Northern Gas Networks

A22.f - Offtakes and PRS Civils

Engineering Justification Paper

Contents

1. Summary table

Name of Project	*Offtakes and PRS Civils – RIIO-GD3*		
Scheme Reference	*A22.f.NGN*		
Primary Investment Driver	*Asset health and health and safety compliance*		
Project Initiation Year	*2026/27*		
Project Close Out Year	*2030/31*		
Total Installed Cost Estimate (£)	*£28.37m*		
Cost Estimate Accuracy (%)	*+/- 5%*		
Project Spend to date (£)	*£0.0*		
Current Project Stage Gate	*Specific delivery identification*		
Reporting Table Ref	*5.01 LTS, Storage & Entry*		
Outputs included in RIIO-GD3 Business Plan	*As per BDPT above, impact of programme in NARM BPDT*		
Spend Apportionment	**RIIO-GD2**	**RIIO-GD3**	**RIIO-GD4***
	£3.98m	*£28.37m*	*c.£20-30m*

** Expecting all investments listed for RIIO-GD3 to complete in RIIO-GD3. RIIO-GD4 cost estimates have been based on RIIO-GD3 indicative asset health spend.*

2. Executive summary

Our civils infrastructure and buildings protect the various assets installed across our Offtakes and Pressure Reduction Stations (PRSs) and are therefore vital to the safe and reliable functioning of our network.

Within NARM civils risk is not specifically calculated, civils act as a modifier to the mechanical asset risk. We have therefore taken an evidence-based approach to develop our civils intervention programme for RIIO-GD3. During 2024 we have tasked our maintenance team with undertaking surveys to gather evidence on the condition of our buildings and civils infrastructure. We now have a strong evidence base of the actual condition of half of our sites, which has allowed us to make informed decisions about our investment needs for RIIO-GD3. The results of our 2024 survey also align with the results of structural surveys that have been undertaken previously, which provides additional support for the validity of results.

We considered various options, including undertaking a more proactive approach to undertake around 100 more interventions under our 'Do More' option. We also considered a 'Do Less' option, pulling back and only intervening on sites we had surveyed with clear evidence of where intervention is required based on information available today, accepting the risk that we will not have the resource available to intervene on other issues that are likely to come to light during the RIIO-GD3 price control.

	Number of Interventions	Total RIIO-GD3 Cost (£m)
Preferred Option	271	28.38
Do More Option	382	39.78
Do Less Option	218	21.87

Table 1 Options Summary

Costs for civils for the RIIO-GD3 EJP are significantly increased (£28.4m) on the projected spend in RIIO-GD2 (£3.0m) on a comparable 23/24 price basis. The RIIO-GD2 programme of investment took a refurbishment-focused approach to extend the life of our assets. In RIIO-GD3 we are continuing a refurbishment led approach to extend life where appropriate, but there has been a significant transition to replacement of assets which have reached end of life following subject matter experts input and an extensive surveying exercise. The significant step change in civils and building investment programme is required to proactively manage safe working conditions on Offtake and PRS sites following extreme weather issues leading to accelerated deterioration of assets (see below). Note that volumes for civils interventions are not necessarily comparable, especially for general site civils which were previously recorded on an individual basis.

	RIIO-GD2		RIIO-GD3 EJP Preferred Option	
	Workload units	Capex (£m) 23/24 prices	Workload units	Capex (£m) 23/24 prices
General site civils	953	3.98	92	28.37
Other Civils	446		179	

Table 2 RIIO-GD2 vs RIIO-GD3 investment

We view our preferred option as a balanced programme required to deliver investments to combat asset health and health and safety issues: maintaining a safe, reliable, compliant network of assets for our customers whilst minimising costs for customers. The investments listed above in our preferred scenario and detailed further in the body of the EJP will enable us to continue to meet our licence obligations over the course of RIIO-GD3.

3. Introduction

The various types of assets maintained by NGN are critical to the infrastructure in the North of England. As such, the safety and reliability of these assets is very important. There are hundreds of above ground installations, and these include Offtakes and Pressure Reduction Stations (PRS). Our buildings and civils infrastructure protects our equipment that requires a secure enclosure, and our recently conducted survey highlighted that we need to intervene at a number of sites to uphold this.

This EJP details our proposals for investment on our Offtake and PRS civils infrastructure and associated buildings or housings during RIIO-GD3 and acts as a narrative to be used in conjunction with the accompanying Cost Benefit Analysis (CBA). It explicitly follows Ofgem's guidance and is set out in accordance with the headings therein.

Our Offtake and PRS assets are a critical part of our gas transportation service and require ongoing maintenance, repair, refurbishment and replacement to ensure we manage increasing risks associated with asset health. In addition to this, they also require protection from the elements in order to maximise their longevity. During RIIO-GD2 we have focused on extending our asset lives as far as possible to ensure maximum value for our customers. We are aware that a number of our buildings at PRS and Offtakes are at (or have exceeded) their expected life and undertook a survey to gather evidence on the condition of our civils assets during 2024 (this is discussed in more detail in **Section 5**).

Our previous investment policy throughout RIIO-GD2 has been focused on extending the life of our assets by focusing on mechanical interventions to gain the most value from them for our customers. We know that a significant proportion of our buildings and civils across Offtakes and PRSs are now nearing, or are beyond, their expected life. Our RIIO-GD2 investment plans were successful in maximising the useful life of these assets. As we started planning for RIIO-GD3, to ensure that interventions that we carried out were value for money, we needed to understand the scope for further asset life extension, before full buildings or civils replacements were required.

In RIIO-GD3 we have determined that there is a need to undertake proportionally more civils and buildings interventions than had been the case in RIIO-GD2. Whilst we have previously been repairing existing infrastructure and assets, our survey has established a need for a number of full building replacements and large civils interventions to ensure the assets within are adequately protected. Fencing installations are proposed so that our sites remain safe, secure and resilient to threats such as unwanted or accidental entry which could result in harm, injury or a security threat (see the Physical Security section within Section 4). It is not only the public who need to be considered. We also need to be mindful that our colleagues have a right to a safe working environment, and it is our legal obligation to provide that (for example, under the Health and Safety at Work etc. Act 1974[1]). A number of our interventions have been identified in the interest of site safety to avoid potential future slips, trips or accidents for colleagues. We define all of these further within **Section 5**.

Allowing our buildings and the associated civils infrastructure across Offtakes and PRSs to degrade would increase risk to our assets but also our colleagues through:

- increased risk of slips, trips, falls or accidents resulting from deterioration of the building, or the surrounding land
- damage to the assets or component parts due to exposure to the elements (noting that a number of our sites are in exposed, remote locations)

[1] https://www.hse.gov.uk/legislation/hswa.htm

- potential findings of non-compliance or notice of improvement by the Health and Safety Executive (HSE). Non-compliance also risks either civil or criminal liabilities. There is also a risk of increasing costs for insurance premia and damage awards.

To inform our preferred strategy, we undertook a survey to identify asset condition during 2024 which demonstrated that we have maximised the useful life of the buildings at a number of sites. They now require refurbishment or replacement in order to ensure that we can continue to operate those sites in a manner which both protects our Offtake and PRS assets, whilst also prioritising the health and safety of our colleagues.

In line with our aim to ensure value for money, we undertook the survey at the same time as other works to increase the cost efficiency of that visit. Going forwards, we have plans to embed routine maintenance surveys in our Business As Usual (BAU) processes so that we can continue to improve the quantity and quality of data and information we hold on our assets, in the most cost effective way.

We prioritised surveys on sites we knew were more likely to need intervention to understand the condition of the oldest, or least intervened assets on sites. We therefore adjusted for this selection bias when extrapolating results out across the remaining sites.

This EJP aims to outline the justification for our proposed RIIO-GD3 investment in civils infrastructure and buildings across our Offtake and PRSs. It details our asset management decision-making process, during which we analyse risk, value and trade-off between different intervention options. It explains the drivers for investment, the inputs and assumptions used in our CBA and how our proposed investment benefits our customers and stakeholders.

Our preferred option for RIIO-GD3 is set out in the Table 3 detailing the driver for investment.

	RIIO-3 EJP Preferred Option		
Intervention	**Workload units**	**Capex (£m) 23/24 prices**	**Driver**
Building – Replace	31	7.08	Asset Health/ Health & Safety
Building - Refurbishment	48	2.78	Asset Health/ Health & Safety
General Site Civils (S - Small) Offtake	2	0.10	Asset Health/ Health & Safety
General Site Civils (S - Small) PRS	23	0.69	Asset Health/ Health & Safety
General Site Civils (M - Medium) Offtake	2	0.20	Asset Health/ Health & Safety
General Site Civils (M - Medium) PRS	23	1.47	Asset Health/ Health & Safety
General Site Civils (L - Large) Offtake	5	1.25	Asset Health/ Health & Safety
General Site Civils (L - Large) PRS	37	5.40	Asset Health/ Health & Safety
Site CP Upgrades (Ground beds)	54	3.95	Asset Health
Offtake fence replacement	2	0.90	Asset Health/ Health & Safety
PRS fence replacement	23	3.45	Asset Health/ Health & Safety
Offtake fence refurbishment	1	0.10	Asset Health/ Health & Safety
PRS fence refurbishment	20	1.00	Asset Health/ Health & Safety
Total	**271**	**28.37**	

Table 3 RIIO-GD3 Workload, Cost and Drivers

Our preferred solution broadly maintains risk +10-12% across most risk categories apart from carbon risk due to rising carbon costs. Service levels are maintained (+7%). Payback is longer than our objective (46 years) as civils risk analysis and CBA only accounts for NARM risks and civils only modify the mechanical asset risk. Compliance with health and safety regulations regarding our workforce and protecting our assets holistically from failing civils infrastructure are not fully covered in NARM, and it is this compliance and protection that is the main driver for our civils investment programme. The preferred option provides a balance between increased investment to

maintain compliance and adequate protection whilst minimising the additional required spend for customers (Section 8.2 and Section 9).

4. Equipment summary

We provide a summary of our existing civils infrastructure within Section 5 where we discuss our survey results.

The importance of our civils assets

Our civils assets provide vital protection from the elements (especially important for some of our assets located in rural parts of Northern England) and this can help with the longevity of those assets. For this reason, maintaining and replacing our civils assets is a vital part of our strategy to maximise consumer benefit. Security of the assets is also important to protect them from theft and damage (both accidental and deliberate) and avoid any potential security threat. We also need to protect the general public from potential harm or injury at our sites and this is why we ensure that our site security (for example our fencing and CCTV) remains fit for purpose.

Our assets require ongoing maintenance throughout their life (both proactive and reactive) where we need to respond quickly to a fault. We must maintain suitable, safe access to our sites at all times so that our colleagues can respond to a situation that may arise. Were we to not maintain proper site access, this could compromise our ability to rectify a fault or maintain an asset quickly, which ultimately could lead to that asset's risk of failure, or risk of serious incident, increasing. Our sites generally serve around 45,000 customers on average - the largest number of customers served from a single site is 794,000 [redacted] and so it is vital that we ensure our sites and access are adequately maintained. Adequate access maintenance could include simply cutting back vegetation and overgrowth, or include things such as maintaining pathways and gates for example.

Our colleagues have a right to a safe working environment, as set out under the Health and Safety at Work Act 1974. A number of our interventions have been identified in the interest of site safety to avoid potential future slips, trips or accidents of our colleagues. Not only is this part of our corporate responsibility to safeguard our employees, but it is also an important consideration for our workforce resilience, ensuring our colleagues remain safe, fit and healthy at work.

We also have a duty to abide by HSE imposed Improvement Notices. Whilst we currently do not have any notices in relation to civils specifically, our aim is to ensure that issues are rectified as identified, rather than waiting for a formal notice. This is an important part of our duty as a responsible employer, both to keep our employees safe but also recognising that our employees are valued and we take our duty of care to them seriously.

[redacted]

5. Problem / opportunity statement

Why are we doing this work and what happens if we do nothing?

Quantifying risk to our civils assets

To inform our RIIO-GD3 strategy, we undertook surveys at a sample of our sites. A total of 87 surveys were carried out in order to gather evidence on the condition of our buildings. We have 23 Offtakes and 146 PRS sites, meaning our survey represented a sample size of 51%. The survey collected information such as:

- building type
- roof construction and condition
- explosion relief
- wall construction and condition
- soffit and fascia materials and condition
- guttering material and condition
- drainpipe material and condition
- ventilation detail and condition
- door material and condition
- floor material and condition
- internal ceiling and roof condition and structure
- potential for presence of Reinforced Autoclaved Aerated Concrete (RAAC) or asbestos.

We surveyed the gas distribution assets at each site in accordance with NGN/PR/PS/3 - Work Procedure for Ensuring Compliance with the Pressure Systems Safety Regulations 2000 For Gas Pressure Systems. The categorisations used were as follows:

- A – (Imminent danger or significant fault) If immediate action is required, the Line Manager and User must be informed immediately, and the competent Inspector must not leave the site or its vicinity until the situation is under control. A significant fault must not give rise to immediate danger but where action is required to prevent system failure.
- B – This is where the component is not in the condition it should be, but not judged to be dangerous.
- C – This category applies to components not categorised as A or B.

