THIS DOCUMENT WAS PREPARED FOR THE
NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION

FINAL
ENVIRONMENTAL ASSESSMENT
for
Recovery Act – Navajo Nation Middle/Last Mile Project: Quality Broadband for the Navajo People
BTOP Award No. NT10BIX5570055

Prepared for

National Telecommunication and Information Administration
Broadband Technologies Opportunities Program
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EXHIBIT E: Floodplain Map, Navajo Water Resources Evaluation Volume XII, Flood Plain, U.S. Bureau of Indian Affairs, Navajo Area Office, Window Rock, Arizona, June, 1977, Morrison Maierle, Inc.

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EXHIBIT M: Navajo Nation Historic Preservation Department, Window Rock, Arizona, Cultural Resources Compliance Form No. HPD-09-739 (DCRM 2009-49), issued August 25, 2009.

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EXHIBIT Q: Biological Resources Compliance Form No.: NNDF&WL Review No. 08/09/10A, Navajo Nation Department of Fish and Wildlife, P.O. Box 1480, Window Rock, Arizona 86515-1480, August 9, 2010.

ACRONYMS

Acronym	Definition
BIE:	Buck Institute for Education
CDP(s):	Census Designated Place(s)
EVDO	Evolution Data Optimized
FCC:	Federal Communications Commission
HSDPA:	High-Speed Downlink Packet Access
IO:	Isolated Occurrences
IUS:	In Use Sites
LTE:	Long Term Evolution
NAIHS:	Navajo Area Indian Health Service
NAPI:	Navajo Agricultural Products Industry
NPDES:	National Pollution Discharge Elimination Systems
OPGW:	Optical Ground Shield Wire
PACS:	Picture Archiving and Communications Systems
PNM:	Public Service Company of New Mexico
POP:	Point of Presence
QAM:	Quadrature Amplitude Modulation
QPSK:	Quadrature Phase Shift Keying
TCP:	Traditional Cultural Places
TDM:	Time-Division Multiplexing
TCRHCC:	Tuba City Regional Health Care Corporation
UMTS:	Universal Mobile Telecommications Systems
VPN:	Virtual Private Network

CHAPTER 1 EXECUTIVE SUMMARY

Purpose and Need

The Navajo Nation is a sparsely-populated, poverty-stricken rural area whose residents have fallen further behind the rest of the country in terms of access to digital and information technology. This inequity stems from both a lack of physical access to technology and the resources and skills needed to effectively participate as a digital citizen. Most of the Navajo Nation's residents have very limited or no access to digital and information technology and, therefore, find themselves on the wrong side of an ever-expanding digital divide.

The Navajo Tribal Utility Authority ("NTUA") is a non-profit enterprise established by the Navajo Nation Council to provide multi-utility services to the Navajo Nation and the Navajo People. Since 1959, NTUA has supplied electricity, water, natural gas, wastewater treatment, and photovoltaic (solar power) services to residents throughout the 26,000 square-mile Navajo Nation, which spreads across northeastern Arizona, northwestern New Mexico, and southeastern Utah. Although NTUA works hard to meet basic utility needs, the Navajo Nation continues to suffer from a lack of viable telecommunications infrastructure.

To help alleviate these problems, NTUA proposes to create and promote sustainable economic development and social benefits via the NTUA's broadband infrastructure initiative. The project, "The Navajo Nation Middle/Last Mile Project: Quality Broadband for the Navajo People" (hereinafter "the Project"), has an important cultural component as it will extend bandwidth to Navajo Nation Chapter Houses serving as community centers where political discussions, elderly care and early childhood education are carried out. Currently, Chapter Houses have limited extended services from central administration and educational institutions. Using technologies enabled only by broadband, the Project will allow Navajo communities to capture, record and share Navajo culture, including language, politics, lifestyle and religion. Navajo culture will be preserved, and in the process, the Navajo people will obtain access to participation in the digital revolution.

