data should be regarded as complementary to, but not a replacement for, existing Environment Agency flood risk maps.

4 Using the Geological Indicators of Flooding dataset

4.1 FORMAT AND CONTENT

The dataset comprises a digital map showing areas prone to the two main types of flooding – fluvial (inland) and coastal/estuarine. The map is available in a range of popular vector formats; suitable for use within GIS systems such as ESRI's ArcGIS and MapInfo (other formats are available on request).

The data is supplied on CD and includes all the files necessary to open that data within the GIS system. Each dataset consists of a map 'layer' showing polygons of flooding potential, each polygon contain a number of attributes.

The content of the data includes the following:

- **Class**: this is the '*zone'* and '*mode*' combined giving 4 possible types of flooding-
  - coastal flood deposits
    - zone 1 – areas susceptible to the first influx of flood waters
    - zone 2 – areas that are susceptible in extreme flood events (e.g. storms surges and exceptionally high tides)
  - fluvial – inland fluvial flood deposits
    - zone 1 – areas susceptible to the first influx of flood waters
    - zone 2 – areas that are susceptible in extreme flood events
- **Zone**: this indicates the level of potential flooding, it is divided into 2 zones; *'Zone 1'* are areas with a high potential to flood; *'Zone 2'* are secondary flood areas that may be susceptible in extreme or prolonged events.
- **Mode**: this indicates the type of flood that an area might be susceptible to; either *'fluvial'* or *'coastal'* flooding.
- **Legend**: a brief explanation of the type of flooding potential
- **Version**: the version number of the dataset

4.2 DATA HISTORY

The GIF data is primarily derived from the 1:50 000 scale digital geological map of Great Britain, DiGMapGB-50. Where 1:50 000 data is not available, data of smaller scale has been used. BGS is continually surveying and resurveying areas of Britain, improving and updating the geological maps (Appendix 1). Therefore, each new release of GIF will be based upon the most recent version of DiGMapGB-50. Below is an outline of the data history of the GIF to date.

Version 1 (released 2007): Derived from DiGMapGB-50 version 3.14 (England & Wales)

Version 5.1 (released 2009): Derived from DiGMapGB-50 version 5.18 (England, Wales & Scotland)

Version 5.2 (released March 2010): Derived from DiGMapGB-50 version 5.18 (England, Wales & Scotland) using new methodologies.

Version 5.3 (released June 2010): Derived from DiGMapGB-50 version 5.18 (England, Wales & Scotland).

Version 6 (released January 2011): Derived from DiGMapGB-50 version 6.18 (England, Wales & Scotland).

(In 2008 BGS introduced its new versioning system whereby the version number of the dataset relates to the version of DiGMapGB-50 base data, hence the reason for the jump between GIF version 1 to version 5).

4.3 POINTS TO CONSIDER WHEN USING THE DATASET

The dataset is based purely on observation of the types of geological deposit present and does not take into account any man-made influences such as flood protection schemes. Nor does the dataset take into account the possibility of flooding onto low-lying ground that is not occupied by the 'indicator' deposits described above and depicted on the GIS. It should also be noted that the dataset is based on geological maps compiled at different times, and at varying scales, and that while every effort is made to upgrade the geological coverage of Britain, there may at present be inconsistencies of interpretation and representation of these deposits from one area to another.

4.3.1 Using the GIF dataset

The dataset is derived from a digital map of 1:50,000 scale and should not be used at any scale greater than this. In practical terms, it is recommended that when carrying out a spatial search against the GIF data, the user should use a 50m buffer for their site/area of interest to allow for the spatial accuracy of the underlying DiGMapGB-50 data.

Users should also be aware that if the GIF indicates their site is underlain by deposits susceptible to flooding, that this **does not necessarily** mean that flooding will occur. The data behind the GIF are purely 'geological' and do not take into account any man-made factors such as flood protection schemes or landscape management. The data is simply indicating those geological deposits which have been associated with flooding in the recent geological past and which therefore may still be vulnerable to flooding.

In summary

- GIF has been developed at 1:50 000 scale and is not suitable to be used at larger scales (care must be taken when using the dataset at different scales due to the accuracy of the underlying geological maps from which the dataset was derived), and all spatial searches against the data should be done with a minimum 50 m buffer.
- Data coverage includes England, Wales and Scotland.
- GIF data are created as vector polygons and are available in a range of GIS formats, including ArcGIS (.shp), ArcInfo Coverages and MapInfo (.tab).
- GIF is concerned with geological deposits which may be vulnerable to flooding related to NATURAL geological conditions only. GIF does NOT cover any man-made factors.

- GIF is based on, and limited to, an interpretation of the records in the possession of The British Geological Survey at the time the dataset was created.

- An indication of geological deposits which may be vulnerable to flooding does not necessarily mean that a location will be affected by flooding.

