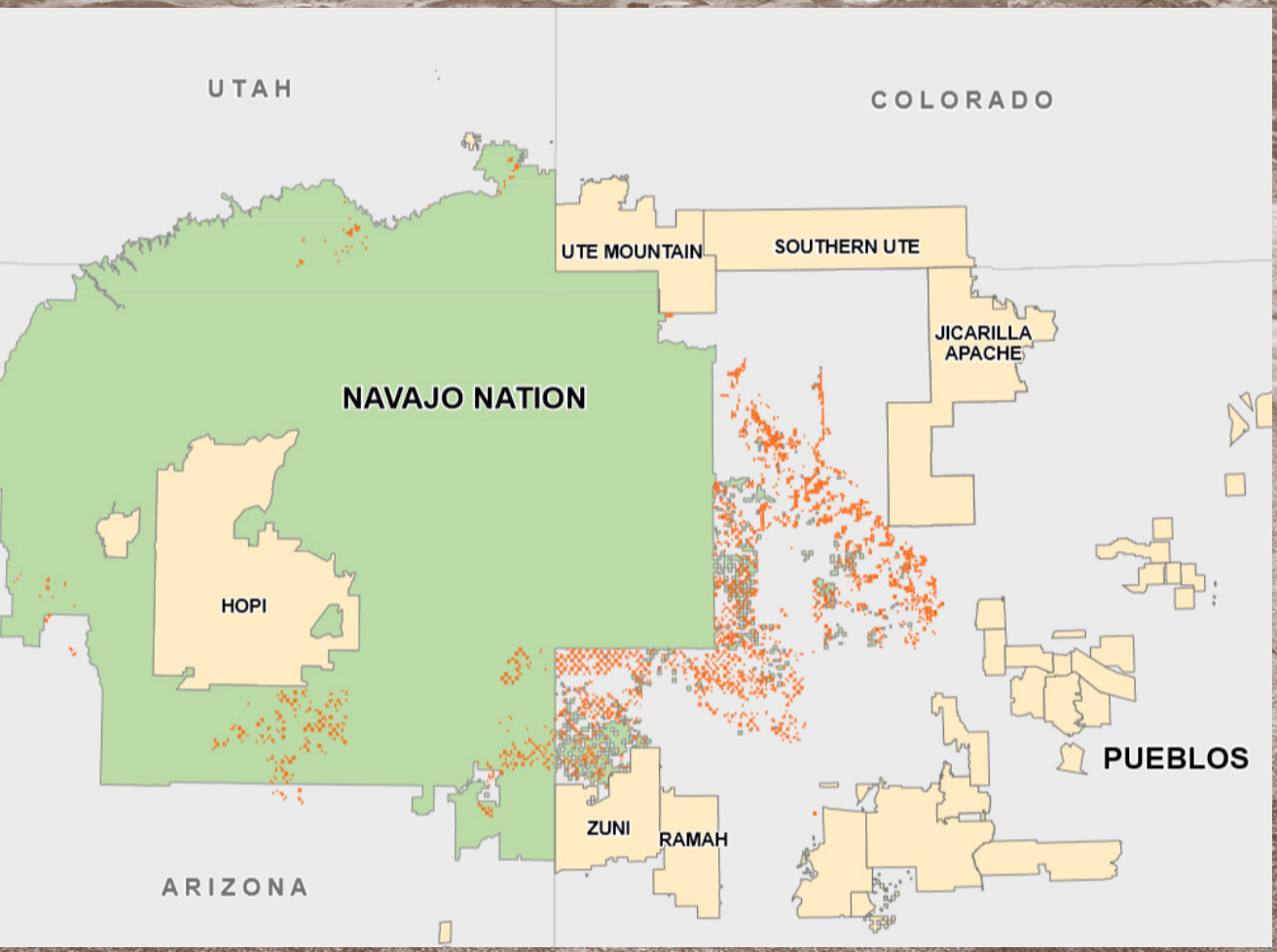
NAVAJO NATION

Navajo Nation Tribal Lands
Arizona, New Mexico, and Utah

SUMMER NAPE 2020

Oil and Gas Leasing Potential
in the San Juan Basin



THE NAVAJO NATION

JONATHAN NEZ | PRESIDENT MYRON LIZER | VICE PRESIDENT

July 15, 2020

MEMORANDUM

TO : President Jonathan Nez
Office of the President and Vice President

Dr. Rudolph R. Shebala, Division Director
Division of Natural Resources

FROM : Rowena Cheromiah
Rowena Cheromiah, Minerals Royalty/Audit Manager
Minerals Department

SUBJECT : **REQUEST AUTHORIZATION TO GIVE A PRESENTATION AT THE VIRTUAL SUMMER NAPE – AUGUST 11 THRU 27, 2020**

This memorandum serves two (2) purposes: 1. to give you a brief introduction to the Division of Energy and Minerals Development (DEMD) and how the Navajo Nation Minerals Department (Minerals Department) is utilizing their technical resources; and 2. to acquire necessary permission to allow the Navajo Nation to be featured at the Summer North American Petroleum Expo (NAPE).

