Natural Gas Utility
Asset Management Plan
2024

Contents

1.0 Introduction

This asset management plan is intended to meet the requirements of Ontario Regulation 588/17 for Asset Management of municipally owned assets in Ontario. The structure of this report closely parallels the sections outlined in the regulation.

Utilities Kingston is a corporation dedicated to the operation and maintenance of the City's Water, Wastewater, Gas, Electric and Fiber Utilities. Utilities Kingston is an asset management corporation responsible for ensuring that the five utilities are operated effectively, efficiently, safely, and reliably. This is reflected in the Utilities Kingston Mission, Vision, and Values:

- Mission: Our mission is to manage, operate, and maintain community infrastructure to deliver safe, reliable services and a personal customer experience.
- Vision: Our vision is to advance the unique multi-utility model to benefit our customers and build better communities.
- Values: Our values are safety, integrity, innovation, and reliability.

Asset Management is current best practice. As an Asset Management system is formalized, adopted, and entrenched in the organization, it is expected that it will provide:

i) Stronger governance and accountability,
ii) More sustainable decision-making,
iii) Enhanced customer service,
iv) More effective risk management, and,
v) Improved financial efficiency.

Utilities Kingston identifies Asset Management as a corporate priority for the next several years. Asset Management does not begin or end with this document. Asset Management has been the core function of Utilities Kingston since its inception. This plan documents the current asset data and system performance indicators in accordance with Ontario Regulation 588/17.

This version of the Gas Asset Management Plan is intended to be the last revision prior to adopting new asset management practices. Utilities Kingston is embarking on major overhaul of how Asset Management is done within the company. Further work is presently underway to advance the methodologies and framework for asset management at Utilities Kingston and many of these changes and improvements will take effect after the current regulatory obligation is met. It is expected and acknowledged that future work is anticipated to be done within the new Asset

Management framework that will positively impact the Asset Management Plan and practices for the gas utility.

1.1 Asset Management Strategy

The Asset Management Strategy for the Natural Gas Distribution Utility utilizes the following principles:

- Risk Management is a primary trigger for asset replacement, or major system upgrade.
- Growth is the primary trigger for new asset construction, facility, and system expansion/upgrades.
- Maintenance activities will otherwise be responsible for maintaining adequate condition and function of assets and provide the lowest lifecycle cost.

Asset management at Utilities Kingston is comprised of four predominant categories of effort:

1. Infrastructure Planning – These studies focus primarily on growth and ensuring that infrastructure meets the growth-driven needs of the city.
2. Risk Assessment – These efforts focus on steps required to determine the risk associated with assets and make appropriate maintenance, upgrade, and replacement decisions. This includes assessment of criticality and condition.
3. Lifecycle Decision-Making – This process focuses on use of lifecycle knowledge to determine the most suitable solution for addressing deficiencies identified in Items 1 and 2 above.
4. Maintenance Management – This is the de facto means of maintaining assets in absence of triggers for asset replacement or major upgrade.

Presently, Asset Management system and processes are undergoing organizational changes and improvements. It is anticipated that key components of the Asset Management process will be subject to change in the next year or two.

2.0 Current Level of Service

Item 5-1 of O. Reg 588/17 requires a description of the current level of service for all asset categories. In the case of non-core assets such as the Natural Gas Distribution System, the level of service is to be based on qualitative descriptions and internally defined metrics.

This version of the Asset Management Plan considers Leak Rate to be the primary indicator of the level of service. Future iterations may work to also incorporate other reliability metrics which include Outages and Incidents. Some discussion of each of these factors is included below.

2.1 Current Practices & Tracking of Parameters

It is proposed to use existing datasets as a starting point for level of service key performance indicators. Existing Canadian Gas Association (CGA) Incident Data and CGA Corporate Profile data set are already being worked on as part of our business. The CGA database represents a collection of key information that has been collected by gas companies across Canada. It is important to leverage this data set because it is time-tested and well vetted by companies who devote substantial resources to this area. ***Table 2.1.1 Complete List of Incident Data Parameters*** below lists the various data that should already be tracked, stored and maintained.

Table. 2.1.1 – Complete list of Incident Data Parameters

Cause:	**Sub-Cause:**
Corrosion Degradation	Metal Loss
	Metal Cracking
	Plastic Degradation
	Seal Degradation
External Interference	1st or 2nd Party
	3rd Party
Incorrect Operation	Improper Operation
	Insufficient Procedures
Material, Manufacturing or Construction Defect	Pipe Body
	Pipe Joining
	Other
Natural Forces	Geotechnical
	Wildfire
	Wildlife / Animal
Unable to Classify	-

These data bases are proposed to be used as a starting point in future iterations of the Asset Management Plan. Further work is required to develop reliable and meaningful data each for indicator. Not all incidents are captured, and not all incident categories will have data each year.

Third party damage is a significant risk to the pipeline system with approximately 1/3 of pipeline incidents involving damaged caused by third parties excavating in the vicinity of gas mains. Third party damage is the focus of the Ontario Regional Common Ground

Alliance (ORCGA) data which contains data related to the asset being struck. Data parameters related to natural gas distribution level of service is presented in ***Table 2.1.2 Selected ORCGA Data Parameters*** below.

Table 2.1.2 Selected ORCGA Data Parameters

Asset Class	Material Type
Size	Location
Outage Duration (if any)	# of Customer Affected by Outage (if any)

The ORCGA report is a mandatory data set that UK Gas maintains for regulatory purposes outside of the Asset Management Plan. In future iterations of the Asset Management Plan, it could be possible to use portions of this data as it relates to Asset Management key performance indicators the current Level of Service.

2.2 Level of Service Metrics

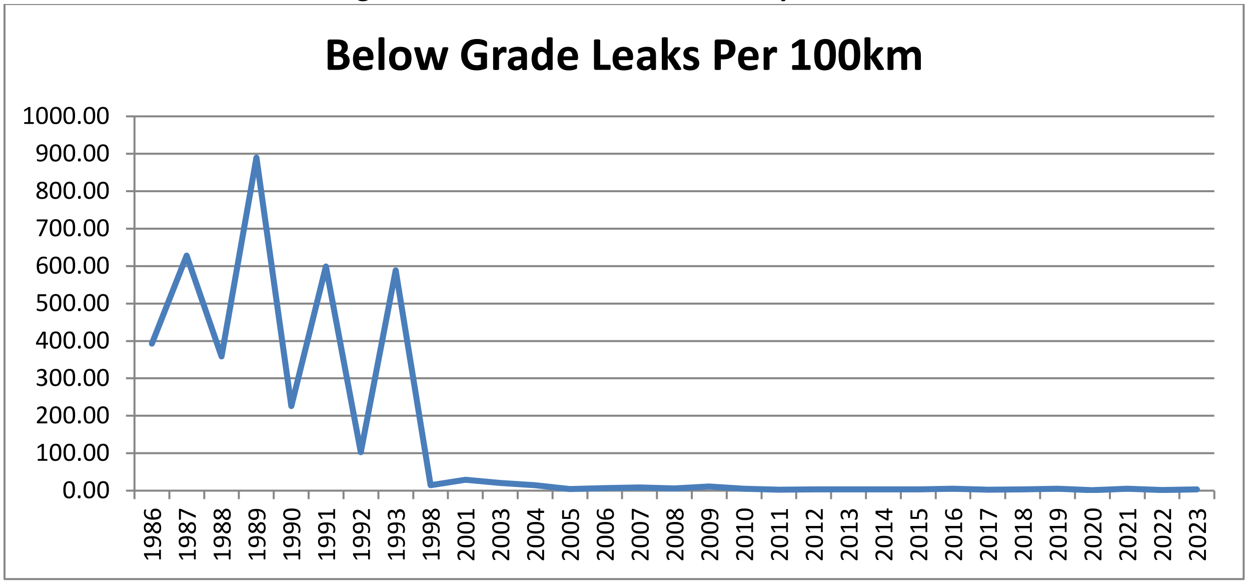
The most relevant data from the above mechanisms could be considered to describe the level of service for the natural gas system. However, at the timing of writing of this report, the level of service metric to be considered is the leak rate. Additional data parameters will require more work to be included herein, and at the time of writing insufficient time/resources were available.

2.2.1 Leak Rates

The leakage rate for below grade piping is presently defined as the key indicator of system health and Level of Service. ***Figure 2.2.1.1 Below Grade Leaks per 100km*** below shows the leak rate observed in the Utilities Kingston distribution network. It is important to note that in any given year only a portion of the entire grid is surveyed. The leakage survey program divides the gas grid into sections and inspects based on a 5-year maximum inspection interval and annually for selected areas of interest. Leak rate data for above grade piping is tracked separately because is generally not an indicator of pipeline condition. Instead, it is tracked separately due to its importance to greenhouse gas (GHG) emission reduction. The leak rate reported below includes the quantity of below grade leaks per 100km of pipelines surveyed in a given year.

Leaks can occur due to deterioration of the materials such as in the case of corrosion. Pipeline leaks can also occur due to other factors including construction or material defects which may affect an asset prior to age and condition related factors becoming an issue.

