Geospatial Commission

NATIONAL UNDERGROUND ASSET REGISTER (NUAR)

ECONOMIC BENEFITS PAPER

NOVEMBER 2021

Detailed cost/benefit methodology and sensitivity analysis

Costs/benefits

There are three sources of benefits:

- Utility Asset Strike savings
- On-site efficiency savings
- Data Exchange and Back-Office efficiency savings

Each is covered in this paper. We first estimated the raw annual costs of each type of benefit source, before then applying the appropriate economic treatments of discounting, deflating, applying optimism bias and applying different participation rates over the 10 years.

The raw annual costs are presented below and the "treated" estimates are presented in the main body of the economic case.

Utility Asset Strike savings

The value from utility strike savings focuses on the total costs of utility strikes that would be avoided as a result of NUAR through increased data quality, format consistency and data accessibility. Better data allows excavators to identify where underground assets are located and enhances their ability to practice safe digging to avoid the assets.

We used academic research to estimate the direct and non-direct costs of utility strikes by asset type. The study by Makana *et al.* (2019) assessed 16 fully detailed case studies in the UK. These case studies covered electric - low voltage: £2,637; electric - high voltage: £10,000; gas - low pressure: £2,238; gas - high pressure: £6,400; water: £5,375; and telecoms: £680. These were supplemented by estimates from Metje *et al.* (2015) which were based on data from 3,348 strike incidents sourced from eight companies which included information on number of strike incidents, date, time, tool, utility type and the costs of strikes, including for fibre optic (known to be more costly than traditional telecoms): £2,800. Market level statistics have also been included from market aggregators (LSBUD, 2020).

Across all of these assets, the average direct cost of a strike is £3,371. This figure is similar to those reported in USAG Strike Damages Reports from 2014-2019, which, through annual industrial surveys, have estimated the direct cost per strike at being approximately £3,600. We therefore take the values from Makana *et al.* (2019) and Metje *et al.* (2015) to determine the direct costs per strike for each utility category.

Makana *et al.* (2019) also compared the direct and indirect costs from the 16 detailed case studies. Indirect costs include project delays, impacts on third parties and costs borne by wider society. Overall, Makana *et al.* (2019) estimated a ratio of direct to indirect costs of 1:29. This ratio is applied in the business case to estimate the total cost savings from reducing utility strikes.

A widely reported industry statistic of 60,000 strikes per year on buried service pipes and cables per year was used as the basis of the strike reduction benefits. This statistic was

reported in USAG 2014, Beck et al (2007) and the Civil Engineering Contractors Association (CECA). Based on this evidence base that underpins our economic estimates and using HMT Green Book discount rates, we estimated that the total cost of utility strikes to be, on average, £2.4bn per annum; composed of £79m p.a. direct costs and £2.31bn p.a. of indirect costs (2021 prices, present value), the latter established by applying the 29x ratio from academic research.

We then assumed that 30% of strikes could be avoided through better data (see below for discussion). As a result, the intervention would be able to reduce the economic costs of utility strikes by approximately £347 million per year: £12 million in savings from direct costs and £341 million in savings from non-direct costs (Table D1). See Table D1 below for the full calculations by asset type.

Utility	**% of total strikes[1]**	**Strikes per year [2]**	**Direct cost per strike[3]**	**Direct cost total (£m)**	**Non-direct cost total[4] (£m)**	**Total costs of utility strikes (£m)**
Electric	40%	23,776	£3,455	£82	£2,382	£2,465
Gas	19%	11,363	£4,319	£49	£1,423	£1,472
Telecoms	19%	11,356	£680	£8	£223	£2,325
Fibre optic	4%	2,460	£2,800	£7	£200	£206
Water (excl. sewer / drainage)	17%	10,376	£5,375	£55	£1,617	£1,673
Sewer / drainage	1%	667	£983	£0.6	£19	£19
Total	**100%**	**60 ,000**	**£3,371 (avg.)**	**£202**	**£5,866**	**£6,068,202**
% of strikes resolved[5]	-	-	-	30%	30%	30%
Cost savings (per annum)	-	-	-	~£61m	~£1,759m	~£1,820m

Table D1. Calculations by asset type. ***Undiscounted, nominal terms, no Optimism Bias adjustment.***

We assumed, based on strike causes in the USAG survey reports 2014 - 2018, that 30% of strikes could be avoided through better data and easier access to it. The NUAR programme involves a Data Transformation phase where data will be digitised and standardised on behalf of Asset Owners who will work collaboratively alongside the Geospatial Commission.

