U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science Directorate
Geologic Resources Division

Everglades National Park

GRI Ancillary Map Information Document

Produced to accompany the Geologic Resources Inventory (GRI) Digital Geologic Data for Everglades National Park

ever_geology.pdf

Version: 7/23/2021

Geologic Resources Inventory Map Document for Everglades National Park

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Geologic Resources Inventory Map Document

Everglades National Park, Florida

Document to Accompany Digital Geologic-GIS Data

ever_geology.pdf

Version: 7/23/2021

This document has been developed to accompany the digital geologic-GIS data developed by the Geologic Resources Inventory (GRI) program for Everglades National Park, Florida (EVER).

Attempts have been made to reproduce all aspects of the original source products, including the geologic units and their descriptions, geologic cross sections, the geologic report, references and all other pertinent images and information contained in the original publication.

This document contains the following information:

1)**About the NPS Geologic Resources Inventory Program** – A brief summary of the Geologic Resources Inventory (GRI) Program and its products. Included are web links to the GRI GIS data model, and to the GRI products page where digital geologic-GIS datasets, scoping reports and geology reports are available for download. In addition, web links to the NPS Data Store and GRI program home page, as well as contact information for the GRI coordinator, are also present.

2)**GRI Digital Maps and Source Citations** – A listing of all GRI digital geologic-GIS maps produced for this project along with sources used in their completion. In addition, a brief explanation of how each source map was used is provided.

3)**Digital Geologic-GIS Map of Everglades National Park and Vicinity, Florida**

3a) **Geologic Map Unit List** – A listing of all geologic map units present on the geologic map.

3b) **Geologic Map Unit Descriptions** – Descriptions for all geologic map units present on the geologic map.

3c) **Geologic Cross Sections** – Geologic cross section graphics for all cross section lines present on the geologic map.

4)**Digital Benthic-GIS Map of Florida Bay (1991-1995 Substrate), Florida**

4a) **Benthic Habitat Map Unit List** – A listing of all benthic habitat map units present on the benthic habit map.

4b) **Benthic Habitat Map Unit Descriptions** – Descriptions for all benthic habitat map units present on the benthic habit map.

5)**Ancillary Source Map Information** – Additional source map information presented by source map. In many cases a link or links to the source map publication site, as well as the National Geologic Map Database (NGMDB) site for the source map is presented.

6)**GRI Digital Data Credits** – GRI digital geologic-GIS data and ancillary map information document production credits.

For information about using GRI digital geologic-GIS data contact:

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About the NPS Geologic Resources Inventory Program

Background

The Geologic Resources Inventory (GRI) provides geologic map data and pertinent geologic information to support resource management and science-informed decision making in more than 270 natural resource parks throughout the National Park System. Geologic resources for management consideration include both the processes that act upon the Earth and the features formed as a result of these processes. Geologic processes include: erosion and sedimentation; seismic, volcanic, and geothermal activity; glaciation, rockfalls, landslides, and shoreline change. Geologic features include mountains, canyons, natural arches and bridges, minerals, rocks, fossils, cave and karst systems, beaches, dunes, glaciers, volcanoes, and faults.

The GRI is one of 12 inventories funded by the National Park Service (NPS) Inventory and Monitoring Program. The Geologic Resources Division of the NPS Natural Resource Stewardship and Science Directorate administers the GRI. The NPS Geologic Resources Division partners with the Colorado State University Department of Geosciences to produce GRI products. Many additional partners participate in the GRI process by contributing source maps or reviewing products.

The GRI team undertakes three tasks for each park in the Inventory and Monitoring program: (1) conduct a scoping meeting and provide a summary document, (2) provide digital geologic map data in a geographic information system (GIS) format, and (3) provide a GRI report. These products are designed and written for nongeoscientists.

Products

Scoping Meetings: These park-specific meetings bring together local geologic experts and park staff to inventory and review available geologic data and discuss geologic resource management issues. A summary document is prepared for each meeting that identifies a plan to provide digital map data for the park.

Digital Geologic Maps: Digital geologic maps reproduce all aspects of traditional paper maps, including notes, legend, and cross sections. Bedrock, surficial, and special purpose maps such as coastal or geologic hazard maps may be used by the GRI to create digital Geographic Information Systems (GIS) data and meet park needs. These digital GIS data allow geologic information to be easily viewed and analyzed in conjunction with a wide range of other resource management information data.

For detailed information regarding GIS parameters such as data attribute field definitions, attribute field codes, value definitions, and rules that govern relationships found in the data, refer to the NPS Geology-GIS Data Model document available at: https://www.nps.gov/articles/gri-geodatabase-model.htm

Geologic Reports: GRI reports synthesize discussions from the original scoping meeting, follow up conference call(s), and subsequent research. Chapters of each report discuss the geologic setting of the park, distinctive geologic features and processes within the park, highlight geologic issues facing resource managers, and describe the geologic history leading to the present-day landscape. Each report also includes a poster illustrating these GRI digital geologic-GIS data.

For a complete listing of GRI products visit the GRI publications webpage: https://go.nps.gov/gripubs. GRI digital geologic-GIS data is also available online at the NPS Data Store: https://irma.nps.gov/DataStore/Search/Quick. To find GRI data for a specific park or parks select the appropriate park(s), enter “GRI” as a Search Text term, and then select the Search button.

For more information about the Geologic Resources Inventory Program visit the GRI webpage: https://www.nps.gov/subjects/geology/gri.htm. At the bottom of that webpage is a “Contact Us” link if you need additional information. You may also directly contact the program coordinator:

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The Geologic Resources Inventory (GRI) program is funded by the National Park Service (NPS) Inventory and Monitoring (I&M) Division. Learn more about I&M and the 12 baseline inventories at the I&M webpage: https://www.nps.gov/im/inventories.htm.

GRI Digital Maps and Source Map Citations

The GRI digital geologic-GIS maps for Everglades National Park, Florida (EVER):

Digital Geologic-GIS Map of Everglades National Park and Vicinity, Florida (*GRI MapCode EVER*)

The following sources were used to produce the above GRI digital geologic-GIS map.

Geologic units and their related contacts were produced from the following source:

Scott, Thomas M., 2001, Geologic Formations of Florida (digital): Florida Geological Survey, Open-File Report 80, scale 1:126,720 (Geologic Formations of Florida). (*GRI Source Map ID 3682*).

Surficial sediment units and their related contacts were produced from the following sources:

Green, Richard, Campbell, Ken, and Scott, Tom, 1995, Surficial and Bedrock Geology of the eastern portion of the USGS 1:100,000 scale Homestead Quadrangle: Florida Geological Survey, Open File Map Series 83/01-07, scale 1:100,000 (Homestead (eastern portion) 1:100,000 scale Quadrangle (Surficial and Bedrock Geology)). (*GRI Source Map ID 4983*).

Green, Richard, Campbell, Ken, and Scott, Tom, 1996, Surficial and Bedrock Geology of the western portion of the USGS 1:100,000 scale Homestead Quadrangle: Florida Geological Survey, Open File Map Series 83/08-12, scale 1:100,000 (Homestead (western portion) 1:100,000 scale Quadrangle (Surficial and Bedrock)). (*GRI Source Map ID 2424*).

Image 2 (Surficial Sediments) from each source map was used.

Geologic cross section lines were produced from the following sources (listed below), as well as from the Green, 1995 and Green, 1996 source maps listed above as sources for surficial sediment units and contacts.

Bergendahl, M.H., 1956, Stratigraphy of parts of De Soto and Hardee Counties, Florida: U.S. Geological Survey, Bulletin 1030-B, 4 sheets, scale 1:158,400 (parts of De Soto and Hardee Counties (Stratigraphy)). (*GRI Source Map ID 5014*).

Causaras, C.R., 1985, Geology of the Surficial Aquifer System, Broward County, Florida: U.S. Geological Survey, Water-Resources Investigations Report 84, 2 sheets, scale 1:134,000 (Surficial Aquifer System (Broward County)). (*GRI Source Map ID 3055*).

Causaras, C.R., 1986, Geology of the Surficial Aquifer System, Dade County, Florida: U.S. Geological Survey, Water-Resources Investigations Report 86, scale 1:136,000 (Surficial Aquifer System (Dade County)). (*GRI Source Map ID 3056*).

Green, R., et al., 1999, Surficial and Bedrock Geology of the eastern portion of the USGS 1:100,000 scale Arcadia Quadrangle, south-central Florida: Florida Geological Survey, Open File Map Series 88, scale 1:100,000 (Arcadia (eastern portion) 1:100,000 scale Quadrangle (Surficial and Bedrock Geology)). (*GRI Source Map ID 3049*).

Green, R., et al., 1998, Surficial and Bedrock Geology of the eastern portion of the USGS 1:100,000 scale Sarasota Quadrangle and the western portion of the Arcadia Quadrangle: Florida Geological Survey, Open File Map Series 87, scale 1:100,000 (Sarasota (eastern portion) and Arcadia

(western portion) 1:100,000 scale Quadrangles (Surficial and Bedrock Geology)). (*GRI Source Map ID 3048*).

Green, R., et al., 1997, Surficial and Bedrock Geology of the western portion of the USGS 1:100,000 scale Sarasota Quadrangle, south-central Florida: Florida Geological Survey, Open File Map Series 86, scale 1:100,000 (Sarasota (western portion) 1:100,000 scale Quadrangle (Surficial and Bedrock Geology)). (*GRI Source Map ID 3050*).

McCartan, Lucy and Moy, Wai-See, 1995, Geologic Maps of the Sarasota and Arcadia, Florida 30 x 60-minute Quadrangles: U.S. Geological Survey, Open-File Report OF-95-261, 6 sheets, scale 1:100,000 (Sarasota and Arcadia 30' x 60' Quadrangles). (*GRI Source Map ID 3051*).

Reese, R.S., and Cunningham, K.J., 2000, Hydrogeology of the Gray Limestone Aquifer in southern Florida: U.S. Geological Survey, Water-Resources Investigations Report 99-4213, scale 1:675,000 (Hydrogeology of the Gray Limestone Aquifer). (*GRI Source Map ID 5320*).

Mine point features were produced from the following sources (listed below), as well as from the Green, Richard, Campbell, Ken, and Scott, Tom, 1995 source map listed above with sources for geologic cross section lines:

Yon, J.W., Spencer, S.M., Hoenstine, R.W., and Lane, Ed, 1988, Mineral Resources of Collier County, Florida: Florida Geological Survey, Map Series 120, scale 1:126,720 (Mineral Resources (Collier County)). (*GRI Source Map ID 3063*).

Lane, Ed, Scott, T.M., Hoenstine, R.W., and Yon, J.W., 1990, Mineral Resources of Lee County, Florida: Florida Geological Survey, Map Series 130, scale 1:126,720 (Mineral Resources (Lee County)). (*GRI Source Map ID 5003*).

Digital Benthic Habitat-GIS Map of Florida Bay (1991-1995 Substrate), Florida (*GRI MapCode EVER_benthic_habitat*)

Benthic habitat units and their related contacts were produced from the following source:

Florida Fish and Wildlife Commission Florida Marine Research Center, 1999, Benthic Habitats of Florida Bay, Florida 1991-1995, CD-ROM: National Oceanic and Atmospheric Administration Coastal Services Center, unpublished digital data, scale 1:48,000 (Benthic Habitats of Florida Bay). (*GRI Source Map ID 5046*).

Digital Geohazards-GIS Map of Everglades National Park and Vicinity (2005 Mapping), Florida (*GRI MapCode EVER_geohazard*)

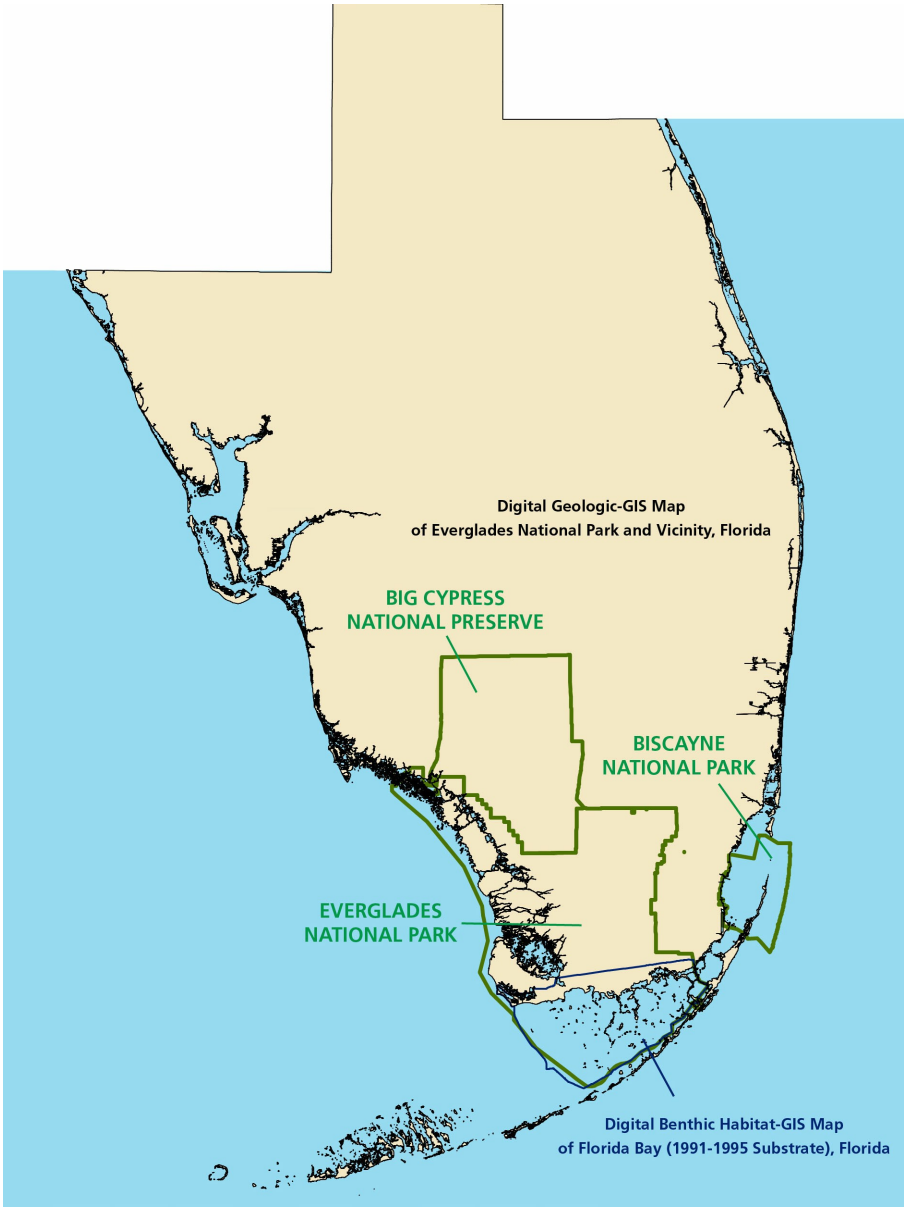
Hazard area features (sink holes) and their related contacts were produced from the following source:

Arthur, J.D., Baker, A.E., Cichon, J.R., Wood, A.R., and Rudin, A., 2005, Florida Aquifer Vulnerability Assessment (FAVA): Contamination Potential of Florida's Principal Aquifer Systems: Florida Geological Survey, Bulletin [in review], scale 1:24,000 (Florida Aquifer Vulnerability Assessment (2005)). (*GRI Source Map ID 6921*).

Additional information pertaining to each source map is also presented in the GRI Source Map Information (EVERMAP) table included with the GRI geologic-GIS data.

Index Map

The following index map displays the extents of the GRI digital geologic-GIS maps produced for Everglades National Park (EVER). The boundary for Everglades National Park, as well as for Big Cypress National Preserve (BICY) and Biscayne National Park (BISC) (all as of July, 2021) are outlined in green. The extent of the GRI Digital Geologic-GIS Map of Everglades National Park and Vicinity, Florida is outlined in black, whereas the extent of the GRI Digital Benthic Habitat-GIS Map of Florida Bay (1991-1995 Substrate), Florida is outlined in navy blue. The extent of hazard sink holes, as of 2005, present in the GRI Digital Geohazards-GIS Map of Everglades National Park and Vicinity (2005 Mapping), Florida, shares the extent of the geologic-GIS map. Both the geologic-GIS map and geohazards-GIS maps fully cover Big Cypress National Preserve (BICY), however, both maps only cover a small portion of Biscayne National Park (BISC). Land and water areas along the Florida coastline near the northern extent of the geologic-GIS map are not shown.



Index map by Stephanie O'Meara (Colorado State University).

Digital Geologic-GIS Map of Everglades National Park and Vicinity, Florida

The geologic unit and surficial sediment unit listing, descriptions for these units, and geologic cross section graphics associated with the GRI Digital Geologic-GIS Map of Everglades National Park and Vicinity, Florida are presented are presented below.

Geologic Map Unit List

The surficial sediment and geologic units present in the GRI Digital Geologic-GIS Map of Everglades National Park and Vicinity, Florida are listed below. Units are listed with their assigned unit symbol and unit name (e.g., d - Disturbed by human activity). Units are generally listed from youngest to oldest. No description for water is provided. Information about each geologic unit is also presented in the GRI Geologic Unit Information (EVERUNIT) table included with the GRI digital geologic-GIS data.

Cenozoic Era

Quaternary Period

Holocene Epoch
d - Disturbed by human activity
sm - Thin soil over Miami Limestone
sk - Thin soil over Key Largo Limestone
pm - Peat with marl
ma - Marl
mp - Marl underlain by peat
mu - Muck
cm - Carbonate mud
Qh - Holocene sediments

Holocene and Pleistocene Periods
Qbd - Beach ridge and dune
Qu - Pleistocene/Holocene undifferentiated

Pleistocene Period
Qa - Anastasia Formation
Qm - Miami Limestone
Qk - Key Largo Limestone

Quaternary and Tertiary Periods

Pleistocene and Pliocene Periods
QTsu - Shell-bearing sediments
QTd - Dunes
QTuc - Reworked Cypresshead Formation

Tertiary Period

Pliocene Period
Tc - Cypresshead Formation
Tt - Tamiami Formation

Pliocene and Miocene Periods
Thp - Hawthorn Group, Peace River Formation
Thpb - Hawthorn Group, Peace River Formation, Bone Valley Member

Miocene and Oligocene Periods
Tha - Hawthorn Group, Arcadia Formation

Geoloogic Map Unit Descriptions

Descriptions of all geologic and surficial sediment map units are presented below. Where unit symbols, names and/or ages differ from the source map, the source map unit symbol, name and age are(s) are also presented

d - Disturbed by human activity (Recent)

No additional description present on source map. Unit present on source map: Homestead (eastern portion) 1:100,000 scale Quadrangle (Surficial and Bedrock Geology)

sm - Thin soil over Miami Limestone (Holocene)

Thin soil over Miami Limestone
The area mapped as thin soil over Miami Limestone covers much of the northern one-quarter of the map. Here, approximately 30 centimeters of soil lie directly on the Miami Limestone. The surface of the Miami Limestone in this region is quite irregular due to micro-karst development; limestone is exposed in limited areas. As a result of the irregularities, pieces of limestone are commonly seen in plowed fields. Description from source map: Homestead (eastern portion) 1:100,000 scale Quadrangle (Surficial and Bedrock Geology)

Thin soil over Miami Limestone
The area mapped as thin soil over Miami Limestone covers much of the area of the Everglades National Park known as the Pinelands, in the northeastern corner of the map. The surface of the Miami Limestone in this region is quite irregular due to micro-karst development. The Miami Limestone is often exposed in this area. Where limestone is not exposed, up to approximately 30 centimeters of sediment may be present. Description from source map: Homestead (western portion) 1:100,000 scale Quadrangle (Surficial and Bedrock)

sk - Thin soil over Key Largo Limestone (Holocene)

The map area showing thin soil over Key Largo Limestone is similar to the area discussed above. A thin soil has developed directly on the Key Largo Limestone. In general, the soil is 15 to 30 centimeters deep, with limestone exposed in limited areas. This map area forms the higher portions of the keys. Description from source map: Homestead (eastern portion) 1:100,000 scale Quadrangle (Surficial and Bedrock Geology)

pm - Peat with marl (Holocene)

In the northwestern part of the study area, there is a unit mapped as peat with marl. This unit, which occurs within the Shark Valley Slough, is comprised predominantly of mangrove and sawgrass peat with minor marl beds (Craighead, 1971). The peat is highly variable in thickness, ranging from a few centimeters to north of Pa-Hay-Okee Lookout Tower, to over 4 meters in the western part of the study

area. The contact between the peat and the The contact between the peat and the muck in the vicinity of the Watson River is speculative and is based on limited data. Description from source map: Homestead (western portion) 1:100,000 scale Quadrangle (Surficial and Bedrock)

ma - Marl (Holocene)

Marl
Surrounding the areas where Miami Limestone is covered by a thin veneer of soil, a marl of variable thickness, ranging from less than 50 centimeters to more than one meter, lies on the limestone. The marl, which is of fresh water origin, grades laterally into mucks (organic-rich sediments with variable clay and carbonate contents) and then marine carbonate muds and marls. Description from source map: Homestead (eastern portion) 1:100,000 scale Quadrangle (Surficial and Bedrock Geology)

Marl
Surrounding the areas where Miami Limestone is covered by a thin layer of sediment, a marl of variable thickness, ranging from less than 30 centimeters to more than one meter, lies on the limestone. The marl, which is of fresh water origin, grades laterally into peats and mucks (organic-rich sediments with variable clay and carbonate contents) to the south and west. Description from source map: Homestead (western portion) 1:100,000 scale Quadrangle (Surficial and Bedrock)

mp - Marl underlain by peat (Holocene)

Marl underlain by peat
Marl underlain by peat occurs between the areas mapped as marl and those areas mapped as muck. This area was delineated from the 1958 soils map (Leighty and Henderson, 1958). Limestone underlies this map unit at depths exceeding 60 centimeters. Description from source map: Homestead (eastern portion) 1:100,000 scale Quadrangle (Surficial and Bedrock Geology)

Marl over peat
South of Mahogany Hammock, marl underlain by peat occurs between the areas mapped as marl and those areas mapped as muck. This area was delineated from the 1958 soils map (Leighty and Henderson, 1958) and from Craighead (1971). There is also an area of marl underlain by peat north and west of the Pa-Hay-Okee Lookout Tower in the north-central part of the map area. Limestone underlies this map unit at depths exceeding 30 centimeters. Description from source map: Homestead (western portion) 1:100,000 scale Quadrangle (Surficial and Bedrock)

mu - Muck (Holocene)

Muck
Muck lies on the Miami Limestone along the coast and inland along many of the drainage areas; mangroves commonly grow in this area. The muck contains varying percentages of organic matter, carbonate mud and marl, and other non-organic components. The contact between the muck and the carbonate mud is speculative and based on limited data. Description from source map: Homestead (eastern portion) 1:100,000 scale Quadrangle (Surficial and Bedrock Geology)

Muck
Muck lies on the Miami Limestone along the coast and inland along many of the drainage areas; mangroves commonly grow in this area. The muck contains varying percentages of organic matter, carbonate mud and marl, and minor siliciclastic components. The contact between the muck and the carbonate mud is based on Leighty and Henderson, (1958), Craighead, (1971), and USGS 7.5 minute orthophoto quadrangles. Description from source map: Homestead (western portion) 1:100,000 scale Quadrangle (Surficial and Bedrock)

cm - Carbonate mud (Holocene)

Carbonate mud
Carbonate mud forms the islands within Florida Bay and occurs along both the bay side and ocean side of Key Largo. Probe data indicates that these carbonate muds may exceed 2.5 meters in thickness. The surface of the exposed carbonate muds are often vegetated by abundant mangroves. A muck component may also be present in these areas. Description from source map: Homestead (eastern portion) 1:100,000 scale Quadrangle (Surficial and Bedrock Geology)

Carbonate mud
Carbonate mud forms the islands within Florida Bay. There is an area of carbonate mud mapped along the southern edge of the mainland in the study area. The mud forms an embankment which is from one to two feet higher than the surrounding muck and marl. Craighead (1971) stated that this embankment is derived from Florida Bay mud which has been deposited by storms. In the southeastern part of the map area, this has been called the Buttonwood embankment, whereas in the southwestern part of the study area, the mud forms the Flamingo embankment (Craighead, 1971). Probe data indicates that these carbonate muds may exceed three meters in thickness. The surface of the exposed carbonate muds are often vegetated by abundant mangroves. A muck component may also be present in these areas. Description from source map: Homestead (western portion) 1:100,000 scale Quadrangle (Surficial and Bedrock)

Qh - Holocene sediments (Holocene)

The Holocene sediments in Florida occur near the present coastline at elevations generally less than 5 feet (1.5 meters). The sediments include quartz sands, carbonate sands and muds, and organics. Description from source map: Geologic Formations of Florida

Qbd - Beach ridge and dune (Holocene and Pleistocene)

See unit description Qu below.

Qu - Pleistocene/Holocene undifferentiated (Holocene and Pleistocene)

Qal Qbd Qtr Qu Undifferentiated Quaternary Sediments (Pleistocene Holocene)
Much of Florida's surface is covered by a varying thickness of undifferentiated sediments consisting of siliciclastics, organics and freshwater carbonates. Where these sediments exceed 20 feet (6.1 meters) thick, they were mapped as discrete units. In an effort to subdivide the undifferentiated sediments, those sediments occurring in flood plains were mapped as alluvial and flood plain deposits (Qal). Sediments showing surficial expression of beach ridges and dunes were mapped separately (Qbd) as were the sediments composing Trail Ridge (Qtr). Terrace sands were not mapped (refer to Healy [1975] for a discussion of the terraces in Florida). The subdivisions of the Undifferentiated Quaternary Sediments (Qu) are not lithostratigraphic units but are utilized in order to facilitate a better understanding of the State's geology.

The siliciclastics are light gray, tan, brown to black, unconsolidated to poorly consolidated, clean to clayey, silty, unfossiliferous, variably organic-bearing sands to blue green to olive green, poorly to moderately consolidated, sandy, silty clays. Gravel is occasionally present in the panhandle. Organics occur as plant debris, roots, disseminated organic matrix and beds of peat. Freshwater carbonates, often referred to as marls in the literature, are scattered over much of the State. In southern Florida,

freshwater carbonates are nearly ubiquitous in the Everglades. These sediments are buff colored to tan, unconsolidated to poorly consolidated, fossiliferous carbonate muds. Sand, silt and clay may be present in limited quantities. These carbonates often contain organics. The dominant fossils in the freshwater carbonates are mollusks.

Description from source map: Geologic Formations of Florida

Qa - Anastasia Formation (Pleistocene)

The Atlantic Coastal Ridge is underlain by the Anastasia Formation from St. Johns County southward to Palm Beach County. Excellent exposures occur in Flagler County in Washington Oaks State Park, in Martin County at the House of Refuge on Hutchinson Island and at Blowing Rocks in Palm Beach County. An impressive exposure of Anastasia Formation sediments occurs along Country Club Road in Palm Beach County (Lovejoy, 1992). The Anastasia Formation generally is recognized near the coast but extends inland as much as 20 miles (32 kilometers) in St. Lucie and Martin Counties.

The Anastasia Formation, named by Sellards (1912), is composed of interbedded sands and coquinoid limestones. The most recognized facies of the Anastasia sediments is an orangish brown, unindurated to moderately indurated, coquina of whole and fragmented mollusk shells in a matrix of sand often cemented by sparry calcite. Sands occur as light gray to tan and orangish brown, unconsolidated to moderately indurated, unfossiliferous to very fossiliferous beds. The Anastasia Formation forms part of the surficial aquifer system.

Description from source map: Geologic Formations of Florida

Qm - Miami Limestone (Pleistocene)

The Miami Limestone (formerly the Miami Oolite), named by Sanford (1909), occurs at or near the surface in southeastern peninsular Florida from Palm Beach County to Dade and Monroe Counties. It forms the Atlantic Coastal Ridge and extends beneath the Everglades where it is commonly covered by thin organic and freshwater sediments. The Miami Limestone occurs on the mainland and in the southern Florida Keys from Big Pine Key to the Marquesas Keys. From Big Pine Key to the mainland, the Miami Limestone is replaced by the Key Largo Limestone. To the north, in Palm Beach County, the Miami Limestone grades laterally northward into the Anastasia Formation.

The Miami Limestone consists of two facies, an oolitic facies and a bryozoan facies (Hoffmeister *et al*. [1967]). The oolitic facies consists of white to orangish gray, poorly to moderately indurated, sandy, oolitic limestone (grainstone) with scattered concentrations of fossils. The bryozoan facies consists of white to orangish gray, poorly to well indurated, sandy, fossiliferous limestone (grainstone and packstone). Beds of quartz sand are also present as unindurated sediments and indurated limey sandstones. Fossils present include mollusks, bryozoans, and corals. Molds and casts of fossils are common. The highly porous and permeable Miami Limestone forms much of the Biscayne Aquifer of the surficical aquifer system.

Description from source map: Geologic Formations of Florida

Qk - Key Largo Limestone (Pleistocene)

The Key Largo Limestone, named by Sanford (1909), is exposed at the surface in the Florida Keys from Soldier Key on the northeast to Newfound Harbor Keys near Big Pine Key on the southwest (Hoffmeister, 1974). This unit is a fossil coral reef much like the present day reefs offshore from the Keys. An exceptional exposure of the Key Largo Limestone occurs in the Windley Key Quarry State

Geological Site in the upper Florida Keys. Exposures of the limestone containing large coral heads are in a series of old quarries.

The Key Largo Limestone is a white to light gray, moderately to well indurated, fossiliferous, coralline limestone composed of coral heads encased in a calcarenitic matrix. Little to no siliciclastic sediment is found in these sediments. Fossils present include corals, mollusks and bryozoans. It is highly porous and permeable and is part of the Biscayne Aquifer of the surficial aquifer system.

Description from source map: Geologic Formations of Florida

QTsu - Shell-bearing sediments (Pleistocene and Pliocene)

TQsu - Tertiary-Quaternary Fossiliferous Sediments of Southern Florida (Pliocene to Pleistocene)
Molluskbearing sediments of southern Florida contain some of the most abundant and diverse fossil faunas in the world. The origin of these accumulations of fossil mollusks is imprecisely known (Allmon, 1992). The shell beds have attracted much attention due to the abundance and preservation of the fossils but the biostratigraphy and lithostratigraphy of the units has not been well defined (Scott, 1992). Scott and Wingard (1995) discussed the problems associated with biostratigraphy and lithostratigraphy of the Plio-Pleistocene in southern Florida. These “formations” are biostratigraphic units.

The “formations” previously recognized within the latest Tertiary-Quaternary section of southern Florida include the latest Pliocene - early Pleistocene Caloosahatchee Formation, the early Pleistocene Bermont formation (informal) and the late Pleistocene Fort Thompson Formation. This section consists of fossiliferous sands and carbonates. The identification of these units is problematic unless the significant molluscan species are recognized. Often exposures are not extensive enough to facilitate the collection of representative faunal samples to properly discern the biostratigraphic identification of the formation. In an attempt to alleviate the inherent problems in the biostratigraphic recognition of lithostratigraphic units, Scott (1992) suggested grouping the latest Pliocene through late Pleistocene Caloosahatchee, Bermont and Fort Thompson Formations in to a single lithostratigraphic entity, the Okeechobee formation (informal). In mapping the shelly sands and carbonates, a generalized grouping as Tertiary-Quaternary shell units (TQsu) was utilized. This is equivalent to the informal Okeechobee formation. The distribution of the Caloosahatchee and Fort Thompson Formation are shown on previous geologic maps by Cooke (1945), Vernon and Puri (1964) and Brooks (1982).

The Nashua Formation occurs within the Pliocene - Pleistocene in northern Florida. However, it crops out or is near the surface is an area too small to be shown on a map of this scale.

Lithologically these sediments are complex, varying from unconsolidated, variably calcareous and fossiliferous quartz sands to well indurated, sandy, fossiliferous limestones (both marine and freshwater). Clayey sands and sandy clays are present. These sediments form part of the surficial aquifer system.

Description from source map: Geologic Formations of Florida

QTd - Dunes (Quaternary and Tertiary)

TQd - Tertiary-Quaternary Dunes (Tertiary/Quaternary)
The dune sediments are fine to medium quartz sand with varying amounts of disseminated organic matter. The sands form dunes at elevations greater than 100 feet (30 meters) msl.

Description from source map: Geologic Formations of Florida

QTuc - Reworked Cypresshead Formation (Quaternary and Tertiary)

TQuc - Undifferentiated reworked Cypresshead Formation (Tertiary and Quaternary)
This unit is the result of post depositional reworking of the Cypresshead siliciclastics. The sediments are fine to coarse quartz sands with scattered quartz gravel and varying percentages of clay matrix..

