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# Regional Broadband Investigation

Needs, Opportunities, and Approaches At the Local Level and for  
the Calgary Region

## Municipal & Regional Opportunities & Options



Calgary Regional Partnership



Prepared for The Calgary Regional Partnership  
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# 1 Executive Summary

Because of the Internet and related technologies, the world is now transitioning to more complex economic systems built around *knowledge*.<sup>1</sup> As a foundational cornerstone of these emerging systems of wealth creation, access to information and communications technology (ICT) has become critical to sustainable economic development in virtually every community and society on the planet.

In spite of the foundational nature of the required underlying connectivity infrastructure, Canada has yet to develop meaningful related technology policy and the results show. Canada, for instance, now ranks 14th in Broadband and in Innovation and whereas at most locations in Canada one may have the option of two wire-line providers, in Västerås, Sweden, there are over thirty.

For the benefit of all communities within the region, the Calgary Regional Partnership (CRP) has elected to face and deal with the issues head-on. Below in the second of the two reports being generated, a view of the issues, options, and opportunities from both municipal and regional perspectives is brought forward.

In preparing this document, meetings with 22 of the 26 communities were held. The variance between the communities was striking. In summary, some half the communities were either interested or very interested and a third now have projects underway. An additional quarter were interested, but due to resource constraints could only move ahead in partnership with their neighbours. Two groups of communities, those in both the West and South sub-regions have begun to explore co-operative approaches to enhancing their broadband infrastructure.

Assuming a utility infrastructure approach, preliminary financials indicate that a positive business case can be made for fibre in each city and town in the region but operational costs require the smaller centres to piggy-back off larger centres to achieve the operational scale required to be sustainable. Of particular issue are the MD's and Counties – with large distances between serviceable homes and businesses, capital constraints will necessitate hybrid fibre/wireless solutions.

Unlike the collaborative transit strategy developed by the Calgary Regional Partnership (CRP) over the last eight years, in the broadband infrastructure game, a land-grab of sorts is currently underway and time is of the essence. The longer it takes communities to debate their options and assemble the required resources, the more time the traditional telecom and cable service providers have to replace aging infrastructure in their most profitable markets with fibre – which then removes valuable cashflow from more inclusive community-wide plays. To move forward quickly, the CRP will likely need to take an active role with those communities most interested in moving ahead. As momentum develops and the issues are resolved, other communities could come onboard.

To be most effective, collaboration will also need to include both distribution and access networks within municipalities as well as the backhaul networks that link the communities together – an issue that will blur the more traditional CRP modus operandi in which their role is solely focused on coordination between communities and not on what each community elects to do itself.

A summary of the key recommendations, appears in Sec. 3.

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<sup>1</sup> Toffler, A&H; Revolutionary Wealth; Knopf; 2006-04-25.

## **2 Problem Definition**

Recognizing both the opportunity and challenge associated with facilitating advanced fibre optic-based broadband infrastructure and services within the CRP region, the CRP has elected to deal with the issues head-on. The purpose of overall study is to identify and organize a research and analysis framework for moving the discussion forward in the Calgary Region – generating new information about broadband availability throughout the region, identifying and exploring key strategic opportunities and, ultimately, informing decision-makers around the types of choices they might consider at local and region-wide levels to strengthen the delivery and affordability of high-speed broadband services across the Calgary region.

Recognizing the importance of being inclusive, for the purposes of this study, CRP has invited all incorporated entities in the region to participate – both members and non-members alike. The study therefore incorporates the aggregated issues and wisdom encompassing the 3 cities, 12 towns, 5 villages, 2 summer villages, 2 municipal districts, and 2 counties within the Calgary region.

The overall project has been broken into two parts – (1) Landscape Issues and (2) Municipal & Regional Opportunities and Options. This document focuses on (2) municipal and regional issues, options, and opportunities and completes the project. It is intended to provide overall perspective and context to the work that will follow.

### 3 Recommendations

#### 1. Region-wide Vision / Framework / Strategy

- On behalf of the region as a whole, establish an encompassing Vision, Framework and Strategy to make ubiquitous, region-wide digital connectivity and broadband a goal and a reality.
- The work would establish shared outcomes, principles, strategies, and rationale for collaborative approaches to design/build/deploy/operate as a regional network.
- Collaborative approaches would include potential business structures and models, governance, regional financing models, infrastructure priorities, the role of market-based players, potential partners, and so on.
- Though ambitious in scope, if done well, the result would enable efficient resource sharing and connectable systems across the region, significant cost savings, be inclusive and likely maximize the benefits to all across the region.
- Recognizing that as every community in the region is starting from a different place, with a unique set of issues, assets and constraints, and that all may not yet be in a position to buy-in to an encompassing strategy, as much as possible, seek to create a strategy that starts with initial investments/assets/partners that wish to charge forward and then optimally augment the initiative and network incrementally as other communities elect to come on board – design for eventual connectivity!
- Report back to the EPSC by June, 2017 with learnings and a recommended vision and framework.

#### 2. Sub-regional Business Case

- Actively engage – to the extent that CRP resources can be made available or secured – with the motivated sub-regions to guide the development of a business case for them:
  - Capital requirements associated with the key DIY options will be estimated at a high level and the most promising alternatives of interest to the sub-region will be quantitatively evaluated.
  - Using an assumed business model and financing structure, the effect of scale will then be evaluated, i.e., does it make more sense for multiple communities to work together or for each to go it alone.
  - Estimate operational costs and service revenues. Together with the capital estimates, these will then be used to generate comparative financial estimates for the governance, business, and operational options of most interest.
  - The financial results together with the associated risks and trade-offs associated with each option will then be reviewed.
  - Potential ownership and financial structures together with associated financing options will then be presented relative to the governance, business, and operational options selected.
  - Once consensus is reached, the business case will be completed and documented.
- Developing the business case and obtaining consensus will require support from financial, IT, marketing, and possibly other resources across the engaged municipalities. In a manner analogous to the regional GIS and economic development forums, create peer support groups to pool resources and share learnings relevant to issues that arise in each specific area of expertise.

### **3. Develop a set of focused pilot deployments**

- As momentum builds, individual members may wish to pursue focused pilot deployments to address issues of particular relevance to them. To the extent that CRP resources can be made available and/or generated, help support these activities and use the resulting experience and learnings to reduce risk and inform more ambitious sub-regional or regional strategies and/or deployments down the road.
- Example pilots might include working through the issues associated with:
  - Providing fibre conduit along water and sewer line deployments (e.g., Okotoks to Calgary waterline)
  - Pilot deployment in truly rural areas using local resources, including perhaps the local contractors, REAs, gas co-ops, and/or ISPs to minimize deployment costs
  - Work with Bow Valley College and a First Nations Community to enhance connectivity and remote delivery of educational material
  - Support culture of use, capacity building, community education, training, 'good neighbour' practices, and so on

### **4. Region-wide Benefits Analysis**

- While the benefits of broadband enablement are becoming more widely understood and appreciated, there remains a need to provide a more encompassing sub-regional or regional 'business case' for enabling fibre access on a utility or community owned basis, particularly where funding is being sought and rationalized.
- Unlike the business case development recommended in (2) above, this work would focus on quantifying the so-called off-balance sheet benefits (or positive externalities) attributable to the availability of a capable broadband infrastructure – whether due to cost savings or increased revenues to the municipalities, its residents, or businesses and, in particular, other public service providers (e.g., distance education, web-based health services, resource management, etc.).
- On a regional basis, such a business case might carry enough weight to:
  - Influence provincial policy with respect to enabling the funding/financing
  - Promote a conversation within and across provincial government departments around how such networks might be used to improve services and reduce costs
  - Instigate small pilot projects to develop and trial the more promising services
- Aggregate off-balance sheet benefits will likely justify, and attract additional funding for, fibre deployment throughout much of the CRP region.

### **5. Expand the CRP Resource and Collaboration Hub**

- To facilitate continuous learning and sharing of relevant and topical information relating to broadband initiatives, develop and integrate a broadband resources section into CRP's Resource and Collaboration Hub.
- This information might include case studies, Best Practices, pitfalls and traps, updated regional info, progress updates on local and sub-regional initiatives, potential funding sources, trends, shifting Federal/Provincial regulations and funding options, CRTC submissions and proceedings, and so on.
- To help build and maintain momentum as well as address common issues, share resources, foster collaboration, create pilot studies, sponsor training, etc., expand CRP's blogging program to include a broadband focus area.

## 6. External Collaboration & Partnerships

- Develop and pursue **collaborative opportunities** – create a common table for on-going partnership; joint planning; ISP negotiations; funding applications
- Build and strengthen **external partnerships** – with public sector (health, education, tourism); private sector (incumbents, ISPs); First Nations; oil and gas; financial; operational; other

## 7. Advocacy

- As a direct result of the 2016-2017 Pilot Funding for Regional Broadband Projects from the Alberta Ministry of Economic Development and Trade, broadband initiatives are being undertaken by most REDAs in the Province. As the various studies complete, CRP should work with the other REDAs to integrate the results and create a more comprehensive provincial perspective on broadband than has heretofore been possible.
- The perspective and learnings should then be used to help inform telecom and related policy at both the Provincial and Federal level.

## 4 An Opportunity Framework

### 4.1 Project Context

#### 4.1.1 Why do Anything?<sup>2</sup>

The Calgary Regional Partnership, in collaboration with local member and non-member municipalities, municipal districts, counties, provincial staff, and partner organizations in the Calgary Region, has initiated an exploration of very high-speed broadband opportunities, needs, benefits and strategic approaches relevant to the Calgary Region and its environs.

Accessible, affordable and reliable high-speed Broadband services, provided in a coordinated and interconnected system, is seen as foundational to supporting economic prosperity locally and regionally, enabling greater social connectedness and well-being of the region's population, and promoting environmental integrity across the region.

High-speed Broadband services provide foundational infrastructure for community prosperity, resiliency and quality of life – not unlike roads, electricity, water and wastewater and other essential utilities that support economic activity and community life – all supportive of achieving shared regional Vision – *We are working together to live in balance with a healthy environment in enriched communities, with sustainable infrastructure and a prosperous economy* – and outcomes as expressed in the *Calgary Metropolitan Plan (CMP)*<sup>3</sup>.

CRP's Vision is one of a clean, green and healthy environment, hosting a network of vibrant, diverse, viable and connected communities offering exceptional quality of life. These communities are fuelled by globally competitive, diverse and resilient local and provincial economies, and serviced by efficient, integrated, sufficient, modern, adaptable and well-maintained infrastructure.

Recent preliminary discussions, benefiting greatly from the active support of the Olds Institute (O-Net), the Alberta Southwest Regional Economic Development Alliance (REDA), Bow Valley College, and staff from the Province's *SuperNet* initiative have together begun to frame a series of strategic opportunities worth exploring at both local and region-wide scales. Subsequent discussions with the author have further focused the information to be researched and documented, describing the questions to be analysed and the types of strategic choices that could be available to communities in the region.

#### 4.1.2 A Framework

In-line with the traditional strategy development process, the opportunity areas were developed in three phases: *Current State* – determine where things stand and the assets that can be drawn upon; *Desired State* – determine the requirements that need to be met, and then *Opportunities* – determine and evaluate the opportunities available to move from the current to the desired state.



<sup>2</sup> Miller, B.; *Preliminary Scoping Documents to Explore HighSpeed Broadband Needs, Opportunities and Approaches at the Local Level and for the Calgary Region*; CRP; 2015-07.

<sup>3</sup> Calgary Regional Partnership; *Calgary Metropolitan Plan*; 2014.

## 4.2 Landscape Issues – Key Take-Away Points<sup>4</sup>

- **Our system of wealth is changing** – Compounding the impacts of both the Industrial and the current Information & Telecommunications revolutions is the fact that they ushered in a new system of wealth. With a change in the wealth system, what made communities successful in the 20th century no longer works today. We are moving from a world in which scalable efficiency generated the most value to one in which scalable peer learning does.
- **Transitioning to higher skilled workforce** – While the ‘hollowing out’ of the middle class is not as evident in Canada as it is in the US, the number of medium and low skilled jobs is declining relative to those requiring higher skill levels. From both the perspective of retraining the folks displaced and creating higher skilled jobs for them, broadband is key.
- **Canada is losing ground** – As of early 2016, Canada ranked 14<sup>th</sup> in terms of mean available download bandwidth, 18<sup>th</sup> in terms of cost, and 23<sup>rd</sup> in terms of fibre penetration. Whereas in Korea, the average download bit rate of 23.6 Mb/s is available for \$ 1.77/mo. (13.3 Mb/s/\$), in Canada, one can only expect 9.7 Mb/s for \$8.00/mo. (1.21 Mb/s/\$).
- **Alberta is not keeping up** – Alberta ranks 11<sup>th</sup> out of 13 provinces and territories based on download speed – and Alberta has the *SuperNet*. Alberta’s two largest cities do not fair well either – Calgary and Edmonton are respectively ranked 11<sup>th</sup> and 21<sup>st</sup> out of 25.
- **Everyone could win** – Economic development is not a zero-sum game in which the winning community takes all. Together, the CRP members and non-members can raise the ‘tide’ of prosperity across the region so that all can benefit.
- **Accomplish more together** – The municipalities, municipal districts, and counties can accomplish more together than separately, ensuring that none are left behind.
- **Too important to miss!** – As the required infrastructure upgrades represent a once in a century opportunity, it is worth getting this right.
- **Fibre as a utility** – Scalable broadband connectivity is critical civic utility infrastructure and should be treated as such. In the US, 25 of the 48 states reporting have a broadband office.
- **Reduced rates as a long-term investment** – As municipalities and regions can fund fibre infrastructure over 20+ year periods, they can provide the infrastructure much less expensively than can a private interest firm intent on recouping its capital in, say, five years. Monthly payments by a community on a \$1M infrastructure loan over 20 years at 2.602% from the Alberta Capital Finance Authority (ACFA) are \$5,349 versus the \$18,417/month payments required of a private firm paying 4% on the same amount over a five year term.
- **Update Provincial and Federal Frameworks** – Both federally and provincially, funding and debt limit policies need to be updated to help enable municipalities to deploy the required infrastructure; regions are an important voice for change.
- **Promoting services-based competition** – Federally, the Canadian Radio-television and Telecommunications Commission’s (CRTC’s) options are inhibited by the facilities-based framework under which it operates. Moving to a services-based framework in which the required underlying fibre infrastructure is provided on an open basis as a fourth utility over which all providers can compete on services would enable ubiquitous deployment and help eliminate the existing digital divide. Under a services-based model, private providers would get access to infrastructure superior to that which they themselves could afford to deploy and could then re-direct the capital saved to innovate and compete on services.

<sup>4</sup> Dobson, C.; *Regional Broadband Investigation – Landscape Issues*; The Calgary Regional Partnership; 2016-08-14.

- **Independent triple-play service providers are now available** – As independent triple-play service providers such as O-Net, VMedia, and Novus are now available, the options available to underserved communities wishing to deploy their own fibre-based networks are expanding.
- **Enhancing broadband is a largely social enterprise** – It has been said that community fibre endeavours are likely 80% social and 20% technical and the Olds' experience supports this from several perspectives.
- **Required Internet capacity continues to grow geometrically** – Both Internet and mobile traffic growth remains robust at a compound rate of 21% and 69% annually. The video portion of that traffic is increasing at 64% and 55% respectively – and not all of this is Netflix.
- **Wireless has limits; fibre does not** – The trade-off between fibre and wireless tends to change over time and depends on available capital, local priorities, and the relative importance of off-balance benefits. A common misconception is that wireless systems are less expensive. While they may be so over a 3 to 5 year period, their ability to expand is limited and over a ten year timeframe when capacity expansion is considered, can prove to be even more expensive than fibre networks.

## 4.3 Current State

### 4.3.1 Regional Profile

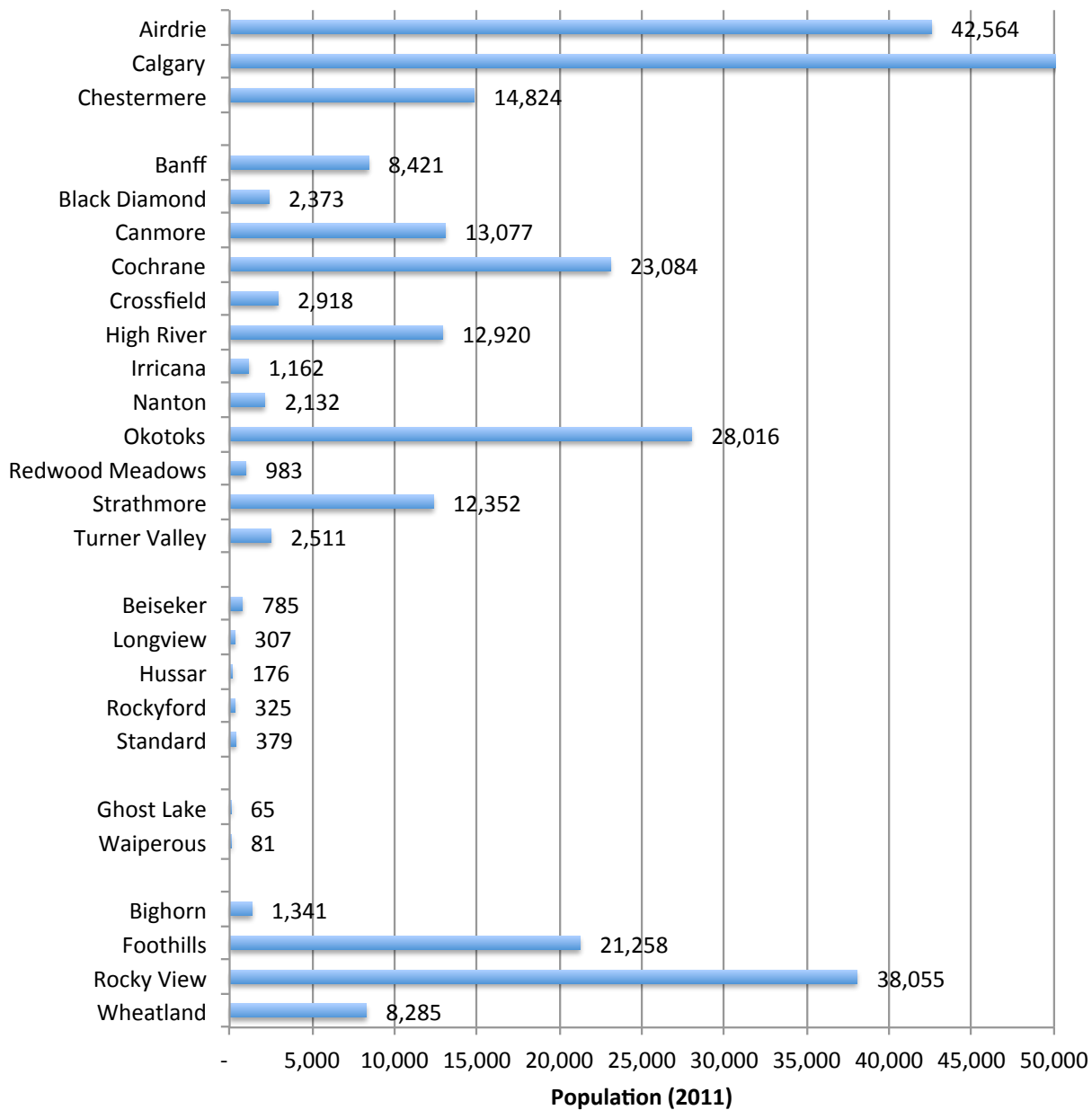
As shown in the table below, the study incorporated the aggregated issues and wisdom encompassing the 3 cities, 12 towns, 5 villages, 2 summer villages, 2 municipal districts, and 2 counties within the Calgary region. Of these, Nanton elected to go with Axia in 2015 and Calgary adopted a fibre strategy in September, 2015. Pending the results of this study, Cochrane effectively withdrew their RFP for fibre to their businesses and, together, Black Diamond and Turner Valley postponed a decision on an Axia solution. Unfortunately, discussions with Hussar, Rockyford, and the First Nations groups could not be scheduled within the timeframe of the project. Crossfield and Ghost Lake did not participate.

Cities	Towns		Villages	Summer Villages	MDs/ Counties	First Nations
Airdrie	Banff	Nanton	Beiseker	Ghost Lake Waiperos	Bighorn	Eden Valley
Calgary	Black Diamond	Okotoks	Longview		Foothills	Siksika
Chestermere	Canmore	Redwood Meadows	Hussar		Rocky View	Stoney Nakoda
	Cochrane	Strathmore	Rockyford		Wheatland	Tsuu T'ina
	Crossfield	Turner Valley	Standard			
	High River					
	Irricana					

The region is home to about 1.4 million residents, with approximately 238,000 people living in twenty-five communities beyond the City of Calgary (2011). The distribution appears in the next chart. Though not shown, the MD/County stats can be further broken down into hamlets, localities such as rural subdivisions, and the remainder.

Whereas the cities and larger towns have sufficient resources to unilaterally pursue whatever opportunities they wish, the smaller towns, villages, and more rural areas will need to collaborate with their neighbours to pursue the more resource intensive options.





### 4.3.2 Municipal Plans

As evident in the next table, the awareness and level of interest in broadband varied across the region – whereas some communities have already begun to move forward, some are beginning to investigate options, while others appear content with the status quo. A more detailed look at the apparent current state of municipal involvement/interest with broadband, based on the meetings undertaken, appears in the subsequent table.

