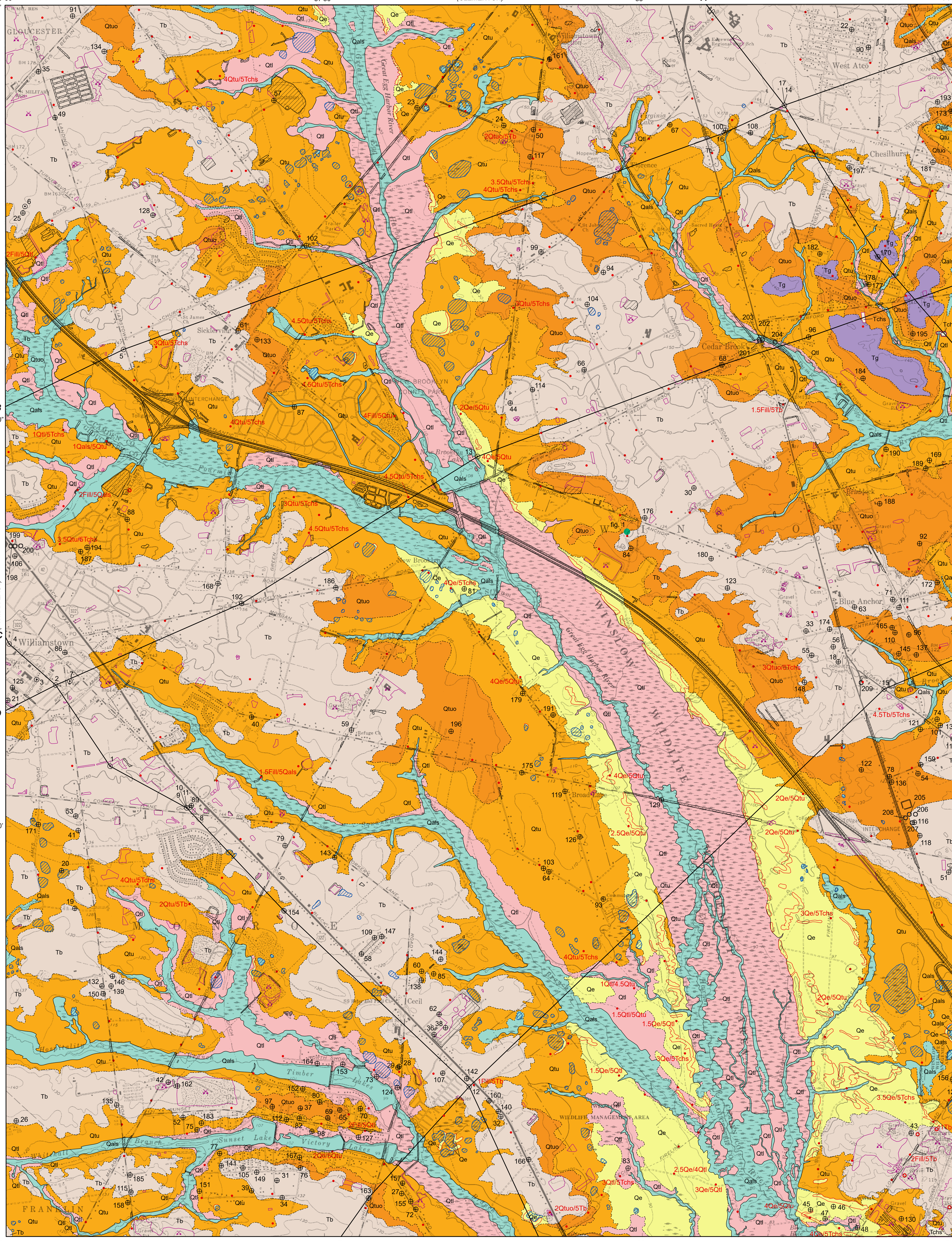
DEPARTMENT OF ENVIRONMENTAL PROTECTION
WATER RESOURCES MANAGEMENT
NEW JERSEY GEOLOGICAL AND WATER SURVEY

Prepared in cooperation with the
U.S. GEOLOGICAL SURVEY
NATIONAL COOPERATIVE GEOLOGIC MAPPING PROGRAM

GEOLOGY OF THE WILLIAMSTOWN QUADRANGLE
CAMDEN AND GLOUCESTER COUNTIES, NEW JERSEY
OPEN-FILE MAP 151
Pamphlet containing Table 1 accompanies map.



Basemap mapped, edited, and published by the U.S. Geological Survey, 1951, photorevised 1981. Coordinate tick marks are on 1927 North American datum.

LOCATION IN NEW JERSEY

SCALE 1:24,000

CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

APPROXIMATE MEAN DECLINATION, 2022

Geology mapped 2020-2021.
Cartography by Alexandra R. Carone.

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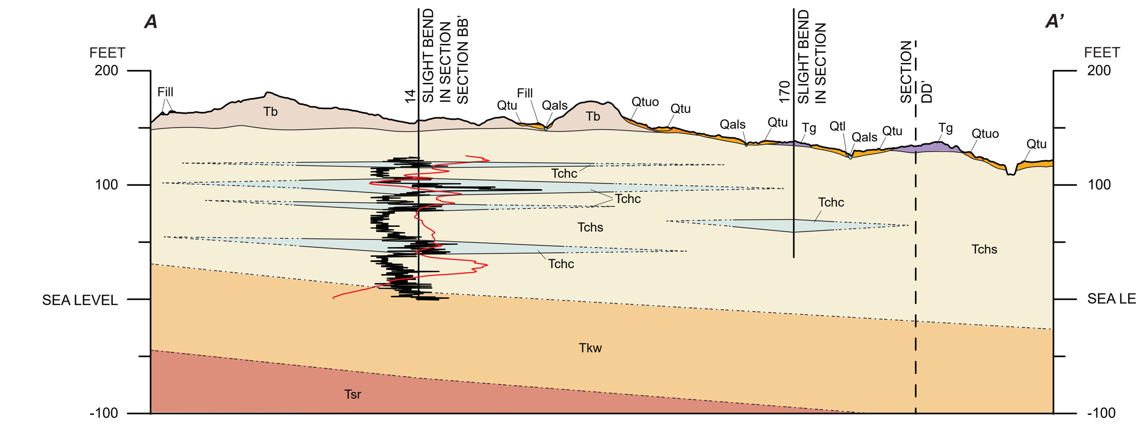
GEOLOGY OF THE WILLIAMSTOWN QUADRANGLE CAMDEN AND GLOUCESTER COUNTIES, NEW JERSEY

