The City of Calgary Fibre Infrastructure Strategy Annual Update

2018 October 18

Chief Financial Officer's Department - Information Technology

Executive Summary

On 2015 September 28, the Fibre Infrastructure Strategy was presented and unanimously approved by Council. This report serves as the 2018 annual update.

By Q4 of 2018, over **600** facilities and assets (e.g. traffic controllers) will be fibre-connected and **avoiding** third-party communication costs estimated to be **$7 million per year.**

2018 revenues are on track for **$900 thousand** which represents a **58% increase** from 2015 and is well above the **$180 thousand** originally projected in the strategy.

New opportunities for revenue exist with the evolution of mobile networks to 5G/Small Cell and possible collaboration with Enmax for automated meter reading.

The current 2019 - 2022 capital budget constraints resulted in a reduction of the capital budget from $4 million per year to $1 million per year, funded entirely from the Information Technology (IT) Reserve which is partially sourced from the fibre revenues.

Under these new constraints, opportunities to reach City facilities will slow and revenue will plateau. All programs, systems and initiatives that benefit from new fibre builds will be impacted. Prioritization will be key to ensuring best value for investment.

Background

On 2015 September 28, the Fibre Infrastructure Strategy was presented and unanimously approved by Council.

The Fibre Infrastructure Strategy is critical to ensure The City of Calgary continues to provide fibre optic to deliver next-generation municipal services in a cost-effective manner.

Investment in City fibre is even more important today and into the next business cycle as our dependence on technology and data increase. City fibre is fundamental to delivering City services which contributes to **resiliency**, service **growth** and innovation and is the **foundation** of all networks which City business units rely on to ensure Calgary continues to excel as a smart, safe and prosperous city now and into the future.

2015 – 2018 Accomplishments
a. Connecting Assets

By Q4 of 2018, over **600** facilities and assets (e.g. traffic controllers) will be fibre-connected, increasing business-unit capabilities with unlimited bandwidth and **avoiding** third party communication costs estimated to be **$7 million per year.**

	Progress in 2015-2018	Total Fibre Connected Assets 2001-2018	Notes
City buildings connected	86	236	Approximately $7M annual cost avoidance
City field assets connected	37	114	LRT Stations, Water Plants, Help Phones, Digital Signs, Parks, Underpasses, Airport Tunnel, BRT's.
Traffic intersections, signs, and sensors.	264	300	Approximately $1.5M in annual cost avoidance

Table 1: 2018 Estimated Number of Assets Connected with City Fibre

b. Enabling Networks

City fibre enables numerous networks for City business units, Civic Partners, post-secondary institutions and external agencies. The City alone has more than 20 different networks specific to its applications; as an example, the network that operates the Light Rail Transit is much different than the network that ensures clean water, but both rely on City fibre.

Figure 1: CCN: Bandwidth Consumption for City services [1 Petabyte (PB) = 1 million Gigabyte]

The Calgary City Net (CCN) is The City's largest, most resilient network which provides high bandwidth, redundancy and security for business units. CCN's success is represented by the rate of adoption by business units. During the last budget cycle, the CCN's bandwidth demands have increased **550%** (*see Figure 1*) as business units deploy connected devices to enrich and modernize their services.
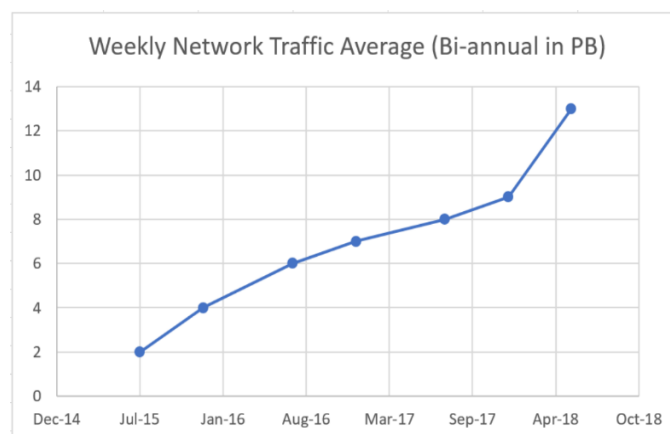
c. Increasing Resiliency

City fibre increases the resiliency of City services which, in turn, enriches citizen confidence. When a city **owns** its fibre, it can respond with greater agility during

extreme events. This was exemplified during the 2013 flood where a catastrophic loss in network resources was mitigated due to the control, agility and capacity afforded through City fibre. This could not have been achieved without full control of the fibre asset.