We consider that condition of rooves, walls and doors at our buildings are the primary drivers for intervention and have therefore assessed the buildings where there are signs of improvement required on these assets. Note that some sites contain multiple buildings, so the totals sum to more than the 87 sites surveyed. Figure 1 shows that 54 out of 122 buildings surveyed require intervention to the rooves, with 18 in category A and 36 in category B. There were also 46 buildings that required intervention to the walls (14 category A and 32 category B), as well as 58 doors requiring improvement (20 of these in category A and 38 in category B).

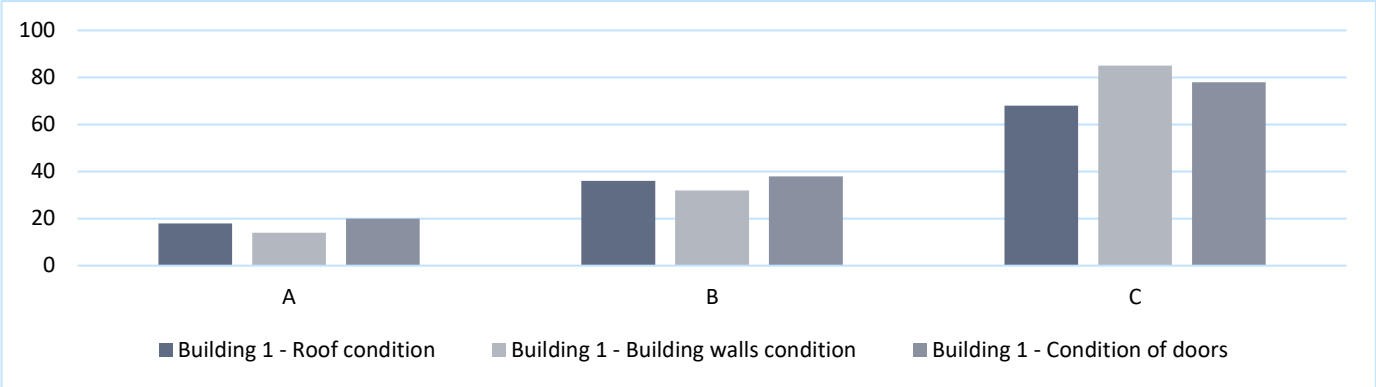

Figure 1 Roof, walls and door condition at our sites

As shown below, over half of the rooves surveyed were found to be in good condition, which is positive considering the age of the buildings. Just over one third were in category B and 15% in category A. Overall, this suggests 44% of the buildings surveyed require some kind of intervention to their rooves. **Case Study 1** discusses this in more detail and provides photographs of some issues found, such as water ingress.

Of the buildings we surveyed, almost two thirds were found to have walls which were in good condition, not requiring any intervention currently. A quarter fell into category B and 11% into category A. **Case Study 2** provides examples of some structural issues identified.

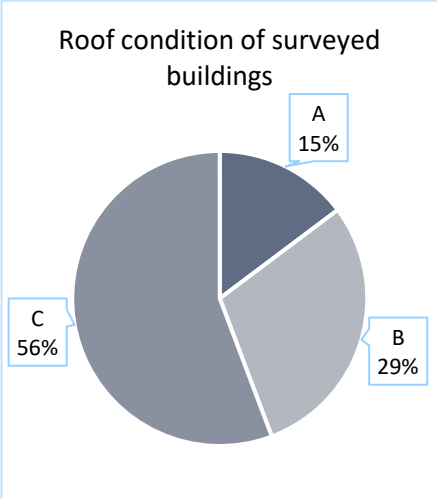

Figure 2 3 Roof condition of surveyed buildings

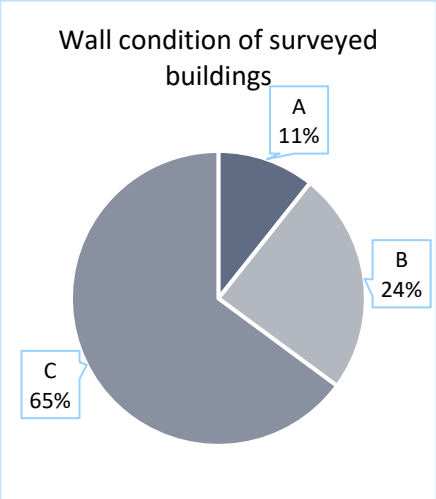

Figure 34 Wall condition of surveyed *of buildings*

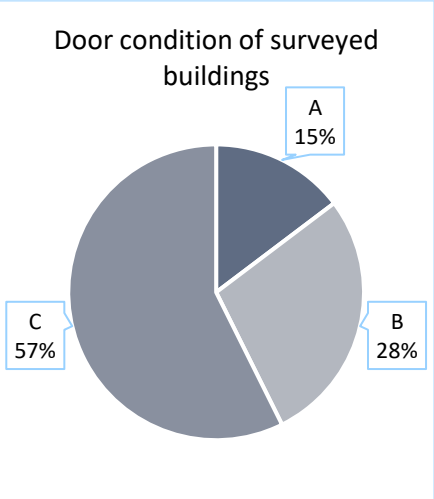

Figure 4 2 Door condition of surveyed buildings

It is a similar story when we consider the condition of the doors across the surveyed sites, with 47% requiring intervention in order to make them safe or improve the condition. **Case Study 3** provides photographic evidence of the condition of doors at two of the sites surveyed.

As our starting point was surveying those most likely to need intervention of some kind, we have already identified the sites most in need of works, so the other half of the sites that we have not surveyed should have a lower intervention rate. To correct for this selection bias, we have assumed that for every two interventions required in our surveyed sample, one intervention would be required in the un-surveyed sample. We have therefore extrapolated the results out against all sites at a rate of 1.5. The rationale for this is that this also helps

to ensure that our proposals remain deliverable. This has resulted in identification of 48 buildings requiring refurbishment and 31 in need of full replacement.

We have assessed assets at a site level in order to identify where there is scope to benefit from efficiency savings by carrying out multiple civils works at once, or alongside other mechanical interventions. **Case Study 4** provides examples of the types of issues found during our survey.

We assessed a wide range of factors, from the condition of the roadways to pipe supports and sandboxes. The stacked bar chart below highlights the findings (note that the total for each category is not the same as not all elements are present at each site)

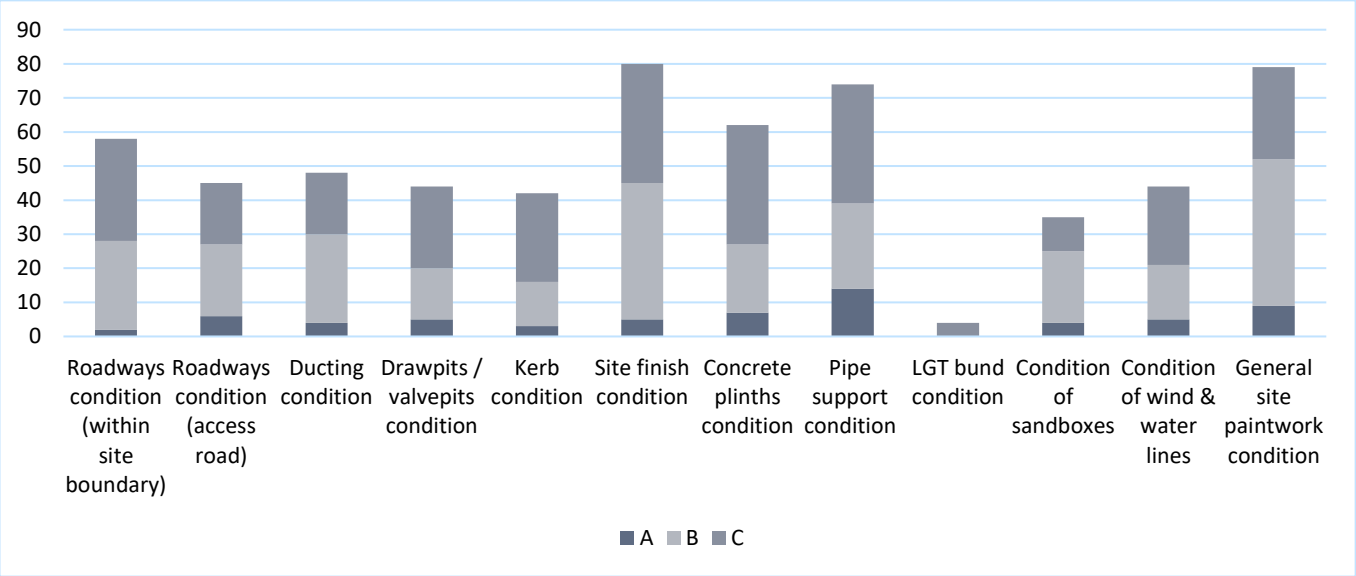

Figure 5 Civils condition of surveyed sites

At the sites surveyed, the category of work requiring the highest number of interventions is paintwork (52), followed by site finish condition (45) and pipe support condition (39).

The condition of sandboxes was the category which required the highest proportion of interventions at 71% of all sandboxes (four in category A and 21 in Category B) however it is worth noting that there were only 35 sandboxes in total located across all of the surveyed sites. This is followed by general site paintwork with 66% of sites requiring improvement, and ducting condition with 63%.

We have categorised the works into small, medium or large civils works according to the following criteria:

- Small civils – at least (1 x A) or (3 x B)
- Medium civils – at least (2 x A) or (1x A and 2 x B) or (5 x B)
- Large civils – at least (3 x A) or (2x A and 2 x B) or (1 x A and at least 5x B) or (7 x B)

This survey has identified 58 sites in our sample which require some form of civils intervention during RIIO-GD3. We assessed around half of our sites within this survey, focusing on those which had not had works carried out recently first.

As per Figure 6, just under half of the interventions required would be deemed large civils works (costing £160,000 on average). We have utilised our site knowledge and extrapolated out the survey findings, resulting in 92 sites planned to have some form of civils intervention in RIIO-GD3.

As shown below, the majority of security fences are in a suitable condition, with between 17% and 28% requiring improvement; none of these were in category A. Of the sample surveyed, 18 interventions were identified due to emergency exit condition, 15 due to fence panel condition, 13 due to the upright post condition, 12 due to topper condition and 11 due to the vehicle access gate condition, (note that more than one reason for intervention could be selected). **Case Study 5** provides examples of the fencing condition around a sample of our sites.

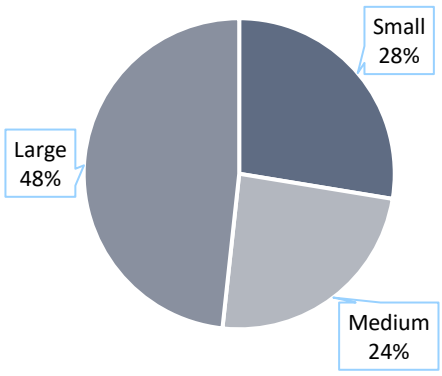

Figure 6 Civils interventions required in RIIO-GD3

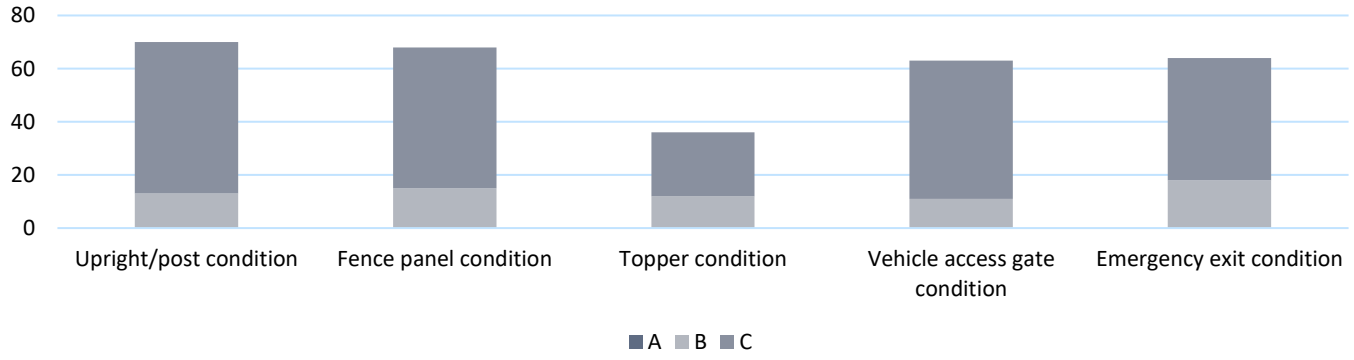

Figure 7 Security fencing condition

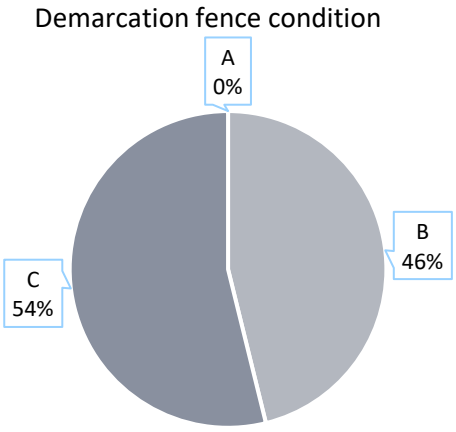

Figure 8 Demarcation fence condition

For demarcation fences, there were also no category A findings, however six of the 13 fences surveyed did require some improvement and were categorised as B condition.

We have extrapolated the results of the survey by 1.5 to result in 46 fences requiring intervention in RIIO-GD3. Three of these relate to offtakes, and the remaining 43 are required at PRS, as per the below.