By

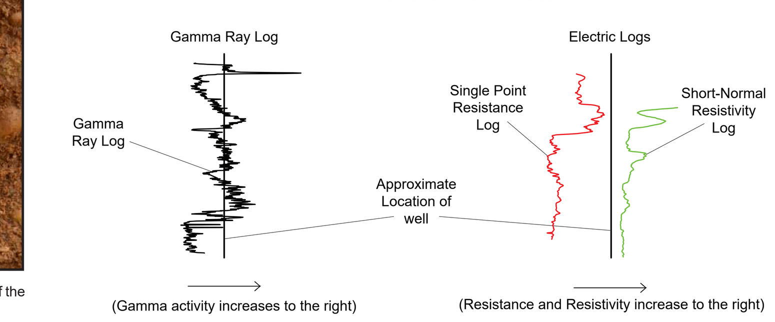
Alexandra R. Carone
2022

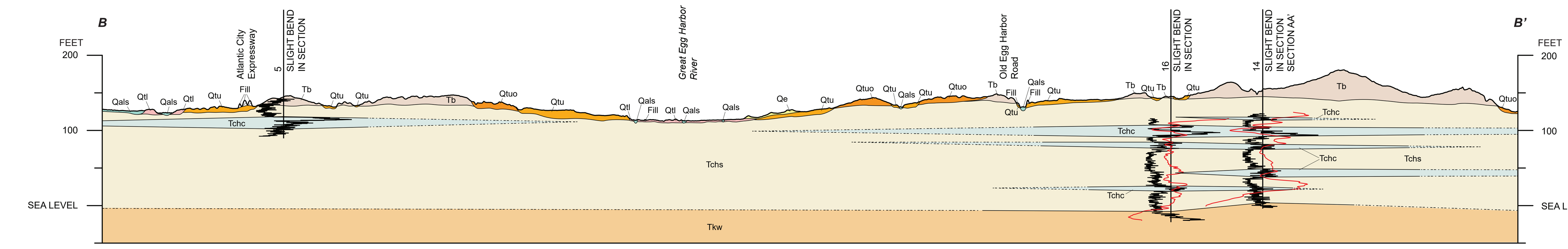


VERTICAL EXAGGERATION 20X

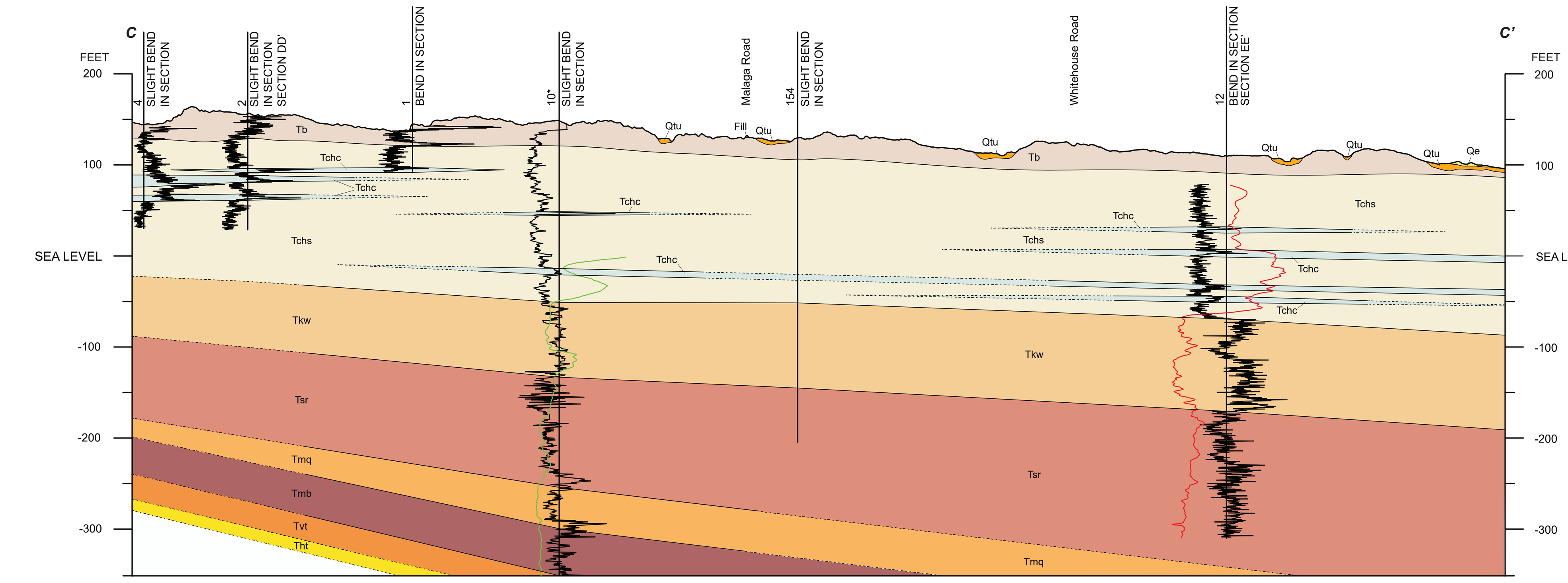
Figure 1. Strong brown (7.5YR5/6) gravelly, medium- to coarse-grained clayey sand of the Bridgeton Formation (Tb). Inset shows the location of this site on the map.

EXPLANATION OF GEOPHYSICAL LOGS



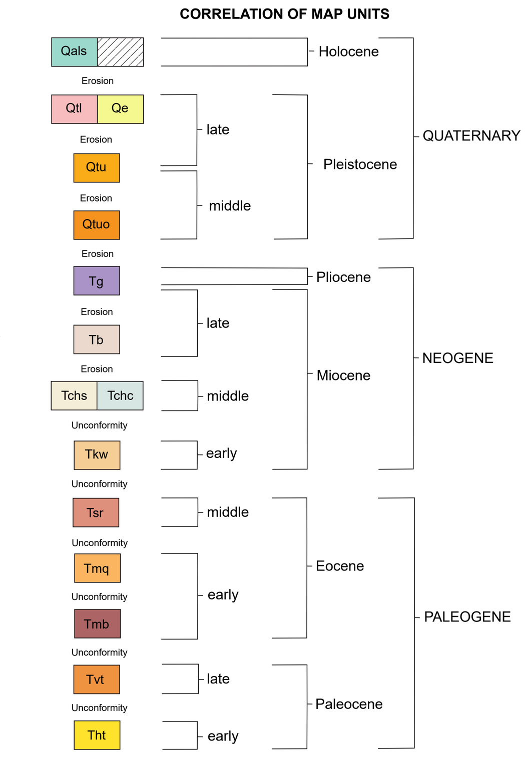


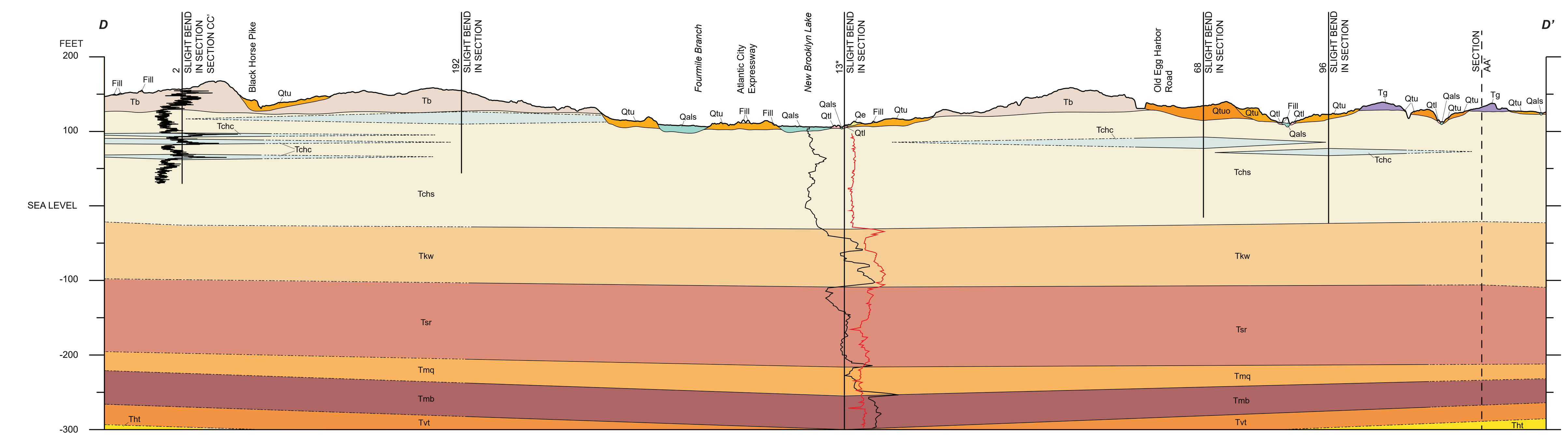
VERTICAL EXAGGERATION 20X



VERTICAL EXAGGERATION 20X. *Total depth of well 10 is 960 feet. Resistivity log shown on well 10 corresponds to well 9.

