IX CLGE CONFERENCE OF THE EUROPEAN SURVEYOR ‘THE ROLE OF THE GEODETIC SURVEYOR IN DISASTER MANAGEMENT’

THE CRITICAL ROLE OF AUTHORITATIVE GEOSPATIAL DATA IN RESILIENCE

Duncan Moss, Principal Consultant

Paris (FR) 2023-11-09

Ordnance Survey

SEE > BETTER PLACE

SEE THE WORLD IN A NEW LIGHT

At OS, we use location data and intelligence to illuminate the unseen.

Ordnance Survey
SEE > BETTER PLACE

Overview

Ordnance Survey is a Location Data Authority, delivering the national mapping service for Great Britain.

As a data and services company wholly owned by government, Ordnance Survey uses its world-class geospatial assets and capabilities, built on the common foundation of our National Geographic Database (NGD), to provide a range of services that meet the diverse needs of our customers.

Working closely in support of the Geospatial Commission, OS contributes capability and data expertise to the execution of the UK's Geospatial Strategy. We serve 6500+ government organisations with data that supports with critical policy and delivery challenges.

* Consolidated, statutory accounts † Over the life of the contract

1791

The year Ordnance Survey was founded

600 million

Geospatial features held in the National Geographic Database

£182.3m

2021/22 Revenue*

1,296

Average monthly number of permanent FTE staff in 2021/22

£52.8m

2021/22 dividend to BEIS

£8bn+

Of economic value to be unlocked by the PSGA†

Our customer profile

Ordnance Survey has a wide range of customers across government, business and consumer markets.

6,126
Public sector customers
Up 5% on last year
(2021–22: 5,836)

2000
Premium
Data users

450
Licensed
Partners

Some of the customers we serve

Areas of focus

Environment and sustainability

OS provides customers the ability to verify and demonstrate transparency for land-based environmental projects, supply chains, and the protection of assets.

Energy and infrastructure

OS data streamlines the decision-making process and enables organisational growth through the location, distribution, and management of critical assets.

Transport and mobility

OS helps planners create a future transport system that is sustainable, efficient and safe for all modes of transport.

Land and property

OS creates assurance for customers when determining accurate locations and addresses, and provides a range of data services such as access to public services, or flood risks.

Health and wellbeing

OS supports critical health services through location data-driven solutions; while also encouraging the improvement of mental and physical health by helping our customers get outside more often.

Resilience and protection of life

OS partners with the emergency services by providing mapping for emergencies service and security planning for significant events such as the G7 Summit and Commonwealth Games.

The National Geographic Database

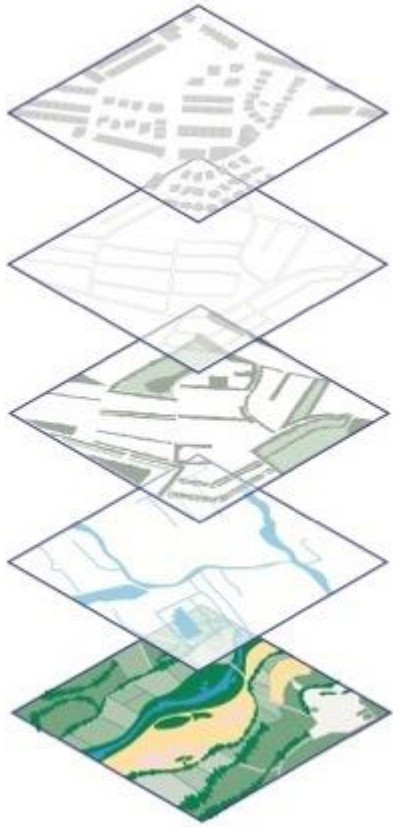
The National Geographic Database contains the authoritative data that describes the geography of Great Britain. Today customers access this through numerous OS products and services.

33 million
addresses

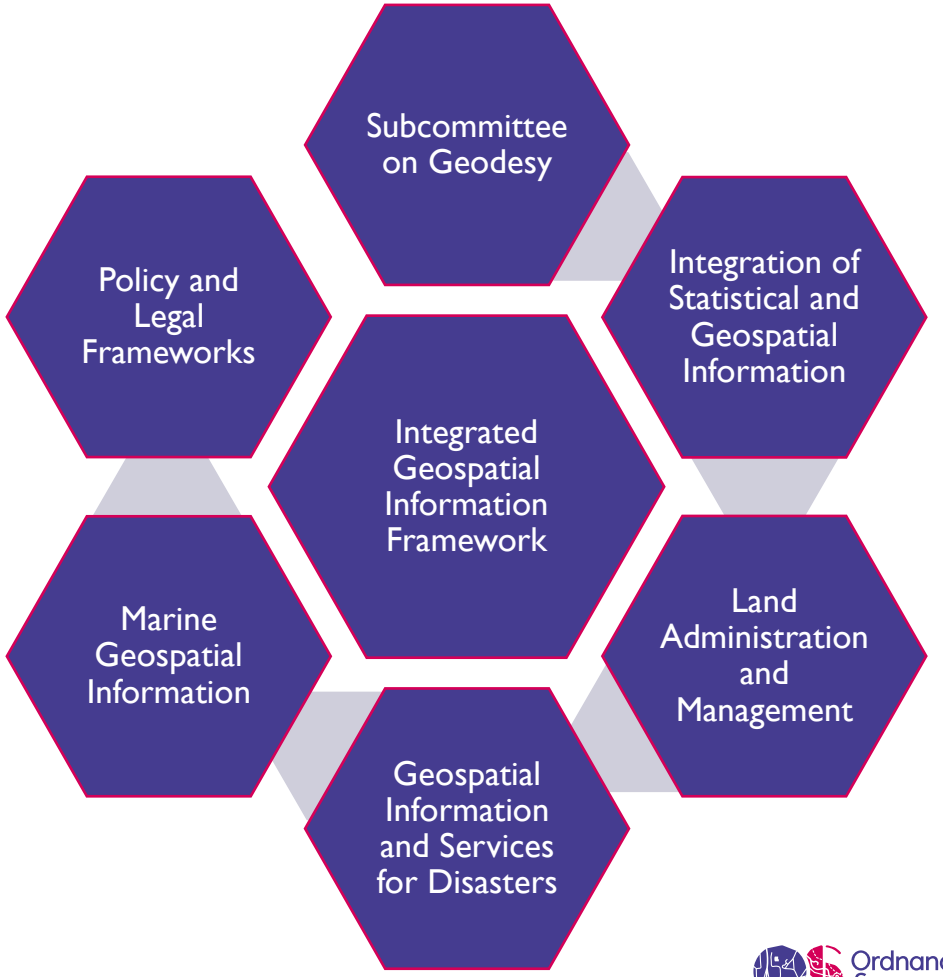
500 million
location features

20,000
updates everyday

Buildings
+
Structures
+
Vegetation
+
Water
+
Land use



The United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM)



Key information:

- The **UK has been actively involved with UN-GGIM from its original concept** through its growth and development into the leading forum to discuss geospatial information on a global stage.
- **OS leads the UK Delegation to UN-GGIM** on behalf of the Geospatial Commission and the UK.
- We bring together a cross-government stakeholder group to contribute to, and shape, our engagement and thinking around UN-GGIM's areas of interest.
- The **UK is represented on every Expert and Working Group** of UN-GGIM.

Find out more:
UN-GGIM website: http://ggim.un.org/
UN-GGIM: Europe website: https://un-ggim-europe.org/
IGIF overview: http://ggim.un.org/IGIF/overview/

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National Risk Register 2023

9 Themes covering 89 Risks

1. Terrorism
2. Cyber
3. State threats
4. Geographic and diplomatic
5. Accidents and systems failures
6. Natural and environmental hazards
7. Human, animal and plant health
8. Societal
9. Conflict and instability

https://www.gov.uk/government/publications/national-risk-register-2023

https://www.gov.uk/government/publications/integrated-review-refresh-2023-responding-to-a-more-contested-and-volatile-world

