

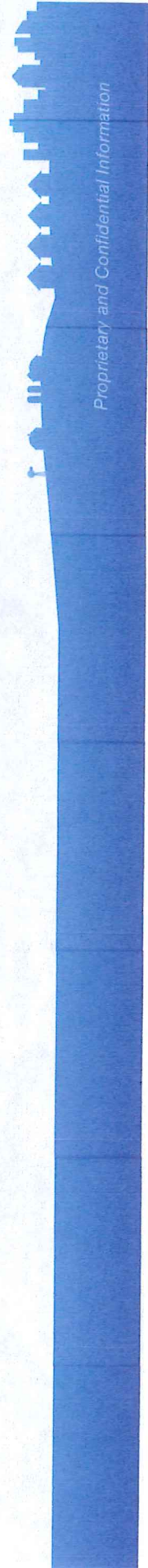
Appendix B

From Concept To Completion

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FIBER BROADBAND

For Paxton, MA



Proprietary and Confidential Information

MATRIX DESIGN GROUP / MILLENNIUM COMMUNICATIONS

From Concept To Completion

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Matrix and Millennium



STATE AND LOCAL GOVERNMENT



EDUCATION



FINANCIAL INSTITUTIONS

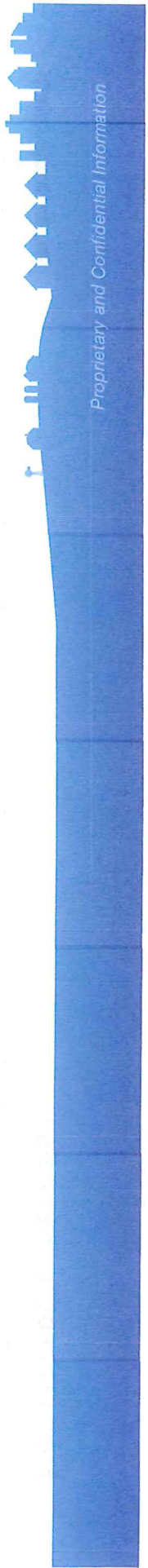


UTILITY COMPANIES



PRIVATE SECTOR

**SECTORS
WE SERVE**



Proprietary and Confidential Information

From Concept To Completion

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Who Matrix Serves

LUMEN™ CROWN CASTLE



bennett

zayo



alice

165 / HALSEY STREET



AT&T



COMCAST

WORLDWIDE EQUINIX

ZenFi NETWORKS

verizon



L.A.M.B. Local Area Municipal Broadband



Petersham



PRINCETON UNIVERSITY



RUTGERS

MA

Greater Franklin

Economic and Community Development



SELCO



STEVENS

Proprietary and Confidential Information

Why We Are Here

- Paxton Municipal Light Department hired Matrix to conduct a broadband feasibility study to help determine if a broadband solution is cost-effective and would add value to the residents of Paxton
- Today we will review key takeaways from that study and answer questions



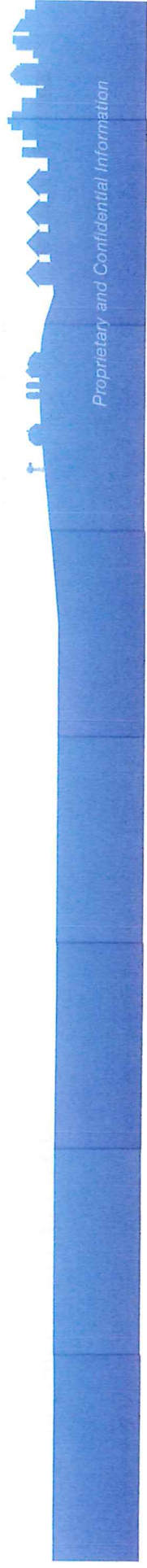
What Goes Into a Fiber Build?

- Engineering, pole survey, fiber design, etc.
- Utility Company Right of Way – Make-ready Process
- Fiber Network Construction
- Home / Business - Fiber Drop
- Internet Service / Customer Service
- Network Maintenance / Operations



Paxton, MA

- Approximately 14.74 total square miles
- Roughly 1,588 homes (United States Census)
- Roughly 108 homes per square mile
- Approximately 45 road miles (Paxton Master Plan)
- Density of about 35 homes per road mile



