Northern Gas Networks

A22.m - Non-Mandatory Repex

Engineering Justification Paper

Contents

1. Summary table

Name of Project	*Non-Mandatory Repex Intervention Programme RIIO-GD3*		
Scheme Reference	A22.m.NGN		
Primary Investment Driver	*Asset Health, Environmental & Safety*		
Project Initiation Year	*2026/27*		
Project Close Out Year	*2030/31*		
Total Installed Cost Estimate (£)	*£198.92m*		
Cost Estimate Accuracy (%)	(+/-5%)		
Project Spend to date (£)	*N/A*		
Current Project Stage Gate	*Design*		
Reporting Table Ref	*CV6.03, CV6.04, CV6.05, CV6.06, CV6.08*		
Outputs included in RIIO-GD3 Business Plan	*As per BDPTs above, impact of programme in NARM BPDT*		
Spend Apportionment	**RIIO-GD2**	**RIIO-GD3**	**RIIO-GD4***
	£147.68m	£198.92m	*c. £200m*

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

2. Executive summary

This Engineering Justification Paper (EJP) sets out the interventions that we plan to undertake on Non-Mandatory Repex investments planned for completion during RIIO-GD3. The investments outlined in the paper are aimed at addressing issues with the distribution pipelines and associated services that fall outside of IMRRP (Iron Mains Risk Reduction Programme) mandated by the Health and Safety Executive (HSE) and described in the A22.l Mandatory Repex Engineering Justification Paper.

Interventions in this area are asset health driven, a key focus on customer safety and minimising leaks and the risks associated with them. It is imperative that mains and services remain in good condition in order to ensure gas continues to flow through our network in a safe and reliable manner.

Our decision-making process for these investments involves a balance of the costs, future benefits, and the potential negative consequences of not proceeding with the non-mandatory mains replacement programme. The targeted investment areas include iron mains in the Tier 2B (T2B) and Tier 3 (T3) categories, those over 30m away from the nearest property (>30m Iron), greater than 2-inch steel (>2ST) and PE mains as well as mains diversions along with the associated services within each category. The drivers behind the investment proposals range from customer demand and compliance (diversions) to asset health, environmental and safety considerations (T2B/T3/>2ST). This document aims to show how each investment area has been carefully selected based on a systematic asset management decision-making process, incorporating risk analysis, value assessment, and trade-offs between different intervention and management options; as well as considering deliverability.

The volumes we are proposing for RIIO-GD3 are as follows:

	RIIO-GD2		RIIO-GD3 EJP Preferred Option	
Asset	**Workload units**	**Repex (£m) 23/24 prices**	**Workload units**	**Repex (£m) 23/24 prices**
Tier 2B	102.0km	£50.15m	109.0km	£61.67m
Tier 3	28.1km	£34.54m	29.1km	£53.80m
>2" Steel	150.9km	£28.09m	139.4km	£43.96m
>30m Iron	34.6km	£11.35m	35.0km	£14.73m
Polyethylene	7.0km	£6.54m	16.0km	£8.30m
Diversions	60.3km	£17.00m	66.5km	£16.47m
Total Non-Mandatory Mains	**382.9km**		**395.0km**	
Non-Mandatory Associated Services	13,199	**£147.67m**	14,177	**£198.92m**

Table 1 Non-mandatory RIIO-GD3 strategy and comparison to RIIO-GD2 summary

The total spend apportionment for these investments in RIIO-GD3 is £198.92m. This constitutes a cost increase of approximately 35% compared to the RIIO-GD2 commitments which is influenced by a variety of factors, described in detail in Chapter 6, Section 6.3 of the business plan.

As set out in this paper, this continuation of our successful RIIO-GD2 strategy into RIIO-GD3 is necessary to maintain risk, safety, leakage and reliability at acceptable standards. It builds on our track record of delivery and ensures that our Repex programme remains balanced and that we retain the resources and skills to undertake essential higher diameter work and meet our safety and licence obligations.

3. Introduction

This Engineering Justification paper outlines the process we have undertaken to determine the Non-Mandatory Repex investments we plan to complete during RIIO-GD3. Non-mandatory Repex investments are made to address known or forecasted issues with distribution pipeline and associated assets which are not covered by specific HSE intervention requirements. The decisions to make these investments are made based on the balance of the cost of making the investment, the benefits that it will deliver and the negative consequences of not making these investments including leakage, safety, repair and loss of supply risk. We cover the following discrete Investment areas:

- Tier 2B Iron Pipes, those >8”and <18” diameter that are below the Tier2A threshold. (Further Tier 2A details outlined in Mandatory Paper)
- Tier 3 Iron Pipes, which are =>18” in diameter
- Steel Pipes >2” in Diameter
- Zero Scoring Pipes, Iron Pipes that are over 30m from a property
- PE pipes
- Diversions

Overcrossings and Risers have their own EJPs and CBAs (A22.k & A22.p respectively). However, all other elements listed above are included in this EJP as part of our balanced non-mandatory programme building on our track record of delivery in RIIO-GD1 and RIIO-GD2.

The basket of work detailed within this Engineering Justification Paper has been developed systematically through our asset management decision-making process during which we analyse risk and value and trade-off between different intervention and management options, whilst striving to satisfy the objectives set out in section 5 of this document. This process includes the following steps which are outlined in more detail later in this paper:

- An understanding of the types of assets we own and the day to day operational issues we encounter
- Knowledge of what our customers and stakeholders want and the outcomes that best achieve this
- Establishing the drivers for investment and the asset intervention options
- Generating the probability of failure data for our assets using the Network Asset Risk Metrics (NARM) methodology as a basis for these calculations
- Agreeing a set of values to use in our Value Framework through which we can assess the intervention options objectively, holistically and consistently
- Undertaking asset class optimisations within our Decision Support Tool to maximise the value from our investments
- Comparison of the net present value of each intervention option using Cost Benefit Analysis to ensure a positive NPV within 16 years.
- Making an informed decision on the optimal workload and expenditure forecasts for our RIIO-GD3 Non-Mandatory Repex programme that is in the best interest of both our existing and future customers.
- Ensuring we still meet the obligations of our Safety Case regarding buried Assets

We will continue to deliver non-mandatory work where there is a clear benefit to customers and the environment. This is determined using a NARM-based CBA framework. There are safety and supply risks associated with the non-mandatory ageing metallic network that need to be addressed to ensure a safe and resilient network and mains replacement is by far the biggest impact we have on reducing fugitive methane emissions. Our preferred non-mandatory mains replacement programme proposal offers a balanced approach to deliver a safe, reliable and compliant network to continue to meet our licence obligations.

4. Equipment summary

NGN's pipe distribution network < 7 bar consists of approximately 36,000km of mains and over 2.5 million services providing gas to domestic, commercial and industrial consumers. This network, whose development began in the late 1800's and continues to this day, is constructed from a variety of materials, principally pit-cast iron; spun-cast iron; ductile iron; steel and polyethylene.

Tier 1 iron mains (<= 8" diameter within 30m of property), Tier 2A iron mains (>8" and <18" diameter scoring above the Risk Action Threshold) and steel mains <= 2" diameter are considered as Mandatory, and their management and replacement is covered in our Mandatory Repex EJP[1].

2,953km of the < 7 bar mains operated by NGN are non-mandatory metallic, which is ageing and deteriorating at the same rate as those under the IMRRP. They are deemed relatively lower risk due to generally further proximity from customers. However, failures on these pipes can still lead to dangerous incidents including gas in building events and explosions, as well as result in significant leakage and disruptive and difficult repairs in population centres and on roadways. These are often larger diameter trunk mains which feed significant numbers of downstream customers, which can lead to a risk of loss of supply incidents as a result of failures as well. Some of the pipe categories in this paper are under review by the HSE for inclusion in the IMRRP due to these significant risks. However, our proposals and classifications are based on policy at the time of submission.

Over 29,500km (c.80%) of the network is now PE and this increases annually due to mains replacement. This is a much safer material which significantly reduces the risk of incidents and leakage. We have included in our proposals a small amount of PE replacement which can occur due to relatively rare failures from historic installation defects and third-party interference, as well as part of efficient metallic replacement projects, i.e. when it is more cost-effective to replace small sections of PE rather than work around them as part of larger works.

The current populations and material mix for non-mandatory mains are shown below:

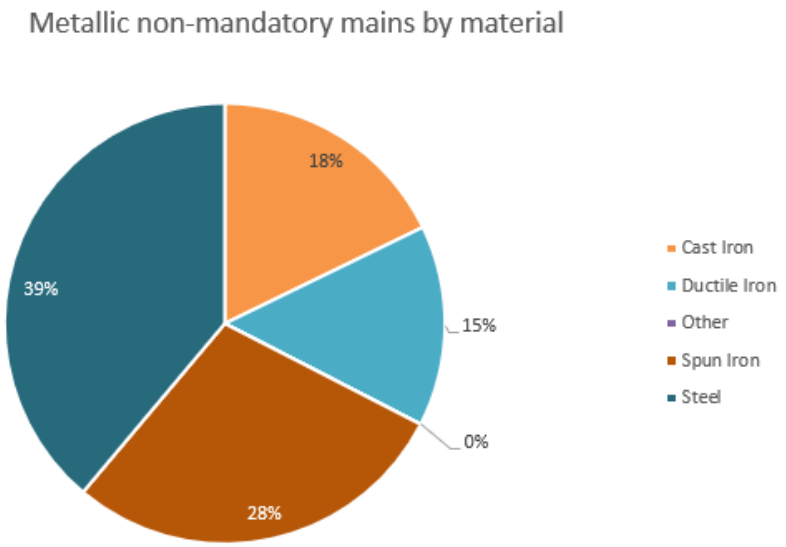


Figure 1 Non-mandatory population summary (excluding PE)

[1] A22.l Mandatory Repex

Tier	Material	Length (km)	% total
T2B	Cast Iron (CI)	365.97	12.40%
T2B	Ductile Iron (DI)	255.56	8.66%
T2B	Spun Iron (SI)	525.16	17.79%
T3	Cast Iron (CI)	107.91	3.66%
T3	Ductile Iron (DI)	23.06	0.78%
T3	Spun Iron (SI)	85.46	2.89%
>2ST	Steel (ST)	1,147.60	38.87%
Iron >30m	Cast Iron (CI)	51.58	1.75%
Iron >30m	Ductile Iron (DI)	157.06	5.32%
Iron >30m	Spun Iron (SI)	233.02	7.89%
Non-mandatory metallic Total	**All**	**2952.38**	**100.00%**
PE	Polyethylene (PE)	29,504.51	

Table 2 Non-mandatory population summary

5. Problem / opportunity statement

When the gas distribution network was established, the pipes transporting gas around towns and districts were made from iron. Iron was considered to be a sound material for gas distribution at the time. However, following several high-profile fatal incidents, national risk-based mains replacement programmes to replace iron mains came into operation and have been in place in various forms since the 1970s.

