Attachment 1: Nome to Homer Development Plan

This document supports Quintillion's easement application to Alaska Department of Natural Resources for the proposed Nome to Homer Express project.

1) Project Description

Quintillion is engaged in developing its *Nome to Homer Express (NTHE; Project)* submarine and terrestrial fiber optic cable (FOC) system across western Alaska, a transformative infrastructure initiative that will interconnect existing fiber telecommunications networks in Nome with competitive fiber infrastructure in Homer. This new middle-mile route—underpinned by a National Telecommunications and Information Administration (NTIA) Middle Mile Grant—would extend Quintillion's existing subsea and terrestrial network south from Nome to Naknek with a branching unit to Emmonak, and traverse overland to Igiugig **(Figures 1 and 2)**. From Igiugig, the system would interconnect with existing dark fiber pairs stretching across Iliamna Lake to Williamsport, onto Homer. The marine segment crosses through both State and Federal waters (**Figures 3-6**).

One of the key leveraging initiatives within the NTHE system is the Hooper Bay Broadband Project. This initiative would utilize a planned branching unit (BU) off the NTHE subsea route to construct a dedicated subsea middle mile extension reaching the Native Village of Hooper Bay under a US Department of Agriculture Rural Utilities Service Reconnect Grant.

A complete Project Description is included as **Appendix A**.

NTHE is composed of both submerged marine segments and terrestrial alignments, crossing various land jurisdictions and remote terrain. The project is structured to enhance statewide broadband capacity and enable service delivery to previously unserved or underserved Alaskan communities.

The Project would include one submarine cable route: Nome to Naknek with two branching units to Hopper Bay and Emmonak) and one terrestrial segment from Naknek to Igiugig (see Section 3 for Construction Methodology). The approximate cable segment distances and details are provided in **Table 1** and **Table 2** for cable lengths across DNR lands. The cable route and landings are subject to final design. Recommendations resulting from the environmental review and permitting stages may influence the route design described in this report.

Priority Consideration

Quintillion wishes to avail itself of priority consideration and expedited processing times afforded via Governor Dunleavy's May 29, 2019, Administrative Order 310, which was created for Alaska's broadband facilities (https://gov.alaska.gov/admin-orders/administrative-order-no-310/). Quintillion respectfully notes it requires DNR approvals no later than July 1, 2026, to make its 2026 installation timeline. We appreciate that DNR has indicated a 6- to-9-month approval timeline, which is compatible with our current schedule.

Table 1. NTHE Route Summary

Segment (s)	From / To	Approx. Distance	Construction Method
Marine Segments			
S 1	Nome BMH to BU Emmonak	113.53 mi.	Buried submarine cable
S1a	BU Emmonak to Emmonak BMH	35.65 mi.	Buried submarine cable
S2b	BU Hooper Bay to Hooper Bay BMH	32.33 mi.	Buried submarine cable
S3	BU Emmonak to Naknek BMH	656.48 mi.	Buried submarine cable
Terrestrial Segments			
T2	Emmonak BMH to Emmonak CLS, and distribution	9.46 mi.	Combination of surface laid, shallow burial, and new aerial FOC strung on existing poles
T3	Naknek BMH to King Salmon	10.33 mi.	New buried plant, directional bores, with a short segment on new poles.
T4	King Salmon to Igiugig	68.89 mi.	Combination of surface laid, and/or shallow burial, standard burial, and directional bores.
T7	Hooper Bay BMH and distribution	6.12 mi.	Combination of surface laid, shallow burial, and new aerial FOC strung on existing poles
KEY: BMH = beach manhole / BU = Branching Unit			

Table 2. NTHE Route Summary Across State Lands

Segment (s)	Location	Approx. Distance on State Lands
Marine Segments		
S 1	Nome Landing	19,400 ft. (3.67 mi.)
S1a	Emmonak Landing	41,000 ft. (7.77 mi.)
S2b	Hooper Bay Landing	21,000 ft. (3.97 mi.)
S3	Naknek Landing	225,000 ft. (42.61 mi.)
Terrestrial Segment		
T4	King Salmon to Igiugig	235,000 ft. (44.5 mi.)

Note: *Engineering Sheets for each segment are provided in Section 5.*

2) CONSTRUCTION METHODOLOGY

Terrestrial Installation

Terrestrial route segments crossing extensive wetlands would be installed during winter months, when the substrate is frozen, to minimize ground disturbances. Wetland segments would use a lightweight submarine cable provided in drums or containers that are towed by light tracked vehicles. When crossing overland sections, the cable would be laid across the ground surface where possible. Placing the cable directly on the ground surface is the preferred installation method as it significantly reduces wetland impacts. The cable would be buried where the route is close to trails, crosses streambanks and riverbanks, or is in other locations where the cable may be susceptible to damage.

When burial is needed, cable segments over wetlands would be trenched and the cable laid directly within the trench. Trenching activities will be conducted with a backhoe along streams and riverbanks; other winter trenching activities will be completed with a rock saw. This method requires much less excavation and lighter equipment than traditional FOC burial methods, minimizing impacts to the environment.

Trench depth would be targeted at a minimum of 12 inches. Where the cable route crosses streams and rivers, cable would be spliced with the terrestrial FOC and buried into each stream bank below the ordinary high-water mark (OHWM). Split pipe articulated armor and driven cable anchors may be deployed in stream crossings for extra stabilization and protection. Natural sediment transport would passively bury the cable. Additionally, the cable would be equipped with an outer plastic covering to avoid ice buildup. Care would be taken to position the crossings on stable banks to provide erosion protection. When crossing anadromous waterbodies, the cable installation would include shallow burial across shallow channels and vegetated areas in winter, and armored cable laid on the riverbed's main channel after opening of any ice. FOC will be surface-laid and anchored by driven stakes to secure the cable in the river flow.

When constructing on soft and unstable soils, heavy equipment would operate on mats. The position of the laid cable would be recorded with a survey-quality Global Positioning System (GPS). Post-lay inspection for terrestrial components would be conducted following snow and ice melt. Any cable left suspended after the snow melt would be repositioned so as not to be hazardous for humans or animals.

Cable repositioning would be done manually by moving the installed slack cable accordingly. If needed, the cable would be pinned to the ground using small duckbill anchors installed using a hammer and drive pin. Cable laid on the vegetation would sink into the vegetated mat and become overgrown, effectively burying itself out of sight. Helicopter and walking inspections would be conducted on an annual basis to monitor for erosion and bank failure.

In general, equipment used across overland routes includes:

- Rubber wheel backhoe
- Tracked excavator or backhoe
- Small bulldozer or other tracked machine to remove snow

- Utility truck and trailer to deliver materials
- Light tracked vehicle
- Rock saw
- Chain trencher
- Hand tools (e.g., shovels, rakes, pry bars, wrenches)
- Survey equipment
- Small utility boat for larger rivers
- Splicing equipment, small genset, and splicing tent

Shore-end (Beach) Landings

Shore-end construction would occur concurrently with marine construction. At each shore-end, the FOC would be trenched within the shoreline between mean low water (MLW) and the beach manhole (BMH). A BMH is an enclosed underground structure that houses the splice between the incoming submarine cable and outgoing terrestrial cable that would connect to the cable landing station (CLS). BMHs are positioned above the high tide line (HTL) and typically measure 3 ft x 4 ft x 4 ft for unpowered cable segments and 4 ft x 6 ft x 6 ft for powered landings (i.e., Nome and Naknek). Shore-end trenching would be conducted with a rubber-wheeled backhoe. Two 4-inch conduits would be buried at no deeper than 36 inches and extend from the BMH to the beach area above MLW.

A new BMH would be constructed at the Nome landing point to support the new submarine cable landing, as well as a power feed equipment (PFE) communication shelter with standby generator and fuel storage. In addition, a seaward conduit would be installed using horizontal directional drilling (HDD). The conduit will be bored underground to cross the Nome-Counsel highway and beach/intertidal area. The existing gravel pad at the Nome landing point will be expanded to allow for construction of a new communication shelter. An excavator would be used for installing the BMH, other vaults, duct, and FOC.

A new CLS is proposed in both Emmonak, Naknek, and Hooper Bay. Quintillion, or a contracted field crew, would install FOC along main corridors near anchor institutions and last-mile communication companies within the local communities of Emmonak, Naknek, and Hooper Bay. The installation crew would consist of personnel supported by light duty vehicles (i.e., crew and service trucks), a tracked excavator, and 1-3 small cranes.

The Naknek landing is planned to be located near the existing wastewater treatment plant at Cape Suwarof. This location avoids other tidal users and leverages existing access infrastructure. A new BMH and HDD conduit would be placed near the base of a bluff onsite. HDD is the preferred installation method to avoid erosion of the bluff.

A new CLS facility will be constructed in Naknek to house submarine line terminal and power feed equipment. FOC between the BMH and CLS would be installed via conventional burial within existing utility right-of-way (ROW) to the extent feasible. Buried ground anodes would be placed near the BMH to serve as a system ground for the submarine cable.

In Hooper Bay, the submarine cable would be trenched from below MLT to the HTL and connected to a new BMH constructed above the HTL.

Marine Installation

Installation is very low impact compared to other marine construction activities common throughout Alaska. The Project will not require pile-driving, use of a spud barge, submarine drilling (e.g., for rock socketing), underwater blasting, or dredging. The submarine cable will be laid on the surface in marine waters using a purpose-built or modified cable lay vessel or barge suitable to perform all necessary operations to install the cable successfully and safely in the anticipated conditions. The construction support vessels will likely be ships of opportunity hired locally and dependent on availability at the time of construction.

The submarine FOC segments would be 100% buried to a depth of approximately 3 ft using a cable plow towed behind a cable-laying vessel. The cable would be fed through the plow’s share blade, penetrating seafloor sediments under the plow 3 ft deep while excavating a path 1 ft wide. The cable would exit the lower aft end of the share blade, and the sediments would immediately collapse on top of the cable behind the plow.

In waters shallower than 50 ft, burial may be achieved by using a jet sled, which is a self-propelled cable trenching system that uses water pressure to destabilize the seafloor and bury the cable. The water used for jetting is supplied from the surface by high pressure hoses. The pressurized water would be focused on the seafloor, liquifying the substrate by turning it into a slurry, and then the cable would sink within the trench. The jet sled would be accompanied by divers who would monitor trenching performance and assist in operations.

3) Land Use Permit

The NTHE project is undergoing an extensive evaluation of potential for environmental impacts under the National Environmental Policy Act ("NEPA"). Additionally, the Applicant is in the process of applying for federal and state permits, including an (assumed) nationwide permit (NWP) #57 from the U.S. Army Corps of Engineers. Note, the project was issued a NWP #6 from USACE (POA-2023-00377 and -2024-00213) to conduct a seafloor survey of the offshore environment in 2023/24 to identify suitable cable routes for the planned submarine cable segment that will connect Nome to Naknek and branching units. The purpose of the survey was to collect geophysical (multibeam echo sounder, side scan sonar, sub-bottom profiler) and geotechnical (gravity cores and grab samples) data to identify seabed bathymetry and bathymetric features, surface and subsurface geology, and any seafloor and substrate obstructions or limitations to identify the best and most environmentally sensible cable routes.

Permits will be obtained from Department of Transportation-Public Facilities to install the utility along right-of-way(s) in Naknek and Hooper Bay, Alaska Department of Fish and Game to cross the Alagnak River. The applicant will apply for a Special Use Permit (Standard Form 299) from the Bureau of Land Management to cross this utility across their managed Federal lands. Permanent structures associated with the project on DNR tidal, submerged, and terrestrial lands will include seaward conduits, as well as the one marine segment (with two branching units) of submarine cable and one terrestrial cable.

4) Planned Activities

Marine Segment

Marine Route

The primary marine route includes submarine FOC segments from Nome to Naknek, including a branch to Emmonak and Hooper Bay. The path chosen for the marine routes was identified through desktop studies and a marine route survey, conducted in 2023 and 2024. These engineering and field studies assist in selecting routes that provide considerations for environmental and anthropogenic forms of disturbance on the cable system that may lead to cable faults.

The submarine cable will be 2 inches in diameter or less, resulting in a very small footprint on the surface of the seafloor. The proposed route identified in the desktop and marine route surveys avoids high-impact fishing grounds where possible. Where ground fishing areas cannot be avoided, the cable would be buried. The submarine cable route design targets soft sediment, avoiding hard substrates, macroalgae, and critical habitats whenever possible.

Submarine FOC components would either be laid on top of the seafloor or buried by plowing. Burial within waters deeper than 40 ft would be conducted using a cable plow. In waters shallower than 40 ft, trenching would occur within areas where cable protection from additional environmental conditions such as surf action and ice scour are needed. The cable would be laid on the seafloor within areas identified as low risk to cable disturbance or where traversing seafloor substrates that do not allow for plowing (e.g., steep grades, bedrock). When placing cable on the seafloor, bathymetric conditions would be analyzed so the vessel can lay the cable with the engineered slack necessary to allow the cable to conform to the seafloor. If the substrate allows, plowing would be used where there is significant risk of outside disturbance to the cable. In high-risk areas where the substrate does not allow for plowing, cable armoring would be implemented.

Access

Submarine cable installation is anticipated to be completed by a specifically designed cable ship equipped with crew accommodations.

Power Source

The cable installation vessel would utilize its on-board generators and propulsion systems. The vessel will mobilize with sufficient fuel to perform the installation.

Waste Types, Water Sources, and Disposal Methods

No discharge is anticipated during beach construction and submarine cable laying activities. Any waste substances from the cable laying vessel will be disposed of in port in accord with MARPOL Annex V.

Terrestrial Segment

Shore-end Landings

Shore-end construction includes segments of the cable route between MLW and BMH at each landing point. This construction would occur concurrently with marine installation. At each shore-end, the cable would be trenched within the shoreline between MLW and the BMH. Shore-end trenching would be conducted with either a rock saw or backhoe. When deemed necessary, additional protection may be provided to the cable at landing point locations with split pipe articulated armor. Two 4-inch conduits would be buried at no deeper than 36 inches and extend from the BMH to the beach area above MLW, allowing the bank to be disturbed only once. Conduit installation would be conducted in a controlled manner using best management practices prior to the arrival of the cable ship.

These segments of the marine route were identified by avoiding developed shorelines and high energy landfalls that are subject to erosion and defined vessel anchorages. Geophysical reviews were also conducted for the route, and considerations were made to avoid areas prone to sediment slumping, fast currents, and other geological hazards.

A BMH is an enclosed underground structure that houses the splice between the incoming submarine cable and outgoing terrestrial cable that would connect to the CLS. BMHs are positioned above the high tide line (HTL) and typically measure 3 ft by 4 ft by 4 ft for unpowered cable segments and 4 ft x 6 ft x 6 ft for powered landings (Nome and Naknek).

For beach construction, personnel will access the site via existing public/private roads/easements and lodge at their homes or in nearby communities. In addition to state-owned tide and submerged lands from Norton Sound to Bristol Bay, the following state-owned cable landing parcels would be affected by terrestrial construction (**Table 3**):

Table 3: State-Owned Calbe Landing Parcels

Parcel ID	Location
153796	Igiugig
213183	Igiugig
212934	Igiugig
205409	Naknek
153933	Naknek
207184	Naknek
153815	Emmonak
153816	Emmonak

Terrestrial (Tundra) Installation

Terrestrial Route

Terrestrial route would cross extensive wetland complexes. Installation would occur during winter months, when the substrate is frozen, to minimize ground disturbances. Wetland segments would use a lightweight submarine cable provided in drums or containers that are towed by light tracked vehicles. Lightweight submarine cables would be coated in high-density polyethylene and measure approximately 0.5 inch in diameter. A splice joint case approximately 10 inches in diameter would be located along the route, approximately every 6.81 miles, to join cable segments. Additional slack would be provided when laying the cable to allow it to settle on the vegetation and conform to changing surface features and environmental conditions. When crossing overland sections, the cable would either be laid across the ground surface or trenched.

Placing the cable directly on the ground surface would significantly reduce wetland impacts and is the preferred installation method. Laying cable within wetlands would include removing deep snow along the cable route to allow it to sit directly on the ground.

