

Appendix C – Plan of Development



NANA Regional Broadband Network Project

Plan of Development

NANA Regional Corporation, Inc. (NT23TBC0290014)

NANA Region Middle Mile Fiber Optic Project

Northwest Arctic Borough, Alaska

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1 INTRODUCTION

The NANA Region Middle-Mile Fiber Optic Project has developed this Plan of Development (POD) to detail the project's in-depth construction methodology and how it was developed.

1.1 BACKGROUND AND MILESTONES

The initial conceptual plan for the project called for subsea and riverine construction of the entire fiberoptic cable (FOC) network. In early 2024, a feasibility study was conducted to evaluate routes and construction methods, with the objective of finding a balanced approach that minimizes environmental and thus subsistence impacts, enhances critical infrastructure resiliency, and considers the costs associated with effective project implementation and operations. Based on that study, it was determined that a primarily ground-lay terrestrial route would offer the most successful and balanced methodology.

In summer and fall 2024, NANA traveled to each village and held tribal and community engagement meetings. The proposed project was introduced and discussed, question and answer sessions were held, project maps were reviewed, and community feedback on proposed cable routes and potential adjustments were gathered.

A virtual project introductory meeting was held with most jurisdictional agencies on December 10, 2024. Attendees included the Bureau of Land Management (BLM), the U.S. Fish and Wildlife Service (USFWS), the Alaska Department of Fish and Game (ADF&G), and the Alaska Department of Natural Resources (ADNR). NANA presented a summary of the proposed project and discussed land status through the project corridor, construction methods, and permit requirements.

Follow-up pre-application meetings were held throughout December 2024-February 2025 with individual agencies, specifically BLM, US Army Corps of Engineers (USACE), USFWS, ADF&G, ADNR, and Kikiktagruk Inupiat Corporation (KIC). The individual meetings allowed for more focused conversations on project details, permit requirements, and timelines. It also allowed NANA to solicit feedback to carry into the final project design.

1.2 LAND USE

The proposed FOC route traverses the Northwest Arctic Borough (NAB) and crosses lands owned by the BLM, USFWS (Selawik NWR), State of Alaska, NANA, and KIC. While the proposed route is shown on maps, the final right of way (ROW) shall be finalized during construction to optimize alignment and minimize impacts.

1.3 FISH AND WILDLIFE

This project shall require compliance with National Environmental Policy Act (NEPA); the NEPA analysis shall detail the project's potential effects on fish and wildlife. This section is a summary of some of the designed mitigation measures currently identified.

The proposed alignment crosses anadromous fish streams and essential fish habitat (EFH), but the project has been designed to minimize any incidental impacts on fish species. Construction methods preferentially design stream crossings to include no streambank impacts, but project integrity requires some bank work at certain crossings to minimize risk to FOC damage. Construction and maintenance activities that have the potential to impact fish and fish habitat shall occur during

timing windows designated by ADF&G and National Marine Fisheries Service (NMFS) to minimize or eliminate detrimental effects on the impacted species, using best available criteria. Long-term operation of the broadband network shall not result in any additional impacts to fish or fish habitat. Further details on avoidance, mitigation, and monitoring measures are outlined in Section 4.0.

NANA shall install bird deterrents and reflective markers for other wildlife (Figure 1, additional information in Section 2.3.5.3). The bird diverters increase the visibility of the cable and decrease bird strikes. This project shall install the same style diverters as used in the Arctic Slope Telephone Association Cooperative FOC project that connects Atkasuk to Utqiagvik, which are proven to be effective in Arctic environments and recommended by USFWS. The diverters spin in winds over 3 miles per hour, reflect light, glow during dawn and dusk, are visible to birds up to 1/4 mile away, and shall be placed at 30-foot intervals. The luminescent material on the diverters emits visible light for up to 12 hours after dusk and in low light or fog conditions.

Clearing and/or grubbing activities shall be necessary when vegetative cover prohibits wintertime off-road vehicle traffic. The proposed FOC alignment has been carefully selected to minimize forested and shrubby land cover to reduce the amount of clearing that would impact birds and other wildlife (Section 2.3.3).

The polar bear (*Ursus maritimus*) and two bird species, the Steller's eider (*Polysticta stelleri*) and spectacled eider (*Somateria fischeri*), are protected under the Endangered Species Act (ESA) and are known to exist within the project area. No adverse impacts are anticipated to affect these species as a result of this low-impact project.



Figure 1: Example of bird diverters to be installed on aerial crossings.

Subsistence activities (gathering, hunting, foraging) were identified as an area of concern related to project activities in agency meetings. Construction is planned for winter months where gathering/foraging is minimal and migratory species shall be absent or overwintering outside the project area; as such, limited or no interference with subsistence activities are anticipated. NANA shall adhere to the project-specific stipulations defined in all permits/authorizations and shall coordinate with all tribes and impacted communities on staging and timing of construction. Further

consultation with tribes and local community members to develop informed and specific construction protocols to limit subsistence impacts is anticipated.

1.4 CULTURAL RESOURCES

A desktop study of potential cultural resources in the project area has been developed. This study identified cultural resource sites, historic properties, and previous cultural resource investigations within the proposed construction corridor. It also identified areas where cultural resources may be located based on topography, area land uses, and other indicators. The desktop study informed an August 2025 field investigation that was performed to further inspect and identify tribal and specific cultural resources across the area.

Overall, the proposed project and construction methodologies are unlikely to disturb surface and subsurface cultural resources. The primary concerns for disturbance would be at river crossings and in the limited areas where trenching is proposed.