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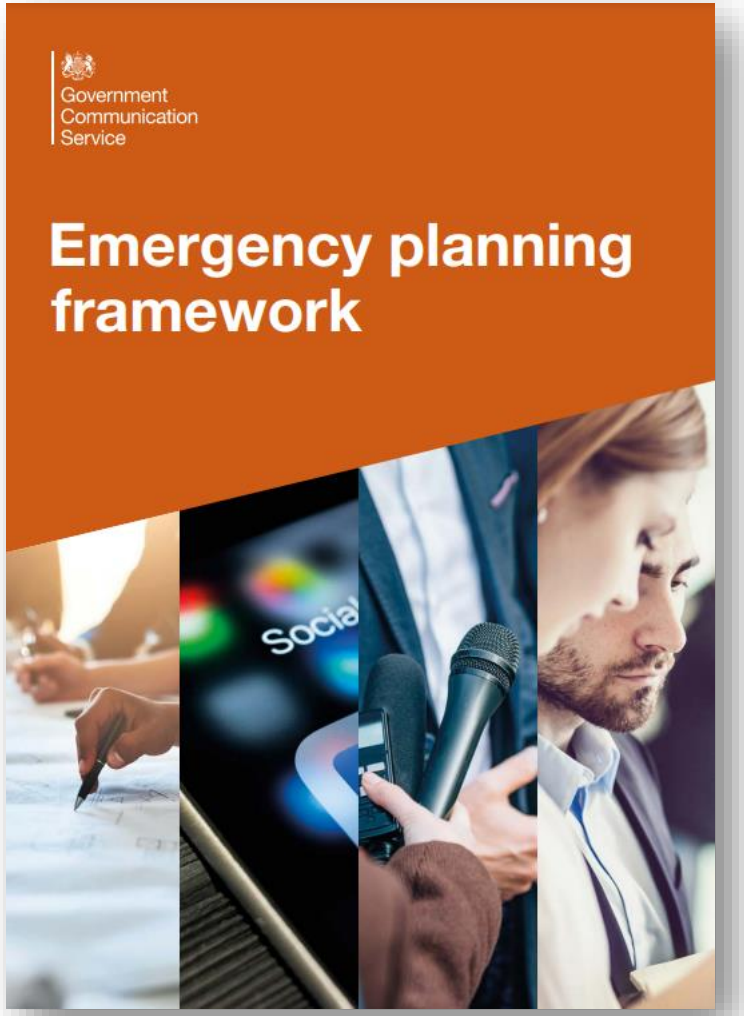
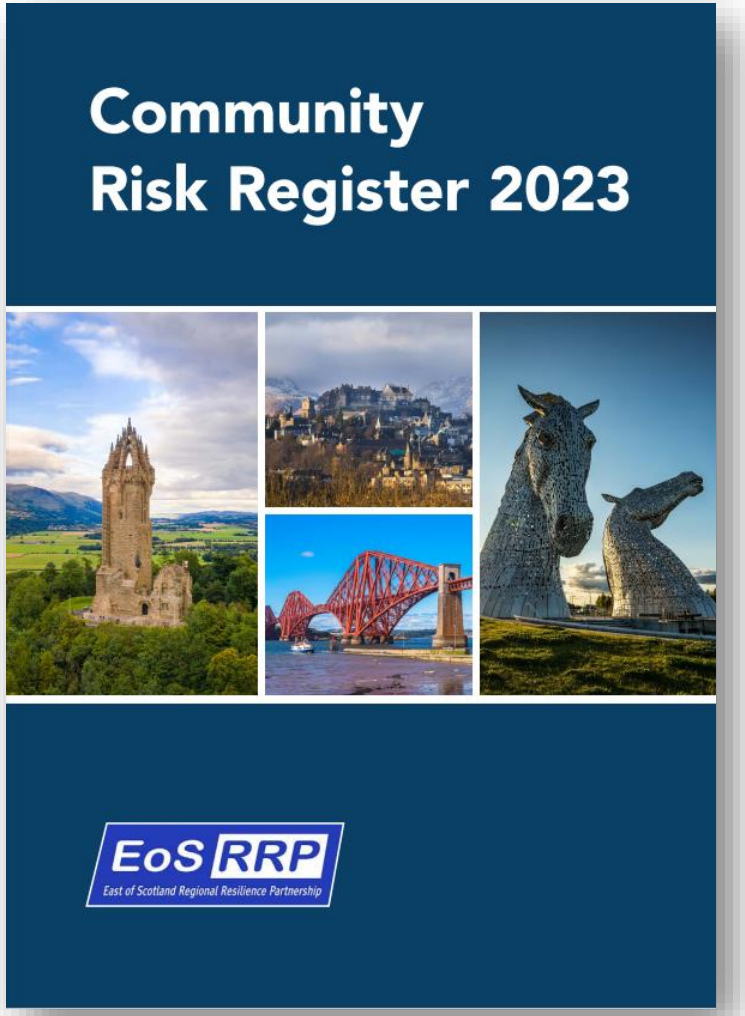
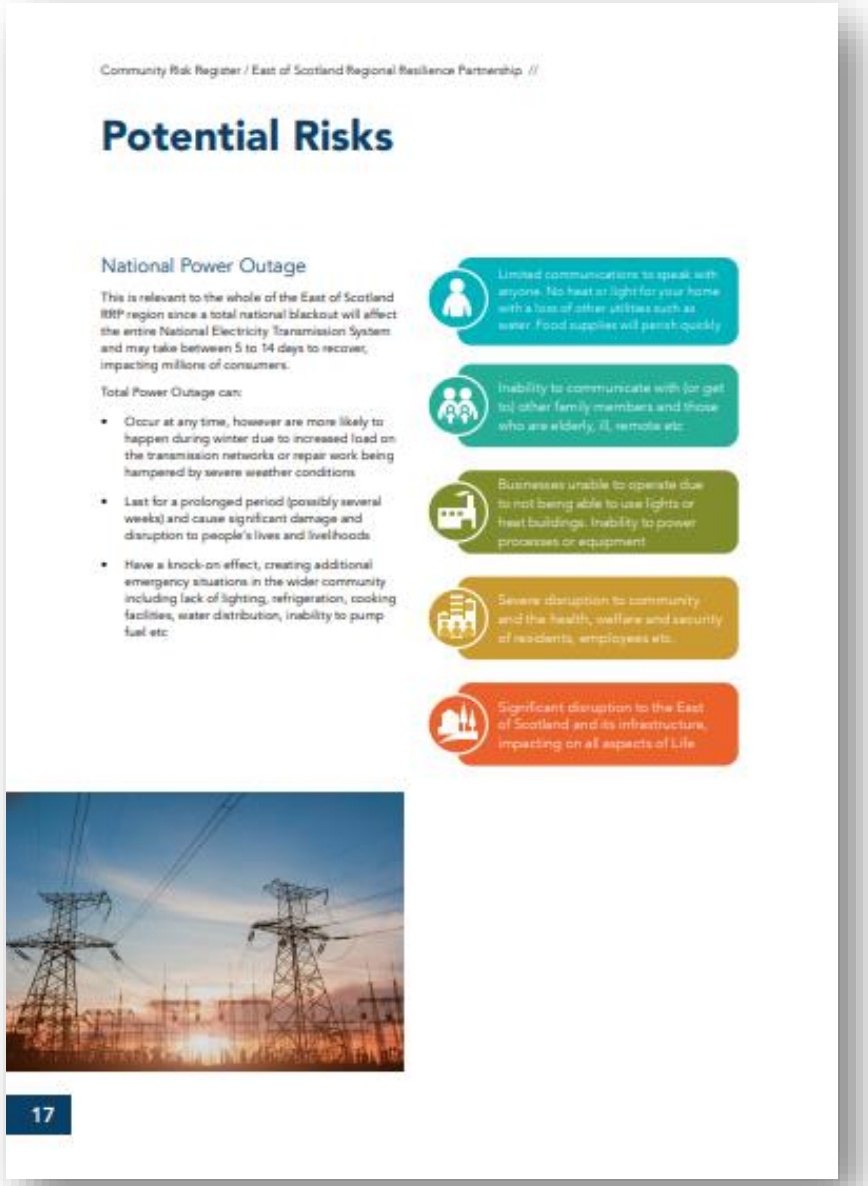
Local Risk Registers



https://gcs.civilservice.gov.uk/wp-content/uploads/2020/04/Emergency-planning-framework-1.pdf



https://www.firescotland.gov.uk/publications/document/?id=722



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[OGC and Climate Resilience - YouTube]

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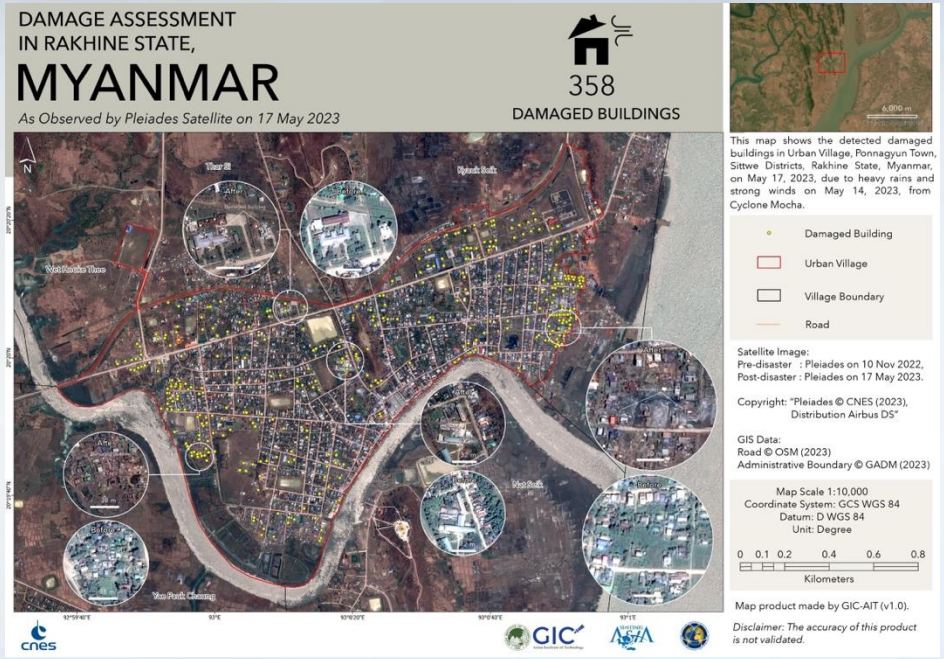
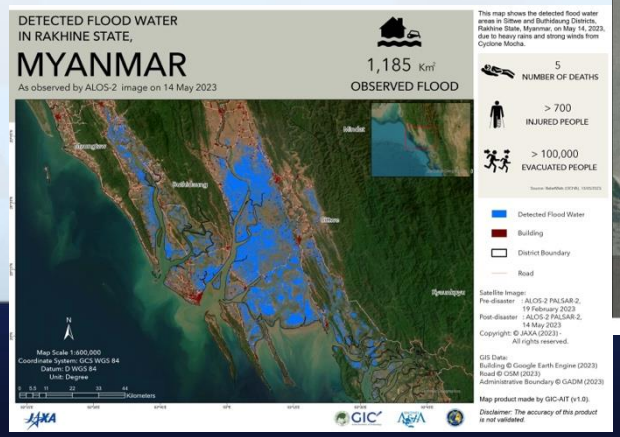
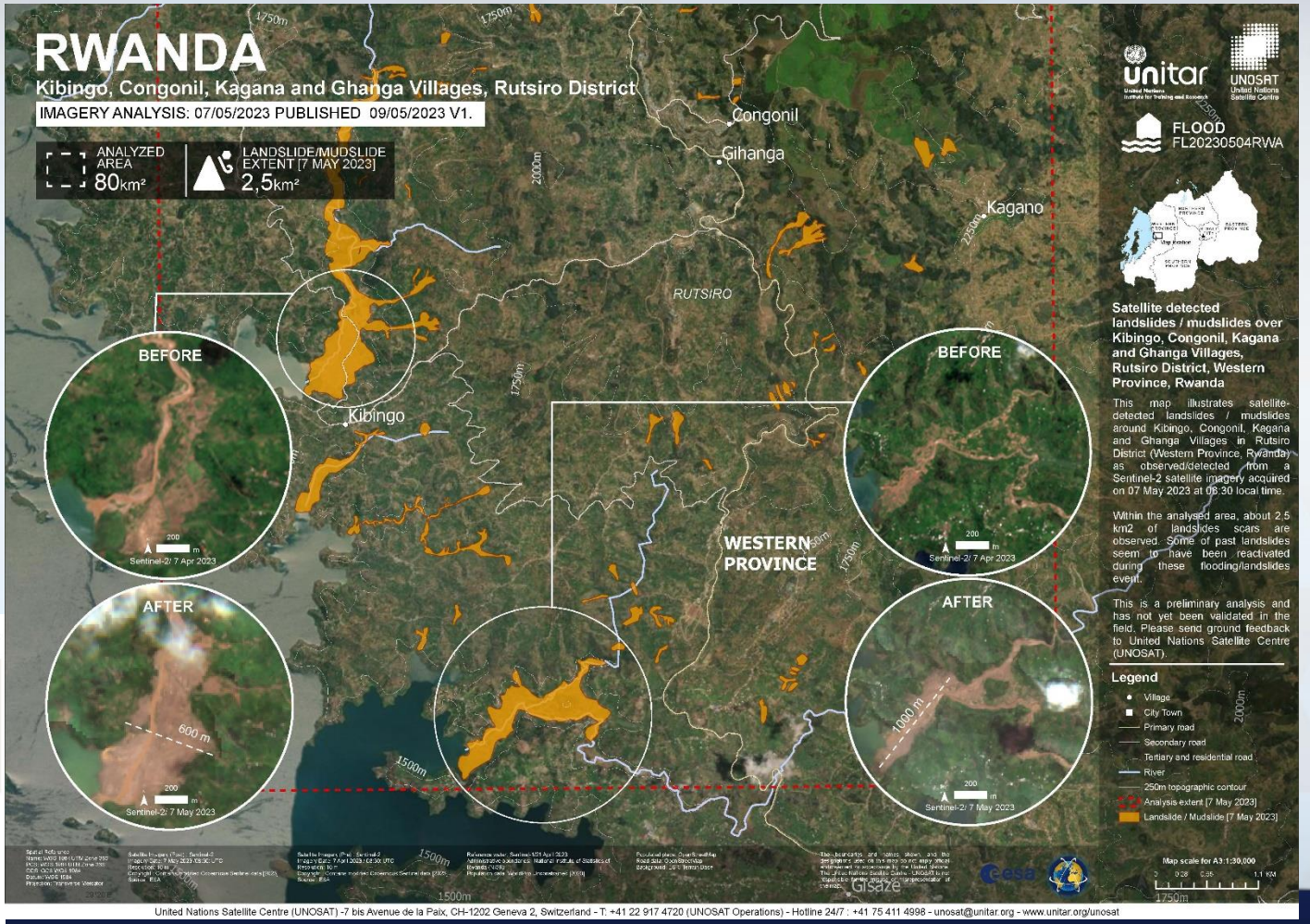
Satellite Data for Emergency Response