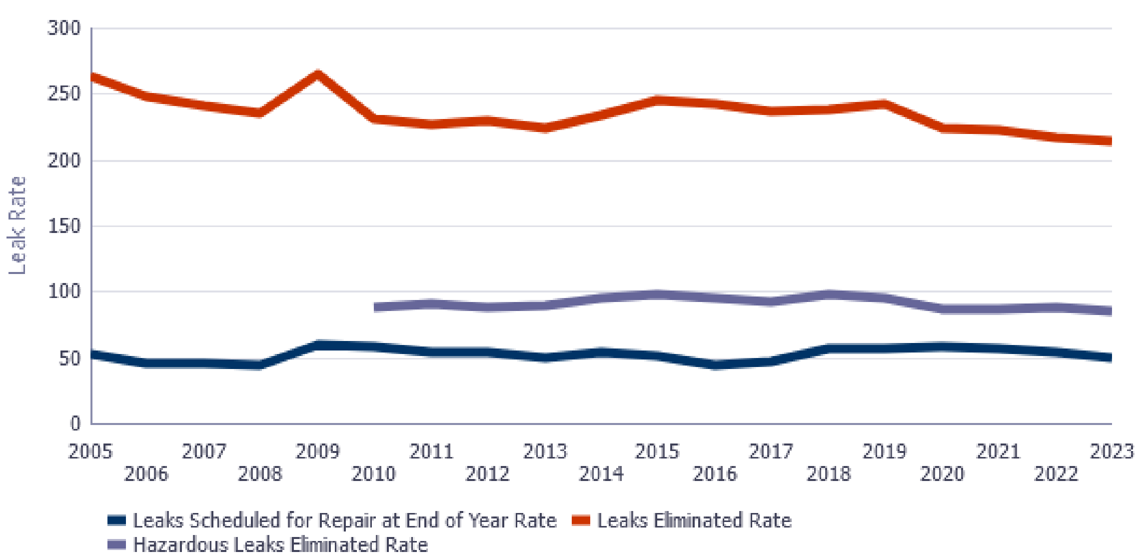
Figure 2.2.1.1 Below Grade Leaks per 100km



To compare the above Level of Service data to a baseline, the US National Pipeline Performance Measures data can be used. Gas Distribution data is collected by the US Pipeline and Hazardous Materials and Safety Administration (PHMSA) and it represents aggregation of data from nearly 2.24 million kilometers of gas distribution main and 72 million gas services.

For comparison purposes, the PHMSA natural gas distribution leak rate data is presented below in ***Figure 2.2.1.2. PHMSA Leak Rate Data***.

Figure 2.2.1.2 PHMSA Leak Rate Data



When comparing Utilities Kingston data to other data sets it is important to ensure that the definition of each parameter is the same. PHMSA defines leak as an unintentional escape of gas from the pipeline. And it clarifies that a non-hazardous release that can be eliminated by lubrication, adjustment, or tightening, is not a leak. Utilities Kingston leak detection program data differentiates leaks by above vs below grade. To simplify the comparison between data sets, below grade leaks are assumed to be those that cannot be fixed by adjustment, tightening or lubrication, while above grade leaks are. Based on experience with how and where gas leaks occur in our system, this assumption is believed to be valid. Using this assumption, we can compare Utilities Kingston leak rate data to that of PHMSA:

Table 2.2.1.1 Leak Rate Level of Service

Year	**Below Grade Leaks Per 100km**	
	UK	**PHMSA**
2022	2.13	13.56
2023	3.49	13.38

As required by the asset management regulation, the current level of service metrics are presented in ***Table 2.2.1.1 Leak Rate Level of Service*** above. The current leak rate at Utilities Kingston compares favorably to the American nation-wide average represented by the PHMSA data.

3.0 Current Asset Performance

Asset performance of the Natural Gas System at Utilities Kingston is presently indicated by the hydraulic conveyance of an asset relative to its maximum capacity. This is intended to inform the amount of capacity remaining in system assets.

The following sections review the relative capacity of linear assets including the intermediate and high-pressure networks, as well as the non-linear regulating station assets. This data is included here to represent the current performance of natural gas assets, in accordance with the Ontario regulation for asset management.

3.1 Linear Assets

The current performance of linear assets is inferred by comparing the upstream pressure to the downstream pressure for an asset. Data for this work is obtained through pressure monitoring programs which generate data. Using knowledge of pipeline system capacity, it is possible to compare the data points and provide insights into the current performance of an asset.

Figure 3.1.1 City Line Pressures

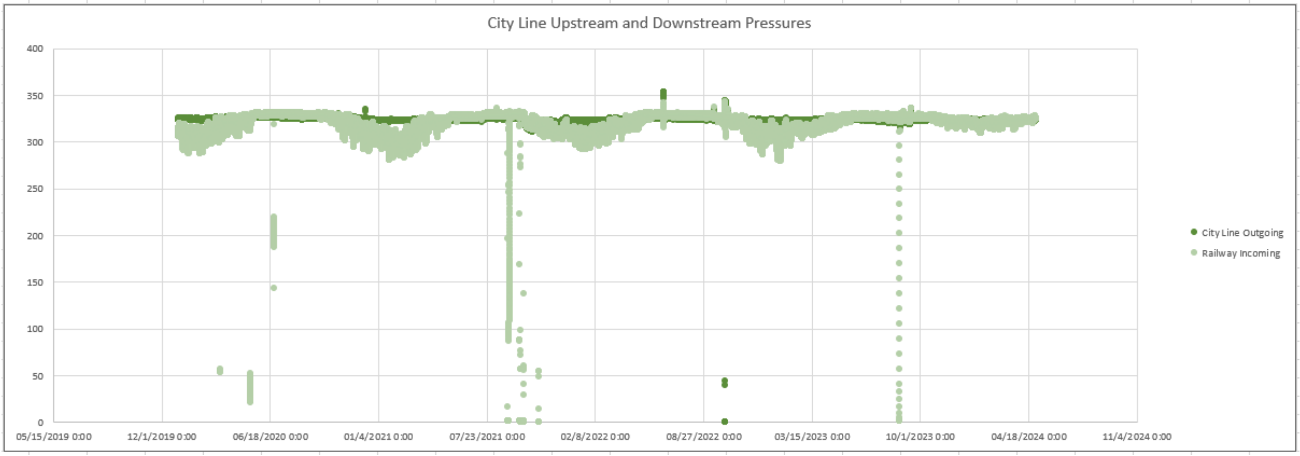


Figure 3.1.1 City Line Pressures above includes data from pressure sensors located at the most upstream and most downstream locations on the pipeline. Some outlier datapoints appear within the data set which appear as brief drops in pressure, occasionally approaching zero. It is believed that these anomolies in the data are generated by maintenance procedures where sections of the pipeline containing the sensor have been subject to maintenance. Data anomolies have been excluded from the analysis.

Figure 3.1.2 Queens Line Presures

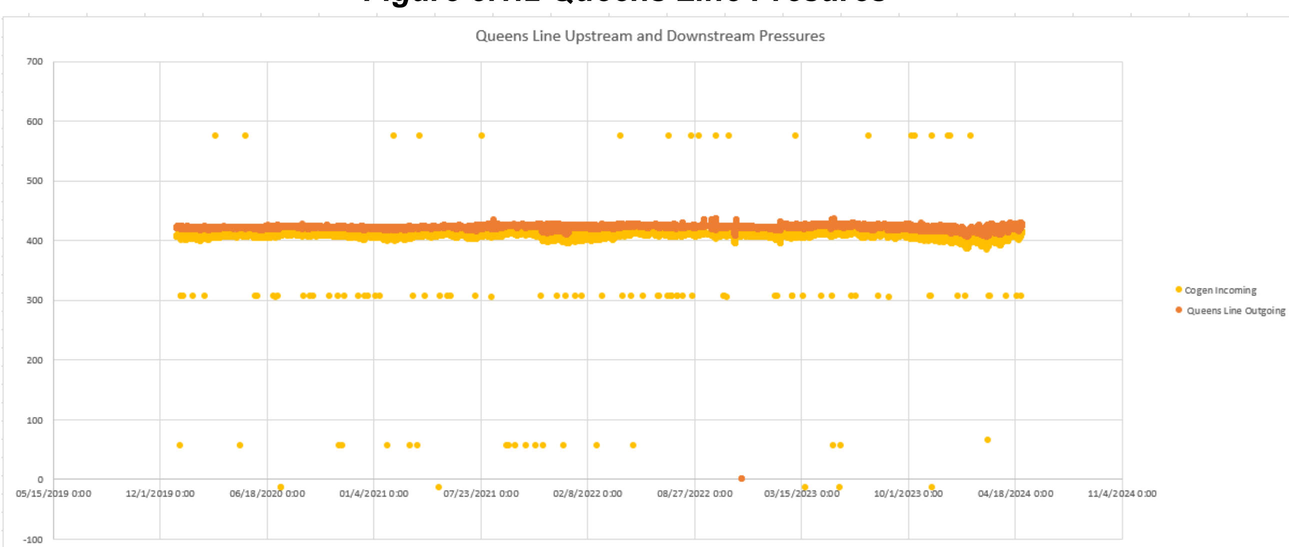


Figure 3.1.2 Queens Line Pressures shows data collected from the sensors installed at the most upstream location, “Queens Line Outgoing”, as well as the most downstream location, “Cogen Incoming”. The data contains some noise but otherwise trends with the downstream pressure closely aligned with the upstream pressure.

Some of the extraneous data points above and below the trendline are believed to be caused by readings taken at or near the same moment in time when the power plant downstream switches instantaneously off/on with a load which ranges from 5,000 to 20,000 Sm3/hr. The system quickly compensates this brief imbalance, but one reading per on/off event persists in our data. Again, data anomalies have been excluded from the analysis.

Table 3.1.1 Capacity of High-Pressure Linear Assets

	P1	P2	P2/P1	Utilized Capacity
	(psig)	(psig)	-	(%)
City Line	325	280.1	0.86	45
Queens Line	421	383.9	0.91	35

The minimum acceptable downstream pressure for the Queens line is 400psi due to the sales agreement in place with Queens University. With an Maximum Operating Pressure (MOP) of 475psi and the 400psi constraint downstream, this pipeline will only ever achieve approximately 45% of its unconstrained pipeline capacity.

Table 3.1.1 Capacity of High-Pressure Linear Assets above summarizes the current asset performance for this asset class and is presented in keeping with the requirements of O.Reg. 588/17.

3.1.1 Intermediate Pressure Network Data

Downstream pressure within the Intermediate Pressure network is the limiting factor in available system capacity and is a highly critical performance indicator. This data can inform Utilities Kingston about the headroom available to connect new customers without investing in capital expansion projects.

To gather this data, Electronic Volume Corrector (EVC) meters are utilized. EVC meters use real-time pressure data to make their volumetric metering calculations. This data was obtained by implementing changes to the data collection and retention mechanisms of existing meters by the Gas and Metering departments working together. The program began collecting data at certain locations in November 2020.

