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THE GEOMORPHOLOGY AND GEOLOGY OF TAYLOR COUNTY, FLORIDA

BY

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The geomorphology and geology of Taylor County, Florida

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GEOMORPHOLOGY

Taylor County is situated in Florida's Big Bend area, lying wholly within a broad geomorphic subdivision named the Gulf Coastal Lowlands (White, 1970). The Gulf Coastal Lowlands are characterized as a low, flat, frequently swampy, seaward-sloping plain with surface slope ranging between 1 and 5 feet per mile seaward. The maximum land surface elevation attained is about 100 feet above mean sea level (msl) along the Taylor/Madison County line in the northern portion of the county. Limestone and dolostone, covered by a veneer of unconsolidated sand, form the near-surface bedrock in most of the county. Similar terrain has been named the Limestone Shelf and Hammocks in neighboring Dixie County by Puri et al. (1967), and is called the Woodville Karst Plain to the west in adjacent Jefferson County (Yon, 1966).

The irregular, highly karstic Oligocene and Eocene carbonates underlying this area are masked by a blanket of undifferentiated Pleistocene sand. Near the coast, the undifferentiated sands are thin to absent. West of Perry, in the San Pedro Bay region, these sands may attain thicknesses of nearly 80 feet and contain enough clay to function as local aquitards to the underlying Floridan aquifer system. The top of the underlying carbonate bedrock rises gently from approximately sea level at the coast to an elevation of approximately 60 feet above msl in the northeastern corner of the county (Alison and Rupert, 1996). Commercial forest and agricultural lands comprise much of the region. Near the coast, the karst plain merges seaward into the coastal marshes, and continues offshore as a broad, sand-covered, continental shelf. Small artesian springs flow from the near surface limestone, and during periods of heavy rainfall, portions of the karst plain may flood to form a shallow swamp. Drainage from the coastal hammocks is sluggish, and occurs through a number of small creeks and sloughs, which empty into the coastal swamps.

Most of the Gulf Coastal Lowlands area is ancient marine terrace terrain. Pleistocene seas alternately flooded and retreated from this region, depositing a step-like series of marine terraces, which generally parallel the modern coastline. Healy (1975) recognizes three marine terrace elevation zones in Taylor County, including the Silver Bluff Terrace (less than 10 feet above msl), the Pamlico Terrace (8 to 25 feet above msl) and the Wicomico Terrace (70 to 100 feet above msl). Superimposed on these terrace surfaces are numerous relict Pleistocene marine features such as bars, dunes, and beach ridge systems. Such relict features, composed principally of white quartz sand, may be observed far inland from the modern coastline.

Taylor County's Gulf shoreline is classified as a low-wave- energy, drowned karst coast. It is characterized by very low wave activity, a general lack of sand beaches, and an irregular outline. A series of small islets, or keys, comprised of limestone pinnacles, are common along the southern portion of the coastline. Extensive coastal salt marshes, with a few small interspersed sand beaches and numerous nearshore oyster bars, are developed at the land-sea interface along the length of the coast.

Coastal Swamps

A zone of low, flat, frequently flooded hammocks and pine flatwoods, rimmed on their seaward edge by salt marshes, occurs along the low-energy Gulf coastline of Taylor County. This subdivision of the Gulf Coastal Lowlands was named the Coastal Swamps by White, (1970). It typically extends from the shore inland to approximately the 10 feet msl contour line, which is situated a distance ranging from about one to four miles inland (Figure 1). Due to lack of sand input and the low wave energy conditions along the Big Bend coastline, sand beaches are poorly developed or absent.

Numerous small surface streams, most of which arise in the swampy hammocks and bays in western Taylor County, flow generally southwestward and empty into the Gulf of Mexico. Most are sluggish, tannic water streams, flowing in narrow channels and draining the interior swamps. Some of these creeks are fed along their courses by small springs seeping freshwater from the carbonate rocks of the underlying Floridan aquifer system. Extensive salt marshes, comprised of *Juncus* and *Spartina* grasses rooted in shallow, organic-rich silts and sands lying on limestone, border the land-sea interface along most of the coast. The marshes are dissected by small, seaward flowing tidal streams and creeks, which may