Figure 2: Traffic Network Uptime

City fibre increases the resiliency of all services that leverage it. As an example, during the last business cycle, City fibre reached over **300** traffic controllers, resulting in an **increase** of service uptime by **22%** (*see Figure 2)* improving the traffic flow through the city.
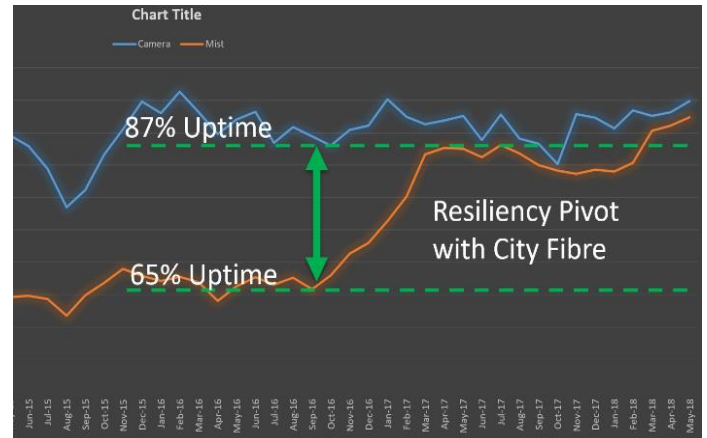
d. **Other Notable Accomplishments**:
- 2018 revenues exceeded projected estimates by 58%.
- Calgary Police Service (CPS) exclusively uses City fibre to build their core network.
- The Calgary Public Library has standardized on City fibre.
- The City won the Ministers Award for Municipal Excellence for Municipal Owned Fibre Infrastructure (2016).
- University of Calgary research on Quantum Key Distribution published their findings in Nature Photonics in 2016. Access to City fibre was acknowledged in the research paper "Quantum teleportation across a metropolitan fibre network" to assist in testing their research in a real-life environment.
- The City won the Ministers Award for Municipal Excellence for Municipally Owned Internet of Things (IoT) Wireless Network (2018). This network is enabled by City fibre.
- The Calgary Internet Exchange is rapidly growing, in part, due to City fibre, making Internet faster for everyone.
- Participated in a number of Canadian Radio-television and Telecommunications Commission consultations influencing policy to include municipal interests.
- Calgary Economic Development (CED) includes City fibre as a technology enabler to attract companies to Calgary (e.g. Amazon bid).
- Participated in regional efforts to increase the importance of municipal fibre through speaking engagements, presentation to rural council and local meetings.
- Contribute and respond to provincial consultations like the Provincial Broadband Strategy.

- City fibre transports video from over 3,000 cameras used by Corporate Security, Transit, Roads and Calgary Parking Authority.
- Fibre infrastructure plays an important role in security by design.
- City fibre is a key element to delivering on business-friendly initiatives for Living Labs in conjunction with CED.

City Fibre Strategy Alignment

The City fibre strategy aligns with corporate and affiliated initiatives underway, including Calgary Economic Strategy, One Calgary and Resilient Calgary. Calgary Economic Development recognizes City fibre as an incentive to attracting high-tech companies to Calgary to support our community's economic diversification.

City fibre is the foundational communications infrastructure that can accelerate Calgary's journey as a "Smart City".

In addition to enabling municipal services, City fibre enables industry and entrepreneurs to innovate and accelerate ideas to commercialization contributing to the diversity of Calgary's economy.