The Iron Mains Replacement Programme (IMRP) was introduced by the Health & Safety Executive (HSE) in 2002 specifically to address concern about the failure of iron mains, particularly cast-iron mains due to fracture. The Mains Risk Prioritisation System (MRPS) was also created at this time to provide an estimate of the risk of an incident presented by each individual section of main. This enabled NGN and other gas distribution networks to prioritise investment on iron main replacement, targeting investment towards replacing the riskiest pipes. The IMRP required the distribution companies to replace all 'at risk' iron mains (i.e. those within 30 metres of a property) within 30 years of 2002 and became known as the "30/30 programme".

Following a 10-year review commissioned by the HSE, IMRP was revised in 2013 to become the current Iron Mains Risk Reduction Programme (IMRRP), also known as 'The Three-Tier Approach'. The key changes to the methodology were:

- For most iron pipes (those ≤ 8" diameter – Tier 1) the requirement remained unchanged – those pipes within 30m of property are still required to be decommissioned by 31st March 2032.[2]
- For iron pipes >8" and <18" (Tier 2) a Risk Action Threshold was established with all pipes above this required to be decommissioned.[3]
- Tier 2 pipes below the Risk Action Threshold and Tier 3 pipes (iron pipes ≥ 18") are subject to Condition Monitoring and management regimes (which may include decommissioning where the pipes have deteriorated beyond safe or effective repair) and may also be subject to decommissioning where this is justified by a Cost Benefit Analysis providing;
    - A greater focus on risk management;
    - A greater flexibility to prioritise replacement based on a wide range of customer and stakeholder benefits, including reductions in gas losses, operating costs, and improvements in safety risk;

[2] The proposal for these mains is contained within the Mandatory Repex Engineering Justification Paper – (A22.l)
[3] The proposal for mains that fall above this Risk Action Threshold is contained within the Mandatory Repex Engineering Justification Paper – (A22.l)

- Greater flexibility to consider other remediation techniques (where available and accepted) to continue the use or extend the life of larger diameter mains; and
- Replacement due to condition or risk is required to undergo cost benefit assessment

Tier 2 pipes below the Risk Action Threshold and Tier 3 pipes, as well as the others listed in the introduction, are covered by this Engineering Justification Paper. This more flexible approach allows us to better balance the removal of the highest risk pipes with delivering efficient, effective and safe management of the network and value for money for customers.

Tier 2B and Tier 3. There are a variety of drivers for the continued replacement of all iron mains and not just those associated with the programme mandated by the HSE. Metallic distribution mains, regardless of specific material, pressure tier or ranking in relation to the Risk Action Threshold are approaching the end their asset lifecycle. This means that as asset health deteriorates, there is an increase to failure rates and therefore the risk of loss of supply increases. Our aim is to mitigate this risk and continue to deliver a safe and reliable gas supply to our region. The continuation of this programme also provides value for money for the customer, which is assessed using our cost benefit analysis and Value Framework model based on historic and forecast asset performance, with the impact on monetised risk being measured using the industry agreed NARM methodology. A proportion of work will also be built into Tier 1 projects to deliver overall efficiency.

RIIO-GD3 Tier 2B workload has been forecast by analysing the remaining pipe population that passes cost benefit analysis with a discounted payback period of 16 years or less. Tier 3 workload has been established in a similar way, although following analysis carried out by DNV on behalf of all GDNs, there is an early indication that greatest levels of risk are removed by targeting Tier 3 pipes for replacement. This has led us to model increased Tier 3 volumes for RIIO-GD3.

Steel (>2") Working with the other GDNs and an external expert organisation we have identified that steel mains are deteriorating at an increased rate. However, from our own internal analysis, we have identified that our continued programme of >2" Steel replacement has kept our leaks per km on this mains type at acceptable levels. We need to continue this into RIIO-GD3 to counter the continuing ageing and deterioration of these assets. With the remaining population we target those pipes which leak the most and pose the highest risk in year to optimise our programme and keep risk and leaks under control.

Zero Scoring Mains. There are three main drivers for replacing these pipes which are greater than 30m from properties:

- **Safety.** These iron mains are essentially the same assets as those that fall under the IMRRP and therefore carry the same risks of failures and incidents. This is somewhat mitigated due to them being less proximate to customers, but the risk isn't eliminated and is unacceptable in some instances. We target those pipes which have the highest relative risk to customers based on failure data.
- **Security of supply issues.** We have several aging single-leg mains where security of supply issues have been identified. We plan to replace a proportion of these pipes in RIIO-GD3 on a risk basis.
- **Efficiency and delivering best value for our customers.** This can be driven by two factors. We add zero-scoring mains into mandatory replacement projects for efficiency where we expect the pipes to become scoring pipes in the future. We also carry out work using CBA analysis for "stand-alone" zero-scoring projects taking into account poor condition and customer impact.
- **Environment.** Failure of these assets result in fugitive emissions of gas (leakage) with a significant environmental impact. Asset replacement results in the removal of these emissions and significant improvement in environmental performance.

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

Non-Mandatory mains hold just over half of the risk of the Distribution Mains assets in RIIO-GD3 with 55% of total risk. Tier 2B holds 23%, >2" Steel has 20% and Tier 3 has 12%. A primary driver for intervention is to reduce Carbon risk as failure in these assets may lead to the escape of gas. The secondary NARM driver for investment is to reduce Financial Risk, as failures in this group of assets may lead to an increase in reactive repair costs. This also carries a safety risk with potential for gas in building (GIB) and ignition events which can have devastating consequences for customers and property.

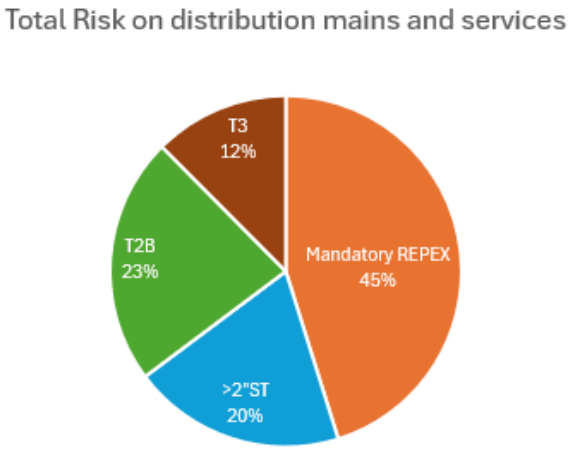


Figure 2 Total risk distribution on < 7bar mains and services

If we do nothing in RIIO-GD3 total Non-Mandatory risk increases by 14%. By not investing in our assets in RIIO-GD3 every asset will move further along its deterioration curve and the probability of failure will increase.

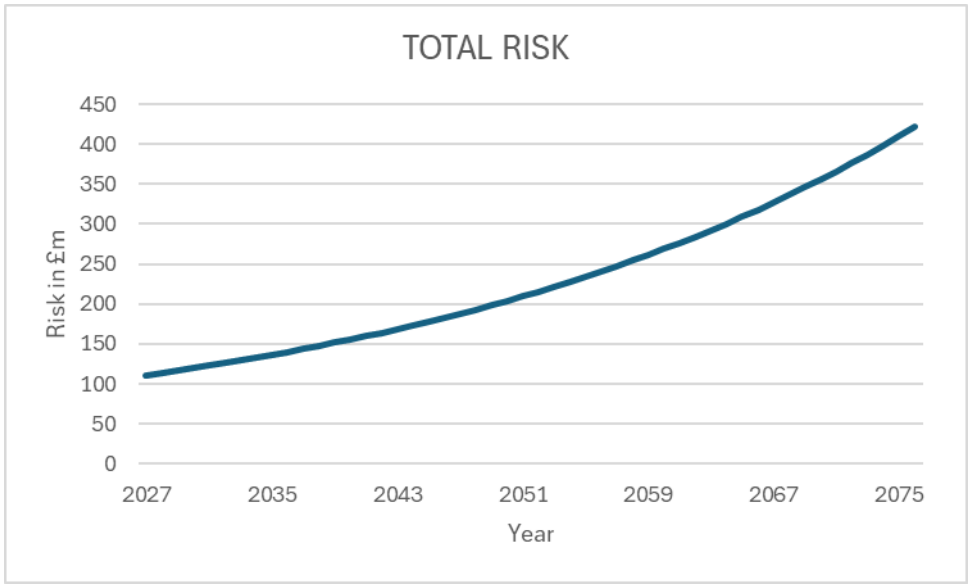


Figure 3 Total Risk trajectory without intervention

The above figure shows the total risk trajectory without intervention. Risk rises consistently through the years, more than quadrupling by 2075.

Below is a graph showing the leak rates for T2, T3 & >2"ST over the RIIO-GD2 period, which shows that our track record of delivering non-mandatory workload as part of a balanced programme throughout RIIO-GD1 and RIIO-GD2 has enabled us to maintain the leak rates across these non-mandatory pressure tiers. This in turn should reduce the average leaks on the network each year as the length of non-PE mains reduces as we replace it.

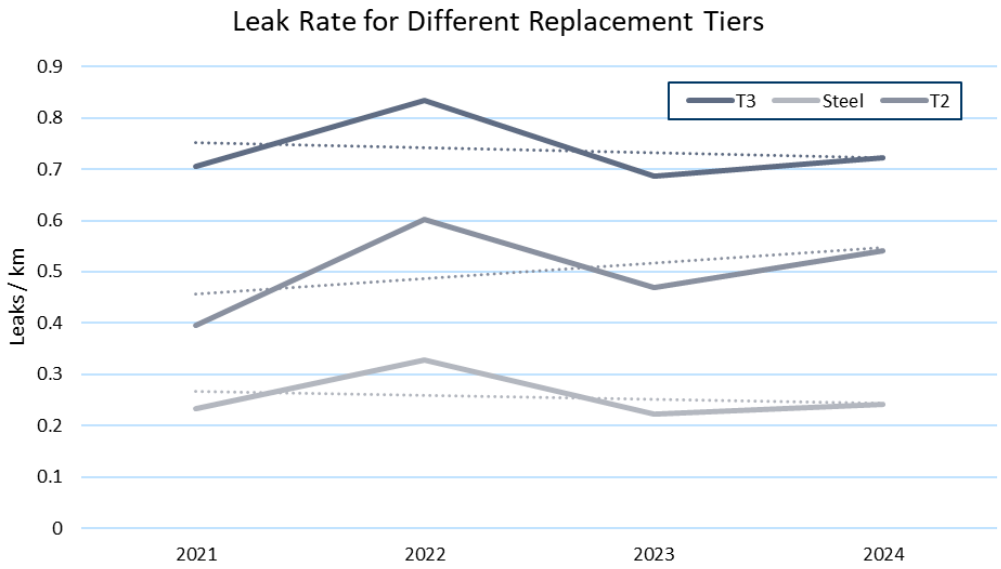


Figure 4 Observed leakage rates

Below is an extract from the **DNV GDNs RIIO-GD3 Repex Deterioration Analysis document**[4] which further explains why reducing our current non-mandatory programme would lead to unacceptable risks.

"If no further replacement is undertaken, it is predicted that by 2055 GiBs from Tier 1 cast and spun iron fractures would be at a similar level to the numbers seen in the decade from 2000-2009 at the start of the IMRRP, with much larger numbers of GiBs also coming from joint failures. Similar trends are seen for Tier 2 and Tier 3 cast and spun iron mains, although the rate of increase is greater, with GiBs from fractures being nearly double the 2000-2009 rate, and GiBs from corrosions and joints predicted to be over six times and over three times the 2000-2009 rates, respectively. For ductile iron mains, total GiBs are expected to rise by 66% from current levels (10-year average) by 2055, with GiBs from corrosion failures having the highest rate of increase. For steel mains, total GiBs are predicted to increase by 108% from current levels (10-year average) by 2055."

