Broadband Planning Report
Implementation Recommendations

Isle au Haut

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Study Background and Steps

Isle au Haut (IAH) contracted with Axiom to provide a solution for the island that would be robust enough to meet the federal stand of 25/3Mbps and be inclusive enough so that all the homes on the island would have the opportunity to access the same level of service. Recently, TDS, the island internet provider upgraded its service to include an area along the western shore that can now receive speeds of up to 50/10Mbps. This is a substantial improvement over past service levels. However, that speed level is not available to most homes, and the speed and reliability can vary greatly and residents and homeowners on the other side of the island cannot obtain anything close to 50Mpbs service, with many receiving speeds of 3Mbps or less.

Additionally, the select board has officially recognized the "Isle au Haut Broadband Committee" as a committee of the town and recruitment and marketing efforts by the committee to build momentum for a long lasting solution. During our time on the island it was apparent that the topographical features of the island, the small year round population and the lack of density creates a significant challenge to find a solution to meet the goals of the community. Raising the challenge further, because Isle au Haut can only be served by a high capacity fixed wireless solution (as is currently the case with TDS), the choices of service delivery method, backhaul options and service levels are all dictated by the various issues described here.

On the other hand, having a current provider that helps a portion of the town reach up to 50Mbps service is a positive development, as is the importance of the local electrical co-op owning the utility pole infrastructure. Taking this situation as a whole, we believe we have a plan that can help the community move forward.

Although much of what the community is looking for was already established when we visited, it is worth noting that Axiom adheres to a Rural Broadband Deployment Kit that helps guide the community and Axiom to actionable solutions.

Note: This process works through the first 3 steps and prepares the community for Step #4, implementation. Several possible deployment scenarios were discussed and evaluated. Below are the results of our engineering and planning process.

The Plan

The information below will outline a plan to use existing pole infrastructure and an innovative wireless design to create a deployment that is both efficient and cost effective. Isle au Haut offers a unique opportunity where the provider of electrical service is a local entity on the island. Many of the utility poles are owned by the local electrical co-op. If a relationship can be developed or further enhanced between the island community and the electrical provider there is quite a bit that could be accomplished with a potential of minimizing cost.

Existing Service

TDS is Isle au Haut's primary provider of broadband service. This provider offers DSL service to their end users offering up to 50/10Mbps depending on their distance from their central office (CO). Because of the technological limitations of DSL service, the service quality and quantity decreases as the distance from their CO increases and can also be impacted by the quality of the copper lines on the utility poles. The chart below outlines a rough approximation of the speeds you should expect to see in ideal circumstances.

50M/10M – up to 2,500 ft.
25M/5M – up to 6,000 ft.
15M/2M – up to 12,000 ft.

Anything beyond 12,000 ft. would get up to 10M/1M service, but in most cases much less.

There is also one Remote Terminal (RT) on the eastern side of the island that feeds up to 25 homes, this RT has not been upgraded and is currently being fed by multiple T1 lines, so many of the residents that have service have mentioned that their speeds are very poor in this area. Often, when the system is overloaded with users, speeds of 1Mbps with negligible uploads are reported.

Below are the tiers of service that TDS currently offers to island residents. Package options depend on a number of factors as described in this section.

Downstream	Upstream
1Mbps	500Kbps
5Mbps	500Kbps
15Mbps	750Kbps
25Mbps	5Mbps
50Mbps	10Mbps

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It is also important to note that TDS uses a fixed wireless backhaul and does not have an undersea fiber connection providing bandwidth to the island and their customers. Our understanding is that TDS is feeding their network on the island with a wireless link from Stonington. If another provider were to bring service to the island, that provider would also have to use a wireless link from the mainland.

Approximate TDS Coverage Area

Green- 50Mbps/10Mbps

Blue- 25Mbps/5Mbps

Yellow- 15Mbps/750Kbps

Red- 10/750Kbps

White- 5Mbps/500Kbps

Fiber Solution

On Isle au Haut we would presume the existing provider would continue to sell service, therefore, a solution that would attract an additional provider must be economical, yet bring a level of service that rivals or exceeds current service offerings making the new service competitive and attractive to any potential internet service provider. Building a fiber trunk line affords the possibility of greatly exceeding current speed offerings on the island, while increasing reliability.