The Minerals Department has been working with the DEMD on a few of our internal projects, namely identifying our mineral development potential and also researching a fair market value to apply to the many rights-of-way throughout the Navajo Nation.

The DEMD Mission Statement is as follows:

> *To provide the best possible technical and economic advice and services in assisting Indian mineral owners to achieve economic self-sufficiency by creating sustainable economies through the environmentally sound development of their energy and mineral resources.*

With the closure of the Kayenta Mine, the Minerals Department is looking to identify future energy and mineral potential for the Navajo Nation.

The DEMD has reached out to us to ask if we, the Navajo Nation, would like to be featured at the Summer NAPE. The NAPE is the oil and gas industry's marketplace for the buying, selling and trading of prospects and producing properties.

*Minerals Department * P.O. Box 1910 * Window Rock, Arizona 86515 * Phone (928) 871-6588 * Fax (928) 871-7095*

DEMD is currently developing a slide presentation for the Summer NAPE and will share the contents with the Minerals Department for our recommendations and critique. Once finalized, the presentation will be shared with Industry leaders in oil and gas.

We, therefore, are requesting your concurrence and will be pleased to answer any questions and/or comments. Please contact Ms. Rebecca K. Gilchrist, Senior Mining Engineer, at (928) 871-7398 or email at rkgilchrist@navajo-nsn.gov.

CONCURRENCES:

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Rebecca K. Gilchrist, Senior Mining Engineer, Minerals Dept.

NAVAJO NATION

Culture and History

The Navajo Nation extends into the states of Utah, Arizona and New Mexico, covering over 27,000 sq. mi. (see Figure 1). It is the largest federally-recognized Tribe in the U.S. with a size comparable to the state of West Virgina. The Navajo people have inhabited the area dated back to 1300 AD and been speaking Dine Bizaad also known as the Navajo language.

The Navajo language was used to create a secret code to battle the Japanese during World War II. Navajo men were selected to create codes and serve on the front line and utilized their native language to overcome and deceive their enemy. Today, these men are recognized as the Navajo Code Talkers, individuals who displayed true bravery and patriotism on behalf of the Navajo people and the United States of America. Today, the Navajo Nation is looking at ways to develop a sustainable and viable economy for an ever increasing population that now surpasses 300,000. The Navajo Business Council was established in 1922 by the U.S. Secretary of Interior in order to certify mineral leases on the Navajo Reservation. A structured government was needed for the Nation to further develop their mineral resources.

