



To: Eric Peterson, Town Manager
From: Emily Bradford, Budget Director
Date: July 18, 2017
Re: Aerial vs Underground Fiber Network

I have been meeting with Orange County's IT Director, Jim Northrup periodically over the last year to discuss the possibility of partnering on a fiber build out. Funding for fiber was approved for both organizations for FY18, so we are now starting to take a detailed look at what this partnership might look like, including, but not limited to deciding whether to go aerial versus underground.

Orange County would like to construct an aerial network. Their feasibility analysis came back with aerial construction costing approximately \$55k/mile and underground costing \$80k/mile. Going aerial on their 36 miles could potentially save them \$900,000.

The Town's consultant, CTC, recommended the Town bury its fiber plant due to our interest in leasing fiber to third party vendors to provide last mile service to citizens. Underground fiber is more secure than aerial and is often looked upon favorably by last mile providers. To construct the Town's network, it will cost an estimated \$154k/mile.

Mr. Northrup had their consultant, ECC, take a look at Hillsborough's routes and prepare a cost analysis as well. Their underground estimate was almost identical at \$155k/mile and was within \$2k of CTC's estimate for the total project. Hopefully this consistency lends a reasonable level of confidence in terms of the total cost of Hillsborough's project. ECC's aerial estimate was \$66k/mile, with a potential cost savings of \$1,543,728 for Hillsborough's 17.5 miles. CTC has however indicated that this aerial estimate seems low to them.

Mr. Northrup and I have also discussed the fact that while on paper there appears to be a sizable cost savings by going aerial, many of our neighboring jurisdictions, and providers such as Google and Ting, are choosing to go underground with their networks. I reached out to a several different people to get their take on aerial versus underground fiber and here are a few of their thoughts:

Jeff Wilson, IT Director for Holly Springs

Holly Springs prefers underground over aerial because it is more secure and more expandable, there tend to be fewer incidents, and it is often easier and quicker to repair. With aerial, you are the last to gain access to the pole for repairs. Squirrels, as the Town of Apex has learned, can also cause a lot of damage to aerial fiber. For these reasons, Holly Springs only uses aerial runs for backup purposes.

In terms of constructing the network, there are often delays in moving existing providers on a pole and installing new poles before the Town can even gain access to the pole. They have experienced year long delays on half-mile aerial runs just waiting on the utility company. You also do not know what attachment rights have already been given up and just not attached yet, which can negatively impact your time and

cost estimates. For these reasons, and past experience, Mr. Wilson was very skeptical that aerial would be cheaper. He indicated that in fact it can often be more expensive to construct.

Holly Springs is seeing Spectrum and telco bury any new lines they run. Companies are only doing aerial where they already have attachment rights. NCDOT, MCNC and new companies that have come to Holly Springs have all run their fiber underground. Duke Energy also has a big initiative to put their electric lines underground. What happens to municipal fiber on the poles if they do that?

Last mile providers Clarity and Ting both like for the network to be underground. They consider it an asset. CTC designed Holly Springs' network around access points. They looked at it strategically and considered where third party providers might want/need access. As a result, accessing underground fiber has not been an issue with their third party providers.

Gene Scott, General Manager Outside Plant for City of Wilson (Greenlight)

The City of Wilson is an ElectriCity that owns their own utility poles, yet they prefer an underground fiber plant. Roughly half of their 500 mile network is in conduits underground. In their experience, aerial is only cheaper if you own your own poles. While buried fiber does have some cost penalties for labor and pipe, one of the major selling points of buried fiber is that it's secure and in conduit. Aerial takes a long time to obtain permits and make ready costs can be more costly than going underground. Mr. Scott recommended going underground if we could.

Aerial fiber comes with more maintenance and restoration issues and is more time consuming to maintain. They have experienced numerous issues with squirrels chewing up their fiber. Squirrels have caused more issues than storms, cuts and car accidents combined. The City of Wilson does have their own crews, so it is easier for them to maintain their fiber than for a municipality that does not have their own crew.

