

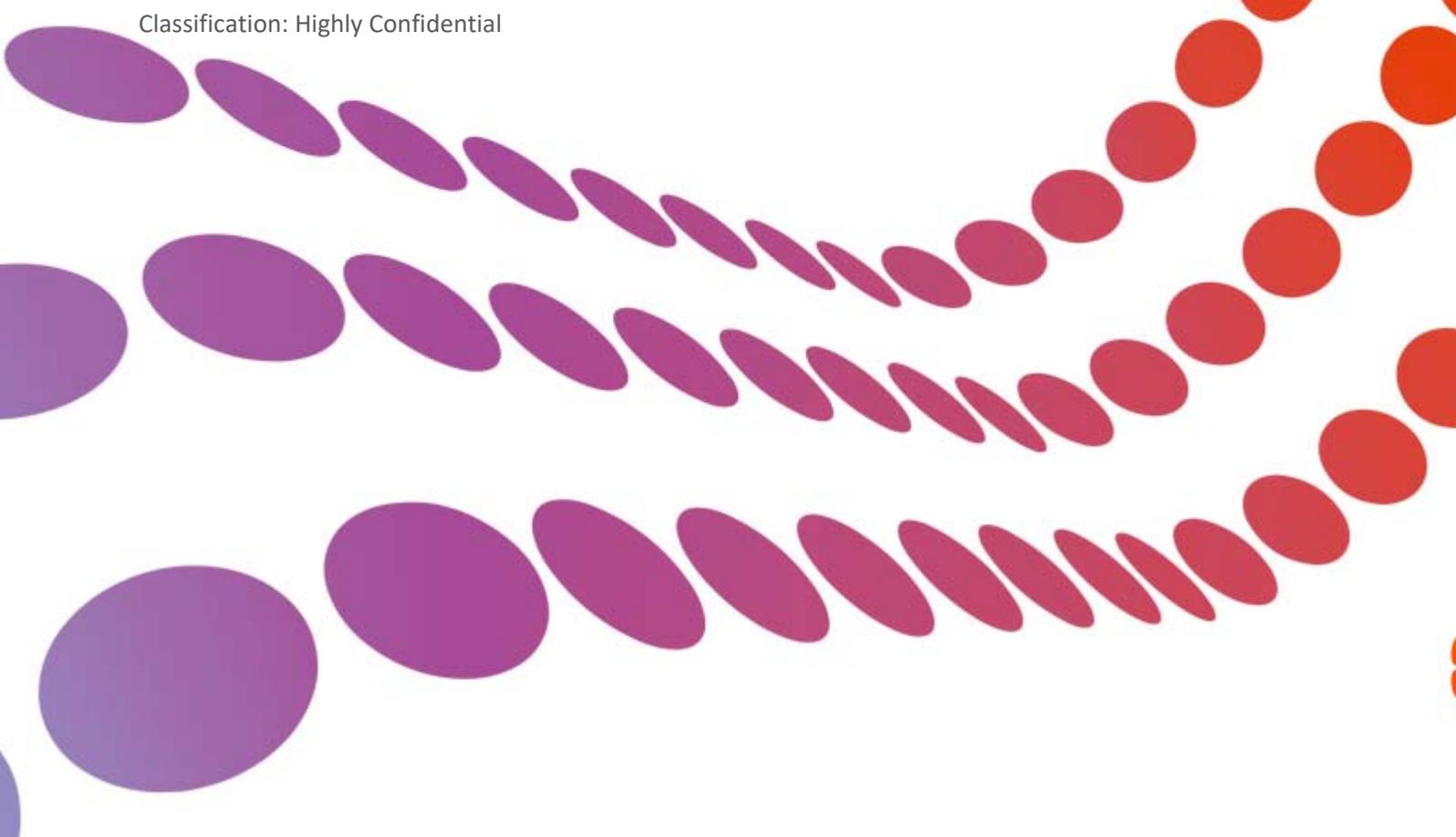
Engineering Justification Paper

CPM1062 Amisfield Mains (Haddington-Dunbar IP) Appendix B – Asset Health

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2 Introduction

Reinforcement has been identified within the Haddington-Dunbar IP system, specifically relating to an anticipated system capacity failure at Dunbar. This project is part of a wider programme of reinforcement associated with the RIIO-GD2 Business Plan Appendix for 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 1:20 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 SGN with confidence that the sites identified will progress to development and, to support this level of growth, SGN has developed a programme of reinforcement across its network.

