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# U.S. Geological Survey Georgia Water Science Center and City of Brunswick–Glynn County Cooperative Water Program—Summary of Activities, July 2005 through June 2006

Open-File Report 2006-1368

U.S. Department of the Interior
U.S. Geological Survey

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DIRK KEMPTHORNE, Secretary

**U.S. Geological Survey**
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# Conversion Factors and Datum

| Multiply | By | To obtain |
|---|---|---|
| | Length | |
| inch (in.) | 2.54 | centimeter (cm) |
| foot (ft) | 0.3048 | meter (m) |
| mile (mi) | 1.609 | kilometer (km) |
| | Area | |
| square foot ($ft^2$) | 0.09290 | square meter ($m^2$) |
| square mile ($mi^2$) | 2.590 | square kilometer ($km^2$) |
| | Volume | |
| gallon (gal) | 3.785 | liter (L) |
| million gallons (Mgal) | 3,785 | cubic meter ($m^3$) |

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

$$°F = (1.8 \times °C) + 32$$

Temperature in degrees Fahrenheit (°F) may be converted to degrees Celsius (°C) as follows:

$$°C = (°F - 32) / 1.8$$

Vertical coordinate information is referenced to the North American Vertical Datum of 1988 (NAVD 88).

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Altitude, as used in this report, refers to distance above the vertical datum.

Specific conductance is given in microsiemens per centimeter at 25 degrees Celsius (µS/cm at 25 °C).

Concentrations of chemical constituents in water are given either in milligrams per liter (mg/L) or micrograms per liter (µg/L).

# U.S. Geological Survey Georgia Water Science Center and City of Brunswick–Glynn County Cooperative Water Program—Summary of Activities, July 2005 through June 2006

By Gregory S. Cherry

## Abstract

Since 1959, the U.S. Geological Survey has conducted a cooperative water resources program (CWP) with the City of Brunswick and Glynn County in the Brunswick, Georgia, area. Since the late 1950s, the salinity of ground water in the Upper Floridan aquifer near downtown Brunswick, Georgia, has been increasing, and its occurrence has been detected across an area of increasing size. Pumping of the Upper Floridan aquifer near downtown Brunswick has lowered water levels in the aquifer and resulted in an upward hydraulic gradient between the highly saline parts of the Lower Floridan aquifer and the normally fresh Upper Floridan aquifer. Saltwater likely enters the Upper Floridan aquifer through localized, vertically oriented conduits of relatively high permeability and moves laterally in response to the distribution of stresses within the aquifer.

The Brunswick–Glynn County CWP for fiscal year 2006 includes the operation and maintenance of 12 continuous water-level recorders. In addition, water-level data were collected from 52 wells and water from 70 wells was analyzed for chloride concentration during June 2005. Geophysical logs were obtained from one well to assess whether the cause of elevated chloride concentration could be due to leaky well casing. A summary of the Georgia Department of Natural Resources, Environmental Protection Division (GaEPD) Georgia Coastal Sound Science Initiative (CSSI) activities that directly benefit the CWP–Brunswick–Glynn County is included in this report. The GaEPD CSSI is a program of scientific and feasibility studies to support development of a final strategy to protect the Upper Floridan aquifer from saltwater contamination. These data presented in this report are needed by State and local authorities to manage water resources effectively in the coastal area of Georgia.

## Introduction

In the Brunswick, Georgia, area, saltwater has been contaminating the Upper Floridan aquifer for more than 50 years, so that presently (2006) within an area of several square miles ($mi^2$) in downtown Brunswick, the aquifer yields water that has a chloride concentration greater than 2,000 milligrams per liter (mg/L) and is above the 250 mg/L State and Federal secondary drinking-water standard (Georgia Environmental Protection Division, 1997; U.S. Environmental Protection Agency, 2000). Saltwater contamination has constrained further development of the Upper Floridan aquifer in the Brunswick area, prompting interest in the development of alternative sources of water supply, primarily from the shallower surficial and Brunswick aquifer systems.

The Federal-State Cooperative Water Program (CWP) is a partnership between the U.S. Geological Survey (USGS) and State and local agencies that provides information that forms the foundation for many of the Nation's water-resource management and planning activities. The Brunswick–Glynn County CWP between the USGS, the City of Brunswick, and Glynn County has been in existence since 1959. Current cooperating entities are the City of Brunswick, Glynn County, the Jekyll Island Authority, Sea Island Corporation, Hercules–Pinova, and Georgia–Pacific Cellulose. The Brunswick–Glynn County CWP was initiated in response to concern about chloride contamination of the Upper Floridan aquifer, which first became evident during the 1940s and 1950s. Since inception, the Brunswick–Glynn County CWP has placed emphasis on providing the necessary information about the Floridan aquifer system to manage saltwater intrusion and evaluate water-resources data. During fiscal year 2006 (FY 2006), the monitoring program was continued, including continuous water-level recording and mapping of the potentiometric surface and chloride concentration of the Upper Floridan aquifer. Additional well and borehole-geophysical data also were collected during FY 2006.

## Purpose and Scope

Hydrologic, geologic, and water-quality data are needed to manage water resources effectively in the coastal area of Georgia. The Georgia Department of Natural Resources, Environmental Protection Division (GaEPD) capped permitted withdrawals from the Upper Floridan aquifer at 1997 levels in Glynn County; therefore, an understanding of the available water supply and potential alternative water sources has grown in importance. During FY 2006, 12 continuous water-level recorders were maintained under the Brunswick–Glynn County CWP. In addition, water levels were collected from 52 wells and water from 70 wells was analyzed for chloride concentration during June 2005. Geophysical logs were obtained from Jekyll Tower well (34G003) to assess whether the cause of elevated chloride concentration could be due to leaky well casing.

## Related Studies

The GaEPD Georgia Coastal Sound Science Initiative (CSSI) is a program of scientific and feasibility studies to support development of a final strategy to protect the Upper Floridan aquifer from saltwater contamination. In support of the GaEPD CSSI CWP, the USGS is working on a comprehensive program to evaluate ground-water conditions in the coastal area of Georgia and adjacent parts of South Carolina and Florida. Other participants in the program include other Federal and State agencies, academic institutions, and private consulting firms. Many of the activities of the GaEPD CSSI CWP directly benefit the Brunswick–Glynn County CWP.

# Progress and Significant Technical Findings during Fiscal Year 2006

Progress and significant technical findings of the cooperative water-resources program during the State FY 2006 (July 1, 2005–June 30, 2006) are summarized below. Ground-water levels and chloride concentrations in the Brunswick–Glynn County area have been monitored for several decades as part of the Brunswick–Glynn County CWP. These data are used to guide water-management decisions by State and local authorities.

## Ground-Water-Level and Chloride Monitoring

During FY 2006, ground-water levels in the Brunswick–Glynn County area were continuously monitored in 28 wells; the Brunswick–Glynn County CWP funded 12, and GaEPD–CSSI CWP funded 16 as part of its Statewide network (fig. 1, table 1). Of the 12 continuous water-level recorders funded through the Brunswick–Glynn County CWP, four are completed in the Upper Floridan aquifer, four in the Lower Floridan aquifer, three in the Brunswick aquifer system, and one in the surficial aquifer system. During 2006, a recently abandoned production well at Jekyll Island and a new test well at Lawrence Road, St. Simons Island, were incorporated into the GaEPD–CSSI CWP statewide monitoring network. The well at Jekyll Island (33G033) will provide information on water-level changes in the Upper Floridan aquifer on the barrier island in the southern part of the county, and the well on St. Simons Island (35H077) will provide water-level monitoring in the lower Brunswick aquifer (fig. 1, table 1). In addition to continuous recorders, synoptic water-level measurements were collected in 28 wells completed in the Upper Floridan aquifer during June 2005 and a potentiometric-surface map was prepared using the data.

The high chloride plume and saltwater intrusion were monitored via sampling during June 2005 and analysis of dissolved chloride in water from 70 wells. The chloride plume at Brunswick during June 2005 was mapped and is included herein. Summaries of ground-water conditions in the Brunswick–Glynn County area are provided in the reports, "Water resources data for Georgia, 2004," by Peck and others (2005a), and "Ground-water conditions and studies in Georgia, 2002–03," by Leeth and others (2005). Description of water-levels and chloride concentrations in the project area are provided in the sections, "Ground-Water Levels" and "Ground-Water Quality of the Upper and Lower Floridan Aquifers."

## Geophysical Logging

Geophysical logging was of limited scope during FY 2006, largely because of a lack of new wells in the area. However, an existing 592-ft-deep well (34G003) located along State Highway 520 and State Highway 17 near the Jekyll Towers was logged during November 2005 to check for possible construction flaws as a possible explanation for the elevated chloride concentrations (see Appendix A for records of logs from this well).

## Reports and Technical Presentations

The USGS prepared several reports and technical presentations on coastal Georgia during FY 2006: The USGS has been attending Glynn County Water Resources Management Advisory Committee (WRMAC) meetings, keeping members posted on the Coastal Sound Science Initiative, presenting results from the most recent aquifer tests for the Brunswick and surficial aquifer systems and other hydrologically significant information (such as the impacts of the Durango Paper Company shutting down its paper mill).

### Reports

- USGS scientific investigations report (SIR) completed as part of the coastal Sound Science Initiative titled, "Simulation of saltwater movement in the Upper Floridan aquifer in the Savannah, Georgia–Hilton Head Island, South Carolina, area, Predevelopment–2004, and projected movement for 2000 pumping conditions," by Alden M. Provost, Dorothy F. Payne, and Clifford I. Voss (*http://pubs.usgs.gov/sir/2006/5058/*)
- USGS SIR completed as part of the CSSI titled, "Application of ground-water flow and solute-transport models to simulate selected ground-water management scenarios in coastal Georgia and adjacent parts of South Carolina and Florida, 2000–2100," by Dorothy F. Payne, Alden M. Provost, Jaime A. Painter, Malek Abu Rumman, and Gregory S. Cherry *(http://pubs.usgs.gov/sir/2006/5077/)*
- USGS SIR completed as part of the CSSI titled, "Hydrogeology, water quality and saltwater intrusion in the Upper Floridan aquifer in the offshore area near Hilton Head Island, South Carolina, and Tybee Island, Georgia, 1999–2002," by W. Fred Falls, Camille Ransom, James Landmeyer, Eric Reuber, and Lucy Edwards (*http://pubs.usgs.gov/sir/2005/5134/*)
- USGS SIR completed as part of the CSSI titled, "Hydrogeology, water quality, and water-supply potential of the Lower Floridan aquifer, coastal Georgia, 1999–2002," by W. Fred Falls, Larry Harrelson, Kevin Conlan, Matthew Petkewich *(http://pubs.usgs.gov/sir/2005/5124/)*
- USGS open-file report completed for the U.S. Army at Fort Stewart titled, "Simulation of selected ground-water pumping scenarios at Fort Stewart and Hunter Army Airfield, Bryan, Liberty, Evans, and Chatham Counties, Georgia," by Gregory S. Cherry *(http://pubs.usgs.gov/of/2006/1148/)*
- USGS fact sheet titled "Helping solve Georgia's water problems—The USGS Cooperative Water Program" by John S. Clarke (*http://pubs.usgs.gov/fs/2006/3032/*), includes a feature on the Brunswick–Glynn County CWP.
- USGS fact sheet titled "Georgia's ground-water resources and monitoring network, 2006" (*http://pubs.usgs.gov/fs/2006/3077/*) describes the current ground-water monitoring network in Georgia and its importance

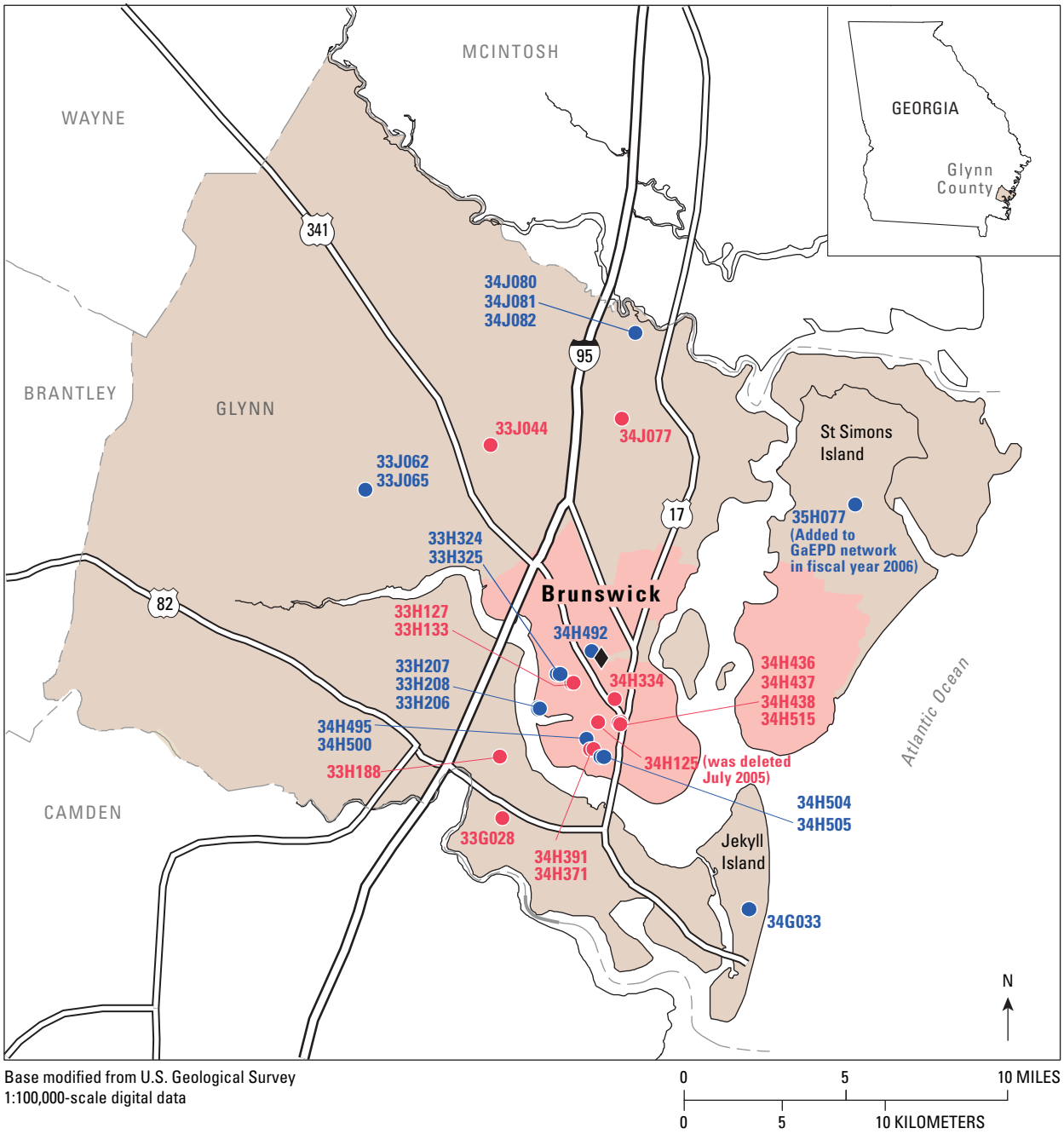
### Technical Presentations

- Presentation by John S. Clarke at the GaEPD, August 2–11, 2005, public meetings titled "Georgia Coastal Sound Science Initiative 2005–What have we learned?" (*http://www.gadnr.org/cws/*)
- Presentation by Dorothy F. Payne at the Georgia Association of Water Professionals 2006 Spring Conference & Expo held in Callaway Gardens, Georgia, on April 4–5, 2006, titled "Saltwater intrusion in Coastal Georgia—What have we learned from the models?"
- Poster presented by Jaime A. Painter at the USGS Geographic Information System workshop held in Denver titled "Chloride concentrations in the Upper Floridan aquifer, City of Brunswick, Glynn County, Georgia, 1957–2005."

## Coastal Sound Science Initiative

Coastal Sound Science Initiative activities, as part of the GaEPD–CSSI CWP during the past fiscal year, have involved completion of the project database and calibration of ground-water flow and solute transport models. The USGS has kept the Glynn County WRMAC informed of progress and results related to modeling, including the development of pumping scenarios to be evaluated by the calibrated models. The WRMAC has made recommendations to the technical advisory committee of the GaEPD–CSSI regarding appropriate scenarios for the Brunswick–Glynn County area.

The GaEPD–CSSI has maintained a saltwater monitoring program near the Brunswick chloride plume at the well sites monitored by MACTEC Engineering and Consulting, Inc. The program consists of monitoring the upper and lower water-bearing zones in the Upper Floridan aquifer in the north Brunswick (wells 33H324 and 33H325) and south Brunswick (wells 34H504 and 34H505) areas (see figure 1 for locations). Each well is equipped with probes that continuously record specific conductance and water levels in an effort to correlate these parameters. The most recent report by MACTEC is reproduced as Appendix B. The MACTEC program ended during January 2006, and the USGS will take over the program as part of the GaEPD–CSSI CWP. The USGS will upgrade the specific conductance and water-level probes to enable monitoring on a real-time basis.




**EXPLANATION**

34J077 Well in Brunswick–Glynn County CWP network for fiscal year 2006

34G033 Well in GaDNR/EPD–CCSI–CWP network for fiscal year 2006

Climatic monitoring site, Coastal Georgia Community College

**Figure 1.** Location of study and continuous ground-water-level monitoring network in the Brunswick–Glynn County area, Georgia. [CWP, Cooperative Water Program; GaDNR/EPD, Georgia Department of Natural Resources, Environmental Division; CCSI, Coastal Sound Science Initiative]

**Table 1.** Brunswick–Glynn County, Georgia, monitoring network, fiscal year 2006.

[do., ditto]

| Well identification | Description | Aquifer or system | Subunit |
|---|---|---|---|
| 33G028 | GPA-3 | Lower Brunswick | None |
| 33H127 | U.S. Geological Survey test well 3 | Upper Floridan | Lower water-bearing zone |
| 33H133 | U.S. Geological Survey test well 6 | do. | Upper water-bearing zone |
| 33H188 | U.S. Geological Survey test well 26 | Lower Floridan | Fernandina permeable zone |
| 33J044 | U.S. Geological Survey test well 27 | do. | Undifferentiated |
| 34H334 | U.S. Geological Survey test well 4 | Upper Floridan | Lower water-bearing zone |
| 34H371 | U.S. Geological Survey test well 11 | do. | Upper water-bearing zone |
| 34H391 | U.S. Geological Survey test well 16 | Lower Floridan | Brackish water zone |
| 34H436 | Coffin Park test well 1 | do. | do. |
| 34H437 | Coffin Park test well 2 | Upper Brunswick | None |
| 34H438 | Coffin Park test well 3 | Surficial aquifer system | Deeper (confined) zone |
| *34H515 | Coffin Park surficial replacement well | do. | do. |
| 34J077 | Golden Isle test well 1S | Upper Brunswick | None |
| | Additional Wells (funded by Georgia Environmental Protection Division) | | |
| 33H206 | Georgia Pacific S test well 1 | Lower Floridan | Brackish water zone |
| 33H207 | Georgia Pacific S test well 2 | Upper Floridan | Upper water-bearing zone |
| 33H208 | Georgia Pacific S test well 3 | Surficial aquifer system | Deeper (confined) zone |
| **33H324 | Georgia Pacific UWBZ | Upper Floridan | Upper water-bearing zone |
| **33H325 | Georgia Pacific LWBZ | do. | Lower water-bearing zone |
| 33J062 | Georgia Forestry Commission GB-1 | Lower Brunswick | None |
| 33J065 | Georgia Forestry Commission GB-4 | Upper Brunswick | None |
| 34G033 | Jekyll No. 9 | Upper Floridan | None |
| 34H492 | Coastal Georgia Community College P-17 | Surficial aquifer system | Water-table zone |
| 34H495 | Georgia Ports Authority Fernandina test well | Lower Floridan | Fernandina permeable zone |
| 34H500 | Georgia Ports Authority Lower Floridan test well | do. | Fresh water-bearing zone |
| **34H504 | Southside Baptist Church UWBZ | Upper Floridan | Upper water-bearing zone |
| **34H505 | Southside Baptist Church LWBZ | do. | Lower water-bearing zone |
| 34J080 | Ebenezer Bend AR-2 | Lower Brunswick | None |
| 34J081 | Ebenezer Bend AR-3 | Upper Brunswick | None |
| 34J082 | Ebenezer Bend AR-4 | Surficial aquifer system | None |
| 35H077 | St. Simons Lower Brunswick 2 | Lower Brunswick | None |

*Replaces 34H438
**See MACTEC report (Appendix B)

# Hydrologic Conditions

Ground-water levels and chloride concentrations in the Brunswick–Glynn County area have been monitored for several decades as part of the Brunswick–Glynn County CWP. These data are used to guide water-management decisions by State and local authorities.