NGN's Value Framework

We have developed a 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) methodology as the basis of our Value Framework and are consistent with the Consequence Measures. However, we have recategorised 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. We discuss each of these in more detail below.

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 GDNs 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

[4] Deterioration Analysis (see appendices)

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 Repex 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.

Quantifying Non-Mandatory Risk

Non-Mandatory Mains and Services Risk Profile (start RIIO-GD3)	Compliance Risk £m	Customer Risk £m	Environmental Risk £m	Financial Risk £m	Health & Safety Risk £m	Total Risk £m	%
Tier 2B	0.27	1.54	16.10	18.91	1.69	**38.50**	42%
Tier 3	0.06	8.67	5.14	6.75	0.40	**21.03**	23%
> 2 ST	0.13	0.56	20.91	10.73	0.80	**33.12**	36%
Total	**0.46**	**10.77**	**42.15**	**36.38**	**2.89**	**92.65**	

Table 3 Non-Mandatory risk profile at start of RIIO-GD3

Without intervention, over the course of RIIO-GD3, risk increases predominantly due to deterioration of the assets but also due to other effects such as environmental risk and the rising cost of carbon. Table Table 4 highlights that without intervention we would see total risk to our non-mandatory assets increase by 14% over RIIO-GD3.

Non-Mandatory Mains and Services Risk Change over RIIO-GD3 w/o intervention	%
Tier 2B	15%
Tier 3	16%
> 2 ST	13%
Total	**14%**

Table 4 Risk change for non-mandatory over RIIO-GD3 without intervention

Consideration of Non-Mandatory Asset Health

We have utilised the NARM Value Framework in order to assess the health of our assets. We are however using the latest NGN asset data rather than the NARM data which is held in time as at the start of RIIO-GD2 for regulatory reporting purposes.

Mains and services assets are assigned a Health Banding 1-10 based entirely on the total failure rate (i.e. the sum of all failure rate components). There are ranges of failure rates which assign an asset to bands 1-10. For mains specifically, if the asset has less than 0.2 total failure rate (expected number of failures per year), it is in band 1, but if the failure rate is greater than 1.8 then it is in band 10.

Consideration of all distribution mains health trends is useful in the calculation of asset risk. The below table highlights the health of our assets using the NARM value measures. This shows that 13% of our distribution mains have a score of 6 or more at the start of RIIO-GD3. Without intervention, this increases to 18% by the end of RIIO-GD3. If our Preferred Option of investment is followed in RIIO-GD3, this remains at 13% (with some movement, increase, between bands) at the end of RIIO-GD3 with investment. This is because we are assuming median risk reduction for mains so movement to HI1 and HI2 bandings with intervention comes from mid-HI bandings.

Distribution Mains Health Index		1	2	3	4	5	6	7	8	9	10	Total
Baseline start of RIIO-GD3	km	28874	0	0	0	1815	106	648	282	1636	1828	35190
	%	82%	0%	0%	0%	5%	0%	2%	1%	5%	5%	100%
End of RIIO-GD3 w/o intervention	km	28874	0	0	0	0	1815	106	274	646	3475	35190
	%	82%	0%	0%	0%	0%	5%	0%	1%	2%	10%	100%
End of RIIO-GD3 with interventions	km	31606	0	0	0	-866	1782	69	43	523	2033	35190
	%	90%	0%	0%	0%	-2%	5%	0%	0%	1%	6%	100%

Table 5 Mains Asset Health Scoring

What is the outcome that we want to achieve?

The primary driver and outcome of mains replacement is an improvement in the **safety** of the gas distribution network and in particular the reduction in the risk of an incident arising from the failure of an iron main and gas entering a property leading to an explosion and potential injury and/or loss of life.

However, replacement of this category of asset also contributes significantly to the reduction of a number of additional risks including:

Reliability: replacement of these assets will improve the condition and operational performance, resulting in fewer leaks arising from joint failures, corrosion and fractures and the associated impacts these have upon the reliability of supply to customers, particularly unplanned interruptions but also interruptions from ongoing planned repair of asset failures.

Environment: failures of these assets result in fugitive emissions of gas (leakage) with a significant environmental impact. Asset replacement results in the removal of these emissions and delivers a significant improvement in environmental performance.

Financial: without full replacement, ongoing asset deterioration leads to asset failures that require permanent repair. These repairs add significantly to the operational costs of these assets on an enduring basis. Replacement forgoes the requirement for future repairs and these associated costs.

To implement a resolution to the problem at hand in a way which aligns with our customer priorities we have defined the following objectives:

We want to manage the risk we hold within this group of assets. We know that reliability and safety remain top of our customers' priorities and so our investments in RIIO-GD3 will be focussed on effectively managing these risks.

We want to ensure efficient costs. We plan to balance risk and value to deliver the optimal solution for our customers at the most efficient cost. We use our decision support tool and asset data to maximise the value of our investments and our financial database to accurately and consistently forecast expenditure.

We want to maintain our excellent service levels. We continually monitor failures and leaks to ensure our investments allow us to maintain levels of service measures, such as expected number of supply interruptions. We target mains that pose the greatest risk and have the most disruptive impact on customers and the environment.

We want to 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. As set out in section 9, our non-mandatory programme pays back within 16 years, meaning that it represents value for money for our customers regardless of energy pathway to Net Zero.

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.

We have proposed five objectives covering risk, cost, service, uncertainty and compliance. These will be used to determine how successful each option considered is at delivering against our customer's expectations.

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. How can we ensure intergenerational fairness amidst these competing priorities?	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 6 Customer insights

We know that our customers expect value for money and that we will make the right investment decisions for both our existing and future customers. We will use the five objectives covering risk, cost, service, uncertainty and compliance to determine how successful each option considered is at delivering against our customers' expectations. There are trade-offs to meeting these objectives; by way of example, if we want to maintain or

reduce risk then we will need to invest, and this may impact upon our cost efficiency objective. We therefore have carefully balanced these competing objectives as part of our options analysis which follows later in this EJP.

How will we understand if the investment has been successful?

The primary assessment of the overall outcome of the investment will be a reduction in risk position as reported under the NARM methodology. We have set a relative risk target which will be reported against annually. With Repex, there is a clear and measurable workload deliverable associated with this. The below table sets out the deliverables under non-mandatory Repex that will ultimately ensure we meet our associated NARM outputs. What we have delivered in RIIO-GD2 demonstrates a track record in this area and that we are sufficiently resourced to continue delivering at this rate into RIIO-GD3.

	RIIO-GD2		RIIO-GD3 EJP Preferred Option	
Asset	**Workload units**	**Repex (£m) 23/24 prices**	**Workload units**	**Repex (£m) 23/24 prices**
Tier 2B	102.0km	£50.15m	109.0km	£61.67m
Tier 3	28.1km	£34.54m	29.1km	£53.80m
>2" Steel	150.9km	£28.09m	139.4km	£43.96m
>30m Iron	34.6km	£11.35m	35.0km	£14.73m
Polyethylene	7.0km	£6.54m	16.0km	£8.30m
Diversions	60.3km	£17.00m	66.5km	£16.47m
Total Non-Mandatory Mains	**382.9km**		**395.0km**	
Non-Mandatory Associated Services		**£147.67m**	14,177	**£198.92m**

Table 7 Non-mandatory RIIO-GD3 strategy and comparison to RIIO-GD2 summary

5.1. Narrative real-life example of problem

Mains and services carry 85% of the total risk associated with all our gas distribution assets, the investment in this asset class is therefore key to ensure the risk is managed.

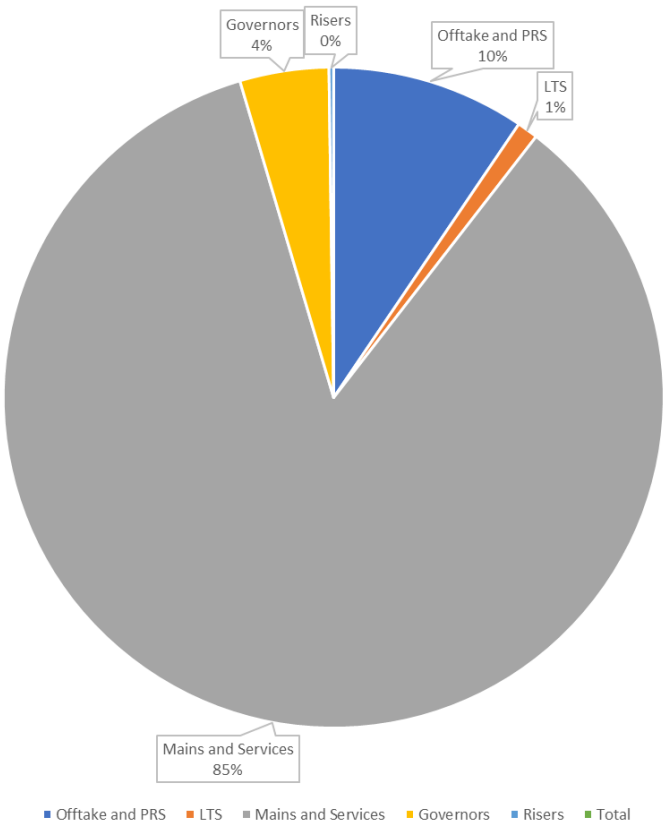


Figure 5 Risk distribution across all asset classes

Ultimately, it is evident that the work carried out under this programme over the last 22 years has led to NGN's below 7 bar distribution network becoming over 81% PE. The programme's impact is reflected across all GDNs, as shown in a recent DNV report[5]—the average number of distribution main failure incidents has dropped from 3.85 per year between 1990 and 2002 to 1.25 per year between 2003 and 2022.

