

Engineering Justification Paper

CPM5288 Mitcham Common CGS (South London IPMP)

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1. Table of Contents

2 Introduction	3
2.1 General Background	3
2.2 Site Specific Background	3
3 Equipment Summary	4
4 Problem Statement	5
4.1 Narrative Real-Life Example of Problem	5
4.2 Spend Boundaries	6
5 Probability of Failure	7
5.1 Probability of Failure Data Assurance	7
6 Consequence of Failure	9
7 Options Considered	10
7.1 Options Summary	10
7.2 First Option Summary – Replace Mitcham Common CGS	11
7.3 Second Option Summary - Reduce Mitcham Common CGS Setting	11
7.4 Third Option Summary - Interruption	12
7.5 Options Technical Summary Table	13
7.6 Options Cost Summary Table	13
8 Business Case Outline and Discussion	14
8.1 Key Business Case Drivers Description	14
8.2 Business Case Summary	15
9 Preferred Option Scope and Project Plan	15
9.1 Preferred option	15
9.2 Asset Health Spend Profile	15
9.3 Investment Risk Discussion	16
Appendix A - Acronyms	17

2 Introduction

Reinforcement has been identified within South London IPMP Grid, specifically relating to anticipated Capacity failure at Mitcham Common CGS. 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 1:20 conditions, supporting a safe, secure and reliable service to those customers and meeting requirements in compliance with 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, to support this level of growth, SGN has developed a programme of reinforcement across its network.

2.2 Site Specific Background

Significant domestic developments are anticipated across South London IPMP Grid, with proposed housing developments within Croydon and Sutton alone amounting to 19,000 new homes within GD2 (2021–26) as per London Ten Year housing Targets extracted from ‘London Plan’ and SHLAA.

Table 1: London Ten Year Housing Targets by Type (2019/20 – 2028/29)

Planning Authority	Large Sites	Small Sites	Non-Self Contained	Total
Bexley	3,777	8,650	30	12,457
Bromley	3,920	10,290	30	14,240
Croydon	14,380	15,110	0	29,490
Greenwich	25,010	6,810	220	32,040
Kingston upon Thames	7,340	6,250	50	13,640
Lambeth	9,210	6,540	140	15,890
Lewisham	12,880	8,290	0	21,170
Merton	6,540	6,710	30	13,280
Richmond	1,770	6,340	0	8,110
Southwark	17,530	8,000	10	25,540
Sutton	2,010	7,380	0	9,390
Wandsworth	15,280	7,740	80	23,100
Total for South London	119,647	98,110	590	218,347

GD2 Growth identified in these plans has been included in our network model forecasts, which have highlighted to us that a Capacity Issue will occur at Mitcham Common CGS, requiring reinforcement or replacement of CGS within RIIO-GD2 period (2021-26).

Identified drivers for the replacement of Mitcham Common CGS are numerous, as Mitcham Common is situated at the Centre of the London IPMP Network, and the CGS Capacity is significantly affected by growth within the neighbouring London Boroughs of Croydon & Sutton, among others.

3 Equipment Summary

South London IPMP Grid is integrated within the South East IPMP Network;

Security

Mitcham Common CGS IP Inlet is primarily sourced from Croydon PRS, with support from Hooley, St. Mary Cray and from the Wilmington Boundary Control at Welling. These PRS stations feed into London IP at 6.9bar.

Mitcham Common CGS Outlet feeds into London MP System at 1.4bar MOP, this system is extensively integrated and supplies 1.4bar MP from Guildford in the West, through London to the Isle of Grain in the East (approx. 65miles).

4 Problem Statement

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

New connections to our networks reduce available capacity, 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.

b) 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.

c) How will we understand if the spend has been successful?

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

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 pressure surveys to ensure the successful outcome is delivered.

4.1 Narrative Real-Life Example of Problem

As a result of the development proposed up to 2026 and existing committed development growth, IP Inlet Pressure at Mitcham Common CGS will drop, affecting available capacity during GD2.

