

Engineering Justification Paper

CPM7472 Sturry MP

(Ashford IPMP)

Version: Final

Date: December 2019

Classification: Highly Confidential



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2 Introduction

Reinforcement has been identified within the Ashford MP system, specifically relating to an anticipated system capacity failure at Sturry. This project is part of a wider programme of reinforcement associated with the RIIO-GD2 Business Plan Appendix covering Capacity Management.

2.1 General Background

The SGN distribution system is built to ensure security of supply for all our customers. Our networks operating at pressures below 7bar are designed to meet a peak six-minute demand level that could be experienced under 1 in 20 conditions, supporting a safe, secure and reliable service to those customers and meeting requirements outlined within our Licence Condition, including, but not limited to, Condition 16 contained therein.

Link: [Gas Transporters Licence – Standard Conditions](#)

Where capacity constraints are identified that are likely to impact on SGNs ability to ensure security of supply to all customers, Network Planning will look to establish optimum, cost-efficient reinforcement strategies to mitigate that risk. Such constraints may arise as a result of a number of factors, but the most common is increased demand levels, often resulting from new connections.

SGN has initiated an extensive programme of stakeholder engagement, working closely with Local Authorities, both in Scotland and the south of England, to establish a fully informed and independently sourced picture of planned development.

This engagement has provided us with confidence that the sites identified will progress to development and, to support this level of growth, we have developed a programme of reinforcement across our network.

2.2 Site Specific Background

Development within the Ashford IPMP Grid is primarily covered by the Canterbury District Council Local Plan. The Local Plan sets out planning policies to guide development, such as housing and employment for the next 10-20 years. A collated list of documents is used to produce the Local Plan, these include Annual Monitoring Reports and Housing Land Audits. SGN have used the Local Plan and its associated documents to identify developments on each specific grid.

Two developments located west of Sturry trigger the reinforcement. SGN contacted the Canterbury District Council regarding the likelihood of the two sites being developed, the council provided the following response:

“The sites Broad Oak Farm (456 dwellings) and Land at Sturry (700 dwellings) both form “Site 3: Broad Oak/Sturry” which is allocated for residential development within the Canterbury District Local Plan. As these sites are allocated in the development plan and have current planning applications (one of which is a hybrid application) there is a high degree of confidence these site(s) will be developed.”

Developments in Sturry will also benefit from the new link-road, which has largely been funded by developers in the Sturry area. The link road has the county councils backing and it is expected that this will help drive development within Sturry, plus it provides extra assurance that the proposed developments will go ahead.

3 Equipment Summary

Sturry CGS operates at 1.2bar (Medium Pressure) and supplies gas to the villages of Sturry and Hersden. Sturry is fed from an approx. 1.4km x 4"PE main. It is expected that the developments Broad Oak Farm and Land at Sturry will both connect to the 4" main. The alternative would be that they connect to the LP system, Popes Lane DG supplies the LP and is found on the tail of the 4"PE leg.

Table 1 - Sturry Equipment Summary

Equipment	Tier	Comment
Sturry PRS	HP-IP	Outlet pressure 6.9bar
Sturry CGS	IP-MP	Outlet pressure 1.2bar. Supplied by Strurry PRS
Popes Lane DG	MP-LP	Supplied by Sturry CGS. The LP offers an alternative connection to the MP
1.2km x 4"PE	MP	Popes Lane found at the tail of main

Security

4 Problem Statement

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

New connections to SGN networks reduce available capacity and when pressures are predicted to fall below minimum acceptable levels it is necessary to reinforce or increase pressures to facilitate increased capacity in the system.

In the case of the Sturry MP system, the potential development identified within the Canterbury Local Plan and associated documents, will see the network approach capacity within RIIO-GD2.

Failure to reinforce the network will restrict the delivery of these developments.

What is the outcome that we want to achieve?

Maintain SGN’s licence conditions to ensure security of supply, avoid becoming a blocker to development and support the economic prosperity of this area.

How will we understand if the spend has been successful?

On completion of the proposed reinforcement, SGN will monitor system performance to ensure expected system pressures are maintained. This will take the form of regular system performance checks and localised pressures surveys to ensure the successful outcome is delivered

At a customer level, SGN will have delivered a reinforcement that ensures a safe and secure network, meets stakeholder aspirations and ensures developments progress timeously.

4.1 Narrative Real-Life Example of Problem

West of Sturry has been identified for major development, with a significant impact on capacity available within the Sturry MP system. The existing network will require significant reinforcement to support these sites.