INTERNATIONAL CHARTER SPACE & MAJOR DISASTERS SATELLITE DATA TO SUPPORT DISASTER RESPONSE WORLDWIDE



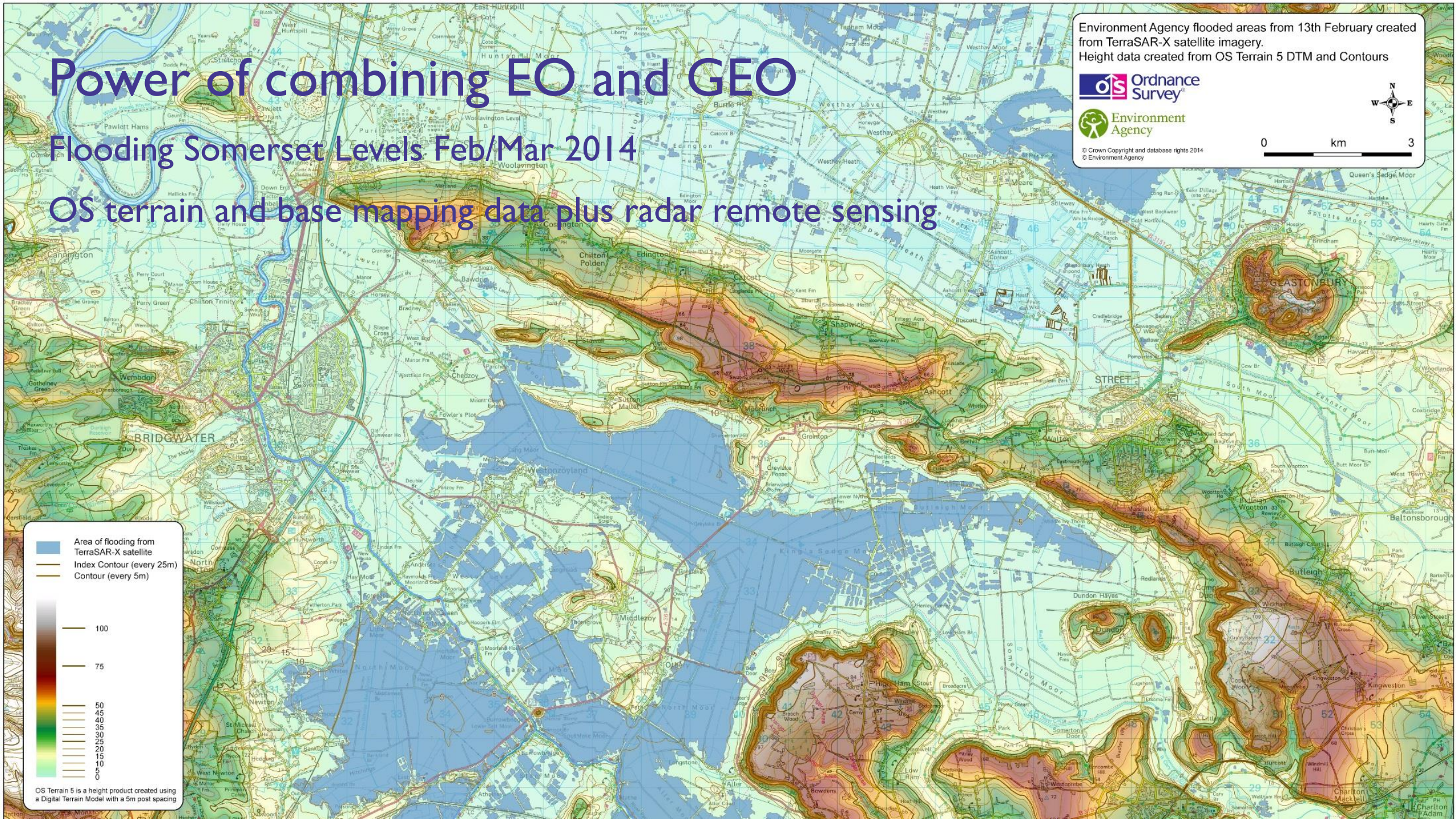




Power of combining EO and GEO

Flooding Somerset Levels Feb/Mar 2014

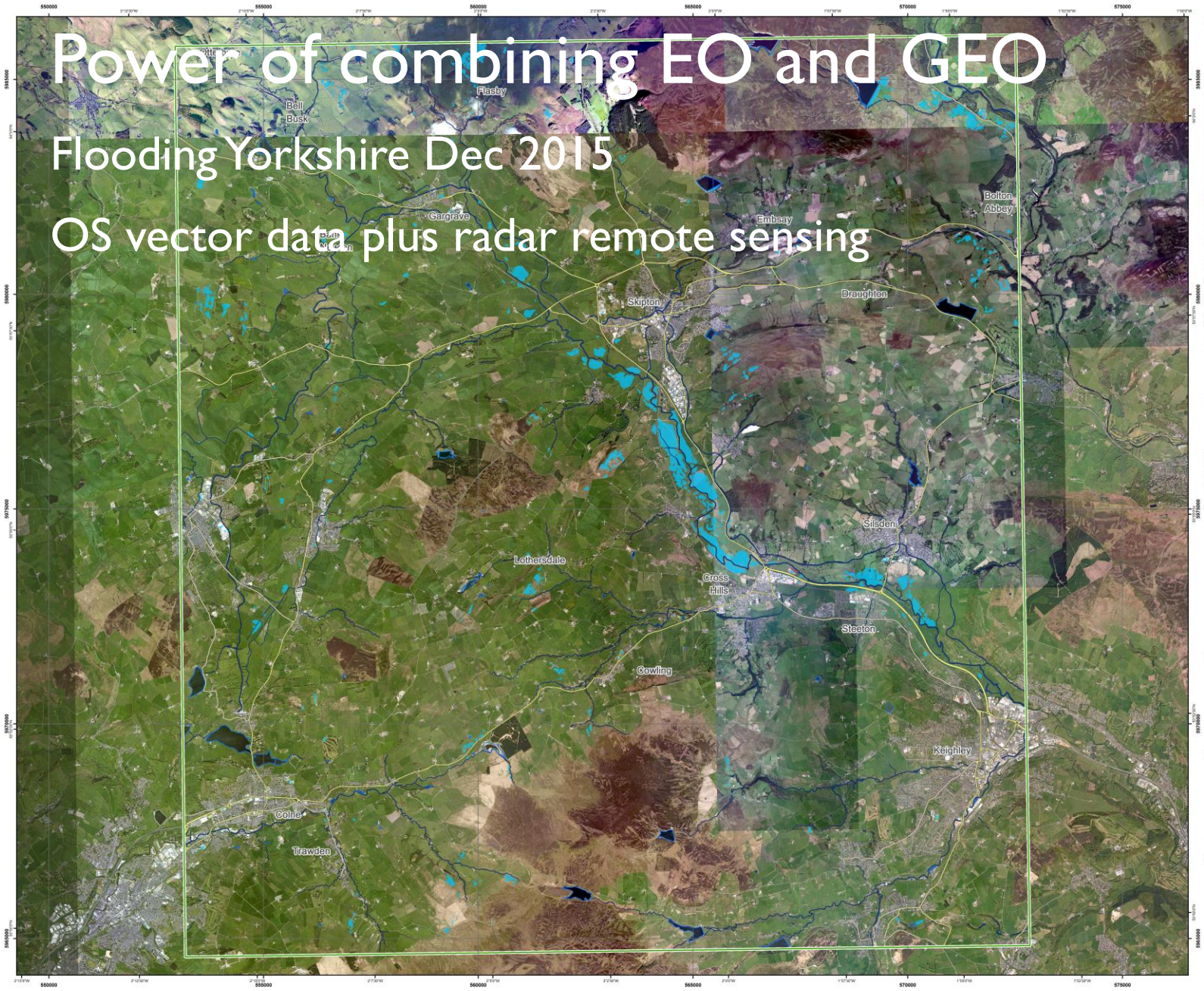
OS terrain and base mapping data plus radar remote sensing

