Asset Health Engineering Justification Framework

Protected Steel Distribution Pipelines

Legal Notice

This paper forms part of Wales & West Utilities Limited Regulatory Business Plan. Your attention is specifically drawn to the legal notice relating to the whole of the Business Plan, set out on page 3 of Document 1 of WWU Business Plan Submission. This is applicable in full to this paper, as though set out in full here

Contents

1 Summary Table

Name of Project	Asset Health – Protected Steel Distribution Pipelines		
Scheme Reference	WWU.3		
Primary Investment Driver	Asset Health		
Project Initiation Year	2026		
Project Close Out Year	2031		
Total Installed Cost Estimate (£)	[redacted]		
Cost Estimate Accuracy (%)	+/-15% based on significant experience of delivering this work and detailed work and cost records.		
Project Spend to date (£)	[redacted]		
Current Project Stage Gate	Not Started		
Reporting Table Ref	Table 5.06		
Outputs included in RIIO-GD3 Business Plan	Outputs will be in the BPDT, Table Ref. 5.06		
Spend apportionment 23/24 prices	G2	G3	G4
	[redacted]	[redacted]	-

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2 Executive Summary

WWU own and operate a population of c. 33,000km buried mains, transporting gas to our consumers at pressures ranging from ~19mbar to 7bar.

The Intermediate Pressure (IP) distribution network (2-7bar) is subject to the Pressure Systems Safety Regulations 2000 (PSSR) due to it operating above 2 bar pressure. These assets total 1,213km and are constructed of either steel or high-density polyethylene (HDPE). The Medium Pressure (MP) (75mbar to 2bar) and Low Pressure (LP) (<75mbar) steel distribution network totals 1,763km. A proportion of this population is protected by Cathodic Protection (CP) where it was installed at construction and is able to be maintained in a functional state. This EJP details the investment requirements for our CP protected distribution steel population. The investment plan for <7bar steel mains without CP can be found in the non-mandatory repex IDP (Ref: WWU.20).

The purpose of this investment in our Protected Steel Distribution Pipeline population is to ensure its continued integrity and compliance with WWU's Safety Case, as well as to meet our commitment to stakeholders' to maintain risk and reliability in a financially efficient manner.

Our preferred option for these assets, our 'Balanced Plan', combines the flexibility of reactive maintenance with the reliability of planned replacement. This option offers the best of both worlds: the agility to address urgent issues promptly and the foresight to implement long-term improvements. It balances short-term operational necessities with strategic, long-term goals, ensuring the network's resilience and compliance with legislative standards.

The Net-Present Value (NPV) relative to baseline of our Balanced Plan (in 2050) is [redacted]

Failure to undertake this work will result in an increased risk of not satisfying the requirements of legislation, non-compliance with the WWU Safety Case and likely enforcement action by the Health & Safety Executive. The pipes would start to degrade much more rapidly leading to gas escapes, methane emissions and increased safety risk, all focus areas for our stakeholders.

The increase between RIIO-GD2 and RIIO-GD3 is due to the additional activities we're carrying out on cross-country distribution steel pipelines. These are highlighting issues that need to be resolved, resulting in further investigation, interventions and short-length diversions.

Table 1 - Cost & Volume Table, RIIO-GD2 to RIIO-GD3

	RIIO-GD2		RIIO-GD3	
	Cost (£m)	Volume (No.)	Cost (£m)	Volume (No.)
Inspections – Pre-Work, Surveys and Defect Investigations/Repairs	[redacted]	671	[redacted]	1,964
Condition-Driven Short Length Diversions		2		5
Above Ground Crossing Refurbishments		180		140
Valve and Valve Chamber Refurbishments		60		400
CP System – TR, Ground bed and Test Post Replacements		457		620
River Bed and Bank Refurbishments		18		120
Shallow Depth of Cover Remediation		49		100
Marker Post Replacements		760		2,400
Build-Over Resolution		4		20
Total		**2,201**		**5,769**

3 Introduction

The document aims to provide a comprehensive overview of Steel Distribution Pipelines. It will highlight key information related to this asset group and examine the probabilities and consequences of failures. Following this, it will explore the various intervention strategies along with their associated costs, culminating in our recommended investment option for Steel Distribution Pipelines during RIIO-GD3.

Figure 1 - Distribution steel pipeline crossing

Gas from Wales & West Utilities' (WWU) Local Transmission System (LTS) is reduced in pressure and enters our distribution systems through pressure regulating installations (PRIs) across the network. The distribution network consists of various pipe materials, predominantly iron, steel and PE. This Engineering Justification Paper (EJP) will only detail the work on the subset of the steel element of our distribution network that is protected by cathodic protection.

The serviceability of these pipelines, which transport gas across our distribution network, is critical in ensuring a reliable and safe gas supply to our consumers.

We have established efficient procedures to manage the risks tied to this asset group; without these measures, we would fail to meet key stakeholder requirements or adhere to our legal obligations.

Each maintenance and inspection visit is an opportunity for our Operatives to raise any issues or observations through our fault reporting processes. These fault records, and the results of other routine activities, feed into our risk models, ensuring that we are making decisions based on recent, accurate records and data.

The proposed level of investment has been set to maintain the current level of risk and to deliver compliance with relevant legislation.

4 Equipment Summary

The diagram below depicts the role and position of Distribution Pipelines (yellow & orange) within the gas distribution network. Note, all mentioned gas pressures refer to gauge pressure unless otherwise specified.

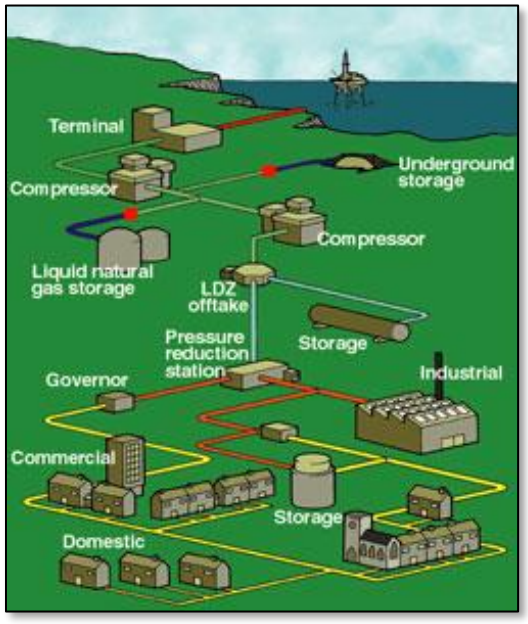


Figure 2 - Gas Distribution Network

WWU own and operate a population of c. 33,000km buried mains, transporting gas to our consumers at pressures ranging from ~19 mbar to 7 bar. There are three distinct operating pressure tiers; Low Pressure (LP) ~25 - 75 mbar, Medium Pressure (MP) 75 mbar – 2 bar and Intermediate Pressure (IP) 2 - 7 bar.

