North Carolina Geological Survey
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NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF ENERGY, MINERAL, AND LAND RESOURCES
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Declination diagram is from USGS 1985 GeoPDF of the Rocky Mount 30 X 60 quadrangle.

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OVERVIEW

This map is the product for Year 2 in a multi-year STATEMAP project to produce a surficial geologic map of the Rocky Mount 100K sheet (30 X 60 quadrangle) based on landform elements interpreted from high-resolution LiDAR as a base map. This is new research with previous morphostratigraphic maps of the Coastal Plain based on topography from non-standardized (sources)—low-resolution, 2 m, 5 ft and 10 foot contour intervals depicted on 7.5-minute topographic quadrangles. None of the 32 7.5-minute quadrangles in the Rocky Mount 100K sheet were previously mapped. Completely new mapping shown in this deliverable was based on high-resolution LiDAR.

Year 1 of the project (FY22) included new mapping in 8 quadrangles in the west including difficult to interpret Fall Zone units; this area will be revised. Year 2 (FY23) includes 16 quadrangles. Year 3 (FY24) and Year 4 (pending deliverables FY25) will cover the remaining 8 quadrangles.

DATA SETS

LiDAR origin: 2004 LiDAR (original source 20 ft DEMs from NC Flood Plain Mapping Program), Q2, 10ft DEMs downloaded from the USGS website and reprojected as STATE PLANE NAD 83 meters. Landform elements were interpreted from hillshade, slope and contour lines (1 m, 0.5 m and 0.25 m) derived from the elevation grids and orthoimages (county) dated circa 2011 (these best matched the 2004 LiDAR data). More recent QL1 LiDAR data is constantly updated across segments of the Coastal Plain. For a standardized unchanging dataset, the QL2 2004 data was chosen.

METHODS

At beginning of the multi-year project, data was assembled into an ArcGIS Pro ™ map project (projected in STATE PLANE NAD 83 M). A common topology was created in the geodatabase and for linework. The project was distributed to all the participants. Under direction of PI Farrell (geomorphologist, stratigrapher), each geologist was responsible for interpreting linework (heads-up digitizing on screen in ARC GIS PRO) to characterize the landform elements within assigned 7.5-minute quadrangles. Topology on linework was applied as the lines were created, and errors removed.

Within quadrangles, linework was interpreted by Kathleen M. Farrell (Falkland, Farmville, Walstonburg, Fountain), Calley Anthony (Hartsease, Tarboro, Speed), Stalin A. Rosero Pozo (Pinetops, Oak City, Robersonville West, Greenville SW), James Chapman (Greenville NE, NW and SE) and MacKenzie S. Hamilton (Old Sparta, Conetoe). Calley Anthony integrated and edgematched linework from geologists Rosero, Chapman and Hamilton and Anthony. Kathleen M. Farrell integrated linework from all 16 quadrangles, developed the standardized DMUs from the 4-quad area previously funded by STATEMAP, and created, edited and coded the +10,000 polygons for the 16 quadrangles.

FUTURE WORK

The goal of this multi-year compilation is a 1:100,000-scale digital geologic map of surficial geology of the Rocky Mount 30 X 60 quadrangle using the USGS Geologic Mapping Schema (GeMS). Revisions to the geodatabase will be required after all 32 7.5-minute quadrangles are interpreted and assigned the final revised DMUs. As the study area expands from west to east across the Rocky Mount 100K, the geomorphic model based on high-resolution LiDAR and the DMUs wll be revised to include new information. Also, high-resolution LiDAR permits interpretation and mapping of features that 5 ft, 10 ft and 2 m contours could not resolve.

Problems in displaying the DMUs on a 100K scale pdf deliverable are acknowledged. These problems result from our new mapping at the 24K scale, which includes polygons that are not simplified for display on a print product at the 100K scale. However, zooming in on the high-quality pdf should probably clarify the units.