Stranded Facilities

Connectivity demands for Field Computing, IoT, 5G and Smart City solutions are increasing every day, and this should be considered the new normal. These new demands emphasize the change in society and how cities need to adapt quickly.

Smart and resilient cities will be impacted by the rapid evolution and adoption of technology and reliance on data. What this means for The City of Calgary is that connectivity through fibre and wireless will experience **sustained and continuous** demand incenting a greater integrated approach in the planning process for both public and private actors. By incorporating digital infrastructure into an integrated solution, The City can mitigate new technology being "bolted on" to assets with a preferred, seamless and aesthetically attractive solution emerging.

Lesson Learned: Stranded facilities are no longer finite as sustained and continuous demands for connectivity is the new normal.

Greenfield

Greenfield communities offered an opportunity to advance City fibre with additional cost reduction by taking advantage of the four-party trench agreement with Atco, Enmax, Telus and Shaw. By leveraging this opportunity, The City experienced a **75% savings** in traditional construction costs. Greenfield opportunities and investment were less than projected due to the reduction of residential development and investment.

Lesson Learned: Leveraging the four-party trench is a cost-effective method of expanding City fibre.

Business Parks and Transit-Oriented Developments (TOD)
Business Parks & Transit-Oriented Developments were also opportunities to expand City fibre. Though only one opportunity was leveraged, there has been no indication of future undertakings. IT continues to work towards strengthening the value proposition with Real Estate and Development Services (RE&DS).

Revenues
As part of the Fibre Infrastructure Strategy, The City operates as a dark fibre optic provider and IT licenses excess fibre-optic capacity to other public-sector organizations, businesses and/or carriers. This revenue is growing and serves to finance further construction activities while reaching self-funding status. 2018 revenues are on track for **$900 thousand** which represents a **58% increase** from 2015 revenues and is well above the **$180 thousand** originally projected in the strategy. Through Council support of the fibre strategy, a dramatic increase in revenue growth has been achieved (*see Figure 3*). Though revenue growth has been better than anticipated, a better understanding of the market is incenting a more targeted and focused approach to revenues. Emerging markets spurred by the trend to densify networks (5G/Small Cell, IoT) will provide new revenue opportunities.
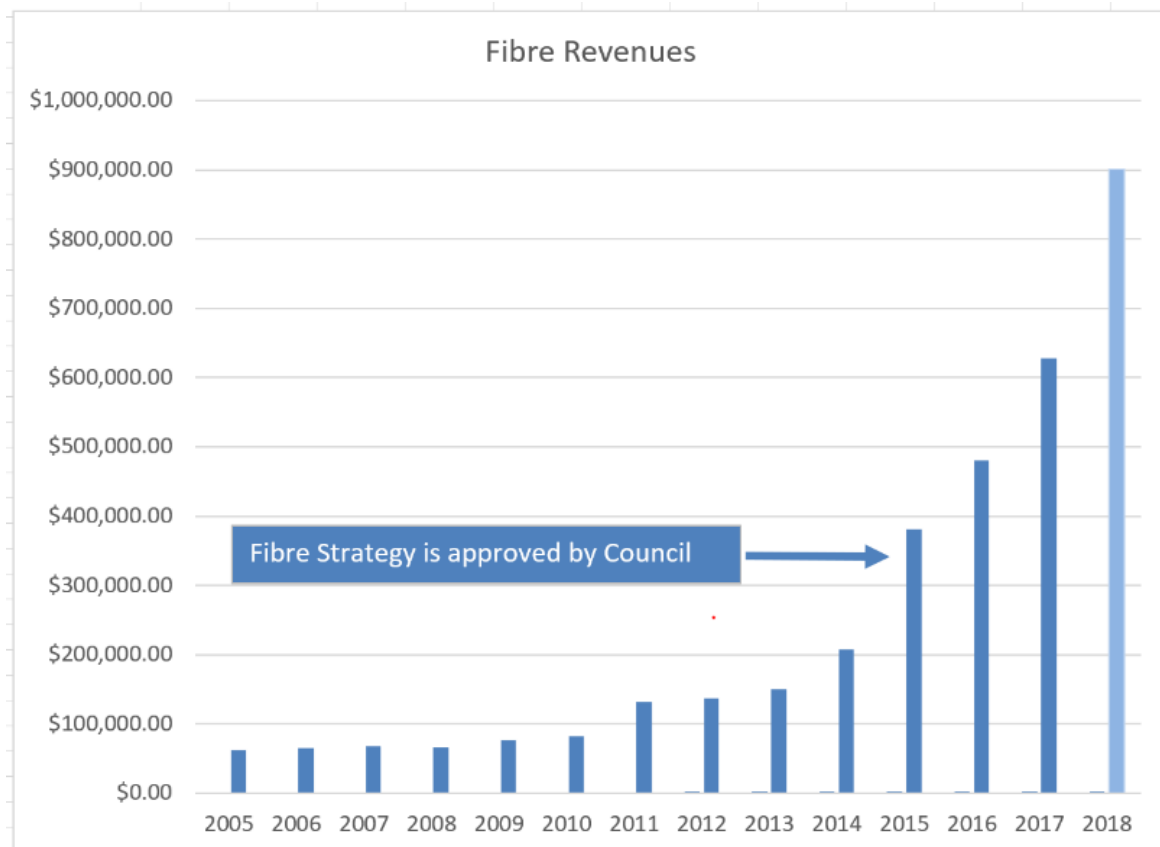

