SHEET 1 OF 2

## INTRODUCTION

Surficial materials in the Perth Amboy and Arthur Kill quadrangles consist of glacial, stream, wetland, and weathered bedrock sediment. The glacial sediment includes sand, gravel, silt, and clay laid down by meltwater in glacial lakes and river plains, and till laid down by glacial ice as a sheet on the bedrock surface and in the terminal moraine. The sand, gravel, silt, and clay, known collectively as stratified drift, are as much as 70 feet thick. Till is as much as 130 feet thick. The stream sediment includes sand, gravel, and silt deposited in floodplains, stream terraces, and former river plains. It is as much as 40 feet thick. The wetland sediment includes peat and organic silt and clay deposited in freshwater swamps and saltwater marshes and estuaries. It is as much as 100 feet thick. The weathered bedrock consists of silty clay and shale fragments formed by chemical and mechanical decomposition of shale bedrock of Triassic and Jurassic age. It is generally less than 10 feet thick.

The accompanying map and sections show the surface extent and subsurface relations of these deposits. Figure 1 shows the extent of glacial lakes and river plains, the terminal moraine, and recessional ice margins. Table 1 lists water-well and test-boring logs used to plot bedrock-surface topography and to infer the subsurface distribution of deposits. Table 2 lists the composition of pebbles in the glacial deposits. The correlation chart shows the temporal relationships and age of the deposits.

## DESCRIPTION OF MAP UNITS

Postglacial Deposits—These include artificial fill, stream, wetland, and beach sediment deposited since retreat of the late Wisconsinan glacier. Alluvial and swamp deposits began to accumulate shortly after deglaciation. Estuarine and salt-marsh deposits began to accumulate as rising sea level entered the Raritan Valley. This occurred as early as 11,500 radiocarbon years before present (yrs B. P.) as indicated by a radiocarbon date of 11,420±560 yrs B. P. (GX-21687) on organic clay at the base of the estuarine deposit at a depth of 98-100 feet in a boring adjacent to boring 139 (table 1) (Lippincott, Jacobs, and Gouda, Inc., 1995, boring B2).

- ARTIFICIAL FILL—Excavated sand, silt, clay, gravel, rock, and till, and man-made materials (bricks, cinders, ash, slag, glass, construction materials and minor amounts of trash). Color is variable, but generally gray to black. In railroad and road embankments, and made land. As much as 50 feet thick but generally less than 20 feet thick. Mapped only where it forms distinct landforms, or where it covers salt-marsh deposits and large floodplains. The extent of fill is based on aerial photographs taken in 1979 and 1986. The extent of fill over salt-marsh deposits and floodplains is based, in part, on the position of shorelines, salt marshes, and alluvial deposits shown on maps in Darton and others (1908) and Ries and Kummel (1904). Fill also occurs in all urban areas, and in most former clay and sand pits, as a thin layer (generally less than 10 feet thick) of fill, or mixed fill and natural material, overlying the mapped surficial material.
- aft TRASH FILL-Trash and construction materials mixed and covered with excavated clay, silt, sand, gravel, rock, and till. As much as 50 feet thick.
- Qb BEACH DEPOSITS—Sand and pebble gravel. As much as 15 feet thick (estimated).
- Qal

  ALLUVIUM—Sand, silt, clay, pebble gravel; minor cobble gravel.

  Contains variable amounts of organic matter. Fine sediment is reddish-brown to dark brown. Gravel and sand composition similar to that of surficial deposits and outcropping bedrock in the drainage basin. Fine sediment is deposited as overbank material on the floodplain and may be as much as 15 feet thick. It generally overlies sand and gravel deposited in the stream channel. The gravel is generally less than 5 feet thick.
- Qs SWAMP AND MARSH DEPOSITS—Gray to brown organic silt and clay, overlain by dark-brown to black peat. As much as 15 feet thick (estimated).
- Qm ESTUARINE AND SALT-MARSH DEPOSITS--Peat and organic clay and silt, brown to dark gray; minor sand and shells. Locally, at base, may include alluvial sand and gravel deposited before marine inundation. As much as 100 feet thick.

Glacial Deposits-These include till and stratified drift deposited by ice and meltwater

during the late Wisconsinan glaciation. The till is a reddish-brown, nonstratified, poorly-sorted sediment consisting of pebbles, cobbles, and a few boulders scattered in a compact matrix of mixed silt, sand, and clay. It is deposited by glacial ice. Stratified drift includes reddish-brown to gray, moderately- to well-sorted, cross- to plane-bedded sand and gravel deposited in deltas and fans in glacial lakes and in glacial river plains; and reddish-brown to gray, well-sorted, laminated to varved silt, clay, and fine sand deposited on the bottoms of glacial lakes. The sand fraction in both till and stratified drift is predominantly quartz and red and gray shale fragments. The composition of pebbles in these deposits is provided in table 2.

Late Wisconsinan ice advanced southerly to southwesterly across the map area to the

southern edge of the terminal moraine. As the glacier advanced, it overrode sand and gravel laid down in lakes and river plains in valleys in front of the ice margin. Records of wells and borings indicate that these deposits are preserved beneath till in a few places, chiefly where valleys drained toward the advancing glacier. These include the preglacial valley in the northwestern part of the map area (units Qpf and Qsu in wells 4-7, 80, 82, 83, 85), the preglacial valley extending from Metuchen to the Rahway area (units Qpf and Qsu, section C-C'; wells 42, 47, 93, 203, 208-210, 221, 331), and in the lowland between the Arthur Kill and Woodbridge Creek (wells 179-182, 237-239, 241, 242, 244-246, 249, 256, 305, 309, 311). Ice also overrode fluvial sand and gravel at Perth Amboy (unit Qpa, section B-B'; wells 134-137, 151, 158, 159, 343).

Ice also overrode, eroded, and deformed unconsolidated Cretaceous deposits and Pensauken Formation sediment at and south of Carteret, Woodbridge, and Metuchen (K and Tp on sections A-A', B-B'). Folded Cretaceous sand and clay, and, in places, Pensauken sand and gravel, were formerly well exposed in the clay pits at Woodbridge, Perth Amboy, and Fords (Ries and others, 1904) and were also observed in several excavations between 1987 and 1995. The two hills mapped as ice-contact deposits (Qic) in Woodbridge and Carteret may contain, or consist largely of, deformed Cretaceous sediment.

North of the Cretaceous outcrop belt the ice advanced across red shale bedrock. Glacial erosion of bedrock in the preglacial valleys was minimal because the valleys were sediment-filled. On low uplands between the valleys, though, ice eroded rock and deposited till to form low, smoothed ridges with a rough northeast-southwest trend parallel to both ice flow and rock strike.

The terminal moraine (Qtm) was deposited while the ice margin stood at and melted back from its maximum position. The moraine is a broad belt of knolls, ridges, and basins, composed mostly of till, extending in an arc from Perth Amboy to Scotch Plains. A prominent frontal ridge as much as 100 feet high marks the south edge of the moraine between Metuchen and Fords, but elsewhere it generally has less than 50 feet of relief. The back edge of the moraine is a gradual transition from constructional moraine landforms to nonmorainic till. As ice stood at the moraine, meltwater deposited sand and gravel in three glacial river plains (Qpf, Qmt, Qpa).

The ice margin was probably in retreat from the moraine by 20,000 years ago (Stanford and Harper, 1991). The retreating ice margin had roughly the same arc-like orientation as the terminal moraine, and three glacial lakes formed in basins between the retreating ice front and the moraine (fig. 1).

Lake Ashbrook occupied the Robinsons Branch valley. It was controlled first by a spillway at an elevation of about 90 feet across the terminal moraine at Oak Tree, about half-a-mile west of Oak Tree School, just west of the map boundary (spillway AB1 on fig. 1). Most of the Lake Ashbrook deposits in the map area (Qab, Qabl) were probably deposited in this higher lake stage. As the ice margin retreated a lower spillway at an elevation of about 80 feet was uncovered on the divide between the Robinsons Branch and South Branch of the Rahway valleys, just north of Shore View (spillway AB2 on fig. 1). Lake Ashbrook lowered to the level of Lake Woodbridge when the retreating ice front uncovered the Robinsons Branch valley in the vicinity of the present Middlesex Reservoir.

Lake Woodbridge occupied the South Branch valley and, later, the Robinsons Branch valley and main Rahway valley upstream of Rahway. It was controlled by a spillway at an elevation of about 60 feet on the Rahway-Woodbridge Creek divide near Colonia (WB on fig. 1), and drained when the ice front retreated north of the low upland between the South Branch and Woodbridge Creek valleys between Avenel and Rahway. Deposits in this lake in the map area include deltaic sediment near Iselin (Qwb).

Lake Bayonne occupied the lowland along the Arthur Kill, Woodbridge Creek, and lower Rahway River. It was controlled at first by a spillway across the terminal moraine at Richmond Valley on Staten Island at an elevation of 25-30 feet. This spillway was succeeded by one across the terminal moraine between Perth Amboy and Staten Island (BN on fig. 1), which gradually lowered as the overflow eroded the moraine. Deposits in Lake Bayonne in the map area are primarily lake-bottom silt and clay (Qbnl) and scant deltaic or fan sand and gravel (Qbn). With continued erosion the spillway migrated northward along the present Arthur Kill and stabilized when it uncovered diabase bedrock near Tremley Point at an elevation of -30 feet. This formed the spillway for Lake Hackensack (HK on fig. 1). Only the southernmost tip of Lake Hackensack extended into the map area, as shallow water along the Arthur Kill north of Tremley Point. Because the ice margin at this time was about 15 miles northeast of Tremley Point, there was

Lakes in the map area had drained by 18,000 years ago (Stanford and Harper, 1991), although meltwater continued to drain down the Rahway, Raritan, and Arthur Kill valleys for a period after lake drainage. In the Rahway valley this meltwater deposited sand and gravel (Qrw). In the Raritan valley the meltwater, sourced mostly from glacial lake overflows in headwater areas, was combined with nonglacial drainage and deposited nonglacial and reworked glacial sediment (Qrt). This deposition likely spanned most of the period when ice was in the Raritan basin. In the Arthur Kill the meltwater was glacial-lake overflow from Lake Hackensack. This drainage carried little sediment and so deepened the channel through the moraine at Perth Amboy and the till plain to the north.

Qrw RAHWAY OUTWASH--Sand, pebble-to-cobble gravel, minor silt. As much as 45 feet thick.

GLACIAL LAKE BAYONNE DEPOSITS—Include lake-bottom deposits (Qbnl), and some minor lacustrine-fan deposits (Qbn) beneath marsh deposits in the Woodbridge Creek, Arthur Kill, and lower Rahway valleys (sections A-A', B-B'), and some outcropping lake-bottom deposits near Port Reading. A deltaic deposit mapped by Darton and others (1908) north of Perth Amboy (the "Maurer delta", indicated as (Qbn) on the map) has been

Qbn Sand and gravel. As much as 30 feet thick.

mined away.

Qbnl Silt, clay, fine sand. As much as 40 feet thick.

GLACIAL LAKE ASHBROOK DEPOSITS—Include deltaic and lacustrine-fan deposits (Qab), and lake-bottom deposits (Qabl). In addition to their outcrop, lake-bottom deposits probably underlie swamp and alluvial deposits in Ash Brook swamp.

- Qab Sand, pebbly sand, minor pebble-to-cobble gravel. As much as 70 feet thick (estimated).
- Qabl Silt, clay, fine sand. As much as 50 feet thick (estimated).