Description from source map: Geologic Formations of Florida

Tc - Cypresshead Formation (Pliocene)

The Cypresshead Formation named by Huddlestun (1988), is composed of siliciclastics and occurs only in the peninsula and eastern Georgia. It is at or near the surface from northern Nassau County southward to Highlands County forming the peninsular highlands. It appears that the Cypresshead Formation occurs in the subsurface southward from the outcrop region and similar sediments, the Long Key Formation, underlie the Florida Keys. The Cypresshead Formation is a shallow marine, near shore deposit equivalent to the Citronelle Formation deltaic sediments and the Miccosukee Formation prodeltaic sediments.

The Cypresshead Formation consists of reddish brown to reddish orange, unconsolidated to poorly consolidated, fine to very coarse grained, clean to clayey sands. Cross bedded sands are common within the formation. Discoid quartzite pebbles and mica are often present. Clay beds are scattered and not areally extensive. In general, the Cypresshead Formation in exposure occurs above 100 feet (30 meters) above mean sea level (msl).

Original fossil material is not present in the sediments although poorly preserved molds and casts of mollusks and burrow structures are occasionally present. The presence of these fossil “ghosts” and trace fossils documents marine influence on deposition of the Cypresshead sediments.

The permeable sands of the Cypresshead Formation form part of the surficial aquifer system.

Description from source map: Geologic Formations of Florida

Tt - Tamiami Formation (Pliocene)

The Tamiami Formation (Mansfield, 1939) is a poorly defined lithostratigraphic unit containing a wide range of mixed carbonate-siliciclastic lithologies and associated faunas (Missimer, 1992). It occurs at or near the land surface in Charlotte, Lee, Hendry, Collier and Monroe Counties in the southern peninsula. A number of named and unnamed members are recognized within the Tamiami Formation. These include: the Buckingham Limestone Member; an unnamed tan clay and sand; an oyster (*Hyotissa*) facies, a sand facies, the Ochopee Limestone Member, the Bonita Springs Marl Member; an unnamed limestone facies; the Golden Gate Reef Member; and the Pinecrest Sand Member (Missimer, 1992). The individual members of the Tamiami Formation were not separately mapped on the geological map.

Lithologies of the Tamiami Formation in the mapped area include: 1) light gray to tan, unconsolidated, fine to coarse grained, fossiliferous sand; 2) light gray to green, poorly consolidated, fossiliferous sandy clay to clayey sand; 3) light gray, poorly consolidated, very fine to medium grained, calcareous, fossiliferous sand; 4) white to light gray, poorly consolidated, sandy, fossiliferous limestone; and 5) white to light gray, moderately to well indurated, sandy, fossiliferous limestone. Phosphate is present in virtually all lithologies as limited quantities of sand- to gravel-sized grains. Fossils present in the Tamiami occur as molds, casts and original material. The fossils present include barnacles, mollusks,

corals, echinoids, foraminifers and calcareous nannoplankton.

The Tamiami Formation has highly permeable to impermeable lithologies that form a complex aquifer. Locally, it is part of the surficial aquifer system. In other areas, it forms a part of the intermediate confining unit/aquifer system.

Description from source map: Geologic Formations of Florida

Thp - Hawthorn Group, Peace River Formation (Pliocene and Miocene)

Thp - **Peace River Formation (Miocene and Pliocene)**
The Peace River Formation crops out or is beneath a thin overburden on the southern part of the Ocala Platform extending into the Okeechobee Basin. These sediments were mapped from Hillsborough County southward to Charlotte County. Within this area, the Peace River Formation is composed of interbedded sands, clays and carbonates. The sands are generally light gray to olive gray, poorly consolidated, clayey, variably dolomitic, very fine to medium grained and phosphatic. The clays are yellowish gray to olive gray, poorly to moderately consolidated, sandy, silty, phosphatic and dolomitic. The carbonates are usually dolostone in the outcrop area. The dolostones are light gray to yellowish gray, poorly to well indurated, variably sandy and clayey, and phosphatic. Opaline chert is often found in these sediments. The phosphate content of the Peace River Formation sands is frequently high enough to be economically mined. Fossil mollusks occur as reworked casts, molds, and limited original shell material. Silicified corals and wood, and vertebrate fossils are also present. The Peace River Formation is widespread in southern Florida. It is part of the intermediate confining unit/aquifer system. Description from source map: Geologic Formations of Florida

Thpb - Hawthorn Group, Peace River Formation, Bone Valley Member (Pliocene and Miocene)

Thpb - **Bone Valley Member, Peace River Formation (Miocene and Pliocene)**
The Bone Valley Member (originally the Bone Valley Formation of Matson and Clapp, 1909), Peace River Formation occurs in a limited area on the southern part of the Ocala Platform in Hillsborough, Polk and Hardee Counties. Throughout its extent, the Bone Valley Member is a clastic unit consisting of sand-sized and larger phosphate grains in a matrix of quartz sand, silt and clay. The lithology is highly variable, ranging from sandy, silty, phosphatic clays and relatively pure clays to clayey, phosphatic sands to sandy, clayey phosphorites (Webb and Crissinger, 1983). In general, consolidation is poor and colors range from white, light brown and yellowish gray to olive gray and blue green. Mollusks are found as reworked, often phosphatized casts. Vertebrate fossils occur in many of the beds within the Bone Valley Member. Shark’s teeth are often abundant. Silicified corals and wood are occasionally present as well.

The Bone Valley Member is an extremely important, unique phosphate deposit and has provided much of the phosphate production in the United States during the twentieth century. Mining of phosphate in the outcrop area began in 1888 (Cathcart, 1985) and continues to the present.

Description from source map: Geologic Formations of Florida

Tha - Hawthorn Group, Arcadia Formation (Miocene and Oligocene)

Tha Hawthorn Group, Arcadia Formation (Oligocene and Miocene)
The undifferentiated Arcadia Formation and the Tampa Member crop out on the southwestern flank of the Ocala Platform from Pasco County southward to Sarasota County. Although ages of the outcropping sediments have not been accurately determined, stratigraphic position suggests that the

Upper Oligocene parts of the Arcadia Formation and Tampa Member are exposed in this region, particularly from Hillsborough County northward to Pasco County.

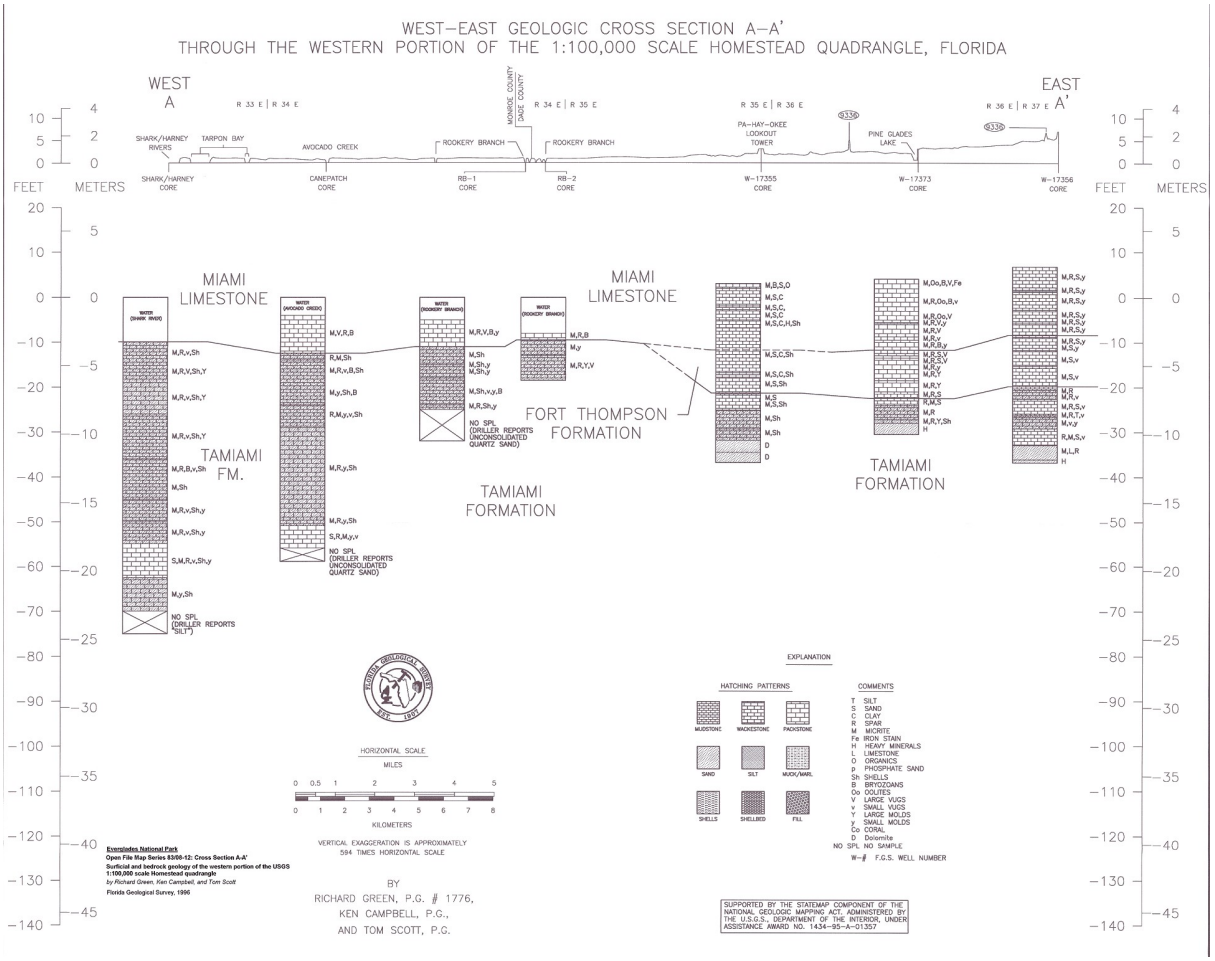
The Arcadia Formation, named by Scott (1988), is predominantly a carbonate unit with a variable siliciclastic component, including thin beds of siliciclastics. Within the outcrop area, the Arcadia Formation, with the exception of the Tampa Member, is composed of yellowish gray to light olive gray to light brown, micro to finely crystalline, variably sandy, clayey, and phosphatic, fossiliferous limestones and dolostones. Thin beds of sand and clay are common. The sands are yellowish gray, very fine to medium grained, poorly to moderately indurated, clayey, dolomitic and phosphatic. The clays are yellowish gray to light olive gray, poorly to moderately indurated, sandy, silty, phosphatic and dolomitic. Molds and casts of mollusks are common in the dolostones. Silicified carbonates and opalized claystone are found in the Arcadia Formation.

Description from source map: Geologic Formations of Florida

Geologic Cross Sections

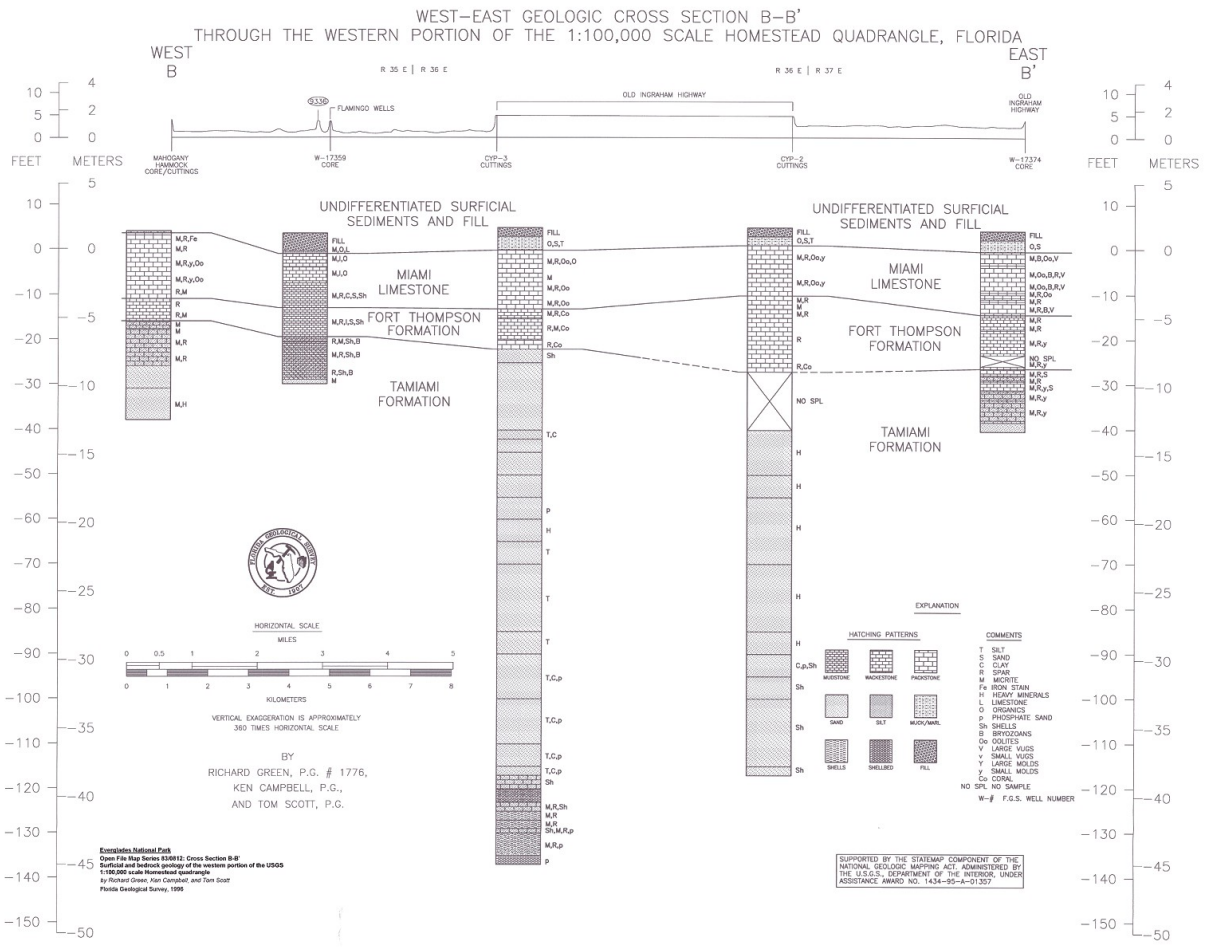
The geologic cross sections present in the GRI digital geologic-GIS data produced for Everglades National Park, Florida (EVER) are presented below. Note that most cross section abbreviations (e.g., A - A') have been changed from their source map abbreviation in the GRI digital geologic-GIS data so that each cross section abbreviation in the GRI data is unique. Cross section graphics were scanned at a high resolution and can be viewed in more detail by zooming in (if viewing the digital format of this document).

Cross Section A-A'



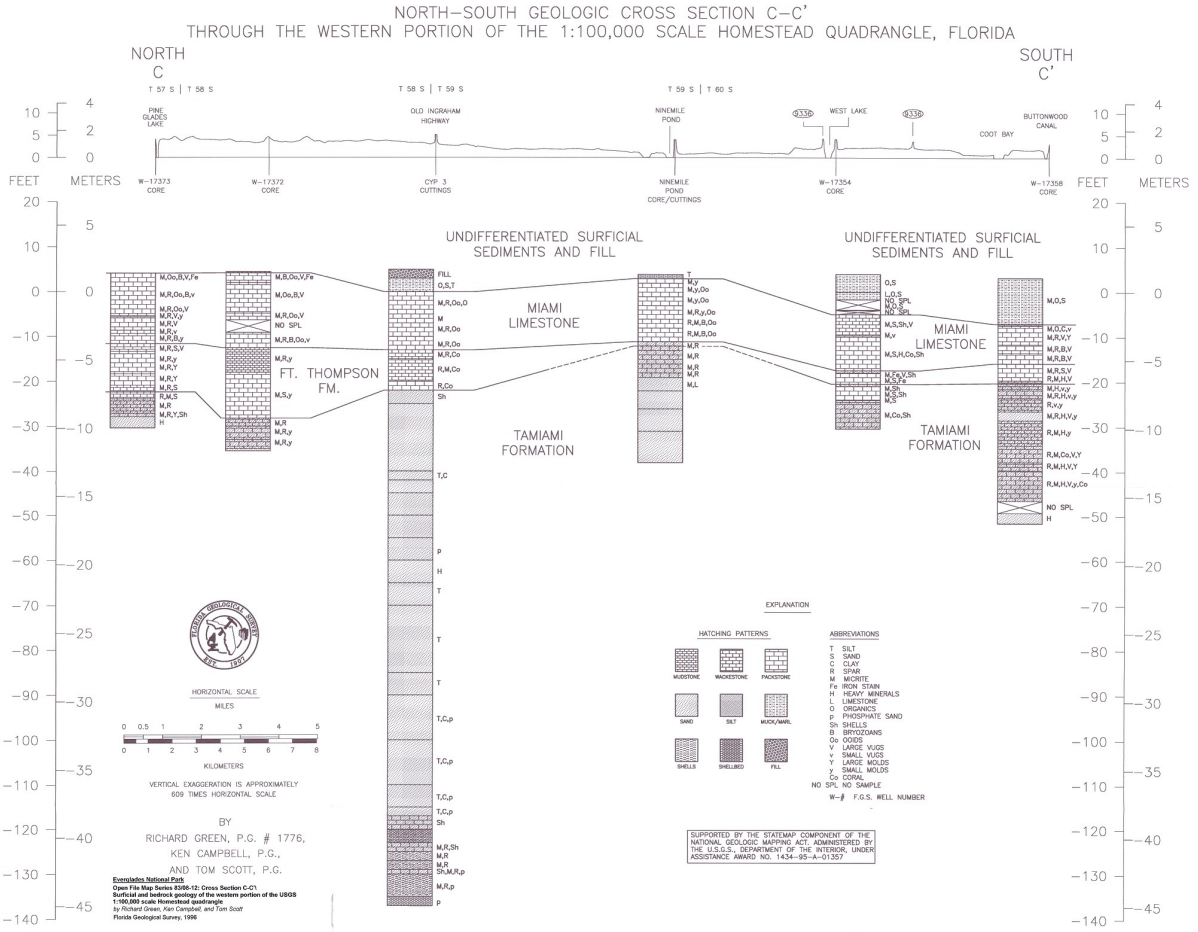
Graphic from source map: Homestead (western portion) 1:100,000 scale Quadrangle (Surficial and Bedrock).

Cross Section B-B'



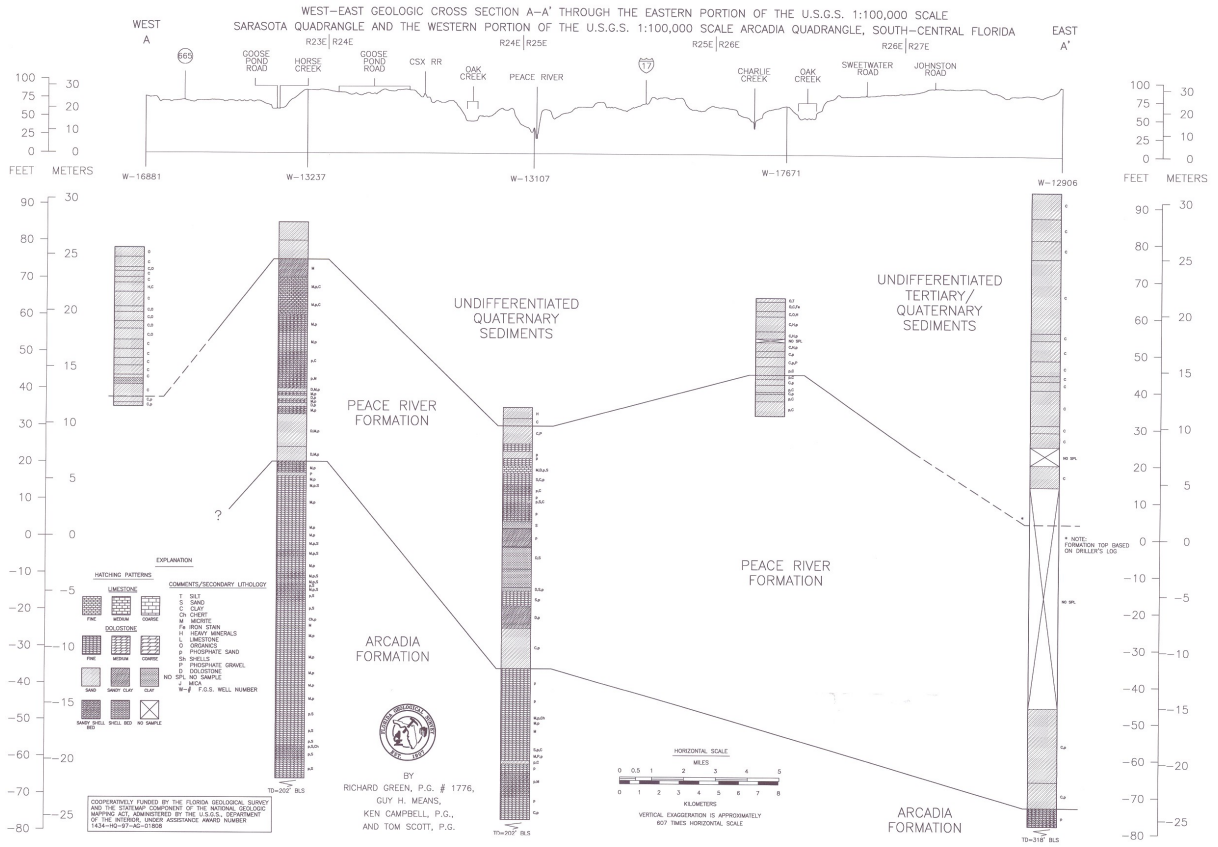
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Cross Section C-C'



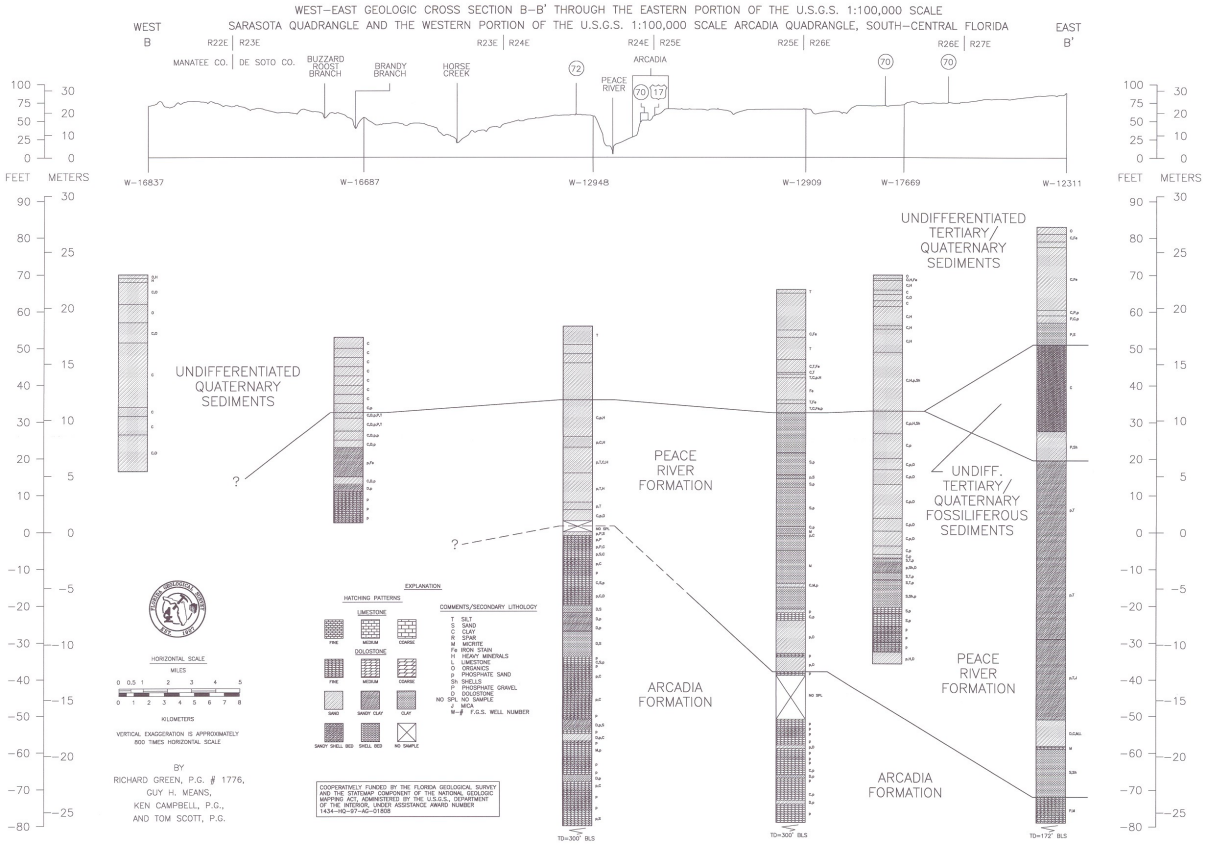
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Cross Section D-D'



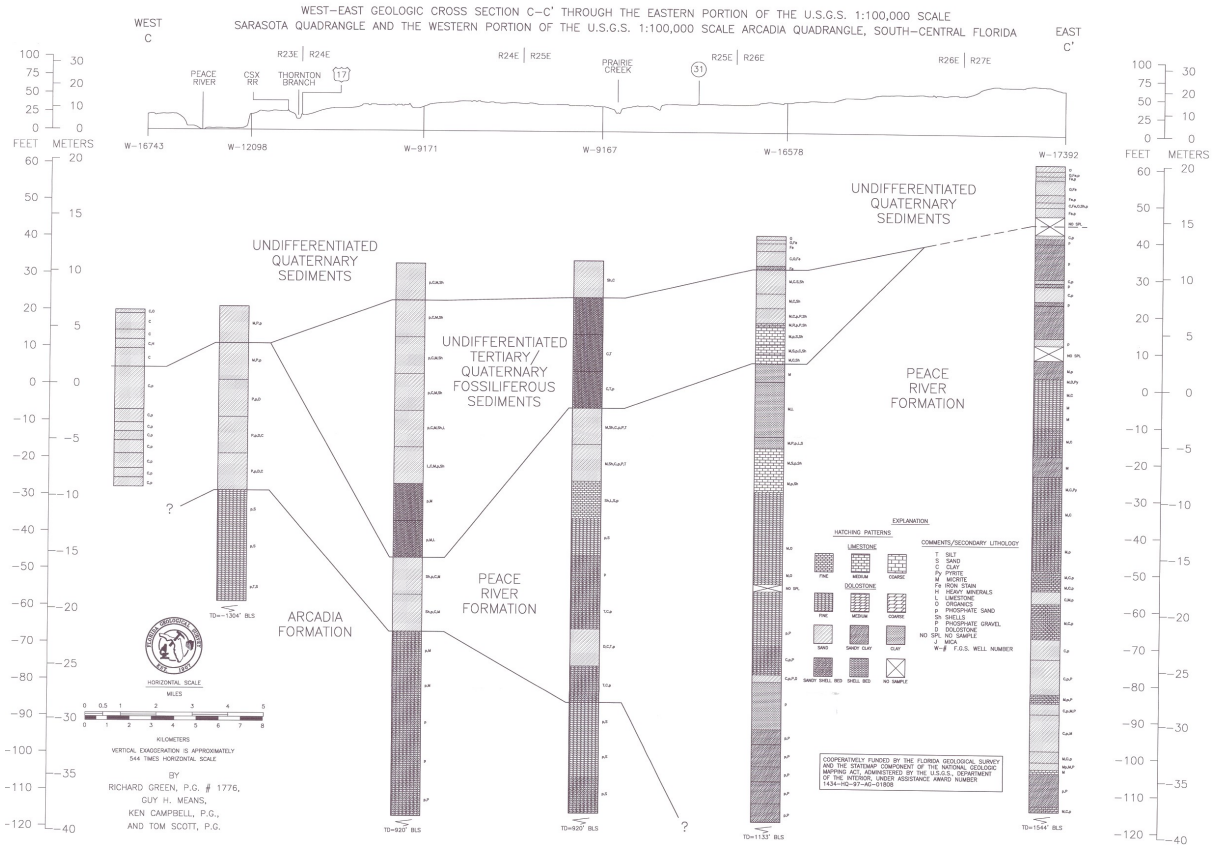
Graphic from source map: Sarasota (eastern portion) and Arcadia (western portion) 1:100,000 scale Quadrangles (Surficial and Bedrock Geology). Cross section A-A' on source map.

