National Park Service
U.S. Department of the Interior
Yellowstone National Park

Fiber Optic Cable Installation, Yellowstone National Park
Environmental Assessment
March 2021

Estimated Lead Agency Total Costs Associated with Developing and Producing this EA: $39,000. Estimated Contractor Total Cost of Preparing EA: $161,452.

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FIGURES

TABLES

ACRONYMS AND ABBREVIATIONS

ACHP	Advisory Council on Historic Preservation
APE	Area of Potential Effect
Applicant	Diamond Communications, Inc.
BMP	best management practice
EA	Environmental Assessment
ESA	Endangered Species Act of 1973
GHG	greenhouse gas emissions
GYA	Greater Yellowstone Area
HDPE	high-density polyethylene
Mbps	megabits per second
MRA	minimum requirement analysis
NHPA	National Historic Preservation Act
NPS	National Park Service
NRHP	National Register of Historic Places
Park	Yellowstone National Park
Project	Fiber Optic Broadband Extension Project
ROW	right-of-way
SHPO	State Historic Preservation Office
USFWS	U.S. Fish and Wildlife Service
VoIP	Voice over Internet Protocol

1. PURPOSE AND NEED

1.1 Proposal

The National Park Service (NPS) is initiating this Environmental Assessment (EA) to evaluate a proposal by Diamond Communications, LLC. (the Applicant) to install a fiber optic network along existing roads in Yellowstone National Park (park).

To implement this proposal, the NPS would need to issue a right-of-way[1] (ROW) permit. The NPS has general authority to issue ROW permits only when allowing such uses is "not incompatible with the public interest," and in doing so, the NPS must consider the purpose and resources of the park, as expressed in statutes, regulations, and policies.

1.2 Purpose and Need

In 2019, the Applicant submitted a ROW permit request to the NPS that would allow for the installation of a fiber optic cable (proposal) along existing roads in the park. The NPS needs to consider the request as required by Executive Order 13821, Streamlining and Expediting Requests to Locate Broadband Facilities in Rural America, as well as the Telecommunications Act of 1996 (P.L. 104-104, 110 Stat. 56). Action is needed at this time because the existing telecommunications infrastructure has reached capacity and is well beyond its operational lifespan, and is incapable of providing the data capacity needed for NPS and concessioners to perform mission critical functions and facilitate proper communication. Upgrades to park telecommunications infrastructure are also needed in order to provide adequate data capacity and bandwidth to employees who live in the park, and to meet the expectations of visitors who rely on mobile devices and networks while in the park. Additionally, this action is needed in order to facilitate real-time communications and educational information from the park to visitors, and to remove obsolete telecommunications facilities from highly visible and backcountry areas.

The purpose of the proposal is to provide reliable voice, data, and internet connections within the park's developed areas; increase the dependability of the park's landline, cellular phone, data circuits, and public safety radio system; create system redundancy to reduce the occurrence of parkwide/systemwide network failures; and, in turn enhance visitor safety and visitor experience, critical park operations, emergency response, transaction speeds at retail venues throughout the park, and employee quality of life.

1.3 Background

Yellowstone National Park is located in the northwest corner of Wyoming and extends to the north and west into Montana and Idaho, at the heart of the Greater Yellowstone Ecosystem. The park encompasses 2.25 million acres, 90% of which is managed as wilderness, and surrounded by six national forests and over 2 million acres of federally designated wilderness. Despite the relative isolation of the park, over 4 million visitors come to Yellowstone each year. Nine frontcountry developed areas provide amenities to park visitors including lodging, dining, retail, gas stations, visitor centers, and emergency services. The NPS and concessionaires employ approximately 4,000 employees each year in order to accommodate visitors, protect resources, and manage day to day operations. Due to the immense size and relative

[1] A ROW is issued by the NPS to a third party to pass over, under, or through an NPS-owned or controlled area; the permit does not convey or imply any interest or ownership of land and is revocable. A ROW permit does not regulate the services, only the facilities located on federal lands.

isolation of the park, employees rely heavily on telecommunications equipment and technology to effectively communicate.

Park management, concessioners, partners, and emergency response increasingly rely on technologies that require access to the internet and intranet systems to perform basic operations and visitor service functions. However, the existing telecommunications infrastructure within the park offers very limited capacity, has little redundancy, and is unreliable. The existing infrastructure routinely reaches capacity and is overwhelmed with data requests throughout the season, and once the existing network is overwhelmed, operations that depend on the data network become impossible to perform. Operational impacts not only include routine management functions such as employee email communications, voice over internet protocol (VoIP) phone calls, and point of sale business transactions, but can also disrupt emergency response and communication due to lack of redundancy across the system. Additional impacts occur to certain operations that exclusively rely on internet connectivity to function including human resource and administrative programs, training and education, and intra-service cooperation platforms.

The existing telecommunications system inhibits the park's ability to adequately communicate and engage with visitors in real-time during their visit. Upon arrival, visitors receive a park newsletter printed quarterly that generally describes what visitors should expect, such as large-scale construction projects, but there is currently no capability to update visitors regarding road closures, traffic delays, weather and resource information, provide emergency notifications, or to provide visitors with interactive educational tools such as mobile applications. The inability for the park to communicate with visitors in real-time results in visitors not being informed on current information that may affect their experience, and also prohibits the park from using modern technology to inform and educate visitors in order to protect and enhance park resources.

The park's lack of suitable telecommunications capacity in developed areas also affects the ability to hire and retain employees. With the current infrastructure, there is a lack of reliable internet and cellular service within facilities and housing areas for use by permanent and seasonal employees and their families living in the park. Limited connectivity to the internet makes it difficult to impossible for those employees to access essential services such as online banking, continuing education, and remote healthcare visits, as well as other services the modern workforce expects to have access to such as social media, personal email, video chat, text messaging, and online shopping. As a result, many previous employees have described the feeling of digital isolation as one of the primary reasons for choosing not to return to Yellowstone.

1.4 Project Location

The project area is 187-miles in length, following the park's Grand Loop Road with spurs or lateral lines branching off into multiple developed and administrative areas (Figure 1). The following segments are included: Madison Junction to Norris Junction, Norris Junction to Mammoth Hot Springs, Mammoth Hot Springs to Tower Junction, Tower Junction to Canyon Junction, Canyon Junction to Fishing Bridge Junction, Fishing Bridge Junction to West Thumb, Madison Junction to Old Faithful Interchange, Old Faithful Interchange to West Thumb, Old Gardiner Road, and West Thumb to South Entrance. The Elk Plaza Service Road and Chittenden Road to Mount Washburn are also included. Lateral lines are proposed into the following developed areas: Mammoth, Tower Junction, Mount Washburn, Canyon Village, Lake Village, Grant Village, South Entrance, Norris, Madison, and Old Faithful.

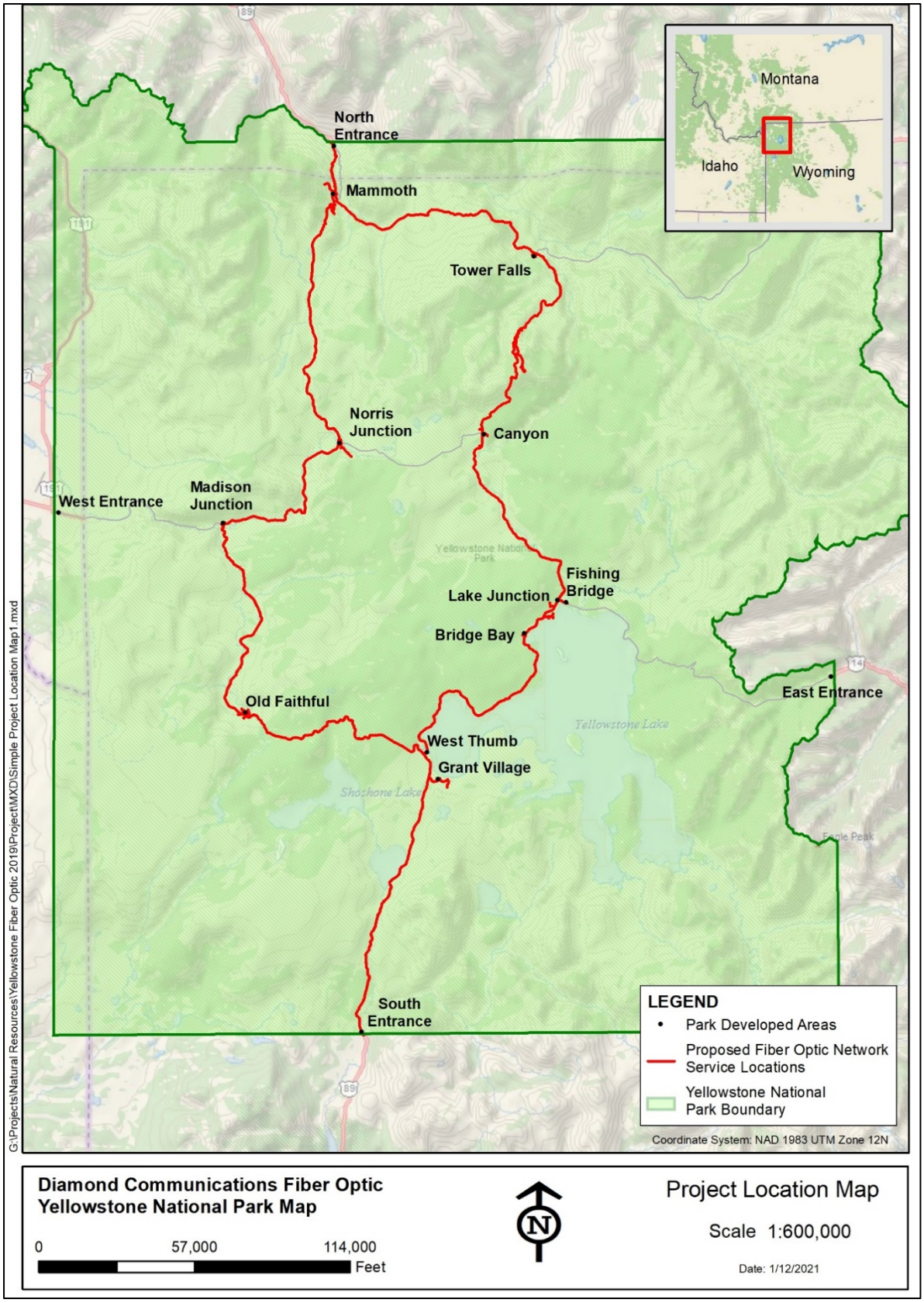


Figure 1. Fiber Optic Line Project Location.

2. ALTERNATIVES

The no action and proposed action alternatives are carried forward for evaluation in this EA. These alternatives are based on preliminary designs and the best information available. Specific distances, areas, and layouts are estimates. If changes during final site design are inconsistent with the analysis documented in this EA and would increase impacts, additional compliance would be completed. A discussion of other alternatives that were considered but dismissed is included in Appendix A.

2.1 Alternative 1: No Action

Under this alternative, the permit application would not be approved and there would be no improvements or changes to the existing fiber optic system.

The existing fiber optic cable from Gardiner, Montana to Mammoth Hot Springs, Wyoming would continue providing connectivity to park headquarters and areas surrounding the Mammoth Hotel. The fiber optic cable is converted to microwave radio signal with a maximum bandwidth of 240 megabits per second (Mbps) at Mammoth Hot Springs and transmitted to Mount Washburn, where signals are divided and re-transmitted to microwave antennas at Canyon, Lake, Grant, Old Faithful, Madison, and Norris, which are then distributed to facilities by buried cable. This microwave transport system consists of aging steel towers and requires 8-foot diameter microwave dishes at telecommunication sites in developed areas and at the fire lookout on the summit of Mount Washburn. Where mountains and geography create obstructions, five existing 28-foot high by 24-foot wide passive reflectors, many of which are located on high points in recommended wilderness, bounce the radio signals to their final connections. Communications to the rest of the park would continue to be transmitted via these microwave links, which have been at full capacity since 2009. All of this infrastructure requires regular maintenance; upgrades could occur when components fail or when other permit requests are received in the future.

Lack of adequate data capabilities would continue to present a challenge for park staff, concessionaires, and visitors. The current microwave radio network leaves many areas of the park vulnerable to being isolated from all telecommunications including 9-1-1, telephone, cellular communications, emergency services radio, and data. This has occurred three times in the last five years (De Young, Personal Communication, 2020). Workforce productivity would continue to be affected, as would emergency response communications.

2.2 Alternative 2: Proposed Action and Preferred Alternative

Under the proposed action, the NPS would approve the application for a ROW to place fiber optic cable in the park. Fiber optic cable would be installed in underground conduit within the engineered road base of existing roadways, and in some limited instances, along utility lines, and would connect existing fiber optic at the South Entrance to existing cable at Mammoth Hot Springs. The new cable would provide broadband data transport and high-speed internet access and data circuits between developed and administrative areas for use by NPS, concessionaires, partners, public safety entities, visitors, internet service providers, voice and data providers, and for the transport of that communication both within and outside the park.

This proposal would not expand existing cell phone coverage areas as defined in the 2008 Wireless Communications Services Plan / Environmental Assessment (NPS 2008), and does not include additional above-ground telecommunications infrastructure. The increased data bandwidth would provide faster broadband speeds and would support more users within the existing coverage areas. Figure 1 shows an overview of the proposed route.

The proposal would include a 288 single-mode fiber optic cable with a theoretical maximum capacity of up to 72 million Mbps of data, high-density polyethylene (HDPE) conduit, ducts, concrete and concrete polymer maintenance holes, splice cases, fiber optic line marker tape, and bridge attachments, as required. HDPE conduit is known to exhibit permanent flexibility and bends and flexes without breakage over a wide range of temperatures, even with ground shifts or heaves (PPI 2018). There are a few areas in the park that are prone to slumping ground. HDPE can tolerate movement and the conduit is expected to stretch and move with the ground if slumping or sliding occurs after installation. If large-scale sliding occurs such that the road is damaged, the conduit would be inspected and repaired along with the road, if necessary. The total path length of the cable is approximately 187 miles including the main trunk cable running north and south on the Grand Loop Road and the Old Gardiner Road from Mammoth to the NPS offices in Gardiner. Installation would occur within existing roadways as shown in Figure 2 (top illustration). Construction would include placement of maintenance holes, multiple HDPE conduits, and fiber optic cable. Lateral lines would be installed to provide fiber optic connectivity to developed areas off the main roadways. These lateral lines branching off the main route would comprise approximately 21 linear miles of the total project. An example of a lateral line is shown in Figure 2 (bottom illustration); Figures 3 through 6 show greater detail of the lateral line locations in the north, east, south, and west sections of the project area.

Installation Techniques and Timing

Installation of the fiber optic cable is proposed to take place during the construction window for the park (typically April to November). Installation would involve multiple crews and is expected to last three years. The actual installation schedule would be coordinated with NPS staff, partners, and concessionaires. It is likely that there would be four crews working at different locations throughout the park during the construction period; these crews would be working in different locations installing conduit, placing maintenance holes (also referred to as manholes or handholes), and attaching conduit to bridges. There would be at least two crews working on fiber placement at different locations in the park after the conduit is installed. Details on sequence and location would be determined as design progresses. The park would coordinate installation activities to minimize disruption of normal park operations and visitor activities.

Most of the work would take place over the first two years with full completion anticipated during year three. Actual installation activity periods for a given area would be determined by the location conditions and the construction method utilized to meet those conditions. On average, over flat terrain approximately 2 miles of conduit can be installed per day using the plowing method. Rougher terrain and other site-specific conditions, such as rocky areas, could reduce that rate of installation to a few hundred feet per day. Rehabilitation and revegetation would follow installation (see mitigation measures and Appendix B for more detail).

Typical Alignment of Fiber Optic Cable along Park Roadways

Example Fiber Optic Lateral Cable Shown in Gold Going into the Grant Ranger Station

Figure 2. Fiber Optic Cable Illustrations.