## Precipitation

A real time climatic site was established as part of the GaEPD–CSSI CWP at the Coastal Georgia Community College campus at Brunswick. Daily value graphs for this site are accessible on the Brunswick–Glynn County CWP project Web page at *http://ga.water.usgs.gov/projects/brunswick/*.

Precipitation data and cumulative departure from normal from 1999–2006 are shown in figure 2. The cumulative departure from normal precipitation for the period of record can be used to evaluate trends in precipitation, which typically relate to recharge of the water-table aquifer. Cumulative departure describes the long-term surplus or deficit of precipitation during a designated period and is derived by adding successive values of departures from normal precipitation. In this report, normal precipitation for a given day is defined as the average of total daily precipitation during the period of record (1999–2006).

Cumulative departure data show a below-normal rainfall from 1999 to mid-2002, corresponding to a drought period that generally is accepted to have begun during 1998. Since early 2004, precipitation has been largely above normal (fig. 2).

## Ground-Water Pumpage

During 2005, about 50 million gallons per day (Mgal/d) were withdrawn from the Upper Floridan aquifer in Glynn County, of which 8.9 Mgal/d was for public supply and 41.1 Mgal/d was for industry (Julia L. Fanning, U.S. Geological Survey, written commun., 2006). According to Payne and others (2005), pumpage from the Upper Floridan aquifer in Glynn County decreased from 95.4 Mgal/d during 1980 to 61.1 Mgal/d during 2000, reflecting increased water conservation by local industry. During 2000–2005, pumpage from the Upper Floridan aquifer at the Georgia–Pacific Cellulose plant decreased by nearly 4 Mgal/d, while pumpage at the Hercules–Pinova plant remained at about 8 Mgal/d and for public supply (City of Brunswick, Sea Island, St. Simons Island, and Jekyll Island) remained at about 9 Mgal/d (fig. 3). During 1980–2005, water use by local industries (Georgia–Pacific Cellulose, and Hercules–Pinova) decreased by nearly half, from 78.3 Mgal/d during 1980 to 41.1 Mgal/d during 2005 (Julie L. Fanning, U.S. Geological Survey, written commun., 2006). The reduction in pumpage had a pronounced affect on ground-water levels in the area.

## Ground-Water Levels

During 2005, water levels in the surficial aquifer system were above normal in the two of three wells monitored in Brunswick–Glynn County, reflecting continued recovery from the 1998–2002 drought (fig. 4). A similar recovery was observed in the Brunswick aquifer system, with water levels at or above normal in the five wells monitored (fig. 5). In well 34J077 at the Golden Isles development, the water level was in the normal range, reflecting the possible influence of pumping in that area. Since pumping from the Brunswick aquifer system at the Golden Isles production well began during 1999, the water level has dropped about 12 feet (see hydrograph for well 34J077, Appendix C).

Water levels in the Upper Floridan aquifer were above normal during 2005 in the five of six wells monitored at Brunswick (fig. 6), reflecting the continued coastalwide recovery from the 1998–2002 drought. In the Lower Floridan aquifer, water levels in four of six wells in the Brunswick–Glynn County area also were above normal during 2005, reflecting continued recovery from the 1998–2002 drought (fig. 7). The other two wells had water levels within the normal range for the period of record.

The Durango Paper Company, which was shutdown during 2002, probably contributed in part to the elevated water levels observed in the Floridan aquifer system in Glynn County. The paper mill is located in the St. Marys area, about 30 miles south of Brunswick, and while in operation pumped 35.5 Mgal/d from the Upper Floridan aquifer. Following closure of the Durango Paper Company during 2002, water levels at the center of the cone of depression at St. Marys had risen 200 ft, and in outlying areas of Camden County rose from 4 to 10 ft (Peck and others, 2005).

## Chloride and Sulfate Concentration

Water supply in the Brunswick, Georgia, area primarily is obtained from wells completed in the Upper Floridan aquifer. Pumping has reduced pressure in the aquifer and resulted in saltwater intrusion locally at Brunswick. The current chloride monitoring network is shown in figure 8 and listed in table 2. Chloride concentrations have been monitored in the Brunswick area since the late 1950s, when saltwater was first detected in the southernmost part of Brunswick (Wait, 1965). Saltwater has migrated upward from deep saline zones through breaches in confining units as a result of reduced pressure in the aquifer. By the 1960s, a plume had migrated northward toward two major industrial pumping centers. During June 2005, chloride concentration in water from the Upper Floridan aquifer was above the 250-mg/L State and Federal secondary drinking-water standard (Georgia Environmental Protection Division, 1997; U.S. Environmental Protection Agency, 2000) in a 2-$mi^2$ area, and exceeds 2,250 mg/L in part of the plume area (fig. 8).

## Upper Floridan aquifer

Graphs of chloride concentration in water samples from wells in the upper and lower water-bearing zones of the Upper Floridan aquifer are shown for the south Brunswick area (graphs for wells 34H393 and 34H403, fig. 9) and north Brunswick area (graphs for wells 33H127 and 33H133, fig. 10). Chloride concentration in water from the Lower Floridan aquifer is shown for well 34H391 in the south Brunswick area (fig. 9). More information on the Brunswick area monitoring can be accessed at *http://ga.water.usgs.gov/projects/brunswick/*.

Maps showing the concentration of dissolved chloride in the Upper Floridan aquifer at Brunswick were prepared for June 2004 and June 2005. The June 2005 map is similar to the previously published map for 2003 (Leeth and others, 2005) and shows that areas of highest concentration are near the two industrial pumping centers in the northern part of the city, as well as the original area of contamination in the southern part of the city. The decreases in chloride concentration observed between 2003 and 2004 were temporary because the values during 2005 closely approximated those of 2003 (table 2).

During 2004–2005, chloride concentration within the plume area generally increased in the western and southern part of the contaminated area, and decreased in the eastern part (toward Hercules–Pinova plant; fig. 11). In the south Brunswick area, the greatest increase was 180 mg/L at well 34H403 (figs. 8*B*, 9, and 11; table 2). In the northwestern part of the Brunswick area, chloride concentrations also generally increased, with a maximum increase of 230 mg/L in well 33H130 (figs. 8*B* and 11, table 2). Chloride-concentration trends in the north Brunswick area are illustrated in the graphs shown in figure 10. In the central Brunswick area, chloride concentrations generally rose, with increases ranging from 10 to 490 mg/L (fig. 11). Well 34H401, which showed a decrease in chloride concentration of 410 mg/L during the previous year (2003–2004), had the largest increase of 490 mg/L (figs. 8*B* and 11; table 2). In parts of the area, concentrations in wells located next to each other varied significantly—for example, in the northeastern plume area, concentrations in well 33H221 decreased by 296 mg/L, whereas concentrations in well 33H227, located about 700 ft southwest of the well increased by 122 mg/L (figs. 8*B* and 12, table 2). The reason for this variation is unknown; however, previous investigators have reported the presence of fractures and solution openings in the Brunswick area that could produce highly variable flow conditions in the area (Maslia and Prowell, 1990; Jones and others, 2002).

Outside the plume area, chloride concentrations are below the 250 mg/L drinking-water standard. However, in local areas, chloride concentrations exceed 50 mg/L, which is considered to be above background levels. This includes wells 33H227, 34G002, 34G003, 34H075, and 34H398 (see locations, fig. 8*A*,*B*). The reason for elevated chloride concentrations in these wells remains unclear, but could be related to failed or improper well casing seal (Hall and Peck, 2005). During FY 2006, borehole geophysical and TV-camera data were collected from well 34G003 to assess well construction (see geophysical logs, Appendix A). Results of this effort were inconclusive; there were no apparent flaws in the well construction, so the source of the saltwater remains unclear.

The Perry Park well (34H368) is also outside the plume area, with chloride concentrations that fluctuate in response to pumping changes. This City of Brunswick production well is currently (2006) out of service and is planned for incorporation into the Brunswick–Glynn County CWP monitoring network during FY 2007. This well is a valuable and important site for continuous water-level and specific-conductance monitoring because this is the only known area where the chloride plume appears to fluctuate in horizontal position.

## Surficial and Brunswick Aquifer Systems

Historically, water-quality data-collection efforts in the Glynn County area have focused on the Floridan aquifer system. However, Clarke and others (1990) recognized that locally, water-quality problems do exist in the surficial and Brunswick aquifer systems, and that these problems typically can be associated with (1) saltwater encroachment in shallow wells near the coast, tidal rivers, and estuaries; (2) upward leakage of water from underlying aquifers through semiconfining units or fractures as a result of natural or pumping-induced head gradients; or (3) failed well casing. Localized saltwater contamination has been recognized in a number of areas along the coast, including Vernonburg in Chatham County (Hall and Peck, 2005) and Sea Island (Julie Vann, Georgia Environmental Protection Division, written commun., July 2005).

Data suggest that the water quality of these shallower aquifer systems can be maintained with careful management. Figure 12 presents chloride concentration data from three wells completed in the semiconfined portion of the surficial aquifer and one well completed in the lower Brunswick aquifer. Well 34H428 (fig. 12) represents freshwater in the surficial aquifer system, with chloride concentrations below 14 mg/L, varying less than 2 mg/L. On the other hand, well 34H438 is completed in the surficial aquifer system and recently has been impacted by saltwater. In the past, it was surmised that the increase in chloride concentration was the result of poor well construction. However, recently conducted borehole geophysical and television surveys indicated no apparent well construction problems, and a replacement well (34H515) drilled during December 2004 had specific conductance values consistent with high chloride concentrations. These data suggest that the high concentrations are unlikely to be associated with well construction flaws.

Wells 34H446 and 34H448 are a well "cluster," with the former completed in the Brunswick aquifer system and the latter in the surficial aquifer. These wells also represent the result of careful use of best management practices. Because of an increase in chloride concentration in the Brunswick aquifer system well, a replacement well into the confined surficial aquifer was completed during May 1989. This resulted in a decrease in chloride concentration of more than 2,000 mg/L in well 34H446—likely because the head gradient that was causing saltwater leakage or encroachment was reduced or eliminated after pumping from the well ceased.

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# Table 2 and Figures 2–12

**Table 2.** Chloride and sulfate concentrations of water samples collected during June 2003, 2004, and 2005 and specific conductance of water samples collected during June 2005.

[Well locations shown in figure 8*A*,*B*; mg/L, milligrams per liter; specific conductance at 25 degrees Celsius; —, no data]

| Well identification | Aquifer or system | June 2003 | | June 2004 | | June 2005 | | June 2005 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Chloride | Sulfate | Chloride | Sulfate | Chloride | Sulfate | Specific conductance | |
| | | mg/L | | mg/L | | mg/L | | Field | Lab |
| 33G001 | Lower Floridan aquifer | 34.9 | 119.0 | 32.7 | 125.0 | 33.2 | 137.0 | 613 | 614 |
| 33G002 | Upper Floridan aquifer | — | — | 70.5 | 130 | 72.8 | 137 | 730 | 731 |
| 33G003 | Floridan aquifer system | — | — | 68.1 | 0.9 | 27.4 | 99.0 | 527 | 528 |
| 33G008 | Upper Floridan aquifer | — | — | 24.1 | 97 | 23.7 | 98.0 | 518 | 518 |
| 33G024 | Upper Floridan aquifer | 18.6 | 90 | 16.8 | 96 | 14.7 | 95.2 | 485 | 485 |
| 33G028 | Brunswick aquifer system | — | — | 14.0 | 0.5 | 12.4 | 2.1 | 192 | 193 |
| 34G002 | Upper Floridan aquifer | 37.1 | 100 | 79.1 | 124 | 77.3 | 128 | 731 | 726 |
| 34G003 | Upper Floridan aquifer | 136 | 150 | 150 | 154 | 153 | 176 | 1,013 | 1,011 |
| 34G005 | Upper Floridan aquifer | — | — | — | — | 22.9 | 97.9 | — | — |
| 34G036 | Lower Floridan aquifer | 305 | 89.1 | 438 | 199 | 453 | 323 | 2,160 | 2,136 |
| 32H001 | Upper Floridan aquifer | 30.2 | 83.2 | 25.3 | 80.3 | 24.8 | 80.3 | 488 | 481 |
| 33H113 | Upper Floridan aquifer | — | — | 381 | 197 | — | — | — | — |
| 33H120 | Upper Floridan aquifer | 23.0 | 89.3 | 19.3 | 89.1 | 17.5 | 85.3 | 462 | 461 |
| 33H127 | Floridan aquifer system | 879 | 346 | 907 | 389 | 906 | 353 | 3,330 | 3,284 |
| 33H130 | Upper Floridan aquifer | 3,010 | 851 | 2,460 | 730 | 2,690 | 780 | 8,790 | 8,670 |
| 33H133 | Upper Floridan aquifer | 2,050 | 631 | 1,950 | 629 | 2,160 | 670 | 7,280 | 7,180 |
| 33H154 | Floridan aquifer system | 1,970 | 541 | 2,060 | 590 | 2,210 | 571 | 7,440 | 7,380 |
| 33H177 | Upper Floridan aquifer | 28.7 | 121 | 24.2 | 122 | 22.4 | 126 | 558 | 560 |
| 33H183 | Upper Floridan aquifer | 25.4 | 104 | 23.7 | 106 | 31.1 | 110 | 560 | 557 |
| 33H188 | Lower Floridan aquifer | — | — | 8,170 | 2,920 | 10,285 | 3,120 | 30,100 | 38,520 |
| 33H190 | Upper Floridan aquifer | 25.2 | 84.6 | 20.8 | 83.8 | 19.1 | 80.8 | 465 | 465 |
| 33H206 | Lower Floridan aquifer | 357 | 253 | 404 | 197 | 416 | 257 | 1,834 | 1,805 |
| 33H207 | Upper Floridan aquifer | 21.0 | 85.9 | 15.5 | 100 | 15.9 | 82.7 | 409 | 408 |
| 33H211 | Upper Floridan aquifer | 15.6 | 83.6 | 14.2 | 84.1 | 16.1 | 80.4 | 450 | 447 |
| 33H212 | Floridan aquifer system | 1,210 | 540 | 1,130 | 516 | 1,160 | 488 | 4,490 | 4,450 |
| 33H213 | Upper Floridan aquifer | 58.1 | 125 | 48.4 | 120 | 35.0 | 112 | 613 | 606 |
| 33H221 | Upper Floridan aquifer | 1,180 | 411 | 1,130 | 430 | 834 | 375 | 4,350 | 3,400 |
| 33H222 | Upper Floridan aquifer | 595 | 249 | 303 | 162 | 626 | 277 | 2,560 | 2,544 |
| 33H227 | Upper Floridan aquifer | 35.8 | 108 | 125 | 125 | 247 | 173 | 1,260 | 1,267 |
| 34H012 | Upper Floridan aquifer | — | — | 26 | 98 | — | — | — | — |
| 34H075 | Floridan aquifer system | 29.0 | 92.1 | 42.8 | 93.9 | 51.3 | 97.9 | 593 | 590 |
| 34H078 | Floridan aquifer system | 222 | 125 | 334 | 154 | — | — | — | — |
| 34H095 | Upper Floridan aquifer | — | — | 26 | 90 | 27.1 | 81.2 | 485 | 490 |
| 34H112 | Upper Floridan aquifer | 1,660 | 472 | 1,580 | 501 | 1,620 | 464 | 5,550 | 5,520 |
| 34H117 | Upper Floridan aquifer | 527 | 206 | 497 | 175 | 499 | 222 | 2,170 | 2,159 |
| 34H125 | Upper Floridan aquifer | 605.0 | 280.0 | 496.0 | 188.0 | 479.0 | 256.0 | 2,180 | 2,171 |

**Table 2.** Chloride and sulfate concentrations of water samples collected during June 2003, 2004, and 2005 and specific conductance of water samples collected during June 2005.—Continued

[Well locations shown in figure 8*A*,*B*; mg/L, milligrams per liter; specific conductance at 25 degrees Celsius; —, no data]

| Well identification | Aquifer or system | June 2003 | | June 2004 | | June 2005 | | June 2005 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Chloride | Sulfate | Chloride | Sulfate | Chloride | Sulfate | Specific conductance | |
| | | mg/L | | mg/L | | mg/L | | Field | Lab |
| 34H128 | Upper Floridan aquifer | 727 | 341 | 682 | 349 | 706 | 349 | 2,920 | 2,906 |
| 34H134 | Floridan aquifer system | 46.7 | 88.0 | 38.9 | 86.7 | 45.3 | 86.9 | 552 | 550 |
| 34H334 | Upper Floridan aquifer | 1,120 | 269 | 1,080 | 288 | 1,070 | 347 | 3,900 | 3,862 |
| 34H344 | Upper Floridan aquifer | 26.9 | 86.5 | 25.7 | 86.1 | 18.6 | 84.8 | 460 | 459 |
| 34H354 | Floridan aquifer system | 1,360 | 502 | 1,360 | 513 | 1,330 | 460 | 4,870 | 4,900 |
| 34H355 | Upper Floridan aquifer | 237 | 129 | 313 | 147 | 321 | 168 | 1,510 | 1,504 |
| 34H371 | Upper Floridan aquifer | 17.0 | 91.8 | 14.5 | 91.8 | 12.7 | 90.0 | 447 | 449 |
| 34H373 | Upper Floridan aquifer | 381 | 217 | 402 | 185 | 387 | 239 | 1,810 | 1,815 |
| 34H374 | Upper Floridan aquifer | 959 | 339 | 985 | 382 | 1,040 | 387 | 3,910 | 3,874 |
| 34H391 | Lower Floridan aquifer | 3,030 | 717 | 2,340 | 621 | 2,470 | 608 | 8,160 | 8,090 |
| 34H393 | Upper Floridan aquifer | 2,130 | 585 | 1,820 | 536 | 1,980 | 518 | 6,560 | 6,520 |
| 34H398 | Floridan aquifer system | 126 | 169 | 135 | 163 | 140 | 197 | 1,008 | 1,007 |
| 34H399 | Lower Floridan aquifer | 6,590 | 1,290 | 5,910 | 1,410 | 6,440 | 1,450 | 18,280 | 21,640 |
| 34H400 | Upper Floridan aquifer | 425 | 190 | 412 | 170 | 422 | 210 | 1,880 | 1,882 |
| 34H401 | Upper Floridan aquifer | 2,200 | 703 | 1,790 | 609 | 2,280 | 750 | 6,580 | 6,530 |
| 34H402 | Floridan aquifer system | 2,740 | 851 | 2,020 | 669 | 2,210 | 702 | 7,470 | 7,370 |
| 34H403 | Floridan aquifer system | 1,310 | 244 | 1,240 | 395 | 1,420 | 399 | 4,790 | 4,790 |
| 34H413 | Upper Floridan aquifer | 623 | 254 | 587 | 256 | 471 | 244 | 2,110 | 2,099 |
| 34H426 | Lower Floridan aquifer | — | — | 854 | 315 | 881 | 327 | 3,430 | 3,432 |
| 34H427 | Upper Floridan aquifer | 1,470 | 497 | 1,520 | 520 | 1,520 | 465 | 5,510 | 5,190 |
| 34H428 | Surficial aquifer system | 13.9 | 81.8 | 12.8 | 77.8 | 11.3 | 82.7 | 480 | 483 |
| 34H434 | Upper Floridan aquifer | 2,040 | 679 | 1,740 | 616 | 1,840 | 583 | 6,330 | 6,320 |
| 34H436 | Lower Floridan aquifer | 22.9 | 103 | 20.2 | 105 | 18.9 | 104 | 495 | 493 |
| 34H438 | Surficial aquifer system | 2,870 | 285 | 2,540 | 304 | — | — | — | — |
| 34H445 | Upper Floridan aquifer | 17.6 | 87.8 | 16.4 | 87.7 | 15.9 | 85.9 | 452 | 449 |
| 34H446 | Lower Brunswick aquifer | 285 | 189 | 285 | 170 | 297 | 208 | 1,470 | 1,486 |
| 34H448 | Surficial aquifer system | 20.7 | 85.5 | 18.3 | 87.0 | 15.3 | 87.4 | 520 | 520 |
| 34H449 | Upper Floridan aquifer | 31.0 | 94.7 | 24.9 | 95.3 | 24.0 | 94.7 | 499 | 499 |
| 34H450 | Upper Floridan aquifer | 21.7 | 85.6 | 17.9 | 84.5 | 15.3 | 81.9 | 448 | 442 |
| 34H469 | Upper Floridan aquifer | 1,350 | 174 | 1,140 | 450 | — | 117 | 4,090 | 4,070 |
| 34H507 | Upper Floridan aquifer | — | — | — | — | 24.9 | 96.9 | — | — |
| 34H514 | Upper Floridan aquifer | — | — | 242 | 118 | — | — | 1,190 | 1,400 |
| 34H515 | Surficial aquifer system | — | — | — | — | 5,370 | 665 | — | — |