Gung Ho	Interested – May Be	Need Help – Too Small
Calgary Canmore Chestermere Cochrane High River Okotoks Redwood Meadows	Airdrie Banff Black Diamond / Turner Valley Strathmore	Beiseker Irricana Longview Standard Wheatland Waiparous
Too Expensive	Unknown	Status Quo
Bighorn Foothills Rocky View	Crossfield First Nations Hussar Rockyford	Ghost Lake Nanton

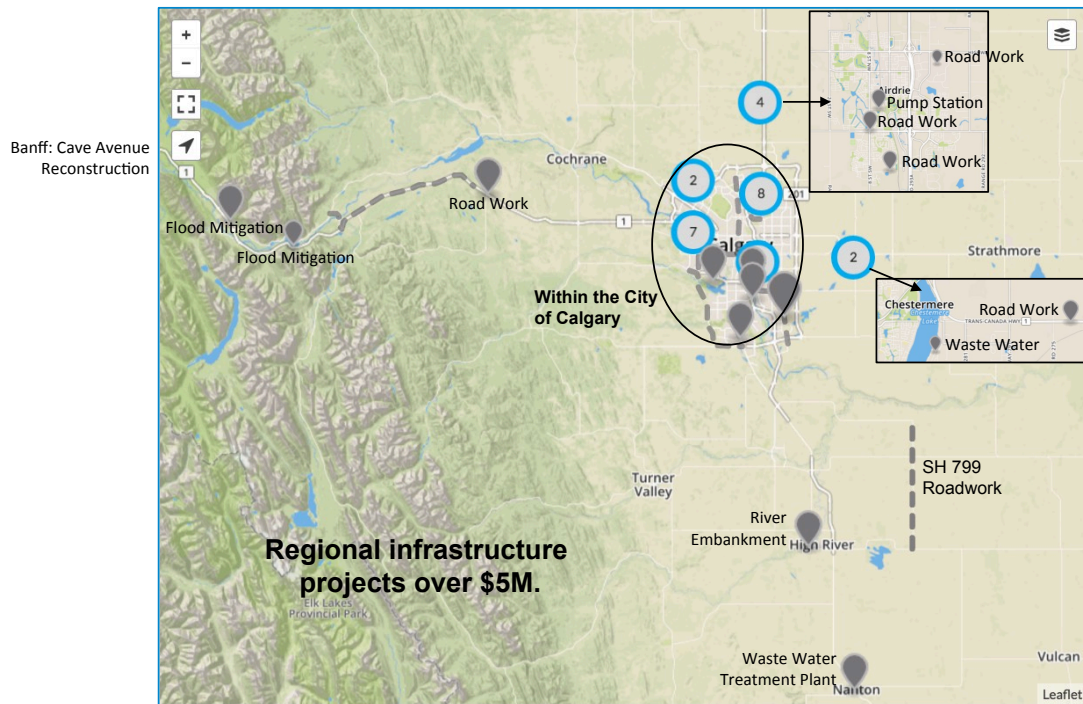
### Impressions Arising From Municipal Meetings

	Is Broadband an Issue?		Do You Have a Strategy	Is an Axia Solution being considered?	Policies		Focus			Is Action Likely? 6 mo, 1 yr, 2 yr, ...?
	Admin / Community	Council			Conduit / Dark Fibre	Open Data	Internal	Business	Residential	
<b>Cities</b>										
Airdrie	√						√			2 yr
Calgary	√	√	√	X	√	√	√			In Progress
Chestermere	√	√		X			√	√	√	In progress
<b>Towns</b>										
Banff	√			X			√	√	√	3 mo
Black Diamond	√	√		√			√	√	√	3 mo
Canmore	√	√					√	√	√	In progress
Cochrane	√	√					√	√	X	In progress
Crossfield	√	√	Wireless	X						
High River	√			X			√	√	√	3 mo
Irricana	√						√	√	√	2 yr
Nanton	X	X	√	In place	X	X	√	√	√	Complete
Okotoks	√	√		X			√	√	√	In progress
Redwood Meadows	√	√		X			√	√	√	6 mo
Strathmore	√									1 yr
Turner Valley	√	√		√			√	√	√	3 mo
<b>Villages</b>										
Beiseker	X	X								2 yr
Longview	√	√					√	√	√	3 mo
Hussar										
Rockyford										
Standard	√	√					√	√	√	2 yr
<b>Summer villages</b>										
Ghost Lake	X	X								na
Waiparous	√	√								2 yr
<b>MDs/Counties</b>										
Bighorn	X	X		na						2 yr
Foothills	√	X		na			√	√	√	3 mo
Rocky View	√	√		na			√			2 yr
Wheatland	√	X		na			√	√	√	2 yr
<b>First Nations</b>										
Stoney										
Siksika										
Tsuu T'ina										

### 4.3.3 Civil Works

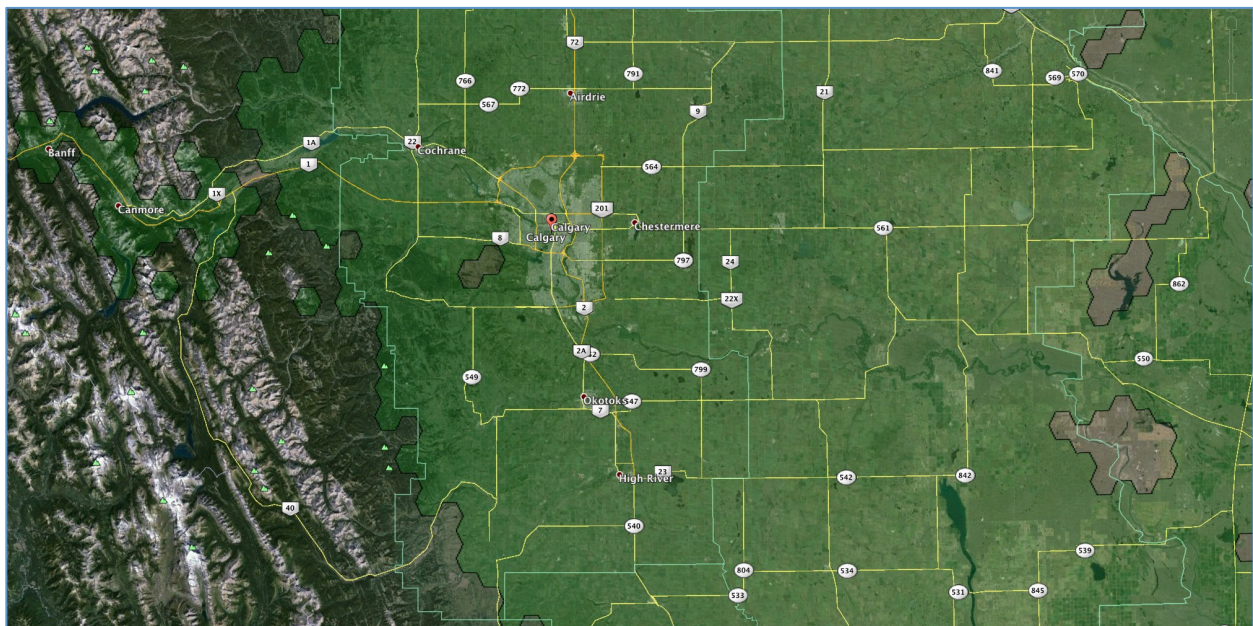
Capital projects that may be leveraged to reduce costs associated with a potential deployment of infrastructure across the CRP region appear in the chart below<sup>5</sup>. Down the road, a water line is planned between Okotoks and Calgary and sanitary sewer lines between Cochrane and Calgary and between Chestermere and Calgary are in the works.

<sup>5</sup> Government of Alberta; Provincial Major Projects List; 2016-06.



#### 4.3.4 Service Availability

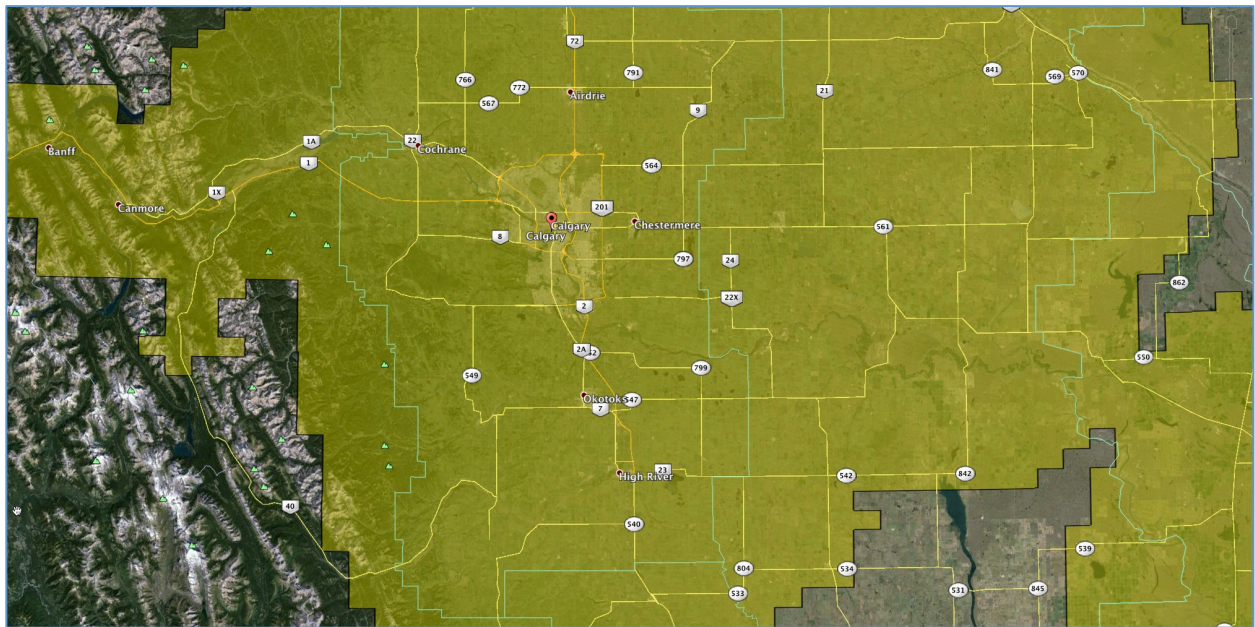
According to the CRTC website<sup>6</sup>, minimal 5 Mb/s down (toward the end-client) by 1 Mb/s up (from the end-client to the network) service is almost ubiquitously available throughout the region. A combined view of the fixed wireless coverage is shown below in green. Providers include CCI, Davinci, Velocity, and XplorNet.



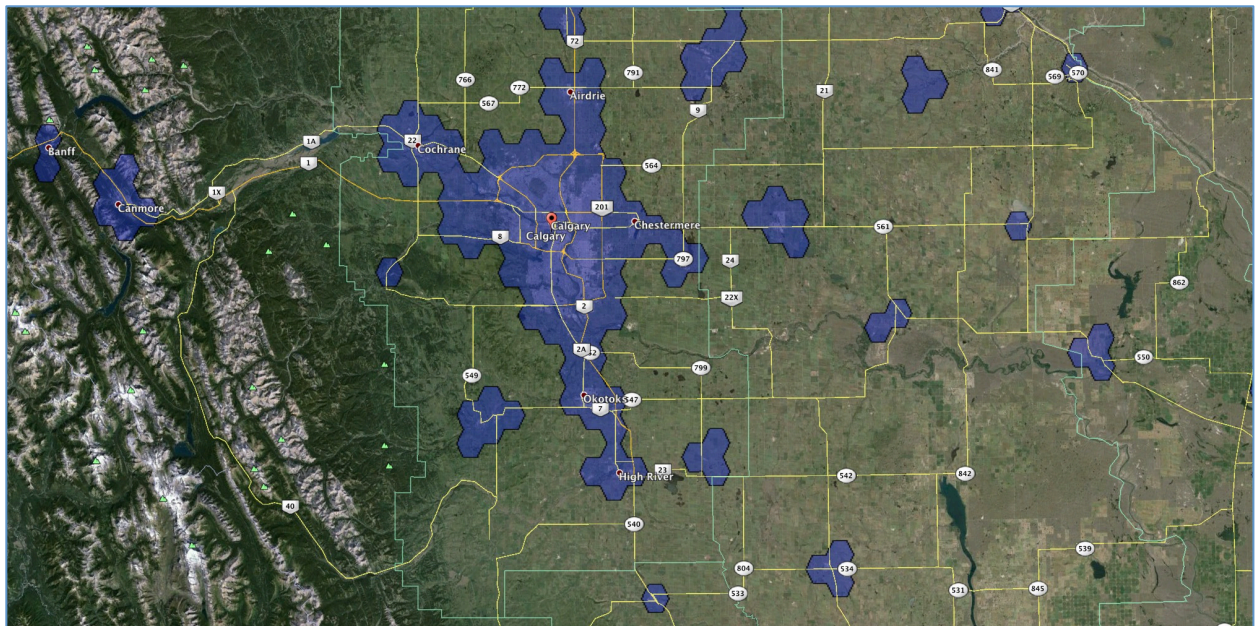
As shown in yellow, mobility data services are also widely available from TELUS/Bell and Rogers.

<sup>6</sup> <http://www.crtc.gc.ca/eng/internet/internetcanada.htm>



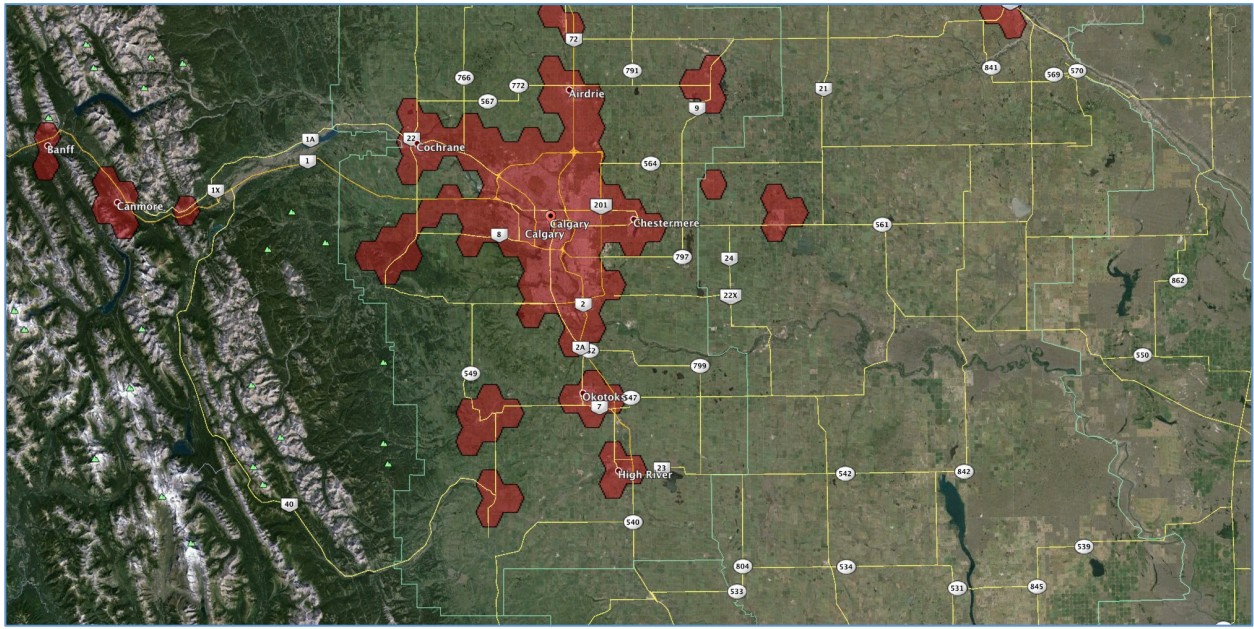


On the wireline side, copper-based DSL services from TELUS are available in the majority of the urban centres – see the blue hexagons below. In targeted areas in Calgary, TELUS is currently upgrading from copper to fibre-based services.

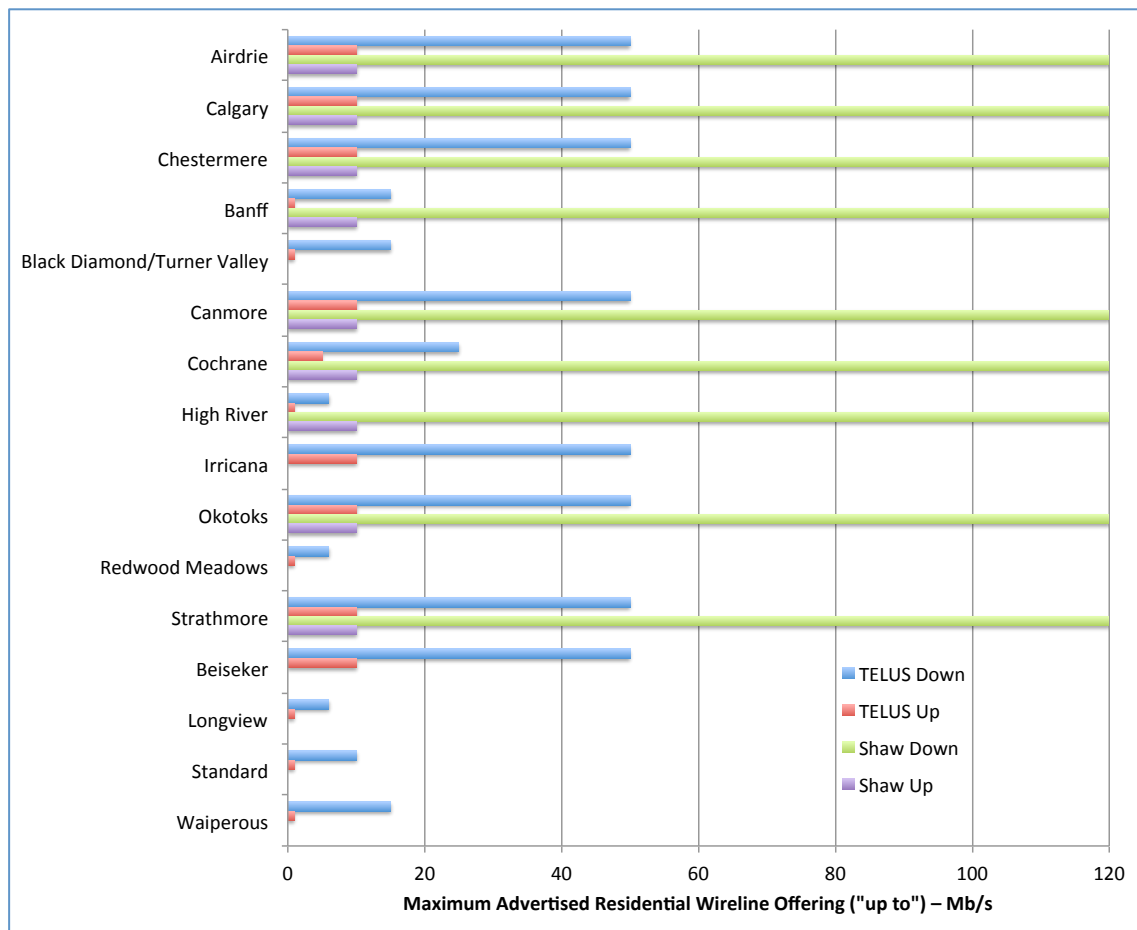


Not surprisingly, the TELUS DSL footprint is largely mirrored by that of Shaw using coaxial cable and cable modem technology – see red areas below.

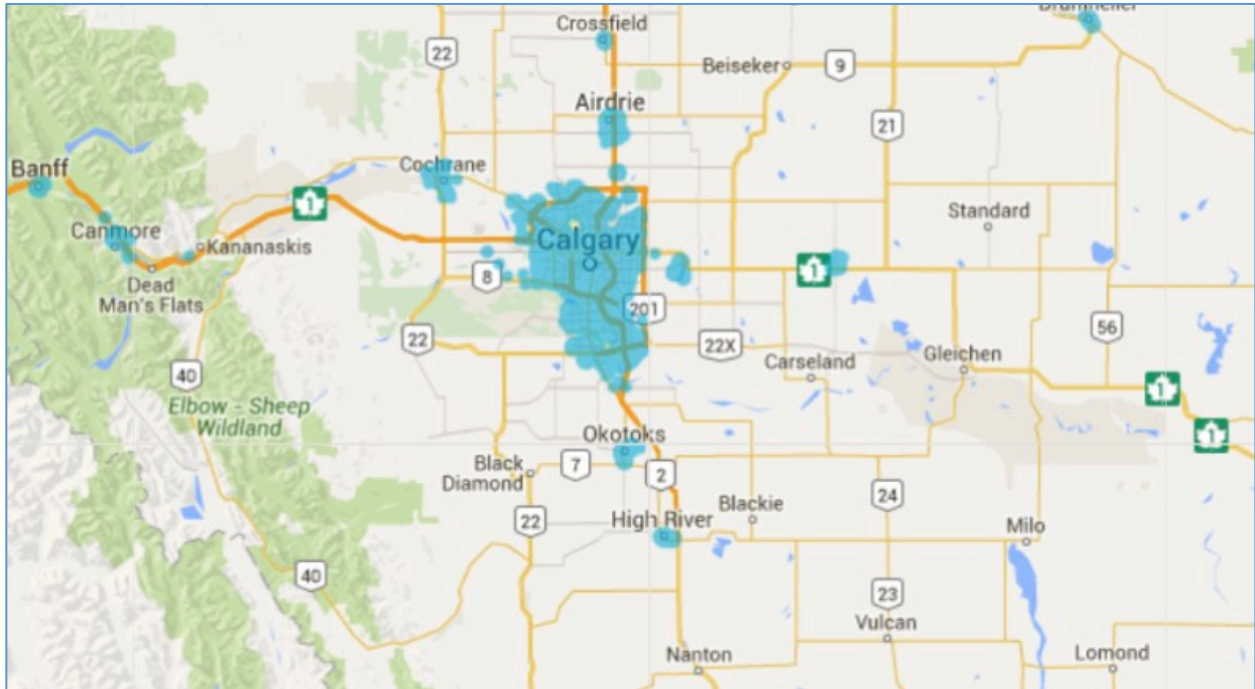




Maximum advertised residential wireline offerings from TELUS and Shaw appear below. As these are 'up to' bit rates, during high usage periods, actual bit rates will be less – Shaw more so than TELUS due to the way the aggregation is implemented. In both cases, the offerings are highly asymmetric – upload and down load bit rates differ significantly.