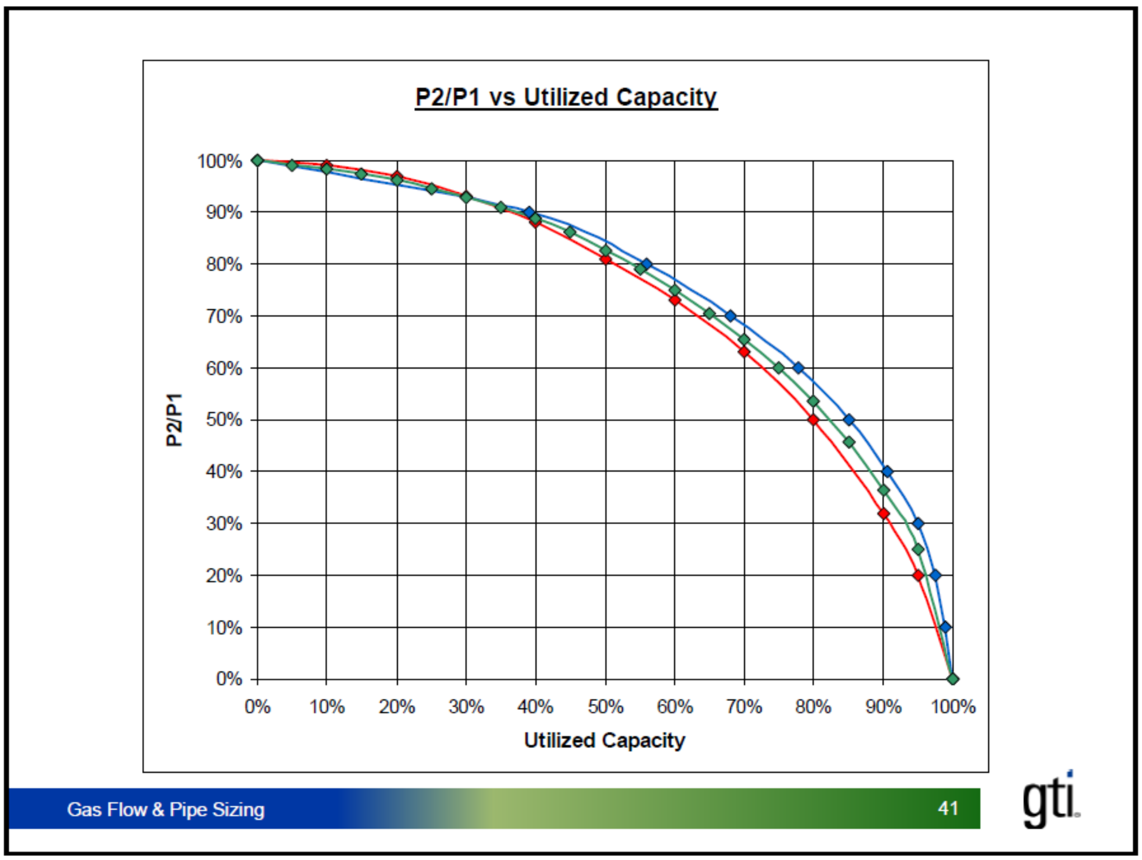
Table 3.1.1.1 Capacity of Intermediate Pressure Linear Assets

	P1	P2	P2/P1	Utilized Capacity
	(psig)	(psig)	-	(%)
1000 King W	48.8	34.4	0.70	65
7 Earl St	48.8	36.5	0.75	55
8 River	50	41.6	0.83	50
100 Portsmouth	48.8	33.5	0.69	65

Table 3.1.1.1 Capacity of Intermediate Pressure Linear Assets above summarizes the comparison of upstream and downstream pressures for the intermediate pressure network. It can be observed that intermediate-pressure network is closer to its maximum capacity than the high-pressure network.

To further inform the analysis and current asset performance, ***Figure 3.1.1.2 Pressure Drop vs Utilized Capacity*** is presented. It can clearly be seen that as a system approaches its maximum capacity, the pressure ratio falls off steeply in a non-linear fashion. The shape of this curve suggests for pressure drop ratios less than 0.5 the risk of exceeding available capacity would increase sharply. To manage this risk, it is suggested that a pressure drop ratio of 0.5 be used as a limit where capacity upgrades would be triggered. This figure corresponds to approximately 80% of a pipeline system's utilized capacity.

Figure 3.1.1.2 Pressure Drop vs Utilized Capacity



The data presented above is based on pressure monitoring at certain selected locations within the system which are used as indicators for the overall pipeline configuration. Locations were selected due to the available technology already in place, and where pressure drops to the customer would be the greatest. ***Figure 3.1.1.3 Map of Intermediate Pressure Monitoring Locations*** below shows where each monitoring location is.

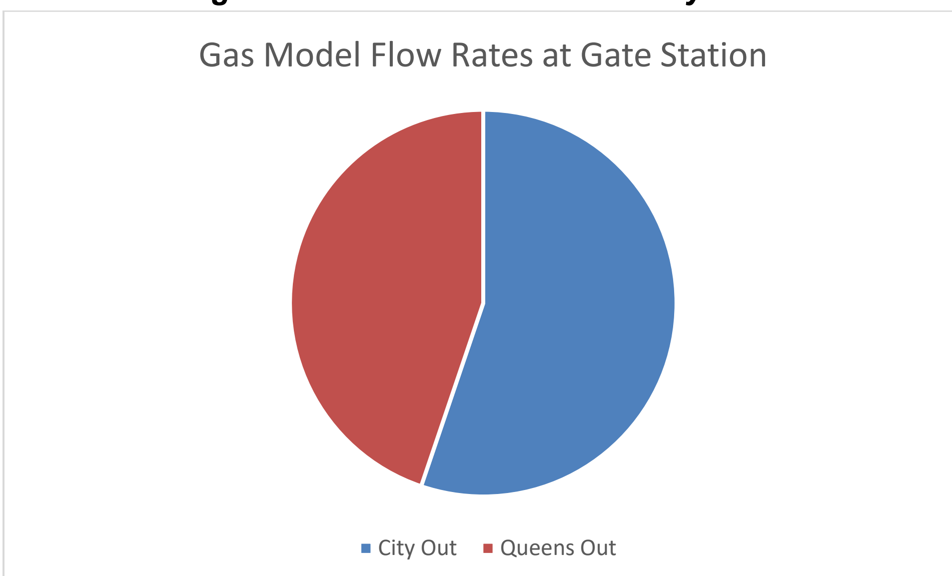
Figure 3.1.1.3 Map of Intermediate Pressure Monitoring Locations

3.2 Facilities

When gas is received into our system flow is split at City Gate Regulating Station #1 into two high-pressure distribution mains. Relative flow rates for these two lines are shown below in ***Figure 3.2.1 – Flow Rates from City Gate***.

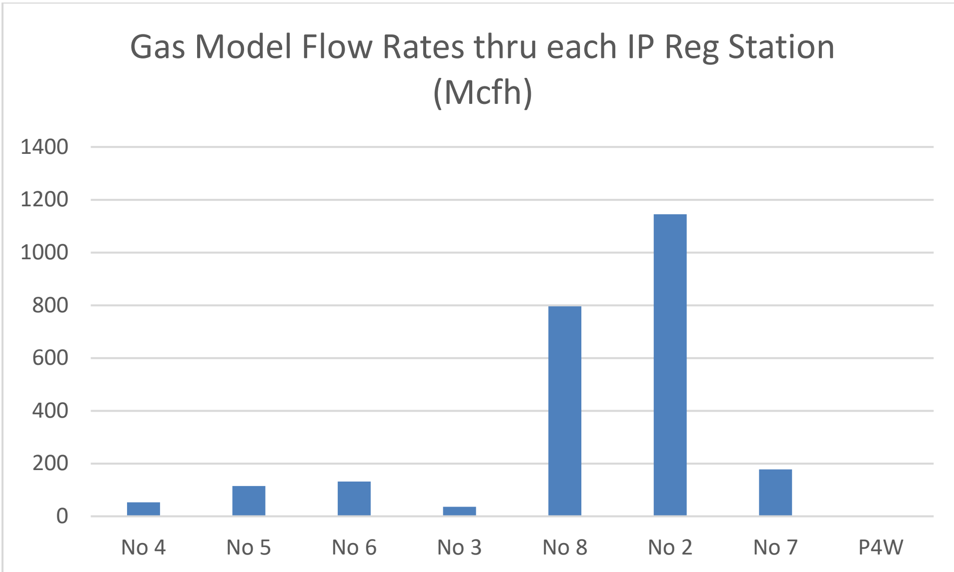
The City Line was originally installed in 1958 and its primary purpose is to feed Regulating Station No. 2 Railway St. Customers on the east side of the distribution system are fed from this supply, based on demand and the resulting relative pressures within the intermediate pressure network. The Queens line was installed in 2006 in order to provide high-pressure and high-volume gas supply to the Queens University Combined Heat and Power (CHP) plant located on the shore of Lake Ontario.

Figure 3.2.1 – Flow rates from City Gate



The second step in gas distribution is the transition from the high-pressure lines to the intermediate pressure distribution piping network. In this case, metering data is not available because these stations are not equipped with meters. Instead, flow rate estimates provided by hydraulic modelling software can be utilized. The flow rate for each of these regulating stations is presented below in ***Figure 3.2.2 Gas Model Flow Rates at each Intermediate Pressure Regulating Stations***.

Figure 3.2.2 Gas Model Flow Rates at each Intermediate Pressure Regulating Stations



Ontario Regulation 588/17 requires that the Current Asset Performance be described for all assets. This data is presented in ***Table 3.2.1 Regulating Station Capacity Utilization*** and ***Table 3.1.1.1 Capacity of Intermediate Pressure Linear Assets*** below.

Table 3.2.1 Regulating Station Capacity Utilization

Station	EstimatedFlow Rate (Sm3/hr)	Capacity (Sm3/hr)	% Utilized
No 1	40,000	50,000	80%
No 2	18,661	40,000	47%
No 3	588	6,800	9%
No 4	867	8,500	10%
No 5	1,864	8,500	22%
No 6	2,141	6,800	31%
No 7	2,903	6,800	43%
No 8	12,977	8,500	153%

In conclusion, the system has some level of surplus capacity which varies depending on the asset class. Intermediate pressure regulating facilities as well as intermediate pressure distribution mains are the most constrained components of the system.