[5] Trend Analysis (see appendices)

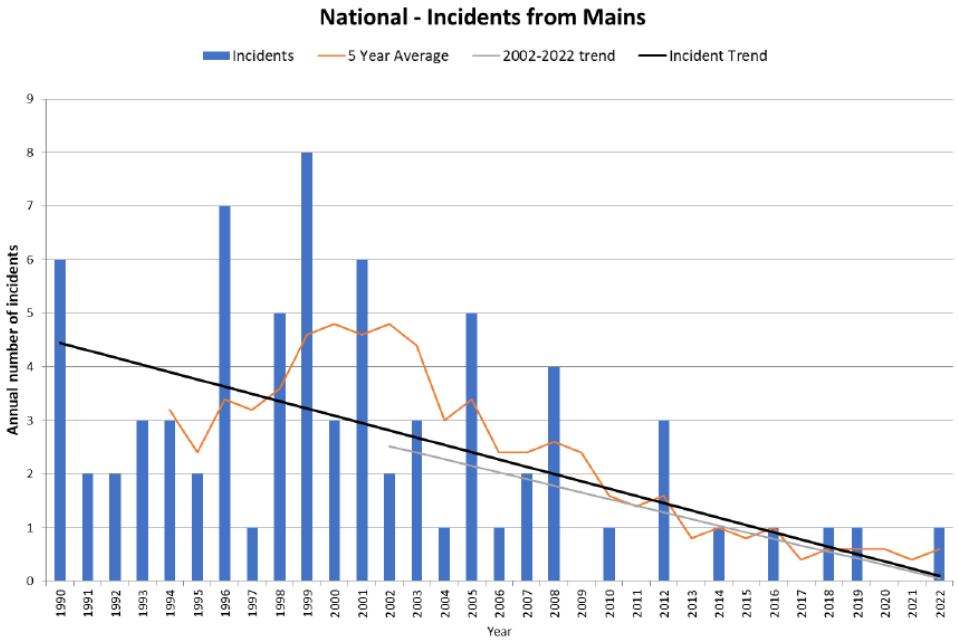


Figure 99 – Annual number of incidents, all GDNs

Figure 6 Trend Analysis for Leaks and Incidents in the UK Gas Distribution System - 2023 update

NGN operates a robust data-driven mechanism to identify non-mandatory pipes which may be subject to future failure using a combination of sources which may include reports from the field, statistical analysis of historic performance and input from wider stakeholders. Potential candidate projects are then assessed using CBA before being considered for approval. A detailed account on this process is outlined below.

CASE STUDY – THE LEAGUE TABLE & INDIVIDUAL PROJECTS

In order to prioritise the replacement of the highest risk assets, NGN utilise a league table (LT) which includes all the non-mandatory pipes on the network. This is refreshed annually to capture any changes from the previous year.

The LT is a report taken from MRPS that lists all metallic pipes in NGN's network. It includes details like the type of pipe, Pipe Object Number (PON), status, project reference number, mandated pipe or non-mandated, lengths, address, post code, Business Operations Lead (BOL) area, diameter, material, tier, Network Analysis Polygon (NAP), Local Authority (LA), replacement diameter, lay method, Network Analysis (NA) detail, number of escapes, number of Gas in Buildings (GIBs) events and risk score.

Weightings are applied to each category to create a position on the league table, the applied weightings are greater for number of escapes and GiBs. This is to ensure the pipes with the most escapes and GIBs are ranked highest from a risk perspective on the league table.

This position is used to rank each pipe in the LT, which in turn is used to prioritise the pipes that will be promoted into projects for consideration for the upcoming years' work. The projects are selected from this list factoring in all the business case requirements / constraints.

The methodology for identification of potential projects has several elements:

1. Pipes that have caused operational issues are identified by Operations via the established Condition Request process.

2. The design team have identified all pipes across the network within the relevant categories, and developed a scoring mechanism incorporating remote pressure, GIB, risk score, condition score, overcrossings, leakage and pipe failures to create a league table of all the pipes. This information is then utilised to group pipes geographically to create projects.
3. The LT is refreshed annually to capture any new PONs that have been created as a result of any previous works that have been undertaken on the network. The refresh also incorporates the previous year's escapes, and the network analysis is checked for all the existing projects, this is to ensure it is still relevant following any changes on the network. For any projects where the network analysis is no longer valid the project is redesigned.
4. The created projects are then reviewed with the local operations leads, planners and a commercial representative for the area to identify any constructability issues or suggested rescope options. This also provides an opportunity for anyone to advise of any issues in the area which may affect the projects, i.e., Section 58 restrictions, stakeholder issues, proximity to schools or emergency services, etc.
5. Any Non-Mandatory projects issued in previous years that, to date, have not been constructed have also been identified and reconsidered within this process.
6. The cost estimates for all projects that have been costed previously have been reviewed and either uplifted by an appropriate factor or re-costed depending on the validity and age of the existing estimate.

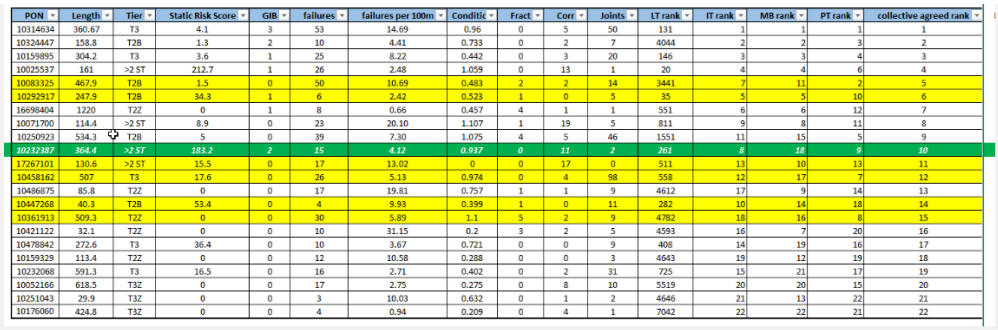
Taking account of the above information and data, a cost benefit analysis is undertaken to identify the risk benefit of intervention using Green Book and NARM methodology approved assumptions. The CBA takes into account the number of recorded repairs since 2007, along with the updated CBA repair costs, including an annual uplift (2% in 2024) and the shrinkage and leakage cost based on the approved E20 leakage model.

Paybacks are calculated by establishing a baseline leakage rate for each PON within a project, this is done by dividing the total number of escapes on each PON since 2007 by the number of years since 2007. This baseline leakage rate is increased by 5% per year to estimate the leakage rate for future years (deterioration curve). The repair cost in each year is calculated by multiplying the number of repairs in the year by the appropriate repair cost. The payback is determined by the number of years required for the cumulative repair cost to equal or surpass the replacement cost.

The historical NGN criteria for the selection of projects to meet the allowances is that projects will deliver a payback period of 16 years or less. However, to achieve this criterion some adjoining and adjacent pipes including T1 mains were not always included as they would have a detrimental effect on the payback. This in turn sometimes led to leaving short, stranded sections of the network to be replaced at a later date, at an increased cost with further disruption for stakeholders and customers. Whereas including these pipes provides significant benefits for stakeholders, customers and cost benefit.

Therefore, for RIIO-GD2 a more holistic approach has been employed and this will be carried into RIIO-GD3. This involved reviewing the top 500 projects based on the league table position, which haven't been issued for a previous year and redesigning them where additional benefits could be obtained by incorporating the adjoining and adjacent pipes. A similar approach has also been adopted for the T1 projects, in that where there is increased benefit by including non-mandatory pipes within the T1 projects they have been included.

Following completion of the above Design Methodology and holistic design approach, all the project costs, CBA paybacks and league table position information was captured. The projects were then ranked based on the lowest CBA paybacks and highest league table position. Then using a top-down approach projects were selected to deliver the allowances whilst also considering the budgetary requirements and length volumes in each cluster area. The below provides a snapshot of the league table.



PON	Length	Tier	Static Risk Score	GIB	failures	failures per 100m	Conditic	Fract	Corr	Joints	LT rank	IT rank	MB rank	PT rank	collective agreed rank
10314634	360.67	T3	4.1	3	53	14.69	0.96	0	5	50	131	1	1	1	1
10324447	158.8	T2B	1.3	2	10	4.41	0.733	0	2	7	4044	2	2	3	2
10159895	304.2	T3	3.6	1	25	8.22	0.442	0	3	20	146	3	3	4	3
10025537	161	>2 ST	212.7	1	26	2.48	1.059	0	13	1	20	4	4	6	4
10083325	467.9	T2B	1.5	0	50	10.69	0.483	2	2	14	3441	7	11	2	5
10292917	247.9	T2B	34.3	1	6	2.42	0.523	1	0	5	35	5	5	10	6
16698404	1220	T2Z	0	1	8	0.66	0.457	4	1	1	551	6	6	12	7
10071700	114.4	>2 ST	8.9	0	23	20.10	1.107	1	19	5	811	9	8	11	8
10250923	534.3	T2B	5	0	39	7.30	1.075	4	5	46	1551	11	15	5	9
10232387	*364.4*	*>2 ST*	*183.2*	*2*	*15*	*4.12*	*0.937*	*0*	*11*	*2*	*261*	*8*	*18*	*9*	*10*
17267101	130.6	>2 ST	15.5	0	17	13.02	0	0	17	0	511	13	10	13	11
10458162	507	T3	17.6	0	26	5.13	0.974	0	4	98	558	12	17	7	12
10486875	85.8	T2Z	0	0	17	19.81	0.757	1	1	9	4612	17	9	14	13
10447268	40.3	T2B	53.4	0	4	9.93	0.399	1	0	11	282	10	14	18	14
10361913	509.3	T2Z	0	0	30	5.89	1.1	5	2	9	4782	18	16	8	15
10421122	32.1	T2Z	0	0	10	31.15	0.2	3	2	5	4593	16	7	20	16
10478842	272.6	T3	36.4	0	10	3.67	0.721	0	0	9	408	14	19	16	17
10159329	113.4	T2Z	0	0	12	10.58	0.288	0	0	3	4643	19	12	19	18
10232068	591.3	T3	16.5	0	16	2.71	0.402	0	2	31	725	15	21	17	19
10052166	618.5	T3Z	0	0	17	2.75	0.275	0	8	10	5519	20	20	15	20
10251043	29.9	T3Z	0	0	3	10.03	0.632	0	1	2	4646	21	13	22	21
10176060	424.8	T3Z	0	0	4	0.94	0.209	0	4	1	7042	22	22	21	22

The Non-Mandatory projects will be assessed during the year with projects added and removed to address newly identified problem mains including ones identified via the Condition request process and budget constraints.

5.2. Project boundaries

This EJP covers only those mains assets which we are planning to replace under the non-mandatory category. It does not include the costs to manage these pipes prior to their replacement (e.g. escape response and repair). The proposed costs do, however, include the costs for service relays and transfers associated with the replacement of non-mandatory mains as these costs are unavoidable under HSE policy and our requirement to maintain customer supplies.

6. Probability of failure

The Probability of Failure (PoF) is the probability an asset will fail at a given point in time. The PoF of non-mandatory iron and steel pipes is calculated within the MRPS model and also within NARM.

When justifying our RIIO-GD2 Investment, we use a combination of MRPS and Condition factors to identify and prioritise Pipes for potential intervention. We then combine this with our Cost Benefit Analysis, which uses the NARM methodology, to calculate the PoF of our Non-Mandatory assets. The algorithm we use to calculate the PoF for each Failure Mode is unchanged from the NARM methodology:

PoF = Function (Install Decade, Diameter, Material, Pressure, Distribution Zone)

This section discusses how we have used the NARM methodology to understand the types of failure of non-mandatory assets as well as the rate of failure, or deterioration.

For distribution mains analysis has been carried out to determine the underlying relationship between mains attributes and the observed PoF. This failure data recorded not only the failed asset but the failure mode. The process involves the identification of statistically significant “explanatory factors” that influence the underlying rate of failure and the derivation of a mathematical relationship between the PoF and the explanatory factors for each failure mode. In statistical terms this is described as a counting process regression model.

We have assessed our probability of failure (and the consequent impact of choosing to replace or continue managing in service) at a deeper level than the NARM process.