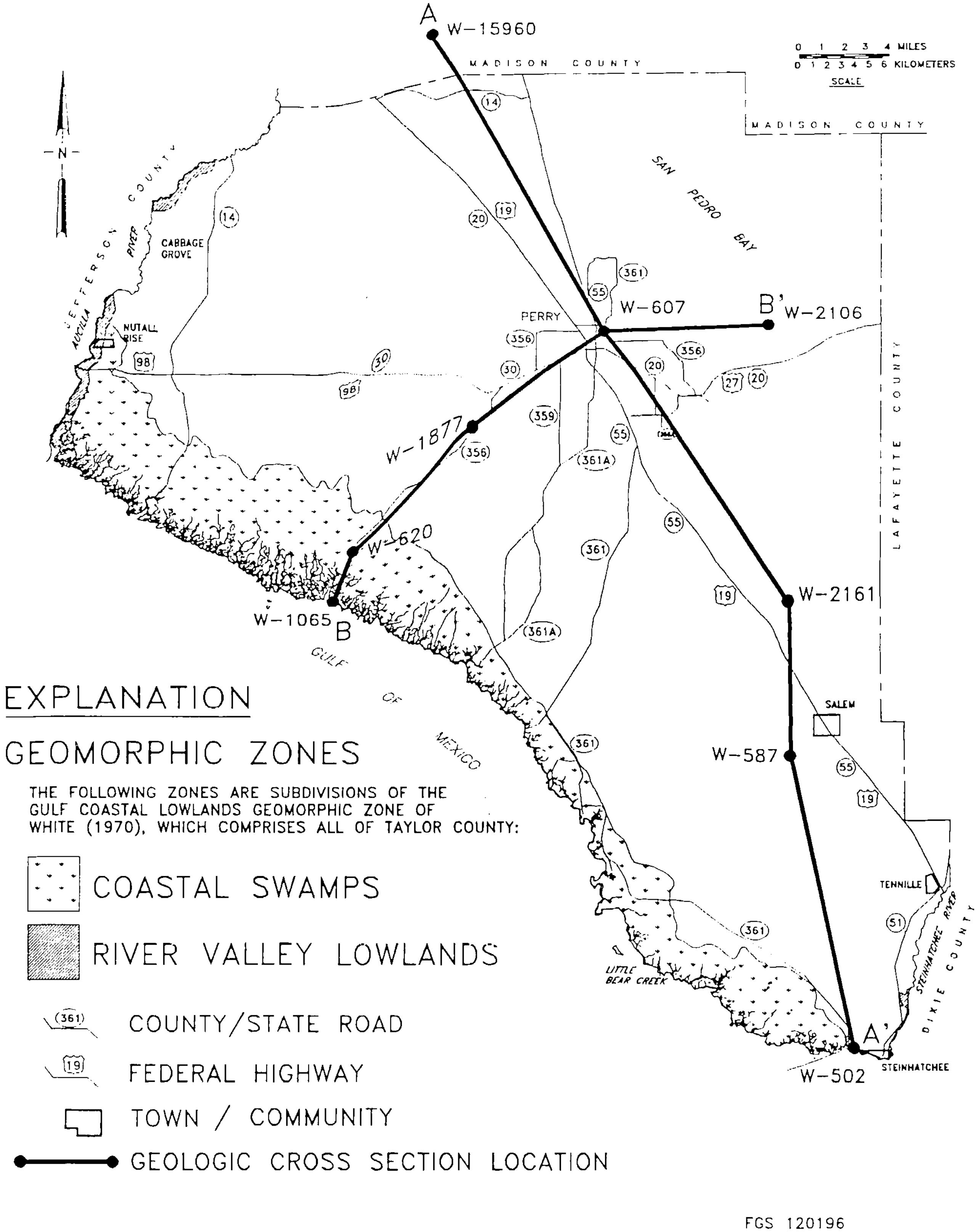

Figure 1. Geomorphic and Cross Section Location Map.

also be fed by freshwater seeping out of the shallow limestone of the Floridan aquifer system.

River Valley Lowlands

The Aucilla and Steinhatchee Rivers are the largest surface streams in the county, forming portions of Taylor County's boundaries with adjacent counties. The Aucilla River forms the county boundary between Taylor and neighboring Jefferson County to the northwest. It flows southwestward from Georgia to the Gulf of Mexico in a variable-width dissolutional valley, carved in the underlying Oligocene carbonates. The topographic lowlands immediately adjacent to the river, generally characterized by thin Holocene sands and clayey sands lying on limestone, comprise the Aucilla River Valley Lowlands (Yon, 1966). River valley floor elevations range from about 35 feet above msl in northwestern Taylor County to sea level where it enters the Coastal Swamps. For most of its course, the valley is less than one mile wide. Along portions of the stream, rapids flow over exposed, silicified limestone. The Aucilla River is captured by subterranean drainage four and a half miles north of Highway 98, and approximately two miles of its underground course are defined by closely-spaced sinks; the river emerges two and a half miles above Highway 98, flowing approximately one and a half miles as a surface stream before flowing underground once again into a sink. The Aucilla reemerges at the community of Nutall Rise, in western Taylor County, for its final course to the Gulf. The river broadens as it merges into the coastal swamps near the coast.

