



North Carolina Continuously Operating Reference Stations (CORS) Network

64th Meeting of the Civil GPS Service Interface Committee

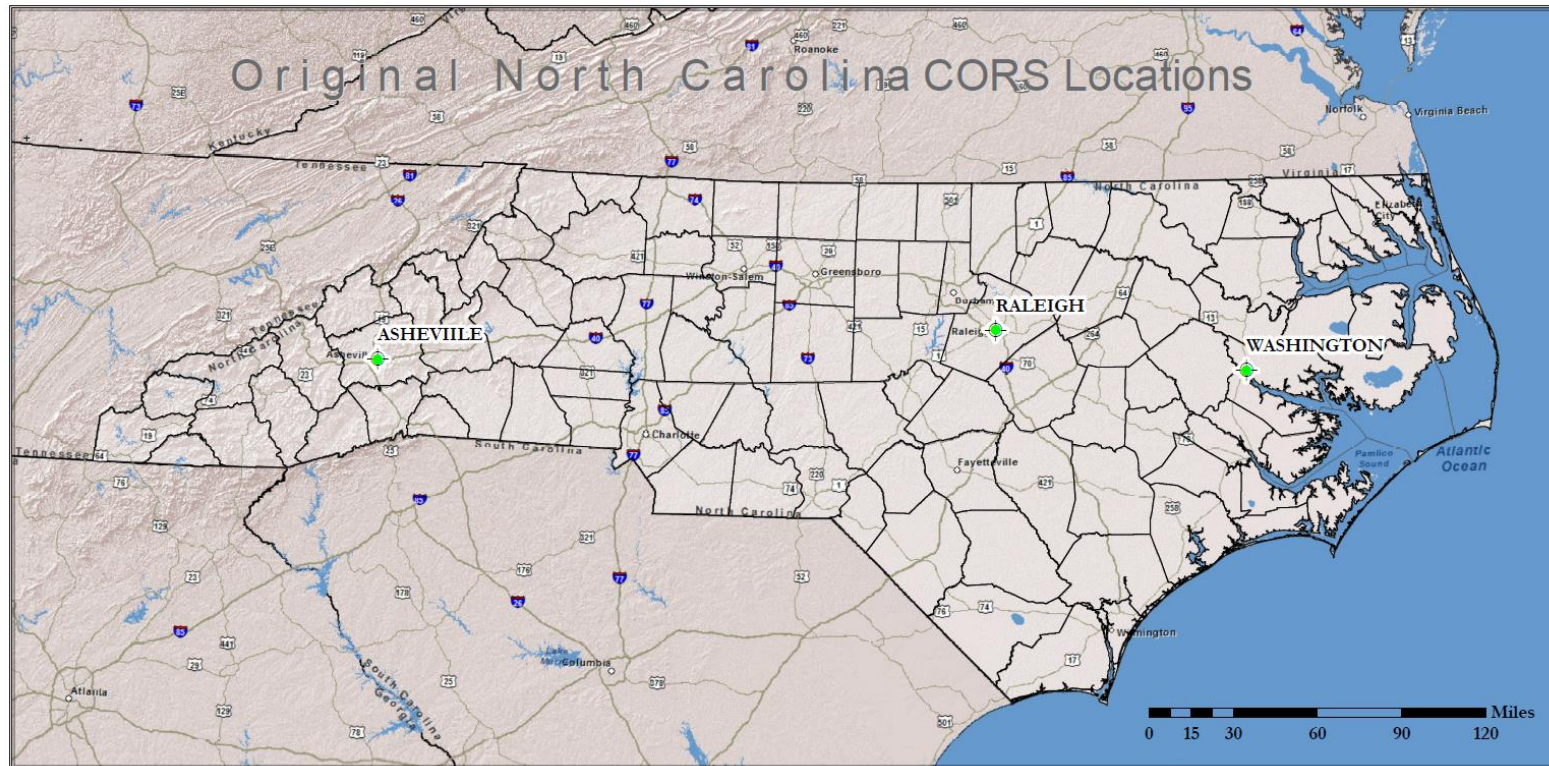
Surveying, Mapping, and Geosciences Subcommittee