1.5 WETLANDS

While the FOC corridor is primarily located within wetlands, the potential environmental impact is minimized through the winter-scheduled ground-laid fiber (GLF) methodology with low ground pressure vehicles (LGPVs), which avoids ground disturbance in most areas. Disturbance is limited to activities related to the river crossings (i.e., pole installations), subsea crossings, and trenching near villages as necessary, as detailed in Sections 2–3. The project and route have been designed to avoid and minimize wetland impacts to the highest extent possible. Temporary and permanent impacts are detailed in the USACE Section 404 permit application.

2 WINTER CONSTRUCTION ACTIVITIES

The majority of the project shall be constructed during the winter months, which includes the GLF method across the terrestrial landscape, lakes/ponds, minor stream crossings, and some of the major stream crossings. This section outlines the proposed winter schedule and construction methodology.

2.1 WINTER SCHEDULE

The FOC ground lay is planned to occur during the 2026 and possible 2027 winter construction season. NANA intends to mobilize equipment, barge supplies, and stage materials in summer/fall 2025 and mobilize personnel in late December 2025 to commence the ground lay in January 2026. Exact winter construction start dates shall depend on subsistence consideration, as well as requirements being met for adequate snow cover and ground conditions to support off-road winter travel to minimize environmental impacts (see Section 2.3 for more details). Cable inspections/seating, in-village work, and major water crossings shall occur during the summer of 2026 and 2027 (Section 3.0). The post-construction cable inspection and seating shall be conducted via helicopters.

2.2 PRE-CONSTRUCTION ACTIVITIES

A ground survey of the route by snowmachine occurred in mid-March 2025. This reconnaissance effort helped to refine/optimize the proposed route with the aim to reduce waterbody crossings, minimize environmental and thus subsistence impacts, avoid challenging terrain/barriers, and ensure a robust construction plan. The reconnaissance effort was successful in helping to identify the appropriate construction methodologies for the larger river crossings (Sections 2.3.5.3 and 3.2.2). Cultural/archaeological surveys of the proposed route are complete.

2.3 CONSTRUCTION DETAILS AND METHODS

Construction is scheduled to commence in January 2026 pending receipt of necessary permits and land access agreements. The winter construction schedule shall also be dependent on subsistence considerations, as well as meeting requirements for snow cover/ground conditions sufficient for off-road winter travel.

Impacts would be reduced by conducting winter overland travel only when the required snow coverage is present. Appendix E2 provides the methods for determining the snow depth.

2.3.1 EQUIPMENT

To minimize ground disturbance, the cable shall be placed during winter months utilizing purpose-built equipment designed to perform with minimal impact to the variable tundra landscape of the NAB (Table 1). LGPVs shall be used to deploy the cable and transport personnel, camps, fuel, equipment, and cable tanks along the route. These are the same types of equipment used on the North Slope, for winter overland travel to support oil industry and fiber optic deployment. The equipment (i.e. CAT Dozer, Steiger) have been utilized for decades in a similar low PSI method on the North Slope.

Table 1: Construction equipment proposed to be used for the project.

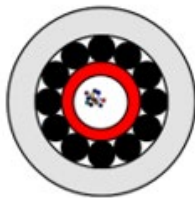
Equipment	Model	Weight (lbs)	PSI
PistenBully (tracked)	PB600	18,000	2
CAT Dozer (tracked)	D6	50,400	4.2
Steiger Case Tractor (tracked)	535	55,000	5.5
Mulcher (tracked)		25,000	3.3
Mini-Excavators (tracked)		~18,000	4.2
Scissorneck Trailer		35,000	2.9
Flatdeck Trailer		26,000	2.1
Medium Sleigh Trailer		20,000	

2.3.2 FIBER OPTIC CABLE SPECIFICATIONS

The FOC is armored and designed for extreme climate conditions and is durable to wildlife disturbances. A cross-section of the cable is provided in Figure 2, with an example of actual cable size. The cable consists of three main layers:

- Cable core: 24 strands of optical fiber surrounded by a rigid seam-welded copper tube filled with water blocking and hydrogen absorbing compound
- Armoring layer: twelve 1.7mm high tensile strength steel wires
- Outer protection: black high-density polyethylene (HDPE) sheath designed to seal the cable from water ingress
- Cable size and durability-related specifications:
- Thickness: 0.472 in. diameter (smaller than a penny)
- Depth capability: >16,000 ft.
- Cable breaking load: 11,240 lbs of force
- Minimum bending radius: 2.5 ft.

Cable Design



DESIGN & CONSTRUCTION

- Bundled Optical Fibers
- Thixotropic Filling Compound
- Copper Buffer Tube, 5 mm Diameter
- 12 Steel Wires, 1.7 mm Diameter
- HDPE Sheath, 1.7 mm nominal Thickness

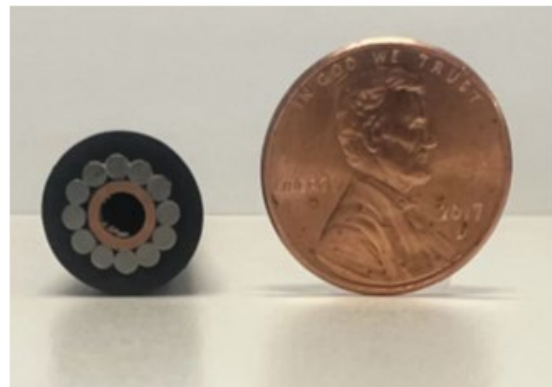


Figure 2: Fiber optic cable specifications.