Because the Mains failure data has been referenced to individual (failed) pipes, this enables the data to be split by key explanatory factors to derive the initial PoF for each failure mode. The explanatory factors include:

- Asset age/installation date/decade
- Diameter

- Material
- Pressure class
- Distribution Zone

Although other mains characteristics are available, engineering experience suggests that these are the most likely explanatory factors that influence variations in the initial rate of failure (and deterioration). If other significant factors that influence failures are identified (e.g. weather/temperature), and can be related to the base asset data, the statistical model can be adapted to accommodate them.

Under NARM, non-mandatory pipe assets are categorised at a cohort level (i.e. grouping assets by common characteristics such as material, diameter, etc.). This gives a reliable measure for the total NARM risk associated with this group. However, in order to robustly identify specific assets for replacement we need to examine the historic and forecast performance of the assets at a much more granular level than overall cohorts.

To calculate the factors to be used to amend the cohort average for non-mandatory iron pipes to the target average we have used data held within the Mains Risk Prioritisation System.

Within the MRPS model, there is a sub-calculation for each individual pipe to calculate its relative condition. This can be used as a good proxy for the NARM cohorted risk metrics for failure but at an individual pipe level, so it can be used to calculate the relative performance of a targeted subgroup compared with the overall population.

To provide additional robustness to the analysis carried out, pipes <50m long were removed from the analysis, as short pipes looked at individually can show a very high benefit in terms of failures / km but at an undeliverable price using an average unit cost. To include these would artificially inflate the actual benefit that can be delivered for the proposed spend.

Within the NARM model there are separate coefficients (at a cohort level) to calculate leakage probabilities based on corrosion, failure, fracture and external interference. There is no impact on the coefficients used for external interference as these are not affected by individual pipe performance.

Changes to the NARM Methodology

Long Term Risk Benefit 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. Changes affecting other asset classes are discussed in relevant EJPs. As well as these and updates to allow long-term risk to be calculated, 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 asset operation.

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 Long Term risk would be used for RIIO-GD3 business planning purposes.

6.1. Probability of failure data assurance

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 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 assesses key areas of data for robustness and completeness for core asset data, asset heath and failure data and financial data.

Our **Core Asset Data** for Distribution Mains includes location, Diameter, Length, Material, Pressure, Failures and Risk Scores. It is scored as amber within our Data Improvement Plan for NARM. Mains location, pressure, material and length data is robust however, assumptions have been applied for the age of metallic distribution mains

Asset Health and Failure Data is scored as green within our Data Improvement Plan for NARM which means our data is robust and complete. This does include some assumptions for the age of metallic Distribution Mains, but can be infilled

Our **Financial Data** is scored as green within our Data Improvement Plan for NARM which means our data is robust and complete.

We have submitted an update to our Data Improvement Plan in 2019 which outlines how we intend to improve our data so that the Monetised Risk is reflective of our network assets and current maintenance regimes.

It is recognised in the NARM methodology that the GDNs will have data gaps and will not hold the same level of asset data in every area. 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.

7. Consequence of failure

Under the IMRRP, the principal consequence of failure (CoF) is the risk of explosion as calculated by the MRPS model. This is the primary output of the model and is used to inform the priority order for the replacement of Tier 1 pipes and also to determine if a Tier 2 pipe falls above the Risk Action Threshold and so is mandated to be replaced. This Risk value makes up part of a number of elements used to identify Non-Mandatory work that requires potential intervention/replacement.

For each failure there may be a 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. The following consequence measures have been identified for Distribution Mains:

Loss of supply to customers

Customer Risk: Supply interruption – failure of the main/s resulting in gas escape and loss of supply / supply interruption to downstream customers.

Safety impact of failure

Health & Safety Risk: Explosion – failure of the main/s resulting in gas escape leading to a gas in building event, leading to an explosion event.

Environmental impact of failure

Carbon Risk: Gas Escape – loss of gas following a failure event, or through leakage, with associated environmental (carbon) impact.

Financial Risk

Financial Risk: Water Ingress – failure of the main/s leading to water ingress, resulting in financial cost to rectify.

Financial: Other - direct financial costs to the business for without-intervention work to the assets such as repair costs.

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

Total monetised risk = PoF x PoC x CoC

To provide an accurate representation of the risk associated with our non-mandatory mains, several uniform assumptions were applied. Firstly, NARM models do not accurately calculate the downstream customer impact resulting from a failure of a larger diameter main (T2B and T3). This is because only directly connected services are considered within the asset attributes. This approach does not account for the fact that these mains often serve as a parent main to several smaller diameter mains that act as the direct feed to the services. If the larger diameter main fails, it could cause a loss of supply incident affecting both directly connected customers and those relying on the supply further downstream. Therefore, we conducted an analysis to determine an additional factor in calculating affected customers to model a more accurate scenario and applied this in our CBA.

Furthermore, as detailed in 5.1, we employ a highly targeted approach in the individual PON selection for replacement. We aim to ensure that the PONs with highest level of leakage are prioritised for replacement, however, the cohorted nature of Mains within NARM (as explained in section 6) means that the monetised risk allocation is under-represented, as the risk reduction is based on the average attributes across the cohort. Instead of targeting “average” mains for replacement, we look to prioritise those with most recorded leaks, therefore arguably, the riskiest assets. This approach means that in reality our investments remove greater amount of risk than suggested by the cohorted average. In order to ensure this is accurately represented in the CBA, we analysed our RIIO-GD2 performance to define conservative uplift factors which, when applied, would bring the risk allocation more in line with the true risk removed. Our data shows that in year we replace pipes 1.76 times more prone to failure than the average for Tier 2b and 1.59 times for Tier 3, these factors have been applied in the relevant CBAs.

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 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 also 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 their benefits during the 20 years from the start of 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 Non-Mandatory Repex from the outset by utilising our SME knowledge and risk and cost assessments described in this document.

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, reliant and compliant network – ensuring we can continue to meet our licence obligations whilst at the same time minimising costs for customers.

8. Options considered

When a distribution main reaches the end of its lifecycle, there are limited options available for addressing its failure. If possible, repairs can be carried out using various techniques to extend asset life. However, due to the high costs associated with repeated repairs and the adverse impact on the surrounding environment and stakeholders (including direct and indirect customers), replacing the asset with a more durable alternative such as PE is the most cost-effective solution. The below sections summarise each of the different options and the following graph shows the impact each of the options have on the Total Risk distribution over time.

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 mains and services assets through leakage or failure. Asset

condition and failure are important because they influence the failure rate of 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 safety risk mitigated, leakage reductions and 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 and 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, including 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 8.66 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 Cost Benefit Analysis template to compare the Net Present Value (NPV) of each option against the baseline option to determine the most suitable repex programme in RIIO-GD3. The diagram below is a simplified representation of this process.

Figure 7 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 System 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 preferred option has been arrived at using a combination of bottom-up analysis and optimisation using our Decision Support Tool (DST) to maximise the value of investments we are making, to maintain our cost efficiency objective. From this preferred option, further sensitivity analysis is undertaken to see if we can in any way improve the option.

The different options we have modelled are set out below in Sections 8.1 to 8.6. These have been appraised against our objectives in Section 5 to determine a preferred option. For non-mandatory mains, although the optioneering is somewhat limited as the only variable is the volume for a given tier, we explored a number of variations to volume to understand the impact and the summary of the options appraised can be seen in section 8.7.

We provide a summary output schedule under each option as well as detailed information on how we have reached our unit cost assumptions in section 10.2.

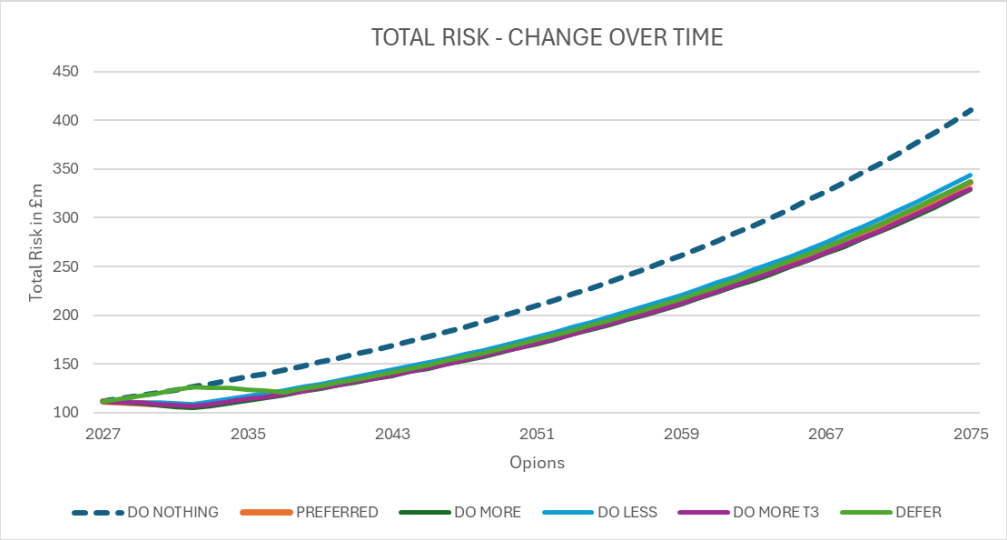


Figure 8 Total Risk change for all options

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 against which other options are measured. It does not include any capital investment but instead considers the cost of ongoing maintenance activities and repairs on failure which is included in 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.

The baseline option shows that there will be an increase in risk of 14% above start of RIIO-GD3 levels if we were to adopt this Do Nothing/ Do Minimum option. The baseline counterfactual is continuing with the current population of non-mandatory mains and services: managing the existing non-mandatory replacement assets by only intervening following failure (i.e. "do nothing / minimum"). This is not acceptable due to the deterioration of assets over time and the significant risks these would result in. This is illustrated by the increasing total risk on non-mandatory mains without intervention shown in figures 1 and 3 above.

8.2. First option summary – Maintain balanced non-mandatory programme (preferred option)

Carry out the proposed RIIO-GD3 Non-Mandatory Replacement programme which is described as follows:

Tier 2B Proposal

Our analysis shows that the failure rates for Tier 2B pipes has stabilised during RIIO-GD2 at 0.498 leaks per km, and so we plan to continue replacing Tier 2B at levels broadly in line with RIIO-GD2 at an average of 22km per year to keep up with the ageing and deteriorating profile of the remaining population.

Projects meeting the CBA payback period of 16 years or less have been identified consistently throughout RIIO-GD2 and analysis of the current population suggests that this will continue to deliver positive results.

As part of this overall workload, we envisage the inclusion of some Tier 2B as part of our approach to efficient Tier 1 Mains Replacement, subject to CBA analysis.

Our overall Tier 2B proposal for RIIO-GD3 shows a payback period of 3 years.

Tier 3 Proposal

Recent analysis has shown that failure rates for Tier 3 pipes are significantly higher than those for Tier 2B at 1.016 leak per km and have this has stabilised in RIIO-GD2 following a deterioration in RIIO-GD1. This suggests that our continued allowed workload of circa. 6km p.a. should continue into RIIO-GD3.

As part of this overall workload, we envisage the inclusion of a small amount of Tier 3 as part of our approach to efficient Tier 1 Mains Replacement, subject to CBA analysis.