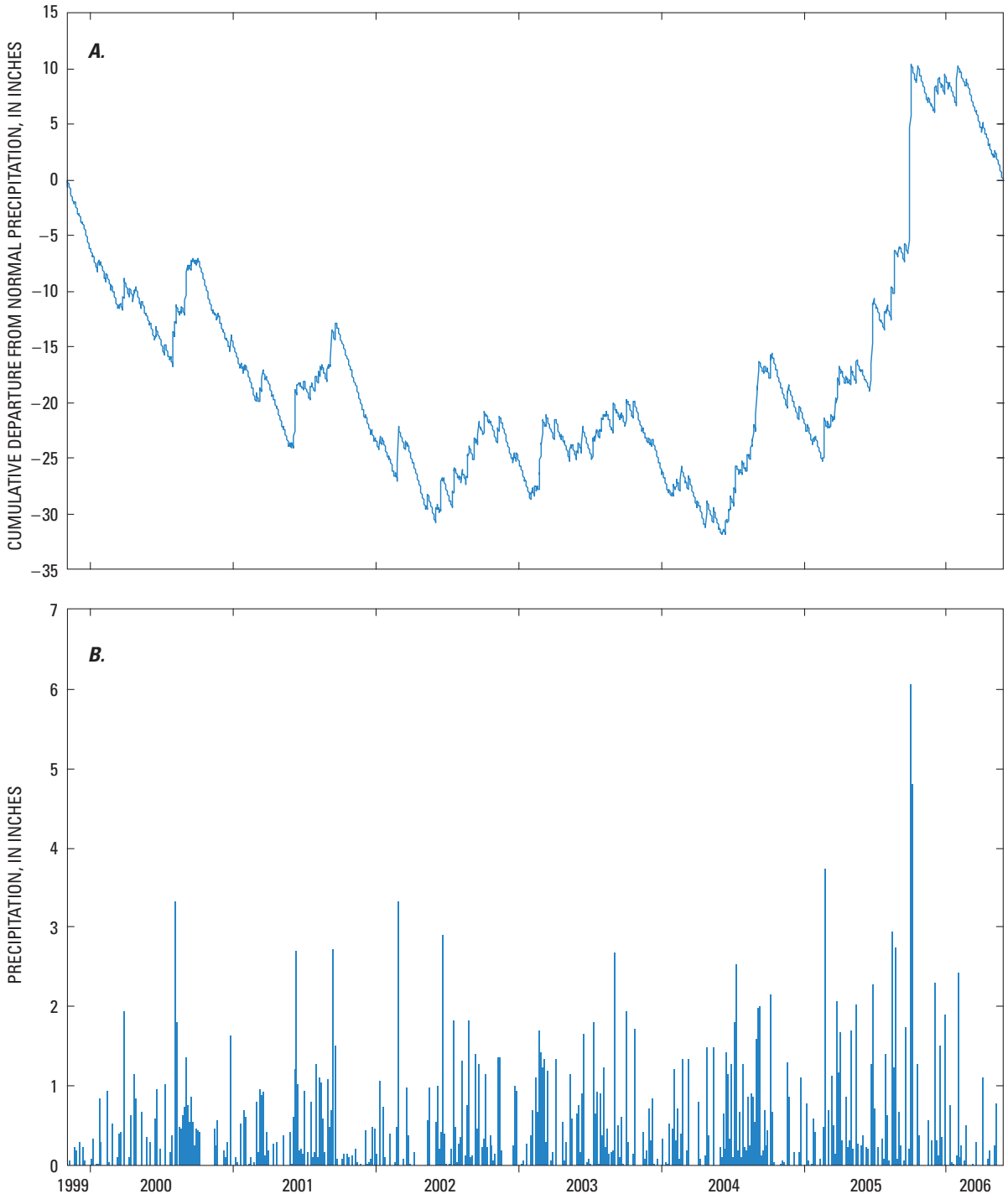



**Figure 2.** (*A*) Cumulative departure from normal precipitation and (*B*) total daily precipitation at Coastal Georgia Community College, Georgia, 1999–2006 (see figure 1 for location).

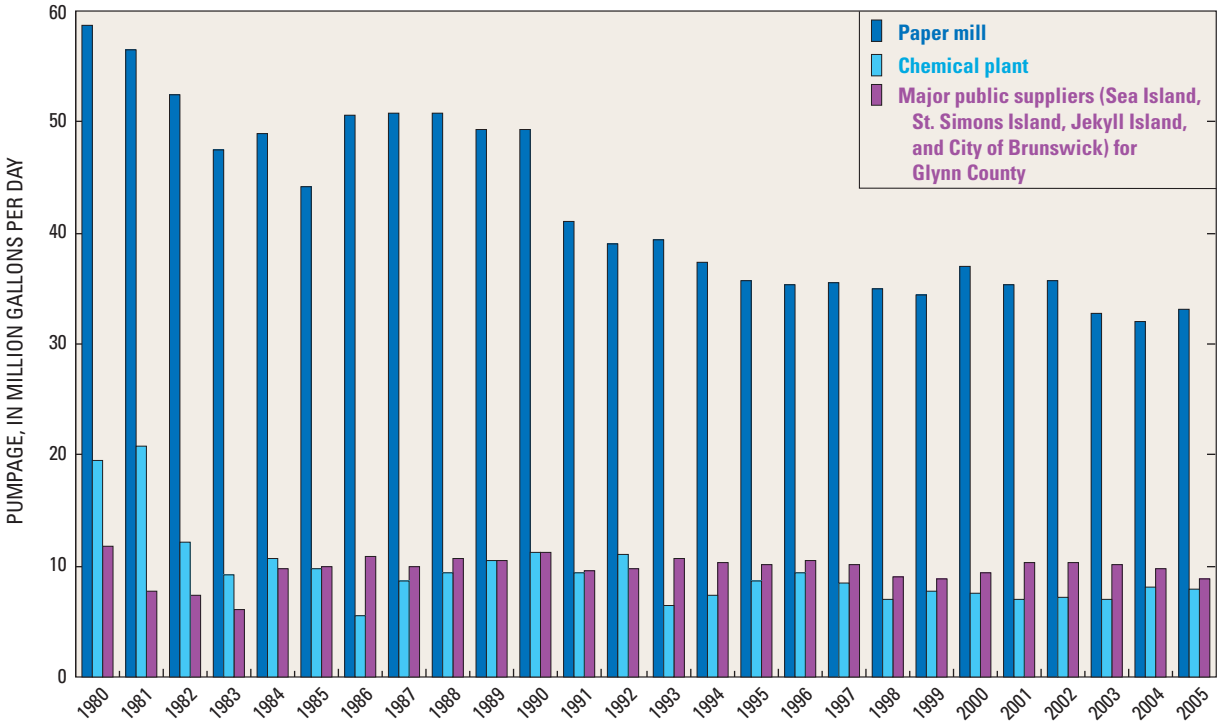
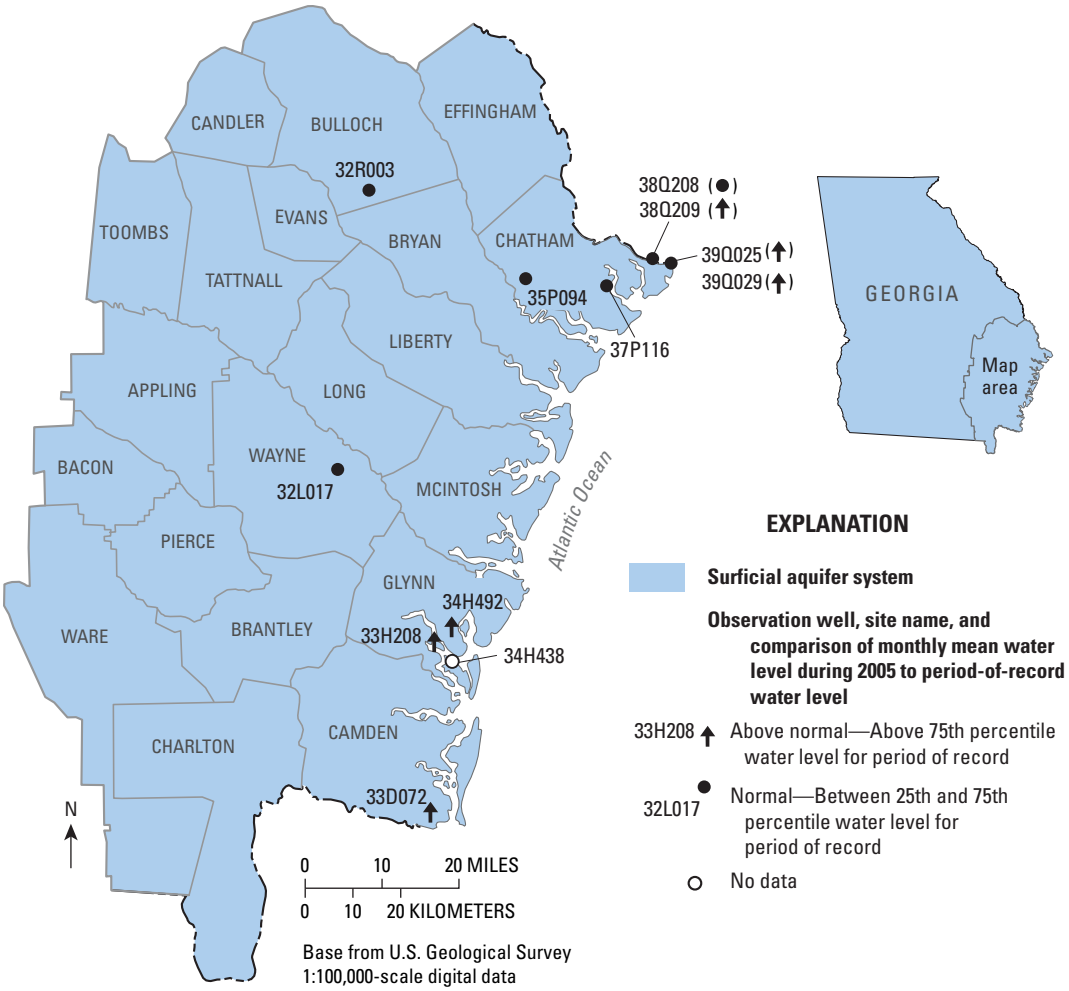
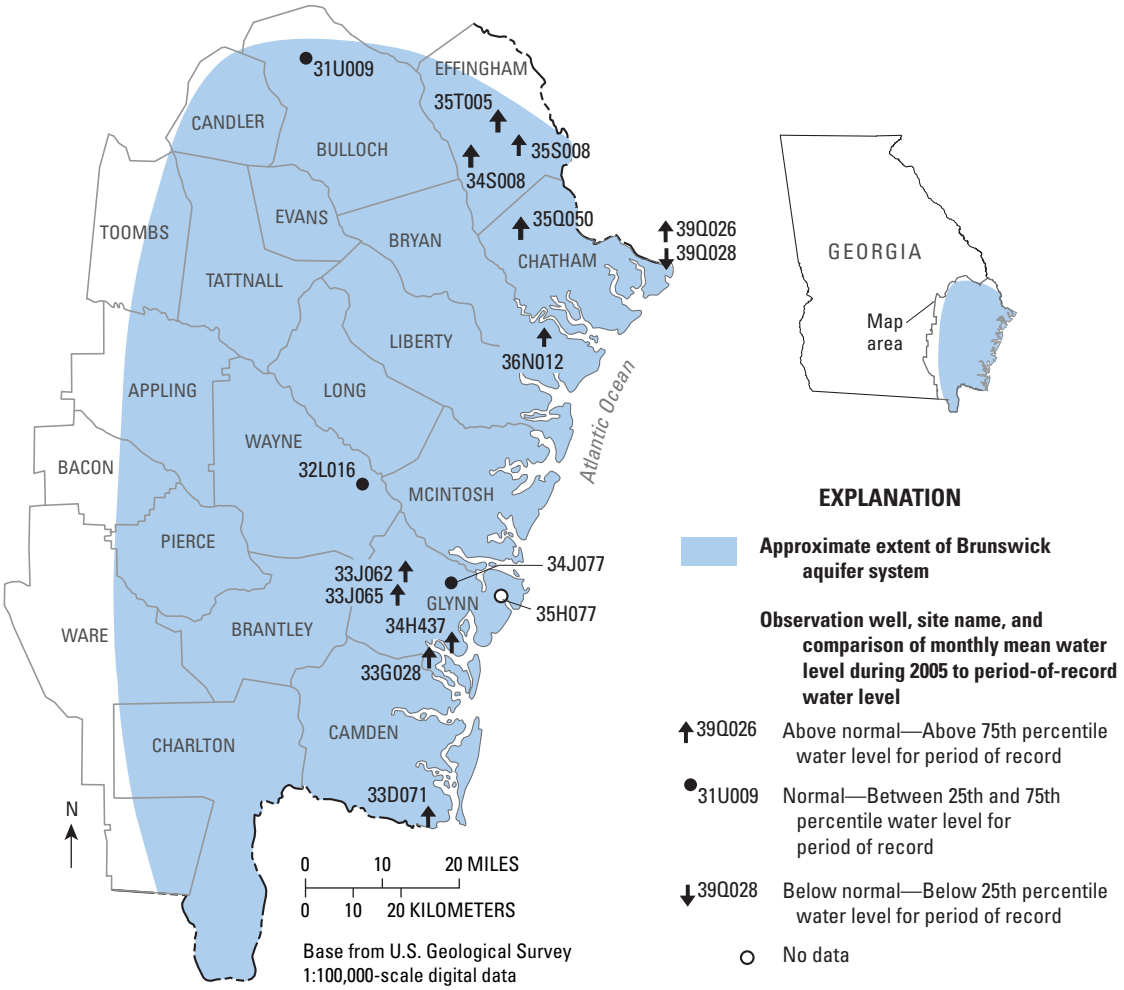



**Figure 3.** Major ground-water pumpage from the Upper Floridan aquifer in the Brunswick–Glynn County area, Georgia, 1980–2005.




| Site name | County | Other identifier |
|---|---|---|
| 32R003 | Bulloch | Bulloch South test well 2 |
| 33D072 | Camden | Georgia Department of Natural Resources, Environmental Protection Division, St Marys, test well 3 |
| 35P094 | Chatham | University of Georgia, Bamboo Farm well |
| 37P116 | Chatham | Georgia Department of Natural Resources, Environmental Protection Division, Skidaway Institute, test well 4 |
| 38Q208 | Chatham | Fort Pulaski, Savannah Harbor Expansion, monitoring well 4, U.S. Army Corps of Engineers (COE) |
| 38Q209 | Chatham | Fort Pulaski, Savannah Harbor Expansion, monitoring well 3, COE |
| 39Q025 | Chatham | Georgia Department of Natural Resources, Environmental Protection Division, Tybee Island, test well 2 |
| 39Q029 | Chatham | Tybee, Savannah Harbor Expansion, monitoring well 1, COE |
| 33H208 | Glynn | Georgia-Pacific, south, test well 3 |
| 34H438 | Glynn | Georgia Department of Natural Resources, Environmental Protection Division, Coffin Park, test well 3 |
| 34H492 | Glynn | Coastal Georgia Community College P-17 |
| 32L017 | Wayne | Georgia Department of Natural Resources, Environmental Protection Division, Gardi, test well 3 |

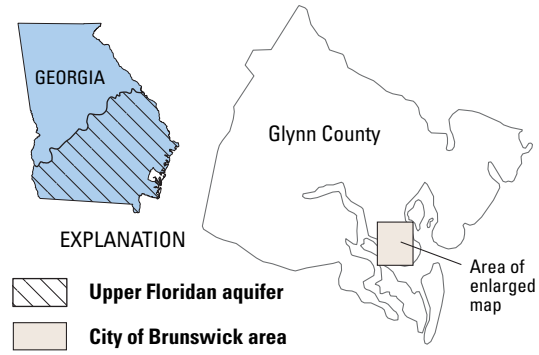
**Figure 4.** Ground-water levels in the surficial aquifer system in coastal Georgia, 2005.



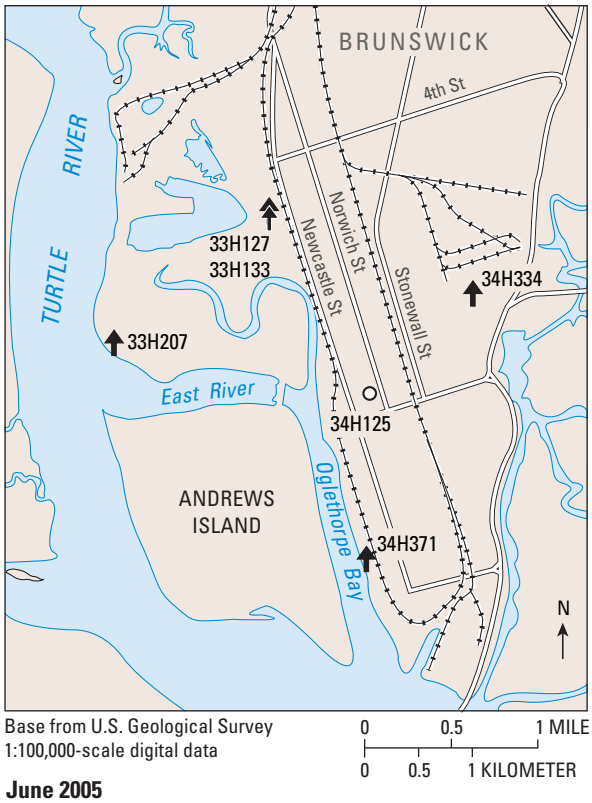

| Site name | Water-bearing unit[1] | County | Other identifier |
|---|---|---|---|
| 36N012 | L | Bryan | Genesis Point |
| 31U009 | UX | Bulloch | Georgia Department of Natural Resources, Environmental Protection Division, Hopeulikit, test well 2 |
| 33D071 | U | Camden | Georgia Department of Natural Resources, Environmental Protection Division, St Marys, test well 2 |
| 35Q050 | B | Chatham | Georgia Forestry Commission, test well CB-1 |
| 39Q026 | UX | Chatham | Tybee Island, test well 3 |
| 39Q028 | UX | Chatham | Tybee, Savannah Harbor Expansion, monitoring well 2, U.S. Army Corps of Engineers (COE) |
| 34S008 | LX | Effingham | Pineora test well EB-1 |
| 35S008 | LX | Effingham | Effingham County, Georgia Geologic Survey, corehole |
| 35T005 | UX | Effingham | Springfield, Georgia, Miocene well |
| 33G028 | B | Glynn | Georgia Ports Authority, well 3 |
| 33J062 | L | Glynn | Georgia Forestry Commission, test well GB-1 |
| 33J065 | U | Glynn | Georgia Forestry Commission, test well GB-4 |
| 34H437 | U | Glynn | Georgia Department of Natural Resources, Environmental Protection Division, Coffin Park, test well 2 |
| 34J077 | U | Glynn | Golden Isle, test well 1S |
| 35H077 | L | Glynn | Georgia Department of Natural Resources, Environmental Protection Division, St Simons lower Brunswick 2 |
| 32L016 | U | Wayne | Georgia Department of Natural Resources, Environmental Protection Division, Gardi, test well 2 |

[1]B, Brunswick aquifer system; L, lower Brunswick aquifer; U, upper Brunswick aquifer; UX, undifferentiated, low-permeability equivalent to the upper Brunswick aquifer; LX, undifferentiated, low-permeability equivalent to the lower Brunswick aquifer

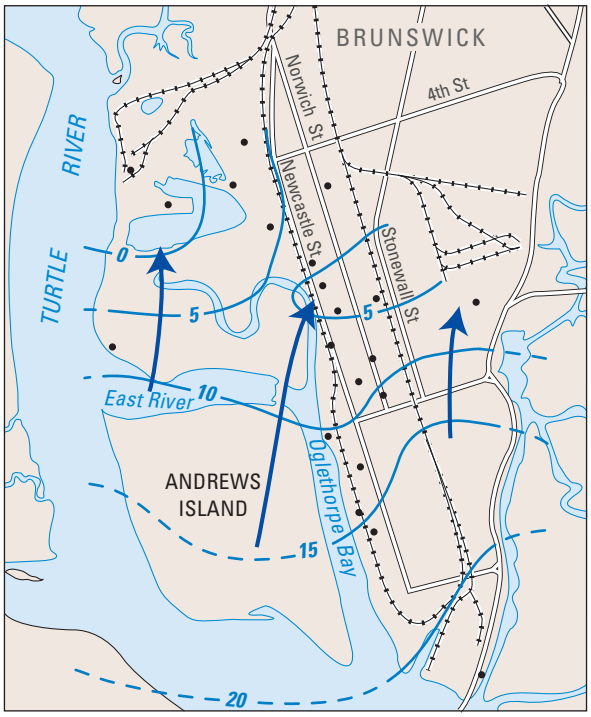
**Figure 5.** Ground-water levels in the Brunswick aquifer system in coastal Georgia, 2005.