Failure to reinforce this area will result in SGN becoming a blocker to proposed development which, if connected prior to reinforcement, will result in the loss of supply to approximately 849 customers.

A recent example of good planning to meet customer expectation, whilst also ensuring security of supply, occurred following the acceptance of a quotation to supply a new development at Milton Heights, Milton, Abingdon, Oxfordshire (P18143337).

Network analysis confirmed a requirement to reinforce SGN’s system in advance of connecting the fully developed site load. However, network analysis also confirmed an interim load/connection of 72 new properties in advance of reinforcement, thereby meeting the GT/Developer’s schedule of works.

Reinforcement to supply the full development was subsequently planned and completed in advance of connections beyond the interim load, ensuring security of supply to approximately 500 new/existing customers

Security

Table 2 - Development Summary

Development Name	Site Usage	Site Status	Confidence
Broad Oak Farm	456 Houses	Awaiting decision on planning application	Probable (>75% confidence)
Land at Sturry	700 Houses	Awaiting decision on planning application	Probable (>75% confidence)

Please see Appendix A of this document which gives further details of the criteria applied when determining the attributable ‘confidence’ level of the above sites progressing to development.

We have deemed the requirement for this reinforcement within the RIIO-GD2 period as ‘Low’ and have therefore included the funding request in our high growth scenario.

4.2 Spend Boundaries

The spend associated with these reinforcement works provides capacity within the Sturry MP system to support projected development during RIIO-GD2.

The monies associated with these works ensure security of supply for existing customers and connection of planned development to the network.

Costs contained within this paper have been prepared using average contracted rates at depot level and validated against known costs for similar, completed projects.

Not included within this spend are the costs for subsequent phases of reinforcement required to support demand out-with the RIIO-GD2 period and/or any costs associated with reinforcement of the upstream transmission system.

5 Probability of Failure

As development identified for Sturry MP progresses, the network is predicted to fail between 65-70% peak demand by winter 2025/26, putting at risk supplies to 849 existing customers.

5.1 Probability of Failure Data Assurance

Model Validation

To ensure the accuracy of the Network Analysis models’ validation is carried out in line with the published requirement under Section 17 of SGN’s Safety Case and is a fundament of SGN’s Licence to Operate.

Validation ensures that the current models are an accurate representation of the actual gas transportation system and can be used to predict network behaviour under a variety of conditions, including the 1 in 20 design condition.

In addition to the validation programme, a robust model maintenance process and annual system performance checks ensure that the models continue to be accurate and fit for purpose. The latest system performance review confirmed the accuracy of the model against actual pressures recorded on 31 January 2019.