4.0 Asset Summary

Item 4 of Ontario Regulation 588/17 requires the following items for each asset category.

i. A summary of the assets
ii. Replacement costs of the assets
iii. Average age of the assets
iv. Asset condition information
v. Description of condition assessment methodologies

This section will include descriptions of items (i) through (v) with items (iv) and (v) being covered further in the subsequent section, titled Risk Management.

4.1 Summary of Assets

Utilities Kingston primary inventory of gas distribution infrastructure assets is contained within an Enterprise GIS system administered by Utilities Kingston. ***Table 4.1 Overview of Natural Gas Utility Assets*** presents a summary of the Asset Classes for the Natural Gas Utility and an indication of whether or not they are currently contained within the GIS Asset Inventory.

The following information has been included in previous iterations of the Asset Management Plan for Natural Gas assets, and it has been updated for 2024. These updates are based on various corrections which include:

- 2024 work fixed an error with the old plan that counted excess flow valves as service shut off valves in one combined total. Now they have been appropriately separated.
- The quantity of anodes is recognized to be too low. Only anodes installed recently are represented in this data.
- Other fitting information is available but not included due to concerns about data quality and limited benefit to the analysis.
- Maximum Operating Pressure (MOP) of City and Queens pipelines have been updated to reflect actual MOP instead of Operating Pressure.
- Total length of high-pressure assets is 11.1km consistent with 2015 data.

Table 4.1 Overview of Natural Gas Utility Assets below includes a summary of the assets grouped by asset category including total quantity of each item, by size.

Table 4.1. Overview of Natural Gas Utility Assets

Group		In GIS Inventory?	Sizes (in.)	Quantity (No.)
Valves	Mainline Valves	✓	1.25 to 12	1398
	Grasshopper Valves	✓	2 to 12	20
	Service Shut-off Valves	✓	0.5 to 6	1257
	Excess Flow Valves	✓	0.5 to 1.25	1442
Cathodic Protection	Locate Stations	✓	-	69
	Cathodic Test Points	✓	-	268
	Anodes	✓	-	123
	Insulators	✓	-	21
Regulating Stations	City Gate Station	✓	-	1
	Railway Station	✓	-	1
	District Stations	✓	-	7
Linear Infrastructure	XHP	✓	12 to 6	15.0 km
	HP	✓	8 and 6	11.1 km
	MIP/IP	✓	8 to 1.25	232 km
	Services	✓	6 to 0.5	233 km

Table 4.2 Summary of Linear Asset Quantities below provides additional detail about linear assets in the Natural Gas Utility. This data is contained within the Asset Inventory (Enterprise GIS). Linear assets include all gas distribution mains and services regardless of material.

Table 4.2 Summary of Linear Asset Quantities

Group	Pressure Class	In GIS Inventory?	Pipe Sizes (in.)	MOP	Quantity (km)
Linear Infrastructure	XHP	✓	12 to 6	550	15.0
	HP	✓	8 and 6	375	11.1
	MIP/IP	✓	8 to 1.25	60	232
	Services	✓	6 to 0.5	60	233

Table below provides a more detailed breakdown of linear assets into pressure classes. The majority of the system operates with a Maximum Operating Pressure

(MOP) of 60psig with a normal delivery pressure of approximately 50 psig (gauge pressure in pounds per square inch).

Table

Decade of Installation	Length of Steel (km)	Length of PE (km)
1950's	2.7	0.0
1960's	15.7	0.0
1970's	6.7	0.0
1980's	15.8	38.9
1990's	6.7	82.5
2000's	0.5	25.0
2010's	0.3	20.5
2020’s	0	2.6
Null	6.6	8.1
Sub Total (km)	54.7	177.9
Percent of Total (%)	23.5%	76.5%
Total (km)	232.6	

The above table contains a material breakdown of gas mains by the two major indicators of condition; material type and age. Polyethylene pipe represents approximately 75% of our gas main infrastructure while steel represents approximately 25%.

Quality of the data is an important concern. Upon review of the GIS asset data it appears that a small number of sections of piping were incorrectly labeled as Polyethylene (PE) where they are most likely to be steel based on the year of construction. The above tables have been manually corrected using the knowledge that PE gas mains were not installed until the 1980s.

It can also be seen that material information on linear assets has generally been maintained adequately in the Asset Inventory, however a certain fraction of the infrastructure is missing the year of installation data. This is particularly true in the gas of gas services where nearly 50% of all gas services have an unknown year of installation.

4.2 Replacement Cost

This section of the report summarizes the current understanding of financials for the Natural Gas Distribution assets.

Replacement costs are based on most recently available data sources and include the most-recent rates seen in open market tender results. Unfortunately, cost data for some items such as regulating stations and high-pressure piping were based on certain assumptions and historic rates as available.

*Error! Reference source not found.**.2.1 Asset Replacement Cost*** below provides a summary by Asset Class. More detailed tables for Linear Infrastructure and Non-Linear Infrastructure are provided below.

Table 4.2.1 Asset Replacement Cost

Non-Linear	Valves	3529	each	$6,230,500
	Regulating Stations	9	each	$6,491,300
	Test & Locate Stations	319	each	$774,300

Linear	Mains	246463	m	$523,512,150
	Services	224099	m	$81,936,000
	High and Extra High Pressure	26003	m	$105,920,100

4.2.1 Linear Assets

Error! Reference source not found. ***Linear Asset Replacement Value Summary*** below provides a detailed breakdown of the replacement cost valuations for Linear Infrastructure Assets.

Table 4.2.1.1 Linear Asset Replacement Value Summary

Group	Size	Quantity	Units	2024 Unit Rate	Replacement Cost (2024)
Services	12mm (1/2")	12808	each	4600	$58,916,800
	19mm (3/4")	967	each	5200	$5,028,400
	25mm (1")	526	each	5500	$2,893,000
	32mm (1-1/4")	1892	each	5900	$11,162,800
	50mm (2")	488	each	6500	$3,172,000
	75mm (3")	20	each	12500	$250,000
	100mm (4")	21	each	15000	$315,000
	150mm (6")	6	each	28000	$168,000

	200mm (8")	1	each	30000	$30,000
	Subtotal	*16729*	*each*	-	*$81,936,000*
IP Mains	25mm (1")	296	m	1500	$444,000
	32mm (1-1/4")	14958	m	1600	$23,932,800
	50mm (2")	150201	m	1800	$270,361,800
	75mm (3")	12877	m	2250	$28,973,250
	100mm (4")	27940	m	2250	$62,865,000
	150mm (6")	16508	m	2700	$44,571,600
	200mm (8")	23683	m	3900	$92,363,700
	Subtotal	*246.463*	*km*	-	*$523,512,150*
High Pressure (City Line)	50mm (2")	913	m	3000	$2,739,000
	75mm (3")	25	m	3000	$75,000
	150mm (6")	117	m	3300	$386,100
	200mm (8")	10000	m	3900	$39,000,000
	Subtotal	*11055*	*m*	-	*$42,200,100*
Extra High Pressure (Queens' Line)	100mm (4")	28	m	3000	$84,000
	150mm (6")	9	m	3300	$29,700
	200mm (8")	5822	m	3900	$22,705,800
	300mm (12")	9089	m	4500	$40,900,500
	Subtotal	*14948*	*m*	-	*$63,720,000*
LINEAR TOTAL					**$711,368,250**

Various updates were necessary to reflect current market conditions and to improve cost estimates. Cost information was also revised to include complete costs of construction based on tendered rates obtained for contracts in the 1-million-dollar value range.

- Market Conditions have changed significantly since previous estimates which included construction contracts from 2015 +/-.
- Inflationary pressures and fuel prices.
- Gas Service valuation was switched from a per meter basis to a per service basis in better alignment with industry pricing.
- Construction Practices have been updated to reflect improved construction practices and increased scope of work which includes:
    - Asphalt restoration specifications have increased scope of work and materials required.

- Double block and bleed procedures led to an increase the work associated with tie-ins.
- Soils Management in accordance with Provincial legislation has seen costs increases.

4.2.2 Non-Linear Assets

Table 4.2.2.1 Detail of Linear Infrastructure Replacement Cost Valuations below **Error! Reference source not found.** provides a detailed breakdown of the replacement costs and net book valuations of the Facilities.

Table 4.2.2.1 Detail of Non-Linear Infrastructure Replacement Cost Valuations.

Above Grade Main Line Shut-off Valves (Grasshopper Valves)	50mm (2")	3	M	15000	$45,000
	100mm (4")	2	M	18000	$36,000
	150mm (6")	6	M	20000	$120,000
	200mm (8")	8	M	22500	$180,000
	300mm (12")	1	M	25000	$25,000
	Subtotal	*20*	*M*	-	*$406,000*
Below Grade Service Shut-Offs (Curbstops)	12mm (1/2")	730	Each	1200	$876,000
	19mm (3/4")	427	Each	1300	$555,100
	25mm (1")	156	Each	1500	$234,000
	32mm (1-1/4")	515	Each	1500	$772,500
	50mm (2")	275	Each	1800	$495,000
	75mm (3")	9	Each	3000	$27,000
	100mm (4")	3	Each	3500	$10,500
	Unknown	86	Each	1800	$154,800
	Subtotal	*2201*	*Each*	-	*$2,970,100*
Main Line Valves	32mm (1-1/4")	70	Each	1500	$105,000
	50mm (2")	998	Each	1800	$1,796,400
	75mm (3")	51	Each	3000	$153,000
	100mm (4")	102	Each	3500	$357,000
	150mm (6")	49	Each	4000	$196,000
	200mm (8")	28	Each	6500	$182,000
	300mm (12")	6	Each	8500	$51,000
	Unknown	4	Each	3500	$14,000
	Subtotal	*1308*	*Each*	-	*$2,854,400*
Regulating Stations	Gate Station	1	Each	2500000	$2,500,000

	Railway Reg Stn No. 2	1	Each	1250000	$1,250,000
	District Regulating Station	7	Each	281000	$1,967,000
	Subtotal	*9*	*Each*	-	*$5,717,000*
Test and Locate Stations	Test Stations	261	Each	2500	$652,500
	Locate Stations	58	Each	2100	$121,800
	Subtotal	*319*	*Each*	-	*$774,300*
NON LINEAR TOTAL					$12,721,800

Notes: gas meters not included in above data

Regulating Station replacement costs for Reg Stations #1 and #2 includes much uncertainty. This is because very little comparable cost information is available for large regulating stations of this nature because they are replaced infrequently.