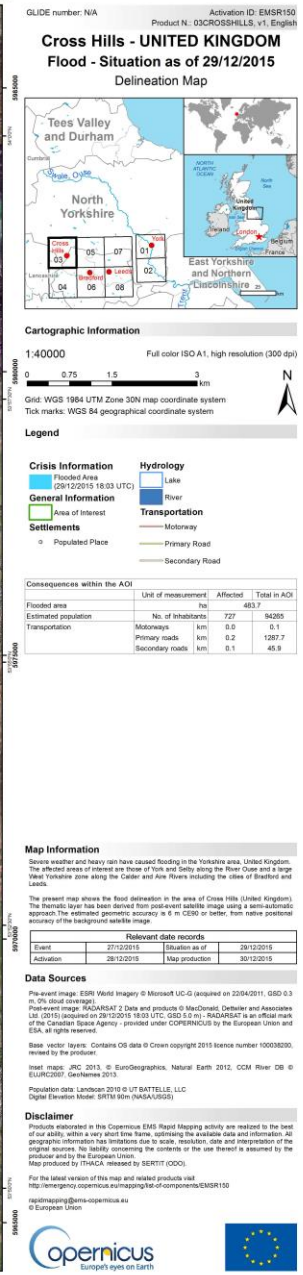


Power of combining EO and GEO

Flooding Yorkshire Dec 2015

OS vector data plus radar remote sensing




GLIDE number: N/A
Activation ID: EMSR150
Product N.: 03CROSSHILLS, v1, English

Cross Hills - UNITED KINGDOM
Flood - Situation as of 29/12/2015
Delineation Map

Tees Valley and Durham
North Yorkshire
East Yorkshire and Northern Lincolnshire

Cartographic Information
1:40000
Full color ISO A1, high resolution (300 dpi)
0 0.75 1.5 3 km
Grid: WGS 1984 UTM Zone 30N map coordinate system
Tick marks: WGS 84 geographical coordinate system

Legend
Crisis Information
Flooded Area (29/12/2015 18:03 UTC)
General Information
Area of Interest
Settlements
Populated Place
Hydrology
Lake
River
Transportation
Motorway
Primary Road
Secondary Road

Consequences within the AOI

	Unit of measurement		Affected	Total in AOI
Flooded area	ha			483.7
Estimated population	No. of Inhabitants		727	94265
Transportation	Motorways	km	0.0	0.1
	Primary roads	km	0.2	1287.7
	Secondary roads	km	0.1	45.9

Map Information

Severe weather and heavy rain have caused flooding in the Yorkshire area, United Kingdom. The affected areas of interest are those of York and Selby along the River Ouse and a large West Yorkshire zone along the Calder and Aire Rivers including the cities of Bradford and Leeds.

The present map shows the flood delineation in the area of Cross Hills (United Kingdom). The thematic layer has been derived from post-event satellite image using a semi-automatic approach.The estimated geometric accuracy is 6 m CE90 or better, from native positional accuracy of the background satellite image.

Relevant date records			
Event	27/12/2015	Situation as of	29/12/2015
Activation	28/12/2015	Map production	30/12/2015

Data Sources

Pre-event image: ESRI World Imagery © Microsoft UC-G (acquired on 22/04/2011, GSD 0.3 m, 0% cloud coverage).
Post-event image: RADARSAT 2 Data and products © MacDonald, Dettweiler and Associates Ltd. (2015) (acquired on 29/12/2015 18:03 UTC, GSD 5.0 m) - RADARSAT is an official mark of the Canadian Space Agency - provided under COPERNICUS by the European Union and ESA, all rights reserved.

Base vector layers: Contains OS data © Crown copyright 2015 licence number 100038200, revised by the producer.

Inset maps: JRC 2013, © EuroGeographics, Natural Earth 2012, CCM River DB © EUIRC2007, GeoNames 2013.

Population data: Landscan 2010 © UT BATTELLE, LLC
Digital Elevation Model: SRTM 90m (NASA/USGS)

Disclaimer

Products elaborated in this Copernicus EMS Rapid Mapping activity are realized to the best of our ability, within a very short time frame, optimising the available data and information. All geographic information has limitations due to scale, resolution, date and interpretation of the original sources. No liability concerning the contents or the use thereof is assumed by the producer and by the European Union.
Map produced by ITHACA released by SERTIT (ODO).

For the latest version of this map and related products visit http://emergency.copernicus.eu/mapping/list-of-components/EMSR150

rapidmapping@ems-copernicus.eu
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Copernicus Europe's eyes on Earth

Ordnance Survey

Loss of Positioning, Navigation and Timing (PNT) services

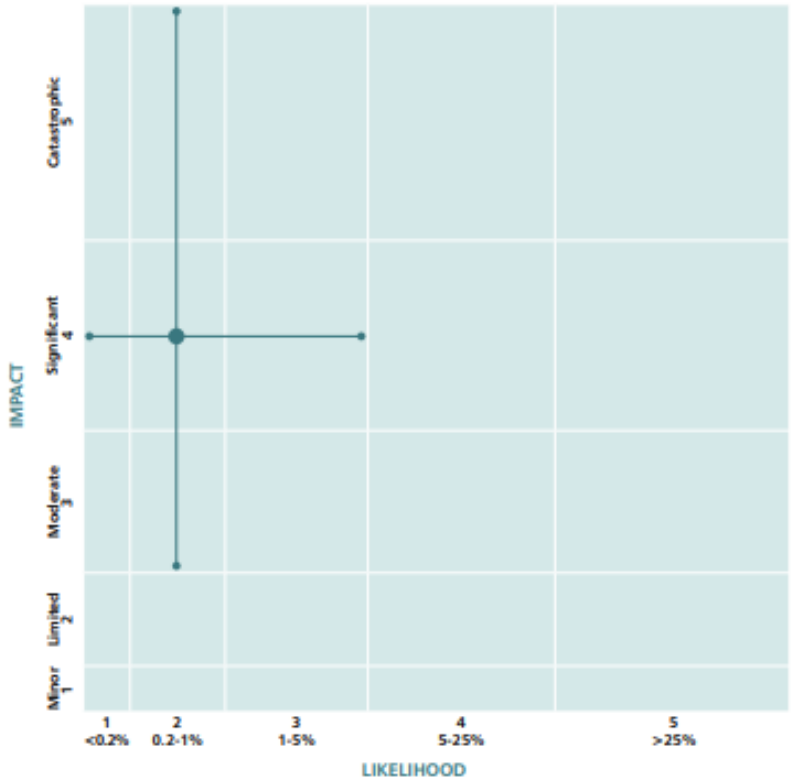
PNT services are a critical component of the UK's infrastructure. They facilitate a diverse range of essential functions across an increasingly interconnected society. For example, PNT is essential for telecommunications, transport navigation and providing precise timings. A loss of PNT services, either due to technological failures or malicious activity, would have catastrophic and cascading effects across the UK and globally.

Scenario

The reasonable worst-case scenario is based on a severe technical failure, due to either hardware failure or human error, in a Global Navigation Satellite System constellation leading to data corruption of that service. This would result in inaccurate position and timing data being delivered to users in space and around the world. The compound series of both technical failure and human error means the service would have no choice but to cease operations. There would be a significant disruption or complete cessation of transport (including aviation and maritime services), communications networks, financial services, energy and emergency services within a few hours of the incident taking place. There is also possible further disruption to other space-based services.

Key assumptions for this scenario

Sectors would revert to older technologies or alternatives to allow for ground services to resume during an extended outage.



'A loss of PNT services, either due to technological failures or malicious activity, would have catastrophic and cascading effects across the UK and globally.'

https://www.gov.uk/government/publications/national-risk-register-2023

GNSS Threats and Vulnerabilities – protecting our critical infrastructure

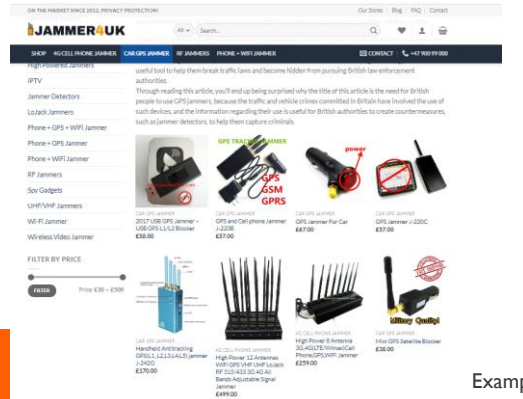
Global satellite navigation constellations broadcast very weak signals (60W light bulb from space), this makes disruption easy to achieve.

Criminal activity is diverse, but aims to disrupt GNSS and other radio based services across the nation.

Cyber threats have only been recently acknowledged by the PNT community.

Space weather causes continuous errors, but on a bad day can damage satellites, even damaging power networks on Earth.

Intentional and non-intentional interference are the biggest and most consistent threats to GNSS.



Example GNSS jammers

OS has been involved with PNT for over 230 years.

Today **Ordnance Survey is today critically reliant upon GNSS**.