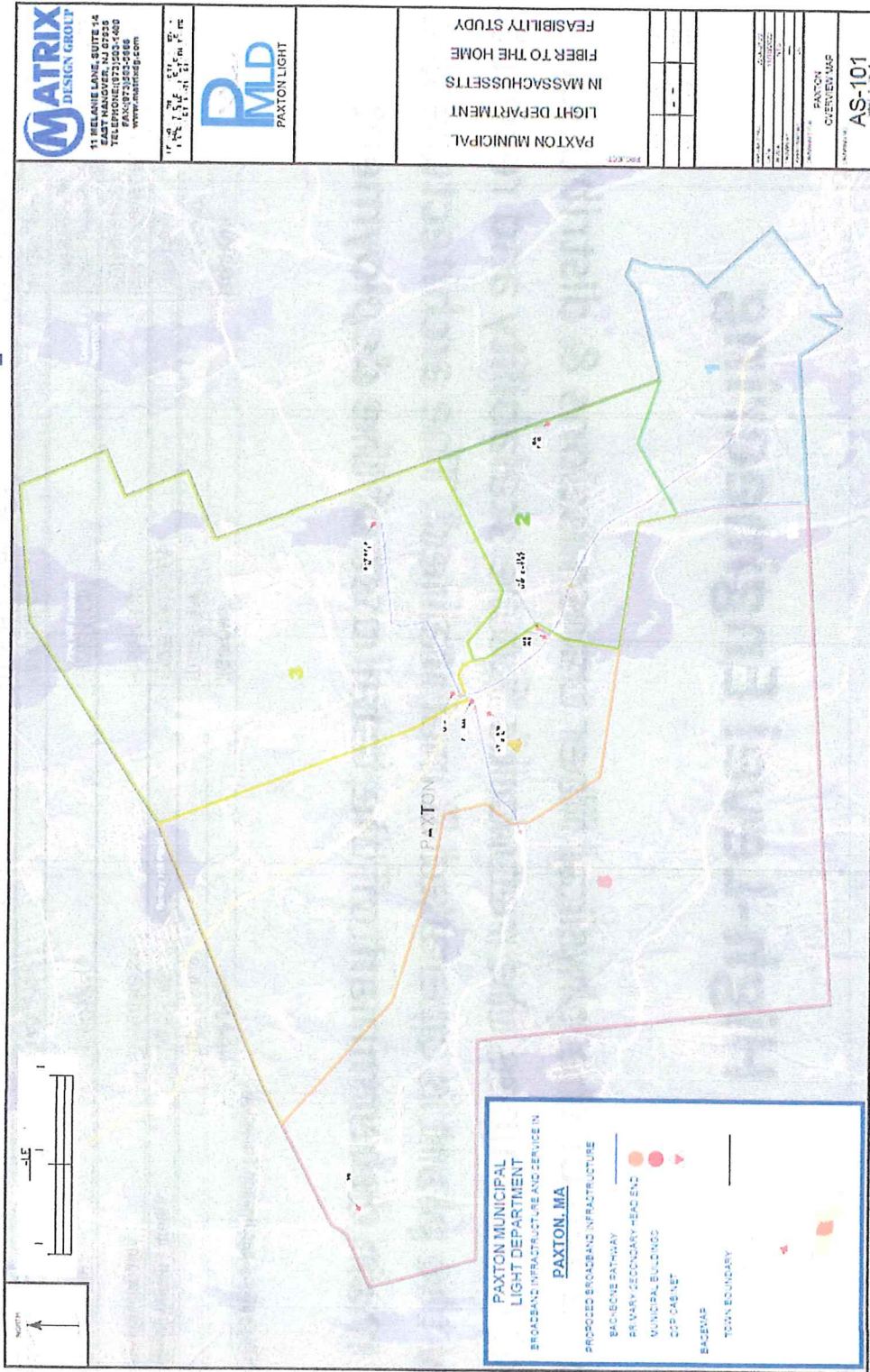
Technical Feasibility

Mission: Develop a community wide broadband solution having the capabilities to facilitate the delivery of communications through several technology platforms. The infrastructure would require fiber optic cable as the medium for all signal transport to equipment demarcation points.

Aera Metrics		
Category	Quantity	Assumptions & Notes
Road Miles	45	All roads within paxton were included in this study
Fiber Miles	45.56	Approximately 30% additional fiber is require for slack, splicing, and sagging along with non linear transitions
Population	5,004	Quantities pulled from 2020 Census data
Potential Subscribers	1,720	Rounded total number of households and added in business q
Aerial Facilities (Miles)	34.73	Majority of infrastructure miles throughout Paxton
UG Facilities (Miles)	6.29	PMLD provided UG data with a list of neighborhoods receiving UG electric utilities



Technical Feasibility



High-Level Engineering

The design of the physical fiber transmissions & distribution plant determines the network's future scalability and restricts how the plant is operated & maintained. The architecture is also the main determinant of the total cost of the deployment.

Upgrade PON System Specification Summary

	NG-PON2	XG-PON	XGS-PON
Standard	ITU-T G.989	ITU-T G.987	ITU-T G.9807
Downstream/Upstream Bitrate	10/2.5, 10/10, 2.5/2.5 Gbs	10/2.5, 10/10 Gbs	10/10 Gbs
Downstream Wavelength	~1596-1603 nm	~1575-1583	Either same as GPON if no current GPON or XG-PON for overlay Either same as GPON if no current GPON or XG-PON for overlay
Upstream Wavelength	~1524-1544	~1290-1290	14, 128, 256
Max PON Splits	64, 128, 256	64, 128, 256	64, 128, 256+
Power Budget*	14-20 dB (min - max) up to 20-35 dB (min - max) in 4 versions with up to 15 dB differential optical path loss	14-20 dB (min - max) up to 20-35 dB (min - max) in 4 versions with up to 20 dB differential optical path loss	13-25 dB (min - max) up to 20-35 dB (min - max) in 4 versions with up to 20 dB differential optical path loss in 2 versions
Coverage	20 and 40 km vers OTS	60 km	60 km

