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Open File Report No. 54

**Carbonate units of the intermediate aquifer system
in the Suwannee River Water Management District**

by

Mark Groszos, Ron Ceryak, David Alison,
Renee Cooper, Mike Weinberg, Milena Macesich,
Meryl Martinez Enright, and Frank Rupert

Florida Geological Survey, Tallahassee, Florida, in cooperation
with the Suwannee River Water Management District
1992

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Introduction and Hydrostratigraphy

The intermediate aquifer system or intermediate confining unit (Southeastern Geological Society Ad Hoc Committee, 1986) is a series of artesian freshwater aquifers and interbedded confining units underlying the northern and eastern portions of the Suwannee River Water Management District (SRWMD). It is used locally as a domestic and a limited agricultural water source. Stratigraphically, it is contained within the Miocene Hawthorn Group sediments.

Characteristically, the Hawthorn Group sediments consist of interbedded sands, sandy clays, clays and carbonates, commonly containing variable amounts of phosphate (Scott, 1988). The Hawthorn is underlain by Eocene to Miocene carbonates which comprise part of the upper Floridan aquifer system. These include the Ocala Limestone, the Suwannee Limestone, and the St. Marks Formation. The Hawthorn Group is overlain by undifferentiated Plio-Pleistocene sands and clayey sands. It extends laterally northward into Georgia, eastward into the neighboring St. Johns River Water Management District, and is truncated by the Cody Scarp to the southwest. In general, clay and clayey sand units within the Hawthorn Group function as confining units for the water-bearing units of the intermediate aquifer system as well as the underlying Floridan aquifer system.

The primary water bearing units of the intermediate aquifer system/confining

unit consist of a regionally extensive Upper Carbonate Unit (UCU), generally situated near the top of the Hawthorn Group, and in the northern portion of the District, an underlying sand unit (Figures 1 and 2). Most local wells draw from the Upper Carbonate Unit. In those areas of the SRWMD where a low permeability clay unit occurs at the top of the Hawthorn, an effective confining bed exists between the intermediate aquifer system and overlying surficial aquifer system. In areas where this confining bed is thin or absent, the upper Hawthorn Group sediments may be in hydrologic contact with the overlying surficial aquifer system.

Three additional deeper carbonate units, consisting of two units stratigraphically situated approximately midway in the section, and a basal unit, are present within the Hawthorn Group in the SRWMD. Named according to their respective stratigraphic positions, they are: the Upper Middle Carbonate Unit (UMCU), the Lower Middle Carbonate Unit (LMCU), and the Lower Carbonate Unit (LCU). The Upper Middle Carbonate unit extends over most of the SRWMD. Less data is available for the Lower Middle Carbonate, and it is probably discontinuous. Both units may function as water bearing units within the intermediate aquifer system. These units are separated from the Upper and Lower carbonates by interbedded sands, clayey sands, and occasional dolosilts. The Lower Carbonate Unit comprises the basal Hawthorn Group, and it may be in hydrologic continuity with the underlying

Floridan aquifer system.

Geomorphology

The SRWMD encompasses two broad geomorphic zones. Spanning the northernmost counties in the District is the Northern Highlands (White, 1970), a stream-dissected remnant of an extensive highlands that covered much of southern Georgia, northern Florida, and southern Alabama. Elevations typically range from about 100 feet above NGVD (National Geodetic Vertical Datum of 1929, which approximates mean sea level) to greater than 200 feet NGVD.

South and west of the Northern Highlands is an elevationally-low zone named the Gulf Coastal Lowlands (White, 1970). This area is characterized by flat, often swampy, sandy terrain overlying karstified limestone. Relict marine bars, dunes and ridges, formed during Pleistocene sea level highstands, are common features throughout the lowlands. Elevations in the Gulf Coastal Lowlands range from 0 feet NGVD at the current coastline to about 100 feet NGVD at the northern and eastern edge of the zone.

A prominent relict marine escarpment named the Cody Scarp (Puri and Vernon, 1964) forms the boundary between the Gulf Coastal Lowlands and the Northern Highlands. The Cody Scarp also forms an erosional, areal limit for many of the Miocene and younger strata underlying the Northern Highlands. As such, it also functions as a southern and western boundary to the intermediate aquifer system/confining unit within the SRWMD.

Regional Geology

Northern Florida is underlain by thousands of feet of predominantly marine carbonates, sands and clays (Ceryak et al.,

1983). The near surface units are composed of Eocene, Oligocene, and Early Miocene limestones, overlain in turn by Miocene through Pleistocene carbonates and siliciclastics. In the Gulf Coastal Lowlands, near-surface limestones belonging to the Eocene Ocala Limestone and the Oligocene Suwannee Limestone form a karstified limestone plain covered by a thin veneer of undifferentiated sands and clays. These limestones comprise the Floridan aquifer system.

North of the Cody Scarp, in the Northern Highlands, these same limestones are overlain by substantial thicknesses of Hawthorn Group siliciclastics and carbonates, and, where present, the Pliocene Miccosukee Formation and/or Plio-Pleistocene siliciclastics. The intermediate aquifer system/confining system and the surficial aquifer system are contained within the Miocene through Pleistocene strata.

In the SRWMD, the intermediate aquifer system and the interbedded clays and clayey sands of the intermediate confining unit are contained in strata of the Hawthorn Group (Scott, 1988). The lithology of the Hawthorn Group sediments is diverse, composed primarily of interbedded phosphatic sands, clayey sands, sandy clays, clays, and carbonates. In general, the Hawthorn Group ranges in thickness from 0 feet south and west of the Cody Scarp, where it has been largely removed by erosion, to at least 410 feet in the eastern portion of the District (Groszos and Rupert, 1992). It underlies the Northern Highlands geomorphic zone, north of the Cody Scarp and typically the upper surface is above elevations of about 110 feet NGVD (Ceryak et al., 1983).