Table 2: Summary Table of Capacity (based on projected 1 in 20 demands @ Mitcham Common CGS)

Year	Inlet (bar)	Pressure	Flow (scm/hr)	Capacity (scm/hr)	% Capacity
2017/18 (GD1)	6.020		84,790	86,100	98.5
2019/20 (GD1)	6.030		87,842	86,225	101.9*
2021/22 (GD2)	6.396		87,956	90,800	96.9
2025/26 (GD2)	6.269		96,479	89,212	108.1

*Table data projects that Mitcham Common CGS Capacity will be exceeded, in relation to a drop in IP Inlet pressure within RIIO-GD1 period, where completion of planned GD1 (2020) Reinforcement at Blackheath Common will increase capacity.

Due to planned growth Mitcham Common CGS Capacity will again be exceeded, in relation to a drop in IP Inlet pressure, within RIIO-GD2 period (2021-26), requiring reinforcement.

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.

4.2 Spend Boundaries

The project spend is limited to both the replacement of the Mitcham Common CGS and re-siting of the larger CGS in same or adjacent location.

Security

Included within the spend are costs involved in providing a larger capacity CGS configuration, to ensure that any replacement CGS is suitably designed to provide for expected growth in demand.

5 Probability of Failure

The existing South East IPMP model predicts a failure of Mitcham Common CGS to maintain its Outlet pressure to the London MP system during 2022/23 in >95% of 1 in 20 demand conditions, which is within GD2 (2021- 26).

5.1 Probability of Failure Data Assurance

Model Validation

To ensure the accuracy of 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 ensures that the models continue to be accurate and fit for purpose.

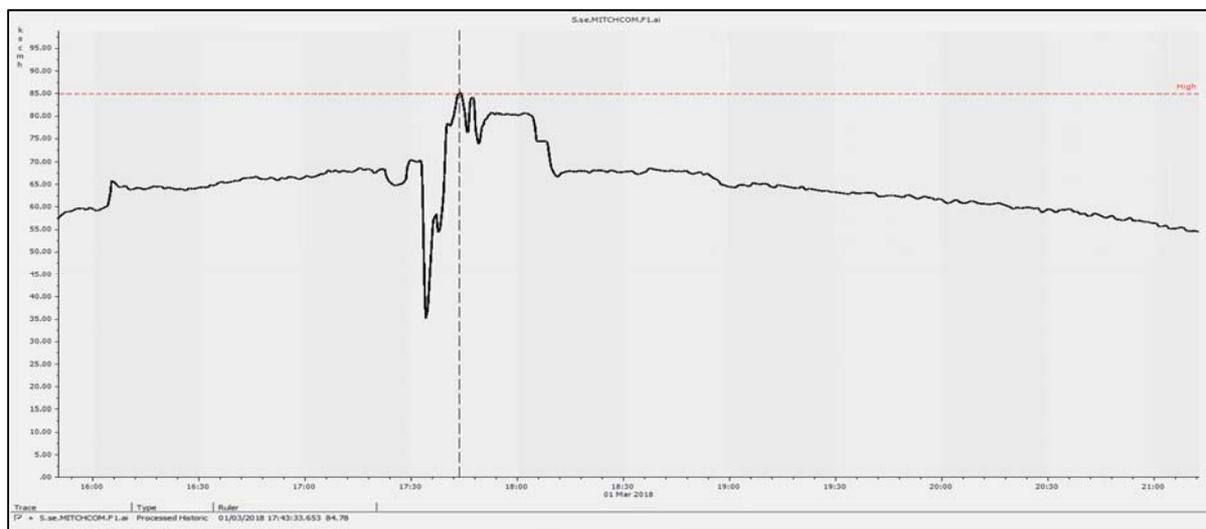
The existing modelled data within South London IPMP section of South East IPMP model was sense checked. This was done using existing DG Inlet Logger data, as well as charts taken from SGN’s DNCS (Distribution Network Control System) after the extreme weather seen at the end of February and early March 2018, known colloquially as “The Beast from the East”.