The Steinhatchee River arises in the swampy hammocks of adjacent Lafayette County, and flows southwestward in a narrow, incised valley generally lying ten feet or less above msl. It forms the southern county boundary between Taylor and Dixie Counties. The Steinhatchee flows in a narrow channel cut in Eocene carbonates, which commonly crop out along the lower portion of the river. The river flows underground for a one-mile stretch near the community of Tennile and emerges about 0.3 miles west of Highway 19. The underground portion of the river's route is mirrored at the surface by a topographic valley containing only intermittent flow. The Steinhatchee River is a sluggish, generally tannic stream, widening near the coast as it enters the coastal salt marshes. The lowlands adjacent to the river are typically very narrow, widening significantly in only one small area northeast of Steinhatchee. Pleistocene and Holocene siliciclastics form a sediment veneer over the carbonates in the river bed and along the banks.

GEOLOGY

The oldest rock commonly penetrated by water wells in Taylor County is marine limestone of the Eocene Avon Park Formation. Undifferentiated Pleistocene and Holocene surficial sands, clayey sands, and alluvium are the youngest sediments present. Figure 2 illustrates the shallow stratigraphy of the county. The Avon Park Formation and the younger overlying carbonates are important freshwater aquifers, and the following discussion of the geology of Dixie County is confined to these Eocene and younger sediments.

Eocene Series

Avon Park Formation

The Avon Park Formation (Miller, 1986) is a lithologically variable Middle Eocene carbonate unit underlying all of Taylor County. It is typically a yellowish-gray to grayish-orange to dark yellowish brown dolostone, commonly interbedded with grayish-white to yellowish-gray limestones and dolomitic limestones. The unit may contain varying amounts of peat, lignite, and plant remains (Florida Geological Survey in-house well logs). Mollusks, echinoids, and foraminifera, where preserved, are the principal fossils present. The top of the Avon Park Formation varies in depth from approximately 300 feet below land surface (bls) in northwestern Taylor County to about 90 feet bls in the southern part of the county. Surface exposures of Avon Park are absent in this county, but do occur to the south in Levy County, over the crest of a positive subsurface structural feature named the Ocala Platform. Deep oil test well data indicate that the Avon Park Formation ranges from approximately 800 to 1400 feet thick under Taylor County (FGS in-house well logs).

Ocala Limestone

Marine limestones of the Ocala Limestone (Puri, 1957; Scott, 1991) unconformibly overlie the Avon Park Formation under all of Taylor County. It is divided into upper and lower units