The intermediate aquifer system is comprised of four distinct carbonate units (Upper, Upper Middle, Lower Middle, and Lower), separated by clays, sands, and clayey sands (Figures 1 and 2). Throughout the District, the carbonate units are predominantly composed of dolomite, with

some localized occurrences of dolosilt or limestone. The intermediate aquifer system/confining unit is absent west and south of the Cody Scarp. Here, the underlying Floridan aquifer system functions largely as an unconfined or semi-confined artesian system. Northeast of the scarp, the intermediate aquifer system overlies the Floridan aquifer system. In some areas, clay and/or tight dolomite (often called chert by drillers) sediments in the basal Hawthorn Group form a confining layer for the underlying Floridan aquifer system. Similarly, clay units near the top of the Hawthorn Group may, in some areas, support an overlying perched surficial aquifer system (Ceryak et al., 1983).

Mapping Methods

The tops and thicknesses (isopachs) of the Upper, Upper Middle, Lower Middle, and Lower carbonate units were mapped in this study. Data from well cuttings and cores, as well as detailed driller's logs were analyzed to delineate the four distinct carbonate units within the Hawthorn Group sediments. Lithologic data were derived from well and core sample descriptions on file at the FGS. Driller's logs were supplied by the SRWMD.

Each carbonate layer was assigned to the Upper, Upper Middle, Lower Middle, or Lower Carbonate Unit based on elevation and stratigraphic sequence. Wells which did not fully penetrate each unit were used for construction of the top of unit maps only. Depths to the top of each unit, corrected to NGVD, and thicknesses of each unit were used to construct the top-of-unit and isopach maps. Well locations and isolines were digitized using the computer assisted drafting program AutoCad.

Isolines were constructed at a 20 feet contour interval, relative to mean sea level (NGVD). The isolines were truncated at the District boundary, or where they

intersected an erosional terminus such as the Cody Scarp, and where data were sparse. The maps shown were constructed based on the best available data. Future studies, benefiting from additional data, may alter the areal extent and or configuration of the mapped units.

Extent and thickness

Upper Carbonate Unit

The Upper Carbonate Unit (UCU) is a water-bearing strata lying near the top of the Hawthorn Group (Figure 3). It is utilized as a water source for rural wells. The UCU is regionally extensive, extending from southeastern Hamilton County southeastward through Columbia, Baker, Union, Bradford, and into Alachua County. It pinches out to the west in central Hamilton County, and it is truncated to the south by the Cody Scarp. The elevation of the top of the UCU varies between less than 20 feet and 120 feet NGVD. It reaches a high of 120 feet NGVD in areas of Columbia, Bradford, and Alachua Counties. The surface then dips to the northeast, dropping to an elevation of 20 feet NGVD or less in Baker County.

Thickness of the UCU ranges from less than 20 feet at the peripheral portions of its extent to about 40 feet near the juncture of Alachua, Bradford, and Union Counties, and in Hamilton County (Figure 4).

Middle Carbonate Units

Two carbonate units are stratigraphically situated in the middle of the Hawthorn Group section. The Upper Middle Carbonate Unit (UMCU) occurs throughout most of the SRWMD south and east of Hamilton County. The top of the UMCU ranges from a high of about 100 feet NGVD in Alachua County, to deeper

than -60 feet NGVD in northeastern Baker County (Figure 5). Isopach data for this unit are sparse, but existing well data indicates it is about 20 feet thick over much of the study area (Figure 6). The unit reaches a maximum recorded thickness of 42 feet in one well in eastern Bradford County. The UMCU is separated from the underlying Lower Middle Carbonate Unit by a sand or clayey sand unit of variable thickness.

The Lower Middle Carbonate Unit (LMCU) is poorly represented in wells, with the bulk of wells containing this unit concentrated around the City of Gainesville (Figure 7). It may occur only sporadically throughout the SRWMD. From the existing well data, the top of the unit varies between about 40 feet NGVD in the west central SRWMD to over -190 feet NGVD in northeastern Baker County. Isopach and top of unit maps were not constructed for the LMCU, and only data is shown on the map in Figures 7 and 8. The known thickness ranges from about 10 to 90 feet.

Lower Carbonate Unit

The Lower Carbonate Unit (LCU) occurs in most of District east and south of Hamilton County (Figure 9). This unit is situated near or at the base of the Hawthorn Group, and rests directly on the Suwannee Limestone or Ocala Limestone sediments. In portions of the District, the LCU is most likely in hydrologic continuity with the underlying Floridan aquifer system, which may supply much of the water to the unit. The elevation of the top of the unit ranges from about 20 feet NGVD in central Alachua County, southwestern Union County, and central Columbia County, to about -280 feet NGVD in northeastern Baker County. Thickness varies from less than 20 feet near the Cody Scarp to approximately 100 feet in northern Baker County (Figure 10).

Acknowledgements

Mapping of the principle carbonate units of the intermediate aquifer system was performed by the Florida Geological Survey (FGS) under contract with the SRWMD, and was funded through the Florida Department of Environmental Regulation Groundwater Quality Monitoring Program.

The authors extend special thanks to Nolan Col, SRWMD, and Drs. Tom Scott and Walt Schmidt of the FGS for critically reviewing drafts of the maps and text for this report.