We are proposing 54 CP upgrades in RIIO-GD3 which are covered under this EJP relating to civils. CP is a system used to control corrosion of buried or immersed metallic structures, including pipelines. There are two types of CP – Impressed Current (ICCP) and Galvanic (Sacrificial) Anode (SA). Both are widely used across the NGN's network to protect pipelines of various pressures and above ground installation inlet and outlet metallic pipework.

The main works that take place as part of a CP upgrade are:

- replacement of a transformer rectifier unit
- replacement of sacrificial anodes
- replacement of cp test posts
- replacement of insulation joints/insulation flange kits
- upgrade of existing CP systems to meet new demand (i.e. more steel pipework buried)

Failure to maintain our buildings or infrastructure would risk the integrity of those assets housed within. Due to the complexity of some of our assets, failure could result from a magnitude of different circumstances. A few examples are detailed below. The below examples relate to failure of mechanical assets at Offtake and PRS sites – this is because the failure of a civils asset has an impact on probability of failure of a mechanical asset within the model (as is detailed in Section 6).

Failure in preheating on site leading to low outlet temperatures – This may result from cracking of fire tubes, corrosion of burner boxes, flues or outer shells, pump failure, heat exchanger failure and boiler failure. There can be a variety of outcomes such as integrity issues with downstream pipework, detrimental effects on pilot control systems, or hydrate or liquid formation which could influence the operation of pressure reduction equipment and other downstream assets. In the event of these failures, we would expect a loss of supply incident.

Failure in pressure control leading to low/high outlet pressures – This may result from failure of the regulators to control, potentially due to the soft parts perishing, failure of the pilot regulators or a complete failure of the regulator, failing in the open or the closed position. This would lead to the primary protective device, the slam shut valve functioning which would stop gas supply and result in a loss of supply event, if the slam shut valve failed, it would result in high outlet pressure which increases the risk of an explosion in the downstream network.

NGN's Value Framework

We have developed a NGN Value Framework which we use to assess the value of intervention options consistently across asset classes for CBA and business planning purposes.

We use the Network Asset Risk Metric (NARM)s methodology as the basis of our Value Framework and are consistent with the Consequence Measures. However, we have recategorized them into five risk groups, not four, so that there is clear distinction between NGN and societal costs and benefits and so that the present values being calculated are correct. This is further explained in our Network Asset Management Strategy. The five risk groups within our Value Framework are: Customer Risk, Health & Safety Risk, Environmental Risk, Compliance Risk and Financial Risk.

To derive a monetary value for the Cost of Consequence each Consequence Measure is allocated a monetary value which is multiplied by the quantity of the consequence. The monetary values used within our Value Framework are based on the agreed NARM assumptions and uses values common across GDN's such as the base price year, industry approved values such as the cost of carbon or the social cost of an injury. In addition, we use values specific to our business such as the cost of maintenance or the cost of loss of supply. The quantities used are specific to our network such as the number of domestic properties at risk of a supply interruption and have been derived from system data, network analysis or assumptions based on demands, flow and redundancy.

When justifying our RIIO-GD3 capital programme the monetary value of each Consequence Measure is calculated to determine the benefit or avoided cost of an intervention. Examples include:

- **Customer Risk** – Avoided GDN costs through a reduction in costs of supply incidents (loss of supply). These costs have been calculated from historic incidents and the probability and scale of the incidents are based on NARM models.

- **Health & Safety Risk** – Societal benefits in avoided costs through reductions in the probability of fatality or non-fatality injury. These costs are in accordance with the NARM methodology.
- **Environmental Risk** – Societal benefits in avoided costs through reductions in the volume of carbon emitted when gas is leaked or consumed. These costs are in accordance with the NARM methodology and industry approved values.
- **Compliance Risk** – Avoided GDN costs through a reduction in costs of fines and paying for explosion damage. These costs are in accordance with the NARM methodology. They have been separated from direct Financial Risk as we consider them highly uncertain and likely significantly underestimated by the values in NARM, which does not consider reputation, legal and handling costs.
- **Financial Risk** – Avoided GDN costs through reductions in the costs to fix assets on failure and the direct financial cost of the gas leaked from and consumed by our assets. These costs are in accordance with the NARM methodology.

What is the outcome that we want to achieve?

From our stakeholder research (for example, see Insight 1, 9 and 10 from Appendix A3 below), we know that network reliability and cost remain our customers key priorities. Customers also value the importance of improving resilience against extreme weather, such as storms. We also know that our customers expect value for money and that we make the right investment decisions for both our existing and future customers.

What we heard	Appendix A3
Keeping bills as low as possible continues to be domestic and SME (Small Medium Enterprise) customers' top priority, however stakeholders are supportive of investment to respond to significant challenges of climate resilience and decarbonisation. Balancing the trade-off between investing now to future-proof and minimising expenditure to prioritise essentials poses a challenge.	Insight 1
Customers expect our top sustainability commitment to be keeping our infrastructure resilient. This means continuing to reliably supply customers in the short and long term, regardless of climatic conditions and impacts experienced by interconnected sectors (such as telecommunications, road networks etc). As customers are satisfied with the performance and availability of our services, they prefer us to maintain service levels at levels similar to today, and asked for us to reduce future risk with targeted investments to enhance removal, reduction, resistance and recovery strategies.	Insight 9
The impact of climate change requires us to proactively reduce the vulnerability of networks to storms, particularly in rural areas, and a collaborative, cross-network approach. 'Preventing supply interruptions from extreme weather by providing back up power' was the most highly valued service improvement among billpayers in our Customer Value Perception study (on average, respondents were willing to pay £0.53pp at 75%).	Insight 10

Table 4 Customer insights

Risk Objective: to maintain total risk to the same level as the starting position of RIIO-GD3 (plus or minus 10%)

We want to manage total risk

We know that safety and reliability are our customers' number one priority and without intervention total risk will increase by 19% for Offtakes and PRS overall within the RIIO-GD3 period. In addition, we want to manage increasing risks to provide a safe working environment for our operatives and avoid loss of supply events. We will *aim* to maintain risk throughout RIIO-GD3 to plus or minus 10% from the RIIO-GD3 starting position, however we understand the need to balance this ambition with service and cost constraints.

We are on track to meet our NARM target in RIIO-GD2. As the regulatory landscape is likely to broadly remain the same in RIIO-GD3, we have seen no need to take a step change approach to risk and have therefore adopted a risk objective that is consistent with that adopted in RIIO-GD2.

Efficiency Objective = to minimise spend in RIIO-GD3 over and above RIIO-GD2 levels

We want to ensure efficient costs. We know that our customers expect us to invest their money wisely and efficiently to enable a reduction in their bills. To do this we need to make sure we maximise value from our existing assets before we replace them. However, we must understand the whole life cost of the decisions we make to ensure we are doing the right thing both now, and in the future. As risk is rising sharply in RIIO-GD3 it is expected that we will need to intervene on more assets than we have during RIIO-GD2 to meet our objectives around managing total risk. To avoid escalating costs, we therefore need to think of pioneering solutions to ensure we are delivering value for money for our customers. Whilst our RIIO-GD3 spend exceeds our RIIO-GD2 spend at a total level, a significant proportion of this is compliance led, driving the need for asset replacement (for example to ensure ongoing compliance with Health and Safety legislation such as the Medium Combustion Plant Directive and the Pressure Systems Safety Regulations). Our aim at the outset is to maintain spend relating to asset health in RIIO-GD3 broadly in line with RIIO-GD2 levels, where possible. We discuss this in more detail in **Section 10.2**.

Our objective in RIIO-GD2 was to maintain cost. However, the objectives we are setting out are becoming increasingly conflicted with one another as we move into RIIO-GD3. For example, increasing rises in risk and supply interruption from deterioration in the asset health of our assets, alongside obsolescence and compliance are key drivers for additional investment in RIIO-GD3 over and above the levels we saw in RIIO-GD2. We view maintaining risk and service levels and delivering a reliable, safe and compliant network for customers as a higher priority than maintaining cost at RIIO-GD2 given the evidenced need for additional investment, which is shown and discussed in our options appraisal. We are continually committed to providing a balanced programme of work and delivering value for customers. We have therefore updated our efficiency objective in RIIO-GD3 to be to minimise spend in RIIO-GD3 over and above RIIO-GD2 levels.

Service Objective = to maintain supply interruptions to the same level as the starting position of RIIO-GD3 (plus or minus 10%)

We want to continue to provide exceptional service

The key service measure for our PRS assets is the Total Expected number of Supply Interruptions. Table 1.06 of the 2023/24 Regulatory Reporting Pack (RRP) submission highlights that our current customer satisfaction scores for unplanned interruptions are exceeding the targets set by Ofgem (9.37 target against our actual performance of between 9.543 and 9.650 between 2022 and 2024). We therefore consider that current service levels are acceptable to our customers and provide a suitable benchmark.

As the regulatory landscape is likely to broadly remain the same in RIIO-GD3, adopting risk and service level objectives that are consistent with that adopted in RIIO-GD2 seems appropriate. Other reliability metrics outlined in Table 1.06 demonstrate that we are currently operating a highly reliable network. Our aim therefore is to maintain our industry leading service levels in RIIO-GD3.

From the analysis in the section above we understand that supply interruptions are increasing by 10% for Offtake and PRS overall within the RIIO-GD3 period to a point where we would be expecting an additional supply interruption approximately every three years at the end of RIIO-GD3 across Offtakes and PRS without intervention on our mechanical assets. Our RIIO-GD3 investments need to target this service measure and reduce it back down to a more acceptable level. Our civils investments are an important part of protecting those mechanical assets.

Certainty Objective = to ensure our investments pay back within 16 years

We will protect our customers from future uncertainty

To ensure the investments we make in RIIO-GD3 are right for both our existing and future customers, and to avoid the risk of asset stranding we must ensure that our investments offer a payback before either the asset life or a point in time where future uncertainty could reduce the forecasted benefits, whichever is the smallest time period. The RIIO-GD3 Business Plan Guidance states that a 16 year payback period is appropriate for the GD sector (page 45)[2], meaning that any new, refurbished or replaced equipment that pays back within this time frame will be deemed suitable for investment.

Compliance Objective = to ensure we are compliant with legislation relevant to each asset class

We want to ensure compliance with all relevant Health and Safety, or Technical Regulations

During RIIO-GD3 we are required to undertake a number of interventions for compliance reasons. For our civils infrastructure and buildings, we have undertaken a survey of half of our Offtakes and PRSs which has identified a number of issues, generally caused by the age of the buildings and general infrastructure, that will need to be rectified in order to maintain a safe working environment for our colleagues, whilst also ensuring that our sites remain secure to protect the public. These interventions are required in order to meet our obligations under the Health and Safety at Work Act, and also to avoid any potential HSE Improvement Notices over the period.

How will we understand if the spend has been successful?

Interventions to buildings and fences improve their condition, which results in a change to the adjustment factor being applied to the Probability of Failure (PoF) of the mechanical assets being protected by these respected civils assets, resulting in a reduction in risk (taken from NARM Methodology). We should be mindful that if we are performing civils interventions where we are also performing mechanical interventions at the same location, in particular replacement of mechanical asset systems, we may be double counting risk reduction in our analysis. Civils interventions will aim to minimise future risk and impact on Supply Interruptions (SI) where possible as they increase aspects such as corrosion and security protection (dependent on the type of civils asset). However, it's important to note as above these only modify the PoF of the mechanical asset. Civils interventions do not reset it as more involved mechanical interventions, such as replacements, do. For this reason, the strategy for the mechanical asset interventions should also be considered (outlined in Investment Decision Packs A22.b to A22.e).

In addition to the NARM target, we would expect to keep the number of supply interruptions from Offtake and PRS asset failure at a manageable level, ideally at the same level seen during RIIO-GD2. During the price control period we would also expect to see a reduction in the numbers of faults and remedials picked up during routine maintenance and PSSR inspections.

Our Decision Support Software allows us to understand various service measures associated with each asset and how these change over time with and without investment.

5.1. Narrative real-life example of problem

NGN rely on a large number of buildings/ fencing and general site civils to ensure the main mechanical and electrical assets are protected, secured, supported and possible to maintain. These assets are vital to allow the

[2] https://www.ofgem.gov.uk/publications/RIIORIIO-GD3-business-plan-guidance

site to perform. They protect from weather, vandalism, suppress noise and extend the life of mechanical assets by offering additional protection.

Below is an example of some of the general issues noted across our Offtake and PRS asset population. There is a requirement to intervene on these assets in RIIO-GD3 for a multitude of reasons, namely:

1. **Safety** - The health and safety of colleagues is paramount. Any serious structural building issues would present an inherent risk to colleagues on site, in the vicinity or venturing inside due to an emergency.
2. **Security of supply -** Any issues that can cause debris to fall on to live gas containing assets and disrupt supply would not only have the potential to cause supply issues downstream, but it would also result in costly replacement of assets and the potential for gas release or explosion as a result.
3. **Extension of life** - A properly applied pipeline coating, a sandbox, wind and water line, valve pits and pipe supports ensure that the asset can function and be protected from the elements. Improper coating can result in accelerated degradation and corrosion of pipework/assets. The lack of a sandbox doesn't allow any pipework flex and can cause issues at pipe transition points. Poor pipe support can result in a lack of support, or a support that cannot be removed. This allows for abrasion and corrosion to be accelerated by trapping debris and water. Finally, a watertight and well-maintained building can protect sensitive E&I equipment from inclement weather that would otherwise cause malfunction and serious safety concerns.
4. **Protection from intruders and vandalism, protection of the public** - Security fencing can delay intruders from entering site, allowing NGN to respond if necessary. It demarcates a site and provides a physical separation from the public/traffic/farmland/animals. A fence line can also prohibit members of public from entering sites who have an intention to cause damage/vandalise or to put themselves in harm's way. NGN have a responsibility to ensure that their assets are suitably locked down to protect the public.