This sense check proved the suitability of our current year models for design purposes, whilst providing essential data regarding the probability of capacity failure at Mitcham Common CGS by 2022/23 (see Figures 3, 4 & 5 for chart evidence taken from 1 March 2018).

During 1 March 2018 ‘Beast from the East’ demand scenario, South East demand levels were considered to be commensurate with our 1:20 demand scenario used in our worst-case modelling and some areas if a 1:50 demand event occurred, beyond our worst-case models.

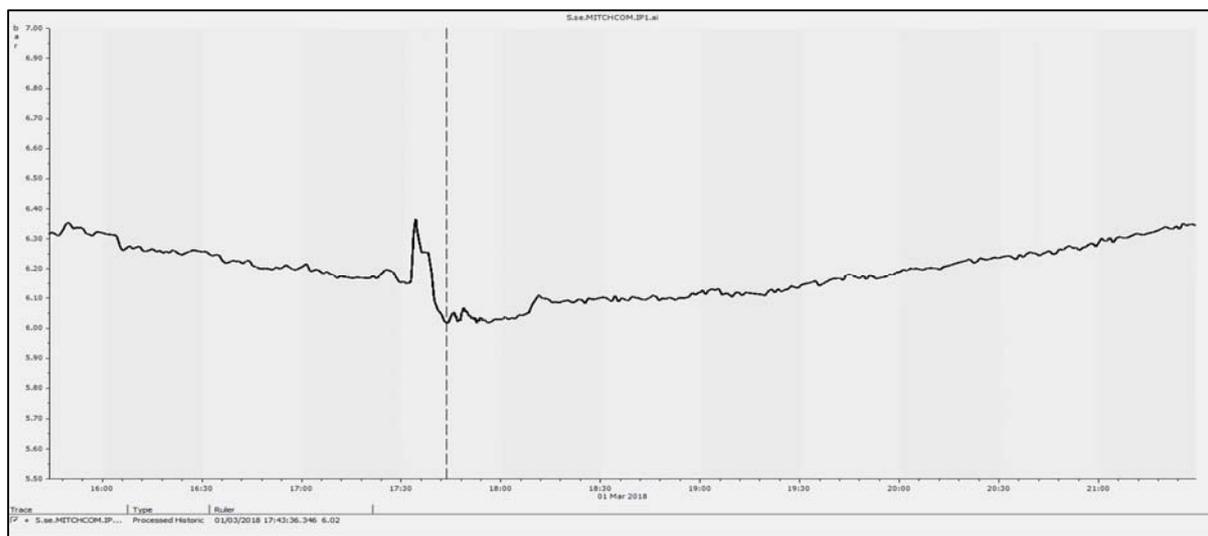
The following charts in Figures 3,4 & 5 show charted results at Mitcham Common CGS Flow (Kscm/hr), Inlet (IP) & outlet (MP) respectively.

Figure 3. chart shows the highest flow recorded at Mitcham Common CGS = 85kscmh at 17:43 on 1 March 2018.



Flow peaked at 17:43 on 1 March 2018 at 85kscm/hr, this was the highest recorded flow at Mitcham Common CGS in recent charted history.