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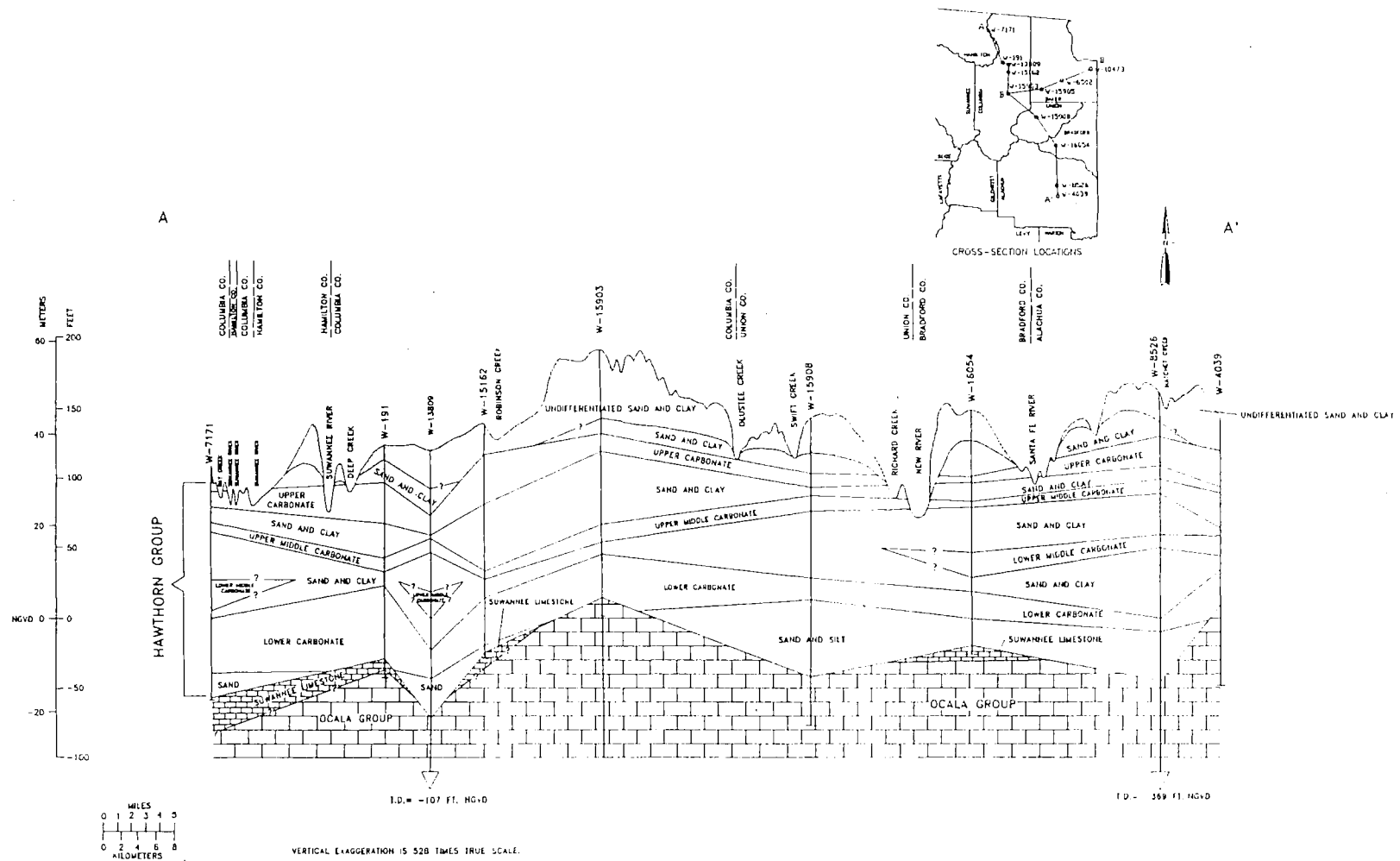


FIGURE 1: CROSS-SECTION A-A' OF THE HAWTHORN GROUP IN THE SRWMD

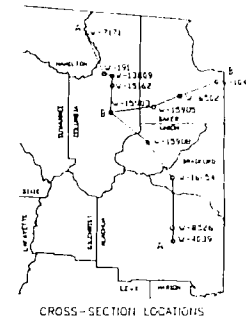
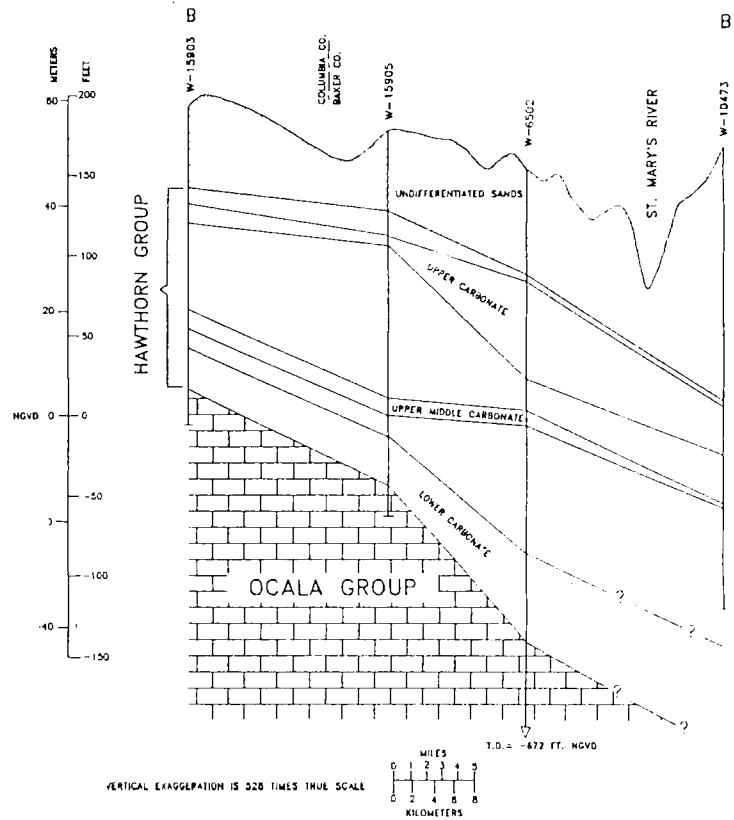


FIGURE 2: CROSS-SECTION B-B' OF THE HAWTHORN GROUP IN THE SRWMD

Figure 3.