The IP network is subject to the Pressure Systems Safety Regulations 2000 (PSSR) due to it operating at more than 2 bar pressure, as well as the Pipelines Safety Regulations 1996 (PSR). These assets total ~1,213km and are constructed of either steel or high-density polyethylene (HDPE). Both sets of regulations include an obligation on WWU to maintain these steel pipelines in good repair, this obligation is in part met by ensuring they are adequately protected from corrosion. This protection is achieved by maintaining the integrity of the pipeline coating and applying Cathodic Protection (CP) systems. These assets rarely fail, and investment is primarily in maintaining the CP systems in good health.

The MP and LP steel network totals 1,763km, a proportion of this population was constructed with adequate coating and is protected by CP and this protection is maintained wherever it is cost effective to do so, however there are some pipes where CP was never installed, or the coating and CP is beyond economic repair. Unprotected steel in the MP and LP distribution system is replaced when cost-benefit analysis (CBA) demonstrates it is more cost-effective to do so than

continue to repair. These steel sections are detailed in the Non-Mandatory Distribution Mains Replacement Programme EJP.

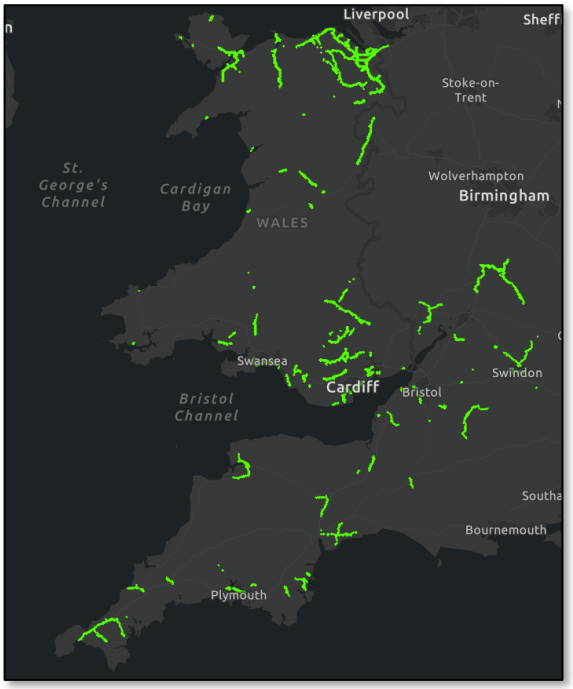


Figure 3 - Network Overview, IP Steel

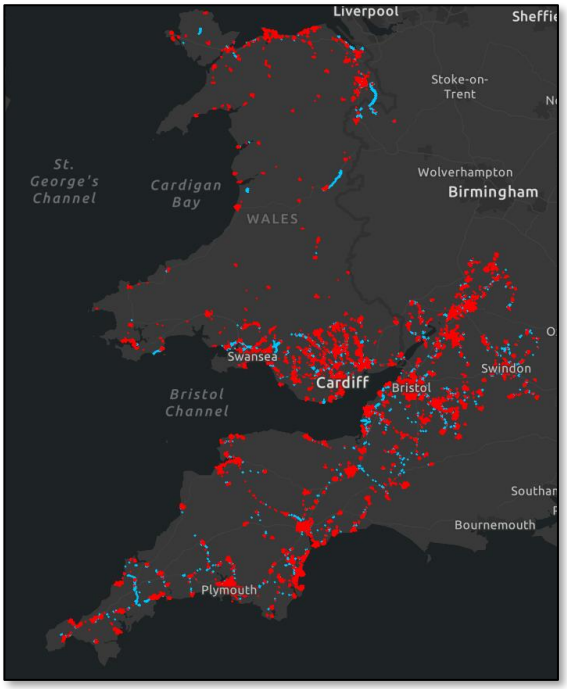


Figure 4 - Network Overview, MP & LP Steel

Table 2 - Asset Population, Steel Distribution Pipelines

	Wales North	Wales South	Southwest North	Southwest South	Total
IP	490.21	369.94	329.82	23.27	1,213.24
MP	71.03	192.58	172.50	123.09	559.20
LP	109.53	180.13	388.69	525.89	1,204.24
Total					2,976.69

WWU also own and operate thousands of connected and related sub-assets that ensure we maintain the integrity of our steel distribution pipeline system. Some of these sub-assets are illustrated in Figure 5, with their populations detailed in Table 3 and descriptions provided thereafter.

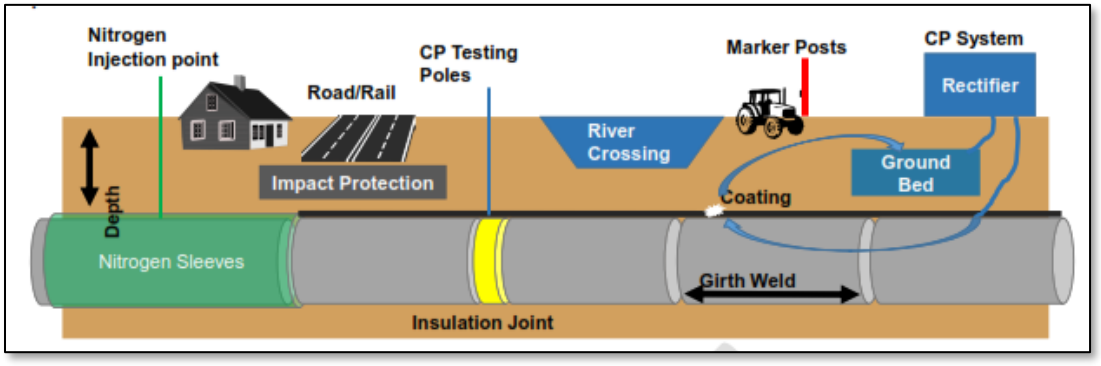


Figure 5 - Overview of Sub-Assets Associated with Steel Distribution Pipelines

Table 3 - Sub-Assets Associated with Steel Distribution Pipelines

Sub-Asset	Count
Cathodic Protection Systems	~540
Strategic Valves	~2,000
Above Ground Crossings	1,396
Below Ground Crossings (River, Road, Rail)	5,786