Figure 3: Current Revenues

Dark fibre is a niche market and a greater understanding of the customer profile is enabling a focused approach for the next business cycle. The customers that subscribe to The City's fibre-optic service are typically agencies that require control, redundancy, scalability, security and privacy for their networks. These customers place priority on these requirements over cost. These customers tend to be larger in size and have sophisticated IT departments, including agencies (such as Alberta Health Services), utilities (such as AltaLink or Enmax), and telecommunication carriers.

Over the last business cycle, a better understanding of the customers and the niche market that City fibre supports determined a number of constraints and opportunities:

a. Fibre customers must be in a state of "readiness" to consider City fibre.
b. Most customers need dark fibre built to their facilities and in today's economy, few, with exception to large organizations, are able to finance this construction.
c. Most customers are willing to sign long-term licenses which reduces the risks associated with any investments in last-mile infrastructure by The City.

Understanding that future demand will be continuous, and to mitigate risks arising from capital funding short falls, more emphasis on becoming **self-funded** is highly recommended. Revenues of $3 to 4 million provide a reasonable base to effectively deliver digital infrastructure. The 2018 revenues are estimated at $900 thousand, almost a third of the way to the self-funding objective.

Recommended Strategy Update: Shifting some funding to reach targeted revenue accelerates the path to becoming self-funded. Though there is some additional risk to the funding, the risk is low and mitigated through long-term licenses.

Future Opportunities
5G/Small Cell and the Evolution of Wireless Opportunities
5G/Small Cell is the next advancement in mobile and wireless technology important to connected, resilient and smart cities. It refers to wireless infrastructure that will enable many sectors and drive the digital economy by enabling automation, connected and autonomous vehicles, smart homes and field sensors. 5G/Small Cell represents a major uplift in infrastructure. It's more than a small antenna on a pole, it also encompasses fibre optics, large cabinets, new power cables, power meters, networking equipment, etc.

The drive for advancing wireless infrastructure is both a risk and an opportunity for The City. Successful deployment of 5G will depend on access to municipal assets like streetlight poles and facilities resulting in thousands of third-party assets integrating with City assets. New standards, processes and agreements will manage both operational and financial risks while preserving aesthetics and public safety.