Although not directly associated with the supply of gas, civils assets are key to the proper functioning of a site. Hence the reason to expand our approach in RIIO-GD3 (based on the survey results).

CASE STUDY 1 – ROOF REPAIR AND REPLACEMENTS

Below is a selection of images taken during the 2024 maintenance condition survey. We identified a number of buildings in need of roof repair or replacement, as shown below:




Issues such as those highlighted above will, without any intervention, lead to water ingress. We can already see evidence of this at some of our sites and will need to undertake remedial works in order to prevent the issue worsening and to fix damage that has been caused to date. The images below highlight some of the water ingress that we noted during our survey:



CASE STUDY 2 – BUILDING STRUCTURAL ISSUES

Our survey also identified this particular building with cracking in the brickwork, identifying that there are issues present in the wall structure. Without intervention this would simply worsen over time, leading to an unsafe building which would likely eventually collapse. This building houses a pressure control system so allowing serious degradation to this building would pose a threat to the safety of that asset.



CASE STUDY 3 – GENERAL BUILDING CONDITION ISSUES

The photographs below highlight some of the issues identified at buildings more generally. As shown in the images below, these buildings require some general maintenance and upkeep in order to bring them back up to standard.


CASE STUDY 4 – GENERAL SITE CIVILS

The images below were taken during the recent survey when our colleagues were assessing the condition of our general site civils. This first image highlights the lack of sandbox at this site, which would preferably be installed as this would allow the pipework to flex as needed. The second image highlights pipework which requires remedial work in order to maintain compliance, given the lack of appropriate pipe support in existence at the moment. This would also result in difficulties removing this particular asset for inspection purposes.


The images below highlight a concrete base which we identified as being in general poor condition, as shown by the degradation for example. We also identified gear boxes in valve pits which are impractical from a health and safety point of view given our colleagues would need to reach across the handrail. In this instance we would look to backfill the valve put or provide a cover to allow for safe access.

CASE STUDY 5 – SECURITY FENCING

As mentioned earlier, security fencing is key to ensuring that our sites remain safe and physically secure. We therefore surveyed the security fencing across a range of our sites to score the general condition and provide us with a firm evidence base from which we should assess our RIIO-GD3 required investment in this area. Generally, a large proportion of our security fencing is in suitable condition, but we do need to carry out some refurbishments and replacements in order to maintain the integrity of some of our sites. The images below were taken as part of the recent survey and highlight that we do need to undertake work at some sites. For example, we have some sites with basic chain link fencing as the main form of security, which requires replacement to maintain site integrity. We also identified one particular site with lack of space for a suitable emergency exit escape route.

5.2. Project boundaries

This EJP is limited to intervention of all civils elements (including buildings) that are required to support upgrades to mechanical, and E&I assets. For the avoidance of doubt, the actual assets and E&I upgrades are covered separately within their respective Investment Decision Packs. Offices, depots and other buildings are out of scope. It includes all necessary project costs such as design, procurement of materials, construction (including labour and materials), commissioning and overheads.

The costs of all interventions have been included within the Total Capex cost shown in the options summary tables. However, only the building and fence replacement and refurbishment costs have been included within the Cost Benefit Analysis (CBA).

Whilst investing in and maintaining site civils and CP upgrades bring about benefits, the benefits are not modelled under NARM. Therefore, general site civils and CP upgrades do not have any NARM benefits included within the

CBA. The costs for general site civils and CP upgrades have not been included in in the CBA analysis to ensure that our CBA was reflective of both costs and benefits being modelled through NARM. These have not been included within our impact on risk or service levels or within the CBA analysis as the impact of these interventions are not able to be modelled as we have no industry agreed basis to do so. However, these elements are key components in protecting the underlying assets and ensuring they continue to operate safely and efficiently; as well ensuring that we remain requirement with relevant legislation. Therefore, we expect the benefits of these elements to be of a similar magnitude to those covered by the NARM methodology and represent value for money for customers over the time period to 2050. We provide the CBA vs non-CBA cost breakdown in Table 5.

	CBA RIIO-GD3 Costs (£m)	Non-CBA RIIO-GD3 Costs (£m)	TOTAL (£m)
Building - Replace	7.08		
Building - Refurb	2.78		
General Site Civils (S) Offtake		0.10	
General Site Civils (S) PRS		0.69	
General Site Civils (M) Offtake		0.20	
General Site Civils (M) PRS		1.47	
General Site Civils (L) Offtake		1.25	
General Site Civils (L) PRS		5.40	
Site CP Upgrades (Ground beds)		3.95	
Offtake fence replacement	0.90		
PRS fence replacement	3.45		
Offtake fence refurbishment	0.10		
PRS fence refurbishment	1.00		
TOTAL	**15.31**	**13.06**	**28.37**

Table 5 RIIO-GD3 CBA vs non-CBA costs

6. Probability of failure

Civils and buildings assets, where they are associated with mechanical assets on Offtake and PRS sites are covered by the NARM framework. We have surveyed 82 sites during 2024 in order to understand the condition of our assets. That said, the buildings and infrastructure are key to protecting the assets housed within them and therefore can impact on the risk facing those assets. For example, were we to allow our buildings to degrade, our assets could become exposed to weather and therefore increase the risk of failure. We can therefore assess the potential risk to these assets by considering any change in risk at the assets across our sites with, or without, intervention across our buildings and civils infrastructure.

The probability of failure is the probability mechanical asset will fail at a given point in time. When justifying our RIIO-GD3 Capital Investment, our Cost Benefit Analysis uses the recently updated NARM methodology to calculate the failure rate of our Offtake and PRS assets. The NARM methodology algorithm used to calculate the initial rate of failure (to which deterioration is applied) for each failure mode is:

Failure rate including factors = Failure rate excluding factors x Fault Detection Rate x Coastal Factor x Housing Factor x FS Factor x Flood Factor x Kiosk Factor

This section discusses how we have used the NARM methodology to understand the types of failure of Offtake and PRS asset classes as well as the rate of failure, or deterioration, which is a function of the assets attributes, age and condition.

Types of Failure

A failure in an asset is defined as the inability of an asset to fulfil one or more of its intended functions to a standard of performance that is acceptable and gives rise to a detrimental outcome. In the NARM methodology these failures have been categorised into failure modes.

Failure modes have been developed by modelling the outcomes rather than components, of which there are many. This avoids the need to accurately identify root cause which can often be difficult to diagnose. The failure modes for which offtake and PRS mechanical assets are a contributing factor can consist of:

Release of Gas – failure of a pressure containing component of the system such as filter bodies.

High or Low Outlet Pressure – where concurrent failure of both regulators and the slam shuts result in either over pressurisation or partial or total loss of the downstream system.

Capacity – where the system has insufficient capacity to meet a forecast 1:20 peak day downstream demand.

General Failure – relating to other failures not leading to a safety, environmental or gas supply consequence such as failure of instrumentation or telemetry systems.

Over / Under or No Meter Reading – meter read errors where the readings are higher, lower or not being read at all and in addition meter read errors affect the measurement of odorant being injected into the system.

High or Low Odorant – where levels of high or low odorant are injected into the gas supply.

Release of Odorant – failure of containment of odorant such as corrosion of the odorant tank.

High or Low Outlet Temperature – where failure in the preheating system results in erroneous heat input for the gas flow through the site resulting in high or low outlet temperatures.

The failure rate for an asset is the frequency of failures at a given point in time, typically measured as the number of failures over a year. We use the Initial Failure Rate from the NARM methodology which has been elicited through structured and formal workshops and adjust it by age, asset attributes and condition to achieve a more accurate estimate for the initial likelihood of failure for an asset. These scaling factors, which include factors dependent upon the condition of our civils assets (kiosk and fencing), are:

Condition Risk (Effective Age) – this is the modified default age of an asset according to its condition.

Location Risk – a multiplication factor is applicable for assets within 3km of the coast.

Housing Risk – a multiplication factor is applicable depending on whether the housing of the asset is above or below ground.

Kiosk Risk – a multiplication factor is applicable depending on the condition of the building/kiosk.

Fencing / Security Risk (FS Factor) – a multiplication factor is applicable depending on the condition of the fencing and security.

Flood Risk – a multiplication factor is applicable depending on the flood zone the asset is located.

Therefore, the condition of civils assets impact the failure rate and, in turn, total monetised risk value of the mechanical assets to which they are associated. The above factors are detailed in full in the NARM Methodology.

Changes to the NARM Methodology

LTRB Updates

The NARM methodology has been updated since RIIO-GD2 to incorporate changes for long term risk modelling and some changes in failure rates and deterioration rates to better reflect reality. This was carried out as a cross GDN project, underwent a consultation process and is awaiting approval by Ofgem. Please refer to full details of updated methodology changes in the updated version of the NARM Risk Methodology document. A brief summary of the updates includes updates enabling GDNs to report on Long Term Risk (LTR) increases and impact of investments on this metric. Data has been pooled across networks enabling an update to deterioration curves to include an end of life (EOL) assumption to eliminate artificially high rates of deterioration towards EOL in the previous models, in particular for governor and offtake and PRS mechanical assets - these now taper off towards EOL and provide much more realistic LTR analysis. Pressure Control and governor's regulator and slam shut failure analysis was also updated, now providing a system view of reliability and failure in the updated version of the model. Mains deterioration was also reviewed as part of the project. The effect of these changes, which have been implemented in the production of the RIIO-GD3 business plan analysis, is to better reflect the reality of operation of the above-mentioned assets. ICS performed a validation process on the results of the changes to the model and LTR as part of the project, but further validation across GDNs is required.

Updates to the methodology have been discussed with Ofgem during their development and have gone out to consultation. Formal approval is to follow on from the consultation. It was agreed with Ofgem that model updates as part of this project including LTR would be used for RIIO-GD3 business planning purposes.

6.1. Probability of failure data assurance

The data used in our probability of failure calculations comes directly from the NARM methodology. The failure models are based on various industry standard guidelines (see GDN Asset Health Risk Reporting Methodology document), and the failure rates have been statistically derived using actual asset information such as age or material and historic failure data taking into consideration other influencing factors such as weather or temperature.

We have an annual process for gathering asset data from the business to support NARM RRP delivery, with the majority of data coming ultimately from SAP. There is a documented process where the business leads supplying the data carry out reasonableness checks on the data supplied to the Asset Strategy team, who then carry out validation and consistency checks.

Our 2024 data improvement plan assess key areas of data for robustness and completeness:

Our **core asset data** for PRS includes location, fault data, health bandings, customers, capacity, obsolescence and maintenance costs. Each year we update the fault data within our systems as a requirement for Regulatory Reporting. Therefore this data is up-to-date as of 2023/24. Our core asset data is assessed to be robust and complete.

Our **asset health and failure data** includes design specification, age, condition, duty, capacity, location and environmental health factors. Our asset health and failure data has been assessed as having some data gaps and assumptions have been applied. This applies in particular to default condition data being applied to some kiosks and no condition data for fences or control systems. Through Smarter Work Management Systems, field work capture capabilities will be developed to improve this. If assumed condition assumptions are lower than reality, this will lead to a conservative calculation of baseline risk and risk reduction on intervention; and vice versa. We have undertaken surveys of our offtake buildings and civils infrastructure across half of our offtake and PRS sites during 2024. This occurred after the capture of our 2024 RRP data which has been used within our risk and CBA

calculations so updates to data from these surveys was not able to be applied to calculations, however the survey data was used by subject matter experts to inform asset management decision making from a bottom-up perspective.

Our **financial data** includes all the financial data held in the core system that is used within the risk models. We have recently updated all the interventions costs within the system using historical project cost knowledge and subject matter experts input on current cost trends (See **Section 8.7**). Data relating to cost nodes in the modelling have been inflated to 2023/24 prices using the Ofgem agreed inflation factors. Our financial data has been assessed as having some data gaps and assumptions have been applied.

If assumed financial costs are lower than reality, this will lead to a conservative calculation of baseline risk and risk reduction on intervention, and vice versa.

It is recognised in the NARM methodology that the GDNs will have data gaps and will not hold the same level of asset data. To facilitate the population of the Monetised Risk modelling, a flexible but consistent methodology (with options) will be utilised to derive the Probability of Failure, Deterioration, Probability of Consequence and associated impacts of Intervention. This is set out in Table 6 of the NARM Methodology and ranges from Option A (GDN specific data from company systems) to Option B (Pooled/shared data - where applicable) to Option C (Global/assumed). Assumed data could be data that has been analysed to be representative of the population, arrived at by expert elicitation, or arrived at by researching relevant published studies/reports.

As mentioned above, we have surveyed half of our sites in 2024 so that we have up to date information on the condition of buildings which house the assets across our offtake and PRSs. As discussed above, this survey data helped inform our investment decision.

7. Consequence of failure

For each failure there may be a consequence of failure (CoF) which can be valued in monetary terms. In the NARM methodology the CoF is calculated as the probability of consequence (PoC) multiplied by the quantity and cost of consequence (CoC) and are linked directly to failure modes which categorise the asset failure.