Cathodic Protection (CP) Systems – A supplementary system to maintain buried steel pipelines and fittings, with its purpose being to protect the buried pipeline from corrosion where the coating alone may be inadequate to protect the steel from the environment in which it is laid. The first form of protection is an appropriate coating system which isolates the steel pipe from contact with the ground in which it is buried. When this coating fails, or contains minor defects, the CP system prevents corrosion by blocking the electrolytic reaction that causes it and allowing a sacrificial anode (ground bed) to corrode in preference to the pipeline. These two major components of a pipeline installation work hand in hand to reduce the key risks associated with failure of the integrity of a steel pipeline through corrosion, which would otherwise lead to a reduction in the pipeline asset life. The application of a cathodic protection system, partnered with an external pipeline coating, ensures the longevity of WWU's steel distribution pipeline population.

Strategic Valves - valves situated in the line of the pipeline and can be operated to segregate parts of the network when carrying out works, during emergencies, etc.

Above Ground Crossings - an above ground section of pipeline that crosses a railway, road or watercourse. These sections are often self-supported but can also be contained within bridge structures or they may have purpose-built pipe bridges.

Below Ground Crossings - a below ground section of pipeline that crosses under a railway, road or watercourse.

5 Problem/ Opportunity Statement

The purpose of this investment in our steel distribution pipeline population is to ensure their continued integrity and compliance with WWU's Safety Case, as well as to meet stakeholders' requirements that we maintain risk and reliability in a financially efficient manner.

This work will ensure that these assets remain fit for purpose and maintain compliance with the following Regulations:

- The Pipelines Safety Regulations 1996
- The Pressure Systems Safety Regulations 2000
- The Gas Safety (Management) Regulations 1996

Failure to undertake this work will result in an increased risk of not satisfying the requirements of legislation or non-compliance with the WWU Safety Case, resulting in enforcement action by the Health & Safety Executive. It would also result in failure to deliver stakeholder outputs relating to safety and reliability of the gas network and targets to reduce methan emissions. In addition, the steel distribution pipeline network may suffer an increasing fault rate due to advanced deterioration, incurring additional costs and in extreme cases an interruption of supplies.

The outcome we want to achieve is the continued safe transportation, distribution and storage of gas to deliver a safe and reliable supply of gas to the public, commercial establishments, and industry. In carrying out its undertaking, WWU protects the safety of its employees and the community, and safeguards the environment from the effects of accidents, incidents and pollution. As a minimum, WWU must always comply with all relevant legislative, regulatory and statutory obligations. We will measure success through several performance indicators including:

- Customer interruption numbers
- Monetised risk levels (NARM)
- Fault and failure rates

The following sections detail some of the specific challenges that we face when managing our steel distribution pipeline system.

Above Ground Crossings

WWU manage c.1,400 pipeline above ground crossings which are scheduled for inspection using a risk-based approach, depending on the type of crossing. The type of crossings differ significantly, from short canal crossings to extensive crossings over railways, roads and rivers. Inspections are performed by direct labour resources wherever possible; however, for larger and more complex crossings, specialist contractors are engaged due to the expertise and equipment required to access and carry out the inspection.

These sections of pipeline are often self-supported but can also be contained within bridge structures or have purpose-built pipe bridges. Once these sections transition above ground they are exposed to the elements and to protect them they are coated with a two-part epoxy coating system. Although these are robust coatings there is a higher potential for damage to the coating and subsequent corrosion, due to the exposed nature of these crossings.

The main area of concern with above ground crossings is the wind/water line transitions, the interface between the soil and the air. This transition is where the coating changes from a standard

pipeline coating to the two-part epoxy system. It is also where the CP system protecting the main pipeline from corrosion below ground becomes ineffective on above ground sections.

Following a tragic incident in another gas distribution network, in which a member of the public was fatally injured falling from an above ground crossing, a programme of work to improve the condition and security of these crossings was instigated UK-wide. Ensuring the crossing guards are maintained, to restrict access, is also a key element when dealing with this sub-asset group.

Distribution Cathodic Protection

Protecting buried steel pipelines is crucial to ensure the safety and reliability of our network. Steel pipelines are prone to corrosion, when exposed to moisture and soil contaminants, which can weaken their structural integrity over time. Without proper protection, such as coatings and cathodic protection systems, pipelines may develop leaks or more substantial failures, leading to loss of gas and the risk of fire, explosion, and environmental damage. Effective protection from corrosion not only prevents costly repairs and service interruptions but also safeguards nearby communities from potential hazards.

Additionally, protecting buried steel pipelines extends their operational life and ensures compliance with regulatory obligations.

In RIIO-GD3 we will continue to invest in our distribution steel pipeline network, ensuring that we maintain corrosion protection on pipelines in a cost-effective manner. Where pipelines are no longer able to be protected by CP, without spending a disproportionate amount of money, we will treat these as a non-mandatory pipes under the mains replacement programme.

Distribution Valves

Strategic valves in the distribution network are critical for isolating sections of the network during maintenance, emergencies, or repairs, and without them, we cannot quickly shut off specific areas in the event of a leak or more substantial failure. This increases the risk of uncontrolled gas release, fire or explosion as well as the associated environmental impact.

In RIIO-GD2 we're carrying out a survey programme on our strategic valve population (~2,000) and are forecasting works to bring them up to the required standard.

These specific challenges are continually managed as part of annual programmes of inspection, maintenance and intervention, and each visit is an opportunity for our Operatives to raise any issues or observations through our long-established fault reporting processes. These fault records, and results of other routine activities, feed into our decision-making processes, ensuring that we are making decisions based on recent, accurate records and data.

The proposed level of investment has been set to maintain the current risk outputs and compliance with the relevant legislation.