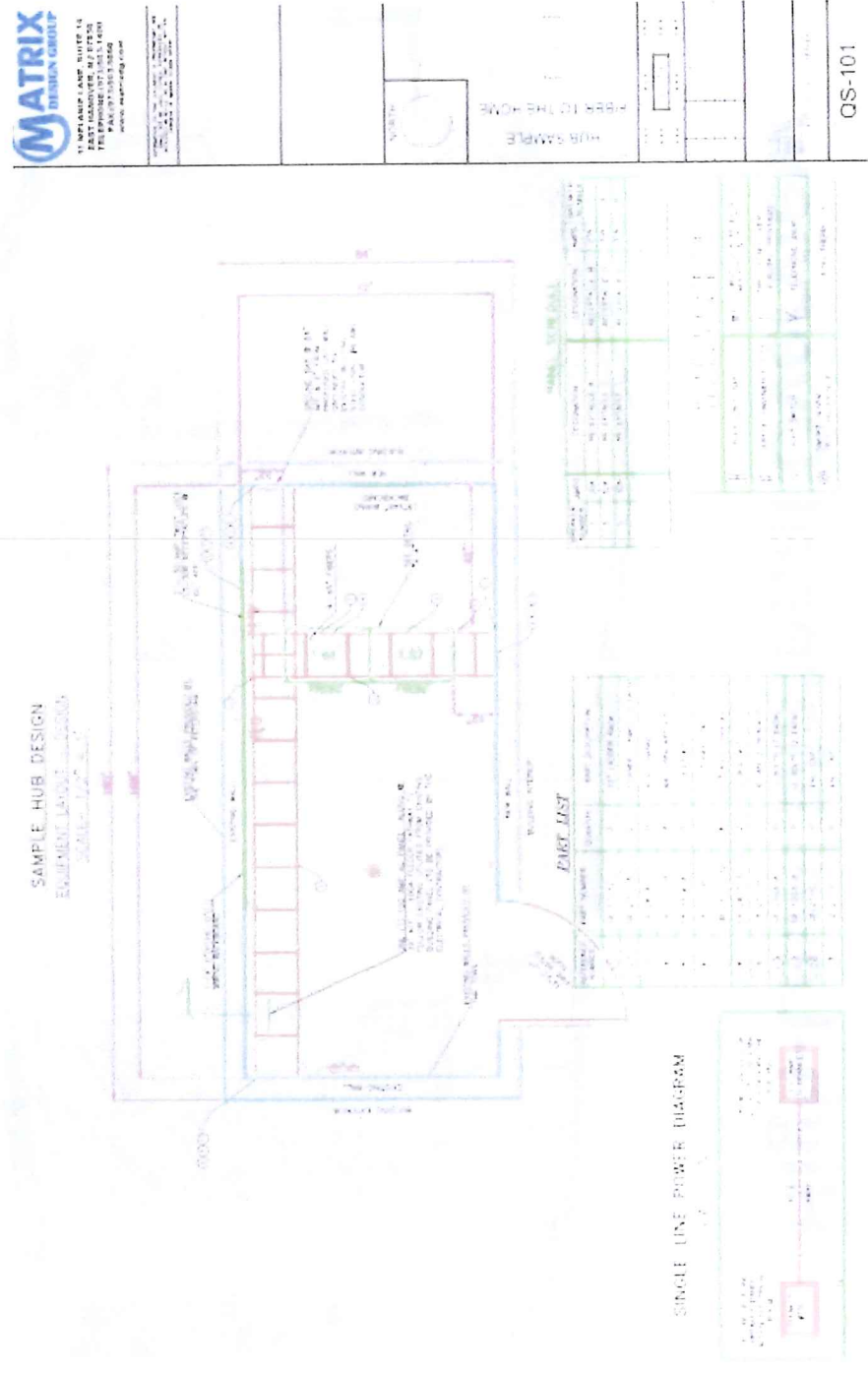
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