gas distribution asset management plan

2020–30

vector

contents

foreword

The Asset Management Plan (AMP) is a document which aims to communicate how Vector intends to manage its gas network assets for the benefit of Auckland energy consumers, for the period 1 July 2020 to 30 June 2030.

The investments we plan to make, set out in this 2020 edition, are required to deliver a safe and reliable gas network for Aucklanders, and are aligned with Vector's symphony strategy, which is how Vector is delivering its vision of creating a new energy future.

This 2020 AMP provides the context and details of our investments, and asset management strategies for our gas network. It explains how we will maintain our assets and ensure the network and the services to customers provided through it remain safe, reliable, nimble and responsive to potential future technological, environmental and consumer-behavioural changes.

The objectives of our AMP are to:

- Be transparent with our customers and stakeholders about our plans and investments for the network;
- Detail the projects and improvements underway for our network and how they will benefit our customers;
- Foster understanding of how our asset management approach works, by providing details about our assets, Vector's plans for them, and the company's objectives; and
- Explain how these plans align with our corporate symphony strategy and vision to bring about a new energy future.

During to the COVID-19 pandemic, businesses in the Vector group have been operating in line with the Vector group's Crisis Management Framework and guidance from the All of Government Pandemic Response. The safety of our teams, our customers and the public will always be Vector's top priority and with COVID-19 there have been additional measures implemented to keep our people and customers safe, and to do our bit to limit the spread of Covid-19 and help the economy recover. We will continue to make adjustments as necessary throughout the pandemic response and consequently there is a measure of uncertainty over the potential for future on operating costs, resourcing, Field Service Provider (FSP) delivery capability, capital project delivery, supply chain risk, and timing of infrastructure development activity throughout Auckland.

This AMP was certified and approved by our Board of Directors on 29 May 2020.

AMP Planning Period

The AMP covers the 10-year planning period as prescribed by the Commerce Commission's Information Disclosure Determination to meet our obligations as a regulated gas distribution business.

AMP Structure

Vector's 2020 AMP has been developed in accordance with good asset management principles. There are six primary sections and supporting details in the appendices that contribute to our asset management story. As described in the following table, the six primary sections of the AMP include:

SECTION	OVERVIEW
1 – Introduction	• Provides the context and summaries for the AMP; • Presents an overview of Vector; who we are, what we do, our vision; and • Considers the purpose, objectives and the operating environment that shapes the AMP.
2 – Customers, Stakeholders and Service Levels	• Identifies Vector's primary stakeholder's interest; • Presents the service level metrics and sets our performance targets to meet their interests; and • Discusses the performance of our network against these service level metrics, along with the primary causes of performance deviation from the service level targets.
3 – Asset Management System	• Provides insight into Vector's asset management practices; • The asset management objectives, scope and governance are presented here; and • Discusses how Vector intends to improve its asset management practices over time.
4 – Our Assets	• Presents an overview of our gas distribution assets and the lifecycle management strategies for them; • Provide insights in to the types, volumes and functional role of assets we manage in the network; and • Summarises our primary asset management strategies that inform and/or drive our expenditure.

5 – Managing Our Asset's Lifecycle	• Provides an overview by asset category, of the plans we have to manage our distribution network assets over the 2020-2030 planning horizon.
6 – Delivering Our Plan	• Outlines how we develop an optimal portfolio of works from our plans and how we will deliver these works to maintain service levels, and deliver our strategic outcomes; • Provide insights into how prioritisation of the plans results in a work portfolio that optimises the outcomes from our network investment; and • Presents a summary of the Capital Expenditure (CAPEX) and Operational Expenditure (OPEX) required to deliver our gas distribution network AMP for the 2020-2030 period.
7 – Appendices	• Contains supporting and supplementary information for Sections 1 to 6; • Lists the key standards that inform our asset management practices; and • Presents a compliance table showing how our AMP meets the Commerce Commission's Information Disclosure requirements.

section 01

introduction

1 – introduction

In recent years Auckland has consistently been one of the fastest growing and most diverse cities in the developed world. As a consequence of this population growth we have experienced growth in the number of new connections to the reticulated gas network. This is largely driven by developers of new-build housing, where reticulated gas infrastructure, whilst remaining a discretionary choice, can be installed economically when sharing resources and costs with essential infrastructure during the construction phase.

We account for this organic growth through our investment approach, and our engagement with developers which is aimed at ensuring customers have access to gas as a fuel, should they desire it. However, feedback from our customers clearly underscores the need for us to move forward with flexible and careful investment. While reticulated gas networks continue to hold their position within the energy mix when it comes to customers making discretionary choices about fuel sources, a likely rise in the cost of carbon over the ten year term of this plan will more and more become of a factor in driving disruption across the energy sector, including reticulated gas networks.

Consumer expectations around choice, control, and experience are also rapidly increasing especially with the digitisation of service delivery occurring across industries. It is Vector's view that these trends point to energy consumers moving beyond being passive users of energy.

Against these local trends, our wider operating environment within the global energy sector is one of continued change and uncertainty. We must take into account of the potential for rapid shifts in customer behaviour driven by uptake and impact of new technology, climate change, changing customer preferences and expectations. Many of these factors will be influenced strongly by national energy, social, economic and climate policy, as well as global trends and developments in the response to climate change.

Vector's approach to planning must therefore allow for shorter horizons, greater uncertainty, and the flexibility to respond to changes quickly and efficiently. This will aid Vector in avoiding poor investment decisions and worst-case performance outcomes, as well as maximising the benefits and options available to consumers.

This approach is encapsulated in our symphony strategy, which underpins how Vector as a group is creating a new energy future.

1.1 Our Symphony strategy

Social equity within the energy sector has been a strong area of focus in recent years. The Electricity Price Review (EPR) has highlighted the need for a coordinated and proactive step-change to ensure that key customer issues that span fuel source – such as energy affordability – are at the centre of the sector's decision making. We maintain our belief that in order to enable a transition to low emissions energy (as a key input to a low emissions economy) at an affordable price, technology and innovation must play a leading role.

It follows that the long-term interests of Auckland's energy consumers cannot be served by a traditional view of what energy distribution networks are and need to deliver. Our traditional network assets will continue to play a key role, while becoming increasingly integrated with digital and consumer assets. This convergence allows more options for load management and will drive a need to adapt more quickly to changing network dynamics. This is a key part of efficiently responding to uncertain and rapidly changing energy demand patterns.

Accordingly, we will continue to target investments as efficiently as we can by supporting traditional network assets with digital and other solutions for the long-term benefit of energy consumers.

1.2 Symphony is creating a New Energy Future for our customers

Whilst energy supply chains have traditionally focused on connecting upstream energy supply to customers, Symphony is creating a New Energy Future which starts with the customer and ensures our energy systems respond seamlessly and efficiently to their needs. With Vector being majority owned by Entrust on behalf of customer beneficiaries, our interests are our communities' interests.

Understanding customer behaviours is key to delivering network optimisation with the needs of the customer at the centre.

We have used behavioural insights to deepen our understanding of the demand impact of new energy solutions including energy efficient appliances, solar PV, or switching to/from gas. These insights inform our network management and strategy and have implications for customer cost and experience as well as New Zealand's wider transition to a low emissions energy future. These insights shed light on the value of implementing customer facing energy efficiency measures to achieve New Zealand's wider energy goals. Understanding the behaviour of our own customers is key also to understanding how transferable overseas policy interventions could be to the New Zealand context.

Symphony creates a new energy future for our customers through the integration of data analytics and digital platforms which enable us to translate our understanding of customer preference to create a system which responds seamlessly to their needs. In turn, this supports the transformation of our wider energy system – to start with the customer, not the power or gas-plant.

1.3 Symphony is a whole group strategy

Symphony provides a blueprint for the Vector group to lead the creation of intelligent and affordable energy systems that empower our customers and communities well into the future. At its core, Symphony leverages new energy solutions to deliver optimal outcomes for customers, society, and the environment in the context of disruptive change.

Because new energy solutions are designed around customer needs – rather than old regulatory or market silos – Symphony is not confined to the parts of the Vector group concerned with running a network. It takes a whole-of-systems approach that requires seamless coordination – between our networks and customers; within the Vector group; across the energy supply chains; and between Government and industry. In order to transition our energy systems to a low emissions future, a whole-systems approach is required which considers a range of energy solutions and sources, affordability, and which puts the customer at the centre.

Across the Vector group the Symphony strategy is shaping our approach to creating a New Energy Future. For example, reducing emissions from transport is a complex challenge which draws on the efforts of many. Vector OnGas, which has a fleet of 80 trucks, is investigating a trial of electric trucks as a first step in understanding the infrastructure costs and changes associated with the electrification of the heavy vehicle fleet – a transition which will have direct implications for Vector's electricity distribution network and the national transmission grid. Vector PowerSmart is concurrently working with Auckland Transport to understand the network impacts of the electrification of buses.

These efforts are alongside our continued engagement with the Ministry of Transport to support the Green Freight Project, which seeks to understand how to reduce greenhouse gas emissions from New Zealand's heavy vehicle fleet. As transport accounts for 20 percent of New Zealand's overall emissions, this strategy is a key first step in New Zealand's decarbonisation efforts and will require a coordinated approach.

"The best way to predict the future is to create it." Peter Drucker

1.4 Symphony for our gas distribution network

We are evaluating options to leverage digital platforms across Vector electricity and gas distribution networks in order to derive benefit to our customers, in an efficient manner. An example of this under consideration is our work to deliver an Advanced Distribution Management System (ADMS) capable of covering the gas and electricity networks. Having both networks visible and controllable through the same ADMS would enable a single view of both network operations, potentially enabling Control Room efficiencies across both networks. This would enable a view of the total energy demand together with the availability of electricity and gas.

Together with other customer insights and technology options – such as advanced gas meters – we are able to make investment decisions for the gas network in consideration of a wider range of inputs to derive more benefit for customers.

Vector is currently undertaking a review of some of its assets and business activities within the Vector group in order to deliver its Symphony strategy. The rationale for such a review is to further leverage our existing capabilities to provide improved services within the group as well as to external parties which in turn will deliver better long term benefits to customers. Should these transactions materially change the CAPEX and OPEX profile for the gas distribution business, this will be identified in Vector's 2021 Asset Management Plan.

1.5 Customer & community growth

In addition to taking a customer-centric view of how to best serve our customers, our gas network must continue to respond to demand and enable customer growth without compromising resilience where the pockets of growth could cause strain. To meet this growth, Vector has plans to:

- Be transparent with our customers and stakeholders about our plans and investments for the network;
- Maintain the network's topology and functionality; and
- Increase capacity to maintain and enhance network reliability.

We further set out our planning and strategy to support our growing region in Section 4 of this AMP.

1.6 New & emerging technologies

Given the pace of change and uncertainty in the global energy sector, and New Zealand's domestic target of net zero emissions by 2050, we need to preserve our ability to facilitate the adoption of new technologies, should Aucklanders choose them, such as:

- A shift towards reticulated supply of hydrogen in addition to natural gas;
- Development of new technologies like fuel cells or bio-gas; and
- Re-purposing of the gas network to accommodate hydrogen.

In this AMP are included the plans and strategies Vector will adopt to better understand and accommodate technological change on and around our network, in line with our symphony strategy.

1.7 Resilience & safety

We have committed to minimising the risks associated with operating our gas distribution network. Vector provides critical infrastructure for a functioning modern city and it is imperative that we continue to invest in assets such as our pipes, District Regulating Stations (DRS), valves, supporting Information Technology (IT) and digital infrastructure, and more to ensure that they perform reliably, safely and resiliently in the future.

We responsibly manage our assets over their full lifecycle to avoid failures that cause interruptions in the supply of gas to our customers, pose hazards to our workers, contractors and the public, or harm the environment. To preserve our ability to fulfil this role, we intend to develop our core systems to enable the capture of enhanced incident data (i.e. fault and failure records) and improved asset inspection records. This will in turn support the development of our Condition Based Asset Risk Management (CBARM models).

One of our public safety challenges is also to protect pipelines from damage by third parties. We maintain active relationships with key industry and community stakeholders and communicate with our stakeholders and other third parties about the appropriate steps to take to avoid damaging our assets. We also communicate with the public to help them understand what to do if they smell gas.

As Vector is also the operator of Auckland's electricity network, Vector is in a good position to learn and evolve network resilience strategies based on outcomes experienced across either network. For example, where network infrastructure damage has occurred as a result of significant weather events, learnings from the electricity network that are also applicable to gas can be implemented.

Further details of how Vector will administer a safe, secure, and resilient network is described in this AMP.

1.8 Sustainability

Vector has established a sustainability framework underpinning how we manage our network equipment over its entire lifecycle and considers the impacts of climate change.

Responding to climate change requires infrastructure providers to tackle a dual approach of reducing their emissions as well as adapting to the inevitable physical impacts. Coupled with this is the economic transition to a low emission economy which will inevitably drive prices up for products like gas that have a carbon content.

Vector has undertaken scenario analysis to better understand the climate change driven transition to a net zero emission economy. This will help inform our understanding of how emission pricing will affect the uptake of reticulated gas into the future.

In terms of physical effects of climate change on the Auckland electricity and gas network modelled climate data suggests that wind speeds are projected to significantly increase in the near future. Summer and winter temperatures are expected to increase by almost 1°C by 2050. Other causes for concern include rising sea levels, storm surges, flooding, and erosion. We expect climate change will lead to increased risks for erosion-prone land, potentially where underground gas assets are located; and increases in flooding events that can impact gas regulator stations.

Vector's assessments are a starting point for improving the business' understanding of the impact climate change will have on our network. Areas of the network that are deemed to be at higher risk will be assessed in more detail over the period of this AMP.

There is no single identifiable plan in this AMP that directly addresses sustainability or climate change. However, there are aspects of our plans and strategies that work together to deliver a more sustainable, energy efficient, and resilient network. Where our asset management plans contribute to Vector's sustainability commitments, we have noted this against the plans in Section 4.

1.9 Company overview

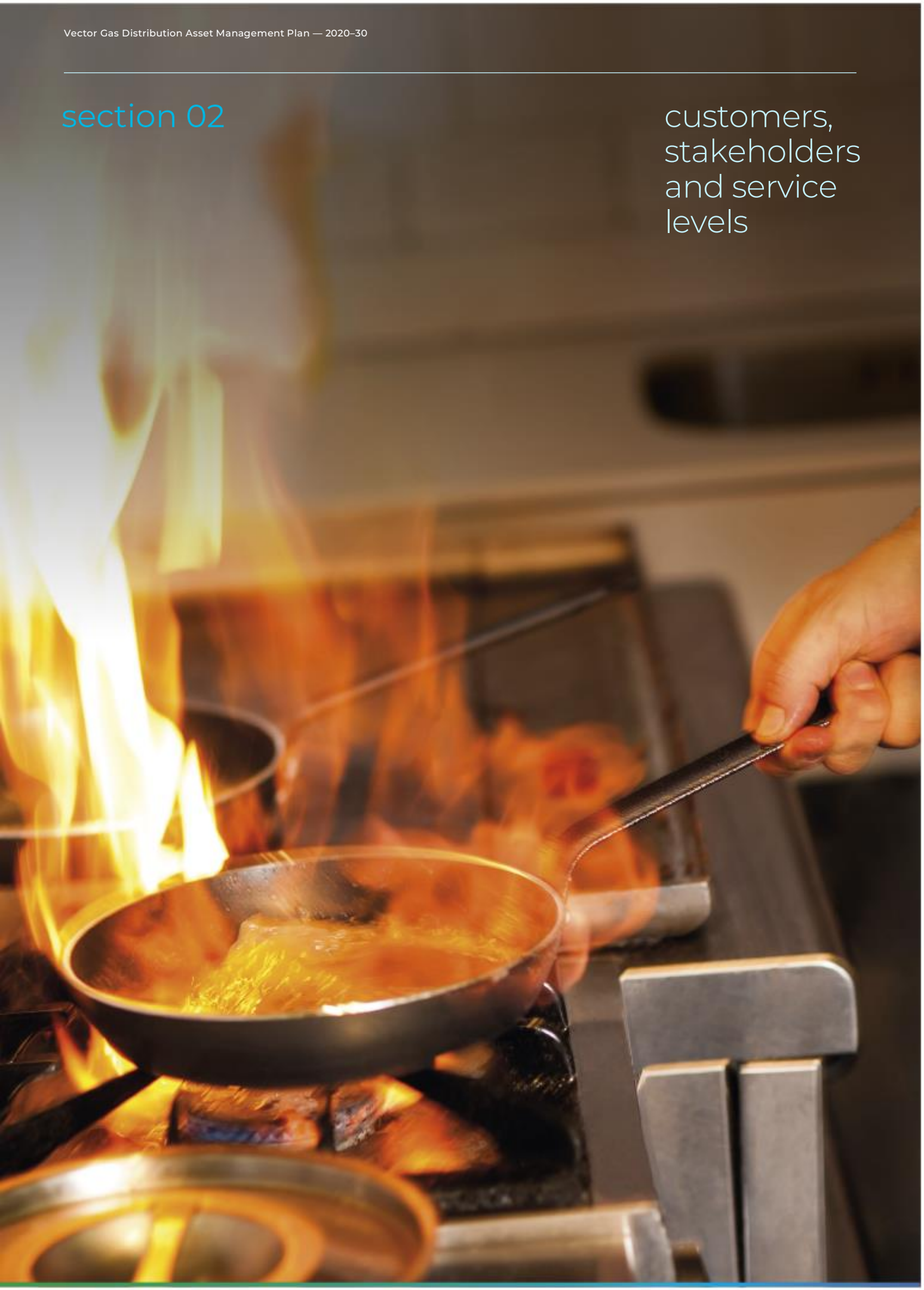
Vector is New Zealand's leading network infrastructure company which runs a portfolio of businesses delivering energy and communication services to more than one million homes and commercial customers across the country. Vector is leading the country in creating a new energy future for customers and continues to grow and invest in the growth of Auckland, and in a wide range of activities and locations. Vector is listed on the New Zealand Stock Exchange with ticker symbol VCT. Our majority shareholder, with voting rights of 75.1%, is Entrust.

Vector owns and operates the gas distribution network in Auckland, New Zealand, supplying gas to over 111,000 installed connection points across the Auckland region from north of Wellsford to Tuakau in the south. Our network has 6,733 Kilometre (km) of underground pipes and supplied our customers with 14.4 Petajoules (PJ) of natural gas energy in Regulatory year 19 (year ending 30 June) (RY19). Vector staff are well-represented on and actively participate in industry bodies covering the New Zealand energy sector and gas more specifically, including the Business Energy Council (BEC), the LPG Association of New Zealand (LPGA) and the Gas Association of New Zealand (GANZ). Vector is also a member of international industry bodies such as the Edison Electric Institute.

For further information, visit www.vector.co.nz

section 02

customers, stakeholders and service levels

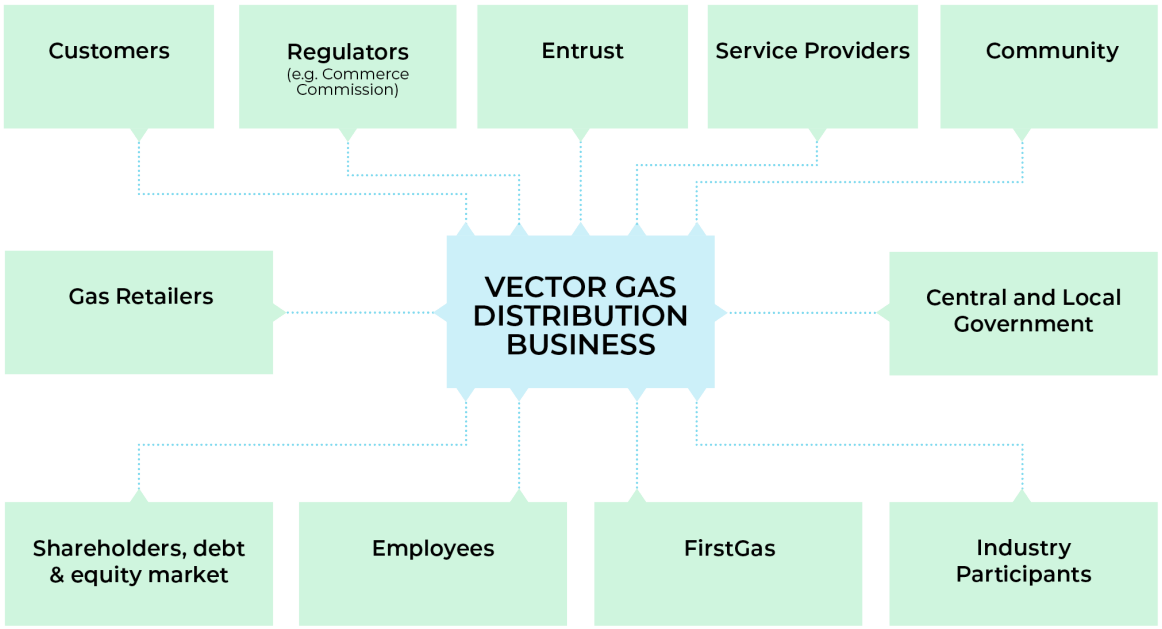


2 – customer, stakeholders and service levels

Stakeholder requirements form the basis of Vector's asset management practices. They define the level of service required of Vector's assets and underpin the need for investment. In this section, the primary stakeholders and their requirements are identified from an asset management perspective. Service level metrics and target performance levels are defined and the performance of Vector's assets against the service level metrics is summarised. Where actual or expected performance gaps are found, consideration is given to the underlying root causes that then inform the development of potential investments required to address asset performance and meet or maintain our stakeholder's service level requirements. Section 5 sets out our plans to manage asset performance.

2.1 Stakeholder requirements

The essential nature of the services provided by Vector's gas distribution network, and its importance to the Auckland community and economy, creates considerable interest in Vector's asset management practices, and there are a large number of stakeholders. The following figure identifies the primary internal and external stakeholders that have an interest in how Vector manages its assets.



To ascertain the service metrics and performance targets that are relevant to managing our gas distribution assets, Vector engages with its stakeholders through a range of channels. These include meetings, discussion forums, political engagement and direct liaison to understand stakeholder needs. Other means of interacting with stakeholders includes surveys, working group memberships, media and publication monitoring, as well as active engagement in the legislative and regulatory consultation processes.

Vector's stakeholders have a broad range of requirements. The following table provides some insight into some of the stakeholder requirements that impact our business operations. As relevant, Vector's board and management translate our stakeholders' requirements into specific business requirements that influence our asset management practice, through guiding values, shaping objectives and informing service level requirements. This includes the need to prioritise when differing stakeholder requirements conflict.

Public Safety e.g. public and worker health and safety risk management	Confidence in board and management	Participation in policy proposals, and regulatory issues
Sound management of customer issues and information including timely outage management	Good governance, reputation, and fair behaviour	Ensure service providers have stable forward work volumes, and quality work, maintenance, and construction standards.
Quality, Security, and Reliability of supply of gas	Maintain legal and regulatory compliance	Maintain effective relationships and ensure ease of doing business
Sustainability and environmental impact	Prudent risk management	Work with stakeholders to Influence regulators and government
Timely network connections and asset relocations	Develop and maintain a clear strategic direction	Sharing experience and learning with the industry
Engage with community and stakeholders on relevant issues	Return on investment and sustainable growth	Ensure effective coordination of planning and operations with other utilities and stakeholders
Provide cost effective and efficient operations	Accurate and timely information and reporting	Ensure transmission network interface is well maintained.

From an asset management perspective, stakeholder requirements are translated into objectives that guide asset management practice and into required asset service levels that inform the investment needed to meet and maintain these requirements. Vector has assessed our stakeholder's requirements and formed a set of asset management objectives that are the basis of our asset management policy. Section 3 sets out these objectives and provides insight into how they inform our asset management governance and practices.

We have also assessed our stakeholders' requirements and defined a set of service level metrics and associated performance targets that reflect our stakeholders' requirements for the performance of our assets. These metrics have been developed to be meaningful to our stakeholders in terms of the services our assets provide, appropriate to managing our assets and relevant to the investments required to meet and maintain service level performance. Section 2.2 provides details of the service level metrics that we use to assess asset performance and establishes the performance targets that reflect the price quality trade-off that our stakeholders require.

Vector also uses a wide range of asset management metrics (refer Section 7.3) that inform our asset experts about the detailed behaviour and performance of various types of network equipment.

2.2 Service levels

The service levels that Vector uses to assess performance of the network against the asset management objectives are described in this section. The service levels include those that are required for regulatory purposes through the Information Disclosure requirements[1]. Further service levels are also measured that inform Vector's asset management practices.

The following sections detail each service level, the methodology of measurement, target level and performance.

2.2.1 RESPONSE TIME TO EMERGENCIES

DEFINITION

Response time to emergencies (RTE) is a measure of the time elapsed from when an emergency is reported to Vector to the time Vector's personnel arrives at the location of the emergency.

MEASUREMENT

The RTE is calculated by adding the number of emergencies responded to within one hour or three hours and dividing this number into the total number of emergencies.

TARGET

The RTE target is set by the Commerce Commission's regulatory determination every five years. The process for setting this target is specified in the DPP[2]. For the Regulatory Period (1 October 2017 to 30 September 2022) Vector's RTE targets have been set at the following limits:

- 80% of RTE are responded to within one hour; and
- 100% of RTE are responded to within three hours.

1 Gas Distribution Information Disclosure Determination 2012.

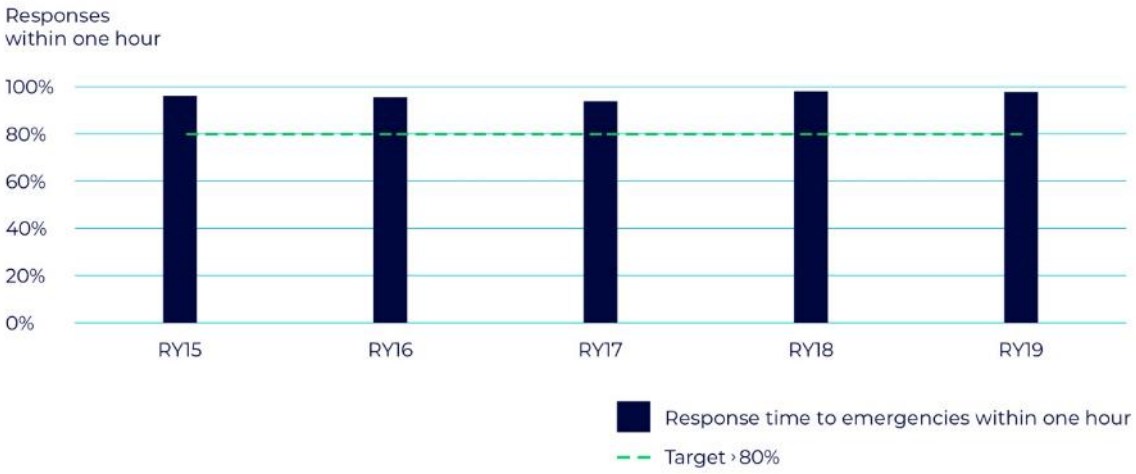
2 Gas Distribution Services Default Price-Quality Path Determination 2017

PERFORMANCE

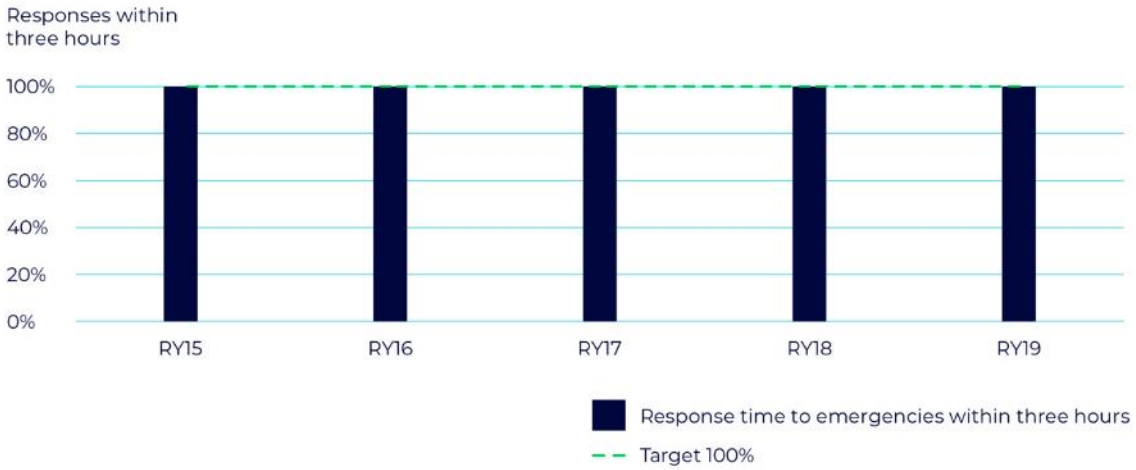
The following table shows the comparison of RTE for the previous five years against the DPP target.

SERVICE LEVEL	RY15	RY16	RY17	RY18	RY19	TARGET	PERFORMANCE AGAINST TARGET
Proportion of RTE within one hour	96.1%	95.6%	93.8%	98.1%	97.8%	>80%	●
Proportion of RTE within three hours	100%	100%	100%	100%	100%	100%	●

RESPONSE TIME TO EMERGENCIES WITHIN ONE HOUR



RESPONSE TIME TO EMERGENCIES WITHIN THREE HOURS



For the period ending 30 June 2019, Vector's RTE targets were met or exceeded. This demonstrates that Vector's current reactive response strategies are effective at ensuring that response times to faults and emergencies are appropriate. Vector, in consultation with its FSPs, is undertaking a review of emergency standby arrangements to identify opportunities to improve the effectiveness of its emergency response by reducing travel times and limiting the effects of growing traffic congestion in Auckland.

2.2.2 INTERRUPTION RATE

DEFINITION

The interruption rate is a measure of the number of times the network supply is interrupted, resulting in a customer outage. This service level includes the total planned and unplanned interruptions on Vector's network, including interruptions caused by the gas transmission system.

MEASUREMENT

The interruption rate is calculated by dividing the total planned and unplanned interruptions on the network (including gas transmission system interruptions and third-party damage events) in the relevant year by the total length (km) of network (mains and services) and dividing by 100.

TARGET

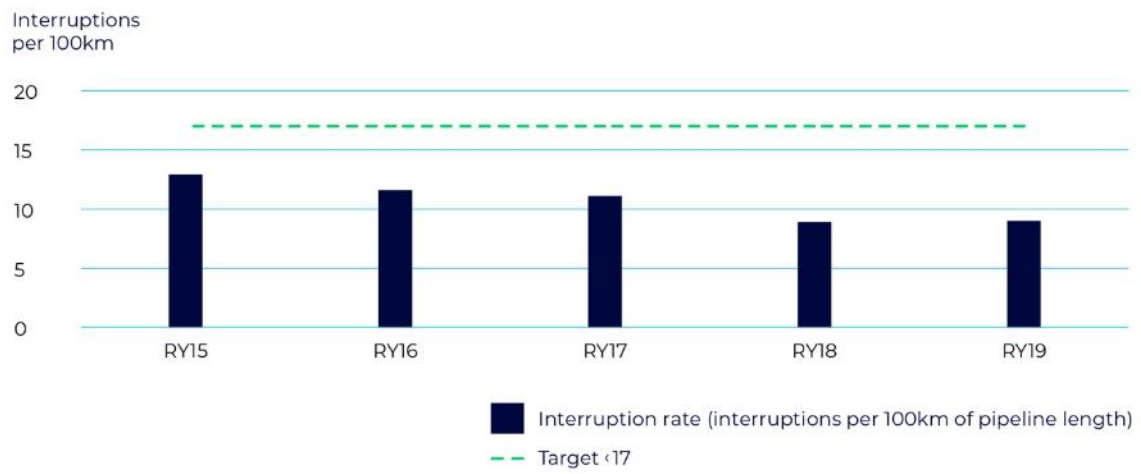
Vector's overall target level performance is 17 interruptions per 100km of system length per annum. This target is based on the historical average for reference period FY13-FY17.

PERFORMANCE

The following table shows the comparison of interruption rates for the previous five years against Vector's target.

SERVICE LEVEL	RY15	RY16	RY17	RY18	RY19	TARGET	PERFORMANCE AGAINST TARGET
Interruption rate (interruptions per 100km of pipeline length)	12.9	11.6	11.1	8.9	9.0	<17	●

INTERRUPTION RATE



The count of interruptions includes planned interruptions on the network, unplanned interruptions on the network and unplanned interruptions caused by third party damage. For the RY19 period, approximately 64% of the interruptions were planned, 6% unplanned and 30% were caused by third party damage; this split is similar to that for previous RY periods.

For the RY19 period approximately 40% of the planned interruptions were due to riser valve faults - i.e. typically associated with a riser valve leaking or passing gas (when in the closed position). This percentage is similar to that for previous RY periods. In order to mitigate the risks associated with riser valve failures, Vector undertakes annual audits of approximately 1,000 riser valves per annum. Vector is also actively investigating the cause of riser valve faults (in particular leakage and passing-gas faults) to determine if a valve design-fault exists or if current maintenance practices need to be modified.

The count of unplanned and third-party damage interruptions has shown a steady decline over recent RY periods. The reduction in third party damage interruptions can be attributed to Vector's ongoing public safety awareness programmes for gas, which are designed to increase public and contractor awareness and reduce the number of third-party incidents.

2.2.3 NUMBER OF POOR PRESSURE EVENTS

DEFINITION

Poor pressure events are a count of the number of unplanned incidents where delivery pressure drops below contracted delivery requirements. Vector uses this measure as an indicator of network capacity to meet customer demand.

MEASUREMENT

Poor pressure events are recorded where the cause of the poor pressure is related to Vector's assets upstream of, and including, the customer isolation valve (CIV). Vector's Quality of Supply (QoS) criteria for system pressure is described in Section 4.3.7.

TARGET

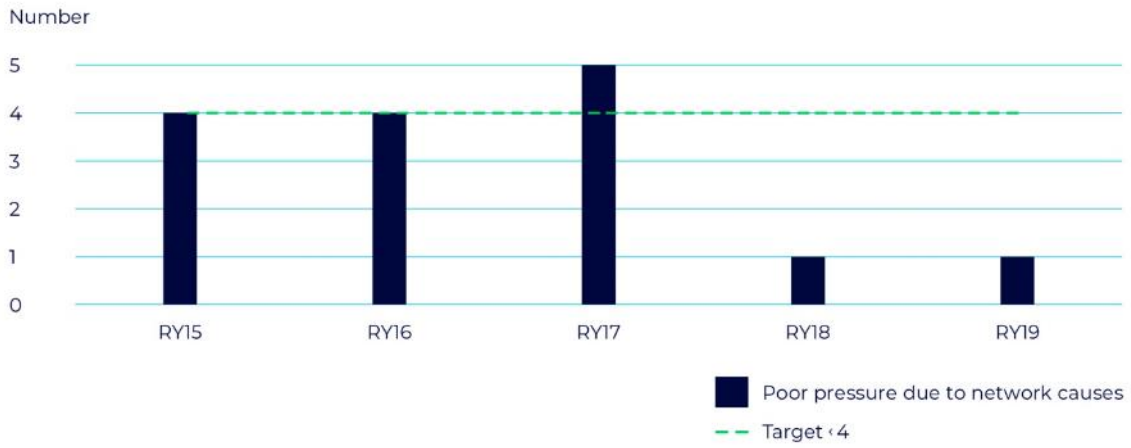
Vector's overall target level performance is four poor pressure events or less per annum. This target is based on the historical average for reference period FY13-FY17.

PERFORMANCE

The following table shows the comparison of poor pressure events due to network causes for the previous five years against Vector's target.

SERVICE LEVEL	RY15	RY16	RY17	RY18	RY19	TARGET	PERFORMANCE AGAINST TARGET
Poor pressure due to network causes	4	4	5	1	1	<4	●

POOR PRESSURE DUE TO NETWORK CAUSES



Only one poor pressure event was recorded for each of the RY18 and RY19 periods. As with all of the poor pressure events recorded over recent RY periods, the events were related to a service pipe fault, a service fitting fault or a service regulator fault. None of the events related to poor pressure on the mains network.

The absence of poor pressure events on the mains network can be attributed to the level of permanent telemetry monitoring currently installed on the network, and the annual pressure monitoring and network analysis programmes that Vector undertakes to identify constraints on the network.

2.2.4 PUBLIC REPORTED ESCAPES

DEFINITION

Vector uses public reported escapes (PRE) as its primary technical network service quality measure for operational purposes. It is a critical safety measure and a reliable indicator of the condition of the network. This measure is impacted by a number of factors, including the effectiveness of renewal strategies, the condition and composition of assets, the level of odorant added (which increases the likelihood of PREs), and the extent and effectiveness of leakage surveys.

MEASUREMENT

PRE is calculated by dividing the total number of confirmed PRE on the network (including mains, service pipes, valves, and pressure stations) in the relevant year by the total length of network (mains and services) and further dividing by 1,000. The measurement of PRE excludes third party damage events, leaks detected by routine survey and no trace events, and is limited to Vector's assets upstream of, and including, the CIV.

TARGET

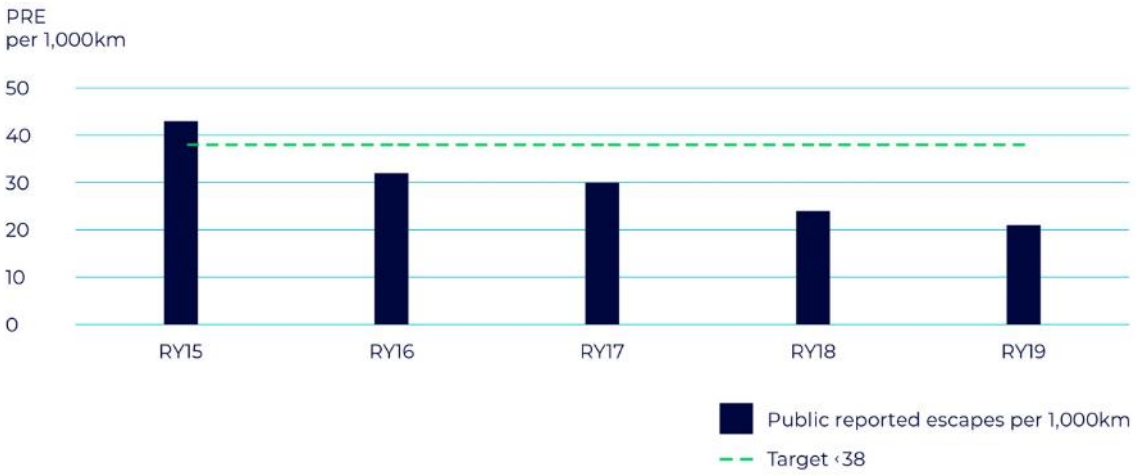
Vector's overall target level performance is 38 PRE or less per 1,000km of distribution network. The target is based on the historical average for reference period FY13-FY17.

PERFORMANCE

The following table shows the comparison of PRE for the previous five years against Vector's target.

SERVICE LEVEL	RY15	RY16	RY17	RY18	RY19	TARGET	PERFORMANCE AGAINST TARGET
PRE per 1000km	43	32	30	24	21	<38	●

PUBLIC REPORTED ESCAPES



For the RY19 period, approximately 38% of all PRE related to service riser faults (i.e. riser valve, pipe or crimp joint); a further 37% of PRE related to service pipe faults (i.e. service pipe or fitting) and the balance related to mains pipes and fittings, DRS and service regulators etc. Over recent RY periods the PRE rate has trended downwards. This trend demonstrates that Vector's current maintenance programmes (in particular preventive maintenance and corrective maintenance), and asset renewal programmes (e.g. pre-1985 Polyethylene (PE) pipeline replacement, riser valve audits etc.) are appropriate strategies to achieve ongoing network performance improvements.

2.2.5 ENVIRONMENTAL BREACHES

DEFINITION

The environmental breach metric is an annual count of the number of environmental non-compliances, prosecutions, fines, or breaches of any specific local requirements, regional council requirements, or environmental regulations or requirements.

MEASUREMENT

Compliance breaches are captured, processed and reported in Vector's legal compliance reports. The metric is measured and reported monthly and summed for each FY.

TARGET

The performance target value is for no environmental breaches. Vector's environmental target is full compliance with the requirements of all local and regional councils, to have no prosecutions or fines based on breaches, and to have full compliance with environmental regulations or requirements.

PERFORMANCE

The following table shows the comparison of environmental breaches for the previous five years against Vector's target.

SERVICE LEVEL	RY15	RY16	RY17	RY18	RY19	TARGET	PERFORMANCE AGAINST TARGET
Environmental breaches	0	0	0	1	0	0	●

For the year ending 30 June 2019, Vector has achieved the environmental target of no environmental breaches.

2.3 Process for recording reactive fault information

Vector's FSP undertakes data capture activities within the gas distribution network. The FSP manages data in accordance with Vector's requirements as defined in the Vector Gas Network Standard (GNS) GSD004 (standard for Gas Distribution Network Reliability, Integrity and Consumer Service).

Gas distribution network performance and consumer service data is captured using two methods:

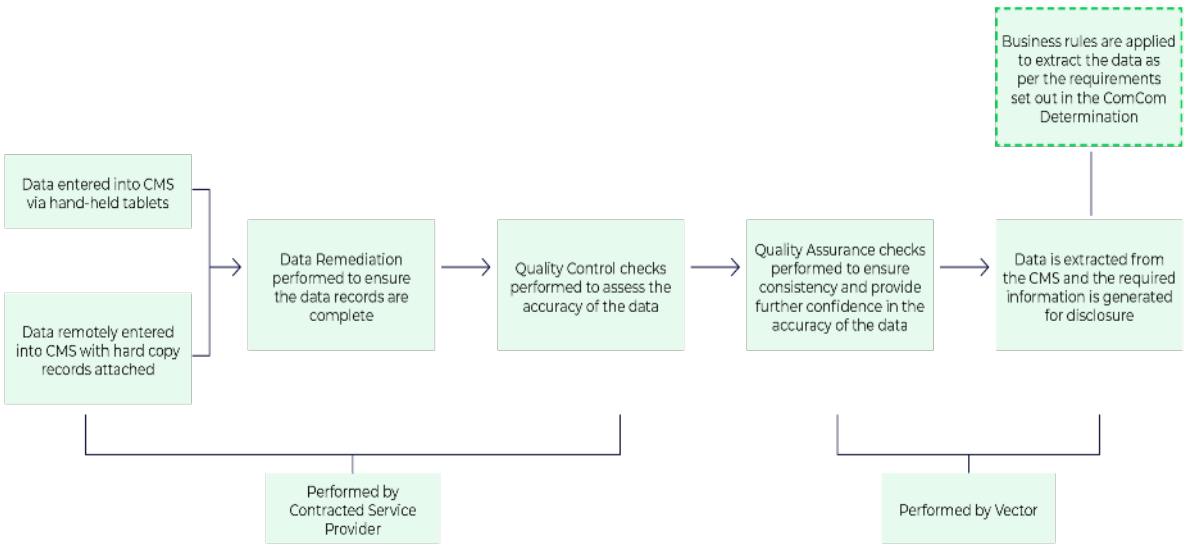
- Electronically via hand-held tablets in the field. Data from the hand-held tablets is automatically uploaded into Vector's Customer Management System (CMS); and
- Remotely entered (external to Vector) directly into Vector's CMS, with hard copy paper records scanned and entered as an attachment. This approach is used only if the electronic data capture systems are not available.

Data entered in Vector's CMS by one of the above methods is then quality checked by the FSP for accuracy, prior to undergoing additional quality assurance checks by Vector personnel. Data is then extracted from Vector's CMS and the required information is generated for reporting purposes.

The following system integrity and reliability metrics are extracted from the CMS database for disclosure reporting:

- RTEs
- System Average Interruption Duration Index (SAIDI) Unplanned
- SAIDI Planned
- System Average Interruption Frequency Index (SAIFI) Unplanned
- SAIFI Planned
- Customer Average Interruption Duration Index (CAIDI) Unplanned
- CAIDI Planned
- Interruptions by Class
- Outage Events
- Outage Events Caused by Third Party Damage
- PREs
- Third Party Damage Events
- Leakage Survey
- Poor Pressure Due to Network Causes
- Emergency Telephone Calls answered within 30 Seconds
- Product Control – Non Compliance Odour Tests
- Number of Complaints

The following figure shows how the reactive fault information is recorded and checked for completeness.



section 03

asset management system

3 – asset management system

This section of our 2020 AMP provides insight into Vector's asset management practice. The objectives and scope of asset management practice are presented along with an outline of the governance arrangements that we apply. An overview of Vector's asset management practices is also provided in this section and the primary policies, standards, information systems and data that support and enable our practice are identified. An assessment of the maturity of our asset management practice is presented along with consideration of how Vector intends to improve its practice over the timeframe of this AMP.

Vector's asset management is a multi-utility practice that includes both gas and electricity distribution assets. While these practices have much in common, the specific nature of each asset type requires differing approaches for some aspects of asset management. In this section, and throughout this AMP, the scope of asset management is limited to Vector's gas distribution network.

3.1 Asset management values and objectives

Vector's asset management policy is the overarching governance document that defines the principles and objectives that guide all aspects of our asset management practice. These principles and objectives accord with our corporate values and align with our corporate vision and mission.

Vector is committed to ensuring a safe, reliable and resilient gas distribution network. Our aim is that it is affordable for the long-term benefit of all our customers. This commitment is demonstrated through the principles and objectives that we apply in managing our network assets.

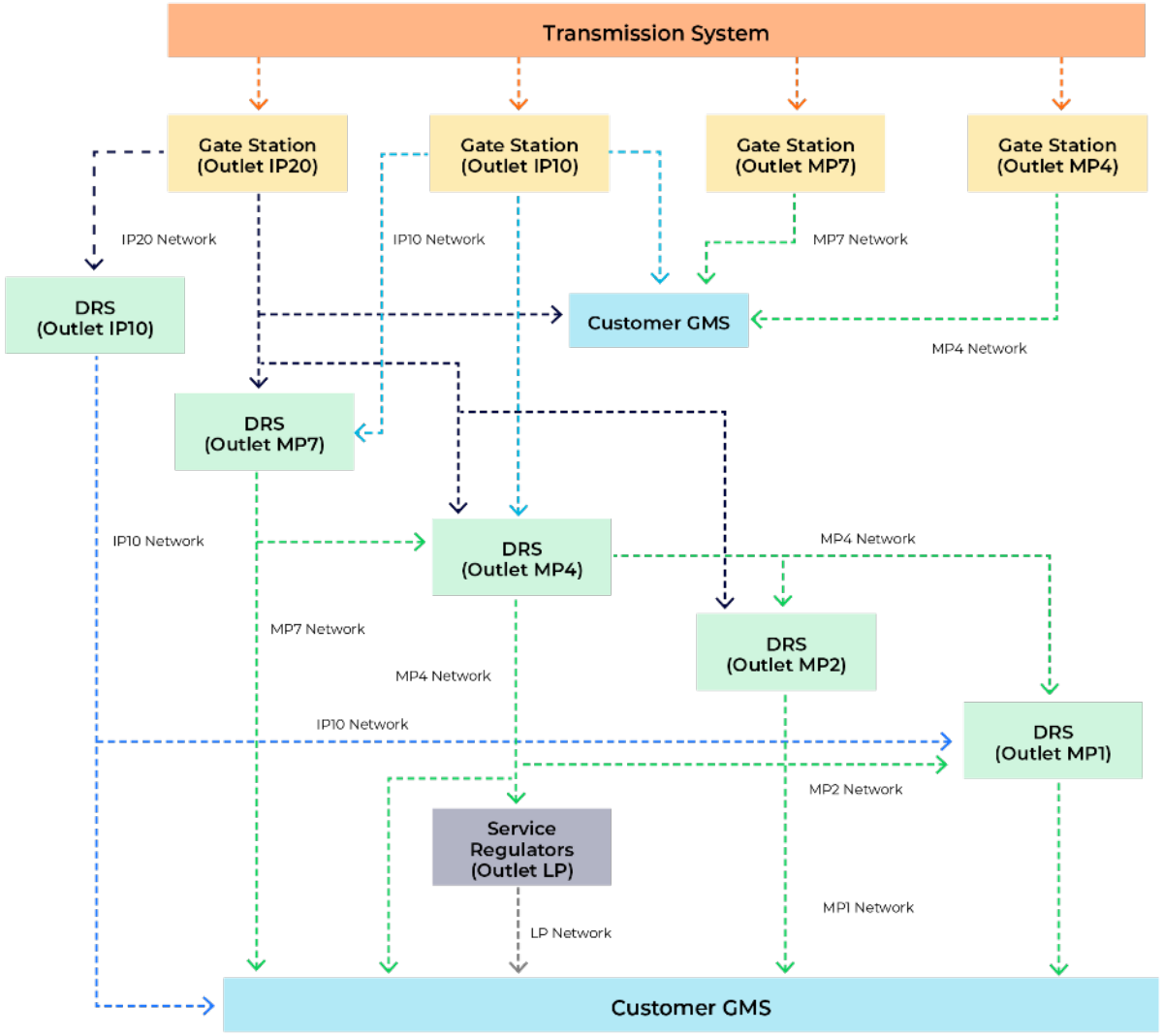
- We are committed to Safety Always with safety being a key focus of how we design, develop, deliver and service our assets over their entire lifecycle. Safety Always extends not only to our employees but also to our contractors and the public;
- As a regulated provider of distribution network services, we aim to comply with all applicable statutory and regulatory obligations and draw on good asset management practice to achieve and maintain this compliance;
- Delivering value to our customers and shareholders is at the core of our business and we maximise the value that our assets deliver across their entire lifecycle through good practice asset management, risk management and sound asset investment decisions;
- We manage the impact of our asset management practices to ensure fairness, affordability and equity of prices and by ensuring our decisions don't burden future generations;
- We strive to serve our customers by managing our assets to provide a safe, reliable, resilient, and efficient distribution network that meets our customer's present and future service expectations in the long-term interest of consumers;
- We recognise that our people are our most valuable resource and we foster a culture of innovation by ensuring we have the right mindsets, skillsets and structure in support of Vector's values;
- Our asset management is fact based, underpinned by customer insights enabled by advanced data analytics to drive the right decision making that allows the management of our assets in the long-term interests of our customers;
- We care for our natural environment, so we manage our assets and work with our suppliers and communities to improve energy efficiency and to manage the environmental impact of our assets, reduce greenhouse gases and minimise the environmental footprint of our distribution network assets through commercial and consumer-choice enabling strategies; and
- We create sustainable value through a long-term strategic focus that we leverage technology, data and systems to drive an innovative approach to asset management that aligns with Vector's corporate vision and goals as a multi-utility asset manager.