The cable would be buried where the route is close to trails, crosses stream- and riverbanks or other locations where the cable may be susceptible to damage. Buried cable segments over wetlands would then be excavated and the cable laid directly within the trench. Trench depth would be targeted at a minimum of 12 inches and would vary with the terrain, with maximum depth of 48 inches.

Submarine cable would be used to cross streams and rivers. The cable would be spliced with the terrestrial FOC and buried into each stream bank below the OHWM. Split pipe articulated armor and driven cable anchors may be deployed in stream crossings for extra stabilization and protection. Natural sediment transport would passively bury the cable. Additionally, the cable would be equipped with an outer plastic covering to avoid frazil (loose, randomly oriented) ice buildup. Care would be taken to position the crossings on stable banks to provide erosion protection.

When constructing on soft and unstable sediments, heavy equipment would be placed on mats. The position of the laid cable would be recorded with a survey-quality Global Positioning System (GPS). Post-lay inspection for terrestrial components would be conducted following snow and ice melt. Any cable left suspended after the snow melt would be repositioned so as not to be hazardous for humans or animals. Cable repositioning would be done manually by moving the installed slack cable accordingly. If needed, the cable would be pinned to the ground using small duckbill anchors that would be installed using a hammer and drive pin. Cable left on the vegetation would sink into the vegetated mat and become overgrown, effectively burying itself out of sight. Helicopter and walking inspections would be conducted on an annual basis to monitor erosion and bank failure.

Unless the cable is being routed on riser poles, it would be trenched within 0.6 miles of each community. If permafrost is present during trenching, trenching would only occur within the vegetative mat above the permafrost, and the permafrost would be left intact.

Power Source

Field construction equipment will utilize built-in fuel systems. Equipment will be transported to the site full of fuel and ready for use. If on-site refueling is required, it will be delivered through use of fuel containers up to twenty gallons delivered by Quintillion’s contractors. No fuel will be stored at the construction site.

Hazardous Substances

Quintillion does not anticipate waste, contamination, or toxic substances being produced in association with submarine cable laying activities and tideland construction activities. An extensive environmental review through NEPA, including a review of historic information was conducted to identify site contamination and hazardous waste sites within the Project area. The assessment revealed no evidence of Toxic Release Inventory, Superfund, Brownfield, or Toxic Substance Control Act sites in connection with DNR lands within the Project area.

Quintillion does not anticipate waste, contamination, or toxic substances being produced in association with tideland construction activities. Quintillion recognizes that equipment contains fuel and other fluids (e.g., hydraulic fluid) that has the potential to be inadvertently released. Typically, accidental releases from heavy construction equipment are a result of deferred maintenance or equipment in poor condition. Equipment required for terrestrial construction (e.g., mini excavators or boring equipment) will be fueled, serviced, and maintained with appropriate protective measures in place. No fuel, lubes, or working fluids will be stored at terrestrial construction sites. Quintillion recognizes that all vehicles include a risk of leaks, and thus will use well-maintained equipment, which will be checked daily for leaks and other signs of malfunction. Quintillion will use small, tracked excavators which will contain significantly less fuel and hydraulic fluid than conventional excavators. Best management practices will be implemented for all terrestrial construction areas to avoid any inadvertent discharge into adjacent waters.

In the highly unlikely event of an inadvertent fluid release, containment, and clean-up operations, per the direction of an onsite Spill Prevention, Control, and Countermeasure Plan, will commence immediately following detection. For releases on land or water the responsible party will be required to contain the spill and prevent fluid from migrating or flowing from the immediate area of the discharge. If cleanup activities pose a threat to a sensitive resource, or a threat to public safety, construction activities will cease immediately until a plan to proceed is coordinated with the assigned State spill on-scene coordinator. Additional containment and mitigation measures may include the following:

- In tidelands of ground disturbing activities, measures will be implemented (e.g., silt fence) to prevent silt laden water from flowing into a nearby water body.
- Site clean-up will commence after completion of excavation, or a release is contained. Clean-up will include removal of all visible debris located in accessible areas. Removal methods will vary based on site-specific conditions. After cleaning up, the area will be returned as close to the original condition as possible.

Water Supply

Not applicable.

Parking Areas and Storage Areas

No long-term or short-term parking and storage areas are proposed on submerged or tidal DNR managed lands. See engineering designs for staging and parking areas associated with the terrestrial route.

Number of People Using the Site

The human resources required for Project installation are highly skilled and specialized. Workers building the terrestrial sections will be experienced contractors with a track record of experience successfully completing similar work. Contracting opportunities exist for the supply of various materials and equipment, fuel, materials storage, and inspection services.

On the marine vessel, crew size is anticipated of up to approximately 12 to 15 vessel crew members, dependent upon the final installation vessel selection.

Maintenance and Operations

Once in operation, the NTHE cable system will be used to transfer digital communications and data between Nome and Homer and rural communities connected to the system. Submarine fiber optic cables typically operate for 25 years; however, industry experience suggests that the actual lifespan often extends to 30+ years. Routine maintenance for the marine segments of the network is unnecessary due to the stability of the ocean-bottom environment.

Closure/Reclamation Plan

Upon installation, sediment will be placed over the buried seaward conduit and restored to pre-construction beach conditions. As the submarine cable will be laid on the seafloor, no trenching will occur and minimal to no seafloor disturbance is expected.

5) FIGURES AND SHEETS

Figures

- Figure 1: Proposed NHTE System with Hooper Bay Branching Unit
- Figure 2: Terrestrial Route – King Salmon to Igiugig Across State Lands
- Figure 3: Marine Route – Nome Landing
- Figure 4: Marine Route – Emmonak Landing
- Figure 5: Marine Route – Hooper Bay Landing
- Figure 6: Marine Route – Nome Landing

Sheets (DNR Specific Areas only)

- Sheet Package A: Segment T1 – Nome Landing
- Sheet Package B: Segment T2 – Emmonak BMH to Emmonak
- Sheet Package D: Segment T4 – King Salmon to Igiugig
- Sheet Package D: Segment T7 – Hooper Bay Landing only

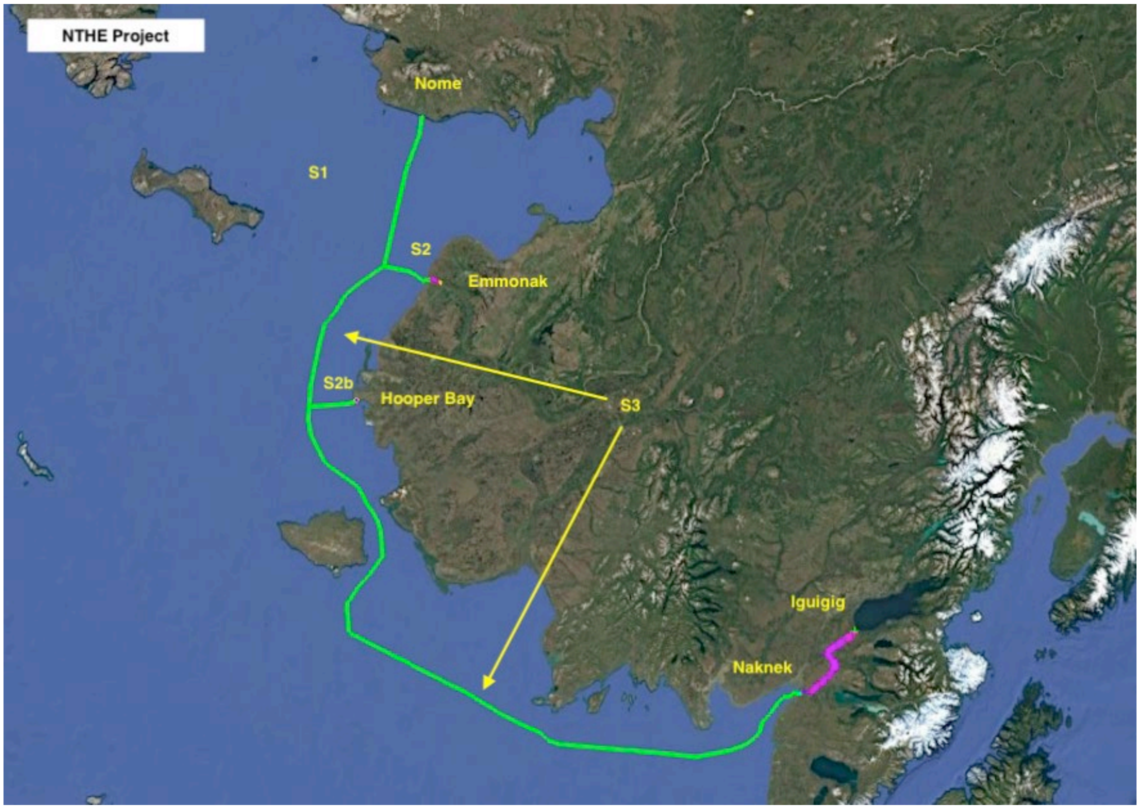
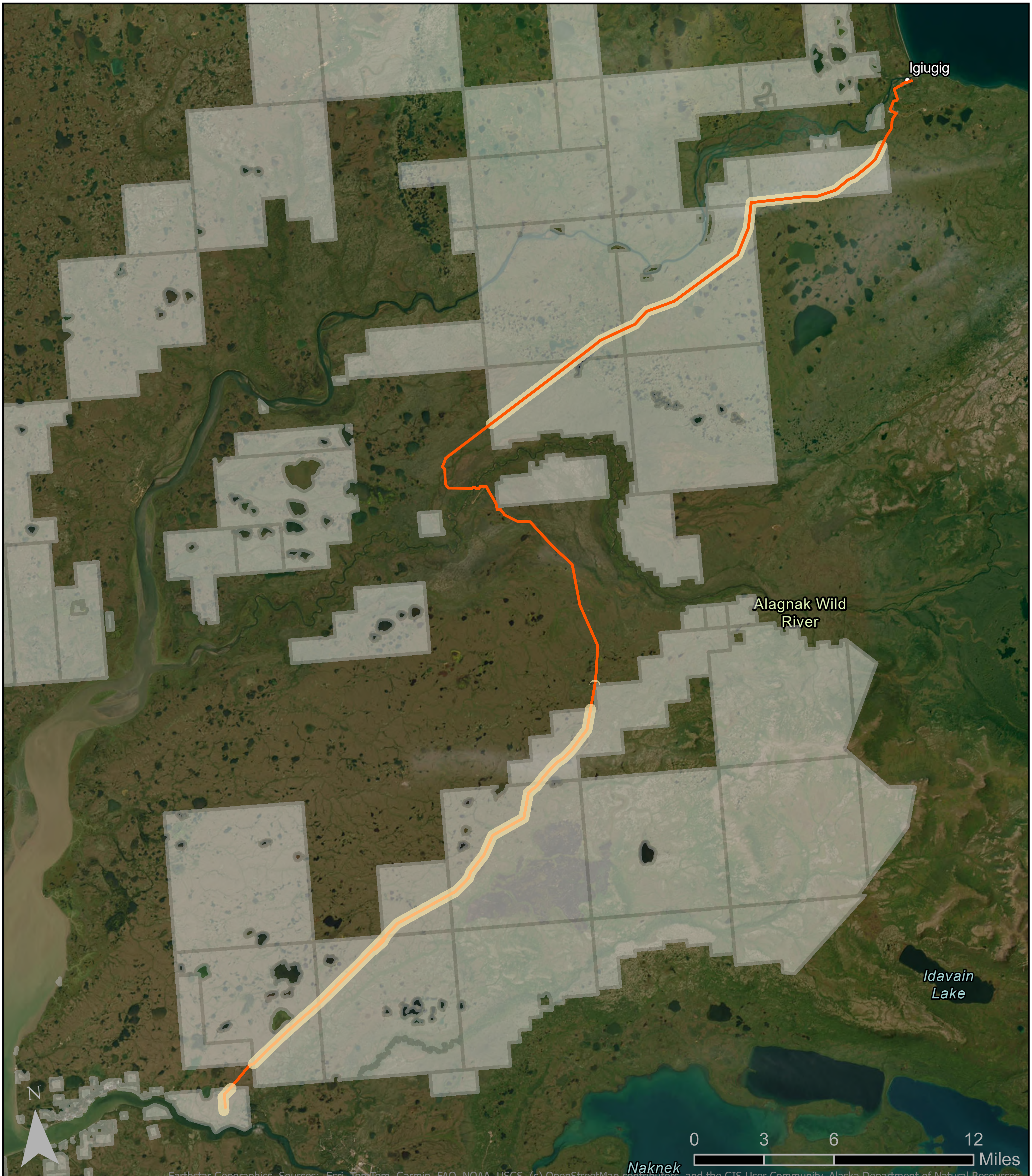


Figure 1: Proposed NTHE System with Hooper Bay Branching Unit



King Salmon to Igiugig Terrestrial Segment in State Lands

Nome to Homer Express Middle Mile & Hooper Bay Network Fiber Optic Cable Project

Legend

Cable Route

Cable within State Lands (235,000 feet)

State Lands

Nome Landing

Nome to Homer Express Middle Mile & Hooper Bay Network Fiber Optic Cable Project

Figure 3

Legend

Cable Route

Cable within State Line (~19,400 feet)

State Line (3 NM)

Emmonak Landing

Nome to Homer Express Middle Mile & Hooper Bay Network Fiber Optic Cable Project

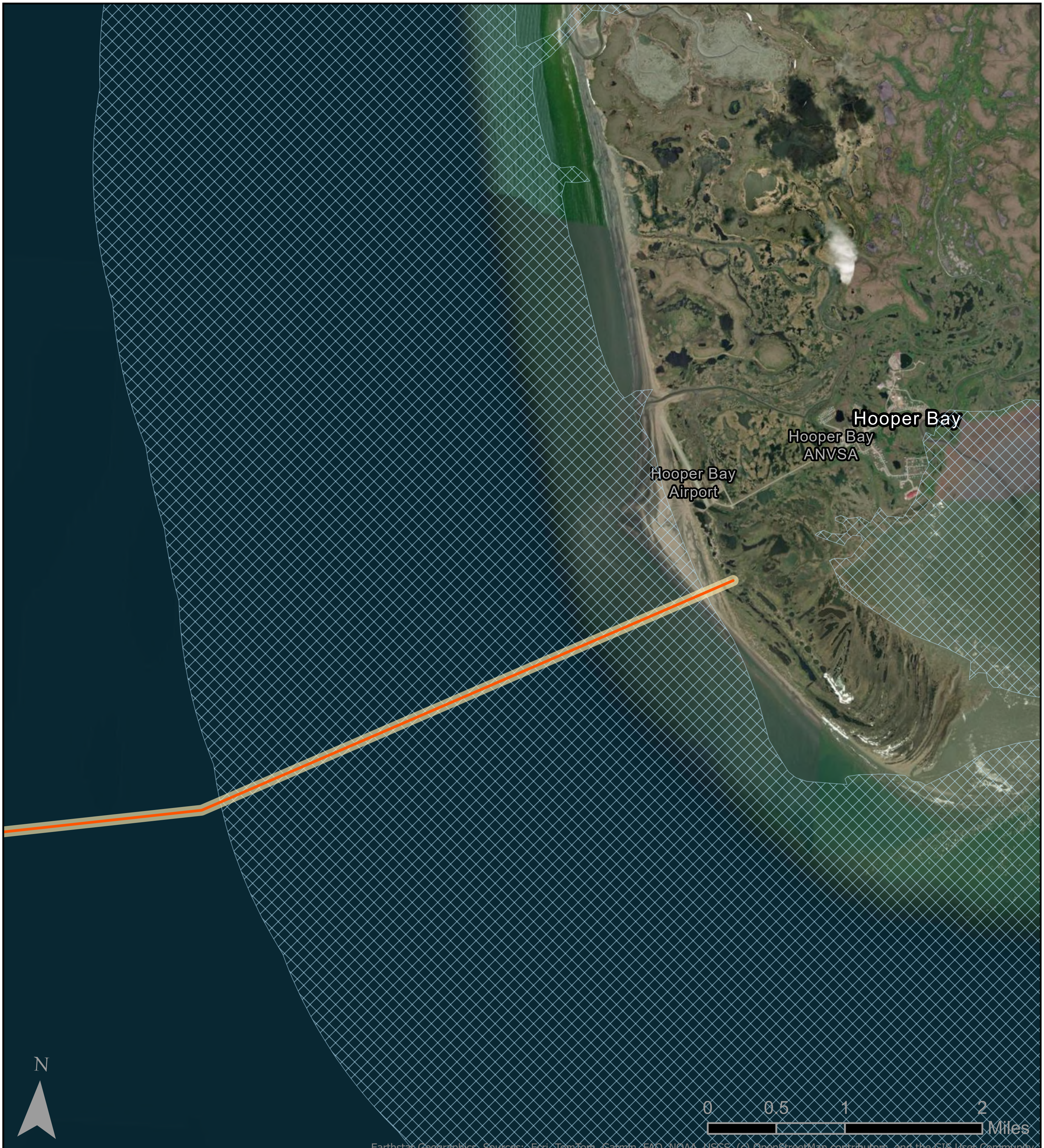
Figure 4

Legend

Cable Route

Cable within State Line (~41,000 feet)