Figure 3 - Popes Lane DG Logger Graph 31/01/2019

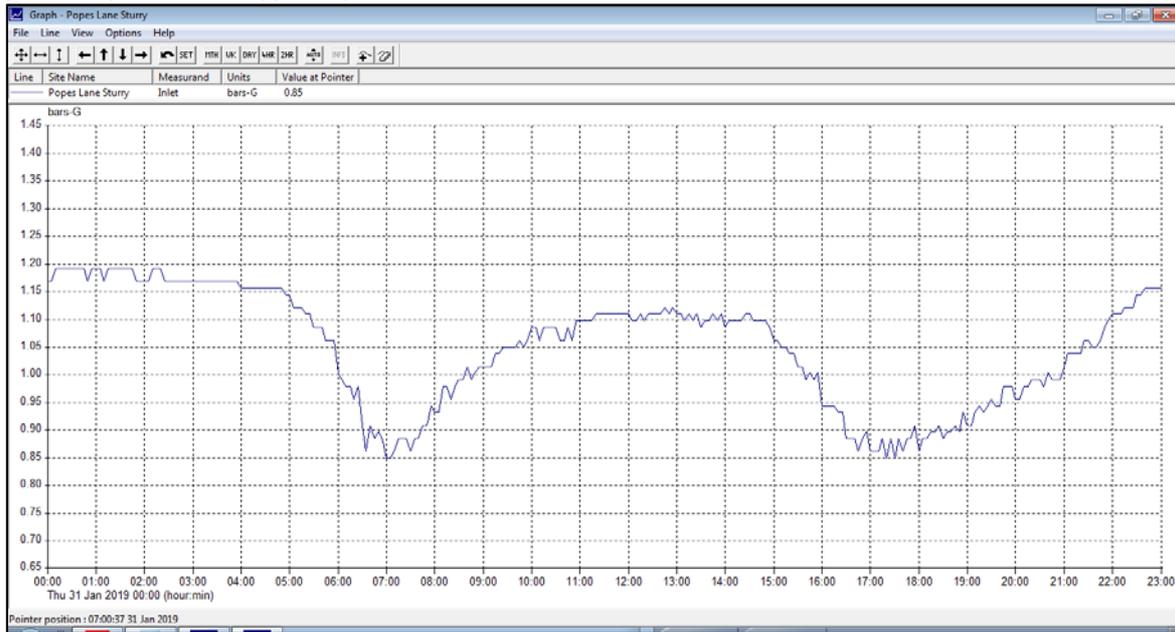


Table 3 - System Performance Review – 31st January 2019 (81% peak demand)

System	Site	System Pressure 81%		System Pressure (1 in 20)	
		Recorded Actual	Modelled Predicted	Min. Acceptable	Modelled Predicted
Sturry MP	Sturry CGS Outlet	1.17bar	1.2bar	n/a	n/a
Sturry MP	Pope's Lane DG	0.85bar	0.95bar	0.35bar	0.76bar

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Network Growth

The local plans and associated documents have been reviewed and an assessment made as to the probability of sites contained therein progressing to construction (see Table 2).

The resulting outputs have been applied to the network model, providing confidence that pre-emptive repair of the network (i.e. reinforcement) will be required during RIIO-GD2 to ensure we meet our licence conditions, maintaining minimum supply pressures under all demand conditions.

6 Consequence of Failure

Loss of Supply to Customers

Failure to reinforce will put at risk the supply to customers supplied via the Sturry MP system. Ultimately this will result in the failure of Pope's Lane DG due to insufficient inlet pressure and the loss of supply to approximately 849 existing customers. Due to failing to meet SGN's licence conditions, it will attract adverse publicity and damage the company's reputation.

Affected customers will include Sturry Surgery and Sturry Church of England Primary School.

Financially, after the first 24 hours, affected householders will be compensated for time without gas. Domestic customers will receive £41 for each 24-hour period without gas, small businesses will receive £69 for each 24-hour period without gas.

Table 4 – Projected RIIO-GD2 (2025/26) Pressures without Reinforcement

Location	Min Required Pressure (bar)	Min. Modelled Pressure (bar)
Sturry	0.35	-1.85

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Safety Impact of Failure

Reinforcement of the Ashford MP system is required to meet the obligations of our licence condition.

In this instance, a failure to reinforce will result in a system failure during peak winter conditions. The resulting loss of supply may have serious health and safety implications for vulnerable customers who rely on gas for essential heating and cooking facilities.

Environmental Impact

A system failure on this scale will result in a major recovery exercise. Environmental impacts will include increased travel to site by SGN operatives, leading to an increase in greenhouse gas emissions and disruption to the public.

On site, the use of fossil fuels to power plant and equipment required in the restoration of supplies will further increase greenhouse gas emissions, as will subsequent travel/plant in use for the reinstatement of public highways following the conclusion of these works.

7 Options Considered

7.1 Options

In accordance with the guidelines set out in the Ofgem guidance document ‘Engineering Justification Paper Frameworks for RIIO-GD2 and RIIO-GT2’ – Appendix B (Section 7), the following options have been considered:

Replace on Failure

Wait until the network fails then replace the system. This option has been discounted as it is impracticable to replace Sturry MP system.

Repair on Failure

Mains reinforcement after the network has failed. This option has been discounted due to non-compliance with SGN’s licence condition.

Pre-emptively Replace

This option has been discounted as asset replacement does not inherently provide additional capacity.

Pre-emptively Repair

Mains reinforcement and/or Interruption based on model data prior to network failure. Four options have been considered for further investigation:

- Option 1 - North of Sturry
- Option 2 - New TRS at Sturry
- Option 3 - Raise Pressures at Sturry CGS
- Option 4 - Interruption

Do Nothing

This is not considered an option. Identified growth dictates the requirement to provide additional capacity on this system through reinforcement.

7.2 Option 1 Summary – North of Sturry

The technical detail of option

This option involves the construction of approximately 1.6km x 180mmPE MP. It reinforces the existing parallel 4”PE MP main.

The basis for cost estimate/unit cost

Costs for this option, amounting to £0.783M, have been prepared using average contracted rates at depot level and validated against known costs for similar, completed projects.

The perceived benefits of the option

This option delivers a robust reinforcement solution within the Ashford MP network. It may also be possible to phase the reinforcement in line with development and spread the costs over a number of years instead of just one, which is the current plan.