September 16-17, 2024





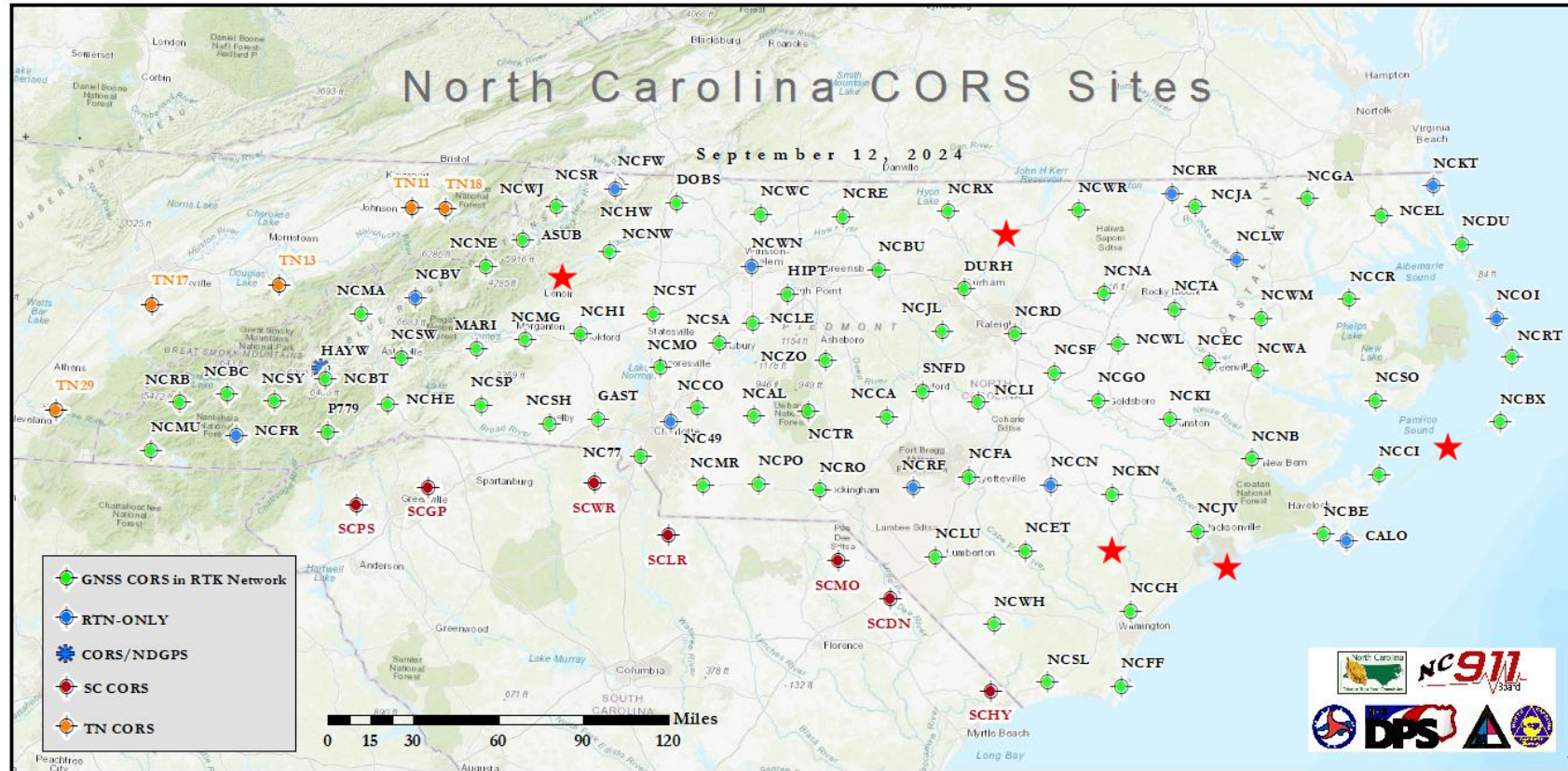
The Original North Carolina (NC) Continuously Operating Reference Stations (CORS) Network



- Original NC CORS Network (1994)
 - Washington, Raleigh, and Asheville
 - Global Positioning System (GPS) only
 - Post processing only
 - Data files via dial up modem
 - Manual quality control



North Carolina (NC) Continuously Operating Reference Stations (CORS) Network 2024

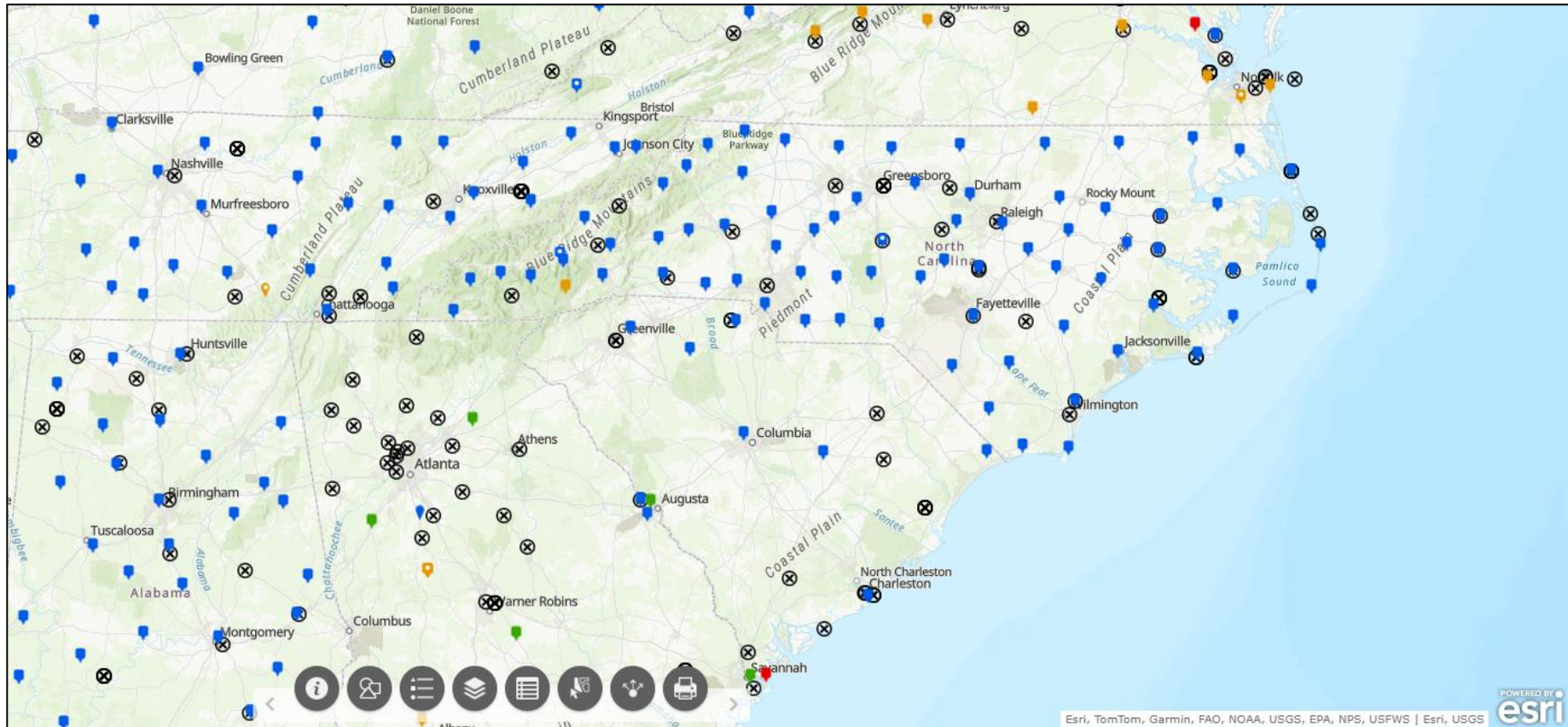


Future CORS location = ★





NC CORS in the National Oceanic Atmospheric Administration (NOAA) CORS Network (NCN)