Mr. Scott did not anticipate underground fiber being an issue for last mile providers. They could access it via a vault, splice into it and bury a small conduit to the home. Aerial service drops to homes tend to be susceptible to issues from thunderstorms. Buried runs would not have this issue. He also mentioned that Google and Ting are both building out underground networks.

Andrew Rakestraw, NetPlanner Systems, Inc.

Mr. Rakestraw, who manages the installation of fiber at Town facilities, consulted their outside plant team on the pros and cons of an aerial versus underground fiber network. He indicated that over the last few years they've seen a shift to underground construction because "aerial comes back to bite you." He said they still see a few consultants recommending aerial, but most are recommending buried fiber.

Aerial is expensive on the front-end due to the paperwork and application fees for each pole. It can take weeks to months for new poles to be installed, and it is expensive to move or have moved. Maintenance and longevity are also better with underground. Whenever there is an outage and repairs are needed, you are always the last on the pole.

In their experience, underground is also easier to sell to a third party because attaching to poles it not easy due to the time, resources and headaches involved.

The logo for the Town of Hillsborough, featuring the text "TOWN OF HILLSBOROUGH" in a stylized font within a dark, arched banner.

To: Eric Peterson, Town Manager
From: Emily Bradford, Budget Director
Date: March 25, 2019
Re: Hillsborough & Orange County Fiber Project

The town has been struggling with an inadequate internet solution for years. Our business class internet lacks reliability, redundancy and adequate speeds. It also prevents the town from being able to create a true town-wide network, needed for sharing information, redundancy and consolidation of infrastructure (i.e. phone systems, servers, and disaster recovery sites). As the town continues to migrate to cloud based software solutions, the need for fast and reliable internet has become even more important. This is especially true as many of these software applications seek to expand the user base from just a few within a department to entire departments, or in some cases, all town employees. In the last few years we have moved personnel records and performance management to the cloud with NeoGov. Utility billing was originally an on premise system, but was brought back in house as a cloud based system. The Exchange (email) server was migrated to the cloud several years ago, with the migration to Office 365.

Office 365's SharePoint platform is used for Board of Commissioner agenda preparation and budget development, as well as a collaboration space for departments and work groups. When we move to a new ERP system, even more functions and services will be pushed to the cloud (i.e. accounting, payroll, time keeping, PO requests, leave requests, employee self-service, etc.). This will mean that all town employees will be accessing this system on a daily basis. And even though we are not currently moving forward with a new ERP system, many of the interim solutions we are exploring will be cloud based. There are also a host of other platforms currently in use by town staff including PowerDMS which is used the Police Department to track training, and Utility Cloud, which is used by Water & Sewer and Stormwater for work order tracking, and location, maintenance and condition tracking of infrastructure, and Works for purchasing card reconciliation and account coding.

The town does use VPNs to connect to Orange County for use of their inspection software. The Planning Department reports that while they can download information from the system, the ability to upload data is a very slow process. The town also has VPNs that connect our various facilities, these connections are slow and periodically go down. This makes working on data at the other end of the connection inefficient. It also means that an internet or VPN outage at a facility can impact users at other facilities who need that data, and prevent them from being able to complete their work.

The town is also trying to move toward a more modern, centralized phone system. This will provide users with more features, create a single phone system to ease internal calling, and allow the town to move toward a centralized phone number. Several facilities have been added to the VoIP system at Town Hall via a VPN, however this is not ideal in that phone service to those facilities is reliant on internet service at both ends being up, and call quality can be impacted by internet speeds.

Having a fiber loop would create redundancy in that if the fiber gets cut, then the data can simply travel a different direction around the loop. Being able to connect to Orange County, who has facilities all over the county, would allow the town to gain access to different internet providers not available in Hillsborough. Not only could this potentially result in a cost savings, but being able to have a primary and a back-up internet provider that are somewhat geographically diverse, could also result in increased up-time, especially during an event.

The town can lease fiber or build its own network. Leased fiber comes with an ongoing monthly expense at each location it connects. From talking to other local governments, this is often a barrier to lighting up non-office facilities such as parks and making wi-fi available to the public, or connecting pump stations, etc. In addition, local governments that have moved from a leased to a private network have found that their actual internet speed needs were significantly higher than what they had been purchasing from their provider. Fiber has a 50+ year useful life, so once the initial investment is paid off, there is limited ongoing expense, and many local governments see payback periods of less than 10 years.