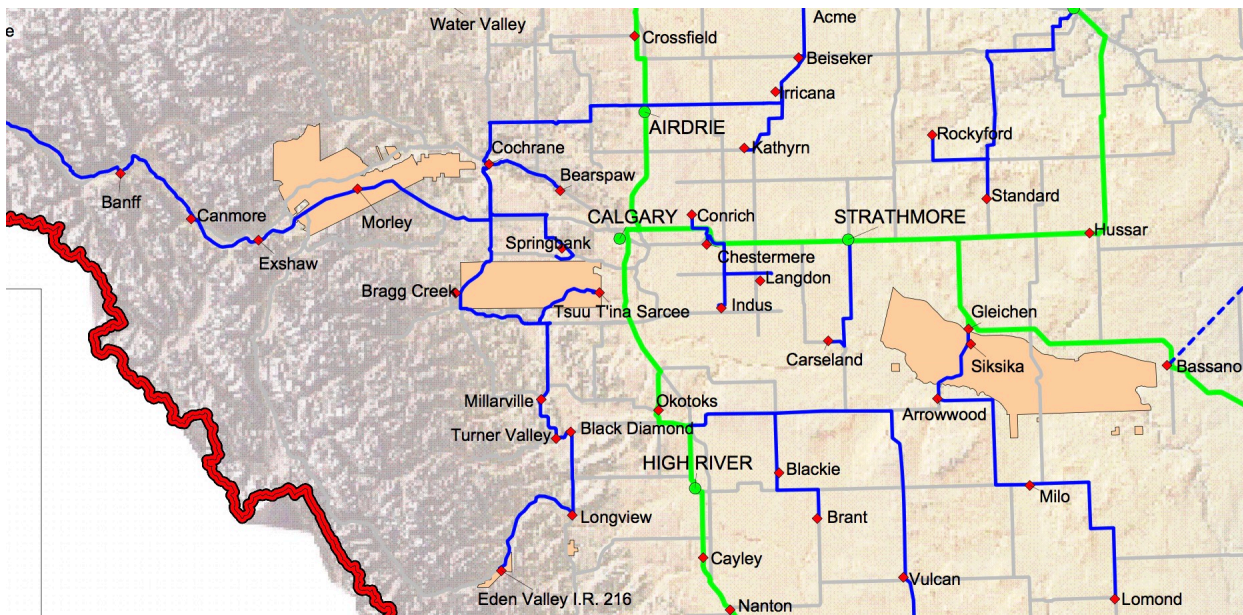
Lastly, Shaw Go-WiFi services are available in some urban areas.



### 4.3.5 Backhaul Availability

#### 4.3.5.1 Alberta SuperNet

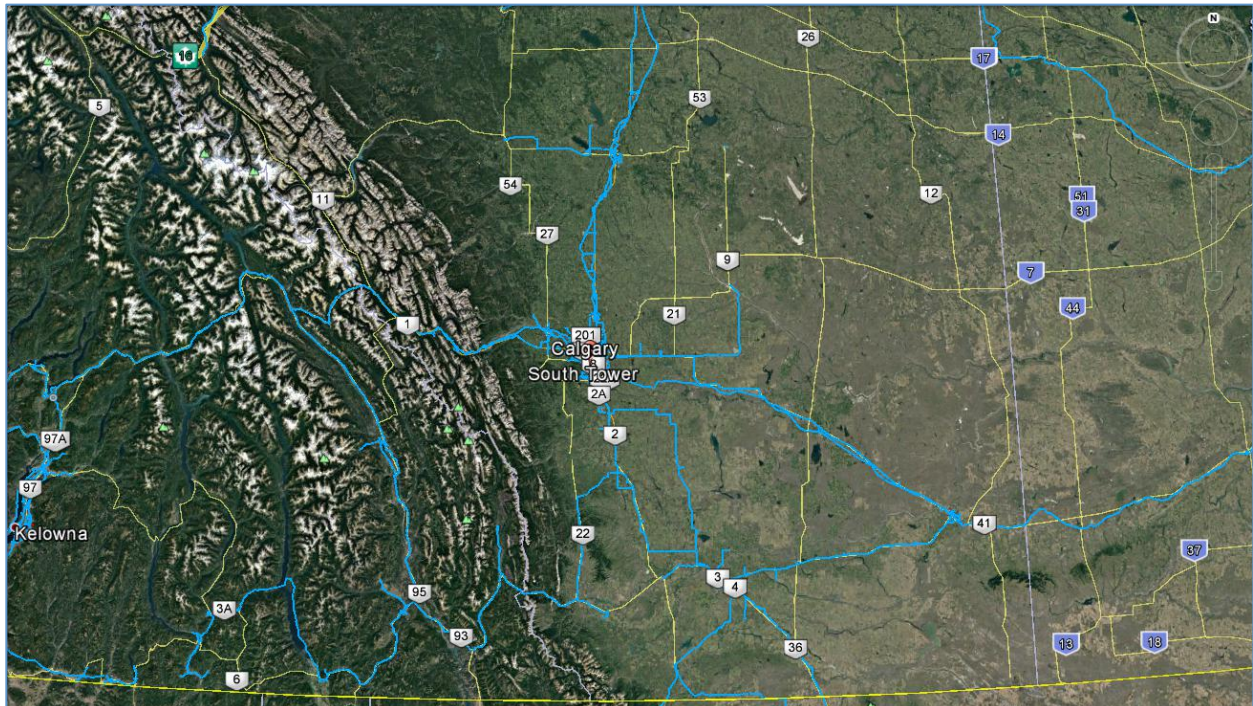
The extent of the Alberta *SuperNet* appears below. More detailed layouts appear later in the section on sub-regional opportunities. Green represents the Bell operated Base Area Network (BAN) portion and blue represents the Axia operated Extended Area Network (EAN) segments.





#### 4.3.5.2 Shaw Wholesale

Given the uncertainty associated with the next iteration of the *SuperNet* contract by June 30, 2018, municipalities requiring access to fibre transport for backhaul to Calgary may wish to approach Shaw, Bell, or TELUS. Shaw fibre routes in the area appear below.



#### 4.3.5.3 TELUS Wholesale

Except under a non-disclosure agreement, TELUS does not provide maps of their fibre assets.

### 4.3.6 SuperNet

#### 4.3.6.1 Context

As explained in the Landscape document,<sup>4</sup> the Alberta *SuperNet* is a broadband superhighway, conceived by the Government of Alberta (GoA) in the early 2000's to connect public institutions, collectively termed the GLHLM (GoA, Learning, Health, Library, and Municipality) clients, to a broadband network for high-speed Internet access, video conferencing and other services. The GLHLM component of the *SuperNet* links 4,200 GLHLM facilities in 429 communities. A second, wholesale backbone services, component enables rural Internet Service Providers (ISPs) to connect their access networks back to a peering point in Calgary and Edmonton. It is on this component that the discussion below is focused.

The Alberta *SuperNet* consists of the Bell-operated Base Area Network (BAN) serving 27 of the larger urban centres in the province and the Axia-operated Extended Area Network (EAN), covering the rest of the province. BAN communities in the CRP area include Airdrie, Calgary, High River, and Strathmore. While the *SuperNet* mostly consists of fibre-optic backbone facilities, wireless links are used to complete the network in the most rural areas.

As the *SuperNet* is operated on an open access basis (its services are available to all service providers on a comparable basis), to preclude any conflicts of interest, neither Bell nor Axia can offer retail services such as Internet within their *SuperNet* footprint. To date, Bell does not offer retail services within the province, but Axia NetMedia does provide retail services to corporate clients and, through AxiaConnect, provides retail Internet services in smaller communities (e.g., Nanton).

Deploying fibre to smaller towns, villages, hamlets, small subdivisions, and other remote groups of premises need not be more expensive than deploying to neighbourhoods in urban areas, except that:

- a backhaul connection is needed to connect the community to the global network, and
- there could be increased operational costs if not in close proximity to maintenance personnel

The availability and monthly costs of the backhaul connections are therefore fundamental to enabling fibre deployment and sustainable operations in all of these communities. To enable triple play services in communities, a 1 Gb/s backhaul connection is the absolute minimum. So the *SuperNet* operating requirement is to enable minimum 1 Gb/s (and preferably 5 or 10 Gb/s) connections between communities and a peering point in Calgary, say YYCIX, at a low enough rate that these community operations can be sustainable. Obviously there are expenses other than just debt service and backhaul, but those can be reduced via scale – either outsourcing operations to a larger player or partnering with a number of local communities to realize scale themselves.

#### 4.3.6.2 Issues Surrounding SuperNet

As originally envisioned, the Alberta *SuperNet* could/should be this enabler, but it is not – it has impeded economic development. Specifically:

- Many of the smaller centres within the CRP do not enjoy competitive Internet Service Provider (ISP) services – something the Alberta *SuperNet* was intended to facilitate.
- Of the 22 communities visited, none were happy with *SuperNet* and frustrations abounded to the extent that some agencies are now financing duplicate *SuperNet* infrastructure to obtain services that better meet their requirements:
  - A recent custom-build (with *SuperNet*) to Elevation Place in Canmore was abandoned due to high costs and poor performance and the services were moved to an incumbent
  - Eight hospitals have moved their primary connection to Shaw. Their *SuperNet* connections are only used for redundancy.
  - In spite of a *SuperNet*-only subsidy from the Board of Education, some Calgary schools are evaluating the options available from other providers. In their case, options include Bell, The City of Calgary, and TELUS.
- Issues include policy, pricing, customer service, contract disputes, poor performance (reliability, packet loss, latency, jitter), and inadequate (and lack of) service level performance guarantees, among other things.
- In addition, there were concerns voiced relative to the perceptions around Axia having direct access to the Alberta *SuperNet* and potentially using it to unfairly compete with other ISPs.

Notwithstanding the ‘non-compete’ intention in the Alberta *SuperNet* agreement, there were concerns expressed that Axia-based companies have entered the retail access service space directly with no transparency between wholesale and retail divisions.



#### 4.3.6.3 Fixing SuperNet

As the *SuperNet* operating agreements are being reviewed by the Province and will roll-over at midnight, June 30, 2018, the opportunity to fix *SuperNet* exists, at least for a limited period of time. If the issues are not fixed, upon renewal, the Alberta *SuperNet* may well be bypassed and rendered irrelevant as proactive municipalities will have little choice but to continue developing new, affordable fibre networks, likely in partnership with other providers, to both enable connections amongst themselves and for backhaul connections.

In terms of fixing these backhaul/*SuperNet* connectivity issues, there are several options. One is to enable aggregation by permitting local connections between communities so that only one higher bit rate connection from a group of communities to YYCIX in Calgary (or YEGIX in Edmonton) is needed – instead of one per community. One could lower the rate or set a rate structure based on community size – effectively enabling cross-subsidization between larger and smaller centres.

It may also make sense to separate out the GLHLM (government) services component from the wholesale connectivity piece. The business model for the latter could then be changed to one based on cost (more like a wavelength or dark fibre service) versus bandwidth, wherein the costs are based on a long-term low interest rate capital recovery program.

Alternatively, one could separate out the underlying physical transport and routing infrastructure (VPLS) layer from the services management (MPLS) layer. From this perspective, the GoA might consider contracting one operator to provide a combined BAN/EAN network on a VPLS-basis and then having a separate contract let for the services layer. Policies, rates, and subsidization issues could then be managed separately from the physical infrastructure.

From a contract management perspective the revised terms need to:

- ensure clear, transparent, structural separation between retail and wholesale service provisioning and operation of the Alberta *SuperNet*.
- enhance oversight, inventory records, operational procedures, and capital procurement to ensure entanglement between *SuperNet* and the operating entities does not recur.
- Provide enforceable service level agreements (SLAs) to ensure adequate performance.

Though mostly beyond Service Alberta's control, operating subsidies available to hospitals, schools, municipal offices, etc. should be transferrable so that the institutions have the flexibility to manage service levels and costs by selecting the network provider that best meets their needs – whether it be the *SuperNet* or another provider.

Options to fix *SuperNet* require proactive and substantive changes to both the governance and operating frameworks. As a matter of urgency, the GoA might create a collaborative process with Alberta's municipal and regional leaders to re-imagine how Alberta *SuperNet* can positively contribute to the economic development of Alberta, its regions and municipalities.

### 4.4 Desired State

Over the next ten years, participation in the knowledge economy will become mandatory. To participate, fibre will be required. During this period, current telecommunications infrastructure will be replaced with fibre, whether constructed on a private, public/private partnership, or on a public fibre utility basis and whether its done with or without CRP involvement. CRP municipalities and the region therefore have the option to be involved, shape their future, and ride the wave – or be drowned by it. Either way, the existing copper and coaxial cable infrastructure is about to be replaced and, depending on how that takes place, broader public benefits may be widely achieved or more limited as a result.

While progress is exponential, infrastructure deployment is not. To stay ahead of the curve, the decision time is now.



As outlined in subsection 4.3.2, the range of interest in broadband varies considerably throughout the region, but even the most gung-ho of the municipalities are still in the early stages of deciding which options to pursue and how. While a formal 'Desired State' has not yet been agreed to in any of the municipalities outside of Calgary, what follows is based on the assumption that, over the next five years, the majority may choose to facilitate the deployment of infrastructure to support a fully scalable broadband network ubiquitously available throughout their municipality and, if possible, the region as a whole. This would typically include a combination of an underlying fibre infrastructure with upgraded wireless services where fibre is not yet practical. Market-wise, the infrastructure would be available on an open access basis to all service providers interested in serving municipal and regional businesses and residents. Whereas the municipalities do not wish to interfere with private enterprise in the services marketplace, they will entertain options relative to facilitating the underlying lit open-access fibre utility infrastructure.

## 4.5 Areas of Opportunity

### 4.5.1 Overview

The CRP Region and its constituents have many options available to facilitate enhanced, more ubiquitous, and more affordable broadband infrastructure within its environs. Indeed, the options range from simply accelerating any currently planned internal fibre initiatives, to negotiating with the incumbents and potentially subsidizing private operators, to do-it-yourself (DIY) initiatives as exemplified by O-Net in Olds and Q-Net in Coquitlam. Options include:

- Status Quo
- Incremental:

- Work with the CRP...
- Deal with fires as they occur
- Embed fibre network requirements in planning processes
- Accelerate currently planned IT infrastructure deployment
- Leverage the civil infrastructure projects
- Develop a Broadband Services Strategic plan
- Negotiate with current providers:
  - Work with the providers – Shaw, TELUS, Axia, CCI, O-Net, ...
  - Subsidize a private partner
- Develop a community-owned utility fibre network (e.g., utility, co-op, not-for-profit)
  - Assume fibre as a utility play and deploy a network as critical civic infrastructure
  - Decisions on governance, business model, financing, services, and operations will be required, but
    - Other than that, you and your council can be as involved, or not, as you wish, as
    - Options range from in-sourced to turn-key outsourced deployment of operations and services
  - The option for the community to become a vertically integrated telecom player is also available.
- Together or separate?

In what follows, the focus will be on the more DIY community fibre network approaches. Note that this does not exclude working with private sector partners to make it so.

#### **4.5.2 Status Quo**

For reasons ranging from a lack of resources, more important priorities, a belief that municipalities should not be in the infrastructure game, to satisfaction with current service levels, communities may elect to leave broadband to the existing players and not get involved.

#### **4.5.3 Incremental**

Should the Region or its constituents not have the support to 'jump in with both feet', but position for a possible broadband play later, interim straightforward and inexpensive approaches include:

- Municipal Planning:
  - Work with the CRP...
  - Develop a Broadband Services Strategic plan
  - Embed fibre network requirements in internal IT planning processes
  - Accelerate currently planned IT infrastructure deployment
- Leverage Planned Civil Works:
  - Develop a policy and business case for including installation of fibre conduit as part of applicable and appropriate town infrastructure projects, such as road (re)construction and water / wastewater projects.
- Position for the future

- Require that the inclusion of fibre conduit be a mandatory requirement in all applications for new residential and businesses development permits.
- Adopt an inside wiring standard with cat-5 wiring as the minimum standard. It does not make any sense for a house builder to use Cat 3 wiring when fibre is available at the curb.

While education and advocacy, as well as municipal processes, can assist in driving broadband service improvement strategies forward, ultimately the success of the strategy depends on realizing investments from both private and public sector stakeholders in the region's connectivity.

#### 4.5.4 Negotiate with Current Providers

##### 4.5.4.1 Work with the Carriers and Seek their Investment

Over the past few years, both TELUS and Axia have been interested in and indeed installing fibre-to-the-premise (FTTP) networks in communities throughout Alberta. As shown in the adjacent summary slide of TELUS deployments, since 2014 and at a cost of \$430M, TELUS' fibre has been deployed to 107,000 Alberta premises.<sup>7</sup> TELUS plans to spend another \$1.2 billion by year-end 2019.

TELUS fibre in the selected communities is deployed at no cost to the municipality. Home and property owners are under no obligation to obtain services when granting permission for TELUS to place the fibre drop directly to their premises. While Axia does offer symmetric 1 Gb/s business and 100 Mb/s residential services together with an option for other service providers to lease fibre access lines, as yet, TELUS has not yet seen a market need for these services. On the other hand, the CRTC will require TELUS to provide wholesale access to their fibre on some yet to be determined basis, whereas Axia will not be so encumbered.

Community	Premises	Community	Premises
Blackfalds	3.1k	Peace River	3.3k
Bonnyville	1.3k	Ponoka	0.9k
Calgary	33.3k	St. Paul	2.7k
Coaldale	2.8k	Stettler	2.6k
Didsbury	1.7k	Taber	3.6k
Drumheller	2.9k	Vegreville	3.1k
Edmonton	17.5k	Wainwright	3.3k
Edson	3.4k	Westlock	2.0k
Hinton	5.0k	Wetaskiwin	5.3k
Innisfail	3.2k	Misc Communities	13k

At this point, TELUS does not provide their retail service sets over community fibre networks, even in smaller centres in which TELUS has not upgraded their plant to fibre, and in which the community networks offer significantly more capacity than TELUS' aging copper plant and would save TELUS significant capital.

On the other hand, in return for access to a municipality's rights-of-way, Axia is offering to deploy fibre infrastructure throughout individual communities and offer Internet services at up to 100 Mb/s for residential subscribers and 1 Gb/s for businesses should 30% of the addressable premises in the town show interest in Axia's services. The offer was contingent on due diligence by Axia and the towns of Barnwell, Nobleford, Nanton, and Vulcan now have town-wide FTTP service. Axia has also announced FTTP services for Magrath, Pincher Creek, Raymond, and Stirling.

While merits of an essentially hassle-free and free, fibre infrastructure are self-evident, the Axia offer is neither without cost nor risk. All revenues from the network would accrue to Axia's shareholders and once deployed, Axia would have monopoly control over critical civic infrastructure. No

<sup>7</sup> Mawji, Zainul; *Expanding Broadband Networks*; 2016-09-12.

infrastructure would be deployed into the surrounding MD and the network would not be open in the traditional sense of the term.

