Clause 5 in Report No. 11 of Committee of the Whole was adopted, without amendment, by the Council of The Regional Municipality of York at its meeting held on June 23, 2016.

5

York Telecom Network Governance Review

Committee of the Whole recommends:

1. Receipt of the presentation by Doug Lindeblom, Director, Economic Strategy.
2. Adoption of the following recommendations contained in the report dated June 3, 2016 from the Commissioner of Corporate Services and Chief Planner:
    1. Council endorse developing the York Telecom Network into a Region owned and operated optical fibre network based on the principles outlined in Attachment 1.
    2. Staff report back to Council with a recommended governance structure and sustainable financial and business plan for the York Telecom Network by the end of 2016.
    3. The Regional Clerk circulate this report to local municipalities, York Regional Police, York Region District School Board and Ontario Research and Innovation Optical Network (ORION).

Report dated June 3, 2016 from the Commissioner of Corporate Services and Chief Planner now follows:

1. Recommendations

It is recommended that:

1. Council endorse developing the York Telecom Network into a Region owned and operated optical fibre network based on the principles outlined in Attachment 1.
2. Staff report back to Council with a recommended governance structure and sustainable financial and business plan for the York Telecom Network by the end of 2016.

3. The Regional Clerk circulate this report to local municipalities, York Regional Police, York Region District School Board and Ontario Research and Innovation Optical Network (ORION).

2. Purpose

The York Telecom Network, the optical fibre network built and managed by York Region, has evolved to a point where decisions must be made regarding its operation and its role as a Regional asset. This report provides an overview of the York Telecom Network review process and recommends the principles under which a detailed analysis of a future governance and business model will be conducted.

3. Background

Broadband connectivity is a key component of the York Region Economic Development Action Plan

Improved broadband connectivity can help influence investment and business growth, while serving to enhance the live/work, access and lifestyle needs of communities throughout the Region. The “Innovation and Entrepreneur Development” section of the Economic Development Action Plan 2016 to 2019 is grounded in the principle that high-speed connectivity promotes economic growth.

This principle is supported by various studies which demonstrate that access to high-speed broadband has a positive impact on local economies.

The York Region Broadband Strategy provides recommendations for improving connectivity in the Region

On May 15, 2014 Regional Council adopted the York Region Broadband Strategy report, which provided recommendations for improving access to high-speed internet connectivity for businesses and institutions and residents throughout York Region.

The strategy lists a number of implementation priorities, organized under three categories:

1. **Education and Advocacy Priorities**, which focus on developing relationships and communicate the importance of broadband connectivity

2. **Municipal Process Priorities**, which focus on regulatory and planning processes that can be leveraged to improve connectivity within a community

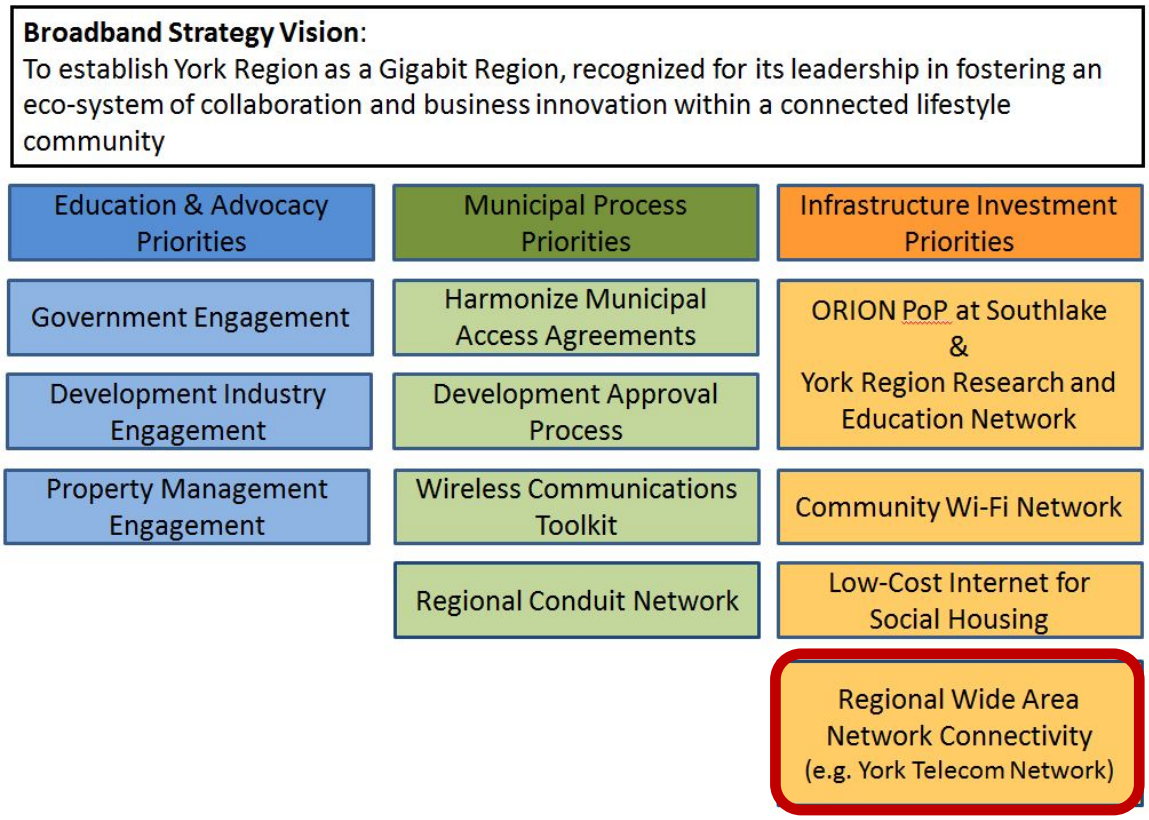
3. **Infrastructure Investment Priorities,** which focus on encouraging investments in infrastructure that can improve connectivity within the Region

The York Telecom Network is an infrastructure investment priority in the Region's Broadband Strategy

The York Telecom Network is identified within the Broadband Strategy under the Infrastructure Investment Priorities. It is one of the elements potentially playing a role in advancing the goals of the strategy.

The Broadband Strategy document recommended that the York Telecom Network be developed to meet the Region's Wide Area Network connectivity requirements and provide interconnectivity between the Region and its public sector partners. Figure 1: York Region Broadband Strategy Overview summarizes the vision and priority areas contained within the Broadband Strategy. This report focuses on the bolded section.

Figure 1
York Region Broadband Strategy Overview



The York Telecom Network is a Region-owned and operated optical fibre network developed to connect Regional buildings and other assets

The York Telecom Network is a network of fibre optic infrastructure connecting Regional locations and facilities. Owned and operated by York Region, the York Telecom Network services only a small portion of the Region's total Wide Area Network needs (i.e. the network required to connect multiple buildings and other assets across York Region).

The majority of Regional Wide Area Network connections are managed through contracts with third party telecommunications companies. The York Telecom Network also connects a limited number of public sector facilities that reside along the fibre pathway.

Regional Council referred a review of the York Telecom Network to the Broadband Strategy Advisory Task Force

Regional Council was advised through a Committee of the Whole report dated June 3, 2015 that a review of the York Telecom Network was underway to

determine future operations of the network. This report also recommended that the review of the York Telecom Network be referred to the Broadband Strategy Advisory Task Force, which was launched in September 2015.

The role of the Task Force is to provide feedback to York Region staff in the development of tools, policies and working groups to advance the goals of the York Region Broadband Strategy. Through the course of several meetings, the Task Force engaged the private and public sector to learn about the York Telecom Network and the options emerging from the review.

In a response to a presentation on the status of the York Telecom Network Governance Model Review on February 3, 2016, the Task Force advised that the review include the potential Economic Development benefits of a Regionally-owned dark-fibre network.

4. Analysis and Options

The role of the York Telecom Network has evolved

The York Telecom Network was established in 2002 as a means of connecting Regional facilities to each other. These initial connections were lower cost than third party connections.

From 2002 to 2011, the York Telecom Network grew incrementally to connect Regional buildings and other assets, including traffic control/cameras, Viva monitoring and payment systems, and water/wastewater monitoring systems.

Since 2011, York Region has been partnering with local municipalities and other public sector organizations to help them meet some of their connectivity needs by allowing them to access the capacity afforded by fibre that is not being used (i.e. dark fibre). These connections were facilitated by allowing local municipalities to access and connect their own communications equipment to the York Telecom Network dark fibre. Current subscribers to the network include: Town of Newmarket; Town of Georgina; Town of Richmond Hill; Town of Aurora; York Region District School Board; and York Regional Police.

The York Telecom Network has grown from a single connection to a network of connections across the Region

In February 2007, workshops were held with Regional staff to develop a high-level vision of how York Telecom Network technologies could be deployed across the Region. From these workshops an operational plan emerged to support the vision of key internal stakeholders. The plan was developed into an internal document entitled the York Region Network Strategic Plan, which identified the need for a single “cross Region network” to consolidate the

connectivity needs of the Regional departments. This plan has largely determined the shape of the completed and planned York Telecom Network.

By the end of 2015, 157 kilometres of fibre infrastructure had been constructed, both underground and on poles. Another 165 kilometres is currently under construction or in design and is scheduled to be completed by the end of 2017. This will result in a network consisting of 322 kilometres of underground and aerial optical fibre.

Attachment 2 includes a map of the Region's completed network existing as of December 31, 2015.

Attachment 3 includes a map of the Region's completed network and work that is currently planned through 2024.

Strategic investments have facilitated the expansion of the York Telecom Network

In 2015, York Region leveraged the York Telecom Network to enable the expansion of the Ontario Research and Innovation Optical Network (ORION) into the Region, which also led to the expansion of the network. ORION is a fibre optic network that supports research, education, collaboration and innovation across Ontario. ORION connects nearly all of Ontario's research and education institutions, including every university, most colleges, several teaching hospitals, public research facilities and several school boards to one another and to the global grid of research and education networks.

This network expansion was achieved by completing an optical fibre link between the ORION Points of Presence (i.e. network access hub) at Southlake Regional Health Centre and York University. ORION has purchased two strands of York Telecom Network optical fibre and York Region will maintain this 10 Gigabit fibre link for a minimum of 10 years.

In recent years Viva rapidway construction has been one of the main drivers of York Telecom Network expansion. The network was identified by Transportation Services as the recommended solution for fibre infrastructure due to the fact that the long term operating costs would be lower than with a third party provider. Future security and system scalability were also factors in this recommendation. Currently, Viva and traffic control connections represent nearly 60% of all York Telecom Network connections, which is a significant increase from 34% of connections in 2013.

Mounting demand on York Telecom Network resources by current and prospective subscribers necessitated a review of current operations and possible future governance models

York Region continues to receive requests to connect to the York Telecom Network from local municipalities and other Municipality, University, Schools and Healthcare (MUSH) partners. Recent examples of such requests range from adding network connections for existing subscribers (e.g. Town of Newmarket and Town of Aurora), to adding new subscribers (e.g. Township of King) to opportunities to share capital costs associated with building new additions to the network (e.g. Town of East Gwillimbury). While these requests currently appear to make sense for all parties involved, a formalized Council-approved process is not in place to facilitate these requests from regional partners, or to ensure the network is sustainable.

In view of the increased demand for access to the York Telecom Network, a review of the opportunities and challenges associated with the future of the network was undertaken. This review is important due to the fact that the Region has invested millions of dollars into building and operating its fibre network and clarity is required on how to best address the Region's connectivity needs, as well as the role the York Telecom Network should play in advancing the goals of the Broadband Strategy. The review was managed by a working group comprised of staff from the CAO's Office, IT Services, Office of the Budget, Audit, Legal, and Economic Strategy.

The York Telecom Review is being completed in three "Phases"

To ensure the future of the York Telecom Network has been thoroughly analyzed and informed decisions are made regarding its future, the review is being completed in three phases:

1. Phase 1: Governance Model Review (Completed)

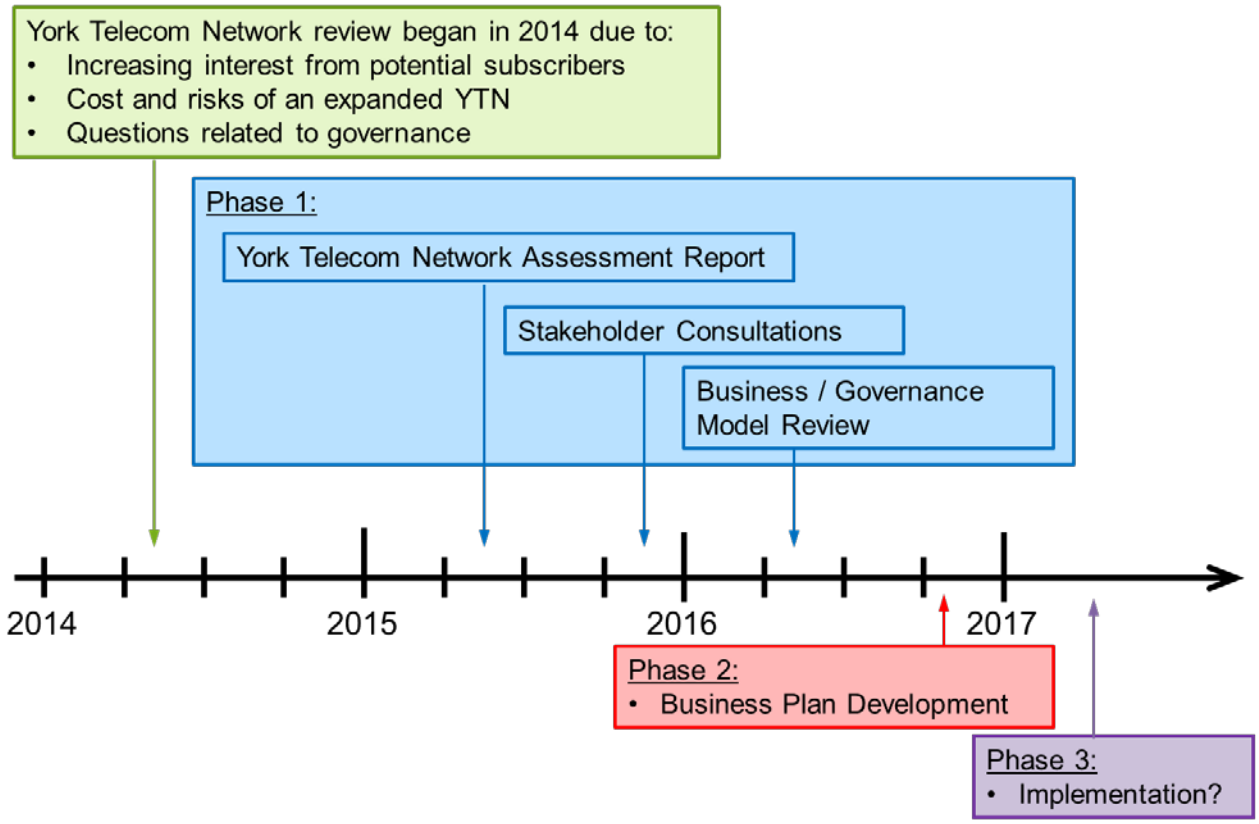
2. Phase 2: Business Plan Development (Pending)

3. Phase 3: Business Plan Implementation (Pending)

Each phase includes a specific set of actions that are required to ensure the review moves forward in a progressive, logical and orderly manner. Figure 2 illustrates the process and timeline for the York Telecom Network Review.

The subject of this report is Phase 1 of the York Telecom Network Review process.

Figure 2
York Telecom Network Review Process



Phase 1 of the York Telecom Network review was completed in three stages

Phase 1 of the York Telecom Network review was completed in three stages and concluded in May 2016. These stages were as follows:

- Stage 1: York Telecom Network Assessment
- Stage 2: York Telecom Network Stakeholders Consultation
- Stage 3: York Telecom Network Governance Model Review

Stage 1: Assessment included a comprehensive study of the current state of York Telecom Network operations

The York Telecom Network Assessment was completed by RedMobile Consulting in partnership with KPMG and Milrad Law. It included a financial analysis, environmental scan, analyses of current operations, and an initial overview of possible business and governance structures.

The work completed by the consultants assessed a range of potential model options. There was indication of positive overall benefits that could be provided by operating the network as a public entity.

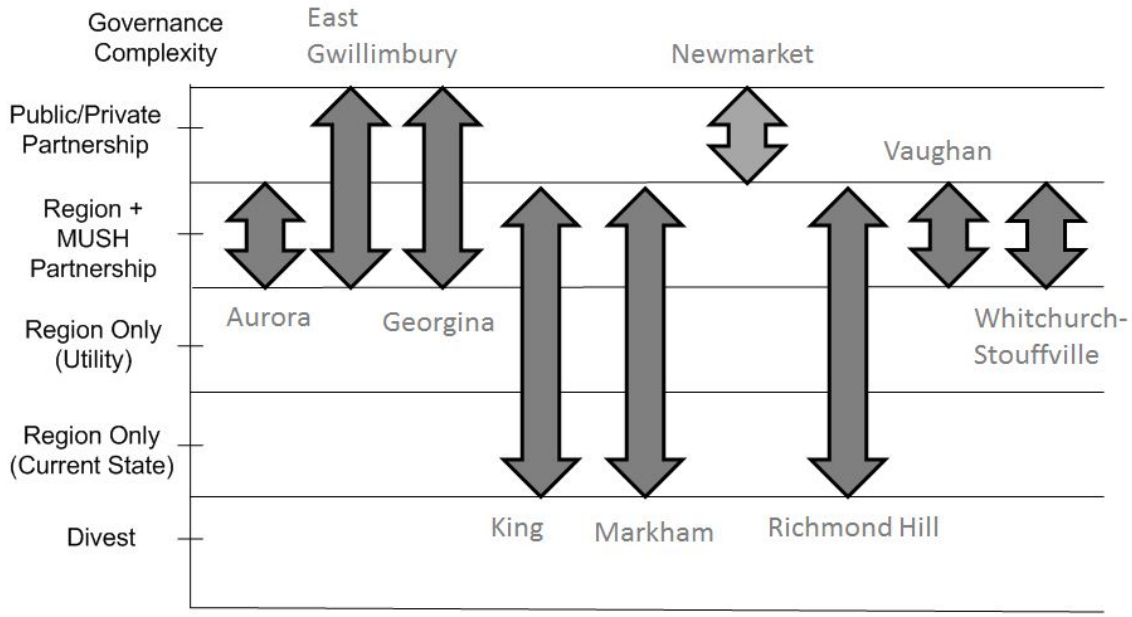
Stage 2: Consultation involved interviewing and surveying internal and external stakeholders

A York Telecom Network Stakeholders Consultation was completed by Prior & Prior Associates Ltd. in December 2015. This consultation involved interviewing and surveying internal and external stakeholders to gather feedback on their experiences with the York Telecom Network and their opinions on possible future directions for the York Telecom Network.

Internal Stakeholders included Regional departments and external stakeholders included all local municipalities, York Regional Police and York Region District School Board. All consultations took place at the staff level and provided insights on the value that the York Telecom Network provides its subscribers, as well as some of the challenges inherent in the current service delivery model.

The consultant's report indicated that stakeholders consider York Telecom Network access important to current and future operations of current subscribers and identified some form of a Regional and public sector partnership model as the most desirable option for the network. Local municipal input is summarized in Figure 3.

Figure 3
Summary of Municipal Staff Preferences on
York Telecom Network Governance Model Options



Source: YTN Consultation, Section 2.13, Page 12 & 13

Stage 3: Governance Model Review involved an evaluation of potential financial projections associated with each of the governance options

In December 2015, IBI Group was contracted to conduct a Governance/Ownership Model Review for the York Telecom Network leveraging the outcomes of both the York Telecom Network Assessment and the York Telecom Network Stakeholders Consultation stages of the overall review.

The Governance Model Review involved an evaluation of potential financial projections associated with each of the governance options using actual and projected financials based on current operations. The financial model was developed in collaboration with York Region staff from CAO's Office, IT Services, Office of the Budget, Audit, Legal, and Economic Strategy.

Table 1 summarizes each of the governance model options included in the analysis.

Table 1
Summary of Potential Governance Models

Governance Option	Description
Privatize/Divest	Involves selling the existing network assets and future reliance on Internet Service Providers (ISPs) to deliver connectivity solutions currently provided by the York Telecom Network
Region Only - Status Quo with Optimal Resourcing	Same as existing, but staffed and resourced appropriately
Region Only - Utility	Same as "Region Only – Status Quo" but pricing will allow an expected rate of return
Region + MUSH Partnership	York Region would share ownership with local MUSH partners to share the benefits and the risks associated with managing the network
Public-Private Partnership	Involves retaining partial ownership of the York Telecom Network and selling a portion to a private sector Internet Service Provider

The Governance Model Review also included a summary of Case Studies, and community impacts of Broadband initiatives from a range of jurisdictions.

Table 2 provides a summary of each Case Study included in the review.

Table 2
Summary of Municipal Broadband Case Studies

	Governance Model	Benefits
Chattanooga and Hamilton County, Tennessee (EPB)	Region Only	Significant impact on business investment and talent attraction, including a new Volkswagen assembly plant in 2011
Coquitlam, British Columbia (Q-Net)	Region Only	Attracting and retaining businesses and investment while enabling competition between Internet Service Providers
Peel Region, Ontario (PSN)	Region + MUSH	Improved administrative efficiency and reduced connectivity costs for Regional Partners
Stratford, Ontario (Rhyzome)	Municipal Only	Improved access to municipal services and a "test city" for autonomous vehicle technologies
Waterloo Region, Ontario (WREPNet)	Region + MUSH	Increased broadband access for public sector while reducing costs

The consultant's report for this stage of the review generated the following recommendations:

1. The York Telecom Network should operate as a separate entity to ensure efficient operations, decision making and financial and performance tracking; similar to York Region Rapid Transit Corporation (YRRTC) and the Housing York Inc.

2. The York Telecom Network business operation should continue to lease its dark fibre capacity to public sector subscribers and consider private sector leasing options to advance economic development objectives, where appropriate.

3. The Region consider developing a governance model for the York Telecom Network that would not preclude adding other public sector partners as network owners.

Attachment 4 contains the consultant's report for the York Telecom Network Governance Review (Phase 1, Stage 3)

Independent studies indicate that municipal government has a role to play in enabling broadband access that promotes economic prosperity

The outcomes from each of the three stages of the York Telecom Network Review provided essential inputs to the many considerations required to make an informed decision for the future role of the network.

Other considerations, from an economic impact perspective, have been assembled through a review of papers from various sources, including:

- International Telecom Union
- Public Policy Institute of California
- Analysis Group
- International Economic Development Council

These papers all suggested that improved broadband connectivity can have positive impact on Gross Domestic Product.

In particular, the 2012 report by the International Telecom Union titled “Impact of Broadband on the Economy” addressed the potential role of government in promoting broadband deployment. The report indicated that government intervention can improve the private sector business case by enacting mechanisms that help telecommunication companies reach the level of critical mass that makes entering the market a worthwhile venture for providers. One such mechanism is infrastructure sharing, which alleviates investment cost pressures on telecommunication service providers.

The report also highlighted the potential impact of broadband on the GDP of developed nations referencing independent studies that suggest that a 10% increase in broadband coverage can result in a 1.3% increase in productivity. This is against the backdrop of managing risks, including: funding limitations; maintaining non-competition with the private sector; and improved operating efficiencies.

In addition to this literature review, staff viewed a number of presentations from various jurisdictions delivered at the 2015 International City Management Association conference in Seattle Washington. These presentations highlighted two key considerations:

- Policy is the key role that government can play in enabling broadband connectivity
- Infrastructure investment does play a role in enabling broadband access, but policies first need to be in place to foster the right environment for investment

The York Telecom Network is already playing a role in enabling broadband access in the Region

The York Region Broadband Strategy identifies the York Telecom Network as a contributor to increased broadband access from the Infrastructure Investment priority area. This asset is already supporting the Region's innovation agenda by enabling significant connectivity into Southlake Regional Health Centre to help establish an ORION point of presence and the build out of a research and education network.

Retaining the York Telecom Network under the control of the Region will continue to make it available to be leveraged to explore these and other opportunities.

Staff recommends pursuing the option to develop the York Telecom Network as a wholly owned Regional subsidiary

Based on this review, Regional staff recommends pursuing the option to develop the York Telecom Network into a Region owned and operated dark fibre network with a business model that allows the future option of joint ownership with Regional MUSH sector entities.

This course of action would allow York Region to continue to influence policy, achieve significant cost savings while improving its connectivity and supporting the priority areas specified in the York Region Broadband Strategy.

Attachment 1 lists the principles that were used to develop the Regional Staff recommendation and which will form the basis for Phase 2 of the York Telecom Network Review.

In addition to guiding principles, a number of other items need to be considered in the business model analysis.

These considerations include, but are not limited to, the following:

- Ownership – Who owns what?
- Business Model – What is the service being provided?
- Financial – Who pays for what?
- Governance Structure – Who is responsible for what?
- Operations – How are the services delivered and payments received
- Target Market – Who are the potential customers?
- Pricing – How are rates established?