2.2 Site Specific Background

Development within the Haddington-Dunbar IPMP Grid is covered by the East Lothian Local Development Plan (LDP) and associated documents. The LDP sets out how and where the requirements of the Strategic Development Plan (SDP) for East Lothian can be met.

East Lothian's population has grown steadily since the mid/late 1980's. The 2011 Census indicates that East Lothian's total usually resident population was 99,717, which is an increase of 10.7% per cent over the equivalent 90,100 population at 2001. This growth is largely as a result of the area's proximity to Edinburgh and because it is part of the wider Edinburgh labour market as well as housing market areas.

Furthermore, the National Records of Scotland 2010 population projection (published 2012) anticipates that by 2035 East Lothian's population will increase by 33%, to around 129,229 the highest percentage rate of growth in Scotland during this period.

The driver for this reinforcement project is a combination of committed growth and proposed development in Dunbar, located at the extremity of the Haddington-Dunbar IP Grid.

3 Equipment Summary

The Haddington-Dunbar IP Grid is supplied via a single TRS at Haddington, which feeds a 7bar pipeline feeding eastwards to Dunbar. DPGs situated at West Barns and Haddington supply the towns of Dunbar and Haddington respectively via relatively short downstream MP systems. In addition, the village of East Linton is supplied direct from the IP.

4 Problem Statement

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

New connections to our 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 Haddington–Dunbar IP system, significant on-going committed development at existing GT sites, combined with potential development identified within the LDP/HLA and associated documents, will see the network approach capacity during 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 and support economic prosperity by not becoming a blocker to development.

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 a successful outcome has been achieved.

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

The Haddington–Dunbar IP system is close to capacity and will be reinforced in the remaining years of RIIO-GD1 to supply on-going, committed development at existing GT sites.

A second phase of this reinforcement strategy will be required to support sites identified by the East Lothian LDP for development during RIIO-GD2.

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 New Mills Balerno (P17141081).

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 30 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 350 new/existing customers.

Security

The developments driving this reinforcement projected are listed in Table 1 below:

Table 1: Development Summary

Development Name	Site Usage	Site Status	Confidence
Halliwell South West	500 houses	Planning Permission	Highly probable (>90% confidence)
Halliwell North	250 houses	Allocation within the Adopted Local Development Plan	Probable (>75% confidence)
Spott Road	21ha employment land	Allocation within the Adopted Local Development Plan	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.

Through this determination SGN have deemed the requirement for this reinforcement within the RIIO-GD2 period as ‘High’ and have therefore included the funding request in both our Base Growth and High Growth scenarios.

4.2 Spend Boundaries

The monies associated with these reinforcement works provide capacity within the Haddington–Dunbar IP 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 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 outside of the RIIO-GD2 period and/or any costs associated with reinforcement of the upstream Edinburgh-Borders Transmission system.

5 Probability of Failure

As development identified for this area progresses, the Haddington-Dunbar IP Network is predicted to fail at 92% peak demand by winter 2025/26, putting at risk supplies to approximately 2,700 customers at Dunbar.

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 winter 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 31st January 2019.

Table 2: System Performance Review – 31st January 2019 (82% peak demand)

System	Site	System Pressure (82% Pk hr)		Yr1 System Pressure (1 in 20)	
		Recorded Actual	Modelled Predicted	Minimum Acceptable	Modelled Predicted
Haddington - Dunbar IP	West Barns DPG	4.37bar	4.18bar	2.76bar	2.80bar

Network Growth

The East Lothian Local Development Plan and associated documents have been reviewed and an assessment made as to the probability of sites contained therein progressing to construction (see Table 1).

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 SGN meets its 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 those customers on the Haddington – Dunbar MP system that are supplied via West Barns DPG.

Insufficient inlet pressure to West Barns DPG will ultimately cause failure of the DPG with the loss of supply to approximately 2,700 customers at Dunbar and a failure to meet SGN's Licence Conditions, attracting adverse publicity and damage to the company's reputation.