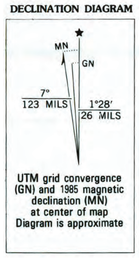
Nashville	Rocky Mount	Hartsease	Tarboro	Speed	Oak City	Hamilton	Quitsna
Winstead Crossroads	Elm City	Pinetops	Old Sparta	Conetoe	Robersonville West	Robersonville East	Williamston
Wilson	Saratoga	Fountain	Falkland	Greenville NW	Greenville NE	Leggetts Crossroads	Old Ford
Fremont	Stantonsburg	Walstonburg	Farmville	Greenville SW	Greenville SE	Grimesland	Washington

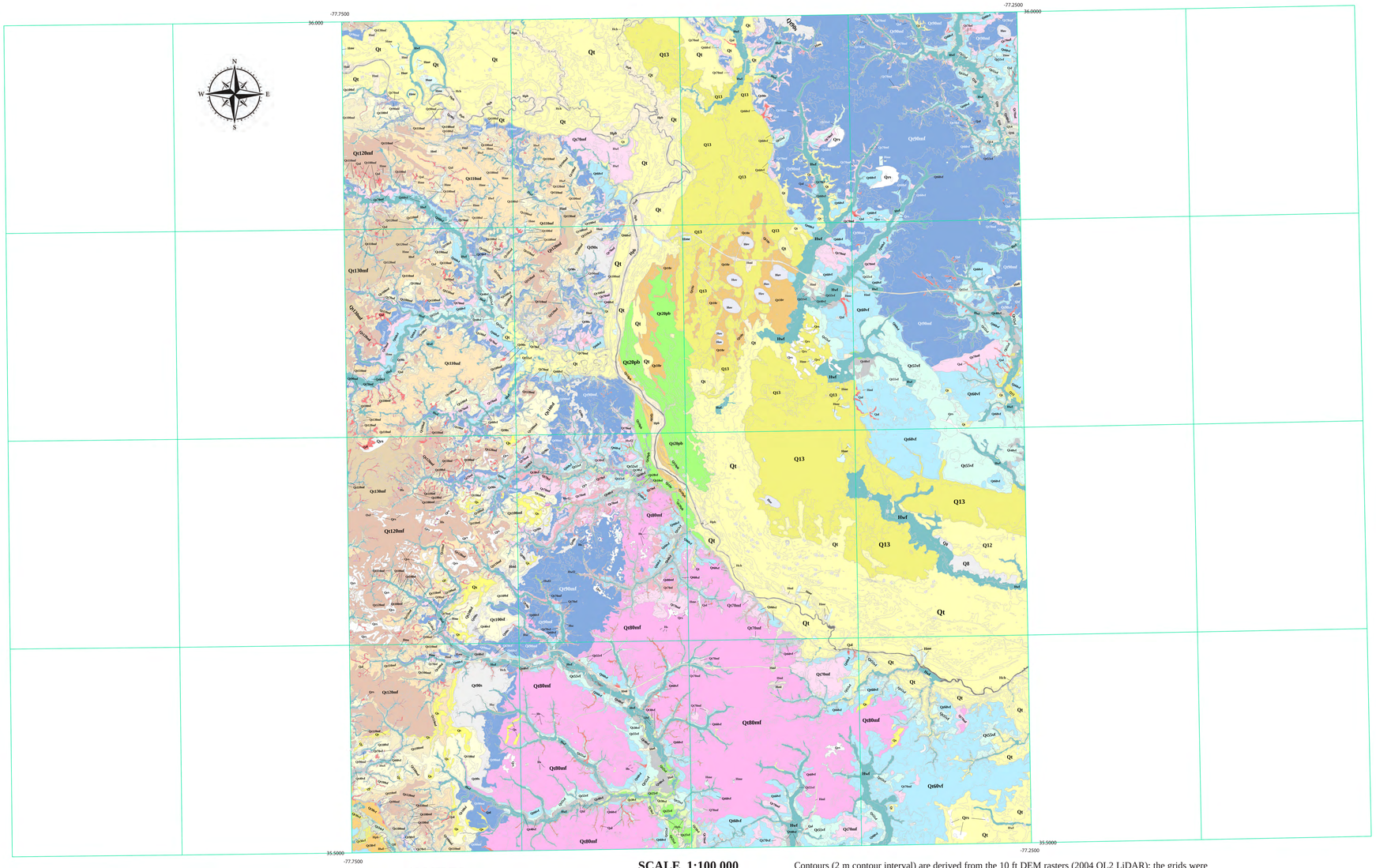
STUDY AREA CONSISTS OF 16 7.5-MINUTE QUADRANGLES IN THE ROCKY MOUNT 100K SHEET

1	2	3
4	5	6
7	8	9

1 - HENDERSON
2 - ROANOKE RAPIDS
3 - ELIZABETH CITY
4 - RALEIGH
5 - ROCKY MOUNT
6 - PLYMOUTH
7 - FAYETTEVILLE
8 - KINSTON
9 - BAYBORO

DECLINATION DIAGRAM





10 MILES

20 KILOMETERS

SCALE 1:100,000

Contour Interval = 2 meters

Contours (2 m contour interval) are derived from the 10 ft DEM rasters (2004 QL2 LiDAR); the grids were geoprocessed using tools in the ARC GIS Pro Toolbox. The input raster was smoothed using the Focal Statistics tool (Image Analyst Tools, Statistical, Focal Statistics). The Neighborhood was defined as Rectangular cell (Unit type) with a Width of 10 m and a Height of 10 m (Projection of map is North Carolina State Plane NAD83 Meters). The chosen Statistics type was 'Mean'. The Contour tool (Spatial Analyst Tools, Surface, Contour) was utilized to create 2 m and 10 m contours from the smoothed grid. The contour lines were smoothed using the Smooth Line tool (Cartography Tools, Generalization, Smooth Line). The selected Smoothing Algorithm was the 'Polynomial Approximation with Exponential Kernal (PAEK)' with an assigned Smoothing Tolerance of 100-meters. Lastly, the attribute table for the contour lines was edited to delete all lines less than 150 m in length. The 10 m contours are labelled in the map.

SURFICIAL GEOLOGIC MAP UNITS/GEOMORPHIC LANDFORM ELEMENTS

HOLOCENE LANDFORM ELEMENTS

Hme Man-Made Excavation – Man-made excavations such as ponds, lakes and lagoons that are commonly infilled with water; may be associated with spoil heaps, dams and mining operations.