Cross Section E-E'



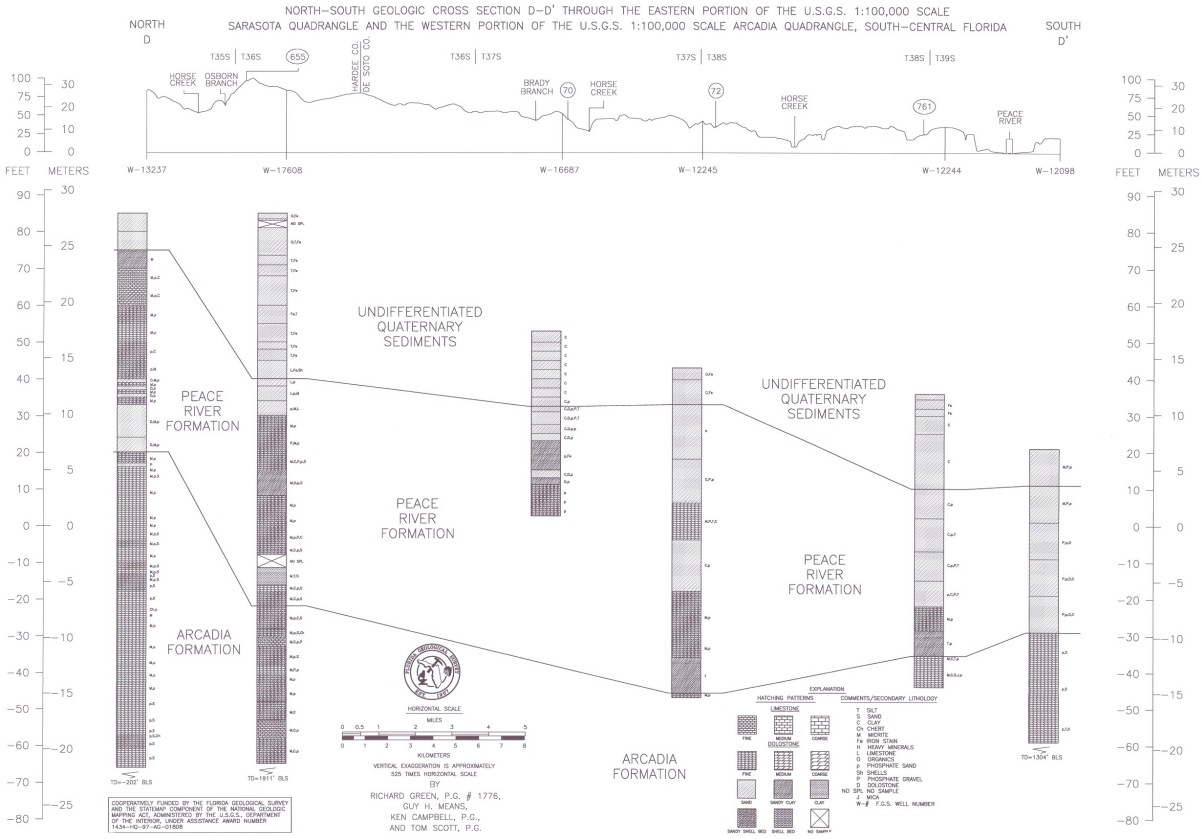
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Cross Section F-F'



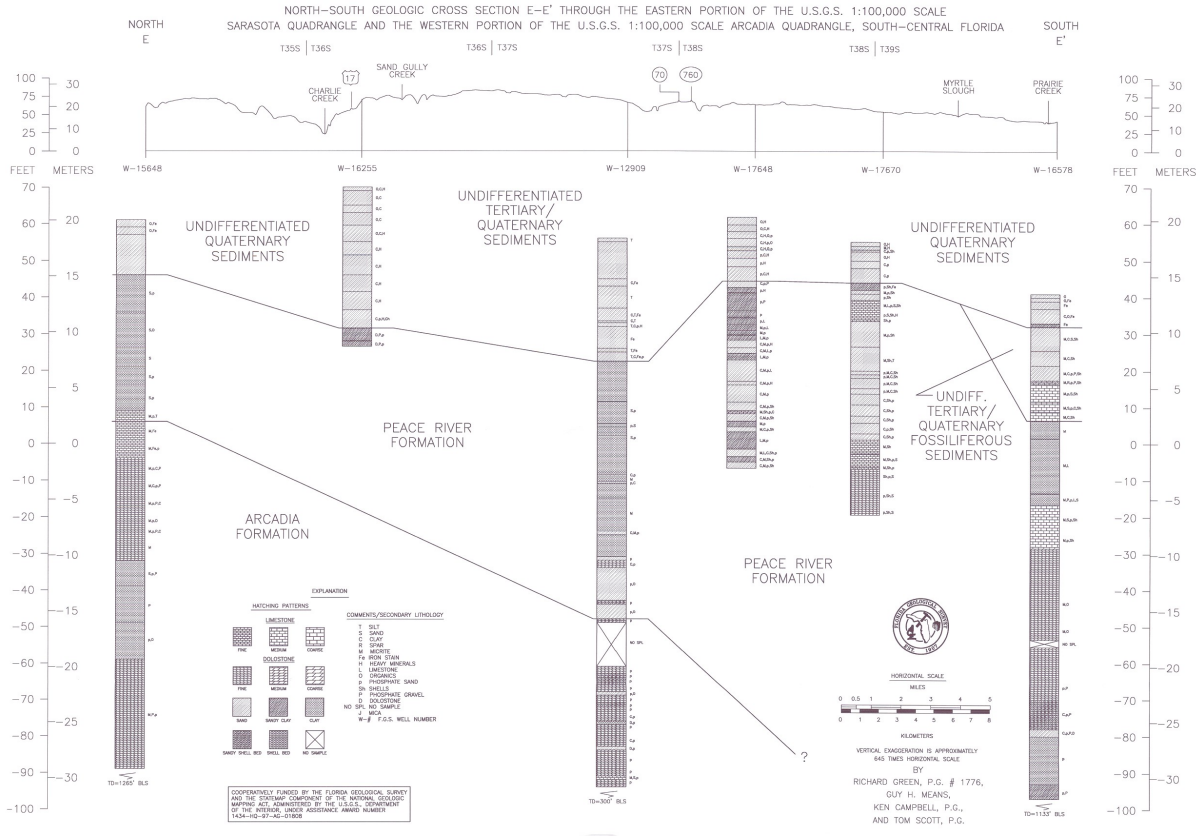
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Cross Section G-G'



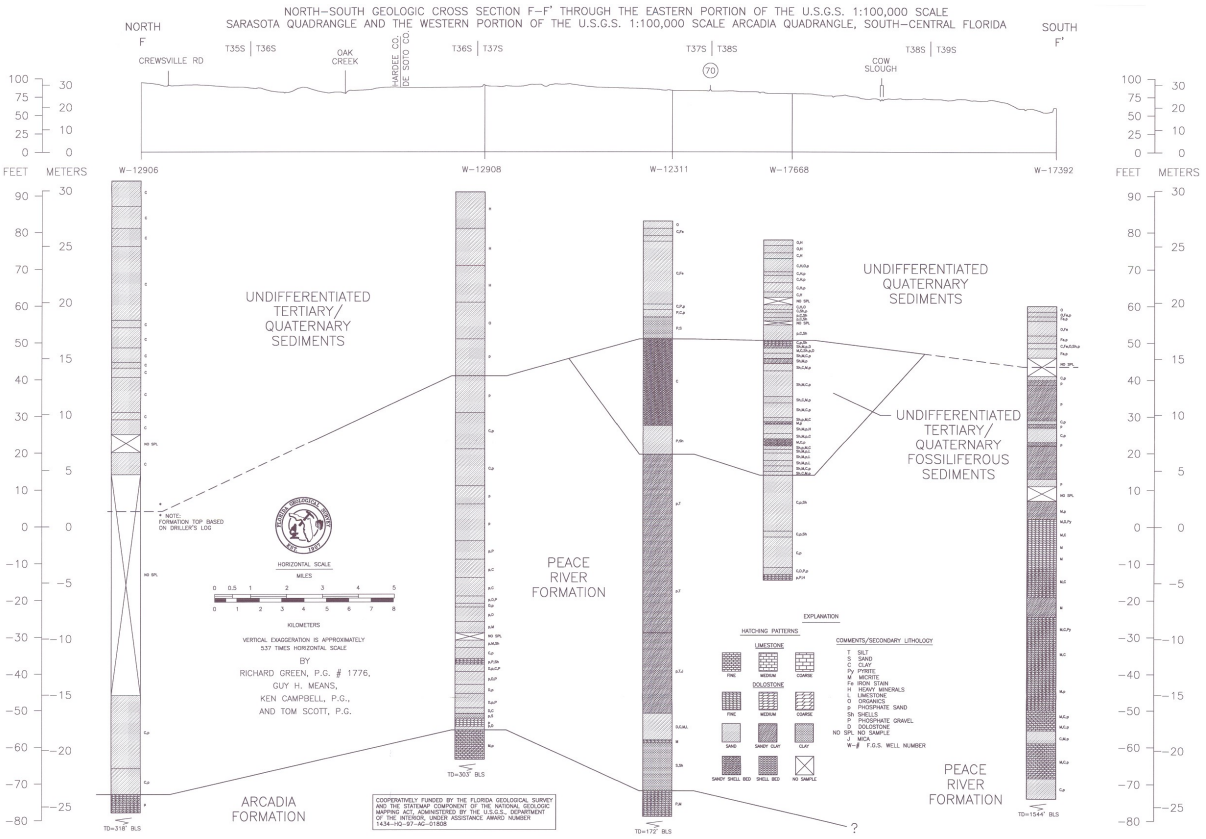
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Cross Section H-H'



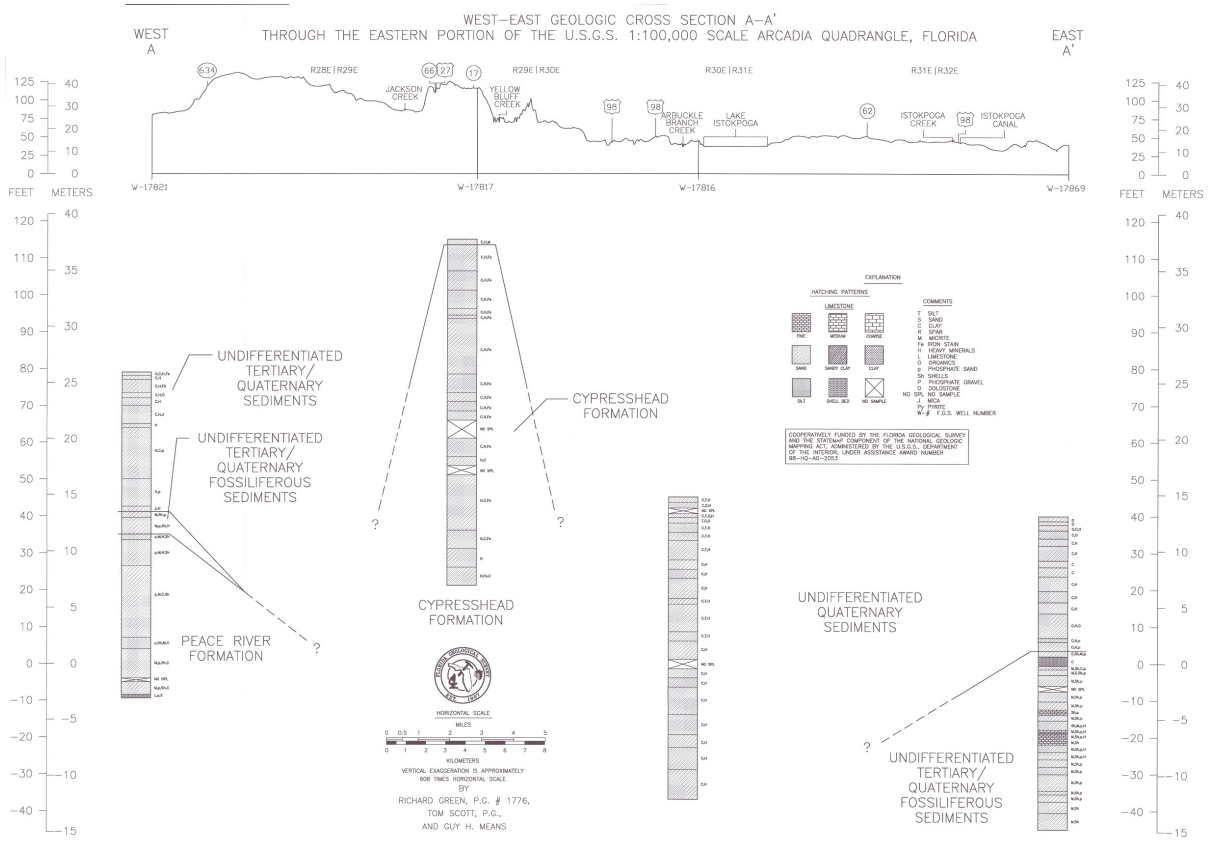
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Cross Section I-I'



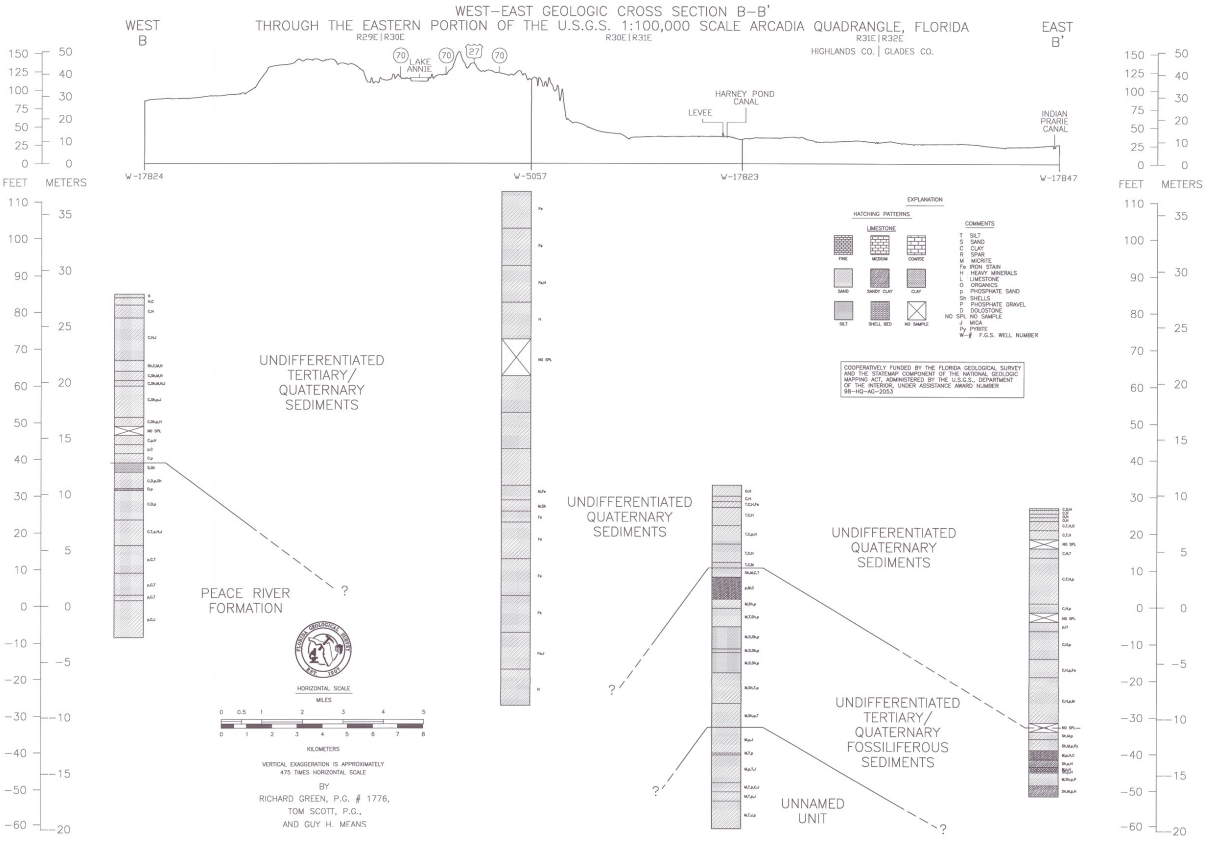
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Cross Section J-J'



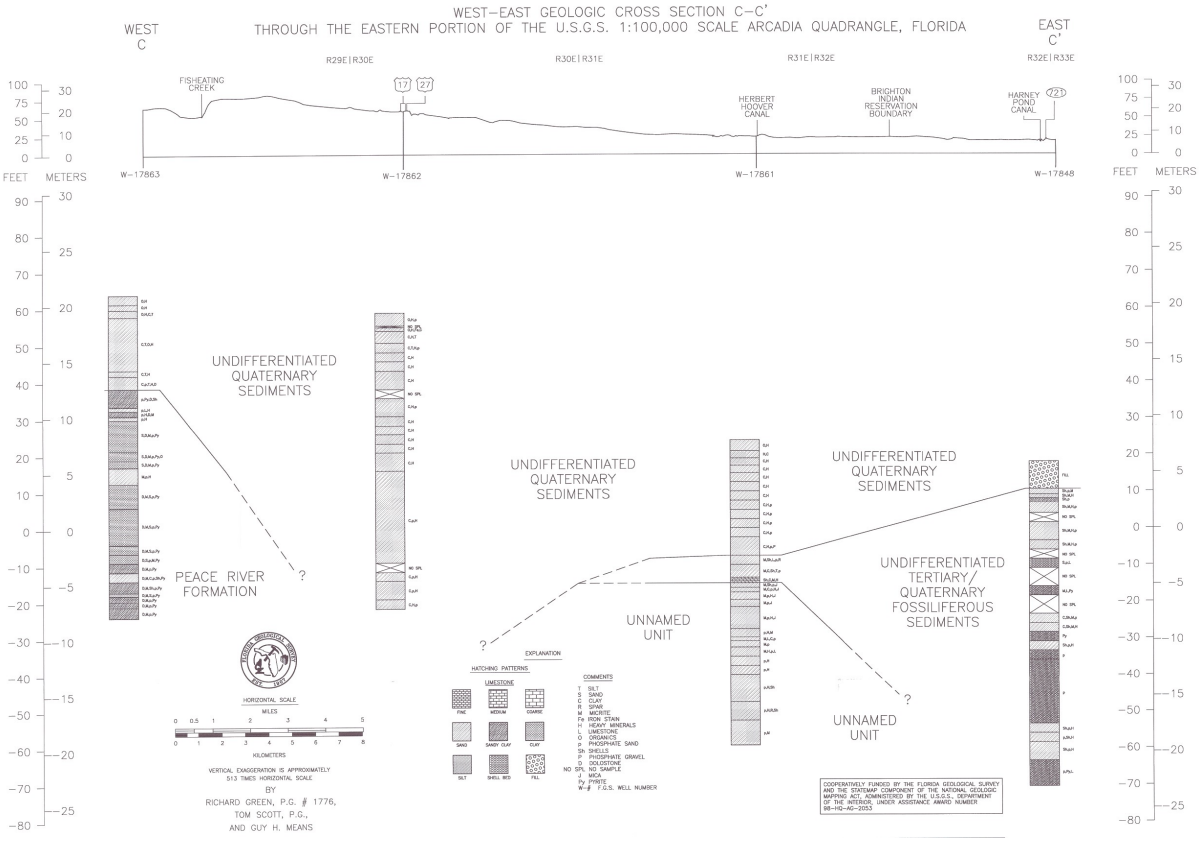
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Cross Section K-K'



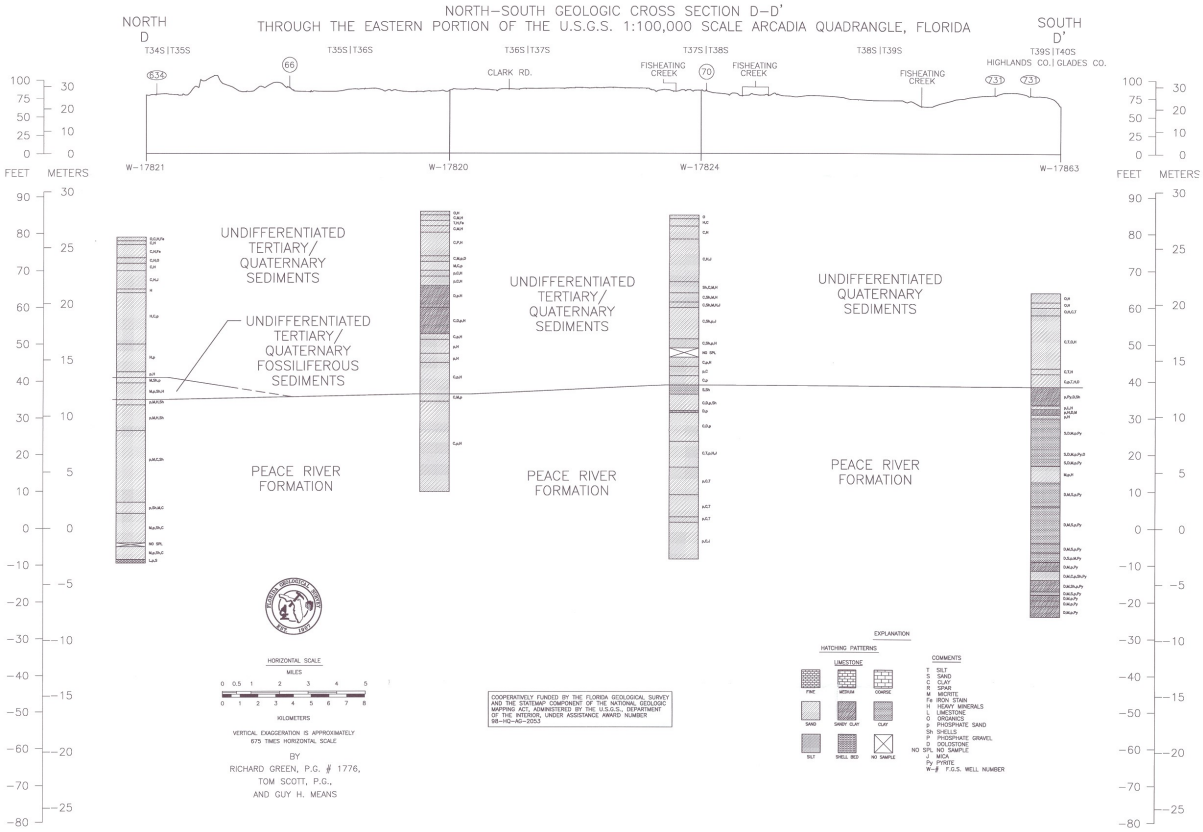
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Cross Section L-L'



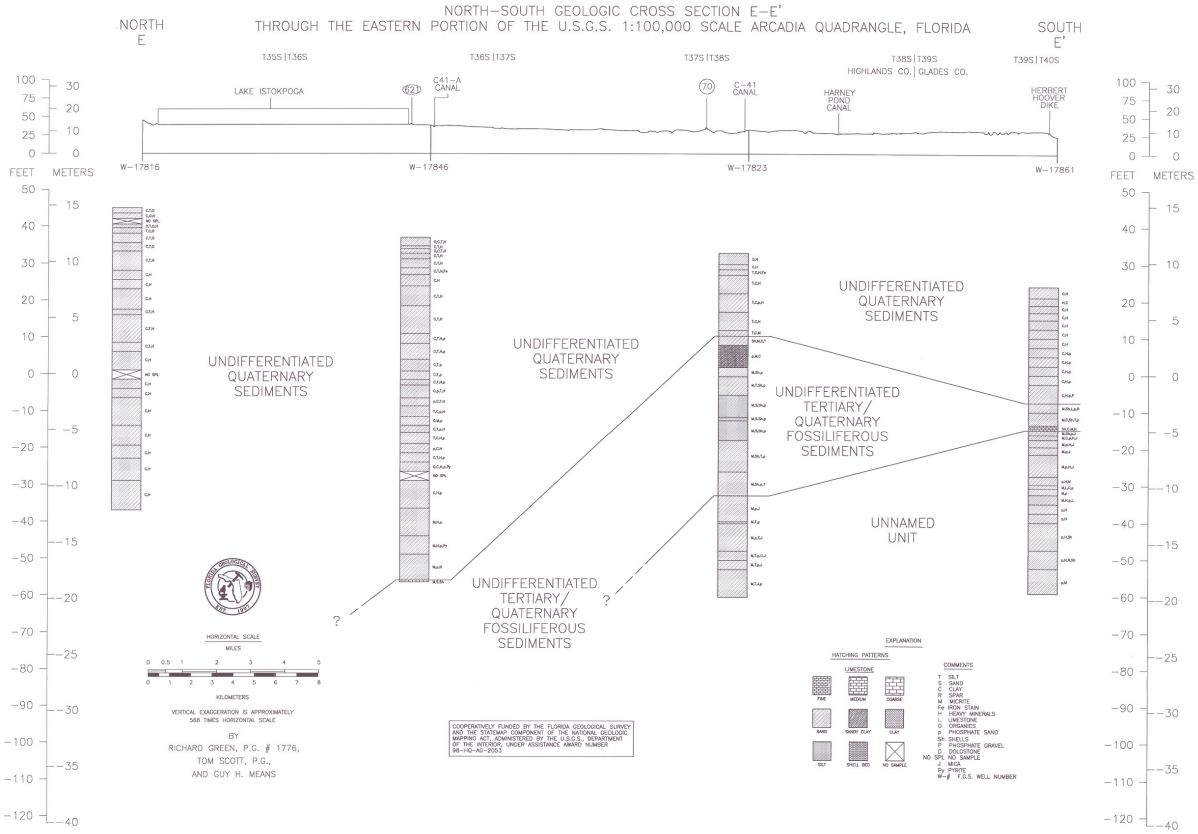
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Cross Section M-M'



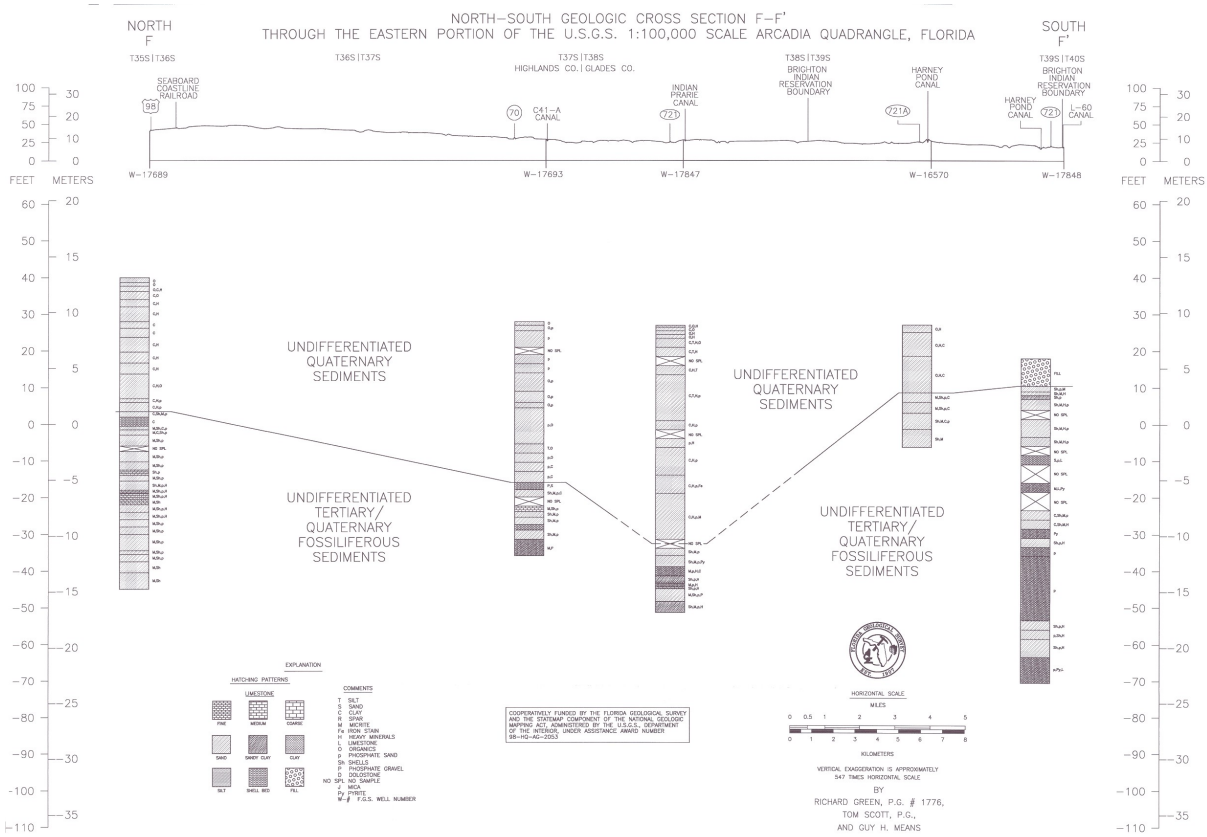
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Cross Section N-N'



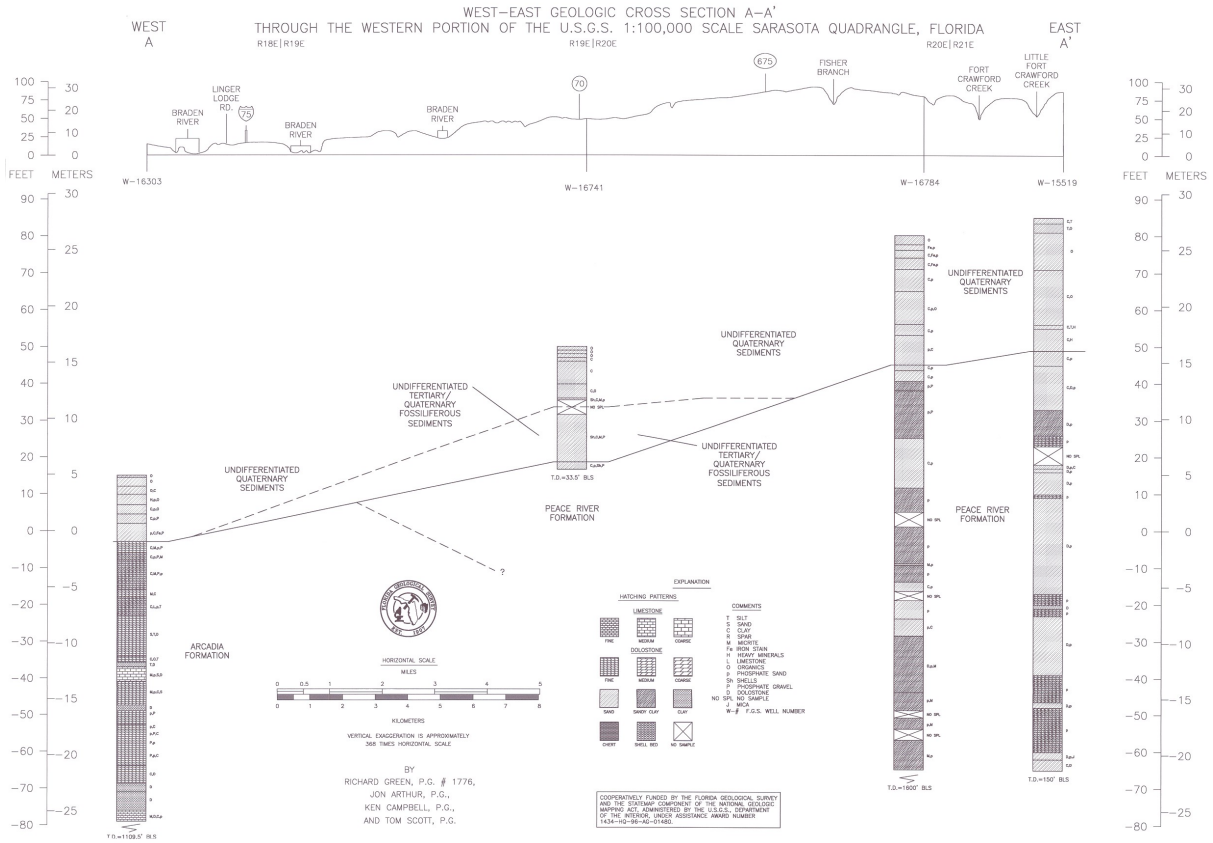
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Cross Section O-O'



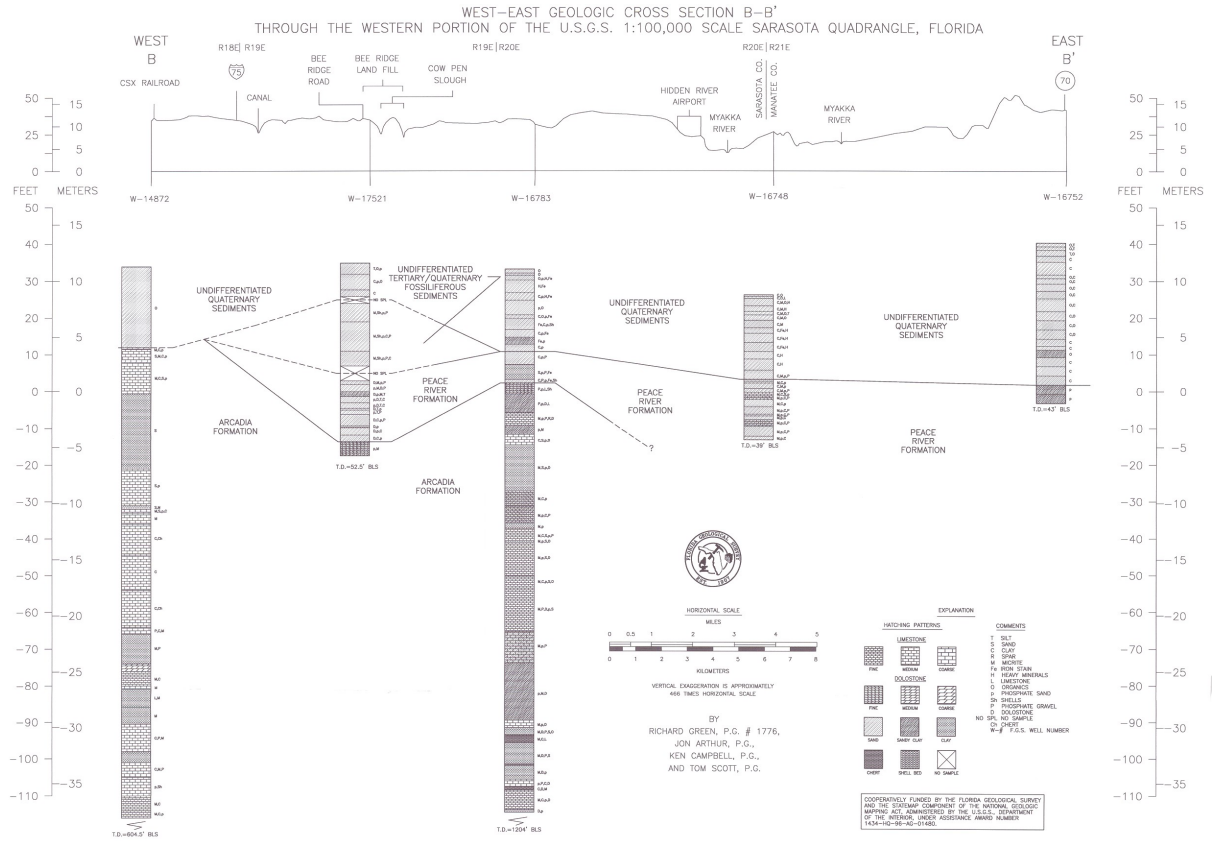
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Cross Section P-P'