2.3.3 CONSTRUCTION SEQUENCE

Two to three temporary deployment trains consisting of 12–14 personnel each shall operate simultaneously for the construction activities:

- One crew shall start in Kivalina and work towards Noatak and Noatak River, and then to Noorvik and Kiana.
- Another crew shall start in Kiana and build toward Ambler, Kobuk, Shungnak, and Selawik.
- A third crew shall start in Kotzebue and ground-lay south along the Baldwin Peninsula to Buckland, Deering, and Selawik.

The Hotham Inlet crossing, Kugruk Estuary crossing, all in-village construction activity, and several complex river crossings shall occur in summer 2026/2027, following the main winter build (summer construction detailed in Section 3.0).

Winter installation shall begin with a field survey of the planned FOC route to determine the precise path that the right-of-way (ROW) shall occupy. This shall be followed by minimal vegetation clearing (as needed to facilitate access by cable placement equipment [Figure 3]), snow movement to create a stable prepacked trail and ensure required minimum snow cover, pole placement in preparation for aerial cable crossings of larger rivers, and finally placement of the ground-laid FOC. Each deployment train shall include:

- Tracked cable deployment equipment and a powered spooling system to ensure adequate slack during placement
- Mobile sleigh camp for crew housing
- Clearing equipment (for vegetation removal)
- Support snowmachines for crew transport
- Digging equipment for stream crossings and aerial pole installation

Cable placement shall occur rapidly with the mobile camp traveling daily with the construction team. The cable deployment vehicles shall generally be moving in one direction and shall only pass a location one time. Snowmachines may travel between the camp and cable deployment equipment, but the travel is anticipated to be minimal.

The mobile camp shall be equipped with water-holding tanks that shall be refilled at each village. Grey water shall be maintained in a small tank and emptied into village sewer systems, as necessary. Compositing toilets are anticipated to be used during construction activities. Solid waste shall be accumulated and disposed of in village landfills. More details on hazardous waste usage and disposal are available in the Hazardous Waste Management Plan.

Where vegetation clearing is necessary, a mulcher shall cut vegetation to the level of the snow surface and replace the cut vegetation where it was originally removed, to minimize non-native species proliferation and ground lay impacts. Clearing of vegetation shall be limited to the 30 ft. construction corridor, though the clearing swath shall be only as wide as necessary to support equipment passage (often only 15 ft. [Figure 3]). Vegetation requiring clearing shall primarily consist of woody shrubs with the potential to be taller than the required minimum snow cover, including willows (*Salix* sp.), dwarf birch (*Betula nana*), and green alder (*Alnus viridis*) (Wells et al. 2022). The preferential placement of the FOC is directly on the ground surface, so construction activities shall

attempt to avoid areas with a high density of shrubs. Larger diameter (> 9-12 in.) woody materials shall be stockpiled and transported back to the nearest community for sustainable use as firewood.

2.3.4 TERRESTRIAL GROUND-LAY FIBER PLACEMENT

Overland route segments cross extensive wetlands and shall be installed during winter months with adequate snow cover and frozen substrate to minimize ground disturbances.

The FOC shall be spooled out of 20 ft. (length) sleigh-mounted cable tanks (Conex containers) that have approximately 24 miles of cable in each container. Cable shall be laid directly on a prepacked trail via a powered spooler and crew members shall manually guide the cable to the center of the alignment in a 12 ft. wide serpentine pattern to provide enough slack (3–5%) to accommodate the contour of the terrain, allowing it to settle on the vegetation and conform to changing surface features and environmental conditions (Figure 3).

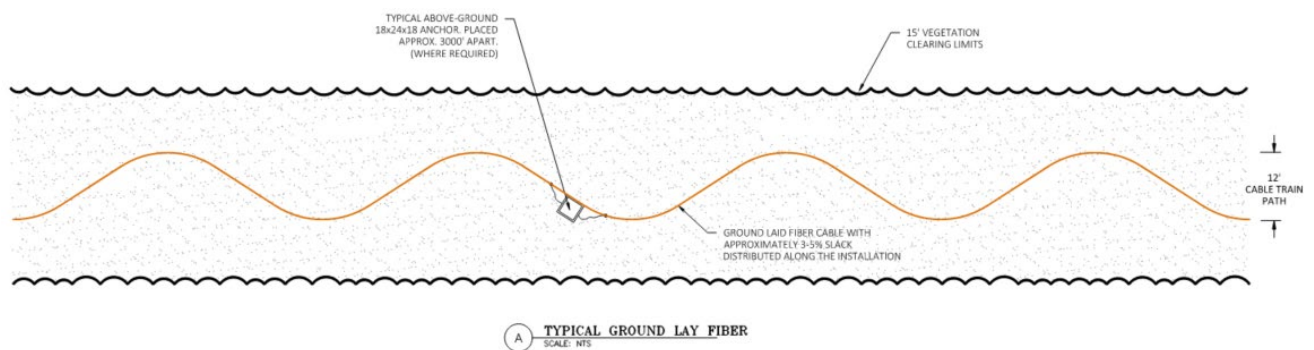


Figure 3: Typical example of ground-lay fiber placement.

Splices at intervals of roughly 24 miles, or closer as necessitated by site conditions, shall be enclosed within weatherproof splice enclosures designed to secure and protect the joint where FOCs are interconnected. Low-profile anchoring devices and cable grips shall be deployed at splice points, elevation transitions, and at regular intervals of no greater than 6,000 ft. to mitigate lateral movement and preserve splice integrity (Figure 4). Additional cable weight, armor, and anchoring measures shall be implemented as required during the cable deployment process to ensure stability and durability.