  GLACIAL LAKE WOODBRIDGE DEPOSIT--Includes deltaic and
- lacustrine-fan deposits (Qwb) in the South Branch valley. Small lakebottom deposits may underlie alluvium in this valley, especially in the floodplain south of Menlo Park, but do not crop out.
- Qwb Sand, pebbly sand, minor pebble-to-cobble gravel. As much as 30 feet thick (estimated).

  Qsu UNCORRELATED SAND AND GRAVEL DEPOSITS--Sand, pebbly
- sand, minor pebble-to-cobble gravel. As much as 20 feet thick. Include small deltaic deposits laid down in glacial ponds on uplands above the levels of lakes Ashbrook, Woodbridge, and Bayonne; and overridden sand and gravel deposits beneath till (section C-C'). These overridden sediments are also most probably deltaic deposits laid down in lakes ponded in front of advancing ice.
- PLAINFIELD OUTWASH--Pebbly sand, minor pebble-to-cobble gravel.

  May include lacustrine sand and silt in the subsurface. Total thickness as much as 60 feet. Crops out as a plain west of Metuchen and occurs in preglacial valleys beneath the terminal moraine northeast of Metuchen (section C-C') and west of Potters (wells 4-7).
- Qmt METUCHEN OUTWASH--Pebble-to-cobble gravel and pebbly sand. As much as 40 feet thick (estimated). Forms a river plain leading from the terminal moraine down the Mill Brook valley.
- Qpa

  PERTH AMBOY OUTWASH--Pebble-to- cobble gravel and pebbly sand.

  As much as 70 feet thick (estimated). Crops out as a plain leading from the terminal moraine at Perth Amboy and occurs beneath the moraine to the north (wells 151, 157-159, 343).
- Qic ICE-CONTACT DEPOSITS—Pebble-to-cobble gravel and pebbly sand, reddish-brown, poorly-to-moderately sorted, weakly stratified to massive. Strata may be steeply dipping or deformed. Contains beds and lenses of till and deformed Cretaceous sand and clay. As much as 40 feet thick (estimated). Forms two hills in Carteret and Woodbridge; these hills may contain or consist largely of Cretaceous sediment. They may have been deposited in ice-walled basins or by ice-push at recessional ice margins.
- RAHWAY TILL-Reddish-brown clayey, silty-sand to clayey, sandy-silt with some to many subrounded and subangular pebbles and cobbles and very few subrounded boulders. Gravel includes, in approximate order of abundance, red and gray mudstone and sandstone, quartz, gneiss, conglomerate, and basalt (table 2). Boulders are chiefly gneiss and quartzite. The clasts are derived from bedrock and preglacial surficial deposits to the north and northeast, along the line of ice flow. The quartz pebbles are eroded from the Pensauken Formation, which formerly covered the entire quadrangle. Where till overlies Cretaceous deposits, it includes blocks, deformed layers, and pebble-sized pieces of gray clay, white to yellow kaolinitic quartz sand, and brown ironstone eroded from the Cretaceous formations. Where it overlies Pensauken Formation, it may include lenses and blocks of yellow arkosic sand and quartz gravel. The till includes both compact, matrixsupported zones, which may have a weak subhorizontal fissility; and noncompact sandy or gravelly zones that may be weakly stratified in places. As much as 50 feet thick; generally 10 to 30 feet thick. Qt delineates areas where till is continuous and generally more than 10 feet thick. Qtt delineates areas where till is discontinuous and generally thinner.
- Qtm TILL OF THE TERMINAL MORAINE—Till, as above, forming knoll, ridge, and basin topography of the terminal moraine. As much as 130 feet thick.
- RARITAN TERRACE DEPOSIT—Sand, silt, pebble gravel, minor clay and cobble gravel. Fine sediment is gray, brown, and reddish-brown. Sand is predominantly quartz, with some shale fragments and feldspar, and minor glauconite and mica. Gravel is predominantly quartz and quartzite; with some red and gray mudstone and shale; and minor chert, gneiss, and sandstone. As much as 40 feet thick. Deposit is on grade with the Plainfield outwash upstream in the Raritan valley and so is, in part, of late Wisconsinan age. It includes both glacially-derived sediment from bedrock to the north and east of the Raritan basin, and nonglacial sediment from bedrock, Coastal Plain formations, and surficial deposits within the basin.

Preglacial Deposits—These include sand and gravel deposited by a preglacial river (Tp), weathered shale bedrock (Qsw), and outcropping sand and clay of Cretaceous age (K). The preglacial river, which may have included drainage from the Hudson valley and southern New England, flowed across the region from northeast to southwest between about 5 and 2 million years ago and deposited a broad plain of sand and gravel that covered the entire map area. This river was diverted, possibly by glacial blockage, about 2 million years ago. Local drainage then eroded valleys into and through the former river plain, leaving remnants of the deposit on uplands. These remnants, except for a small area in the southwest corner of the map area, beyond the glacial limit, were then overridden by the late Wisconsinan glacier.

PENSAUKEN FORMATION--Sand, pebbly sand, and minor pebble-tocobble gravel, reddish-yellow to yellow. Sand is predominantly quartz; with
some feldspar; and minor red shale, mica, and glauconite. Some of the
feldspar in the sand is weathered to clay. Gravel is predominantly white to
light gray (stained reddish-yellow to yellow) quartz and quartzite; with some
chert, red to gray mudstone and sandstone; and minor ironstone (from
Coastal Plain formations), gneiss, schist, and diabase. All the clasts except
quartz, quartzite, chert, and ironstone generally have thick weathering rinds
or are fully decomposed. Cobble gravel channel deposits are restricted to the
basal few feet of the deposit and contain abundant clasts of quartzite, sandstone,
and mudstone, and scattered clasts of gneiss, schist, and diabase. Tabular,
planar cross-bedded sand with minor pebble gravel dominates the deposit
above the basal gravel. The pebble gravel is chiefly quartz and quartzite with

some chert and minor mudstone. Salisbury and Knapp (1917) defined and mapped the Pensauken Formation. Owens and Minard (1979) reassigned the Pensauken deposits north of Trenton to the Bridgeton Formation (a higher fluvial sand and gravel in southern New Jersey), based on projection of the elevations of the deposits from their type areas in southern New Jersey. This usage was followed by Martino (1981) and Stanford (1993, 1995). However, the deposits north of Trenton are continuous in both extent and elevation with those at the Pensauken type locality, so the original nomenclature is used here. The age of the Pensauken is not firmly established. Berry and Hawkins (1935) describe plant fossils from the New Brunswick area 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 the Pensauken near Plainsboro, New Jersey (about 18 miles southwest of Metuchen), include a few pre-Pleistocene species, suggesting a Pliocene age (G. Brenner, written communication, 1991). This age is also consistent with the geomorphic and stratigraphic relation of the Pensauken to late Pliocene or early Pleistocene till and middle to late Miocene marine and fluvial deposits (Stanford, 1993).

WEATHERED SHALE--Poorly-sorted, nonstratified to weakly stratified, reddish-brown to yellowish-red silty clay to clayey silt with some to many angular to subangular chips of red (and minor gray) shale. Derived from mechanical and chemical decomposition of shale of the Passaic Formation of Triassic and Jurassic age. Where Pensauken Formation overlies or is upslope from weathered shale, material may include some white to yellow quartz pebbles and yellow sand derived from cryoturbation or bioturbation of the overlying or colluviated Pensauken sediment. Generally less than 10 feet thick.

K CRETACEOUS DEPOSITS—Gray, white, yellow, pink, red clay and fine-to-coarse quartz sand, minor quartz granule gravel. May contain mica, lignite, and ironstone. Massive to laminated; clays may be jointed. Sand may include white kaolinite clay from decomposition of feldspar. Exposed in former clay and sand pits, where it is generally overlain by fill or regraded natural material.

## MAP SYMBOLS

- Contact--Solid where well-defined by landforms, long-dashed where approximate, short-dashed where gradational or feather-edged, dotted where excavated or projected under fill.
- Limit of excavation—Ticks point into excavation. Dashed where obscured by regrading or filling. Marks extent of former clay, sand, and gravel pits. These areas have a discontinuous layer of artificial fill and displaced and regraded surficial and bedrock materials as much as 20 feet thick. Contacts within these areas show the approximate extent of natural material beneath this man-made layer. Fill is mapped separately only where it has a distinct landform. Extent of pits based, in part, on Ries and others (1904). In places, the base map topography within the excavation has been significantly altered since the date of the topographic survey (1934). Contacts within excavated areas show the location of

materials at the time of mapping rather than with respect to the base topography.

- at/Qm Unit to left of slash overlies unit to right--Shows extent of natural material beneath large areas of fill. Extent of natural materials is based, in part, on Ries and others (1904) and Darton and others (1908).
- (Qbn) Unit formerly present--Unit in parentheses removed by excavation. Shows location of Maurer delta deposited in Lake Bayonne, based on Darton and others
- (1908).

  47. Well or boring with log in table 1--Location accurate to within 100 feet.
- 74 Well or boring with log in table 1--Location accurate to within 500 feet.
   47 Elevation of bedrock surface in italics.
- Elevation of bedrock surface in well or boring—Data from Nemickas (1974).
   Elevation of bedrock surface in well or boring—Data from N. J. Geological Survey files.
- 8 Site of pebble count-Data in table 2.

prepared for RPMS Consulting Engineers.

Elevation of bedrock surface in italics.

- r→ Bedrock outcrop--Some outcrop locations from R. A. Volkert and D. H. Monteverde, N. J. Geological Survey (personal communication, 1996).
- (r) → Former bedrock outcrop—No longer exposed. From field maps of H. B. Kummel, N. J. Geological Survey (undated).
- Elevation of bedrock surface—Contour interval 50 feet. Includes surface of Cretaceous deposits.
- Spillway for glacial lake--Symbol in spillway area, arrow shows direction of drainage, lettering indicates associated deposit.
- Well or boring-On section, projected to line of section.

Depth to bedrock in well or boring-On section, projected to line of section.