The process intends to provide a bespoke conformance report to each asset owner outlining to what degree their data will conform to the standard required for NUAR. This will cover characteristics such as completeness (of data and metadata, e.g. about depth, data quality measures, accuracy metadata), domain conformance (conformance of values to agreed standardised categories), data currency and more.

The report will provide objective information which could be used by Asset Owners to define focus areas for data quality improvement. Whilst NUAR will not be the sole solution to

resolving some of these data issues, collectively it is expected to help drive change across industry and support improvements in quality for individual datasets over time by making. For example, in cases where procedures are not followed because of confusion from interpreting the data, NUAR will help alleviate some of those pressures, reducing burdens on teams which can also lead to a reduction in strikes

The USAG report breaks strike causes into planning and execution-related causes. The planning-related reasons we assumed can be resolved through the data platform are “Assets not on relevant plans”, “Plan of asset damaged not present”, “Inaccuracy of plans”, “Inadequate assessment of works”, and “Inadequate survey.” Better quality and comprehensive data that is more easily accessible to project teams should improve planning processes and output, resolving these utility strike causes. We also included one execution-related reason, “Not following procedure”, because increasing the ease and speed of accessing data, as well as the interpretation and orientation of data on-site should increase compliance with safe digging procedures. These reasons make up approximately 30% of utility strikes (rounded to account for uncertainty from visual estimates). See Table D2.

We recognise that there is uncertainty with regards to the 30% assumption, so we have tested the robustness of the NUAR case with both a lower proportion of mitigated strikes (5%) and assuming no strike cost savings – see scenarios 1 and 4 in the Sensitivity Analysis section. These still show NUAR to be very high value for money with a benefit-cost ratio of 13 and 9 respectively.

Cause	Description in USAG survey	% of strikes	How strike is avoided
Assets not on relevant plans	“Plans of relevant utility did not show utility asset damaged”	7%	Observations from users reported back via NUAR platform will identify data errors or missing assets to Asset owners. This will lead to more comprehensive data that shows most available underground assets on plans.
Plan of asset damaged not present	“Plans of utility damaged not present”	~0%	More easily accessible and comprehensive data will provide plans from all asset owners
Inaccuracy of plans	“Utility asset damaged not shown correctly on plans on site”	2%	Standardised data presented in a common format, scale, comprehensively shown in a singular base map will show all underground assets accurately on plans
Inadequate assessment of works	“Insufficient assessment of works required including not sufficient equipment provided etc.”	4%	Better quality and comprehensive data will support better assessment of work required and avoid high-risk activities within the dig

Cause	Description in USAG survey	% of strikes	How strike is avoided
Inadequate survey	“Survey practices not sufficient”	8%	NUAR conformance report will highlight to Asset Owners where their data may need improvement and focus on specific improvement areas.
Not following procedure	“Identified that Company procedures were not being fully followed by individual or group”	11%	More accessible data that is also easier to orient on-site will reduce pressure on site workers who are working to tight deadlines.
Total		**~30%**	

Table D2. Reasoning for 30% reduction assumption in asset strikes.

On-site project savings

The total value of on-site project savings of approximately **£122 million per annum (undiscounted, nominal terms, no OB adjustment)** comes from three areas – the cost of resuming projects after discovering unexpected underground assets, the cost of abandoning projects due to constraints from unexpected underground assets, and the cost of orienting multiple maps on-site.

Resumption cost savings of approximately £91 million per annum (undiscounted, nominal terms, no OB adjustment) drive the value of on-site project savings. Comprehensive underground asset data would improve project planning and help on-site teams avoid re-surveying and re-planning, reducing disruption to the public.

We assumed that overall found asset incidents occur at the same rate as low-severity utility strikes, given that these have the closest comparable impact on an underground asset. The number of large project incidents is based on information provided by experts while the number of small project incidents is the remainder to reach the total number of incidents estimated.

The cost of large project resumptions is sourced from the user interviews while the cost of small project resumptions is based on the labour and equipment cost of a 2-day re-planning and re-surveying delay. It is likely that roadworks make up a significant proportion of the small projects and so delays there would incur additional non-direct costs such as traffic disruption and disruption to local businesses.

We included an additional non-direct cost multiplier but conservatively assumed only 25% of the Makana et al. ratio, given that these incidents do not result in damage to the underground asset (Makana *et al.* 2019). Larger projects are likely to be sufficiently isolated with fewer traffic disruptions and other costs smaller projects (such as roadworks) would incur.