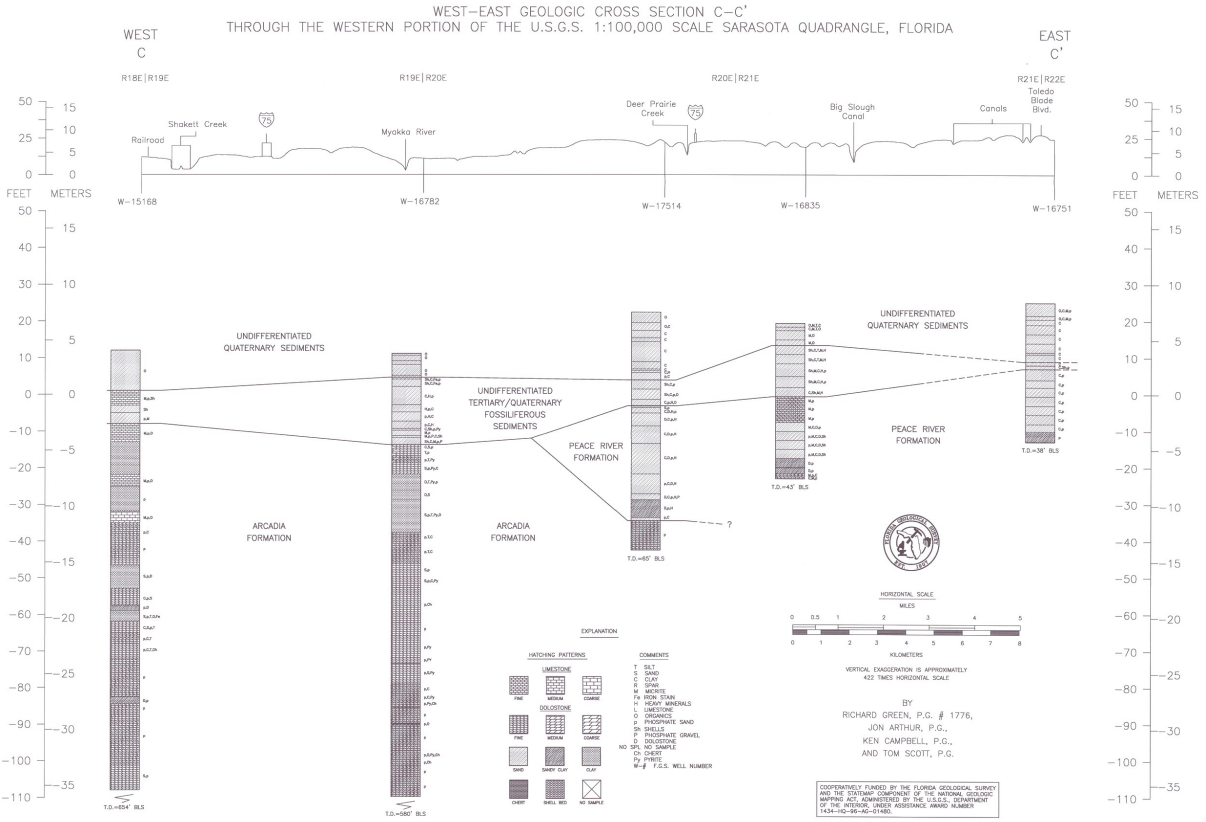
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Cross Section Q-Q'



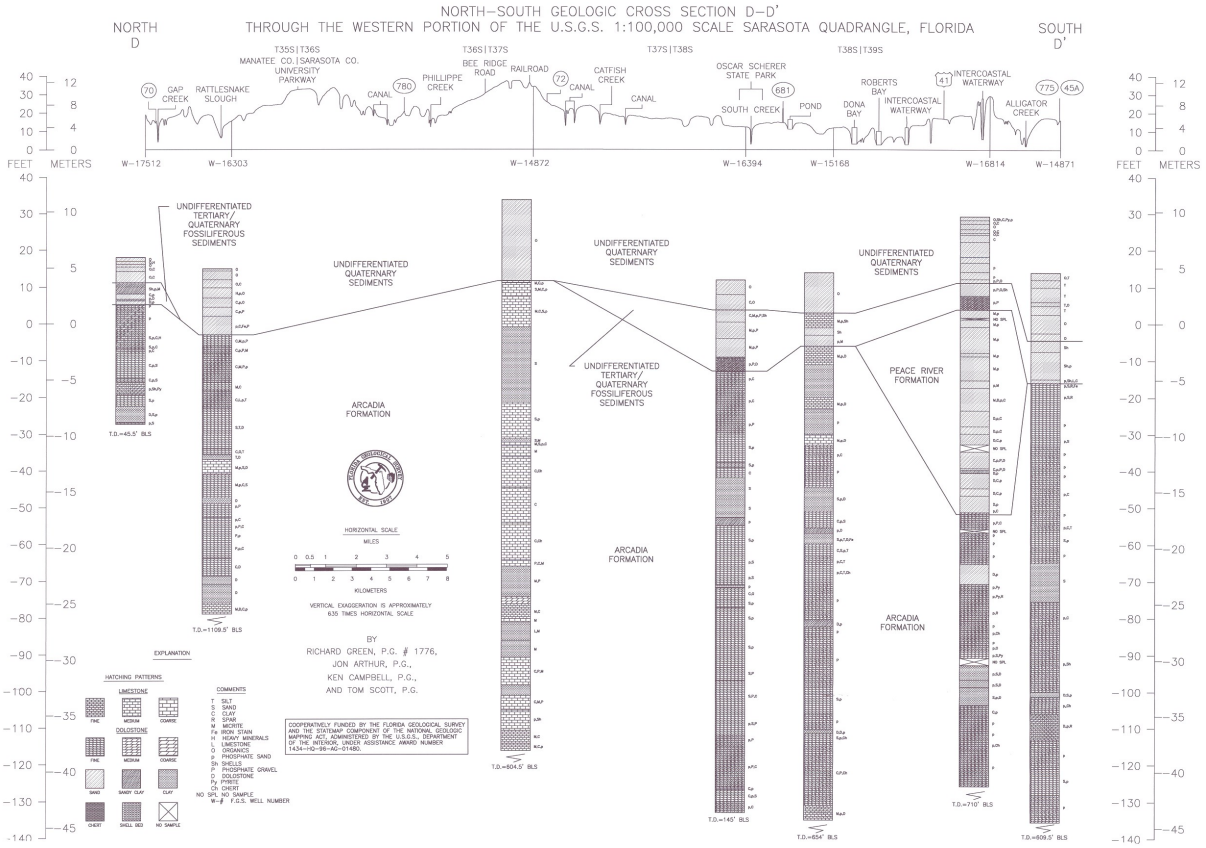
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Cross Section R-R'



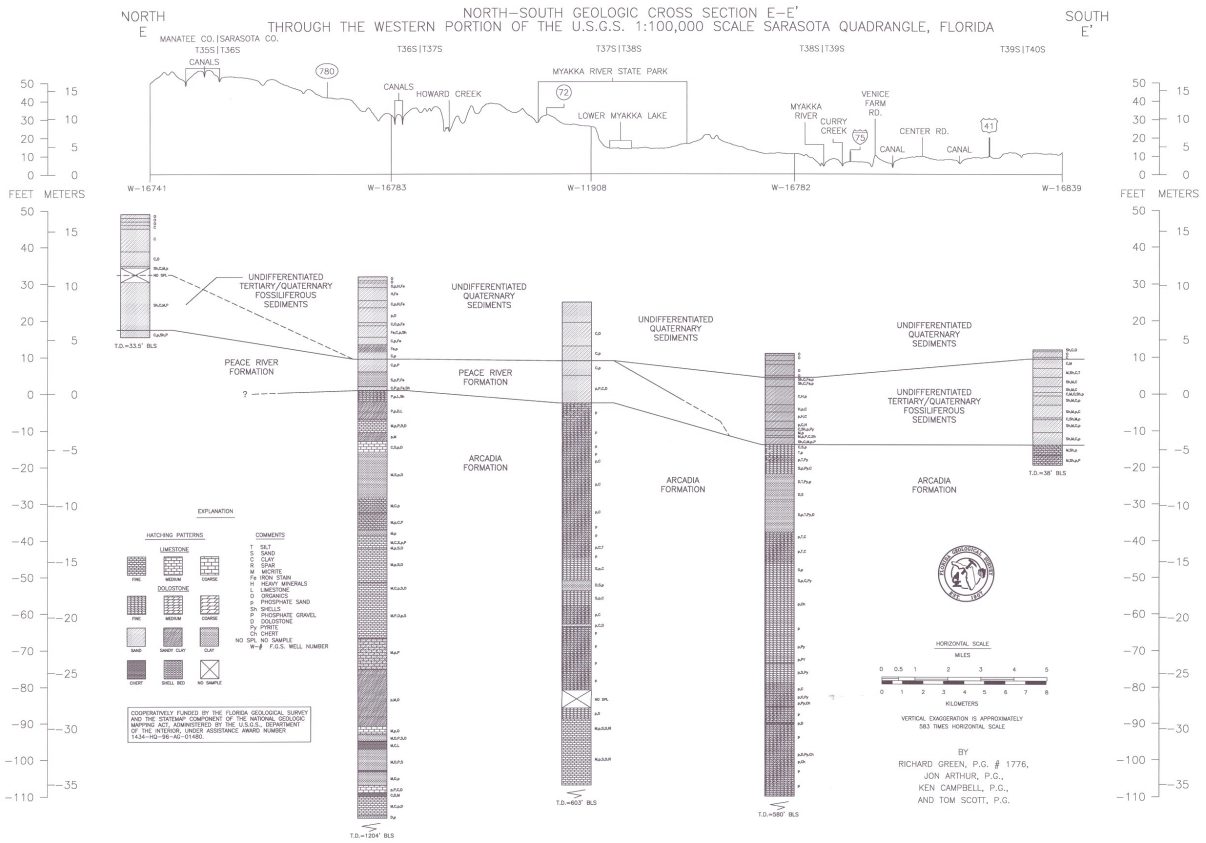
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Cross Section S-S'



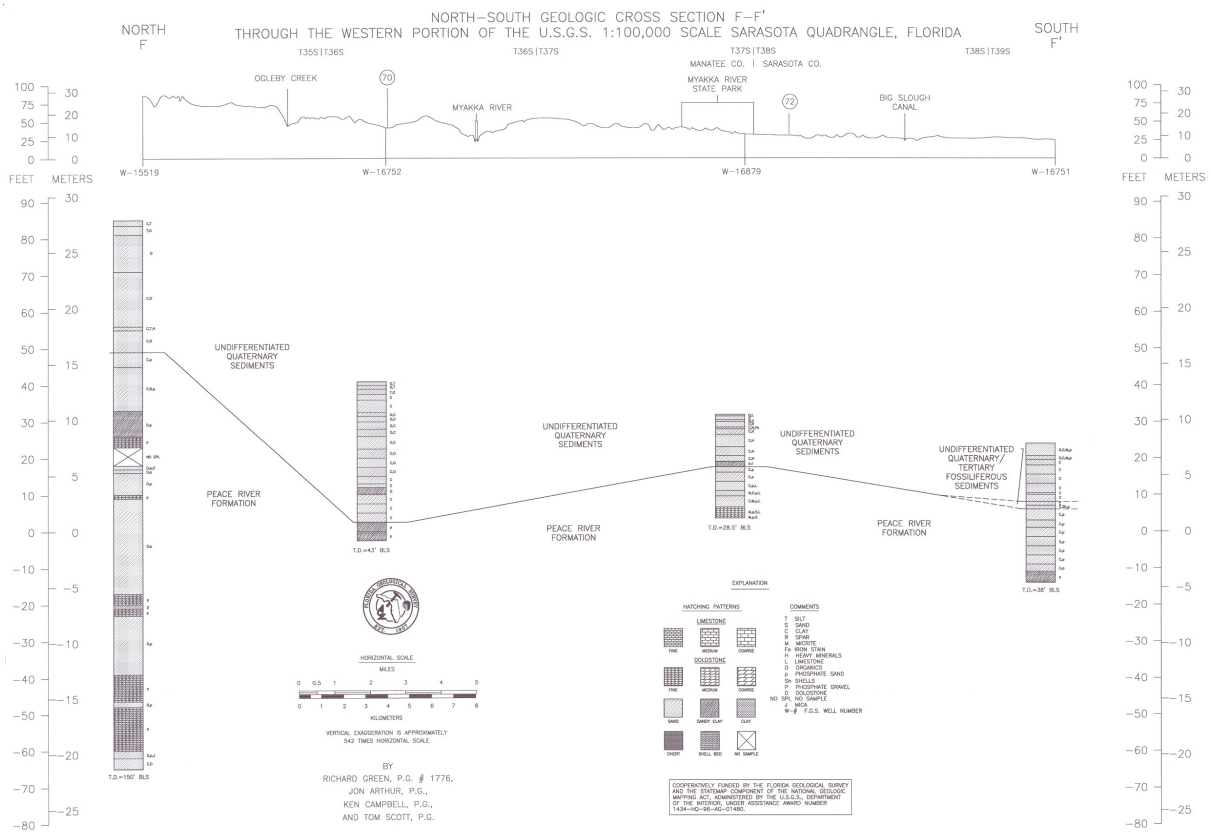
Graphic from source map: Sarasota (western portion) 1:100,000 scale Quadrangle (Surficial and Bedrock Geology. Cross section D-D' on source map.

Cross Section T-T'



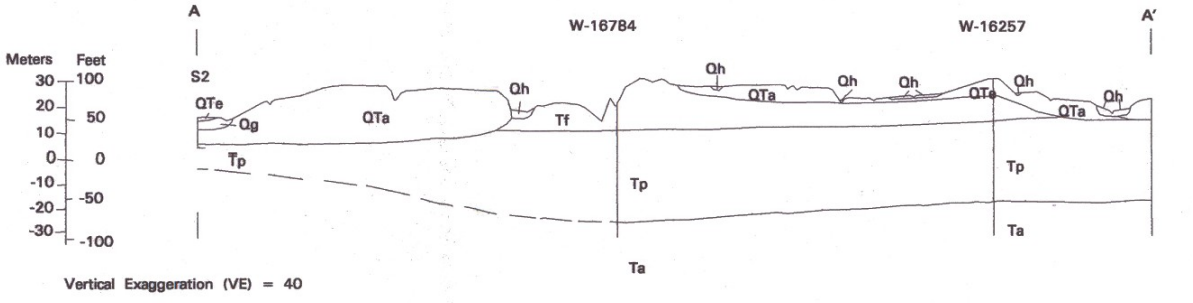
Graphic from source map: Sarasota (western portion) 1:100,000 scale Quadrangle (Surficial and Bedrock Geology. Cross section E-E' on source map.

Cross Section U-U'



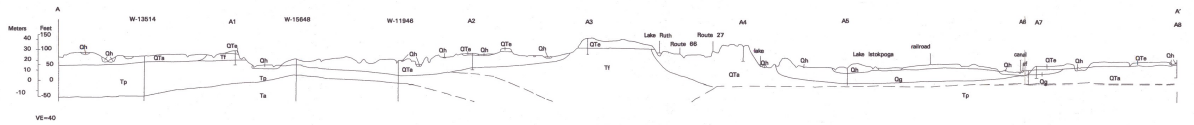
Graphic from source map: Sarasota (western portion) 1:100,000 scale Quadrangle (Surficial and Bedrock Geology. Cross section F-F' on source map.

Cross Section V-V'



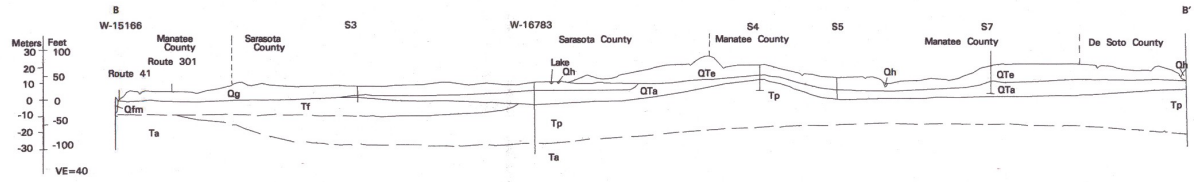
Graphic from source map: Sarasota and Arcadia 30' x 60' Quadrangles. Cross section A-A'1 on source map.

Cross Section W-W'



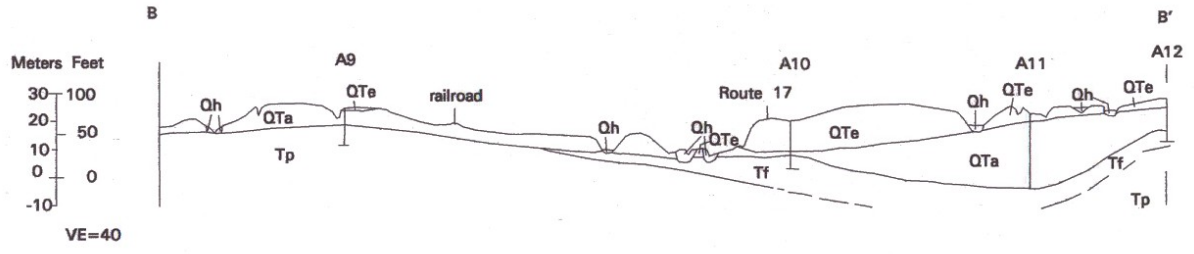
Graphic from source map: Sarasota and Arcadia 30' x 60' Quadrangles. Cross section A-A'2 on source map.

Cross Section X-X'



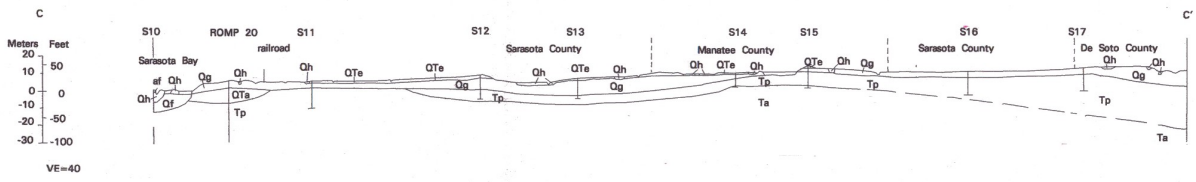
Graphic from source map: Sarasota and Arcadia 30' x 60' Quadrangles. Cross section B-B'1 on source map.

Cross Section Y-Y'



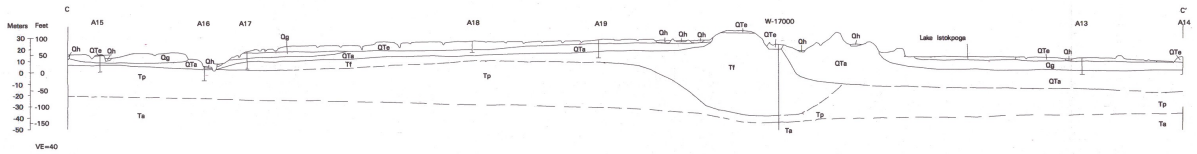
Graphic from source map: Sarasota and Arcadia 30' x 60' Quadrangles. Cross section B-B'2 on source map.

Cross Section Z-Z'



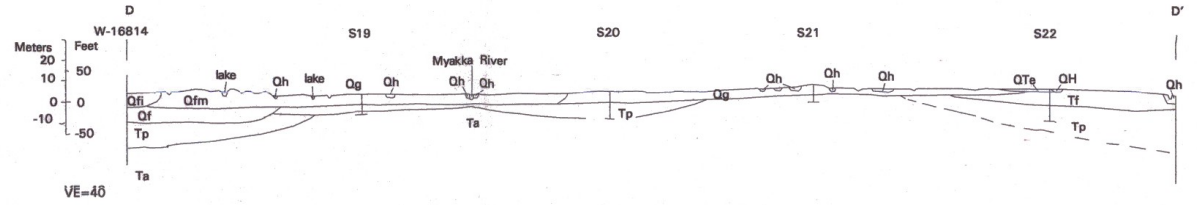
Graphic from source map: Sarasota and Arcadia 30' x 60' Quadrangles. Cross section C-C'1 on source map.

Cross Section A1-A1



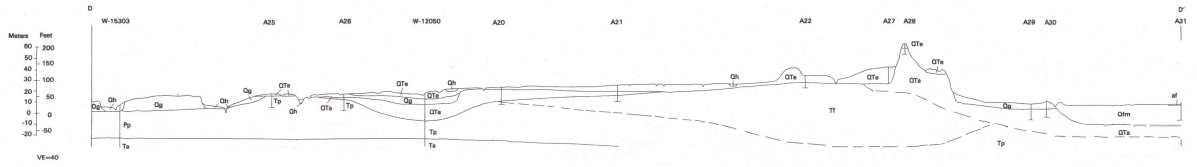
Graphic from source map: Sarasota and Arcadia 30' x 60' Quadrangles. Cross section C-C'2 on source map.

Cross Section B1-B1'



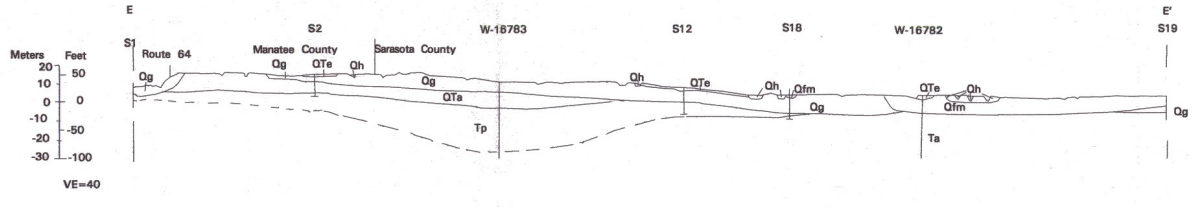
Graphic from source map: Sarasota and Arcadia 30' x 60' Quadrangles. Cross section D-D'1 on source map.

Cross Section C1-C1'



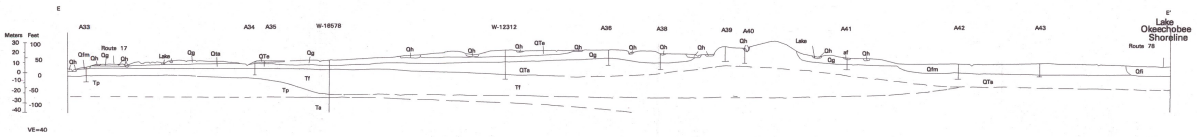
Graphic from source map: Sarasota and Arcadia 30' x 60' Quadrangles. Cross section D-D'2 on source map.

Cross Section D1-D1'



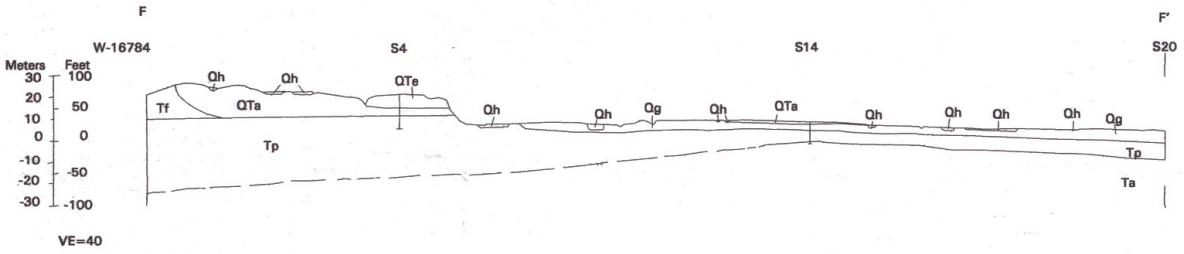
Graphic from source map: Sarasota and Arcadia 30' x 60' Quadrangles. Cross section E-E'1 on source map.

Cross Section E1-E1'



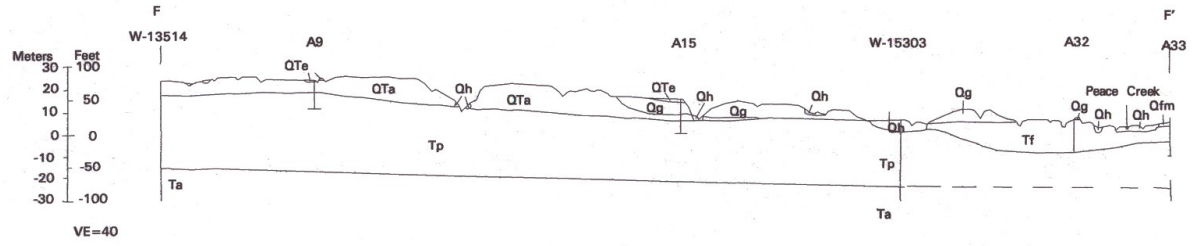
Graphic from source map: Sarasota and Arcadia 30' x 60' Quadrangles. Cross section E-E'2 on source map.

Cross Section F1-F1'



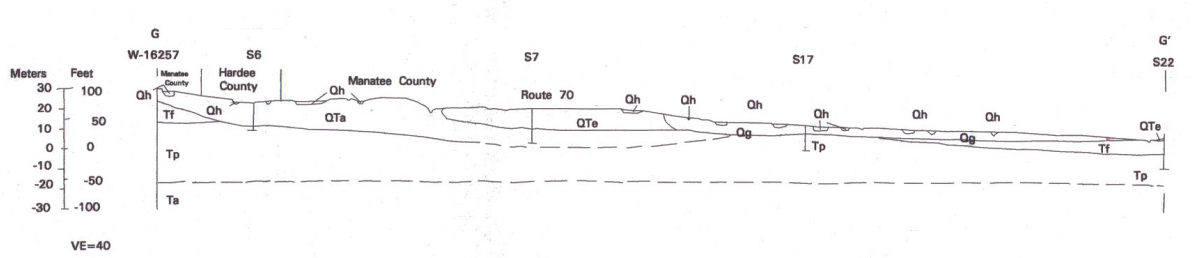
Graphic from source map: Sarasota and Arcadia 30' x 60' Quadrangles. Cross section F-F'1 on source map.

Cross Section G1-G1'



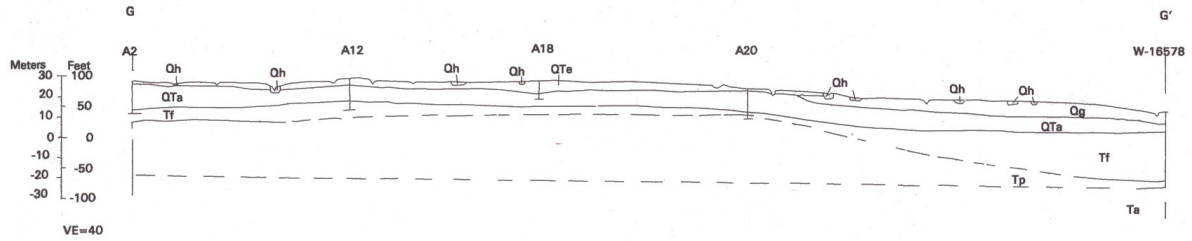
Graphic from source map: Sarasota and Arcadia 30' x 60' Quadrangles. Cross section F-F'2 on source map.

Cross Section H1-H1'



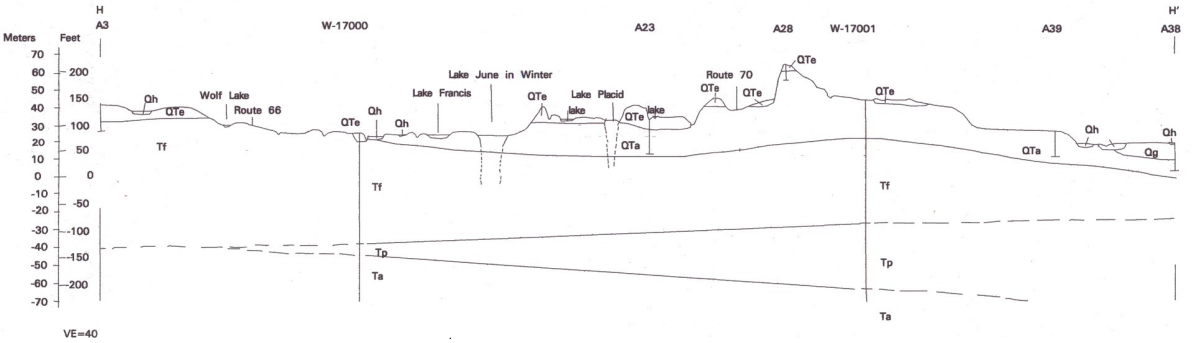
Graphic from source map: Sarasota and Arcadia 30' x 60' Quadrangles. Cross section G-G'1 on source map.

Cross Section I1-I1'



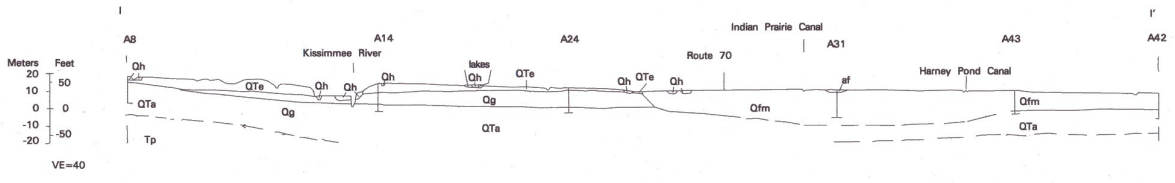
Graphic from source map: Sarasota and Arcadia 30' x 60' Quadrangles. Cross section G-G'2 on source map.

Cross Section J1-J1'



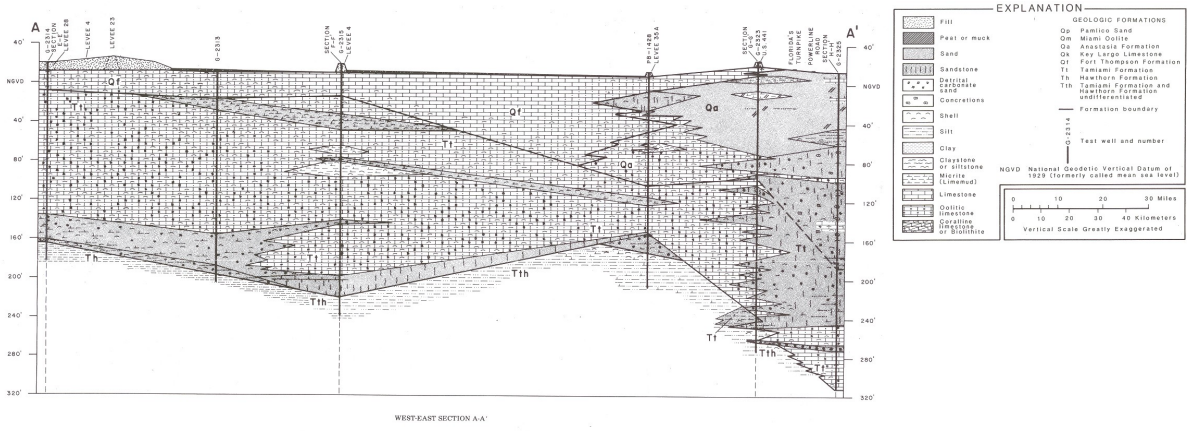
Graphic from source map: Sarasota and Arcadia 30' x 60' Quadrangles. Cross section H-H'2 on source map.

Cross Section K1-K1'



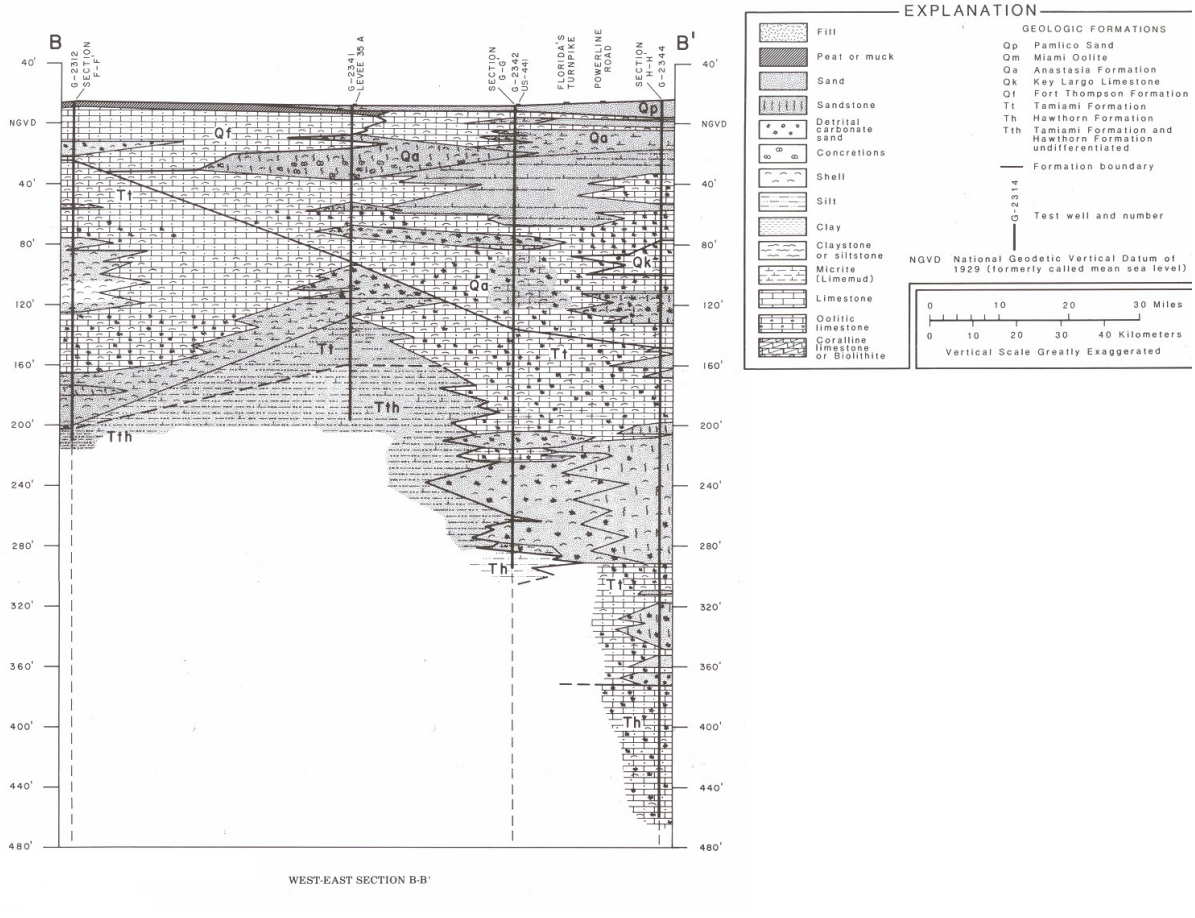
Graphic from source map: Sarasota and Arcadia 30' x 60' Quadrangles. Cross section I-I'2 on source map.