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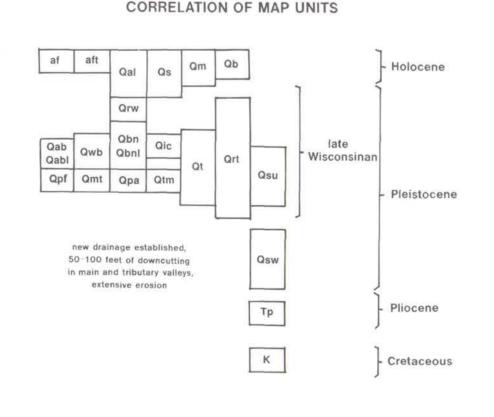
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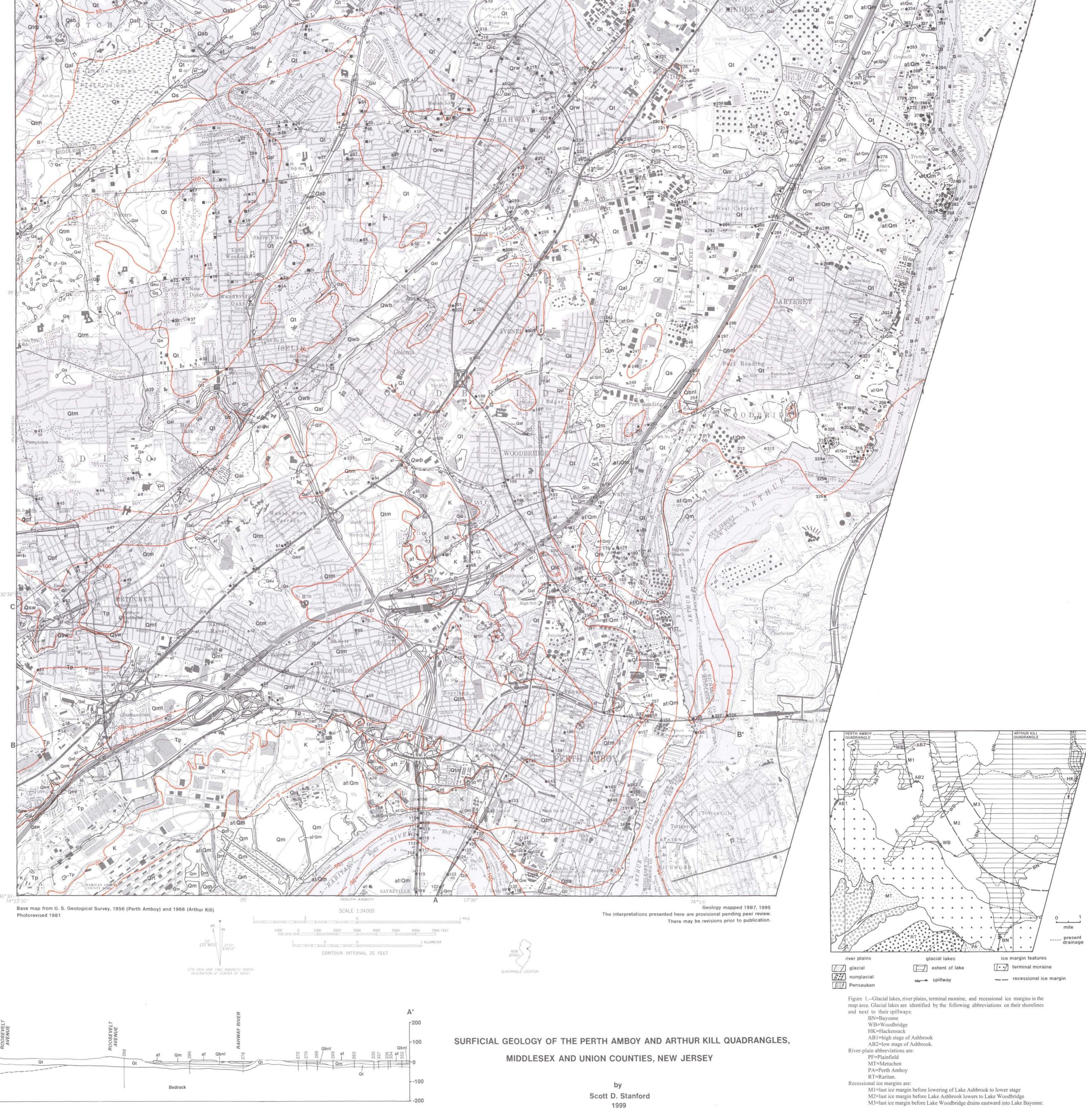
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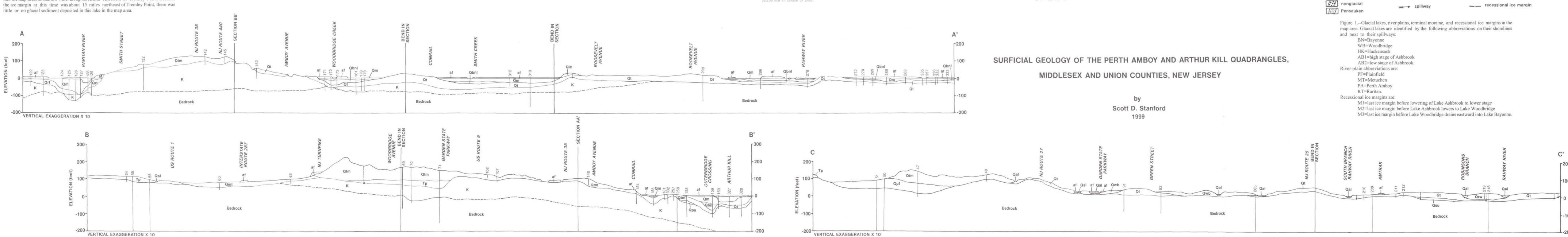
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NEW JERSEY GEOLOGICAL SURVEY			NATIONAL GEOLOGIC MAPPING PROGRAM			OPEN FILE MAP OFM 28 SHEET 2 OF 2
Table 1Selected Well Logs  Well Identifier Driller's Log2  no.	71 26-1040 log by F. J. Markewicz, NJGS, abbreviated here 0-60 reddish-brown, pale-red, pale-brown silty clayey fine-to-coarse sand with scattered pebbles (Qtm) 60-110 yellowish-brown slightly clayey fine-to- medium arkosic sand with some pebbles (Tp) 110-153 dark-gray, light-gray, grayish-pink	Route 9 bridge boring 2  0-7 water 7-32 river mud (Qm) 32-37 reddish sand and gravel (Qrt) 49-52 brown sand and gravel (Qrt) 49-52 brown clay and serpentine (weathered diabase) 52-57 serpentine (weathered diabase)	161 26-7230 0-7 fill (af) 7-15 organic silt (Qm) 15-20 gray silty sandy clay (Qtm) 20-27 gray silty clay with yellow sand seams and lignite (K)  162 26-4688 0-16 dry brown clay (Qt)	216 26-380  0-8 clay and silty sand (Qal) 8-18 medium sand and a little clay (Qal) 18-24 coarse sand and gravel (Qal over Qrw) 24-28 soft shale (Qt or Qsw) 28-51 red shale  217 26-724  0-76 sand and gravel (Qic)	272 26-19748 abbreviated log 0-8 sand, clay, wood fill (af) 8-16 black silty clay and peat (Qm) 16-30 red-brown silty clay, trace gravel and sand (Qt) 30-51 red shale	318 26-5680  O-2 cement fill (af) 2-8 gray silty clay (Qm) 8-9 brown coarse-to-medium sand (Qm) 9-18 gray silty clay (Qm) 18-28 gray silty clay and peat (Qm) 28-31 light-gray coarse sand (Qm)
Depth <sup>3</sup> Description  1 25-21337 0-68 clay and gravel overburden (Qtm) 68-125 red slate	110-153 dark-gray, light-gray, grayish-pink micaceous, lignitic clayey silt with some fine sand (K) 153-157 yellowish-gray fine-to-very-coarse angular sand (K) 157-170 red clay (weathered shale)	52-57 serpentine (weathered diabase) 57-62 trap rock (diabase)  118 NJGS files Route 9 bridge boring 26 0-9 water 9-53 black river mud and shells (Om)	16-78 dark gray clay (K) 78-98 sand, fine gray clay, streaks of lignite (K) 98-122 red shale 122-134 brown soft rock 134-146 red and gray shale rock	218 26-1595	273 26-22858 0-8 brown to black medium-to-fine sand and silt (af) organic peat (Qm) 15-23 gray clayey silt with peat (Qm) 23-40 red-brown silt (Qbnl) 40-45 red till (Qt) 45-50 red decomposed sandstone (Qsw)	31-37 red coarse-to-medium sand and gravel (Qt) at 37 bedrock  319 26-5679 0-28 slag (af) 28-33 gray silty clay (Qm) 33-41 medium gravel mixed with red clay (Qt)
2 25-1203 0-14 red sand clay (Qtm) 14-30 boulders and heavy gravel (Qtm) 30-45 hard red clay (Qtm) 45-60 red hardpan (Qtm) 60-65 red muddy sand (Qtm) 65-67 red hard clay (Qtm or Osw)	170-302 dusky-red finely micaceous shale  72 N 26-31-793 0-11 red clayey sand till (Qtm) 11-20 yellow sand and gravel (Tp) 20-90 gray and white clay and sand (K)	53-57 clayey brown sand and gravel (Qrt) 57-71 clay (K over weathered diabase) 71-77 disintegrated rock (weathered diabase) 77-81 trap (diabase)	146-402 gray to black hard rock (diabase)  163 26-9967 abbreviated log 0-15 red-brown, gray-brown silty sand (Qt) dark gray silty clay, some medium-to-fine sand layers, some mica and lignite (K)	219 26-9620 abbreviated log 0-18 red-brown silty clay, some sand, trace gravel (Qrw) 18-26 brown coarse-to-fine sand, little clayey silt, trace fine gravel (Qrw)	274 26-22861 0-10 brown to black sand, wood, cinders (af) 10-20 gray clayey silt, trace peat (Qm) 20-25 gray fine sandy silt (Qm) 25-35 red-brown silt (Qbnl)	41-52 fine-to-medium sand with gravel, trace clay (Qt)  320 26-5678 0-19 slag (af) 19-35 gray clay and brown peat (Qm) 35-36 gray clay and silt (Qm)
65-67 red hard clay (Qtm or Qsw) hard red sand rock  3 25-627 0-5 red sandy clay (Qt) 5-15 hard pan with streak of red sand (Qt) 15-33 hard red clay, heavy gravel (Qt)	73 26-5929 abbreviated log 0-45 orange-brown and gray fine-to-coarse sand and tan to gray clay lenses (K)  74 26-22460 abbreviated log	119 NJGS files Route 9 bridge boring 14 0-12 water 12-58 river mud (Qm) 58-68 dirty brown sand and gravel (Qrt) 68-70 serpentine (weathered diabase) 70-74 trap rock (diabase)	abbreviated log 0-12 gray to brown sandy silt, trace gravel (Qt) 12-46 dark gray clay, silt, and medium-to-fine sand, some lignite (K)	220 26-629	35-40 red till (Qt) 40-55 decomposed red sandstone (Qsw) 55-60 red sandstone  275 26-22856 0-5 gray sand, silt, gravel, wood (af) 5-20 peat and gray silty clay (Qm)	36-48 fine-to-medium sand and gravel (Qt) 48-52 decomposed limestone—white clay and trace of fine sand (weathered diabase)  321 26-5677 abbreviated log 0-16 sand and slag fill (af)
4 25-1298 0-25 red sand and gravel mixed with red clay (Qtm) 25-75 red hard pan with streaks of yellow dry sand (Qtm)	0-47 gray, brown, yellow medium-to-fine sand; some brown clay and silt (K) 47-58 gray marl (K or weathered shale) 58-60 dark gray shale rock  75 26-18605 abbreviated log	120 NJGS files Route 9 bridge boring 16 0-10 water 10-40 river mud (Qm) 40-63 fine-to-coarse light-gray sand (K)	165 26-18987 0-7 fill 7-14 red-brown silty clay, trace sand and gravel (Qt) 14-24 gray medium-to-fine sand, trace silt (K) 24-25 black silty clay (K)	13-18 dark-gray silty sand, trace gravel (Qsu)  222 26-50 0-21 red dirt (Qt) 21-349 red shale  223 26-5251 0-25 overburden (Qt)	20-30 red till (Qt) 30-40 red-brown clay and silt (Qt) 40-45 red-brown till (Qt) 45-50 red shale	16-38 gray clay with organics (Qm) 38-45 gray clayey fine-to-medium sand with gravel (Qt) 45-54 red sandy loam with medium gravel (Qt) 54-57 decomposed rockwhite clay (weathered diabase)
75-100 red muddy sand (Qpf?) 100-110 hard red clay (Qsw) 110-170 red sand rock  5 25-28739 0-12 brown coarse-to-fine sand; trace silt, clay, cobbles, and boulders (Qtm)	0-12 olive-yellow, light-gray, yellowish-brown fine sand, silt, and some rounded medium-to-coarse quartz river gravel (Qrt) 12-38 gray, brown very-fine-to-medium quartz sand with some interbeds of gray clay (K)	63-70 decomposed limestone (weathered diabase) trap rock (diabase)  121 NJGS files Route 9 bridge boring 20 0-17 water 17-21 mud (Qm)	166 26-10971 0-38 gray silty clay (K) 38-45 clay and sand (K) 45-59 sand (K)  167 N 26-31-891 0-40 red clay, sand, gravel (Qt)	25-254 red rock  224 26-4447 0-10 clay and sand (Qt) 10-359 red shale	0-10 silt, sand, clay fill (af) 10-16 dark-brown silt and peat, trace clay (Qm) 16-25 reddish-brown silty clay, some gray organic seams (Qm over Qbnl?) 25-51 reddish-brown clayey silt with fine sand	322 26-5676 0-14 slag and miscellaneous fill (af) 14-33 gray clay with organics (Qm) 33-53 fine-to-medium sand and gravel (Qt) at 53 red silty clay (Qt or weathered diabase)  323 26-3009 0-42 red clay (Qt)
12-40 red-brown coarse-to-fine sand, trace silt (Qpf?) 40-60 red-brown fine sand, trace silt (Qpf?) 60-76 red-brown coarse-to-fine sand, little coarse-to-fine gravel, trace silt (Qpf?) 76-170 red shale	38-42 greenish-gray clay with white mottling specks (weathered shale)  76 26-22502 abbreviated log 0-42 brown fine-to-coarse sand, trace silt, some fine-to-coarse gravel (Qrt)	21-27 reddish-brown clayey sand and gravel (Qrt) 27-65 very-fine-to-fine light-gray sand and some clay (K) 65-72 decomposed limestone (weathered diabase) 72-75 trap rock (diabase)	40-55 pinkish, medium-to-coarse sand, with rounded red shale grains (Qsu) 55-65 medium-to-coarse white sand and granules (K) 65-75 light-gray sandy clay over green decomposed trap (K over weathered diabase) 75-77 dark green trap (diabase)	225 26-120 0-7 fill 7-31 red clay (Qt) 31-37 broken red shale, clay and boulders (Qt) 37-266 red shale  226 26-1124 0-30 hard clay (Qt)	seams (Qbnl over Qt?)  51-71 shale rock  277 26-28657 0-8 fill (af) 8-12 black silt, organic clay (Qm) 12-15 peat (Om)	10-42 red clay (Qt) 42-55 red shale 55-75 gray rock 75-78 trap rock (diabase)  324 Lovegreen, boring on section 12
6 25-8379 0-70 sand (Qtm over Qpf) 70-127 shale  7 25-408 0-50 dirt, red sand, some clay (Qtm over Qpf) 50-402 red shale	42-70 gray very-fine-to-fine lignitic sand (K) 70-72 gray to green laminated clay (weathered shale)  77 26-22474 abbreviated log 0-25 brown and gray fine-to-coarse sand, little	122 N 26-41-511	168 N 26-31-892 0-50 glacial drift (Qt) 50-73 Raritan formation (K) 73-80 greenish baked shale  169 26-21745 0-36 glacial till (Qt)	30-250 red shale and hard sandstone streaks 250-285 red and purple shale 285-308 hard red and purple shale  227 26-530 0-10 red and yellow clay (Qt) 10-20 red hard pan (Qt)	15-20 gray silty clay (Qm or Qbnl) 20-40 reddish-brown silty clay with trace fine sand and gravel seams (Qt) 40-45 reddish-brown decomposed shale rock (Qsw) 45-50 shale rock	1974 0-7 water 7-25 organic silt, clay, meadow material, shells (Qm) 25-45 brown and gray sand (Qt or Qal) 45-49 green, gray, yellow clay (weathered diabase) 49-50 diabase
