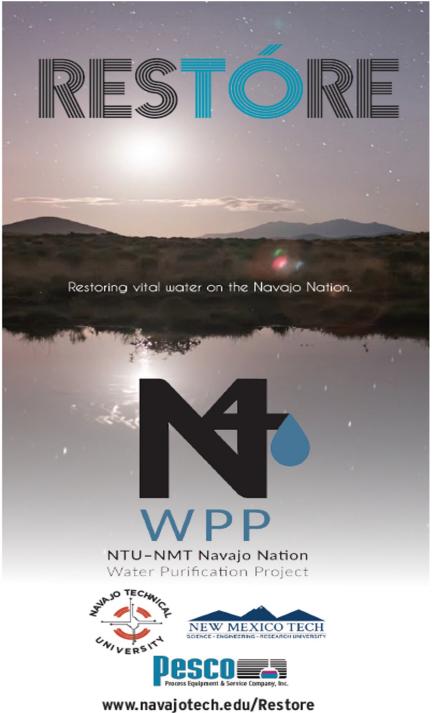


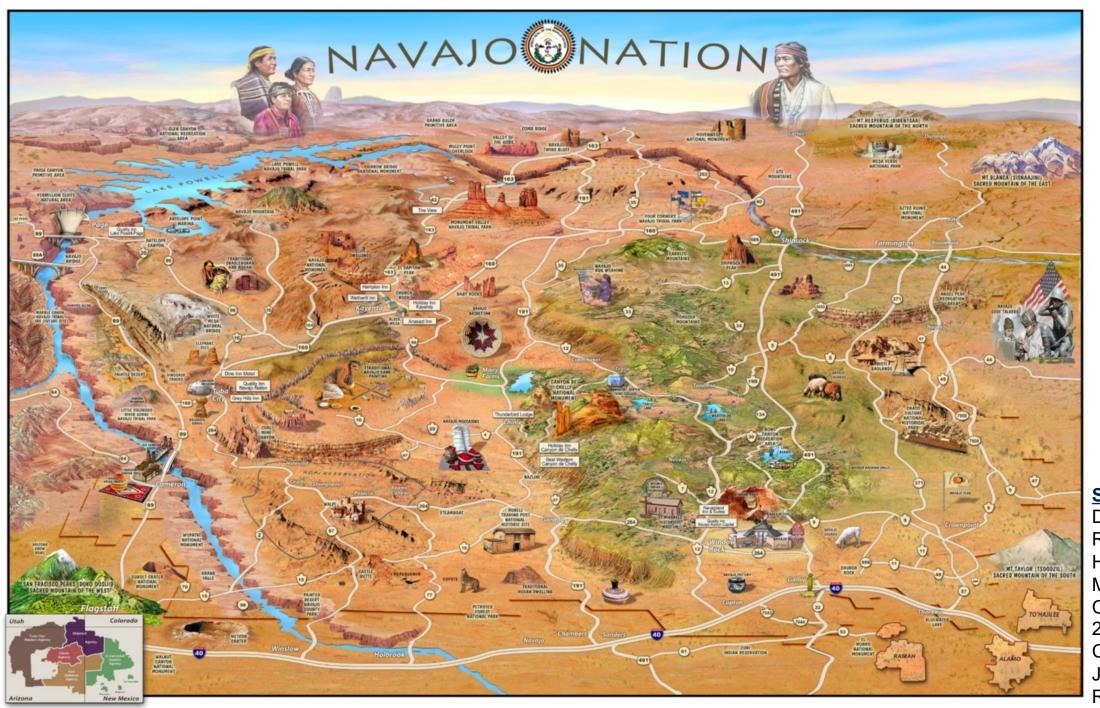
NTU-NMT Navajo Nation Water Purification Project