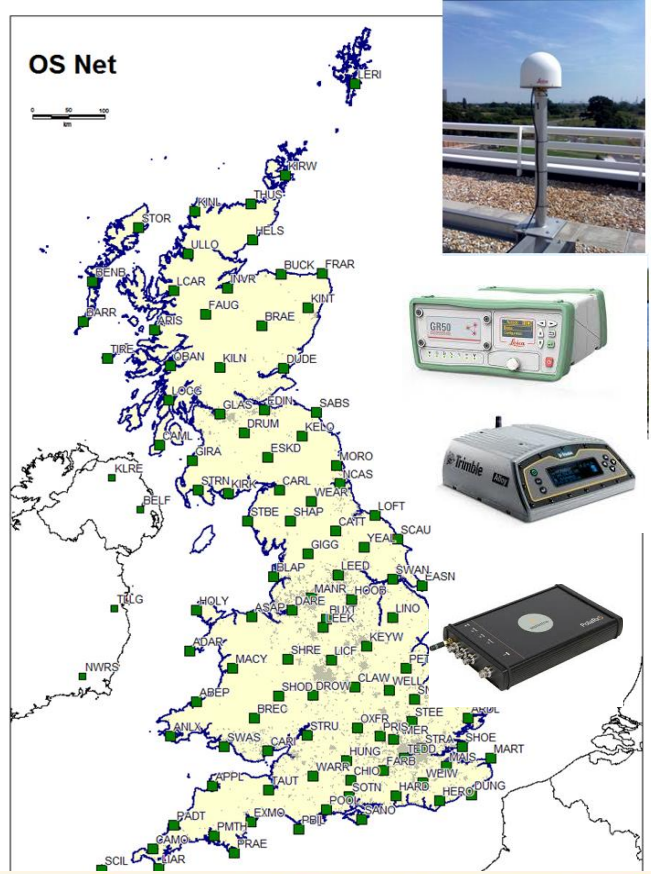
OS Net is a network of 114 (+ 4) continuously operating GNSS receivers about 60km apart, but varies considerably depending upon geography

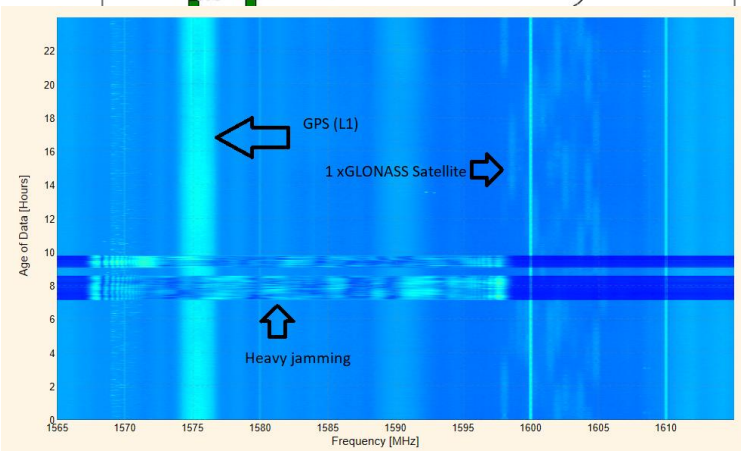
OS Net realizes the national Coordinate Reference System for Great Britain, a frame of ETRS89

OS Net enables real time cm positioning using RTK – supporting OS surveyors, commercial partners and the Met Office.

GNSS faces a wide variety of threats and vulnerabilities.

OS Net, our surveyors and your own devices experience multiple natural, non-intentional and intentional **interference events everyday**.





OS Net station impact during jamming

GNSS: Global Navigation Satellite Systems, includes GPS, Galileo, GLONASS and Beidou

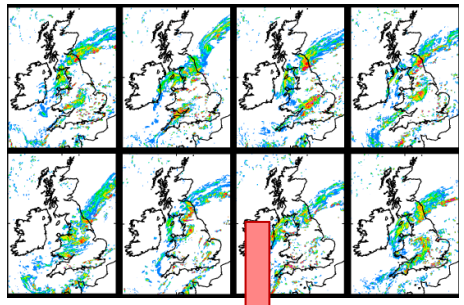
Natural Hazards PARTNERSHIP

The UK's trusted voice for coordinated natural hazards advice

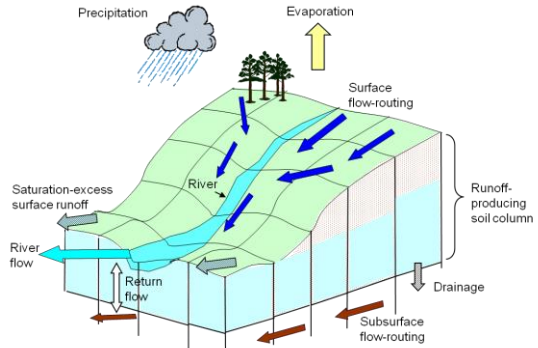
Surface Water Flooding
Hazard Impact Model Overview

SWF HIM innovation builds on existing models, data and tools

Rainfall ensembles (MOGREPS-UK)



Grid-to-Grid Hydrology

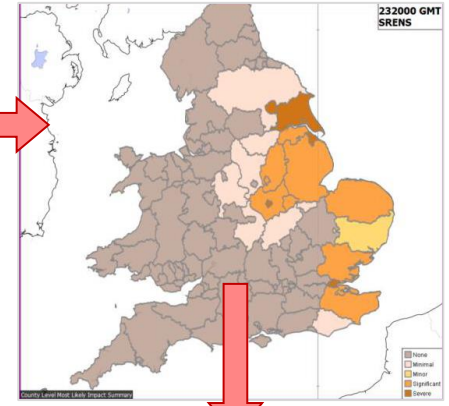


SWF Hazard Footprint

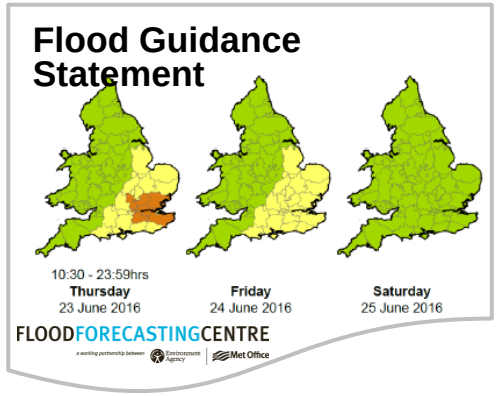
SWF HIM

Real-time SWF risk outputs

Visual Weather



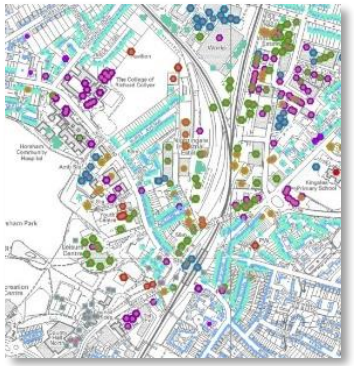
Dissemination



Impact Library

Updated Flood Map for Surface Water

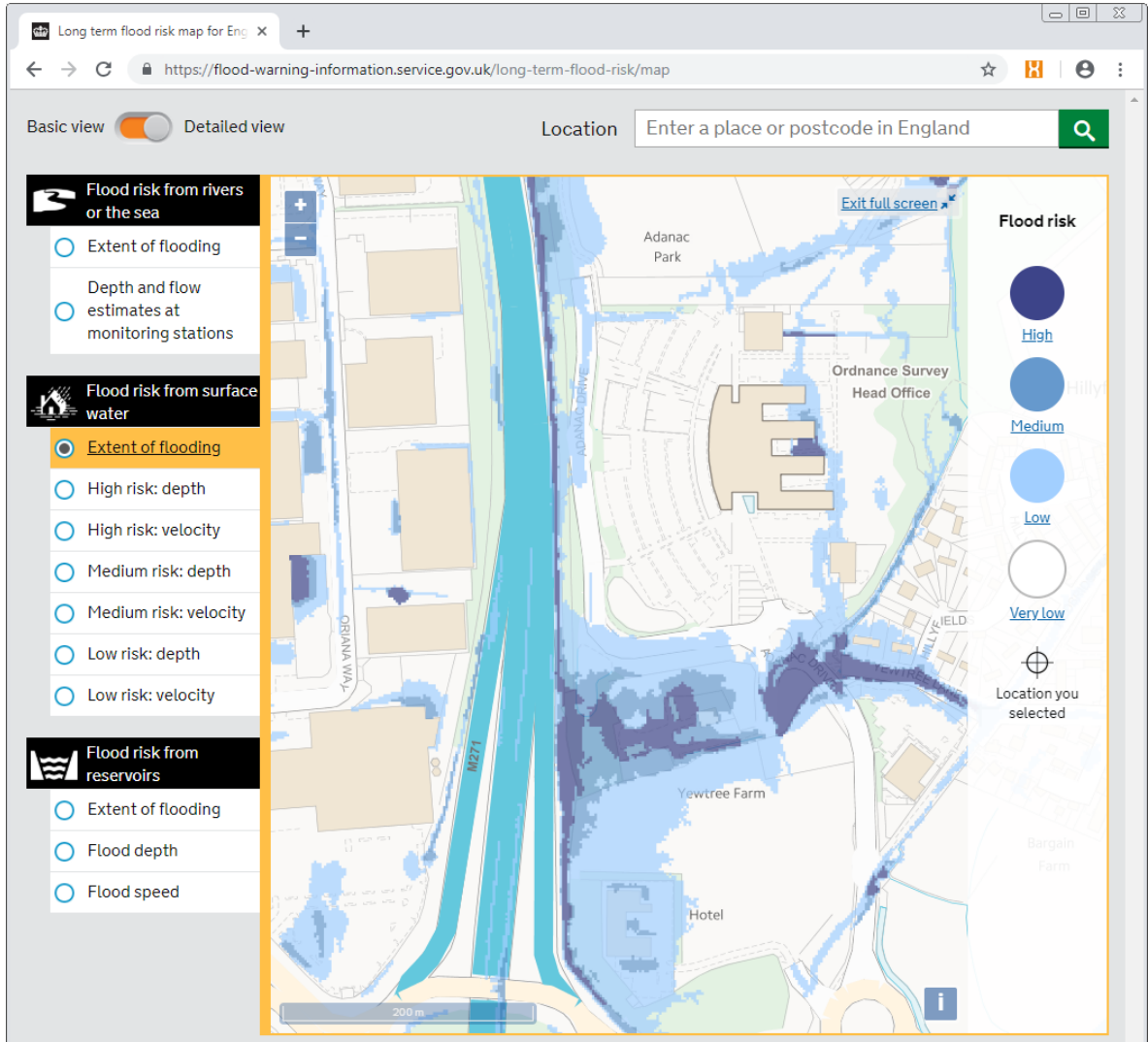
National Receptor Database (NRD)



National Population Database (NPD)