When developing the business model, the analysis will also need to consider potential broader roles and impacts of the York Telecom Network, including the potential for:

- supporting economic development in the Region as a whole, and not just as a means to reduce municipal connectivity costs
- enabling wireless communications across York Region
- aiding York Region's development as an Intelligent Community encouraging Internet Service Provider investment via pilot projects

The York Region Broadband Strategy Advisory Task Force provided input on this recommendation at its meeting on March 30, 2016

In providing input on the recommendation outlined, the York Region Broadband Strategy Advisory Task Force noted this approach supports:

- Regional connectivity needs
- the Infrastructure Investment priorities of the Broadband Strategy

  Regional Economic Development

Link to key Council-approved plans

Regional Council has approved a number of strategic documents that provide direction, within the current term of Council and beyond, regarding the significant role that broadband access plays in supporting Economic Development:

- Vision 2051; Fostering an Innovation Economy - to be supported by "Infrastructure and Resources Supporting a Knowledge Economy"
- York Region Official Plan – 2010; Economic Vitality (Chapter 4) - states that broadband-related initiatives support the York Region Official Plan objective "To encourage and accommodate economic activities that diversify and strengthen the Region's economic base, employment opportunities for residents and competitive advantage for its businesses"
- 2015 to 2019 Strategic Plan; Strengthen the Region's Economy - Objective 3: "focusing on networks and systems that connect people, goods and services"
- The Economic Development Action Plan 2016 to 2019 Section C - "Innovation and Entrepreneur Development" – is grounded in the fact that high-speed connectivity promotes economic growth

5. Financial Implications

To date, the costs of the York Telecom Network have been accommodated within the Finance (IT) budget.

By the end of 2015, the cumulative total capital costs for the York Telecom Network had reached approximately $12 million. 2015 operating costs for the York Telecom Network were $137,000 and revenues from subscribers totaled approximately $163,000.

At present, the capital cost of expanding the network beyond 2017 has not been included in the approved 10 year capital plan.

Future costs related to operation of the York Telecom Network will depend on the business model and governance structure chosen, which will be reported as part of the York Telecom Network review. Staff will explore and consider funding opportunities with the Building Canada Fund and other programs as appropriate.

Costs associated with developing a Business Plan will be covered by the Planning and Economic Development Branch budget.

6. Local Municipal Impact

To date, the municipalities of Aurora, Georgina, Newmarket and Richmond Hill, York Regional Police, and the York Region District School Board are subscribers to the York Telecom Network. York Region has also received network connection requests from East Gwillimbury, King Township, King Public Library, Seneca College, York University and other MUSH sector entities.

The recommended course of action would continue to allow local municipalities and various MUSH sector stakeholders to lease access to the dark fibre network and potentially create the opportunity to share in the planning, oversight, ownership, benefit and risk of further developing and managing the network.

7. Conclusion

The York Telecom Network is a network of fibre optic telecommunications infrastructure connecting Regional locations and other assets. It also connects a limited number of other public sector facilities that reside along the fibre pathway.

A review is underway to determine the future use, extent, ownership and governance of the York Telecom Network. Regional staff have concluded that a Region-owned and operated dark fibre network business model that allows the

future option of joint ownership with Regional MUSH sector entities should be advanced.

A more detailed review and analysis is required to develop an organizational structure and financial and business plan for the recommended business model. Staff will report back with a recommended governance model and business plan by the end of 2016.

For more information on this report, please contact Doug Lindeblom, Director, Economic Strategy at ext.71503.

The Senior Management Group has reviewed this report.

June 3, 2016

Attachments (4)

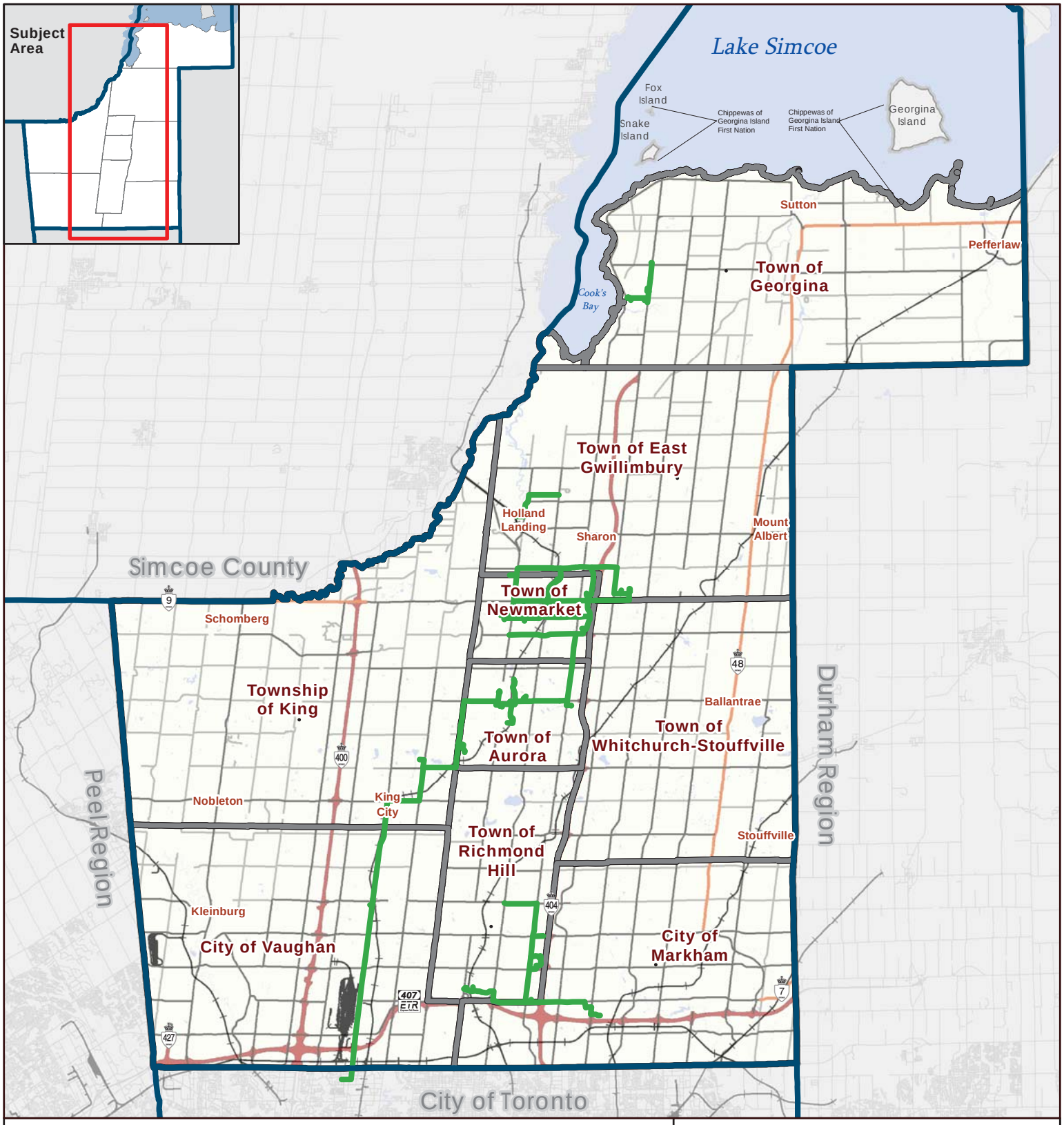
#6796275

Accessible formats or communication supports are available upon request

Guiding Principles for York Telecom Network Business Model Review

Scope of the Network	
Confined within York Region's boundaries	The fibre network will not extend beyond York Region
Limited to dark fibre access only	No lit-services will be provided
Financial Considerations	
Full cost recovery	All financial investments will be recovered within a pre-determined timeframe.
Service Cost savings through cost avoidance	The network will be leveraged to reduce the Region's connectivity service costs that would otherwise be paid to Internet Service Providers (ISPs)
Policy Considerations	
Wholly-owned subsidiary of York Region	York Region will retain ownership and oversight of the network
Support York Region's connectivity needs to the extent possible	The network will be leveraged to connect Regional buildings and other assets
Assist in meeting the needs of local Municipal, University, School and Healthcare (MUSH) partners	Where practical, the Region will partner with local MUSH sector entities to assist them in connecting their assets with optical fibre
Open to the possibility of joint ownership with local MUSH partners	The Region will be willing to discuss sharing ownership of the network with willing local MUSH partners
Primarily public sector subscribers	The network will continue to be designed to serve the connectivity needs of local MUSH entities
Open to pilot projects with third parties including the private sector	The Region will maintain flexibility to enter into pilot projects with local MUSH partners and Telecommunications companies to support Broadband Strategy objectives
Leverage funding and partnership opportunities as appropriate	The Region will explore opportunities with Provincial and Federal funding programs as well as partnership opportunities with the private sector and local MUSH partners
Non-dominant carrier	The Region will retain the network's Non-Dominant Carrier status with the CRTC
Not compete with current Internet Service Providers (ISPs)	The network will not offer services that compete with Bell, Rogers, Telus or other communications services providers
Future-ready, redundant and reliable	Network operations will be appropriately resourced to ensure it is compatible with technological advances, that it is reliable and able to mitigate issues that may cause harm to network infrastructure (e.g. wind storms that damage aerial cables)
Support economic development and growth	The network will be leveraged to enable improved broadband connectivity for businesses, institutions and residents across York Region

Attachment 2



Completed York Telecom Network - December 2015

York Telecom Network Governance Review - June 16, 2016

Produced by:
The Regional Municipality of York
GIS Branch, Corporate Serivces , May 2016

Data Sources:

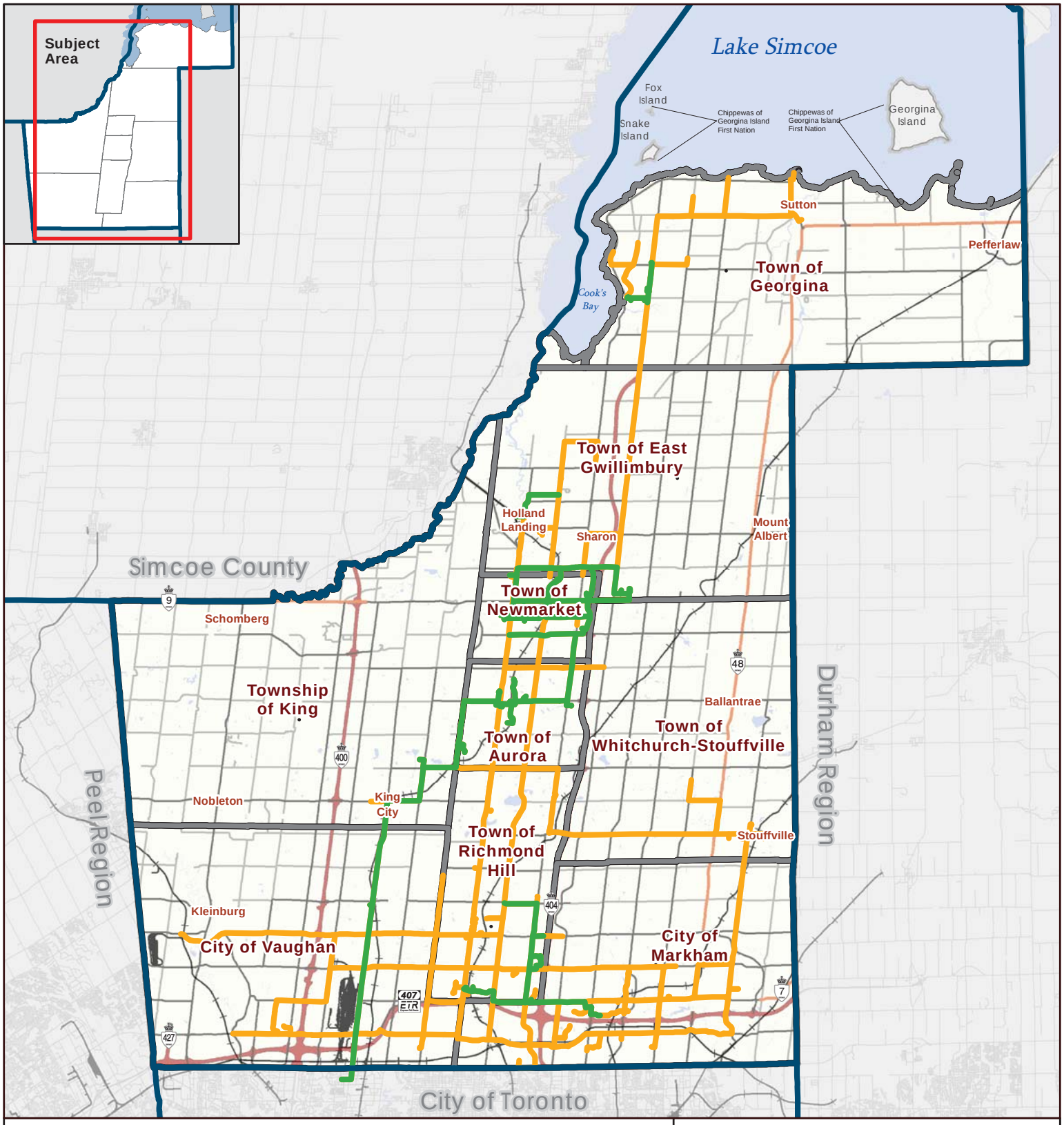
York Region yorkmaps

0 1 2 4 6 8 10 Km

Legend

- Completed Network
- Railway
- Regional Boundary
- Municipal Boundary
- Rural Road
- Regional Road
- Provincial Highway
- Freeway

Attachment 3



York Telecom Network Map - Completed & Planned

York Telecom Network Governance Review - June 16, 2016

Produced by:
The Regional Municipality of York
GIS Branch, Corporate Serivces , May 2016

Data Sources:

York Region yorkmaps

0 1 2 4 6 8 10 Km

Legend

- Completed Network
- Planned Network
- Railway
- Regional Boundary
- Municipal Boundary
- Rural Road
- Regional Road
- Provincial Highway
- Freeway

Report

York Telecom Network (YTN) Governance Model Review and Financial Assessment

Prepared for Planning and Economic Development Branch, Corporate Services Department,
The Regional Municipality of York
by IBI Group
May 18, 2016

Document Control Page

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1 Executive Summary

York Region has been deploying a dark fibre network called York Telecom Network (YTN) across various parts of the Region since 2002. Currently spanning approximately 157 km, the YTN was established with the aim of connecting two Region-owned buildings and has seen considerable growth as the Region has realized the benefits of owning and managing a dark fibre network. Presently, YTN operates under a governance model where the Region is solely responsible for building, operating and maintaining the network, with various local Municipalities, Universities, Schools, and Hospitals (MUSH) partners paying fees in exchange for network access.

Future direction of the YTN has been in question and the Region is now in the process of completing a governance and financial assessment of the asset.

This report builds upon previous work and provides a well-defined and thorough analysis of the governance models under review, which include the following:

- **Divest –** The Region would sell off the YTN assets and enter into a leaseback agreement
- **Region Only (optimized structure) –** YTN would continue to be owned and managed by the Region with subscribers restricted within the MUSH sector
- **Region Only (positioned as a utility)** – YTN would continue to be owned and managed by the Region, but have the option to open up the network to the business community and have a target rate of return to help grow and maintain the network
- **Region + MUSH** – The Region would enter into an ownership partnership with select MUSH partners to build and maintain the network
- **Private Sector Joint Venture** – The Region would enter into a partnership with the private sector to build and maintain the network

Case studies representing a variety of governance models are presented and provide context and benchmarks to the options available to the Region. The analysis includes a number of local networks, such as: Peel Sector Network (PSN); Rhyzome Networks (in Stratford, ON); and WREPNet (in Waterloo, ON).

A number of qualitative factors were analyzed and factored into the review of the governance models, including:

- Control – The ability of Region to maintain control over the assets of YTN and the future direction of the network
- Risks - Financial, operational and partnership risk associated with various governance models
- Economic Development – The ability of the Region to use YTN as a tool for economic development, to attract business and residents to the Region and improve the overall quality of life for members of the Region

A quantitative analysis, including a financial projections template was developed and financial projections for each governance model were also analyzed and evaluated relative to each option. Sensitivity analyses confirmed the results and conclusions did not change under varying input or growth assumptions.

The resulting analysis detailed in this report point to a recommendation for York Region to **continue the YTN program and adopt a Region + MUSH governance model**, with an emphasis on actively inviting more MUSH partners to become subscribers and even co-owners of the YTN.

There is also a recommendation that York Region establish YTN as a separate entity to create a more formal governance approach. **The analysis also concludes that a divesture of the YTN asset would not be recommended**. Both the intangible/qualitative and quantitative benefits support such a direction.

Next steps for the Region include:

1. Seek approval on the governance model option
2. Further investigate setting up YTN as a separate entity (not necessarily a separate legal entity),
3. Begin MUSH stakeholder consultations in order to formally create a Region + MUSH partnership model

Completion of these steps would ultimately lead to developing and implementing a business plan as a basis for YTN to engage MUSH stakeholders and continue the sustainable growth of the network.

2 Introduction

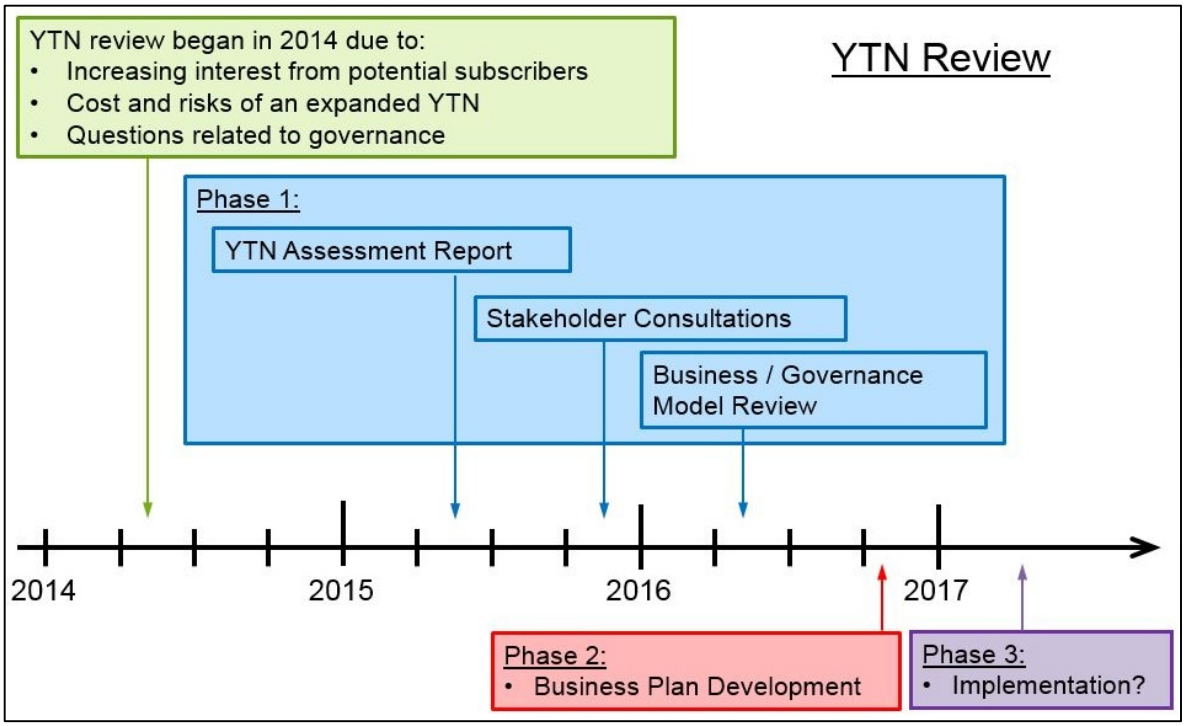
The importance of cost-effective, high-speed connectivity to a community's economy cannot be underestimated – especially in a community like York Region. The Region is known as a global hub for Information and Communications Technology (ICT) businesses, many of which are globally renowned, and is home to a strong entrepreneurial movement within a diverse ecosystem of new and established businesses across a range of industries.

With a highly educated population including an increasing population, and a diversified economy, a broadband network is the underlying enabler in connecting the Region's facilities and Region-owned infrastructure, as well as potentially the businesses and residents who continue to explore global opportunities for businesses, research, education and entertainment. Ultimately, YTN is an important asset that has the potential to further elevate York Region's status as a global economic hub.

The York Telecom Network (YTN) program has been in place since 2002. The program has seen sustained growth since its inception, yet it continues to be managed and resourced at its original levels. The program is at a mature point in its lifecycle where a detailed review of its continued operation is required. This includes a review of potential governance models the program can implement moving forward. As such, the Region has undertaken a detailed review of the YTN.

The exhibit below details the timelines of the YTN program review. This report is the final task of Phase 1. An initial Assessment Report completed by Red Mobile was submitted in July 2015 and Prior & Prior completed a Stakeholders Consultation in December 2015.

Exhibit 1 – YTN Review Timeline



This report delivers an analysis of the various governance models considered for YTN, the corresponding financial projection and analysis for each option, the financial modeling template used, and a recommendation on a way forward for governance of the YTN program. This analysis was performed using telecommunications industry standard approaches, and the same

principles that have been used to analyse other Canadian municipal and utility dark fibre networks have been applied to this analysis. Network and financial data for this analysis was provided by York Region Finance and IT Services staff and these numbers formed the basis of the financial analysis that was completed.

The structure of this report is broken into the following sections:

- Current State of YTN – Provides context to the YTN program from where it started to where it is today.
- Spectrum of Services – Provides an overview of the various telecommunications services a program such as YTN can endeavour to operate. This section is for information only.
- Inputs and Assumptions – Identifies the key inputs and assumptions that factor into the governance and financial analysis.
- Governance Review – Review of the qualitative and intangible considerations for the various governance models reviewed under this report.
- Financial Analysis – Quantitative financial review of the governance models considered for the YTN program.

3 Current State of YTN

York Telecom Network (YTN) is a York Region owned and operated dark fibre-optic infrastructure asset that is positioned towards meeting the connectivity needs of the Region and MUSH (Municipalities, Universities, Schools, and Hospitals) sector. YTN's fibre infrastructure is both underground in conduits, and aerial (i.e. above ground installed on utility poles).

The first fibre optic installation for YTN by York Region was in 2002, with the plan to connect two Regional buildings. The intent at this time was to save the Region's costs of connecting two buildings using a purpose-built and Region-owned dark fibre network versus having a telecommunications service provider connection between the two buildings.

In 2009, York Region identified the potential benefits of a single "cross Region network"[1] with connections between Regional buildings as well as Regional 'things' that include traffic controls & cameras, vivaNext Intelligent Transportation Systems (ITS) and water & wastewater Supervisory Control And Data Acquisition (SCADA) systems. This plan led to further growth of YTN to support various departmental needs within York Region.

In 2011, York Region started adding municipal subscribers to the YTN[1], with the Town of Newmarket being the first[1]. This enabled Newmarket to connect their facilities at a competitive rate while allowing York Region to collect revenues to help off-set YTN operating costs.

In 2013, based on external legal opinion, the Region acquired a Non-Dominant Carrier's license from Canadian Radio-Television and Telecommunications Commission (CRTC) for YTN[1]. Leveraging YTN's fibre optic cable infrastructure, this license allowed the Region to provide telecommunications services to the public for compensation. Since YTN was still working as a dark fibre network primarily for serving MUSH needs, the subscribers had to attach their own network equipment to use the connection. This requirement, along with limiting connections to public sector locations meant that there was no significant impact on the overall telecommunications industry competition with this move. After this transition, YTN subscribers further increased to include the Town of Newmarket (15 locations), Town of Georgina (2 locations), Town of Richmond Hill (3 locations), Town of Aurora (9 locations), York Region District School Board i.e. YRDSB (2 locations) and York Regional Police (6 locations). By the end of 2014, York Region expanded YTN to approximately 79.6 km with 130 connections (50 buildings and 80 other connections)[1].

