CLACKAMAS COUNTY BOARD OF COUNTY COMMISSIONERS
Policy Session

Presentation Date: July 6, 2021 **Approximate Start Time:** 1:30 **Approximate Length:** 1 hour

Presentation Title: Internet Service Provider (ISP) and Broadband Update Report

Department: Technology Services

Presenters: Dave Devore and Cindy Becker

Other Invitees: Duke Dexter, Dave Stockton, Neil Shaw

WHAT ACTION ARE YOU REQUESTING FROM THE BOARD?

Last August, the Board directed staff to contract with a consultant to develop a plan to identify options for best practices, business models, costs and direction for expanding connectivity to all areas of the county including determining whether the County should become an ISP (Internet Service Provider). This document is a follow-up to the Board's action.

EXECUTIVE SUMMARY (why and why now):

Background

- Between 2011-2013, Technology Services constructed a fiber broadband network using $7.8m from federal grants and $3.3m of county funds.
- Since October 2013, County Broadband Exchange (CBX) has successfully converted to a self-sustaining utility service for the County with revenue based on affordable rates for public and private agencies utilizing the fiber infrastructure.
- Current status of CBX:
  - 348 total miles of fiber deployed
  - No debt
  - Partners with SandyNet

Updated Business Plan

In October 2020, the County contracted with Uptown Services to update the county's broadband exchange business plan including options for the provision of internet services to underserved communities.

Six underserved areas, with some access to the county's fiber network, were identified for review. The attached report provides a detailed description of the areas and resources needed to serve them.

The consultants recommended that the County continue to provide the backbone network but not become an ISP. Instead, the County should contract with public and private agencies to be the Internet Service Providers.

FINANCIAL IMPLICATIONS (current year and ongoing):

Is this item in your current budget?	☐ YES X NO
What is the cost?	$6-21 million depending on areas selected
What is the funding source?	Federal, State and/or County funds

Funding Options (for all six areas)*

- Full Financing- An investment of $21M would alleviate the need for any County debt and external funding (e.g. local improvement district fees)
- Partial Financing: An investment of $16M would alleviate the need for any County debt (using Local Improvement District/LID $) and fund the full construction of the expansion including all capital expenditure needs for Years 1-5
- Minimal Financing: An investment of $6M would alleviate the need for external funding but would still require the County to issue a $15m bond

  * Note: The cost to serve all under/unserved areas of the County is estimated to be $65 million.

STRATEGIC PLAN ALIGNMENT:

How does this item align with your Department's Strategic Business Plan goals?

This aligns with the purpose of the Clackamas Broadband eXchange program to provide fiber optic design, allocation, installation and maintenance services to County departments, public institutions, bandwidth intensive businesses and ISP Providers so they can experience fast, reliable connectivity at a low cost while also providing business opportunities.

How does this item align with the County's Performance Clackamas goals?

It aligns with the Building a Strong Infrastructure Goal: *By 2026, 100% of County residents and businesses - where served - have access to safe and affordable infrastructure: multimodal transportation including roads, sewer and broadband services*

LEGAL/POLICY REQUIREMENTS: N/A

PUBLIC/GOVERNMENTAL PARTICIPATION:

Work with local communities and organizations to raise awareness about expansion projects

OPTIONS:

There are two decision points: role of county as ISP model and funding for expansion:

Role of County as ISP:

Option 1: County becomes the Internet Service Provider (ISP)
Option 2: County becomes the ISP, with some services provided by public/private entities
Option 3: County contracts with Public/private entities to be the ISP
Option 4: Maintain current model of fiber construction with no ISP expansion

Funding:

Option 1: Seek available funding from federal and state resources
Option 2: Invest County general funds
Option 3: Raise funds through bonds and/or Local Improvement Districts
Option 4: Combination of Options 1 and 2
Option 5: Do not proceed with expansion

RECOMMENDATION:

Staff recommends Role of County as ISP Option 3: County contracts with Public/private entities to be the ISP
Staff recommends Funding Option 1: Seek available funding from federal and state resources

ATTACHMENTS: CBX Last Mile Fiber Report

SUBMITTED BY:

Division Director/Head Approval _____
Department Director/Head Approval _____
County Administrator Approval _____

For information on this issue or copies of attachments, please contact _____@ 503-_____

Clackamas Broadband eXchange

Infrastructure Strategy Options, Financial Feasibility, and Business Plan for Last-Mile Fiber to The Premises

Business Plan, Strategy Options, Capital Investment, & Financial Feasibility Report

April 2021

Uptown Services, LLC

Dave Stockton & Neil Shaw, Principals

Executive Summary

STUDY OBJECTIVE

OPPORTUNITY: Can the assets of CBX be utilized to improve broadband infrastructure and availability within underserved areas within Clackamas County?

CBX ASSETS: *CBX represents a significant asset to the County*

- 348 total miles of fiber
- No debt
- Cash flow positive since 2013
- Partnership with SandyNet and other potential municipal ISPs
- Staff knowledge and experience

STUDY OBJECTIVE: *Identify and evaluate the financially feasibility of a range of options for CBX to significantly enhance the availability, reliability, and capacity of broadband infrastructure within underserved areas of the County*

- Greatest incremental value to the community but at the greatest investment requirement
- Involves making the leap from a 'middle-mile' fiber strategy to full 'last-mile' via an extensive build out with new fiber passing every residence and business
- Can be accomplished under various business models that vary in the CBX operating role and level of investment required, but all require significant additional funding

KEY FINDINGS

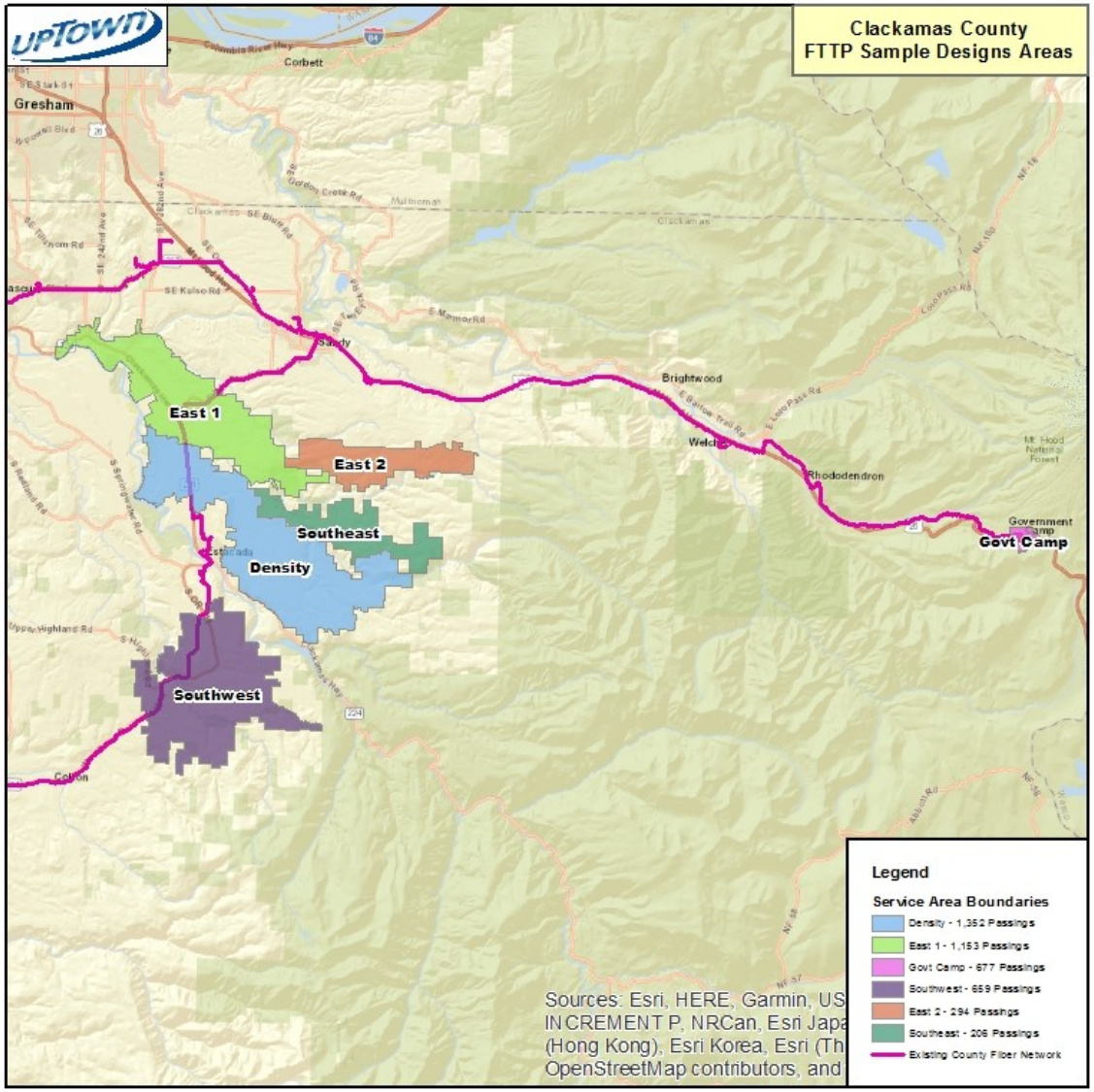
Uptown completed a comprehensive evaluation of the financial ramifications of expanding CBX resulting in the following key findings:

- **Business Model: CBX does not need to become a retailer of Internet services. In fact, the most financially viable business model is for CBX to remain as a wholesale provider and partner with an existing Internet Service Provider (e.g. SandyNet)**
- **Service Area:** GIS analysis of census data was used to identify targeted underserved areas that would most benefit from this expansion of CBX (next slide)
- **Staffing:** Additional staffing is minimal due to CBX remaining a wholesale provider. Only one (1) incremental employee is required (Maintenance Technician)
- **Financial Feasibility:** Proceeds from wholesale fees payback the full cost of the project in 20 years – a reasonable timeframe for a long term capital investment project
- **Funding:** The total funding requirement excluding wholesale fees generated by operations is ≈ $21M. We identified 2 potential sources for this funding:
  - Preferred Funding Source: ARPA grant funds allocated to Clackamas County
  - Optional Funding Source: Long term bond of ≈ $15M plus Local Improvement District Assessments of ≈ $6M

PROPOSED SERVICE AREAS

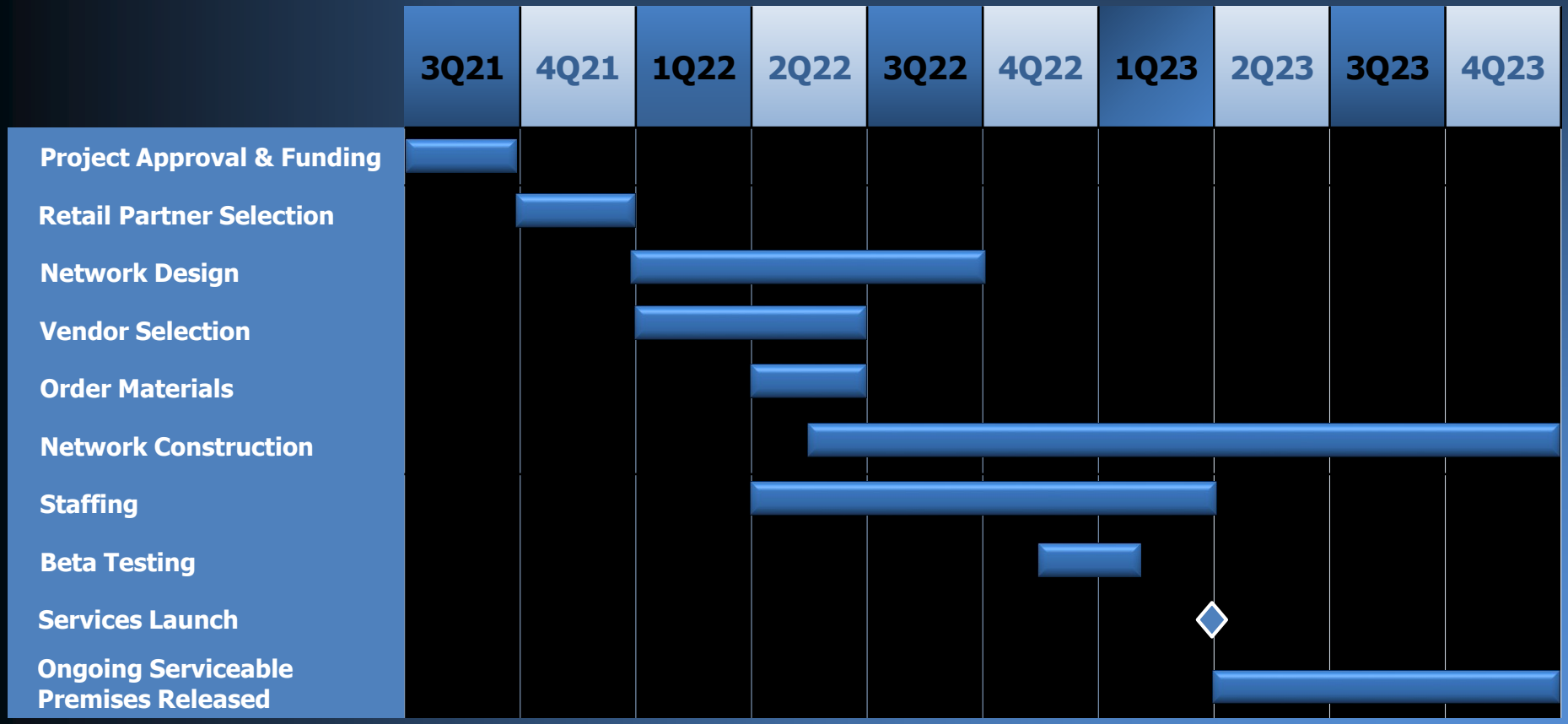
The proposed service area is comprised of 6 individually evaluated under-served regions:

- Density
  - Premises: 1,352
  - Square Miles: 22.3
- East 1
  - Premises: 1,153
  - Square Miles: 15.8
- Government Camp
  - Premises: 677
  - Square Miles: 0.6
- Southwest
  - Premises: 659
  - Square Miles: 19.0
- East 2
  - Premises: 294
  - Square Miles: 6.7
- Southeast
  - Premises: 206
  - Square Miles: 6.5



IMPLEMENTATION TIMELINE

If the County proceeds we would expect a 'start-up' phase of 12-16 months prior to the first premises becoming serviceable. The network construction phase will take approximately 2 years to complete…



Clackamas Broadband eXchange

Business Plan for Last-Mile Fiber to The Premises

METHODOLOGY

Uptown completed a comprehensive evaluation of the financial ramifications of expanding CBX and developed a detailed business plan in support of this analysis including:

- Business plan covering all operational aspects including technology architecture, service offerings, personnel plan, customer care, service fulfillment, marketing strategy, and software
- Professional estimation of expected take rates and revenue based on actual penetration results of Uptown clients
- Cost estimates reflecting current CBX actuals regarding staffing, fiber construction, and other operating costs, or alternatively, Uptown quotes obtained for fiber electronics, hardware, and bandwidth sourcing
- Pro forma financial analysis to identify financial feasibility and funding requirement of 5 potential business models beyond the current CBX dark fiber model

    1. Retail: Own & Operate
    2. Retail: Own & Operate with Operating Partner
    3. Wholesale: Public/Private Partnership
    4. Wholesale: Public/Public Partnership
    5. Wholesale: Neighborhood-level Wholesale Public/Public Partnership

SUMMARY FINANCIALS

The wholesale models evaluated are financially superior to the retail models. Uptown identified two financially feasible options for CBX to wholesale fiber services to a Public Partner:

- Full deployment of the proposed service area with external funding of $6.0M
- Phased deployment by neighborhood supported by Local Improvement District funding

Input/Outcome	**Wholesale with Public Partner**	
Deployment Strategy	All of Proposed Service Area	Phased by Neighborhood
Premises Passed	4,341	120 (1st neighborhood)
Other External Funding	≈ $6.0M	≈ $550k
Retailer or End User Fees	$21.2M Wholesale Connection Fees	$650k LID assessment is $20.00/mo. for 20 years
Long Term Bond Amount	$15.1M	-
Working Capital Loan	$0.1M	-
Total Funding	**$42.4M**	**$1.2M*** *Initial area only. Subsequent neighborhoods require additional funding.
Net Cash – Year 20	$300k	$300k
Project Break Even	**20 Years**	**14 Years**

CONTENTS: BUSINESS PLAN

- Technology Plan
- Target Service Offering
- Take Rate and Dispersion Forecast
- Bandwidth Sourcing
- Personnel Plan
- Customer Care
- Service Fulfillment
- Marketing Strategy
- Software Tools
- SWOT Analysis
- Implementation Timeline

APPLICABILITY TO EVALUATED BUSINESS MODELS

- Business Plan sections applicable to all business models
  - Technology Plan
  - Take rate and dispersion forecast
  - Personnel Plan*
- Business Plan sections applicable only to Retail business models
  - Target Service Offering
  - Bandwidth Sourcing
  - Customer Care**
  - Service Fulfillment**
  - Marketing Strategy
  - Software Tools***

*With staffing changes detailed in Financial Feasibility Report.

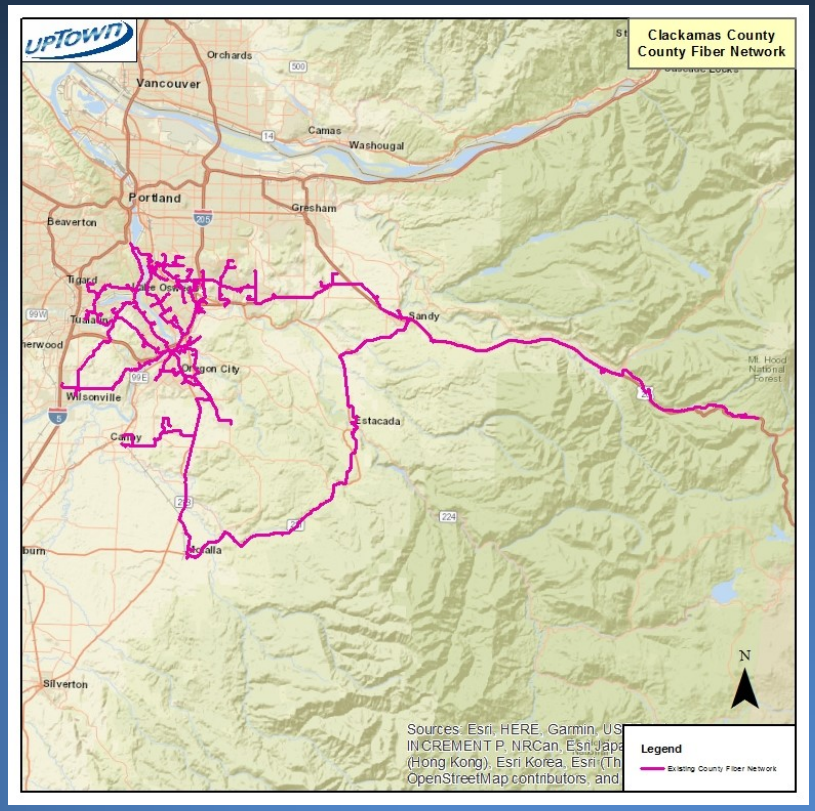
**These functions move to the operating partner under the Own & Operate with Operating Partner business model.

***Fiber management software is also required under Wholesale models, but other software tools are not.

Technology Plan

EXISTING FIBER NETWORK CAPABILITIES

- County owns a significant fiber network
  - Approximately 348 fiber miles deployed
  - Majority (90%) is aerial construction
  - Middle mile consists of 144 fiber & 288 fiber cables
  - Last mile is mostly 24 fiber cable
  - Rural capacity – 85% available
  - Urban capacity – 40% available
- Technology
  - County doesn't own active electronics (switches or routers)
  - Some wave division multiplexing (WDM) utilized
  - 98% of all applications are dark fiber based
- Four primary nodes in the County
  - West County, North Sheriff's Station & Sandy City Hall
  - East County node located in Hoodland Fire Station
- Two primary connections outside the County
  - Leased connection to Portland (Pittock) – 400G WDM
  - Leased connection to Denver (Denver Dry) – 100G WDM
- Kiwanis Partnership
  - Last mile fiber network in Kiwanis area (134 cabins)
  - County provides fiber network
  - SandyNet provides the equipment on each end
  - SandyNet operates end to end network for subscribers



IMPLICATIONS OF EXISTING FIBER NETWORK

- Physical Infrastructure (Layer 1)
  - Significant fiber capacity can serve as feeder network for FTTP
  - Existing network nodes could house new fiber equipment
  - Experience with WDM systems could be very valuable
  - Experience with PGE pole attachment process would be a benefit
  - Preponderance of aerial construction will lower FTTP costs

- Switching and Routing (Layer 2 and Layer 3) Infrastructure
  - Lack of County owned and operated Layer 2 and Layer 3 systems is a drawback for some business models
  - Learning curve for switching and routing systems is steep
  - Would need to rely on new hires as appropriate for each strategy

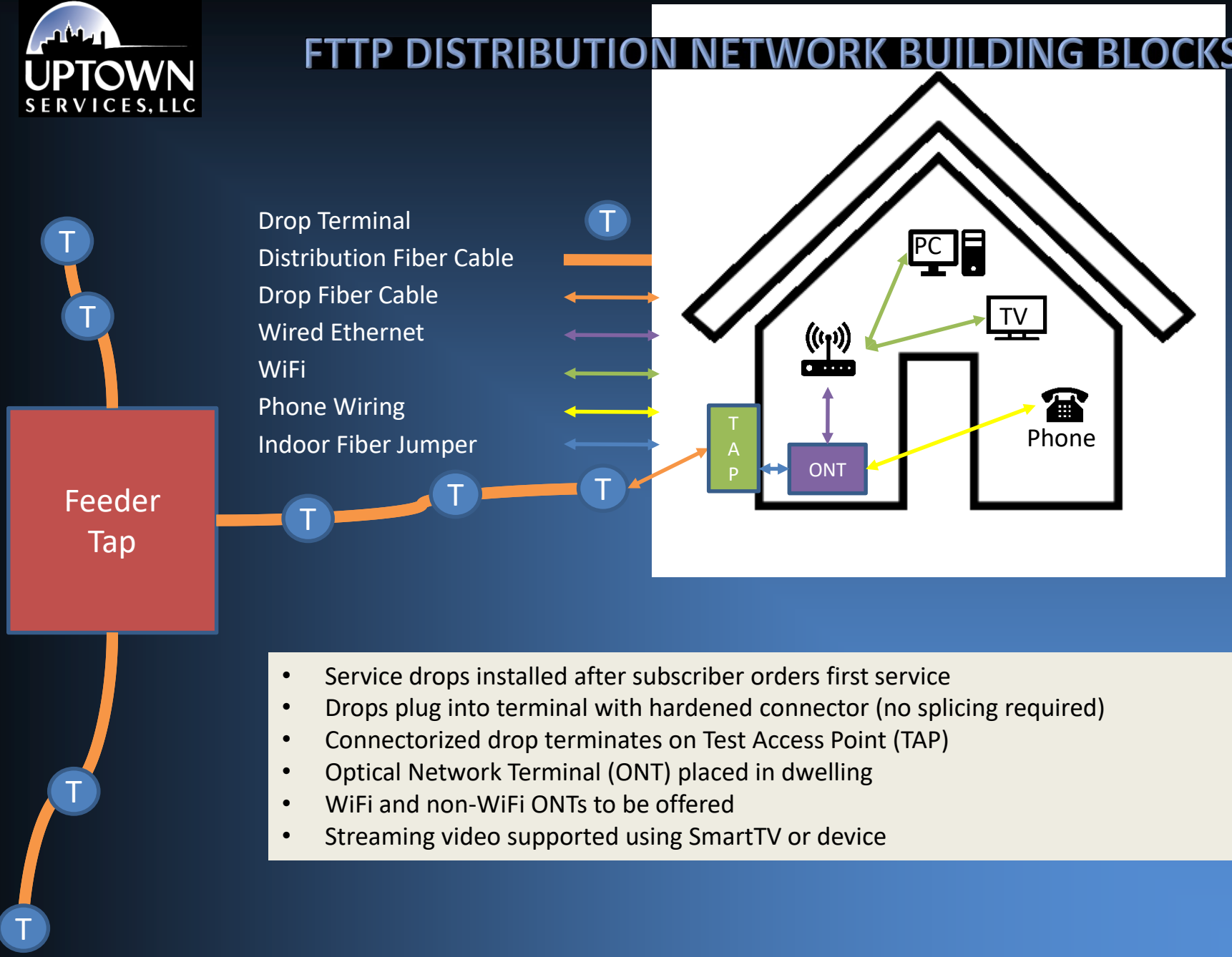
- Conclusion
  - County network provides solid foundation for future efforts
  - Ubiquitous fiber capacity allows for opportunistic add-on deployments

SERVICE DROP AND DROP TERMINAL

- Drop Terminal
  - Drop terminals connect service drops to the distribution network
  - One terminal serves between two and twelve passings
  - Terminals allow for plug and play at the serving pedestal / pole
  - Terminals attach directly to distribution fiber cable

- Service Drop and Test Access Point
  - Drops only installed after subscriber orders service
  - One fiber drop cable installed from terminal to each premises
  - Fiber drop pushed or pulled in shallow drop conduit in underground
  - Aerial drops are flat self support cable
  - Drop fiber terminated in test access point (TAP) mounted on dwelling
  - TAP provides demarcation between outside and inside fiber (bulkhead)

FTTP DISTRIBUTION NETWORK BUILDING BLOCKS



- Service drops installed after subscriber orders first service
- Drops plug into terminal with hardened connector (no splicing required)
- Connectorized drop terminates on Test Access Point (TAP)
- Optical Network Terminal (ONT) placed in dwelling
- WiFi and non-WiFi ONTs to be offered
- Streaming video supported using SmartTV or device

LOCAL DISTRIBUTION NETWORK

- Distribution and feeder fiber
  - Distribution fiber connects network terminals to the feeder network
  - Feeder network connections can occur at a splice closure or cabinet
  - Distribution cables can range in size from 1 to 144 fibers
  - The size and type of cable is driven by the splitting approach

- Distributed split approach
  - 1x4 and 1x8 splitters deployed in network terminals
  - 1x4 and 1x8 splitters also deployed upstream in closure or cabinet
  - Approach reduces fiber and splicing in distribution network by 87.5%
  - Outside plant savings offset by added electronics and splitter cost

OPTICAL LINE TERMINALS AND FEEDER

- Optical Line Terminals (OLTs)
  - An OLT combines all digital content onto PON ports
  - Typically requires environmentally controlled space
  - One Chassis can serve up to 1,024 connected ONTs
  - OLTs typically connect upstream via multiple 10G uplinks
  - Current network operation center would serve as primary OLT location
  - Government Camp would require a stand alone OLT in fire station

- Feeder Network
  - Feeder connects distribution network to serving OLTs
  - Typically one feeder fiber per 32 passings (PON port)
  - ≈ 100 feeder fibers would be required to service 3,000 passings
  - Most feeder would route back to existing network equipment room
  - Government Camp would be served from fire station node

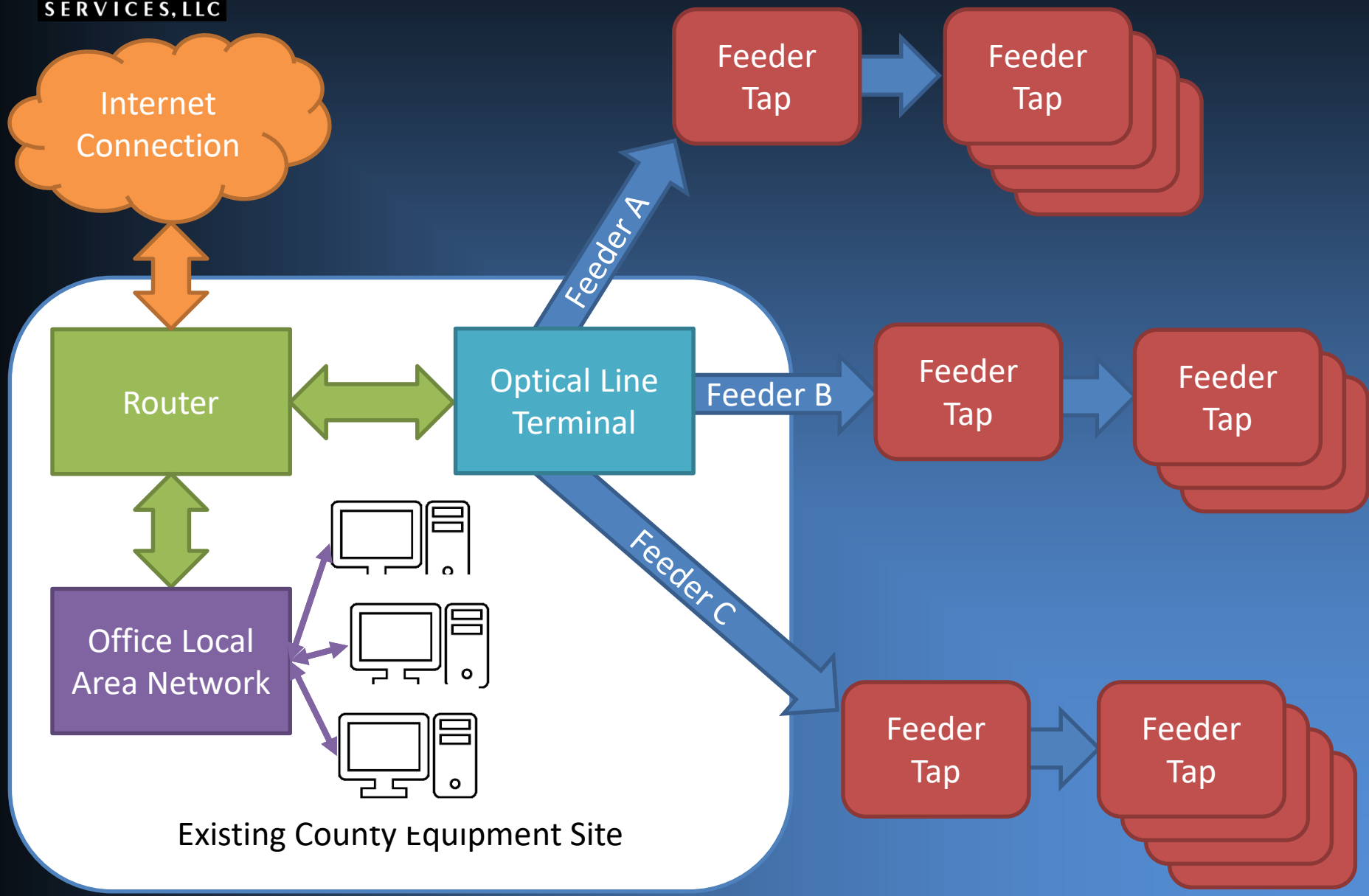
NETWORK BACKBONE AND CORE

- Core Network – Layer 3
  - Core network safely routes traffic to and from the outside world
  - Border Gateway Protocol (BGP) routers connect to the Internet
  - BGP routers deployed in pairs
  - Typically installed on backbone network in physically diverse locations
  - Each router connects to at least two Internet backbone providers

- Outside World – Content
  - Two physically diverse Internet backbone connections desired
  - Video content would come in over one or both Internet connections
  - Phone would also route over one or both Internet connections

- Business Model Implications
  - Layer 3 switching would be the responsibility of the retail ISP
  - Internet backbone connectivity also provided by retail ISP

EQUIPMENT SITE COMPONENTS



Target Service Offering

PROPOSED SERVICES OFFERING

- Residential Segment
  - Internet access up to multi-Gig tiers with exceptional value
  - Affordable Internet offering for lower income households
  - Integrated wireless gateway for in-home wireless mesh capability across all devices
  - Wireline voice service including line, calling features, and unlimited long distance via VoIP with battery back-up and no need to redo wiring or replace phones
- Small-Medium Business Segment
  - Data and voice offerings similar to residential with differentiated packages, features, and pricing
- Large Business and Institutional Segment
  - Advanced data services to meet unique needs and capacity expectations

INCUMBENT RESIDENTIAL INTERNET PRICING

	Download	Upload	Data Cap	Price	Technology
SandyNet	5M 10M 300M 1G	-	Unlimited	$39.95 $49.95 $41.95 $59.95	Fixed Wireless Fixed Wireless Fiber Fiber
Reliance Connects	6M 12M 25M 50M 100M	1M 1M 10M 25M 50M	Unlimited	$59.95 $69.95 $79.95 $89.95 $99.95	DSL DSL Fiber Fiber Fiber
CenturyLink	1000M 940M	100M 940M	Unlimited	$49 $85	Fiber Fiber
Comcast	25M 100M 200M 400M 600M[1] 1G[1]	-	1.2 TB + $10/50 GB	1 Year Promo / Rate Card[2] $19.99 / $56 $34.99 / $76 $49.99 / $86 $64.99 / $96 $74.99 / $106 $84.99 / $116	Cable Modem
Wave Broadband	100M 500M 940M	5M 10M 10M	400 GB/800 GB +$20 500 GB/1 TB +$20 Unlimited[3]	2 Year Promo / Rate Card $35.57[4] / 2 month notice of increase $45.57[4] / 2 month notice of increase $55.57[4] / 2 month notice of increase	Fiber
Ziply Fiber *(was Frontier)*	12M 25M 30M[5] 100M[5] 1G[5]	1M 2M 30M 100M 1G	Unlimited	1 Year Promo / Rate Card $35 / $40 $35 / $40 $20 / $40 / $60 /	DSL DSL DSL Fiber Fiber

[1]DOCSIS3.1 is not available in all areas that Comcast serves. [2]Comcast has announced a $3/mo. increase on all Internet tiers effective 1/1/2021. [3]Wave rate shapes traffic after 2 TB of usage. [4]Price includes $5.57 Internet surcharge. [5]Not available in all areas.

PROPOSED RESIDENTIAL INTERNET PRICING

Internet Tier Download / Upload	Monthly Price	Forecast Dispersion	Static IP Address	Data Cap
25M Affordable Internet	$10		N/A	Unlimited
1G / 1G	$70			
2G / 2G	$100		$10	
4G / 4G	$150			
WiFi ONT Upgrade (80211.ac)	Add $10		N/A	
Wireless Extender	$75 *End user one-time purchase*			

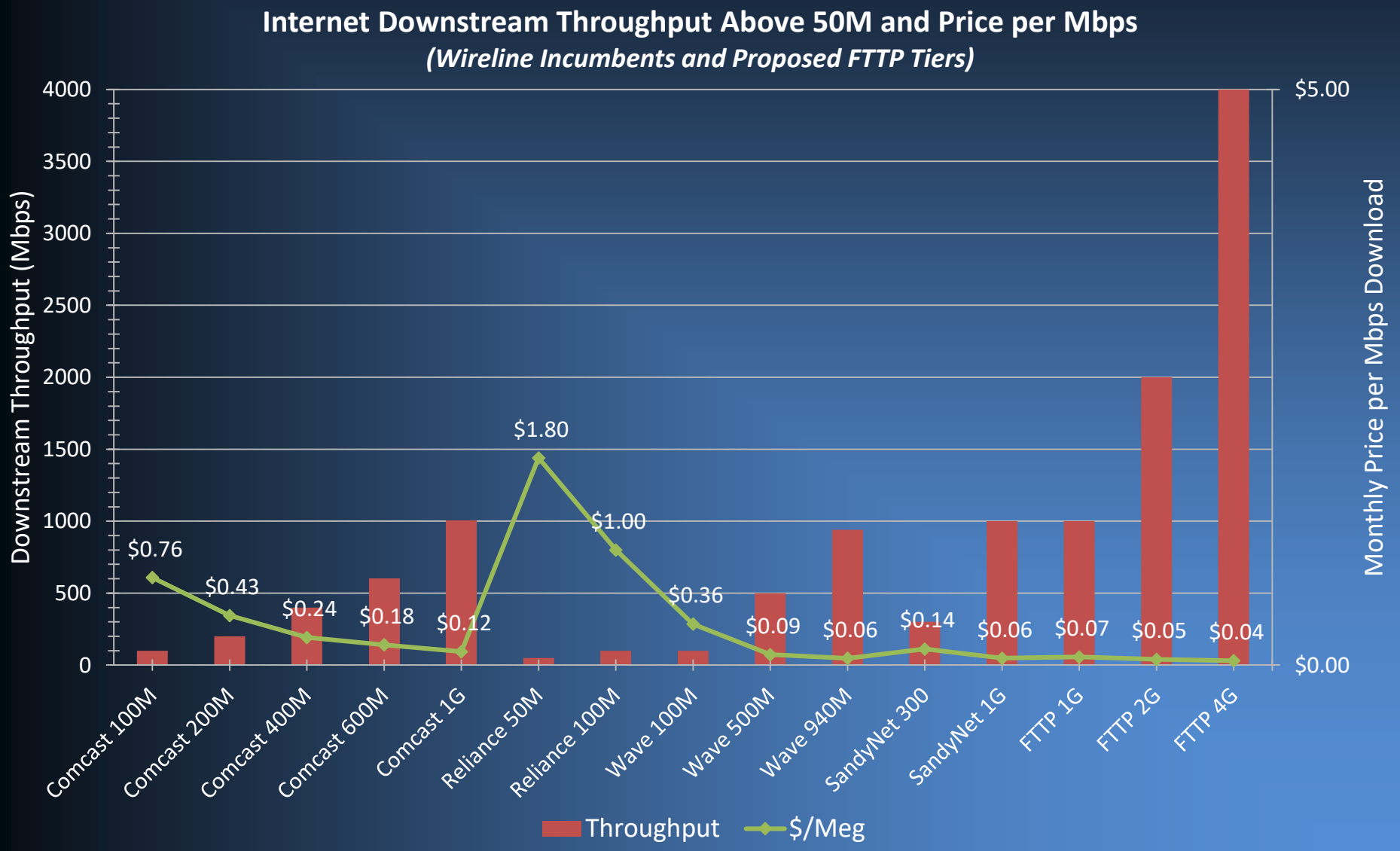
ONT models reflect Calix as budgetary reference.