CORRELATION OF MAP UNITS





VERTICAL EXAGGERATION 20X. *Total depth of well 13 is 2,050 feet.

EXPLANATION OF MAP SYMBOLS

Contact of deposits - Solid where well-defined on LiDAR and aerial photographs; dashed where approximately located.

2Qe/5Qtu — Material observed in exposure, excavation, or 5-foot hand-augered hole - Annotation present where more than one unit was observed. Number is depth (in feet) followed by unit observed. Unit to left of slash overlies unit to right. Last number is total depth of hand-auger hole rather than base of unit.

11Tb — Material formerly observed in outcrop or excavation - Annotation represents depth (in feet) followed by unit observed. Locations are just north of Williamstown and in the southeastern corner of the quadrangle. Field notes on file at N.J. Geological and Water Survey.

205, 3 — Wells with lithologic (top) and geophysical (bottom) log(s) - Identifier is number shown in Table 1 (in pamphlet). List of all formations penetrated provided in Table 1. Well locations accurate to within 500 feet.

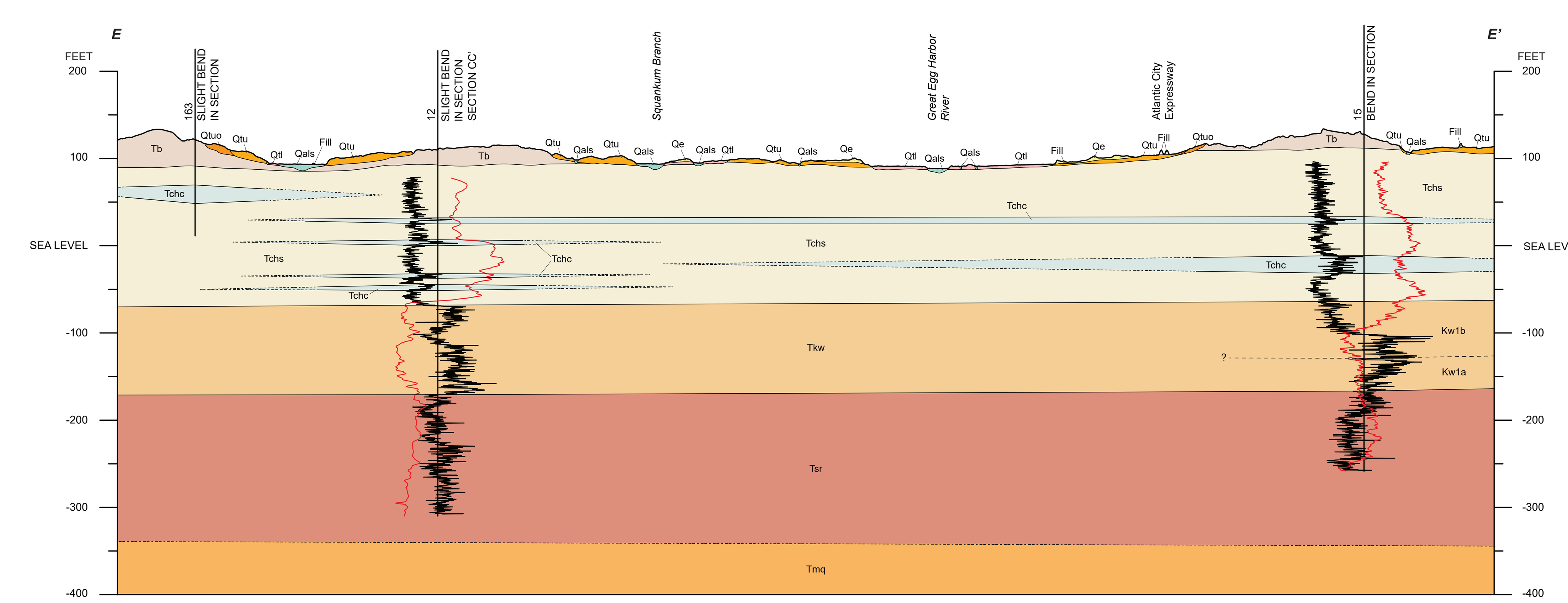
227 — Soil boring with lithologic log - Identifier is number shown in Table 1 (in pamphlet). List of all formations penetrated provided in Table 1. Boring locations accurate to within 100 feet.

fig. 1 — Photograph location.

Dune and dune remnants - Features comprised of eolian sand (Qe); outlined in red.

Shallow topographic basin - Includes thermokarst basins formed from the melting of permafrost and deflation basins formed by wind erosion.

Excavation Perimeter - Line encloses area of excavation. Areas without symbol are stormwater management basins and channels, road cuts, or man-made ponds. Top symbol indicates sand or gravel pits inactive in 2021. Bottom symbol indicates sand or gravel pits active in 2021 (only two; located in the northeastern and southwestern corners of the quadrangle).



VERTICAL EXAGGERATION 20X

INTRODUCTION

The Williamstown quadrangle is situated in the Coastal Plain physiographic province of New Jersey where it spans into both Camden and Gloucester counties. This quadrangle is dominated by the Great Egg Harbor River and its tributaries (i.e. the Fourmile Branch, the Squankum Branch, and the Hospitality Branch). Uplands with clayey sand and gravel substrate border these watercourses and are forested where they have not been replaced by agricultural areas and urban/suburban areas which include Sicklerville, Williamstown, Cedar Brook, West Atco, and Chesilhurst. Elevation in the quadrangle ranges from approximately 90 to 180 feet with the lowest elevations occurring in the southern most part of the Great Egg Harbor River area and the highest elevations occurring in the northeastern corner of the quadrangle in West Atco. Most of this quadrangle is encompassed by the Great Egg Harbor Watershed Management Area (WMA). However, a small part of the Mullica WMA and an even smaller part of the Lower Delaware WMA exist in the northeastern and northwestern corners of the quadrangle.

Geologic units range in age from the Paleocene (approximately 66 Ma; Ma = million years ago) to present day (see Correlation of Map Units). Surficial units were deposited from the late Miocene (approximately 11 Ma) to present day and include fluvial (Tb, Tg, Qtuo, Qtu, and Qtl), wetland (Qals), and eolian deposits (Qe), and artificial fill. Surficial units are underlain by older, unconsolidated bedrock units that were deposited from the Paleogene to the middle Miocene and include marine and marginal marine deposits. Of these unconsolidated bedrock units, the sand facies of the Cohansey Formation (Tchs) crops out within the map area only in excavations. Other unconsolidated bedrock units, including the Hornerstown (Tht), Vincentown (Tvt), Marlboro (Tmb), Manasquan (Tmq), Shark River (Tsr), and Kirkwood (Tkw) formations, are mapped in the subsurface and shown in cross section.