Delivery Timescales

The reinforcement is scheduled for 2023/24 and it is expected to be completed in the same financial year.

Key Assumptions Made

It is assumed that known potential demand growth both within RIIO-GD2 period and beyond will require the same level of gas supply as that currently experienced.

Any other items that differentiate the option from the others considered

This is economically the best option that can ensure security of supply at the tail of the 4". Only feasible option that the reinforcement may be possible to be phased and the cost spread over a number of years.

Security

7.3 Option 2 Summary - New TRS at Sturry

The technical detail of option

As can be seen from Figure 7, the HP main crosses the extremity of the 4" MP at the site border of the Broad Oak Farm/Land at Sturry development. This option proposes that at this location a TRS is installed.

The basis for cost estimate/unit cost

Costs for this option, amounting to £3.748M, have been prepared using average contracted rates at depot level and validated against known costs for similar, completed projects.

Delivery Timescales

The reinforcement is scheduled for 2023/24 and it is expected to be completed in the same financial year.

Key Assumptions Made

It is assumed that known potential demand growth both within RIIO-GD2 period and beyond will require the same level of gas supply as that currently experienced.

Any other items that differentiate the option from the others considered

The option would provide a second source to the isolated Sturry MP system.

Security

7.4 Option 3 Summary – Raise Pressures at Sturry CGS

This option was disregarded, as increase to Sturry CGS from 1.2bar to 2bar did not provide the required minimum system pressure across the MP network.

7.5 Option 4 Summary – Interruption

In addition to the above, consideration was given to interruption. As part of Interruption reform, also known as the Mod 90 process, SGN has the option to offer a tender for interruptible contracts to customers to offset the need to invest for capacity.

Interruptible consumers receive discounted transportation charges for the flexibility they provide to the system for demand side management at times of high demand.

All eligible interruptible sites were reviewed, none are in a location where they could be considered as an alternative to reinforcement.

7.6 Options Technical Summary Table

Table 5 - Options Technical Summary Table

Option	First Year of Spend	Final Year of Spend	Volume of Interventions	Design Life (Years)	Total Cost (£M)
1. North of Sturry	2023/24	2023/24	1.6km x 180mmPE MP	10	0.783
2. New TRS at Sturry	2023/24	2023/24	New TRS	10	3.748
3. Raise Pressures at Sturry CGS	n/a	n/a	n/a	n/a	n/a
4. Interruption	n/a	n/a	n/a	n/a	n/a

Costs inclusive of Overheads and Efficiencies

7.7 Options Cost Summary Table

Table 6 - Summary of Cost

Option	Volume of Interventions	Cost (£M)	Total (£M)
1	1.6km x 180mm PE MP		0.783
2	New TRS		3.748
	10m x 180mm PE TRS outlet to connect to existing 4"PE		
	10m x LTS main to connect to existing main to LTS inlet		

Commercial Confidentiality

8 Business Case Outline and Discussion

Validation, a robust model maintenance process and system performance checks have confirmed the accuracy of the Ashford IPMP model for use in network analysis.

A full review of the relevant local plans and associated documents, followed by close engagement with stakeholders, has provided confidence in the level of development expected during RIIO-GD2.

The development outputs have been applied to the validated network model which predicts a failure at between 65-70% pk demand by winter 2025/26, putting at risk supplies to 849 existing customers.

To mitigate this risk and meet licence conditions it will be necessary to pre-emptively reinforce the network during RIIO-GD2.

There have been no external costs incurred in assessing the options considered as these have been prepared by the in-house Network Planning and Design teams.

8.1 Key Business Case Drivers Description

Reinforcement: Option 1 – North of Sturry

Provides capacity for development identified for construction by the Canterbury District Council Local Plan and associated documents, during RIIO-GD2. The route of the reinforcement follows the existing 4"PE, mostly through fields, preventing disruption to public and faster project turn over compared to main lay on roads. There are multiple access points to the fields already available from the roads running parallel.

Reinforcement can potentially be phased in line with the two developments driving the reinforcement, providing some flexibility in the scheduling and splitting costs over multiple years instead of just one.

Pressure loss will be substantially reduced by the reinforcement over the 4"PE main leading to Pope's Lane DG, where the two potentials developments are expected to connect to the network.

Reinforcement: Option 2 – New TRS at Sturry

Project costs for this solution can be expected to be significant, involving LTS mains/stations. The option enhances resilience by adding a second source to the Sturry MP system. However, in this case the Sturry MP system is only a small isolated network, where resilience is useful, but only provides a limited benefit.