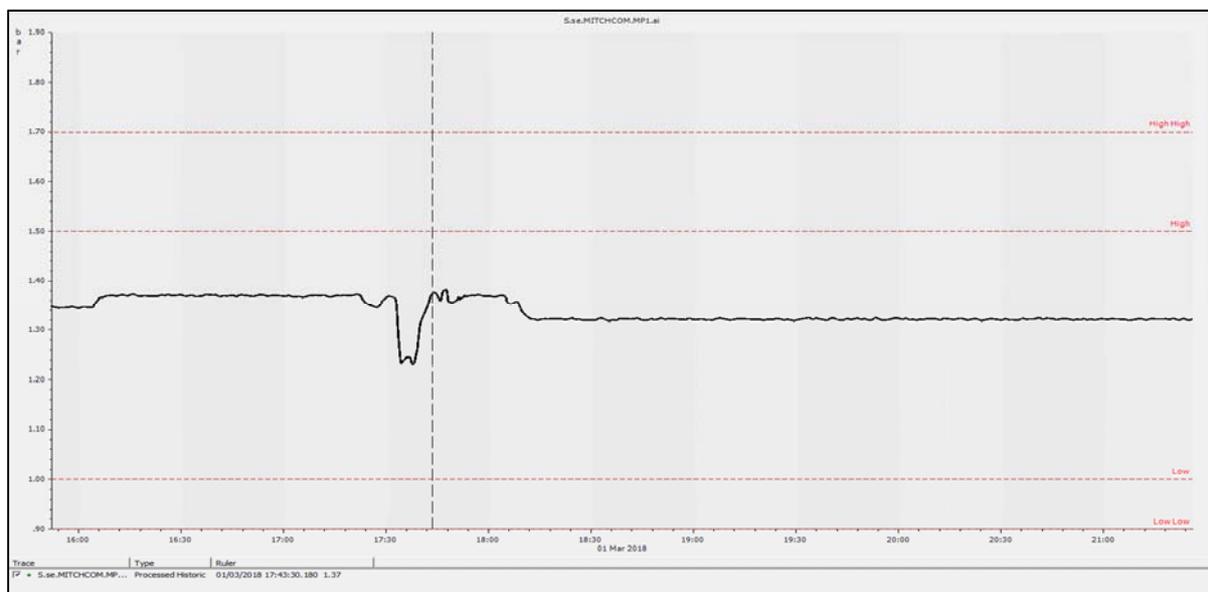
Figure 4. chart showing Mitcham Common CGS Minimum IP Inlet pressure of 6.02bar at 17:43 on 1st March 2018



IP Inlet pressure is critical to the capacity, charted IP Inlet pressures fell to 6.02bar at the time of the highest flow through Mitcham Common CGS. Further investigation found plant settings, on this London IP extremity, were raised for downstream operational activities, creating an abnormal impact on IP Inlet pressures at Mitcham Common.

In this low IP Inlet pressure scenario, the MP Outlet of Mitcham Common CGS was found to be impacted through charted evidence of a slight pressure drop.

Figure 5. chart showing drop in Outlet pressure, at the highest demand period on 1 March 2018 at 17:43



Reinforcement completion will therefore be required to maintain Security of Supply to MP extremities of London MP Network and maintain Capacity of neighbouring PRS and CGS Stations, within GD2.

6 Consequence of Failure

Loss of Supply to Customers

The South London IPMP network will be unable to support both committed growth as well as proposed developments identified within London Plan during GD2. This is in direct violation of SGN's license obligations to maintain Security of Supply of committed customer development.

Ultimately, this will result in the failure of Mitcham Common CGS due to insufficient inlet pressure. Leading to either restrictions in flow with the equivalent of approximately 10,000 existing/new customers or, being redirected to neighbouring stations leading to a failure to meet SGN's Licence Conditions, attracting adverse publicity and reputational damage.

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.

Cost implications of altering the design of Chessington PRS / Worcester Park CGS and Blackheath Common CGS, far outweigh the cost of reinforcing Mitcham Common CGS.

Failure to invest in reinforcement would also prevent gas from becoming a part of the energy mix at growth areas identified within the South London Local Plan. SGN would be deemed to have blocked local development affecting the growth of the local economy.

Table 3: Projected Pressures (2025/26) without Reinforcement

Lowest Pressure Location	Required Minimum Pressure	Minimum Failing Pressure
Lower Addiscombe Road DG	345mbar	117mbar

Security

Safety Impact of Failure

Reinforcement of the South London IPMP 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

7.1 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 as it is impracticable to replace South London IPMP 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

Replace the system prior to network failure. This option has been discounted as it is impracticable to replace South London IPMP system.