Lithologies are described in the Description of Map Units. Lithologies and geologic interpretations of outcropping geologic units, excavation perimeters (outlined in purple on the map), dune and dune remnants (outlined in red on the map), and shallow topographic basins (shown with blue diagonal ruling pattern on the map) are based on new and previously collected field data, well records, 1-meter resolution LiDAR data, aerial photography, and published geologic maps adjacent to this quadrangle. Lithologies for units only present in the subsurface are based on driller's logs, published geologic maps adjacent to this quadrangle, geophysical logs (gamma, single-point resistance, and short-normal resistivity), and corehole studies at Ancora, New Jersey (Miller and others, 1999), which is approximately two miles east of Blue Anchor within the Hammonton quadrangle and Wilson Lake, New Jersey (Miller and others, 2017), which is approximately three and a half miles southwest of Williamstown within the Pitman East quadrangle.

Cross sections A-A', B-B', C-C', D-D', and E-E' show the lateral extent and thickness of surficial and unconsolidated bedrock units to elevations of as much as 400 feet below sea level. Cross sections A-A' and E-E' were correlated to the stratigraphic corehole at Ancora, New Jersey (Miller and others, 1999) and cross section D-D' was correlated to the stratigraphic corehole at Wilson Lake, New Jersey (Miller and others, 2017). Clarification on how the geophysical logs are shown in cross section is provided in the Explanation of Geophysical Logs.

Table 1 (in pamphlet) reports the geologic formations penetrated by New Jersey Department of Environmental Protection (NJDEP) permitted wells shown on the map to depths of as much as 500 feet and Department of Transportation soil borings shown on the map to depths of as much as 37 feet. Interpretations are based upon driller's lithologic descriptions and geophysical logs. The majority of the wells are finished in the Cohansey Formation making the Kirkwood-Cohansey aquifer system an important groundwater source for this area. Sand beds within the Shark River Formation, known as the Piney Point aquifer (Sugarman and Monteverde, 2008) are also tapped by wells.

DESCRIPTION OF MAP UNITS

Color designations are based on Munsell Color Company (1975).

Outcropping Units

ARTIFICIAL FILL – Gray, brown, and yellow gravel, sand, silt, and clay; organic material, construction debris, and trash in places. Unstratified. As much as 15 feet thick. Typically occurs in roadway and railroad fills, dams, dikes, and infilled mined areas.

Qals — **ALLUVIUM** – Light- to dark-gray, brown, and dark brown sand, silt, clay, and peat with some gravel. Sand is fine- to coarse-grained, sub- to well-rounded, quartz. Gravel consists of well-rounded to sub-angular white, yellow, orange, pink, and smoky gray quartz and some quartzite. Gravel size ranges from fine- to very coarse-grained pebbles (4-64 mm). Sediments are moderate to poorly sorted. Overlain by dark brown and black peat in places. As much as 8 feet thick but typically less than 5 feet. Deposited in floodplains and wetlands.

Qe — **EOLIAN SAND** – Light brown, yellow, and white, very fine- to medium-grained, well rounded, quartz sand. Occasional coarse grains (1-3% or less). Deposited in the form of dune ridges and dune fields in places. Dune and dune remnants (outlined in red on the map) are linear and parabolic in shape and can be as much as a half mile long but are typically less. Total thickness of deposit is as much as 10 feet. Typically occurs along the flanks of the lower terrace in the Great Egg Harbor River valley.

Qtl — **LOWER TERRACE DEPOSITS** – Light- to dark-gray and brown sand and gravel with some silt and clay. Sand is fine- to coarse-grained, sub- to well-rounded, quartz. Gravel consists of sub- to well-rounded, white, yellow, and gray quartz and some quartzite and ranges in size from very fine- to very coarse-grained pebbles (2-64 mm). As much as 9 feet thick especially in the low-lying areas surrounding the Great Egg Harbor River, its tributaries, and its floodplains. Forms on terraces and pediments with top surfaces that are within 5 feet above the modern-day floodplain.

Qtu, Qtuo — **UPPER TERRACE DEPOSITS** – Light- to dark-yellow and brown sand and gravel with some silt. Sand is fine- to coarse-grained, sub- to well-rounded, quartz. Gravel consists of sub- to well-rounded, yellow, white, and gray quartz and some quartzite and ranges in size from very fine-grained pebbles to small cobbles (2-128 mm). Upper terrace deposits are divided into two subunits (Qtu and Qtuo) that are distinguished from each other by elevation and relative age. The younger phase of this deposit (Qtu) is as much as 20 feet thick and forms terraces and pediments with top surfaces that are 5 to 15 feet above the modern-day floodplain. The older phase of this deposit (Qtuo) is as much as 30 feet thick and forms terraces with surfaces 15 to 35 feet above the modern-day floodplain. It is inset by younger terrace deposits (Qtu).

Tg — **UPLAND GRAVEL** – Reddish-brown and brown sand and gravel. Sand is fine- to coarse- grained and consists of quartz with minor amounts of weathered chert. Contains trace amounts of weathered feldspar. Gravel consists of sub- to well-rounded, yellow, white, and gray quartz and quartzite and ranges in size from very fine pebbles to small cobbles (2-128 mm). Occurs at elevations between 130 to 150 feet. Thickness is as much as 10 feet, as illustrated in cross section D-D'. Occurs south of Chesilhurst in patchy remnants on highlands generally lower in elevation than the base elevation of the Bridgeton Formation.

Tb — **BRIDGETON FORMATION** – Strong brown, reddish-brown, and yellow-brown, clayey sand and gravel (fig. 1). Sand is medium- to coarse-grained quartz with some chert and feldspar. Very clayey in places, as shown in the gamma log for well 2 (cross section C-C' and D-D'). Gravel consists of well- to sub-rounded, yellow, orange, pink, and white quartz, gray and white chert, and minor amounts of quartzite and ranges in size from very fine- to very coarse-grained pebbles (2-64 mm) with lesser amounts of cobble-sized materials (64-256 mm). Gravel is iron-stained and occurs in thin- to thick-beds. Chert pebbles are highly weathered. In northwestern areas of the quadrangle, deposits cap areas of generally 145 feet in elevation and higher. However, in southeastern areas of the quadrangle, deposits cap areas of generally 90 feet in elevation and higher. Such base elevations suggest a southeastern drainage which matches observations previously made by Owens and Minard (1979), Martino (1981), and Stanford (2003). Total thickness is as much as 45 feet as illustrated in cross section A-A'. Owens and Minard (1979) and Pazzaglia (1993) used stratigraphic position and petrologic correlations to marine deposits to suggest a late Miocene age.

Units in Subsurface Only

COHANSEY FORMATION – Predominantly quartz sand with interbedded sandy clay. As much as 175 feet thick in the map area. Unconformably overlies the early to middle Miocene Kirkwood Formation indicating an age of at least middle Miocene and possibly younger. The Cohansey Formation is divided into two subunits that are distinguished from each other by lithology:

Tchs — **Sand Facies** – Very pale brown, brownish-yellow, yellow, reddish-yellow, and rarely red, medium- to coarse-grained with minor amounts fine grains, quartz sand with trace amounts of weathered chert and feldspar. Minor amounts of very fine grained (2-4 mm), and trace amounts of fine- to medium-grained (4-16 mm), opaque white and gray, subround to sub-angular, quartz pebbles in places. Mostly found in the subsurface but outcrops in excavations in the northeastern and southeastern corners of the quadrangle.

Tchc — **Clay-Sand Facies** – White, light gray, yellow, and brown clay and sandy clay. Sand is fine- to medium-grained, quartz. As much as 20 feet thick and may extend laterally as much as four miles within the subsurface of the map area.

