

NOVEMBER 2017

PROJECT ICEBERG BREAKING NEW GROUND FOR FUTURE CITIES

Our cities are growing, and with increasing pressure on space, higher land prices and a drive for compact, resource efficient cities, **we are seeing more urban development underground**. This is leading to increased pressure on subsurface space in our cities. Urban subsurface space provides a **valuable resource often forgotten in city planning** – out of sight, out of mind. Yet we rely on land beneath cities to **build on**, to house our **critical transport** and utility infrastructure, to provide natural resources to **sustain urban growth** and increasingly for **innovative applications** such as growing food underground, ground heat recovery, and underground data-stores.



Ordnance
Survey



British
Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

CATAPULT
Future Cities

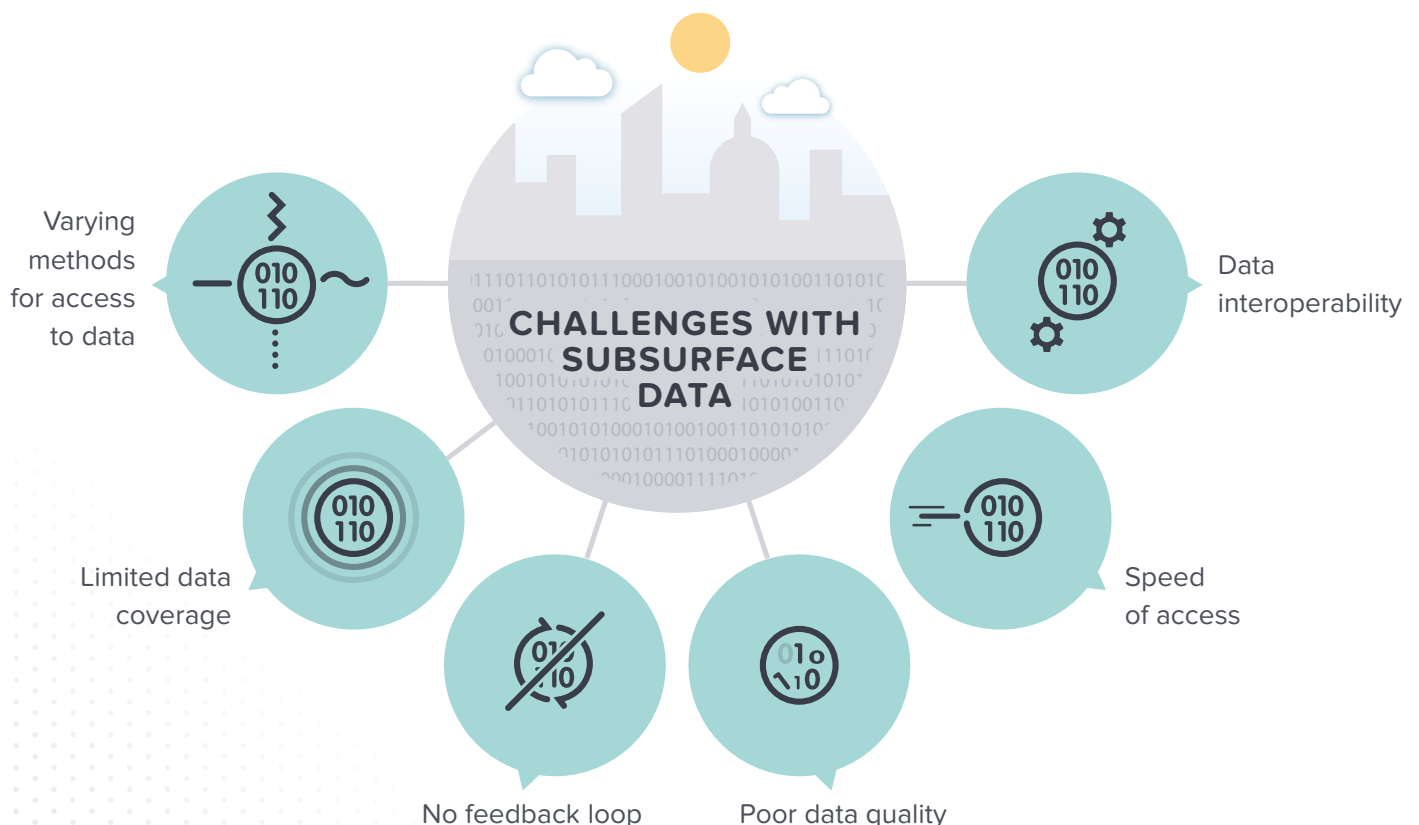
THE CHALLENGE

The direct costs associated with 'normal' maintenance of underground electricity, gas and water assets runs into the billions of pounds a year without considering indirect costs such as increased road congestion during ground works. How we understand and manage underground space determines how sustainable and resilient our cities will be. As extreme weather conditions become more persistent we must consider the environmental risks to infrastructure and the capacity of the ground to dampen extremes. More than 50 London Underground sites are at high risk of flooding. Meanwhile our limited knowledge of the condition of land means that sites with the potential to accommodate desperately needed housing are dismissed as unviable.