ONT MODELS BY TIER

Internet Tier	Wireless?	ONT Model*	Ports*	Cost/ Unit*	Other CPE
Affordable Internet & 1G / 1G	No	803G	1 RJ11 1 RJ45	$95	W/O Voice: Power Cord ($12) W/ Voice: UPS ($50)
1G / 1G	Yes	803G+U4	2 RJ45 80211.ac	$200	
1G / 1G	Yes	803G+U6	2 RJ11 4 RJ45 80211.ac	$245	
Multi-Gig	Yes	GP1000X & 844E	4 RJ45 2 RJ11 80211.ac	$385	
Multi- Tenant Commercial	No	716GE (outdoor)	2 RJ11 4 x 10/100/1000 GigE interface	$265	
	No	762GX (outdoor)	8 RJ11 8 x 10/100/1000 GigE interface	$1,180	
Wireless Extender	Yes	804	80211.ac	$86	

* ONT models reflect Calix as budgetary reference

RESIDENTIAL INTERNET VALUE BENCHMARKS



FTTP COMMERCIAL DATA SERVICES

1. Standard Internet Access (last mile)
   - Shared capacity connection over GPON with no contract requirement and no SLA guarantees
   - Can upgrade to symmetrical bandwidth and add BGP Routing (some tiers) *
   - Can upgrade to 'dedicated' capacity via ActiveE connection (same ONT) with dedicated fiber strand*

2. High Capacity Direct Fiber Access (last mile)
   - Dedicated capacity for businesses with intensive data needs (1G to 10G)
   - Custom-priced via contract agreement with SLA and term requirement
   - Protected connection is optional. Resale rights are excluded

3. Point-to-Point Transport Circuit (middle mile) *
   - Dedicated pathway of defined capacity with or without access typically required by other service providers/resellers
   - Typically either a lateral off the CBX ring or backhaul transport to a data center (Pittock)
   - Custom-priced via contract agreement with SLA and term requirement
   - Pricing varies by entity type (private versus public sector)
   - Protected connection is optional. Resale rights may be included

*Not included in the Retail Lit Services business case pro forma as revenues.

CONTRACTUAL TERMS AND SLA

- Contract term of 3 years with auto-renewal
- Incremental construction cost recovered during the initial term
- Minimum capacity commitment with potential for increase(s) during the term
- Protected route options (optional)
- Service Level Agreement Terms
  - Availability
  - Latency
  - Packet Loss Ratio
- Outage credits
- Maintenance windows and advance notification
- Escalation and notification procedures

STANDARD COMMERCIAL INTERNET PRICING

CBX Download / Upload	Monthly Price	Installation	Optional Upgrades
50M / 5M *Add Symmetrical*	$80.00 *+ $10*	Years 1-2: $0 Year 3: $100.00	Add BGP Routing: $100
100M / 20M *Add Symmetrical*	$130.00 *+ $50*		
250M / 50M *Add Symmetrical*	$250.00 *+ $100*		
500M / 250M *Add Symmetrical*	$400.00 *+ $150*		
1G / 500M *Add Symmetrical*	$600.00 *+ $200*		
Wireless Gateway	$20.00	$30.00	
Static IP Address	$15.00 each	NA	

PRICING FRAMEWORK: TRANSPORT TO PITTOCK

Transport Only to Pittock (Portland)	MRC – 1 Year Term [2]	MRC – 3 Year Term [1,2]	Restrictions
500M [3]	Private: $550 ($1.10/Mbps) Public: $525 ($1.05/Mbps)	Private: $500 ($1.00/Mbps) Public: $475 ($.95/Mbps)	Subject to capacity availability as determined by CBX
1G [3]	Private: $1,000 ($1.00/Mbps) Public: $950 ($.95/Mbps)	Private: $900 ($.90/Mbps) Public: $850 ($.85/Mbps)	
5G [3]	Private: $4,500 ($.90/Mbps) Public: $4,250 ($.85/Mbps)	Private: $4,000 ($.80/Mbps) Public: $3,750 ($.75/Mbps)	
10G [3]	Private: $8,000 ($.80/Mbps) Public: $7,500 ($.75/Mbps)	Private: $7,000 ($.70/Mbps) Public: $6,500 ($.65/Mbps)	
Additional Port MRC after 2	$500 ea.	$500 ea.	

[1] Maximum lease term. [2] Public sector discounts are applicable to non-private sector leasing entities. [3] Transport capacity is shared

PRICING FRAMEWORK: OTHER TRANSPORT

All Other Transport Only	MRC – 1 Year Term [2]	MRC – 3 Year Term [1,2]	Restrictions
500M	Private: $750 ($1.50/Mbps) Public: $725 ($1.45/Mbps)	Private: $700 ($1.40/Mbps) Public: $675 ($1.35/Mbps)	Subject to fiber availability as determined by CBX. Resale to end-user business and households prohibited.
1G	Private: $1,300 ($1.30/Mbps) Public: $1,250 ($1.25/Mbps)	Private: $1,200 ($1.20/Mbps) Public: $1,150 ($1.15/Mbps)	
5G	Private: $5,500 ($1.10/Mbps) Public: $5,250 ($1.05/Mbps)	Private: $5,000 ($1.00/Mbps) Public: $4,750 ($.95/Mbps)	
10G	$10,000 ($1.00/Mbps) Public: $9,500 ($.95/Mbps)	$9,000 ($.90/Mbps) Public: $8,500 ($.85/Mbps)	
Additional Port MRC after 2	$500 ea.	$500 ea.	

[1] Maximum lease term. [2] Public sector discounts are applicable to non-private sector leasing entities.

PRICING FRAMEWORK: BANDWIDTH

Bandwidth Capacity [3] (Committed Data Rate)	MRC [1,2]	Restrictions
500M	Private: $185 ($.37/Mbps) Public: $175 ($.35/Mbps)	Resale to end-user business and households prohibited within city limits
1G	Private: $350 ($.35/Mbps) Public: $330 ($.33/Mbps)	
5G	Private: $1,500 ($.30/Mbps) Public: $1,400 ($.28/Mbps)	
10G	Private: $2,500 ($.25/Mbps) Public: $2,300 ($.23/Mbps)	

[1] MRC is not subject to a term discount for bandwidth. [2] Public sector discounts are applicable to non-private sector leasing entities. [3] Bandwidth MRC is additional to Transport MRC for Direct Internet Access.

VOICE PROVIDER ROLE

Function	Operational Responsibility	FTTP System	CLEC
Capital	Local Loop and Premises NIU	✓	
	Fiber MUX, Transport, and Switch		✓
Interconnect	LNP, Operator Services, PSAP, IC Agreements		✓
Marketing & Sales	Advertising, Sales	✓	
	Brand, Pricing	✓	✓
Provisioning	Work Order Creation	✓	
	Bell Processes		✓
	Switch Provisioning		✓
	Customer Install	✓	
Billing	Bill Fulfillment	✓	
	Call Detail Record (LD), Taxes & Fees		✓
Internet	Backbone Interconnection		✓

PROPOSED RESIDENTIAL VOICE PRICING

Service	Monthly Price
Home Phone* (calling features & unlimited local/LD)	$35.00
Additional Line (calling features & unlimited local)	$30.00
Unlimited North America Long Distance	$1.00
Long Distance HI, AK and US Territories (per minute)	$0.05
International Calls (per minute)	Varies
Port Number (one time fee)	$5.00

Service	Monthly Price
Non-Listed & Non-Published Listing	Included
Published Listing or Additional Listing	Free
411/Directory Assistance (per minute)	$ 0.75
Directory Assistance Call Completion (per call)	$ 0.50
Directory Assistance Call Completion (per minute)	$ 0.10
Operator Assisted Dialing (per minute)	$ 0.75
Person to Person Calls (per call)	$ 3.00
Person to Person Calls (per minute)	$ 0.10

* Residential voice service requires subscription to Internet service.

PROPOSED COMMERCIAL VOICE PRICING

Service	Month to Month	2 Year Term	3 Year Term
Business Line – With Internet	$30	$26	$24
Business Line – Without Internet	$40	$36	$34
Digital SIP Trunk (per channel) - With Internet Service	NA	$25	$23
Digital SIP Trunk (per channel) - Without Internet Service	NA	$30	$28
Hosted PBX (per seat)	NA		1-5: $25 6-24: $23 25-49: $22 50+: $21

Service	Monthly Price
DID Numbers (each)	Included
800 Number Service (per minute)	$0.05
Unlimited Continental US Long Distance (per line) [10]	Included
Unlimited North America Long Distance (per line)	$5.00
International Calls (per minute)	Varies
Port Number (one time fee)	$5.00
Operator Services	Same as residential
Directory Listings	

NON RECURRING PRICING

Service	One-Time Price
Custom Install Hourly Rate	$50.00
Custom Install Half-Hour Rate	$25.00
Unwired Premises (additional fee)	$100.00
Install Wireless Gateway	$30.00
Install Wireless Gateway Extender (ea.)	$90.00
Service Call - Customer Premise Issue	$50.00
Change of Service - Technician	$50.00
Change of Service - Electronic	Free
Additional Outlet - At Initial Install	$30.00
Additional Outlet - Separate Trip	$50.00
Relocate Outlet - At Initial Install	$20.00
Relocate Outlet - Separate Trip	$50.00
Wall Fish (each)	$25.00
NSF Check Fee	$25.00

Service	One-Time Price
Reactivation Fee	$35.00
Unreturned Equipment	Replacement Cost
Paper Bill (eBill is free)	$2.00
Port Number Cancellation - Prior to 2 days before install	$6.00
Port Number Cancellation - Less than 2 days before install	$75.00
Snapback	$300.00

VOICE ARPU

		FTTP Retail	Wholesale Rate	FTTP Share	Dispersion	Contribution per Line
Residential	Unlimited local & LD	$35	≈ $5.00	≈ $30	100%	≈ $30
Commercial (Unl. LD)	Business Package (Monthly)	$30	≈ $8.00	≈ $22	40%	-
	Business Package (2 Year)	$26	≈ $8.00	≈ $18	20%	-
	Business Package (3 Year)	$24	≈ $8.00	≈ $16	40%	-
	Total Commercial					≈ $19

Take Rate and Dispersion Forecast

TAKE RATE MODELLING CONSIDERATIONS

- Findings from 37 quantitative surveys that measured purchase intent (next slide)
  - Take rate range of low 30's to low 50's depending upon degree of competition
  - High capacity combined with lower pricing is key (greater value)
  - If the project proceeds, a similar survey should be completed to confirm Uptown estimates

- Actual results from clients who have deployed
  - All municipals with 5 to 15+ years since launch. Mix of HFC and FTTP.
  - Internet penetration ranges from 35% to 62% and averages 47%

- Preliminary pro forma estimates
  - 'Likely Case' of 45% Internet penetration (residential and commercial)
  - 'Likely Case' of 10% residential voice penetration (due to wireless substitution)
  - 'Likely Case' of 40% commercial voice penetration
  - Sensitivity analysis to evaluate impact of lower take rate on financial feasibility
  - Proposed service area demographics indicate affordability at proposed price levels (next slide)

AFFORDABLE INTERNET

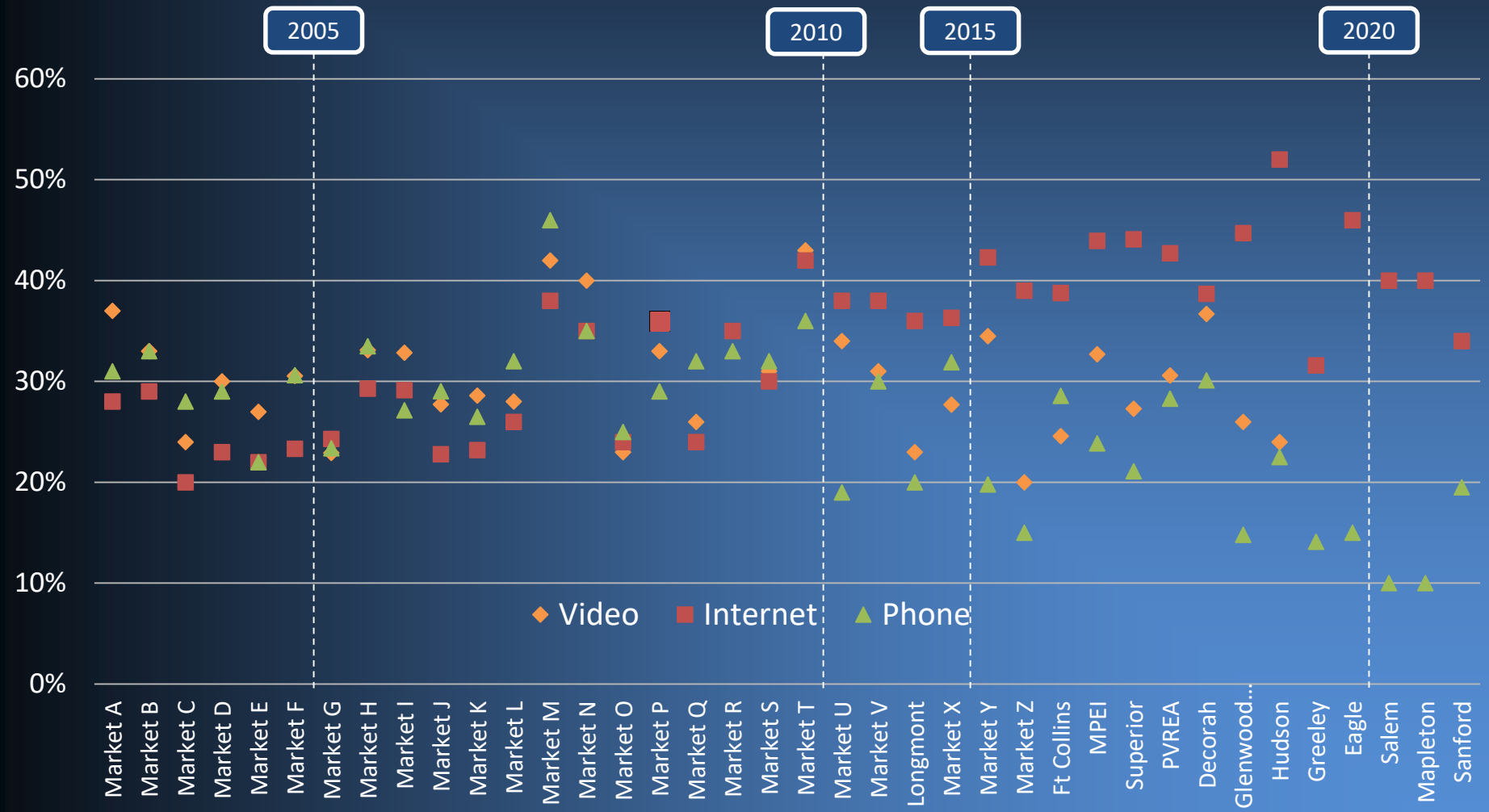
Up to 331 households are eligible for affordable Internet within the proposed service area. Upton recommends income of ≤130% of poverty (full subsidy) for determining eligibility. This program may have ramifications for LID financing options…

	Partial Subsidy ***Pro Forma Baseline***	**Full Subsidy**
Income Eligibility *USDA Child Nutrition Programs*	185% of Poverty Level	130% of Poverty Level
Annual Income Cutoff *Family of Four*	$48,470	$34,060
Eligible Households *ACS 2019 Census Data (5 Year)*	Tract 235: 160 Tract 236: 52 Tract 242: 80 Tract 243.02: 39 Service Area Total: 331 **% of Households: 5.4%**	Tract 235: 131 Tract 236: 36 Tract 242: 56 Tract 243.02: 39 Service Area Total: 262 **% of Households: 4.3%**
Participating Households		Year 1: 50% Year 5: 60% Year 10: 70%

PURCHASE INTENT BENCHMARKING

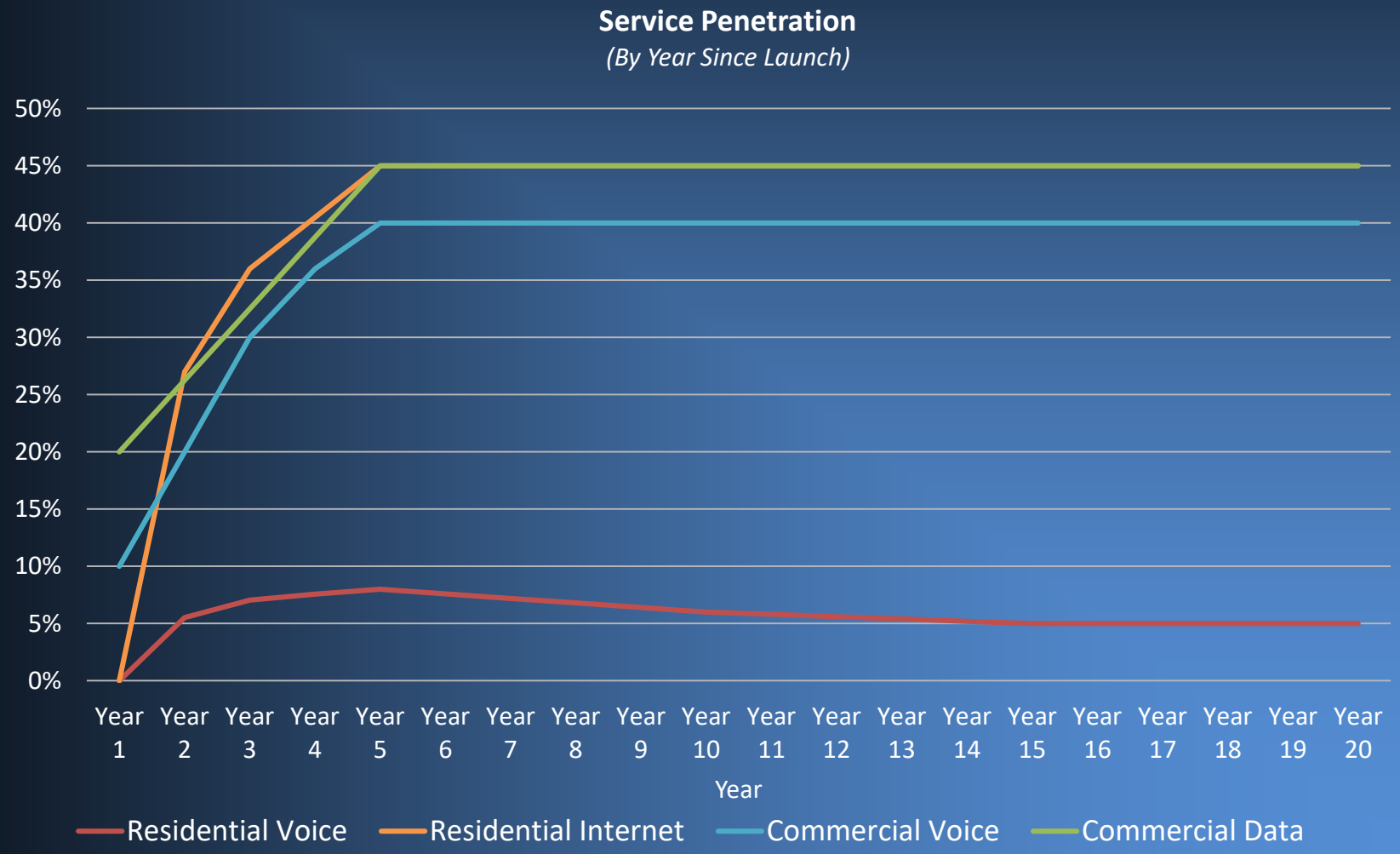
Terminal Penetration by Service

(quantitative survey outcomes)



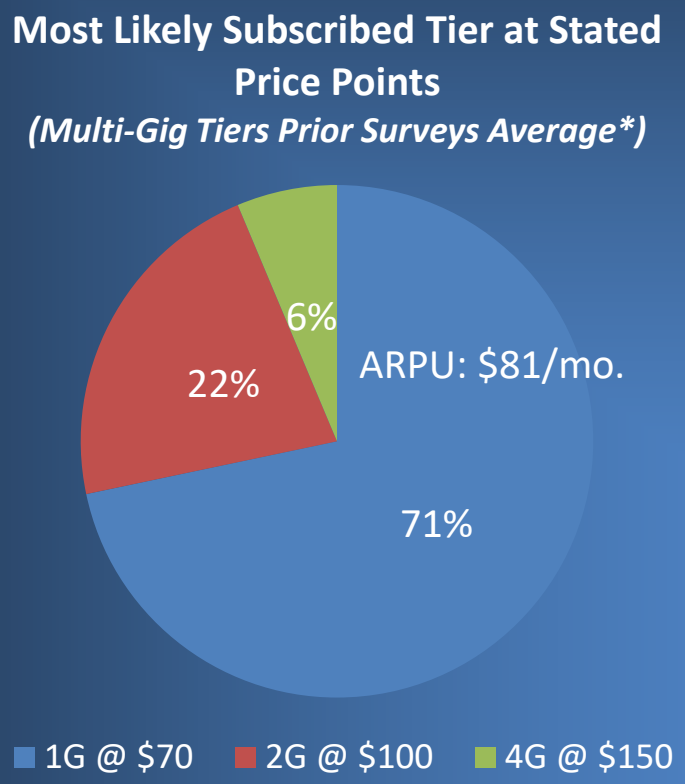
PENETRATION FORECAST

Pro forma take-rate projections reflect ongoing wireless (voice) substitution within the residential segment…



INTERNET DISPERSION & ARPU

Under a multi-tier model, about 1 in 4 households would upgrade to multi-Gig tiers if the cost to upgrade was reasonable. Uptown has used surveys to test 1,2 and 4 Gig tiers over the last two years with a resulting Average Revenue Per User (ARPU) of $81 per month…



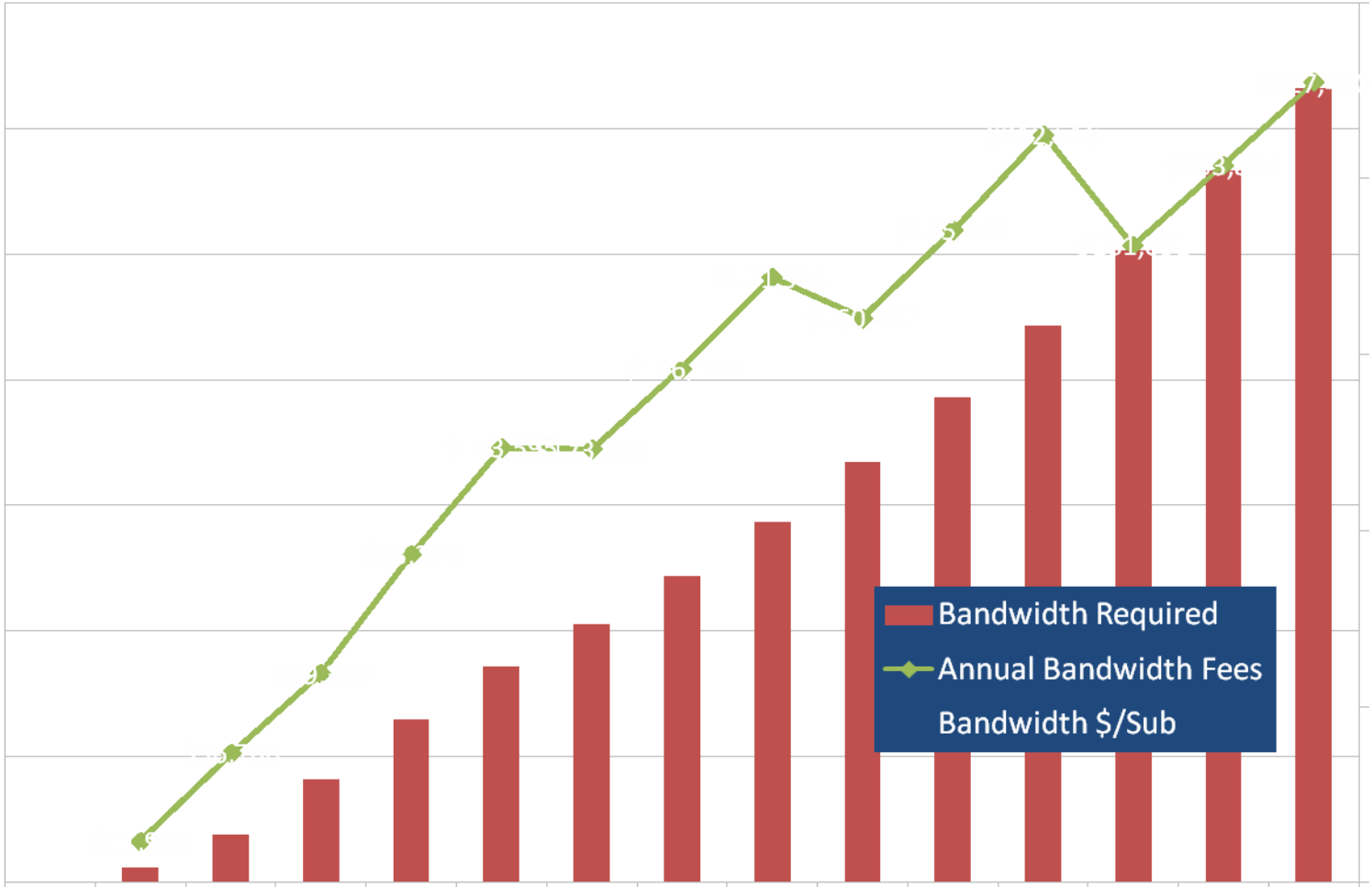
Bandwidth Sourcing

BANDWIDTH SOURCING

CBX already has assets in place to cost-effectively source bandwidth required to function as an Internet Service Provider (ISP) via one of the largest data centers in the U.S. with bandwidth at $0.10/Mbps…

	Direct Access Configuration at Pittock
Transport	CBX currently has fiber terminating at the Pittock Internet Exchange in Portland • Terminating in Meet-Me Room and able to connect with 16 carriers for access to the greater Internet • No transport cost given fiber ownership
Access	Lease 2 backbone connections at 921 SW Washington Street (Pittock) for 10G capacity (CDR) on each • Provider "A": 10G bandwidth for $1,050 MRC/$0 NRC and 1 year term & $1500 NRC • Provider "B": 10G bandwidth for $700 MRC/$0 NRC and 5 year term • Lease IP addresses (IPv4). Budget at 50¢ each.
Other Fees	X-Connect: $300 MRC per circuit x 2 = $600 MRC

BANDWIDTH FORECAST EXAMPLE



Personnel Plan

FTE LEVELS: MANAGEMENT EMPLOYEES

- Dedicated FTTP System Full Time Equivalents (FTE)
  - System GM: 1 FTE
  - Data Technician: 1 FTE
  - Marketing Coordinator: 1 FTE (starts in Year 2)
  - Commercial/MDU Account Rep: 1 FTE

- Position unloaded salaries based on current CBX salary ranges, 59% benefits loading, and 4% annual salary increase

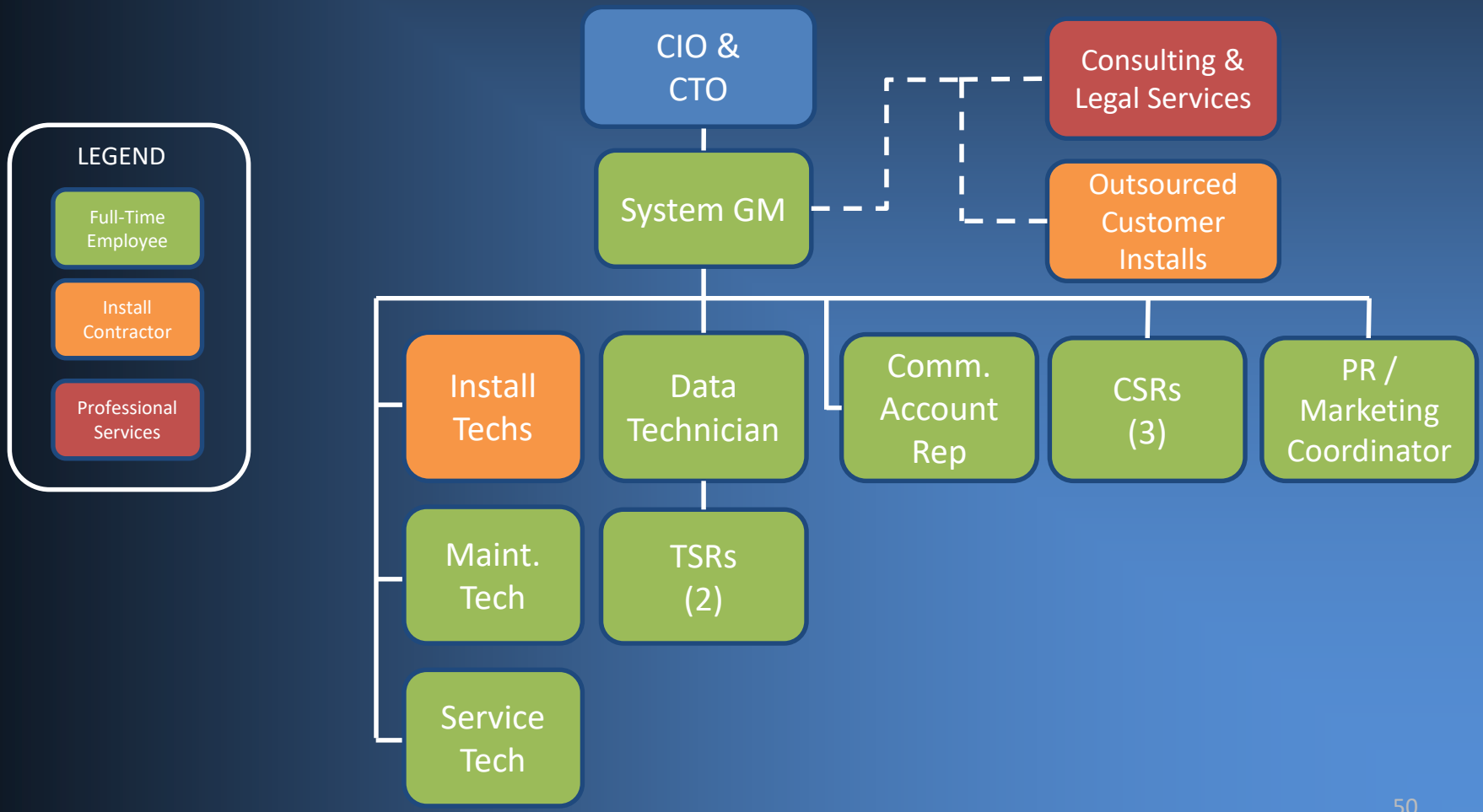
FTE LEVELS: DEDICATED FRONTLINE EMPLOYEES

- Customer / Technical Service Representatives (CSRs/TSRs)
  - CSRs handle inbound/office sales, order entry and first tier support
  - TSRs handle all second tier customer support, dispatch and service provisioning
  - Staffed at 1 FTE per 2k accounts growing to 4k by Year 5, but with minimum of 3 CSR and 2 TSR positions to ensure phone coverage
- Install Technicians
  - Installs are 2-phase with pre-install followed by separate premise install
  - Pre-installs completed by a contractor at fixed rate ($350) for all connections for Years 1-3, and then insourced
  - Premise installs are completed by a contractor at fixed rate ($250), for all connections for Years 1-3, and then insourced
  - Each Install Tech can complete 3/day
- Service Technicians
  - Service techs fix subscriber problems
  - Service call volume equals 50% of all subscribers/year dropping to 25% by year 5
  - Each Service Tech can complete 4/day growing to 6/day by Year 5
- Maintenance Technicians
  - Network techs maintain the fiber system from the backbone to the network access point
  - Increases from two currently to three in Year 3

ORGANIZATION CHART (YEARS 1-3)

Contractor services should be utilized in the early years to complete some start-up tasks and avoid short term hiring:

- Legal: Bond counsel and legal start-up tasks
- Consulting: Implementation support (12-18 months)
- Installs: Outsourced for 3 years and then internally staffed after install volume normalizes



STAFFING DETAILS

Position	Role	Staffing Entity	Compen-sation	Location
System GM	Lead responsible for all broadband electronics and systems	CBX	Exempt FTE	Onsite - desk space needed
Marketing Coordinator	Develop and implement direct marketing and fulfillment materials, and manage advertising campaigns.			
Commercial Account Rep	Direct sales to business accounts and installation coordination and MDU ROE agreements.			
Network Engineer	Secondary responsible for all broadband electronics and systems			
Customer Service Reps	Phone and email support for work order creation, trouble tickets, billing		Non-Exempt Hourly	
Technical Service Reps	Help desk support			
Install Techs	Complete pre and premise installs	Install Contractor	Per Job	Contractor leased garage
Maintenance Techs	Resolve outage and maintain OSP	CBX	Non-Exempt Hourly	City garage /operations center
Service Techs	Complete service calls			

Customer Care

CUSTOMER SUPPORT OVERVIEW

Daypart		Contact Method	Sales / Support Functions
M-F 8am–9pm	CBX CSRs	Inbound calls	Serviceability inquiries, connect orders, change/move orders, disconnect orders, billing
		Outbound Calls	Ready-for-service notifications
	CBX TSRs	Inbound call or warm transfer (by CSR)	Help desk support and troubleshooting
	CBX Field Techs	Dispatched via OSS Trouble Ticket	Onsite service issue resolution
After Hours M-F 9pm–8am / Sat / Sun	3rd Party Call Center	Inbound calls	Sales: Create account and work order for next day callback Support: Help desk support and troubleshooting
	CBXS On-Call Tech	Network alarm notification / Customer notification (via IVR)	Response to Severity I incidents

CUSTOMER SUPPORT STAFFING REQUIREMENTS

Hours of Operation will need to extend beyond regular public access hours:

- Inbound calls answered by CSRs and TSRs will peak between 5-8pm weekdays
- Maintenance Tech will be on-call after hours for any network outage
- Install Techs will be scheduled into 4 hour install windows (morning and afternoon) with 1 hour arrival window commitment

Position	Compen-Sation *(unloaded)*	Shift Schedule	Skillset Requirement*
Commercial Account Rep	$75,000	M-F 8am-5pm	Account sales / Prospect management / Knowledge of telecom services / Wiring design & cost estimation
Customer Service Reps	$51,181	3 Shifts (M-F) Shift 1: 8am-5pm Shift 2: Noon-9pm Shift 3: Noon-9pm	Customer service experience / sales experience / computer and software proficiency /
Technical Service Reps	$61,586	2 Shifts (M-F) Shift 1: 8am-5pm Shift 2: Noon-9pm	ISP help desk experience / PC, home router, and WiFi knowledge / software proficiency / basic network understanding
Install Techs	$54,000	2 Install Windows Morning & Afternoon	Field Tech experience / Low-voltage wiring knowledge / basic OSP construction knowledge
Maintenance Techs	$67,642	M-F 8am-5pm After Hours: On-Call	
Service Techs	$54,000	M-F Noon-9pm	

* Ideal candidates for these positions will possess previous industry experience in similar roles with CenturyLink, Comcast or other service providers.