Cross Section L1-L1'



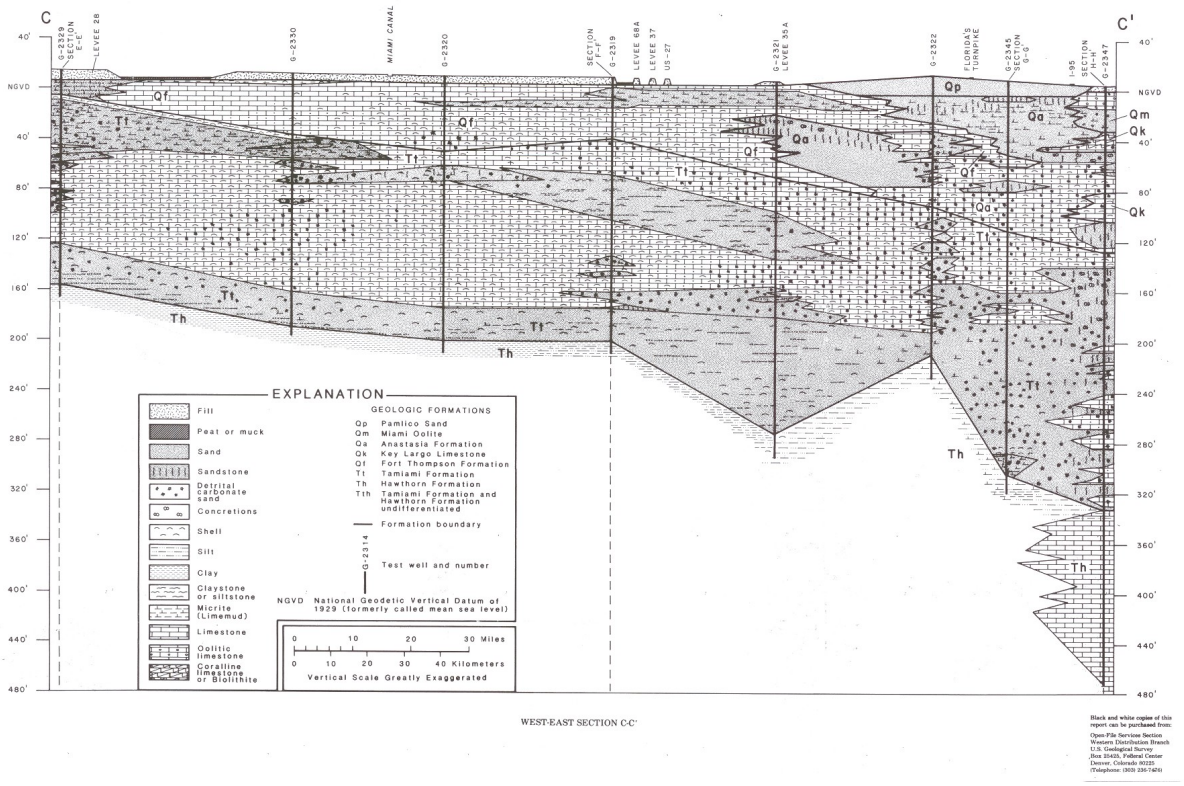
Graphic from source map: Surficial Aquifer System (Broward County). Cross section A-A' on source map.

Cross Section M1-M1'



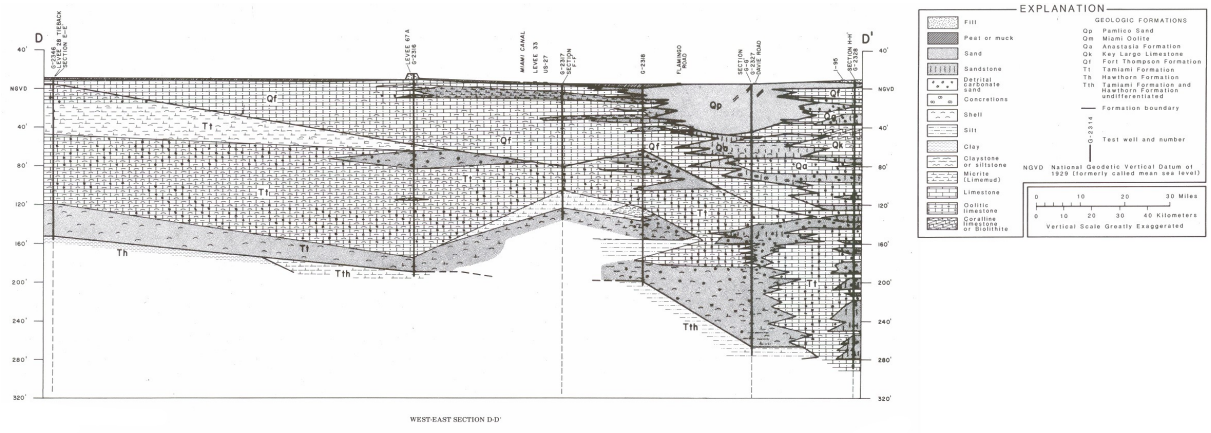
Graphic from source map: Surficial Aquifer System (Broward County). Cross section B-B' on source map.

Cross Section N1-N1'



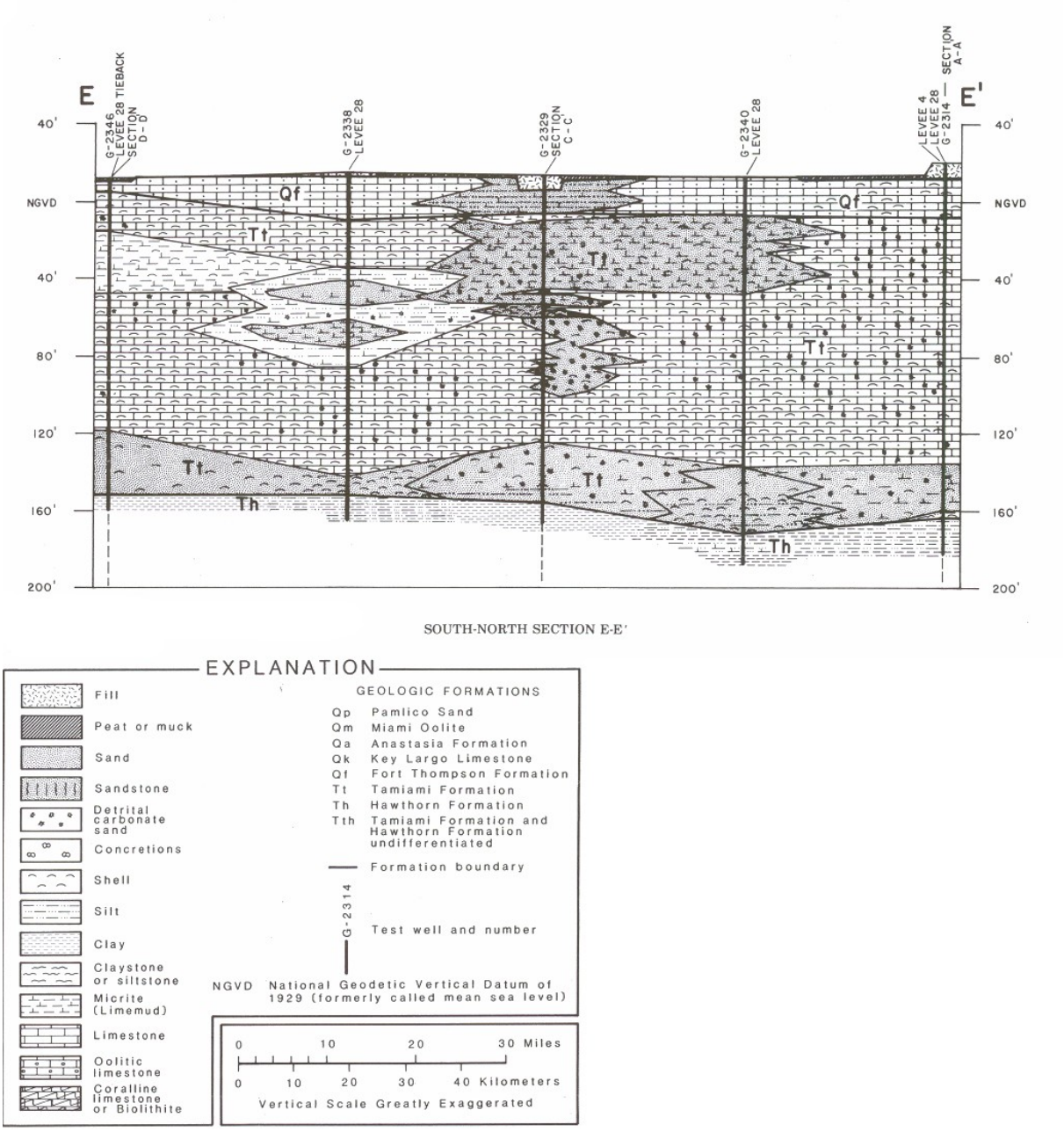
Graphic from source map: Surficial Aquifer System (Broward County). Cross section C-C' on source map.

Cross Section O1-O1'



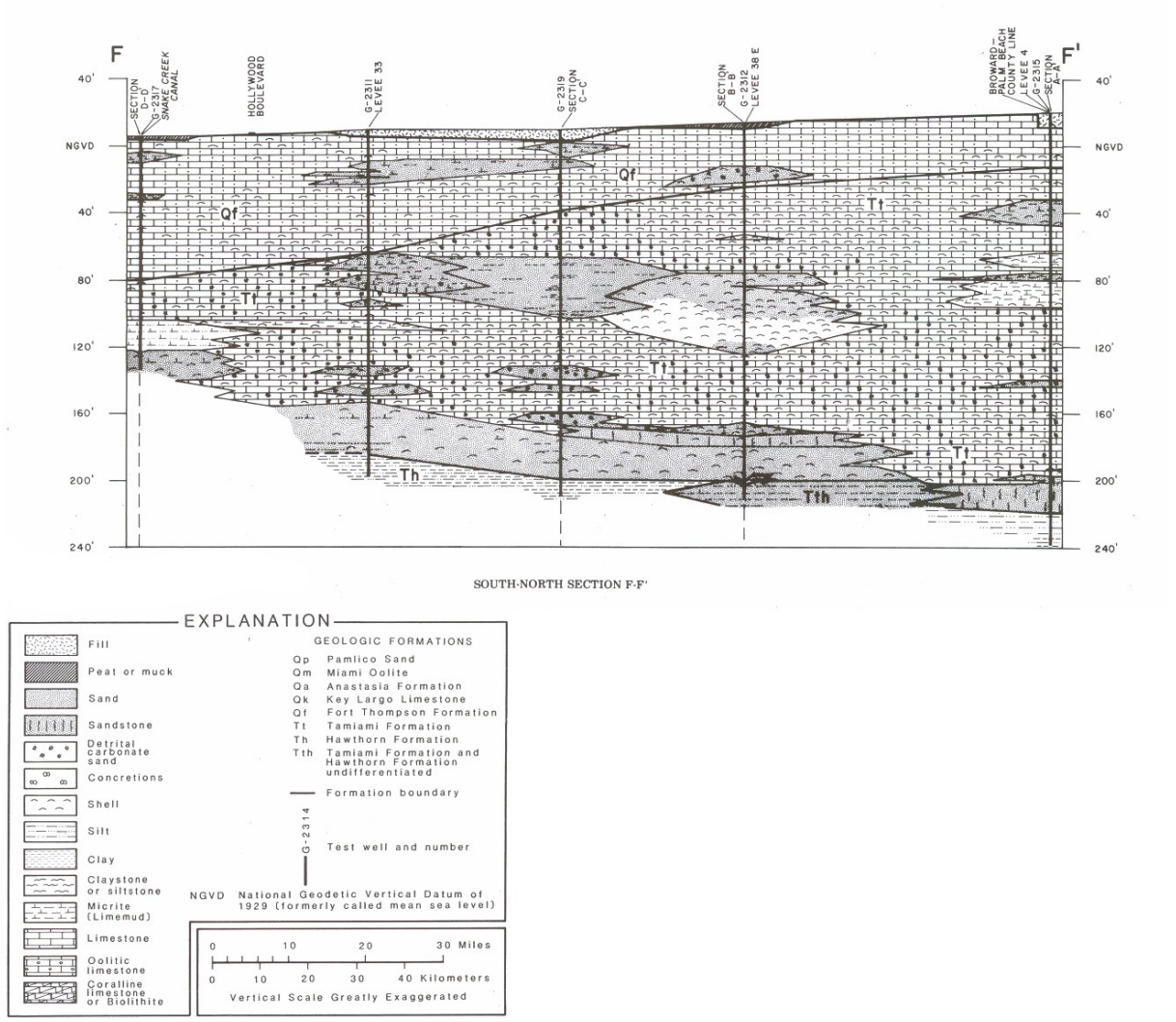
Graphic from source map: Surficial Aquifer System (Broward County). Cross section D-D' on source map.

Cross Section P1-P1'



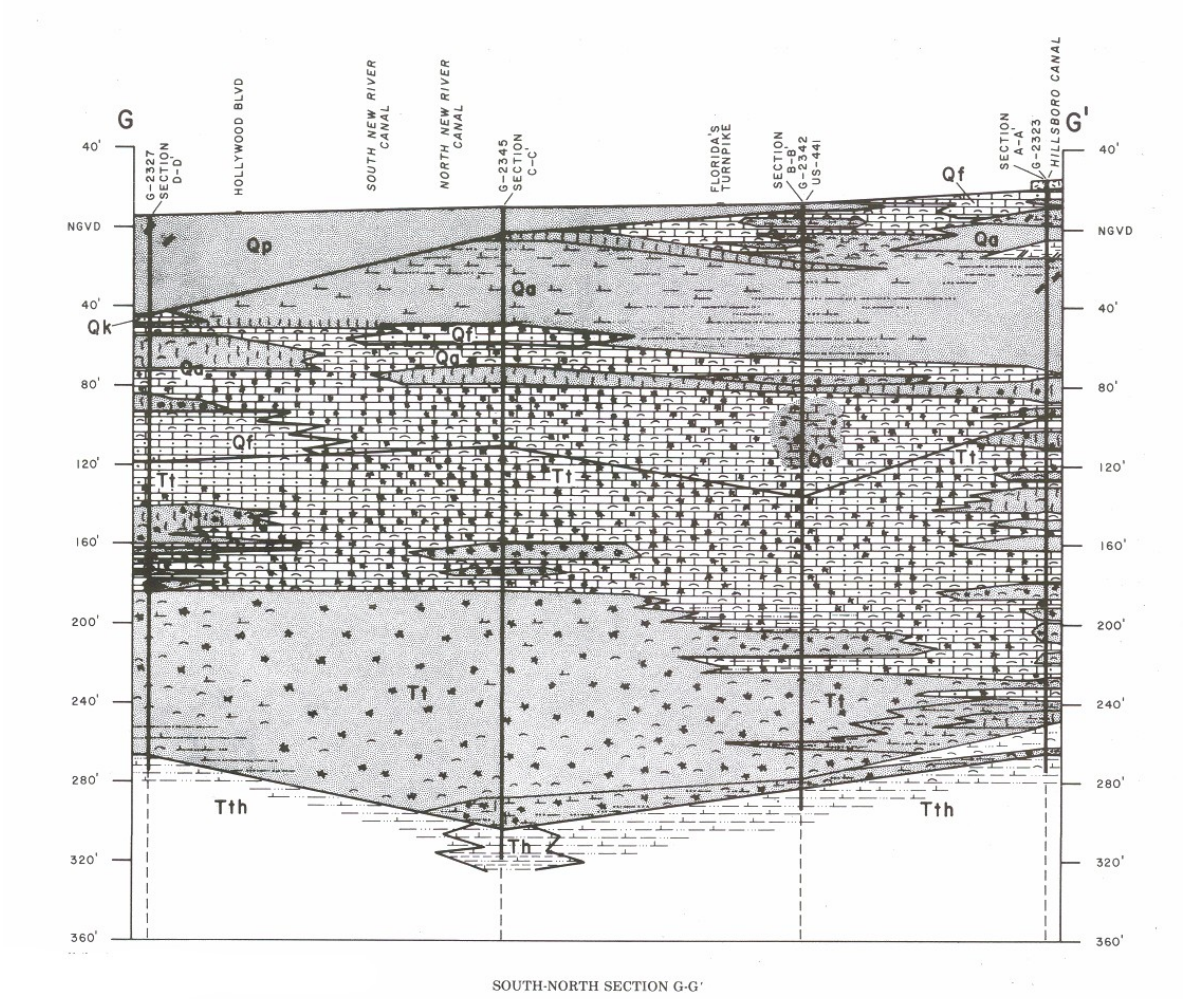
Graphic from source map: Surficial Aquifer System (Broward County). Cross section E-E' on source map.

Cross Section Q1-Q1'



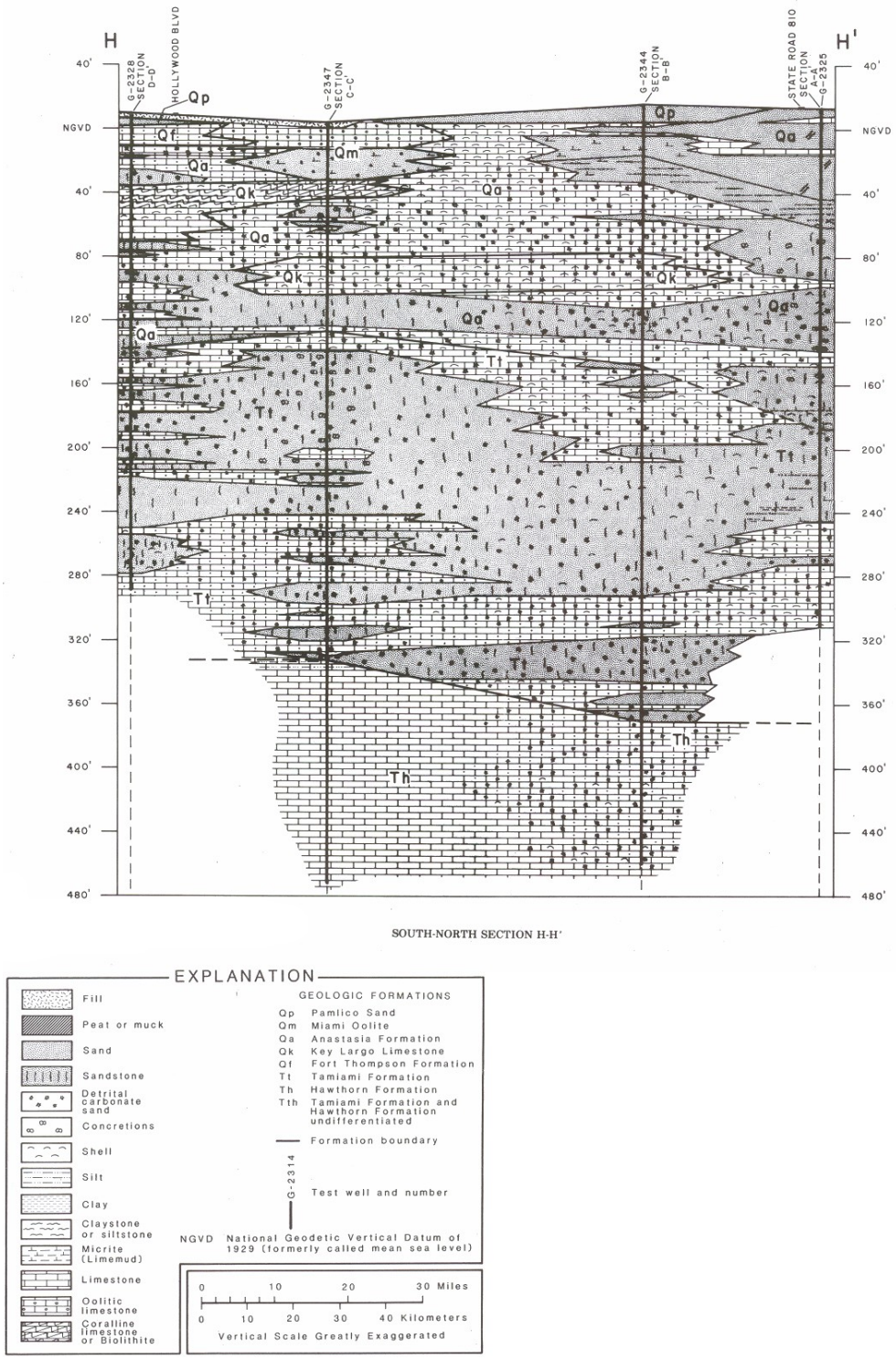
Graphic from source map: Surficial Aquifer System (Broward County). Cross section F-F' on source map.

Cross Section R1-R1'



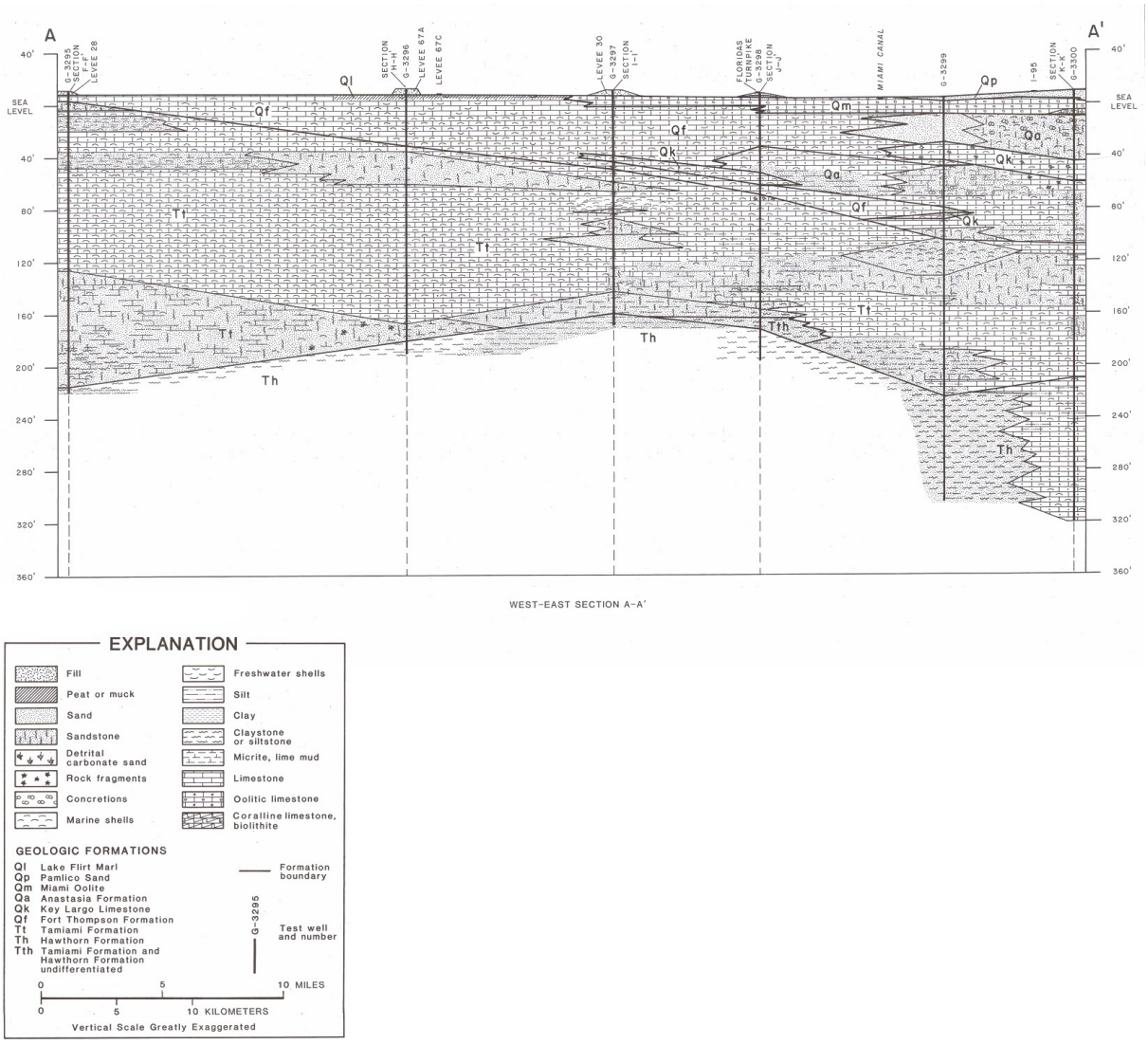
Graphic from source map: Surficial Aquifer System (Broward County). Cross section G-G' on source map.

Cross Section S1-S1'



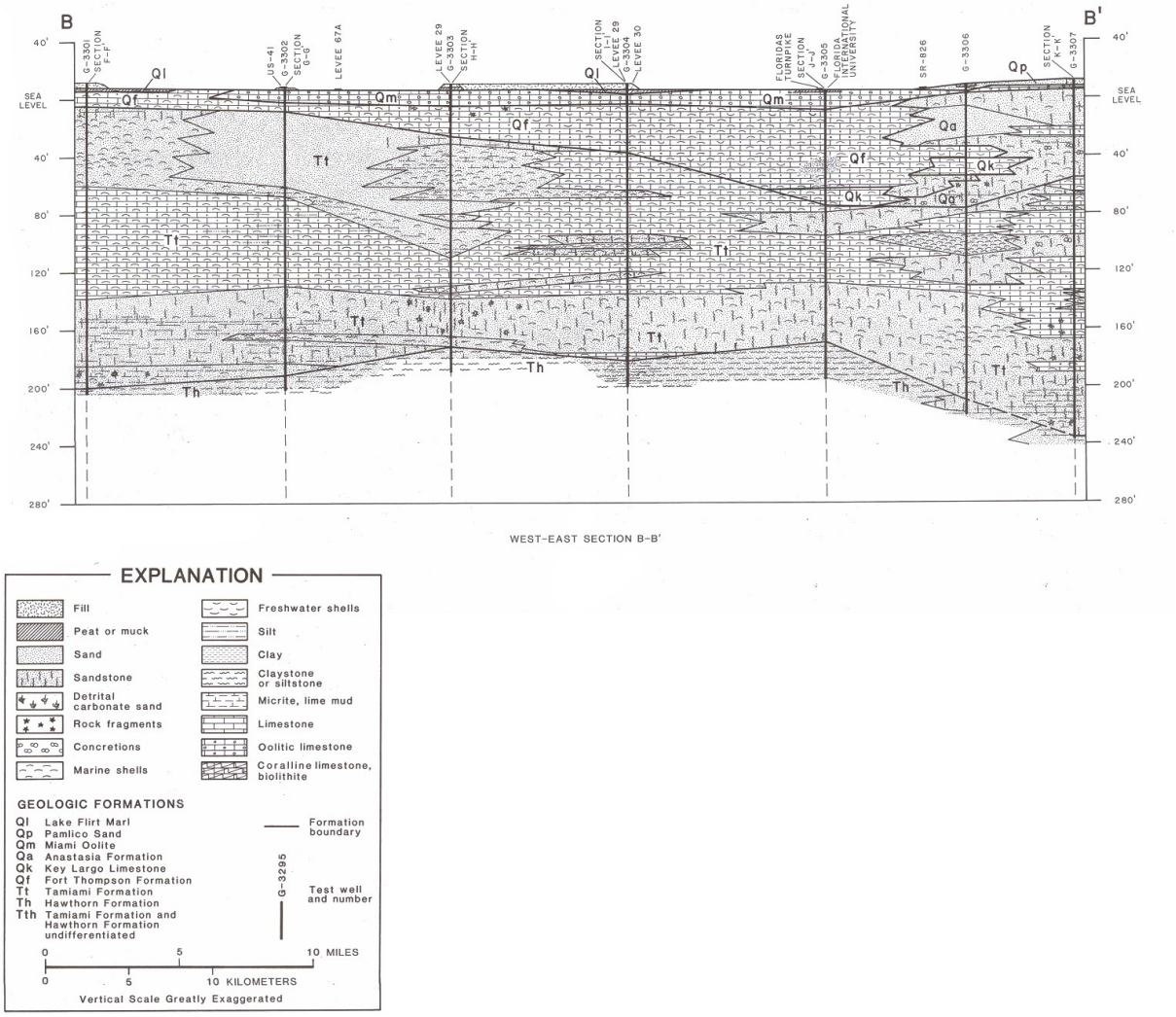
Graphic from source map: Surficial Aquifer System (Broward County). Cross section H-H' on source map.

Cross Section T1-T1'



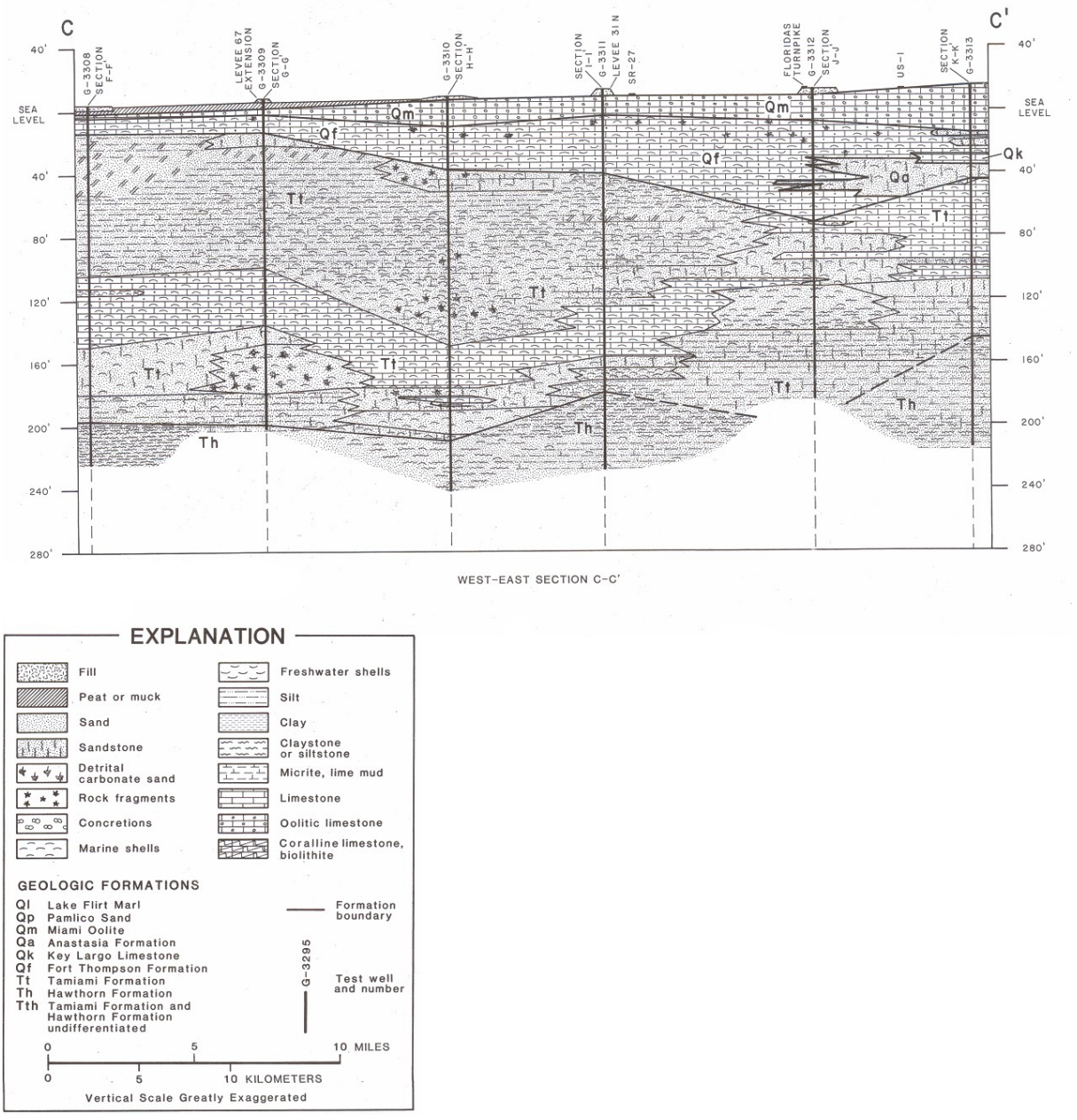
Graphic from source map: Surficial Aquifer System (Dade County). Cross section A-A' on source map.