Hmd Modified Land – Undifferentiated modified land that includes man-made earthen structures such as spoil piles from mining and dredging, dams associated with ponds and lagoons, roadways (cuts and causeways) that interfere with the natural landscape, and associated excavations.

Hch Stream Channel – Natural stream and river channels; may be dredged and straightened.

Hwf Wetland Flat (Holocene) – Vegetated wetland flat at base of incised valleys; commonly with an anastomosed channel network activated during flood stage. Hwf is the main component of the active flood plain; it may be drained by a single main channel, which is commonly trenched and straightened by human activity. Locally or seasonally, Hwf may become lacustrine. Basal quartz sand fines up into organic-rich sand and mud. Deposits are typically less than 3 m thick. Flat is typically flanked by colluvium, alluvial fan, and partly buried channel belts. It is incised into pre-existing deposits and may be separated stepwise from other active or inactive wetland flats. Upstream, especially in first order streams, the flat narrows and is replaced by undifferentiated Quaternary alluvium. the wetland flat rises in elevation across the Coastal Plain in drainages from sea level (bay head delta in estuaries) to the Fall Zone. It is intermittently replaced by Hpb, the Holocene point bar complex. Downstream and in large river systems, Hwf is replaced by large-scale point bar complexes, and is restricted to low-lying flood basins between meander belts. Upstream in the Fall Zone, Hwf may merge with older terraces and colluvium.

Hpb Point bar complex (Holocene) – The Holocene point bar complex is part of the active flood plain and occurs in two settings. It intermittently replaces the wetland flat (Hwf) along incised drainages that typically lack a major channel. Along major streams, Hpb occurs as a small-scale narrow complex adjacent to the principal channel, where it is the 'zone in which the channel meanders'. In this setting, Hpb is incised (1-2 m) into a slightly older, higher elevation point bar complex, which becomes active during major floods.