Initially fiber optics is the most expensive solution.   However, there are significant benefits to fiber that reduce cost downstream that makes this investment a smart choice. By limiting the amount of fiber and creating a hybrid solution that combines both fiber and wireless technologies, the system becomes considerably more affordable.

It is recommended that a fiber trunk be constructed along Main Rd. starting just before Lighthouse Rd on the western side of the island and ending just after Head Harbor Rd. on the east. This 6.7mile length of fiber would be used primarily to provide a broadband link to the wireless access points distributed throughout the island. The cost of this fiber could be greatly reduced if the constructor of the fiber could be licensed or authorized to use the existing co-op pole structure to hang the fiber. If that authorization were granted, a significant cost to the project would be reduced or eliminated.

For those along the trunk line of fiber, they would still have an option to hook directly into the fiber. Perhaps neighbors could work together and potentially reduce the cost of installation, with the responsibility of the cost from the pole to the home aerially, just as you receive your electrical service now.

There are some areas where the existing utilities are buried; this is the case near the end of Birch Point Rd. and the cluster of homes located there. From our initial observations, there did not appear to be any open conduits available so getting fiber to these homes will be at a significant expense if it buried. There are several options that can be used in this location that would be less expensive than burying fiber lines.

1. Run the fiber line over ground through the woods and along the edge of the road where possible.
2. Install utility poles to extend the line, rather than bury it.
3. Install the fiber as far as possible, then use a wireless solution to extend the service where needed.

The cost to run the 6.7 miles of trunk fiber is estimated to be approximately $340,000. This figure is derived using the assumption that the local electrical provider would allow the town to run the fiber on their poles as a possible exchange of service.

For residents wishing a direct fiber connection a typical drop between 500 and 1000 ft. in length is estimated at $800- $1000 per home, this also includes the projected cost of the requisite electronics and hardware.

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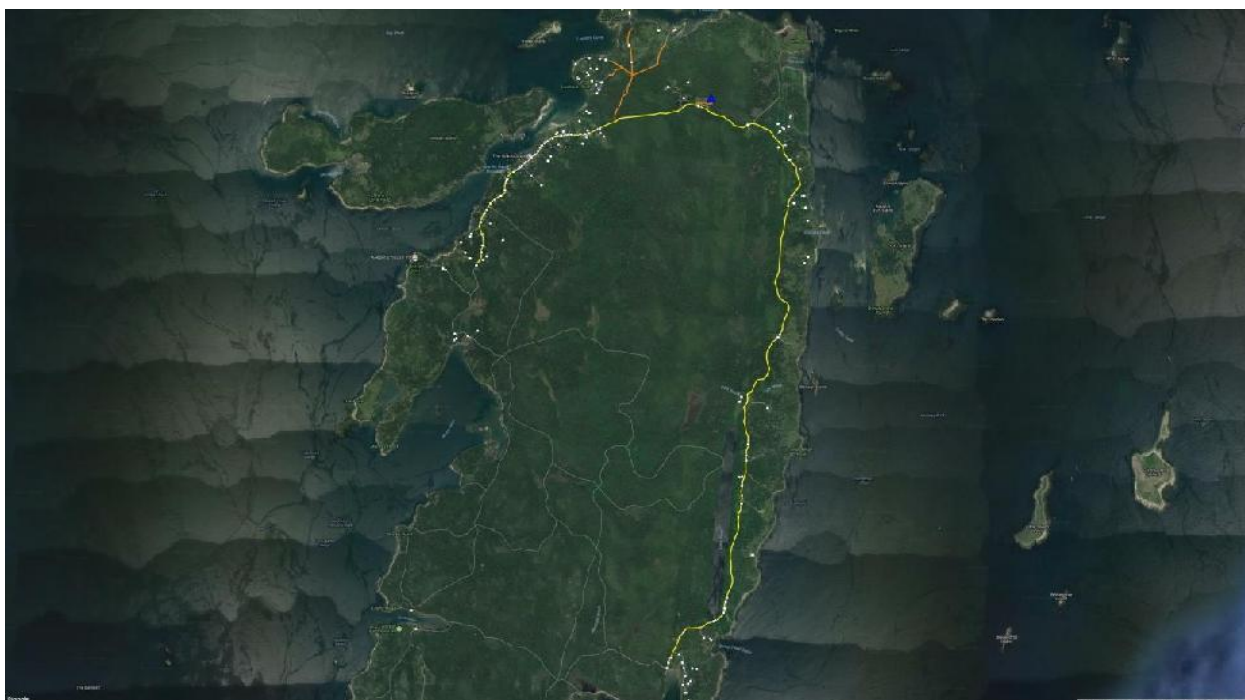
Proposed 6.7-Mile Fiber Route plus spurs