In 2015, Ontario Research and Innovation Optical Network (ORION) purchased two YTN fibre strands to provide a link between their Points of Presence (PoPs) at York University and Southlake Regional Health Centre[1]. By the end of 2015, the Region expanded YTN to approximately 157 km of fibre optic cable. Of this completed network, approximately 50% was attached to hydro poles (i.e. aerial connections) and the remaining 50% was underground. In many cases, the network deployment was carried out in-conjunction with capital projects delivered by Environmental Services, Transportation Services and vivaNext.[2]

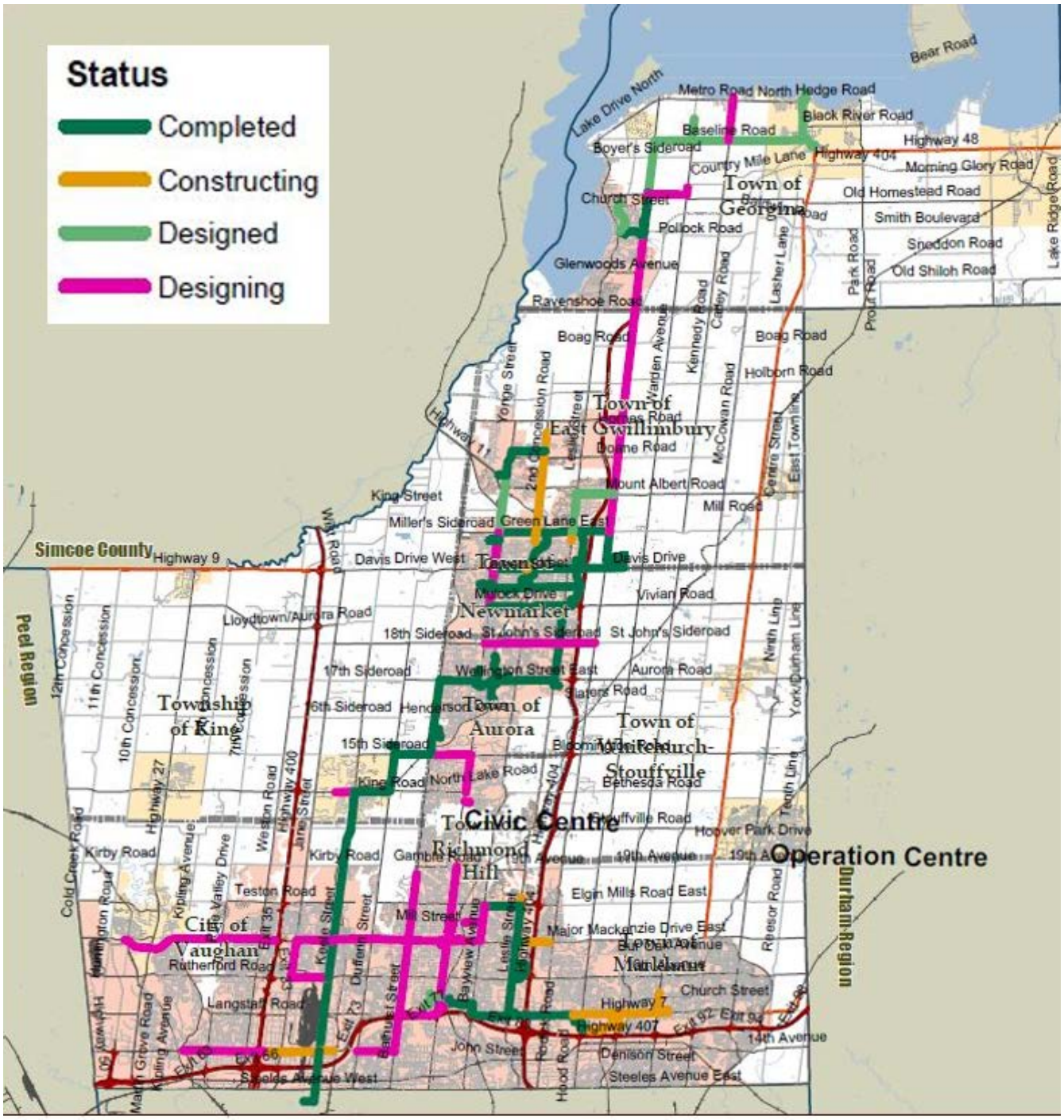
The current and planned YTN fibre builds will increase the total network length to approximately 270 km – of which 78% will be connection to the Regional facilities and "things", and the remaining 22% of connections will be for the local municipalities, libraries and the York Region District School Board. The vivaNext rapidway construction has been identified as one of the main drivers of this YTN expansion. It was estimated that by the end of 2015, vivaNext and traffic control connections represented nearly 60% of all YTN connections; up from 34% of connections in 2013[2].

Overall, YTN has evolved from being a small fibre asset connecting Regional buildings, to a complex operation with a variety of internal and external subscribers and multiple connection types. However, it still only serves a small portion of the total Region's Wide Area Network (WAN) needs. The majority of the Regional WAN connections are managed through contracts

with third-party telecommunications companies. YTN also connects a limited number of other public sector facilities that reside along the fibre optic cable's path. From a governance perspective, YTN is wholly-owned, operated and managed by York Region. Currently it is not a legal entity and has no independent financial performance reporting. Revenues collected from subscribers based on access agreements between the Region and each subscriber flow directly to the Region. Capital construction costs, operational expenses and other operational costs are also funded directly from the Region. Supporting administrative functions (legal, finance, etc.) are also provided directly by the Region. YTN's construction and operations activities are managed by two staff members from the York Region IT Services, with support from project staff in Environmental Services, Transportation Services and vivaNext.

Exhibit 2 shows the status of YTN builds as of the end of 2015. Planned sections of the YTN in this figure are scheduled for completion by the end of 2019.

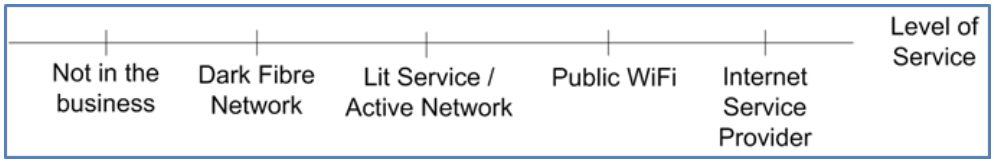
Exhibit 2 – Current and Planned Status of YTN Builds as of end of 2015



4 Spectrum of Services

There are many options for the Region to consider in terms of varying Regional involvement in the ownership and operations of a regional/municipal telecommunications network. Exhibit 3, below identifies the spectrum levels of services which will be further discussed in this section.

Exhibit 3 – Spectrum of Services



In this section of the report, we will examine the various points on the spectrum, as well as wholesale/ retail market opportunities available at each point on the spectrum. We will also discuss the risks and benefits of delivering services at each point on the spectrum from the perspective of the Region. It is for information only.

It should be noted that the analysis provided in this report in reviewing governance model alternatives and providing recommendations is limited to the current Dark Fibre Network services being offered by YTN. Should other service models be contemplated by the Region, it would be important to review the governance model within the context of the services being contemplated.

Wholesale Market Overview

The wholesale telecommunications market exists as a mechanism, typically for facility based network operators to sell telecommunications services to other telecommunications based providers who then resell, in some cases with value added services, to the end users (business or consumer) of the service. Wholesale market providers typically sell larger volumes of their services, in bulk discounts, that allow retail telecommunications provider to mark up and add additional value added services in order to sell these services in the retail market to business and consumers. By the very nature of the services and volumes of services that are sold in the wholesale market, retail businesses and consumers do not typically participate in this market.

Retail Market Overview

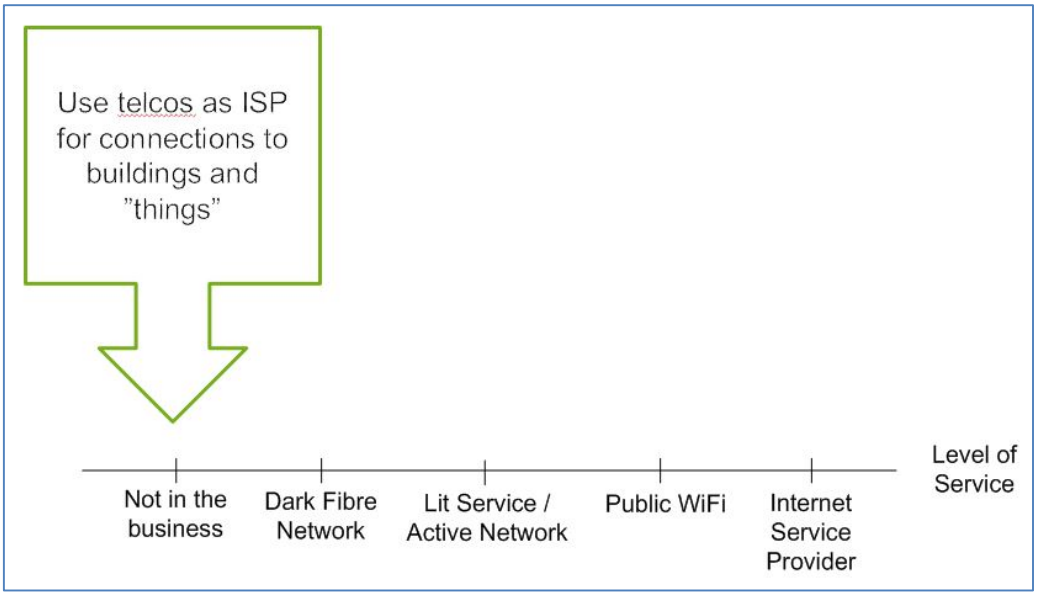
The retail telecommunications market exists as a mechanism for end users (business and residential consumers) to purchase telecommunications services for their use (not for resale). Customers in the retail marketplace have expectations of high levels of customer service and responsiveness to requests for new services, service troubleshooting and repair, as well as billing inquiries.

The discussion that follows presents York Region's opportunities and risks under each of the spectrum of services offerings.

4.1 Not in the Business

Exhibit 4 illustrates where Not in the Business lies on the spectrum of services.

Exhibit 4 – Not in the Business



Under this scenario, the Region would purchase all the connectivity services it requires from commercial telecommunications providers, at the broadband speeds and prices currently available in the current marketplace.

Benefits and Risks

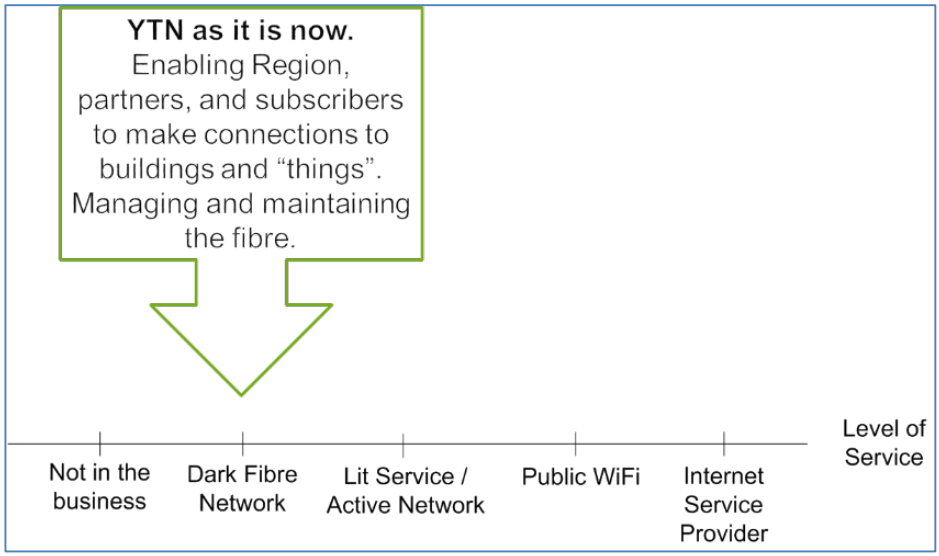
This option has the benefit of no investment being required.

However, there is a risk that places the Region at a comparative disadvantage if commercial telecommunications providers do not make investments in fibre optic infrastructure to support the needs of the Region. Furthermore, since the YTN network is already in operation, relinquishing the existing communications infrastructure results in further cost risk, by removing the Region's control over some cost components. Additionally, the Region will experience strategic risk, whereby the Region will not have control over the geographic location of further resources (for example, along the BRT lines) and may have to explore alternative connectivity options for technology assets along these corridors.

4.2 Dark Fibre Network

Exhibit 5 illustrates where Dark Fibre Network lies on the spectrum of services.

Exhibit 5 – Dark Fibre Network



The Regional Municipality of York, under the YTN program has constructed and maintains a dark fibre network to meet the connectivity needs of the Region as well as select subscribers. This network is being constructed using a combination of aerial and underground (buried conduit) construction techniques to connect various Regional locations requiring dark fibre connectivity. The dark fibre network is constructed as a passive or 'dark' fibre network, meaning that the Region provides a network consisting of fibre cable and strand connections configured to connect individual locations to each other, and in some cases back to a centralized connection point in order to facilitate hub-spoke connectivity requirements. It should be noted that additional electronics are required to be added, by the Region or select subscribers, to the fibre optic connections in order to 'light' the fibre and enable the transmission of broadband signals required for each Regional application or connectivity need.

Under this scenario, the Region would continue to invest the construction of dark fibre networks to support its connectivity needs and the needs of any current subscribers / stakeholders. Using Region connectivity requirements as a network anchor / backbone, and installing additional duct and fibre capacity at the time of construction, incremental extensions to the Regional network could be made, driven by private sector commercial demand. The Region could effectively enter the wholesale telecommunications business, by selling capacity to retail telecommunications providers. While the Region has chosen to focus on the needs of itself and other public subscribers/stakeholders to this point, it would be possible for the Region to offer dark fibre access to the wholesale or retail telecommunications market. These are discussed below.

Wholesale Market

In general, there is a viable wholesale market for dark fibre services. Potential market participants include incumbent carriers such as Bell and Rogers, in locations where they may have the need for additional fibre connectivity, as well as competitive local providers such as Vianet, Xplornet, et cetera.

Retail Market

There is a limited retail market for dark fibre services. These include other public sector clients in the "MUSH" sector, provincial and federal government departments, law enforcement agencies, electric utilities, etc. Private sector clients include electric utilities, owner/operators of data centers and large commercial enterprises (banks, insurance companies, etc.) that operate multi-location businesses within the municipal region. The purchase of dark fibre services

requires a certain level of sophistication from clients that would include having the expertise to purchase configure and install broadband electronic equipment to allow them to take advantage of the dark fibre connectivity service.

Benefits and Risks

The benefits of a dark fibre service include a simplified technology and services model that only requires physical fibre connectivity be constructed and maintained. This greatly simplifies the ongoing operational requirements for the network operator. There is very limited technology risk in that fibre optic technology has proven long term viability and longevity. Risks with dark fibre services include the overall investment risk of the high initial cost of construction, as well as a risk, over time, that connectivity requirements of the Region change as public buildings / locations are relocated due to a variety of factors. There is also the risk of fibre relocation being required due to road construction / widening or utility pole relocation.

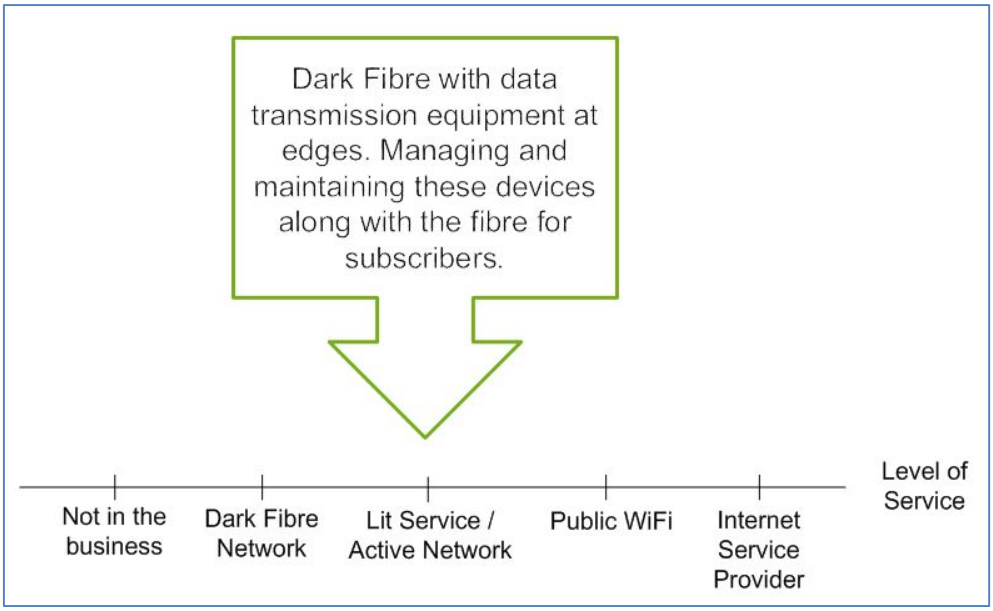
This option also provides the benefit of stimulating the opportunity for increased competition for broadband services as it would allow telecommunications resellers to develop and offer services based on a fibre optic network. Incumbents are likely to respond in the form of additional network investments and capacity to maintain their existing market share. The Region retains local control over its assets and this scenario leaves options open for the Region to both expand the network as needed, or enter the retail telecommunications market in the future. Since ducts and dark fibre have low operational requirements, the Region does not require a large investment in operational staff to pursue this option.

Risks with this model are primarily financial. The cost of construction presents a risk that can be managed through diligent procurement and construction management. However, there is a longer term risk of demand for wholesale services not meeting initial forecasts, or competitive forces creating price pressure on wholesale services. This may result in underutilized or stranded network investment in the longer term; however this risk is mitigated by the Region's focus on building in areas in which it has a specific need.

4.3 Lit Service / Active Network

Exhibit 6 illustrates where Lit Service / Active Network lies on the spectrum of services.

Exhibit 6 – Lit Service / Active Network



This scenario would see the Region making an additional investment beyond building fibre optic networks to implement electronics to activate a broadband network for the use of subscribers, as well as potentially offering broadband services to the wholesale and retail telecommunications market. Typical 'lit' service offerings would be various speeds of IP (Internet Protocol) based connectivity as well as IP based point to point connection services, enabling the transmission of data, voice and video traffic between locations, or in a hub/ spoke structure to connect many distributed devices (such as video cameras, dynamic message signs, traffic control devices) to a centralized location.

Wholesale Market

In general, there is not a viable wholesale market for lit services offered at this scale. Potential market participants look to create a value add by enabling services on top of a dark fibre infrastructure. Some smaller resellers may have interest in purchasing/ supplying broadband connection services to offer to their retail clients.

Retail Market

There is a large market for retail services and there are many highly sophisticated retail competitors in this marketplace. These include Bell, Rogers and other providers. Entering the retail market requires a high degree of marketing, operational and customer service sophistication to effectively compete.

Benefits and Risks

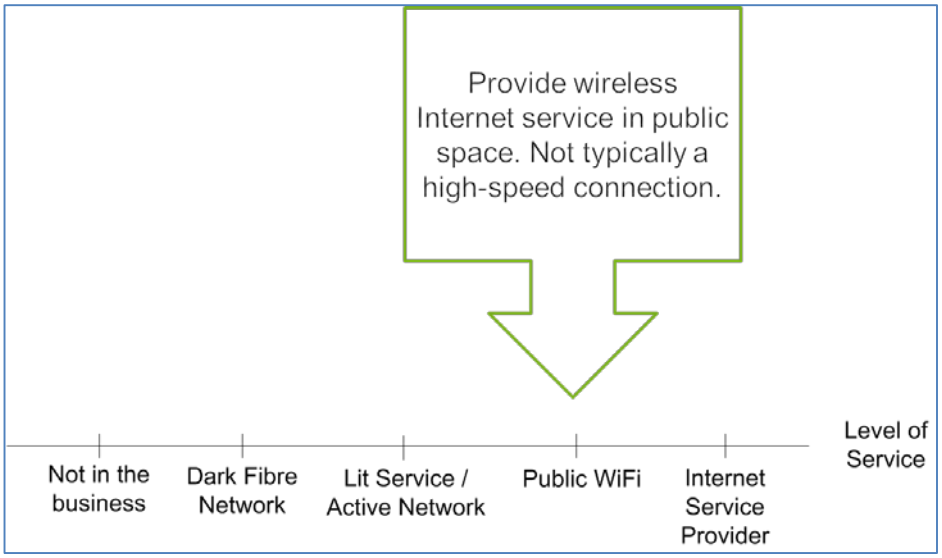
This option provides the benefit of lowering the level of sophistication and investment for subscribers of the network to connect and achieve desired levels of broadband connectivity.

In addition to the risks discussed with dark fibre services, risks with the lit services model include financial, technology risk as well as operational risk. There is an overall financial risk with the additional investment of electronics equipment to create lit services. In addition, the rate of change, improvement and advancement of fibre optic transmission equipment is high, and this equipment typically has a commercial viability of five years or less, creating the need for additional funding cycles for technology refresh requirements. Operating lit network services requires additional technological sophistication from the network operator to perform network management, troubleshooting, maintenance and maintain network security. This will require additional staff with increased and ongoing levels of technology training. York Region would not be able to provide this level of service without a significant funding influx and shift in operations.

4.4 Public WiFi

Exhibit 7 illustrates where Public WiFi lies on the spectrum of services.

Exhibit 7 – Public WiFi



This scenario is a special case of the lit services scenario where public WiFi hotspots would be deployed and activated based on the requirements identified for the Region for connectivity. Locations could include public buildings, transit facilities, parks, recreational facilities. Members of the public could connect to this service using computers, smartphones or tablets for the purpose of connecting to the internet. In order to minimize the costs associated with this service, most providers (Regions/Municipalities) restrict the speed of these offerings, limiting the ability of end users to perform video streaming or other applications requiring high bandwidth and low latency. Providers also restrict the connection time of these services, causing users to be automatically logged off after a defined period of time (e.g. 30 or 60 minutes) or create a subscription based model where the user pays beyond this time. This enables network capacity to be available for other users. Most public WiFi offerings also track user consent / agreement to abide by a defined code of conduct, preventing the connection for being used for illegal / immoral activities. Some public WiFi offerings are supported by advertising or marketing programs, forcing the user to view advertising in the sign up process, or by forcing the user to provide their mobile number in the process of network login. The mobile number is then retained for future marketing uses via SMS (i.e. text) messaging or other platforms.

Wholesale Market

In general, there is not a viable wholesale market for public WiFi services.

Retail Market

There are a few competitors in the retail market for public WiFi services. These competitors rely on either advertising revenue or offer the service as a free value add differentiator to their existing customer base.

Benefits and Risks

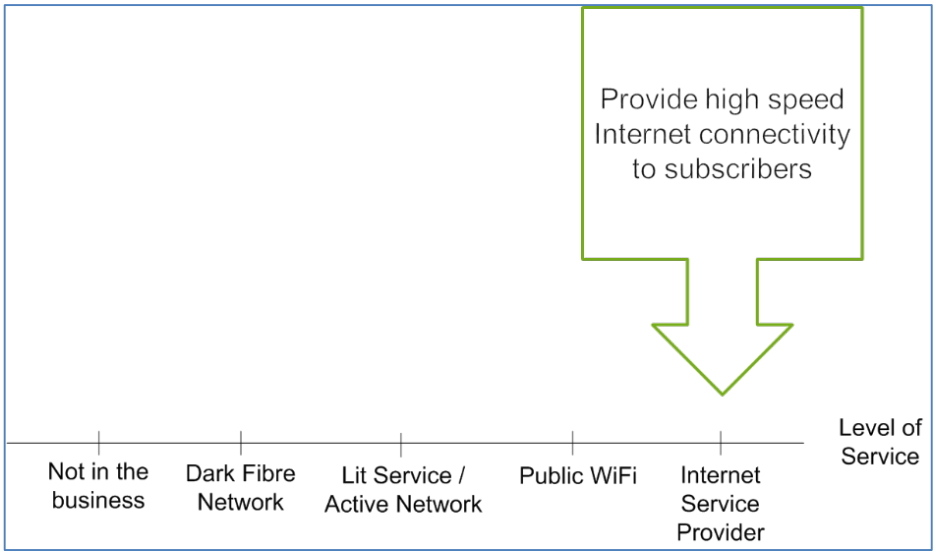
This option provides the benefit of providing publically funded broadband connectivity in many Region locations, potentially funded in whole or in part by advertising, encouraging citizens to use public facilities and creating an improved citizen experience. This approach also supports the migration of many civic services to on-line platforms and encourages the citizens to use these forums to interact with the Region in a more effective fashion for both parties. The proliferation of public WiFi may also accomplish social policy objectives for the Region in the form of providing free internet access through public kiosks or workstations in public buildings.

Risks of this service offering include: the financial risk of investing in WiFi electronics; the operational risk and complexity of operating and maintaining such a service; managing citizen complaints of service quality and coverage; and challenges associated with any partners that are selected to managing revenue from advertising and marketing programs.

4.5 Internet Services

Exhibit 8 illustrates where Internet Services lies on the spectrum of services.

Exhibit 8 – Internet Service Provider



This scenario would see the Region making an additional investment beyond building fibre optic networks to implement electronics to activate a broadband network for the use of stakeholders/ partners, as well as potentially offering broadband services, including Internet connectivity to the wholesale and retail telecommunications market. Typical service offerings would be various speeds of Internet connectivity as well as IP based point to point connection services, enabling the transmission of data, voice and video traffic between locations, or in a hub/ spoke structure to connect many distributed devices (such as video cameras, dynamic message signs, traffic control devices) to a centralized location were Internet access would be aggregated and shared.

Wholesale Market

In general, there is not a viable wholesale market for Internet services offered at this scale. Wholesale Internet providers rely on much larger volumes of traffic in order to generate economies of scale in distribution. Some smaller resellers may have interest in purchasing/ supplying internet or broadband connection services to offer to their retail clients.