The town currently has a unique opportunity to partner with Orange County to share a significant portion of the cost of building out and maintaining the fiber. A fiber feasibility study estimated it would cost approximately \$2.7M to build a fiber network, connecting all town facilities, including the future public safety facility in Waterstone, Gold Park and Cates Creek Park. Orange County is planning to build their own fiber network, and it was determined that we have several routes in common, making partnering a logical option. Rough estimates, put total savings from partnering at around \$900,000 for construction. Then going forward, any maintenance expense on these routes would also be shared.

The initial fiber loop design was done to include all town facilities, create a redundant loop, and run in such a manner as to be attractive to a third-party internet provider to lease fiber from the town and provide last mile service to citizens. To reduce costs, we could reexamine whether it is still necessary to run down Churton Street now that Financial Services has moved to the North Campus, and the Police Department also plans to move out of downtown. There may be alternative routes that are less expensive. In addition, the scope of the project could be reduced. We could examine what would be needed to simply connect town facilities, and/or reduce or eliminate the amount of redundancy that is built into the route. We could also look to only build out the routes the town has in common with Orange County and connect any remaining sites via leased fiber.

Should the town decide not to move forward with building a fiber network at this time, we need to strongly consider leasing fiber. The town is currently utilizing the maximum speed available for business class internet, but it does not provide sufficient bandwidth or a centralized computing environment needed to meet the needs of our users.

Cost Comparison

Current Internet - \$36,000/year

Leased Fiber - \$97,000/year (plus \$4,000 in yr-1 for installation; speeds based on provider's assumption of the town's needs, so price could change based on actual need). A redundant connection would bring the total to approximately \$200,000/year.

Private Fiber - \$235,000/year (debt service + fiber internet service; drops to \$11,000/year after debt retired). Adding a redundant internet connection would bring the total to \$22,000/year.

Summary

Why Needed:

- Reliability and redundancy
- Increased speeds to handle increasingly hosted/web-based environment
- Centralized servers/network
- Centralized phone system

Why Now:

- Cost savings by partnering with Orange County



To: Eric Peterson, Town Manager and Emily Bradford, Budget Director
From: Beth Yurchisin, IT Manager
Date: February 10, 2020
Re: Hillsborough Fiber Project

As the town enters the final phase of review for the proposed fiber project, I have been asked to provide insight from my past experience with fiber networking of facilities and to provide some justifications, points, formatting, and/or other ways that best inform everyone of the need for this project.

After reviewing all of the documentation provided with the feasibility study and various documentation on justification of how fiber can benefit the town, it all comes down to the simple fact that the town needs to be able to provide access to necessary data and information in the most efficient and effective method possible in order to provide the best services to the town constituents.

Fiber cabling to all of the town facilities will allow the town to create a true town-wide network infrastructure allowing for the sharing of needed data and information amongst all departments within the town at a reliable, fast speed, with built-in redundancy and provide the ability for the town to continue moving forward into the future with an infrastructure that will continue to deliver adequate access to all data and information as technology advances.

In the simplest of terms, the advantages of fiber include:

- **Speed:** Fiber truly is super fast. Fiber uses light to transmit data, which means potentially we will be able to process transmission of data at the speed of light someday. Currently that speed is limited by the devices transmitting and translating the data on each end of the cabling and therefore we are not up to those speeds just yet.
- **Faster Cloud Application Access:** Over the past few years, industry standards have been shifting away from on-premise applications to hosted, cloud-based application solutions. Cloud-based options allow the applications to be provided to users anywhere, anytime, on any device. This also allows the software vendors to provide better, stronger security measures for these applications and to release upgrades to the features and functions of these applications in real time. To date, the town is utilizing many hosted, cloud-based applications within all departments with the largest of the applications being Office 365. Every employee within the town utilizes at least one application from the Office 365 suite every day whether it is Outlook for email, Word for document processing, Excel for financial spreadsheets and calculations, or PowerPoint for some type of presentation. Providing a network infrastructure utilizing fiber provides the speed, bandwidth, reliability, redundancy, and symmetric upload and download speed to allow all users to access any hosted, cloud-based application effectively and efficiently.
- **Redundant, Reliable Connectivity –** Fiber connectivity offers significant reliability advantages over coaxial (copper) connectivity, due to the fact that fiber is stronger, not susceptible to inclement weather conditions, and resistant to electrical interference. Providing fiber interconnectivity to all town facilities will create a fiber loop. By creating a fiber loop the town insures reliable, redundant connectivity for all town facilities. In the unlikely event of a fiber cut or break, the data will