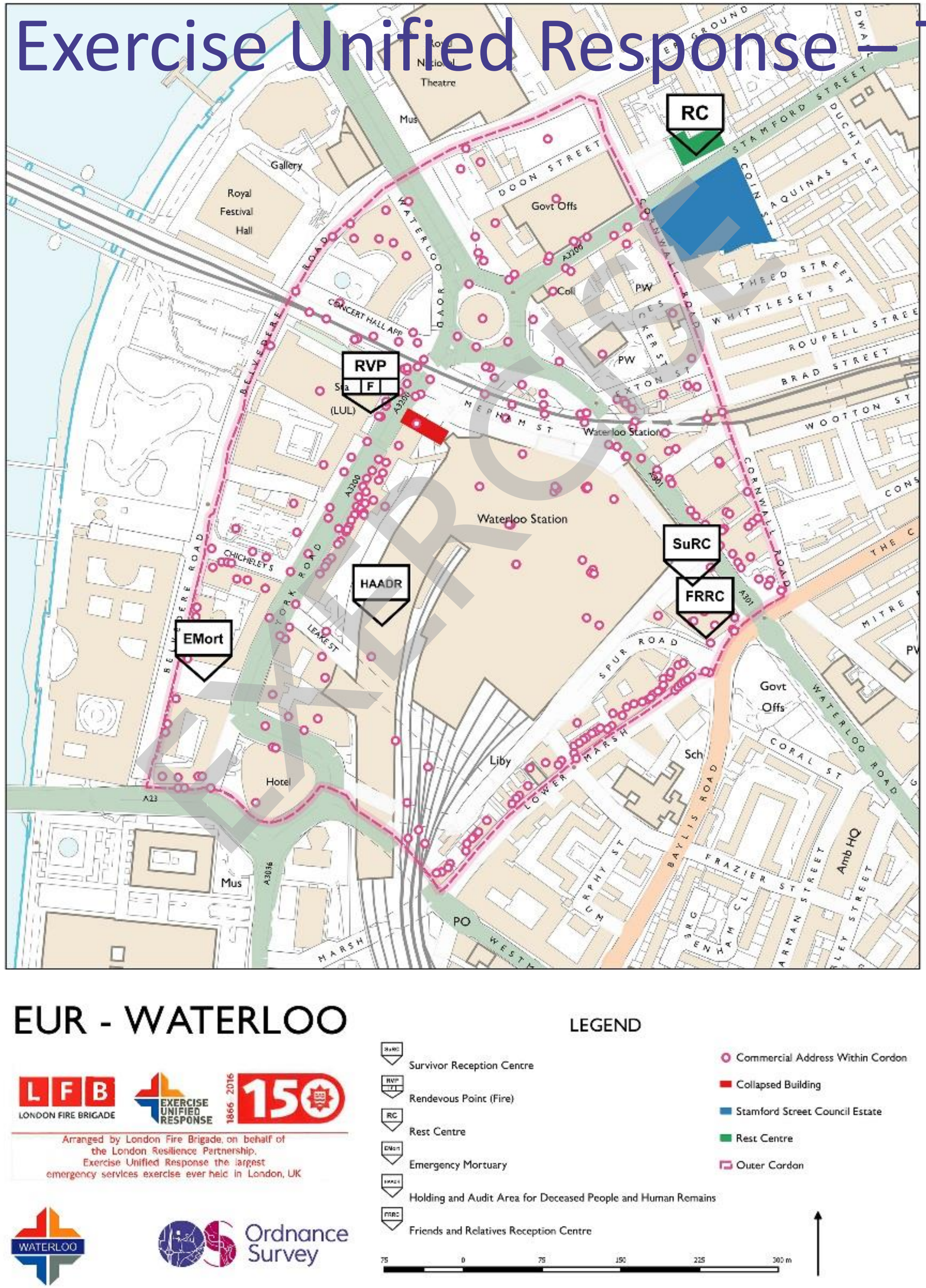
Surface Water Flooding (SWF) Risk

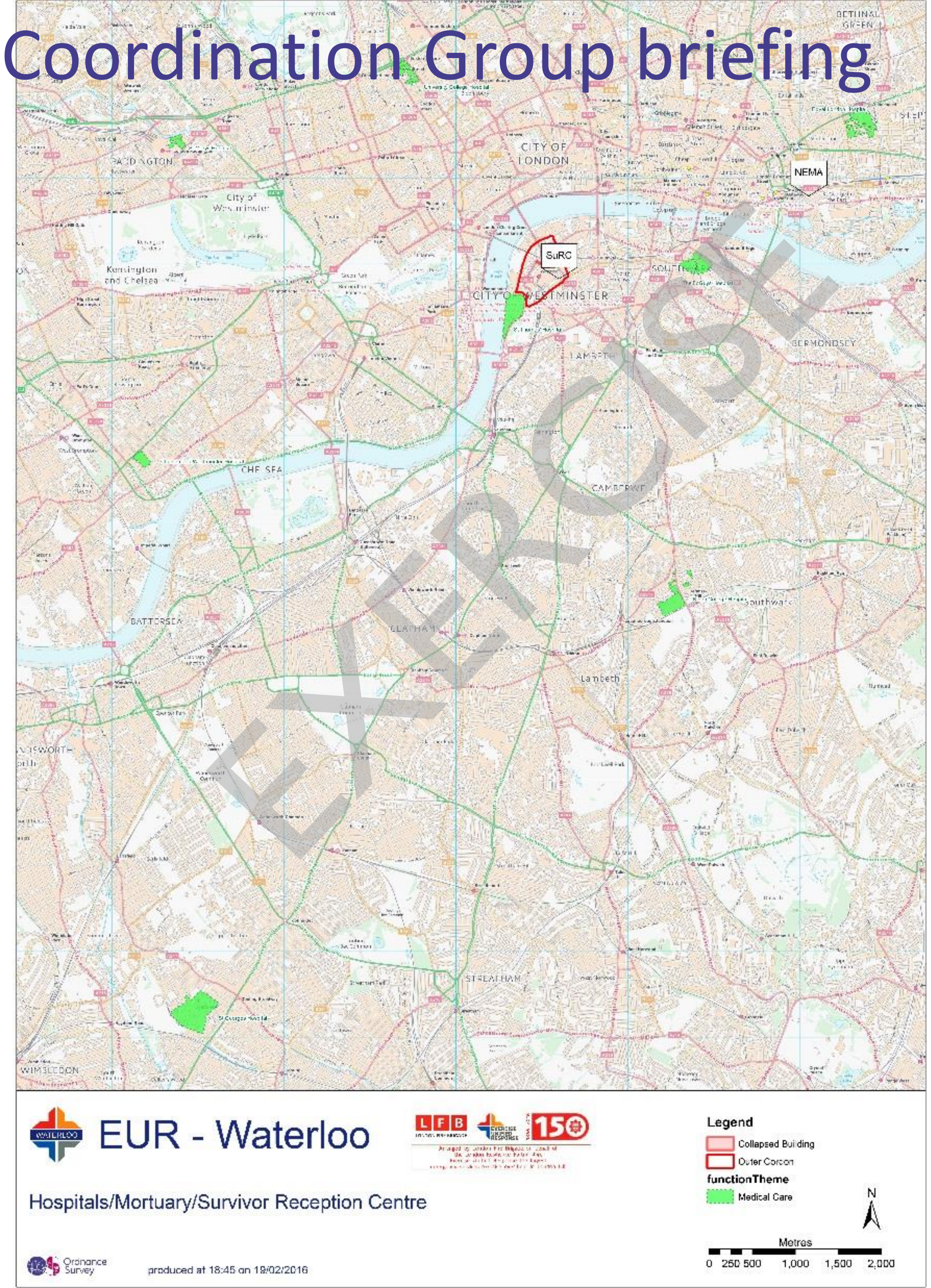
- "Hidden" Risk, rapid onset
- Urban areas often affected, not always near rivers, those at risk may not be aware
- More people and property (3 million) at risk from SWF compared to river and coastal flooding (2.7 million)



https://flood-warning-information.service.gov.uk/long-term-flood-risk/map

Exercise Unified Response – Tactical Coordination Group briefing





Exercise ‘Border Reiver’ – Strategic Coordination Group briefing

Exercise Border Reiver

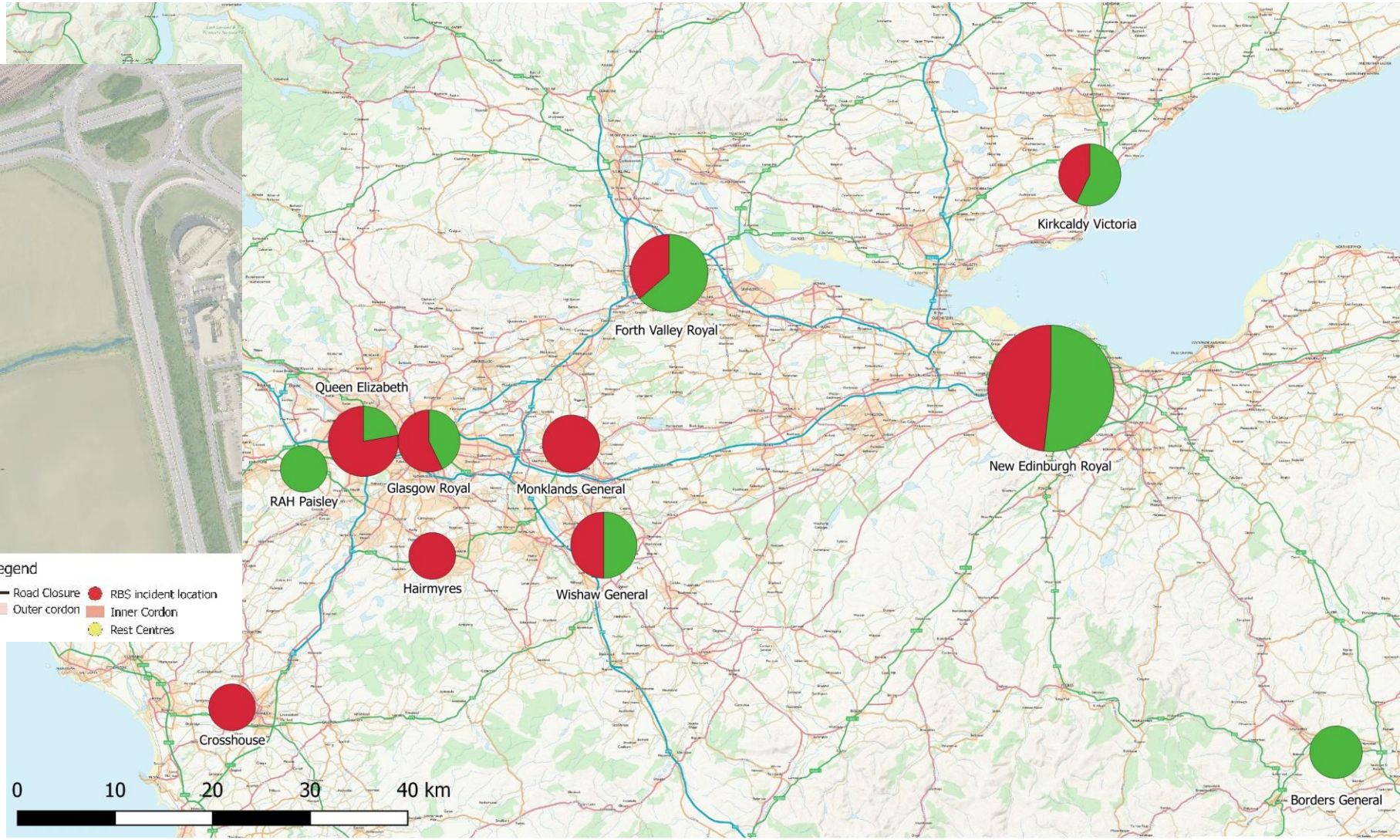
Ordnance Survey

RBS incident location - site
3rd October 2017

Produced: 2017-10-03T22:09:04

Legend

Road Closure
Outer cordon
RBS incident location
Inner Cordon
Rest Centres



Exercise Border Reiver

Ordnance Survey

P1 & P2 Casualty Distribution for
Incident at RBS, Edinburgh 03-10-17

Produced: 2017-10-03T19:19:02

Legend

Casualty Category

P1

P2

‘What’s In Each Area’

Emergency Planning & Exercises

Supporting Lancashire County Council & Local Resilience Forum to prepare emergency plans for **chemical and civil nuclear** regulated sites.