➢ Cost of Trunk fiber $340,000 ○ Based on access
to co-op electrical poles
➢ Ability for residents along the route to access the
fiber line directly at their cost ➢ Provides a
robust backbone of service for a series of
wireless access points

Wireless Access Points

Due to the topography of the island and the location of many of the homes, a wireless solution that utilizes the proposed fiber would be an affordable solution that would potentially avoid the costly attachments and fiber drops to the homes that can cost up to $1000 per home, depending on the distance from the main trunk line of fiber. This section of the proposal would add a series of wireless HotSpots on the poles themselves that would bring service wirelessly to homes.

This design is not typical of many terrestrial fixed wireless solutions where a high point is used to broadcast a signal over several miles. Instead, many smaller cells will be used, using the existing utility poles as mounting locations. By using this deployment method, many of the homes would be able to use their existing devices (cell phones, laptops, tablets, etc....) to connect directly to these "HotSpots". In cases where the locations might be further than the range of these devices, an outdoor range extender can be installed to the outside of the home to boost the signal to the home desiring coverage, these units typically range from $50 to $150 depending on the power requirements needed.

The effective range of these access points can be anywhere from a 400 to 600 ft. radius from the access point; however, the density of the local foliage and any significant obstructions to the broadcast signal can reduce the signal. Locations that are a significant distance from an access point can be fed with a wireless bridge as long as there is a potential for a line of sight from the end location to a point on the main fiber trunk line.

Each access point can offer up to 400Mbps throughput at a 2.4 GHz frequency or up to 800Mbps throughput using the 5.8 GHz frequency. Speed offerings would be dependent on the amount of bandwidth available through the backhaul link, but this is a solution that is scalable over time as bandwidth needs increase.

The cost to deploy the described solution above is estimated at $2000 per utility pole based on the layout provided in the following maps. There are 30 access points required to reach the majority of the areas with homes or structures in any significant grouping. This brings the total to approximately $60,000.

Significant additional engineering would need to be conducted to ensure proper coverage, if Axiom were invited to enter into a construction and operations agreement with the town. This is an example of Axiom's expertise to deliver a solution that can save significant dollars, while still offering a robust system that meets all of the criteria of the Broadband Committee.

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Sample Wireless HotSpot Maps

Examples of possible access point layouts. Note that these are samples only and more exact measurements are needed to ensure maximal coverage. Any residences appearing to be outside a range circle will be accommodated with further design work.