CUSTOMER SERVICE ISSUE CLASSIFICATIONS

	Service	Residential	Commercial	Key Account / SLA
Single Premise Affecting	Voice	**Severity I Incident:** • No dial tone • Cannot initiate calls **Severity II Incident:** • ONT not powered • Cannot receive calls **Severity III Incident:** • Calling feature or voicemail not working		**Severity I Incident:** • All connectivity- related issues Class III Incident: • All voice feature issues
	Data	**Severity III Incident:** • ONT not powered • No Internet or Slow Internet • Email issues (if using City-provided email)	**Severity II Incident:** • ONT not powered • No Internet **Severity III Incident:** • Slow Internet • Email issues (if using City-provided email)	
Multiple Premise Affecting	Voice	**Severity I Incident:** • No dial tone • Cannot initiate calls • ONT not powered • Cannot receive calls **Severity III Incident:** • Calling feature or voicemail not working		
	Data	**Severity I Incident:** • ONT not powered • No Internet **Severity III Incident:** • Slow Internet • Email issues (if using City-provided email)		

Severity I: TSR, on-call engineer or tech will immediately initiate appropriate steps to resolve the issue as soon as possible

Severity II: Initiate within 4 hours of receiving notification from the customer

Severity III: Initiate response such that resolution activity will be underway prior to 5pm of the same day if notification from the customer was received by 11am – otherwise resolution next business day

Service Fulfillment

SERVICE FULFILLMENT PLAYERS / ROLES

Fulfillment Component	Who?	Outsourced?	Fulfillment Tasks/Role
Front-Line Personnel	Customer Service Reps (CSRs) Technical Service Reps (CSRs)	Not recommended, but possible for after-hours support	• CSRs key connect, change, move and disconnect orders • TSRs assist in service provisioning
Systems	Primary examples are: • Great Lakes Data Systems • ETI • Innovative Systems • Cogsdale	Yes	• House file and premises serviceability status • Direct marketing lists • Customer account management • Work order flow management • Device interdiction / device inventory • Reporting
Processes	Internal methods and procedures prepared by staff	Consultant assistance is recommended	• Detailed, step-by-step instructions for personnel and contractors to complete all fulfillment tasks including installs, service suspensions/disconnects, billing, and trouble resolution
Documentation	Internal policies and customer agreements prepared by staff	Consultant assistance is recommended	• MDU Right of Entry Agreement • Commercial Services Agreement w/ SLA (complex accounts) • Terms and Conditions • Work Order Acknowledgement • Digital Voice Disclaimer
Third Party Vendors	• Locate Contractor • Install Contractor • After Hours Call Center • Voice Provider • TPV Provider • Payment Processors	Yes, with the exception of insourcing installs to CBX field techs in Year 4	• Locates for all underground drops prior to install • Drop install and inside wiring • Help desk support and trouble ticketing • Voice provisioning and number ports • Verification of provider change involving number port • ACH and credit card billing set up during account creation

SERVICE FULFILLMENT LESSONS LEARNED

- **Separate CSR and TSR Functional Roles**
  - Reflects natural differences in skill sets/work experience and ideal shift schedules
- **Record Non-Ready Service Inquiries in the OSS**
  - Prospect calls that are not yet serviceable should be keyed as a Prospect Work Order to facilitate outbound calls just prior to node certification
- **Two Phase Customer Install**
  - During the initial last-mile buildout, all systems at least partially offload drop and premises installs to a field technical services contractor
- **Install Interval of 1-2 Weeks with 80% Quota Utilization**
  - Interval 'sweet spot' limited on both ends:
    - Minimum interval to accommodate locates and number ports
    - Maximum interval can vary but cannot be excessive or connect order cancels will occur
  - Interval managed via direct marketing drop timing and volume
  - Interval managed via install contractor crew scheduling
  - Some install quota should be reserved for 'new resident' connect orders without existing Internet service
- **Utilize a Third Party Verification Vendor**
  - While a Letter of Agency can be signed by the customer, this precludes closing the sale on an inbound call inquiry

SERVICE FULFILLMENT LESSONS LEARNED

- **Equip Field Techs with Real-Time OSS Access**
  - Use smart devices to make work order edits while on the job site (signatures, fiber assignment details, pictures, etc.)
  - This further allows service upgrades, updating of WO status, and pre-closing of the work order
  - This means contractor must utilize the same OSS platform for their dispatcher and in the field
- **Install ONT to Support Customer Self-Disconnect**
  - Avoid the cost of a Field tech truck roll to retrieve installed customer equipment
  - To avoid damage to the inside wiring, the ONT should not be directly connected via fiber, but through a wall jack with a fiber jumper that is easily disconnected from the wall plate (not the ONT)
- **Install Tech Crew Productivity Requires Careful Management**
  - Start with half-day appointment windows and migrate to 3 daily windows after productivity gains – especially with Premises Installs
  - Crew sizes should be 2-Tech teams on pre-installs and single Techs on premises installs (except for training of new Techs)
- **Electronically Automate both Billing and Payment**
  - Bills rendered electronically (emailed PDF and online access). Printed/mailed bill statement optional for monthly fee
  - No check payment via mail. Credit card and ACH checking withdrawal set up as recurring payments
  - Allow online payments via the OSS platform

CUSTOMER CONNECT ORDER OVERVIEW

BILLING POLICIES OVERVIEW

- **Bill Cycles**
  - Multiple bill cycles are typical to balance staff workload to process billing and the size of pro-rates (4 is typical)
- **Partial Payments**
  - Partial payments shall be posted against the current balance of the account and not applied to specific services
  - Partial and late payments shall be posted to the oldest aging bucket where non-current balances exist
- **Promise-to-Pay**
  - A customer may defer going into non-pay treatment if the customer agrees to a promise-to-pay (PTP) arrangement. The CSR will record the payment extension date in the OSS with the following limitations:
    - The PTP must be keyed prior to the soft disconnect being processed. Once service is suspended, the customer must pay the full past due balance
    - The PTP extension cannot go beyond the date of the next billing cycle due date
    - The PTP payment amount being extended must be a minimum of the past due amount (current balance excluded)
    - Customers may use PTP no more than 3 times per year
- **Non-Payment**
  - Re-Activation Fee (No Premise Visit Required): The CSR will apply a fee (e.g. $20) to the account that must be paid along with the full past-due balance before service will be restored
  - Re-Activation Fee (Premise Visit Required): A higher fee (e.g. $50) if a truck roll is required to restore service (e.g. to install a new ONT). The fee must be paid along with the full past-due balance before re-activation
  - Un-Collected/Damaged Equipment Fees: The replacement cost for the ONT and other equipment as applicable will be applied to the customer account via their credit card on file

SERVICE SUSPENSION/DISCONNECT PROCESS

Recommended policies for determination of late payment fees and collection actions are reflected in the table below. It is industry-standard practice to 'soft disconnect' the customer via electronic service deactivation as an interim step to avoid full service disconnect and truck roll.

Action	Timeframe (Calendar Days)	Penalty Fee Applied
Bill Processed/Issued	T0	
Bill Due	T+15	
Email Notification (automated outgoing notification)	T+16	
Phone Call Notification (CSR outbound call via late report)	T+20	
Suspend Service via Soft Disconnect (Data Only)	T+22	None. Billing stops.
Disconnect Service (Data & Voice)	T+25	Re-Activation Fee will be required if service is subsequently restored. CSR enters equipment pickup order
CSR Outbound Call (Notify of Non-Collected ONT Fee and make appointment for ONT recovery)		
Truck Roll to Collect ONT	T+30	
ONT Not Collected	T+40	Un-Collected/Damaged ONT Fee Posts to Account
Mail Final Bill Notice		
Account Turned Over to Collections Agency	T+100	

NEW SERVICEABLE PREMISES RELEASE PROCESS

As the system design is completed, the serving cabinets need to be associated with each premise so that the serviceability of each premise can be indicated in the premise module of the OSS. This process links the GIS-based data to the OSS via a file export/import to ensure that the launch marketing plan accurately targets the newly serviceable premises.

Process Step	Actions Required
Premises assignment to Service Area	The feeder tap assignment will be used to designate the service area. The Service Area assignments are typically done on a rolling basis as the system design is completed.
Designation of Service Area launch cohorts (optional)	Service Areas – depending upon the pace of construction and install backlog – can be combined into a single launch cohort with higher new premises counts
Creation of New Serviceable Premises File via GIS export	Create a GIS output file in Excel format that includes all the required information for each premise: • GIS coordinates (Location X and Y) • Service Area (Area ID) • Address • Fiber Founder expiration date (may need to be entered manually) • Number of dwellings at the address • Number of buildings at the address • Serviceability status (changed manually after import) • Premise type (Residential or Commercial) • Serving vault address • Vault location • NAP Vault address • Drop type (AE or UG)
Import of New Serviceable premises File into OSS	CoGS OSS System Administrator will run a utility to import the file into OSS
Batch update of premises status	After network certification is completed, a batch process will be used to update the service availability field status for each Service Area in OSS to “Service Available”
Export of address list for marketing	After serviceability is updated for the new premises, an address file will be exported and used for all mailings in the launch marketing tactics.

REQUIRED OSS FUNCTIONALITY

The following OSS functions are critical to having robust and reliable control over the customer fulfillment process. Furthermore, in order to minimize front-line staff efficiency and reduce human error, the OSS should fully interoperate with both the FTTP electronics vendor and the voice provider.

Functionality / Module	Required Capabilities
Platform Options	Onsite or Hosted
Supported Service Set	Internet, Voice, Video (including hosted video apps)
House File	Import from GIS database. Serviceability status for each premises.
End User Billing	Service and package codes, discounting, bill cycles, bill statement rendering, campaign codes/rules, prorating, cash drawer, billing file export, call detail record import, payment posting, deposits, online bill payment
Service Order Management	Create and manage work order (WO) types (Connect, Disconnect, Suspension, Change, and Trouble Ticket), WO reporting, WO routing, notes filed, sales ID assignment, reason codes
Work Force & Asset Management	Scheduling and quota management, technician skill ratings, activity codes and task points assignment, inventory tracking/location of ONTs and other CPE, technician productivity reports, on-time appointments, inventory level reports
Interoperability & Integration	Interoperability and devise control over all ONT models including WiFi and extenders
Trouble Ticketing	Trouble ticket creation (both manual and automated), definable problems with categories and reason codes, definable customer types and categories, notification via email based on groups, problem codes, severity

Marketing Strategy

MARKETING PLAN OVERVIEW

- Municipal Broadband Marketing 'Lessons Learned'
- Marketing Goals
  - Long-Term Strategic Objectives
  - Marketing Milestones
  - Near-Term Key Performance Indicators (KPIs)
- Competitive Advantage / Brand Messaging
- Marketing Campaigns: Launch and Remarketing
  - Sales channels
  - Consider 'Fiber Founder' offer (Longmont, CO example)
  - Direct marketing tactics
  - Detailed marketing budget (Years 0-4)
- Uptown Marketing Planning Tool

FTTP MARKETING LESSONS LEARNED

- **The service sells itself**
  - Brand preference for the County (retail model) or possibly SandyNet (wholesale model) and greatly improved Internet speed/value quickly generate residential demand

- **Marketing must be targeted to service-available areas**
  - Generate market demand where it can be met via direct marketing versus city-wide tactics
  - Scale down launch areas to smaller geographic areas for maximum flexibility
  - Ability to adjust direct marketing volumes to install capacity (excess or backlog)

- **Conservatively communicate project progress and availability status**
  - Manage expectations on service availability
  - Address lookup or map available on the website with anticipated service availability (by quarter)
  - Communicate project successes via public information channels

LONG-TERM STRATEGIC OBJECTIVES

- Launch a separate brand identity for the fiber system to enhance both awareness and differentiation from incumbents, or alternatively, run a brand awareness campaign to present CBX as a mass market retail brand
- Accelerate initial take rate in new service areas with a limited time offer of exceptional value – beat the pro forma target of 45%
- Elevate Internet ARPU above typical municipal broadband levels – meet the pro forma target of ≈$80
- Reduce subscriber churn by allowing subscribers to lock in terms they will not want to give up
- Accurately communicate and update construction progress and timing of service availability to preserve positive community anticipation

MARKETING MILESTONES (RETAIL MODELS ONLY)

- Create and launch a new brand identity for the fiber system
  - 6 week campaign prior to launch of last mile fiber service
  - Media: Direct Mail, Website, and Social Media

- Conduct Alpha Test with Friendly Users prior to full launch
  - Initially connect 10-20 households (free service for 30 days)
  - Test all key processes and vendor interaction
  - Conduct satisfaction survey and quality assurance calls
  - Test billing process with dry and live bills issued
  - Begin targeted direct marketing campaign of remaining service available homes

- Commercial launch in Month 14 of implementation. Exceed Year 2 pro forma subscriber targets:
  - Residential Internet: 595 (27.0% penetration)
  - Residential Voice: 122 (5.5% penetration)
  - Commercial Internet: 26 (24.9% penetration)
  - Commercial Voice: 20 (19.0% penetration)
  - Commercial High Cap: 1 (18% penetration of estimated target segment)
  - Total Revenue: $338K (incremental to current CBN revenues)

BRAND POSITIONING / USP

- LOCAL & RESPONSIVE
  - Local/regional investment by the County for its residents and businesses
  - Critical infrastructure for households and businesses alike as connectivity increasingly supports lifestyle and business needs
  - Network is managed by County staff reporting to the County Commissioners

- 100% FIBER
  - Technically superior network can connect every premises with 100% fiber
  - Significant improvement in network performance, reliability, and security over hybrid copper and coax incumbent networks

- FAIR PRICING
  - Internet service will provide greater capacity/speed at lower prices
  - Subscriber revenues will be used to pay for the system construction and, in the long run, contribute to economic development within the County

SALES CHANNELS

- Account Executive (1 FTE)
  - Commercial/MDU Accounts: Commercial direct sales and account management. For MDUs, secure Right Of Entry agreements.
- CBX Website (retail models only)
  - Lead generation via Service Interest Form and service inquiry phone calls
  - When serviceable, outbound contact by CSRs to schedule priority install
- Mass Market Sales (SFU/MDU/Small Business)
  - Customer Service Representatives. Respond to inbound sales and customer service calls and walk-in traffic (excluding help desk calls handled by TSRs)
  - CSRs can staff events marketing opportunities when possible
  - No online ordering or residential direct sales (door-door)
- OSS Service Orders & Account Management
  - All Connect, Service Change, and Disconnect/Transfer work orders are keyed by CSRs
  - Trouble tickets are keyed by TSRs
  - OSS system administration handled by Lead CSR or division General Manager

LAUNCH CAMPAIGN PROCESS

1. T-60+ days: Construction door hanger
2. T+0: Outbound telemarketing to prospect lists (with install date priority)
3. T+0: Letter from the County Official announcing availability
4. T+15: 6-panel brochure
5. T+30: Oversized postcard
6. T+45: 6-panel brochure (2nd flight)
7. T+60: Oversized postcard (2nd flight)
8. T+75: Letter announcing last chance for discounted Gig (if promo pricing is offered)
9. T+90: Launch campaign ends

COMMUNICATING SERVICE AVAILABILITY

- Published Project Schedule
  - Groupings of cabinet areas will be assigned a target launch quarter indicating the beginning of service availability within each launch area cohort.
  - The quarterly launch schedule will be published on the CBX and/or County website and will be updated as needed.

- Direct Marketing Launch Campaigns (cabinet level)
  - Due to the unpredictable nature of FTTP construction, conduct rolling launch campaigns at the individual cabinet level
  - This accommodates the practical realities typical of OSP construction
    - Variability in the delivery of cabinets released for service over time
    - Released cabinets not being contiguous to each other
    - Rapid changes in install backlog or unfilled install quota
  - Once a cabinet is certified for release, direct marketing tactics will begin towards the specific premises served by the cabinet

UPTOWN MARKETING PLANNING TOOL

- Marketing Planning Tool
  - Excel workbook with variable inputs to integrate operations planning across:
    - Monthly construction forecast
    - Monthly take rates during first 6 months of launch by launch cohort
    - Monthly customer connect capacity and resulting contractor budget
    - Monthly direct marketing quantity and budget requirement
- KPI metrics will include:
  - Serviceable premises released (actual vs forecast)
  - Subscriber net gain by month (connects, moves/transfers/disconnects)
  - Active subscribers by service (actual vs forecast)
  - Service penetration (actual vs forecast)
  - Install capacity forecast (install techs & installs/day/tech)
- KPIs should be tracked monthly against both updated forecasts and pro forma metrics
  - Comparison to annual pro forma metrics for premises passed, subscribers and penetration for each service

MARKETING BUDGET* (YEARS 0-3)

	Year 0	Year 1	Year 2	Year 3
Brand Launch	$10,000	-	-	-
Creative Services	-	$5,000	$5,000	$5,000
Launch Campaigns	-	$32,500	$15,000	-
Re-Marketing	-	-	-	$15,000
Signage, Collateral, etc.	-	$2,500	-	-
Awareness Advertising	-	-	-	-
Pro Forma Budget	**$10k**	**$40k**	**$20k**	**$20k**

* Retail models only.

Software Tools

SOFTWARE TOOLS OVERVIEW

- **Operations Support Software** (OSS) is the primary software tool controlling nearly all aspects of service provisioning & management, customer account management, and billing
  - Examples: ETI and Great Lakes Data Systems
  - Key Consideration: Degree of interoperability between/across the FTTP electronics platform and the voice service provider for both provisioning and billing
- **Voice Provider Production Admin Portal** is a browser-based online tool for inputting configuration settings for the voice services offering. For specific account management (except complex commercial accounts), configuration will be automated via the OSS software commands.
- **Fiber Management Software** is the GIS-based design tool for drafting OSP pathway, assigning fiber strands, and maintaining the fiber assets. The City has purchased ArcFM Fiber Manager as part of the design task. The design will be delivered with full fiber cable, closure and splicing detail for all feeder and distribution systems. The City will need to keep the system updated as new subscribers are added and the network is expanded to new build areas.
- **Network Element Management Software** (EMS) provides an integrated system for sharing device information across management applications, automation of device management tasks, visibility into the health and capability of the network, and identification and localization of network trouble. This functionality should be acquired as part of the FTTP Equipment RFP. Capabilities from suppliers like Calix have expanded greatly in the last five years.

REQUIRED OSS FUNCTIONALITY

The following OSS functions are critical to having robust and reliable control over the customer fulfillment process. Furthermore, in order to minimize front-line staff efficiency and reduce human error, the OSS should fully interoperate with both the FTTP electronics vendor and the voice provider.

Functionality / Module	Required Capabilities
Platform Options	Onsite or Hosted
Supported Service Set	Internet, Voice, Video (including hosted video apps)
House File	Import from GIS database. Serviceability status for each premises.
End User Billing	Service and package codes, discounting, bill cycles, bill statement rendering, campaign codes/rules, prorating, cash drawer, billing file export, call detail record import, payment posting, deposits, online bill payment
Service Order Management	Create and manage work order (WO) types (Connect, Disconnect, Suspension, Change, and Trouble Ticket), WO reporting, WO routing, notes filed, sales ID assignment, reason codes
Work Force & Asset Management	Scheduling and quota management, technician skill ratings, activity codes and task points assignment, inventory tracking/location of ONTs and other CPE, technician productivity reports, on-time appointments, inventory level reports
Interoperability & Integration	Interoperability and devise control over all ONT models including WiFi and extenders
Trouble Ticketing	Trouble ticket creation (both manual and automated), definable problems with categories and reason codes, definable customer types and categories, notification via email based on groups, problem codes, severity

Strengths, Weaknesses, Opportunities, & Threats

SCOPE OF OPPORTUNITIES AND THREATS

- Uptown sees two substitute technologies to FTTP as the primary opportunity/risk areas for the CBX last mile system being considered
  - 5G Wireless Data Service
  - Low Earth Orbit (LEO) Satellite Internet Access

- The potential viability of both technologies may have long-term impacts to a last-mile expansion of fiber within the County both as an opportunity or a threat, depending upon future CBX direction
  - If CBX deploys last-mile fiber: Both 5G and LEO could potentially compete for market share of the residential Internet segment and limit long term CBX revenue growth
  - If CBX does not deploy last-mile fiber: Both 5G and LEO could potentially fulfill the need for improved Internet access within under-served areas and alleviate the need for the County to deploy fiber infrastructure to all premises.

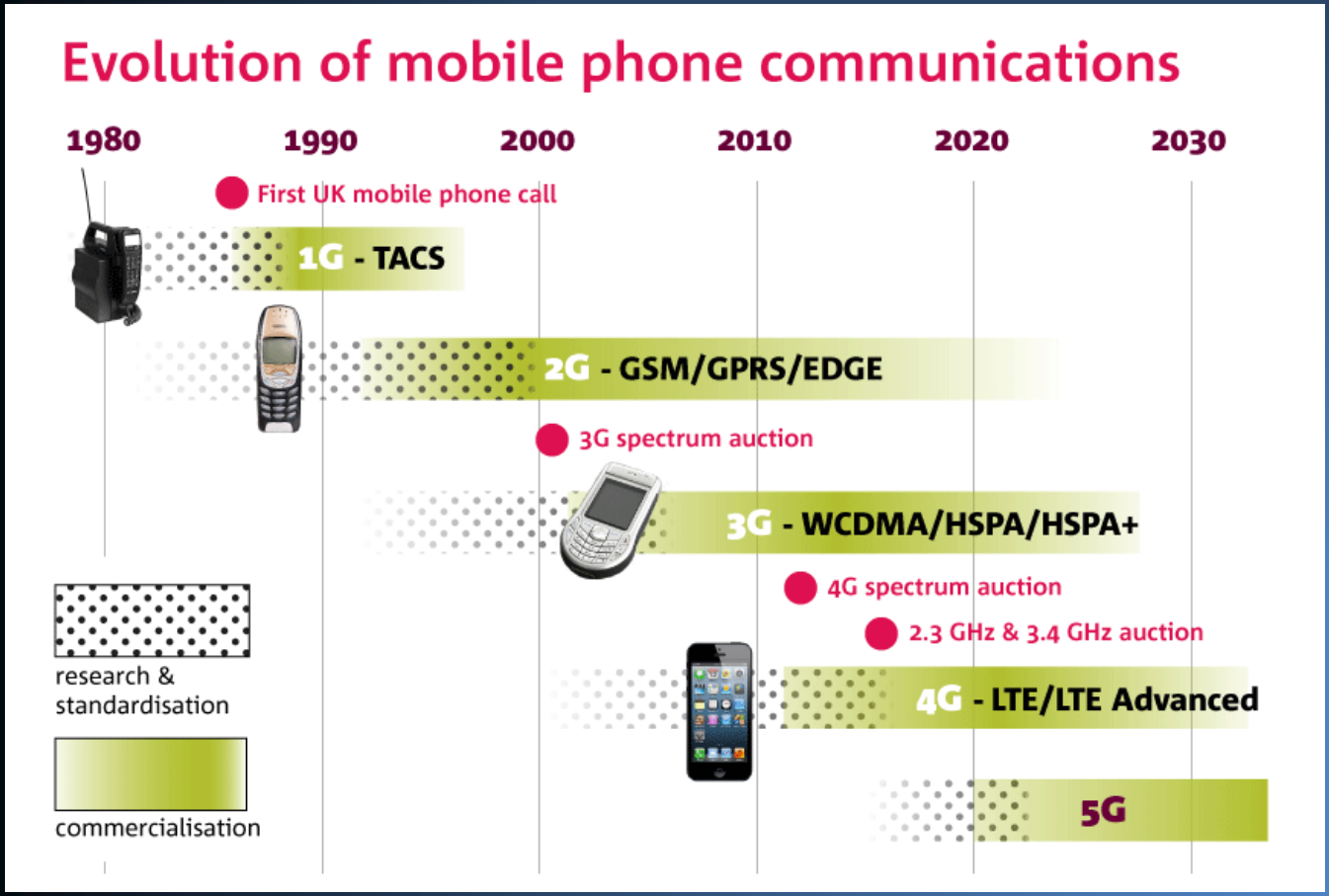
5G Wireless

KEY QUESTIONS REGARDING 5G

- What is "5G"?
  - Overview and comparison to previous generations
  - Initial deployments by Verizon and AT&T
- Cost to deploy 5G – is widespread deployment financially feasible?
  - Small cells require deep fiber that approaches cost for last-mile FTTP
  - Cost to deploy compared to carrier capital budgets
- If deployed, would 5G become a true substitute service for wireline broadband?
  - The ongoing need for more bandwidth in the home
  - Wireline vs. wireless provider usage policies
  - Service value ($/Mbps)
- We conclude that 5G, while improving wireless data performance, will remain a complementary – and not substitute – service for the vast majority of households

EVOLUTION OF WIRELESS TECHNOLOGY

Wireless technology undergoes a significant capacity evolution every ≈10 years. There is substantial industry/press hype with each, and 5G is no exception. But of the 4 evolutions since 1G, 5G brings a much smaller proportional increase from the previous generation…



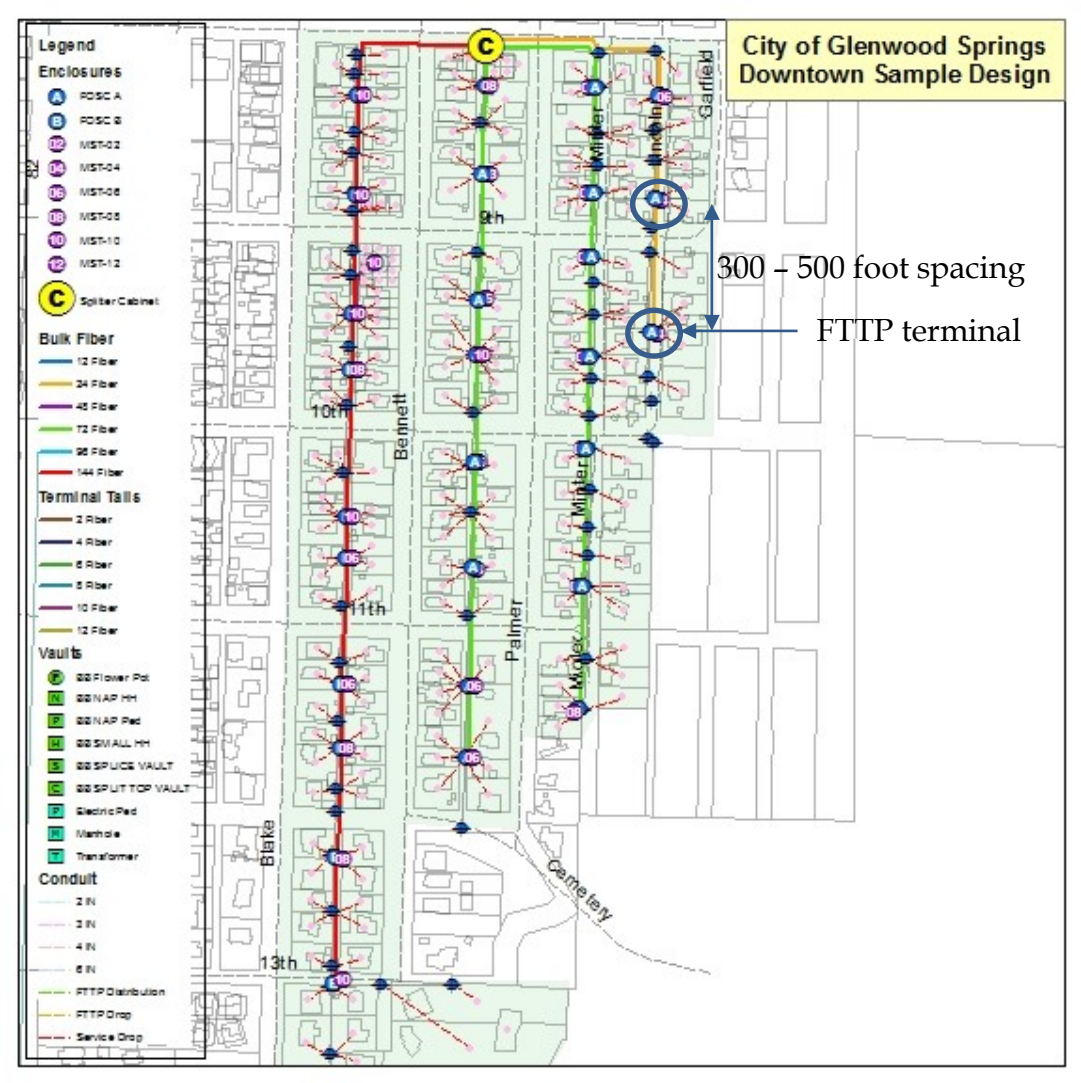
	Years	Capacity (down)	Capacity Change
1G	1980s	2kbps	-
2G	1990s	64kbps	31x
3G	2000s	2Mbps	31x
4G	2010s	200Mbs	99x
5G	**2020s**	**1Gbps**	**4x**

Source: FutureTimeline.net, Laying the Foundations for 5G mobile, January 2015.

TECHNICAL CHARACTERISTICS OF 5G

- Wireless spectrum
  - Very high frequencies opened for 5G – 28Ghz, 39GHz and 60GHz
  - Some use of existing bands where required for seamless 4G-5G service coverage
- Bandwidth capacity
  - New bands allow for wider channels and higher data rates
  - Promises capacity to deliver 1 Gig service packages to mobile devices
- Propagation and range
  - Line of site required from serving antenna to 5G device
  - Range is less than 500 feet at very high frequencies
  - New micro-cells required every 300-500 feet for true 5G coverage
  - Homes may need external antennas to effectively bring signal into the structure
- Fiber interconnection required
  - Fiber required to provide bandwidth to new micro-cells
  - Fiber deployment requirements could rival those of FTTP

5G DEEP FIBER REQUIREMENTS MIRROR FTTP



- FTTP fiber terminal spacing close to 5G antenna spacing (300 – 500 feet)
- Antenna spacing dependent on line of site barriers
- Each carrier will be deploying their own antenna arrays
- Aerial service areas will require the same amount of fiber construction
- Underground areas will not require street crossings – 33% cost reduction compared to FTTP
- Antenna systems will cost much more than a typical FTTP terminal (< $1,000)
- True 5G cost will closely approximate that of FTTP

NEW SMALL CELL ANTENNAS BRING ISSUES

Existing Pole

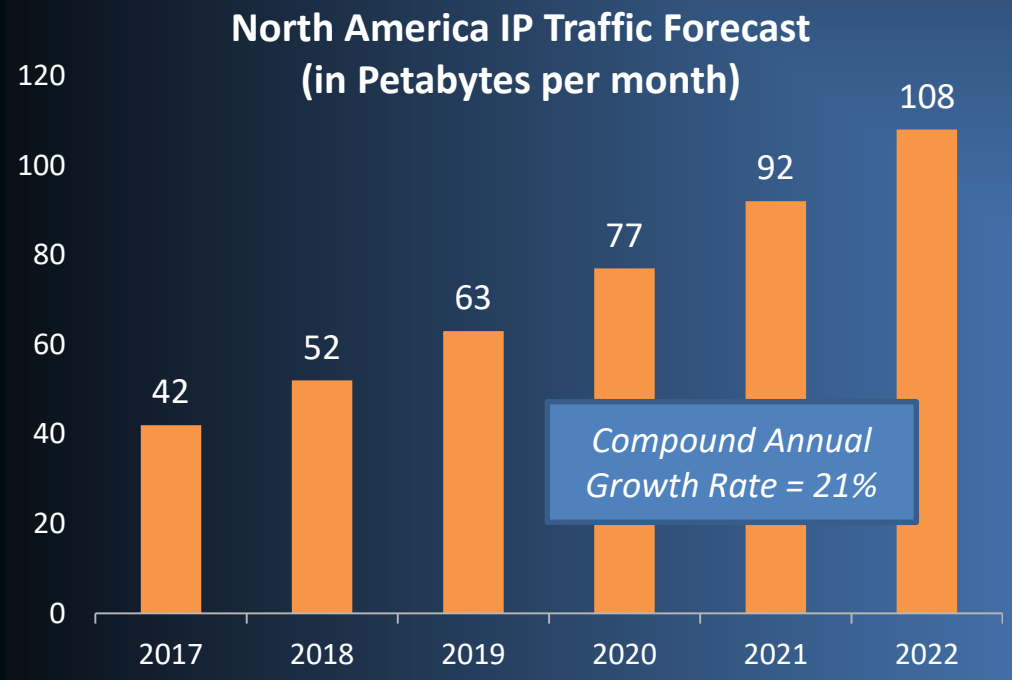
Light Pole – No Ground Cabinet

Light Pole – Ground Cabinet

- Significant resistance to hundreds and thousands of small cell antenna sites required for 5G
- Small cell sites required to cover Stillwater is highly variable due to variability in signal range
  - 500 foot range = 1,005 new small cells
  - 400 foot range = 1,570 new small cells
  - 300 foot range = 2,790 new small cells
- Placing small cells closer to homes may be cost prohibitive non urban service areas

INTERNET TRAFFIC KEEPS GROWING…

Higher definition video content and increased OTT video streaming will continue driving Internet traffic growth into the future…



(Source: Cisco VNI 2018)

Traffic Share by Network Type & Segment
Year End 2022

	Consumer	Business	Total
Internet	57%	12%	69%
Managed IP	10%	1%	11%
Mobile Data	17%	2%	20%
Total	84%	16%	100%

(Source: Cisco VNI 2018)

