Our Fibre Plans

Our Fibre Plans

This document introduces our first proposal under new regulatory arrangements.
It describes our fibre plans for the three years from January 2022, known as Regulatory Period 1.

CHORUS

Dear stakeholders,

Fibre has given New Zealand a gigabit head start

Over the last nine years Chorus has invested billions of dollars - and contributed significantly more value through use of our existing network assets - to help create New Zealand's ultra-fast broadband network. The contribution of Crown financing means New Zealanders have an enduring stake in the success of the network.

Together, our public-private partnership has helped provide more than 83% of New Zealanders with access to a network that many other developed countries are racing to replicate. This is because gigabit connectivity is now widely recognised as critical to ongoing socio-economic success.

When Dunedin was crowned as our first gigatown in 2014 we did not fully appreciate the power of fibre to accelerate change. Back then, 30 megabits per second was considered good enough and consumers averaged 47 gigabytes in data a month. Fast forward to today:

- fibre has overtaken copper as the primary way we connect to the internet, with 62% uptake to date, exceeding all expectations
- average speeds are over 240 megabits per second with 17% of fibre consumers having already chosen 1,000 megabit (1 gigabit) services and monthly data use is over 400 gigabytes
- we're connecting the first consumers to our new 2 and 4 gigabit Hyperfibre services and are trialling 8 gigabit services, with 25 gigabit services on the horizon
- our fibre services are enabling significant opportunities for Kiwi businesses both in terms of productivity gains and the development of new sectors, such as gaming and film production

These developments reflect a virtuous cycle of improved technology enabling new applications that create value for consumers.

The demands placed on our network through the COVID-19 lockdowns revealed the extent to which broadband has become an essential service. During lockdown, broadband traffic increased by 35% virtually overnight and upstream data traffic demand changed forever with the shift to greater working from home and video conferencing. Underpinning all of this is the ever growing capacity of the fibre network. Average monthly household data usage on fibre is now 413 gigabytes and on current trends average speeds will exceed 1 gigabit per second and average data usage will be well over 1,000 gigabytes in 2024.

COVID-19 underlined the importance of continued investment in capacity and new products to keep ahead of fast changing consumer demands. The pace of change will accelerate in coming years as fast fibre services proliferate in the developed world. We're at the start of a period of rapid growth in customer demand for bandwidth and data volume, as applications emerge quickly to respond to the new market created by the availability of multi-gigabit fibre services.

Our expenditure proposal reflects consideration of these dynamic forces shaping demand. The expenditure is incremental: the core fibre network we have built is enduring and the expenditure serves to unlock its potential. Importantly, our proposal also reflects the need to keep supporting the evolution and efficiency of our industry partners. The investments we make in automating and streamlining our systems and processes help retail service providers enhance their own service delivery, drive longer term reductions in our operational costs, and enabling much better service to New Zealand consumers.

Our goal is to simplify the end-to-end experience for consumers. The improvements in our customer satisfaction scores in recent years show steady progress towards this goal, but there's plenty more we need to do. Our role as an open access wholesaler means we also have a part to play in enabling thriving and increasingly diverse broadband competition. Recent product developments such as our wi-fi enabled network terminal and enhanced support for peering services will advance greater competition and consumer outcomes. Network resilience is also a growing focus as consumer reliance on broadband-based services expands and fibre becomes an increasingly integral part of smart cities and wireless connectivity.

Our activity as a wholesaler has expanded in recent years to support greater education and awareness amongst consumers of the benefits of fibre. This has served to drive uptake of fibre, thereby spreading our costs across more consumers and helping New Zealand realise the wider socio-economic benefits fibre can deliver.

Increasingly though there is a need for us to help consumers understand the difference between fibre and other technologies. This is in response to the "confusopoly" the Commission's research has noted consumers face when comparing communications services and pricing, accentuated by the major mobile network owners using their privileged access to their major, historical customer bases to directly favour their own fixed wireless. This market structure means we're not a traditional utility monopoly. As such, the in-market incentives we provide to retailers and the education channels we support are critical to supporting greater awareness of fibre and maintaining a level playing field for more diverse and effective retail competition. This benefits consumers through better retail offers and choice, and, as more consumers connect to fibre, secures the sustainability of the fibre network.

The focus of our proposal – maintaining our gigabit advantage

We support the new price quality regulation and its purpose. Specifically, promoting the long-term interests of consumers by ensuring we have incentives to innovate, invest and improve efficiency to provide services of a quality that reflect consumer demand.

Our expenditure proposal aligns with our strategic priorities and will help make New Zealand better by:

1. completing and building on our successful UFB deployment

2. maximising consumer value now and into the future by controlling costs, promoting fibre and investing in new products and technologies

3. smoothly transitioning through major changes in our operational focus, regulatory arrangements and service mix.

Underpinning these plans is our strong intention to maintain and evolve the cost discipline and creative partnerships we've employed to deliver one of New Zealand's largest infrastructure projects. We cannot stand still. As we transition from build phase to operating the fibre network, we can see opportunities to evolve our business and supply chain capability to help minimise the whole of life cost of the network. The benefits of this will flow directly to consumers.

We believe positive consumer outcomes will be achieved by continuing to invest to maintain New Zealand's fibre advantage. To support this, we've proactively had our expenditure forecasts tested and reviewed extensively by independent experts. Further constraining our investment would risk the positive consumer outcomes delivered through Chorus' creation as a standalone wholesale broadband network.

New Zealand has a great opportunity to capitalise on its gigabit head start over the rest of the world. We look forward to working with the Commission and other stakeholders to help us realise that ambition.

Yours sincerely,

PATRICK STRANGE
CHAIR

Executive Summary

Our success hinges on our ability to make New Zealand better by sharing the benefits of fibre broadband as widely as possible and by keeping up with rapidly evolving consumer demand. We are confident that, with our proposed investment, the value to New Zealand of fibre access services will continue to grow.

Importantly, our proposal achieves these objectives while decreasing investment (as we complete major network build programmes) and improving cost per connection (as we grow connection numbers and control recurring costs).

Fibre comes of age

At the inception of Ultra-Fast Broadband (UFB), the long-term use case for fibre was uncertain. The last few years and our experience with COVID-19 in 2020 have proven the value of fibre to consumers[1] and highlighted fibre's role in enabling New Zealand's economic, education, social, health and environmental policy goals. All indications are that recent trends will continue, driven by ever expanding digital opportunities for consumers. By 2025, this indicates:

- average speed will quadruple to over 1 gigabit per second (Gbps)
- average monthly data usage will grow to well over 1 terabyte (TB).

We plan to deliver these extraordinary increases in speed, usage and value to consumers while holding network quality stable, significantly reducing expenditure and materially reducing cost per connection.

Our plan is that from 2021 to 2024:

- average per annum expenditure will reduce by 29%
- capital and operating costs per connection will reduce by 9% and 8% respectively.

To enable these outcomes, we must continue our role as an active wholesaler, informing consumers of the benefits of fibre, supporting healthy retail competition and retailer promotion of fibre services.

To keep pace with evolving technology and consumer trends, we must also sustain investment in new products and technologies that leverage the vast potential of our fibre network. This includes ring-fencing a portion of capital expenditure for longer horizon product development.

Our proposal

Our proposal – the first regulatory expenditure proposal for fibre access services[2] – aligns with our strategic priorities and will help make New Zealand better by:

- completing and building on our successful UFB deployment
- maximising consumer value now and into the future by controlling costs, promoting fibre and investing in new products and technologies
- smoothly transitioning through major changes in our operational focus, regulatory arrangements and service mix.

Below we discuss each of these areas, then provide an overview of our planned expenditure and proposed quality settings.

	Complete UFB	In 2022 we will complete our successful decade-long work on the UFB initiative

Chorus was formed as a standalone company to deliver UFB in partnership with government. The partnership was designed to provide the best possible outcome for consumers by marrying our existing network assets and capability with government (and market funding) to take fibre to well over a million homes and businesses.

[1] We use the term 'consumers' to refer to end-users of fibre services – including businesses, homes and other organisations such as schools, hospitals, etc.
[2] Our proposal is for price-quality fibre fixed line access services (or PQ FFLAS) as defined in the Input Methodologies.

Supporting demand

When the fibre rollout began in 2011, consumer demand for fibre was uncertain and our contractual target was 20% uptake by 2020. Entry level fibre plans were 30 megabits per second (Mbps) and 100 Mbps was a premium product.

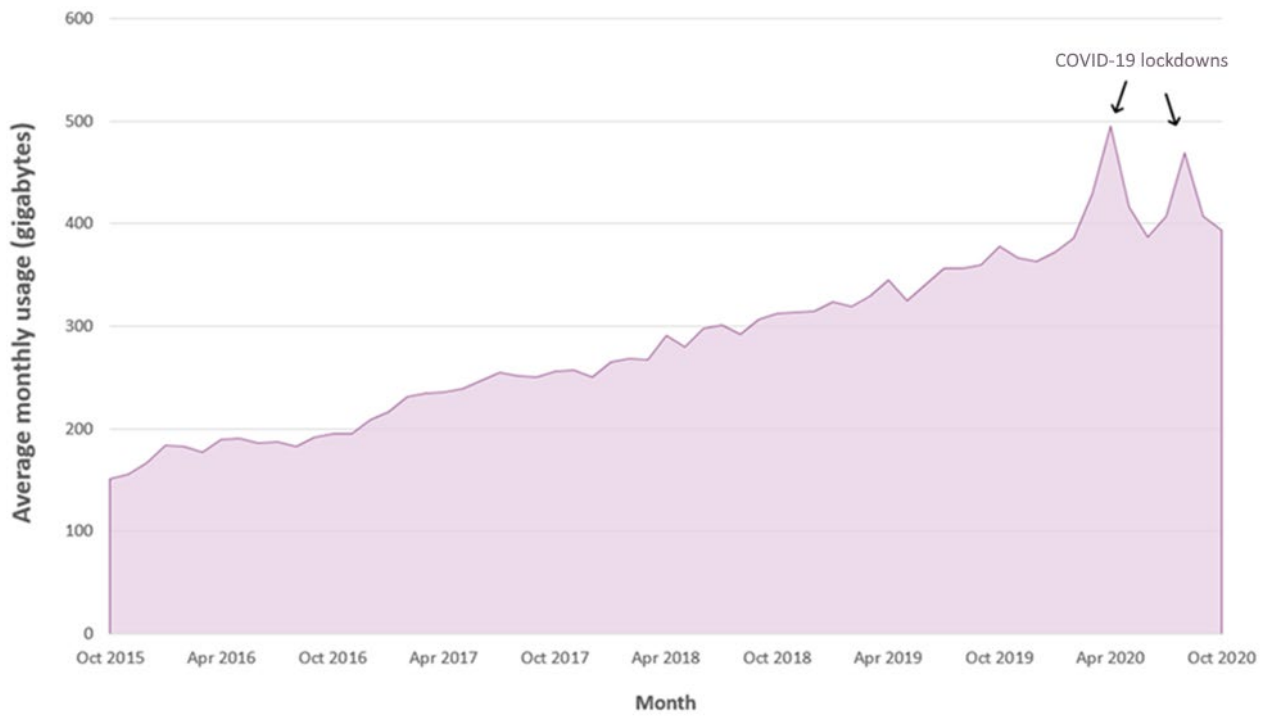
Today, the rollout is considered a resounding success, with uptake of more than 60% across the completed footprint, and 17% of connections on gigabit plans.

Data usage on our fibre network continues to grow rapidly as more and more activity moves online.

Average monthly broadband usage on fibre approached 500 gigabytes (GB) during the lockdown in April 2020, up from an average of 150 GB as recently as October 2015. The increased reliance placed on our network during lockdowns confirmed broadband as an essential service and fibre as the gold standard.

We expect network usage trends to continue – our own and independent international forecasts suggest average data usage is likely to exceed 1,000 GB a month in 2024.

Figure 0.1: Average monthly usage per connection on our fibre network



Supporting competition

We are one of a small but growing number of broadband network owners internationally that operate as a standalone network wholesaler. We enable a level playing field that stimulates retail competition over our network. New Zealand now has a thriving retail broadband market with around 90 retailers and new providers beginning to compete strongly against incumbents.

Our wholesale-only model, alongside extensive government oversight and market scrutiny[3], works to ensure a strong focus on cost-effective operations and long-term consumer value.

We operate in a highly dynamic market and face competitive pressure from alternative broadband technologies. This distinguishes us from other regulated utilities and provides strong commercial incentives to drive efficiency, keep up with technology evolution and consumer demand so we provide services consumers want and that retailers find easy to offer.

	Deliver value	Our proposal delivers value by growing connections, driving efficiency and product innovation

Our proposal is designed to ensure we deliver value now and into the future, including through:

- ensuring we continue our key role promoting fibre to drive uptake
- investing in future products and technologies to keep up with demand by unlocking the potential of fibre
- maintaining our focus on efficiency and consumer experience.

We have a critical role promoting fibre uptake

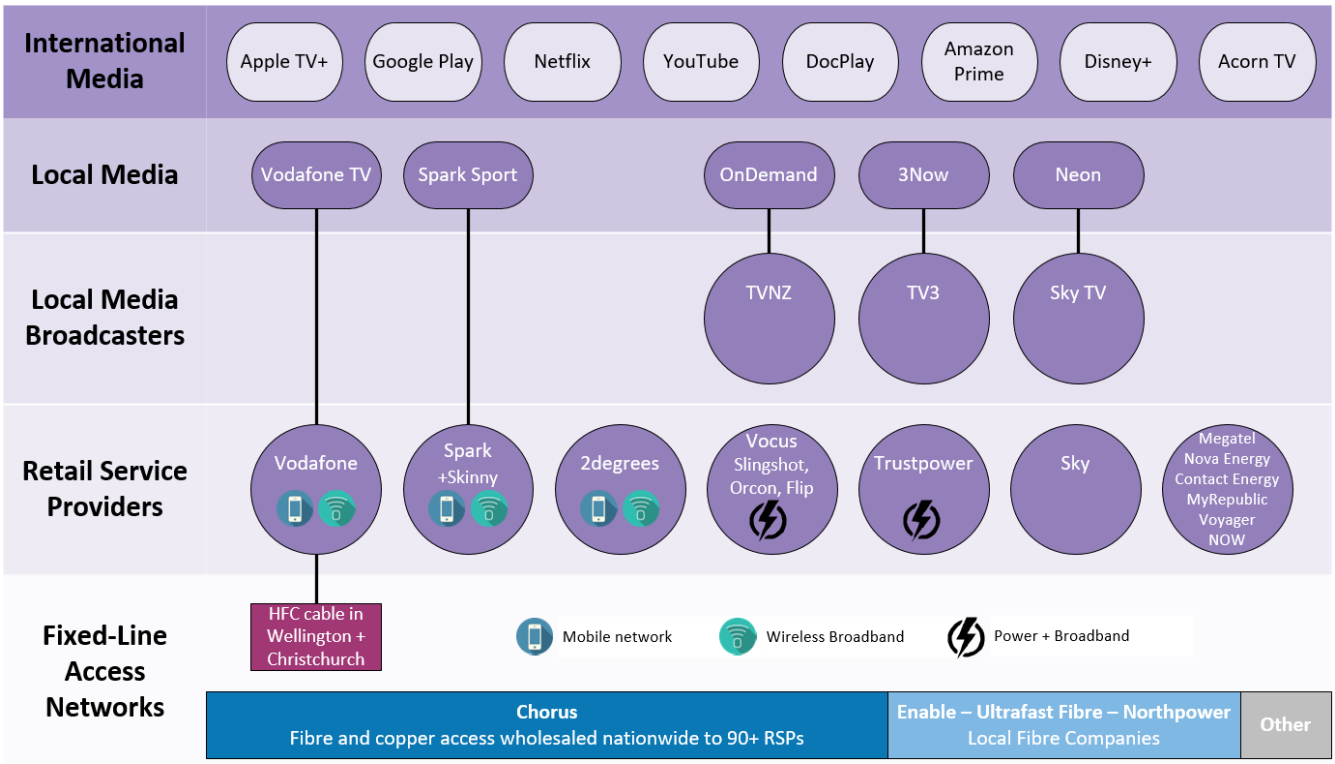
Promoting fibre is essential to our longer-term success. Connection growth brings the benefits of fibre to more people, unlocks more potential for services that rely on fibre, and spreads our fixed costs across a wider base. As an independent wholesaler we have a key role promoting fibre uptake, and our proposal carries forward our promotional activity.

A recent paper by the Fibre to the Home (FTTH) Council in Europe[4] shows that until consumers experience fibre they don't appreciate the benefits it brings. Also, consumers can be reluctant to change providers and are often confused by pseudo-technical language used in broadband advertising.

A recent review for the Commerce Commission[5] highlighted that "confusopoly" can sometimes stand in the way of rational and informed decision-making by New Zealand broadband consumers. This necessitates continued investment in consumer education and transparency to ensure the benefits of fibre access are understood. Our role in this is even more important given major vertically integrated retailers have an incentive to promote their own competing networks.

[3] Chorus is listed on the New Zealand and Australian stock exchanges (NZX and ASX).
[4] FTTH Council Europe, *Identifying European Best Practice in Fibre Advertising, Jun 2020*
[5] Behavioural Biases in Telecommunications. A review for the Commerce Commission, 13 May 2019, section 1.3, Complexity and confusopoly.

Figure 0.2: Our largest customers own competing networks



Continued development is essential to unlock fibre's potential

Fibre to the home is a generational technology update, critical for enabling social and economic participation and growth. For example, a 2017 study estimated the wider social benefits from fibre uptake at about $2 billion annually[6]. This was on top of a $3 billion annual contribution to gross domestic product from business uptake.

These benefits have likely been amplified by ongoing changes in the way consumers use our network, particularly in the wake of COVID-19, which accelerated trends in working from home, education, telemedicine and education.

[6] Sapere, 2017, *Estimating the wider socio-economic impacts of ultra fast broadband for New Zealand*, Benefits to consumers from UFB - Sapere 24 8 2017.

Figure 0.3: Remote working makes high quality broadband even more essential [7]

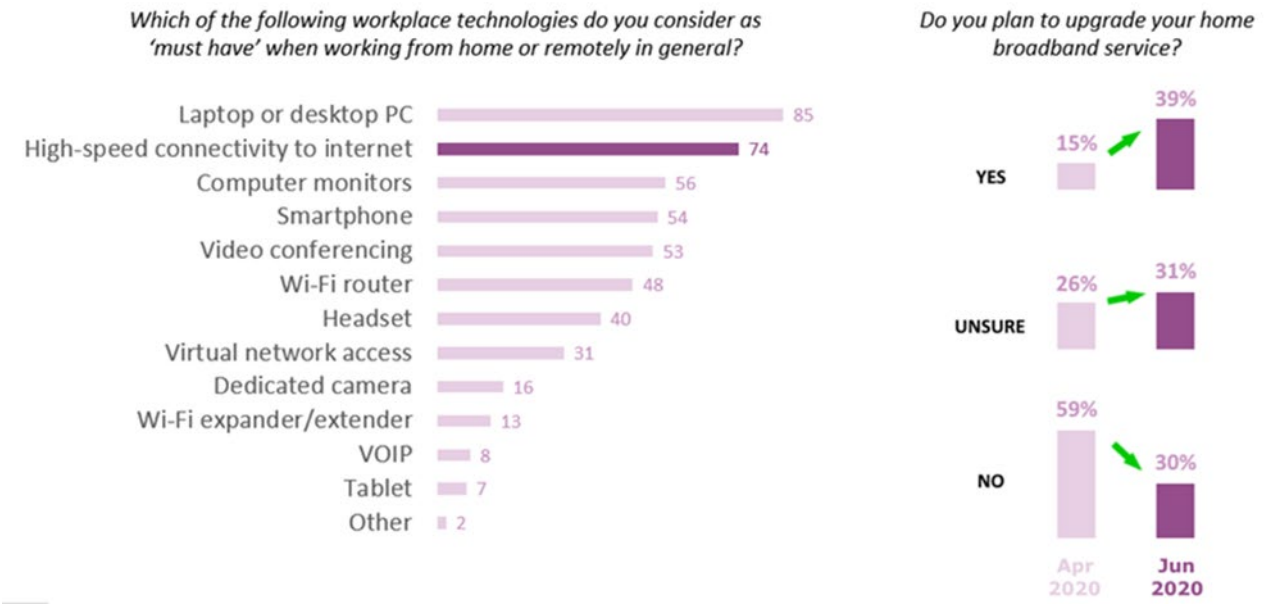
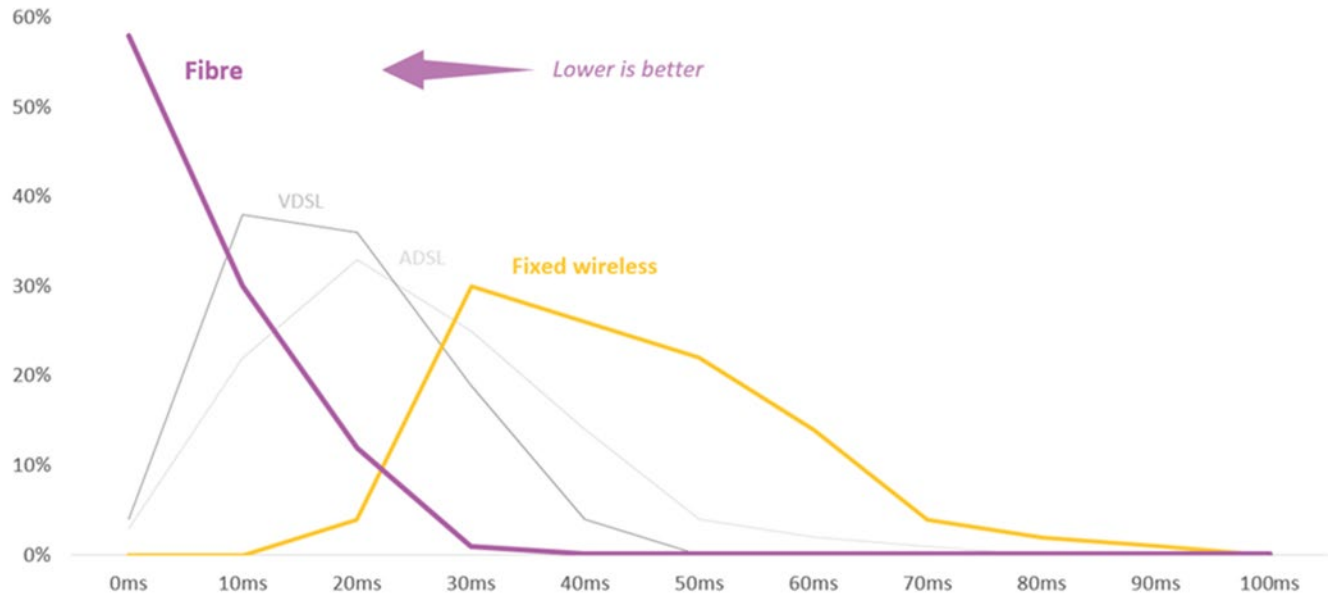


Figure 0.4: Fibre is the most responsive (low latency) broadband option [8]



7 Figure 0.3 – IDC (International Data Corporation), Remote working survey 2020. Figure 0.4 – Chorus, Consumer monitor, June 2020.
8 Figure 0.4 – Measuring Broadband New Zealand, Winter Report, August 2020

Fibre is a future-proofed technology – with fibre in place, major ongoing performance upgrades can be achieved through investment in electronics and optics. A recent example of this is our introduction of Hyperfibre, which provides a very efficient investment path for a significant increase in the maximum speed on our network from 1 Gbps to 4 Gbps.

We have ring-fenced capex, managed through our internal Chorus X programme, to ensure we continue to invest in technology and product developments to improve outcomes for consumers and unlock the potential of fibre to meet the ever growing and evolving demands of a digital society.

Efficiency and consumer experience

Alongside our efforts to promote fibre and invest in new services, we have an ongoing focus on efficiency and consumer experience.

This involves prudent and efficient investment and operations. We have successfully managed the cost of our UFB rollout and fundamentally have a culture influenced by periods of tight finances and a strategic imperative to grow revenue by attracting consumers.

Ongoing optimisation and cost control, while not losing sight of consumer experience and longer-term technology developments, coupled with connection growth, will enable us to deliver value by reducing the cost per connection from 2022 to 2024 by:

- 8% for operating expenditure
- 9% for recurring capital expenditure.

Smooth transitions

We are moving from build to operate, migrating consumers from copper and entering new regulatory arrangements

We are focussed on delivering a successful transition through three major changes:

- With the UFB rollout nearing completion, we need to make organisational changes as we transition to a more operational focus
- with fibre uptake exceeding 80% in some suburban areas, the time to migrate remaining consumers from copper is approaching
- from 2022 we will transition from current contractual arrangements to our first three-year regulatory period, RP1.[9]

While these changes have a major impact on our business, fibre consumers can expect a smooth transition that delivers price and quality stability.

Price and quality

The price of our core "anchor product" will have regulatory control as we enter RP1. In time, our maximum allowable revenue (MAR), which is informed by our investment and operating costs, will work alongside ongoing competition from other broadband technologies to constrain prices and protect consumers from price shocks.

At a macro level, our aim for the first regulatory period is to sustain the quality, including performance, reliability and customer satisfaction, of our fibre access services. This means we need to continue investing in network capacity, product development, enhancing resilience and renewing assets. We also need to ensure we have enough skilled technicians in the field to maintain quality as connection numbers and usage grow, and as assets age.

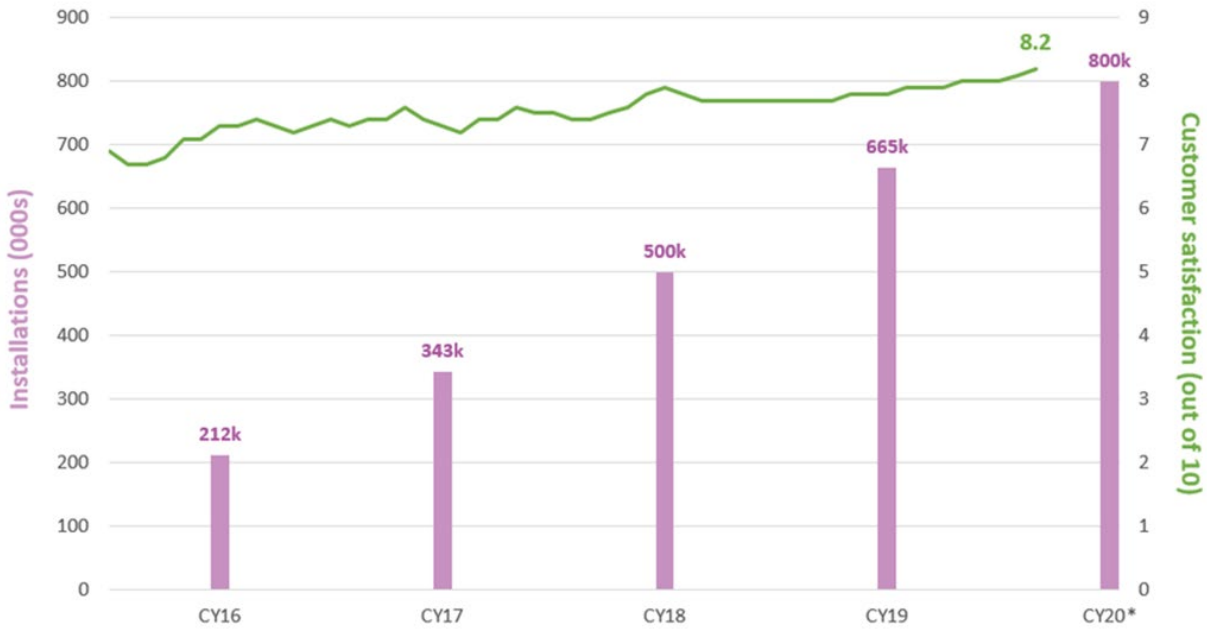
We are not planning for a step change in quality, although such a change may be warranted in future to address increasing dependence on reliable broadband. This approach reflects feedback from our retailer customers and other stakeholders. This does not impact our ongoing focus on delivering better outcomes across the industry, which meet consumer expectations and is a key part of our strategy to encourage consumers to switch to and stay on fibre.

As our fibre rollout has progressed, we've strived to improve the fibre installation and connection experience for consumers. This is reflected in customer satisfaction scores, which have steadily climbed from

[9] Regulatory Period One (or RP1) runs for three years from 1 January 2022 to 31 December 2024.

6.8 to 8.2 out of 10 since 2016. This improvement flowed from efforts to reduce rescheduling, minimise site visits through our 'fibre in a day' process, and generally streamline the way we work with retailers.

Figure 0.5: We've steadily improved customer satisfaction, even as work volumes have grown[10]



We're transitioning out of major build

The transition to much smaller volumes of work in the field – as we complete our major build programme and as fibre replaces higher-maintenance copper – will drive a major shift in our business and in arrangements with our service company partners. Our aim is to efficiently adapt our resourcing to a smaller and evolving work programme without disrupting delivery.

We are confident we can manage this transition, drawing on our recent experience and that of our service company partners. Having successfully delivered one of New Zealand's largest infrastructure projects, we are confident we can deliver on our plans for the coming years.

We also recognise that the transition from build to operate reorients our asset management priorities. We have existing strengths in delivery and risk management, and will need to build capability in asset knowledge, strategy and planning. Our new regulatory arrangements reinforce this shift and our proposal provides for realistic progress. This work will help ensure we can optimise the lifetime cost and performance of our network.

[10] Customer satisfaction scores are based on installation satisfaction surveys. The 2020 customer satisfaction figure shown in the chart is from September. The 2020 installation figure is an estimate from early December.

We're transitioning into new regulatory arrangements

This proposal is a major component of our regulatory transition and we have gone to significant lengths to ensure it is robust, including:

- building the proposal from our underpinning business plan for the whole of Chorus, which is board approved and captures our management and directors' best view (at a point in time) of the operation and plans for our business in a dynamic market
- commissioning an independent review by CutlerMerz to identify whether our forecasts reflect good telecommunications industry practice and are consistent with the efficient costs of a prudent fibre operator
- implementing extensive governance arrangements and improvement initiatives to complement our usual business planning processes
- building in formal stakeholder consultation that, despite being constrained by COVID-19 and the challenges of still formative regulatory arrangements, provided useful insights and input to our proposal.

More fundamentally, our proposal is informed by ongoing customer engagement regarding products and service quality over the past nine years. We believe our product-centred engagement gives us rich inputs for planning. Our proposal preparation has benefited from this, as will our delivery during RP1. We also plan to build on our first formal stakeholder consultation effort as we prepare for our next regulatory proposal, due in 2023.

	RP1	This proposal sets our direction for the three years from January 2022 to December 2024.

Our proposal enables us to complete the UFB roll out, continue with efficient network extension, connect more consumers, keep pace with growing demand, sustain network quality and invest in future services.

More than 1 million premises will have fibre by the end of 2024, and consumers can have confidence that the strong reliability and performance of our fibre services will endure. Growing fibre connections delivers real value to New Zealanders because the fibre network provides the best internet experience and can readily accommodate growing demand. Also, importantly, the more consumers we connect, the better value we can offer by spreading fixed costs further.

Investments will be made in an environment of rapidly growing demand and increasing reliance on fibre services. For network capacity planning purposes, we forecast system peak throughput in 2024 that is more than triple what we serve today.

To meet this growth while continuing to extend our network, connect more consumers and sustain quality of service, we propose to invest $983 million in capital expenditure and incur $599 million of operating expenditure over the three years from January 2022 to December 2024.

Below we provide a breakdown and brief overview of our proposed expenditure and quality objectives.

	**Establishment capex** One-off investment to extend our network and enable new connections.	$504 million

Our proposal includes $504 million for establishment capex during RP1, comprising:

- $71 million for Extending the Network footprint. This includes completing committed UFB work, building infill capacity to cater for address growth, servicing new property developments and completing some other minor augmentation work. This investment provides more homes and businesses with the opportunity to install fibre
- $433 million for Installations. This is demand-driven work to link individual consumers to the communal network. This work enables new fibre connections.

Our establishment capex will be much lower in RP1 than it has been during the main part of the UFB rollout. It will take the number of sites passed by our fibre access network from around 1.4 million at the beginning of RP1 to around 1.5 million, and the number of connections beyond 1 million.[11]

It is possible that plans may emerge during RP1 to extend fibre to more communities across New Zealand. If this does arise and requires additional funding, we will consider making a separate 'individual capex' application.

Installation volumes are uncertain, so our proposal breaks most installation capex out into a separate 'connection capex' regulatory mechanism.[12] This means our MAR will be adjusted in time for any difference between forecast and actual installation volumes. The adjustment uses pre-approved unit rates, so we retain an incentive to carefully manage installation costs while continuing to promote efficient fibre uptake.

	**Recurring capex** Investment to manage network risk, meet demand growth and evolve products and services.	$479 million

We are proposing $479 million as the prudent and efficient level of investment in recurring capex for RP1. This investment will enable us to keep pace with growing bandwidth demand, while broadly sustaining the quality of service we provide and continuing to develop our products and services to meet demand.

Our recurring capex comprises:

- $158 million of Network Sustain and Enhance investment. This includes lifecycle investment in our site and field assets, relocation work to accommodate other parties' roading and pole programmes and investment in route diversity aimed at sustaining resilience as connection numbers grow. This investment enables us to meet important obligations, and supports our ability to provide reliable services
- $170 million of Network Capacity investment. This covers ongoing lifecycle investment, and investment to evolve our network technology and grow capacity. This investment enables us to keep our network congestion free, and supports our ability to provide reliable and attractive services
- $151 million of IT and Support investment. This covers lifecycle and development work for our IT systems and applications, product development, and investment in sundry items such as corporate accommodation.

There is upward pressure on recurring capex as our network grows and ages, and as we work to keep pace with demand growth and sustain attractive products. However, growing connection numbers and a disciplined approach to investment means we are forecasting recurring capex per connection will fall by 9% across RP1.

[11] These figures refer to estimated fibre access sites and connections. We forecast increases from 1.37 million sites at the end of 2021 to 1.47 million sites at the end of 2024 and 1 million connections by 2022 and increasing thereafter.
[12] We propose connection capex of $335 million. Note that a small amount of this relates to Hyperfibre linecards and optics, which we do not classify as establishment capex.

While our proposal aims to hold quality steady, there are indications that growing dependence on connectivity may justify more investment in resilience.

We will be considering whether to develop a separate 'individual capex' proposal to accelerate route diversity work and progress targeted exchange enhancements.

	**Opex** Ongoing costs of sales, operations, maintenance and business support.	$599 million

We are proposing $599 million as the prudent and efficient level of opex for RP1, comprising:[13]

- $87 million for Customer Opex. This includes product, sales and marketing work and our customer operations activities. This work supports our ability to work with RSPs and to attract and retain consumers
- $211 million for Network Opex. This includes network maintenance activities, operating costs (such as power) and our network operations activities
- $301 million for Support Opex. This includes technology costs associated with our IT systems (such as licences and support) and costs across our asset management and corporate activities such as engineering, professional services, stakeholder engagement, audit, insurance and governance.

As with recurring capex, growing connection numbers and a disciplined approach to expenditure means we forecast opex per connection will also fall across RP1 – in this case by 8%. We forecast this result despite the pressures of a growing network.

	**Quality standards** Compliance requirements relating to overall quality outcomes	Downtime & Utilisation

Our proposed expenditure aligns with our aim to hold quality stable as we transition into new regulatory arrangements. While there appears to be a trend of increasing reliance on our infrastructure, it would have been premature to respond to this in our proposal. We are considering developing an individual capex proposal for accelerated or enhanced resilience.

The Commerce Commission will need to set quality standards and measures for RP1 that are consistent with our quality objectives. We know it will take time to get the balance of these right – particularly for the framework's first quality standards which will need to reflect consumer expectations, but not trigger unnecessary compliance interventions or over-cautious risk management.

As such, for RP1 we are proposing that our quality standard is to report on key statistics relating to network availability and performance. For availability we propose a downtime statistic and for performance we propose a utilisation statistic. These statistics are based on existing quality measures developed by Crown Infrastructure Partners. A reporting-focused quality standard will get parties used to the reporting framework and provide a baseline to develop quality standards for the second regulatory period and beyond.

Next steps

The balance of our proposal provides rich information on the basis for our plans and more detail on our quality objectives and our plans for each expenditure area.

The next step is for the Commerce Commission to evaluate our proposal before reaching a decision in late 2021. We look forward to working closely with the Commission, our customers and other stakeholders over that time to ensure the benefits of our planned investment are well understood.

At the same time, we will continue our focus on making New Zealand better, by providing great fibre service for our customers and New Zealand consumers.

[13] We include lease costs in these figures (and opex forecasts throughout this document) to support a clear explanation of trends. In practice, we capitalise lease costs consistent with NZ IFRS 16. Lease costs will be capitalised for revenue setting purposes, consistent with IM requirements.

1.0 Introduction

This document – Our Fibre Plans – forms the heart of our proposal for expenditure on Fibre Fixed Line Access Services (FFLAS) during our first regulatory period (RP1) covering the three calendar years from January 2022 to December 2024.

1.0 Introduction

1.1 Proposal scope

Our proposal is for FFLAS in areas where we're subject to price-quality regulation (PQ FFLAS). Section 5 of the Telecommunications Act 2001 defines FFLAS as:

"Means a telecommunications service that enables access to, and interconnection with, a regulated fibre service provider's fibre network [subject to specified exclusions]."

Key services excluded from FFLAS are:

- **copper services** – telecommunications services provided, in any part other than a part located within an end-user's premises or building, over a copper line, or a telecommunications service used exclusively in connection with such a service
- **most backhaul services** – transport services provided beyond the specified point of interconnection (POI).[1]

PQ FFLAS excludes information disclosure-only FFLAS areas, which include:

- Enable Networks areas in Christchurch and surrounds
- Northpower Fibre areas in Kaipara and Whangarei, and
- Ultrafast Fibre areas in the central North Island including Hamilton, Tauranga, New Plymouth and Whanganui.

While our proposal is for PQ FFLAS in RP1[2], we also present information on:

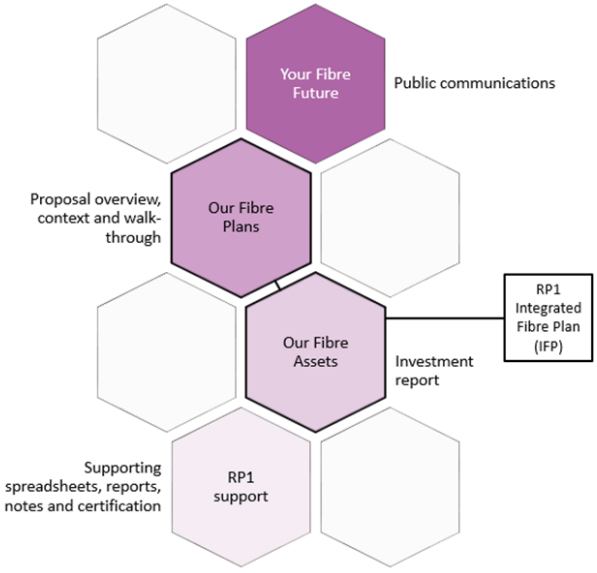
- historical expenditure, and forecast expenditure up to RP1 and for the two years after RP1, and
- some of our wider governance and management activities. We operate as an integrated business across fibre and other services, and we deliver fibre services using shared assets and resources.

1.2 Documents

Our Fibre Plans works alongside three other sets of information:

- **Your Fibre Future** – supporting communications material for our stakeholders. This material is not a formal part of our proposal
- **Our Fibre Assets** – our investment report. This describes how we manage our network and provides detailed information on every area of investment and operating expenditure
- **RP1 support** – technical material including regulatory templates (spreadsheets) agreed with the Commission, expert reports, responses to information requests and our directors' certification of our proposal.

Figure 1.1: RP1 Proposal document set



Our Fibre Plans and Our Fibre Assets together cover the requirement to provide an integrated fibre plan (IFP) suite of reports.[3] To provide a holistic view, we have woven opex into our IFP suite rather than providing separate opex documents.

[1] The Commission prescribes the specified points of interconnection under section 231 of the Telecommunications Act and made its first determination last year. These specified POIs establish the fibre handover points and define the upstream boundary of a regulated fibre service provider's fibre network.
[2] We adopted the term RP1 early in our proposal preparation process. You may also see this referred to as price-quality period one, or PQP1.
[3] Fibre Input Methodologies, clause 3.7.7

Our Fibre Assets covers all material required in our IFP Investment Report.

All other IFP reports – Overview, Governance, Demand, Quality, Delivery and Engagement – are covered in Our Fibre Plans.

Our Fibre Plans also includes a chapter on installation volume risk. This is designed (along with cross-referenced material) to meet our requirement to provide a connection capex baseline proposal.[4]

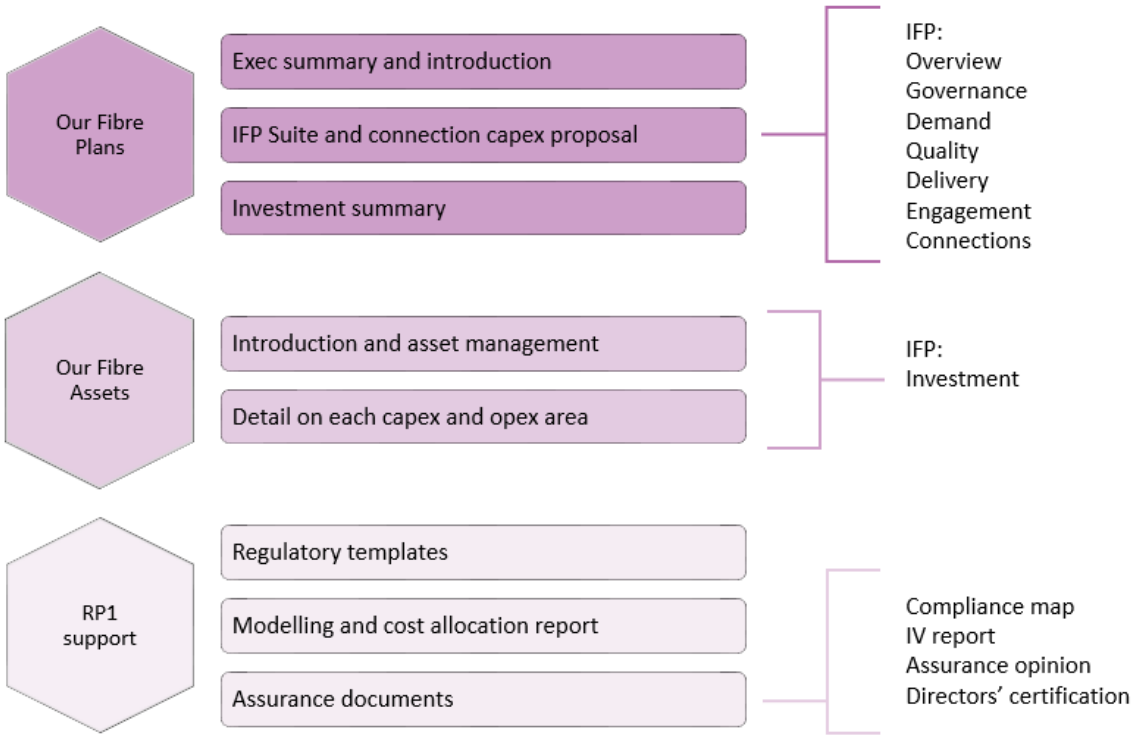
Note that throughout Our Fibre Assets and Our Fibre Plans we discuss and present a total capex view, where total capex includes base capex and baseline connection capex. This provides a more complete picture of our proposal and reflects the way we plan and operate our business.

The Investment Summary of Our Fibre Plans provides a complete walk-through of all the expenditure areas covered in our proposal. This provides a shorter and more targeted overview of our proposal than Our Fibre Assets, which is the place to look if you want to dig deeper into an expenditure area.

We have put the majority of the IFP reports in one document, together with the Investment Summary, so that Our Fibre Plans can provide a complete and self-contained guide to our RP1 proposal. It contains more information about our business and our plans than we have published before, and we have tried to make it as clear and accessible as possible. However, we have also had to ensure we comply with IFP and other proposal information requirements. This means Our Fibre Plans is formulaic in parts and dives in and out of detail.

We would welcome feedback from all stakeholders on how informative and accessible you find this first proposal and would love to hear suggestions for improvement. You can provide feedback by emailing RP1@chorus.co.nz.

Figure 1.2: RP1 Integrated Fibre Plan and associated documents



[4] Fibre Input Methodologies, clause 3.7.14.

1.3 Conventions

At the front of the Investment Summary, you will find useful information on expenditure conventions used throughout this document plus an overview of our how we have categorised expenditure. Key things to know as you start reading this document are:

- figures are in 2020 dollars throughout, and forecast figures use constant prices (i.e. they exclude economy-wide cost movements)
- historical capex (from 2016 to 2019) is presented on an unallocated basis, i.e. including all Chorus expenditure
- forecast costs (from 2020 to 2026) are for FFLAS – i.e. directly attributable FFLAS costs and an allocation of shared costs.

2.0 Overview

We’re making New Zealand better

This is our IFP Overview report. It provides an overview of our integrated fibre plan and RP1 proposal. More detail on all the points covered can be found in the balance of this document and the Our Fibre Assets report.

2.0 Overview

2.1 We're making New Zealand better

As we enter the first regulatory period (RP1), we will be nearing completion of our work with the government on the Ultra-Fast Broadband (UFB) initiative.

We will have built a fibre access network that brings world-class connectivity to hundreds of thousands of homes, businesses and public facilities.

Fibre access prior to RP1

1.4M sites able to connect[1]		We have built a network that extends fibre coverage across much of the country.
250 Mbps average connection speed[2]		With 17% of consumers on gigabit or better plans, the average connection speed on our fibre network is growing.
8.2/10 installation satisfaction		Our connection processes are streamlined, and our network is congestion-free.

Our aims for RP1 are to:

- continue connecting more consumers to our fibre access network – attracting and retaining consumers is a top priority. Our fibre network provides excellent internet experience, and connecting more consumers reduces cost per connection by spreading fixed costs further
- continue investment in network capacity, product development and resilience, and carefully manage a transition in our field workforce, so we can sustain quality of service
- continue to innovate and invest to ensure we sustain the fibre access value proposition in a fast-moving industry and for rapidly evolving consumer needs, and
- adapt and develop our asset management capability to support our transition from network build to network operation.

Fibre access at the end of RP1

7.6 Tbps system peak		Our capacity planning uses a forecast of network traffic at peak time that is approximately triple today's levels.[3]
<-> sustained service quality		As usage grows and we transition from build to operate, we aim to sustain our quality of service.

[1] We forecast our fibre access network will extend past 1.37 million sites by the end of 2021.
[2] For our total fibre network in October 2020, average speed was 251 Mbps and 17.3% of lines had gigabit plans.
[3] Throughput peaked at 2.4 Tbps on our fibre network in August 2020 and we are planning for 7.6 Tbps in 2024.

2.2 We're investing $983 million

We propose to invest $983.3 million – comprising $504.4 million for network extension and installations, and $478.9 million on recurring capex to sustain service quality while managing lifecycle and compliance needs.