State Line (3 NM)



Hooper Bay Landing

Nome to Homer Express Middle Mile & Hooper Bay Network Fiber Optic Cable Project

Figure 5

Legend

Cable Route

Cable within State Line (~21,000 feet)

State Line (3 NM)

Naknek Landing

Nome to Homer Express Middle Mile & Hooper Bay Network Fiber Optic Cable Project

Figure 6

Legend

Cable Route

Cable within State Line (~225,000 feet)

State Line (3 NM)

Appendix A: Nome to Homer Express
Project Description

Nome to Homer Express Middle Mile Network Project with Joint Agency Collaboration on the Hooper Bay Broadband Project

Project Description

Quintillion
3601 C Street, Suite 1000B
Anchorage, AK 99503

September 11, 2025

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ACRONYMS AND ABBREVIATIONS

AK	Alaska
ANCSA	Alaska Native Claims Settlement Act
BMH	Beach Manhole
CAI	Community Anchor Institutions
CLS	Cable Landing Station
DA	Double Armor
DGPS	Differential geographic positioning system
DNR	Alaska Department of Natural Resources
DOT-PF	Alaska Department of Transportation and Public Facilities
EA	Environmental Assessment
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FOC	Fiber Optic Cable
FONSI	Finding of No Significant Impact
FTTP	Fiber-to-the-Premises
GCI	GCI Communication Corp.
HDD	Horizontal Directional Drilling
HDPE	High-density polyethylene
LW	Lightweight
LWA	Lightweight-Armored
m	Meter
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	NOAA National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPFMC	North Pacific Fisheries Management Council
NPS	United States National Park Service
NTHE	Nome to Homer Express
NTIA	National Telecommunications and Information Administration

OSP	Outside plant
PFE	power feed equipment
Project	Nome to Homer Express submarine fiber optic cable system
ROV	Remotely operated vehicle
ROW	Right-of-way
SA	Single Armor
SHPO	State Historic Preservation Office
US	United States
USACE	United States Army Corps of Engineers
USFWS	United States Fish & Wildlife Service

Project Name: Nome to Homer Express Middle Mile Network Project with Joint Agency Collaboration on the Hooper Bay Broadband Project
Applicant: QSH Parent Holdco LLC

Total Estimated Project Cost:
$160,564,315.94 – Nome to Homer Express (NTHE)
$24,957,845 – Hooper Bay Project

1. PROJECT DESCRIPTION

1.1 INTRODUCTION

Quintillion is deploying its *Nome to Homer Express (NTHE)* submarine and terrestrial fiber optic cable system across western Alaska, a transformative infrastructure initiative that will interconnect existing fiber telecommunications networks in Nome, AK, with competitive fiber infrastructure in Homer, AK. This new middle-mile route—underpinned by a National Telecommunications and Information Administration (NTIA) Middle Mile Grant—will extend Quintillion's existing subsea and terrestrial network south from Nome to Emmonak, follow the Yukon-Kuskokwim (YK) Delta coastline to Naknek, and traverse overland to Igiugig. From Igiugig, the system interconnects with existing dark fiber pairs stretching across Iliamna Lake to Pile Bay and Williamsport, culminating in a final submarine segment across Cook Inlet to Homer. At Homer, NTHE will tie into multiple regional carriers, enabling resilient, low-latency, competitive broadband access and interconnection to national and global networks, including cloud services **(Figure 1)**.

NTHE is composed of both submerged marine segments and terrestrial alignments, crossing various land jurisdictions and remote terrain. Quintillion is committed to full compliance with the National Environmental Policy Act (NEPA), National Historic Preservation Act (NHPA), Endangered Species Act (ESA), and all relevant federal, state, tribal, and local environmental permitting requirements. The project is structured to enhance statewide broadband capacity and enable service delivery to previously unserved or underserved Alaskan communities.

Quintillion currently owns and operates a subsea fiber optic cable system serving Alaska's Northwest and North Slope Arctic regions, utilizing terrestrial infrastructure to reach its internet gateway in Seattle, WA. Building on this backbone, the NTHE project serves as the critical expansion of Quintillion's open access middle mile network, driving redundancy, resiliency, and regional accessibility across Alaska.

One of the key leveraging initiatives within the NTHE ecosystem is the Hooper Bay Broadband Project. This initiative will utilize a planned branching unit off the NTHE subsea route to construct a dedicated subsea middle mile extension reaching the Native Village of Hooper Bay under a US Department of Agriculture (USDA) Rural Utilities Service (RUS) Reconnect Grant (**Figure 2**).

As part of its integrated network strategy, Quintillion will design, construct, own, operate, and maintain the Hooper Bay subsea and terrestrial fiber optic infrastructure. Quintillion will act as the Internet Service Provider (ISP), offering enterprise and residential broadband through advanced Operational Support Systems and Business Support Systems (OSS/BSS), including dedicated technical support and customer service teams. Moreover, consistent with its open access model, Quintillion will operate the new Hooper Bay middle mile infrastructure as part of its broader NTIA Middle Mile Grant-backed network, providing equitable backhaul access to other broadband and advanced service providers serving the region.

The integration of the Hooper Bay project within the broader NTHE framework represents a scalable and sustainable approach to broadband expansion, utilizing shared infrastructure to maximize public investment, extend middle-mile reach, and ensure service delivery in alignment with NTIA objectives and community needs.

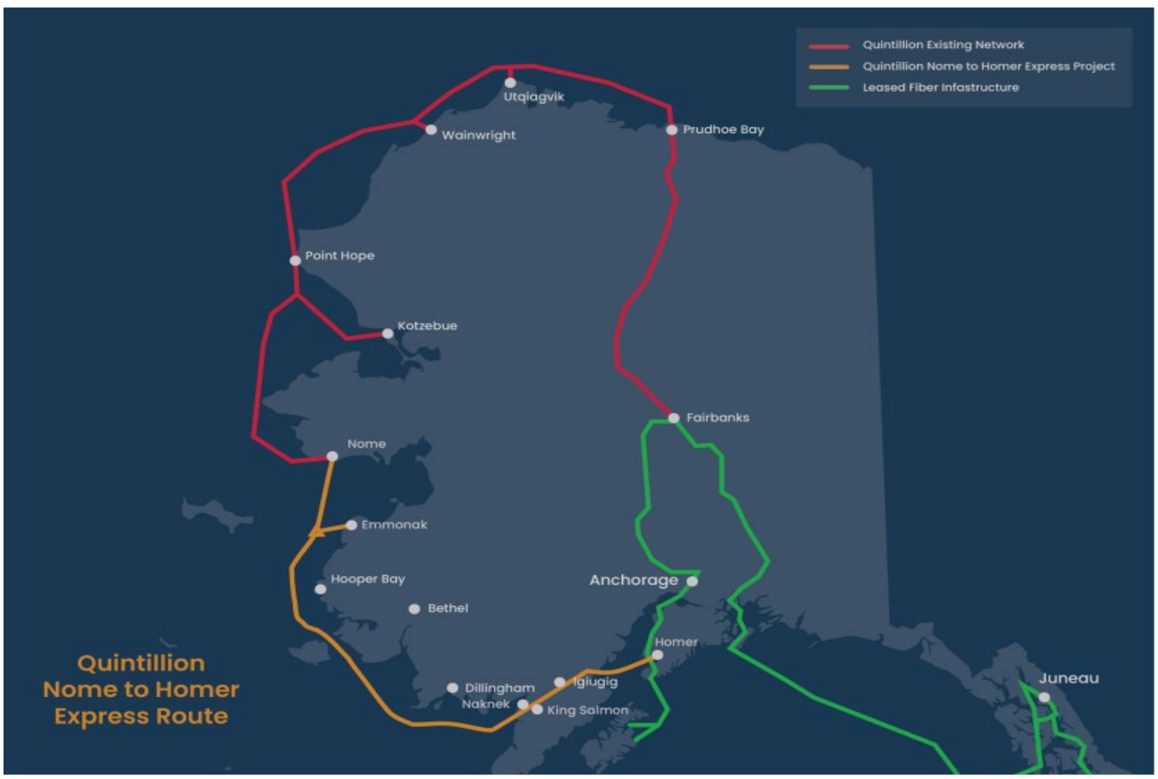

Figure 1: Proposed NTHE Network relative to Quintillion's entire network

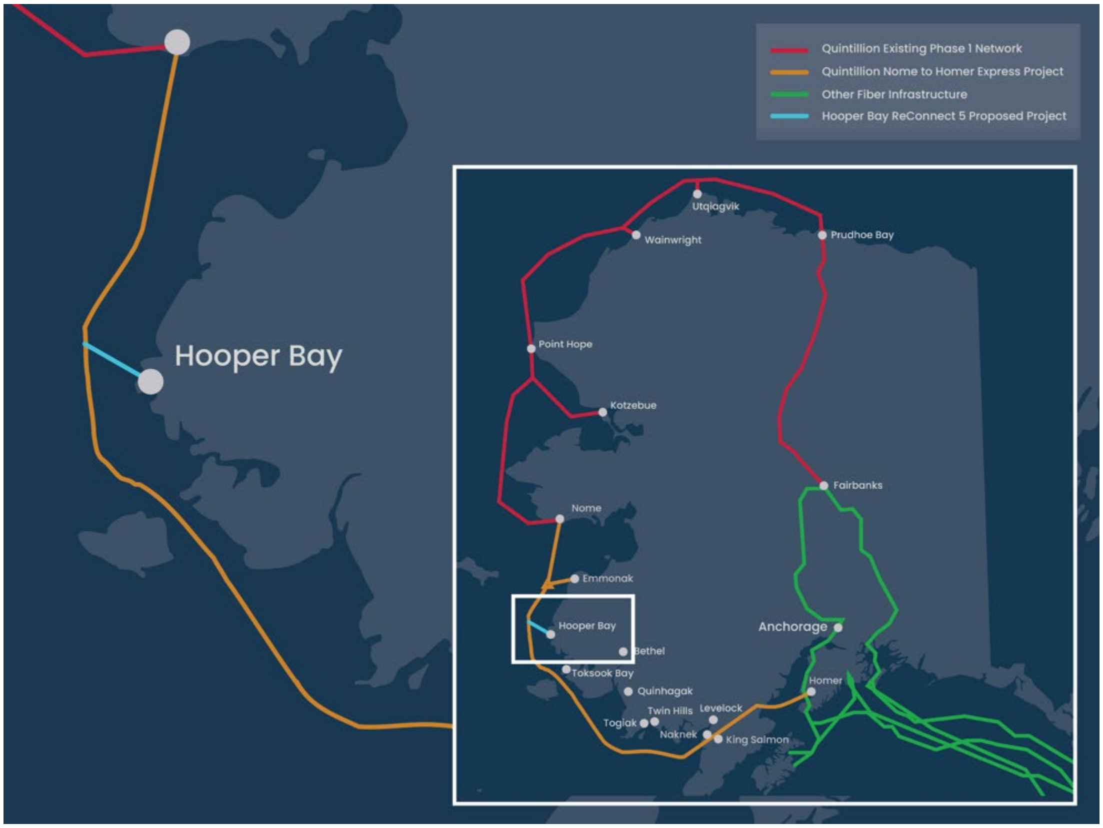

Figure 2: Hooper Bay branch relative to Quintillion's entire network

1.2 PROJECT PURPOSE AND BENEFITS

The NTHE system will provide direct fiber access and communications facilities for the communities of Emmonak (population 858), Naknek (464), and Igiugig (61), and access and facilities to Hooper Bay (1,193) with Fiber-to-the-Premises (FTTP). The Community Anchor Institutions (CAI) for these communities have been identified and will be considered in the construction plan, providing access points to the fiber optic cable (FOC), ensuring ease of access for last-mile providers and key CAIs. Additional and future prospective projects include expanding on the Nome to Homer Express network to serve the communities of Homer (5,491), Toksook Bay (682), Quinhagak (713), Eek (356), Oscarville (74), Napaskiak (434), Bethel (6,179), Goodnews Bay (277), Togiak (858), Dillingham (2,226), King Salmon (307), and Levelock (60). The NTHE project would help strengthen long-term economic and community stability in rural Alaska, where legacy industries such as timber and mining have been in decline and where residents have ever-increasing needs for broadband to support telemedicine, distance learning, remote working, civic engagement, e-commerce, marketing, and sharing cultural resources and knowledge. Additionally, the project will bring new resilient middle- mile capacity to the vicinity of military bases including Fort Wainwright, Fort Greely, and Eielson AFB, several Alaska Army National Guard bases, and Alaska Coast Guard stations. The project is funded primarily (61%) by a Middle Mile Grant from NTIA with an RUS Reconnect Grant for the branching unit to Hooper

Bay with FTTP. The project provides broadband service to tribally- and ANCSA-owned land and facilities, and helps to support economic development, community sustainability, and self-determination objectives. A key feature of this project will be to complete a transformative, foundational, and resilient fiber ring that connects Anchorage, Fairbanks, and Prudhoe Bay to the Northwest Arctic, down to Bristol Bay, and across the Alaska Peninsula to Homer and back to Anchorage.

1.3 PROPOSED CONSTRUCTION ACTIVITIES

Quintillion's Nome to Homer Express (NTHE) project proposes to construct approximately 894.34 miles of middle-mile fiber optic cable (FOC) infrastructure comprising both submarine and terrestrial segments from Nome to Igiugig. This new route will interconnect with Quintillion's existing Phase I subsea system at the Cable Landing Station (CLS) in Nome and extend to leased dark fiber pairs on GCI's network from Igiugig to Homer (204 miles). At Homer, the system will interconnect with multiple regional providers to establish a diverse, resilient, low-latency, and competitive broadband pathway to the continental United States and global cloud services. By closing the loop on Quintillion's statewide fiber infrastructure, the NTHE project will create a redundant fiber ring, improving broadband resiliency for carriers and end users statewide and significantly enhancing Alaska's digital connectivity to the world (illustrated in **Figure 1**).

The NTHE project includes the construction of new subsea and terrestrial cable infrastructure that will:

- Deploy a new submarine fiber optic cable from the existing CLS in Nome to a new CLS in Naknek, Alaska.
- Install a Branching Unit (BU) and lateral spur connecting to a new CLS in Emmonak, located within the Yukon River Delta.
- Extend a terrestrial fiber optic route from Naknek to Igiugig, where the system will transition to subsea infrastructure again, interconnecting with existing dark fiber pairs.
- Utilize these dark fiber segments to carry service from Igiugig across Lake Iliamna to Pile Bay, then overland to Williamsport, and across Cook Inlet to Homer, where the system will terminate at Quintillion's co-located CLS facility. This location serves as a critical network aggregation point, supporting interconnection with multiple terrestrial and subsea carriers.