8 25-5432 0-41 brown clay and stone (Qtm) 41-608 red shale, some brownstone and clay seams  9 25-5637 0-26 fine red sand, few streaks of gravel (Qtm) 26-629 red shale, some brownstone	fine-to-coarse gravel, trace silt (Qrt) dark-gray very-fine-to-coarse sand, trace pyrite and lignite, little silt (K) 49-62 olive, red, gray dense laminated clay (weathered shale) 62-64 bedrock, dark-green weathered shale	42-50 gray black clay (K)  123 N 26-41-512 0-11 sand and silt (af over Qm) 11-25 sand (Qrt) 25-39 sand and gravel (Qrt) 39-51 gray clay (K)	36-55 fine-to-coarse brown sand, gravel, and cobbles (Qsu) white beach sand (K)  170 26-9604 0-4 silt, sand, clay fill (af)	20-35 hard red clay (Qt) 35-96 red sand rock  228 26-5108 abbreviated log 0-16 red-brown sandy silt and clay, trace gravel	278 26-10390 0-10 fill (af) 10-27 black organic silt (Qm) 27-41 red-brown clay (Qbnl over Qt) 41-57 gray siltstone	325 Lovegreen, boring on section 12 1974 0-20 water 20-35 organic silt, clay, meadow material, shells (Qm) 35-45 brown and gray sand (Qt or Qal) 45-72 gray varved silt and clay with lignite (K)
10 25-27174 0-30 sand and gravel, stones (Qt) 30-110 red shale  11 25-24853 0-41 overburden (Qt)	78 26-3325 0-4 fill (af) 4-10 gray silt, gray clay (Qm) 10-19 reddish-brown sand, gravel, streaks of clay (Qrt)	51-65 sand and clay (K) 65-75 gray and brown clay (K) 75-85 red brown clay (K) 85-107 brown and white clay (K or weathered rock)	4-8 dark-gray silty clay, some sand (af over Qm) 8-12 brown, gray organic silty clay and meadow mat (Qm) 12-20 olive-black silty clay (Qm) 20-27 red silt, trace of clay (Qbnl)	16-23 angular red-brown shale and siltstone fragments and clay and silt (Qsw)  229 26-5786 0-27 red-brown sandy silt and clay, some weathered	279 NJGS files abbreviated log 0-9 cinder, brick, sand, gravel fill (af) 9-20 peat (Qm) 20-26 dark-gray river mud and vegetable matter (Qm) 26-39 gray, reddish-brown silty sand and gravel (Qt	326 Lovegreen, boring on section 12 1974 0-17 fill 17-21 brown and gray sand, gravel, boulders (af?) 21-42 brown and gray varved clay (Qbnl) 42-60 brown and gray sand, gravel, boulders (Qt)
41-300 red rock  12 25-1073 0-25 sand and clay (Qt) 25-130 shale  13 25-1256 0-23 sand and clay (Qt)	19-40 fine-to-medium light gray sand (K) 40-62 fine-to-coarse light gray sand and fine gravel (K) 62-73 gray clay and shale  79 26-25873 0-6 fill (af)	124 N 26-41-278 0-59 silt (Qm) 59-65 sand (Qrt) 65-75 sandy silt (Qrt) 75-83 sand and gravel (Qrt) 83-86 hard clay (weathered diabase)	abbreviated log 0-4 sand and gravel fill (af) 4-16 soft gray, black, brown clay (Qm) 16-41 red-brown dense fine-to-coarse sand, some gravel and silt (Qt)	shale fragments (Qt) red-brown clay and silt with angular shale fragments (Qsw) 37-47 red-brown shale  230 26-10560 0-8 brown silty clay (Qt)	or Qbn) reddish-brown clayey silt, numerous shale and sandstone fragments (Qt or Qsw) 59-72 gray and green shale  280 NJGS files abbreviated log	60-70 red and gray clay (K) 70-78 gray varved silt and clay with lignite (K) 78-102 gray sand (K) 102-155 green, gray, yellow mottled clay (K over weathered shale)
23-90 shale  14 25-13392 0-30 sand and gravel (Qt)	6-15 interbedded lenses of soft black clay and meadow mat (Qm) 15-17 yellow clay (Qrt?) 17-25 fine silty light-brown sand (Qrt or Qal) 25-42 sandy light-gray clay (K)	at 86 trap rock (diabase)  125 N 26-41-275 0-69 silt (Qm) 69-92 sand, gravel at base (Qrt) 92-126 clay and sand (K) at 126 trap rock (diabase)	41-53 light-gray medium-to-fine sand, very dense (K) 53-72 very tough gray-green clay (weathered hornfels) hard gray-black weathered hornfels rock  172 26-5313 abbreviated log	8-10 brown sandy clay with large gravel (Qt) decomposed red-brown shale (Qsw)  231 26-10490 0-14 red sandy-clayey silt with red shale fragments (Qt)	0-14 cinder, sand, gravel fill (af) 14-28 black, dark gray soft river mud (Qm) 28-45 gray medium-to-coarse sand and gravel (Qt or Qbn) 45-50 hard gray shale	155-180 red shale and arkosic sandstone  327 NJGS files Outerbridge Crossing boring 69+95, C2 0-37 water 37-57 silt and sand (Qm) 57-66 large gravel (Qt)
15 25-12799	42-70 weathered fine-to-coarse gray and white quartz sand with trace of clay (K) 70-80 decomposed gray shale with gray clay lenses  80 26-452 0-25 red hard pan (Qt) 25-35 brown muddy sand (Osu or Ot)	126 N 26-41-276 0-8 water 8-85 silt (Qm) 85-88 gravel (Qrt) 88-132 mixed clay (K)	0-11 sandy fill (af) 11-19 dark-brown clayey peat (Qm) 19-54 very tough red silt, trace clay and fine sand (Qbnl) 54-64 brown sandy clayey silt, some gravel (Qt) very tough green to gray clay (weathered	14-20 decomposed red sandy shale  232 26-9158 0-5 soft, silty clay (Qt) 5-6 reddish silty sand (Qt) 6-12 reddish weathered shale	281 NJGS files abbreviated log 0-13 cinders, sand, gravel, sulfer fill (af) 13-28 soft brown peat and dark gray river mud (Qm) 28-35 gray silty sand and gravel (Qt or Qbn)	66-98 fine gray sand (K) 98-120 red clay (K or weathered shale)  328 NJGS files Outerbridge Crossing boring 76+70 0-6 water
17 25-13060 0-30 sand and gravel (Qt) 30-150 red shale  18 25-28407 0-30 overburden (Qt) 30-300 shale	35-50 red hard packed fine dry sand (Qsu or Qt) 50-60 red quick sand (Qsu or Qt) 60-68 red hard clay (Qsw) 68-100 red hard sand rock	at 132 rock (diabase)  127 N 26-41-276 0-8 water 8-94 silt (Qm) 94-112 mixed clay (K) at 112 rock (diabase)	at 75 diabase) at 75 diabase fragments, refusal  173 26-5314 abbreviated log 0-11 clay and sand fill (af)	233 26-522 0-5 red and yellow sandy clay (Qt) 5-25 red hard pan (Qt) 25-40 hard red clay (Qt) 40-60 red sand rock	35-43 light-gray medium sand (Qt or Qbn) 43-50 reddish-brown decomposed shale (Qt or Qsw) 50-55 hard gray sandstone  282 NJGS files 0-22 water (drilled from dock) 22-30 very soft dark gray river mud (Qm)	6-30 silt (Qm) 30-50 mud and silt (Qm) 50-58 gray clay and sand (Qt) 58-63 sand (Qt) 63-108 gray clay (K) 108-120 red clay (K or weathered shale)
19 26-577 0-42 sand and gravel (Qt) rock  20 26-356 0-32 sand and clay (Qt) 32-85 shale	81 26-4002	128 N 26-41-273 0-27 water 27-45 silt and sand (Qm) 45-55 sand and gravel (Qrt) 55-61 silt (Qrt) 61-64 clay (Ort)	11-20 gray clay and peat (Qm) 20-59 dense red-brown coarse-to-fine sand and some gravel (Qbn over Qt) 59-70 very stiff gray clay (K over weathered shale) at 70 weathered shale, refusal	234 NJGS files 0-3 mud (Qal) 3-20 sand and gravel (Qal or Qrw) rock or boulder  235 26-428 0-42 sand and clay (Qt) 42-81 rock	30-35 medium-to-coarse brown sand and gravel (Qt or Qbn) 35-40 hard gray shale  283 26-25830 0-15 gray clay, sand, gravel (af)	329 26-5884 abbreviated log 0-20 reddish-brown sandy clay with stones (Qt) at 20 red shale
21 26-329 0-23 sand, clay, gravel (Qt) 23-80 rock  22 25-12610 0-25 sand and gravel (Qt)	30-35 boulders and fine sand (Qt or Qsu) 35-59 gravel and cobbles some fine sand (Qsu) at 59 red shale rock screened 48-59, yield 360 gpm	64-76 silt and sand (Qrt) 76-80 boulders (Qrt) at 80 rock (diabase)  129 N 26-41-273 0-3 water	abbreviated log 0-14 fill (af) 14-18 soft brown moist peat (Qm) 18-31 red sandy silty clay, trace gravel (Qt) 31-55 red-brown coarse-to-fine sand and gravel (Qsu)	236 26-8781	15-25 gray clay (Qm) 25-40 gray fine-to-medium sand and fine-to-coarse gravel (Qbn) 40-45 red clayey silt (Qbn or Qt) 45-55 red till (Qt) 55-60 gray decomposed shale (Qsw)	330 26-5885 abbreviated log 0-12 reddish-brown sandy clay (Qt) at 12 rock  331 N 26-31-725 0-18 red clayey gravel (Qt) 18-23 boulder (Qt)
25-110 red shale  23 26-330 0-10 sand (Qt) 10-16 clay (Qt) 16-82 shale	83 26-2981 0-78 sand (Qt over Qsu?)  84 26-482 0-8 red sandy clay and gravel (Qt)  8-12 red hard pan (Qt)  12-32 boulders and heavy gravel, dry (Qt)	3-20 silt and gravel (Qm over Qrt) 20-53 sand (Qrt) 53-56 clay (K) 56-96 mixed clav (K) at 96 rock (diabase)	55-73 very dense light-gray medium-to-fine sand (K) 73-96 hard gray to green clay; some black, brown veins (weathered diabase) weathered diabase  175 26-9706 0-5 clay and gravel (af)	237 26-14186 0-10 red-brown coarse sand and gravel (Qt) 10-15 red-brown coarse sand and gravel, trace clay (Qt) 15-25 red-brown medium-to-coarse sand, trace gravel (Qt)	60-65 green marl (Qsw?)  284 NJGS files 0-26 water (drilled from dock) 26-30 soft river mud and fine sand (Qm) 30-37 reddish-brown silty sand and grayel (Ot)	23-46 red clayey gravel (Qt) 46-59 clean water-bearing red gravel (Qsu?) 59-63 gray fine sand (Qsu?) at 63 red shale