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 3: Projected RIIO-GD2 Pressures (2025/26) without Reinforcement

Location	Min Required Pressure (bar)	Min. Modelled Pressure (bar)
West Barns DPG	2.76	-5.29

Security

Safety Impact of Failure

Reinforcement of the Haddington – Dunbar IP system is necessary to meet the requirements 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

Options Summary

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 due to non-compliance with SGN's Licence Condition.

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. Three options have been considered for further investigation, two of which are main-laying solutions

Security

Do Nothing

Not considered practicable as on-going committed development at existing GT sites, combined with potential development identified/programmed within the LDP/HLA and associated documents, will see the Haddington-Dunbar IP system approach capacity towards the latter part of RIIO-GD2.

7.1 First Option Summary: Amisfield Mains IP

The technical detail of the option i.e. capacity, system rating, availability etc.

The first option considered for further investigation, **Amisfield Mains IP**, involves the construction of approximately 1.8km x 250mm HDPE IP.

The basis for the cost estimate/unit cost

Costs for this option, amounting to £0.592M, 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

The proposed works provide capacity for committed/planned development identified for construction during RIIO-GD2.

Delivery timescales

This project has been scheduled to commence in 2022/23 and is expected to be completed in the same financial year.

Key assumptions made

Land Easements will be required.

Any other items that differentiate the option from the others considered

There is scope to phase these works in line with projected development.

7.2 Second Option Summary: Amisfield Mains TRS

The technical detail of the option i.e. capacity, system rating, availability etc

The second option considered for further investigation, **Amisfield Mains TRS**, involves the construction of approximately 4.3km x 168mm ST LTS main to a new TRS.

The basis for the cost estimate/unit cost

Costs for this option, amounting to £7.395M, 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

The proposed works provide capacity for committed/planned development identified for construction during RIIO-GD2.

Delivery timescales

This project has been scheduled to commence in 2021/2022 and is expected to be completed in 2022/23.

Key assumptions made

Land Easements will be required, and a site purchased for a new TRS

Any other items that differentiate the option from the others considered

There is no scope to phase these works.

7.3 Third Option 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.

Supplies to sites **Commercial Confidentiality** meet the criteria for an interruptible supply. However, interruption of either site will have minimal impact on system pressures and will not remove the requirement for reinforcement during RIIO-GD2.

7.4 Options Technical Summary Table

Table 4: Options Technical Summary Table

Option	First Year of Spend	Final Year of Spend	Volume of Interventions	Design Life (years)	Total (£M)
1/ Amisfield Mains IP	2022/23	2022/23	1.8km x 250mm HDPE IP	10	0.592
2/ Amisfield Mains TRS	2021/22	2022/23	4.3km x 168mm ST LTS	10	7.395
			New TRS		

7.5 Options Cost Summary Table

Table 5: Options Cost Summary Table

Option	Volume of Interventions	Cost Breakdown (£M)	Total (£M)
1/ Amisfield Mains IP	1.8km x 250mm HDPE IP		0.592
2/ Amisfield Mains TRS	4.3km x 168mm ST LTS		7.395
	New TRS		

Commercial Confidentiality

8 Business Case Outline and Discussion

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

A full review of the relevant Local Development 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 92% peak demand by winter 2025/26, putting at risk supplies to 2,700 customers.

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

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

Pre-emptively Repair: Option 1, Amisfield Mains IP

This option provides a robust reinforcement solution in support of sites identified by the East Lothian LDP and associated documents for development during RIIO-GD2.

A first phase of this strategy will be carried out in the remaining years of RIIO-GD1 to support committed development at ongoing GT sites.

The second phase of this solution will be constructed during RIIO-GD2 to support planned development. Following a route in parallel with the existing IP network, this section can be split into further phases as schedules for development are confirmed.

An opportunity was taken to upsize the section of main between Phase 1 and Phase 2 during earlier diversionary works for improvements to the A1 carriageway. As such, reinforcement of this section of the network is not required.

Pre-emptively Repair: Option 2, Amisfield Mains TRS

This option provides a robust reinforcement solution in support of sites identified by the East Lothian LDP and associated documents for development during RIIO-GD2.

This solution involves the extension of the existing LTS network to a new TRS, connecting to the existing IP network.

This option requires all works to be carried out in a single phase and at a significantly greater cost than that for Option 1.