Establishment capex – one off investment to extend our network or enable new connections		
51% of capex is non-recurring		More than half of capex is for one-off investment to extend the network and connect new customers.
66% reduction across four years		Our investment in these activities is declining – falling from $351 million in 2021 to $120 million in 2024.
Recurring capex – investment to manage network risk, meet demand growth and evolve products and services		
49% of capex is recurring		The balance is for recurring investment to sustain and enhance our network, manage capacity and provide supporting systems.
100,000 more sites passed[4]		We have more network assets to manage and higher network usage, which increases recurring capex…
9% improvement in cost per connection		…but we'll spend less per connection – falling from $162 in 2022 to $147 in 2024.
1M+ Connections to our network		This trend reflects growing demand for our services and spreads fixed costs across more connections.

[4] Forecast growth in number of sites passed during RP1 is around 97,000 across UFB build, new property development, infill and other augmentation.

Figure 2.1 provides a more complete overview of our proposed investment, with historic investment shown for context.

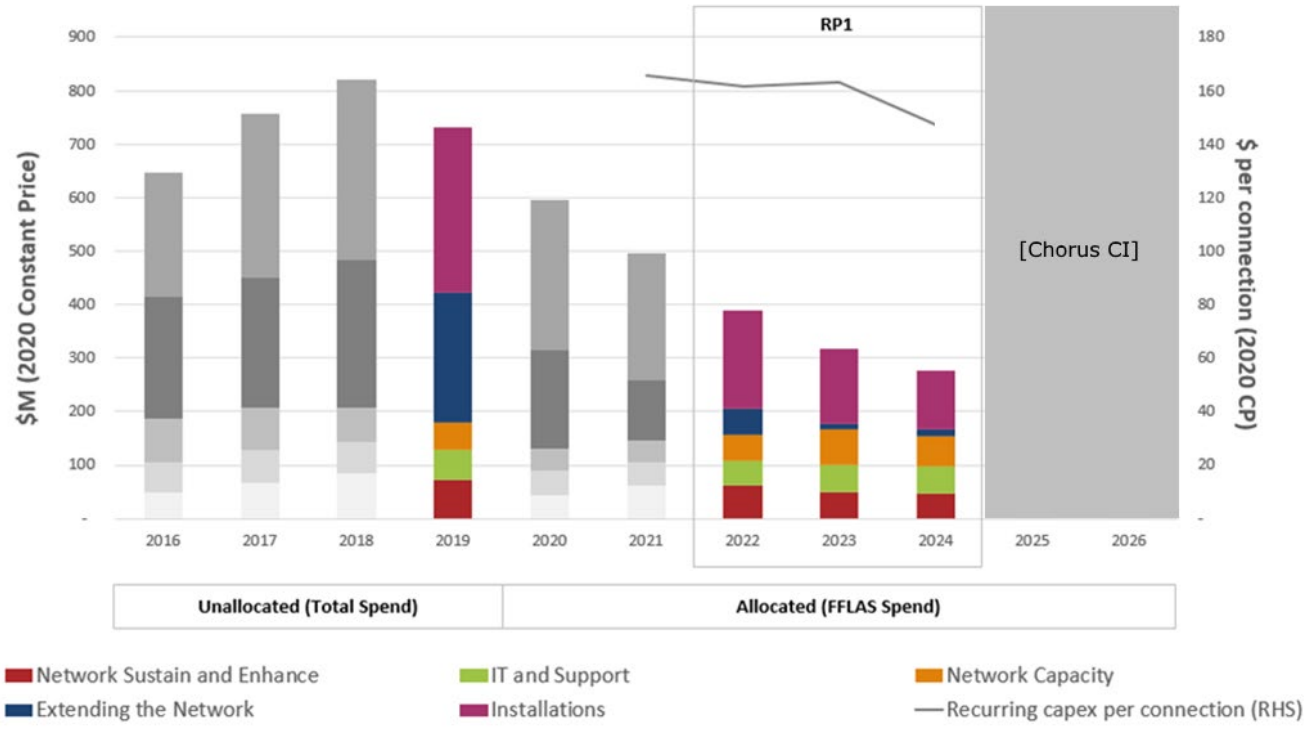
Having successfully delivered very large build, connect and capacity programmes in recent years, we are confident we can access and coordinate the resources needed to deliver our plans.

Beyond RP1 our high-level forecasts assume:

[

Chorus CI]

Figure 2.1: Overview of capex[5]



[5] Throughout out proposal we use forecast capex and opex from 2020 and historical figures for 2019 and earlier.

2.3 We're forecasting $599 million of operating expenditure

We forecast $599.2 million for operating costs across:

- customer – product development, sales and marketing plus customer operations
- network – maintaining and operating our network
- support – asset management and corporate functions, and operating costs for IT systems.

Operating costs

flat		Opex is held flat as increases due to network growth are offset by savings…
8% improvement in cost per connection		…but we'll spend less per connection – falling from $207 in 2022 to $190 in 2024.

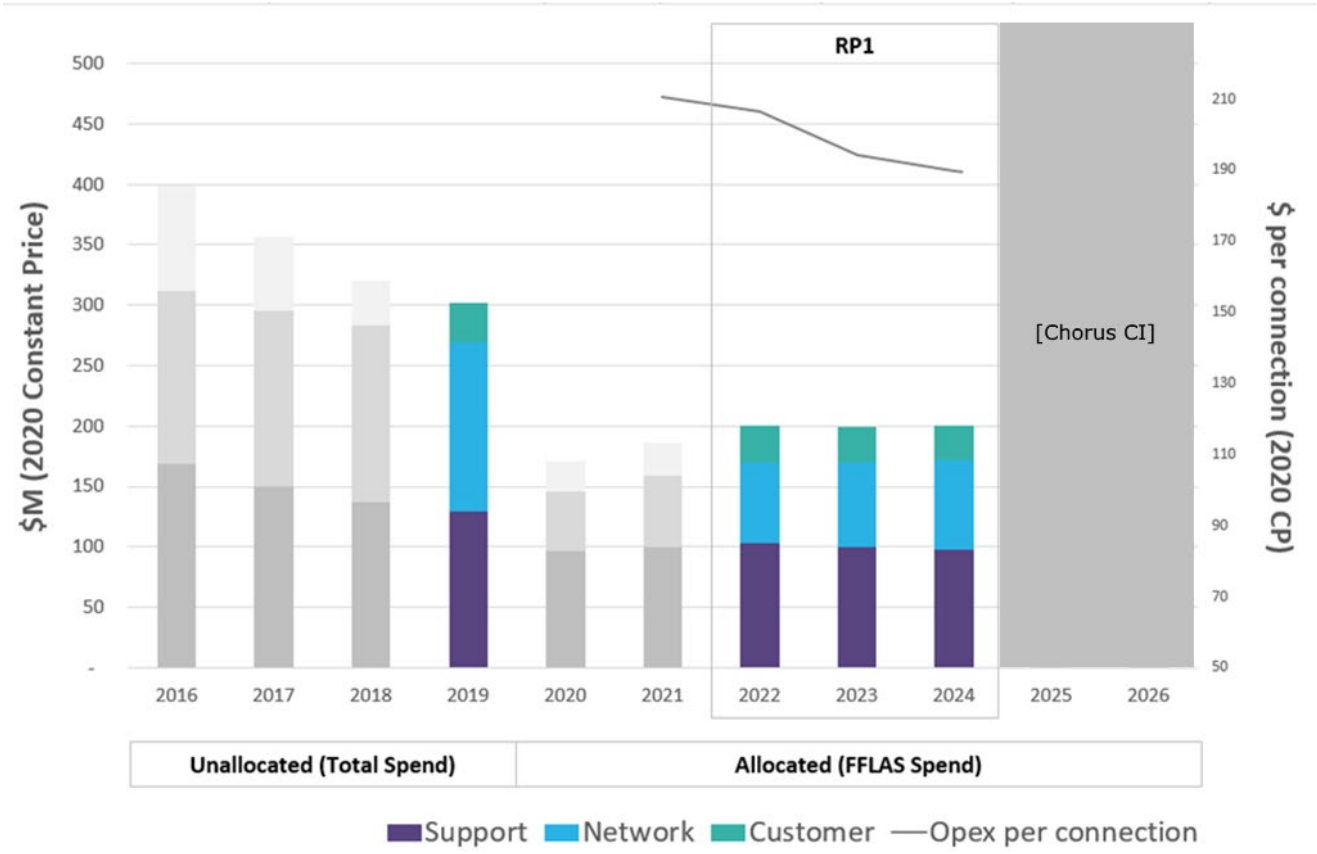
Figure 2.2 provides a more complete overview of our forecast operating costs, with historic costs shown for context.

Key trends across opex areas are:

- new fibre costs less to operate and maintain than older copper, with fewer faults and lower power and cooling requirements
- we expect reduced scale economies due to lower extension, installation and fault response activity in the field will translate into cost pressure
- less extension and installation activity will also mean we capitalise less of our remaining operating costs, translating into upward pressure on opex
- we will offset many of these pressures by reshaping our resourcing to match lower activity levels, continuing to invest in automation and optimisation and practising tight cost control
- these gains combine with connection growth to produce an improvement in operating cost per connection.

Beyond RP1 our high-level forecast assumes we hold costs steady.

Figure 2.2: Overview of opex



3.0 Governance

Our plans and forecasts are robust

This is our IFP Governance report. It describes governance at Chorus, and the key management frameworks we use to support effective governance. It describes how we have built our proposal from this foundation.

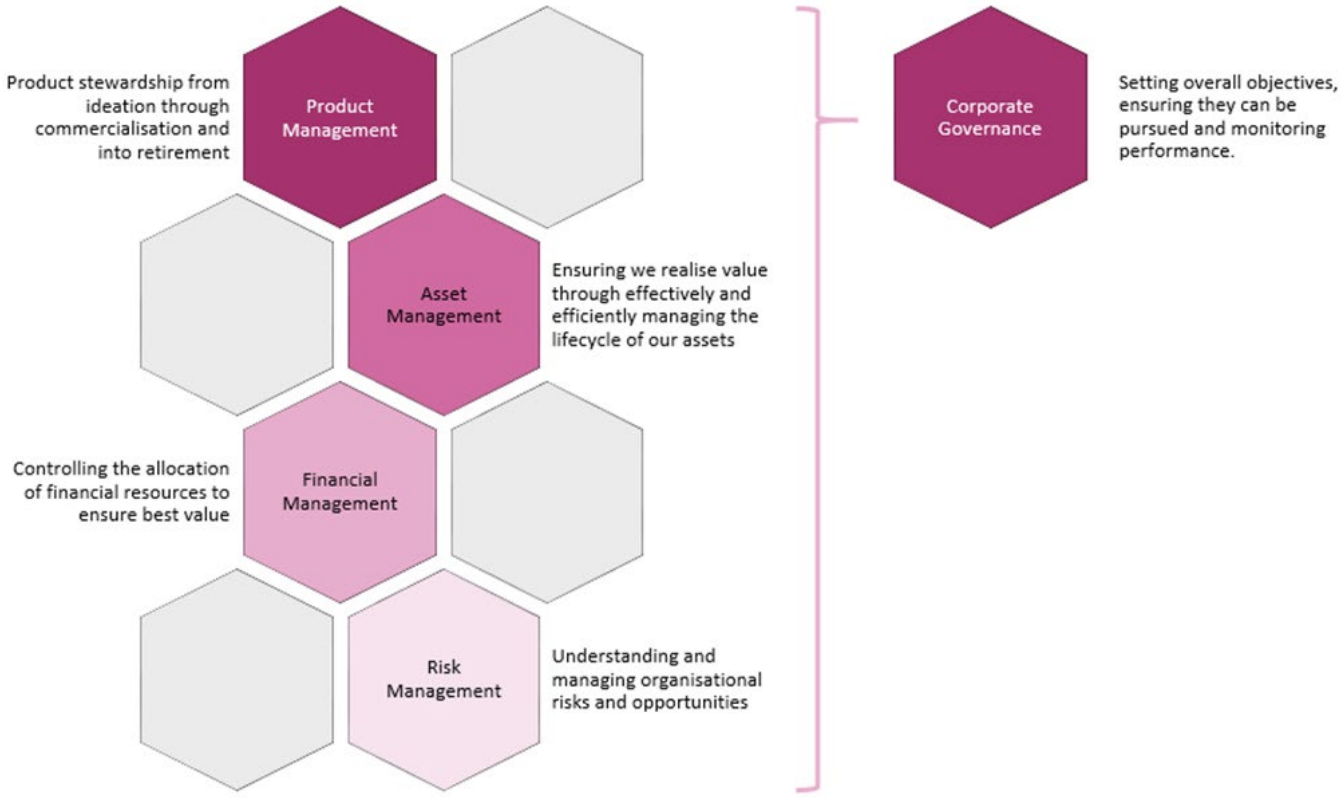
3.0 Governance

3.1 We've built our proposal on solid foundations

We developed our first regulatory proposal alongside our 2020 and 2021 business planning rounds. This means our proposal (and its delivery) benefits from our wider corporate governance and key management frameworks we use to run our business.

The diagram below shows key management frameworks and our overarching corporate governance, which we step through in Figure 3.1.

Figure 3.1: Key management frameworks and overarching corporate governance



3.1.1 Corporate governance

Chorus is a New Zealand-based company listed on the New Zealand and Australian stock exchanges, with an independent board chair and members. Our company constitution and other key documents are publicly available[1].

Our board appoints our Chief Executive Officer (CEO), Chief Financial Officer (CFO) and our General Counsel and Company Secretary. These three officers attend board meetings and attend most board committee meetings.

Our board works with and through our CEO and their team to exercise its responsibility for strategy, culture, governance and performance. Our board delegates authority to the CEO to allow for effective operational management and leadership. The CEO further delegates authority within the company subject to the limits of a board approved delegation policy.

The board's responsibilities include ensuring Chorus has effective management frameworks in place. Accountability for developing, operating and enhancing management frameworks rests with the CEO and their executive team.

[1] https://company.chorus.co.nz/governance.

The board has three committees, which each have delegated responsibilities, powers and authority:

- People, Performance and Culture Committee (PPCC)
- Nominations and Corporate Governance Committee (NCGC)
- Audit and Risk Management Committee (ARMC).

The committee charters are available on our website[2].

The PPCC and NCGC are responsible for:

- **PPCC** – overseeing Chorus' people, culture and related policies and strategies
- **NCGC** – identifying and recommending individuals for appointment and re-appointment to the board and board committees; developing, reviewing and making recommendations to the board on corporate governance principles; and establishing, developing and overseeing a process for the board to annually review and evaluate board, board committee, and individual director performance.

The ARMC plays a key role in assisting the board oversee our financial and risk management frameworks, including:

- assisting the board in discharging its responsibility to exercise due care, diligence and skill in relation to (amongst others) financial management, internal controls, accounting policy and practice, the risk management framework, the integrity of external financial reporting, and compliance with applicable laws, regulations and standards
- ensuring processes are in place that keep the board properly and regularly informed on corporate financial matters
- oversight and monitoring of the performance of internal and external auditors
- providing a structured reporting line for, and ensuring the objectivity of, internal audit
- acting as a forum for free and open communication between the board, internal audit, external auditors and management.

Routine board (or ARMC) processes with direct relevance for our RP1 Proposal include:

- **business planning** – our board approves business plans, including setting opex and capex budgets and revenue targets for the coming year. Business planning begins in each functional unit and is subject to challenge by the responsible member of the executive team, and subsequently to scrutiny by the CFO and CEO. The board approved the FY2021-25 business plan, which has a five-year forecast horizon, as the base for our RP1 Proposal (including base capex, connection capex, and opex)
- **financial reporting** – the ARMC oversees preparation of audited annual and interim reports, and the board approves their release. These reports form the basis for the historical financial information used in our proposal
- **capital governance** – our board approves in advance any significant projects or programmes of work (over $10m in value or more than 5 years duration). Individual financial or contract approval requirements still apply after board approval of the business plan
- **director certification** – directors are also required to sign a certificate regarding the compliance and accuracy of our RP1 Proposal. While the certificate is signed by two directors, our full board approves the governance processes that support the certification and delegates the authority to two directors to sign the certificate.

3.1.2 Product management

Product management is concerned with bringing new products to market, improving existing products, and managing products through to retirement. This process is critical for:

- ensuring our services are attractive, competitive and compliant
- prioritising product efforts to make best use of limited change capacity
- linking product priorities into asset management to drive network capability
- linking product priorities into financial, regulatory and wider management activities.

'Product' in our context can mean anything from major new features or services, to small enhancements or tweaks to existing offerings. Product encompasses:

- **new network capabilities or technology** – for example, emerging Optical Network Terminal (ONT) capabilities (such as newer Wi-Fi functionality and smaller-form-factor for 'Internet of things' use cases), XGS-PON technology (which enables our

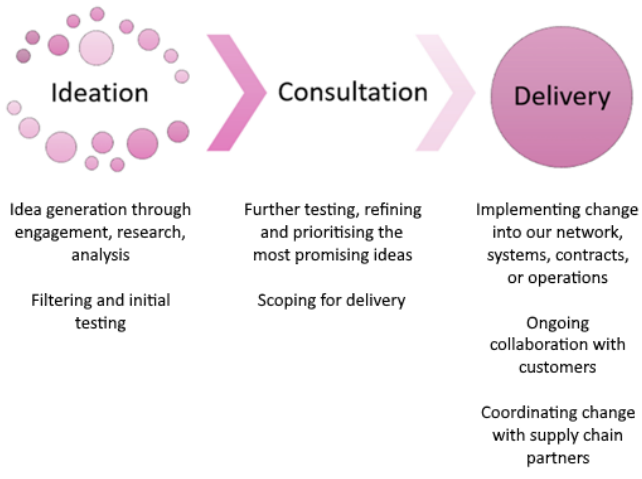
[2] https://company.chorus.co.nz/governance.

Hyperfibre plans) and improved network transport technology (e.g. 100Gbps high bandwidth handover links)

- **new market opportunities** – for example, In-Home Services and Mesh, Small Business Fibre
- **process improvements** – for example, Fibre in a Day connections, improved property developer account management, faster fibre activation times
- **commercial arrangements** – for example, incentive offers for Retail Service Providers (RSPs) such as the current Mix It Up, and Business Boom
- **implementation of the contractual framework** – necessary for the post-2022 environment, including the new regulatory framework
- **social or community benefit initiatives** – for example, Network for Learning (N4L) with schools, the Gigatown competition won by Dunedin in 2014, COVID-19 Ministry of Education subsidy, Lockdown Relief Fund made available to RSPs
- **product lifecyle management** – for example, copper withdrawal plans, grandfathering legacy business services.

Product management starts with ideation and moves through consultation and into delivery, which can involve commercial, operational, information technology and network technology changes. Delivered products are then managed through their lifecycle and into retirement.

Figure 3.2: Product development sequence



Our Chief Customer Officer is accountable for the operation of this process. Key components of the management system are:

- **Initiative to Market (I2M) process** – this involves a weekly forum that reviews initiatives and operates an approval gate between ideation and consultation, and a launch approval process for taking initiatives from delivery into operation. Stakeholders from across the business (including financial, legal, commercial and operational) meet to discuss initiatives' aims and risks, with a view to broad internal visibility of our product pipeline and to making sure there's appropriate scrutiny
- **RSP engagement** – we have around 90 RSP customers (at the time of writing) who are critical to the success of our products. We coordinate our engagement through multiple channels that include the TCF Product Forum, Product Roadmaps, account management, Chorus Live roadshows and Chorus Informer updates made available on our service provider website
- **market research** – we have a dedicated consumer and market insights team that frames research objectives, plans and executes research initiatives and develops recommendations based on findings. We also run a monthly customer experience survey with an external research partner
- **Product, sales and marketing technology delivery** – we run an integrated technology and business delivery programme to bring new product capability and changes to market. The technology office is responsible for the coordination and delivery of network, IT and integration business change.

Key links between the product management system and other management systems include:

- **financial management** – our Chorus Capital Council operates an approval gate between consultation and delivery where the product strategy is looking to commit capital expenditure
- **business planning** – product strategy and roadmap interact with business planning to form revenue targets, and expenditure budgets and forecasts
- **asset management** – our product strategy and roadmap links with our network strategy and planning, delivery and operation, providing a continued focus on the customer and products.

3.1.3 Regulatory management

There is also an important regulatory management element to our product management system.

Since demerger, various regulatory instruments have played a role in shaping our products and how we provide them. Our product processes are geared at keeping the business aware of the landscape, and at ensuring appropriate oversight from a regulatory and legal perspective. Particularly relevant are:

- **our open access deeds of undertaking for fibre services** – these require us to supply services over parts of our network on a non-discriminatory basis, and in some cases to an equivalence of inputs (same prices, processes and systems) standard
- **the line of business restrictions** – these are intended to prevent vertical re-integration. At a high level they constrain us from selling telecommunications services directly to consumers, services above Open Systems Interconnection layer 2, and 'end-to-end' links without any aggregation between sites
- **general competition law** – obligations set out in the Commerce Act that apply to all businesses and inform our interactions with customers and competitors.

From RP1 we will need to ensure appropriate processes are in place to:

- test whether new products or product variations fall within the scope of Fibre Fixed Line Access Services (FFLAS) regulation
- comply with geographically consistent pricing requirements for new and existing FFLAS
- meet compliance requirements relating to revenue control, quality standards, information disclosure and declared services.

Development priorities

Product management is a fast-moving area for telecommunications, and an ongoing priority as we work to attract and retain fibre consumers. Important trends over RP1 include:

- as connection numbers grow and connection activity slows, an increasing part of our business is focussed on managing intact services. In addition, we will be managing the final stages of migration from copper services in some parts of our network
- to protect and enhance the long-term value of our network, we have a renewed focus on longer-horizon innovation activity. This involves embedding Chorus X, our recently revamped innovation management approach, for generating, exploring and validating ideas that will help form our future services and revenue streams
- to augment our core fibre offerings with services that ensure RSPs and end customers get the best experience on our network and remove any inhibitors to this (for example, by reducing in-home network problems and improving service ordering and management processes)
- as our network matures, we have an opportunity to enhance product lifecycle planning and improve linkages to asset lifecycle management
- new regulatory arrangements provide impetus and opportunity to develop new ways of engaging effectively on longer-horizon product development priorities.

3.1.4 Financial management

Financial management is concerned with ensuring financial resources are put to their best use. It includes core financial planning, funding, control and reporting functions.

Our CFO is accountable for our financial management systems. Key activities include:

- **business planning** – our board approves a business plan in June each year that sets budgets and revenue targets for the coming year and forecasts performance over five years. The business planning round spans six months of direction setting, forecast preparation, challenge and approval activities
- **Chorus Capital Council (CCC)** – our CEO and CFO hold monthly CCC meetings that operate as an approval gate for capital projects. The CCC reviews business cases above certain thresholds, ensures cross-functional alignment and alignment to the wider company strategy and approves prioritisation decisions that balance changing needs against budgeted resources. CCC approval is tailored, from bulk-approval for some routine work to multi-gate approval for novel and complex work
- **external reporting** – we prepare annual and interim audited financial statements, and as a dual listed issuer have continuous disclosure obligations on both the NZX and ASX. We also prepare annual

regulatory disclosures for submission to the Commerce Commission and respond to ad hoc regulatory information requests

- **performance reporting** – we track monthly progress against operating and capital budgets, and delivery against financial targets and objectives. This supports reporting to management, our board and the market
- **policy setting** – developing and updating financial policies for board, ARMC or CEO approval. Policies include – delegation of authority, accounting, procurement, external auditor independence, fraud, legal and compliance, managing risk, and market disclosure
- **asset accounting** – we maintain a Fixed Asset Register (FAR) that records asset settlement and depreciation. We document our approach to asset capitalisation, which is updated as required.

Key links between the financial management system and other management systems include:

- **product management** – our Initiative to Market (I2M) process operates an approval gate between ideation and consultation and a launch approval process ahead of delivery, and we scale overall resourcing through interaction with business planning
- **risk management** – financial management interacts with risk management to identify financial risks and opportunities and implement mitigations
- **asset management** – intersections occur in planning, decision-making and delivery with the allocation of financial resources to efficiently manage the total cost of ownership. Our CCC operates as an approval gate between planning and delivery.

Development priorities

As we enter RP1 we will be moving from regulatory development and first application, into full implementation. This will drive considerable change, including:

- implementing settled regulatory rules into our planning and reporting activities – for example, embedding cost allocation into business planning, capital governance, asset settlement, performance monitoring and external reporting
- implementing new information disclosure requirements (to be developed by the Commerce Commission in 2021) and any reporting requirements that flow from the RP1 price-quality decision
- developing capability to monitor performance against RP1 regulatory settings, including being able to forecast the impact on allowable revenue of regulatory CPI, connection volume adjustments and revenue wash-ups
- building on our RP1 preparation efforts to streamline and enhance our ability to produce regulatory proposals in future
- evolving decision-making to account for regulatory incentives.

3.1.5 Risk management and internal audit

Risk management is concerned with understanding and addressing risks and opportunities. Our risk management system is concerned with ensuring:

- risk management is consistently embedded into day-to-day business operations and decision-making
- suitable processes and ownership are in place for identifying, understanding and managing risks
- our board can effectively set risk policy, calibrate risk appetite and monitor principal risks.

Our board annually reviews and sets a risk appetite statement and risk tolerance levels and reviews and approves principal risks, along with holding quarterly discussions on unforeseen risk. The ARMC receives and reviews regular management reporting against the risk management framework and on principal, business unit and emerging risks. Our board also periodically reviews and approves a managing risk policy available on our website[3].

We have an internal audit programme that includes the use of external specialists to review and report on internal processes and controls for management risk, and aspects of our risk management implementation. The ARMC provide oversight of the internal audit programme and monitor actions arising.

A dedicated Compliance Manager, including with the support of external specialists, also provides expertise and oversight of a framework for managing key legislative, regulatory and contractual obligations, and over internal policies.

Our General Counsel and Company Secretary is accountable for risk management and internal audit, and our CEO and wider executive have company-wide oversight and decision-making responsibilities for operational risks within their functional units within the board-approved risk management framework. We have a dedicated team to support effective risk management, including by promoting awareness, building capability and advising on good practice.

Key links between risk management and other management systems include:

- **product management** – the relevant approval gates ensure risk assessment from a wide range of stakeholders
- **financial management** – the ARMC has responsibilities across risk and financial management, and much of the financial management system is directed at addressing risk. The risk management system provides supporting expertise and systems for monitoring and reporting, including through the internal audit programme
- **asset management** – the asset management system considers risk profiles and impacts against the Chorus risk framework. It identifies mitigation plans where progress is monitored and reported. The risk management system provides the overarching system for monitoring and reporting.

Development Priorities

As we move from network build, through connection and into operation, our risk management priorities and focuses are changing. In particular, we're working to:

- enhance asset risk management, as part of our wider asset management capability build
- embed a framework to manage compliance obligations associated with new price-quality and information disclosure regulation
- optimise the BBM regime in Chorus, to ensure the sustainability of our business for consumers and other stakeholders.

[3] https://company.chorus.co.nz/sites/default/files/downloads/chorus-board-approved-policy-managing-risk-policy.pdf.

3.1.6 Asset management

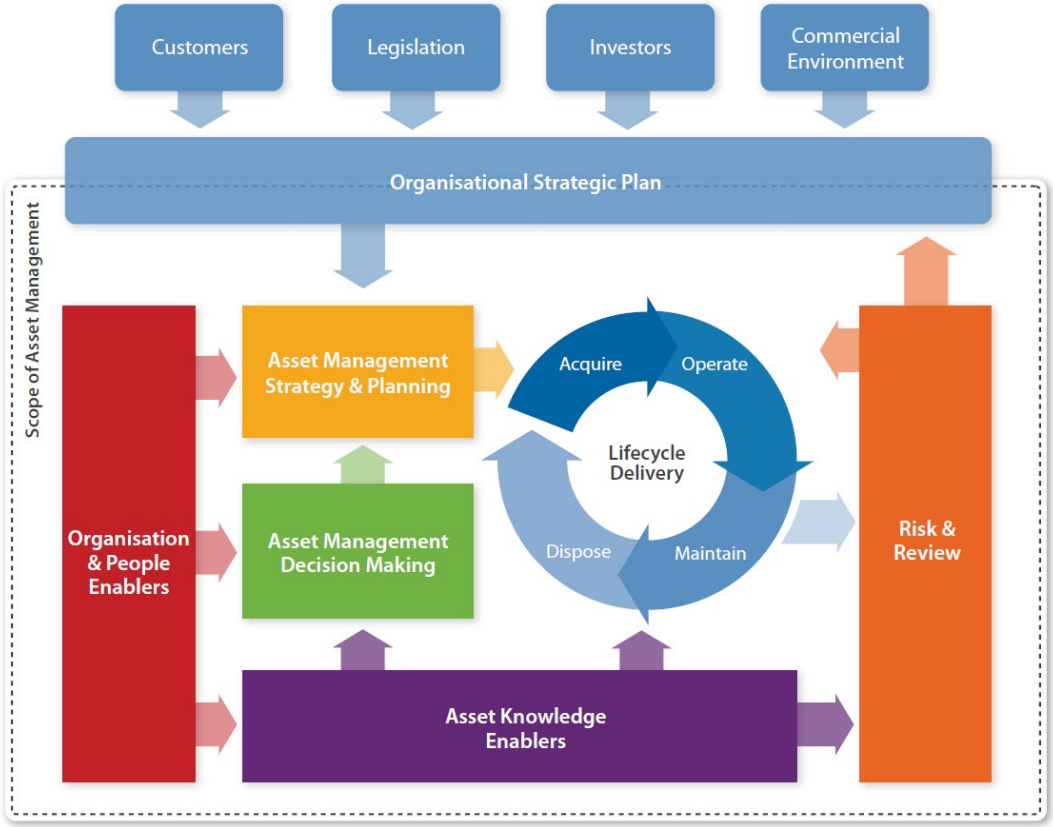
Asset management is concerned with realising value from our assets. As an infrastructure business, this is relevant to most of what we do.

Our asset management needs are changing as we move from building to operating our fibre network, so we recently completed a thorough capability assessment and roadmap development exercise to guide this change. We worked with an Institute of Asset Management (IAM) endorsed assessor for this work and used the IAM conceptual asset management model.

Key insights from this work included:

- our capability is comparable to other organisations undertaking the first assessment
- since 2011, building the fibre network has been our priority and lifecycle delivery has become an area where we have developed leading practices and show a high level of maturity relative to many utilities
- many of our assets are short lived, and we offer services that compete in an environment of fast-paced technological change. This means we have strengths in organisational culture and decision-making agility relative to many utilities
- as we transition beyond build, through connection and into operation our priorities are shifting and there will be value in lifting capability around asset information management, documentation and longer-term asset strategy and planning.

Figure 3.3: The IAM conceptual asset management model © Copyright 2014 Institute of Asset Management (www.theIAM.org)



Our Chief Technology Officer (CTO) is accountable for our asset management system overall, though the breadth of asset management means there are strong links to finance, strategy, operations and customer executives.

We have a CEO approved asset management policy. We are developing a more strategic approach to asset management and have made progress documenting domain plans for IT assets and Portfolio Asset Management Plans (PAMPs) for physical assets and network electronics. These activities have supported and underpinned the stakeholder-facing material in our RP1 Proposal (including this report, and its companion Our Fibre Assets).

Key components of our asset management system include:

- our business planning process translates asset plans into financial forecasts that are challenged and approved to set annual budgets and provide a five-year view of expenditure needs
- our CCC reviews and approves programme and individual capital expenditure plans based on business cases that provide analysis to support decision making
- our product and risk management systems interact with these planning and approval processes to support our asset management plans and influence our capital programme and network capability
- physical network lifecycle delivery is managed through our customer and network operations executive using contracted field service providers
- asset information is managed by investment managers, with enterprise-wide systems for financial accounting (FAR) and geospatial data (Netmap).

Development priorities

Priorities for enhancing our asset management system include:

- **documentation** – implement a review and upkeep cycle for our asset management documentation that will support accountability, improve capability and further inform improvement priorities
- **asset information** – develop an asset information management strategy and an asset information management framework, and begin to implement asset information system improvements
- **reliability** – develop a network reliability strategy suitable for the transition from a contractual to regulatory investment framework
- **planning** – scope improvements to our planning and decision-making, including to adapt to our new regulatory arrangements
- **organisation and people** – review whether and how we should further evolve our operating model as build activity winds down and installation activity eases.

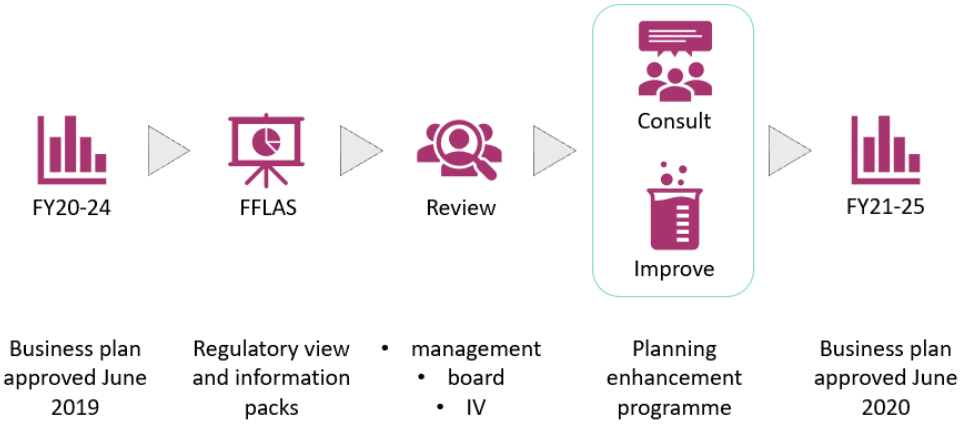
3.2 We used a robust process to bring our proposal together

We have structured our RP1 Proposal preparation around our 2020 and 2021 business planning rounds, with objectives of ensuring:

- our proposal builds on, and benefits from, our business-as-usual governance and management systems
- our proposal has business ownership and buy-in
- the proposal preparation process serves as an opportunity to embed capability improvements.

The main components of the forecasting stream of our preparation process are shown in Figure 3.4.

Figure 3.4: Main components of the forecasting stream



Our business planning builds on extensive stakeholder engagement, and in 2020 we added consultation on our priorities for RP1. Over the course of that preparation process above, we have:

- prototyped and refined methods and models that produce a regulatory view of planned expenditure. This includes implementing cost allocation, transparent cost escalation, conversion from financial (June) to regulatory (December) years, opex presentation of capitalised leases and breakdown into regulatory categories
- documented and challenged key assumptions, forecasting methods and treatment of risks and uncertainties. This includes a full management review cycle and rigorous Independent Verification (IV) exercise
- executed an extensive improvement programme that has enhanced the robustness and transparency of our forecasts, including through implementing good spreadsheeting practice to improve traceability
- familiarised our board with a regulatory view of our business, including building an understanding of the maturity of our forecasts and the key judgements that impact our proposal
- aligned our 2020 business planning round and proposal preparation, including by adopting our FY2021-25 business plan forecast as the basis for our proposal.

We have operated the forecasting workstream described above alongside other activities that have contributed to our RP1 Proposal, including:

- **asset management system enhancements** – this has included developing more complete documentation of our practices, and conducting a thorough capability assessment and road mapping exercise
- **proposal engagement** – we have run stakeholder engagement and consultation processes to begin building understanding of our proposal, to seek input on key judgement areas, and to develop our regulatory communications
- **evaluation planning** – we have worked with the Commission to support an effective evaluation process. This has included working on regulatory templates and information requests, providing early visibility of our proposal preparation approach and sharing material on independent verification and asset management capability assessment
- **proposal documentation** – this has included developing our first Integrated Fibre Plan (of which this report is a major component) and other documents with the dual aims of providing accessible communications and meeting compliance requirements
- **assurance and certification** – our proposal is supported by an extensive programme of internal and external assurance activities designed to support board approval and director certification

- **proposal governance** – we have had a dedicated team leading proposal preparation, with multiple-levels of governance. This has included executive sponsorship from our Chief Financial Officer and Chief Technology Officer, an executive-level programme steering group, and extensive board engagement (involving 12 board meetings and three education sessions).

Our proposal governance process extended beyond adoption of the FY2021-25 business plan forecast to include activities such as:

- management and board scrutiny, challenge and approval of variances from the FY2021-25 business plan. This includes items where a different treatment is required for proposal purposes (such as self-insurance, execution risk, innovation and Customer and Network Operations labour cost) and post-business plan developments (such as inclusion of the pit inspection and remediation programme, and the Rural Connectivity Group (RCG) mobile backhaul project)
- extension of the forecast horizon beyond RP1 to include 2025 and 2026 years. This was developed using a high-level approach, with bottom-up and top-down sense checking, scrutiny by executives and approval via the overall assurance and certification process
- finalisation of the independent review by CutlerMerz of our proposal, including scrutiny of the above variances and completion of the final independent verification report
- confirmation of the naming, scope and mapping of regulatory categories and sub-categories, plus engagement with the Commerce Commission to finalise regulatory template requirements. Categories and sub-categories were developed and internally approved through our proposal team in consultation with business owners and finance teams
- confirmation of the naming, scope and mapping of connection cost groups plus associated engagement with the Commerce Commission to finalise regulatory template requirements.

This process culminated in approval of our total capex, base and connection capex and opex proposal amounts. This process encompasses all expenditure, including base capex sub-categories, and all opex sub-categories.

4.0 Demand

Our proposal is designed to accommodate rapid demand growth

This is our IFP Demand report. It introduces demand types and their linkages to our plans, presents our key forecasts and explains how we put those forecasts together.

4.0 Demand

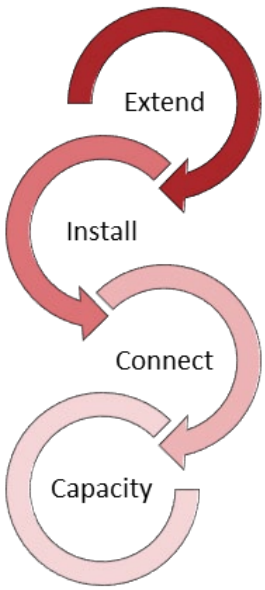
4.1 Introduction

There are three key types of demand that drive our activities:

- **network extension** – before consumers can install fibre, we need to extend the communal network into their town, street or development. Much of this work is contracted well in advance – typically with the government (e.g. Ultra-Fast Broadband (UFB) programmes) or property developers. Over a longer horizon, we need to forecast un-contracted demand for network extension
- **installation and connection** – once the communal network is available, consumers can order an installation for their house, office, or other end point (such as digital billboards). Once equipment is installed, consumers can activate a connection
- **bandwidth** – once connected, consumers begin to transfer data across our network. We design our network to be congestion-free, so we need capacity headroom to stay ahead of growing peak demand.

The following sections step through these key types of demand. For each we provide context, present current forecasts, explain our methodology and discuss key assumptions and linkages. Finally, we summarise other types of demand-driven activity not covered in detail.

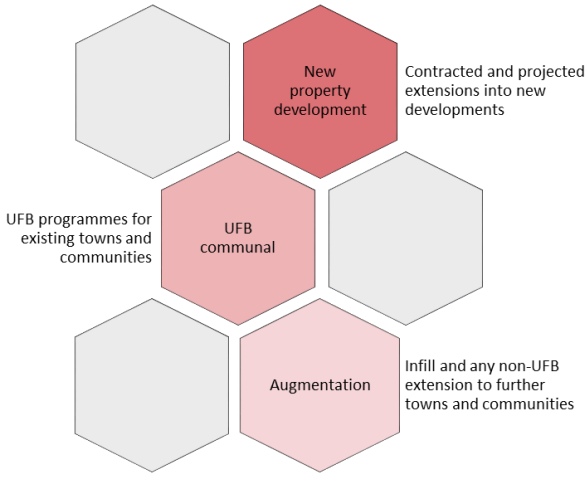
Figure 4.1: Network demand sequence



4.2 Network extension

Extending the network makes fibre available to new consumers. It involves installing fibre in a street or development, establishing a connection back to a local central office, and provisioning enough access coverage and capacity, aggregation capacity and transport capacity to begin serving installation and connection demand.

Figure 4.2: Network extension expenditure sub-categories



Our Ultra-Fast Broadband (UFB) communal forecast includes contracted completion of the UFB2+ programme in 2022. UFB communal infrastructure build has been our second largest area of activity but will become a minor activity as we enter our first regulatory period (RP1). We do not have visibility of the timing or scope of any future government programmes to further extend the network. We would bring any such programmes into our forecast as and when they emerge (and if we are successful in securing the work).

We forecast minimal augmentation activity during RP1. The potential drivers for augmentation are:

- **infill** – over time we need to augment our network within its existing footprint to accommodate more connections – for example, due to infill housing or apartment conversions
- **community initiatives** – occasionally, communities or individuals will self-fund extension of the network outside government programmes. This is a small source of demand, and the direct costs are currently funded via a mix of community and Crown funding

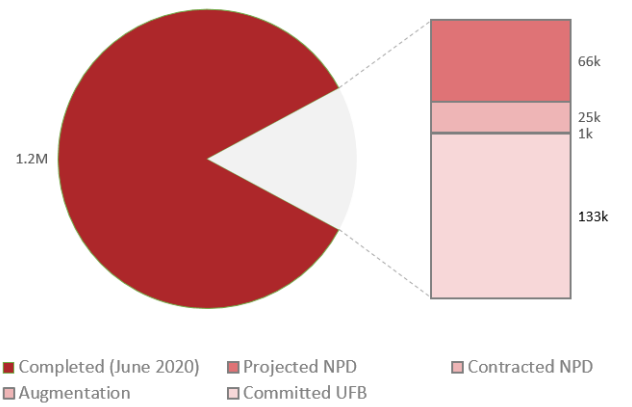
  non-UFB government programmes – our augmentation forecast includes network extension to Haast and Milford Sound that is funded through the provincial growth fund

- **lifecycle** – occasionally, it will become economic to extend the fibre network in preference to reinvesting in legacy networks. This can be prompted by some combination of demand growth or asset end of life
- **economic** – in theory, it may become economic in the future for us to proactively extend the network into existing towns and communities. At this stage we have not formed a view of the scale or timing of any such work. Potentially, we could develop plans and seek funding through an individual capex proposal to the Commerce Commission.

As we enter RP1 and committed UFB programmes come to an end, New Property Development (NPD) will become our biggest area of network extension activity. We will have largely completed NPD work for which we already have contracts by RP1, so RP1 network extension activity will be dominated by work that is not currently on our books. Forecasting this un-contracted NPD demand is our most significant network extension forecasting task.

At June 2020 our fibre network extends past around 1.2 million sites, and we have contracts (including UFB2+, NPD contracts and other augmentation) to extend the network past nearly 160,000 more. Forecast un-contracted demand accounts for a further 66,000 connections to the end of RP1 (or around 30% of forecast network extension).

Figure 4.3: Forecast composition of sites passed at end of RP1



The balance of this section focusses on forecasting NPD demand.

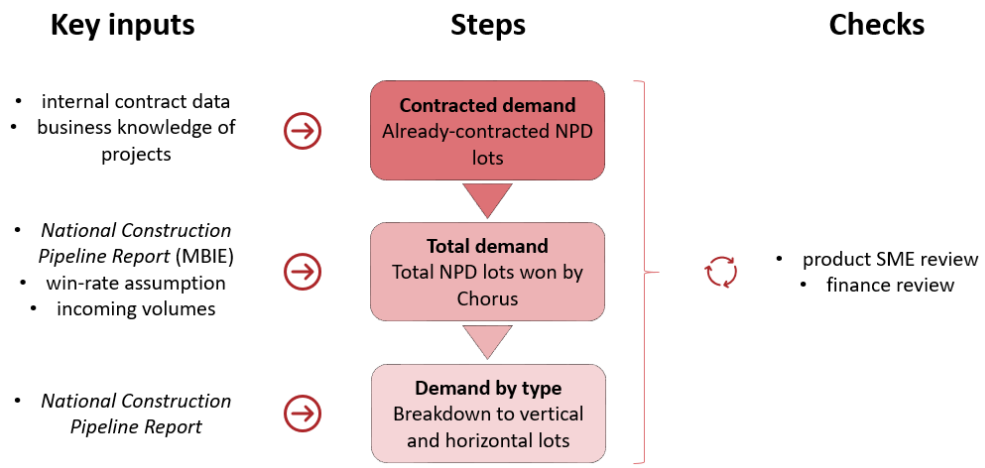
4.2.1 Forecast inputs, methodology and process

Key forecasting tasks are to form a view of:

- the timing of contracted NPD work – we develop this based on our records of committed contracts, and business knowledge of the status and progress of projects
- the volume of projected NPD work – we develop this based on dwelling consent data (and forecasts) and a view of our win-rate for new developments.

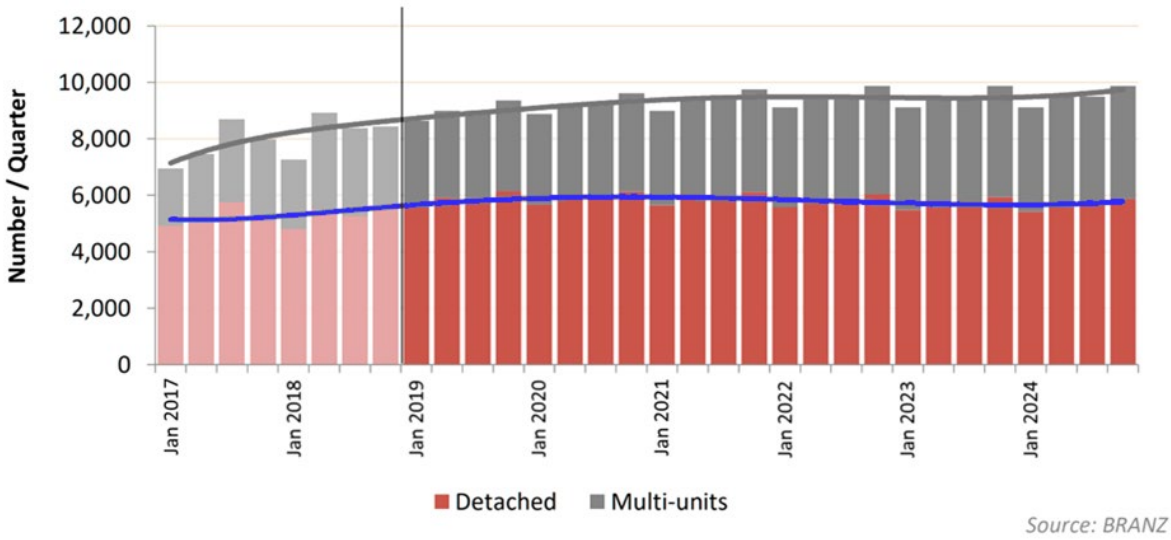
The main steps in our process are shown in Figure 4.4, with information on key inputs and checks.

Figure 4.4: Network extension demand forecasting



The National Construction Pipeline Report is prepared by MBIE in August each year and has a six-year forecast horizon.[1] It provides residential and non-residential consent forecasts, with breakdowns by type and region. MBIE's key residential dwelling unit forecast is reproduced in Figure 4.5.

Figure 4.5: Dwelling units consented nationally



We scale the MBIE forecasts for post-publication developments, based on our own market intelligence and incoming volume trends. We use the scaled forecast to inform our view of vertical and horizontal breakdown (apartments vs. subdivisions). We convert overall NPD activity into Chorus demand based on our historical win-rate by region, and business owner insights on whether we expect this to shift in the future.