TOP OF THE UPPER CARBONATE UNIT,
INTERMEDIATE AQUIFER SYSTEM
IN THE
SUWANNEE RIVER WATER MANAGEMENT DISTRICT

COMPILED BY:
MARK GROSZOS (FGS)
RON CERYAK (SRWMD)
DAVID ALLISON (FGS)

WITH ASSISTANCE FROM:
RENEE COOPER (FGS)
MIKE WEINBERG (FGS)
MILENA MACESICH (FGS)
NETTIE MARTINEZ (FGS)

EXPLANATION

Well Number, Top of Unit in Feet NGVD, ¹⁰⁷³
and Location Point ₉₈

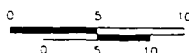
County Boundary 

Cody Scarp 

Contour Line (Relative to NGVD) 

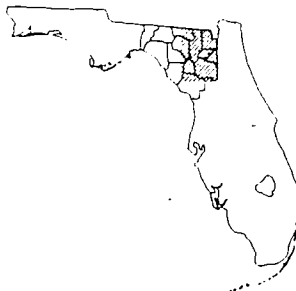
Contour Interval = 20 Feet

MILES



KILOMETERS

Study Area Location



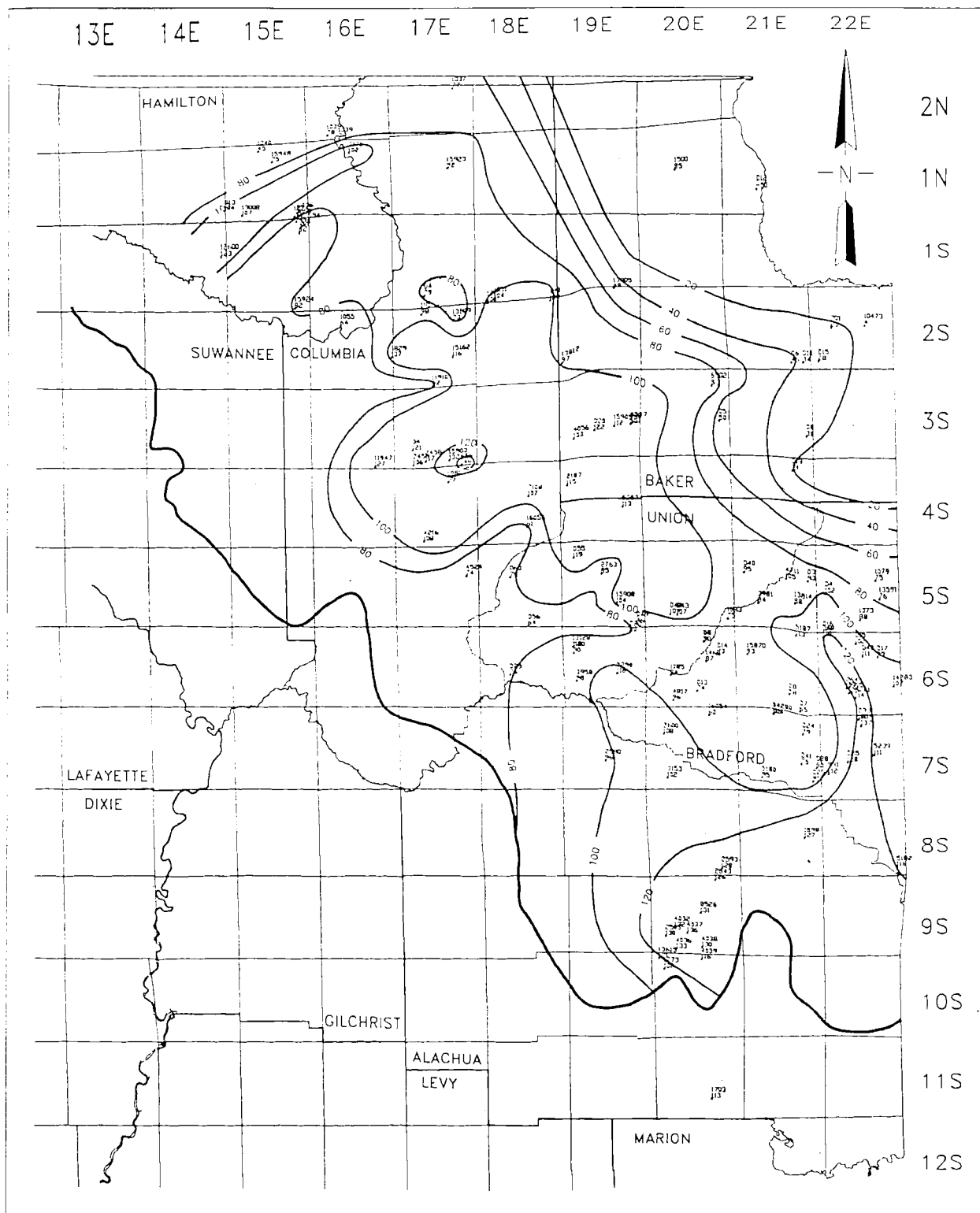


Figure 4.

ISOPACH OF THE
UPPER CARBONATE UNIT,
INTERMEDIATE AQUIFER SYSTEM,
SUWANNEE RIVER WATER MANAGEMENT DISTRICT

COMPILED BY:
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EXPLANATION

Well Number, Top of Unit in Feet NGVD, and Location Point

14283
21

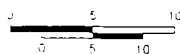
County Boundary

Cody Scarp

Contour Line (Relative to NGVD)