5.1 Narrative Real-Life Example of Problem

The following examples show previous intervention works on distribution steel pipelines:

CAERGWRLE to CONNAHS QUAY – Tree / Vegetation Management

Pipeline ID	WWU-WA-MN-PIN130
Project ID	19806
Completion Year	2024
Total Cost	[redacted]

During the recent over-ground Close Interval Potential Survey (CIPS), 24 trees were identified as a potential safety risk due to their proximity to the pipeline. Figure 6 shows a plan view of the numbered trees, with the pipeline route running close or directly underneath these trees. With Figure 7 and Figure 8 showing examples of these trees.

Figure 6 - Location of trees

Figure 7 - Ash Tree on top of IP main

Figure 8 - Maple Tree 0.7m away from centre of IP main

Following a risk assessment on each tree, 17 required felling and 7 are now to be monitored and re-assessed within 5 years. WWU liaised with the school, the local authority, the local community and tree felling contractors, with meetings held on site to summarise the decision making and highlight the risk these trees posed.

Figure 9 - Felled trees

As part of the project, we planned a planting scheme on the school grounds to mitigate the loss of the trees. The mitigation provides shade for schoolchildren and creates a screening effect along

the school boundary. Figure 10 outlines the planting scheme, which was a mix of semi-mature trees, low-level shrubs and wooden planters from the felled trees.

Figure 10 - Planting Scheme to mitigate the loss of the trees

PENRHIWCEIBER MP SPUR – Cathodic Protection Remedial

Pipeline ID	WWU-WA-MN-SAS173
Project ID	SAS173
Completion Year	2022
Total Cost	[redacted]

As part of our on-going programme of identifying those MP and LP steel pipelines that may be brought back into CP compliance, we carry out CP scheme investigation works. This work allows us to understand whether it is feasible and cost effective to restore part, or all of a failed CP system to full function. This decision is based on the interventions required and their cost and is then subject to a cost-benefit assessment. If the work passes the CBA then the intervention work is undertaken, and if it fails the CBA then the pipe is deemed unprotected steel and is assessed for replacement in line with the non-mandatory mains replacement programme. The example below details where we've been able to bring a section of steel back into CP compliance.

This scheme comprises 236m of 250mm and 150mm MP steel as well as 6m of 150mm LP outlet at Penrhiwceiber District Governor. The steel pipework is part of a larger MP pipeline network, which is a mix of materials including PE, steel, spun iron etc. Figure 11 shows the scheme highlighted in yellow and the location of each test point.

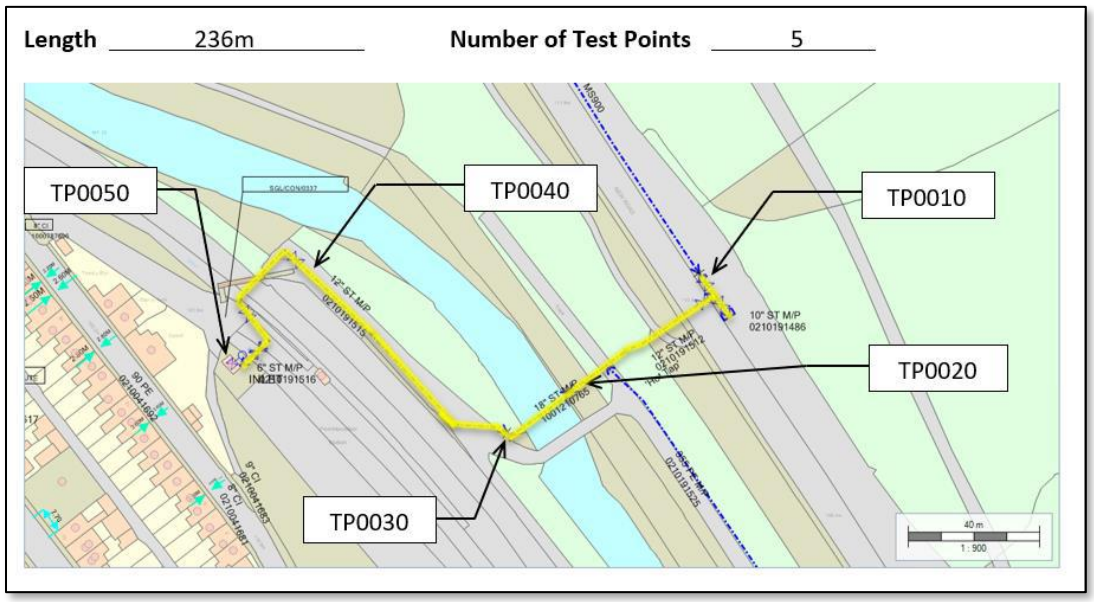


Figure 11 - Location of CP Scheme

An investigation was carried out to identify all test posts connected to the CP scheme to understand the operating condition of the CP on the main. Figure 12 shows a defective test post that was found on the ground, in dense vegetation, and required remedial work to become operational once again.

Figure 12 - Test Post in poor condition

Upon initial measurements the steel protection was below the required level, but some level of protection was being provided, which showed there was potential to be able to reinstate full

protection. The valve shown in Figure 13 was identified as source of current drain on the CP scheme, the coating of the valve was poor, causing a current drain at this location.

Figure 13 - New PE pipeline tying into existing valve

In order to bring the steel protection back into compliance, magnesium anode bags were installed nearby, and pin-brazed to the steel section. The section was then properly coated and wrapped, providing excellent insulation from the surrounding environment. Following commissioning tests, it was confirmed that this intervention had been successful and this section of ~240m was now fully protected by the CP scheme once again.

Figure 14 - Valve Flange Coated and Wrapped

TREHERBERT, LLWNYPIA MP NETWORK - Above Ground Crossing Refurbishment

Pipeline ID	Treherbert, 1001384364
Project ID	18143
Completion Year	2023
Total Cost	[redacted]

As part of our on-going inspection programme of above ground crossings, we periodically identify crossings that require follow-up remediation works. This intervention project illustrates one of these examples, where we identified the need for refurbishment works following inspection.

Figure 15 shows the location of a 150mm MP steel above ground water crossing. During an inspection of the crossing in 2022, the condition was identified as being poor, with corrosion impacting the integrity of the asset in several areas. The crossing also had no clear warning stickers and poor condition of the crossing guards.

A fault was raised, through our established fault-reporting process, and a follow-on project for 2023 was created.