ED BY THE ROUTER
automatically redirect itself along the fiber loop in order to reach the intended device resulting in increased uptime for all town facilities.

- Symmetric Upload and Download Speed – Fiber is currently the only option providing equal upload and download speeds for data transfer. Equal upload and download speeds are crucial when using VoIP telephony solutions (including video conferencing and teleconferencing) as well as with the transfer of video. Symmetric upload and download speeds prevent delays in telephone conversations and eliminates poor audio and video quality.
- Bandwidth, Signal Strength, Latency, and Resistance to Interference – Fiber provides the most bandwidth currently available, the best signal strength available, the lowest latency issues, and is the most resistant to any interference from any other cabling near it. Again, fiber will allow data to be transferred at the highest speeds with the least amount of degradation making it the best way to provide data and information to all town employees which, in turn, allows them to provide the best quality service to the town constituents.

(ESPECIALLY
HD VIDEO)

OR CROSS TALK

— WITHOUT FIBER — 25 ← 30 — 14 STEAD OF 50
— VIDEO / VIDEO CONFERENCE / TELECONFERENCE
— DOWNLOAD / UPLOAD 14 EQUALITY
— DECENTRALIZED TOWN NETWORK

Beth Yurchisin

From: Emily Bradford
Sent: Sunday, January 12, 2020 11:26 PM
To: Beth Yurchisin
Subject: FW: Thoughts on Fiber in the Budget

Hey Beth,

Coming out of last year's budget retreat, the Board's #1 priority was building a fiber network. Unfortunately we weren't able to find sufficient funding to cover the cost. As a result, it continues to be an unfunded priority. Below is an email from Eric from last week about the fiber project. I'm including the link below to the Fiber Loop CIP form. I would love your thoughts on all of this.

https://hillsboroughnc.sharepoint.com/:x:/g/Budget/EaY24H9pKedGsRwzW9S21_sBFBgnUhJ-uCmCqZPVATuT9g?e=wl5dAk

Thanks,
Emily

From: Eric Peterson <Eric.Peterson@hillsboroughnc.gov>
Sent: Wednesday, January 08, 2020 9:17 AM
To: Emily Bradford <Emily.Bradford@hillsboroughnc.gov>
Subject: Thoughts on Fiber in the Budget

Hi Emily,

I thought it would be easier to share some random thoughts on fiber then blurt them out during our meeting this afternoon. They really are thoughts and questions as opposed to providing direction.

I've been struggling on where fiber lands as a priority. Part of me feels it might be number one, but the other part just isn't moved by the urgency. As you said it's hard because we can't see it. If that's the case, then we need to figure out how to communicate those key points to paint a clearer picture of the benefits and problems it will solve. It seems there is a lot of good information already in the prior justifications but something is missing that delivers a "punch" of clarity for readers (i.e., me and the board).

It seems that fiber and new ERP are connected, so that's a factor in what other big items get funded or delayed. And, I'm worried if we don't decide fast to move we'll lose county participation if we do want to move forward soon. Either way, getting direction from the board at the retreat is important.

Having just read again this morning other case studies about how people with outside views often see things clearer (i.e., problems, opportunities, details, warning signs, and such). The same concept was in the chapter from the book, "Range" that we all read late last year. That's also part of the reason for trying to leverage the diverse perspectives of the management team more often on issues. Anyway, I don't know if Beth has much experience in fiber networking of facilities, but do you think it would be helpful to have her review the justifications that we are using to make the case to see if she has suggestions for improvement? It could be changes in points, formatting, or other ways that could help inform everyone of the need, consequences/costs of not funding, and any options that may be available.