Types of consequence

The NARM methodology sets out the consequence measures for each failure mode categorised into four risk groups: Customer Risk, Health & Safety Risk, Carbon Risk and other Financial Risk. These are detailed below for offtake and PRS assets. Civils assets have an impact on the magnitude of the PoF of the associated mechanical asset, the magnitude of consequence given a failure (by specific failure mode) is unchanged. Civils assets therefore impact the PoF/failure rates related to the failure modes listed below, as associated to the relevant risk.

Customer Risk

- **Offtake/PRS Site Failures** – a failure of the site resulting in loss of supply to downstream domestic, commercial or industrial consumers.
- **PRE Odour Release/High Odour** – an increase in publicly reported escapes in the vicinity of the offtake due to odour release or high odour.

Health & Safety Risk

- **Down stream gas escapes/Explosion** – an explosion at the asset itself or in the downstream network following failure. This could lead to subsequent death, injury and/or property damage. Failure of the asset

can lead to an increase in downstream gas escapes, which in turn leads to an increased risk of explosion and injury/damage.

Carbon Risk

- **Down stream gas escapes/Loss of gas** - the volume of loss of gas from either the asset itself or in the downstream network constitutes the consequence of a failure. Environmental impact is assessed from the carbon equivalent of the gas lost.

Financial Risk

- **Down stream gas escapes/Loss of gas** - the volume of loss of gas from either the asset itself or in the downstream network constitutes the consequence of a failure. Financial risk is determined from the cost of the lost gas.
- **Ground Heave** – a preheater failure resulting in damage to structures, roads and other assets due to low outlet temperatures. Financial risk is determined from the cost to repair the ground heave.
- **Repair costs** - the direct financial costs to the business without intervention work to the assets such as such as repair.

Probability of consequence

Within our assessment of asset risk, we use the probability of consequence data from the NARM methodology which has been calculated from a mix of observed data, shared GDN data, industry standard data and expertly elicited data.

All of these aspects of risk have been taken into account to analyse the impact on total risk with respect to the start of RIIO-GD3 level for all of our options in Section 9, and within our cost benefit analysis.

Where the principal of total monetised risk, applied across the asset base, is:

Total monetised risk = PoF x PoC x CoC

Different supply/demand scenarios have not been considered during our modelling as the current NARM methodology does not include analysis for this. This is a future update to NARM in gas distribution that has been identified within the methodology document and will be reviewed by the networks through NARM working groups. Overall, we are forecasting a slow recovery from impacts of the cost-of-living crisis and total domestic demand is forecast to return to 2021 levels between 2029 and 2031 for the NE and NO distribution zones of our network. This is based on established econometric modelling and demand forecasting methodologies.

Although the NARM methodology does not account explicitly for supply demand scenario analysis, the fault and failure data we currently base our modelling calculations on includes data collected over a period of historic years, which goes back to before 2021. Consequence data from company systems also reflects the latest available view for our asset base at 2023/24 and is based on data from historic events collected over a period of time. Therefore, we do not anticipate demand to have a material impact on our investment decisions or benefits during RIIO-GD3.

Our commitment to resilience

Chapter 5 of our Business Plan demonstrates our longstanding commitment to ensuring that we are able to operate and maintain a resilient network. We have formalised our Resilience Framework and developed a number of individual resilience strategies which allow us to maintain our high standards. Our Resilience Framework ensures that we continually review the hazards facing our business and assess whether mitigations

that we have in place remain sufficient or need to change. This is relevant to our asset management strategies as we need to take into account exogenous factors when considering both short- and long-term investment plans. Our Network Asset Management Strategy which is set out in **Appendix A18** brings this all together.

We have introduced a range of other resilience strategies, such as **Appendix A8 – Climate Resilience Strategy**. A climate risk assessment sets out the risks facing NGN currently, in 2050 and in 2100, as set out in section 1.5.2 of the strategy. The climate scenario risk analysis did not identify high risks for either the 2°C or worst-case 4°C warming scenarios assessed. As such, this recognises our resilience to material climate change risks in the long, to very long, term (2050+). This is due to our comprehensive asset integrity and management procedures that are in operation to ensure asset condition and performance. In addition, there is inherent resilience afforded by gas infrastructure assets being a sealed, pressurised system principally located underground. Resilience levels to climate change risks will be greater in lesser warming scenarios should they arise, due to lower climatic extremes. The likely current and future climate risk has been factored into our preferred strategies across offtake and PRSs from the outset by utilising our subject matter expert's knowledge and risk assessments mentioned above.

We are taking a similar approach to RIIO-GD2 in putting together our investment plan, taking a balanced approach to asset management to ensure a safe, reliable and compliant network – ensuring we can continue to meet our licence obligations whilst at the same time minimising costs for customers.

8. Options considered

This section summarises all options considered with regards to interventions on civils and buildings across offtake and PRS sites. There are various ways in which we can intervene on our assets within this asset group. Each intervention has its own merits and drawbacks and the key to good asset management is to understand how the assets behave and use data and information to ensure the right decisions are made to balance risk and value to deliver a safe and reliable service for our customers. The interventions available for this asset group are:

Refurbishment – a proactive planned intervention which includes inspection and replacement or servicing of major components and soft parts with the intention of extending the expected life of the asset. Refurbishment of our buildings includes minor works to replace individual parts, to bring a building back up to standard. Examples of this could include replacement of doors, repointing brickwork, roof replacement and gutter replacement.

Replacement– installation or full replacement of new buildings or civils infrastructure would be a replacement. We would likely opt for replacement over refurbishment where refurbishment would not have the desired effect or is not as cost effective, or where compliance requirements dictate that replacement is necessary.

Future Energy Pathways

The assumed proportion of methane is important within the risk calculations and CBA as within the NARM methodology the carbon equivalent of the methane content of the gas lost from our assets is quantified, resulting in a monetised Carbon Risk. Gas can be lost from our mechanical assets through leakage or failure. Civils and E&I asset condition and failure are important because they influence the failure rate of mechanical assets, and the duration of the loss of gas consequence respectively.

We have gone with the default assumption of current assumed proportion of methane CO2 in natural gas projected forwards due to uncertainties in the potential energy pathways and because this is reflective of the current gas quality legislation. However, we acknowledge that significant changes to gas demand or the allowed methane content of gas, for example due to the blending with or conversion to hydrogen, would impact the benefits of our investments.

We have not explicitly modelled changes in the methane content of gas in our CBAs, as overall gas demand and the change in CO2 content of the gas is not expected to be different enough to materially impact the NPV, payback & option ranking of our preferred investment programme. Our chosen programme represents value for money over a 20-year period regardless and is mainly driven by customer benefits such as avoiding loss of supply. The investments also ensure that we are compliant with relevant legislation. Our strategy therefore represents a no regrets investment programme that is consistent with net zero and will deliver value to customers whether a hydrogen or electrification pathway is chosen.

How we make asset decisions

We aspire to make conscious decisions that are balanced across our asset portfolio to ensure we can leverage the most value out of our assets. In making conscious decisions we can evaluate the risk we hold as a business and the impact it has on our strategic objectives. Asset management relies on accurate data, during RIIO-GD2 we have been working to improve our data and the way we capture and store this information, so it can be used to benefit our decision-making process. We use a wide range of asset data, global values such as the cost of carbon and specific values such as the loss of supply, costs from our updated unit cost analysis (see section 8.77 and the NARM methodology to calculate risk and value. Technical experts analyse options and set constraints (such as a constraint with the objective of maintaining risk) within our Decision Support Software which maximises the value of our investments for the given constraints. We use the value measures from our Decision Support Software in Ofgem's CBA template to compare the net present value (NPV) of each option against the baseline option to determine the most suitable capital programme in RIIO-GD3. The diagram above is a simplified representation of this process.

Figure 9 How we make asset decisions

Options analysis

We consider various options when making asset management decisions to ensure the interventions we undertake are in the best interests of our customers and are optimal in terms of asset performance, capital expenditure and risk management.

Our decision support software is used to quantify risk and level of service measures and to aid asset management decision making. Optimisation within the software allows us to maximise the value of investments we are making, but we also combine this with bottom-up analysis and constraint application which comes from collaboration with our subject matter experts.

Our process for offtake and PRS assets is to undertake asset class optimisations where we set different constraints for our options and use our decision support software to optimise within each secondary asset class. By undertaking optimisations at this level, we are allowing the system to maximise the value from investments

within each asset class. Once we have run these optimisations, we analyse the results in terms of risk, service and cost and use Ofgem's CBA template to understand the customer benefits derived from each option.

In the early stages of options analysis, optimisations were carried out in our Decision Support Tool (DST) to obtain the best value investments over RIIO-GD3, by applying constraints such as maintain risk or investment cost with the objective of maximising value from intervention. The resulting intervention plan recommendations were then reviewed by subject matter experts, who fed back on specific site and asset intervention applicability providing additional bottom-up insights around factors such as obsolescence and compliance. This information was used to further develop the modelling and intervention selections by applying additional constraints within the modelling process.

A preferred option has been arrived at using a combination of bottom-up analysis and optimisation using our DST to maximise the value of investments we are making. From this preferred option, further sensitivity analysis is undertaken to see if we can in any way improve the option. This sensitivity analysis is undertaken at the asset class level looking at the different effects of refurbishment and replacement interventions, as well as seeing if there is more merit in delaying the investment. During this sensitivity analysis we will also run each asset class individually through Ofgem's CBA template to ensure that they have a positive NPV and within a reasonable timeframe. This provides additional confidence that our decision support software hasn't been inadvertently constrained during the first stage and not been able to deliver the best value for our customers.

The different options we have modelled are set out below in Sections 8.1 to 8.5. These have been appraised against our objectives in Section 5 to determine a preferred option. In summary, we have produced a preferred option which we have deemed appropriate to maintaining a safe, reliable and compliant network. Subject matter experts were consulted to create reasonable Do More and Do Less options, with a particular focus on practical deliverability of the programme of works. It is important to note however that the options discussed have implications on a combination of safety, reliability and compliance which are discussed in the options analysis review. A deferral investment option was also considered.

We provide a summary output schedule under each option Table 8 and detailed information on how we have reached our unit cost assumptions are provided in section 8.6.

Ofgem CBA Template Assumptions

For all CBAs in our RIIO-GD3 submission, we used an assumed weighted average cost of capital (WACC) of 3.92% based on Ofgem guidance (a real average basis). We have assumed a depreciation Acceleration Factor of 100% across all CBAs and scenarios, i.e. no additional acceleration of depreciation. For Capex CBAs we have assumed a capitalisation rate of 33.7% based on our Totex forecasts in BPDTs and 100% for Repex CBAs. First year of expenditure outflow is set to 2027 in all scenarios for consistent relative NPV calculations. This is in line with Ofgem guidance for RIIO-GD3 and the approach taken in RIIO-GD2. We consider that the plausible ranges of these parameters would not materially affect CBA outcomes and have provided only one version of templates with these consistently applied (as they can be adjusted by Ofgem in any case).

We have not provided direct Opex associated with each CBA scenario as it would require us to artificially and subjectively divide up our maintenance and repair expenditure into each sub-asset class (CBA) and make a judgement on how this would be affected by each scenario. We do not record or report data at this level and we have no robust basis on which to provide it. In reality, maintenance and repair teams attend to multiple asset classes in single visits as part of an efficient function. Instead, we have provided the objectively calculated VF Financial risk, which is based on agreed industry NARM based calculations for estimating impacts on Opex under each CBA scenario. For those asset groupings not covered by NARM we have only included benefits and impacts of key benefits e.g. leakage. We consider this to be a more robust and objective approach to our CBAs. We have

completed the NARM monetised risk memo lines from values in the NARM BPDT for baseline and preferred where they are available and relevant.

8.1. Baseline – Do minimum/nothing

This option is used as the baseline for which all other options are measured against. It does not include any capital investment but instead considers the cost of ongoing maintenance activities and repairs on failure which are captured within the financial risk element of the NARM modelling. There are no direct benefits accrued under this option, however it does include societal impacts associated with leakage, fatality and injury.

Our analysis demonstrates that without intervention we can expect a 20% risk increase and a 9% increase in supply interruptions above the start of RIIO-GD3 levels if we were to adopt this Do Nothing/ Do Minimum option (Table 10). The primary driver of risk increase is carbon risk as the cost of carbon is increasing, but we also see significant increases from all of the other categories of risk over RIIO-GD3 (Table 12).

Given our objectives in Section 5 of maintaining risk and supply interruption levels, this option has been deemed to be unacceptable, but forms the option against which the following options have been measured against.

8.2. First option summary – Balanced strategy (preferred option)

We are planning to undertake a total of 271 interventions in RIIO-GD3 at a cost of £28.38m. This consists of:

- 31 buildings replacements
- 48 buildings refurbishments
- 92 general site civils (this includes a mix of work required on assets such as ducting, pipework or sandboxes for example)
- 54 site CP upgrades
- 25 fence replacements
- 21 fence refurbishments.

These interventions were identified following a comprehensive survey of around half of our sites during 2024. This survey collected actual site condition information so that we could evidence the interventions required to maintain site safety and physical security (which, as noted earlier in Section 4, is a growing concern). We extrapolated the results of the survey out by 1.5 to account for the remaining sites that were not surveyed and take into account how we targeted the sites we knew were either in need of some intervention or were likely to be based on their age or last intervention date. On this basis, we were likely to have already identified a good portion of the sites in need of intervention.