Our overall Tier 3 proposal for RIIO-GD2 shows a payback period of approximately 12 years. It is longer than Tier 2b despite the higher leaks per km due to the relatively higher unit rates for this difficult to do work due to the higher diameters and locations involved.

>2" Steel Proposal

As a result of combined work we have conducted with other GDNs via DNV, Steel is as an increasing risk to the network. In 2018, NGN and the other gas networks commissioned AESL Consulting and Newcastle University to assess the performance of steel mains across the UK networks. This analysis has shown that steel mains are deteriorating at an increasing rate, and ahead of the rate at which they were being replaced at the time. More recently, a report commissioned by the GDNs and produced by DNV (excerpt in section 5 above) clearly concludes that lack of investment in steel main replacement will lead to a substantial increase in number of GIBs (by 108% compared to current levels).

However, from our own internal analysis, we have identified that our continued programme of >2" Steel replacement In RIIO-GD2 has kept our leaks per km on this mains type at acceptable levels. However, we need to continue this into RIIO-GD3 to counter the continuing ageing and deterioration of these assets. With the

remaining population we target those pipes which leak the most and pose the highest risk in year to optimise our programme and keep risk and leaks under control.

We have therefore concluded that the appropriate level of elective > 2" steel replacement through RIIO-GD3 should continue at circa. 28km / year. Our view is that this represents an appropriate balance between managing the current and future performance of the asset group whilst not overinvesting and unnecessarily increasing customers bills. CBA analysis shows that this has a payback period of approximately 8 years.

Zero Scoring Proposal

We have a number of key single feeds in our network which have significant risk of supply issues associated with them, based on a CBA driven approach we intend to review and promote for replacement. Additionally, we envisage the inclusion of some Zero scoring mains as part of our approach to Mains Replacement where this represents the most efficient solution. We propose to continue replacing this workload at circa. 7km p.a.

Other Mains Proposal

We decommission PE where there is a known and unacceptable increased risk of failure, or where it is effective to do so as part of a holistic replacement scheme. Workload within this category is generally in line with that seen through RIIO-GD2 at just over 3km a year.

Diversions Proposal

Diversions are driven by requests from third parties to move our mains or by other external factors such as due to being built over, due to landslip or river bank erosion. They can be rechargeable to the third party or non-rechargeable dependant on our legal rights covering the current position of our pipes. However, even for rechargeable pipes we may incur a net cost, for instance if we are required to apply a discount for betterment or under the provisions of the New Roads and Street Works Act (NRSWA).

Workload has been trending up slightly mainly driven by economic factors, and analysing the number of quotes we have been responding to we expect the average workload in RIIO-GD3 to continue at RIIO-GD2 levels at around 13km p.a.

Figure 3 shows that this option is the third best in terms of maintaining risk levels. Unsurprisingly, the Do More and an increase in T3 replacement both provide marginally better risk levels, however, they also come with a higher price tag – approximately 9% higher than preferred.

8.3. Second option summary - Do more

With mains replacement, the only options are to vary the workload. We considered a do more option where we modelled increasing the workload by 10%. Proportionally, this will remove a similar amount of risk per km in NARM due to cohorting of these assets. In reality, the additional 10% of workload will have a lower average risk removal due to our targeted approach to non-mandatory replacement on the mains with the highest failure rates pipes being selected in a continuous programme. While our CBA and risk analysis could justify more workload than we have proposed, we have considered deliverability and that our current track record of delivering a balanced programme has been successful in keeping risk and service levels stable and at acceptable levels. Therefore, we have rejected this option as it would unnecessarily increase customer bills.

8.4. Third option summary – Do less

We considered a do less option where we modelled decreasing the workload by 10%. Proportionally, this will remove a similar amount of risk per km in NARM due to cohorting of these assets. In reality, the reduced 10% of

workload will forgo a higher average risk removal due to our targeted approach to non-mandatory replacement on the mains with the highest failure rates pipes being selected in a continuous programme. We also believe that the cost of this option would not reduce in line with the volume reduction. Instead, our analysis shows that the unit cost would increase by around 15.4%. During previous RIIO periods we have delivered a consistent level of Non-mandatory Replacement as part of our Repex strategy and associated delivery model. This is enabled by a DSP (Direct Service Provider) model which is resourced with a wide ranging skill-set of engineering competencies to deliver the full range of Repex pipe specifications in an efficient way.

This DSP model has evolved over RIIO-GD1 and RIIO-GD2 to embed the required competencies to complete non-mandatory replacement work which requires a more specific skill-set than mandatory Tier 1 and Tier 2A mains. By having the associated resource and skill set within the business and secured to the end of the replacement programme via successful tender event in RIIO-GD2, we are able to deliver non-mandatory work efficiently to reduce network risk at an efficient cost to the customer.

If non-mandatory workload was to reduce by, for example, 10% then we would have to revise our population of delivery partners and or associated teams in-line with workload resulting in reduced efficiency and increased cost to deliver replacement projects. We are aware that our delivery costs are industry leading and that is partly enabled by economies of scale achieved through a mix on mandatory and non-mandatory projects. To release resource and then look to reacquire at a later date would see our delivery costs increase significantly and a potential loss of competencies/availability in the local area if existing workforce is attracted to other GDNs or the wider sector due to market factors.

Any reduction in non-mandatory replacement would also link to less PE pipe being laid in the network and non-mandatory assets further ageing prior to replacement, leading to increased high diameter mains leaks. Gas escapes and associated repairs on non-mandatory, large diameter mains are typically very expensive to repair and therefore any reduction in non-mandatory replacement (Repex) would have a negative impact on Gas Escapes which would increase Opex Repair costs considerably for those non-mandatory mains which fail due to non-replacement.

Overall, this option represents poor value for money for customers and leads to unacceptable risk increases by undoing the overall stabilisation of failures we have achieved in RIIO-GD2.

8.5. Fourth option summary - Increase in Tier 3, Less >2” Steel

Based on internal and DNV analysis, we examined an option to increase the volume of our Tier 3 replacements while reducing the volume of >2ST replacements. The analysis indicated that Tier 3 mains are generally more susceptible to leakage than >2ST mains, making their replacement more effective for risk reduction. Concentrating our efforts on replacing Tier 3 mains may address the higher leakage risk associated with these assets, thereby improving the security of our supply network and ensuring compliance with safety standards. Conversely, to manage the cost of the programme, it is important to note that the replacement of Tier 3 pipes is on average over 5 times more expensive per kilometre than mains in the >2ST category and result in £15.4m more expenditure than the preferred option which already includes some rebalancing of >2” Steel towards Tier 3 mains. Therefore we rejected this option and propose to continue with the balanced programme we have delivered in RIIO-GD2.

8.6. Fifth option summary – Deferral

We modelled a scenario where we deferred non-mandatory work until RIIO-GD4. As discussed in earlier sections, this would lead to unacceptable increases in risk due to ageing and deteriorating mains. This is illustrated by the increasing total risk on non-mandatory mains without intervention shown in figures 1 and 3 above. This option results in an inferior NPV and payback and has been rejected.

8.7. Options technical summary table

Option name	Asset category	Annual volume	Total GD3 Repex cost £m	GD3 Cost per asset cat £m	Outcome
Baseline	All	No prescribed volume	Linked to volume	Linked to volume	Rejected
Preferred	Tier 2B	21.8	**£198.9**	**£58.9**	*Preferred*
	Tier 3	5.8		**£53.7**	
	>2" steel	27.9		**£39.7**	
	Zero Scoring	7.0		**£14.7**	
	PE	3.2		**£8.2**	
	Diversions	13.3		**£15.5**	
	Services	2,836		**£8.3**	
Do More (+10%)	Tier 2B	24.0	**£216.3**	**£64.8**	Rejected
	Tier 3	6.4		**£59.0**	
	>2" steel	30.7		**£43.6**	
	Zero Scoring	7.7		**£16.2**	
	PE	3.2		**£8.2**	
	Diversions	13.3		**£15.5**	
	Services	3,081		**£9.0**	
Do Less (-10%)	Tier 2B	19.6	**£204.7**	**£61.2**	Rejected
	Tier 3	5.2		**£55.8**	
	>2" steel	25.1		**£41.2**	
	Zero Scoring	6.3		**£15.3**	
	PE	3.2		**£8.2**	
	Diversions	13.3		**£15.5**	
	Services	2,591		**£7.6**	
Do More T3 and Less >2" Steel	Tier 2B	21.8	**£214.3**	**£58.9**	Rejected
	Tier 3	7.8		**£72.1**	
	>2" steel	25.9		**£36.8**	
	Zero Scoring	7.0		**£14.7**	
	PE	3.2		**£8.2**	
	Diversions	13.3		**£15.5**	
	Services	2,745		**£8.0**	
Defer	Tier 2B	0.0	**£16.5**	**£0.0**	Rejected
	Tier 3	0.0		**£0.0**	
	>2" steel	0.0		**£0.0**	
	Zero Scoring	0.0		**£0.0**	
	PE	0.0		**£0.0**	
	Diversions	13.3		**£15.5**	
	Services	347		**£1.0**	

Table 8 Options technical summary

9. Business case outline and discussion

9.1. Key business case drivers description

Do Nothing option was rejected. We have an obligation under our safety case to ensure a safe and resilient network is maintained. With no approved 're-lifing' techniques on the network we would have to manage pipes based on a fail then fix approach without a programme of planned replacement work. For larger diameter mains we can also consider the use of innovative techniques such as STASS (a robot-deployed tool allowing us to internally treat multiple pipe joints through a single operation). We do (and will continue to) use these options where they are the most appropriate interventions but classify them as Opex activities. To manage pipes without any planned replacement strategy would have negative impacts in terms of safety, cost, reliability, environmental and stakeholder outcomes and represent unacceptable risk for our customers.

Option 1 – maintain balanced non-mandatory programme is our preferred option. This will deliver a sustainable and efficient level of Non-Mandatory replacement. Where they are encountered as part of a replacement project, existing PE services will be transferred to the replacement main and steel services will be re-laid in PE in line with our agreed procedures. We anticipate the overall workload will be split as 60% relays and 40% transfers. As explained in section 8.2, this option allows us to maintain acceptable levels of risk, whilst not exposing our customers to additional costs.

Option 2 - Do More option was considered but rejected for RIIO-GD3. This would increase our overall spend and analysis using our CBA method shows that this would deliver a worse NPV over 20 years and, based on current and forecast pipe performance through RIIO-GD2, we could not demonstrate that this would deliver better value for customers compared with the preferred option.

Option 3 - Do Less option was considered but rejected for RIIO-GD3 as analysis using our CBA method shows that this would deliver a consistently worse NPV and would lead to an unacceptable increase in risk with an upward trend of escapes on non-mandatory pipes if we deliver less than our continued balanced programme.

Option 4 - Increase in Tier 3 replacements was considered but rejected for RIIO-GD3. While this does have a marginally higher NPV than our preferred strategy, it is important to note that the replacement of Tier 3 pipes is on average over 5 times more expensive per kilometre than mains in the >2ST category and result in £15.4m more expenditure than the preferred option which already includes some rebalancing of >2" Steel towards Tier 3 mains. Therefore we rejected this option and propose to continue with the balanced programme we have delivered in RIIO-GD2.