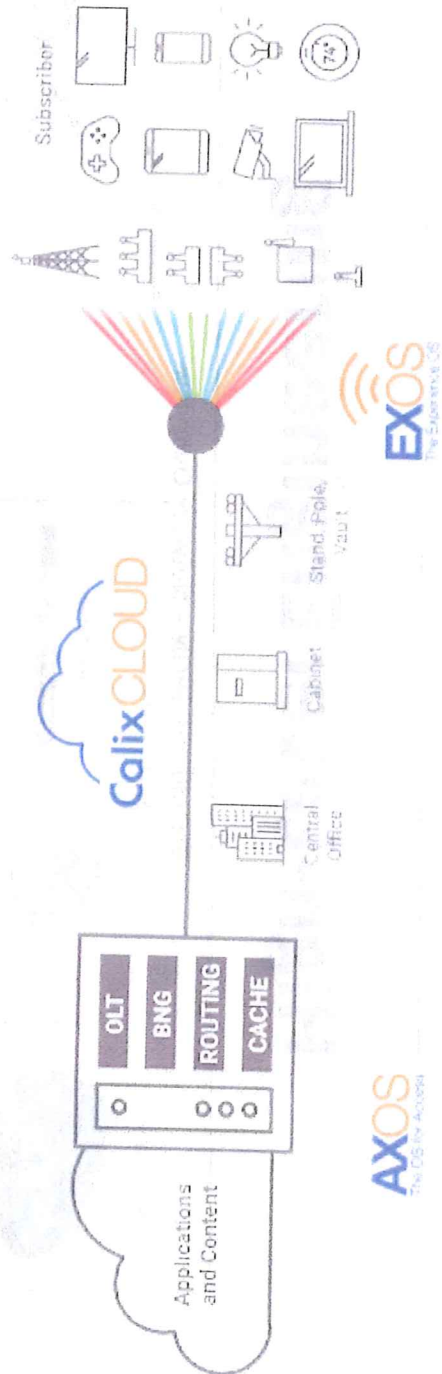
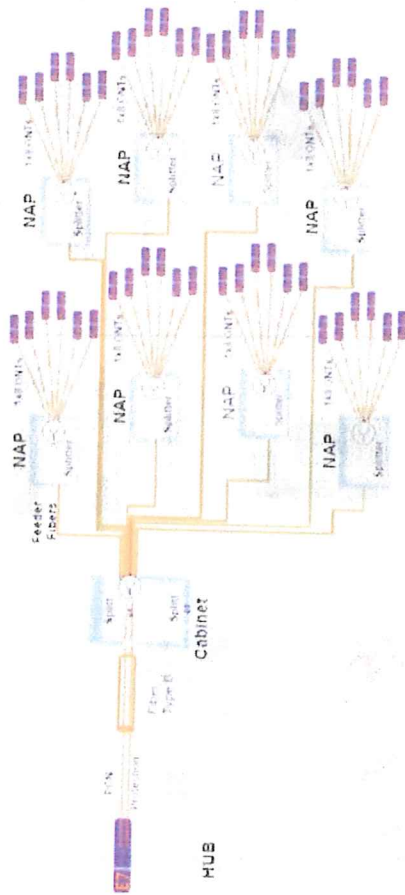
High-Level Material Overview