In addition to these principles and objectives, Vector's asset management practice seeks to accord with the principles of ISO 55001 (Asset management – Management systems – Requirements) and reflects a whole of lifecycle approach.

3.2 Asset management scope

Throughout this AMP, the scope of asset management is limited to Vector's gas distribution network, while the scope of our plans covers the period from 1 July 2020 to 30 June 2030. Consistent with Information Disclosure requirements, a greater level of planning detail is provided for the first five years of this period.

The primary asset within this scope is Vector's gas distribution network. This asset is an interconnected network that operates as a geographically distributed machine with many interdependent elements as shown in the following figure.



KEY:
IP = Intermediate Pressure MP = Medium Pressure LP = Low Pressure
DRS = District Regulator Station GMS = Gas Measurement System

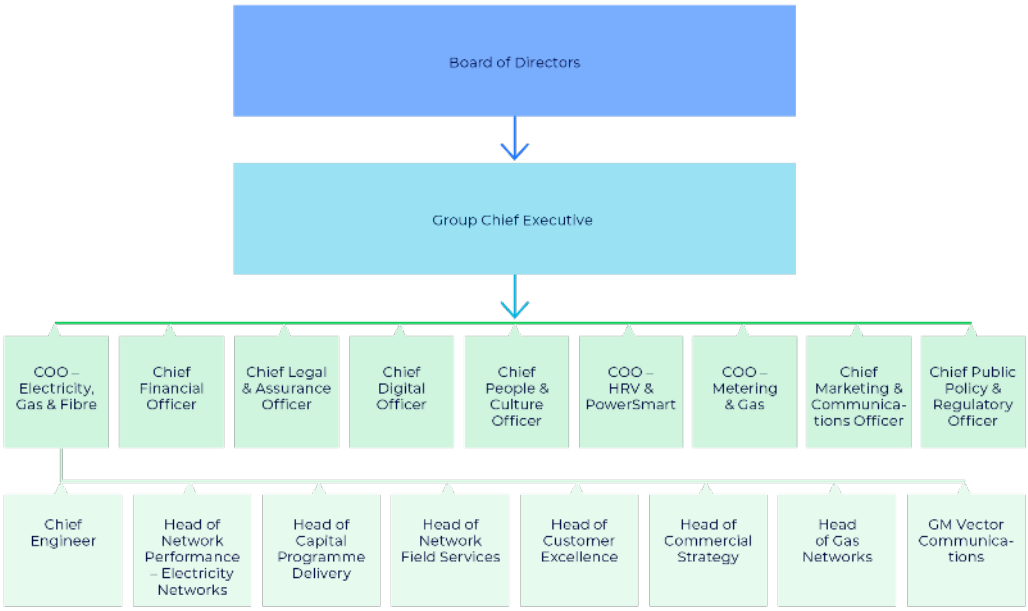
However, for the purposes of this AMP, we have defined asset categories that correspond to the major functional elements of our network. The following table shows the asset categories we have adopted in this AMP and compares them to the Information Disclosure asset categories[3].

SCHEDULE 11A (III) ASSET CATEGORIES	AMP ASSET CATEGORIES
Mains pipe	Distribution pipelines
Service pipe	
Stations	Stations
Line valve	Valves
Special crossings	Special crossings
Other network assets Monitoring and control systems	Monitoring and control systems
Cathodic protection systems	Corrosion protection systems

3 Gas Distribution Information Disclosure Determination 2012.

3.3 Vector's asset management organisation and governance

Vector's asset management organisation and our governance structure is shown in the following figure. This structure provides oversight and controls all aspects of our asset management practice. An overview of the asset management responsibilities and governance roles within this structure are set out below.



3.3.1 BOARD OF DIRECTORS

At the highest level, the Board of Directors operates under the Board Charter, and provides governance over all aspects of Vector's asset management practices on behalf of Vector's owners and the broader stakeholder community. While taking advice from Vector's management, the board exercises oversight of the objectives of asset management, its strategic direction, investment approvals and the customer service level outcomes achieved by Vector's gas distribution network. Overall budgets, significant asset investments and Vector's AMP are reviewed and approved at the board level.

Vector's Board of Directors maintains its asset management oversight through the implementation of governing policy, a Delegated Authorities' Framework (DAF), management reporting and periodic reviews including internal and external operational audits. The Board also receives performance reporting which among other things include reporting against key service levels and regulatory reliability targets.

The Board Risk and Assurance Committee (BRAC) assists the board in fulfilling its responsibilities to protect the interests of shareholders, customers, employees and communities in which Vector operates. It provides strategic guidance on the development of the maturity of Vector's Enterprise Risk Management framework, oversees the effective management of the company's material risks, and ensures rigorous processes for internal control.

Vector is committed to maintaining the highest standards of corporate governance, ensuring transparency and fairness, and recognising the interests of our shareholders and other stakeholders. Full details of Vector's board members, the executive leadership team and our corporate governance structure are available in our Annual Report.

3.3.2 GROUP CHIEF EXECUTIVE

Under the DAF, the approved strategic plan, approved annual budgets and the day to day operation of the business is the responsibility of the Group Chief Executive (GCE). The GCE maintains oversight of Vector's asset management practices, including effective risk management (both strategic and operational), service level outcomes, strategic direction and investment approvals. To assist with this oversight the GCE receives performance reporting against key metrics and service levels which include reporting against regulatory reliability targets.

All Vector's activities are governed through the DAF which links approved budgets to the authority to authorise or commit expenditure. Under this structure, the GCE has delegated overall responsibility for the gas distribution business to the Chief Operating Officer – Electricity Gas & Fibre (COO).

3.3.3 CHIEF OPERATING OFFICER – ELECTRICITY GAS & FIBRE

Under delegation from the Board and GCE, the COO – Electricity Gas & Fibre has full responsibility for Vector's gas distribution business. This includes the establishment and enforcement of Vector's Asset Management Policy, the overall performance of Vector's gas distribution network, development and implementation of the approved AMP and budgetary control with the DAF.

Within the asset management context, the COO – Electricity Gas & Fibre is supported by the Chief Financial Officer, Chief Legal & Assurance Officer, Chief People & Culture Officer and the Chief Digital Officer in ensuring that appropriate systems, policies and procedures are in place that support and enable asset management, as well as implementation of the management and governance practices required by the Board of Directors and GCE. The COO – Electricity Gas & Fibre role is responsible for compliance with the requirements of Vector's risk management framework, delegated financial authorities, and in conjunction with the Chief Digital Officer, for ensuring that Vector's Digital Strategy meets the needs of our asset management practice and enables our network vision (see Section 5.3.1).

3.3.4 HEAD OF GAS NETWORKS

The Head of Gas Networks reports to the COO – Electricity Gas & Fibre and has responsibility for network design and planning, engineering standards and the day to day operation of Vector's asset management practice for Vector's gas distribution business. This position is responsible for asset performance, for ensuring that Vector's Asset Management Policy is implemented, for monitoring the service level performance and quality of our assets, for the development of asset strategy, for the development of Vector's AMPs (including technical standards) and for developing asset management practice. This role also has limited budgetary control within the DAF.

This role manages the day to day operations as well as delivery of the approved gas network CAPEX and OPEX works programme under Vector's Multi Utility Service Agreement (MUSA) with our FSPs.

3.3.5 HEAD OF CUSTOMER EXCELLENCE

The Head of Customer Excellence reports to the COO – Electricity Gas & Fibre and is responsible for ensuring customer expectations are met through the Contact Centre Management and Customer Initiated Projects processes. The Head of Customer Excellence also champions the voice of our customers within Vector's asset management practice. This role manages the approved customer-initiated CAPEX works programme under Vector's MUSA with our FSPs.

3.3.6 OTHER SENIOR POSITIONS THAT SUPPORT ASSET MANAGEMENT

There are several other senior roles that provide critical support to the COO – Electricity Gas & Fibre role. Specifically:

- Group Manager Information & Insights: this role reports to the Chief Public Policy and Regulatory Officer and is responsible for Networks Analytics, Business Intelligence, Information Management and Data Platforms. This function provides analytical support and information that is essential to understanding customer behaviour, asset performance, developing and evaluating asset strategy and managing asset risks.
- Head of Pricing & Regulatory Compliance: this role this role reports to the Chief Public Policy and Regulatory Officer and ensures that Vector's regulatory activities and pricing is managed appropriately. The Head of Pricing & Regulatory Compliance provides regulatory compliance oversight as well as expert regulatory advice and support to Vector's asset management practice.
- Head of Commercial Strategy: This role leads and enables the development of the strategic plan for the Electricity, Gas and Fibre, and the detailed current year operating plan. This function leads the transition from gas distributor to customer energy enabler and provides management oversight for quality business cases and budgets – matching projects, incentives and expenditure profiles over various timeframes.

The governance framework overarching each of these roles is defined by the Code of Conduct and Ethics - the Vector way, Vector's DAF, the Delegated Financial Authorities Policy (DFA) and position descriptions for each role. Vector's Board has delegated specific authorities to the GCE and authorised delegation of certain authorities to other levels of Vector's management. The limits and rules applied to delegations are prescribed in the DAF documentation and govern the authority to commit to transactions or expose Vector to a risk.

Vector's Enterprise Resource Planning (ERP) System (SAP) is the primary management system used to implement the DAF and DFA. Financial delegations for approvals under the DAF for OPEX and CAPEX are set and managed within Vector's ERP system. Periodic audit of the DAF is undertaken to ensure ongoing compliance. The ERP system also provides control of asset management workflows, as well as the management of information that enables our asset management and project management practices. Further details of Vector's asset management practice and our project management practice are provided in Section 3.5 and Section 6.3 respectively.

3.4 Key documents

3.4.1 LEGISLATIVE REQUIREMENTS

Vector's gas distribution assets have been designed and constructed and are operated in accordance with the following principal Acts, Regulations and industry codes:

- Gas Act 1992 and Gas Amendment Act;
- Health and Safety in Employment Act;
- Gas (Safety and Measurement) Regulations;
- Civil Defence and Emergency Management Act;
- Hazardous Substances and New Organisms Act;
- New Zealand Standard (NZS) 7901 Electricity and Gas Industries – Safety Management Systems for Public Safety;
- AS/NZS 4645.1 Gas Network Management;
- AS/NZS 2885 Pipelines – Gas and liquid petroleum; and
- NZS 5263 Gas detection and odorisation.

These Acts, Regulations and industry codes include both prescriptive and performance-based requirements which have been embedded into Vector's suite of asset management documentation.

3.4.2 DOCUMENT HIERARCHY

This AMP is a cornerstone document and is the tactical plan for managing the physical assets to deliver targeted outcomes of safety, reliability, resilience, operational efficiency, data and cyber security, improve the customer experience while also achieving optimal financial impact. The outputs of the AMP include: (i) the operational programme which drives OPEX on our gas network and informs the development of asset maintenance plans and, (ii) the capital programme which drives CAPEX on Vector's gas network and informs the business cases prepared for capital investments. To achieve this, Vector uses a range of documents to stipulate and control the requirements for its network and that inform our asset management practices. The following pyramid represents Vector's document hierarchy.[4]

Vector has a robust set of policies and standards that inform our asset management practice, supported by a continuous improvement process to review and update processes and documentation. The following subsections provide insight into these governing documents and how we use them.

3.4.3 POLICIES

Policies are high level statements that outline Vector's compulsory state of performance. Policies provide statements of fact from which other documentation is developed and aligned. The table below summaries those policies that relate to asset management. Section 7.2 provides an overview of other important asset management policies and related documents that inform specific aspects of Vector's asset management practice.

4 Our safety alerts are not controlled and are therefore not included in the hierarchy

POLICY DOCUMENT	ROLE IN ASSET MANAGEMENT PRACTICE
Asset Management Policy	This policy is Vector's formative asset management document. It defines the principles and objectives that guide all aspects of our asset management practice.
Delegated authorities framework (DAF)	The DAF applies to all business activities that have financial or non-financial consequences including contracts and expenses. The DAF set out specific approvals for particular transactions and governs the level of financial commitment that individuals can make on behalf of Vector. All decisions within asset management that require expenditure or involve significant risk will be made under this policy and in accordance with Vector's project approval process. Under this policy, projects in the early stages of development are given preliminary approval, while final approval must be provided before expenditure is committed.
Risk Management Policy	This policy provides the overarching risk management intent that Vector strives for. Its purpose is to (a) outline our key management objectives and the principles underpinning them, (b) provide a framework for optimising opportunities minimising risks, (c) demonstrate Vector's understanding and commitment to promoting a culture of risk awareness throughout the organisation, and (d) define key risk management roles, responsibilities, accountabilities and reporting requirements.
Health and Safety Policy	This policy sets out Vector's commitments and requirements for health and safety. Vector will conduct its business activities in such a way as to protect the health and safety of all workers of Vector Limited and its related companies ("Vector People"), the public and visitors in its work environment.
Environmental Policy	This policy sets out Vector's commitment for managing the environmental aspects of its businesses and sets out the standards expected of all workers of Vector Limited and its related companies ("Vector People").
Sustainability Policy	This policy provides Vector's framework for managing environmental, social and governance risks and opportunities. It includes commitments to recognised international agreements and sets out the key principles by which sustainability will be adopted within the business.
Gas Distribution Safety and Operating Plan	This Safety and Operating Plan (SAOP) has been developed for Vector's gas network to detail the controls in place to mitigate the risks that have been identified under the hazard and risk assessment processes for minimisation of harm to persons, property, the public and the environment, including emergency response.
Group Data and Information Policy	The purpose of this policy is to govern and guide Vector's key data and information principles and includes everyone's responsibilities regarding data. Data and Information refers collectively to all records and documents (both physical and electronic) used to describe and document Vector's business.

3.4.4 STRATEGIES

Strategies provide a course of action that stipulates the direction and key processes required. They are strategic documents required to bridge the gap between the criteria detailed in the standards and specifications and the key decision points listed in the policies. Our strategies are listed in Section 7.2.

3.4.5 STANDARDS

Engineering standards and specifications provide the basis for how our network is designed and operated and for the procurement of equipment and plant. Standards and specifications are an integral part of our asset management framework and Vector applies a large number of these standards to the management of our gas distribution assets. Standards also allow us to ensure any concept design takes the initial hazards into consideration. We also have a process in place to introduce any new asset into the network in a controlled manner to ensure the equipment will comply with our technical objectives and H&S requirements. We draw extensively on AS/NZS and IEC standards for our design, procurement and installation of equipment and plant. Ongoing assessment of design effectiveness reviews are undertaken and used to improve future designs, guidelines and standards. The following table lists the major standards and specifications that support the design, procurement, supply, commissioning. operation and maintenance of existing, new or replacement assets. A more comprehensive list of standards are listed in Section 7.2.

ASSET STANDARD	ROLE IN ASSET MANAGEMENT PRACTICE
Planning Standards	Planning standards guide the planning and development of Vector's overall distribution network. These standards work in conjunction with the service level metric to ensure that the network has sufficient capacity and capability to provide the required service levels, enable customer connections, and accommodate growth. These standards also set requirements that enable appropriate operation of the network in accordance with the Network Operating Standards (see below). Technical specifications are listed in Section 7.2.
Maintenance Standards	The objective of maintenance is to ensure the realisation of the required safety and reliability levels of the asset at optimum cost. Vector has developed a set of maintenance standards for each major class of asset that detail the required inspection, condition monitoring, maintenance and data capture requirements. Where a cyclic maintenance strategy is applied, these standards also set out the maximum maintenance cycle frequency. Maintenance standards are listed in Section 7.2.
Network Operating Standards	These standards define protocols and procedures for operating and controlling Vector's gas network, including contingency plans. They also inform minimum requirements for network planning and design practices.
Design and Construction Standards	Design standards and their accompanying standard design drawings set out the requirements for and the detailed design and installation of equipment. They also include the data capture requirements for our asset management systems and plant in Vector's network. Our design standards and standard designs has modularity and simplicity at its core to enable deployment at any site or situation. Design standards are listed in Section 7.2.
Equipment Specifications	Equipment specifications specify the materials and equipment to be used on the gas network and the quality and performance requirements with which the materials and equipment shall comply. Equipment specifications are listed in Section 7.2.
AS/NZ Standards	Australian and New Zealand standards are referenced extensively in our standards and scopes of work. A full list of these standards is beyond the scope of this AMP.

3.4.6 PROCESSES

A process document is a detailed view of tasks to achieve a particular end. It includes business rules for the running of day to day operations and established protocols of a procedure or behaviour in any group or situation. In many cases these will include process flowcharts. We are reliant to a large extent on standards and specifications to guide us but we have a number of processes for which flowcharts are required. For example, our engineering design manual contains the flow process from inception of a project to delivery and commissioning; and our controlled document standard explains the flow process for how a new standard or document is assigned a number. Not all of our standards and specifications include processes – they form part of the document as appropriate and where required.

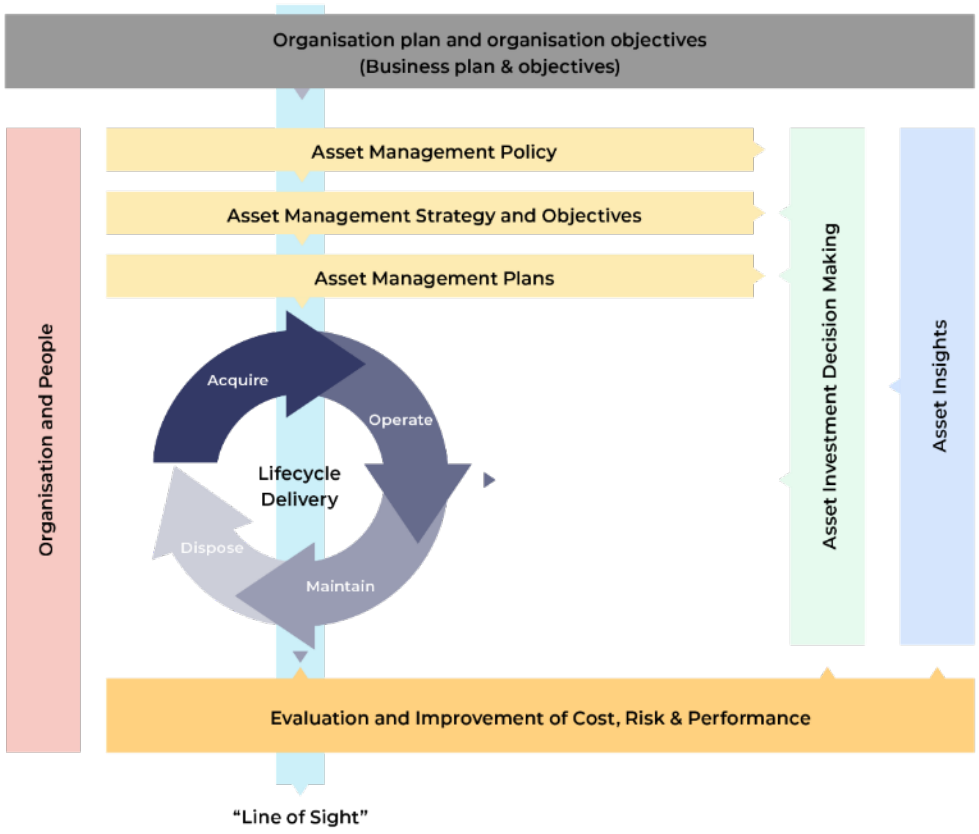
3.4.7 GUIDES

A guide or guideline is a written instruction that shows or tells how something should be done, e.g. manuals, handbooks, guidelines, and codes of practice. We make extensive use of manuals and guidelines for our network plant: manuals are delivered as part of the delivery and commissioning of the plant in both hard and soft copies. Hard copies are stored in our structured software filing system. We also refer extensively to guides for our engineering designs and system modelling.

3.5 Asset management system

Our Asset Management System encompasses all practices associated with a co-ordinated approach to realise value across the full asset lifecycle from planning to disposal. This aims to create clear linkages from organisational strategic objectives that set clear Asset Management objectives and enable effective Asset Management Plans to be created that, when delivered, achieve on the series of aligned objectives.

Continuous improvements in our Asset Management System, with supporting risk, cost and performance monitoring, and data driven reporting, will ensure a full "Line of Sight" throughout the Asset Management governance structure, from organisational objectives to individual asset level performance. We continuously measure and review the progress against the stated objectives to ensure we remain on track and respond quickly to changes in our operating environment. Our Asset Management System is shown in the following figure.



The Vector Asset Management System has been designed utilising knowledge available internationally as best practice to support the strategic objective of seeking accord with the principles of ISO 55000.

The Asset Management System comprises of a series of six documented process standards which cover the entire landscape of Asset Management. As they are finalised, they will supersede the existing practice and ensure any pre-existing gaps in process, structure or accountability are closed. These standards will be continually reviewed and updated as a process of continuous improvement. The Asset Management Standards being formalised include:

- **AMS 01: Asset Management System, Strategy and Planning;**

  Documents the Asset Management System as a series of six Vector standards, outlining the framework for setting the Asset Management Policy, Asset Management Strategy (including Asset Insight Strategy), Asset Management Objectives and finally Asset Management Plans. It is the latter that specify the detailed activities, resources, responsibilities and timescales required, in conjunction with the associated risks, in order to achieve the Asset Management Objectives, which in turn should then see Vector achieve the required organisational / corporate objectives as expected by our stakeholders and customers.

- **AMS 02: Asset Investment Planning & Decision Making;**

  Documents how asset investment decisions around prioritisation and optimisation are made to compile the final asset management plans. Includes capital investment for new growth requirements as well as replacement for end of life existing assets. This standard also establishes the maintenance requirements for the assets, documents these as standards, and seeks to make optimal decisions with the objective of achieving the lowest overall asset lifecycle cost. The last element of this standard is how resourcing, procurement and shutdown planning strategies are derived to enable effective delivery of the plans, in terms of required service providers, materials and spares, and with the smallest noticeable impact on our stakeholders and environment.

- **AMS 03: Life Cycle Delivery;**

  Documents how AMPs are translated into more detailed work plans, namely project scopes, programme scopes or routine maintenance plans. It covers the acquisition phase of the asset lifecycle including programme management, project management, commissioning and handover, plus the detailed plans that drive the delivery of required ongoing operations and maintenance activities throughout the asset life. This includes shutdown/outage planning, fault and incident response, contingency plans for critical assets and business continuity. Configuration management is included, being the management processes in place to ensure desired asset functions are retained. Assurance of compliance with relevant legislation, standards and industry best practice also falls into this standard. The final element is the policy, procedures and plans around asset decommissioning, including the re-assessment of the impact of asset disposal if the situation has changed since his was considered at acquisition stage.

- **AMS 04: Asset Insights;**

  Documents how Asset Data Standards and Systems are defined and implemented in line with the Asset Insight Strategy in order to collect, store and utilise meaningful data to drive effective decisions around asset management activities. Undertaken effectively, data becomes information, leading to knowledge and ultimately wisdom – a deep understanding (the definition of

insight) of the assets. This standard also documents how the Asset Data Standards are compiled to specify the required structure, format, location and desired quality for storing data, as well as the associated management processes in place around data collection, management, governance, assurance and audit.

- **AMS 05: Organisation and People;**

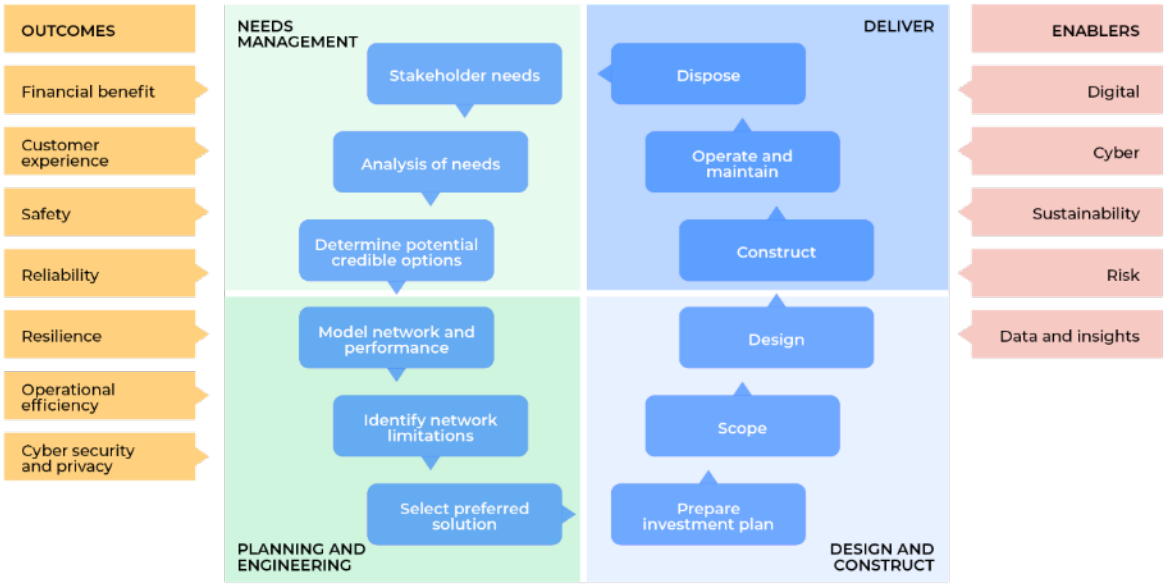
  Documents how outsourced activities such as equipment suppliers, service providers and other contracted services are aligned to promote a whole life asset management approach that delivers on the clearly stated objectives of the organisation, with corresponding documented accountabilities. Other enablers to this are also documented such as how the organisation structure, roles and responsibilities are set, plus how it is ensured that a supply of competent and motivated people is available now and into the future to meet and continue to fulfil the set objectives.

- **AMS 06: Evaluation (of Cost, Risk and Performance), Review and Improvement.**

  The final document in the set, and arguably the most important in completing the line of sight through to the stakeholders, documents how continuous evolution of asset performance takes place to identify any discrepancies with desired objectives. This is undertaken utilising data and analytical abilities in terms of cost, risk and performance against key indicators and metrics aligned to the objectives, these in turn being set as an output of reliability and resilience planning where the expected performance of an asset is set within a defined normal operating environment. For scenarios where the environment deviates from the normal stated operating environment, such as a major weather event, this standard documents how the need for resilience/contingency plans is identified and how they are derived. Aside from just the assets, this standard also documents how the performance of the Asset Management System itself is measured, and how this feeds into a continuous improvement process. The processes in place to manage risk within the Asset Management System are documented and align to the organisational risk management system. The final element is how management / stakeholder review and audit are undertaken.

3.6 Asset investment process

Our present asset investment process consists of four stages as highlighted in the figure below and described in the following subsections.



3.6.1 NEEDS MANAGEMENT

This is the formative stage of our asset investment process where the needs of stakeholders are identified and measured against the target outcomes, i.e. customer experience, safety, risk, reliability, compliance, resilience, operational efficiency as well as the financial justification (direct and indirect). During this stage, all stakeholders are engaged to identify and understand the needs, requirements and the target outcomes. By understanding stakeholders' requirements, Vector is able to develop meaningful service level metrics and associated performance targets that are used to assess asset performance. Section 2 provides details of our primary stakeholders and the service levels metrics and targets we use in managing our gas distribution network assets.

Vector assesses asset performance against the service level targets defined in Section 2. Trends are analysed to identify potential performance issues. Understanding historical performance is key but we also consider the expected future performance, likely influencers, expected changes in the operating environment through advanced data analytics. When actual or foreseen performance gaps are identified, root cause analysis and risks analysis are undertaken to identify the source and significance of any actual compliance or expected service level breaches. External influences, volatility and trends are used to identify any significant systemic performance issues.

The result of this analysis is to identify the need for asset or service-related interventions (corrective or preventative) to address actual or expected degradation of service performance. Project proposals are created to address these needs. These proposals specify the need identified, the options considered to address the need and the preferred option. Project proposals are also

created through the network planning process (see below), which is responsible for managing the development of the network through a probabilistic planning approach.

All project proposals are approved by Vector's subject matter experts and are then subjected to a portfolio prioritisation and optimisation process as described in Section 6.1. Through the portfolio optimisation process, any conflicting requirements are addressed by assessment to select the option with the greatest overall benefits and least cost. The project proposals for this AMP are provided in Section 5 and the results of selections made through the optimisation process are set out in Section 6.4.

3.6.2 PLANNING AND ENGINEERING

Planning and Engineering involve the development and evaluation of possible options that then culminate in a front-end engineering report and concept. Options may include traditional network solutions such as asset replacement or renewal, accepting the risks of service level breach (do nothing), new technology solutions, non-asset solutions or combinations of these options. Each option is developed, and a preferred option selected based on the option's economic value, technical feasibility, risk, strategic alignment and on asset management policy considerations including sustainability. Safety in Design forms a critical part of this stage of the asset investment process and is a mandatory consideration that requires collaboration with stakeholders.

Where an asset solution is recommended, functional and performance requirements are specified, lifecycle management plans are developed, and a project scope is prepared as the basis of the Design and Construct stage. Where appropriate, we also assess non-traditional solution options to meet the functional or performance requirements expected, and a combination of these options may be developed to address a requirement. Where a non-asset solution is recommended, appropriate specialist processes are engaged to progress the response. In some cases, where no technically or economically feasible option is identified, the front-end engineering design may lead to a revaluation of the identified need.

Under our governance practices, approval of the preferred option is required prior to proceeding to the Design and Construct stage or prior to referral to a specialist non asset solution process.

3.6.3 DESIGN AND CONSTRUCT

During the Design and Construct stage, Vector translates the selected option into a project scope, functional requirements and performance requirements and a set of design specifications and design drawings, where applicable.

In accordance with our asset management policy, life-cycle cost minimisation is undertaken during design to ensure that ownership and acquisition costs are minimised. Vector also undertakes assessment of safety, constructability, standards compliance, reliability (i.e. failure modes effects analysis), design standardisation, sustainability, environmental impact and operability during design to ensure that assets can be safely and effectively maintained and operated across the lifecycle. In addition, design is undertaken to align with relevant corporate and asset management strategies.

The outputs of the design process are detailed technical design documentation that is used to guide procurement and construction. During design, essential information is captured in Vector's system of record to enable and support the ongoing management of our assets.

Asset Support forms a further essential part of the Design and Construct stage and provides key links with the Programme Delivery stage. Drawing on service level gap and root cause analysis undertaken in the Needs Management stage, Asset Support develops detailed plans for maintenance, spares holding, data systems, finance and resources that maintain asset performance across the lifecycle. All assets are reviewed annually, and a comprehensive set of plans are produced that set priorities to maintain asset performance against the required service levels. These plans are approved under our governance practices before being programmed and delivered by Vector's FSPs.

3.6.4 PROGRAMME DELIVERY

Programme Delivery is a process that involves asset acquisition, construction and commissioning, operations, maintenance and disposal. Construct and Dispose links Design and Construct with Programme Delivery. Through this process, the detailed design documentation produced is translated into network assets. Construction of new assets, testing and verification of "as built" assets and disposal of old assets is undertaken through the Construct and Dispose process to ensure compliance with design documentation, and Vector's standards (see Section 7.2). Critical asset data records are created or updated in Vector's systems of record during this process.

Once in service, Operations & Maintenance manages the asset across the operational phase of its lifecycle. This involves maintaining the assets in accordance with Vector's maintenance standards, under the annual plans produced by Asset Support. Asset inspections are also carried out and inspection data is captured in SAP to inform Vector's asset management practices, service level performance analysis and root cause analysis. This inspection data is also used to identify any network components that require replacement due to an unacceptable failure risk. Operations & Maintenance is also responsible for operating the assets to manage system performance, implement planned changes to the network's static configuration and for providing access to undertake planned or emergency works. Delivery of Operations and Maintenance is contracted to FSPs and is managed under a contract-based performance framework.

3.6.5 NETWORK PLANNING PRACTICE

Vector's probabilistic planning practice forms an important specialist aspect of Needs Management that applies across the segment, focusing on network development. Our network planning practice involves processes to manage network peak demand and improving network resilience, and delivery of gas capacity to meet customer's needs and major asset relocations.

The need for asset services initiated directly by customers includes network connection need and minor asset relocations. In most cases, network connections and minor asset relocations are managed directly by FSPs who undertake design, execute necessary works and maintain associated asset records, in accordance with our standards. Where practical, opportunities to combine network development or asset replacement works with customer-initiated works are leveraged to achieve cost savings and other advantages.

Growth in network peak demand (organic growth) and Vector's QoS criteria (GNS-0074) is discussed in Section 5.1. The QoS criteria captures a cost-quality trade-off that reflects the ability of our assets to accommodate gas demand without breaching QoS requirements, and to provide restoration capacity that supports planned and unplanned supply interruption events. Performance against QoS is managed through an annual network planning cycle that involves:

- Development of Vector's annual network load forecast in accordance with the Gas Distribution Forecast Utilisation (GNS-0086). An overview of Vector's load forecasting process is provided later in this section;
- Updating of Vector's network model with asset changes and the latest load forecast in accordance with GNS-0089 Gas distribution model building. To support this practice, data on customer connections is extracted from Gentrack and Smallworld;
- Modelling of the network to identify future capacity or security constraints that breach the QoS service level requirements. Modelling is undertaken using Synergi Gas, our network modelling software, and in accordance with the Gas Distribution Model Building standard (GNS-0089). This model includes the capability of modelling all pressure systems to ensure adequate capacity under contingency conditions or other nominated scenarios including future loads increases, the impact of investment in additional network capacity and effect of seasonal load and asset ratings to meet QoS; and
- Undertaking a risk assessment where a breach of the QoS service level is identified and developing options as outlined under Asset Engineering (see above). Any proposal to respond to an expected breach will be developed to address the breach on a just-in-time basis and are developed in accordance with Vector's corporate and asset strategies and with the Piping System Design standard (GNS-0002).

The QoS criteria is also taken into consideration when reviewing asset replacement options, and any synergies with network development works are investigated. Moreover, not all breaches of the QoS criteria are addressed through network investment, as in some cases non-network solutions are practical and more economical.

Further information regarding the standards used in Vector's network planning practice are provided in Sections 3.4 and 7.2.

3.6.6 NETWORK LOAD FORECASTING PROCESS

A time-series moving average model has been developed for gas demand forecasting. The model delivers steady-state winter peak loads, at gate-station level, forecasted for the ten-year planning period effective from the date of the published AMP. Hourly daily readings from each gate station form the basis of historical data, from which monthly flows are summarised into quarterly peak values, allowing seasonal trends to be observed. Because the gate station meters provide data for upstream network reconciliation and billing a high degree of accuracy is inherent. Input into the time-series was taken as the maximum flow of each quarter (Jan-Mar as Q1, Apr-Jun as Q2, etc).

Various gate stations are comprised of multiple supply streams and therefore are fitted with multiple meters, resulting in multiple simultaneous meter readings. At these sites, hourly flows are summed to account for either parallel supply or switching of supply streams. Graphical presentation of the trends allows easy identification of zero, anomalous or incomplete data, which can then be omitted or corrected.

The time-series quarterly values are analysed for several factors: long-term trend, business cycle effects, seasonality, and unexplained, random variation. Because it is usually very difficult to isolate the business cycle effects, the method described here assumes the trend component has both long-term average and cyclical effects. The multiplicative model calculates the value using the formula:

Value = Trend x Seasonal x Random

The process of analysing time-series comprises two stages. The first stage is called 'decomposition' by applying moving averages to eliminate the irregular and seasonal variation in the data and identifying the long-term growth trend within the time-series. Secondly, historical flow data is seasonally adjusted and the trend of the adjusted quarterly flow values is extrapolated and multiplied by an appropriate seasonal index to obtain the forecasted long-term gas demand at each gate station. Using actual gate station flow data and providing the results of the updated time series analysis allows the demand forecasts to be developed using maximum values for year "zero", and derived values for successive years during the ten-year planning period.

Where a gas network is supplied from two (or more) gate stations, the timing of the network peak gas flow may not coincide with any individual gate station peak flow. In such cases, a co-incidence factor is calculated and applied to the growth trend. It is expressed as the maximum peak flow into the network divided by the sum of the individual peak flows of the two gate stations.

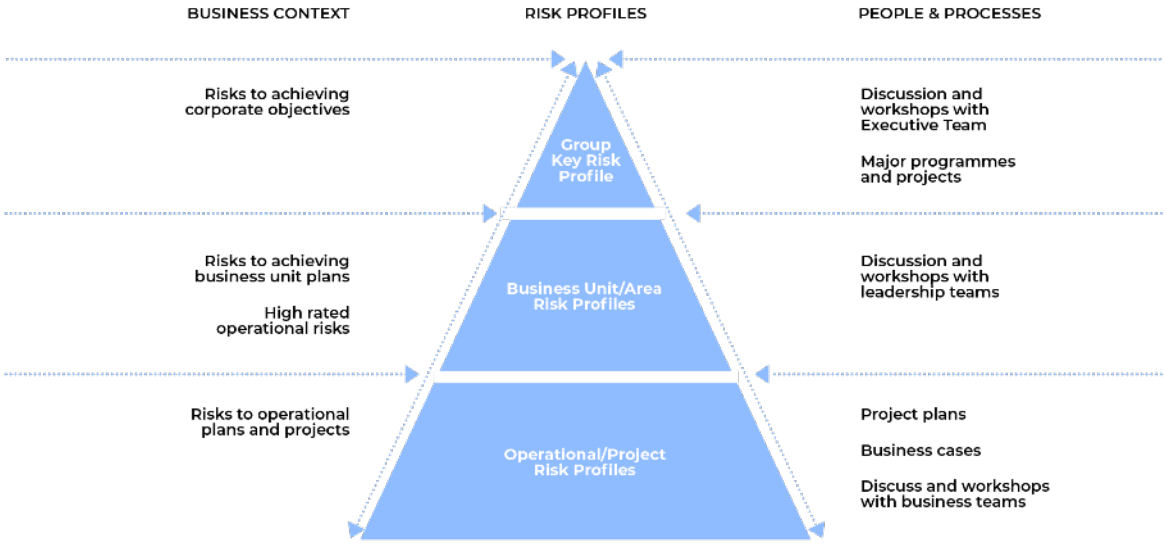
Vector's load forecasts can be found in Section 7.5.

3.6.7 RISK MANAGEMENT

At Vector, we recognise that rigorous risk and opportunity management is essential for corporate stability and performance. To drive sustainable growth, support effective decision making, and ensure business resilience, we must anticipate and respond to risks affecting both our strategic objectives and our operations. As such, our risk management practices form an integral part of the asset management process.

As outlined in our Risk Management Policy, our enterprise risk management (ERM) framework provides a flexible and purpose-built approach to the application of risk management across Vector and reflects the nature of our business as a supplier of critical infrastructure, a leading New Zealand-listed company and an operator of potentially hazardous material.

Our ERM framework allows for a single, enterprise-wide view of risk, aligning across a number of profiles and contexts (as illustrated in the following figure), to support the achievement of strategic corporate objectives while ensuring key operational activities are appropriately managed and assessed.



The framework is consistent with ISO 31000:2009 “Risk management – Principles and Guideline” and, as illustrated in the following figure, is focused on understanding, monitoring and proactively treating the uncertainty and risks within our business.

In line with the Three Lines of Defence principle, all Vector people are responsible for applying Vector’s ERM framework within their individual roles and are encouraged to proactively identify, analyse, escalate and treat risks, including considering the external trends and drivers that might impact Vector’s operating environment going forward.

Identified risks are assessed on both the likelihood of the risk occurring and the potential impact(s) of the risk. The resulting evaluation informs the asset investment process and the development of asset class strategies and ensures appropriate treatment plans (which supplement existing controls) are developed and prioritised. This assessment is mapped against the Vector Group Risk Assessment Matrix, which articulates the Board’s risk appetite and enables risks from across the business to be raised and discussed using a consistent and transparent approach.

Asset risk management is undertaken using a combination of risk and asset reliability models, including a Failure Mode and Effects Analysis (FMEA), to identify maintenance and other proactive controls, while Bow Tie diagrams enable a comprehensive (and visual) assessment of the causes and consequences of an individual risk and the controls in place to manage the risk. The network-related risk assessment includes identifying potential High Impact Low Probability (HILP) events that could adversely affect the state of the network with specific controls and mitigating activities identified to manage and address the potential consequences. Where appropriate, a visual inspection of the network’s health is undertaken post-HILP events to confirm the ongoing resilience of the system.

The management and tracking of identified risks and associated treatment plans is undertaken using Vector's enterprise risk management system, Active Risk Manager (ARM).

To confirm the effectiveness of governance, risk management and internal controls across all business operations, Vector’s Group Internal Audit function operates an independent and objective assurance programme. The team follows a co-sourced

model, drawing on both in-house and external expertise, and has unrestricted access to all Vector staff, records and third parties as deemed necessary. The team also liaises closely with KPMG, as Vector's external auditor, to share the outcomes of the internal audit programme (to the extent that they are relevant to the financial statements).

3.7 Asset management improvement

Periodically, we review our asset management practices using the Commerce Commission's Asset Management Maturity Assessment Tool (AMMAT). In addition, Entrust, Vector's majority shareholder, biennially conducts an independent review of the state of Vector's network that includes an assessment of asset management. We use these reviews to inform our plans to improve our asset management practice.

At an overall level, our asset management maturity compares well with generally accepted New Zealand gas asset management practices to ensure the ongoing safe and efficient operation of the gas network. Section 7.15 provides details of the latest AMMAT self-assessment.

Our latest AMMAT review highlighted the good progress we are making in terms of formalising our asset management practices and improving our asset management information systems and processes. We recognise the importance of continuous improvement and that this process is ongoing, in our aim of achieving a target score of three on each AMMAT rating criteria. We will continue to develop our CBARM models and formalise our data and information systems to support these models. We have reviewed our operating and contracting models in response to changes in our health and safety policies, potential risks associated with climate change, cyber-security, privacy and data analytics.

Set out below is an overview of the primary areas where improvement of our asset management practice is being implemented.

3.7.1 ISO 55001 FRAMEWORK

We have more recently been consolidating our asset management practice as a basis for improvement. The next step is to revise the key processes so they better accord with an ISO 55001 framework. This will involve further development of our asset management framework, assessment and amendment of some of our asset management processes, training and some documentation redevelopment.

It is expected that this initiative will provide benefits through improved skills and more effective and efficient asset management practices. Improvements will become apparent through progressive increases in the self-assessment against the AMMAT model.

3.7.2 ENHANCING STRATEGIC ASSET MANAGEMENT PRACTICE

Adopting an ISO 55001 framework highlights strategic asset management as a core practice. While Vector has a range of asset strategies, their effectiveness can be enhanced through the development of a formal strategy framework that improves their alignment and relationship with service level metrics. This initiative involves the review and mapping of current strategies, service levels and corporate strategies, and the development of a strategic asset management plan. Development and redevelopment of several asset management strategies may also be required. Dedicated resource has been assigned to ensure focus on these activities is maintained with external resource retained for advising and review.

This improvement initiative will provide benefits through more effective and efficient asset management practices and greater alignment of asset investment. This will be evidenced through progressive increases in Vector's self-assessment against the AMMAT model.

3.7.3 IMPROVED DATA-DRIVEN DECISION-MAKING

Vector has launched an Open Data Portal with network asset location information, including main, service and standby pipes on Vector's gas distribution network. The site allows third parties the ability to access location information for gas and electricity feeders electronically. In addition to creating map views, third parties can download the data or connect their systems directly to Vector data.

This initiative ensures that infrastructure companies, construction companies and entities like Auckland Council and Civil Defence have access to up-to-date information about Vector assets. This is also another way in which Vector can assist construction companies to prevent third party asset damage.

The planned implementation of CBARM along with ISO 55000 best practices will help address an opportunity for improvement highlighted through the recent AECOM Risk Management Review[5], namely developing a formalised framework which links to Vector's risk management framework to better enable risk-based decision-making across the network and across asset groups.

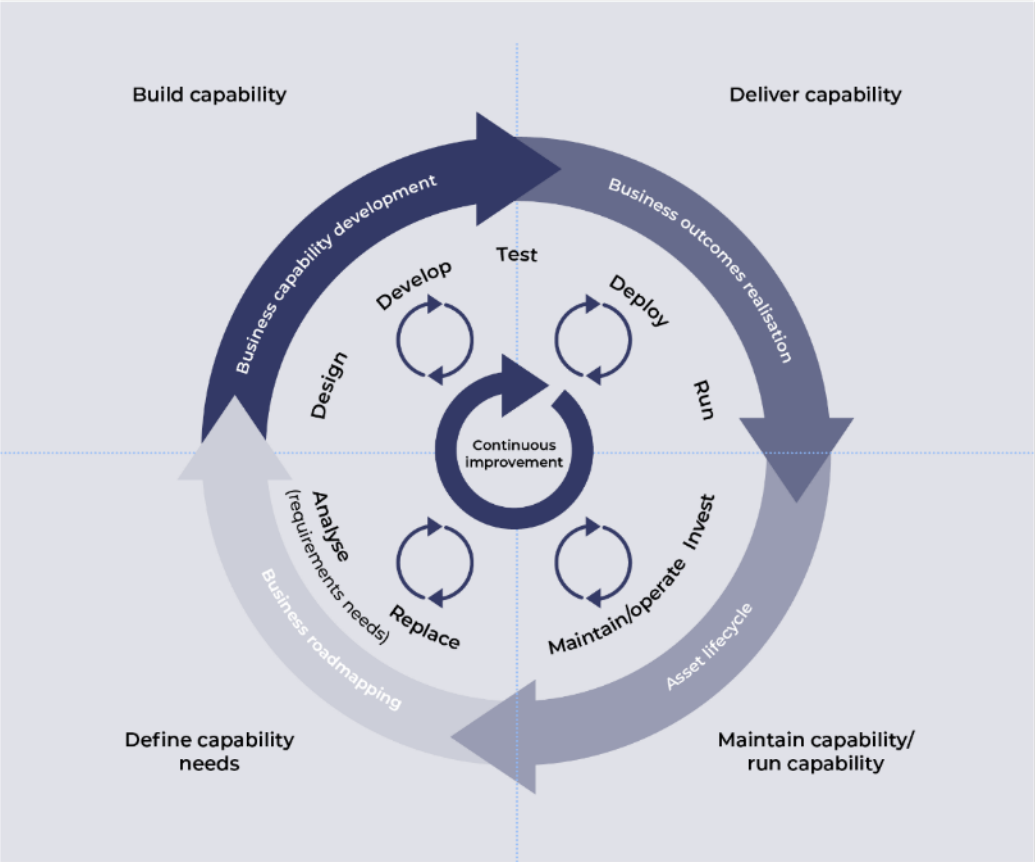
5 AECOM Risk Management Review of NZ Gas Pipeline Businesses, Oct 2019.

3.8 Enabling the asset management system through information systems

The asset management information systems enable the asset management systems to achieve cyber-security and privacy outcomes, as well as the targeted customer experience. To achieve this, we have aligned our operational and supporting infrastructure systems with the IEC (International Electrotechnical Commission) network distribution reference model.

3.8.1 VECTOR'S ASSET INFORMATION MANAGEMENT FRAMEWORK

As shown below, the management of the network asset management information systems follows our Digital lifecycle framework to ensure the information systems are fit for purpose to support and enable the delivery of Network services.



Vector has a suite of information systems that support its asset management practice. These, and other critical systems, are described below. The primary systems used by Vector to manage the operation and performance of its network assets, and the related financial and project management activities are shown in Sections 5.2 and 6.4.

PRIMARY SYSTEMS

Many of Vector's information systems operate through an integration layer that extends across these systems and enables the reporting and data analytics that support Vector's asset management processes. The following table provides an overview of the primary systems and provides insight into how they support asset management.