Tkw — **KIRKWOOD FORMATION** – Gray and very dark gray, silty, micaceous, very fine- to fine-grained, quartz sand and clay. Mica is white, very fine- to coarse-grained, and ranges in content from 5 to 20% (Carone, 2021). Silty clays are thinly bedded to massive (Miller and others, 1999). Total thickness is as much as 100 feet in the map area. Well 15 (cross section E-E') was correlated to the Ancora corehole study, which describes a massive, fine- to medium-grained, quartz sand at the top of sequence Kw1b (Miller and others, 1999). However, the lower limit of the Kirkwood Formation and sequence Kw1a at well 15 was based on its driller's log, which reports a silty clay underlain by a fine- to medium-grained sand at 296 feet. Early to middle Miocene based on strontium isotope age-estimates (Sugarman and others, 1993). Unconformably overlies the Shark River Formation.

Tsr — **SHARK RIVER FORMATION** – Dark greenish gray, grayish-green, pale green, pale olive, shelly, medium- to coarse-grained, quartz sand and glauconitic silty clay (Miller and others, 2017 and 1999). Glauconite content is as much as 25 percent (Miller and others, 1999). Geophysical logs within the map area generally show clays overlain by sands, although such sands seem to be interbedded with silt and clay in places. These sands vary in thickness from 30 to 70 feet and most likely correspond to the Piney Point aquifer as interpreted in Sugarman and Monteverde (2008) in wells 13 (31-04446) and 9/10 (31-56306/31-56307). Total formation thickness is as much as 170 feet in the map area. Middle Eocene based on nannofossils (Browning and others, 2011). Unconformably overlies the Manasquan Formation.

Tmq — **MANASQUAN FORMATION** – Dark greenish gray, greenish gray, and sometimes pale green and black, glauconitic, silty clay. Glauconite content ranges from trace amounts to 50% and increases with depth (Miller and others, 1999, 2017). As much as 45 feet thick in the map area. Early Eocene in age based on calcareous nannofossils (Owens and others, 1998). Unconformably overlies the Marlboro Formation.

Tmb — **MARLBORO FORMATION** – Green and white, slightly glauconitic clay (Miller and others, 2017). As much as 50 feet thick in the map area. Early Eocene in age based on dinoflagellates and acritarchs (Edwards, 1996). Unconformably overlies the Vincentown Formation.

Tvt — **VINCENTOWN FORMATION** – Dark greenish gray, slightly micaceous and shelly, glauconitic, clayey silt and silty clay; glauconite content increases with depth from trace amounts to as much as 40% (Miller and others, 2017 and 1999). Late Paleocene in age, based on foraminifera (Olsson and Wise, 1987). Unconformably overlies the Hornerstown Formation.

Tht — **HORNERSTOWN FORMATION** – Very dark gray and dark greenish gray, fine grained, clayey, glauconite sand; glauconite content can be as much as 70% (Miller and others, 1999). Early Paleocene in age based on foraminifera (Olsson and others, 1997).

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Geology of the Williamstown Quadrangle
Camden and Gloucester Counties, New Jersey

New Jersey Geological and Water Survey
Geologic Map Series OFM 151
2022

Pamphlet containing Table 1 to accompany map.

Table 1. Selected well and boring records. Well identifiers and permit numbers are **bolded** where depicted on cross sections. Footnotes at end of table (p. 6).

Identifier	Permit or Boring Number[1]	Inferred Stratigraphy[2]
1	**31-51568, G**	25 Tb; 47 Tchs; 53 Tchc **(depicted on cross section C-C')**
2	**31-75229, G**	28 Tb; 60 Tchs; 65 Tchc; 69 Tchs; 76 Tchc; 89 Tchs; 96 Tchc; 128 Tchs **(depicted on cross sections C-C' and D-D')**
3	31-75226, G	24 Tb; 77 Tch; 82 Tchc; 95 Tch; 99 Tchc; 114 Tch
4	**31-75224, G**	17 Tb; 56 Tchs; 69 Tchc; 78 Tchs; 85 Tchc; 115 Tchs **(depicted on cross section C-C')**
5	**31-52273, G**	12 Tb; 26 Tchs; 42 Tchc; 54 Tchs **(depicted on cross section B-B')**
6	31-51570, G	16Tb; 34 Tch; 37 Tchc; 54Tch
7	31-05035, E	4 Fill; 10 Tb; 20 Tch; 58 Tchs; 63 Tchc; 68 Tch; 79 Tchc; 87 Tch; 92 Tchc; 180 Tch
8	31-13257, G & E	28 Tb; 100 Tch; 104 Tchc; 164 Tch
9	**31-56306, G & E**	28 Tb; 100 Tchs; 104 Tchc; 162 Tchs; 170 Tchc; 200 Tchs; 282 Tkw; 405 Tsr; 487 Tmq; 500 Tmb **(depicted on cross section C-C')**
10	**31-56307, G**	28 Tb; 100 Tchs; 104 Tchc; 162 Tchs; 170 Tchc; 200 Tchs; 282 Tkw; 405 Tsr; 487 Tmq; 500 Tmb **(depicted on cross section C-C')**
11	31-56367, G	28 Tb; 100 Tchs; 104 Tchc; 162 Tchs; 170 Tchc; 188 Tchs; 282 Tkw; 405 Tsr; 487 Tmq; 500 Tmb
12	**31-58697, G & E**	19 Tb; 78 Tchs; 85 Tchc; 103 Tchs; 111 Tchc; 142 Tchs; 148 Tchc; 155 Tchs; 160 Tchc; 179 Tchs; 281 Tkw; 420 Tsr **(depicted on cross sections C-C' and E-E')**
13	**31-04446, G & E**	3 Qe+Qtl; 140 Tchs; 217 Tkw; 324 Tsr; 409 Tmq **(depicted on cross section D-D')**
14	**31-64904, G & E**	10 Tb; 36 Tchs; 42 Tchc; 51 Tchs; 63 Tchc; 73 Tchs; 80 Tchc; 105 Tchs; 117 Tchc; 149 Tchs; 153 Tkw **(depicted on cross sections A-A' and B-B')**
15	**31-64921, G & E**	15 Tb; 95 Tchs; 103 Tchc; 139 Tchs; 160 Tchc; 192 Tchs; 296 Tkw; 387 Tsr **(depicted on cross section E-E')**
16	**31-66818, G & E**	39 Tb+Tch; 55 Tchc; 61 Tchs; 70 Tchc; 119 Tchs; 127 Tchc; 153 Tchs; 167 Tkw **(depicted on cross section B-B')**
17	31-67845, G & E	26 Tb; 41 Tchc; 51 Tchs; 63 Tchc; 75 Tchs; 80 Tchc; 105 Tchs; 116 Tchc; 160 Tchs
18	31-00225	40 Tb+Tch; 84 Tchc, 150 Tchs
19	31-01877	18 Tb; 71 Tchs; 104 Tchc; 140 Tch
20	31-04823	10 Qtu; 69 Tchs; 106 Tchc; 140 Tchs; 141 Tchc
21	31-05150	30 Tb; 36 Tchs; 43 Tch; 51 Tchs; 60 Tchc; 64 Tchs; 69 Tchc; 87 Tchs; 115 Tchc; 150 Tchs
22	31-05916	14 Tb; 34 Tchs; 39 Tchc; 57 Tchs; 60 Tch, 70 Tchs