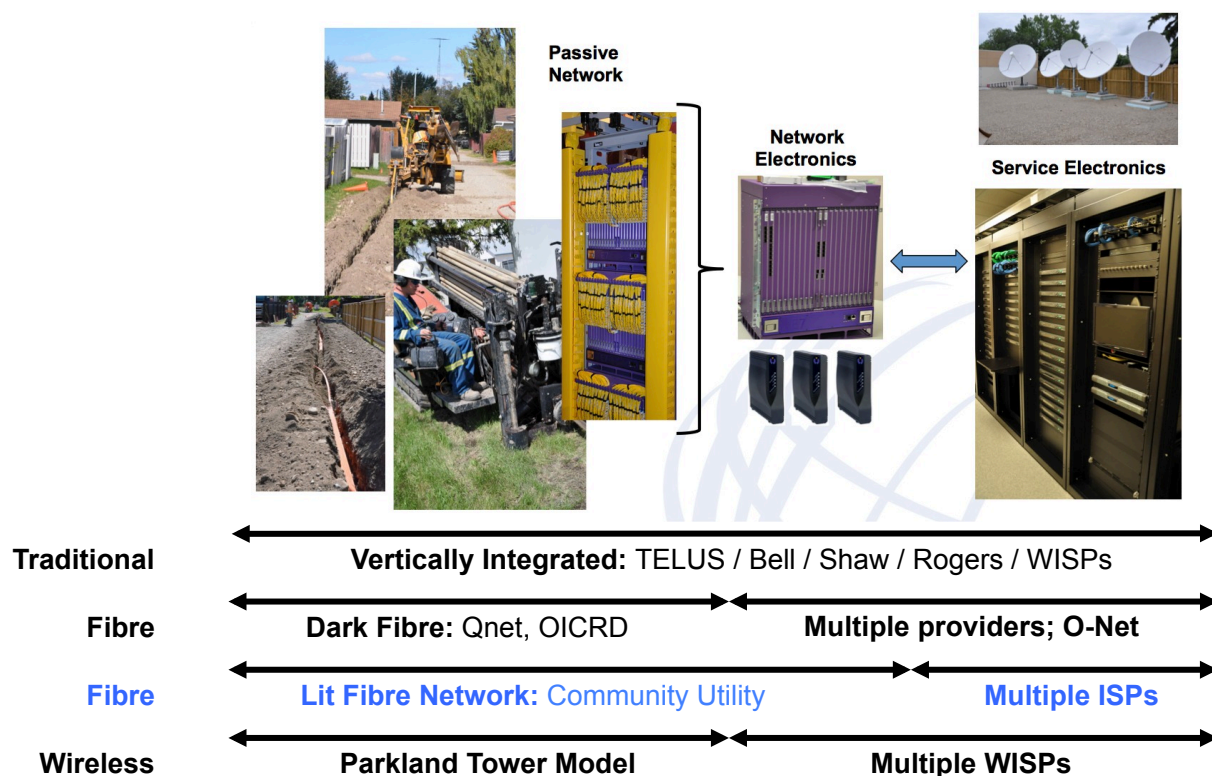
#### 4.5.4.2 Subsidize a Private Partner

The traditional market driven, private sector led business model is not providing many CRP municipalities with the infrastructure they desire due to a lack of financial incentives. By directly subsidizing a private operator, municipalities could provide that operator with adequate incentive. Given that this approach in essence anoints a select supplier, it does provide the supplier with a market advantage in an area where market forces do not prevail and municipalities need to carefully consider the terms under which these arrangements are made. On the plus-side, the arrangement keeps the infrastructure deployment and operations in the hands of private sector players and minimizes Council involvement and resources. On the other hand, as in the AxiaConnect offer, the selected supplier will end up with a defacto monopoly in the municipality.

When the arrangements involve fixed wireless players, additional issues arise from the fact that the infrastructure does not scale well. While an upfront subsidy may result in infrastructure adequate for current requirements, additional capital infusions will likely be required to meet ever increasing capacity demands.

#### 4.5.5 Develop a Community Fibre Network

Given the lack of interest from the incumbent telecom and cable operators, the municipalities in the CRP region may wish to consider establishing their own community fibre network. Indeed, with an appropriate and sustainable business model, individual municipalities could establish, either on their own or in partnership, a fibre-based community broadband network and operate it as a fourth utility.





As proven by deployments throughout Europe and the Far East, utility infrastructure could enable a town to provide competitive service providers equal access to unmatched symmetric bandwidth capabilities and thereby enable the delivery of a variety of novel community-based intelligent community services (as well as entertainment services such as HD-TV) to its residents and businesses.

Should a municipality wish to consider this option, a number of the more common business model, financing, and governance options available to help make it happen appear in the table below. Common models are outlined in more detail in Appendix 12.1.

**Options Available to Community Networks**

Business Model	Funding	Governance
<ul style="list-style-type: none"> <li>• Conduit only</li> <li>• Wholesale fibre: dark or lit</li> <li>• Retail: open or closed and with or without service partners</li> </ul>	<ul style="list-style-type: none"> <li>• Debt financed via ACFA</li> <li>• MCI Funding / Grants</li> <li>• Co-operative</li> <li>• Utility/Power</li> <li>• Private-public partnership (PPP)</li> <li>• Private Equity</li> <li>• Hybrid</li> </ul>	<ul style="list-style-type: none"> <li>• Commission</li> <li>• Municipality</li> <li>• Municipal Services Corporation</li> <li>• Co-operative</li> <li>• Not-for-profit</li> <li>• Private</li> </ul>

**Different choices** offer different advantages, disadvantages, costs and outcomes for municipalities:

- Negotiating **space in the utilities trench** – should there be room for everyone’s conduit in the trench ? or first-come-first-served ? or exclusive access to a few ? and/or for municipal conduit ?
- To **own municipal conduit** (and rent space to multiple fibre providers), or not ?
- To **own the fibre network** and rent space in the fibre to private ISPs, or not ?
- To **become an ISP** (like O-Net) and provide direct (retail) programming to customers, or not ?

While community options do involve more hassle and risk than simply transferring responsibility to private enterprise such as Axia, they come with significant advantages. As well, to minimize the hassle-factor, close to turn-key options do exist and can be easily incorporated into community deployment programs –once the community has decided upon the business and governance structure, operational arrangements, and financing.

## 5 The DIY Business Case

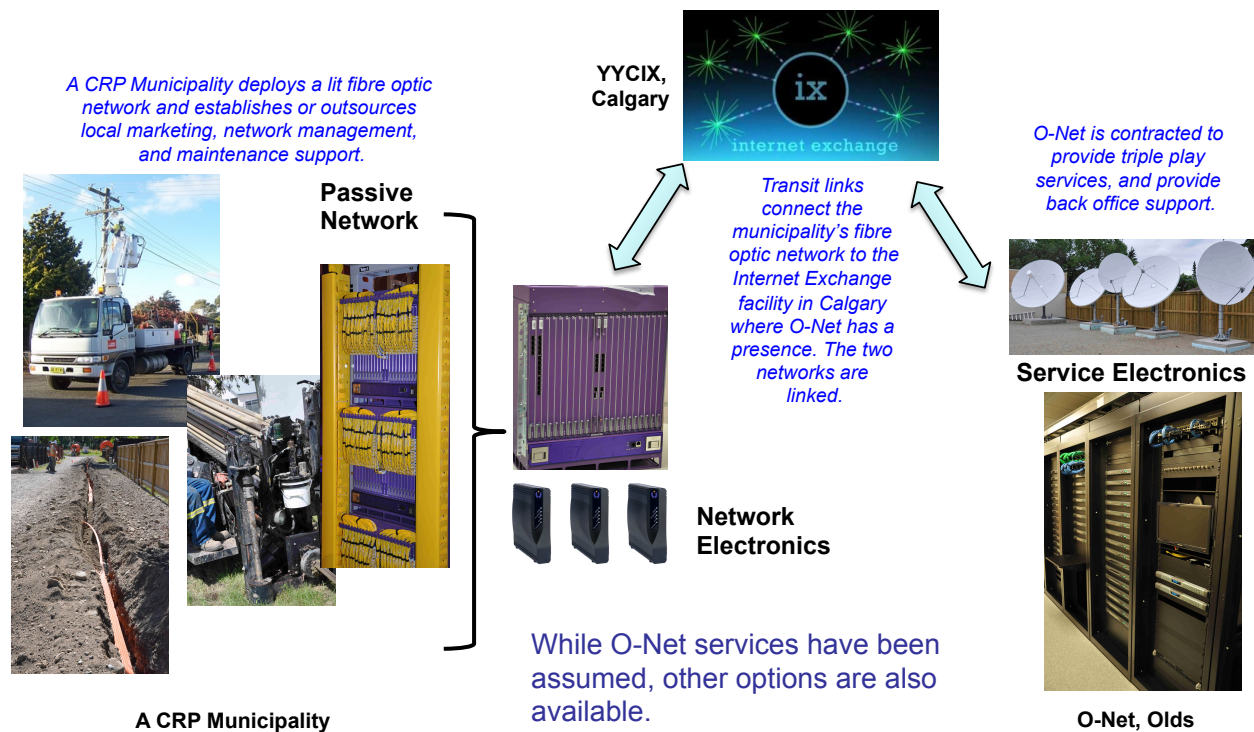
### 5.1 Business Structure

Building on work and experience gained in other communities, this portion of the study provides CRP municipalities with a high level view of the business case associated with the deployment of broadband infrastructure and services to homes and businesses within each of their communities. Such capabilities could significantly enhance economic development in each municipality.

Referring to the figure below, each business case assumes that the municipality deploys the passive aerial/buried fibre infrastructure that passes every home and business in the community. Drops – the connections from the street to client premises – are only deployed when that premise takes service. The community also provides the opto-electronics to light the infrastructure and arranges for a backhaul connection to the YYCIX in Calgary which connects the now functional community network to

various service providers or with the global Internet. As O-Net is the only triple play service provider currently around, the financials assume that the triple play – Internet, Telephone, and Television – services, are provided on a wholesale-basis by O-Net (O-Net has a point-of-presence at YYCIX in Calgary). O-Net is also contracted to provide all back-office, billing, network monitoring, and customer support. The community itself sets up a local sales office and arranges for administration, marketing, sales, and technical support staff. The latter look after drop, home and business service installations as well as network maintenance based on trouble tickets issued by O-Net.

Once the services eco-system matures, communities may wish to only provide the utility lit fibre infrastructure and connection to YYCIX and leave everything else to competitive service providers interested in providing services to the community. For the present, the assumed structure minimizes risk to the community and has a proven track record in Alberta.



Capital cost estimates assume a mixture of aerial and buried plant based on the proportion of the community that has aerial power pole infrastructure and buried estimates assume soil conditions similar to those found in Olds. Should the aerial infrastructure turn out to be inadequate or the ground conditions turn out to be largely rock, costs will be higher. While sufficient for planning purposes, should any community elect to move ahead, more detailed planning and more accurate estimates will be required. Opto-electronics costs are based on supplier quotations.

## 5.2 Financing

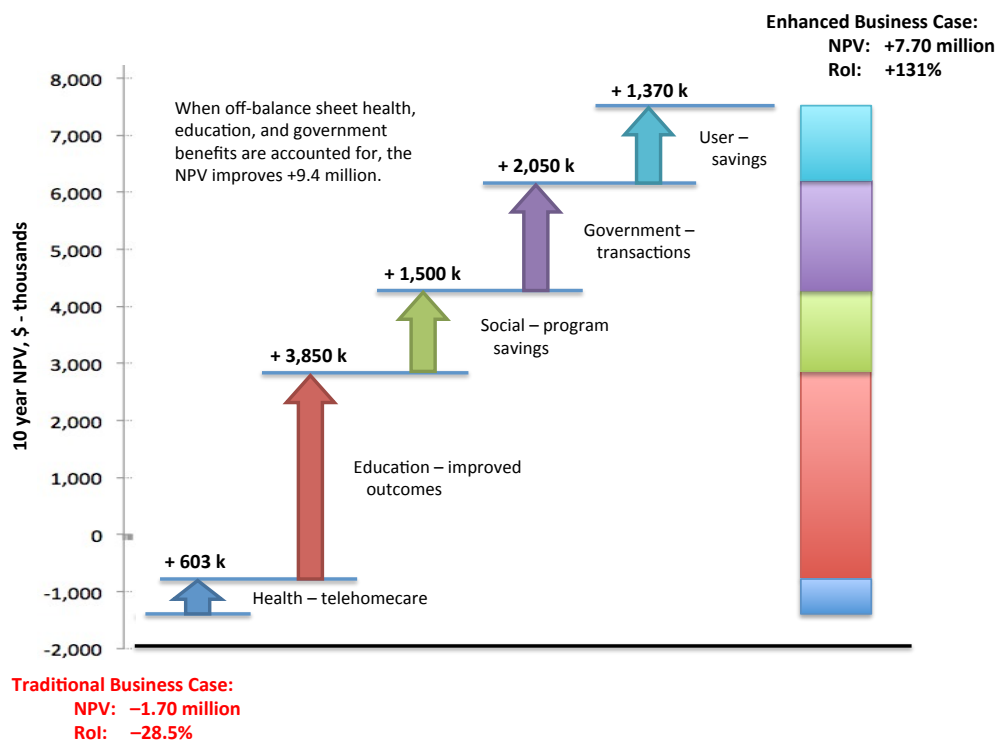
### 5.2.1 Financial Considerations

#### 5.2.1.1 Off-balance Sheet Considerations

Whereas the business case numbers generated later in this section are 'traditional' in that to obtain estimates of the financing requirements, only direct revenues generated by the provisioning of triple-play services in the community, together with estimated operational capital expenditures are considered. When it comes to Council considerations, though, a community may wish to capture

broader community (off-balance sheet) benefits such as positive impacts on the community's quality of life, youth retention, business attraction, and competitiveness. At the Council level, the debate as to whether this new infrastructure will focus largely on private benefits (broadband fibre as a market commodity) or public benefits (broadband fibre as a utility to achieve purposeful public benefits) will be decided. The results will help dictate who should own and control the fibre assets and how well the assets will achieve broader public benefits.

In more rural settings, by quantifying and including broader community benefits, fibre can be justifiably deployed far deeper into rural areas than generally realized based on a simple 'internet-only' case. For a set of First Nations communities in the Wood Buffalo area, for example and as is evident in the chart below, including tangible, broader community benefits turned a marginal case for fixed-wireless into a strong case for fibre. In that business case, the educational benefits would only be realized with fibre – the wireless alternatives at that time could not provide the required capacity or performance.



### 5.2.1.2 Public versus Private Financing

Private enterprise cannot compete with municipalities when financing long-term infrastructure. To see this, consider a \$1M fibre deployment project. With 20 year financing from the Alberta Capital Finance Authority (ACFA) at the current rate of 2.832% (16-06-01), municipality payments come in at \$5,462/mo – \$10.92/subscriber/mo with 500 subscribers. Private enterprise looking to finance this over 5 years at 2% would face payments of \$17,528/mo – \$35.06/subscriber/mo with 500 subscribers.

### 5.2.1.3 Aerial versus Buried Deployment

If a deployment area receives its power aerially – i.e., via power pole infrastructure – and the poles can take the additional weight and there is sufficient clearance, fibre can be provided aerially at about a third of the cost of a buried deployment. On the other hand, if the pole infrastructure must be upgraded, then the buried deployment is likely the least expensive.



Deployments (using power poles) can save money and facilitate private investment. If the pole infrastructure is suitable, aerial fibre deployments can be done for one-third the cost of buried deployments. On the other hand, if the pole infrastructure must be upgraded, then the buried deployment is likely the least expensive. Should a community with a sizeable portion of aerial infrastructure elect to move forward, due diligence to determine the suitability of the poles will be required.

Though buried infrastructure is more secure on a long-term basis, if the lower cost of an aerial deployment can be realized, the reduced capital requirements increases the possibility of attracting private equity.

#### 5.2.1.4 Wireless versus Wired

Though wireless solutions may initially be less expensive to deploy, they are both capital and operationally more expensive over terms exceeding ten years. As home and business Internet usage tends to increase at rates exceeding 20%/yr and has done so for over a decade, to meet this increasing demand, capacity requirements must be increased over 5-fold per decade. As scaling fixed wireless systems to keep pace with these demands becomes increasingly expensive, fibre/wireless cost comparisons are more properly done on a minimum ten year total cost-of-ownership basis. On a total cost of ownership basis, fibre is generally found to be the least expensive technology to deploy.

*In a sample design for a 200 mi<sup>2</sup> rural area in Chamberlain, S.D., Vantage Point Consulting found that whereas the least expensive wireless deployment came in at \$370 per Mb/s per client, fibre came in at \$9. In this comparison, the wireless network was designed to support 4 Mb/s per client whereas the fibre network could support 1 Gb/s.<sup>8</sup>*

#### 5.2.1.5 Cherry-Picking

In general *Cherry-picking* refers to a provider going after the so-called low-hanging fruit – the premises, businesses, and areas with the highest margin potential first. If the provider is private, then, once picked, the remaining less profitable areas may be permanently left out. If a public provider, then the resulting cashflow from the high margin areas/customers can be a real asset to further deployment into less profitable areas. The more cherry-picking that is done by a private provider in a target community, the more difficult it becomes for that community to fund the deployment to the higher cost premises and subdivisions yet to be connected. Examples include:

- AxiaConnect deploying FTTP to a town, in a regional context
- TELUS and Shaw providing custom builds to provide fibre to the large businesses and institutions, which are then unavailable as contributors to a larger public network.

Though all of the above represent legitimate and potentially profitable business strategies, from an inclusive community utility fibre perspective, each removes potentially valuable customers and cashflow. Removing a town's cashflow from that available to the region strands the more rural areas outside the town's boundary. Removing business revenue strands a community's residential areas.

Given that a land-grab of sorts is underway and that outside the larger centres only one fibre network is likely to be deployed, community's interested in inclusive fibre as a fourth utility play need to move quickly before aggressive cherry-picking by private providers leaves their area with an untenable business case.

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<sup>8</sup> Thompson, L., et al; *Comparing Wired and Wireless Broadband*; Vantage Point; 2015 05/06.

## 5.2.2 Capital Issues

Business cases for fibre deployments tend to be interesting for two reasons. First, significant upfront capital is required to finance deployments and, second, the capital required increases with both the initial take-up rates (due to the costs to connect clients) and the intensity of the competition in the community (which decreases revenue). To offset these effects, initial deployments typically target more densely populated business districts to initiate revenue streams, then move on to the residential areas, and then to the outlying areas. Service uptake is typically higher for businesses, and margins on voice and Internet services are higher than those for television services. In essence, the strategy is to use cashflow from the more profitable areas to help finance deployments in the less profitable areas.

Strategies to reduce capital requirements include:

- Finance the project over as long a term as possible (e.g. a 30+ year fibre asset with a 30 year debt repayment term) to lower the monthly bill to customers
- Use aerial deployment where pole infrastructure is satisfactory to reduce overall costs
- Leverage planned civil works wherever possible (e.g., laying conduit whenever trenches and roadways are opened-up for repair or made available due to work on water, power, gas or telecom utilities in new development areas). In buried builds, civil works (i.e. “the trench”) account for ~70% of the deployment costs.
- Require conduit deployment and cat-5 wiring in all new developments
- Leverage the additional cashflow available from the business, commercial, and greenfield areas (in some ways, the low-hanging fruit) to offset the less dense/lower revenue areas of the community or region
- Allocate a portion of expected municipal operational savings to the project
- Use a tax levy for, say, the drop portion of the build
- In lower density areas, provide fibre-to-the-tower to enable higher bit rate, higher capacity wireless services to the surrounding area.
- Go with wi-fi first – e.g., leverage Fortis’ LED street lamp upgrade – build a community/customer base first

Incredibly, some smaller communities cannot even raise the ¼ M\$ an aerial deployment might cost them. As this is a trivial amount to larger communities with, say, a \$15M build, larger communities might consider including the smaller communities in their plans. The additional scale their inclusion brings to the table, combined with the added municipal participation, can help leverage their operational costs, enhance grant applications, and enhance the sub-region’s connectivity and capacity generally.

## 5.3 Sample Financials

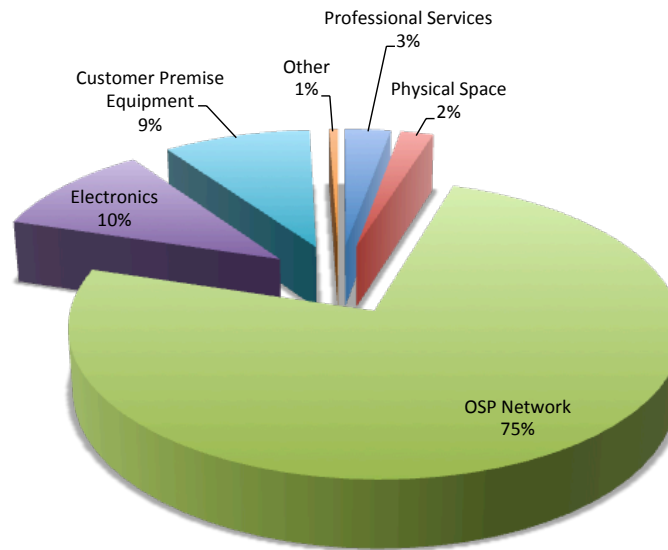
### 5.3.1 Larger Municipalities

Assume a municipality of 7,500 residential premises and 375 businesses (~20k people). The town is growing at a rate of 3%/year and some 20% of the town is served via aerial power infrastructure and deployment will take three years. No grants are received and the town takes out a 30 year loan from the ACFA with an interest rate of 2.78%. Assuming:

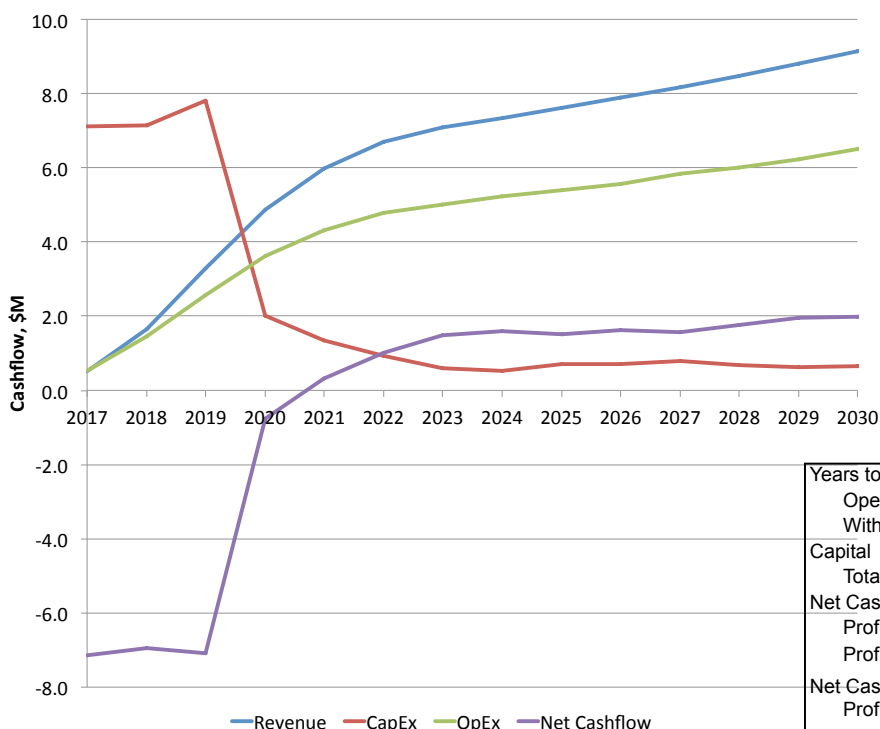
- 15% capital and operating contingencies,
- that drops are only deployed when services are ordered by individual customers,
- that a project manager is hired to manage the deployment, and
- that there is no leverage from civil infrastructure projects,

the core network build will cost approximately \$13M.