Integrated planning can mitigate the operational and financial risks affiliated with wireless infrastructure deployment on City assets and presents opportunities for new sources of revenues. Wireless infrastructure requires fibre optic to transport data and

some carriers lack sufficient fibre optic to achieve this. Other potential sources of revenue can be found in attachment fees for antennas or co-location fees in City buildings.

It is difficult to predict the viability of this opportunity as it is still in its infancy.

Wireless opportunities also exist with Enmax and other utilities. Automated meter reading is an example whereby The City (water), Enmax (power) and Atco (gas) all have a requirement for meter reading. Joint efforts can drive down costs for new technologies that enable both the provider and the consumer to manage consumption intelligently.

Recommended Strategy Update: Enhance collaboration initiatives with other utility providers like Enmax and Atco who share an interest in enhancing services to citizens through technologies like automated meter reading.

Smart City, Economic Diversity, Digital Economy, Innovation, Collaboration
As The City of Calgary, in collaboration with community stakeholders, builds our communities' smart city strategy, continued investment in digital infrastructure is key to success. A smart city invests in technology and data solutions to provide excellent services to citizens.

To support Council's Business-Friendly directive and as part of the Smart City focus of diversifying our economy, The City of Calgary is partnering with CED to create the "Calgary as a Living Lab" initiative. As one of the largest owners of infrastructure in Calgary, The City is formalizing the process to open our infrastructure (where suitable) for companies and researchers to test, try and demo their products in real-world environments. The goal is to accelerate the commercialization of new products, services and research findings. It is not intended as a route for City solutions as there are avenues for those requests through existing procurement channels. For example, The City opened up Shephard Landfill for companies like Lougheed-Martin and NASA to test drone technologies. The Calgary Film Centre was used by an augmented reality software company to demo their products to potential clients.

Access to City fibre is a fundamental enabler for a large number of these technology tests as connectivity is often required. Often these ventures are limited in scope and resources; thus, providing access to municipal infrastructure at rates that encourage its use is critical to success.

Recommended Strategy Update: The City of Calgary's living lab initiative will be enhanced with City fibre to establish cost-effective connectivity in a timely manner. The dark-fibre rate structure will be adjusted for temporary use of City fibre under the living lab initiative. Should permanent use of the fibre be anticipated, then regular fibre rates will apply.

Miscellaneous Opportunities
From time to time, unique opportunities arise which can contribute to the expansion of City fibre. These opportunities can contribute in reducing construction costs, providing conduit (Greenline) and possible funding.

Regulatory, Legislation and Advocacy
Consistent with the 2015 Fibre Infrastructure Strategy, The City's participation as an advocate in the regulatory and legislative domain is still a priority to ensure that municipal interests are represented.

By the time this report is published, the review of the Telecommunications, Broadcasting and Radiocommunications Act will have started and is an important legislative change. (Government of Canada, June 2018)

Early indications suggest that some proposed legislative amendments will have significant ramifications to municipalities - impacts that could last for decades. The most significant risk municipalities face is loss of jurisdictional control over some components of municipal infrastructure and assets. This is mainly driven by the proliferation of wireless technologies like 5G/Small Cell, whereby the wireless carriers want access to municipal assets (streetlight poles, buildings) to install antennas. Though advanced wireless networks are attractive to any modern city, a careful balance between municipal and industry interests are important considerations. By participating in the review, The City may help shape opportunities for new revenue sources such as pole and building attachment licenses and fibre-optic licenses while providing installation standards that preserve safety and aesthetics of the community.

Advocacy and regulatory participation remains a high priority of the Fibre Infrastructure Strategy to protect municipal interests.

2019 – 2022 Business Cycle
The 2015 – 2018 Fibre Infrastructure Strategy was based on a capital requirement of approximately **$7 million** per year till 2023, then **$4 million** per year onward with revenues supporting capital in its entirety by 2030 whereby self-funding status was anticipated to be achieved. Total funding requirement between 2015 – 2030 amounted to **$49.7 million**.