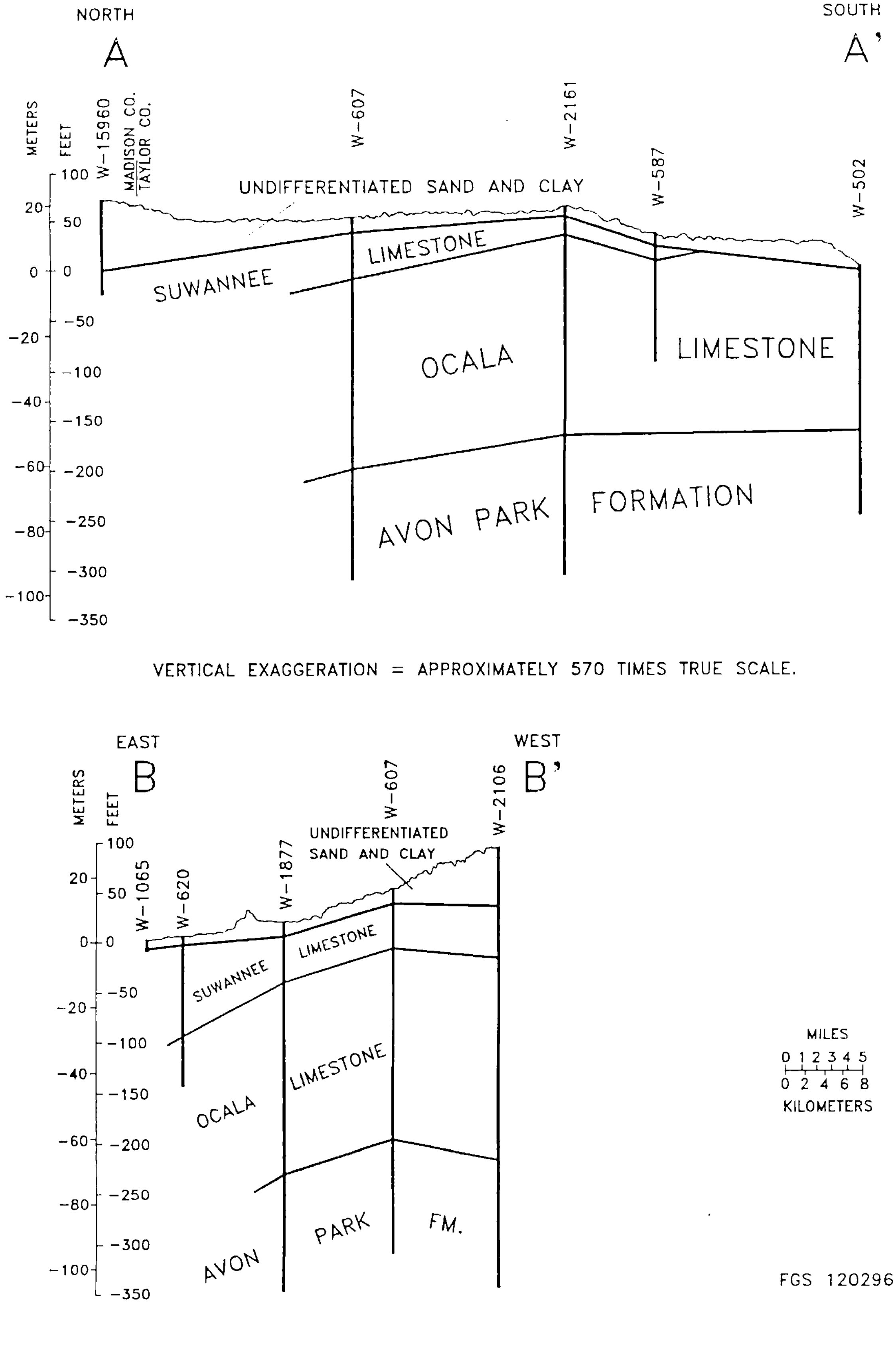

Figure 2. North-South and East-West Cross Sections in Taylor County.

based on lithology. The lithology of the Ocala Limestone grades upward from alternating hard and soft, white to tan to gray fossiliferous limestone and dolomitic limestone of the lower unit into white to very light gray to light yellowish-orange, abundantly fossiliferous, chalky limestones of the upper unit (FGS in-house well files). Foraminifera, mollusks, bryozoans, and echinoids are the most abundant fossils occurring in this unit. Thickness of the Ocala Limestone sediments under Taylor County ranges between 80 and 220 feet thick. It generally thins against the structurally high Avon Park Formation toward the crest of the Ocala Platform in the southern and eastern portions of the county. Depth to the irregular and highly-karstic top of the Ocala Limestone is generally between 10 and 100 feet. The overlying Suwannee Limestone pinches out against the Ocala Limestone along an approximate contact extending northeast-southwest from near the town of Salem to Little Bear Creek, on the Gulf coast (Figure 1). North of this contact line the Suwannee Limestone is the uppermost carbonate unit; to the south, the Suwannee is absent and the Ocala Limestone forms the upper carbonate (Campbell, 1993). The Ocala Limestone commonly crops out in the hammocks and coastal marshes of southernmost Taylor County. Offshore of the modern coastline, a thin blanket of quartz sand covers the Ocala Limestone, and exposures in the form of limestone boulders and pinnacles are common. Dolomitized exposures of the unit occur in the vicinity of the town of Steinhatchee, along the Steinhatchee River in southernmost Taylor County.

The highly permeable and cavernous nature of the Ocala Limestone make it an important freshwater bearing unit of the Floridan aquifer system. Many drinking water wells in southern Taylor County withdraw water from this limestone.