If the target residential and business penetration targets of 30% and 50%, respectively, are reached in four years, the overall capital required during the first five years of operation will be \$22M and breaks down as shown in the pie chart below. The additional capital is due to the costs of connecting customers, i.e., deploying drops, providing the required client electronics, and completing the home installation. The US\$ exchange rate is set at \$1.35 (the opto-electronics quotes are in US\$) and 2% annual inflation is assumed.



Estimated project cashflow is shown below. The significant upfront required capital appears in red and net cashflow appears in purple. As can be seen, the project goes cashflow positive during year 4 and the operating margin – the difference between the revenue (blue) and operating expense (green) curves is healthy and growing (due to the 3% growth rate).



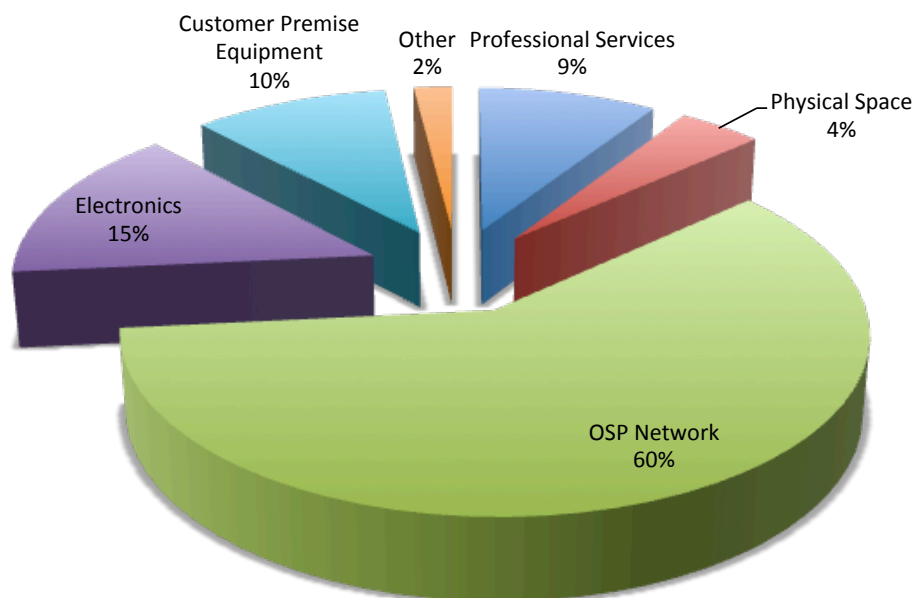
Results	
Years to positive cashflow	
Operating	4
With debt servicing (p&i)	5
Capital	
Total capital required	23,119,783
Net Cashflow - before debt servicing	
Profit - annual at 10 yr	1,623,647
Profit - annual at 15 yr	2,177,641
Net Cashflow - after debt servicing	
Profit - annual at 10 yr	1,015,083
Profit - annual at 15 yr	1,480,097

Sufficient project financing must be arranged to cover the initial operating deficits. In this case, \$23M is required and the project will return some \$1M annually to the town by year ten.

### 5.3.2 Smaller Municipalities

Now let's assume a smaller centre with 1500 residential premises and 38 businesses (~4k people). The town is growing at 1%/yr and due to aging TELUS infrastructure and no Shaw, residential and business penetrations increase to 40% and 60% by year four. The network is deployed in one year and assuming all other parameters remain the same, the core network build will cost approximately \$2.7M.

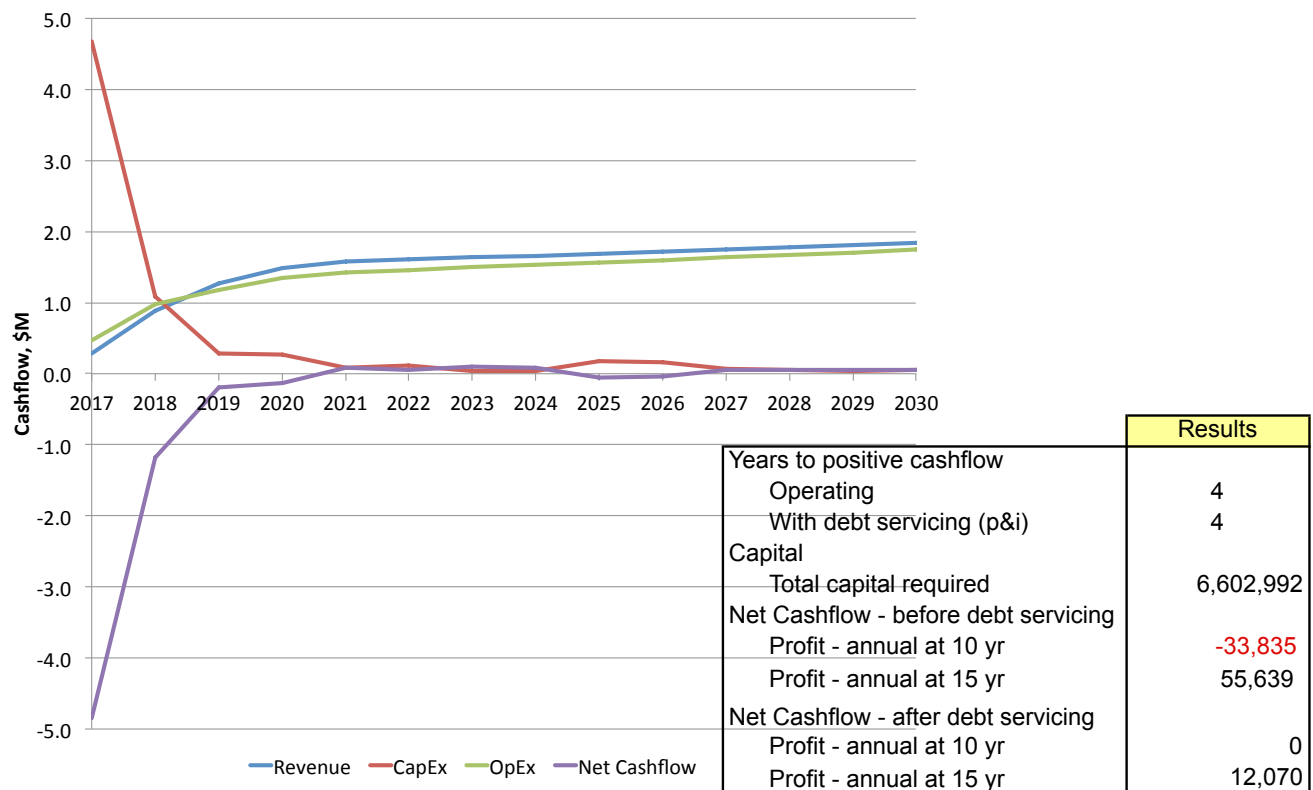
With these assumptions, the overall capital required during the first five years of operation will be \$5.6M and breaks down as shown in the pie chart below. The additional capital is due to the costs of connecting customers, i.e., deploying drops, providing the required client electronics, and completing the home installation. The US\$ exchange rate is set at \$1.35 (the opto-electronics quotes are in US\$) and 2% annual inflation is assumed.



Estimated project cashflow is shown below. The significant upfront required capital appears in red and net cashflow appears in purple. As can be seen, the operating margins – again, the difference between the revenue (blue) and operating expense (green) curves – are so tight that the project is barely sustainable. Indeed, in 2025, cashflow goes negative due to the need to upgrade the opto-electronics hardware. Overall financing required is \$6.6M.

Based on these numbers, towns smaller than 1500 premises will have a hard time deploying utility fibre infrastructure on a sustainable basis by themselves. Increased operational scale, outsourcing operations, grant funding, and tax levies are all ways to help alleviate these constraints.

One way to increase operational scale is to cluster communities in an area so that they can share operations as well as a single, more affordable, and shared backhaul connection to Calgary. Options to accomplish this exist in each sub-region. In the South, for example, the communities of Black Diamond, Turner Valley, Longview, High River, Foothills, and possibly Okotoks might set up a sub-regional operation. In the West, Cochrane, Redwood Meadows, Canmore, and Banff could do the same.



### 5.3.3 Municipal Districts & Counties

Whereas larger municipalities have to option to go it alone and smaller centres are constrained by operational expenses, more rural areas are constrained by both. Due to significant variations in density and geography, sample numbers can't be realistically generated for a 'typical' rural area. Instead, consider a \$1M fibre deployment.

Simplistically, at two farms per km and \$30/m in deployment costs + \$5k/subscriber install, for example, with \$1M one could only pass 57 farms with little left over for electronics

Premise Count	57	Core fibre network	855,000
Penetration	50%	Subscriber connections	145,000
Clients	29	Fibre CapEx	1,000,000
Pricing: \$/mo	100	Interest, %/yr	2.832%
Revenue: \$/mo	2,900	Term, yr	20
Debt Service	5,462	Payments: \$/mo	5,462
Net margin	-2,562 /mo		
	-30,747 /yr		

On the operations side, the deal is negative just based on debt servicing requirements. Hence, below some threshold density, fixed wireless solutions will be required to provide services in a sustainable fashion. The threshold will vary from county to county based on financial strength and priorities as well as over time, as technology matures and capacity requirements increase.

The approach then, is to note that premises are not evenly distributed, indeed, many are in close proximity, especially in hamlets and rural subdivisions. Excluding mobilization costs to move a crew and the required materials to a rural community, and assuming a backhaul connection to a major centre is

available, the costs to deploy fibre within these clustered communities (e.g., Cochrane Lakes) is similar to that in larger centres.

In the MD of Bighorn, for example, only ~21% of the premises lie outside their 5 hamlets and 4 small subdivisions – so 79% of the MD (the clustered areas) could be served if inexpensive connections between the communities were available. Inexpensive intercommunity links can be obtained by:

- Updating the *SuperNet* usage restrictions, adjusting the pricing, and/or adjusting the business model to make serving these hamlets/small subdivisions financially feasible
- Bypassing the *SuperNet* by negotiating with the incumbents' carrier services divisions
- Using point-to-point (PTP) wireless links to connect hamlets/small subdivisions in close proximity and to which *SuperNet* and/or incumbent connections are not available or too expensive together and then arranging for one backhaul connection to a major centre .

Once the communities down to the small subdivisions are served, the remaining more rural premises (e.g., farms, ranches, and acreages) would need to be looked at. Even these are not likely to be evenly distributed, so the more clustered areas would be evaluated first and possibly connected via fibre. These fibre runs would terminate on fixed wireless towers so that the point-to-multipoint wireless equipment could be upgraded to deliver higher bit rate services to the remaining farms and premises.

A detailed analysis for Clearwater County showed that by including the towns of Rocky Mountain House and Caroline, fibre to over 80% of the premises was possible within the available budget.

***In summary, when broken down to do-able parts, the scale is not as overwhelming as it would initially seem – real, practical solutions are possible in rural areas, but are made more possible if part of a broader fibre network deployment in partnership with larger municipal neighbours and existing ISPs.***

### 5.3.4 Summary Financials

To help anchor discussions with each municipality visited, high level financials assuming the above model, but with no contingencies, were generated. The results are summarized in the table below. As mentioned, these are high level numbers only and will therefore change as the assumptions are updated and more detailed planning and due-diligence takes place.

	Current State				Market Penetration		Required Capital, \$M		Term yr	Breakeven years	Net Cashflow/yr, \$M	
	# Premises	# Businesses	Growth	% Aerial	Residential	Business	Core - Build	Financing			10 yr	15 yr
Cities												
Airdrie	15,208	760	2%	25%	30%	50%	25.20	32.10	30	4	4.87	5.67
Calgary	430,146											
Chestermere	4,702	235	7%	0%	30%	50%	9.90	15.50	20	5	1.04	2.04
Towns												
Banff	2,651	133	2%	0%	30%	50%	5.67	9.21	30	5	0.21	0.40
Black Diamond/ Turner Valley	1,884	94	2%	90%	40%	60%	1.11	3.68	30	3	0.33	0.51
Canmore	6,015	301	2%	40%	30%	50%	8.58	12.33	30	3	1.53	1.89
Cochrane	8,565	428	8%	30%	30%	50%	13.67	13.96	30	4	1.93	3.59
Crossfield	1,040											
High River	5,367	268	2%	25%	40%	60%	9.02	13.65	30	4	1.80	2.25
Irricana	455	23	2%	60%	40%	60%	0.50					
Nanton	921											
Okotoks	8,564	428	2%	10%	30%	50%	16.46	22.30	30	4	2.13	2.60
Redwood Meadows	350	25	2%	90%	40%	60%	0.75					
Strathmore	4,683	237	3%	20%	30%	50%	8.26	12.76	30	4	0.86	1.05
Turner Valley												
Villages												
Beiseker	330	17	2%	90%	40%	60%	0.19					
Longview	136	10	2%	90%	40%	60%	0.29					
Hussar	81											
Rockyford	141											
Standard	145	10	2%	80%	40%	60%	0.11					



As smaller communities are not sustainable by themselves, financial estimates (required capital, breakeven, and net cashflow) for them were not generated as, due to ongoing deficits, the capital requirements simply continue to increase with time.

## 6 Sub-regional Considerations

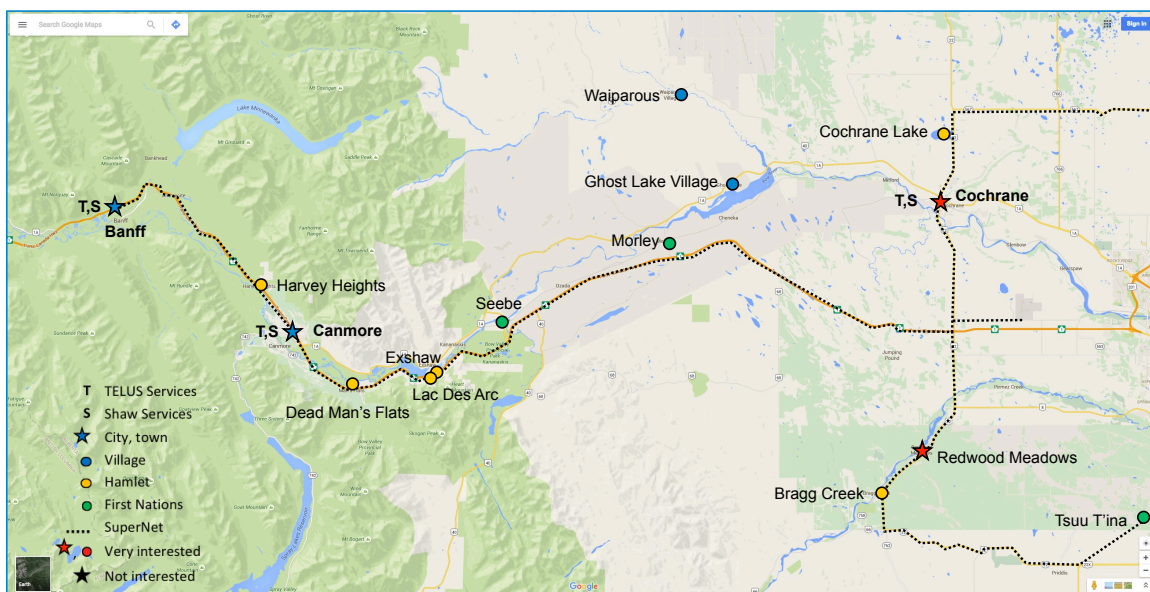
### 6.1 Context

As discussed in the DIY Business Case section above, more can be accomplished more efficiently and with better financial returns and less risk, when communities work together in partnership. This is particularly true of communities within close proximity to each other. In looking at the CRP region, four natural sub-regional groupings emerge – West, South, East, and North sub-regions. Given current sub-regional dynamics, the South and West sub-regions are mostly likely to move ahead first. If so, then the East and North sub-regions will be able to learn from their experience and then move ahead when they are ready.

### 6.2 West

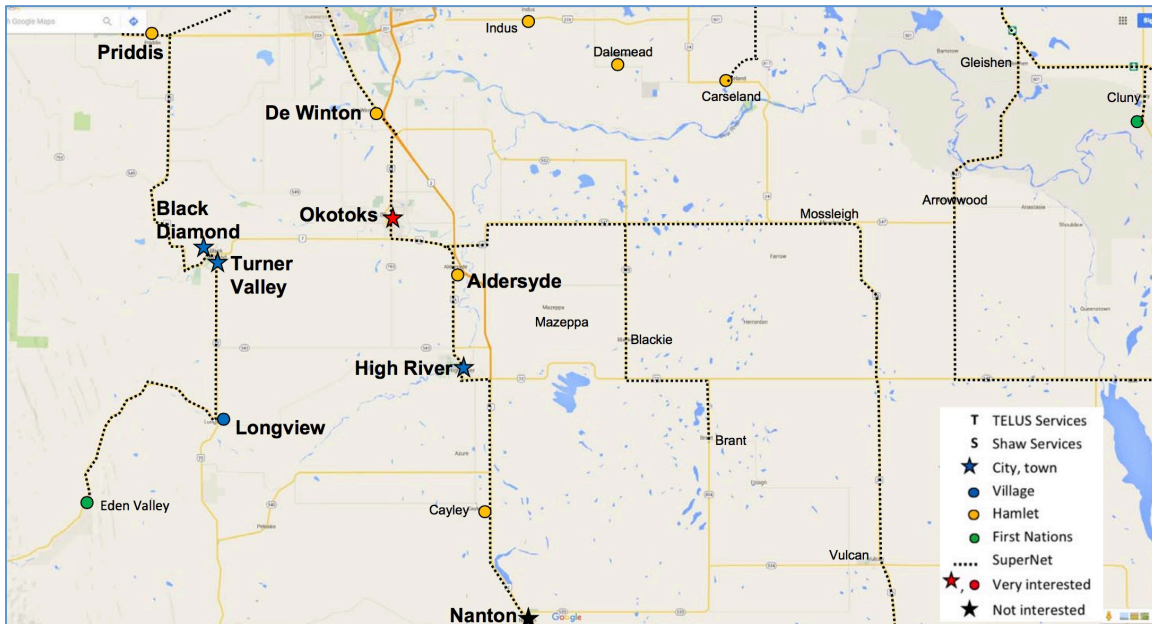
In the Western sub-region of the CRP, utilizing the *SuperNet* plus several short PTP wireless links would facilitate connections to pretty much every community along the Trans-Canada corridor. However, in utilizing *SuperNet*, under current provisions, each community (including both incorporated and hamlets) would need to pay for its own direct link back to Calgary which, replicated over 14 communities, would cost between \$42,000 and \$70,000/month, depending on how much bandwidth each community required. Such an operational charge is prohibitively expensive for the smaller communities and unreasonably so for the corridor as a whole. If *SuperNet* provisions permitted direct community-to-community links, communities could group into clusters – and with each cluster sharing the cost of a single \$5,000 link back to Calgary, the costs would be manageable.

***Thus, there is a choice of four futures – either the rules around SuperNet change, or other fibre-based networks are put in place (a work-around), or competitive networks (TELUS, Shaw) are utilized, or the smaller centres remain excluded.***



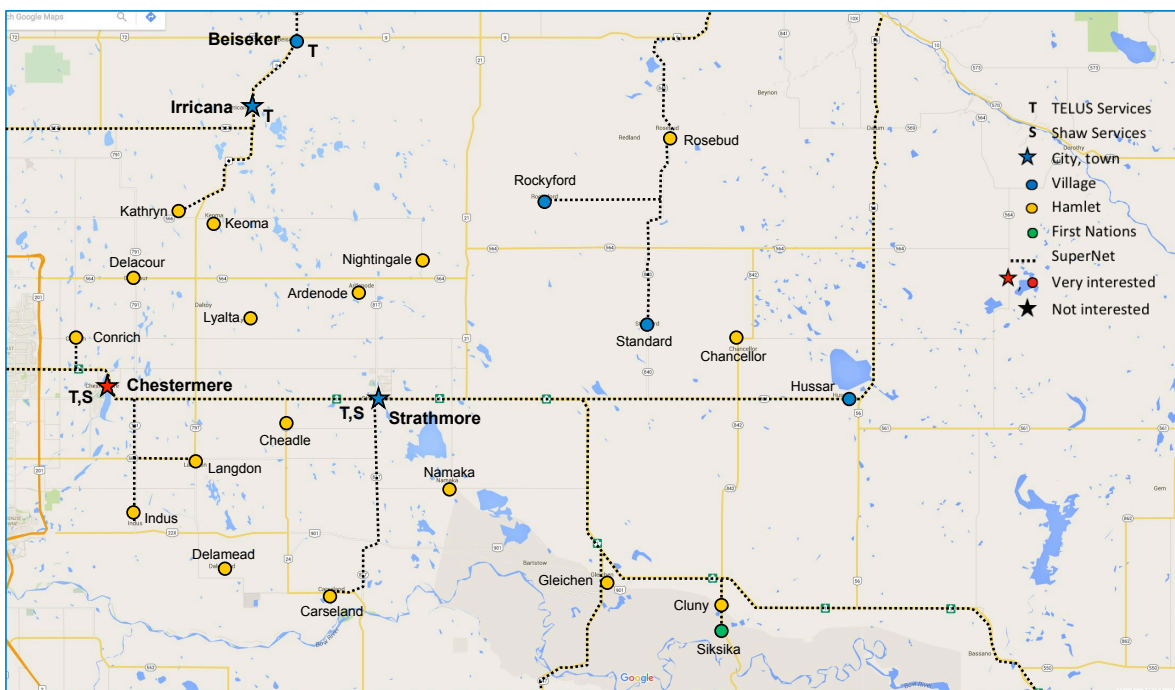
## 6.3 South

A similar situation is found in the Southern sub-region. Whereas several PTP wireless links together with the *SuperNet* should make fibre access solutions economically feasible for every town, village, and hamlet in the sub-region, with current pricing, *SuperNet* policy prohibits long-term feasibility. Fortunately, backhaul alternatives exist as both TELUS and Shaw have fibre running along the corridor.