Identifier	Permit or Boring Number[1]	Inferred Stratigraphy[2]
23	31-13938	2 Fill; 29 Qtu+Tchs; 50 Tch
24	31-15497	18 Qtu+Tchs; 35 Tchc; 100 Tchs; 300 Tkw+Tsr+Tmq; 410 Tmb+Tvt+Tht
25	31-17658	38 Tb+Tchs; 44 Tchc; 154 Tch; 370 Tkw+Tsr+Tmq+Tmb+Tvt
26	31-17986	30 Tb; 40 Tch; 50 Tchs; 60 Tch; 98Tchs; 100 Tchc; 116 Tch; 120 Tchc
27	31-19308	5 Qtu; 68 Tchs; 79 Tchc; 110 Tchs
28	31-19549	10 Qtu; 30 Tch; 80 Tchs; 100 Tchc; 130 Tchs; 140 Tchc; 150 Tchs; 160 Tchc
29	31-19550	10 Qtu; 50 Tch; 80 Tchs; 100 Tch; 120 Tchs
30	31-21276	20 Tb; 50 Tch; 90 Tchc; 131 Tchs
31	31-21446	17 Tb; 35 Tchc; 40 Tch; 50 Tchc; 70 Tch; 85 Tchc; 110 Tch
32	31-22755	25 Tb; 40 Tch; 55 Tchs; 62 Tchc; 64 Tchs; 85 Tch; 110 Tchs
33	31-24210	92 Tb+Tch; 100 Tchc; 107 Tchs; 111 Tchc; 135 Tchs
34	31-24712	38 Tb+Tchs; 43 Tchc; 92 Tchs; 94 Tchc; 115 Tchs
35	31-25007	20 Tb; 40 Tch; 100 Tchs; 390 Tkw+Tsr; 415 Tmq
36	31-25214	25 Tb; 35 Tch; 55 Tchs; 67 Tchc; 85 Tch; 93 Tchc; 101 Tchs; 110 Tch; 130 Tchs
37	31-25410	25 Qtuo; 40 Tchc; 45 Tch; 60 Tchc; 65 Tchs; 80 Tch; 115 Tchs
38	31-25535	25 Tb; 85 Tch; 110 Tchs
39	31-25872	23 Qtu+Tchs; 29 Tchc; 66 Tchs; 71 Tchc; 104 Tchs; 109 Tchc
40	31-25902	8 Qtu; 61 Tchs; 65 Tchc; 110 Tchs
41	31-26578	15 Tb; 40 Tch; 80 Tchs; 110 Tch; 135 Tchs; 140 Tkw
42	31-27803	22 Tb; 61 Tchc; 73 Tchs; 85 Tchc; 105 Tchs
43	31-28426	24 Tb+Tch; 34 Tchc; 50 Tch; 70 Tchc; 104 Tchs
44	31-28589	20 Tb+Tchs; 40 Tchc; 60 Tch; 100 Tchs
45	31-28760	5 Qe+Qtu; 25 Tchs; 30 Tch; 35 Tchs; 40 Tch; 55 Tchs; 76 Tch; 80 Tchs; 82 Tch; 92 Tchs; 96 Tch; 106 Tchs; 110 Tchc; 146 Tchs; 148 Tch
46	31-28763	10 Qe; 15 Qtu; 25 Tchs; 35 Tchc; 90 Tchs
47	31-28765	10 Qe; 25 Qtu; 45 Tchs; 55 Tch; 75 Tchs; 90 Tch; 100 Tchs
48	31-28769	5 Qtl; 10 Qe; 15 Qtu; 25 Tch; 30 Tchs; 70 Tch; 80 Tchs; 90 Tch
49	31-28854	21 Tb; 52 Tchs; 75 Tchc; 110 Tchs
50	31-29324	35 Qtuo + Tb; 120 Tchs; 210 Tkw; 310 Tsr+Tmq; 360 Tmb+Tvt
51	31-29746	20 Tb; 40 Tch; 70 Tchs; 100 Tch; 130 Tchs
52	31-30506	15 Tb; 30 Tch; 50 Tchs; 60 Tchc; 80 Tch; 110 Tchs
53	31-30598	30 Tb; 85 Tch; 90 Tchc; 105 Tch; 135 Tchs
54	31-30647	20 Qtuo; 100 Tchs; 120 Tch; 160 Tchs; 200 Tch; 284 Tkw; 314 Tsr
55	31-30778	20 Tb; 40 Tchs; 60 Tchc; 80 Tch; 100 Tchs; 120 Tch; 130 Tchs
56	31-30945	20 Tb; 40 Tchc; 90 Tchs; 114 Tch; 150 Tchs
57	31-30990	10 Qtu; 22 Tchs; 46 Tchc; 67 Tchs; 84 Tch; 105 Tchs; 110 Tch
58	31-31098	20 Tb; 80 Tch; 105 Tchs
59	31-31581	37 Tb+Tchs; 70 Tch; 76 Tchc; 140 Tchs
60	31-31695	10 Qtu; 30 Tchs; 40 Tch; 105 Tchs
61	31-32414	5 Qtuo; 19 Tb
62	31-34074	25 Tb; 66 Tchs; 68 Tchc; 105 Tchs
63	31-34400	80 Tb+Tch; 140 Tchs

Identifier	Permit or Boring Number[1]	Inferred Stratigraphy[2]
64	31-34732	18 Qtu; 30 Tchs; 36 Tchc; 80 Tchs
65	31-34832	18 Qtuo; 42 Tchs; 50 Tchc; 108 Tchs
66	31-34844	20 Tb; 50 Tchc; 80 Tchs; 84 Tchc; 115 Tchs
67	31-34936	40 Qtu+Tchs; 60 Tch; 70 Tchc; 100 Tchs
68	**31-35324**	20 Qtuo; 40 Tchs; 60 Tchc; 150 Tchs **(depicted on cross section D-D')**
69	31-35610	22 Qtuo; 63 Tchs; 80 Tch; 110 Tchs
70	31-35656	10 Qtu; 23 Tchs; 45 Tch; 85 Tchs; 98 Tchc; 115 Tchs
71	31-35935	24 Tb; 40 Tchs; 100 Tchc; 114 Tch; 134 Tchs
72	31-37351	25 Qtu+Tchs; 30 Tchc; 70 Tchs; 75 Tchc; 95 Tchs; 125 Tch; 134 Tchs
73	31-37764	11 Qtl+Qtu; 25 Tchs; 30 Tchc; 90 Tchs; 93 Tchc; 110 Tchs
74	31-37971	14 Qtu; 132 Tchs
75	31-39040	7 Qtu; 16 Tch; 36 Tchs; 45 Tchc; 102 Tchs
76	31-39148	23 Qtuo+Tb; 37 Tchs; 49 Tchc; 103 Tchs
77	31-39402	60 Qtu+Tch; 80 Tchs; 86 Tchc; 115 Tchs
78	31-40522	14 Qtuo; 94 Tchs; 124 Tch; 134 Tchs
79	31-41184	8 Tb; 20 Tchs; 90 Tch; 115 Tchc; 132 Tchs
80	31-47542	17 Qtu; 34 Tchs; 59 Tchc; 74 Tchs; 89 Tch; 125 Tchs
81	31-48168	20 Qe+Qtu; 38 Tchc; 40 Tch; 95 Tchs
82	31-49310	11 Qtu; 25 Tchc; 105 Tchs
83	31-49658	15 Qtl+Qtu
84	31-49659	11 Qtuo+Tb; 32 Tchs
85	31-51426	15 Qtu; 280 Tch+Tkw; 300 Tsr
86	31-51567	13 Tb; 40 Tchs; 44 Tch; 49 Tchs
87	31-51569	5 Qtu; 48 Tchs
88	31-52276	5 Qtu; 45 Tchs
89	31-56879	58 Tb+Tch; 182 Tchs; 274 Tkw; 326 Tsr
90	31-59400	34 Tb; 49 Tch; 61 Tchc; 120 Tchs
91	31-62608	16 Tb; 100 Tchs
92	31-64203	8 Qtuo; 42 Tb+Tchs; 52 Tchc; 100 Tchs; 126 Tch; 150 Tchs
93	31-65239	6 Qtu; 36 Tchs; 39 Tchc; 52 Tchs; 59 Tchc; 63 Tchs; 65 Tchc; 100 Tchs
94	31-65678	14 Tb; 84 Tch; 100 Tchs; 105 Tch
95	31-66105	20 Qtuo+Tb; 40 Tch; 140 Tchs; 160 Tch; 200 Tchs; 270 Tkw; 340 Tsr
96	**31-66128**	45 Qtu+Tchs; 55 Tchc; 110 Tch; 145 Tchs **(depicted on cross section D-D')**
97	31-66352	19 Qtuo; 27 Tchc; 67 Tchs; 98 Tchc; 120 Tchs
98	31-66450	4 Qtu; 28 Tchs; 51 Tch; 63 Tchc; 105 Tchs
99	31-66724	20 Tb; 40 Tch; 55 Tchs; 63 Tchc; 81 Tchs
100	31-66771	20 Tb+Tch; 60 Tch; 155 Tchs; 175 Tkw
101	31-66975	15 Qtu; 75 Tchs; 87 Tch; 170 Tchs; 195 Tch; 283 Tkw; 305 Tsr
102	31-67124	3 Fill+Qtu; 25 Tchs; 32 Tchc
103	31-67151	6 Qtu; 28 Tchs; 34 Tchc; 63 Tchs; 64 Tchc; 108 Tchs; 111 Tchc
104	31-67293	15 Tb; 59 Tchs; 65 Tchc; 126 Tchs