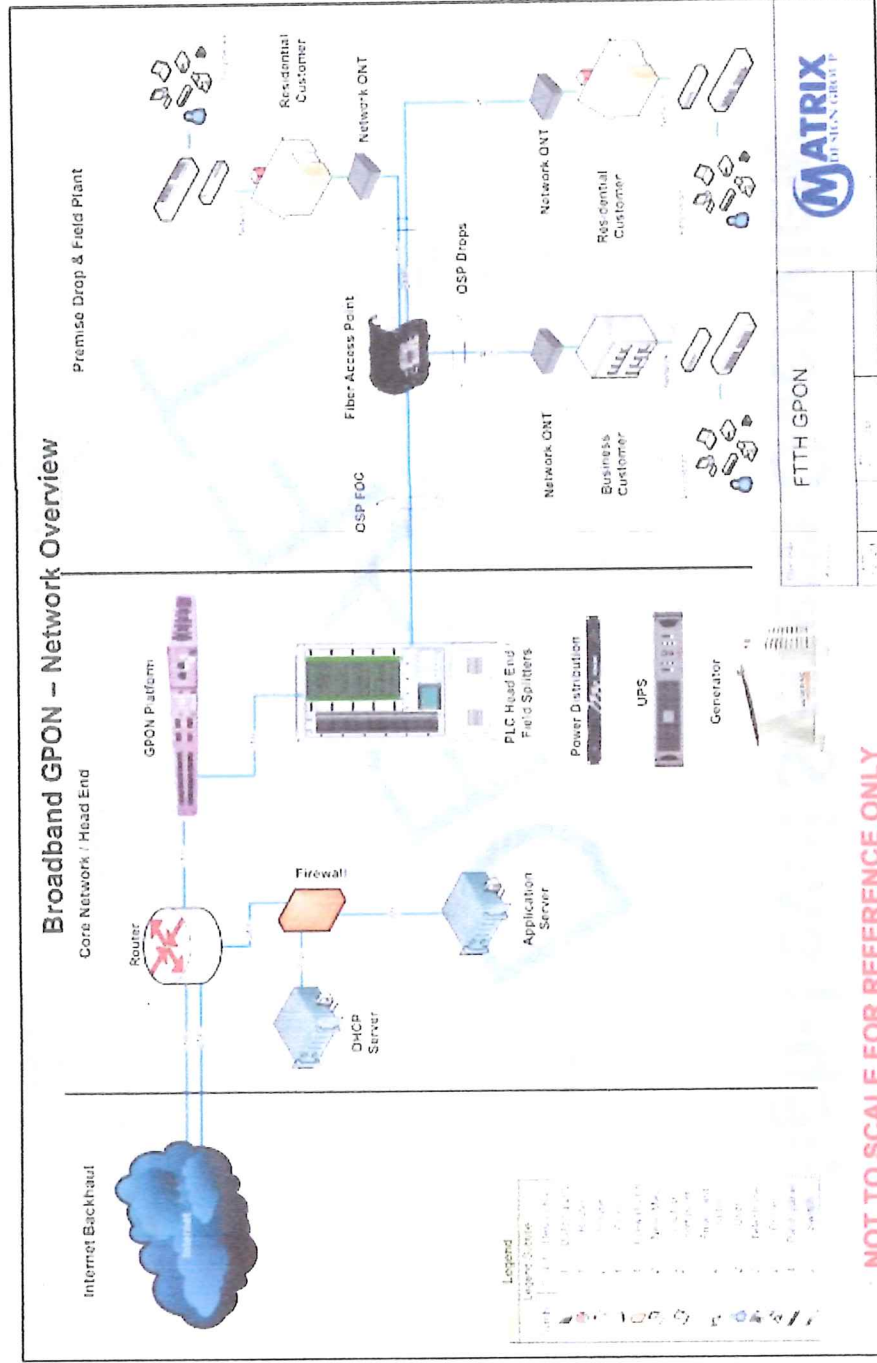
High-Level Material Overview



High-Level System Overview



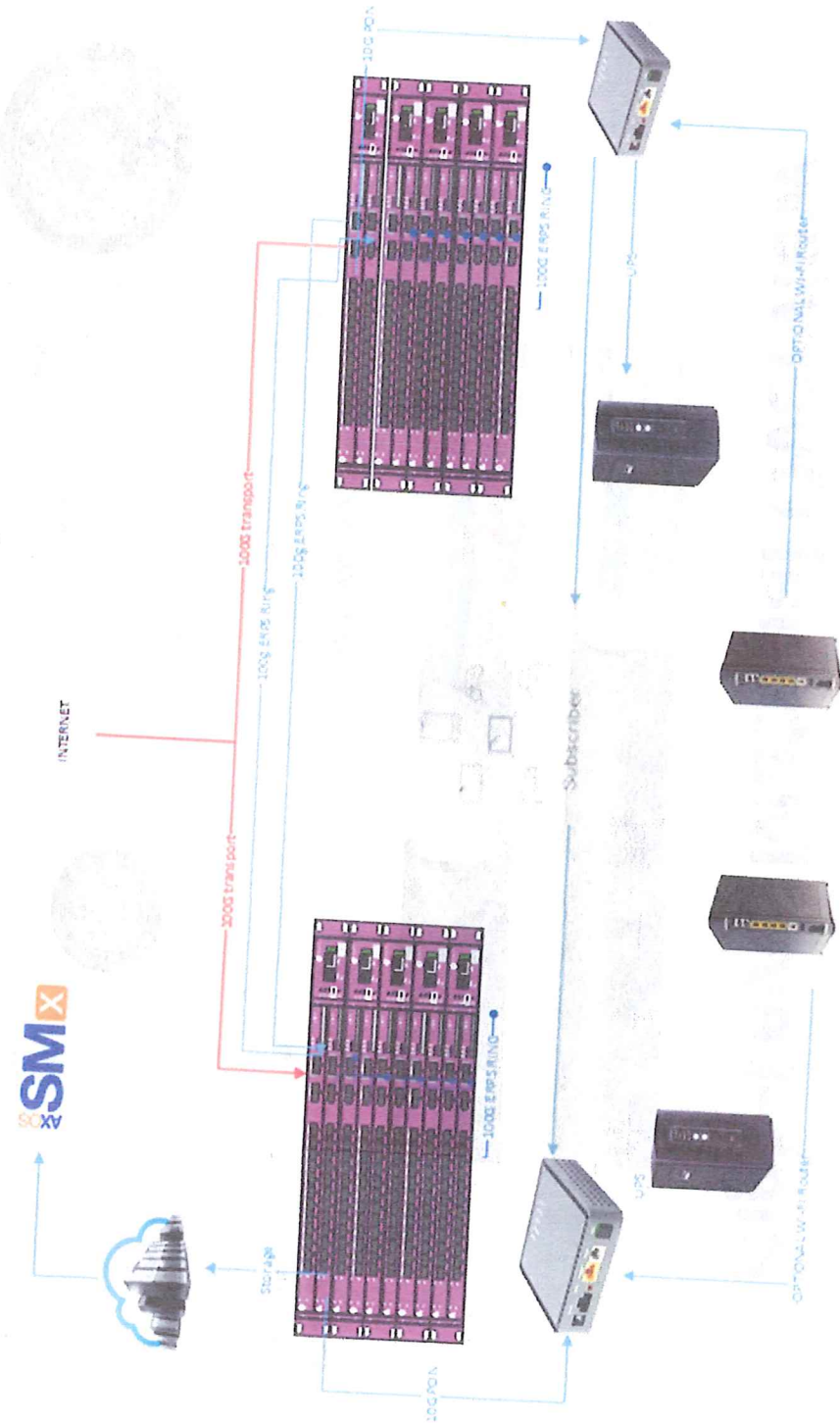
High-Level Engineering



NOT TO SCALE FOR REFERENCE ONLY

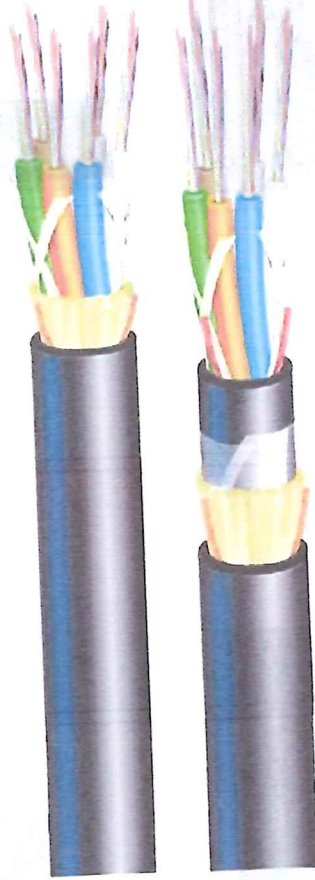


High-Level Material Overview



From Concept To Completion

High-Level Material Overview



ADSS SAG AND TENSION PROPERTIES

Requirements of:

Customer:
 File Number:
 Maximum Span:
 Maximum Temperature:
 File Code:

Cable Specifications:

Material:
 Cable Length:
 Cable Weight:
 Cable Diameter:
 Cable Cross Section:
 Cable Tension:
 Cable Sag:
 Cable Temperature:

Loading Conditions:

Ice Thickness:
 Wind Pressure:
 Temperature:
 Safety Factor:
 Maximum Allowable Sag:
 Maximum Cable Tension:

Cable Description:
 Part Number:

17F SM ADSS LONG SPAN KP 1715LB (17FT)
 ADLS1715LB-072



ADSS SAG AND TENSION PROPERTIES

Requirements of:

Customer:
 File Number:
 Maximum Span:
 Maximum Temperature:
 File Code:

Cable Specifications:

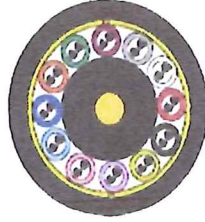
Material:
 Cable Length:
 Cable Weight:
 Cable Diameter:
 Cable Cross Section:
 Cable Tension:
 Cable Sag:
 Cable Temperature:

Loading Conditions:

Ice Thickness:
 Wind Pressure:
 Temperature:
 Safety Factor:
 Maximum Allowable Sag:
 Maximum Cable Tension:

Cable Description:
 Part Number:

28UF SM ADSS LONG SPAN KP 1655LB (24F)
 ADLS165524 HB 283



From Concept To Completion

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High-Level Material Overview

High-Performance Wi-Fi
and so much more

Unprecedented Wi-Fi Performance
In Every Room In Your Home

See how it's done. Home

Experience the difference. Home

See how it's done. Home

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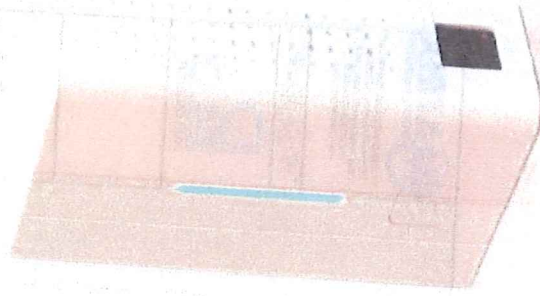
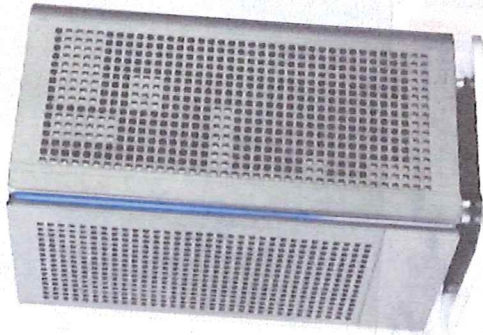
Experience the difference. Home