## 6.4 East

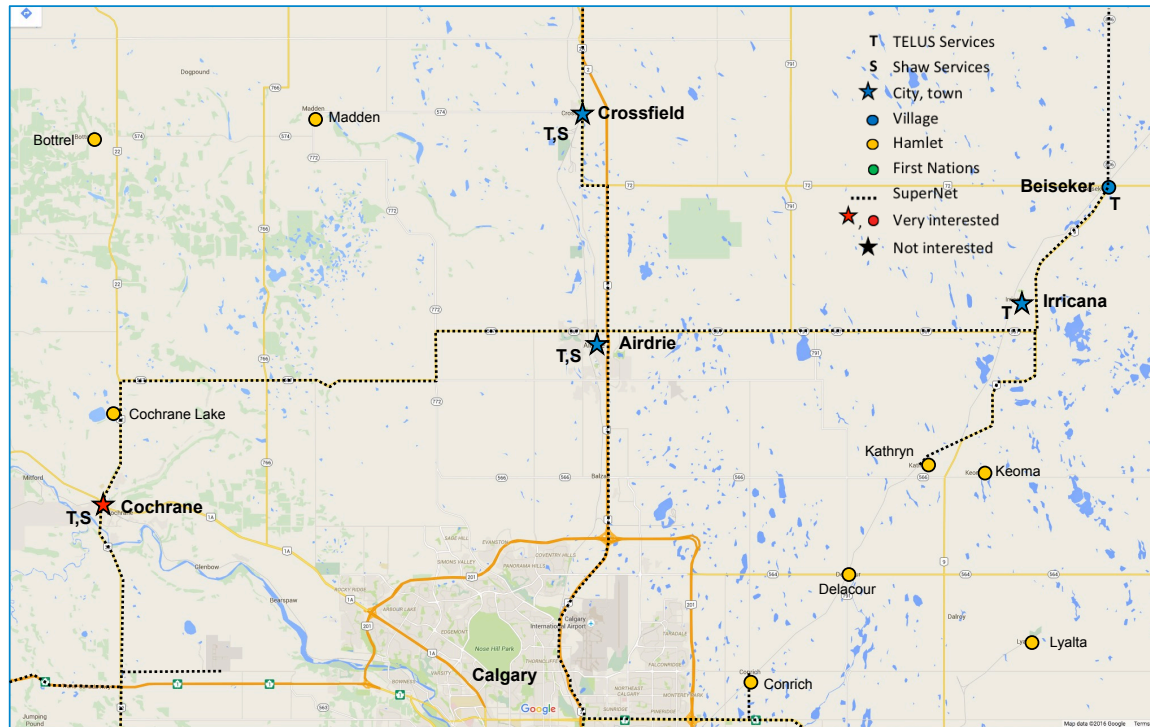
The Eastern sub-region could be served by a number of short point-to-point wireless links in addition to *SuperNet*. To improve reliability, the links would be arranged to form rings.





## 6.5 North

In the Northern sub-region, there is some overlap with the Eastern sub-region, so there are several options for linking the PTP wireless links to the global network. *SuperNet* here is key as well, but again, will only work if *SuperNet* provisions can be revised. Given the distances to Bottrel and Madden (west of Crossfield and north of Cochrane), existing wireless provider networks might need to be leveraged if they are to be included.



## 6.6 Rural Areas in the Sub-regions

For rural areas within the sub-regions, the approach would be to:

- Initially focus on all communities in which premises are in close proximity (clustered)
- Interconnect those communities as efficiently as possible and then aggregate the capacity requirements onto shared backhaul links to increase redundancy and save cost
- Finally, focus on the densest rural areas and layout fibre designs to both serve the largest number of premises in the smallest areas and increase fixed wireless capacity by providing fibre to ISP towers
- Collaborate to establish sufficient operational scale to ensure sustainability
- Evaluate practical and novel ways to finance the required deployments
- Reboot the Alberta *SuperNet* so to make fibre-to-the-farm (and the smaller centres) a practical reality.

## 7 The Calgary Region

On a regional scale, the potential big moves are outlined in some detail below.

### 1. *Region-wide Vision / Framework / Strategy*

- On behalf of the region as a whole, establish an encompassing Vision, Framework and Strategy to make ubiquitous, region-wide digital connectivity and broadband a goal and a reality.
- The work would establish shared outcomes, principles, strategies, and rationale for collaborative approaches to design/build/deploy/operate as a regional network.
- Collaborative approaches would include potential business structures and models, governance, regional financing models, infrastructure priorities, the role of market-based players, potential partners, and so on.
- Though ambitious in scope, if done well, the result would enable efficient resource sharing and connectable systems across the region, significant cost savings, be inclusive and likely maximize the benefits to all across the region.
- Recognizing that as every community in the region is starting from a different place, with a unique set of issues, assets and constraints, and that all may not yet be in a position to buy-in to an encompassing strategy, as much as possible, seek to create a strategy that starts with initial investments/assets/partners that wish to charge forward and then optimally augment the initiative and network incrementally as other communities elect to come on board – design for eventual connectivity!
- Report back to the EPSC by June, 2017 with learnings and a recommended vision and framework.

### 2. *Sub-regional Business Case*

- Actively engage – to the extent that CRP resources can be made available or secured – with the motivated sub-regions to guide the development of a business case for them:
  - Capital requirements associated with the key DIY options will be estimated at a high level and the most promising alternatives of interest to the sub-region will be quantitatively evaluated.
  - Using an assumed business model and financing structure, the effect of scale will then be evaluated, i.e., does it make more sense for multiple communities to work together or for each to go it alone.
  - Estimate operational costs and service revenues. Together with the capital estimates, these will then be used to generate comparative financial estimates for the governance, business, and operational options of most interest.
  - The financial results together with the associated risks and trade-offs associated with each option will then be reviewed.
  - Potential ownership and financial structures together with associated financing options will then be presented relative to the governance, business, and operational options selected.
  - Once consensus is reached, the business case will be completed and documented.
- Developing the business case and obtaining consensus will require support from financial, IT, marketing, and possibly other resources across the engaged municipalities. In a manner analogous to the regional GIS and economic development forums, create peer support

groups to pool resources and share learnings relevant to issues that arise in each specific area of expertise.

### **3. Develop a set of focused pilot deployments**

- As momentum builds, individual members may wish to pursue focused pilot deployments to address issues of particular relevance to them. To the extent that CRP resources can be made available and/or generated, help support these activities and use the resulting experience and learnings to reduce risk and inform more ambitious sub-regional or regional strategies and/or deployments down the road.
- Example pilots might include working through the issues associated with:
  - Providing fibre conduit along water and sewer line deployments (e.g., Okotoks to Calgary waterline)
  - Pilot deployment in truly rural areas using local resources, including perhaps the local contractors, REAs, gas co-ops, and/or ISPs to minimize deployment costs
  - Work with Bow Valley College and a First Nation's Community to enhance connectivity and remote delivery of educational material
  - Support culture of use, capacity building, community education, training, 'good neighbour' practices, and so on

### **4. Region-wide Benefits Analysis**

- While the benefits of broadband enablement are becoming more widely understood and appreciated, there remains a need to provide a more encompassing sub-regional or regional 'business case' for enabling fibre access on a utility basis, particularly where funding is being sought and rationalized.
- Unlike the business case development recommended in (2) above, this work would focus on quantifying the so-called off-balance sheet benefits (or positive externalities) attributable to the availability of a capable broadband infrastructure – whether due to cost savings or increased revenues to the municipalities, its residents, or businesses.
- On a regional basis, such a business case might carry enough weight to:
  - Influence provincial policy with respect to enabling the funding/financing
  - Promote a conversation within and across provincial government departments around how such networks might be used to improve services and reduce costs
  - Instigate small pilot projects to develop and trial the more promising services
- Aggregate off-balance sheet benefits will likely justify, and attract additional funding for, fibre deployment throughout much of the CRP region.

### **5. Expand the CRP Resource Hub**

- To facilitate continuous learning and sharing of relevant and topical information relating to broadband initiatives, develop and integrate a broadband resources section into CRP's Collaboration and Resource Hub.
- This information might include case studies, Best Practices, pitfalls and traps, updated regional info, progress updates on local and sub-regional initiatives, potential funding sources, trends, shifting Federal/Provincial regulations and funding options, CRTC submissions and proceedings, and so on.
- To help build and maintain momentum as well as address common issues, share resources, foster collaboration, create pilot studies, sponsor training, etc., expand CRPs blogging program to include a broadband focus area.

## 6. External Collaboration & Partnerships

- Develop and pursue **collaborative opportunities**- create a common table for on-going partnership; joint planning; ISP negotiations; funding applications
- Build and strengthen **external partnerships** - with public sector (health, education, tourism); private sector (incumbents, ISPs); First Nations; oil and gas; financial; operational; other

## 7. Advocacy

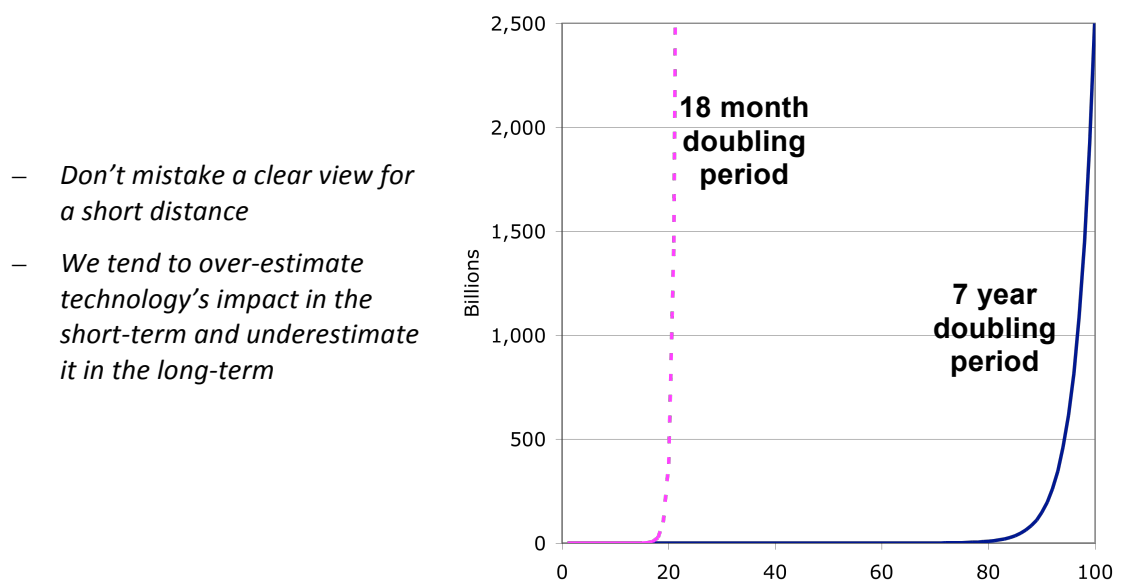
- As a direct result of the 2016-2017 Pilot Funding for Regional Broadband Projects from the Alberta Ministry of Economic Development and Trade, broadband initiatives are being undertaken by most REDAs in the Province. As the various studies complete, CRP should work with the other REDAs to integrate the results and create a more comprehensive provincial perspective on broadband than has heretofore been possible.
- The perspective and learnings should then be used to help inform telecom and related policy at both the Provincial and Federal level.

# 8 A Sense of Urgency

While technology and the utility of the Internet are increasing exponentially, infrastructure deployment is not. To stay ahead of the curve, and minimize the effects of cherry-picking by the private sector, the decision time is now. David Suzuki's smart bug analogy comes to mind:

*Say you have a colony of smart bugs living in a jar with a population that doubles every second and that in one minute, they will fill the jar and perish due to a lack of room and resources. Several smart bugs realize this and try to warn the others. Finally, once the jar is 12.5% full, others start to listen. It is too late, however, as this doesn't occur until they have only 3 seconds left.*

As is evident in the linear plot of two exponential curves below, while progress may be imperceptible until the knee of the exponential curve is hit, once there, the impacts become truly significant.



- Don't mistake a clear view for a short distance
- We tend to over-estimate technology's impact in the short-term and underestimate it in the long-term

## 9 Next Steps

While municipal, sub-regional, and regional DIY options do involve more hassle and risk than simply transferring responsibility to private enterprise such as Axia, both hassle and risk can be reduced with collaboration; the DIY options come with significant community advantages. From a sub-regional and regional perspective, options to move ahead – next steps – are as outlined in Sec. 7.

## 10 Conclusions

Because of the Internet and related technologies, the world is now transitioning to more complex economic systems built around *knowledge*.<sup>9</sup> As a foundational cornerstone of these emerging systems of wealth creation, access to information and communications technology (ICT) has become critical to sustainable economic development in virtually every community and society on the planet.

Recognizing both the opportunity and challenge associated with facilitating advanced fibre optic-based broadband infrastructure and services within the CRP region, the CRP has elected to deal with the issues head-on. The purpose of overall study is to identify and organize a research and analysis framework for moving the discussion forward in the Calgary Region – generating new information about broadband availability throughout the region, identifying and exploring key strategic opportunities and, ultimately, informing decision-makers around the types of choices they might consider at local and region-wide levels to strengthen the delivery and affordability of high-speed broadband services across the Calgary region.

Unlike the collaborative transit strategy developed by the Calgary Regional Partnership (CRP) over the last eight years, in the broadband infrastructure game, a land-grab of sorts is currently underway and time is of the essence. The longer it takes communities to debate their options and assemble the required resources, the more time the traditional telecom and cable service providers have to replace aging infrastructure in their most profitable markets with fibre – which then removes valuable cashflow from more inclusive community-wide utility plays. To move forward quickly, the CRP will likely need to take an active role with those communities most interested in moving ahead. As momentum develops and the issues are resolved, other communities could come onboard.

To be most effective, collaboration will also need to include both distribution and access networks within municipalities as well as the backhaul networks that link the communities together – an issue that will blur the more traditional CRP modus operandi in which their role is solely focused on coordination between communities and not on what each community elects to do itself.

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<sup>9</sup> Toffler, A&H; Revolutionary Wealth; Knopf; 2006-04-25.

## 11 Acronyms

ABF	air blown fibre
ACFA	Alberta Capital Finance Corporation
BAN	base area network
CAD\$	Canadian dollars
CAGR	cumulative annual growth rate
CRTC	Canadian Radio-television and Telecommunications Commission
DIY	do it yourself
EAN	extended area network
FDH	fibre distribution hub
FTTH	fibre-to-the-home
FTTP	fibre-to-the-premise
GB	gigabyte, where 1 B = 8 bits (b)
Gb/s	gigabits ( $10^9$ bits) per second (1000 Mb/s)
GLHLM	GoA, Learning, Health, Library, and Municipality
GPON	gigabit passive optical network
HDD	horizontal directional drilling
ICT	information and communications technology
IRR	internal rate of return
M	mega, million ( $10^6$ )
Mb/s	megabits ( $10^6$ bits) per second
MPLS	multiprotocol label switching
NAP	network access point
NPV	net present value
OICRD	Olds Institute for Community & Regional Development
ONT	optical network unit
OSP	outside plant
PTP	point-to-point
SLA	service level agreement
US	United States (of America)
VPLS	virtual private line service
yr	year

## 12 Appendix

### 12.1 Business Model Options

Dark Fibre	Conduit	<p><b>E.g:</b> Montreal</p> <p><b>Open access</b> can be provided via conduit sharing or subducting, but is limited by the size of the existing conduit.</p>
		<p><b>Pro's:</b> Simple operationally, can be handled by traditional utility departments. Takes 50-60% of the deployment expense off the table for service providers if well designed.</p> <p><b>Con's:</b> Typically only includes feeder and some distribution routes; Limited breakout points; May restrict fibre architecture</p>
	Fibre	<p><b>E.g:</b> Stokab in Stockholm, Qnet in Coquitlam, OICRD in Olds, Calgary</p> <p><b>Open access</b> is typically provided via home-run architecture and by provisioning multiple fibres per premise. If fibre counts are limited, a community may opt for first-come, first-served arrangements.</p>
		<p><b>Pro's:</b> Simple operationally, but considerably more helpful than a conduit-only play. Takes 50-75% of the deployment expense off the table for service providers. Reduces disruption due to civic construction. Enables efficient conduit/fibre design and can be optimized for connectivity. Over-provisioning is required to ensure sufficient fibre and space for multiple sets of network equipment.</p> <p><b>Con's:</b> Potential service providers must also deploy network equipment to light the fibres they wish to lease prior to providing services. In large metropolitan areas, this works, but in smaller communities, it will limit the number of service providers available to you. O-Net, for instance, is not likely to play, and if one does come in, it's likely that no-one else will, due to the limited market – giving them a defacto monopoly.</p>

Lit Fibre		<p><b>E.g:</b> SuperNet in Alberta (backbone only). Common in Europe and would work well here.</p> <p><b>Open access</b> can be provided via an independent network operator and a well-managed routing centre.</p>
		<p><b>Pro's:</b> Facilitates unencumbered services-based competition amongst pure-play service providers and thus opens up services innovation to all players.</p> <p><b>Con's:</b> Goes against long standing (if not antiquated) federal policy of facilities-based competition. A services-based eco-system has not yet developed in Canada and current incumbents will boycott your network.</p>

Integrated		<b>E.g:</b> Bell, Rogers, Shaw, TELUS; Traditional business model. All incumbents.
		<p><b>Pro's:</b> Good for single-purpose networks and universal service.</p> <p><b>Con's:</b> Inhibits competition and innovation is only with permission from the network operators. Results in defacto monopoly control of critical civic infrastructure. Interests of the incumbent shareholders do not align with the needs of the communities they serve.</p>

## 12.2 Current Providers

### 12.2.1 Airdrie

Both TELUS and Shaw provide Internet services in Airdrie. Shaw Go Wi-Fi services are available at some 200 locations. Airdrie is served by TELUS'/Bell's and Roger's 4G LTE networks.

	Wireline Providers						Fixed Point-to-Multipoint Wireless		
	TELUS (copper)			Shaw (coaxial cable)			XplorNet (licensed)		
	Cost \$/mo	Bandwidth - Mb/s Down	Up	Cost \$/mo	Bandwidth - Mb/s Down	Up	Cost \$/mo	Bandwidth - Mb/s Down	Up
Cities									
Airdrie (RV)									
Residential									
Option 1	55.00	1.5 to 6	up to 1	53.00	up to 5	up to 0.5	59.99	up to 5	up to 1
Option 2	58.00	3 to 15	up to 1	63.00	up to 15	up to 0.5	69.99	up to 10	up to 1
Option 3	63.00	5 to 25	up to 5	73.00	up to 30	up to 5	79.99	up to 25	up to 1
Option 4	78.00	20 to 50	up to 10	93.00	up to 60	up to 6	109.99	up to 25	up to 1
Option 5				123.00	up to 120	up to 10			
Business									
Option 1	55.95	6	1	54.95	up to 5	up to 0.5			
Option 2	60.00	up to 15	up to 1	64.95	up to 20	up to 1.5	69.99	up to 10	up to 1
Option 3	85.95	up to 25	up to 5	84.95	up to 30	up to 5	79.99	up to 25	up to 1
Option 4				109.95	up to 60	up to 6	109.99	up to 25	up to 1
Option 5				259.95	up to 120	up to 10			

### 12.2.2 Banff

Both TELUS and Shaw provide Internet services in Banff. Shaw Go Wi-Fi services are available at over 60 locations. Banff is served by TELUS'/Bell's and Roger's 4G LTE networks.

	Wireline Providers						Fixed Point-to-Multipoint Wireless		
	TELUS (copper)			Shaw (coaxial cable)			XplorNet (licensed)		
	Cost \$/mo	Bandwidth - Mb/s Down      Up		Cost \$/mo	Bandwidth - Mb/s Down      Up		Cost \$/mo	Bandwidth - Mb/s Down      Up	
<b>Banff</b>									
<b>Residential</b>									
Option 1	55.00	1.5 to 6	up to 1	53.00	up to 5	up to 0.5	59.99	up to 5	up to 1
Option 2	58.00	3 to 15	up to 1	63.00	up to 15	up to 0.5	69.99	up to 10	up to 1
Option 3				73.00	up to 30	up to 5	79.99	up to 25	up to 1
Option 4				93.00	up to 60	up to 6	109.99	up to 25	up to 1
Option 5				123.00	up to 120	up to 10			
<b>Business</b>									
Option 1	55.95	6	1	54.95	up to 5	up to 0.5	69.99	up to 10	up to 1
Option 2	60.00	up to 15	up to 1	64.95	up to 20	up to 1.5	79.99	up to 25	up to 1
Option 3				84.95	up to 30	up to 2.5	109.99	up to 25	up to 1
Option 4				104.95	up to 50	up to 3			
Option 5				259.95	up to 100	up to 5			



### 12.2.3 Beiseker

TELUS provides Internet services in Beiseker. Shaw does not and no Go Wi-Fi sites are available. Beiseker is served by TELUS'/Bell's and Roger's 4G LTE networks.