## NTU-NMT Navajo Nation Water Purification Project (N<sup>4</sup>WPP)

Abhishek RoyChowdhury, PhD Navajo Technical University

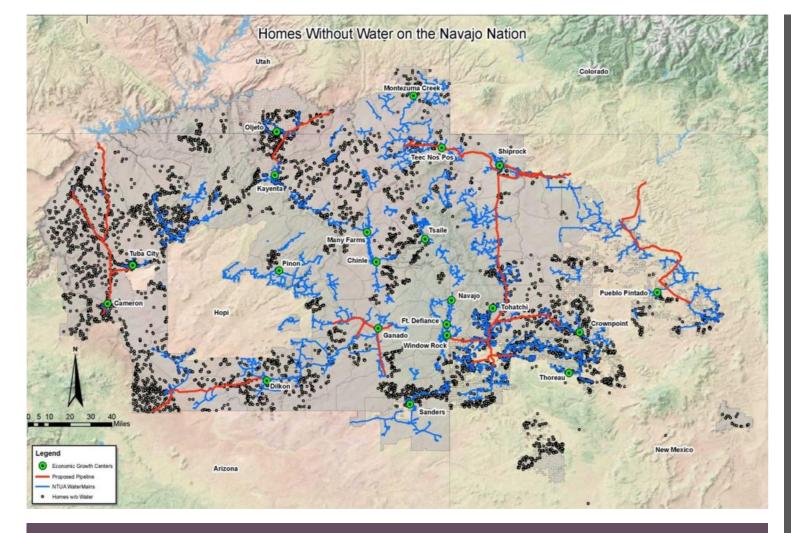
Four Corners Energy Water Innovation Symposium April 6, 2023





#### Source:

David
Rumsey
Historical
Map
Collection,
2012
Copyright
Jean-Louis
Rheault

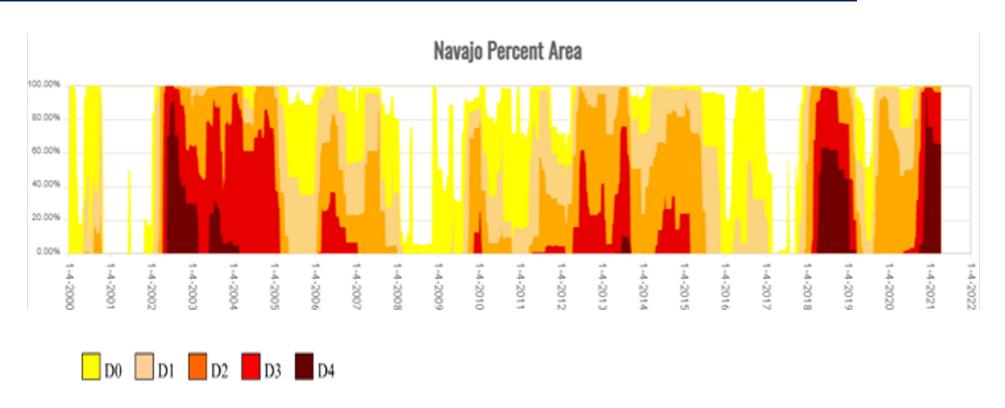


[Source: The Salt Lake Tribune. July 25, 2020]

# Homes Without Water on the Navajo Nation

- 30% of the homes on the Navajo Nation have no direct access to public water systems
- The households haul water long distances to provide water for their families
- Navajo households are 19 times more likely than white households to be without running water

## <u>Water scarcity on Navajo Nation- Natural Causes</u>



The U.S. Drought Monitor (USDM) data showing drought conditions in the Navajo Nation since 2000. Where D0: Abnormally Dry; D1: Moderate Drought; D2: Severe Drought; D3: Extreme Drought; and D4: Exceptional Drought.

(Source: The National Drought Mitigation Center, University of Nebraska-Lincoln, 2021)

## <u>Water scarcity on Navajo Nation - Anthropogenic Causes</u>

- Long history of mining on the Navajo Nation:
  - Gold, Copper, Lead, and Silver since the mid-1800s
  - Uranium since the early 1900s
  - Coal since the 1960s
- Elevated levels of metals resulted from these mining activities in groundwater and surface water
- Unregulated wells and springs are contaminated with high levels of metals.