…DUE TO EVER-INCREASING VIDEO RESOLUTION…

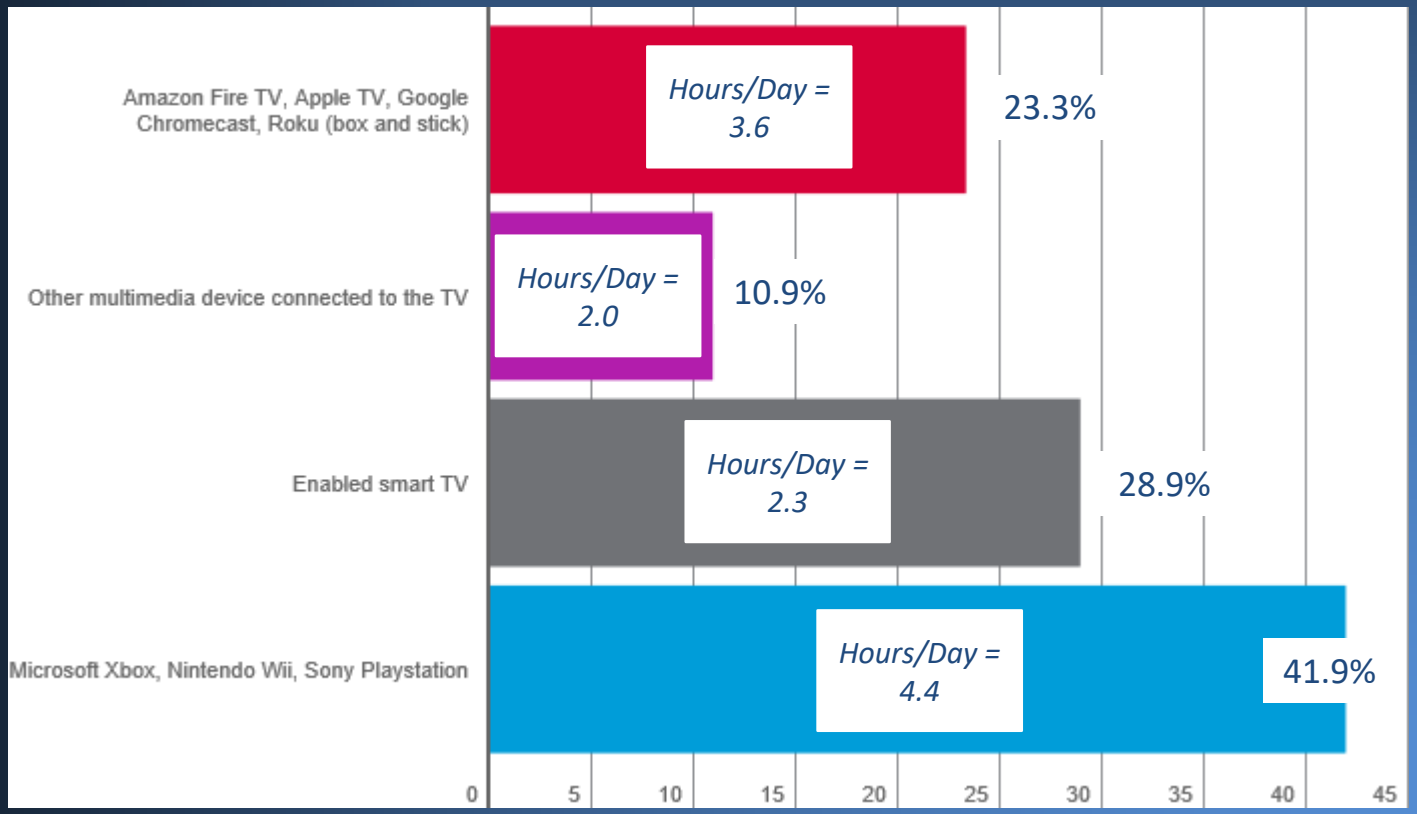
The second evolution of ultra high definition has arrived with 8K television sets now on sale. The geometric increase in resolution has lead to a corresponding increase in bandwidth to support UHD…

	TV Format	Resolution (in pixels)	Total Pixels per Frame	Bandwidth (per device)
SD	480p	720 x 480	≈ 350k	1Mbps
HD	720p	1280 x 720	≈ 920k	2.5Mbps
	1080p	1920 x 1080	≈ 2M	5Mbps
UHD	4K	3840 x 2160	≈ 8.3M	15-25Mbps
	8K	7680 x 4320	≈ 33.2M	80-100Mbps
	10K	10240 x 4320	≈ 44.2M	105-135Mbps
	16K	15360 x 8640	≈ 132.7M	240-300Mbps

…AS HOUSEHOLDS USE MORE STREAMING DEVICES

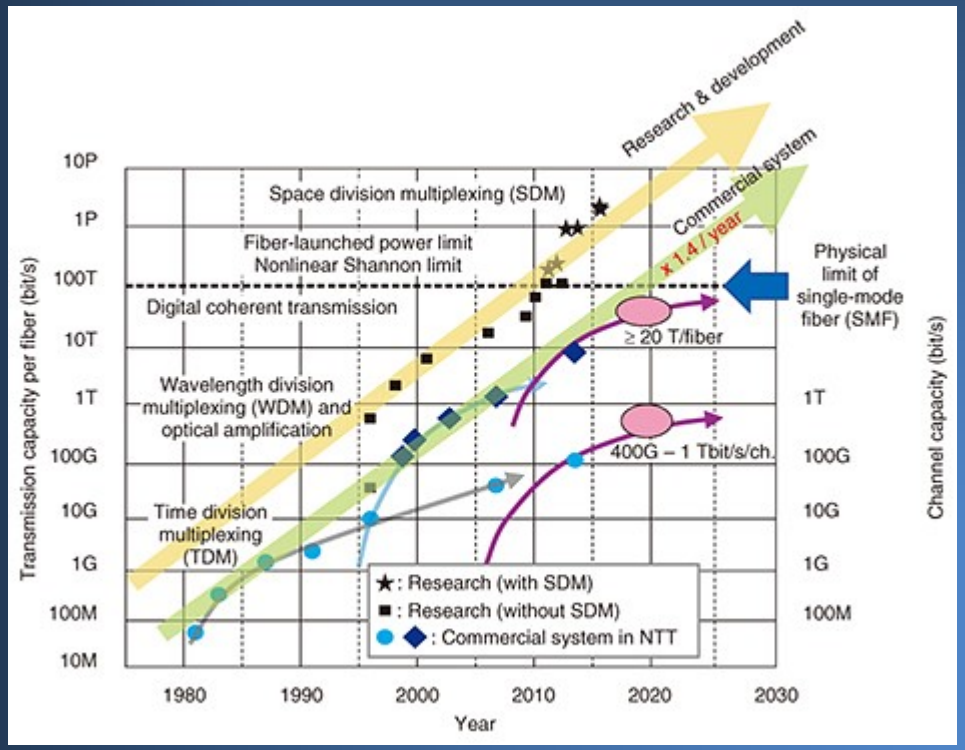
The average American household is no longer a 'traditional pay TV household,' but instead owns multiple streaming devices delivering content over the wireline Internet connection…

Device Ownership as % of Total TV Households / Average Daily Usage
Nielsen – January 2017



FIBER CAPACITY IS READY FOR THIS GROWTH

- Optical transmission technology has developed rapidly across both commercially available technology as well as R&D
- Wave division multiplexing can deliver transmission speeds of 10T (10 million Mbps) per fiber. Further research efforts will continue to advance the capacity of fiber
- Wireless capacity will never come close to the physical transmission capacity of fiber as both technologies evolve over time



Source: Space Division Multiplexing Optical Transmission Technology to Support the Evolution of High-capacity Optical Transport Networks, NTT Review, June 2017.

COST TO DEPLOY 5G

- The projected cost to deploy 5G is massive
  - Accenture (2018): $275B for US deployment
  - Fierce Wireless (2017): $56B
  - Deloitte (2017): $130-150B in fiber alone
  - Barclays (2016): $300B for 28GHz US deployment
  - McKinsey & Company: High-band 5G will cost 4-6 times the cost of LTE due to small cells
- US wireless carriers are experiencing near-flat revenue growth of 1.5% annually (2013-2018) under intense competition (IBISWorld research)
- This capital requirement, when considered against wireless carrier capital budgets, necessitates a gradual and targeted deployment of 5G that will likely skip smaller markets.

All Figures Mobile Division Only Unless Noted (2020)	**AT&T**	**Verizon**
Annual Revenue	$80B	$92B
Annual Capex Budget at 15% of Wireless Revenue	$12B (All AT&T capex budget is $10B)	$14B (All Verizon capex budget is $18B)
Annual EBITDA	$28B	$45B (all Verizon)

CONCLUSIONS: 5G OPPORTUNITY/THREAT

Due to the need to deploy extensive fiber for data traffic backhaul, Uptown believes that 5G cannot be economically deployed into the under-served areas of the County

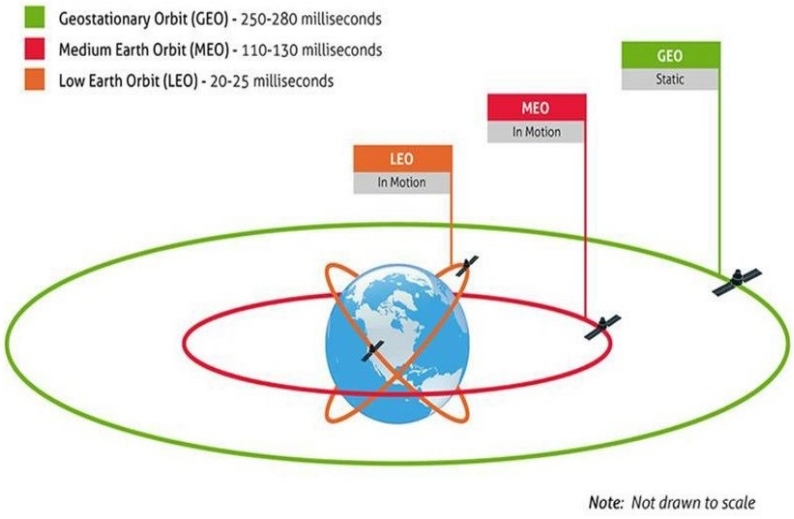
- Nationally, the cost to deploy 5G will create limitations to where the service can be economically deployed. We expect dense, urban areas to be the focus until 5G economics dramatically change
- As a broadband technology, 5G is - and will remain - technologically inferior to FTTP
  - Capacity & symmetry
  - Reliability
  - Indoor coverage
- The end user value proposition of 5G will be inferior to FTTP
  - Price per Meg
  - Cellular provider pricing and usage restrictions
- Uptown sees 5G as neither an opportunity nor threat to whatever actions the County takes regarding last-mile fiber expansion to under-served areas

LEO Satellite Internet

EVOLUTION OF BROADBAND SATELLITE TECHNOLOGY

Satellite technology has evolved since the 1960s from broadcast television to GPS to near real time voice and data systems. Lowering the orbital altitude improves latency for voice and data, but doing so requires many more satellites for complete coverage.

Satellite Applications - Latency



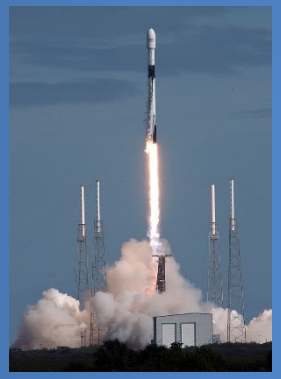
Satellite Applications - Characteristics

Orbital Type	Altitude, Miles	Satellite Coverage*	Applications
Geosynchronous	22,000	3	Weather
Geostationary	22,000	3	Broadcast and Data
Medium Earth	3,100 – 7,500	20	Global Positioning System
Low Earth	210 – 1,000	1,440 – 7,500	Voice and Data

* - Number of satellites required for 100% coverage along the orbital plane.

LOW EARTH ORBIT (LEO) CHARACTERISTICS

- Why LEO?
  - Requires minimal energy for satellite delivery - smaller satellite and shorter trip for the rocket
  - Lower altitude offers shorter round trip for time sensitive traffic – real time voice and data
  - Lower altitude reduces transmission power required – smaller satellite and smaller subscriber dish
- Drawbacks of LEO
  - Smaller footprint per satellite requires “constellations” of satellites for complete coverage
  - Starlink plans call for more than 12,000 satellites at full deployment
  - Satellites deployed at lower altitudes will experience “orbital decay” which will require re-boosting
  - Most satellites eventually burn up in the atmosphere and will require replacement
- LEO deployment examples (orbital altitude)
  - Iridium satellite phone services – 480 miles
  - International Space Station – 250 miles
  - Hubble Space Telescope – 340 miles
  - SpaceX Starlink – 210 to 690 miles



STARLINK OVERVIEW

- What is Starlink?
  - A LEO satellite technology being deployed by SpaceX (Elon Musk)
  - Initial constellation will be 1,440 satellites, of which 1,200 are in orbit as of March 2021
  - FCC has approved up to 30,000 satellites
- When and where will it be available?
  - Currently in beta testing and delivering speeds of 50M-150M
  - Current geographic coverage is between 44 and 53 degrees latitude (northern US & Canada)
  - Full commercial rollout in 2021 (pre-orders now being accepted on the Starlink website)
- What is the Internet service offering?
  - Customer Premises Equipment: $499
  - Internet Access: $99/month
  - The speed should increase as 'density' is improved with ongoing satellite launches

CONCLUSIONS: LEO OPPORTUNITY/THREAT

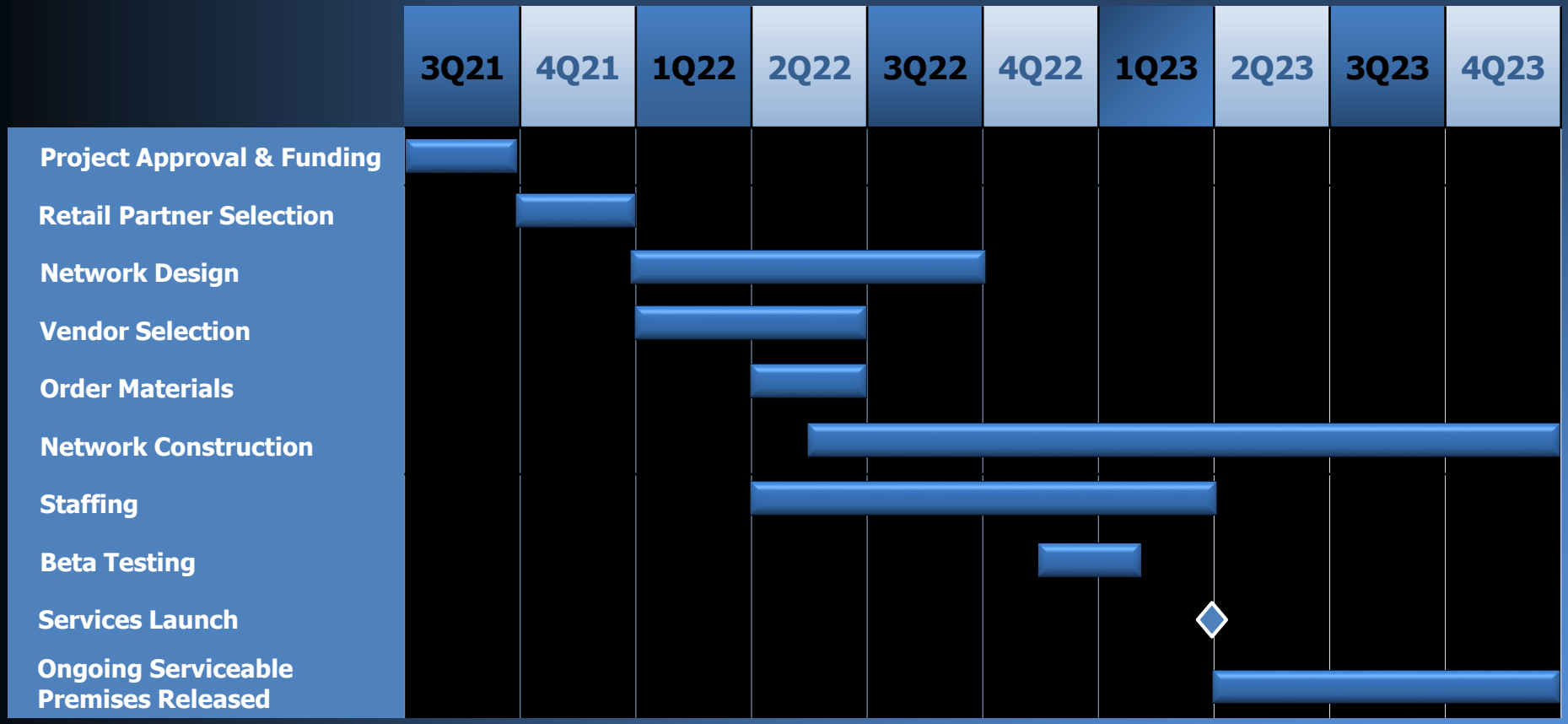
The current value proposition of LEO, with higher upfront and recurring fees for a ≈ 100M service, will limit it to primarily rural applications where wireline Internet connectivity is limited in availability and/or performance.

- Starlink could be a successful national/global alternative as a 'provider–of-last–resort' to underserved and unserved rural areas
  - While expensive, speeds will be geometrically higher than incumbent offerings in these areas
  - Upon achieving needed satellite density, the offering will be ubiquitous with no need for franchise approval, local network build-out, or local-level investment
- In areas where cable modem and/or FTTP Internet is available, Starlink should not pose a threat to market share
- In the case of the underserved areas within Clackamas County, Uptown sees LEO as an potential solution for current connectivity issues. While providing less value than FTTP in speed and price, a Starlink offering could accomplish many of the same goals being sought by the County under a business model being driven solely by the private sector.

Implementation Timeline

IMPLEMENTATION TIMELINE

If the County proceeds we would expect a 'start-up' phase of 12-16 months prior to the first premises becoming serviceable. The network construction phase will take approximately 2 years to complete…



Clackamas Broadband eXchange

Infrastructure Strategy Options and Financial Feasibility for Last-Mile Fiber to The Premises

CONTENTS: FINANCIAL FEASIBILITY

- Potential Business Structures
- Potential Financing Options
- Capital Investment Requirement
- Pro Forma Analysis – 6 potential business models subject to financial analysis
  - A. Last-Mile (primary objective)
    1. Retail: Own & Operate
    2. Retail: Own & Operate with Operating Partner
    3. Wholesale: Public/Private Partnership (Ting Internet example)
    4. Wholesale: Public/Public Partnership (municipal partner example)
  - B. Middle-Mile (secondary objective)
    1. Wholesale: Dark Fiber
    2. Wholesale: Neighborhood-level Wholesale Public/Public Partnership
- Pro Forma Conclusions

Potential Business Structures

Overview

RANGE OF BUSINESS MODELS

	WHOLESALE		RETAIL	
	Status Quo Dark Fiber	Public-Public or Public-Private Partnership*	Own & Operate with Operating Partner	Own & Operate
Ownership Role of CBX	CBX owns fiber backbone and funds fiber laterals via one-time connection fees	CBX funds capex for fiber build (FTTC) and owns backbone & distribution fiber	CBX funds capex for fiber build (FTTP), working capital, and some operating expenses	CBX funds capex for fiber build (FTTP), working capital, and all operating expenses
Operating Role of CBX	CBX constructs & maintains fiber plant (excluding electronics)	Partner is the service provider. CBX only co-brands & maintains fiber plant (excluding electronics)	CBX is service provider. Partner provides customer care, help desk, fiber maintenance/outage response, and network management/administration	CBX is service provider and provides all operating roles (excluding providing voice service)
Services Offered	Dark fiber transport to CAIs, dark fiber transport to commercial accounts, and local loop ISP wholesale	Internet: 1G @ $60 Voice: $20/mo.	Internet: 1G @ $70/mo. Voice: $35/mo.	
Revenue	All revenue retained by CBX	All revenue retained by the Partner. CBX compensated with monthly fee per connected end-user.	All revenue retained by CBX. Partner compensated with monthly fee per connected end-user.	All revenue retained by CBX

*Commonly abbreviated as PPP or 3P.

EXAMPLE MUNICIPAL FTTP SYSTEMS MODELS

Uptown expanded the business models to be reviewed to include an operating partner model under the retail model

Business Model	Governmental Entity	Service Provider or Operating Partner
Dark Fiber	Clackamas County, OR Palo Alto, CA	Unaffiliated 3rd Party ISPs
Wholesale *(Public/Private or Public/Public)*	Westminster, MD Centennial, CO	Ting
	Huntsville, AL	Google Fiber
Retail (with Operating Partner)	Salem, UT Eagle, CO	Spanish Fork, UT Glenwood Springs, CO
Retail (Own and Operate)	Longmont, CO	Longmont, CO

BUSINESS MODEL ROLES

Function	Operational Responsibility	Dark Fiber	Wholesale PPP	Retail (Operating Partner)	Retail (Own & Operate)
Private Partner		NA	ISP		NA
Network Services		NA	Data: RSP Video & Voice: RSP or 3rd Party	Data: County Voice: CLEC Video: Not Offered	
Network Assets	Backbone, Feeder, & Distribution Conduit/Fiber	County	County	County	County
	FTTP Electronics	ISPs	RSP		
	Fiber Drop		County		
	ONT and Inside Wiring		RSP		
Network Admin & Maintenance	Network Administration			ISP	
	Fiber & Conduit	County	County	County	
	Electronics	ISPs	RSP		
	Outage Response	County & RSP	County	ISP	
Bandwidth	Backbone Interconnection	ISPs	RSP		
Software	OSS/BSS			County	
	Fiber Management	County & RSP	County & RSP		
Marketing & Promotion	Advertising, Sales, Branding	ISPs	RSP or 3rd Party		
	Community Engagement	County & RSP	County & RSP		
	End User Pricing	ISPs	RSP		
Customer Operations	Help Desk, Service Calls, Billing		RSP or 3rd Party	ISP	
	Customer Installs and Disconnects		RSP	County	

Potential Financing Options

POTENTIAL FUNDING SOURCES

1. Long Term Bond
   - Single round of financing (Year 1) via 20-year tax exempt revenue bond
   - Interest rate of 3.0%, 4 years interest of capitalized interest, and 1.5% issuance cost
2. Working Capital Loan
   - 10 year term with interest rate of 4.0%
   - Interest accumulates over first 5 years with Year 6 balloon payment
   - Level payments begin in Year 6 and complete in Year 10
3. Local Improvement District
   - Monthly fee assessed to all residential premises as they become serviceable
   - Assessed for full 20 years
   - No imputed interest expense
4. Wholesale fees paid by the ISP to CBX under wholesale partnership models
   - Monthly fee per connected end user, or
   - Monthly fee per connection and per serviceable premises
5. Equity
   - Either upfront or ongoing annual general fund contributions
   - Not considered a viable option for Clackamas County

Capital Investment Requirement

TECHNOLOGY ANALYSIS METHODOLOGY

Uptown used CBX-provided resources, along with specialized GIS-based fiber design software, to evaluate the current broadband network capabilities and identify future requirements related to each business model…

- To the extent possible, Uptown compared CBX's existing network with the incumbent provider's network for possible synergies and/or gaps;
- Uptown performed a technical evaluation of the existing fiber optic network resources and its ability to provide broadband services, including the ability to address underserved areas.

  - Step #1: Evaluation of Current Network
    - Complete asset inventory for existing network
    - Characterize each key asset in terms of applicability to each business model

  - Step #2: Develop Reference Architecture
    - Develop applicable reference architecture
    - Describe reference architecture core building blocks

  - Step #3: Complete Sample Designs / Capital Budget
    - Complete sample FTTP designs for primary underserved areas in the County
    - Develop capital budget based on representative sample designs

REFERENCE ARCHITECTURE

- 100% Passive Optical Network (PON) standards based
  - Relying on next generation standards to support future growth
  - Nx10G capabilities over time

- Distributed split architecture
  - Primary splitters housed in Feeder Tap for each service area
  - Most primary splitters will be 1x4 (feeding four 1x8 drop terminals)
  - Distribution fiber connects series of 1x4 and 1x8 drop terminals
  - Drop terminals connect subscriber drops to distribution network
  - County may choose to splice pigtail on subscriber end of each drops
  - Mechanical connectors are also an option at the subscriber end

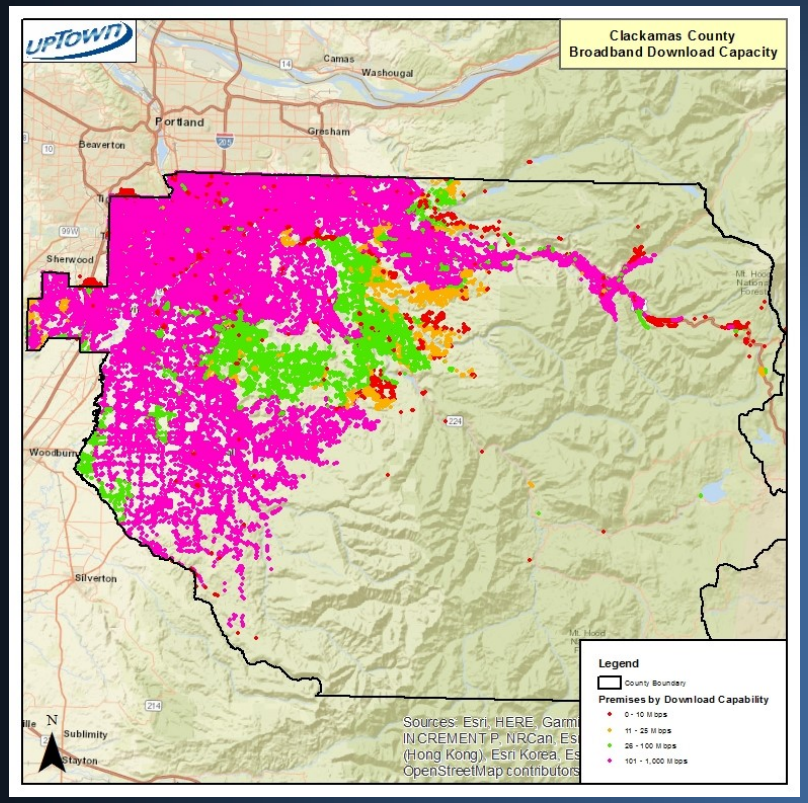
- Design assumes the use of standard cable technology
  - Single jacket, single armor cable for aerial (com zone)
  - Single jacket all dielectric for underground

OUTSIDE PLANT COST ASSUMPTIONS

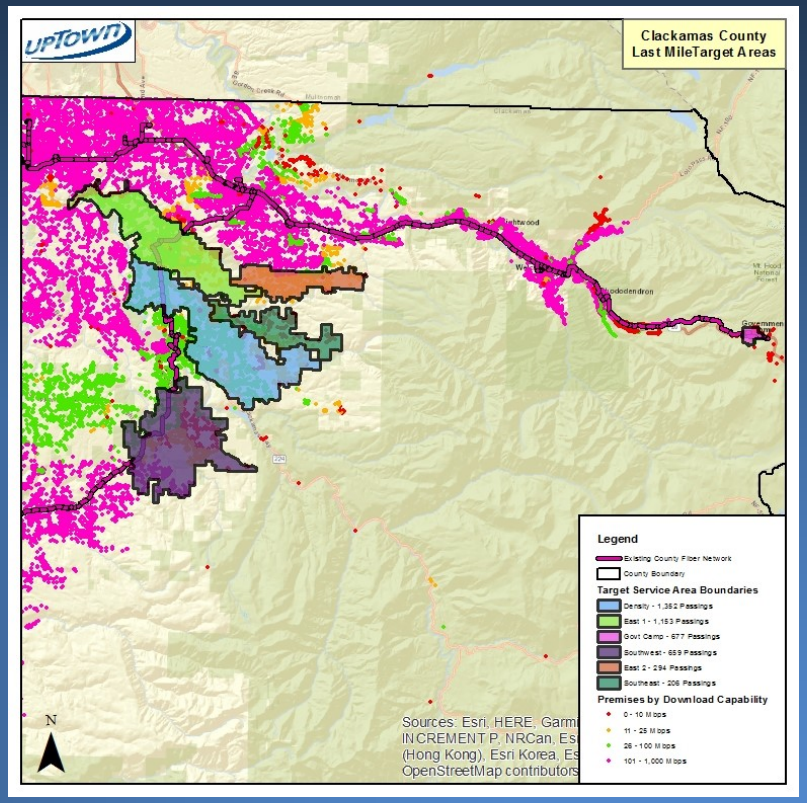
- New underground path creation
  - $20.00 per foot composite for conduit placement (100% boring)
  - $2.00 per foot for 2IN poly conduit in each pathway
  - Per structure adder for all vaults, pedestals and handholes
- Fiber placement
  - $1.50 per foot labor to install fiber cable in new conduit system
  - $1.00 per foot average fiber material cost
- Aerial construction costs
  - $1.50 per foot composite rate to install new messenger in com zone
  - $1.50 per foot to lash each cable to strand in com zone
- Technical services
  - $25 per fusion splice
  - $250 - $450 closure prep for terminals, splice points and feeder taps
- Material pricing assumptions
  - Fiber, terminal and structure pricing based on recent client bids
  - Labor estimates based on recent Colorado mountain region bid results

IDENTIFYING UNDERSERVED AREAS

BROADBAND CAPACITY PER FCC REPORTING



TARGET AREAS FOR FTTP DEPLOYMENT

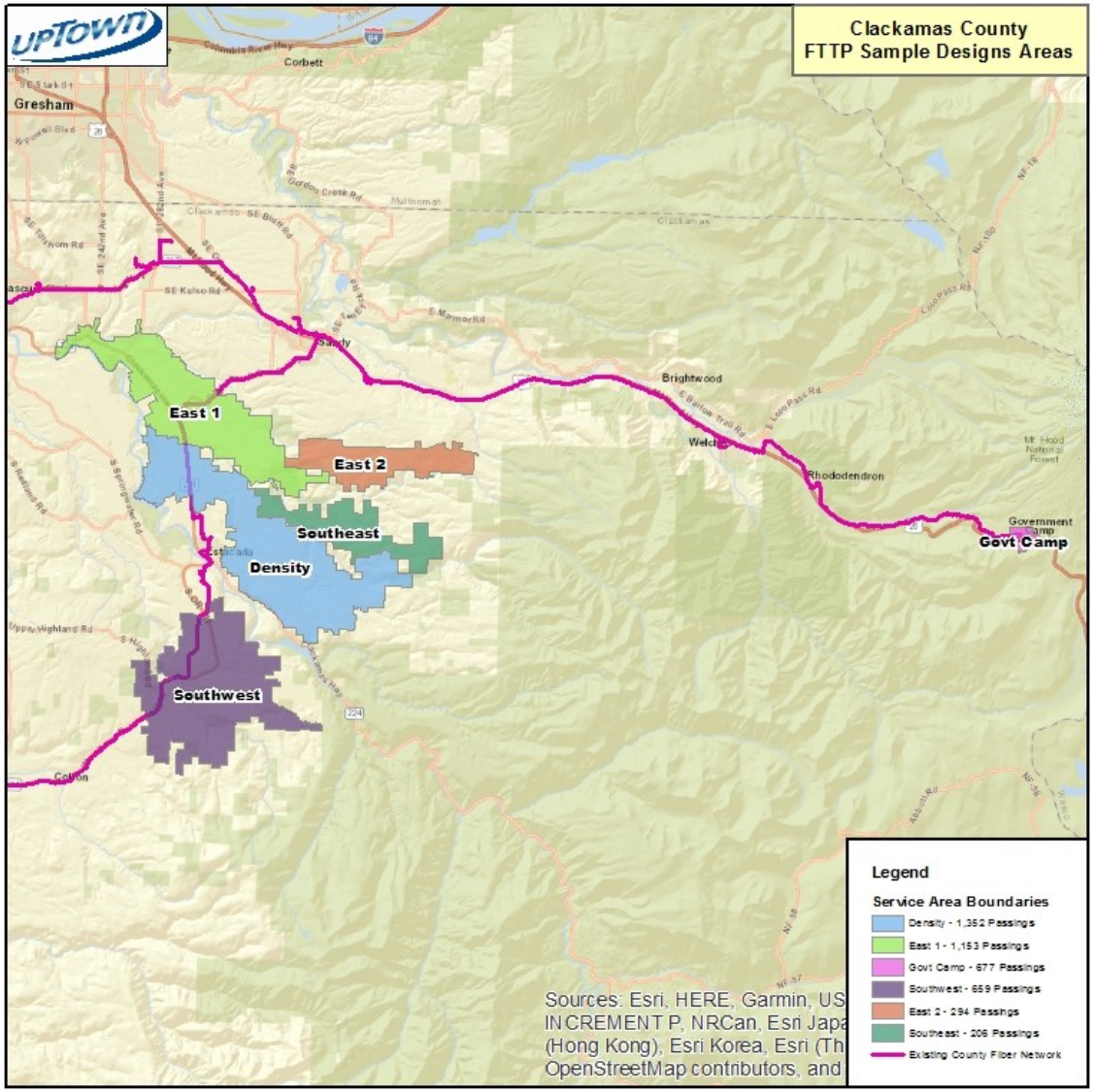


- Targeted last mile service areas focused on underserved locations
- Proximity to existing County fiber network deemed essential for selection
- Any “served” premises on the way to underserved areas would be included

PROPOSED SERVICE AREAS

The proposed service area is comprised of 6 individually evaluated under-served regions. See next slide for demographics.