Retail Market

There is a large competitive market for Internet services and there are many highly sophisticated retail competitors in this marketplace. These include Bell, Rogers and other boutique providers of high end Internet such as Hurricane Electric and others. Entering the retail market requires a high degree of operational and customer service sophistication to effectively compete.

Benefits and Risks

This option provides the benefit of lowering the level of sophistication and investment for users of the network to connect and achieve desired levels of Internet connectivity. It also allows for aggregation of Regional demand for Internet connections and the purchase of Internet capacity

in bulk, reducing Internet transit costs across the Region. However, this would require York Region to incur increased capital costs.

In addition to the risks discussed with the other services noted above, risks with the Internet Service Provider (ISP) model include financial, technology risk as well as operational risk. There is an overall financial risk with the additional investment of electronics equipment to create Internet service provider services, as well as the risk of committing to Internet transit volumes that may not be required or fully utilized. In addition, the rate of change, improvement and advancement of fibre optic transmission equipment is high, and this equipment typically has a commercial viability of 5 years or less, creating the need for additional funding cycles for technology refresh requirements. Operating ISP services requires additional technological sophistication from the network operator to perform network management, troubleshooting, maintenance and maintain network security. This will require additional staff with increased and ongoing levels of technology training.

5 Inputs and Assumptions

The scope of analyzing a governance model review for a program such as YTN can be extensive. There are numerous business directions an agency can take on (including a range of services as noted in the previous section). There can also be guidelines imposed by senior management, finance, and others that create some constraints. As such, and for the purposes of placing boundaries around this report's analysis, a number of assumptions have been made for this YTN assessment.

The following key inputs and assumptions were provided by and developed in collaboration with York Region staff, and were used for this analysis:

Non-Financial Assumptions

1. YTN is assumed to be a dark fibre network for all public-public options presented
2. YTN is a separate entity in all options (except Divest)
3. YTN is assumed to retain non-dominant carrier status
4. It is assumed YTN will have no intention to compete against established retail service providers for the public-public options
5. Partnership will be limited to MUSH for Region only and Region + MUSH options
6. Business and residential community connectivity is assumed to be "closed" (i.e. not an option) for Region only and Region + MUSH governance options
7. Business and residential community connectivity is assumed to be "open" for Region as a utility and public-private options

Financial Assumptions

Majority of financial numbers have been extracted from YTN spreadsheet v30 which was provided by York Region.

1. Analysis period of 10 and 30 years are selected based on discussions with York Region
2. Variable Discount/ Inflation rates were provided by York Region Finance team
3. Cost recovery is analyzed for 0% ROI (non-profit) for Region/MUSH options
4. It is assumed that privatized sale is total capital cost spent to date minus sinking fund depreciation – calculated to be approximately = $8.4M
5. Installed fibre at the beginning of 2016 is taken to be 157 km. Installed fibre at the beginning of 2026 is assumed to be 400.25 km, based on York Region IT Services projections. This growth rate is extrapolated linearly beyond 2026, with a maximum value of 800km.
6. Construction cost per km = $80,000, based on current costs
7. Buried fibre vs. aerial fibre is split 50/50, based on the current ratio
    a) Buried maintenance cost = $1,569 per km
    b) Aerial maintenance cost = $1,158 per km
8. One-time fee per connection value is variable across the cost recovery models and timeframes selected
9. Fee per km is variable as per cost recovery model and timeframe selected
10. Service cost per connection is assumed to be:

a) 2016 = $9,783 per year

b) 2026 = $5,354 per year

This value remain constant after this point. These figures were developed on the basis of average cost to operate existing service at all connection points in each year.

11. Number of connections (beginning of 2016) are as following:

    a) York Region = 134

    b) External (MUSH and other connections) = 40

    Projected connections in 2026 are variable based on governance model, and future connections are extrapolated from the 2016 and 2026 values.

12. Fee km (beginning of 2016) are as following:

    a) York Region = 260

    b) External (MUSH and other connections) = 107

    Projected fee kilometres in 2026 are variable based on the governance model, and future fee kilometres are extrapolated from the 2016 and 2026 values.

13. Sinking fund length = 70 years

Further information on the financial assumptions are detailed in the Financial Review section.

6 Governance Review

This section presents a review of the governance models that are considered for the YTN. Before reviewing the governance analysis, it is important to summarize and understand the "what", "how" and "why" before detailing the governance analysis.

"What" the YTN program currently is has been defined as a dark fibre network that was originally deployed in effort to reduce operating costs and challenges with telecommunications providers' level of service. "What" now is being looked at to enhance the Region's connectivity needs with smart city initiatives, create and sustain economic development, and enable the Region's local municipalities to have better operating cost control and better quality of service for their telecommunication services.

"How" to enable and manage YTN are the governance model alternatives that are under review within this report. Governance, in the context of YTN and this report, is the organizational ownership and structure that enables the program to operate, report, manage finances, risks, and resources, as well as make tactical and strategic decisions in the best interest of YTN and the Region overall.

"Why" is the need to validate and confirm YTN's mandate prior to continuing to invest in and expand the network beyond the original mandate of providing connectivity to meet the Region's administrative and operational needs. YTN has been able to help meet the connectivity needs of the Region (and its subscribers) in a cost effective fashion and has been able to create a subscriber base and a network that is quite sizeable. Through the YTN network, the subscribers are also able to realize the benefits associated with a 'connected' network. A network such as YTN can be positioned as the underlying enabler to create and sustain economic growth and benefits for municipalities and the Region.

Creating a Formal Governance Model

The implementation of a selected governance model will, in most cases take the form of a selection of a Board of Directors (in the case of a stand-alone/ arms-length corporation), or a senior level Steering Committee that is tasked with guiding the strategy and managing the financial and operational performance of YTN. Representation on the Board or Steering Committee would normally be chosen based on the Region's equity in YTN (relative ownership of assets compared to other MUSH or private sector partners) as well as functional representation/ management expertise in the areas of finance, network planning/ operations, marketing and economic development. It could also involve representation from various partners that are a part of the YTN build, operations and maintenance activities.

The Board or Steering Committee would normally receive recommendations from other committees or groups that would be focused on (i) Network Planning and Operations (ii) Business Planning and Operations as well as any other functional/technical/ management focus that is determined to be required. Representation on these committees or groups would be chosen based on functional expertise as well as relative ownership/ representation from MUSH or private sector partners.

Once the Region has confirmed the desired governance model, the actual governance mechanisms/committees and decision making/voting rights would be identified in the articles of incorporation/association and/ or the business plan that is recommended as a next step. This would be completed in Phase 2 of the ongoing YTN review.

In the following section, details of various governance models that can be considered for YTN are presented. Relevant and recent case studies are also presented in this section providing some context to how YTN can be governed.

6.1 Governance Models

The governance models can be characterized into three broad areas: 'Sell/Divest' which includes selling the existing fibre asset to the private sector, 'Public-Public' which includes participation only from public sector entities, and 'Public-Private' which includes participation by both the public and private sector:

1. Sell/Divest:
    a. Sell to Private Entity and Leaseback
2. Public-Public:
    a. Region Only (optimized structure)
    b. Region Only (positioned as a utility)
    c. Region + MUSH
3. Public-Private:
    a. Joint Venture – Public/Private

The following sections provide further context and discussion on the governance model options noted above. A detailed matrix evaluating each of the governance models is included in Appendix A.

6.1.1 Privatization/Divestiture:

In this model, there would be a divestiture or privatization of the existing YTN whereby a private sector will most likely take the ownership, control and all associated operations of the YTN. The Region would sell its YTN asset to a private sector purchaser for a fixed price. However, there will be a need to establish a leaseback agreement with the private sector purchaser for the Region or its MUSH sector subscribers to continue to use the existing portion of the YTN.

Most private sector purchasers will be looking to make a return on their capital investment, so subscriber fees would likely be increased to account for profit (in addition to full cost recovery). The Region will likely have very limited control in directing any of the future builds of the YTN. Future builds will likely be targeting 'for-profit' deployments and not necessarily serving any underserved areas of the Region. Ultimately, since the private sector will completely take over the control of the YTN, there is likely to be a potential risk associated with the reputation of the YTN from the perspective of a changed mandate from its original vision and service levels that current subscribers are accustomed to.

In addition, York Region would have no control over when and where fibre builds would take place, and the impact of the York Region Broadband Strategy would be diminished.

6.1.2 Public-Public Governance Models:

Region Only, Region Only – Positioned as a Utility, and Region + MUSH are the three sub-models presented and reviewed in this report for the Public-Public governance model options. They offer varying levels of support for the York Region Broadband Strategy.

In general, these options maintain public ownership with the Region and potentially joint ownership with the MUSH sector.

6.1.2.1 Region Only (Optimized Structure)

Under this model, YTN will continue to be owned, operated and controlled by the Region with subscribers restricted within the local MUSH sector network. Complete control of the network

will continue to be with the Region. However, the overall structure and operations of YTN will be optimized from the current state per the details provided as part of this section. In the current structure, York Region does not track the financial performance of YTN separately. As an optimized structure, YTN would be established as a separate entity to more effectively view YTN's financial performance including the revenues and expenses. In this governance model, the YTN would continue to be built and leveraged primarily for the Region's needs.

YTN can continue to be positioned as a dark fibre network within the Region. Two types of subscribers will exist in this model – Region departments that contribute in the capital costs of the network, and the subscribers within the MUSH sector that pay an annual fee for using the YTN. The dark fibre network is used to connect buildings, traffic signals, 'things' that are all either Region owned, or owned by the respective subscribers from the MUSH sector. No local businesses or residential dwellings will have access to the YTN network, which will prevent any direct competition within the telecommunications industry outside of the MUSH market.

To support additional expansion of the network, the Region can also leverage funding from various capital projects including vivaNext and other publically funded initiatives, beyond the budget from Information Technology (IT) services. Through these implementations, YTN can also overbuild and lease excess conduits to the subscribers or other entities while owning an asset that will be hard to acquire otherwise (leasing services from telecom service providers).

With a focus on Region only needs, YTN will be dependent primarily on funds from the Region or associated initiatives and therefore may have a limited growth potential that is directly proportional to the availability of funds. Connections to additional subscribers (e.g. MUSH sector) will only occur if the new subscribers have a connection need that is geographically aligned with the Region's own needs. Further, the subscribers that pay on an annual basis are the only revenue contributors. The network implemented is a capital investment by the Region and as a minimum, the Region should aim to meet its operating costs through the revenues obtained from the subscribers. Ultimately, the Region would need to recover all its capital and operating costs through the fees charged to the subscribers. Therefore, the Region may need to increase the fees charged to subscribers to meet the financial operating requirements. However, since the subscriber is generally not a part of the overall vision of YTN from a network footprint perspective and there is no direct mandate to connect subscribers while planning for the network expansion, it may be hard to have a minimum number for target subscriber generated revenue.

YTN through its network deployment can also act as the infrastructure enabler for intelligent communities/ smart city initiatives. This can be achieved by connecting 'things' within the Region for municipal/Regional infrastructure and by targeting areas where there is low broadband penetration. In today's economy, broadband penetration is directly proportional to economic growth and development. The areas where there is low broadband penetration within the Region can be served by YTN's conduits that can be leased to telecom service providers that are generally not interested to provide advanced broadband services to communities that do not have a dense population. With this model, economic growth and development via enhanced broadband penetration and connectivity of 'things' is achievable as YTN is not positioned as a 'for-profit' business.

6.1.2.2 Region Only – Positioned as a Utility

In this model, YTN would still be owned, operated and controlled by York Region and will include MUSH subscribers. However, beyond the MUSH subscribers, YTN can also target businesses as subscribers for this network. This model would allow YTN to be positioned as a utility, which means that YTN can have a target rate of return every year that can be tracked against the actual financial performance. If the rate of return is not achieved in any given year, YTN may have the flexibility to increase its fees that it charges to its subscribers. With this model, YTN

can also take a key role in providing advanced broadband infrastructure and enhanced broadband connectivity to MUSH sectors that is required for enabling business investments and economic development in York Region. It can also serve as a wholesale network whereby it can lease additional conduits and fibre strands to other telecommunications service providers.

Generally, the benefits noted above for Region Only model also apply to this governance model. The key difference is that the YTN as a utility would have more flexibility to charge subscriber fees with a view to generating a positive rate of return. These revenues could be used to fund network expansion and additional subscriber connections, thereby lessening reliance on Regional capital funding, and to potentially target businesses as subscribers creating additional value for the Region.

6.1.2.3 Region + MUSH

In this model, some of the subscribers of the MUSH network will act as partners, funding construction of new YTN connections to their desired locations/geographies as well as having governance (decision making) inputs into the overall direction of YTN's future expansion and ongoing operations. YTN would continue to offer dark fibre services but there would also be a focus on marketing the network to the potential MUSH partners. In turn, the MUSH sector partners can decide if they want to be owners (i.e. financially invest in building and managing the YTN) or act as subscribers where they only pay an annual fee for using the network. Beyond the budget received from capital projects, and other public sector initiatives, there will be a potential to receive additional funds from the partners which would further result in a more planned network expansion that is targeted towards meeting the needs of MUSH partners and subscribers. With the increased number of potential partners and subscribers (compared to the Region only model), there is an enhanced growth potential for the network with this model. This would result in the MUSH partners having some control of the overall YTN decisions and priorities for network expansion. With more potential partners on-board, there is a need to consider the partnership agreements and decision making mechanisms in such a way that mutually benefit both the partners.

Since this model would likely require some marketing to the MUSH subscribers and potential partners, there may be a need to include staff roles for marketing within the Region. Similar to the Region only governance model, there will be no retail (business or residential) service offerings in this model.

6.1.3 Public-Private Joint Venture Governance Model:

A Joint Venture model will include the active participation by the private sector along with the Region for the ownership and operations of YTN. With the participation of the private sector, this model would enable active marketing of YTN with a target market of all potential subscribers (with wholesale and retail service offerings). Essentially, YTN could choose to compete within the retail telecommunications industry among other players like Rogers, Bell, and other telecommunications service providers by offering a suite of services over the YTN network, or could choose to limit its competition to the wholesale telecommunications market with a limited suite of services. The Joint Venture will be responsible for development, control, operation and future expansion of the network. The capital and the operating cost of the build will be shared between the private sector and the Region. Typically, the interest of a private sector participant is 'for-profit' business and accordingly, it is more inclined to build a network in areas where there is a larger density of population for a quick revenue turnaround. Although the Region would have an economic development focus, the private sector partner's push for profits may prevent or delay network growth in underserved areas. Overall with the Joint Venture, YTN is likely to focus on a combination of economic development through broadband infrastructure and profitability with the business. This will require a mutually established vision and goals of the YTN in terms of the current builds and future plans.

Driving the 'for-profit' part of the model, would require a strong focus on active marketing. Like any other telecommunications service provider, the Joint Venture will have to actively market its services to the broader potential subscribers that could include both retail and wholesale markets. The Joint Venture may also be able to interface with other service providers for additional services including data centre connectivity along with the ability to become a wholesale Internet Service Provider (ISP) and offer lit services (beyond the dark fibre services). Because of the private sector participation, the Joint Venture would have access to additional funding compared to the other 'Public-Public' models. The private sector will have to rely on financial instruments including debt and equity to facilitate the funding but the Joint Venture together will have shared risks associated with the external financial borrowing. Because of the external financial borrowing and participation from the private sector, the Joint Venture would have to drive a target based strategy that will require a minimum number of subscriber base every year to recoup the financial investments and result in a financial profit/surplus for the overall Joint Venture. However, with the private sector participation on funding and governance, the Region would have comparatively lower control in terms of the ownership and direction of YTN. The private sector partner would have its own human resources to suit the requirements of this model beyond the resources required by the Region. This model would also need to establish a strong business case in terms of the roles and responsibilities, financial contributions, rates of return (for private sector) and other non-tangible benefits, key performance indicators and an exit strategy among other critical parameters.

6.2 Case Studies

This section presents the case studies of networks that are operating in other parts of North America, and share attributes with the YTN network. Each of these case studies can be aligned with the potential governance models that have been detailed in Section 6.1. Considering the timelines of the project, the information presented as part of the case studies has been primarily obtained through secondary research only. Please note that additional case studies have been provided as part of the matrix in Appendix B.

6.2.1 Rhyzome Networks – Stratford, Ontario

Rhyzome Networks is a data infrastructure utility which is owned by the City of Stratford. It operates independently while being a part of Stratford's overall broadband strategy for economic development. It launched as a commercial and residential Internet Service Provider (ISP) in 2011 to the public in the City of Stratford. Rhyzome Networks operates a 70km loop[3] of data transmission optical fibre cable running throughout the city, and has built a city-wide wireless network that accesses the fibre grid to provide mobile high-speed Internet access through Wi-Fi at over 400 access points across the city and six smaller rural communities[4].

Rhyzome Networks developed a city-wide wireless network using wireless mesh technology as part of an initiative to connect all the residential and commercial energy meters, which were installed in the city. Rhyzome Networks further became a wholesale service provider for fibre and Wi-Fi to other ISPs in the region as well. Services like dark fibre, lit fibre and co-location (for other service providers) are also provided by Rhyzome Networks.

Governance Model – Municipal Only

Rhyzome Networks is a subsidiary of Festival Hydro Services Inc. (FHSI)[5], which itself is owned by the City. Rhyzome Networks was originally created to meet the demands of the Provincial government's mandate to switch all residential energy meters to smart meters. By leveraging

the infrastructure developed to connect all smart energy meters, Rhyzome Networks started offering broadband and Wi-Fi services to other ISPs and the public.

Rhyzome Networks worked in collaboration with private parties including Motorola and Solution Inc. to build a city-wide wireless network. A city-wide municipal services network based on Motorola's 802.11n Mesh Wide Area Network (MWAN) technology was used by the city that supported both smart metering and high-speed mobile Internet access[6]. Further, the city works in collaboration with Solution Inc., which is responsible for billing, location based marketing and registration of users over the Wi-Fi Network[7].

Financial Indicators

$1.2 Million was invested by 2009 in fibre optic network by the City[8]. Financial statements of Rhyzome Networks are published as a part of Festival Hydro Services Inc. (FHSI). Last financial statement was published in 2015.

Benefits to the Community

Rhyzome Networks has been one of the initiatives taken by City of Stratford for their Smart City Programme. Wireless broadband initiatives have been able to stimulate economic growth by attracting and retaining businesses. Since the deployment of wireless networks was planned as part of smart metering network, it has been beneficial in promotion of electricity conservation, and accurate forecasting and billing for residents and businesses among other benefits. Through the high speed wireless network, the entire community has access to all of city services, library and other local services electronically which has further improved the inclusiveness of the community. Stratford is also a strong candidate for testing of self-driving cars due to availability of city-wide wireless network and was recently featured as a 'test city' by the CBC[9].

6.2.2 WREPNet – Waterloo, Ontario

WREPNet (Waterloo Region Education and Public Network) is a partnership between the Region of Waterloo, City of Kitchener, the City of Waterloo, the City of Cambridge, the local school boards, Waterloo library boards and Conestoga College[10], which implemented and operates an affordable, dedicated, high speed fibre optic network to the educational and public sector institutions within the Region of Waterloo. This fibre optic network, which is referred to by the acronym of WREPNet, is widely utilized and has grown from the original 227 sites to over 325 sites since its launch in 2000[10].

Original vision behind the development of WREPNet was to link public organizations in the Waterloo region via a dedicated high speed network. Prescient International Inc. partnered with Waterloo Region District School Board (WRDSB) and the Waterloo Catholic District School Board (WCDSB) to design and implement the network[10]. After development of the business case and design of the network, tenders were floated, after which WREPNet partnered with Atria Networks, MFP Financials and other sub-contractors for implementation of the network[10].

Each partner's staff and clients have access to the network. Decision is made by each partner on what services and information is made available to its users.

Governance Model – Region and MUSH

Each partner in WREPNet shares the development, operation and maintenance cost of the network. The partnership created a governance model comprised of committees and teams with all WREPNet partners. The governance model was established to facilitate business and technical planning processes for development of the network. It was also established to ensure

the thorough participation of all WREPNet partners in the processes used to define technical solutions and make business decisions about the approach used in defining, implementing and managing WREPNet. Governance model consisted of following committees[11]:

1. Steering Committee:

   The Steering Committee, co-chaired by the Superintendents of Business from WRDSB and WCDSB, comprised of Chief Financial Officer (CFO) level representatives of the WREPNet participant organizations. The committee provides an overall corporate direction and oversight to the project and program resources and was the top approval body.

2. Business Planning Group:

   The Business Planning Group (BPG), co-chaired by the WCDSB Chief Information Officer (CIO) and the City of Kitchener Director of IT, comprised of IT Directors and managers from the participant organizations and Prescient International. The BPG provides operational direction to the project, reviewing all technical and business subjects and made recommendations to the Steering Committee for approval.

3. Technical Team:

   The Technical Team comprised of IT technical staff of the WREPNet participant organizations and Prescient International. Technical experts from Prescient International and vendor organizations provide direct consultation to the Technical Team. The Technical Team is co-chaired by the City of Kitchener Technical Support Supervisor and the WCDSB Manager of Technical Support Services. The purpose of the Technical Team is to solve technical problems and make recommendations to the BPG on technical issues and subjects.

4. Project Management Office:

   The Project Management Office (PMO) comprised of key representatives of the WREPNet partnership and the business partners. To ensure the utmost continuity between the Business Planning Group, Technical Team and the PMO, the co-chairs of both committees are present on the PMO. Considering the number of board sites to be implemented, one Technical Team representative from the Waterloo Region District School Board is also present on the PMO. The PMO is responsible for the day-to-day management of the network implementation and ended once full implementation had been achieved.

WREPNet has a lease agreement to supply and maintain dark fibre optic cabling for the WREPNet network. The original agreement was signed between the partners and Fibretech Telecommunications Inc. on August 1, 2000. This agreement was then assumed by Atria Networks in 2005, which was then acquired by Rogers Communications Partnership in 2013. This agreement was renewed in August of 2006, and again in November of 2010[12].

WREPNet also has an agreement to provide support and implementation services and management of the overall network for the partners. The original agreement was signed between the partners and Unis Lumin Inc., and was assumed in 2011 by Softchoice LP. This agreement was renewed for a five year period beginning January 1st 2016[12].

There exists a cost sharing agreement amongst the partners based on number of sites. This agreement outlines the responsibility of each partner to manage billing of the agreements made with Rogers Communications Partnership and Softchoice, and all shared costs are broken out by partner on a per site basis[12].

The Region of Waterloo coordinates renewals of contracts on behalf of the WREPNet partners for lease agreements and management of network. Partners are a participant in voting for the renewal agreements.

Financial Indicators

Ministry of Education in Ontario provided a one-time infrastructure grant of $10 Million for implementation of the network around the year 2000. Expenditure by the Region is catered by 2015 Information Technology Services (ITS) Operating Budget. Financial statements regarding the costs/benefits are published by some partners. Key financial indicators of the agreement of WREPNet with Rogers and Softchoice over their last five year contract is presented in Exhibit 10 below[12]

Exhibit 9 – Key Financial Indicators of the Agreement of WREPNet with Roegers and Softchoice over their last 5 year contract

PARAMETER	VALUE
Total cost for WREPNet partners (Contract with Rogers)	$2,206,634 annually
Total cost for Region (Contract with Rogers)	$415,449 annually
Total cost for WREPNet partners (Contract with Softchoice LP)	$685,649 annually
Total cost for Region (Contract with Softchoice LP)	$129,087 annually

Benefits to the Community

WREPNet led to economic growth & development to the Region while reducing the costs of broadband connectivity for partners & providing advanced services to citizens through electronic delivery of services.

The cities and the Region use WREPNet to manage and access internal data that is needed to conduct their day-to-day business. The libraries use the network to provide Internet-based products and services directly to their customers.

6.2.3 Public Sector Network (PSN) – Peel Region, Ontario

PSN is a formal partnership which was created to provide a shared fibre optic network between the Region of Peel and its municipalities. Ownership of the network is limited to Region of Peel and Municipalities within the Region, consisting of City of Brampton, City of Mississauga, and Town of Caledon[13].

PSN was launched in 1999 and has a fibre optic network of approximately 693 km (96 count) with a majority of network (almost 90-95%) being aerial installation (hydro utility poles were the major facilitators)[13], connecting almost 580 partner sites and 18 subscribers by 2015[14]. It is mainly a dark fibre network where any public sector agency working within the Peel Region can have access to this network through the partners.

Governance Model – Region and MUSH

PSN is a non-dominant telecom carrier registered with the CRTC[15]. Each partner is responsible for implementation and maintenance of fibre optic network within its own boundaries and maintains ownership of what is built within their respective boundaries. Included under the municipal umbrella are

various services operated by related boards and commissions, including Police, Fire, Transit and Libraries[13]. The municipalities contribute to the development of the PSN through their respective municipal budgets. Each Partner complies with the common design, construction and operating standards and must grant access to the network to all other partners and subscribers. Each partner also assumes a lead role in one aspect for the business, as follows[13].