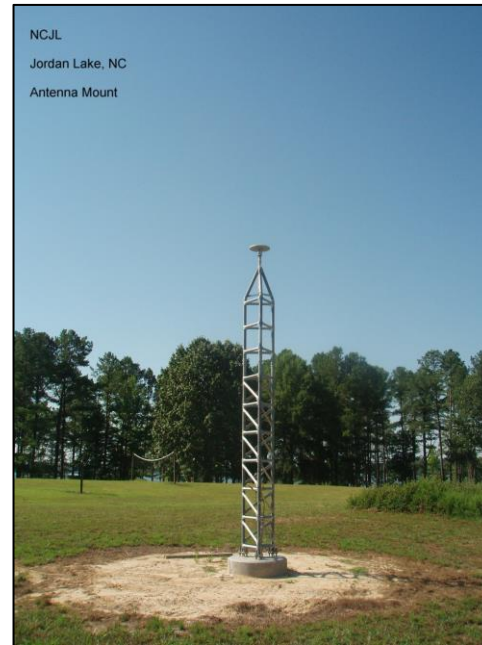




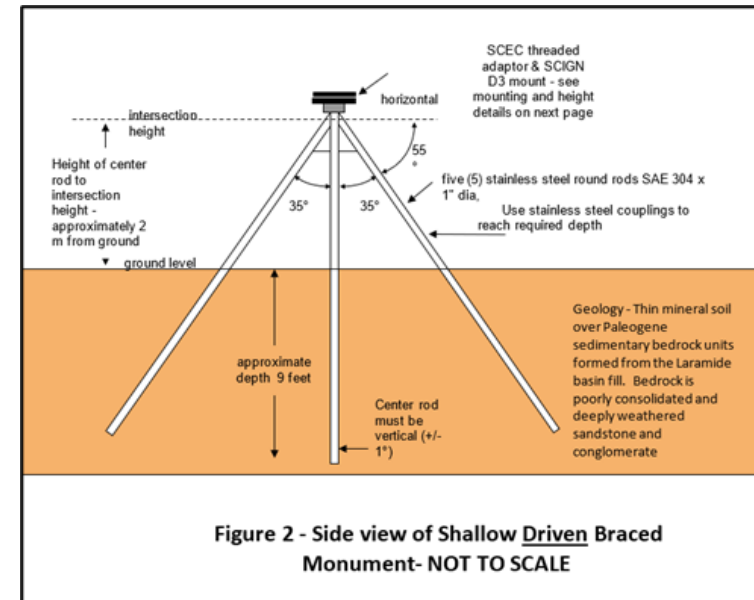
NC CORS Network/Real Time Network (RTN)

- 99 CORS
 - 85 CORS operated and maintained by NC Geodetic Survey
 - 1 CORS from EarthScope
 - 1 CORS from the National Park Service
 - 12 CORS from neighboring states
 - 7 CORS in South Carolina
 - 5 CORS in Tennessee
- Main CORS/RTN servers installed at the Eastern data center
- Backup CORS/RTN servers installed at the Western data center

NC CORS Network



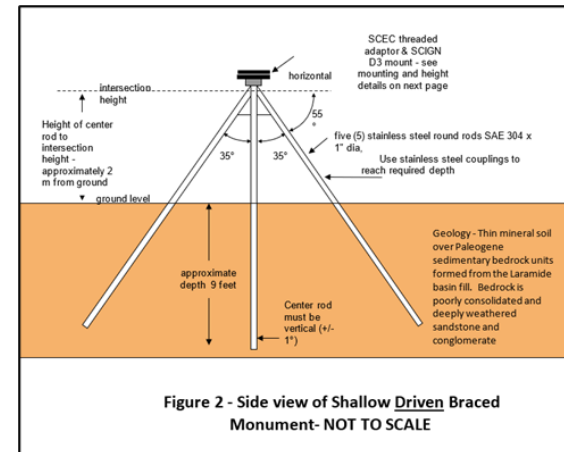
New CORS in Franklin, NC (NCFR)



SCEC = Southern California Earthquake Center
SAE = SAE International



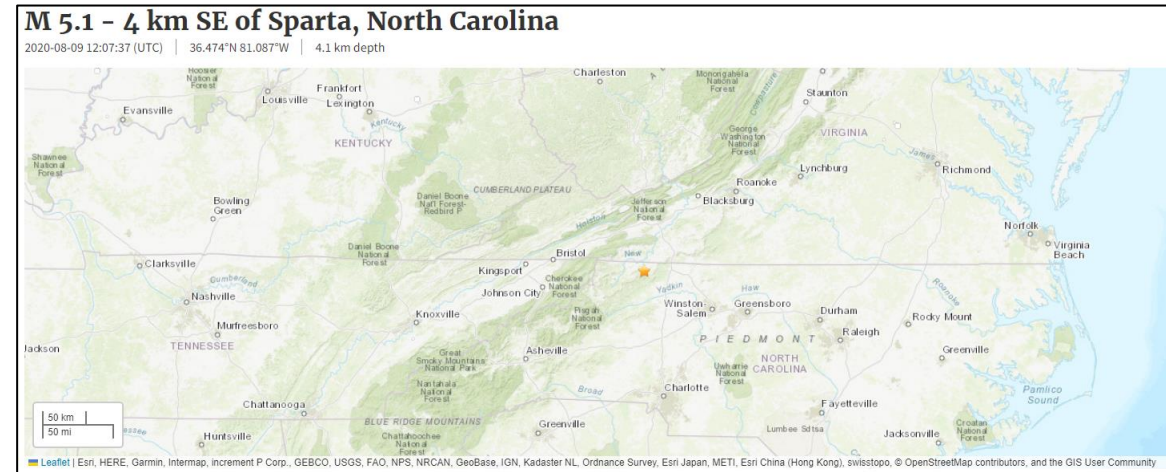
Peanut Belt Research Station CORS (NCLW)