Cross Section U1-U1'



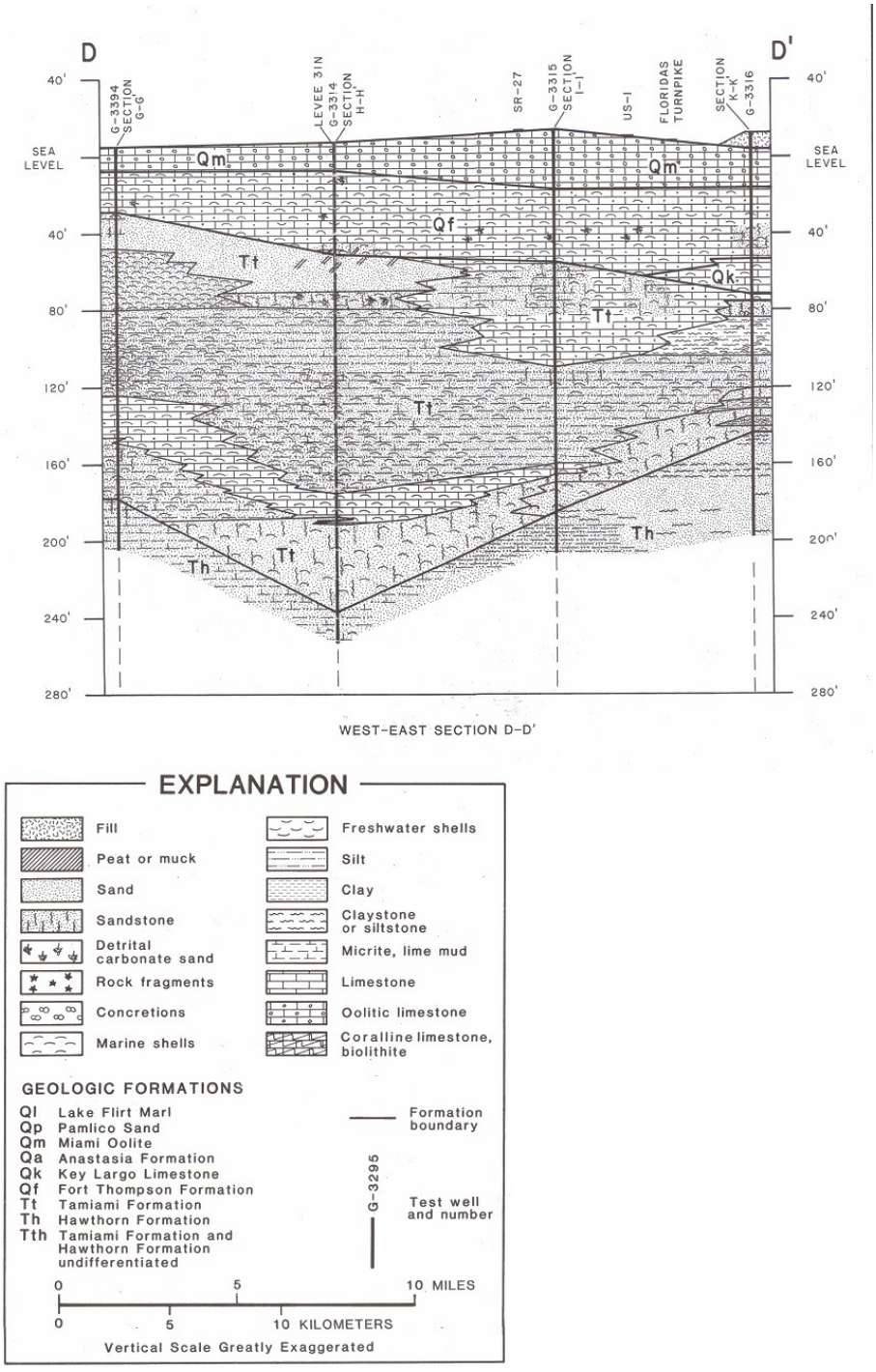
Graphic from source map: Surficial Aquifer System (Dade County). Cross section B-B' on source map.

Cross Section V1-V1'



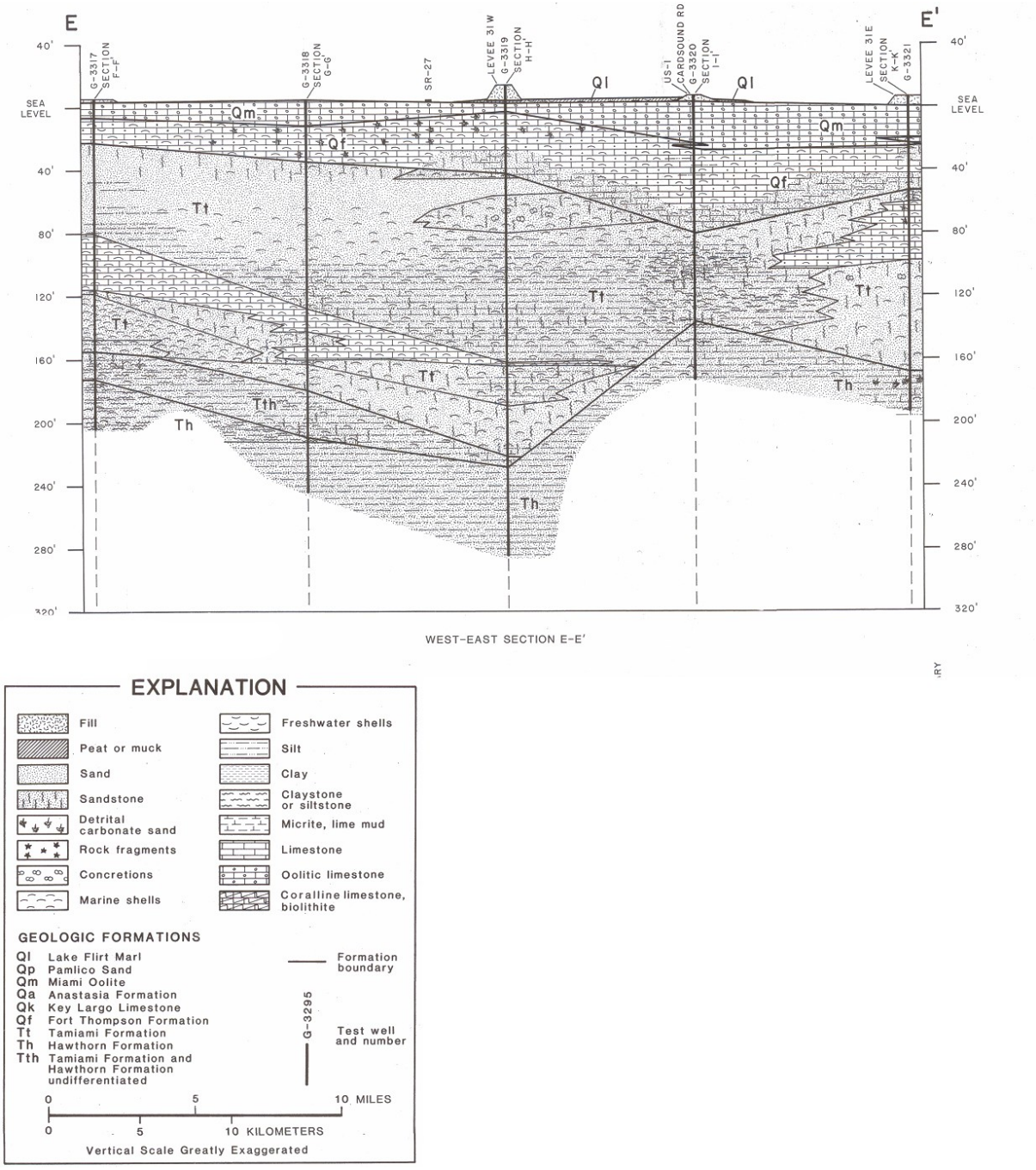
Graphic from source map: Surficial Aquifer System (Dade County). Cross section C-C' on source map.

Cross Section W1-W1'



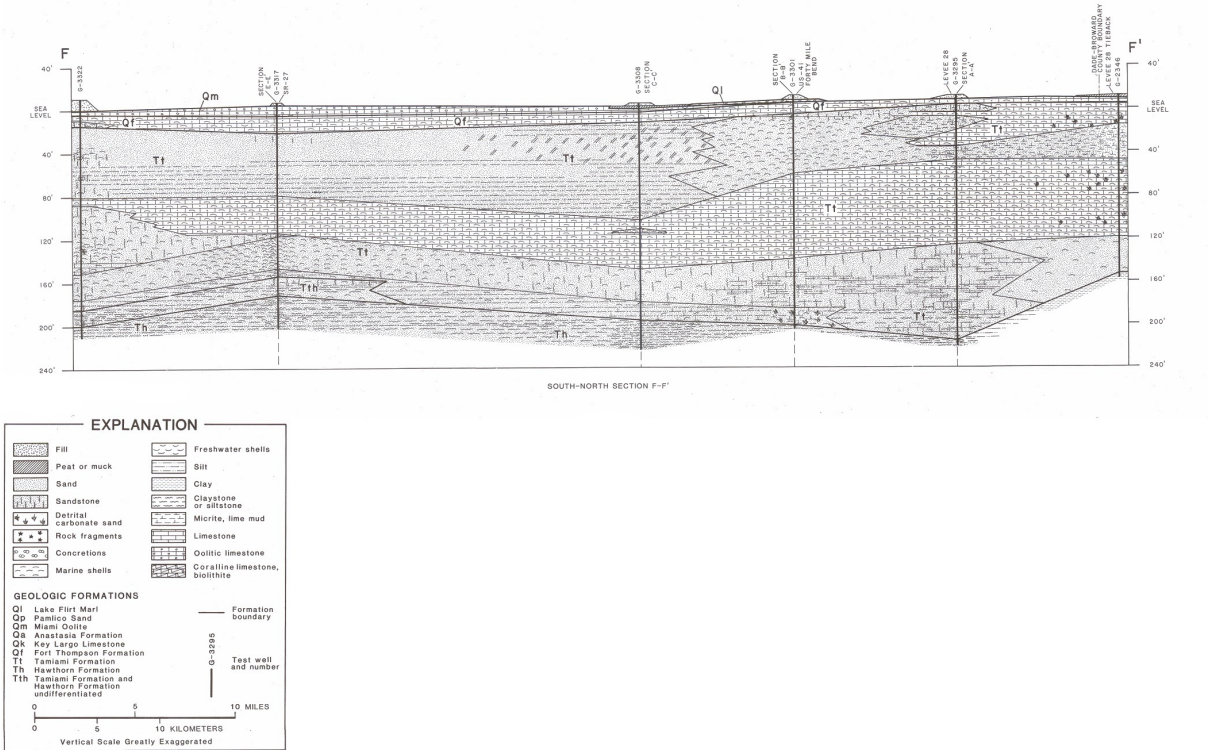
Graphic from source map: Surficial Aquifer System (Dade County). Cross section D-D' on source map.

Cross Section X1-X1'



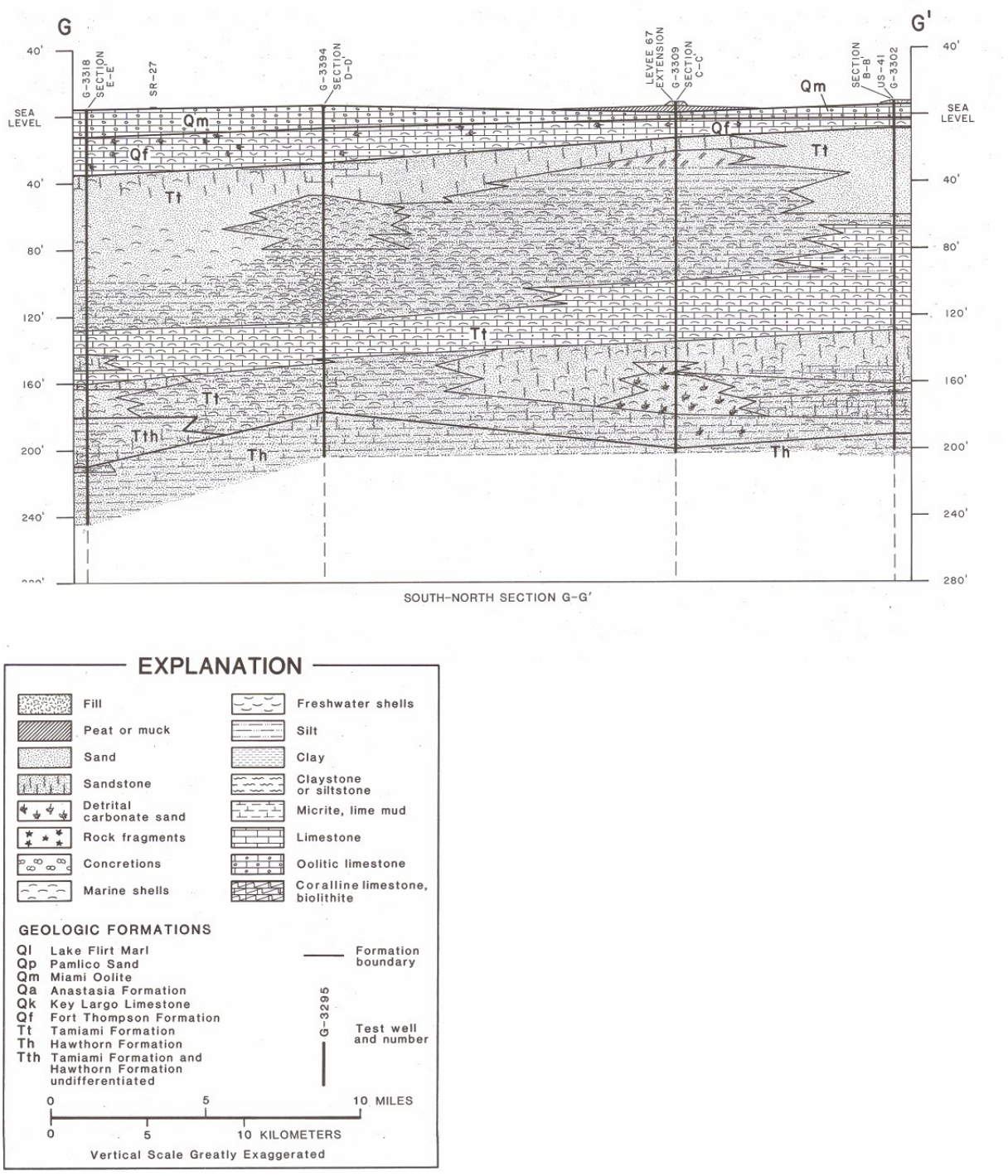
Graphic from source map: Surficial Aquifer System (Dade County). Cross section E-E' on source map.

Cross Section Y1-Y1'



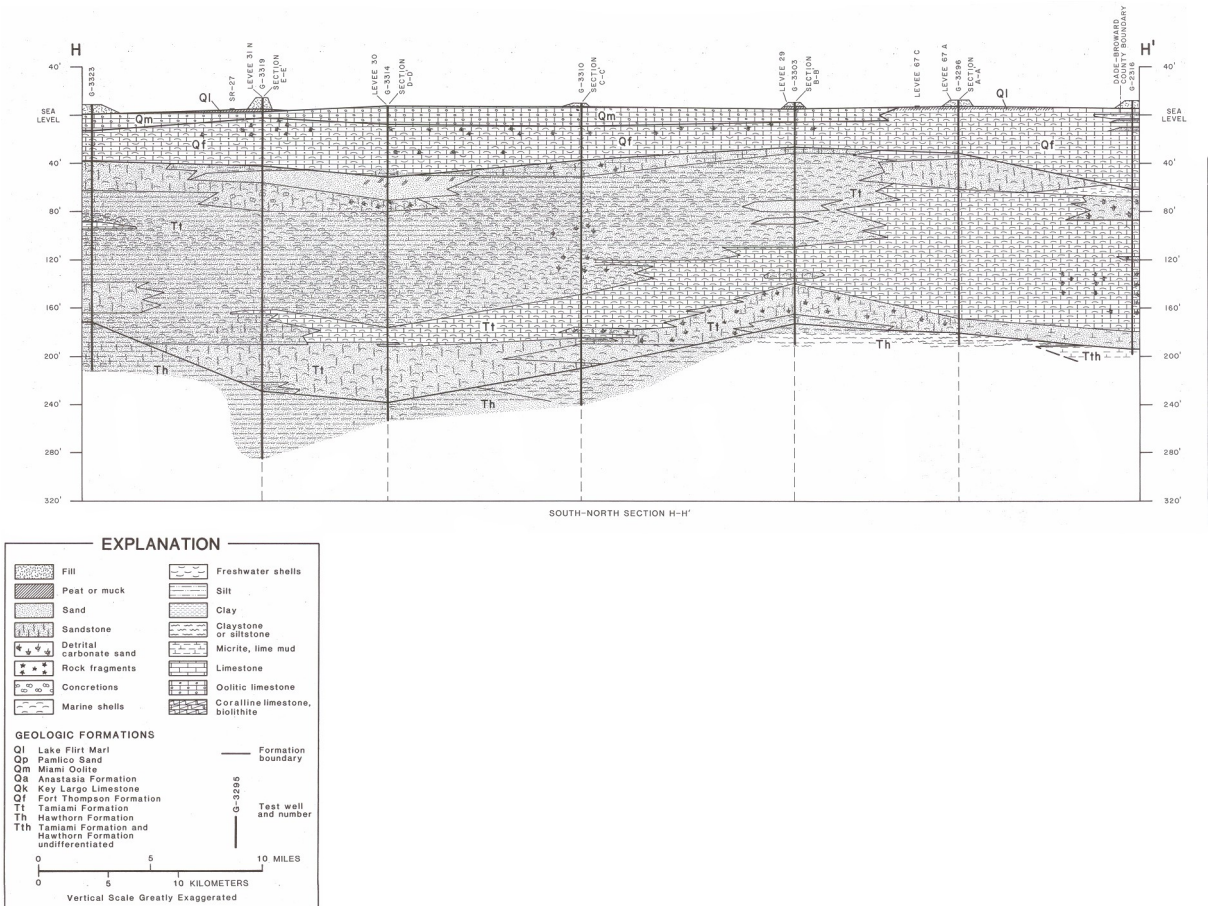
Graphic from source map: Surficial Aquifer System (Dade County). Cross section F-F' on source map.

Cross Section Z1-Z1'



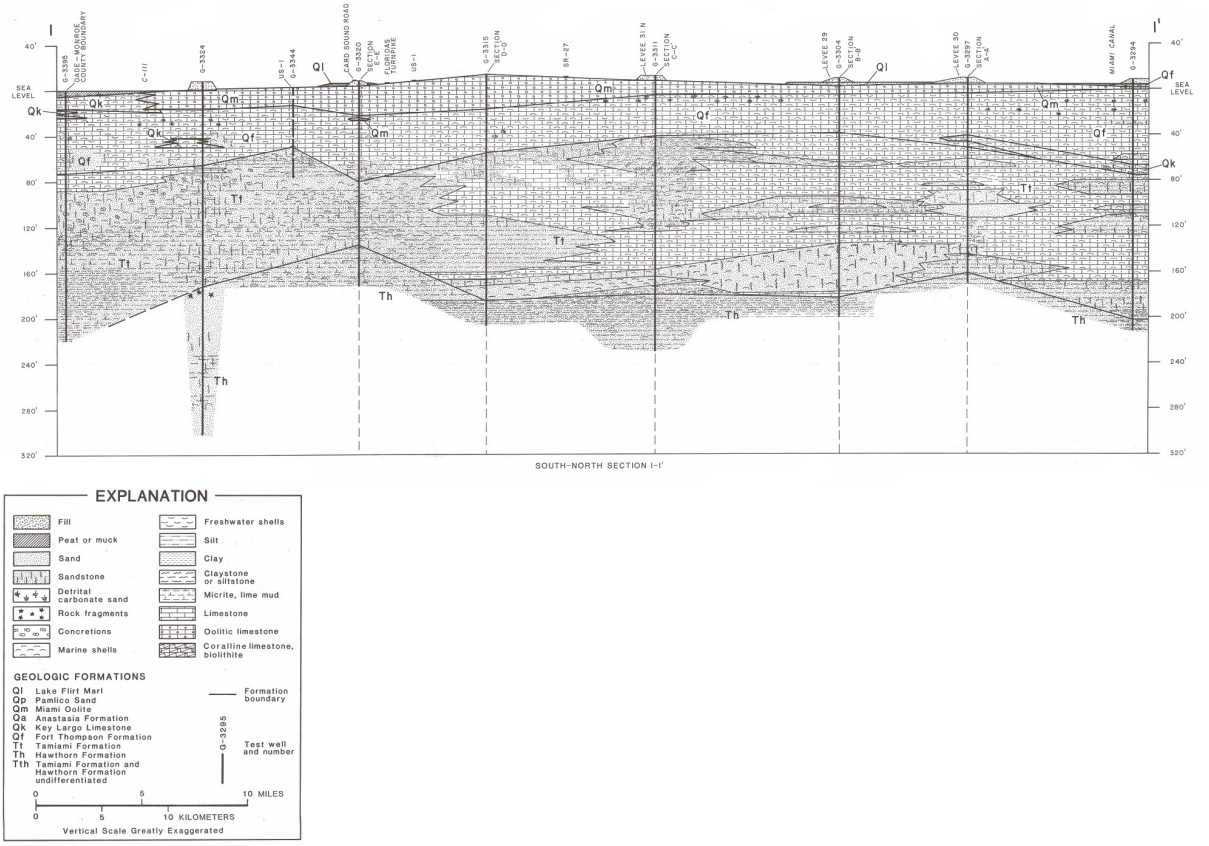
Graphic from source map: Surficial Aquifer System (Dade County). Cross section G-G' on source map.

Cross Section A2-A2'



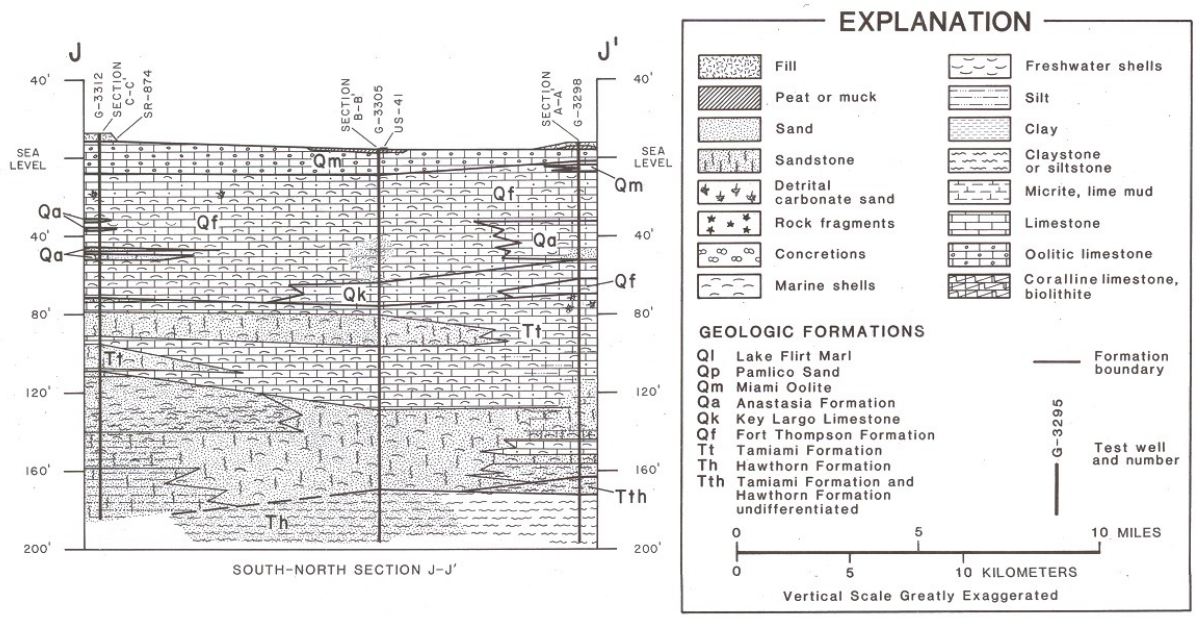
Graphic from source map: Surficial Aquifer System (Dade County). Cross section H-H' on source map.

Cross Section B2-B2'



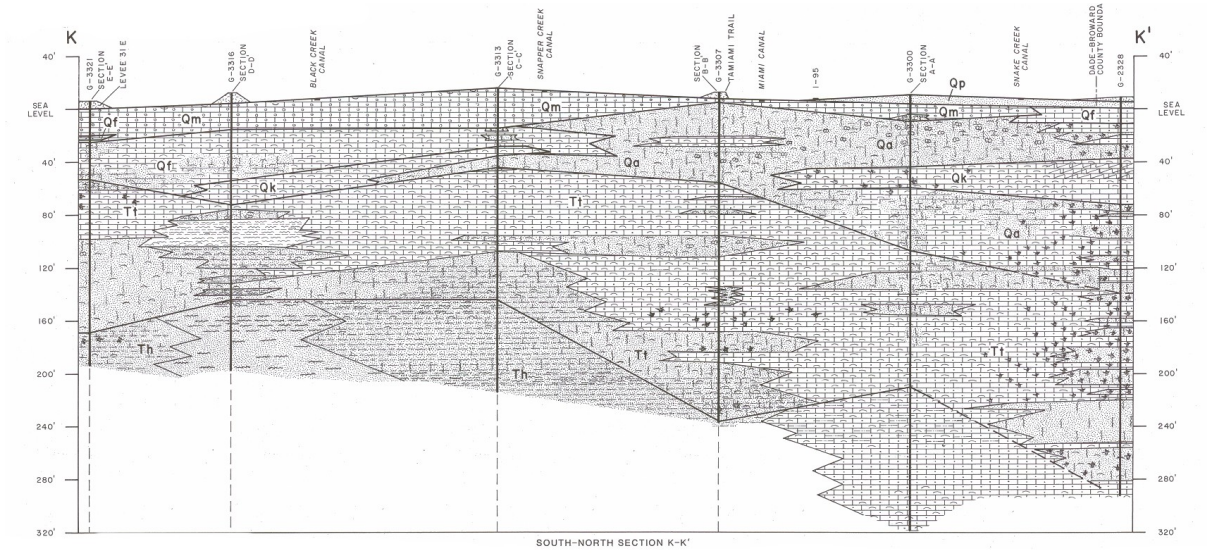
Graphic from source map: Surficial Aquifer System (Dade County). Cross section I-I' on source map.

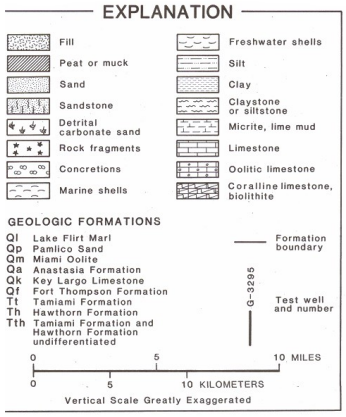
Cross Section C2-C2'



Graphic from source map: Surficial Aquifer System (Dade County). Cross section J-J' on source map.

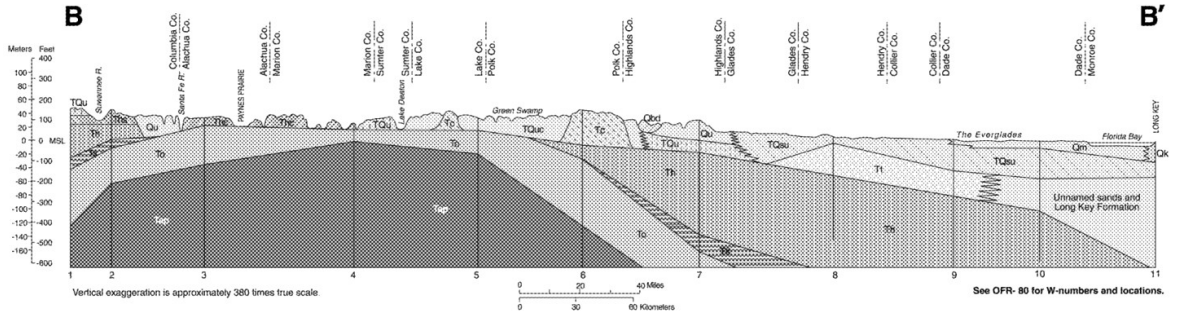
Cross Section D2-D2'





Graphic from source map: Surficial Aquifer System (Dade County). Cross section K-K' on source map.