PRIMARY SYSTEM	FUNCTIONAL OVERVIEW
SAP	SAP is Vector's ERP System. It contains records for all assets and is used for managing the asset lifecycle from procurement and operation, to maintenance and disposal. SAP also provides financial management related to asset management and project management
GE Smallworld	This system provides the geographic, schematic and connectivity information used in managing Vector's network assets
ARC-GIS	This system provides geospatial visualisation and analytics tools
Siebel	Siebel is Vector's Customer Relationship Management system. This system is used for managing customer requests for new connections, QoS complaints management, and fault and outage management
Gentrack	Gentrack provides records for all connected Installation Connection Points (ICP) as well as their regulatory and market attributes. It is used to manage energy consumption, revenue assurance and interfaces with the Gas Industry registry
Data Analytics Layer	This is a bespoke integration layer that provides reporting, monitoring and associated analytics related to network assets. It is a critical source of information for most of Vector's asset management processes
Siemens Power TG	This is Vector's Supervisory Control and Data Acquisition (SCADA) system and is used to monitor and control operations on the network as well provide data on network loading and other critical asset data
ARM	ARM is Vector's corporate risk management system. Under the Corporate Risk Policy all asset management risks are recorded, prioritised and managed through this system. A supporting system, Risk Incident Management System (RIMS) is used to record any associated incidents

OTHER IMPORTANT SYSTEMS

Vector uses a number of other information systems, computer models and computer-based tools in the management of is gas distribution assets. In particular:

- OSIsoft PI: is a real-time network performance management system that imports data from various corporate systems (e.g. SCADA – see above) and provides a permanent archive of historical network data. Data may be extracted for later analysis in Microsoft EXCEL;
- Telenet SCADA: is the telemetry systems used by Vector to monitor its gas distribution networks.
- Forecast Scenario Model: this is bespoke load forecasting model used in Vector's load forecasting practice (see Section 3.5). It is implemented in Microsoft EXCEL and draws data from other corporate systems and databases and third-party sources; and
- Synergi: is a network modelling tool gathering inputs from Smallworld, Gentrack and the PI archiving system to enable modelling of the meshed gas network. Outputs are gas network flow, pressure profile and capacity margins

3.9 Data and Information Management

Vector has taken a coordinated approach to the management and governance of its information and data assets. The following four capabilities have been aggregated into a single centre of excellence reflecting the operational, strategic and governance overlaps across the disaggregated functions:

- **Enterprise Information Management:** This function establishes and administers the data management and governance frameworks applicable to both physical and electronic data and information. In addition, this function oversees the operational application of information management across the gas network's systems of record for assets and operational activities;
- **Business Intelligence:** Primarily a technical function, this team provides the data integration, visualisation and reporting capability to the business;
- **Data Platforms:** A technical function, this team is responsible for the management and development of the data and analytics platforms; and
- **Analytics:** Provides the technical analytics capability and highly specialised business operational knowledge to support all core functions within the Networks business to provide the research and advanced modelling capability.

3.9.1 GOVERNANCE

Vector's Group Data & Information Policy is the foundation document that sets out the governance requirements and operating model for the information lifecycle, as shown below. This covers both data and information in electronic and physical form. In preparing the policy and operating model, Vector has followed the principles and framework as set out in the Data Management Association's body of knowledge[6].

6 DAMA-DMBOK, Data Management Body of Knowledge, Second Edition, DAMA International

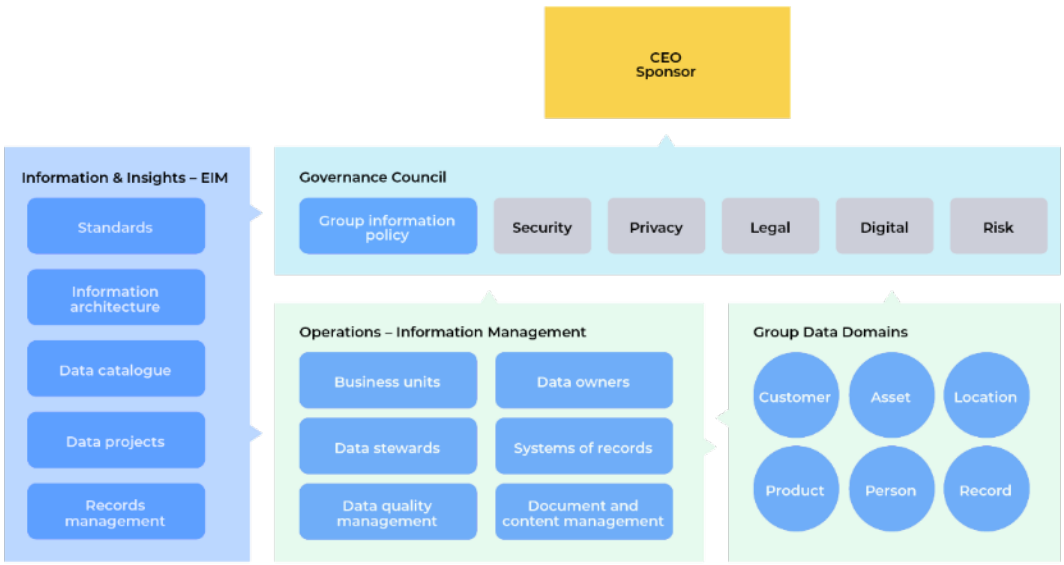
The Group Data & Information Policy is supplemented and supported where necessary by other operational and policy documents including our Privacy Principles and Cyber Security Policy.

3.9.2 OPERATING MODEL

Vector's data and information management model is represented in the following diagram. Operationally, the Enterprise Information Management (EIM) function within the Information & Insights centre of excellence provides capability horizontally across the different business units. Within each business unit, data stewards have been established to work with the defined data owners to ensure that business (i.e. operational) and governance requirements are met for each data set. The data stewards are trained and overseen by the Enterprise Information Manager.

The Group Information Governance Council has responsibility for setting and enforcing the Group Data & Information policy. This includes being the escalation point for data related events and conflict. Importantly the council is made up of the core disciplines and functions from across the business that impact on privacy and data management including, but not limited to, the Privacy Officer, Cyber Security, Digital Architecture, Information Management and Data & Analytics. The council reports directly to our Chief Executive Officer.

Operationally, the gas business maintains a dedicated Networks Information Management team to perform the majority of the data activities as depicted in the box titled "Operations – Information Management". This team is responsible for defining and ensuring the implementation of data standards, as well as managing the data within the System of Record for asset, asset performance, geo-spatial and customer data. In addition, the team also manages regulatory reporting (including one-off requests) as well as managing other third-party data requests such as location information and asset information.



3.10 Cyber Security and Privacy

In the context of our AMP, our strategic intent in regards to cyber security is focused on addressing two key risks:

1. The protection of critical network assets from unauthorised access that could result in disruptions to service/physical damage
2. Safeguarding and restricting access to any personal/customer data that is used for network management purposes

Effectively managing these risks requires the implementation of a combination of technical, process and behavioural controls that will allow us to quickly detect, respond and recover from potential cyber security threats. The security threats, the nature of network assets and the volume of data required to manage the network is constantly evolving. This requires continual re-assessment of the effectiveness of the risk and the corresponding controls.

In this environment, balancing resilience and security provides both challenges and opportunities. These challenges are not new – resiliency and security have always been cornerstone principles of how we deliver our services. However, as the network becomes more open in terms of protocols, communication channels and technologies, this will inevitably increase the attack surface and therefore the risk of compromise.

As a major cyber-attack becomes increasingly likely (it is not if but when), we must ensure we are appropriately prepared and are able to quickly respond to limit any impacts. Maintaining effective security controls and response strategies is a key priority and an area in which we continue to invest heavily to ensure we appropriately manage this risk. We have improved our ability to prevent and detect potential cyber security threats with our new Security Operations Centre (SOC) which provides 24/7/365 monitoring of our SCADA and Corporate network and continue to improve our preventative and detective controls such as malware detection and our firewalls. In addition, we continue to actively contribute to key NZ industry security forums, across public and private sectors, and our SOC constantly monitors available threat intelligence feeds for the latest attack trends which are automatically deployed to enhance our perimeter security controls.

We have a clear vision of the level of process and control maturity required to adequately protect the network and data for which we are custodians and a roadmap which supports how this will be achieved.

3.10.1 PRIVACY

As part of managing network assets, privacy must be considered in all things and not just in the cyber security context. The volume and potential sources of data required to effectively manage and operate the network continues to expand. New network and customer devices generate increasingly important information about consumption patterns, faults, performance and resilience which enables us to efficiently and effectively manage the network. This information is also extremely sensitive, and this means there is an increased risk that we may be targeted by malicious actors wishing to gain unauthorised access to this information.

Accordingly, we are elevating our internal controls to ensure this information is appropriately protected particularly where Personally Identifiable Information (PII) is involved. Effective management of information is critical to maintaining trust in the network and in Vector as its custodians and we take our obligations very seriously. We have begun a data governance programme which takes a wholistic view of how our data is managed and governed. Privacy is a key element of this, with the principals of the NZ Privacy Office being used as key guiders.

The Vector Group Data and Information Policy is the guiding document for the collection, storage, use and sharing of personal information to ensure we only use personal information in a way that is permitted and ethical.

3.11 Sustainability

3.11.1 SUSTAINABILITY AND THE ASSET MANAGEMENT FRAMEWORK

Responding to sustainability challenges will shape how we develop our gas infrastructure. Climate change and decarbonisation initiatives are obvious opportunities. Other changes that influence how we manage our asses include the adoption of broader sustainability principles – sustainable procurement and better resource efficiency, plus a shift to embedding circular economy thinking that emphasises re-use and minimises waste.

Throughout the planning process, consideration is given to Vector's sustainability policy through the following targeted initiatives:

- Supply chain
  - Reducing exposure to high risk suppliers or products
  - Opportunity to work with suppliers on mutually beneficial sustainability innovation projects
- Adapting for climate change
- Enabling energy efficiency (decarbonisation of the economy) options for our customers through our managed integration planning approach
- Starting shift to a circular economy
  - Consider end of life when designing and constructing to avoid expected increases in future landfill costs

3.11.2 GOVERNANCE AND PRINCIPLES OF OUR SUSTAINABILITY APPROACH

Sustainability is overseen at the executive level by the Executive Risk and Audit Committee. The Committee provides a company-wide forum for staff from different disciplines to discuss both the current and emerging risks we face.

Our Sustainability Policy is based on our sustainability framework which has four key guiding principles at its heart – Integrity, Transparency, Inclusive and Kaitiakitanga. Of these, Kaitiakitanga, the Māori concept of stewardship and care of the environment, is very relevant when it comes to managing our assets and is a founding principle. It recognises the need to adopt a whole-of-life approach that includes both the upstream (supply chain), downstream (end-of-life), and, very importantly, customer interfacing aspects of asset management.

In order to apply these sustainability principles to asset management Vector utilises appropriate international standards and tools.

ISO 14001 Environmental Management System certification is maintained. This ensures there are competent resources and effective systems in place across the business to manage the interface with and impact on the environment.

Our sustainable procurement strategy aligns with the Flexible Framework[7] for sustainable procurement and draws from frameworks such as BS 8903 and ISO 20400. It is intended to support New Zealand's emerging circular economy.

All suppliers of products and services to Vector will, in a phased approach, be required to adhere to our Supplier Code of Conduct. This sets out Vector's expectation on labour / workplace, health and safety, environmental, governance / ethical, community, and supply chain matters.

Sustainability criteria are included in the assessment of all significant purchases made by the business, and sustainability is weighted accordingly in tender evaluations.

3.12 Emergency Response and Contingency Plans

As a "lifeline utility" under the Civil Defence and Emergency Management (CDEM) Act 2002, Vector is required to be able to function to the fullest possible extent, even if this may be at a reduced level, during and after an emergency. In line with our obligations, we have a range of plans (detailed in the following table) governing how we will function under an emergency. These plans, which are reviewed and updated regularly, help support network resiliency by driving effective assessment of and response to disruptive incidents affecting network assets. In addition, we actively participate in the development of a CDEM strategy and are a member of:

- The Auckland Lifelines Group (ALG);
- The National Engineering Lifelines Committee; and
- Various lifeline groups throughout New Zealand.

7 The Flexible Framework is a widely used self-assessment mechanism developed by the business-led Sustainable Procurement Task Force, which allows organisations to measure and monitor their progress on sustainable procurement over time.

TITLE	DESCRIPTION
Business Continuity Management (BCM) Policy	• Formal representation of Vector's commitment to BCM, which forms an essential part of Vector's enterprise risk management framework. • Defines key BCM roles, responsibilities, accountabilities and reporting requirements. • Approved by the Board, it is consistent with the following Standards: – Australian/NZS AS/NZS 5050:2010 "Business Continuity - Managing disruption-related risk"; – ISO 22313:2013 "Societal security - Business continuity management systems - Guidance"; – SAA/SNZ HB 221:2004: "Business Continuity Management" – AS/NZS ISO 31000:2009 "Risk management - Principles and guidelines.
Crisis Management Plan	• Provides the enterprise-wide framework and structure to assess and respond to any crisis-level incident or event affecting Vector, its customers and/or its employees, contractors and other stakeholders. • Takes account of both the operational response and broader considerations including staff, customer and wider stakeholder engagement and support • Includes the Incident Management Guideline, which provides direction on how to categorise incidents - this categorisation determines the appropriate response team, response plan and escalation hierarchy. • Annual crisis management exercises and regular plan reviews are undertaken to ensure usability and understanding and support continuous improvement of the plan.
Issue / Crisis Communications Plan	• Standalone plan governing the communications and external relations approach and processes during a crisis, emergency or business continuity events.
Incident Response Plans	• Individual business unit / team plans outlining the general procedures for assessing and responding to any disruptive events or incident (below crisis level) within a specific business area.
Emergency Response Plan	• Ensures Vector is prepared for, and responds quickly to, any major incident that occurs or may occur on the gas distribution network. • Describes the roles and responsibilities for staff during a major incident. • Reviewed annually to ensure continuous improvements and standardised approach to all operational incidents.
Business Continuity Plans	• Individual business unit / team plans which identify the critical functions and services provided by a unit / team and outline the recovery procedures to be undertaken during a disruptive event to maintain or resume these functions

3.13 Covid-19 pandemic response

As has been the case globally, Covid-19 pandemic response has directed Vector activities in recent months. Vector identified three objectives which were fundamental to successful business operations and continuity during Covid-19, namely:

- Health and safety remain Vector's top priority, through protecting the health of staff and workers and maintaining long term operational continuity by ensuring human segregation and isolation;
- Maintain reliability and minimise customer disruption by ensuring the number and duration of outages are minimised as much as possible; and
- Supporting Vector's FSP whilst not compromising Vector's commercial position.

As a lifeline utility, Vector completed an essential services plan for all maintenance and capital activities for the duration of the national lockdown. Along with reactive maintenance work to repair gas leaks, poor pressure or no gas, planned and corrective maintenance work is permissible when such work can be completed safely, and supports public safety and network reliability, i.e. through odorant checks and patrols respectively. In addition, new connections were acceptable when required by an essential business or a primary, occupied residence as well as disconnections relating to emergency service calls. An assurance programme helped ensure that contact tracing, hygiene and physical distancing practices were adopted.

section 04

our assets

4 – our assets

This section of the AMP sets out Vector's gas distribution assets; the types and volumes of assets, their functional role and key statistics. The asset management strategies are summarised both at a network wide level and for specific asset classes. These strategies inform when we act and what actions are taken in managing the lifecycles of our network assets. It is these asset management strategies that inform or drive the plans set out in Section 5.

4.1 Overview

Vector's gas network supply area is centred on the Auckland isthmus and extends from north of Wellsford to Tuakau in the south. The supply area is shown in the following figure.

4.1.1 LOAD CHARACTERISTICS

The capacity of an individual pipeline is determined by the operating pressure, the diameter and the allowable pressure difference between inlet and outlet. Meshed distribution networks work on the same principle with the difference that pipelines are interconnected at several points and that such distribution networks can be fed at multiple points.

While this can result in large networks the advantage is that failure of one single item does not compromise the entire network. Secondly, the size of the network ensures that organic load increases have minimal impact on the overall immediate impact on the network as the network pressures are continually rebalancing through the connectivity. Changes to network pressure are best identified by long term trending as explained in Section 3.6. Significant offtakes, particularly on the smaller networks, can significantly impact the performance of the network and these are modelled separately.

As the distribution networks expand and demand grows, certain parts of the networks, feeder mains, can develop large pressure drops that constrain delivery in downstream parts of the distribution systems. Each year, Vector prepares network pressure monitoring surveys and carries out distribution network analysis to identify any constraints and to reinforce networks to ensure operating pressures do not become insufficient.

DRSs have nominal outlet pressures which supply each discrete pressure system on the distribution network. System pressures in the network decrease in accordance with demand and the supply pressure. Under normal network operating arrangements, Vector's QoS standard stipulates the pressure at any point on the network shall be no less than 50% of its

nominal pressure and no more than 10% above its maximum operating pressure. Further details of Vector's QoS standard can be found in Section 4.3.7.

Pressure drops on each pressure system need to be considered separately, due to the meshed nature of the network and the different characteristics, i.e. mix of residential, commercial and industrial customers, each system exhibits.

Vector uses individual system pressure profiles to illustrate the load characteristics of each network. These are based on system pressure data that Vector collects as part of its system pressure monitoring programme and an understanding of the relationship between pressure and flow.

The typical daily winter pressure profile for residential loads and load profile for commercial / industrial customers are illustrated in Section 7.4.

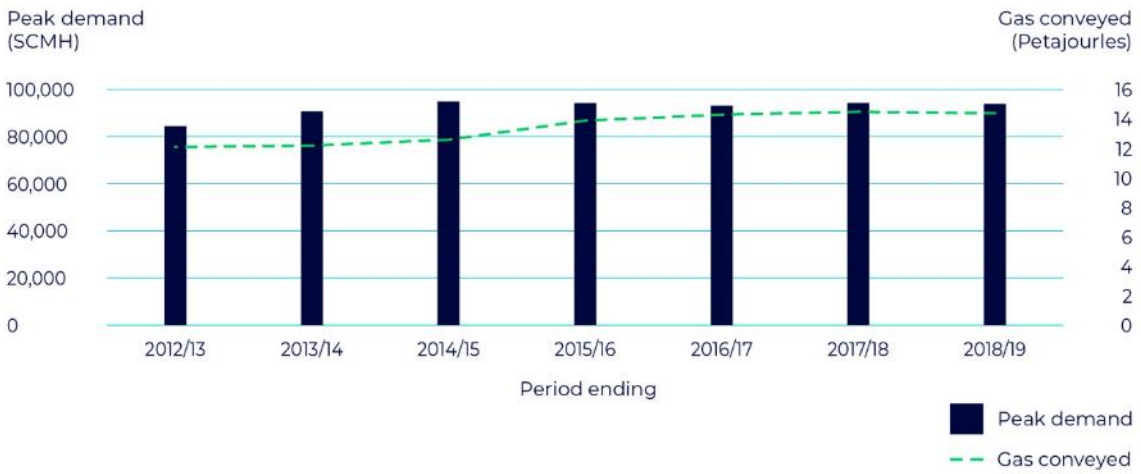
4.1.2 PEAK DEMAND AND ENERGY DELIVERED

Historical trends show gas demand (and sales volume) is primarily influenced by economic activities in an area, price and availability of substitute fuels (e.g. electricity, fuel oil etc.), marketing effort, population / household growth, socio-economic factors, climate, and the investment decisions made by large industrial and commercial gas consumers. In the short-term, gas demand is very sensitive to climatic conditions. A cold snap, for example, could drive up the demand for gas significantly. Conversely, a warm winter could result in a materially lower demand. Hence on a year–by-year basis, demand can vary significantly.

Historical information, after normalising for year-on-year variances, shows a reasonably steady demand trend. The exceptionally high peak demand hours occur due to extreme weather conditions and normally represent only a small percentage of hours in a year.

The peak demand and the gas conveyed on the gas distribution network for the past seven years is shown in the following graph (the individual demand forecasts for all gate stations on Vector's network are detailed in 7.5).

PEAK DEMAND AND GAS CONVEYED



The values reported above are the coincidental peak demands of all gate stations delivering supply to Vector's gas distribution networks.

Vector has a number of large customer sites at various locations in its network. Section 7.9 provides maps which indicate those customer sites with annual energy requirements in excess of 20 Terra Joule (TJ), and which hence have a significant impact on network operations and asset management.

4.2 Asset overview

Vector takes bulk gas supply from the High Pressure (HP) transmission systems operating across the North Island. The transmission systems operate at pressures ranging between approximately 50 and 80 bar and typically deliver gas to Vector's distribution systems at IP20, IP10, MP7 and MP4 pressure level (20 bar down to 4 bar). A schematic view is shown in Section 3.2.

The HP and Intermediate Pressure (IP) systems tend to be radial in design, whereas the design of the majority of MP systems tends to be of a mesh nature, providing back-feed security to large numbers of residential and commercial loads. Medium Pressure (MP) systems are often supplied from multiple DRSs thereby further increasing the Security of Supply (SoS). Typical load profiles of the network and a map of Vector's large customers that have an impact of network operations, can be found in Section 7.4 and 7.9, respectively.

Key statistics of Vector's network are given below.

Customer connections[8]	111,642
Distribution pipelines – includes mains and service pipes (km)[9]	6,733
Gate stations[10]	16
Pressure stations[11]	236
Peak load (m3/hour)[12]	93,890
Gas conveyed (PJ per annum)[13]	14.4

Distribution networks extend from the outlet valve of the transmission gate station to the inlet valve on a consumer Gas Measurement System (GMS). Distribution networks broadly contain the following six main categories of assets:

- Distribution pipelines (includes mains and service pipes);
- Pressure stations;
- Valves;
- Corrosion protection equipment;
- Monitoring and control equipment; and
- Special crossings.

4.2.1 DISTRIBUTION PIPELINES

Key statistics of the distribution pipeline assets are shown below.

PRESSURE LEVEL	MAINS PIPE (KM)	SERVICE PIPE (KM)	TOTAL	% OF TOTAL NETWORK
Intermediate Pressure (700 - 2,000kPa)	241	6	247	4%
MP (7 - 700kPa)	4,228	2,257	6,484	96%
Low Pressure (LP) (0 - 7kPa)	0	2	2	0%
Total	4,468	2,265	6,733	100%

MAINS PIPELINES

Vector's bulk mains pipelines are operated in the IP range of 1,000 to 2,000kPa. The selection of these pressures has, in the majority of cases, historically been justified on an economic basis (considering gas volumes, transmission distances, delivery pressures etc). The IP pipelines are all constructed to a high technical standard of welded steel with all of them being protected against corrosion by Cathodic Protection (CP), using either a system of sacrificial anodes or an impressed current installation.

The IP systems are generally the principal "backbone" systems of the distribution networks with laterals radiating from them to supply adjacent areas. The distribution assets which are used to directly supply gas consumers are constructed mostly of PE and operate in the MP range.

Vector's gas distribution network includes a HP pipeline which is integrated into the gas distribution network. The pipeline is a 200mm steel pipeline running from the Henderson Gate Station (North West of Auckland) to Albany on Auckland's North Shore. The pipeline was constructed and is maintained to HP standards, and is rated to operate at 4,600kPa, but is currently only operating at 1,900kPa. The higher design pressure was selected to enable the operating pressure to be increased in the future.

The figure below depicts the age profile of mains pipelines.

8 Source: Information Disclosure 2019 Schedule 9d(ii) (http://vector.co.nz/disclosures/gas-financial-and-network-information).

9 Source: Source: Information Disclosure 2019 Schedule 9c (http://vector.co.nz/disclosures/gas-financial-and-network-information). Includes mains and service pipe lengths.

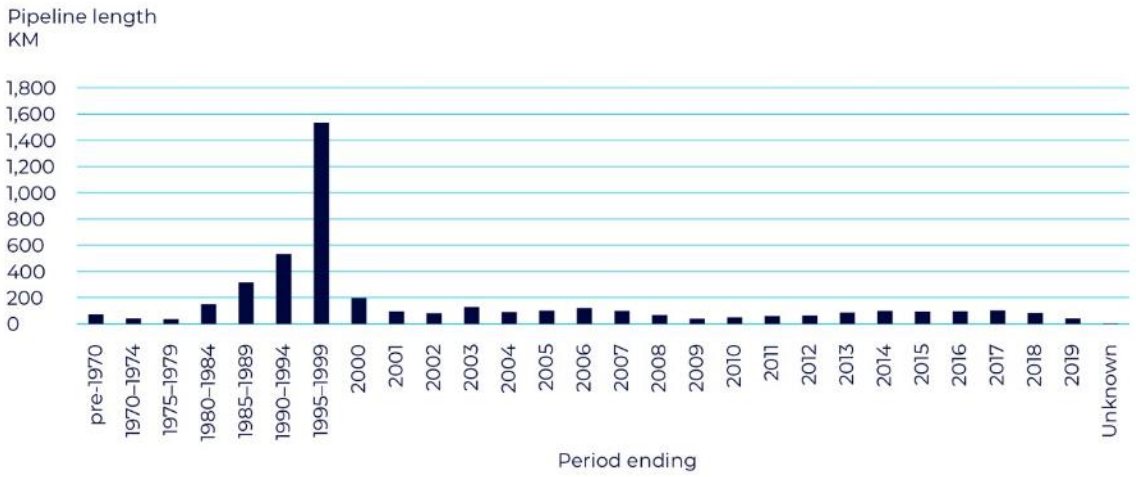
10 Source: Vector's Geographical Information System (GIS).

11 Source: Information Disclosure 2019 Schedule 9a (http://vector.co.nz/disclosures/gas-financial-and-network-information). Includes Vector's district regulating stations and service regulators as described in section 4.2.2.

12 Calculated by adding the coincident load of each network system for a calendar year. Measured as standard cubic metres per hour (scmh).

13 Source: Information Disclosure 2019 Schedule 9d(ii) (http://vector.co.nz/disclosures/gas-financial-and-network-information).

MAINS PIPELINES

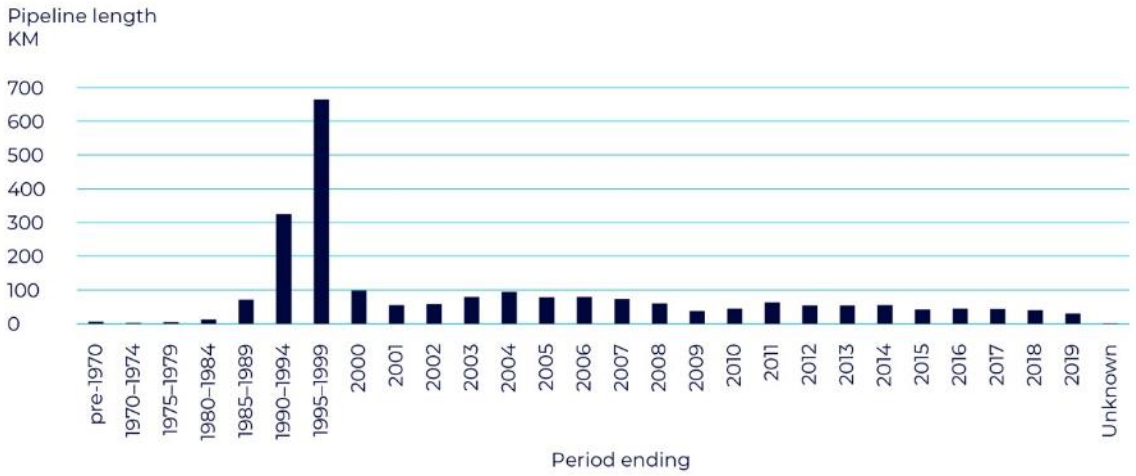


SERVICE PIPELINES

Service pipelines provide the link between the gas mains in the street and the customer's gas meter and are comprised of a service pipe, riser and a riser valve. The outlet connection of the riser valve designates the end of Vector's distribution system. A service regulator is normally fitted downstream of the riser valve to regulate the gas pressure to the consumer meter-set and to downstream appliances / plant (in these cases the regulator is owned by retailers or GMS owners).

The figure below depicts the age profile of service pipelines.

SERVICE PIPELINES



4.2.2 PRESSURE STATIONS

Pressure stations are those parts of a gas system that link two pipeline systems operating at different pressure levels. The station automatically reduces and regulates the gas pressure being supplied into the downstream pipeline system to which it is connected. Vector has three categories of pressure stations: gate stations, DRSs and service regulators.

GATE STATIONS

Where the pressure station is the link between the gas transmission system and a gas distribution network, it is known as a gate station. HP equipment (i.e. pressure regulating equipment and custody transfer metering etc) within the gate station is operated by FirstGas Limited, whereas distribution system equipment (i.e. check metering (where installed) and associated valves and pipework etc) within the gate station is operated as part of Vector's gas distribution networks. Key statistics of equipment owned by Vector but installed at gate stations is listed in the following table.

GATE STATION NAME	ASSETS OWNED BY VECTOR
GS-00001-AK Alfriston	All facilities downstream of the Interconnection Point

GS-00002-AK Bruce McLaren	All facilities downstream of the Interconnection Point
GS-00003-AK Drury	All facilities downstream of the Interconnection Point
GS-00004-AK Hunua	All facilities downstream of the Interconnection Point
GS-00005-AK Kingseat	All facilities downstream of the Interconnection Point
GS-00006-AK Papakura	All facilities downstream of the Interconnection Point, including DRS DR-00170-AK equipment, structures and downstream distribution outlet pipework, and associated telemetry equipment.
GS-00007-AK Pukekohe	All facilities downstream of the Interconnection Point
GS-00008-AK Ramarama	All facilities downstream of the Interconnection Point
GS-00009-AK Tuakau	All facilities downstream of the Interconnection Point including DRS DR-00250-AK equipment, structures and downstream distribution outlet pipework, and associated telemetry equipment
GS-00010-AK Waikumete	All facilities downstream of the Interconnection Point, including associated telemetry equipment
GS-00013-AK Westfield	All facilities downstream of the Interconnection Point including DRS DR-00244-AK equipment, structures and downstream distribution outlet pipework, and associated telemetry equipment
GS-00016-AK Henderson	All facilities downstream of the Interconnection Point, including DRS DR-00177-AK equipment, structures and downstream distribution outlet pipework, and associated telemetry equipment
GS-00018-AK Wellsford	All facilities downstream of the Interconnection Point
GS-00020-AK Warkworth 2	All facilities downstream of the Interconnection Point, including DRS DR-00256-AK equipment, structures and downstream distribution outlet pipework.
GS-00021-AK Waitoki	All facilities downstream of the Interconnection Point, including DRS DR-00254-AK equipment
GS-00023-AK Harrisville	All facilities downstream of the Interconnection Point.

DISTRICT REGULATING STATIONS

Where the pressure station is the link between two Vector gas pressure networks it is known as a DRS. DRSs are used to reduce the operating pressure from higher operating pressure systems to systems with lower operating pressures.

DRSs are strategically located within the distribution network such that a continuous and safe gas supply of gas is delivered to all connected customers. They are primarily used to reduce the higher pressures associated with 'high volume' mains, (i.e. those with an operating pressure of 1,900kPa, 1,000kPa and 700kPa), down to a more economical distribution pressure level of between 200kPa and 420kPa.

Generally, a DRS converts significant volumes of gas from one pressure to another and they are the source of supply to a significant number of consumers. The importance of DRSs in the supply networks means duplicate assets are often provided in order to deliver a reasonable level of security. This duplication also enables maintenance to take place without a loss of supply to customers.

The lower operating pressures provided by the DRS assets allow modern technology and materials to be used to provide a safe, assured and economical gas supply to the areas where customers are situated.

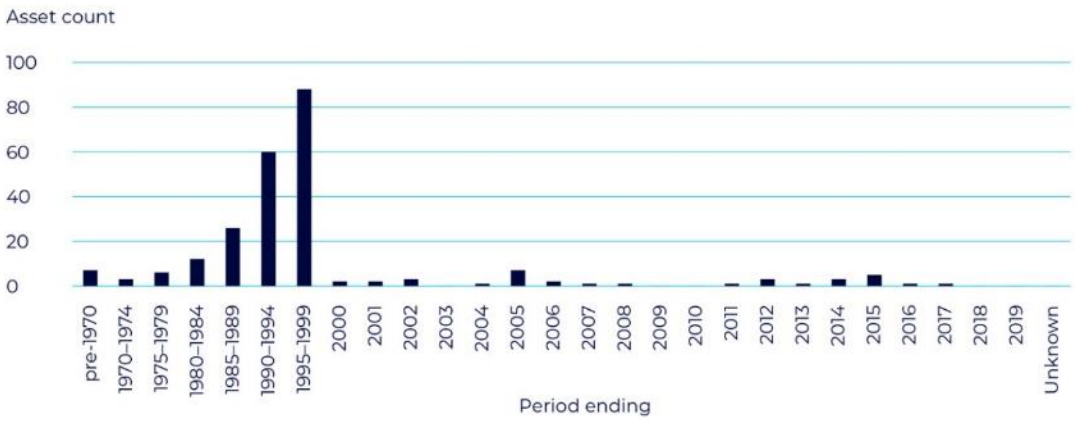
A service regulator is used to regulate the flow and pressure of gas to individual customer premises. Where for practical reasons a regulator cannot be installed immediately adjacent the gas meter (i.e. as part of the GMS) it is installed at a location upstream from the GMS and in some cases, is owned and maintained by Vector.

Key statistics of the pressure station assets are shown below.

Number of gate stations	16
Number of DRSs and service regulators	236

The figure below depicts the age profile of pressure stations.

PRESSURE STATIONS



4.2.3 VALVES

LINE VALVES

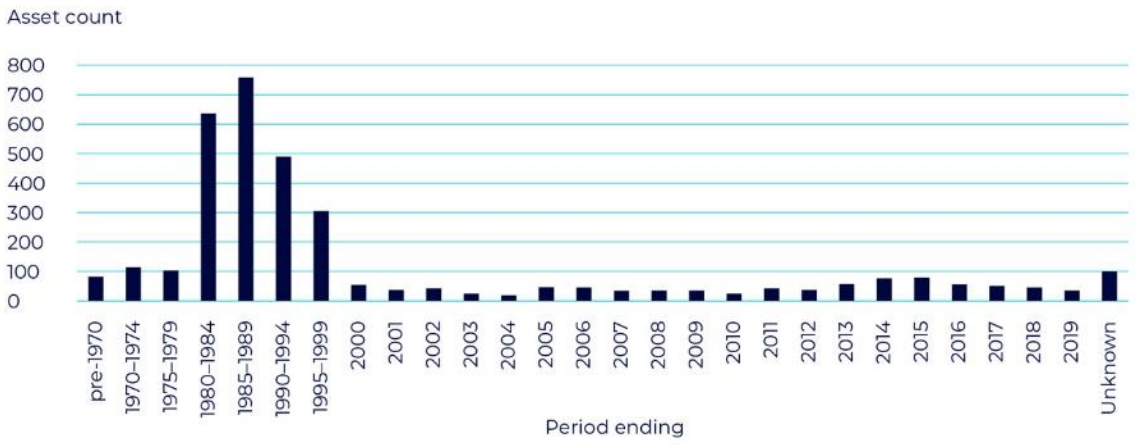
Line valves are comprised of buried in-line mains and service valves (to isolate the flow of gas within the system) and blow down valves (to depressurise sections of the system in the event of an emergency). Valve types currently in use include ball valves, plug valves, gate valves and a relatively small number of other valve types.

Key statistics of the line valves are shown below.

Number of IP line valves	641
Number of MP line valves	2,815
Number of LP (low pressure) line valves	2

The figure below depicts the age profile of line valves.

LINE VALVES



RISER VALVES

Aboveground riser valves are installed at every GMS; they are positioned immediately upstream of the GMS service-regulator to allow the GMS (and downstream pipework) to be isolated from the gas distribution network in the event of an emergency or for maintenance purposes. The riser valve population is comprised of 10mm risers (approximately 92%), 25mm risers (4%), 32mm risers (2%), 50mm risers (1%) and various other riser sizes (1%).

Prior to the introduction of ball valves in the early 1990s, plug type riser valves were used for residential and small commercial connections - i.e. typically 10mm and 25mm risers. Due to its mechanical design and the length of time in service, this type of valve has been found to be prone to seizing, leaking or passing gas when in a closed position.

Key statistics of the riser valves are shown below.

Number of IP riser valves	256
Number of MP riser valves	108,472
Number of LP riser valves	601

4.2.4 CORROSION PROTECTION EQUIPMENT

Below ground steel plant is protected against corrosion by the provision of protective coatings (e.g. high-density polyethylene) and the application of impressed current or sacrificial anode CP systems. Protective coatings are inspected whenever underground plant is exposed. CP test points are monitored on a periodic basis and maintained to ensure that the levels of protection being provided to the underground plant are kept within prescribed maximum and minimum levels.

The majority of Vector's interconnected steel network is protected by 9 impressed-current CP systems; the balance of the steel network (typically smaller standalone networks) are protected by sacrificial-anode CP systems.

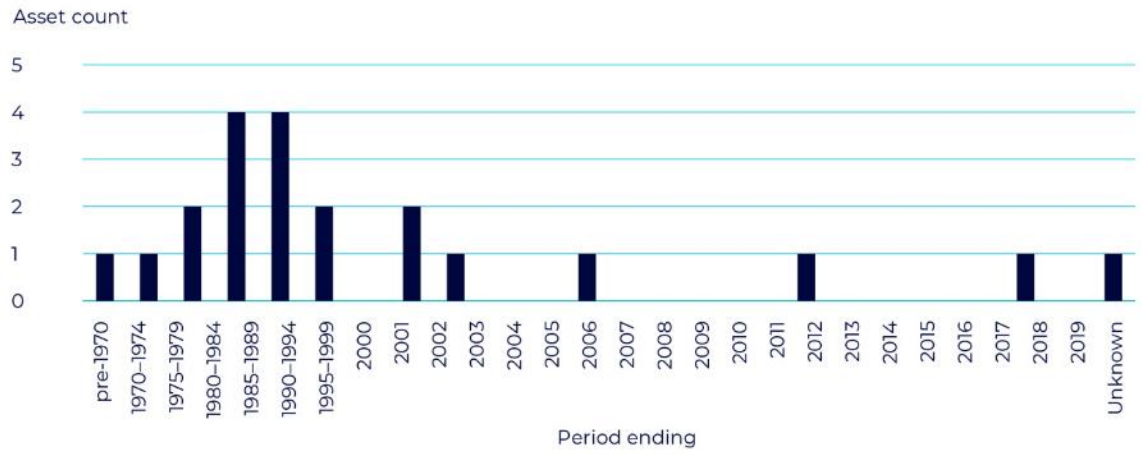
Above ground steel or metallic plant is protected against corrosion by the provision of paint or other suitable protective coating e.g. wrapping. Periodic inspections are carried out to monitor the condition of protective coatings and pipeline support brackets etc.

Key statistics of the corrosion protection equipment are shown below.

Number of impressed current CP systems	9
Number of sacrificial-anode CP systems	21

The figure below depicts the age profile of corrosion protection equipment.

CATHODIC PROTECTION SYSTEMS



4.2.5 MONITORING AND CONTROL SYSTEMS

The telemetry systems used by Vector to monitor its gas distribution networks comprise the Telenet SCADA system, and the Cello system.

The Telenet system provides near real-time monitoring - i.e. it provides data refresh rates that range between 5 minutes and 30 minutes; approximately half of the Telenet sites utilise a radio communication platform and the balance utilise a General Packet Radio Service (GPRS) communication platform. The Cello system provides 15-minute time-stamped monitoring data (typically pressure only) that is refreshed once a day. Communication between the Cello field sites and the base station is via the Global System for Mobile (GSM) communication network using Short Message Service (SMS) communication. Cello equipment is utilised at both permanent and temporary (e.g. winter gauging) monitoring sites.

Access to Telenet and permanent Cello site monitoring-data is provided via the PI archiving system. Access to the temporary Cello site monitoring-data is provided via a proprietary PMAC database.

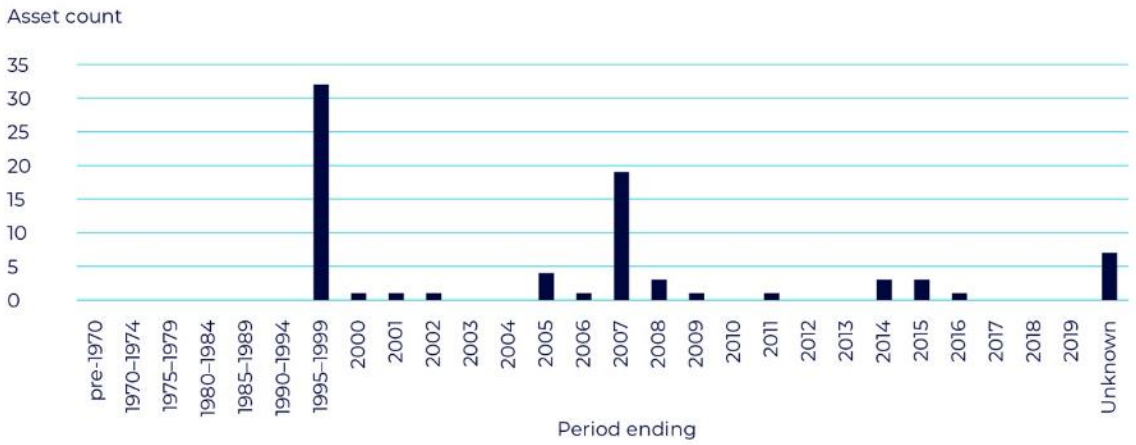
The telemetry systems provide remote monitoring and alarming of critical inlet/outlet pressures, temperatures and flow rates, and corrected and uncorrected metering data. The telemetry system monitors data at gate stations, DRSs and major gas customer sites, and provides remote control facilities for the operation of the IP20 valves located at either end of the Auckland Harbour Bridge.

Key statistics of the telemetry systems are shown below.

Number of telenet monitoring sites	78
Number of permanent Cello monitoring sites	33

The figure below depicts the age profile of monitoring and control systems.

MONITORING AND CONTROL SYSTEMS



4.2.6 SPECIAL CROSSINGS

Special crossings are locations where a section of pipeline is installed aboveground in order to cross over a roadway, river or railway etc. They are typically installed where the installation of a belowground crossing is not practical.

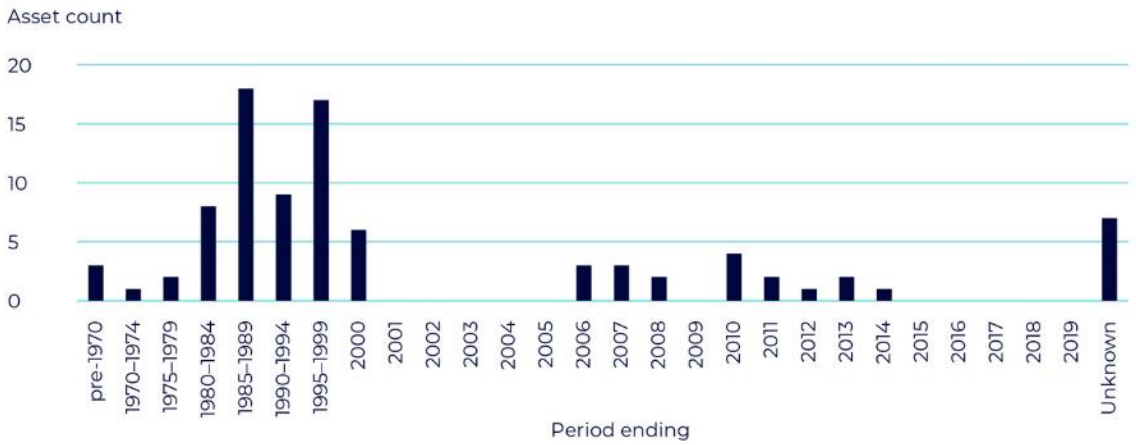
Where the carrier pipe is PE it is encased in a steel or Polyvinyl Chloride (PVC) duct in order to provide physical and ultraviolet protection to the carrier pipe. The duct is typically attached to the bridge structure by means of galvanised or stainless steel fittings. Where the carrier pipe is steel it is typically either painted or wrapped (to provide corrosion protection) and attached directly to the bridge structure by means of galvanised or stainless steel fittings.

Key statistics of the special crossings are shown below.

Number of IP special crossings	20
Number of MP special crossings	69

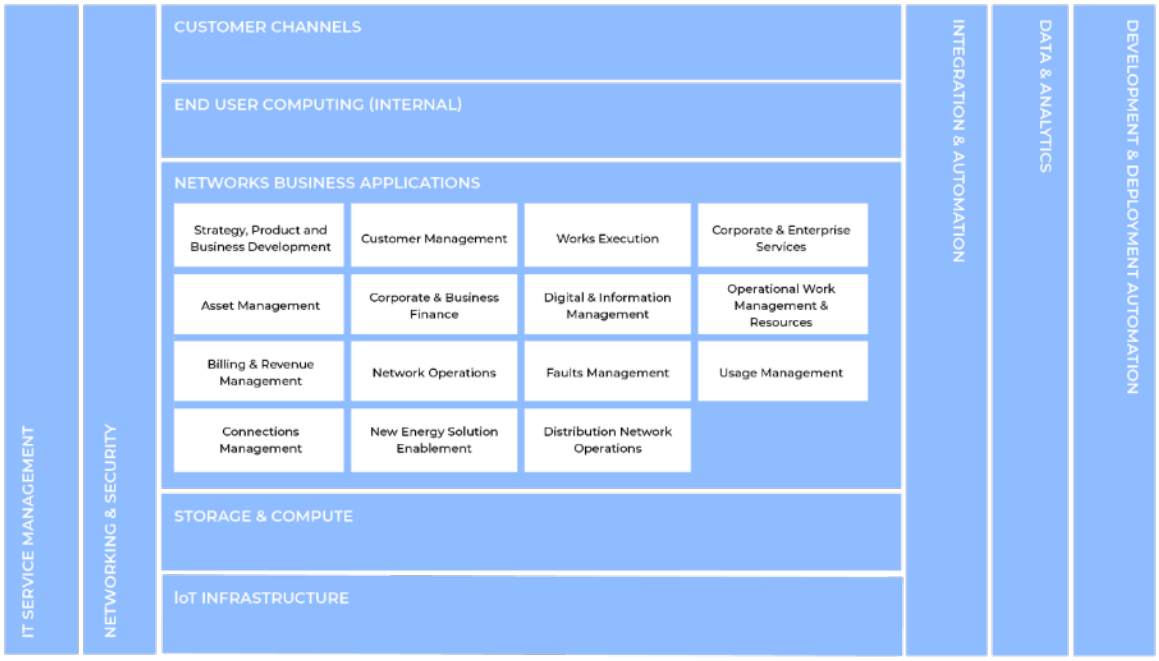
The figure below shows the age profile of special crossings.

SPECIAL CROSSINGS



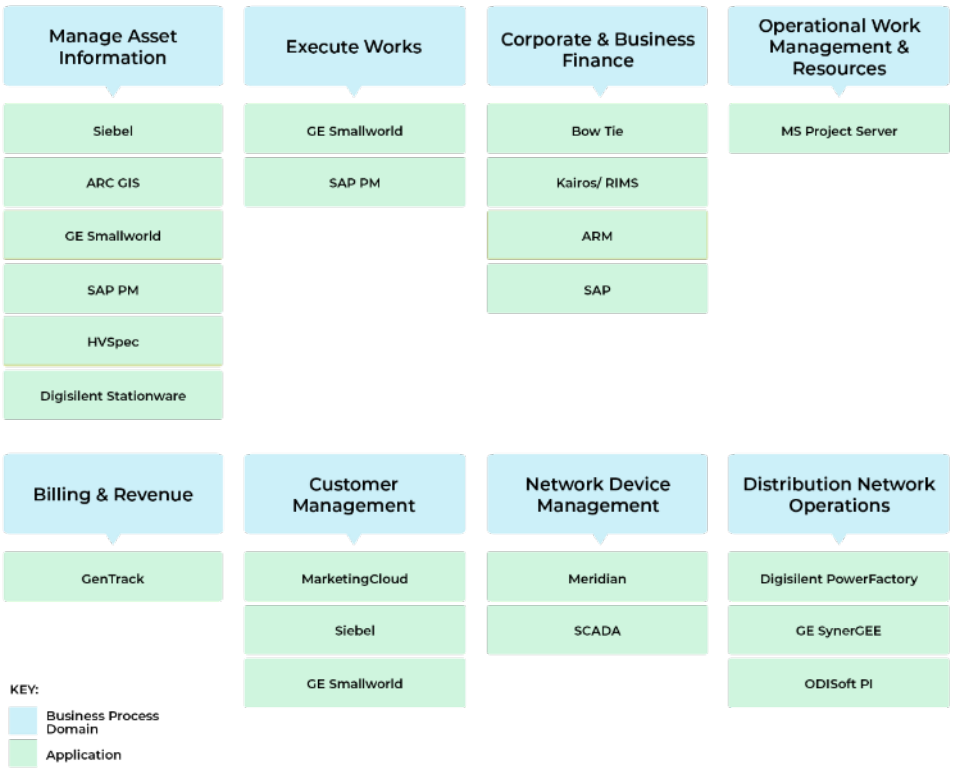
4.2.7 NON-NETWORK ASSETS

Vector implements and manages its information systems and their related infrastructure components according to an overall digital technical reference model. This ensures that each component has clear boundaries, which ensures that the technology used to support these components are "fit-for-purpose". It also helps ensure that Vector's information systems environment maintains a "separation of concerns" between its information systems and infrastructure. The technical reference model is shown in the following figure.