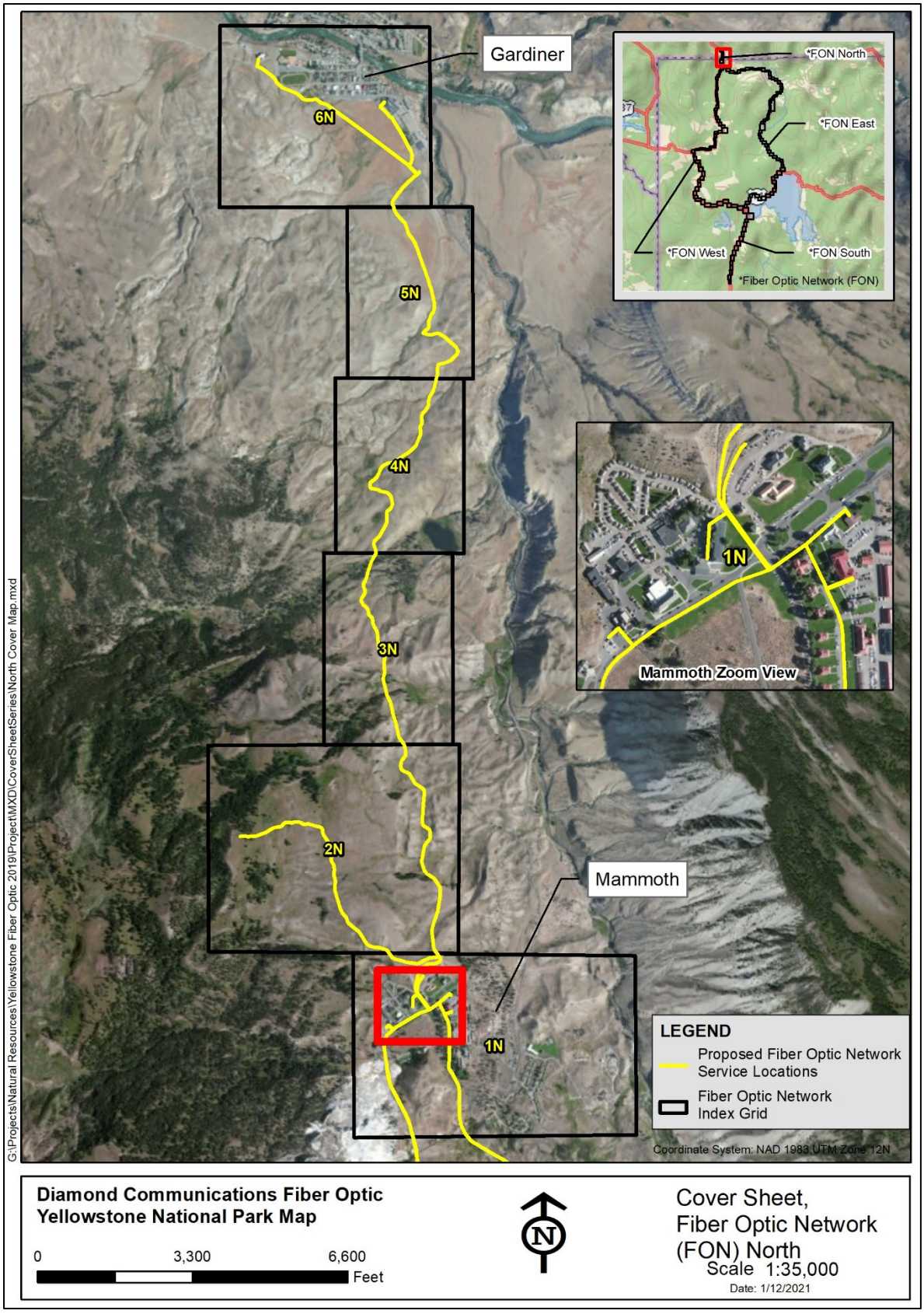


Figure 3. Proposed Action – North Section Detail.

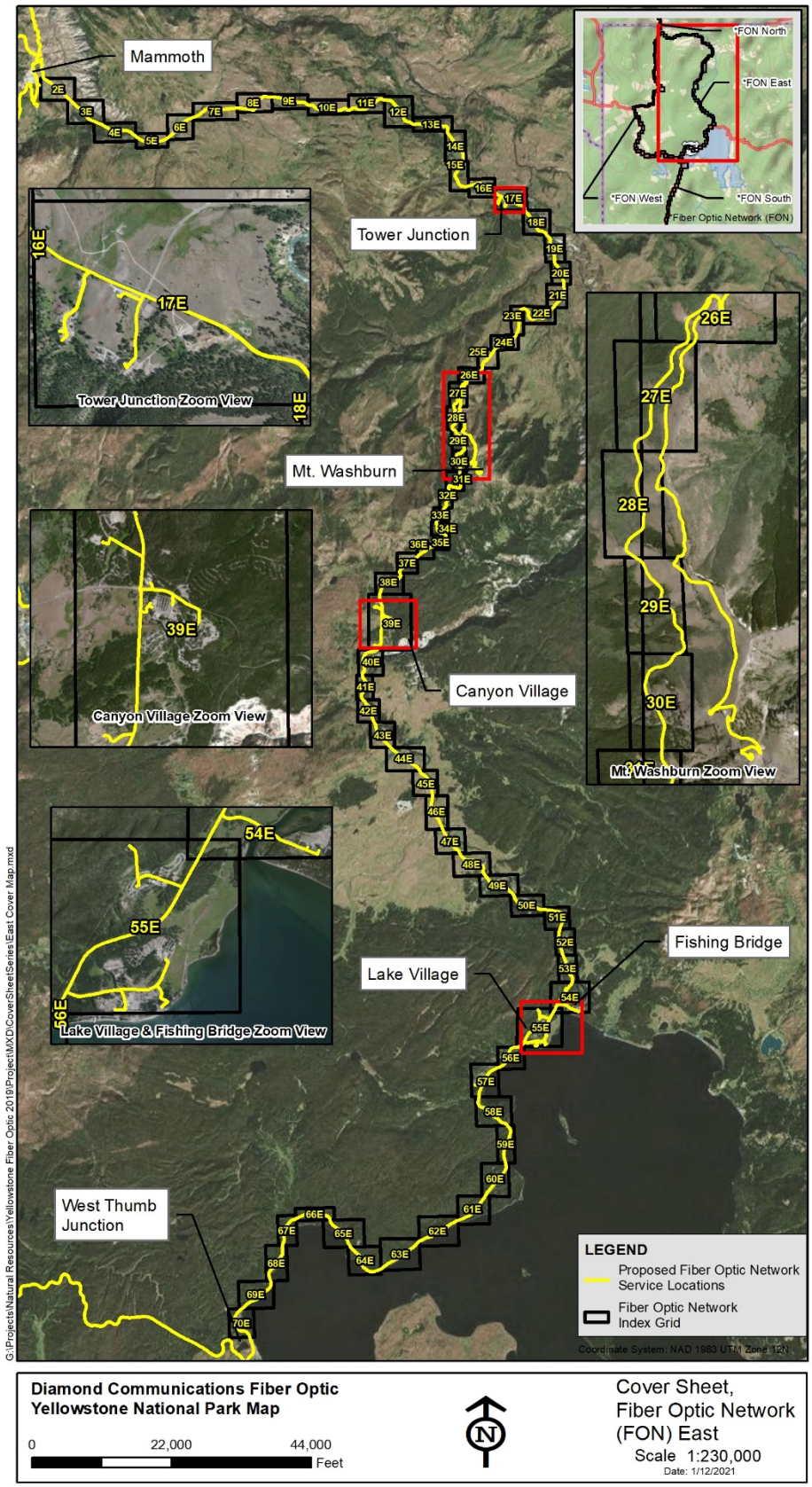


Figure 4. Proposed Action – East Section Detail.

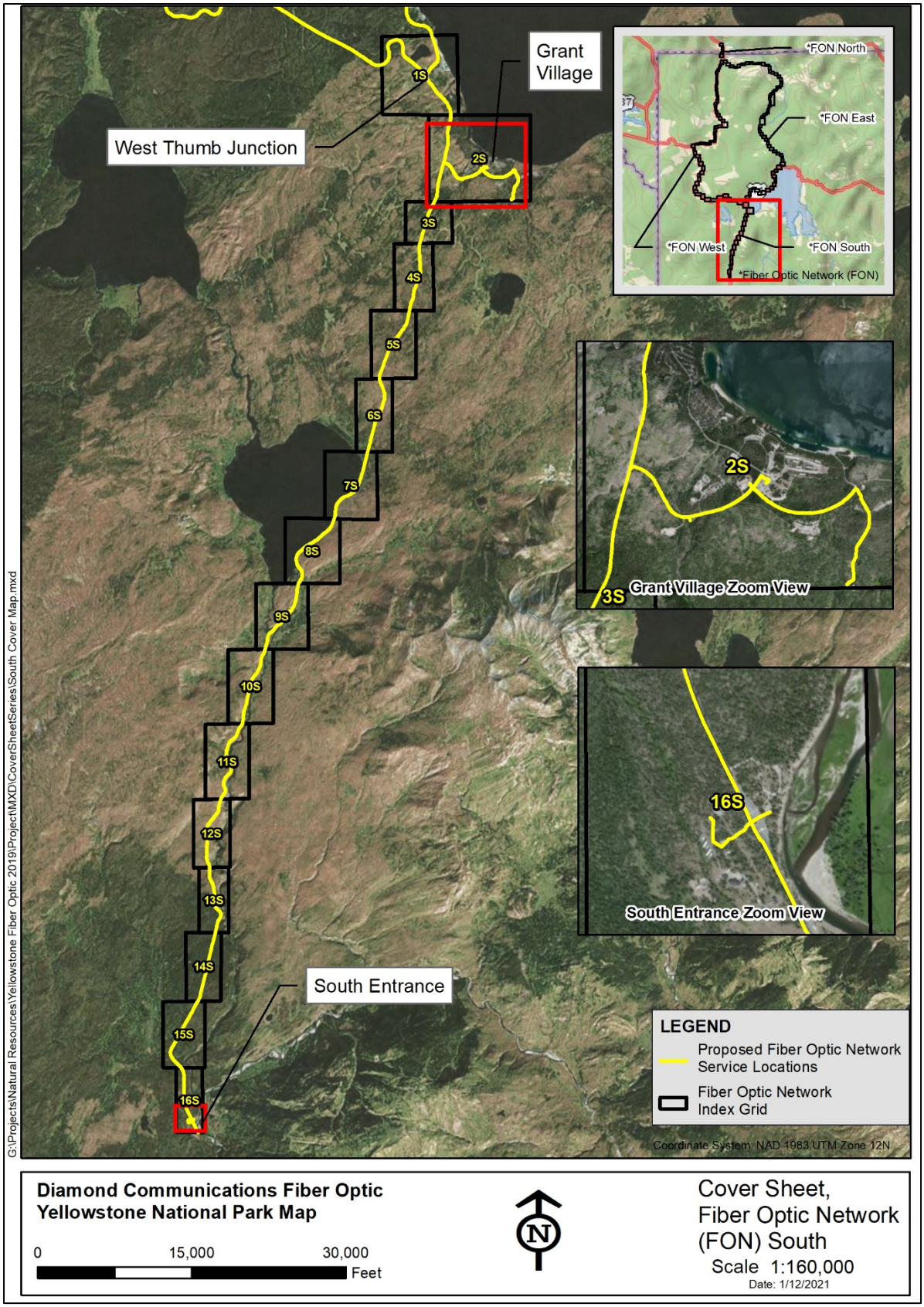


Figure 5. Proposed Action – South Section Detail.

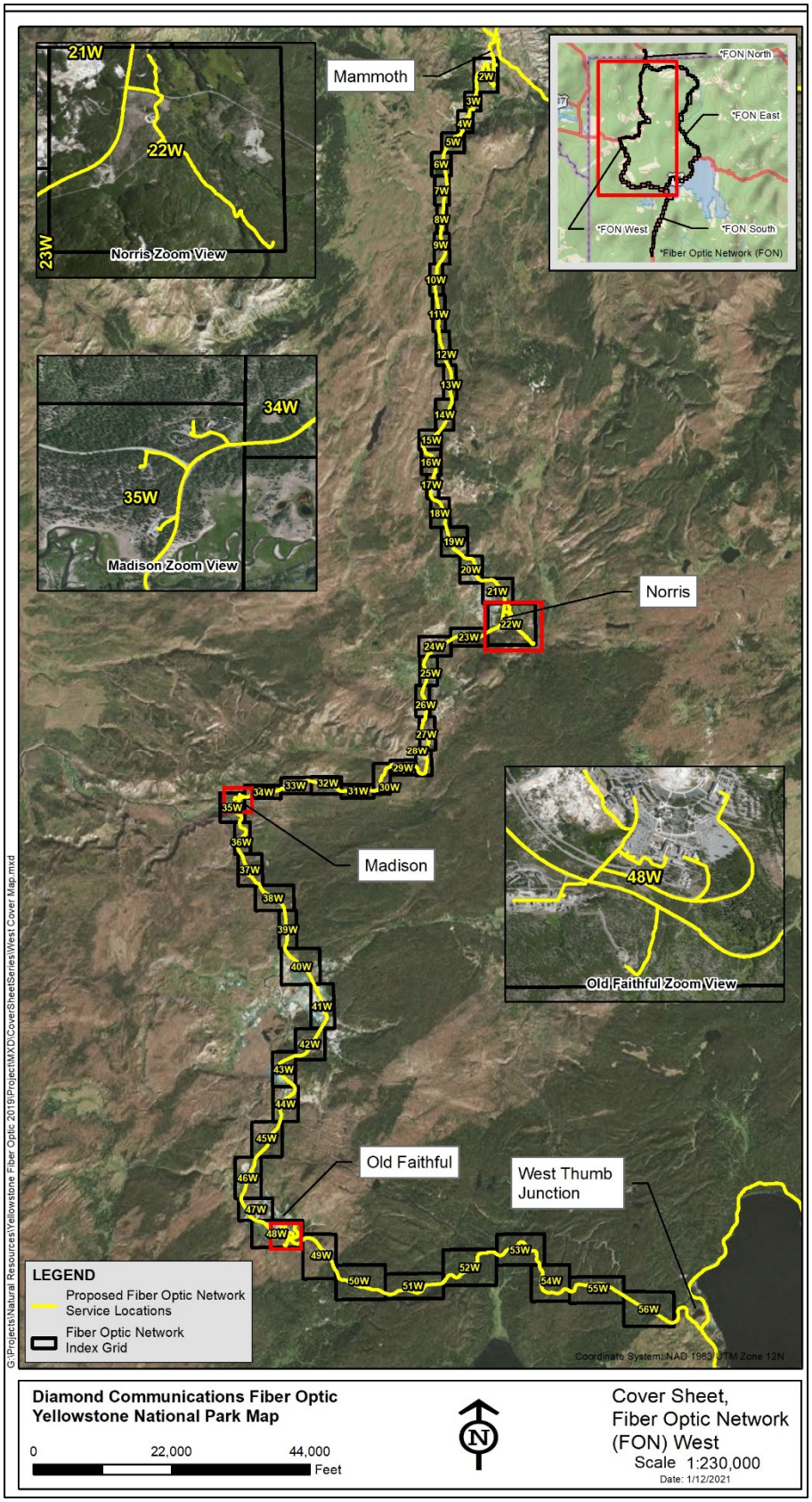


Figure 6. Proposed Action – West Section Detail.

Fiber optic installation would be accomplished using standard construction equipment such as vibrating plows, rock saws, small backhoes/excavators, skid steers, trenchers, directional drilling equipment, trucks and trailers hauling materials, and fuel trucks (no fuel tanks would be stored along the route or at existing equipment staging areas). Walk-behind and tractor-mounted trenching equipment would make a cut in the ground 4 to 8 inches wide to a depth of 10 to 20 inches. In most cases, an offset plow tooth would be used to place the conduit in the existing road prism as near to the paved road shoulder as possible, minimizing environmental impacts and off-road travel (Figure 7). The road prism is the area within the ROW that supports the paved roadway between the bottom of the ditch and the toe of slope. It includes the subgrade, base courses, surfacing courses, pavement, and roadway fill-slopes. Typical equipment and disturbance are shown in the images in Table 1.

Conduit and cable would be installed in the engineered road base (engineered fill material), meaning within the fill that has been placed to create the roadbed surface, as shown in Figure 7. This would help to mitigate potential impacts in thermal zones because the conduit would be installed in existing roads that typically are already elevated to address concerns related to higher ground temperatures. In thermal zones, the conduit would be installed at shallower depths within this engineered road base to ensure no new impacts to thermal areas (Figure 8). No installation would occur in previously undisturbed areas and there would not be any direct impacts to surface thermal features.

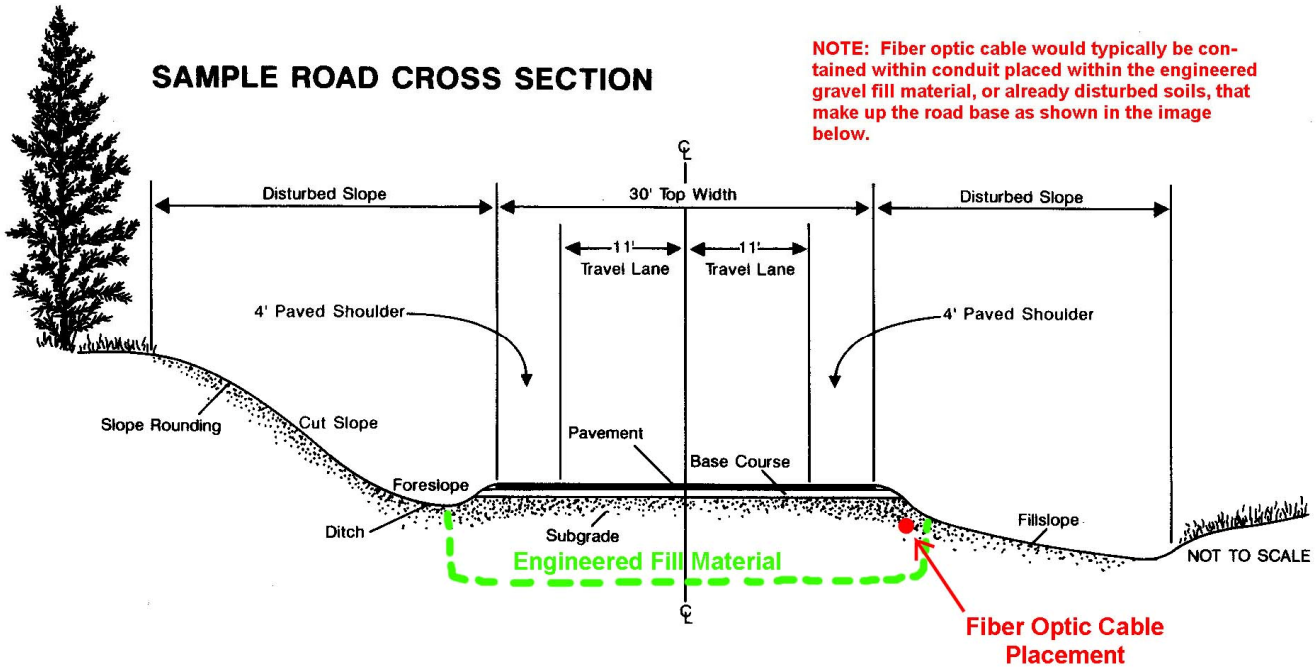
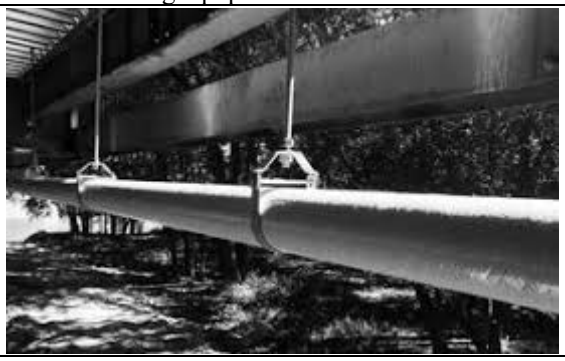


Figure 7. Road Cross-Section.