The surface world is mapped down to a matter of centimetres but interest in and understanding of the underground is limited to a small number of transport planners, urban geologists and construction workers. There is some information about who owns what water pipe, where the electricity cable was laid or the type of soil that is surrounding the new tube line but its scattered amongst many, many different public and private organisations, held in different formats. Some data is security sensitive, but much is withheld for reasons of perceived commercial advantage or lack of incentive to invest in data sharing. Even if you can request the information, it often take weeks to receive it.

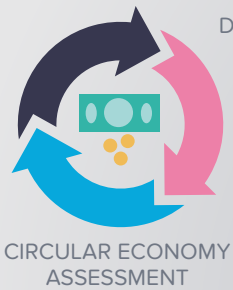
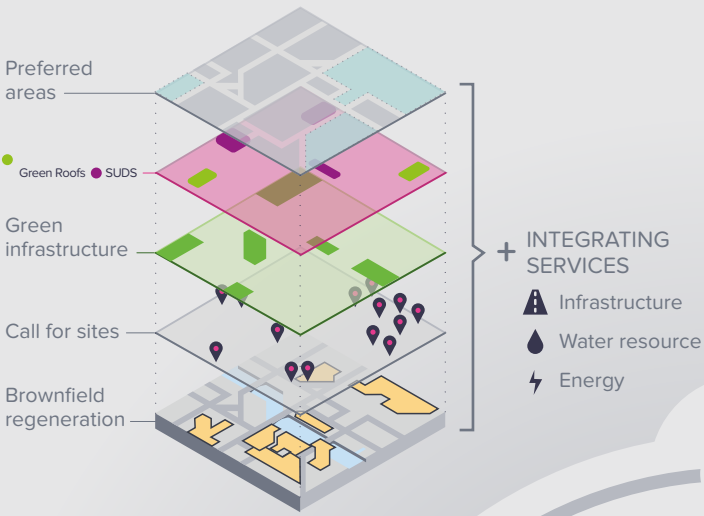
Critically the holders of this data have different technical expertise, different incentives and different approaches to data utilisation. New sensing and sensor technologies are beginning to capture more data, more precisely about assets, their condition and the soil they sit in. However until there is a way for anyone who needs to know about the subsurface to easily and reliably access the appropriate data for their task, it will be impossible to manage the growing costs associated with underground development and asset management, creating a financial burden for society.

This lack of coordination and collaboration has many costs. The Department of Transport estimates that street works account for an estimated cost of £4.3bn annually (2005). Meanwhile the Treasury estimated in 2013 that greater cross infrastructure collaboration can save the economy an estimated £3bn. Not only could we do things more efficiently with subsurface data but also quicker. It was estimated that the \$2bn light rail scheme in Sydney could have been built one and a half years earlier if they had reliable underground utility information. We can only guess at the acres of brownfield land that might become economically viable for housing development if there was greater sharing of subsurface information.