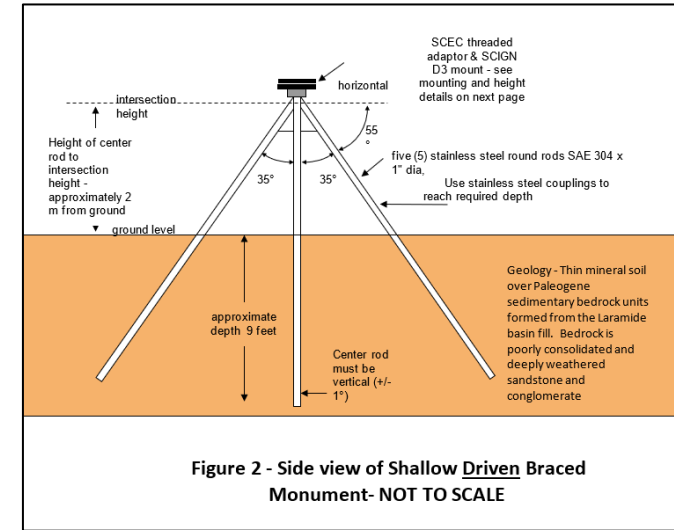
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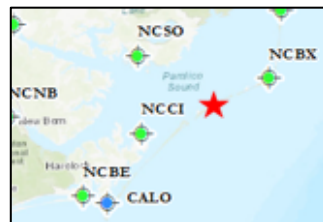
Sparta CORS



Proposed CORS on Ocracoke Island



Proposed CORS will be co-located with a NOAA CO-OPS gauge.



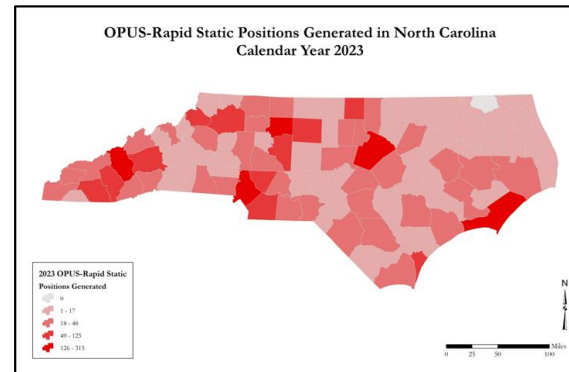
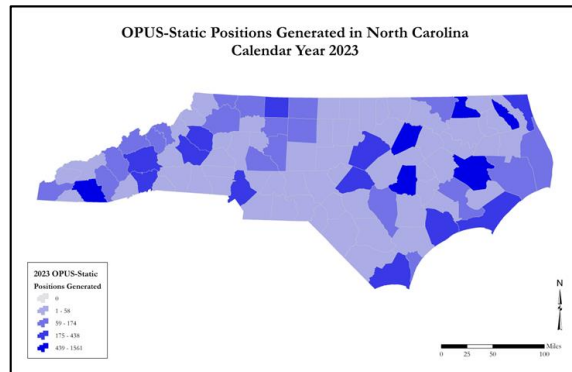


NC CORS/RTN Network Data Users

- Engineering/Surveying/Mapping/Imaging
- Construction/Grading/Paving/Mining/Dredging
- Farming/Forestry
- Government/Military
- Education
- Utility
- Service
- Research projects

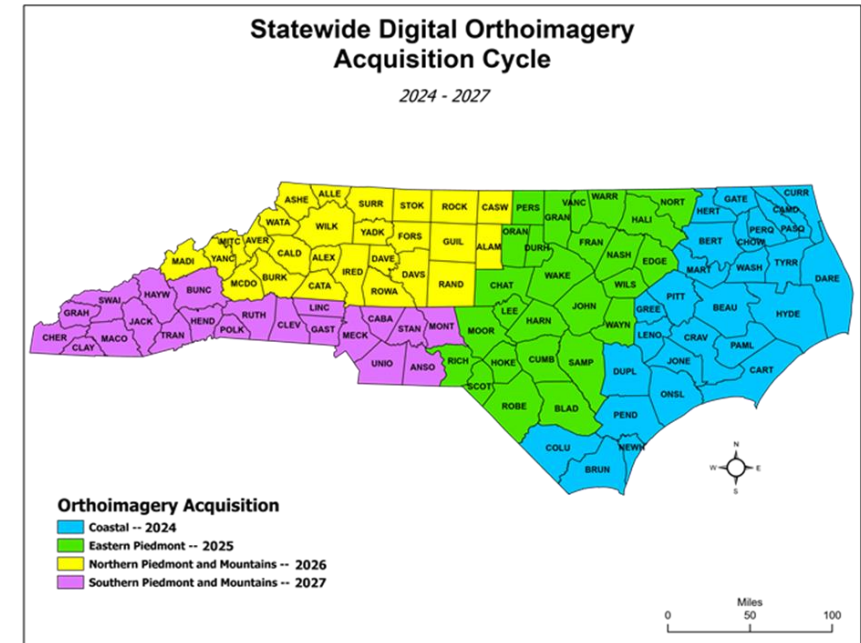
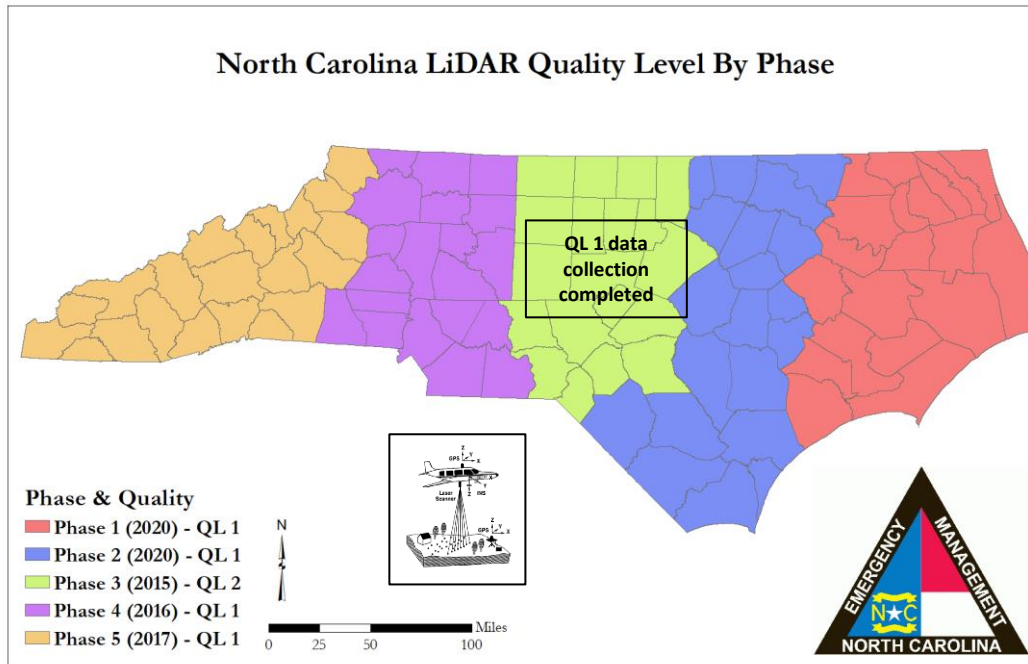
NC CORS Network Supports Online Positioning User Service (OPUS)