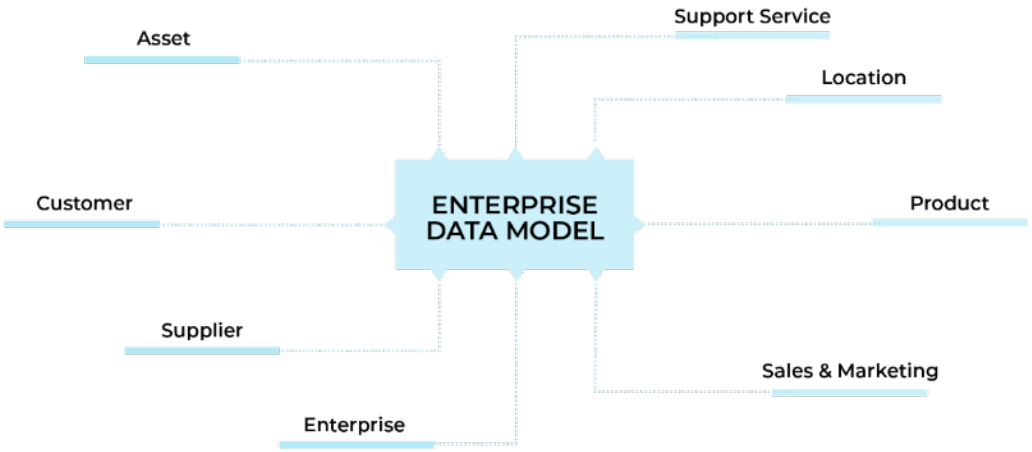
Vector's core network and supporting network information systems are used to manage data that is necessary for the effective day-to-day operation of its network and customer assets and the ongoing planning activities relating to those assets.

The following figure illustrates the relationship between Vector's business functions and processes, referred to as business process domains, and its core network related applications.



4.2.8 INFORMATION AND DATA

Vector's information systems are used to manage data that is necessary for the effective day-to-day operation of its network assets and the ongoing planning activities relating to those assets. The information can be divided into several entities as shown in the following figure.



The information entities above consist of multiple attributes and stored in source systems. The Entity->Attribute->Source System mapping is captured in Vector's Enterprise Data Model.

4.3 Management strategy

4.3.1 OVERVIEW

Management of Vector's network is undertaken in accordance with Vector's asset strategies. These strategies are focused on meeting service level targets. To this end, Vector's assets are managed over their full lifecycle to avoid failures that pose a hazard to workers, public safety or harm to the environment and minimise interruptions of supply to our customers. Strategies are also aligned with statutory and regulatory requirements and design and maintenance standards. A list of key asset strategy documents, design and maintenance standards are provided in Section 7.2.

This section describes the asset management strategies that are in place at Vector that span across all asset classes. These include planning, operation and maintenance strategies as well as specific strategies relating to service level performance i.e. safety, reliability, gas quality and environment. Asset specific strategies are described in Vector's asset strategy documents (see Section 7.2 but have been summarised in Section 4.4).

4.3.2 NETWORK PLANNING STRATEGY

The planning strategy ensures that both Vector's QoS and SoS are maintained across the network. Broadly speaking QoS addresses network pressure issues, both current and forecast, while SoS addresses the level of redundancy or the degree meshing across the network.

Demand for new customer connections outside existing network boundaries is typically supplied through the development of new distribution pipelines and pressure stations. Where forecast demand within an existing network supply area is expected to exceed the nominal capacity of an asset, causing a QoS breach, then solutions are identified to address the constraints. The timing of the solution is scheduled to ensure that the QoS is not compromised. Forecast QoS constraints are reviewed annually or if a significant load is added to the network, to ensure the scheduling of the solution remains valid. Where target forecasts are not achieved, the solution may be deferred.

The SoS criteria determines the level of redundancy required on the network to ensure the risk profile remains within acceptable limits set by Vector's Risk Framework (refer Section 3.6.7). Key factors include scenario modelling examining the consequences of non-supply through equipment failure or damage on customers and Vector.

Further details on Vector's QoS criteria is provided in Section 4.3.7.

4.3.3 STANDARDISED ASSET DESIGN STRATEGY

Vector uses standardised design and equipment on its network. This has the advantage of lowering project costs through competitive bulk materials supply agreements, standardised installation drawings and practices, lower stock-holding and emergency spares, standardised maintenance practices, and engaging in a rigorous equipment selection process to ensure fit-for-purpose whilst ensuring appropriate equipment performance over the life of the equipment.

Standardisation has been applied to pipelines, DRS equipment and installation practices. Vector may apply differing architectural treatments to its DRS to better align with local architecture but construction techniques, materials and fit-outs align with well-established standards.

Standard designs are introduced to avoid producing customised solutions for identical network installations. The standard designs ensure rigour and consistency in evaluation, design and application, cost savings over bespoke designs, simplified procurement and reduced stockholding, less rework during construction, safer outcomes and improved mechanism for capturing incremental improvements.

The approach that has been adopted within Vector is that when designs are repeatedly used on the network, standard designs are developed. As design improvements are identified either by Vector's own staff or as feedback from our FSPs, standard designs are amended and updated.

A list of all of Vector's design standards is provided in Section 7.2.

4.3.4 REFURBISHMENT AND REPLACEMENT STRATEGY

Assets that are no longer able to deliver the level of service that customers require in a safe, efficient and economical way, will be replaced or refurbished. In dealing with distribution assets, where Vector has large populations of low cost assets and associated components, the optimal investment options to repair, replace or refurbish are relatively limited and are readily evaluated.

For DRS assets where replacement costs are typically high, the optimal investment options to repair, replace or refurbish will require more complex multi-criteria evaluation and business case justification. Factors that may be considered include:

- Maintenance costs over the remaining life of the asset will exceed that of replacement;
- The asset has become obsolete, component fabrication is expensive, the asset may be the last of its kind and difficult to maintain;
- Low cost retrofit replacements are available with enhanced ratings and safety features; and
- Associated risk and asset performance history.

Economic asset refurbishment is generally restricted to DRS. This is an efficient way of extending the asset life where appropriate.

The choice to refurbish assets is based on the condition of the asset, accessibility, its age, history of faults, known issues and criticality of the asset. The availability of assets and the safety of assets also play an important part to elect whether refurbishment is an option.

Asset replacement is generally condition based, rather than age based. Vector is moving towards developing CBARM models for its assets, which would support a more risk based approach to replacement. This approach would be similarly applied to maintenance prioritisation.

4.3.5 MAINTENANCE STRATEGY

Vector's assets are maintained over their whole lifecycle to avoid failures that pose a hazard to workers or public safety. The core that underpins the maintenance strategy is scheduled inspections for equipment in accordance with maintenance standards for each asset class. Maintenance inspections are used to perform maintenance tasks, repairs and identify and record any non-compliances with the maintenance standards.

Vector has a comprehensive suite of in-house developed maintenance standards that define asset inspections, condition testing and associated maintenance tasks by asset class. In general, Vector's philosophy is to keep its assets in use for as long as they can be operated safely, technically and economically. The maintenance standards support this goal to ensure optimal performance. Corrective maintenance for non-compliances will then be undertaken within specified time frames, as stipulated in the maintenance standards.

Each maintenance standard addresses the purpose, content, frequency, record requirements and associated treatment criteria. The treatment criteria and resulting actions generally direct field workers, to repair defects identified.

In addition to the foregoing, Vector has taken a pro-active approach to the management of its gas distribution network and assets. This involves improving overall asset management capability and the ability to monitor the condition of the network as well as the implementation of programmed replacements in circumstances where these are deemed appropriate.

Some capability improvements in train are the transition from NZS 5258 to AS/NZS 4645 and the proposed use of criticality information developed for CBARM to move to a risk based prioritisation of maintenance.

Improved monitoring initiatives includes scheduled "drive-by" leakage detection surveys, pro-active identification of physical works with the potential to affect the gas distribution network with routine patrols, and the regular survey of riser valves.

4.3.6 RELIABILITY AND RESILIENCE STRATEGY

The operation of the gas network is focused on safety and reliability. Where network failures occur either through equipment maloperation or third party damage, it must be possible to manage these situations safely. The impact these abnormal situations have on other gas users is dependent on the resilience of the network.

Through scenario modelling, it is possible to remove critical assets from the model to simulate an asset failure and test the impact the absence these assets have on the performance of the network. Where the resultant network pressure model signals unsafe operating pressures, mitigation measures may be identified and enacted before a real situation arises. The determination of acceptable mitigation measures can be identified through a risk-based approach (consequences x likelihood).

Vector has introduced a number of QoS and SoS projects to improve the resilience of the network. The intention is to extend this scenario-based approach and look more closely at the resilience of the various pressure networks.

Reliability and resilience can also be impacted by cyber-attacks that target the core control systems with downstream impacts on the physical infrastructure. While the majority of controls will be implemented at a group level, we will continue to investigate and deploy specific tools designed to detect and prevent attacks on the core control systems of the gas network. These will integrate into the broader security monitoring capabilities of the group.

4.3.7 QUALITY OF SUPPLY CRITERIA

The QoS criteria is specified in GNS-0074. The objective is to ensure that the Minimum Operational Pressure (MinOp) is at greater than 50% of the Nominal Operating Pressure (NOP) and no more than 110% of its Maximum Allowable Operating Pressure (MAOP).

Where network modelling forecasts potential QoS issues, closer field monitoring of the pressure at the extremities of the network is carried out to confirm the accuracy of the model. Where forecast QoS breaches are confirmed, solutions are investigated and implemented in a timely manner to ensure the breach does not occur in practice.

In some cases, non-standard minimum network pressures are used as a result of network configuration, cost efficiency or special agreements with customers. Vector's QoS standard provides the Minimum Operating Pressures (MinOp) that apply at the critical locations where non-standard conditions apply.

Under contingency situations, networks are isolated to maintain safety to customers and the public. During contingency conditions, network pressures may drop below those experienced during standard and non-standard operating conditions. In these situations, maintaining network pressure depends on the type of fault and the network configuration. Contingency provisions such as customer load shedding are used to maintain network pressure to the end users. Upon loss of a critical element in the supply chain, the following minimum network pressures shall be maintained using contingency provisions:

- IP networks shall be operating at no less than 40% of NOP;
- MP networks shall be operating at no less than 30% of NOP; and
- LP networks shall be operating at no less than 1.2kPa.

4.3.8 SECURITY OF SUPPLY STRATEGY

The QoS strategy ensures the local gas networks operate within safe pressure limits but lacks the wider perspective of managing the network against HILP risks such as ensuring the safe delivery of gas upon the loss of critical components. The widespread application of meshed networks not only ensures efficient use of the network assets but allows a level of redundancy as a precaution against asset failure. For example, a single IP20 pipeline supplying a network has no redundancy, whereas the downstream MP4 network may have multiple DRS's and interconnected pipelines offering additional levels of redundancy.

The SoS criteria is a risk-based assessment based on the numbers of customers affected by an event, network pressure modelling following a simulated contingent event, and the costs and benefits of mitigation measures. The assessment criteria for a project to be implemented under the SoS category is on a case-by-case basis determined by evaluating the risk-mitigation cost trade-off.

4.3.9 ENVIRONMENTAL STRATEGY

Sustainability lies at the heart of creating a new energy future and Vector strives to be an industry leader in Health, Safety and Environmental performance. The Environmental Strategy is to provide sufficient competent resources and effective systems at all levels of the organisation to fulfil this objective. Vector has ISO14001 Environmental Management System certification and will strive to maintain this.

To achieve the above, Vector is committed to:

- Ensuring environmental aspects and impacts are considered as part of all business decisions;
- Meeting and where possible, exceeding the requirements of all relevant environmental compliance obligations;
- Providing environmental leadership through participation in business networks and working with government to create pragmatic laws, regulations, standards and codes of practice to protect the environment;
- Operating in a manner that prevents pollution, minimises environmental impacts and promotes beneficial environmental performance;
- Monitoring and continually improving our environmental footprint;
- Consulting with Vector People, customers and other relevant stakeholders on our environmental performance; and
- Using our knowledge, resources and technology to influence positive environmental outcomes throughout the industries and geographic areas we interact with.

To deliver this strategy Vector will:

- Increase environmental awareness across the business;
- Focus on responsible energy management within our assets;
- Establish environmental goals through our business health, safety and environmental plans and continually monitor, review and improve the effectiveness of our Health, Safety and Environmental Management System;
- Improve environmental capability of all Vector People;
- Set environmental criteria through our purchasing processes; and
- Deliver services and technology to our customers that displace carbon emissions and other forms of pollution.

4.3.10 SAFETY IN DESIGN STRATEGY

The distribution of natural gas involves managing significant hazards, and the Health and Safety in the Work Act 2015 places greater accountability on designers to achieve safe outcomes for works. Safety in Design means the integration of control measures early in the design process to eliminate or, if this is not reasonably practicable, minimise the risks to health and safety throughout the life of the structure being designed. Safety in design applies to any plant, substance or structure that is constructed whether fixed or movable.

It is the fundamental of getting Asset Management practices right and forces us to take a collaborative, well considered, risk based multidisciplinary approach across the lifecycle of the asset.

This strategy is covered by Vector's Corporate HSEMS Key Requirement 12.1, Safety in Design.

4.3.11 DIGITAL STRATEGY

The Vector digital strategy has evolved to reflect the changing nature of our business, the wider energy landscape, and new digital technologies. Vector leverages smart digital platforms, optimised across five key value streams: Customer Operations, Records & Asset Management, Network Operations, Maintenance & Construction, and Network Innovation & Planning.

As part of the continuous improvement path for asset management we continue to invest in key systems that will enhance our core capabilities around asset replacement, planning, and maintenance and use network level data analytics and customer behavioural insights to ensure that our physical network investments are targeted.

Accordingly, we will continue to target investments as efficiently as we can by supporting traditional network assets with digital and new energy solutions for the long-term benefit of energy consumers.

4.4 Asset specific strategies

Vector's Asset Strategies for each of its asset classes describe in detail Vector's long-term actions and plans required to deliver specific objectives and network outcomes based on stakeholder requirements and long-term service level performance criteria. A list of all of Vector's Asset Strategies is provided in Section 7.2.

Each asset strategy provides an overview of the class of asset, its purpose and information about its population, asset class replacement considerations, its maintenance requirements, failure modes, specific known issues, risks and asset health indicators and refurbishment requirements. A high-level summary of these strategies is given below.

4.4.1 DISTRIBUTION PIPELINES

Our asset strategy for distribution pipelines is described in GAA001 Distribution Pipelines. The strategies cover distribution mains and services pipelines.

Vector's distribution pipelines are comprised of PE pipe (92.7%), steel pipe (7.2%) and nylon and cast iron pipe (0.1%).

PE PIPELINES

The average age of Vector's mains and service PE pipelines is approximately 20 years; the standard life for pre-1985 PE is 40 years and the standard life for modern PE is 60 years.

Although issues have been identified with pre-1985 PE systems (refer below), the majority of the total PE mains systems (i.e. over 98% of Vector's PE network) are comprised of modern PE. The overall condition of the modern-PE pipelines is good and no programmed replacement of these pipelines is envisaged within the standard life of the assets.

PE pipelines have been in use on Vector's networks since the 1970s. PE pipe manufactured up to the mid-1980s is known to be susceptible to premature brittle-like failure issues due to the resin type that was in use at the time of manufacture. The issues occur as a result of stress intensification brought on by the PE pipe being exposed to excessive shear and/or bending forces while in service.

Analysis carried out over recent years has shown that that the PRE rate for pre-1985 PE systems is significantly higher than the average PRE rate for the whole of the Vector network, and that the PRE the rate for MP4 pre-1985 PE systems is significantly higher than that for MP1 and MP2 pre-1985 PE systems. The analysis also showed that for the 5-year period to 2019, approximately 75% of pre-1985 PE PRE were caused by either a squeeze-off failure or a manual-fusion joint failure. To address the risks associated with pre-85 PE systems Vector has implemented an ongoing programme of targeted pipeline replacement initially targeting higher priority areas; priorities are based on risk factors which include PRE history, operating pressure, pipe diameter and pipeline criticality etc.

The majority of PE pipe used by Vector is Series 3 (i.e. imperial size) PE80 pipe. This pipe is manufactured in New Zealand from yellow PE resin. In 2017, there was an international shortage of yellow PE80 resin which led to rationing of PE80 pipe throughout the wider New Zealand gas industry. Since then Vector has been working with GANZ (Gas Association of New Zealand) to investigate and facilitate a possible move away from the use of yellow PE80 pipe by the wider gas industry and the adoption of yellow-jacketed black PE80 and/or PE100 pipe instead. It is anticipated that this will avoid pipe shortages and result in improved price stability going forward. As part of this move, Vector, with support from GANZ, is also evaluating the adoption of 15mm pipe as the minimum size for new service connections; the key driver for this change is the increased resilience to 3rd party damage that the heavier wall thickness of the 15mm pipe offers over the 10mm pipe.

STEEL PIPELINES

Underground steel pipelines are protected from corrosion by means of pipe coatings and the use of CP systems. The average age of Vector's steel pipelines is approximately 35 years; the standard life for steel pipe is 60 years for MP pipelines and 70 years for IP pipelines. The overall condition of buried steel pipelines is good and no programmed replacement of these pipelines is envisaged within the standard life of the asset. The replacement of steel pipelines is expected to continue to be of a corrective nature, targeting specific locations and addressing localized issues.

Where a steel pipeline is located in close proximity to a high voltage power network, hazardous voltages can occur on the pipeline in the event of a fault on the power network. The electrical hazards can be caused by Earth Potential Rise (EPR) where the pipeline is located in proximity to a power system earthing-current discharge point, or by Low Frequency Induction (LFI) where a steel pipeline runs parallel with a high voltage power line. To mitigate these risks Vector has developed a draft Electrical Hazard Management Plan (EHMP) in accordance with the requirements of AS/NZS 4853. The EHMP identifies and assesses all electrical hazards that present a threat to the integrity of Vector's steel pipelines or the safety of people in contact with the pipelines and includes assessment and inspection and test procedures. The draft EHMP also includes a number of recommended mitigation measures (e.g. installation of additional earthing, surge diverters etc) some of were installed during FY20; the remaining mitigation measure recommendations will be reviewed and implemented as appropriate as part of ongoing reviews of the EHMP.

The North Harbour Pipeline is currently operated as part of Vector's IP20 network but is managed and maintained as a HP pipeline in accordance with the requirements of the Health and Safety in Employment Regulations (Pipelines) Regulations. The pipeline was commissioned in the late 1990s and the initial certificates of fitness cited NZS 5223 as the code of practice to which it was certified. The Pipelines Regulations also cites AS 2885 as a means of compliance, and as this standard is now recognised as industry best-practice. Vector initiated a review of the pipeline's design, construction and operating standards to align them with the requirements of AS 2885. The review was initiated in FY14 and the programme of work to adopt AS 2885 was completed in FY18; the pipeline certificate of fitness issued in May 2019 cites NZS 5223 as the code that the pipeline was designed and constructed to, and AS 2885 as the code under which the pipeline is operated and maintained.

An inventory of critical spares and equipment items is held for Vector's networks; the items are owned by Vector and held on its behalf by its FSP, Electrix. The inventory includes items that are low volume (turnover) or high cost, or have long lead times for purchase, or are no longer produced (obsolete) or where the level of risk associated with not holding a spare is considered high. The general condition of the critical spares and equipment is adequate, however some of the equipment (e.g. TDW drilling equipment) is at least 25 years old and its current condition reflects the relatively high level of service.

NYLON AND CAST IRON PIPELINES

Small quantities of nylon mains pipe were installed on Vector' network during the early 1980s, however all known sections of nylon mains pipe have since been replaced (with PE) or decommissioned. A small-bore (6mm) nylon piping system known as Flexigas was also used for a short period during the late 1980s however it quickly became obsolete due to the introduction of PE pipe; approximately 2.5km of 6mm nylon service pipe remains in use. Nylon service pipes are replaced (with PE) whenever any reactive or planned work is carried out on these services.

Approximately 100 m of cast iron mains pipe remains in service on the Panmure MP1 system; although the installation date is not known, it's thought to have been installed around the 1960s. Cast iron pipelines are constructed from sections of pipe that are joined with a mechanical joint and are prone to leakage due to damage to the joints and/or fractures in the pipe. The replacement of this section of pipeline will be carried out as part of a mains relocation project associated with a major Auckland Council road-upgrade programme.

PIPE IN BUILDINGS

There are approximately 200 sites where Vector owns a gas service pipe that terminates within a building - typically at a GMS location or a meter room. Vector undertakes annual inspections of these sites to assess the condition and accessibility of the service pipe, and the adequacy of available ventilation and installed gas-tight conduits etc. The primary risk associated with pipe-in-buildings sites is an asset failure resulting in a gas-in-building event.

During FY20 Vector undertook a field-audit of all pipe-in-building sites to clarify the demarcation point between network and GMS assets at each site and undertake a condition assessment to identify any upgrade work required to mitigate any safety risks associated with the site. This work forms the basis of a pipe-in-building upgrade programme that is scheduled for the FY21 to FY24 period (refer to Section 5.2.2).

4.4.2 PRESSURE STATIONS

Management of our pressure station fleet is undertaken in accordance with Vector's asset strategy GAA201 Pressure stations. The strategies cover equipment at gate stations, DRS and service regulators.

GATE STATIONS

HP equipment (pressure regulating equipment, custody transfer metering, etc.) within the gate station is owned, operated and maintained by the transmission company (FirstGas Limited), whereas distribution system equipment (i.e. check-metering where installed, and associated valves and pipework etc.) within the gate station is owned, operated and maintained as part of Vector's distribution networks.

These assets are the main supplies into the local distribution network and are critical to the overall supply system. Condition assessment form the basis of Vector's upgrade programme to address corrosion on pipe spools and equipment including pipe supports.

The condition assessment has identified a need to implement a 5-year programme to replace the present support systems with modern technology that reduce the effects of corrosion at the contact points, these will also provide additional support during a seismic event.

DISTRICT REGULATOR STATIONS

Vector has approximately 100 DRS in service on its distribution network. The average age of the DRS population is 21 years; the standard life of a DRS is 35 years. The majority of DRS are installed aboveground and have a twin stream active/monitor/slam-shut (i.e. over-pressure protection) configuration.

DRS condition assessments are carried out on an ongoing basis to allow DRS upgrade priorities to be determined; the condition assessments cover the following general areas:

- Enclosure dimensions, amount below ground, enclosure type and ventilation provided;
- Confirmation that the reliefs valves are vented to a safe location;
- Inlet and outlet fire valves present and accessible;
- The condition of the enclosure and ease of access/egress; and
- The condition of DRS equipment – i.e. regulators, pipework, filter, relief valve, meter and corrector.

The ongoing DRS condition assessments form the basis of Vector's DRS upgrade programme to address integrity issues, and the overall condition of the DRS population has shown a steady improvement over the period since the condition assessments were initiated in FY10. Although the overall condition of the DRS population is improved, there are ongoing integrity issues that still need to be addressed; some common examples of these issues include:

- Corrosion of pipe spools and/or equipment;
- Presence of relief valve over-pressure protection at a small number of sites;
- Deficiencies in legacy DRS enclosure designs - e.g. inadequate protection against vehicle impact; inadequate access or egress resulting in confined or restricted spaces; inadequate enclosure ventilation; and
- Inadequate inlet and/or outlet fire valves.

In order to mitigate electrical hazards that could be present at DRS installations, Vector undertook a 3-year programme (FY17 to FY19) to retrofit equipotential bonding and earthing to all existing DRS; this work was implemented as part of the development of an EHMP in accordance with the requirements of AS/NZS 4853. This work was largely completed by early FY20; however, a small number of sites remain outstanding due to the need for bespoke designs at these sites to cater for aerial earthing, HP pipeline certification or 3rd party design requirements; this work is expected to be completed during FY21.

SERVICE REGULATORS

Approximately 130 service regulators remain in service on Vector's network. The average age of the service regulators is 26 years, with the majority installed between the mid-1980s and the mid-1990s; the standard life for service regulators is 35 years. Existing service regulators are mostly installed in small pits below ground, however all new service regulators are installed above ground. Service regulators are typically installed in situations where it is not possible (or considered impractical) to locate the GMS outside of the customer's premises. A service regulator is typically comprised of a small-capacity pressure regulator along with upstream and downstream isolation valves.

In some situations, underground service regulators can be affected by the ingress of water, silt or other debris that over time leads to corrosion and impaired regulator performance. This can result in gas escapes from corroded fittings and pipework and can allow unacceptable over-pressure gas into downstream systems (and venting gas to atmosphere). An ongoing removal programme targets higher risk belowground service regulator sites; the service regulators are removed where possible, or alternatively relocated above ground. Replacement candidates are identified through planned maintenance inspection records, fault reports or an assessment of other risk factors - e.g. the service regulator location relative to buildings, roadways etc. It is anticipated that all remaining belowground service regulators will have been removed (or relocated aboveground) by FY26.

4.4.3 VALVES

Vector's strategy for underground valves is described in GAA301 Valves.

LINE VALVES

The line-valve population is comprised predominantly of ball valves and plug valves with a small number of gate valves. The average age of the line valve population is 29 years; the standard life of valve assets is 35 years. In general valves are expected to last the lifetime of the network system to which they are connected, however valves will be replaced on an as required basis due to operational issues, leakage etc.

Plug valves were installed on Vector's network up until the mid-1980s; because of their design, plug valves require a higher level of maintenance which includes regular greasing to prevent the valve seizing and/or leaking. Ball valves have been used since the mid-1980s and are considered to be reliable and relatively maintenance free. Exact information on valve types (i.e. ball, plug etc.) installed on the network is not available (i.e. legacy valve information is not complete) however it is estimated that over 40% of mains valves are plug valves.

Mains and service valves are typically installed belowground. The majority are direct-buried and access to the valve is provided via a valve sleeve. In some cases (e.g. on larger diameter mains) valves are installed in pits or above ground. Aboveground valves that are installed at gate station and DRS sites are operated and maintained as part of the station equipment.

The principal operational risks for line-valves are lost valves (i.e. a valve cannot be located in the field due to road alterations or re-sealing etc.) and seized plug valves (i.e. corrective maintenance procedures are unable to make a seized valve operable). Where lost valves or seized valves are confirmed, they are identified as such in Vector's asset database and a risk assessment carried out to determine if a replacement valve is required.

AS/NZS 4645 requires adequate sectional isolation valves be installed to facilitate the safe operation of the gas distribution network. Vector uses network isolation modelling to determine the need for additional isolation valves in higher risk areas - e.g. CBD, large catchment areas etc. An ongoing programme to install additional isolation valves (including DRS fire valves) as identified by the isolation modelling is planned for the duration of the planning period.

RISER VALVES

Riser valve faults are a major cause of both planned and unplanned interruptions on the network. Typical riser valve faults are the valve passing gas when in the closed position, the valve leaking or the valve being inoperable (e.g. seized). Vector is actively investigating the cause of riser valve faults (in particular leakage and passing-gas faults) to determine if a valve design-fault exists or if current maintenance practices need to be modified.

Prior to the introduction of ball valves in the early 1990s, a plug type riser valve was used for all residential and small commercial connections on Vector's network. Because of its mechanical design, this type of valve is prone to seizing and gas escapes. In order to mitigate the risks associated with riser plug valves, annual audits of approximately 1,000 riser valves have been undertaken over recent years targeting areas known to have relatively high populations of plug type riser valves. However more recent riser valve audits carried out in predominantly residential areas have found only a relatively small quantity of plug valves in service; this indicates that the risks associated with seized or leaking riser plug valves have been significantly reduced.

Since FY17, the annual riser valve audits have targeted IP and larger size MP riser valves. The targeting of these types of riser valves is due to a noticeable increase in the number of faults that were being reported for larger sized steel risers. The results of these surveys have shown that larger size steel risers present a greater risk than the standard MP4 residential riser due to risks associated with corrosion of the riser and/or riser valve. Future annual riser valve surveys will therefore continue to target larger sized risers (i.e. >25mm) until such time as the full population of this type of riser valve has been surveyed.

The crimped riser assemblies currently used by Vector (and the majority of NZ gas utilities) for 10mm and 15mm PE service connections are deemed to be 'proprietary' fittings under AS/NZS 4645 and as such need to be tested to demonstrate that the assembly meets the Formal Safety Assessment (FSA) criteria stipulated in AS/NZS 4645. During 2018 and 2019 the Gas Association of New Zealand (GANZ) facilitated (on behalf of its members) the development of a failure mode effects analysis (FMEA) report and the commissioning of a strength and integrity testing programme for the crimped riser assembly to meet the FSA requirements of AS/NZS 4645. For the FSA to remain valid, all crimping must be carried out using an approved crimp tool and in accordance with approved crimping procedures; it is anticipated that Vector will introduce the new crimp tool and procedure in or before FY21.

4.4.4 CORROSION PROTECTION EQUIPMENT

Vector's strategy for corrosion protection equipment is described in GAA401 Corrosion protection systems.

The majority of Vector's interconnected steel network is protected by impressed-current CP systems; the balance of the steel network (i.e. typically smaller standalone networks) are protected by sacrificial-anode CP systems. The CP systems comprise 9 transformer rectifiers and associated ground beds, 12 sacrificial-anode beds and approximately 1,000 CP test points.

The impressed-current CP (ICCP) systems have an average age of 30 years, and the sacrificial-anode CP systems have an average age of 29 years; the standard life of CP assets is 20 years. The condition of the overall CP system is considered adequate, and the performance requirements of AS 2832 are generally being met.

Additional CP test points have been installed over recent years to meet the test-point spacing requirements of AS 2832, however there is a need for the installation of further test points to address ongoing test-point spacing issues and to replace lost or damaged test-points; a 5-year programme to install additional CP test points is therefore planned for FY21 to FY25. In addition, there is an ongoing requirement to install interference test points on an as-required basis to allow joint monitoring (i.e. by the respective pipeline owners) of Vector's steel pipeline and other steel pipelines (e.g. Watercare's) to address any CP interference issues at points where the pipelines cross or are in close proximity to one another.

Although ICCP system ground beds are generally expected to last the lifetime of the network system to which they are attached, sacrificial-anode system anodes require replacement when the anodes have been consumed, or when the CP current requirement exceeds the capacity of the anode system. Replacement of the anodes is carried out as required based on an assessment of the performance of the relevant anode system.

The Otara ICCP system encompasses Vector's steel networks that stretch from East Tamaki to Otahuhu and from the Airport south to Papakura. This ICCP system is supported by a single ground-bed located in Otara and is currently running at its maximum output and is susceptible to minor isolation faults. The installation of an additional ICCP transformer/rectifier and ground-bed in the Papakura area is planned for FY21. This additional ICCP system will strengthen the level of CP being provided to the steel networks located in the Papakura area and allow for faster fault identification across this large CP system.

The replacement programme for Vector's CP assets includes an annual provision for the replacement of CP assets as required - e.g. installation of surge diverters, installation of new ground beds or upgrade of existing ground beds, replacement of expired sacrificial anodes, installation or replacement of test points etc.

4.4.5 TELEMETRY EQUIPMENT

Vector's strategy for telemetry equipment is described in GAA501 Telemetry equipment.

The telemetry systems used by Vector to monitor its gas distribution networks comprise the Telenet SCADA system, and the Cello system. Telenet equipment is typically installed at gate station and DRS sites, and Cello equipment is typically installed at system extremity or other critical pressure-monitoring points.

The use of Telenet monitoring is considered for all DRS that are supplied from an MP7 or higher pressure system and where the DRS location provides a critical monitoring point for the associated pressure system/s, or where the DRS has a peak throughput in excess of 500 scmh or it supplies 1,000 ICPs or more. The use of Telenet monitoring is also considered for any system extremity point where the ability to monitor real-time system pressure data during a contingency event is critical. The use of the Cello monitoring is considered for all DRS sites and system extremity monitoring points where the availability of real time system pressure data is not considered to be critical, but where the availability of pressure data is considered vital for planning purposes.

The Telenet system employs two communication platforms - i.e. approximately half of the sites utilise Kingfisher Remote Telemetry Units (RTU) to monitor pressure, temperature and flow data and communicate with a master RTU by means of a digital radio transceiver. The balance of the Telenet sites utilise an electronic gas volume corrector to monitor pressure, temperature and flow data and communicate with the Vector base station by means of a GPRS router utilising the Vector Communications Wireless Plus service. The Telenet data is passed from the Kingfisher master RTU and the GPRS base station to Vector's Power TG SCADA system from where it is archived in the PI archiving system.

A 5-year programme (FY17 to FY21) to replace aging Kingfisher field-RTU and master station equipment and upgrade the radio comms system from analog to digital was completed ahead of schedule in FY20. The upgrade also included the upgrade of the communication link between the field RTUs and the SCADA system to utilise the standard DNP3 communications protocol.

The average age of the GPRS Telenet field equipment is approximately 11 years and it is in good condition. Intermittent performance issues have been encountered at some GPRS sites where a new corrector type has been installed however these are expected to be addressed through ongoing corrector-firmware upgrades.

The Cello system is comprised of GSM remote data loggers that use SMS messages for communication, and a receiving PC which has proprietary PMAC software and a GSM modem installed. In addition to the population of Cello units installed at permanent pressure-monitoring locations, a small population of Cello units is also used for temporary pressure-monitoring - e.g. for winter gauging purposes. The 15 minute time-stamped data is uploaded from the Cello unit to the PMAC base station once a day; data from permanent monitoring sites is then archived in the PI archiving system. The average age of the Cello units is approximately 5 years; the equipment is in good working order.

The Cello units operate on Vodafone's 2G network and although there currently doesn't appear to be any firm plans for Vodafone to shut its 2G network, it is considered likely at some time in the near future in order to free up capacity for other services (e.g. 5G) as has already occurred in other countries around the world. The acquisition and deployment of further Cello equipment has been temporarily put on hold in the meantime while Vector explores available options that will ensure all new remote data logger sites are connected to the 3G (or later) network and allow the existing population of remote data loggers to be progressively migrated to the alternative network within the next few years; this would entail upgrading or replacing the existing data logger units.

4.4.6 SPECIAL CROSSINGS

Vector's strategy for special crossings is described in GAA601 Special crossings.

Vectors special crossings utilise either a steel carrier pipe (57%) or a PE carrier pipe (43%).

Periodic detailed condition assessments have been completed for most of the steel special-crossings (detailed assessment of a small number of sites is currently not possible due to restricted physical access). The results of these assessments indicate that the majority of the crossings are in good or reasonable condition with a small number of sites requiring various levels of upgrade work to address corroded and/or poorly designed pipeline support brackets and damaged and/or loose bracket fixings etc. The sites requiring upgrade work have been prioritised and the higher priority sites scheduled into a four-year programme of work spanning FY21 to FY24.

Condition assessments have also been carried out for all PE special crossings however for the majority of these crossings the PE carrier pipe is either buried in the road carriageway or enclosed within the bridge structure; detailed condition assessments have not been carried out at these sites.

All special crossing sites have safety measures installed where there is a risk of the public accessing the pipe attached to the crossing structure; the measures typically include safety barriers and/or warning signs. Ongoing risk assessments are carried out as part of routine special-crossing preventive maintenance inspections to ensure the existing public-safety measures at that site are adequate. A public-safety risk assessment is also carried out for any planned new special-crossing to ensure that appropriate public-safety measures are included in the special crossing design.

A five-year programme of work (FY18 to FY22) to replace all pipeline support brackets on the Auckland Harbour Bridge IP20 pipeline crossing and to recoat the entire pipeline is ongoing. The work was initiated due to the poor condition of the original support brackets and is proceeding on schedule; it is expected to be completed during FY22.

section 05

managing our assets lifecycle

5 – managing our assets lifecycle

This section sets out Vector's project proposals for the next 10-year period. Project proposals are created through the 'Needs Management' process described in Section 3.6 and are categorised as either 'Asset Development' or 'Operate, Maintain, Renew, Replace' projects. They comprise both standalone projects, where investment is focused on a specific asset and need, and programmes of work, which may comprise a series of projects to address the same need.

These proposals will assist Vector in achieving service level targets through addressing the current or performance targets identified in Section 2.2 and Appendix 7.3. The proposals are developed based on our asset management strategies (see Section 4.3). Each project proposal provided in this section details the following:

Need: The need sets out how the project is aligned with Vector's service level targets and particular shortfalls in performance (see Section 2.2), and particular strategies (see Section 4.3). Any risks relating to the ongoing performance of the network are highlighted. By having close alignment with the service levels, this ensures projects are in accordance with the asset management objectives.

The proposed projects are identified from the assessment of the possible viable options to address the need. Where applicable, options consider non-network solutions and innovations, and deferral of investment. All the proposed projects have been subject to technical assessment, modelling and simulation, exclusion viability, financial feasibility and post investment risk assessment.

Investment summary: An investment summary table gives forecast expenditure on the project for the 10-year period in New Zealand dollars. The forecast annual expenditure is given in financial years and all amounts are shown in millions of dollars nominal to two decimal figures.

5.1 Network development

Network Development is driven by network demand exceeding the capacity of existing assets. These are generally caused by increases in new customer connections or increasing demand from existing connections (see Section 5.1.2). Other factors such as pressure rating reappraisal (e.g. pressure de-rating due to changing conditions) or the identification and (partial) mitigation of high-impact low-probability events may also be managed as part of Network Development.

As network demand increases, the capacity of the network needs to be increased to maintain network reliability. The QoS criteria describes the level of redundancy to which the network is designed to deliver the accepted reliability levels. Subject to these levels being delivered network reliability is determined by the performance of the network assets. Vector's approach to asset development is outlined in the Network Planning Strategy (see Section 4.3.2). In addition, a 'system pressure drops below acceptable levels' risk and SoS risk, and associated controls and treatment plans have been registered in Vector's risk management system. These risks have been assessed in accordance with Vector's risk management process, described in Section 3.5.

The following sections detail the asset development projects and programmes planned across the network over the next 10 years. A full list of all pressure systems and their performance against Vector's QoS criteria (refer Section 4.3.7) is provided in 7.6.

5.1.1 AUCKLAND CENTRAL NETWORK SYSTEM

The Auckland Central network system is supplied from the transmission system at five gate stations. This network system consists of one IP20 pressure system, three IP10 pressure systems, two MP7 pressure systems, eighteen MP4 pressure systems, five MP2 pressure systems and three MP1 pressure systems. The Auckland Central network system is Vector's largest network system in terms of the number of connections. It is expected that future gas demand will be driven by the population growth and potential industrial and commercial activities in Auckland. Forecast breaches over the next 10 years is shown in Sections 7.6 and 7.13.

EAST AUCKLAND IP20/MP4

NEED

Network modelling of the East Auckland IP20/MP4 pressure system confirms a forecast QoS breach (886kPa) in the Gilbert Road / Alexander Crescent area of Otahuhu within the next five years. The steel IP20 pipeline reduces in size from 200mm to 100mm in Gridco Road, causing an unacceptable pressure drop at the Alexander Crescent DRS (DR-00116-AK), this further impacts the inlet pressures at three other DRSs; DR-00136-AK, DR-00135-AK and DR-00160-AK.

To mitigate the breach of Vector's standards for QoS and SoS, the following projects have been identified:

- Construct approximately 2km of 200mm IP20 steel main in parallel to the existing 100mm pipeline from Gilbert Road to Alexander Road. This project will increase the minimum pressure at the inlet of DR-00116-AK to 1,700kPa (modelled) which ensures the inlet pressure at DR-00136-AK is maintained within Vector's QoS standards. At present, DR-00136-AK is connected to the IP20 / IP10 pressure system which supplies gas to the eastern side of Auckland through a 100mm steel IP10 pipeline which is operating at a nominal pressure of 875kPa. Network modelling using the forecasted growth anticipated in the area confirms that the increasing demand in several MP4 networks will reduce the inlet pressure at both DRS's mentioned earlier and will risk breaching the MinOp standards at the backbone of the IP20 and IP10 pipelines. This project is split into two stages; the first stage in FY21 will cover the first 400m and the second stage in FY24 covering the remaining of the pipeline. This

approach will allow Vector to monitor the impact of the first stage and reassess the investment. Route selection and project planning are underway in FY20. Alternative options, such as extending the 200mm pipeline to connect into the existing 200mm pipeline, have been investigated but determined not to be financially feasible;

- Construct approximately 500 metres of 100mm MP4 PE pipeline along Harris Road from Cryers Road to Ti Rakau Drive, Pakuranga. Network modelling confirms that installing an MP4 connection will substantially improve the network pressure northwest of Ti Rakau Drive (Botany Road) and west of Harris Road . Alternative options, such as Ti Rakau Drive road crossings, were either less effective than the proposed solution or more expensive and required private property access to achieve the desired outcomes; and
- Construct approximately 330 metres of 100mm PE MP4 pipeline between 18 and 40 Smales Road, East Tamaki. Network modelling confirms that an MP4 mains extension in Smales Road allows the connection between the commercial network supplied by the Kerwyn Ave DRS and the residential areas in Franshell Crescent and Redcastle Drive. Apart from the pressure improvement further to the north in Moorestead Ave, the mix of commercial and residential load improves the utilisation of the Kerwyn Ave DRS and maintains the desired SoS.

FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
IP20 upgrade from Gilbert Road to Alexander Crescent, Otahuhu-Stage 1	1.60										1.60
IP20 upgrade from Gilbert Road to Alexander Crescent, Otahuhu-Stage 2				2.00							2.00
MP4 pipeline extension in Harris Road, Pakuranga								0.34			0.34
MP4 pipeline extension in Smales Road East Tamaki		0.14									0.14
Total	**1.60**	**0.14**		**2.00**				**0.34**			**4.08**

CENTRAL AUCKLAND MP4

The Central Auckland MP4 pressure system operates at a NOP of 400kPa and supplies gas to the Auckland central area bounded by the suburbs of Hillsborough, Avondale, St Heliers, and includes the Auckland and Newmarket central business districts.

NEED

Modelling of the forecasted growth confirms a QoS breach in Mission Bay and extends west to include Orakei and the lower end of Victoria Ave and Portland Road areas in Remuera, which will eventually breach Vector's QoS standards in the MP4 network.

To mitigate the potential breach of Vector's QoS standards, the following projects have been identified:

- A major three-stage project to connect the 100mm PE MP4 pipeline at the intersection of Kohimarama Road and Whythead Crescent, to the 100mm PE MP4 pipeline at the northern end of the Orakei Road bridge, through Kepa Road. The three stages of the project include a total of approximately 3.5km of 100mm PE MP4 mains pipelines. Each stage of the project will be connected to the existing 50mm PE mains at several identified points. Network modelling of the proposed three stages shows that this approach enhances the SoS and maintains Vector's QoS standards, increasing the minimum pressure of the network by 20%. Alternative options, such as supplying Orakei from Whytehead Crescent and upgrading the MP4 network to IP20 network at Ellerslie Racecourse and adding another DRS, have been investigated but were not financially feasible;
- Construct approximately 730 metres of 50mm PE MP4 pipeline link in Motions Road. Modelling of the proposed project confirms that it will improve the network resilience and a marginal improvement in network pressure;
- Construct approximately 130 metres of 100mm PE MP4 pipeline to connect the 100mm PE at Dell Avenue to the 100mm PE pipeline at the eastern side of Upland Road. Modelling of the proposed project showed that it will increase the minimum pressure in Orakei area, north of Remuera, and will enhance the network SoS;
- Construct eight PE MP4 road crossings and mains extensions across the network. Network modelling confirms that the meshing of the MP4 mains will increase the minimum pressure at critical locations and will enhance the SoS of the network;
- Construct six PE MP4 road crossings and mains extensions in Remuera Road and Stephens Avenue. Network modelling confirms that the meshing of the MP4 mains will increase the declined pressure at critical locations and will enhance the SoS of the network;
- Construct a new DRS at the eastern side of Remuera to cater for the forecasted increasing demand of the network. Network modelling confirms that due to the expected organic growth, the network will require a new DRS to mitigate the risk of breaching the capacity of the current supply DRSs; and

- Construct 20 metres of 50mm PE MP4 road crossing in Glenview Road. This proposed project will secure the stand alone MP4 network supplied from DR-00002-AK which was lost during an outage incident in New Lynn. In addition, this project will improve the utilisation of DR-00002-AK, which is currently supplying 15% of its capacity.

FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
Remuera MP4 mains RNF Stage 1	0.35										0.35
Remuera MP4 mains RNF Stage 2					0.35						0.35
Remuera MP4 mains RNF Stage 3						0.46					0.46
MP4 pipeline extension along Motions Road									0.64	0.17	0.81
MP4 pipeline extension along Upland Road				0.09							0.09
Network PE-MP4 pipe crossings	0.13	0.08									0.21
Remuera Road and St Stephens ave PE pipeline crossings				0.20	0.20						0.40
Remuera new DRS								1.10			1.10
Glenview Road MP4 road crossing	0.04										0.04
Total	**0.52**	**0.08**		**0.29**	**0.55**	**0.46**		**1.10**	**0.64**	**0.17**	**3.81**

AUCKLAND AIRPORT MP4

The Airport MP4 system provides supply to the Auckland International Airport and domestic terminal complex and is currently supplied with natural gas via a single MP4 pipeline, running from the western end of Puhinui Road and over the Pukaki Creek bridge crossing. The MP4 supply is fed from DR-00107-AK located east of the Pukaki Creek bridge crossing. The pipeline crossing the Pukaki Creek is owned by Auckland International Airport Limited (AIAL). Vector is contracted to maintain and operate the pipeline.

NEED

Auckland Airport includes a number of sizable commercial loads and with the planned expansion of the airport terminal, further load increases are forecasted within both the Airport complex and commercial area to the north. Network modelling of the forecasted growth confirmed declining pressures at several points of the network, breaching Vector's QoS standards and the design capacity of the airport DR-00107-AK.

To mitigate the forecasted breach of Vector's QoS standards and more importantly maintain the SoS to critical consumers, the following projects have been identified:

- Auckland Airport SoS; Construct approximately 1.5km of 150mm PE MP4 pipeline to link the Airport and East Auckland MP4 pressure systems. The connection of the two networks significantly improve the SoS to the Auckland Airport which is currently supplied by a single DRS in Puhunui Road;
- Upgrade the existing 100mm steel MP4 on both sides of the bridge on Puhunui Road to 160mm PE MP4. Network modelling confirms that upgrading the pipeline will improve the MinOp, driven by the increasing forecasted demand in the area. Alternative options, such as moving the DRS to the Airport side across the bridge and uprating the 100mm steel MP4 pipeline to IP10, have been considered in previous AMPs but found to be not financially feasible, since the current proposed projects will result in achieving the same outcomes in terms of QoS and SoS improvements; and
- Upgrading the existing DR-00107-AK to mitigate the forecasted breach of its design capacity, due to the organic growth of the network, and the expected expansion of the airport terminal. This upgrade will also allow for new connections in the developing area around the Auckland airport.

The proposed projects significantly improve the QoS and SoS to a very critical/strategic consumer, Auckland Airport. The proposed methodology of the projects are driven by a risk assessment of the SoS along with the need to mitigate the forecasted breach of the QoS due to the organic growth and the expected expansion of the Auckland Airport. Alternatives, such as relocating the IP20/MP4 DR-00107-AK in Puhunui Road to the Airport-side of the Pukaki Creek bridge, and uprating the MP4 line to IP20, were investigated and mentioned in previous AMPs, but determined not financially feasible compared to the projects above.

FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
Auckland Airport SoS		0.50									0.50
Upgrade the existing 100mm steel MP4 in Puhunui Road to 160mm PE MP4							0.67				0.67
Upgrading the existing DR-00107-AK										0.39	0.39
Total		**0.50**					**0.67**			**0.39**	**1.56**

NORTH-HARBOUR MP4

The North Harbour MP4 pressure system operates at a NOP of 400kPa, it is serving a combination of residential and commercial loads several residential developments. It extends from Paremoremo and travels east to Lucas Heights on the northern side of Albany.

NEED

The forecasted increasing demand on this network, due to future residential developments, results in an increasing SoS risk. The linking of the North Harbour MP4 pressure system with the North Shore MP4 system, will enhance the SoS of the North Harbour MP4 network, which is currently supplied by a single DRS, and will allow for future growth of the network.

To supply the future demand in the area and enhance the SoS, the following projects have been identified:

- Construct approximately 180 metres of 100mm PE MP4 in a duct across the Dairy Flat Highway bridge to secure the MP4 network. This proposed project will provide multiple supply points to the North Harbour MP4 network. Network modelling confirms that it will also enhance the QoS on the heavily utilised North Shore MP4 network. Alternative options, such as building a new DRS on the North Harbour MP4 network, have been investigated but determined not financially feasible.

FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
Dairy Flat Highway MP4 bridge crossing			0.33								0.33
Total			**0.33**								**0.33**

NORTH SHORE MP4

The North Shore MP4 pressure system operates at a NOP of 400kPa and supplies gas to the North Shore area bounded by the suburbs of Beachhaven, Devonport and Torbay. This network is identified as one of the heavy utilised networks (refer to section 7.6) as it supplies a highly populated area with mix of commercial, residential and industrial loads.

NEED

It is anticipated that the forecast high demand growth in metropolitan Takapuna will result in a breach of Vector's QoS standard during the planning period. The vulnerability of the system is caused by the large distance between Devonport and the Council Terrace DR-00046-AK, which is its nearest point of supply. Modelling has identified a forecast QoS pressure breach, starting with Devonport and progressively moving along the peninsular towards Takapuna as forecast gas load increases.