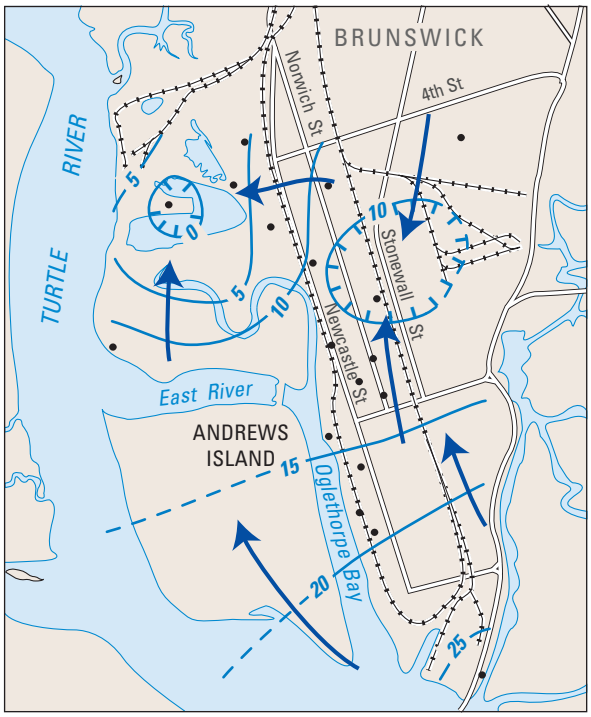

| Site name | County | Other identifier |
|---|---|---|
| 33H127 | Glynn | U.S. Geological Survey, test well 3 |
| 33H133 | Glynn | U.S. Geological Survey, test well 6 |
| 33H207 | Glynn | Georgia-Pacific, south, test well 2 |
| 34H125 | Glynn | U.S. Geological Survey, test well 1 |
| 34H334 | Glynn | U.S. Geological Survey, test well 4 |
| 34H371 | Glynn | U.S. Geological Survey, test well 11 |




**June 2004**




**June 2005**



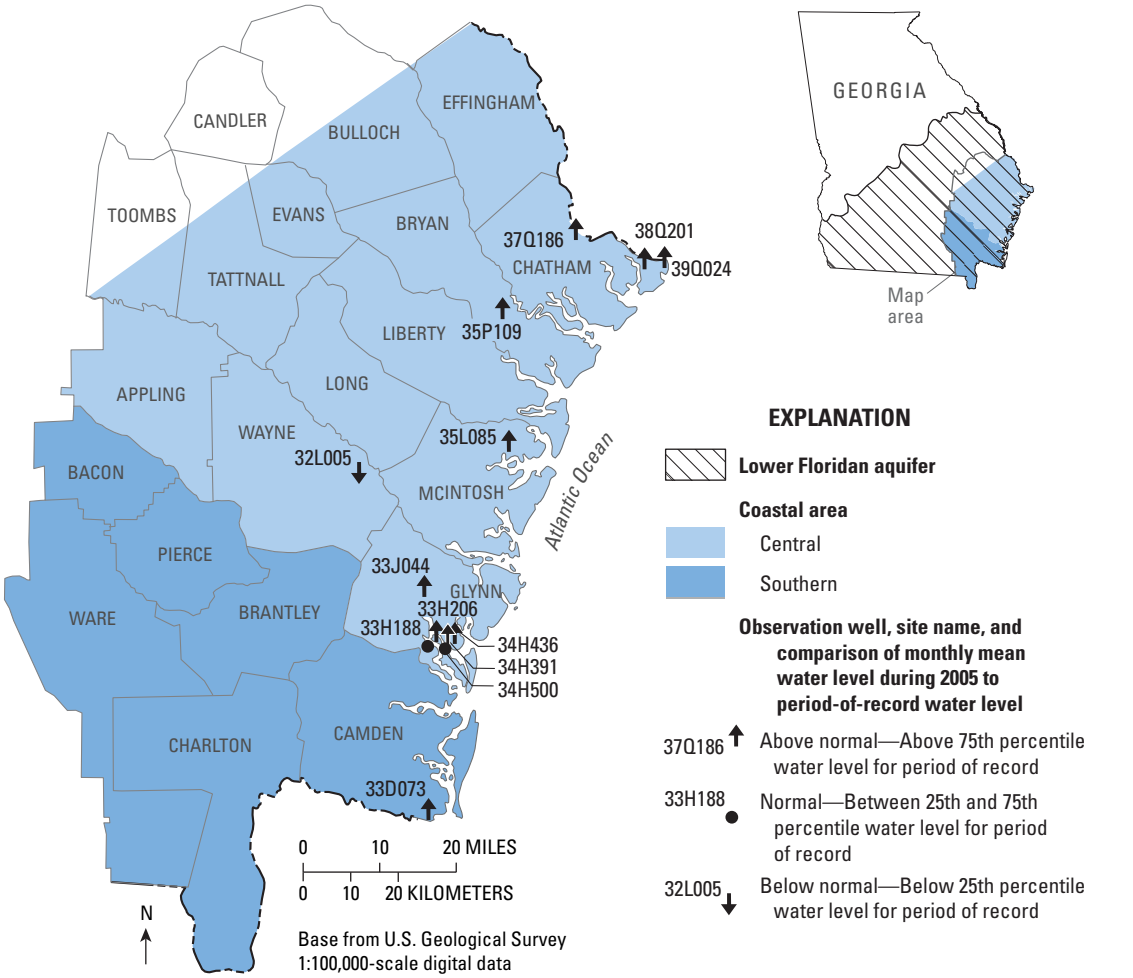

**EXPLANATION**

**15** **Potentiometric contour**—Shows altitude at which water level would have stood in tightly cased wells in the upper Floridan aquifer. Dashed where approximately located. Hachures indicate depression. Contour interval 5 feet. Datum is NAVD 88.

**General direction of ground-water flow**

**Observation well**

**Figure 6.** Ground-water levels in the Upper Floridan aquifer in the Brunswick area, Georgia, 2004–2005.




| Site name | Water-bearing unit[1] | County | Other identifier |
|---|---|---|---|
| 35P109 | LF | Bryan | Richmond Hill, test well |
| 33D073 | LF | Camden | St Marys, test well (deep) |
| 37Q186 | P | Chatham | Hutchinson Island, test well 2 |
| 38Q201 | P | Chatham | Georgia Department of Natural Resources, Environmental Protection Division, Fort Pulaski, test well |
| 39Q024 | LF | Chatham | Georgia Department of Natural Resources, Environmental Protection Division, Tybee Island, test well 1 |
| 33H188 | F | Glynn | U.S. Geological Survey, test well 26 |
| 33H206 | LF | Glynn | Georgia-Pacific, south, test well 1 |
| 33J044 | LF | Glynn | U.S. Geological Survey, test well 27 |
| 34H391 | LF | Glynn | U.S. Geological Survey, test well 16 |
| 34H436 | LF | Glynn | Georgia Department of Natural Resources, Environmental Protection Division, Coffin Park, test well 1 |
| 34H500 | LF | Glynn | Georgia Department of Natural Resources, Environmental Protection Division, test well 30 |
| 35L085 | LF | McIntosh | McIntosh County, test well 1 |
| 32L005 | LF | Wayne | Hopkins No. 2 |

[1]LF, Lower Floridan aquifer; P, Paleocene unit of lower permeability; F, Fernandina permeable zone

**Figure 7.** Ground-water levels in the Lower Floridan aquifer in the central and southern coastal areas, Georgia, 2005.

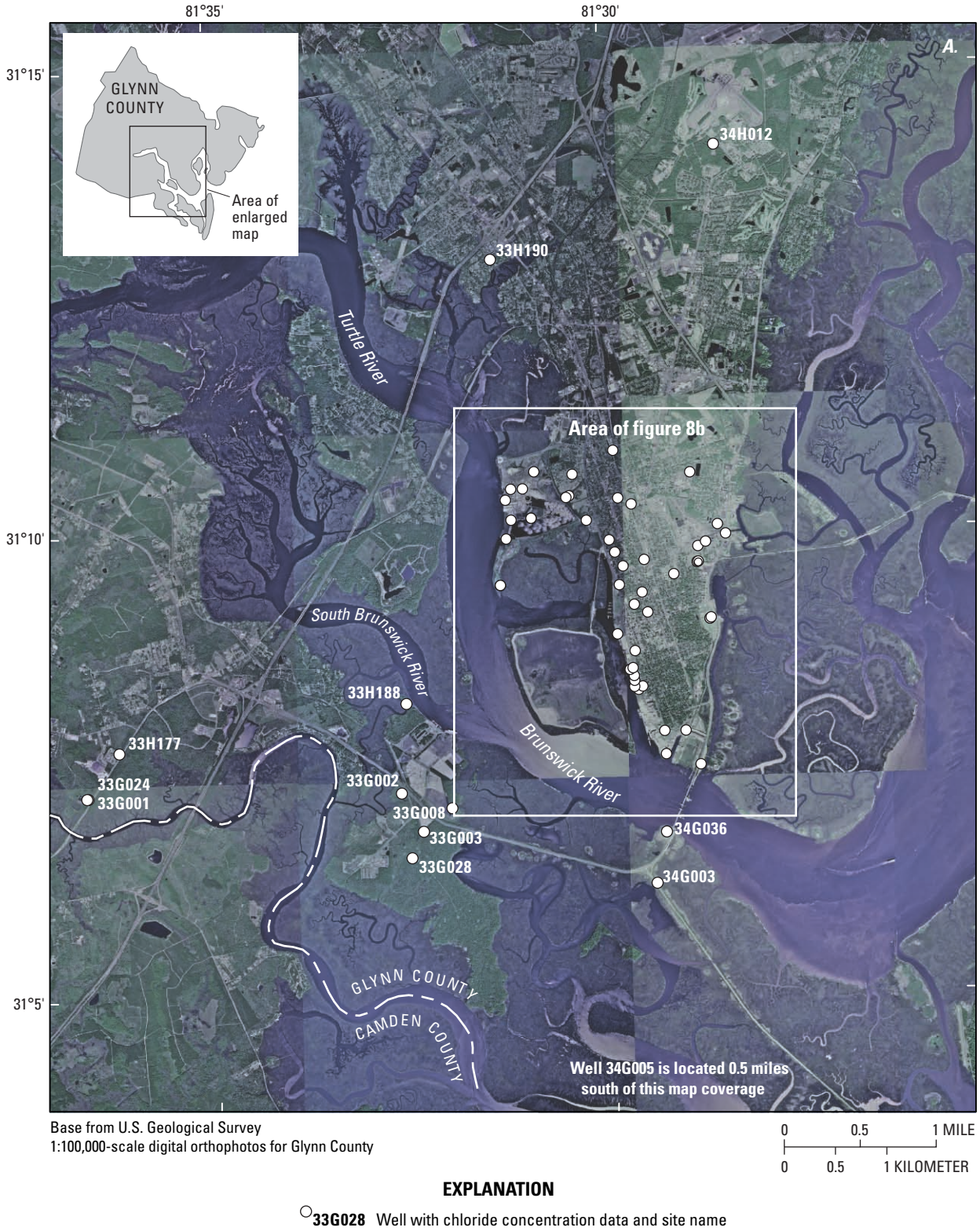



**Figure 8.** (*A*) Chloride-monitoring network in the Brunswick–Glynn County area, Georgia, June 2005; (*B*) chloride-monitoring network in the Brunswick area, Georgia, June 2005.


**Figure 8.** (*A*) Chloride-monitoring network in the Brunswick–Glynn County area, Georgia, June 2005; (*B*) Chloride-monitoring network in the Brunswick area, Georgia, June 2005.—Continued

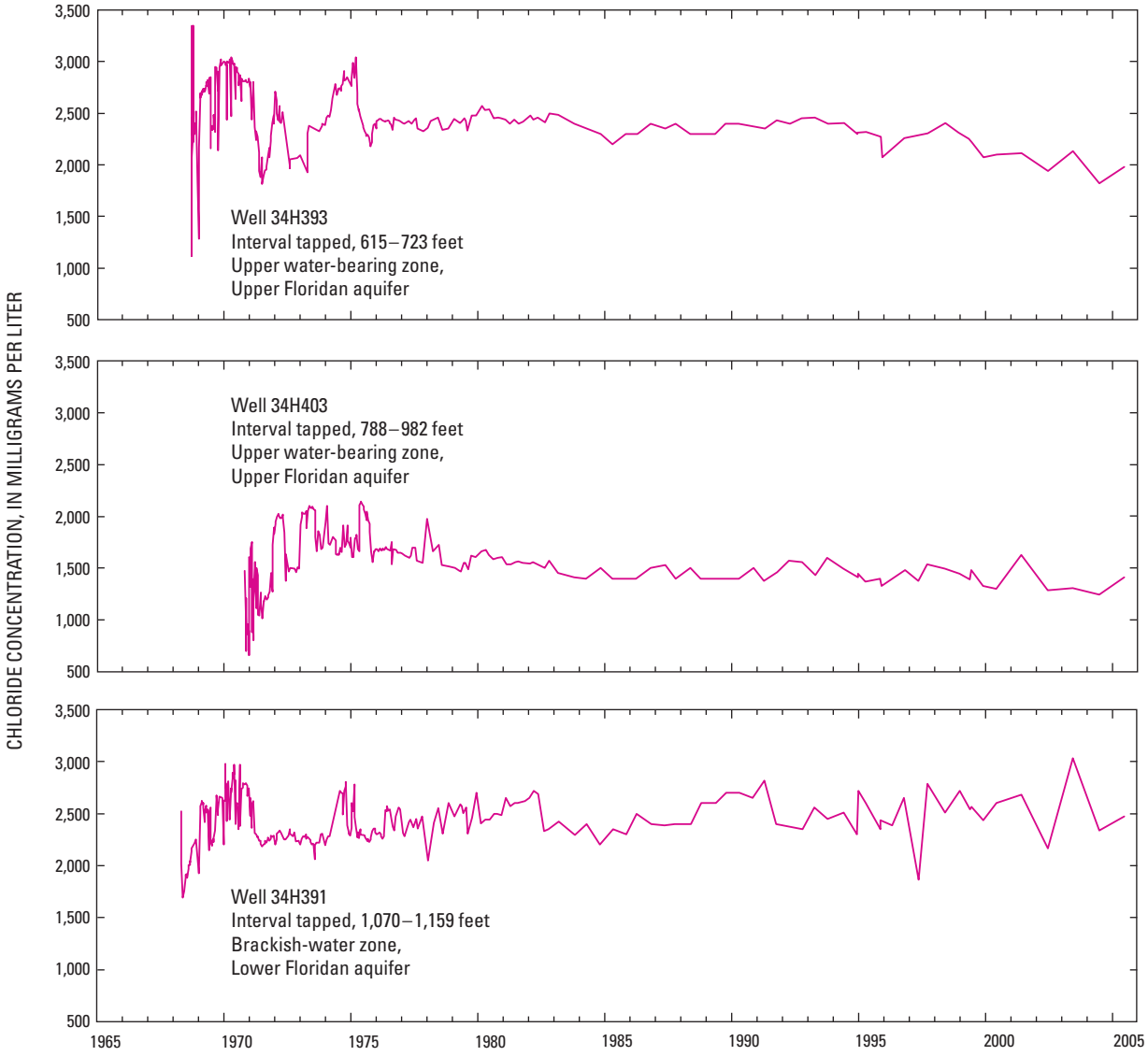



**Figure 9.** Chloride concentration in water for selected wells in the southern Brunswick area, Georgia, 1968–2005 (see figure 8*B* for well location).

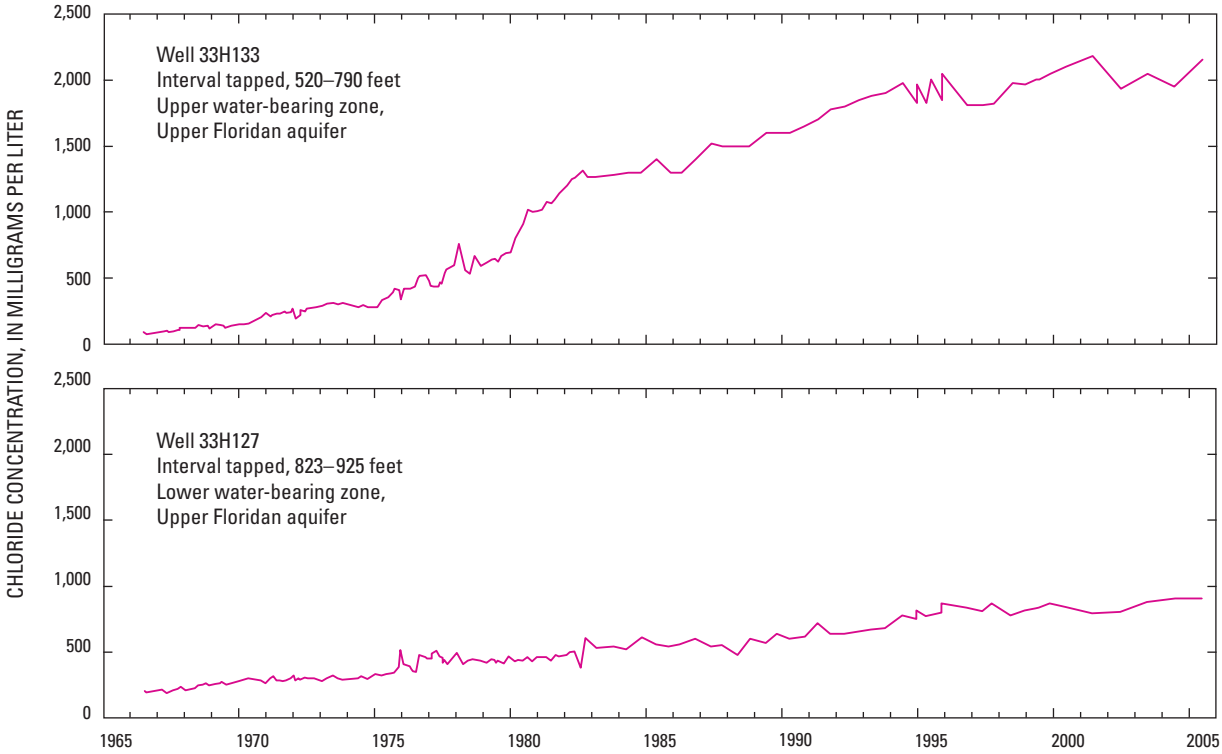
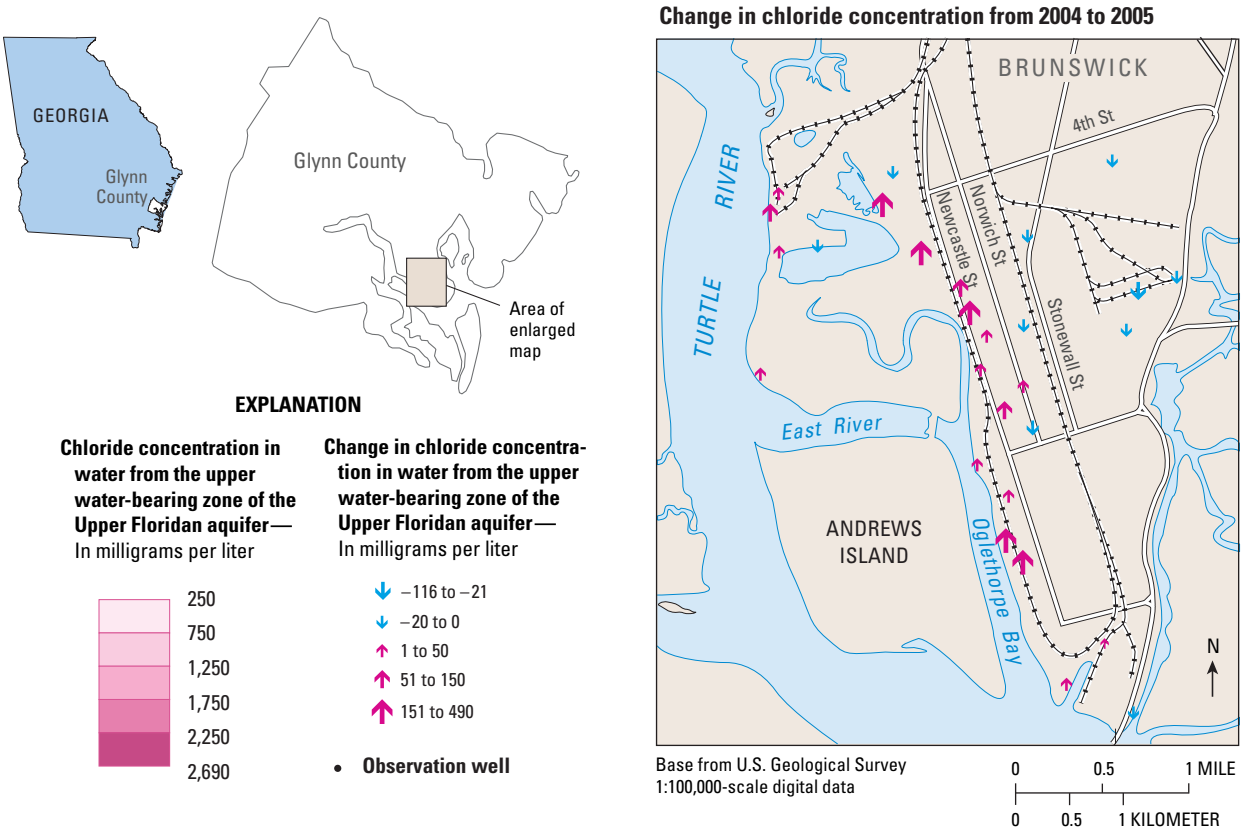
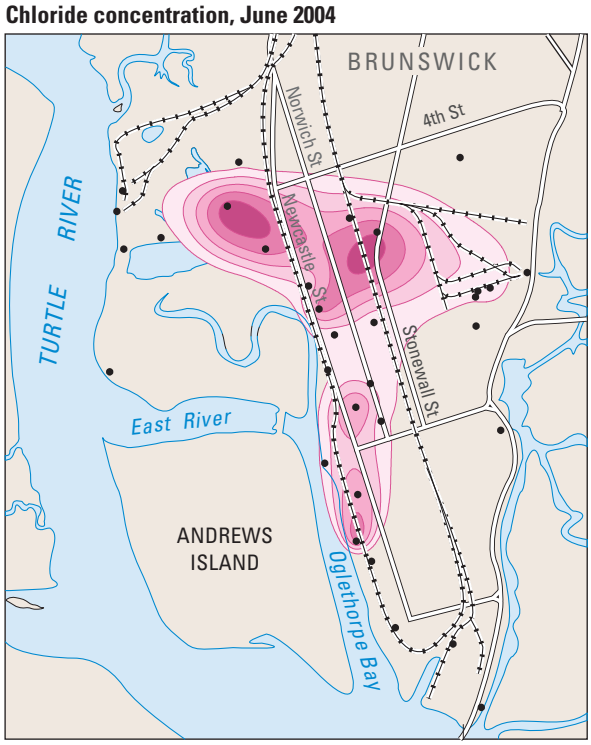



**Figure 10.** Chloride concentration in water for selected wells in the northern Brunswick area, Georgia, 1966–2005 (see figure 8*B* for well location).