Random thoughts:

- Develop a one page summary, in an easy to read format, that hits all the key points.

- IIRC, we're the only or one of the only local governments using business class internet. I think you mentioned we're 20 years behind in the way our system is set up. If that's the case, what does that mean? Can we produce a list showing of other area governments that have already done this.
- When I asked last month whether if a Gigabit speed provider came into town if that would solve our problem. The answer was, no, we'd still have to do this. That would be very important point to convey.
- IIRC, one of the really big costs is paying for redundant service...like maybe half of the overall cost? IF this is correct, as a temporary bridge to make it more affordable, could we move forward with the fiber project without having a back-up provider? I'm assuming this doesn't have anything to do with the type or number of strands we put in the ground. My thought is this...we currently have no back-up, if we build a fiber system then it should be more reliable than what we have, some of our facilities (Town Hall and the Annex) have Verizon as back-up. So, while it's not ideal, it would still be noticeably better than what we have now. We can pay for back-up access at a later date when it's more affordable. If that freed up \$75,000/year to pay for the project that could be a big deal. I may be wrong on all this.

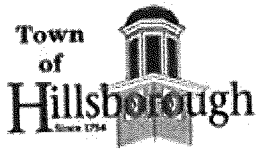
Please don't type a response back, we can just talk. That's probably faster, easier, and will help ration your keystrokes.

Thanks!

Sincerely,

Eric

Eric Peterson



Eric Peterson
Town Manager
Town of Hillsborough
P O Box 429
101 E. Orange Street
Hillsborough, NC 27278