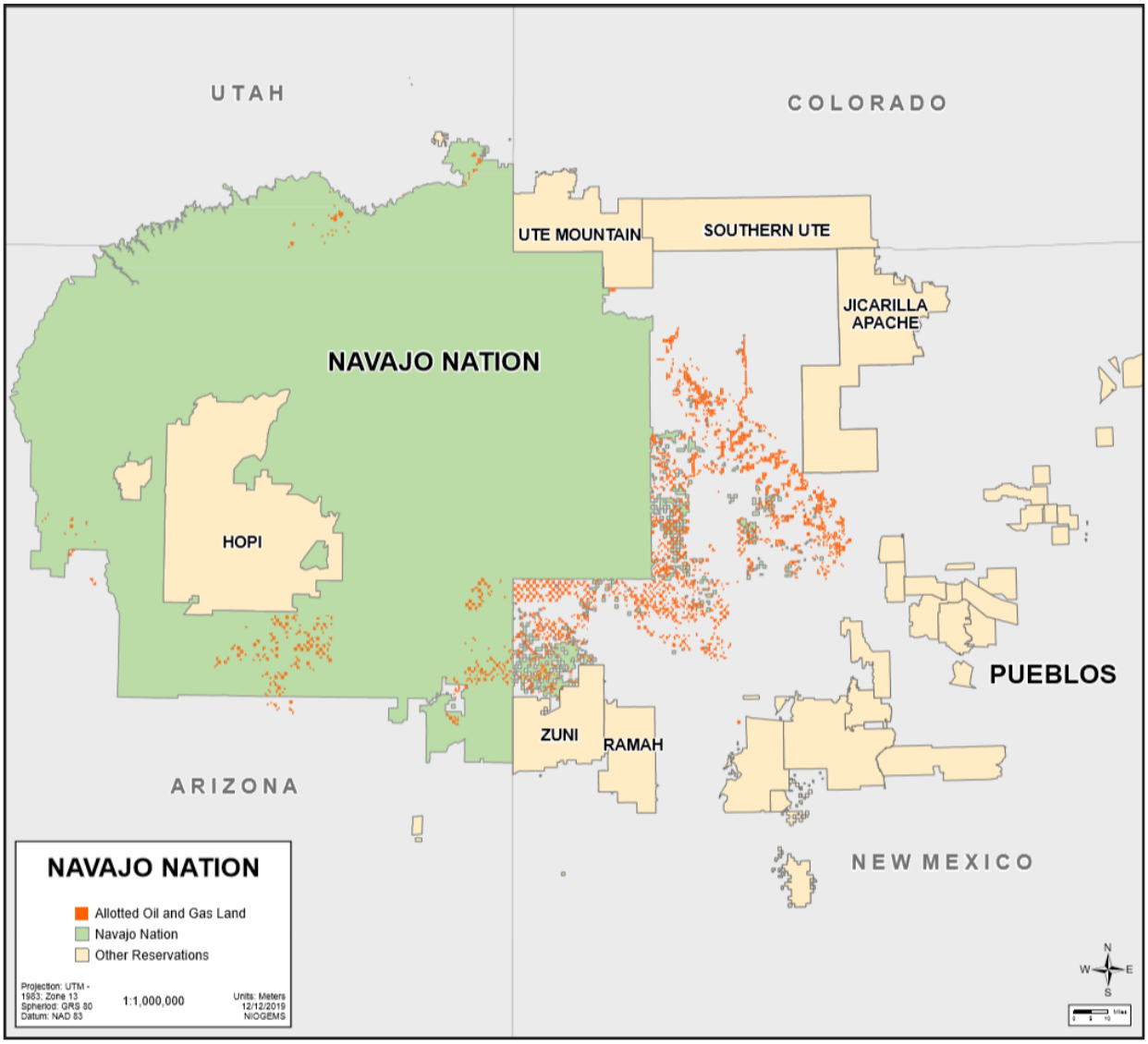

Figure 1. Location of the Navajo Nation.

Cover and opposite: Burnham Badlands, New Mexico by tsaiproject, *https://flic.kr/p/AN3eiP*, edited.

In 2008, the Navajo Nation Council was reduced from 88 to 24 council members. The 24 council delegates (representing 110 Navajo Nation chapters, or communities) discuss critical issues and enact legislation to determine the future of the Navajo people. Reorganized in 1991 to form a three-branch system (executive, legislative and judicial), the Navajos utilize this form of government to continue to build the Navajo Nation economy. The Navajo Nation retains its unique cultural heritage while continuing to move ahead with modern progress. More information on the Navajo Nation can be found at *https://www.navajo-nsn.gov/*.

Allotted Land History

The eastern border was shaped primarily as a result of allotments of land to individual Navajo households under the Dawes Act of 1887. The federal government proposed to divide communal lands into plots assignable to heads of household and tribal members for their subsistence farming, in the pattern of small family farms. The land allocated to Navajos was initially not considered as part of the reservation. Further, the government determined that land "left over" after all members had received allotments was to be considered "surplus" and available for sale to non-Native Americans. The allotment program continued until 1934. Today, this patchwork of reservation and non-reservation land is called "the checkerboard" area.

Summary

The eastern Navajo Nation lands are situated within the San Juan Basin and have existing legacy vertical well production from the Mancos and Gallup. Advances in horizontal drilling and hydraulic-fracturing technology have established the Mancos Shale and associated Gallup Sandstones as successful unconventional plays. World class helium deposits exist near the Four Corners area and provide great opportunity for helium production on the Navajo Nation Reservation (Figure 2). Present and future development of these plays will benefit the Navajo Tribe.

Geologic Overview and Oil and Gas Plays

San Juan Basin

The San Juan Basin covers over 20,000 sqaure miles in northwest New Mexico and southwestern Colorado and is known for its prolific oil and natural gas production, with over 326.8 MMBO and 50 TCFG produced since January 1923. Much of this production is from the Late Cretaceous (80-95 million years old) Mancos Shale having produced 36.9 MMBO and 176.4 MMCFG, and associated Gallup Sandstones having produced 108.8 MM BO and 748.7 BCFG. The Mancos Shale was deposited over a large portion of the Western Interior Cretaceous Seaway including within the San Juan Basin, a structural depression that was formed during Laramide time which also contains sediments ranging from Devonian through Tertiary time (Craigg, 2001). The basin is bounded on the east side by the Naciemento Uplift, on the north side by San Juan Mountains and on the west side by Hogback Monocline and the Four Corners platform, and on the south side by the Zuni uplift and Chaco Slope (see Figure 3) with over 326.8 MMBO and 50 TCFG produced since January 1923. Much of this production is from the Late Cretaceous (80-95 my old) Mancos Shale having produced 36.9 MMBO and 176.4 MMCFG, and associated Gallup Sandstones having produced 108.8 MM BO and 748.7 BCFG. The Mancos Shale was deposited over a large portion of the Western Interior Cretaceous Seaway including within the San Juan Basin, a structural depression that was formed during Laramide time which also contains sediments ranging from Devonian through Tertiary time (Craigg, 2001). The basin is bounded on the east side by the Naciemento Uplift, on the north side by San Juan Mountains and on the west side by Hogback Monocline and the Four Corners platform, and on the south side by the Zuni uplift and Chaco Slope (see Figure 3).