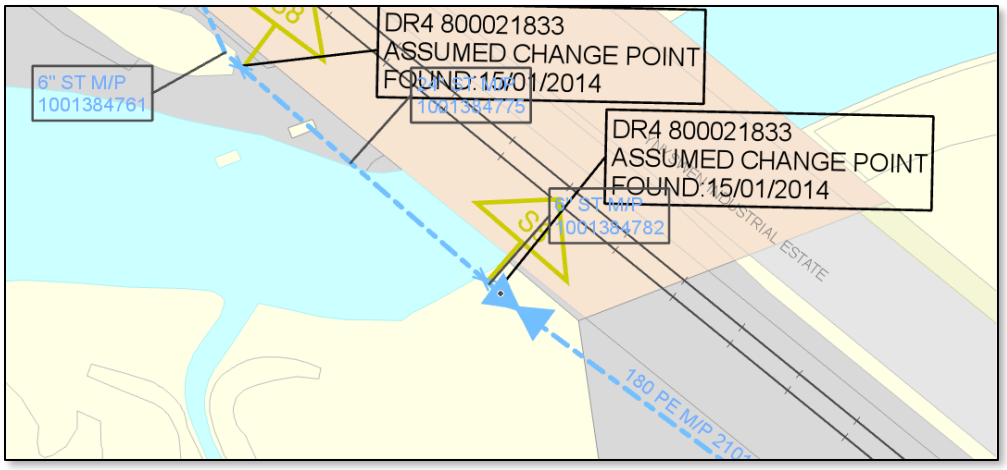


Figure 15 - Location of Treherbert Above Ground Crossing

Figure 16 shows photographs taken during the survey which shows the poor condition of the crossing and poor condition of the crossing guards.

Figure 16 - Photographs of the poor condition of the crossing prior to refurbishment

Figure 17 and Figure 18 shows the condition of the crossing after refurbishment. The pipeline was coated and shows the installation of brand-new crossing guards and warning stickers.

Figure 17 - Photograph showing the condition of the newly refurbished crossing and new warning stickers

Figure 18 - Photograph showing newly installed crossing guards with warning stickers

LLANWRIN to MOAT LANE – Riverbed and Bank Remedial

Pipeline ID	Llanwrin - Moat Lane IP
Project ID	14732
Completion Year	2021
Total Cost	[redacted]

As part of our river survey programme, we periodically identify river crossings that require riverbed or bank remedial works. The below intervention works is one of these examples, where remedial works were required to reprofile the riverbank upstream and downstream to re-bury an exposed gas main, which was obstructing the normal flow in the channel. In addition to this, the concrete protection matting had become dislodged. Figure 19 shows the location of the IP gas main which crosses the river in Powys.

The scope of works included reprofiling the river bank up-stream and down-steam to re-bury the gas main, installing bank hardening around the gas main with a concrete mattress, securing the rock mattress together to ensure no movement, and vegetation clearance work on the embankment.

WWU liaised with the local authority for land drainage consent / ordinary watercourse consent, the land registry for land ownership and with landowners for access (including fishing clubs), with meetings held on site to summarise the decision making and highlight the risk the exposed main posed.

Figure 19 - Location of the IP gas main river crossing

Figures 20 shows the protection matting which was originally installed over the pipeline. The matting was lifted and became dislodged exposing the IP main as seen in Figure 21.

Figure 20 - Exposed IP main

Figure 21 - Protective matting reinstated

The total cost of the project included the preconstruction works, and the construction phase. Once the work was completed, and the gas main was re-buried and secured with a concrete mattress, marker posts were installed either side to highlight the presence of the gas main.

5.2 Project Boundaries

Examples of project spend boundaries can be seen below:

- **Wholesale Replacement** – replacement of main components of a pipeline system e.g. pipeline diversion, TR and ground bed replacement, valve replacement
- **Component Replacement -** replacement of test posts, crossing guards or marker posts
- **Refurbishment/Repair** – removal of old coating system and application of new one, repair of defects and other pipeline features, refurbishment of valves etc.
- **Inspections** – pre-work, surveys and defect investigations/repairs

As stated previously, this engineering justification paper only includes the projects associated with maintainable distribution pipeline assets and sub-assets. The distribution assets associated with the mandatory and non-mandatory replacement programmes have their own Investment Decision Packs.

6 Probability of Failure

Failure modes and probabilities of failure have been agreed, assessed and documented as part of the cross GDN process to develop NARMs models. This was done through several cross-GDN workshops with asset experts and through careful analysis of available data held by companies to assess and quantify the rates of failures and future asset deterioration.

Figure 22 is an illustration of the process to monetise risk. It shows the relationship between the asset (left) and the total monetised risk value (right), taking into account the failure modes, the probabilities of failure, the consequences of failure and the costs of these consequences occurring.

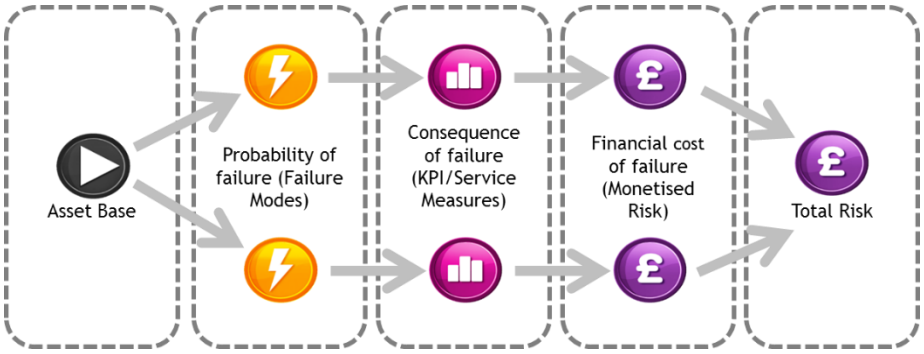


Figure 22 - From the asset to the total monetised risk, illustrative example

The failure modes for steel distribution pipelines include:

- **Defects** – corrosion defects identified on a pipe following a survey, of which some are scheduled for repair
- **Corrosion** – either internal or external corrosion of the pipe
- **General Failures** – general and other causes, e.g. due to over-pressurisation, fatigue or operation outside of the design limit
- **Interference** – external interference caused by third parties
- **Ground Movement** – Either natural (e.g. landslide) or man-made (e.g. excavation or mining).