To mitigate the forecasted breach of Vector's QoS standards, the following projects have been identified:

- Construct seventeen PE road crossings and mains extensions. This project is a continuation of an ongoing project to mitigate the imminent breach of the MinOp. These proposed critical crossings are split into four stages (one constructed in FY20 and three in the scope of this AMP) have been prioritised based on their improvement on the network pressure. Network modelling and actual system pressure monitoring has confirmed that the benefits from the road crossings completed in Devonport in FY20, significantly improved system pressures, resulting in the deferment of the previously proposed steel project, estimated to be $10 million (see further details below);
- Construct approximately 1.8km of 150mm PE MP4 pipeline to connect the existing 150mm PE/steel pipeline in Northcroft Road with the existing 150mm steel MP4 in southern Lake Road. The modelling of this proposed project confirms that it will maintain the minimum pressure in the network within Vector's standards (270kPa), with the forecasted increasing demand in 2030. This project will defer, if not eliminate, the need of a major investment of more than $10 million to build the steel pipeline proposed in previous AMPs;

- Construct a new IP20/MP4 DRS at the junction of East Coast Road and connect into the 150mm steel IP20 pipeline in East Coast Road. The new DRS will supply the proposed new 150mm PE MP4 link from Glenvar and East Coast Roads to the Long Bay developments, as described in the following project. Network modelling showed that adding another supply to the network, along with the project mentioned above of linking the North Harbour MP4 and the North Shore MP4, will also allow Vector to capitalise on new uptake further to the North, if such need does arise;
- Construct approximately 2.5km of 150mm PE MP4 pipeline from East Coast Road along Glenvar Road to the Long Bay development to reinforce the Long Bay developments as new load intensifies. The new network mains will link the developments with a new IP20/MP4 DRS proposed at the junction of Glenvar Road and East Coast Road. Total estimated demand arising from the full extent of the proposed development is expected to exceed available capacity and breach Vector's QoS standard. Building an additional MP4 backbone will significantly improve network integrity and better accommodate the full extent of the proposed developments in the area; and
- Construct approximately 3.8km of 100mm PE MP4 pipeline from East Coast Road along Okura River Road and Vaughans Road to Long Bay development. Following Glenvar Ridge Road, this backbone reticulation between East Coast Road and Long Bay will be along Okura River Road and Vaughans Road. This project will secure the supply and support the growth in the Long Bay area. Residential developments are driving the installation of the back-bone MP4 network down Glenvar Road to Long Bay. This pipeline will also be supplied by the new IP20/MP4 DRS located at the top of Glenvar Road; and
- Downrating the existing 100mm steel IP20 pipeline in east of Browns Bay to MP4. The existing IP20 pipeline is currently not utilised for its current pressure rating and there are no future plans to add a new DRS on that line, since the area is fully developed and there are no capacity constraints on this part of the network. Meanwhile, network modelling confirms that the proposed downrating will increase the pressure of the MP4 network and will address the forecasted breach of the QoS.

Residential developments are driving the installation of the back-bone MP4 network down Glenvar Road to Long Bay. These two proposed pipelines will be supplied by a new IP20/MP4 DRS located at the top of Glenvar Road and connected into the 150mm steel IP20 pipeline in East Coast Road. Those proposed projects will increase the capacity of the network at its northern end and will allow for future expansion in a highly growing development area. Along with the early mentioned linking with the North Harbour MP4, this approach will have significant impact on the network SoS and future growth.

FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
Construct 17 PE road crossings and mains extensions	0.28	0.15									0.43
Construct 1.8km of 150mm PE-MP4 pipeline along Lake Road.			0.82	1.00							1.82
Construct a new IP20/MP4 DRS at the junction of East Coast Road							0.55				0.55
Construct approximately 2.5km of 150mm PE MP4 along Glenvar Road			0.35								0.35
Construct approximately 3.8km of 100mm PE MP4 pipeline along Okura River Road				0.70							0.70
Downrating the existing IP10 pipeline in east of Browns Bay	0.10										0.10
Total	**0.38**	**0.15**	**1.17**	**1.70**			**0.55**				**3.95**

NORTH-WESTERN MP4

This new proposed MP4 Network will be supplied from two new Class 300 IP20/MP4 DRSs feeding from the IP20 North Harbour and Helensville IP20 pipelines. The pipeline will extend approximately 4km to supply West Harbour, Westgate, Hobsonville and Whenuapai, including Kumeu and Huapai.

NEED

This proposed network is in a rapidly growing area with large residential developments planned for Red Hills, Westgate, Hobsonville Point, Scotts Point and Whenuapai. To enable the connection of new gas customers in these greenfield areas, a back-bone gas infrastructure is required. The current developments in Redhills and Westgate areas will add approximately 1,700 scmh adding to the future organic growth on the network.

To supply the future demand, the following projects have been identified:

- Construct a new IP20/MP4 DRS at Kumeu, off the Helensville IP20 pipeline, to support the greenfields residential developments extending from Hobsonville and Whenuapai towards Kumeu;
- Construct a new IP20/MP4 DRS at Taupaki, off the North Harbour HP pipeline, to supply the greenfields developments of Westgate and Redhills; and
- Construct approximately 4km of 150mm PE MP4 mains pipeline from the new proposed DRS to the Westgate and Redhills developments.

FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
Construct a new IP20/MP4 DRS at Kumeu				0.14	0.60						0.74
Construct a new IP20/MP4 DRS at Taupaki						0.11	0.75				0.86
Construct approximately 4km of 150mm PE-MP4 to Westgate and Redhills					1.60						1.60
Total				**0.14**	**2.20**	**0.11**	**0.75**				**3.20**

WARKWORTH IP20/MP4

The Warkworth MP4 pressure system operates at a NOP of 400kPa, it is supplied from a single gate station feeding to the MP4 network and to an IP20 pipeline from the gate station to an IP20/MP4 DR-00253-AK, located in town approximately 4km from Warkworth gate station. The MP4 network supplies the entire township of Warkworth and few industrial loads.

NEED

The Warkworth MP4 network has the highest forecasted growth among all of Vector's gas network, driven by subdivision growth to the northeast of Matakana and Sandspit Roads. The network now requires reinforcement to support these developments. In addition, system pressure is expected to drop 30% across the 50mm steel IP20 pipeline currently feeding Warkworth, resulting in a potential breach of Vector's QoS standards.

To mitigate the forecast breach of Vector's QoS standards the following projects have been identified:

- Construct approximately 2km of 150mm PE MP4 pipeline from Woodcocks Road, Auckland Road to Sandspit Road through Whitaker Road and Elizabeth Street to support growth on the north-eastern side of Warkworth. Modelling of the forecasted demand has showed imminent constraints on the MP4 system, and also on the IP20 pipeline which feeds the MP4 network via DR-00253-AK. The proposed project will allow the Warkworth Gate Station DP MP4 direct feed to provide more of the required new load on the MP4 network; and
- Relocate the Warkworth DR-00253-AK to Mason Heights Road. This relocation will bring the DRS closer to the upstream/supply gate station reducing the pressure drop in the 50mm steel IP20 pipeline. In addition, this proposed project will enable the decommissioning of a section of 50mm steel IP20 passing through private property, which will be developed in FY21.

FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
MP4 pipeline extension from Woodcocks Road					0.50	0.57					1.07
Warkworth DR-00253-AK Relocation	0.66										0.66
Total	**0.66**				**0.50**	**0.57**					**1.73**

DRURY AND RAMARAMA MP4

The Drury network system is supplied from the transmission system at one gate station located in Waihoehoe Road. This network system consists of two MP4 pressure systems; Drury CT and Drury NC. The two networks supply a mix of residential, commercial and industrial loads. Within the same region; the Ramarama MP4 pressure system operates at a NOP of 400kPa. The Ramarama network system is supplied from the transmission system at one gate station located near Ararimu Road, and it supplies gas to a few small commercial customers and two large industrial consumers.

NEED

Due to the organic growth and the expected development in the region, i.e. New Town Drury, the forecasted demand of the network is expected to breach Vector's QoS standards. The Drury NC MP4 network is the most utilised network, it is currently operating at 60% of its NOP (refer to section 7.6). All three previously mentioned networks in the region are supplied by a single point of supply, increasing the SoS risk in the area.

To mitigate the potential QoS breach and maintain the SoS, the following projects have been identified:

- Link the Drury NC, Drury CT and Ramarama MP4 gas distribution pressure systems, into one interconnected network. This proposed project will reinforce the heavily constrained Drury NC pressure system by meshing it with two additional points of supply. Linking the proposed networks will mitigate the QoS and SoS risks, and better position network infrastructure to accommodate future demand growth. Network modelling confirms this proposed project will enhance the pressure profile of all the proposed networks. The project will mitigate the potential network constraints forecast in 2023 and will maintain Vector's QoS standards. The proposed linking is achieved with the following;
- Construct approximately 1.3km of 150mm PE MP4 mains extension to link Ramarama MP4 with Drury NC MP4, along Great North Road
- Construct two 10 metres 100mm PE MP4 road crossings to link Drury NC with Drury CT MP4 in Waihoehoe Road.

FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
Integration of the Drury NC, Drury CT and Ramarama MP4			0.24								0.24
Total			**0.24**								**0.24**

WAITOKI IP20/MP4

The Waitoki network system is supplied from the transmission system from one gate station located in Kahikatea Flat Road. This network system comprises one IP20 pressure system, one MP4 pressure system and one DRS which supplies the entire Silverdale, Orewa and entire Whangaparaoa Peninsula.

NEED

The current MP4 is supplied by a single IP20/MP4 DR-00255-AK. Due to the forecast increasing demand in the area and the expected developments in Silverdale, there is a high risk on the SoS of the MP4 network. The current DRS is supplying a large number of consumers (more than 3,300) expanding over vast area, increasing the risk of the loss of supply to customers. In addition, network modelling has confirmed that with the forecast increasing demand, particularly the industrial loads, the result is an imminent breach of Vector's QoS.

To mitigate the breach of QoS and maintain the SoS, the following projects have been identified:

- Construct a new DRS at the end of the IP20 line in Wainui Road. This proposed project will improve SoS of a large and expanding MP4 network and eliminate the risk of losing supply to more than 3,300 consumers.

FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
Construct a new DRS		0.79									0.79
Total		**0.79**									**0.79**

MP4 NETWORK MESHING

NEED

Provision for additional unexpected MP4 network meshing has been allowed for during the planning period. This allowance will enable single feed MP4 networks to be interconnected and will mitigate potential, unexpected breaches in QoS and SoS. The network meshing provision will include road crossings between MP4 mains and small extensions and connections. Previously installed MP4 meshing projects have proven to significantly improve network pressure and compare very favourable to other more expensive solutions.

FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
Network meshing	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	2.50
Total	**0.25**	**0.25**	**0.25**	**0.25**	**0.25**	**0.25**	**0.25**	**0.25**	**0.25**	**0.25**	**2.50**

DRS UPGRADES

NEED

Provision is made for the upgrading of DRS's over the forthcoming year that are unforeseen at the time this AMP is prepared. The provisional budget ensures that DRSs that exceed their design capacity can be upgraded. DRS upgrade to address unforeseen capacity issues is critical to avoid maloperation of DRS's due to operation beyond their design capacity. Failure to address the capacity constraint could lead to maloperation of the DRS and potential local network QoS supply issues or even loss of supply.

FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
DRS upgrade to address unforeseen capacity issues	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	4.60
Total	**0.46**	**0.46**	**0.46**	**0.46**	**0.46**	**0.46**	**0.46**	**0.46**	**0.46**	**0.46**	**4.60**

5.1.2 CUSTOMER CONNECTIONS

The interface with the customer is managed by the Customer Excellence Team within Vector. Requests for new connections or changes to existing connections are forwarded to the Customer Excellence Team from our FSP's, for small projects, and from developers or consultants for subdivision and customer substation works. Provisional budgets are then developed.

These are the connection (and disconnection) of smaller customers to Vector's network. This includes extensions to mains pipelines and service pipelines inside the customer's property. For the purposes of estimating the budget the average cost of connection has been applied to the expected connection numbers for the year and regulatory period.

NEW CUSTOMER CONNECTIONS

NEED

Vector is not obligated to provide new customer connections. However, the provision of new customer connections is part of Vector's core business and it is good business practice. The table below shows the historical and forecast number of customer connections anticipated during the planning period.

ACTUAL FORECAST

	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
Number of Customer Connections	3,323	3,515	3,169	3,344	3,572	3,748	3,532	3,425	3,425	3,425	3,425	3,425	3,425	3,425	3,425

FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
Subdivision and mains extensions	5.57	5.57	5.57	5.59	5.59	5.59	5.59	5.59	5.59	5.59	55.85
Residential connections	10.04	9.43	9.13	9.13	9.13	9.13	9.13	9.13	9.13	9.13	92.55
Commercial connections	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	19.97
Total	**17.61**	**17.00**	**16.70**	**16.72**	**16.72**	**16.72**	**16.72**	**16.72**	**16.72**	**16.72**	**168.36**

5.1.3 RELOCATIONS

NEED

Vector is obliged to provide customer relocations in accordance with Section 33 of the Gas Act.

Some of the future investment required flows directly from other infrastructure decisions made either by central or local government. The proposal to build a light rail line (Auckland Light Rail or ALR) from the city to the airport is a good example – depending on the route finally chosen, we anticipate a capital cost in the vicinity of $12m to move the gas assets.

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
Asset Relocations excl Auckland Light Rail Project	4.60	2.73	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	31.31
Auckland Light Rail Project	0.00	0.00	1.72	3.00	3.00	3.00	1.14	0.00	0.00	0.00	11.88
Total	**4.60**	**2.73**	**4.72**	**6.00**	**6.00**	**6.00**	**4.14**	**3.00**	**3.00**	**3.00**	**43.19**

5.2 Operate, maintain, renew and replace

The safe and reliable operation of the network relies upon renewal and replacement of assets together with a sound maintenance regime. We undertake regular meetings with our FSPs to discuss the progress of maintenance programmes and proactively discuss potential issues to ensure the maintenance programme is effective in improving or maintaining service levels. Vector's ultimate aim for operations and maintenance is to meet the service level targets set out in Section 2.2 This includes ensuring asset safety and any associated environmental requirements are met.

Projects or programmes are initiated to address gaps in service level targets that are either already apparent or are forecast in the next 5-10 years.

This section provides details on all the renew, replace or maintain projects proposed for the next 10-year period for the continued safe and reliable operation of the network. Programmes of work have been created where expenditure is planned across a number of years.

Vector's forecast expenditure for Routine and Corrective Maintenance and Inspections is set out in Schedule 11b in Section 7.11 as part of the disclosure Report on Forecast OPEX. Asset replacement and renewal is forecast in Schedule 11a in Section 7.10 as part of the disclosure Report on Forecast CAPEX. A typical breakdown of Vector's spend on Routine and Corrective Maintenance and Inspections across the primary asset categories is shown in the following table, reflected as a percentage of the value forecast in Schedule 11b.

DESCRIPTION	FY21 – FY30 ($M)	FY21 – FY30 (%)
Distribution pipelines	35.00	68%
Pressure stations	3.57	7%
Valves	7.08	14%
Corrosion protection systems	3.22	6%
Monitoring and control systems	1.66	3%
Special crossings	1.18	2%

5.2.1 NETWORK MAINTENANCE

NEED

Vector's network maintenance programmes are categorised as follows:

- Reactive maintenance
- Preventive maintenance
- Corrective maintenance
- Third party services

Reactive maintenance is considered to encapsulate all maintenance activities that relate to the repair and restoration of supply, and the safeguarding of life and property (targets and measures for Vector's responses to Emergencies are detailed in Section 2.2). It primarily involves:

- Safety response and repair or replacement of any part of the network components damaged due to environmental factors or third party interference; and
- Remediation or isolation of unsafe network situations.

Preventive maintenance covers activities defined through Vector's maintenance standards (see Section 7.2), and relates to the following:

- Provision of network patrols, inspection and condition detection tasks, sampling and maintenance service work;
- The coordination of shutdowns and decommissioning, and re-commissioning and restoration, along with the capture and management of all defined data; and
- In addition to routine periodic preventive maintenance inspections, Vector also undertakes one-off audits where necessary to assess risk and formulate mitigation plans - e.g. a pipe-in-buildings audit (refer Section 4.4.1). The OPEX forecast includes a provision to undertake a one-off field-audit of all non-residential inactive service pipes (i.e. service pipes that are live but not in use) that have been inactive for a period of 5 years or more; this follows a recent incident where an inactive IP riser was damaged by a vehicle resulting in a major gas leak. The purpose of the audit is to assess the condition of the service pipe and associated riser pipe and evaluate risks from 3rd party damage or property development etc; where the assessed risk warrants it, the inactive service will be scheduled to be cut-off.

Corrective maintenance catches the follow-up maintenance repair and component replacement requirements resulting from:

- Assets identified from planned inspections or service work to be in poor condition, requiring repair;
- Poor condition or unserviceable assets identified via one-off coordinated network inspections or identified through proximity capital works;
- Removal of graffiti, painting and repair of buildings and asset enclosures, removal of decommissioned assets, one-off type inspection and condition detection tasks outside of planned maintenance standards; and
- Coordination of shutdowns and associated restoration, along with the capture and management of all defined data.

Third party services maintenance activities describe third party directed requests such as the following:

- Issuing maps and site plans to indicate the location of network assets via the 'beforeudig' service;
- Asset location services, including the marking out of assets, safe work practice site briefings, worksite observer, urgent safety checks, safety disconnections;
- Issuing close approach consents; and
- Disconnection and reconnection associated with customers' property movements and any concerns relating to non-compliance with gas regulations.

The overall performance of Vector's Gas distribution network has remained within the service level and reliability targets set. This indicates that the current maintenance program is effective. As a result, the maintenance strategy for the following period is to continue with the programmes already initiated to ensure this performance endures. However, in some cases further improvements and programmes have been identified to maintain the current performance levels described in Section 2.

FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
Reactive Maintenance	2.29	2.29	2.29	2.29	2.29	2.29	2.29	2.29	2.29	2.29	22.87
Preventative Maintenance	1.15	1.10	1.10	1.10	1.10	1.10	1.11	1.11	1.11	1.11	11.09
Corrective Maintenance	1.22	1.22	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	10.02
Third Party Services	0.74	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	7.72
Total	**5.39**	**5.38**	**5.11**	**5.11**	**5.11**	**5.12**	**5.12**	**5.12**	**5.12**	**5.12**	**51.71**

5.2.2 DISTRIBUTION PIPELINES

The works programme covered in this needs requirement is in line with Vector's asset strategy for this asset type, strategy document GAA001 Distribution pipelines.

TARGETED REPLACEMENT OF HIGH PRIORITY MP PRE-1985 PE PIPE

NEED

Overseas research indicates that much of the PE pipe manufactured and used for gas networks from the 1960s through the early 1980s may be susceptible to premature brittle-like failures when subjected to stress intensification - these failures represent a potential public safety hazard.

Vector's gas distribution network currently includes approximately 81km of PE mains that were installed in 1984 or before - approximately 45% operate at MP4, 36% at MP2, and 19% at MP1. Incidents of brittle-like failure have occurred on Vector's network and the probability of failure is anticipated to rise with time due to factors such as installation, operating and environmental conditions – e.g. the use of PE squeeze offs during construction and repair.

Recent analysis of pre-85 PE PREs on Vector's network shows that the rate of pre-85 PE failures is significantly higher than the rate of failures on the whole of the Auckland network. The analysis also shows that the PRE rate for MP4 pre-85 PE systems is significantly higher than that for MP1 and MP2 systems. Vector has therefore adopted a strategy of targeted pre-85 PE mains and service pipeline replacement initially targeting higher priority areas. Priorities have been based on risk factors which include PRE history, operating pressure, pipe diameter, pipeline criticality, and proximity to business areas, hospitals etc.

The planned programme of pre-85 PE pipeline replacement work aligns with Vector's asset management policy and in particular a commitment to prevent harm to the public through the management of its assets over their entire lifecycle. The work programme also aligns with Vector's service level objectives and will improve overall network performance (as measured against service level targets) by reducing the number of unplanned interruptions and the number of PREs.

A 'Pre-1985 PE pipe' risk with associated controls and treatment plans has been registered in Vector's risk management system and been assessed in accordance with Vector's risk management process described in Section 3.5. The planned programme of pre-85 PE pipeline replacement work forms part of the treatment plan that has been developed for this risk.

FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
Targeted replacement of high priority MP pre-1985 PE pipe	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	10.77
Total	**1.08**	**1.08**	**1.08**	**1.08**	**1.08**	**1.08**	**1.08**	**1.08**	**1.08**	**1.08**	**10.77**

PIPE-IN-BUILDINGS REPLACEMENT

NEED

Vector carries out annual preventive maintenance inspections at sites where a gas service pipe terminates within a building, normally at a GMS location; the purpose of the inspection is to assess the condition and accessibility of the service pipe, and the adequacy of available ventilation and installed gas-tight conduits etc. The primary risk associated with pipe-in-buildings sites is an asset failure resulting in a gas-in-building event.

Vector's database of pipe-in-building sites was known to be out of date and so a search of Gas Registry ICP data was made to identify additional sites that needed to be added to the master list based on available meter-location information. A field-audit of all confirmed and potential pipe-in-building sites was undertaken during FY20; the primary objectives of the audit were to confirm if the sites were pipe-in-building sites, confirm site location details, clarify the demarcation point between network and GMS assets and undertake a condition assessment of the site to identify any upgrade work required to mitigate any safety risks associated with the site.

The results of the field-audit form the basis of a 4-year programme of work (FY21 to FY24) to carry out site upgrades at higher priority pipe-in-building sites. The upgrades typically involve service pipe and GMS configuration changes to mitigate the risk of a gas-in-building event occurring; this typically entails relocating the GMS to a suitable outdoors location and reconfiguring the upstream and downstream pipework as required.

The planned programme of pipe-in-building upgrade work aligns with Vector's asset management policy and in particular a commitment to prevent harm to the public through the management of its assets over their entire lifecycle. A 'Gas pipes into and/or under buildings' risk with associated controls and treatment plans has been registered in Vector's risk management system and been assessed in accordance with Vector's risk management process described in Section 3.5. The planned programme of pipe-in-building upgrade work forms part of the treatment plan that has been developed for this risk.

FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
Pipe-in-buildings replacement	0.10	0.10	0.10	0.10							0.41
Total	**0.10**	**0.10**	**0.10**	**0.10**							**0.41**

PRESSURE UPRATING OF THE PANMURE MP1 SYSTEM TO OPERATE AT MP4

NEED

The Panmure MP1 system includes approximately 100 metres of cast iron mains pipe. This section of pipeline will be replaced (with PE) as part of a mains relocation project associated with a major Auckland Council road-upgrade programme and allow the MP1 system to be pressure-uprated. This work was originally included in the FY20 CAPEX forecast, however phasing of the civil works related to the Council programme meant that the project had to be deferred to FY21.

The Panmure MP1 system is supplied from a single DRS; it is approximately 2.7km in length and supplies approximately 40 service connections. As the majority of the pipeline system has been constructed and tested to operate at MP4, Vector is planning to pressure uprate the pipeline system to operate at MP4. This will allow this pipeline system to be linked with neighbouring MP4 systems as these systems grow thereby improving SoS for this system and the adjoining systems.

The planned programme of work to pressure uprate the Panmure MP1 system aligns with Vector's asset management policy and in particular a commitment to manage its assets to provide a reliable, sustainable, resilient, and efficient distribution network that meets its customer's present and future service expectations.

FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
Pressure uprating of the Panmure MP1 system to operate at MP4	0.05										0.05
Total	**0.05**										**0.05**

PRESSURE UPRATING OF THE NORTHERN PORTION OF TOTARA HEIGHTS MP1 SYSTEM TO OPERATE AT MP4

NEED

The existing Totara Heights MP1 pressure system comprises approximately 61km of mains and 1,280 service connections; it is supplied via a single DRS located at the southern end of the system.

The northern portion of the Totara Heights MP1 system and the south-eastern portion of the East Auckland MP4 pressure system are currently growing at a rapid pace due to the intensive residential development that is taking place in the Flatbush area. As a result, the two pressure systems are converging upon one another and there are currently 4 interface zones where the MP1 and MP4 systems are terminated in close proximity to one another; this has resulted in an increased risk of an accidental tie-in being made between the MP4 and MP1 systems.

To mitigate this risk, it is proposed that the northern portion of the MP1 system be uprated to MP4 and tied-in to the existing MP4 system at the 4 existing interface zones, and that the southern portion of the MP1 system be isolated from the northern portion by decommissioning sections of pipeline at two key locations. This reconfiguration of the two pressure systems will ensure that the majority of new residential development in the Flatbush area will take place within the MP4 system and limit the likelihood of new interface zones (i.e. between the MP4 and MP1 systems) being developed in the future. The project would include the uprating of approximately 24km of mains and 480 service connections, and the decommissioning of approximately 100 m of PE main.

The planned programme of work to pressure-uprate the northern portion of the Totara Heights MP1 pressure system aligns with Vector's asset management policy and in particular a commitment to prevent harm to employees, contractors and the public through the management of Vector's assets over their entire lifecycle.

A 'System pressure above acceptable levels' risk with associated controls and treatment plans has been registered in Vector's risk management system and been assessed in accordance with Vector's risk management process described in Section 3.5. The planned programme of work to pressure uprate a portion of the Totara Heights MP1 system forms part of the treatment plan that has been developed for this risk.

FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
Pressure uprating of the northern portion of Totara Heights MP1 system to operate at MP4	0.23										0.23
Total	**0.23**										**0.23**

STRATEGIC SPARES AND EQUIPMENT

NEED

The general condition of the inventory of critical spares and equipment is adequate, however some of the equipment (e.g. TDW drilling equipment) is at least 25 years old and its current condition reflects the relatively high level of service. An appropriate range of critical spares and equipment is held although in some cases the type of drilling equipment currently held limits the range of specialized fittings that can be used - e.g. completion plugs.

Regular planned maintenance inspections of critical spares and equipment periodically identify items that need to be replaced due to integrity issues - e.g. damaged, worn or corroded parts. An ongoing programme for the replacement of these assets as they are identified is required to ensure that as far as practicable the response to contingency situations is not compromised by the lack of specialist equipment or critical spares.

The ongoing replacement programme aligns with Vector's asset management policy and in particular a commitment to prevent harm to the public through the management of its assets over their entire lifecycle. The work programme also aligns with Vector's service level objectives and will improve overall network performance (as measured against service level targets) by reducing the risk of prolonged outages associated with contingency events.

FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
Replacement of critical spares and equipment as required	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.22
Total	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.22**

UNSPECIFIED ASSET REPLACEMENT AND RENEWAL

NEED

Periodically sections of mains and service pipeline will be identified that need to be replaced (on an as required basis) due to safety or compliance issues. Examples include pipes located under buildings, or pipes of non-compliant material specification. An ongoing programme for the replacement of these assets as they are identified is planned to ensure that H&S and compliance risks are mitigated. The projected cost for this programme is based on historical expenditure.

The planned programme of work aligns with Vector's asset management policy and in particular a commitment to prevent harm to the public through the management of its assets over their entire lifecycle. The work programme also aligns with Vector's service level objectives and will improve overall network performance (as measured against service level targets) by reducing the number of unplanned interruptions and the number of PREs.

FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
Unspecified asset replacement and renewal	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	3.06
Total	**0.31**	**0.31**	**0.31**	**0.31**	**0.31**	**0.31**	**0.31**	**0.31**	**0.31**	**0.31**	**3.06**

5.2.3 PRESSURE STATIONS

The works programme covered in this needs requirement is in line with Vector's asset strategy for this asset type, strategy document GAA201 Pressure stations.

GATE STATIONS

GATE STATION UPGRADES TO REPLACE PIPELINE SUPPORTS

NEED

Recent condition assessments of gate station assets observed that the pipeline support systems installed on the distribution pipeline assets were of an older style that didn't adequately safeguard against pipeline corrosion at the contact points. A 5-year programme of work (FY21 to FY25) is therefore planned to undertake the replacement of the existing pipeline support systems with redesigned support systems that utilise proven designs and materials.

The planned programme of work to replace gate station pipeline support systems aligns with Vector's asset management policy and in particular a commitment to maximise the value that Vector's assets deliver across their entire lifecycle through good practice asset management and risk management.

FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
Gate station upgrades to replace pipeline supports	0.10	0.10	0.10	0.10	0.10						0.48
Total	**0.10**	**0.10**	**0.10**	**0.10**	**0.10**						**0.48**

DISTRICT REGULATING STATIONS

WAINUI DRS UPGRADE

NEED

DR-00255-AK is a belowground (i.e. pit mounted) DRS located in Wainui Road, Silverdale; it is currently the sole supply for the Whangaparaoa MP4 pressure system which encompasses Whangaparaoa, Orewa and Silverdale and surrounding areas.

The DRS is sited within the road reserve in an open location and adjacent to a bend in the road; because the road has an open-road speed limit (i.e. 100 kph), DRS maintenance staff are exposed to H&S risks due to the DRS's proximity to high speed traffic. The DRS also has a number of integrity issues - i.e. the DRS enclosure is considered to be a confined space and has very restricted physical access; the clearances between the DRS equipment and the enclosure walls and floor are minimal; and the enclosure regularly experiences water ingress during wet weather.

To resolve these issues Vector is planning to replace this DRS during FY23. This planned work is to be phased with a planned reinforcement project (refer Section 5.1.1) that will see a second DRS being constructed in the same vicinity to mitigate SoS risks associated with the Whangaparaoa MP4 pressure system; the reinforcement project (scheduled for FY22) must be completed before the DRS replacement project can commence.

The DRS replacement project aligns with Vector's service level objectives and will improve overall network performance (as measured against service level targets) by reducing the risk of unplanned interruptions and poor pressure events associated with a DRS failure. The work programme also aligns with Vector's asset management policy and in particular a commitment to prevent harm to the public through the management of its assets over their entire lifecycle.

A 'Regulator station failure' risk with associated controls and treatment plans has been registered in Vector's risk management system and been assessed in accordance with Vector's risk management process described in Section 3.5.

FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
Wainui DRS upgrade			0.45								0.45
Total			**0.45**								**0.45**

DRS UPGRADES TO ADDRESS COMPLIANCE AND INTEGRITY ISSUES

NEED

Periodic DRS condition assessments identify integrity and compliance issues that need to be addressed. Where the number and type of defects warrant it, an upgrade of the DRS will be considered. The scope of the upgrade can range from the replacement of individual components, to the complete refurbishment or rebuild of the DRS. Where an upgrade of a DRS is required for integrity reasons, the design capacity of the DRS will be reviewed to determine if a capacity upgrade is also warranted.

Trends over recent years show that an ongoing programme targeting one major DRS upgrade per year is required to address integrity and/or compliance issues identified by the periodic condition assessments.

A planned programme of work will target one major DRS upgrade per year to address integrity related issues. The programme aligns with Vector's service level objectives and will improve overall network performance (as measured against service level targets) by reducing the risk of unplanned interruptions and poor pressure events associated with a DRS failure. The work programme also aligns with Vector's asset management policy and in particular a commitment to prevent harm to the public through the management of its assets over their entire lifecycle.

A 'Regulator station failure' risk with associated controls and treatment plans has been registered in Vector's risk management system and been assessed in accordance with Vector's risk management process described in Section 3.5. The planned programme of work to complete one major DRS upgrade per year to address integrity and/or compliance issues forms part of the treatment plan that has been developed for this risk.

FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
DRS upgrades to address compliance and integrity issues	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	4.59
Total	**0.46**	**0.46**	**0.46**	**0.46**	**0.46**	**0.46**	**0.46**	**0.46**	**0.46**	**0.46**	**4.59**

DRS EARTHING AND BONDING

NEED

AS/NZS 4853 sets out minimum requirements that pipeline owners must comply with to control electrical hazards on metallic pipelines due to the close proximity of high voltage power networks, electrical traction systems or lightning activity; amongst the treatments described for managing electrical hazards is the installation of pipeline earthing and the use of equipotential bonding. AS/NZS 4853 also requires pipeline owners to document the hazards and controls in an EHMP.

In FY17 Vector initiated a programme of work to retrofit earthing and bonding to all DRS sites that did not already have earthing and bonding installed; with the exception of sites requiring non-standard solutions, the programme of work was completed in FY20. The retrofitted earthing and bonding were installed in accordance with the standard mitigation design requirements for DRS earthing and bonding as described in Vector's draft EHMP. However, a small number of DRS sites required non-standard solutions - e.g. bespoke earthing designs for lightning protection where a telemetry mast is present, or engineering certification for HP DRS installations etc; these sites were deferred to FY21 as a separate body of work to allow the bespoke design solutions to be developed and engineering certification to be obtained as appropriate.

The planned programme of work to install earthing and bonding at all remaining DRS sites aligns with Vector's asset management policy and in particular a commitment to prevent harm to employees, contractors and the public through the management of Vector's assets over their entire lifecycle.

A 'Touch voltages on steel pipelines' risk with associated controls and treatment plans has been registered in Vector's risk management system and been assessed in accordance with Vector's risk management process described in Section 3.5. The planned programme of earthing and bonding work forms part of the treatment plan that has been developed for this risk.

FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
DRS earthing and bonding	0.20										0.20
Total	**0.20**										**0.20**

SERVICE REGULATOR REMOVAL

NEED

Approximately 130 service regulators remain in service on Vector's network; approximately 85% are installed belowground. In some situations, belowground service regulators can be affected by the ingress of water, silt or other debris which can result in gas escapes from corroded fittings and pipework and can allow unacceptable over-pressure gas into downstream systems.

To mitigate the risks associated with the relatively large number of belowground service regulators, Vector has implemented an ongoing service regulator removal programme that targets the removal (or relocation aboveground) of a small number of higher priority service regulators annually. Service regulator replacement candidates are prioritised according to maintenance history, fault reports or an assessment of other risk factors - e.g. the presence of steel outlet pipework without CP, the service regulator location relative to buildings, roadways etc.

The remaining population of service regulators includes a relatively high percentage of sites with more complex outlet supply arrangements - e.g. sites that supply multiple service connections. The cost of removing service regulators is therefore anticipated to increase for the remaining stages of the belowground service regulator removal programme. The budget for service regulator removal has therefore been increased to $200k per annum; this is anticipated to allow the remaining population of belowground service regulators to be removed (or relocated aboveground) over the six-year period FY21 to FY26 and substantially mitigate risks associated with service regulator failures.

The planned programme of service regulator removal aligns with Vector's service level objectives and will improve overall network performance (as measured against service level targets) by reducing the number of unplanned interruptions, the number of poor pressure events and the number of PREs. The work programme also aligns with Vector's asset management policy and in particular a commitment to prevent harm to the public through the management of its assets over their entire lifecycle.

A 'Service regulator failure' risk with associated controls and treatment plans has been registered in Vector's risk management system and been assessed in accordance with Vector's risk management process described in Section 3.5. The planned programme of service regulator removal work forms part of the treatment plan that has been developed for this risk.

FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
Service regulator removal	0.20	0.20	0.20	0.20	0.20	0.20					1.20
Total	**0.20**	**0.20**	**0.20**	**0.20**	**0.20**	**0.20**					**1.20**

5.2.4 VALVES

The following sections set out the project proposals for distribution valves. The works programme covered in this needs requirement is in line with Vector's asset strategy for this asset type, strategy document GAA301 Valves.

INSTALLATION OF ISOLATION VALVES (INCLUDES DRS FIRE VALVES)

NEED

AS/NZS 4645 requires sectional isolation valves be installed to facilitate the safe operation of the gas distribution network; AS/NZS 4645 also requires fire valves to be installed on all DRS inlet and outlet supply lines.

Vector periodically undertakes network-isolation modelling to identify the need for additional isolation valves to improve the safe operation of the network and minimise the severity of outages - e.g. in the event of damage to the network from third party activities. An analysis of the availability of DRS inlet and outlet fire valves has also been undertaken to identify sites where additional fire valves are required to allow the DRS to be isolated in the event of an emergency.

The network isolation studies and the DRS fire valve analysis completed to date have identified a number of sites where additional isolation valves are required. These have been prioritised and scheduled according to risk.

The programme of work to install additional isolation valves aligns with Vector's service level objectives and will improve overall network performance (as measured against service level targets) by limiting the severity of outages due to third party damage thereby reducing the number of unplanned interruptions. The work programme also aligns with Vector's asset management policy and in particular a commitment to prevent harm to the public through the management of its assets over their entire lifecycle.

An 'Inability to isolate gas supply' risk with associated controls and treatment plans has been registered in Vector's risk management system and been assessed in accordance with Vector's risk management process described in Section 3.5. The programme of work to install additional isolation valves forms part of the treatment plan that has been developed for this risk.

FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
Installation of isolation valves (includes DRS fire valves)	0.05	0.05	0.35	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.84
Total	**0.05**	**0.05**	**0.35**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.84**

RISER VALVE REPLACEMENTS

NEED

Vector undertakes annual audits of approximately 1000 riser valves; the purpose of the audit is to assess the general condition, accessibility and operability of the riser valve and carry out corrective maintenance and asset replacement as required.

The initial driver of the audit programme was to address performance issues related to plug-type riser valves which were prone to leakage and seizing. However, since FY17, the annual riser valve audits have targeted IP and larger size MP riser valves; the targeting of these types of riser valves is due to a noticeable increase in the number of faults that were being reported for larger sized steel risers. The results of these surveys have shown that larger size steel risers present a greater risk than the standard MP4 residential riser due to risks associated with corrosion of the riser and/or riser valve. Future annual riser valve surveys will therefore continue to target larger sized risers (i.e. >25mm) until such time as the full population of this type of riser valve has been surveyed.

The planned programme of riser valve audits aligns with Vector's service level objectives and will improve overall network performance (as measured against service level targets) by reducing the number of unplanned interruptions and the number of PREs. The work programme also aligns with Vector's asset management policy and in particular a commitment to prevent harm to the public through the management of its assets over their entire lifecycle.

An 'Inability to isolate gas supply' risk with associated controls and treatment plans has been registered in Vector's risk management system and been assessed in accordance with Vector's risk management process described in Section 3.5. The planned programme of riser valve audits forms part of the treatment plan that has been developed for this risk.

FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
Riser valve replacements	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.81
Total	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.81**

5.2.5 CORROSION PROTECTION EQUIPMENT

The following sections set out the project proposals for distribution valves. The works programme covered in this needs requirement is in line with Vector's asset strategy for this asset type, strategy document GAA401 Corrosion protection systems.

REPLACEMENT OF CP ASSETS AS REQUIRED

NEED

AS/NZS 4645 requires all buried steel pipelines to be provided with CP to give long term protection against corrosion in accordance with AS 2832 (Cathodic protection of metals). Where CP system assets fail (e.g. sacrificial anodes, CP test points etc) due to age or third-party damage etc, new or upgraded CP assets may be required to ensure that the CP performance criteria of AS 2832 are met.

An ongoing programme of CP asset replacement or upgrade is required to ensure that CP assets can be replaced or upgraded on an as-required basis so that the level of CP protection on Vector's steel pipelines continues to meet the performance criteria of AS 2832. The planned programme of work aligns with Vector's asset management policy and in particular a commitment to maximise the value that Vector's assets deliver across their entire lifecycle through good practice asset management and risk management.

A 'Steel systems without CP' risk with associated controls and treatment plans has been registered in Vector's risk management system and been assessed in accordance with Vector's risk management process described in Section 3.5. The planned programme of CP asset replacement or upgrade forms part of the treatment plan that has been developed for this risk.

FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
Replacement of CP assets as required	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.75
Total	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.75**

INSTALLATION OF NEW PAPAKURA ICCP SYSTEM

NEED

The impressed current cathodic protection (ICCP) system located in Otara comprises a single transformer rectifier and associated ground-bed and currently provides CP for the steel MP and IP pipelines extending from Otahuhu and East Tamaki to the Auckland airport and south to Papakura. This CP system is currently running at its maximum output and is susceptible to minor isolation faults. The installation of an additional transformer rectifier and associated ground-bed located in or near Papakura is proposed to bolster the level of CP protection across the southern portion of this large steel system and allow for faster fault identification and resolution.

The planned programme of work aligns with Vector's asset management policy and in particular a commitment to maximise the value that Vector's assets deliver across their entire lifecycle through good practice asset management and risk management.

FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
Installation of new Papakura ICCP system	0.15										0.15
Total	**0.15**										**0.15**

INSTALLATION OF ADDITIONAL CP TEST POINTS

NEED

Analysis of Vector's CP test point spacing has shown that on some sections of Vector's network the test point spacing may not meet the requirements of AS 2832.1 Cathodic protection of metals. In particular the test point spacing in some suburban and high-rise areas does not meet the 500m spacing requirement stipulated in AS 2832.1, and in some cases there is no test point installed at the end of the pipeline. This is a legacy issue and is often due to the original test point being destroyed or lost as a result of street works. A 5-year programme (FY21 to FY25) to install additional CP test points on Vector's network to meet the requirements of AS 2832.1 is planned.

The planned programme of work aligns with Vector's asset management policy and in particular a commitment to maximise the value that Vector's assets deliver across their entire lifecycle through good practice asset management and risk management.

A 'Steel systems without CP' risk with associated controls and treatment plans has been registered in Vector's risk management system and been assessed in accordance with Vector's risk management process described in Section 3.5.

FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
Installation of additional CP test points	0.05	0.05	0.05	0.05	0.05						0.26
Total	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**						**0.26**

INSTALLATION OF MINITRANS REMOTE MONITORING EQUIPMENT

NEED

The transformer rectifier (TR) units currently installed on Vector's impressed current cathodic protection (ICCP) systems have no means of generating warnings or alerts of power failures or faults; in the event that the CP system is tripped due to an electrical fault, the fault will not be discovered until the next scheduled visit.

In order to provide the TRs with remote monitoring and alarm facilities, the installation of MiniTrans remote monitoring equipment at all 9 TRs is planned. This will allow the output of the TRs to be monitored by the system and automatically adjusted when environmental conditions change and will enable immediate notifications of CP system power failures or faults to be generated. The system will also allow the TR to be controlled remotely (i.e. from the field via a smart phone) for routine CP monitoring or DCVG survey purposes thereby significantly reducing travel time to and from the TR. In addition, the system provides constant data-logging of the CP system enabling AC interference or changes in current requirements to be readily identified.

The planned programme of work aligns with Vector's asset management policy and in particular a commitment to maximise the value that Vector's assets deliver across their entire lifecycle through good practice asset management and risk management.

A 'Steel systems without CP' risk with associated controls and treatment plans has been registered in Vector's risk management system and been assessed in accordance with Vector's risk management process described in Section 3.5.

FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
Installation of MiniTrans remote monitoring equipment			0.11								0.11
Total			**0.11**								**0.11**

5.2.6 TELENET/SCADA EQUIPMENT

The following sections set out the project proposals for distribution valves. The works programme covered in this needs requirement is in line with Vector's asset strategy for this asset type, strategy document GAA501 Telemetry equipment.

TELENET UPGRADES TO ADDRESS INTEGRITY ISSUES

NEED

The average age of Kingfisher Telenet equipment is 20 years and the average age of GPRS Telenet equipment is 11 years. Although a Kingfisher RTU refurbishment programme to replace aging Kingfisher RTU equipment and upgrade radio communication systems was completed in FY20, an ongoing programme for the reactive replacement of failed ancillary equipment (e.g. powder coated steel cabinets, power supplies, transducers etc.) due to age and/or environmental factors is required to ensure that telemetry-system downtime is minimised.

The planned programme of work will reduce Telenet system down-time and improve Vector's ability to monitor and respond to poor pressure events. The programme aligns with Vector's service level objectives and will improve overall network performance (as measured against service level targets) by reducing the number of poor pressure events.

A 'Gas distribution SCADA system failure' risk with associated controls and treatment plans has been registered in Vector's risk management system and been assessed in accordance with Vector's risk management process described in Section 3.5. The planned programme of work forms part of the treatment plan that has been developed for this risk.

FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
Telenet upgrades to address integrity issues	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.65
Total	**0.06**	**0.06**	**0.06**	**0.06**	**0.06**	**0.06**	**0.06**	**0.06**	**0.06**	**0.06**	**0.65**

INSTALLATION OF ADDITIONAL PERMANENT CELLO MONITORING SITES

NEED

The availability of real-time and historical system-pressure monitoring data is a valuable resource for both operational and network planning purposes. Approximately 65% of Vector's DRS stations have permanent inlet and outlet pressure-monitoring, and 50% of pressure systems have permanent system-extremity pressure monitoring at one or more locations. However further permanent pressure-monitoring sites are required to ensure that all critical DRS sites and system extremity locations have adequate monitoring for network planning and operational purposes.

Cello data loggers have been identified as a cost-effective pressure monitoring solution where real-time pressure, volume and temperature data is not required. The Cello records 15-minute time-stamped pressure data which is critical for network planning purposes and provides real-time alarm notifications for threshold breaches which are critical for operational purposes. It is anticipated that at recent rates of Cello unit deployment, adequate system pressure monitoring at DRS sites (i.e. where real-time monitoring is not required) and pressure system extremities will be achieved by FY26.

All of Vector's existing population of Cello units operate on Vodafone's 2G network however new models currently available are compatible with both the 2G and 3G networks, and future models are expected to support NB-IoT and Cat M1 comms technology. Vector put a temporary hold on deploying additional Cello units in the latter part of FY20 while comms system upgrade paths were evaluated; the deployment of new Cello units is expected to commence again in FY22.

A planned programme to install additional permanent Cello pressure-monitoring sites at critical DRS and system extremity locations will improve Vector's ability to monitor and respond to poor pressure events. The programme aligns with Vector's service level objectives and will improve overall network performance (as measured against service level targets) by reducing the number of poor pressure events.

A ' System pressure drop below acceptable levels' risk with associated controls and treatment plans has been registered in Vector's risk management system and been assessed in accordance with Vector's risk management process described in Section 3.5. The planned programme of work to install additional permanent Cello pressure-monitoring sites forms part of the treatment plan that has been developed for this risk.

FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
Installation of additional permanent Cello monitoring sites		0.05	0.05	0.05	0.05	0.05					0.25
Total		**0.05**	**0.05**	**0.05**	**0.05**	**0.05**					**0.25**

5.2.7 SPECIAL CROSSINGS

The following sections set out the project proposals for distribution valves. The works programme covered in this needs requirement is in line with Vector’s asset strategy for this asset type, strategy document GAA601 Special crossings.

REPLACEMENT OF AUCKLAND HARBOUR BRIDGE IP20 PIPELINE SUPPORT BRACKETS

NEED

During FY18 a five-year programme (FY18 to FY22) was initiated to replace all of the original roller bracket assemblies that were fitted to the IP20 pipeline installed on the Auckland Harbour Bridge.

Previous preventive maintenance inspections of the pipeline had identified integrity issues with a significant proportion of the original pipeline-support brackets. The 200mm steel pipeline was constructed in 1983 and utilises approximately 170 pipeline support brackets along its length. The original pipeline-support design incorporated heat-shrink sleeves fitted to the pipe at each bracket location, and pipeline rollers which incorporated a urethane rubber layer on the outer contact surface. Over time the rollers and the rubber heat-shrink sleeves have sustained damage due to the axial-movement of the pipe (e.g. due to thermal expansion) against the rollers; to minimise ongoing damage to the pipeline and the pipeline support brackets, a programme to upgrade all the original pipeline roller bracket assemblies was undertaken.

The upgrade programme is on schedule and is due to be completed during FY22; the bracket upgrade work is being carried out in conjunction with the re-coating of the pipeline which is being managed as OPEX work.

The planned programme of work to upgrade the Auckland Harbour Bridge pipeline brackets aligns with Vector's asset management policy and in particular a commitment to maximise the value that Vector's assets deliver across their entire lifecycle through good practice asset management and risk management.

An 'Aboveground gas pipeline crossings' risk with associated controls and treatment plans has been registered in Vector's risk management system and been assessed in accordance with Vector's risk management process described in Section 3.5. The planned programme of work to upgrade the Auckland Harbour Bridge pipeline brackets forms part of the treatment plan that has been developed for this risk.

FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
Replacement of Auckland Harbour Bridge IP20 pipeline support brackets	0.46	0.41									0.87
Total	**0.46**	**0.41**									**0.87**

SPECIAL CROSSING UPGRADE PROGRAMME

NEED

Periodic maintenance inspections of special crossings have identified seven sites that are in need of significant upgrades due to corroded pipe brackets and bracket-fixings and to address deficiencies in the design of the crossing - e.g. bracket design, bracket spacing, ground penetration etc. The sites have been prioritised and the upgrades scheduled over a 2-year programme of work (FY23 to FY24).

The planned programme of work to upgrade the seven identified special crossings aligns with Vector's asset management policy and in particular a commitment to maximise the value that Vector's assets deliver across their entire lifecycle through good practice asset management and risk management.

An 'Aboveground gas pipeline crossings' risk with associated controls and treatment plans has been registered in Vector's risk management system and been assessed in accordance with Vector's risk management process described in Section 3.5. The programme of work to replace pipeline support brackets and bracket-fixings etc. forms part of the treatment plan that has been developed for this risk.

FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
Special crossing upgrade programme			0.30	0.40							0.70
Total			**0.30**	**0.40**							**0.70**

REPLACEMENT OF BRIDGE CROSSING REPLACEMENT BRACKETS AND SUPPORTS

NEED

Periodic maintenance inspections of special crossings show that at any given time there are a small number of sites requiring various levels of upgrade work to address corroded and/or poorly designed pipeline support brackets and damaged and/or loose bracket fixings etc.

Vector has a small ongoing programme of work to replace pipeline support brackets and bracket-fixings etc. as identified by the periodic maintenance inspections. This work is required to improve public safety and reduce the risk of an asset failure that disrupts the operation of the bridge facility to which the pipeline is attached.

The planned programme of work to replace bridge crossing brackets and supports where required (due to condition) aligns with Vector's asset management policy and in particular a commitment to maximise the value that Vector's assets deliver across their entire lifecycle through good practice asset management and risk management.

An 'Aboveground gas pipeline crossings' risk with associated controls and treatment plans has been registered in Vector's risk management system and been assessed in accordance with Vector's risk management process described in Section 3.5. The programme of work to replace pipeline support brackets and bracket-fixings etc. forms part of the treatment plan that has been developed for this risk.

FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
Replacement of bridge crossing	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.54

brackets and supports											
Total	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.54**

5.3 Non network assets

5.3.1 INFORMATION SYSTEMS, PROCESSES AND DATA

The Vector digital strategy has evolved to reflect the changing nature of our business, the wider energy landscape, and new digital technologies. Vector leverages smart digital platforms, optimised to deliver business outcomes across five key value streams: Customer Operations, Records & Asset Management, Network Operations, Maintenance & Construction, and Network Innovation & Planning. The platforms are heavily focused on enabling Vector to significantly reduce the cost of complex, customised legacy platform migration and lifecycle maintenance due to the development of best in class micro services and the associated reduction in core system complexity.

CUSTOMER OPERATIONS

Customer operations is focused on utilising digital technology and platforms to improve the customer's experience by providing them with frictionless interactions and touchpoints throughout the end to end customer lifecycle, leading to a significantly reduced cost to serve and improve customer experiences.

By investing in enhanced customer engagement capabilities, Vector will ensure that it can meet changing customer expectations for service providers and deliver best in class utility services at a lower cost.

RECORDS & ASSET MANAGEMENT

Records & Asset Management is focused on utilising core capabilities to enable asset investment planning, network inventory management and geographical inventory management. This will enhance our asset replacement, planning and maintenance capabilities by centralising operational history, providing additional condition data and auditing capability for planned and corrective maintenance activities and incorporating financial transactions.

NETWORK OPERATIONS

This value stream covers a range of digital capabilities to enable network operational functions and field service capabilities including Network monitoring, network control, network real-time calculations, fault management, operation work scheduling, operational statistics & reporting. These enhanced operational capabilities will deliver increased visibility and control of our infrastructure and associated operations. The scope of investment will be focused on enabling improved insight capability to drive efficiencies and reduce risk exposure and to drive greater control and (near real-time to real time) automation across our energy assets.

MAINTENANCE AND CONSTRUCTION

Maintenance and Construction is focused on core digital capabilities to enhance and enable planned maintenance and construction across the network. This includes maintenance and inspection, work scheduling, construction and design, field recording & design, and work dispatch. Condition data captured from the field is used to help prioritise and drive the maintenance and construction work.

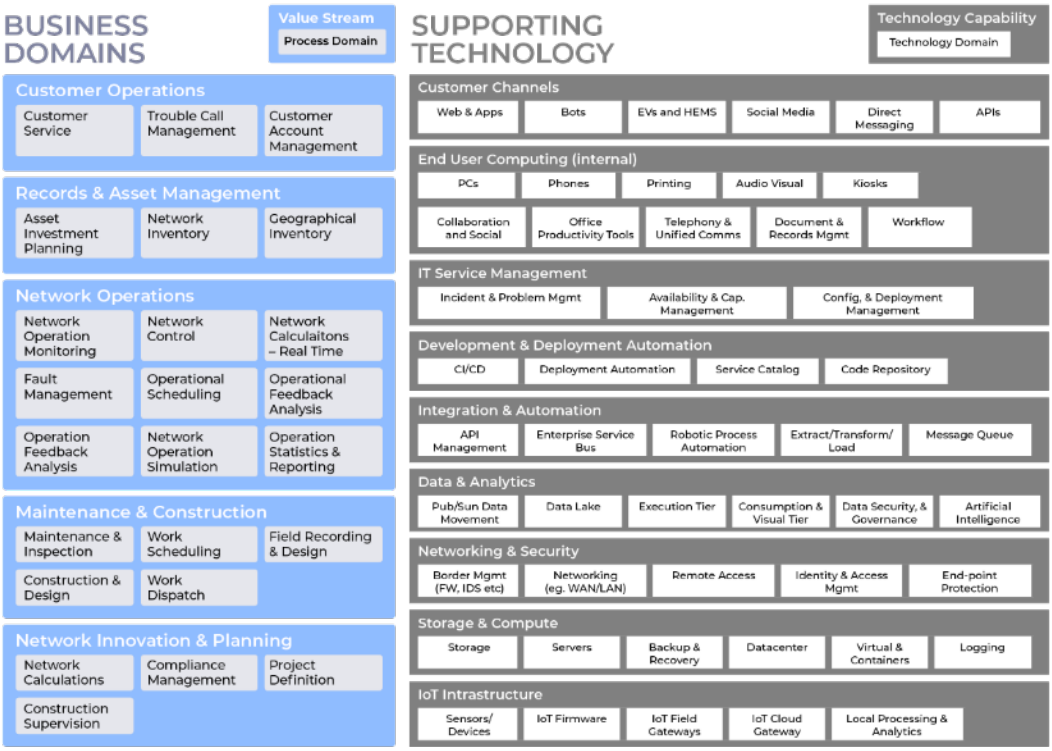
NETWORK INNOVATION & PLANNING

This value stream will be focussed on utilising digital capabilities to enable effective project planning, compliance management, construction supervision and network calculations.

5.3.2 PLATFORM ARCHITECTURE

NETWORKS PLATFORM REFERENCE MODEL

Vector implements and manages its digital systems according to an overall Reference Model (refer to figure below). This is comprised of the business process domains that are in turn supported by the underlying technology components of the technology reference model. Over the 10-year period this reference architecture will be utilised to deliver ongoing enhancements and improvements towards the achievement of our business objectives for our core businesses.



FORECAST INVESTMENT SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
Non-network CAPEX	1.93	3.23	2.29	2.37	2.12	1.73	1.45	2.03	1.56	1.44	20.15
Total	**1.93**	**3.23**	**2.29**	**2.37**	**2.12**	**1.73**	**1.45**	**2.03**	**1.56**	**1.44**	**20.15**

5.4 Non network OPEX

Non-network OPEX provides the support services required to ensure the network business can operate as an effective, well-governed business. The networks business benefits from economies of scale with Vector providing shared support services across its group of regulated and non-regulated businesses. Support services include health & safety, finance, legal, human resources, digital and risk management.

PROPOSED EXPENDITURE SUMMARY ($MILLION NOMINAL)

DESCRIPTION	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
System operations and network support	2.96	2.96	2.96	2.96	2.96	2.96	2.96	2.96	2.96	2.96	29.63
Business support	5.08	5.08	5.08	5.08	5.08	5.08	5.08	5.08	5.08	5.08	50.85
Total	**8.05**	**8.05**	**8.05**	**8.05**	**8.05**	**8.05**	**8.05**	**8.05**	**8.05**	**8.05**	**80.48**

section 06

delivering our plan

6 – delivering our plan

This section of the AMP outlines how we develop an optimal portfolio of works from the plans set out in Section 5 and how we will deliver these works to maintain service levels and deliver our strategic outcomes. Our approach to project prioritisation and resourcing is summarised and the CAPEX and OPEX required to deliver our gas network AMP for the 2020-2030 period is presented.

6.1 Investment Prioritisation Process

The key objectives of asset management, as stated in Vector's Asset Management Policy, relate to safety, reliability and the environment (see Section 3.1) with performance against these objectives captured by the service level metrics (see Section 2.2). By using a robust portfolio prioritisation process, Vector aims to ensure that the investment required to meet these objectives and targeted service levels is efficient, bringing the greatest total benefit to our customers. This is also an important step towards achieving best industry practice in asset management principles, prescribed in ISO 55000.

The planning process is described below and is undertaken yearly as part of Vector's annual budgeting cycle.

- **Project proposals:** Once the need for a project has been identified, project proposals are created. The need of the projects is underpinned by customer needs, asset conditions and risks, network performance and strategies. These proposals describe the project need, provide a cost estimate and project value assessment against a set of decision making criteria (see section 3.6.1), and where relevant show the options considered and detail the preferred option (see Section 5). Project proposals are prepared by Vector's subject matter experts;
- **Preliminary investment plan:** Project proposals are peer reviewed to ensure consistency of project proposals before incorporation into the preliminary investment plan. In this preliminary plan, projects are staggered to account for the realistic volume of work that can be undertaken in each year. This uses engineering judgement to take into consideration resources available for delivery including the construction and procurement capabilities available. Any synergies and interdependencies between projects are highlighted and incorporated into the preliminary plan;
- **Portfolio prioritisation:** The preliminary investment plan is assessed against the resource and financial constraints, and where appropriate prioritised considering the key business objectives. This is an iterative process and is described below:
- The business objectives of a project proposal are expressed based in terms of improvements to service level metrics or in terms of risk mitigation and is aligned with the Network Risk Management Framework.
- The risk evaluation process considers both the credible event based on the most likely consequences should a risk eventuate, and where relevant any catastrophic event that might occur. The process incorporates expert knowledge and experience with the network asset and network system to ensure that the assessed consequences, likelihood and resulting risk score is credible and consistent.
- The resulting risk score provides guidance to the relative importance of different projects and is used to inform subject-matter experts in the process of prioritising projects to meet the constraints applied.
- **Draft investment plan:** Once projects have been through the prioritisation process, the draft investment plan is formed. This plan is reviewed and approved by the executive management team. The risk associated with projects that have not formed part of the draft investment plan following optimisation is highlighted and acknowledged; and
- **Final Investment Plan:** Following consideration and approval by the executive management team, the final investment plan is reviewed and approved by the Board.

6.2 Resource requirements and constraints

Vector has a MUSA with two key contractors, and they are known as our Field Service Providers (FSPs). We provide project guidance to our FSPs in monthly meetings where we disclose the upcoming programmes of work. This provides them at least two years of visibility on the upcoming workstream. It is our expectation that the FSPs manage their resources to meet this pipeline of work.

Typically, Vector uses the MUSA as the contract mechanism for delivering projects including the civil works. However, depending on the size and technical requirements of a project we may directly engage contractors using AS/NZS 3910.

Designs for all delivery projects are reviewed and approved by Vector. Further internal engineering support is provided based on the level of effort anticipated. These levels of engineering support are defined as:

- Level 1 – Vector to provide general support to review and approve designs developed by Vector's FSPs;
- Level 2 – Vector to provide general support to review and approve designs developed by external consultants; and
- Level 3 – detailed design delivered by Vector internal engineering resources.

At any time during the delivery of these projects, Vector may engage specialist consultants to assist. For example, consultants are used to:

- Compile, submit and facilitate resource consents;
- Define the scope associated with the removal of hazardous material such as asbestos;
- Route assessment and design; and
- Undertake geotechnical studies.

6.3 Delivery

Development of Vector's Project Delivery Framework (PDF) has been based on industry best practises, and the Project Management Body of Knowledge. Its function is to provide a framework to ensure projects are delivered to minimise Vector's corporate and asset risk profile.

The PDF essentially provides standard procedures and processes that the project manager must comply with, for example safety in design and standard contract templates. It focuses on core corporate obligations associated with health and safety, environment and time, cost and quality. This is achieved through its alignment with corporate policies.

The PDF is reviewed and updated on a regular basis to ensure that it provides flexibility to deliver the range of projects in the capital programme. This flexibility also allows us to manage projects with varying degrees of risk.

The PDF includes seven distinct phases associated with the project delivery lifecycle; pipeline, concept, procurement, development, construction, test and commission and project closure. In addition, the PDF provides Vector's project managers with templates, guidelines and tools relevant to each of these phases.

Inception of a project usually follows three distinct stages:

1. Initially project is defined in the AMP;
2. When the project is planned to be delivered a CAPEX Justification (business case) is developed which includes a budget estimate. It is submitted to the business for approval to proceed; and
3. Following approval, a project scope is generated, and CAPEX approval is granted, and the project handed over to a Vector project manager for delivery.

6.4 Investment plan

This section describes the CAPEX forecasts for the gas distribution network assets for the next 10-year planning period and provides a comparison with the forecast prepared and disclosed in the 2019 AMP (disclosed in July 2019).

6.4.1 CAPEX FORECAST

The table below shows the forecast CAPEX during the planning period, broken down into the asset categories defined in the Commerce Commission's Gas Distribution Information Disclosure Amendments Determination 2012. The figures are presented in 2021 dollars. For reference purposes, Vector has also included the corresponding CAPEX forecast disclosed in the 2019 AMP escalated to 2021 prices, using an inflator of 2.8%.

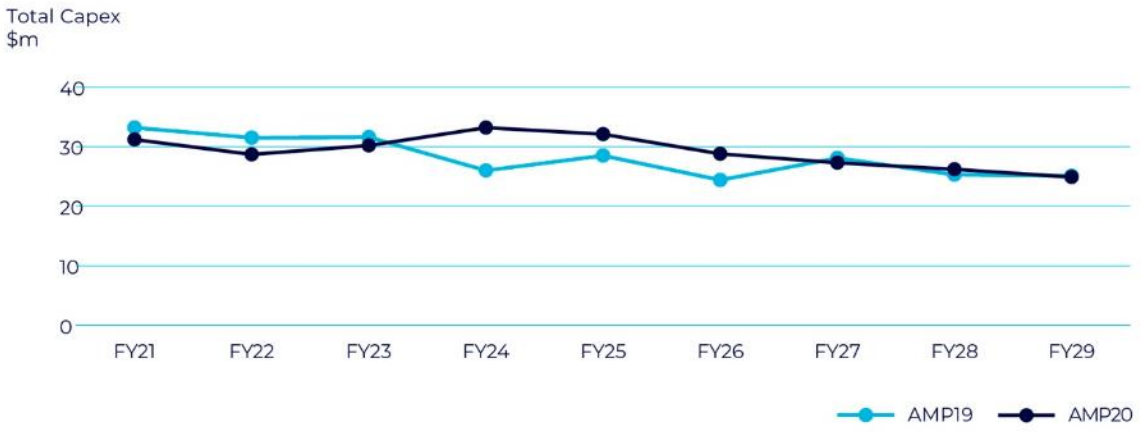
AMP2020 ($'000)	**FY21**	**FY22**	**FY23**	**FY24**	**FY25**	**FY26**	**FY27**	**FY28**	**FY29**	**FY30**	**TOTAL**
Consumer connection	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	Total
System growth	17,607	16,997	16,697	16,722	16,722	16,722	16,722	16,722	16,722	16,722	168,358
Asset replacement and renewal	3,248	1,559	2,176	4,971	4,042	1,885	2,741	2,163	729	1,124	24,638
Asset relocations	3,340	3,080	3,084	3,071	2,555	2,404	2,198	2,198	2,198	2,198	26,328
Quality of supply	4,595	2,727	4,716	6,004	6,004	6,004	4,144	2,999	2,999	2,999	43,189
Legislative and regulatory	36	1,002	387	51	643	51	0	0	650	178	2,999
Other reliability, safety and environment	0	0	0	0	0	0	0	0	0	0	0
Non network asset	1,926	3,234	2,291	2,375	2,123	1,728	1,446	2,028	1,562	1,440	20,152
Total CAPEX	**31,247**	**28,654**	**30,173**	**33,250**	**32,144**	**28,850**	**27,307**	**26,166**	**24,917**	**24,718**	**287,425**

AMP2019 ($'000)	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
Consumer connection	20,496	16,300	16,333	16,333	16,333	16,333	16,333	16,333	16,333
System growth	1,540	5,253	6,622	1,565	4,202	682	944	1,206	782
Asset replacement and renewal	2,985	2,933	2,628	2,513	2,408	2,356	2,356	2,356	2,356
Asset relocations	5,457	2,826	3,260	3,260	3,260	3,260	3,260	3,260	3,260
Quality of supply	746	2,086	336	0	0	0	78	0	650
Legislative and regulatory	0	0	0	0	0	0	0	0	0
Other reliability, safety and environment	164	55	362	55	55	55	55	55	55
Non network asset	1,806	2,060	2,047	2,277	2,195	1,669	5,048	2,105	1,633
Total CAPEX	**33,194**	**31,512**	**31,588**	**26,004**	**28,454**	**24,356**	**28,075**	**25,316**	**25,069**

6.4.2 COMPARISON TO PREVIOUS AMP

The section highlights the significant changes to the 2019 disclosed expenditure forecasts. The following figure shows the difference between the 2020 and 2019 AMP expenditure forecasts with the following table breaking down the variance by expenditure categories.

AMP MOVEMENT 2019 V 2020



2019/2020 AMP VARIANCE ($'000)	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	TOTAL
Consumer connection	(2,889)	698	364	389	389	389	389	389	389	506
System growth	1,708	(3,694)	(4,445)	3,405	(160)	1,204	1,797	957	(53)	719
Asset replacement and renewal	355	147	455	558	147	48	(157)	(157)	(157)	1,239
Asset relocations	(862)	(99)	1,456	2,744	2,744	2,744	884	(261)	(261)	9,088
Quality of supply	(710)	(1,084)	51	51	643	51	(78)	0	0	(1,075)
Legislative and regulatory	0	0	0	0	0	0	0	0	0	0
Other reliability, safety and environment	331	0	459	0	0	0	0	0	0	791
Non network asset	120	1,174	244	98	(72)	58	(3,602)	(77)	(70)	(2,128)
Total CAPEX	**(1,947)**	**(2,858)**	**(1,415)**	**7,246**	**3,691**	**4,494**	**(768)**	**850**	**(153)**	**9,140**

6.4.3 EXPLANATION OF MAJOR CAPEX CHANGES

This section highlights the significant changes in CAPEX over the 9-year period for which the 2019 AMP and 2020 AMP overlap, reflect the following key changes:

- Customer connection expenditure is in line with the 2019 AMP. An increase in customer service connection cost is forecast driven by a higher number of non-standard service connections, which is partially offset by a lower number of reticulation lots, and a cancellation of a large commercial connection;
- System growth expenditure is inline with the 2019 AMP. A cost increase associated with the Gilbert Road steel pipeline extension ($4m) and provision for additional MP4 network meshing ($2m) is offset by the deferral of the Takapuna 150mm steel pipeline reinforcement project ($9.8m), which was enabled by adopting an alternative solution ($2.2m);
- A $1.2m increase in asset replacement due to a new provision for a special pipeline crossing upgrade programme and gate station equipment upgrades;
- A $9m increase in relocation expenditure reflecting the provision for the Auckland Light Rail projects ($11m);
- A $1m decrease in quality of supply expenditure due to removal of the Wainui Road 150mm pipeline extension and recategorization of the Wainui DRS upgrade project to 'Other reliability and safety' category. This is partially offset by the deferral of the Harris Road DRS upgrade project from FY20 to the 2020 AMP planning period and provision for new remote system pressure monitoring devices; and
- Non-network CAPEX is $2m lower largely driven by rephasing of the capitalised leased cost.

6.5 Operating expenditure forecast

This section describes the OPEX forecasts for the gas distribution network assets for the next 10-year planning period and provides a comparison with the 10-year forecast prepared and disclosed in the 2019 AMP (disclosed in July 2019).

6.5.1 OPEX FORECAST

The table below shows the forecast OPEX during the planning period, broken down into the asset categories defined in the Commerce Commission's Gas Distribution Information Disclosure Determination 2012. The figures are presented in 2021 dollars. For reference, Vector has also included the corresponding OPEX forecast disclosed in the 2019 AMP escalated to 2021 prices using an inflation factor of 2.3%

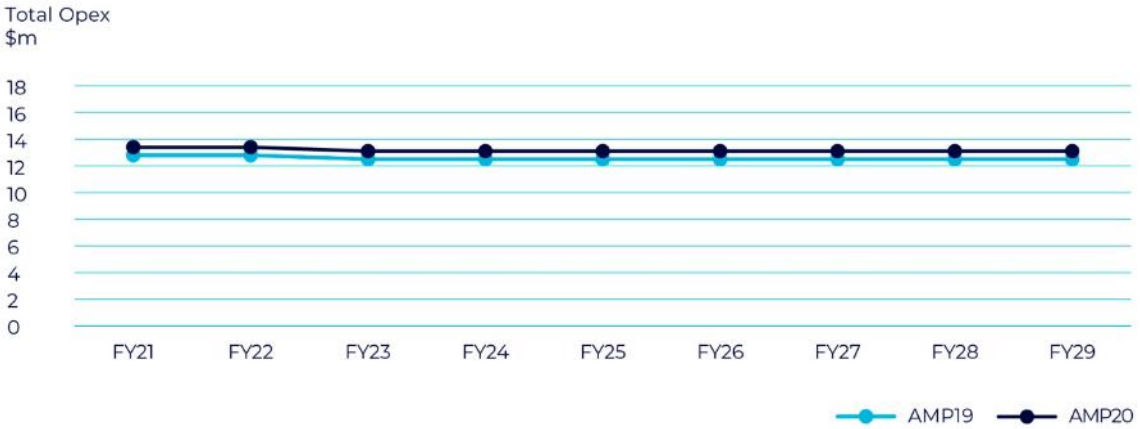
2020 AMP ($'000)	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	TOTAL
Service interruptions and emergencies	2,287	2,287	2,287	2,287	2,287	2,287	2,287	2,287	2,287	2,287	22,871
Routine and corrective maintenance and inspection	3,108	3,088	2,824	2,825	2,827	2,829	2,831	2,833	2,835	2,837	28,836
Asset replacement and renewal	0	0	0	0	0	0	0	0	0	0	0
System operations and network support	2,963	2,963	2,963	2,963	2,963	2,963	2,963	2,963	2,963	2,963	29,630
Business support	5,085	5,085	5,085	5,085	5,085	5,085	5,085	5,085	5,085	5,085	50,849
Total OPEX	**13,443**	**13,423**	**13,159**	**13,160**	**13,162**	**13,164**	**13,166**	**13,168**	**13,170**	**13,172**	**132,186**

2019 AMP ($'000)	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29
Service interruptions and emergencies	2,288	2,288	2,288	2,288	2,288	2,288	2,288	2,288	2,288
Routine and corrective maintenance and inspection	3,008	3,010	2,714	2,716	2,718	2,720	2,722	2,723	2,725
Asset replacement and renewal	0	0	0	0	0	0	0	0	0
System operations and network support	2,468	2,468	2,468	2,468	2,468	2,468	2,468	2,468	2,468
Business support	5,034	5,034	5,034	5,034	5,034	5,034	5,034	5,034	5,034
Total OPEX	**12,797**	**12,799**	**12,504**	**12,506**	**12,508**	**12,509**	**12,511**	**12,513**	**12,515**

6.5.2 COMPARISON TO PREVIOUS FORECAST

The section highlights the significant changes to the 2019 disclosed expenditure forecasts. The following figure shows the difference between the 2020 and 2019 AMP expenditure forecasts, with the following table breaking down the variance by expenditure categories.

AMP MOVEMENT 2019 V 2020



2019/2020 AMP VARIANCE ($'000)	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	TOTAL
Service interruptions and emergencies	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(6)
Routine and corrective maintenance and inspection	100	79	109	109	109	109	109	109	109	944
Asset replacement and renewal	0	0	0	0	0	0	0	0	0	0
System operations and network support	495	495	495	495	495	495	495	495	495	4,453
Business support	51	51	51	51	51	51	51	51	51	460
Total OPEX	**645**	**624**	**655**	**655**	**655**	**655**	**655**	**655**	**655**	**5,852**

6.5.3 EXPLANATION OF MAJOR OPEX VARIANCES

This section highlights the significant changes in CAPEX over the 9-year period for which the 2019 AMP and 2020 AMP overlap, reflect the following key changes:

- Network OPEX forecast is largely in line with the previous AMP with is an increase of $0.9m over the 9-year comparable period, driven by an increase in resources to reduce corrosion and improve the condition of DRSs, and an increase forecast expenditure in disconnection services; and
- Non network OPEX is $4.9m higher largely attributed to the reclassification of personnel and service costs to the gas business and an increase in the corporate allocator. This is partially offset against savings initiatives.

section 07

appendices

7 – appendices

7.1 Appendix A – Glossary of Terms

ADMS	Advanced Distribution Management System
ALG	Auckland Lifelines Group
AMMAT	Asset management maturity assessment tool
AMP	Asset management plan
ARM	Active risk manager
BCM	Business continuity management
BEP	Business engagement platform
CAIDI	Customer average interruption duration index
CAPEX	Capital expenditure
CBARM	Condition based asset risk management
CDEM	Civil Defence emergency management
CEP	Customer engagement platform
CIV	Customer isolation valve
CMS	Customer management system
COO	Chief operating officer
CP	Cathodic protection
DAF	Delegated authorities framework
DFA	Delegated financial authority
DPP	Gas distribution services default price-quality price path determination
DRS	District regulating station
EHMP	Electrical hazard management plan
EPR	Earth potential rise
ERP	Enterprise resource planning
FMEA	Failure mode and effects analysis
FSA	Formal safety assessment
FSP	Field service provider
FY	Vector financial year (year ending 30th June)
GCE	Group chief executive
GIS	Geographical information system
GMS	Gas measurement system
GNS	Gas network standard
GPRS	General packet radio service
GSM	Global system for mobile communication
HILP	High impact low probability
HP	High pressure
ICP	Installation control point
IEC	International electrotechnical commission
IP	Intermediate pressure
ISO 55001	International standard for asset management
IT	Information technology

km	Kilometre
LCI	Labour cost index
LP	Low pressure
MAOP	Maximum allowable operating pressure
MinOp	Minimum operating pressure
MP	Medium pressure
MUSA	Multi utility service agreement
NOP	Nominal operating pressure
NZIER	New Zealand Institute of Economic Research
NZS	New Zealand standard
OPEX	Operational expenditure
PDF	Project delivery framework
PE	Polyethylene
PJ	Peta joule
PPI	Producers price index
PRE	Public reported escape
PVC	Polyvinyl chloride
QoS	Quality of supply
Reliability	The ability of the network to deliver gas consistently when demanded.
Resilience	The ability of the network to recover quickly and effectively from an event.
RIMS	Risk and incident management system
RTE	Response time to emergencies
RTU	Remote Telemetry Unit
RY	Regulatory year (year ending 30 June)
SAIDI	System average interruption duration index
SAIFI	System average interruption frequency index
SAP	Systems applications and processes (Vector's corporate enterprise resource planning system)
SCADA	Supervisory control and data acquisition system
scmh	Standard cubic metres per hour
SoS	Security of supply
SMS	Short message service (communications)
QoS	Quality of Supply
TJ	Terra joule

7.2 Appendix B – Key Asset Strategies and Standards

Vector has a set of asset strategies and standards that together define Vector's approach to Asset Management. An overview of the key policies and standards are set out below.

ASSET CLASS	1XX DISTRIBUTION PIPELINES
Strategies	GAA101 Distribution pipelines
Equipment Specifications	GNS-0029 Specification for polyethylene pipe GNS-0030 Specification for polyethylene fittings GNS-0031 Specification for polyethylene to steel transition fittings GNS-0033 Specification for steel pipe GNS-0034 Specification for steel pipe coating GNS-0035 Specification for steel fittings and flange components GNS-0036 Specification for steel punch tees GNS-0037 Specification for stainless steel tube and fittings GNS-0038 Specification for ducts and sleeves GNS-0043 Specification for facility markers warning tape and tracer wire GNS-0048 Specification for repair clamps GNS-0050 Specification for polyethylene to steel transition risers GNS-0055 Specification for under pressure fittings
Maintenance Standards	GNS-0018 Damage prevention and public training GNS-0019 Leakage survey GNS-0020 Odourisation system maintenance GNS-0024 System pressure monitoring GNS-0069 Pressure uprating without decommissioning
Engineering Standards	GNS-0002 Piping system design GNS-0064 Construction of steel pipe systems GNS-0065 Construction of plastic pipe systems GNS-0066 Purging GNS-0067 Hot tapping and flow-stopping GNS-0068 Steel non-destructive testing and inspection GNS-0072 Plastic pipe insertion

ASSET CLASS	2XX PRESSURE STATIONS
Strategies	GAA201 Pressure stations
Equipment Specifications	GNS-0039 Specification for filters GNS-0044 Specification for pressure regulators GNS-0045 Specification for meters GNS-0049 Specification for pressure gauges GNS-0076 Specification for below ground district regulating stations
Maintenance Standards	GNS-0012 Maintenance of gate and district regulating stations GNS-0073 Service regulator maintenance
Engineering Standards	GNS-0001 Design of district regulating stations GNS-0056 Construction of district regulating stations

ASSET CLASS	3XX VALVES
Strategies	GAA301 Valves
Equipment Specifications	GNS-0032 Specification for polyethylene ball valves GNS-0040 Specification for steel ball valves GNS-0041 Specification for meter valve assembly GNS-0042 Specification for butterfly valves GNS-0047 Specification for valve boxes
Maintenance Standards	GNS-0013 Valve maintenance
Engineering Standards	GNS-0057 Construction of valve installations

ASSET CLASS	4XX CORROSION PROTECTION SYSTEMS
Strategies	GAA401 Corrosion protection systems
Equipment Specifications	GNS-0051 Specification for corrosion protection wrapping materials GNS-0052 Specification for anodes GNS-0053 Specification for paint systems GNS-0054 Specification for insulating joints
Maintenance Standards	GNS-0014 Maintenance of above ground corrosion protection systems GNS-0015 Maintenance of below ground corrosion protection systems
Engineering Standards	GNS-0003 Design of above ground corrosion protection systems GNS-0004 Design of below ground corrosion protection systems GNS-0058 Construction of above ground corrosion protection systems GNS-0059 Construction of below ground corrosion protection systems

ASSET CLASS	5XX TELEMETRY EQUIPMENT
Strategies	GAA501 Telemetry equipment
Equipment Specifications	GNS-0046 Specification for Telenet equipment
Maintenance Standards	GNS-0016 Telenet maintenance
Engineering Standards	GNS-0005 Design of Telenet systems GNS-0060 Construction of Telenet systems

ASSET CLASS	6XX SPECIAL CROSSINGS
Strategies	GAA601 Special crossings
Equipment Specifications	Covered in above asset categories
Maintenance Standards	Covered in above asset categories
Engineering Standards	Covered in above asset categories

ASSET CLASS	GENERAL
Strategies	Not applicable
Equipment Specifications	Not applicable
Maintenance Standards	GNS-0017 Asset repair GNS-0021 Patrolling GNS-0022 Decommissioning of facilities GNS-0070 Gas leak investigation GNS-0071 Investigation of failures GNS-0078 Maintenance of critical spares and equipment GNS-0082 Auditing
Engineering Standards	GNS-0007 Class location GNS-0008 Pressure classification and operating ranges GNS-0009 Distribution system analysis GNS-0011 Continuing surveillance GNS-0062 Pressure testing GNS-0063 As-built field recording GNS-0074 Gas distribution quality of supply criteria GNS-0080 Personnel qualification GNS-0084 Techni cal records management GNS-0085 Management of change GNS-0086 Gas distribution forecast utilisation GNS-0087 Asset condition grading GNS-0089 Gas distribution model building

HEALTH, SAFETY AND ENVIRONMENT KEY REQUIREMENTS
HSEMS01 Management systems framework and HSE policies
HSEMS02 Leadership and Accountability
HSEMS03 Competence and Behaviour
HSEMS04 Engagement, Participation and Consultation
HSEMS05 Contractor HSE Management
HSEMS06 Emergency Management
HSEMS07 Wellness and Fitness to Work
HSEMS08 Risk Management
HSEMS09 Incident Management
HSEMS10 Audits, Reviews and Performance Reporting
HSEMS11 Operational Control
HSEMS12 HSE in Project Management

GAS DISTRIBUTION OPERATING STANDARDS
UCO004 Networks Event Management and Investigation
GNS-0081 Gas distribution network performance indicator data capture
GNS-0083 Gas safety and operating plan
GNS-0088 North Harbour pipeline management plan
GNS-0090 Gas emergency response event guide
GNS-0091 North Harbour Pipeline Integrity Management Plan
GNS-0092 North Harbour Pipeline Remaining Life Review

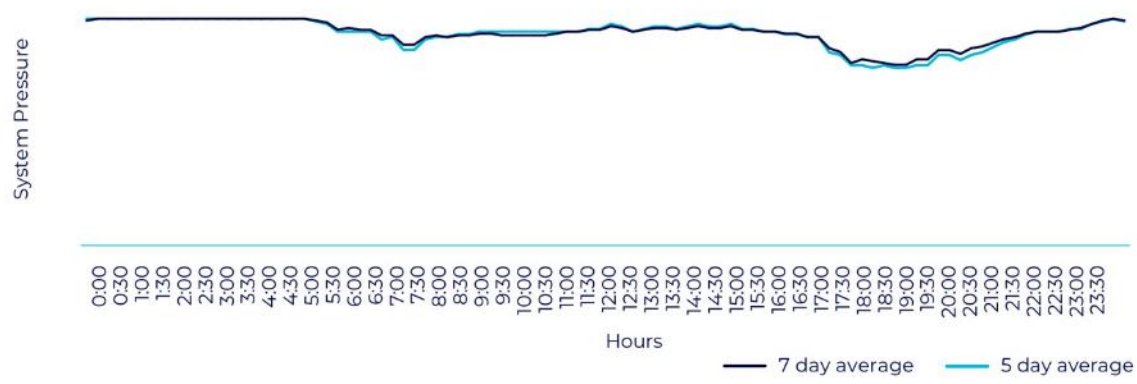
7.3 Appendix C – Asset Management Metrics

CLASSIFICATION	METRIC	FY15	FY16	FY17	FY18	FY19	TARGET (AVERAGE RY13 TO RY17)	PERFORMANCE AGAINST TARGET
Interruptions	Number of planned interruptions on the network (Class B)	407	440	448	357	389	<743	
Interruptions	Number of unplanned interruptions on the network (Class C)	84	64	52	38	36	<79	
Interruptions	Number of unplanned interruptions caused by third party damage (Class I)	270	241	226	195	181	<241	
Interruptions	Number of unplanned outage events (interruptions that affect more than 5 ICPs)	2	9	8	6	5	<6	
Interruptions	Number of unplanned outage events caused by third party damage (interruptions that affect more than 5 ICPs)	1	7	6	4	4	<5	
Reliability	SAIDI - Based on the total number of interruptions	2,010	1,413	1,375	1,013	1,110	<2,624	
Reliability	SAIDI - Class B (planned interruptions on the network)	564	731	612	386	392	<1,795	
Reliability	SAIDI - Class C (unplanned interruptions on the network)	151	324	346	220	379	<199	
Reliability	SAIDI - Class I (unplanned interruptions caused by third party damage)	1300	357	417	407	339	<625	
Reliability	SAIFI - Based on the total number of interruptions	10.0	9.6	8.7	7.2	7.6	<13.6	
Reliability	SAIFI - Class B (planned interruptions on the network)	5.4	5.3	5.1	4.3	4.0	<9.2	
Reliability	SAIFI - Class C (unplanned interruptions on the network)	1.1	1.1	0.8	0.6	0.4	<1.0	
Reliability	SAIFI - Class I (unplanned interruptions caused by third party damage)	3.5	3.3	2.8	2.4	3.1	<3.4	
Reliability	CAIDI - Based on the total number of interruptions	202	147	158	140	147	<185	
Reliability	CAIDI - Class B (planned interruptions on the network)	104	139	119	90	97	<165	
Reliability	CAIDI - Class C (unplanned interruptions on the network)	141	309	451	360	873	<212	
Reliability	CAIDI - Class I (unplanned interruptions caused by third party damage)	371	109	149	172	110	<183	
System Condition and Integrity	Number of third party damage events per 1000 km	60	56	52	49	46	<57	
System Condition and Integrity	Number of non-compliant odour tests	0	2	0	0	0	<1	
System Condition and Integrity	Leak detected by system survey per 1000 km	1.0	7.4	4.6	8.5	3.3	<3.4	
Customer Service	Number of complaints per average total of customers	0.0005	0.0013	0.0009	0.0012	0.0010	<0.0011	
Consumer Service	Number of telephone calls to emergency numbers answered within 30 seconds per total number of calls	94%	90%	88%	78%	78%	>91%	
Customer Service	Average call response time (hours)	0.59	0.60	0.65	0.58	0.61	<0.61	
Customer Service	Number of emergencies	102	91	96	103	89	<107	

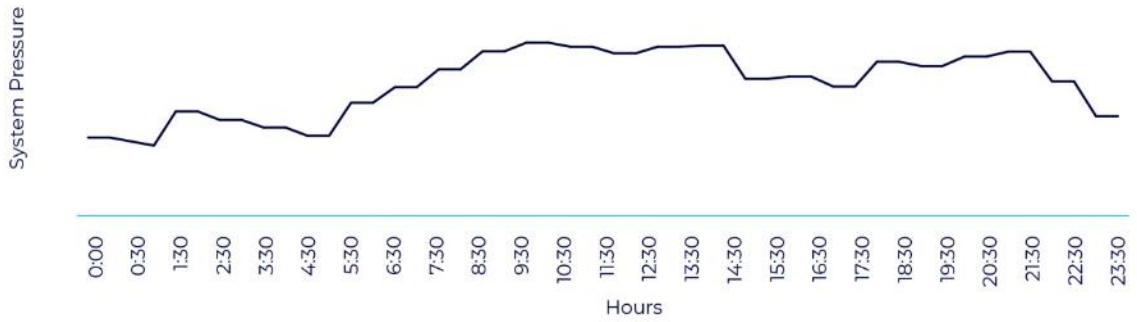
7.4 Appendix D – Typical Load Profiles

The typical daily winter pressure profile for residential loads and load profile for commercial/industrial customers are illustrated in the following figures. Residential load typically has two peaks whereas the commercial and industrial load is more consistent for the whole day.

TYPICAL DAILY PRESSURE PROFILE RESIDENTIAL – WINTER



TYPICAL DAILY PRESSURE PROFILE COMMERCIAL/INDUSTRIAL – WINTER



Demand curves for specific industrial consumers are far more variable – conforming closely to the nature of the customer's business. A typical industrial load curve is therefore not a meaningful concept.

A measure of load diversity is achieved with residential customers providing peaks in the morning and early evening, with the commercial and industrial load filling in the trough between these peaks. The mix of customer types within a distribution network, and their location, influences the size and duration of the peaks.

7.5 Appendix E – Load Forecast

	ACTUAL (SCMH)							FORECAST (SCMH)									
NETWORK SYSTEM	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**ANNUAL GROWTH**	**TOTAL GROWTH (FORECAST PERIOD)**
Alfriston	148	148	146	133	112	99	99	99	99	99	99	99	99	99	99	-1.2%	-11.6%
Central Auckland Network System (co-incident)	79,071	78,559	77,534	78,970	75,057	74,860	74,943	75,025	75,108	75,191	75,274	75,356	75,439	75,522	75,605	0.1%	0.7%
Drury Gate Station (co-incident)	2,131	2,283	2,200	2,236	2,466	2,289	2,297	2,305	2,313	2,321	2,329	2,337	2,346	2,354	2,362	-0.4%	-4.2%
Harrisville	3,733	3,521	3,613	3,516	3,788	4,085	4,202	4,319	4,436	4,554	4,671	4,789	4,906	5,024	5,141	3.6%	35.7%
Hunua	711	700	625	619	648	553	553	553	553	553	553	553	553	553	553	-1.5%	-14.7%
Kingseat	34	19	8	8	20	0	0	0	0	0	0	0	0	0	0	-10.0%	-100.0%
Pukekohe	516	888	647	657	931	740	761	782	804	825	846	867	888	909	930	0.0%	-0.1%
Ramarama	322	264	352	350	376	326	332	338	345	351	357	363	369	375	381	0.1%	1.4%
Tuakau	2,961	3,190	4,066	3,723	6,294	5,264	5,760	6,255	6,751	7,249	7,744	8,240	8,736	9,233	9,729	5.5%	54.6%
Waitoki	3,116	2,433	1,767	1,807	1,768	2,011	2,088	2,166	2,243	2,321	2,398	2,475	2,552	2,630	2,707	5.3%	53.1%
Warkworth	2,157	2,332	2,287	2,334	2,429	2,635	2,714	2,793	2,871	2,950	3,029	3,107	3,186	3,265	3,343	3.8%	37.6%
Wellsford	No data																
Total	**94,900**	**94,335**	**93,245**	**94,352**	**93,890**	**92,862**	**93,749**	**94,636**	**95,523**	**96,413**	**97,300**	**98,187**	**99,074**	**99,963**	**100,850**	**0.7%**	**7.4%**

7.6 Appendix F – System Pressure Modelling Register

PRESSURE SYSTEM	NOMINAL OPERATING PRESSURE (NOP) KPA)	BASE YEAR			10 YEAR FORECAST14		
		FLOW (SCMH)	MIN. OPERATING PRESSURE (KPA)	PROPORTION OF NOP	FLOW (SCMH)	MIN. OPERATING PRESSURE (KPA)	PROPORTION OF NOP
Auckland Airport MP4	400	996	339	85%	1,110	327	82%
Broadway Park MP2	200	38	200	100%	42	200	100%
Bruce Maclaren IP10	1000	2,374	949	90%	2,736	933	89%
Central Auckland IP20	1900	73,946	1429	75%	82,459	1,168	61%
Central Auckland MP4	400	31,135	270	67%	38,309	207	52%
Central Auckland MP7	700	6,108	653	93%	7,042	639	91%
Conifer Grove MP2	200	182	189	94%	210	186	93%
Drury NC MP4	400	2,030	234	60%	2,253	211	53%
East Auckland IP10	1000	6,922	662	66%	7,980	556	56%
East Auckland MP4	400	9,645	292	73%	11,119	241	60%
Glendene MP4	400	205	395	99%	237	394	99%
Harrisville MP7	700	3,788	454	65%	5,234	376	54%
Herd Road MP4	400	7	400	100%	8	400	100%
Holloway Place MP4	400	460	398	100%	530	397	99%
Landsford Crescent MP2	200	67	176	88%	77	175	87%
Mangere Bridge MP4	400	77	395	99%	89	395	99%
Manukau MP2	200	270	152	76%	311	143	72%
Manurewa IP10	1000	968	854	85%	1,116	848	85%
Manurewa North MP4	400	2,720	274	69%	3,136	253	63%
Manurewa South MP4	400	717	385	96%	827	382	96%
Monahan MP1	35	58	30	86%	67	29	84%
North Shore MP4	400	13,937	216	54%	15,820	167	42%
Pakuranga MP4	400	10	400	100%	12	399	100%
Panmure MP1	35	43	30	86%	50	29	83%
Papakura MP4	400	267	334	84%	304	318	80%
Penrose MP2	200	1,179	170	85%	1,359	158	79%
Puhinui MP4	400	42	398	100%	49	398	100%
Pukekohe IP10	1000	931	991	99%	1,164	987	99%
Pukekohe MP4	400	917	381	95%	1,146	370	93%
Ramarama MP4	400	376	261	65%	449	235	60%
South Auckland MP7	700	2,182	647	92%	2,515	632	90%
Te Atatu MP4	400	418	381	95%	482	377	94%
Totara Heights MP1	100	446	69	66%	514	62	60%
Tuakau IP20	1900	6,294	1629	86%	11,329	1,493	79%
Tuakau MP7	700	1,945	533	76%	3,221	400	57%
Universal Drive MP4	400	82	395	99%	95	393	98%
Waitoki IP20	1900	1,768	1,676	88%	2,210	1661	87%
Whangaparaoa MP4	400	1,807	364	91%	2,259	344	86%
Warkworth IP20	1900	668	1017	54%	765	911	48%
Warkworth MP4	400	2,428	334	84%	3,075	318	80%
Wattle Downs & Wiri MP4	400	884	343	86%	1,019	323	84%

14 System pressure values exclude any future system reinforcements

7.7 Appendix G – AMP Information Disclosure Compliance

INFORMATION DISCLOSURE DETERMINATION REQUIREMENT	AMP SECTION REFERENCE
Contents of the AMP	
3. The AMP must include the following:	
3.1. A summary that provides a brief overview of the contents and highlights information that the GDB considers significant;	Executive Summary and Section 1
3.2. Details of the background and objectives of the GDB's asset management and planning processes; and	Section 3.1 and Section 3
3.3. A purpose statement which:	
(a) makes clear the purpose and status of the AMP in the GDB's asset management practices. The purpose statement must also include a statement of the objectives of the asset management and planning processes;	Section 1 and Section 3.1
(b) states the corporate mission or vision as it relates to asset management;	Section 1
(c) identifies the documented plans produced as outputs of the annual business planning process adopted by the GDB;	Section 3.5 and Section 6
(d) states how the different documented plans relate to one another, with particular reference to any plans specifically dealing with asset management; and	Section 3.4, Section 3.5 and Section 6
(e) includes a description of the interaction between the objectives of the AMP and other corporate goals, business planning processes and plans.	Section 1 and Section 3.1
3.4. Details of the AMP planning period, which must cover at least a projected period of 10 years commencing with the disclosure year following the date on which the AMP is disclosed.	Executive Summary, Section 1 and Section 3.2
3.5. The date that it was approved by the directors.	Section 1 and Section 7.17
3.6. A description of each of the legislative requirements directly affecting management of the assets, and details of:	Section 3.4
(a) how the GDB meets the requirements; and	Section 3.4
(b) the impact on asset management.	Section 3.4
3.7. A description of stakeholder interests (owners, consumers, etc) which identifies important stakeholders and indicates:	Section 2.1

	(a) how the interests of stakeholders are identified;	Section 2.1
	(b) what these interests are;	Section 2.1
	(c) how these interests are accommodated in asset management practices; and	Section 2.1 and Section 6
	(d) how conflicting interests are managed.	Section 2.1 and Section 6
3.8.	A description of the accountabilities and responsibilities for asset management on at least 3 levels, including-	Section 3.3
	(a) governance—a description of the extent of director approval required for key asset management decisions and the extent to which asset management outcomes are regularly reported to directors;	Section 3.3
	(b) executive—an indication of how the in-house asset management and planning organisation is structured; and	Section 3.3
	(c) field operations—an overview of how field operations are managed, including a description of the extent to which field work is undertaken in-house and the areas where outsourced contractors are used.	Section 3.3 and Section 6.2
3.9.	All significant assumptions-	
	(a) quantified where possible;	Section 1
	(b) clearly identified in a manner that makes their significance understandable to interested persons, including-	Section 1
	(c) A description of changes proposed where the information is not based on the GDB's existing business;	Section 1
	(d) the sources of uncertainty and the potential effect of the uncertainty on the prospective information; and	Section 1
	(e) the price inflator assumptions used to prepare the financial information disclosed in nominal New Zealand dollars in the Report on Forecast Capital Expenditure set out in Schedule 11a and the Report on Forecast Operational Expenditure set out in Schedule 11b.	Section 7.16
3.10.	A description of the factors that may lead to a material difference between the prospective information disclosed and the corresponding actual information recorded in future disclosures.	Section 1
3.11.	An overview of asset management strategy and delivery.	Section 3.5, Section 3.6, Section 4.3, Section 4.4 and Section 6
3.12.	An overview of systems and information management data.	Section 3.5, Section 3.6 and Section 3.9
3.13.	A statement covering any limitations in the availability or completeness of asset management data and disclose any initiatives intended to improve the quality of this data.	Section 3.7
3.14.	A description of the processes used within the GDB for:	

(a) managing routine asset inspections and network maintenance;	Section 4.3
(b) planning and implementing network development projects; and	Section 4.3
(c) measuring network performance.	Section 2.3
3.15. An overview of asset management documentation, controls and review processes.	Section 3.4, Section 3.5 and Section 6
3.16. An overview of communication and participation processes.	Section 3 and Section 6.2
3.17. The AMP must present all financial values in constant price New Zealand dollars except where specified otherwise.	Compliant
3.18. The AMP must be structured and presented in a way that the GDB considers will support the purposes of AMP disclosure set out in clause 2.6.2 of the determination.	Compliant
ASSETS COVERED	
4. The AMP must provide details of the assets covered, including-	
4.1. A map and high-level description of the areas covered by the GDB, including the region(s) covered; and	Section 4.1, Section 4.2 and Section 7.9
4.2. A description of the network configuration, including-	
(a) A map or maps, with any cross-referenced information contained in an accompanying schedule, showing the physical location of:	Section 4.1 Section 4.2 and Section 7.9
(i) All main pipes, distinguished by operating pressure;	Section 7.9
(ii) All ICPs that have a significant impact on network operations or asset management priorities, and a description of that impact;	Section 7.9
(iii) All gate stations;	Section 7.9
(iv) All pressure regulation stations; and	Section 7.9
(b) if applicable, the locations where a significant change has occurred since the previous disclosure of the information referred to in subclause 4.2(a), including-	N/A
(i) a description of the parts of the network that are affected by the change; and	N/A
(ii) a description of the nature of the change.	N/A
NETWORK ASSETS BY CATEGORY	
5. The AMP must describe the network assets by providing the following information for each asset category-	
5.1. pressure;	Section 4.2