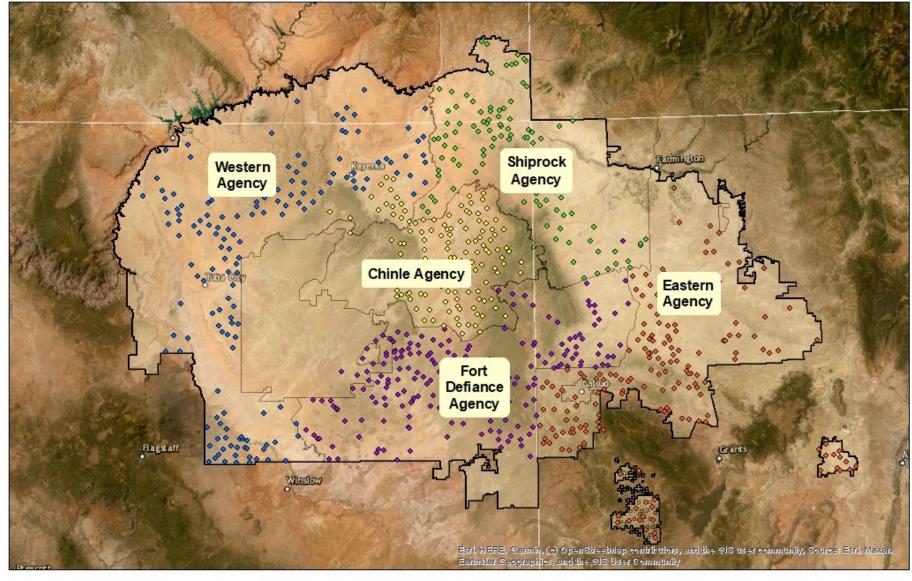
# Water Scarcity on Navajo Nation















- Chinle Agency LSW
- Eastern Agency LSW
- Fort Defiance Agency LSW
- Shiprock Agency LSW
- Western Agency LSW

agency polygon

#### **Navajo Nation Agency** Livestock Wells (LSW)



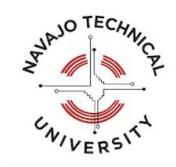




## **Overview**

The N<sup>4</sup>WPP is a joint endeavor to install water filtration equipment testing facilities on the Navajo Nation. These sites will be used to train students to test water quality and maintain filtration units to provide sustainable long-term water resources suitable for agriculture and livestock use, cleaning, and eventually clean drinking water.