The majority oil and gas produced in the San Juan Basin comes from Cretaceous aged rocks with minor amounts from Jurassic and Pennsylvanian Formations. The stratigraphic column in Figure 4, shows the relative thickness and placement of each formation. The Fruitland Formation is composed of sandstone, shales and coals, coals provide for a highly productive coal bed

methane (CBM) reservoir. The Pictured Cliffs Sandstone, and the Mesaverde Group which is composed of the Cliff House, Menefee and Point Lookout Formation are gas bearing zones and combined is a major reservoir known as the Mesaverde Group. The Pictured Cliffs was the first major drilling play to be explored for gas. The Dakota Sandstone is a major gas field in the basin and represents the basal Cretaceous aged rocks. The Chacra Gas Production is a minor gas reservoir in the south half of the basin but is incorporated into the Mesaverde Group in the northern portion.

The major oil bearing formation is located in the Mancos Shale predominately in the Gallup where major fields have been vertically developed since the 1950's. This is currently the zone being developed by horizontal drilling in the basin. The Mancos Shale lies under portions of the Navajo checkerboard area. Although traditionally viewed as a source rock and seal for conventional plays, the naturally fractured Mancos Shales and interbedded sandstones are now recognized as a major unconventional oil and gas play. There is also a Mancos dry gas play in the northern deeper portion of the basin.

The Gallup, considered the shelf-ward equivalent of the Niobrara, represents a sandy zone within the Mancos Shale. The Mancos interval is composed of the Juana Lopez, Gallup Sandstone, Middle Mancos, Tocito, and El Vado Sands (see Figure 5). In recent years horizontal development of oil zones along with legacy vertical oil wells from the Late Cretaceous Mancos Shale and associated Gallup Sandstones have produced 145.7 MMBO and 748.7 BCF.

Other Production on the Reservation

Although most of the production on the reservation occurs within the San Juan basin, there are other basins in the area that hold opportunity.

The majority of the Paradox Basin is located in southeast Utah and southwest Colorado. The Aneth Field lies in the southern part of the basin on the Navajo Reservation. This field has produced more oil than any other field at over 440 million barrels of oil. Other production in the area comes from the Holbrook Basin as well as the Black Mesa Basin.

Helium Opportunity

The Four Corners area holds some of the best helium opportunities in the United States. There are over 59 wells on the reservation that contain 0.3% or greater helium content. Our of those 59 wells, 41 wells contain