As a result, we conservatively excluded the non-direct cost multiplier. We estimated approximately £91 million (undiscounted, nominal terms, no OB adjustment) in project costs could be saved.

Better data will also allow teams to **avoid abandoning projects** as they can better plan around critical underground assets. We estimated a potential cost savings of approximately £3 million per annum (undiscounted, nominal terms, no OB adjustment) based on incident rate and cost estimates from user interviews. The value potential is relatively small as only a relatively small number of excavations are abandoned.

Finally, the unified platform should provide a single, integrated view of all the underground assets, saving on-site teams from interpreting multiple maps. **Total field efficiency savings** are approximately £27 million per annum (undiscounted, nominal terms, no OB adjustment), based on market trade rates for site projects and time savings estimates from our Pilot Phase findings[6]. There could still be significant uncertainty around these figures given the relatively small sample size so these figures should be taken more as indicative of the scale of savings that could be unlocked.

Across all these areas, we assumed the data platform can resolve approximately 56% of incidents, which is based on the current application of map data in projects. Table D3 below summarises the calculations for on-site project savings (undiscounted, nominal terms, no OB adjustment).

Resumption costs - Small projects	**# of incidents per year[1]**	**~37k**
	Re-working cost per incident[2]	**~£520**
	Wider cost ratio[3]	**~7x**
	% of incidents reduced[4]	**56%**
	Small projects resumption costs value (p.a.)	**~£88m**
Resumption costs - Large projects	**# of incidents per year[5]**	**~150**
	Cost per incident[6]	**~£40k**
	% of incidents reduced[7]	**56%**
	Large projects resumption costs value (p.a.)	**~£3m**

[1] Assumed occurs at the same rate as low-severity utility strikes (USAG 2016)

[2] Re-work costs based on 2 day delay (cited in user interview), covering project manager labour to re-plan works and equipment rental to re-survey site. Labour cost and rental rates taken from (Sealand Survey and Safety Equipment, n.d.) and (Totaljobs, n.d.)

[3] Assumed 25% of the non-direct cost ratio given there is less disruption from undamaged utilities. See (Makana *et al.* 2016)

[4] Assumed to impact all projects that use searches, based on ~2.2 million searches on LSBUD platform relative to total ~4 million excavations. See (LSBUD, 2018)

[5] User interviews and expert engagement provided estimates of ~1-2k large projects and 10% incident rate

[6] User interviews

[7] Assumed to impact all projects that use searches, based on ~2.2 million searches on LSBUD platform relative to total ~4 million excavations. See (LSBUD, 2018)

Resumption costs - Small projects	**# of incidents per year[1]**	**~37k**
Resumption costs - Total	**Total resumption costs value (p.a.)**	**~£91m**
Abandonment costs savings	**# of excavations[8]**	**4m**
	Rate excavations are abandoned[9]	**0.5%**
	Cost per excavation abandoned[10]	**£300**
	% of incidents reduced[11]	**56%**
	Total abandonment costs value (p.a.)	**~£3m**
Field efficiencies	**# of excavation**	**4m**
	Additional time needed to interpret multiple maps[12]	**~30 mins**
	Trade rate for site projects[13]	**£24 / hr**
	% of applications in projects[14]	**56%**
	Total field efficiencies value (p.a.)	**~£27m**
Total (per annum)		**~£122m**

Table D3. Summary of calculations for on-site project savings.

Data exchange and back-office efficiency savings

The Data Exchange and Back Office efficiency estimates were based on research commissioned by the Geospatial Commission to understand the detailed processes currently involved in requesting, collating and preparing underground asset data and how NUAR would make it more efficient.

A survey was undertaken of stakeholders that are involved in excavation activities. This ranged from those undertaking the digs (e.g. site teams from Tier 1 contractors[15], highways authorities, utility asset owners) to those who hold underground asset data (e.g. utility asset owners, other infrastructure asset owners). Overall, 84 stakeholders of varying sizes, asset classes and regional spread were surveyed: highways authorities (24), utility asset owners (29), other infrastructure asset owners (2) and Tier 1 contractors (29).

[8] (Beck *et al.* 2007)

[9] User interviews

[10] User interviews

[11] Assumed to impact all projects that use searches, based on ~2.2 million searches on LSBUD platform relative to total ~4 million excavations. See (LSBUD, 2018)

[12] Based on NUAR Pilot Phase findings - User Surveyed.