Option 5 – Deferral was considered but rejected for RIIO-GD3 as analysis using our CBA method shows that this would deliver a consistently worse NPV and would lead to an unacceptable increase in risk. To manage pipes without any planned replacement strategy throughout RIIO-GD3 would have negative impacts in terms of safety, cost, reliability, environmental and stakeholder outcomes and represent unacceptable risk for our customers.

9.2. Business case summary

The tables below detail the headline business case metrics to allow a high-level comparison of the options and shows that our preferred option has the highest NPV at 2050.

Option	Desciption	RIIO-GD3 Intervention Volume		Total NPV compared to Baseline at 2070 (£m)	Objectives		
		Mains (km)	Services (no)		Total Risk Change from 2026	RIIO-3 Total Repex Cost (£m)	Payback (years)
-	Baseline	-	-	-£4,531.7	13.7%	£0.0	-
1	Preferred	395	14,178	£481.5	-4.4%	£198.9	10
2	Do More	426	15,403	£534.0	-6.3%	£216.3	10
3	Do Less	364	12,953	£407.3	-2.6%	£204.7	13
4	Do More T3	395	13,725	£511.7	-4.3%	£214.3	11
5	Defer	0	0	£382.4	13.7%	£16.5	19

Table 9 Business case summary

Option	Desciption	RIIO-GD3 Intervention Volume		Total NPV compared to Baseline at 2070 (£m)						Payback (years)	Total Risk Change from 2026
		Mains (km)	Services (no)	2035	2040	2045	2050	2060	2070		
-	Baseline	-	-	-£1,043.8	-£1,588.9	-£2,113.2	-£2,618.9	-£3,585.4	-£4,531.7	-	13.7%
1	Preferred	395	14,178	-£3.6	£32.0	£91.4	£165.7	£323.9	£481.5	10	-4.4%
2	Do More	426	15,403	-£2.4	£37.6	£103.5	£185.6	£360.1	£534.0	10	-6.3%
3	Do Less	364	12,953	-£17.5	£7.9	£58.1	£123.9	£265.9	£407.3	13	-2.6%
4	Do More T3	395	13,725	-£11.1	£27.1	£91.1	£171.2	£341.7	£511.7	11	-4.3%
5	Defer	0	0	-£18.7	-£30.3	£4.8	£71.3	£227.2	£382.4	19	13.7%

Table 10 Options Summary including NPV

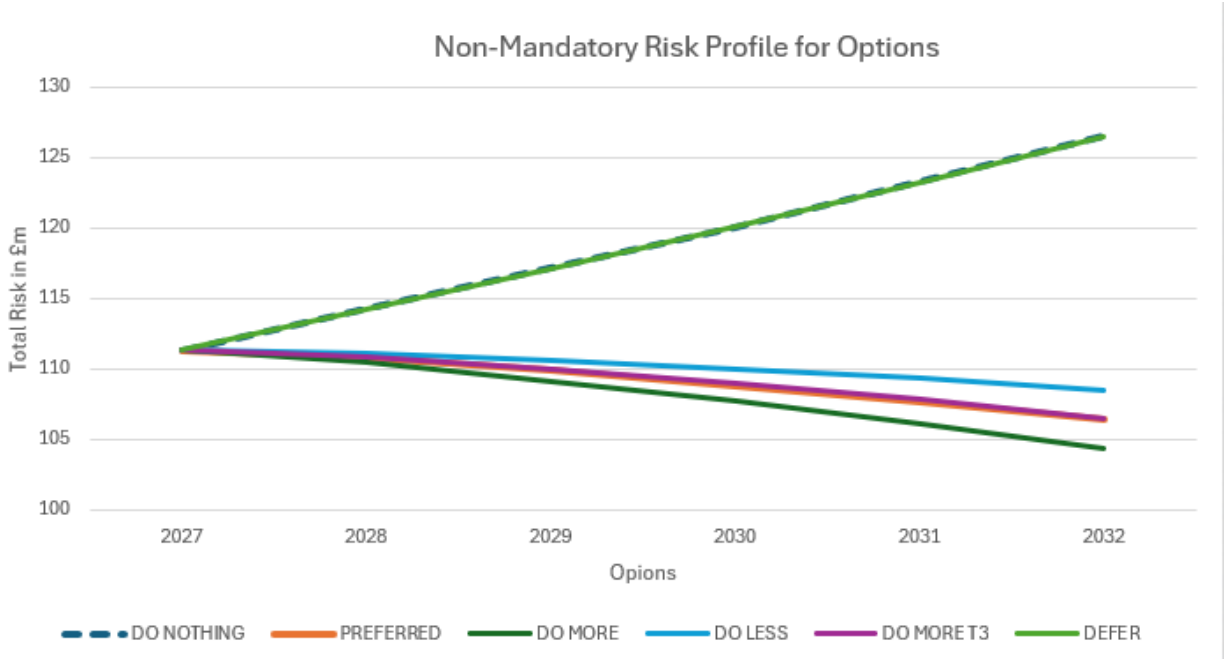


Figure 9 Non-Mandatory Risk Profile for Options

Our preferred option comes at a cost of £198.9m and delivers 4.4% risk reduction across the non-mandatory mains and services asset class. This investment pays back within 10 years – same as the option to do 10% more volume in all non-mandatory tiers.

The Do More option also reduces more risk (approx. 1.9% more) and has the highest Net Present Value by 2070 therefore indicating that it is a good long-term investment. However, Do More option also costs 8% more. Our stakeholder research shows (Insight 1, Appendix A3) that now more than ever our customers are concerned about our investments and the impact those investments have on their energy bill; cost is therefore a key consideration in the rejection of this option.

10. Preferred option scope and project plan

10.1. Preferred option

The preferred option is that described in section 8.2 – replace non-mandatory mains and associated services at a constant rate from 2026/27 and at a comparable level to RIIO-GD2 to achieve a stable and acceptable leakage per km across our non-mandated mains and services assets to keep risks of this asset based acceptable for customers. This is a key component to ensuring our network is safe, reliable and resilient, as well as being the biggest impact we have on the environment by reducing fugitive emissions.

The table below provides details of the preferred option Repex spend (all A1) alongside Single Year Risk benefit and Long-Term Risk benefit output as shown in our NARM BPDT (Business Plan Data Template). 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. In section 8.2 we detail the investments within our Preferred option.

	REPEX Spend (£m)	NARM BPDT	
	All Investments	Single Year Risk Benefit (R£m)	RIIO-GD3 Long Term Benefit Output (R£m)
Non-mandatory mains and services	198.92	7.783	473.953

Table 11 A1 Non-mandatory mains and services investment NARM benefit

10.2. Asset health spend profile

Throughout RIIO-GD3 we anticipate being able to deliver an ongoing efficiency cost reduction of 0.5% year-on-year. We also anticipate that the “other services” workloads and associated costs will gradually decline through the period as steel services are replaced as part of our ongoing mains replacement activities.

The spend and workload for our preferred option estimated to be as follows:

	Cost in £m				
	2027	2028	2029	2030	2031
Tier 2B	10.53	11.37	12.32	13.30	14.15
Tier 3	9.63	10.15	10.75	11.37	11.90
Steel >2"	7.76	8.24	8.78	9.34	9.83
Iron >30m	2.70	2.82	2.94	3.07	3.20
PE	1.52	1.59	1.66	1.73	1.80
Diversions	1.90	2.36	3.05	3.99	5.16
TOTAL	34.05	36.52	39.51	42.79	46.04

Table 12 Non-Mandatory spend profile

	Unit	2027	2028	2029	2030	2031
Tier 2B	*km (mains)*	21.80	21.80	21.80	21.80	21.80
Tier 2B	*no (services)*	945.75	945.75	945.75	945.75	945.75
Tier 3	*km (mains)*	5.82	5.82	5.82	5.82	5.82
Tier 3	*no (services)*	41.76	41.76	41.76	41.76	41.76
Steel >2"	*km (mains)*	27.88	27.88	27.88	27.88	27.88
Steel >2"	*no (services)*	1461.70	1461.70	1461.70	1461.70	1461.70
Iron >30m	*km (mains)*	7.00	7.00	7.00	7.00	7.00
Iron >30m	*no (services)*	0.00	0.00	0.00	0.00	0.00
PE	*km (mains)*	3.20	3.20	3.20	3.20	3.20
PE	*no (services)*	39.00	39.00	39.00	39.00	39.00
Diversions	*km (mains)*	13.29	13.29	13.29	13.29	13.29
Diversions	*no (services)*	347.33	347.33	347.33	347.33	347.33
TOTAL MAINS	km (mains)	78.99	78.99	78.99	78.99	78.99
TOTAL	no (services)	2835.54	2835.54	2835.54	2835.54	2835.54

Table 13 Non-Mandatory workload profile

The table overleaf details the preferred option's workload and expenditure profile through RIIO-GD3: Throughout RIIO-GD3 we anticipate the cost of the Repex program increasing by 35% compared to RIIO-GD2. This change is not unexpected, as the analysis during RIIO-GD1 and RIIO-GD2 shared with Ofgem indicated a cost increase at the end of this 30-year program, which also impacts the non-mandatory program. We established the key contributors to this cost increase as follows:

1. Labor/Contractor Market
2. Increased mobilisation
3. Replacement Technique
4. Local Authority/Streetworks costs
5. Materials mix change

By establishing delivery unit rates for all remaining works using some key factors including tier and material type, area, construction method and surface type has allowed a more accurate breakdown of our works and the costs involved, all pointing to the above listed cost increase drivers. This section will expand on these contributors individually to explain the reasons behind their importance.

Labour/Contractor Market: Rising wages, limited availability of skilled workers and inflationary pressures all contribute to higher labour and contractor costs. In order to retain the workforce required to complete this programme of work we must address these challenges by securing the necessary funding. Additionally, recent inflation has meant increased material prices which adds to the overall financial burden.

Increased Mobilisation: Compared to previous RIIO periods, RIIO-GD3 projects are shorter, more spread out, or disjointed. This shift is due to the nature of the replacement program, which has historically targeted the riskiest iron mains on the network. Instead of the longer, continuous projects that benefited from economies of scale, RIIO-GD3 must address a greater number of smaller, more isolated segments of the distribution network. This fragmentation increases the overall "cost per metre" of the replaced pipe, as the fixed costs such as setup, design, mobilisation, demobilisation, and administrative expenses cannot be distributed over a larger volume of work.

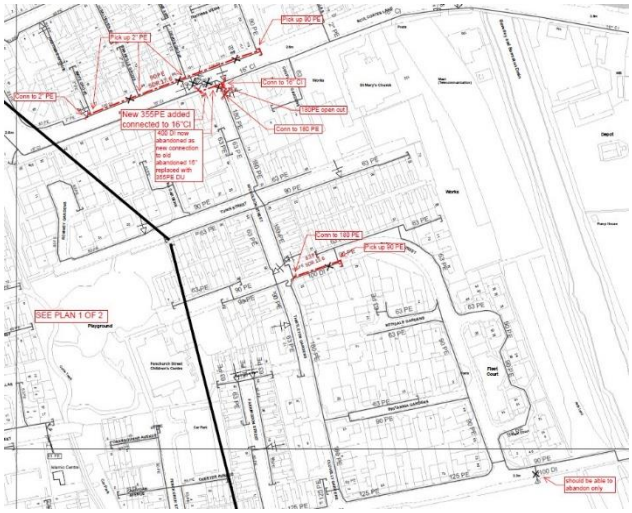


Figure 10 R1/001043 [redacted] Hull project schematic showing replacement sections in red and unaffected mains in black

The type of projects in RIIO-GD3 inherently reduces the ability to achieve efficiency gains witnessed in previous periods. Long projects allow for more streamlined approach and associated cost savings; however, the shorter lengths and scattered nature of RIIO-GD3 projects negate these benefits, largely due to the increased mobilisation costs associated with frequent setups and removals.