Pre-emptively Repair

Mains reinforcement based on model data prior to network failure, three options considered for further investigation: *(See Sections 7.1, 7.2, 7.3 for further details)*

Do Nothing

Discarded as Mitcham Common CGS is already shown to be close to capacity, as seen from charted DNCS evidence from 1 March 2018, and is forecast to exceed design capacity by 2023, in direct contravention to SGN’s Licence Condition to maintain Security of Supply to existing and proposed customers.

7.2 First Option Summary – Replace Mitcham Common CGS.

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

Replace Mitcham Common CGS with larger capacity CGS.

The basis for cost estimate/unit cost

Cost estimate for the replacement CGS is based on average contracted rates supplied by depot, validated against known costs for similar completed projects.

The perceived benefits of the option

Larger Capacity CGS will accommodate known forecast growth within RIIO-GD2 (2021-2026), whilst being designed to provide for known growth up to a 10 year design horizon (2022–2032).

Delivery timescales

New CGS is required to be delivered before winter 2022/23 to avoid anticipated capacity issues.

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

Replacement CGS to be sited within existing compound or adjacent site on common (See Figure 2 for site location), therefore saving on any easement or traffic management costs.

7.3 Security

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

Reducing Mitcham Common CGS setting from 1.4bar to 1.3bar, redirects CGS flow by up to 30%.

Integrated South London MP system predominately allocates this redirected flow 6km west to neighbouring Worcester Park PRS and 10km north east to proposed new Blackheath Common CGS.

The basis for cost estimate/unit cost

Cost estimate for the replacement CGS is based on average contracted rates supplied by depot, validated against known costs for similar, completed projects.

The perceived benefits of the option

Removes requirement to replace existing CGS to accommodate known forecast growth within RIIO-GD2 (2021-2026).

Delivery timescales

CGS Setting alteration is required to be delivered before winter 2022/23 to avoid anticipated capacity issues.

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

Flow increase at Worcester Park PRS will have a significant cost implication for existing feasibility design study works being carried out ^{Commercial Confidential}, for former gas holder site clearance.

Study includes for existing PRS to be re-sited 4-5km west at Chessington, with new CGS remaining on site, to maximise available space for development **Commercial Confidentiality**

New Blackheath Common CGS is being delivered under replacement in GD1 (2020), however increased flow from Mitcham Common will invalidate ordered design capacity, requiring current CGS order to be cancelled and reordered. Associated lead times with plant orders would create a delay in delivery of this project from GD1 into GD2, where budget does not accommodate (redesigned project cost moved into GD2 = ^{Commercial Confidential}).

7.4 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, we have 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.

There are a number of sites within the London IPMP Network that meet the criteria for an interruptible supply. However, interruption at all of these sites would only offer a short delay in the requirement for reinforcement and has been discounted.

7.5 Options Technical Summary Table

Table 4 – Options Technical Summary

Option	First Year of Spend	Final Year of Spend	Volume of Interventions	Equipment / Investment Design Life	Total Cost (£m)
Replace Mitcham Common CGS	2022	2022	New CGS	10 Years	1.316
Decrease CGS Setting	2022	2022	from 1.4bar to 1.3bar	10 Years	3.588
Interruption	n/a	n/a	n/a	n/a	n/a

7.6 Options Cost Summary Table

Table 5 - Cost Summary

Option	Cost Breakdown	Total Cost (£m)
Replace Mitcham Common CGS	Materials = <input type="text"/> Labour = <input type="text"/> Design = <input type="text"/> Commercial Confidentiality Traffic Management = <input type="text"/>	1.316
Decrease Mitcham Common CGS	Chessington PRS / Worcester Park CGS design upsizes + new feasibility study for Holder site clearance = Upsize Blackheath Common CGS and delay GD1 project into GD2 =	3.588

* Costs for the options considered have been prepared using average contracted rates at depot level and validated against known costs for similar, completed projects. All costs inclusive of Overheads & Efficiencies.