The ideal site for the TRS would be at the small field where Pope's Lane is situated off the A291. Procurement of the whole field will be required to house the TRS. The site is easily accessible with access from the A291 already available.

Table 7 - Summary of Key Value Drivers

Option No.	Name of Option	Key Value Driver
1	North of Sturry	Economically the best option. Long-term solution.
2	New TRS at Sturry	Most expensive. Long-term solution.

8.2 Business Case Summary

This project is driven by SGN's Licence Conditions to ensure security of supply.

Table 8 - Business Case Matrix

	North of Sturry	New TRS at Sturry
CAPEX (£M)	0.783	3.748
Design Life	10 years	10 years
Positive Impact/Pros	Meets license obligations to maintain security of supply. Possible to phase reinforcement over a number of years splitting costs.	Meets license obligations to maintain security of supply. Enhanced resilience to Sturry MP system. Limited/no disruption to public.
Negative Impact/Cons	Likely to cause disruption to public and land owners.	Purchase/procurement of land. Overall cost.

Costs inclusive of Overheads and Efficiencies

9 Preferred Option Scope and Project Plan

9.1 Preferred option

Reinforcement: Option 1 – North of Sturry

Approx. 1.6km x 180mmPE MP.

9.2 Asset Health Spend Profile

Table 9 - Summary of Schedule of Spend

Asset Health Spend Profile (£M)						
Pre GD2	2021/22	2022/23	2023/24	2024/25	2025/26	Post GD2
0	0	0	0.783	0	0	0

Costs inclusive of Overheads and Efficiencies

9.3 Investment Risk Discussion

Delay/Cancellations

The project is demand driven by two developments west of Sturry. If these developments are delayed or the developer pulls out, then the investment will be a risk, as the reinforcement may be postponed to a later date or no longer be required.

Canterbury Council was contacted regarding the details of the developments. For all housing, which is the main trigger for the reinforcement, the council gave SGN confidence that the developments would go ahead and in the next few years.

Costs

SGN have prepared costs using average contracted rates at depot level and have validated them against known costs for similar, completed projects. Nevertheless, whilst all reasonable steps have been taken to ensure accuracy of costs outlined in this paper, it is recognised that external variables may change and subsequently impact on actual costs at time of construction. Examples of such could include unforeseen increases in contractor rates driven by a surplus of market demand for labour or sharp cost increases for materials.

Costs Under/Overspend

Factors such as market driven demand linked to the economy, the UK's potential exit from the European Union, emerging decarbonisation strategies and industry innovation can potentially impact on the scope of works outlined in this paper. SGN has proposed a volume driver funding mechanism to de-risk underspend/overspend for these works. Further details of this proposal can be found in Section 6.2 in the RIIO GD2 Business Plan Appendix for Capacity Management.

Political/Environment Situation (i.e. low/zero carbon)

As stated in the SGN Environmental Action Plan, and in line with current UK Government targets, SGN's long term target is to achieve Net Zero emissions by 2045. This means a decarbonisation of the energy network and supporting the transition to an environmentally sustainable low-carbon energy system. Indeed, SGN recognise that there have been preliminary government targets set facilitating a move toward a renewable or low carbon heat solutions by the end of the RIIO-GD2 period. As such, throughout the RIIO-GD2 period we will continue to closely monitor this emerging heat strategy with a view to refining any potential impact on current growth forecasts.

Appendix A - Categorisation of Potential Load Growth

The following Table sets out the manner in which identified potential load growth has been categorised and applied, leading to customer driven reinforcement, when looking to establish the optimum investment strategy for SGN networks.