Table 1. Typical Equipment and Disturbance

	
Rock saw for road and rock cutting/trenching	Rock saw disturbance in road
	
Rubber track fiber plow	Directional drilling equipment
	
Maintenance hole	Bridge attachment
	
Plow disturbance along roadway.	Plow with conduit.

Each segment placed along Grand Loop Road (that is not within a designated thermal zone) would consist of placing two 1-1/4-inch HDPE conduits with one carrying a 288 single-mode fiber optic cable (about 0.69-inch in diameter) inserted by air compression after the conduit is buried (Figure 8). The extra conduit would provide for future expansion as needed, although any future expansion is speculative at this time and may be subject to additional compliance, as appropriate. In areas adjacent to thermal features where soil temperatures are elevated compared to ambient soil temperatures in other locations throughout the park, near Old Faithful for example, two 4-inch HDPE conduits would be placed with one carrying a 288 single-mode fiber optic cable (Figure 8). The larger size HDPE is required to help insulate the fiber optic cable from the ground heat in thermal zones. Lateral lines installed to service areas would consist of one 1-¼ inch HDPE conduit, and bridge attachments would consist of one 4-inch PVC conduit.

Along the majority of the road where terrain is relatively level, conduit would be placed within a 4-inch cut just off the road pavement, as close to the road edge as possible. Standard depths in the road shoulder would be approximately 20 inches deep. In areas with known geothermal features, the cable would be buried at a shallower depth, around 10 inches, to avoid geothermal resources. In areas where geothermal features are directly adjacent to the road, the cable would be buried underneath the paved road surface. For installation in the shoulder, traffic would be slowed but should be able to operate in both lanes. Road shoulder work areas would be approximately 1,000 feet long and would move forward at a constant and steady pace. In these areas there would be a moving traffic restriction for the shoulder and adjacent lane; traffic would be slowed down in the 1,000-foot portions of the road where the equipment is currently working, and the restriction would migrate or move along with the equipment as the work area moves down the road. After the equipment passes an area, the shoulder would be reopened. Speed limits through construction areas would be reduced to 20 mph and posted.

Where the conduit must be placed beneath the road surface to avoid impacts to park resources or where steep terrain borders the road on both sides, methodology would be similar to that described above for shoulder placement. The difference would be that the conduit would be placed in a 4-inch cut beneath the road itself rather than in the shoulder (Figure 8). Standard roadbed depth would also be approximately 10 inches. The work area at any given time would be the length of road cut required, ranging from 40 feet to 4,100 feet based on engineering surveys. After installation, the road would be repaired with hot patch asphalt, compaction, and restriping (if necessary) in accordance with Federal Highway Administration specifications. Installation in the roadbed would require temporary traffic controls to allow one-direction flow in accordance with park traffic control standards. The shoulder and one lane would be restricted in the work area during installation. Time of lane restriction would vary based on distance of cut required and underlying road base. Pilot vehicles would be used for traffic flow in work areas. Speeds would be reduced to 20 mph in work areas. (The process would be similar for road repair work that may occur in the future.)

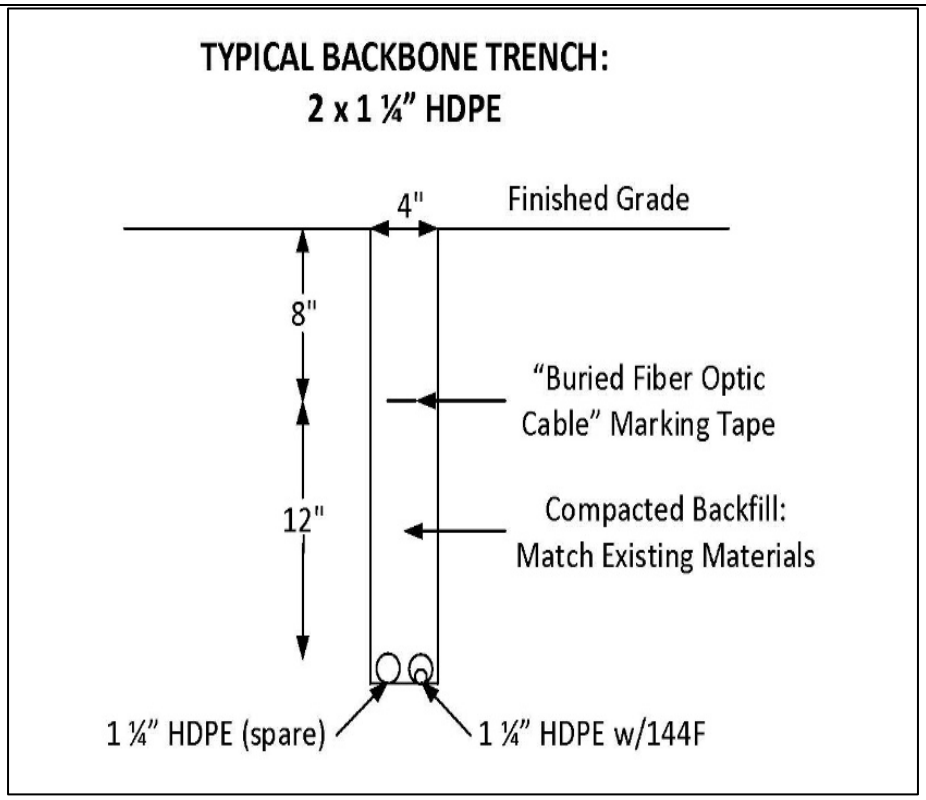
Directional drilling and asphalt cutting would be used for road crossings and intersections, and to avoid sensitive resources such as cultural sites, thermal areas, and wetlands; and roadside infrastructure such as drainage culverts. In most cases, these resources would be avoided by drilling (boring) under the road to move the cable from one side of the road to the other. In locations where resources are present on both sides of the road, the conduit would be installed in the roadbed in order to avoid impacts. Directional drilling would occur on less than 5% of the entire line. In some cases, the drillings would require a temporary pit approximately 3-feet wide, 4-feet long, and 2- to 3-feet deep be dug on the side of the road at the beginning of the section being drilled. These pits would be installed outside of bank and floodplain areas. Bore lengths for this project range from 50 feet to 800 feet and the conduit would be installed approximately 2 or 3 feet under the bed of the road. Drilling may also be used in areas with narrow shoulders, steep slopes, and sharp turns, to facilitate installation in order to minimize the need to disturb the pavement. Drilling would not occur in thermal areas, but would be used to detour the cable route from one side of the roadway to the other in order to avoid thermal resources in close proximity to the road

edge. As mentioned above, any excavations in thermal areas would be limited to a maximum depth of 10" to avoid impacting thermal resources.

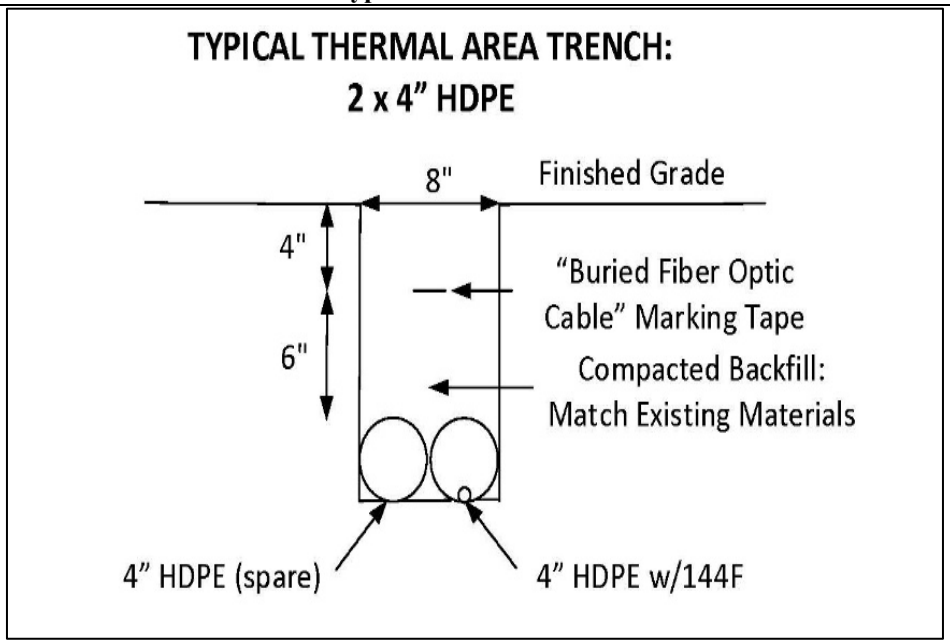
Asphalt cutting would require an approximately 4-inch road cut that would be patched after installation. The work area would be the length of the road cut, typically 100 to 200 feet. This installation method would only change if a different approach was determined to be less intrusive. Crossing rivers, streams, and creeks would be achieved by attaching a 4-inch conduit on the underside of existing bridges to avoid impacts to water resources.

One lane of traffic could be temporarily closed while conduit is placed at intersections and road crossings; the time would vary based on distance of cut required and specific conditions in an area during the construction season. Speed limits would be reduced to 20 mph in the immediate work area as traffic would continue through the area.

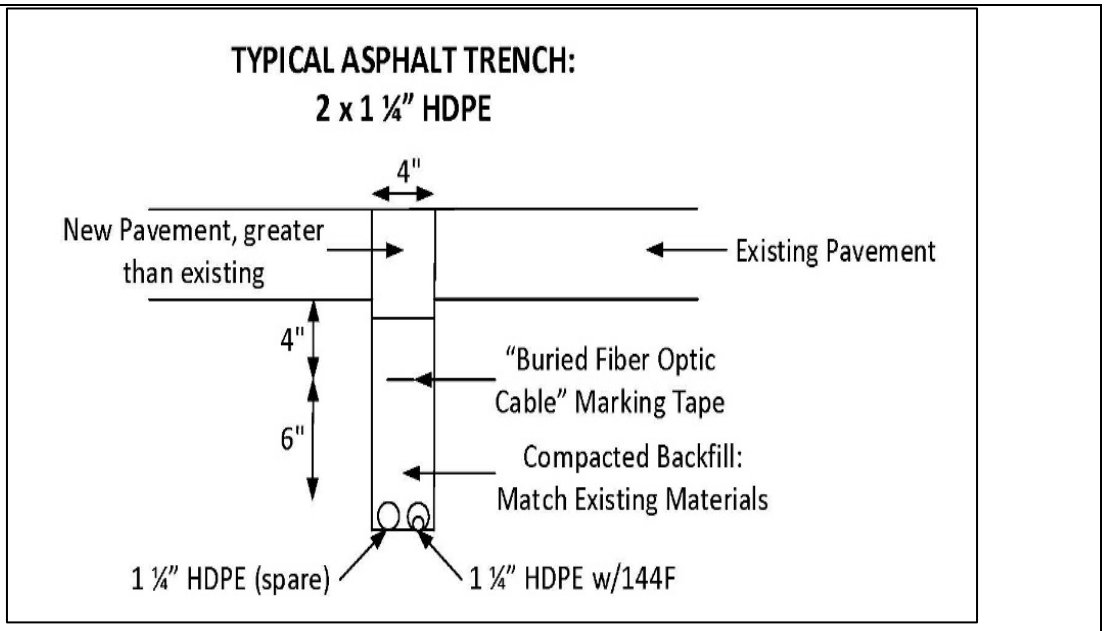
Maintenance holes (concrete or concrete polymer boxes) would be needed to join sections of the fiber optic cable and provide points to service the line. These maintenance holes would be installed at not more than 4,000-foot intervals and would be buried two to four inches below grade with incidental traffic-graded lids. Small concrete polymer maintenance holes (pull boxes) would be installed in developed areas to help deliver fiber to specific users. None of the maintenance holes or pull boxes would be located in sensitive resource sites. In total, it is anticipated that approximately 575 maintenance holes and 35 pull boxes would be installed below grade. The exact number of maintenance holes and pull boxes would be determined in the field pending site-specific conditions. There would be no visible markers for conduit or maintenance holes above ground; maintenance hole locations would be noted using GPS coordinates on the as-built drawings and would be located using a device such as a metal detector when necessary for maintenance and/or repair. Figure 9 shows details for a typical maintenance hole (this includes maintenance holes, manholes, pull boxes, splice boxes, etc.). Excess fill (aggregate, gravel, asphalt) would be removed for maintenance and/or repair. A locate request would be required for organizations conducting underground activities in areas where there are underground utilities. In addition to buried boxes, the HDPE conduit would have to be spliced at intervals of 500 to 3,000 feet. (Distance would depend on the installation method and equipment used; 500 feet would be the distance in areas that require directional drilling and 3,000 feet would typically be the distance for other installation methods). In these locations, a small hole would have to be dug to allow the HDPE conduit to be spliced.



Typical Shoulder Trench



Typical Thermal Area Trench



Typical Road Trench

Figure 8. Details for Typical Roadbed, Shoulder, and Thermal Area Trenches.

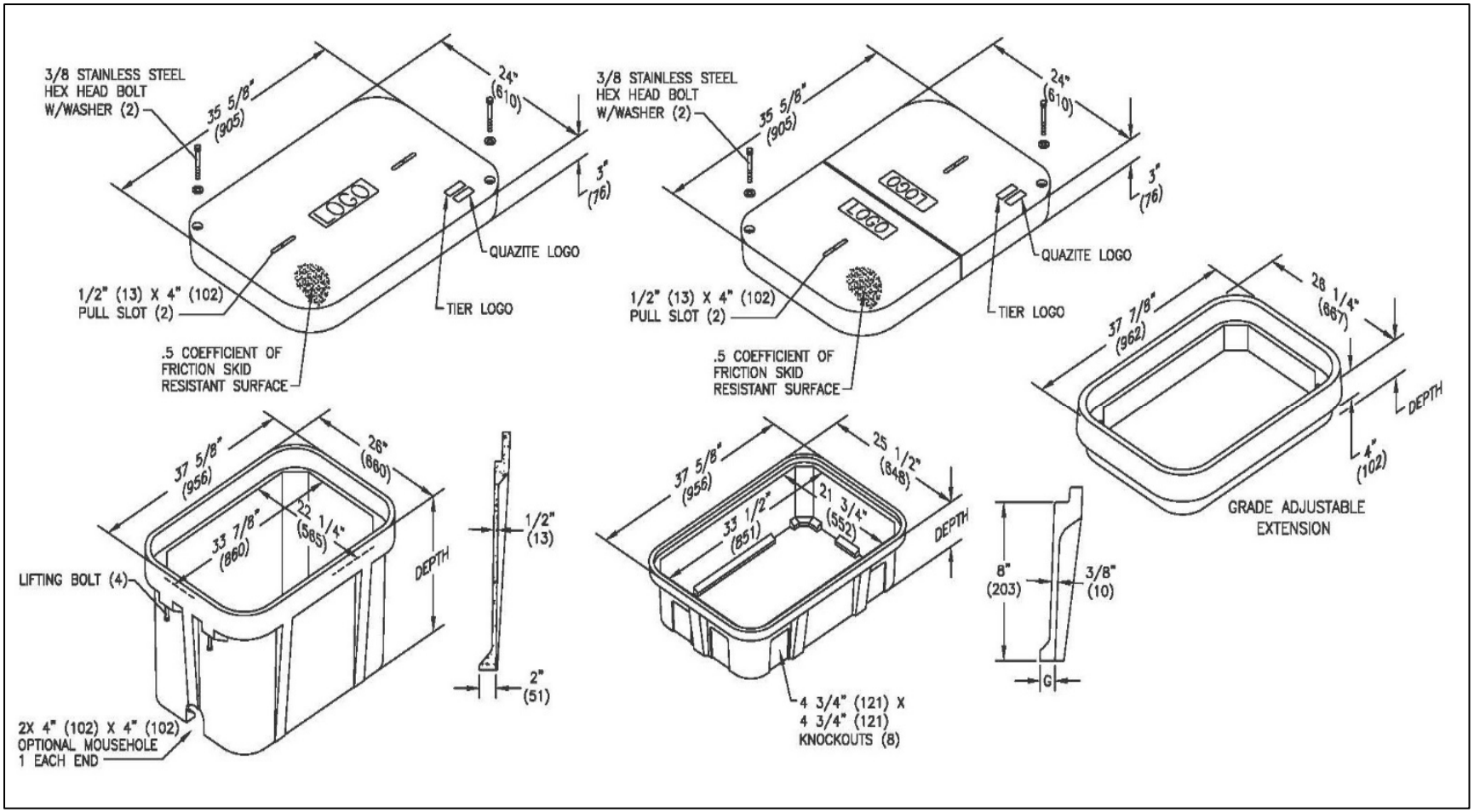


Figure 9. Details for Typical Maintenance Hole.

Work zone areas for maintenance hole placement and fiber placement, splicing, and testing would be approximately 100 feet long. The shoulder would be closed at each location during the placement of the box or during the splicing and testing of the fiber cable while equipment is at the location. Speeds would be reduced to 20 mph in the work area, but lane closures would not typically be required, except in areas where the road is very narrow or there is a sharp drop off that would not allow the equipment to operate safely in the shoulder.