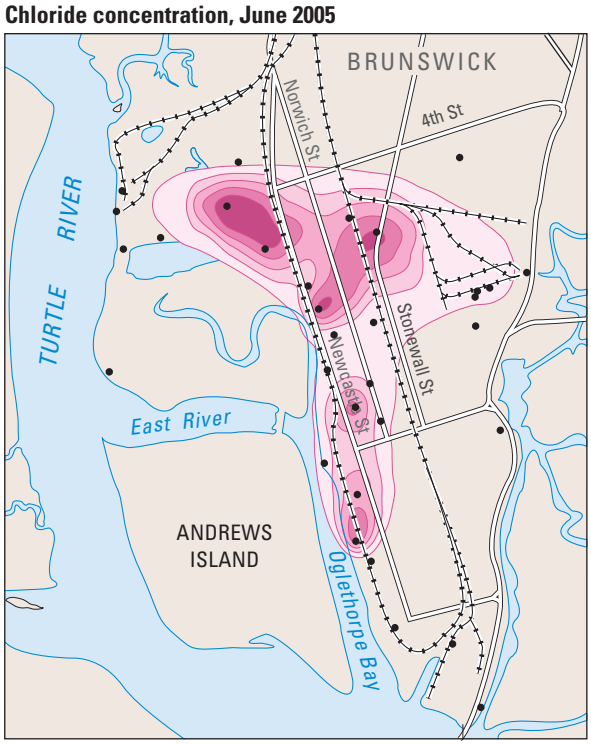




**Figure 11.** Chloride concentration in the Upper Floridan aquifer in the Brunswick area, Georgia, June 2004 and June 2005.

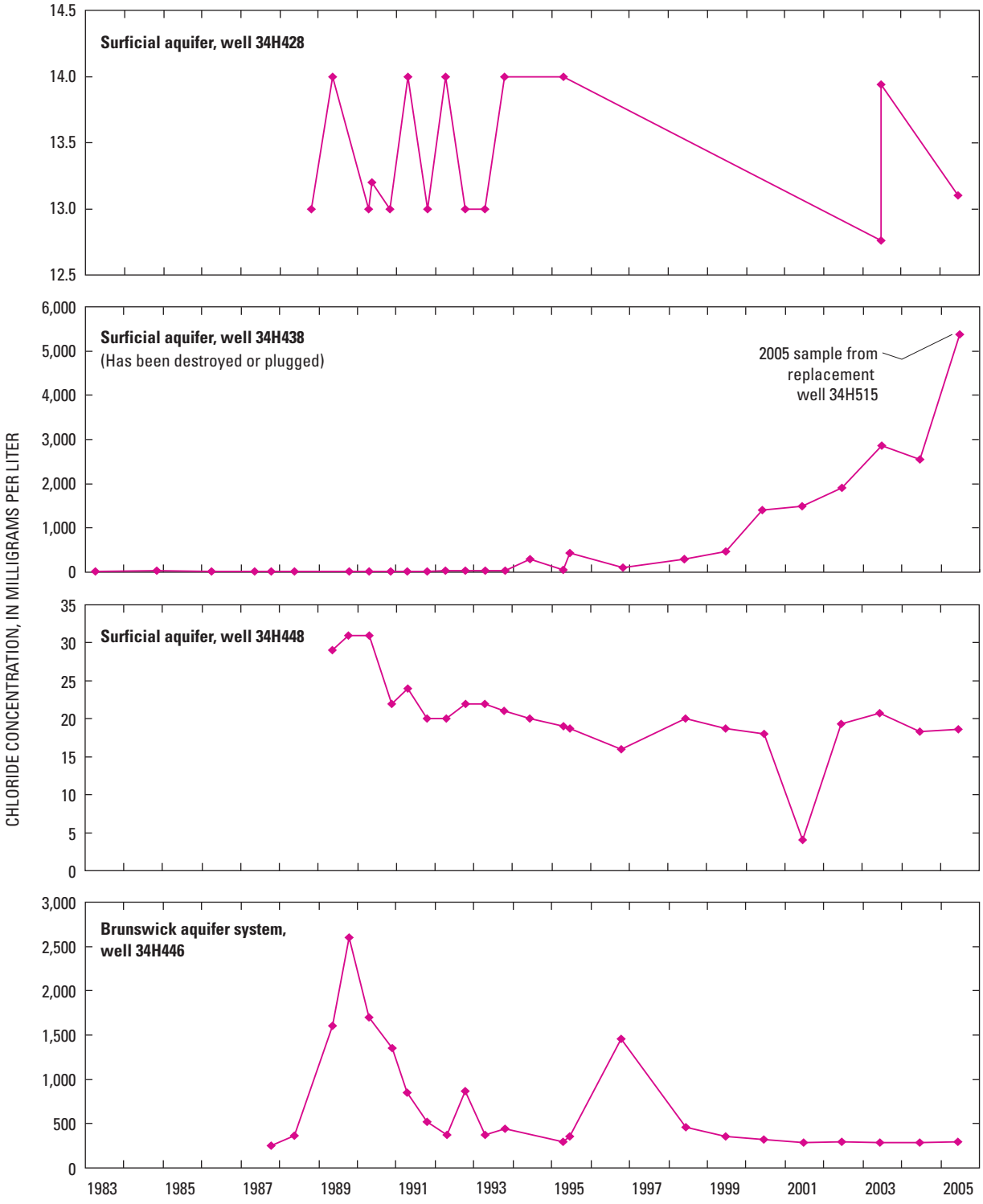



**Figure 12.** Chloride concentration in observation wells in the surficial and Brunswick aquifer systems, in the Brunswick area, Georgia, 1983–2005 (see figure 8*B* for well location).

# Appendix A. Records of Geophysical Logs from Well 34G003 Collected during October 2005

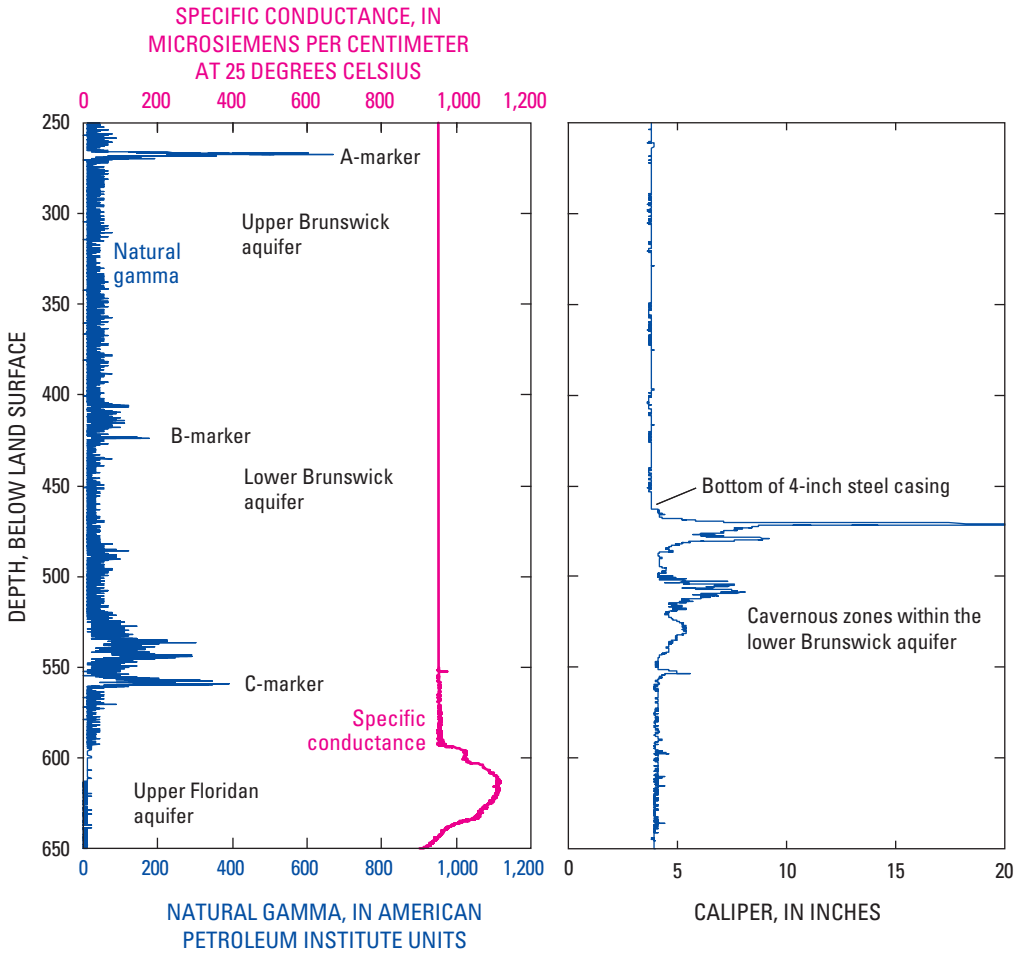



**Figure A1.** Examples of geophysical logs collected from an unused irrigation well, located near the access road to Jekyll Island, using a multiparameter logging tool. The natural-gamma logs are used to determine different water-bearing units, the specific conductance log indicates water with higher conductivity entering the well from the Upper Floridan aquifer, and the caliper log indicates good water-producing zones within the lower Brunswick aquifer.

# Appendix B. Georgia Environmental Protection Division/ MACTEC Saltwater Intrusion Monitoring Program Report

February 6, 2006

Ms. Sue Grunwald
Program Manager
Water Resources Branch
Environmental Protection Division
Georgia Department of Natural Resources
19 Martin Luther King, Jr. Drive, Suite 400
Atlanta, Georgia 30334

Mr. John S. Clarke
Assistant District Chief
U.S. Geological Survey
3039 Amwiler Road, Suite 130
Atlanta, Georgia 30360

**Subject: Fourth Quarter Monitoring Report – Year 2005**
**Salt-Water Monitoring of the Upper Floridan Aquifer**
**Brunswick, Georgia**
**MACTEC Project Number 12000-1-0071**

Dear Ms. Grunwald and Mr. Clarke:

MACTEC Engineering and Consulting, Inc. (MACTEC), is pleased to present you with the results of the fourth quarter 2005 salt-water monitoring conducted in Brunswick, Georgia. This is the final report to be prepared under the current contract.

**Monitoring System**

The monitoring system is comprised of an array of electronic water quality and water level probes installed within two dual-zone monitoring wells – TW34H504/505 (Southside Baptist Church site) and TW33H324/325 (Georgia Pacific site). Identical sets of instruments were installed in each well. In a single installation, the dual zone monitoring well design facilitates monitoring the two higher-permeable zones within the Upper Floridan aquifer at Brunswick, Georgia.

Each zone has been instrumented with electronic water level and conductivity recorders, although not all are currently functional. The Hydrolab Diver® water level recorders installed in each zone consist of a self-contained temperature-compensated pressure transducer and datalogger programmed to collect water level data on an hourly basis. To eliminate the need for vented cables, one Hydrolab Baro-Diver® has been deployed at the TW34H504/TW34H505 wellhead to provide barometric data for barometric compensation of the recorded water levels. The Hydrolab Diver® originally installed in the lower zone of the Georgia Pacific site (TW33H325) was installed in the upper zone of the Southside Baptist Church site

(TW34H504) on July 1, 2004 to replace the failing probe located there. A new pressure transducer/data logger probe was installed in the lower zone of the Georgia Pacific site on June 2, 2004. This probe is a Solinst Levelogger® and is similar to the Hydrolab Diver® employed in the other zones, but is rated at approximately 30 psi instead of 15 psi. The increased pressure rating is better suited to measure the large intermittent fluctuations noted in this zone.

The varying deployment depths and the down-hole annular space restrictions require usage of different specific conductivity probes in each zone. The conductivity probe deployed in the upper permeable zone is the dedicated Solinst ReeLogger®. This unit, which has a smaller diameter probe that can be used in the limited annular space of the upper zone, uses a transmission cable between probe and datalogger, is rated to operate at depths of up to 2,000 feet, and has a measuring range from 40 to 60,000 µS/cm. The lower permeable zones are monitored using the Hydrolab MiniSonde® 4A, a self-contained measuring and recording unit rated to operate at depths up to 980 feet with a measuring range of 0 to 100,000 µS/cm. The temperature and conductivity probes are programmed to record data on an hourly basis at a minimum, and are retrieved to land surface for data recovery and recalibration.

**Water Elevations**

The Hydrolab Baro-Diver® deployed at the TW34H504/TW34H505 wellhead to provide barometric data failed early in the second quarter of 2005. Therefore, the water elevations could not be corrected for barometric pressure. A review of historical barometric corrections showed the corrected water levels to be about three feet lower than the uncorrected water levels for both zones at well TW33H324/325.

At well TW33H324/325, water levels in the upper zone for the period were recorded on an hourly basis between October 1 and December 31 (Figure 1) with the exception of two hours on October 25 when the probe was recovered to attempt a download of the data. MACTEC was unable to recover the data from the probe; therefore, the probe was sent to the manufacturer (Solinst®) for assistance in the data retrieval upon final removal from the well on January 6, 2006. The data was received via email from Solinst® on February 3, 2006. The water levels recorded during this quarter showed similar daily variability not seen in the data since early in the third quarter of 2004. However, the variability was much greater during the fourth quarter 2005. The average for this quarter was 7.0 ft. below land surface (bls), with the maximum and minimum of 24.5 above land surface (als) and 20.4 ft bls respectively. It is unclear why the probe started showing large daily fluctuations in the water levels following its redeployment in October 2005.

At well TW33H324/325, water levels for the lower zone during the period were recorded on an hourly basis between October 1, 2005 and December 31, 2005 (Figure 1), and were similar to water levels observed in this zone during the third quarter of 2005. The average for this quarter was 56.9 ft. bls, with the maximum and minimum of 57.3 and 55.8 ft. bls respectively. This probe was replaced in June 2004 and it is not expected to be failing.

At well TW34H504/505, water levels in the upper zone and lower zone were not recorded during the fourth quarter of 2005 due to the previous failures of the probes located in these zones. The probe in the lower zone (TW34H505) failed between the second and the third quarter of 2004 as first noted in the third quarter of 2004 report. The probe in the upper zone (TW34H504), previously installed in the lower zone well at the Georgia Pacific site (TW33H325), failed between the third and fourth quarter as first noted in the fourth quarter of 2004 report. Although no data were collected from the probes during the fourth quarter, flowing conditions were observed at this well indicating the water level was above land surface for this reporting period. This is consistent with the data from the previous quarter and historic trends for this well.

**Conductivity/Temperature**

As approved by Georgia EPD, the requirement to record hourly conductivity/temperature measurements is waived during any time period that the water level is at or above ground surface. Water levels in the upper zone at well TW34H504/505 have remained above land surface since instrumentation in December 2001 and are known to be free flowing as of January 6, 2005. Accordingly, specific conductance and temperature (SCT) data from the upper zone at this well were not reported for this period. At well TW33H325 (lower zone), SCT data will not be reported for this and subsequent periods since MACTEC's contracted initial 6-month monitoring period for this zone has expired.

At well TW33H324 (upper zone), SCT for the period were recorded hourly between October 1, 2005 and December 31, 2005 (Figure 2). The temperature appears stable throughout the period with an average of 27.0º Celsius. The conductivity also appeared stable and ranged from 8,986.8 to 9,163.1 µS/cm with an average of 9,046.3 µS/cm during the fourth quarter. This is similar to the previous quarter (average), but greater then the Georgia EPD laboratory tested sample (7,960 µS/cm) collected from the zone on January 4, 2002. However, it should be noted that the sample reflected the entire zone, whereas the probe readings are from the discrete depth of 630 ft. bls.

MACTEC appreciates the opportunity to submit this report of Fourth Quarter Monitoring for the Year 2005. This report represents the final quarterly report due under the contract. We value our future relationship with you and Georgia EPD, and look forward to our continuing assistance on other projects.

Respectfully yours,

**MACTEC ENGINEERING AND CONSULTING, INC.**

David W. Knaub
Staff Scientist II
Manager

Nils W. Thompson, P.G., CPG
Principal Geologist / Project

cc: File
James R. Wallace, Sc.D., P.E.