Rapid impact assessment methodology for impact on residential/commercial premises, critical and vulnerable infrastructure using OS AddressBase data within Detailed Emergency Planning Zones (**DEPZ**), Outline Planning Zones (**OPZ**) and Public Information Zones (**PIZ**).

The outputs are:

- CSV for counts of selected infrastructure
- CSV list of addresses

This automated SQL query process saves many hours of manual work during planning or an incident and is an example of best practice

```
48  ------------------------------------
49  ----- COMMON TABLE EXPRESSIONS ------
50  ------------------------------------
51
52      -------KNOWN HAZARDS-----------
53
54   --- COMAH Sites ----
55
56  BEGIN
57  WITH comah_site_count AS ( -- xxx_count is the alias to this query
58  SELECT a.geom, a.slice, oa.number_of_comah_sites
59  FROM [dbname].[schemaname].[tablename] a  -- the A-L sector circle table
60    OUTER APPLY
61      (
62      SELECT COUNT(*) as number_of_comah_sites
63        FROM [dbname].[schemaname].[tablename] b -- input comah sites dataset
64        WHERE a.geom.STIntersects(b.geom) = 1
65      ) AS oa )
66
67  INSERT INTO [dbname].[schemaname].[tablename] (geom, sector, comah_sites) -- these are t
68  SELECT geom, slice, number_of_comah_sites -- here we are selecting the columns we just m
69  FROM comah_site_count;  -- xxx_count is the alias to above query
70  END
71
```

Canals	-	-	-	-	-	-	-	-	-	-	-	-
Environment	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**
Parks & Woodlands	-	-	-	-	-	-	1	1	1	1	-	-
Reservoirs	-	-	-	-	-	-	-	-	-	-	-	-
Flood Zone 2	Yes	Yes	Yes	-	-	-	-	-	-	Yes	Yes	Yes
Flood Zone 3	Yes	Yes	Yes	-	-	-	-	-	-	Yes	Yes	Yes
Biological Heritage / SSSI Sites	-	-	-	-	-	-	-	-	-	-	-	-
Utilities	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**
Electricity Sub-Stations	-	-	-	-	-	-	-	-	-	-	-	-

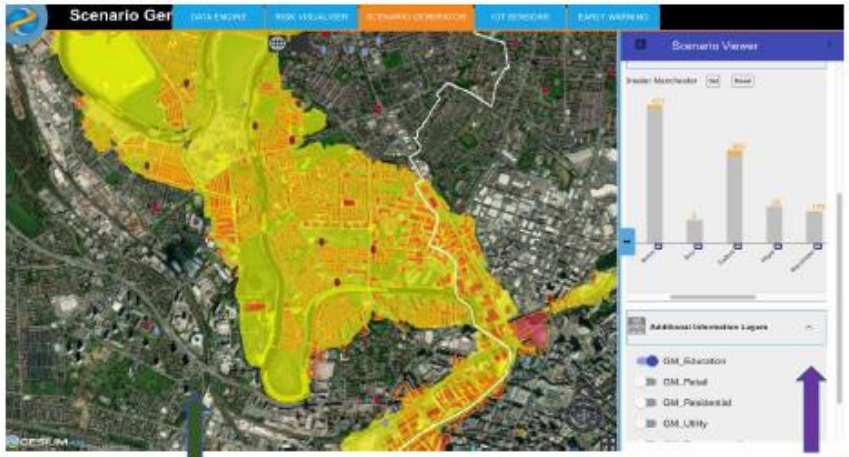
Greater Manchester Local Resilience Forum Innovation Pilot

TIDE DEMONSTRATOR

- Core Team
  - Greater Manchester Combined Authority
  - Greater Manchester Resilience Unit (GMRU)
  - Ordnance Survey
  - Salford University – THINKlab

Aim: Explore how a digital platform can be used to simulate disaster scenarios to enhance multi-agency training and exercising..

- ✓ Chosen scenario – Breach of Jumbles Reservoir
- ✓ Built on MOBILISE Scenario Generator



Visual Map

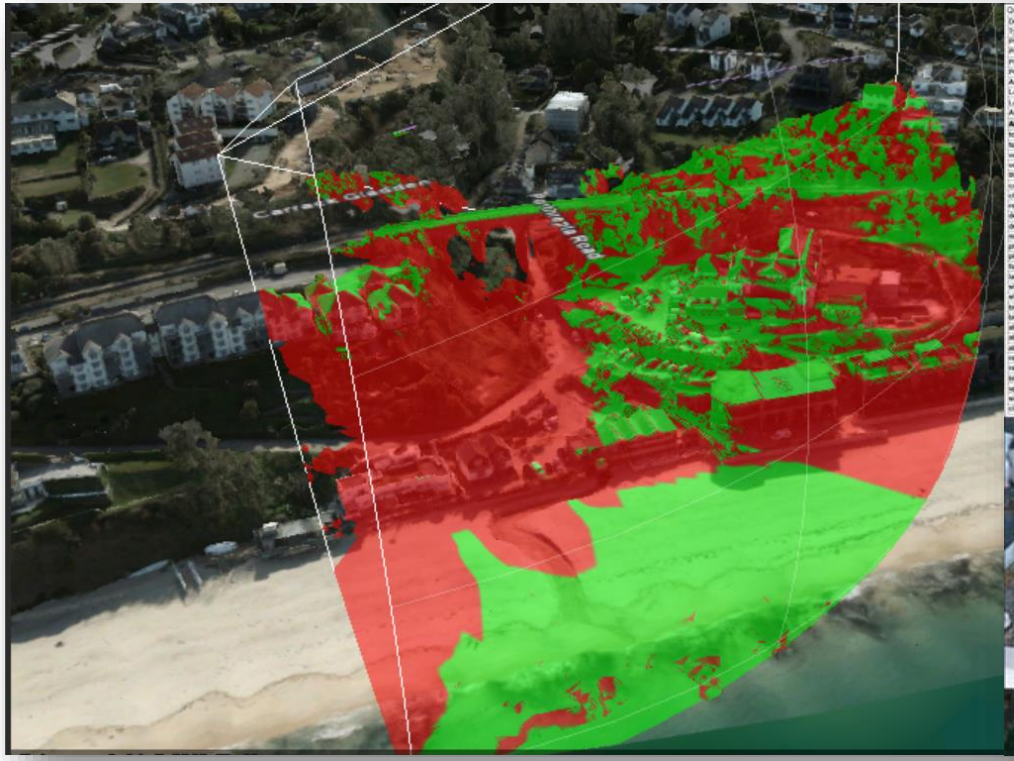
Infographics

- ✓ **Visual Map:** Provides a visual representation of the impact of hazards on properties, infrastructure, and communities.
- ✓ **Infographics**: Offers quantitative data; brings additional information; controls the scenario context

RESIDE Demo (for understanding climate-induced risks)
TIDE Demo (for training and exercise or risk exploration)
RISE Demo (for community engagement support

Ordnance Survey

International Political Events - G7 Summit - 11 to 13 June 2021



3D Mesh Model – line of sight analysis from neighbouring residential building to Carbis Bay Hotel, giving actionable insight.

Selectable 3D mesh features with integrated OS attribution such as addresses and building classification codes


Combining imagery from fixed wing aircraft for context and imagery from UAV captured immediately prior to a major event to provide up-to-date situational awareness.
Mission rehearsal at major sporting venues