Generally, no fill material would be required for placing the conduit. If any fill material is needed at specific sites, it would be obtained from park-approved vendors. Need for bedding material would be determined as design progresses. If any asphalt needs to be replaced it would be done following Federal Highway Administration requirements and practices. No blasting is anticipated as part of the project.

All existing man-made structures such as drainage culverts, culvert headwalls, underdrains, and utilities, would be avoided by placing conduit over, under, or around based on site-specific conditions. As with all construction that has underground utilities in the work area, the Applicant would obtain locates prior to the work being conducted to notify/coordinate with the utility infrastructure owner. There would be no impact to ditch cleaning.

Staging Areas

To minimize the amount of ground disturbance, staging and stockpiling areas would be located within existing maintenance/administrative sites near the project footprint, away from visitor use areas to the extent possible, such that vehicle traffic of construction equipment, visitors, or park staff would not be impeded. Potential staging locations include maintenance stockpile areas such as the Old Faithful Pit, Grant West Pit, Mesa Pit, Swan Lake Pit, and Gibbon Meadows Pit, as well as in developed administrative areas including Grant, Old Faithful, Canyon, and Norris. Standard construction equipment such as cable plows, small backhoes/excavators, directional drilling/boring equipment, vehicles (daily transport use for workers), trailers, skid steers, trenchers, and rock sawing equipment would be placed in staging areas, and a construction trailer would be required for the project in a location approved by the park. In addition, materials such as rolls of conduit, fiber optic cable, and supplies needed for maintenance holes could be found in staging areas. Any combination of the above equipment may be stored at multiple staging areas simultaneously, and may also be found along the fiber optic route depending on installation phase, personnel, and location of work progress.

Fuel would not be stored in staging areas or along the project route. Fuel would be delivered by approved fuel handling services and would only occur on non-permeable surfaces such as asphalt/concrete roadways, pullouts, and parking areas, and measures would be implemented to protect resources from fuel spills. The Applicant would regularly monitor and check construction equipment to identify and repair any leaks. Refueling and servicing equipment would be done in accordance with NPS requirements and following National Pollutant Discharge Elimination System (NPDES) guidelines, likely in staging areas or turnouts away from water bodies. Special precautions (spill kits, training of operators in fuel containment) would be put in place to alleviate the risk of fuel spills. Spill kits would always be required at work sites. Stormwater runoff control measures, including silt capture techniques such as silt fences would be employed to minimize post-construction runoff and prevent degradation of wetlands and water bodies in areas where there is the potential for impacts (e.g., adjacent to wetlands). A stormwater pollution prevention plan would be established in accordance with the Wyoming Department of Environmental Quality requirements prior to start of project based on final construction design, and a spill plan would be developed to address hazardous materials risks and how to mitigate them.

Disturbance
The proposed action would create a linear disturbance[2] along main park roads from the South Entrance to the North Entrance and on the east and west sides of the Grand Loop Road. Fiber optic installation would result in an estimated temporary disturbance width of up to 2 feet (along the construction corridor) where the actual plow line, or cut, is placed, although it is anticipated that it would be narrower in some locations because of the installation techniques being implemented, and particularly when the cable is installed in the roadbed itself. The width of actual soil disturbance would be approximately 12-inches or less in good soils with no large buried rocks.

In order to properly analyze potential impacts that the proposal may have on resources, the park used a standard 2-foot disturbance width along the length of the proposed project area to estimate linear disturbance and to account for larger areas of impacts, such as where holes are dug to splice lines, and for boring under roads and wetlands and other sensitive areas[3]. Thus, the 187 miles x 2 feet would result in approximately 45 acres of temporary disturbance in previously disturbed soils. Of the 187 linear miles proposed for installation, it is estimated that 3.2 miles (1.7%) would be installed by boring, 4.5 miles (2.4%) would be installed in the road itself, and 0.5 mile (0.3%) of the line would be attached to bridges. Approximately 0.2 mile of the line would be installed by boring as mitigation in thermal zones. This would be at a shallower depth than other borings. Installation of maintenance holes would disturb approximately 0.85 acres for a total estimated disturbance of approximately 46 acres (Table 2).

Table 2. Installation Summary

Feature/Installation Technique	Estimated Disturbance
Total Fiber Optic Cable Line	Approximately 187 miles x 2 feet wide (45 acres) of previously disturbed soils within the engineered road base (fill) of park roads.
Installation in Shoulder	Approximately 182 miles (97.3%) is estimated to be installed in the road shoulder by trenching. Standard depth in the road shoulder would be approximately 20 inches.
Installation in Roadway	Approximately 4.5 miles (2.4%) is estimated to be installed in the road itself. Standard depth in the road would be approximately 10 inches.
Installation to Avoid Geothermal Zones	Approximately 0.2 miles (0.1%) is estimated to be installed by directional drilling (boring) to avoid impacts to geothermal features. Boring would occur outside of the thermal area to shift the cable from one side of the road to the other. Standard depth of excavation in geothermal areas would be approximately 10 inches or shallower if required.
Installation to Protect Other Sensitive Resources (Boring)	Approximately 3 miles (1.6%) is estimated to be installed by boring to avoid impacts to sensitive resources.
Bridge Attachments	There would be approximately 0.5 mile (0.3%) of bridge attachments.

[2] Ground disturbance under the proposed action would consist primarily of excavations in areas previously disturbed during the construction of park roadways. The fiber optic cable would be installed within the engineered fill material (Figure 7) of existing roads in order to avoid new ground disturbance.

[3] Cultural Resource impacts include both temporary and permanent impacts on historic properties, defined by the Area of Potential Effect (APE). As described under Appendix C, the APE for this proposal included a width of 50 feet along the proposed route.

Maintenance Holes	Disturbance from maintenance holes is estimated to be 0.85 acres.
Total Disturbance	Total project disturbance is estimated to be approximately 46 acres.

Maintenance Activities
The ROW permit would allow for routine operations and maintenance of the proposed infrastructure. Because this would be a buried line with the fiber optic cable protected in conduit, revisiting a site for repair or malfunction of the cable would be rare. However, if a problem with the fiber had to be corrected, a technician would be able to pinpoint the location of the problem site within inches of its location. Maintenance may also be needed if road or bridge maintenance occurs, or if any road or utility construction occurs that impacts the conduit. More frequent maintenance may be required in thermal areas due to accelerated fiber degradation. In thermal zones, fiber cable may have to be replaced in the conduit every 10 years, but new disturbance would not occur because a spare conduit would be placed during the initial installation. As a result, new fiber could be installed into the spare conduit without additional disturbance. The issues cannot be anticipated, would be addressed on a case-by-case basis as they arise, and may require additional environmental compliance that would be conducted at that time.

NPS Bidding Process and Future Associated Actions
If the application is approved and a permit is issued, the Applicant would be responsible for all construction and maintenance costs associated with the fiber optic cable. The NPS would seek offerors to deliver broadband internet and local area network connection services to various NPS-operated locations throughout the park, as well as dark fiber[4] capacity for transmission of NPS network services. The Applicant would recover their costs over time by leasing the fiber optic infrastructure to other service providers, all of whom would require their own ROW if they were to install any facilities (e.g., Wireless Access Points or cellular collocation on existing sites). The Park would issue an indefinite delivery/indefinite quantity request for proposals and would evaluate bids based on factors defined in the Federal Acquisition Regulations.

The methodology of the existing telecommunications network is exclusively dependent upon unobstructed line-of-sight microwave pathways from signal repeaters to passive reflectors. Given the expanse and topography of the park, microwave repeater equipment has been located on highly visible ridgelines such as Mount Washburn and Bunsen Peak, and passive reflector equipment in areas recommended for wilderness designation. Existing equipment is not easily accessible, and requires increasingly recurring maintenance and associated actions such as vegetation clearing, re-trenching of electrical lines, transporting of heavy equipment/machinery, and roadwork. These actions collectively perpetuate numerous impacts on park resources, visitors, and staff, and also impact wilderness character when they occur within recommended wilderness. Implementation of the proposed action would allow for the removal of obsolete telecommunications equipment throughout the park, including equipment located within recommended wilderness. These future actions, subject to additional compliance review, minimum requirement analysis (MRA) under the Wilderness Act, and other pertinent laws and regulations, would ultimately improve the condition of recommended wilderness while also reducing maintenance costs and impacts to invaluable park resources, and improving visitor experience.

The proposed action may also lead to requests by service providers to construct cell towers in developed areas or to add equipment to existing infrastructure. Because the NPS has not received any applications for this additional infrastructure and cannot speculate on what might be proposed in the future, the NPS did not analyze the corresponding effects in this EA. Instead, the NPS would evaluate these requests as

[4] Dark fiber or unlit fiber is an unused optical fiber that has been laid and is available for use in fiber-optic communication. While it is unused, it is known to be "dark" as no light pulses are being transmitted through it.

they are received, in a separate compliance process as needed and in accordance with the park's Wireless Communications Services Plan.

2.3 Mitigation Measures/Project Design Measures/BMPs

The following measures were developed to minimize the degree and/or severity of adverse effects and would be implemented during execution of the chosen action alternative, as needed. The Applicant would be responsible for ensuring all contractors and personnel associated with implementation of the proposed action adhere to all mitigations identified by the park.

General Construction

- Construction zones for a given week will be identified in advance and the NPS project manager will be responsible for ensuring the project remains within the construction limits.
- Prior to construction activities, sensitive resource areas to be avoided will be identified, marked, and flagged. Detailed protection measures will be clearly stated in the construction specifications.
- Daily housekeeping practices will be implemented to ensure trash and construction debris is removed from the project area and properly disposed. All equipment and project materials must be removed from the project work limits upon project completion.
- The contractor will coordinate with NPS personnel to minimize disruption of normal park activities. The contractor will be responsible for traffic control along the route during construction, to ensure safety of the public, park employees, and residents.

Visitor Use and Experience

- Informational signs, alerts, press releases, and notifications will be posted/issued to inform visitors of traffic delays prior to and throughout the duration of construction.
- To minimize the potential for impacts to park visitors, curfews on construction timing may be implemented near campgrounds and developed areas to avoid quiet hours. Daily hours of operation will be determined as design progresses and a final construction schedule is developed.

Geothermal Resources

- The proposed route would be located along existing roadways, confined within the existing engineered road base material. Trenching in thermal areas would not exceed 10" below the road surface.
- In areas with abundant geothermal resources, such as Old Faithful, active thermal features and/or elevated soil temperatures would be avoided to the maximum extent possible. Site-specific geothermal investigations would be required prior to installation of the fiber optic cable in these areas.
- The contractor will cease all work in the immediate vicinity and contact the park geologist if any of the following conditions are encountered: 1. A pre-existing hole in the ground the size of a basketball, or larger, 2. Standing or flowing water, either hot or cold, 3. Any concentrations of either carbon dioxide or hydrogen sulfide are measured by the Applicant installing the conduit, 4. If during excavation a red clay layer is encountered, or 5. Ground temperatures above 80 degrees Fahrenheit are measured (early morning) by the contractor installing the conduit.

Vegetation and Soils

- Nonnative/invasive plants will be identified within the project area and control methods (previously approved in the Yellowstone Invasive Vegetation Management Plan and Environmental Assessment, NPS 2013) such as spraying herbicides and mechanical removal will be implemented prior to project commencement to minimize the introduction of invasive species.

- Construction workers and supervisors will be informed about special status species. Contract provisions will require the cessation of construction activities if a species is discovered in the project area until park staff can evaluate and determine adequate protection measures.
- All equipment, including heavy equipment and hand tools, must be thoroughly cleaned and free of seeds and seed-carrying soil, debris, and mud to prevent the spread of exotic and/or invasive weeds. Equipment must be cleaned prior to entering the park and between construction sites within the park. Equipment shall be pressure washed within the identified boundaries of construction prior to relocating equipment between construction sites.
- To reduce the threat of nonnative/invasive vegetation being introduced to the park, all imported material must be obtained from a park-approved source.
- Topsoil reclamation and revegetation efforts will follow guidelines established by the park described under Appendix B. Revegetation of boring pits and maintenance box disturbance with native plant species/native seed will take place following construction to reduce the possibility of infestation of invasive species.
- Hay bales will not be used for erosion control or revegetation. Hay often contains seed of undesirable or harmful alien plant species. Therefore, on a case-by-case basis the following materials could be used for any necessary erosion control dams: wood bark mulch, sandbags, coir logs, and silt fences. Wood bark mulch will be used to reduce surface erosion, help retain soil moisture, and promote seed generation of native plants. Standard erosion control measures such as silt fences and/or wattles will be used near waterways and wetlands to prevent sedimentation and erosion.
- Standard erosion control measures such as installing erosion control wattles or sediment fences will be implemented to minimize potential soil erosion in areas where soil is disturbed adjacent to wetlands, rivers, streams, and stormwater inlets.

Wildlife

- Construction personnel will receive orientation on appropriate behavior in the presence of wildlife, including working in grizzly bear country prior to project commencement. Orientation will include information about park regulations regarding proper food storage, handling and disposal of garbage and other bear attractants, and approaching or harassing wildlife.
- To avoid impacts to migratory birds during nesting season, all tree removal activities will be conducted outside of March 1 to August 15 for raptors and May 1 to August 1 for songbirds. If tree, shrub, and grass removal will occur within the specified dates, the contractor must contact the NPS Bird Program Manager to schedule a survey of the project site prior to vegetation removal.
- Any nesting birds encountered during construction should not be disturbed until any young have fledged the nests. Grubbing and clearing would occur during non-nesting periods or after a survey of the area showing no active nests being located.

Water Resources

- Silt fencing fabric will be inspected weekly and after every major storm. Accumulated sediments will be removed when the fabric is estimated to be approximately 50% full. Silt removal will be accomplished in such a way as to avoid introduction of fine particle materials into any wetlands or flowing water bodies.
- To minimize possible petrochemical leaks from construction equipment, the contractor will regularly monitor construction equipment to identify and repair any leaks. Equipment will not be serviced or refueled near bodies of water. Storage and refueling of equipment, and construction

parking will be at least 150 feet from streams or riparian areas in designated staging areas on nonpermeable surfaces.

Air Quality and Soundscapes

- To reduce noise and emissions, construction equipment will not be permitted to idle for more than 10 minutes while not in use according to the Superintendent's Compendium, based on CFR 36 § - 5.13 Nuisances. All motor vehicles and equipment will have mufflers conforming to original manufacturer specifications that are in good working order and are in constant operation to prevent excessive or unusual noise, fumes, or smoke.

Archeological and Paleontological Resources

- Prior to project commencement, contractors will be informed of the procedures to follow in the event of archeological, ethnographic, and paleontological resource discovery, as well as the penalties for illegally collecting artifacts or intentionally damaging paleontological materials, archeological sites, or historic properties.
- The contractor will be required to notify the park's Cultural Resources Branch before activities involving earthwork or digging occurs in areas with high probability of locating archeological or paleontological remains. Surveys have taken place in order to identify these areas, and park staff will work with the contractor to develop monitoring and mitigation plans.
- If previously unknown archeological resources are discovered during construction, all work in the immediate vicinity (600 feet) of the discovery shall be halted until the resources are identified and documented and an appropriate mitigation strategy developed, if necessary, in accordance with pertinent laws and regulations, including the stipulations of the 2008 Programmatic Agreement Among the National Park Service (U.S. Department of the Interior), the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers. The cultural remains will be assessed, and the Wyoming and Montana State Historic Preservation Offices (SHPOs) notified as necessary, according to §36 CFR 800.13, Post Review Discoveries.
- In the event that human remains are discovered during construction, operations must immediately be suspended, and the park Cultural Resources Branch notified. Work will not be allowed to resume until the resources are identified and documented in accordance with the Native American Graves Protection and Repatriation Act (1990).
- If the cultural remains are assessed as significant and retain integrity for the archeological information they may provide, the site will be avoided and protected. If avoidance is not possible, data recovery excavations will be conducted prior to any construction activity resuming in the area. If the park, with the concurrence of the Wyoming and Montana SHPOs, determines the artifacts or remains are not sufficient to meet the definition of a National Register eligible site, or the archeological information within the site is not significant, all cultural remains will be collected and construction activity will be allowed to recommence with archeological monitoring.
- If unknown paleontological resources are discovered during construction, work in that location will be stopped until the resources could be properly recorded and evaluated by the park geologist. Measures will be taken to avoid further resource impacts or to mitigate their loss or disturbance.
- Any paleontological remains found within the project area are the property of the NPS and shall be removed only by NPS staff or designated representatives.

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter describes the affected environment (current and future expected conditions of the environment, including trends in conditions) and analyzes the potential environmental consequences (impacts or effects) that would occur as a result of implementing the alternatives. The analysis of impacts includes all effects that are reasonably foreseeable and have a reasonably close causal relationship to this proposal. Effects to Vegetation and Visitor Experience are discussed in this chapter. Other resources that were considered but dismissed are discussed in Appendix C.

3.1 Vegetation

3.1.1 Affected Environment

The majority of Yellowstone National Park is undeveloped, dominated by native vegetation communities typical of the Rocky Mountains, and also includes a number of native species more commonly found in the Great Plains and the Intermountain West. Native plant communities in the park are generally described as montane forest communities consisting of lodgepole pine, Engelmann spruce, limber pine, subalpine fir, whitebark pine, and Douglas fir; and non-forest communities including sagebrush-steppe, alpine meadows, wetlands and riparian areas, and geothermal communities. Variable topography, soils, and weather influence the types and distribution of plant communities found in the park, and approximately 1,386 native plants, including three plants only found in or near the park (Ross's bentgrass [*Agrostis rossiae*], Yellowstone sand verbena [*Abronia ammophila*], and Yellowstone sulfur wild buckwheat [*Eriogonum umbellatum* var. *cladophorum*]), and 97 rare plants can be found in the park. The desired conditions for vegetation in the park are sustainable native plant communities with functioning water, soils, and energy and nutrient cycles influenced by natural disturbance events such as fires, floods, and insect outbreaks.