2. HOOPER BAY INTEGRATION – LEVERAGING THE NTHE BACKBONE

As a key leveraging initiative, Quintillion's Hooper Bay Broadband Project, which is approximately 38.45 mi., is fully integrated into the NTHE architecture via a planned Branching Unit off the NTHE subsea main line. This branch will:

- Extend a dedicated subsea middle mile spur from the BU to a new Beach Manhole (BMH) in Hooper Bay, Alaska

- Establish a new Cable Landing Station (CLS)—also referred to as a Communications Shelter—within Hooper Bay to terminate the subsea segment.
- Support the deployment of a fiber-to-the-premises (FTTP) last-mile network, delivering 10 Gbps symmetrical XGS-PON service to every Broadband Serviceable Location (BSL) within the Hooper Bay service area.

This integrated last-mile architecture will ensure comprehensive connectivity for this Unserved community, advancing the NTIA's digital equity goals and Alaska's broadband access objectives.

Quintillion will design, construct, own, operate, and maintain the Hooper Bay subsea and terrestrial FOC infrastructure as part of its open-access network. As with the broader NTHE system, the Hooper Bay middle mile segment will be operated on an open-access basis, ensuring fair and non-discriminatory access to other service providers and enabling third-party ISPs to extend services to Hooper Bay using Quintillion's backhaul.

Quintillion will serve as the Internet Service Provider (ISP) for the FTTP segment, with full-service delivery supported by its Operational Support Systems (OSS) and Business Support Systems (BSS), as well as its internal technical support and customer service teams.

This integrated deployment approach—leveraging the NTHE backbone to deliver high-capacity middle mile to remote community endpoints—demonstrates Quintillion's commitment to scalable, equitable broadband deployment in alignment with NTIA's Middle Mile Grant (MMG) program.

3. FIBER OPTIC CABLE SYSTEM

3.0 CABLE AND CONSTRUCTION TYPES

The NTHE project is a hybrid system consisting of submarine and terrestrial cables, components, and facilities. The diagram presented in **Figure 3** provides an overview of the components that constitute this hybrid submarine cable system. It serves as a reference for identifying and describing the various components. This includes the transition point from submarine FOC to terrestrial FOC, while identifying the various components from the Beach Manhole (BMH) to the CLS, and beyond the CLS for access to the system. **Figure 4** shows the complete route, including segment IDs for easy reference. **Table 1** lists the distances for each segment, including submarine and terrestrial.

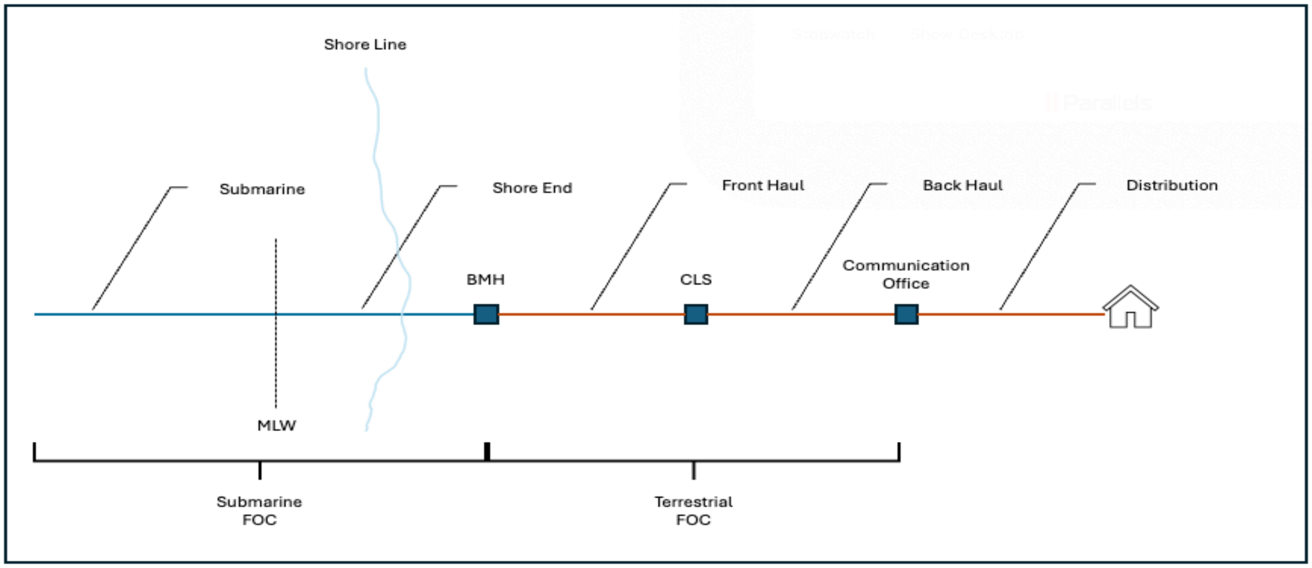

Figure 3: Hybrid Submarine Cable System diagram with associated components

Submarine FOC: This construction involves the installation of a submarine FOC within the marine environments from BMH to BMH. These segments are either plowed or laid on the seafloor (surface-lay). The submarine FOC components include BUs, which allows the extension of the submarine FOC branches from the main trunk to the BMH, at which point the Submarine FOC transitions to a Terrestrial FOC. From the BMH the terrestrial FOC will be constructed to the CLS (referred to as Front Haul) and will extend beyond the CLS to provide access points for CAIs in the region. Landing points for the submarine FOC will include shore-end construction from the MLW to the BMH, where the construction method and timing are different from the main trunk construction.

Terrestrial FOC: This construction involves the installation of a terrestrial fiber optic cable (FOC) across a variety of Alaskan landscapes, including wetlands, inland lakes, and stream crossings. Terrestrial FOC segments will terminate at Beach Manholes (BMHs), underground vaults, and Cable Landing Stations (CLSs). The scope of construction also includes front haul segments (Table 2) extending from the BMH to the CLS for Nome, Emmonak, and Naknek.

Additionally, the Hooper Bay Broadband Project will mirror this approach, with a subsea branch from the Nome to Homer Express (NTHE) mainline landing at a newly constructed BMH in Hooper Bay. From this BMH, a front haul segment will be constructed to a new CLS (Communications Shelter) located within the community. This terrestrial link will support the transition from the subsea middle mile to the local fiber-to-the-premises (FTTP) network, enabling last-mile connectivity to every Broadband Serviceable Location (BSL) in Hooper Bay.

The NTHE project will require a comprehensive set of Federal, State, and Local permits, with a particular focus on historical, environmental, and cultural resource risks, as well as the development of mitigation plans where necessary. Quintillion, with technical support from

Environmental Science Associates (ESA), has identified the construction path to guide these permitting and compliance efforts, as outlined below and in **Figure 4**.

Construction Paths:

Submarine FOC: 410 ft. on each side of route centerline, with total width of 820 ft.
Terrestrial FOC: 25 ft. on each side of route centerline, with total width of 50 ft.

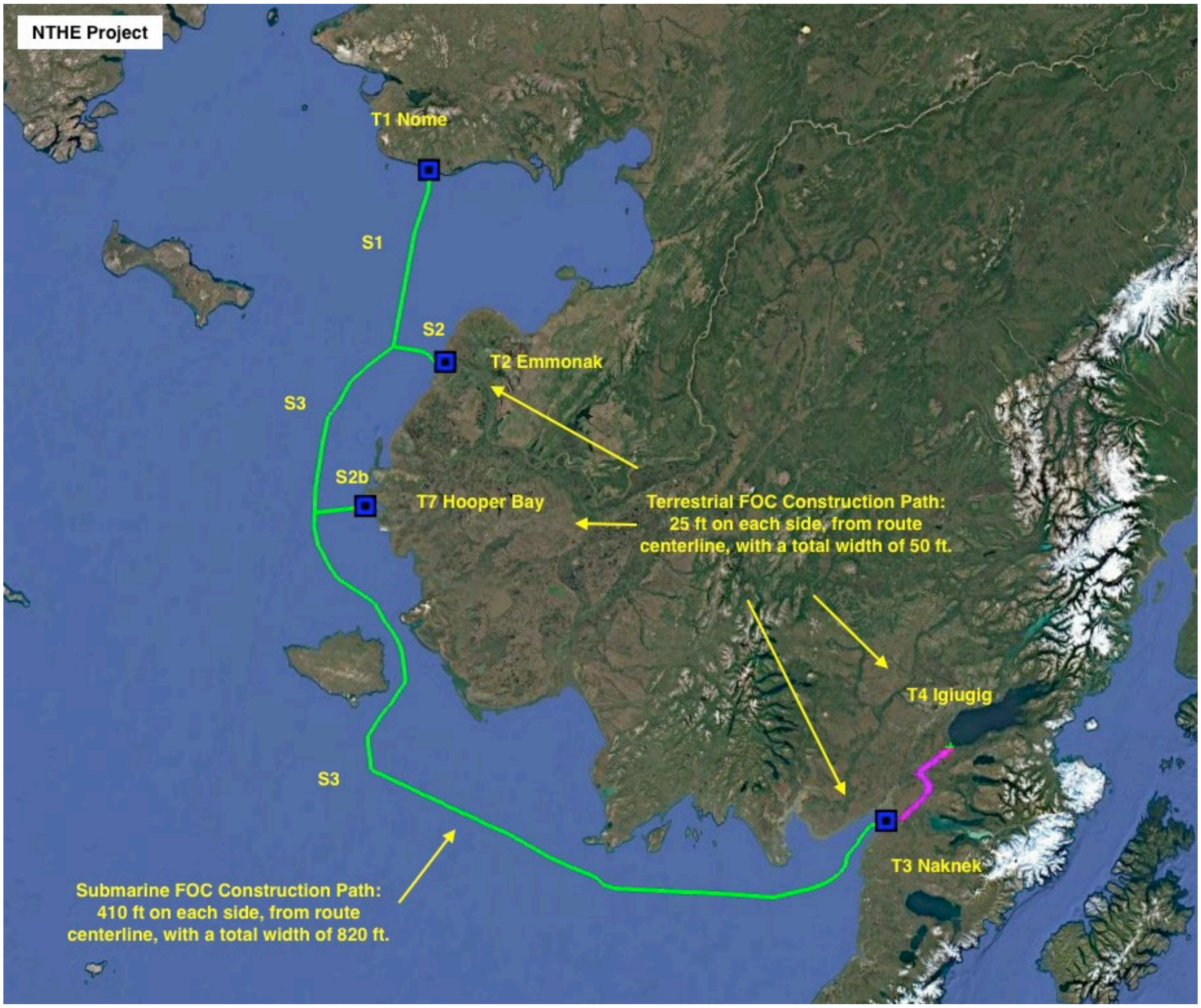

Figure 4: Submarine Routes and Identification Numbers (Segment IDs)

In parallel, the Hooper Bay Broadband Project, which leverages a planned branching unit off the NTHE mainline, will also undergo site-specific permitting and regulatory review, including the establishment of a construction path. This construction path will address both the subsea spur route to Hooper Bay and the terrestrial infrastructure extending from the Beach Manhole (BMH) to the new Cable Landing Station (CLS). The Hooper Bay construction path will specifically evaluate potential impacts to cultural resources, subsistence use areas, coastal habitats, and wetlands, ensuring alignment with National Environmental Policy Act (NEPA), National Historic Preservation Act (NHPA), and other applicable permitting frameworks. Mitigation strategies will be developed accordingly, consistent with those applied across the NTHE system.

Segment Type	Project Area	Seg ID	from	to	Length (mi.)	Associated Facilities
Terrestrial FOC	Nome	T1	Nome CLS	Nome BMH	0	Existing CLS, BMH, New CLS
Submarine FOC	Bering Sea	S1	Nome BMH	Emmonak BU	113.53	Existing BMH and CLS, and new BU
Submarine FOC	Bering Sea	S2	Emmonak BU	Emmonak BMH	35.65	New BMH and CLS
Terrestrial FOC	Emmonak	T2	Emmonak BMH	Emmonak	9.46	New BMH and CLS
Submarine FOC	Bering Sea	S3	Emmonak BU	Naknek BMH	656.48	New Bu
Terrestrial FOC	Naknek - King Salmon	T3	Naknek BMH	King Salmon	10.33	New BMH and CLS
Terrestrial FOC	King Salmon - Igiugig	T4	King Salmon	Igiugig BMH	68.89	New BMH
Submarine FOC	Bering Sea	S2b	Hooper Bay BU	Hooper Bay BMH	32.33	New BU
Terrestrial FOC	Hooper Bay	T7	Hooper Bay BMH	Hooper Bay CLS	6.12	New BMH and CLS
				Total	932.79	

Table 1: Submarine and Terrestrial segments

System Component	Landing Points	Front Haul	Length (mi.)
Shore-ends	Nome	Existing BMH and CLS	0.0
Shore-ends	Emmonak	New BMH and CLS	9.11
Shore-ends	Naknek	New BMH and CLS	3.20
Shore-ends	Hooper Bay	New BMH and CLS	1.95

Table 2: Front Haul segments from BMH to CLS

3.1 SUBMARINE FOC

3.1 TRUNK AND BRANCH INSTALLATION

The primary marine route includes submarine FOC segments from Nome to Naknek, including a branch to Emmonak and Hooper Bay. The path chosen for the marine routes was identified through desktop studies and a marine route survey, conducted in 2023 and 2024. These engineering and field studies assist in selecting routes that provide considerations for environmental and anthropogenic forms of disturbance on the cable system that may lead to cable faults. The International Cable Protection Committee (ICPC) has identified fishing activities as the primary cause for submarine cable faults and repairs (ICPC 2021). As such, the proposed route identified in the desktop and marine route surveys avoids high-impact fishing grounds where possible. Where ground fishing areas cannot be avoided, the cable would be buried. Shore-end segments of the marine route were identified by avoiding developed shorelines and high energy landfalls that are subject to erosion and defined vessel anchorages. Geophysical reviews were also conducted for the route, and considerations were made to avoid areas prone to sediment slumping, fast currents, and other geological hazards.

The marine route would rely on two or more vessels for construction operations. The vessel used for cable installation operations would be dependent upon water depth, location, and installation method. A cable ship (**Figure 5)** would be used for cable-laying and plowing operations within areas of the marine route with water depths exceeding 49 feet (ft) and would rely on dynamic positioning. Proposed construction in waters shallower than 49 ft would be conducted using a contracted Alaska Vessel of Opportunity (VOO), which is a tug and barge, a small landing craft stored on the cable ship, or any small vessel capable of operating in shallow waters. Additionally, shore-end locations would be assisted by a landing craft. These vessels would have a shallow draft, making shallow waters and landings more accessible.

Figure 5: Main lay cable vessel depiction

The submarine FOC will consist of lightweight submarine cable, while all other marine portions of the route would use either a single or double armor submarine cable. The submarine cable, measuring approximately 1 inch in diameter, is constructed from benign materials (**Figure 6**).

Figure 6: Submarine Cable Profile

Prior to trenching operations on the seabed, a pre-lay grapnel run (PLGR) would be conducted along segments of the cable-laying route selected during the desktop studies. The objective of the PLGR operation would be to identify and clear any seabed debris (e.g., wires, hawsers, fishing gear) deposited along the route. PLGR is conducted by pulling a grapnel (**Figure 7**) along the route over the seabed. Any debris recovered by the grapnel would be discharged ashore upon completion of the operations and disposed of in accordance with local regulations. If debris cannot be recovered, then a local re-route would be planned to avoid the debris. The PLGR operation would be conducted to industry standards for employing towed grapnels, and the type of grapnel would be determined by the nature of the seabed.

Figure 7: Grapnel on the deck of main lay cable vessel

3.2 CONSTRUCTION METHODOLOGY

3.2.1 SURFACE LAY

Submarine FOC components would either be laid on top of the seafloor or buried by plowing. The Cable would be laid on the seafloor within areas identified as low risk to cable disturbance or where traversing seafloor substrates that do not allow for plowing (e.g., steep grades, bedrock). When placing cable on the seafloor, bathymetric conditions would be analyzed so the vessel can lay the cable with the engineered slack necessary to allow the cable to conform to the seafloor. If the substrate allows, plowing would be used where there is significant risk of outside disturbance to the cable. In high-risk areas where the substrate does not allow for plowing, cable armoring would be implemented.

