DEPARTMENT OF ENVIRONMENTAL PROTECTION
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U. S. GEOLOGICAL SURVEY
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SURFICIAL GEOLOGY OF THE MOORESTOWN QUADRANGLE BURLINGTON AND CAMDEN COUNTIES, NEW JERSEY

OPEN-FILE MAP OFM 63

INTRODUCTION

Surficial sediments in the Moorestown quadrangle include artificial fill and fluvial, estuarine, salt-marsh, and hillslope deposits. They are as much as 50 feet thick but are generally less than 20 feet thick, and are absent over much of the quadrangle. The deposits lie upon a landscape shaped by three main episodes of valley incision. The deposits are described below. The age of the deposits and the episodes of valley erosion are shown on the correlation chart. The underlying Coastal Plain formations are mapped by Stanford and Sugarman (2005).

DESCRIPTION OF MAP UNITS

ARTIFICIAL FILL--Sand, silt, gravel, clay; gray to brown; demolition debris (concrete, brick, wood, metal, etc.), cinders, ash, slag, glass. Massive to weakly stratified. As much as 30 feet thick. In highway and railroad embankments and filled marshes and floodplains. Many small areas of fill, particularly along streams in urban areas, are not mapped.

afl TRASH FILL--Trash mixed with, and covered with, silt, clay, sand, and minor gravel. As much as 30 feet thick. In solid-waste landfill near mouth of Parkers Creek. Small areas of trash fill may be included within artificial fill.

Qal ALLUVIUM--Sand, silty sand, silt, some clay and peat; brown, yellowish-brown, gray, black; and pebble gravel. Contains variable amounts of organic matter. Sand and silt is massive to weakly stratified. Gravel occurs in massive to weakly stratified beds generally less than 2 feet thick. Sand is chiefly quartz with some glauconite and mica. Gravel is chiefly white, gray, and yellow quartz and quartzite, and a trace of gray chert. Sand and gravel beds may be locally cemented with iron. As much as 15 feet thick (estimated). Deposited in modern flood plains, stream channels, and groundwater seepage areas. In some urban areas alluvium is mapped from 1979 aerial photographs and the 1953 edition of the base map. In these areas the alluvium is now covered by fill and regraded sediment from adjacent surficial deposits and Coastal Plain formations. These emplaced materials are not everywhere mapped.

Qm SALT-MARSH AND ESTUARINE DEPOSITS--Silt, sand, silty sand, clay, peat; brown, dark-brown, gray, black; and minor pebble gravel. Contain abundant organic matter. As much as 30 feet thick (estimated). Deposited in modern salt marshes and tidal channels during the Holocene sea-level rise, chiefly within the past 6000 years.

Qtl LOWER TERRACE DEPOSITS--Fine-to-coarse sand, silty sand, minor silt and clay; yellow, reddish-yellow, olive-yellow; pebble gravel. Sand is massive to well-stratified. Gravel occurs in thin beds (generally less than 6 inches thick) within and at the base of the deposit. Sand is chiefly quartz and glauconite, with a little mica. Gravel is chiefly white, gray, and yellow quartz and quartzite, and a trace of gray chert. As much as 15 feet thick (estimated). Form stream terraces with surfaces 5 to 15 feet above modern flood plains.

Qcl LOWER COLLUVIUM--Fine-to-medium sand, silty sand; yellow, brownish-yellow, light-gray, very pale brown; and pebble gravel. Massive to weakly stratified. Sand is quartz with minor glauconite and mica. Gravel composition as in unit Qtl. As much as 15 feet thick (estimated). Rests on footslopes that grade to the lower terraces or modern floodplain.