The park has a network of approximately 466 miles of roads which directly transect, or are directly adjacent to, all major native vegetation communities identified above (Figure 10 below). Road construction, repair, rehabilitation, redesign, and road shoulder maintenance have occurred repeatedly throughout the history of the park, resulting in the direct loss of native vegetation and fragmentation of vegetation communities, crushing of plants, and changes in plant species composition along road corridors and developed areas. Vegetation along road edges is further disturbed by vehicles pulling off the edge of the road for purposes such as wildlife and scenery viewing, photography, vehicle emergencies, and snow removal.

An increasing threat to native plant communities in the park, however, is not from the direct loss of individual plants, but from the introduction and spread of nonnative invasive plants that can encroach on native habitats and outcompete native species. Many factors influence the establishment and spread of nonnative plants, including the biology of the plants; climate; soil type; land use history; activities that promote ground disturbance; grazing and/or transport by wildlife; and transport by contaminated equipment, stock feed, gravel, and fill material (NPS 2017).

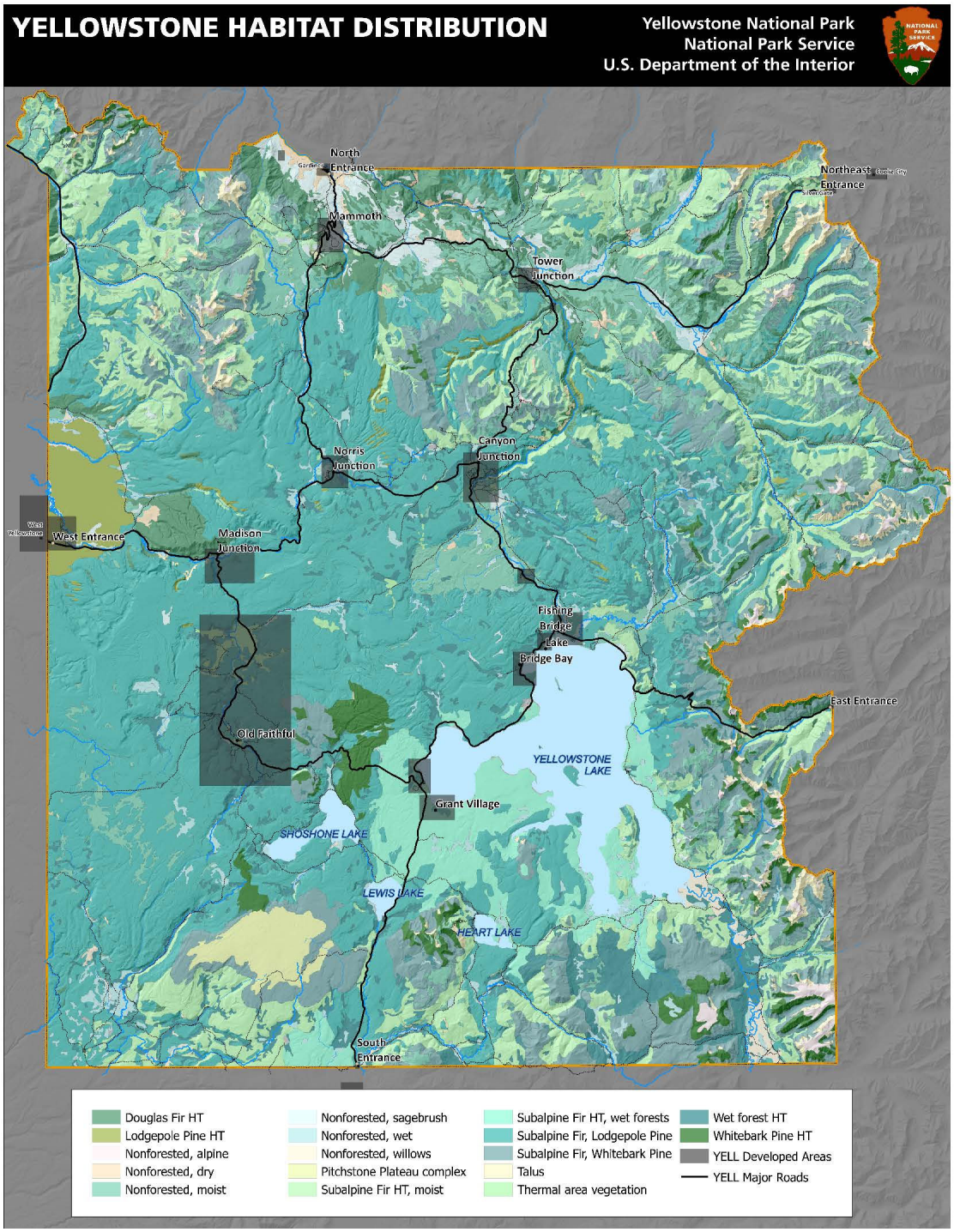
Nonnative invasive plants already exist in varying abundances in the park, and typically originate from areas that are highly disturbed by human use, particularly along road corridors and in developed areas, which can then spread into more pristine areas. At least 225 species among 33 different taxonomic families of nonnative plants have now been documented in Yellowstone, representing approximately 18% of the total known vascular plant species found in the park (YCR 2018). In 2015, a native plant inventory was conducted in the park, and of the 7,914 total acres surveyed, nonnative vegetation was found on

7,189 of those acres (YNP, 2020). Nonnative plants including cheatgrass, desert alyssum, annual wheatgrass, spotted knapweed, houndstongue, dalmation toadflax, and yellow sweetclover are commonly found in the park, and in some instances, are the dominate species. For example, nonnative crested wheatgrass and desert alyssium completely dominate the vegetation type in the Gardiner Basin, and while vast expanses of the park's higher elevations remain relatively free of nonnative plants, they are highly vulnerable to nonnative plant invasions (NPS 2013).

To further compound the increasing threat of nonnative invasive plants in the park, current data indicates that warming temperatures and changes in precipitation patterns over the past century are affecting native plant communities, and the climate is becoming more favorable to further expansion of invasive species (YCR 2018). Forecasts predict warmer, drier summers with earlier peaks in the growing season and more frequent droughts. This trend towards warming temperatures could accelerate the spread of invasive plants, change the composition of plant communities, and alter natural disturbance regimes such as fires.

Ongoing and upcoming projects involving ground disturbance throughout the park contribute to the introduction and/or proliferation of nonnative plant species, and can also contribute to the direct loss of native plants, resulting in the deterioration of native plant communities. These activities include road construction projects such as the replacement of the Lewis River and Yellowstone River Bridges, reconstruction of road segments including Norris to Golden Gate, Northeast Entrance to Tower Junction, and from Old Faithful to West Thumb; as well as major construction projects outside of road corridors including the redesign of the Fishing Bridge RV Park, and NPS and Concessions Housing Improvement projects. The park works to restore native vegetation through revegetation efforts where ground disturbance has occurred, but results of these efforts are mixed; a restoration goal of 100% native plant cover is often unrealistic because many nonnative plants are already present in most work areas. The park also mitigates the spread of nonnative plants through a variety of measures including control of construction materials entering the park, equipment inspections at park entrances, allowing only certified weed-free hay to be transported through the park, restrictions on the use of hay in the backcountry. In addition, the NPS uses herbicides to control the spread of nonnative plants in areas disturbed by ongoing construction and other ground disturbance activities.

Figure 10: Yellowstone Habitat Types



3.1.2 Impacts of No Action

Under the no action alternative, the fiber optic proposal would not proceed, and vegetation conditions and trends described in the affected environment would continue. The park would continue to prescribe mitigation measures to restore native vegetation and remove nonnative vegetation for ground disturbance activities.

3.1.3 Impacts of Proposed Action

Implementation of the proposed action would result in minor loss of native vegetation within existing road corridors and developed areas. Vegetation in these areas has been repeatedly manipulated over time by vehicles and machinery, and from ongoing construction projects within the developed areas of the park. The proposed action would result in approximately 46 acres of ground disturbance, limited to roads and road shoulders, which are already disturbed from either road cuts or fills from construction of the existing roadways, by on-going visitor use, or by road maintenance. There are few if any trees present in the road prism and therefore tree cutting or loss due to root damage is expected to be minimal and would affect individual plants but not overall plant community composition.

During installation, effects to native vegetation would include crushing by equipment or removal through excavation. Disturbance would be linear, following existing road corridors from the south entrance station to the north entrance station and on the east and west sides of the Grand Loop Road. Ground disturbance would not extend more than 10 feet from road pavement, and excavation of soil would include a width of up to two feet for conduit and six feet for maintenance holes, and to an average depth of 10 to 20 inches. Disturbance would occur where the actual plow line, or cut, is placed. The width of actual soil disturbance would be approximately 12-inches or less in good soils with no large buried rocks. In areas where buried boulders are discovered, the route would be adjusted slightly or the rocks would be excavated, which may lead to a wider area of disturbance. During installation, the inside track of the vibrating plow vehicle, which is six feet in width, would remain on pavement in most areas. The outside track of the vehicle would be off pavement and would likely crush or flatten some plants. This would limit ground disturbance to the smallest area possible to minimize impacts to soils and plants and limit the potential for the introduction and/or spread of nonnative, invasive plant species. The use of a vibratory plow for the majority of the installation would minimize the total surface disturbance. The plow would cause some uplifting of soil, which would cause root zone damage for plants on the edges of the disturbance, and some uprooting of plants. Such effects to vegetation would be mitigated within three growing seasons following revegetation efforts after project completion.

Plow disturbance in areas with nonnative plants could lead to further spread of nonnative plant species along the road edge. Linear disturbance along roadways is difficult to rehabilitate due to repeated disturbance and movement of seeds along the path of work, and also results in a seed source of nonnative species that can then be moved by wildlife, cars, and social trailing, when anyone/thing crosses the path of invasive species into the adjacent native communities. Approximately 187 miles of disturbance under the proposed action would provide opportunities for nonnative plants to invade intact communities and wildlife habitat. This project, in conjunction with other ongoing and future park road projects, will continue to provide opportunities for the spread of nonnative plant species throughout the park along road corridors. In addition, shifting growing seasons and warmer temperatures will accelerate the spread of nonnative plants into pristine plant communities adjacent to road corridors and degrade the quality of those communities.

The spread of nonnative plant species would be mitigated through implementation of project design measures and BMPs including, pre-installation herbicide treatment of the project area, keeping equipment clean and reseeding specific disturbed areas. Following installation, the park would spray herbicide or use

mechanical treatments on invasive species in the project area and would use BMPs (see Section 2.3) to enhance plant regrowth. Therefore, the impacts of this project on native vegetation are expected to be minimal. As a result, the proposed action would not have meaningful impacts on broader vegetation communities in the project area.

3.2 Visitor Experience

3.2.1 Affected Environment

Visitors from around the world come to Yellowstone each year to experience its wonders. Park visitation has consistently exceeded 4 million visitors since 2016 and this trend is expected to continue. Visitation is highly seasonal; June, July, and August are the months of highest use, with 50% of the park's visitors arriving in July and August. However, in the last decade, visitation during spring and fall has increased significantly. During the busy summer season, more than 13,000 vehicles can enter and exit the park in one day (Otak 2017). Similarly, the NPS and park partners have increased operations and staffing levels to keep up with the increasing number of visitors in order to maintain visitor expectations and services, provide emergency response, and protect park resources.

The reliability and available bandwidth of the park's telecommunications network affects visitor experience, and demand on the network far exceeds existing network capabilities. As mentioned in Chapter 2, the existing network consists of signals transported over microwave radio from Mammoth to Mount Washburn at a maximum bandwidth capacity of 240 Mbps, where the signal is divided into smaller parts and shared among the nine developed areas throughout the park interior. The current bandwidth capacity of 240 Mbps is profoundly inadequate, as a single modern smartphone requires an average minimum bandwidth of 5-12 Mbps, to as much as 25 Mbps, to successfully operate functions such as email, downloads, and text messaging (FCC, 2011). This existing bandwidth not only serves the voice and data needs of park visitors, but also the needs of park operations and management, park partner and concessionaire needs, and employee professional and personal requirements.

The lack of available bandwidth means that once inside the park, visitors do not have reliable access to the internet or cellular service for park information about road closures, wildfires, traffic delays or for general trip planning. Furthermore, because of limited bandwidth and locations for new wireless equipment on infrastructure, many locations in the park are served by only one cellular service provider; and visitors who do not have a contract with that provider do not have cellular service in the park at all.

Bandwidth capacity and quality of cellular service varies greatly by location. A visitor at Old Faithful may experience no cell phone service at all while a visitor at Canyon could experience excellent cellular service because these areas have different visitation patterns and infrastructure. Generally, wireless phone user's complaints increase concurrently with increased visitation, primarily during the months of June through September, when daily visitation overwhelms the capacity of the existing network. Seasonal complaints include the inability to make calls, inability or extreme latency in sending/receiving text messages, inability to open web pages, and dropped calls (De Young, Personal Communication, 2020). A network upgrade improved services to Mammoth and Canyon where satisfaction with wireless service is good or better, while Lake, Grant, and Old Faithful continue to be virtually inoperable throughout the day and night. Many users attempt to connect late in the evening or early in the morning with limited to no success.

A visitor use study conducted in the park from August 4 through August 14, 2016, gathered information about park experiences and satisfaction with park services and facilities (RSG 2017). Data collected from

a park-wide sample of visitors indicates that the majority of respondents consider the connectivity quality in the park to be either "poor" or "no service" at all (Table 3).

Table 3. Visitor Survey of Connective Quality

Connectivity Quality	Phone Calls	Text Messages	Sharing Multi-media	Internet Searches
No Service	25%	24%	33%	32%
Poor	28%	29%	27%	29%
Average	26%	26%	25%	24%
Good	17%	18%	12%	12%
Very Good	4%	3%	3%	3%

While the quality of service for personal electronic devices was rated "poor" by many visitors, using these devices was rated as relatively unimportant to visitors while in the park, with mean scores for importance falling below the midpoint of the importance scale (moderately important). Data collected suggests that making and receiving phone calls is the most important network service for visitors, followed by sending/receiving text messages, searching the internet, sharing to social media, and downloading NPS podcasts (Table 4; RSG 2017).

Table 4. Importance of Communication Types.

Use	Importance
Make/Receive Phone Calls	32%
Send/Receive Text Messages	30%
Internet Search	25%
Share Pictures/Video/Audio on Social Media	18%
Download NPS Podcasts	9%

Some visitors come to Yellowstone looking to disconnect from technology. Increasing trends in the global population and rapidly expanding network coverage areas make it increasingly difficult to find areas where modern technology does not exist. Despite rapid population growth in communities adjacent to the park, only a fraction of the park has access to a wireless network. The very limited data services provide excellent opportunities for visitors to disconnect. In addition, the existing microwave transport system towers and large antennas are positioned on ridgelines and prominent high points at various locations throughout the park, including on the summit of Mount Washburn and 28-foot high passive reflectors located within recommended wilderness. These structures are visible from road corridors, front-country attractions, and backcountry areas, and some visitors feel these installations degrade park scenery and/or their park experience.

Increasing demand on the existing network has severe impacts on the capabilities of NPS and park partners to sustain mission critical functions as well. Medical clinics located in the park must be able to share medical records between facilities and corporate offices, and to communicate with regional medical facilities and emergency vehicles such as air and ground ambulances. Concessions partners increasingly rely on modern lodging reservation systems, personnel management systems, and facility management maintenance systems to maintain NPS-assigned assets and provide adequate visitor facilities and services. NPS and park partners also require internet access for employees to assist in the retention of thousands of seasonal workers each summer. Fueling stations and stores in the park require efficient, reliable point of sales capability at fuel pumps and cash registers. Furthermore, the existing telecommunication system has little redundancy, which is critical for public safety and emergency operations. The link from Mammoth to Mount Washburn is an important communication hub that supports telephone, cell tower, data and internet connection, and public safety radio connection to Tower/Roosevelt, Canyon Village, Bridge Bay,

Lake Hotel, Lake Lodge, Grant Village, Old Faithful, Madison Junction, and Norris. The existing network is extremely volatile and any obstruction or equipment failure on the four antennas and three reflector panels along this link could result in a complete loss of signal, which can isolate locations within the park and prevent 9-1-1 calling from landline and cellular phones.

In order to address increasing demand on the telecommunications network, the park continues to explore opportunities to increase network capacity and improve performance as existing infrastructure allows. However, efforts to increase capacity through existing infrastructure only provides temporary relief, as the network again reaches capacity within months of upgrades. Locations for new equipment is limited to existing structures, but available space for new equipment on those structures have become increasingly scarce as equipment continues to accumulate. Presently, the park is working with internet providers to deliver Wi-Fi services in some developed areas, and the park has also approved an extension of a fiber optic cable from the South Boundary to the South Entrance Ranger Station and Administrative Area, and installed satellite internet in administrative areas. Projects of this sort produce compartmentalized benefits, wherein people in small areas or clusters of buildings see an improvement.