Risk objective (maintain risk +/- 10%) - Under this option we would undertake 271 interventions, costing £28.38m. This option increases risk by 18.8% compared to start of RIIO-GD3 levels but delivers a slight mitigation of 1.2% from the baseline scenario. The modest reduction in risk compared to the investment is to be expected due to the way that risk is modelled through NARM for this asset class as civils interventions are a modifier to the probability of failure of the mechanical asset it is associated. This is by virtue of the civils asset providing protection or security to the mechanical asset. The risk reduction is not measuring the risk reduction of the civils asset but on the associated mechanical asset. The risk and CBA analysis does not therefore take into account risks such as health and safety risks to personnel and equipment, e.g. from collapsing civils infrastructure. Whilst we are not meeting our risk objective when quantifying risk through NARM, we do know that we are targeting sites

which are in need of intervention, having utilised our subject matter experts insight as to where we are most exposed to health and safety issues (see Table 10) and having carried out a survey exercise to support this. Our programme of works in RIIO-GD2 focussed more on refurbishment of civils infrastructure for offtake and PRS, but our subject matter experts and surveys are indicating that significant numbers of buildings and fences are reaching end of life, requiring a much more involved replacement of our civils infrastructure if we are to continue to protect our assets and keep our personnel safe. Having said this, the majority of risk categories are close to maintaining risk to within +10% as per our objective (Table 12) apart from carbon risk, which we are struggling to mitigate due to the increasing cost of carbon.

Service level objective (maintain SI levels +/- 10%) – Our preferred option would result in a 7% increase in supply interruptions and we are therefore delivering against this objective.

Efficiency objective (minimise RIIO-GD3 spend over and above RIIO-GD2 levels) – We recognise that our assets have now reached an age where intervention is required. We have extended our asset lives as far as possible during RIIO-GD1 and RIIO-GD2, however, with more assets reaching the end of their useful lives we are faced with no option but to carry out proportionally more interventions than in previous regulatory periods in order to maintain a safe working environment for our colleagues, ensure site safety and security to protect the public. If we do not carry out the interventions, there is chance that we would incur an HSE improvement notice.

Uncertainty objective - We want to ensure that our investments pay back within 16 years. Our preferred option pays back within 46 years. We recognise that this is outside of the 16 years outlined above. However, as detailed earlier, for this particular group of assets we are not necessarily able to capture the full benefits when quantifying this through NARM, meaning our risk reduction is likely to be understated. Please refer to our discussion under Risk objective.

Compliance objective - We want to ensure we are compliant with legislation relevant to each asset class. We identified these interventions following a survey of half of our sites during 2024 where we assessed actual condition of our buildings and civils infrastructure. There is therefore a known need to undertake the works identified and to not do so would result in potential non-compliance with legislation such as the Health and Safety at Work Act which requires our colleagues are provided with a safe working environment.

8.3. Second option summary – Do more

We considered the implications if we were to increase our proposed interventions by extrapolating the results by 2 rather than 1.5, to assume that the surveyed sample were representative of the remaining sites. This increased the total interventions required to 382 at a cost of £39.78m, these include:

- 40 buildings replacements
- 64 buildings refurbishments
- 120 general site civils (this includes a mix of work required on assets such as ducting, pipework or sandboxes for example)
- 54 site CP upgrades
- 72 fence replacements
- 32 fence refurbishments.

The survey was devised with specific sites chosen for survey where issues were known, or likely to be present. We are confident that the worst condition sites have already been included within our survey sample. This is a more pro-active approach where we intervene on sites likely to have more category B issues. The £11.4m increase in cost is significant, and still results in risk increasing by 15.9%. We also need to consider the deliverability of this piece work given it would require our teams to carry out 111 more interventions over five years.

Risk objective (maintain risk +/- 10%) - Under this Do More option we would undertake 382 interventions, costing £39.78m. This option increases risk by 15.9% compared to start of RIIO-GD3 levels, a mitigation of around 4% and 3% compared to our baseline and preferred options respectively. We are not meeting our risk objective due to the way civils interventions are accounted for in the modelling (please refer to a fuller discussion under the risk objective header in section 8.2). As for the preferred option, we are mitigating the majority of risk categories to broadly maintaining levels +/-10% except carbon risk, owing to the increasing cost of carbon.

Service level objective (maintain SI levels +/- 10%) – Our Do More option would result in a 4.2% reduction in supply interruptions, and we are therefore delivering against this objective.

Efficiency objective (minimise RIIO-GD3 spend over and above RIIO-GD2 levels) – We have developed our preferred option following analysis of an evidence-based assessment of our sites, in order to maintain a safe working environment for our colleagues, ensure site safety and security to protect the public. We extrapolated our survey results out by 1.5 in order to correct for the selective bias introduced by having surveyed the worst condition sites first. The Do More option assumes that the remaining un-surveyed sites are in the same or similar condition to the surveyed sites. In reality, this is unlikely to be the case and this option is therefore a more proactive approach, allowing us to intervene across more sites before the works become required from a safety point of view. Considering the increase in projected spend between RIIO-GD2 and RIIO-GD3 that is already outlined in our preferred strategy, carrying out additional works voluntarily is unlikely to be justifiable. We do not consider that we can meet our efficiency objective under this option.

Uncertainty objective - We want to ensure that our investments pay back within 16 years. Our Do More option pays back within 29 years. We recognise that this is outside of the 16 years outlined above. However, as detailed earlier, for this particular group of assets we are not necessarily able to capture the full benefits when quantifying this through NARM, meaning our risk reduction is likely to be understated. This pays back quicker than the preferred option as the benefit accrual increase outweighs the cost increase.

Compliance objective - We want to ensure we are compliant with legislation relevant to each asset class. We identified these interventions following a survey of half of our sites during 2024 where we assessed actual condition of our buildings and civils infrastructure. There is therefore a known need to undertake the works identified and to not do so would result in potential non-compliance with legislation such as the Health and Safety at Work Act which requires our colleagues are provided with a safe working environment.

All things considered, it was determined that this option would likely place undue pressure on the teams undertaking the work, putting our delivery programme at risk. We would also not be meeting our efficiency objective outlined above. For these reasons, we did not take this option forwards.

8.4. Third option summary – Do less

We considered the impact of us scaling back interventions to only those identified as part of a survey. Under this option we would undertake a total of 218 interventions at a cost of £21.87m. It includes:

- 20 buildings replacements
- 32 buildings refurbishments
- 60 general site civils (this includes a mix of work required on assets such as ducting, pipework or sandboxes for example)
- 54 site CP upgrades
- 36 fence replacements
- 16 fence refurbishments.

Whilst this option ensures that all interventions are evidence led, it does not leave any room for other issues that might be identified during RIIO-GD3. Considering we have not yet surveyed the other half of our sites, there is a high chance other issues will be identified.

Risk objective (maintain risk +/- 10%) - Under this option we would undertake 218 interventions, costing £21.87m. This option increases risk by 19.5% compared to start of RIIO-GD3 levels, compared with 20.0% under the baseline and 18.8% under our preferred option. We are not meeting our risk objective due to the way civils interventions are accounted for in the modelling (please refer to a fuller discussion under the risk objective header in section 8.2). Unlike the preferred and Do More options we are not maintaining risk broadly +/- 10% across the majority of risk categories and carbon risk increase still predominates.

Service level objective (maintain SI levels +/- 10%) – Our Do Less option would result in a 8.7% increase in supply interruptions, compared with a 9.4% increase under the baseline and a 7.2% increase under our preferred strategy and we are therefore delivering against this objective. We are meeting this objective however, we do need to carefully consider the impact on our customers of a supply interruption change of this magnitude.

Efficiency objective (minimise RIIO-GD3 spend over and above RIIO-GD2 levels) – We have developed our preferred option following analysis of an evidence-based assessment of our sites, in order to maintain a safe working environment for our colleagues, ensure site safety and security to protect the public. This option involves only intervening on those sites where there is clear evidence of the need to do so, in order to minimise spend and improve cost efficiency to meet this objective. However, we also acknowledge that it does not provide any contingency to intervene on additional sites that may be identified as requiring works from further surveying throughout RIIO-GD3 (of which we are confident there will be some) and which we have allowed for within the preferred scenario, as we have only been able to survey a proportion of representative sites (50%) ahead of RIIO-GD3 planning. This option would place risk around maintaining a health and safety compliant environment for our workforce and reducing the risk of impact on assets from civils infrastructure not accounted for in the NARM models.

Uncertainty objective - We want to ensure that our investments pay back within 16 years. Our Do Less option does not result in positive NPV and therefore cannot deliver against this objective (it fails to payback within a 50-year time horizon). However, as detailed earlier, for this particular group of assets we are not necessarily able to capture the full benefits when quantifying this through NARM, meaning our risk reduction is likely to be understated.

Compliance objective - We want to ensure we are compliant with legislation relevant to each asset class. We identified these interventions following the survey of half of our sites during 2024. We know we need to undertake the works to remain compliant with legislation such as the Health and Safety at Work Act which requires our colleagues are provided with a safe working environment. Although we have not quantified the issues that exist at the remaining 50% of our sites yet, we have a good understanding of the sites and know that we are likely to uncover issues throughout RIIO-GD3 that will require intervention of some kind. The lack of contingency provided under this option is an issue and would likely result in a number of issues unable to be addressed during the upcoming regulatory period. It may also result the physical security of our sites being compromised if we do not have the facility to appropriately address those issues.

8.5. Fourth option summary – Deferral of investment

The fourth option we considered was deferral of the investments detailed in option 8.2. We have outlined in Section 4 the importance of our buildings and civils to both protect our assets and provide adequate protection from security threats. Given we have undertaken a survey to identify sites in need of intervention, we did not consider deferral of investment to be a viable option and for this reason it has not been modelled.

8.6. Options technical summary table

NGN's expenditure forecasts are built on a tried and tested, robust and efficient process. This is founded in asset management principles that has seen NGN consistently benchmarked as the most efficient gas distribution company by Ofgem since 2005. It should be noted that "robust and efficient costs" should not be interpreted as lowest cost. We have and currently are experiencing external and internal cost drivers that are increasing the cost to deliver some workloads and maintain service and compliance objectives.

NGN's efficient and robust process to determine expenditure is as follows (for further details see Appendix A21 – Cost Assessment and Benchmarking Approach):

1. Historic analysis of previous investment programmes to understand how expenditure has been effective in managing network risk (NARM) and the service levels that have been delivered. This provides the actual delivered cost of reducing risk and delivering services levels.
2. Forward looking analysis of risk profile, cost drivers and pressures to understand what the forecasted programme of work is, and the cost associated with maintaining or enhancing performance. This allows a clear articulation of how actual delivered efficiency translates into future cost, accounting for any cost variance.
3. A comparison of historic cost base versus forward projection to ensure costs are targeted at addressing compliance requirements (HSE), supply demand and account for additional costs drivers or challenging areas of work. To ensure costs are robust we embed the following process:
    - Compare asset specific costs against third party industry database to understand where deviations from average costs might be, and the reason for these changes. Third party data base provided by Aqua Consultants who maintain databases for other regulated sectors.
    - Compare costs against Yr3 Industry RRP to assess how NGN costs compare to current delivered costs across GDNs (with Aqua Consultants highlighting that NGN's unit costs were competitive when compared to other GDNs).
    - Compare future investment programme to current actuals using Ofgem RIIO-GD2 benchmarking to understand where NGN may be benchmarked on a like for like for like basis.
    - Undertake robust internal challenge with independently appointed experts to weigh pro's and cons of business case and relevance of costs to meet service levels and manage network risk.
4. The costs are then deemed to be robust and efficient from an NGN perspective and will be subject to a final technical scrutiny by an external consultant to ensure costs, benefits and risk removal are justified.

As demonstrated above, the unit costs used in both our Cost Benefit Analysis and capital expenditure forecasts have been derived using historical project cost knowledge, sunject matter experts input on current cost trends and current cost quotations, to provide confidence in their accuracy, consistency and credibility. Since the introduction of SAP HANA S4 in Oct 2019 we have captured project costs at a more granular level to support regulatory reporting and to aid future investment decisions. During RIIO-GD1 the Unit Cost Database (UCD) was developed, this used extensive volumes of project cost data to derive cost curve models and provide a cost trend allowing for an accurate cost estimate, the allowances for RIIO-GD2 were driven by the UCD. External project management, untimely delivery by contractors and third party delays could all impact on costs, but uncertainty risk relating to unit cost was built in during the development of the UCD in RIIO-GD1 and has carried through as these costs have been developed into the unit costs for developing the RIIO-GD3 business plan, as described below. The RIIO-GD3 unit rates incorporate analysis of efficient historical projects (note that we removed outliers from our sample in cases where we had identified things such as significant delays, unusually high mobilisation/demobilisation rates to ensure those inefficient costs were excluded). No explicit efficiency over and above this is included within this EJP appendix as our efficiency target is covered within the main business plan - a 0.5% Ongoing Efficiency (OE) target. This means that in reality, NGN will be subject to a further 0.5% cost

reduction target throughout RIIO-GD3 in order to meet the OE objectives that will be set by Ofgem (refer to Chapter 6 of NGN's business plan).