Sample Access Points, Main Road along the western side of the island

➢ 10 HotSpots proposed to provide coverage in this area of the island
➢ Ability for homeowners to connect to fiber directly if they choose to incur expense
➢ Wireless extenders available at reasonable cost to extend coverage to harder to reach areas
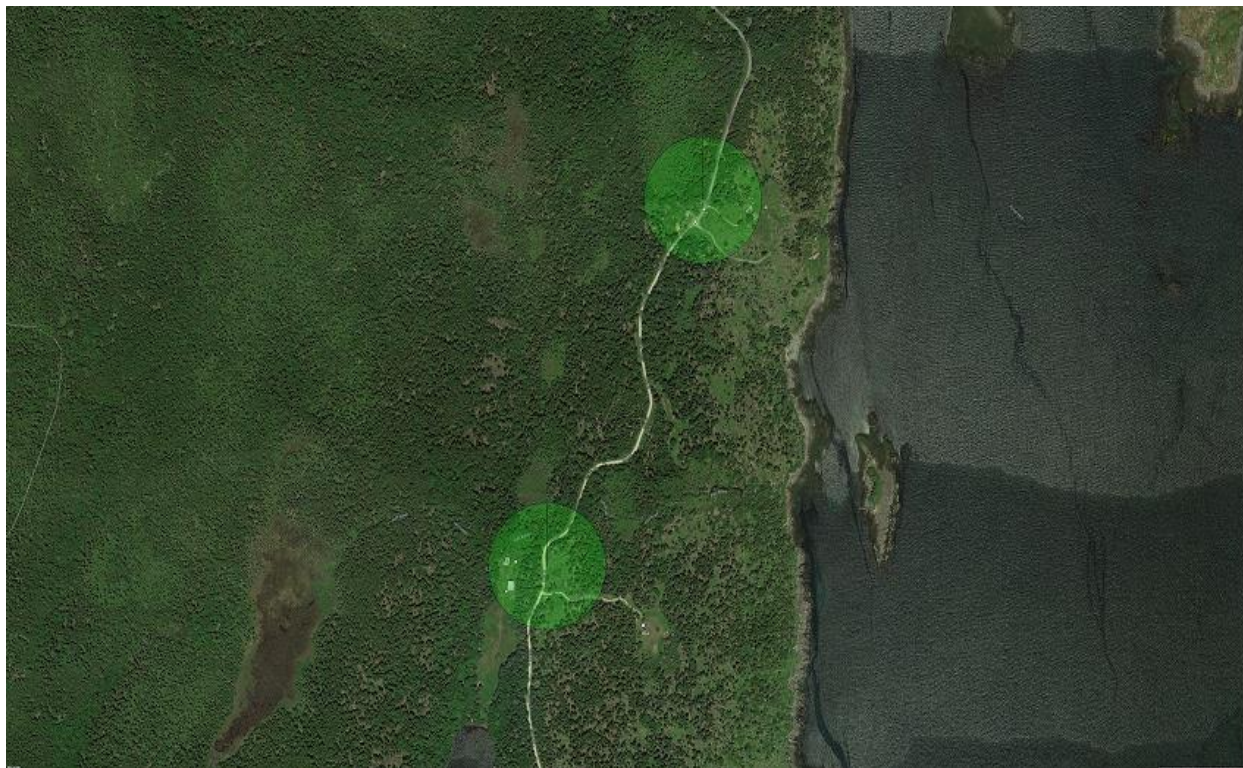
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Sample Access Points, Point Lookout/Birch Point northwest shore area

➢ 7 HotSpots proposed to provide coverage in this area of island
➢ Ability for homeowners to connect to fiber directly if they choose to incur expense
➢ Wireless extenders available at reasonable cost to extend coverage to harder to reach areas

Sample Access Points along the northeast shore area

➢ 4 HotSpots proposed to provide coverage in this area of island
➢ Ability for homeowners to connect to fiber directly if they choose to incur expense
➢ Wireless extenders available at reasonable cost to extend coverage to harder to reach areas
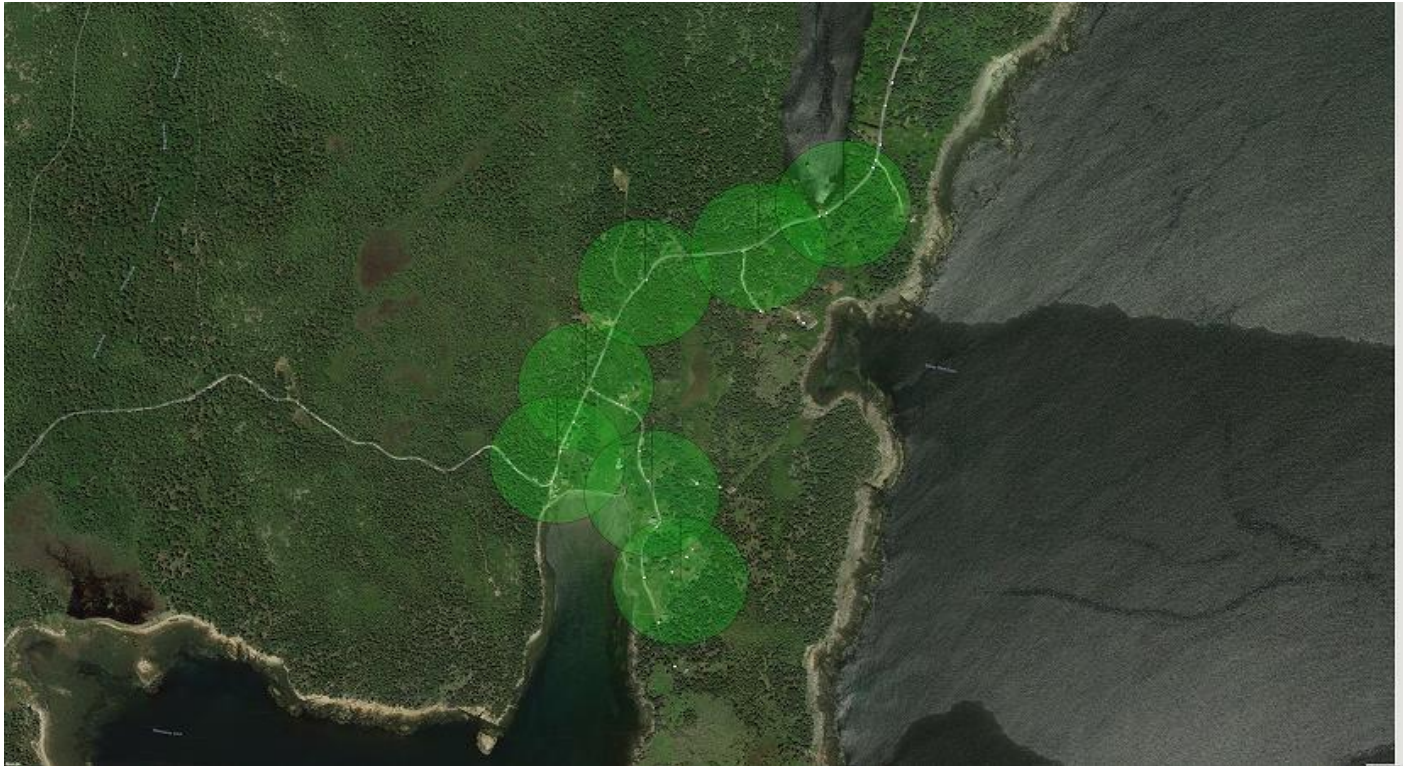
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Sample Access Points along the eastern side of the island