Qtu UPPER TERRACE DEPOSITS--Fine-to-coarse sand, silty sand, minor silt and clay; yellow, reddish-yellow, brownish-yellow, light-gray, locally olive-yellow; pebble gravel. Beds of olive to green glauconitic silty clay are common in the upper terrace deposits in the lowland between Parkers Brook and the North Branch of Pennsauken Creek, but rarely present elsewhere. Sand is massive to well-stratified. Gravel occurs in thin beds (generally less than 6 inches thick) within and at the base of the deposit. Sand is chiefly quartz with some glauconite and a little mica. Gravel is chiefly white, gray, and yellow quartz and quartzite, and a trace of gray chert. As much as 30 feet thick but generally less than 10 feet thick. Form stream terraces with surfaces 15 to 40 feet above modern flood plains. Grade downvalley to, or are onlapped by, unit 2 of the Cape May Formation (Qcm2), and so are contemporaneous with, or slightly older than, the Cape May 2.

Qcu UPPER COLLUVIUM--Fine-to-medium sand, silty sand; yellow, brownish-yellow, light-gray, very pale brown; and pebble gravel. Massive to weakly stratified. Sand is quartz with minor glauconite and mica. Gravel composition as in unit Qtu. As much as 15 feet thick (estimated). Rests on footslopes that grade to the upper terraces.

Qcm2 CAPE MAY FORMATION, UNIT 2 (Salisbury and Knapp, 1917; Newell and others, 2000)--Fine-to-coarse sand, silty fine-to-medium sand, minor silt; yellow, brownish-yellow, very pale brown, light-gray; pebble gravel. Massive to well-stratified. Sand is quartz with some glauconite and a little mica. Gravel composition as in unit Qtu. As much as 40 feet thick. Forms a terrace with a surface elevation of between 30-35 feet along Rancocas Creek and the downstream reaches of North Branch Pennsauken Creek. Fossils, pollen, and amino-acid racemization ratios in shells from this unit elsewhere in the Delaware estuary indicate that it is an estuarine deposit of Sangamon age (about 125,000 years ago), when sea level was approximately 20-30 feet higher than at present in this region (Woolman, 1897; Newell and others, 1995; Lacovara, 1997; Wehmiller, 1997). Salisbury and Knapp (1917) included stream terrace deposits within the Cape May Formation; here they are mapped separately as upper and lower stream terrace deposits (units Qtu and Qtl) because they differ in age and origin from the Cape May Formation.

TQg UPLAND GRAVEL, LOWER PHASE--Fine-to-coarse sand, silty fine-to-medium sand; olive, yellow, yellow-brown; pebble gravel. Sand is chiefly quartz with some glauconite and a little mica; silty beds are glauconite-rich. Gravel is white, gray, and yellow quartz and quartzite, with a trace of gray chert. As much as 15 feet thick. Occurs as erosional remnants of former flood plains and stream terraces on low interfluves, between 60 and 85 feet in elevation, around the headwaters of North Branch Pennsauken Creek.

Tp PENSAUKEN FORMATION (Salisbury and Knapp, 1917)--Fine-to-medium sand, silty sand, minor coarse sand and silt; reddish-yellow to yellow; pebble gravel. Massive to well-stratified, commonly with tabular, planar cross-beds in sand. Pebble gravel occurs as thin layers (generally less than 3 inches thick) within the sand and as thicker, massive beds in places at the base of the formation, where it may include some cobble gravel. Sand is chiefly quartz with some feldspar, rock fragments (chert and shale), and glauconite (Bowman and Lodding, 1969; Owens and Minard, 1979). The feldspar is generally partially weathered to a white clay. Gravel is chiefly yellow, reddish-yellow (from iron-staining), white, or gray quartz and quartzite; a little brown to gray chert and reddish-brown ironstone; and a trace of brown, reddish-brown, and gray sandstone and shale, and white-to-gray gneiss. The chert, sandstone, shale, and gneiss are generally partially weathered or fully decomposed. As much as 50 feet thick in the Cinnaminson area and locally in the lower Parkers Creek valley, but generally less than 30 feet thick elsewhere. Occurs as erosional remnants capping uplands in the northwestern and northern parts of the quadrangle. The base of the deposit descends from an elevation of about 80 feet south of Colestown to between 50 and 60 feet (with some channels as low as 20-30 feet) in the Moorestown-Maple Shade area, to about 25 feet in the northwest corner of the quadrangle, reflecting overall thickening of the deposit towards the main Delaware Valley. This geometry, and regional paleoflow data (Owens and Minard, 1979; Martino, 1981), and the provenance of the sand and gravel, indicate that the Pensauken was deposited by a large river flowing southwesterly from the New York City area to the Delmarva Peninsula. The Moorestown quadrangle is on the southeastern edge of the former river valley.