As a reliable starting point, our RIIO-GD2 unit cost allowances were converted to 23/24 prices, RIIO-GD2 project costs and forecasts were then compared against the 23/24 allowances. Where there were significant variances time was spent with delivery and commercial subject matter experts to thoroughly review those costs. Technology improvements (new functionality), resource scarcity and project management are examples of where we have seen deviations in the RIIO-GD2 allowance, these have been reflected in the base RIIO-GD3 unit costs.

We have framework partners in place for Capex delivery projects which improve certainty and ensure efficiency of costs.

Table 6 provides a summary of the assumed unit costs applied in modelling and CBA analysis for civils assets. For the avoidance of doubt, costs are shown in 2023/24 prices.

	RIIO-GD3 Unit Cost 23/24 prices
Building – replace	£228,226
Building – refurbishment	£57,985
General Site Civils (S) Offtake & PRS	£30,5005
General Site Civils (M) Offtake & PRS	£65,2002
General Site Civils (L) Offtake & PRS	£160,000
Site CP Upgrades (Ground beds)	£73,179
Offtake fence replacement / refurbishment (per metre)	£2,400

Table 6 RIIO-GD3 unit costs summary

Whilst we are proposing to spend more in RIIO-GD3 than we had in RIIO-GD2, this is primarily due to the volume of interventions that need to be carried out as our civils assets have reached or exceeded their useful life at a number of our sites. We have evidenced the need for the interventions through the survey. Table 7 outlines the cost of each of the options. Asset lives vary: Buildings are likely to have 25 years, steelwork pipe supports 40 years and interventions on pathways or sandboxes may have a 15-to-20-year life span for example.

Option	First Year of Spend	Final Year of Spend	Volume of Interventions	Equipment or Investment Design Life	Total Installed Cost (RIIO-GD3 Capex) 23/24 prices
Baseline (Do Nothing)	N/A	N/A	0	N/A	£0
First Options Summary – Preferred Option	2026/27	2030/31	271	15 to 40 years	£28,382,495
Second Option Summary – 'Do More'	2026/27	2030/31	328	15 to 40 years	£39,779,112
Third Option Summary – 'Do Less'	2026/27	2030/31	164	15 to 40 years	£21,865,399
Fourth Option Summary – Deferral of Investment	2031/32	2036/3737	271	15 to 40 years	£28,382,495

Table 7 Option costs technical summary table

We detail below how our output schedule would differ under each of the options:

Workload Intervention Volumes	2026/27	2027/28	2028/29	2029/30	2030/31	Total
Preferred Option	55	53	56	53	54	271
Do More Option	76	78	75	79	74	382
Do Less Option	44	43	44	45	42	218

Table 8 workload intervention profile by option

9. Business case outline and discussion

Table 9 details a summary of the options appraisal against objectives carried out in Sections 8.1 to 8.5.

In Summary: It has not been possible to meet the 'maintain risk' objective in any of our options however, we expected this to be the case given the way in which NARM accounts for risk across civils assets. This is by virtue of the way civils impacts the mechanical assets risk (and it is impact on mechanical asset risk we are measuring) that results in small risk mitigation (see risk objective header in Section 8.2). Risk under the majority of risk categories is broadly being maintained +/-10% for the Preferred and Do More options, but not for the Do Less option. Carbon risk is a significant cause of risk increase in all options owing to the increase in the cost of carbon.

All objectives fail to meet our uncertainty objective of paying back within 16 years. This is a consequence of the small risk mitigation, the reasons above. Baseline risks and risk mitigation relating to the health and safety of the workforce and the impact on mechanical assets due to failing civils infrastructure, e.g. collapsing buildings do not form part of the NARM risk modelling and so are not part of the risk analysis presented.

		Objectives					
Option	Description	Maintain Risk (+/- 10%)	Maintain Supply Interruptions (+/- 10%)	Efficiency	Uncertainty	Compliance	Comments
-	Baseline	Not Met (+20%)	Met (+9%)	N/A	N/A	Not Met	Not maintaining risk level objective and also increasing H&S for personnel and damage to assets from failing civils infrastructure.
1	Preferred	Not Met (+19%)	Met (+7%)	Significant increase in spend on RIIO-GD2. Met using SME expertise.	Not Met (46yrs)	Met	Significant increase in spend on RIIO-GD2. We have met this objective of minimising necessary spend using SME expertise. Majority of risk categories close to maintain +10% but carbon is difficult to mitigate. Risk mitigation is small owing to civils being a modifier to the mechanical asset. H&S to personnel and incursion risk to assets are not accounted for.
2	Do More	Not Met (+16%)	Met (-4%)	Not Met - additional £11.4m	Not Met (29yrs)	Met	All things considered, it was determined that this option would likely place undue pressure on the teams undertaking the work, putting our delivery programme at risk. We would also not be meeting our efficiency objective outlined above. For these reasons, we did not take this option forwards.
3	Do Less	Not Met (+20%)	Met (+9%)	Cost Reduction (£6.5m) - refer to comments	Not Met (>50yrs)	Not Met	This cost reduction is by virtue of reduced workload to the preferred option. This option would place risk around maintaining a health and safety compliant environment for our workforce and reducing the risk of impact on assets from civils infrastructure not accounted for in the NARMs models.

Table 9 Options appraisal versus objectives

matter experts and representative surveying of 50% of our sites indicating that a significant proportion of our civils infrastructure is approaching end of life in RIIO-GD3 requiring a significant replacement programme to ensure we remain compliant with legislation and continue to protect our workforce and our assets adequately. It also maintains the physical security of our sites, which is a growing area of concern.

The Do More option considers additional investment on top of this, and we assessed that this would be an unpalatable option for customers from a cost perspective. Coupled with this there would be undue pressure on delivery teams putting programme delivery at risk.

The Do Less option is at reduced cost to the preferred option by virtue of reduced workload. This option would place risk around maintaining a health and safety compliant environment for our workforce and reducing the risk of impact on assets from civils infrastructure not accounted for in the NARM models.

The preferred option has therefore been assessed to provide the right balance between managing risks (NARM and risks associated with compliance not covered under NARM) whilst minimising the increased expenditure that is required over RIIO-GD2 levels to ensure a safe, reliable and compliant network.

Our preferred option is detailed in full in Section 10.1.

9.1. Key business case drivers description

This section discusses the development of the preferred strategy and sensitivity analysis undertaken. We have assessed the present value of each investment option utilising Ofgem's CBA template. To calculate all present value figures, we have compared the capital and operational costs associated with each scenario and overlaid them against the leakage reductions (associated with reduced numbers of failures) and reductions in risk relating to customer, compliance, financial and health and safety we expect each to attain.

The baseline position outlines what we expect our annual shrinkage position to be, assuming zero interventions on civils assets across offtakes and PRS. The present value of each alternative relates to our expected reduction in shrinkage given the funding received under each option. To value each of these efficiency gains we have used the non-traded price of carbon dioxide, as quoted by Ofgem.

As noted above, each alternative option also analyses the impact of the change in customer, compliance, financial and health and safety risk. The preferred strategy development is discussed in Section 8.2 with the options (sensitivity analysis) detailed in Sections 8.1 to 8.5.

The key drivers for investment in civils assets are asset health and compliance. Our RIIO-GD2 programme of investment was a refurbishment focussed approach to extend the life of our assets. In RIIO-GD3 we are continuing a refurbishment approach to extend life where appropriate, but there has been a significant transition to replace assets which have reached end of life. The significant step change in civils and building investment programme is required to proactively manage safe working conditions on offtake and PRS sites following extreme weather issues leading to accelerated deterioration of assets.

Conditionalities included within our options analysis are detailed in Section 7.

9.2. Business case summary

The analysis results for each of the options detailed in Sections 8.1-8.5 are summarised in Table 10, Table 11 and Table 12. Options appraisal is detailed in Sections 8.1 to 8.5 for each option and option selection is detailed at the start of Section 9. It can be seen that the options do not payback within 16 years. However, we have carried out a cost benefit analysis for offtake and PRS at an aggregated level (including all costs and benefits as detailed within Investment Decision Packs A22.b to A22.g which includes civils). For this aggregated CBA, the pay back is 13 years.

Option	Desciption	RIIO-GD3 Secondary Interventions					Total NPV compared to Baseline at 2070 (£m)	Objectives			
		Building Replace	Fence Replace	Building Refurb	Fence Refurb	General Civils		Total Risk Change from 2026	RIIO-GD3 Total Capex Cost (£m)	Supply Interruption change from 2026	Payback (years)
-	Baseline	0	0	0	0	0	-£ 2,486.8	20.0%	0	9.4%	-
1	Preferred	31	25	48	21	146	-£ 0.9	18.8%	£28.4	7.2%	46
2	Do More	40	72	64	32	174	£ 50.0	15.9%	£39.8	-4.2%	29
3	Do Less	20	36	32	16	114	-£ 4.4	19.5%	£21.9	8.7%	N/A

Table 10 Options summary risk, SI impact and CBA

Option	Description	No. of Secondary Interventions in RIIO-GD3	Forecast		Total NPV Compared to Baseline (£m)						Payback (years)	Total Risk Change from 2026	Supply Interruption change from 2026	Preferred Option
			Capex RIIO-GD3 (£m)	Totex RIIO-GD3 (£m)	2035	2040	2045	2050	2060	2070				
-	Baseline	0	0	0	-£ 162.0	-£ 252.8	-£ 343.1	-£ 433.6	-£ 1,429.8	-£ 2,486.8	-	20.0%	9.4%	N
1	Preferred	271	£28.4	£28.4	-£ 11.4	-£ 11.9	-£ 11.7	-£ 11.1	-£ 5.9	-£ 0.9	46	18.8%	7.2%	Y
2	Do More	382	£39.8	£39.8	-£ 16.2	-£ 15.5	-£ 13.9	-£ 11.7	£ 17.8	£ 50.0	29	15.9%	-4.2%	N
3	Do Less	218	£21.9	£21.9	-£ 9.1	-£ 9.8	-£ 9.9	-£ 9.7	-£ 7.0	-£ 4.4	N/A	19.5%	8.7%	N

Table 11 Options summary including NPV

Option	Desciption	Risk Change from 2026					Total Risk
		Total VF Carbon Risk	Total VF Compliance Risk	Total Customer Risk	Total VF Financial Risk	Total VF Health & Safety Risk	
-	Baseline	24.2%	14.5%	12.4%	14.9%	14.5%	**20.0%**
1	Preferred	24.2%	12.0%	10.6%	11.3%	12.0%	**18.8%**
2	Do More	23.6%	7.0%	-13.5%	5.9%	11.9%	**15.9%**
3	Do Less	24.2%	13.0%	12.2%	13.8%	13.0%	**19.5%**

Table 12 Options summary detailed risk summary

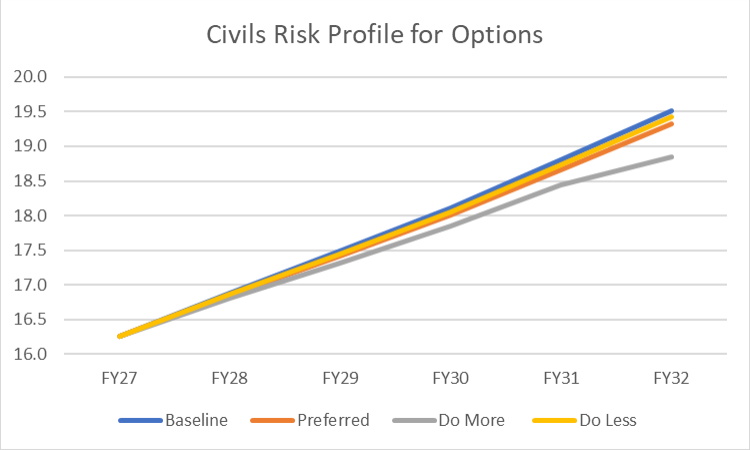

Figure 10 Civils risk profile for options

10. Preferred option scope and project plan

10.1. Preferred option

For the avoidance of doubt, our preferred option is to undertake 271 interventions in RIIO-GD3 at a cost of £28.38m. This consists of:

- 31 buildings replacements

- 48 buildings refurbishments
- 92 general site civils (this includes a mix of work required on assets such as ducting, pipework or sandboxes for example)
- 54 site CP upgrades
- 25 fence replacements
- 21 fence refurbishments.

These interventions have been identified following a comprehensive site survey conducted during 2024 which was intended to identify works required to maintain both site safety and physical security.

This programme of works is primarily driven by maintaining compliance around the health and safety of our workforce and protection of assets from failing civils infrastructure which are approaching end of life.

Costs for civils for the RIIO-GD3 EJP are significantly increased (£28.4m) on the projected spend in RIIO-GD2 (£3.0m) on a comparable 23/24 price basis. The RIIO-GD2 programme of investment focussed on a refurbishment focussed approach to extend the life of our assets. In RIIO-GD3 we are continuing a refurbishment approach to extend life where appropriate, but there has been a significant transition to replacement of assets which have reached end of life following subject matter experts input and an extensive surveying exercise. The significant step change in civils and building investment programme is required to proactively manage safe working conditions on Offtake and PRS sites following extreme weather issues leading to accelerated deterioration of assets.