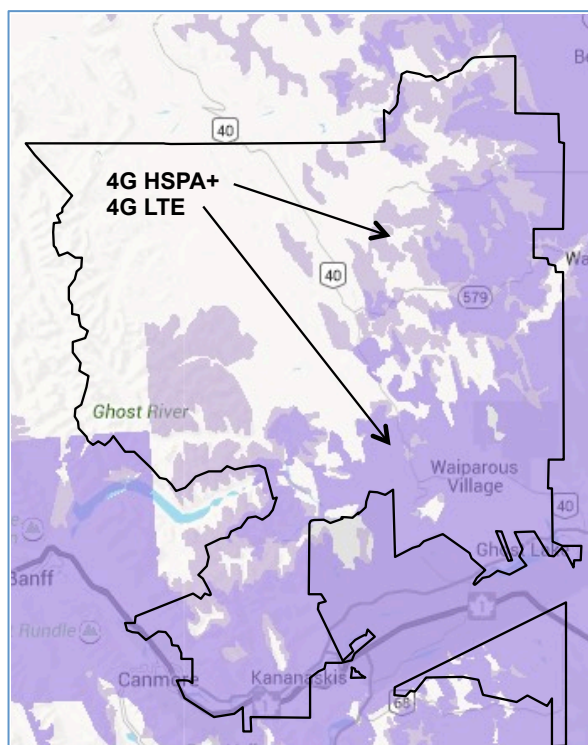
	Wireline Providers			Fixed Point-to-Multipoint Wireless					
	TELUS (copper)			CCI (licensed)			XplorNet (licensed)		
	Cost \$/mo	Bandwidth - Mb/s Down Up		Cost \$/mo	Bandwidth - Mb/s Down Up		Cost \$/mo	Bandwidth - Mb/s Down Up	
<b>Beiseker</b>									
<b>Residential</b>									
Option 1	55.00	1.5 to 6	up to 1	44.99	up to 2	up to 0.75	59.99	up to 5	up to 1
Option 2	58.00	3 to 15	up to 1	65.99	up to 5	up to 1	69.99	up to 10	up to 1
Option 3	63.00	5 to 25	up to 5	89.99	up to 10	up to 1	79.99	up to 25	up to 1
Option 4	78.00	20 to 50	up to 10				109.99	up to 25	up to 1
Option 5									
<b>Business</b>				na	up to 6	up to 2			
Option 1	55.95	6	1						
Option 2	60.00	up to 15	up to 1				69.99	up to 10	up to 1
Option 3	85.95	up to 25	up to 5				79.99	up to 25	up to 1
Option 4							109.99	up to 25	up to 1
Option 5									

### 12.2.4 MD of Bighorn

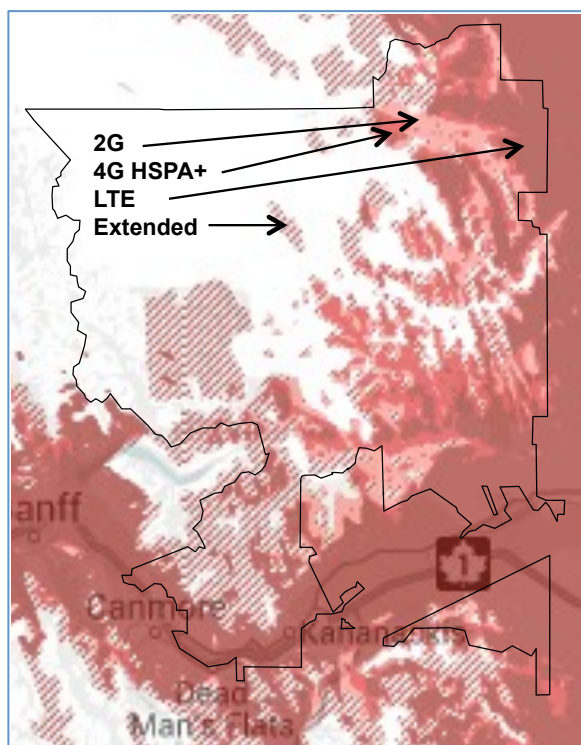
Neither Shaw nor TELUS are actively upgrading wireline facilities in rural areas. Neither TELUS nor Shaw appear to offer wireline services in Bighorn. Shaw Go Wi-Fi services are not available.

	Fixed Point-to-Multipoint Wireless		
	XplorNet (licensed)		
	Cost \$/mo	Bandwidth - Mb/s Down Up	
<b>MD of Bighorn</b>			
<b>Residential</b>			
Option 1	69.99	up to 5	up to 1
Option 2	89.99	up to 10	up to 1
Option 3			
Option 4			
Option 5			
<b>Business</b>			
Option 1	89.99	up to 10	up to 1
Option 2			
Option 3			
Option 4			
Option 5			

As shown in the coverage maps below, Bighorn is partially served by TELUS'/Bell's and Roger's 4G LTE networks.



TELUS, Bell



Rogers

### 12.2.5 Black Diamond / Turner Valley

The only available wireline Internet service in Black Diamond and Turner Valley is that from TELUS. Shaw does not provide service and no Go Wi-Fi sites are available. Black Diamond and Turner Valley are served by TELUS/Bell's and Roger's 4G networks.

	Wireline Providers			Fixed Point-to-Multipoint Wireless		
	TELUS (copper)			XplorNet (licensed)		
	Cost \$/mo	Bandwidth - Mb/s		Cost \$/mo	Bandwidth - Mb/s	
		Down	Up		Down	Up
<b>Black Diamond/Turner Valley</b>						
<b>Residential</b>						
Option 1	55.00	1.5 to 6	up to 1	59.99	up to 5	up to 1
Option 2	58.00	3 to 15	up to 1	69.99	up to 10	up to 1
Option 3				79.99	up to 25	up to 1
Option 4				109.99	up to 25	up to 1
Option 5						
<b>Business</b>						
Option 1	55.95	6	1	69.99	up to 10	up to 1
Option 2	60.00	up to 15	up to 1	79.99	up to 25	up to 1
Option 3				109.99	up to 25	up to 1
Option 4						
Option 5						

### 12.2.6 Calgary

The City of Calgary adopted a dark fibre strategy in September, 2015. The strategy is based on simplifying line assignments, enabling sufficient connectivity to meet their current and future needs as

related to connecting and managing smart city infrastructure, and providing dark fibre to help meet the needs of private enterprise.

They are working with Cybera to gain access to the optical ground wires available on AltaLink high voltage transmission infrastructure, intervened in the CRTC's *Review of Wholesale Wireline Services and Associated Policies* consultation last summer, supported Cybera on their recent intervention at the *Review of Basic Telecommunication Services* consultation, and plan to intervene in the *Establishment of a Regulatory Framework* for Next-Generation 9-1-1 in Canada consultation next year.

Both TELUS and Shaw provide a full slate of services to residents and businesses in Calgary. In select neighbourhoods, TELUS has begun to deploy a fibre-to-the-premise solution.

### 12.2.7 Canmore

Both TELUS and Shaw provide Internet services in Canmore. Shaw Go Wi-Fi services are available at over 100 locations. Canmore is served by TELUS'/Bell's and Roger's 4G networks.

	Wireline Providers						Fixed Point-to-Multipoint Wireless		
	TELUS (copper)			Shaw (coaxial cable)			XplorNet (licensed)		
	Cost \$/mo	Bandwidth - Mb/s Down Up		Cost \$/mo	Bandwidth - Mb/s Down Up		Cost \$/mo	Bandwidth - Mb/s Down Up	
<b>Canmore</b>									
<b>Residential</b>									
Option 1	55.00	1.5 to 6	up to 1	53.00	up to 5	up to 0.5	59.99	up to 5	up to 1
Option 2	58.00	3 to 15	up to 1	63.00	up to 15	up to 0.5	69.99	up to 10	up to 1
Option 3	63.00	5 to 25	up to 5	73.00	up to 30	up to 5	79.99	up to 25	up to 1
Option 4	78.00	20 to 50	up to 10	93.00	up to 60	up to 6	109.99	up to 25	up to 1
Option 5				123.00	up to 120	up to 10			
<b>Business</b>									
Option 1	55.95	6	1	54.95	up to 5	up to 0.5	69.99	up to 10	up to 1
Option 2	60.00	up to 15	up to 1	64.95	up to 20	up to 1.5	79.99	up to 25	up to 1
Option 3	85.95	up to 25	up to 5	84.95	up to 30	up to 2.5	109.99	up to 25	up to 1
Option 4				104.95	up to 50	up to 3			
Option 5				259.95	up to 100	up to 5			

### 12.2.8 Chestermere

Both TELUS and Shaw provide Internet services in Chestermere. Shaw Go Wi-Fi services are available at some ~40 locations. Chestermere is served by TELUS'/Bell's and Roger's 4G networks.

	Wireline Providers						Fixed Point-to-Multipoint Wireless		
	TELUS (copper)			Shaw (coaxial cable)			XplorNet (licensed)		
	Cost \$/mo	Bandwidth - Mb/s Down Up		Cost \$/mo	Bandwidth - Mb/s Down Up		Cost \$/mo	Bandwidth - Mb/s Down Up	
<b>Cities</b>									
<b>Chestermere</b>									
<b>Residential</b>									
Option 1	55.00	1.5 to 6	up to 1	53.00	up to 5	up to 0.5	59.99	up to 5	up to 1
Option 2	58.00	3 to 15	up to 1	63.00	up to 15	up to 0.5	69.99	up to 10	up to 1
Option 3	63.00	5 to 25	up to 5	73.00	up to 30	up to 5	79.99	up to 25	up to 1
Option 4	78.00	20 to 50	up to 10	93.00	up to 60	up to 6	109.99	up to 25	up to 1
Option 5				123.00	up to 120	up to 10			
<b>Business</b>									
Option 1	55.95	6	1	54.95	up to 5	up to 0.5	69.99	up to 10	up to 1
Option 2	60.00	up to 15	up to 1	64.95	up to 20	up to 1.5	79.99	up to 25	up to 1
Option 3	85.95	up to 25	up to 5	84.95	up to 30	up to 5	109.99	up to 25	up to 1
Option 4				109.95	up to 60	up to 6			
Option 5				259.95	up to 120	up to 10			

### 12.2.9 Cochrane

Both TELUS and Shaw provide Internet services in Cochrane. Shaw Go Wi-Fi services are available at over 60 locations. Cochrane is served by TELUS/Bell's and Roger's 4G networks.

	Wireline Providers						Fixed Point-to-Multipoint Wireless		
	TELUS (copper)			Shaw (coaxial cable)			XplorNet (licensed)		
	Cost \$/mo	Bandwidth - Mb/s Down	Up	Cost \$/mo	Bandwidth - Mb/s Down	Up	Cost \$/mo	Bandwidth - Mb/s Down	Up
<b>Cochrane</b>									
<b>Residential</b>									
Option 1	55.00	1.5 to 6	up to 1	53.00	up to 5	up to 0.5	59.99	up to 5	up to 1
Option 2	58.00	3 to 15	up to 1	63.00	up to 15	up to 0.5	69.99	up to 10	up to 1
Option 3	63.00	5 to 25	up to 5	73.00	up to 30	up to 5	79.99	up to 25	up to 1
Option 4				93.00	up to 60	up to 6	109.99	up to 25	up to 1
Option 5				123.00	up to 120	up to 10			
<b>Business</b>									
Option 1	55.95	6	1	54.95	up to 5	up to 0.5	69.99	up to 10	up to 1
Option 2	60.00	up to 15	up to 1	64.95	up to 20	up to 1.5	79.99	up to 25	up to 1
Option 3	85.95	up to 25	up to 5	84.95	up to 30	up to 2.5	109.99	up to 25	up to 1
Option 4				104.95	up to 50	up to 3			
Option 5				259.95	up to 100	up to 5			

### 12.2.10 Crossfield

Did not participate.

### 12.2.11 First Nations

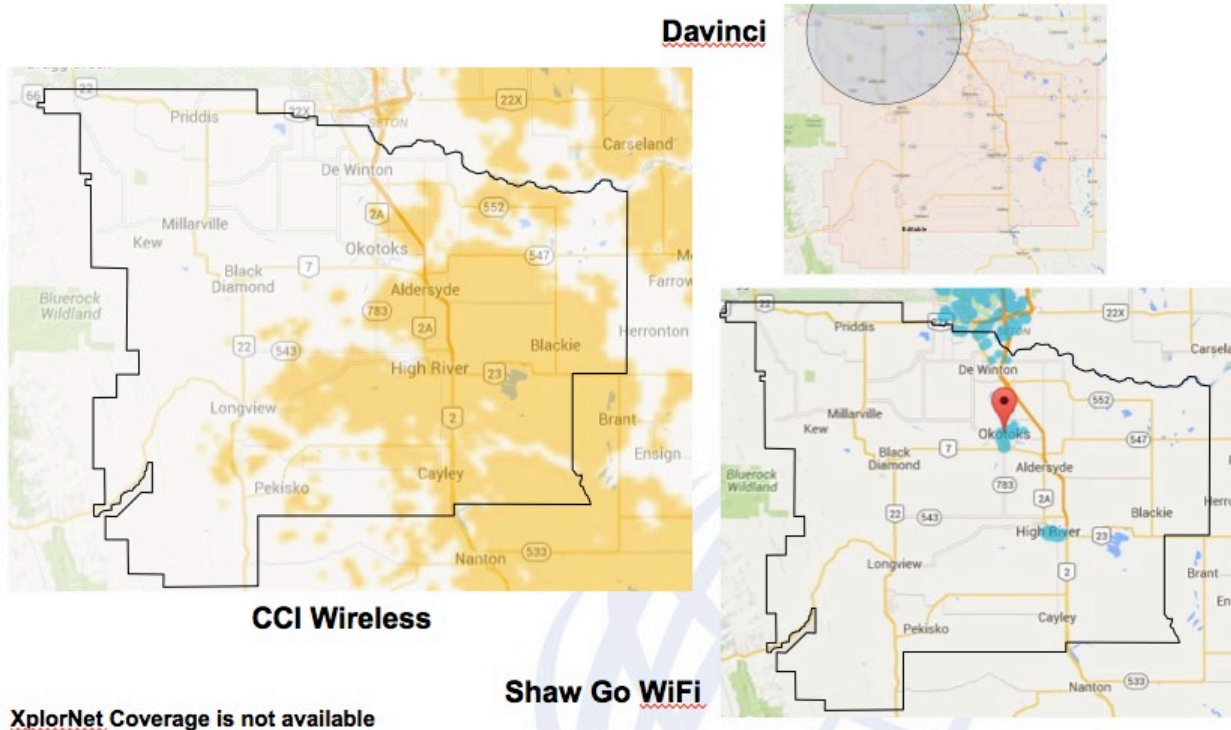
Meetings with the Siksika, Stoney, and Tsuu T'ina First Nations in the CRP region could not be arranged within the timeframe of the study.

### 12.2.12 MD of Foothills

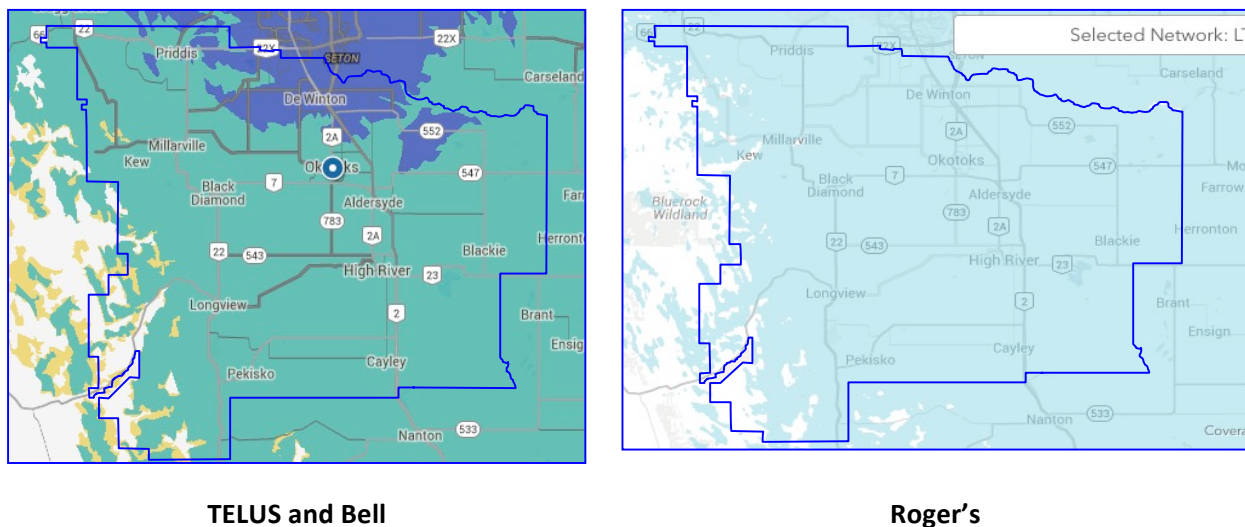
Broadband service capabilities throughout the MD are limited. Neither Shaw nor TELUS are actively upgrading wireline facilities in rural areas. Shaw Go Wi-Fi services are limited to populated centres.

	Fixed Point-to-Multipoint Wireless								
	CCI (unlicensed)			Davinci (unlicensed)			XplorNet (licensed)		
	Cost \$/mo	Bandwidth - Mb/s Down	Up	Cost \$/mo	Bandwidth - Mb/s Down	Up	Cost \$/mo	Bandwidth - Mb/s Down	Up
<b>MD of Foothills (F)</b>									
<b>Residential</b>									
Option 1	44.99	up to 2	up to 0.75	59.95	1.5 minimum	n/a	59.99	up to 5	up to 1
Option 2	65.99	up to 5	up to 1				69.99	up to 10	up to 1
Option 3	89.99	up to 10	up to 1				79.99	up to 25	up to 1
Option 4							109.99	up to 25	up to 1
Option 5									
<b>Business</b>	na	up to 6	up to 2	74.95	1.5 minimum	n.a			
Option 1							69.99	up to 10	up to 1
Option 2							79.99	up to 25	up to 1
Option 3							109.99	up to 25	up to 1
Option 4									
Option 5									

Except along the western border, fixed wireless ISP services are also available. The services are insufficient to support television.



Foothills is served by TELUS'/Bell's and Roger's 4G networks.



### 12.2.13 Ghost Lake

Did not participate.

### 12.2.14 High River

Both TELUS and Shaw provide Internet services in High River. Shaw Go Wi-Fi services are available at over 50 locations. Wireless ISP services are also available. Video is not generally supported. High River is served by TELUS'/Bell's and Roger's 4G networks.



	Wireline Providers						Fixed Point-to-Multipoint Wireless					
	TELUS (copper)			Shaw (coaxial cable)			CCI (unlicensed)			XplorNet (licensed)		
	Cost \$/mo	Bandwidth - Mb/s Down Up		Cost \$/mo	Bandwidth - Mb/s Down Up		Cost \$/mo	Bandwidth - Mb/s Down Up		Cost \$/mo	Bandwidth - Mb/s Down Up	
<b>High River</b>												
<b>Residential</b>												
Option 1	55.00	1.5 to 6	up to 1	53.00	up to 5	up to 0.5	44.99	up to 2	up to 0.75	59.99	up to 5	up to 1
Option 2				63.00	up to 15	up to 0.5	65.99	up to 5	up to 1	69.99	up to 10	up to 1
Option 3				73.00	up to 30	up to 5	89.99	up to 10	up to 1	79.99	up to 25	up to 1
Option 4				93.00	up to 60	up to 6				109.99	up to 25	up to 1
Option 5				123.00	up to 120	up to 10						
<b>Business</b>												
Option 1	55.95	6	1	54.95	up to 5	up to 0.5	na	up to 6	up to 2	69.99	up to 10	up to 1
Option 2	60.00	up to 15	up to 1	64.95	up to 20	up to 1.5				79.99	up to 25	up to 1
Option 3	85.95	up to 25	up to 5	84.95	up to 30	up to 2.5				109.99	up to 25	up to 1
Option 4				104.95	up to 50	up to 3						
Option 5				259.95	up to 100	up to 5						

### 12.2.15 Hussar

A meeting with Hussar could not be arranged.

### 12.2.16 Irricana

Irricana is very interested in the project, but requires support from the surrounding communities.

The only available wireline Internet service is that from TELUS. Shaw does not provide service in Irricana and no Go Wi-Fi sites are available. Irricana is served by TELUS'/Bell's and Roger's 4G networks.