Project Description

The Project covers 15,120 square miles on Navajo Lands within Arizona, New Mexico and Utah, encompassing some 24,843 census blocks and 15 of the largest census-designated places ("CDPs") within the tribal boundary. The Project will enable wireless, fixed and mobile broadband access to 3,694 households and 1,000 businesses; it will also provide high-capacity connectivity on the combined middle-mile backbone to at least forty-nine community locations, of which twenty-five communities will have access via microwave and twenty-four communities will have access via fiber. The Project will provide access for a total of 1,039 critical facilities: tribal and federal facilities, including police, detention and fire response centers; health, social service and emergency care facilities; public schools, private schools and Buck Institute for Education ("BIE") facilities; and 100 tribal Chapter Houses. NTUA has consulted with numerous agencies and related organizations in developing the Project. *See* Appendix 2.

The Project will utilize NTUA's current utility infrastructure for the majority of the installation of the fiber backbone and NTUA has been approved by the United States Department of Agriculture Rural Utility Service ("RUS") to integrate the middle and last-mile network on NTUA's existing utility infrastructure, for which RUS maintains a security interest. On July 28, 2010, the Project received a notice from RUS that the construction of the Project, e.g., a broadband network utilizing fiber optic and microwave and wireless systems, last-mile, qualified for a categorical exclusion not requiring the preparation of an environmental report in accordance with 7 C.F.R. Part 1794.21 (b) (2,4). *See* Exhibit A.

The fiber infrastructure will be installed on existing power lines (aerial fiber). Approximately 704 utility poles will be replaced to accommodate the extra weight of the aerial fiber. This process will involve minimal disturbance of ground in the immediate vicinity of the existing poles. Furthermore, after replacement work is completed there is a formal inspection to ensure that the poles and surrounding area have been properly installed and maintained. Additionally, all poles within NTUA's utility system are placed in an inspection queue which is updated annually as part of utility maintenance and reporting.

Absent the pole replacement, there will not be any additional disturbance of ground to deploy the aerial fiber infrastructure. Installation of cables, electronics, huts, generators and any other ancillary equipment to support the aerial fiber will not involve disrupting subsurface conditions.

The replacement of 328 miles of static wire on existing 115 KV and 69 KV lines with 550 miles of 72-96 strands of OPGW and all dielectric aerial fiber optic cable on existing distribution lines lashed to the neutral or messenger will take approximately thirty months to complete. During Phase I, NTUA will install aerial fiber optic cable on its 69 KV Transmission line from a network POP in Farmington, NM to its Shiprock District Office located in Shiprock, NM; continuing south on its three-phase 25 KV distribution line from its Shiprock District Office to a network POP located in Yah-Ta-Hey, NM. During Phase II, NTUA will install aerial fiber optic cable on its 69 KV transmission line from Tohatchi, NM to its Coalmine substation near Window Rock, AZ; then on its 69 KV transmission line from Window Rock, AZ to Navajo, NM; continuing on its 115 KV line from its Coalmine substation to its Burnside substation near Burnside AZ; then northward on its 69 KV transmission line up to Round Rock substation in Round Rock, AZ; and finally looping around to the community of Tsaile, AZ on NTUA's 24.94 KV three-phase distribution line. During Phase III, NTUA will install aerial fiber optic cable on its 24.94 KV three-phase distribution line from Chinle's District Office located in Chinle, AZ to its substation near Forest Lake, AZ; continuing on its 69 KV line from its Forest Lake substation to its Kayenta District Office in Kayenta, AZ. An alternate proposed recommended route is to go north from Chinle on NTUA's existing 69 KV line via the communities of Rock Point, Mexican Waters and Dennehotso to Kayenta. During Phase IV, NTUA will install aerial fiber optic cable on its 69 KV transmission line starting from Burnside Substation, south to connect the Cornfields Substation, Sunrise Trading Post, Lower Greasewood Substation, and the Indian Wells Substation; then heading west on NTUA's 24.94 KV three-phase distribution line; and ending approximately 14.3 miles southwest of the Dilcon, AZ District Office, Near Indian Route

15 just past the Coyote Wash Bridge. During Phase V, NTUA will install aerial fiber optic cable on its three-phase distribution line from Kayenta Town Substation, AZ to a substation south of Red Lake, AZ; then heading southwest on the three-phase primary overhead distribution line to the community of Coal Mine Canyon, AZ. These phases are described in more detail in Chapter 3.