Table 6: Summary of Key Value Drivers

Option No.	Desc. of Option	Key Value Driver
1	Amisfield Mains IP	Least cost solution
2	Amisfield Mains TRS	Significantly more expensive than the IP solution

8.2 Business Case Summary

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

Table 7: Business Case Matrix

	Amisfield Mains IP	Amisfield Mains TRS
Cost (£M)	0.592	7.395
Positive Benefit (Pros)	A robust reinforcement solution. Opportunity to phase in line with development. The least cost solution.	A robust reinforcement solution.
Negative Impact (Cons)	Land Easements will be required.	Further phasing is not possible. A site for a new TRS will require to be secured. Land Easements will be required. A significantly more expensive solution than the IP option.

Costs inclusive of Overheads and Efficiencies

9 Preferred Option Scope and Project Plan

9.1 Preferred option

Pre-emptively Repair - Option 1, Amisfield Mains IP: 1.8km x 250mm HDPE IP

9.2 Asset Health Spend Profile

Table 8: 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	0.592	0	0	0	0

Costs inclusive of Overheads and Efficiencies

9.3 Investment Risk Discussion

The requirement for reinforcement of the Haddington-Dunbar IP system is demand driven, primarily development identified by the East Lothian Local Development Plan and associated documents, and with a clear programme for anticipated development. Through this determination SGN has identified this requirement for reinforcement within the RIIO-GD2 period.

A risk exists that the planned development does not materialise or proceeds more slowly than anticipated. As reinforcement will not be required until the midpoint of RIIO-GD2, the progress of development will be monitored during the early 2020’s and, if required, reinforcement will be modified to suit at that time.

SGN has prepared costs using average contracted rates at depot level and has 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 the 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.

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 and further details of our proposal can be found in Section 6.2 in the RIIO-GD2 Business Plan Appendix for Capacity Management.

As stated in our Environmental Action Plan, and in line with current Scottish Governments 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 our 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 - Summary of Towns

Haddington (Population 9,064)

Haddington was an important town in the Middle Ages. Its location on the River Tyne meant that it became a point of conflict between the Scots and English. In the 18th and 19th centuries it was an important agricultural centre with a grain market. It is the administrative centre for East Lothian. The former Mitsubishi plant closed in the late 1990's but the town continues to be an important service centre and has a maltings.

There is a particularly wide range of people, housing and activities. The number of older couples with no children are higher than average. There is a mix of professional and non-professional jobs, and part-time and self-employment are both important for a significant proportion of residents. Socioeconomic status is higher than in other kinds of town and there is a mix of professionals and nonprofessionals, those with higher and lower educational attainment.

Dunbar (Population 8,486)

Dunbar was historically a port. Bypassed by the new A1 it is now a commuter settlement. It retains a tourist function. The Lafarge cement works, and Torness Power Station provide some local employment.

There is a particularly wide range of people, housing and activities. The number of older couples with no children are higher than average. There is a mix of professional and non-professional jobs, and part-time and self-employment are both important for a significant proportion of residents. Socioeconomic status is higher than in other kinds of town and there is a mix of professionals and nonprofessionals, those with higher and lower educational attainment.

Source:

[Scotland's Towns Partnership](#)

Appendix C - Acronyms

Acronym	Backronym (spelled out acronym)	Definition / explanation
Pressure Tiers ○ IP ○ MP ○ LP	○ Intermediate Pressure ○ Medium Pressure ○ Low Pressure	○ Intermediate Pressure i.e. 2 – 7bar ○ Medium Pressure i.e. up to 2bar ○ Low Pressure i.e. up to 75mb
CSEP	Connected System Exit Point	A connection point for one of more Individual System Exit Points, most usually supplying a GT Network (see GT below).
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.
GT	Independent Gas Transporter	GT networks are directly connected to the Gas Distribution Network (GDN) via a Connected System Entry Point or indirectly to the GDN via another IGT.
HDPE	High Density Polyethylene	Pipe material for use in 7bar rated systems.
HLA	Housing Land Audit	Local Authority planning document.
LDP	Local Development Plan	Local Authority planning document.
PE	Polyethylene	Pipe material.
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	Pipe material.
TRS	Transmission Reduction Station	Pressure regulator primarily used for reducing pressures from Local Transmission System tier to IP/MP.
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.