	Wireline Providers			Fixed Point-to-Multipoint Wireless					
	TELUS (copper)			CCI (licensed)			XplorNet (licensed)		
	Cost \$/mo	Bandwidth - Mb/s Down Up		Cost \$/mo	Bandwidth - Mb/s Down Up		Cost \$/mo	Bandwidth - Mb/s Down Up	
<b>Irricana</b>									
<b>Residential</b>									
Option 1	55.00	1.5 to 6	up to 1	44.99	up to 2	up to 0.75	59.99	up to 5	up to 1
Option 2	58.00	3 to 15	up to 1	65.99	up to 5	up to 1	69.99	up to 10	up to 1
Option 3	63.00	5 to 25	up to 5	89.99	up to 10	up to 1	79.99	up to 25	up to 1
Option 4	78.00	20 to 50	up to 10				109.99	up to 25	up to 1
Option 5									
<b>Business</b>									
Option 1	55.95	6	1	na	up to 6	up to 2	69.99	up to 10	up to 1
Option 2	60.00	up to 15	up to 1				79.99	up to 25	up to 1
Option 3	85.95	up to 25	up to 5				109.99	up to 25	up to 1
Option 4									
Option 5									

### 12.2.17 Longview

The only available wireline Internet service is that from TELUS. Shaw does not provide service in Longview and no Go Wi-Fi sites are available. Wireless ISP services are available from XplorNet. Video is not generally supported. Longview is served by TELUS'/Bell's and Roger's 4G networks.

	Wireline Providers			Fixed Point-to-Multipoint Wireless		
	TELUS (copper)			XplorNet (licensed)		
	Cost \$/mo	Bandwidth - Mb/s Down Up		Cost \$/mo	Bandwidth - Mb/s Down Up	
<b>Longview (F)</b>						
<b>Residential</b>						
Option 1	55.00	1.5 to 6	up to 1	59.99	up to 5	up to 1
Option 2				69.99	up to 10	up to 1
Option 3				79.99	up to 25	up to 1
Option 4				109.99	up to 25	up to 1
Option 5						
<b>Business</b>						
Option 1	55.95	6	1			
Option 2				69.99	up to 10	up to 1
Option 3				79.99	up to 25	up to 1
Option 4				109.99	up to 25	up to 1
Option 5						

### 12.2.18 Nanton

Nanton elected to go with AxiaConnect in 2015. Prior to Axia's deployment, wireline Internet service was only available from TELUS (15 Mb/s) and EastLink (25 Mb/s). Shaw does not provide service in Nanton and no Go Wi-Fi sites are available. A Wi-Fi site sponsored by Alberta SouthWest is available at the Bomber Command Museum. Wireless ISP services are also available. Video is not generally supported. Nanton is served by TELUS/Bell's and Roger's 4G networks.

	Wireline Providers						Fixed Point-to-Multipoint Wireless					
	Axia (Fibre)			TELUS (Copper)			CCI (unlicensed)			XplorNet (licensed)		
	Cost \$/mo	Bandwidth - Mb/s Down Up		Cost \$/mo	Bandwidth - Mb/s Down Up		Cost \$/mo	Bandwidth - Mb/s Down Up		Cost \$/mo	Bandwidth - Mb/s Down Up	
<b>Nanton</b>												
<b>Residential</b>												
Option 1	69.00	25	25	55.00	1.5 to 6	up to 1	44.99	up to 2	up to 0.75	59.99	up to 5	up to 1
Option 2	89.00	50	50	58.00	3 to 15	up to 1	65.99	up to 5	up to 1	69.99	up to 10	up to 1
Option 3	109.00	100	100	63.00	5 to 25	up to 5	89.99	up to 10	up to 1	79.99	up to 25	up to 1
Option 4				78.00	20 to 50	up to 10				109.99	up to 25	up to 1
Option 5												
<b>Business</b>												
Option 1	119.00	25	25	55.95	6	1	na	up to 6	up to 2	69.99	up to 10	up to 1
Option 2	229.00	50	50	60.00	up to 15	up to 1				79.99	up to 25	up to 1
Option 3	329.00	100	100	85.95	up to 25	up to 5				109.99	up to 25	up to 1
Option 4	699.00	1,000	1,000									
Option 5												

### 12.2.19 Okotoks

Both TELUS and Shaw provide Internet services in Okotoks. Shaw Go Wi-Fi services are available at over 80 locations. Wireless ISP services are also available. Video is not generally supported. Okotoks is served by TELUS/Bell's and Roger's 4G networks.



	Wireline Providers						Fixed Point-to-Multipoint Wireless		
	TELUS (copper)			Shaw (coaxial cable)			XplorNet (licensed)		
	Cost \$/mo	Bandwidth - Mb/s Down	Up	Cost \$/mo	Bandwidth - Mb/s Down	Up	Cost \$/mo	Bandwidth - Mb/s Down	Up
Okotoks									
Residential									
Option 1	55.00	1.5 to 6	up to 1	53.00	up to 5	up to 0.5	59.99	up to 5	up to 1
Option 2	58.00	3 to 15	up to 1	63.00	up to 15	up to 0.5	69.99	up to 10	up to 1
Option 3	63.00	5 to 25	up to 5	73.00	up to 30	up to 5	79.99	up to 25	up to 1
Option 4	78.00	20 to 50	up to 10	93.00	up to 60	up to 6	109.99	up to 25	up to 1
Option 5				123.00	up to 120	up to 10			
Business									
Option 1	55.95	6	1	54.95	up to 5	up to 0.5	69.99	up to 10	up to 1
Option 2	60.00	up to 15	up to 1	64.95	up to 20	up to 1.5	79.99	up to 25	up to 1
Option 3	85.95	up to 25	up to 5	84.95	up to 30	up to 2.5	109.99	up to 25	up to 1
Option 4				104.95	up to 50	up to 3			
Option 5				259.95	up to 100	up to 5			

### 12.2.20 Redwood Meadows

The only available wireline Internet service is that from TELUS. Shaw does not provide service in Redwood Meadows and no Go Wi-Fi sites are available. Wireless ISP services are available from XplorNet. Video is not generally supported. Redwood Meadows is served by TELUS'/Bell's and Roger's 4G networks.

	Wireline Providers			Fixed Point-to-Multipoint Wireless		
	TELUS (copper)			XplorNet (licensed)		
	Cost \$/mo	Bandwidth - Mb/s Down	Up	Cost \$/mo	Bandwidth - Mb/s Down	Up
<b>Redwood Meadows</b>						
<b>Residential</b>						
Option 1	55.00	1.5 to 6	up to 1	59.99	up to 5	up to 1
Option 2				69.99	up to 10	up to 1
Option 3				79.99	up to 25	up to 1
Option 4				109.99	up to 25	up to 1
Option 5						
<b>Business</b>						
Option 1	55.95	6	1			
Option 2				69.99	up to 10	up to 1
Option 3				79.99	up to 25	up to 1
Option 4				109.99	up to 25	up to 1
Option 5						

### 12.2.21 Rockyford

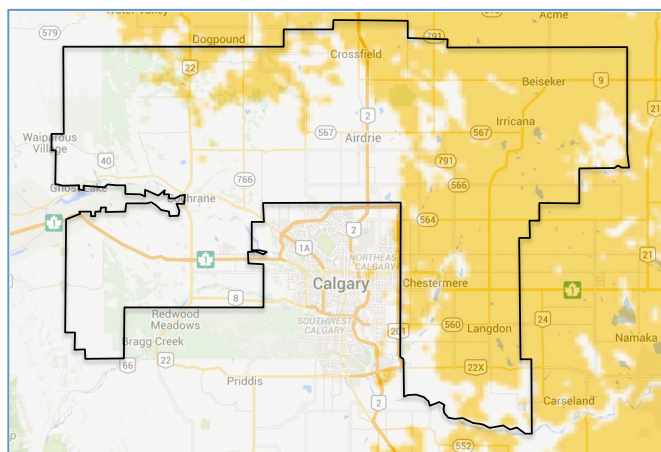
A meeting with Rockyford could not be arranged.

### 12.2.22 MD of Rocky View

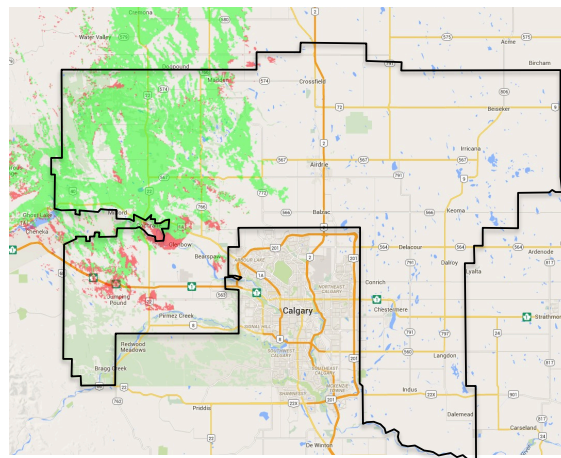
Broadband service capabilities are throughout the County are limited. Neither Shaw nor TELUS are actively upgrading wireline facilities in rural areas.

	Fixed Point-to-Multipoint Wireless								
	CCI (licensed)			Velocity (unlicensed)			XplorNet (licensed)		
	Cost \$/mo	Bandwidth - Mb/s		Cost \$/mo	Bandwidth - Mb/s		Cost \$/mo	Bandwidth - Mb/s	
		Down	Up		Down	Up		Down	Up
<b>Rocky View County</b>	Per Coverage Map						Location Dependent		
<b>Residential</b>									
Option 1	44.99	up to 2	up to 0.75	60.00	up to 4	up to 1	59.99	up to 5	up to 1
Option 2	65.99	up to 5	up to 1	80.00	up to 8	up to 2	69.99	up to 10	up to 1
Option 3	89.99	up to 10	up to 1	100.00	up to 12	up to 3	79.99	up to 25	up to 1
Option 4							109.99	up to 25	up to 1
Option 5									
<b>Business</b>									
Option 1	na	up to 6	up to 2	200.00	up to 15	up to 5	69.99	up to 10	up to 1
Option 2				300.00	up to 25	up to 5	79.99	up to 25	up to 1
Option 3							109.99	up to 25	up to 1
Option 4									
Option 5									

Fixed wireless ISP services are available from CCI, Velocity, and XplorNet. Offerings are generally insufficient to support broadcast television.

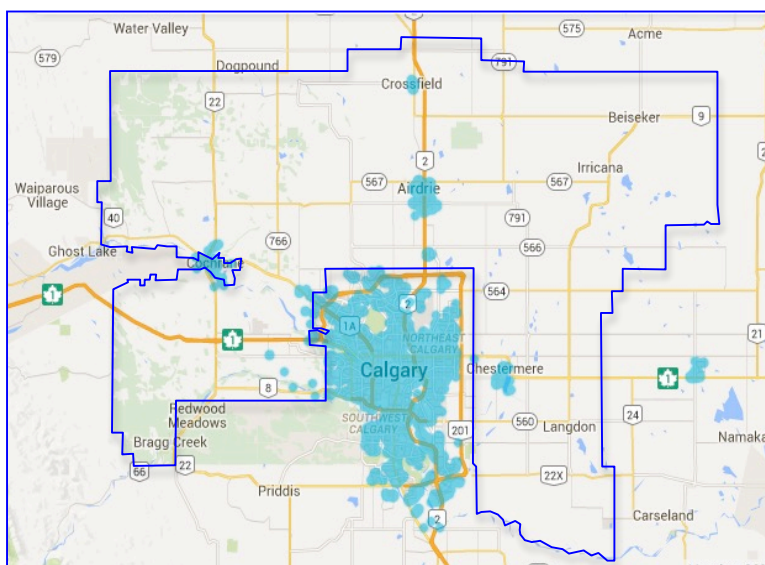


CCI Wireless

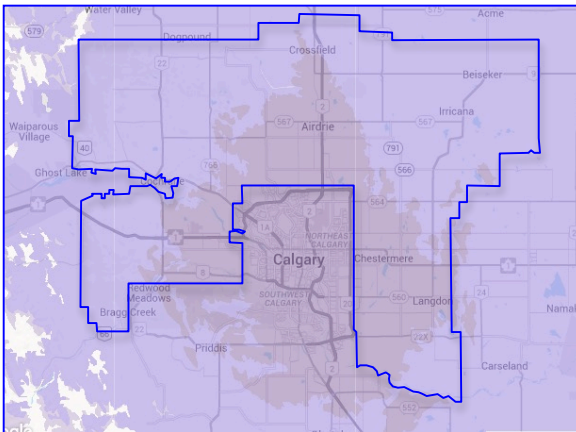


Velocity Wireless

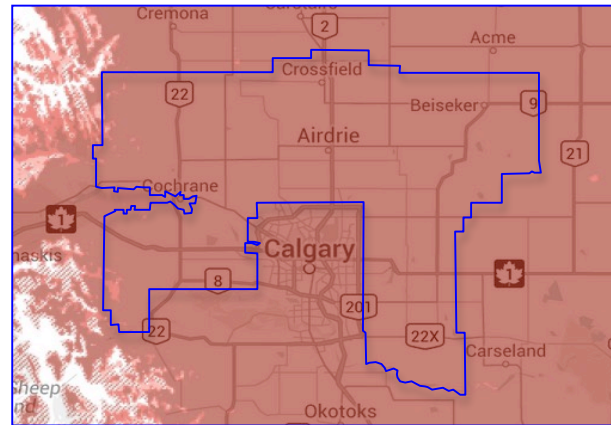
Shaw Go Wi-Fi services are limited to populated centres.



Rocky View is served by TELUS'/Bell's and Roger's 4G networks.



**TELUS and Bell**



**Roger's**

### 12.2.23 Standard

Wireline Internet service did not seem to be available from TELUS. Shaw does not provide service and no Go Wi-Fi sites are available. Wireless ISP services are available from CCI Wireless and XplorNet. Standard is served by TELUS'/Bell's and Roger's 4G networks.

		Fixed Point-to-Multipoint Wireless					
		CCI (licensed)			XplorNet (licensed)		
		Cost \$/mo	Bandwidth - Mb/s		Cost \$/mo	Bandwidth - Mb/s	
Standard			Down	Up		Down	Up
<b>Residential</b>							
	Option 1	44.99	up to 2	up to 0.75	59.99	up to 5	up to 1
	Option 2	65.99	up to 5	up to 1	69.99	up to 10	up to 1
	Option 3	89.99	up to 10	up to 1	79.99	up to 25	up to 1
	Option 4				109.99	up to 25	up to 1
	Option 5						
<b>Business</b>							
	Option 1	na	up to 6	up to 2			
	Option 2				69.99	up to 10	up to 1
	Option 3				79.99	up to 25	up to 1
	Option 4				109.99	up to 25	up to 1
	Option 5						

### 12.2.24 Strathmore

Both TELUS and Shaw provide Internet services in Strathmore. Shaw Go Wi-Fi services are available at some ~60 locations. Wireless ISP services are also available. Strathmore is served by TELUS'/Bell's and Roger's 4G networks.

		Wireline Providers						Fixed Point-to-Multipoint Wireless					
		TELUS (copper)			Shaw (coaxial cable)			CCI (licensed)			XplorNet (licensed)		
		Cost \$/mo	Bandwidth - Mb/s Down Up		Cost \$/mo	Bandwidth - Mb/s Down Up		Cost \$/mo	Bandwidth - Mb/s Down Up		Cost \$/mo	Bandwidth - Mb/s Down Up	
<b>Strathmore</b>													
<b>Residential</b>													
	Option 1	55.00	1.5 to 6	up to 1	53.00	up to 5	up to 0.5	44.99	up to 2	up to 0.75	69.99	up to 5	up to 0.5
	Option 2	58.00	3 to 15	up to 1	63.00	up to 15	up to 0.5	65.99	up to 5	up to 1	89.99	up to 10	up to 1
	Option 3	63.00	5 to 25	up to 5	73.00	up to 30	up to 5	89.99	up to 10	up to 1			
	Option 4	78.00	20 to 50	up to 10	93.00	up to 60	up to 6						
	Option 5				123.00	up to 120	up to 10						
<b>Business</b>													
	Option 1	55.95	6	1	54.95	up to 5	up to 0.5	na	up to 6	up to 2	89.99	up to 10	up to 1
	Option 2	60.00	up to 15	up to 1	64.95	up to 20	up to 1.5						
	Option 3	85.95	up to 25	up to 5	84.95	up to 30	up to 2.5						
	Option 4				104.95	up to 50	up to 3						
	Option 5				259.95	up to 100	up to 5						

### 12.2.25 Turner Valley

Included under Black Diamond.

### 12.2.26 Waiparous

The only available wireline Internet service is that from TELUS. Shaw does not provide service and no Go Wi-Fi sites are available. Wireless ISP services are available from Velocity and XplorNet. Waiparous is served by TELUS/Bell's and Roger's 4G networks.

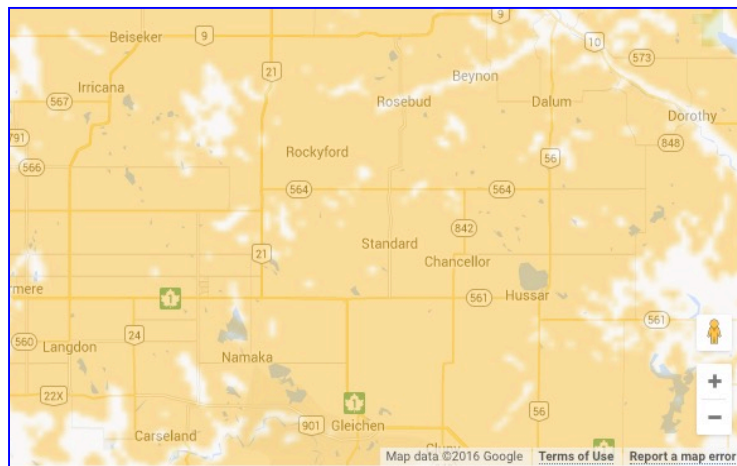
		Wireline Providers			Fixed Point-to-Multipoint Wireless					
		TELUS (copper)			Velocity (unlicensed)			XplorNet (licensed)		
		Cost \$/mo	Bandwidth - Mb/s Down Up		Cost \$/mo	Bandwidth - Mb/s Down Up		Cost \$/mo	Bandwidth - Mb/s Down Up	
<b>Waiparous (Bh)</b>										
<b>Residential</b>										
	Option 1	55.00	1.5 to 6	up to 1	60.00	up to 4	up to 1	69.99	up to 5	up to 1
	Option 2	58.00	3 to 15	up to 1	80.00	up to 8	up to 2	89.99	up to 10	up to 1
	Option 3				100.00	up to 12	up to 3			
	Option 4									
	Option 5									
<b>Business</b>										
	Option 1				200.00	up to 15	up to 5	89.99	up to 10	up to 1
	Option 2	55.95	6	1	300.00	up to 25	up to 5			
	Option 3	60.00	up to 15	up to 1						
	Option 4									
	Option 5									

### 12.2.27 Wheatland County

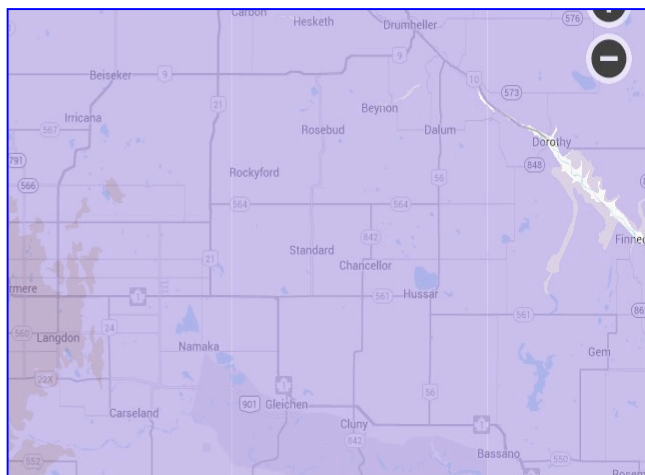
Broadband service capabilities are throughout the County are limited. Neither Shaw nor TELUS are actively upgrading wireline facilities in rural areas. Shaw Go Wi-Fi services are limited to populated centres.

	Fixed Point-to-Multipoint Wireless					
	CCI (licensed)			XplorNet (licensed)		
	Cost \$/mo	Bandwidth - Mb/s		Cost \$/mo	Bandwidth - Mb/s	
		Down	Up		Down	Up
<b>Wheatland County</b>	Per Coverage Map			Location Dependent		
<b>Residential</b>						
Option 1	44.99	up to 2	up to 0.75	59.99	up to 5	up to 1
Option 2	65.99	up to 5	up to 1	69.99	up to 10	up to 1
Option 3	89.99	up to 10	up to 1	79.99	up to 25	up to 1
Option 4				109.99	up to 25	up to 1
Option 5						
<b>Business</b>						
Option 1	na	up to 6	up to 2	69.99	up to 10	up to 1
Option 2				79.99	up to 25	up to 1
Option 3				109.99	up to 25	up to 1
Option 4						
Option 5						

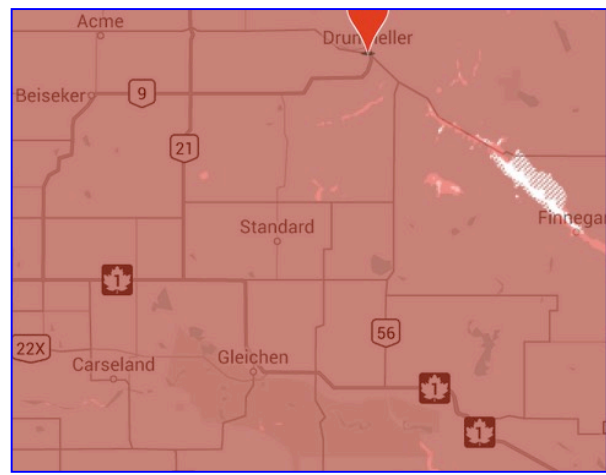
Fixed wireless ISP services are available from CCI and XplorNet. The CCI coverage is shown below, XplorNet does not provide coverage maps. Offerings are generally insufficient to support television.



Wheatland is served by TELUS' /Bell's and Roger's 4G networks.



TELUS and Bell



Roger's