See how it's done. Home

Experience the difference. Home

See how it's done. Home

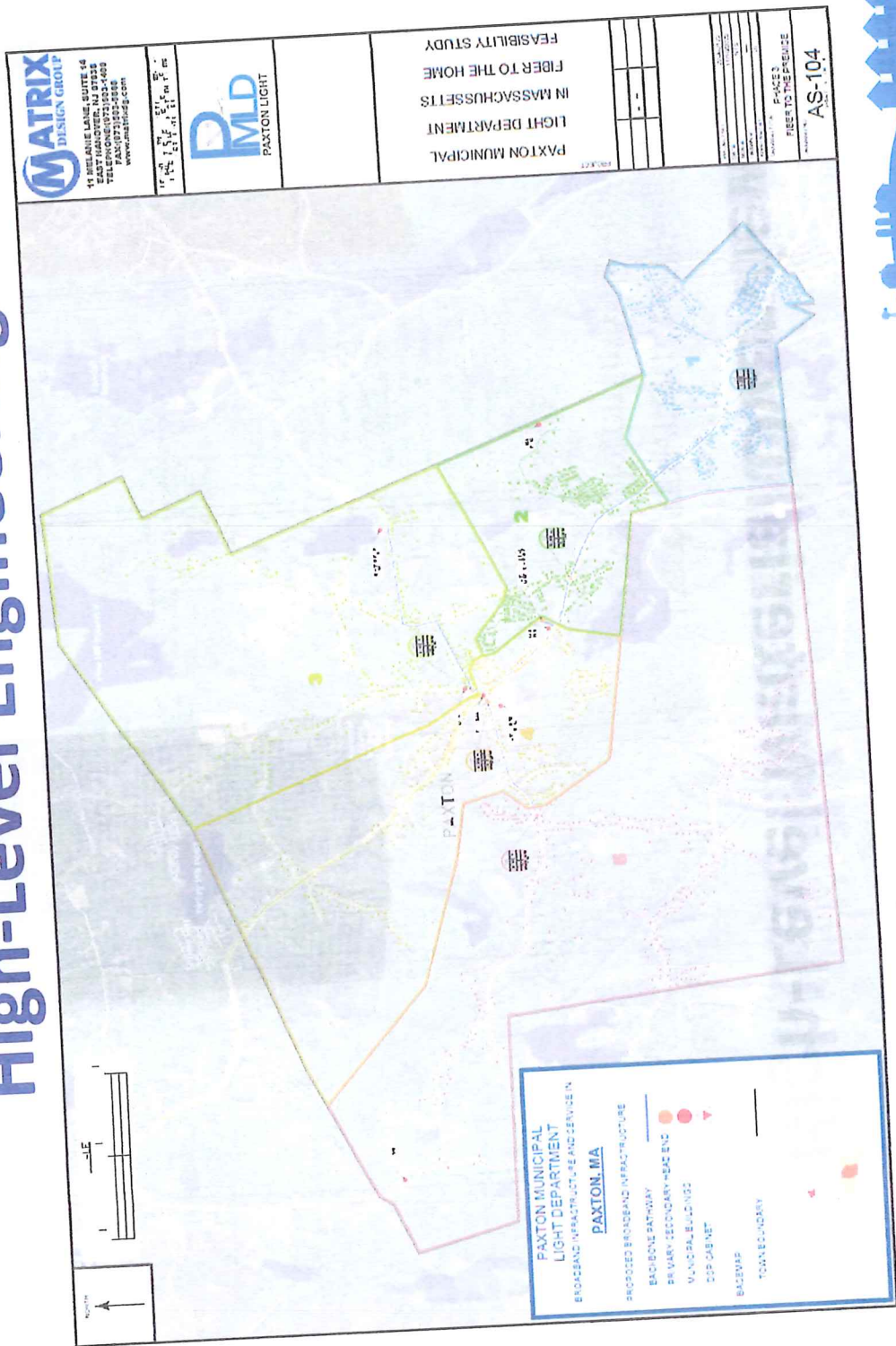
Experience the difference. Home



Proprietary and Confidential Information

From Concept To Completion

High-Level Engineering

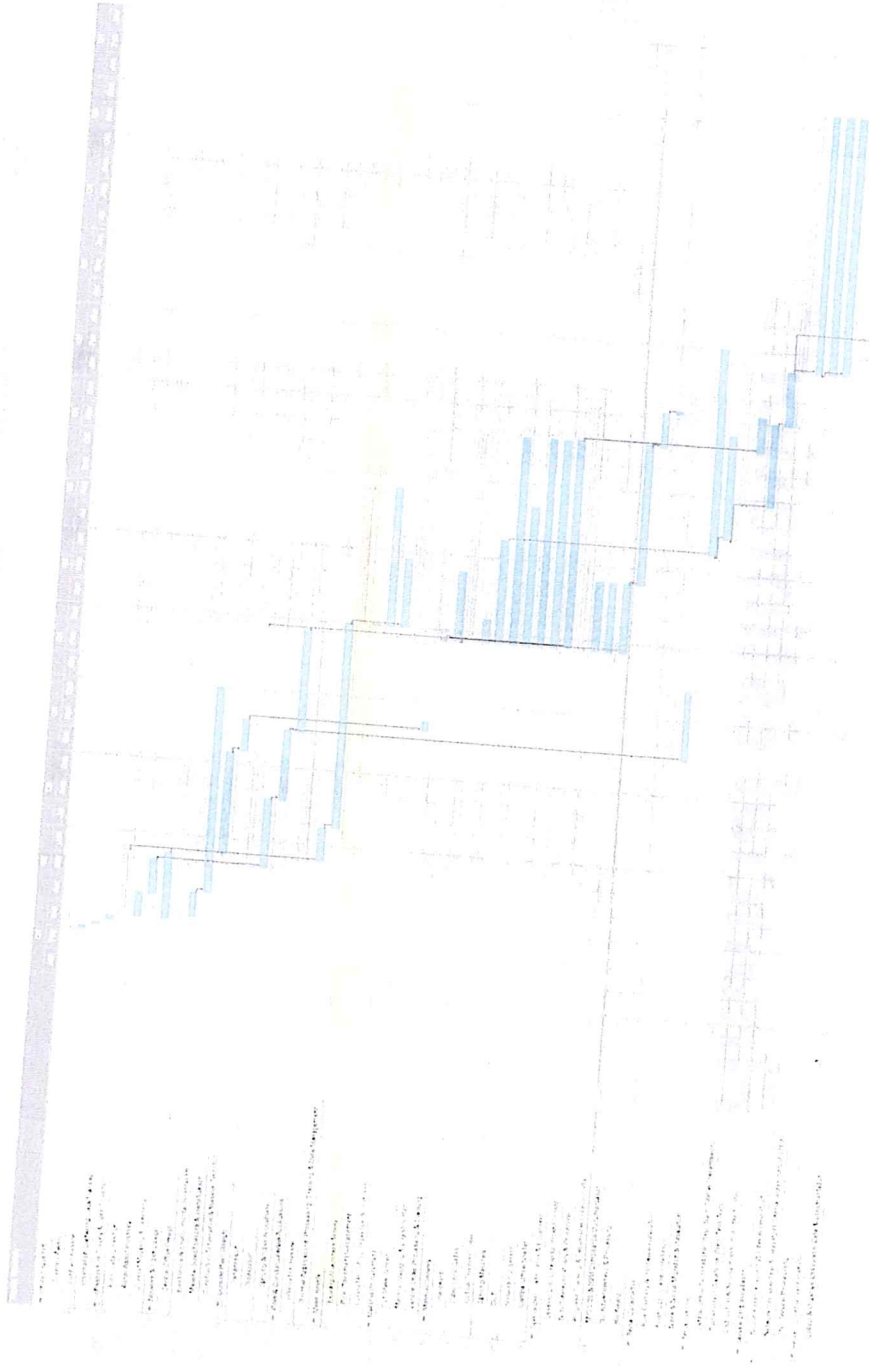


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High-Level Engineering

Construction Schedule PMLD



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Financial Estimations

Category	Node 1	Node 2	Node 3	Node 4	Node 5
Location	\$553,940.83	\$360,955.17	\$437,575.52	\$687,127.00	\$735,965.81
Fiber Build	\$30,000.00	\$30,000.00	\$30,000.00	\$30,000.00	\$30,000.00
Territory Equipment Cost	\$28,050.00	\$28,050.00	\$28,050.00	\$28,050.00	\$28,050.00
Field Deployment Equipment Cost	\$38,475.00	\$38,475.00	\$38,475.00	\$37,125.00	\$34,897.50
Premise Equipment Cost	\$23,085.00	\$23,085.00	\$20,587.50	\$22,275.00	\$20,992.50
Premise ISS Labor Cost	\$35,910.00	\$35,910.00	\$3,025.00	\$34,850.00	\$32,655.00
Premise 3rd Party Labor Cost	\$749,460.83	\$516,475.17	\$582,550.52	\$1,039,227.00	\$882,651.81
	81%	93%	94%	70%	87%
Total Project Cost	342	342	305	330	311
Aerial Percentage	7.23	6.02	8.34	6.67	11.07