Long Term Risk impact on preferred option

Table 13 provides details of the preferred option Capex spend alongside Single Year Risk benefit and Long Term Risk (LTR) benefit output as shown in our NARM BPDT. Long Term Risk calculations allow for accrual of benefit over the life of the intervention. These intervention lives are detailed in full in our NARM BPDT submission. Section 5.2 Project boundaries detail the investments within our preferred option where we have been able to model risk and risk reduction under NARM. We have provided undiscounted Long Term Risk benefit both here and in the NARM BPDT. Further clarification with Safety Regulation Working Group (SRWG) is needed around the requirement for discounting LTR.

	Capex Spend (£m)	Capex Spend (£m)	NARM BPDT	
	All Investments	NARM Modelled Investments	Single Year Risk Benefit (R£m)	RIIO-3 Long Term Benefit Output (R£m)
Civils	28.38	15.32*	0.02	0.27

Table 13 Civils long term risk presentation

* For civils, NARM Capex spend cannot be compared to NARM BPDT LTR benefit as we are not able to model a lot of the civils in NARM BPDT as there is a mechanical intervention on the asset and we can only model one intervention (E&I has also been prioritised above civils in the BPDT). In the EJP, we have separated the asset classes out and modelled these separately so there may be some inconsistencies between risk presentation for the EJP and BPDT for this reason.

10.2. Asset health spend profile

The total forecast capital expenditure for offtakes and PRS's has been included within the accompanying CBA.

We have managed our spend proportionally over the RIIO-GD3 period to ensure a flat spend profile. Our proposed plan is to spend between £5.6m and £5.8m per annum, to ensure we avoid large peaks and troughs in spend. With such a large project, this is vital to ensure the financial viability of the project lifecycle.

£m 23/24 prices	2026/27	2027/28	2028/29	2029/30	2030/31	Total
Building - Replace	£1.60	£1.14	£1.60	£1.14	£1.60	**£7.08**
Building - Refurb	£0.58	£0.52	£0.58	£0.52	£0.58	**£2.78**
General Site Civils (S - Small) Offtake & PRS	£0.15	£0.15	£0.15	£0.15	£0.15	**£0.76**
General Site Civils (M - Medium) Offtake & PRS	£0.33	£0.33	£0.33	£0.33	£0.33	**£1.63**
General Site Civils (L - Large) Offtake & PRS	£1.28	£1.44	£1.28	£1.44	£1.28	**£6.72**
Site CP Upgrades (Ground beds)	£0.80	£0.80	£0.80	£0.80	£0.73	**£3.95**
Offtake fence replacement	£0.00	£0.48	£0.00	£0.48	£0.00	**£0.96**
PRS fence replacement	£0.72	£0.58	£0.72	£0.58	£0.72	**£3.31**
Offtake fence refurbishment	£0.00	£0.00	£0.10	£0.00	£0.00	**£0.10**
PRS fence refurbishment	£0.22	£0.22	£0.22	£0.22	£0.22	**£1.08**
Total	**£5.68**	**£5.66**	**£5.78**	**£5.66**	**£5.60**	**£28.38**

Table 14 Asset spend profile

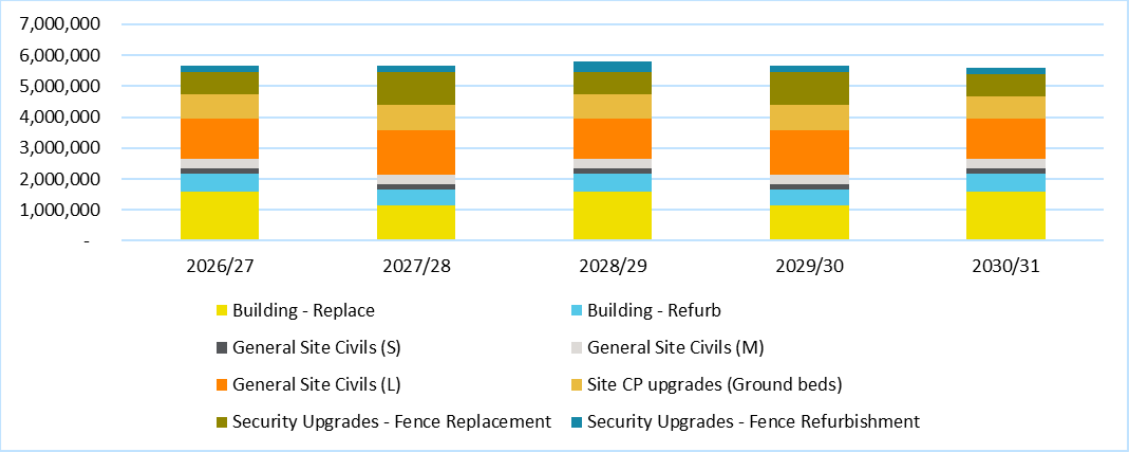

Figure 11 Asset spend profile

Cost comparison between RIIO-GD3 and RIIO-GD2 spend is included in Section 10.1.

10.3. Investment risk discussion

We have controls and processes in place throughout the development of our RIIO-GD3 Capital Expenditure programme to ensure we mitigate both our customer's and our own exposure to risk. Workload and unit cost risks are inherent when forecasting failure rates and intervention solutions for large populations of assets.

As a starting point, we allowed our Decision Support Tool to identify a sensible solution as a starting point. We conducted sensitivity analysis and presented our findings to subject matter experts who provided suitable challenge and input by utilising their detailed site knowledge. For example, at this point, we could remove any interventions identified by the DST where we knew that works were already due to be carried out in the remainder of RIIO-GD2 for example.

Our subject matter experts also provided input as to whether the DST was producing results which were deliverable from an operational point of view. This engagement was a particularly important part of the process as our regular interactions with the operational team ensured we did not lose track of the bigger picture by considering the overall portfolio of works that were required in RIIO-GD3.

The bullet points below outline the steps we have undertaken to ensure we limit these risks to provide an accurate capital programme.

Workload Risk Mitigations

- We have used the NARM methodology to calculate individual assets probability of failure which uses asset attributes to determine specific failure rates.
- As most of our equipment installed on our offtake and PRS sites are from a few select manufacturers, for example our boiler houses are almost exclusively from Armstrong's, we have not witnessed different failure rates across the populations.
- We have considered various options within the CBA including workload volumes and chosen the solution which provides our customers with the most appropriate balance between cost, risk and service.
- We have sense checked our preferred option against other asset data such as age, condition surveys, fault trends.
- We have consistently engaged on our preferred strategy with our subject matter experts and operational colleagues to ensure that our strategy is both viable and deliverable.
- As part of the above, we have ensured adequate internal and external resource for design and delivery.
- We have procurement strategies in place which take into account the likely volumes and lead times we could experience. Our Workforce and Supply Chain Resilience Strategy (Appendix A7) has been developed with this in mind.
- Our project managers have been engaged throughout so that we have developed appropriate workload planning procedures.
- Land requirements have been factored into our project plans to ensure that they are dealt with well in advance of project construction to avoid undue delays.

Unit Cost Risk Mitigations

- We have used our updated unit cost analysis (see section 8.7) to ensure our unit costs are fair and reasonable, representative of an efficient, frontier company.
- We are not planning to undertake new work activities. We have undertaken all interventions previously and have historic costs allocated within our unit cost analysis.
- We have experienced Project Managers who have a proven track record of delivering this type of work, and a commercial team of quantity surveyors who are focussed on delivering value for money.

Section 4.1 of **Appendix A7 – Workforce and Supply Chain Resilience Strategy** sets out some of the supply chain challenges that we have faced throughout RIIO-GD2. It acknowledges how NGN is a comparatively smaller GDN, which reduces our buyer power (section 4.1.2) and also discusses the significant inflationary pressures that have been placed on GDNs (section 4.1.4). For example, it discusses how the prices charged for coiled pipes have increased by 82% in the period from January 2020 to August 2023. In spite of these challenges, we are confident that our input unit costs remain efficient. This Appendix also touches on a number of external shocks which have impacted on things such as lead times. Examples include the Covid-19 pandemic, the Suez Canal blockage, Russia's invasion of Ukraine and rising geopolitical tensions. We outline in the strategy how we expect volatility to continue across our supply chain, and that we will utilise storage facilities in order to mitigate against supply input shortages. We plan to resource our supply chain and procurement team appropriately to help us overcome these challenges.

Appendix A21 – Cost Assessment and Benchmarking Approach demonstrates how, despite challenges facing us, NGN leads the industry in terms of cost efficiency, having been ranked the most efficient operator by Ofgem in both RIIO-GD1 and RIIO-GD2. This Appendix further outlines the value of NGN in Ofgem's cost assessment modelling at RIIO-GD2 by showing how NGN's frontier setting performance enabled Ofgem to set cost allowances that were £211 million lower than they would otherwise have been. In other words, our efforts to lead the sector on cost efficiency have resulted in significantly lower bills for consumers across the whole country.

We have achieved this position through innovative thinking and directly and aggressively challenging industry norms and practices by bringing forward market-led, commercially focussed business solutions across almost every area of our business. For example:

- NGN introduced modern labour terms and conditions (T&Cs) for the majority of its operational workforce, leading to a significant reduction in legacy staff costs.
- NGN introduced a Direct Service Provider (DSP) model, leveraging small local engineering firms to deliver its replacement program instead of relying on the traditional 'Tier 1' companies that have typically dominated the industry.
- Given that NGN has made strong productivity improvements over time, we have re-invested our outperformance payments in areas that (among other things) improve our productivity further. For example, we have used outperformance to invest heavily in IT systems through the SAP4 Hana investment and 'Future Ways of Working' programme. These projects are expected to significantly improve the customer experience and enable NGN to become a data-focused business.

10.4. Project plan

As we are carrying out significantly more interventions than in RIIO-GD3, ensuring deliverability is going to be a key factor in this strategy. We have carefully balanced our workload across the RIIO-GD3 period so that we are undertaking between 53 and 56 interventions per annum. As shown, we have staggered the workload so we can be confident we will have the resource available. For example, ensuring we reduce the number of building refurbishments in years 2 and 4 to accommodate an additional large site civils intervention.

	2026/27	2027/28	2028/29	2028/30	2030/31	Total
Building - Replace	7	5	7	5	7	31
Building - Refurb	10	9	10	9	10	48
General Site Civils (S)	5	5	5	5	5	25
General Site Civils (M)	5	5	5	5	5	25
General Site Civils (L)	8	9	8	9	8	42
Site CP upgrades (Ground beds)	11	11	11	11	10	54
Security Upgrades - Fence Replacement	5	5	5	5	5	25
Security Upgrades - Fence Refurbishment	4	4	5	4	4	21
TOTAL	**55**	**53**	**56**	**53**	**54**	**271**

Figure 12 Project workload profile

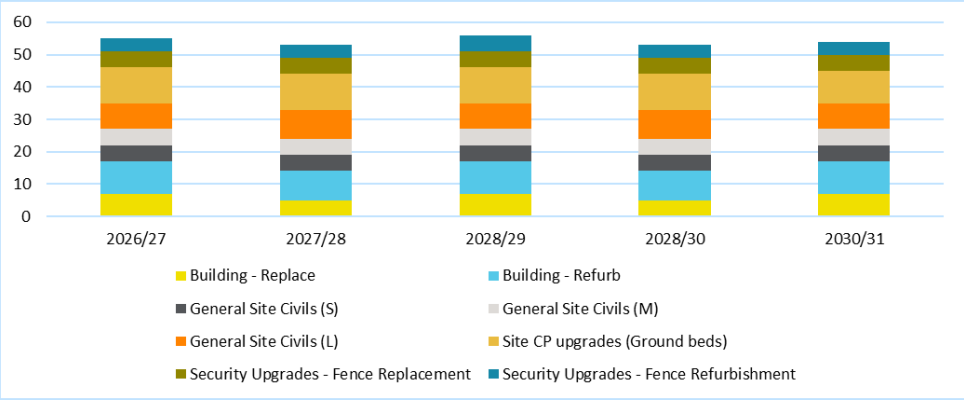

Figure 13 Project workload profile

Project planning is currently underway for RIIO-GD3. The screenshot below provides an insight to the level of detail to which we are going into developing offtake and PRS investment projects, which are being planned at the site level. The excerpts show the timings and milestones for the key project stages of an example project. There is greater level of detail below this that can be drilled into.

10.5. Key business risks and opportunities

Risks *(a risk register is included within the accompanying CBA)*

- Failure to invest in the assets assessed to be in urgent need of refurbishment or replacement, or diverting funds to upgrade assets that are not on the priority list, thus leaving insufficient budget to complete all the critical upgrade scope. This will create a consequential Health and Safety Risk that could lead to an official HSE Intervention.
- Cost variability, external project management, untimely delivery by contractors and 3rd party delays could all impact on costs. However, framework partners who deliver the Capex workload are rigorously challenged to deliver value for money and alternative partners are continually being used where cost or delivery is a challenge. Uncertainty risk associated with unit costs has also been built into the analysis for unit costs used in the RIIO-GD3 planning process (see Section 8.6 for further details).

Opportunities

- Over-delivery by value engineering and packaging low skills/small jobs up into larger programmes to reduce tender costs and benefit from economies of scale.
- Likely reduce our ‘slips, trips, and falls’ incident frequencies.
- Efficiencies – the level of efficiency depends on the site we are working on, the type of asset being replaced and whether the site gas supply can be isolated. Ideally if we were carrying out three separate replacements (crossing asset types) on a single site we would look to do all the work at the same time to minimise mobilisation and demobilisation cost for instance.

10.6. Outputs included in RIIO-GD2 plans

We do not expect to carry over any RIIO-GD2 interventions into RIIO-GD3.