- OPUS NC positions (2023)
 - OPUS-S = 15,701
 - OPUS – RS = 3,264
 - UFCORS downloads = 45,460





NC CORS Network Supports statewide LiDAR and Orthoimagery Projects



QL = Quality Level



NC CORS Network Supports Flood Risk Information System (FRIS)



Am I at risk of flooding?

Enter all or part of your address and click GO.

Address, City, or ZIP

OR select a county

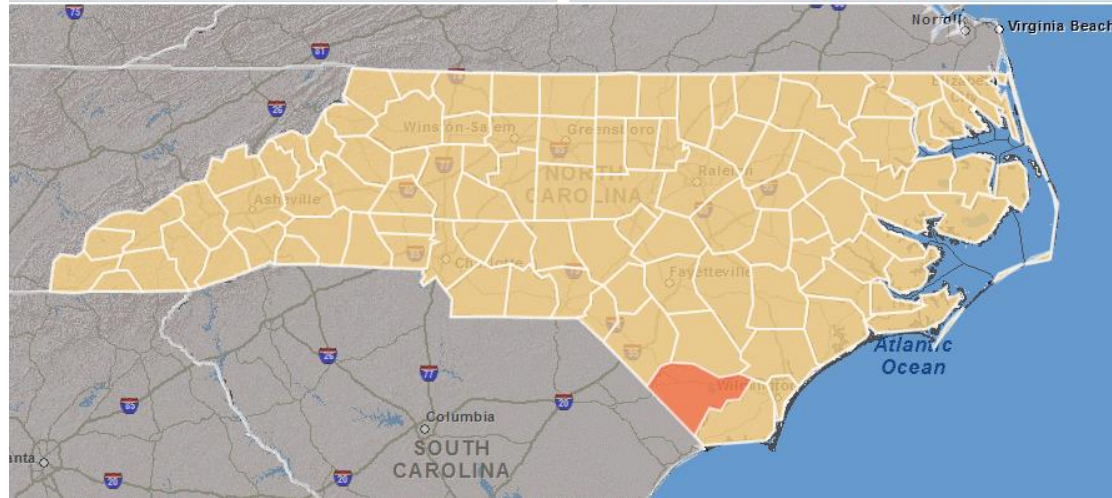
County Columbus, North Carolina



Benefits of Floodplain Mapping

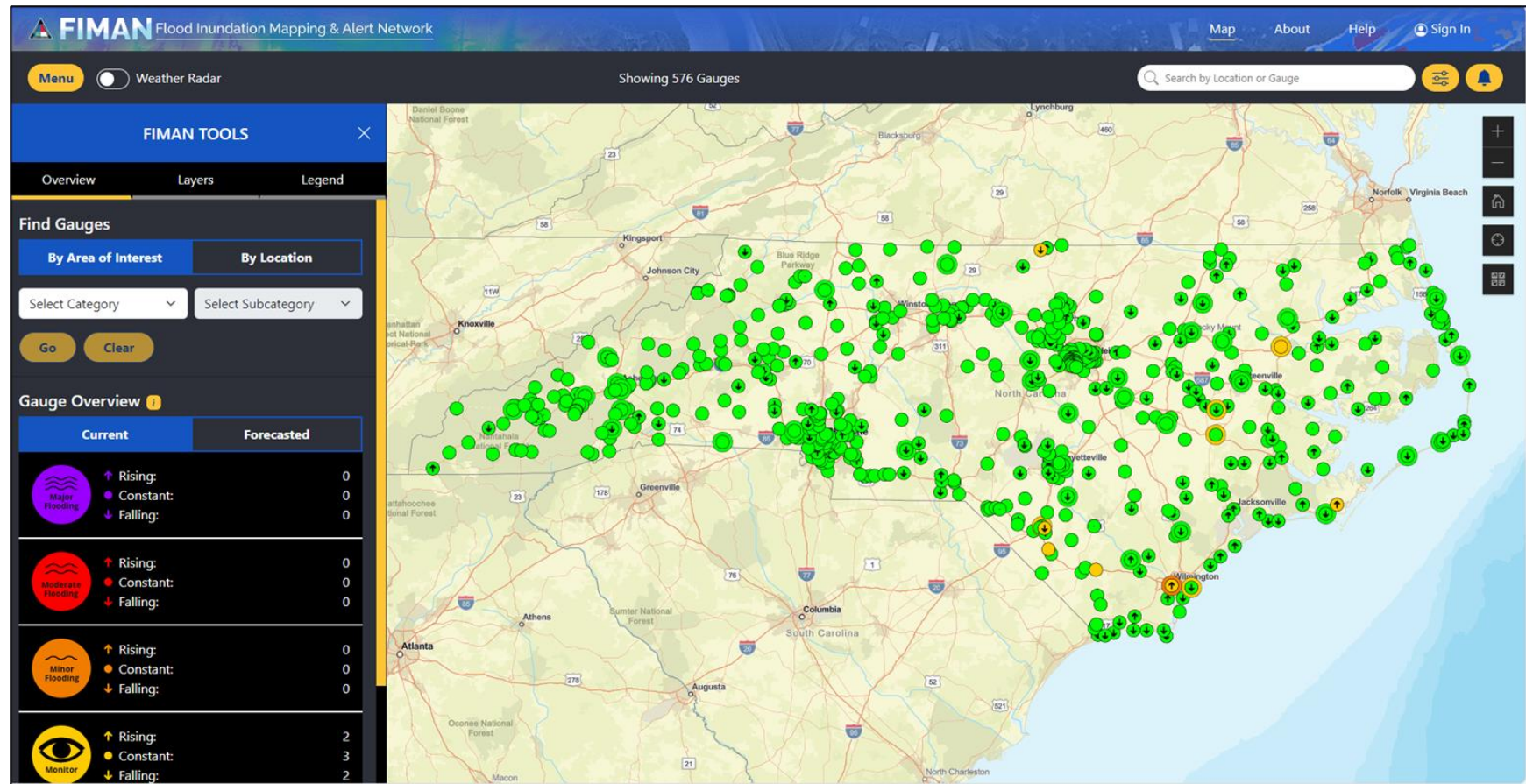
Floods are among the most frequent and costly natural disasters in terms of human hardship and economic loss. North Carolina's Digital Flood Insurance Rate Maps (DFIRM) enable business leaders and residents to more accurately predict flood hazards and prepare for flood risks.