24 26-673 0-42 sand and clay (Qt) 42-90 rock  25 26-423 0-26 sand and clay (Qt) 26-80 rock	32-42 hard red clay (Qsw) 42-150 hard red sand rock  85 26-4106 0-5 clay (Qt) 5-45 sand, gravel (Qt over Qsu?)	130 26-9400 0-30 metal, glass, wood, paper, sand, etc. fill (aft) 30-36 dark-gray silty clay with layers of light-gray medium-to-fine sand (K)  131 26-9068 abbreviated log	5-22 gummy gray clay with interbedded lenses of sand (Qm) 22-45 decomposed red shale (K over weathered shale) 45-67 red to gray shale 67-74 dense hard rocklimestone or granite (diabase)	25-29 red-brown coarse sand and gravel (Qt or Qsu) 29-30 weathered shale (Qsw)  238 26-24304 0-21 red clay, silt (Qt) 21-28 sand, cobbles (Qt or Qsu)	37-47 reddish-brown decomposed shale and clayey silt (Qt or Qsw) 47-60 soft greenish decomposed shale (Qsw) hard gray shale  285 NJGS files abbreviated log	332 NJGS files  Outerbridge Crossing boring 33+00 0-5 fill 5-9 sand and gray clay (Qtm) 9-18 yellow and gray clay (Qtm) 18-20 red clay, gray sand and gravel (Qtm) 20-27 gray clay and sand (K)
26 26-477 0-28 sand and clay (Qt) 28-89 rock  27 26-474 0-25 clay and sand (Qt) 25-78 rock	45-140 shale  86 26-314 0-2 topsoil (Qt?) 2-85 red shale  87 25-7075 0-13 sand (Qt)	0-40 cinder, brick, metal, soil fill (aft) 40-45 red-brown clayey silty gravelly medium-to- fine sand (Qtm) 45-57 brown, gray, white fine sand and clay (K)  132 26-28814 0-19 yellow sand and gravel with clay lenses (Qtm)	abbreviated log 0-10 stone and sand fill (af) 10-18 peat (Qm) 18-45 red-brown clayey sandy silt, trace gravel (Qt) 45-52 fine-to-medium gray sand (K)	28-29 red clay (Qt or Qsw)  239 26-14426 0-23 red silty clay (Qt) 23-35 brown-red sand and gravel (Qt or Qsu)  240 26-82 0-50 red dirt and rock (Qt)	0-4 cinders, sand, gravel fill (af) 4-15 very soft dark-gray river mud (Qm) 15-25 soft sandy river mud with peat and shells (Qm) 25-35 gray medium-to-coarse silty sand and some small gravel (Qbn or Qt)	27-42 dark-gray clay (K) 42-47 gray clay and fine beach sand (K)  333 NJGS files Linden powerplant boring 11 0-7 meadow mat (Qm)
28 26-478 0-17 sand and clay (Qt) 17-85 rock 29 26-554 0-24 sand and clay (Qt)	13-150 red rock  88 26-349 0-9 clay (Qt) 9-25 sand, gravel (Qt or Qsu) 25-70 red shale	19-97 soft gray clay (K) 97-104 medium-to-coarse weathered white coarse sand (K) 104-118 gray clay (K) 118-140 medium-to-coarse weathered gray quartz sand with trace clay lense (K)	177 NJGS files 0-21 fill (af) 21-24 silt (Qm) 24-58 sand and gravel (Qbn over Qt)	50-405 red rock  241 26-5547 0-5 red silty clay, trace sand, occasional cobble, very dense (Qt) 5-10 red silty clay, trace sand, dense (Qt)	35-49 reddish-brown coarse silty sand and gravel, some large gravel (Qt) 49-53 soft red sandstone with limey shale nodules and clayey silt (Qsw) 53-60 greenish soft decomposed shale (Qsw) 60-65 hard dark-gray shale	7-14 brown fine sand, some silt (Qm) 14-18 red fine sand, some silt and clay (Qbnl) 18-24 red clay, some gravel (Qt) 24-26 red soft weathered shale (Qsw) 26-31 red shale rock
24-82 rock  30 26-291 0-18 clay and sand (Qt) 18-86 shale  31 26-469 0-10 red hard pan (Qt)	89 26-320 0-12 red sandy clay and gravel (Qt) 12-22 red hard pan (Qt) 22-42 hard red clay with streaks of white clay (Qt over Qsw) 42-102 red sand rock	140-145 gray clay (K or weathered shale)  133 26-10574 abbreviated log 0-20 red-brown sand, little silt and clay, trace gravel (Qtm) 20-32 dark-gray medium-to-fine sand, little clavey	178 26-28361 0-16 dark-reddish-brown fine-to-medium silty sand (Qt) 16-42 dark-reddish-brown coarse-to-fine sand, trace silt (Qt) 42-70 light-green-gray clay (K)	10-15 red silty clay, trace sand (Qt) wet red silty clay (Qt or Qsu)  242 26-7505  0-23 red-brown clayey silt (Qt) red-brown coarse-to-fine sand and coarse-to-fine gravel (Qsu or Qt)	286 26-10386 0-11 black organic sand (Qm) 11-35 red-brown clay (Qbnl over Qt) 35-60 red siltstone	334 NJGS files  Linden powerplant boring 9 0-10 meadow mat (Qm) 10-18 gray fine sand, some organic silt (Qm) 18-24 red clay and gravel (Qt) 24-26 red soft weathered shale (Qsw)
10-20 red muddy sand (Qt) 20-27 red hard clay (Qt or Qsw) 27-100 red sand rock  32 26-275 0-5 red hard pan (Qt)	90 26-1806 0-32 earth, clay, stones (Qt) 32-315 red shale  91 25-13262 0-30 sand, clay, gravel (Qt)	silt, trace fine gravel (K)  134 26-7096 abbreviated log 0-30 red-brown silty clayey sand with some gravel (Qtm)	179 26-28352 0-16 dark-reddish-brown fine-to-medium silty sand (Qt) 16-42 dark-reddish-brown coarse-to-fine sand, trace silt (Qt or Qsu) 42-70 light-gray-green clay (K)	243 26-22308 0-21 red-brown silt and clay (Qal over Qt) 21-23 red-brown decomposed shale (Qsw) 23-40 red-brown shale	287 N 26-32-411 0-6 gray clay and roots and red medium sand (Qm) tough red silty clay (Qbnl or Qt) 13-19 rusty-red fine sand with shale pebbles (Qt) red sandy, micaceous red shale  288 26-26175 0-37 red-brown fine sand with gravel, silt, clay (Qt)	26-31 red shale rock  335 NJGS files Linden powerplant boring 6 0-14 meadow mat (Qm) 14-16 gray fine sand, some organic silt (Qm) 16-26 red clay, some gravel, trace sand (Qt)
5-145 red shale and red sand rock  33 26-341 0-10 red sandy clay, hard, mixed with some fine gravel (Qt)  10-30 tough hard red clay (Qt) 30-43 red hard pan (Qt)	30-120 red shale  92 26-1 0-5 sand (Qwb) 5-20 hardpan (Qt) 20-102 red shale at 102 gray shale	30-47 brown-yellow sand and gravel (Qpa?) 47-54 dark-gray plastic silty clay (K)  135 26-30698 0-2 fill material 2-8 brown silt, sand, gravel (Qtm)	180 26-28359 0-16 dark-reddish-brown fine-to-medium silty sand (Qt) 16-42 dark-reddish-brown coarse-to-fine sand, trace silt (Qt or Qsu) 42-70 light-gray-green clay (K)	244 26-26065 0-10 silty clay (Qt) 10-28 red-brown coarse sand, trace silt (Qsu or Qt)  245 26-26335 0-7 red-brown silt, some clay (Qt) 7-18 red-brown medium sand (Qsu or Qt) 18-20 red shale	289 N 26-31-636 0-36 sand and small variegated pebbles (Qt) 36-42 red clay, sand, gravel (Qt) 42-47 typical glacial material of variegated color and type (Qt)	26-31 red soft weathered shale (Qsw) 31-36 red shale rock  336 NJGS files Linden powerplant boring 20 0-15 brown meadow mat (Qm)
43-150 red sand rock  34 26-460 0-22 sand and clay (Qt) 22-99 rock	93 26-24439 0-18 red-brown clayey sand and gravel (Qt) 18-35 orange-brown silty fine sand (Qt or Qsu) 35-40 red-brown clayey sand and gravel (Qt)	8-15 brown sand, gravel (Qpa?) 15-20 white sand (Qpa?) 20-35 gray sand and gravel (Qpa?) 35-40 brown medium-to-fine sand and gravel (Qpa?) 40-45 gray silty clay (K) 45-52 gray silty clay with mica (K)	abbreviated log 0-54 gray to reddish-brown clayey silty sand, little fine-to-coarse gravel; sandier below 27 feet (Qt, possibly over Qsu)	246 26-23758 0-17 red-brown sandy clay (Qt) 17-20 coarse sand and gravel (Qsu or Qt) 20-22 red clay lenses (Qsu or Qt)	290 26-15616 abbreviated log 0-5 gravelly fill 5-22 red sandy clay, some gravel (Qt)  291 26-14699 abbreviated log	15-18 gray river mud, some peat (Qm) 18-32 red and brown silty clay, shattered shale, some gravel (Qt) 32-43 rock  337 NJGS files Linden powerplant boring 18
35 26-8535 0-18 red-brown clayey silt till (Qt) soft shale (Qsw) red shale  36 25-21970 0-10 topsoil and clay (Qt) shale	94 26-25069 abbreviated log 0-15 red clayey silt and sand, some pieces of bedrock (Qt) 15-16 decomposed shale (Qsw)	abbreviated log 0-5 cinders on gray-green silty clay (af over Qm) 5-15 red-brown clayey silty sand with gravel (Qtm) 15-42 red-brown, yellow-orange sand and gravel (Qpa) 42-45 light-gray silty very micaceous clay (K)	54-59 white to gray fine-to-medium sand (K) 59-90 white to gray clay, becoming green and brittle with depth (K over weathered diabase)  182 N 26-31-971 0-20 red clay and sand (Qt) 20-40 gray sand and gravel (Qsu?)	247 26-29549 0-20 silty clay (Qt) 20-25 weathered shale (Qsw) red shale  248 26-14834 0-10 red-brown till with red shale fragments (Qt) 10-60 Brunswick shale	0-17 reddish-brown sandy silty clay, little to some gravel (Qt)  292 26-433 0-39 sand (Qt) 39-108 rock	0-2 fill (af) 2-19 river mud (Qm) 19-21 gray sand and river mud (Qm) 21-27 red clay, some shale and sand (Qt) 27-34 red clay, some fine gravel, some shale (Qt)