Adjusting for lessons learned and implementing the above recommendations, the same objectives can be achieved from the 2015 strategy with a reduced capital requirement of **$4 million** per year and reducing the total funding requirement between 2015-2030 from **$49.7 million** to **$28.1 million.**

By capitalizing on new revenue sources like wireless opportunities, self-funding status is anticipated to be achieved in **2025** – five years earlier than originally predicted (see Figure 4).
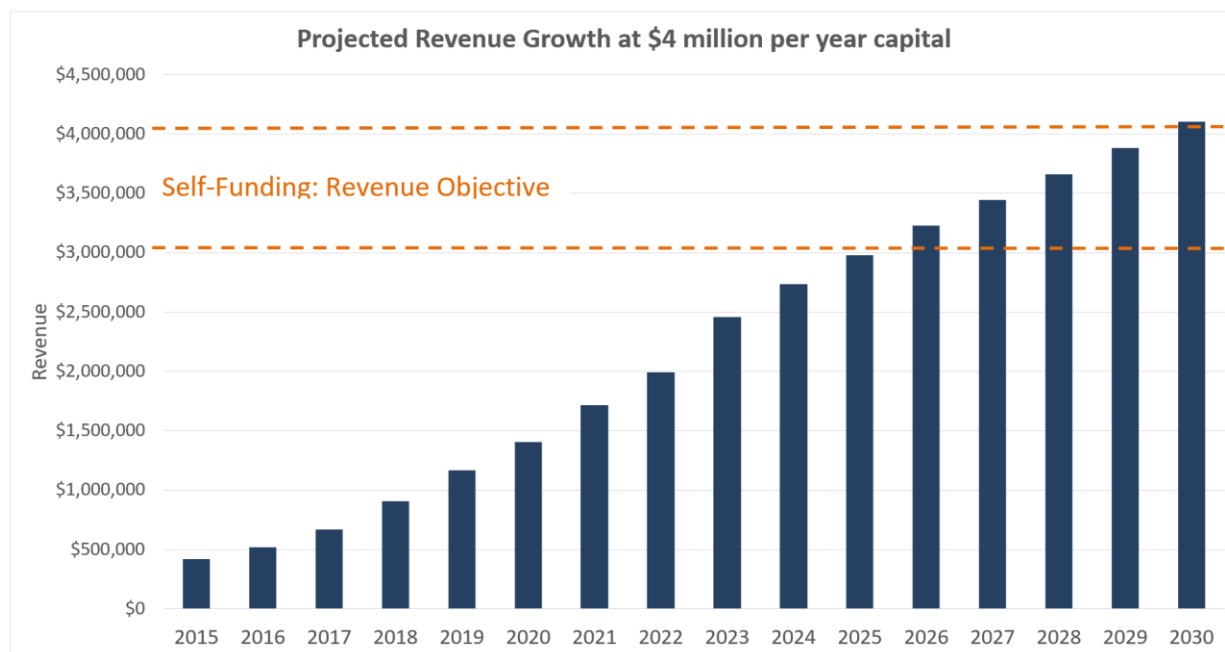

Figure 4: Projected Revenue Growth fully funded

2019- 2022 Capital Budget Constraint

The current 2019- 2022 capital budget constraints resulted in a reduction of the capital budget from $4 million per year to $1 million per year, funded entirely from the IT Reserve which is partially sourced from fibre revenues. In this scenario, the current Fibre Infrastructure Strategy cannot be supported to the level required to achieve all the objectives at the same rate seen in the 2015-2018 period. Revenue is expected to flatline (see Figure 5) with only modest growth as not all opportunities can be pursued. Fibre builds to civic facilities or devices (traffic controllers) will be prioritized but will not achieve the same rate of connectivity.

Under these new constraints. it is unlikely that self-funding can be achieved as forecasted in the 2015 strategy.