FIGURE 1: TW33H324/325 Water Levels (Fourth Quarter 2005)

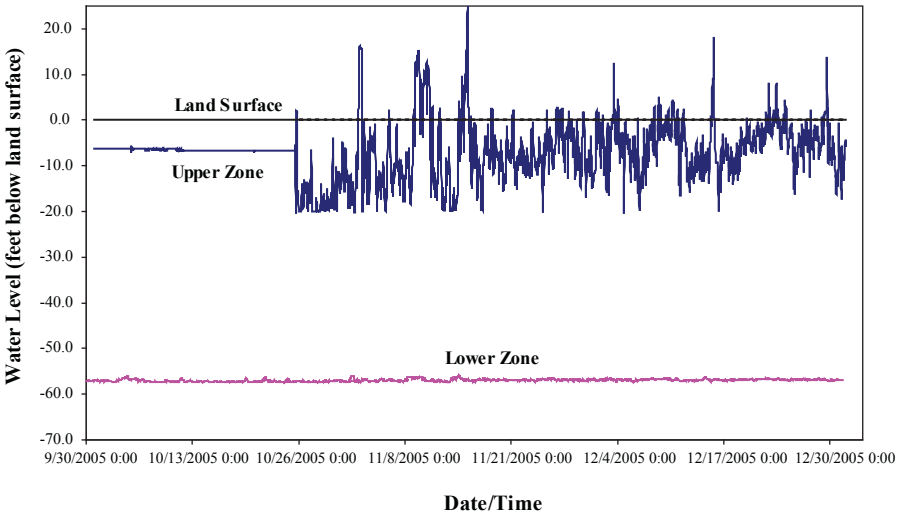
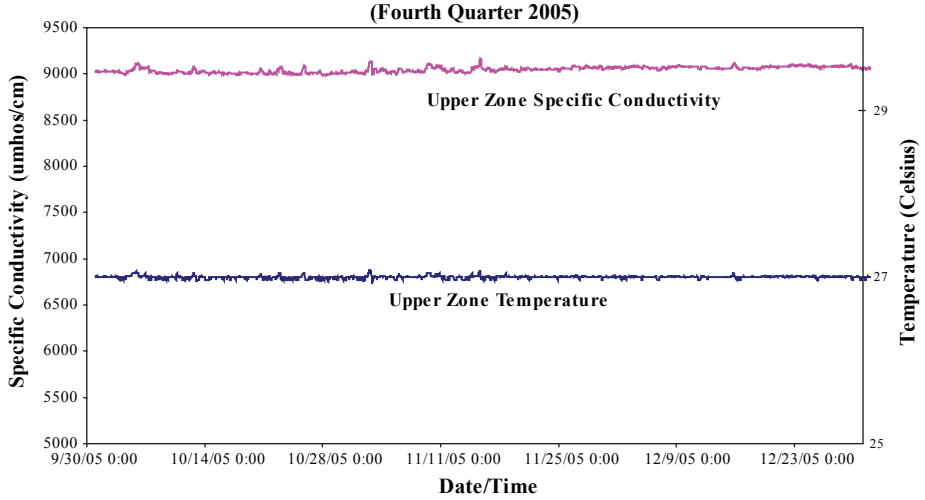



FIGURE 2: TW33H324 Temperature and Specific Conductivity (Fourth Quarter 2005)

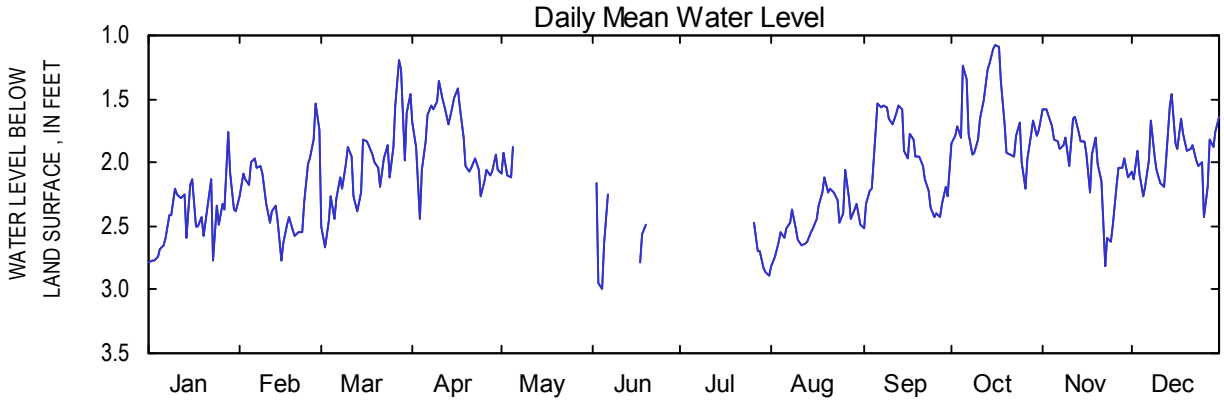


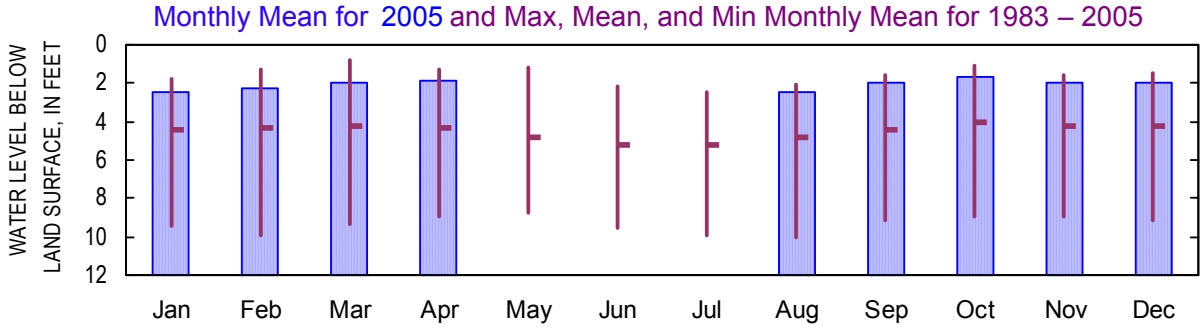
# Appendix C. Hydrographs and Water-Level Statistics for Selected Wells in the City of Brunswick–Glynn County, Georgia, Area

## Surficial aquifer system
## 2005 Calendar Year

**310925081312203** **Site Name: 33H208**

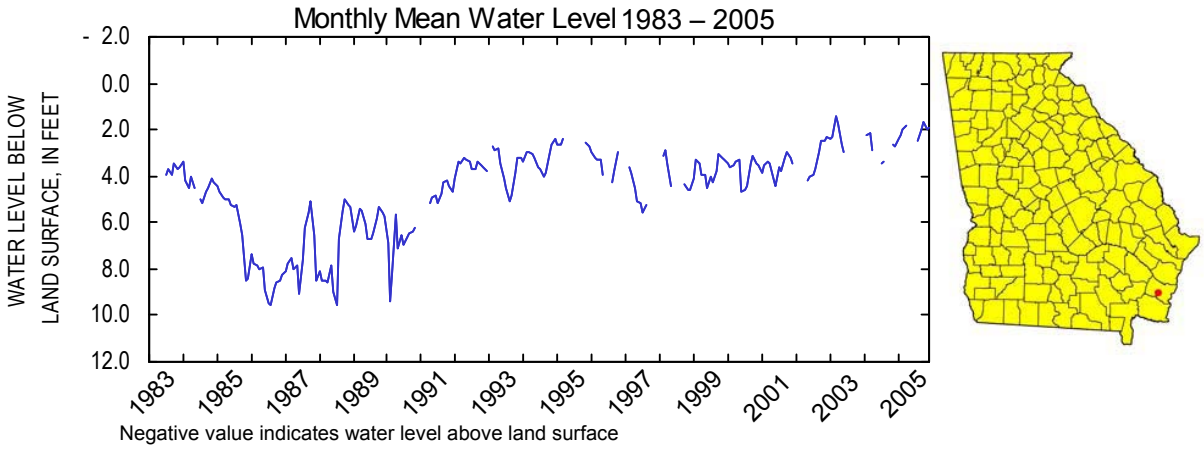
Latitude: 31° 09' 25" Longitude: 081° 31' 22" GLYNN Period of Record: 1983 – 2005
Well Depth: 155 feet Datum: 7.00 feet NGVD29 Well Diameter: 4.00 inches




### Monthly Water Level Statistics

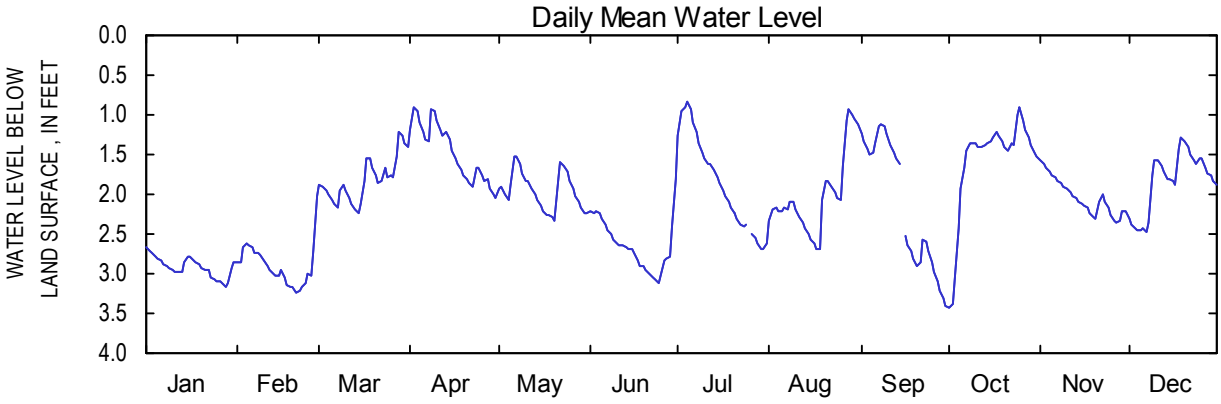
| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2005 | | | | | | | | | | | | |
| Mean | 2.42 | 2.24 | 2.01 | 1.83 | | | | 2.44 | 1.98 | 1.66 | 1.98 | 1.94 |
| Max | 2.79 | 2.77 | 2.66 | 2.45 | | | | 2.82 | 2.53 | 2.21 | 2.82 | 2.43 |
| Min | 1.75 | 1.53 | 1.20 | 1.35 | | | | 2.05 | 1.54 | 1.08 | 1.57 | 1.47 |
| 1983 – 2005 | | | | | | | | | | | | |
| Mean | 4.42 | 4.37 | 4.24 | 4.31 | 4.77 | 5.25 | 5.26 | 4.86 | 4.47 | 4.08 | 4.25 | 4.27 |
| Max | 9.44 | 9.93 | 9.38 | 8.96 | 8.74 | 9.56 | 9.97 | 10.04 | 9.12 | 8.92 | 8.92 | 9.16 |
| Min | 1.75 | 1.24 | 0.77 | 1.31 | 1.21 | 2.16 | 2.44 | 2.05 | 1.54 | 1.08 | 1.57 | 1.47 |

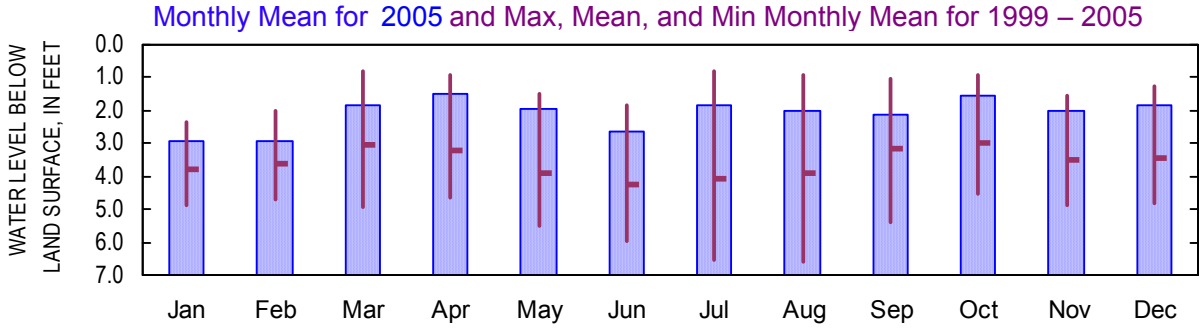


**Surficial aquifer system**
**2005 Calendar Year**

**311059081285702** **Site Name: 34H492**

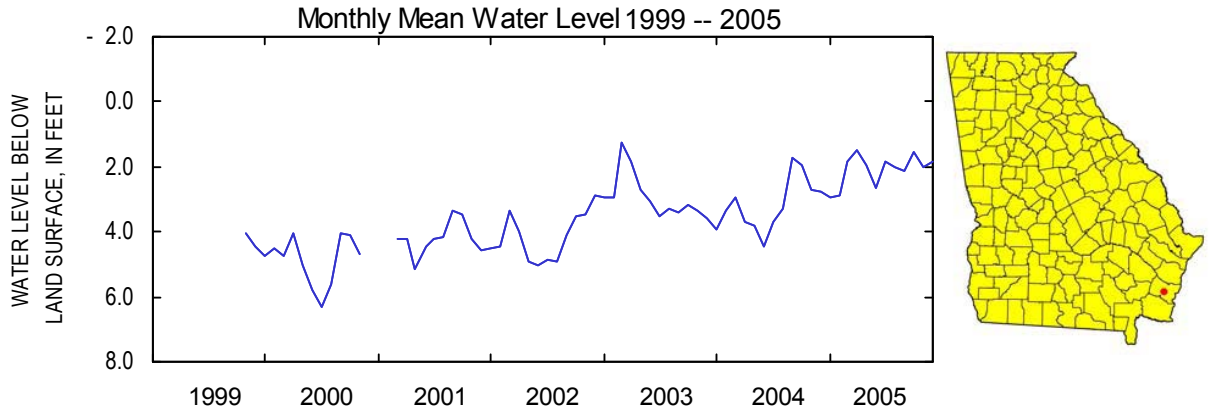
Latitude: 31° 10' 59" Longitude: 081° 28' 57" GLYNN Period of Record: 1999 – 2005
Well Depth: 48.5 feet Datum: 12.54 feet NAVD88 Well Diameter: 2 inches




Monthly Water Level Statistics

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2005 | | | | | | | | | | | | |
| Mean | 2.92 | 2.90 | 1.82 | 1.48 | 1.95 | 2.64 | 1.86 | 2.02 | 2.14 | 1.58 | 2.04 | 1.84 |
| Max | 3.17 | 3.23 | 2.24 | 2.04 | 2.33 | 3.13 | 2.70 | 2.68 | 3.41 | 3.44 | 2.35 | 2.46 |
| Min | 2.67 | 2.03 | 1.21 | 0.91 | 1.51 | 1.81 | 0.82 | 0.93 | 1.11 | 0.91 | 1.56 | 1.29 |
| 1999 – 2005 | | | | | | | | | | | | |
| Mean | 3.81 | 3.63 | 3.05 | 3.21 | 3.93 | 4.24 | 4.09 | 3.88 | 3.13 | 2.98 | 3.50 | 3.44 |
| Max | 4.90 | 4.69 | 4.91 | 4.65 | 5.51 | 5.95 | 6.54 | 6.62 | 5.38 | 4.51 | 4.85 | 4.84 |
| Min | 2.36 | 2.03 | 0.78 | 0.91 | 1.51 | 1.81 | 0.82 | 0.93 | 1.03 | 0.91 | 1.56 | 1.29 |

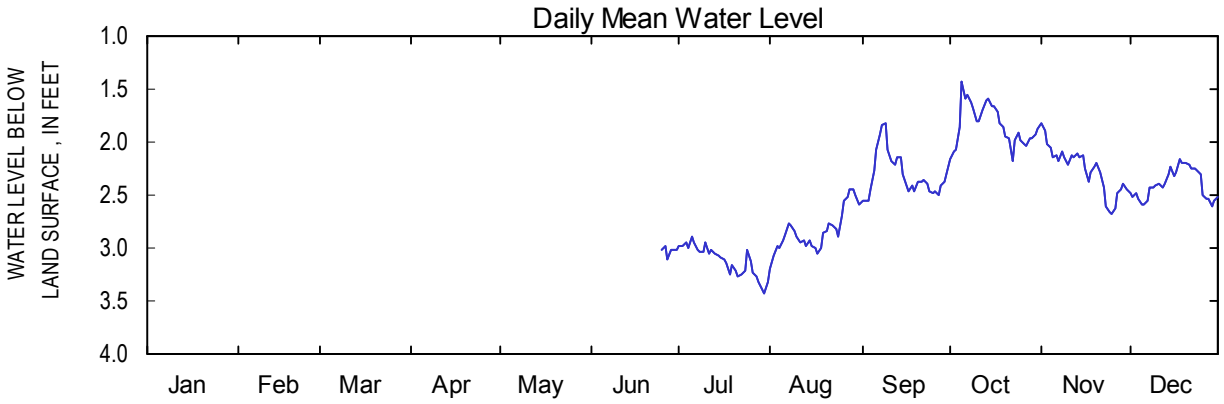


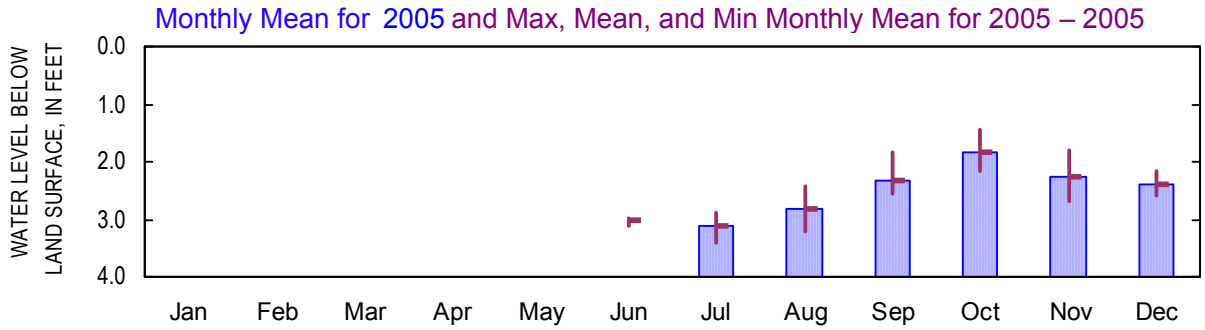

Negative value indicates water level above land surface

## Surficial aquifer system
## 2005 Calendar Year

**310902081284201** **Site Name: 34H515**

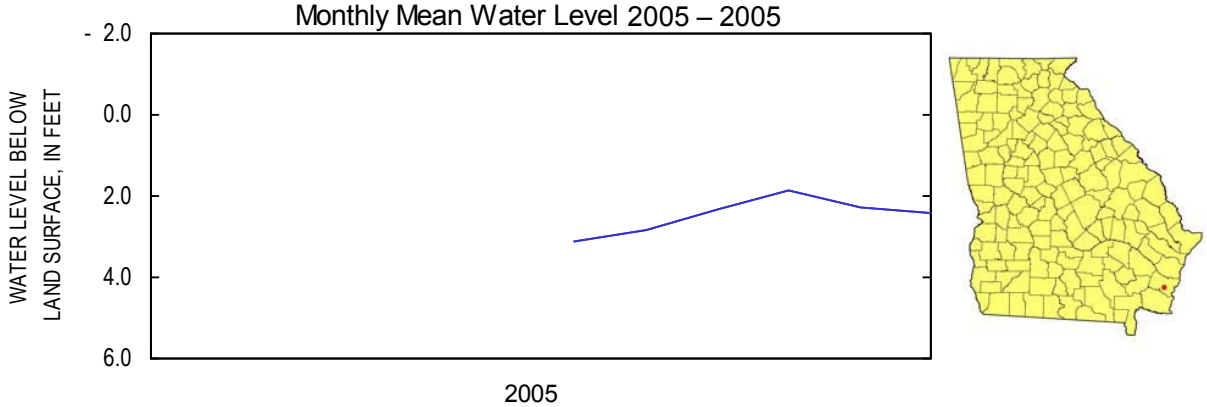
Latitude: 31° 09' 02" Longitude: 081° 28' 42" GLYNN Period of Record: 2005 – 2005
Well Depth: 205 feet Datum: 9 feet NGVD29 Well Diameter: 2 inches




### Monthly Water-Level Statistics

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2005 | | | | | | | |
| Mean | | 3.12 | 2.83 | 2.31 | 1.84 | 2.26 | 2.40 |
| Max | | 3.43 | 3.20 | 2.55 | 2.17 | 2.68 | 2.60 |
| Min | | 2.89 | 2.44 | 1.82 | 1.43 | 1.81 | 2.17 |
| 2005 – 2005 | | | | | | | |
| Mean | 3.03 | 3.12 | 2.83 | 2.31 | 1.84 | 2.26 | 2.40 |
| Max | 3.11 | 3.43 | 3.20 | 2.55 | 2.17 | 2.68 | 2.60 |
| Min | 2.98 | 2.89 | 2.44 | 1.82 | 1.43 | 1.81 | 2.17 |




Negative value indicates water level above land surface

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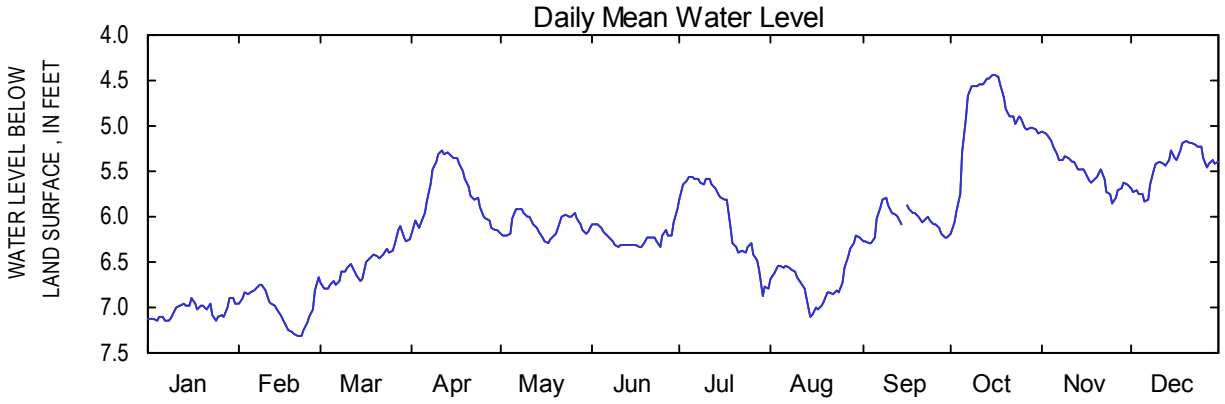
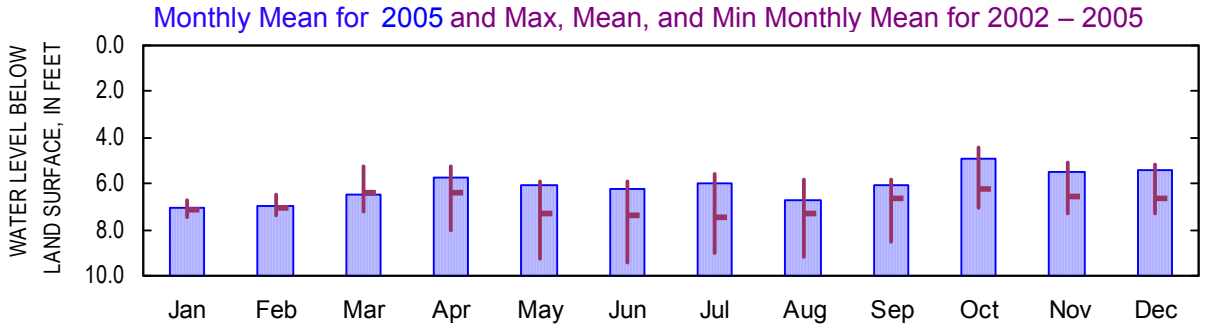
**Surficial aquifer system**
**2005 Calendar Year**