Oligocene Series
Suwannee Limestone

The Suwannee Limestone (Cooke and Mansfield, 1936) is an Oligocene age marine limestone and dolostone underlying the northern two-thirds of Taylor County. It is typically a white to yellowish-gray to grayish-brown, skeletal to micritic limestone, altered in some areas to variably recrystallized dolostone. Mollusks, foraminifera, echinoids, bryozoans, and ostracods, in various degrees of preservation, comprise the dominant fossil assemblage present in this unit. It's top typically ranges in depth from as much as 50 feet below land surface in northwestern Taylor County to some surface exposures in the west central part of the county and along the Gulf coastline. The unit climbs and thins to the southeast. It decreases from about 50 feet thick in the northeastern part of the county to zero at its pinchout against the Ocala Limestone in southern Taylor County. The Suwannee Limestone locally comprises the uppermost unit of the Floridan aquifer system. Shallow domestic and agricultural wells draw water from this unit.

Pleistocene-Holocene Series

Undifferentiated Pleistocene marine quartz sands and clayey sands form a thin veneer over all of Taylor County. They are generally less than about 50 feet thick county-wide, and thin to less than 20 feet thick near the coast. They directly overlie the karstic carbonates of the Suwannee and Ocala Limestones. Many of the larger and higher sand bodies in Taylor County are relict dunes, bars, and barrier islands associated with various Pleistocene sea level high stands.

Discontinuous deposits of sparsely-phosphatic, clayey sands, likely reworked Hawthorn Group sediments (Tom Scott, personal communication, 1992) comprise portions of the undifferentiated sediments in northern Taylor County. These deposits are common in karst depressions and may, in part, represent Plio-Pleistocene paleosinkhole fill.

GROUND WATER

Ground water is water that fills the pore spaces in subsurface rocks and sediments. This water is derived principally from precipitation within Taylor and adjoining counties. The bulk of Taylor County's consumptive water is withdrawn from ground water aquifers. Two aquifer systems are present under Taylor County, the surficial aquifer system and the Floridan aquifer system.

Surficial aquifer system

The surficial aquifer system is the uppermost freshwater aquifer in Taylor County. This non-artesian aquifer is present only within the Pleistocene undifferentiated sands and clays of the San Pedro Bay region of northeastern Taylor County. In this area, a variably thick clay unit semi-confines the underlying Floridan aquifer system and separates it from the surficial aquifer system. In some areas, the Floridan and surficial aquifer systems are in hydrologic contact, but typically, the two contain chemically different water. The surficial aquifer system, where present, is unconfined and its upper surface is the water table. In general, the water table elevation fluctuates with precipitation and conforms to the topography of the land surface.

Recharge to the surficial aquifer system is largely through rainfall percolating downward through the unconsolidated surficial sediments, and to a lesser extent, by upward seepage from the underlying Floridan aquifer system. Water naturally discharges from the aquifer by evaporation, outflow from surface seeps, and downward seepage into the Floridan aquifer system. The surficial aquifer system is not used as a source of consumptive water in Taylor County.

Floridan aquifer system

In Taylor County, the Floridan aquifer system is comprised of hundreds of feet of Eocene and Oligocene marine limestones, including the Avon Park Formation, Ocala Limestone, and Suwannee Limestone. It is the principle source of drinking water in the county. The Floridan aquifer system exists as an unconfined, non-artesian aquifer in most of Taylor County, where porous quartz sand directly overlies the limestone. In the San Pedro Bay area, clay units may serve to locally confine the aquifer. Depth to the top of the Floridan aquifer system generally corresponds to the depth of limestone, and varies from less than five feet in the coastal marshes and River Valley Lowlands to more than 80 feet under the larger relict Pleistocene sand bodies. The potentiometric gradient is southwestward.

Recharge to the Floridan aquifer system in Taylor County is obtained from lateral inflow from the north and, to a lesser extent, from local rainfall entering karst features and percolating downward through the permeable surficial sands. The highest recharge by percolation occurs in a narrow, northwest-southeast trending swath of dune sands overlying karstic carbonates in southwestern Taylor County (Stewart, 1980).

Water leaves the Floridan aquifer system through natural movement down-gradient and subsequent discharge through numerous springs and seeps. These springs generally occur in the River Valley Lowlands and along the coastal marshes and offshore on the continental slope where the potentiometric surface of the Floridan aquifer system is at or above land surface.

MINERAL RESOURCES

Taylor County contains deposits of several economic mineral commodities. The most important of these is dolostone. Other minerals of lesser potential include limestone and sand. Each commodity and its economic potential and mining status at the time of publication are summarized below, with data from Spencer (1996 in prep.)