- Density
  - Premises: 1,352
  - Square Miles: 22.3
- East 1
  - Premises: 1,153
  - Square Miles: 15.8
- Government Camp
  - Premises: 677
  - Square Miles: 0.6
- Southwest
  - Premises: 659
  - Square Miles: 19.0
- East 2
  - Premises: 294
  - Square Miles: 6.7
- Southeast
  - Premises: 206
  - Square Miles: 6.5



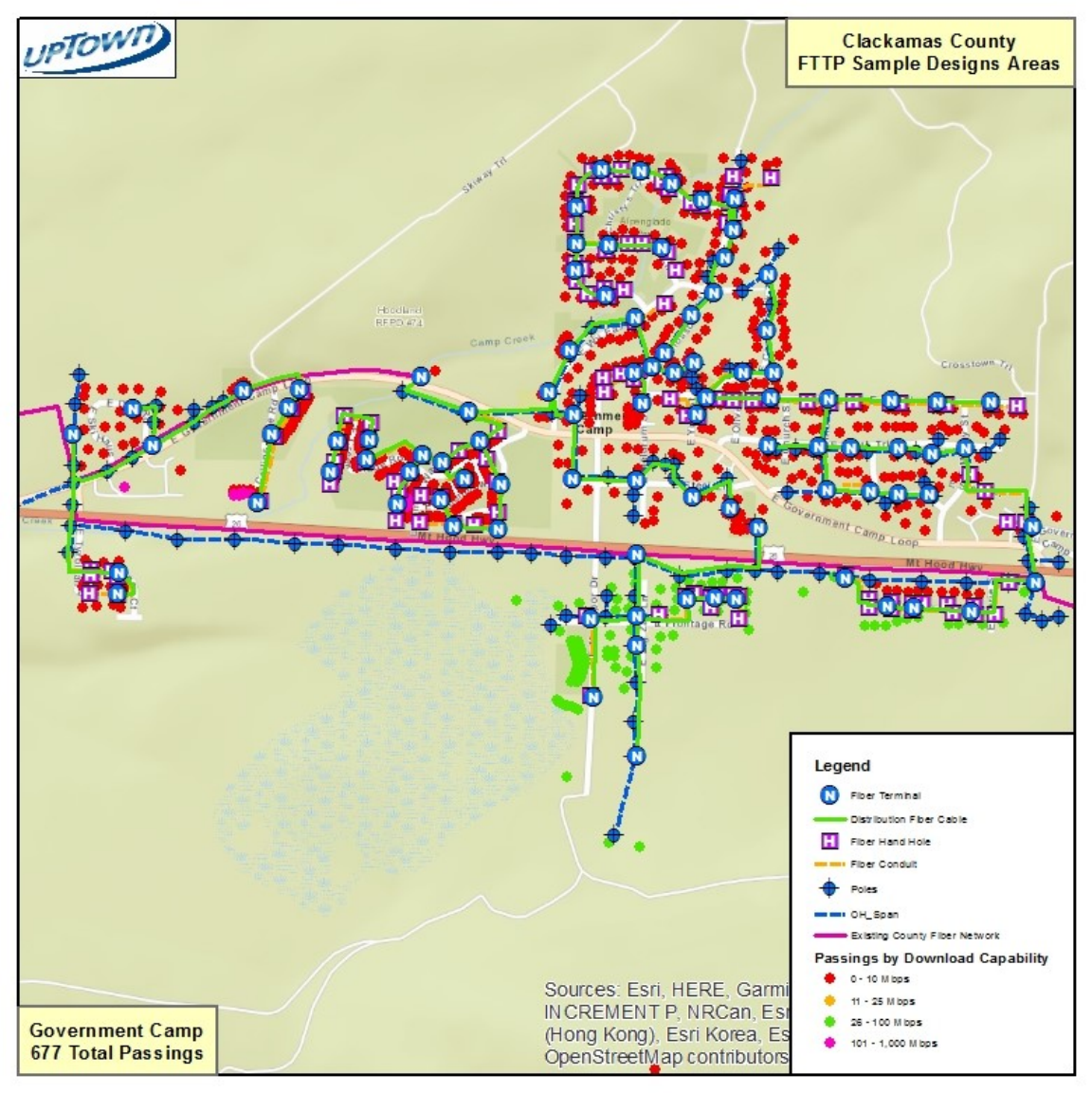
DEMOGRAPHICS

2019 census data on households (HHs) indicates that the proposed service area, when compared to the County, has:

- More residents below poverty, but with similar median HH income
- Older HHs with a lower incidence of school age children at home
- Fewer non-white HHs
- Lower educational attainment

	Tract 235.00	Tract 236.00	Tract 242.00	Tract 243.02	Service Area Average	Sandy	Clackamas County	Variance of Average to Sandy	Variance of Average to County
Median HH Income	$71,711	$82,870	$70,891	$84,715	$77,547	$73,443	$80,484	106%	96%
Persons Below Poverty	8.5%	11.0%	5.7%	18.0%	10.8%	9.5%	8.0%	114%	135%
Bachelors Degree or Higher	15%	29%	19%	18%	20%	19%	37%	106%	54%
Median Age	48.3	48.1	47.3	48.6	48.1	36.2	41.5	133%	116%
Race (White/Other)	5%	14%	5%	8%	8%	17%	19%	47%	42%
HH with School Age Children	26%	36%	32%	23%	29%	49%	38%	60%	77%

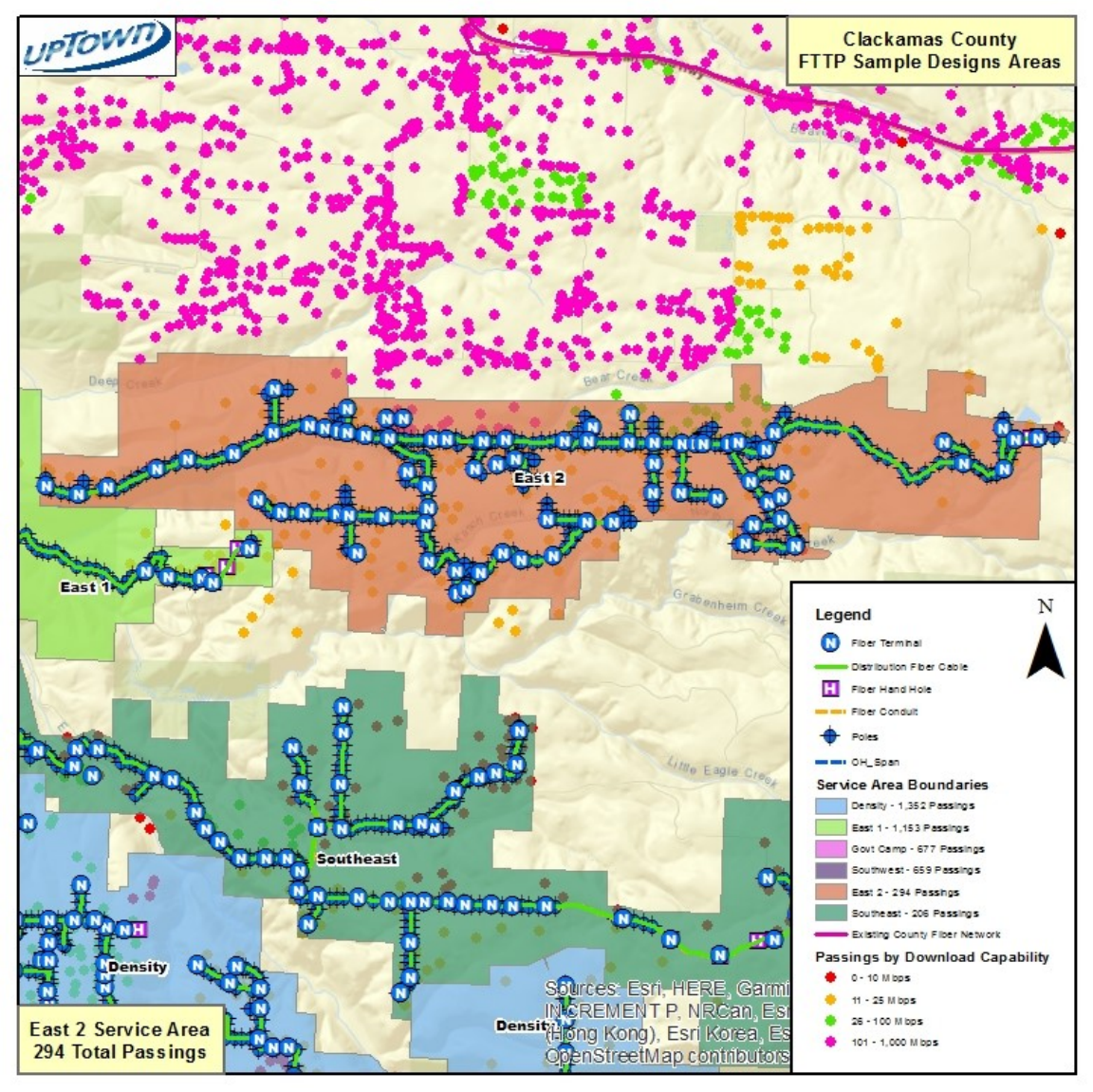
GOVERNMENT CAMP SERVICE AREA



Design Metric	Value
New Aerial Plant Miles	5.1
New Underground Plant Miles	3.4
% Aerial	60%
% UG	40%
Passings	677
Passings per Mile of Plant	80
Materials Cost per Passing	$232
Labor Cost per Passing	$814
Total Cost per Passing	**$1,046**
Total Materials (no drops)	$157,057
Total Labor (no drops)	$550,900
Total Cost	**$707,958**

* - Does not include engineering, fixed equipment, subscriber capital and installation costs.

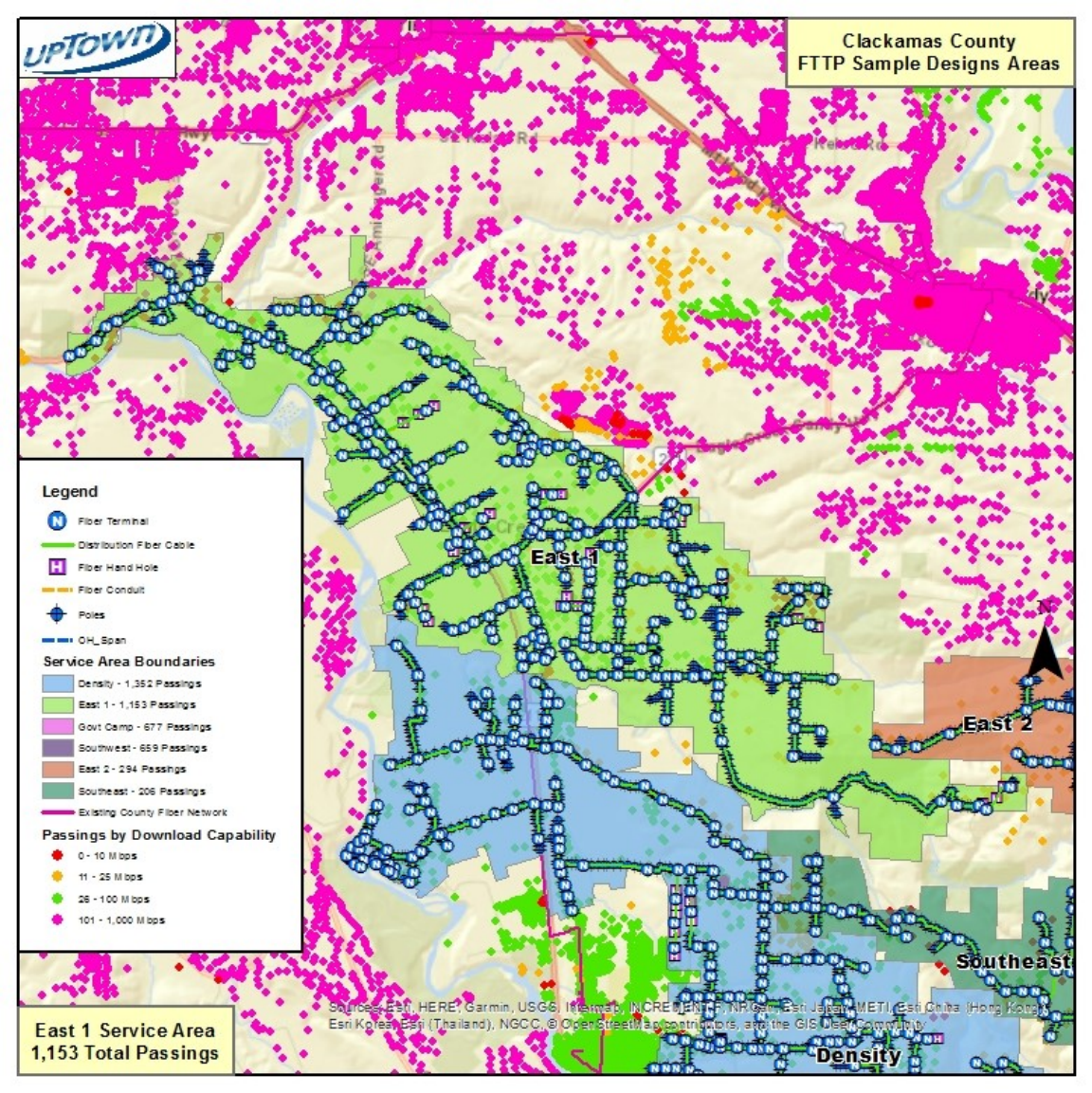
EAST 2 SERVICE AREA



Design Metric	Value
New Aerial Plant Miles	20.7
New Underground Plant Miles	0.2
% Aerial	99%
% UG	1%
Passings	294
Passings per Mile of Plant	14
Materials Cost per Passing	$899
Labor Cost per Passing	$1,379
Total Cost per Passing	**$2,278**
Total Materials (no drops)	$264,299
Total Labor (no drops)	$405,565
Total Cost	**$669,864**

* - Does not include engineering, fixed equipment, subscriber capital and installation costs.

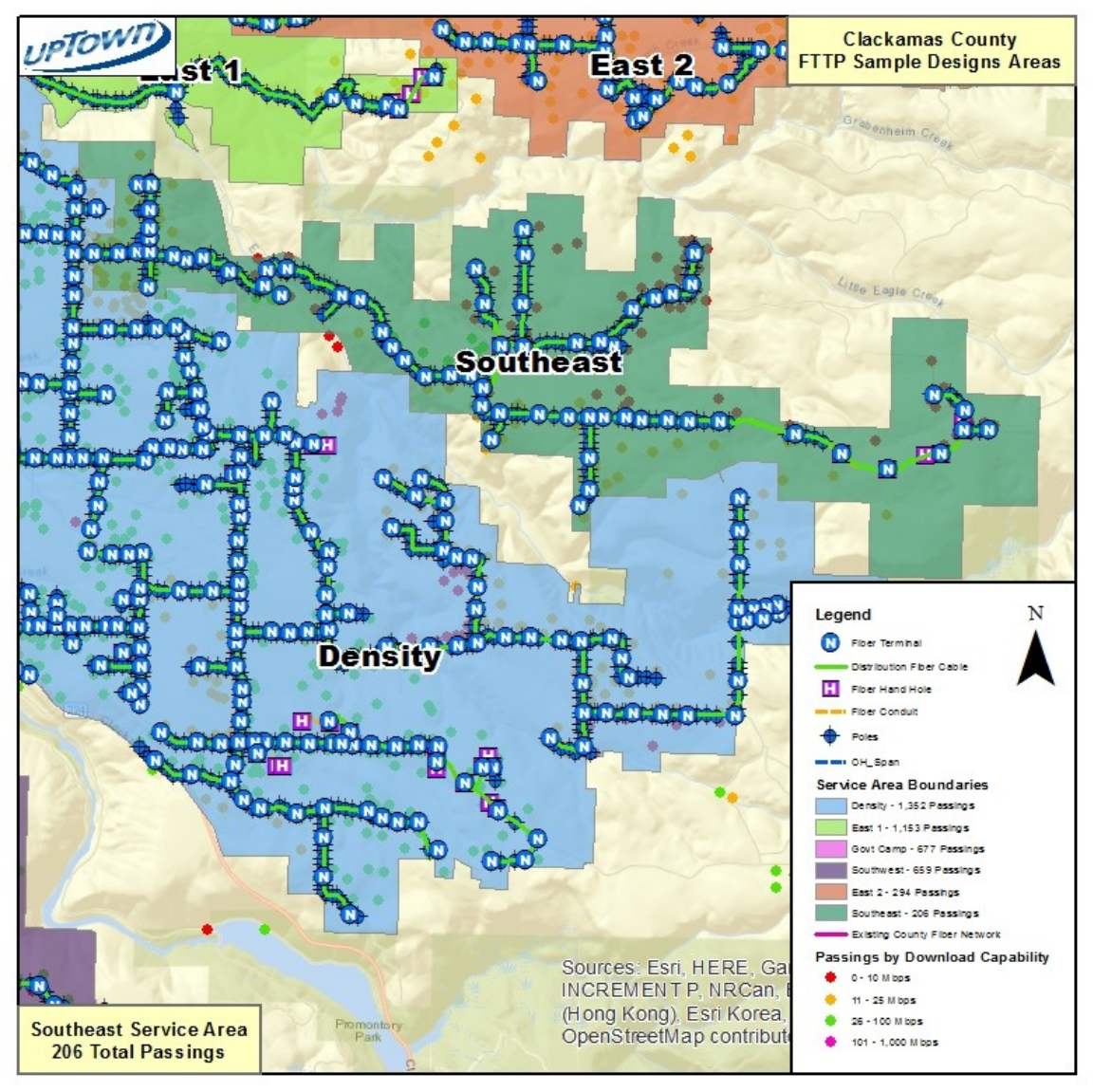
EAST 1 SERVICE AREA



Design Metric	Value
New Aerial Plant Miles	55.7
New Underground Plant Miles	4.3
% Aerial	93%
% UG	7%
Passings	1,153
Passings per Mile of Plant	19
Materials Cost per Passing	$699
Labor Cost per Passing	$1,376
Total Cost per Passing	**$2,075**
Total Materials (no drops)	$806,190
Total Labor (no drops)	$1,586,711
Total Cost	**$2,392,901**

* - Does not include engineering, fixed equipment, subscriber capital and installation costs.

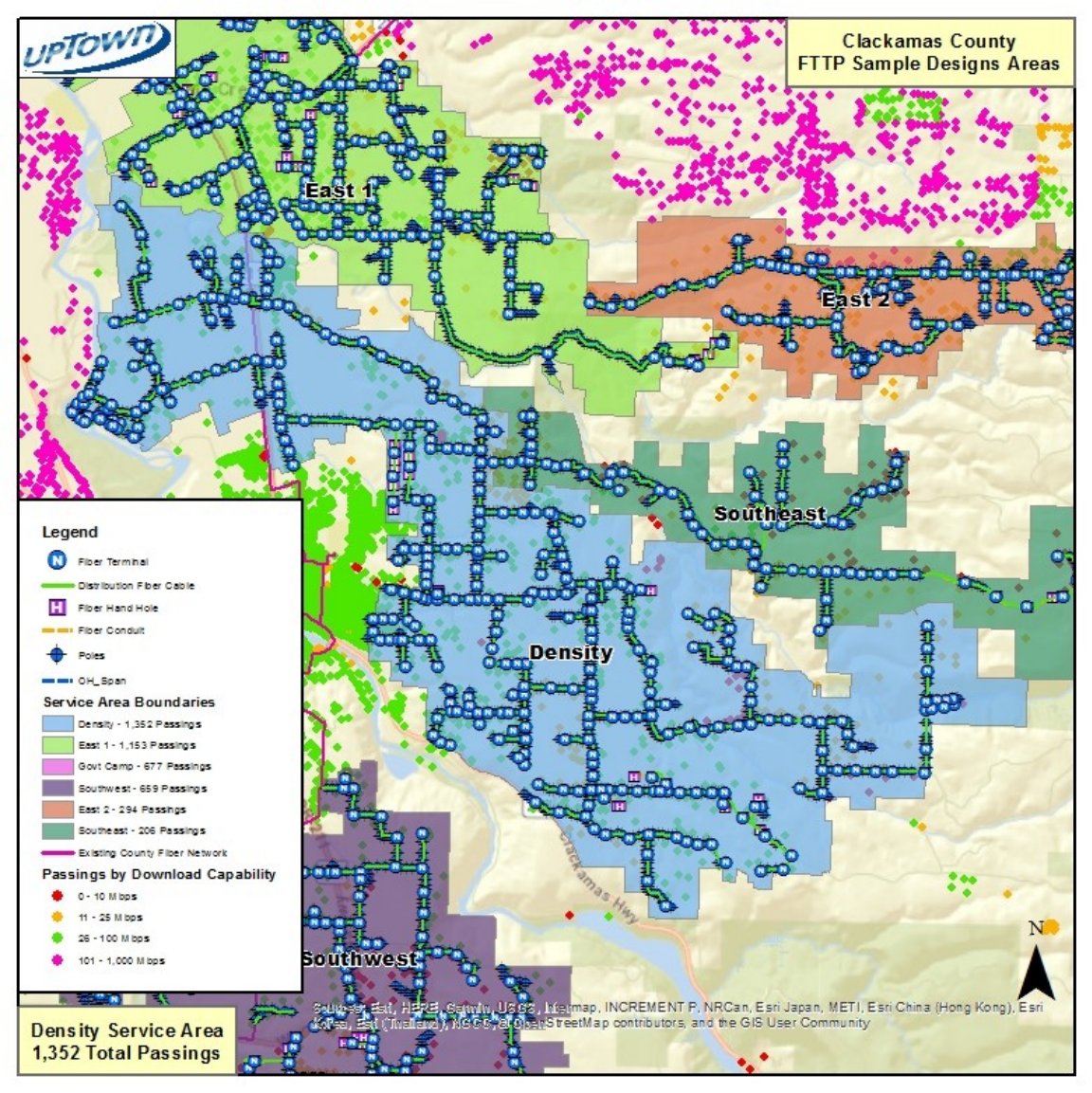
SOUTHEAST SERVICE AREA



Design Metric	Value
New Aerial Plant Miles	12.0
New Underground Plant Miles	2.8
% Aerial	81%
% UG	19%
Passings	206
Passings per Mile of Plant	14
Materials Cost per Passing	$1,063
Labor Cost per Passing	$2,894
Total Cost per Passing	**$3,957**
Total Materials (no drops)	$218,999
Total Labor (no drops)	$596,224
Total Cost	**$815,223**

* - Does not include engineering, fixed equipment, subscriber capital and installation costs.

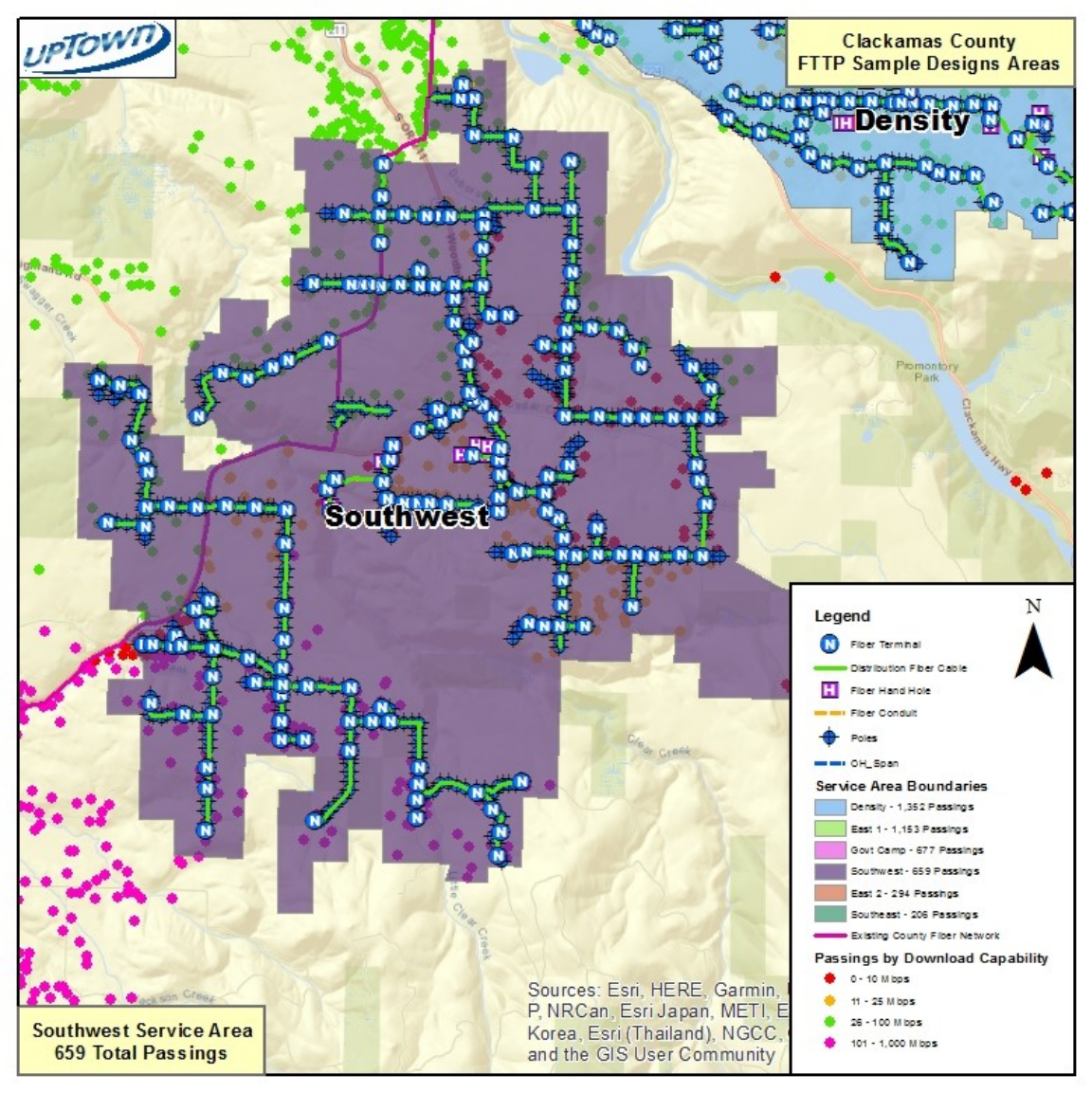
DENSITY SERVICE AREA



Design Metric	Value
New Aerial Plant Miles	61.4
New Underground Plant Miles	4.4
% Aerial	93%
% UG	7%
Passings	1,352
Passings per Mile of Plant	21
Materials Cost per Passing	$682
Labor Cost per Passing	$1,311
Total Cost per Passing	**$1,993**
Total Materials (no drops)	$922,419
Total Labor (no drops)	$1,772,652
Total Cost	**$2,695,071**

* - Does not include engineering, fixed equipment, subscriber capital and installation costs.

SOUTHWEST SERVICE AREA



Design Metric	Value
New Aerial Plant Miles	40.4
New Underground Plant Miles	0.3
% Aerial	99%
% UG	1%
Passings	659
Passings per Mile of Plant	16
Materials Cost per Passing	$825
Labor Cost per Passing	$1,243
Total Cost per Passing	**$2,068**
Total Materials (no drops)	$543,849
Total Labor (no drops)	$818,893
Total Cost	**$1,362,742**

* - Does not include engineering, fixed equipment, subscriber capital and installation costs.

CONSTRUCTION COST SUMMARY

Proposed Service Areas	New OH Miles	NewUG Miles	Passings	Passings per New Mile of Plant	Weight	Materials per Passing	Labor per Passing	Total per Passing
Govt Camp	5.1	3.4	677	80	16%	$232	$814	$1,046
East 2	20.7	0.2	294	14	7%	$899	$1,379	$2,278
East 1	55.7	4.3	1,153	19	27%	$699	$1,376	$2,075
Southeast	12.0	2.8	206	14	5%	$1,063	$2,894	$3,957
Dense	61.4	4.4	1,352	21	31%	$682	$1,311	$1,993
Southwest	40.4	0.3	659	16	15%	$825	$1,243	$2,068
Overall	**195.3**	**15.5**	**4,341**	**21**	**100%**	**$671**	**$1,320**	**$1,991**

- Proposed service areas made up of most underserved areas in the County
- Total fiber mileage estimated to be 210.8 miles

Pro Forma Analysis

Wholesale Model: Dark Fiber (status quo)

DARK FIBER MODEL OVERVIEW

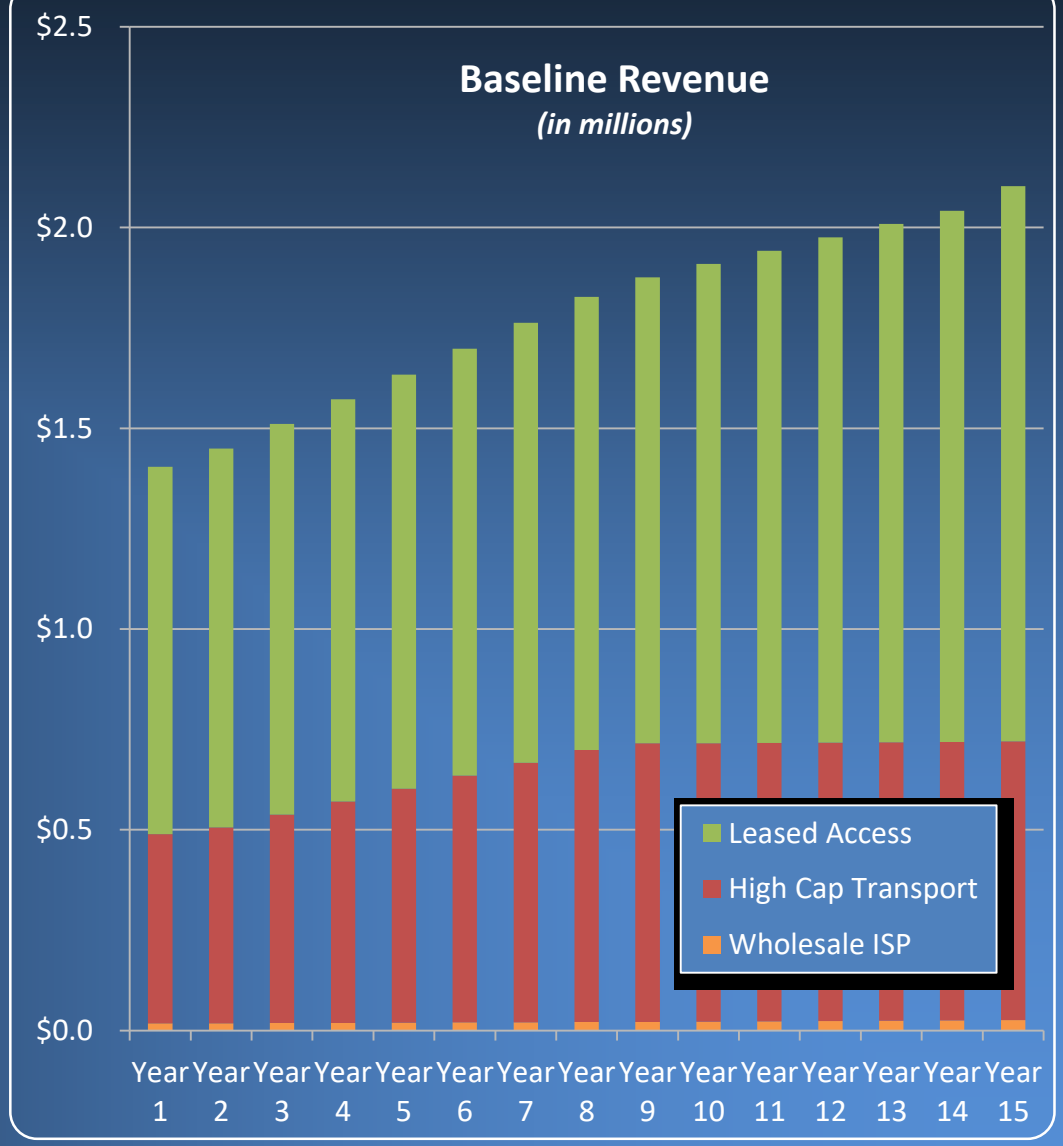
- Services set reflect status quo offerings
  - Leased Access Connections
    - Dark fiber leases to both County and non-County public entities
    - Pricing is $255/fiber pair
    - Currently 299 connections
    - Budget classification is ‘County or Non-County Revenue’
  - High Capacity Transport
    - Dark fiber leases to non-public entities
    - Pricing is distance sensitive and averages $925/month/connection
    - Currently 42 connections
    - Budget classification is ‘Commercial’
  - Wholesale ISP Connections
    - Wholesale access provided to an ISP retailer (SandyNet)
    - Pricing is $40.95/month/end-user connection (local loop)
    - Currently 36 end-user connections
    - Budget classification is ‘ISP Revenue’

DARK FIBER REVENUES

KEY INPUTS

- Premises
  - Residential: 0
  - Commercial: 5,000*
  - % Complex: 5%
- Commercial Accounts - Year 1/5/10
  - Leased Access: 299/337/390/
  - High Cap Transport: 42/54/63
  - Wholesale ISP: 36/41/45
- Commercial Services Pricing
  - Leased Access: $255/month
  - High Cap Transport: Avg. $925/mo./connection
  - Wholesale ISP: $41/mo./connection
- Install Fees
  - Pass-through of construction costs as non-recurring fee

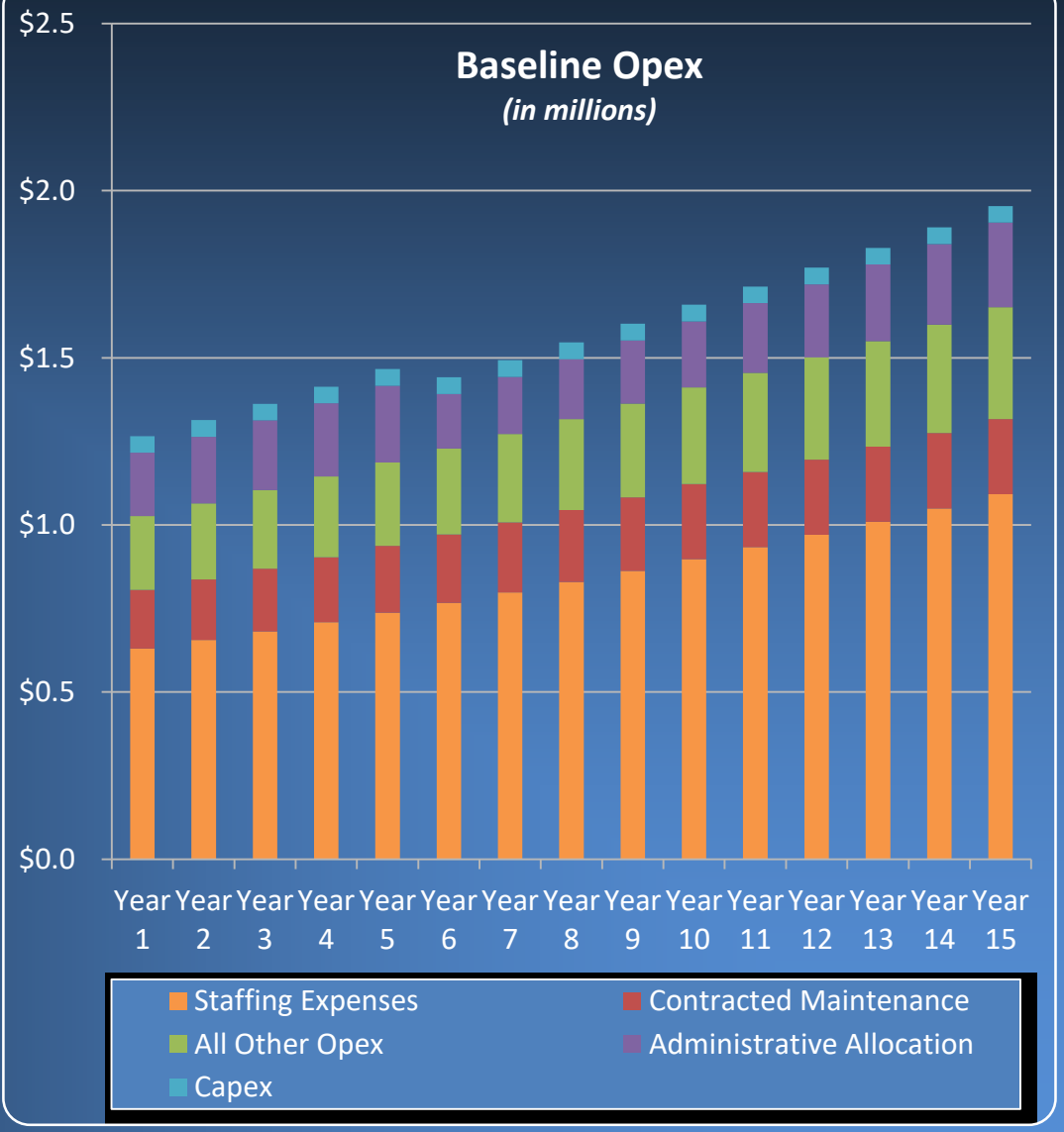
** Within 1,000 feet of fiber backbone*



DARK FIBER OPERATING & CAPITAL EXPENSE

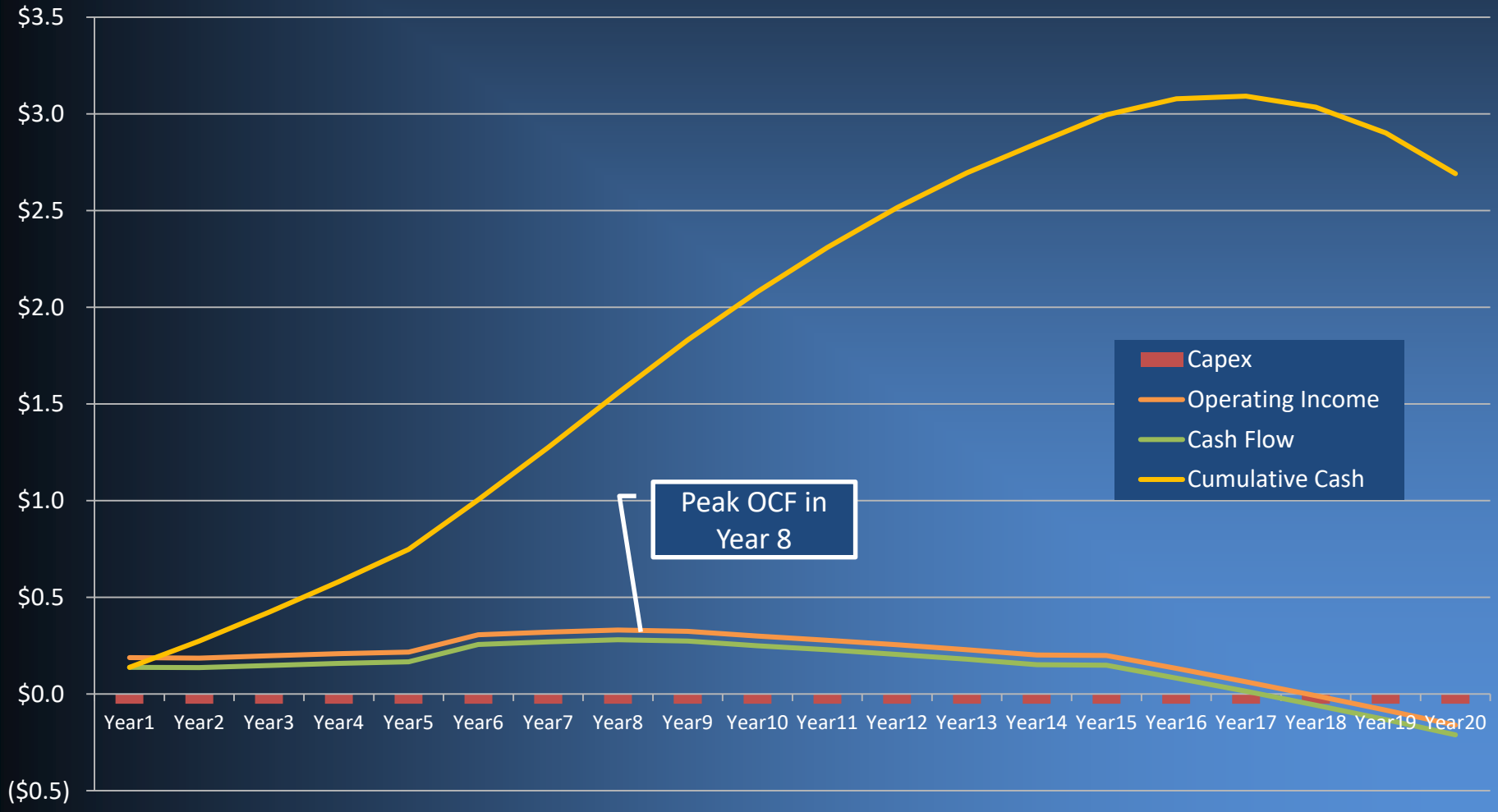
KEY INPUTS

- Staffing
  - Duke, Scott, and 2 new Field Techs
  - Overtime/On-call is $57k in Yr1
  - 4% annual wage and overtime increases
  - 59% benefits loading
- Contracted Maintenance
  - $175k (Yr1)
  - Grows to $225k by Yr10
- Administrative Allocation
  - $128k (Yr1)
  - 5% annual increase
- Construction Fund Reimbursement
  - $62k (Yr1)
  - 5.0% annual increase
  - Final payment in FY 25/26
- Pole Attachment
  - Not included
- All Other Opex
  - $221k (Yr1)
  - 3% annual increase
- Capex
  - $50k annually