3.2.2 BURIAL

Burial within waters deeper than 40 ft would be conducted using a cable plow (**Figure 8**). Burial within deep sea segments would protect the submarine FOC against activities known to cause cable faults such as ground fishing operations, shallow anchor dragging, and earthquakes. The cable plow would be pulled along the seafloor by a tow wire connected to the cable ship. The cable would be fed through the plow's share blade, penetrating seafloor sediments under the plow up to 5 ft deep while excavating a path 1 ft wide. The cable would exit the lower aft end of the share blade, and the sediments would immediately collapse on top of the cable behind the plow.

Figure 8: Submarine Cable Plow

In waters shallower than 40 ft, trenching would occur within areas where cable protection from additional environmental conditions such as surf action and ice scour are needed. At these depths, trenching would be conducted by a jet sled, which is a self-propelled cable trenching system that uses water pressure to destabilize the seafloor and bury the cable. The water used for jetting is supplied from the surface by high pressure hoses. This system would allow for jetting pressure and flow rates to be manipulated based on local conditions. The pressurized water would be focused on the seafloor, liquifying the substrate by turning it into a slurry. The cable would then sink within the trench. The jet sled would be accompanied by divers who would monitor trenching performance and assist in operations. **Figure 9** shows a typical jet sled

Figure 9: Typical jet sled

Upon completing the cable-laying operations, a post-lay inspection and burial will be conducted using a remotely operated vehicle (ROV) equipped for cable trenching. This inspection aims to review sections of the cable ship route where laying operations might have encountered challenges. These challenges include plow failure, unexpected cable repairs, uncontrolled cable payout, branching unit or joint placement, or other unforeseen events. If burial corrections are necessary, the ROV will perform jet burial, similar to the method used by a jet sled, to trench the cable. The ROV will be remotely operated from the cable-laying ship, generating pulsed sounds and utilizing cameras for precise positioning and orientation.

3.2.3 SUBMARINE TRUNK AND BRANCH ROUTES (S1 – S3)

This section describes the primary segments of the proposed submarine cable routes for the trunk and branches, as illustrated in Figure 10. The main trunk route will terminate at an existing Cable Landing Station (CLS) in Nome and a new CLS in Naknek, with a branching unit extending service to a new CLS in Emmonak. The trunk route includes three submarine cable landings—Nome, Emmonak, and Naknek—and features one major river crossing of the Alagnak River along the T4 terrestrial segment from King Salmon to Igiugig, which includes buried and/or surface-laid terrestrial cable connecting Naknek to Igiugig, as well as community buildouts (aerial and buried) in Emmonak, Naknek, and Igiugig.

Additionally, a dedicated branch line from the NTHE subsea trunk will extend service to Hooper Bay, terminating at a new CLS constructed within the Native Village of Hooper Bay. This submarine spur will include a new Beach Manhole (BMH) at the landing site and a short terrestrial segment connecting to the CLS. This buildout will enable the delivery of middle mile fiber capacity directly to Hooper Bay, supporting a FTTP last-mile deployment throughout the community.

The approximate cable segment distances and design specifications are outlined in Table 3 and are based on Quintillion's current engineering plan. These details remain subject to refinement following completion of the marine survey, environmental review, and permitting phases. Recommendations and conditions identified during these stages may result in modifications to the final route alignment or construction methodology as described in this report.

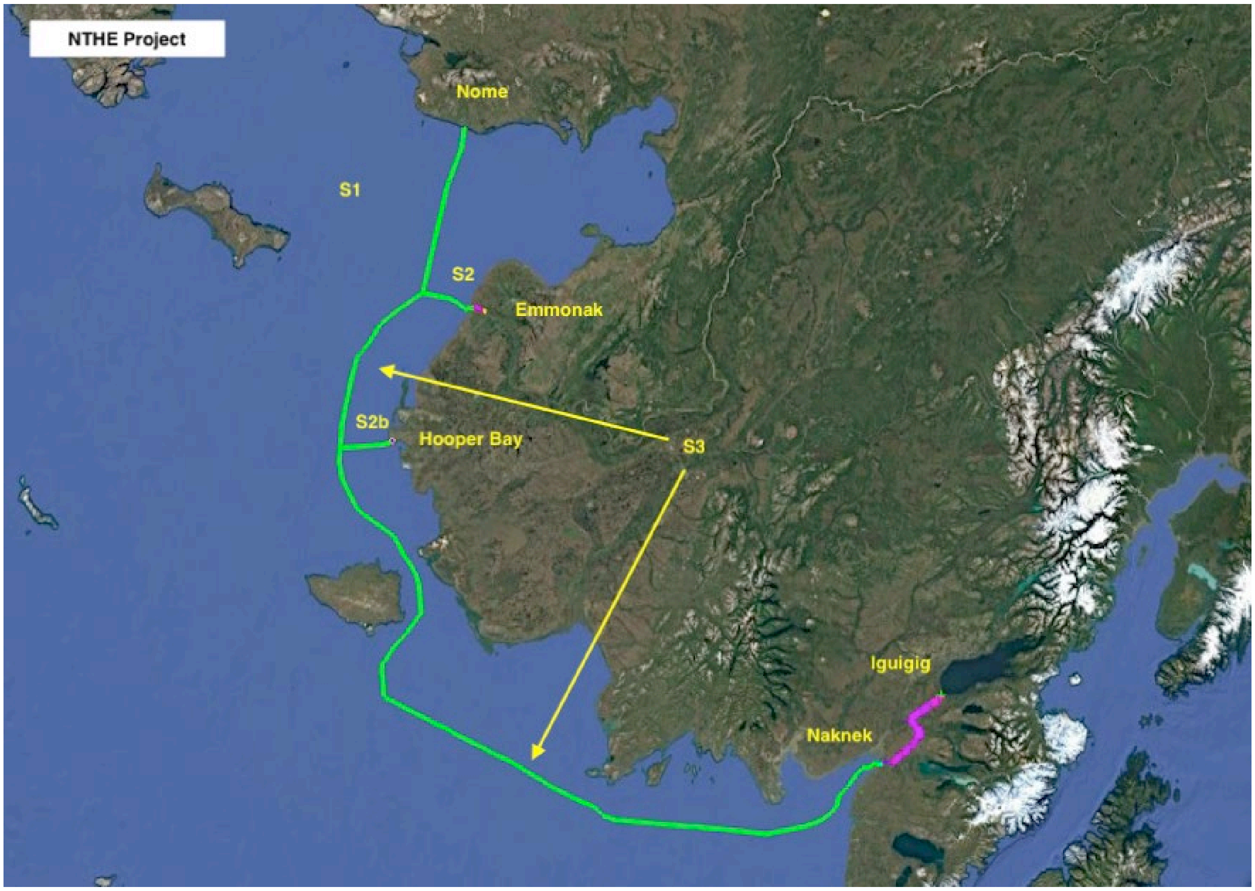

Figure 10: Submarine FOC segments

System Component	Project Area	Seg. ID	From	To	Length (mi.)
Submarine FOC	Bering Sea	S1	Nome BMH	Emmonak BU	113.53
Submarine FOC	Bering Sea	S2	Emmonak BU	Emmonak BMH	35.65
Submarine FOC	Bering Sea	S3	Emmonak BU	Naknek BMH	656.48
Submarine FOC	Bering Sea	S2b	Hooper Bay BU	Hooper Bay BMH	32.33
				Total	837.99

Table 3: Submarine cable segments

3.2.4 SHORE-END INSTALLATION (MLW TO BMH)

Shore-end construction includes segments of the cable route between MLW and a BMH at each landing point. Shore-end construction would occur concurrently with marine construction, at each shore-end, the cable would be trenched within the shoreline between MLW and the BMH. A BMH is an enclosed underground structure that houses the splice between the incoming submarine cable and outgoing terrestrial cable that would connect to the CLS. BMHs are positioned above the high tide line (HTL) and typically measure 3 ft by 4 ft by 4 ft for unpowered cable segments and 4 ft by 6 ft by 6 ft for powered landings (Nome and Naknek). Shore-end trenching would be conducted with either a rock saw or backhoe. When deemed necessary, additional protection may be provided to the cable at landing point locations with split pipe articulated armor (**Figure 11**). Two 4-inch conduits would be buried at no deeper than 36 inches and extend from the BMH to the beach area above MLW, allowing the bank to be disturbed only once. Conduit installation would be conducted in a controlled manner using best management practices prior to the arrival of the cable ship.

Figure 11: Articulated Pipe being installed

While conducting shore-end construction, care would be taken to protect shorelines from future erosion. Additionally, best practices would be employed to address stormwater runoff concerns. For all intertidal work (MLW to HTL), construction operations would occur only during low tide. When constructing on shorelines without firm sediments such as large boulders, heavy equipment would be placed on mats to protect the substrate from slumping and erosion. Alterations to shorelines would be temporary. Best management practices to minimize the impact of landfall construction on the environment will be provided in the Environmental Assessment report.

3.2.5 HORIZONTAL DIRECTIONAL DRILLING (HDD)

In locations where Submarine FOC may be disturbed by human activities and/or at risk of damage, burial may be required. The burial depth is determined based upon local conditions (e.g., soil type, anticipated activities in the area, environmental conditions, and operational needs).

Burial is achieved by a variety of means, and includes Horizontal Directional Drilling (HDD), which is typically employed when the submarine cable is landed at the BMH. Specifically, where there are areas of environmental sensitivity and/or risk to the submarine FOC. HDD is accomplished using a large-tracked bore machine (**Figure 12**) to bore a steel conduit underground for the cable.

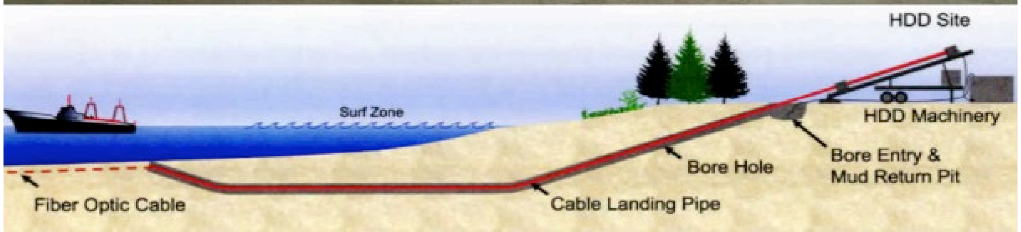

Figure 12: Bore Machine

When conducting HDD operations, it's common to utilize excavators (**Figure 12**) with an approximately 2–3-foot bucket to excavate bore entry, move equipment and material around the operations site.

3.2.6 BMH LOCATIONS

Beach landing facilities, including the BMH and seaward conduit, would be constructed on public and state tidelands and submerged tidelands using a “mini-sized” tracked excavator. Where conditions preclude the seaward duct from being buried by an excavator at low tide, the seaward duct may be pinned to the seabed or otherwise anchored to a submerged concrete bulkhead to provide seaward stability and prevent the duct from floating off the seabed.
The total time to place a pre-cast concrete BMH vault and construct a seaward conduit is estimated at 4-5 days at each landing, except where HDD will be utilized at Nome (HDD operations may take 3-4 weeks). Staging of equipment and materials would occur on-site and would be compliant with local construction permit requirements obtained at each location. **Table 4** lists the BMH locations/coordinates, and the following sections describe the BMH construction plan and location.

Beach Manholes	Location Coordinates
Nome	64.486583 -165.3207
Emmonak	62.80051 -164.78216
Naknek	58.72439 -157.05553
Hooper Bay	61.51135, - 166.13467

Table 4: BMH locations and coordinates

3.2.7 NOME

A new BMH would be constructed at the Nome landing point **(Figure 13)** to support the new submarine cable landing, as well as a power feed equipment (PFE) communication shelter with standby generator and fuel storage. In addition, HDD seaward conduit may be required to further protect the submarine FOC. An HDD bore machine will be used to cross the Nome-Counsel highway and beach/intertidal area. The existing gravel pad will be expanded to allow construction of a new communication shelter. An excavator would be used for setting BMH, other vaults, installing duct, and fiber. Construction would be completed in Spring/Summer (pending environmental approval).

Figure 13: Nome Landing Point - BMH Location

3.2.8 EMMONAK

A new CLS is proposed in both Emmonak and Naknek. Quintillion, or a contracted field crew, would install fiber along main corridors near anchor institutions and last-mile communication companies within the local communities of Emmonak and Naknek. The installation crew would consist of personnel supported by light duty vehicles (i.e., crew and service trucks), one or two bucket trucks (**Figure 14**), tools, equipment, and possibly traffic control devices and signage.

Figure 14: Bucket Truck

The front haul route for Emmonak, which is the portion of the route extending from the BMH to the CLS in Emmonak **(Figure 15)**, is planned to be surface laid across land managed by Emmonak Corporation. The cable would be installed where existing poles exist (from Alaska Village Electric Cooperative) in Emmonak to reach the proposed CLS. Quintillion would communicate proactively with property owners in the area to inform them of its installation schedule, and coordinate work as necessary.

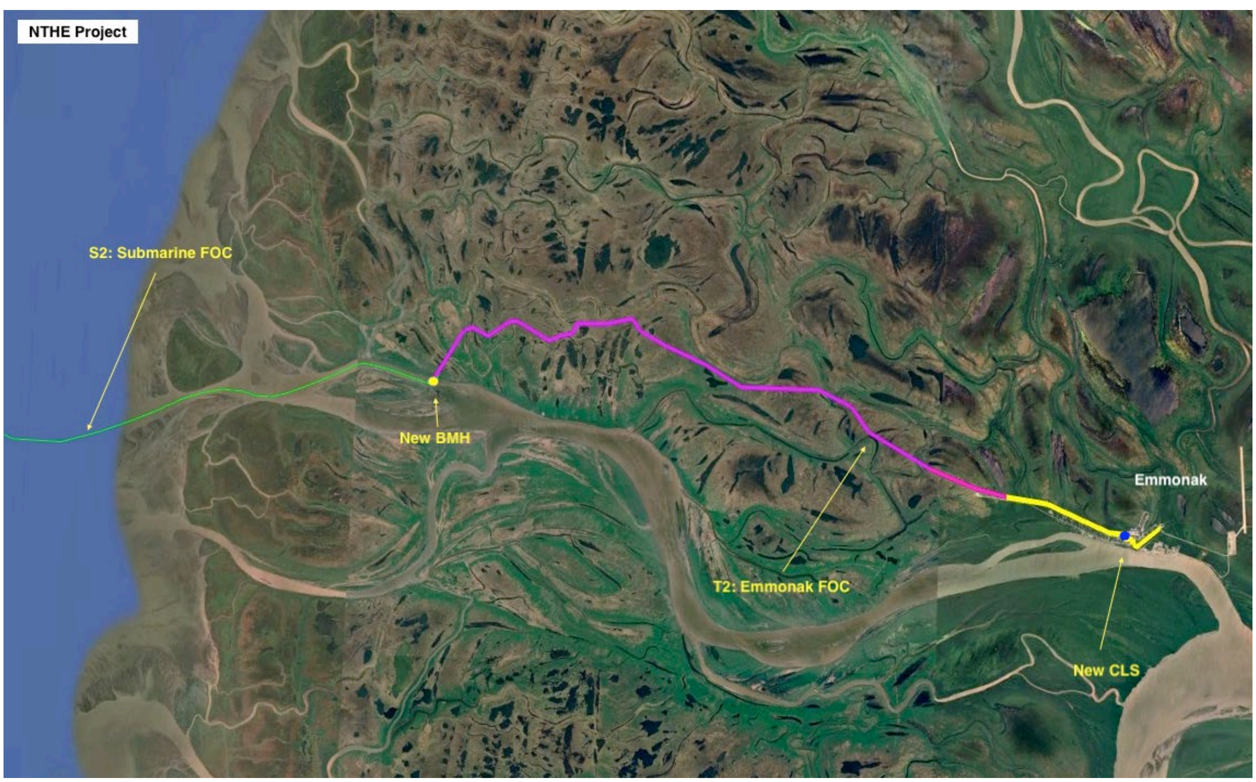

Figure 15: Emmonak Landing Point – BMH location

3.2.9 NAKNEK

The Naknek landing (**Figure 16**) is planned to be located near the existing wastewater treatment plant at Cape Suwarof. This location avoids other tidal users and leverages existing access infrastructure. A new BMH and HDD conduit from the BMH to a concrete headwall would be placed near the base of the bluff. HDD is preferred to avoid erosion of the bluff. The cable would be buried from the headwall seaward with mini excavator. A new CLS facility will be constructed in Naknek to house submarine line terminal and power feed equipment. Cabling between the BMH and CLS would be installed via conventional burial within existing utility ROW to the extent feasible. Buried ground anodes would be placed nearby the BMH to serve as a system ground for the submarine cable.