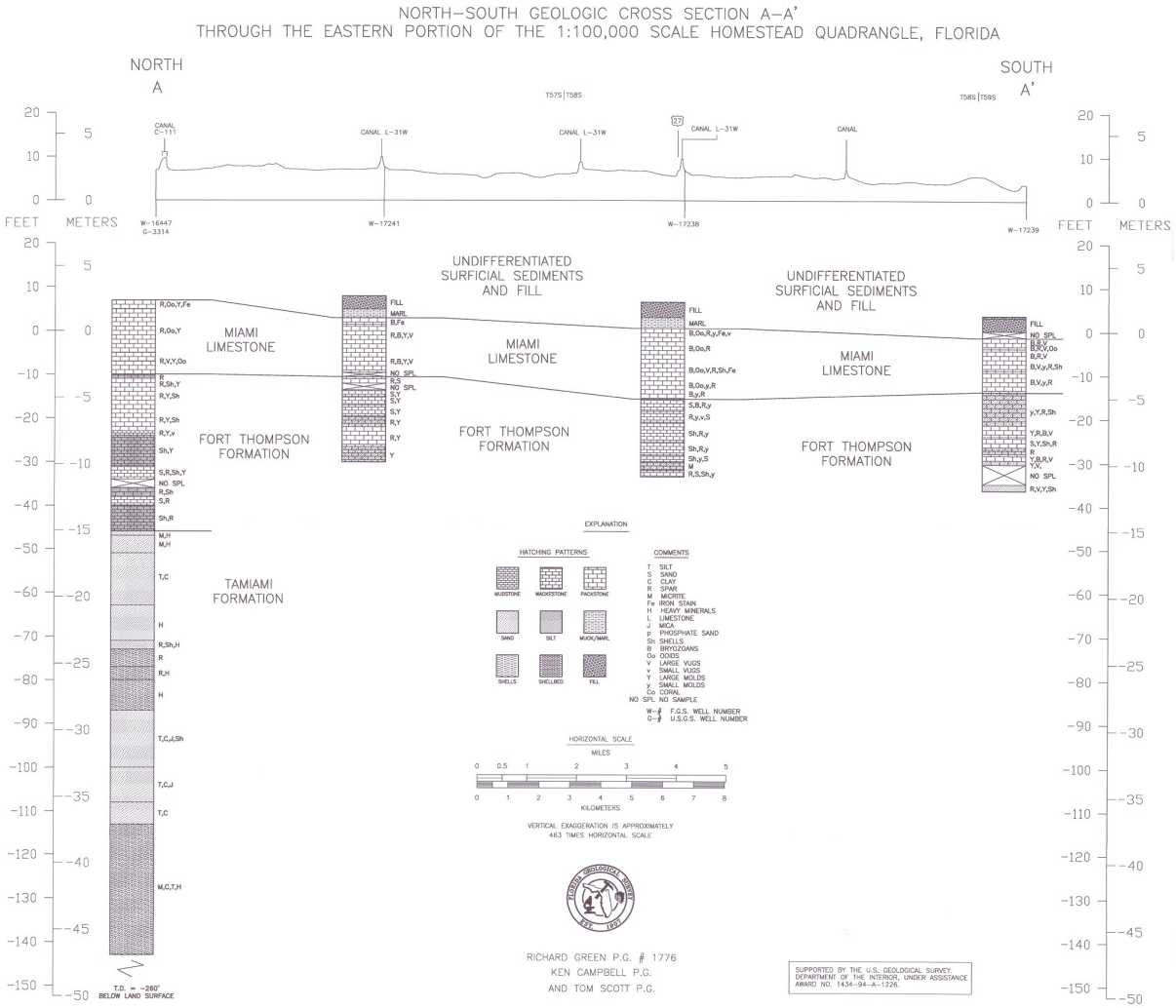
Cross Section E2-E2'



Graphic from source map: Geologic Formations of Florida. Cross section B-B' on source map. Note that a portion of the northern (left) extent of the cross section graphic is outside the extent of the GRI

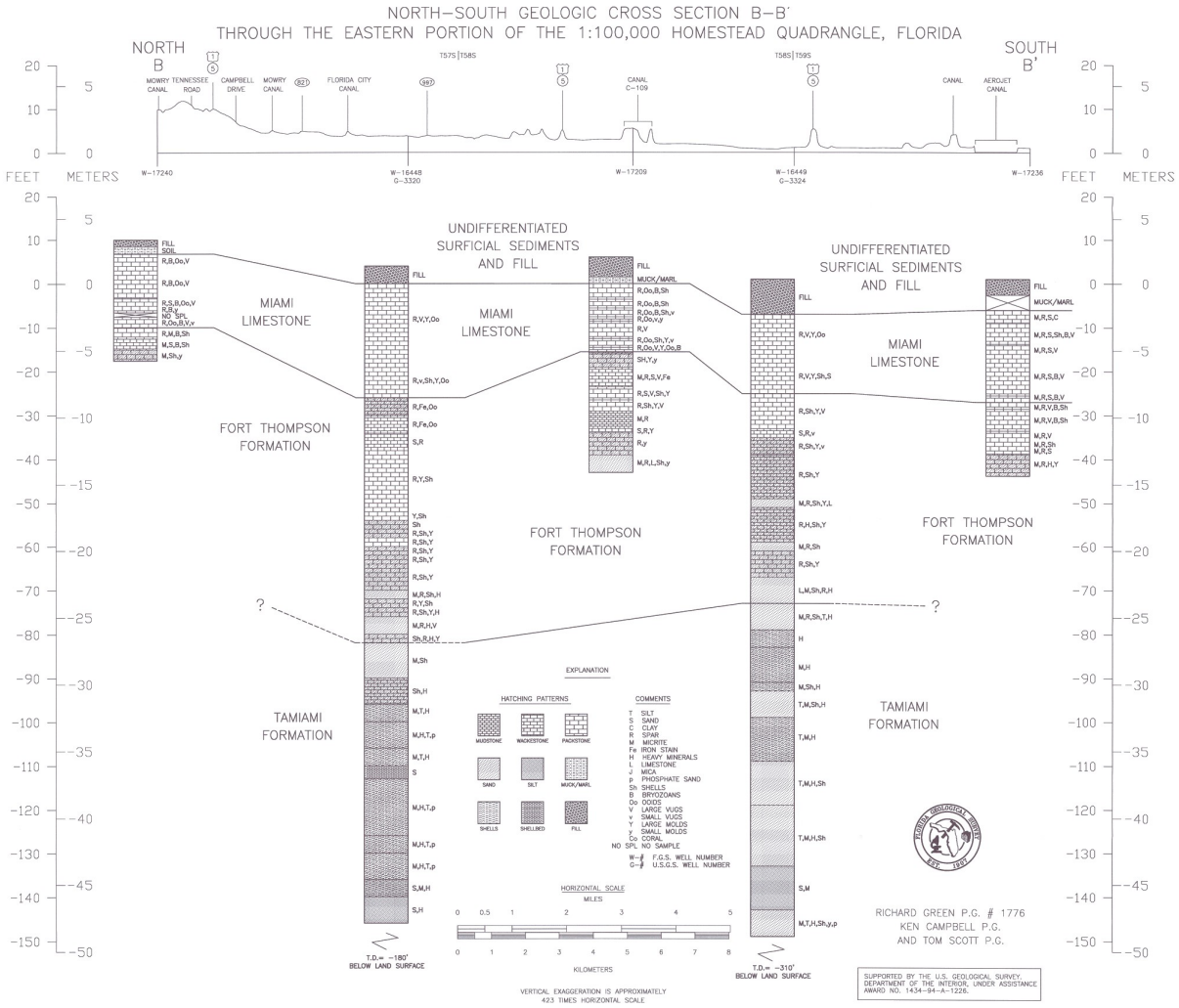
digital geologic-GIS map.

Cross Section F2-F2'



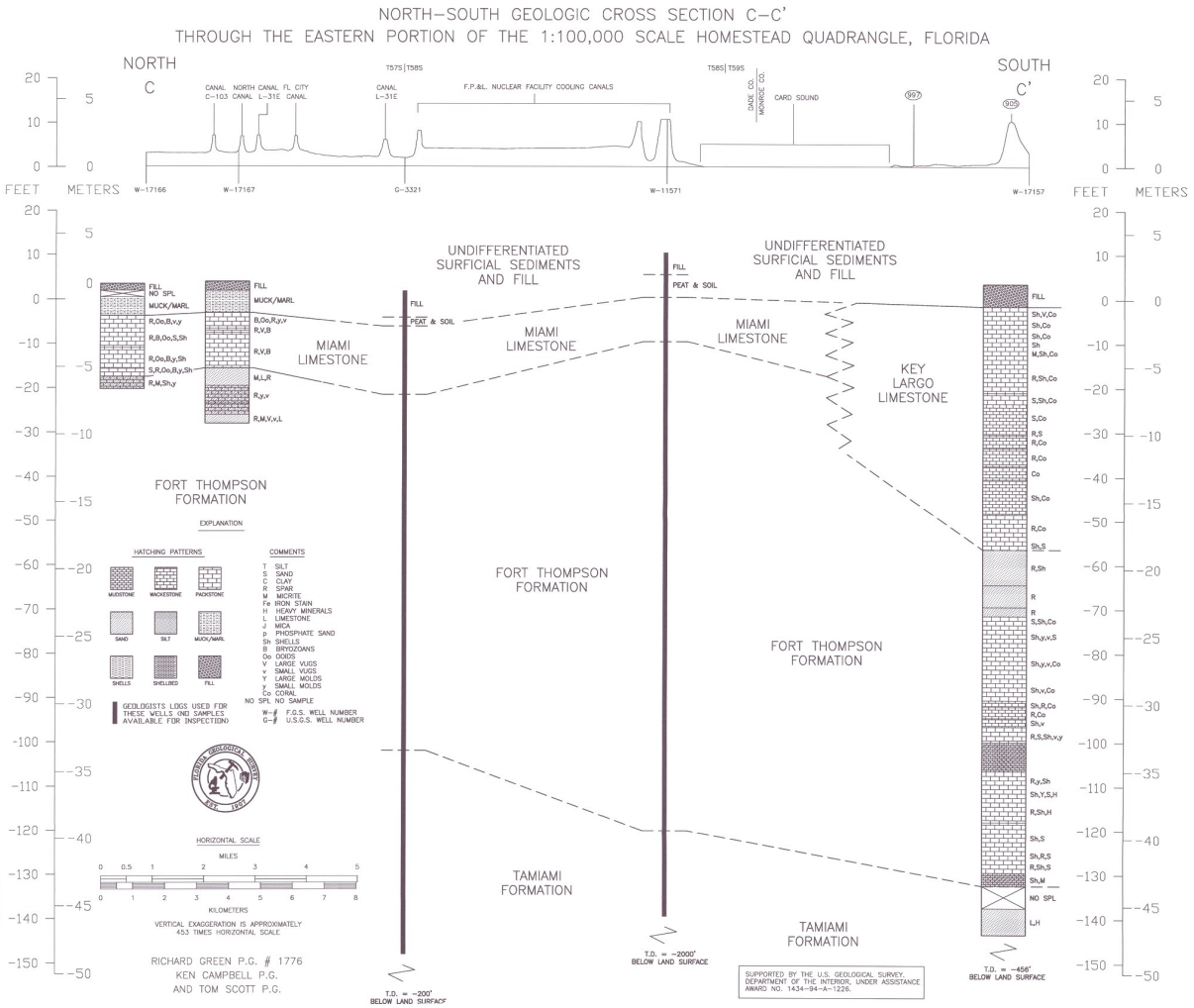
Graphic from source map: Homestead (eastern portion) 1:100,000 scale Quadrangle (Surficial and Bedrock Geology). Cross section A-A' on source map.

Cross Section G2-G2'



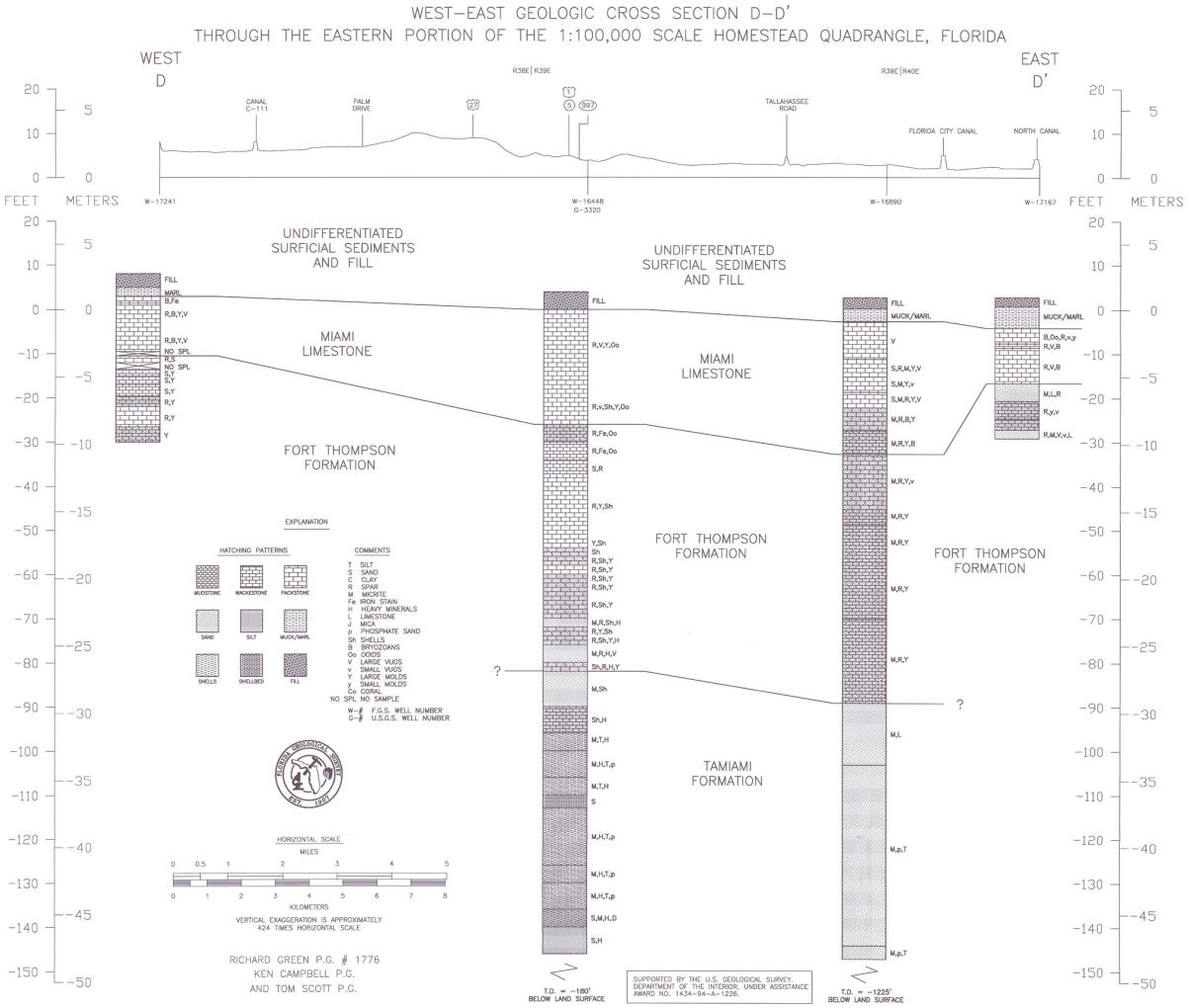
Graphic from source map: Homestead (eastern portion) 1:100,000 scale Quadrangle (Surficial and Bedrock Geology). Cross section B-B' on source map.

Cross Section H2-H2'



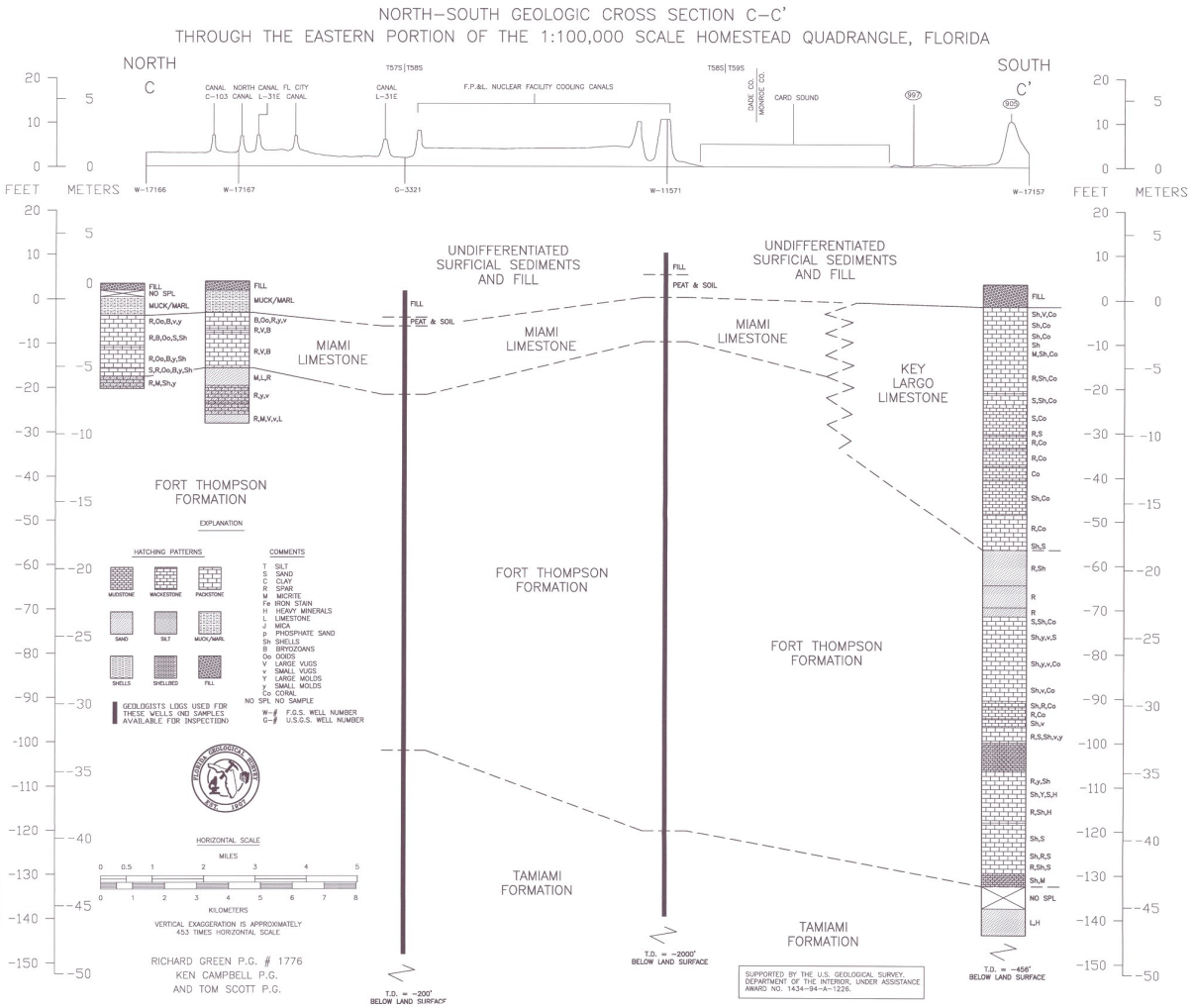
Graphic from source map: Homestead (eastern portion) 1:100,000 scale Quadrangle (Surficial and Bedrock Geology). Cross section C-C' on source map.

Cross Section I2-I2'



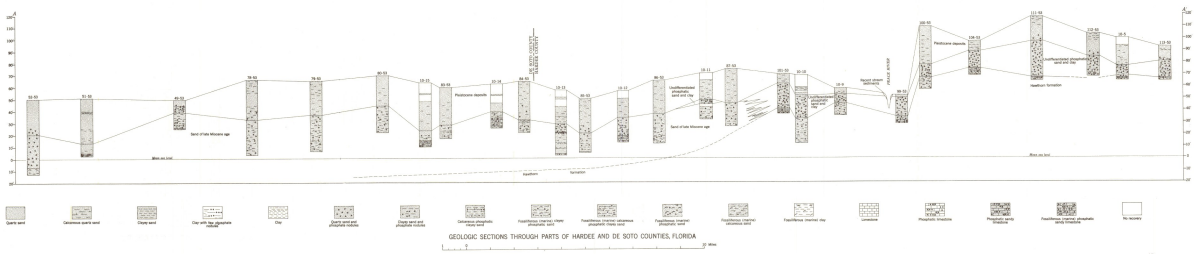
Graphic from source map: Homestead (eastern portion) 1:100,000 scale Quadrangle (Surficial and Bedrock Geology). Cross section D-D' on source map.

Cross Section J2-J2'



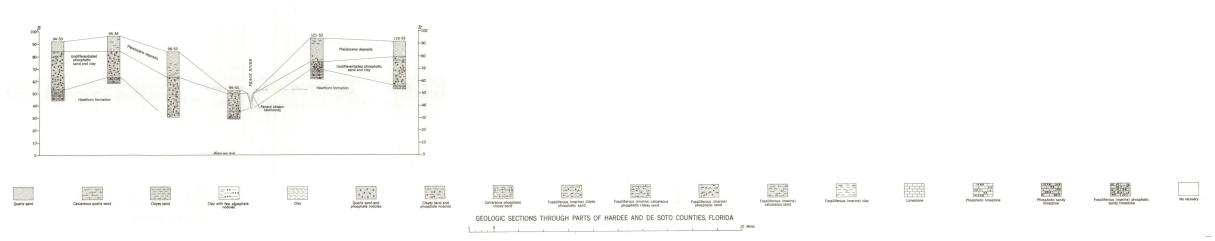
Graphic from source map: Homestead (eastern portion) 1:100,000 scale Quadrangle (Surficial and Bedrock Geology). Cross section E-E' on source map.

Cross Section K2-K2'



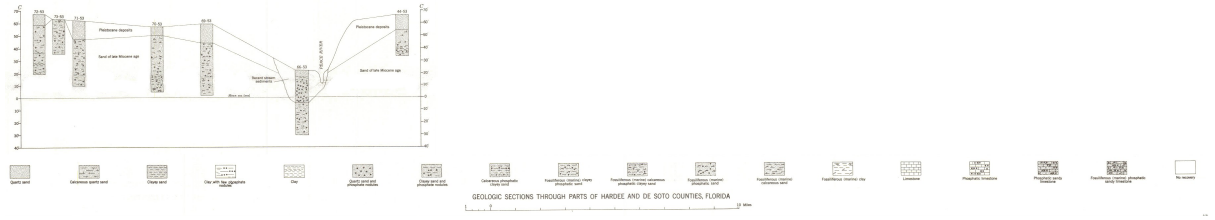
Graphic from source map: parts of De Soto and Hardee Counties (Stratigraphy). Cross section A-A' on source map.

Cross Section L2-L2'



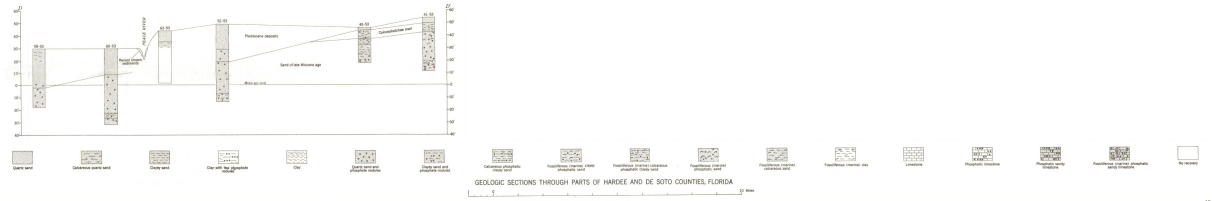
Graphic from source map: parts of De Soto and Hardee Counties (Stratigraphy). Cross section B-B' on source map.

Cross Section M2-M2'



Graphic from source map: parts of De Soto and Hardee Counties (Stratigraphy). Cross section C-C' on source map.

Cross Section N2-N2'



Graphic from source map: parts of De Soto and Hardee Counties (Stratigraphy). Cross section D-D' on source map.

Cross Section O2-O2'

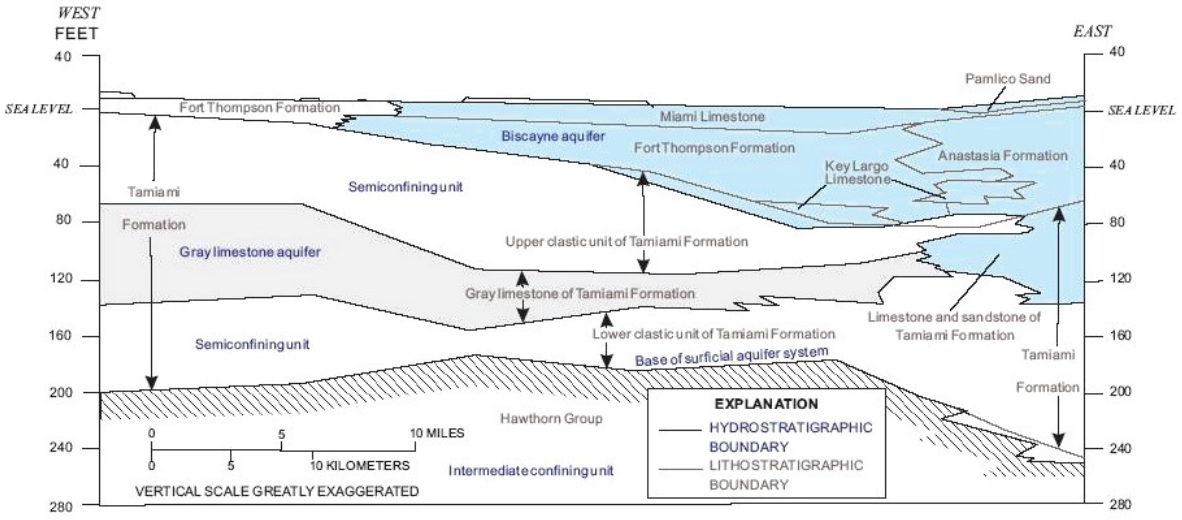


Figure 2. Hydrogeologic section in central Miami-Dade County along Tamiami Trail (modified from Fish and Stewart, 1991, fig. 6b(. Line of section shown in figure 1.

Graphic from source map: Hydrogeology of the Gray Limestone Aquifer. Cross section Fig2 on source map.

Cross Section P2-P2'

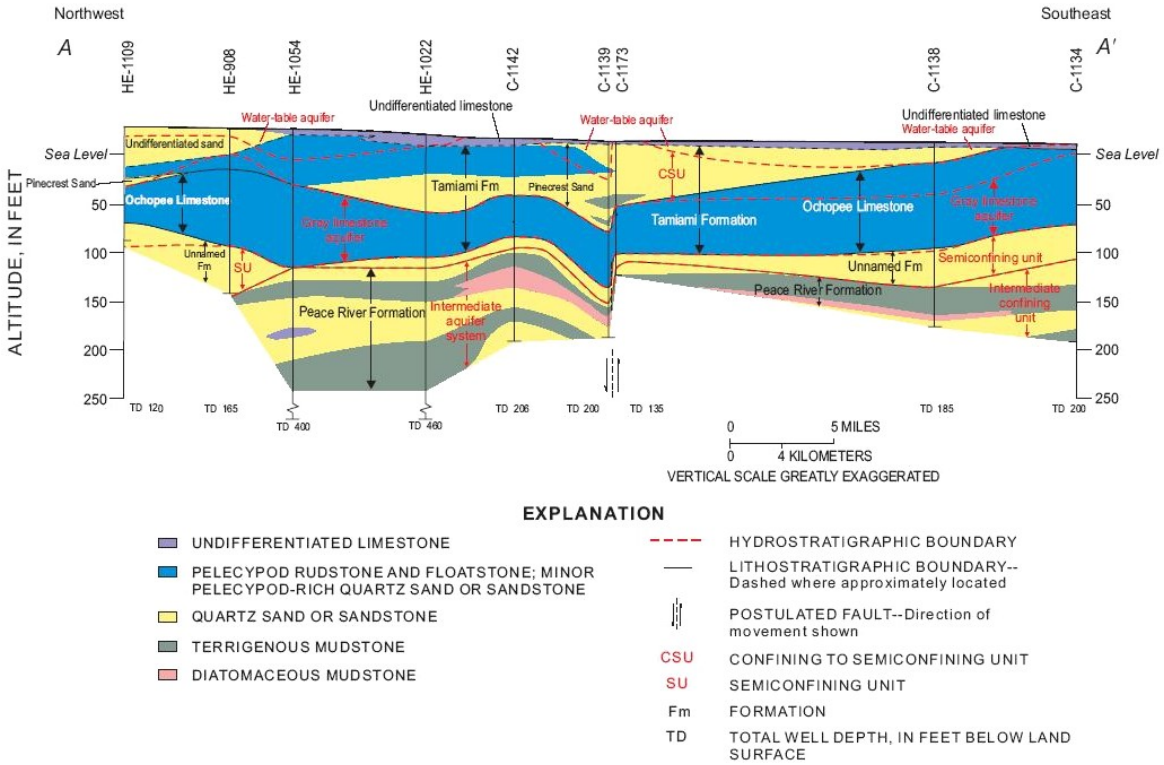


Figure 10. Hydrogeologic section A-A′. Location of section line shown in figure 9.

Graphic from source map: Hydrogeology of the Gray Limestone Aquifer. Cross section A-A' on source map.

Cross Section Q2-Q2'

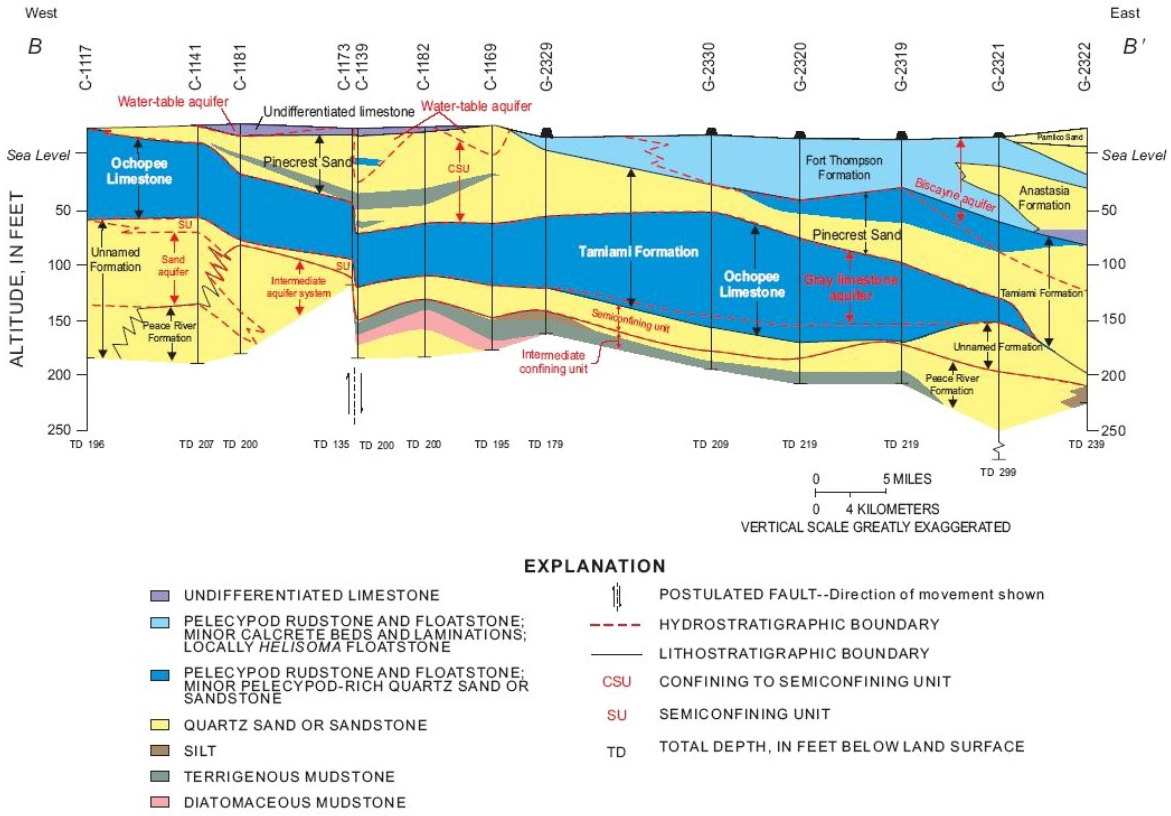


Figure 12. Hydrogeologic section *B-B'*. Location of section line shown in figure 9.

Graphic from source map: Hydrogeology of the Gray Limestone Aquifer. Cross section B-B' on source map.

Cross Section R2-R2'

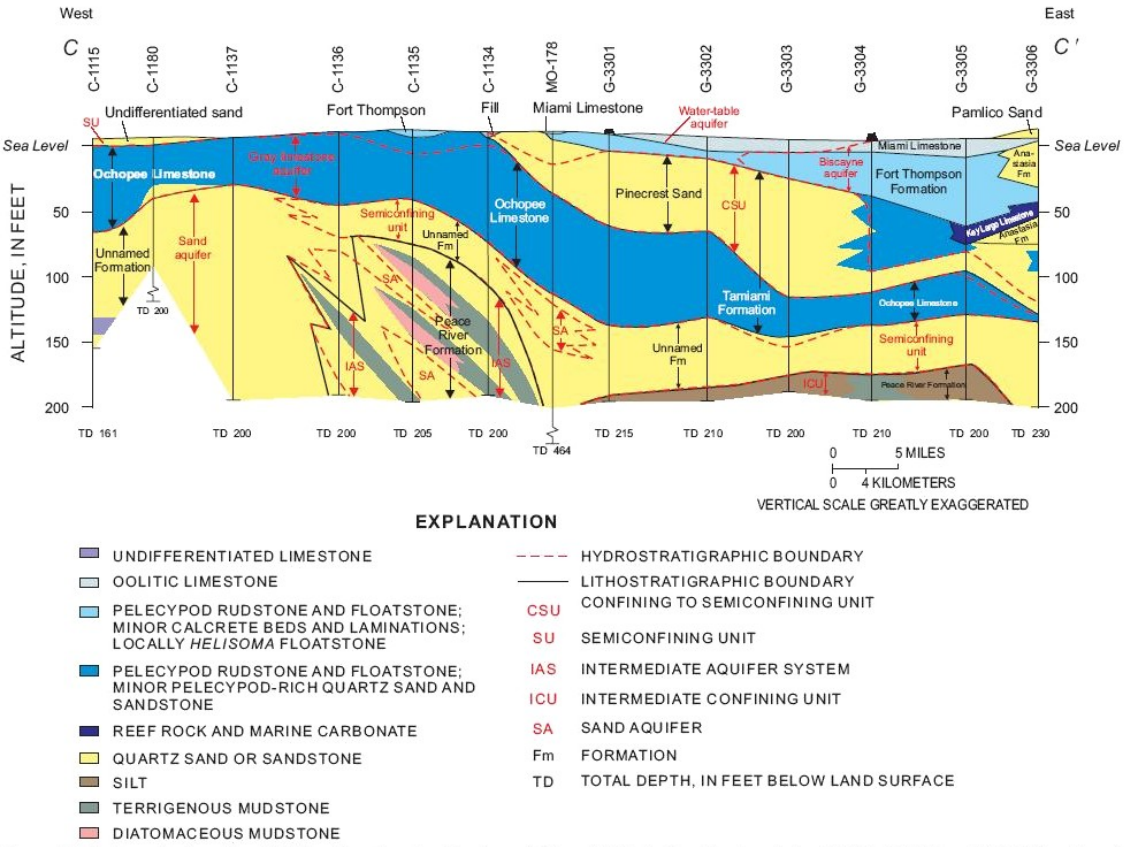


Figure 13. Hydrogeologic section *C-C'*. Location of section line shown in figure 9. Lithologies of test coreholes C-1134, C-1136, and MO-178 are based in part on descriptions from Weedman and others (1999).