**311909081281103** **Site Name: 34J082**

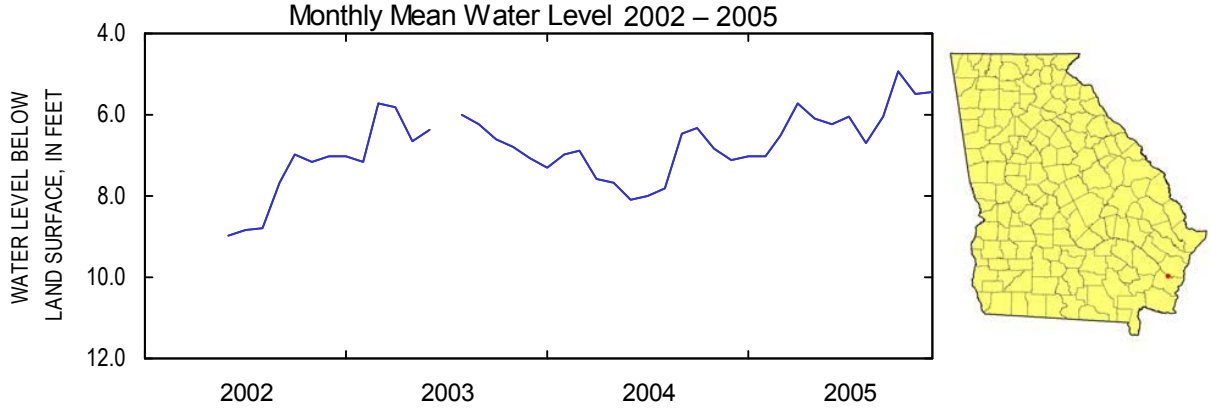
Latitude: 31° 19' 09" Longitude: 081° 28' 11" GLYNN Period of Record: 2002 – 2005
Well Depth: 160 feet Datum: 15.90 feet NGVD29 Well Diameter: 4 inches




Monthly Water Level Statistics

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2005 | | | | | | | | | | | | |
| Mean | 7.04 | 7.00 | 6.51 | 5.73 | 6.09 | 6.23 | 6.02 | 6.69 | 6.05 | 4.93 | 5.48 | 5.44 |
| Max | 7.15 | 7.31 | 6.80 | 6.19 | 6.28 | 6.34 | 6.87 | 7.11 | 6.29 | 6.19 | 5.85 | 5.82 |
| Min | 6.89 | 6.66 | 6.10 | 5.27 | 5.91 | 5.93 | 5.56 | 6.21 | 5.80 | 4.44 | 5.06 | 5.17 |
| 2002 – 2005 | | | | | | | | | | | | |
| Mean | 7.11 | 7.06 | 6.36 | 6.38 | 7.27 | 7.41 | 7.47 | 7.33 | 6.62 | 6.20 | 6.56 | 6.66 |
| Max | 7.45 | 7.37 | 7.18 | 8.02 | 9.26 | 9.41 | 8.99 | 9.17 | 8.50 | 7.08 | 7.28 | 7.31 |
| Min | 6.76 | 6.49 | 5.25 | 5.27 | 5.91 | 5.89 | 5.56 | 5.79 | 5.80 | 4.44 | 5.06 | 5.17 |



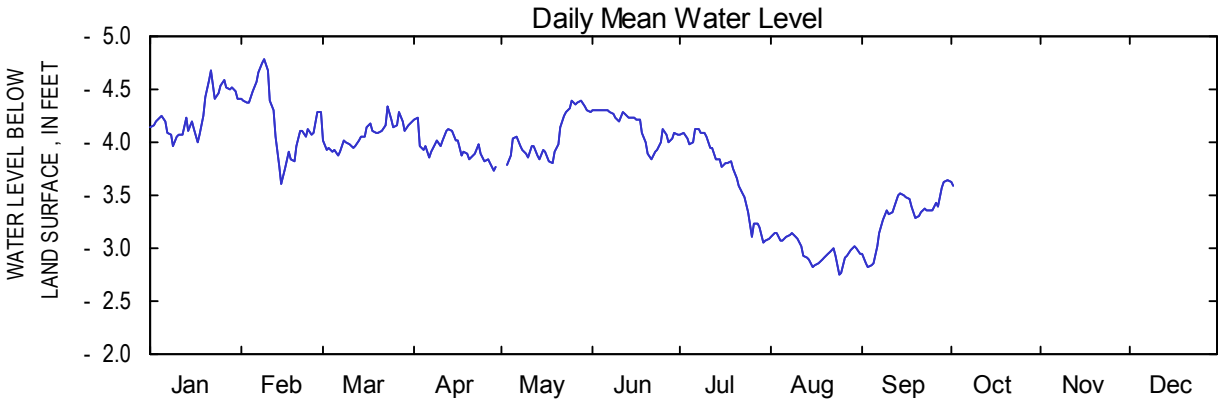

Negative value indicates water level above land surface

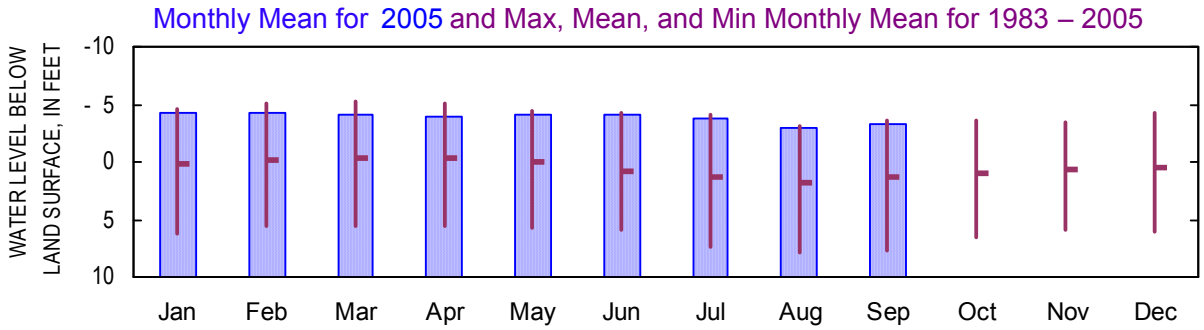
## Upper Brunswick aquifer
## 2005 Calendar Year

**310901081284402** **Site Name: 34H437**

Latitude: 31° 09' 01" Longitude: 081° 28' 44" GLYNN Period of Record: 1983 – 2005

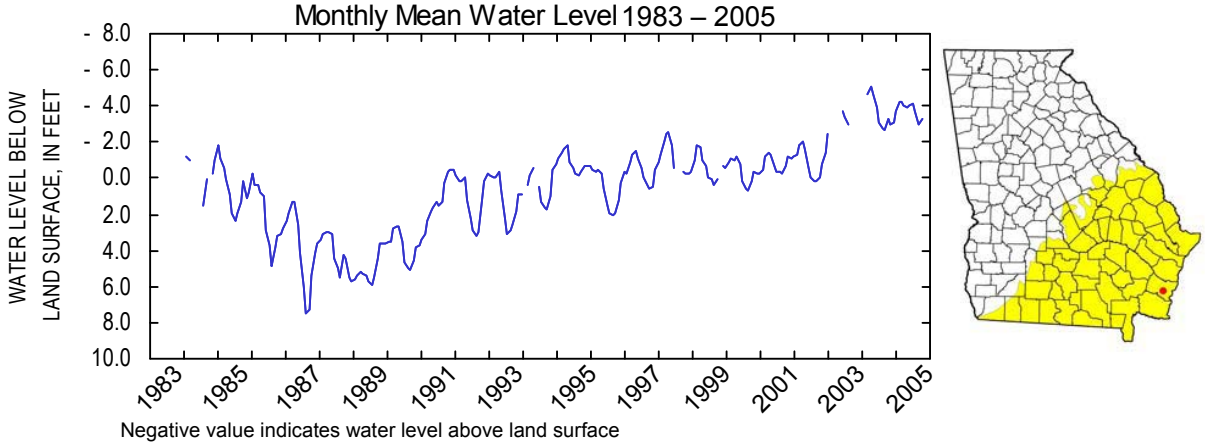
Well Depth: 328 feet Datum: 7.00 feet NGVD29 Well Diameter: 10.00 inches




### Monthly Water Level Statistics

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2005 | | | | | | | | | | | | |
| Mean | -4.28 | -4.21 | -4.07 | -3.95 | -4.06 | -4.15 | -3.70 | -2.98 | -3.30 | | | |
| Max | -3.97 | -3.61 | -3.88 | -3.73 | -3.79 | -3.84 | -3.06 | -2.75 | -2.82 | | | |
| Min | -4.67 | -4.79 | -4.33 | -4.24 | -4.40 | -4.31 | -4.12 | -3.14 | -3.65 | | | |
| 1983 – 2005 | | | | | | | | | | | | |
| Mean | 0.14 | -0.19 | -0.35 | -0.31 | 0.08 | 0.86 | 1.38 | 1.81 | 1.36 | 1.02 | 0.68 | 0.41 |
| Max | 6.15 | 5.64 | 5.58 | 5.60 | 5.72 | 5.90 | 7.32 | 7.80 | 7.74 | 6.53 | 5.97 | 6.12 |
| Min | -4.67 | -5.08 | -5.21 | -5.11 | -4.40 | -4.31 | -4.12 | -3.14 | -3.65 | -3.62 | -3.38 | -4.29 |

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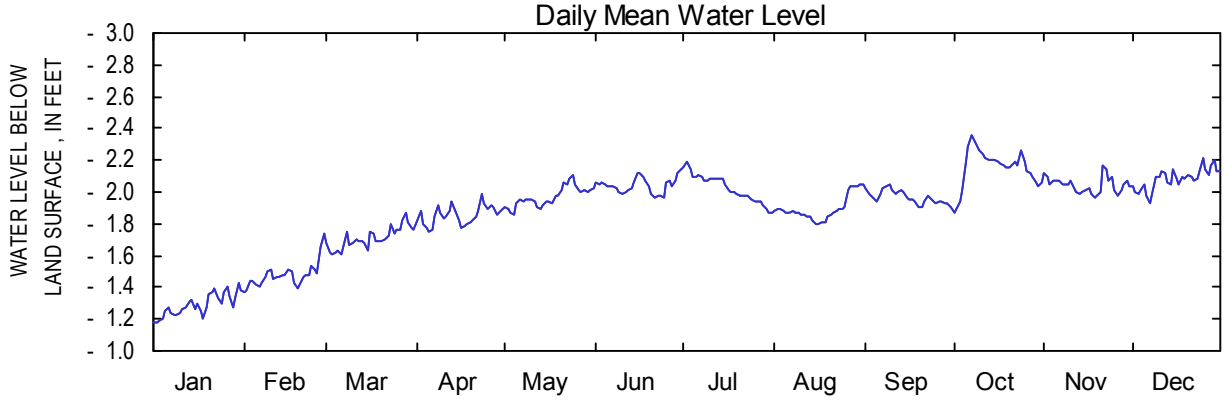
## Upper Brunswick aquifer
## 2005 Calendar Year

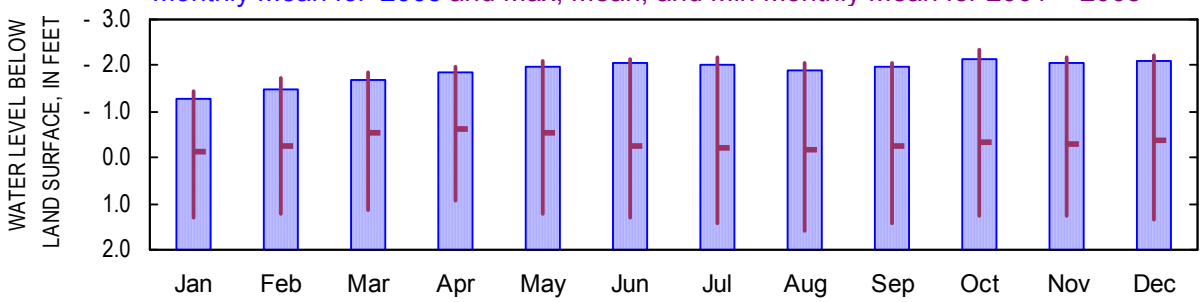
**311530081363904** **Site Name: 33J065**

Latitude: 31° 15' 30" Longitude: 081° 36' 39" GLYNN Period of Record: 2001 − 2005
Well Depth: 412 feet Datum: 12 feet NGVD29 Well Diameter: 6 inches

Daily Mean Water Level



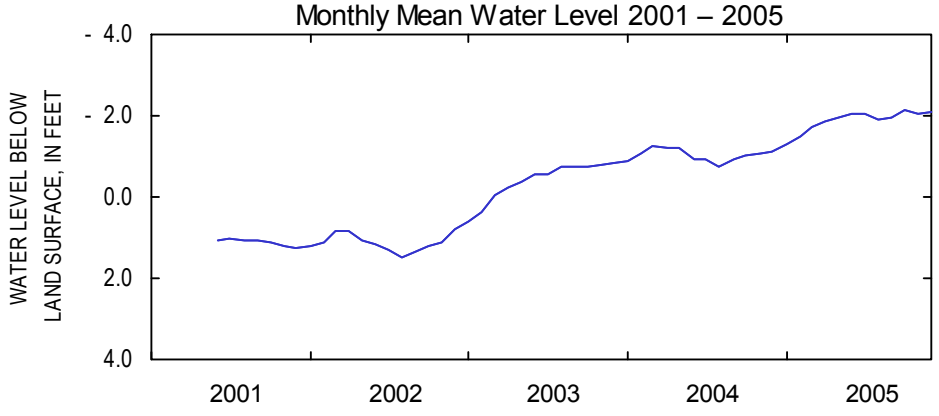

Monthly Mean for 2005 and Max, Mean, and Min Monthly Mean for 2001 – 2005




Monthly Water-Level Statistics

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2005 | | | | | | | | | | | | |
| Mean | -1.29 | -1.47 | -1.71 | -1.85 | -1.97 | -2.04 | -2.02 | -1.89 | -1.97 | -2.15 | -2.04 | -2.08 |
| Max | -1.18 | -1.37 | -1.60 | -1.75 | -1.85 | -1.97 | -1.87 | -1.79 | -1.90 | -1.87 | -1.96 | -1.93 |
| Min | -1.43 | -1.74 | -1.87 | -1.98 | -2.10 | -2.14 | -2.19 | -2.05 | -2.04 | -2.36 | -2.17 | -2.22 |
| 2001 − 2005 | | | | | | | | | | | | |
| Mean | -0.12 | -0.27 | -0.54 | -0.61 | -0.53 | -0.25 | -0.23 | -0.17 | -0.24 | -0.32 | -0.31 | -0.39 |
| Max | 1.31 | 1.23 | 1.13 | 0.93 | 1.21 | 1.31 | 1.44 | 1.58 | 1.43 | 1.26 | 1.26 | 1.33 |
| Min | -1.43 | -1.74 | -1.87 | -1.98 | -2.10 | -2.14 | -2.19 | -2.05 | -2.04 | -2.36 | -2.17 | -2.22 |

Monthly Mean Water Level 2001 – 2005




Negative value indicates water level above land surface

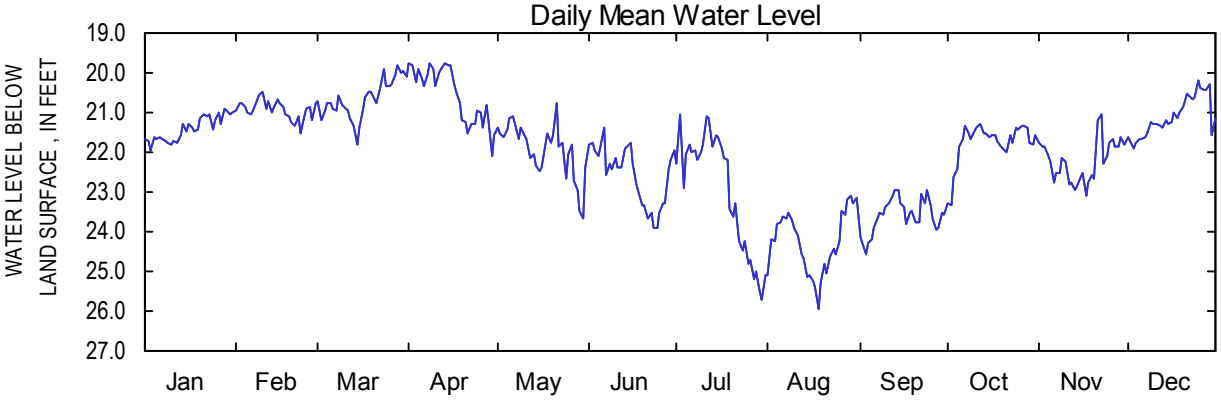
## Upper Brunswick aquifer
## 2005 Calendar Year

**311711081283002** **Site Name: 34J077**

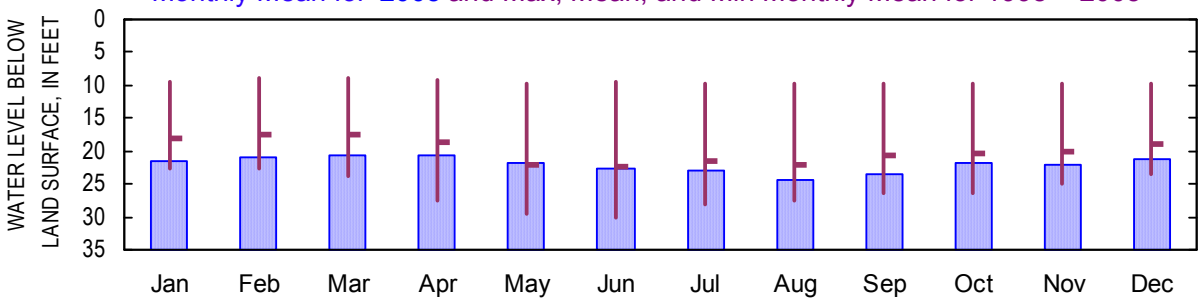
Latitude: 31° 17' 11" Longitude: 081° 28' 30" GLYNN Period of Record: 1998 – 2005

Well Depth: 390 feet Datum: 15 feet NGVD29 Well Diameter: 4 inches

Daily Mean Water Level



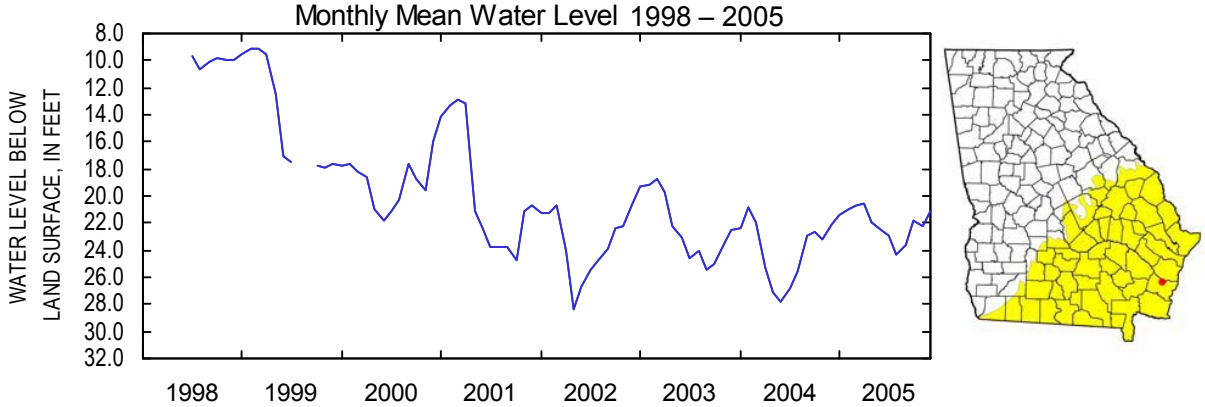

Monthly Mean for 2005 and Max, Mean, and Min Monthly Mean for 1998 – 2005




Monthly Water Level Statistics

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2005 | | | | | | | | | | | | |
| Mean | 21.41 | 20.93 | 20.65 | 20.55 | 21.93 | 22.57 | 23.00 | 24.27 | 23.60 | 21.76 | 22.23 | 21.11 |
| Max | 21.97 | 21.50 | 21.79 | 22.07 | 23.68 | 23.92 | 25.70 | 25.96 | 24.55 | 23.31 | 23.11 | 21.88 |
| Min | 20.91 | 20.48 | 19.81 | 19.77 | 20.76 | 21.39 | 21.04 | 23.11 | 22.93 | 21.27 | 21.07 | 20.19 |
| 1998 – 2005 | | | | | | | | | | | | |
| Mean | 17.96 | 17.46 | 17.46 | 18.71 | 22.02 | 22.33 | 21.50 | 22.00 | 20.54 | 20.35 | 19.95 | 18.85 |
| Max | 22.5 | 22.5 | 23.9 | 27.5 | 29.6 | 30.0 | 28.1 | 27.5 | 26.33 | 26.29 | 25.10 | 23.65 |
| Min | 9.40 | 8.91 | 8.87 | 9.30 | 9.66 | 9.53 | 9.62 | 9.70 | 9.77 | 9.71 | 9.81 | 9.78 |