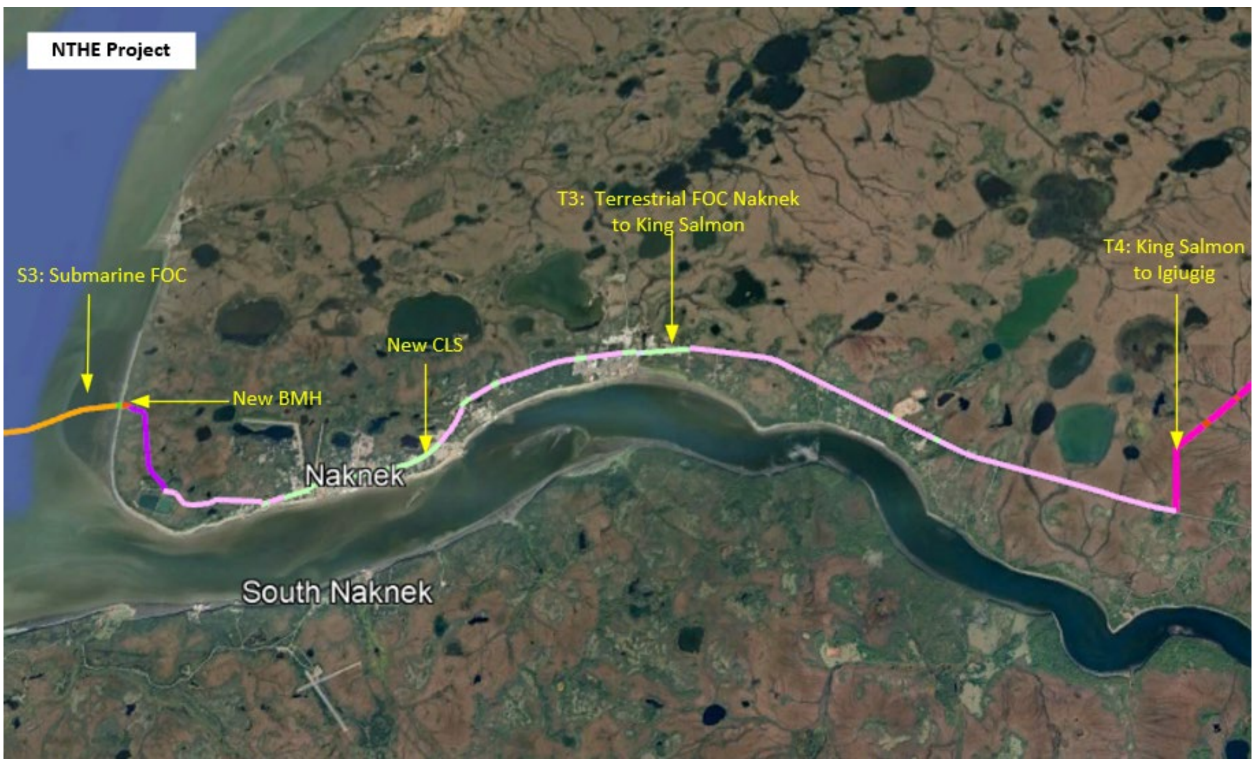

Figure 16: Naknek Landing Point – BMH location

3.2.10 HOOPER BAY

The Hooper Bay landing (**Figure 17**) is planned to be located south of the airport. This location avoids other tidal users and a wide gravel shoreline below HTL. This spur will come ashore at a new BMH, extend inland to a newly constructed CLS, and support the deployment of a full FTTP last-mile network. A new CLS facility will be constructed in Hooper Bay to house submarine line terminal and power feed equipment.

The new BMH would be placed above HTL. Buried ground anodes would be placed nearby the BMH to serve as a system ground for the submarine cable. HDD conduit would be trenched from the BMH across DOT&PF airport property and then surface laid to the airport road. The cable would be trenched along the airport road for approximately 0.66 mile to a power pole with a mini excavator. From this power pole, the FOC would be aerial to the CLS and throughout the community.

Figure 17: Hooper Bay Landing Point – BMH location

3.3 TERRESTRIAL FOC

As described in **Figure 3** in section 3.1, the terrestrial route starts at the BMH and extends to the CLS, in most cases, and can in some cases extend beyond the CLS to allow last-mile providers easier access to the Submarine cable system. The terrestrial FOC components include the front haul, CLS and some back haul. The following sections describe the proposed terrestrial FOC construction activities.

3.3.1 FRONT HAUL SEGMENTS

The proposed submarine cable would include the construction of several front haul segments to include Nome, Emmonak, Naknek, Homer, and Hooper Bay. The term "front haul" is used in the submarine cable system industry to describe the segment of cable from the BMH to the CLS. The BMH is the point where the submarine cable is spliced or transitions to terrestrial cable, which is constructed from the BMH to the CLS, where the FOC is terminated. **Table 5** lists the fronthaul segments and associated facilities.

System Component	Project Area	Segment ID	Distance (mi.)	Associated Facilities
Fronthaul	**Nome**	**T1**	**0.00**	**Existing BMH and CLS, and new BU**
Fronthaul	**Emmonak**	**T2**	**9.11**	**New BMH and New CLS**
Fronthaul	**Naknek**	**T3**	**3.20**	**New BMH and New CLS**
Fronthaul	**Hooper Bay**	**T7**	**1.95**	**New MBH and New CLS**

Table 5: Fronthaul segments (BMH to CLS)

3.3.2 CABLE LANDING STATION & COMMUNICATION SHELTER LOCATIONS

The CLS is a building that provides the enclosure for the submarine line terminal equipment, terrestrial transmission equipment, any required power feed equipment, network monitoring equipment, and building management equipment. The terrestrial FOC from the BMH terminates in the CLS and connects to the submarine line terminal equipment. The NTHE project would utilize an existing CLS at Nome and Homer. A new CLS building is proposed at Emmonak, Naknek, and Hooper Bay, as well as a small communication building in the Igiugig area. Table 6 lists the CLS locations/coordinates, while **Figure 18** illustrates a typical CLS building.

CLS	Existing or New	Location Coordinates
Nome	Existing CLS	64.486538 -165.320710
Emmonak	New CLS	62.778093 -164.534843
Naknek	New CLS	58.731087 -157.993489
Igiugig	New Communication Shelter	59.307638 -155.911942
Homer	Existing CLS	59.641613 -151.545950
Hooper Bay	New CLS	61.526920, -166.110252

Table 6: CLS location/coordinates

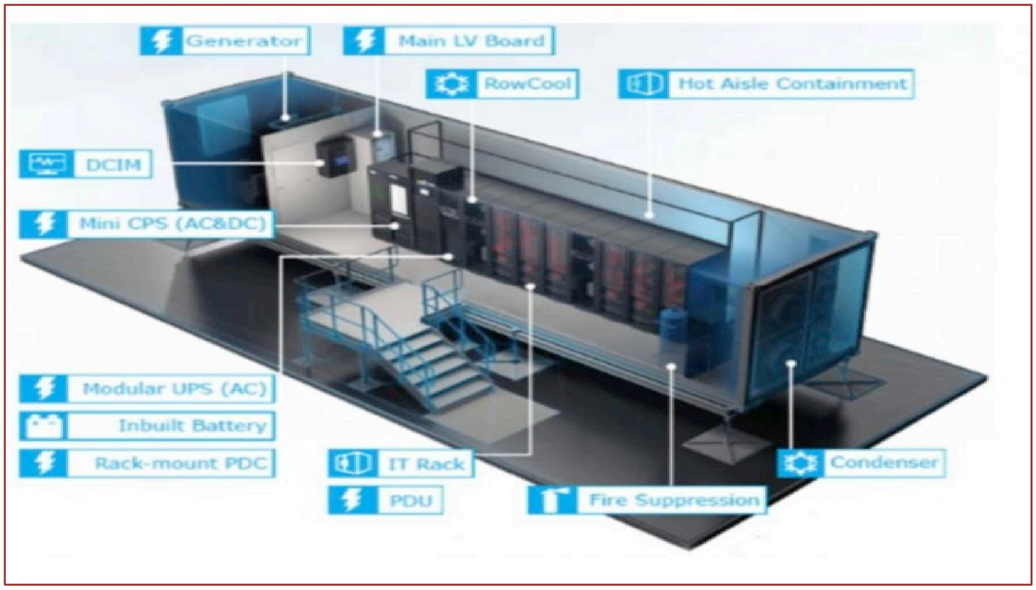

Figure 18: Typical CLS internal configuration

3.3.3 CONSTRUCTION METHODOLOGY

Terrestrial route segments crossing extensive wetlands would be installed during winter months, when the substrate is frozen, to minimize ground disturbances. Wetland segments would use a lightweight submarine cable provided in drums or containers that are towed by light tracked vehicles. Lightweight submarine cables would be coated in high-density polyethylene and measure approximately 0.5 inch in diameter. A splice joint case approximately 10 inches in diameter would be located along the route, approximately every 6.81 miles along the route, to join cable segments. Additional slack would be provided when laying the cable to allow it to settle on the vegetation and conform to changing surface features and environmental conditions. When crossing overland sections, the cable would either be laid across the ground surface or trenched. Placing the cable directly on the ground surface significantly reduces wetland impacts and is the preferred installation method. The cable would be buried where the route is close to trails, crosses streambanks and riverbanks, or is in other locations where the cable may be susceptible to damage. Additionally, unless the cable is being routed on riser poles, it would be trenched within 0.6 mi of each community. If permafrost is present during trenching with any method, the trenching would only occur within the vegetative mat above the permafrost, and the permafrost would be left intact.

The process of laying cable within wetlands would begin by removing deep snow from the cable route. Buried cable segments over wetlands would then be excavated and the cable laid directly within the trench. Trench depth would be targeted at a minimum of 12 inches and would vary with the terrain, with maximum depth of 48”. Submarine cable would be used to cross streams and rivers. The cable would be spliced with the terrestrial FOC and buried into each stream bank below the ordinary high-water level. Split pipe articulated armor and driven cable anchors may be deployed in stream crossings for extra stabilization and protection.

Natural sediment transport would passively bury the cable. Additionally, the cable would be equipped with an outer plastic covering to avoid frazil (loose, randomly oriented) ice buildup. Care would be taken to position the crossings on stable banks to provide erosion protection.
When constructing on soft and unstable sediments, heavy equipment would be placed on mats (**Figure 19)**. The position of the laid cable would be recorded with a survey-quality Global Positioning System (GPS). Post-lay inspection for terrestrial components would be conducted following snow and ice melt. Any cable left suspended after the snow melt would be repositioned so as not to be hazardous for humans or animals. Cable repositioning would be done manually by moving the installed slack cable accordingly. If needed, the cable would be pinned to the ground using small duckbill anchors that would be installed using a hammer and drive pin. Cable left on the vegetation would sink into the vegetated mat and become overgrown, effectively burying itself out of sight. Helicopter and walking inspections would be conducted on an annual basis to monitor erosion and bank failure.

Figure 19: Drill mat “road”

In general, equipment used across overland routes includes:
- Rubber wheel backhoe
- Tracked excavator or backhoe
- Small bulldozer or other tracked machine to remove snow
- Utility truck and trailer to deliver materials
- Light tracked vehicle
- Rock saw

- Chain trencher
- Hand tools (e.g., shovels, rakes, pry bars, wrenches)
- Survey equipment
- Small utility boat for larger rivers
- Splicing equipment, small genset, and splicing tent

The method of construction is determined by considering environmental impact, cost, logistical feasibility, and weather conditions. An effective method to mitigate environmental impacts is to conduct construction during specific weather windows, summer vs winter, which are in some cases dictated by permitting agencies. The NTHE project has two project areas that have weather windows as represented in the **Figure 20** for T2 Emmonak, and **Figure 21** for T4 King Salmon to Igiugig.

Figure 20: Construction weather window for T2 Emmonak

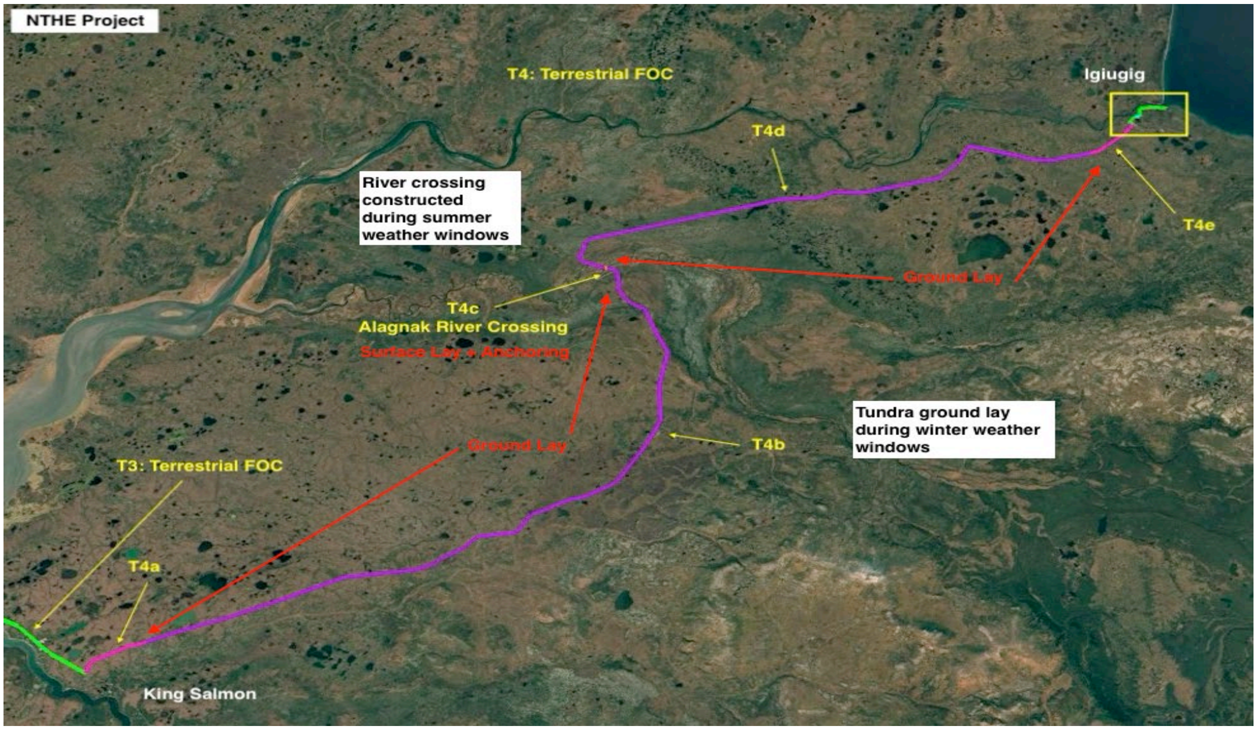

Figure 21: Construction weather window for T4 King Salmon to Igiugig

3.3.4 SURFACE LAY

In previously undisturbed areas along the cable route, Quintillion aims to limit disturbances and impacts to the environment by laying the cable on the surface where feasible, anchoring where needed. Due to the remote nature of some of the cable route's segments, surface-laid cable would not be at risk of damage from other users or their activities.