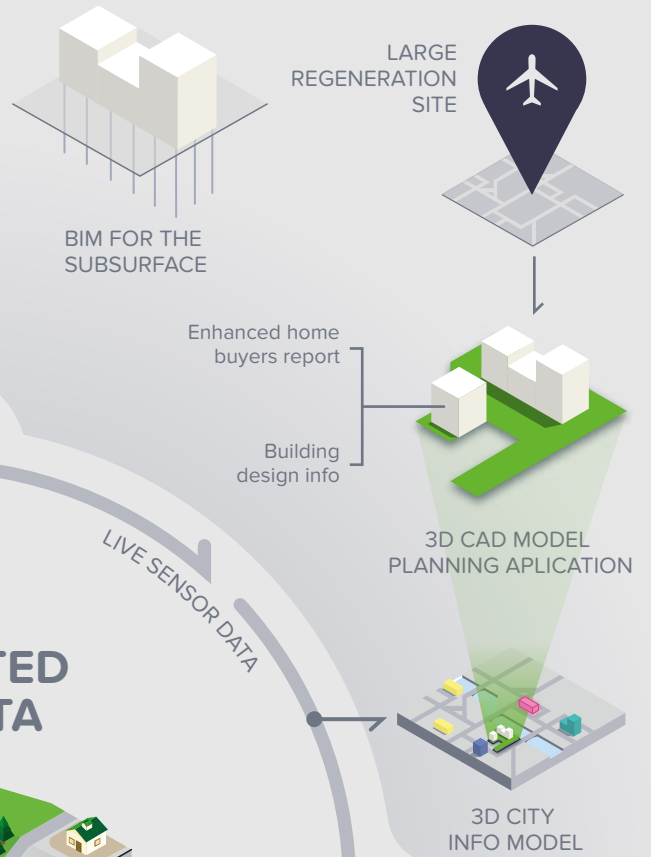
DEVELOPING TOOLS, SERVICES & SOLUTIONS: USE CASE APPLICATIONS

INTEGRATED PLANNING



LOCAL DEVELOPMENT PLANS

INTEGRATED 3D MODELLING



INTEGRATED CITY DATA



Urban planner

LIVE SENSOR DATA

NEW DATA

BROWNFIELD LAND

BROWNFIELD REMEDIATION COSTING TOOL

REFINED BROWNFIELD REGISTER



Developer

UTILITIES

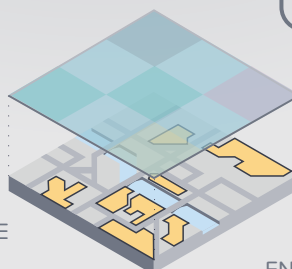
UTILITIE LIFECYCLE COST

RISK ASSESSMENT

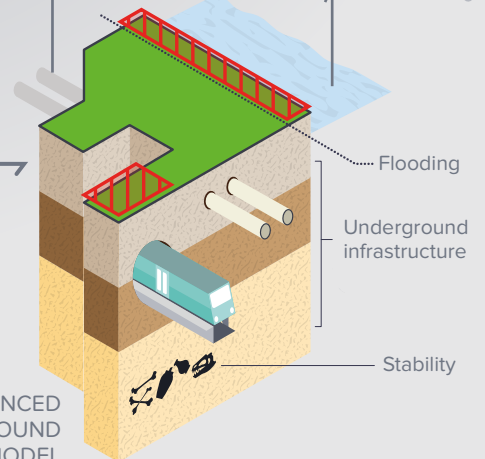


TOOL TO ASSESS CAPACITY IN ALL UTILITIES AT A SPECIFIC SITE

INTEGRATED UTILITY INFRASTRUCTURE MAP



ENHANCED 3D GROUND CONDITION MODEL



THE SOLUTION

Recognising that this is a national-scale challenge, and the need to collaborate across sectors, the British Geological Survey, Ordnance Survey and Future Cities Catapult have been working together on Project Iceberg – the long-term aim being to help increase the viability of land for development and de-risk future investment through better use of subsurface information. In reviewing international projects that use shared data to increase understanding of infrastructure, it's clear that the business case isn't necessarily the problem. All the projects we reviewed showed a positive return-on-investment (ROI) that ranged from \$2.05 to \$6.59 for every dollar spent.