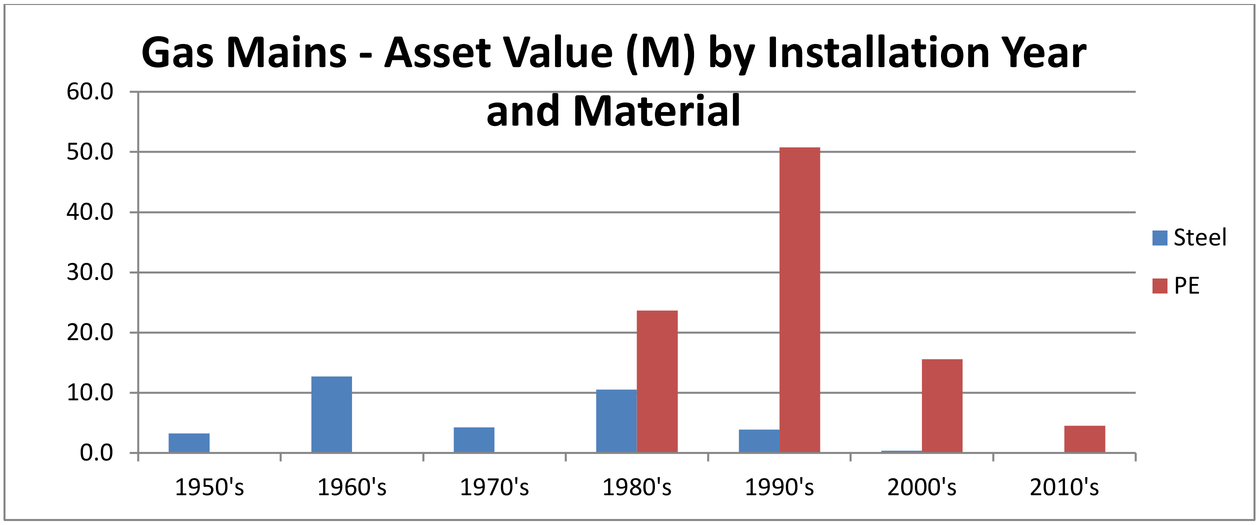
4.3 Asset Age

This section presents the known age information of assets in Utilities Kingston's Natural Gas Utility.

4.3.1 Asset Age of Linear Assets

Figure illustrates the age distribution of Mains. As determined by industry standards and anticipated material performance the anticipated useful life of a gas main is approximately 60 years. However, life-expectancy will vary considerably based on in-situ conditions such as temperature, soil pH, and soil conductivity. Perhaps more importantly, material quality, installation practices and third-party damage can significantly shorten the useful life of a pipeline. Additionally steel mains require more maintenance due to the continual need for adequate cathodic protection, however, the steel mains can last longer than polyethylene which loses strength over time with the rate of decay being a function of residual stresses and ground temperature. Since plastic pipe (medium density polyethylene) is a relatively new material, the overall lifespan is still being understood industry wide.

Figure 4.3.1.1 Gas Main Age Distribution by Material



Roughly 6% of gas mains have unknown age. It should be noted that this is based on an estimated installation year. True installation year is not available or documented in the Asset Inventory for many assets.

Approximately 39% of gas services have an unknown age. Records for the installed gas services are generally not as accurate as the other records in the system. Over the years gas services have been installed and modified by both Capital and Operations groups, perhaps leading to the low level of record keeping. New services are normally installed by capital program with an inspector however repairs, replacements and relocations may have been necessary due to other pipeline work, gas hits, or changes to the building. It may be possible to infer the age of services by observing the constructed year of the adjacent main, however this method will generate errors for all services not replaced at the same time as the gas main. At the time of writing this report the quantity of services with installation dates which match that of the gas main are approximately equal to the number of services which do not match the installation year of the gas main.

Table 4.3.1 Gas Main Age Distribution as % of Expected Useful Life.

era	Length of Steel (km)	Length of PE (km)	% of Remaining Life
1950's	5.3	0.0	-8.3
1960's	20.8	0.0	8.3
1970's	7.0	0.0	25.0
1980's	17.3	38.8	41.7
1990's	6.4	83.3	58.3
2000's	0.6	25.5	75.0

2010's	0.2	7.4	91.7
null	7.9	4.7	-
Sub Total	65.5	159.7	-
% STL / PE	29%	71%	
Total (kms)	*225.1*		

As can be seen in the above table, there are approximately 5 km of gas main which are past due for replacement based on a 60-year life cycle. Similarly, there is nearly 21km which have less than 10% of their life remaining at the time of writing this report. Replacement rates presently are approximately 1.0 km / year which is much less than the 'break-even' replacement rate which corresponds to 3.75km per year.

4.3.2 Non-Linear Assets

Table Summary of Non-Linear Asset Age and Remaining Life below provides an indication of the age of Non-Linear asset upgrades.

Table 4.3.2 Summary of Non-Linear Asset Age and Remaining Life.

	Average Age (years)	Avg Life Remaining (% of total life)	% of Total with Unknown Age
Above Grade Valves	13	74	55
Below Grade Main Valves	25	50	8.5
Curb Stop Service Valves	17	66	25
Test Stations	-	-	86
Meters	-	-	-
Reg Station - City Gate	10	80	0
Reg Station - Railway	40	10	0
Reg Station - District (typical)	5 - 15*	88 – 67	89

Most non-linear assets are currently replaced when the adjacent linear infrastructure is replaced on a life cycle basis. Regulating stations of all sizes are treated separately and have been replaced or upgraded as dictated by the ability of the infrastructure to meet the needs of the utility.

4.3.3 Summary

Asset age is an attribute that is important for evaluating life-cycle decisions and developing average annual expenditure estimates. In accordance with O.Reg. 588/17 the preceding asset inventory and cost information has been provided. Moving forward, it is important to document this information accurately for all asset classes.

4.4 Condition Assessment Information

4.4.1 Linear Asset Condition Assessment Information

Several condition assessment parameters are tracked as it relates to the condition of steel gas mains and services. These parameters include asset age, cathodic protection survey results, and leak history. Consideration has been given to in-line-inspection of high-pressure distribution assets; however both the City and Queens lines are not currently constructed to facilitate this type of work. Costly alterations to both lines would be required to implement this technology. As distribution piping assets, in-line-inspection is not required to be done under the pipeline safety code CAN/CSA Z662-19 as adopted by the Transportation Safety Standards Authority (TSSA).

The Medium Density Polyethylene (MDPE) linear assets comprise just over half of our distribution network and are among the most recently installed gas assets. For the MDPE piping, age is a primary indicator of condition. Incidents are also tracked to help identify systematic material or installation issues.

4.4.2 Facility Condition Assessment Information

Like the linear infrastructure, condition assessment information for the non-linear infrastructure is generally not available. Historically this issue seems to have been handled informally and the stations are believed to be in good shape because most are relatively new.

The district regulating stations are a relatively new addition to the system and all have been installed within the past 10-20 years. Each station receives maintenance as required by code and as detailed in the Utilities Kingston Standard Operating Procedures.

Table 4.4.2.1 Regulating Station Condition Assessment Summary

Asset Class	Current Name	Criticality	Condition
Regulating Station	No.1 City Gate	A	4.0[1]
	No.2 Railway St	B	2.5
	No.3 Division/Weller	C	3.0
	No.4 Dalton Ave	C	3.5
	No.5 John Counter	C	3.5
	No.6 Division St	C	3.5
	No.7 Elliot Ave	C	3.5
	No.8 Sir John A. MacDonald	B	2.5
	No.9 Novelis	C	3.5
	No. 10 P4W	C	4.0

Condition **Information is presented based on interviews with Operations staff. Routine maintenance is performed on the stations in accordance with the Standard Operating Procedures as required by pipeline safety regulations.**

Table 4. 4.4.2.1 Regulating Station Condition Assessment Summary above contains the key for Condition and Criticality grades/scores used in the above condition summary table. Criticality scores are primarily attributed to an asset's redundancy in the system. Assets which are required to be in operation for the gas system to function are assigned the highest Criticality score. Conversely, assets which can be temporarily taken offline without negatively impacting the level of service are assigned a lower Criticality score.

City Gate Station #1 includes redundancy within its design in accordance with gas safety codes, however the station itself has no back-up. Therefore, a Criticality score of A Highly Critical has been assigned. If City Gate station lost gas supply, all customers would be compromised and trigger a safety critical incident response as it returned to operational status which may take several days to work through. All other regulating stations in our system rely on supply from City Gate.

Railway Regulating Station #2 is by far the largest regulating station to feed the Intermediate Pressure Network. At times of high system flows during the heating season of November to March, the capacity offered by this station is essential to maintain sufficient system pressure and gas supply. However, in times of lower system demand, the station could be taken offline without consequence and therefore a Criticality Grade of B has been assigned.

District Regulating Station #8 located at Sir John A MacDonald Boulevard and Johnson Streets has a Criticality Grade of B because its flow rate exceeds that of other District Regulating Stations. Condition Assessment for this station includes physical observations of the internal surfaces which has shown some metal loss within the body of the regulator. The location of the metal loss and wear pattern appears to be consistent with scour caused by high flow rates. The installation of District Regulating #10 in 2023 will help reduce the overloading. However, given the relatively higher criticality and lower asset condition score, District Regulating Station #8 should be considered for remediation.

The other remaining District Regulating Stations have been assigned a Criticality Grade of C because these stations have full redundancy in the system and can be turned-off for maintenance purposes without compromising system performance.

Condition Information is presented based on interviews with Operations staff. Routine maintenance is performed on the stations in accordance with the Standard Operating Procedures as required by pipeline safety regulations.

Table 4.4.2.2 Condition and Criticality Key

Criticality Grade	Description	Condition Score	Description
A	Highly Critical: significant facility and/or substantial consequence of failure	≥4.0	Excellent condition
B	Moderately Critical: moderately-sized facilities with moderate consequence of failure	3.5-4.0	Good condition
C	Low Criticality: Small or very small facilities, often with redundancy or minimal consequence of failure	3.0-3.5	Satisfactory condition
		2.0-3.0	Poor condition
		<2.0	Very poor condition

4.5 Condition Assessment Methodologies

The following sections contain information about the various condition assessment methodologies utilized on the Natural Gas Distribution assets.