Hs Sinkhole (Holocene) – Sinkholes are ovate depressions that form when underlying carbonate-rich units dissolve and collapse forming a geologically active landscape. Sinkholes may be associated with incipient Carolina Bay formation, and may act as conduits for degassing and dewatering of underlying units. Some sinkholes may have formed prior to the Holocene.

Hsv Ovate depression – Oval-shaped, topographic low in center of Carolina Bay; dry to wet, with some including wetlands. May be an erosional feature related to headward erosion; commonly occur in association with remobilized sands or muds that form rims.

Hsc Side Valley Colluvium – A narrow zone of colluvium marginal to the wetland flat or other feature; at the base of slopes and in association with breaklines in topographic relief.

Hwf2 Wetland Flat 2 – Secondary wetland flat that occurs upstream from Hwf, and formed in response to a higher base level. For example, a step like feature may separate Hwf from Hwf2. In some cases, Hwf2 may be a dry wetland flat because of drainage modifications (channelizing flow) and a small catchment area. In other cases, Hwf may directly merge into a relict Pleistocene wetland flat with no geomorphic evidence to suggest a change in landform element, except for the change from wet to dry flat.

UNDIFFERENTIATED HOLOCENE/PLEISTOCENE LANDFORM ELEMENTS

Qal Undifferentiated Quaternary alluvium – Qal is here specifically defined as valley-fill alluvium, colluvium, feeder channels and alluvial fans that are upstream components of the currently active landscape (Holocene depositional system). In many cases, sediment may be Pleistocene or Pliocene in age. Typically, Qal occurs upstream or updrainage from the Holocene wetland flat (Hwf, Hwf2) and is common in first order streams. It is not flat, but may have an irregular surface. Surfaces of some colluvial deposits and alluvial fans are concave downward. Incised feeder channels may lead down slope from sediment sources to fan sinks, especially in areas where clay-rich sediment forms steep banks that separate terraces.

Qrs Remobilized sand – Remobilized sand refers to sands that through a variety of processes now form topographic highs in otherwise flat landscapes. Qrs map units may help identify rims affiliated with Carolina Bays, sand ridges, or undifferentiated high-standing sand accumulations. An alternative interpretation is that, in certain cases, these are erosion resistant remnants of the older, higher landform elements that are mud-dominated, rather than sand dominated. This can only be resolved by direct drilling into the features.

Qbf Barforms – Transverse or attached barforms with several possible origins. Barforms that postdate the Hwf and incised valley terraces may have formed in response to Holocene major flood events that impacted the local basin. Alternatively, these barforms may be remnants of older point bar deposits that are currently undergoing burial by the Holocene wetland flat.

Qs Shoreline sand – Shoreline marker unit helps emphasize shoreline landforms such as barrier islands, strand lines,shorefaces, alongshore bars, barrier islands, and dunes.

Qlf Levee overwash fans – overwash fans along channels, that form during overtopping of natural levees during floods; usually associated with point bar complexes.

Qt Unassigned terraces – Unassigned incised valley deposits; in many cases, these are undifferentiated valley fill deposits of Middle to Late Pleistocene age.

Q16 Unassigned 16 m terrace.

Q14 Unassigned 14 m terrace.

Q13 Unassigned 13 m terrace.

QUATERNARY VALLEY FILL TERRACES

Qt10pb Pleistocene point bar complex at 4-7 m – Tar River – Pleistocene terrace set at 4-7 m is one of the two principal point bar complexes in the Tar River incised valley. The point bar complex is reoccupied during Holocene flood events with high-water flows travelling along point bar swales. Post dates Qt20pb.

Qt10vf Pleistocene valley fill terrace at 7-4 m – Point bar complex at 4-7 m is situated in a side valley (Otter Creek drainage) to the main Tar River and correlates downstream with main Tar River point bar terrace Qt10pb.

Qt10r Ridges on Pleistocene point bar complex (Qt10pb).