Along segments of the route where two cables are laid in the same corridor for redundancy (i.e., out and back from a village or the single corridor through Selawik NWR), the dual FOCs shall be placed side by side during the ground-lay operation.

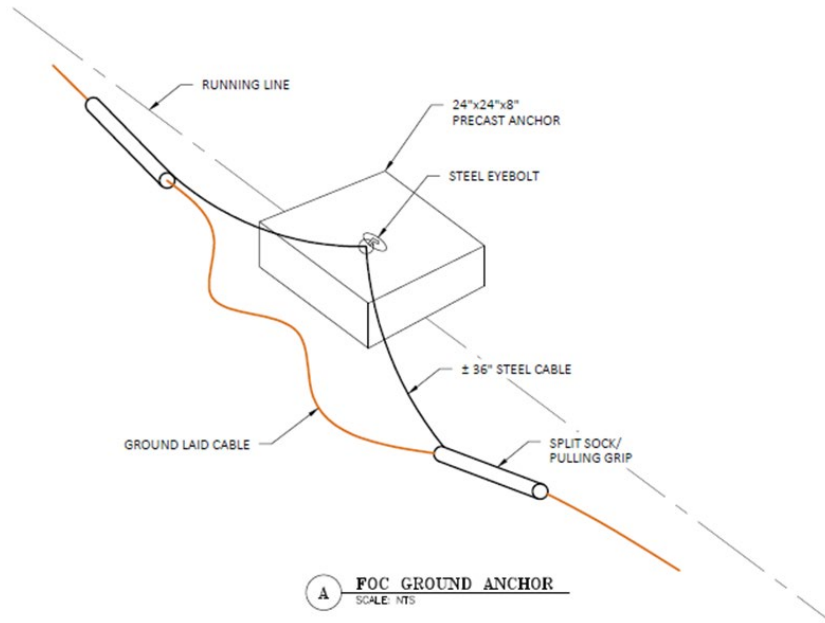


Figure 4: Schematic of the GLF anchor system.

Track mounted GPS systems shall verify placement within approved corridors and monitor linear footage to ensure 3-5% slack is provided (this shall be placed in a serpentine pattern as shown in Figure 3). Winter deployment is expected to last 100-110 days.

2.3.5 WATERBODY CROSSINGS

Waterbody crossings are minimized by routing overland when possible (Section 1.2.3).

2.3.5.1 LAKES AND PONDS

When it is not possible to avoid a lake or pond, the cable shall be laid with adequate slack on the ice surface to facilitate the cable passively dropping to the bottom after the ice thaws. Anchors on either side of the waterbody shall secure the cable at the top of the banks (Figure 4). The low-profile anchors shall be connected to the cable and placed on top of the snow surface. They shall descend to the ground surface with the melting snow and shall remain in place on the bank. The cable shall sink into the waterbody under its own weight after ice thaws and is expected to self-bury within aquatic bed sediments over a short period of time.

2.3.5.2 MINOR STREAMS

For small streams/ivers, the FOC shall be laid in a manner similar to the deployment of lakes and ponds during winter construction. The cable shall be deployed across the ice surface with enough slack for the cable to passively drop to the bottom of the stream once the ice thaws. Heavy, low-profile anchors securing the cables shall be placed on either stream bank. Care shall be taken to position the crossings where the streambanks are most stable (e.g., straight, laminar sections of rivers, well-graded bank material, gentle bank slope angle, etc.) to provide erosion protection and stability for the cable. Once the snow and ice melt, the anchors and cable shall descend to the stream bed or ground surface (Figure 5).

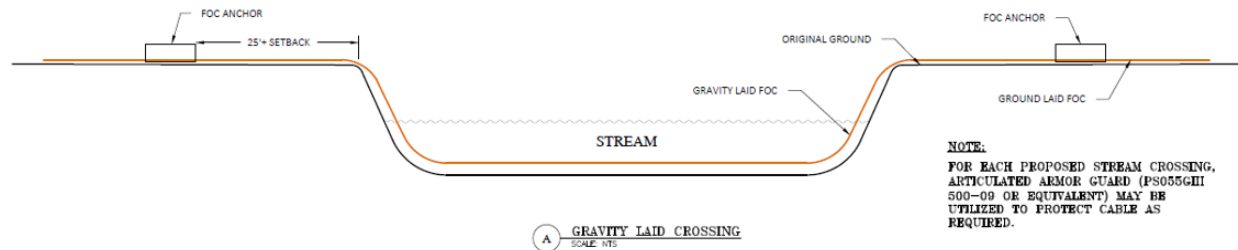


Figure 5. Typical gravity lay fiber cross-section for small stream crossings, as depicted after the snow melts.

When crossing incised streams with steep banks, the cable shall need to be secured in the bank to avoid risks associated with the cable not being flush with the stream bed and bank (Figure 6). These crossings shall involve clearing snow, shallowly excavating into the bank using a mini excavator, placing the fiber in the trench, and backfilling the trench with side cast bank material. During excavation, the organic layer shall be temporarily removed, but excavations shall not reach the permafrost layer. The cable shall transition to gravity laid in the stream bed. The number of such crossings shall be minimized by selecting crossing locations with more favorable geometry during construction that would allow for crossing without temporary bank disturbance, as illustrated in Figure 6. It is estimated that 10 of the ground lay stream crossings shall require bank excavation and the construction crews shall prioritize locating a crossing section that does not involve bank disturbance.