DEFINITION TABLE				
Confidence	Definition	Factors to be considered	Base Growth	High Growth
Highly probable (>90% confidence)	Connection expected in RIIO-GD2 for all sites	<ol style="list-style-type: none"> 1. Quotation accepted but not yet on stream 2. Building is in progress. 3. Detailed planning permission granted. 4. Economic conditions indicate that sites for consumers of a particular type are likely to be developed, e.g. <ol style="list-style-type: none"> a. Domestic sites where there is a high demand for housing and there is a shortage of land available. b. Interest has been shown in having a connection made to a non-domestic site and economic factors suggest development will go ahead. 	✓	✓
Probable (>75% confidence)	Connection Likely in RIIO-GD2 for majority of sites	<ol style="list-style-type: none"> 1. Outline planning consent has been granted. 2. Recent development has been carried out in the area. 3. The land is a prime site for development, but no connection enquires have yet been received. 4. Adopted Local Plan Site 	✓	✓
Good prospects (>50% confidence)	Connection expected for some sites in RIIO-GD2	<ol style="list-style-type: none"> 1. Proposed Local Plan Site 2. No indication of planning permission being granted for the site. 3. The site is outside existing gas supply areas. 4. The site would involve physical problems in delivering a gas supply. 5. The site would require substantial additional infrastructure, e.g. additional roads, schools. 6. Site marked “reserve” in Local Plan. 7. Site is known to be contaminated ground. 8. Site has “protection” orders served over it – e.g. SSSI. 		✓
Poor prospects (<50% confidence)	Significant time or investment required to progress	<ol style="list-style-type: none"> 1. Does not meet the above planning criteria. 2. Site has been deemed as ‘speculative’. 3. The site would require significant additional infrastructure, e.g. additional roads, schools. 		

Appendix B - Overall Sites Driving Reinforcement

Site	Planning Ref	Sum of GD1 Total	Sum of GD2 Total	Sum of Post GD2 Total	Total
Broad Oak Farm	CA//18/00868	200	256	0	456
Land at Sturry/Broad Oak	CA//17/01383	0	500	200	700

The above trajectory is based on previous council trajectories of the sites and the following statement from Canterbury District Council regarding:

“The Council currently estimates that initial dwelling completions will occur in early 2020 and that both sites will be constructed simultaneously until around 2029/2030.”

Appendix C - List of Acronyms

Acronym	Backronym (spelled out acronym)	Definition / explanation
Pressure Tiers		
○ HP	○ High Pressure	○ High Pressure i.e. above 7bar LTS (NTS)
○ IP	○ Intermediate Pressure	○ Intermediate Pressure i.e. 2 – 7bar
○ MP	○ Medium Pressure	○ Medium Pressure i.e. up to 2bar
○ LP	○ Low Pressure	○ Low Pressure i.e. up to 75mb
CSEP	Connected System Exit Point	Third party connection to Gas network from an iGT or UIP
DG	District Governor	Pressure regulator primarily used for reducing pressures from IP and MP tiers to LP.
DPG	Distribution Pressure Governor	Pressure regulator primarily used for reducing pressures from IP tier to MP.
HDPE	High Density Polyethylene	Material standard for plastic pipe – High density allows for use at > 2bar operation due to thicker pipe wall. Reduced internal diameter increases weight of pipe, is not suitable for use < 2bar. Cheaper material and jointing than Steel.
iGT (GT)	Independent Gas Transporter	Third party supplier of gas and infrastructure to closed developments, not generally adopted by SGN.
LTS	Local Transmission System	High Pressure system feeding from National Offtakes to P(T)RS Inlets
MDPE	Medium Density Polyethylene	Material standard for plastic pipe – Medium density allows for greater internal diameter for extra capacity required at lower tiers, but thinner pipe wall thickness is not considered safe for operation at >2bar. Cheap material and jointing due to electro fusion welding.
MOP	Maximum Operation Pressure	Highest design pressure for a mains system, however regulator may be set lower than this but not higher.
NTS	National Transmission System	High Pressure system feeding National Offtakes from Terminals
PMAC	Pressure Management and Control	Third Party monitoring system which communicates live data via BT Comms link, facilitates remote control of pressure settings and profiles on SGN Plant, used at all Plant levels.
P(T)RS	Pressure (Transmission) Regulator Station	Pressure regulator primarily used for reducing pressures from HP (LTS/NTS) tier to IP / MP or LP.
UIP	Universal Infrastructure Provider	Provides and connects infrastructure to gas network but does not supply gas. UIP infrastructure is generally adopted by SGN.
RIIO-GD1	Revenue=Incentives + Innovation + Outputs – Gas Distribution 1	8-Year price control period (2013-2021)
RIIO-GD2	Revenue=Incentives + Innovation + Outputs – Gas Distribution 2	Proposed 5-Year price control period (2021-2026)
SHP	SHP File Format	SHP is a file extension for a Shapefile shape format used in geographical information systems (GIS) software.

ST	STEEL	Steel pipe material is used where PE cannot i.e. protection from heavy traffic or bridge crossings, Regulator outlets where excessive gas cooling may be experienced at pressure reduction. Steel pipe laying can be expensive due to welded joints.
1:20	1:20 Demand Conditions	Designing a network to operate whilst experiencing demand conditions historically only seen every 20 years, during severe weather events.