Go to flood.nc.gov for more information.





NC CORS Network Supports Flood Indundation and Mapping Alert Network (FIMAN)



Flood Scenario Mode

FIMAN Flood Inundation Mapping and Alert Network

ABOUT US MAP WELCOME DAVID

VIEW: Gage NexFIM Search Gages Gages Summary Legend Building Legend Weather Radar

Search for location ...

Zoom In to See Buildings Affected

Flood Height

- > 5 Ft
- 4-5 Ft
- 3-4 Ft
- 2-3 Ft
- 1-2 Ft
- 0-1 Ft
- < 0 Ft

Drag to simulate flood severity

Stage (ft) 9.5 11.5 13.5 15.5 17.5 19.5 21.5 23.5 25.5 27.5 29.5

Elevation (NAVD 88) 6 8 10 12 14 16 18 20 22 24 26

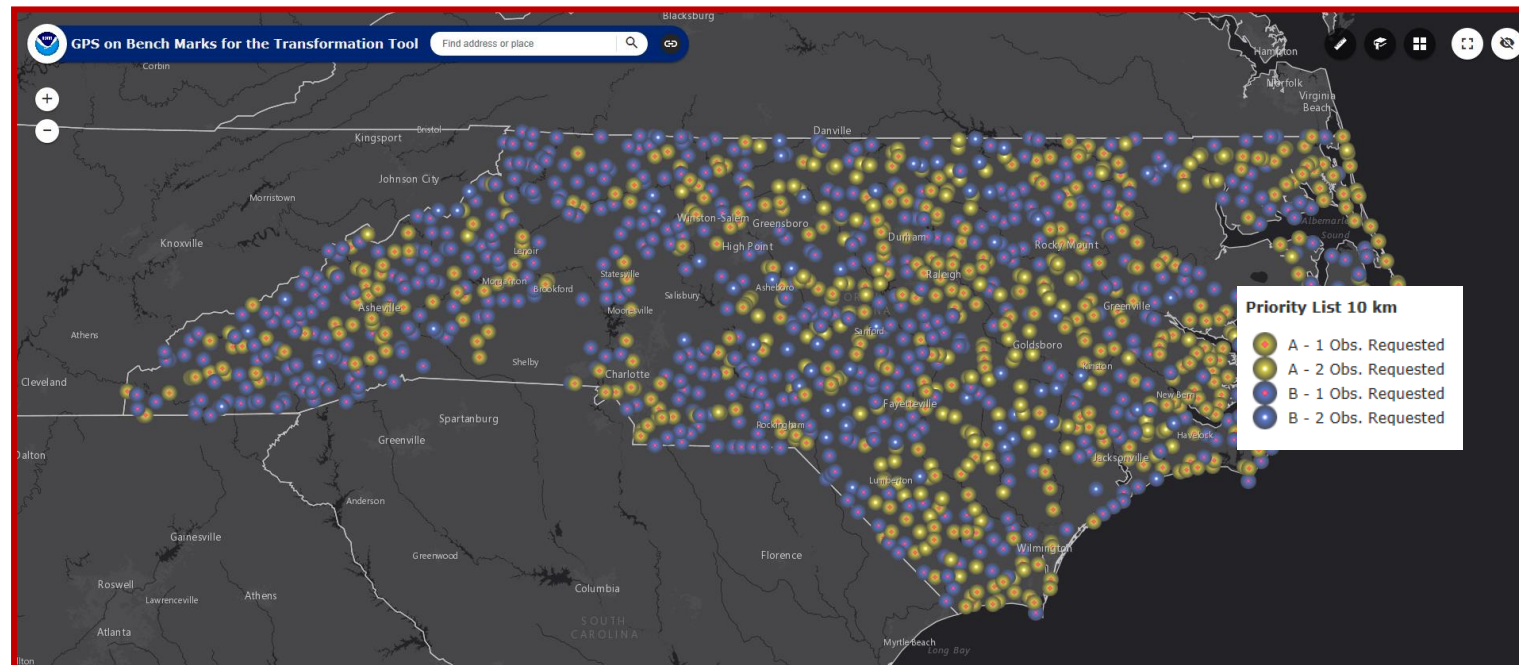
Tar River at Greenville

Last updated: Feb 10, 2016 at 11:45 AM Gage datum: -3.5ft NAVD88 Site ID: 02084000