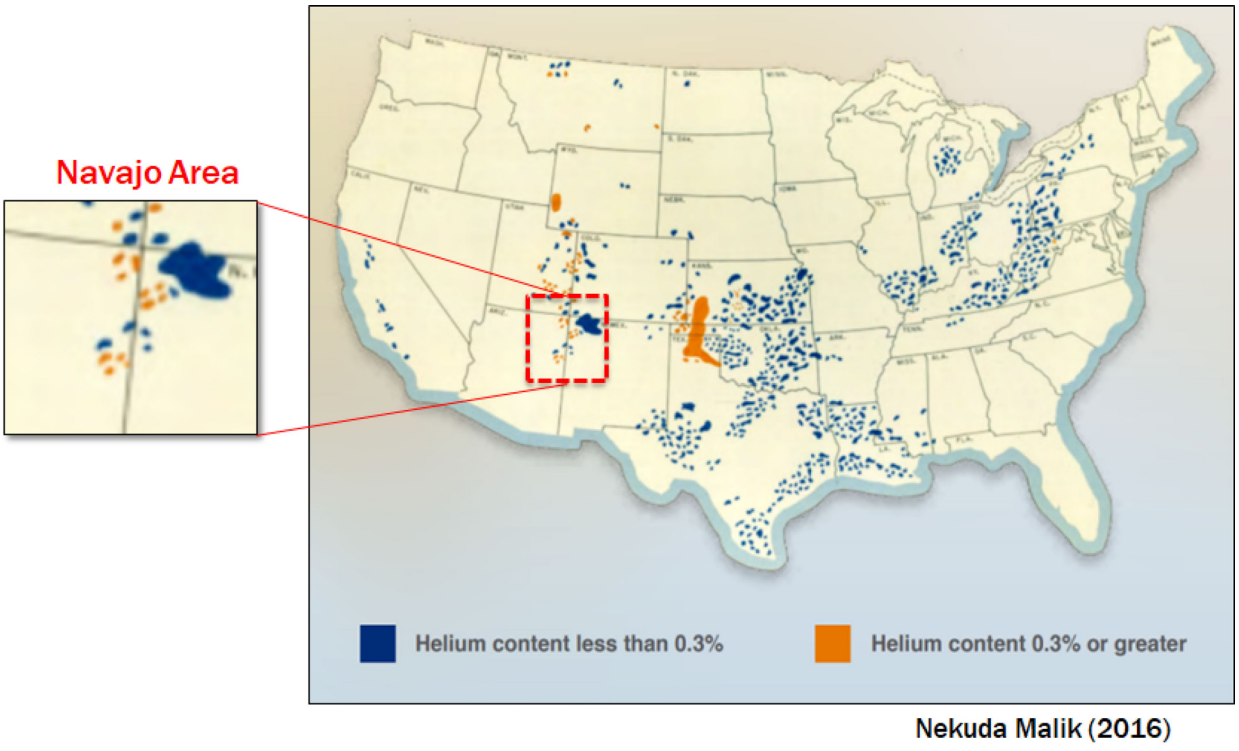

Figure 2: Helium content map in the United States. The colors represent helium content less or greater than 0.3%. the Navajo area contains multiple areas where the helium content exceeds 0.3%.