As visitation numbers continue to increase, more visitors will utilize park infrastructure along the road corridor. The 2016 visitor traffic study indicates that 34% of visitor groups spend less than one day visiting the park and 66% of visitor groups visited for one or more days. A follow up Transportation and Vehicle Mobility Study was prepared in 2017 to collect and analyze data related to traffic and parking conditions in the park in order to provide a foundation for future visitor use management and transportation planning. That study found that traffic delays were most common near major parking lots and pullouts (Otak 2017), with the longest delays likely to occur in late July and early August which is the busiest time of year. Ongoing and future roadway construction projects contribute to visitor experience impacts. These projects include the replacement of the Lewis River Bridge and Yellowstone River Bridge, road segment reconstruction from Norris to Golden Gate, Northeast Entrance to Tower Junction, and Old Faithful to West Thumb, and parking lot renovations at Norris Geyser Basin and Midway Geyser Basin. These projects are expected to result in minor to significant traffic delays, and complete closures of certain segments resulting in detours and traffic congestion in various areas throughout the park.

3.2.2 Impacts of No Action

Under the no action alternative, the fiber optic proposal would not proceed, and visitor experience and trends described in the affected environment would continue.

3.2.3 Impacts of Proposed Action

Under the proposed action, the park would permit the installation of fiber optic cable along 187 miles of roadway within the park. Implementation of the proposed action would lead to an increase in available bandwidth capacity in the park from 240 Mbps to a theoretical bandwidth capacity of over 72 million Mbps. The increased bandwidth capacity would drastically improve the quality of wireless connectivity for visitors inside developed areas within the park, where connectivity is currently poor or non-existent. The proposed action would also provide opportunities for the park to offer separate network systems to NPS, park partners, and concessionaires, and may also allow for additional service providers. The fiber optic cable would provide greater redundancy, which would increase network reliability critical to visitor safety and emergency operations such as the use of 9-1-1 and incident communication and response. Improved data bandwidth in developed areas across the park would enable the NPS to disseminate information about traffic, road conditions, closures, and wildfires with greater speed and reliability, and could also be used to disseminate educational information in more ways. Mission critical operational capabilities such as telephone, email, electronic transactions, and internet would vastly improve, and

would ultimately allow for visitors in developed areas to use the cellular network to make and receive phone calls, access park information, and use the internet.

The proposed action would result in minor traffic delays during construction. Rolling one-lane traffic restrictions would likely occur at multiple locations in the park, depending on how many crews are in the field, and would typically last five to ten minutes, with a maximum anticipated delay of 30 minutes. These delays may contribute to longer delays at a parkwide level, where there could be one or more hours of delays on a given day depending upon the route selected and the number of active road projects. The majority (66%) of visitors spend one or more days in the park, so they may be inconvenienced by additional traffic or slowdowns on multiple days. For visitors who spend a day or less in the park, their experience may be primarily affected by additional traffic delays and congestion. For those visitors, delays and congestion could prevent them from seeing some of the attractions they want to see during their brief visit. The worst conditions are likely to occur in late-July and early-August during the busiest time of the year. Since weekdays tend to be busier in the park than weekends, traffic congestion would likely be highest during weekdays.

Visitors may also be affected by visual and acoustic impacts during construction. Intermittent construction noise, comparable to normal vehicle traffic noise, in the 70 A-weighted decibel (dBA) range, would be audible in the immediate area where equipment is operating, which may affect opportunities for visitors to experience solitude, naturalness, and undeveloped attributes they expect to discover in a national park. Impacts would be limited to the immediate area of construction and would be similar to impacts caused by normal vehicle traffic and other construction activities along the road corridor. As mentioned in Section 2.2, staging of all construction equipment related to the proposed action would occur within administrative areas outside the typical viewshed provided to visitors traveling along roadways, trails, and in developed areas.

In areas with improved connectivity, visitors may increase their use of devices for route finding, trip planning, general information, and for personal communications. Visitors who appreciate the relative isolation they experience from limited connectivity in the park may be negatively affected by an increase in those capabilities. For those visitors, it may become increasingly difficult to disconnect from technology and to find opportunities to experience solitude. Some visitors may also experience more people talking on phones, texting, and using tablets and other electronic devices which may have adverse effects on their park experience. Those visitors seeking a more primitive experience may choose to pursue activities in less developed areas and/or may report lower levels of satisfaction with their visit, or they may avoid coming to Yellowstone altogether. However, the proposed action would not increase the size of existing coverage areas within the park and it is unlikely that visitors outside of developed areas would be impacted by the proposed action.

Additionally, implementation of the proposed action could allow the park to remove obsolete telecommunications equipment from highly visible areas such as Mount Washburn and Bunsen Peak, and from recommended wilderness. Removal of this equipment would improve visitor experience and wilderness character, however, any future actions pertaining to the decommissioning and removal of equipment as a result of the proposed action would be subject to additional compliance and MRA reviews, and other pertinent laws and regulations.

To minimize potential impacts to park visitors, variations on construction timing may be considered, such as implementing daily construction activity curfews in specific areas or ceasing operation of construction equipment on busy holiday weekends. Implementation of measures described in Section 2.2, would assist in preventing impacts caused by construction of the proposed action on visitor experience. Furthermore, the park would not expand existing network coverage areas. As a result, the proposed action would not

have meaningful impacts on visitor experience in the project area and overall, and would result in a substantial improvement to the availability of telecommunications services to visitors.

4. COMPLIANCE REQUIREMENTS, CONSULTATION, AND COORDINATION

Agencies and organizations consulted in development of this document are listed below:

- Wyoming State Historic Preservation Office, Cheyenne, Wyoming
- Montana State Historic Preservation Office, Helena, Montana
- United States Fish and Wildlife Service, Wyoming ES Field Office, Pinedale, Wyoming
- Yellowstone's 27 associated tribes:

  Assiniboine & Sioux Tribes, Fort Peck
  Blackfeet Tribe
  Cheyenne River Sioux Tribe
  Coeur d'Alene Tribe
  Comanche Tribe of Oklahoma
  Confederated Salish and Kootenai Tribes
  Confederated Tribes of the Colville Indian Reservation
  Confederated Tribes of the Umatilla Indian Reservation
  Crow Creek Sioux Tribe
  Crow Tribe
  Eastern Shoshone Tribe
  Flandreau Santee Sioux Tribe
  Gros Ventre and Assiniboine Tribes
  Kiowa Tribe of Oklahoma
  Little Shell Tribe of Chippewa Indians
  Lower Brule Sioux Tribe
  Nez Perce Tribe
  Northern Arapaho Tribe
  Northern Cheyenne Tribe
  Oglala Sioux Tribe
  Rosebud Sioux Tribe
  Shoshone-Bannock Tribes
  Sisseton-Wahpeton Sioux Tribe
  Spirit lake Sioux Tribe
  Standing Rock Sioux Tribe
  Turtle Mountain Band of Chippewa Indians
  Yankton Sioux Tribe

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APPENDIX A – ALTERNATIVES CONSIDERED AND DISMISSED

Two alternatives were considered for installation of a data network to provide the high-speed capacity needed within the park: 1) upgrading and reusing the park's existing microwave and copper network; or 2) Satellite Internet Service. The first alternative was dismissed because the existing microwave and copper network is in poor condition. Upgrading the existing system would not fully meet current demand and would be grossly insufficient as visitation grows. With continued reliance on microwave radio infrastructure, the park would always have antennas, reflectors, and equipment rooms located in highly visible locations, in recommended wilderness, and on the summit and fire lookout of Mount Washburn, which is not optimal because these degrade the park's scenic values.

The second alternative of using satellite service providers has severe limitations due to the latency (600 millisecond delay) in geostationary satellite applications, costly and limited data plans, speed limitations, high cost of service, and lack of reliability due to geostationary and geosynchronous orbits being blocked by terrain and vegetation, and the visibility of satellite dishes. New non-geosynchronous very low orbit satellite systems solve the latency issue but are prohibitively expensive and untested. For the reasons mentioned, this alternative has been dismissed from further analysis.

APPENDIX B – YELLOWSTONE VEGETATION MANAGEMENT GUIDELINES

Revegetation efforts within the park have focused on careful management of topsoil as an available growing medium and seed source. This is based on a park policy that seed obtained from sources outside the park will contaminate the park gene pools. It also recognizes that regeneration occurs readily from mychorizae and seeds within the organic layer of soil in this environment. Although it is a conservative method, the topsoil management approach has worked well. All construction work within the park involving ground disturbance, which has received clearance, should follow the criteria for revegetation accepted by the park.

CONSTRUCTION REQUIREMENTS

General

- All construction will be limited to that area necessary to complete required work. All activities, including vehicle or material use or storage, or equipment washing will not be allowed outside the predetermined construction zone. The topsoil needs to be removed before any vehicles travel through an area, and the same tracks should be used to prevent compaction in other areas. Compacted zones must be treated (raking, aerating, and replacement of topsoil) to assist revegetation.
- Excavation and rehabilitation will be handled in manageable sections, which reflect changes in the soil and vegetation.

Cleaning Equipment

- All equipment, including heavy equipment and hand tools, shall be cleaned and free of seeds and seed-carrying soil, debris, and mud to prevent the spread of exotic and/or invasive weeds. Equipment shall be cleaned prior to entering the park and prior to transporting between construction sites (generally > 1 mile apart) within the park. Equipment shall be pressure washed within the identified boundaries of construction.

Clearing and Grubbing

- Trees and shrubs are to be avoided if possible during trenching or excavation. Such vegetation shall be removed and replaced in a manner which least disturbs the topsoil. Pushing trees over with heavy equipment, disturbing the root systems, or performing grubbing operations shall not be permitted until topsoil is conserved. Any deviation must be approved by the park. To avoid impacts to migratory birds during the nesting season, all tree removal should occur prior to March 1. If you are within the March 1 to August 15 window, contact the Bird Program Manager at 307-344-2218 to schedule a survey prior to tree removal.

Topsoil Removal

- Topsoil refers to the uppermost soil horizon, usually darker in color, in which the majority of roots grow. It is usually found in the top 2-6 inches. In areas where there is no darker layer, the top 2-4 inches will be treated as topsoil. Topsoil will be removed and returned to the same area. Live vegetation less than 3 feet in height and limbs less than 2 inches in diameter may be incorporated as topsoil in the stockpiles. Care will be taken to assure that topsoil and fill material are not mixed and are stockpiled in separate areas (i.e., topsoil to the right of the trench and fill to the left). All excess fill shall be removed from the park and disposed of by the contractor.

- Due to the limited amount of material available for topsoil in Yellowstone and the need to establish the best growing medium possible to revegetate the roadside, non-conventional methods will be required to excavate, stockpile, and place the conserved material. Equipment capable of excavating small, isolated pockets of soil; working around areas of designated vegetation or tree stumps prior to the grubbing operations; and placing material on slopes and in pockets on rock ledges will be required.

Topsoil Handling

- Sections will be rehabilitated as soon as possible. Topsoil may not be stockpiled over the winter or for longer than three months in sagebrush/rabbitbrush zones or longer than six months in grass and tree dominated zones. Any deviation must be approved by the park.

- Topsoil may not be used as bedding material. Separate bedding material must be obtained from sources approved by the park.

Topsoil Placement

- Conserved topsoil shall be spread a minimum of 2 inches in depth, (in a mixture of topsoil and vegetation associated with the topsoil) and will be reworked over the site in a manner, which preserves the seed source while spreading the soil over the area. If the conserved quantities of topsoil are not sufficient to obtain the designated depth, then the lower one-third of the embankment slopes and the least visible portions of the cut slopes shall be eliminated for topsoil requirements.

- On rock slopes, topsoil shall be placed into depressions, pockets, and on ledges to establish areas for planting and special vegetation. Special equipment and manual methods may be required to obtain the workmanship desired for revegetation.

- All conserved topsoil shall be utilized on the disturbed slopes if possible. The contractor's grading operations shall be so coordinated that topsoil is replaced on the slopes within three to six months of stockpiling; however, stockpiling of topsoil over the winter will not be permitted.

- No topsoil will be imported from outside the park or moved internally within the park unless approved by the park. The source of any imported material (e.g., bedding) must be checked for exotic plants and seeds.

- After spreading of topsoil has been completed, large clods, loose stones larger than 12 inches, stumps, and large roots shall be removed from the site. Stones smaller than 12 inches that are

firmly embedded in the topsoil may be left on the finished slopes. All stones protruding more than 4 inches and within 6 feet of the road shoulder shall be removed from the site.

Post Construction

- Park resource management personnel will monitor the disturbed areas for encroachment of exotics when construction has finished. The length of monitoring will depend upon the extent of disturbance and concentrations of exotics in the area.

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APPENDIX C – IMPACT TOPICS DISMISSED FROM FURTHER ANALYSIS

The following impact topics were dismissed from further analysis because they are not of critical importance to this proposal, do not exist in the project area, would not be affected by the proposal, or through the application of mitigation measures there would be no measurable effects from the proposal.

Air Quality & Green House Gas Emissions - The park is designated as a Class I air quality area under the Clean Air Act, with the highest level of protection that allows only a small amount of additional air pollution. Air pollutants (i.e., ozone, nitrogen, sulfur, and mercury) directly impact the park by reducing visibility, contaminating vegetation, soils, and surface waters, as well as disrupting lifecycle and behavior patterns of certain wildlife species. Use of construction equipment would result in a small increase of greenhouse gas emissions (GHGs) in the project area, including an increase in vehicle exhaust, emissions, and fugitive dust during the construction period from April to November over a three-year period. Less than two dozen construction vehicles would likely be needed (depending on number of crews operating simultaneously). These vehicles would be maintained in proper working condition in order to minimize air emissions. There would also be minor dust emissions from construction activities like trenching and digging maintenance holes during the construction period. Traffic delays in and around the project area would result in some vehicle idling but this would have only a temporary, localized effect on air quality. Periodic use of various types of equipment (e.g., excavators and trucks) during the construction period would produce emissions that would be very small relative to those produced from visitor travel throughout the park and would make an inconsequential contribution to the park's overall emissions profile. Any increase in GHGs would cease once construction is complete; therefore, no lasting effects are expected. For the reasons outlined above, this topic has been dismissed from further analysis.

Cultural Resources - The Area of Potential Effects (APE) for the project includes approximately 187 miles of a 50-foot-wide area along both sides of the proposed route, encompassing approximately 2,183 acres. Approximately 99% of the project area (approximately184 of the 187-mile route) has been surveyed; approximately 2.7 miles were not surveyed due to safety issues related to steep slopes with no shoulders or cliff edges, or in areas where there were bridges (NWRC 2020). A total of 14 cultural resource sites were recorded as a result of the survey for this project. Of these, 11 are previously recorded and three are newly recorded. The 11 previously recorded sites consist of the Nez Perce Trail, which is a National Historic Trail, one historic fire lookout, two historic dumps, and seven prehistoric lithic scatters[5] (NWRC 2020).

Of these 14 sites identified in the APE, three sites were previously unevaluated for listing in the National Register of Historic Places (NRHP), two sites were previously unevaluated for listing in the NRHP but are recommended eligible for listing in the NRHP under Criterion D, and three new sites were recommended as not eligible for listing in the NRHP. The sites recommended eligible for listing in the NRHP are located on both sides of the Grand Loop Road and would be avoided by placing the fiber optic cable in the roadbed. An archaeological monitor who meets the Secretary of the Interior's Standards would be present during any ground disturbing activity at all of these sites.

The project area is also adjacent to existing historic districts. The proposed fiber optic route parallels the Grand Loop Road Historic District and the proposed South Entrance Road and North Entrance Road Historic Districts (Figure C-1). The Grand Loop Road Historic District is included on the NRHP under Criteria A, B, and C. The proposed South Entrance Road and North Entrance Road Historic Districts are eligible for the NRHP under similar circumstances to the formally listed Grand Loop Road Historic District. There would be some temporary noise and visual intrusions during construction that would affect

[5] A lithic scatter is a surface scatter of cultural artifacts and debris that consists primarily of chipped or flaked stone debris produced during flaked-stone tool manufacture.

setting and feel, but the proposed action would not adversely impact or result in a loss of integrity to the defining characteristics of these roads. This project would not have an adverse effect to the National Register eligibility of the Grand Loop Road Historic District, or the proposed South Entrance Road and North Entrance Road Historic Districts, as the importance of the roads lie not within the roads themselves, but in the vision of a fully integrated road system, and in the feeling, design, location, and setting to impart to the visitor the qualities of a "park road."

Underground utilities are common within the Old Faithful Historic District, Canyon Village Historic District, Canyon Service Area Historic District, Tower Junction Ranger Station Historic District, Roosevelt Lodge Historic District, Bunsen Peak Historic District, Mammoth Hot Springs Historic District, Fort Yellowstone National Historic Landmark, and the western perimeter of the Obsidian Cliff National Historic Landmark, and do not detract from the integrity of these areas. The areas to be impacted within these historic districts are all previously disturbed, and archaeological resources are not anticipated to be disturbed or destroyed because they would be avoided.

A number of bridges are located in the project area, including some that are historic. Bridges of the design and vintage found in the project area are generally ineligible for inclusion on the National Register, however, some of the bridges located within the historic districts in the project area are contributing features. The Crawfish Creek is a contributor to the proposed South Entrance Road Historic District. Fishing Bridge is a contributor to the Fishing Bridge Historic District, and Beryl Springs Bridge and the Gardiner River High Bridge are contributors to the Grand Loop Road Historic District. All bridges would have bridge attachments added to run the conduit and fiber optic cable underneath the bridge. Because bridge attachments would be designed and painted to retain the historic character of the existing bridge in accordance with the Secretary of Interior’s Standards on Historic Preservation there would be no adverse impacts to the bridges.

Installation of fiber optic cable along the shoulder of the Chittenden Service Road would be tied to existing utilities at the fire lookout atop Mount Washburn. Although project activities as proposed would occur within the current boundaries of the site, the installation of the fiber optic cable would not alter the appearance or location of this site. Similarly, the installation of the fiber optic cable would not affect the setting of the site as it would be constructed underground and would not be visible. Therefore, the project activities would result in no adverse effect to this site.