What is needed is a government-backed data-exchange framework for the subsurface that can be integrated with existing city data systems. It's not desirable to have a single map of the subsurface but a consistent framework into which data is supplied, assured, stored, accessed and analysed by a multitude of users in the short term. Smaller-scale exemplar projects demonstrate that this concept is viable. The benefits and business opportunities for the wider UK economy that may be delivered by integrating surface and subsurface information need to be better articulated. The full potential of the subsurface data integration and subsequent sharing needs to be countered against the prevailing bias towards silo'ed delivery of services which are often incentivised on efficiency over better (longterm) outcomes. Accompanying national standards and supporting legislation are also needed to ensure that data is collected and shared in the correct format.

We already have world leading research and practice in this area to build on. Heathrow airport has developed a live map of 72% of its subsurface which led to strike incidents caused by inaccurate data falling six-fold. The Mapping the Underworld and Assessing the Underworld projects led by University of Birmingham have built the evidence base for a commercially-developed multi-sensor device and decision support software. But they have faced the same barrier in terms of accessibility and quality of data as many others.

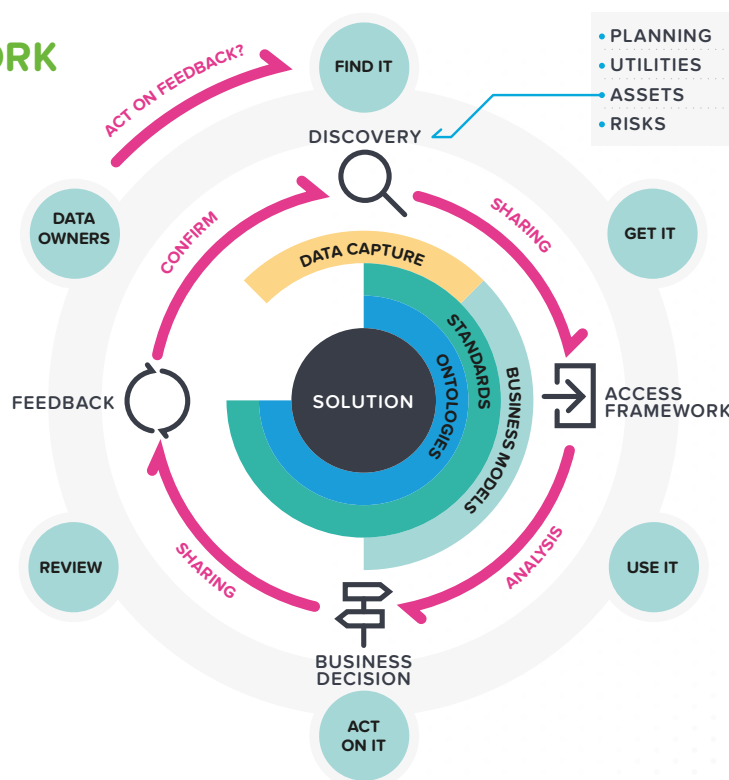
With a national subsurface data exchange framework integrated with surface city data the potential of new technologies can be realised. We would see augmented reality being used to view the accurate location of pipes before they dig; sustainable drainage schemes being modelled to help manage surface water and reduce the pressure on the water pipe network; quickly and more accurately estimate the costs of remediating land for housing; and accelerate conveyancing for homebuyers.