The terrestrial segment between greater Naknek and Igiugig is currently an undisturbed area. Due to its remote location and the difficulty of bringing heavy equipment on-site, Quintillion proposes to surface-lay the cable in the winter months, when the substrate is frozen, to minimize ground disturbance. The risk of damage to the cable is low in this area with few other ongoing activities. The frozen ground helps protect vegetation while also being stable enough to support heavy equipment. Surface lay overland segments will use a lightweight submarine cable provided in large spools that are towed by light tracked vehicles. Over the course of several freeze and thaw cycles, it is anticipated that the cable will become embedded into the surface layer or achieve a shallow self-bury.

In areas where land managers or other stakeholders prefer burial, Quintillion proposes to shallow-bury the cable by trenching within the upper 12-18 inches of the surface, with a minimum depth of approximately 12 inches depth (if achievable). This method would require much less excavation and lighter equipment than a typical buried cable, minimizing impacts to the environment, while remaining feasible to mobilize such equipment on-site at these locations. The cable will also be shallow buried when the route is near trails, crosses streambanks and riverbanks, or is in other places where the cable may be susceptible to damage. Additionally, unless the cable is being routed on poles, it will be buried within 0.6 mi of each receiving community. Trenching activities will be conducted with a backhoe along streams and riverbanks. All other winter trenching activities will be completed with a rock saw.

3.3.5 BURIAL

Burial is achieved by a variety of means, most commonly, telecommunications cables are buried by plowing, trenching, and horizontal directional drilling, and include the installation of conduits in some scenarios. For newly buried construction along existing rights-of-way (ROW), Quintillion would follow storm water pollution prevention plans (SWPPP), and other requirements associated with this installation effort. Burial will include conduits where appropriate, and following conduit installation, fiber optic cable would be pulled or "blown" into place. Hand holes would be placed along the route as necessary to provide future access points to the fiber system and splice cable segments together. The location and spacing of the hand holes will be subject to final design.

Due to the anticipated landscape conditions of the NTHE project (i.e., tundra), conventional trenching is likely not feasible. In undisturbed tundra conditions, a shallower trench would be excavated using a rock saw or chain trencher to cut a narrow slot, with the cable buried to a minimum of approximately 12 inches below grade. Performing this trenching during winter conditions allows the local environment to better withstand impacts from the heavy machinery in the area, such as tracked chain trenchers or rock saw for installation. Inspections would be conducted in summer to verify trench cover and would then be backfilled by hand as required.

3.3.6 TRENCHING

Trenching techniques will vary, depending on local conditions and the presence of other utilities near the NTHE cable route. A trenched burial is typically to a depth of 12-48 inches (minimum 12 inches if achievable), depending on the conditions. Due to the anticipated landscape conditions of the NTHE project (i.e., tundra), conventional trenching is likely not feasible. In undisturbed tundra conditions, a shallower trench would be excavated using micro-trenching, with the cable buried to a minimum of approximately 12 inches below grade. Performing this trenching during winter conditions allows the local environment to better withstand impacts from the heavy machinery in the area, such as tracked chain trenchers or rock saw (**Figure 22**) for installation. Inspections would be conducted in summer to verify trench cover and backfill as required.

Figure 22: Rock saw trencher

In areas accessible for summer construction, backhoes and excavators would be utilized to excavate and backfill a trench for placement of conduit. Non-mechanical trenching would be employed as necessary to install buried cable near other utilities. Excavators (**Figure 23**) with an approximately 2–3-foot bucket are utilized to trench an opening for laying the conduit, installing CVs, and moving materials around the construction site.

Figure 23: Excavator

Associated with burial are handholes and cable vaults, which are used to house extra cable, splice points and access points for further distribution of the FOC. **Figure 24** is a typical hand hole, while **Figure 25** illustrates a typical cable vault.

Figure 24: Handhole with FOC and splice case

Figure 25: Cable Vault with extra FOC cable

3.3.7 HORIZONTAL DIRECTIONAL DRILLING (HDD)

HDD is commonly utilized where there are congested areas with other utilities, and to reduce environmental impact. HDD is accomplished using a small-tracked bore machine (**Figure 26**) to bore a conduit underground for the cable. While HDD is a good construction method to reduce environmental impact, it must be noted that in the remote tundra areas of Alaska, utilization of this method is limited due to logistics and the harsh environmental conditions that may prohibit the use.

Figure 26: HDD rig utilized in terrestrial boring

In general, equipment used at each landfall location may include:
- Rubber wheel backhoe
- Tracked excavator or backhoe
- Utility truck and trailer to deliver materials
- Chain trencher or cable plow (optional)
- Hand tools (e.g., shovels, rakes, pry bars, wrenches)
- Survey equipment
- Winch or turning sheave
- Small utility boat to run the pull line to the beach
- Splicing equipment, small genset, and splicing tent

3.3.8 AERIAL INSTALLATION

Aerial installation involves mounting the cable between poles. Where there is pre-existing pole infrastructure, Quintillion will seek to utilize it to the greatest extent feasible to minimize additional disturbances and construction activity. Additionally, aerial installation will be considered for areas where burial or surface-laid cable cannot be achieved. Quintillion's crews would use a highway-based boom truck (flatbed truck with a boom crane) and bucket truck **(Figure 27)**, a cable trailer, traffic control lighting, and light vehicles for crew and tools, where necessary, for any aerial installations.

Figure 27: Aerial Pole Construction

When crossing anadromous waterbodies, the cable installation would include shallow burial across shallow channels and vegetated areas in winter, and armored cable laid on the riverbed's main channel after opening of the ice. The FOC will be surface laid and anchored by driven stakes to secure the cable in the river flow. The crossing methodology will be determined by the final design, accounting for feedback from land managers and other stakeholders.

3.3.9 TERRESTRIAL FOC ROUTES

Terrestrial segments are located at Nome (T1), Emmonak (T2), Naknek to King Salmon (T3), King Salmon to Igiugig (T4), and Hooper Bay (T7) as listed in **Table 7**. In Nome the construction plan expands the existing BMH and landing point site to include PFE shelter and larger BMH. The Emmonak segment includes front haul from the BMH to the CLS but also extends the cable beyond the CLS to provide access to the FOC for ACIs. At Naknek the terrestrial FOC segment includes fronthaul but also extends the system beyond Naknek to Igiugig to a point just short of King Salmon, where the cable turns north to Igiugig. The King Salmon to Igiugig segment begins at the turning point at King Salmon and includes the Alagnak river crossing, extending the system to Igiugig, where the Terrestrial FOC will interconnect with the leased fiber pairs at the GCI CLS. The Hooper Bay segment includes front haul from the BMH to the CLS but also extends the cable beyond the CLS to provide FTTP for the community through aerial installation.

The following table summarizes the terrestrial routes:

Segment Type	Project Area	Seg ID	from	to	Length (mi.)
Terrestrial FOC	Nome	T1	BMH	Power Hut	0
Terrestrial FOC	Emmonak	T2	Emmonak BMH	End of Route	9.46
Terrestrial FOC	Naknek – King Salmon	T3	Naknek BMH	King Salmon	10.33
Terrestrial FOC	King Salmon – Igiugig	T4	King Salmon	End of Route	68.89
Terrestrial FOC	Hooper Bay	T7	Hooper Bay BMH	FTTP	6.12
				Total Length	94.80

Table 7: Terrestrial segment distances

3.3.10 NOME

As described in previous sections, there will be a new BMH, PFE shelter, and HDD pipe installed at the landing point. However, there is no need to construct a terrestrial FOC from the BMH to the existing CLS.

The CLS in Nome is an existing structure in operation currently. New equipment may be placed in the CLS. No physical alterations to the building are planned. The existing gravel pad will be expanded, and a new facility will be constructed at the existing BMH site to house PFE for the cable extending between Nome and Naknek.

3.3.11 EMMONAK (T2)

In Emmonak, a terrestrial fiber optic cable will extend from the BMH to a new CLS to be constructed in Emmonak, as shown in **Figure 28**. This fiber optic route will consist of a surface laid submarine type cable across undisturbed tundra from the BMH to a point near the Emmonak waste disposal area, where a CV would be placed prior to transitioning to conventional aerial attachment on existing utility poles for the remainder of the route to the CLS (**Table 8**).

The FOC route in Emmonak will also extend past the CLS, providing strategically placed access points to serve anchor institutions, passing less than 1000ft from three Anchor Institutions. The Emmonak Community Center, Emmonak Clinic, and Emmonak School. Quintillion will work with landowners and tribal communities to identify future anchor institutions, and consider these needs, if any additional needs are identified.

Segment	ID	Distance (mi.)	Construction Method
T2	A	0.64	TGL – Tundra Ground Lay
T2	B	0.13	Anchored Water Crossing
T2	C	0.33	TGL – Tundra Ground Lay

T2	D	0.07	Anchored Water Crossing
T2	E	4.18	TGL – Tundra Ground Lay
T2	F	0.18	Anchored Water Crossing
T2	G	0.97	TGL – Tundra Ground Lay
T2	H	0.28	Anchored Water Crossing
T2	I	0.93	SBT – Shallow Bury Trench
T2	J	1.34	Aerial Pole Line
T2	K	0.01	Aerial Pole Line
T2	L	0.34	Aerial Pole Line

Table 8: Segment T2 Construction Method by segment ID

Figure 28: Terrestrial Segments Emmonak

Regarding the CLS In Emmonak, we will modify an existing building into our CLS or replace an existing structure with a communications shelter. Our fiber optic cable will be buried along the main road and will have buried vaults that allow us to branch off to Community Anchor Institutions. One of these vaults will be near our chosen CLS location, with the connecting fiber to be buried and inside conduit where it connects to the building.

Figure 29: Communications Shelter

3.3.12 NAKNEK TO KING SALMON (T3)

In Naknek, we will place a telecommunications shelter along our fiber route and install equipment to serve as our CLS. Our fiber optic cable will be buried along the main road and will have buried vaults that allow us to branch off to CAIs. One of these vaults will be near our chosen CLS location, with the connecting fiber to be buried and inside conduit where it connects to the building. See **Figure 29** above for a sample shelter.

The terrestrial segment would travel east out of Naknek, beyond the CLS to a turning point near King Salmon before turning north to Igiugig across an undeveloped tundra environment (**Figure 30**). In Naknek, the cable would be installed via conventional burial, and directional boring (**Table 9**), leveraging existing utility ROW to the extent possible. Beyond the developed area of Naknek, the cable is planned as a half-inch armored type, surface-laid directly on the tundra or shallow-buried during winter. Installation methodology is subject to final design, determined in part by feedback from the land managers and other stakeholders.

Segment	ID	Distance (mi.)	Construction Method
T3	A	0.96	Standard Burial
T3	B	0.84	Standard Burial
T3	C	0.04	DB -Directional Bore
T3	D	0.02	Standard Burial
T3	E	0.06	DB -Directional Bore
T3	F	0.12	Standard Burial
T3	G	0.57	DB -Directional Bore
T3	H	0.04	Standard Burial
T3	I	0.51	DB -Directional Bore
T3	J	0.003	Standard Burial
T3	K	0.27	DB -Directional Bore
T3	L	0.37	Standard Burial
T3	M	0.13	DB -Directional Bore
T3	N	0.19	Standard Burial

T3	O	0.06	DB -Directional Bore
T3	P	0.66	Standard Burial
T3	Q	0.10	DB -Directional Bore
T3	R	0.03	Standard Burial
T3	S	0.13	DB -Directional Bore
T3	T	0.06	Aerial Pole Line
T3	U	0.41	DB -Directional Bore
T3	V	1.86	Standard Burial
T3	W	0.06	DB -Directional Bore
T3	X	0.36	Standard Burial
T3	Y	0.05	DB -Directional Bore
T3	Z	2.06	Standard Burial

Table 9: Segment T3 Naknek Construction Method by segment ID

Figure 30: Terrestrial Segments from Naknek to King Salmon

3.3.13 KING SALMON TO IGIUGIG (T4)

At a point near King Salmon, the FOC route turns north to Igiugig across an undeveloped tundra environment (**Figure 31**). Beyond the developed area at this turning point, the cable is planned as a half-inch armored type, surface-laid directly on the tundra or shallow-buried during winter (**Table 10**). Installation methodology is subject to final design, determined in part by feedback from the land managers and other stakeholders.

This route would cross the Alagnak River on lands managed by the U.S. Bureau of Land Management (BLM). The proposed installation would include shallow burial across shallow channels and vegetated areas in winter, and armored cable laid on the riverbed's main channel after opening of the ice. The FOC will be laid on the surface and anchored by driven stakes to secure the cable in the river flow.

A small communications shelter is planned for Igiugig to house the required amplifier equipment due to the distances from Igiugig to Homer. This equipment will amplify the signal at this intermediate point between these locations. In addition, a terrestrial FOC (1 mi.) will be installed from the communications shelter to the GCI CSL, and another distribution cable from the communication shelter to a vault just short of Iliamna Lake for future access to community CAIs. This distribution FOC provides fiber access points are strategically planned along the route for future services to CAIs and local service providers. The planned FOC route will be roughly 1500ft from the Camai Community Health Center and the Bristol Bay School District building and roughly 1200ft from the Naknek Health Clinic. In Igiugig, the FOC will pass the airport and will be about 25ft from the school.

Segment	ID	Distance (mi.)	Construction Method
T4	A	0.88	SBT – Shallow Bury Trench
T4	B	0.06	Anchored Water Crossing
T4	C	0.30	SBT – Shallow Bury Trench
T4	D	0.03	Anchored Water Crossing
T4	E	0.90	SBT – Shallow Bury Trench
T4	F	2.32	TGL – Tundra Ground Lay
T4	G	0.05	Anchored Water Crossing
T4	H	1.11	TGL – Tundra Ground Lay
T4	I	0.09	Anchored Water Crossing
T4	J	00.89	TGL – Tundra Ground Lay
T4	K	0.04	Anchored Water Crossing
T4	L	2.31	TGL – Tundra Ground Lay
T4	M	0.05	Anchored Water Crossing
T4	N	0.89	TGL – Tundra Ground Lay
T4	O	0.07	Anchored Water Crossing
T4	P	0.30	TGL – Tundra Ground Lay
T4	Q	0.05	Anchored Water Crossing
T4	R	0.90	TGL – Tundra Ground Lay
T4	S	0.10	Anchored Water Crossing
T4	T	0.52	TGL – Tundra Ground Lay
T4	U	0.10	Anchored Water Crossing
T4	V	6.69	TGL – Tundra Ground Lay
T4	W	0.12	Anchored Water Crossing
T4	X	1.39	TGL – Tundra Ground Lay

T4	Y	0.06	Anchored Water Crossing
T4	Z	3.61	TGL – Tundra Ground Lay
T4	Aa	0.03	Anchored Water Crossing
T4	Ab	2.77	TGL – Tundra Ground Lay
T4	Ac	0.06	Anchored Water Crossing
T4	Ad	5.18	TGL – Tundra Ground Lay
T4	Ae	0.11	Anchored Water Crossing
T4	Af	2.31	TGL – Tundra Ground Lay
T4	Ag	0.02	Anchored Water Crossing
T4	Ah	2.32	TGL – Tundra Ground Lay
T4	Ai	0.02	Anchored Water Crossing
T4	Aj	1.37	TGL – Tundra Ground Lay
T4	Ak	0.17	Anchored Water Crossing
T4	Al	0.16	TGL – Tundra Ground Lay
T4	Am	0.07	Anchored Water Crossing
T4	An	1.14	TGL – Tundra Ground Lay
T4	Ao	0.06	Anchored Water Crossing
T4	Ap	0.32	TGL – Tundra Ground Lay
T4	Aq	0.08	Anchored Water Crossing
T4	Ar	9.69	TGL – Tundra Ground Lay
T4	As	0.09	Anchored Water Crossing
T4	At	0.54	TGL – Tundra Ground Lay
T4	Au	0.06	Anchored Water Crossing
T4	Av	1.92	TGL – Tundra Ground Lay
T4	Aw	0.03	Anchored Water Crossing
T4	Ax	2.95	TGL – Tundra Ground Lay
T4	Ay	0.09	Anchored Water Crossing
T4	Az	1.50	TGL – Tundra Ground Lay
T4	Ba	0.07	Anchored Water Crossing
T4	Bb	0.58	TGL – Tundra Ground Lay
T4	Bc	0.12	Anchored Water Crossing
T4	Bd	2.19	TGL – Tundra Ground Lay
T4	Be	2.08	SBT – Shallow Bury Trench
T4	Bf	0.03	Anchored Water Crossing
T4	Bg	1.67	TGL – Tundra Ground Lay
T4	Bh	1.34	SBT – Shallow Bury Trench
T4	Bi	0.06	Anchored Water Crossing
T4	Bj	1.23	SBT – Shallow Bury Trench
T4	Bk	0.09	Standard Burial
T4	Bl	0.01	DB -Directional Bore
T4	Bm	0.00	Standard Burial
T4	Bn	0.14	Standard Burial
T4	Bo	0.01	DB -Directional Bore