The integrated middle and last-mile network design will support point to point data services and large broadband connections for commercial carriers and government and institutional users alike. Additionally, a last-mile 4G Long Term Evolution ("LTE") wireless network will provide mobile and fixed broadband access for residents, businesses and government customers. The wireless network elements have been planned to minimize ground and environmental impacts to the greatest extent possible. In order to accomplish this objective the design (1) utilizes existing NTUA and other carrier tower infrastructure wherever possible and (2) locates new structures within NTUA utility compounds, which have successfully undergone EA clearances. Whenever these two approaches are not possible, new "Greenfield" sites have been selected that will have the least amount of environmental impact, i.e., relatively flat, cleared areas in close proximity to other development and void of vegetation and other natural features that have existing access routes.

The Project's wireless network will interface with the fiber backbone at least (6) strategic locations consider gateways from the wireless to the fiber but at other points extends microwave and LTE radio electronics to less populated and remote areas. A typical wireless site is no more than 100 x 100 ft and typically 50x50 ft in area; and incorporates a self-supported tower (between 60 – 180 ft) erected on concrete foundation with electrical connections and an electronics shelter of various sizes (nominally 10x20 ft).

The wireless network component of the Project will enable a variety of vital educational broadband services currently inaccessible to many students residing out of reach of any current broadband provider. The wireless network also offers a highly functional and secure data network solution to support law enforcement, fire protection and other emergency care providers. This greatly expands the ability of the tribal public safety and communications departments to provide enhanced 911 services.

The Project will utilize NTUA's current utility infrastructure for the majority of the installation of the fiber backbone and NTUA has been approved by the United States Department of Agriculture Rural Utility Service ("RUS") to integrate the middle and last-mile network on NTUA's existing utility infrastructure, for which RUS maintains a security interest. On July 28, 2010, the Project received a notice from RUS that the construction of the Project, e.g., a broadband network utilizing fiber optic and microwave and wireless systems, last-mile, was approved as part of NTUA's RUS Work Plan and qualified for a categorical exclusion not requiring the preparation of an environmental report in accordance with 7 C.F.R. Part 1794.21 (b) (2,4). *See* Exhibit A for a copy of the Letter and Amendment 22 incorporating broadband and tower infrastructure.

Alternatives Considered

Chosen Alternative

The broadband system that will be deployed is a combination of fiber optics, mobile wireless (LTE network) and fixed wireless (Fixed Point to Point Licensed Microwave communications standard) with the availability to support other wireless technologies such as WiMAX, WiFi and others. For bandwidth purchase from Tier 1 providers, NTUA will lease four dark fibers from the Public Service Company of New Mexico ("PNM") to gain access to a Point of Presence ("POP") in Albuquerque. In exchange, PNM will lease four fibers from Farmington to Yah-Ta-Hey, NM.

NTUA has the utility infrastructure, construction crews, technical skills and business systems in place to manage and sustain large broadband services for the Navajo Nation. Commnet Wireless is a major wireless roaming provider in rural America and currently supports both GSM and CDMA wireless data platforms. In addition, Commnet Wireless is affiliated with Choice Communications via its parent company, Atlantic Tele-Network, which is the largest internet provider in the Virgin Islands.

This Project combines the strengths of NTUA as an experienced utility operator and the strengths of Commnet as a national wireless carrier specializing in rural markets, with proven commercial experience and a 700 MHz spectrum. This partnership is prepared to support a 550 mile fiber backbone and 72% coverage of Wireless Broadband to the Navajo Nation residences, which has a combined project cost of $46,000,000.

The $45,985,810.05 total overall infrastructure costs include $23,889,282.01 for construction of a 550 mile fiber optic backbone ring and related electronics; $7,402,322.20 for the LTE wireless broadband access network; $5,643,500.00 for the construction of the tower and structures of the network; $5,069,160.56 for Project Management, Engineering Services and other related services; $3,071,545.28 for the High-Capacity Microwave Network for the main backbone and access routes; and $910,000.00 for the Data Center.

The five-year forecast for projected broadband subscribers for wireless, fixed and mobile services is 13,418, of which 8,051 are residential. This modest assessment was based on comparing wireless propagation modeled coverage to the most current demographics to derive an assessment of potential customer locations passed. More detailed annual projects were constructed based on an assessment of the Project schedule and network phasing.

The estimated number of immediate full-time jobs to be created or saved as a result of this Project is estimated at twenty to thirty high-paying jobs. This estimate includes an increase in network and microwave technical support staff within NTUA as well as positions dedicated to the network operating center and wireless switching facility. Additionally, the Project will open doors to economic development, spurring economic growth on the Navajo Nation in telecommunications applications and services, and creating additional jobs.