The path of the Nez Perce Trail, which is a National Historic Trail, crosses the Grand Loop Road. The trail would be avoided by placing the fiber optic cable in the roadbed. In areas such as this where cultural resources are present on both sides of the road, the fiber optic cable would be installed at a shallower depth to ensure it is seated only in existing road fill. This would apply to one of the sites that has been determined eligible for listing in the NRHP and another site that is recommended eligible for listing in the NRHP with no Wyoming SHPO concurrence; both of these sites would be avoided by placing the fiber optic cable in the roadbed.

Historic Structures - No historic structures are located in the APE for direct effects, which will be confirmed in consultation with the Wyoming and Montana SHPOs. Therefore, this topic is dismissed from detailed analysis.

Overall, impacts to cultural resources would be avoided because construction activity would occur almost entirely in the existing road prism, where previous disturbance has occurred. The alignment of the fiber optic conduit and location of maintenance holes has been planned to avoid direct impacts to all sites of cultural importance discovered during surveys. This has been achieved by shifting the location of the fiber line from one side of the road to the other or by placing the cable in the roadbed itself. Furthermore, no equipment, vehicles, or staging areas would be located within cultural resources sites. Therefore, the proposed action would result in no historic properties affected, and no avoidance or further work is necessary.

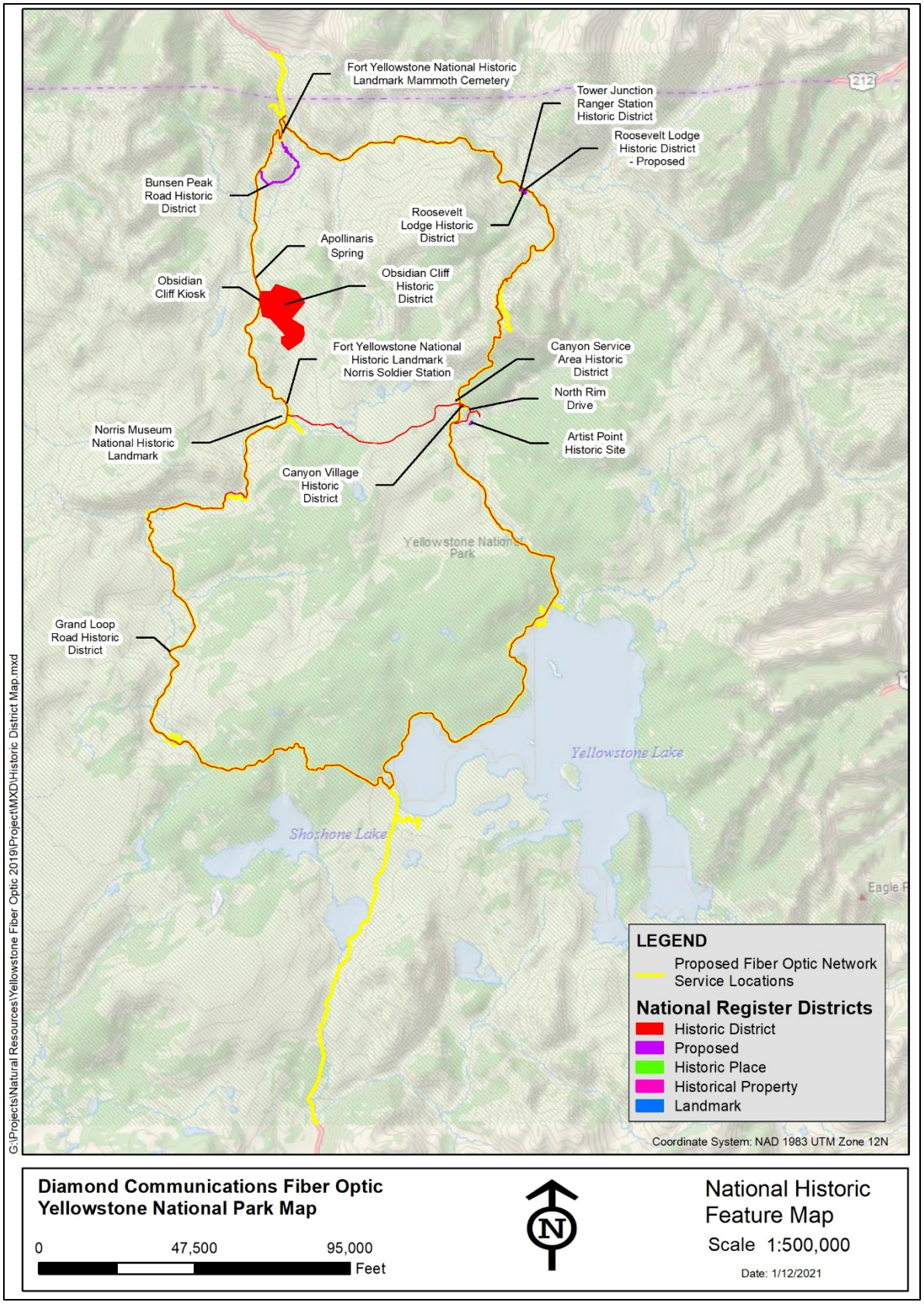

Figure C-1. Historic Districts.

Environmental Justice - Executive Order 12898, *Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations*, requires federal agencies to analyze potential impacts to minority and low-income populations, including human health and environmental effects, resulting from their activities. The goal of Executive Order 12898 is to ensure activities that affect human health and the environment do not discriminate against minority or low-income populations. Because the fiber optic cable would be available for use by all people regardless of race or income, and the construction workforce would not be hired based on race or income, the project would not have disproportionate health or environmental effects on minorities or low-income populations. This issue is dismissed from further analysis.

Ethnographic Resources - The NPS has previously consulted with the park's 27 associated tribes regarding the location of any ethnographic resources within the park. The NPS has not been made aware of any ethnographic resources in the project area. Associated tribes will be notified of this proposed action and will be given an opportunity to comment on the EA. Additional consultation will occur as needed. Because the park has no knowledge of any ethnographic resources that would be affected by the proposed action, this topic has been dismissed from further analysis.

Fish and Wildlife - The park is home to roughly 2.2 million acres of habitat and a wide variety of wildlife, including many large mammals such as bison, elk, moose, antelope, grizzly and black bears, big horn sheep, deer, mountain lions, coyotes, and wolves. A variety of other small animals and birds, including migratory bird species, are also present. Wildlife and bird species are often present near roads and are accustomed to high volumes of vehicles and visitor use. Individual animals may be temporarily displaced from the immediate area while construction equipment operates. Displacement of individual animals would occur as the equipment proceeds with installation along the road edge, thus impacts to animals in a given location would only last from several hours to a couple of days depending on conditions. Because construction activities would occur in high-use, high-traffic areas and during the season of highest visitation, and because construction activities would last no more than several hours to a day or two in a given location, the operation of construction equipment in the project area is expected to have little if any impact on wildlife.

Birds, including migratory bird species, could be temporarily disturbed and displaced from the project area during installation activities due to noise and increased human presence. Although some birds may be accustomed to high volumes of vehicles and visitor use, the vegetation adjacent to the road where disturbance would occur does not represent good quality habitat because of the existing level of disturbance. No tree cutting is proposed as part of the proposed action, but if tree removal is necessary, a survey for nesting birds would be completed prior to construction, and trees found to have active nests would not be removed, further reducing the potential for impacting nesting birds. Bird vocalizations when trying to find mates could be muffled and potential nesting sites near this activity may not be used. However, due to the rolling nature of the project installation, birds with active nests would be unlikely to abandon nests and impacts to bird vocalization would only last from hours to a day or two in a given location, and any impacts to nesting success would only affect individual birds and not overall populations of bird species in the park.

Rivers and lakes adjacent to the park's road corridor support populations of mountain whitefish, Yellowstone cutthroat trout, lake trout, brook trout, and brown trout. Construction activities may result in erosion of soils or infiltration of loose soils into adjacent waterways. However, erosion control devices such as silt fences and wattles would be used in areas where there is the potential for sedimentation to waterways, such as where streams are immediately downhill of the installation. Thus, any effects on fish would likely not be measurable after mitigation measures are implemented.

Overall, the project area has high traffic and high levels of visitor use, and animals who frequent roadside areas are likely accustomed to human presence. There would be some temporary habitat loss from vegetation disturbance and displacement of individual animals is possible in areas while construction

equipment is in operation. However, habitat in the project area is inconsequential compared to what is available in the surrounding areas and the park as a whole. For the reasons discussed above, the proposed action would not affect wildlife, fish, or birds beyond the installation period. Therefore, this impact topic has been dismissed from further analysis.

Floodplains - Executive Order 11988, *Floodplain Management*, requires federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. No modification of a floodplain area is proposed. The width of any of the floodplains in the project area would not change. The project would not change the course of river channels, force them to re-occupy former channel segments, or inundate the channel's floodplain. The project would not cause debris loading in any river channel or floodplain or create new aboveground encroachments into floodplains. Mitigation measures would be in place to minimize impacts to riverbank stability and reduce the potential for erosion during the project and after completion. Therefore, the project does not require a floodplain risk assessment or statement of findings per NPS policy, and this topic is dismissed from further analysis.

Geothermal Resources - Yellowstone National Park was originally set aside because of its geothermal wonders- the planet's most active, diverse, and intact collection of geothermal, geologic, and hydrologic features and systems and the underlying volcanic activity that sustains them. The park is world-renowned for its hot springs, geysers, mudpots, and fumeroles, resulting in annual visitation surpassing more than 4 million visitors. Over 460 miles of roads have been built since the creation of the park, including the Grand Loop Road, entrance spurs, and developed areas. Roadways in the park have been designed and routed to avoid traversing known geothermal resources, and in some instances have been redesigned or relocated in response to dynamic geothermal features. Construction of park roads generally consist of a road surface built on top of engineered fill material comprised of rock, gravel, and soil fill, which elevates the road above the surrounding terrain and resources, and insulates roadways from elevated soil temperatures.

The park has identified all surface geothermal resources and features in the project area, and the design has taken these features into consideration to avoid potential impacts. The fiber optic cable would be placed along existing roadways, confined within the engineered road base (Chapter 2, Figure 7); meaning that although the cable would be buried, impacts to resources would be avoided because the soils in which the cable would be located are soils that have been engineered and placed there previously as part of the existing roadway structure. In locations where geothermal resources are present, such as along the Geyser Basin road segment, the cable would be placed at a shallower depth, not to exceed a depth of 10" below the road surface (see typical installation sketches, Figure 8 in Chapter 2). Trenching in these areas would require asphalt cutting in order to place the cable below the road surface, and in some instances, directional drilling would be used to shift the cable alignment from one side of the roadway to the other. However, directional drilling would only be used in advance of a thermal area to proactively shift the cable alignment to avoid a feature, and would not be used within or directly adjacent to a thermal feature.

In areas with significant geothermal activity, particularly at Old Faithful, the proposed project route would avoid areas containing active thermal features and elevated soil temperatures to the maximum extent possible. Cable would be installed in areas that have been identified as either having some potential for future thermal activity, or areas with no evidence of thermal activity at all. However, some structures, such as the Old Faithful Inn, the Lower General Store, and the Lower Gas Station, are located within an area that has active geothermal features and elevated soil temperatures. To avoid impacts in these areas, the park would require site-specific geothermal investigations prior to cable installation, in addition to the other mitigation measures outlined in this assessment. If impacts to resources cannot be avoided through these mitigation measures, the park would require the Applicant to provide a suitable alternative that would maintain the telecommunications capability otherwise provided by fiber optic connection, while also avoiding ground disturbance resulting in impacts to thermal features.

The approximately 575 maintenance holes and 35 pull boxes that would be installed as part of the proposed action (described in Chapter 2, Figure 9) would not be dug in or near surface features or areas with hot ground. In the unlikely event that geothermally active substrate is encountered, additional mitigation measures would be followed and details for avoiding impacts would be determined in consultation with the park geologist. Measures include stopping work in the immediate vicinity and contacting the park geologist if any of the following conditions are encountered: 1. A pre-existing hole in the ground the size of a basketball, or larger, 2. Standing or flowing water, either hot or cold, 3. Any concentrations of either carbon dioxide or hydrogen sulfide are measured, 4. If during excavation a red clay layer is encountered, or 5. Ground temperatures above 80 degrees Fahrenheit are measured (early morning). No installation would occur in previously undisturbed areas and there would not be any direct impacts to surface thermal features. Because geothermal resources would be avoided through project design and mitigation measures, this topic has been dismissed from further analysis.

Indian Trust Resources and Sacred Sites - Trust resources are those natural resources reserved by or for Indian tribes through treaties, statutes, judicial decisions, and executive orders, which are protected by fiduciary obligation on the part of the United States. The federal Indian trust responsibility is a legally enforceable fiduciary obligation on the part of the United States to protect tribal lands, assets, resources, and treaty rights, and it represents a duty to carry out the mandates of federal law with respect to American Indian and Alaska Native tribes. No trust resources would be affected by this proposal, and access to the park for tribes would not be affected. Sacred sites are those places having established religious meaning and as locales of private ceremonial activities. Through previous consultation efforts with tribes, the park has not been made aware of any Indian sacred sites in the project area. Therefore, this issue is dismissed from further analysis.

Lightscapes - Night work would not occur and the proposal would not result in new light sources. Therefore, there would be no impacts on lightscapes, and this issue is dismissed from further analysis.

Soils - Analysis of the proposed alignment indicates that an estimated 187 miles of fiber optic cable would be buried along roads within the park. Because the proposed alignment is located primarily within the existing road prism for the Grand Loop Road, the area has been disturbed in the past from either road cuts, fills, and/or road widening. Much of the roadside area is comprised of compacted soil, gravel, and rock with some native and nonnative invasive vegetation species present. Soil along the road edge is frequently disturbed by vehicles pulling to the edge of the road to watch wildlife, view scenery, and take photos. As a result of this frequent disturbance, the areas along the road edge are much less likely to exhibit pristine soils than areas outside of the road corridor.

There are a few areas in the park that are prone to slumping ground. High density polyethylene (HDPE) would be used as conduit for the fiber optic cable, and can tolerate movement and the conduit is expected to stretch and move with the ground if slumping or sliding occurs after installation. HDPE conduit exhibits permanent flexibility and bends and flexes without breakage over a wide range of temperatures, even with ground shifts or heaves (PPI 2018). If large-scale sliding occurs such that the road is damaged, the conduit would be inspected and repaired along with the road, if necessary.

Use of a vibratory plow for the majority of the installation would minimize the surface disturbance caused by the project due to the slicing action of the plow, rather than open trenching which requires far more soil disturbance. Use of plow and other motorized equipment would cause localized areas of soil compaction and soil disturbance on the surface (generally less than two feet in width). The soil disturbance would be restored immediately after placement of conduit or maintenance holes to enhance regrowth. Then topsoil conservation measures would be employed in accordance with Yellowstone's Vegetation Management Guidelines (see Appendix B).

BMPs for erosion control are expected to minimize the potential for adverse impacts to soils in and around the project area. In areas adjacent to wetlands, rivers, streams, and stormwater inlets, temporary erosion/sediment control measures would be placed. Mitigations are described in detail in Section 2.3. In

some cases, organic cover (mulch, wood chips, etc.) would be placed over disturbed soil until the following growing season. Trenching equipment would make a cut in the ground 4 to 8 inches wide, with standard depths in the road shoulder of approximately 20 inches and shallower in areas with known resource concerns. Because soil disturbance would be shallow in depth, minimal at the surface, and confined entirely to previously disturbed road prisms or areas immediately adjacent, this topic is dismissed from further analysis.

Soundscapes - Sounds in the project area are a mix of natural and man-made noise. Natural sounds may include wind, wildlife, and moving water, but in road corridors, visitors also regularly experience the sounds of automobiles and buses, generators, motorized equipment, and other people. Human-caused sounds would increase in the project area during the construction window (April–November), including the sounds of mechanical equipment, vehicular traffic, and construction crews. Operation of vibrating plows would not cause substantially more noise than normal vehicle traffic such as buses, cars, and motorcycles. Intermittent construction noise in the 70 A-weighted decibel (dBA) range would be comparable to vehicle traffic noise, and would be audible in the immediate area where equipment is operating. Increased noise from operation of installation equipment would only be temporary, lasting no more than three construction seasons. Periodic use of vibrating plows, skid steers and similar equipment during the construction seasons would make an inconsequential contribution to the overall soundscape profile of the project area. Because of the rolling nature of the project, increased noise would only be present in a given location for a few hours to a few days. Therefore, no lasting impacts to the park's soundscape would occur and this topic has been dismissed from further analysis.

Threatened and Endangered Species - Consultation with the U.S. Fish and Wildlife Service (USFWS) is ongoing for this project. Federally listed or proposed species and critical habitat identified by the USFWS that are known to occur or may occur in the park include Canada lynx (*Lynx canadensis*) and Canada lynx critical habitat, grizzly bear (*Ursus arctos horribilis*), and whitebark pine (*Pinus albicaulis*)[6] Mitigation proposed by the park for impacts on threatened or endangered species could include avoidance, minimization, and conservation measures as agreed upon by the USFWS.

Canada Lynx and Critical Habitat: The USFWS listed the Canada lynx as a threatened species under the Endangered Species Act of 1973 (ESA; 16 USC §1531 et seq.) in 2000 (USFWS 2000; 65 FR 16052) and they designated critical habitat for the species on February 27, 2009 (USFWS 2009). Critical habitat overlaps Lynx Analysis Units (LAUs) in the park. The project area intersects one LAU that was designated as critical habitat, the Tower Creek LAU located in the northeast section of the project area (Figure C-2). Surveys conducted from 2001 to 2004 documented one possible, two probable, and two definite cases of lynx presence in the park. None of the historical lynx detections are located near the project area and there is no current evidence of resident lynx within the park. While there is not a parkwide effort to detect lynx, none have been detected on the camera system that is set up in the northern part of the park for monitoring of other species. Any lynx that may occur, including in the project area, would likely be transitory (Dan Stahler, personal communication, May 14, 2020).