4.5.1 Passive Data Gathering System

High pressure pipelines are subject to a passive data gathering system which leverages the multi-utility model to obtain asset information without the expenses involved in proactive test pit programs.

Figure 4.5.1.1 GIS Based Data Gathering System

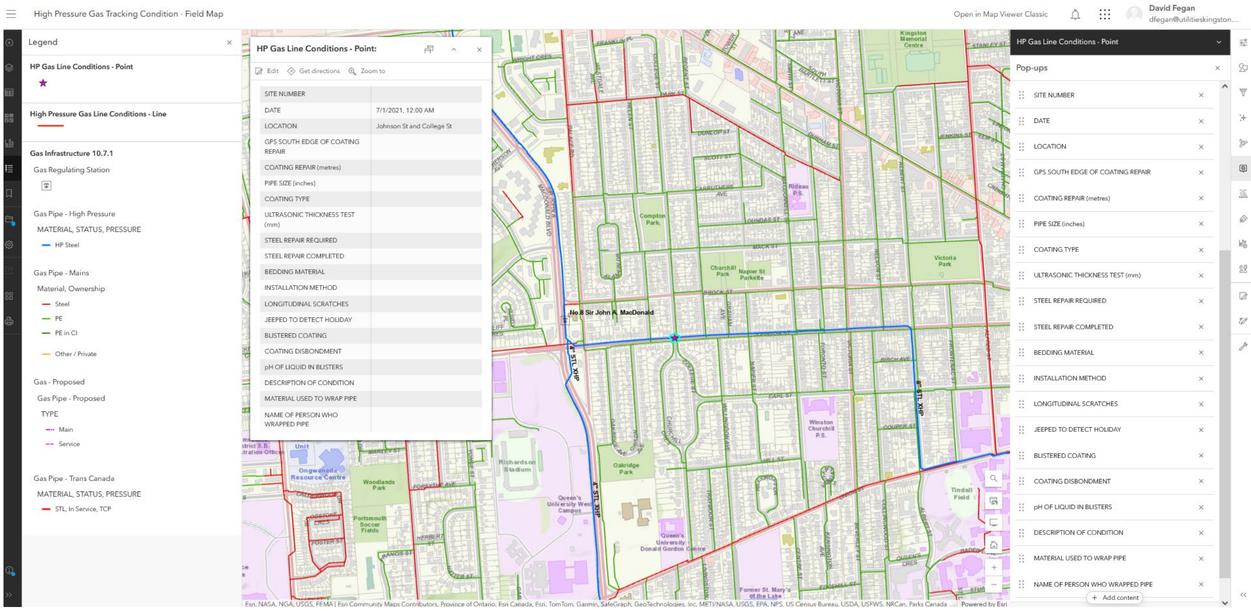


Figure 4.5.1.1 GIS Based Data Gathering System above screenshot of the GIS interface shows the various fields that can be captured. These include ultrasonic thickness testing results, coating damage information, and various other parameters that relate to pipeline condition.

This program is in its initial stages but offers the benefit of gathering condition assessment information without the significant expense associated with tradition test pits. Using Utilities Kingston's multi-utility model there are many opportunities to gather condition information about the Natural Gas Distribution assets when Water and Wastewater reconstruction work is undertaken such as, daylighting when new crossings are installed, and other excavations such as those done for watermain relining.

4.5.2 Leak Survey

Leak surveying is performed at regular intervals according to the Leak Detection Program as documented in policy document GG-01-07 Leakage Survey Programs. The table below summarizes and describes the leak detection work included in the policy.

Table 4.5.2 Leak Survey Program Summary

Survey Program Elements	Method	Frequency	Asset Types	Completion Timeline (Projected)
Building Survey - Basement Meter & Regulator	Walking	Annual	All Basement Meters & Regulators	January to March
Main and/or Service Repairs	Walking	Event Driven	Mains & Services	Target 30-60 days post repair
Special Surveys	Walking	Event Driven	Survey Mains and Services in designated area	As determined by Engineering or Operations
Sewer & Water Main Replacement	Walking	Project Driven	Mains & Services	Survey upon project completion
Blasting Areas	Walking	Project Driven	Mains & Services in designated area	Based on review of Blast Project Daily post Blasting 30 Days post completion
Over Pressure Event	Walking	Event Driven	Mains & Services in determined area	As determined by Engineering
Commercial District	Walking	Annual	Mains& Services	April to October
Distribution System	Walking	5 Year Cycle	Mains& Services	April to October
High Pressure Mains	Walking	Annual	HP& XHP Mains Includes Novelis Service	April to November
Gate Station and HP Delivery Stations	Walking	Annual	City Gate Railroad Station All HP Regulating Stations	
Rooftop Main and Services	Walking	Annual	Mains & Services	April to October

Leaks are identified and reported with records kept on file. Repair work is performed within a timeline which is prescribed by policy depending on the severity of the leak and its subsequent leak classification (A, B, or C).

4.5.3 Cathodic Protection

The Cathodic Protection system is a passive system relying on sacrificial anodes distributed throughout the network of steel mains to ensure that the pipelines are protected. The current system relies on direct measurement of the pipe-to-soil potential difference at each test station, on an annual basis. These measurements are reviewed and areas which need additional protection have additional anodes installed.

The intent behind the program is sound however much room for improvement exists to obtain consistent data and to act consistently based on that data.

There is a need to revisit test station installation practices to ensure uniformity between the various installations. Presently wires of various colors are used, sometimes with regard to what the color might mean, and sometimes not. The locations of the test points are not very well understood although some do appear on the GIS. As an example, when reviewing potentials for the City Line the location of the stations was not known, and the report occasionally refers to a test station numbers that are not shown anywhere else – neither on physical labels nor in the GIS data. As a result, a certain amount of preparation work was required before embarking on a potential survey. Further, physical spacing between test station locations is too large in many cases and more stations are recommended.

There may also be a need to revisit the standard operating procedures to remind field staff of the construction details regarding where steel and plastic pipe systems meet. Many reports have been received where the tracer wire for the plastic system has been connected to the steel system, a practice which weakens the cathodic protection levels.

4.5.4 District Regulating Stations

District Regulating Stations are subject to condition assessment by way of physical observations during maintenance work. The Risk Assessment framework includes a mechanism to formally gather qualitative information regarding the condition of the asset. This includes operator observations make during disassembly for maintenance purposes.

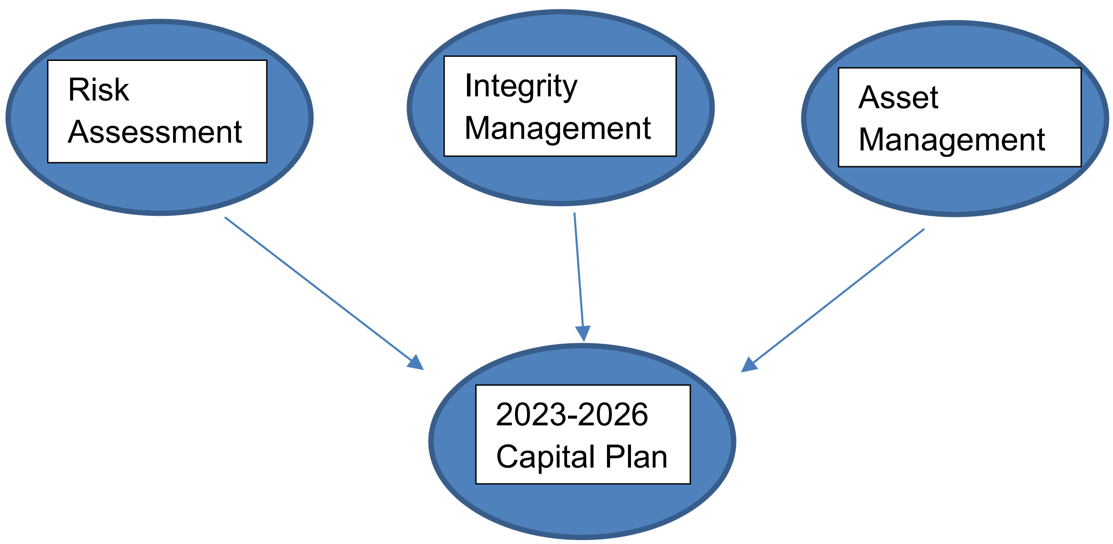
5.0 Risk Assessment

The following describes the Risk Assessment process and the methodology by which the 2023 – 2026 Capital Plan was determined.

The 2020 TSSA Audit Recommendation #5 was to improve Risk Assessment process, with the goal of achieving compliance with the guidelines laid out in the gas code Z622 in Annex N.   UK therefore embarked upon Risk Assessment process updates in early 2022 with the new processes rolled out to staff in Q3. Further improvements to the risk assessment process and methodology are contemplated over the next few years based on resource availability, data maturity, process documentation etc.

Therefore, the approach utilized below reflects a balance between limited available resources and the overall goal of improving our risk assessment approach to include better documentation.

5.1 Risk Assessment Methodology



5.2 Risk Assessment Process

A series of meetings were held to plan out the Risk Assessment update process. Through these discussions a few different approaches were considered with various advantages and disadvantages associated with each. As with previous years, it was decided that an observation-based, eyes-on type approach would best leverage our strengths as a small LDC.

The following factors generally shaped the development of the 2022 Risk Assessment updates:

1. Canadian Gas Association Participation: Distribution Risk Management (DRM) sub-committee of the Asset and Integrity management task force (AIM TF).

    a. Compared and contrasted various approaches by the other LDC's in Canada.
    b. Benefits of a numerical approach taken by larger LDC's with excellent data. E.g. Enbridge's multi-year project used advanced regression analysis to predict asset failure.
    c. Examples of limited data approaches and advantages of gathering Operations level observations.
2. Consideration for numerical based risk approaches was given. These efforts stemmed from the TSSA Audit recommendation action items and related work. In our case, the available incident data is fairly limited with some incident record availability being in question. With only a very small number of below grade leaks (only 2 or 3 some years) and only 250km of distribution mains, the statistical sample size within which UK can gather data is very small. Furthermore, a fully numerical risk model would take years to develop utilizing high level statistical expertise. It was therefore concluded that the numerical approaches would not be appropriate. Accordingly, our work is focused on physical observation with eyes on our assets.
3. Staff survey format was selected for this year's work instead of a meeting-based format. This approach is taken from the successes seen in other LDC's from the DRM where operations lead observation inputs were more heavily relied upon. This allowed for consideration of some of the requisite aspects defined in Z662 although this could be further developed.