We first prepared our RP1 Proposal NPD forecasts early in 2020 and confirmed them in May 2020 to support our final business plan. Our process included sense-checking MBIE's August forecasts against subsequent developments, including our observations of how COVID-19 was impacting new developments.

4.2.2 Observations and uncertainties

NPD demand is subject to a raft of uncertainties relating to building sector activity and our positioning in the market. However:

- New Zealand has a housing shortfall that is expected to persist as the population continues to grow. This means that housing development is generally supply-constrained, and hence tends to be relatively stable at a national level
- the scale of NPD activity is small compared to recent UFB activity. Absent major new UFB or augmentation initiatives, we are transitioning to a world where steady organic growth is likely to be the predominant type of network extension activity
- the volume of installations driven by new communal infrastructure is small compared to overall installation activity. This will gradually change as installations reach saturation in the existing network. Because NPD is greenfield work, the associated installations are lower cost than (brownfield) UFB installations.

[1] Our RP1 forecasts use the report published in August 2019. https://www.mbie.govt.nz/assets/national-construction-pipeline-report-2019.pdf

4.2.3 Linkages

Network extension has been our dominant activity through the peak of the UFB programmes. This will change as we enter RP1 and extension activity settles to a lower steady state. Installations and managing capacity will remain major areas of activity. In the longer-term, installation activity will fall away and sustaining the physical network, managing network capacity and servicing product development and switching will become our major areas of activity.

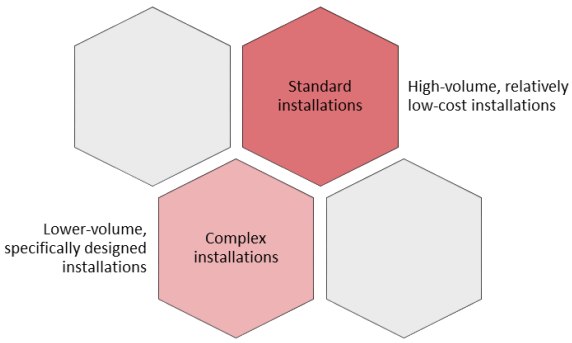
In the meantime, network extension links to other expenditure areas through:

- **sustain** – network extension creates new assets for us to operate, maintain and (eventually) replace. Fibre is lower cost to operate (more energy efficient and temperature tolerant) and maintain (fewer faults) than copper
- **installations** – network extension expands the pool of sites where fibre can be installed
- **network capacity** – network extension includes providing initial access, aggregation and transport coverage and capacity. We then have ongoing investment to optimise demand, capability and lifecycle requirements
- **support** – network extension uses some shared assets and operating resources (including central office buildings). As the fibre network grows, more shared costs are required to support it.

4.3 Installations and connections

Once the communal network is in place, we can start to install fibre to homes, businesses and other end use points (including 'smart locations', such as digital billboards). This involves coordinating with Retail Service Providers (RSPs), then visiting the site to fit an Optical Network Terminal (ONT) and build fibre back to the communal network. Once fibre is physically installed, we can readily enable new connections.

Figure 4.6: Installation expenditure sub-categories

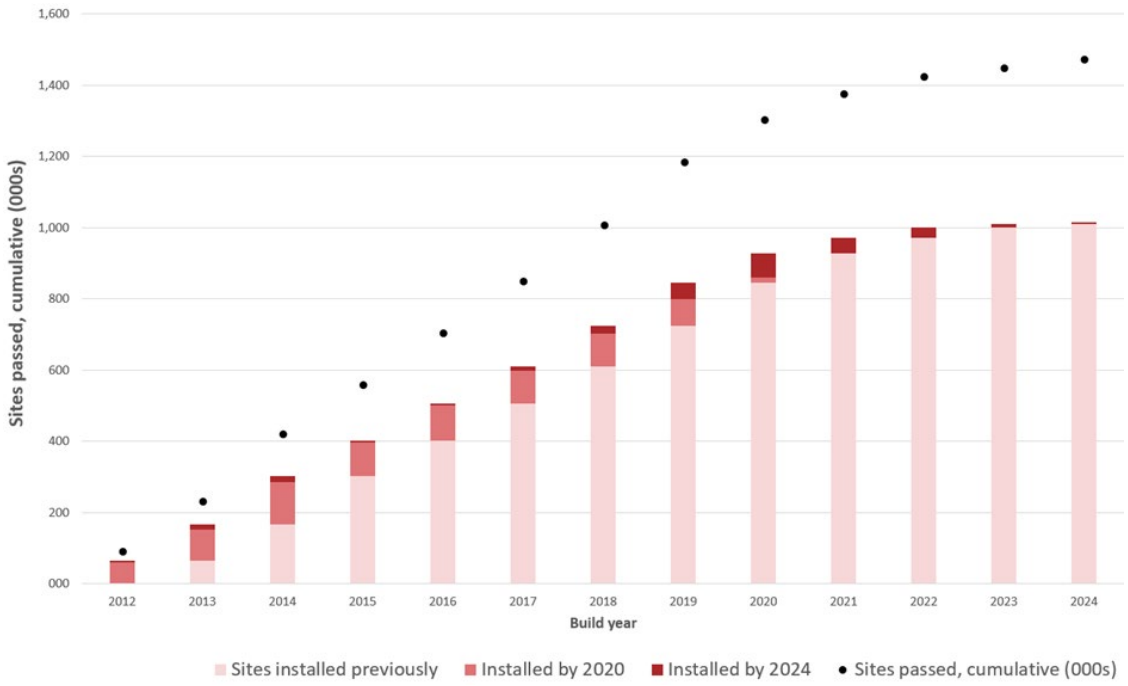


Our forecast activity is dominated by standard installations as a market-led migration from copper to fibre continues to play out.[2] We estimate well over 60% of sites passed early in the UFB build have had an ONT installation, and we assume uptake at similar levels for newer parts of the network.

Figure 4.7 shows how network size and uptake have grown since 2012, and overlays how we forecast both measures to grow further to the end of RP1. We measure network size in terms of 'sites passed', noting that some sites may generate multiple installations and connections. Sites passed can grow without network build due to address growth within established parts of the network. We define uptake here as installations divided by sites passed. Note that we have fewer connections than installations (due to inactive installations) and potential installations is a bigger number than sites passed.

[2] Note that the standard installation category used here is not the same as the "standard installation" as defined in our commercial arrangements.

Figure 4.7: RP1 change in network uptake by network build year[3]



Installation activity is concentrated in the newer parts of the network, as the more established parts near saturation. As UFB rollout nears completion the amount of network extension is reducing, so we expect overall installation activity to decline.

As well as forecasting overall installation activity, our forecast breaks down into 33 standardised types with combinations of:

- **communal network type** – whether the communal network was built under the UFB1 or UFB2 programme, as developer communal or other
- **dwelling type** – whether the installation is directly to a Single Dwelling Unit (SDU), via a Right of Way (ROW), to a unit within a Multi Dwelling Unit (MDU) or to a (non-building) smart location (such as a digital billboard)
- **construction method** – whether the installation will involve aerial, civil, surface mounting or conduit construction
- **infill** – some new installs trigger work to augment coverage of the existing communal network. For example, this can occur when subdivision activity has increased the number of sites to be served.

For regulatory purposes, we have aggregated standard install types into nine installation cost groups (cost groups 1 – 8 and 10). In line with our UFB contract with government, standard installations for mass market residential services are usually done at no cost to the consumer (or their RSP) and we typically contribute to RSP costs as an incentive for new connections. Incentives are a component of our investment to increase fibre uptake.

Complex installations (cost group 9) make up a comparatively small component of installation activity by volume and by total cost. The cost per complex installation is usually significantly higher, though this can be offset by capital contributions in some cases. Examples of complex installations include providing diverse paths to a large site, or establishing a point-to-point service for a hospital, school or office complex.

[3] Our forecasts are not constructed using network build year, so this chart is indicative only. All figures are for Price-Quality Fibre Fixed Line Access Services (PQ FFLAS).

Figure 4.8: Installation expenditure sub-category breakdown

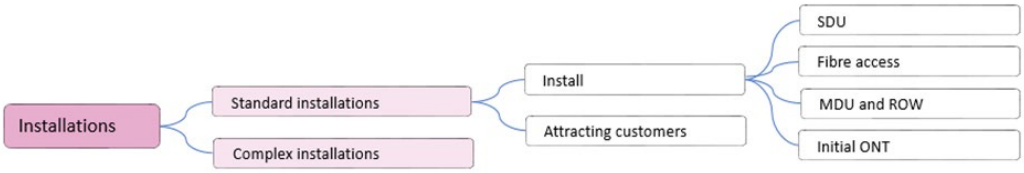


Figure 4.9 shows forecast and historical installation volumes, broken down by cost group. Hyperfibre installs also contribute to access network capacity upgrades over time, so we have defined a non-linear cost group to capture these costs.

Figure 4.9: SDU installations, ROW and MDU extensions and complex installations

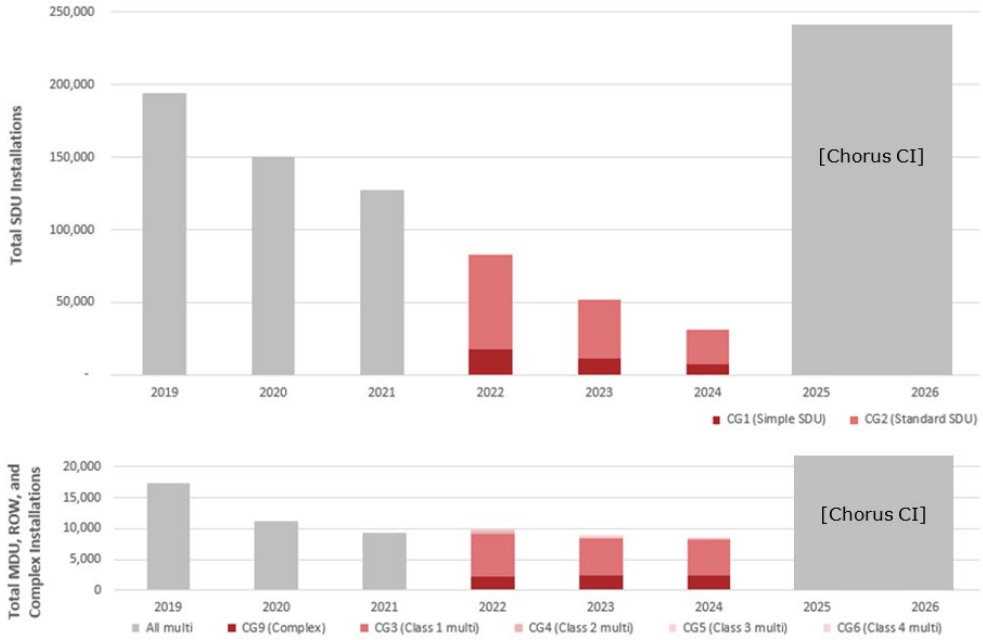
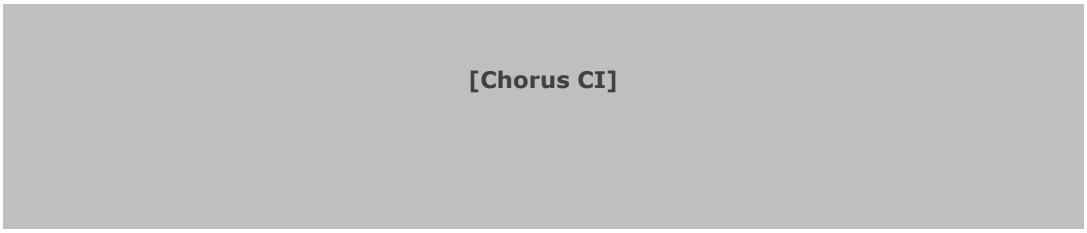


Figure 4.10: Hyperfibre Installations [All chart Chorus CI]



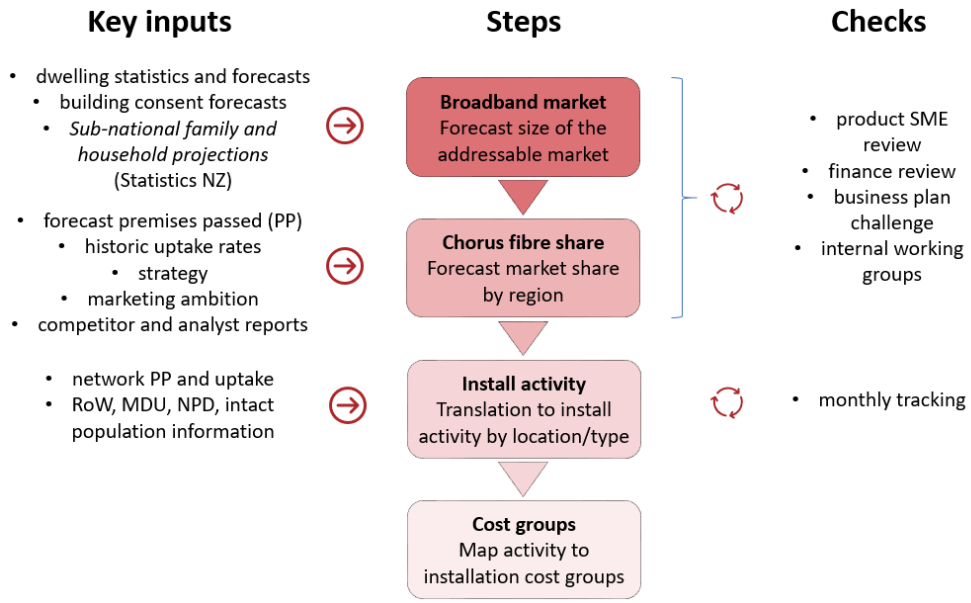
4.3.1 Forecast inputs, methodology and process

The key forecasting tasks are to form a view of:

- growth in fibre consumers as a share of the overall broadband market
- how this translates into installation activity
- how installations map to cost groups.

The main steps of our process are shown in figure 4.11, with information on key inputs and checks.

Figure 4.11: Installations demand forecasting



We have a major forecast refresh cycle aligned with our business planning process each year. This involves developing an initial forecast in February that is challenged and updated through the business planning process. A baseline is then locked down in June when the board approves the business plan. We then run a monthly sales and operations planning process that refines forecasts and assesses in-field capacity to meet demand.

Traditionally, our major refresh has its strongest focus on the year ahead. As we prepare for RP1 we have an increased focus on longer-horizon forecasting.

4.3.2 Observations and uncertainties

Connection volumes have significantly outperformed the expectations that government, Chorus and other commentators held when we started building the UFB network. Over the eight years since the first UFB network areas went live, we have built a much better understanding of uptake curves for New Zealand communities. This understanding is built into our forecasts now but remains a moving target.

Installation activity peaked at nearly 190,000 new connections in 2019 and we forecast it will ease to just over 40,000 in the final year of RP1. The forecast period includes the now-familiar early-uptake phase for newer parts of the network, through to near full penetration for the most established parts of our network.

Through the forecast period we expect to transition to new service provider arrangements. Our aim is to complete this transition without material disruption to installation delivery.

We expect RP1 installs to include the first migrations carried out as part of copper withdrawal activity under the proposed copper withdrawal code. We expect this to be localised and relatively small-scale, so the uncertainty about the success of this new activity contributes to overall uncertainty but is not significant in scale.

We have seen recently that global events can impact activity. During the early 2020 COVID-19 lockdown we had a temporary reduction in activity, and then rapid recovery reflecting the value people place on high-

quality home connectivity. New or improved online services are also a driver, with fibre providing the best experience for services such as gaming and high-resolution media streaming that benefit from low latency or high bandwidth.

Forecast volumes are sensitive to the uptake of competing broadband technologies, such as fixed wireless. This is influenced by competitors' plans and, ultimately, by the fibre value proposition. We support our competitiveness through the quality and pricing of our services, and our efforts as an active wholesaler.

For regulatory purposes, install volume uncertainty is mitigated through:

- structuring connection-based allocators so they can be washed-up for actual connection numbers. This mitigates the risk of over- or under-allocating shared costs due to connection uncertainty
- install volume adjustments. Our capex allowances will be adjusted by pre-determined unit rates for any mismatch between forecast and actual installation volumes. This mitigates install volume risk, while ensuring we retain (and therefore have an incentive to manage) cost risk.

4.3.3 Linkages

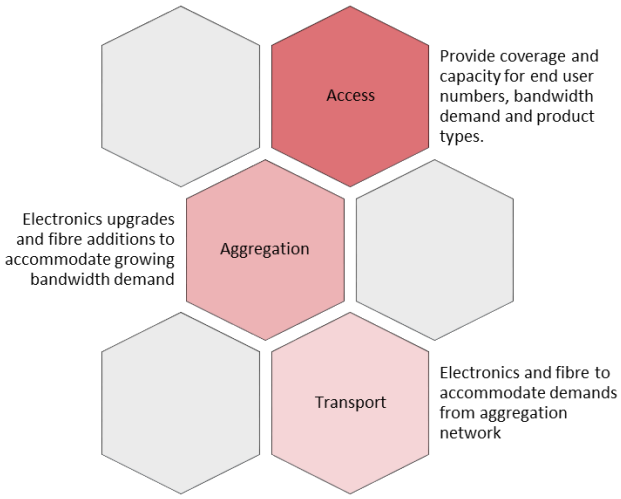
Installations will be our dominant activity in RP1 and will remain significant into RP2. Installations link to other expenditure areas through:

- **extending the network** – network extension feeds into install activity by increasing available addresses
- **attracting customers** – we provide incentives to encourage fibre installations, and we promote fibre through our active wholesaler activities. This supports our forecast volumes and helps us attain (and retain) fibre connections, that in turn supports efficiency by spreading our fixed costs across a larger number of connections
- **sustain** – installations establish new physical network assets that we must maintain and eventually replace. As the fibre network grows, it drives a larger portion of maintenance costs. Recurring capex per-connection reduces as connection numbers grow
- **network capacity** – installations establish ONTs at a site that we must manage through their lifecycle. Each installation consumes an access port in our exchanges and (once connected) generates additional bandwidth demand that feeds into capacity optimisation considerations
- **support** – as fibre connections grow and copper connections decline, shared costs are reallocated to fibre. As installation activity declines, we capitalise fewer costs and some resources can be scaled down. Cost per-connection reduces as connection numbers grow.

4.4 Bandwidth

To provide a congestion-free service[4], we need to ensure capacity stays ahead of growing bandwidth demand. Bandwidth demand increases as we have more active connections, and as demand per connection continues to grow.

Figure 4.12: Network capacity expenditure sub-categories



[4] We have a contractual obligation through RP1, under the NIPA, to provide a congestion-free network.

We forecast bandwidth demand by starting at the consumer level, and modelling how increasing connections and growing data per connection will impact the access, aggregation and transport parts of our network.

Our key forecasting metric is Average Throughput Per User (ATPU). This is a measure of the average contribution per connection during the network peak. Two key points about ATPU are:

- **diversity of behaviour** – every connection behaves differently, so they don't all peak at the same time of the day. Many connections will have their individual peak at a different time to the network peak on any given day. This means the network peak is typically much lower than the sum of all connection peaks
- **averaging** – many connections will have zero or low demand at network peak time. This means that ATPU is also typically much lower than the average of all connection peaks.

These points are illustrated in Table 4.1 by comparing measures based on usage of the Chorus fibre network in June 2020.

Table 4.1: System demand measure build-up and comparison

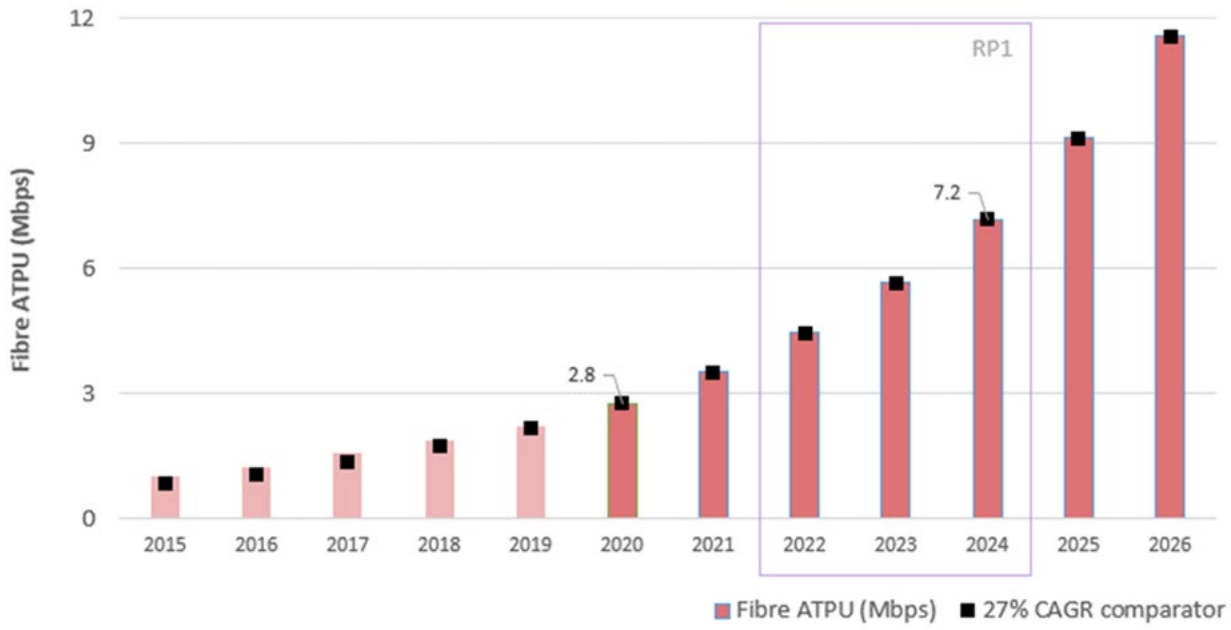
Measure	Description	Value	Comments
Number of connections	Total number of active connections on the Chorus fibre network (GPON only).	740,000	This figure is used as the denominator for averaging calculations
Sum of connection speeds	Theoretical demand on the network if every connection downloaded at its maximum plan speed at the same time	164 Tbps	This scenario is improbable and would be impeded by various bottlenecks, but it provides useful context
Average speed	Sum of connection speeds divided by number of connections	221 Mbps	
Sum of peaks	Theoretical network demand if each connection's peak throughput for the day had occurred at the same time	20.9 Tbps	This is a more plausible but still unlikely scenario
Average peak	Sum of peaks divided by the number of connections	28.3 Mbps	This is 13% of the average speed, indicating that plan speeds are not a limiting factor for many users
System peak	Actual peak throughput observed on the network for the day	1.99 Tbps	This is 10% of the sum of peaks, due to diversity in the timing of connection peaks
Average throughput per user (ATPU)	System peak throughput divided by the number of connections	2.69 Mbps	This is the primary measure we use for capacity planning.

Our forecasting and network capacity planning work their way up from access to transport as follows:

- **access** – when we extend the network, we provision ports to enable initial installations. As installations grow, coverage is exhausted, and we add more ports and incremental feeder fibres and splitters. We also overbuild when moving to a new product technology (such as XGS-PON). Finally, we invest in more capacity as needed to stay ahead of bandwidth demand. We use forecast ATPU and connection numbers to plan for capacity expansion
- **aggregation** – we map access network demand to our aggregation network to assess aggregation capacity needs. Aggregation networks provide capacity between our access networks and retailer points of interconnection, so capacity needs are also influenced by where retailers choose to interconnect with our network
- **transport** – aggregation network planning produces a view of the capability we require from the transport network (which is used to connect distant points). We often use system peak demand to characterise overall demand on the network, but it is demand between locations that is the key input to transport network planning.

To ensure a congestion-free network we plan for 50% headroom between network capacity and forecast demand, which amounts to building around nine months ahead of our best estimate of demand. This approach provides a buffer for surges in demand such as those seen during major gaming releases, the 2019 Rugby World Cup and the early 2020 COVID-19 lockdown. These surges have been growing larger relative to base demand, i.e. demand volatility has been increasing.

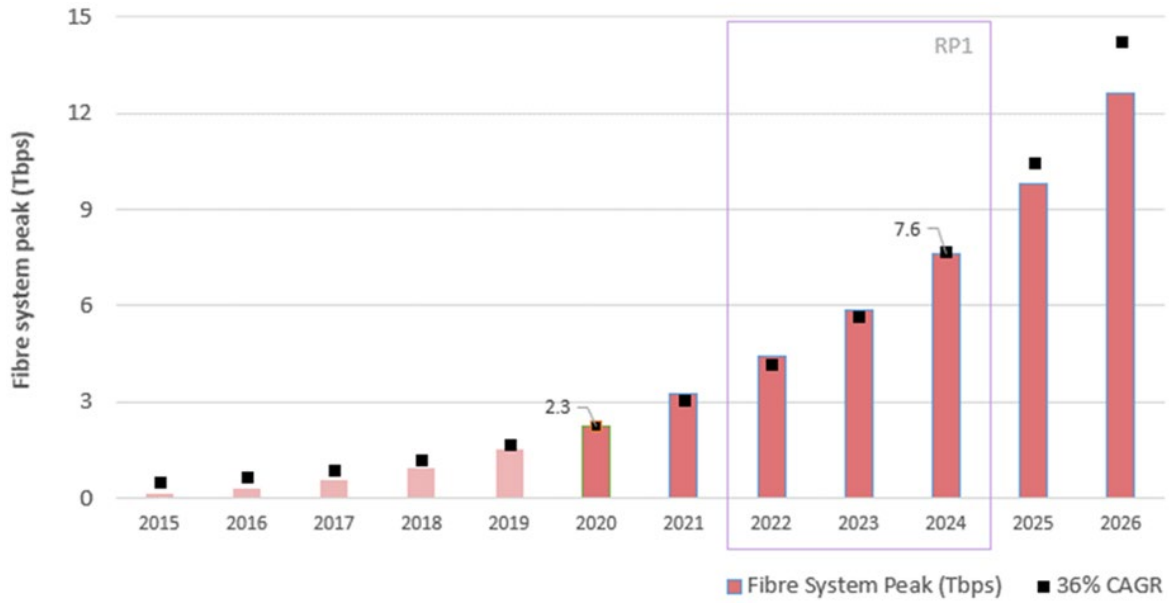
Figure 4.13: Forecast and historical fibre ATPU



We anticipate ATPU will continue to show a 27% compound average growth rate (CAGR), due to a continuation of the consumer and technology trends that have historically driven this level of growth. This will take ATPU from 2.8 Mbps in December 2020 to 7.2 Mbps in December 2024.

We forecast network peak demand will show around 36% CAGR, due to the combination of ATPU and connection growth. This will take system peak from 2.3 Tbps in December 2020 to 7.6 Tbps in December 2024.

Figure 4.14: Forecast and historical fibre system peak[5]



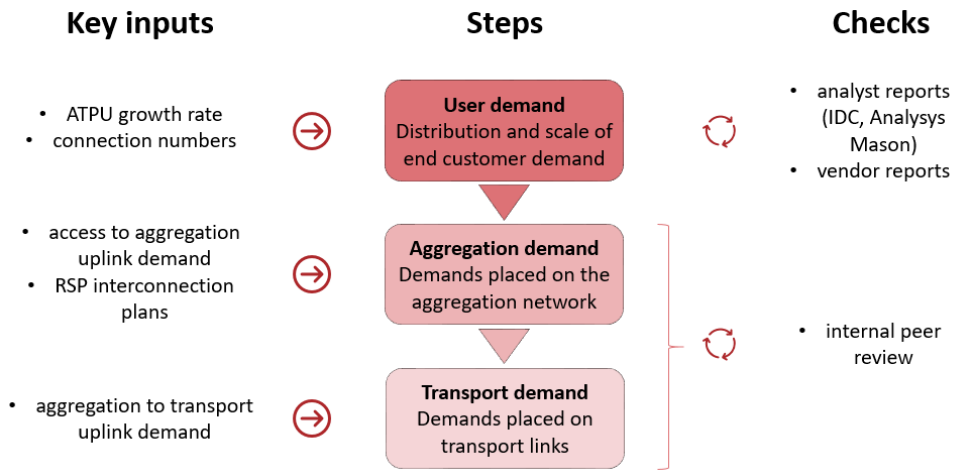
4.4.1 Forecast inputs, methodology and process

The key forecasting tasks are to form a view of:

- the distribution and scale of consumer demand
- how consumer demand maps to aggregation network demand
- how the aggregation network demand maps to transport network requirements.

The main steps of our process are shown in Figure 4.15, with information on key inputs and checks.

Figure 4.15: Bandwidth demand forecasting



[5] Figures in this chart are as per our 2020 planning round. Fibre system peak for 2020 subsequently reached 2.4 Tbps in August 2020.

The aggregation and transport steps are an iterative part of our system capacity planning work. We simulate the network with growing demand, solve for bottlenecks and then simulate again until we have a five-year outlook for demand and optimised capacity expansion.

4.4.2 Observations and uncertainties

ATPU and connection growth will remain as dual drivers of data usage on our network through RP1. As connection growth eases beyond RP1, we expect we will still experience strong ATPU growth driven by factors such as:

- more capable devices in homes and businesses, including streaming, gaming, smart home devices and PCs – and more devices per connection
- bandwidth-hungry content services, such as higher-resolution video streaming and videoconferencing; cloud-based gaming, application and storage systems; and large, high-speed, coordinated software updates
- changing consumer behaviours, such as more remote-working and online viewing.

Strong ATPU growth has been a constant for telecommunications networks since the dawn of the internet age. While we cannot predict what technologies or services will fuel growth in years to come, it is prudent for us to plan for strong growth.

There tends to be a strong confluence between the investment needed to support growth, and investment needed to optimise equipment lifecycle management and deliver service enhancements. As such, the relationship between bandwidth demand and capacity investment is complex.

4.4.3 Linkages

Bandwidth demand links to expenditure areas through:

- **extending the network** – network extension stimulates more connections and changes the spatial distribution of demand. We provision access coverage and capacity when we extend the network and this feeds through to aggregation and transport demand. For rural extensions, we may also build transport fibre to tie back to the existing network
- **installations and connections** – new connections fuel bandwidth growth. When initial coverage is consumed, we provision additional ports and when bandwidth demand reaches a threshold, we need to upgrade access capacity, which can flow through to aggregation and transport bandwidth demand
- **sustain** – growing bandwidth demand can drive new transport and aggregation fibre that will eventually need to be replaced. Bandwidth growth can also drive new access, aggregation and transport electronics equipment, which in turn consumes electricity and requires cooling (though it is more power efficient and heat tolerant than copper equipment)
- **support** – some shared costs are allocated based on bandwidth metrics, meaning growth drives a reallocation of some shared costs from copper to fibre.

4.5 Other demand

The sections above cover the key demand forecasting tasks. Below we note other material demand forecasting activities:

- **roadworks** – we have obligations to relocate and reinstate network elements to accommodate roading authorities. This is a major activity area, with typically limited visibility of firm demand. We forecast activity based on historical run rates, with adjustments for known large projects that require more work
- **pole relocation or removal** – we have obligations to relocate the network when electricity utilities relocate or remove poles carrying our network elements. This can involve converting network from overhead to underground. We forecast this activity based on historical trends, and information from electricity utilities on their development plans
- **switching** – after a connection is established, we need to service switching activities as consumers change retailer, product or site. This is an increasing activity area as the intact network grows and will become a key determinant of capacity requirements for business-to-business systems, and our processing and call centres
- **unbundling** – since January 2020 we have offered a layer 1 service in UFB 1 areas. As this is a new product with uncertain demand (and take-up is based on customer demand), our plans do not include significant unbundling activity.[6] We will

[6] We forecast around [**Chorus CI**] unbundled connections per year, with a total cost of $[**Chorus CI**] across RP1 base capex.

address any such demand if we receive firm enquiries. Unbundling can have various impacts, such as increased need for exchange space, increased need for commercial and works management and coordination, altered product development needs, etc. We note that we could apply for individual capex approval if this becomes a major activity area with a material net increase in capex needs. Alternatively, if unbundling causes a net reduction in costs then this will flow through to our MAR beyond RP1

- **product development** – we work with RSPs to form a development roadmap that drives product development investment. The roadmap has a one-year horizon to inform delivery planning. We sought views on longer-term demand through our RP1 consultation and received limited (and conflicting) feedback from two major RSPs. In the absence of wider or clearer input, we have assumed demand for product development will continue to outstrip development capacity. This aligns with our observations on the scope and ongoing strong appetite for development
- **colocation and interconnection** – we provide Fibre Fixed Line Access Services (FFLAS) colocation and interconnection (including handover) services to RSPs. These are ancillary to our core FFLAS services and our supply of these services is driven by RSP requests. Handover services demand generally tracks in line with bandwidth demand on our network
- **backhaul services** – we provide some FFLAS transport services, e.g. ICABS (also referred to as backhaul services). Demand for FFLAS backhaul is reactive to demand from RSPs and a significant proportion of backhaul demand is for non-FFLAS backhaul services.

4.6 Linkages

The Commerce Commission describes the following types of fibre access services:[7]

- voice
- bitstream PON
- unbundled PON
- point-to-point
- transport
- co-location and interconnection
- connection.

In our proposal we use the term installations to describe connection services. Installations are needed to enable voice, PON and point-to-point services. Other linkages between demand for these types are as follows:

- most installations are prompted by demand for bitstream PON
- some consumers wanting bitstream PON services will also take voice
- the number of consumers wanting only voice is negligible, though may increase as we begin copper withdrawal
- unbundled PON demand may add to overall installations, with some substitution for bitstream PON
- unbundled PON does not contribute to bandwidth demand though may contribute to transport demand
- point-to-point services can add to bandwidth demand and sometimes substitute for PON demand
- co-location and interconnection demand may grow with overall installations and growth in PON and point-to-point demand
- transport demand may grow with PON and point-to-point demand.

[7] FFLAS services, including connection services are described in the Commerce Commission, Fibre Input methodologies – Main final decisions Reasons paper, 13 October 2020, pp 45-46 (https://comcom.govt.nz/__data/assets/pdf_file/0022/226507/Fibre-Input-Methodologies-Main-final-decisions-reasons-paper-13-October-2020.pdf).

5.0 Quality

We will sustain quality through a period of transition

This is our IFP Quality report. It describes the quality of service we plan to deliver, explains how we measure quality, forecasts key outcomes and shows links to planned expenditure.

5.0 Quality

5.1 What is Quality?

Our proposal aims to sustain the quality of our fibre services – we are not intending to relax quality, and do not have plans for investment or changes in our operations that would lift quality to a new level. We think this is appropriate as we transition into new regulatory arrangements, and while our focus remains on initial network build and connection growth. To be clear, sustaining quality will require ongoing investment as the network grows, assets age and risk profiles evolve.

Quality is a broad concept – it's the user-facing outcomes we seek from our expenditure – and has specific regulatory meaning and context. Some key ideas about quality are:

- **balance** – any regulatory proposal should aim for the right price-quality (PQ) balance. If we spend more then, all things being equal, prices and quality will be higher over time (and vice versa). A key goal for any infrastructure provider is to align this balance with the longer-term interests of consumers
- **wholesale** – we provide wholesale services to our Retail Service Providers (RSPs), who in turn provide services to consumers. This means we cannot control everything that will impact the quality that consumers experience. However, our infrastructure is critical to consumer experience. As a wholesaler, we have a dual focus on our direct customers – working with them to provide seamless services – and consumers
- **products** – unlike many utilities, we offer differentiated products – e.g. with differing speeds, configurations, fault restoration targets and technologies. This allows our customers and consumers more choice because we offer multiple price-quality trade-off points, albeit based on a common underlying infrastructure. We also have regulatory oversight and contractual arrangements that govern our product offers in detail
- **infrastructure** – in this context, the appropriate focus of our proposal is on infrastructure quality, i.e. the broad capability and performance levels our network and operational arrangements are set up to support (and from which we can offer differentiated services)
- **pace** – our ability to shift quality over a four-year timeframe is not absolute.[1] Some quality outcomes are readily altered by changes in expenditure – for example, we could double or halve customer operations resourcing, and this would noticeably impact timeliness. Other quality outcomes are slow moving or indirect – for example, we could double the pace of resilience investment, and this would eventually flow through to reduced downtime, and
- **other outcomes** – quality is not the only investment outcome we target. Other important drivers can include safety (of our workers and the public), lifetime cost (i.e. spending more now to reduce costs in future) and community outcomes (such as reducing visual impact).

Our RP1 Proposal addresses quality as follows:

- **objectives** – we describe our overall quality objective, show how this links to our expenditure plans and provide historic and forecast performance information for selected quality statistics
- **standards** – we propose the quality standards that should be set for compliance purposes during RP1. The Commission is required to determine standards, and failure to meet standards can trigger a range of enforcement activities. This aims to provide the Commission with an avenue for detecting and addressing under-investment or management issues
- **disclosure** – we also discuss measures for Information Disclosure (ID). During 2021, the Commission will develop new, enduring disclosure requirements for Chorus and other fibre companies. Disclosure is generally public and aims to provide all stakeholders with performance information they can use to assess the success of regulatory arrangements.

We do not propose any financial incentives for quality for RP1. In future regulatory periods, we may propose arrangements where our allowable revenue can be increased (or reduced) for outperforming (or underperforming) quality targets. Such arrangements can reward continuous improvement and operate in constructive tension with efficiency improvement incentives.

Our discussion of quality uses ideas set out in the IMs. Table 5.1 provides a guide to terminology

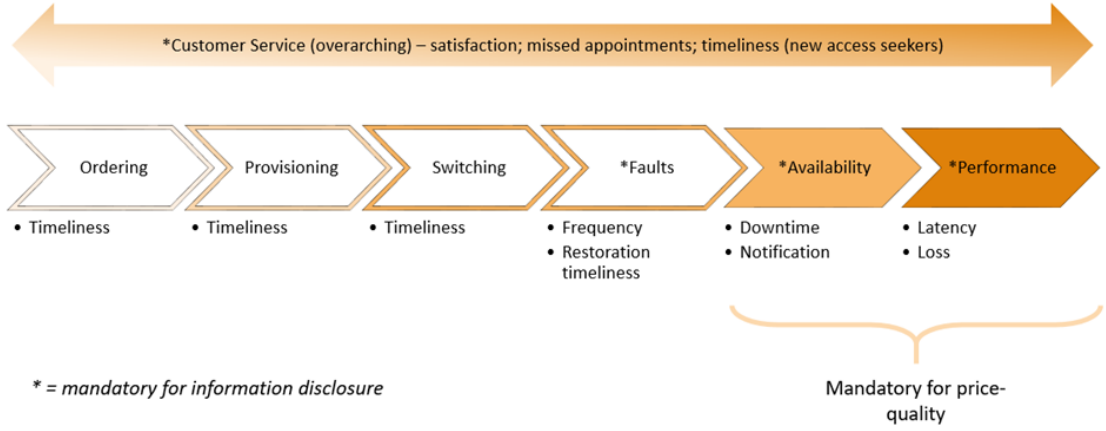
[1] Four years is the timeframe for submitting our proposal to the end of the first regulatory period (RP1).

Table 5.1: Guide to quality terminology

Term	Meaning	Examples
Quality dimension	A high-level aspect of service quality. Defined in the IMs.	• Provisioning • Faults • Performance
Quality metric	Something that can be measured. Examples given in the IMs.	• Time to provision • Time to restore • Port utilisation
Quality performance measure	A specific measure of quality. Set in PQ and ID determinations.	• Average utilisation (%) over a 5-minute period
Quality performance statistic	A level of quality (e.g. for a target). Set in PQ determinations.	• % of [type] ports with high (>70%) utilisation • % of [type] ports with very high (>90%) utilisation • % of [type] ports with extreme (>95%) utilisation
Quality standard	A specific quality-related compliance requirement. Set in PQ determinations.	• not more than 20% of [type] ports should have very high utilisation in any month

Figure 5.1 provides an overview of the quality dimensions set in the IMs, which include six lifecycle-based dimensions and one over-arching customer service dimension. Two dimensions are mandatory for PQ regulation, meaning they must have associated quality standards. Four dimensions (including the two PQ dimensions) are mandatory for information disclosure.

Figure 5.1: Regulatory quality dimensions

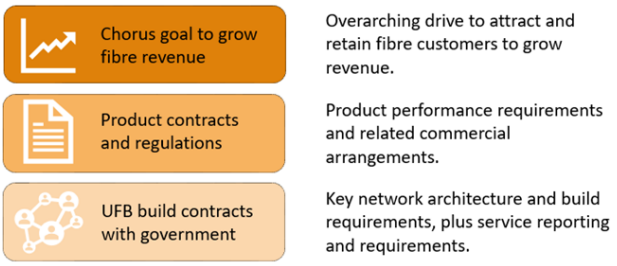


5.2 Transition from build to operate

The quality we deliver now has the Ultra-Fast Broadband (UFB) build contract at its foundation, product contracts and regulations as a guide to outcomes, and our strategic goals as an over-arching driver for continuous improvement.

We signed our first UFB contract with the government in 2011 following a competitive tender and negotiation process. This plays a major role defining the quality designed and 'built-in' to the network.

Figure 5.2: Quality context



We also agreed product specifications that have been added to and updated through subsequent regulatory and commercial developments. For example, direct fibre access (DFAS, our unbundled, point-to-point 'dark fibre' offering) was required in our UFB agreement and was introduced in 2011 subject to a government approved reference offer. We agreed an updated service level framework for our reference offer in 2018. The initial product requirements informed our initial build, and the updated requirements build on what we've learned since and inform our ongoing investment and operations.

As we enter RP1, the UFB build contracts and their product frameworks transition to new regulatory requirements. For products, there is a policy goal of a smooth transition for both price and quality. For underlying infrastructure quality, we are guided by:

- our network architecture, as developed and implemented through the UFB programme. While architecture can be changed for future extensions, altering existing architecture would require major investment over a long timeframe
- UFB requirements that are 'built-in' to the network through our planning, asset and operational standards and practices. We could build towards new performance levels over time as assets are replaced, cycled or augmented
- our product environment, which is evolving in terms of product speeds but otherwise generally stable in terms of quality requirements. The anchor services for RP1 will reflect the price and quality set out in the existing UFB reference offer, which limits the extent to which we could offer higher quality performance. Increased quality may also increase prices and (depending on the quality measure) take some time to flow from planning to reality.

Cutting across these requirements, we have a strong commercial interest to grow fibre revenue by attracting and retaining customers. We do this by:

- monitoring and adapting to customer and consumer preferences and experiences, competing technologies and consumer trends
- striking a balance between quality and cost that makes our services attractive now and into the future
- promoting our services so we can attract consumers, sustain momentum and spread fixed costs across more connections
- continually seeking out and implementing improvement opportunities to reduce costs or improve services
- proactively providing our customers with visibility of real-time network information to help them manage the retail services they provide across our network
- prudently adopting good industry practices that cost-effectively enhance the long-term quality of our infrastructure.

Considering this context, we think the prudent course is that we aim to hold quality stable as we transition into our new regulatory arrangements.

We acknowledge that there appears to be a trend of increasing reliance on our infrastructure – as customer numbers grow, but also as more people come to depend on fibre-grade connectivity for productivity and quality of life. We have not sought to respond to this trend in our RP1 Proposal, but we are assessing whether an uplift in resilience could be warranted. We could develop an individual capex proposal for any such change or, alternatively, build a shift in approach into our RP2 Proposal.

This position is reinforced by feedback we received on our RP1 consultation. In particular:

- Vodafone observed that "we now rely on telecommunications services more than ever" and noted this in the context of the (then-current) early 2020 lockdown. Spark observed that dependence on fibre services is "nuanced and complex", is wider than our infrastructure and varies by customer type
- Spark noted that "UFB build standards would likely become less relevant over time"
- Vodafone and Spark both had useful suggestions for the information and processes that could inform good engagement on changes in quality levels. In both cases, the suggestions are beyond what we could aim to deliver for this proposal.

We also note that we anticipate timeliness of some field activities will fluctuate as we transition out of build and into a new steady state. This transition will involve major reconfiguration of our contracts for in-field services, including extension, installation and fault response work. While we cannot predict how timeliness will fluctuate due to the procurement and resourcing changes (and associated delivery impacts), our aim is to broadly sustain our service levels.

5.3 Price-quality measures

We have selected statistics for each of the mandatory quality dimensions (performance and availability) that best capture the quality of service supported by our infrastructure. Our selections draw on our experience reporting performance to the government under our UFB contracts. For each statistic, we step through below:

- a definition of the statistic, and why we think it is a good way of measuring quality
- information on historic performance and a forecast of future performance
- observations and commentary on past and future performance
- information on how changes in expenditure would link to changes in performance.

Each discussion of linkages between expenditure and quality includes a summary with simple icons to depict the strength and pace of each linkage. The icons provide a broad characterisation, rather than a precise assessment.

Finally, we propose an approach to quality standards for RP1 based on our view of the best set of quality measures for price-quality regulation.

5.3.1 Performance

'Performance' is the final link in the Commission's lifecycle model for quality dimensions and is defined in the IMs as "…the technical functioning of [ID/PQ] Fibre Fixed Line Access Services (FFLAS), including the extent to which this affects the experience of an access seeker or end-user;". Example metrics given in the IMs are 'frame delay', 'frame loss ratio', 'frame delay variation' and 'port utilisation'.

Our capacity planning aims to maintain a congestion-free network. In practice, this means we aim to always provide network port capacity that is higher than traffic demand or, in other words, we keep port utilisation well below 95%. If we achieve this, other metrics such as frame delay or loss are unlikely to be an issue.

With this context, we think port utilisation is the best performance metric to provide an overall indication of performance-related investment or management.

Port utilisation is best measured within the aggregation part of our network. Our planning and measurement have historically focussed on aggregation, because this is where there is greatest scope for congestion and capacity is a key investment driver. In contrast:

- our transport links are contention-free by design, so there is no value in setting a port utilisation standard for transport
- historically, our access architecture provided enough capacity such that congestion was not an issue. As penetration of higher-speed (>100 Mbps) connections increases, capacity is becoming an investment driver for the access network.

We have also excluded RSP handover ports as these are not within our control, as they are governed by RSP investment.

Other design choices for port utilisation reporting are:

- **measurement area** – we can report at a whole-of-network level, or more granular (such as by point of interconnect (POI) area)
- **averaging interval** – we report average utilisation over a given interval – for example, average utilisation across a five-minute interval
- **port types –** there are many network-to-network port types within our aggregation network, including virtual ports. We can report on all port types or a subset
- **direction –** we can report on upstream or downstream utilisation, or on both directions
- **statistic –** we could report mean, median, maximum or percentile statistics. Alternatively, we could report a count (or percentage) of ports above a given threshold.

Table 5.2 sets out the statistics we have selected to show historic and forecast performance

Table 5.2: Network performance

Metric	Measure	Statistics
Aggregation port utilisation	Portion of aggregation ports above utilisation threshold The percentage of ports with utilisation in excess of the threshold for any interval during a day. Port means a physical port within the network, excluding UNI, E-NNI and PON ports[2]. All virtual ports and sub-interfaces within the physical ports must however automatically scale up to the physical port capacity otherwise they will also form part of a port. Utilisation means the average bandwidth utilised on a port, expressed as a percentage of the total bandwidth available on that port, measured over an interval. Interval = five minutes.	Monthly maximum portion of very high utilisation ports • Threshold is 90% • Measurement area = PQ FFLAS • Service = fibre access Reported by month, using the maximum result for any day in that month.
		Monthly maximum portion of high utilisation ports • Threshold is 70% • Measurement area = PQ FFLAS • Service = fibre access Reported by month, using the maximum result for any day in that month.