DARK FIBER CASH FLOW ($M)

Because operating expenses are growing faster than forecasted revenue, the operating cash flow (OCF) peaks in Year 8, but Uptown would anticipate that CBX can beat the long-term Dark Fiber model revenue forecast through incremental fiber lateral extension opportunities

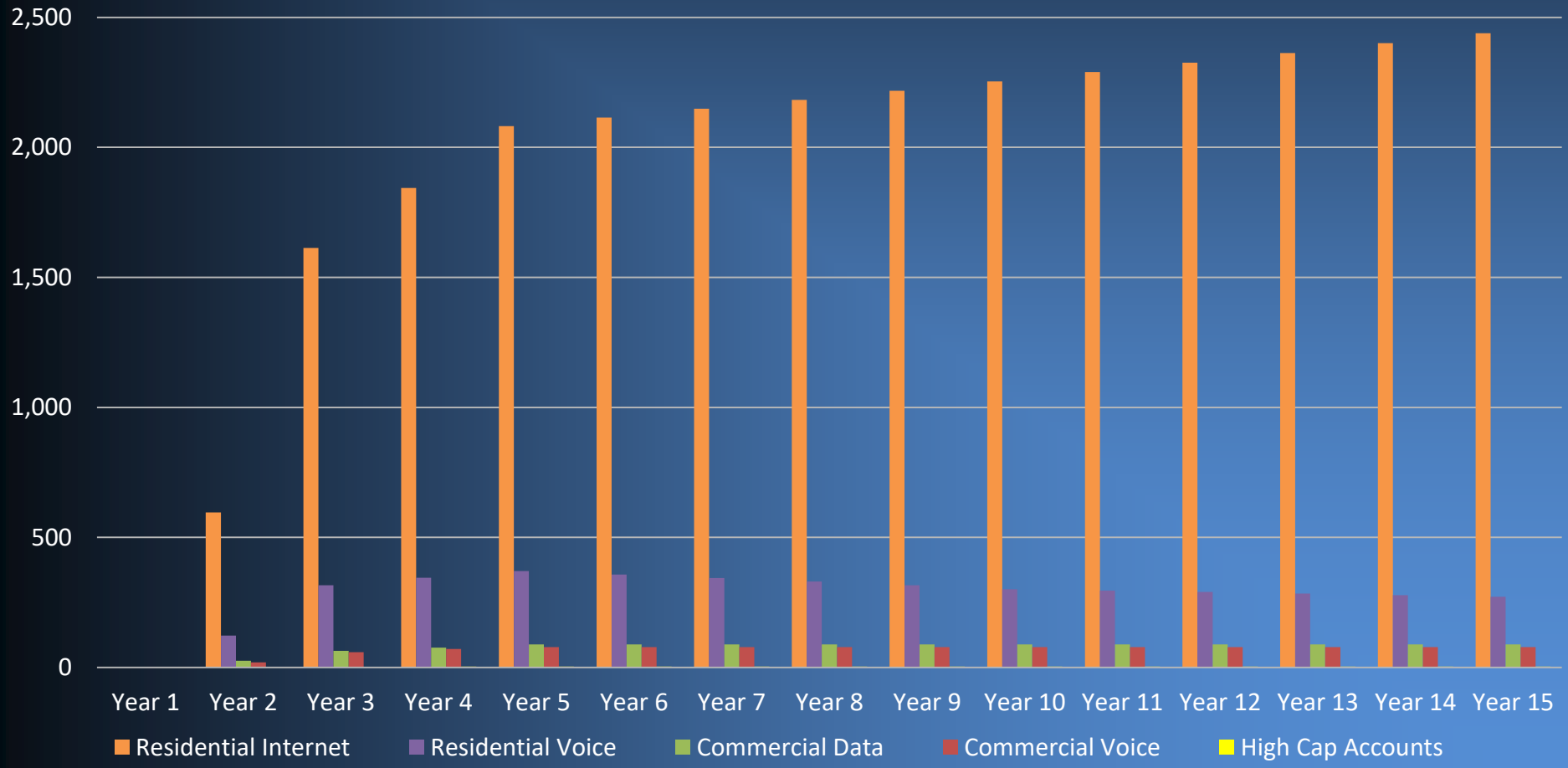


Pro Forma Analysis

Retail Model: Own & Operate

SUBSCRIBER FORECAST

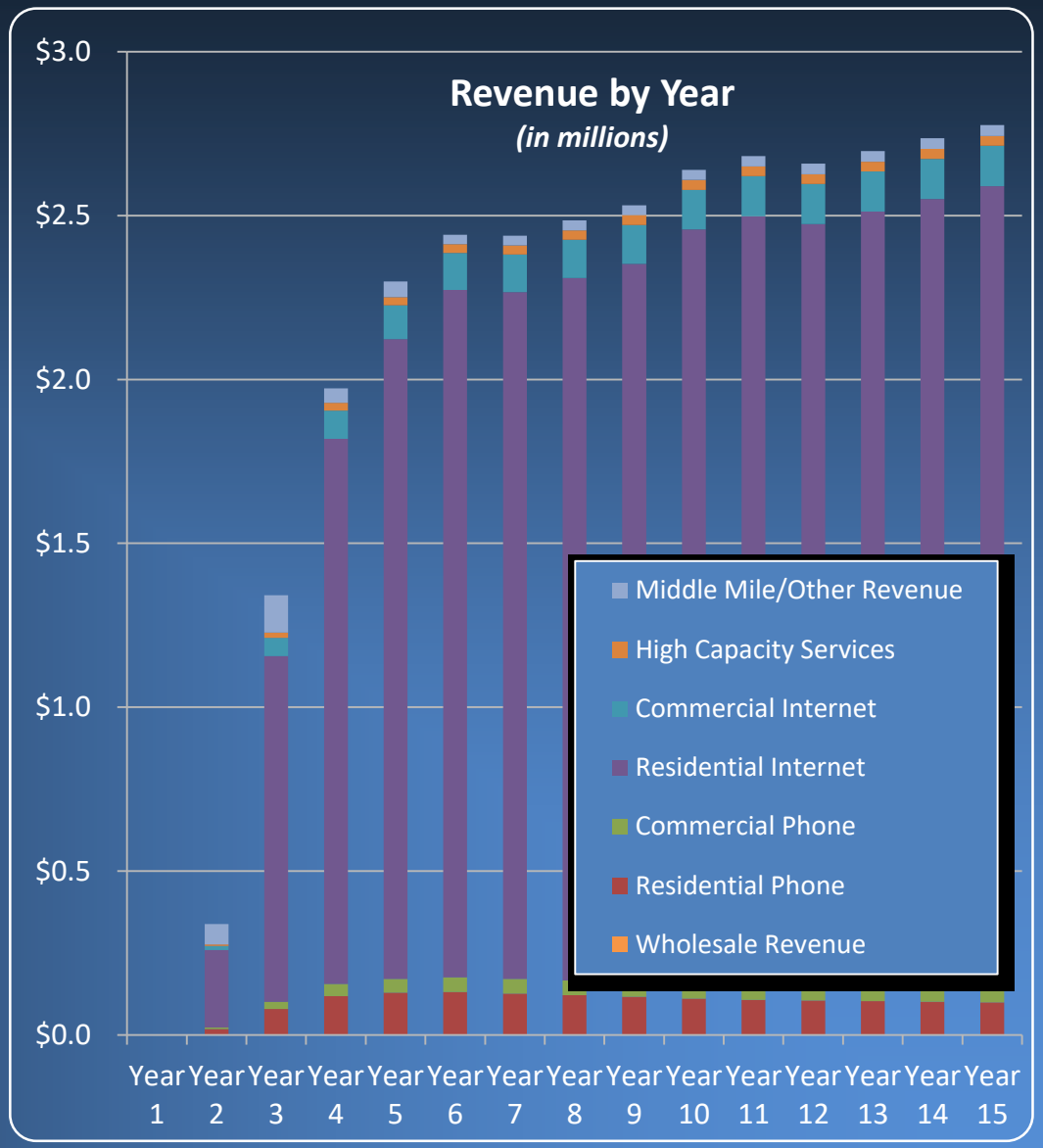
The subscriber forecast is based upon the take rate analysis presented in the Business Plan Report and reflects Uptown's Likely Scenario take rate in an underserved rural area. The subscriber forecast remains constant over all business models being evaluated, but does remain dependent upon final retail price levels set by the ISP under Wholesale models



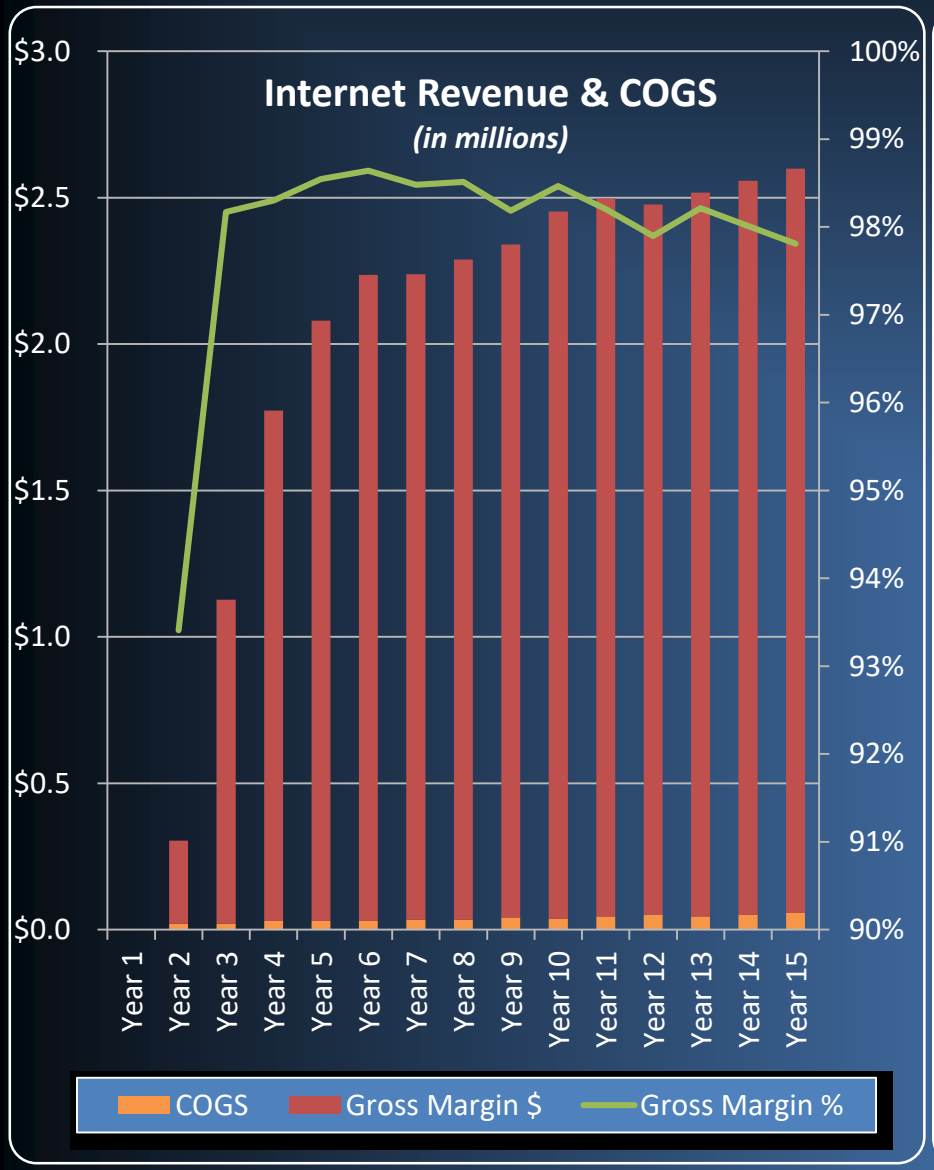
REVENUES

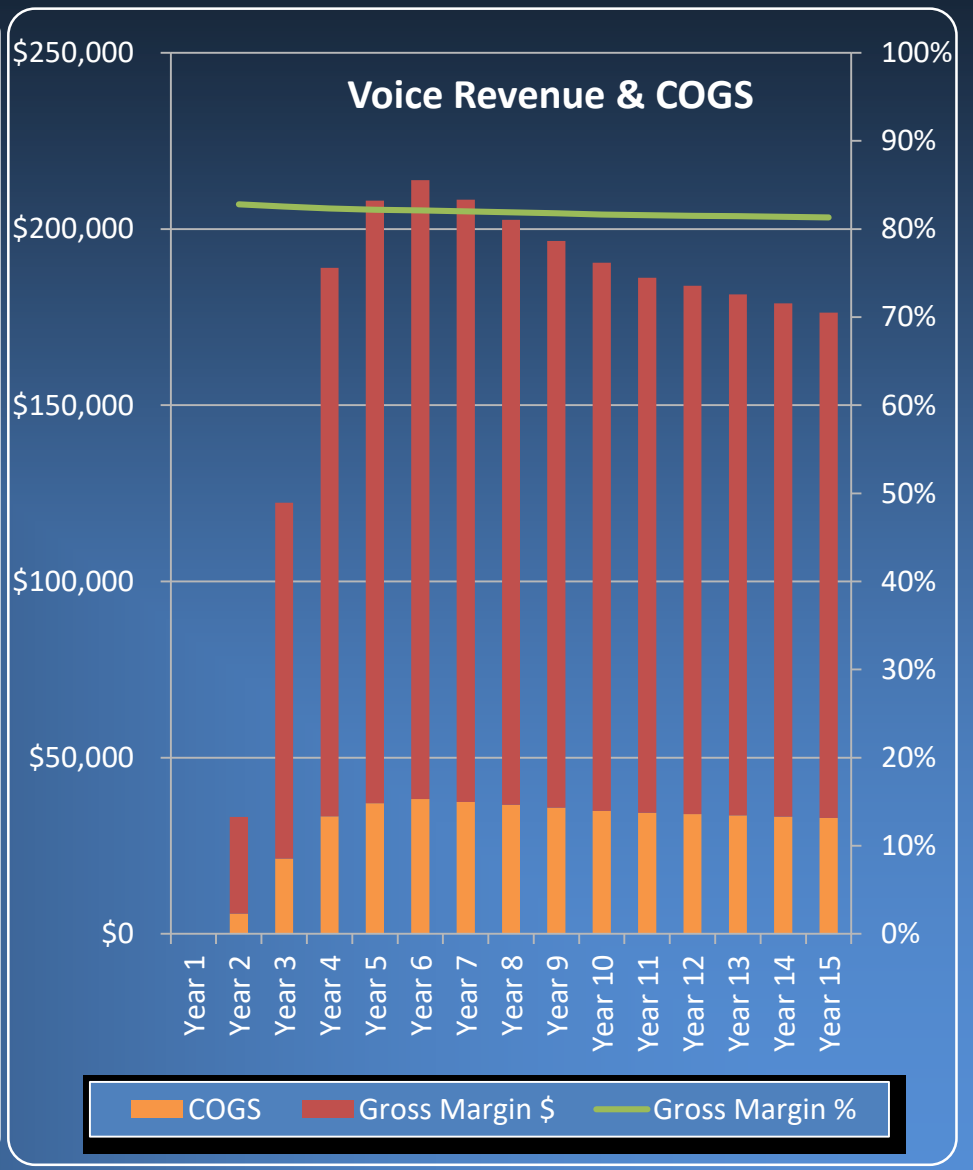
KEY INPUTS

- Timing
  - Year 1: 0 months
  - Year 2: 10 months
- Premises
  - Residential: 4,341
  - Commercial: 217
  - % Complex: 5%
- Year 5 Penetration
  - Internet: 45.0%
  - Voice (eroded): 8.0%
- Residential Internet
  - Affordable Internet: $10
  - 1Gbps Tier: $70
  - 2Gbps Tier: $100
  - 4Gbps Tier: $150
  - WiFi Upgrade: $10
- Commercial Internet
  - 50Mbps Tier: $80
  - 100Mbps Tier: $130
  - 250Mbps Tier: $250
  - 500Mbps Tier: $400
  - WiFi Upgrade: $20
- Voice
  - Residential: $30 net wholesale
  - Commercial: $19 net per line
- Install Fees
  - Residential: $100
  - Commercial: $100



COGS & GROSS MARGIN

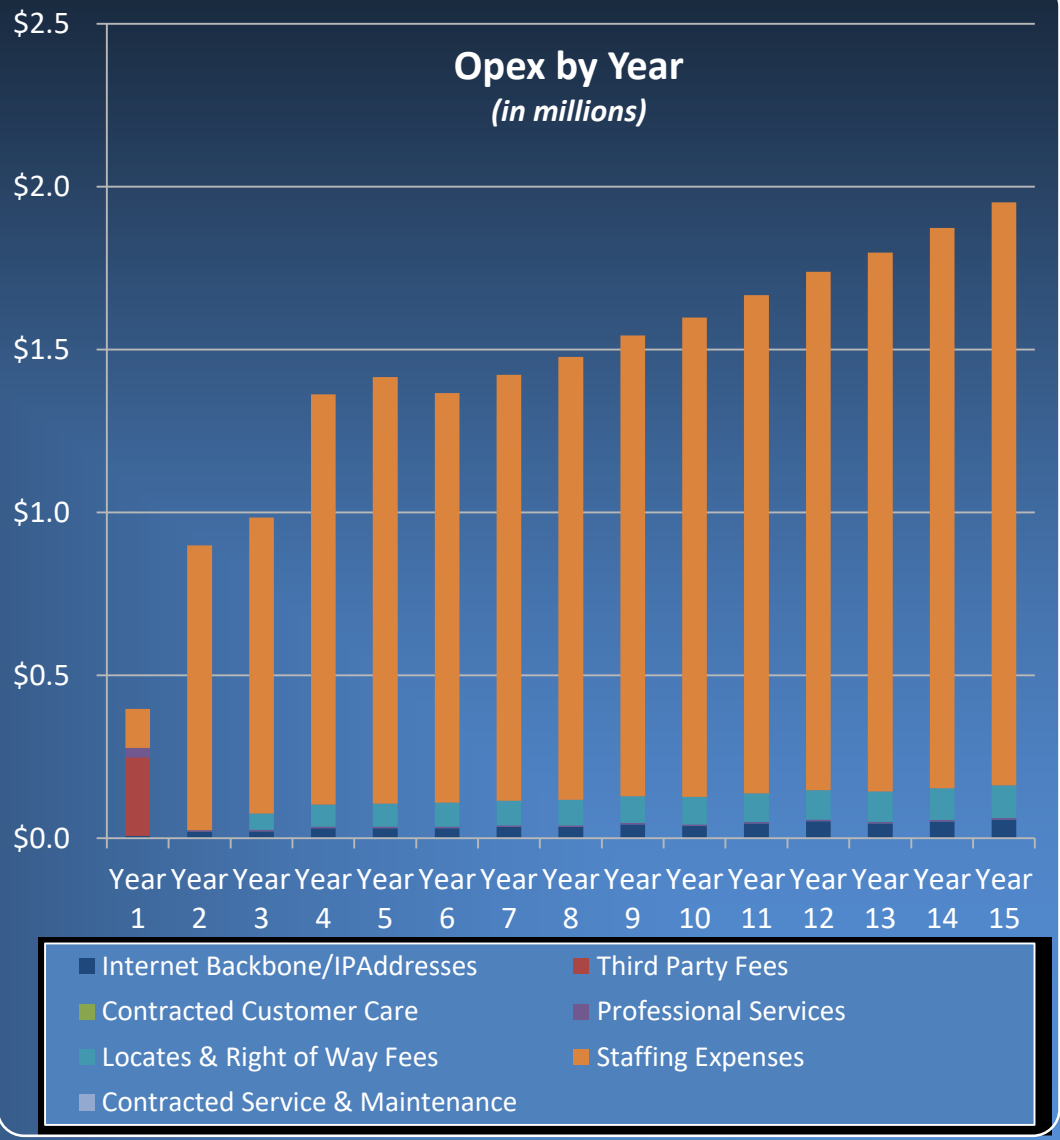




OPERATING EXPENSE

KEY INPUTS

- Bandwidth/IP Addresses
  - 2 fiber circuits to Pittock (no cost)
  - Bandwidth quoted at $.11/Meg (Yr1). Forecast at $.06/Meg (Yr10)
  - X-Connect fee at Pittock of $300 ea.
  - Allocated bandwidth starting at 3.0M (res) and 1.5M (com) per user
  - IPv4 lease fee of $.50/address/mo.
- Staffing *(see slide detail)*
  - 13 total Full Time Equivalent, with 11 incremental FTE to current CBX
  - 2 CBX Techs remain 100% middle mile
  - 4% annual wage increase
  - 59% benefits loading
- Vehicle Maintenance
  - 15k miles annually per vehicle
  - $.75/mile growing at 4%
- Professional Services
  - Implementation: $240k
  - Legal/Acct: $30k (Yr1)/$5k (Yr2+)
- Other Opex
  - ROW Fees: $17/pole/year (Yr3+)
  - Vendor maintenance of $55k/year for OSS/BSS and FTTP electronics
  - $20k/year for utilities



INCREMENTAL BROADBAND FTE REQUIRED

Based upon our experience working with public entities that have deployed and operate last-mile FTTP systems, Uptown forecasts growing Full Time Equivalent (FTE) headcount to 14 under the Retail Own & Operate model, with all but two of these positions being incremental hires

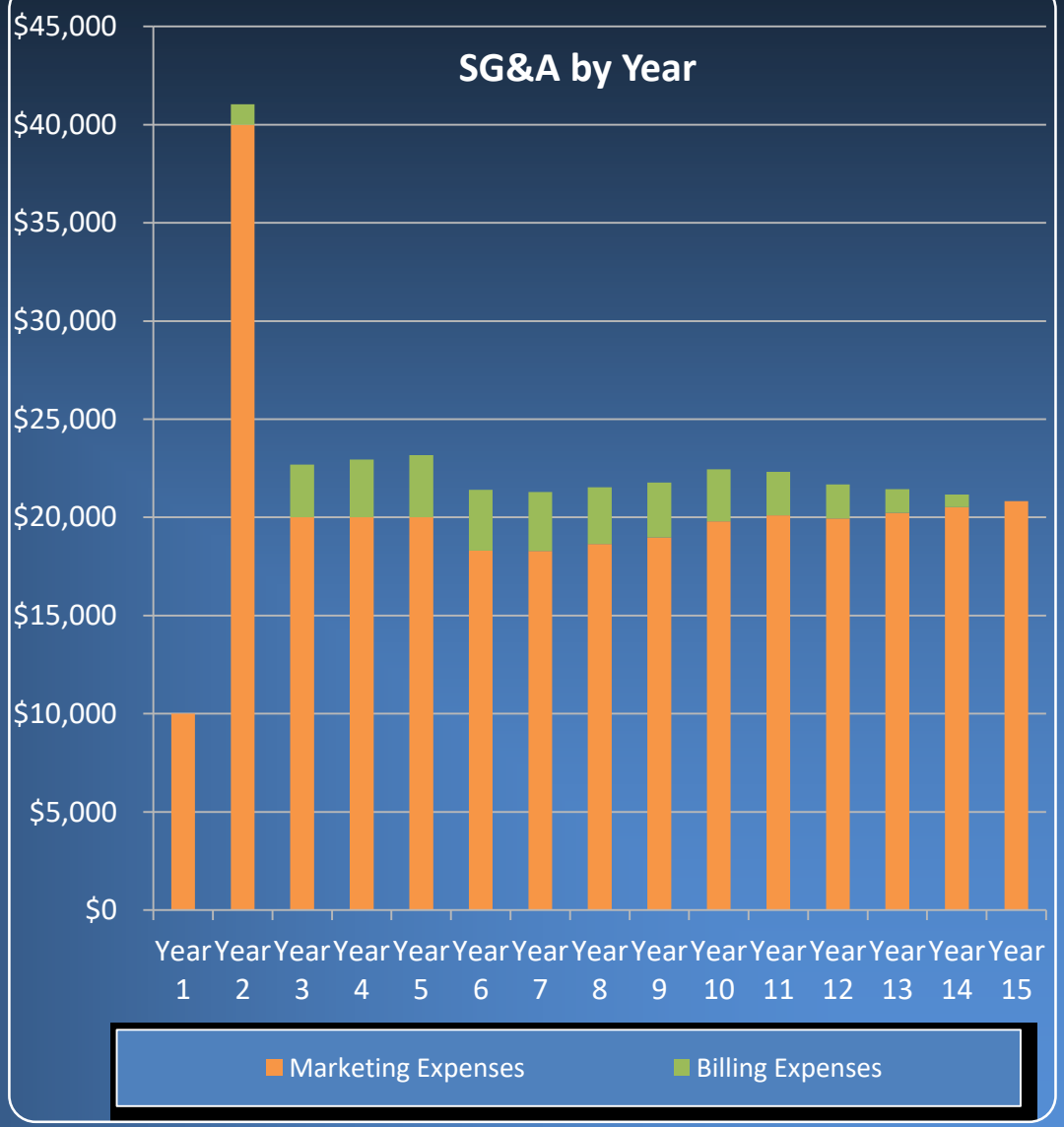
Position Title	Salary (unloaded)	Year1	Year2	Year3	Year4	Year5	Year6	Year7
System GM*	$115,000	1	1	1	1	1	1	1
Marketing Coordinator	$55,000		1	1	1	1	1	1
MDU/Comm. Account Manager	$75,000	1	1	1	1	1	1	1
Data Tech*	$110,000	1	1	1	1	1	1	1
CSRs	$50,000		3	3	3	3	3	3
TSRs	$60,000		2	2	2	2	2	2
Install Techs	$55,000				2	2	1	1
Maintenance Techs	$67,000		1	1	2	2	2	2
Service Techs	$54,000		1	1	1	1	1	1
Total Headcount		**3**	**11**	**11**	**14**	**14**	**13**	**13**

* Not incremental headcount to current CBX and included in Dark Fiber Model pro forma.

SALES, GENERAL, & ADMINISTRATIVE

KEY INPUTS

- Marketing
  - Year 1: $10k
  - Year 2: $40k
  - Years 3-5: $20k/year
  - Year 6+: 0.75% of revenues
- Billing
  - 80% of residential customers on paperless billing (Yr1) growing to 100% (Yr15)
  - 100% of commercial customers on paperless billing (Yr1+)
  - Paper bill cost of $.75/each/month and growing 3% annually



CAPITAL

- Network Construction
  - OSP Construction: $1,991 composite cost per passing
  - Subsequent plant extensions: $ 1,000 /passing
  - FTTP Optical Line Terminals: $100/passing
  - Backbone/Feeder cost: $25/passing
  - Year 10 Network electronics upgrade: $75/premise passed
  - Make ready cost per pole: $250
- Facility Capital Costs
  - No incremental capex
- Back Office Systems (OSS/BSS)
  - OSS/BSS: $200k
  - Fiber Management & Network Management: $50k
- Backup Power
  - Generator w/ UPS: $25k
- Fixed Equipment
  - Core data switch: $200k
  - Internet systems back office: $100k
  - Splice Trailer/Field Tech Equipment/Tools: $98k

CAPITAL (CONT.)

- Vehicles
  - Service Vans Per Install Technician: 1.0
  - Heavy Service Trucks Per Maintenance Technician: 0.5
  - Service vans: 3 at $30k each
  - Heavy Service Trucks (non-insulated): 1 at $120k each
  - Install Rigs: 1 per Install or Service Technician at $20k each
  - Vehicles replaced at 6 year intervals
- Contract Labor
  - Pre-Installs: 100% of Years 1-3 at $350 each
  - Premise Installs: 100% of Years 1-3 at $250 each
- Optical Network Terminals (ONTs)
  - Without WiFi: $95
  - With WiFi Data Only: $200
  - With WiFi Data and Voice: $245
  - Multi-Gig with WiFi: $385
  - Year 7 ONT upgrade: $90k ($40/ea.)
- Fiber Drop & Powering
  - Fiber drop and connectors: $125 each
  - Power cord and UPS: $52 each ($12 for non-voice install without UPS

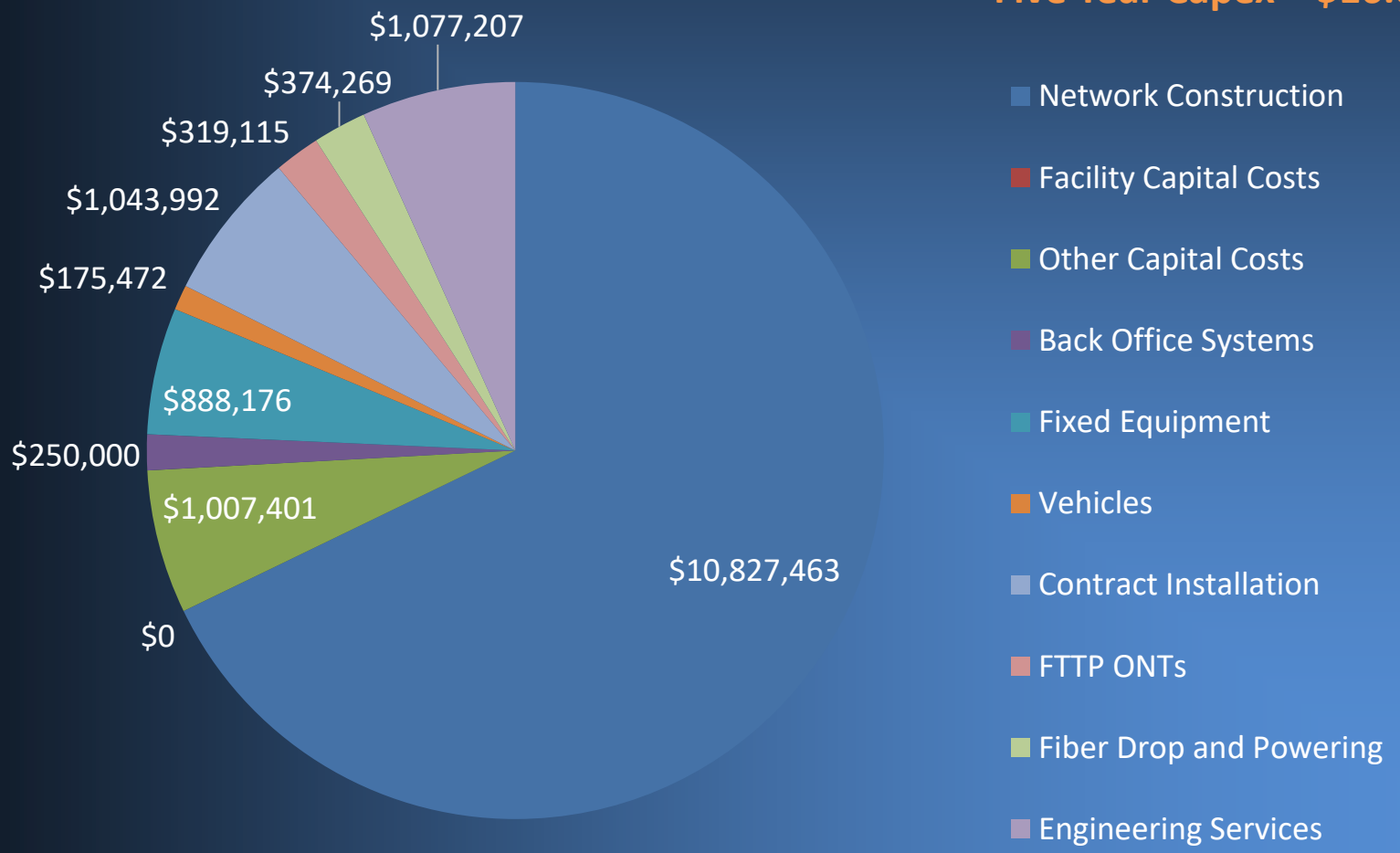
CAPITAL (CONT.)