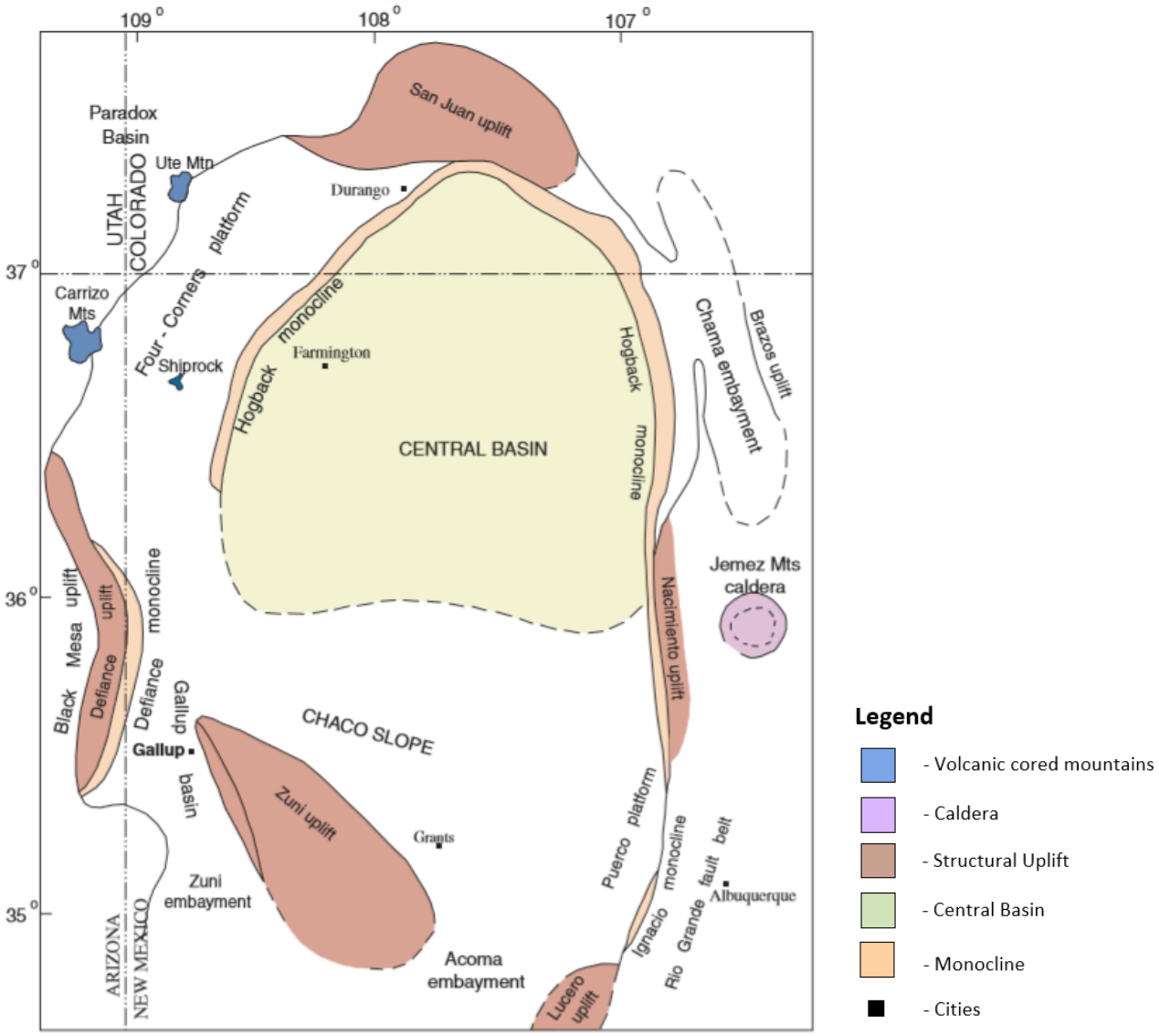

Figure 3. Index map showing the geographic and structural elements of the San Juan Basin (Fasset, 2010). Areas of steeper dip(monoclines) are patterned; arrows indicate the direction of dip. The dashed line separating the central basin from the Chaco slope is drawn approximately along the outcrop of the Pictured Cliffs Sandstone.

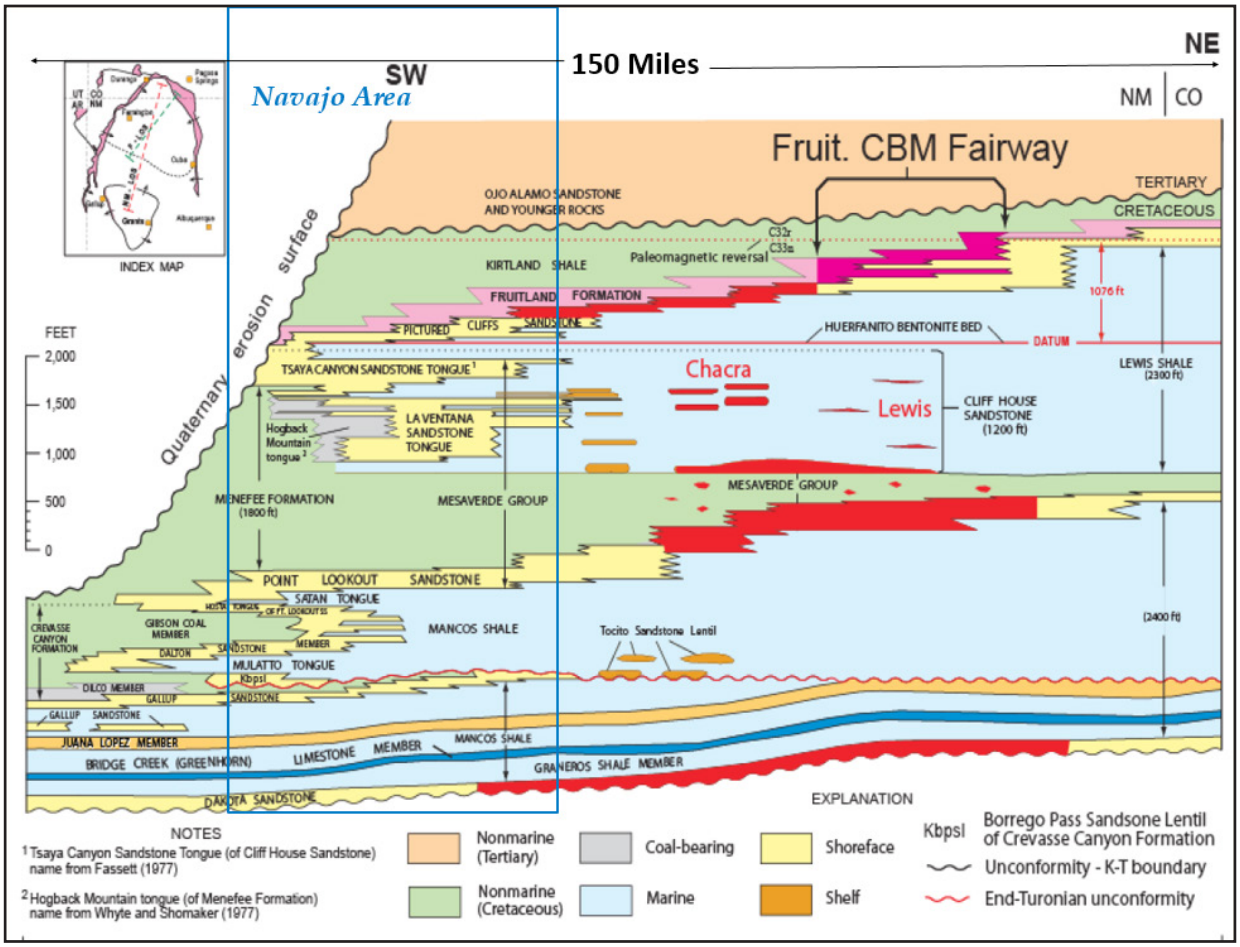

Figure 4. Stratigraphy of the San Juan Basin. Blue outline highlights the stratigraphy under the Navajo lands.