1. Region of Peel is responsible for administration, contracts, legal agreements, marketing and subscriber relations
2. City of Mississauga is responsible for network repair and maintenance
3. Each municipality is responsible for new construction within their regional boundary.

PSN is for the "business use" of the participating organizations, primarily for communications between their own facilities to conduct every aspect of municipal business. Spare fibre is made available for the use of other partners on a case-by-case basis. Through these builds, the partners are able to connect various subscribers within their respective municipal boundaries which results in revenues for the partners. Examples of the partners include[16]:

1. Region of Peel
2. Peel Region Police
3. City of Mississauga
4. City of Brampton
5. Town of Caledon

The following are some of the requirements needs to be fulfilled by the subscribers to become part of the network[13].

1. Only public sector organizations are eligible to become PSN subscribers
2. Subscribers are responsible for all costs to connect to the network. They must also pay an annual access fee, which is set at a fraction of commercial rates for dark fibre. Fee structure of PSN is based on an allocated share of long term amortized costs for network construction, maintenance and replacement.
3. Where a subscriber builds an extension to PSN to connect one or more of its facilities, PSN may assume ownership of the extension, if it wishes to make it available to other users. In such cases, the subscribers are fully compensated for its construction costs through a reduction in its annual fees.
4. Subscribers must accept that PSN is a co-operative in spirit, if not in legal form. Since it is providing access to public sector organizations, essentially at cost, the partners do not accept the same legal liability as a private carrier.

Ultimately, the subscribers pay for connecting the PSN to their respective sites called as subscriber sites, which contribute to the revenues for PSN.

Following are the examples of some of the subscriber sites who are part of PSN[16]:

1. Sheridan College
2. William Osler Health Centre
3. Trillium Health Centre
4. Credit Valley Hospital
5. University of Toronto, Mississauga Campus

Financial Indicators

$17 Million has been invested by the Partnership till 2015 for development of the PSN[14]. Subscriber sites such as Sheridan College, Trillium Health Centre which are connected to the network, are responsible for all the revenue generated by PSN.

Subscriber revenue and expenditure statements are published by the Partners, latest in 2014. Subscriber revenue of PSN for 2014 is presented in Exhibit 11 below[16]:

Exhibit 10 – Subscriber Revenue of PSN for 2014

SUBSCRIBER SITES	REVENUE
Sheridan College	$82,200
University of Toronto	$6,024
Trillium Health Centre	$64,509
William Osler Health Centre	$62,796
Credit Valley Hospital	$159,458
Total	**$374,987**

PSN achieved break-even in 2014 and has accrued a reserve fund of $469K[16] by that time.

The Reserve Fund balance at the end of 2015 is approximately at $490K[16].

In accordance with the PSN Partnership Agreement, subscriber revenues are applied to offset shared costs for operation and support of the network, thereby reducing the partner's cost of ownership.

Benefits to the Community

PSN has been able to bring administrative efficiency within the Region and has provided the ability to share data amongst the partners and subscribers at a minimal cost. It has been able to cultivate a program within a Region where various municipal and public sector partners have a shared vision of a fibre optic network and invest financially to support this build through contributions from their respective budgets.

6.2.4 QNet – Coquitlam, British Columbia

The Coquitlam Optical Network Corporation (QNet) is a wholly owned subsidiary of the City of Coquitlam which provides businesses, schools and residential high-rises with access to high speed broadband access through City's state of the art fibre optic network[17].

QNet leases unused capacity in the city's carrier-grade fibre optic network to telecommunications companies that offer high-speed internet, phone, TV/video and cellular services in Coquitlam[17].

Coquitlam began running ducting throughout the city in the 1980s for the traffic signal system, later taking advantage of this underground network to install carrier-grade fibre optic cabling to support traffic cameras and telecommunications services in city facilities[18]. To leverage a considerable amount of unused capacity of fibre network, QNet was formed in 2008 to lease out the unused fibre optic capacity to competitive telecom service providers with the aim of enabling economic growth and development by providing accessible and affordable broadband services across the city.

Length of QNet's fibre optic network is approximately 60 km[17] which covers almost the whole of the community. Eight telecommunication companies are operating in Coquitlam by leasing dark fibre from QNet. Data centre co-location services are also available to QNet subscribers.

Governance Model – Region Only

Coquitlam City Council is the sole shareholder of QNet. It is registered as a non-dominant telecom carrier required to file annual reports with the CRTC, and is governed by a Board of Directors. Internal organization of QNet consists of the following teams[19]:

1. Council and Executive Team – responsible for shareholder & board oversight
2. Financial Services – responsible for accounting and billing
3. Economic Development – responsible for business and economic development
4. Corporate Communications – responsible for branding, advertising, media relations
5. Planning and Development – responsible for developer relations, bylaws & policies
6. Engineering – responsible for design, permitting, GIS and infrastructure installation
7. Facilities – responsible for data centre & co-location facilities support
8. ICT – responsible for business systems, cable management software and website

Financial Indicators

QNet is economically dependent on City of Coquitlam for its operation. $5.1 Million was provided by the city (20 years loan) for startup costs etc.[11].

QNet became cash positive as of 2013 and started repaying its loan[18].

Yearly financial statements are published by QNet, with latest one being in 2014. Key financial indicators of QNet for the year of 2014 are presented in Exhibit 12 below[20]:

Exhibit 11 – 2014 Key Financial Indicators of QNet

PARAMETER	VALUE
Total Revenue	$434,060
Operating Expenses	$168,158
Earnings before adjustments	$94,341
Cash flow surplus	$26,369
Loan Balance	$5,171,033

Benefits to the Community

QNet has played a critical role in attracting and retaining businesses, and residents due to the availability of high-speed Internet and data centre co-location services, which has led to city's economic growth and job creation. QNet realized the City of Coquitlam total annual operating savings of $360,000 on telecom costs since its launch in 2008[18]. QNet's dark fibre network has enabled competition among ISPs which has resulted in improved choice and prices for the businesses and residents of Coquitlam, connecting more than 2,500 businesses and 20,000 homes in residential high-rises[17].

6.2.5 EPB – Chattanooga, Tennessee

Electric Power Board of Chattanooga (EPB) is an electricity distribution and telecommunications company owned by the City of Chattanooga, Tennessee which acts as an ISP (also provides phone and TV) to residents and businesses.

EPB was established in 1935 as an Agency of City of Chattanooga for the sole purpose of providing electric power. In 1996, Board of EPB decided to connect the electrical assets through a communications network. Upon implementation, the communications network was under-utilized, which resulted in EPB entering into the telecom business in 2000 by launching EPB Telecom that provided telecommunication services to local area businesses[21].

EPB, as a part of the smart grid initiative, started installing fibre optic cable to connect all smart energy meters in the City. EPB leveraged the fibre installed for this project and launched Fibre to the Home (FTTH) service to residents and businesses in 2009 as 'EPB Fiber'. Today, the fibre infrastructure has grown to approximately 12,900 km and connects almost 61,000 homes, 5000 businesses and all the smart meters within the City[21] and is considered to be the first city in United States to offer Gigabit internet service.

Governance Model – Region Only

EPB is a non-profit utility owned by the City of Chattanooga and is governed by a five member board appointed by the City of Chattanooga. Internal organization of EPB consists of the following teams[22]:

1. President and Chief Executive Officer
2. Finance and Chief Financial Officer
3. Economic Development and Government Relations
4. Strategic Systems
5. Customer Relations
6. Corporate Communications
7. Strategic Research
8. EPB Fiber Optics
9. Human Resources
10. Information Technology and Chief Information Officer
11. Marketing
12. Technical Operations
13. Field Operations

Financial Indicators

$330 Million USD were invested for the deployment of smart grid and Gigabit broadband service. Out of this amount, $111.5 Million USD was provided by the federal stimulus funding from the U.S. Department of Energy. To raise additional funds needed to build the fibre optic network, EPB issued $229 Million USD of local revenue bonds in 2008. About 70% of this bond issue (i.e. approximately $162 Million USD) was used to fund the fibre optic build out. By 2012, EPB's 'Fiber Optics Division' had borrowed approximately $50 Million USD from the Electric

Division to finance the costs of adapting the broadband network to provide telecommunications services to its customers[23].

Financial statements of EPB is published every year, which includes the financial performance of 'EPB Fiber'. Key financial indicators for the last financial statement in 2015 is presented in Exhibit 13 below[24]:

Exhibit 12 – Key Financial Indicators for the Last Financial Statement in 2015

PARAMETER	VALUE
EPB Fiber Optics Revenue	$118.2 Million
EPB Fiber Optics Expenses	$101.3 Million

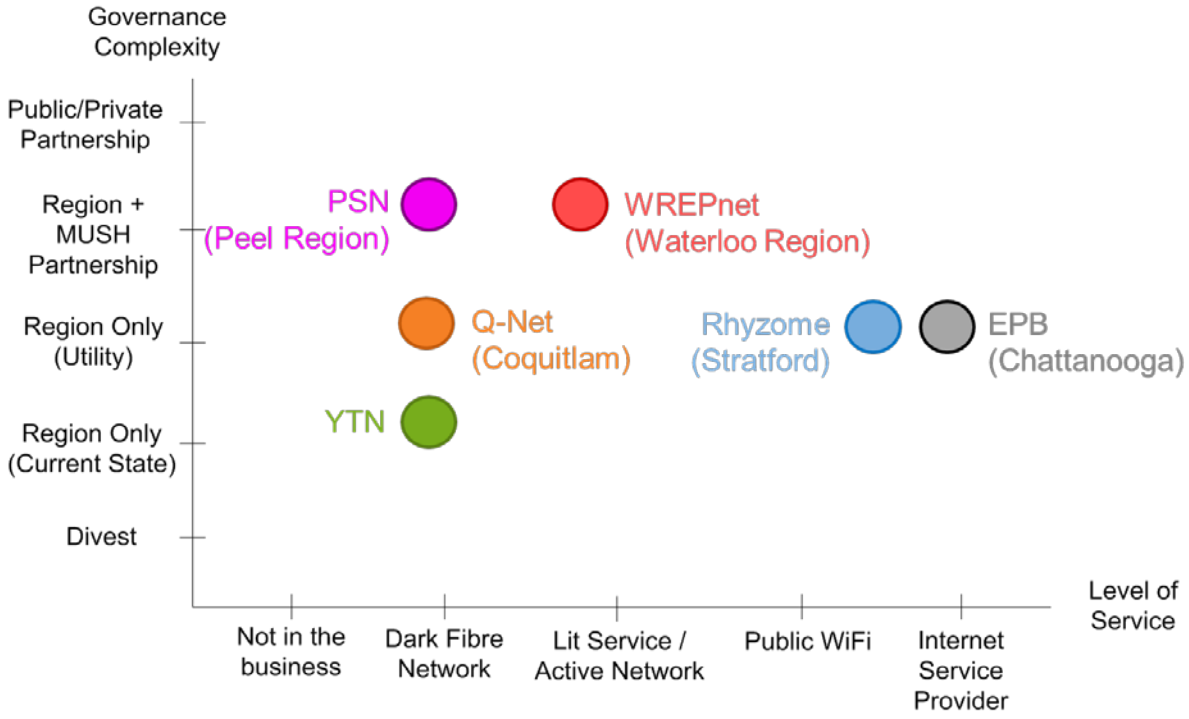
Benefits to the Community

Broadband initiatives have helped to spur economic development in Chattanooga which has been vital in attracting new businesses and in generation of jobs. The community has greatly benefitted due to wide-spread access to affordable high speed fibre optic Internet. An independent study shows the city-owned utility's fibre optic infrastructure has generated $865.3 Million USD to $1.3 Billion USD in economic and social benefits in the areas of education, healthcare, businesses, arts, wired and automated homes and municipal services while creating between 2,800 and 5,200 new jobs[25]. Smart grid and the fibre communications network has been instrumental in improving services to electric utility customers. The smart grid system uses fibre network to analyze power parameters from smart meters about distribution and consumption of energy on a real-time basis because of which which has resulted in providing efficient and optimized services to the community[23] and has delivered $237 Million USD in benefits that include avoiding power outages.

6.2.6 Relationship to Governance Models and Spectrum of Services

Each case study presented above identifies an associated spectrum of services as well as corresponding governance model. There is no single correct answer as to the most appropriate governance model relative to the level of broadband services being offered. The exhibit below summarizes the case studies reviewed relative to the current state governance model of YTN.

Exhibit 13 – Case Studies Governance Complexity vs. Level of Service



6.3 Governance Model Analysis

The following exhibit reflects on the key considerations for each governance model option specific to YTN.

Exhibit 14 – Governance Model Summary

	Privatization/ Divestiture	Public – Public			Public – Private
	Sell to Private Entity & Leaseback	**Region Only (optimized structure)**	**Region Only (positioned as a utility)**	**Region + MUSH**	**Joint Venture**
Network Usage	• Focus only on Region usage needs	• Primarily Region usage, but open to MUSH connections on a subscriber fee basis	• Primarily Region usage, but open to MUSH connections on a subscriber fee basis	• Combination of Region + MUSH usage	• Target all potential subscribers
Ownership	• No ownership, must enter into lease agreement with private purchaser	• Full ownership and freedom to manage network access, growth, and operations	• Full ownership and freedom to manage network access, growth, and operations	• Partial ownership with some freedom to manage network, growth, and operations	• Partial ownership with some freedom to manage network, growth, and operations
Degree of Control	• Very limited control of ongoing service levels, maintenance response, and all other operational matters	• High degree of control for managing service requirements	• High degree of control for managing service requirements	• Shared high degree of control for managing service requirements, but with large influence from partners	• Moderate degree of degree of control for managing service requirements
Community Impact	• No influence on local business operations	• Local businesses have no access to YTN	• Potential to open up for local businesses to have access to YTN	• Local businesses have no access to YTN	• Potential to open up for local businesses to have access to YTN

	Privatization/ Divestiture	Public – Public			Public – Private
	Sell to Private Entity & Leaseback	**Region Only (optimized structure)**	**Region Only (positioned as a utility)**	**Region + MUSH**	**Joint Venture**
Capital Expenses (CAPEX) Requirements	• No CAPEX required	• Large CAPEX	• Large CAPEX	• Large CAPEX but shared with MUSH partners	• Moderate CAPEX
Operational Expenses (OPEX) Requirements	• Large OPEX required	• Low OPEX	• Low OPEX	• Low OPEX	• Low OPEX
Risks	• Risk of increased leasing costs & dependency on private sector	• Risk in construction, ongoing maintenance requirements (e.g. fibre breaks), relocation of operations	• Risk in construction, ongoing maintenance requirements (e.g. fibre breaks), relocation of operations	• Risk in construction, ongoing maintenance requirements (e.g. fibre breaks), relocation of operations	• Risk in private partnership, construction, ongoing maintenance requirements (e.g. fibre breaks), relocation of operations
Excess Assets	• No opportunity to build and sell off assets	• Potential to overbuild and sell off excess (e.g. conduits)	• Potential to overbuild and sell off excess (e.g. conduits)	• Potential to overbuild and sell off excess (e.g. conduits)	• Potential to overbuild and sell off excess (e.g. conduits)
Economic Development	• No added economic development opportunities	• Increased economic development opportunities	• Increased economic development opportunities	• Increased economic development opportunities	• Increased economic development opportunities
Smart Community Initiatives	• More challenging to enhance smart community initiatives such as connections to buildings, traffic signals, "things"	• Ease of enhancing smart community initiatives such as connections to buildings, traffic signals, "things"	• Ease of enhancing smart community initiatives such as connections to buildings, traffic signals, "things"	• Ease of enhancing smart community initiatives such as connections to buildings, traffic signals, "things"	• Ease of enhancing smart community initiatives such as connections to buildings, traffic signals, "things"
Ownership Value	• No value	• Intrinsic value of owning network as opposed to purchasing from private sector (very difficult to acquire)	• Intrinsic value of owning network as opposed to purchasing from private sector (very difficult to acquire)	• Intrinsic value of owning network as opposed to purchasing from private sector (very difficult to acquire)	• Partial ownership has some value as opposed to purchasing from private sector
Funding Availability	• Less likelihood for access to publically funded initiatives	• Potential for greater access to publically funded initiatives (e.g. Metrolinx/Viva)	• Potential for greater access to publically funded initiatives (e.g. Metrolinx/Viva)	• Potential for greater access to publically funded initiatives (e.g. Metrolinx/Viva)	• Potential for greater access to publically funded initiatives (e.g. Metrolinx/Viva)
Quality of Service	• Quality of service limited to service provider	• High-quality of service	• High-quality of service	• High-quality of service	• High-quality of service
Financial Impact	• Market costs for services	• Lower than market cost for Region and non-region subscribers	• Lower than market cost for Region and non-region subscribers	• Lower than market cost for Region and non-region subscribers	• Lower than market cost for Region and non-region subscribers
Full Time Equivalent (FTE) Requirements	• No impact of FTE requirements	• Increased FTE requirements	• Increased FTE requirements	• Modest increase in FTE requirements	• Modest increase in FTE requirements

Of particular note is the ability for the Region to maintain ownership and control of YTN for all Public-Public governance model options. There is intrinsic value in this and ownership of an asset of this size is very difficult to acquire. There are many challenges associated with

constructing such a sizeable network, which YTN has successfully addressed over time and has afforded the Region full control and manageable operating and maintenance costs with the current state of the YTN network.

Although there are risks identified with the Public-Public options, they are relatively low and primarily considered high-cost disaster events related to fibre optic cable assets. It is assumed that YTN assets are covered under an umbrella of insurance held by the Region. Regardless, there is better ability to manage maintenance and operating costs through the ownership of YTN versus relying on third party telecommunication service providers. Managing the cost of services through others is a risk and costs are not guaranteed. YTN has a cost certainty over a long period of time. This is not necessarily the case for the Divest and Joint Venture option. While the Region can negotiate a leaseback arrangement with third party service providers, there is likely no ability to control costs beyond the term of the lease negotiated.

While there is a significant capital expenditure requirements for the Public-Public options, operating expenses are lower and more manageable compared to Public-Private options.

Owning and managing a dark fibre network in the Public-Public governance model options also has advantages with regards to potential impact on the community and economic development in particular. The Region can make use of existing YTN fibre assets to deploy smart community initiatives such as enhanced Public WiFi, advanced parking systems, traffic signal connectivity, and future “Internet of things” ideas. The Region can also position the YTN network for enabling accessible and affordable broadband access in rural areas which may not be a priority for the telecom service providers. Essentially the ability to better manage costs is passed on to the local business community. Divesting and entering into a Joint Venture makes these possibilities more challenging.

In a Public-Private scenario (JV), the private sectors interest will be ‘for-profit’ while the interests of the Region still will include non-tangible/qualitative benefits. The private sector usually forms a partnership with the public sector with the ultimate goal of enhancing its own respective footprint and suite of services to its customers. Moreover, a private sector telecom service provider usually targets expansion in densely populated areas where it can quickly recoup the investments. Therefore, in this model, there would be a need to establish the common goals and vision of such a partnership which should ideally not just be ‘for-profit’.

The overall financial impact on the Region is analyzed in the following section, but generally an owner and its subscribers see substantial cost savings (along with soft non-tangible benefits) in a Public-Public governance model. This is primarily due to the fact that the agency owning the asset is not in the business to make a profit. In contrast, telecommunications providers are looking for reasonable rates of return on their investment of infrastructure and services. This can typically be in the neighbourhood of 8 to 10% per year. By avoiding these profit margins, the Region and its subscribers benefit in cost savings.

Stakeholder Consultation Report

In parallel with this report, a stakeholder consultation was completed by Prior & Prior in December 2015. It is understood that this outreach was conducted with Municipal IT staff and was intended to gather information about user experiences and opinions on the future of the YTN program. Stakeholders included Regional staff, local municipalities, York Regional Police, and York Region District School Board.

Focusing on the future needs identified from the Prior & Prior report, the following are highlights summarized from the report:

- Demand for fibre connectivity is growing
- There is growth in applications for streaming video

- Emerging Internet of Things and Smart City initiatives
- Drivers of service selection include:
  - Speed
  - Reliability
  - Manageability
  - Lower costs

Manageability, reliability, and increased demand speak to the need for the Region to maintain control of its broadband infrastructure. There is also a consensus that broadband communications are the enabler for Emerging Internet of Things and Smart City initiatives and these initiatives align with economic development strategies for the Region.

Further into the stakeholder consultation report, perhaps the most interesting finding of all is the fact that nine out of nine stakeholders interviewed expressed no desire for the Region to divest the YTN program and its assets. In fact, eight out of nine municipalities identified Region + MUSH as a preferred way forward for governance.

The stakeholder consultation report also notes "the lack of formality with which the YTN is operated", and details concerns about insufficient resources at YTN. While these concerns have been identified and brought forward, the report also identifies an appetite for expanding YTN to ensure the Regional Municipalities have better access to YTN. This again speaks to the desire to leverage, maintain, and grow the YTN.

In general, the findings from the Prior & Prior report suggest the status quo for running YTN as it currently operates is not a preferred option and a more formal, dedicated program be established for the YTN program. In particular, with the ability to better serve the Municipalities and other stakeholders of interest.

YTN as a Separate Entity

Currently, YTN is not operating as a separate entity from both a legal and from a financial reporting perspective. For better governance and financial reporting, YTN should consider operating as a separate entity. This means that YTN is setup in such a way that as a minimum, it is able to publish its financial indicators separately for better tracking of performance. York Region has few examples within the Region that can be reviewed for setting up YTN as a separate entity. These include York Region Rapid Transit Corporation (YRRTC) and the York Housing Inc. While these entities each have unique governance elements, lessons learned from each of these can be synthesized into an operations model that is most appropriate for the YTN application.

The pros and cons for setting up YTN as a separate entity (either legal entity or specifically for financial reporting) are detailed below.

PROS	CONS
• Better accountability enabling better planning and operations • Clean and transparent financial books • Quicker decision making • More efficient operations • Better structure for selling dark fibre or services	• Fundamental shift in the current structure requiring consensus among stakeholders • Initial setup cost • Effort to setup entity • Additional operational overhead (legal, marketing, etc.)

PROS	CONS
• Easier to plan/deploy any future exit strategy • More attractive to future potential buyers • More agility to partnerships • Region has YRRTC and Housing York as precedents • Alignment with industry best practices • Better management of liability; separation of responsibility from other Region operations • More universal view of Region needs / convergence • Potential for higher revenues • Opportunity for growth • Sustainability • Ability to re-invest surplus revenues back into the initiative	• Some measure of less control/direction of YTN (i.e. control shifts to board of directors) • Challenge to align of multiple interests/demands (e.g. need to connect underserviced areas) • Ability to handle financial losses • Still bound by Region/municipal by-laws and regulations as they may relate to arm's length municipal corporations • May result in additional insurance requirements (requires further investigation)

Note that the consideration of transitioning YTN into separate entity is not an analysis that was carried out under the scope of this report. The details are presented for information only. However it is an item that the Region will need to make a decision on depending on how the Region decides to move forward with the YTN program.

7 Financial Review

In this section, an overview of the financial analysis to support the respective governance models is presented.

The objective of this study is to select between governance models based on available information, and not to revisit work previously undertaken by York Region. To proceed with this objective, demand forecasts for connections to the YTN used in this report were provided by York Region via a spreadsheet initially authored by York Region IT. This spreadsheet included information on actual buildout costs, maintenance costs, and services provided from 2002 to present, and projected buildout and other costs and services from present to the beginning of 2026. The projections made in the provided spreadsheet seem reasonable given the size of the Region and its assets. Further, since the publication of the spreadsheet provided, the information has been updated with actual costs and builds, allowing the refinement and validation of a number of variables. Any projections made that extend beyond the provided 2026 horizon have been linearly extrapolated from existing data to a maximum buildout. A linear projection was selected considering an absence of sufficient evidence to support a logarithmic, exponential, or higher order polynomial projection.

The ultimate objective of the financial analysis is to provide estimated costs and benefits of each of the governance models, keeping the current fee structure and rates intact. The exception to this rule is in the "Region Owned Utility" model, where it is assumed that the YTN will set rates equivalent to an 8% annual rate of return. This annual rate of return is conservative compared to other utility peers. For example, the average permitted return on investment for power utilities in the United States is 10.13%[26], Canadian Utilities Limited experiences annual compound returns of 16.6%[27], and EPB in Chattanooga, in the same business as the YTN, experienced a return on investment of 16.7% in 2015[28].

7.1 Financial Review Assumptions

To facilitate a result from the financial model, a number of assumptions and variables had to be defined across the five governance models. Some of these assumptions are the same for all five models, effectively enabling a calculation so that the end result can be expressed as a dollar amount, and some of these assumptions vary across the models, which articulates the projected differences between them.