Dolomite

Shallow dolomitized Suwannee Limestone occurs in the Cabbage Grove area (Townships 3 and 4 South, Ranges 4, 5 and 6 East) of northwestern Taylor County. This area is one of only about five high-quality dolostone producing areas in Florida (Schmidt et al., 1979). The dolostone in Taylor County is mined primarily for use as road gravel. The rock is extracted by dragline, crushed on-site, and trucked to customers. Four companies operating in the Cabbage grove area at the date of this writing are E.R. Jahna, Martin Marietta, Proctor and Gamble, and White Construction.

Elsewhere in the county, private pits produce dolostone on a sporadic, as-needed basis. The Florida Department of Transportation operates a road base pit in Section 4, Township 5 South, Range 5 East and Steinhatchee Construction maintains a pit southwest of Perry. Although sufficient dolostone reserves for continued commercial mining are present in Taylor County, the lack of more extensive local markets for the product precludes an extensive industry in this commodity.

Limestone

Ocala Limestone occurs near the surface under southernmost Taylor County. The economic grade may vary considerably from one area to another. Although mining potential remains high, no companies commercially mine limestone in the county. At this writing, Steinhatchee Construction operates a private pit in Suwannee Limestone southwest of Perry, and

Proctor and Gamble maintains two private road base pits in southeastern Taylor County. As with dolostone, low local demand precludes extensive mining of this mineral.

Sand

A number of shallow private pits in Taylor County are worked for fill sand. Pleistocene quartz sand deposits occur as a variably thick blanket over most of the county. Since there is insufficient local demand for sand products, the potential for commercial mining is low at this time.

Clay

Clay sporadically occurs as a component of the undifferentiated surficial sediments covering Taylor County. Due to the impure nature of this clay, it is not an economic commodity in the county.

Peat

Peat forms in a wet, reducing environment when accumulation of organic materials exceeds the decomposition rate of that material. Shallow wetlands in the San Pedro Bay region of northeastern Taylor County provide potential peat formation sites. However, while no peat surveys have been conducted within the county, studies in adjacent counties indicate that the peat formed in such areas is too thin to be of economic interest (Davis, 1946; Bond et al., 1986). Therefore, the potential for peat mining in Taylor County is low.

REFERENCES

Alison, D., and Rupert, F.R.,1996, Top of rock of the Floridan aquifer system in the Suwannee River Water Management District: Florida Geological Survey Open File Map Series 84.

Bond, P.A., Campbell, K.M., and Scott, T.M., 1986, An overview of peat in Florida and related issues: Florida Geological Survey Special Publication No. 27, 151 p.

Campbell, K.M., 1993, Geologic Map of Taylor County, Florida: Florida Geological Survey Open File Map Series n. 29.

Cooke, C.W., and Mansfield, W.C., 1936, Suwannee Limestone of Florida (abs.), Geological Society of America Proceedings, 1935, p. 71-72.

Davis, J.H. Jr., 1946, The peat deposits of Florida: their occurrence, development, and uses: Florida Geological Survey Bulletin 30, 250 p.

Healy, 1975, Terraces and shorelines of Florida: Florida Bureau of Geology Map Series 71.

Miller, J.A., 1986, Hydrogeologic framework of the Floridan aquifer system in Florida and in parts of Georgia, Alabama, and South Carolina: U.S. Geological Survey Professional Paper 1403-B, p. 25-27.

Puri, H.S., 1957, Stratigraphy and zonation of the Ocala Group: Florida Geological Survey Bulletin 38, 248 p.

_________, Yon, J.W., and Oglesby, W.R., 1967, Geology of Dixie and Levy Counties, Florida: Florida Geological Survey Bulletin 49, 155 p.

Schmidt, W., Hoenstine, R.W., Knapp, M.S., Lane, B.E., Ogden, G.M., and Scott, T.M., 1979, The limestone, dolomite and coquina resources of Florida: Florida Bureau of Geology Report of Investigation No. 88, 54 p.

Scott, T.M., *in*: Scott, T.M., Lloyd, J.M., and Maddox, G., (eds.), 1991, Florida's Ground Water Monitoring Program Hydrological Framework: Florida Geological Survey Special Publication 32, p. 5-14.

Spencer, S.M., 1996 (in preparation), The Industrial Minerals Directory of Florida: Florida Geological Survey Information Circular.

Stewart, J.W., 1980, Areas of natural recharge to the Floridan aquifer in Florida: Florida Bureau of Geology Map Series 98.

Yon, J.W., 1966, Geology of Jefferson County, Florida: Florida Geological Survey Bulletin 48, 119 p.

White, W.A., 1970, Geomorphology of the Florida peninsula: Florida Geological Survey Bulletin 51, 164 p.