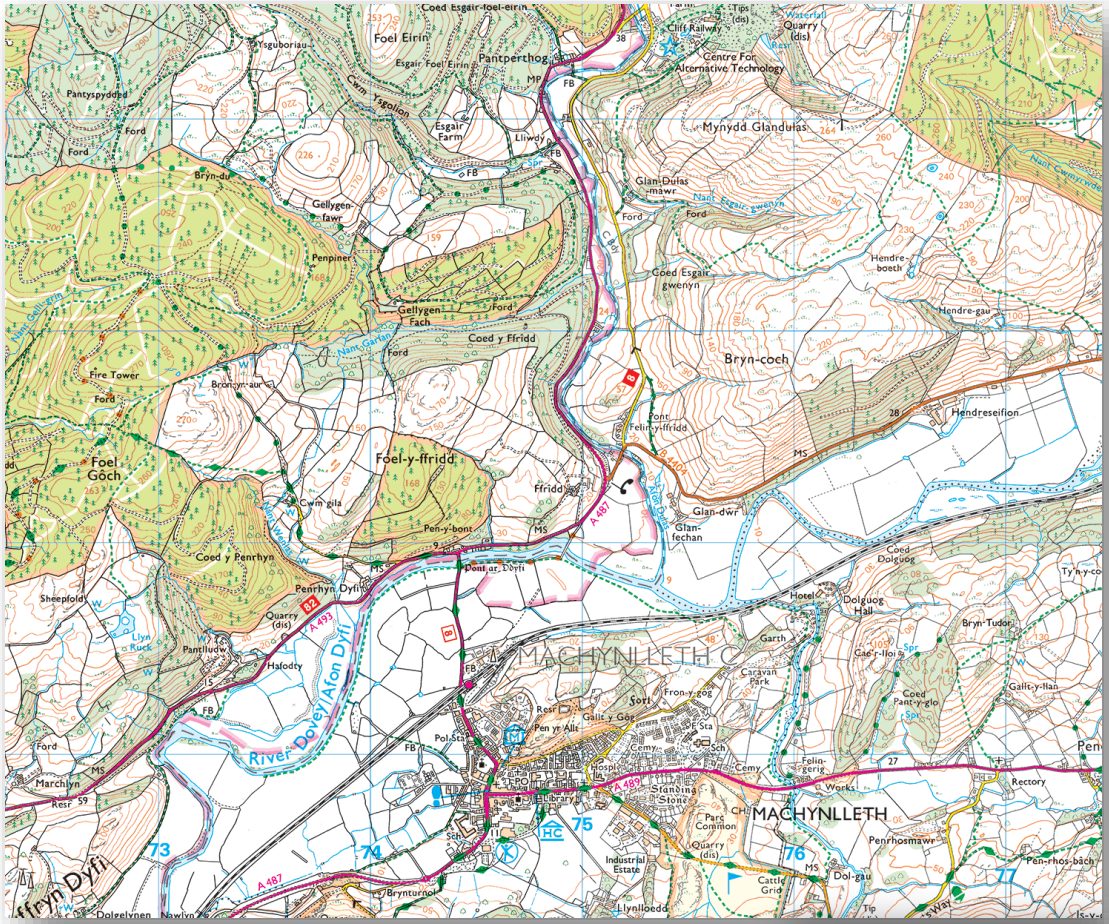
Mapping for Emergencies (MfE) service

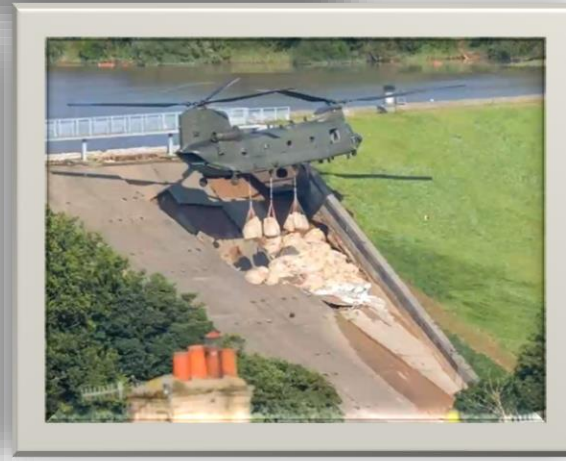
- Access to support from Ordnance Survey during a crisis or major incident*
- Available 24 hours a day, 365 days a year with no charge to service user
- Funded by UK Government as part of the Public Sector Geospatial Agreement (PSGA)
- Primarily aimed at Category 1 and 2 responders (under the Civil Contingencies Act 2004) and Government Departments
- The service provides geospatial support during an emergency or major incident.

***Great Britain Only**

MfE activation examples

- Pan Am Flight 103 – ‘Lockberbie Bombing’ - 21 December 1988
- Kegworth Air Disaster, Flight BD92 – 8 January 1989
- Selby Rail Crash - 28 February 2001
- Animal Health - Foot and Mouth Disease – 2001 and 2007
- Maritime – MSC Napoli, Dorset Coast - 18 January 2007
- London Bombings – ‘7/7’, 7 July 2007
- H1N1/09 Pandemic (Swine Flu) 2009
- Shetland Helicopter Crash - 23 August 2013
- Flooding – Thames & Somerset Levels 2014, Carlisle 2015,
- Reservoir Breach Threat - Ulley Dam June 2007, Todbrook Reservoir August 2019
- SARS-CoV-2 (Covid-19) - 2020 to 2022
- Storms – Storm Eunice 14 to 19 February 2022
- Murder investigations – multiple
- Missing persons - multiple
- Escaped convicts - multiple
- Slavery and servitude investigations - multiple





Rapid basemap creation capability - Lusaka, Zambia use case

- The driver for the data generated for Zambia was the identification and monitoring of informal settlements to support government planning and service provision.
- Additional uses of this data are now being explored and additional value extracted.

Census	Use of building level information to better plan enumeration area, undertake the census and analyse the data collected
Transport	Provision of transport services to/from informal settlements to support population in travelling to/from business district area to help with employment opportunities
Health	Provision of appropriate health and WASH services to meet demands/needs of those living within informal settlements
Disaster Management	Flood, Pandemic management of multiple emergency responders
Energy and Infrastructure	Provision of energy services into informal settlements and public infrastructure to support them

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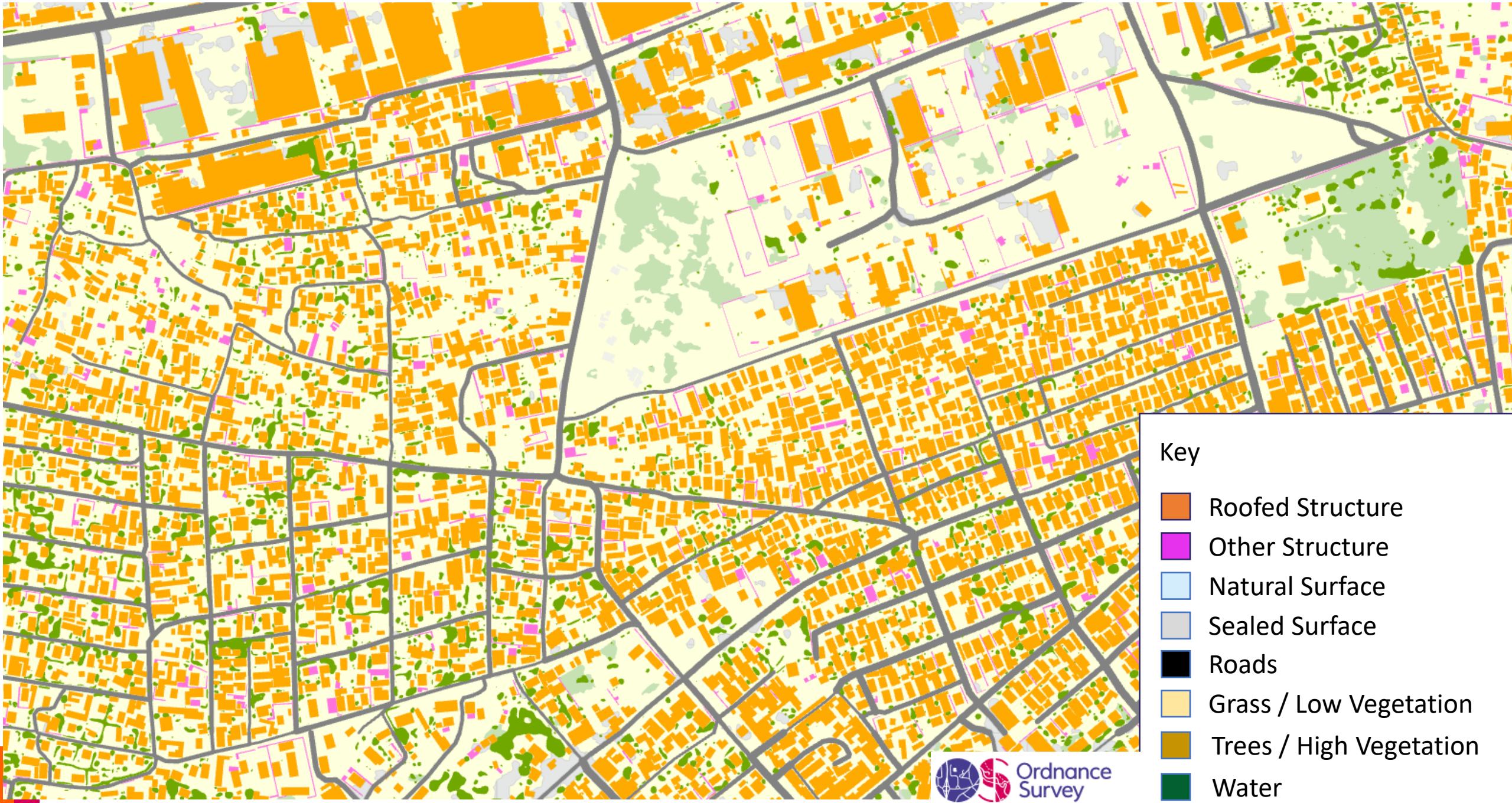
SEE > BETTER PLACE



What is the RBOC Network+?

“ to develop a research agenda that addresses Security threats and challenges facing us in the future (around 2050) by bringing together existing researchers working on individual elements of this challenge and forming them into a coordinated and coherent whole.”

“ a coordinated, sophisticated and catastrophic hybrid cyber-attack on a UK city on 11 January 2051”

RBOC Objectives

Insight

In responding to the scenario, the RBOC Network+ will investigate what capabilities, techniques and vulnerabilities could be exploited by adversaries to mount high-impact attacks against the UK, and what capabilities (technological, organisational, legal and behavioural) could be used by public authorities (central government, local authorities, first responders) to prepare for and respond to such attacks.

Innovation

To develop, accelerate and apply these capabilities to prepare for, respond to, recover, and mitigate threats, the N+ will lead and facilitate the production of original research using novel combinations of disciplines and methods, and build new relationships between researchers and policy makers and practitioners in government and industry. It will also develop a 'safe-space' simulator for modelling the scenario with outputs providing insight to policy and practice implications, impacts and research gaps.

Impact

RBOC's research and networks will initiate and facilitate the creation of new understanding and capabilities for government and industry to prepare for, respond to, and mitigate the impacts of major attacks from hostile actors.

Conclusions - DTPI

- Data – fusing data from multiple sources, to answer complex questions quickly
  - Geospatial foundation data – authoritative and official
  - EO / UAV data
  - Real time data e.g. weather, news, social media, IOT sensors, monitoring stations
  - Event / thematic data
  - Emergency planning data

- Tradecraft – learn to work together, understand each other, practise regularly and upskill
  - Domain expertise (multi-agency)
  - Geospatial expertise
  - Emergency management and coordination expertise

- Partnerships – we get better outcomes through collaboration, get involved, don't wait to be asked!
  - Public sector
  - Private sector
  - Inter-governmental bodies
  - Standards bodies
  - Voluntary sector
  - Academia

- Innovation – we are responding to more threats and more often, we need to innovate to stay ahead and scale

THANK YOU

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