Replacement Technique: One of the key cost drivers for the entire Repex program is the technique used to lay the replacement pipe, with Insertion being less disruptive to customers and more cost efficient from a productivity perspective when compared to open cut i.e. less excavations and plant & materials used to complete works. The table below summarises the increase in Open Cut works due to the remaining work basket and associated factors limiting insertion technique.

TECHNIQUE			
	GD1 & GD2 (Actuals)	GD2 Forecast	GD3 Forecast
Insertion	89%	85%	74%
Open Cut	11%	15%	26%
TOTAL	**100%**	**100%**	**100%**

Figure 11 Replacement technique ratio across different regulatory periods

Local Authority/Streetworks costs: We have always been conscious of maintaining positive relationships with Local Authorities and Stakeholders – sometimes leading to changes to the program and more intrusive or expensive work being rescheduled. The ability to do this will be highly limited going forward resulting in us not being able to spread out the more expensive works in sensitive areas such as city centers, on arterial routes or those that are affected by any other Local Authority embargo. The cost difference between work in more and less sensitive locations is evidenced by the cost change during COVID where such work was prioritised due to national restrictions and Local Authority support. Unit Cost on Tier 1 & <2" Steel (Mains & Services), for example, increased from £132/m to £158/m (20%).

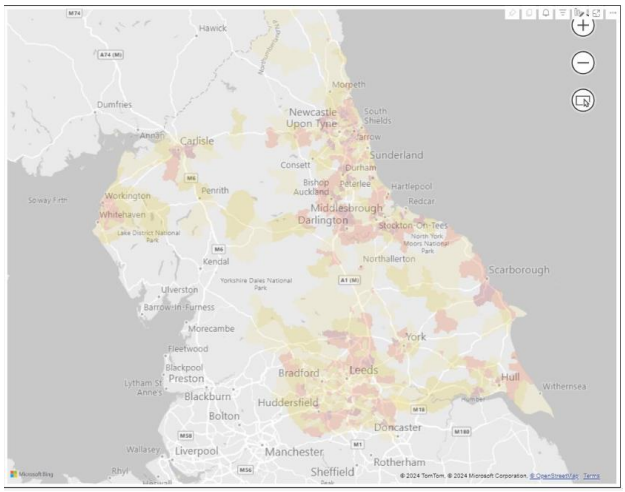


Figure 12 Heat map showing highest concentration of replacement work remaining

Furthermore, Local Authorities are imposing additional requirements on undertakers of streetworks which include lane rental charges and stricter permit conditions. These new rules can substantially increase the costs of mains replacement projects through more rigorous traffic management such as temporary traffic signals, manual control associated with that or road closures. We anticipate that these charges will continue to increase, and it is essential to account for them in the Repex budget.

Material mix: As well as technique, another key cost driver is the material type of the pipe being replaced. As shown in section 4, Ductile Iron constitutes the largest percentage of our remaining mandatory main population. Replacement of ductile iron pipes bring additional costs to the project due to the technique required to abandon the pipe resulting in additional equipment costs and reduced productivity.

10.3. Investment risk discussion

There are several risks associated with the Non-Mandatory Repex program to be mitigated and managed. Most significantly, the skilled workforce completing this work on the ground are highly sought after within our, as well as other industries, due to their transferrable skillset. NGN have maintained our DSP model successfully since 2013, moving away from the nation-wide Tier 1 contractors, in favor of smaller, local businesses, allowing us to have a more meaningful partnership, rather than a strict contractor/manager relationship. This model, led by a team of NGN's operational leads, is underpinned by hundreds of skilled workers, driving excellent safety record, customer service, efficiency, and ongoing improvement. Retaining this workforce until the end of the replacement program, in the light of the reducing levels of certainty around workload post 2032 is viewed as a major risk. Through regular engagement with our partners, it became clear that to mitigate this risk, an incentive mechanism had to be developed, we have therefore implemented a Long Term Incentive Program, allowing our partners to benefit from a lump-sum payment in 2032, which is accrued through their loyalty until the end of the replacement program.
In addition to the resourcing challenge, an ongoing risk to the investment is associated with accessing the distribution mains proposed for replacement. Due to the nature of our network, we predominantly work on public highways, therefore impacting a variety of stakeholders – from regular road users to other infrastructure custodians. Access has to be carefully coordinated and the Local Authorities are at the heart of this process. NGN developed some excellent working relationships with the Local Authorities within our network and maintain regular engagement to ensure that these relationships remain mutually beneficial. This is evident, as NGN is the only utility company in the Northeast, Cumbria & Yorkshire with no improvement notice from local highway authorities. So far, NGN have been able to align our replacement program with the Local Authority plans, where possible, deferring projects to future years on Local Authority request. With the mandatory replacement program coming to an end, we will be far more restricted in the way we can manage this, therefore it is imperative that the stakeholder engagement continues to grow and develop. As these stakeholders also deliver our non-mandatory program, these risks apply to all of our Repex proposals.

The most significant risks that we envisage are a failure to have adequate resources (numbers, skills, location) to complete the work and failure to have access to the required locations.

10.4. Project plan

This is an ongoing programme which is currently at the construction stage and will remain as such during RIIO-GD3. The programme will continue as long as there are non-PE pipes on our network and/or sections of the network are decommissioned. We anticipated this to be required well beyond RIIO-GD3. The programme does

not require any long lead items and the individual projects are being planned based on individual merits, but also in line with the annual volume commitments. This project can be described as cyclical – the annual workload will be analysed, designed and scheduled at least a year in advance, ready for delivery and close out in the allocated year. The high-level outline of the RIIO-GD3 tranche of this larger replacement programme is illustrated below.

	RIIO-2 Year 5	RIIO-3 Year 1	RIIO-3 Year 2	RIIO-3 Year 3	RIIO-3 Year 4	RIIO-3 Year 5	
Design							Year 1 workload
Schedule							Year 2 workload
Deliver							Year 3 workload
Close out							Year 4 workload
							Yeah 5 workload

Figure 13 Project plan

10.5. Key business risks and opportunities

The mains replacement programme is very well established, so risks associated with it are relatively static and well managed. As the programme is nearing completion, costs and workload spread are the two key risks that require additional focus.

We already see a significant increase in the cost associated with this workload, reasons for which are explored in section 10.2, we are therefore seeking ways to minimise this increase. As one of the cost drivers is replacement technique, we looked at ways to reduce the requirement to open cut, in favour of usually less invasive and cheaper insertion alternative. We analysed our network to pinpoint areas that would benefit from reinforcement – construction of small sections of new distribution mains to improve supply capacity. Doing this will allow us to increase efficiency, by extending our reinforcement programme we will be able to reduce our open cut to insertion ratio overall.

We discussed in section 7 that we are not expecting any changes to supply or demand scenarios in RIIO-GD3.

Risks

Mains replacement is specialist and reliant on a pool of third party resource (our local Direct Service Partners) for delivery, so we are sometimes constrained by contractors' availability. We aim to try and reduce our reliance on this limited resource by using our internal design team as much as possible and we will continue to work with our contract delivery partners to develop staff and ensure that we are able to support all works both internally and externally.

External Project management, untimely delivery by contractors and 3rd party delays could all impact on costs. However, framework partners who deliver the Repex workload are rigorously challenged to deliver value for money and alternative partners are continually being used were 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

We are aiming to use our in house design team as much as possible to reduce reliance on third party contractors and will be standardising equipment further (for example the floodlight replacement) and producing generic approved designs to again reduces time and costs on projects.

We discuss in Chapter 5 of our Business Plan how we are mitigating against the immediate risks facing our business in the RIIO-GD3 period. In terms of network asset management we have identified asset condition deterioration, obsolescence and compliance – all of which are relevant to the odorant and metering interventions

set out in our preferred strategy. There are also wider considerations which indirectly impact on our investment decisions. Our Workforce and Supply Chain Resilience Strategy (Appendix A7) sets out our plans to tackle potential future skills shortages. Whilst we are not envisaging specific skills shortages in the RIIO-GD3 period thanks to our long standing commitment to ensuring we have a 24/7, highly skilled workforce, we do need to ensure that our longer term investment proposals are deliverable given the future challenges we may face as an industry. This strategy also discusses how we ensure that we have a resilient supply chain that can withstand shocks and unforeseen circumstances. This is also an important consideration given the limited supplier and resource pool facing increased demand as we move towards Net Zero.

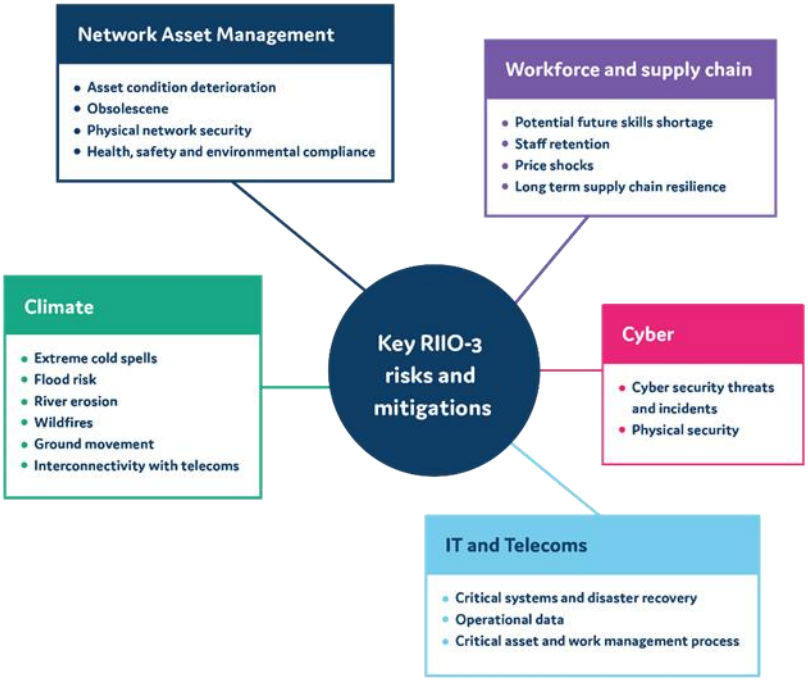


Figure 14 Key RIIO-GD3 risks and mitigations

10.6. Outputs included in RIIO-GD2 Plans

We committed to replacing c.380km of non-mandatory mains during RIIO-GD2 and are delivering on our commitment with no carry over into RIIO-GD3. The proposals for RIIO-GD3 are a continuation of this programme.