37 25-1104 0-26 sand and clay (Qt) 26-80 shale  38 26-1155 0-30 clay (Qt)	95 26-22292 abbreviated log 0-4 fill 4-24 red silty clay, little sand, trace gravel (Qt) 24-34 brown fine-to-coarse sand little silty clay, occasional quartz gravel (Tp)	137 26-7267 0-13 fill of cement, cinder, sand, clay, gravel (af) 13-21 gray clay with peat moss (Qm) 21-39 brown coarse-to-fine sand and gravel (Qpa) 39-111 gray silty clay with layers of gray fine sand	40-75 clay and sand (K) 75-78 red shale 78-148 trap (diabase) 148-150 red sandstone 150-157 trap (diabase)	249 26-29799 abbreviated log 0-15 red hard silt with some gravel, little sand (Qt) 15-24 red very dense fine-to-coarse gravel and fine-to-coarse sand, some silt (Qt or Qsu)	293 26-4159	34-39 rock  338 NJGS files Linden powerplant boring 29 0-12 miscellaneous fill (af) 12-19 river mud (Qm) 19-24 gray sand, some clay and vegetable matter (Om)
30-320 red shale  39 25-10489	96 N 26-31-818 section formerly exposed in pit 0-10 red clayey till, boulders of baked shale, quartzite, and granite-gneiss (Qtm) 10-40 yellow medium sand with occasional small pebbles (Tp)	and some wood (K with lignite) 111-137 gray coarse-to-medium sand with some wood (K with lignite) 137-140 gray clay, layer of gray medium-to-fine sand (K)  138 26-12857 abbreviated log	183 26-30216 0-38 red-brown coarse-to-fine sand, some silt, little gravel (Qt) 38-65 white coarse-to-fine sand, little silt (K) 65-69 layered white sand and clay (K) at 69 gray silt and clay (K)	24-31 red, gray, green moist hard silt and weathered shale (Qsw)  250 26-19868 0-5 red-brown clayey silt with rock fragments (Qt) 5-12 red-brown clayey silt (Qt) 12-19 red-brown clayey silt, trace sand (Qt)	295 N 26-31-662 0-30 red gravelly and sandy clay, some shale fragments (Qt)  296 26-26740 0-33 red-brown silty-clayey fine sand, some gravel (Qt)	24-29 gray sand and gravel, some clay (Qt) 29-32 red clay, sand, and gravel (Qt) 32-36 red clay and shale (Qt) 36-41 rock
gravel (Qt) 5-12 red-brown silty clay (Qt or Qsw) 12-13 soft red shale  41 25-62 0-49 red dirt (Qtm)	40-60 clay and sand (K) at 60 red shale  97 N 26-31-841 section formerly exposed in pit 0-10 red clayey till, boulders of gneiss and	0-5 fill dirt 5-42 gray and red silt, fine sand, and clay (Qtm) 42-60 brown and gray clay and fine sand (K)  139 NJGS files boring B4 from Lippincott, Jacobs, and Gouda (1995)	184 26-30214 0-35 red-brown coarse-to-fine sand, trace gravel and clayey silt (Qt) 35-68 brown-white coarse-to-fine sand, trace silt and fine gravel (K)	19-32 red-brown clayey silt with fine gravel and rock fragments (Qt) 32-40 red-brown decomposed shale  251 26-238 0-10 red hardpan (Qt)	33-36 decomposed rock (Qsw)  297 26-26183 abbreviated log 0-30 red-brown silty fine sand, some gravel (Qt) 30-36 red-brown decomposed rock (Qsw)	339 NJGS files  Linden powerplant boring 28 0-9 meadow mat and river mud (Qm) 9-14 river mud and vegetable matter (Qm) 14-19 gray sand and vegetable matter (Qm) 19-23 gray clay some gravel and red shale (Qt) 23-32 red clay and shale (Qt)
49-102 red shale  42 25-21996 0-20 sand and gravel (thin Qtm over Qpf) 20-200 shale  43 25-14787A 0-50 sand and gravel (Qtm over Qpf?)	quartzite (Qtm) 10-20 yellow sand (Tp) 20-35 clay and sand (K)  98 26-563 0-10 sand and gravel mixed with red clay (Qt) 10-14 blue, yellow, white, red clay (K clast in Qt?)	0-12 black river mud (Qm) 12-41 reddish-brown coarse-to-fine sand, trace silt, little gravel (Qm) 41-105 dark-gray silty clay with organic matter, trace fine sand (Qm) 105-116 gravel (Qpa)	at 68 decomposed shale  185 26-28367 0-15 dark-reddish-brown silty fine sand, trace clay (Qt) 15-35 dark-reddish-brown fine-to-medium sand, trace silt (Qt)	10-30 yellow mud with streaks of fine muddy sand (Qsu or Qt) 30-60 gray, black, red, green silt (K?) 60-85 green, white, blue clay (K over weathered shale) 85-146 mica rock (shale?)	298 26-4139 0-40 clay (Qt) 40-145 diabase 299 26-22031 0-10 miscellaneous fill (af) 10-21 peat with silt (Qm)	23-32 red clay and shale (Qt over Qsw) 32-72 red shale rock  340 NJGS files Linden powerplant boring 47 0-9 river mud (Qm) 9-22 red clay, some gravel (Qt)
50-180 red shale  44 25-21969 0-70 sand and gravel (Qtm) 70-250 red shale	14-35 hard pan (Qt) 35-50 very muddy fine sand (Qt or Qsu) 50-55 red hard clay (Qsw) 55-100 hard red sand rock  99 26-5534 0-60 sand, gravel (Qt over Qsu or Tp)	at 116 refusal on cobble or bedrock  140 NJGS files boring B3 from Lippincott, Jacobs, and Gouda (1995) 0-11 black river mud (Qm) 11-22 black, green to reddish-brown coarse-to-fine	35-48 dark-reddish-brown medium-to-coarse sand, trace coarse gravel (Qsu?) 48-70 light-gray-green clay (K)  186 26-5175 0-10 stones, sand fill (af) 10-12 peat (Qm)	252 26-26108 0-13 red-brown fine sand with gravel, silt, clay (Qt) 13-33 red-brown medium-to-fine sand and gravel with silt (Qsu or Qt) 33-37 gray silty clay (K)  253 N 26-31-685 abbreviated log	21-30 fine silty sand, some fine gravel (Qbn or Qt) 30-33 fine-to-coarse sand and gravel (Qbn or Qt) 33-46 till (Qt) 46-50 decomposed rock	at 22 top of rock  341 NJGS files Linden powerplant boring 40 0-2 river muck and gray sand (Qm) 2-9 red sandy clay (Qbnl or Qt) 9-11 red sandy clay, soft shale (Qt over Qsw)
45 25-13343	100 26-5193 0-3 red clay and sand (Qt) 3-15 gray dense clay (K clast in Qt?) 15-21 red and brown coarse sand (Qt)	sand, trace silt and fine gravel (Qm)  22-41 interbedded black organic silty clay and reddish-brown coarse-to-fine sand (Qm)  41-110 dark-gray silty clay, some peat and shell fragments (Qm)  110-120 gravel with alternating layers of sand, silt,	12-21 black clay and silt (Qm) 21-24 red clay and sand (Qbnl) 24-26 red clay (Qbnl) 26-33 red shale and gravel (Qt)	0-31 red-brown sandy gravelly clay (Qt)  254 N 26-31-688 abbreviated log 0-6 red sandy clay (Qt) 6-36 yellow and gray fine-to-medium lignitic sand	abbreviated log 0-10 silty sand fill (af) 10-14 brown peat (Qm) 14-18 gray fine-to-medium sand, some silt (Qm) 18-42 red-brown sandy clayey silt, trace gravel (Qt) 42-49 gray silt and fine sand (Qt or Qsu or K)	11-16 rock  342 N 26-41-266 well 2 0-20 red clay (Qtm) 20-55 gray clay mixed with gravel (Qtm)
52-110 red shale  47 25-233 0-105 clay and sand (Qtm over Qpf) 105-126 sand and gravel (Qpf) 126-143 shale	21-65 red glacial tillsilty sand and boulders, occasional layers of reddish brown clay (Qt) 65-212 Brunswick formation (shale)  101 26-10473 0-17 black to gray clay, trace silt (K)	at 120 refusal on cobble or bedrock  141 26-28568 abbreviated log 0-51 red-brown fine-to-medium sand, some silt	187 26-15044 0-24 brown medium-to-coarse sand, gravel, cobbles (Qt) 24-40 brown fine sand (Qsu?)  188 26-14632 abbreviated log 0-14 reddish-brown sandy silty clay, some gravel (Qt)	with some clayey streaks (K) 36-47 greenish-gray and dull-red clay (K over Qsw) at 47 soft, weathered shale  255 26-5052 0-115 clay, sand (Qt over K) 115-300 shale	301 N 26-32-456 0-45 yellowish sand (af over Qm over Qt?) 45-50 bluish sand mixed with black clay (K?) 50-60 fine white clay (K or weathered diabase) at 60 trap rock (diabase)	55-140 tough gray clay (K) 140-160 gray clay, sand, and wood (K with lignite) 160-175 red clay (weathered shale) 175-463 red shale  343 N 26-41-266 well 3
48 25-27254 0-20 red silt and clay with sandstone, shale, and siltstone fragments (Qtm) red shale  49 25-13009 0-55 sand and clay (Qtm)	102 26-21695	and clay and fine-to-medium gravel (Qtm)  51-52 gray clayey silt with mica (K)  142 26-16641 abbreviated log 0-20 red-brown, brown silty, clayey, gravelly sand (Otm)	14-22 reddish-brown clayey sand, trace gravel (Qt)  189 26-21239 abbreviated log 0-9 sandy, gravelly fill (af) 9-10 gray silty clay (Qm)	256 N 26-31-891 log by M. E. Johnson, NJGS, abbreviated here 0-40 red clay, sand, gravel (Qt) 40-50 pinkish medium-to-coarse sand, with rounded grains of red shale (Qsu)	302 26-5795 0-40 red overburden with roundstones (Qt) 40-70 gray sand (K) 70-150 Palisades traprock (diabase)  303 26-30330 abbreviated log	0-10 fill 10-35 hardpan (Qtm) 35-55 yellow sand and gravel (Qpa) 55-132 gray clay (K) 132-141 fine gray sand, a little black clay (K)
55-150 red shale  50 25-6989 0-50 clay (Qpf) 50-403 red shale	10-25 brown silty clay (K) 25-30 yellow-brown silt and sand (K) 30-40 gray silty sand (K) 40-45 red-brown silty clay (K)  104 26-866 0-15 reddish-brown sandy clay (Qtm)	20-32 yellow-brown silty coarse-to-fine sand (K or Qtm) 32-38 white-tan sandy silty clay (K)  143 26-11042 abbreviated log	10-41 red-brown to light-gray silty clayey sand, some gravel (Qt) 41-49 light-brown clay and silt, trace fine sand (K) 49-50 green-gray fractured rock (diabase?)  190 N 26-31-863 0-8 soft gray meadow mat (Qm)	50-65 white medium-to-coarse sand and pea gravel (K) 65-74 light-gray sandy clay (K) 74-77 green decomposed trap (weathered diabase) at 77 dark-green trap (diabase)	0-9 miscellaneous fill (af) 9-10 gray silt and clay, trace shells (Qm) 10-25 red sandy, clayey silt, trace gravel and fragmented shale (Qt) 25-42 gray, orange, red interbedded clay,	Numbers of the form xx-xxxx (for example, 26-29514) are well permit numbers issued by the N. J. Department of Environmental Protection, Bureau of Water Allocation. Numbers of the form N xx-xx-xxx (for example, N 26-41-266) are New Jersey Atlas Sheet grid locations of entries in the N. J. Geological Survey permanent note collection. The notation "NJGS files"