During the cable inspections, which shall occur during the summer following installation, locations where the bank cut method was performed shall be closely monitored for vegetation regrowth and bank stability. If the backfilled material does not appear to be stable and regenerative, then streambank restoration techniques shall be implemented using best practices. ADF&G shall be informed of these locations and shall be consulted prior to restoration efforts.



Figure 6: Typical gravity lay fiber cross-section for small stream crossings with steep banks.

The contractor shall install anchoring devices at each stream bank to minimize stress, avoid potential damage, and limit cable movement in flowing water (Figures 4-6). At crossings with substantial depth and turbulence, the FOC shall be encased in split armor piping or similar between anchor points to increase stabilization and protect the cable and prevent ice buildup. The armored piping shall be continuous from an anchor on one side of stream bank to the anchor point on the opposite bank. It is expected that natural sediment transport shall passively bury the cable over time.

For segments with dual-placed fiber (for system redundancy), the cables may be laid together. This shall minimize physical impacts on the environment.

2.3.5.3 MAJOR RIVERS

At major river crossings, the FOC shall be directionally bored (as described in Section 3.2.2 below), or shall be run aurally over the water to allow safe passage for boats, aircraft, and wildlife.

The aerial cable shall be connected to 35-45 ft. treated wooden poles with the following conceptual design considerations:

- Installing the pole and guy wire anchors, with the method to be determined by ground conditions, into frozen tundra and placing wooden poles vertically
- Filling voids around pole with native fill material
- Splicing and mounting the cable
- Attaching the FOC to a galvanized steel cable and stringing over river crossings
- Increasing visibility of the cable and infrastructure at each aerial crossing:
- Bird diverters to avoid bird strikes (Figure 1)
- Reflective markers on guy wires and poles to protect travelers (e.g., boats, float planes, snowmachines) and wildlife

At aerial crossings, the anchoring design and configuration shall ensure cable sag does not fall below the minimum engineered 20-ft. ice-loaded clearance above bank elevation. All aerial crossings have been designed with a single anchor attached to each pole (Figure 7). Where aerial applications involve dual FOCs sharing the same corridor, the cables shall be installed on the same poles to minimize environmental and visual impacts. Similar aerial installations were used for the Arctic Slope Telephone Association Cooperative (ASTAC) fiber optic project, which can be seen from the photos in Figure 8 approximately 1 year after installation.

The aerial crossings are designed to minimize impacts to the streams and rivers they are crossing. Minimum 25-foot setbacks for pole installation shall ensure that this method does not result in streambank erosion. Periodic inspections throughout the project's duration shall monitor for any structural changes over time and, if any maintenance is needed, it shall occur early on to prevent impacts on the stream or stream banks.

Most waterbody crossings shall be installed during the main winter construction window. However, the most complex river crossings shall be constructed in summer 2026 utilizing horizontal directional drilling (HDD, Section 3.2.2).

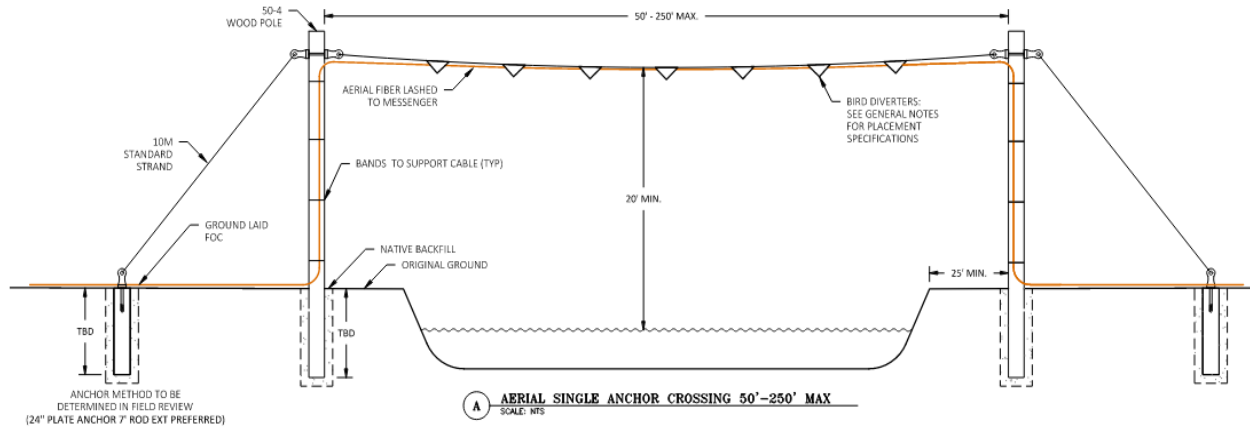


Figure 7: Schematic of an aerial crossing design.



Figure 8. Photos of the ASTAC aerial crossings one year after installation (July 2023).

2.4 CONSTRUCTION SUPPORT DETAILS

Fuel shall be stored in 5,000-gallon fuel sleighs alongside the mobile camps and shall be disbursed to field crews in quantities up to 2,500 gallons. Mobile camps shall move with the crews. Fuel shall be supplied from nearby villages.