2 UNI = User to Network Interface (access ports); E-NNI = External Network to Network Interface (handover ports); PON = Passive Optical Network (fibre access network).

These statistics are appropriate because:

- aggregation network port utilisation is where we have the best baseline data and established reporting under our UFB contract requirements.[3] We use a five-minute interval for this existing reporting and measure across both directions for all ports
- the 90% threshold provides a timely indication of network stress. It is lower than the 95% maximum utilisation threshold we have as a contractual service level, so provides a timelier indicator with a low (but non-zero) result under normal conditions. At 90% there is minimal performance degradation but limited headroom
- the 70% threshold provides a complementary lead indicator of network stress. The two indicators together provide a sufficiently rich picture of the upper end of the distribution of utilisation results
- reporting the percentage of ports above a threshold is more meaningful than a population statistic (such as mean or P90)
- fibre access is our main service with linkages to most of our expenditure
- a whole-of-PQ FFLAS view provides a good indication of overall quality in a form that aligns with our proposal. We do not have historic reporting on this basis but can work on developing this view as we operationalise RP1 settings[4]
- monthly reporting provides visibility of within-year trends, and reporting the maximum daily result is consistent with the focus on periods of high utilisation.

Figures 5.3 and 5.4 show historic performance against our proposed statistics and forecast performance for the five years from 2022. Note that this data is for all fibre, not PQ-FFLAS.

Historic data shows that the measure is reasonably volatile, in part because we are interested in maximum utilisation over a period rather than the average. However, heavy utilisation has been consistently contained below 2% and very heavy utilisation below 0.2% across the period shown.

Over the last couple of years, short-term spikes have mostly been driven by launches of popular games driving downloads of very large files by large numbers of users simultaneously. These events are particularly noticeable when global launches timed to occur off-peak in the USA coincide with our network peak in New Zealand.

For the forecast period, we have used the mean of our historic dataset. This is consistent with our aim to hold performance steady across RP1. We have extended this approach beyond RP1 as a placeholder. We also show a band of plus or minus one standard deviation, to indicate that performance will vary.

[3] Access network reporting could be developed as a measure for use in RP2 or beyond. Measuring access network utilisation is more challenging due to the volume of ports, so a longer measurement interval can be appropriate.
[4] We do not have an historic view because PQ FFLAS is a new construct (and the precise set of services it captures is not fully settled). For this report we have reported on all fibre.

Figure 5.3: Network Stress – Proportion of aggregation ports with heavy (>70%) utilisation

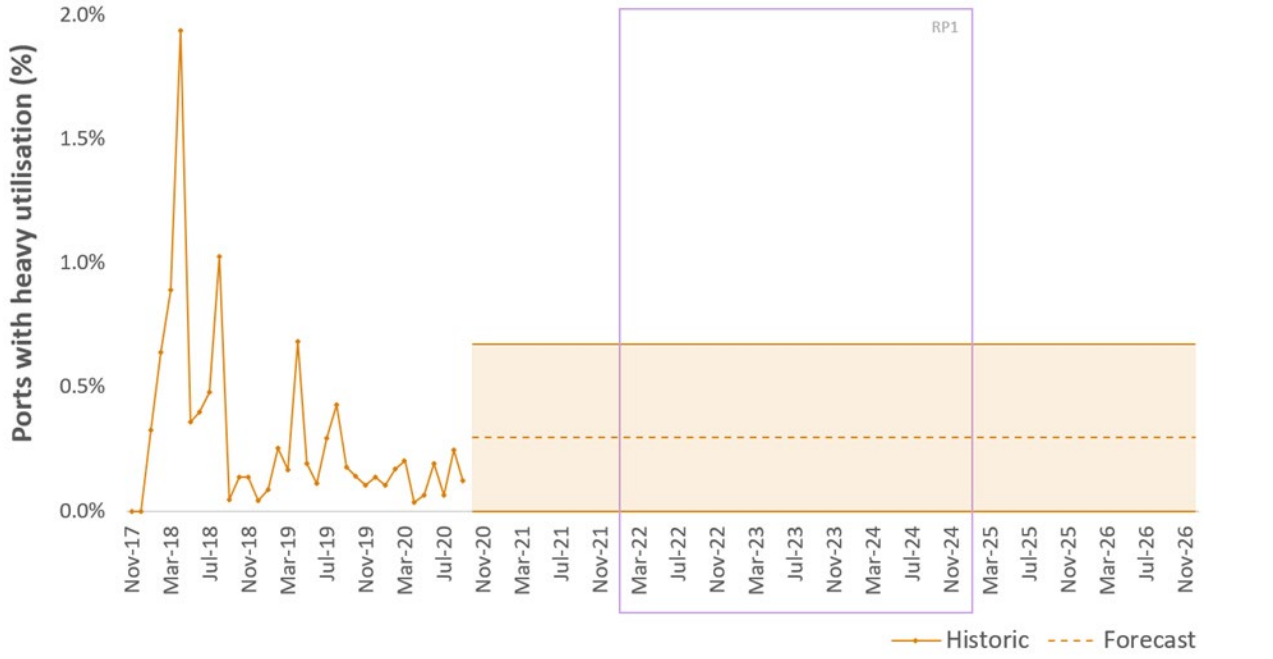
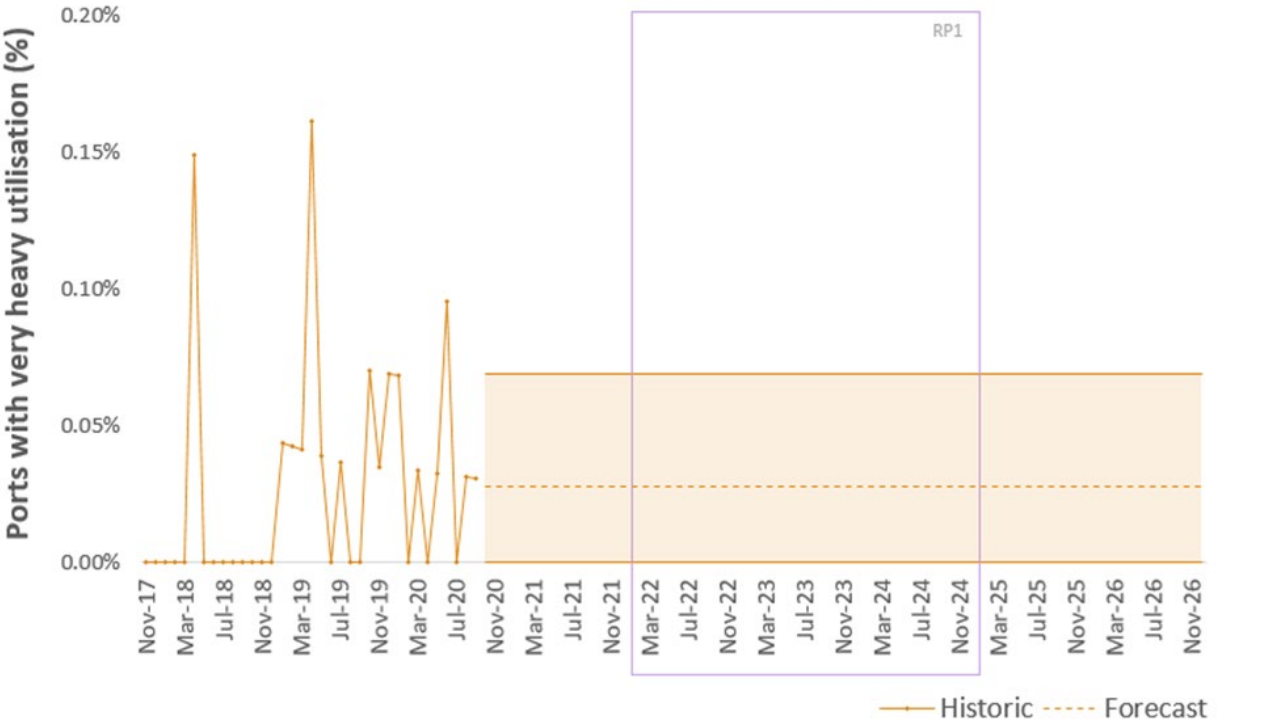


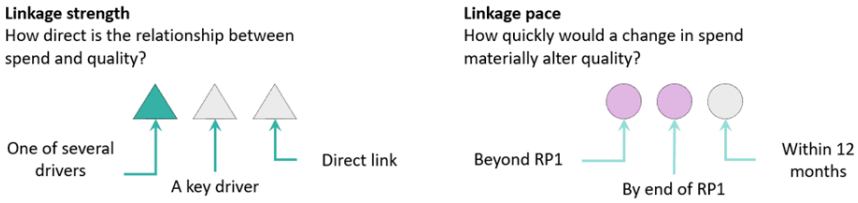
Figure 5.4: Network Stress – Proportion of aggregation ports with very heavy (>90%) utilisation



Links to expenditure

Linkages between expenditure and performance are summarised in Table 5.3.

Table 5.3: Linkages between expenditure and performance



Area	Strength	Pace
Network capacity | all We manage aggregation port utilisation through ongoing aggregation network capacity investment. A major change in RSP points of interconnection would also shift aggregation port utilisation patterns. Aggregation capacity investment has knock-on impact on transport needs. We invest in new transport links or link capacity to stay ahead of demand. Our access network is designed to minimise the need for physical reconfiguration. We stay ahead of bandwidth growth through technology investment. We will sustain investment to meet growing demand as connections grow and as ATPU increases. Even without bandwidth growth, we would invest for lifecycle (reliability and vendor support) and product evolution.	▲▲▲	●●●
Network | network operations Our Network Operating Centre (NOC) monitors and manages network operation, including technical support and escalation.	▲▲△	●●●
Network | operating costs Investment in capacity can impact power and cooling needs and increase the fibre access share of exchange space.	▲▲△	●●●
Support | asset management Our engineering teams manage network capacity.	▲▲△	●●●

5.3.2 Availability

'Availability' is the second-to-last link in the Commission's lifecycle model and is defined in the IM as "…the extent to which [ID/PQ] FFLAS is not subject to downtime". Example metrics in the IMs are 'maximum downtime', 'average downtime' and 'notification to access seekers of outages'.

The IMs also define downtime as "the length of time an access seeker or end user experiences a planned outage or unplanned outage to their FFLAS", and an outage is defined as a cessation in supply.

There are multiple design choices for downtime reporting:

- **impact** – our current arrangements only record downtime that has been reported to us by RSPs. These are events that have been noticed by a customer or consumer and identified by the RSP as being likely to have their origin within our network. This only includes unplanned downtime, and generally only a subset of access lines impacted by an event
- **modelled** – we do not currently capture unreported downtime. Our systems can record equipment outages, but to translate this into downtime we would need systems that translate equipment outages to downtime impact to produce a view of 'modelled' downtime
- **planned** – we do not currently report planned downtime. As with unreported downtime, we would need systems that translate equipment outages to downtime impact to produce this reporting
- **cause** – incidents are reported to us by RSPs when they think the cause is a fault within our network. When we investigate, we record whether we confirmed a fault in our network, confirmed the fault lies outside our network or found no fault
- **layer** – when we restore service, our field technicians record whether downtime was caused by a fault in layer one (physical) or layer two (electronic) infrastructure
- **measurement area** – we can report downtime at a whole-of-network level, or at a more granular level. Our existing reporting is by point of interconnection (POI) area
- **statistic** – we could report mean, median, maximum or any other statistic (such as 90th percentile).

Table 5.4 sets out the statistic we have selected to show historic and forecast availability.

Table 5.4: Network Availabilty

Metric	Measure	Statistics
Average downtime	Average downtime per access line The mean downtime per access line within each measurement area that is caused by a fault in the layer 1 or layer 2 fibre service. Average downtime per access line is equal to A/B, where: A = the sum of the downtime for all access lines in the measurement area for the measurement period that is caused by a fault in the layer 1 or layer 2 service, and B = the average total number of access lines within the measurement area over the measurement period.	Average downtime (reported, unplanned, confirmed, annualised) Measurement area = PQ FFLAS Service = fibre access Unit = minutes Measurement period = monthly, but annualised (i.e. multiplied by 12)

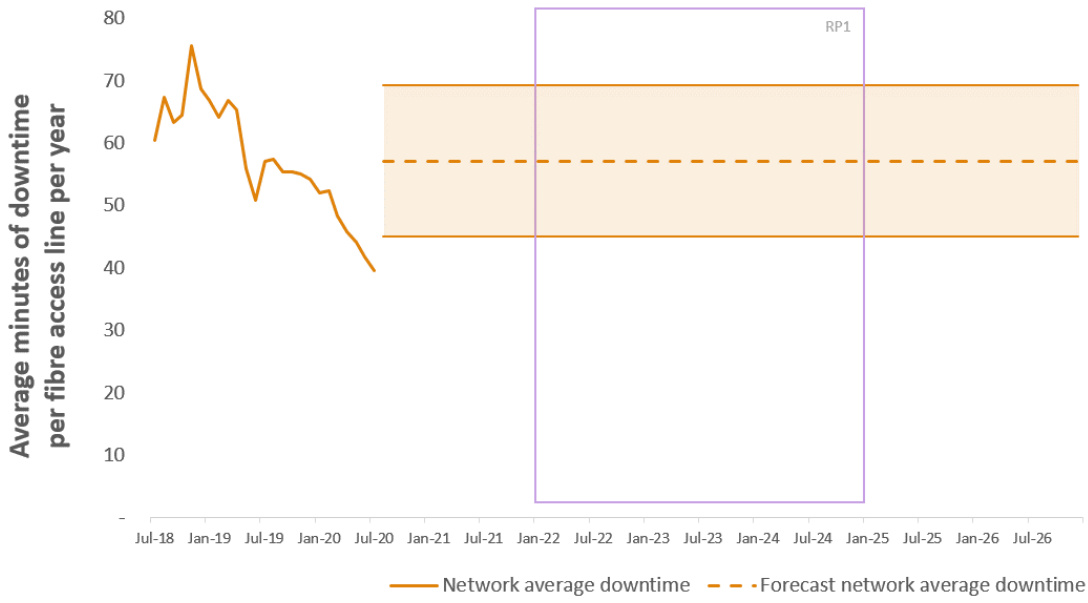
Note we have included utilisation in excess of bitstream reference offer service level agreement (SLA) (95%) as downtime for the purpose of our proposed statistic. This is for consistency with SLA obligations, which are likely to be incorporated into the new framework through the anchor service regulations. Under the IMs, 'downtime' is limited to 'cessation in the supply of FFLAS' and does not include reduction in performance (in contrast with 'fault'). Therefore, for the purposes of this statistic, we are characterising utilisation beyond the SLA threshold as cessation in supply of FFLAS.

This statistic is appropriate because:

- average downtime is the best way to characterise the full distribution of performance (across all users) with a single statistic
- we have historic data for reported unplanned downtime, but not modelled downtime. We could potentially develop reporting of modelled downtime (unplanned and planned) as well but have not scoped this work
- confirmed downtime focusses on downtime originating from an identified fault in our network. Information on other reported faults may be of secondary interest – e.g. because it sheds light on RSP fault handling trends
- combining layer 1 and layer 2 provides a user experience-focussed view. Separate reporting of layer 1 and layer 2 downtime may be appropriate for information disclosure or future proposals, with the caveat that data quality is dependent on field technician coding
- fibre access is our main service with linkages to most of our expenditure
- a whole-of-PQ FFLAS view is the best way to represent overall quality in a form that aligns with our proposal. We do not have historic reporting on this basis but can develop this view as we operationalise RP1 settings[5], and
- monthly reporting provides visibility of within-year trends, while annualising the figures makes them more relatable.

Figure 5.5 shows historic performance against our proposed statistic and forecast performance for the five years from 2022.

Figure 5.5: Fibre access line downtime



[5] We do not have an historical view because PQ FFLAS is a new construct (and does not have a fully settled definition). For this report we have reported on all fibre.

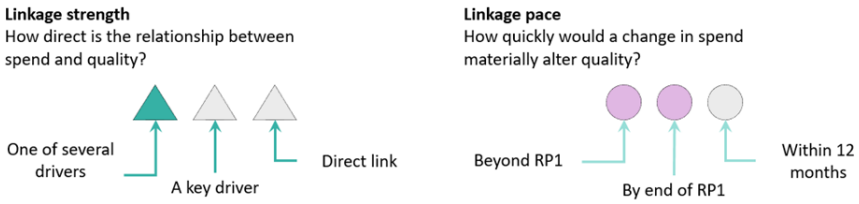
While the time series is short, there appears to be a trend of improving downtime performance across the past two years. This reflects continuous improvement, maturing of field procedures, a reduction in the scale of activity (i.e. fewer 'hands in the network') and faster restoration times.

For the forecast period, we have used the mean of our historic dataset. This is consistent with our aim to hold performance broadly steady across RP1. We have extended this approach beyond RP1 as a placeholder. Given the limited history we have for this measure, we also show a band of plus or minus two standard deviations, to indicate that downtime will vary.

Links to expenditure

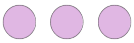
Linkages between expenditure and availability are summarised in Table 5.5.

Table 5.5: Linkages between expenditure and availability



Area	Strength	Pace
Extending the Network | all **Installations | all** The initial build quality of our network will influence layer 1 reliability over coming decades. Additionally, without overbuilding the network, some planned downtime is required for short periods when growing the footprint of our network	▲▲△	●○○
Network sustain and enhance | resilience Investment in resilience can reduce the risk of widespread downtime events.	▲▲▲	●○○
Network sustain and enhance | field sustain Replacing or refurbishing in-field assets reduces layer 1 downtime risk.	▲▲▲	●●○
Network sustain and enhance | site sustain Replacing or refurbishing site assets reduces layer 2 downtime risk.	▲▲▲	●●○
Network sustain and enhance | relocations Relocation work protects network elements.	▲△△	●●○
Network capacity | all The age, built (or configured) quality and capacity of our network electronics influences layer 2 reliability. We build in a certain amount of duplication in high customer concentration areas to protect services. Investing in non-production environments allows us to test changes to give confidence they will be delivered as seamlessly as possible into the live network.	▲▲△	●●○

Table 5.5 continues:

Area	Strength	Pace
IT and support | all Our network and customer IT systems coordinate management of the network, including fault response activities. Our business IT systems provide the infrastructure and integration to support them.		
Network | maintenance Network maintenance directly addresses downtime through preventative (e.g. inspections) and reactive (e.g. repair and restoration) activities.		
Network | network operations Our network operating centre (NOC) monitors and manages network operation, including technical support and escalation.		
Support | asset management Our engineering teams manage network risk.		
Support | technology We can't take or fix faults without working and well-supported IT, including licensing, hosting and support.		

5.4 Quality standards proposal

The IMs require the Commerce Commission to set RP1 quality standards for performance and availability. Standards are optional for other quality dimensions.

The purpose of quality standards is to act as a trigger for compliance activity – in effect, they should operate as a backstop that is triggered infrequently to provide an opportunity to address emerging issues or arrest a deterioration. In practice, there is an art to setting standards at a level that:

- avoids false positives, i.e. triggering compliance activity unnecessarily when there is no statistically significant deterioration in underlying performance
- is nonetheless sensitive enough to function effectively
- does not have unintended adverse impacts – e.g. stimulating overly cautious risk management that raises costs, slows innovation or otherwise worsens quality.

Experience from other regulated businesses is that it takes time to get the balance right, and a reporting-only approach is a useful starting point. Accordingly, we propose that the quality standards for RP1 should be to report on two of the three statistics defined above, namely:[6]

- maximum portion of very high utilisation ports by month
- average downtime (reported, unplanned, confirmed, annualised) by month.

We would meet the quality standard by publishing these statistics after each year of RP1. We recommend the publication date is aligned with suitable price-quality or information disclosure reporting dates, which have not been determined yet.

These cover the mandatory quality dimensions for price-quality regulation and provide a starting point for RP2 (and beyond). Reporting during RP1 will provide a baseline from which design decisions for future quality standards can be developed, including:

- **normalisation** – rules for excluding extreme events so that standards are not breached due to factors outside our control

[6] The third statistic (maximum portion of high utilisation ports by month) is better suited to information disclosure rather than quality standard use. It provides an early indication of tightening headroom and may fluctuate across a wide range without indicating a problem with late or low investment.

- **calibration** – the combination of pooling[7] and threshold adjustment that avoids false positives and adverse incentives while retaining effectiveness.

5.5 Information disclosure measures

In 2021 the Commerce Commission will develop new information disclosure requirements, covering at least four of the quality dimensions – performance, availability, faults and customer service. Below we discuss the last two (having already covered the first two above). For each we:

- provide an introduction
- briefly discuss measurement considerations
- outline linkages between quality and expenditure.

5.5.1 Faults

'Faults' is defined in the IMs as an "unplanned outage" or "a reduction in the performance of [ID/PQ] FFLAS below any levels specified in an [ID/PQ] determination". Example metrics in the IMs are 'incidence of faults' and 'time to restore'.

Faults and downtime are closely linked:

- downtime is caused by faults. The IM definition of faults is different from downtime, because it includes deterioration and cessation of service. Our current reporting counts both, though in practice we record very few deterioration events. In part, this is because we only capture reported events, but it also reflects that deterioration is uncommon on our network, and
- average downtime per access line is a function of the frequency and duration of fault events. A worsening of either measure would translate into more downtime.

Given these linkages, an information disclosure-only approach to fault reporting should serve as a useful complement to PQ reporting of downtime.

We also note that including 'time to restore' in our set of price-quality measures would be particularly problematic. This is because we use restoration timeframes commercially as a key differentiator between business and residential products. Price-quality regulation should be careful to focus on infrastructure-wide (common) quality measures to avoid overriding healthy service differentiation dynamics.[8]

Overall, we've achieved a steady improvement in fault rate performance over the life of the network. This is shown in the total monthly fibre faults per 100 fibre access lines in Figure 5.6. This reflects continuous improvement, maturing of field procedures, and a reduction in the scale of activity (i.e. fewer 'hands in the network').

We have shown both the confirmed Chorus network faults (indicator of quality), as well as the larger total of all reported faults (indicator of activity and expenditure). All reported faults require resources to investigate, even if the result is that there is no fault found or the cause of the fault is outside of our control, such as RSP or consumer equipment.

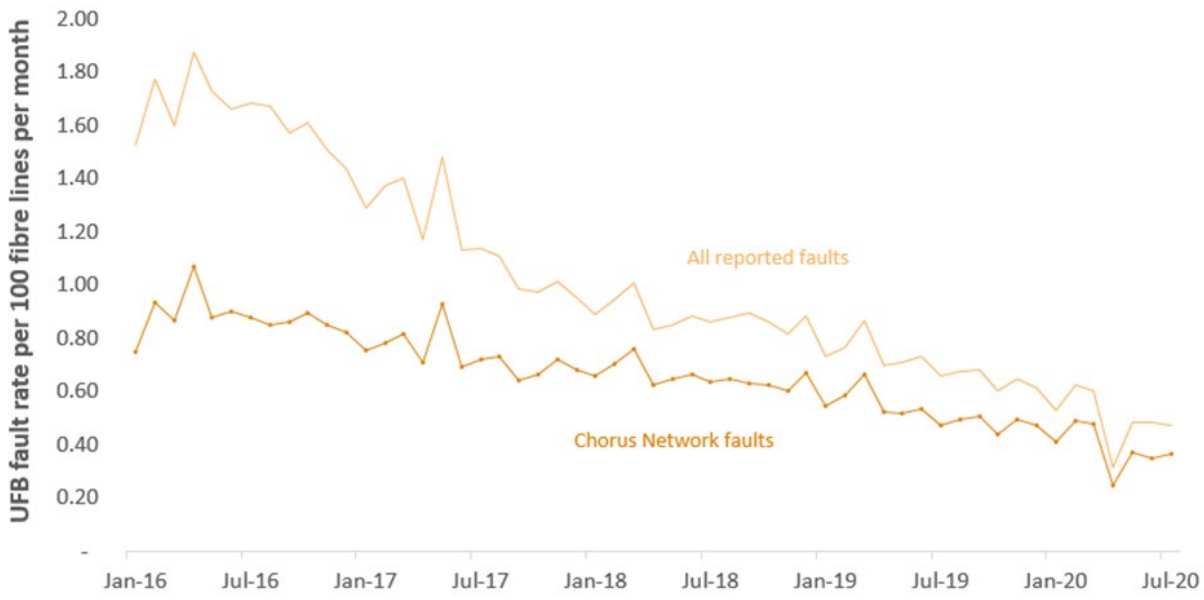
Links to expenditure

Linkages between expenditure and faults are the same as links to availability.

[7] Pooling is where the standard is not breached unless thresholds are exceeded across multiple reporting periods, or multiple measures.

[8] This point was noted by CEPA (Cambridge Economic Policy Associates) in their report accompanying the Commission's paper on the new framework for fibre services. The CEPA report identified service differentiation as key to retail competition and the ability to provide services consumers want. CEPA, *Quality Dimensions of Wholesale Fibre Telecommunication Services* (1 November 2018), Appendix A.1. p61-62

Figure 5.6: Chorus network faults per 100 fibre access lines per month



5.5.2 Customer service

'Customer service' is defined in the IMs as "the way a regulated provider interacts with access seekers and end-users in relation to the supply of [ID/PQ] FFLAS". Example metrics in the IMs are 'end-user connection satisfaction', 'missed appointments' and 'time to establish an access seeker'.

The scope of measures and standards that could fall under customer service is very wide. We have focussed on the three examples from the IMs.

Consumer connection satisfaction

We survey consumers after key interactions, provided we can obtain permission from the consumer's RSP. We survey quarterly and have a target satisfaction score linked to default payment provisions in our UFB contracts.

There are three distinct types of connection experiences:

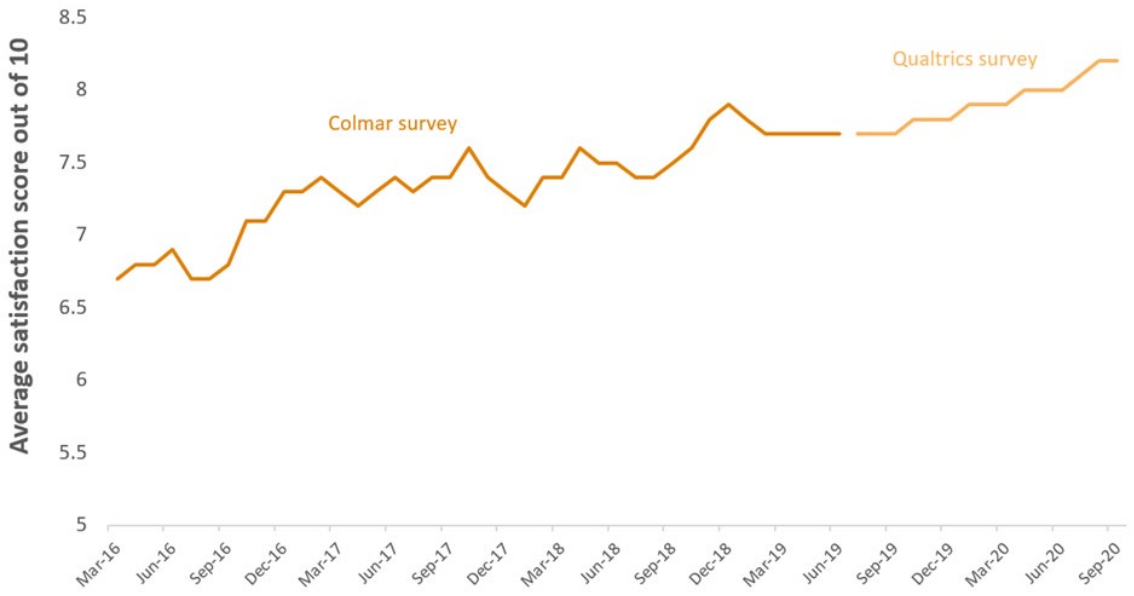
- **simple installation** – where a consumer requires a relatively straightforward new installation to enable connection – for example, a Hyperfibre Optical Network Terminal (ONT) upgrade or a single dwelling unit (SDU) installation
- **complex installation** – where a more complex enabling task (such as a Right of Way (ROW) or Multi Dwelling Unit (MDU) extension) is required as part of the installation process
- **intact** – where a consumer already has a suitable installation such that connection can be established without a truckroll.

Monitoring installation satisfaction has been a key focus since the beginning of our UFB work. We have used surveys to track and direct significant process and performance improvement gains. Recently, intact volumes have begun to exceed install volumes. This trend will continue as we move into RP1 and the network moves closer to full uptake. As we enter RP1, we will also have our first connections associated with copper withdrawal.

Given the changing nature of connections, and the value of our surveys as a business tool, it will be important that reporting requirements do not curtail our ability to continuously refine our survey activities. With careful design, this may be possible within the information disclosure regime.

Overall, we've achieved a steady improvement in customer satisfaction over the life of the network. This is shown in Figure 5.7, which focusses on install satisfaction. Data is shown monthly on a 3-month rolling average. This reflects continuous improvement and our ongoing investment in customer systems.

Figure 5.7: Customer installation satisfaction survey



Missed appointments

We appreciate that missed appointments are a pain-point for consumers trying to have fibre installed, so the fibre SLAs we agreed with RSPs in 2018 include a requirement to complete scope visits within the agreed half-day window (am/pm) and to complete on the day agreed. Failure of either target results in a credit of one month's rental fee.

If missed appointment reporting is built into information disclosure, we will need a clear definition of what constitutes a missed appointment (as opposed to a rescheduled appointment or an appointment not met by the consumer).

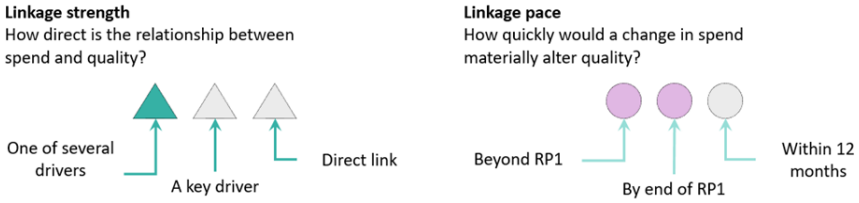
Time to establish an access seeker

This relates to RSP on-boarding. We have successfully onboarded over 90 RSPs through the establishment phase of our fibre network. This activity has dwindled to a low level as the market has matured, so may not lend itself to regular, standardised reporting. However, it is in our interests to on-board access seekers to diversify our wholesale customer base.

Links to expenditure

Linkages between expenditure and customer service are summarised in Table 5.6.

Table 5.6: Linkages between expenditure and customer service



Area	Strength	Pace
Installations | all **Extending the network | all** Installs make up a declining portion of connection activity. Installs and extensions are when we have our most direct interaction with customers.	▲▲▲	●●●
Network sustain and enhance | all Asset replacement and refurbishment and investment in resilience sustain our low fault and downtime rates, which support customer satisfaction.	▲▲△	●●○
Network capacity | all Our investment in network capacity ensures the performance of our network supports customer satisfaction.	▲▲▲	●●○
IT and support | all Our systems support our network operations and customer interactions, including installations, connections, fault restoration and billing.	▲▲▲	●●○
Customer | all Our customer-facing operations, and our product, sales and marketing activities have direct links to customer satisfaction.	▲▲▲	●●●
Network | all Our fault-response work and network operations impact customer experience and satisfactions.	▲▲△	●●○
Support | asset management Our engineers aim to align network quality and performance with customer and consumer preferences over time.	▲▲△	●○○
Support | technology We can't take or fix faults without working and well-supported IT, including licensing, hosting and support.	▲▲△	●●○

5.6 Other quality linkages

Above we have described linkages between expenditure and quality for the four mandatory quality dimensions. Below, we summarise linkages for the three optional dimensions – switching, provisioning and ordering – using the same approach.

5.6.1 Switching

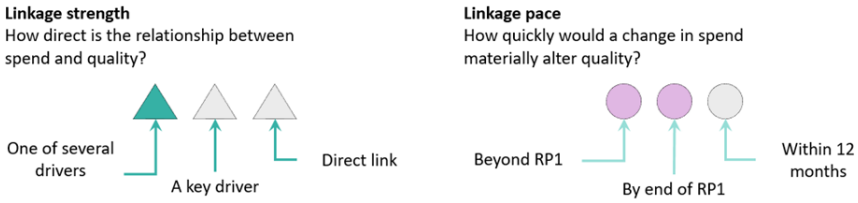
'Switching' refers to our role in facilitating switching a consumer between different RSPs. The only example metric given in the IMs is "time to disconnect [ID/PQ] FFLAS from a losing access seeker and connect to a gaining access seeker".

Our switching activity includes a mix of automated processes (for simpler, higher-volume switches) and manual processes (for new or complex switches). In some cases, there is a trade-off between speed and accuracy and often switches are requested for an agreed date (rather than as soon as possible e.g. to align with number porting timeframe).

Links to expenditure

Linkages between expenditure and switching are summarised in Table 5.7.

Table 5.7: Linkages between expenditure and switching



Area	Strength	Pace
Network Capacity | all There is a connection with market share of RSPs. Switching could require new ports for different RSPs to manage their demand.	▲	●
IT and support | all Automated switching activity uses systems developed, maintained and enhanced through our network and customer IT investment, supported by our business IT infrastructure and integration.	▲▲	●●
Customer | customer operations We have obligations to provide a smooth transfer of service from one RSP to another, reducing barriers to fibre access and switching.	▲▲	●●
Support | technology Our switching activities require working and well-supported IT, including licensing, hosting and support.	▲▲	●●

5.6.2 Provisioning

'Provisioning' refers to our role establishing or modifying connections and carrying out disconnections. It excludes the retailer switching operations described above. The example metrics given in the IMs are 'time to provision [ID/PQ] FFLAS' and 'time to disconnect from one type of [ID/PQ] FFLAS and connect to another'.

We expect RP1 to be a time of transition in the type of provisioning activities we carry out. For example:

- new installation activity will taper off. This will remain our largest activity area in RP1, but new installations peaked at nearly 190,000 in 2019 and we forecast they will ease to just over 40,000 in 2024
- we expect a growing share of installation activity will be active migrations, which is where we approach a household directly to pre-install fibre for later connection
- a growing share of provisioning will be for intact connections – including the first connection of pre-installed fibre, disconnection, or replacing the installed ONT to enable Hyperfibre.

This changing mix will alter the balance between in-field activities (installations), work in exchange buildings (adding coverage or capacity), network configuration management and business-to-business technical and commercial interfaces.

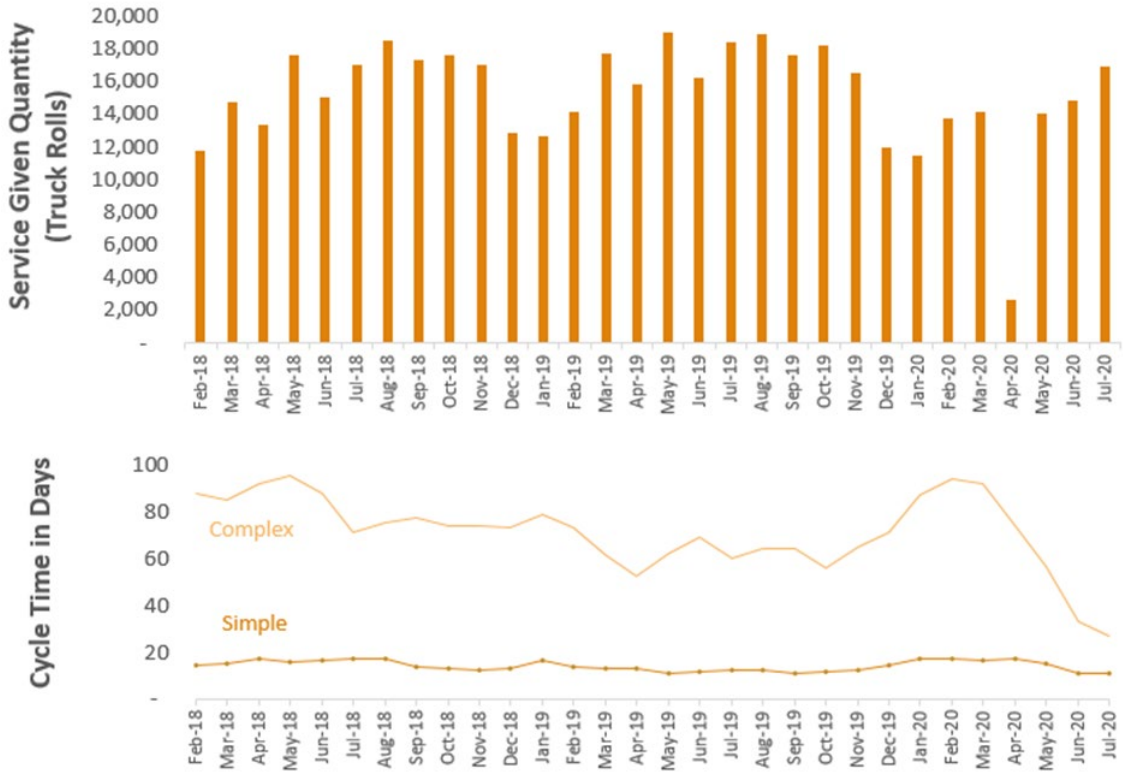
Overall, we've achieved a steady provisioning performance over the life of the network, with the notable exception of extended complex cycle times during late 2019 and early 2020, as shown in Figure 5.8. Complex cycle time measures are based on those jobs that have triggered the consent, design, or build process (and spent time being manually assessed, seeking consent, or having design or build done).[9]

During the COVID-19 lockdown, fibre installations slowed markedly, from a typical average of 650 daily to about 100 a day, and the number of working installation crews dropped from more than 600 to fewer than 300. This was because we could only perform installations in limited circumstances, even though broadband was recognised as an essential service. We issued a force majeure notice to suspend commercial mechanisms relating to certain service levels, including median cycle time measures, between April and June.

Note: The data is shown based on the median cycle time per month. Cycle time is the time from order receipt to service given. Service given quantity is based on new installation truckrolls.

[9] Note that complex here is referring to complex orders and is not the same as the complex installation category we use when presenting expenditure forecast.

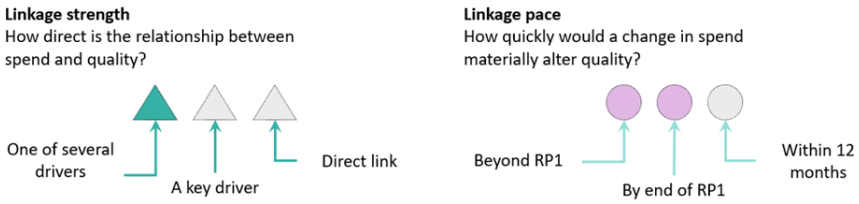
Figure 5.8: Fibre provisioning – cycle time



Links to expenditure

Linkages between expenditure and provisioning are summarised Table 5.8.

Table 5.8: Linkages between expenditure and provisioning



Area	Strength	Pace
Installations | all The most complex provisioning activities involve establishing new installations or installing new ONT capability.	▲▲▲	●●●
Extending the network | augmentation Sometimes provisioning involves infill work to expand network coverage and capacity to accommodate organic growth in premises passed.	▲▲△	●●●
Network capacity | access and aggregation Network management systems are needed to facilitate provisioning. Sometimes provisioning involves providing new access coverage or capacity.	▲△△	●●○
IT and support | all Automated provisioning activity uses systems developed, maintained and enhanced through our network and customer IT investment, supported by our business IT infrastructure and integration.	▲▲▲	●●○
Customer | all Customer operations team handles provisioning tasks that require more complex coordination	▲▲▲	●●●
Support | technology Our provisioning activities require working and well-supported IT, including licensing, hosting and support.	▲▲△	●●○

5.6.3 Ordering

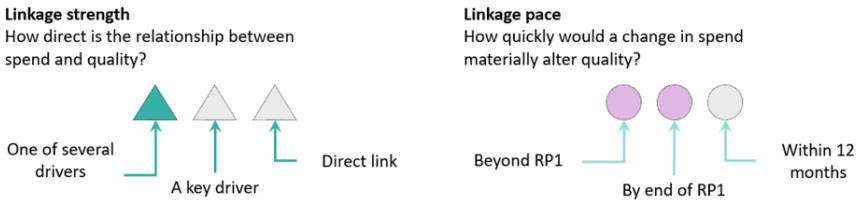
'Ordering' is defined in the IMs as "processing and management of a request from an access seeker to provide [ID/PQ] FFLAS, change [ID/PQ] FFLAS, change an end-user's PQ FFLAS connection from one access seeker to another access seeker, and disconnect [ID/PQ] FFLAS, including how the request is accepted or rejected". The only example metric given in the IMs is 'time to accept or reject a request'. Ordering does not include 'time to establish an access seeker' because this comes under customer service.

In practice, this is a high-volume automated activity managed through a web portal. Ordering is a relatively small part of the end-to-end process of switching or provisioning.

Links to expenditure

Linkages between expenditure and ordering are summarised in Table 5.9.

Table 5.9: Linkages between expenditure and ordering



Area	Strength	Pace
IT and support | all Automated ordering activity uses systems developed, maintained and enhanced through our network and customer IT investment, supported by our business IT infrastructure and integration.	▲▲▲	●●●
Customer | all Need to keep customers and RSPs informed about what product offerings we have available and when. Communication is important to explain and smooth processes.	▲▲▲	●●●
Support | technology We can't take orders without working and well-supported IT, including licensing, hosting and support.	▲▲△	●●○

6.0 Delivery

We are confident we can deliver on our plans

This is our IFP Delivery report. It describes how we are set up to deliver on our plans, identifies key delivery risks and mitigations and describes key linkages between delivery programmes and network performance.

6.0 Delivery

6.1 Our delivery task is evolving

In the nine years since demerger, we have successfully delivered one of New Zealand's largest infrastructure projects. We do not face any new delivery tasks that are materially more challenging than what we have delivered before, though there are some challenges as the COVID-19 pandemic plays out in New Zealand and overseas.

As we look to the first regulatory period (RP1) our challenge is to adapt our resourcing to a smaller and evolving work programme without disrupting delivery. We are confident we can manage this transition, drawing on the recent experience of Chorus and our Field Service Providers (FSPs).

6.1.1 How we deliver

The following diagrams illustrate the flow from consumer drivers and network knowledge through to strategy and planning, and then into delivery of our projects and programmes. More information on our functional unit accountabilities is provided in the support opex chapter of the Investment Report and in supporting organisational structure information.

Figure 6.1 is an overview of the Chorus asset management lifecycle from consumer need to disposal and renewal. This shows the main accountabilities across our functional units through this lifecycle.

Figure 6.1: Overview of flow from drivers to delivery

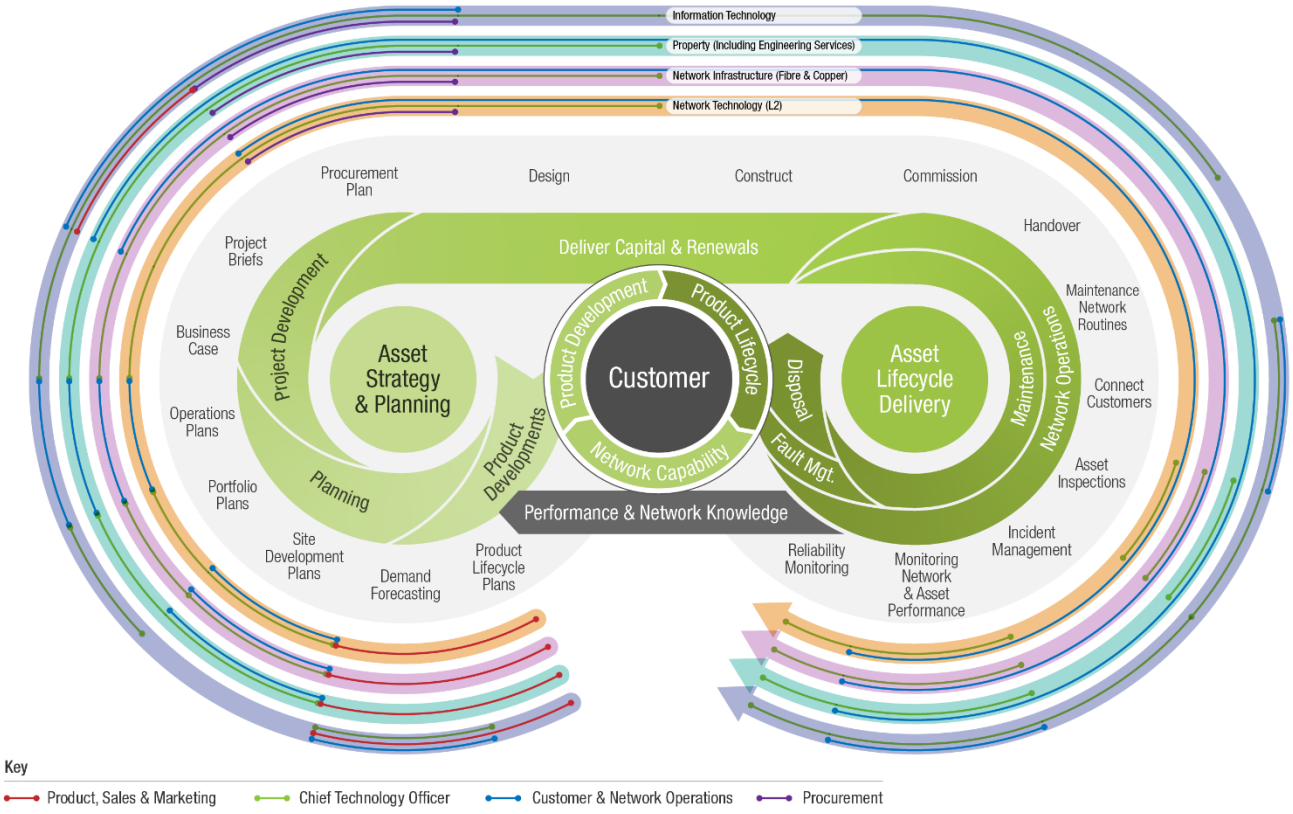


Figure 6.2 shows activities and resources for our main delivery areas. Together, these comprise the bulk of the capex and opex work in our RP1 plan.

We make extensive use of outsourcing for in-field, building and network capacity work as shown in Table 6.1 below. Since 2013 we have separated in-field work across three main contract types (business as usual field services, Ultra-Fast Broadband (UFB) build and UFB connect).

This configuration is geared towards UFB delivery and as we enter RP1 we expect to reconfigure these contracts to achieve efficient utilisation across activities as work volumes decline. Our other work areas have more stable contract structures because work volumes are not changing significantly.