The age of the Pensauken is not firmly established. Berry and Hawkins (1935) describe plant fossils from the Pensauken near New Brunswick, New Jersey that they consider to be of early Pleistocene age. Owens and Minard (1979) assign a late Miocene age based on correlation to units in the Delmarva Peninsula. Pollen from a black clay bed within the Pensauken near Princeton, New Jersey, includes cool-temperate species and a few pre-Pleistocene taxa. This assemblage suggests a Pliocene age (Stanford and others, 2002). A Pliocene age is also consistent with the geomorphic and stratigraphic relation of the Pensauken to upper Pliocene or lower Pleistocene till and to middle and upper Miocene marine and fluvial deposits in central New Jersey (Stanford, 1993).

Tg UPLAND GRAVEL--Fine-to-coarse sand, silty fine-to-medium sand, minor clayey sand to sandy clay; yellow, olive-brown, olive, reddish-yellow, very pale brown; and pebble gravel. Massive to weakly stratified. Gravel occurs as thin beds (generally less than 1 foot thick) within the sand, and at the base of the deposit. Sand is chiefly quartz, with some glauconite. Silty and clayey beds are glauconite-rich and are most common in the southeastern part of the map area. Gravel is chiefly yellow, reddish-yellow (from iron-staining), white, and gray quartz and quartzite, with a little ironstone and a trace of weathered chert. As much as 30 feet thick. Occurs as erosional remnants of former flood plains and stream terraces capping hilltops and interfluves in the eastern and southern parts of the quadrangle. The base of the deposits descends from an elevation of about 90 feet in the southeast to about 60 feet in the west and central parts of the quadrangle, where the deposits grade into the Pensauken Formation. This relationship, and the northwest-southeast trend of many of the deposits, suggests that the upland gravels were laid down by northwesterly flowing local streams that were tributaries to the Pensauken river. Post-Pensauken stream erosion resulted in a topographic inversion, and the former valley-bottom deposits now form interfluves.

Tb BRIDGETON FORMATION (Salisbury and Knapp, 1917)--Fine-to-coarse sand, silty sand, clayey sand; yellow-brown, reddish-yellow, olive-yellow, very pale brown; pebble gravel. The gravel and coarse sand beds are locally iron-cemented. Sand is chiefly quartz with some feldspar and rock fragments (chiefly chert and shale). The feldspar and chert are generally weathered to white clay, which has been translocated by ground water to form coatings on the quartz grains and to fill voids in the coarser sand beds. Silty beds are glauconite-rich. The glauconite is derived from erosion of Coastal Plain formations that formerly cropped out well to the north and west of the map area, because the local glauconitic Coastal Plain formations were not exposed during deposition of the Bridgeton. Gravel is chiefly yellow, reddish-yellow, and reddish-brown (from iron-staining) to white and gray quartz and quartzite with some gray and brown chert, and a trace of weathered reddish-brown to gray sandstone and shale and weathered white-to-gray gneiss. Many of the chert pebbles are weathered to white and yellow clay. As much as 15 feet thick. Occurs as an erosional remnant on Hutton Hill, above 145 feet in elevation. The Bridgeton Formation is a fluvial-plain deposit that formerly covered the entire map area above an elevation of 140-200 feet. The Bridgeton was deposited by a river that flowed southeasterly to easterly across the southern New Jersey Coastal Plain. Stratigraphic position and petrologic correlations to marine deposits in the Delmarva Peninsula suggest a late Miocene age (Owens and Minard, 1979; Pazzaglia, 1993).

Qwcp OUTCROP OF COASTAL PLAIN FORMATIONS--Exposed formations of Cretaceous through Miocene age. Soil zone generally includes some lag pebbles from eroded surficial deposits. May include thin, patchy colluvial or alluvial sediments less than 3 feet thick.