Historically at UK risk assessment models have followed a score based relative ranking system. The scores are used to compare the various assets against each other. This year's changes are primarily in how the rankings are gathered (individually completed questionnaire instead of a group-based meeting).

Questionnaire developed with consideration for capturing all potential risks (Hazard Identification). Previous year's work was reviewed to ensure asset areas are covered. Assets were grouped into the following asset classes.

- High Pressure Distribution
- Intermediate Pressure Distribution
- Facilities
    - City Gate
    - Railway
    - District Stations

Risk rankings were calculated for each asset area as an average of all the relative rankings received. Risks for each asset class were ranked with the highest-ranking items selected for actionable work in 2023-2026. A criticality threshold of 3.75 out of

5.00 was used to distinguish the highest priority risk items. This limit was selected to allow a manageable number of projects to be selected for further action. In addition to the above, all items identified in the comments were also included within the Capital Plan.

The focus was to identify and focus in on the highest risk items. Place big item projects like the Railway rebuild into our 4-year budget.

5.3 Integrity Management

This item refers to assets which have an asset specific integrity management program. These assets have been the subject of special study with various reports and recommendations. Recommendations for capital work on the pipeline or assets are included here so that appropriate funding can be allocated for their completion.

Primarily, this item refers to the XHP Queens line and the ongoing monitoring and condition assessment work. Also included is the HP City Line with recommendations following from previous voltage and leak survey work.

5.4 Previous Capital Planning

Existing budgets were based on Asset Management Plan written previously. Milestone projects and those items previously identified as important priorities but have not yet been funded. These projects include the Railway Reg Station full rebuild and are identified on the existing budget. The proposed capital plan includes these items subject to review and modification if required.

Retained Projects:

- Railway Reg Station Rebuild: Design 2026 reconstruct in 2027
- SCADA upgrades at District Reg Stations funded at $30,000 per year

Opportunities to update and improve the previous funding regimen were taken where appropriate. These updates include moving more money out of linear and into facilities, moving money into integrity management projects in lieu of replacement.

5.4 Risk Assessment Survey Results

The following sections summarize the risk assessment survey results and are broken down into asset categories including high pressure assets, intermediate pressure assets, and facility assets.

5.4.1 High Pressure Assets:

High Pressure (XHP & HP)	Rank (1 - 5)											Avg.
Condition of the Queens Line	5		4	5	4	4	3		4	5	2	4.00
Third party Damage	4	5	2	4	3	3	4		3	4	5	3.70
Condition of the City Line	3	3	4	4	4	4	4		3	3	4	3.60
Cathodic protection	2	3	3	4	3	4	3		5	3	3	3.30
Pipeline marking and identification	3	3	3	4	2	3	1		2	1	5	2.70
Inoperable/inaccessible valves	2	1	3	3	2	3	1		2	4	5	2.60
Proximity to other utilities	4	2	2	2	2	2	1		3	1	3	2.20
Over pressurization	2	2	2	3	2	2	1		3	2		2.11
Geotechnical (Earth Movements, etc.)	2	1	2	1	2	1	1		2	3	1	1.60

High Pressure Comments	Freq. (#)
Queens Line	5
Pipeline Accessibility	2
Age of City Line	2
Third Party Damage	1
Pipeline Marking	1

5.4.2 Intermediate Pressure:

Distribution (IP/MIP network)	Rank (1 - 5)											Avg.
Steel Islands	2	5	4	4	4	4	3	4	3	3	5	3.73
Steel services and risers (i.e. corrosion)	4	3	4	5	3	3	3	3	4	4	5	3.73
Material Degradation and corrosion	3	3	3	5	3	3	3	3	4		5	3.50
Coating issues	2	5	3	4	3	3	3	4	3		5	3.50
Untraceable assets	3	4	3	3	2	3	4	4	2	2	5	3.18
Third Party damage	4	5	2	3	2	2	4	2	2	3	4	3.00
Inoperable/inaccessible valves	2	2	3	4	3	3	3	2	2	3	5	2.91
Materials(known issues and/or improper use)	2	1	4	3	3	3	2	4	1	3	5	2.82
Over pressurization	3	2	2	2	2	3	2	2	2	2	4	2.36
Meter sets	2	2	2	3	1	2	2	2	1	2	5	2.18

Distribution Comments	Freq. (#)
Steel Island Mains	2
Steel Island Services	2
Risers	1
Compton Wilson Weller Risers	1
Materials: “Plexco” Tapping Tee Caps	1
Aging Infrastructure	1
Un-tracible Assets	1
Coating Holidays	1
Meter Protection	1
Contractor Management (materials)	1
Cathodic Protection Program - transparency & training	1
Risers in the Compton Wilson Weller area	1

5.4.3 Facility Assets:

City Gate	Rank Score (1-5)										Avg.
Boiler system i.e. vacuum loss, redundancy	5	4	5	4	4	5	4	5	5	5	4.60
Mercaptan system Building & Safety	3	4	4	3	3	3	3	3	4	4	3.40
Bypass valves and procedures	3	3	4	3	4	4	3	3		3	3.33
Grasshopper Valves		4	5	3	3	3	4	2	2	4	3.33
Over pressurization downstream	4	3	3	2	3	3	3	2	3	5	3.10
Regulating Runs	3	3	4	3	2	3	2	3	4	3	3.00
Underground piping at the station	2	3	3	3	2	4	3	2	3	3	2.80
Instrumentation and monitoring failure	4	1	3	2	2	2	4	2	3	2	2.50
TC incoming line	2		3	3	2	2	3	1	5	1	2.44
Security (Third Party Tampering)	4	1	2	2	2	2	2	2	4	3	2.40
Building grounds (Access, roads etc.)	2	1	2	2	2	2	1	2	2	2	1.80
Building Issues (walls door roofs heaters etc.)	2	1	2	2	2	2	1	2	2	1	1.70

City Gate Comments:	Freq. (#)
Heater	5
Valve Repair	1
Mercaptan Building Roof Maintenance	1

Railway Reg Stn. No 2	Rank Score (1-5)										Avg.
Boiler system i.e. vacuum loss, redundancy	4	3	5	4	3	5		4	5	5	4.22
Grasshopper Valves	1	5	5	4	4	4		3	3	5	3.78
Bypass valves and procedures	2	3	5	4	4	5		2	3	5	3.67

Building Envelope	3	5	4	4	2	2		4	5	4	3.67
Under ground piping at the station	2	4	3	3	2	3		2	3	3	2.78
Security (Third Party Tampering)	4	2	2	2	2	3		2	4	3	2.67
Over pressurization downstream	4	2	2	2	2	3		2	3	3	2.56
Instrumentation and monitoring failure	2	2	2	2	2	2		2	5	1	2.22
Regulating Runs	2	1	2	2	2	3		2	4	1	2.11

Railway Comments:	**Freq. (#)**
Bypass Valve	3
Building Issues (walls, roof, etc.)	3
Heater	2
Relief Reg Venting Location	1
Training on Relief Operation	1

District Reg Stations	**Rank Score (1-5)**										**Avg.**
Relief Valves	3	3	3	3	3	3		2	5	2	3.00
Underground piping and valves to the station	2	2	4	4	3	3		1	3	4	2.89
Regulator Ice Over	2	3	3	3	2	2		2	5	3	2.78
Security (Third Party Tampering)	4	3	2	2	3	3		1	4	2	2.67
Enclosures	2	1	3	3	3	3		1	4	1	2.33
Over pressurization downstream	2	2	2	2	3	3		1	3	2	2.22

District Reg Comments:	**Freq. (#)**
Risers Need to be re-coated	1
Geotechnical Movement at RS #5	1
Palace Rd showing excessive wear	1
Filter Maintenance	1
Gas Contamination	1

5.5 Results Summary:

The results from this work are summarized in ***Table 5.5.1 Capital Investment Summary***. The investment summary includes specific linear projects until the year 2030. This iteration of the Asset Management Plan focuses on near term investments. Investments made farther into the future will be subject to further analysis, risk assessment, and managerial direction. Operational and Maintenance activities are not included in this table, but continuation of the existing programs is appropriate.

Table 5.5.1 Capital Investment Summary

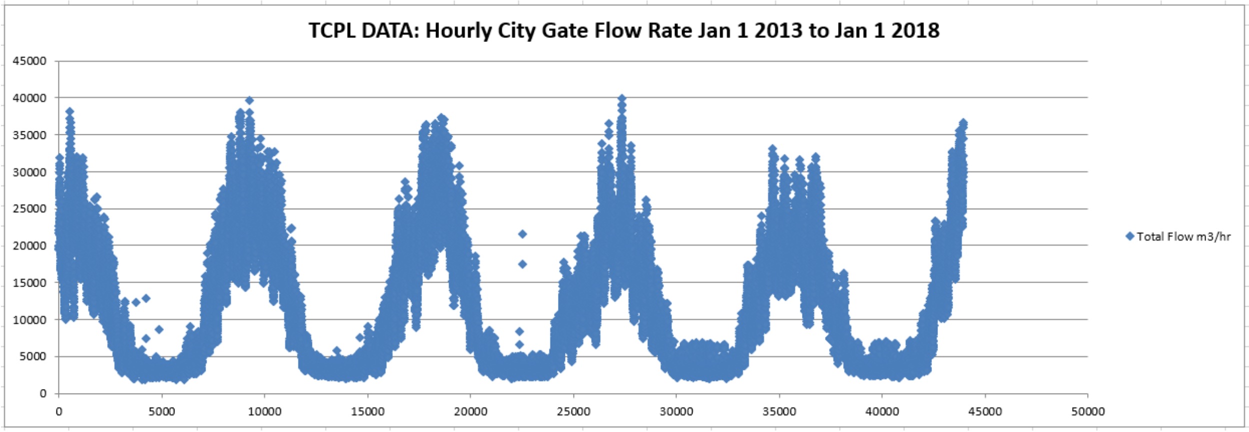
YEAR	Stations	IP Mains	HP Mains	Services
2024	Re-coating	Princess Portsmouth to Hillendale	HP Line Survey	New as req'd
2025	Re-coating	Fraser & Joesph	-	New as req'd
2026	Railway Design	Bath Rd & Armstrong	HP Line Survey	New as req'd
2027	Railway Rebuild	Kingscourt	-	New as req'd
2028	Palace Rd upsizing	Raglan	HP Line Survey	Wilson/Weller area
2029	TBA	Rideau St (lower)	-	New as req'd
2030	TBA	Rideau St (upper)	HP Line Survey	New as req'd
2031	TBA	TBA	-	New as req'd
2032	TBA	TBA	HP Line Survey	New as req'd
2033	TBA	TBA	-	New as req'd
2034	TBA	TBA	HP Line Survey	New as req'd