6.1 Probability of Failure Data Assurance

Fault and failure data are collected when a defect is identified during routine or reactive inspection. This data is recorded through our robust fault reporting process into our core asset repository, SAP. This process allows us to attribute faults and failures against individual components and provides a full record of integrity issues identified over time across WWU's steel distribution pipeline asset base. All faults and condition reports are investigated, and plans are put in place to address the issues found to restore or maintain integrity.

7 Consequence of Failure

Failure to undertake this work would result in the following risks:

- **Loss of containment** – leading to a release of gas, or a fire / explosion / loss of supply / and environment harm
- **Accelerated deterioration** – the condition of the below 7bar network and ancillary equipment, reducing expected asset life and increasing cost relating to fault rectification
- **Deterioration in the condition of equipment** – leading to enforcement action by the Health & Safety Executive under PSR or PSSR and increasing the likelihood of failures with additional call out and maintenance costs.

8 Options Considered

This section details the options considered for managing our Distribution Pipeline population, following on from the Problem/Opportunity Statement set out in Section 5, and the probability of failure and consequences of failure, set out in Sections 6 & 7, respectively.

8.1 Baseline Option Summary: Reactive Only

This option focuses on ensuring compliance with existing legislative requirements through the implementation of basic repair and refurbishment activities, as necessary. The nature of the actions taken is generally reactive, responding to issues as they arise rather than through pre-planned interventions, implementing temporary and/or short-life fixes.

Unlike a proactive, long-term approach, this reactive option focuses on immediate compliance and minimal intervention, prioritising repairs based on legislative urgency and operational necessity. Generally, this option enables quick response times to critical issues while deferring less urgent repairs to align with budgetary constraints

Table 4 - Benefits & Disbenefits of Baseline Option

Benefits	Description
Cost	Lowest cost option, maintaining and repairing only

Disbenefits	Description
Reliability	Lack of redundancy (multi-feed), decommissioning lines that can't be repaired
Safety	Require Operatives to work on increasingly dangerous assets
Safety	As areas develop around these lines, public safety will become unmanageable
Environment	Repeat short-fix interventions, creates more environmental disruption over time
Environment	Increased leakage occurrences, leading to increased gas emissions
Cost	Increased maintenance activities to manage deteriorating network
Cost	Cost of repairs will be increasingly expensive (mobilising multiple times, etc.)
Cost	Deferring significant works to future years, therefore more involved / expensive
Health / Risk	Health deteriorating, risk increasing, not what our stakeholders want from us
Reputation	Increasing reputational damage from incidents, increased public scrutiny
Regulator	Enhanced monitoring from HSE, leading to increasing scrutiny/enforcement

Delivery Timescales: 2026 - 2031

8.2 1st Option Summary: Balanced Plan

This balanced plan option strategically integrates both reactive work and wholesale replacement activities, ensuring that it meets legislative requirements while optimising time, money, and resource allocation. By adopting a hybrid approach, the programme aims to provide a pragmatic solution that prioritises urgent repairs without neglecting the long-term sustainability of the network.

The balanced approach combines the flexibility of reactive maintenance with the reliability of planned replacement. This option offers the best of both worlds: the agility to address urgent issues promptly and the foresight to implement long-term improvements. It balances short-term operational necessities with strategic, long-term goals, ensuring the network's resilience and compliance with legislative standards.

Table 5 - Benefits & Disbenefits of Option 1

Benefits	Description
Reliability	Replacing assets with new (when applicable) will improve reliability / resilience
Safety	New, modern-standard assets will be safer to work on and for public in area
Safety	Balance of repair & replace with maintain high standards of safety
Environment	Replace end-of-life asset with new, long-life asset: less ongoing disruption
Environment	Reduced emissions from leaks & lower embedded carbon with effective spend
Cost	Offers good value when assessed using CBA
Health / Risk	Health and risk of these assets maintained, in-line with stakeholder feedback
Regulation	Maintain good relationship with regulators: compliant, with minimal findings

Disbenefits	Description
Cost	Higher upfront cost than a re-active option but pays back very quickly

Delivery Timescales: 2026 - 2031

8.3 2nd Option Summary: Replacement Only

The Replacement Only option focuses on a proactive approach to asset management, ensuring that any component or system that fails or shows signs of potential failure is promptly replaced. This not only mitigates the risk of extensive downtime and costly reactive repairs, but also enhances overall system reliability and safety.

This option however means replacement of assets before their end-of-life, whereby affecting a repair would be sufficient, and results in significant, ineffective cost

Table 6 - Benefits & Disbenefits of Option 2

Benefits	Description
Reliability	Replacing broken assets with new will increase reliability / network resilience
Safety	New, modern-standard assets will be safer to work on and for public in area
Health / Risk	Improved health and risk metrics

Disbenefits	Description
Environment	Significant embedded carbon increase with construction of new/disposal of old
Disruption	Increased disruption to local communities as we carry out more involved works
Cost	Significant capital cost, unpalatable to our stakeholders based on feedback
Cost	Replacing asset before end-of-life (repair sufficient) results in ineffective spend
Safety	Large capital construction programme results in risk to workforce and public

Delivery Timescales: 2026 - 2031

8.4 Other Things Considered

As part of the option identification process, there were several things considered and discounted, and therefore not progressed through to a cost-benefit analysis assessment. These are documented below:

a) Do Nothing: we have legal obligations in primary and secondary legislations to manage our steel distribution pipeline population, predominantly in accordance with the Pipeline Safety Regulations (1996) and the Pressure Systems Safety Regulations (2000), the option of doing nothing is not allowed. As a minimum, we need to continue our inspection and maintenance programmes, and fix what is identified as being defective.