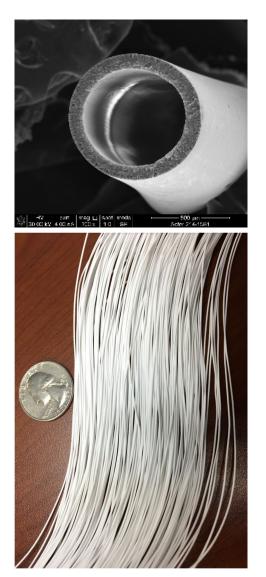






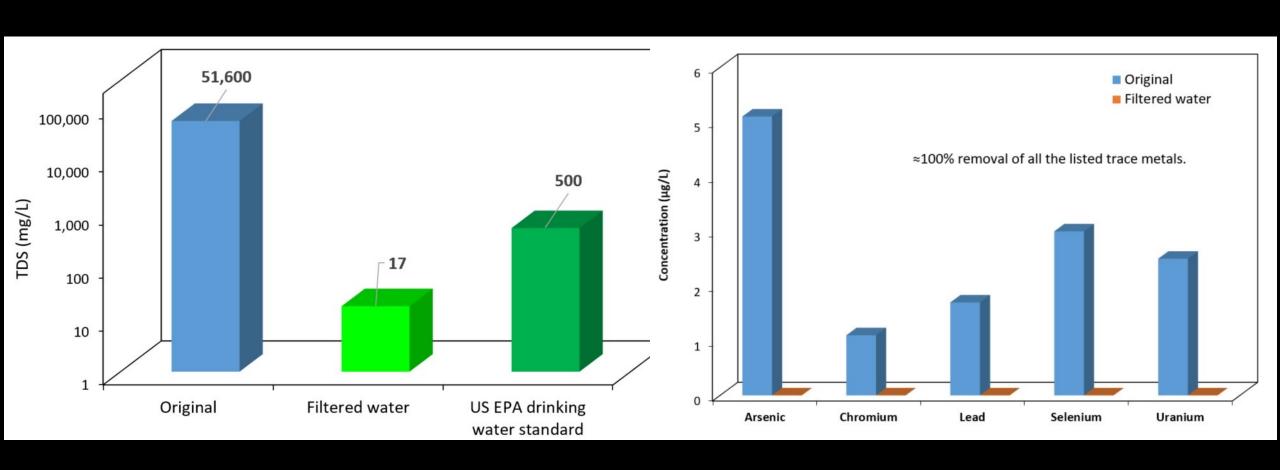
## The Water Purification Technology

- The filtration technology to be used was developed by research scientists at the Petroleum Recovery Research Center (PRRC) at New Mexico Tech (NMT).
- It involves the application of a hollow fiber membrane-based direct contact membrane distillation (DCMD) process.
- Unusable water will be channeled through the bundles of hollow fiber membrane to filter out salt, phosphates, nitrates, and metals.
- Previous studies showed the efficiency of this process for desalinization.



The hollow fiber membrane

# **Preliminary Results- Lab Study**



# Ongoing Work Plan

### I) Site selection:

- NTU students are working with the N<sup>4</sup>WPP team members.
- Initially, water at windmills, tanks and wells are being collected and analyzed at New Mexico Bureau of Geology and Mineral Resources at NMT.
- We are proposing to install 10 filtration units across the Navajo Nation.

## Proposed Work Plan

## **II)** Installation of the filtration unit(s):

- Obtaining required permits.
- Unit installation and continuous monitoring.
- Students are involved in all aspects of permitting, installation, operation, maintenance, and monitoring.

## Proposed Work Plan

## **III) Long-term Goals:**

- Educating members of the community about water quality, the filtration system, system maintenance, and simple repairs for long-term use.
- Install similar filtration units across the Navajo Nation.
- Transfer the ownership of the units to the community.
- Train a workforce with the knowledge to guide decisions and longterm water planning as well as the skills to operate and maintain these systems

## **Educational Component**

- Local workforce building: Local students are being trained in database management, water sampling and analysis techniques, unit operations, and data analysis.
- Classroom learning are being augmented with field sampling, planning, critical thinking, and communication skills.
- NTU and NMT is in the process of making an education model:

High School Students ———— NTU (Undergraduate study)

NMT (Graduate Study)



NTU & NMT students are receiving hands-on training

## We are working with the communities



JONATHAN NEZ MYRON LIZER PRESIDENT VICE PRESIDENT

#### LAKE VALLEY CHAPTER

Mark Freeland, Council Delegate | Tony Padilla, President | Edison Tso, Vice President | Betty S. Dennison, Secretary/Treasurer Janice Padilla, Land Beard | Lucinda Begay, Community Services Coordinator | Accounts Maintenance Specialist-Vacant

#### LVC-APR24-029

#### **RESOLUTION OF LAKE VALLEY CHAPTER**

SUPPORTING THE INVESTIGATION OF WATER QUALITY AND PERFORM SITE EVALUATIONS FOR INSTALLATION OF A WATER FILTRATION UNIT WITHIN LAKE VALLEY CHAPTER.