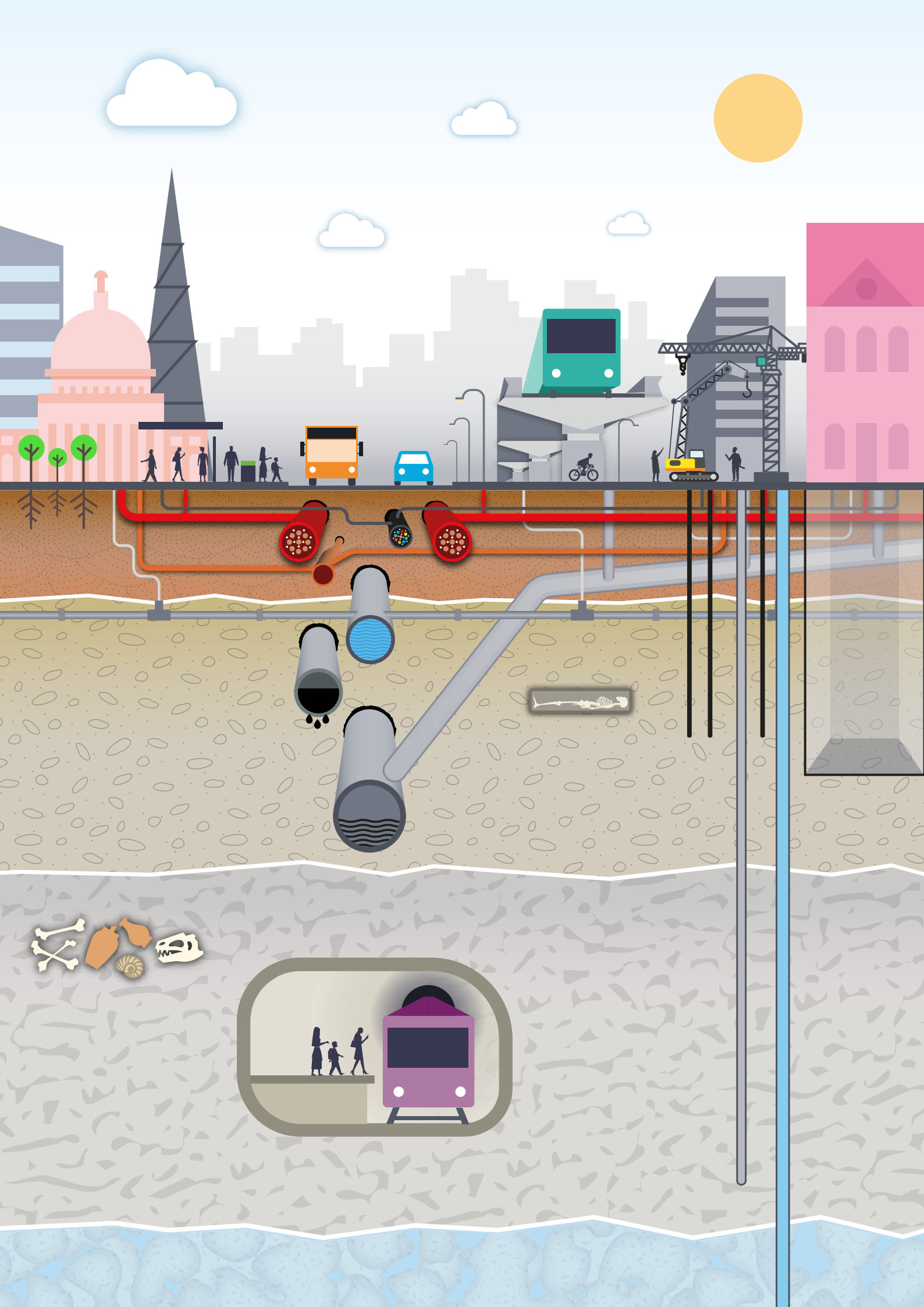
Visit our website to learn more about project Iceberg, the evidence base and key outcomes.

<http://os.uk/projecticeberg>

If you would like to participate in phase two of the project, or would like to know more about how you might benefit from this work, please email us at projecticeberg@os.uk

DATA FRAMEWORK







**INTERESTED IN WHAT
WE'RE DOING?
THEN WHY NOT...**

Visit our websites

www.ordnancesurvey.co.uk/projecticeberg

www.bgs.ac.uk/urban/icebergwww.futurecities.catapult.org.uk

futurecities.catapult.org.uk/project/future-planning-project-iceberg/

Or send us an email

projecticeberg@os.uk

Project Iceberg is an exploratory project undertaken by **Future Cities Catapult**, **British Geological Survey** and **Ordnance Survey**. The project aims to address the serious issue of the lack of knowledge about the ground beneath our cities and the un-coordinated way in data about the subsurface is captured, used and reused. **The long-term goal is to help increase the viability of land for development and de-risk future investment through better management of subsurface data.** To help achieve this, our study aims to enable a means to discover and access relevant data about the ground's physical condition and assets housed within it, in a way that is suitable for modern, data driven decision making processes.