Qt15vf Pleistocene valley fill terrace at 10-8 m (postdates Q20vf in Otter Creek drainage).

Qt20pb Pleistocene point bar complex at 8-11 m – Point bar complex at 8-11 m is a major terrace system in the Tar River incised valley (Falkland); terrace set may correlate with upstream equivalent Qt25vf. Predates Qt10pb.

Qt25vf Pleistocene valley fill terrace at 14-11 m – Major point bar complex. Upward fining channel belt sands, abandoned channels, oxbox lakes, and associated wetland flats. In core holes, unit is typically less than 4 m thick. Hwf and Hpb are incised into this unit. May correlate with Qt20 pb.

Qt28vf Pleistocene valley fill terrace at 13-11 m (Otter Creek) – Fairly flat valley fill terrace at 13-11 m, lacks the point bar landforms. Postdates Qt30vf, and predates Qt20pb. Mapped in Otter Creek drainage.

Qt30vf Pleistocene valley fill terrace at 15-12 m – Fluvial to possibly estuarine valley fill terrace at 15-12 m; varies from a flat to a point bar complex. Predates Q25vf, a major point bar complex at 11-12 m. Incised into or may downstep from Qt40vf (20200).

Qt34vf Pleistocene valley fill terrace at 14-13 m – Point bar complex at 14-13 m; incised into and postdates Qt36 vf. Locally may merge into Hpb system. Typically Hpb is incised into this unit. Defined in Contentnea Creek area (Walstonburg).

Qt36vf Pleistocene valley fill terrace at 15-14 m.

Qt38vf Pleistocene valley fill terrace at 17-14 m – Flat to wave-swept valley-fill terrace at 17-14 m; includes internal downsteps that resemble bars deposited from a succession of standing waves. Very sandy. Farmland with subtle topography; lacks well developed point bar system in some areas. Some upstream areas in smaller-scale drainages have well-developed point bar topography. Closely affiliated with Qt40vf, which may be an estuarine terrace, and can be mapped directly to it. Defined in Contentnea Creek area (Walstonburg).

QUATERNARY MARINE/ESTUARINE TERRACES

Qt40vf Pleistocene valley fill at 21-14 m. With fluvial and estuarine components. Upstream, unit is incised into Qt60vf and/or Qt55vf, as a downstep. In downstream confluence areas it tends to converge in elevation with Qt55vf, so that these landform elements are difficult to separate geomorphically (areas with larger sediment supply). This unit may mark the transition from older marine/estuarine terraces (Early Pleistocene) to younger point bar terraces which may be Middle Pleistocene.

Qt55vf Pleistocene valley fill at 21-14 m. Flat estuarine terrace at 21-14 m that forms as a downstep from Qt60vf. Downstream, Qt55vf forms a broad flat at 14 m. It is likely Early Pleistocene, forming during falling stages in sea level after occupation of the Surry paleosshoreline.

Qt60vf Pleistocene valley fill at 22-18 m. Estuarine terrace at 22-18 m that has downstepped from Qt80mf, a principal marine flat. Qt60vf similarly downsteps to form Qt55 vf. It is likely Early Pleistocene, forming during falling stages in sea level after occupation of Surry paleosshoreline

Qt70ef Pleistocene estuarine flat and incipient valley fill colluvium at 23.5-21.5 m; postdates marine flat Qt70mf (in Falkland quadrangle) but is closely related to it; unit includes major colluvial 'event' that includes slope failures, fan and collivial deposits, and extensive remobilized sands that outline Carolina Bays. Unit helps demarcate the incised valley incision event in sandy areas. It is likely Early Pleistocene, forming during falling stages in sea level.

Qt70mf Pleistocene marine and estuarine flats at ~25-22 m. Marine and estuarine flats at 25-22 m are slightly incised into Qt80mf (Otter Creek, Falkland). Down valley, the estuarine terrace merges with the equivalent marine flat along the open paleosshoreline. (This unit may be grouped with Qt90mf and Qt80mf, but exhibits downstepping, especially in the incipient incised valley.