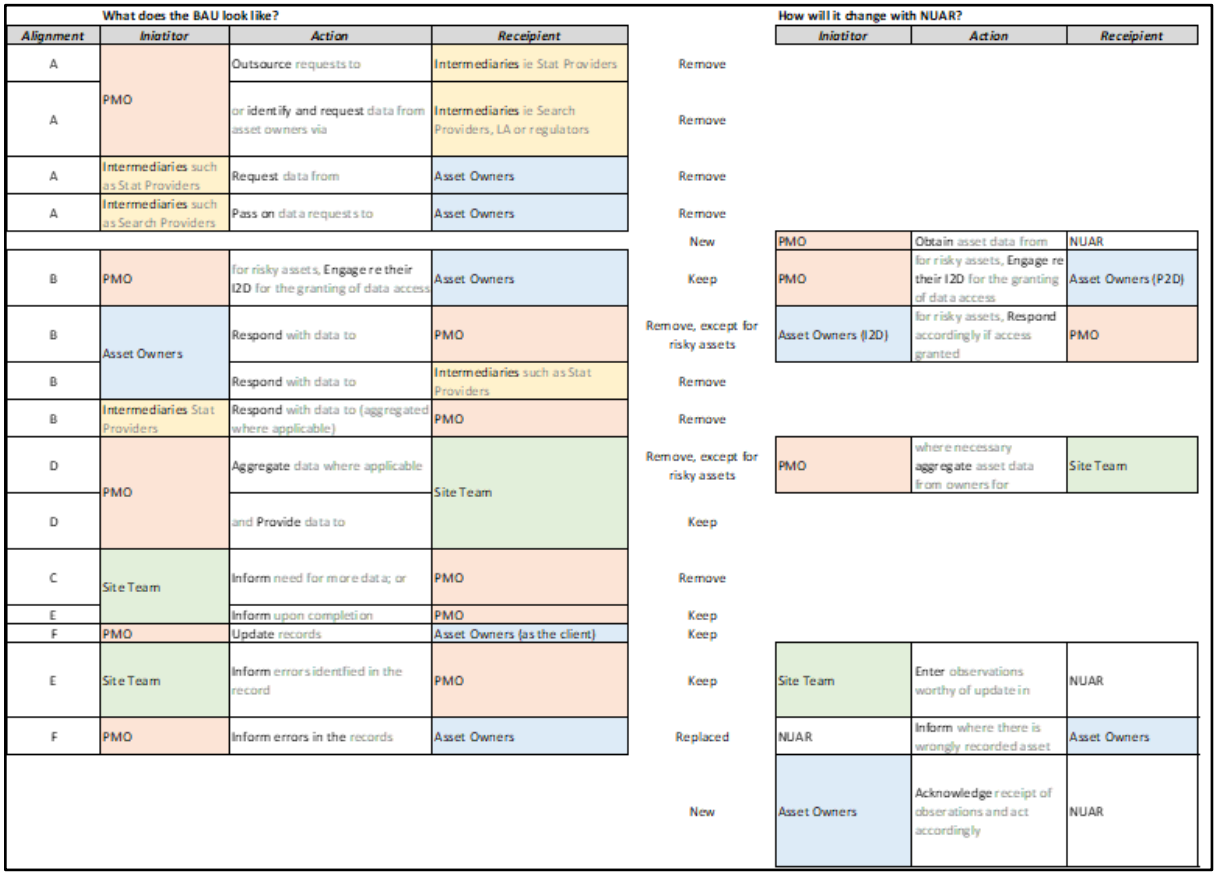
[13] User interviews discussed potential on-site savings of approximately £270 thousand over 135 thousand excavations. Trade rate of £24 per hours results from applying lowest user interview saving estimate of 5 minutes per job

[14] Assumed to impact all projects that use searches, based on ~2.2 million searches on LSBUD platform relative to total ~4 million excavations. See (LSBUD, 2018)

[15] Tier 1 contractors use a range of different operating models to deliver large infrastructure projects and programmes, in part to be able to respond effectively to different client requirements. This includes choosing between directly employing project staff, sub- contracting work or a combination of the two.

The surveys aimed to identify and quantify the key time and cost drivers involved in the data-seeking and data-responding process in “business-as-usual” and “NUAR” scenarios. These drivers included (but were not limited to): the number of data requests involved in one excavation, average cost per search (both internal and outsourced to external providers), number of data requests sent and received and average time spent collating and analysing the data and putting into site-packs for the site team.