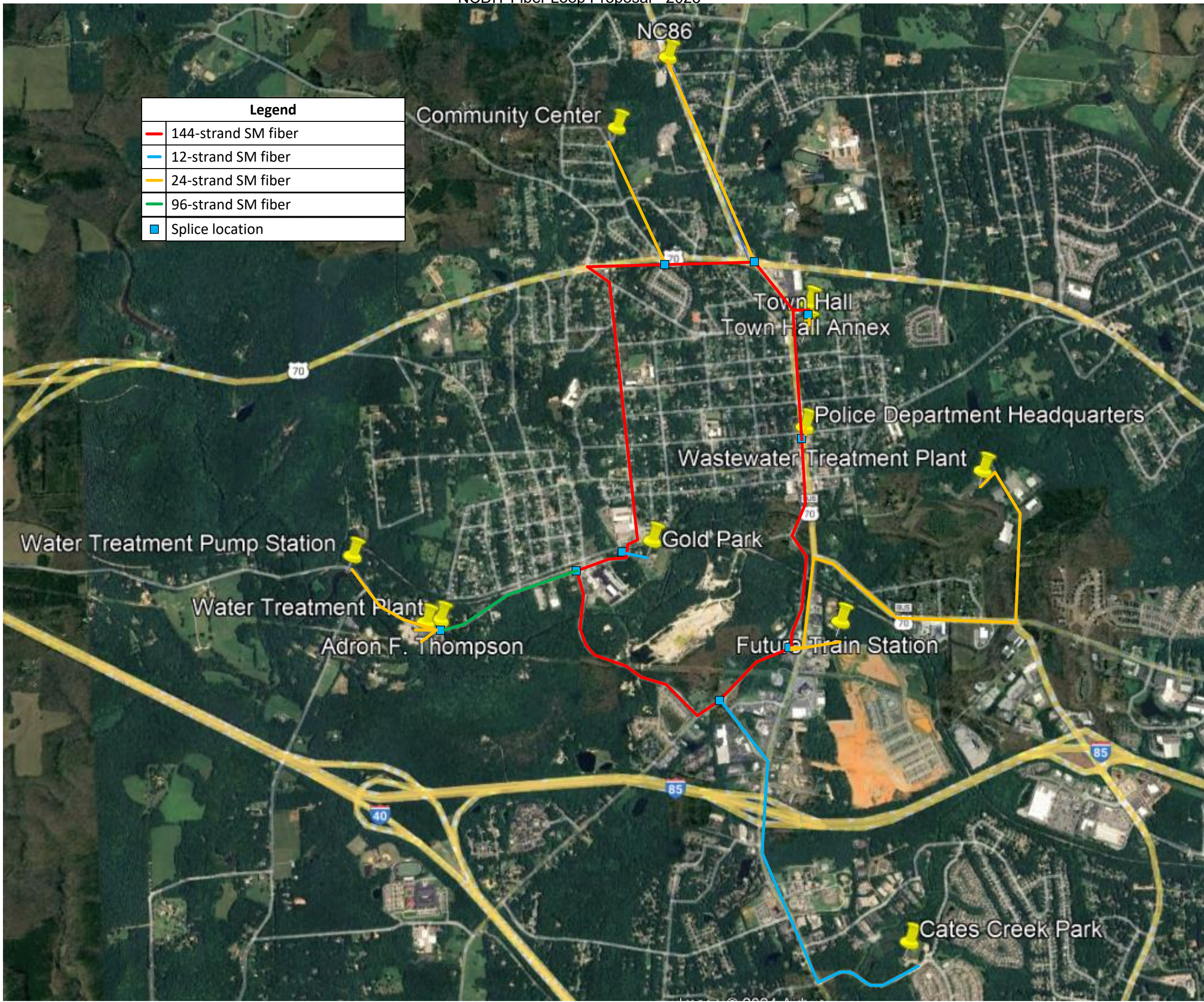
☎ 919-296-9421

☎ 919-732-3921

E-Mail: eric.peterson@hillsboroughnc.gov

Web: www.hillsboroughnc.gov

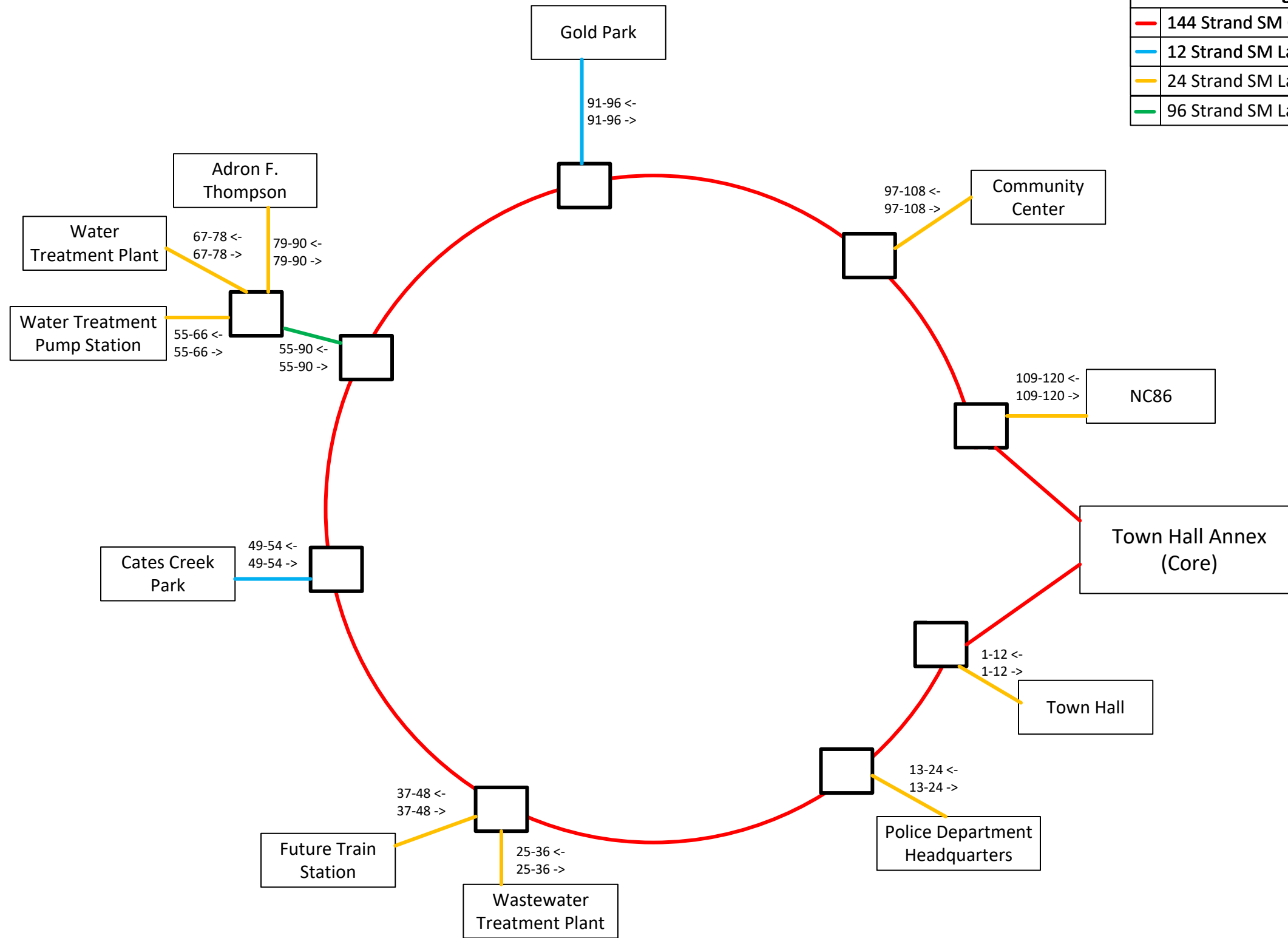
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Legend	
—	144-strand SM fiber
—	12-strand SM fiber
—	24-strand SM fiber
—	96-strand SM fiber
■	Splice location