51 25-10771 0-85 soft red shale and sandstone (Qpf over Qsw) 85-296 red shale  52 25-5278 0-28 earth, sand, clay (Qpf) 28-35 soft red shale rock (Qsw) 35-231 red shale rock	15-30 brown sand and boulders (Qtm) 30-40 yellow sandy clay (K) 40-50 gray clay (K) 50-65 black clay (K) 65-78 white sandy clay (K)	0-20 red-brown sandy silty clay, trace medium-to- fine gravel (Qtm)  144 26-18368 0-24 red medium sand (Qtm) red weathered shale (Qtm or K, Qsw unlikely)	8-14 yellow and gray clay, sand and gravel (Qal) 14-40 red clayey sand and gravel (Qt) hard red sandy red shale  191 N 26-31-863 0-10 gray clay and medium-to-coarse sand with shell	0-14 brown and gray silty clay with fragments of red sandstone (Qtm) 14-30 black and gray silty clay with partings of fine sand and mica; some lignite (K)	silt, and sand (K)  304 26-891	indicates records of borings or wells on file at the N. J. Geological Survey that are not entered in the permanent note collection. These borings were made for various construction projects. Notations of the form "Lovegreen, 1974" refer to logs provided in the cited publication.  2All descriptions are as they appear in the original source, except for minor
53 25-6877 0-28 red clay (Tp over Qsw) 28-170 red shale  54 N 25-44-363 0-15 brown, gray, yellow clayey sand and gravel (Tp)	78-82 fine white sand—muddy (K) 82-95 black clay (K) 95-100 gray muddy sand (K) 100-108 coarse gray sand (K)  105 26-3586 abbreviated log	abbreviated log 0-8 fill 8-36 red-brown clayey sandy silt, trace fine gravel (Qtm)	fragments (Qm) 10-21 slightly clayey medium-to-coarse red sand (Qt) 21-31 compact red clay and shale fragments (Qt over Qsw)  192 N 26-31-865 0-43 red sandy clay, some gravel (Qt)	258 26-7714 0-160 sand, clay (Qtm over K) 160-580 serpentine (probably diabase)  259 26-8679 0-23 reddish-brown medium-to-fine sand, gravel, silt (Qt) 23-26 reddish-brown coarse sand, gravel, clay,	33-42 gray sand (K?) at 42 clay (K?) 305 26-892 0-3 clay (Qt) 3-14 red clay and gravel (Qt)	format, punctuation, and spelling changes. Most logs are drillers' reports; a few are reports of geologists or engineers. Inferred map units and comments by author are in parentheses. Logs identified as "abbreviated" have been condensed for brevity. Some descriptions of bedrock and thin surface fill and soil layers have also been omitted or condensed for brevity. "NR" indicates
15-27 red clay (Qsw)  55 25-42 0-36 clay, stones, and hardpan (Tp)  36-95 red shale  95-105 gray slate  105-417 red rock	0-15 red hard clay (Qtm) 15-21 sand and stones and rocks (Qtm) 21-98 gray clay (K) 98-118 white, red, yellow clay (K) 118-14 coarse brown sand, some mixed clay and ironstone (K)	146 26-4071 0-250 sand and clay (Qtm over K) 250-650 trap (diabase)  147 N 26-41-266 well 1 0-50 red clay and coarse gravel (Qtm) 50-190 black to dark-brown clay, minor sand (K)	at 43 stiff bluish-gray micaceous clay (K)  193 26-1269 0-21 silt, clay, and gravel (Qt) 21-200 shale  194 26-18360 abbreviated log	shale fragments (Qt)  260 26-8466 abbreviated log 0-7 cinder, gravel, sand, clay fill (af) 7-15 dark-gray silt, peat, and clay (Qal)	14-24 fine red sand (Qt or Qsu) 24-28 fine gray sand (K?) 28-40 fairly coarse gray sand (K?) at 40 gray clay (K?)  306 26-8525 abbreviated log	"not reported". For wells completed in surficial material, the screened interval in feet below land surface and yield in gallons per minute (gpm) are provided below the geologic log.  3In feet below land surface.
56 25-58 0-5 stones and sandy clay (Tp) 5-10 hardpan, stones (Tp) 10-12 yellow clay (Tp or Qsw) 12-18 pink clay (Qsw) 18-32 purple clay (Qsw)	ironstone (K) 144-147 gray and red clay (K or weathered shale)  106 26-5550 abbreviated log 0-15 red-brown silty clay with imbedded angular gravel (Qtm)	190-523 varicolored rock (possible hornfels rock)  148 26-15929 abbreviated log 0-20 red clay, trace medium-to-fine red sand (Qtm)  149 26-22638 0-5 fill	0-17 red silty clay, trace sand and gravel (Qt) 17-18 red siltstone  195 26-24837 abbreviated log 0-14 red to gray silty clayey sand, some gravel (Qt)	15-18 gravel and silty sand (Qal or Qt) 18-55 red-brown shale  261 26-5968 abbreviated log 0-8 brown, orange, red silty clay, some sand and gravel (af)	brown fine-to-coarse sand, trace gravel (Qt) red silty sand, trace clay and fine gravel (Qt)  307 26-29566 0-8 red-brown silty medium-to-fine sand with gravel (Qt) 8-14 red-brown silty medium-to-fine sand (Qt)	
32-82 brown and red rock 82-92 red and gray rock 92-402 red rock 57 26-1026 0-10 earth and clay (Qt)	107 26-23805 abbreviated log 0-19 red-brown silty sandy clay with some pebbles (Qt) 19-21 yellow-brown clayey sand, some silt (K)	5-12 sand, fine, silty with clay (Qtm) 12-20 sand, fine, silty with fractured shale (Qtm) 20-45 weathered shale (K, Qsw unlikely)  150 26-24632 abbreviated log	14-18 red siltstone  196 26-28597 0-10 mixed red clay, sand, gravel (Qt) 10-24 soft red shale  197 26-2266 0-29 red clay (Qt)	8-10 meadow mat (Qm) 10-12 dark-brown silty clay and meadow mat (Qm) 12-16 olive-gray silty clay trace fine sand (Qbnl) 16-18 red silty clay and fine sand (Qbnl) 18-21 red silty clay, gravel, fine sand (Qt)	14-36 red-brown silty clayey sand with gravel (Qt) 36-38 red-brown silty coarse-to-fine sand (Qt) white and green decomposed rock (weathered diabase)	Table 2Composition of pebbles in surficial units.  Site Unit Number Percentage of pebbles
10-394 red shale rock  58 26-6661 0-6 red-brown clayey silt, trace gravel (Qt) red-brown coarse-to-fine sand, some fine gravel, little clayey silt (Qt)	108 NJGS files  Parkway bridge boring 103 0-4 fill, brick 4-13 silt, clay (K) 13-43 gray and brown sand (K) 43-61 gray clay (K)	0-14 gravel, wood, concrete fill 14-31 red-brown silty sand, some gravel (Qtm) 31-39 dark-gray micaceous clayey silt (K)  151 26-23061 0-29 reddish-brown silty sand with some gravel and cobbles mixed (Qtm)	29-350 red shale  198 26-1428 0-30 clay and boulders (Qt) 30-298 shale	21-22 red weathered shale (Qsw)  262 26-5967 0-5 gray, orange silty clay (af) 5-7 black, brown meadow mat and organic silty clay (Qm) 7-20 red silt, trace of clay, gravel, and fine	308 26-29514 0-30 red-brown silty clayey sand with little gravel (Qt) 30-40 gray silty fine sand (K)  309 N 26-31-689 0-15 red clay with a few sand grains (Qt) 15-25 red slightly clayey fine-to-coarse sand	Pebbles red shale gray shale Pensauken gneiss conglom- basalt and and Fm. 1 erate <sup>2</sup> sandstone sandstone
59 22-22018 0-7 fill red silty clay, little gravel, fragmented shale and gravel (Qt)  60 25-9026 0-28 coarse brown sand and gravel (Qmt)  78-40 red and white clay, streaks of red shale (Osw)	61-66 sand, peat (probably lignite)  109 NJGS files Parkway bridge boring 92 0-11 fill, ashes, brick (af) 11-18 organic silt (Qm)	29-40 reddish brown sand and silt (Qpa?)  152 26-5216 0-20 silty clay (Qt) 20-22 silty clay and gravel (Qt) 22-48 gray clay (K)	199 26-9469	sand (Qt) 20-26 red silt, fine sand, trace clay (Qt) 26-27 red weathered shale (Qsw)  263 26-22622 0-8 white soda ash (af)	and gravel including angular quartz, chert, sandstone and trap grains (Qt) 25-35 reddish-brown sand and gravel (Qt or Qsu) 35-43 pinkish-buff fine-to-coarse sand (K) at 43 white sandy clay with light-green streaks (K or weathered diabase)	1 Qab 116 86 6 3 2 2 1 2 Qtm 138 72 9 4 11 2 0 3 Qtm 146 68 14 4 10 1 2 4 Qtm 121 69 9 11 8 2 2
28-40 red and white clay, streaks of red shale (Qsw)  61 26-20207 abbreviated log 0-31 red sandy clay, trace pebbles (Qt) 31-35 red clayey sand and gravel (Qt)	18-25 brown sand, silt (Qrt) 25-55 white, gray interbedded clay and sand (K) 55-72 white to brown medium-to-coarse sand (K) 72-81 decomposed rock (weathered diabase) 81-91 rock (diabase)	48-60 gray silty sand and clay (K)  153 26-5213 0-12 clay, sand, gravel (Qt) 12-19 silty clay, trace of sand (Qt) 19-23 silty sand, some clay (Qt) 23-59 gray silty sandy clay (K)	201 26-6896	8-16 brown peat (Qm) 16-29 red-brown till—silty clay with gravel (Qt) 29-30 red-brown shale  264 26-22608 0-10 gravel, silty sand, silty clay (af) 10-24 peat to medium sand and gravel (Qm over Qt)	310 26-26232 0-40 reddish-brown sand, silt, clay, gravel (Qt) refusal (diabase?)  311 26-19611 0-5 fill (af)	5 Qtm 128 70 15 8 5 2 0 6 Qmt 143 70 8 11 10 1 0 7 Qmt 136 81 11 1 7 0 0 8 Qmt 185 59 5 23 11 1 0