The full process identified from stakeholders and those in industry under “business-as-usual” and “NUAR” scenarios are summarised in the figure below:



What does the BAU look like?					How will it change with NUAR?		
Alignment	*Iniatitor*	*Action*	*Receipient*		*Iniatitor*	*Action*	*Receipient*
A	PMO	Outsource requests to	Intermediaries ie Stat Providers	Remove			
A		or identify and request data from asset owners via	Intermediaries ie Search Providers, LA or regulators	Remove			
A	Intermediaries such as Stat Providers	Request data from	Asset Owners	Remove			
A	Intermediaries such as Search Providers	Pass on data requests to	Asset Owners	Remove			
				New	PMO	Obtain asset data from	NUAR
B	PMO	for risky assets, Engage re their I2D for the granting of data access	Asset Owners	Keep	PMO	for risky assets, Engage re their I2D for the granting of data access	Asset Owners (P2D)
B	Asset Owners	Respond with data to	PMO	Remove, except for risky assets	Asset Owners (I2D)	for risky assets, Respond accordingly if access granted	PMO
B		Respond with data to	Intermediaries such as Stat Providers	Remove			
B	Intermediaries Stat Providers	Respond with data to (aggregated where applicable)	PMO	Remove			
D	PMO	Aggregate data where applicable	Site Team	Remove, except for risky assets	PMO	where necessary aggregate asset data from owners for	Site Team
D		and Provide data to		Keep			
C	Site Team	Inform need for more data; or	PMO	Remove			
E		Inform upon completion	PMO	Keep			
F	PMO	Update records	Asset Owners (as the client)	Keep			
E	Site Team	Inform errors identfied in the record	PMO	Keep	Site Team	Enter observations worthy of update in	NUAR
F	PMO	Inform errors in the records	Asset Owners	Replaced	NUAR	Inform where there is wrongly recorded asset	Asset Owners
				New	Asset Owners	Acknowledge receipt of observations and act accordingly	NUAR

High-level process map for BaU and NUAR scenarios.

The process of obtaining and feeding back on data involves a number of different agents - the **Project Management Office (PMO)** of organisations who coordinate and plan works on behalf of site teams by requesting for underground asset data before undertaking a dig (usually an Asset Owner, Highways or Rail authority or other types of infrastructure asset owner, contractors and subcontractors), **Intermediaries** who request data on-behalf of PMO (which include search providers or statistic/data providers), **Asset Owners** (those who hold the underground asset data) and the **Site Team** (those on the ground who will be undertaking the dig).

NUAR will remove a lot of the current inefficient processes involved which require contact with intermediaries or direct contact with asset owners (with the exception of risky assets[16] where official Permission-to-Dig must be sought with each asset owner). NUAR will also add a new step to the data-request and feedback process whereby site teams can, via the NUAR platform, report when particular assets are not in their expected position, allowing the asset owner the chance to update its records and benefit the next user. There are steps where NUAR will have a neutral impact on time and costs.

The sample first assessed impacts from the perspective of the PMO. The average cost (time and monetary cost) per request is split into **outsourced** and **internal** requests based on proportions from the survey.

For outsourced requests our survey identified the average no. of requests for data per annum, the fees charged per request and person hours involved in making those requests and interacting with intermediaries and stat providers.

For internal requests, our survey identified that PMO's in our sample conducted searches through search providers. Where asset owners have not subscribed to search providers, PMOs would also have to get in touch directly with the asset owners to obtain their data, before bringing together multiple data sources at different scales and qualities into site packs ready for site teams.

From the perspective of the Asset Owner, our survey identified how many requests they respond to a year. Nearly 90% of these requests are by or on behalf of statutory undertakers. Asset Owners require staff hours to respond to enquiries at a disbursement cost[17].

These results from the sample were then scaled up to national level using national level statistics on: no. of excavations per year in the UK of 4,000,000 (LSBUD Digging Up Britain Report)[18] 2020, national water and electricity mains kilometres (Metje *et al.*, 2015) and population density estimates (ONS). These results were sense-checked with input from sector experts.

Separately, we did some internal analysis to assess, at a high level, the potential costs of asset owners complying with NUAR data standards both initially and the longer-term / ongoing costs. Asset owners being onboarded onto NUAR will, as part of the build phase, take part in a data transformation exercise to map out and understand the processes required to transform data from an asset owner's internal format and quality to a standard required by NUAR. These will be unique to each asset owner. The process is split into the "**Initial Transformation"** and "**Ongoing Transformation"** process.