MAP SYMBOLS

Contact--Solid where well-defined by landforms; dashed where approximately located, dotted where featheredged or gradational.

31-4865 20 **Thickness of surficial material in well or boring--**Upper number is the well permit number, issued by the N. J. Department of Environmental Protection, Bureau of Water Allocation; lower number is thickness in feet of surficial material inferred from driller's log.

8 **Surficial material formerly observed--**No longer exposed. Number indicates thickness of surficial deposit in feet. From files of the N. J. Geological Survey, based on field observations between 1900 and 1945 by H. B. Kummel, G. N. Knapp, and M. E. Johnson.

Surficial material observed in hand-auger hole, exposure, or excavation

Excavation perimeter--Marks limits of former sand pits.

Sand and gravel pit--Inactive in 2003.

Shallow topographic basin--Line at rim, pattern in basin. Depth of closure generally less than 5 feet, but may be as much as 15 feet. Formed by melting of ground ice following the last glacial cold period, between 20,000 and 15,000 years ago. Drawn from air photos taken in 1979.

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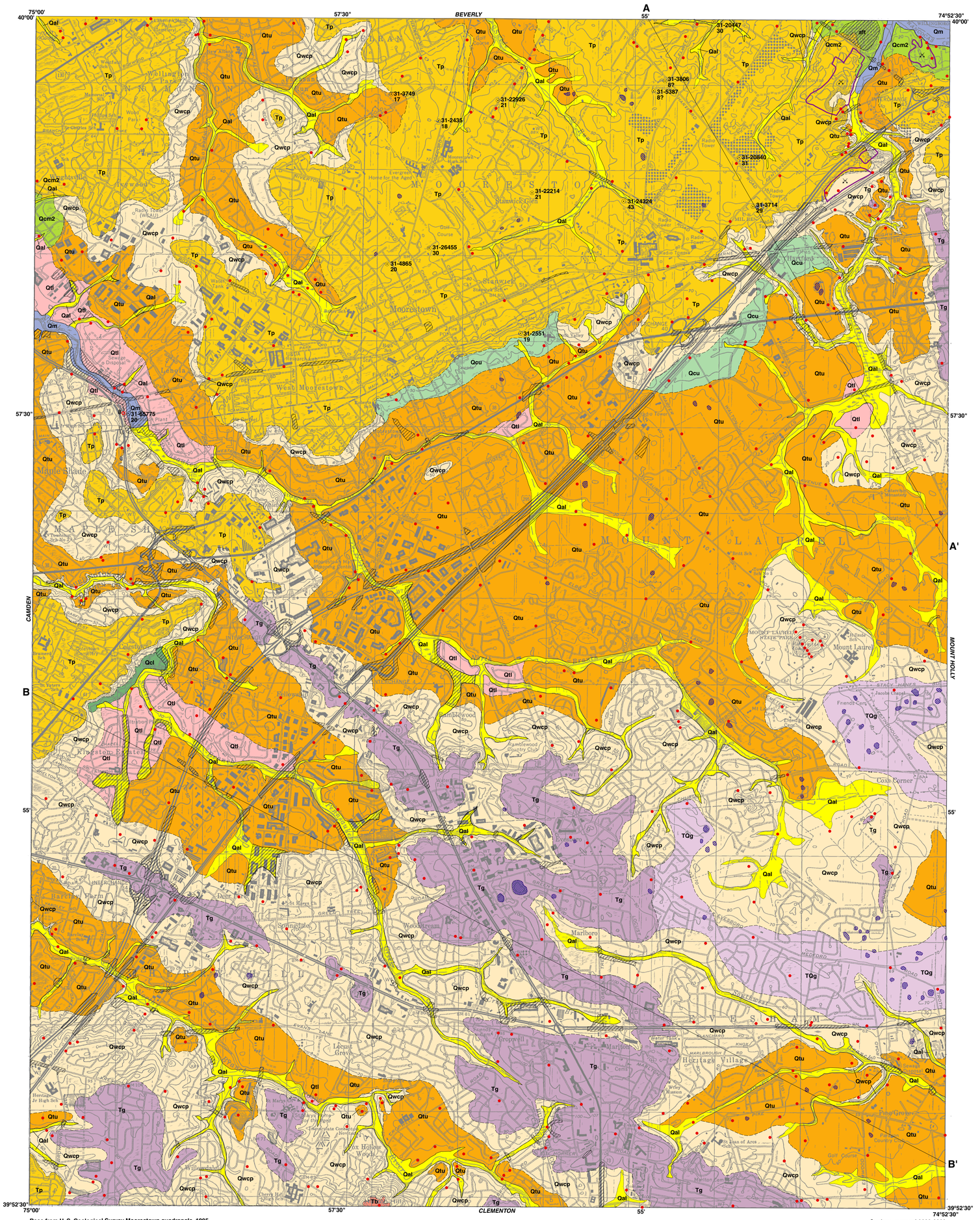