Figure 6.2: Key delivery areas and resources types for each area

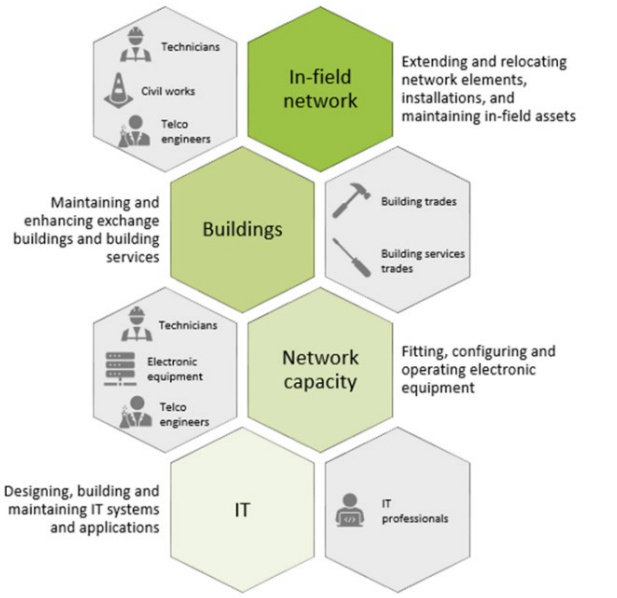


Table 6.1: Service company contracting framework

Area	Contract	Contracts	Key resources	Scope
In-field	Field services agreement	2	Technicians Civil works	Network sustain, restoration, maintenance and relocation. Also covers BAU build such as infill and capacity extension, copper connect and network restoration and maintenance services
	UFB Build	3	Technicians Civil works	Covers communal build, including civil works and technician work in-field and at exchanges for the UFB rollout programme
	UFB Connect	2	Technicians	Connections, including work in consumer premises
	MDU connect	1	Technicians	Connections in multi-dwelling units
Buildings	Network property maintenance	1	Building services and trades	Property maintenance, minor works and project work for exchange buildings
	Building and engineering services	1	Building services and trades	Maintenance, minor works and project work for power, cooling, security, fire and other services
Capacity	Network operations centre	1	Telco engineers	Remote configuration management and commissioning activities along with network surveillance, incident and problem management
	Security operations centre	1	Security services	Physical security, site surveillance and alarm monitoring
	Equipment supply	1	Network electronics vendors	Supply and technical support for access, aggregation and transport electronics, plus element managers

This framework encompasses outsourced services for in-field network, buildings and network capacity.

Our other main delivery task is IT change. We use internal resources to manage and coordinate this work. Much of the actual delivery also uses internal resources, with support from vendors, contractors and outsourced service providers.

Over the past nine years, we have been executing a major IT programme of work to de-merge IT systems from Spark. We've also built digital capability to offer fibre products and efficiently execute connection, provisioning and switching activities. This work requires close coordination with RSPs to prioritise, develop, test and deploy changes. Finally, we have developed and evolved systems to support fibre network operation and in-field activities. These systems require coordination with key vendors and FSPs.

Major one-off delivery programmes

In addition to the areas covered above, we deliver one-off projects or programmes in our work plan. Examples include:

- major transport fibre route extensions, such as the Fox Glacier to Haast to Lake Hawea fibre extension project
- major building refurbishment programmes
- extension of network coverage to new housing and subdivisions
- relocation of network for large infrastructure projects such as Auckland city rail corridor.

For these larger one-off projects or programmes our procurement team works with business owners to negotiate and execute a contract that best balances time, cost and quality objectives.

6.1.2 Procurement

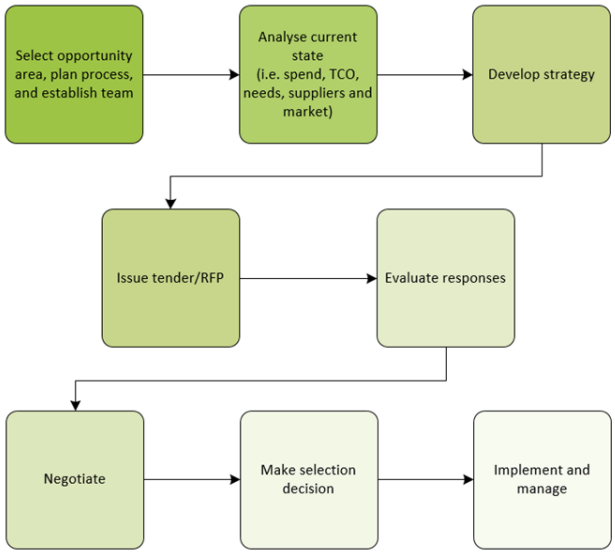
Our procurement policy is to ensure we apply a consistent, professional procurement practice and secures necessary materials and services at appropriate quality levels on commercially favourable terms.

Our policy commits us to use of best practice procurement strategies and tools. These strategies and tools help ensure the lowest whole of life cost through sustainable relationships that enable and incentivise suppliers to deliver the best possible outcome through:

- procurement processes to establish, renew and vary supply arrangements
- commercial terms that incentivise efficiency, quality and performance
- contract governance and performance management.

Our procurement processes utilise competitive processes to identify, evaluate and award outsourced work.

Figure 6.3: Chorus procurement process



Section 6.2.3 describes key governance and performance processes for our major contracts. In the risk tables we flag risks associated with procuring, resourcing and delivering the four delivery programmes.

Below we provide more detail on delivery arrangements in each of the four areas, and information on risks and mitigations, and linkages between areas and with network performance. To provide a complete picture of the delivery programme we show both Fibre Fixed Line Access Services (FFLAS) and non-FFLAS expenditure in this section. FFLAS only information is provided in other parts of the proposal including the Investment Report and Regulatory Templates.

6.2 Delivery in the field

In-field work accounts for 39% of our planned expenditure (across opex and capex) in RP1. Overall, the volume of in-field work will be considerably lower than recent peaks.

Current UFB build programmes will conclude in 2022, and we are forecasting limited brownfields network extension. Greenfield work (discussed in the new property development section of the Extending the Network chapter of Our Fibre Assets) is much lower volume and does not draw as heavily on our delivery resources, because we typically coordinate with the developer's civil works within new developments.

New installation activity peaked in 2019 and we are forecasting it will decline through RP1 as a flow-on from less network extension work.

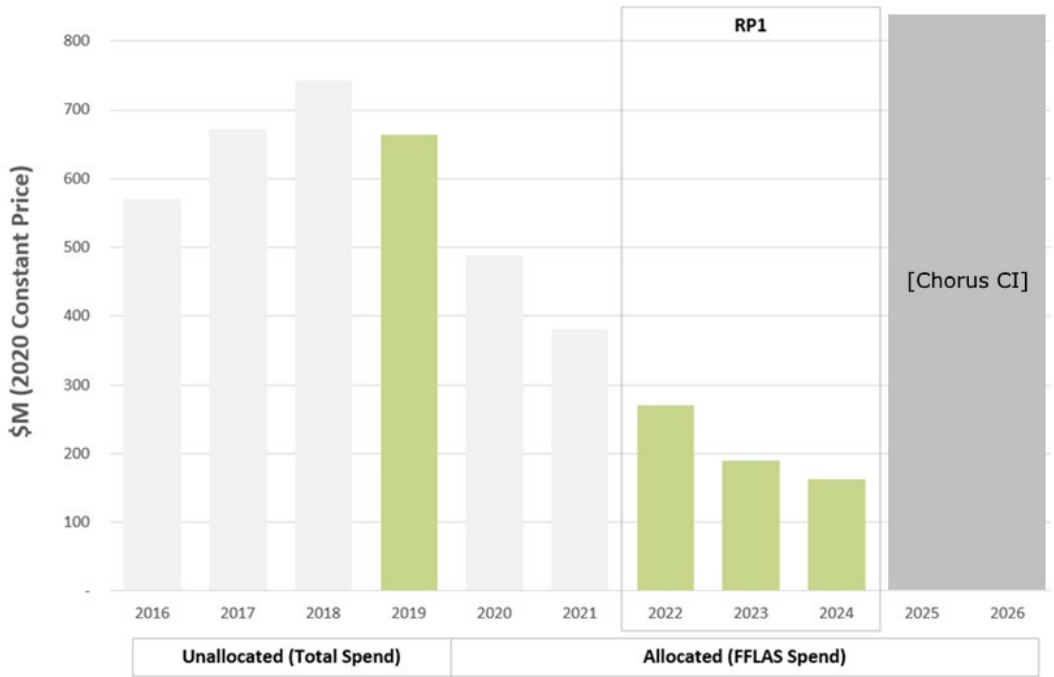
Fibre relocation and maintenance work is growing as we extend the fibre network, but net fault volumes will decline across fibre and copper. This is because new fibre requires less environmental related maintenance than older copper and the number of copper lines are declining as customers migrate to fibre.

Further information on activity volumes, trends, forecast assumptions and uncertainties are covered in the in the 'our plans' and 'forecast expenditure' sections of Network Opex, Extending the Network, Installations and Network Sustain and Enhance (field sustain) chapters of Our Fibre Assets.

6.2.1 Historical and forecast delivery in the field expenditure

In the RP1 period and beyond we transition to a steadier state with lower expenditure on build and connect and growing focus on lifecycle management. This is shown in Figure 6.4.

Figure 6.4: Historical and forecast in-field expenditure



To address the changing scale and mix of work in the field, we are planning to reset key service company contracts. This may include some consolidation of contracts and geographic regions.

The overall aim is to reset scale efficiencies and operational synergies as work volumes decline and to achieve this while sustaining capability and capacity. This will allow us to deliver our plan at current levels of network performance, keeping fault response and customer experience steady.

We are working to ensure a sustainable field services ecosystem by reviewing our internal operating model and capability to support a shift in focus from build to operate.

We will time changes to align with natural breakpoints in existing contracts, with the most significant milestones being completion of currently committed UFB build and expiry of the Field Services Agreement (FSA) in early 2022.

6.2.2 Managing Delivery

Table 6.2 summarises how we manage key field delivery work types, with a focus on how we hand work over from planning (or policy) to delivery, and how we monitor delivery performance.

Table 6.2: Work type and Handover for in-field delivery

Work Type	Handover
UFB build	Once work has been awarded to a service company to construct, fibre flexibility points (FFPs) are loaded into our iTools work management system. This allows for tracking of design and build related tasks against baseline dates and acts as a document repository relating to the build activity.
Standard connections	An order comes through the Chorus Portal from a retail service provider (RSP). Chorus generates a service order via our Integrated Customer Management System (ICMS) that is sent to the applicable FSP who dispatch it to a field crew that has the correct skillset, training and capabilities to complete the job.
Complex connections	An order comes through the Chorus Portal from an RSP. The build portion of the complex order is then raised in iTools and the FSP picks up the build component and allocates it to the correct workforce. On completion of the "build" the FSP completes the "connect" portion of the order via ICMS.
Field sustain – volumetric	Field sustain work is identified either from field observations, monthly network performance reporting, or triggered by third-party activity such as roadworks. Some identified works of a transactional nature are approved via a weekly management review forum. Other works are checked for alignment to approved business plans and are approved within the capital investment approval framework. Network elements requiring replacement, remediation or new build are managed via the iTools work track system.
Reactive and recoverable maintenance	Reactive maintenance is either customer reported loss of service or equipment alarm generated faults. Work is entered into our fault management systems - HP Service Manager (HPSM) and Open Up Time (OUT).

Table 6.2 continues:

Work Type	Handover
Preventative maintenance	Network maintenance routines are scheduled preventative maintenance which is dispatched monthly via our Work Management System (WMS). WMS is being replaced with a cloud-based system called eMaint. Proactive Batch Tests (PBTs) and Rehabilitation works are identified via weekly reporting on the condition of the network. Network elements requiring replacement or remediation are managed via the iTools work track system.

6.2.3 Governance and performance management

Governance and performance management for our major outsourced contracts are as follows.

Each contract contains a comprehensive governance regime that requires parties to meet regularly to monitor performance and risk and encourages and incentivises continuous improvement:

- layer one CEO meeting – bi-annually
- layer two General Manager meeting – quarterly
- layer three heads of departments – monthly and as needed
- layer four senior operational leads and business and project leads – monthly
- annual plans: specific annual action plans for quality, health and safety, and objectives
- daily operational calls.

Key performance indicators: set of key deliverables with performance measures supported by risk-reward financial incentives

Technical documents: clear standards for technical requirements, process and customer service. Technical Documents may also contain specific and more detailed performance standards and measures that apply to different tasks and services at a more granular level

Performance clauses:

- **default notices** – requirements to produce for approval performance improvement plans
- **completion** - rights for Chorus to complete service or get third parties to complete works where there is non-performance
- **standard contractual rights** – warranties, breach, step-in, termination (all or in part)
- **quality provisions** – assurance audits and reporting, quarterly plans, NCR (non-conformance reporting) put right and continuous improvement.

These governance and performance management arrangements are designed to achieve key service outcomes at the best cost. Contract design and periodic calibration ensure contracts, governance and performance management arrangements remain fit for purpose.

These processes also apply to our buildings and network capacity delivery programmes where outsourced work is delivered under the contracting framework described in Table 6.1.

6.2.4 Risks

In Table 6.3 we identify, assess and describe mitigations for key risks for delivery in the field.

Table 6.3: Key risks associated with procuring, resourcing and delivering for delivery in the field

Key Risk	Assessment	Mitigation
Service company sustainability Declining expenditure impacts service company sustainability under current contractual structures.	Current contractual arrangements are optimised for build and connect and reflect underlying maintenance volumes. These need revision in light of evolving and smaller work programmes. Unaddressed, this risk has the potential to impact both delivery and quality outcomes.	Reset service company contracts to optimise for future volumes and Chorus requirements, including ensuring sustainable service companies.
Rural sustainability Sustaining adequate coverage in rural areas will be challenging as work volumes decline.	Copper work contributes to sustainability of work volumes for rural technicians. Declining copper connections exacerbates transition challenge.	Structuring of contracts and engagement with potential providers.
Contractor insolvency	This risk has the potential to impact delivery and service quality, for example provisioning and availability.	Ensure contract structures support sustainable service companies. Contingency plans that can be executed in event of service company failure.
Worker welfare Long supply chains and use of migrant or vulnerable workers exacerbate risk to worker welfare.	Poor worker welfare is not desirable or sustainable and can contribute to poor quality outcomes.	Ensuring sufficient supply chain oversight.
Operating model change Handover to delivery, and performance monitoring, could be disrupted as we implement change.	Change can cause a dip in productivity, including due to staff shifting focus, or needing to re-learn, upskill, or redevelop processes and relationships.	Careful change planning, management and support. Retaining capacity to rapidly catch-up on any delayed work.
FSP reset In-field productivity and performance could be impacted as we implement change.	Changes in contracted parties, contract arrangements, or service areas could disrupt productivity temporarily. Unaddressed, this risk has the potential to impact delivery and service quality (specifically new installations).	Careful change planning, management and support. Retaining capacity to rapidly catch-up on any delayed work.
COVID-19 At higher alert levels some of our work is restricted. A domestic outbreak could disrupt productivity further. Domestic or global outbreaks could interrupt materials and equipment supply.	We have developed work practices that have limited disruption during lockdowns to date, while protecting worker and public safety. We have not experienced any interruption to materials or equipment supply to date. However, this has the potential to impact delivery and service quality (specifically new installations).	Evolve work practices as needed to minimise lock-down impacts while protecting worker and public safety. Monitor and review supplier capabilities and performance. Increase local holdings of imported equipment. Precautions to mitigate against the impact of a severe domestic outbreak or escalation of offshore outbreaks.

6.2.5 Expenditure linkages and synergies and linkages with network performance

Key opex and capex linkages for delivery in the field

We use common resources across build, connect, relocations, network sustain (capex) and maintenance (opex)[1]. We also use common resources across fibre and copper. The overall scale and mix of work across all these areas is the key consideration for how we setup contract structures and manage workflows.

As overall volumes decline, due to completing committed UFB work, connections easing and maintenance needs declining, we will lose some scale efficiencies in the field.[2] We cannot scale resourcing down too far without compromising fault response times and provisioning timeliness. Reconfiguring contract structures will mitigate, but not eliminate, these challenges. As build and connect volumes decline we expect to see less specialisation and greater reliance on multi-skilled technicians. One constraint on this transition is the growing proportion of complex fibre installations over the RP1 planning period.

There is a link between delivery volumes in the field, and our in-house resourcing for planning, programme management and contract administration. As volumes in the field decline, we will need less internal resourcing. However, we will lose scale economies and we will capitalise less internal labour and other support costs as the work mix changes.

Our work in the field grows the number of connections, which feeds through to demand for network capacity. We deliver initial coverage and capacity through our extend and install work, then optimising for lifecycle, enhancement and growth becomes an ongoing network capacity stream of work.

Our work in the field also flows through to changing building and engineering services needs. Fibre consumes less electricity than copper equipment 'per-bit', and as we transition our building services need to meet the needs of two networks. As copper equipment is gradually decommissioned, this will flow through to opportunities to optimise buildings and building services.

Our delivery in the field is supported by IT systems, which we scale and adapt to support product enhancements and improve asset management and operations. An example of which is the assure (fault management) programme of work that is overhauling our fault reporting and management systems which allows RSPs to automatically diagnose customer connections before sending technicians out to repair. Technicians can also view and carry out the same diagnostics via a mobile app.

Delivery in the field is also supported by our customer operations teams who support activities that cannot be fully automated and ensure effective coordination between field activities, RSPs, consumers and network configuration activities.

Key network performance linkages for delivery in the field

In-field maintenance activity will typically address identified faults or other issues, resolving current service performance issues, or mitigate future issues which may adversely impact service, network resilience or increase whole of life costs.

Build and connect activity will typically increase access to UFB and FFLAS services by increasing network coverage areas and increasing network capacity to match growth, retire obsolete technology, and in some cases increase network resilience.

Third-party activity such as roadworks or electricity network construction and maintenance can drive faults and impact to our RSPs and consumers. We work with third parties to mitigate this risk by relocating and managing our assets around their activities.

In-field activity can drive faults that impact our customers and consumers. Our work procedures, training, quality assurance and network architecture are designed to limit these impacts, and we have been able to reduce the detrimental impact of 'hands in the network' over time.

Some in-field activity also requires planned outages which we coordinate with and communicate to RSPs.

In-field activities have a significant impact on customer service perceptions. This includes:

- our network extension work – which is highly visible and can be disruptive
- installation work, which is the most direct interaction most people have with us as it involves technicians in the home

[1] Build and connect resources interrelate to our Extending the Network and Installations expenditure categories; relocations and network sustain interealte to our Network Sustain and Enhance expenditure category; and maintenance opex interrelates to our Network Opex expenditure category.

[2] Declining total Chorus connections (fibre and copper) also impact overall work volumes and scale. For example, total connections have declined from ~1.8m at demerger to 1.4m today.

- restoration services, which directly impacts consumer experience.

Minimising the impact of network extension work and smoothing the customer experience in connecting to the fibre network has been and remains a major focus area. A good measure of progress improving the connection experience is the proportion of fibre installations completed in a single day – which has increased from below 40% to over 70% in the last two years. This is reflected in strong customer satisfaction ratings. In September 2020 this is at 8.2 out of 10 for installations that require physical work to be done (a steady increase from 6.9 in 2016).

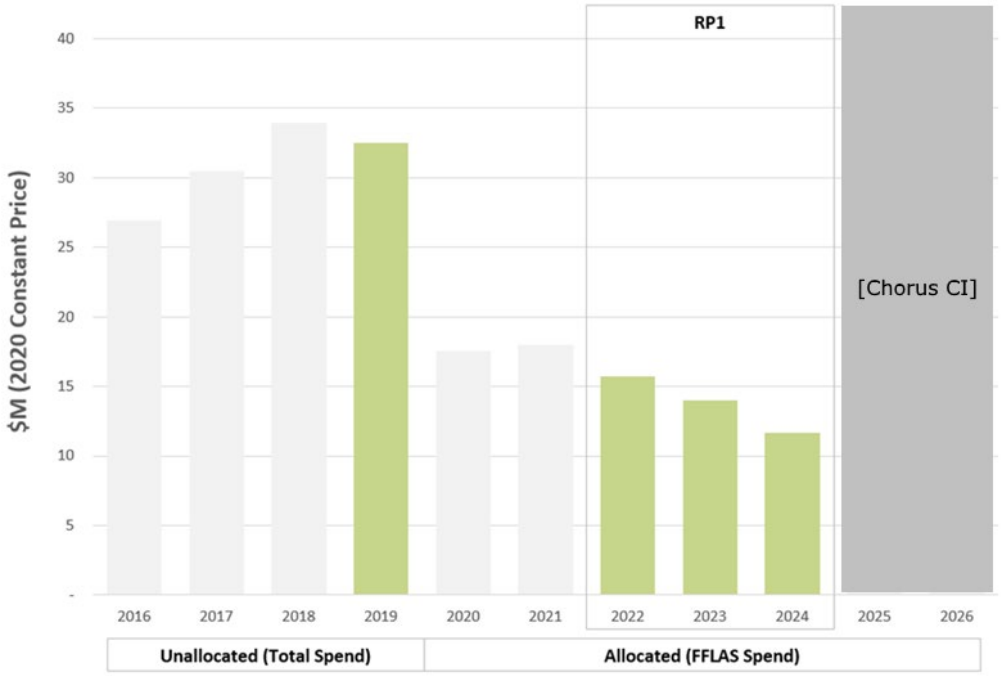
In-field activity determines the built-quality of our assets. We have evolved network and asset design over the course of the UFB programme to continually improve built-quality. We've also evolved how we manage workmanship standards. Some of these matters have an immediate impact on network performance (for example, changing from above-ground cabinets to in-ground pits has reduced vehicle damage) but mostly it will take time for built-quality to translate to lifecycle cost or network performance outcomes.

Significant coordination is required across our internal and external product ecosystem to identify, develop and execute changes. Our FSPs are a key part of such efforts, which in turn support performance across all quality dimensions.

6.5 Delivering site services

Network buildings and engineering services account for 3% of our planned expenditure (across opex and capex) in RP1. Excluding large projects and programmes, the volume of work will remain reasonably steady into RP1. This is shown in Figure 6.5.

Figure 6.5: Historical and forecast Network Buildings and Engineering Services



Further information on activity volumes, trends, forecast assumptions and uncertainties for network buildings and engineering services are covered in the 'our plans' and 'forecast expenditure' sections of the Network Opex, and Network Sustain and Enhance (site sustain) chapters of Our Fibre Assets.

At present the following notable projects are underway:

- **Courtenay Place mid-life refurbishment** – a staged upgrade of building infrastructure with an estimated total investment of $13.8m[3]. Works include chilled water, electrical services, engine alternator and uninterruptible power supply (UPS), seismic improvement works, window remediation and lift upgrade. We plan to complete this project in 2024
- **alternative sites** – a multi-year programme of work to enable reduced dependency on key Spark sites. Works include the upgrade and capacity increase of key power and building services. We have carried out this work at 25 sites and expect this programme to be completed in 2023.

Along with these projects, annual maintenance and equipment upgrade programmes target equipment that is approaching end of life and/or capacity constraints.

Projects are either delivered through our FSPs for routine work, or through competitive tender for larger and more complex works. For routine work an annual asset maintenance and replacement programme is developed in conjunction with the FSP, based on asset performance data, with oversight from investment managers.

These projects are procured through competitive tender. The projects do not tend to have a large component of specialist resources, so we don't anticipate any significant resource shortages. For more routine work, overall volumes are reasonably stable. Our focus in this area in RP1 is to complete the most critical work, while gathering information and developing plans for optimal investment and operations beyond RP1.

[3] Unallocated nominal dollars.

6.3.1 Managing Delivery

Table 6.4 summarises how we manage key field delivery work types, with a focus on how we hand work over from planning (or policy) to delivery, and how we monitor delivery performance.

The governance and performance management processes described earlier in this section, under section 6.2.3, apply to this work area.

Table 6.4: Work type and Handover for Network Buildings and Engineering Services

Work Type	Handover
Scheduled equipment upgrades and replacements (capex).	Annual programme developed in conjunction with the applicable maintenance provider. Using asset condition data, resilience and importance levels to determine priority.
Major projects and programmes.	Engagement of specialist technical design followed by competitive procurement process.
Annual routine maintenance programmes and reactive maintenance (opex).	Annual programme developed in conjunction with the applicable FSP, with support from investment manager. Using asset condition data, resilience and importance levels to determine priority.

6.3.2 Risks

In Table 6.5 we identify, assess and describe mitigations for key risks for network building and engineering services delivery.

Table 6.5: Key risks associated with procuring, resourcing and delivering for Network Buildings and Engineering Services

Key Risk	Assessment	Mitigation
Unplanned work We have not made provision for any major, urgent and unanticipated work.	This kind of work can arise, for example, due to natural events (earthquake or storms), fires, vandalism, or latent issues (such as structural defects, weathertightness or hazardous materials). We would not anticipate difficulty securing materials or labour unless the issue is widespread (e.g. a major urban earthquake). Our network architecture is designed to limit the impact of issues in core sites. Unaddressed, this risk has the potential to impact delivery of unplanned and potentially planned work and quality outcomes, potentially across all quality dimensions (depending on the nature of the event).	Insurance. Contracted FSPs for Property Maintenance and Engineering Services. Engineering Consultancy services contracts in place for specialist technical support. Redundancy for core sites. A severe event could constitute a catastrophic event under the IMs. This would allow quality or price path reconsideration.

Table 6.5 continues:

Key Risk	Assessment	Mitigation
Contractor insolvency	This is deemed a very low risk as the incumbent parties are large facilities and asset maintenance providers and the skills can be sourced from a broad general supplier market. This risk has the potential to impact delivery and service quality, for example provisioning and availability.	Ensure contract structures support sustainable service companies. Contingency plans that can be executed in event of service company failure.
COVID-19 At higher alert levels some of our work is restricted. Further domestic outbreaks could disrupt productivity. Domestic or global outbreaks could interrupt materials and equipment supply.	We have developed work practices that have limited disruption during lock downs to date, while protecting worker and public safety. We have not experienced any significant interruptions to materials or equipment supply to date. This risk has the potential to impact delivery and service quality, for example provisioning and availability and performance.	Evolve work practices as needed to minimise lock-down impacts while protecting worker and public safety. Precautions to mitigate against the impact of a severe domestic outbreak or escalation of offshore outbreaks.

6.3.3 Expenditure linkages and synergies and linkages with network performance

Key opex and capex linkages for network building and engineering services delivery

Some network building and engineering services work is driven by demand for space, power or cooling needs of equipment built to expand the network and required performance of the asset.

Newer generations of fibre network electronics are more efficient but higher demand increases net electricity usage, flowing through to opex.

Investment to maintain or extend the useful life using asset data such as condition rating, criticality, and consequence of failure helps minimise whole of life cost (opex and capex).

Key network performance linkages for network building and engineering services delivery

Our network buildings and engineering work does not typically directly affect network performance though secure, well maintained and resilient buildings support underlying network performance. For example:

- building structure and envelope integrity and robustness protects network equipment, which supports availability
- security and fire systems protect network equipment, reducing risk of faults and unavailability
- maintaining or enhancing building services and investing in back-up systems reduce faults and improves availability.

Retaining more sites, with meshed connections, improves network resilience and reduces the impact of faults on network availability, and upgrading power supplies and cooling supports higher-performance services and increasing demand.

6.4 Delivering network capacity

Network capacity accounts for 17% of our planned capex expenditure in RP1, excluding initial coverage and capacity fitted as part of extension and connection work.

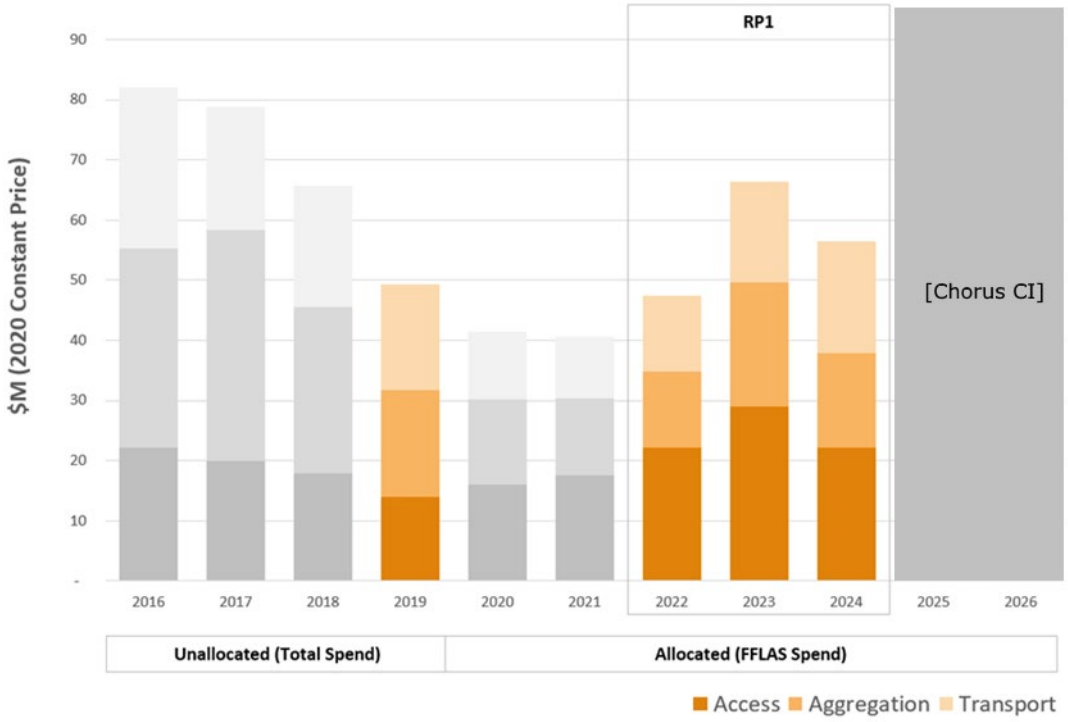
Further information on activity volumes, trends, forecast assumptions and uncertainty for Network Capacity are covered in the 'our plans' and 'forecast expendiiture' sections of the Network Capacity chapter in Our Fibre Assets.

Network capacity is one area where expenditure is growing, in particular for access electronics. Access electronics include in-home equipment and access network equipment. This is shown in Figure 6.6.

This change in expenditure is due to a combination of growing network, connection and service speed and data use as well as lifecycle investment. Forecasts also include:

- acceleration of a generational change in aggregation equipment, due to vendor mandated obsolescence
- increasing lifecycle and upgrade of Optical Network Terminals (ONTs) and access electronics as first-generation equipment ages and customer upgrades trigger equipment change in-home and in the access network.

Figure 6.6: Historical and forecast Network Capacity expenditure



Proactive programmes enable tailored procurement and efficient delivery

A large proportion of network capacity expenditure is on equipment and associated vendor configuration work, so these are a key focus in delivering our network capacity programme.

The majority of the network coverage and capacity build is driven by proactive programmes. This allows effective medium-term planning for us, equipment suppliers and service companies. This mitigates most delivery risk and enables efficient design, procurement and delivery. Further, by proactively deploying the equipment chassis and linecards in anticipation of demand we enable shorter lead times when connecting consumers or enabling additional bandwidth. This approach also enables the lowest whole of life cost outcome.

Procurement – we have tailored engagement with equipment suppliers appropriate for the scale and complexity of each relationship. This agreement covers terms and conditions around supply, including contractual lead times by technology domain and how we engage and track the supply chain during the term e.g. Chorus forecasting and Nokia updates on supply chain status of in-flight orders and generally.

Managing equipment supply chain risk

To ensure equipment availability, we

- hold local inventory holdings e.g. Optical Network Terminals (ONT's). We now hold up to six months inventory given COVID-19 related global supply chain risk
- forecast volumes to vendors to signal requirements and trigger different contractual thresholds for delivery lead times e.g. 12 weeks for forecasted orders and 18 weeks for unforecast orders
- track vendor lifecycle notifications especially end of supply dates where replacement technologies will need to be selected to use in the future or alternatively order on a project by project basis for high unit cost and/or low turnover items (to avoid high holding costs and mitigate obsolescence risk during the holding period).

We have not experienced any material issues delivering our network capacity work programme. This programme is supported by mature forecasting, planning and delivery processes. A large proportion of network capacity expenditure is on equipment with the balance on work planning and delivery where we rely on a skilled technical workforce of inside plant technicians. The main labour challenge is ensuring geographic availability of this specialist labour force.

Equipment availability and supply is a risk for New Zealand. As a small market with no domestic manufacturing capacity we rely on international suppliers, and one supplier in particular, so their performance is critical. To date we have not experienced issues, including as a result of COVID-19, though this is a risk we monitor closely.

Table 6.6: Work type and handover for Network Capacity

Work Type	Handover
New build for capacity or coverage.	Centrally planned and translated in to briefs for FSPs to complete final design and scheduling.
Network renewal (replacement).	Centrally planned and translated in to briefs for FSPs to complete final design and scheduling.
Decommissioning and network removal.	Centrally planned and translated in to briefs for FSPs to complete final design and scheduling.
Platform software upgrades.	Planned and executed using using the same processes as IT delivery, utilising internal and external suppliers.

6.4.1 Managing Delivery

Table 6.6 summarises how we manage key field delivery work types, with a focus on how we hand work over from planning (or policy) to delivery.

The governance and performance management processes described earlier in this section, under section 6.2.3, apply to this work area.

6.4.2 Risks

In Table 6.7 we identify, assess and describe mitigations for key risks for network capacity delivery.

Table 6.7: Key risks associated with procuring, resourcing and delivering for Network Capacity

Key Risk	Assessment	Mitigation
Chassis change out Planned generational change in aggregation electronics during RP1 will require chassis change-out.	This work has a higher potential for service disruption, specifically availability and performance.	Minimise service impact in design phase. Coordination with RSPs to minimise service impact and communicate with consumers.
RSP acceptance As a wholesaler, we must manage the impact of network changes on RSP integration and commitments.	We consult with RSPs on all network change. Where this identifies breaking change that impacts RSP integration or commitments, we must work with RSPs to resolve issues and gain acceptance. This can delay or prevent change. This risk has the potential to impact delivery and service quality, for example provisioning and availability.	Early consultation on key 'breaking change' risks. Relationship management to support effective coordination and issue resolution.
Access to Spark buildings We have significant equipment installed in Spark buildings. Access to these buildings can be slower and costly compared to our own buildings.	At demerger, Spark held several large urban exchange buildings. We have leases with Spark that govern access arrangements, including pricing. This risk has the potential to impact delivery and service quality, for fault restoration.	Forward planning and coordination with Spark. Redeploying to alternative sites where feasible and cost-effective.
COVID-19 (in New Zealand) Potential for compound impacts of accelerated demand coupled with installation challenges if severe outbreak occurs.	We have developed work practices that have limited disruption during lockdowns to date, while protecting worker and public safety. These may need to be evolved if more severe or widespread outbreaks occur. This risk has the potential to impact delivery and service quality, for example provisioning and availability.	Evolve work practices as needed to minimise lock-down impacts while protecting worker and public safety. Ensure contingency plans anticipate severe COVID-19 outbreak scenario.
COVID-19 (overseas) Global outbreaks could impact manufacturing, shipping or access to vendor support.	We have not experienced any significant interruptions to materials or equipment supply to date. However, supply interruptions are possible. This risk has the potential to impact delivery and service quality, for example performance.	Precautions to mitigate against impact of escalating disruption from COVID-19 internationally. For example: locking in supply contracts and larger on-shore stocks of critical equipment.

6.4.3 Expenditure linkages and synergies with network performance

Key opex and capex linkages for network capacity delivery

Network capacity expansion is dependent on suitable building space, condition and building services capacity. There is some cross-over in technician and engineering resources between in-field work and network capacity work.

Consumer and RSP behaviour changes are related to major events such as the Olympic Games and the Rugby World Cup.

Key network performance linkages for network capacity delivery

Network capacity delivery is critical for sustaining performance as demand grows, it maintains support and compatibility across the network, which reduces faults and supports network availability.

We provide resilience through duplication, which supports network quality and improves flexibility for network capacity work.

We tend to replace our network electronics before they break because of the pace of change of technology. We also build network capacity in advance of growth to ensure that services remain available.

6.5 Delivering IT change

IT accounts for 11% of our planned capex expenditure in RP1. Overall, the volume of IT work will be slightly lower than recent peaks.

We have largely completed a major programme of reducing reliance on legacy Telecom systems managed by Spark. This has included developing core systems such as a separate desktop environment, our enterprise resource planning system (SAP), data warehouse, fibre and copper fulfilment, and customer billing.

We have also put in place a suite of systems and applications to support UFB deployment, connection activity, network configuration management, and product management. Most of these systems interact with each other, and with RSP systems or people.

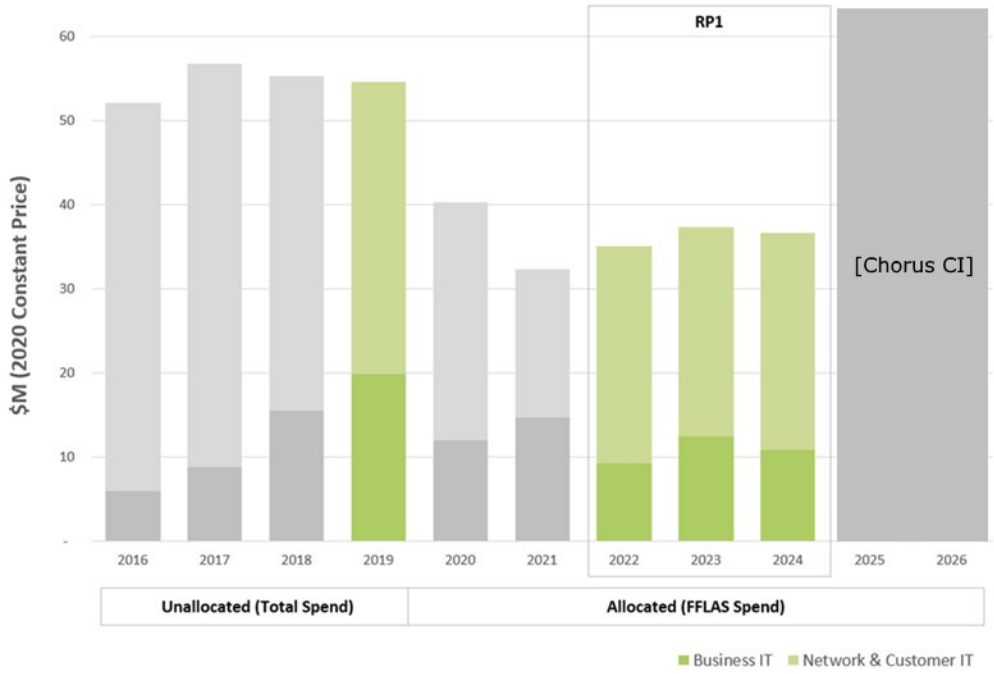
Further information on activity volumes, trends, forecast assumptions and uncertainties for delivering IT change are covered in the 'our plans' and 'forecast expenditure' sections of the IT and Support chapter in Our Fibre Assets.

Figure 6.7 shows the changing profile of IT capex as programmes to transition from shared Spark systems conclude and we enter a steadier state. The RP1 period sees fewer large, one off transition projects with greater focus on customer and business optimisation and lifecycle investment.

Our plan for IT capex into RP1 is scaled to fit delivery constraints:

- we scale our product investment forecast to deliver a steady pace of change. This reflects that there are change capacity limits across the sector, so we cannot execute more product change than our customers can absorb
- we size lifecycle and compliance work based on our best view of the extent of work needed to manage risk and maintain support across our existing systems
- customer experience and optimisation initiatives can be flexed over time to help balance peaks and troughs and delivery constraints across the IT delivery programme
- our plan includes provision for asset-management focussed work to link existing systems and introduce new capability.

Figure 6.7: Historical and forecast IT capex



6.5.1 Managing Delivery

Our overarching approach to delivering IT is about continuous improvement. Our current Delivery approach encompasses multiple delivery models, including traditional Waterfall project approaches to delivering change and our more recent operating model transition to DevOps[4] and Agile.

Agile is an iterative and incremental approach for delivery. It is a methodology for developing a product or managing work where solutions evolve through collaboration. This is done together between self-organising and cross functional teams and their customers to focus on delivering the highest value in the shortest time. Our new operating model is largely designed around Agile in order to:

- meet the growing number and complex changing needs of our customers, our business needs to continue to evolve in the way we work to be able to respond quickly and efficiently
- be effective, our delivery needs to become smaller and more frequent, iterative and strategically aligned across our organisation
- be successful, we need to demonstrate that we can deliver more customer value, faster, without compromising quality, in an open and transparent manner across our organisation to ensure we minimise wasted effort.

At the core of this operating model we have designed three virtual organisations.

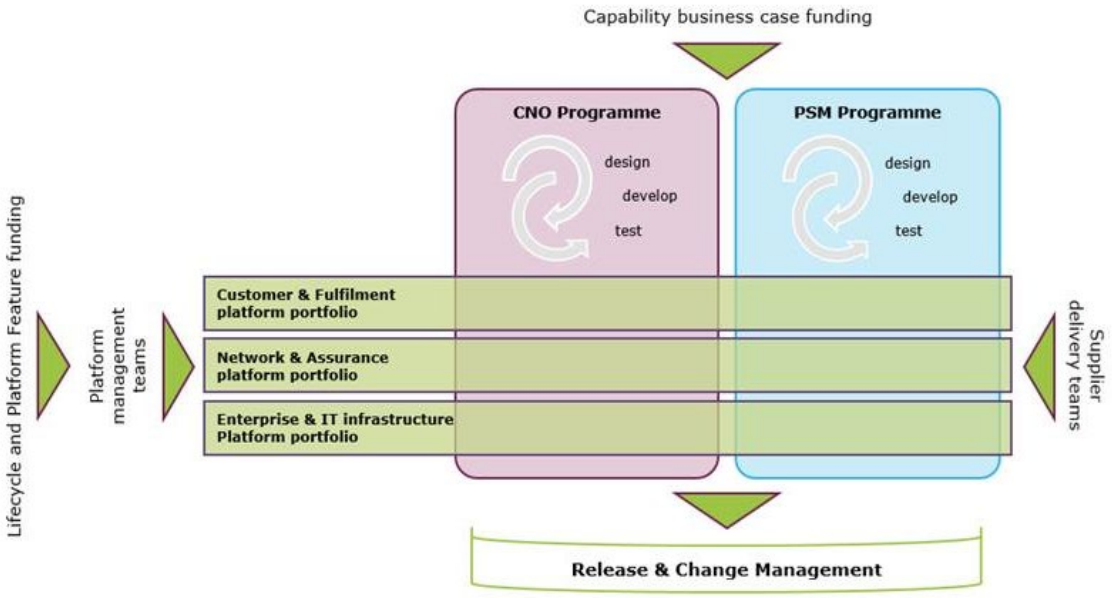
Platform – dedicated teams assigned to a single or a small group of technology platforms where intellectual property and technical leadership can be fostered and grown. These teams are responsible for the whole-of-life of these platforms; technology strategy, investment planning, platform performance and cost, lifecycle, design, change, quality, operations and eventually replacement.

Programme – dedicated virtual organisations that assemble to consolidate, govern and deliver on the strategic objectives for both PSM (Product, Sales and Marketing) and CNO (Customer and Network Operations). Deeply integrated with and dependent on the input from all parts of our business.

Release – a governing function that works with the programmes and platforms to ensure that we maintain quality and structure to how we bring change to production whilst protecting the current-state performance of our environment.

[4] DevOps combines software development and IT operations to shorten the system development life cycle and provide continuous delivery with high software quality.

Figure 6.8: Chorus CTO IT delivery operating model



Agile

The Agile framework has a set of descriptive terms and ceremonies that underpin it. The main elements are broken out below:

- **epic** – an epic outlines functionality at a high level, a business outcome that can be broken down into a number of features and user stories
- **feature** – a feature describes a discrete piece of functionality that delivers tangible value. It can fulfil a specific outcome for the RSP, consumer or Chorus business within an epic
- **story** – a user story is the description of what to create. User Stories are used by the team as the 'requirements' of what to deliver. Collectively, a group of User Stories can fulfil a Feature and/or a portion of an epic. These are key pieces of delivery that ensure we are making traction on a RSP, consumer or Chorus business need
- **sprint** – a sprint is a short, time-boxed period when an Agile scrum team works to complete a set amount of work
- **release** – a release is the movement of a software product or system from development into production. One principle of Agile development is to focus on releasing software into productive use as soon as a minimum marketable feature set can be delivered, and then proceeding with frequent incremental releases. Releasing features to the business needs to be co-ordinated across platforms and releases. Concepts such as 'Feature Toggling' can be used to silently release components until a feature can be turned on for the business
- **launch** – enabling features in production to be used by the business to deliver business value, and
- **big room planning** – an annual and quarterly planning ceremony that shares strategic priorities, determines epics that will proceed, recognises success and determines plan feasibility.

The full framework expands on activities and artefacts at each stage for business engagement, change management, technology design and delivery, commercials, testing and operations.

Table 6.8: Chorus CTO IT delivery operating model

Status	Description
Funnel	Future Epics are created and described by a business owner within Chorus
Reviewing	Epics are elaborated to provide a shared understanding of intent and business objectives Standard methodology (WSJF5) is used to prioritise
Analysing	Solution options are assessed and costs are estimated The Minimum Viable Product (MVP) is defined The business case for investment of the MVP is prepared and approved
Backlog	Epics are now in a state of readiness to begin implementation Planning ceremonies agree allocation of resources to begin work
Implementing (Minimum Viable Product)	Implementation of all features required to meet the MVP Refine features, refine stories, build, test and release Verify the business outcome hypothesis
Implementing (Persevere)	Implement remaining features for as long as business prioritisation dictates Prepare and approve additional funding if required
Done	Either Did not proceed to business case MVP implemented but did not meet business outcome hypothesis MVP delivered and remaining features deprioritised Full value realised

[5] Weighted shortest job first.

6.5.2 Risks

In Table 6.9 we identify, assess and describe mitigations for key risks for IT delivery.

Table 6.9: Key risks associated with procuring, resourcing and delivering for IT delivery

Key Risk	Assessment	Mitigation
Unplanned legacy system treatment Inability to manage increasing costs and complexity to operate and replace shared legacy systems and platforms.	Unplanned action or investment in replacing legacy systems within Spark could impact our overall delivery capacity.	Reduce level of change in legacy environments. Maintain shared plans with Spark. Agree plans to maintain shared IP. Complete exit plans to re-platform key systems.
Volume and disruption of change Increasing cadence and impact of planned IT change may become too disruptive for customers and Chorus users.	Change can cause unanticipated delays in programmatic work, delaying the launch of new capability.	Careful change planning, management and support. Managing IT project pipeline to minimise change-related disruption. Design for and build technology resilience within platforms to reduce impact of change.
Inability for suppliers and our people to operate and manage IT assets Stable operations are required to provide a platform to continually drive effective change.	An unstable operations platform would reduce our ability to drive effective change, slowing the rate of change and driving further operational and cost risks.	Convert contract staff to permanent delivery evolution and DevOps programme driving in-situ changes to Chorus organisation as well as key tier 2 suppliers who support our environment. Optimise key supplier contract renewals in 2021. Maintain visibility of Spark exit plans through joint plans and governance. Implement Asset Management frameworks indentified in asset capability improvement plans. Business governance around strategic priorities and application of resources.
Failure of information and network security Any major cyber impact including the DDOS attacks seen in late 2020 can impact IT delivery.	The impact or and response to a cyber attack could disrupt our ability to meet our intended plans.	Regulatory control formalisation and reviews. Security awareness programmes. Formal policy and standards. Vendor security reviews. Operational auditing.
COVID-19 A domestic outbreak could disrupt productivity. Domestic or global outbreaks could impact key vendors.	We have not experienced any interruption to date. This risk has the potential to impact delivery and service quality, for example provisioning and availability.	Evolve work practices as needed to minimise lock-down impacts while protecting worker. Contingency plans anticipate severe domestic and or international COVID-19 outbreak scenario. Chorus and suppliers also have effective remote working capabilities.