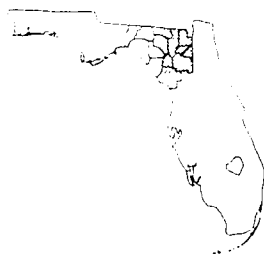
Contour Interval = 20 Feet

MILES



KILOMETERS

Study Area Location



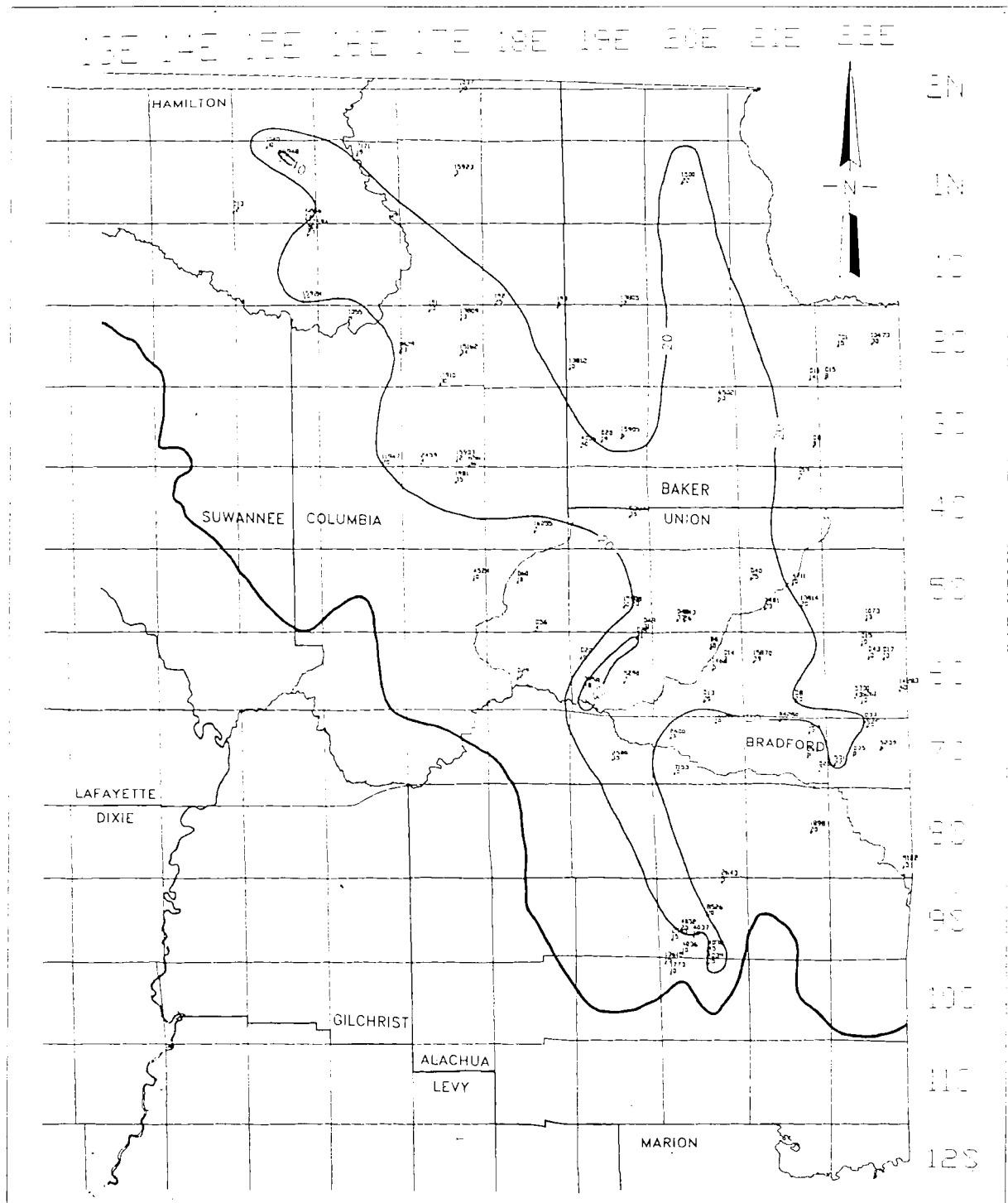


Figure 5.

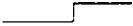
TOP OF THE UPPER MIDDLE CARBONATE UNIT,
INTERMEDIATE AQUIFER SYSTEM
IN THE
SUWANNEE RIVER WATER MANAGEMENT DISTRICT

COMPILED BY:
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EXPLANATION

Well Number, Top of Unit in Feet NGVD, ¹⁰⁷³
and Location Point ₂₈

County Boundary 

Cody Scarp 

Contour Line (Relative to NGVD) 

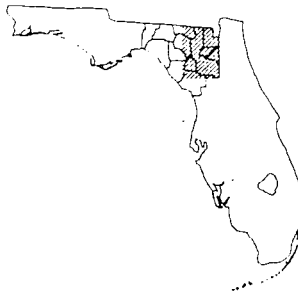
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MILES