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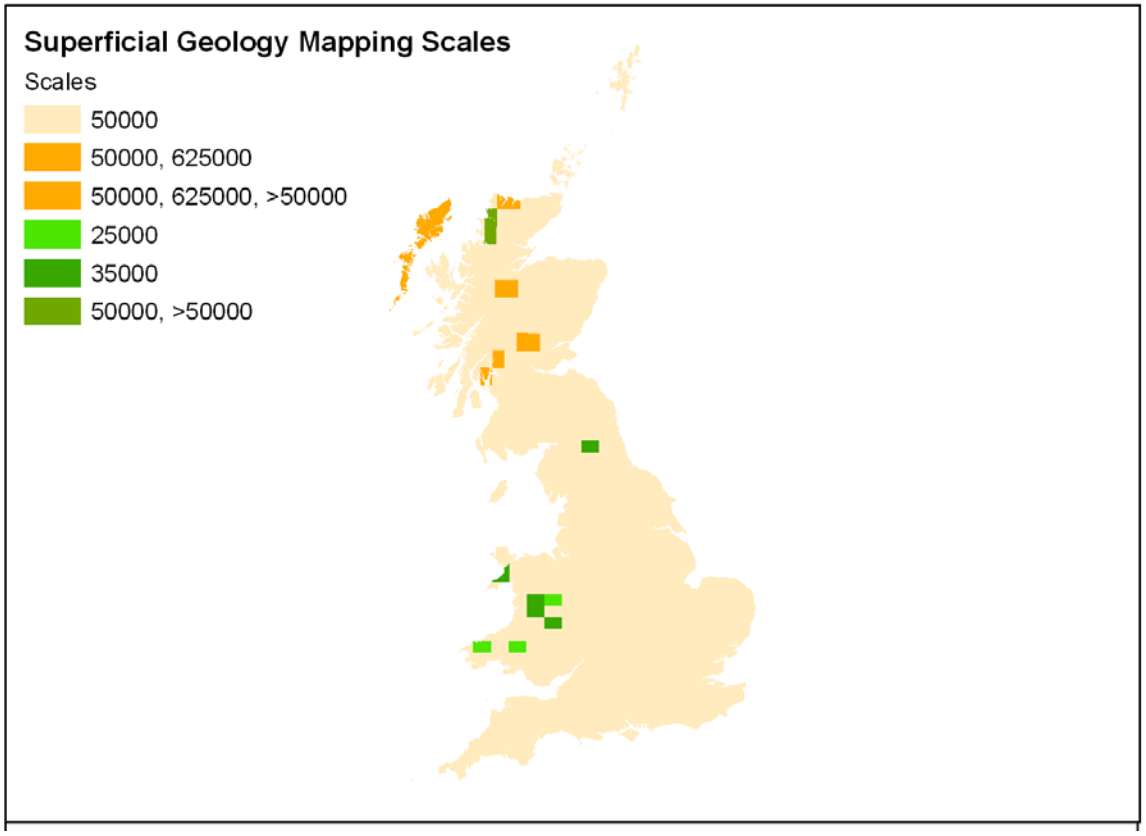
SEPA, Flood Risk Management (Scotland) Act 2009. http://www.sepa.org.uk/flooding/flood_risk_management.aspx

Appendix 1: Mapping scales used in the GIF data



Appendix 2 Rationale for the creation of the Geological Indicators of Flooding dataset.

Legislation

In recent years, and particularly after the events of 2007, flooding hazard has been high profile both in the news and within governmental departments. This has resulted in new reviews, consultations, management plans, recommendations and government legislation. At the time of writing, much of this is ongoing and implementation is continuing. The Geological Indicators of Flooding dataset could provide additional valuable information for planners and other statutory bodies, and contribute towards mitigation strategies. A summary of the main legislative developments are outlined below;

The Pitt Review

An independent review of the 2007 flooding, commissioned by the government and led by Sir Michael Pitt, looked at its causes and subsequent management to see what lessons needed to be learned about how to manage and respond to this type of event in the future. Sir Michael's final report was published on 25 June 2008.

Summer 2007 Flooding and the Government Response

The Secretary of State published the Government's response to Sir Michael's Review of the 2007 Summer Floods on the 17 December 2008. It sets out a clear action plan to deliver against the challenging agenda identified by Sir Michael. The government response to the Pitt Review emphasizes the need for better knowledge of where flood risks are greatest to enable better planning. The BGS GIF dataset can assist in meeting this objective. (The Government's Response to Sir Michael's Review, 2009; Flood Review, 2007; Ministerial statement announcing review into floods, 2007; Statement by Secretary of State, 2007).

The government promised to implement many of the recommendations made in Sir Michael Pitt's review. This includes giving local authorities a clear leadership role in local flood risk management, encompassing all sources of flooding.

The Floods and Water Bill: DEFRA

The Government have taken high profile action in the quest to mitigate climate change as Environment Secretary Hilary Benn announced a £15million increase in funding for local authorities to implement surface water management plans.

The Floods and Water Bill was set to take this further, with new responsibilities, tools and more importantly, funding to ensure that a changing water system can be effectively managed.
In April 2009 a Draft Floods and Water Bill was published for consultation and is currently going through Parliament.

The Flood and Water Management Act 2010, now being implemented, will provide better, more comprehensive management of flood risk for people, homes and businesses. The first parts of the Act began implementation in October 2010 and consultation exercises were launched in November 2010.

There is also a DEFRA Shore management Plan.

The role of the Environment Agency

The Environment Agency has been given responsibility to be the point of contact for all flood related issues and is tasked with taking forward and implementing the recommendations in the Pitt Review. They now have a number of documents and guidance notes including the following

Catchment Flood Management Plans (CFMPs)

The Environment Agency, Defra and the Welsh Assembly have recently updated volume 1 of the draft guidance for CFMPs. This guidance sets out the scope of a CFMP and it has been revised to reflect the lessons learned to date from the pilot studies. It held a consultation process in 2004.

Development and flood risk

Local Planning Authorities (LPAs) in England are now required to consult the Environment Agency (EA) on most development proposals at risk from flooding. Planning Policy Statement 25 (PPS25) 'Development and Flood Risk' and its associated Practice Guide set out Government policy and advice on the subject.

The EA provide technical advice to LPAs and developers on how best to avoid, manage and reduce the adverse impacts of flooding.

The Scottish Parliament

The Scottish Environment Protection Agency (SEPA) to have responsibility for flood-risk management. The Scottish Government has introduced legislation on flood management (The Flood Risk Management (Scotland) Act 2009).