- Engineering and Integration
  - Walk out & strand mapping: $500 per mile
  - Make ready engineering: $1,000 per mile
  - FTTP design: $3,000 per mile
  - Construction management services: $4,449 per mile (equates to $150/hour)
  - As-built drawings: $250 per mile
  - Backbone/Feeder design: $250 per mile

CAPEX BY TYPE: YEARS 1-5

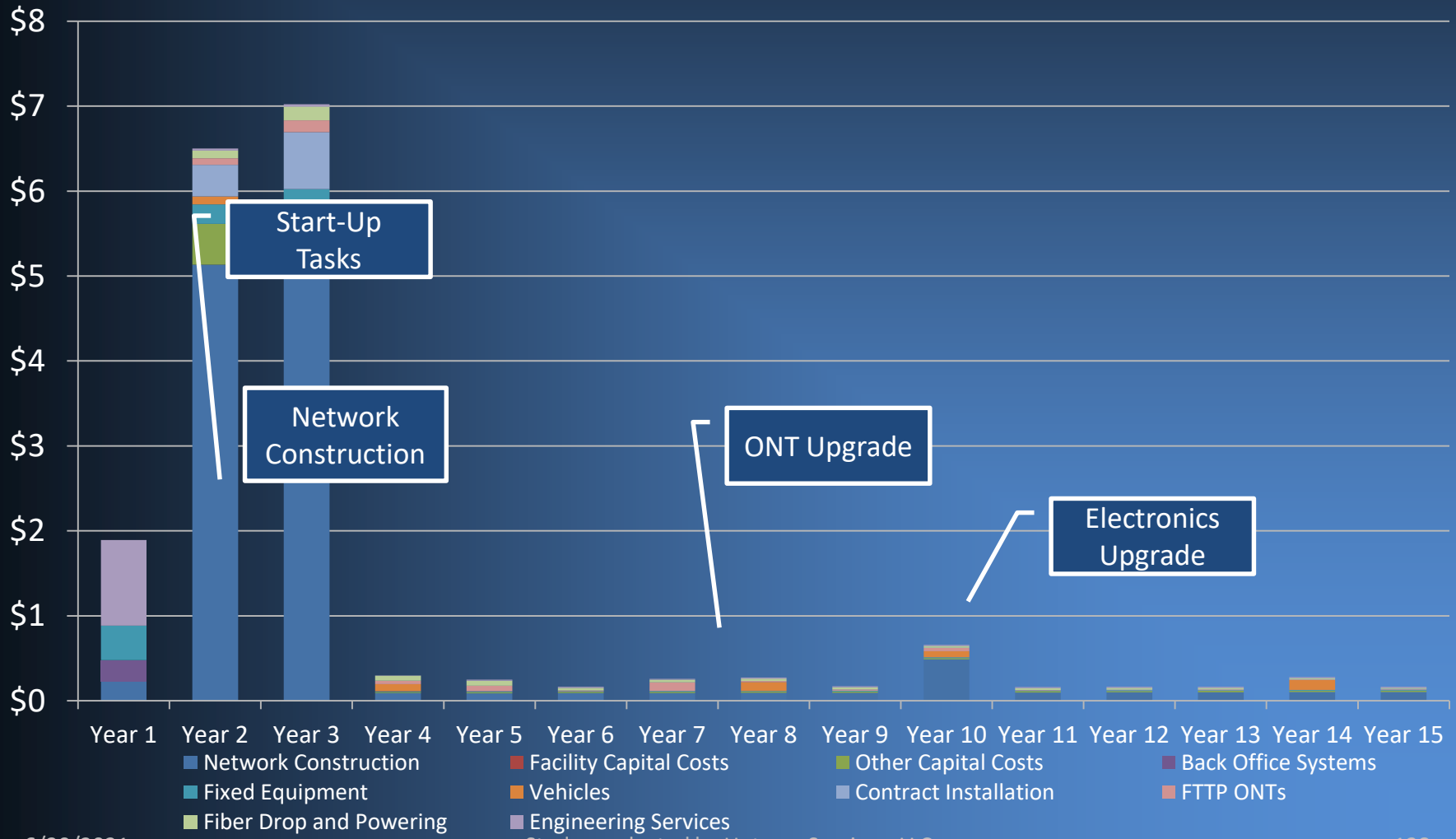
Fully two-thirds of the 5 year capex requirement is due to outside plant construction, primarily composed of the labor cost to install aerial and underground conduit and fiber. This capex requirement is the primary driver of the long-term bond amount required to fund FTTP

Five Year Capex = $16.0M



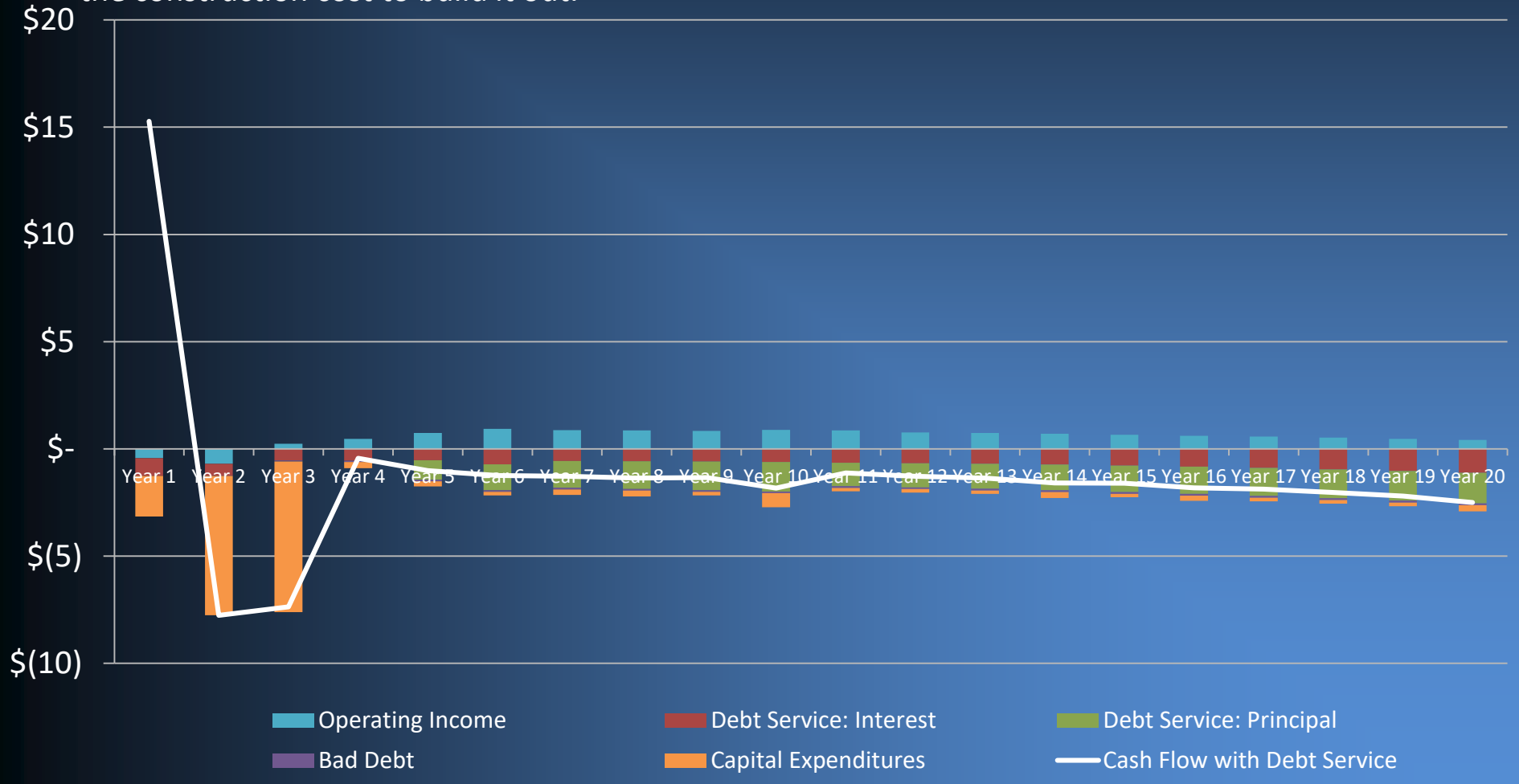
CAPEX BY YEAR ($M)

Capex spending is front-end loaded during the start-up and construction phases of the project, but the pro forma also includes incremental capex for electronics upgrades in Years 7 and 10



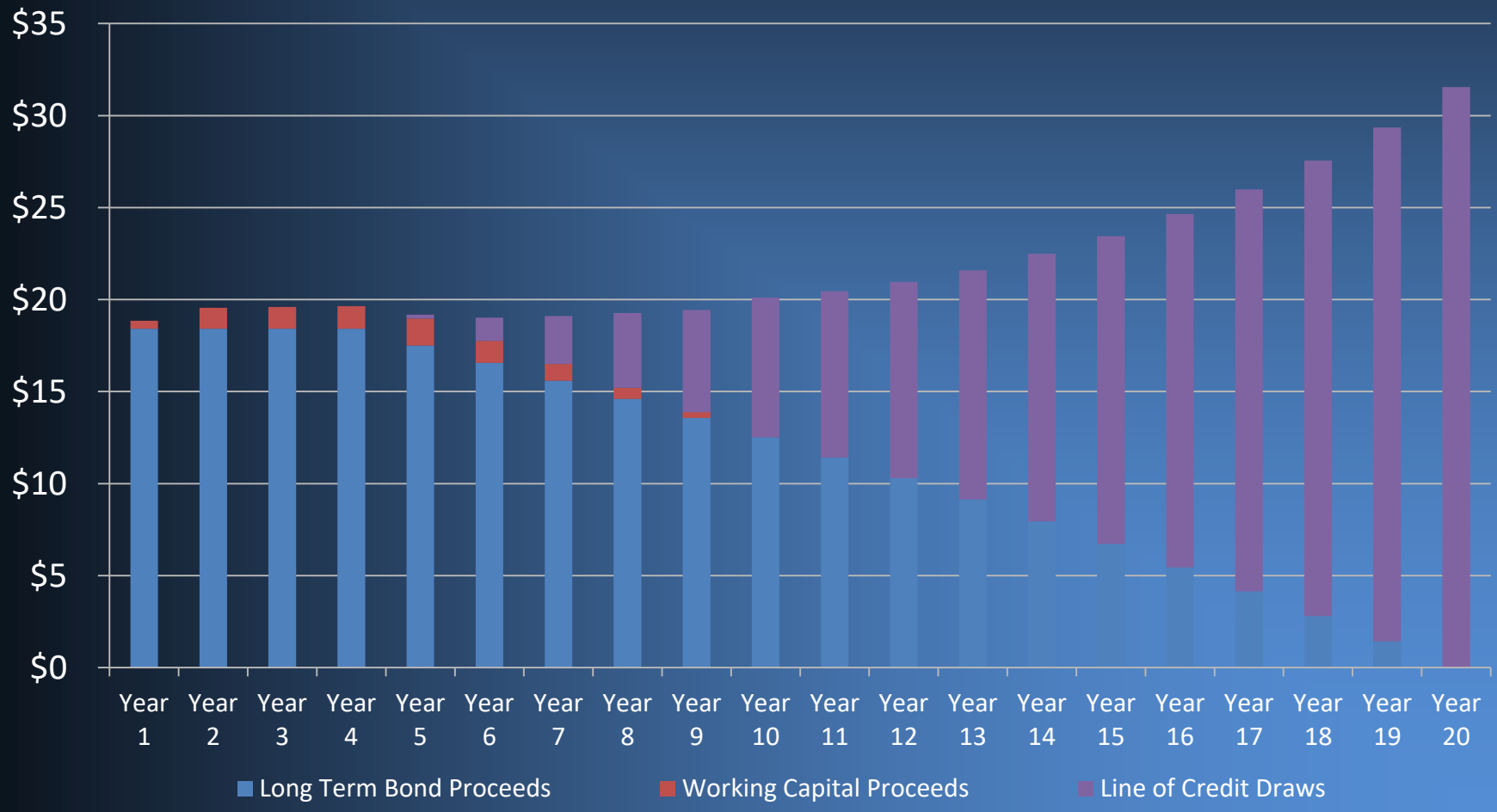
CASH FLOW AFTER DEBT SERVICE ($M)

Over the 20 year forecast, operating income is not sufficient to service annual debt service, meaning that the revenue opportunity within the proposed service area is not commensurate with the construction cost to build it out.



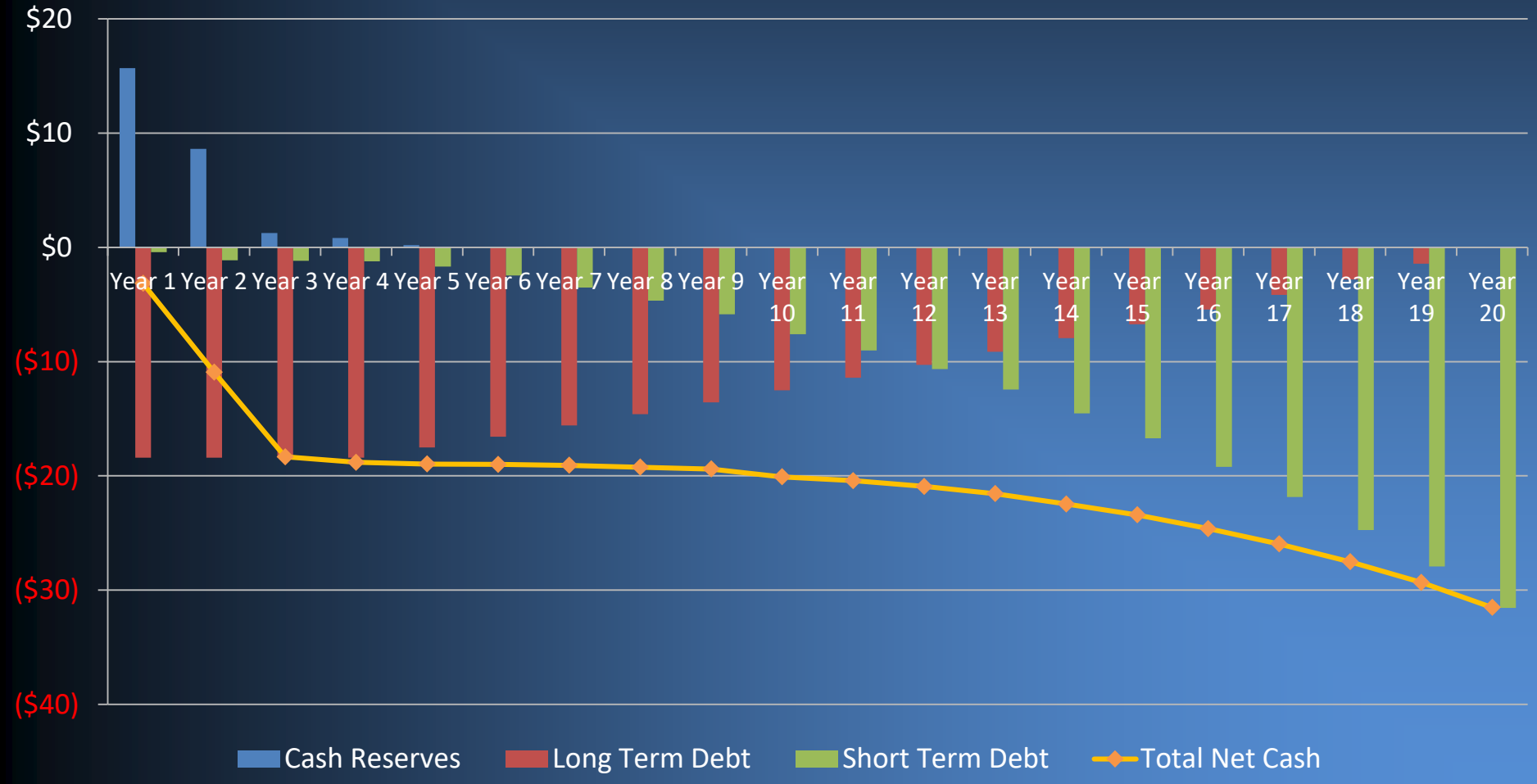
TOTAL DEBT ($M)

By Year 5 of the forecast, traditional financing (bond and working capital loan) proceeds are not sufficient to cover debt service, and therefore a 3rd funding source is required. Uptown models this as an open line of credit



NET CASH ($M)

Due to the ongoing need for financing via the line of credit, the Retail Own & Operate model does not achieve financial self-sufficiency, and continues to require external funds to maintain operations



Pro Forma Analysis

Retail Model: Own & Operate with Operating Partner

OPERATING PARTNERSHIP FRAMEWORK

Uptown has developed similar operating partnerships for other systems under the following preliminary framework for how the partnership could be structured…

Ownership Role of the County	• County funds capex for fiber build (FTTP), working capital, and all operating expenses • County is 100% owner of the FTTP system.
Operating Role of the County	• County is the service provider and performs some administrative functions (e.g. billing), general management, and on-site account support.
Operating Role of ISP	• Customer Operations: ISP provides customer care, help desk, billing, and services provisioning • Data Network Services: Network configuration/administration, hardware/software platform, and system monitoring.
Services Offered	• Internet and Voice
Services Revenue	• All revenue retained by the County • Partner compensated with monthly fee per connected end-user.
Partnership Terms	• Monthly fee per connected premises (household or business) of $10

VALUE OF OPERATING PARTNER

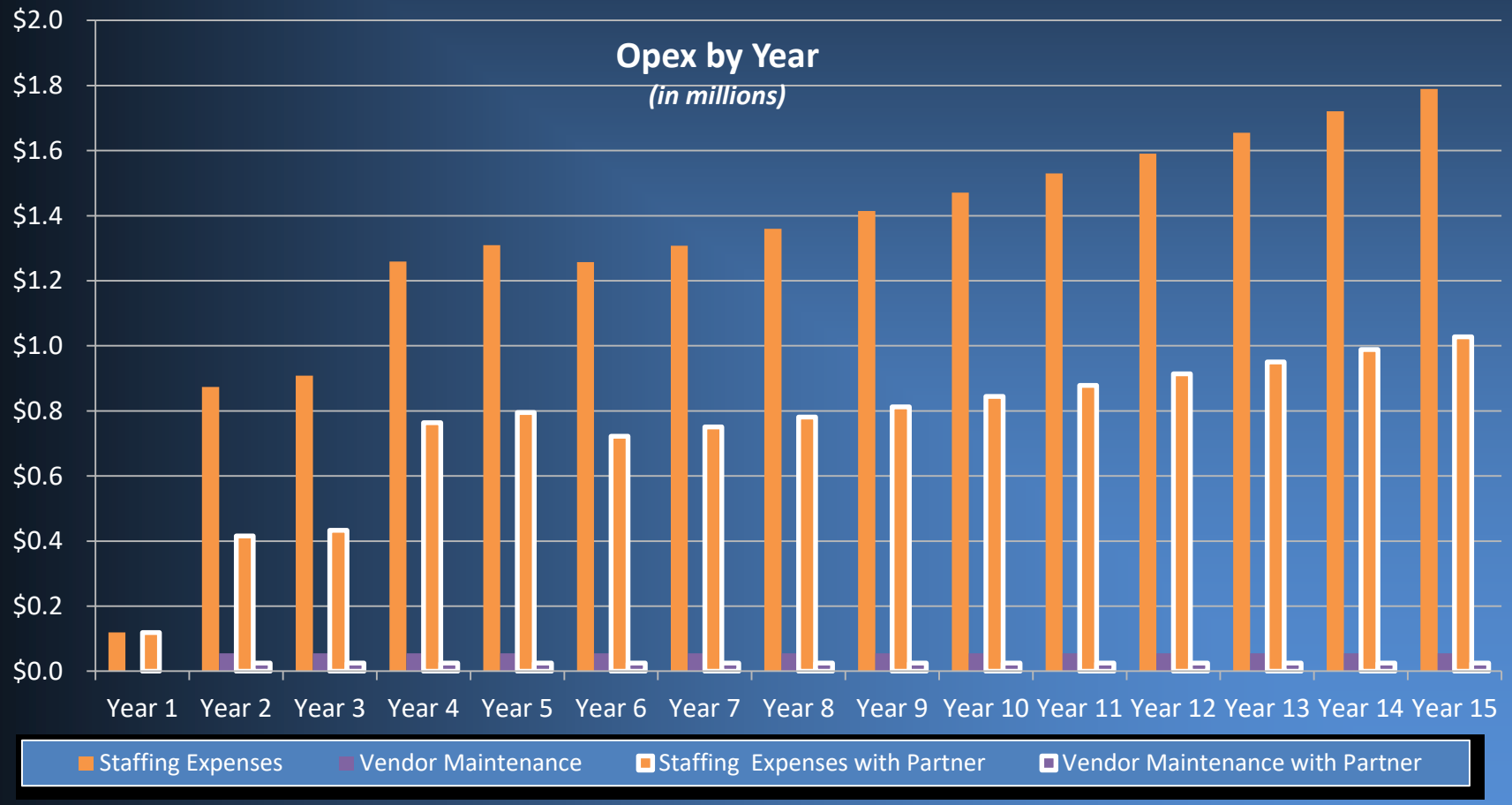
Strategic Value:

- Utilize ISP's expertise to operate a broadband system across key areas of technical and customer operations
- Efficient use of existing ISP personnel and equipment, ideally without incremental hiring
- Lowers the total funding requirement by ≈$10M

PRO FORMA IMPACT	
Revenue	• Monthly fee per connected premises (household or business) of $10 included in the pro forma as contra-revenue
Operating Expense	• Staffing requirement reduced by 5 incremental, full-time employees • Some annual maintenance fees
Capital Expense	• Operations Support Software of $200k is not required • Generator/UPS of $25k is not required • Core switch/router of $200k (layer 3) is reduced to $100k (layer 2) • Internet service back-office platform of $100k is not required

OPERATING EXPENSE

The primary value for the County to work with an operating partner would be to reduce staffing expense to approximately 57% of the Own & Operate model by Year 15, and with total 15 years staffing opex reduction of $8.3M



INCREMENTAL BROADBAND FTE REQUIRED

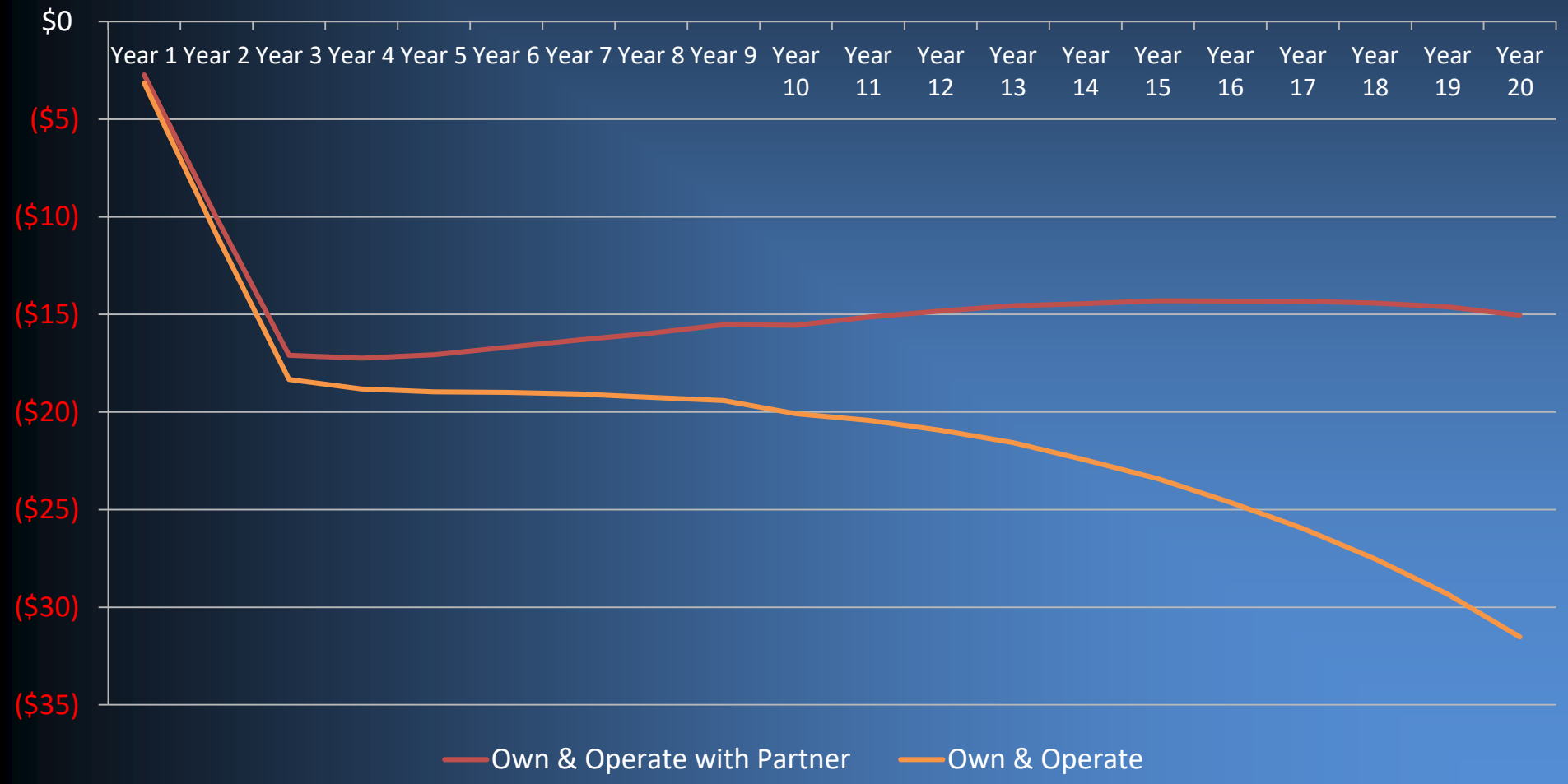
The Own & Operate model requires 14 FTE in Year 4, with 12 incremental hires. Under the Operating Partner model, this is reduced to 9 FTE by moving the green shaded functions to the operating partner…

Position Title	Salary (unloaded)	Year1	Year2	Year3	Year4	Year5	Year6	Year7
System GM*	$115,000	1	1	1	1	1	1	1
Marketing Coordinator	$55,000		1	1	1	1	1	1
MDU/Comm. Account Manager	$75,000	1	1	1	1	1	1	1
Data Tech*	$110,000	1	1	1	1	1	1	1
CSRs	$50,000		~~3~~	~~3~~	~~3~~	~~3~~	~~3~~	~~3~~
TSRs	$60,000		~~2~~	~~2~~	~~2~~	~~2~~	~~2~~	~~2~~
Install Techs	$55,000				2	2	1	1
Maintenance Techs	$67,000		1	1	2	2	2	2
Service Techs	$54,000		1	1	1	1	1	1
Total Headcount		**3**	**6**	**6**	**9**	**9**	**8**	**8**

* Not incremental headcount to current CBX and included in Dark Fiber Model pro forma.

NET CASH ($M)

While improved over the Own & Operate model, the 20 year net payback threshold is not met under the Retail Own & Operate with Operating Partner model as operating income is still insufficient to cover debt service costs…



SUMMARY FINANCIAL METRICS: RETAIL

Summary pro forma metrics across the baseline retail models evaluated reveal the necessity of external funding. This have been modelled as a LID with identification of the monthly fee per premises for the 20 years term.

Input/Outcome	Retail Own & Operate		Retail Operating Partner	
Local Improvement District (LID)*	-	$18.2M $16/premises/mo.	-	$9.1M $8/premises/mo.
Operating Partner Payment	-	-	$10/connection per month	
Long Term Bond Amount	$18.5M	$18.5M	$17.9M	$17.9M
Working Capital Loan**	$25.7M	$800k	$11.6M	$600k
Total Funding	**$44.2M**	**$37.5M**	**$29.5M**	**$27.6M**
Net Cash – Year 20	($31.5M)	$500k	($13.7M)	$200k
Project Break Even	**> 20 Years**	**20 Years**	**> 20 Years**	**20 Years**
Minimum Cumulative Cash	**$0**	$500k	**$0**	$200k

**LID payments for 20 years*
***Includes Line of Credit draws if needed*

Pro Forma Analysis

Wholesale Model: Ting Internet & Municipal Partner Examples

WHOLESALE MODEL OVERVIEW

- Shares funding, revenue and operating costs with retailer partner. Typical outcomes in analyzing actual PPP contractual financial terms:
  - Capital requirement reduced to ≈80% of retail
  - Opex requirement reduced to ≈10-20% of retail
  - Revenue reduced to ≈25-40% of retail
- Financial feasibility requires both parties to meet financial return obligations
  - Municipal: Debt service and operating expense
  - Retailer: Sufficient ROI for shareholders
- Example PPP provider serving as ISP for public wholesale systems: Ting Internet
- Two service area sizes evaluated:
  - All 6 service areas with total households of 4,341
  - East 1 only with total households of 1,153

TING INTERNET OVERVIEW

- Background
  - Virtual Wireless Network Operator launched in 2012. Sprint and T-Mobile are their host networks.
  - Owned by parent Tucows
- FTTP Services
  - Residential: 1G/1G: $89/month + Modem ($200 purchase or $9/mo. lease) + Up to $200 install fee
  - Commercial: Custom pricing for 1G/1G service depending on SLA, static IPs, etc.
- Retail Service Provider for 9 municipal FTTP systems since 2015. Note that while Ting is serving smaller markets, they are not rural:
  - Charlottesville, VA (18k households)
  - Westminster, MD (7k households)
  - Holly Springs, NC (8k households)
  - Sandpoint, ID (4k households)
  - Centennial, CO (36k households)
  - Solana Beach, CA (6k households)
  - Fuquay-Varina, NC (12k households)
  - Wake Forest, NC (16k households)
  - Fullerton, CA (45k households)

WESTMINSTER, MD KEY CONTRACT TERMS

- City Role
  - Design, construction, and maintenance of the fiber network. City retains title to the network.
  - 24/7 availability for unscheduled maintenance with 4 hour on-site response timeframe
- Network Point of Demarcation
  - Residential: Exterior wall closest to public ROW
  - Commercial: Patch panel in telecom closet
- Services
  - Triple Play with Ting providing data service (up to 1Gbps) and 'arranging' for voice and video
  - Retail rates are at the sole discretion of Ting
- Financial Terms
  - Premise Passed Fee: $6/month and Connected Premise Fee: $17/month
  - Fees apply whether business or residential connection
  - ARPU Adjustment: The Connected Premise Fee will increase by $1 for every 10% increase in Ting's realized ARPU (compared to baselined ARPU at 1,500 subscribers)
- Other Terms
  - 10 Year Term with 2 ten year renewal periods
  - City must renew if actual wholesale revenues exceed debt service by 10% or more
  - Termination for Convenience: City can terminate with 6 months notice

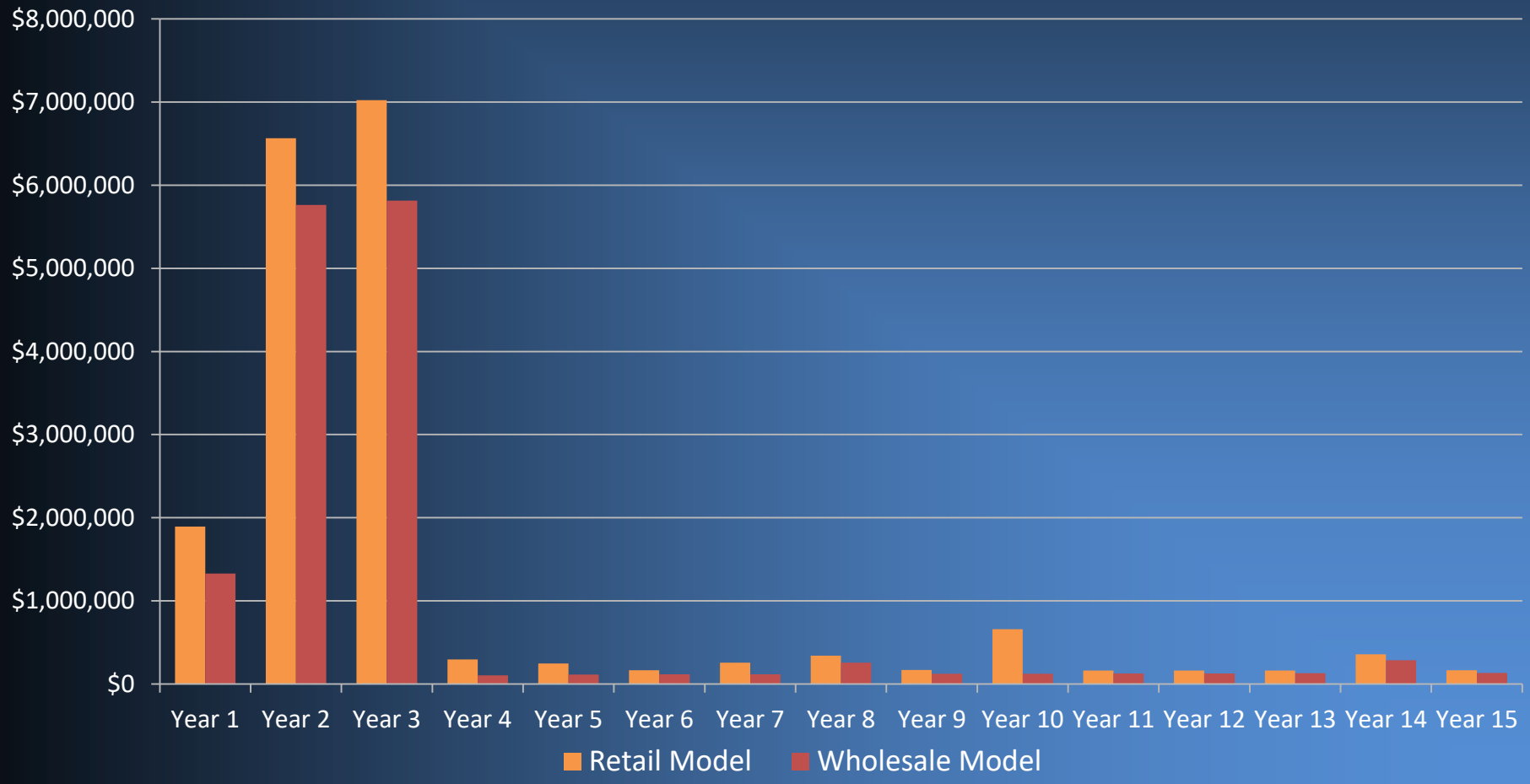
MUNICIPAL PARTNER OVERVIEW

- Uptown has evaluated various scenarios for a partner relationship whereby a municipal partner would serve as an ISP across the proposed service area across several possible financial terms:
  1. Scenario #1: Wholesale access fee of $40.95/connection/month
  2. Scenario #2: $40.95 access fee plus 20-year LID paid by all serviceable premises
  3. Scenario #3: $40.95 access fee plus monthly fee per serviceable premises (similar to Westminster example)

- For potential finance terms of scenarios #2 and #3 Uptown identified the wholesale fee levels required for CBX to achieve financial feasibility

WHOLESALE MODEL CAPEX BY YEAR

The capex requirement under the wholesale model is $14.7M, which is 79% of the retail model capex of $18.6M. The capex requirement does not vary by ISP provider…



INCREMENTAL BROADBAND FTE REQUIRED

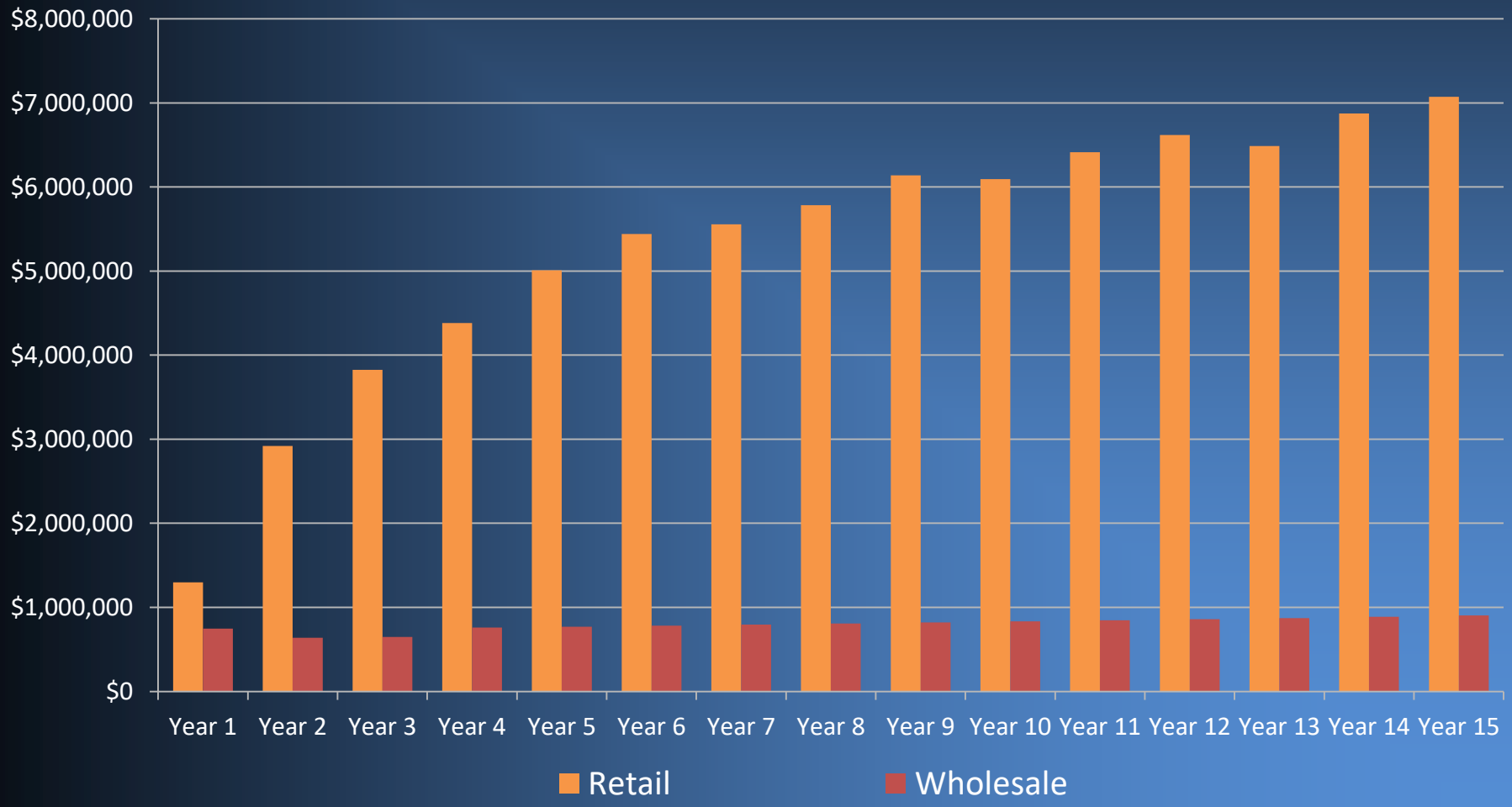
The Wholesale model requires 3 FTE, with 1 incremental hire. The Retail model positions shared in green would not be required under a Wholesale model. This reflects virtually all operating responsibilities residing with the ISP partner given the allocation of functional responsibilities…

Position Title	Salary (unloaded)	Year1	Year2	Year3	Year4	Year5	Year6	Year7
System GM*	$115,000	1	1	1	1	1	1	1
Marketing Coordinator	$55,000		~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~
MDU/Comm. Account Manager	$75,000	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~
Data Tech*	$110,000	1	1	1	1	1	1	1
CSRs	$50,000		~~3~~	~~3~~	~~3~~	~~3~~	~~3~~	~~3~~
TSRs	$60,000		~~2~~	~~2~~	~~2~~	~~2~~	~~2~~	~~2~~
Install Techs	$55,000				~~2~~	~~2~~	~~1~~	~~1~~
Maintenance Techs	$67,000		1	1	~~2~~ 1	~~2~~ 1	~~2~~ 1	~~2~~ 1
Service Techs	$54,000		~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~
Total Headcount		**2**	**3**	**3**	**3**	**3**	**3**	**3**

* Not incremental headcount to current CBX and included in Dark Fiber Model pro forma.