1 hr: 0 in 6 hrs: 0 in 12 hrs: 0 in 24 hrs: 0.01 in	Stage: 16.3 ft 12.7 ft NAVD 88	9990 cfs	Constant	Peak Stage: 16.2 ft Peak Elev.: 12.7 ft 2/11 12:00 AM No est. damages forecast Forecasted Peak	1,172 buildings \$27,294,000 Damages
Rain	Stream Elevation	Flow	Constant	Forecasted Peak	Damages

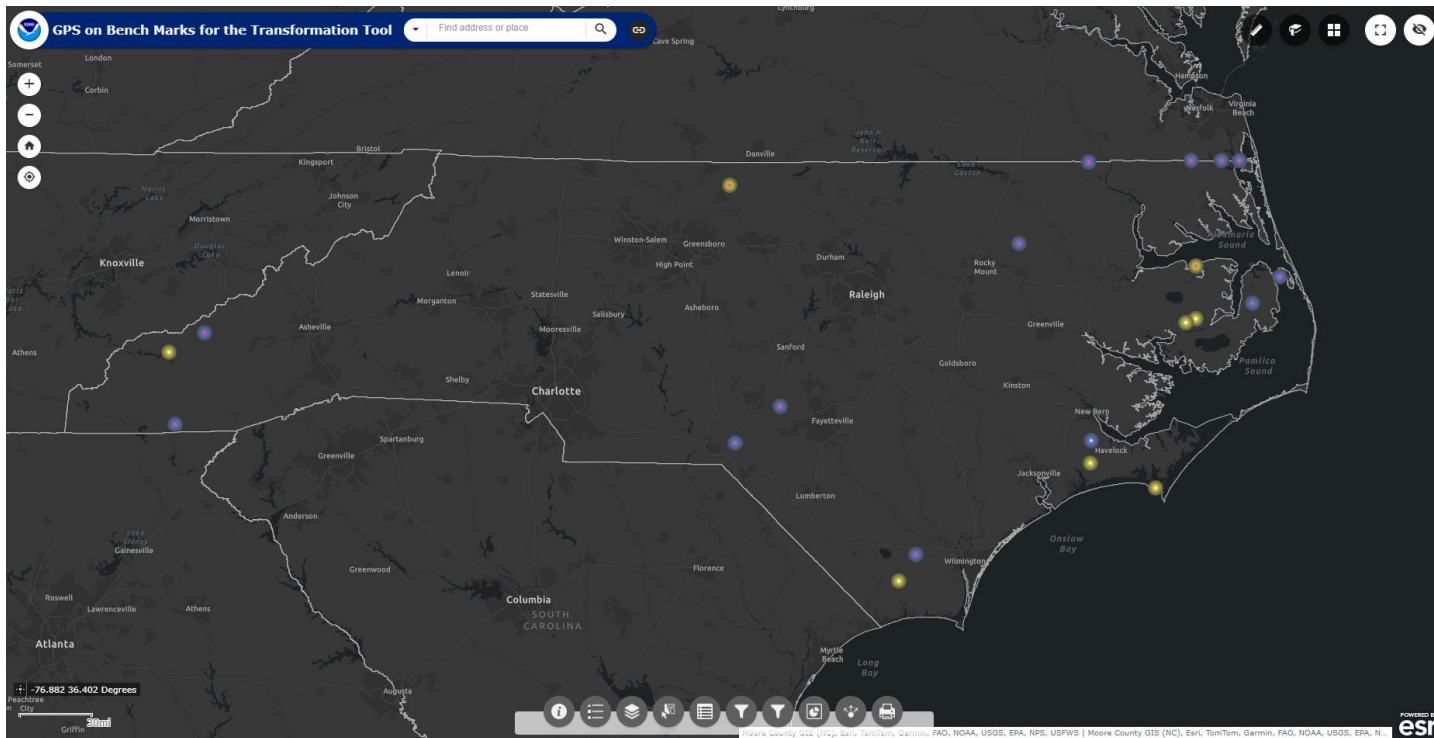
National Geodetic Survey Global Positioning System (GPS) on Bench Marks 2020

- 2020
 - NGS has prepared a list of geodetic monuments that we review for possible GNSS data collection