6.5.3 Expenditure linkages and synergies and linkages with network performance

Key opex and capex linkages for IT delivery

IT optimisation investment supports business performance, improved service outcomes and efficiency. For example:

- customer focused optimisation investment improves efficiency for customers and Chorus, including B2B interfaces, or consumers, such as end to end systems linking (RSP – Chorus – FSP)
- asset management systems investment improves business capability, supports optimised asset decision making and minimises whole of life costs (opex and capex), and
- process automation investment is typically targeted at reducing high volume manual processes and results in lower labour costs and reduced human error risk.

More generally, IT optimisation investment is an enabler of our shift from build to operate, helping scale down build connect programmes and optimise for a new operating model. IT systems support delivery in the field, which we scale and adapt to support product enhancements and improve asset management and operations.

An example of this is the assure (fault management) programme of work that is overhauling our fault reporting and management systems which allows RSPs to automatically diagnose consumer connections before sending technicians out to repair. Technicians can also view and carry out the same diagnostics via a mobile app. The programme is also replacing legacy systems to manage regular asset maintenance (e.g. regular servicing of generators, batteries and cooling systems) and also payment reconciliation technology to drive efficiency into how field activity is paid for.

Key network performance linkages for IT delivery

As outlined above, delivering our IT programme is necessary to support core business operations to meet internal requirements and critical stakeholder impacting systems and interfaces. For example, business to business (B2B) interfaces and systems linking RSP, Chorus and FSPs to support service provisioning and change as well as fault identification and remediation.

Customer optimisation investment improves service outcomes and efficiency for RSPs and consumers. For example, by improving B2B interfaces to provide enriched order or fault status information leads to an improved consumer experience, on a more self-service basis.

7.0 Engagement

We will sustain our focus on customers and consumers

This is our IFP Engagement report. It describes how engagement shapes our plans, including consultation on our RP1 proposal. It outlines how we will continue to engage, including as we execute our RP1 plan and prepare our RP2 Proposal.

7.0 Engagement

7.1 We benefit from rich engagement[1]

For the past nine years, we've been building a new network, connecting new customers, and continuously evolving our products. This context shapes the engagement that has informed our plans into our first regulatory period (RP1):

- **policy** – the Ultra-Fast Broadband (UFB) initiative stemmed from government policy that aimed to transform broadband in NZ. We actively participate in government policy processes, including on such matters as the new regulatory framework and consumer safeguards to enable copper network withdrawal
- **build** – our UFB contracts have established an initial price-quality (PQ) balance through network architecture, construction, operations and product requirements. Crown Infrastructure Partners (CIP) monitor our performance, and work with us to resolve issues and fine-tune PQ settings
- **connect** – we have an overriding interest in attracting consumers to our new network by making connection as attractive and painless as we can, while also efficiently handling high volumes of installation and connection activity. Connection is a multi-party activity dependent on effective coordination between us, consumers, our Retail Service Provider (RSP) customers and our Field Service Providers (FSPs), and
- **products** – to attract and retain customers we need to continuously improve and evolve our services to address pain points, and anticipate and respond to technology developments, consumer trends and aspirations. Successful product investment requires effective and extensive engagement with RSPs and other key industry stakeholders, as well as detailed market and consumer research to understand how our products are ultimately used in the real world.

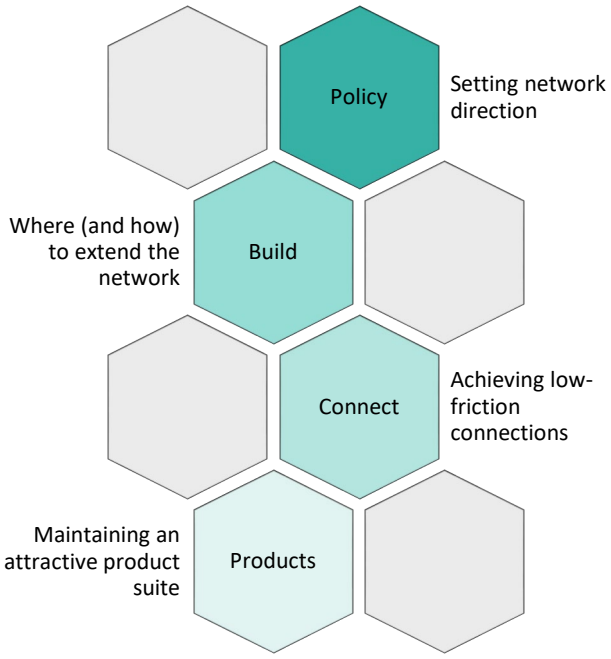
As we move into RP1, most of our connect and product engagement will continue, with some changes as we transition from UFB build contracts to new regulatory and commerical arrangements.

The environment for policy and build engagement will change more significantly and regulatory planning cycles will become a material factor.

In contrast to most other regulated utilities:

- rapid product improvement and evolution cycles are major forces shaping our activities and plans. We have a complex stakeholder environment for this work
- most of our fibre network is newly built under government contract, so policy questions have largely been resolved within that context to date
- attracting and retaining customers are powerful and enduring strategic drivers for engagement.

Figure 7.1: Engagement topic areas



[1] This report focusses on engagement with customers, consumers and related stakeholders. Our engagement with vendors and other parties who assist us to deliver our services is discussed in the Delivery report and Our Fibre Assets.

7.2 Most engagement is ongoing

Our product management system involves considerable customer engagement and consumer research.

Figure 7.2: Product management cycle

Key product engagement activities include:

- RSP requests and feedback are a source of material for the ideation phase. We have been developing more engagement on a product roadmap, which provides a longer-term view of how initiatives may move through to consultation and delivery
- we consult on the short-list of initiatives that are moving towards delivery within the coming one or two years, and
- increasingly, we are extending engagement into the delivery phase with product co-design and product trials.

The objective for these engagement activities is to prioritise product development activity and ensure delivery is commercially and operationally successful. This means the scope of the engagement covers technical, operational and commercial matters.

This work spans product development in the consumer, business and network market segments, collaborating with RSPs and technology partners on process and system enhancements to ensure an ever improving and equivalent customer experience, and activities such as extending our network into new property developments. Key engagement channels for this work include:

- regular informs and engagement via email and online channels[2]
- formal consultation sessions with RSPs
- ad hoc engagement on specific initiatives with key RSP stakeholders, facilitated by dedicated RSP account teams
- seeking feedback on white papers exploring new technology use cases
- industry events, such as Chorus Live, and
- the UFB Product Forum facilitated by the NZ Telecommunications Forum (TCF).

Our engagement with RSPs is designed to ensure we comply with competition and regulatory requirements and take account of the needs of different RSPs. This includes ensuring we do not inappropriately favour any RSP (for example, with access to information not shared with others) and that we do not engage in a way that risks facilitating collusion between competitors. In several cases, our customers are also competitors.

We supplement our customer engagement work with direct consumer research, which includes monthly survey activity and targeted research. This is an important input for ideation, and as we short-list, refine and test the marketability of product initiatives.

Finally, we supplement these structured engagement channels with layers of relationship management. Key product-focussed relationship layers are summarised in Table 7.1.

[2] https://sp.chorus.co.nz/ and associated Chorus stakeholder updates.

Table 7.1: Relationship management layers

Layer	Key Stakeholders	Engagement Purpose
Chief Customer Officer (CCO)	Senior staff from RSP and industry stakeholders	Strategic alignment and escalation point where required.
Account Teams	RSPs	Key point of contact for sales and service enquiries.
Product Teams	RSP product, sales & marketing teams	Ensure Chorus products meet customer and market needs and RSPs are equipped to leverage them.
Marketing Team	General public RSP marketing teams	Brand promotion, targeted marketing.
Consumer and Market Insights	General public Market research organisations RSPs	Gain insights into consumer and business behaviours and market trends to inform planning and engagement. Prepare insights for RSP consumption.
Commercial and Industry	Industry bodies (incl. TCF, CIP, TUANZ)	Inform and coordinate.

We take feedback gathered from this engagement and combine it with our regulatory, network and product performance obligations (for example, our commitment to a congestion-free network) to form robust product initiative plans. These plans run through a gated cross-functional business case process to ensure alignment to IT and network roadmaps.

7.2.1 Linkages

Product requirements inform most aspects of our planning – ultimately all our investment is directed at cost-effective delivery of attractive products.

The most immediate link is with network and customer IT – most engagement is directed at prioritising, designing and delivering our fibre product development investment. This flows through to lifecycle and optimisation investment in product systems over time, and associated operating costs.

Product requirements also have an immediate link through to our customer operating costs – both customer operations and product, sales and marketing.

Less directly, our product changes flow through to Installations and Network Capacity investment. Installation activity is demand-driven, but product evolution flows through to process and technology changes (e.g. Wi-Fi-capable ONTs) over time. Capacity investment optimises across lifecycle, growth and product objectives.

Product requirements can also flow through to our network maintenance and technology operating costs. For example, availability-related product requirements are a factor that informs how we optimise field maintenance activities – including resourcing levels and asset maintenance strategies.

Over a longer timeframe, there is a link between product evolution and our investment in network renewal, resilience and extension. This will become more important as the network ages and the relevance of the initial build standards ebbs away. More immediately, there can be more targeted links at a project level (for example, taking up incremental resilience improvement opportunities when planning network extensions) or product level (for example, investing to support resilient handover products).

7.2.2 Development plans

Improving how we join up our product and asset management systems to sustain end-to-end alignment between product requirements and mid to long-term infrastructure investment is one of our priorities through RP1.

Ultimately, our planning must reconcile product drivers and all other drivers, which we refer to here as policy drivers. To date, engagement on policy drivers has centred around the UFB programme and the telecommunications reform process. For example:

- the UFB agreements have a significant role in shaping network resilience – directly through architectural standards (input requirements) and performance requirements, and less directly through the commercial conditions and financing arrangements that exist under the agreements
- network extension has primarily been through government UFB and RBI initiatives, and
- telecommunications reform has driven policy developments in areas such as anchor product requirements, consumer protections for copper withdrawal, 111 contact code and retail service provision and quality.

The context for these policy drivers changes as we enter RP1 and it will become increasingly important to evolve our policy engagement channels to ensure they mesh with regulatory processes and product drivers.

7.3 We added new engagement for RP1

Product-centred engagement provides us with richer input to our planning than most regulated utilities. However, we recognise there is value in developing new forms of engagement to support our new regulatory planning cycle to:

- extend our product-centred engagement, i.e. to engage more stakeholders and focus on a longer horizon, and
- provide a new channel for policy-centred engagement, i.e. as we transition away from the era where UFB contracts and sector reform shaped network direction.

Our objective for RP1 Proposal engagement was to begin opening new channels of engagement focussed on areas of discretion relevant to the two points above. Key context for this engagement included:

- **novel** – this form of regulation is new for the NZ telecommunications sector and not familiar for most of our stakeholders. It is also relatively uncommon in other NZ sectors, with limited examples across energy and airports of regulatory planning and evaluation processes
- **tentative** – by necessity, we prepared our regulatory proposal in parallel with regulatory development processes such as IM consultation and anchor product regulation. This meant key issues impacting our proposal were not settled at the point we consulted stakeholders. This impacted the scope and content of our RP1 consultation
- **sensitive** – we could not share expenditure forecasts. This includes because we only had a tentative view at best of RP1 settings, and there is heightened market sensitivity around our expenditure forecasts as we move toward RP1, and
- **uncertainty** – as we transition into RP1 we are unable to show how expenditure choices may translate to regulatory revenue, let alone into prices. This is due to the dual uncertainty around key regulatory decisions (critically, on the opening value of our regulated asset base) and around demand.

To fit this context, we designed RP1 engagement that included the following elements:

- **linkage** – we linked our regulatory engagement to existing product teams and channels. This included engaging with the TCF Product Forum, using our "Informer" updates and account managers and involving product experts in the design and execution of consultation activities. We also used our existing stakeholder managers to reach out to wider stakeholders
- **open and informative** – we published an open consultation paper, held an open forum, contributed to a Commerce Commission workshop and made submissions available on our website[3]. Our consultation paper and forum materials were designed to educate and inform stakeholders about us, the regulatory framework and our plans. We used a tree map presentation of expenditure to provide the best possible view of our plans within the constraints described above, and
- **meaningful** – we focused our consultation on key areas of discretion that are relevant to our RP1 Proposal. We developed innovative 'slider' diagrams (Figure 7.4) to highlight key policy and longer-term product choices.

[3] https://sp.chorus.co.nz/future-of-fibre

The slider diagrams were designed to convey, as best we could, the relative scale of relevant expenditure areas and relative scope for varying our level of investment. They also drew a link to the emerging design of regulatory arrangements by showing where we may have scope to add investment outside the main regulatory planning and approval cycle.

We timed our consultation in early 2020, which is part-way through the business planning round that underpins our RP1 Proposal. This timing meant we had information and insights to use for consultation but hadn't locked in key decisions.

Unfortunately, this timing ended up coinciding with the early 2020 pandemic lockdown. We adapted our planning accordingly by using an online forum instead of planned workshops but naturally the circumstances made it more difficult for people to engage and for us to reach out to wider stakeholders. Ultimately, we had eight attendees to the online forum from five organisations, including RSPs and representative industry groups and received written submissions from Vodafone and Spark.

Figure 7.3: Process excerpt from consultation process

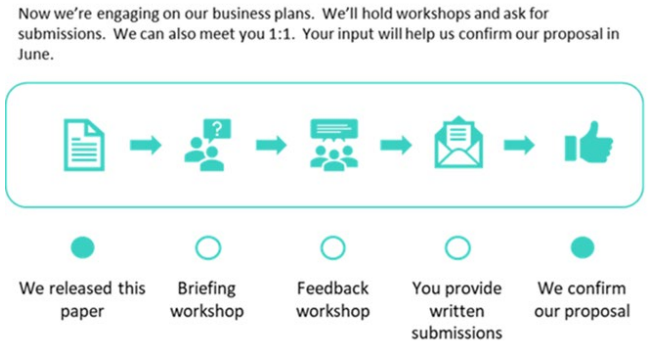
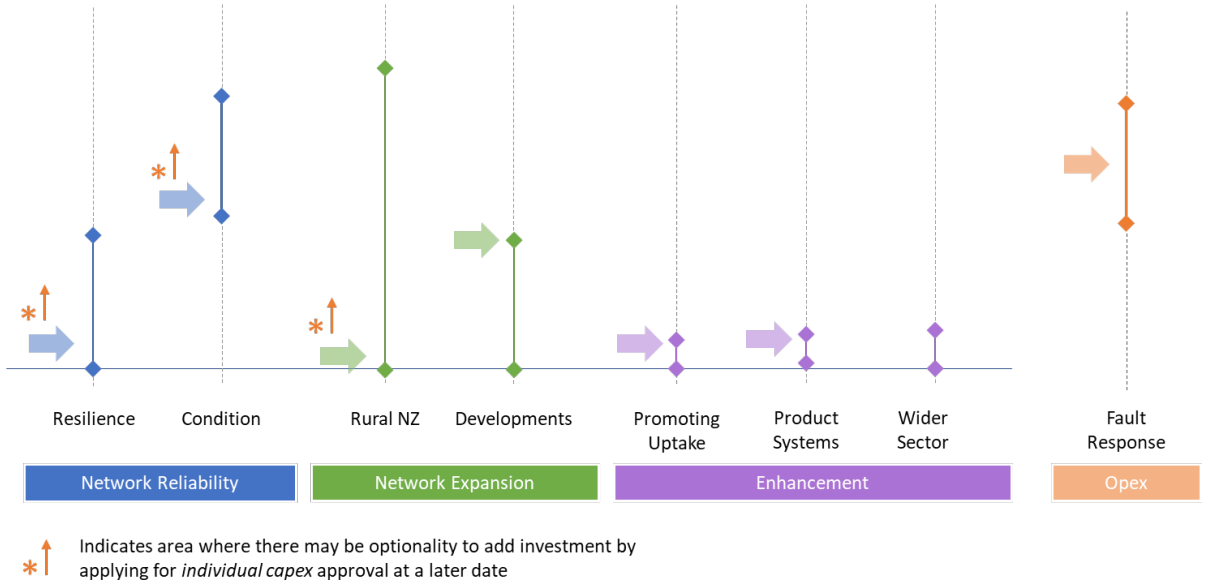


Figure 7.4: Investment slider diagram used as a consultation tool



7.4 Consultation informed our proposal

Key insights we gained from the consultation process were:

- stakeholders appreciated our efforts to engage under difficult circumstances. The regulatory planning and approval cycle is new to most and we have a role to inform and engage people in the process. It will require sustained effort and will take time to build effective channels for this form of engagement
- the policy issues we raised in our consultation were generally too difficult for stakeholders to engage on effectively with the information we were able to provide as we enter RP1. Stakeholders did have good suggestions for the type of information that would be useful, including translating expenditure decisions into cost per connection terms. This will become more feasible as regulatory settings are established and as connection numbers stabilise, and
- there was some agreement that people are becoming more dependent on connectivity, which may have implications for network extension and resilience. For resilience, there will be a need for us to fit engagement on our regulated services into the wider context of telecommunications infrastructure. For extension, there are policy framework questions around the extent to which this can be funded through regulated revenues.

Overall, this engagement validated three key parts of our planning:

- **holding quality steady for RP1** – while there are signs of growing dependence on our infrastructure, it would be premature to build a step change in resilience, robustness or fault response into our proposal. We should work on this policy area in preparation for RP2, and have the option to progress work via an individual capex application if it becomes clear that earlier action is warranted
- **proposing a tight RP1 programme** – consistent with the above, it would be premature to build proactive network extension into our proposal. This leaves further UFB programmes, community-funded initiatives or an individual capex application as avenues for extending connectivity to more towns and communities, and
- **engaging on how to approach RP2 planning** – we have planned a second round of consultation focussed on informing how we will engage stakeholders as we prepare our RP2 Proposal (due by the end of October 2023). Our engagement experience confirmed that this will be worthwhile.

We have responded to the suggestion that per-connection information would be useful by developing two metrics that we use in our proposal:

- **recurring capex per connection** – we cannot quantify total revenue-requirement per connection, but we can present the ongoing investment that feeds through to price levels over time. We have separated our capex into establishment and recurring capex for this purpose, where establishment covers network extension and installation costs. This analysis excludes capitalised lease costs (see below), and
- **opex per connection** – we present opex per connection, excluding forecast pass-through costs, but including lease costs. This presentation provides the best view of costs that are controllable and annual in nature.

For both metrics we average costs across total fibre connections (rather than allocating costs to product types) to ensure the metric is meaningful.

7.5 We will enhance engagement for RP2

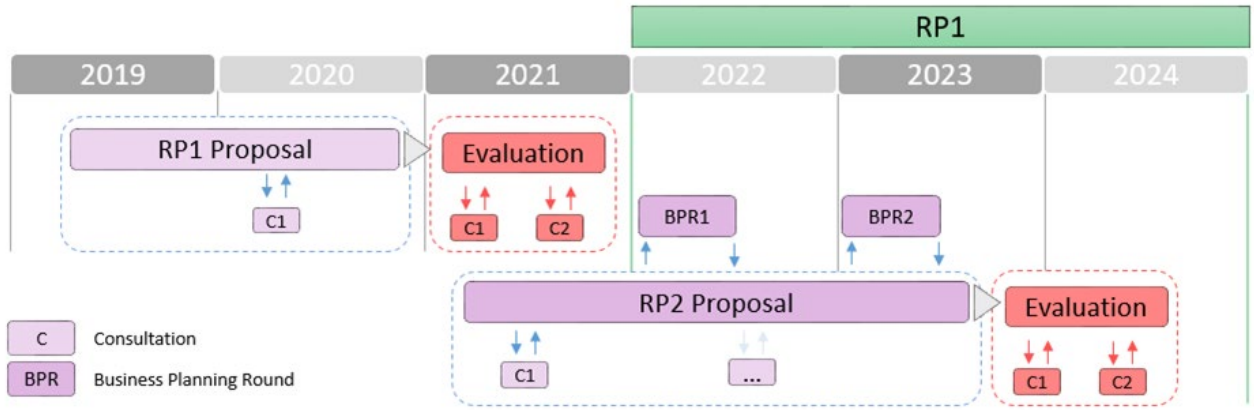
RP1 will start in 2022 and run for three years. During 2021 the Commerce Commission will be evaluating our proposal and establishing the opening value of our regulated asset base. The proposal evaluation is likely to involve at least two consultation rounds, detailed draft and final decision papers, and extensive interaction between us and the Commission as we respond to queries and produce information to support evaluation.

During 2021 we intend to start the early stages of preparing our RP2 Proposal. That Proposal will cover three to five years from 2025 and needs to be ready for evaluation by October 2023. Our process will likely involve using our 2022 business planning round to support a draft proposal, and our 2023 business planning round to support our final proposal.

2021 and 2022 are the key years for building any business capability improvements or new engagement channels to support RP2 planning.

Given these timeframes, we are planning an engagement round during 2021 focussed on gathering input on our RP2 Proposal process. Our engagement objectives will include making more progress with finding and informing interested parties, gathering input on how and when we should engage on our RP2 Proposal, and gathering views on key product and policy drivers.

Figure 7.5: Five-year view of key proposal consultation and planning activities



8.0 Connection Capex

Our proposal isolates installation volume risk

This section explains how we propose to manage installation volume risk using the connection capex mechanism.

8.0 Connection Capex

8.1 Installation volumes are uncertain

Although volumes have passed their peak, new installations will remain our largest investment area in our first regulatory period (RP1). This is a high-volume activity area – we forecast more than 170,000 installations with an average cost of about $1,900 each.[1] Installation volumes are the most material uncertainty in our proposal.

It is appropriate that any risk around the cost per installation should rest with us, because we are the party best able to manage this risk. However, installation volume risk should be isolated because it is demand dependent and outside our control. If we don't isolate installation volume risk, then:

- we could recover materially more than our actual costs if volumes turn out to be lower than our forecast. This would flow through to higher prices over time, or
- if volumes turn out to be higher than our forecast, we would need to slow down or turn away installations to ensure we don't face a material funding shortfall.

To avoid these undesirable outcomes, we have designed our proposal to use the connection capex mechanism provided in the IMs.

8.2 Connection capex mechanism

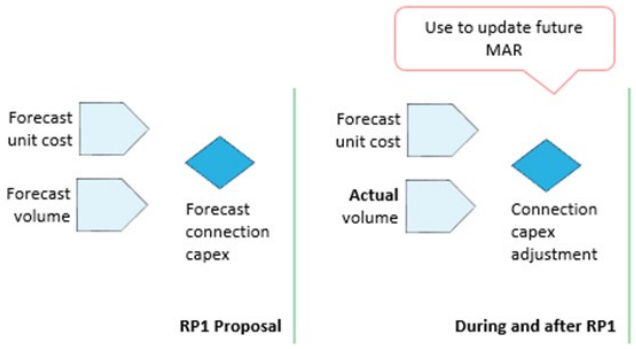
We have developed unit cost and volume estimates to isolate volume risk for installations.

This works by adjusting our funding (up or down) using pre-set unit rates. The rates are applied to differences between forecast and actual volumes to determine a capex adjustment. This can then flow into revenue modelling to update future allowable revenues.

With this mechanism, risks relating to cost per installation rest with us, but we isolate the risk around installation volumes.

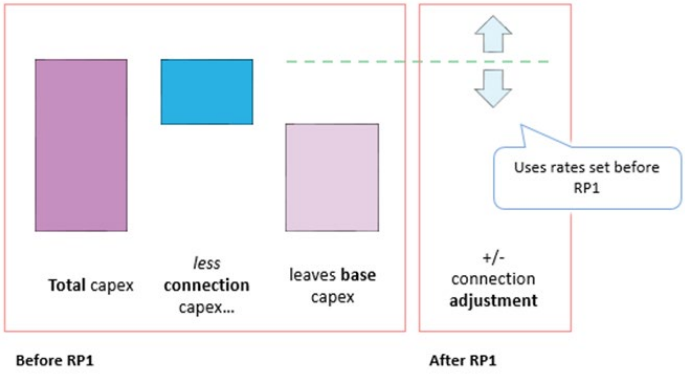
We have approached this mechanism as follows:

Figure 8.1: Connection capex mechanism operation



- **consistency** – we developed our entire proposal using our best estimate of installation volumes. This aligns with our normal business planning approach and means we implicitly assume our business, IT systems, network, service partner arrangements, etc are all sized to suit expected installation volumes and connection levels
- **symmetry** – we think our installation volume forecast is as likely to be too high as too low. This means we minimise the likely size of any capex adjustment, plus it means stakeholders can be confident we have no reason to over- or under-state our unit cost forecasts
- **completeness** – we have built our view of total costs first, and then used installation volume and unit cost estimates to separate total costs into base and connection components. This means there is no risk of double counting between these component parts of our proposal.

Figure 8.2: Total, connetion and base capex definitions



[1] Note that this is an average across all installation costs for all installation types – including costs such as ROW extension, high-cost diverse installs and Hyperfibre access. In other words, this figure is based on proposed connection capex divided by forecast new installations.

8.2.1 We have developed 10 cost groups

Within our business, we use more than 30 activity types to manage installations. For our proposal, we have grouped these into 10 cost groups. This grouping aims to simplify the connection adjustment mechanism by bringing together activities that have similar cost levels.

The 10 cost groups are spread across five broad activity types:

- **extensions** – if an end customer is not in a standalone building fronting a public street, a connection request may trigger work to extend the communal network. This can involve fitting fibre in the shared areas of a Multi Dwelling Unit (MDU) or down a Right of Way (ROW). Requests for non-premises fibre access (e.g. for digital billboards) triggers similar network extension work. We have defined four cost groups for this work
- **installation** – once extension work is completed (if applicable) each installation request triggers additional work to visit site and fit fibre to the premises. We have defined two cost groups for this work
- **ONT and incentive** – we have separated out the cost of Optical Network Terminals (ONTs) and customer incentives so we can recognise the difference between Hyperfibre and non-Hyperfibre installations. We have two costs groups for these costs
- **complex** – installations for sites such as cell towers, hospitals, schools, banks and large offices are different from our standard installations. These are lower-volume, specifically designed projects. We have one cost group for these costs
- **Hyperfibre access** – as Hyperfibre installations grow, we need to provision equipment in our exchanges. Rather than estimating this as a consistent per-unit cost, we have defined a non-linear cost function. This captures the way that unit costs decline at higher volumes (and increase at lower volumes). We have one cost group for this non-linear cost type.

Table 8.1: Installation cost groups

Group	Description	RP1 volume (000s)	Unit cost[2] ($k)
Standard – installation			
1	Simple – installation to greenfield, or to MDU or ROW extension	36.5	0.8
2	General	129.9	1.2
Standard – extension			**[Chorus CI]**
3	Class 1 (two to five MDU drop-off points or ROW buildings) and fibre access	18.6	
4	Class 2 (six to 12 MDU drop-off points or ROW buildings)	1.1	
5	Class 3 (13 to 48 MDU drop-off points or ROW buildings)	0.2	
6	Class 4 (49+ MDU drop-off points or ROW buildings)	0.03	
Standard – ONT and incentive		**[Chorus CI]**	**[Chorus CI]**
7	Hyperfibre		

[2] Unit costs are shown here using constant prices, consistent with other figures in our proposal.

Table 8.1 continues:

Group	Description	RP1 volume (000s)	Unit cost[3] ($k)
8	Non-Hyperfibre		
Complex			**[Chorus CI]**
9	All complex	7.0	
Hyperfibre access		**[Chorus CI]**	**[Chorus CI]**
10	Non-linear Hyperfibre costs		

Table 8.2: Aggregated installation cost groups

Group	Description	RP1 volume (000s)	Unit cost[4] ($k)
Standard – installation			
1	Simple – installation to greenfield, or to MDU or ROW extension	36.5	0.8
2	General	129.9	1.2
Standard – extension			
3-6	Class 1 to Class 4 (from two or more MDU drop-off points or ROW buildings) and fibre access	19.9	5.2
Standard – access equipment (ONTs) and incentives			
7-8, 10	Hyperfibre and non-hyperfibre	166.4	0.2
Complex			
9	All complex	7.0	3.3

Table 8.2 provides an aggregated view of installation cost groups. Following discussions with the Commission, we have aggregated volumes and unit costs across certain groups to enable effective stakeholder consultation given that the detailed volume and unit cost information provided for certain categories is commercially sensitive. Groups 3-6 reflect installations where an extension to the network is required, and groups 7-8, 10 reflect access equipment and incentive costs associated with installation activity. For completeness the aggregated unit costs is calculated as total cost of the group divided by total volume of the group.

[3] Unit costs are shown here using constant prices, consistent with other figures in our proposal.
[4] Unit costs are shown here using constant prices, consistent with other figures in our proposal.

Points to note:

- volumes shown are totals across RP1, and unit costs are an average across RP1
- regulatory template RT04 presents price and volume breakdowns by year
- a single installation request can trigger costs from multiple groups. For example, the first installation request in an apartment building could trigger costs from (say) groups one, five, seven and 10. Subsequent requests in that building would not trigger further group five costs
- group 10 covers non-linear costs. The unit costs shown are an average across RP1 at forecast volumes but would adjust for any changes in volume
- forecast amounts are net of capital contributions (where applicable).

Group two makes up the biggest part of total connection costs, averaging more than $50 million per year. It covers all construction types – aerial, conduit, surface and civil – for UFB1 and UFB2/2+ and excludes only lower-cost simple installations. While costs vary across these construction types, the dispersion is relatively low, so it is appropriate to group these activities together. [5]

For cost group 10, we have defined a non-linear cost function based on declining average unit costs, i.e. the more Hyperfibre installations we make, the lower the average cost per Hyperfibre installation. This is because Hyperfibre cards and optics in our exchanges can accommodate 16 connections per unit. As we provision more Hyperfibre connections, there's a growing likelihood that coverage will already be available.

The relationship between Hyperfibre installation requests and average unit costs for Hyperfibre access is as follows:

$$Average\ unit\ cost = [\quad\quad\quad\quad\quad\quad\quad\quad \textbf{Chorus CI}]$$

In this equation, H = total Hyperfibre installation requests across RP1. Given this relationship, the total cost for the Hyperfibre access cost group is as follows:

$$Total\ cost = [\quad\quad\quad\quad\quad\quad\quad\quad \textbf{Chorus CI}]$$

It's important to note that this relationship:

- holds only for total Hyperfibre installations across RP1. It cannot be applied separately to each year of RP1
- does not hold for total Hyperfibre volumes in excess of [**Chorus CI**] (which would be more than [**Chorus CI**] our central forecast)
- only covers costs of optics (port cards are treated as linear costs).

In addition, connection capex only captures Hyperfibre installed as part of a new installation. It excludes intact Hyperfibre installations (i.e. where we upgrade an existing installation to provision Hypefibre).

We expect most Hyperfibre demand will be intact upgrades, as early adopters of fibre access become early adopters of new products. It would make sense to include intact upgrades as connection capex but the wording of the IM definition of connection capex seems to preclude this at present.

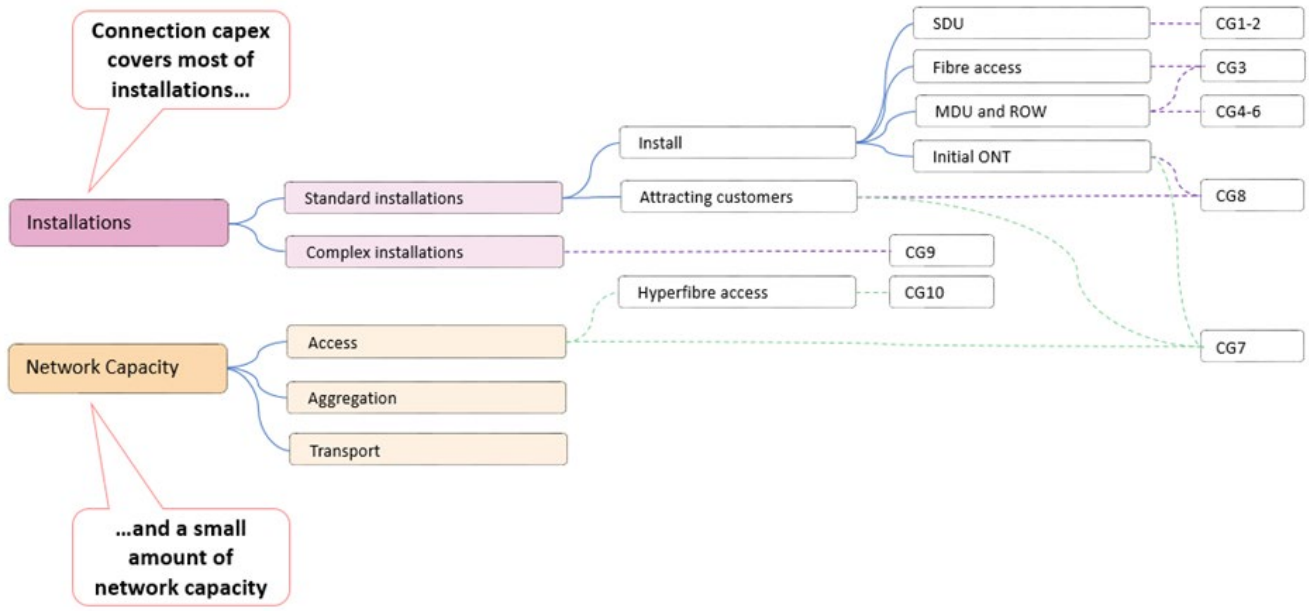
8.2.2 Expenditure categories

Connection capex is defined using the cost groups discussed above, i.e. connection capex is equivalent to unit rate times volume across all cost groups, plus the non-linear cost determined using the cost group 10 formula. Base capex is defined as the remaining costs (i.e. total capex minus connection capex).

In the Investment Summary of Our Fibre Plans, we introduce narrative categories that we use to explain how we have built up our forecasts. The diagram below shows how cost groups, connection capex, and narrative categories relate to each other.

[5] The coefficient of variation is less than 10% across the eight sub-types in cost group two.

Figure 8.3: Mapping between expenditure categories and installation cost groups



The key points are:

- most capex in the installation narrative category is connection capex. Installation also includes some retention capex relating to intact connections that does not map to any cost group and therefore remains in base capex
- a small amount of capex from the network capacity narrative category is connection capex. This is picked up by the non-linear cost group 10 and contributes to cost group seven.

We also note that connection capex does not encompass all costs that would vary in some way if installation activity were materially higher or lower than forecast. Other examples are:

- **network capacity** – new connections add to bandwidth demand, which is a driver for aggregation, transport and access capacity investment
- **network maintenance and operating costs** – installations add to the pool of assets for which we incur inspection, repair and lease costs. Installation activity also adds to aggregate activity levels that support higher in-field utilisation and help achieve lower costs.

The nature of these costs is such that we cannot readily break out the amounts that would vary across a given range of installation volumes.

8.3 Connection capex baseline proposal

This chapter is part of our connection capex baseline proposal as per clause 3.7.14(1) of the IMs. The other components of the proposal are:

- **regulatory template RT04** – connections capex and adjustment. Sets out forecast connection volumes and unit costs by year for each year of RP1 and for each connection cost group
- **regulatory template RT01** – forecast expenditure. Calculates the breakdown of total capex into connection and base capex amounts for each year
- Our Fibre Assets sections:
  - **Installations** – explains how we manage installation activity, including how we forecast installation costs and information on historic investment
  - **Network Capacity** – explains how we manage network capacity, including cards and optics
- Our Fibre Plans sections:
  - **Demand report** – explains how we forecast installation demand
  - **Governance report** – our governance and key management systems
  - **Delivery report** – information on procurement, resourcing and deliverability

9.0 Investment Summary

This section provides a complete walk-through of all the expenditure areas covered in our proposal. It provides a shorter and more targeted overview of our proposal than Our Fibre Assets, which is the place to look if you want to dig deeper into an expenditure area.

9.0 Investment Summary

9.1 Introduction

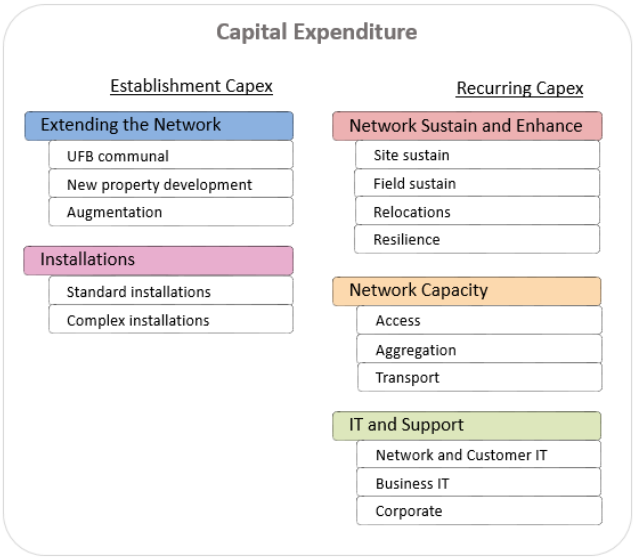
This section introduces narrative categories, and how we've used them to structure this Investment Summary. It explains important conventions that will help you interpret the figures in our proposal.

9.1.1 Narrative categories[1]

We have developed narrative categories described below to breakdown and explain our proposal. These are different from internal reporting and accounting breakdowns, because their aim is to support clear communication to external stakeholders and to provide an enduring basis for future regulatory reporting and performance management. They also differ from previous external reporting and guidance, because they focus on explaining Price-Quality Fibre Fixed Line Access Service (PQ FFLAS) forecasts.

Our discussion of capex follows the structure shown in figure 9.1.

Figure 9.1: Capital expenditure categories



At the highest level, we divide our investment into establishment and recurring capex:

- **establishment capex** extends our network footprint and installs equipment to enable new connections. This is a one-off set of costs to establish fibre access for new end points
- **recurring capex** is ongoing investment in physical network components, network capacity and supporting infrastructure. This investment impacts the long-term price path and quality of our services.

We further breakdown recurring capex into three categories:

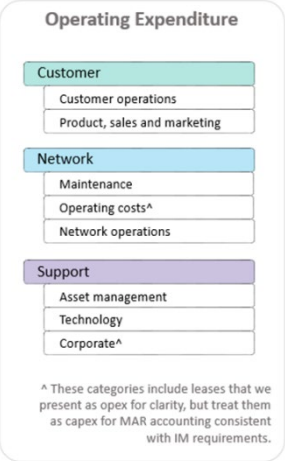
- **Network Sustain and Enhance** – lifecycle work to replace or alter physical network assets in the field and at network sites
- **Network Capacity** – lifecycle work to replace or alter active components and their direct management systems, and investment to expand capacity
- **IT and Support** – lifecycle and enhancement work on information systems and applications, as well as work on corporate accommodation and related assets, and longer horizon product investment.

Our discussion of opex follows the structure shown in figure 9.2, divided across three broad categories:

- **Customer** – internal and external costs of customer-facing operations and product development, sales and marketing
- **Network** – internal and external costs of maintaining and operating our network. Includes maintenance activities, operating costs (such as power) and our network and security operating centres
- **Support** – internal and external costs of managing our assets (i.e. our engineering teams), operating our IT systems (including licencing and support costs) and supporting our business corporate costs (such as governance, finance, legal, etc).

[1] We refer to narrative categories interchangeably with expenditure categories or areas.

Figure 9.2: Operating expenditure categories



We have inter-woven capex and related opex in this report – Customer Opex follows Installations, Network Opex follows Network Sustain and Enhance, and Support Opex follows IT and Support.

We provide an overview of each category in turn – presenting our forecast broken into sub-categories and describing key trends. We then discuss drivers, assumptions, uncertainties and linkages for each sub-category.

9.1.2 Expenditure conventions

Unless stated otherwise, wherever we present costs we use the following conventions:

- **calendar year** – all information is on a calendar year basis. This means figures will not match our financial reporting (which uses a June year-end) but should align with future revenue control and regulatory information disclosure years
- **2020 base year** – all prices are expressed using 2020-dollar values
- **real historical** – historical figures are expressed in real terms, with Consumer Price Index (CPI) adjustments to bring values up to 2020-dollar equivalent values
- **constant price forecasts** – forecast figures do not have CPI or real price effects (see explanation below) added. This allows us to show expenditure trends independent of economy-wide movements in input costs or dollar values
- **real price effects** – forecast figures exclude real price effects. In our regulatory templates we separately forecast movement in the real price of key inputs. We intend for real price effect forecasts to be locked into our revenue setting but expect CPI impacts will be adjusted for actual outturn inflation
- **capex forecasts** – capital expenditure is presented excluding Interest During Construction (IDC)[2]. In our regulatory templates we separately model IDC and the timing shift for converting capex to Value of Commissioned Assets (VCA). We expect VCA will be used for revenue setting
- **historical capex and first half 2020 -** historical capex (from 1 January 2016 to 31 December 2019) and January 2020 to 30 June 2020 is consistent with our annual reports. We have generated calendar year values by adding together relevant financial half-year amounts
- **unallocated historical** – historical capex and opex is presented on an unallocated basis – i.e. including all Chorus expenditure. We have taken this approach because allocation is not yet settled
- **2025 and 2026 forecasts** - our current business planning process only takes our detailed planning to 30 June 2025. To extend the forecast for calendar year 2025 and 2026 we have applied a high-level approach to project the forecast forward, with bottom-up and top-down sense checking to adjust for anticipated step changes
- **fibre access costs** – our proposal is for PQ FFLAS only. All our figures are based on our working interpretation of the scope of PQ FFLAS and of how shared costs should be allocated. In both cases (FFLAS scope and cost allocation) our approach is consistent between this proposal and our current (November 2020) modelling of the opening value of our Regulated Asset Base (RAB)
- **forecast lease costs** – our forecasts (starting in 2021) present lease costs together with opex – i.e. using a cashflow view – to support clear explanations of trends. Lease costs are also included in opex per connection figures. In practice, we capitalise lease costs consistent with NZ IFRS 16. Lease costs will be capitalised for revenue setting purposes, consistent with IM requirements

[2] If underlying capex forecasts include IDC we zero rate IDC in the regulatory template.

- **historical lease costs** – historical figures are presented with the lease accounting treatment in place at the time. We adopted NZ IFRS 16 accounting standard in July 2017, from which time lease costs are shown as capex. For earlier periods, operating leases are shown as opex and finance leases are shown as capex consistent with NZ IAS 17
- **narrative categories** – we present forecast and historical expenditure using narrative categories. For historical opex we have mapped expenditure from recorded categories to narrative categories at a cost-centre level.

9.2 Overview

This section provides a summary of notable trends and drivers, and links to company and asset management strategy. It also identifies key linkages and trade-offs, describes how consultation informs our proposal and explains our approach to efficiency.

9.2.1 Trends, drivers and strategy

As we move through Regulatory Period 1 (RP1) we will:

Complete committed Ultra-Fast Broadband (UFB) network extension and continue a lower level of network extension – mainly through infill and new property development. The driver for this work is to pursue low cost (or government or community supported) network extension opportunities so we can bring fibre access to more New Zealanders.

Continue to promote installations, including through our active wholesaler strategy, customer incentive and managed migrations programmes, and ongoing investment in product development. The drivers for this are to grow fibre access revenue, spread fixed costs and reduce risk. Each installation is directly demand driven.

Sustain quality as we transition from network build to network operate. This requires:

- continued investment in Network Capacity to stay ahead of bandwidth demand and deliver uncongested performance
- ongoing investment in IT systems to support customer and network operations that deliver ordering, provisioning, switching and fault response
- Resilience investment to maintain standards and sustain availability as connections grow
- Site and Field Sustain investment to control fault rates by managing network risk as assets age
- careful management of the field workforce transition that will accompany a declining in-field workload so that we can sustain fault response and provisioning quality.

Invest in longer horizon technology and product development through our Chorus X programme to ensure we are building the future product pipeline that will enable us to ensure fibre access keeps pace with future demands, makes the most of new technologies and adapts to changing market dynamics.

Implement asset management improvements to lift our asset information and strategy and planning capability, while adapting our lifecycle delivery, risk and review and organisation and people capability. This will support achievement of our asset management policy objectives, which align with our company strategy.

Adapt our corporate operations and business IT systems to operate successfully under new regulatory arrangements (including extensive new compliance requirements) while carefully managing the associated costs.

Continue to take a cautious approach to non-essential expenditure, including discretionary opex and capex. We may develop more proactive network sustain and enhance programmes in future aimed at managing lifecycle costs and network risk. This would build on asset management capability improvements and be facilitated by connection-driven revenue growth.

We are developing a potential network resilience programme as an individual capex proposal. This proposal would include a programme of improvements for single site resolution times. There could also be other programmes we consider for an individual capex proposal, for example accelerating route diversity work and investing in targeted exchange enhancements.

Fibre access use of shared opex and recurring capex will also increase across RP1, albeit more slowly than the rate of increase in prior years.

Key outcomes of our RP1 efforts and the impact of shared cost usage changes include:

- reductions in both opex and recurring capex per connection. We forecast opex will reduce from $207 per connection in 2022 to $190 in 2024, and recurring capex will reduce from $162 to $147 per connection
- a platform for sustaining long-term delivery of fibre access services that are attractively priced for the

value they offer, and well supported by Retail Service Providers (RSPs)

- a significant rebalancing from establishment to recurring capex, and from connection to base capex – installations will fall from 48% of total capex in 2020 to 40% in 2024, while establishment capex will fall from 79% to 44% over the same timeframe[3]
- a significant rebalancing from capex to opex, as establishment capex falls from around two-thirds of totex in 2020 to around one-quarter in 2024.

9.2.2 Linkages, synergies and trade-offs

There are many linkages, synergies and trade-offs between parts of our proposal, with key items including:

- Extending the Network and Installations (which falls within Connection Capex) creates new network assets to sustain and maintain and drives ongoing investment in Resilience and Network Capacity (which fall in base capex and opex)
- over time, there is a linkage between Hyperfibre installations (connection cost groups CG7 and CG10) and investment in network capacity (base capex) to sustain congestion-free performance
- investment in physical network assets and Network Capacity drives network operating costs, including power and leases. Site Sustain investment can also help to manage Maintenance and Operating Costs
- there are linkages, and sometimes trade-offs, between capital investment in IT systems and technology operating costs such as application licences, support and subscriptions
- Customer and Asset Management opex enable us to deliver services to a quality that supports installations, and Asset Management enables us to optimise and deliver maintenance activities and all capex
- there are synergies between Network Extension, Installations and Maintenance as they rely on similar field resources. The combined activity level across these areas helps us sustain good utilisation, which supports efficient costs.

9.2.3 Consultation

Our proposal is built on extensive and ongoing consultation with access seekers (RSPs) and consumer research that informs our product development efforts. This in turn builds on engagement with government through the UFB programme that has shaped network footprint, architecture and key performance measures.

We also carried out proposal-specific consultation that was effective at validating three key parts of our planning:

- holding quality steady through RP1 – there are signs that a lift in resilience may be warranted but it would be premature to include this in our proposal now. We will consider developing an individual capex proposal for accelerated or enhanced Resilience
- proposing a tight RP1 programme that omits discretionary items such as proactive network extension initiatives
- planning for further consultation focussed on how we should engage stakeholders in the development of our RP2 proposal.