Identifier	Permit or Boring Number[1]	Inferred Stratigraphy[2]
105	31-67532	16 Tb; 58 Tchs; 64 Tchc; 68 Tchs; 89 Tchc; 105 Tchs
106	31-68126	35 Tb+Tchs
107	31-68212	22 Tb; 41 Tchs; 63 Tchc; 87 Tchs; 96 Tchc; 120 Tchs
108	31-68274	62 Tb+Tch; 76 Tch; 137 Tchs; 138 Tchc; 169 Tchs; 180 Tkw
109	31-68709	22 Tb; 81 Tchs; 93 Tchc; 125 Tchs
110	31-68750	15 Qtuo; 40 Tchs; 50 Tchc; 180 Tchs; 280 Tkw; 335 Tsr
111	31-69267	35 Tb, 104 Tchs; 108 Tchc; 131 Tchs; 135 Tchc; 184 Tchs; 278 Tkw; 301 Tsr
112	31-69738	8 Qtu; 29 Tchc; 34 Tchs; 39 Tchc; 72 Tchs; 75 Tchc; 105 Tchs
113	31-69919	18 Tb; 33 Tch; 127 Tchs
114	31-70044	56 Tb+Tchs; 60 Tchc; 105 Tchs
115	31-70060	41 Tb+Tchs; 70 Tchc; 105 Tchs
116	31-70266	20 Tb; 80 Tchs; 110 Tch; 120 Tchc; 140 Tchs
117	31-70906	126 Qtuo+Tchs; 420 Tkw+Tsr+Tmq+Tmb; 445 Tvt
118	31-71085	20 Tb; 100 Tchs; 120 Tchc; 140 Tchs
119	31-71297	4 Qtu; 28 Tchs; 33 Tchc; 41 Tchs; 72 Tchc; 105 Tchs; 108 Tchc
120	31-71522	12 Qtu; 20 Tchs; 40 Tch; 74 Tchs; 80 Tchc; 104 Tchs
121	31-71980	60 Qtu+Tchs; 80 Tch; 85 Tchc; 100 Tchs; 130 Tch; 150 Tchs
122	31-72223	10 Qtuo; 50 Tchs; 60 Tchc; 140 Tchs
123	31-72592	20 Tb; 50 Tchs; 60 Tchc; 80 Tch; 100 Tchs; 130 Tch; 160 Tchs
124	31-72801	19 Qtl+Qtu; 36 Tchs; 54 Tchc; 79 Tchs; 98 Tchc; 120 Tchs
125	31-72897	28 Tb; 65 Tch; 68 Tchc; 130 Tchs; 140 Tch
126	31-72981	14 Qtu; 18 Tchs; 20 Tchc; 54 Tchs; 59 Tchc; 81 Tchs
127	31-73096	9 Qtl; 14 Qtu; 21 Tchc; 58 Tchs; 63 Tchc; 72 Tchs; 85 Tchc; 105 Tchs
128	31-73230	23 Tb; 30 Tchs; 35 Tchc; 70 Tchs; 90 Tch; 105 Tchs
129	31-74048	5 Fill; 8 Qals; 10 Tch; 47 Tchs
130	31-74124	8 Qtu; 19 Tchs; 25 Tchc; 35 Tchs; 48 Tchc; 58 Tchs; 69 Tchc; 102 Tchs
131	31-74244	18 Tb; 32 Tchc; 217 Tchs; 314 Tkw; 347 Tsr
132	31-75120	31 Tb+Tchs; 53 Tch; 80 Tchc; 130 Tchs
133	31-75391	10 Qtuo; 45 Tchs; 48 Tchc; 60 Tchs
134	31-76098	19 Tb; 46 Tchc; 90 Tchs
135	31-76236	24 Tb; 62 Tchs; 77 Tchc; 96 Tchs; 130 Tkw
136	31-76489	20 Qtuo; 90 Tchs; 100 Tchc; 130 Tchs
137	31-76666	40 Qtuo+Tch; 68 Tchc; 90 Tch; 135 Tchs
138	31-76785	17 Tb; 49 Tch; 72 Tchc; 110 Tchs
139	E200909563	17 Tb; 44 Tchs; 54 Tchc; 86 Tchs; 94 Tch; 120 Tchc; 132 Tchs
140	E201010029	27 Tb; 54 Tchc; 105 Tchs
141	E201010691	18 Tb; 40 Tch; 78 Tchc; 85 Tch; 105 Tchs
142	E201015842	31 Tb+Tch; 65 Tchc; 90 Tchs; 103 Tchc; 150 Tchs; 285 Tkw; 305 Tsr
143	E201100975	40 Qtu+Tch; 42 Tchc; 105 Tch; 155 Tchs
144	E201108538	141 Tb+Tch; 257 Tkw; 305 Tsr
145	E201203299	46 Qtuo+Tchs; 77 Tchc; 130 Tchs