Essentially, the Fibre Infrastructure Team will be operating in a similar manner before the Council-approved strategy and additional funding was realized in 2015. Though this is not ideal, the momentum and accomplishments over the last business cycle have resulted in considerable gains. In the 2019-2022 business cycle, the Fibre Infrastructure Team will continue to focus on:

a. Leveraging capital projects such as Greenline, Bus Rapid Transitway's Airport Trail, etc.

b. Collaborating with stakeholders such as Transportation, Water, Facility Management, Integrated Civic Facilities, CPS, Calgary 911, Planning and Development, RE&DS and Enmax.
c. Pursuing alternate funding sources such as grants or joint builds.
d. Establish partnerships to leverage opportunities to expand the fibre plant or generate additional revenues through technology advancements like 5G, automated meter reading, Smart City applications, etc.
e. Reduce deployment costs by leveraging Enmax poles.
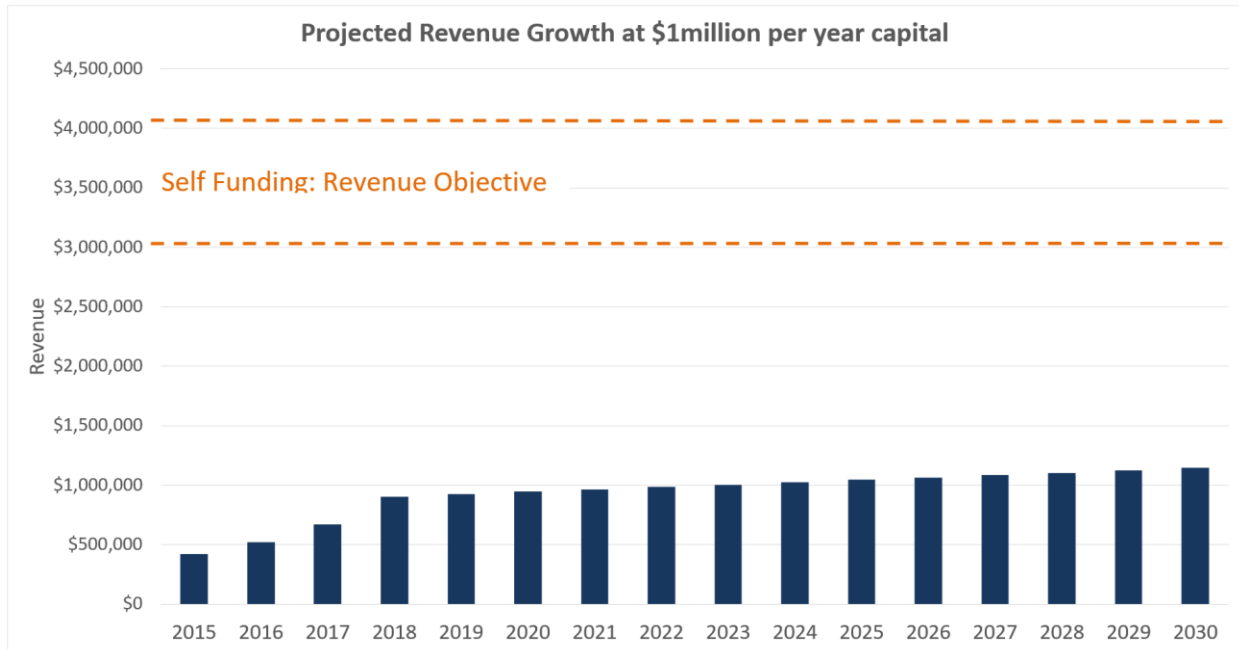f. Promote and market through speaking engagements.

Figure 5: Projected Revenue Growth with reduced capital

Should additional funding of approximately $3 million per year be sourced for the 2019-2022 business cycle, continuity of the 2015 strategy towards self-funding can be achieved.

Works Cited

Government of Canada Innovation, Science and Economic Development Canada and Canadian Heritage, "*Government of Canada launches review of Telecommunications and Broadcasting Acts",* https://www.canada.ca/en/canadian-heritage/news/2018/06/government-of-canada-launches-review-of-telecommunications-and-broadcasting-acts.html, (June 5, 2018).