5.2.	description and quantity of assets;	Section 4.2
5.3.	age profiles; and	Section 4.2
5.4.	a discussion of the results of formal risk assessments of the assets, further broken down by subcategory as appropriate. Systemic issues leading to the premature replacement of assets or parts of assets should be discussed.	Section 4.4 and Section 5
6.	The asset categories discussed in clause 5 should include at least the following:	
6.1.	the categories listed in the Report on Forecast Capital Expenditure in Schedule 11a(iii); and	Section 5.2
6.2.	assets owned by the GDB but installed at gate stations owned by others.	Section 4.2
SERVICE LEVELS		
7.	The AMP must clearly identify or define a set of performance indicators for which annual performance targets have been defined. The annual performance targets must be consistent with business strategies and asset management objectives and be provided for each year of the AMP planning period. The targets should reflect what is practically achievable given the current network configuration, condition and planned expenditure levels. The targets should be disclosed for each year of the AMP planning period.	Section 2.2 and Section 7.3
8.	Performance indicators for which targets are defined in clause 7 must include—	
8.1.	the DPP requirements required under the price quality path determination applying to the regulatory assessment period in which the next disclosure year falls;	Section 2.2 and Section 7.3
8.2.	consumer oriented indicators that preferably differentiate between different consumer types;	Section 2.2 and Section 7.3
8.3.	indicators of asset performance, asset efficiency and effectiveness, and service efficiency, such as technical and financial performance indicators related to the efficiency of asset utilisation and operation; and	Section 2
8.4.	the performance indicators disclosed in Schedule 10b of the determination.	Section 2.2 and Section 7.3
9.	The AMP must describe the basis on which the target level for each performance indicator was determined. Justification for target levels of service includes consumer expectations or demands, legislative, regulatory, and other stakeholders' requirements or considerations. The AMP should demonstrate how stakeholder needs were ascertained and translated into service level targets.	Section 2.2 and Section 3.5
10.	Targets should be compared to historic values where available to provide context and scale to the reader.	Section 2.2
11.	Where forecast expenditure is expected to materially affect performance against a target defined in clause 7, the target should be consistent with the expected change in the level of performance.	N/A
NETWORK DEVELOPMENT PLANNING		
12.	AMPs must provide a detailed description of network development plans, including—	
12.1.	A description of the planning criteria and assumptions for network development;	Section 3.5 and Section 4.3
12.2.	Planning criteria for network developments should be described logically and succinctly. Where probabilistic or scenario-based planning techniques are used, this should be indicated and the methodology briefly described; and	Section 3.5 and Section 4.3

12.3. The use of standardised designs may lead to improved cost efficiencies. This section should discuss:	
(a) the categories of assets and designs that are standardised; and	Section 4.3 and Section 7.2
(b) the approach used to identify standard designs.	Section 4.3
12.4. A description of the criteria used to determine the capacity of equipment for different types of assets or different parts of the network.	Section 3.4, Section 4.1 and Section 4.3
12.5. A description of the process and criteria used to prioritise network development projects and how these processes and criteria align with the overall corporate goals and vision.	Section 6.1
12.6. Details of demand forecasts, the basis on which they are derived, and the specific network locations where constraints are expected due to forecast increases in demand:	Section 3.5, Section 7.5 and Section 7.6
(a) explain the load forecasting methodology and indicate all the factors used in preparing the load estimates;	Section 3.5, Section 4.1 and Section 4.3
(b) provide separate forecasts to at least system level covering at least a minimum five-year forecast period. Discuss how uncertain but substantial individual projects/developments that affect load are taken into account in the forecasts, making clear the extent to which these uncertain increases in demand are reflected in the forecasts; and	Section 4.1 and Section 7.5
(c) identify any network or equipment constraints that may arise due to the anticipated growth in demand during the AMP planning period.	Section 5.1, Section 7.5 and Section 7.6
12.7. Analysis of the significant network level development options identified and details of the decisions made to satisfy and meet target levels of service, including-	
(a) the reasons for choosing a selected option for projects where decisions have been made;	Section 5.1
(b) alternative Options assessment for projects that are planned to start in the next five years; and	Section 5.1
(c) consideration of planned innovations that improve efficiencies within the network, such as improved utilisation, extended asset lives, and deferred investment.	Section 5.1
12.8. A description and identification of the network development programme and actions to be taken, including associated expenditure projections. The network development plan must include-	
(a) a detailed description of the material projects and a summary description of the non-material projects currently underway or planned to start within the next 12 months;	Section 5.1 and Section 7.8
(b) a summary description of the programmes and projects planned for the following four years (where known); and	Section 5.1
(c) an overview of the material projects being considered for the remainder of the AMP planning period.	Section 5.1

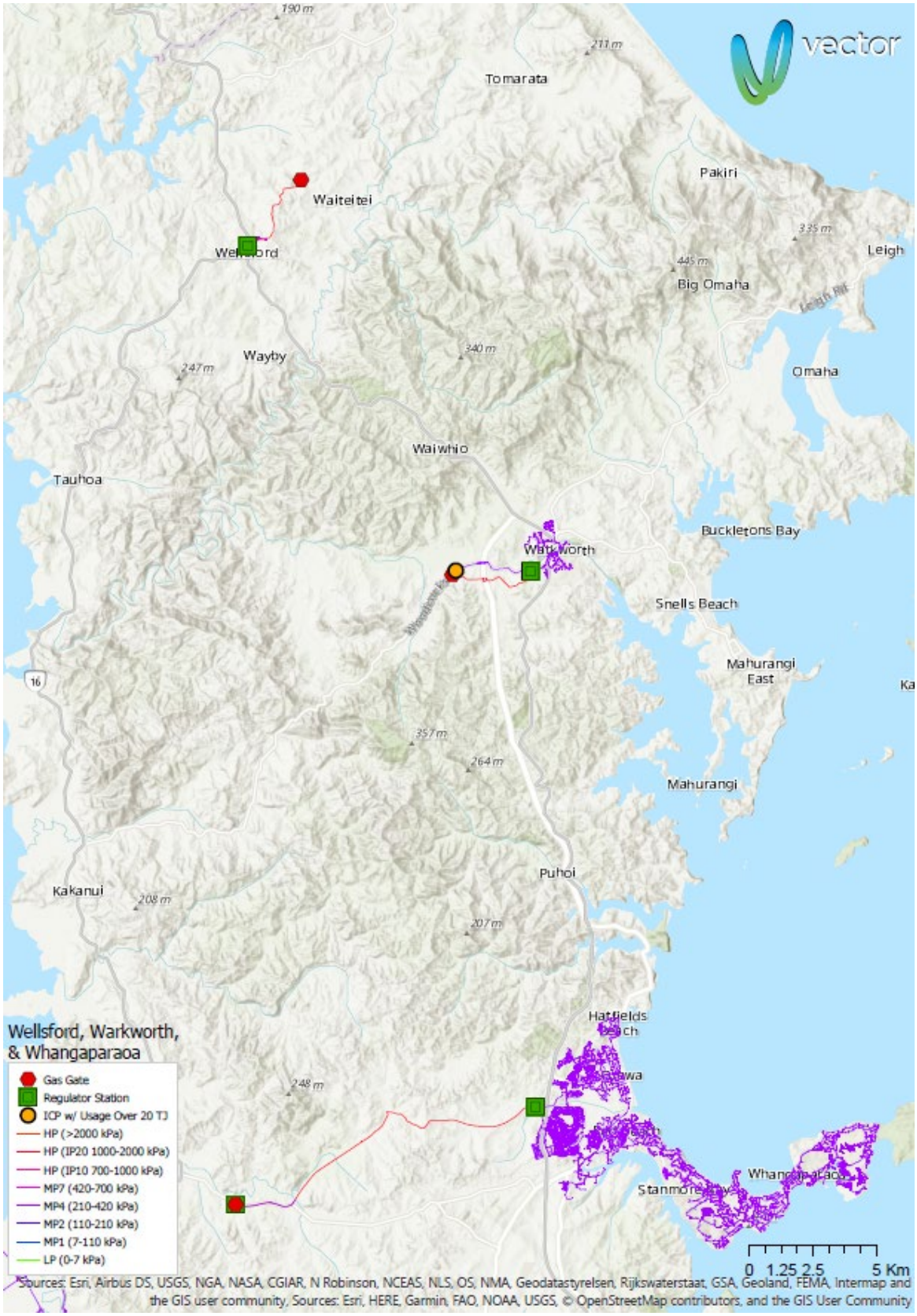
LIFECYCLE ASSET MANAGEMENT PLANNING (MAINTENANCE AND RENEWAL)		
13.	The AMP must provide a detailed description of the lifecycle asset management processes, including—	
13.1.	The key drivers for maintenance planning and assumptions;	Section 4.3 and Section 4.4
13.2.	Identification of routine and corrective maintenance and inspection policies and programmes and actions to be taken for each asset category, including associated expenditure projections. This must include-	Section 4.3 and Section 5.2
(a)	the approach to inspecting and maintaining each category of assets, including a description of the types of inspections, tests and condition monitoring carried out and the intervals at which this is done;	Section 3.4
(b)	any systemic problems identified with any particular asset types and the proposed actions to address these problems; and	Section 4.4 and Section 5.2
(c)	budgets for maintenance activities broken down by asset category for the AMP planning period;	Section 5.2
13.3.	Identification of asset replacement and renewal policies and programmes and actions to be taken for each asset category, including associated expenditure projections. This must include-	
(a)	the processes used to decide when and whether an asset is replaced or refurbished, including a description of the factors on which decisions are based, and consideration of future demands on the network and the optimum use of existing network assets;	Section 4.3
(b)	a description of innovations that have deferred asset replacements;	Section 5.2
(c)	a description of the projects currently underway or planned for the next 12 months;	Section 5.2 and Section 7.8
(d)	a summary of the projects planned for the following four years (where known); and	Section 5.2
(e)	an overview of other work being considered for the remainder of the AMP planning period; and	Section 5.2
13.4.	The asset categories discussed in clauses 13.2 and 13.3 should include at least the categories in clause 6.	Compliant
NON-NETWORK DEVELOPMENT, MAINTENANCE AND RENEWAL		
14.	AMPs must provide a summary description of material non-network development, maintenance and renewal plans, including—	
14.1.	a description of non-network assets;	Section 4.2
14.2.	development, maintenance and renewal policies that cover them;	Section 4.2
14.3.	a description of material capital expenditure projects (where known) planned for the next five years; and	Section 5.2
14.4.	a description of material maintenance and renewal projects planned (where known) for the next five years.	Section 5.3

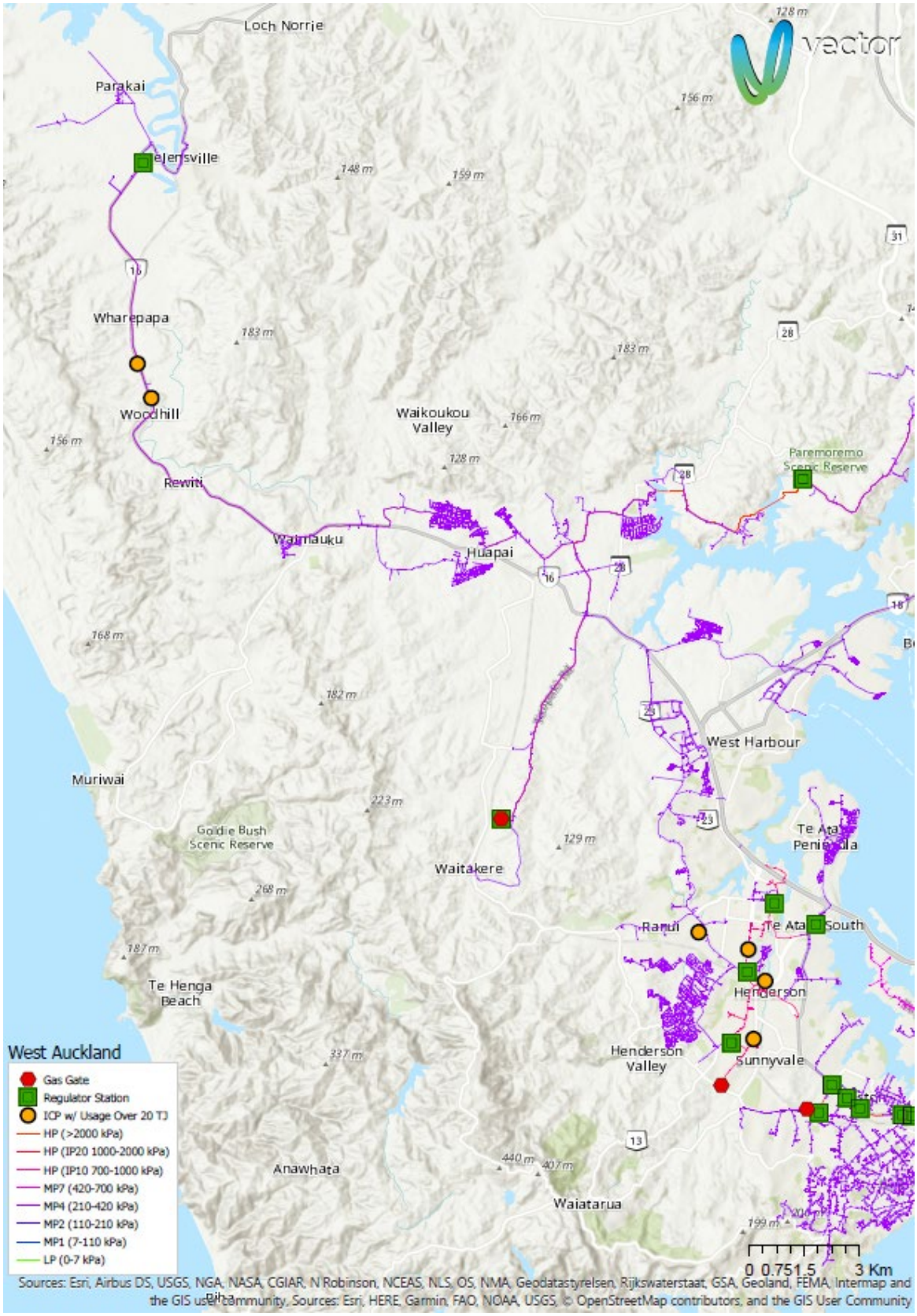
RISK MANAGEMENT		
15.	AMPs must provide details of risk policies, assessment, and mitigation, including—	Section 3.5
15.1.	Methods, details and conclusions of risk analysis;	Section 3.5
15.2.	Strategies used to identify areas of the network that are vulnerable to high impact low probability events and a description of the resilience of the network and asset management systems to such events;	Section 3.5 and Section 4.3
15.3.	A description of the policies to mitigate or manage the risks of events identified in clause 15.2; and	Section 3.5 and Section 3.8
15.4.	Details of emergency response and contingency plans.	Section 3.8 and Section 3.12
EVALUATION OF PERFORMANCE		
16.	AMPs must provide details of performance measurement, evaluation, and improvement, including—	
16.1.	A review of progress against plan, both physical and financial;	Section 5, Section 6.4 and Section 7.8
16.2.	An evaluation and comparison of actual service level performance against targeted performance-	Section 2.2 and Section 7.3
16.3.	An evaluation and comparison of the results of the asset management maturity assessment disclosed in the Report on Asset Management Maturity set out in Schedule 13 against relevant objectives of the GDB's asset management and planning processes.	Section 3.7
16.4.	An analysis of gaps identified in clauses 16.2 and 16.3. Where significant gaps exist (not caused by one-off factors), the AMP must describe any planned initiatives to address the situation.	Section 2.2, Section 3.7 and Section 5
CAPABILITY TO DELIVER		
17.	AMPs must describe the processes used by the GDB to ensure that-	
17.1.	The AMP is realistic and the objectives set out in the plan can be achieved; and	Section 6.1 and Section 6.2
17.2.	The organisation structure and the processes for authorisation and business capabilities will support the implementation of the AMP plans.	Section 6.3

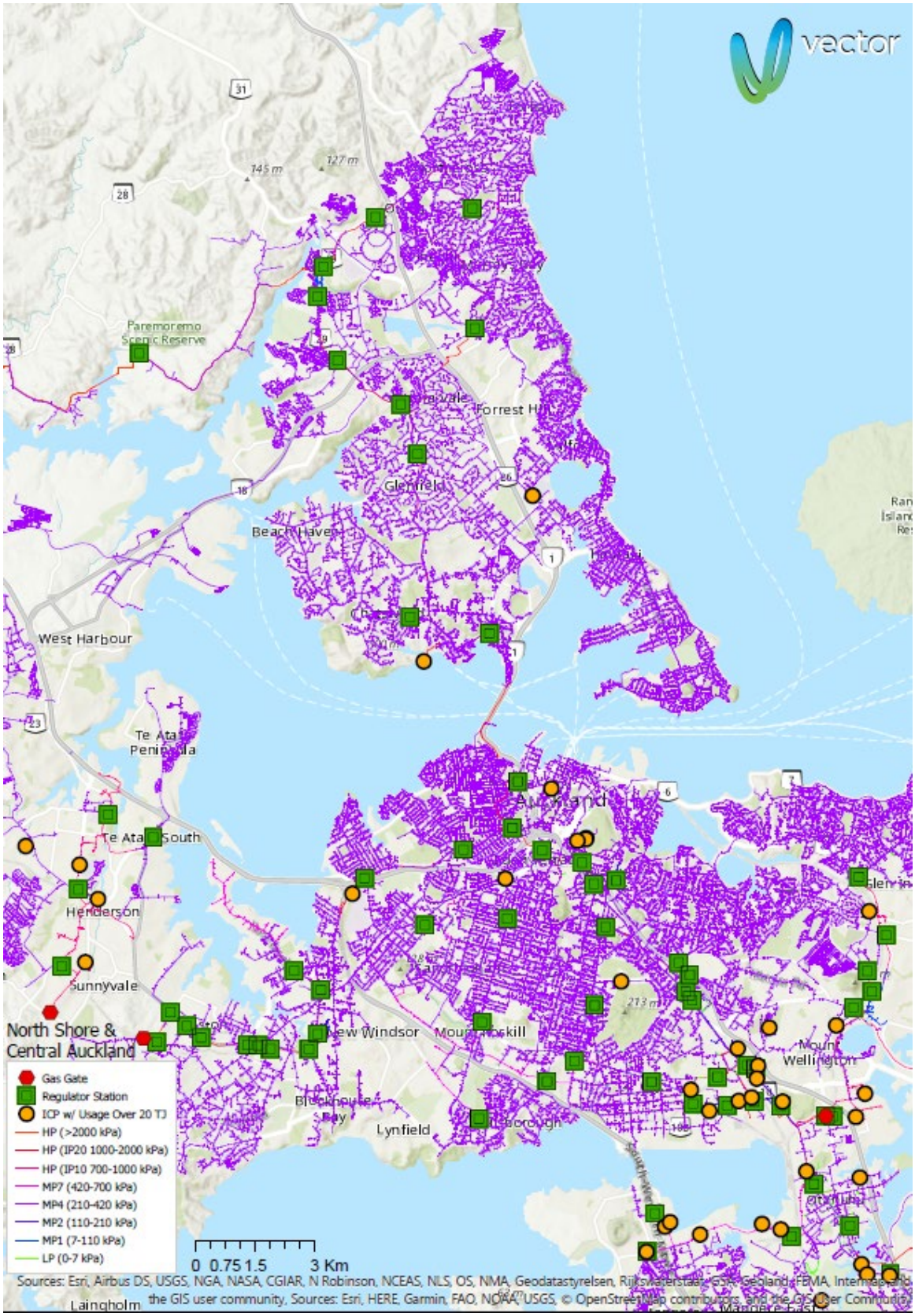
7.8 Appendix H – Significant Changes From 2019 AMP

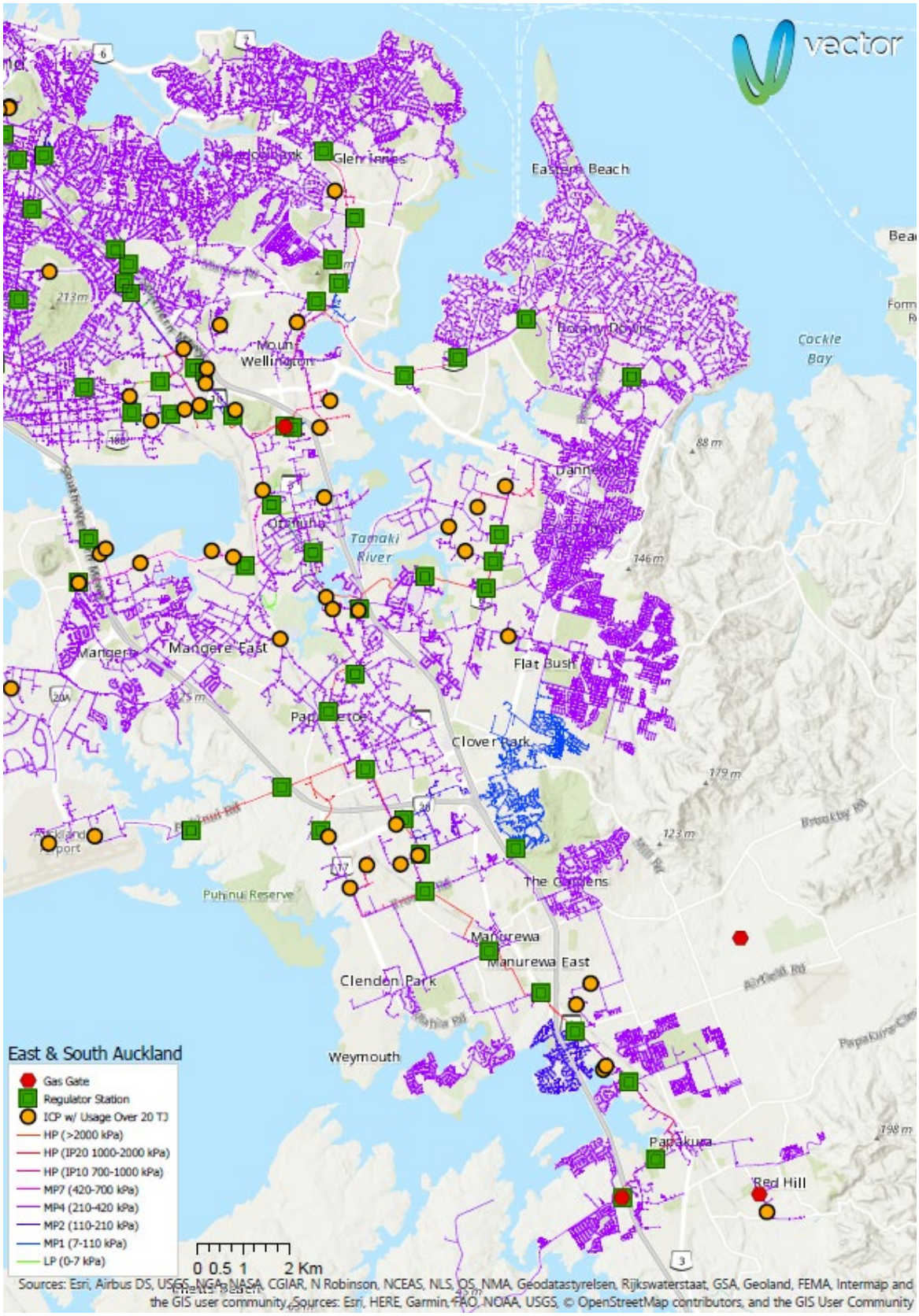
2020 AMP SCHEDULE DATE	PROJECT AND PROGRAMME DESCRIPTION	2020 AMP SCHEDULE DATE	REASON FOR CHANGE
FY20	Kingfisher RTU replacement	FY21	Completed
FY26	New remote pressure monitoring devices installations	FY21	Project reassessed - additional sites
FY20	Ray Emery Drive MP4 PE pipe installation	FY21	Completed
FY21	Remuera MP4 mains RNF Phase-1	Beyond FY29	Project reassessed - project split
FY21	Totara Heights MP1	FY27	Project reassessed - safety requirement
FY21	Gilbert Rd to Alexander Cr Steel Main extension	FY20	Carry over project
FY27	Auckland Airport bridge MP4 upgrade	FY24	Alternative solutions
FY30	Auckland Airport DR00107 upgrade	FY23	Alternative solutions
FY27	Taupaki new HP DRS installation	FY25	Alternative solutions
Beyond FY30	Takapuna 150mm steel pipeline reinforcement for Devonport	FY23	Alternative solutions
Beyond FY30	Takapuna new DRS installation for Devonport	FY23	Alternative solutions
FY25	Remuera rd and St Stephens ave PE pipe crossings	FY26	Revised pressure forecast
FY25	Remuera MP4 mains RNF Phase-2	FY28	Project reassessed - project split
FY26	Remuera MP4 mains RNF Phase-3	FY29	Project reassessed - project split
FY26	Woodcocks Rd to Sandspitt Rd PE pipe installation	FY25	Project reassessed
FY21	DRS earthing and bonding	FY20	Project reassessed - additional sites
-	Electrical Hazard Management Plan mitigation measures	FY21	Project cost reallocated
FY22	Devonport PE pipe crossings	FY20	Project reassessed - additional sites
-	Winston Wallboards	FY21	Project removed
-	Park Estate Rd housing development	FY21	Project removed
FY25	Harris Rd intersection DRS136 upgrade SOS	FY20	Align with AT timing
FY22	Auckland Airport SOS	FY21	Project reassessed
-	Wainui Rd 150mm extenstion SOS	FY22	Project reassessed
FY21	New Papakura ICCP system	-	New Project
FY24	Special-crossing upgrade programme	-	New Project
FY23	Takapuna RNF reinforcement	-	New Project
FY23	Wainui DRS Upgrade	-	New Project
FY22	Remuera PE pipe crossings	-	New Project
FY28	Remuera new DRS	-	New Project
FY23	Drury Merging	-	New Project
-	Gate station upgrades	-	New Programme
FY21	Warkworth IP/DRS relocation	-	New Project
-	MP4 network meshing	-	New Programme

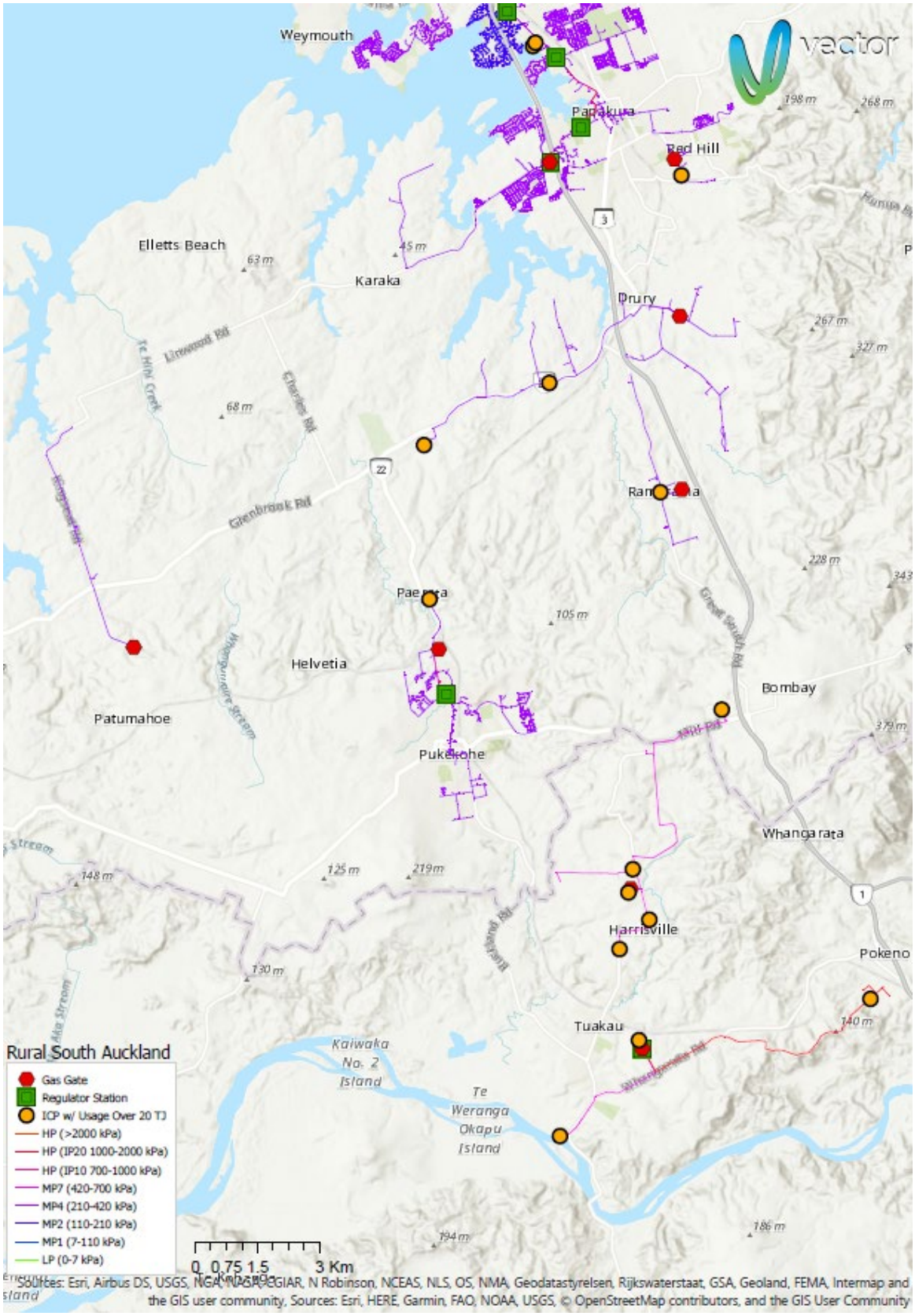
7.9 Appendix I – Gas Distribution Maps




Loch Norrie
Parakai
Helensville
Wharepapa
Woodhill
Waikoukou Valley
Rewiti
Waimauku
Huapai
Paremoremo Scenic Reserve
West Harbour
Muriwai
Goldie Bush Scenic Reserve
Waitakere
Te Henga Beach
Ranui
Te Atatu South
Henderson
Henderson Valley
Sunnyvale
Anawhata
Waiatarua
West Auckland
Gas Gate
Regulator Station
ICP w/ Usage Over 20 TJ
HP (>2000 kPa)
HP (IP20 1000-2000 kPa)
HP (IP10 700-1000 kPa)
MP7 (420-700 kPa)
MP4 (210-420 kPa)
MP2 (110-210 kPa)
MP1 (7-110 kPa)
LP (0-7 kPa)
0 0.751.5 3 Km
Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community, Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community


vector
Paremoremo Scenic Reserve
Forrest Hill
Glenfield
Beach Haven
West Harbour
Te Ata Peninsula
Te Ata South
Henderson
Sunnyvale
North Shore & Central Auckland
New Windsor
Lynfield
Mount Wellington
Gas Gate
Regulator Station
ICP w/ Usage Over 20 TJ
HP (>2000 kPa)
HP (IP20 1000-2000 kPa)
HP (IP10 700-1000 kPa)
MP7 (420-700 kPa)
MP4 (210-420 kPa)
MP2 (110-210 kPa)
MP1 (7-110 kPa)
LP (0-7 kPa)
0 0.75 1.5 3 Km
Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap, and the GIS user community, Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community


East & South Auckland
Gas Gate
Regulator Station
ICP w/ Usage Over 20 TJ
HP (>2000 kPa)
HP (IP20 1000-2000 kPa)
HP (IP10 700-1000 kPa)
MP7 (420-700 kPa)
MP4 (210-420 kPa)
MP2 (110-210 kPa)
MP1 (7-110 kPa)
LP (0-7 kPa)
0 0.5 1 2 Km
Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community, Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community
vector
Glen Innes
Eastern Beach
Mount Wellington
Cockle Bay
Otahuhu
Tamaki River
Mangere
Mangere East
Flat Bush
Clover Park
Puhinui Reserve
Manurewa
Manurewa East
Clendon Park
Weymouth
Papakura
Red Hill


Weymouth
Papakura
Red Hill
Elletts Beach
Karaka
Drury
Pukekohe
Helvetia
Patumahoe
Bombay
Whangarata
Harrisville
Pokeno
Tuakau
Kaiwaka No. 2 Island
Te Weranga Okapu Island
Rural South Auckland
Gas Gate
Regulator Station
ICP w/ Usage Over 20 TJ
HP (>2000 kPa)
HP (IP20 1000-2000 kPa)
HP (IP10 700-1000 kPa)
MP7 (420-700 kPa)
MP4 (210-420 kPa)
MP2 (110-210 kPa)
MP1 (7-110 kPa)
LP (0-7 kPa)
0 0.75 1.5 3 Km
Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community, Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

7.10 Appendix J – Report on Forecast Capital Expenditure (Schedule 11a)

Company Name	**Vector Limited**
AMP Planning Period	**1 July 2020 – 30 June 2030**

SCHEDULE 11a: REPORT ON FORECAST CAPITAL EXPENDITURE

This schedule requires a breakdown of forecast expenditure on assets for the current disclosure year and a 10 year planning period. The forecasts should be consistent with the supporting information set out in the AMP. The forecast is to be expressed in both constant price and nominal dollar terms. Also required is a forecast of the value of commissioned assets (i.e., the value of RAB additions)
GDBs must provide explanatory comment on the difference between constant price and nominal dollar forecasts of expenditure on assets in Schedule 14a (Mandatory Explanatory Notes).
This information is not part of audited disclosure information.

sch ref			*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*	*CY+6*	*CY+7*	*CY+8*	*CY+9*	*CY+10*
8		for year ended	**30 Jun 20**	**30 Jun 21**	**30 Jun 22**	**30 Jun 23**	**30 Jun 24**	**30 Jun 25**	**30 Jun 26**	**30 Jun 27**	**30 Jun 28**	**30 Jun 29**	**30 Jun 30**
9	**11a(i): Expenditure on Assets Forecast**		**$000 (nominal dollars)**										
10	Consumer connection		14,895	17,508	17,337	17,458	17,878	18,283	18,283	18,686	19,097	19,517	19,946
11	System growth		658	3,169	1,561	2,233	5,216	4,337	2,023	3,005	2,424	835	1,316
12	Asset replacement and renewal		2,454	3,318	3,139	3,221	3,280	2,791	2,626	2,454	2,508	2,563	2,620
13	Asset relocations		2,222	4,565	2,779	4,927	6,413	6,558	6,558	4,626	3,422	3,497	3,574
14	Reliability, safety and environment:												
15	Quality of supply		395	35	1,022	404	55	702	57	-	-	759	212
16	Legislative and regulatory		19	-	-	-	-	-	-	-	-	-	-
17	Other reliability, safety and environment		159	491	56	856	59	60	60	61	63	64	65
18	**Total reliability, safety and environment**		573	526	1,078	1,260	114	762	116	61	63	823	278
19	**Expenditure on network assets**		20,802	29,086	25,894	29,099	32,901	32,731	29,606	28,832	27,514	27,235	27,734
20	Expenditure on non-network assets		2,055	1,901	3,275	2,379	2,521	2,304	1,874	1,605	2,299	1,810	1,705
21	**Expenditure on assets**		22,857	30,987	29,169	31,478	35,422	35,035	31,481	30,437	29,813	29,045	29,438
22													
23	*plus* Cost of financing		163	259	226	249	329	308	240	249	238	200	211
24	*less* Value of capital contributions		5,693	9,114	7,598	7,565	7,747	7,922	8,096	8,274	8,456	8,643	8,833
25	*plus* Value of vested assets		-	-	-	-	-	-	-	-	-	-	-
26	**Capital expenditure forecast**		17,327	22,132	21,797	24,162	28,004	27,421	23,625	22,412	21,595	20,602	20,816
27													
28	Assets commissioned		17,979	21,526	21,258	23,507	27,450	26,798	23,852	22,606	21,776	20,659	21,156
29													
30			*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*	*CY+6*	*CY+7*	*CY+8*	*CY+9*	*CY+10*
31		for year ended	**30 Jun 20**	**30 Jun 21**	**30 Jun 22**	**30 Jun 23**	**30 Jun 24**	**30 Jun 25**	**30 Jun 26**	**30 Jun 27**	**30 Jun 28**	**30 Jun 29**	**30 Jun 30**
32			**$000 (in constant prices)**										
33	Consumer connection		14,895	17,028	16,439	16,148	16,172	16,172	16,172	16,172	16,172	16,172	16,172
34	System growth		658	3,082	1,480	2,065	4,718	3,836	1,789	2,601	2,053	692	1,067
35	Asset replacement and renewal		2,454	3,227	2,976	2,979	2,967	2,469	2,323	2,124	2,124	2,124	2,124
36	Asset relocations		2,222	4,440	2,635	4,557	5,801	5,801	5,801	4,004	2,898	2,898	2,898
37	Reliability, safety and environment:												
38	Quality of supply		395	34	969	374	50	621	50	-	-	629	172
39	Legislative and regulatory		19	-	-	-	-	-	-	-	-	-	-
40	Other reliability, safety and environment		159	478	53	792	53	53	53	53	53	53	53
41	**Total reliability, safety and environment**		573	512	1,022	1,166	103	674	103	53	53	682	225
42	**Expenditure on network assets**		20,802	28,289	24,552	26,915	29,761	28,952	26,188	24,954	23,300	22,568	22,486
43	Expenditure on non-network assets		2,055	1,849	3,105	2,200	2,280	2,038	1,658	1,389	1,947	1,500	1,382
44	**Expenditure on assets**		22,857	30,138	27,657	29,115	32,041	30,990	27,846	26,343	25,247	24,068	23,868
45	**Subcomponents of expenditure on assets (where known)**												
46	Research and development		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5	CY+6	CY+7	CY+8	CY+9	CY+10
for year ended		30 Jun 20	30 Jun 21	30 Jun 22	30 Jun 23	30 Jun 24	30 Jun 25	30 Jun 26	30 Jun 27	30 Jun 28	30 Jun 29	30 Jun 30
Difference between nominal and constant price forecasts		$000										
Consumer connection		-	480	898	1,310	1,706	2,111	2,111	2,514	2,925	3,345	3,774
System growth		-	87	81	168	498	501	234	404	371	143	249
Asset replacement and renewal		-	91	163	242	313	322	303	330	384	439	496
Asset relocations		-	125	144	370	612	757	757	622	524	599	676
Reliability, safety and environment:												
Quality of supply		-	1	53	30	5	81	7	-	-	130	40
Legislative and regulatory		-	-	-	-	-	-	-	-	-	-	-
Other reliability, safety and environment		-	13	3	64	6	7	7	8	10	11	12
Total reliability, safety and environment		-	14	56	94	11	88	13	8	10	141	53
Expenditure on network assets		-	797	1,342	2,184	3,140	3,779	3,418	3,878	4,214	4,667	5,248
Expenditure on non-network assets		-	52	170	179	241	266	216	216	352	310	323
Expenditure on assets		-	849	1,512	2,363	3,381	4,045	3,635	4,094	4,566	4,977	5,570

		Current Year CY	CY+1	CY+2	CY+3	CY+4	CY+5
11a(ii): Consumer Connection	for year ended	30 Jun 20	30 Jun 21	30 Jun 22	30 Jun 23	30 Jun 24	30 Jun 25
*Consumer types defined by GDB**		$000 (in constant prices)					
Mains Extensions/Subdivisions		4,430	5,384	5,384	5,384	5,408	5,408
Service Connections - Residential		9,195	9,713	9,124	8,833	8,833	8,833
Service Connections - Commercial		1,270	1,931	1,931	1,931	1,931	1,931
Customer Easements		-	-	-	-	-	-
* include additional rows if needed							
Consumer connection expenditure		14,895	17,028	16,439	16,148	16,172	16,172
less Capital contributions funding consumer connection		4,161	4,809	4,673	4,606	4,615	4,615
Consumer connection less capital contributions		10,734	12,219	11,766	11,542	11,557	11,557
11a(iii): System Growth							
Intermediate pressure							
Main pipe		-	1,561	-	-	1,949	-
Service pipe		-	-	-	-	-	-
Stations		69	448	448	448	580	1,042
Line valve		-	-	-	-	-	-
Special crossings		-	-	-	-	-	-
Intermediate Pressure total		69	2,009	448	448	2,529	1,042
Medium pressure							
Main pipe		589	1,073	1,032	1,617	2,189	2,794
Service pipe		-	-	-	-	-	-
Stations		-	-	-	-	-	-
Line valve		-	-	-	-	-	-
Special crossings		-	-	-	-	-	-
Medium Pressure total		589	1,073	1,032	1,617	2,189	2,794

92		**Low Pressure**						
93		Main pipe	-	-	-	-	-	-
94		Service pipe	-	-	-	-	-	-
95		Line valve	-	-	-	-	-	-
96		Special crossings	-	-	-	-	-	-
97		**Low Pressure total**	-	-	-	-	-	-
98		**Other network assets**						
99		Monitoring and control systems	-	-	-	-	-	-
100		Cathodic protection systems	-	-	-	-	-	-
101		Other assets (other than above)	-	-	-	-	-	-
102		**Other network assets total**	-	-	-	-	-	-
103								
104		**System growth expenditure**	658	3,082	1,480	2,065	4,718	3,836
105	*less*	Capital contributions funding system growth						
106		**System growth less capital contributions**	658	3,082	1,480	2,065	4,718	3,836
107								
108								
109			*Current Year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
		for year ended	**30 Jun 20**	**30 Jun 21**	**30 Jun 22**	**30 Jun 23**	**30 Jun 24**	**30 Jun 25**
110	**11a(iv): Asset Replacement and Renewal**							
111		**Intermediate pressure**	**$000 (in constant prices)**					
112		Main pipe	-	-	-	-	-	-
113		Service pipe	-	-	-	-	-	-
114		Stations	566	551	551	551	551	551
115		Line valve	134	-	-	-	-	-
116		Special crossings	408	509	459	53	53	53
117		**Intermediate Pressure total**	1,108	1,060	1,010	604	604	604
118		**Medium pressure**						
119		Main pipe	1,178	1,426	1,374	1,672	1,771	1,374
120		Service pipe	112	-	-	-	-	-
121		Station	27	300	300	300	300	199
122		Line valve	-	-	-	-	-	-
123		Special crossings	-	-	-	-	-	-
124		**Medium Pressure total**	1,317	1,726	1,674	1,972	2,071	1,573
125		**Low Pressure**						
126		Main pipe	-	-	-	-	-	-
127		Service pipe	-	-	-	-	-	-
128		Line valve	-	-	-	-	-	-
129		Special crossings	-	-	-	-	-	-
130		**Low Pressure total**	-	-	-	-	-	-

131	**Other network assets**						
132	Monitoring and control systems	4	64	64	64	64	64
133	Cathodic protection systems	25	275	126	237	126	126
134	Other assets (other than above)	-	102	102	102	102	102
135	**Other network assets total**	29	441	292	403	292	292
136							
137	**Asset replacement and renewal expenditure**	2,454	3,227	2,976	2,979	2,967	2,469
138	*less* Capital contributions funding asset replacement and renewal						
139	**Asset replacement and renewal less capital contributions**	2,454	3,227	2,976	2,979	2,967	2,469
140							

11a(v): Asset Relocations

142	*Project or programme**						
143							
144							
145							
146							
147							
148	** include additional rows if needed*						
149	All other projects or programmes - asset relocations	2,222	4,440	2,635	4,557	5,801	5,801
150	**Asset relocations expenditure**	2,222	4,440	2,635	4,557	5,801	5,801
151	*less* Capital contributions funding asset relocations	1,532	4,055	2,531	2,392	2,392	2,392
152	**Asset relocations less capital contributions**	690	385	104	2,165	3,409	3,409
153							

11a(vi): Quality of Supply

		Current Year CY	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
154	for year ended	**30 Jun 20**	**30 Jun 21**	**30 Jun 22**	**30 Jun 23**	**30 Jun 24**	**30 Jun 25**
155							
156							
157	*Project or programme**	**$000 (in constant prices)**					
158							
159							
160							
161							
162							
163	** include additional rows if needed*						
164	All other projects or programmes - quality of supply	395	34	969	374	50	621
165	**Quality of supply expenditure**	395	34	969	374	50	621
166	*less* Capital contributions funding quality of supply						
167	**Quality of supply less capital contributions**	395	34	969	374	50	621
168							

11a(vii): Legislative and Regulatory

	Project or programme						
	** include additional rows if needed*						
	All other projects or programmes - legislative and regulatory	19	-	-	-	-	-
	Legislative and regulatory expenditure	19	-	-	-	-	-
	less Capital contributions funding legislative and regulatory						
	Legislative and regulatory less capital contributions	19	-	-	-	-	-

11a(viii): Other Reliability, Safety and Environment

	*Project or programme**						
	** include additional rows if needed*						
	All other projects or programmes - other reliability, safety and environment	159	478	53	792	53	53
	Other reliability, safety and environment expenditure	159	478	53	792	53	53
	less Capital contributions funding other reliability, safety and environment						
	Other Reliability, safety and environment less capital contributions	159	478	53	792	53	53

11a(ix): Non-Network Assets

Routine expenditure

	*Project or programme**						
	** include additional rows if needed*						
	All other projects or programmes - routine expenditure	1,347	1,426	1,829	1,312	1,680	1,643
	Routine expenditure	1,347	1,426	1,829	1,312	1,680	1,643

Atypical expenditure

	*Project or programme**						
	** include additional rows if needed*						
	All other projects or programmes - atypical expenditure	708	423	1,276	888	600	395
	Atypical expenditure	708	423	1,276	888	600	395
	Expenditure on non-network assets	2,055	1,849	3,105	2,200	2,280	2,038

7.11 Appendix K – Report on Forecast Operational Expenditure (Schedule 11b)

Company Name	**Vector Limited**
AMP Planning Period	**1 July 2020 – 30 June 2030**

SCHEDULE 11b: REPORT ON FORECAST OPERATIONAL EXPENDITURE

This schedule requires a breakdown of forecast operational expenditure for the disclosure year and a 10 year planning period. The forecasts should be consistent with the supporting information set out in the AMP. The forecast is to be expressed in both constant price and nominal dollar terms.
GDBs must provide explanatory comment on the difference between constant price and nominal dollar operational expenditure forecasts in Schedule 14a (Mandatory Explanatory Notes).
This information is not part of audited disclosure information.

sch ref												
7		*Current year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*	*CY+6*	*CY+7*	*CY+8*	*CY+9*	*CY+10*
8	for year ended	**30 Jun 20**	**30 Jun 21**	**30 Jun 22**	**30 Jun 23**	**30 Jun 24**	**30 Jun 25**	**30 Jun 26**	**30 Jun 27**	**30 Jun 28**	**30 Jun 29**	**30 Jun 30**
9	**Operational Expenditure Forecast**	**$000 (in nominal dollars)**										
10	Service interruptions, incidents and emergencies	2,193	2,287	2,338	2,390	2,440	2,491	2,543	2,596	2,650	2,705	2,761
11	Routine and corrective maintenance and inspection	2,912	3,108	3,157	2,950	3,014	3,080	3,146	3,214	3,282	3,352	3,425
12	Asset replacement and renewal	-	-	-	-	-	-	-	-	-	-	-
13	**Network opex**	5,105	5,395	5,495	5,340	5,454	5,571	5,689	5,810	5,932	6,057	6,186
14	System operations and network support	2,901	2,963	3,029	3,096	3,161	3,228	3,295	3,364	3,434	3,505	3,578
15	Business support	4,969	5,085	5,198	5,313	5,424	5,539	5,654	5,771	5,891	6,014	6,139
16	**Non-network opex**	7,870	8,048	8,227	8,409	8,585	8,767	8,949	9,135	9,325	9,519	9,717
17	**Operational expenditure**	12,975	13,443	13,722	13,749	14,039	14,338	14,638	14,945	15,257	15,576	15,903
18		*Current year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*	*CY+6*	*CY+7*	*CY+8*	*CY+9*	*CY+10*
19	for year ended	**30 Jun 20**	**30 Jun 21**	**30 Jun 22**	**30 Jun 23**	**30 Jun 24**	**30 Jun 25**	**30 Jun 26**	**30 Jun 27**	**30 Jun 28**	**30 Jun 29**	**30 Jun 30**
20		**$000 (in constant prices)**										
21	Service interruptions, incidents and emergencies	2,193	2,235	2,235	2,235	2,235	2,235	2,235	2,235	2,235	2,235	2,235
22	Routine and corrective maintenance and inspection	2,912	3,037	3,018	2,759	2,761	2,763	2,765	2,767	2,768	2,770	2,772
23	Asset replacement and renewal	-	-	-	-	-	-	-	-	-	-	-
24	**Network opex**	5,105	5,272	5,253	4,994	4,996	4,998	5,000	5,002	5,003	5,005	5,007
25	System operations and network support	2,901	2,896	2,896	2,896	2,896	2,896	2,896	2,896	2,896	2,896	2,896
26	Business support	4,969	4,969	4,969	4,969	4,969	4,969	4,969	4,969	4,969	4,969	4,969
27	**Non-network opex**	7,870	7,865	7,865	7,865	7,865	7,865	7,865	7,865	7,865	7,865	7,865
28	**Operational expenditure**	12,975	13,137	13,118	12,859	12,861	12,863	12,865	12,867	12,868	12,870	12,872
29	**Subcomponents of operational expenditure (where known)**											
30	Research and development	-	-	-	-	-	-	-	-	-	-	-
	Insurance	252	252	258	264	270	276	281	287	293	299	306
32												
33		*Current year CY*	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*	*CY+6*	*CY+7*	*CY+8*	*CY+9*	*CY+10*
34	for year ended	**30 Jun 20**	**30 Jun 21**	**30 Jun 22**	**30 Jun 23**	**30 Jun 24**	**30 Jun 25**	**30 Jun 26**	**30 Jun 27**	**30 Jun 28**	**30 Jun 29**	**30 Jun 30**
35	**Difference between nominal and real forecasts**	**$000**										
36	Service interruptions, incidents and emergencies	-	52	103	155	205	256	308	361	415	470	526
37	Routine and corrective maintenance and inspection	-	71	139	191	253	317	381	447	514	582	653
38	Asset replacement and renewal	-	-	-	-	-	-	-	-	-	-	-
39	**Network opex**	-	123	242	346	458	573	689	808	929	1,052	1,179
40	System operations and network support	-	67	133	200	265	332	399	468	538	609	682
41	Business support	-	116	229	344	455	570	685	802	922	1,045	1,170
42	**Non-network opex**	-	183	362	544	720	902	1,084	1,270	1,460	1,654	1,852
43	**Operational expenditure**	-	306	604	890	1,178	1,475	1,773	2,078	2,389	2,706	3,031