[16] Risky assets are defined as those which are a particular safety and security risk if tampered with. These include intermediate-to-high pressure gas pipes, high-voltage electricity cables, as well as underground assets directly serving sites of particular security risk e.g airports, military bases and ports.

[17] The fee charged by asset owners to cover the cost of providing access to their data. Some asset owners do not charge a disbursement, and there is no common charging logic for those that do.

[18] https://www.linesearchbeforeudig.co.uk/digging-up-britain-report

The **initial transformation** requires asset owners to work with the NUAR's supplier to understand what repeatable processes are necessary for the asset owner to consistently and regularly provide updates to NUAR. Conversations with teams have established it would take around two weeks (or 10 working days, assuming 8 hour days) with around 10 people involved from the asset owner side. There are 650+ asset owners in the UK, so this, multiplied by the average hourly wage from IT architects, systems designers and business analysts (£24.73[19]) yields an annual economic cost of **£1,285,960 per annum in the NUAR scenario** across all asset owners.

The **ongoing transformation** can either be absorbed in-house by asset owners or outsourced to external suppliers. For simplicity, we conservatively assume the cost of these are the same (noting in reality in-house transformation to be significantly lower in cost than current external rates). We use the top-end cost per externally contracted person of £1,250 a day. We assume it takes 10 working days to transform the data (but conversations with stakeholders suggest that this would only be a matter of minutes once the process is established). We also assume that the optimal update frequency to NUAR is quarterly (this is yet to be determined as part of the transformation workstream) and that the number of people involved halves from 10 to 5 people. Therefore, the per annum cost **is £165,714,900 in the NUAR scenario**.

The difference in time and costs between the "business-as-usual" and "NUAR" scenarios yields the **data exchange and back-office efficiency savings of £694,360,837 p.a (nominal, undiscounted, no OB applied).** These raw estimates then receive the appropriate economic treatments of discounting, deflating, applying optimism bias and applying different participation rates over the 10 year appraisal period.

As a sense-check of our results, we looked at results from Project Iceberg (a collaborative research project into above/below ground planning conducted by the Future Cities Catapult, the British Geological Survey and Ordnance Survey, which reported its findings in 2017): it collected a number of useful statistics and estimates that contextualised our analysis potential scale of the overall economic impact. International exemplars, such as KLIP in Belgium, also provided references for estimates of the data exchange savings (Daems, 2017).

Sensitivity analysis - summary

In this section, we discuss the sensitivity analysis conducted on each source of value and their impact on the project's BCR. The discounted, real terms and optimism-bias adjusted benefits and costs (i.e. the "treated" estimates) are used to determine the benefit-cost ratios below.

The BCR (including optimism bias adjustments) is presented with the low-end of potential value for each of the sources of value, keeping everything else equal. In these scenarios, the economic BCR is still significantly above 1, showing the strength and diversity of value available in the project. As an extremely conservative test, we have also tested the optimism bias-adjusted BCR assuming only one source of value is approached. In all cases, the BCR

[19] ONS ASHE Database (2020 - provisional).

is greater than one. This indicates that there should be sufficient economic value to merit the intervention in most scenarios, even in the worst case of only obtaining value from just one of the sources of value. See Table D5 for the BCRs in each scenario.

	NUAR Sensitivity Tests - Scenarios summary	Economic BCR
1	5% strikes mitigated (rather than 30%)	13
2	Metje et al (2015) direct cost of strike (lower than current)	14
3	No Indirect:direct ratio (0 instead of 29)	10
4	No strike savings	9
5	Only utility strikes	21
6	Only on-site efficiency savings	1.4
7	Only data exchange and back-office efficiency savings	8
8	Data Exchange: Risky assets - High (40% rather than the assumed 20%)	28
9	Data Exchange: Excavations - High (4.7m instead of 4m)	32
10	Data Exchange: Cost per outsourced search (low - 30p rather than £250)	30
11	Data Exchange: Time collating data in BaU (Low - 30 mins rather than 1hr 30)	30
12	Data Exchange: Time obtaining data from NUAR (High - 3 hours rather than 1 hour)	27
13	Data Exchange: Scenarios 8, 10, 11, 12 & 20 together (most pessimistic assumptions)	24
14	Low end direct strike costs (£583 from KLIC rather than £3,371 from Makana et al.)	13
15	High end direct strike costs (£3600 from USAG rather than £3,371 from Makana et al.)	32
16	Half off resumption costs	30
17	Half of abandonment costs	30
18	Half off interpretation time	30
19	Half off on-site efficiencies overall	29
20	Data Exchange: Time collating data from SEARCH PROVIDER queries in BaU (Low - 3 hours rather than 10 hours)	27
21	Data Exchange: 100% More searches result from NUAR platform than business-as-usual (resulting in additional costs to new search users)	29