The variables that are held constant are as follows:

- **Annual Discount Rate: 7.4%** – This value was prescribed by York Region and represents their best practices for calculating net present value on future assets including inflation.
- **Inflation: 2%** – This value was prescribed by York Region and is used to inflate all non-capital costs and recovered subscriber fees on a year-to-year basis, independent of discount rate.
- **Capital Inflation: 2.8%** – This value is tied to the Non-residential Building Construction Price Index (NRBCPI) and is used to inflate capital costs in future years in this model.
- **Proportion of Underground Fibre: 50%** – The proportion of underground fibre to all fibre in the network is held constant for all governance models at 50% - as per the current ratio. The choice of whether to build underground fibre is based more on the geography and current development state of the area, and isn't directly influenced by the governance model.
- **Start 2016 Fee Km (YR): 260 –** The number of fee km currently used by York Region.

- **Start 2016 Connections (YR): 134 –** The number of connections currently used by York Region
- **Start 2016 Fee Km (External): 107 –** The number of fee km currently used by subscribers external to York Region.
- **Start 2016 Connections (External): 40** – The number of connections currently used by subscribers external to York Region.
- **Service Costs Per Connection 2016: $9,783 –** The average service costs paid by York Region for an equivalent connection in the public sector in 2016.
- **Service Costs Per Connection 2026: $5,354 –** The average service costs projected to be paid by York Region for an equivalent connection in the public sector in 2026.
- **Number of Years in Sinking Fund: 70** – The number of years used to calculate the sinking fund calculation – equivalent to the expected lifetime of the fibre assets from installation.
- **Full Time Equivalent (FTE):** Variable representing the number of York Region FTE staff required to operate the system.
- **Labour Loaded Rate: $125,000 –** The expected loaded rate annually for each FTE operations staff for the YTN.

A number of variables also differ from governance model to governance model. They include:

- **Lump-Sum Initial Payment:** For governance models where all or some portion of the network is divested, the lump sum initial payment is equivalent to the total capital cost spent on installing the system up to 2016 minus the sinking fund.
- **Desired Annual Rate of Return:** Calculated as 8% for the utility model, and 0% for all other York Region owned models.
- **Fee Per Location:** Assumed to be the current charge ($2500) for Region-Owned and Region-Owned utility models. In the Region + MUSH model, it is assumed that the MUSH partners will fund their own connections to the network, and thus not have a connection fee. In the Joint Venture model, it is approximated that the connection fees will be divided equally between the Region and its private sector partner, thereby reducing the fee per location to $1,250.
- **Fee Per Strand km:** Set as $2,000 for Region and Region + MUSH, $1,000 for JV model, and calculated to result in an 8% annual return over 10 years for the Utility model.
- **Physical km, start 2026:** Set as the projected total fibre kms installed by the beginning of 2026.
- **Upper Bound km:** Projected maximum linear km of fibre in each governance model.
- **2026 Fee km / Connections:** Projected fee km and connections for York Region and External subscribers at the beginning of 2026.
- **Construction per km Costs:** $80,000 for Exclusively York Region owned models, $40,000 for shared ownership models.

A summary of all assumptions and variables is provided below.

Exhibit 15 – Summary of Financial Assumptions

	Privatize/Divest	Region-Owned	Region-Owned Utility	Region+Muni/MUSH	JV with Private sector
Annual Discount Rate	7.4%	7.4%	7.4%	7.4%	7.4%
Inflation	2.0%	2.0%	2.0%	2.0%	2.0%
Capital Inflation	2.8%	2.8%	2.8%	2.8%	2.8%
Return on Free Cash	6.0%	6.0%	6.0%	6.0%	6.0%
Lump-Sum Initial Payment	$ 8,398,180.00	$ -	$ -	$ -	$ 4,199,090.00
Desired Internal Rate of Return	0.0%	0.0%	8.0%	0.0%	8.0%
Proportion of Underground Fiber	50.0%	50.0%	50.0%	50.0%	50.0%
Fee Per Location	$ -	$ 2,500.00	$ 2,500.00	$ -	$ 1,250.00
Fee Per strand km	$ -	$ 2,000.00	$ 2,000.00	$ 2,000.00	$ 1,000.00
Buried Maintenance per km	$ -	$ 1,569.00	$ 1,569.00	$ 1,569.00	$ 784.50
Aerial Maintenance per km	$ -	$ 1,158.00	$ 1,158.00	$ 1,158.00	$ 579.00
Physical km - start 2016	157.10	157.10	157.10	157.10	157.10
Physical km - start 2026	0.00	400.45	480.54	520.59	560.63
Upper Bound km	0.00	800.00	800.00	800.00	1200.00
Fee km - start 2016 (YR)	260.00	260	260	260	260
connections - start 2016 (YR)	134.00	134	134	134	134
Fee km - start 2026 (YR)		1762	2114	2290	2467
connections - Start 2026 (YR)		908	1090	1180	1271
fee km - start 2016 (external)	107	107	107	107	107
connections - start 2016(external)	40	40	40	40	40
fee km - start 2026 (external)	0.00	1451	1742	1887	2032
connections - start 2026 (external)	0.00	329	395	428	461
Service Costs Per Connection - start 2016 (Y	$ 9,783.00	$ 9,783.00	$ 9,783.00	$ 9,783.00	$ 9,783.00
Service Costs Per Connection - start 2026 (Y	$ 5,354.00	$ 5,354.00	$ 5,354.00	$ 5,354.00	$ 5,354.00
Number of Years in Sinking Fund	70.00	70.00	70.00	70.00	70.00
Construction Per km Costs - Weighted	$ -	$ 80,000.00	$ 80,000.00	$ 40,000.00	$ 40,000.00
FTE's	0	3	3	1.5	1.5
Rate	$ 125,000.00	$ 125,000.00	$ 125,000.00	$ 125,000.00	$ 125,000.00

Please note that all values in the assumptions table are considered to be in effect at the start of the calendar year, either in 2016 or as specified.

7.2 Financial Modeling Template

The financial modelling template is organized into expenses and benefits and presents these in a disaggregated view that articulates the results into a number of individual categories to present a more detailed picture of the results. The expenses are articulated first and include:

- Growth-Related Capital;
- Service Costs;
- Asset-Replacement and Lifecycle Needs;
- Maintenance Costs;
- Operations and Administrative Costs; and
- Opportunity Costs.

Next, the benefits received by the region in each scenario is calculated. The individual benefits articulated include:

- Lump Sum Divestiture Payment;
- Subscriber Fees;
- Return on Free Cash; and
- Service Cost Savings.

Lastly, the results of each financial scenario are articulated through six key indicators:

- Total Expenses;
- Total Benefits;
- Net Benefit (Loss)
- Cumulative Tax Levy Required
- Annualized Rate of Return; and
- Region Cost Ratio.

These measures are calculated for both the ten- and thirty- year scenarios to show the effects of time on the expected return.

7.3 Financial Projections Analysis

The financial analysis for a 10-year horizon is as shown in Exhibit 17.

In this analysis, the subscriber fees for the Region-Owned Utility scenario are set at current fee rates. It can be seen from this analysis that the Joint Venture provides the greatest opportunity for cost recovery and rate of return, followed by the Region + MUSH scenario. We can also see that total expenses are moderated in the Region + MUSH scenario and Joint Venture scenarios when compared to scenarios where York Region is the sole owner of the asset. Overall, all scenarios result in a positive annualized return with the exception of the Divest option. The divest option is negative because any benefit realized by the divestiture of the system is offset by costs related to providing network services to the region.

Exhibit 16 – 10-Year Financial Summary

	Privatize /Divest	Region-Owned	Region-Owned Utility	Region + MUSH	Joint Venture
Expenses (10 Year Horizon)					
Growth-Related Capital	$ -	$ 15,000,000.00	$ 20,000,000.00	$ 11,200,000.00	$ 12,500,000.00
Service Costs	$ 9,800,000.00	$ -	$ -	$ -	$ -
Asset-Replacement/Lifecycle Needs	$ -	$ 6,400,000.00	$ 6,700,000.00	$ 6,700,000.00	$ 2,100,000.00
Maintenance Costs	$ -	$ 2,900,000.00	$ 3,300,000.00	$ 3,500,000.00	$ 1,800,000.00
Operations and Administrative Costs	$ -	$ 2,800,000.00	$ 2,800,000.00	$ 1,400,000.00	$ 1,400,000.00
Opportunity Cost	$0.00	$ 1,800,000.00	$ 2,400,000.00	$ 1,200,000.00	$ -
Total Expenses (End of 10th Year)	**$ 9,800,000.00**	**$ 28,900,000.00**	**$ 35,200,000.00**	**$ 24,000,000.00**	**$ 17,800,000.00**
Benefits					
Lump Sum Divestiture Payment	$ 8,400,000.00	$ -	$ -	$ -	$ 4,200,000.00
Subscriber Fees	$0.00	$12,000,000.00	$14,000,000.00	$11,400,000.00	$8,000,000.00
Return on Free Cash	$800,000.00	$500,000.00	$500,000.00	$600,000.00	$1,100,000.00
Service Cost Savings	$ -	$23,200,000.00	$26,700,000.00	$28,400,000.00	$30,200,000.00
Total Benefits (End of 10th Year)	**$ 9,200,000.00**	**$ 35,700,000.00**	**$ 41,200,000.00**	**$ 40,400,000.00**	**$ 43,500,000.00**
Summary (10 Year)					
Total Expenses	$ 9,800,000.00	$ 28,900,000.00	$ 35,200,000.00	$ 24,000,000.00	$ 17,800,000.00
Total Benefits	$ 9,200,000.00	$ 35,700,000.00	$ 41,200,000.00	$ 40,400,000.00	$ 43,500,000.00
Net Benefit (Loss)	$ (600,000.00)	$ 6,800,000.00	$ 6,000,000.00	$ 16,400,000.00	$ 25,700,000.00
Cumulative Tax Levy Required	$ 5,500,000.00	$ -	$ -	$ -	$ -
Annualized Rate of Return	**-0.70%**	**2.38%**	**1.76%**	**5.96%**	**10.44%**
Region Pays	**14%**	**58%**	**60%**	**53%**	**31%**

When the Region-Owned Utility model is set to an industry-standard 8% rate of return, we can backsolve for the subscriber fees required to achieve this level of return over an 8-year period. In the 10-year horizon, we can see that the required Subscriber fees to achieve an 8% return in the Region-Owned utility model are $5,082.51 per strand km per year, or roughly 2.5 times the current subscriber fees.

	Privatize/Divest	Region-Owned	Region-Owned Utility	Region+Muni/MUSH	JV with Private sector
Fee Per strand km	$ -	$ 2,000.00	$ 5,082.51	$ 2,000.00	$ 1,000.00

For the 30-Year summary, similar results are observed. The Joint Venture option has the highest rate of return, while the Region + MUSH model is the second most favoured model. The total expenses can be moderated by partnering with the private sector or with the MUSH sector vs. the other scenarios, and the privatize option is even less attractive over a longer horizon.

Exhibit 17 – 30-Year Financial Summary

	Privatize /Divest	Region-Owned	Region-Owned Utility	Region + MUSH	Joint Venture
Expenses (30 Year Horizon)					
Growth-Related Capital	$0.00	$29,100,000.00	$32,800,000.00	$17,100,000.00	$17,700,000.00
Service Costs	$19,100,000.00	$0.00	$0.00	$0.00	$0.00
Asset-Replacement/Lifecycle Needs	$0.00	$12,600,000.00	$13,000,000.00	$13,200,000.00	$4,000,000.00
Maintenance Costs	$0.00	$8,800,000.00	$10,700,000.00	$11,600,000.00	$6,300,000.00
Operations and Administrative Costs	$0.00	$5,500,000.00	$5,500,000.00	$2,700,000.00	$2,700,000.00
Cost of Borrowing	$0.00	$1,800,000.00	$2,400,000.00	$1,200,000.00	$0.00
Total Expenses (End of 30th Year)	**$ 19,100,000.00**	**$ 57,800,000.00**	**$ 64,400,000.00**	**$ 45,800,000.00**	**$ 30,700,000.00**
Benefits					
Lump Sum Divestiture Payment	$ 8,400,000.00	$ -	$ -	$ -	$ 4,200,000.00
Subscriber Fees	$0.00	$56,200,000.00	$64,900,000.00	$51,800,000.00	$35,300,000.00
Return on Free Cash	$800,000.00	$36,700,000.00	$44,800,000.00	$33,300,000.00	$30,800,000.00
Service Cost Savings	$0.00	$80,200,000.00	$92,200,000.00	$96,600,000.00	$100,400,000.00
Total Benefits (End of 30th Year)	**$ 9,200,000.00**	**$ 173,100,000.00**	**$ 201,900,000.00**	**$ 181,700,000.00**	**$ 170,700,000.00**
Summary (30 Year)					
Total Expenses	$ 19,100,000.00	$ 57,800,000.00	$ 64,400,000.00	$ 45,800,000.00	$ 30,700,000.00
Total Benefits	$ 9,200,000.00	$ 173,100,000.00	$ 201,900,000.00	$ 181,700,000.00	$ 170,700,000.00
Net Benefit (Loss)	$ (9,900,000.00)	$ 115,300,000.00	$ 137,500,000.00	$ 135,900,000.00	$ 140,000,000.00
Cumulative Tax Levy Required	$ 8,700,000.00	$ -	$ -	$ -	$ -
Rate of Return (Annualized)	**-7.80%**	**12.96%**	**13.54%**	**16.55%**	**21.00%**
Region Pays	**56%**	**3%**	**-1%**	**-13%**	**-29%**

When setting the rate of return to an industry-standard 8% over a 30-year horizon, it can be seen that the annual charge should be $786.23 per strand km per year, which is significantly lower than current subscriber fees. When comparing this to the result in the 10-year horizon, it can be seen that there is significant opportunity to reduce required subscriber fees with an up-front investment in the implementation of a more robust YTN network.

In summary, it can be seen that the same models are recommended from a cost recovery or rate of return perspective over both the 10-year period and the 30-year period. This suggests that the time horizon over which the scenarios are evaluated has no significant impact on the recommendations.

Lastly, based on the assumptions made, the annual subscriber fee per strand km required to reach cost recovery over each time period is calculated as follows:

Exhibit 18 – Subscriber Fee per Strand km

	Privatize/Divest	Region-Owned	Region-Owned Utility	Region+MUSH	JV with Private sector
1 Year	N/A	$ 9,346.79	$ 10,733.30	$ 10,130.24	$ 5,542.20
5 Years	N/A	$ 2,671.18	$ 3,424.64	$ 3,764.15	$ 1,679.73
10 Years	N/A	$ 1,648.62	$ 1,709.63	$ 1,966.42	$ 814.80
20 Years	N/A	$ 744.88	$ 742.91	$ 865.98	$ 327.83
30 Years	N/A	$ 424.65	$ 417.41	$ 532.10	$ 194.95

Please note that given the fees in the chart above are different from the current $2,000 per strand kilometre that is used in the analysis, if either of these fees rates are selected, it will affect the outcome of the 10 and 30 year projections indicated earlier. Therefore the model should be adjusted to include these results based on the selected fee per strand kilometre. Please also note that annual fees per strand km in the Region + MUSH model appear higher because there are no initial connection fees in this model.

7.4 Model Considerations

This section discusses the various considerations that went into the development of the model and reasons why actual results may differ from projected results.

Connections and Project Buildout

This model assumes that when the total buildout of fibre network reaches 800 kilometers, no more physical fibre buildout is expected. This point occurs in 2042 for the Region-Owned model, and in 2033 for the Region + MUSH model, and is variable across all scenarios. This model assumes that once the buildout hits this maximum size, no more physical fibre buildout is to be expected. This assumption is both highly variable and conservative. If subscription rates to connect to the YTN are sufficiently low, it will become reasonable for low bandwidth devices such as sensors and next generation video cameras to connect as they come online. Further, as population grows, there should continue to be increasing opportunities for connecting both regional and municipal assets to the YTN. Should more connections be made to the YTN after 800kms is reached, a greater benefit would be realized for all models that is proportional to the rate at which each governance model is expected to add fibre to the YTN. Since buildout plans were extrapolated beyond 2026, any projections beyond this horizon are imprecise. As part of the business plan analysis, it is recommended that the Region develop a longer-term buildout plan, as the current capital plan only extends through 2020 in detail, and 2026 for aggregate long-term projections.

Asset Replacement and Lifecycle Needs

This model proposes that in the Joint Venture with the private sector model, the private sector will be responsible for paying 50% of the asset replacement and lifecycle costs. Conversely, this model proposes that for the Region + MUSH model, York Region would be paying for all of the asset replacement and lifecycle costs. In practice, however, both of these partnerships may distribute asset replacement costs according to a different method, for example, as a proportion of use, or each partner may be responsible for lifecycle costs on specific assets. The details of

this asset replacement distribution should be discussed at the commencement of the respective partnership agreements.

Economies of Scale

The forecast upon which this model is based does not project any change in demand for connections to the YTN as a function of buildout, that is, there are no economies or diseconomies of scale projected. The presence of any economies of scale is highly dependent on the deployment strategy, and what rules are used by the YTN to determine which part of the network any investment is applied to, in the context of limited funds. These economies are also impacted by the availability of private sector fibre assets in the selected buildout locations. Because of these uncertainties, the demand has been projected to be linear, since there is insufficient information to support an exponential, logarithmic, or higher order polynomial projection of demand at this time.

Local Municipal Connections

While the model predicts that York Region will use the YTN to connect a number of devices including Bus Rapid Transit (BRT) technology and traffic lights, the level at which each municipality will utilize YTN infrastructure to connect devices is predicted to be highly price-sensitive. The utilization of the network for these purposes and the collection of fees for low-bandwidth devices will be directly correlated to the acceptable payback period for any investment in the YTN by York Region, and should be considered very carefully in any revised pricing and implementation discussions.

Sensitivity of Demand

This analysis has taken current buildout plans, previous studies, and other reference points to develop a financial model, but does not include a robust analysis of latent market demand. In our opinion, this demand is highly sensitive to both the governance model chosen and projected subscriber costs and should be investigated more robustly in any subsequent business case work.

7.5 Sensitivity Analysis

To provide some additional insight into the effects each variable has on the outcome of this financial model, a sensitivity analysis was also conducted for the variables that have the greatest outcome on the model. Below are the findings from this analysis for a 10% increase in each of the key variables. A positive value indicates an increase in the benefits realized, while a negative value indicates an increase in the costs incurred.

Exhibit 19 – Sensitivity Analysis

Effect of a 10% increase on Total Costs and/or Benefits (10 year horizon)					
	Privatize/Divest	Region-Owned	Region-Owned Utility	Region+Muni/MUSH	JV with Private sector
Lump-Sum Initial Payment	10.80%	N/A	N/A	N/A	3.21%
Fee Per Location	N/A	0.80%	0.70%	N/A	0.70%
Fee Per Strand km	N/A	3.50%	3.30%	3.50%	2.00%
Physical Km - 2026	N/A	-4.40%	-3.30%	7.90%	3.90%
2026 Fee km (YR)	N/A	3.50%	3.30%	3.50%	2.00%
2026 fee km (external)	N/A	3.50%	3.30%	3.50%	2.00%
2026 Connections (YR)	N/A	0.00%	0.00%	0.00%	0.00%
2026 Connections (external)	N/A	0.00%	0.00%	0.00%	0.00%
Construction Per km Costs - Weighted	N/A	-6.20%	-7.10%	-5.80%	-7.30%
FTE's	N/A	-1.04%	-1.14%	-0.83%	-0.56%

It can be seen from this analysis that the variable that has the most significant effect on the results of the model is the number of physical kilometers built in 2026. A 10% increase in this

variable results in a significant increase in benefit for the partnership options, but a negative benefit for the region-owned model. This indicates that each investment in infrastructure pays for itself faster in the partnership options. The other values indicate that there are no major differences between the models when key assumptions are modified. This indicates that if the assumptions are less precise, the result of the model should remain the same.

8 Recommendations and Next Steps

8.1 Relative Ranking

In order to evaluate both financial and non-financial attributes to each governance model, we have developed a ranking analysis based on the relative merits of each governance model. The model assumes a 40% weighting for financial considerations, equally weighted between benefits and expenses, and a 20% weighting for each of the Control, Risk, and Economic Development factors. The ranking criteria, and relative weighing, while somewhat arbitrary, are reflective of the strategic goals and objectives of YTN, as well as the emphasis on the financial benefits and costs of YTN. These were identified during meetings and consultation with York Region staff. The resulting score for each governance model falls between 5 and 25, with 5 being the lowest possible and most unfavourable score, and 25 being the highest possible and most favourable.

Methodology

Each governance model is given a score on a scale ranging from 1 to 5, with 5 being the best (most favorable score). In the case of financial parameters, rankings are based on the financial analysis ranking of total benefits and total expenses. Other factors ranked for each model are:

(i) Control – Ability to maintain a strong influence in the future direction and use of the network assets, types of services offered and market sectors of focus.

(ii) Risk – The relative financial and operational/ partnership risk of each model, factoring in overall size of investment, risk of stranded assets alignment of partner interests.

(iii) Alignment with Economic Development objectives of the Region, including availability of broadband services to support public sector initiatives and future smart city objectives required to attract business investment in the Region. Moreover, improve the overall quality of life for residents, the ability to invest in programs to facilitate broadband in underserved areas or provide free or subsidized broadband for disadvantaged residents.

The following two exhibits represent the governance model scoring – One for the 10 year financial projections, and a second for the 30 year financial projections.

Exhibit 20 – Governance Model Ranking (based on 10 year financial projections)

	BENEFITS (FINANCIAL)	EXPENSES (FINANCIAL)	CONTROL	RISK	ECONOMIC DEVELOPMENT	TOTAL
Divest	1	5	1	5	1	**13**
Region Only	2	2	5	3	4	**16**
Region Only - Utility	4	1	3	2	3	**13**
Region + MUSH	3	3	4	4	5	**19**
Joint Venture	5	4	2	1	2	**14**

Exhibit 21 – Governance Model Ranking (based on 30 year financial projections)

	BENEFITS (FINANCIAL)	EXPENSES (FINANCIAL)	CONTROL	RISK	ECONOMIC DEVELOPMENT	TOTAL
Divest	1	5	1	5	1	**13**
Region Only	3	2	5	3	4	**17**
Region Only - Utility	5	1	3	2	3	**14**
Region + MUSH	4	3	4	4	5	**20**
Joint Venture	2	4	2	1	2	**11**

While Joint Venture and Region Only (positioned as a utility) models achieve a relatively higher financial ranking as they are profit driven (or have a minimum target rate of return), the above relative ranking tables indicates that across the financial and non-financial differences in each governance model, the Region + MUSH model achieves the highest "Total" ranking (most favorable).

8.2 Recommendations

Based on the information and analysis presented herein, it is suggested that York Region transition the YTN program into a Region + MUSH partnership governance model. The following considerations are the primary reasons behind this recommendation.

- There are a number of intangible, non-financial considerations that favour York Region retaining control of the YTN program. This includes the ability to control and manage capital and operating costs, better manage the risks associated with the services YTN provides, and the ability to have an impact on the community and economic development
- There is strong rationale, both intangible and financial, that suggests the Region not divest YTN. Similar to the first point, divesting may result in less control of the services being provided, a relook at the existing set of subscribers and their associated pricing models, reduced quality of service, and higher overall operating costs as the Region may be subject to market rates
- The stakeholder consultation completed by Prior & Prior reported a strong desire for Regional Municipalities to have better access to YTN. Moving YTN into partnership with the Municipalities will help facilitate this need. In fact, there was a consensus amongst the stakeholders to form Region + MUSH partnership
- With Region + MUSH, there would be a common vision of the partners to invest in building a network that serves various needs in a cost effective fashion. It also allows capital investments from the partners which helps in the overall cash flows from an implementation and operations perspective
- There is nearby similar case study (Peel Region) that has found success at the Region + MUSH partnership
- The developed financial projection template indicates positive returns for this recommendation under the referenced conditions.

The principle underlying assumption for the above recommendation is that the YTN continues to be a dark fibre provider. As highlighted in Section 4, there is no real motivating factor for the YTN to alter this mandate. However, if there is to be any

exploration into offering services to subscribers, it is recommended that this be done in collaboration with an established ISP.

YTN as a Separate Entity

Currently, YTN is not operating as a separate entity either from a legal or from a financial reporting perspective. For better governance and financial reporting, it is recommended that YTN operate as a separate entity.

This means that YTN is setup in such a way that as a minimum, it is able to publish its financial indicators separately for better tracking of performance. York Region has few examples within the Region that can be reviewed for setting up YTN as a separate entity in order to incorporate lessons learned and optimize the structure of the YTN. These include York Region Rapid Transit Corporation (YRRTC) and the Housing York Inc.

8.3 Next Steps

With the recommendation noted above, it is suggested the Region move forward as follows:

- Seek approval and adoption of this report by Regional Council.
- Further investigate and review the feasibility of establishing YTN as a separate entity (either reporting or legal). This recommendation should further engage the Region's Finance and Legal teams.
- Notify the local Municipalities and other stakeholders of the YTN governance decision. The task should move ahead quickly and be fairly straight forward since the Region and YTN have already been engaged and working with MUSH sector partners such as the nine municipalities, York Regional Police, and the York Region District School Board.
- Develop a formal partnership amongst all interested parties through a consultative approach. This includes determining the specifics of the partnership. A further review of the partnership options may be explored at this time. The Region and its partners will need to consider numerous aspects of the partnership including ownership specifics, capital funding commitments, sharing of operating expense, staff resources, and marketing.
- Develop a business plan, including robust demand forecast and capital plan. The plan should be developed in collaboration with the Region's partners that meets YTN's set vision.
- Deploy YTN under the new partnership and business plan.