#### WHEREAS

- Lake Valley Chapter is a certified Navajo Nation Chapter Government, which was created pursuant to the Navajo Nation Council Resolution No. C-J25-55, is delegated governmental authority with respect to local matters consistent with Navajo laws, including customs, traditions, and fiscal matters; and
- 2. Lake Valley Chapter is empresend by the Navigh Matien Guessi is review all matters affecting the community te make its reveals docisions in the best interest for the general health, active and very experience of chapter membership through implementation solutions for commit development, cultural preservation, recreation, solid waste management, elderly care, quality broasing, public adelty, read maintenance, educations any appear for community students and
- Lake Yallay Chapter communities understand that in pursuant to the Navaje Nation Code (NNK) Title 26, Local Oavermance Act, which allows chapters to make
  decisions over local matters. This authority in the long run at lamptere community decision-making by allowing committees to excel and flourish, enable
  Navajo beaders to lead feward a prosperous Noture, and improve the strongth and sovereignty of the Navajo Nation; through adoption of this Act, chapters are
  compelled to govern with responsibility and accountability to the local citizens; and
- 4. Lake Yelley Chapter community met on Agrik 15, 2022 Planning Meeting to discuss and plan upcoming business items to be place on the agenda which Darlene Wilson, student at MIT (Data Major Sinlargy/Enricommental Science) provided information to conduct the whole water cystem testing for Lake Valley Chapter, that the goal is to provide observable to the occurrency about chinding safe water and the main flows is one windrall located east of LIVE versus the road. She also provided a resolution template for approval to dis water testing of Lake Valley Chapter community for the Regular Chapter Meeting, and
- Lake Valley Chaptor is aware that poor water quality has limited the use of some of its wells, acknowledges the need for additional water quality testing and site assessments to determine the best treatment options for these impacted wells; and
- Lake Yalley Chapter furthermore acknowledges that the NAMPP (Nevajo Tach-Naw Mexico Tech-Navajo Nation Nater Purification Project) team has
  expressed interest in aiding the Chapter in documenting water quality and filtering are well if possible; and
- Lake Yalley Chapter acknowledges that the research is free to the Chapter, but the orient of sampling will be limited by project funds, and with this
  understanding, Lake Valley Chapter adopted Resultrian Ns. LVC-APEZA-D2 on April 24, 2022 to support its request to install water filtration unit for testing
  which is the best interest of community people within Lake Yalley Support.

#### NOW THEREFORE BE IT RESOLVED THAT:

Lake Valley Chapter of the Navajo Nation hereby approves to support the Investigation of Water Quality and Perform Site Evaluations for Installation of a Water Filtration Unit within Lake Valley Chapter.

#### CERTIFICATION

MR HARREY CRITEY that the foregoing resolution was duly considered by the Lake Valley Chapter at a duly called chapter meeting at Lake Valley Olew Mexico) Navaja Nation, at which a quorum was present and that same was passed by a vate of ten (DII) in favors, zero (B) opposed and three (S) abstained on this Ze<sup>26</sup> day of Apra (2022. Motion by Larry Montoys; and second by Cheller Zafelez.

Mr. Tony Padillo Jr., Chapter President

Mr. Edison Tso, Chapter Vice President

Mr. Mark Freeland, Council Delegate





Navajo Nation RDC

## Students are getting trained on public outreach





**AISES, 2021** 

N<sup>4</sup>WPP Water Symposium, 2022



# Water Filtration Unit Ready for Operational Testing





## Public Outreach Component

- Students are participating in outreach activities to Navajo Nation communities
- The team is attending local Chapter House meetings and is organizing water symposiums and other public outreach campaigns.
- Educate members about water quality, the filtration system, system maintenance and simple repairs.
- Foster the importance of **Tó éí ííná** (Water is Life).

#### **N4WPP Water Symposium**



### Announcing the 2022 N<sup>4</sup>WPP Water Symposium

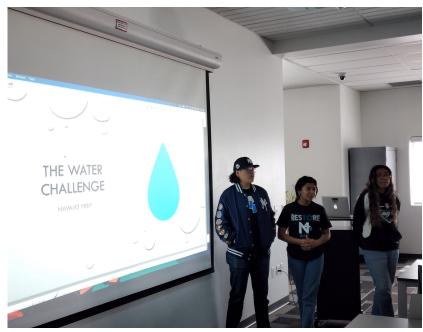
The Navajo Tech-New Mexico Tech Navajo Nation Water Purification Project (N<sup>4</sup>WPP) is excited to invite you to the 2022 Water Symposium. Four Corners area high school students are invited to help solve some of the most important water challenges in New Mexico and across the Navajo Nation. Students will have the opportunity to hear from leading water conservation experts, talk to college students presenting their research in a poster session, and get hands on experience with the problem by participating in the Water Challenge. Prizes and awards include cash and scholarships.