We also picked up on the suggestion made in submissions that it would be useful to present cost information on a per-connection basis.

Overall, stakeholders found it difficult to engage at this formative stage of the new regulatory arrangements. The arrangements are unfamiliar to most stakeholders and were not settled at the time we were consulting, which also meant we could not share expenditure or revenue forecast information. The proposal consultation was effective given this context, and our proposal rests on extensive underlying business-as-usual consultation and engagement activities.

9.2.4 Efficiency

Our proposal uses current costs as a starting point, picking up our current level of efficiency. This has been shaped by our context, which includes:

- revenue shocks when copper services were re-priced early in our life as a standalone entity, which drove significant cost tightening and had an enduring impact on our culture and operations[4]
- tight finances as we execute a major capital programme and transition revenue from copper to fibre. This leaves little room for discretionary activity

[3] Establishment capex includes Installations and Extending the Network capex.
[4] The Commerce Commission announced price cuts for copper services in December 2012 and this flowed through to credit rating downgrade the following year.

as we manage to credit rating agency metrics and investor expectations

- successful performance against a UFB contract structured to incentivise cost effective delivery to contractual time and quality targets
- a strategic drive to ensure fibre access competes with rival technologies on price and quality so that we can grow and sustain revenue
- a flexible and innovative approach to reconfiguring field contracting arrangements to help us deliver on our UFB obligations and strategic objectives
- market discipline as a dual-listed[5] company with close investor scrutiny that consistently pushes for efficiency.

These factors mean we start from an efficient base, achieved through tight cost control, careful procurement, and continual attention to process improvement and optimisation. This efficient cost base is the starting point for our opex forecast, and cost-based capex forecasts.

Key efficiency challenges as we move into RP1 and beyond are:

- restructuring field services again to suit changing work volumes and mix while holding on to the benefits of scale as far as possible. We have assumed we can limit job cost increases through this transition, which benefits network extension, Installation, Sustain and Enhance and Maintenance
- containing costs as we renegotiate Technology and Network Operations contracts. We have assumed we can hold costs steady through these changes
- holding our opex costs in check as our capital programme scales down, capitalisation rates reduce, and we work on enhancing Asset Management capability and adapting to new regulatory arrangements (including new reporting and compliance requirements). We have assumed our customer experience and optimisation IT investment will contribute to this goal, alongside ongoing non-capital process optimisation efforts
- starting (or scaling up) new lifecycle activities as our relatively new fibre access assets age. Examples include Optical Network Terminal (ONT) replacements and manhole inspection programmes
- navigating vendor technology roadmaps and pricing cycles to optimise network capacity cost-per-bit as network demand continues to grow.

9.2.5 Risks and uncertainties

Our proposal uses forecasts developed in the first half of 2020 and (mostly) confirmed mid-2020. They extend to the end of 2024, so our forecast horizon is nearly five years. There is always considerable uncertainty over such a long horizon. For our proposal, notable risks and uncertainties include:

- volume of Installation activity and cost of Complex Installations
- volume of New Property Development work
- impact of field services restructuring on the cost of in-field tasks across Maintenance, Network Sustain and Enhance, and Installations
- impact of field services restructuring on responsiveness for fault and provisioning work
- pricing outcomes for other major contract re-pricing events, including in Technology opex and Network Operations
- economy-wide changes in input costs, including labour and equipment costs that may be impacted by global events. These flow through to all expenditure
- the potential for unanticipated lifecycle or compliance costs in areas such as Network Sustain and IT capex, and Corporate opex.

[5] Chorus is listed on the New Zealand and Australian stock exchanges (NZX and ASX)

9.3 Extending the Network

9.3.1 Overview

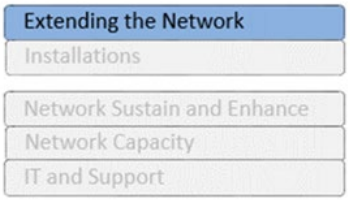
Extending the Network is the first of two establishment capex categories. It covers work to extend communal infrastructure to new streets or developments, and to infill the network to accommodate address growth.

Communal extension involves building out infrastructure so that we are ready to start accepting installation and connection requests. Communal extension involves providing fibre, splitters and access terminals in the street and capacity in our network buildings. Our UFB communal work has involved extending the network into existing communities, while our new property development work involves ongoing lower cost "greenfield" communal work.

Extending the Network makes up 14% of proposed establishment capex, and 7% of total proposed capex for RP1.

Figure 9.3: Extending the Network expenditure as a proportion of total first regulatory period (RP1) capex

Figure 9.4: Expenditure category



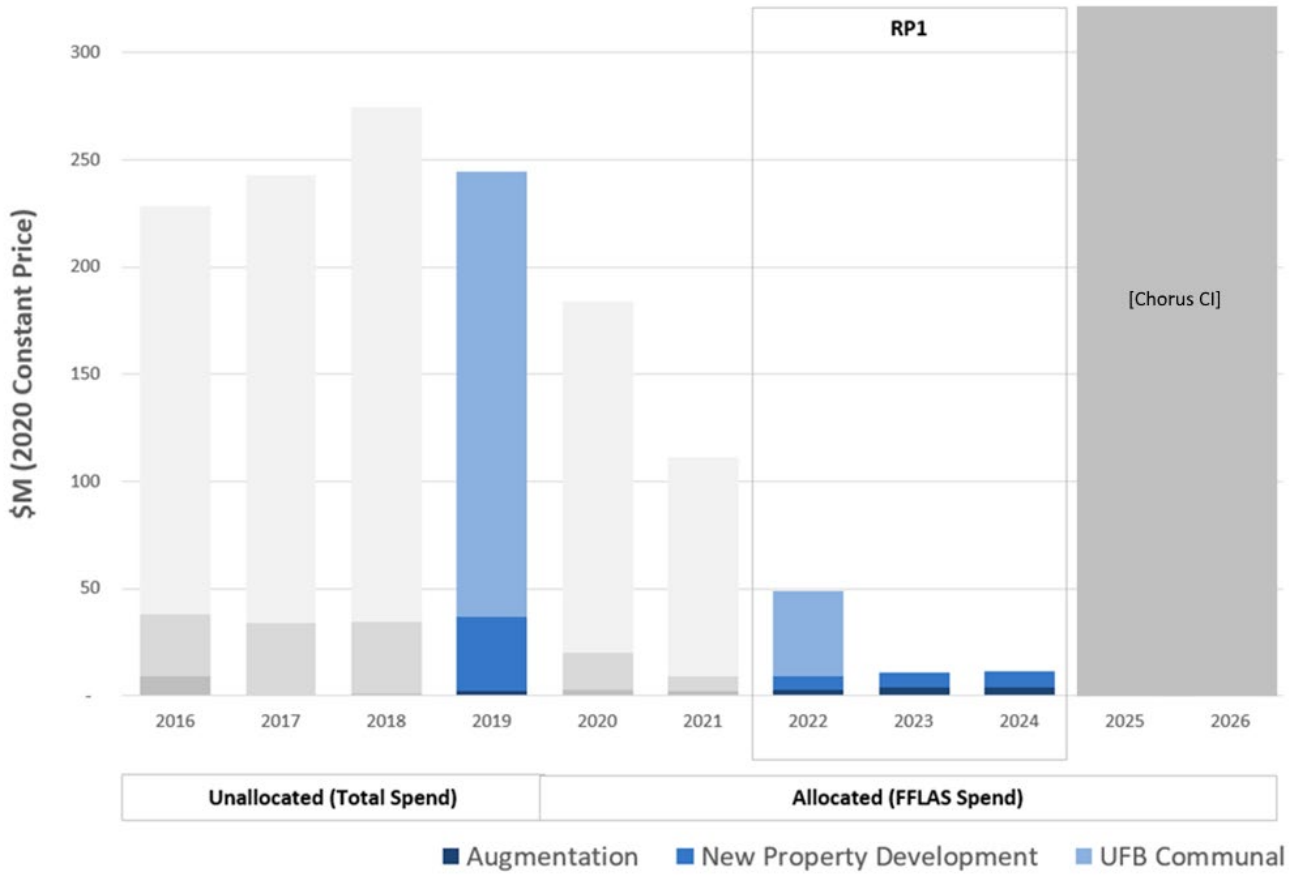
We forecast this capex across three areas:

- **UFB Communal** – work with government on UFB initiatives to provide fibre access across most of New Zealand
- **New Property Development** – work with developers to extend communal infrastructure into new developments
- **Augmentation** – all other investment to extend or infill communal infrastructure.

This breakdown is shown in figure 9.5.

Figure 9.5: Expenditure category and sub-categories

Figure 9.6: RP1 expenditure for Extending the Network showing unallocated historical spending



Our forecast for Extending the Network is shown in figure 9.6, broken into sub-categories.

Our work with government on the UFB initiative dominated expenditure as we extended fibre across New Zealand. We will complete committed UFB work early in RP1 and capex will settle to a new, much lower, level. Residual activity will be dominated by new property development, with some investment in augmentation projects such as our non-UFB contract with government to extend our network through Haast.

9.3.2 UFB Communal

UFB Communal covers our contracted commitments with the government under the ultrafast broadband programme. We are nearing the end of this programme, with completion scheduled within the first year of RP1.

We have not included any provision for further UFB work. If this were to arise, we would consider applying for additional capex (if needed) through the individual capex mechanism.

The UFB programme is structured to incentivise timely, efficient delivery to appropriate quality standards. We have driven Cost Per Premise Passed (CPPP) down over the course of the UFB programme as we have refined our processes and methodologies and sought continuous efficiency improvement. This has included refining our arrangements for outsourced build services.

This spend is for the remaining UFB build to a further 27,000 premises. Our forecast for UFB Communal is based on build schedules and agreed prices with our Field Service Providers (FSPs). There is a high level of certainty as costs are driven by existing contractual obligations.

The only forecasting risk relates to change requests raised from our FSPs for unplanned costs not reflected in designs.

Linkages, synergies and trade-offs

UFB Communal work links to other expenditure areas:

- Installations and Customer Opex flow as new premises are ready to connect. UFB communal links to all Installation cost groups
- Network Capacity investment is needed as new connections contribute to bandwidth demand growth, and network extension alters the geographic distribution of demand growth. Communal build also establishes new Access and Aggregation electronics that need ongoing lifecycle investment regardless of bandwidth growth
- New Property Development occurs as developments near UFB towns gain the opportunity for greenfield fibre build that can be more cost-effectively tied back to an existing network
- Augmentation investment in infill is needed as address growth exhausts the initial capacity of the network
- Network Sustain and Enhance, and Network Opex flow as newly built assets add to the populations of physical network assets for us to manage and operate.

UFB Communal links to quality dimensions:

- communal build activity impacts established neighbourhoods and can be perceived negatively (as disruptive) or positively (as bringing improved connectivity) which can influence customer service satisfaction scores
- provisioning is more complex for Installations in UFB areas than for New Property Developments
- network build sets up the network architecture and build quality that will influence faults and availability over time.

9.3.3 New Property Development

New Property Development covers work with developers to build communal fibre into new developments, such as residential subdivisions or office parks. Developers place ducts that we supply, while we carry out (via our FSPs) jointing and other technical work. We also build a feeder segment to tie the extension back to our network.

Our forecast is based on:

- **lots** – we forecast how many lots (i.e. future premises) of various types we will be contracted to extend the network past. Our forecast reflects both underlying developer activity, and our success at winning this work
- **cost** – we use an average cost per lot for each lot type to derive a gross cost. [

Chorus CI]

- **capital contribution** – we forecast net costs by deducting forecast capital contributions from the gross forecast.

The key uncertainties for this work are demand, feeder segment cost and the impact of new service provider arrangements on the cost per lot.

Linkages, synergies and trade-offs

New property development work links to other expenditure areas:

- Installations and Customer Opex flow as lots are built out and new premises are ready to connect. New Property Development links to connection Cost Group (CG) 1, 7, 8, and 10
- Network Capacity investment is needed as new connections contribute to bandwidth demand growth, and network extension alters the geographic distribution of demand growth
- Network Sustain and Enhance, and Network Opex flow as newly built assets add to the populations of physical network assets for us to manage and operate.

New Property Development links to quality dimensions:

- provisioning is typically more straightforward for Installations in New Property Developments, which can impact customer service satisfaction scores. Fibre is also a selling point for new developments, which can also influence customer service satisfaction
- Network Extension sets up the network architecture and build quality that will influence faults and availability over time.

9.3.4 Augmentation

Augmentation covers two types of work:

- **infill** – new address creation within the existing footprint of the network drives investment over time to cover more installations. Infill activity adds fibre and electronics
- **extension** – work to extend coverage to communities outside the UFB contracts.

Infill is our main augmentation activity, and we are forecasting limited extension work.

Infill work is demand-driven and typically triggered by installation requests that are unable to be fulfilled with existing built coverage. Infill demand is uncertain, because it depends on address creation and fibre uptake.

Extension work can arise when communities or individuals agree to part-fund additional coverage outside government programmes, through non-UFB government programmes (such as the provincial growth fund) or as an economic investment. We anticipate we would apply for individual capex approval if any material (>$5m) investment of this type were to materialise during RP1.

Linkages, synergies and trade-offs

Augmentation work links to other expenditure areas:

- Installations and Customer Opex. Infill work is driven by installations, while extension creates more Installation demand. Augmentation can link to any cost group
- Network Capacity investment is needed as new connections contribute to bandwidth demand growth, and extension alters the geographic distribution of demand growth
- Network Sustain and Enhance, and Network Opex flow as newly built assets add to the populations of physical network assets for us to manage and operate.

Augmentation links to quality dimensions:

- Installations that trigger infill work have longer provisioning timeframes, which can impact customer service satisfaction
- Network Extension sets up the network architecture and build quality that will influence faults and availability over time.

9.4 Installations

9.4.1 Overview

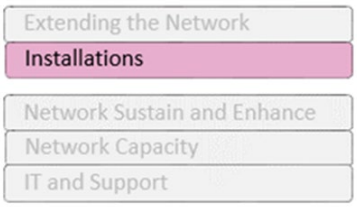
Installations is the second of two establishment capex categories. It covers work to establish a physical link between the communal network and an ONT at an end point. It includes associated provisioning and incentive costs.

Installations are demand driven, with most activity being high-volume, low-cost installations completed within a short time of receiving a customer order. At the other end of the scale, we service a smaller number of complex installations for large customers who require enhanced resilience.

Installations makes up 86% of proposed establishment capex, and 44% of total proposed capex for RP1.

Figure 9.7: Installations expenditure as a proportion of total first regulatory period (RP1) capex

Figure 9.8: Expenditure category



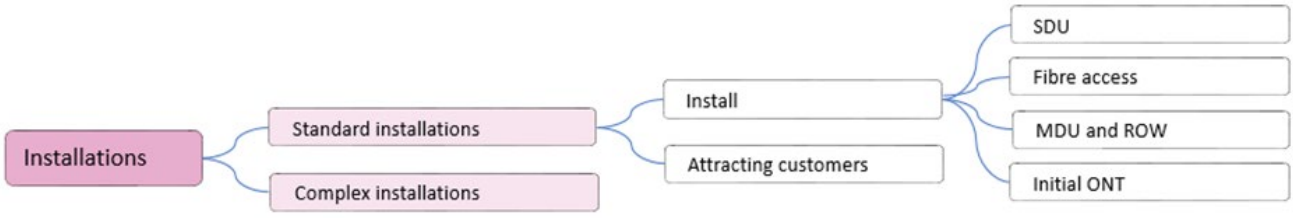
We forecast Installations across two categories:

- **Standard Installations** – high-volume installations. Also includes Right-of-Way (RoW) and Multi-Dwelling Unit (MDU) extensions and customer incentive programmes
- **Complex Installations** – lower-volume specifically-designed connections for sites such as cell towers, hospitals, schools, banks and large offices.[6]

This breakdown is shown in figure 9.9.

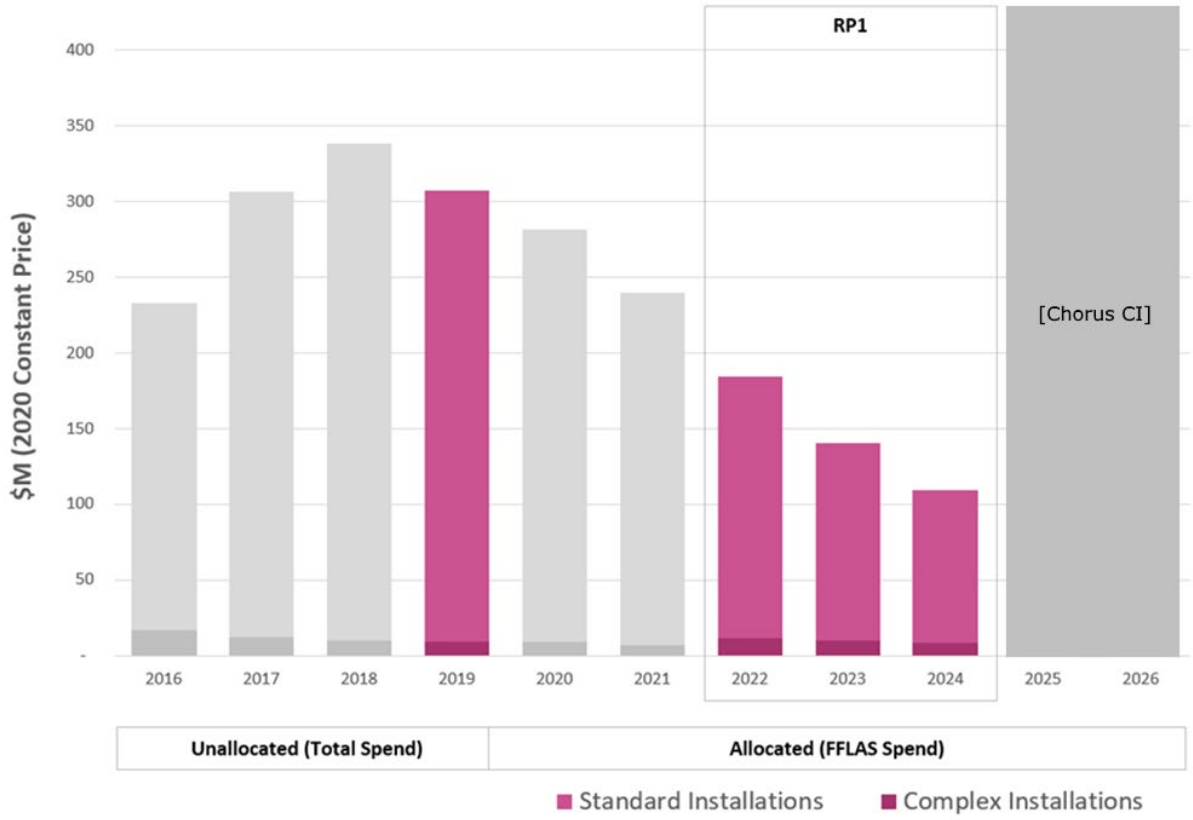
We map connection activities to 10 cost groups (CG1 to CG10). The cost groups are designed to work with a regulatory adjustment mechanism that isolates installation volume risk (while ensuring we retain exposure to cost per installation).

Figure 9.9: Expenditure category and sub-categories



[66] Note that these regulatory categories are *not* the same as the definitions of simple and complex used on our RSP service level agreements.

Figure 9.10: RP1 expenditure for Installations showing unallocated historical spending



Our forecast for Installations is shown in figure 9.10, broken into sub-categories.

We expect installation activity will continue to decline, starting RP1 at just over half the historical peak and ending RP1 below one-third. This reflects the more established parts of our network reaching saturation, and the whole network moving past its most rapid uptake phase. We tentatively forecast a small uptick beyond RP1 as Hyperfibre installations increase.

9.4.2 Standard Installations

The Standard Installations forecast covers most install work, and associated investment in incentives. Install work includes:

- **initial ONT** – supply and installation of an ONT within consumer premises
- **fibre lead-in** – supply and installation of equipment to connect the ONT back to the communal network
- **provisioning** – an allocation of related system and people costs.

The cost of the fibre lead-in varies depending on the construction type. New developments have the lowest cost, whereas UFB installations present a range of aerial, underground and surface-mounted construction types.

Most installations are prompted by an RSP request, but we also have a managed migration programme that aims to generate further installations. In RP1 we will also gradually begin withdrawing copper services, which may prompt further installation activity.

Some installations prompt additional work:

- **extension** – work to Extend the Network into a RoW or MDU, or to support a non-premise consumer (such as a digital billboard). Once extension work is completed, individual connections are relatively low cost

- **infill** – this work is captured in Extending the Network as it involves providing additional network coverage
- **Hyperfibre access** – providing a suitable ONT and exchange equipment. This can involve replacing an existing ONT for intact connections. Exchange equipment can serve multiple connections, so this cost has a non-linear relationship with Hyperfibre volumes.

We also provide incentives to RSPs to encourage fibre installations and upgrades. This helps overcome consumer inertia and support uptake, which in turn helps drive lower opex and recurring capex per connection.

We have well-established processes for installation work and have continually refined and improved our delivery of this work since completing our first UFB network area.

The key uncertainties for this work are the volume and type of installations. We have addressed these uncertainties by proposing the use of the connection capex mechanism. This adjusts funding based on installation volumes using pre-determined unit costs.

Other significant uncertainties include equipment costs and field labour costs. The latter includes uncertainty regarding the outcome of reconfiguring service provider arrangements to suit declining in-field work volumes.

Linkages, synergies and trade-offs

Standard Installations work links to other expenditure areas:

- Extending the Network stimulates installation work by increasing coverage, and some installation requests prompt infill work
- Customer Opex includes Product, Sales and Marketing activities that drive Installations, and Customer Operations work that supports installation activity. Customer Opex is net of costs capitalised as part of installation provisioning
- Network Capacity investment responds as new installations contribute to bandwidth demand growth. New installations also add to the population of ONTs that will require replacement as they age
- Network and Customer IT and related Technology opex funds systems to support efficient installation activity. Technology opex is net of costs capitalised as part of installation provisioning
- Network Sustain and Enhance, and Network Opex responds as newly built assets add to the populations of physical network assets for us to manage and operate.

Standard Installations links to quality dimensions:

- installation delivery is a key driver of provisioning performance and customer service satisfaction
- installation volumes can impact availability and faults.

9.4.3 Complex Installations

The Complex Installations forecast covers design and build of installations for specific business requirements. Complex Installations are common for cell sites, hospitals, schools, banks and large office complexes that need a dedicated resilient connection.

Complex Installations can involve any combination of diverse fibre routes, multiple premises entry points or multiple exchanges. The gross cost of complex installations varies widely, but the volumes are much lower than standard installations. Our forecast is net of capital contributions.

Linkages, synergies and trade-offs

Complex Installations work links to other expenditure areas in the same way as standard installations, except provisioning costs are a lower proportion of installation costs and provisioning is less automated.

9.5. Customer Opex

9.5.1 Overview

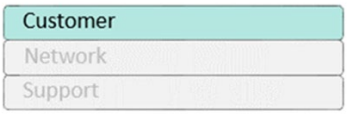
Customer Opex is the first of three opex categories. It covers expenditure on products, sales and marketing and the cost of customer operations.

Customer Opex includes our customer-facing people in operational roles, and in roles focussed on promoting fibre access, evolving our product suite and managing our commercial relationships with RSPs. It also includes associated external costs, including marketing spend.

Customer Opex makes up 15% of proposed opex (including leases) for RP1.

Figure 9.11: Customer Opex as a proportion of total first regulatory period (RP1) opex.

Figure 9.12: Expenditure category



We forecast Customer Opex across two areas:

- **Customer Operations** – demand-driven work managing ordering, provisioning and switching activities, and project work for complex installations and programmes such as managed migrations
- **Product, Sales and Marketing** – work to promote fibre access, and to manage our product suite and our commercial relationships with our customers.

This breakdown is shown in figure 9.13.

Figure 9.13: Expenditure category and sub-categories

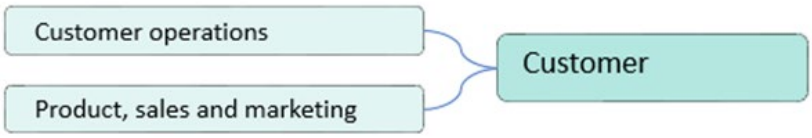
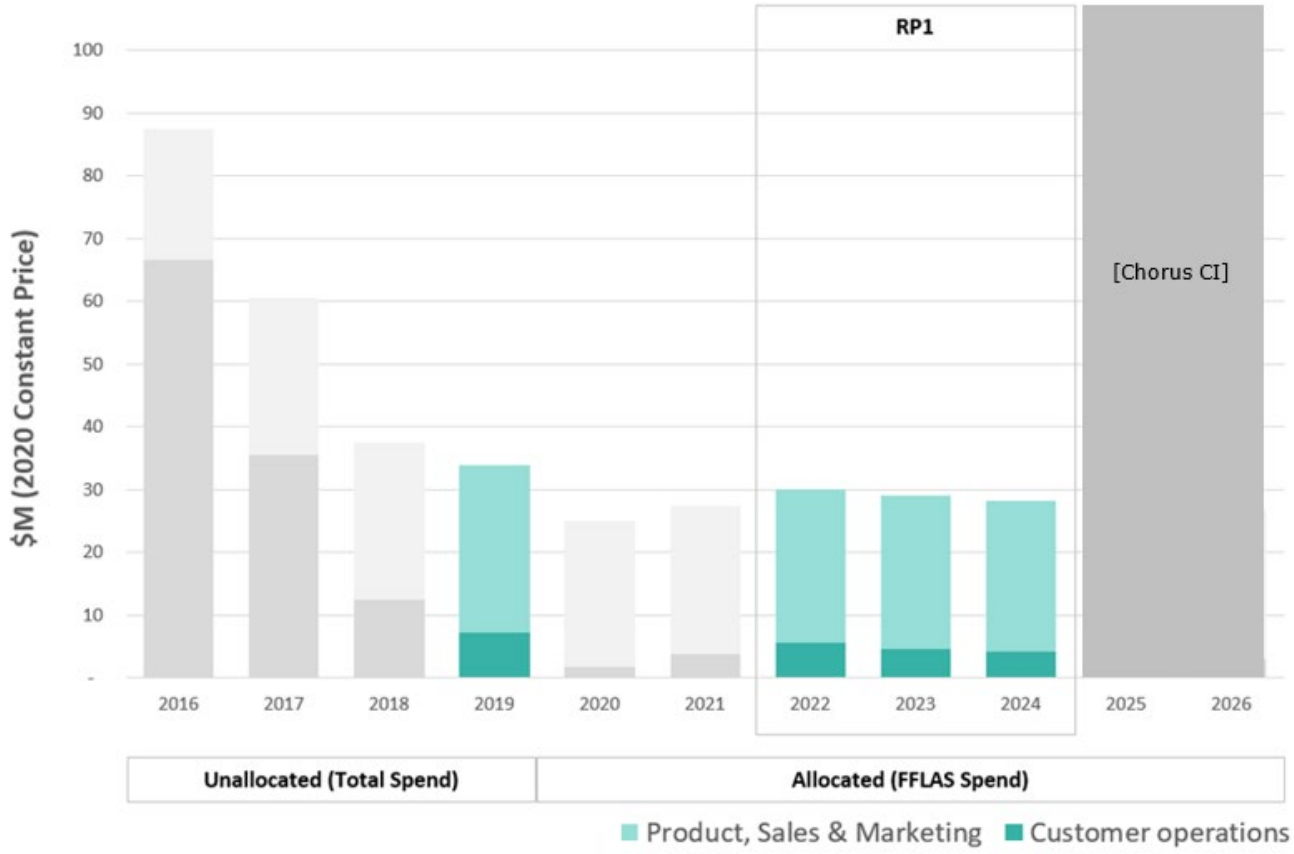


Figure 9.14: RP1 expenditure for Customer Opex showing unallocated historical spending



Our forecast for Customer Opex is shown in figure 9.14, broken into sub-categories.

Key trends are:

- **Customer Operations** costs have fluctuated historically, due to factors such as activity levels and changes in capitalisation approach. Through RP1 we forecast a gradual decline from current levels
- **Product, Sales and Marketing** costs have grown over time as we've worked to promote fibre access, including through marketing campaigns, and enhance our product suite. We forecast no material change across RP1.

9.5.2 Customer Operations

Customer Operations expenditure includes a mix of higher-volume demand-driven activity (such as our call centre), lower-volume demand driven activity (such as coordinating Complex Installations and multi-unit extensions) and project work (such as managed migrations programme field work).

As we move through RP1:

- activity linked to high-volume Standard Installations will decline as the rate of Installations falls. This will enable us to scale down some resources
- this trend is offset by an increase in the complexity of Customer Operations, including as we target late-movers and begin to manage copper withdrawal. We will also continue with managed migrations work, which involves approaching consumers directly to promote fibre installation
- a declining portion of Customer Operations activity will be capitalised to Installations. This is a further offset to volume-linked opex reductions
- we are also managing a growing volume of intact customers, such as consumers moving address or switching RSP or product.

Linkages, synergies and trade-offs

Customer Operations work links to other expenditure areas:

- Extending the Network drives Customer Operations work, including coordinating infill projects, New Property Development and multi-site extensions. Some of this work is capitalised
- Installations drive Customer Operations work, much of which is capitalised
- there is a trade-off between IT capex and customer operations, as IT systems can be used to automate or streamline Customer Operations processes.

Customer Operations links to quality dimensions:

- Customer Operations play a key role in ordering, provisioning and switching, which in turn impact customer service satisfaction
- Customer Operations have a customer-facing role in managing response to faults and any performance issues.

9.5.3 Product, sales and marketing

Product, Sales and Marketing (PSM) expenditure is directed at attracting and retaining consumers and managing RSP relationships. As we move through RP1, we plan to sustain our:

- active wholesaler activities that promote the benefits of fibre access, including marketing campaigns, branding and advertising
- work on actively managing and evolving our product suite, including through customer engagement and consumer research activity, and our Chorus X programme. We also need to ensure we maintain compliance with new and evolving regulatory requirements
- commercial management of our RSP customers that supports non-discriminatory network access and vibrant retail competition.

Linkages, synergies and trade-offs

PSM work links to other expenditure areas:

- PSM activity drives Installation, New Property Development and Augmentation volumes
- PSM shapes much of the work programme delivered through Network and Customer IT investment and influences capability requirements delivered through Network Capacity investment.

PSM links to quality dimensions:

- PSM play a key role in customer service satisfaction
- PSM activity helps drive our understanding of consumer and customer preferences across all quality dimensions.

9.6 Network Sustain and Enhance

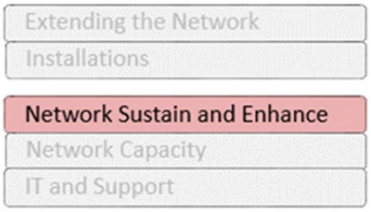
9.6.1 Overview

Network Sustain and Enhance is one of three recurring capex categories and covers investment in our physical network assets. Having established our network in an area, we reinvest in the physical assets as needed to cost-effectively sustain or enhance their performance, manage risk or satisfy compliance requirements.

Network Sustain and Enhance makes up 33% of proposed recurring capex, and 16% of total proposed capex for RP1.

Figure 9.15: Network Sustain and Enhance expenditure as a proportion of total first regulatory period (RP1) capex

Figure 9.16: Expenditure category



We forecast Network Sustain and Enhance capex across four areas:

- **Site Sustain** – investment to replace, enhance or extend the life of our network buildings and engineering services (power, cooling and building management)
- **Field Sustain** – investment to replace, enhance or extend the life of our in-field assets, such as poles, fibre and manholes
- **Relocations** – investment to relocate network assets to accommodate roadworks, electricity network undergrounding or third-party relocation requests
- **Resilience** – investment to enhance the resilience of our network, including a programme to increase fibre route diversity as the network grows.

This breakdown is shown in figure 9.17.

Figure 9.17: Expenditure category and sub-categories

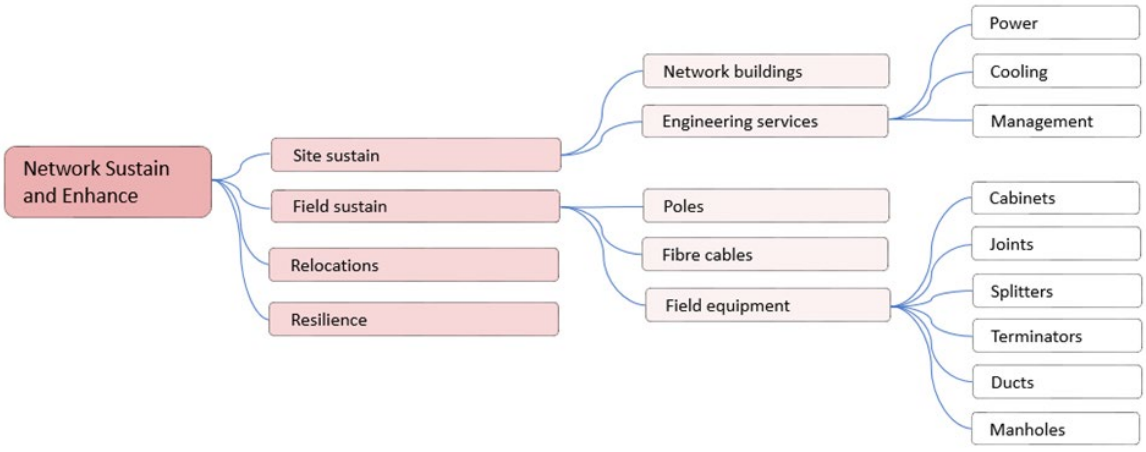
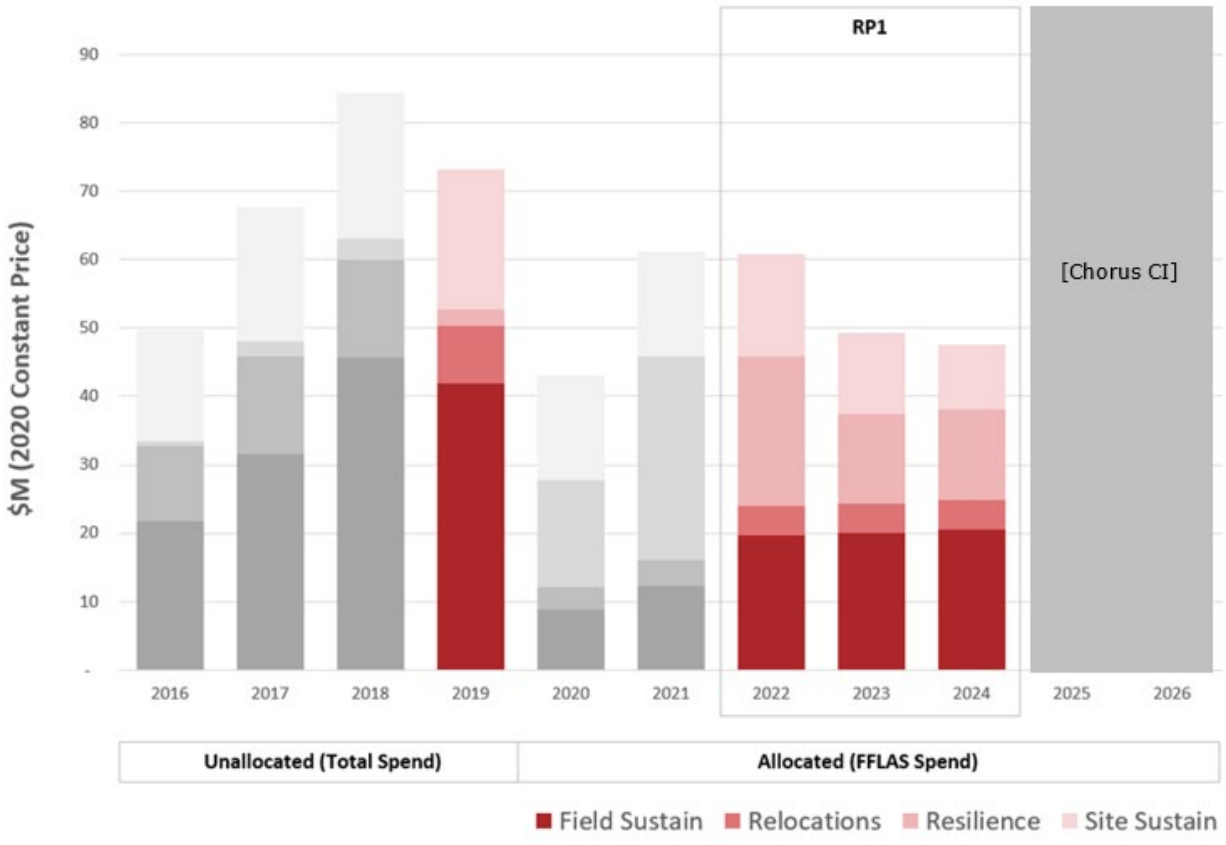


Figure 9.18: RP1 expenditure for Network Sustain and Enhance showing unallocated historical spending



Our forecast for Network Sustain and Enhance is shown in figure 9.18, broken into sub-categories.

Key trends are:

- Field Sustain is increasing steadily as the fibre network grows and ages
- we held Site Sustain low through the network build and are increasing investment from 2020 to address compliance risks and execute programmes to manage longer-term costs
- buildings and engineering services are shared assets, so Site Sustain expenditure also grows due to growing use of shared costs
- we have a Resilience programme that aims to sustain quality outcomes as connection numbers grow.

Together, these trends produce a step up in investment as we approach RP1.

9.6.2 Site Sustain

Site Sustain covers ongoing investment in our network buildings and their power, cooling and management services.

Assets

We manage over 2,500 network sites that house the electronic equipment needed to run our copper and fibre networks. Our oldest buildings are more than 100 years old, the youngest are around 25 years old and the average age is over 50 years.

Our buildings can house one or more of the following four functions:

- **handover –** where we handover data to retail service providers. Up to 100,000 consumers can be dependent on a single handover building. We have 40 buildings with handover functions
- **core** – where we aggregate data from several mesh sites. These can serve up to 250,000 consumers but

are always paired with another core site to provide resilience. We have 12 buildings with core functions

- **mesh** – where we aggregate data from several access sites. A mesh site can serve up to 50,000 customers. We have 45 buildings with mesh functions
- **access** – access sites host equipment used to connect consumers to the network.

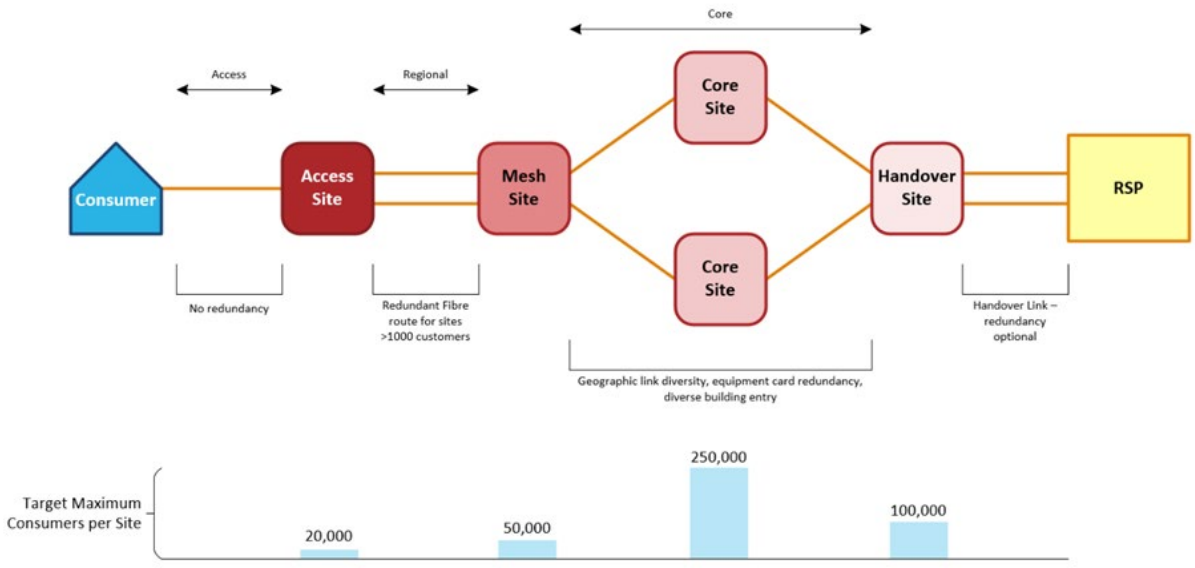
This site architecture is illustrated in figure 9.19.

We manage buildings for integrity, lifetime cost, safety and compliance with regulatory requirements.

Each building has engineering services suited to the network equipment inside:

- **power** – can include AC and DC power systems, and backup systems such as diesel generators and fuel tanks. Power systems are sized to support network electronics and engineering services and have redundancy as needed to meet our resilience standards
- **cooling** – equipment to maintain the indoor environment within an acceptable temperature range for the electronics (and people) inside the building
- **management** – building management systems that monitor and control engineering services (in some buildings), and systems such as fire, security and gas detection.

Figure 9.19: Fibre to the Home architecture showing redundancy levels for network elements



Management and plans

For our buildings, we have a proactive approach to safety and compliance requirements and a preventative and reactive approach to maintenance. We carry out routine Condition Assessment Reports (CARS) to identify defects and rate building condition, with inspection intervals ranging from one year at our most important sites to five or more years for our smallest sites.

In the context of our RP1 focus on uptake and transition – from build to operate, and from copper to fibre – our plans generally minimise near-term investment (while preserving integrity and meeting safety and compliance obligations). Of note, we:

- have been investing to enable reduced dependence on key Spark-owned buildings. This will reduce lease costs and improve access. We aim to complete this programme in 2023
- plan to review our buildings as copper assets are removed in future. Fibre assets need less space and have lower power and cooling needs. During our RP1 we will assess our sites and develop plans for

life extension, replacement or retirement with a view to best managing overall cost.

During RP1 we also plan to enhance our Asset Management, including:

- continue to prepare site development plans
- improving asset knowledge by identifying and capturing missing information and developing centralised property information storage.

For engineering services, demand is transitioning through a peak as we support sizeable fibre and copper networks. Fibre networks have lower power demands than copper and tolerate a wider range of operating temperatures. We manage engineering services by:

- adding assets when needed due to network growth
- replacing assets as needed to manage performance (e.g. battery capacity) or reliability, address safety or obsolescence or optimise costs (i.e. where reduced running costs justify replacement)
- retiring assets where possible due to reduced cooling or power demand (e.g. as copper connections decline).

We are planning to prepare site development and site evolution plans for 60 Chorus sites and 32 Spark sites. These will support enhanced asset management plans for these key sites.

Linkages, synergies and trade-offs

Site Sustain work links to other expenditure areas:

- Extending the Network increases the population of assets to sustain longer term and shifts the balance between fibre and copper. Construction can displace Site Sustain work in the near term (as some assets are replaced or refurbished to enable extension)
- Installations shift the balance between copper and fibre. Fibre is more space and power efficient, and more temperature tolerant. Initially, fibre installations increase demand, but high uptake enables copper removal and a reduction in engineering services needs
- Network Capacity investment alters site space, power and cooling requirements over time
- Network Opex is impacted by Site Sustain investment. Generally, replacement assets have lower Operating Costs and Maintenance requirements
- Asset Management expenditure and Network and Customer IT investment support prudent and efficient Site Sustain investment.

Site Sustain links to quality dimensions:

- availability and fault performance are supported by ongoing investment to manage asset risk. Some Site Sustain work can involve planned outages, which can impact availability.

9.6.3 Field Sustain

Field Sustain covers ongoing investment in physical network assets outside of network sites, such as poles, fibre and terminators.

Assets

Our main in-field assets are:[7]

- **poles** – we have between 210,000 and 280,000 total poles, most of which are in urban areas and were originally installed for our copper network but now carry fibre as well. Around 98% of our poles are softwood, with an expected life of 40 years
- **fibre** – we have more than 120,000 km of fibre cable, most of which is loose tube construction installed underground. Loose tube construction houses several fibre strands in a support tube, with tubes bundled up to form a cable. Life expectancy for this cable is 20 years. We have around 3,200 km of older slotted core cables
- **ducts** – we have more than 66,000 km of mostly underground ducting. This includes older earthenware, cast iron and cement fibre ducting (used until the 1960s), and newer PVC and PE ducts, steel trunking and microduct. We have used microduct extensively for UFB build. Underground ducts have a very long useful life if undisturbed
- **terminators** – we have over 90,000 drawers, trays and shelves in our Optical Fibre Distribution Frames (OFDFs) used for jointing, over 13,000 Fibre Flexibility Points (FFPs) that house splitters and over 48,000 Fibre Access Terminals (FATs) used to connect lead-ins. This equipment is relatively young though we have evolved design and work practices through the UFB programme to improve cost and quality outcomes

[7] Note that asset numbers are estimated as of June 2019.

- **manholes** – we have around 250,000 manholes. Manholes are covered openings that provide access to buried ducts. They consist of pit and lid components, which need to be stronger if placed in a roadway and can be lower cost if placed in a berm or footpath.

These are all high-volume assets, distributed across New Zealand with a mix of newer assets built as part of our UFB work and older shared or repurposed assets.

Management and plans

We have proactive programmes for:

- **poles** – we are running a programme to test and tag every pole, replace the poorest condition poles and return to a steady state of replacement. This programme will also provide a baseline for future testing and allow us to develop a better understanding of pole deterioration rates. By the beginning of RP1 we will have completed the initial test and tag programme, and by the end of RP1 we aim to have addressed the poorest condition poles
- **manholes** – we are planning to develop a proactive inspection programme
- **slotted core fibre cables** – these older cables are deteriorating, so we have a programme to replace the oldest cables
- **fibre route survey** – we have an annual survey programme to identify potential faults on core fibre routes.

Beyond these programmes, our field sustain investment is predominantly reactive.

We have some limited surveying programmes (for core fibre routes) to identify issues and can measure optical loss to identify fibre deterioration. We participate in the multi-utility beforeUdig service to help prevent damage to underground assets. Otherwise, we rely on fault or other reporting to identify assets that need repair or replacement, with public safety being a key driver.

Linkages, synergies and trade-offs

Field Sustain work links to other expenditure areas:

- Extending the Network increases the population of assets to sustain longer term and shifts the balance between fibre and copper. Construction can displace Field Sustain work in the near term (as some assets are replaced or refurbished to enable extension)
- Installations shift the balance between copper and fibre for shared assets such as ducts and poles
- Network Opex is impacted by field sustain investment. Generally, replacing assets reduces Maintenance requirements
- Asset Management activity and Network and Customer IT investment support prudent and efficient Field Sustain investment.

Field Sustain links to quality dimensions:

- availability and fault performance are supported by ongoing investment to manage asset risk. Some Field Sustain work requires planned outages, which can impact availability.

9.6.4 Relocations

There are three key drivers for network asset Relocation work:

- **roadworks** – we must relocate assets to accommodate roading authority work programmes. We receive capital contributions for this work. This is high-volume, demand-driven work
- **undergrounding** – we must accommodate Overhead to Underground (OHUG) programmes where we are leasing pole access from electricity businesses. We also underground assets proactively where economic
- **other third-party** – we are occasionally requested to move infrastructure for other parties, e.g. to enable access for a driveway. We receive capital contributions for some of this work.