62 26-16079 abbreviated log 0-34 reddish-brown sandy silt, little gravel and clay (Qt)  63 25-22689 0-8 red to light-brown clay, trace sand (Qmt or af) 8-11 brown sand and gravel, some clay, gravel is	Parkway bridge boring 86 0-27 water 27-40 gray, brown coarse sand and gravel (Qrt) 40-52 coarse gray sand (K) 52-59 decomposed rock (weathered diabase) 59-66 sandstone (probably diabase)	59-63 clay and sand (K) 63-99 gray clay (K) 99-123 gray clay (A) 123-138 green clay (weathered diabase?) 138-139 basalt (diabase)	8-15 red shale  203 26-564 0-10 red, white, yellow clay (af or Qt) 10-30 red hard pan (Qt) 30-50 very muddy fine sand (Qsu? or Qt) 50-60 hard red clay (Qsw)	24-42 medium silty sand and gravel (Qt) at 42 bedrock  265 26-22567 0-13 stone, concrete, gravel fill (af) 13-24 brown peat Qm) 24-40 red-brown till (Qt)	5-9 reddish clayey gravel (Qt) 9-40 fine-to-coarse sand with some clay and gravel (Qt or Qsu) 40-50 reddish-brown fine-to-coarse sand with some clay and gravel (Qt or Qsu) 50-57 grayish clay (K)	10 Qmt 144 69 10 13 8 0 0 11 Qtm 137 73 11 5 7 1 2 12 Qtm 169 59 15 18 7 1 0 13 Qt 138 72 7 9 10 1 0
rounded (Qmt) white, orange, brown fine sand; a little light green clay (K)  64 26-20274 0-16 fill	59-66 sandstone (probably diabase) trap rock (diabase)  111 NJGS files Parkway bridge boring 72 0-6 water 6-49 organic silt (Qm)	Outerbridge Crossing boring 14+28 0-15 red clay and sand (Qtm) 15-75 gray clay and sand (K)  155 NJGS files Outerbridge Crossing boring 25+00	60-115 hard red sand rock  204 26-1201 0-40 clay, sandy clay (Qt) 40-204 red shale	266 26-19873 0-12 black silty clay with woodfill (af) 12-24 peat grading to organic silt with some sand (Qm) red-brown clayey silt, some fine-to-medium sand and trace of gravel (Ot)	312 26-9305 abbreviated log 0-7 reddish-brown to dark-brown sand (af) 7-30 gray silt and peat (Qm) 30-50 reddish-brown medium-to-coarse sand (Qt or Qbn)	14 Qt 143 70 11 4 11 1 2 15 Qt 118 85 7 2 7 0 0 16 Qt 123 81 12 2 3 2 0 17 Qt 119 84 5 1 7 1 2 18 Qrw 181 72 9 2 17 1 0
16-25 red-brown sand and clay (Qtm over Qmt) 25-30 red-brown clay (Qsw)  65 26-12460 abbreviated log 0-6 brown and gray medium-to-fine sand, a little	49-59 coarse brown sand and gravel (Qrt) 59-67 decomposed rock (weathered diabase) 67-77 rock (diabase)  112 NJGS files Parkway bridge boring 62	0-5 fill 5-22 soft mud, clay, and sand (Qtm) 22-44 blue clay (K) 44-50 fine sand, stiff gray clay (K)  156 26-4934 0-8 brown silty sand, lttle clay (Qtm)	205 25-11829	29-34 red-brown fine-to-medium sand and some clay and fine gravel with shale fragments (Qt) red-brown shale  267 26-19876 0-13 black sand, silt, cinders, gravel, wood (af) 13-25 dark-brown and gray peat and organic clayey	313 26-1829 0-12 fill (af) 12-20 muck (Qm) 20-30 gray clay (Qm) 30-45 fine sand (Qbnl or Qt) 45-55 sand and gravel mixed with brown sand (Qt or	19 Qt 110 91 4 0 2 1 2 20 Qic 169 71 7 2 18 1 0 21 Qt <sup>3</sup> 110 73 15 4 7 0 0 21 Qt <sup>4</sup> 128 78 16 2 4 0 0 22 Qtm 188 48 10 40 2
medium-to-fine gravel (Qmt) 6-25 dark-gray silt and clay with lignite and pyrite (K) 25-27 light-gray to buff medium-to-fine quartz sand (K)	0-7 water 7-56 organic silt and shells (Qm) 56-69 rock (diabase)  113 NJGS files Parkway bridge boring 52 0-4 water	8-12 brown and gray silty clay (K) 12-20 gray-black silty clay with partings of mica and fine sand, some lignite (K)  157 26-19837 abbreviated log	207 26-1654 0-53 red clay (Qt) 53-500 red shale 208 26-4118 0-35 sand and gravel (Qt, possibly over Qsu)	silt and sand (Qm) 25-42 red-brown clayey silt, some fine-to-coarse gravel and sand (Qt) 42-45 red-brown shale	Sand and gravel mixed with brown sand (Qt or Qbn)  55-62 white sand (K)  62-71 gray clay (K)  71-106 grayish-green clay (K over weathered diabase)  106-168 gray rock (diabase)	23 Qtm 171 41 6 48 3 1 0 24 Qtm 165 39 10 35 7 1 8 25 Qtm 146 68 7 18 5 2 0 26 Qtm 168 59 12 20 4 1 4
66 26-12462 abbreviated log 0-4 fill 4-7 light-gray to light-brown medium-to-fine sand (Qmt) 7-33 dark-gray clay and silt, lignitic, with sand seams (K)	4-40 organic silt and shells (Qm) 40-51 fine gray sand, some silt (K) 51-62 decomposed rock (weathered diabase) 62-91 rock (diabase)  114 NJGS files Parkway bridge boring 40	0-11 brown silty clayey sand, some gravel (Qtm) 11-18 brown silty clay, trace fine sand (Qtm) 18-36 brown fine-to-medium sand, trace fine gravel (Qpa) 36-50 gray silty clay, trace fine sand and lignite (K)	35-200 red shale  209 26-4944 0-50 sand (Qt, possibly over Qsu) 50-700 red shale  210 26-11291 abbreviated log	268 26-22560	314 26-23039 abbreviated log 0-28 silty clayey sand with some gravel (Qt) 28-30 saprolite clay (weathered diabase) 30-38 diabase	27     Qtm     181     55     19     25     1     0     0       28     Qtm     165     45     25     26     2     1     0       29     Qtm     179     20     18     56     2     1     0       30     Qtm     160     29     5     62     2     1     0       31     Qt     184     65     9     12     11     0     3
seams (K) orange-brown to light-gray medium-to-fine quartz sand (K)  67 26-12 0-50 dirt and sand (Qtm over K) 50-90 clay (K)	0-10 organic silt (Qm) 10-58 coarse brown sand and gravel, trace clay (Qrt) 58-68 rock (diabase)  115 NJGS files Parkway bridge boring 18	Outerbridge Crossing boring 38+82 0-25 yellow clay (Qtm) 25-39 brown sand and gravel (Qpa) 39-125 black, gray, red clay, some fine white sand (K)	0-18 red sandy clayey silt, some gravel (Qt) 18-24 fine-to-medium sand and gravel (Qsu or Qt)  211 26-10667 0-4 fill 4-11 red medium sand, some gravel (Qt)	269 26-19749 abbreviated log 0-12 clay and silt fill (af over Qm) 12-22 red-brown silty clay, some sand (Qbnl) 22-32 red silty clay and shale fragments (Qt) 32-54 red shale	315 26-23038 abbreviated log 0-37 silty-sandy clay to clayey sand with trace gravel (Qt) 37-41 saprolite clay (weathered diabase) 41-42 rock (diabase)	32 Qic 143 70 16 8 6 0 0  Quartz and quartzite; 1-4% chert. Purple to red-brown quartzite-conglomerate of the Green Pond Formation. Count in till.
at 90 red rock  68 26-6550 abbreviated log 0-12 red-brown clayey silt, trace sand and gravel (Qtm)	0-14 clay and silt (af) 14-22 silt, plant remains (Qm) 22-26 sand, silt, plant remains (Qm) 26-45 brown sand (Qrt) 45-55 decomposed rock (weathered diabase)	159 NJGS files  Outerbridge Crossing boring 58+86 0-48 silt (Qm) 48-60 gray sand (Qm over Qbn) 60-90 coarse brown sand (Qbn) 90-95 clay, sand, gravel (Qbn) 95-105 hardpan (Qtm?)	11-14 weathered shale  212 26-10669	270 26-15657 abbreviated log 0-6 silt and clay fill (af) 6-10 gray peat, organic silt, shell fragments (Qm) 10-26 red clay, silt, sand, little gravel (Qt) 26-28 weathered Brunswick (Qsw)	316 26-21918 abbreviated log 0-19 concrete and slag fill (af) 19-20 peat, organic silt (Qm) 20-27 gray medium sand, trace rounded fine-to- medium gravel (Qbn or Qt)	<sup>3</sup> Count in till. <sup>4</sup> Count in gravel bed in till.
69 N 26-31-794 0-75 glacial drift (Qtm) 75-100 yellow-brown pebbly sand (Tp) 100-160 clay, sand, clayey sand (K) 160-235 red shale	Parkway bridge boring 9 0-14 silt and clay (af over Qm) 14-35 sand, gravel (Qrt) 35-54 clay and silt (K) 54-68 clay, gravel (K)	105-110 brown sand (Qtm or Qpa) 110-119 gray fine-to-coarse sand and clay, some beach sand (K)  160 26-13984 abbreviated log	213 26-11416 0-4 fill 4-20 silty sand (Qt) 214 26-520 0-25 sand and clay (Qt) 25-109 rock	28-46 rock  271 26-5293 abbreviated log 0-7 slag, cinder, brick fill (af) 7-14 black-gray organic clay (Qm)	27-35 red medium sand, trace gravel (Qbn or Qt) 35-38 red silty fine sand, trace rounded to subangular gravel (Qt) diorite (diabase)	
70 26-484 0-105 red clay and red hard pan (Qtm) 105-160 dirty, muddy, fine gray sand (K) 160-165 yellow hard clay (K) 165-195 hard black and brown clay (K) 195-200 gray clay and boulders (shale bedrock?)	68-77 decomposed rock (weathered diabase) 77-87 rock (diabase)	0-10 water 10-40 gray soft silt, some sand and shells (Qm) 40-45 gray sandy silt (Qm) 45-50 brown firm sand and gravel (Qtm) 50-70 gray and red silt, clay, and sand, very firm (K)	215 26-381 0-8 clay and silt (Qal) 8-20 sand and gravel (Qal over Qrw) 20-23 silt and clay (Qt or Qsw) 23-30 soft red shale (Qt or Qsw) 30-50 red shale	14-42 red-brown clayey silt with some sand and pebble-to-cobble gravel (Qt) at 42 bedrock	abbreviated log 0-14 black slag fill (af) 14-16 gray clay (Qm) 16-32 red to brown fine-to-medium sand, some silt, little gravel (Qt or Qbn) 32-38 red fine sand and gravel till (Qt)	
					38-40 saprolite (weathered diabase) 40-44 diorite (diabase)	