Houses Passed	1.37	0.42	0.48	2.60	1.44
Total Fiber Road Mileage	\$21,429.72	\$6,562.92	\$7,525.44	\$40,575.50	\$22,449.96
Underground Mileage	\$109,629.94	\$104,631.70	\$141,478.27	\$113,611.88	\$160,290.45
Fiber Construction (UG) Labor Cost	\$26,876.00	\$26,876.00	\$23,790.00	\$25,740.00	\$24,258.00
Fiber Construction (Aerial) Labor Cost	\$12,804.48	\$12,804.48	\$11,419.20	\$12,355.20	\$11,643.84
Fiber Splicing Construction Labor Cost	\$450,125.44	\$68,851.84	\$101,862.88	\$549,831.20	\$803,937.92
Fiber Testing Construction Labor Cost	1.37	0.42	0.48	2.60	1.44
Conduit Construction (UG) Labor Cost	25650	25650	22875	24750	23225
New Conduit Mileage	\$133,275.26	\$121,428.23	\$151,479.72	\$145,513.32	\$193,385.64
Drop Cable Footage	26	26	23	25	23
Backbone Material Cost	4	4	23	4	23
Total Splice Locations	26	26	3.0	3.0	3.0
Subscribers/FAP					
FAP Locations					
DSP Cabinet Locations					
Total	\$749,460.83	\$516,475.17	\$582,550.52	\$1,039,227.00	\$882,651.81
Cost per passing	\$2,151.41	\$1,910.00	\$1,910.00	\$9,149.17	\$2,838.11
Cost per sub	\$657.42	\$453.05	\$573.00	\$944.75	\$651.43
Cost per mile	\$103,659.87	\$72,456.53	\$72,456.53	\$119,954.71	\$79,733.68



QUESTIONS / THANK YOU!