NCDIT Fiber Loop Proposal - 2025

Legend	
—	144 Strand SM Core Ring Fiber
—	12 Strand SM Lateral Fiber to Bldg.
—	24 Strand SM Lateral Fiber to Bldg.
—	96 Strand SM Lateral Fiber



Orange County Fiber Rollout - March, 2026 - Phase One

UTILITY OWNER: PERFORMANCE CABLING TECHNOLOGIES
PROJECT NUMBER: U98011 / ----
PROJECT NAME: ORANGE COUNTY AERIAL FIBER
ADDRESS: 1020 US-70 suite 130, Hillsborough, NC 27278



3201 ROTARY DRIVE
CHARLOTTE, NC 28269

SCOPE OF WORK:
STARTING FROM AN EXISTING DUKE POLE NEAR THE NC COOPERATIVE EXTENSION ON THE SOUTH SIDE OF CORNELIUS STREET FIBER WILL RUN ALONG EXISTING DUKE ENERGY POLES BY MEANS OF AERIAL ATTACHMENT ALONG CORNELIUS ST., REVERE RD., N MAIN ST., W UNION ST., N OCCONEECHEE ST., W KINGS ST., N HASSEL ST., N WAKE ST., AND W MARGARET LN. ENDING AT EXISTING DUKE POLE AT THE ORANGE COUNTY PUBLIC LIBRARY.