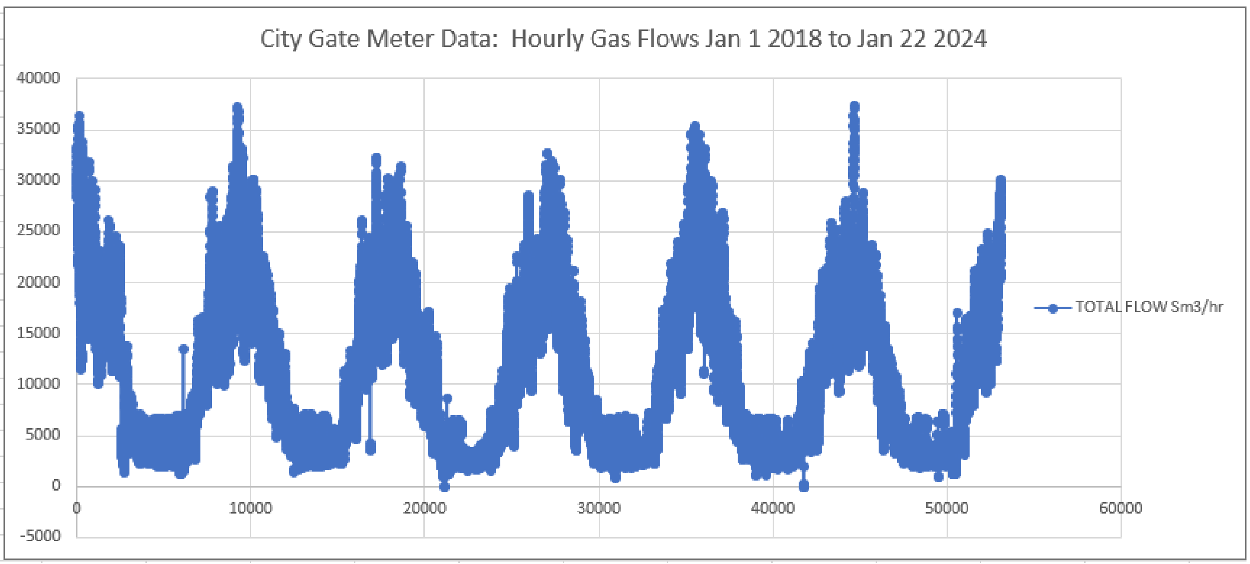
Capital investment plans are subject to City Council approval and the project list is revisited at regular intervals to keep this approval current. This approach should be maintained going forward, with adjustments to the investment program made as new asset condition and risk information becomes available.

6.0 Demand Forecasting

The following section looks at total consumption and touches on growth and climate change which are both subject to their own more detailed report.

Existing flows in the Utilities Kingston Natural Gas Distribution Network typically experience a peak hourly flow rate in the morning on cold winter days when demand for heat and hot water is highest.





The above figures show 10-years of hourly system wide flow data. The minimum flow rate is approximately 2,500 standard cubic meters per hour while the peak hourly flow rate is approximately 40,000 standard cubic meters per hour, depending on the year.

Since much of the natural gas consumed is used for space heating, flow rates are highly dependent on the weather including specifically temperatures and wind speed which vary considerably on a year over year basis. While the industry is trending toward reduced natural gas consumption per dwelling, new customer connections continue to be added. These influences on demand are the subject of further study.

6.1 Growth

The City of Kingston is currently undertaking what is understood to be a comprehensive long-term plan for growth in Kingston. At the time of writing the study is underway with first phase completed and presented to the Utilities Kingston team in Q1 2024. Significant growth is forecast for Kingston although the location of this growth is yet to be determined. Further work by the City is underway to better understand where this growth is intended to occur. Results from this work are anticipated to be released later in 2024 and UK Gas will work closely with City Planning to ensure adequate gas supply.

Additional work is underway to better monitor and model the system's capacity relative to demand. This work includes pressure monitoring, hydraulic modelling software updates, and other technical efforts. The goal is to fully utilize all distribution assets before investments in capacity upgrades are made. The Natural Gas Utility will maintain close alignment with the growth forecasts to meet the needs of its customers.

6.2 Electrification & Climate Change

Utilities Kingston is undertaking a Strategic Plan for the Gas Utility which will largely focus on the energy transition and what it will mean for the gas utility. Additionally, the Climate Action Leadership Plan is also underway and is presently in its initial stages.

The contents of these reports will contain strategic changes that could be considered for the UK Gas Utility. These opportunities may include:

- Renewable Natural Gas (RNG)
- Green Hydrogen production and utilization
- Integrated Energy opportunities
- Demand side management and other conservation initiatives

While growth in the City is anticipated to grow the demand for energy and natural gas, decarbonization is expected to simultaneously reduce demand for natural gas. The net effect of these competing factors is to be studied in further detail in the reports referred to above.

7.0 Life Cycle Activities Required

In accordance with O.Reg. 588-17 the following section includes a description of life cycle activities that will need to be done to maintain the current level of service.

7.1 Operations and Maintenance

Gas Pipeline Systems safety code requires that various maintenance activities are conducted at prescribed or performance-based intervals.

The Standard Operating Procedures contain a detailed response to the maintenance work that is required by both policy and by code. A selection of key components of this program is included below with its maintenance intervals in ***Table 7.1.1 Example Maintenance Intervals***

Table 7.1.1 Major Maintenance Item Intervals

Asset Category	Maintenance Item	Frequency
Linear	Leak Survey	Annual & 1 in 5 years
Linear	Cathodic Protection Survey	Annual
Linear	Priority Shut-off Valves	As per SOP
Facilities	Regulator Rebuild	Annual
Facilities	Relief Valve Verification	Annual
Facilities	Odorant System	As Req'd
Facilities	Boiler Maintenance	As Req'd

7.2 Capital Investments

Details of the Capital Program are included in section 6.5 and are summarized in Table 6.5.1. The list of projects to be implemented should continue to be subject to continuous improvement and revision as new information comes available.

Appendix A

10-Year Budget Forecast

Gas - 10 Year Capital Budget

Gas - 10 Year Capital Budget	2023 Budget (Rates)	2024 Budget (Rates)	2025 Budget (Rates)	2026 Budget (Rates)	2027 Budget (Rates)	2028 Budget (Rates)	2029 Budget (Rates)	2030 Budget (Rates)	2031 Budget (Rates)	2032 Budget (Rates)	2033 Budget (Rates)
Regulating Stations											
Planning & Design				250,000				50,000			
Construction	1,175,000	150,000	500,000		450,000	400,000			250,000	250,000	
Equipment Upgrades/Replacement											
Buildings Structure	20,000	15,000	10,000	-		15,000	15,000	10,000			
Buildings Fixtures	10,000	10,000	10,000	10,000		15,000	15,000	10,000	10,000	15,000	15,000
Mechanical Equipment	275,000	150,000	150,000	25,000		25,000	10,000	30,000	25,000	75,000	75,000
Electrical Equipment	10,000	10,000	10,000	10,000		10,000	10,000	30,000	30,000	15,000	400,000
Pipe Networks											
Planning & Design								10,000			
Construction											
Main Replacement HP	250,000	150,000				300,000	350,000	350,000	300,000	300,000	
Main Replacement IP	300,000	1,500,000	1,800,000	1,800,000	2,300,000	2,400,000	2,000,000	2,040,000	2,100,000	2,100,000	2,142,000
Main Expansion IP				100,000	100,000	150,000	150,000	150,000	150,000	150,000	150,000
New Services	540,000	525,000	525,000	525,000	500,000	480,000	485,760	485,000	485,000	450,000	425,000
Equipment Upgrades/Replacement											
Valves	200,000	200,000	200,000	225,000	225,000	180,000	300,000	300,000	300,000	325,000	300,000
Pipe	75,000	75,000	75,000	100,000	125,000	150,000	125,000	100,000	100,000	125,000	125,000
Service Upgrades/Replacement	250,000	250,000	250,000	450,000	475,000	200,000	150,000	150,000	150,000	150,000	170,000
Meters	2,800,000	1,850,000	1,800,000	1,600,000	925,000	900,000	900,000	925,000	925,000	930,000	940,000
General											
Property											
Land - Gas Facilities	10,000							20,000			
Office Building Improvements	20,000										
Business Systems											
SCADA	40,000	40,000	40,000	40,000	40,000	40,000	10,400	10,400	10,600	10,600	10,600
Business Systems UK	400,000	900,000	875,000	375,000	25,000	25,500	26,010	26,530	27,061	27,602	28,154
Business System City Transfers	192,400	195,200	210,850	203,500	207,850	207,925	213,350	217,600	221,970	225,425	229,935
Construction and Office Equipment											
Tools, Locating Equipment & Radios	62,000	62,000	62,000	62,000	62,000	55,000	55,000	55,000	55,000	55,000	55,000
Office Equipment	16,000	7,500	7,500	7,500						10,000	
City Restoration Costs	760,000	760,000	800,000	800,000	800,000	800,000	816,000	820,000	820,000	835,000	835,000
Vehicles											
New Vehicles	55,000	500,000									
Vehicle Upgrades	8,000	8,000									
Total	7,468,400	7,357,700	7,325,350	6,583,000	6,234,850	6,353,425	5,631,520	5,789,530	5,959,631	6,048,627	5,900,689