[1] Presentation, 'YTN 101-Presentation to Broadband Task Force', December 16, 2015
[2] Report, 'Committee of the Whole-Finance and Administration', June 18, 2015
[3] http://www.investstratford.com/en/Wifi.asp
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Appendix A

Governance Model Evaluation Matrix

York Telecom Network (YTN) Governance Model Evaluation Matrix

Considerations			Privatization/ Divestiture	Public - Public			Public - Private
			Sell to Private Entity & Leaseback	**Region Only (optimized structure)**	**Region Only (positioned as a utility)**	**Region + MUSH**	**Joint Venture**
Scope of YTN	**Services to be offered**	1. Dark fibre only 2. Lit fibre / Broadband Services 3. Point to point design 4. Network design 5. Predominantly buildings 6. Buildings and "things"	- dark fibre network - Use network for Region's purposes via leaseback arrangements - Very limited control of ongoing service levels, maintenance response, and all other operational matters	- dark fibre network - Region subscribers primarily (currently do not pay monthly maintenance fee, some pay capital/setup costs) - Open to MUSH connections (subscribers pay connection and monthly per km fee) - Connections to buildings, traffic signals, "things" - no active equipment to external subscribers (only on Region only subscribers)	- dark fibre network - Region subscribers primarily (currently do not pay monthly maintenance fee, some pay capital/setup costs) - Open to MUSH connections (subscribers pay connection and monthly per km fee) - Connections to buildings, traffic signals, "things" - no active equipment to external subscribers (only on Region only subscribers)	- dark fibre network - Region subscribers primarily (currently do not pay monthly maintenance fee, some pay capital/setup costs) - More MUSH connections (subscribers pay connection and monthly per km fee) - Connections to buildings, traffic signals, "things", plus USH - no active equipment to external subscribers (only on Region only subscribers)	- dark fibre network or lit services because of private sector - Target all potential subscribers - Connections to buildings, traffic signals, "things" - active equipment supplied by Region or private partner
	Subscribers / Customers	1. RMoY users 2. Local Municipalities 3. Broader MUSH sector 4. Business and residential users	-Region only	- Primarily Region, some MUSH - no marketing - Local businesses have no access to YTN	- Primarily Region, some MUSH - Focus on marketing - Open up for local businesses to have access to YTN	- Mix of Region and MUSH - Focus on marketing to MUSH - Local businesses have no access to YTN	- All potential subscribers including businesses & residential - Focus on marketing - Open for local businesses - Ability to target wholesale only, or wholesale/ retail market

Considerations			Privatization/ Divestiture	Public - Public			Public - Private
			Sell to Private Entity & Leaseback	Region Only (optimized structure)	Region Only (positioned as a utility)	Region + MUSH	Joint Venture
	Geographic Footprint	1. Local municipalities to be served 2. Extensions required to serve MUSH entities 3. Extensions required to serve other customers	- Within Regional Boundaries	- Within Regional boundaries - Small connection to York U (ORION) - There is a MAA (municipal access agreement) with City of Toronto	- Within Regional boundaries - Small connection to York U (ORION) - There is a MAA (municipal access agreement) with City of Toronto	- Within Regional boundaries - All municipalities to be included - Higher concentration in urban areas - Small connection to York U (ORION) - There is a MAA (municipal access agreement) with City of Toronto - Potential extend beyond Region with USH connection	- Within Regional boundaries - Municipalities may become independent - Small connection to York U (ORION) - There is a MAA (municipal access agreement) with City of Toronto -Potential for expansion through JV partner to interconnect with other networks, data centers and wholesale ISPs
Financial	Value to Region	1. Ongoing Capex, Opex needs 2. Cost avoidance 3. Projected revenues 4. Discount rate 5. Funding/financing models 6. Ownership 7. Competitive offer relative to commercial carrier service contract	- No ownership - Enter into lease agreement with private purchaser	- Leveraged Metrolinx for Viva for capital build (may not have resulted in net savings) - Greater access to funding from Metrolinx and other publically funded initiatives - Ownership - have full control - Can overbuild and sell off excess (conduits) - Intrinsic value of owning network as opposed to purchasing from private sector (very difficult to acquire)	- Leveraged Metrolinx for Viva for capital build (may not have resulted in net savings) - Greater access to funding from Metrolinx and other publically funded initiatives - Ownership - have full control - Can overbuild and sell off excess (conduits) - Intrinsic value of owning network as opposed to purchasing from private sector (very difficult to acquire)	- Leveraged Metrolinx for Viva for capital build (may not have resulted in net savings) - Greater access to funding from Metrolinx and other publically funded initiatives - Ownership - have control with input from MUSH - Can overbuild and sell off excess (conduits) - Intrinsic value of owning network as opposed to purchasing from private sector (very difficult to acquire)	- Greater access to funding from private sector - Ownership - have lower control - Can overbuild and sell off excess (conduits) - Can potentially offload the CAPEX and OPEX by sharing it with the private sector - Competitive in the market with ability to have different business models (beyond dark fibre if needed)

Considerations			Privatization/ Divestiture	Public - Public			Public - Private
			Sell to Private Entity & Leaseback	Region Only (optimized structure)	Region Only (positioned as a utility)	Region + MUSH	Joint Venture
	Upfront Investment Required	1. Initial Capex 2. Impact on other funding priorities (funding tradeoffs) 3. Funding sources 4. Access to funding from other sources (e.g., senior levels of government)	- No CAPEX with limited OPEX - Ongoing lease back charges would likely need to be charged back to user departments	- Budget from IT services - Funds from tax levy	- Budget from IT services - Funds from tax levy - Additional funding from business subscribers	- Budget shared amongst invested MUSH and the Region - Additional capex from partners to expand network - Additional opex recoup from partners (proportionally) - Funds from tax levy	- Budget from IT services and private partner - Funds from tax levy
	Credit Rating	1. Impact on credit rating 2. Impact of cost of borrowing	- No impact on credit rating - No impact on borrowing	- No impact on credit rating because of relative small size compared to other Region costs - Borrowing (if needed) may impact other Region initiatives	- No impact on credit rating because of relative small size compared to other Region costs - Borrowing (if needed) may impact other Region initiatives	- No impact on credit rating because of relative small size compared to other Region costs - Borrowing (if needed) may impact other Region and MUSH initiatives	- No impact on credit rating because of relative small size compared to other Region costs - Borrowing might be a requirement for the private sector - Less financial risk than other models - JV partner shares risk
	Financial Risk	1. Risk events 2. Ability to mitigate risk 3. Probability of event occurring 4. Consequence of event occurring	- Risk of increased leasing costs & dependency on private sector - Mitigate by entering into long term lease agreements	- Risk of unforeseen events in construction - Risk of building leases expiring and having to redirect fibre to new facility (low risk) - no target revenues (revenues must meet operating costs) - Risk of breaks and other unforeseen maintenance items	- Risk of unforeseen events in construction - Risk of building leases expiring and having to redirect fibre to new facility (low risk) - target revenues - target rate of return - Risk of breaks and other unforeseen maintenance items	- Risk of unforeseen events in construction - Risk of building leases expiring and having to redirect fibre to new facility (low risk) - no target revenues (revenues must meet operating costs) - Risk of breaks and other unforeseen maintenance items - Partnership risks (financial and legal)	- Risk of unforeseen events in construction, but hedge with private partner - Risk of building leases expiring and having to redirect fibre to new facility (low risk) - No target revenues for Region, but private partner will have targets - Risk of breaks and other unforeseen maintenance items

Considerations			Privatization/ Divestiture	Public - Public			Public - Private
			Sell to Private Entity & Leaseback	Region Only (optimized structure)	Region Only (positioned as a utility)	Region + MUSH	Joint Venture
Policy	Flexibility	Degree to which the Region can control and has flexibility over: 1. Services offered 2. Level and quality of service 3. Coverage area 4. Capacity 5. Prioritizing needs (e.g. emergency)	- Limited by who acquires the assets and how they position the utilization	- Limited growth- limited services offered (dark fibre only) - Coverage area/capacity dictated by available funds - high quality of service	- Able to grow, but limited to funding and geographical reach - limited services offered (dark fibre only) - Coverage area/capacity dictated by available funds- high quality of service	- Growth through Region and MUSH needs - limited services offered (dark fibre only) - Coverage area/capacity dictated by available funds - high quality of service	- Able to grow, but limited to funding and geographical reach - Services offered can include both dark fibre and lit services - Coverage area/capacity dictated by available funds- high quality of service
	Degree of Control		- Low degree of control	- High degree of control	- High degree of control	- High degree of control - Influence from partners	- Some degree of control
	Regulatory Impact	1. Impact of current and future CRTC, Industry Canada, or industry standards 2. Competitor to commercial carriers	- Municipal act considerations	- Municipal act considerations (to be clarified)	- Municipal act considerations	- Municipal act considerations	- Municipal act considerations
	Impact of Technology and Disruptive Innovation	1. Region's policy around future evolution, technology obsolescence, and network resilience 2. Region's ability to assess and manage impact of technology evolution and disruptive innovation	- N/A	- no impact (dark fibre is enabler) - only potential disruption on pricing	- no impact (dark fibre is enabler) - only potential disruption on pricing	- no impact (dark fibre is enabler) - only potential disruption on pricing	- majority of asset is fibre, so little impact -widespread adoption of service may exhaust existing fibre capacity sooner than planned

Considerations			Privatization/ Divestiture	Public - Public			Public - Private
			Sell to Private Entity & Leaseback	Region Only (optimized structure)	Region Only (positioned as a utility)	Region + MUSH	Joint Venture
	Pricing and Cost Recovery	1. Pricing principles (e.g., Recover costs only, make profits, etc.) 2. Pricing policy (e.g., same for all vs. varying based on type of subscriber) 3. Pricing rate plan structure by service 4. Price planning over time	- N/A - Pay lease as per agreement with service provider	- Need to recover costs - no cost to region user - lower than market cost for non-region user - price by per strand km - price increases to maintain cost recovery - non-profit pricing model, but need funds for future capital investments and cash flow to manage operations/maintenance	- Target rate of return - no cost to region user - lower than market cost for non-region user - price by per strand km - price increases to maintain target rate of return	- Need to recover costs - cost to region and MUSH users - price by per strand km - price increases to maintain cost recovery - non-profit pricing model, but need funds for future capital investments and cash flow to manage operations/maintenance	- Region needs to recover costs - Private partner will want some rate of return which would be per their usual business targets - no cost to Region user - lower than market cost for non-Region user - price by per strand km or for bandwidth - price increases to maintain cost recovery
	MUSH Support	1. Degree to which various lower level municipalities will support 2. Degree to which broader MUSH will support	- MUSH independent	- MUSH can be supported (subscriber only) - adhoc and as requests come in - no specific mandate - on requests only	- MUSH can be supported	- Large MUSH support given partnership	- MUSH can be supported, but likely independent
	Impact on Existing Obligations	Impact on: 1. Lower level municipalities 2. Broader MUSH (e.g., Orion, Southlake)	- Current MUSH connections need to be included in any leaseback agreement	- No impact on existing obligations	- No impact on existing obligations	- No impact on existing obligations	- Some impact on existing obligations - Long term agreements may need to be included in partnership
	Reputational Risk	Impact on reputation in the minds of: 1. Rate payers 2. Business community 3. Peer group	- Potential risk depending on how the new entity positions the usage of the network	- No impact on reputation if program supports itself - Pressure from business community, may ask for connection	- No impact on reputation if program supports itself - Positive impact if business community offered connection	- No impact on reputation if program supports itself - Pressure from business community, may ask for connection	- No impact on reputation if program supports itself - Positive impact if business community offered connection - Risk of long term partnership alignment - need exit strategy & protocol if interests diverge with YTN

Appendix B

Case Studies

Region Only

Parameters	QNet	Columbia Basin Broadband Corporation (CBBC)	O-Net	EPB
Owner	City of Coquitlam	Columbia Basin Trust	Community (The Old's Institute for Community & Economic Development)	City of Chattanooga
Location	City of Coquitlam , BC	Columbia Basin, BC	Olds, Alberta	Chattanooga, Tennessee
Population	126,840 (2011 Census)	89,865 (2014)	8,235 (2011)	173,366 (2013)
Model	Region Owned - started with spare capacity through traffic signals projects	Region Owned	Region Owned	Region Owned - started laying fibre backbone as part of smart grid
Operations	2008	Set up in 2011 when CBT acquired the assets of Columbia Mountain Open Network	2013	• In 2000 started offering services to Business • Started FTTH services in 2009
Separate Identity	Yes	Yes	Yes	Yes
Legal Framework	• Wholly owned subsidiary of Coquitlam City Council • Coquitlam City Council is the sole shareholder. • Economically dependent on City of Coquitlam • Registered as a non-dominate telecom carrier required to file annual reports with the CRTC	• Wholly owned subsidiary of Columbia Basin Trust	• Wholly owned subsidiary of The Olds Institute for Community & Regional Development	• EPB is a nonprofit agency owned by the city of Chattanooga • EPB was established in 1935 as an Agency of City of Chattanooga for the sole purpose of providing electric power • EPB entered into the telecommunications business in 1999 as EPB Telecom • Changed its name from EPB Telecom to EPB Fibre Optics in 2007 at FTTH service launch
Team	• Council & the Executive Team • Financial Services	• Chief Economic Officer • Chief Technical Officer	• 21 full-time staff on the payroll plus contractors	• Five-member Board is appointed by the City of Chattanooga

Region Only

Parameters	QNet	Columbia Basin Broadband Corporation (CBBC)	O-Net	EPB
	• Economic Development • Corporate Communications • Planning and Development • Engineering • Facilities • ICT	• Network Infrastructure Manager • Business Services Coordinator		• President and Chief Executive Officer • Finance and Chief Financial Officer • Economic Development and Government Relations • Strategic Systems • Customer Relations • Corporate Communications • Strategic Research • EPB Fibre Optics • Human Resources • Information Technology and Chief Information Officer • Marketing • Technical Operations • Field Operations
Financial Statements Published	Yes	Yes	Not readily available	Yes
Last Financial Statement	2014	2014		2015
Investment	• $5.1 Million by City (20 years loan) for startup costs etc.	• $1.5 Million invested between 2011 to 2013. • $6.5 Million committed by CBT to be invested between 2013-2018	• $14-$21 Million (By provincial grant, a loan backed by the town, and a line of credit); • $6 million loan from the Town to build the network	• $ 330 Million to set up fibre network • $220 million came from bond money and $111.5 million from federal stimulus dollars from the U.S. Department of Energy
Key Financial Indicators	• Cash positive by 2013 (excluding loan payments) • Savings by City = $360,000 per year • Total Revenue (2014) = $434,060 • Operating Expenses (2014) = $168,158	• Deficit(2014) = $968,000 • Revenue (2014-15) = $439,000 • Expenses (2014-15) = $1,407,000 • All losses incurred by CBBC addressed through the	• O-NET is in a cash flow positive position • • Company now generates enough revenue to fund it's daily operations	• EPB Operating Revenues FY 2015 = $ 671 Million • Revenue EPB Fibre Optics FY 2015 = $118.2 Million • EPB Fibre Optics Expenses FY 2015 = $101.3 Million

Region Only

Parameters	QNet	Columbia Basin Broadband Corporation (CBBC)	O-Net	EPB
	• Earnings for adjustment (2014) = $94,341 • Cash Flow Surplus (2014) = $26,369 • Loan Balance (2014) = $5,171,033	Delivery of Benefits Budget set by CBT		
Fibre Length	More than 60 km	Access to 724 km	Not published	About 12,900 km
Services	• Lease Dark Fibre • Data Centre Services	• CBBC would be the ISP to the municipalities. • The Municipalities could further choose to be the ISP to the City • Municipalities could also choose to work on a PPP model with existing Internet service provider • CBBC's intent not to provide retail ISP services, or any telecommunication services. CBBC's network to provide opportunities for ISPs	• O-net acts as an ISP to residents • Phone • Internet • TV	• EPB acts as an ISP to residents and businesses • Phone • Internet • TV
Subscribers	Telus, Shaw, Bell, Allstream, Novus, Uniserve, Arima and Secure Data	Other Municipalities in Columbia Basin	Residential and Business Users	Residential and Business Users
Pricing Policy	• Services packages per the TSP • Fibre Leasing = $400 per month for wired leasing • Fibre Leasing = $500 per month per strand for wireless providers, typical point-to-point fibre leases up to five kilometers between end points	• Local governments (> 5,000 residents) = $1,500/month • Local governments (between 2,000 to 5,000 residents) = $1,250/month • Local governments (< than 2,000 residents) = $750/month • ISPs (single connection) = $1,000/month • Internet usage pricing is $20/Mbps transferred	• BW: 50 Mbps (D/L & U/L) @ $90/month (500 GB) • BW: 100 Mbps (D/L & U/L) @ $100/month (1TB) • BW: 1000 Mbps (D/L & U/L) @$120/month (2TB)	• BW: 1000 Mbps (D/L & U/L) @$69.99/month • BW: 100 Mbps (D/L & U/L) @$57.99/month
Role	• Greater access to reliable, affordable high-speed internet	• Own and Development of Fibre Optic Backbone	• Made Olds the first Gigabit town in Canada	• The EPB fibre network provides commercial

Region Only

Parameters	QNet	Columbia Basin Broadband Corporation (CBBC)	O-Net	EPB
	services. • Provides business and residential users with improved choice and rates by enabling competition	Network in Basin • Serve as a resource for communities • Provide dark fibre • Serve as the ISP for Columbia Basin Trust (CBT), Columbia Power Corporation (CPC) and where requested • Own and manage the electronics necessary to operate the network • Work in conjunction with the various regional districts, First Nations and others to help deliver broadband to more rural areas.		broadband service and supports a smart grid system

Region (Positioned as a Utility)

Parameters	PowerStream	York Region Rapid Transit Corporation (YRRTC)	Housing York Inc.
Owners	Jointly owned by the City of Barrie, the City of Vaughan and the City of Markham	York Region	York Region
Model	Utility + Municipality	Design Build	Local Housing Corporation (incorporated as OBCA corporation under the *Social Housing Reform Act, 2000*)
Separate Identity	Yes	Yes	Yes
Legal Framework	• Formed as a result of a merger of Markham Hydro, Hydro Vaughan, and Richmond Hill Hydro that took place in 2004 • Ownership of City of Vaughan - 45.3% • Ownership of City of Markham - 34.2% • Ownership of City of Barrie - 20.5% • Purchased Aurora Hydro in 2005, merged with Barrie Hydro in 2009 and Purchased 50 per cent ownership of Collus Power from the Town of Collingwood in 2012 • In 2013, new affiliate, PowerStream Energy Services Inc., was created to facilitate the pursuit of non-regulated business opportunities. • It resulted in a corporate governance restructuring and the establishment of PowerStream Holdings Inc. as the parent company • Merger proposed between Enersource, Hydro One Brampton and Horizon Utilities Corporation • PowerStream sold its excess fibre-optic assets and related contracts to Atria Networks LP, while retaining the fibre infrastructure required to support its current and future operational requirements	• Wholly-owned subsidiary and share capital corporation of The Regional Municipality of York	• Wholly-owned subsidiary and share capital corporation of the Region.
Governance	• The PowerStream Board of Directors is appointed by the company's three shareholders - the Cities of Barrie, Markham and Vaughan • PowerStream's Executive Management Team is responsible for the day-to-day management	• Board of Directors comprises the York Region Chairman & CEO and four directors who are the Mayors of the Towns of Richmond Hill and Newmarket and Cities of Markham and Vaughan	• Board of Directors comprises the York Region Chairman & CEO and six directors who are Regional Councillors. • There is no private sector or other

Parameters	PowerStream	York Region Rapid Transit Corporation (YRRTC)	Housing York Inc.
	and is accountable to the company's Board of Directors • Executive Team comprises of CEO, Executive VP, COO, CFO, Executive VP (Renewable Generation and Conservation) & Executive VP (Corporate Services and Secretary)	• No private sector or other public sector representation on the YRRTC Board of Directors • Executive Team consists of President, CFO, Chief Engineer, Design Chief, Chief Communications Officer, Associative Council who report to Board of Directors	public sector representation on the HYI Board of Directors. • Executive Team consists of President, Secretary, CFO, General Manager and Solicitor, all of which positions are staffed by senior staff of the Region through a Management Services Contract between HYI and the Region. They report to the HYI Board of Directors.
Financial Statements Published	Yes	Yes	Yes
Last Financial Statement Published	2014	Q2 2015 (Quarterly statements are published)	2014
Financial Indicators	• Total Revenue (2014) = $1,110,960,000 • Operating Expenses (2014) = $90,355,000 • Total Income (2014) = 16,432,000 • PowerStream owns and operates $950.6 million in assets	• Gross Capital Expenditure (Q2 2015) = $189.8 Million • Gross Operating Expenditure (Q2 2015) = $18 Million • Current Capital Program = $3.2 Billion • Region's Contribution = $510.4 Million • Federal Contribution = $436.6 Million • Provincial Contribution = $2.2 Billion	• Total Revenue (2014) = $28,807,574 • Expenditure (2014) = $26,494,070 • Retained Earnings (end of 2014) = $3,052,836
Description	• PowerStream serves 9 municipalities making it the 3rd largest electric utility in Ontario and 4th largest municipally owned utility in Canada • Number of Customers - 335,000 • Number of Employees - 513	• York Region Rapid Transit Corporation (YRRTC) is responsible for the planning, design and construction of the rapid transit network and related infrastructure	• HYI is responsible for the operation, management, delivery and maintenance of social housing, non-profit housing, and affordable housing portfolio in York Region.