WHOLESALE MODEL OPEX BY YEAR

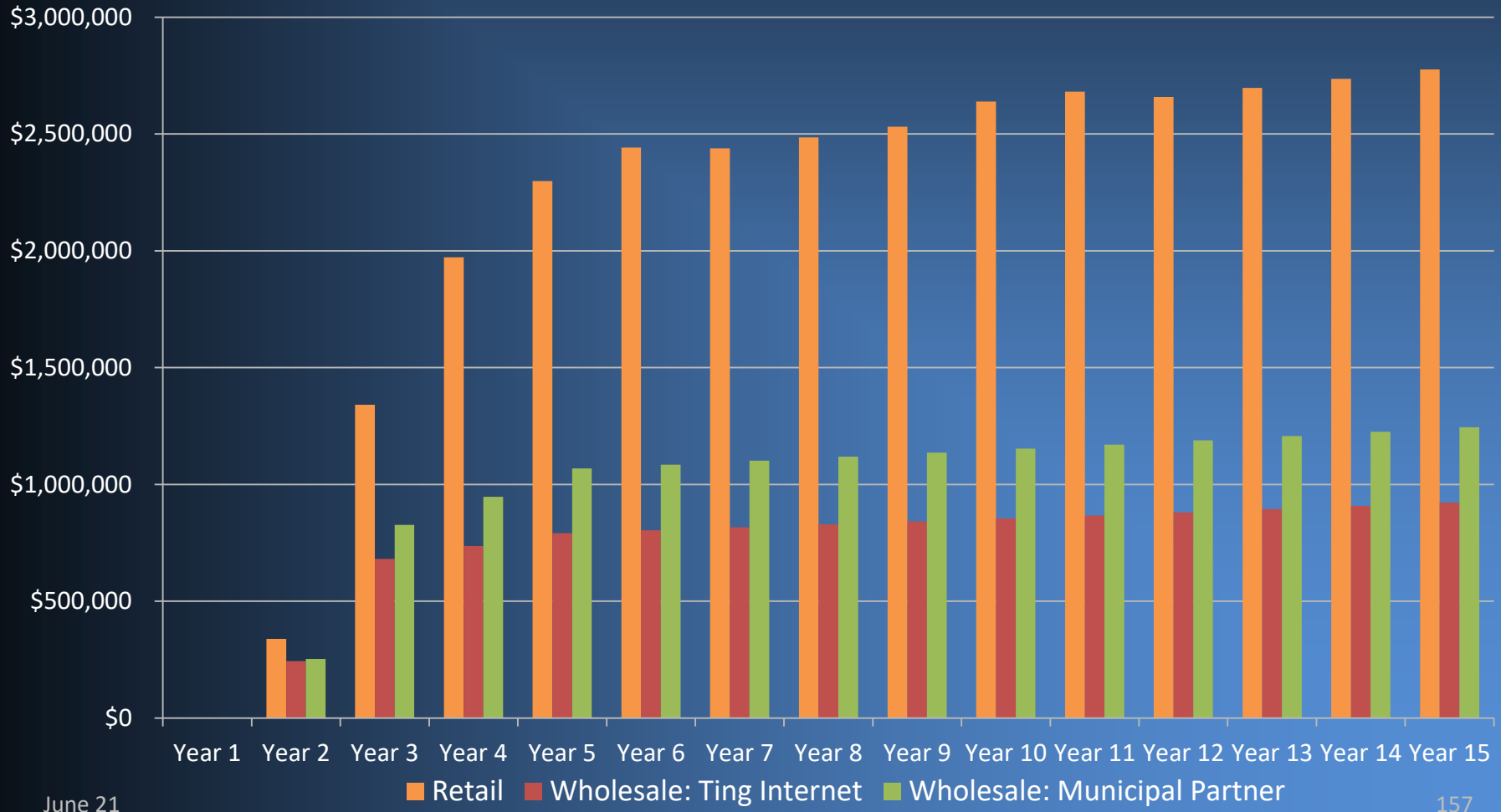
The opex requirement (Years 1-15) under the wholesale model is $12.0M, which is 15% of the retail model opex of $79.9M, primarily due to staffing cost savings. The opex requirement does not vary by ISP provider…



WHOLESALE MODEL REVENUES BY YEAR

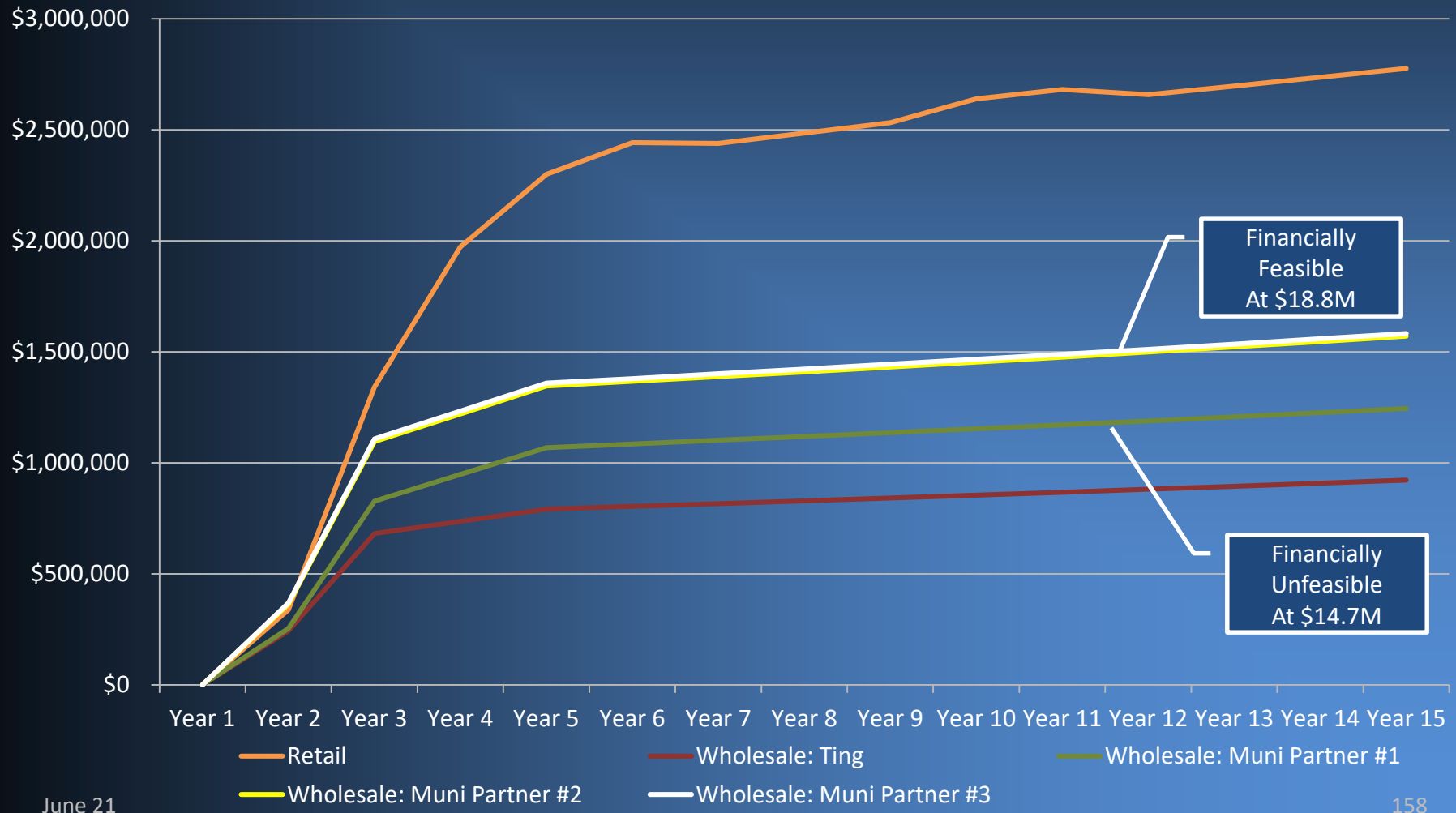
The forecasted revenue (Years 1-15) varies by ISP, and indicates that a municipal partner, under anticipated wholesale fee terms, would be a superior ISP partner to national providers such as Ting:

- Ting Internet as ISP: $11.1M, which is 35% of the retail model revenue of $32.0M
- Municipal partner as ISP: $14.7M, which is 46% of the retail model revenue



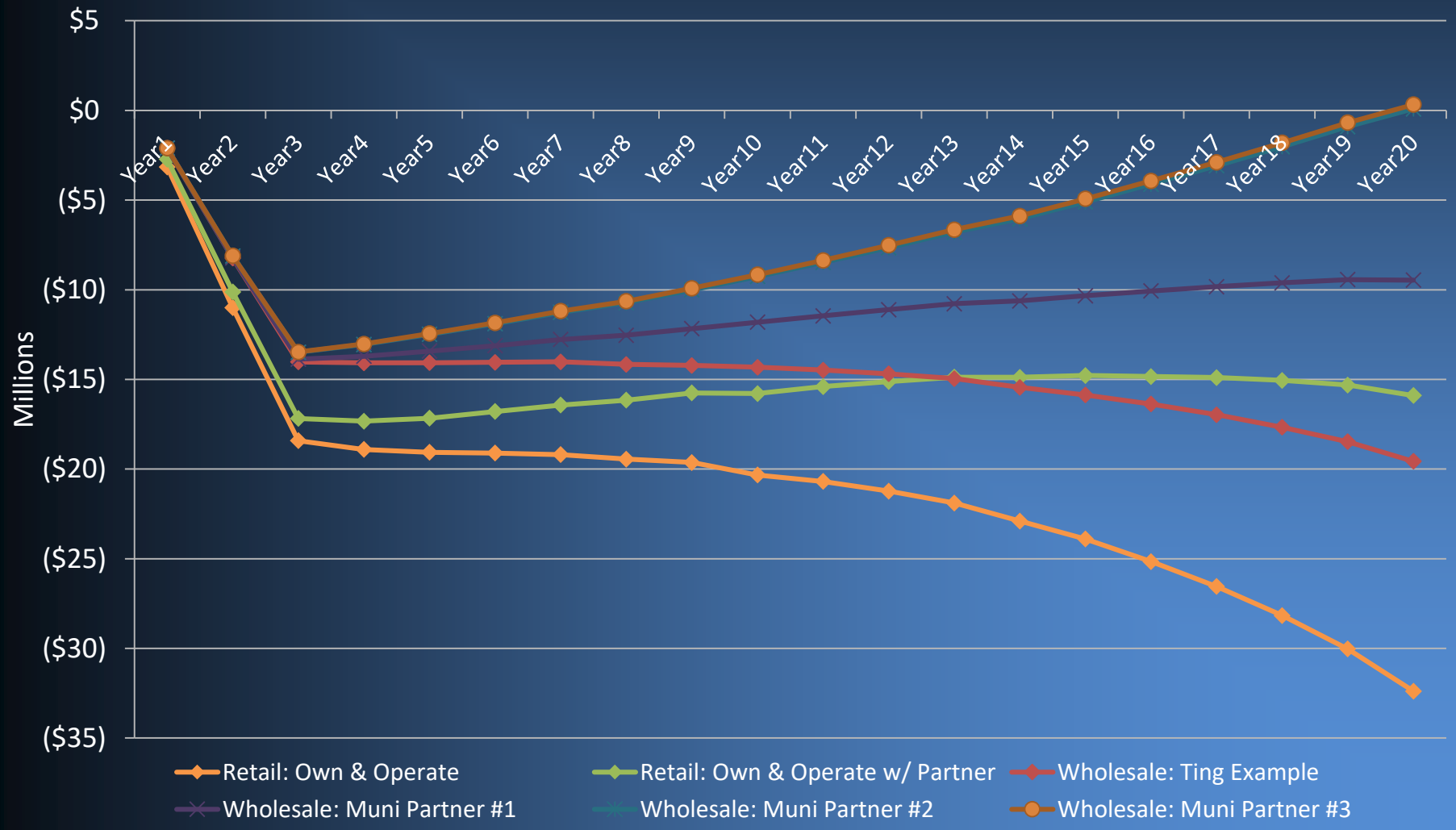
WHOLESALE MODEL REVENUE SCENARIOS

The forecasted revenue (Years 1-15) under the Municipal Partner #1 wholesale model is $14.7M, which is insufficient for financial feasibility. The terms for Municipal Partner scenarios #2 and #3 were set to generate $18.8M in revenue over years 1-15, which is sufficient for financial feasibility…



NET CASH: ALL MODELS

The 20 year net payback threshold requires a LID of $5.00/premises/month, or a serviceable premises fee of $5.00/premises/month to generate an additional ≈$6M in non-traditional funding over 20 years



SUMMARY FINANCIALS: WHOLESALE

Similar to Retail models, the summary pro forma metrics across the baseline wholesale models evaluated again reveal the necessity of external funding, but reduced from $9M-$18M to $6M. This have been modelled as a LID with identification of the monthly fee per premises for the 20 years term.

Input/Outcome	Wholesale Ting	Wholesale Muni Partner #1	Wholesale Muni Partner #2	Wholesale Muni Partner #3
Local Improvement District*	-	-	**$5.7M** **$5/premises/mo.**	-
Wholesale Premises Passed Fees	$7.1M	-	-	**$5.9M** **$5/premises/mo.**
Wholesale Connection Fees	$8.8M	$21.2M	$21.2M	$21.2M
Long Term Bond Amount	$15.1M	$15.1M	$15.1M	$15.1M
Working Capital Loan**	$15.4M	$7.7M	$0.1M	$0.1M
Total Funding	**$46.4M**	**$44.0M**	**$42.1M**	**$42.3M**
Net Cash – Year 20	($19.6M)	($9.5M)	$100k	$300k
Project Break Even	**> 20 Years**	**> 20 Years**	**20 Years**	**20 Years**
Minimum Cumulative Cash	$0	$0	$100k	$300k

**LID payments for 20 years by all residential properties **Includes Line of Credit draws if needed*

SENSITIVITY ANALYSIS: WHOLESALE

Uptown additionally evaluated potential upside required to achieve 20 year net payback across the most sensitive pro forma metrics. The improvements required are unlikely without non-traditional funding

Input/Outcome	Wholesale Muni Partner #1 @ B/E Take Rate	Wholesale Muni Partner#1 @ B/E Capex per Passing	Wholesale Muni Partner #1 @ B/E Interest Rate
Residential Internet Take Rate	58%	45%	45%
Construction Cost/Passing	$1,991	$1,150	$1,991
Long/Short Interest Rates	3.0%/4.0%	3.0%/4.0%	0%/0%
Wholesale Connection Fees	$27.1M	$21.2M	$21.2M
Long Term Bond Amount	$15.1M	$10.6M	$13.5M
Working Capital Loan	$0.1M	$0.1M	$0.2M
Total Funding	**$42.3M**	**$31.9M**	**$34.9M**
Net Cash – Year 20	$300k	$50k	($10k)
Project Break Even	**20 Years**	**20 Years**	**21 Years**
Minimum Cumulative Cash	$300k	$50k	$0

SUMMARY FINANCIALS: EAST 1 SERVICE AREA ONLY

By reducing the size of the proposed service area down from over 4,000 passings to just over 1,000, the total funding requirement drops by about two-thirds. However, the external funding requirement is still significant at just over $4M.

Input/Outcome	Wholesale Muni Partner #1 EAST 1 ONLY	Wholesale Muni Partner #2 EAST 1 ONLY	Wholesale Muni Partner #3 EAST 1 ONLY
Local Improvement District*	-	**$4.2M $14/premises/mo.**	-
Wholesale Premises Passed Fees	-	-	**$4.1M $13/premises/mo.**
Wholesale Connection Fees	$5.6M	$5.6M	$5.6M
Long Term Bond Amount	$3.5M	$3.5M	$3.5M
Working Capital Loan**	$5.8M	$0.1M	$0.1M
Total Funding	**$14.9M**	**$13.4M**	**$13.3M**
Net Cash – Year 20	($7.2M)	$300k	$150k
Project Break Even	**> 20 Years**	**20 Years**	**19 Years**
Minimum Cumulative Cash	$0	$300k	$150k

**LID payments for 20 years by all residential properties **Includes Line of Credit draws if needed*

Pro Forma Analysis

Wholesale Model: Neighborhood-level Wholesale Public/Public Partnership

STRATEGY ALTERNATIVE: PHASED APPROACH

- Because all business models examined require external funding support at reasonable take rate and construction cost parameters, Uptown evaluated an alternative strategy to incrementally extend the CBX backbone into neighborhood-level last-mile service areas of 100-300 premises over time
  - Essentially a limited expansion of the current CBX wholesale ISP service ISP where CBX constructs to a neighborhood
  - CBX serves as a wholesale provider of the fiber 'local loop' to a retail Internet Service Provider (ISP)
  - Construction costs can be financed through a Local Improvement District (LID) to minimize the upfront funding requirement

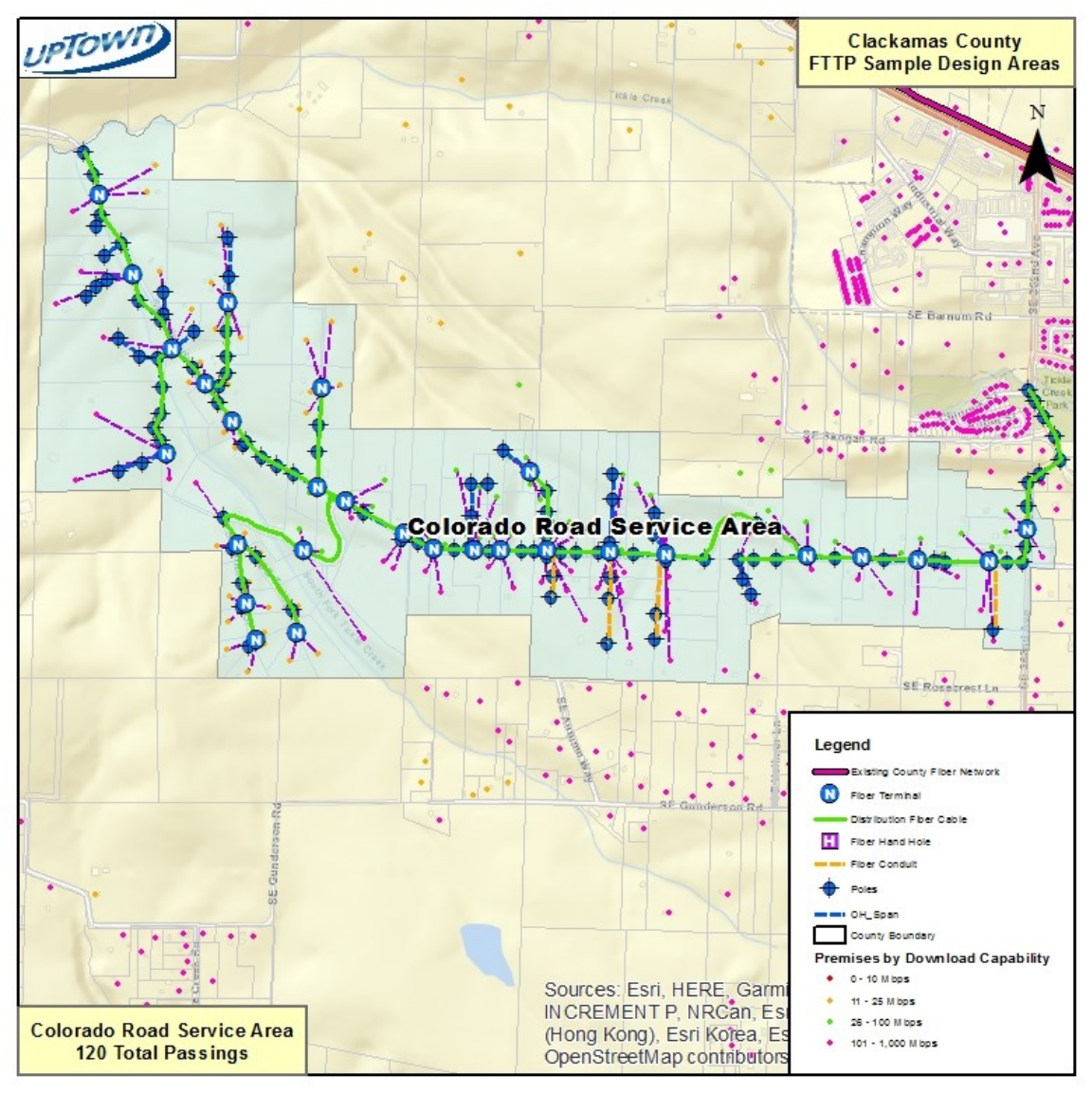
- This 'Phased Approach' would limit the initial capital funding requirement and allow the system revenues to generate cash proceeds that could replicate further geographic expansion over time

- To evaluate the Phased Approach strategy, a 'real-world' example from a service request on Colorado Road was identified as a seventh service area and was subject to sample designs and pro forma analysis.

PHASED APPROACH DETAILS

- This model is based on significant neighborhood-level demand for improved broadband infrastructure where incumbent options are weakest and typified by
  - Proactive resident requests for CBX expansion to a specific neighborhood
  - Strong demand expending to a majority of homeowners
  - Support for Local Improvement District financing commitment
- Practical example – Colorado Road
  - 120 total premises in a low-density (18 premises/mile) underserved area
  - Social media polling indicating >50% support for $16/month LID
- Key tentative financial terms
  - Total Funding Required: $550k ($411k OSP Construction and $145k for Equipment)
  - Residential Offering: 300M fiber Internet for $61.95/month
    - ISP bills the end user $41.95/ month
    - LID assessment is $20.00/month for 20 years
  - Revenue Share: ISP gets $25.00/month and CBX gets $16.95/month

COLORADO ROAD SAMPLE DESIGN



Design Metric	Value
New Aerial Plant Miles	4.7
New Underground Plant Miles	1.8
% Aerial	72%
% UG	28%
Passings	120
Passings per Mile of Plant	18
Materials Cost per Passing	$784
Labor Cost per Passing	$2,642
Total Cost per Passing	**$3,426**
Total Materials (no drops)	$94,031
Total Labor (no drops)	$317,066
Total Cost	**$411,097**

* - Does not include engineering, fixed equipment, subscriber capital and installation costs.

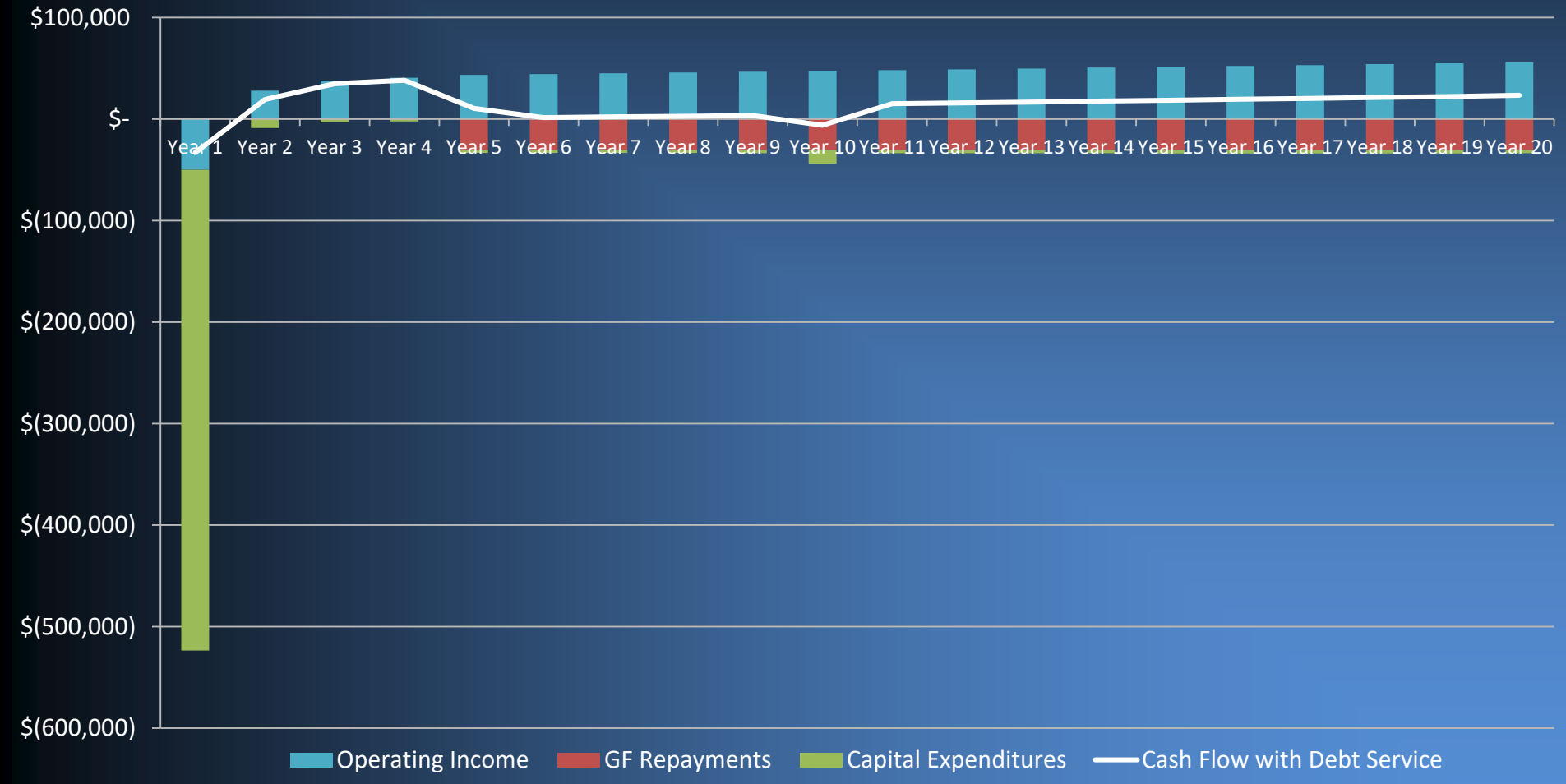
INCREMENTAL FINANCIAL IMPACT

The Neighborhood-Level Wholesale Model is significantly different from the other wholesale models in these areas

- Revenue
  - Residential only. Penetration increases from 45% to 80%
  - Reduced to $16.95 per connected end user
  - LID assessment of $20/month to refund County General Fund financing in Year 1 (modelled as equity)
- Operating Expenses
  - Staffing: No incremental headcount required to status quo CBX headcount of 4 FTE's
  - Professional Services: No implementation support. Year 1 legal is $50k, then $5k annually
  - Vendor Maintenance: Reduced to $1k annually for 1 OLT
- Capex
  - OSP Construction: Cost/passing increases to $3,426 (Colorado Road only)
  - OLTs: One required at $20k
  - Drop Installs: One trenching rig at $25k
  - Splicing & Test Equipment: Not required
  - Capital Contingency Fund: $25k
  - Year 10 network upgrade budget of $75/passing
- Funding
  - Long Term Debt: Bond financing replaced by County GF equity with reimbursement through LID assessments

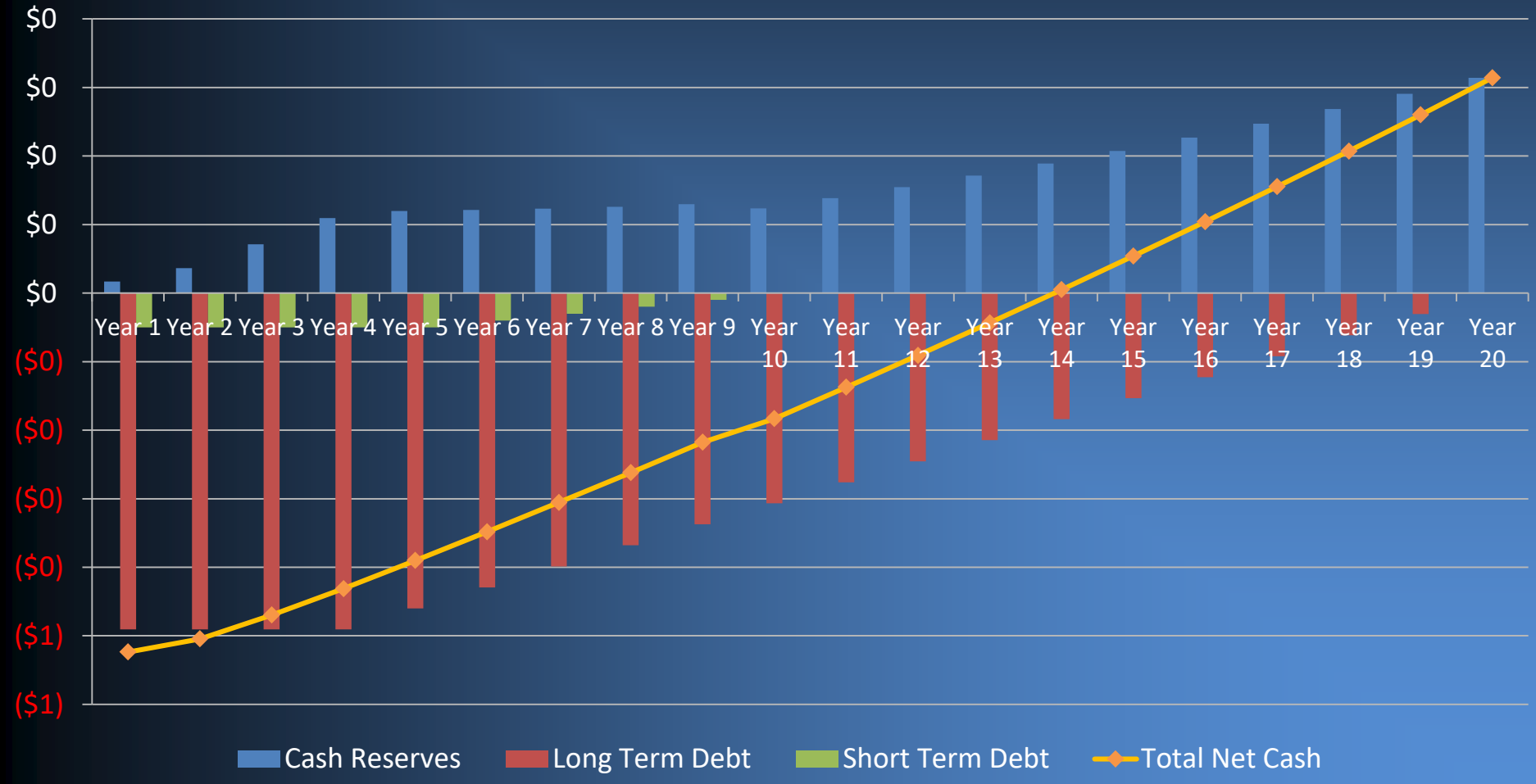
CASH FLOW AFTER DEBT SERVICE

The reduced scale of a neighborhood-level FTTP build combined with LID assessment financing is financially self-sufficient by Year 2. The Uptown pro forma model assumes repayment of initial operating expenses in Years 6-10 and capital expenses in Years 5-20.



NET CASH ($M)

This business model becomes Net Cash positive in Year 14.



Pro Forma Analysis

Conclusions

BUSINESS PLAN SIGNIFICANT FINDINGS

1. The current dark fiber model that CBX is under is financially self-sustaining
   - Tempered, organic growth through incremental dark fiber leased access and transport should grow revenues and net position (retained earnings) over time. The policy of end-users funding the fiber lateral build has been a success
   - Whether a last-mile expansion is pursued or not, an expansion of CBX's wholesale ISP service should be prioritized as an efficient revenue growth opportunity for both parties

2. A last-mile build out of the proposed service area requires significant capital expense due to low density and a cost-per-passing of nearly $2,000. This is required across all business models. The high cost per passing to construct last-mile fiber has been the deterrent to incumbents considering investing in these areas of the County.

3. Among the retail and wholesale model options for a last-mile expansion of CBX, wholesale models are financially superior
   - Significant incremental staffing costs can be alleviated by partnering with an existing ISP that already has the resources and skill sets in place with zero to minimal incremental cost to that operating partner
   - However, the funding requirement remains significant because the capital expenditure required under the wholesale model is nearly $15M and 79% of the capital budget required under a retail model

BUSINESS PLAN SIGNIFICANT FINDINGS (CONTINUED)

4. To achieve the primary objective, non-traditional funding, beyond a long-term bond and working capital loan totaling ≈$36M, will be required at an estimated $6.0M. For traditional funding to be sufficient, pro forma metrics would have to significantly change:
   - The residential Internet take rate would need to improve to 58% from 45%
   - Construction cost per passing would need to improve to $1,150 from $1,991
   - Interest rates for the bond and working capital loans would have to both drop to 0%

5. The County should solicit interest in fiber neighborhoods as a gradual, long term strategy to deploy additional fiber into small, underserved communities. This secondary objective, as analyzed using Colorado Road as a proof of concept, is financially self sufficient under two conditions:
   - Homeowners approve a 20 year LID at $20/month
   - The County funds initial construction and legal costs of approximately $500k

6. While not ideal given higher fees and nascent technology, the Starlink Internet service could be a viable alternative to residents and businesses in underserved portions of the County. The County does not need to actively facilitate deployment, but should monitor the progress of Starlink relative to the following metrics:
   - Total satellites launches and latitudinal coverage area
   - Speed and latency improvements
   - Density improvements to enable ongoing subscriber growth without performance deterioration
   - Changes in non-recurring and recurring fees

OPPORTUNITY FOR NON-DEBT FINANCING

The timing of this proposed expansion of CBX aligns well with federal funding programs that prioritize the deployment of broadband infrastructure projects:

- American Rescue Plan Act (enacted): $65B allocated to counties for broadband infrastructure*
- Biden Infrastructure Plan (proposed): $100B to provide every American with access to high speed broadband

With all necessary analysis completed, this project is an outstanding candidate for grant funding of this nature as 'shovel-ready', including a detailed plan to target funds where they are most needed.

Funding Requested:

- Full Financing: $21M will alleviate the need for any County debt and external funding (e.g. local improvement district fees)
- Partial Financing: $16M will alleviate the need for any County debt and fund the full construction of the expansion including all capex needs for Years 1-5
- Minimal Financing: $6M will alleviate the need for external funding but would still require the County to issue a $15m bond

*The American Rescue Plan Act has allocated significant funds that will be allocated at the state and local level in support of broadband, including investments in broadband infrastructure. This creates a one-time opportunity for a project of this nature to be funded without debt. The County level allocation across the US is $65B.

CONCLUSIONS & RECOMMENDATIONS

1. A last-mile build out of the proposed service area requires significant capital expense due to low density and a cost-per-passing of nearly $2,000. This is required across all business models. The high cost per passing to construct last-mile fiber has been the deterrent to incumbents considering investing in these areas of the County.

2. The proposed build out would require non-traditional funding of $6.0M, in addition to a long-term bond and working capital loan totaling ≈$36M. The county can fund this project through a combination contributed equity, federal infrastructure grants, long term debt (e.g. a 20 year bond), local improvement district proceeds, and wholesale fees.

3. If these additional funds cannot be secured, The County could solicit interest in fiber neighborhoods as a gradual, long term strategy to deploy additional fiber into small, underserved communities. This alternative strategy, as analyzed using Colorado Road as a proof of concept, is financially self sufficient under two conditions:
   - Homeowners approve a 20 year LID at $20/month
   - The County funds initial construction and legal costs of approximately $500k