Identifier	Permit or Boring Number[1]	Inferred Stratigraphy[2]
146	E201203728	19 Tb; 42 Tchc; 95 Tchs; 112 Tchc; 130 Tchs
147	E201207946	53 Tb+Tch; 76 Tchc; 92 Tchs; 97 Tchc; 120 Tchs
148	E201211385	29 Tb+Tchs; 48 Tch; 83 Tchc; 110 Tch; 130 Tchs
149	E201218032	26 Tb+Tchs; 49 Tch; 76 Tchc; 110 Tchs
150	E201301251	31 Tb+Tchs; 94 Tchc; 130 Tchs
151	E201301470	18 Qtu+Tb; 60 Tchs; 68 Tchc; 105 Tchs
152	E201310528	20 Qtu+Tchs; 30 Tchc; 50 Tchs; 70 Tchc; 105 Tchs
153	E201505141	2 Qtl; 37 Tchs; 72 Tchc; 110 Tchs
154	**E201601134**	23 Tb; 145 Tchs; 180 Tch; 275 Tkw; 334 Tsr **(depicted on cross section C-C')**
155	E201601964	28 Qtu+Tch; 40 Tchc; 62 Tch; 77 Tchc; 110 Tchs
156	E201610902	9 Qtu; 28 Tchs; 39 Tch; 65 Tchs; 72 Tchc; 106 Tchs
157	E201710824	50 Qtu+Tch; 85 Tchc; 115 Tchs
158	E201801987	30 Qtu+Tb; 85 Tch; 105 Tchs
159	E201802833	17 Tb; 64 Tchs; 72 Tchc; 88 Tch; 137 Tchs
160	E201804101	40 Tb+Tch; 65 Tchc; 95 Tchs; 115 Tchc; 120 Tchs; 135 Tchc; 156 Tchs
161	E201904703	24 Qtuo; 33 Tchc; 125 Tchs; 190 Tkw; 300 Tsr; 370 Tmq+Tmb+Tvt
162	E201907733	30 Tb; 58 Tchs; 75 Tch; 110 Tchs
163	**E202001630**	30 Tb; 50 Tch; 75 Tchc; 110 Tchs **(depicted on cross section E-E')**
164	E202008587	18 Qtl+Qtu; 44 Tchs; 53 Tch; 72 Tchs; 88 Tchc; 115 Tchs
165	E202010751	19 Qtuo; 40 Tch; 65 Tchc; 95 Tchs; 100 Tchc; 135 Tchs
166	E202011409	20 Tb; 70 Tchs; 120 Tch; 145 Tchc; 160 Tchs
167	E202013665	40 Qtu+Tch; 60 Tchc; 90 Tch; 110 Tchs
168	P200800116	29 Tb+Tch; 60 Tchc; 115 Tchs
169	P200800140	30 Qtu+Qtuo; 52 Tchs; 70 Tchc; 100 Tchs
170	**P200800501**	20 Tg+Tchs; 40 Tch; 68 Tchs; 80 Tchc; 102 Tchs **(depicted on cross section A-A')**
171	P200801303	87 Qtu+Tb+Tch; 100 Tchc; 125 Tchs
172	P200802546	20 Qtuo+Tb; 40 Tch; 50 Tchc; 60 Tchs; 80 Tch; 100 Tchs
173	P200802696	18 Qtuo; 35 Tchc; 58 Tchs; 70 Tchc; 110 Tchs
174	P200802935	15 Tb; 40 Tchs; 47 Tchc; 80 Tch; 105 Tchs
175	P200803243	17 Qtu; 42 Tchc; 115 Tchs
176	P200803409	55 Tb+Tchs; 60 Tch; 70 Tchs; 74 Tchc; 115 Tchs
177	P200900186	27 Tchs; 41 Tch; 70 Tchc; 120 Tchs
178	P200900194	41 Qtl+Tch; 70 Tchc; 120 Tchs
179	P200900279	36 Qtu+Tchs; 57 Tch; 87 Tchc; 135 Tchs
180	P200900737	34 Tb+Tch; 46 Tchc; 82 Tchs; 103 Tch; 109 Tchs; 123 Tch; 154 Tchs
181	P200900780	47 Tb+Tch; 69 Tchc; 110 Tchs
182	P200901674	42 Qtu+Tchs; 80 Tchc; 120 Tchs
183	P200902867	14 Qtu; 31 Tchs; 65 Tchc; 110 Tchs
184	P200903498	40 Tchs; 72 Tchc; 120 Tchs
185	P200908051	18 Tb; 35 Tchc; 70 Tchs; 78 Tchc; 110 Tchs

Identifier	Permit or Boring Number[1]	Inferred Stratigraphy[2]
186	P200908417	30 Tb; 52 Tchs; 70 Tchc; 100 Tchs
187	P200908684	7 Qtu; 22 Tchs; 68 Tchc; 120 Tchs
188	P200908870	24 Qtuo; 52 Tchc; 75 Tch; 110 Tchs
189	P200909345	19 Qtu+Tchs; 40 Tchc; 75 Tchs; 80 Tchc; 110 Tchs
190	P200909582	9 Qtu; 20 Tchs; 43 Tch; 70 Tchc; 105 Tchs
191	P200910681	15 Qtu; 40 Tchs; 48 Tchc; 70 Tchs; 75 Tchc; 100 Tchs
192	**P200912269**	27 Tb; 45 Tchc; 110 Tchs **(depicted on cross section D-D')**
193	P200915324	15 Tb; 40 Tchc; 100 Tchs
194	P201002478	32 Qtu+Tch; 63 Tchs; 78 Tchc; 100 Tchs
195	P201004752	80 Qtuo+Tchs; 85 Tchc; 103 Tchs
196	P201004784	27 Qtuo; 31 Tchc; 110 Tchs
197	P201005441	20 Tb; 40 Tch; 60 Tchs; 80 Tch; 90 Tchs; 100 Tchc; 116 Tchs
198	B0047000	15 Tb; 21.5 Tchs
199	B0047002	15 Tb; 21.5 Tchs
200	B0047003	15 Tb; 21.5 Tchs
201	B0052388	7 Qtl; 29.5 Tchs
202	B0052390	6 Qals; 29.5 Tchs
203	B0052391	7 Qals; 29.5 Tchs
204	B0052400	6.5 Qals; 25 Tchs; 29.5 Tch
205	B0054506	16 Qtuo; 22.5 Tchs; 37 Tchs
206	B0054507	14 Tb; 37 Tchs
207	B0054508	16 Tb; 37 Tchs
208	B0054509	22 Qtuo; 37 Tchs
209	B0058251	23 Tb; 25 Tchs

[1] Permit numbers are in the form of 31-xxxxx, Exxxxxxxxx, and Pxxxxxxxxx and are issued by the N.J. Department of Environmental Protection. Boring numbers are in the form of B00xxxxx and are N.J. Department of Transportation Test Hole Numbers / Boring Numbers. Boring data can be found at http://www.state.nj.us/transportation/refdata/geologic/. Well identifiers and permit numbers are **bolded** where depicted on cross-sections. A "G" following the permit/boring number indicates that a gamma ray log is on file at the New Jersey Geological and Water Survey; an "E" indicates that an electric log (single point resistance, spontaneous potential, and/or long or short resistivity) is on file at the New Jersey Geological and Water Survey. Well locations are shown on the map to an accuracy of within 500 feet. Soil boring locations are shown on the map to an accuracy of 100 feet.

[2] Number preceding the unit abbreviation is the depth (in feet below land surface) of the unit's base. For example, "23 Tb; 25 Tchs" indicates Tb from 0 to 23 feet below ground surface and Tchs from 23 to 25 feet below ground surface. The last number in the sequence represents the total depth reported in the log, which is not necessarily the base of the unit. A "+" sign between units indicates that such units could not be differentiated in the lithologic and/or geophysical log. Many logs do not distinguish surficial units from the uppermost bedrock unit. In these cases, the surficial unit is included in the uppermost bedrock unit. Lithologic descriptions for the Cohansey Formation can sometimes group sands and clays together rather than identify each separately. If clays and sands are grouped together in the lithologic description, "Tch" is indicated. Unit abbreviations are explained in the Description of Map Units. Units are inferred from drillers', geologists', or engineers' lithologic descriptions in well records filed with the N.J. Department of Environmental Protection, N.J. Department of Transportation boring logs, or geophysical logs on file at the New Jersey Geological and Water Survey. Interpretation of sediments described in the logs may not match the map and sections due to variability in drillers' descriptions and lag times involved in the drilling process.