When: April 23, 2022

Where: Farmington High School - Farmington, NM

# N<sup>4</sup>WPP Water Symposium







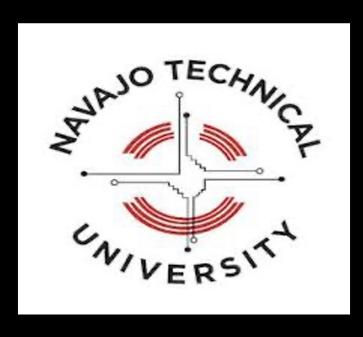








## Database Management Platform





□ A collaborative effort is ongoing to develop a secure database management platform at NTU to store water data.





☐ We are following Navajo Nation's data sovereignty policies.



# **Key Contacts**

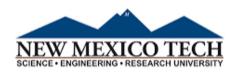


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NTU Provost
cbowman@navajotech.edu
505.387.4102

#### Dr. Abhishek RoyChowdhury

Environmental Science and Natural Resources aroychowdhury@navajotech.edu 505.387.7434



#### **New Mexico Tech:**

**Dr. Sharon Sessions**NMT Director of Outreach
Sharon.Sessions@nmt.edu

## NM Bureau of Geology and Mineral Resources:

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Geochemist / Analytical Laboratory Manager bonnie.frey@nmt.edu

#### **Laila Sturgis**

Aquifer Mapping Program Manager Laila.Sturgis@nmt.edu

#### PRRC:

#### Dr. Robert Balch

Director NMT Petroleum Recovery Research Center Robert.balch@nmt.edu

#### Dr. Jianjia Yu

Research Scientist jianjia.yu@nmt.edu

#### PESCO:

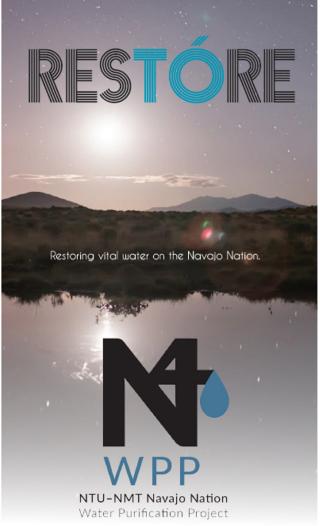
#### **Steven Grey**

Consultant to PESCO Bizardi53@gmail.com

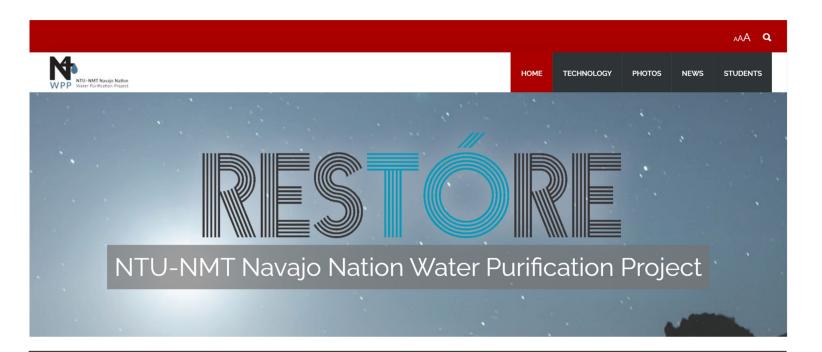


#### John A. Byrom

Business Development Manager johnbyrom@pescoinc.biz







## Questions?

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#### Thank You

Please visit: http://www.navajotech.edu/restore/