- ➢ 2 HotSpots proposed to provide coverage in this area of island
- ➢ Ability for homeowners to connect to fiber directly if they choose to incur expense
- ➢ Wireless extenders available at reasonable cost to extend coverage to harder to reach areas

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Sample Access Points along the southeastern area of the island

➢ 7 HotSpots proposed to provide coverage in this area of island
➢ Ability for homeowners to connect to fiber directly if they choose to incur expense
➢ Wireless extenders available at reasonable cost to extend coverage to harder to reach areas

Backhaul

Backhaul refers to the amount of bulk internet service transport required to serve the island. Because of the relatively unique arrangement with your current provider, the backhaul for TDS comes from a tower located in Stonington. The equipment on that tower transmits a wireless radio signal to a tower located off of Main Road on the western side of the island. We are unaware of the amount of internet service that is being transmitted on that link. In this part of the report, we address this critical part of any solution for the island.

In order to bring a high capacity service to the island a delivery method is required. In reviewing the available options, the most reasonable one would be erecting a tower on a high point of the island that has a good clear view of Stonington and bringing the backhaul bandwidth over via a licensed wireless link.

On the northern head of the island there is a high point that would be ideal for a 100 ft. tower. The local electrical company is clearing the top for solar panels so there is a potential for much of the clearing work required for tower footprint to already be completed, or some clearing may be required depending on the final location of the tower. 100 ft. should be more than adequate for clearing the

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local trees and the profile shot from there to Stonington is clear. FairPoint Communications, now Consolidated Communications, does offer up to a gigabit of symmetrical service in Stonington and there is a water tower in Stonington that might be a viable broadcast location in order to get the service out to the Island. The provider of the internet service should be able to provision a wholesale connection to FairPoint fiber in Stonington, for the purpose of wirelessly broadcasting that connection to the island.

Current wireless technologies can accommodate a Gigabit of bandwidth transport and more if there is a need for it. The equipment necessary to broadcast a high capacity licensed wireless link from the island to the main land would be estimated at $30,000.

The tower location would also work as the central location where the majority of the networking equipment would reside. This typically is in the form of a small building or outdoor rated cabinet mounted onto a concrete slab or pedestal.

The cost of the tower can vary greatly when working on islands as there are additional costs involved in delivery and construction that you wouldn't normally incur when working on the mainland. A 100 ft. self-supporting tower is estimated at $100,000 and the cost of the enclosure and hardware necessary to operate a fiber/wireless network is approx. $50,000. The hardware cost provided is a general number, as this cost can vary based on what type of equipment is used to serve both the wireless access points as well as the "to-the-home" runs for those residents desiring direct service.