Table D5. Summary of sensitivity analysis (including optimism bias adjustments)

Economic sensitivities – utility strike savings

Table D6 shows the value of the utility strike savings within the different parameters (Numbers in parentheses include optimism bias adjustments) :

		Average direct cost per strike			
		~£583[20] KLIC	**~£1,685 Half direct strike costs**	**£3,371[21] Makana *et al.* (2019)**	**£3,600[22] USAG**
% of strikes avoided	**13%[23] KLIC**	~£134m p.a. (~£67m p.a.)	~£394m p.a. (~£197m p.a.)	~£789m p.a. (~£394m p.a.)	~£827m p.a. (~£413m p.a.)
	15%[24] Low-end USAG	~£160m p.a. (~£80m p.a.)	~£455m p.a. (~£288m p.a.)	~£910m p.a. (~£455m p.a.)	~£972m p.a. (~£486m p.a.)
	30%[25] Baseline USAG	~£315m p.a. (~£157m p.a.)	~£910m p.a. (~£455m p.a.)	~£1,820m p.a. (~£910m p.a.)	~£1,944m p.a (~£972m p.a.)

Table D6. Utility strike savings sensitivity

Two key variables that drive the utility strike savings are the percentage of strikes avoided and the average direct cost per strike. The baseline estimate of £910 million assumes ~30% of strikes can be avoided, based on the proportion of strikes caused by data-resolvable reasons, £3,371 average direct costs, and a 29:1 ratio of wider societal costs to direct costs.

At the lowest end, if the percentage of strikes avoided and average direct cost per strike values were taken from the savings KLIC in the Netherlands has been able to achieve, then the utility strike savings would be approximately £134 million. All else equal, the optimism bias-adjusted BCR of the project is still highly positive at 15.

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[20] Based on KLIC statistics. See the infographic from (Agentschap Telecom, Ministerie van Economische Zaken en Klimaat, 2017)

[21] (USAG Data & Reporting Working Group, 2016)

[22] (USAG Data & Reporting Working Group, 2016)

[23] Calculated from (Agentschap Telecom, Ministerie van Economische Zaken en Klimaat, 2017)

[24] (USAG Data & Reporting Working Group, 2016). Low-end only takes planning-related reasons that we assume can be resolved through the data platform: “Assets not on relevant plans”, “Plan of asset damaged not present”, “Inaccuracy of plans”, “Inadequate assessment of works”, and “Inadequate survey.”

[25] (USAG Data & Reporting Working Group, 2016). The planning-related reasons we assume can be resolved through the data platform are “Assets not on relevant plans”, “Plan of asset damaged not present”, “Inaccuracy of plans”, “Inadequate assessment of works”, and “Inadequate survey.” We also include one execution-related reason, “Not following procedure”, because the data platform should make obtaining underground asset data for a site much easier and interpretation of maps, thereby increasing compliance with procedures

Even without any utility strike savings, the optimism bias-adjusted project BCR is 13, indicating the diversity of value driving the project. Moreover, there is some small upside potential, as respondents in the USAG 2014 survey reported average direct cost per strike could be £3,600, which is slightly more than the £3,371 used in the baseline[32].

Economic sensitivities – on-site project savings

The baseline estimates for on-site project savings are based on a number of parameters obtained through user interviews. A common parameter is the 56% efficiency factor assumed through the proportion of excavations with searches conducted[33]. As a general sensitivity test, we test the impact of individually and collectively halving the efficiencies gained.

	Half resumption cost savings	Half abandonment cost savings	Half field-efficiencies	Half on-site project savings
Value of individual savings	**£46m p.a.**	**£2m p.a.**	**£13m p.a.**	**£61m p.a.**
Economic BCR	**30**	**30**	**30**	**29**

Table D7. On-site project savings sensitivity. All include optimism bias.

Even after halving the individual and collective savings, the optimism bias-adjusted economic BCR is still high, driven by the utility strike and data exchange/back office efficiency savings.