Graphic from source map: Hydrogeology of the Gray Limestone Aquifer. Cross section C-C' on source map.

Cross Section S2-S2'

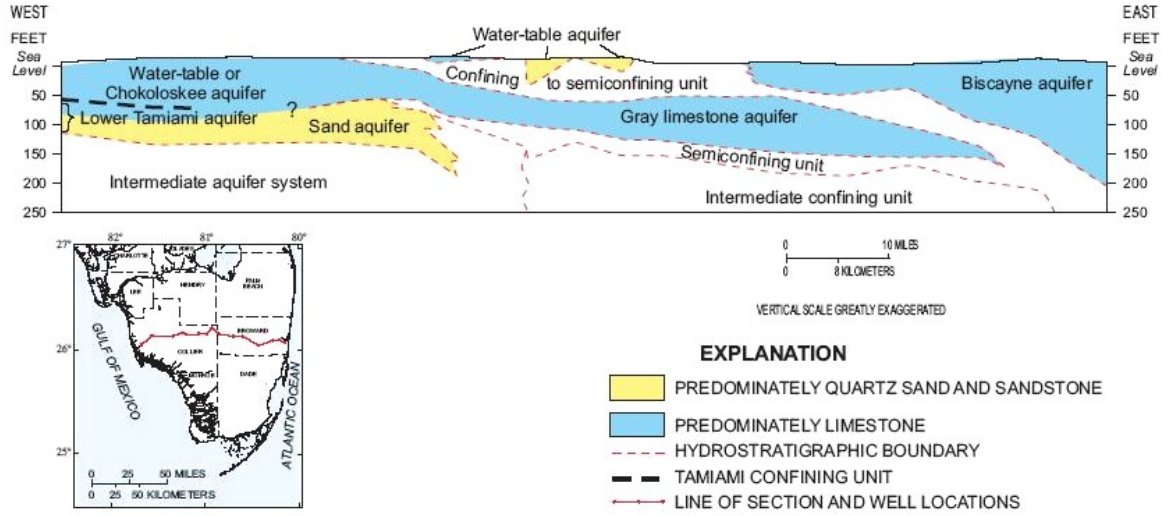


Figure 19. Relations among aquifers and confining units in a coast-to-coast section across the southern peninsula of Florida along Alligator Alley. Section line drawn, from west to east, through the Southern States Utilities and Picayune Strand test wells (Weedman and others, 1997), wells C-1117, C-1141, C-1181, C-1173, C-1139, C-1182, C-1169, G-2329, G-2330, G-2320, G-2319, G-2321, G-2322 (all listed in appendix II), and G-2345 and G-2347 (both listed in Fish, 1988).

Graphic from source map: Hydrogeology of the Gray Limestone Aquifer. Cross section Fig19 on source map.

Digital Benthic Habitat-GIS Map of Florida Bay (1991-1995 Substrate), Florida

The benthic habitat unit listing and descriptions for these units associated with the GRI Digital Benthic Habitat-GIS Map of Florida Bay (1991-1995 Substrate), Florida are presented below.

Benthic Habitat Unit List

The benthic habitat units present in the GRI Digital Benthic Habitat-GIS Map of Florida Bay (1991-1995 Substrate), Florida are listed below. Units are listed with their assigned unit symbol and unit name (e.g., l - Land). No description for water is provided. Information about each benthic habitat unit is also presented in the GRI Benthic Habitat Unit Information (EVERUNIT_benthic_habitat) table included with the GRI digital geologic-GIS data.

Cenozoic Era

Quaternary Period

Holocene Epoch

l - Land
rh - Reef/hardbottom, seagrass
srv - Submersed Aquatic Vegetation (SAV), Submersed Rooted Vascular Plants (SRV), undifferentiated
srvc - Submersed Aquatic Vegetation (SAV), Submersed Rooted Vascular Plants (SRV), Continuous SRV
srvcb - Submersed Aquatic Vegetation (SAV), Submersed Rooted Vascular Plants (SRV), Continuous SRV, bank
srvcd - Submersed Aquatic Vegetation (SAV), Submersed Rooted Vascular Plants (SRV), Continuous SRV, dredged
srvcp - Submersed Aquatic Vegetation (SAV), Submersed Rooted Vascular Plants (SRV), Continuous SRV, Dense patches of SRV in matrix of continuous sparse SRV
srvcpb - Submersed Aquatic Vegetation (SAV), Submersed Rooted Vascular Plants (SRV), Continuous SRV, Dense patches of SRV in matrix of continuous sparse SRV, bank
srvd - Submersed Aquatic Vegetation (SAV), Submersed Rooted Vascular Plants (SRV), Discontinuous SRV
srvdb - Submersed Aquatic Vegetation (SAV), Submersed Rooted Vascular Plants (SRV), Discontinuous SRV, bank
srvdd - Submersed Aquatic Vegetation (SAV), Submersed Rooted Vascular Plants (SRV), Discontinuous SRV, dredged
usm - Unconsolidated sediments, mud
usmb - Unconsolidated sediments, mud, bank
usmd - Unconsolidated sediments, mud, dredged
usmfb - Unconsolidated sediments, mixed fine, bank
usmfs - Unconsolidated sediments, mixed fine, seagrass
uss - Unconsolidated sediments, sand
ussb - Unconsolidated sediments, sand, bank
ubh - Unknown benthic habitat
ubhd - Unknown benthic habitat, dredged
ubhs - Unknown benthic habitat, streams
ubhstc - Unknown benthic habitat, submersed tidal canals

Benthic Habitat Map Unit Descriptions

Descriptions of all benthic habitat map units are presented below. All descriptions were derived from the source map Benthic Habitats of Florida Bay. Additional information concerning benthic habitat map units can be obtained from the source map at: https://www.fisheries.noaa.gov/inport/item/47893.

l - Land

Class: Land
Subclass1: none
Subclass2: none
Subclass3: none
Modifier: none

rh - Reef/hardbottom, seagrass

Class: Reef/Hardbottom
Subclass1: Hardbottom
Subclass2: none
Subclass3: none
Modifier: seagrass

srv - Submersed Aquatic Vegetation (SAV), Submersed Rooted Vascular Plants (SRV), undifferentiated

Class: Submersed Aquatic Vegetation (SAV)
Subclass1: Submersed Rooted Vascular Plants (SRV)
Subclass2: none
Subclass3: none
Modifier: none

srvc - Submersed Aquatic Vegetation (SAV), Submersed Rooted Vascular Plants (SRV), Continuous SRV

Class: Submersed Aquatic Vegetation (SAV)
Subclass1: Submersed Rooted Vascular Plants (SRV)
Subclass2: Continuous SRV
Subclass3: none
Modifier: none

srvcb - Submersed Aquatic Vegetation (SAV), Submersed Rooted Vascular Plants (SRV), Continuous SRV, bank

Class: Submersed Aquatic Vegetation (SAV)
Subclass1: Submersed Rooted Vascular Plants (SRV)
Subclass2: Continuous SRV
Subclass3: none
Modifier: bank

srvcd - Submersed Aquatic Vegetation (SAV), Submersed Rooted Vascular Plants (SRV), Continuous SRV, dredged

Class: Submersed Aquatic Vegetation (SAV)
Subclass1: Submersed Rooted Vascular Plants (SRV)
Subclass2: Continuous SRV
Subclass3: none
Modifier: dredged

srvcp - Submersed Aquatic Vegetation (SAV), Submersed Rooted Vascular Plants (SRV), Continuous SRV, Dense patches of SRV in matrix of continuous sparse SRV

Class: Submersed Aquatic Vegetation (SAV)
Subclass1: Submersed Rooted Vascular Plants (SRV)
Subclass2: Continuous SRV
Subclass3: Dense patches of SRV in matrix of continuous sparse SRV
Modifier: none

srvcpb - Submersed Aquatic Vegetation (SAV), Submersed Rooted Vascular Plants (SRV), Continuous SRV, Dense patches of SRV in matrix of continuous sparse SRV, bank

Class: Submersed Aquatic Vegetation (SAV)
Subclass1: Submersed Rooted Vascular Plants (SRV)
Subclass2: Continuous SRV
Subclass3: Dense patches of SRV in matrix of continuous sparse SRV
Modifier: bank

srvd - Submersed Aquatic Vegetation (SAV), Submersed Rooted Vascular Plants (SRV), Discontinuous SRV

Class: Submersed Aquatic Vegetation (SAV)
Subclass1: Submersed Rooted Vascular Plants (SRV)
Subclass2: Discontinuous SRV
Subclass3: none
Modifier: none

srvdb - Submersed Aquatic Vegetation (SAV), Submersed Rooted Vascular Plants (SRV), Discontinuous SRV, bank

Class: Submersed Aquatic Vegetation (SAV)
Subclass1: Submersed Rooted Vascular Plants (SRV)
Subclass2: Discontinuous SRV
Subclass3: none
Modifier: bank

srvdd - Submersed Aquatic Vegetation (SAV), Submersed Rooted Vascular Plants (SRV), Discontinuous SRV, dredged

Class: Submersed Aquatic Vegetation (SAV)
Subclass1: Submersed Rooted Vascular Plants (SRV)
Subclass2: Discontinuous SRV
Subclass3: none
Modifier: dredged

usm - Unconsolidated sediments, mud

Class: Unconsolidated Sediments
Subclass1: Mud
Subclass2: none
Subclass3: none
Modifier: none

usmb - Unconsolidated sediments, mud, bank

Class: Unconsolidated Sediments
Subclass1: Mud
Subclass2: none
Subclass3: none
Modifier: bank

usmd - Unconsolidated sediments, mud, dredged

Class: Unconsolidated Sediments
Subclass1: Mud
Subclass2: none
Subclass3: none
Modifier: dredged

usmfb - Unconsolidated sediments, mixed fine, bank

Class: Unconsolidated Sediments
Subclass1: Mixed Fine
Subclass2: none
Subclass3: none
Modifier: bank

usmfs - Unconsolidated sediments, mixed fine, seagrass

Class: Unconsolidated Sediments
Subclass1: Mixed Fine
Subclass2: none
Subclass3: none
Modifier: seagrass

uss - Unconsolidated sediments, sand

Class: Unconsolidated Sediments
Subclass1: Sand
Subclass2: none
Subclass3: none
Modifier: none

ussb - Unconsolidated sediments, sand, bank

Class: Unconsolidated Sediments
Subclass1: Sand
Subclass2: none
Subclass3: none
Modifier: bank

ubh - Unknown benthic habitat

Class: Unknown benthic habitat
Subclass1: none
Subclass2: none
Subclass3: none
Modifier: none

ubhd - Unknown benthic habitat, dredged

Class: Unknown benthic habitat
Subclass1: none
Subclass2: none
Subclass3: none
Modifier: dredged

ubhs - Unknown benthic habitat, streams

Class: Unknown benthic habitat
Subclass1: none
Subclass2: none
Subclass3: none
Modifier: streams

ubhstc - Unknown benthic habitat, submersed tidal canals

Class: Unknown benthic habitat
Subclass1: none
Subclass2: none
Subclass3: none
Modifier: submersed tidal canals

Ancillary Source Map Information

The following sections present ancillary source map information associated with sources used for this project. Information and graphics directly relevant to features present in the GRI digital geologic-GIS data are presented. Each source map's publication site, as well as its site on the National Geologic Map Database (NGMDB) site, if available, is also presented.

Arcadia (eastern portion) 1:100,000 scale Quadrangle (Surficial and Bedrock Geology)

The formal citation for this source.

> Green, R., et al., 1999, Surficial and Bedrock Geology of the eastern portion of the USGS 1:100,000 scale Arcadia Quadrangle, south-central Florida: Florida Geological Survey, Open File Map Series 88, scale 1:100,000. (*GRI Source Map ID 3049*).

The source map can be accessed from the following site: https://ufdc.ufl.edu/UF00099553/00001/1x. Images associated with the source map are also available at: https://ngmdb.usgs.gov/Prodesc/proddesc_31327.htm

Benthic Habitats of Florida Bay

The formal citation for this source.

> Florida Fish and Wildlife Commission Florida Marine Research Center, 1999, Benthic Habitats of Florida Bay, Florida 1991-1995, CD-ROM: National Oceanic and Atmospheric Administration Coastal Services Center, unpublished digital data, scale 1:48,000 (*GRI Source Map ID 5046*).

The source map can be accessed from the following site: https://www.fisheries.noaa.gov/inport/item/47893

Florida Aquifer Vulnerability Assessment (2005)

The formal citation for this source.

> Arthur, J.D., Baker, A.E., Cichon, J.R., Wood, A.R., and Rudin, A., 2005, Florida Aquifer Vulnerability Assessment (FAVA): Contamination Potential of Florida's Principal Aquifer Systems: Florida Geological Survey, Bulletin [in review], scale 1:24,000 (*GRI Source Map ID 6921*).

The source map can be accessed from the following site: http://ufdcimages.uflib.ufl.edu/UF/00/09/91/61/00001/FAVA_REPORT_MASTER_DOC_3-21-05.pdf. This source served as the source map for the GRI Digital Geohazards-GIS Map of Everglades National Park and Vicinity (2005 Mapping), Florida.

Geologic Formations of Florida

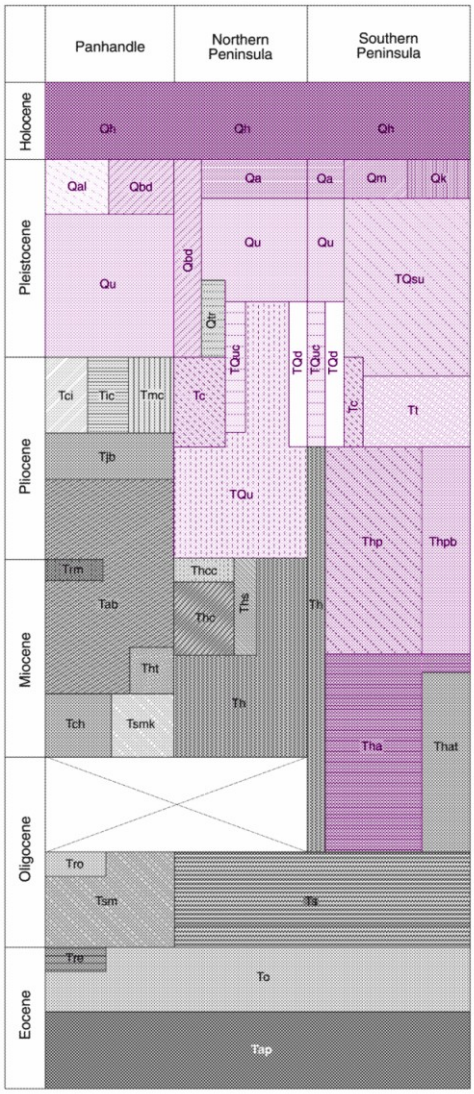
The formal citation for this source.

Scott, Thomas M., 2001, Geologic Formations of Florida (digital): Florida Geological Survey, Open-File Report 80, scale 1:126,720 (*GRI Source Map ID 3682*).

Related text and graphics, including the unit descriptions derived for this source map, can be accessed from the following site: https://ufdc.ufl.edu/UF00094041/00001

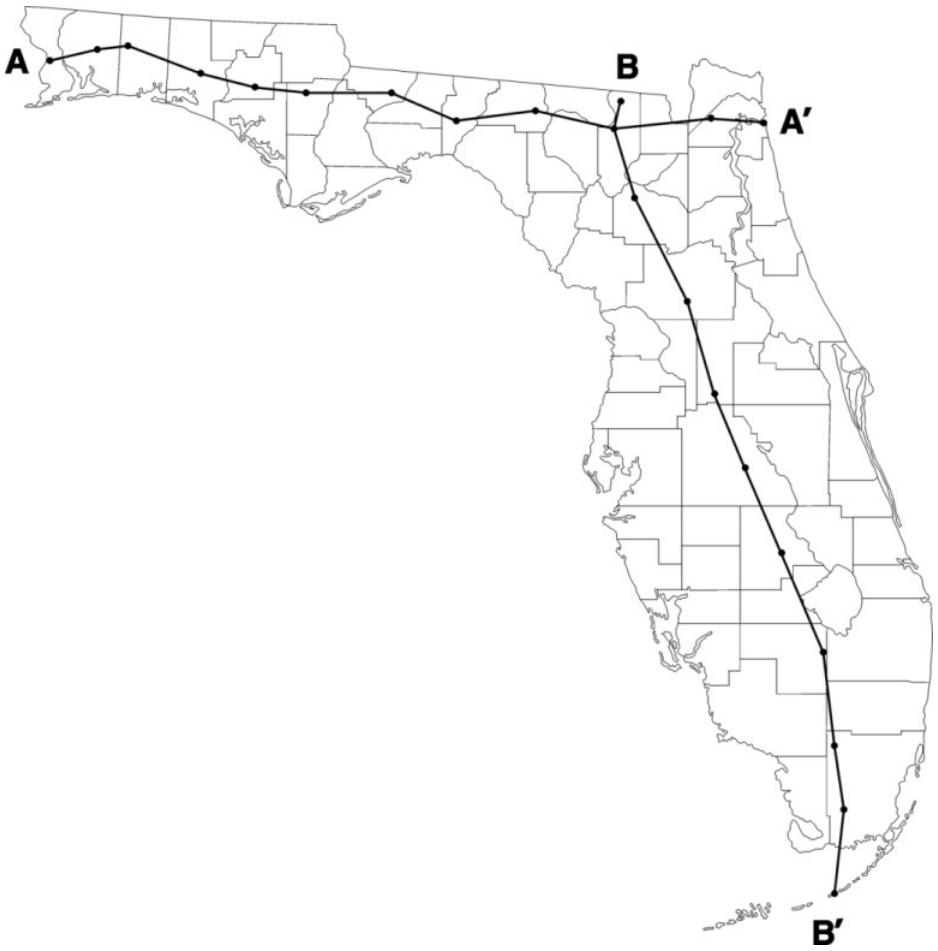
Prominent graphics associated with this source.

Stratigraphic Section



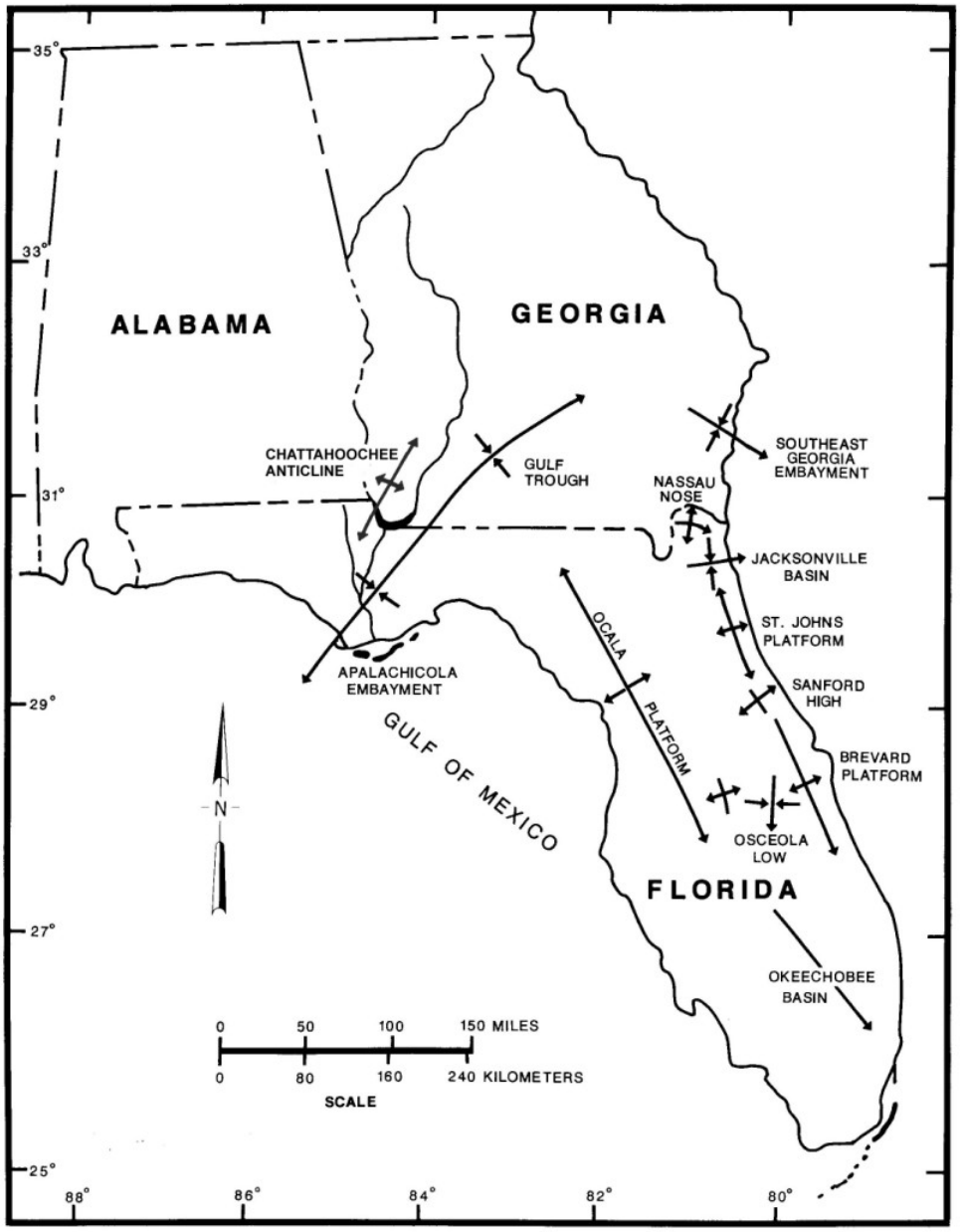
Graphic from source map: Geologic Formations of Florida. Southern peninsula units are those found in the extent of the GRI digital geologic-GIS map.

Section Lines



Graphic from source map: Geologic Formations of Florida. Only cross section B-B' is within the extent of the GRI digital geologic-GIS data. The B-B' cross section graphic, E2-E2' in the GRI digital geologic-GIS data, is presented at E2-E2' (Geologic Cross Sections section) of this document.

Figure 4: Geologic structures in Florida (modified from Scott, 1988).



Graphic from source map: Geologic Formations of Florida

Homestead (eastern portion) 1:100,000 scale Quadrangle (Surficial and Bedrock Geology)

The formal citation for this source.

> Green, Richard, Campbell, Ken, and Scott, Tom, 1995, Surficial and Bedrock Geology of the eastern portion of the USGS 1:100,000 scale Homestead Quadrangle: Florida Geological Survey, Open File Map Series 83/01-07, scale 1:100,000. (*GRI Source Map ID 4983*).

The source map can be accessed from the following site: https://ufdc.ufl.edu/UF00099543/00001. Images associated with the source map are also available at: https://ngmdb.usgs.gov/Prodesc/proddesc_31330.htm

Homestead (western portion) 1:100,000 scale Quadrangle (Surficial and Bedrock Geology)

The formal citation for this source.

> Green, Richard, Campbell, Ken, and Scott, Tom, 1996, Surficial and Bedrock Geology of the western portion of the USGS 1:100,000 scale Homestead Quadrangle: Florida Geological Survey, Open File Map Series 83/08-12, scale 1:100,000. (*GRI Source Map ID 2424*).

The source map can be accessed from the following site: https://ufdc.ufl.edu/UF00099544/00001. Images associated with the source map are also available at: https://ngmdb.usgs.gov/Prodesc/proddesc_31329.htm

Hydrogeology of the Gray Limestone Aquifer

The formal citation for this source.

> Reese, R.S., and Cunningham, K.J., 2000, Hydrogeology of the Gray Limestone Aquifer in southern Florida: U.S. Geological Survey, Water-Resources Investigations Report 99-4213, scale 1:675,000 (*GRI Source Map ID 5320*).

The source map can be accessed from the following site: https://pubs.er.usgs.gov/publication/wri994213

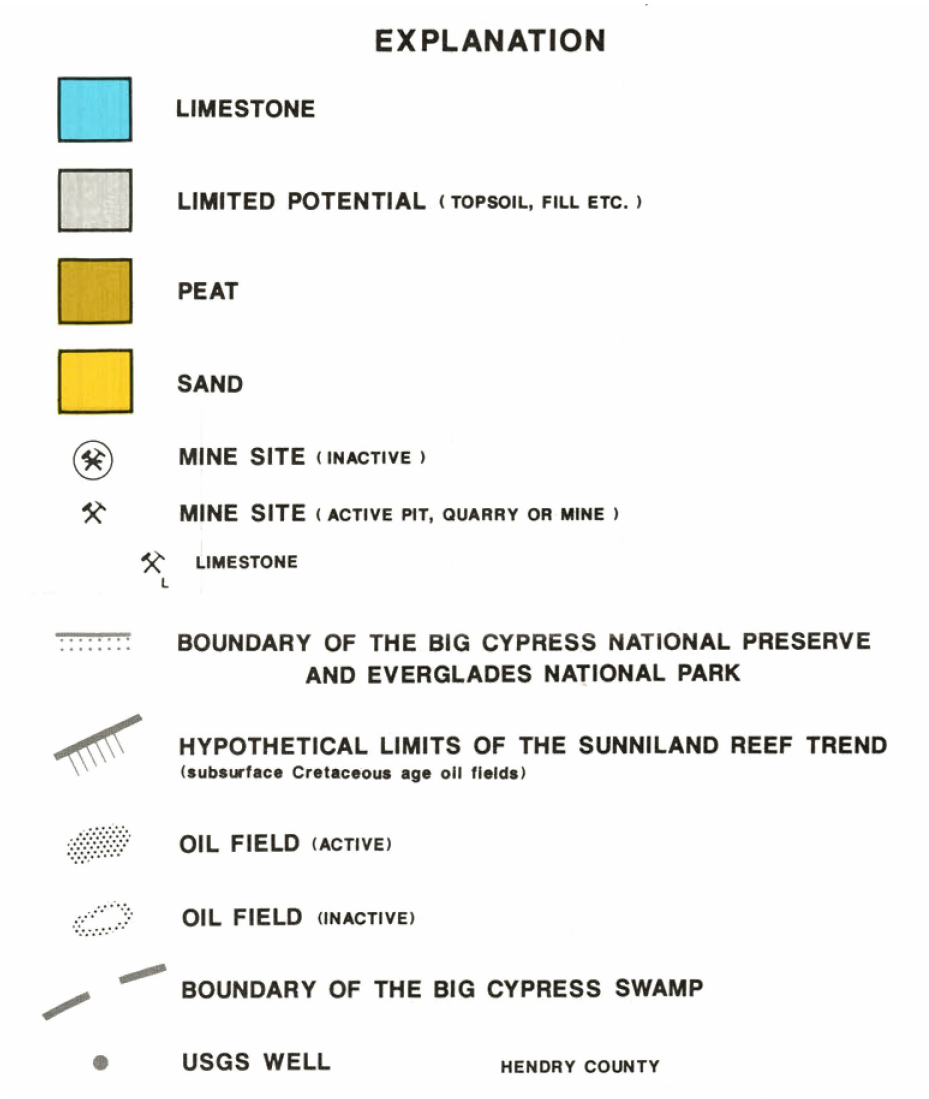
Mineral Resources (Collier County)

The formal citation for this source.

> Yon, J.W., Spencer, S.M., Hoenstine, R.W., and Lane, Ed, 1988, Mineral Resources of Collier County, Florida: Florida Geological Survey, Map Series 120, scale 1:126,720 (*GRI Source Map ID 3063*).

The source map can be accessed from the following site: https://ufdc.ufl.edu/UF90000372/00001

Explanation



Graphic from source map: Mineral Resources (Collier County). Only mine sites and wells were captured in the GRI digital geologic-GIS data.

Mineral Resources (Lee County)

The formal citation for this source.

Lane, Ed, Scott, T.M., Hoenstine, R.W., and Yon, J.W., 1990, Mineral Resources of Lee County, Florida: Florida Geological Survey, Map Series 130, scale 1:126,720 (*GRI Source Map ID 5003*).

The source map can be accessed from the following site: https://ufdc.ufl.edu/UF00015038/00001

Explanation



Graphic from source map: Mineral Resources (Lee County). Only mine sites and quarries were captured in the GRI digital geologic-GIS data.

Parts of De Soto and Hardee Counties (Stratigraphy)

The formal citation for this source.

> Bergendahl, M.H., 1956, Stratigraphy of parts of De Soto and Hardee Counties, Florida: U.S. Geological Survey, Bulletin 1030-B, 4 sheets, scale 1:158,400 (*GRI Source Map ID 5014*).

The source map can be accessed from the following site: https://pubs.er.usgs.gov/publication/b1030B

Sarasota (eastern portion) and Arcadia (western portion) 1:100,000 scale Quadrangles (Surficial and Bedrock Geology)

The formal citation for this source.

> Green, R., et al., 1998, Surficial and Bedrock Geology of the eastern portion of the USGS 1:100,000 scale Sarasota Quadrangle and the western portion of the Arcadia Quadrangle: Florida Geological Survey, Open File Map Series 87, scale 1:100,000. (*GRI Source Map ID 3048*).

The source map can be accessed from the following site: https://ufdc.ufl.edu/UF00099546/00001. Images associated with the source map are also available at: https://ngmdb.usgs.gov/Prodesc/proddesc_31327.htm

Sarasota (western portion) 1:100,000 scale Quadrangle (Surficial and Bedrock Geology)

The formal citation for this source.

> Green, R., et al., 1997, Surficial and Bedrock Geology of the western portion of the USGS 1:100,000 scale Sarasota Quadrangle, south-central Florida: Florida Geological Survey, Open File Map Series 86, scale 1:100,000. (*GRI Source Map ID 3050*).

The source map can be accessed from the following site: https://ufdc.ufl.edu/UF00099545/00001. Images associated with the source map are also available at: https://ngmdb.usgs.gov/Prodesc/proddesc_31328.htm

Sarasota and Arcadia 30' x 60' Quadrangles

The formal citation for this source.

> McCartan, Lucy and Moy, Wai-See, 1995, Geologic Maps of the Sarasota and Arcadia, Florida 30 x 60-minute Quadrangles: U.S. Geological Survey, Open-File Report OF-95-261, 6 sheets, scale 1:100,000 (*GRI Source Map ID 3051*).

The source map can be accessed from the following site: https://pubs.er.usgs.gov/publication/ofr95261 Images associated with the source map are also available at: https://ngmdb.usgs.gov/Prodesc/proddesc_40301.htm

Surficial Aquifer System (Broward County)

The formal citation for this source.

> Causaras, C.R., 1985, Geology of the Surficial Aquifer System, Broward County, Florida: U.S. Geological Survey, Water-Resources Investigations Report 84, 2 sheets, scale 1:134,000 (*GRI Source Map ID 3055*).

The source map can be accessed from the following site: https://pubs.er.usgs.gov/publication/wri844068. Images associated with the source map are also available at: https://ngmdb.usgs.gov/Prodesc/proddesc_35964.htm

Surficial Aquifer System (Dade County)

The formal citation for this source.

> Causaras, C.R., 1986, Geology of the Surficial Aquifer System, Dade County, Florida: U.S. Geological Survey, Water-Resources Investigations Report 86, scale 1:136,000 (*GRI Source Map ID 3056*).

The source map can be accessed from the following site: https://pubs.er.usgs.gov/publication/wri864126. Images associated with the source map are also available at: https://ngmdb.usgs.gov/Prodesc/proddesc_36566.htm

GRI Digital Data Credits

This document was developed and completed by Stephanie O'Meara (Colorado State University) for the NPS Geologic Resources Division (GRD) Geologic Resources Inventory (GRI) Program. Quality control of this document by Ron Karpilo (Colorado State University).

The information in this document was compiled from GRI source maps and is intended to accompany the digital geologic-GIS maps and other digital data for Everglades National Park, Florida (EVER) developed by Stephanie O'Meara (see the GRI Digital Maps and Source Map Citations section of this document for all sources used by the GRI in the completion of this document and related GRI digital geologic-GIS maps). Initial GRI digital geologic-GIS data was produced by Anne Poole (NPS GRD) and Heather Stanton (Colorado State University).

GRI finalization by Stephanie O'Meara.

GRI program coordination and scoping provided by Bruce Heise, Jason Kenworthy and Tim Connors (NPS GRD, Lakewood, Colorado).