The development of several plans/policies shall guide construction activities. These measures may include, but are not limited to, the following:

- Waste Handling Plan
- Wildlife Interaction Plan
- Cultural Resources Orientation and Management Plan
- Weed Control/Invasive Species Management Plan
- Stormwater Pollution Prevention Plan (SWPPP)

- BLM Required Operating Procedures ROPs from the Kobuk Seward Peninsula Resource Management Plan

3 SUMMER CONSTRUCTION ACTIVITIES

Several complex components of the project’s construction shall occur during the summer months when snow and ice-free conditions are needed, including the Hotham Inlet subsea crossing, several major river crossings, trenching outside of villages, and securing the FOC to existing utility poles. This section outlines the proposed summer schedule and construction methodology.

3.1 SUMMER SCHEDULE

The summer construction schedule shall commence once sea and river ice melts, allowing barges hauling equipment to travel upriver (approximately May 2026). Construction within the villages shall occur throughout the summer of 2026 and 2027. Subsea construction is scheduled for June-July 2026. Major river crossings with HDD installations shall occur June-August 2026. Winter GLF inspections and cable seating shall take place from July-August 2026/2027. Finally, demobilization and final inspections shall be completed by September 2026 or 2027. This schedule is subject to change, and all legally required stakeholders shall be consulted and apprised of project activities.

3.2 SUMMER CONSTRUCTION DETAILS AND METHODS

Snow and ice-free conditions are needed for some of the more complex construction components of the project. The subsea crossing at Kotzebue Sound, major river crossings, and work occurring in and near villages (including trenching and tying into existing utility poles) shall occur during the summer; their construction methodologies are detailed in this section.

3.2.1 SUBSEA CROSSING (KOTZEBUE SOUND/HOTHAM INLET)

For the subsea crossings, FOC shall be anchored to 48 in. x 78 in. concrete beach manholes (BMH) on either side of the channel, which shall be constructed in stable locations that minimize environmental impacts. The cable shall then be trenched between the BMH and the lowest tide point. Construction shall then be transitioned to operations utilizing an excavator on floats, two tugboats (25 ft. and 92 ft. long) and two accompanying barges (150 ft. x 50 ft. and 205 ft. x 60 ft.). As barge shall place cable in tandem with the excavator on floats to be trenched. Once the water is too deep to allow trenching, the cable shall be gravity laid or fixed-plowed across the sea floor to the opposite side of the inlet, where laying activities shall commence (Figure 9). Best practices shall be implemented throughout the operation to protect the aquatic environment, minimize bank erosion, and avoid creating drainage paths. Construction of the subsea crossing is expected to take 4-12 days.

NOTE:

BMH ON EITHER END, TRENCHED/PLOWED
CABLE FROM BMH TO LOW TIDE POINT, CABLE
PLACED ON OCEAN BOTTOM FOR CROSSING.

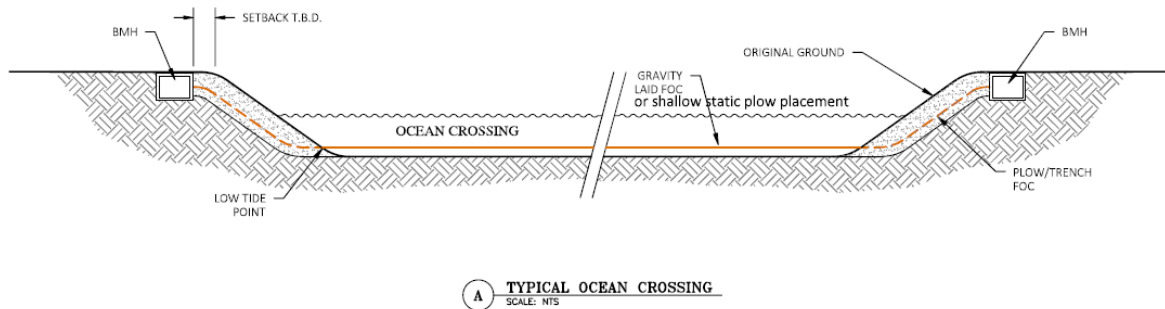


Figure 9: Schematic of the subsea cable crossing.

3.2.2 MAJOR RIVER CROSSINGS

Directional boring equipment as necessary for the major river crossings not on federal lands shall be transported upriver by the tugboats and barges utilized in the subsea crossing. Some of the equipment to be transported includes mini-excavators, utility poles, and the FOC. One of the barges may serve as the field camp facility.

NANA anticipates utilizing Horizontal Directional Drilling (HDD) at major rivers, with an eye toward minimal environmental impacts. The FOC shall be installed approximately 4 ft. beneath the riverbed. This method is ideal for eliminating FOC crossing risks at these major rivers for the short and long-term duration of the project.

This trenchless construction method involves drilling a pilot hole along a pre-determined, curved path starting from an entry point on one riverbank to an exit point on the opposite bank (Figure 10). Drilling fluid, typically a bentonite-water mixture, shall be used to stabilize the borehole, lubricate the drill bit, and transport cuttings to the surface. Following the completion of the borehole, the 2 in. conduit and FOC shall be pulled through the hole and secured. On both sides of the river, 15-20 ft. of conduit shall extend from the borehole openings to serve as a transition to ground-level installation, providing protection for the cable and mitigating potential damage from freeze-thaw cycles. The ends of these pipes shall be sealed and watertight.