Other Alternatives Considered

In order to plan for telecommunications infrastructure and services throughout the Navajo Nation, different technologies were considered, of which some presented drawbacks due to cost, time for deployment, and technical capabilities. For instance, a total backbone underground fiber deployment was considered due to the advantage of providing a longer life cycle than aerial fiber; however, an underground fiber deployment throughout Navajo Lands seemed cost prohibitive to implement due to the geography of the area and the lack of infrastructure that allows for an underground deployment in other areas (such as the existence of man-made ducts or trenches as the ones found in metropolitan areas). In addition, environmental and archeological constraints would restrict the trenching needed for underground fiber burial. Since NTUA already has rights-of-way to its power pole infrastructure, the deployment of fiber in this infrastructure is more economical than other wired solutions considered.

Due to the location of the target areas, a network solution incorporating fiber and wireless point to point data transport was evaluated, including a Fixed Point to Point microwave solution based on Licensed Spectrum and a Fixed Point to Point microwave solution based on Unlicensed Spectrum. The second solution, based on Unlicensed Spectrum, has the advantage of lower price points (the cost of implementation is anywhere from 10% to 30% lower than the licensed spectrum solution); however, the unlicensed solution does not offer any long-term protection regarding technical issues such as radio interference and security. Unlicensed solutions also have a lower capacity in terms of data transport in addition to a higher maintenance cost in the medium- and long-term view. Licensed Spectrum-based solutions are protected by the Federal Communications Commission ("FCC") in terms of the use of spectrum and have lower maintenance cost in the medium- and long-term perspective.

For the access or last-mile solution, mobility technologies such as 3G (UMTS/EVDO) were also considered. The main disadvantages of these solutions were the speed capabilities of the 3G technologies compared to those of the 4G LTE technology. In terms of cost, the technologies were similar, but LTE provides a larger coverage footprint and speed several times that of 3G.

A satellite-based solution to provide data transport or access to broadband service was not considered due to the elevated cost for a network capable of speeds required for the project and due to the very poor performance in terms of speed for the end user. The Navajo Nation has a bad experience with a legacy satellite-based network that attempted to provide E-Rate and Chapter House connections during the past decade.

No Action Alternative

Although taking no action would result in not having to modify the infrastructure described herein, the societal and economic benefits related to this Project justify the development. By taking no action, the Navajo Nation will continue to be without a safe, reliable, and adequate telecommunications/broadband infrastructure to address emergencies and economic development. The desire of the Navajo Nation to benefit from modern use of these

facilities will not be met and the Navajo Nation's business opportunities and other goals will not be reached.

Conclusions of the Analysis

The selection of the technology was based on four main aspects:

1. Cost of the overall solution
2. Environmental factors assessed
3. Time to deploy the solution
4. Technical capabilities and longevity of the solution

Overall, the solution based on aerial fiber and Fixed Point to Point Licensed Microwave Network will have minimal environmental impacts and provided the possibility of a timely deployment compared with other technologies mentioned above. The aerial fiber utilizing the NTUA infrastructure will provide a more streamlined regulatory (a major issue on tribal lands), and the microwave network will expedite the deployment of telecommunications infrastructure in an area lacking telecommunication services. The fiber network and microwave network are expected to have long life cycles, and the latter will be implemented using the latest technology available based on IP protocols and high-capacity modulation schemes.

In the broadband access technology, a 4G technology was chosen. It will have minimal environmental impacts. This is the latest trend (followed by the main wireless services providers such as Verizon and Vodafone) and is capable of faster speed than 3G technologies currently in place. Tapping into the trend of the major players will allow the price points of the hardware and user units to drop significantly to the point of becoming comparable to existing, more mature technologies such as UMTS, HSDPA or WiMAX.

NTUA sought and received environmental reviews related to the Project. The The comments received from both Navajo and Federal agency reviewers requested certain environmental mitigation measures. NTUA will comply with the requested environmental mitigation measures and suggestions provided by the reviewing agencies reviewers in completing the construction and implementation of the Project. Compliance with the environmental mitigation measures will ensure that the Project has minimal environmental impact.