T4	Bp	0.29	Standard Burial
T4	Bq	0.01	DB -Directional Bore
T4	Br	0.20	Standard Burial
T4	Bs	0.24	DB -Directional Bore
T4	Bt	1.29	Standard Burial

Table 10: Segment T4 King Salmon to Igiugig Construction Method by segment ID

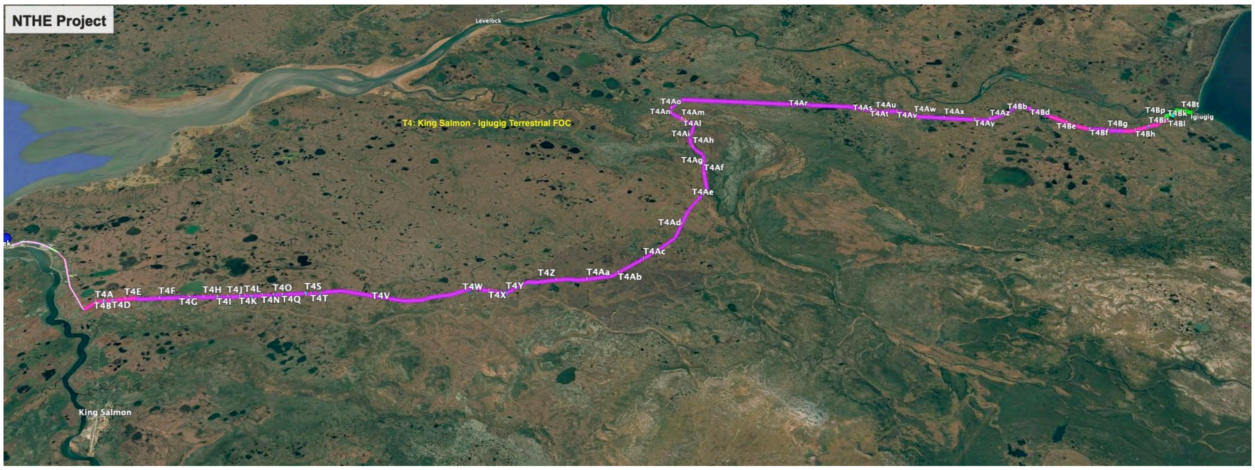

Figure 31: Terrestrial Segments from King Salmon to Igiugig

3.3.14 HOOPER BAY (T7)

In Hooper Bay, a terrestrial fiber optic cable will extend from the BMH to a new CLS to be constructed in Hooper Bay, as shown in **Figure 32, as well as distribution segments beyond the CLS**. This fiber optic route will consist of a trenched cable from the BMH across DOT&PF airport property and then a surface laid submarine type cable across undisturbed tundra from the BMH to a point along the airport road where the FOC would be trenched 0.66 mile to a power pole. At the transition power pole, a CV would be placed prior to transitioning to conventional aerial attachment on existing utility poles for the remainder of the route to the CLS (**Table 9**). The FOC route in Hooper Bay will also extend past the CLS, providing FTTP.

Segment	ID	Distance (mi.)	Construction Method
T7	A	0.93	TGL – Tundra Ground Lay
T7	B	0.18	Standard Burial
T7	C	0.18	Standard Burial
T7	D	0.67	Aerial – Existing Pole Line
T7	E	1.06	Aerial – Existing Pole Line
T7	F	0.10	Aerial – Existing Pole Line
T7	G	0.44	Aerial – Existing Pole Line
T7	H	1.39	Aerial – Existing Pole Line
T7	I	0.30	Aerial – Existing Pole Line

T7	J	0.30	Aerial – Existing Pole Line
T7	K	0.09	Aerial – Existing Pole Line
T7	L	0.48	Aerial – Existing Pole Line

Table 11: Segment T7 Hooper Bay Construction Method by segment ID

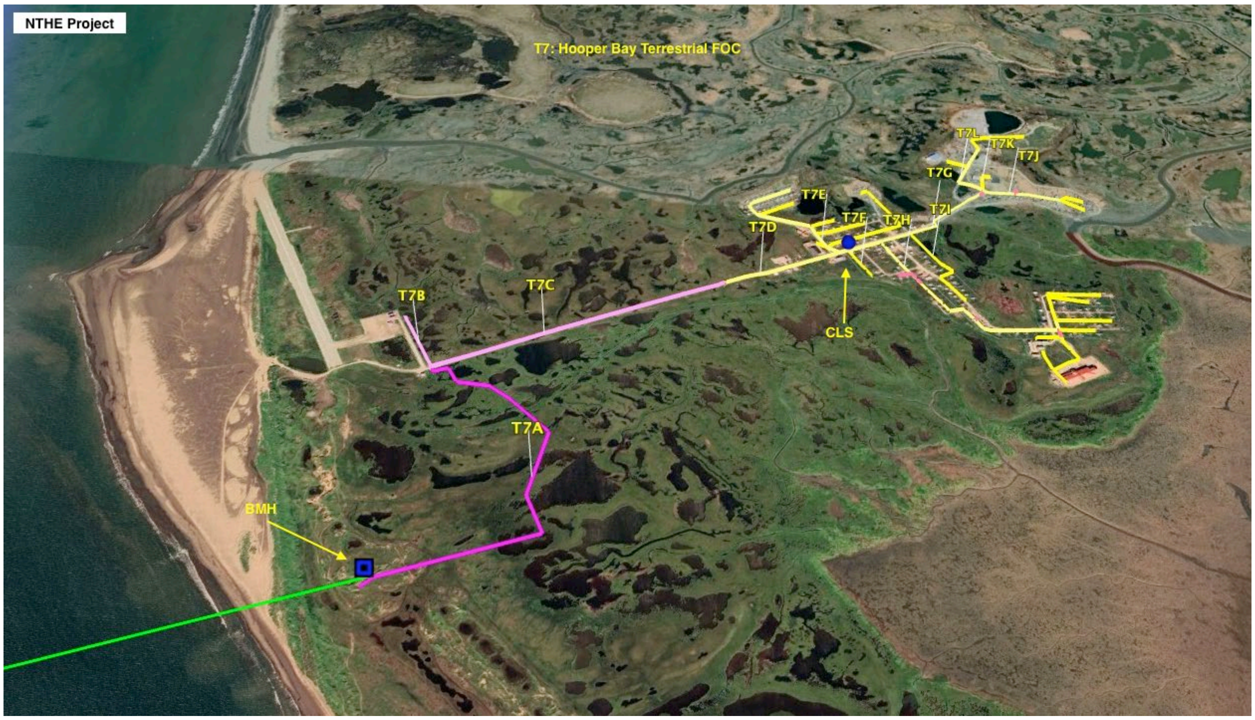

Figure 32: Terrestrial Segments Hooper Bay

Regarding the CLS In Hooper Bay, we will construct the CLS on a small gravel pad. Our fiber optic cable will be aerial throughout the community for FTTP with pedestals attached to the base of power poles.

3.4 CABLE ROUTE SURVEY

Prior to finalizing the submarine cable routes, a geophysical and geotechnical survey of the entire proposed submerged segments will be conducted. Survey work would include beach topographic, and offshore geophysical, and geotechnical surveys. The topographic survey would be to determine the precise cable landing points, BMH locations, shore tide line, and all other necessary topography features. The marine geophysical and geotechnical survey of the planned marine cable segments is required to identify suitable cable routes for these segments along the seabed. Data to be collected include geophysical (multibeam echo sounder, side scan sonar, sub bottom profiler) and geotechnical (cone penetration tests (CPTs), gravity cores and grab samples) data to identify seabed bathymetry and bathymetric features, surface and subsurface geology, and any seafloor and substrate obstructions or limitations. This data is needed to identify the best and most environmentally sensible cable routes. The data will also be evaluated to locate feasible burial conditions to better protect the cable based on site specific conditions. This survey data will assist with the review under the National Environmental Policy Act (NEPA) and supporting documents.

Bottom samples would be taken using a combination of cone penetration tests (CPTs), gravity core or similar, and/or grab sampler. Samples would be taken either every 3.1 or 6.2 miles, based on data collected during the geophysical portion of the survey. These samples would provide an understanding of the nature of the sediment type of the seafloor. Samples would be discarded over the side of the ship after analysis is completed. Findings from this offshore survey would be used to develop a suitable route for the submarine section of the NTHE network. The submarine cable segments are planned to be 100% buried at a minimum depth of approximately 3 feet. In the event there are other submarine cables in the vicinity, the marine survey contractor will collect magnetometer survey data and side scan sonar data to identify the existing cable systems, and crossing agreements with in-service cable owners will be created per industry standards for cable crossings.

Terrestrial surveys may also occur in the form of in-field investigations where cultural resources and/or any critical habitats are identified. No construction activities would be conducted during any survey efforts.

4. STAKEHOLDER AND TRIBAL ENGAGEMENT

Quintillion has commenced government, public, and industry engagement activities regarding the project and intends to continue ongoing engagement as the project progresses.

4.1 APPLICATION PERIOD OUTREACH

Quintillion conducted community outreach and engagement during the grant application preparation period. This included coordinating with local stakeholders to gain feedback. This effort consisted of postings on the Quintillion website, emails to key Stakeholders, meetings and attendance of community council meetings. The Stakeholders included various community entities, such as tribal councils, corporations and landowners. The program sought stakeholder feedback and specifically any concerns with that project that needed to be addressed. The communities support the project and are interested in the benefits that this system will bring to the area. In addition, Quintillion is also continuing the outreach, as we progress the project through environmental assessment and permitting process, seeking stakeholder acceptance of the plan. Quintillion will contact community leaders in Hooper Bay to post flyers in the community center with information about the project and signing up for service.

4.2 TRIBAL/ALASKA NATIVE CLAIMS SETTLEMENT ACT STAKEHOLDER SUPPORT

Quintillion continues ongoing coordination with tribal members to define positive impacts to tribally- and Alaska Native Claims Settlement Act (ANCSA)-owned facilities and land, and the sociocultural benefits of broadband availability.

4.3 CONTINUED STAKEHOLDER ENGAGEMENT

Quintillion intends to continue sharing key project milestones as the project (**Figure 33**) progresses. This would occur through bilateral communication with tribes and local government, as well as press releases and announcements.

Following environmental and regulatory approvals, Quintillion would announce an update to its project schedule, which is dependent upon the timing of the NEPA and environmental approval processes. Prior to terrestrial construction, Quintillion would notify communities of upcoming construction activities and would coordinate with property owners on the build-out of local community fiber networks.

5. NATIONAL ENVIRONMENTAL POLICY ACT

The projects are funded by grants awarded by NTIA and the RUS, and is therefore subject to evaluation under NEPA. NTIA will serve as the lead federal agency for NEPA compliance, with RUS and the Bureau of Land Management (BLM) participating as cooperating agencies. NTIA will coordinate the environmental review process, including the determination of whether the project qualifies for a categorical exclusion, requires an Environmental Assessment (EA), or necessitates a more comprehensive Environmental Impact Statement. At this time, preparation of an EA is anticipated.

Documentation submitted for NEPA evaluation would address the project's purpose and need, a reasonable range of alternatives, environmental impacts of the proposed action and alternatives, consultations with stakeholders, and ultimately determines whether the action has the potential to cause significant effects on the environment. This process would include consultations with National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) on protected species and habitat (i.e., Endangered Species Act [ESA], Essential Fish Habitat [EFH]), as well as consultations with the Alaska Department of Archaeology and Historic Preservation (i.e., the State Historic Preservation Office [SHPO]) on cultural resources. If the agencies determine that the action would not have significant impacts on environmental and cultural resources, NTIA will issue a FONSI. However, if the environmental review determines that the environmental impacts of a proposed Federal action would be significant, a Notice of Intent to prepare an EIS would be issued.

Although submarine cable systems are considered low-impact projects and environmentally benign, the permitting process will involve coordination with multiple federal, state, and local agencies. A summary of anticipated permits and approvals is provided in Table 11, with the final list to be confirmed in consultation with the relevant regulatory authorities.

Land status is a key consideration in permitting. The marine segments of the project will involve coordination with agencies such as the U.S. Army Corps of Engineers (USACE), U.S. Fish & Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), Bureau of Land Management (BLM) and the Alaska Department of Natural Resources (ADNR). Terrestrial cable segments will be located within existing rights-of-way (ROW) managed by the Alaska Department of Transportation and Public Facilities (DOT-PF), BLM, and ADNR. Fiber will be installed utilizing various construction methods, including ground lay, shallow burial, standard burial, and directional boring, as well as some aerial on existing utility poles to minimize disturbance and remain within the existing ROW to the greatest extent possible.

Responsible Agency	Permit or Approval	Regulated Activity
USACE	Nationwide permit (NWP) #6 Survey Activities NWP #57 Utility Line Activities	Geophysical sediment sampling. Construction of utility lines and associated facilities provided the activity does not result in the loss of greater than ½-acre of waters of the U.S. for the complete project.
	Federal Section 10 Permit *River and Harbors Act of 1899*	Construction of artificial islands, installations, and other devices on the seabed, to the seaward limit of the outer continental shelf, pursuant to Section 4(f) of the CWA, as amended (see 33 CFR 320.2(b).)

	Section 404 Permit *Clean Water Act (CWA)*	Discharge of dredged or fill materials in navigable waters of the U.S., including marine waters.
NMFS	ESA Consultation / EFH Assessment	Potential to cause harm to ESA-listed species, EFH species, and/or affect their respective habitat.
USFWS	ESA Consultation	Potential to cause harm to threatened and endangered species.
U.S. Coast Guard	Local Notice to Mariners	Notification of activity during surveying and cable laying.
DNR	Public Utility Easement	Required for placing a cable on state-owned tide and submerged lands over the long term.
	State Lands Lease	Required for the construction of permanent structures on State lands.
Alaska Dept. of Environmental Conservation	Section 401 of CWA – Water Quality Certificate (WQC)	Regulatory authority to review federal actions in or affecting the quality of waters of the State. Required before USACE can issue Section 404/Section 10 permits. If USACE issues an NWP, a separate 401 WQC is not needed.
	Section 402 of CWA – APDES General Construction Permit	Required for construction sites that disturb 1 or more acres and discharge into waters of the U.S.
DNR Office of History and Archaeology (OHA)	Section 106 of National Historic Preservation Act of 1966 (NHPA) Alaska Historic Preservation Act (AHPA)	NHPA requires federal and state agencies to consider the effects of their undertakings on historic and cultural resources and afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on such undertakings. AHPA requires a review of State public construction projects to determine if historic, prehistoric, or archaeological sites may be adversely affected.
Alaska Dept. of Fish & Game (ADFG)	Fish Habitat Permit	Work within or across a specified anadromous waterbody.

	Special Area Permit	Work that would use land or water within a Special Area in the state
DOT-PF	Utility Permit	Utility construction activities in DOT-PF right-of-way
Alaska Dept. of Public Safety, Fire, and Safety	State Fire Marshal's office review	Required for construction of any building/structure
Borough	Building Permit	Required for construction of a CLS
	Land Lease	Required for placing cable/construction on Borough-owned land over the long term

Table 12: Anticipated Permits, Consultations, and Approvals to Install the NTHE Cable System