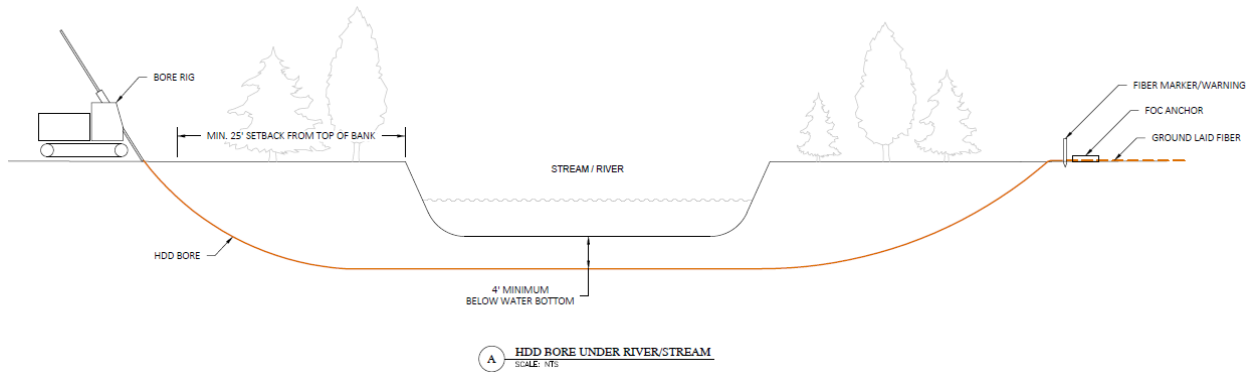


Figure 10. Schematic of an underground river crossing using Horizontal Directional Drilling (HDD).

Drilling operations shall comply with site-specific erosion and sediment control plans and include 24/7 monitoring to ensure the integrity of the drill path and avoid inadvertent returns of drilling fluid to the river. All activities shall operate in consultation with tribal and impacted community stakeholders and adhere to federal, state, and local permitting requirements, with restoration of the affected areas to pre-construction conditions upon project completion.

3.2.3 KUGRUK ESTUARY SUMMER GRAVITY LAY

The Kugruk Estuary east of Deering shall be crossed using gravity-lay methods in the summer months. The winter construction crews shall ground-lay the FOC up to the overbanks of the estuary. Crews shall return by barge in the summer to gravity lay across the estuary and splice the cables. No BMHs or trenching are expected.

3.2.4 AERIAL UTILITY POLE INSTALLATION

The project shall utilize existing utility poles outside of Kivalina and Kotzebue. Pole access agreements are being initiated with the appropriate utilities.

3.2.5 TRENCHING

Where ground-lay sections have the potential to interact with community crossings, the cable shall need to be buried to reduce risk to public safety and to prevent cable damage. The project shall utilize the existing utility poles when exiting villages, then transition to shallow trenched sections. The trenches shall extend for varying lengths outside of each village:

- Ambler: 500 ft.
- Buckland: 150 ft.
- Deering: 60 ft.
- Kotzebue: 200 ft.
- Noatak: 250 ft.
- Noorvik: 1500 ft.
- Shungnak: 500 ft.
- Selawik: 600 ft.
- Kiana, Kivalina, and Kobuk shall not require trenching

Trenches shall be excavated approximately 1 ft. x 2 ft., but may vary with the terrain, and the cable shall be laid directly into the trench. Once permafrost is encountered, excavation won't proceed deeper. Side cast material shall be temporarily placed (i.e., less than 1 week) adjacent to the trench and then backfilled and recontoured to the original pre-existing conditions. This construction segment shall require a temporary, 3-person line crew and a 2-person splicing crew immediately behind them.

3.3 INSPECTIONS OF WINTER GROUND-LAY SEGMENTS

Following winter construction activities, a crew shall return in the summer to ensure the cable is properly seated on the tundra, within waterbody crossings, and to ensure all construction materials and debris have been cleared from the area with minimal environmental and species disruption. These inspections are proposed to occur early in the season prior to significant leaf-out or early in the fall after the leaves had shed to ensure good visibility of the cable. Timing shall be coordinated with relevant agencies to avoid bird nesting activities and seasons and to minimize disturbance to caribou.

Inspections shall be performed by aerial flyovers, while paying particular attention to waterbody crossings and shrubby-vegetated areas to ensure that the anchors and cable are seated securely to the ground and substrate. Where significant anomalies are observed, inspectors shall land the helicopter and perform necessary cable realignment by moving the cable to the ground surface by hand. Helicopter altitudes shall vary according to the visibility of the cable and the sensitivity of environmental resources in the area but shall generally fly about 100-200 ft. above the ground surface.

3.4 OPERATIONS AND MAINTENANCE

The FOC network shall have minimal operations and maintenance requirements following construction. NANA shall conduct aerial annual inspections (1-3 days) at times that accord with subsistence patterns for migratory species to assess cable conditions, focusing on river crossings and areas with high traffic that are prone to physical disturbances. Network outages, however, are not expected to occur as fiber optic networks are robust systems and generally offer greater than 99.9% uptime.

In the event of a cable break or service interruption, emergency repairs shall be carried out by NANA technical staff, village technicians, or qualified contractors with experience in species avoidance and Arctic environments generally. If a break occurs, the system shall automatically switch feed to the redundant route, and the technicians at the Network Operating Center shall use an Optical Time Domain Reflectometer to pinpoint the fault's location.

The type of repair operation would depend on the location and nature of the failure and the time of year when the failure occurs. Depending on the location and season, a technician shall travel by air to the site, or as appropriate, snowmachine or other LGPV in winter. Repairs shall involve splicing the damaged section or replacing it with a new cable segment. Repairs materials, such as spare cable and splicing supplies, shall be pre-staged on NANA property in each village to ensure rapid response.