7.12 Appendix L – Report on Asset Condition (Schedule 12a)

Company Name	**Vector Limited**
AMP Planning Period	**1 July 2020 – 30 June 2030**

SCHEDULE 12a: REPORT ON ASSET CONDITION

This schedule requires a breakdown of asset condition by asset class as at the start of the forecast year. The data accuracy assessment relates to the percentage values disclosed in the asset condition columns. Also required is a forecast of the percentage of units to be replaced in the next 5 years. All information should be consistent with the information provided in the AMP and the expenditure on assets forecast in Schedule 11a.

sch ref

					Asset condition at start of planning period (percentage of units by grade)						
8	Operating Pressure	Asset category	Asset class	Units	Grade 1	Grade 2	Grade 3	Grade 4	Grade unknown	Data accuracy (1–4)	% of asset forecast to be replaced in next 5 years
9	Intermediate Pressure	Main pipe	IP PE main pipe	km	-	-	-	-	-	N/A	-
10	Intermediate Pressure	Main pipe	IP steel main pipe	km	-	-	100.00%	-	-	3	-
11	Intermediate Pressure	Main pipe	IP other main pipe	km	-	-	-	-	-	N/A	-
12	Intermediate Pressure	Service pipe	IP PE service pipe	km	-	-	-	-	-	N/A	-
13	Intermediate Pressure	Service pipe	IP steel service pipe	km	-	-	100.00%	-	-	3	-
14	Intermediate Pressure	Service pipe	IP other service pipe	km	-	-	-	-	-	N/A	-
15	Intermediate Pressure	Stations	Intermediate pressure DRS	No.	1.22%	-	97.56%	1.22%	-	4	5.05
16	Intermediate Pressure	Line valve	IP line valves	No.	-	2.18%	80.25%	3.89%	13.69%	3	-
17	Intermediate Pressure	Special crossings	IP crossings	No.	-	-	80.00%	20.00%	-	3	13.70
18	Medium Pressure	Main pipe	MP PE main pipe	km	-	0.41%	1.59%	98.00%	-	3	0.21
19	Medium Pressure	Main pipe	MP steel main pipe	km	-	-	100.00%	-	-	3	-
20	Medium Pressure	Main pipe	MP other main pipe	km	-	100.00%	-	-	-	3	100.00
21	Medium Pressure	Service pipe	MP PE service pipe	km	-	0.22%	99.78%	-	-	3	0.11
22	Medium Pressure	Service pipe	MP steel service pipe	km	-	-	100.00%	-	-	3	-
23	Medium Pressure	Service pipe	MP other service pipe	km	-	-	100.00%	-	-	3	-
24	Medium Pressure	Stations	Medium pressure DRS	No.	-	-	94.12%	5.88%	-	4	-
25	Medium Pressure	Line valve	MP line valves	No.	-	2.00%	78.80%	7.42%	11.78%	3	-
26	Medium Pressure	Special crossings	MP special crossings	No.	-	6.06%	63.64%	30.30%	-	3	10.70
27	Low Pressure	Main pipe	LP PE main pipe	km	-	-	13.61%	86.39%	-	3	-
28	Low Pressure	Main pipe	LP steel main pipe	km	-	-	-	-	-	N/A	-
29	Low Pressure	Main pipe	LP other main pipe	km	-	-	-	-	-	N/A	-
30	Low Pressure	Service pipe	LP PE service pipe	km	-	-	9.18%	90.82%	-	3	-
31	Low Pressure	Service pipe	LP steel service pipe	km	-	-	100.00%	-	-	3	-
32	Low Pressure	Service pipe	LP other service pipe	km	-	-	-	-	-	N/A	-
33	Low Pressure	Line valve	LP line valves	No.	-	-	50.00%	-	50.00%	3	-
34	Low Pressure	Special crossings	LP special crossings	No.	-	-	-	-	-	N/A	-
35	All	Monitoring and control systems	Remote terminal units	No.	-	-	18.57%	81.43%	-	4	
36	All	Cathodic protection systems	Cathodic protection	No.	-	9.52%	57.14%	33.33%	-	3	11.78

7.13 Appendix M – Report on Forecast Utilisation (Schedule 12b)

Company Name	**Vector Limited**
AMP Planning Period	**1 July 2020 – 30 June 2030**

SCHEDULE 12b: REPORT ON FORECAST UTILISATION

This Schedule requires a breakdown of current and forecast utilisation (for heavily utilised pipelines) consistent with the information provided in the AMP and the demand forecast in schedule S12c.

sch ref

Forecast Utilisation of Heavily Utilised Pipelines

Utilisation

Region	Network	Pressure system	Nominal operating pressure (NOP) (kPa)	Minimum operating pressure (MinOP) (kPa)	Total capacity at MinOP (scmh)	Remaining capacity at MinOP (scmh)	Unit	*Current Year CY* y/e 30 Jun 20	*CY+1* y/e 30 Jun 21	*CY+2* y/e 30 Jun 22	*CY+3* y/e 30 Jun 23	*CY+4* y/e 30 Jun 24	*CY+5* y/e 30 Jun 25	Comment
Auckland	Auckland Central	AU North Shore MP4	400	200	13,957	21	scmh	13,937	14,084	14,233	14,383	14,535	14,689	The pressure increase in CY+1 is due to the proposed network meshing in the network prior to the major reinforcement of constructing a new 160mm PE MP4 pipeline in CY+2.
							kPa	216	227	277	274	271	269	
Auckland	Warkworth	WW Warkworth	1,900	800	866	198	scmh	668	687	698	708	720	731	CY was modelled based on the lowest recorded supply pressure at the gate station (1,313 kPa). FirstGas are proposing to increase the supply pressure to 1,500 kPa in CY+1. Following the supply pressure increase, the system will not reach the 60% limits of NOP. Nevertheless, Vector will consider relocating the downstream DRS in CY+1 due to ongoing development in this area.
							kPa	1,017	1,270	1,258	1,246	1,234	1,222	
							scmh							
							kPa							
							scmh							
							kPa							

** Current year utilisation figures may be estimates. Year 1–5 figures show the utilisation forecast to occur given the expected system configuration for each year, including the effect of any new investment in the pressure system.*

Disclaimer for supply enquiries

The information in this table contains modelled estimates of utilisation and capacity. Any interested party seeking to invest in supply from Vector's distribution networks should contact their retailer and confirm availability of capacity.

Notes and assumptions

1. A 'heavily utilised' pressure system is a pressure system where the modelled flow rate, at system peak during 2019, is greater than or equal to 500 scmh, and its utilisation (pressure drop) is greater than or equal to 40% from the nominal operating pressure (NOP). The utilisation of a pressure system is calculated using the formula: [1 – (system minimum pressure/nominal operating pressure)] *100%; the pressure values are considered based on the stimulated corresponding flow rates.
2. The remaining capacity of a 'heavily utilised' pressure system is obtained by examining the modelled flows at various extremity points in each pressure system, and the level at which the minimum operating pressure (MinOP) is reached. Vector's security standards set the MinOP at 50% of the rated pressure (which equates to approximately 82% of the pipeline capacity) for a pressure system (based on standard operating pressures). The minimum modelled flow rate, analysed at one extremity point, is used to calculate the remaining capacity of the entire pressure system being studied.
3. A forecast model of a pressure system is obtained by applying either its forecast flow rate or an annual growth rate in each forecast year; and scaling its loads evenly to give the system total flow. The resulting minimum system pressure is simulated on this basis.
4. The forecast system flow for the Central Auckland network system is based on an annual growth rate of 1.056%. The stated growth rate extrapolates trends across historical actuals, which include the flows most recently observed during 2019.
5. Stated annual growth rates are averaged across a 10-year planning period. Owing to seasonality factors influencing the forecasting model the discrete forecast system flows may not mirror the 10-year averaged growth rate incrementally.
6. Schedule 12b provides a snapshot in time of the pressure system capacity, at the date of its preparation, and it should be noted that the figures will change over time. Schedule 12b is provided on the basis that it be used for consumer guidance only.
7. The capacity limits specified in Schedule 12b for each 'heavily utilised' pressure system, highlight only the most constrained part of the pressure system. At that specific location the MinOP is lowest; in reality more capacity may be available at other locations within the pressure or network system.
8. Consumers considering using gas or wanting more capacity should always contact Vector to confirm availability. In these cases, Vector will prepare a dedicated model that will provide an accurate assessment of available gas capacity at the specified location.
9. The network models used to compile Schedule 12b are updated on a 3 year rolling cycle, meaning that the model update, forecast and validation of some models may not have been updated since 2018.
10. It has been assumed that the load forecasting documented in the AMP is correct, and that all assumptions and risks associated with this forecasting have been reviewed and approved as part of a separate exercise associated with signing off the AMP.

7.14 Appendix N – Report on Forecast Demand (Schedule 12c)

Company Name	**Vector Limited**
AMP Planning Period	**1 July 2020 – 30 June 2030**

SCHEDULE 12c: REPORT ON FORECAST DEMAND

This schedule requires a forecast of new connections (by consumer type), peak demand and energy volumes for the disclosure year and a 5 year planning period. The forecasts should be consistent with the supporting information set out in the AMP as well as the assumptions used in developing the expenditure forecasts in Schedule 11a and Schedule 11b and the capacity and utilisation forecasts in Schedule 12b.

sch ref

12c(i) Consumer Connections

Number of ICPs connected in year by consumer type

	Current year CY	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
Consumer types defined by GDB	**30 Jun 20**	**30 Jun 21**	**30 Jun 22**	**30 Jun 23**	**30 Jun 24**	**30 Jun 25**
Residential	3,390	3,563	3,347	3,240	3,240	3,240
Commercial	182	185	185	185	185	185
Total	3,572	3,748	3,532	3,425	3,425	3,425

12c(ii): Gas Delivered

	Current year CY	*CY+1*	*CY+2*	*CY+3*	*CY+4*	*CY+5*
	30 Jun 20	**30 Jun 21**	**30 Jun 22**	**30 Jun 23**	**30 Jun 24**	**30 Jun 25**
Number of ICPs at year end (at year end)	114,151	116,658	118,948	121,132	123,315	125,499
Maximum daily load (GJ per day)	60,892	63,552	64,272	64,991	65,710	66,430
Maximum monthly load (GJ per month)	1,544,032	1,543,594	1,557,462	1,571,331	1,585,200	1,599,068
Number of directly billed ICPs (at year end)	-	-	-	-	-	-
Total gas conveyed (GJ per annum)	14,646,524	14,752,189	14,931,796	15,109,848	15,283,257	15,453,220
Average daily delivery (GJ per day)	40,018	40,417	40,909	41,397	41,758	42,338
Load factor	79.05%	79.64%	79.89%	80.13%	80.34%	80.53%

7.15 Appendix O – Asset Management Maturity (Schedule 13)

Company Name	**Vector Limited**
AMP Planning Period	**1 July 2020 – 30 June 2030**
Asset Management Standard Applied	

SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY

This schedule requires information on the GDB'S self-assessment of the maturity of its asset management practices.

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	Record/documented Information
3	Asset management policy	To what extent has an asset management policy been documented, authorised and communicated?	3	Vector's Asset Management Policy has been authorised by our Chief Network Officer. The document is part of the controlled document management system and reviewed periodically.		Widely used AM practice standards require an organisation to document, authorise and communicate its asset management policy (eg, as required in PAS 55 para 4.2 i). A key pre-requisite of any robust policy is that the organisation's top management must be seen to endorse and fully support it. Also vital to the effective implementation of the policy, is to tell the appropriate people of its content and their obligations under it. Where an organisation outsources some of its asset-related activities, then these people and their organisations must equally be made aware of the policy's content. Also, there may be other stakeholders, such as regulatory authorities and shareholders who should be made aware of it.	Top management. The management team that has overall responsibility for asset management.	The organisation's asset management policy, its organisational strategic plan, documents indicating how the asset management policy was based upon the needs of the organisation and evidence of communication.
10	Asset management strategy	What has the organisation done to ensure that its asset management strategy is consistent with other appropriate organisational policies and strategies, and the needs of stakeholders?	2	Good asset management is practiced implicitly based on the policies and strategies which are approved by Vector's Board. The Board also approves the asset management plans and associated budget. However, there is room to improve.		In setting an organisation's asset management strategy, it is important that it is consistent with any other policies and strategies that the organisation has and has taken into account the requirements of relevant stakeholders. This question examines to what extent the asset management strategy is consistent with other organisational policies and strategies (eg, as required by PAS 55 para 4.3.1 b) and has taken account of stakeholder requirements as required by PAS 55 para 4.3.1 c). Generally, this will take into account the same polices, strategies and stakeholder requirements as covered in drafting the asset management policy but at a greater level of detail.	Top management. The organisation's strategic planning team. The management team that has overall responsibility for asset management.	The organisation's asset management strategy document and other related organisational policies and strategies. Other than the organisation's strategic plan, these could include those relating to health and safety, environmental, etc. Results of stakeholder consultation.
11	Asset management strategy	In what way does the organisation's asset management strategy take account of the lifecycle of the assets, asset types and asset systems over which the organisation has stewardship?	2	Specific and more detailed asset management strategies are being developed for all assets. Lifecycle cost and service implications are adequately considered in maintenance and replacement decisions. This is an ongoing program of work with the opportunity to improve and integrate the results with Vector's Condition Based Asset Risk Management (CBARM) models once these are developed.		Good asset stewardship is the hallmark of an organisation compliant with widely used AM standards. A key component of this is the need to take account of the lifecycle of the assets, asset types and asset systems. (For example, this requirement is recognised in 4.3.1 d) of PAS 55). This question explores what an organisation has done to take lifecycle into account in its asset management strategy.	Top management. People in the organisation with expert knowledge of the assets, asset types, asset systems and their associated life-cycles. The management team that has overall responsibility for asset management. Those responsible for developing and adopting methods and processes used in asset management	The organisation's documented asset management strategy and supporting working documents.
26	Asset management plan(s)	How does the organisation establish and document its asset management plan(s) across the life cycle activities of its assets and asset systems?	2	High level strategies and plans are contained in the Asset Management Plan (AMP). Life cycle activities are documented in the form of standards (maintenance, inspection, testing). Asset condition data for two types of assets (DRS's and bridge crossings) and the collection process will be expanded to ensure the remaining assets are included, and specific asset strategies will be developed.		The asset management strategy need to be translated into practical plan(s) so that all parties know how the objectives will be achieved. The development of plan(s) will need to identify the specific tasks and activities required to optimize costs, risks and performance of the assets and/or asset system(s), when they are to be carried out and the resources required.	The management team with overall responsibility for the asset management system. Operations, maintenance and engineering managers.	The organisation's asset management plan(s).

Company Name	**Vector Limited**
AMP Planning Period	**1 July 2020 – 30 June 2030**
Asset Management Standard Applied	

SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	Record/documented Information
27	Asset management plan(s)	How has the organisation communicated its plan(s) to all relevant parties to a level of detail appropriate to the receiver's role in their delivery?	3	The AMP is communicated to all stakeholders including employees and Field Service Providers (FSPs). The organisation, end to end process, Vector's Delegated Financial Authorities (DFA) and works programmes are all set up to deliver the works effectively. The AMP is also published on the Vector web site. A monthly meeting is held to review and report progress against the plan with all internal stakeholders present.		Plans will be ineffective unless they are communicated to all those, including contracted suppliers and those who undertake enabling function(s). The plan(s) need to be communicated in a way that is relevant to those who need to use them.	The management team with overall responsibility for the asset management system. Delivery functions and suppliers.	Distribution lists for plan(s). Documents derived from plan(s) which detail the receivers role in plan delivery. Evidence of communication.
29	Asset management plan(s)	How are designated responsibilities for delivery of asset plan actions documented?	3	The AMP outlines the key roles responsible for the delivery for the AMP. Vector's delegated authorities framework and policy, and position descriptions for each role define the roles and authorities further. Key tasks and responsibilities are allocated to team members who report on progress against plan on a monthly basis.		The implementation of asset management plan(s) relies on (1) actions being clearly identified, (2) an owner allocated and (3) that owner having sufficient delegated responsibility and authority to carry out the work required. It also requires alignment of actions across the organisation. This question explores how well the plan(s) set out responsibility for delivery of asset plan actions.	The management team with overall responsibility for the asset management system. Operations, maintenance and engineering managers. If appropriate, the performance management team.	The organisation's asset management plan(s). Documentation defining roles and responsibilities of individuals and organisational departments.
31	Asset management plan(s)	What has the organisation done to ensure that appropriate arrangements are made available for the efficient and cost effective implementation of the plan(s)? (Note this is about resources and enabling support)	3	Vector has a process to optimise proposed projects to improve cost effective delivery. Regular meetings with FSPs on capital and maintenance programmes, identify any potential resource constraints. Specialised resources are employed as required e.g. resource consents and pipeline fracture control plans .		It is essential that the plan(s) are realistic and can be implemented, which requires appropriate resources to be available and enabling mechanisms in place. This question explores how well this is achieved. The plan(s) not only need to consider the resources directly required and timescales, but also the enabling activities, including for example, training requirements, supply chain capability and procurement timescales.	The management team with overall responsibility for the asset management system. Operations, maintenance and engineering managers. If appropriate, the performance management team. If appropriate, the performance management team. Where appropriate the procurement team and service providers working on the organisation's asset-related activities.	The organisation's asset management plan(s). Documented processes and procedures for the delivery of the asset management plan.
33	Contingency planning	What plan(s) and procedure(s) does the organisation have for identifying and responding to incidents and emergency situations and ensuring continuity of critical asset management activities?	3	Contingency plans are in place for emergency events, business continuity, supply restoration, response to natural disasters, health, safety and environmental events. Regular reviews of events are conducted weekly, in addition to an annual emergency exercise, performed to test response preparedness.		Widely used AM practice standards require that an organisation has plan(s) to identify and respond to emergency situations. Emergency plan(s) should outline the actions to be taken to respond to specified emergency situations and ensure continuity of critical asset management activities including the communication to, and involvement of, external agencies. This question assesses if, and how well, these plan(s) triggered, implemented and resolved in the event of an incident. The plan(s) should be appropriate to the level of risk as determined by the organisation's risk assessment methodology. It is also a requirement that relevant personnel are competent and trained.	The manager with responsibility for developing emergency plan(s). The organisation's risk assessment team. People with designated duties within the plan(s) and procedure(s) for dealing with incidents and emergency situations.	The organisation's plan(s) and procedure(s) for dealing with emergencies. The organisation's risk assessments and risk registers.

Company Name	**Vector Limited**
AMP Planning Period	**1 July 2020 – 30 June 2030**
Asset Management Standard Applied	

SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	Record/documented Information
37	Structure, authority and responsibilities	What has the organisation done to appoint member(s) of its management team to be responsible for ensuring that the organisation's assets deliver the requirements of the asset management strategy, objectives and plan(s)?	3	As defined in the AMP, the COO - Electricity Gas & Fibre has overall responsibility for Vector's Network Asset Management. The Heads of Gas Networks, Field Services, Capital Programme Delivery, Customer Excellence and Commercial Strategy all report to the COO and are tasked with delivering various parts of the asset management policy and plan. External Field Services Providers have a good understanding of their roles in the delivery of asset management strategy, objectives and plans.		In order to ensure that the organisation's assets and asset systems deliver the requirements of the asset management policy, strategy and objectives responsibilities need to be allocated to appropriate people who have the necessary authority to fulfil their responsibilities. (This question, relates to the organisation's assets eg, para b), s 4.4.1 of PAS 55, making it therefore distinct from the requirement contained in para a), s 4.4.1 of PAS 55).	Top management. People with management responsibility for the delivery of asset management policy, strategy, objectives and plan(s). People working on asset-related activities.	Evidence that managers with responsibility for the delivery of asset management policy, strategy, objectives and plan(s) have been appointed and have assumed their responsibilities. Evidence may include the organisation's documents relating to its asset management system, organisational charts, job descriptions of post-holders, annual targets/objectives and personal development plan(s) of post-holders as appropriate.
40	Structure, authority and responsibilities	What evidence can the organisation's top management provide to demonstrate that sufficient resources are available for asset management?	3	Vector utilises external FSP's and consultants to supplement internal resources to help deliver on its AMP. Specialist consultants provide advice on resource consents, pipeline route assessment and engineering analysis.		Optimal asset management requires top management to ensure sufficient resources are available. In this context the term 'resources' includes manpower, materials, funding and service provider support.	Top management. The management team that has overall responsibility for asset management. Risk management team. The organisation's managers involved in day-to-day supervision of asset-related activities, such as frontline managers, engineers, foremen and chargehands as appropriate.	Evidence demonstrating that asset management plan(s) and/or the process(es) for asset management plan implementation consider the provision of adequate resources in both the short and long term. Resources include funding, materials, equipment, services provided by third parties and personnel (internal and service providers) with appropriate skills competencies and knowledge.
42	Structure, authority and responsibilities	To what degree does the organisation's top management communicate the importance of meeting its asset management requirements?	3	Service Levels and KPI's are set and monitored across the organisation through readily accessible dashboards. In addition, monthly reporting, quarterly team updates and strong engagement with programme delivery and service providers ensure that there is a strong focus on the delivery of asset management requirements.		Widely used AM practice standards require an organisation to communicate the importance of meeting its asset management requirements such that personnel fully understand, take ownership of, and are fully engaged in the delivery of the asset management requirements (eg, PAS 55 s 4.4.1 g).	Top management. The management team that has overall responsibility for asset management. People involved in the delivery of the asset management requirements.	Evidence of such activities as road shows, written bulletins, workshops, team talks and management walk-abouts would assist an organisation to demonstrate it is meeting this requirement of PAS 55.
45	Outsourcing of asset management activities	Where the organisation has outsourced some of its asset management activities, how has it ensured that appropriate controls are in place to ensure the compliant delivery of its organisational strategic plan, and its asset management policy and strategy?	3	Maintenance, design and planning standards have been developed which together, with the controls established in the commercial contracts with the service providers, ensure that the KPI's established are being monitored and deficiencies addressed. Maintenance information is collected and stored in SAP-PM. The requirements and performance expectations are communicated through well-established communications mechanisms. Dedicated field assessors provide assurance against these standards.		Where an organisation chooses to outsource some of its asset management activities, the organisation must ensure that these outsourced process(es) are under appropriate control to ensure that all the requirements of widely used AM standards (eg, PAS 55) are in place, and the asset management policy, strategy objectives and plan(s) are delivered. This includes ensuring capabilities and resources across a time span aligned to life cycle management. The organisation must put arrangements in place to control the outsourced activities, whether it be to external providers or to other in-house departments. This question explores what the organisation does in this regard.	Top management. The management team that has overall responsibility for asset management. The manager(s) responsible for the monitoring and management of the outsourced activities. People involved with the procurement of outsourced activities. The people within the organisations that are performing the outsourced activities. The people impacted by the outsourced activity.	The organisation's arrangements that detail the compliance required of the outsourced activities. For example, this this could form part of a contract or service level agreement between the organisation and the suppliers of its outsourced activities. Evidence that the organisation has demonstrated to itself that it has assurance of compliance of outsourced activities.

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	Record/documented Information
48	Training, awareness and competence	How does the organisation develop plan(s) for the human resources required to undertake asset management activities - including the development and delivery of asset management strategy, process(es), objectives and plan(s)?	2	An HR strategy is in place to align competencies and human resources with Vector's AMP and strategy, but there is still opportunity to improve. A cadet program is in place and some asset management training is completed.		There is a need for an organisation to demonstrate that it has considered what resources are required to develop and implement its asset management system. There is also a need for the organisation to demonstrate that it has assessed what development plan(s) are required to provide its human resources with the skills and competencies to develop and implement its asset management systems. The timescales over which the plan(s) are relevant should be commensurate with the planning horizons within the asset management strategy considers e.g. if the asset management strategy considers 5, 10 and 15 year time scales then the human resources development plan(s) should align with these. Resources include both 'in house' and external resources who undertake asset management activities.	Senior management responsible for agreement of plan(s). Managers responsible for developing asset management strategy and plan(s). Managers with responsibility for development and recruitment of staff (including HR functions). Staff responsible for training. Procurement officers. Contracted service providers.	Evidence of analysis of future work load plan(s) in terms of human resources. Document(s) containing analysis of the organisation's own direct resources and contractors resource capability over suitable timescales. Evidence, such as minutes of meetings, that suitable management forums are monitoring human resource development plan(s). Training plan(s), personal development plan(s), contract and service level agreements.
49	Training, awareness and competence	How does the organisation identify competency requirements and then plan, provide and record the training necessary to achieve the competencies?	2	The competency requirements and associated training requirements e.g. Certificate of Competence (CoC) are well established for safety critical activities across both FSP's and Vector. Individuals when recruited have their competency assessed against the job skill requirements. Training needs are identified and agreed. Training achieved is recorded in Vector's learning management system. However, there is room for improvement through ongoing succession and talent development plans and ongoing skills development in asset management. A qualifications register is maintained which identifies CoC expiry dates and any refresher training required.		Widely used AM standards require that organisations to undertake a systematic identification of the asset management awareness and competencies required at each level and function within the organisation. Once identified the training required to provide the necessary competencies should be planned for delivery in a timely and systematic way. Any training provided must be recorded and maintained in a suitable format. Where an organisation has contracted service providers in place then it should have a means to demonstrate that this requirement is being met for their employees. (eg, PAS 55 refers to frameworks suitable for identifying competency requirements).	Senior management responsible for agreement of plan(s). Managers responsible for developing asset management strategy and plan(s). Managers with responsibility for development and recruitment of staff (including HR functions). Staff responsible for training. Procurement officers. Contracted service providers.	Evidence of an established and applied competency requirements assessment process and plan(s) in place to deliver the required training. Evidence that the training programme is part of a wider, co-ordinated asset management activities training and competency programme. Evidence that training activities are recorded and that records are readily available (for both direct and contracted service provider staff) e.g. via organisation wide information system or local records database.
50	Training, awareness and competence	How does the organization ensure that persons under its direct control undertaking asset management related activities have an appropriate level of competence in terms of education, training or experience?	3	The competency requirements and associated training requirements are well established for safety critical activities across both FSP's and Vector. These are assessed regularly and the currency monitored. As mentioned above, there is still room for improvement.		A critical success factor for the effective development and implementation of an asset management system is the competence of persons undertaking these activities. organisations should have effective means in place for ensuring the competence of employees to carry out their designated asset management function(s). Where an organisation has contracted service providers undertaking elements of its asset management system then the organisation shall assure itself that the outsourced service provider also has suitable arrangements in place to manage the competencies of its employees. The organisation should ensure that the individual and corporate competencies it requires are in place and actively monitor, develop and maintain an appropriate balance of these competencies.	Managers, supervisors, persons responsible for developing training programmes. Staff responsible for procurement and service agreements. HR staff and those responsible for recruitment.	Evidence of a competency assessment framework that aligns with established frameworks such as the asset management Competencies Requirements Framework (Version 2.0); National Occupational Standards for Management and Leadership; UK Standard for Professional Engineering Competence, Engineering Council, 2005.
53	Communication, participation and consultation	How does the organisation ensure that pertinent asset management information is effectively communicated to and from employees and other stakeholders, including contracted service providers?	3	Readily accessible two-way communication channels are in place for staff and other stakeholders in the form of dashboards, reporting, standards, meetings and additional information on Vector's web site. In addition, the FSPs have direct access to a suite of controlled technical standards and pertinent systems, such as GIS and SAP. The effectiveness of these are reviewed and monitored regularly. Regular operational meetings are held with the FSPs to review the delivery of the annual plans and identify any areas for improvement.		Widely used AM practice standards require that pertinent asset management information is effectively communicated to and from employees and other stakeholders including contracted service providers. Pertinent information refers to information required in order to effectively and efficiently comply with and deliver asset management strategy, plan(s) and objectives. This will include for example the communication of the asset management policy, asset performance information, and planning information as appropriate to contractors.	Top management and senior management representative(s), employee's representative(s), employee's trade union representative(s); contracted service provider management and employee representative(s); representative(s) from the organisation's Health, Safety and Environmental team. Key stakeholder representative(s).	Asset management policy statement prominently displayed on notice boards, intranet and internet; use of organisation's website for displaying asset performance data; evidence of formal briefings to employees, stakeholders and contracted service providers; evidence of inclusion of asset management issues in team meetings and contracted service provider contract meetings; newsletters, etc.

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	Record/documented Information
59	Asset Management System documentation	What documentation has the organisation established to describe the main elements of its asset management system and interactions between them?	2	The AMP is approved by the Board and widely communicated to internal and external stakeholders, including FSPs. In addition, a comprehensive set of design, maintenance and operating standards have been established. Specific asset strategy plans are being developed and enhancements to Vector's asset management framework and system are underway.		Widely used AM practice standards require an organisation maintain up to date documentation that ensures that its asset management systems (ie, the systems the organisation has in place to meet the standards) can be understood, communicated and operated. (eg, s 4.5 of PAS 55 requires the maintenance of up to date documentation of the asset management system requirements specified throughout s 4 of PAS 55).	The management team that has overall responsibility for asset management. Managers engaged in asset management activities.	The documented information describing the main elements of the asset management system (process(es)) and their interaction.
62	Information management	What has the organisation done to determine what its asset management information system(s) should contain in order to support its asset management system?	2	Asset Management Systems have been developed but are evolving further. This includes further collection and analysis of data and improving the utilisation of SAP for asset lifecycle information. A data analytics team has been established to deliver consistent and relevant information needed for quality decision-making. With the review of the asset maintenance standards, a data standard will be developed to ensure the data standards align with the business requirements for information. An Enterprise Information Management team has been established to ensure the requirements for data and data quality improvement are considered.		Effective asset management requires appropriate information to be available. Widely used AM standards therefore require the organisation to identify the asset management information it requires in order to support its asset management system. Some of the information required may be held by suppliers. The maintenance and development of asset management information systems is a poorly understood specialist activity that is akin to IT management but different from IT management. This group of questions provides some indications as to whether the capability is available and applied. Note: To be effective, an asset information management system requires the mobilisation of technology, people and process(es) that create, secure, make available and destroy the information required to support the asset management system.	The organisation's strategic planning team. The management team that has overall responsibility for asset management. Information management team. Operations, maintenance and engineering managers	Details of the process the organisation has employed to determine what its asset information system should contain in order to support its asset management system. Evidence that this has been effectively implemented.
63	Information management	How does the organisation maintain its asset management information system(s) and ensure that the data held within it (them) is of the requisite quality and accuracy and is consistent?	2	Controls have been developed to govern the data quality in Vector's asset management systems. However, there are still gaps in the data and more work is needed to improve this in time. A comprehensive data standard is being developed to ensure quality and consistency of asset master data throughout its lifecycle. Data assurance processes exist to ensure the data is accurate and complete.		The response to the questions is progressive. A higher scale cannot be awarded without achieving the requirements of the lower scale. This question explores how the organisation ensures that information management meets widely used AM practice requirements (eg, s 4.4.6 (a), (c) and (d) of PAS 55).	The management team that has overall responsibility for asset management. Users of the organisational information systems.	The asset management information system, together with the policies, procedure(s), improvement initiatives and audits regarding information controls.
64	Information management	How has the organisation's ensured its asset management information system is relevant to its needs?	2	Business requirements such as condition data and updated AS/NZ standards have driven the need for a review of Vector's standards. Condition data requirements are being reviewed to improve the integrity and quality of the data. With the review of the asset maintenance standards, a data standard will be developed to ensure the data standards align with the business requirements for information.		Widely used AM standards need not be prescriptive about the form of the asset management information system, but simply require that the asset management information system is appropriate to the organisations needs, can be effectively used and can supply information which is consistent and of the requisite quality and accuracy.	The organisation's strategic planning team. The management team that has overall responsibility for asset management. Information management team. Users of the organisational information systems.	The documented process the organisation employs to ensure its asset management information system aligns with its asset management requirements. Minutes of information systems review meetings involving users.

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	Record/documented Information
69	Risk management process(es)	How has the organisation documented process(es) and/or procedure(s) for the identification and assessment of asset and asset management related risks throughout the asset life cycle?	3	Risk management processes are documented and managed proactively with the aid of supporting systems such as Active Risk Manager (ARM), Risk and Incident Management System (RIMS), Failure Mode and Effects Analysis (FMEA), HSE Management Systems and Bowtie Analysis. Both the FMEA and Safety Management Systems specifically work to identify risks through the asset lifecycle. These activities and systems are aligned through an established framework. Improvements in the identification of risk controls and assurance activities are ongoing.		Risk management is an important foundation for proactive asset management. Its overall purpose is to understand the cause, effect and likelihood of adverse events occurring, to optimally manage such risks to an acceptable level, and to provide an audit trail for the management of risks. Widely used standards require the organisation to have process(es) and/or procedure(s) in place that set out how the organisation identifies and assesses asset and asset management related risks. The risks have to be considered across the four phases of the asset lifecycle (eg, para 4.3.3 of PAS 55).	The top management team in conjunction with the organisation's senior risk management representatives. There may also be input from the organisation's Safety, Health and Environment team. Staff who carry out risk identification and assessment.	The organisation's risk management framework and/or evidence of specific process(es) and/ or procedure(s) that deal with risk control mechanisms. Evidence that the process(es) and/or procedure(s) are implemented across the business and maintained. Evidence of agendas and minutes from risk management meetings. Evidence of feedback in to process(es) and/or procedure(s) as a result of incident investigation(s). Risk registers and assessments.
79	Use and maintenance of asset risk information	How does the organisation ensure that the results of risk assessments provide input into the identification of adequate resources and training and competency needs?	3	Risk assessments are used to support high level asset management decisions associated with asset management strategies and plans, and the prioritisation and allocation of resources, budget and activities. These are well established in Vector's risk, incident and investigation processes. However, there is room for further improvements.		Widely used AM standards require that the output from risk assessments are considered and that adequate resource (including staff) and training is identified to match the requirements. It is a further requirement that the effects of the control measures are considered, as there may be implications in resources and training required to achieve other objectives.	Staff responsible for risk assessment and those responsible for developing and approving resource and training plan(s). There may also be input from the organisation's Safety, Health and Environment team.	The organisations risk management framework. The organisation's resourcing plan(s) and training and competency plan(s). The organisation should be able to demonstrate appropriate linkages between the content of resource plan(s) and training and competency plan(s) to the risk assessments and risk control measures that have been developed.
82	Legal and other requirements	What procedure does the organisation have to identify and provide access to its legal, regulatory, statutory and other asset management requirements, and how is requirements incorporated into the asset management system?	3	The business has a regulatory team that advises the business of its obligations. The business utilises "Comply With" software to assist with this. This includes HSE requirements. Regulatory changes are assessed and corresponding changes are made to business operating procedures and practices. In addition, Vector's asset management is also subject to external audit e.g. regular TELARC audits.		In order for an organisation to comply with its legal, regulatory, statutory and other asset management requirements, the organisation first needs to ensure that it knows what they are (eg, PAS 55 specifies this in s 4.4.8). It is necessary to have systematic and auditable mechanisms in place to identify new and changing requirements. Widely used AM standards also require that requirements are incorporated into the asset management system (e.g. procedure(s) and process(es))	Top management. The organisations regulatory team. The organisation's legal team or advisors. The management team with overall responsibility for the asset management system. The organisation's health and safety team or advisors. The organisation's policy making team.	The organisational processes and procedures for ensuring information of this type is identified, made accessible to those requiring the information and is incorporated into asset management strategy and objectives
88	Life Cycle Activities	How does the organisation establish implement and maintain process(es) for the implementation of its asset management plan(s) and control of activities across the creation, acquisition or enhancement of assets. This includes design, modification, procurement, construction and commissioning activities?	3	A suite of technical standards form the basis of Vector's control and management of its network assets. These are supported by the AMP, a maintenance plan and good project and operations management. The effective management of associated projects, budgets and high level work plans are monitored against the expectations established in the AMP. Work is underway to further improve Vector's asset management system.		Life cycle activities are about the implementation of asset management plan(s) i.e. they are the "doing" phase. They need to be done effectively and well in order for asset management to have any practical meaning. As a consequence, widely used standards (eg, PAS 55 s 4.5.1) require organisations to have in place appropriate process(es) and procedure(s) for the implementation of asset management plan(s) and control of lifecycle activities. This question explores those aspects relevant to asset creation.	Asset managers, design staff, construction staff and project managers from other impacted areas of the business, e.g. Procurement	Documented process(es) and procedure(s) which are relevant to demonstrating the effective management and control of life cycle activities during asset creation, acquisition, enhancement including design, modification, procurement, construction and commissioning.

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	Record/documented Information
91	Life Cycle Activities	How does the organisation ensure that process(es) and/or procedure(s) for the implementation of asset management plan(s) and control of activities during maintenance (and inspection) of assets are sufficient to ensure activities are carried out under specified conditions, are consistent with asset management strategy and control cost, risk and performance?	3	A suite of maintenance standards are in place. In addition, a standards improvement register and assurance (audit) process is in place.		Having documented process(es) which ensure the asset management plan(s) are implemented in accordance with any specified conditions, in a manner consistent with the asset management policy, strategy and objectives and in such a way that cost, risk and asset system performance are appropriately controlled is critical. They are an essential part of turning intention into action (eg, as required by PAS 55 s 4.5.1).	Asset managers, operations managers, maintenance managers and project managers from other impacted areas of the business	Documented procedure for review. Documented procedure for audit of process delivery. Records of previous audits, improvement actions and documented confirmation that actions have been carried out.
95	Performance and condition monitoring	How does the organisation measure the performance and condition of its assets?	2	Service levels, asset condition and performance information is gathered and reviewed. Vector has also adopted a condition based risk management approach to its asset management with modelling, dashboard KPI's and performance reporting in development.		Widely used AM standards require that organisations establish implement and maintain procedure(s) to monitor and measure the performance and/or condition of assets and asset systems. They further set out requirements in some detail for reactive and proactive monitoring, and leading/lagging performance indicators together with the monitoring or results to provide input to corrective actions and continual improvement. There is an expectation that performance and condition monitoring will provide input to improving asset management strategy, objectives and plan(s).	A broad cross-section of the people involved in the organisation's asset-related activities from data input to decision-makers, i.e. an end-to end assessment. This should include contactors and other relevant third parties as appropriate.	Functional policy and/or strategy documents for performance or condition monitoring and measurement. The organisation's performance monitoring frameworks, balanced scorecards etc. Evidence of the reviews of any appropriate performance indicators and the action lists resulting from these reviews. Reports and trend analysis using performance and condition information. Evidence of the use of performance and condition information shaping improvements and supporting asset management strategy, objectives and plan(s).
99	Investigation of asset-related failures, incidents and nonconformities	How does the organisation ensure responsibility and the authority for the handling, investigation and mitigation of asset-related failures, incidents and emergency situations and non conformances is clear, unambiguous, understood and communicated?	3	Vector has an investigation process in place and clear responsibilities defined. This is managed in line with Vector's HSE management system and is supported by our Risk and Incident Management and Active Risk Manager systems. Incidents are reported as defined by Vector's Incident Management Process. Major events are investigated systemically, risk assessed and appropriate mitigation plans are developed. Ownership of the actions are defined and followed up and reported on.		Widely used AM standards require that the organisation establishes implements and maintains process(es) for the handling and investigation of failures incidents and non-conformities for assets and sets down a number of expectations. Specifically this question examines the requirement to define clearly responsibilities and authorities for these activities, and communicate these unambiguously to relevant people including external stakeholders if appropriate.	The organisation's safety and environment management team. The team with overall responsibility for the management of the assets. People who have appointed roles within the asset-related investigation procedure, from those who carry out the investigations to senior management who review the recommendations. Operational controllers responsible for managing the asset base under fault conditions and maintaining services to consumers. Contractors and other third parties as appropriate.	Process(es) and procedure(s) for the handling, investigation and mitigation of asset-related failures, incidents and emergency situations and non conformances. Documentation of assigned responsibilities and authority to employees. Job Descriptions, Audit reports. Common communication systems i.e. all Job Descriptions on Internet etc.
105	Audit	What has the organisation done to establish procedure(s) for the audit of its asset management system (process(es))?	3	Vector has an established audit procedure. External and internal audits against maintenance, design and planning standards, and reviews of asset management practices, including action registers from audits, investigations, risks and legal compliance, are carried out on a regular basis. Field work carried out by contractors is sample audited. However, further improvements in the internal audit process and end-to-end capture of audit actions is underway.		This question seeks to explore what the organisation has done to comply with the standard practice AM audit requirements (eg, the associated requirements of PAS 55 s 4.6.4 and its linkages to s 4.7).	The management team responsible for its asset management procedure(s). The team with overall responsibility for the management of the assets. Audit teams, together with key staff responsible for asset management. For example, Asset Management Director, Engineering Director. People with responsibility for carrying out risk assessments	The organisation's asset-related audit procedure(s). The organisation's methodology(s) by which it determined the scope and frequency of the audits and the criteria by which it identified the appropriate audit personnel. Audit schedules, reports etc. Evidence of the procedure(s) by which the audit results are presented, together with any subsequent communications. The risk assessment schedule or risk registers.

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SCHEDULE 13: REPORT ON ASSET MANAGEMENT MATURITY (cont)

Question No.	Function	Question	Score	Evidence—Summary	User Guidance	Why	Who	Record/documented Information
109	Corrective & Preventative action	How does the organisation instigate appropriate corrective and/or preventive actions to eliminate or prevent the causes of identified poor performance and non conformance?	3	Actions arising from audits, investigations, asset performance reviews, risks and legal compliance are captured in various systems and registers. Formal investigation processes are in place for major events. Root cause analysis and condition and performance reviews are being completed when needed but there is room to improve.		Having investigated asset related failures, incidents and non-conformances, and taken action to mitigate their consequences, an organisation is required to implement preventative and corrective actions to address root causes. Incident and failure investigations are only useful if appropriate actions are taken as a result to assess changes to a businesses risk profile and ensure that appropriate arrangements are in place should a recurrence of the incident happen. Widely used AM standards also require that necessary changes arising from preventive or corrective action are made to the asset management system.	The management team responsible for its asset management procedure(s). The team with overall responsibility for the management of the assets. Audit and incident investigation teams. Staff responsible for planning and managing corrective and preventive actions.	Analysis records, meeting notes and minutes, modification records. Asset management plan(s), investigation reports, audit reports, improvement programmes and projects. Recorded changes to asset management procedure(s) and process(es). Condition and performance reviews. Maintenance reviews
113	Continual Improvement	How does the organisation achieve continual improvement in the optimal combination of costs, asset related risks and the performance and condition of assets and asset systems across the whole life cycle?	2	Continuous improvement processes exist for the ongoing improvements to Vector's technical standards. Internal action registers are also in place to capture improvements associated risks, audits and asset performance reviews. Optimisation improvements across risk, cost and performance will improve with improved data and SAP reporting, currently underway. In addition, further embedded risk thinking and assurance processes will drive continuous improvement in budgeting, strategic thinking and project optimisation.		Widely used AM standards have requirements to establish, implement and maintain process(es)/procedure(s) for identifying, assessing, prioritising and implementing actions to achieve continual improvement. Specifically there is a requirement to demonstrate continual improvement in optimisation of cost risk and performance/condition of assets across the life cycle. This question explores an organisation's capabilities in this area—looking for systematic improvement mechanisms rather that reviews and audit (which are separately examined).	The top management of the organisation. The manager/team responsible for managing the organisation's asset management system, including its continual improvement. Managers responsible for policy development and implementation.	Records showing systematic exploration of improvement. Evidence of new techniques being explored and implemented. Changes in procedure(s) and process(es) reflecting improved use of optimisation tools/techniques and available information. Evidence of working parties and research.
115	Continual Improvement	How does the organisation seek and acquire knowledge about new asset management related technology and practices, and evaluate their potential benefit to the organisation?	3	Vector participates in a number of industry groups and national working groups to share knowledge and identify new asset management technologies and practices.		One important aspect of continual improvement is where an organisation looks beyond its existing boundaries and knowledge base to look at what 'new things are on the market'. These new things can include equipment, process(es), tools, etc. An organisation which does this (eg, by the PAS 55 s 4.6 standards) will be able to demonstrate that it continually seeks to expand its knowledge of all things affecting its asset management approach and capabilities. The organisation will be able to demonstrate that it identifies any such opportunities to improve, evaluates them for suitability to its own organisation and implements them as appropriate. This question explores an organisation's approach to this activity.	The top management of the organisation. The manager/team responsible for managing the organisation's asset management system, including its continual improvement. People who monitor the various items that require monitoring for 'change'. People that implement changes to the organisation's policy, strategy, etc. People within an organisation with responsibility for investigating, evaluating, recommending and implementing new tools and techniques, etc.	Research and development projects and records, benchmarking and participation knowledge exchange professional forums. Evidence of correspondence relating to knowledge acquisition. Examples of change implementation and evaluation of new tools, and techniques linked to asset management strategy and objectives.

7.16 Appendix P – Mandatory Explanatory Notes on Forecast Information (Schedule 14a)

1. This schedule requires GDBs to provide explanatory notes to reports prepared in accordance with clause 2.6.6.
2. This schedule is mandatory-GDBs must provide the explanatory comment specified below, in accordance with clause 2.7.2. This information is not part of the audited disclosure information, and so is not subject to the assurance requirements specified in section 2.8.

Commentary on difference between nominal and constant price capital expenditure forecasts (Schedule 11a)

3. In the box below, comment on the difference between nominal and constant price capital expenditure for the current disclosure year and 10 year planning period, as disclosed in Schedule 11a.

BOX 1: COMMENTARY ON DIFFERENCE BETWEEN NOMINAL AND CONSTANT PRICE CAPITAL EXPENDITURE FORECASTS

Vector has used a capital expenditure inflator based on the model used by the Commerce Commission in its DPP price reset on 1 September 2017. We have used PPI as the capital expenditure inflator.

Vector has used the NZIER (New Zealand Institute of Economic Research) December 2019 PPI (Producer Price Index-outputs) forecast up to June 2024. Thereafter, we have assumed a long-term inflation rate of 2.20%.

The constant price capital expenditure forecast is inflated by the above-mentioned index to convert to a nominal price capital expenditure forecast.

Commentary on difference between nominal and constant price operational expenditure forecasts (Schedule 11b)

4. In the box below, comment on the difference between nominal and constant price operational expenditure for the current disclosure year and 10-year planning period, as disclosed in Schedule 11b.

BOX 2: COMMENTARY ON DIFFERENCE BETWEEN NOMINAL AND CONSTANT PRICE OPERATIONAL EXPENDITURE FORECASTS

Vector has used an operational expenditure inflator based on the model used by the Commerce Commission in its DPP price reset on 1 September 2017. We have used an inflator which is a mix of Producer Price Index (PPI) and Labour Cost Index (LCI). The weighting between PPI (40%) and LCI (60%) as per the Commission's model.

Vector has used the NZIER (New Zealand Institute of Economic Research) December 2019 PPI (Producer Price Index-outputs) forecast up to June 2024. Thereafter, we have assumed a long-term inflation rate of 2.20%.

The LCI forecast is 2%, which is based on a 10 year New Zealand average to June 2019.

The constant price operational expenditure forecast is inflated by the above-mentioned index to convert to a nominal price operational expenditure forecast.

7.17 Appendix Q – Certificate for Year Beginning Disclosures

Schedule 17 Certification for Year-beginning Disclosures

Clause 2.9.1

We, Alison Paterson and Jonathan Mason, being directors of Vector Limited certify that, having made all reasonable enquiry, to the best of our knowledge:

a) The following attached information of Vector Limited prepared for the purposes of clauses 2.6.1, 2.6.6 and 2.7.2 of the Gas Distribution Information Disclosure Determination 2012 in all material respects complies with that determination.

b) The prospective financial or non-financial information included in the attached information has been measured on a basis consistent with regulatory requirements or recognised industry standards.

c) The forecasts in Schedules 11a, 11b, 12a, 12b and 12c are based on objective and reasonable assumptions which both align with Vector Limited's corporate vision and strategy and are documented in retained records.

Director

Director

29 May 2020
Date

vector

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