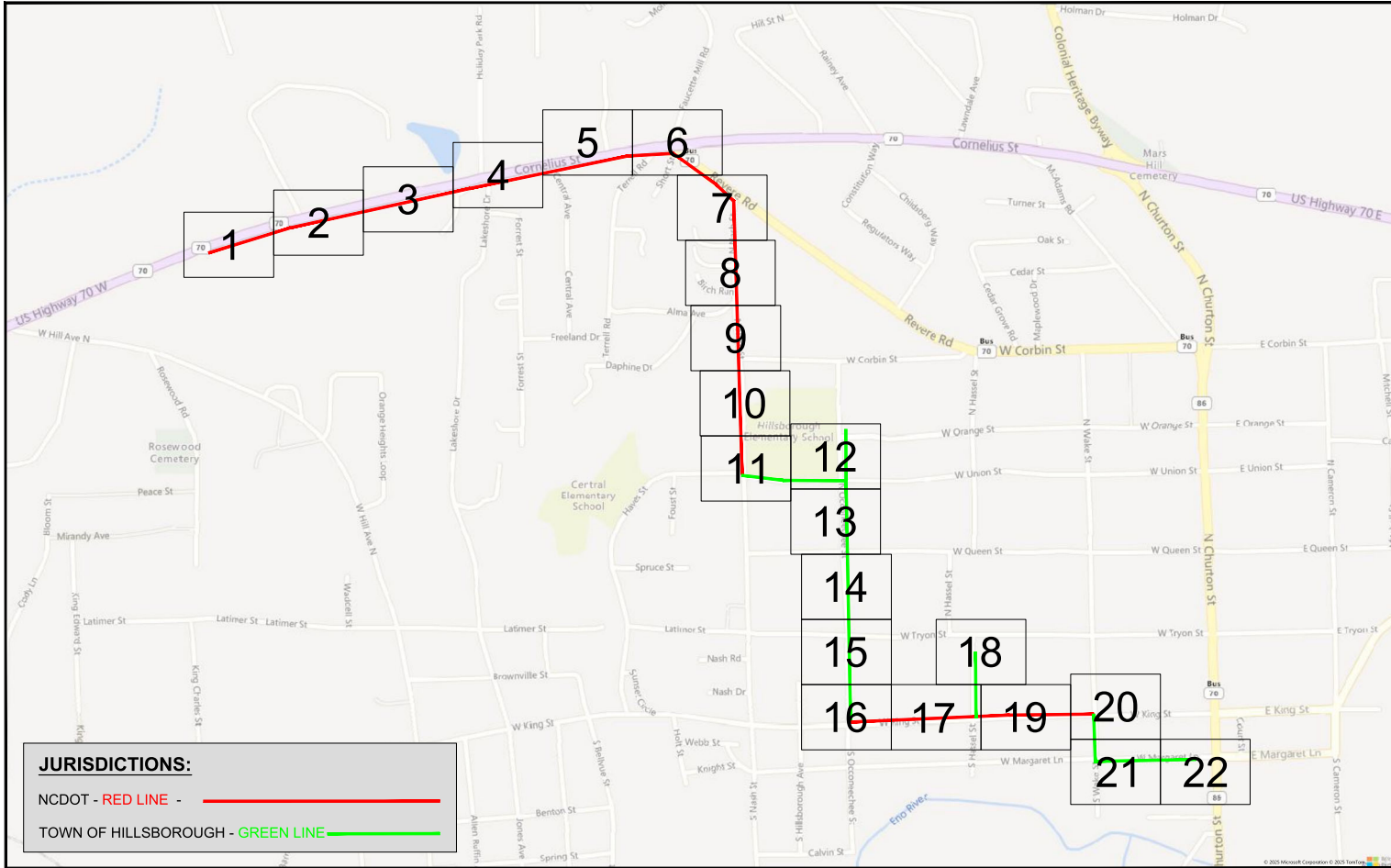
PERMITS REQUIRED:
NCDOT - 7,829' / TOWN OF HILLSBOROUGH - 4,625'

CONTACTS:
SENIOR OSP PROJECT MANAGER:
PHILLIP WAUGH
336-964-0307
PHILLIP@PCT-NC.COM

REV	DESCRIPTION	DATE
0	ORIGINAL	10/17/2025
1	----	----
2		
3		
4		
5		
6		

PE SEAL:

SHEET TITLE:	
COVER SHEET	
PROJECT MANAGER:	JEFFREY SMITH
PROJECT ENGINEER:	TYLER FIGARO
PROJECT NUMBER:	U98011 / ----
DESCRIPTION:	AERIAL FIBER OPTIC
DRAWING NAME:	PERFORMANCE CABLING TECHNOLOGIES-U98011 - Orange County Aerial Fiber 10-13-2025-01.dwg
SHEET:	A1
<small>CONFIDENTIAL/PROPRIETARY</small>	



JURISDICTIONS:
 NCDOT - RED LINE - —————
 TOWN OF HILLSBOROUGH - GREEN LINE - —————



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