Management and plans

Most Relocation work is reactive, and roadworks is the main activity. We have a steady volume of undergrounding and more limited and ad hoc third-party work. The scale and cost of Relocation activity fluctuates from year to year depending on other parties' roading and undergrounding programmes.

We deliver Relocation work through our field services workforce, generally using standard job costings. We have some visibility of roading programmes in coming years, and through RP1 we assume steady expenditure.

Linkages, synergies and trade-offs

Relocation work links to other expenditure areas:

- Extending the Network and Installation activity increases the population of assets exposed to Relocation. Underground vs. aerial components have different exposures to Relocation costs, as does urban vs. rural.

Relocation links to quality dimensions:

- availability is impacted if planned outages are needed to enable Relocation work.

9.6.5 Resilience

Resilience is our ability to keep the network running. We add resilience to the physical network in three ways:

- **redundancy** – providing backup assets (or capacity) so that failure of a single component does not interrupt service. Geographically diverse routes, or ring configurations, provide better resilience than spur configurations
- **robustness** – building (or upgrading) assets to a higher standard to better withstand stresses. For example, designing equipment racks to higher seismic standards
- **contingency** – putting measures in place to mitigate the impact of an adverse event.

This forecast only captures part of the first item – i.e. investment in additional dual fibre routes. Other resilience investments are included in other forecasts, such as:

- **Extending the Network** – resilience built into the network from the outset, including dual routes and core sites
- **network buildings** – compliance-driven seismic upgrade work
- **engineering services** – backup power supplies or other engineering services.

Our investment is driven by the UFB requirement that no single element failure should affect more than 3,000 consumers. As connection numbers grow, more towns will cross a threshold where an additional route is needed to meet this requirement. As such, we have a 10-year programme to build new dual fibre routes to UFB2 towns.

This investment is part of our plan to sustain quality as the network grows, however the construction work itself carries some risk of causing outages as we add handover links to buried in-service fibre.

We are considering whether we should develop a resilience programme as an individual capex proposal. This programme involves targeted exchange enhancements and potentially route diversity work in future.

Linkages, synergies and trade-offs

Resilience work links to other expenditure areas:

- Installations prompt ongoing Resilience work to sustain architecture standards for the maximum number of connections exposed to a single point of failure
- as described above, other Resilience work (outside of dedicated Resilience programmes) is captured in Extending the Network and Site Sustain.

Resilience links to quality dimensions:

- availability is improved over the long-term by Resilience investments, including diversity investments that limit exposure to single points of failure
- reported faults are also reduced by Resilience investments, including diversity investments that reduce the risk of an asset failure causing service cessation or degradation.

9.7 Network Opex

9.7.1 Overview

Network Opex is the second of three opex categories. It covers costs relating to our physical network.

Network Opex covers outsourced physical network Maintenance activities, physical network Operating Costs (such as power and leases) and outsourced costs of our network and security operating centres.

Network Opex makes up 35% of forecast opex for RP1.

Figure 9.20: Network Opex as a proportion of total first regulatory period (RP1) opex

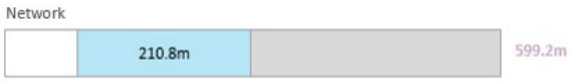


Figure 9.21: Expenditure category

We forecast Network Opex across three areas:

- **Maintenance** – outsourced physical network inspection and repair activities, plus our associated internal costs
- **Operating Costs** – running costs, including electricity, leases and our Security Operations Centre (SOC) that controls site access
- **Network Operations** – outsourced Network Operation Centre (NOC) costs, non-capitalised project costs, hardware support costs and incentive payments (to field service providers and RSPs).

This breakdown is shown in figure 9.22.

Figure 9.22: Expenditure category and sub-categories

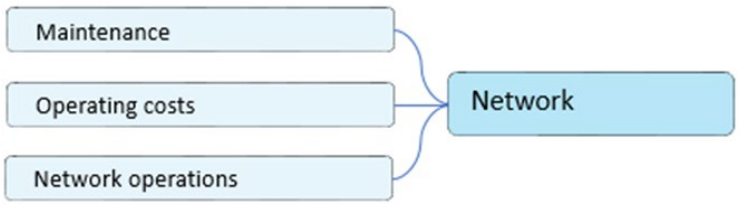
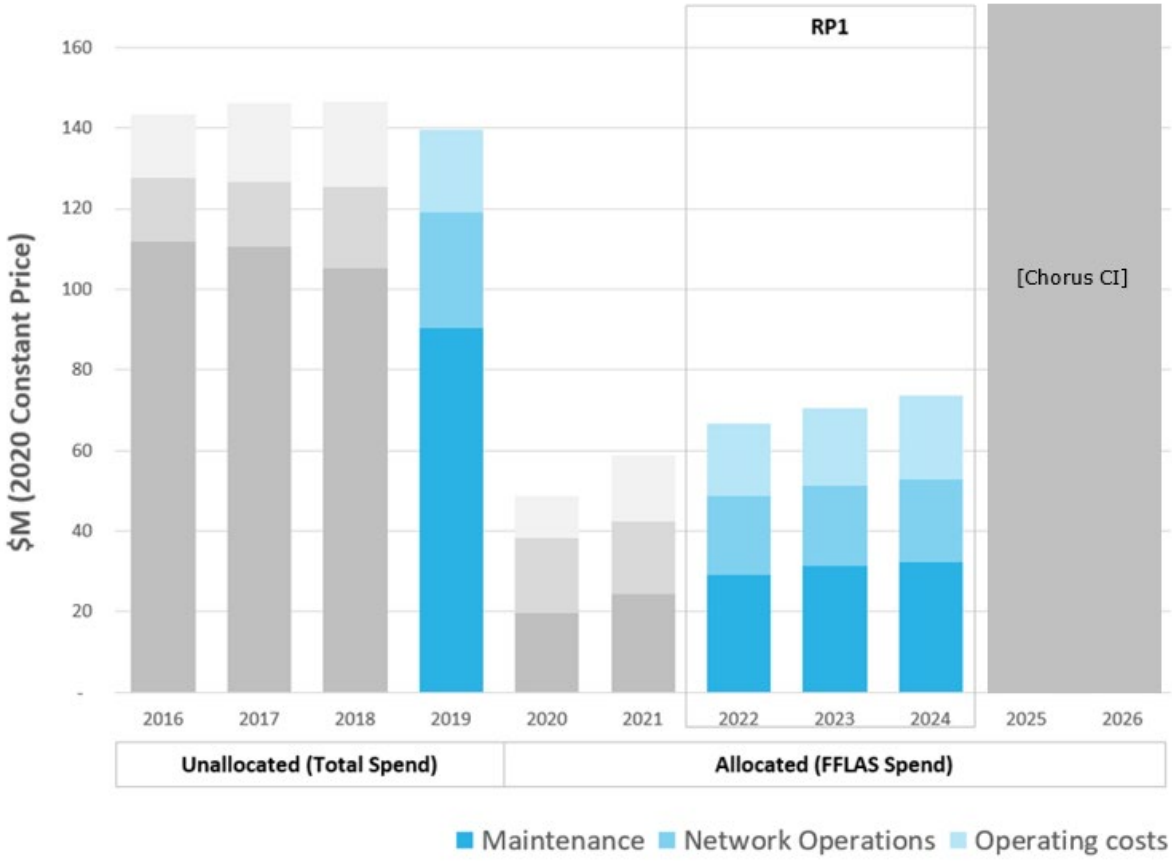


Figure 9.23: RP1 expenditure for Network Opex showing unallocated historical spending



Our forecast for Network Opex is shown in figure 9.23, broken into sub-categories.

We forecast growing expenditure due to growing allocation of shared costs, plus:

- new Maintenance activities, including safety-driven pole and pit inspection programmes
- increasing costs for in-field activities as build and install work volumes decline
- growing electricity demand as we increase network capacity and extend coverage.

9.7.2 Maintenance

- Most of our network Maintenance costs are outsourced through separate field services, facilities and engineering services contracts. Equipment consigned for repairs is also included in maintenance. We deliver three types of maintenance activities:
  - **reactive** – work to address an issue identified through a fault, alarm or inspection
  - **recoverable** – work for which we can recover all or part of the cost from another party. Includes some third-party damage, and events where we find no fault, or find and repair a fault in an RSP network
  - **preventative** – routine inspection works, including testing and survey. Also includes cable location services.

Notable changes and trends through RP1 include:

- we expect to reconfigure our field services arrangements as we transition from build to operate
- pole inspection activity will shift from a capitalised programme of work, to routine re-inspection work that is treated as opex
- we plan to mobilise a 10-year inspection cycle for manholes and pits.

Linkages, synergies and trade-offs

Maintenance work links to other expenditure areas:

- Extending the Network and Installations create new assets to maintain
- Network Capacity creates new assets to maintain and replaces assets, which helps reduce maintenance work
- Site Sustain and Field Sustain investment helps to reduce reactive Maintenance, and is informed by preventative Maintenance activities
- Network and Customer IT provide the systems we use to manage Maintenance activities
- Asset Management helps shape our approach to Maintenance.

Maintenance work links to quality dimensions:

- by responding to faults, which supports availability and customer service.

9.7.3 Operating Costs

Operating Costs include:

- **leases** – including for poles, exchange space (from Spark) and rights-of-way. We capitalise these costs, but present them as opex here for clarity[8]
- **electricity** – used to power network electronics, cooling and other site systems
- **security operations** – outsourced SOC and associated internal costs
- fire protection and building compliance costs.

The key trends through RP1 are growing lease and electricity costs as we extend the network and continue to invest in network capacity to meet growing bandwidth demand.

Linkages, synergies and trade-offs

Operating costs link to other expenditure areas:

- Extending the Network, Installations and Network Capacity create new (or higher capacity) assets with associated operating costs
- undergrounding Relocations work reduces lease costs
- some Site Sustain investment is directed at reducing Spark lease costs and investment in engineering services generally alters Operating Costs
- Asset Management helps shape our approach to optimising operating costs.

9.7.4 Network Operations

Network Operations includes:

- **NOC and associated internal labour** – the NOC manages network electronics alarms, provides technical support and configuration services, and provides network electronics equipment repair and return
- **hardware support** – hardware and software maintenance and support services not covered by the NOC agreement
- **incentives** – performance payments for service providers
- payments to Spark for remaining NOC or network electronics-related shared systems
- **project opex** – non-capitalised network project-related costs.

We are forecasting relatively stable Network Operations costs through RP1, with some increase as fibre access uses more shared costs.

Linkages, synergies and trade-offs

Network Operations links to other expenditure areas:

- Network Capacity investment shapes the fleet of network hardware requiring operation and support
- IT investment is reducing our dependence on Spark shared systems.

Network operations links to quality dimensions:

- by managing network electronics faults, which supports availability and customer service
- by monitoring and managing network operation to sustain network performance.

[8] Leases are capitalised on formation, so a capex view is sporadic and does not reveal cost trends.

9.8 Network Capacity

9.8.1 Overview

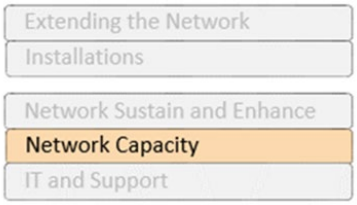
Network Capacity is the second of three recurring capex categories. It covers ongoing investment in network electronics and associated systems to optimise for capacity growth and lifecycle requirements.

Having established initial coverage and capacity, we reinvest in Network Capacity as needed to cost-effectively stay ahead of growing bandwidth demand while managing lifecycle factors such as support, reliability, functionality and cost of replacement assets.

Network Capacity makes up 36% of proposed recurring capex, and 17% of total proposed capex for RP1.

Figure 9.24: Network Capacity expenditure as a proportion of total first regulatory period (RP1) capex

Figure 9.25: Expenditure category



We forecast Network Capacity across three areas:

- **Access** – lifecycle replacement of ONTs, and capacity and lifecycle investment in exchange-based access components, including the access network element management platform
- **Aggregation** – lifecycle and growth investment in aggregation network components, including the aggregation network management platform. Aggregation provides the connection between local access and RSP points of interconnection
- **Transport** – lifecycle and growth investment in transport links used to connect across medium to long distances.

This breakdown is shown in figure 9.26.

Figure 9.26: Expenditure category and sub-categories

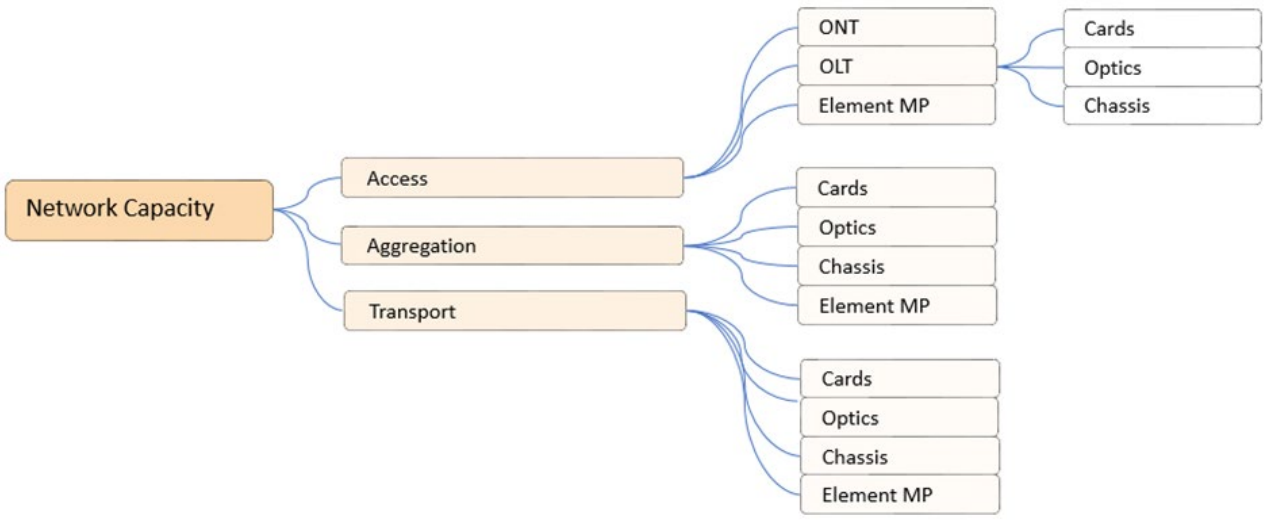
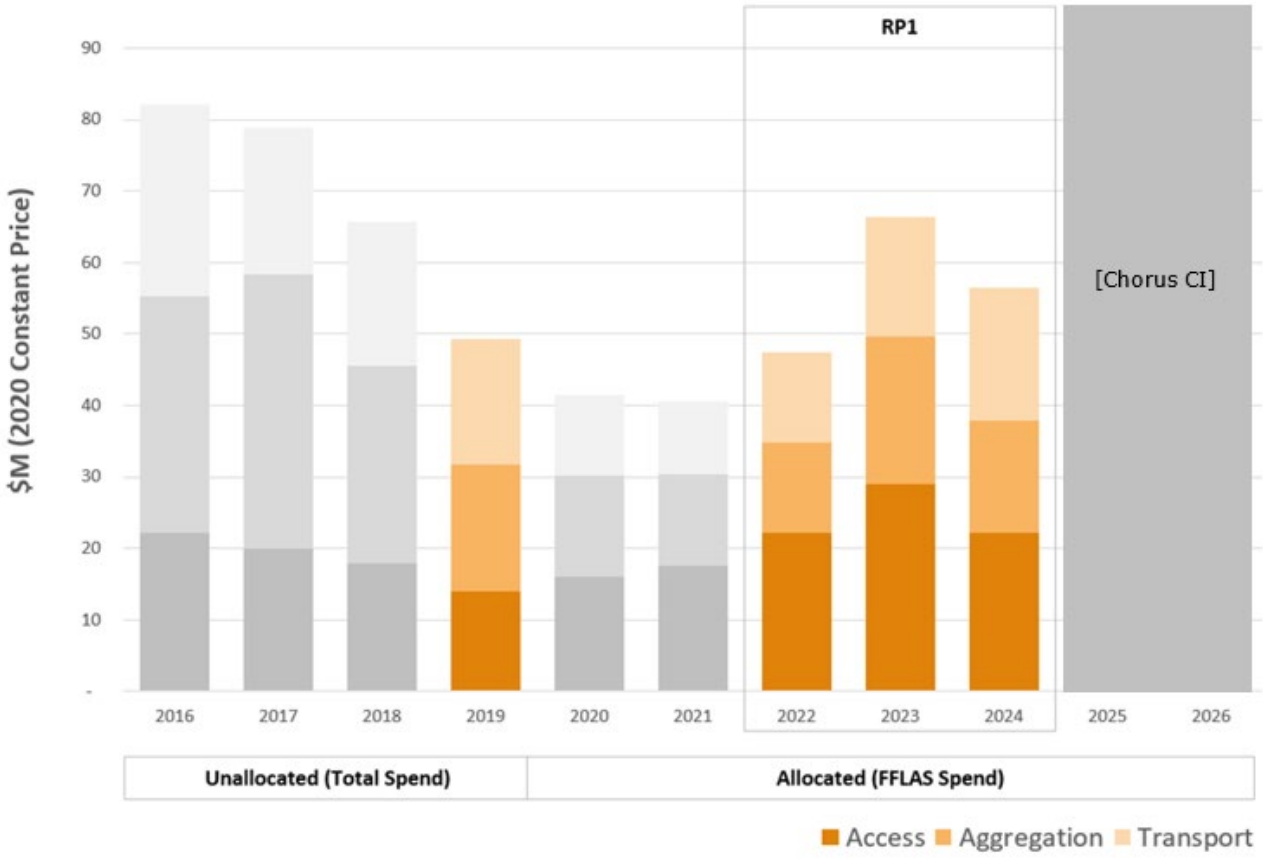


Figure 9.27: RP1 expenditure for Network Capacity showing unallocated historical spending



Our forecast for Network Capacity is shown in figure 9.27, broken into sub-categories.

Our planned investment during RP1 is higher than the prior period because:

- assets such as ONTs and chassis fitted early in the UFB build are beginning to reach end of life, so we will have growing replacement volumes across all three sub-categories
- initial access network capacity is beginning to be exhausted in some areas as average connection speeds increase
- to provision Hyperfibre access, we need to invest in new access cards and optics
- bandwidth demand growth, including due to Hyperfibre, will prompt a pickup in transport capacity expansion from 2023
- the phasing of lifecycle upgrades causes fluctuations in expenditure, such as the dip in 2024.

We expect further increases beyond RP1, driven by a growing volume of ONTs and other equipment reaching end of life.

9.8.2 Access

Access networks enable consumer connections to the fibre network.

Assets

Every intact installation has an ONT fitted at the consumers premises. We do not control the operating environment for this equipment and need consumer permission to obtain access for upgrade or lifecycle work.

The other components of our access networks are housed in our network buildings or cabinets. We have:

- over 1,000 Optical Line Terminal (OLT) chassis. These are the longest-lived network capacity assets at 8-12 years. Chassis securely house other network capacity equipment
- nearly 2,000 controller cards and nearly 8,000 line-cards that form the active components. These have a life of 5-8 years
- over 100,000 pluggable optics, which provide the interface between electronic cards and optical fibre. Their lifespan is typically dictated by compatibility with line cards
- two access element management platforms. These monitor and control network electronics, including the ONTs and OLTs.

Management and plans

Providing initial coverage as we extended the network has been the primary driver of access investment to date. This activity continues through RP1, but at a reduced rate as UFB programmes are completed and Augmentation and New Property Development provide a lower base rate of extension.

During RP1, lifecycle and growth become more material drivers of access investment:

- as average connection speeds increase, bandwidth demand approaches initial build capacity and we need to add capacity to sustain congestion-free performance
- to enable Hyperfibre access, we need to provide XGS Passive Optical Network (XGS-PON) coverage by replacing ONTs, cards and optics
- some equipment fitted as part of UFB build and install is moving into its first replacement cycle. For example, we expect ONT failures rates will increase (driving increasing reactive replacement volumes).

For new installations, the Hyperfibre access investment noted above is mapped to connection capex through cost group ten (CG10 – non-linear Hyperfibre costs).[9] As well as investing in planned replacements to optimise cost and capacity, we invest in spares to enable rapid replacement of failed assets.

Linkages, synergies and trade-offs

Access work links to other expenditure areas:

- Network Extension prompts investment to provide initial (or infill) coverage
- Installations contribute to bandwidth demand, which prompts investment in access capacity (once initial capacity limits are reached)
- Site Sustain investment provides the power and cooling plant needed to support access equipment, while electricity purchase is captured in Operating Costs.

Access links to quality dimensions:

- failure of access electronics has a direct impact on availability and faults
- as average speeds grow, access capacity begins to become relevant for performance and supports customer service satisfaction
- for Hyperfibre orders, adding coverage is sometimes part of the provisioning process.

9.8.3 Aggregation

Aggregation networks link access networks to RSP points of interconnection.

Assets

The aggregation network has fewer assets than the access network, all housed in network buildings. We have:

- just under 80 chassis housing just over 300 controller cards and 600 line-cards
- just over 5,000 pluggable optics
- one element management platform.

[9] Hyperfibre ONTs and incentives (covered under installations) are mapped to CG7. We expect the majority of Hyperfibre demand will be for intact connections. It would make sense to shift this investment to connection capex too, but this would appear to require amendment to the definition of Connection Capex in the Fibre Input Methodologies.

Management and plans

Bandwidth demand growth is the major driver for aggregation investment.

To enable cost-effective capacity expansion and vendor support, we keep element management platforms up to date and optimise our investment in new technology. We develop a schedule of upgrades through a capacity planning process that forecasts constraints and determines an optimal capacity expansion sequence. We also plan for new or upgraded capacity as needed to support network extension.

The pace of demand growth and technological obsolescence means that condition or fault-driven investment is low.

Linkages, synergies and trade-offs

Aggregation work links to other expenditure areas:

- Extending the Network prompts investment to provide initial aggregation capacity
- Installations contribute to bandwidth demand, which prompts ongoing investment in capacity
- Site Sustain investment provides the power and cooling plant needed to support Aggregation equipment, while electricity purchase is captured in Operating Costs.

Aggregation links to quality dimensions:

- failure of Aggregation electronics can impact availability and faults (depending on Resilience)
- Aggregation port capacity is a key driver of performance and supports customer service satisfaction.

9.8.4 Transport

The optical transport network transports large amounts of data over medium to long distances.

Assets

We have:

- over 500 chassis
- more than 1,200 controller cards and more than 2,500 line-cards
- over 8,500 pluggable optics
- two element management platforms.

Management and plans

Traffic includes broadband uplinks for access electronics, inter-nodal links for aggregation switches and other services. We plan for new links or capacity upgrades through our capacity planning process. We also plan for new or upgraded links as needed to support network extension.

Linkages, synergies and trade-offs

Transport work links to other expenditure areas:

- Network Extension prompts investment to provide medium or long-distance links as needed
- Installations contribute to bandwidth demand, which prompts ongoing investment in capacity
- Site Sustain investment provides the power and cooling plant needed to support Transport equipment, while electricity purchase is captured in Operating Costs.

Transport links to quality dimensions:

- failure of Transport links can impact availability and faults (depending on Resilience)
- Transport link capacity supports performance and supports customer service satisfaction.

9.9 IT and Support

9.9.1 Overview

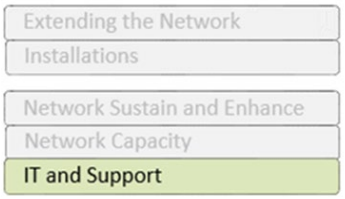
IT and Support is the final recurring capex category. It covers investment in our information technology systems, plus corporate capex. Corporate capex includes longer horizon product development. This investment is ring-fenced but typically split between IT (product development) and network investment.

We use IT systems to support our operations and invest to enhance capability or to manage systems through their lifecycle. We have also grouped Corporate investment into this category. Corporate includes sundry items such as office fitouts, ring-fenced longer horizon product innovation[10].

IT and Support makes up 32% of proposed recurring capex, and 15% of total proposed capex for RP1.

Figure 9.28: IT and Support expenditure as a proportion of total first regulatory period (RP1) capex

Figure 9.29: Expenditure category

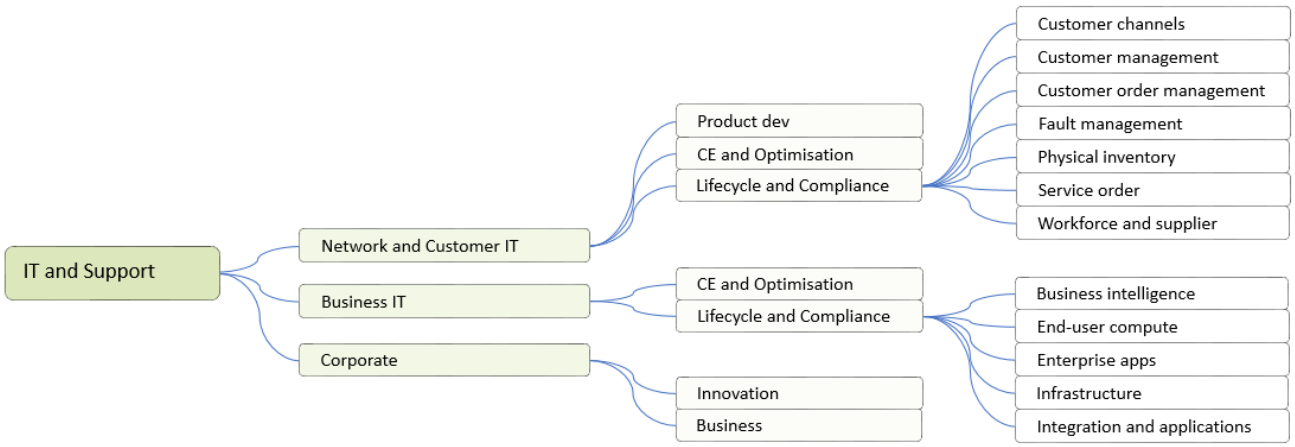


We forecast IT and Support across three areas:

- **Network and Customer IT** – investment in systems and platforms across seven IT domains that support network or customer activities. We forecast three management classes for these systems (product development; customer experience and optimisation; lifecycle and compliance)
- **Business IT** – investment in systems and applications across five IT domains that support business activities. We forecast two classes of investment in these systems (customer experience and optimisation; lifecycle and compliance)
- **Corporate** – sundry business investment, plus ring-fenced longer horizon product investment.

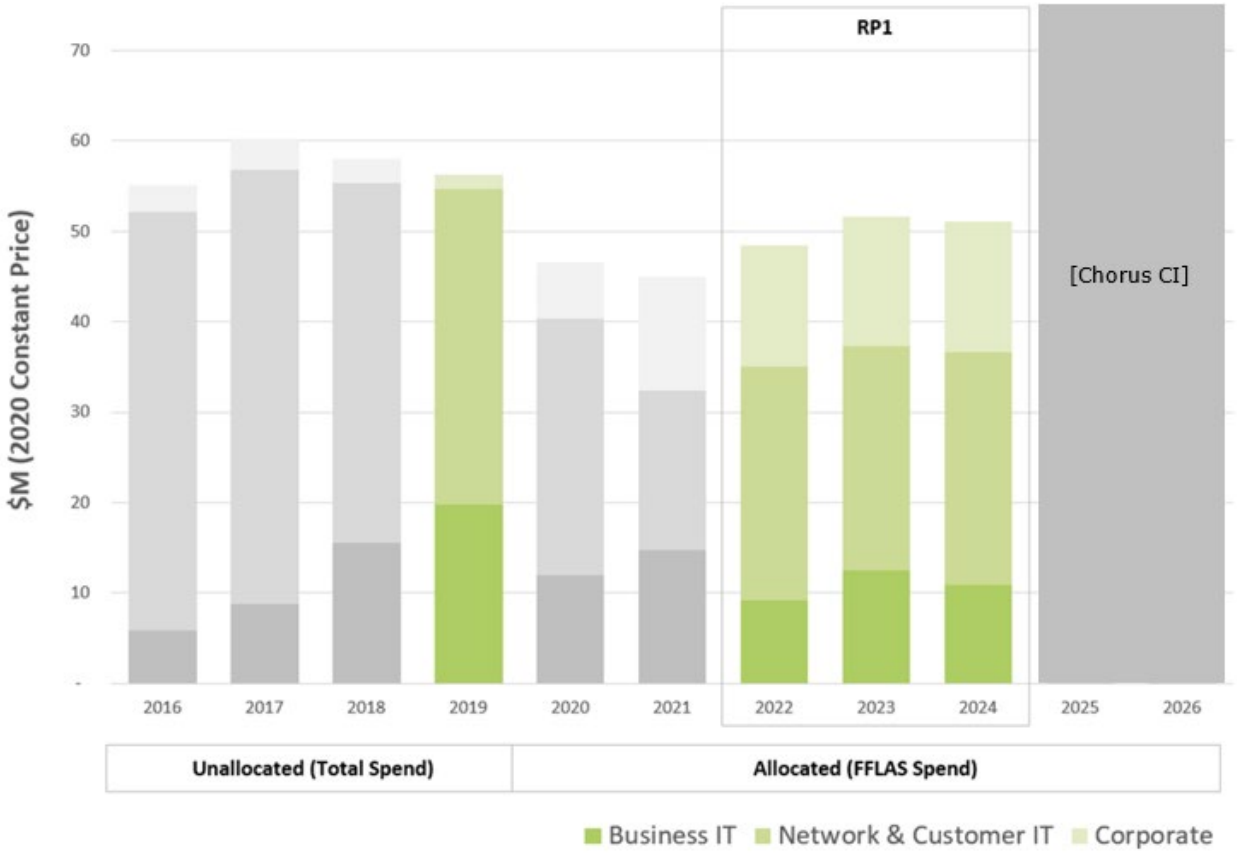
This breakdown is shown in figure 9.30.

Figure 9.30: Expenditure category and sub-categories



[10] This expenditure is contained under the sub-category called 'Innovation'.

Figure 9.31: RP1 expenditure for IT and Support showing unallocated historical spending



Our forecast for IT and Support is shown in figure 9.31, broken into sub-categories.

Key trends are:[11]

- Our historical IT investments have been driven by the managed transition and exit from Spark with projects often requiring large multi-year investments
- We sequence IT capability, shifting investment between Network and Customer IT and Business IT
- For example, our Network and Customer IT spending peaked between 2016 and 2017 due to the establishment of new copper fulfilment (~$40m), assure trouble ticketing (~$5m) and new digital channels (~$9m)
- We deliberately sequenced this so 2018 to 2019 focused on the billing system developments (~$20m) in Business IT. There are also similar spend increases in Business IT in 2021 and 2025 as a result of the 4-yearly relicencing of a key piece of integration software
- Within corporate, our spending is split between business, remaining steady at around 1% of recurring capex, and longer horizon product development. Our innovation spend will increase as our Chorus X programme matures and as we aim to keep pace with developments in technology and the expectations of our consumers.

Below we discuss both categories of IT investment (because they use a common management approach) and then the innovation component of Corporate investment.

[11] Project costs are quoted as estimated unallocated nominal dollars.

9.9.2 IT

We have over a hundred IT systems that help us deliver network services and run our business. We group these into seven Network and Customer domains and five Business domains.

Network and Customer domains

Our Network and Customer domains are:

- **customer channels** – websites and integration points that allow consumers, RSPs or third parties to access data, view product information, place orders, report issues, and interact with billing and payment functions
- **customer management** – customer relationship management tools that record interactions and track workflows, manage sales, and provide marketing capability
- **customer order management** – systems that manage processes for taking requests and managing organisation, tracking and fulfilment
- **fault management** – support for RSPs to diagnose, triage and report faults, plus fault ticket systems that interact with NOC and field service providers
- **physical inventory** – tools that support network planning, provisioning, fault management and asset management by holding geospatial and logical representations of network assets
- **service order** – systems that support product delivery by allocating network resources and recording configurations
- **workforce and supplier gateway** – systems that distribute work to field technicians and provide scheduling visibility and record keeping.

Business domains

Our business domains are:

- **business intelligence** – business data repository, analysis and reporting tools
- **end-user compute** – desktop hardware and systems for staff
- **enterprise applications** – billing, finance, human resources and other core systems
- **infrastructure** – datacentre and office network services
- **integration and applications** – systems for application integration, file transfer and contact centre telephony.

Management and plans

We use a common management approach across all our Network and Customer and Business domains. This involves managing:

- **lifecycle and compliance** – management of current systems through their lifecycle from planning to retirement. We use a risk management framework to prioritise this expenditure
- **customer experience and optimisation** – investment to improve customer experience, lift capability or reduce costs – for example, through process automation, system consolidation or infrastructure streamlining
- **product** – investment to test and implement product development initiatives. This investment is relevant to Network and Customer IT only.

Historically, lifecycle and compliance work has been dominated by work to remove dependence on legacy systems shared with Spark.[12] We have some residual shared systems, but most future lifecycle investment is reinvestment in our own systems.

Customer experience and optimisation is shaped in part by limitations of change capacity – e.g. due to resource, system access or process change capacity. Over RP1 our investment in this area will:

- support our transition from build to operate. This includes supporting operating cost reductions that are built into our opex forecasts
- help to deliver early gains in asset management. This work will translate into more optimal risk and cost management over the longer term as our network ages.

Our product investment is driven by our product development roadmap and pipeline. The roadmap does not extend into RP1, but we have assumed a similar pace of development will continue as fibre products continue to evolve.

[12] Chorus and Spark were both part of Telecom until 2011 and retained shared systems at demerger.

Linkages, synergies and trade-offs

IT work links to other expenditure areas:

- IT systems support and enable efficient operation in all opex areas
- IT systems support and enable efficient capital investment, including in Network Sustain and Enhance and Network Capacity
- IT systems are used to automate processes that would otherwise drive Customer Operations expenditure
- Technology opex covers costs associated with our IT systems, including where we use an opex (service) solution in favour of a capex (build) solution,
- Asset Management includes people who manage our IT investment
- Product, Sales and Marketing activities form the product roadmap and pipeline that we deliver through network and customer IT.

IT links to quality dimensions:

- we use IT systems to manage availability and fault response, and to monitor and manage performance
- we use IT systems to manage ordering, provisioning and switching
- the efficiency and effectiveness of our IT systems influences customer satisfaction.

9.9.3 Innovation

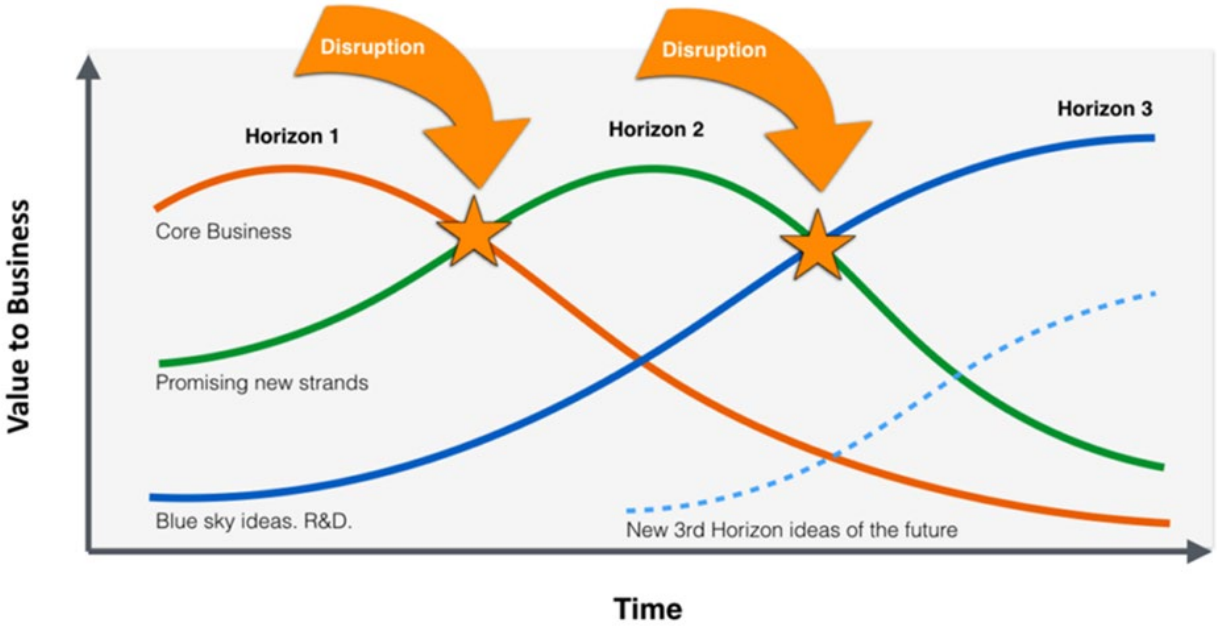
We have ring-fenced funding within IT and Support for longer horizon produt development.

As we transition from building the fibre network to operating in a highly dynamic market environment, it is important we invest to sustain the fibre access value proposition in a fast-moving industry and for rapidly evolving consumer needs.

This includes through:

- evolving our fibre access services to meet existing and future customer and consumer needs (horizon one new product development and incremental innovation on the existing portfolio)
- leveraging new, evolving and emerging technologies and responding to macro trends to improve customer experience and access to fibre access services, reduce costs and create opportunities for market innovation (horizon two)
- grow revenue streams that spread our fixed costs and help us sustain attractive fibre access pricing (horizon two and three).

Figure 9.32: Innovation phases



The UFB programme has contributed to major changes in the broadband market already and continues to drive change as we turn yesterday's innovation into today's product. With the infrastructure in place to enable New Zealand's digital readiness, continued investment in product development across shorter and longer term horizons will enable RSPs to offer better consumer and business experiences and enable more New Zealanders to access and connect – lifting wellbeing and productivity.

We have an internally branded Chorus X programme focussed on structured management of product development opportunities through ideation, exploration, validation and transition to commercialisation.

Our proposed investment for RP1 is roughly 3.7% of total capex. Chorus X also includes incubating and accelerating innovative ideas to ensure they meet market need and drive desired benefits at scale.

In time, commercialised products flow through into regular business planning cycles. For example, Hyperfibre costs are built into RP1 forecasts in the relevant expenditure categories.

Linkages, synergies and trade-offs

Innovation work links to other expenditure areas:

- Corporate opex includes non-capitalised management of the Chorus X programme and associated discovery and exploration activities that occur ahead of capitalisation
- innovation investment can flow through to future Product, Sales and Marketing activity, and IT and Network Capacity investment.

Innovation links to quality dimensions:

- innovation is a driver of future customer satisfaction.

9.9.4 Business

Business capex is the second of two corporate capex areas.

Business capex is a minor area of investment, comprising around 1% of recurring capex. It covers office fitout work and other sundry capex. We are not planning any large business capex projects or programmes in RP1.

9.10 Support Opex

9.10.1 Overview

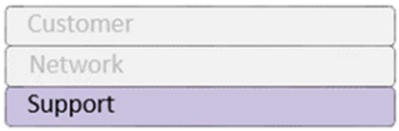
Support Opex is the third of three opex categories. It covers expenditure on asset management and corporate functions, and operating costs for IT systems.

Support Opex covers the balance of the costs of operating our business, including our engineering and corporate teams and associated costs, plus IT operating costs – including support arrangements, software as a service, etc.

Support Opex makes up 50% of forecast opex for RP1.

Figure 9.33: Support Opex as a proportion of total first regulatory period (RP1) opex

Figure 9.34: Expenditure category



We forecast Support Opex across three areas:

- **Corporate** – business governance, management and support resources and associated costs (such as insurance, professional services, office expenses)
- **Asset Management** – (non-capitalised) project, engineering and associated resources involved in network strategy, planning and operation activities
- **Technology** – external IT costs such as licencing, support and subscription fees.

This breakdown is shown in figure 9.35.

Figure 9.35: Expenditure category and sub-categories

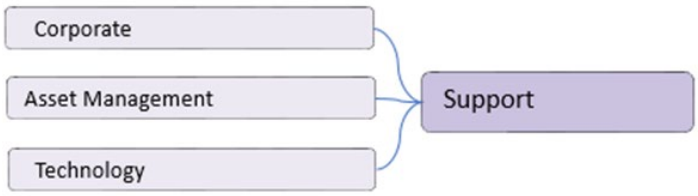
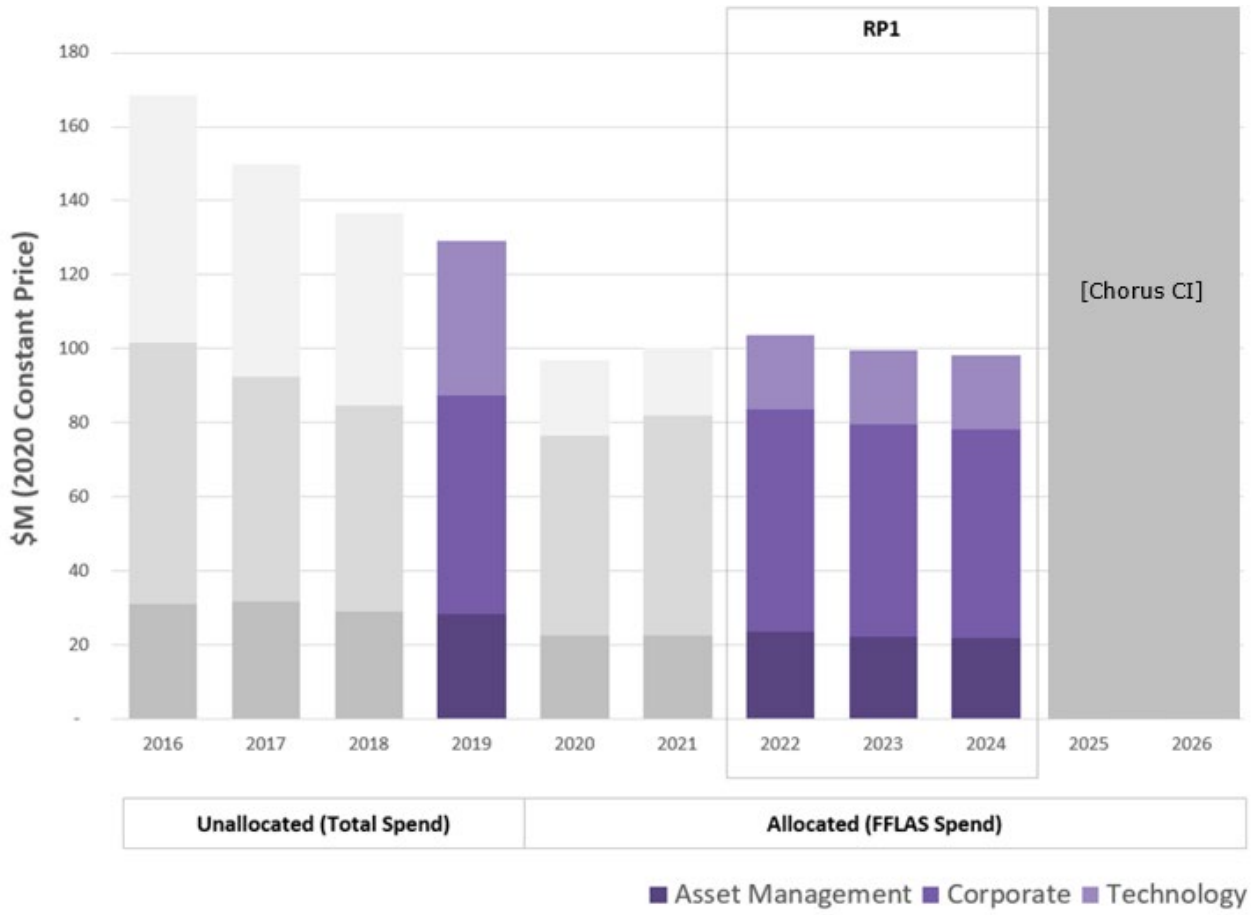


Figure 9.36: RP1 expenditure for Support Opex showing unallocated historical spending



Our forecast for Support Opex is shown in figure 9.36, broken into subcategories.

Key trends are:

- the portion of shared costs used by fibre access has grown over time, while total costs have fallen. The rate of change in shared cost growth slows through RP1, leaving a net trend of falling costs
- we aim to ease Corporate costs as we move through RP1 and overall business activity reduces. This is despite starting from an efficient base and taking on additional workload relating to new regulatory arrangements
- Asset Management costs are relatively flat, mostly moving due to changes in usage of shared costs. This reflects the ongoing need for non-capitalised Asset Management activities as we shift from build to operate
- Technology costs show a similar trend. This reflects that most of these costs are fixed, and that we aim to hold prices as contracts renew.

9.10.2 Corporate

Corporate covers internal labour, accommodation and items such as office expenses, insurance and professional services. The functions covered include:

- governance and executive management
- finance
- people and culture
- stakeholder management
- strategy.

Office expenses relate to our office accommodation in Wellington, Auckland and Christchurch. Professional services and other costs include:

- legal, regulatory or specialist advice
- audit and advisory services
- insurance premiums.

Our forecast also includes an amount for self-insurance, with the quantum based on actuarial advice.

As we move through RP1, we forecast a net reduction in Corporate costs, partly offset by costs related to operating new regulatory arrangements, and by fibre access increasing its use of shared costs.

Linkages, synergies and trade-offs

Corporate opex links to other expenditure areas:

- corporate teams provide governance and support for all capex and opex.

Corporate opex links to quality dimensions:

- by supporting our ability to deliver services.

9.10.3 Asset Management

Asset Management includes resources from two parts of our business:

- Chief Technology Office (CTO) – all CTO costs, which covers activities such as strategic planning, investment management and technology operations for our fibre network and supporting IT systems
- Customer and Network Operations (CNO) – CNO costs not mapped to customer or network opex. Includes activities such as programme management, contract management, property operations, consent acquisition, network scoping, health, safety and environment, and process optimisation.

As we move through RP1:

- our overall capital expenditure will reduce. This translates into less capitalised CTO and CNO resource, but has a relatively neutral impact on opex resource
- we will adapt and develop our asset management capability to suit a change in focus from build to operate. This transition will build on the work we have done with AMCL[13] to assess capability and identify development priorities.

Linkages, synergies and trade-offs

Asset Management work links to other expenditure areas:

- Extending the Network and Installations work is guided and facilitated by our Asset Management people
- Asset Management people shape and govern Network Capacity, Network Sustain and Enhance, and IT investment, and contribute to innovation
- Asset Management people shape our approach to Network Opex and manage our Technology opex.

Asset Management work links to quality dimensions:

- by helping to understand quality preferences and network performance, and guiding network investment accordingly to drive customer service satisfaction.

9.10.4 Technology

Technology covers the non-capitalised costs of operating our Business IT and Customer and Network IT systems – including licences, support and maintenance. Around 70% of these costs are fixed, with periodic (typically 1-3 year) re-pricing intervals. The balance is linked to (typically slow-moving) metrics such as headcount, transaction volumes, server counts, etc.

As we move through RP1, we forecast that we will hold technology opex flat as systems change, contracts are re-priced, and volumes and capitalisation rates change.

Linkages, synergies and trade-offs

Technology opex links to other expenditure areas:

- some system costs are capitalised, including to Installations
- Technology opex supports the systems created through IT capex, and we sometimes have the option to purchase IT services (Technology opex) rather than building or modifying systems (IT capex) where this provides a lower whole-of-life cost

[13] Asset Management Consulting Limited.

- some Technology opex links to headcount, which is distributed across Customer, Network and Support Opex.

Technology opex links to quality dimensions:

- by supporting the systems used to deliver services.

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