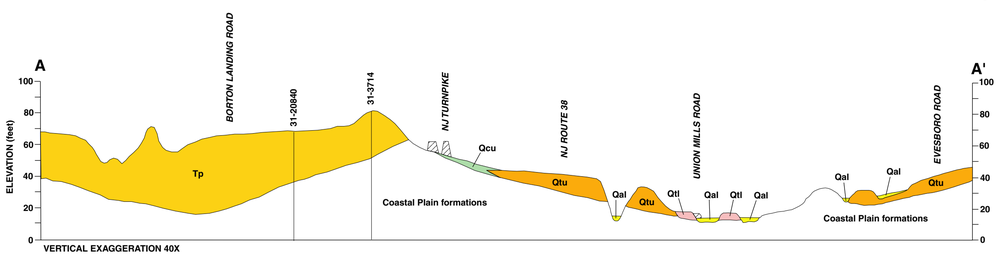

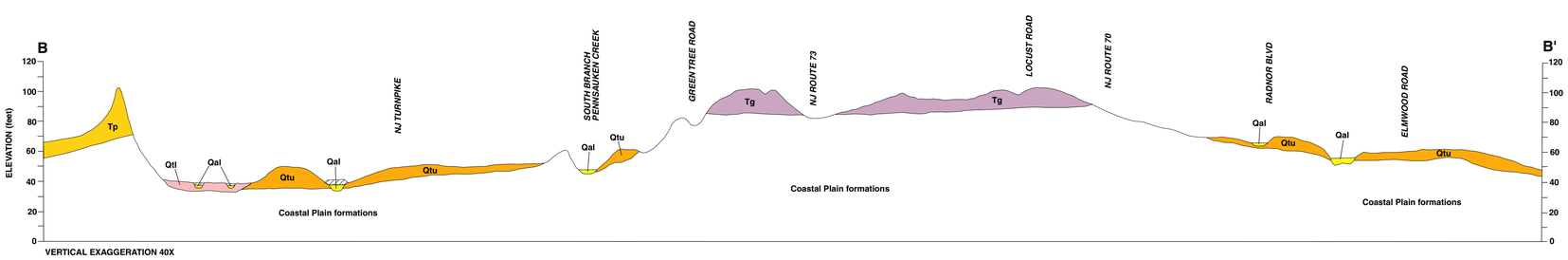

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by
Scott D. Stanford
2005

SCALE 1:24 000

1 1/2 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER

NATIONAL GEODETIC VERTICAL DATUM OF 1929

CONTOUR INTERVAL 10 FEET

12.5° APPROXIMATE MEAN MAGNETIC DECLINATION, 1998

LOCATION IN NEW JERSEY

CORRELATION OF MAP UNITS

Qm, Qal, afl — Holocene
5-20 feet of stream incision
Qcl, Qtl — late Pleistocene
20-50 feet of stream incision
Qcu, Qtu, Qcm2 — middle Pleistocene
weathering and erosion, new drainage established
TQg — early Pleistocene
Tp, Tg — Pliocene
weathering and erosion, new drainage established
Tb — late Miocene