KILOMETERS

Study Area Location



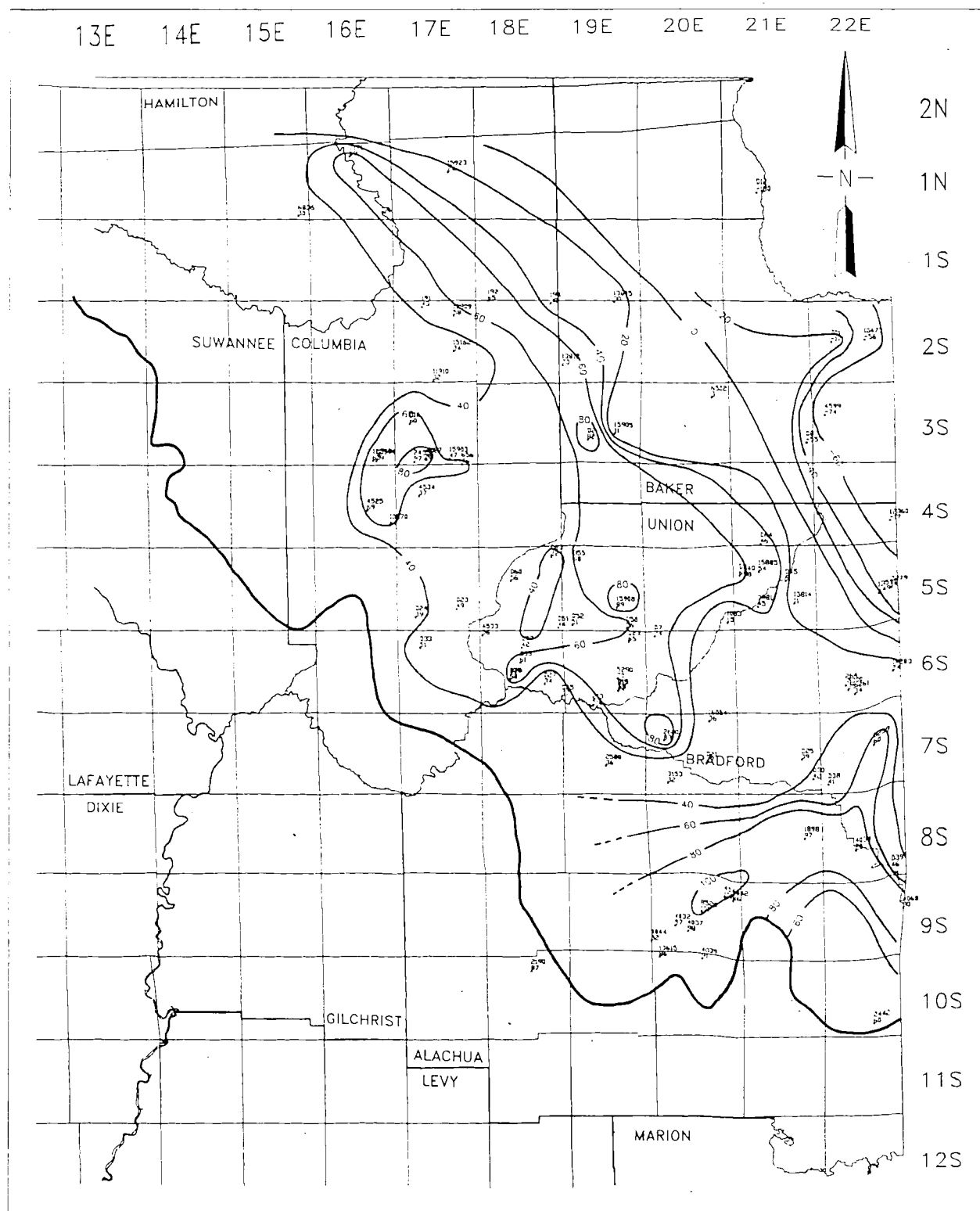


Figure 6.

ISOPACH OF THE
UPPER MIDDLE CARBONATE UNIT,
INTERMEDIATE AQUIFER SYSTEM,
SUWANNEE RIVER WATER MANAGEMENT DISTRICT

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NETTIE MARTINEZ (FGS)

EXPLANATION

Well Number, Top of Unit in Feet NGVD,
and Location Point

14283
21

County Boundary 

Cody Scarp 

Contour Line (Relative to NGVD) 

Contour Interval = 20 Feet

MILES



KILOMETERS

Study Area Location



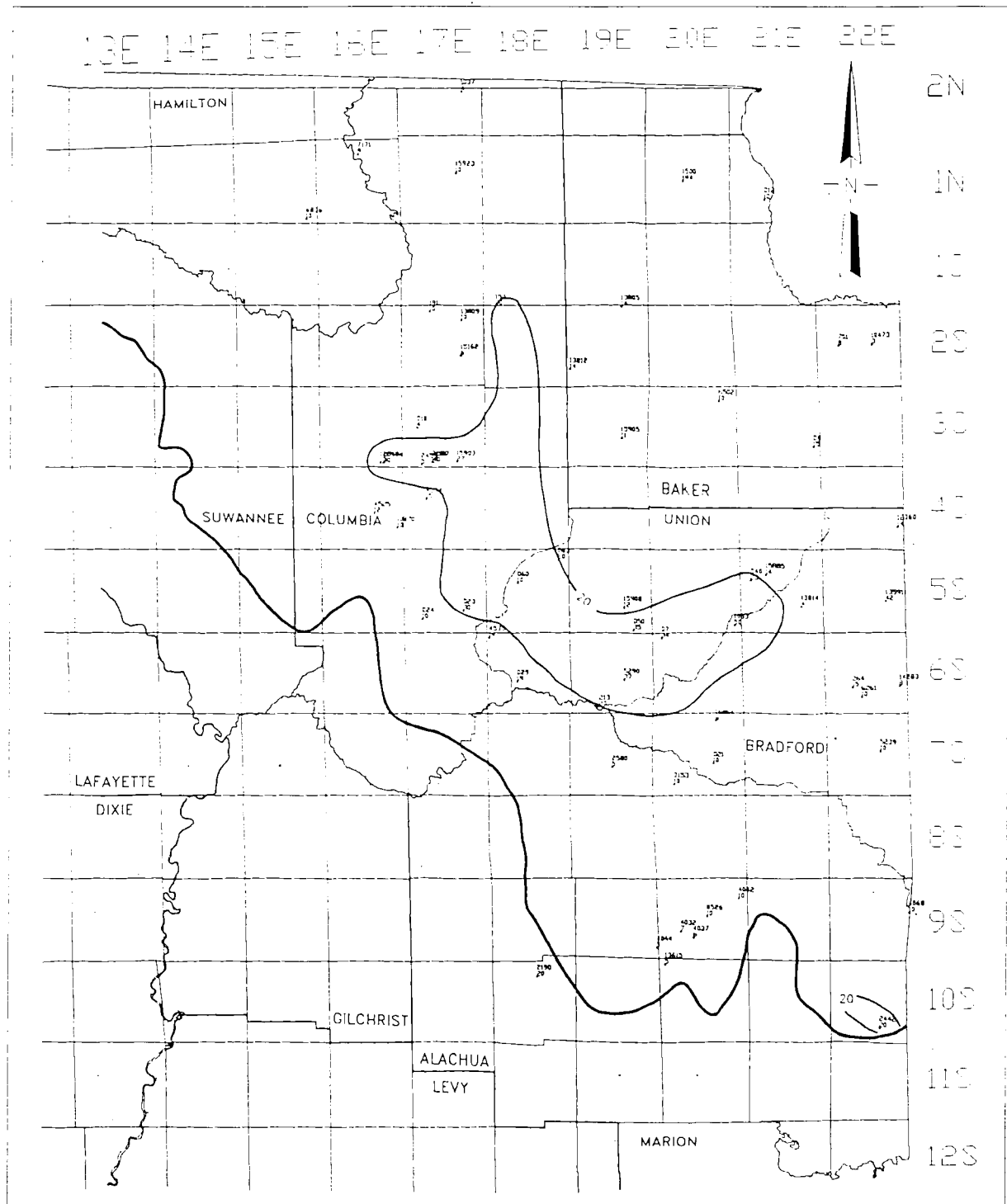


Figure 7.