Any provider considering a bid on this project would use their own methodology and pricing, but our experience provides you with a very strong estimate of cost.

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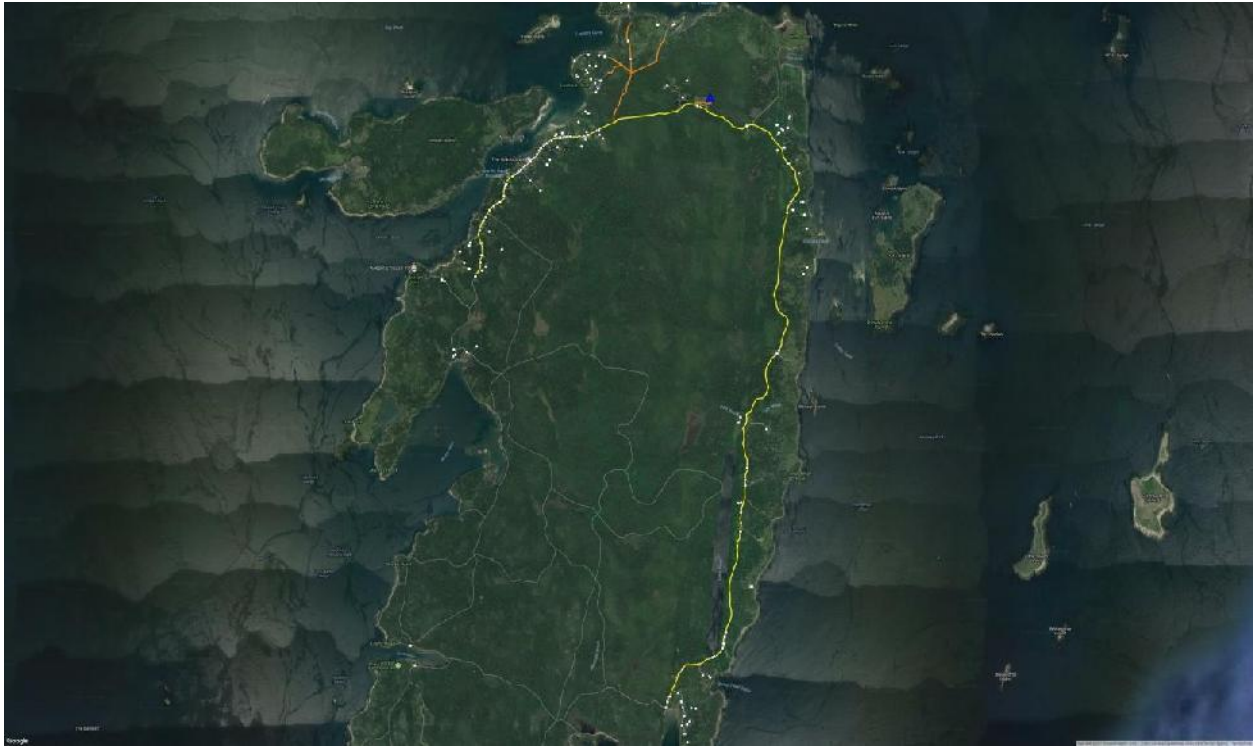
Cost

Fiber	6.7 Miles plus spurs	$340,000
HotSpots	30 Access Points/$2000 each	$ 60,000
Tower & Equipment	100' Tower, equipment and hut	$170,000
Total		$570,000

- Cost is dependent on accessing utility poles at low to no cost

Final Thoughts

By building out a fiber trunk on the island, Isle au Haut would make significant progress toward a connectivity solution that will be an investment in its future. As the island and island living evolves, 21st Century connectivity becomes increasingly urgent to attract new residents to the island, keep up with the needs of children and education, allows for year round and seasonal residents to take advantage of emerging telemedicine opportunities, and creates on-line economic opportunities and a majority of entertainment content and phone service to be provided - all from one pipe.

Importantly, the fiber would stay in place as a one-time investment, with minimal upgrade cost over the next 20 years or more. We believe the Broadband Committee can make a compelling case to the town select board that this investment would actually pay for itself over time, while increasing property values and the vibrancy of the island. We can think of very few more impactful investments for an island community to make.

Last, by owning the fiber, the town would be able to play a significant and influential role in the choice of the operator of the network, the cost and levels of service offered and the Service Level Agreement and partnership between the town and the provider.