Region + MUSH

Parameters	WREPNet (Waterloo Region Education and Public Network)	Peel Region Public Service Network (PSN)
Owner	Strategic alliance of the school boards, local governments, public libraries and the local community college	Region of Peel
Location	Waterloo Region, Ontario	Region of Peel
Model	Region + MUSH	Region + MUSH
Built By	Prescient International, Atria, MFP Financial, and sub-contractors were all partners to WREPNet - 8 municipal partners came on board	Peel Region. Hydro Utilities is the facilitator
Separate Identity	Yes	Yes
Legal Framework	• Partners include Waterloo Region District School Board, Region of Waterloo, City of Kitchener, City of Cambridge, City of Waterloo, Waterloo Public Library, Grand River Hospital etc. • Network governed by a Steering Committee, Business Planning Group, Technical Team and Project management office with representation from all partners • Each partner shares development, operating and maintenance cost of network • A cost sharing agreement amongst the partners based on number of sites for lease agreement and management of network. • Partnership with Rogers Communications for the provisioning and supply of a dark fibre network for a 5 year period • Partnership with Softchoice for support and implementation services and management of the overall network • Previous agreements with Fibretech Telecommunications Inc. , Atria and Unis Lumin Inc. - Atria was acquired by Rogers Communications • The Region of Waterloo coordinates renewals of contracts on behalf of the WREPNet partners. Partners get to vote on subject to renewal	• Ownership is limited to Region, Area Municipalities within Peel Region (City of Brampton, City of Mississauga, Town of Caledon) • PSN is a non-dominant telecom carrier registered with the CRTC • Each partner responsible for implementing fibre network within their municipal boundaries • Spare fibre made available for the use of other partner • PSN is for the “business use” of the participating organizations, primarily for communication between their own facilities to conduct every aspect of municipal business. • Subscribers are responsible for all revenues
Financial Statements Published	Some partners publish their respective costs/benefits (District School Board)	Subscriber Revenue and Expenditure Statements
Financial Statements Last Published	Some partners publish their respective costs/benefits	2014
Investment	Ministry of Education in Ontario provided a one-time infrastructure grant of $10 Million for implementation of the network	$ 17 Million until 2015 by Partnership
Financial Indicators	• Total cost for WREPNet partners (Lease with Rogers) = approximately $2,206,634 annually • Total cost for Region (Lease with Rogers) = $415,449 annually • Total cost for WREPNet partners (Support from Softchoice LP) = $685,649 annually • Total cost for Region (Support from Softchoice LP) = $129,087 annually • Expenditure by Region is catered by preliminary 2015 Information Technology	• Achieved break even in 2014, achieving reserve fund of $469K. • The Reserve Fund balance at the end of 2015 is anticipated at $490K

Parameters	WREPNet (Waterloo Region Education and Public Network)	Peel Region Public Service Network (PSN)
	Services (ITS) Operating Budget	
Subscribers	WREPNet connects approximately 325 individual sites at schools, municipal government offices, and public libraries	Connects 580 partners and 18 subscriber facilities
Access to Network	Each partner's staff and clients will have access to the network as defined by the partner	Any Public Sector Agency operating in Peel Region
Fibre Length	Approximately 585 kilometers	Approx. 693km (96 Count)

Public Private Partnership (Joint Venture)

Parameters	Alberta SuperNet	EORN (Eastern Ontario Regional Network)	Rhyzome Networks
Owner	• Government of Alberta • Bell	Created by Eastern Ontario Wardens' Caucus (EOWC)	Subsidiary of City of Stratford
Location	Alberta	Eastern Ontario	Stratford, Ontario
Model	PPP	PPP	Region Only
Separate Identity	Yes	Yes	Yes
Finished in	2005	2014	2010
Legal Framework	• One network component is owned by Bell and covers 27 cities in Alberta. • Other 402 communities network in rural Alberta are owned by Government of Alberta • Axia responsible as wholesaler	• Not-for-profit corporation accountable to the Eastern Ontario Wardens' Caucus (EOWC) • EOWC created EORN to by partnering with ISPs to help build new services • Any registered ISP can buy wholesale bandwidth on the backbone	• Rhyzome Networks is a subsidiary of the City • Festival Hydro Services Inc. ("FHSI") is operating as Rhyzome Networks • Festival Hydro is wholly owned by the City of Stratford • Rhyzome launched its own commercial and residential ISP services over fibre and Wi-Fi in 2011 • Citywide Wireless Network uses Wireless mesh technology developed by Motorola to connect users and smart electricity meters • Citywide Wireless Network uses solutions from Solution Inc. for billing, location based marketing and registration of users
Financial Statements Published	Financial statements published as part of Service Alberta & Axia	Yes	Financial statements published as part of Festival Hydro Services Inc.
Last Financial Statements Published	2014-2015	2015	2015
Total Investment	Over $330 Million	• $ 170 Million • $55 Million each by Federal and Provincial Governments • EOWC Inc. contributed $10 Million and $50 Million by Private Sector Partners • Project now valued at more than $260 million when private sector, in-kind contributions are considered	$1.2 Million invested by 2009 in Fibre Optic Network
Financial	• Expenses (2014-15) = Approx. $18 Million	• Total Revenue 2014-15 = $34,181,860	• Total Revenue 2014-15 = $493,512

Parameters	Alberta SuperNet	EORN (Eastern Ontario Regional Network)	Rhyzome Networks
Indicators		• Total Expenses 2014-15 = $33,707,890 • Accumulated Surplus = $473,370	• Total Expenses 2014-15 = $253,445 • Net Income for 2015 = $10,210
Service Provider	• Axia Supernet Ltd. (Wholesale ISP) • Over 100 service providers, 500 service connections and 429 communities are connected to the SuperNet.	• Bell Alient, Xplorenet, Nexicom, Storm • Satellite access provided for areas where fibre cannot be reached by Xplorenet Communications	• Wholesale Service provider for Wi-Fi and fibre access to ISPs is Rhyzome Networks • Dark Fibre, Lit Fibre, City WiFi and Collocation services provided • Dark fibre connections provided to Hydro One Telecom • Switch offers mobile and residential broadband, exclusively via Rhyzome Wi-Fi
Cost for users	• O-Net: BW: 1000 Mbps (D/L & U/L) Price: $120/Month (2 TB Monthly) • Distributel: BW: 30 Mbps D/L & 2.5 Mbps U/L Price: $79.95 (Unlimited) • Axia: BW: 100 Mbps for $99/month	• Storm Internet: 60 Mbps D/L & 10 Mbps U/L Price: $62 (300Gb Monthly) • Nexicom: 60 Mbps D/L & 10 Mbps U/L Price: $99.95 (Unlimited)	• $30.97 for WiFi Residential Internet Services • $26.55 per month for WiFi Mobile Internet Services
Fibre Length	13,000 km of fibre has been laid down	5,500 km network of new and existing fibre	70 km

Divest

Parameters	360Networks
Owner	• Current Owner - Zayo Group • Previous Owner - Ledcor Industries of Canada
Location	Maximum presence in Canada and USA
Model	Privatize/Divest
Separate Identity	Yes
Legal Framework	• Publicly Traded Company • Originated from the telecommunications division of Ledcor Industries of Canada in 1998 • Previously known as Worldwide Fiber, Inc. and Pacific Fiber Link • 360 group originally consisted of more than 90 companies registered in approximately 33 jurisdictions around the world • Filed for Bankruptcy in 2001 • 360networks sold its Canadian telecommunications business to Bell Canada in 2004 • Zayo Group bought the company in 2011.
Operations	The company is a regional wholesale provider of integrated fibre-optic communications network and computer telephony services to businesses, ISPs, cable companies, and telecom carriers
Financial Statements Published	Yes
Last Financial Statement Published	2012 (Before its acquisition by Zayo Group)
Investment	Initial Public Offering raised $1.4 Billion which funded the company's expansion
Financial Indicators	• $2 Billion in debt at time of bankruptcy • Bell Canada bought Canadian assets of 360Networks for $275 Million • Delisted from NASDAQ in 2001 • After selling off assets to Bell Canada and turned its focus on accretive acquisitions, company started to recover and expand • Revenue (First six months of 2012) = $44 Million • Profit (First six months of 2012) = $6.2 Million • Zayo Group bought the company for $345 Million • At the time of purchase it was debt free and worth about $350 million with $50 million cash, in the bank
Fibre Length	Almost 30,000 km fibre network in USA

Broadband Strategy Update and York Telecom Network Review

Presentation to

Committee of the Whole Council

Doug Lindeblom

June 16, 2016

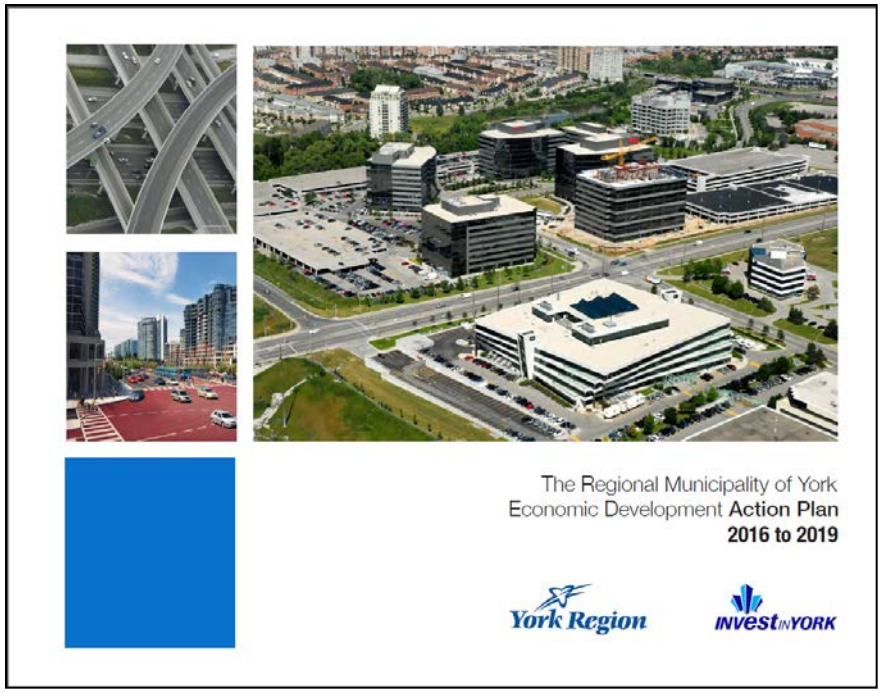
York Region

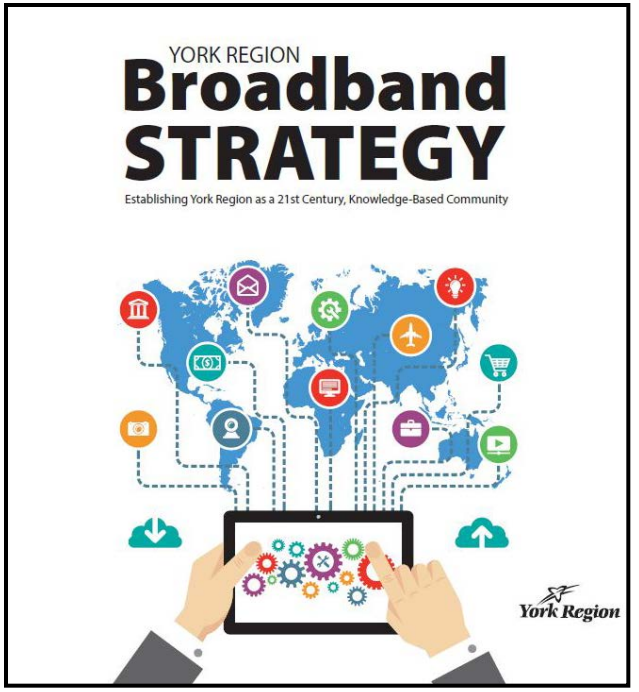
Purpose

- Provide an annual update on York Region Broadband Strategy initiatives

- Provide an overview and recommendations for the York Telecom Network Phase 1 Review

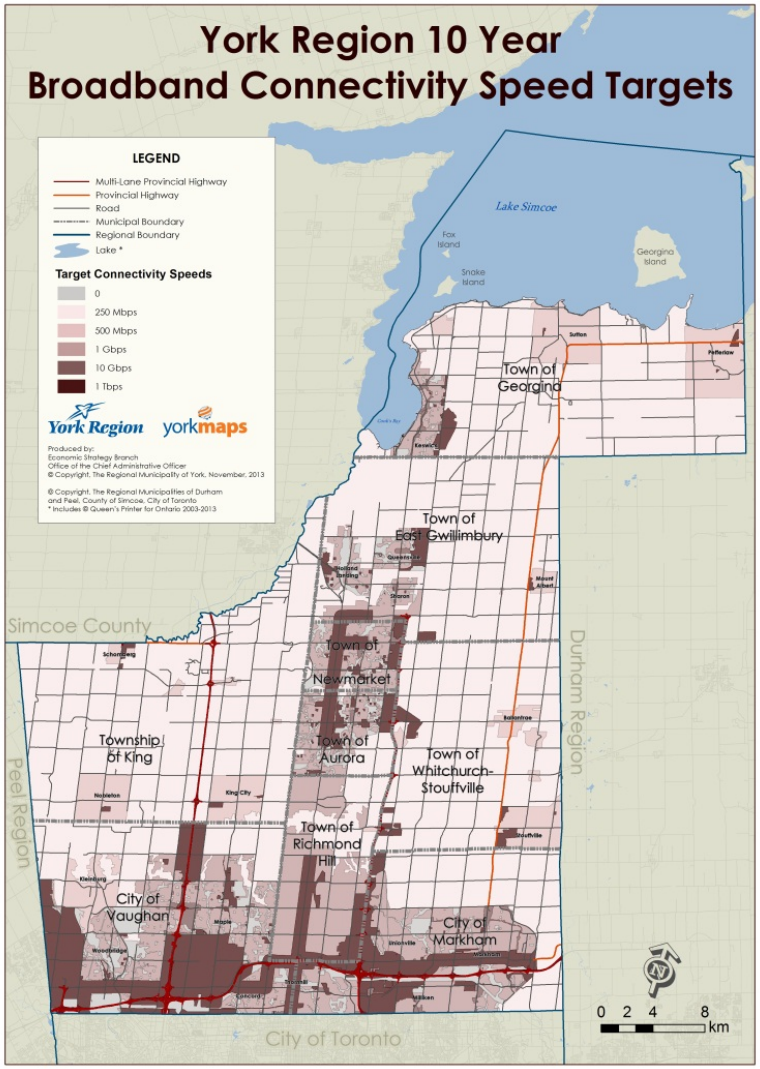
Broadband Strategy Update





Elevating broadband access and capacity supports economic activity and job growth

Broadband Strategy Direction



Connectivity Priorities

- Centres & Corridors
- Employment Lands
- Rural Areas

Hierarchy of Approaches

- Private Investment
- Public-Private Partnerships
- Public Investment

A range of approaches and initiatives is required to improve connectivity across the Region

Broadband Strategy Vision:
To establish York Region as a Gigabit Region…

Education & Advocacy Priorities	Municipal Process Priorities	Infrastructure Investment Priorities
Government Engagement	Harmonize Municipal Access Agreements	ORION PoP at Southlake & York Region Research and Education Network
Development Industry Engagement	Development Approval Process	
Property Management Engagement	Wireless Communications Toolkit	Community Wi-Fi Network
	Regional Conduit Network	Low-Cost Internet for Social Housing
Council endorsed the Vision and Implementation Priorities of the Broadband Strategy in 2014		Regional Wide Area Network Connectivity (e.g. York Telecom Network)

Accomplishments - Education & Advocacy

Engaging the public and private sector enables awareness and promotes partnerships that support connectivity

Accomplishments – Municipal Process

Improving processes will help attract and enable Broadband investment

Accomplishments – Infrastructure Investments

Coordinating broadband infrastructure builds will leverage increased connectivity

Broadband Strategy – What's Next

- Continue Broadband Strategy Advisory Task Force
- Initiate Intelligent Community Initiative (2016 – 2018)
- Undertake 2nd Annual Broadband & Innovation Summit (Oct 2016)
- Revise York Region (Wireless) Telecom Policy (Q4 2016)
- **Establish York Telecom Network Governance & Business Structure (End of 2016)**

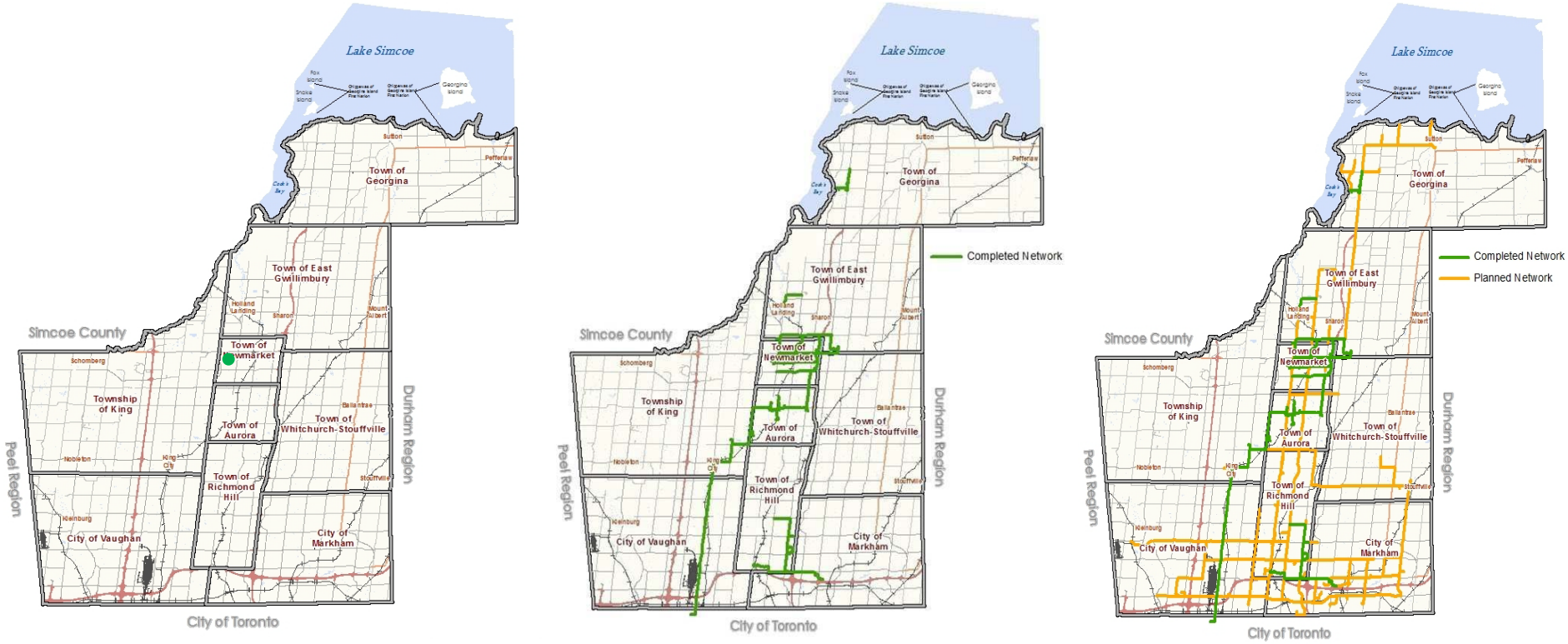
Ongoing efforts to enable connectivity are critical for maintaining and improving York Region's competitiveness and attractiveness

York Telecom Network Governance Review

The York Telecom Network is the Region owned dark fibre network connecting the Region and partners buildings and ‘things’

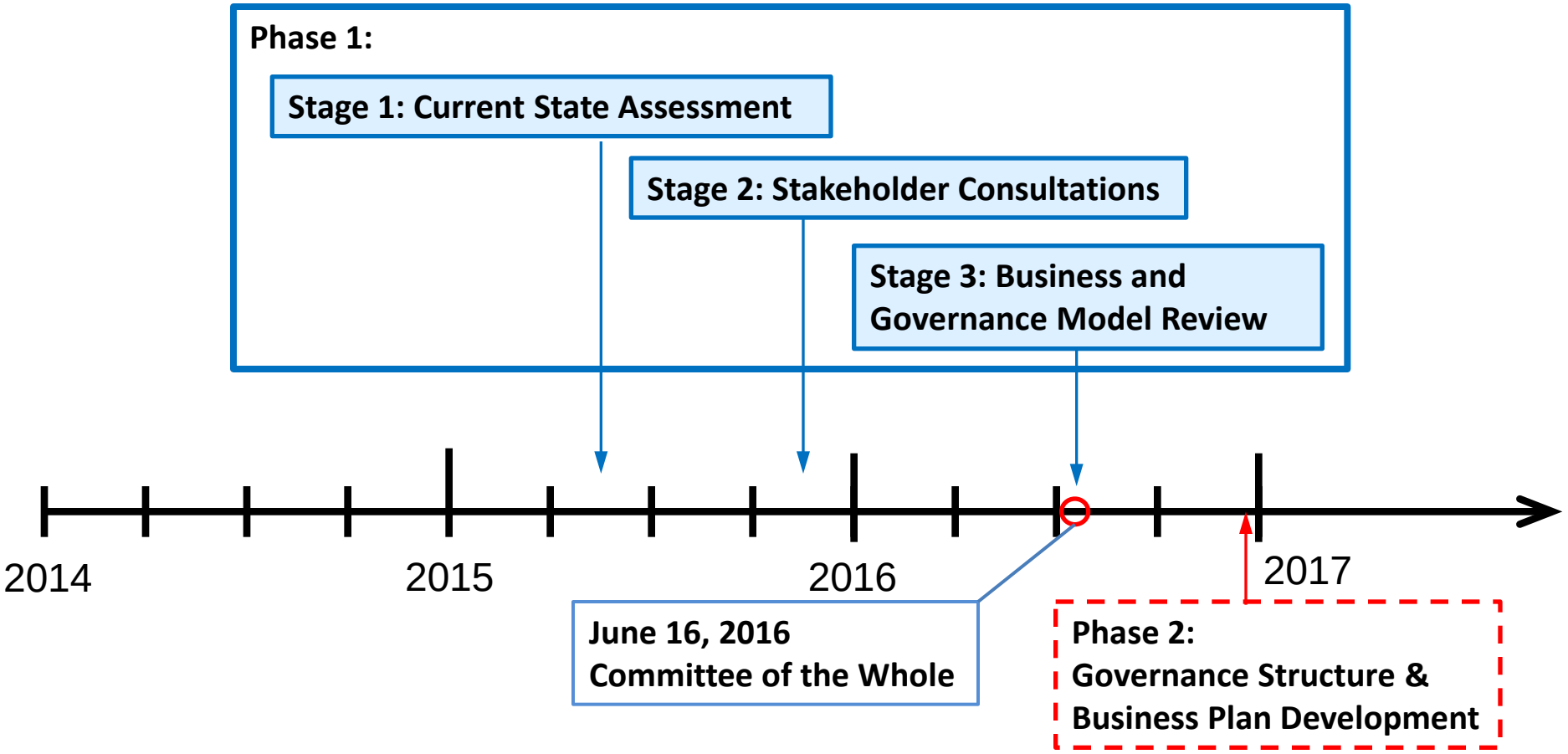
York Telecom Network Growth

2002 → 2015 → 2024

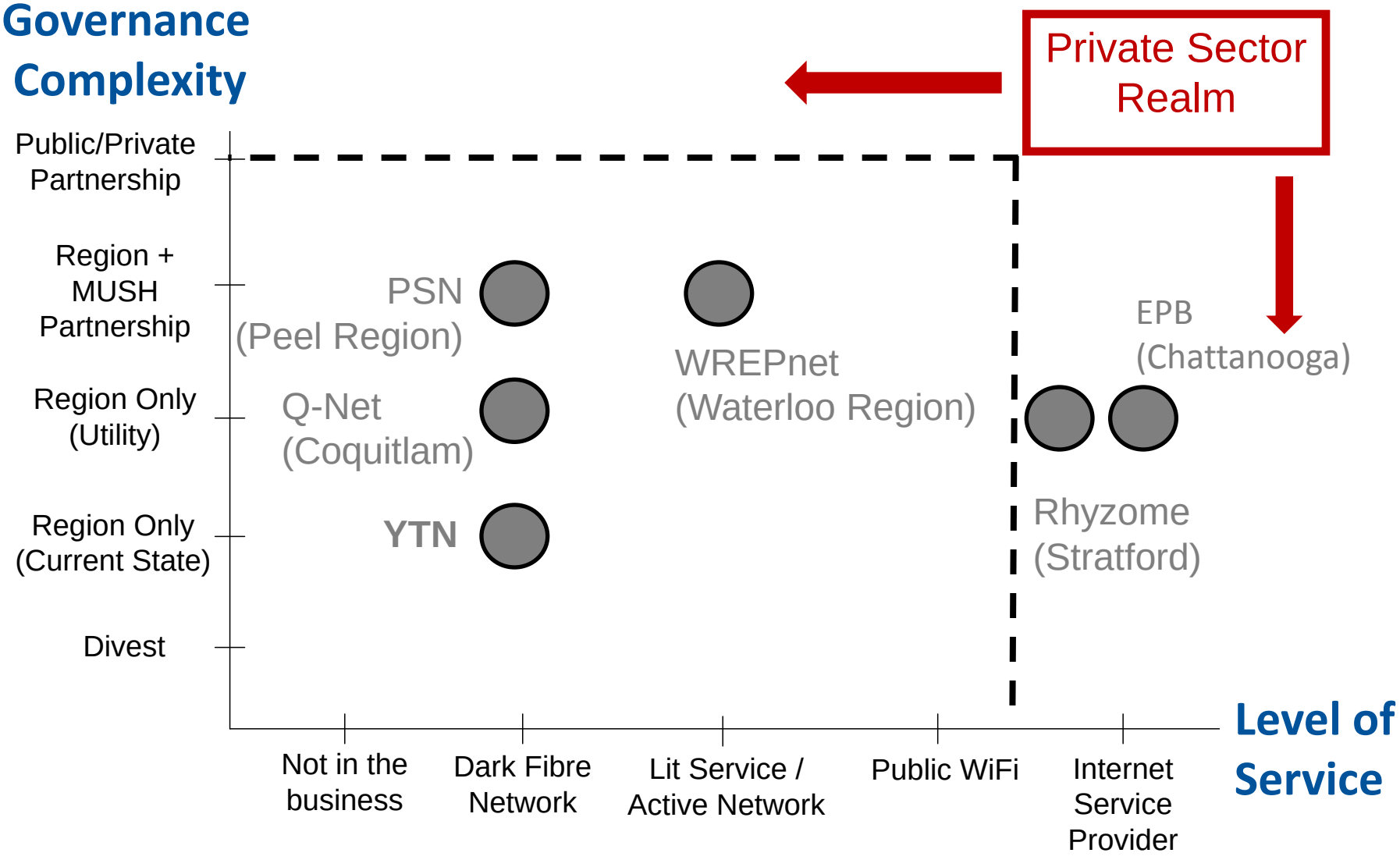


Growth in demand, complexity and costs prompted a review of the York Telecom Network

York Telecom Network Review Process



Positioning YTN – Governance and Service Options



There are several different municipal models for delivering broadband connectivity

Policy Direction Considerations

- Role and Scope
- Ownership
- Governance
- Users
- Financials

Proposed policy directions for York Telecom Network were reviewed by the Broadband Strategy Advisory Task Force

Conclusions from the Review

- Continue to operate York Telecom Network
- Formalize a structure for governance and operations
- Establish a sustainable business model
- Continue to lease dark fibre capacity to public sector subscribers
- Consider private sector leasing options as appropriate
- Develop a governance model that would not preclude adding other future network owners/partners

Phase 1 concludes that the York Telecom Network should continue but with a formal plan, more structure and consideration for partnerships

Recommendations

- Develop the York Telecom Network as a Region owned fibre network based on principles outlined in the report
- Report back to Council by the end of 2016 with a detailed governance structure and financial and business plan
- Circulate the report to municipalities and network stakeholders