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 South London 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 95% peak demand by winter 2022/23, putting at risk supplies to 10,000 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 – Replace Mitcham Common CGS.

Option 1. Involves replacement of Mitcham Common CGS with a larger capacity rig, in the existing above ground installation, with adjacent land to be acquired for any compound extension.

Pre-emptively Repair: Option 2 – Reduce Mitcham Common CGS.

Option 2. Place Settings restriction of 1.3bar (currently 1.4bar) on Mitcham Common CGS, to restrict flow below CGS Capacity. Stations on integrated London MP system will require significant modifications to planned PRS / CGS replacement projects at Worcester Park and Blackheath Common.

Table 6 – Summary of Key Value Drivers

Option No.	Desc. of Option	Key Value Driver
1	Replace Mitcham Common CGS	Least cost industry solution for maintaining London MP throughout GD2 period 2021-2026 and beyond.
2	Reduce Mitcham Common CGS	Would extend life of existing Mitcham Common CGS, avoiding direct reinforcement in GD2. Maintains London MP throughout GD2 period 2021-2026 and beyond.

8.2 Business Case Summary

This project is driven by the requirement to maintain Security of Supply to our existing and proposed customers, throughout the RIIO-GD2 period 2021- 2026.

Table 7 - Business Case Matrix

	Replace CGS Unit	Reduce CGS Settings
Capex (£m)	1.316	3.588
Number of Interventions	New CGS within existing compound or adjacent site in Mitcham Common.	Reduce setting of CGS to avoid capacity breach in GD2, with impact on major projects in both GD1 & GD2.
Design Life	10 Years	10 Years
Positive Benefit (Pros)	Maintains SGN licence Obligations to maintain Security of Supply whilst accommodating notified growth up to 2031. Site is to remain within Mitcham Common Compound where possible to avoid extra siting costs in Mitcham Common.	Maintains SGN licence Obligations to maintain Security of Supply whilst accommodating notified growth up to 2031. Avoids need to replace Mitcham Common CGS in GD2.
Negative Impact (Cons)	May not be able to replace in existing compound and obtaining an adjacent site within Mitcham Common may not be possible.	Significant impact on existing Major Project at Worcester Park Holder clearance, requiring re-run of feasibility study. >£2m GD1 project at Blackheath Common CGS would be delayed into GD2 which should be avoided.

All costs inclusive of Overheads & Efficiencies.

9 Preferred Option Scope and Project Plan

9.1 Preferred option

Pre-emptively Repair: Option 1. Replacement of Mitcham Common CGS with a larger capacity rig.

9.2 Asset Health Spend Profile

Existing Mitcham Common CGS expected to breach capacity by 2022/23, requiring CGS Reinforcement by replacement to be completed by 1 October 2022, to ensure Security of Supply.

Subsequently all spend is expected within Financial Year 2022/23, with all CGS workload laid in 2022.

Table 8: Asset Health Spend Profile (£m)

Asset Health Spend Profile (£m)						
Pre GD2	2021/22	2022/23	2023/24	2024/25	2025/26	Post GD2
0	0	1.316	0	0	0	0

All costs inclusive of Overheads & Efficiencies

9.3 Investment Risk Discussion

Gas demand growth has been based around current Local Plan projections for new housing within RIIO-GD2 period 2021-26, with new CGS design providing for future capacity needs beyond 2026 to the limit of the Local Plan in 2031.

Risk exists if 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 modified to suit at that time.

SGN has 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 the time of construction. Examples of such could include unforeseen increases in contractor rates driven by a surplus of market demand for labour or 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. Further details of this 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 UK 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. We recognise there have been preliminary government targets set facilitating a move toward a renewable or low carbon heat solutions by the end of RIIO-GD2. As such, throughout RIIO-GD2 we will continue to closely monitor this emerging heat strategy with a view to refining any potential impact on current growth forecasts.

Appendix A - 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.