Economic sensitivities – data exchange savings and back-office efficiencies

The baseline estimate for data exchange savings and back-office efficiencies is based on several assumptions about:

- **Percentage of underground assets that are considered "risky"**. Currently assumed to be 20% based on five broad categories of underground assets - gas, electricity, telecoms, water/sewerage, infrastructure. Of these, gas is assumed to be the most high-risk in terms of mortality and injury. Subsequent analysis by the Geospatial Commission looked at the length of electricity network assets which are high voltage/transmission and of gas network assets which are intermediate pressure or above and found this proportion to be around 10%. Nevertheless, for the core analysis we have continued to assume 20%, and for one of the sensitivities considered a proportion of 40%. The higher the proportion of assets that are considered "risky", the less of an impact NUAR will have.

- **Number of excavations per year in the UK.** We currently assume 4 million excavations and 60,000 utility strikes per year (USAG, 2014 - 2018). However, further analysis by the Geospatial Commission has determined the number of

excavations could be as high as 4.7 million a year in the UK (17% increase), based on dig statistics from some asset owners and data on asset length (km). Assuming the ratio between excavations and strikes is the same, a 17% increase in strikes yields total UK annual strikes to 70,000. The higher the annual number of strikes in the UK, the higher the impact from NUAR (and vice versa).

- **Cost per outsourced request.** Currently, when PMOs outsource requests to intermediaries, they are charged a fee per request. The survey indicated a range of between £250 to £0.30 - the lower the cost per outsourced request in the BaU process, the less of an impact NUAR will have on data-exchange and back-office efficiencies. For the purposes of this test, we assume the cost per outsourced request is on the lower-end of £0.30 per request.

- **Time spent collating data from DIRECT LINE queries under business-as-usual**. The current estimate of 6 hours of collation time includes 1.5 hours for PMOs to identify and engage with asset owners and subsequently collate their data. This was based on user interviews. For the purposes of this test, we reduce this by 3x to 0.5 hours. The lower the time spent collating data under business-as-usual, the less of an impact NUAR will have on data-exchange and back-office efficiencies.

- **Time spent collating data from SEARCH PROVIDER queries under business-as-usual**. The current estimate of 10 hours for PMOs to identify and engage with asset owners. This was based on user interviews. For the purposes of this test, we reduce this to 3 hours. The lower the time spent collating data under business-as-usual, the less of an impact NUAR will have on data-exchange and back-office efficiencies.

- **Time spent obtaining data from NUAR**. From our survey, PMOs who obtain data from providers via platforms do so in 0.6 hours. Our core analysis has assumed 1 hour in that it is expected searches will take no longer than on current platforms. For the purposes of this scenario, we have assumed an extreme amount of time to obtain NUAR - 3 hours. The longer the time spent collecting data through NUAR, the less of an impact NUAR will have on data-exchange and back-office efficiencies.

- **All of the above scenarios together (excluding a higher number of excavations).** Taking the most pessimistic assumptions from the above scenarios and testing the effect on NUAR's BCR.

- **Additional searches as a result of NUAR, compared to the business-as-usual scenario**. Because of the efficiencies that NUAR generates, it's not unlikely that it could result in even more prospective and less well-planned searches by excavators (given the low relative time and cost of doing so). That would mean more searches take place compared to the BaU scenario resulting in additional costs that wouldn't have otherwise occurred without NUAR. The higher the number of searches on NUAR post-implementation compared to BaU, the lower the impact it can have. For this scenario, we've assumed a 100% increase in searches.

	NUAR Sensitivity Tests - Data Exchange and back-office scenarios	Economic BCR
7	Only data exchange and back-office efficiency savings	8
8	Data Exchange: Risky assets - High (40% rather than assumed 20%)	28
9	Data Exchange: Excavations - High (4.7m instead of 4m)	32
10	Data Exchange: Cost per outsourced search (low - 30p rather than £250)	30
11	Data Exchange: Time collating data from DIRECT LINE queries in BaU (Low - 30 mins rather than 1hr 30)	30
12	Data Exchange: Time obtaining data from NUAR (High - 3 hours rather than 1 hour)	27
13	Data Exchange: Scenarios 8, 10, 11,12 and 20 together (most pessimistic assumptions)	29
20	Data Exchange: Time collating data from SEARCH PROVIDER queries in BaU (Low - 3 hours rather than 10 hours)	24
21	Data Exchange: 100% More searches result from NUAR platform than business-as-usual (resulting in additional costs to new search users)	29