However, it is possible that individual lynx could cross the road as they travel through suitable habitat adjacent to the project area. Increased noise during construction may result in lynx temporarily avoiding construction areas, although construction noise would only be a marginal increase above ambient traffic noise in road corridors. Operation of vibrating plows would not cause substantially more noise than normal vehicle traffic such as buses, cars, and motorcycles. Intermittent construction noise in the 70 A-weighted decibel (dBA) range would be comparable to vehicle traffic noise and would be audible in the immediate area where equipment is operating. Transient individuals that avoid the area would be able to use ample surrounding habitat and this would not result in population level effects. Managers use the

[6] March 31, 2020 USFWS official species lists. Consultation Code: 06E13000-2020-SLI-0022 (Wyoming) and 06E11000-2020-SLI-0061 (Montana)

standards and guidelines provided in the Canada Lynx Conservation and Assessment Strategy (Ruediger et al. 2000) to gauge the effects of projects on lynx. Under the strategy, projects occurring outside LAUs have no effects on lynx. Projects inside LAUs may affect lynx, but not adversely, if the location occurs: 1) outside of lynx habitat; 2) in habitat currently unsuitable for lynx foraging; or 3) in lynx foraging habitat, but ample suitable habitat is otherwise available. Based on criteria outlined in the Canada Lynx Conservation and Assessment Strategy and the rare occurrence of lynx in the park, these impacts are discountable and the proposed action "may affect, but would not adversely affect" Canada lynx. Although one portion of the project area is located within designated critical habitat, the installation of fiber optic cable occurs within the existing road prism and would have "no effect" on designated critical habitat.

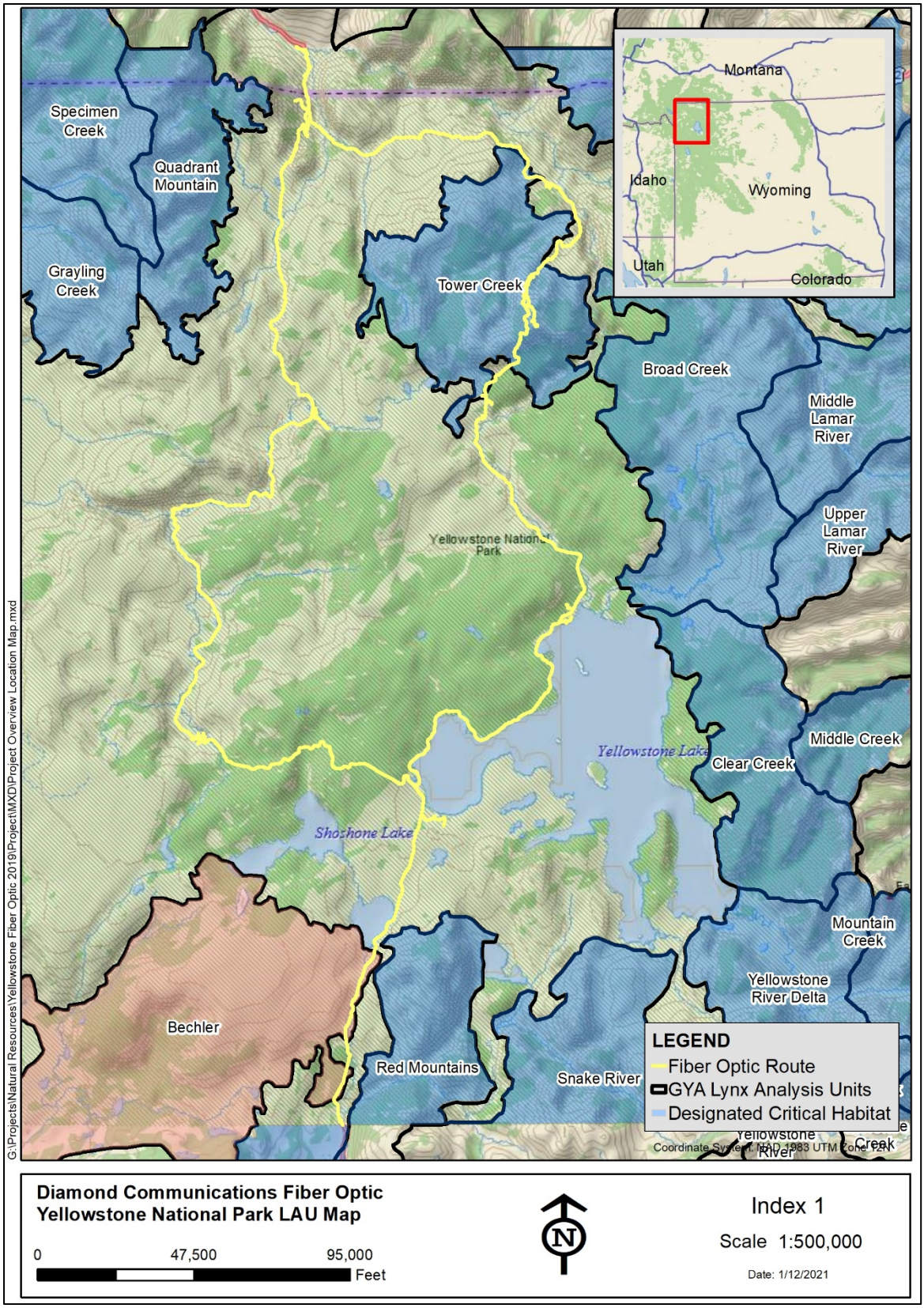

Figure C-2. Designated Critical Habitat and LAU Locations within Yellowstone National Park and Surrounding Greater Yellowstone Ecosystem.

Grizzly Bear: The Yellowstone grizzly bear population is currently listed as threatened under the ESA. Management of grizzly bears in the park has been successful in enabling grizzly bear recovery and reducing bear-human conflicts (e.g., property damage, incidents of bears obtaining human food, bear-inflicted human injuries) and human-caused bear mortalities in the park (Gunther 1994, Gunther and Hoekstra 1998, Gunther et al. 2000, Gunther et al. 2004). Grizzly bears continue to expand outward in the Greater Yellowstone Ecosystem with the greatest expansion occurring in the northern, eastern, and southern regions of the range. In 2018, all bear management units were occupied by female grizzly bears with cub of the year, and there were verified observations of females with young in at least four years of the 2012-2018 period (Bjornlie and Haroldson 2019). The proposed fiber optic route occurs within portions of multiple bear management areas (Gunther et al. 1998). Ongoing park activities may result in increased human noise and temporary displacement of individual bears or temporary alteration of feeding and other behaviors but would not have lasting effects because the actions are short in duration and confined to frontcountry areas. Within the park, some grizzly bears have become habituated to traffic noise and can be seen within feet of the road corridor. Grizzly bears are often observed traveling through the project area in the meadows along the road corridor or along the lake shore, in spite of the high traffic volume.

Installation activities under the proposed action would be restricted to previously disturbed areas associated with roads and developed areas within the park. Activities would occur within the road shoulder or roadbed along most of the proposed route. Thus, the installation would impact a narrow band of ground, generally within 10 feet of the edge of pavement. Noise from equipment operation and human presence would increase in these areas during construction. It is anticipated that activities would typically deter grizzly bears from using the same areas.

Noise and increased human presence during construction activities are expected to last less than a few hours in most locations, which may cause some individual bears to avoid the area. Some bears may continue to use adjacent areas even during active construction. As with all park construction projects, the NPS would direct the Applicant to manage food and garbage so that they are not available to grizzly bears and would implement other wildlife mitigations as outlined in Section 2.3. This project would not result in impacts on bear populations, breeding, or access to habitat, of which there is plenty surrounding the project area. The project area is located within high visitor use areas of the park and is not designated critical habitat. The area does not represent high quality habitat because of the number of visitors, vehicles, noise, and movement during the seasons of highest use. Therefore, the proposed action "may affect, but would not adversely affect" grizzly bear.

Whitebark Pine: On December 2, 2020, the U.S. Fish and Wildlife Service (Service) published a proposed rule (85 FR 77408) to list the whitebark pine as a threatened species under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.) (Act). Designation of critical habitat (CH) was deemed imprudent for the whitebark pine, hence CH was not proposed. Whitebark pine exist both as an overstory and understory component within the forest communities in many regions of the park, including forest areas within the project area. Whitebark pine populations in the park have been declining due to native mountain pine beetles (*Dendroctonus ponderosae*) and nonnative blister rust, which is caused by a fungus, *Cronartium ribicola* (Schwandt 2006). Whitebark pine trees are generally observed at elevations above 8,400 feet, and two sections of the proposed project, Craig Pass and Dunraven Pass, exceed that elevation. However, whitebark pine has not been identified within the project area, and thus, no impacts are expected to individual trees such as cutting or removal or root damage. Therefore, implementation of the proposed action is anticipated to have no effect on whitebark pine.

Visual Resources - Crews and equipment associated with this project would stay within road corridors and would not impede access to vistas or overlooks. Many visual intrusions are already present in road corridors such as vehicles, traffic control devices, equipment supporting road construction projects, and evidence of previous construction projects such as silt fences and mulch. The fiber optic cable would be buried below the surface, as would maintenance holes. The only surface evidence of this project after

construction would be the covers for maintenance holes, which would be below grade to blend with the environment. Therefore, this issue is dismissed from further analysis.

Water Resources - No impacts to surface waterways are anticipated from the project. The fiber optic cable would be installed in the road prism. Mitigations would be implemented to reduce potential for impacts to hydrologic conditions or water resources, including standard erosion control techniques such as installing erosion control wattles or sediment fences to minimize post-construction runoff and prevent degradation of wetlands and water bodies near the project area. All perennial and ephemeral drainages would be avoided as described in the project design measures. Perennial waterways would be crossed by attaching the fiber optic cable under existing bridges. Therefore, there is little if any potential for impacts to surface water resources or water quality and accordingly this topic has been dismissed from further discussion in this EA.

Wetlands - Wetlands are important for water infiltration and storage, as a nutrient source, and as waterfowl and other bird habitat. A survey of the project area was conducted in July and August 2019 to identify wetland areas located along the proposed fiber optic route. The delineation encompassed an area within 25 feet of the edge of soil on both sides of the road. The delineation identified 123 wetlands in the survey area that are identified in Appendix D. The dominant species present within the delineated areas are also listed in Appendix D. A complete list of species observed is contained in the Wetland Delineation Report, Diamond Communications Fiber Optic Line Installation, Yellowstone National Park (NWRC 2019).

The wetland delineation performed for the project determined that multiple segments of the initial fiber optic route were located within delineated wetlands; as a result, these were rerouted during the designing process to avoid impacts to wetlands, and/or alternative installation methods, such as boring, would be used. Design measures associated with the proposed fiber optic installation that would be implemented to avoid impacts to delineated wetland habitat include: 1) shifting the location of the fiber optic cable to the very edge of the pavement or to the opposite side of the road where possible; 2) directional boring under smaller wetlands; or 3) relocating the fiber optic cable within the road prism where wetlands occur on both sides of the road. As a result of these measures and others listed in Section 2.3, no wetlands would be impacted by the proposed action and this topic has been dismissed from further analysis.

Wilderness - Approximately 2,032,721 acres of the park have been recommended for wilderness designation. Although not formally designated by Congress, *NPS Management Policies 2006* Director's Order 41 requires the park to manage recommended wilderness areas in a manner that protects wilderness resources, character, and values. Implementation of the proposed action would not affect wilderness character or future wilderness designation, as construction would occur outside of recommended wilderness along roadways and in developed areas. Furthermore, the proposed action would not expand existing cellular network coverage areas established under the 2008 Wireless Communications Services Plan, and would not extend coverage into recommended wilderness areas. Therefore, this topic has been dismissed from further analysis.

APPENDIX D – WETLAND DELINEATION INFORMATION

Wetland locations were identified along the proposed route by identifying hydrophytic vegetation and the presence of hydrology and hydrophytic soils. Wetland indicators include a predominance of vegetation typically adapted for life in saturated soil conditions (hydrophytic); soils formed under saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions (hydric); and inundation of the area or soil saturated to the ground surface during all or a portion of the growing season (hydrology). The delineation identified 123 wetlands in the survey area (Table D-1). The dominant species present within the delineated areas are listed in Table D-2. A complete list of species observed is contained in the Wetland Delineation Report, Diamond Communications Fiber Optic Line Installation, Yellowstone National Park (NWRC 2019).

Delineation began at the closest point to the road (edge of soil) that was dominated by hydrophytic vegetation and extended out to a maximum of 25 feet from edge of soil. The area within 25 feet of the existing road was scanned for the presence of normal circumstances, A-typical situations, or problem areas associated with wetland characteristics. Areas that were outside of the 25-foot survey area or that were smaller than nine square meters were not delineated. The purpose of the survey was to identify wetland locations in order to modify the fiber optic cable installation route such that impacts to wetlands would be avoided.

The wetland delineation was performed using the USACE Wetland Delineation Manual (USACE 1987) Routine Method for five acres or less with onsite inspection and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (USACE 2008). Prior to the field visit, the USFWS National Wetland Inventory Digital Data website was reviewed for known wetlands in the project area (USFWS 2019) and the USDA Natural Resources Conservation Service website was reviewed for soils information (USDA NRCS 2019).

Within the Cowardin Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et al. 1979), six systems were found: palustrine forested (PFO), palustrine scrub-shrub (PSS), palustrine emergent (PEM), Lacustrine Littoral Aquatic Bed (L2AB), Palustrine Aquatic Bed (PAB), and riverine (R). Each classification exhibited slightly different water regimes.

Table D-1. Wetlands Delineated in 2019 by Segment.

Segment	Wetlands delineated	Features associated with the delineated areas
Madison Junction to Norris Junction	17	Wet meadows, seeps, streambanks, roadside ditches, and banks of the Gibbon River
Norris Junction to Mammoth Hot Springs	16*	Wet meadows, seeps, streambanks, lake shores, and roadside ditches
Old Gardiner Road between Mammoth Hot Springs and North Entrance	5	Drainages, ponds, and depressions containing wet meadows
Mammoth Hot Springs to Tower Junction	9	Wet meadows, seeps, depressions, roadside ditches, and overflow areas associated with Mammoth Hot Springs
Tower Junction to Canyon Junction	1	Rainy Lake
Canyon Junction to Fishing Bridge Junction	32	Wet meadows and other areas associated with the banks of the Yellowstone River

Fishing Bridge Junction to West Thumb	15	Wet meadows, seeps, stream channels, lake shores, and roadside ditches
Old Faithful Interchange to West Thumb	4	Scaup Lake, Isa Lake, a small pond, and a hillside seep
Madison Junction to Old Faithfull Interchange	14	Firehole River, Gibbon River, and Nez Perce Creek
West Thumb to South Entrance	10	Wet meadow, roadside ditch, and stream or river crossings

*Additional wetlands are present in this segment, but they were not delineated in 2019 because of ongoing road construction in a portion of this segment. Those areas have been noted in the project design and would be avoided.

Table D-2. Dominant Species Observed in Wetland Areas along the Proposed Route.

Common Name	Scientific Name	Indicator*
Alpine Nerve Sedge	*Carex neurophora*	OBL
Arrow Leaved Groundsel	*Senecio triangularis*	FACW
Baltic Rush	*Juncus balticus*	OBL
Basin Wild Rye	*Leymus cinereus*	FAC
Beaked Sedge	*Carex* utriculata	OBL
Brookgrass	Catabrosa aquatica	OBL
Bull Rush	*Scirpus acutus*	OBL
Cattail	*Typha latifolia*	OBL
Chairmaker's Bulrush	*Schoenoplectus americanus*	OBL
Coyote Willow	*Salix exigua*	OBL
Creeping Spikerush	*Eleocharis palustris*	OBL
Field Horsetail	*Equisetum arvense*	FAC
Foxtail Barley	*Hordeum jubatum*	FAC
Lodgepole Pine	*Pinus contortus*	FAC
Monkey Flower	*Mimulus guttatus*	OBL
Mountain Timothy	*Phleum alpinum*	FAC
Nebraska Sedge	*Carex nebrascensis*	OBL
Redtop	*Agrostis stolonifera*	FAC
Reed Canary Grass	*Phalaris arundinacea*	FACW
Squirrel Tail	*Elymus elymoides*	FACU
Smooth Brome	*Bromus inermis*	FAC
Sordleaf Rush	*Juncus ensifolius*	OBL
Tall Tumble Mustard	Sisymbrium altissimum	FACU
Timothy	*Phleum pratense*	FAC
Water Sedge	*Carex aquatilis*	OBL
White Clover	*Trifolium repens*	FACU
Yellow Lilly Pad	*Nuphar polysepala*	OBL

*****Categories developed and defined by the USFWS National Wetland Inventory and subsequently modified by the National Plant List Panel.
OBL - Obligate Wetland Plants: Plants that occur almost always (estimated probability >99 percent) in wetlands under natural conditions, but which may also occur rarely (estimated probability<1 percent) in non-wetlands.
FACW - Facultative Wetland Plants: Plants that occur usually (estimated probability >67 percent to 99 percent) in wetlands, but also occur (estimated probability 1 percent to 33 percent) in non-wetlands.
FAC - Facultative Plants: Plants with a similar likelihood (estimated probability 33 percent to 67 percent) of occurring in both wetlands and non-wetlands. This includes FAC+ and FAC- plants.
FACU - Facultative Upland Plants: Plants that occur sometimes (estimated probability 1 percent to <33 percent) in wetlands but occur more often (estimated probability >67 percent to 99 percent) in non-wetlands