greater than 3% helium. Permian, Pennsylvanian, Mississippian, and Devonian horizons are accountable for the majority of helium production in the area. With rising helium prices, the Navajo Reservation holds great opportunity for helium exploration and production. Figure 6 displays the leased and open acreage on the reservation where there are millions of open acreage available to produce oil, gas, or helium.

Oil and Gas Activity in the Region

Historically, the San Juan Basin has been primarily a gas producing province with the notable exception of the aforementioned Gallup Oil Fields, but within the last 10 years, new technologies and methodologies have allowed once unrecoverable oil to be economically extracted. In the southwestern portion of the San Juan Basin, the horizontal well play was originally dominated by Encana Corp. and WPX Energy. These companies sold to DJR Resources and Enduring Resources, respectively and they have continued drilling horizontal wells, with plans to drill more as economics allow.

Leasing Procedure

Please contact the Navajo Nation Minerals Department for leasing details.

Eastern San Juan Cretaceous Stratigraphic Nomenclature

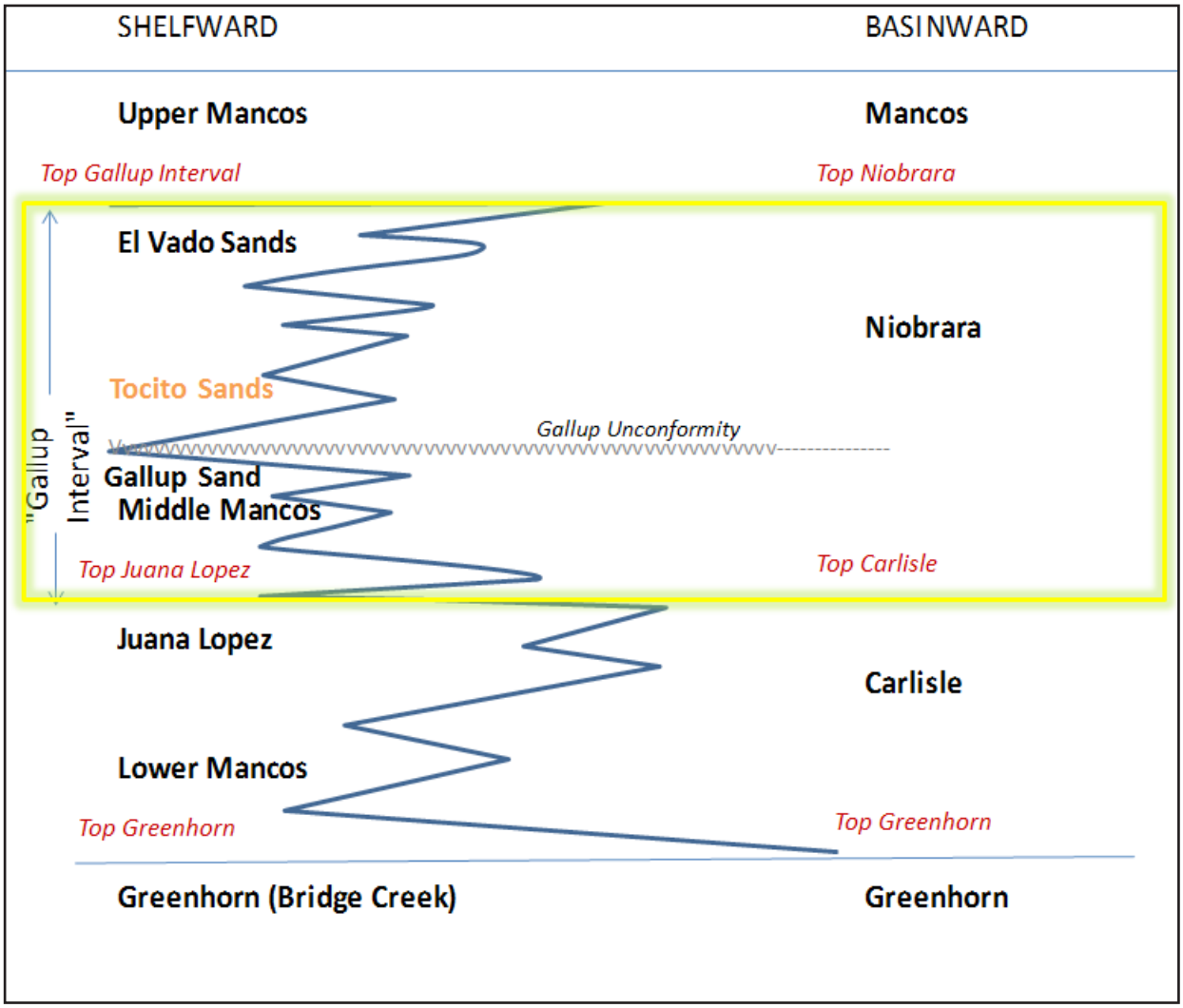

Figure 5. Shows the Eastern San Juan Cretaceous Stratigraphic Nomenclature. Blue lines represent shoreline shifts due to transgressive/ regressive cycles.

Navajo Nation Leases July 2020

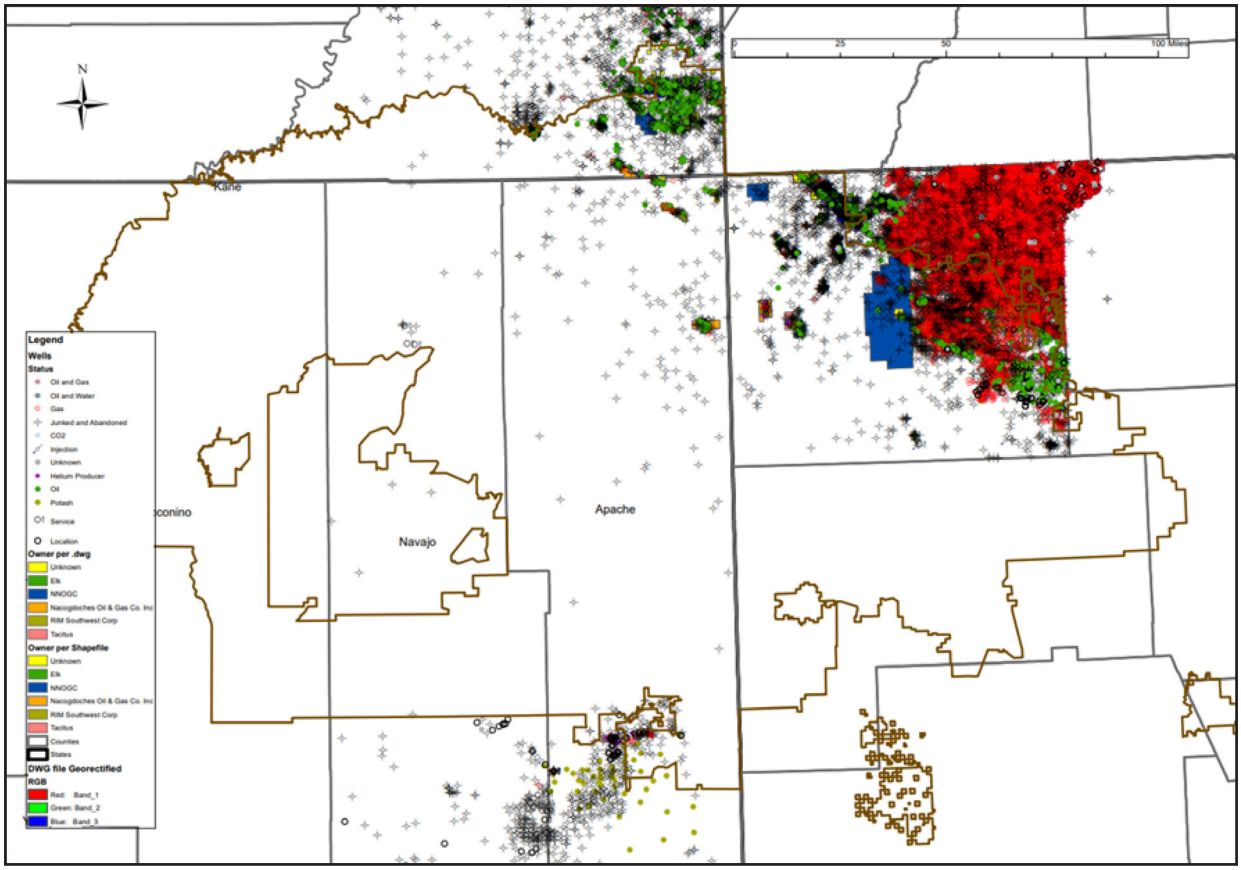

Figure 6. Oil and Gas Map covering the Navajo Nation Reservation including leased areas, and wells as of July 2020.

References

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CONTACT INFORMATION

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GREAT SEAL OF THE NAVAJO NATION