8.5 Options Technical Summary Table

The below table details the technical summary of each option:

Table 7 - Options Technical Summary Table

	First Year of Spend	Final Year of Spend	Volume of Interventions	Equipment or Investment Design Life	Total Installed Cost
(Baseline) Reactive Only	Year 1 - 2026/27	Year 5 - 2030/31	2,584	~10 years	[redacted]
(1) Balanced Plan	Year 1 - 2026/27	Year 5 - 2030/31	5,769	~10 - 45 years	[redacted]
(2) Replacement Only	Year 1 - 2026/27	Year 5 - 2030/31	5,769	~10 - 45 years	[redacted]

8.6 Options Cost Summary Table

The below table details the range of costs for each Steel Distribution Pipeline intervention option:

Table 8 - Range of unit costs for Steel Distribution Pipeline interventions, by option number

Intervention Type	(Baseline) Reactive Only	(1) Balanced Plan	(2) Replacement Only	Unit Cost Range (£)
Inspections – Pre-Work, Surveys and Defect Investigations/Repairs	✓	✓	✓	[redacted]
Condition-Driven Short Length Diversions		✓	✓	[redacted]
Above Ground Crossing Refurbishments		✓		[redacted]
Valve and Valve Chamber Refurbishments		✓		[redacted]
CP System – TR, Ground bed and Test Post Replacements	✓	✓	✓	[redacted]
River Bed and Bank Refurbishments		✓		[redacted]
Shallow Depth of Cover Remediation		✓		[redacted]
Marker Post Replacements		✓	✓	[redacted]
Build-over Resolution		✓	✓	[redacted]

9 Business Case Outline and Discussion

9.1 Key Business Case Drivers Description

The table below sets out the top three value drivers for each CBA, demonstrating where the majority of the monetised risk benefit is represented:

Table 9 - Key Value Drivers for Each CBA Model

	Financial Node	Description	CBA Model Percentage
Pipe	F_Carbon	The carbon footprint value associated with the gas lost from general emissions	~97%
	F_Loss of gas	The cost associated with the retail value of loss of product	

9.2 Business Case Summary

Our CBAs have been completed in line with Treasury Green Book Guidance and utilise the Ofgem issued model that is compliant with this guidance.

The table below is extracted from the Ofgem issued CBA model, populated for our assets and the programmes of work considered. For further detail, please see the corresponding CBA models as submitted to Ofgem with the RIIO-GD3 Business Plan.

Table 10 - NPV Relative to Baseline: Steel Distribution Pipelines

[redacted]

10 Preferred Option Scope and Project Plan

10.1 Preferred Option

The below table sets out the preferred option to manage our Steel Distribution Pipeline population: **Option 1 - Balanced Plan**. Our plan is predominantly compliance-driven, in accordance with the Pipeline Safety Regulations (1996) and the Pressure Systems Safety Regulations (2000). However, by the very nature of operating a gas distribution network there will be unforeseen issues, and therefore this plan also accounts for some reactive interventions based on historical experience, see volumes below:

Table 11 - Intervention volumes, preferred option: Option 1, Balanced Plan

Intervention Type	Workload Volume
Inspections – Pre-Work, Surveys and Defect Investigations/Repairs	1,964
Condition-Driven Short Length Diversions	5
Above Ground Crossing Refurbishments	140
Valve and Valve Chamber Refurbishments	400
CP System – TR, Ground bed and Test Post Replacements	620
River Bed and Bank Refurbishments	120
Shallow Depth of Cover Remediation	100
Marker Post Replacements	2,400
Build-Over Resolution	20
Total	**5,769**

10.2 Asset Health Spend Profile

The table below details the spend profile, by year, for the Steel Distribution Pipeline interventions:

Table 12 – Steel Distribution Pipelines spend profile

	2026/27 (£m)	2027/28 (£m)	2028/29 (£m)	2029/30 (£m)	2030/31 (£m)	Total (£m)
Spend	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

10.3 Investment Risk Discussion

The future of energy in the UK is not certain over the long term, with the Future Energy Scenarios (FES) offer a number of pathways to 2050. We have considered these pathways when testing the robustness of our investment plan against future uncertainty, ensuring that it supports all credible pathways and avoids the risk of asset stranding.

The Distribution Pipelines assets identified for proactive intervention have been tested using CBA. This gives a view on the time period over which an investment pays back i.e. at what point in time it becomes lower cost to invest than to not invest. Our test is whether this point in time at which the investment pays back is within the useful lifespan of the asset. If an asset was expected to be needed as part of the UK energy network until 2040 but not beyond, investment paid back by

2035 remains beneficial to bill payers. If the investment didn't pay back until 2042 then we would consider options to extend asset life within the expectations on us to keep the public safe.

The ongoing role of the gas network and the importance of maintaining resilience and security of supply is widely recognised beyond government, even taking longer term uncertainty into account. For example, all Future of Energy (FES) 2024 scenarios involve at least 20% of homes still on natural gas in 2045, even as many transition to electrification or hydrogen and NESO's Clean Power 2030 advice on the required gas generation capacity referenced above. As the gas system needs to meet peak demands, substantial infrastructure for safe, reliable supplies will be required even in scenarios where annual throughput may have significantly dropped.

All Future Energy Scenarios show a decrease in gas volumes albeit over different time periods and to different scales. If 50% of consumers in a street came off the gas network, the pipes feeding the street would still be required to service the other 50% of consumers, as would the district governors feeding the street, the higher-pressure pipes feeding the governor, the PRIs feeding the higher-pressure pipes and so on.

This challenge is exasperated by government policy and approach to electrifying heat, where the decision is left to consumers rather than a mandated approach targeting regions. With this approach, it is incredibly unlikely whole areas will leave the gas network in the short and medium term. If it does happen, it will be a much more sporadic move from gas, resulting in a requirement to operate our assets until the last consumer in a region decides to transfer.

Our plan for CP extends steel pipe asset life significantly and is much lower cost than steel pipe replacement following deterioration. This fits well in managing uncertainty on energy futures, keeping options to use the pipe network open without having to invest in steel pipe upgrades if the decision on future use is positive.

Another challenge is FES gives UK wide pathways and does not provide a view and data on the individual GDN regions. This presents significant limitations in its usefulness with very broad assumptions required to influence regional plans.

The chart below shows how previous FES scenarios have not reflected the experienced reality.