Failures of the line along the terrestrial portion of the line would be repaired in place. If the failure occurs along the ground-lay portion, the line would be pulled up, likely by hand, from shallow

cover. If some mechanical assistance is needed, it is anticipated that the snowmachine/boat would provide the leverage to help raise the cable. The cable would be respliced or a replacement section inserted to repair the failure, and then the cable would be laid back on the ground. It is very unlikely that the failure would occur along a trenched portion. These sections are trenched during the initial construction, because it makes breaks in the line so unlikely. But if it did break, a new line would be spliced into the existing above ground line and laid on the ground. It is unlikely that the line would be excavated and reburied.

Failures along the stream crossings would be influenced by seasonality. If the failure occurs on the aerial crossings, repairs could be conducted in any season. The cables would be respliced and reattached to the poles. If new poles need to be installed, these could be completed in any season and attached to the existing anchors. It is very unlikely that new anchors would need to be constructed, but if new anchors need to be installed, this would need to occur with a mini-excavator during the summer. If the failure occurs along the ground-lay portion at a stream crossing, the cable would need to be pulled up, respliced, and re-laid (likely by hand). This would occur during the summer. A temporary ground-lay portion could be installed in the winter to provide service. It is very unlikely that the failure would occur along an HDD portion. Cable repair for any HDD shall entail removal of the broken cable from the conduit and replacement; it is unlikely that the conduit would be damaged.

No regular brush clearing is planned along the ROW, except in cases where substantial vegetation growth occurs around aerial crossings. In such instances, clearing shall be conducted using aerial access or snowmachines during winter. All maintenance activities shall adhere to the same environmental protection and subsistence maintenance measures implemented during the initial construction phase.

3.5 CLOSURE AND RECLAMATION

The FOC network is anticipated to have a service life or lifespan of 50 years, with minimal signal degradation over that time. If the network is still viable and relevant after 50 years, then a ROW renewal process shall be considered. The FOC shall descend into the crossed waterbodies and surrounding vegetation once the snow melts. The cable shall be quickly buried by aquatic sediments and overgrown by the vegetation of the area. This may render removal of the cable exceedingly challenging and possibly damaging to waterbodies and the landscape. ASTAC installed a similar GLF on the tundra between Atqasuk and Utqiagvik in late winter 2022 (ASTAC 2024). After nearly three full years, this cable is now barely visible in many locations, as it becomes incorporated into the underlying vegetation, streambanks, streambeds and lake beds over time.

Access for the cable removal would have to occur during the winter, which would require digging through snow/ice (and into frozen ground) using heavy equipment. This would have the potential to cause damage to the sensitive tundra habitat. For these reasons, NANA proposes the following closure and reclamation measures:

Cable Removal: The FOC shall not be removed.

Aerial Crossings: The wooden poles installed for aerial crossings shall be cut at ground level and removed. Guy wires, bird diverters and other associated infrastructure shall likewise be removed.

Waste Disposal: All removed materials shall be disposed of in the nearest community landfill in accordance with best practices and waste mitigation efforts.

Final Inspection: A comprehensive inspection shall document the condition of the site after reclamation activities are complete.

If upon final inspection and closure activities, if there is any unaddressed project infrastructure reclamation step, this shall be undertaken to address and resolve all remaining environmental impacts to the greatest extent possible.

3.6 “LAST MILE” COMMUNITY CONNECTIONS

While not part of this “middle mile” project, the full project includes the installation of the appropriate FOC into each community, providing service for individual households, businesses, schools, and other entities. These connections shall utilize FOC planned for each community, with cable hung on existing utility poles and appropriate service drops for each served customer. NANA is self-funding this investment for the “last-mile” infrastructure in these communities.

4 AVOIDANCE, MITIGATION, AND MONITORING MEASURES

The project has been carefully designed with avoidance and mitigation strategies to minimize adverse impacts to the environment and the subsistence way of life in the NANA Region, while providing a sustainable, long-term broadband network.

Avoidance

- The chosen route was comprehensively designed to minimize the number of stream crossings to the greatest extent possible.
- With the majority of construction occurring during the winter, the construction impacts on fish and their habitats are greatly reduced. Over 97% of the streams and rivers and 100% of the lakes and ponds along the route shall be crossed with LGPVs in the winter months when adequate snow and ice cover allows for adequate protection of the underlying vegetation.
- Construction methods at large, complex river crossings, such as aerial crossings and HDD, eliminate direct impacts to waterbodies.

Mitigation

- Selecting the HDD method for large river crossings allows for the installation of cables beneath streams and rivers without disturbing the waterbody itself. This technique minimizes sediment disturbance and preserves aquatic habitat.
- Utilizing aerial installation to deploy the cable above large rivers has been chosen to avoid trenching.
- In consultation with community and tribal members, construction shall be scheduled during periods with the lowest possible impact for migratory species, such as caribou and birds, as well as marine life.

Monitoring

- Spring and summer inspections shall verify proper cable placement, assess any potential erosion issues, and confirm that crossings are functioning as designed.
- Annual inspections shall occur throughout the life of the project. If any waterbody issues are identified, ADF&G shall be informed, and corrective measures shall be implemented.

5 CONCLUSION

The project represents a carefully planned, environmentally and culturally sensitive approach to delivering essential broadband infrastructure to the underserved and unserved, predominately indigenous communities of northwest Alaska. The project has been designed to balance technical requirements, environmental protection, and community needs while providing lasting, once-in-a-generation benefits to the region.

6 REFERENCES

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