National Geodetic Survey GPS on Bench Marks

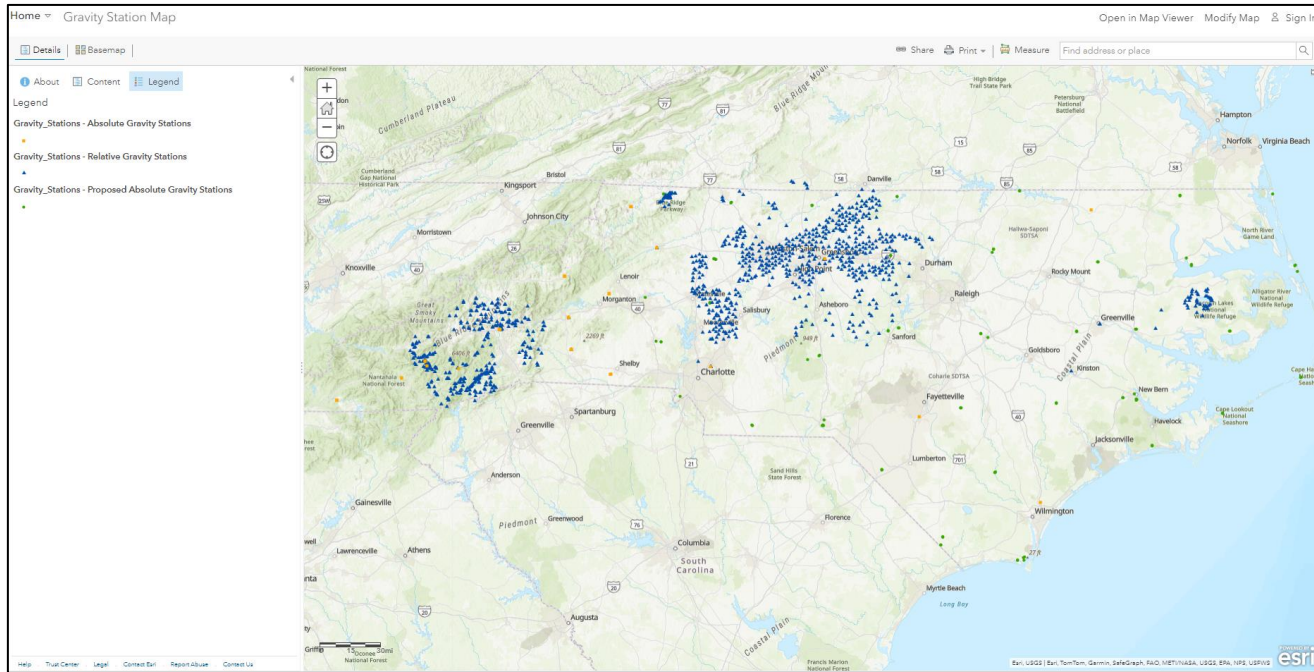
- Status of 4/02/2024



Priority List 10 km

- A - 1 Obs. Requested
- A - 2 Obs. Requested
- B - 1 Obs. Requested
- B - 2 Obs. Requested

Gravity Data Collection

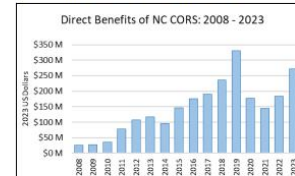


2023 Economic CORS/Real Time Network Benefits

- 2021 economic benefits
 - \$230 million
- 2022 economic benefits
 - \$330 million
- 2023 economic benefits
 - \$450 million

2023 ECONOMIC BENEFITS OF THE NC CORS NETWORK

North Carolina Geodetic Survey (NCGS) operates the state's network of Continuously Operating Reference Stations (CORS). NCGS collects, processes, and distributes data from these sites in support of high-accuracy three-dimensional positioning activities throughout the state. **In 2023, NC CORS data was used over 2.4 million times and generated efficiency gains worth over \$270 million.** This value includes only incremental cost savings and productivity gains to NC CORS users above those that would have existed without the NC CORS network.



Direct benefits represent an estimate of how much the downloaded information is worth to NC CORS users in 2023 dollars. The economic productivity method used to estimate direct benefits is discussed in Irving Lewson, *Socio-Economic Benefits Study: Scoping the Value of CORS and GBM-3D* Report to the National Geodetic Survey, January 2009.

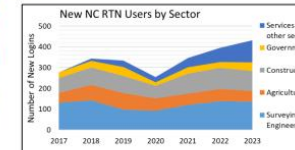
The total value of the NC CORS Network to the state's economy includes not only the direct benefits in terms of efficiency gains to users in the state, but also contributions to productivity in the industries that support or utilize the services provided by NC CORS users. Including indirect and induced benefits and excluding benefits realized outside the state, the NC CORS network generated over an estimated **\$450 million in total benefits to North Carolina's economy**; nearly 700 times the annual cost of the program. Moreover, the economic activity supported by NC CORS is estimated to generate more than **\$6 million in annual state sales and income tax revenue, as well as over \$1.3 million in local sales tax revenue.**¹ This is more than enough to fund the network's annual operating cost of \$645,000, which

includes annual equipment and labor costs of approximately \$550,000 and \$95,000, respectively.

The NC CORS network is composed of Global Navigation Satellite System (GNSS) base station receivers spaced 20-40 miles apart across the state. Each receiver continuously records the GNSS data received through its permanently mounted antenna, which has a surveyed reference point to calculate the second-by-second positioning error caused by signal delays, satellite clock errors, and inaccurate orbit information. **NC CORS data allows spatial data users to increase the accuracy of field data from 10 meters to 2 centimeters.**



NC CORS data may be downloaded free of charge for post-processing applications such as mapping and land surveying. Real-time data for GNSS-guided machine operations such as precision agriculture, construction site grading, and real-time land surveying is offered via the NC Real-Time Network (NC RTN). NC RTN users pay \$500 for the first two user ports and \$250 for each additional port. **In 2023, 431 new logins were requested to access the NC RTN; more than 5,700 logins from over 2,300 organizations now have access to the network.**



¹Indirect and induced benefits are estimated using 2022 IMPLAN industry spending patterns. Tax revenue is estimated using data from the NC OSBM.



CORS Fund

NCEM - North Carolina Emergency Management
NORTH CAROLINA GEODETIC SURVEY
Positioning North Carolina today and for the future.

Home About NCGS Geodetic Control CORS/GNSS County/State Boundaries Library Other Programs Tools Information Videos Feedback

CORS Fund Donation

First Name *

Last Name *

Company / Organization

Email *

Address

City

State

Zip

Donation Amount (\$USD) *

What sector do you work in? *

Comment

What is the answer to 4 + 4? (confirms that you are not a bot) *

Mail your donation check to:
North Carolina Geodetic Survey
4298 Mail Service Center
Raleigh, NC 27699-4298

Donation Restrictions

Donations may not be accepted from individuals, for-profit organizations, non-profit organizations, or other non-governmental entities if any of the activities described in North Carolina General Statute 133-32 (see below) applies to the potential donor.

- (a) It shall be unlawful for any contractor, subcontractor, or supplier who:
- (1) Has a contract with a governmental agency; or
 - (2) Has performed under such a contract within the past year; or
 - (3) Anticipates bidding on such a contract in the future

Please check any of the below statements that are true.

- Is under contract or is otherwise doing business with DPS
- Has performed under a contract, been involved in the procurement process, or has done business with DPS within the past 12 months
- Intends to bid on a contract, or otherwise do business with DPS within six months following the donation

OK

https://ncgs.state.nc.us/Donate_CORS





Questions?

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