Qt80mf Pleistocene marine flat at 25.5 to 24 m; Marine flat at 25.5 to 24 m is locally separated from more landward Qt90mf by a subtle downstep in topography; it is underlain by the same geologic unit as Q90mf. This unit helps demonstrate the early stages of incised valley formation (Otter Creek - Falkland) during the falling stage in sea level from the Qt80s event. Early Pleistocene, falling stage marine ramp.

Qt90mf Pleistocene marine/estuarine flat at 27.0 to 25.5 m, that marks a reoccupation of the Surry paleosshoreline after the highstand at 30 m, and the incipient formation of incised valleys that formed as sea level fell after forming the Surry shoreline; estuarine equivalents are mapped upvalley.

QUATERNARY MARINE/ESTUARINE TERRACES, CONTINUED

Qt90s Pleistocene shoreline sands at 27-28 m form a marine flat that postdates the main Surry paleosshoreline high stand at 30 m (Qt100sf); it formed at a paleo- sea level of about 27-28m and marks the landward most extent of the regional-scale marine terrace (Qt90mf, Qt80 mf, Qt70 mf) that extends from 27-24 m; it occurs along the open coast (Surry) and in estuaries, only occurs near the paleosshoreline; upestuary it merges with the downstepping Qt90mf.

Qt100sf Sand flat at 28-30 m occurs along the Surry paleosshoreline; it is slightly higher in elevation and more landward than Qt90s (the 27-28 m flat); it is seaward and slightly lower in elevation than Qt100mf, the principal highstand flat at 29-32 m. In upstream incised valleys, this unit is mappable marking a high-stand or the first downstep after the first occupation of the Surry paleosshoreline. May include remobilized sands marking Carolina Bay rims.

Qt100mf Pleistocene marine flat at 29-32 m is associated with the primary occupation of the Surry Paleosshoreline complex; flat likely formed at a sea level of approximately 30 – 31 m; it includes remobilized sands that outline Carolina Bays and define other shoreline-related sandy features; unit may has an uneven topography because of the fan and colluvial deposits, and extensive remobilized sands that outline Carolina Bays. Unit helps demarcate the incised valley incision event in sandy areas. It is likely Early Pleistocene, forming during falling stages in sea level.

Qt110mf Marine/estuarine flat at 32-34 m that occurs as a widespread downstep from Qt136, a major marine terrace; associated with the incipient formation of Surry paleosshoreline complex; unit is geomorphically complex especially with respect to its interfacing with the eastern margin of Qt136mf.

Qt120mf Pleistocene marine flat at 34-36 m is a geomorphically complex area that likely includes beach ridge accretion plain near the Surry paleosshoreline, remobilized sands that demarcate Carolina Bay ovals, and numerous colluvial failures likely caused by thick shallow sands; Closely affiliated with Qt138 to west, as a local downstep.

Qt130mf Pleistocene marine flat at 36-38 m is part of a major downstepping marine terrace complex that extends westward to vicinity of Kenly paleosshoreline complex (scarp toe at 48 m).

This geologic map was funded in part by the USGS National Cooperative Geologic Mapping Program, award number G23AC00464. The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either express or implied, of the U.S. Government. This map and explanatory information is submitted for publication with the understanding that the United States Government is authorized to reproduce and distribute reprints for governmental use.

Disclaimer:
This Open File Report is preliminary. It has been reviewed internally for conformity with the North Carolina Geological Survey editorial standards. Further revisions or corrections to this preliminary map may occur.

PRELIMINARY MAP OF GEOMORPHIC LANDFORM ELEMENTS FOR SIXTEEN 1:24,000 SCALE QUADRANGLES IN THE ROCKY MOUNT 100K SHEET (30 X 60 QUADRANGLE), NORTH CAROLINA

By
Kathleen M. Farrell, Calley Anthony, Stalin A. Rosero, James S. Chapman, McKenzie S. Hamilton

Map preparation, digital cartography and editing by Kathleen M. Farrell, with editing assistance by Calley Anthony
2025

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