TOP OF THE LOWER MIDDLE CARBONATE UNIT,
INTERMEDIATE AQUIFER SYSTEM
IN THE
SUWANNEE RIVER WATER MANAGEMENT DISTRICT

COMPILED BY:
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MILENA MACESICH (FGS)
NETTIE MARTINEZ (FGS)

EXPLANATION

Well Number, Top of Unit in Feet NGVD,
and Location Point

1073
98

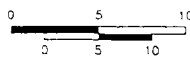
County Boundary



Cody Scarp



MILES



KILOMETERS

Study Area Location

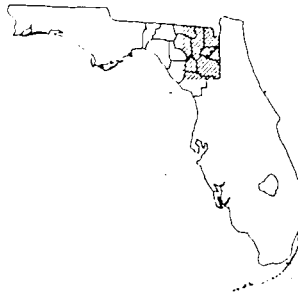


Figure 8.

ISOPACH DATA FOR THE
LOWER MIDDLE CARBONATE UNIT,
INTERMEDIATE AQUIFER SYSTEM,
SUWANNEE RIVER WATER MANAGEMENT DISTRICT

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EXPLANATION

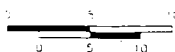
Well Number, Top of Unit in Feet NGVD,
and Location Point

14283
21

County Boundary 

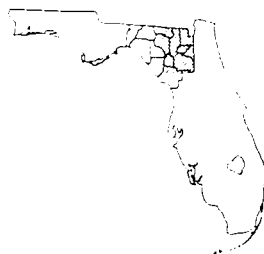
Cody Scarp 

MILES



KILOMETERS

Study Area Location



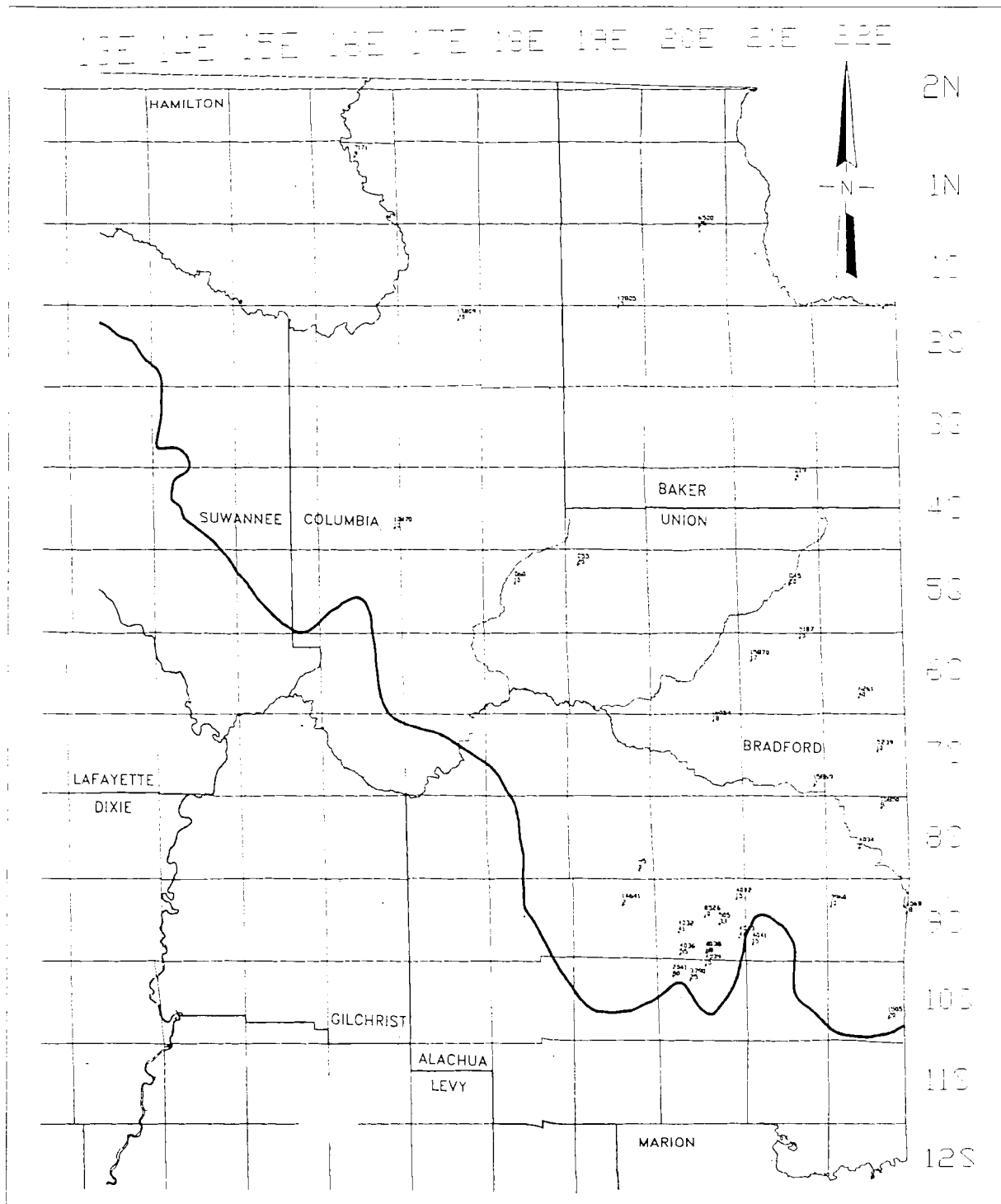


Figure 9.