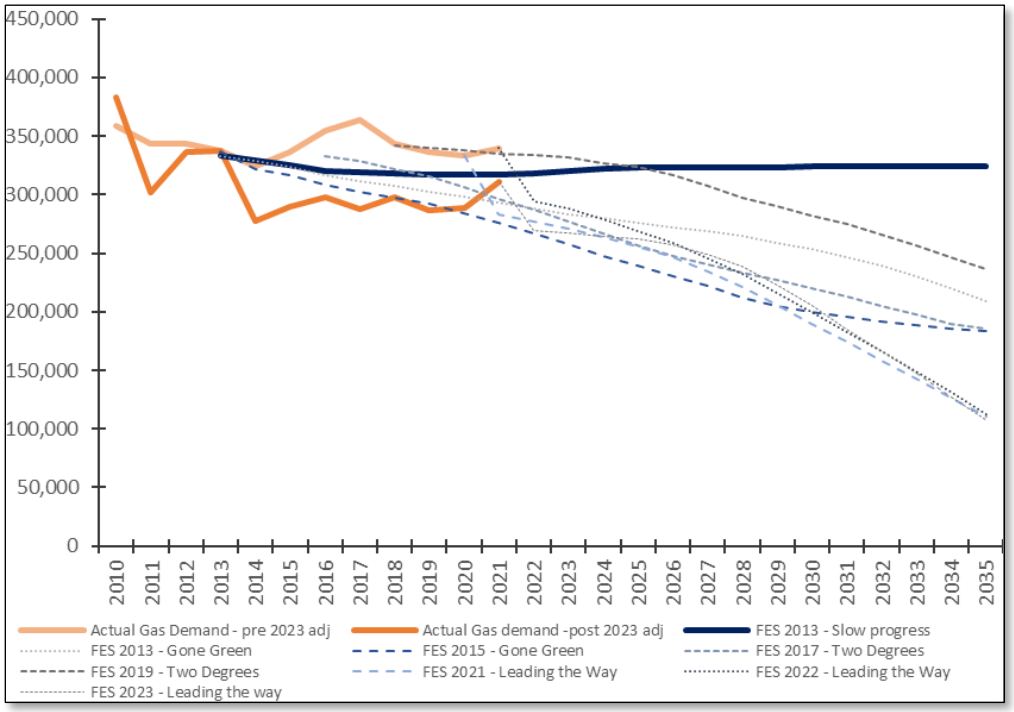


Figure 23 - Historical residential gas demand against most optimistic scenario in every 2nd year of publication, dating back to 2013

It should be noted that in the 2023 FES scenarios there was an adjustment to historical gas demand figures, and as such we have shown historical data both before and after the adjustment to maintain comparability with the original 2013 forecast. What is noticeably clear from these graphs is that, to date, the most accurate forecast appears to be the 2013 slow progress. As such it is difficult to have confidence that future forecasts will be any more reliable.

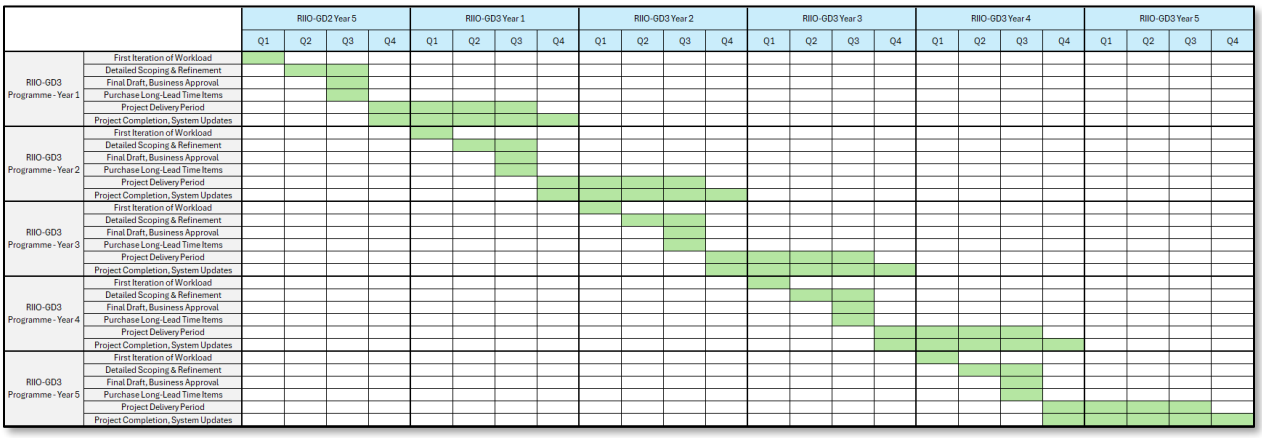
Due to slower and geographically dispersed take-up of heat pumps, and whilst we wait for the Heat Policy decision, moving to a short payback period cut-off for investments is not compatible with ensuring a safe, resilient, and efficient gas network while we transition to Net Zero. The gas sector collectively believes 25 years as a payback period is more realistic across all scenarios and prudent given the sector's legislative duties.

To manage sensitivities in delivery costs and benefits, we are using a prudent 20-year period to assess cost and benefits. This means investments paying back within this period can be justified with a high level of confidence.

10.4 Project Plan

The project plan in Table 13 below details the various stages of the project from the initial workload iteration stage through to record update and project completion. We don't envisage any long lead-time items that will put a RIIO-GD3 delivery in jeopardy, with all items able to be purchased and delivered within 3-6 months.

Table 13 - Project Plan of RIIO-GD3 Planned Investment



10.5 Key Business Risks and Opportunities

The table below summarises risks and mitigations related to delivery of our plan for this asset group:

Table 14 - Summary of Risks & Impacts of the Delivery Plan

Risk Description	Impact	Likelihood	Mitigation/Controls
Programme does not manage risk to required levels	WWU would not be meeting agreed targets for RIIO-GD3	<=20%	We have invested in data and analytics. Probability of failure and deterioration curves have been validated against reality. As long as the physical programme is delivered, this risk is minimal.
Risk to delivery timescales	Increased cost to recover programme if falling behind. Benefits to consumers not realised in a timely manner. Wouldn't comply with HSE mandated requirements	<=20%	We have established processes in place to deliver programmes such as this and have successfully delivered in RIIO-GD2. We have a robust workforce resilience strategy as documented in our RIIO-GD3 submission. Delivery of our investment plans are monitored at Exec / CEO level in our organisation.
Risk to planned costs	Consumers and WWU paying more than planned for work making it less cost beneficial. If cost is below planned cost, then consumers and WWU benefit from Total Expenditure (Totex) sharing incentive	<=20%	We hold excellent data on these assets, and we scope work well in advance. We have an excellent track record in delivering programmes like these. We operate an insourced delivery model for the bulk of our Distribution Pipelines programme. Therefore, risk is minimal.

10.6 Outputs included in GD2 Plans

Although preparatory work for the RIIO-GD3 programme will be completed in RIIO-GD2, no physical and hence, outputs, will move between the two price controls.