TOP OF THE LOWER CARBONATE UNIT,
INTERMEDIATE AQUIFER SYSTEM
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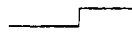
MIKE WEINBERG (FGS)

MILENA MACESICH (FGS)

NETTIE MARTINEZ (FGS)

EXPLANATION

Well Number, Top of Unit in Feet NGVD, ¹⁰⁷³₉₈
and Location Point

County Boundary 

Cody Scarp 

Contour Line (Relative to NGVD) 

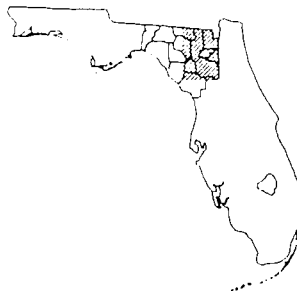
Contour Interval = 20 Feet

MILES



KILOMETERS

Study Area Location



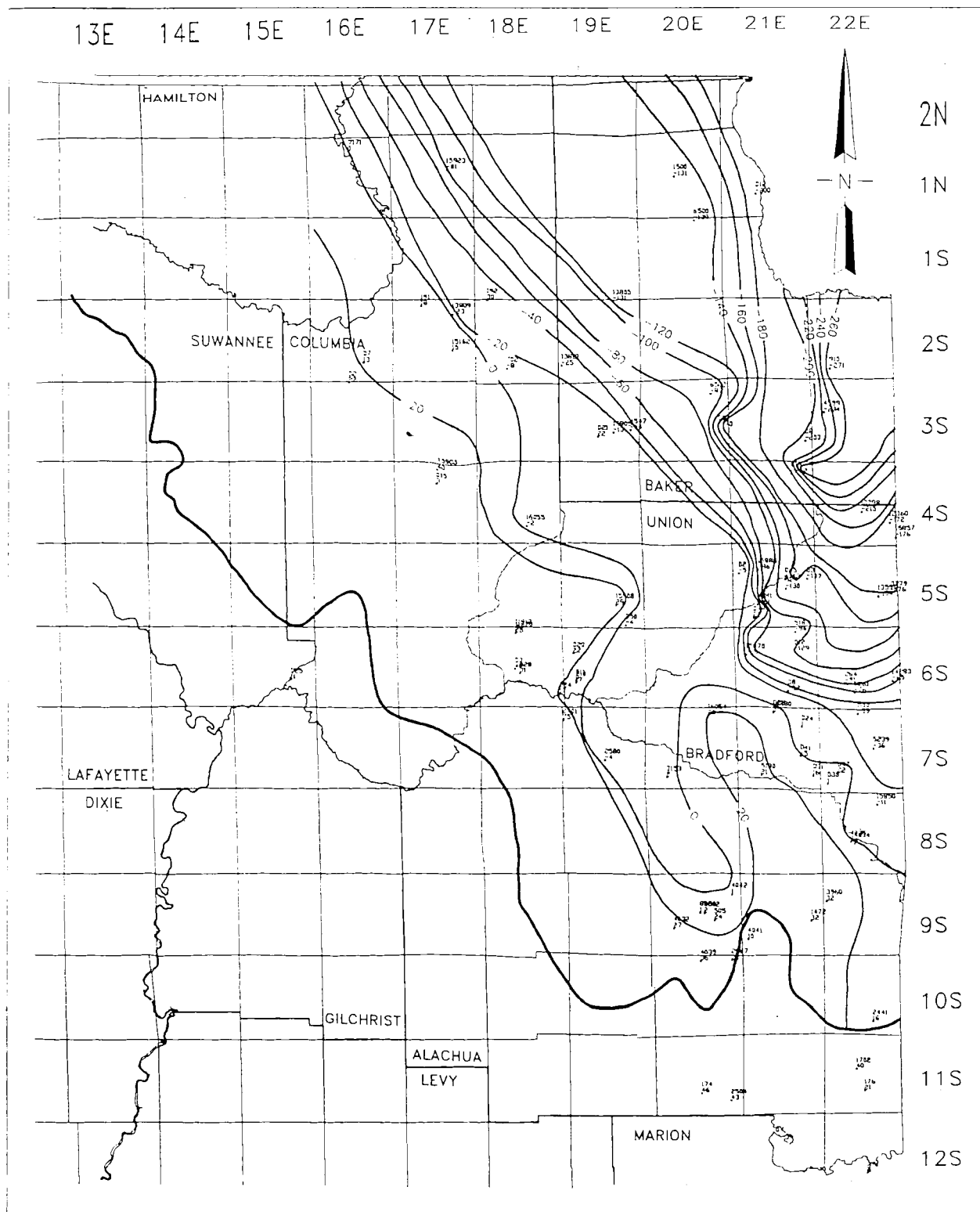


Figure 10.

ISOPACH OF THE
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INTERMEDIATE AQUIFER SYSTEM,
SUWANNEE RIVER WATER MANAGEMENT DISTRICT

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EXPLANATION

Well Number, Top of Unit in Feet NGVD, and Location Point ¹⁴²⁸³₂₁

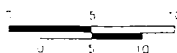
County Boundary 

Cody Scarp 

Contour Line (Relative to NGVD) 

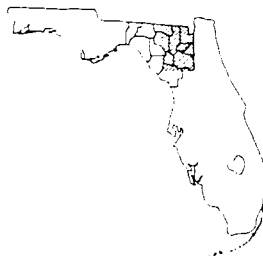
Contour Interval = 20 Feet

MILES



KILOMETERS

Study Area Location



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