Monthly Mean Water Level 1998 – 2005






Negative value indicates water level above land surface

USGS science for a changing world

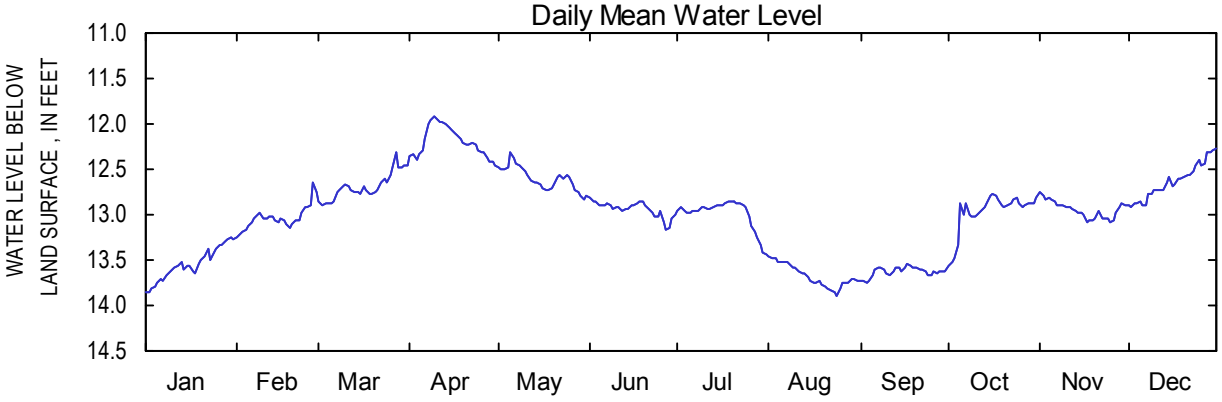
# Upper Brunswick aquifer
## 2005 Calendar Year

**311909081281102** **Site Name: 34J081**

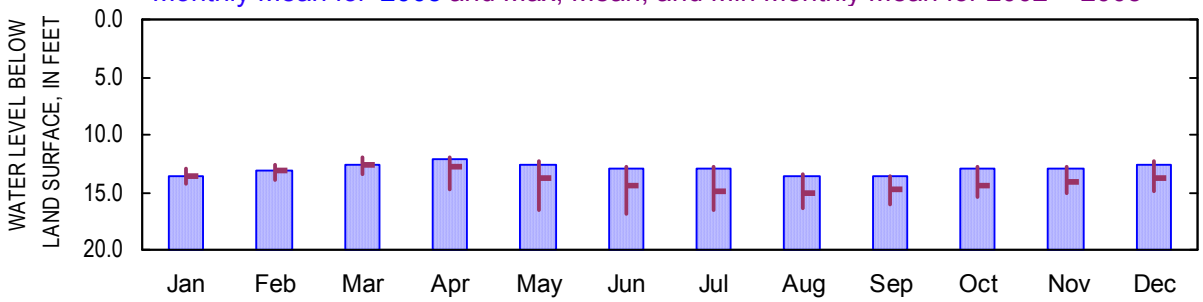
Latitude: 31°19'09" Longitude: 081°28'11" GLYNN Period of Record: 2002 – 2005

Well Depth: 435 feet Datum: 14.68 feet NGVD29 Well Diameter: 4 inches

Daily Mean Water Level



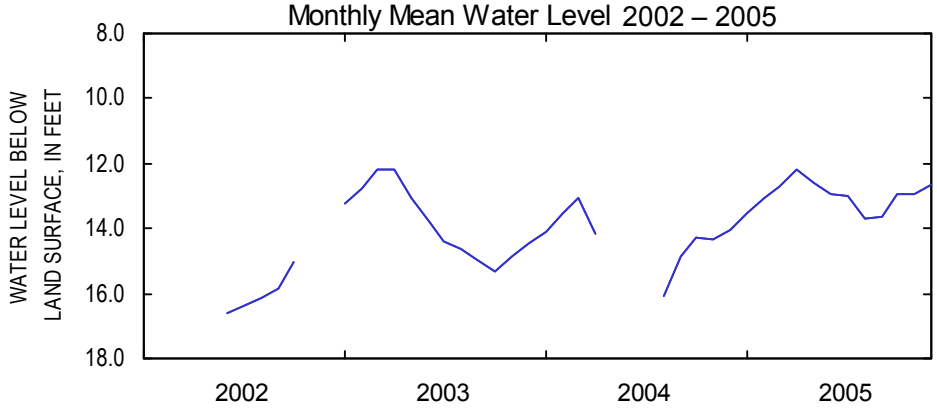

Monthly Mean for 2005 and Max, Mean, and Min Monthly Mean for 2002 – 2005




Monthly Water Level Statistics

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2005 | | | | | | | | | | | | |
| Mean | 13.55 | 13.04 | 12.69 | 12.19 | 12.60 | 12.94 | 12.99 | 13.67 | 13.63 | 12.97 | 12.95 | 12.63 |
| Max | 13.86 | 13.25 | 12.89 | 12.45 | 12.83 | 13.17 | 13.44 | 13.89 | 13.76 | 13.57 | 13.09 | 12.91 |
| Min | 13.25 | 12.64 | 12.32 | 11.91 | 12.31 | 12.81 | 12.85 | 13.46 | 13.55 | 12.77 | 12.76 | 12.26 |
| 2002 – 2005 | | | | | | | | | | | | |
| Mean | 13.62 | 13.10 | 12.65 | 12.85 | 13.77 | 14.43 | 14.92 | 15.12 | 14.82 | 14.39 | 14.14 | 13.72 |
| Max | 14.24 | 13.97 | 13.46 | 14.83 | 16.49 | 16.85 | 16.49 | 16.38 | 16.04 | 15.48 | 15.04 | 14.84 |
| Min | 12.89 | 12.54 | 11.90 | 11.91 | 12.31 | 12.81 | 12.85 | 13.46 | 13.55 | 12.77 | 12.76 | 12.26 |

Monthly Mean Water Level 2002 – 2005



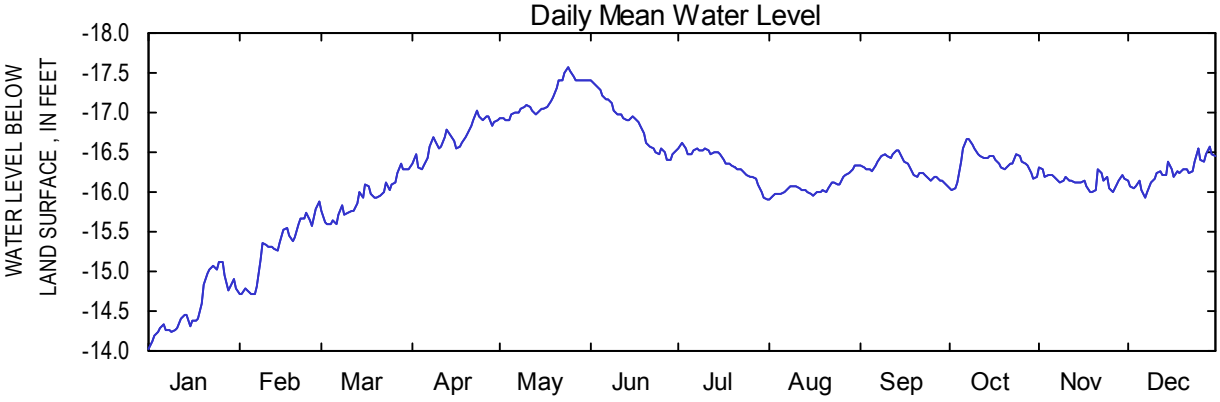

Negative value indicates water level above land surface

## Lower Brunswick aquifer
## 2005 Calendar Year

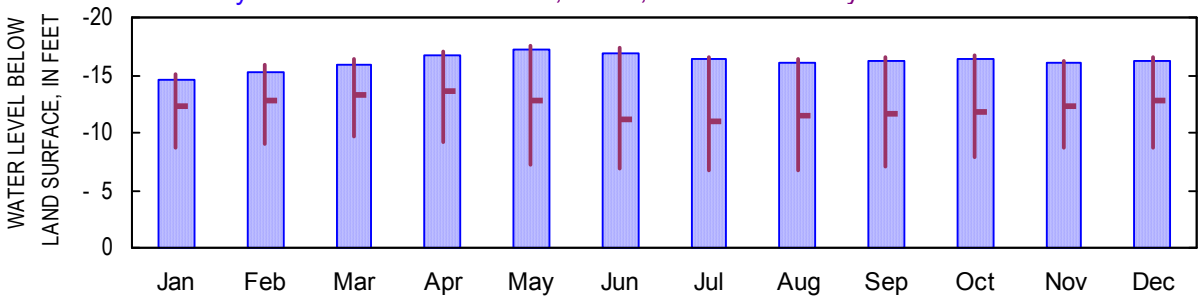
**311530081363901** **Site Name: 33J062**

Latitude: 31° 15' 30" Longitude: 081° 36' 39" GLYNN Period of Record: 2001 – 2005
Well Depth: 500 feet Datum: 12.00 feet NGVD29 Well Diameter: 6.00 inches

Daily Mean Water Level



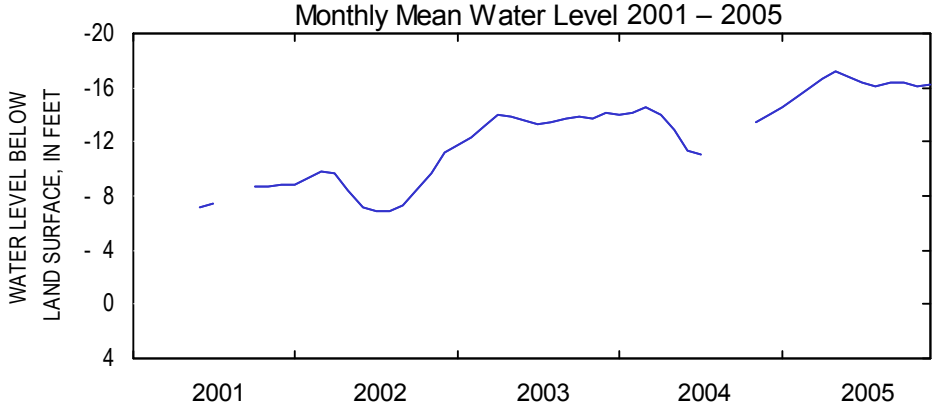

Monthly Mean for 2005 and Max, Mean, and Min Monthly Mean for 2001 – 2005




Monthly Water-Level Statistics

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2005 | | | | | | | | | | | | |
| Mean | -14.56 | -15.30 | -15.93 | -16.68 | -17.18 | -16.85 | -16.36 | -16.07 | -16.30 | -16.36 | -16.14 | -16.25 |
| Max | -14.02 | -14.70 | -15.59 | -16.28 | -16.90 | -16.40 | -15.91 | -15.91 | -16.10 | -16.02 | -16.01 | -15.93 |
| Min | -15.12 | -15.88 | -16.37 | -17.03 | -17.57 | -17.41 | -16.63 | -16.34 | -16.53 | -16.66 | -16.30 | -16.58 |
| 2001 – 2005 | | | | | | | | | | | | |
| Mean | -12.28 | -12.82 | -13.35 | -13.56 | -12.80 | -11.22 | -11.00 | -11.49 | -11.70 | -11.82 | -12.32 | -12.85 |
| Max | -8.67 | -8.94 | -9.62 | -9.23 | -7.17 | -6.89 | -6.76 | -6.77 | -7.00 | -7.90 | -8.65 | -8.64 |
| Min | -15.12 | -15.88 | -16.37 | -17.03 | -17.57 | -17.41 | -16.63 | -16.34 | -16.53 | -16.66 | -16.30 | -16.58 |

Monthly Mean Water Level 2001 – 2005




Negative value indicates water level above land surface

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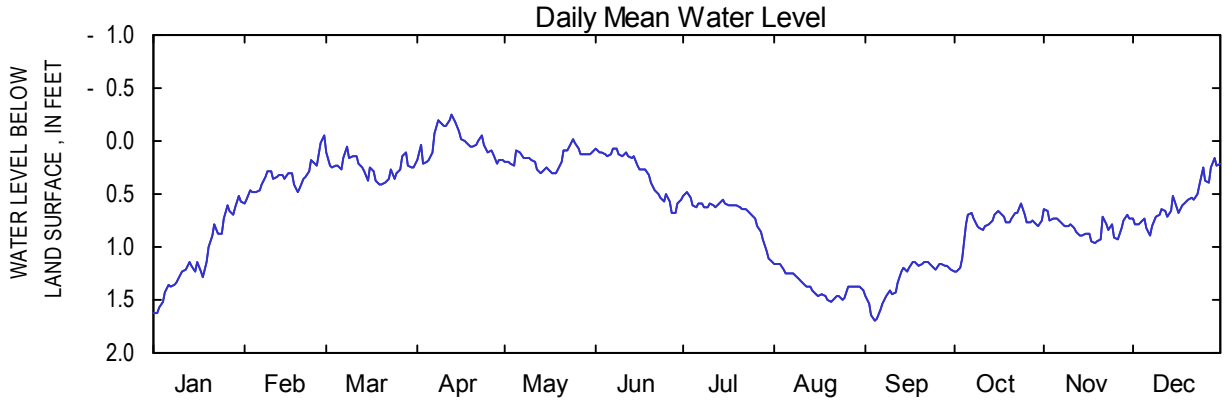
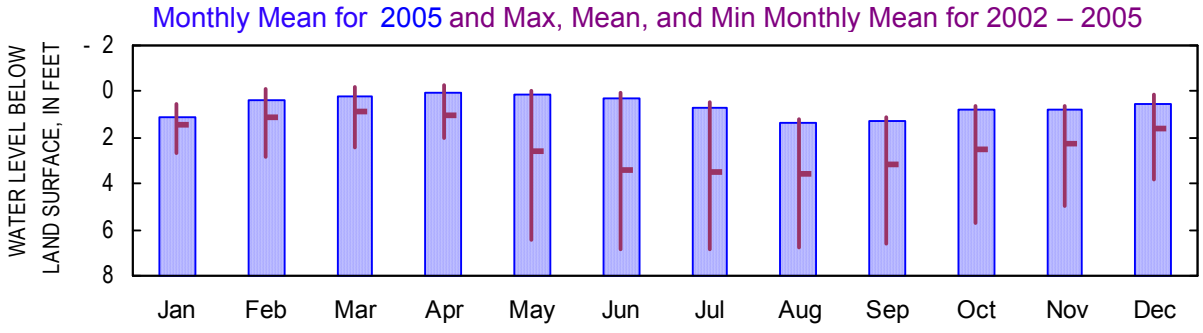
# Lower Brunswick aquifer
## 2005 Calendar Year

**311909081281101** **Site Name: 34J080**

Latitude: 31° 19' 09" Longitude: 081° 28' 11" GLYNN Period of Record: 2002 – 2005

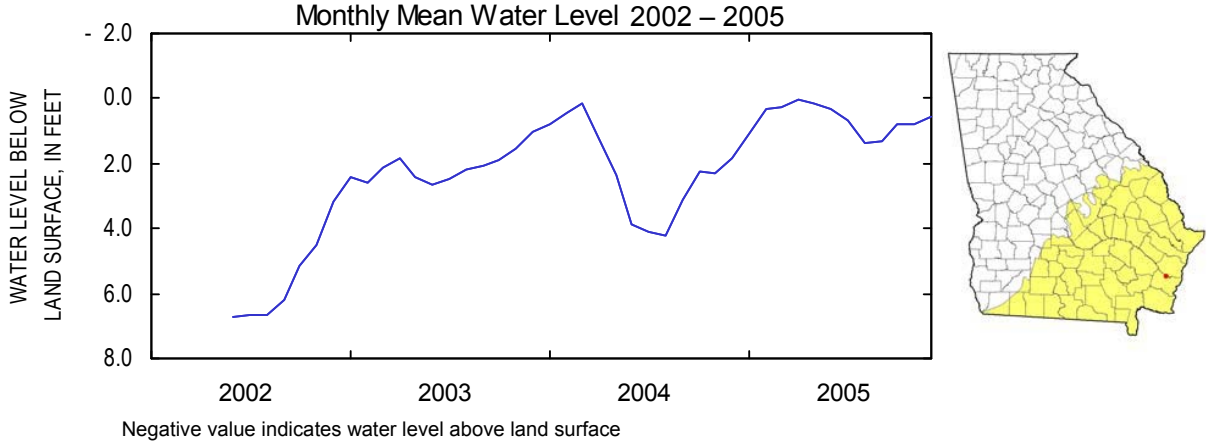
Well Depth: 555 feet Datum: 13.66 feet NGVD29 Well Diameter: 4 inches




### Monthly Water Level Statistics

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2005 | | | | | | | | | | | | |
| Mean | 1.10 | 0.34 | 0.25 | 0.02 | 0.17 | 0.30 | 0.68 | 1.37 | 1.32 | 0.80 | 0.81 | 0.58 |
| Max | 1.63 | 0.59 | 0.41 | 0.21 | 0.31 | 0.68 | 1.14 | 1.53 | 1.70 | 1.23 | 0.96 | 0.89 |
| Min | 0.52 | -0.06 | 0.06 | -0.25 | -0.01 | 0.07 | 0.48 | 1.16 | 1.14 | 0.58 | 0.65 | 0.16 |
| 2002 – 2005 | | | | | | | | | | | | |
| Mean | 1.43 | 1.12 | 0.84 | 1.04 | 2.57 | 3.38 | 3.49 | 3.60 | 3.18 | 2.54 | 2.29 | 1.65 |
| Max | 2.65 | 2.84 | 2.44 | 2.04 | 6.41 | 6.85 | 6.89 | 6.78 | 6.57 | 5.74 | 4.94 | 3.85 |
| Min | 0.52 | -0.13 | -0.17 | -0.25 | -0.01 | 0.07 | 0.48 | 1.16 | 1.14 | 0.58 | 0.65 | 0.16 |



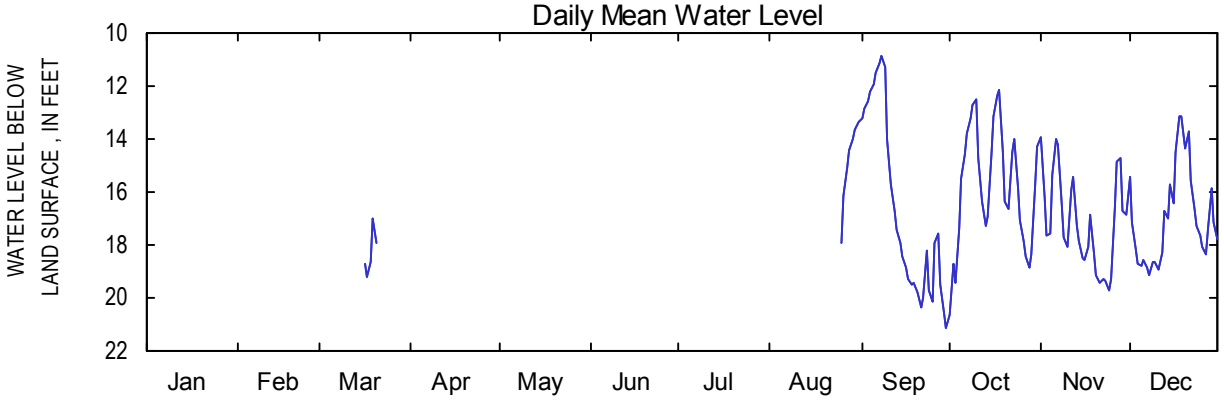

Negative value indicates water level above land surface

## Lower Brunswick aquifer
## 2005 Calendar Year

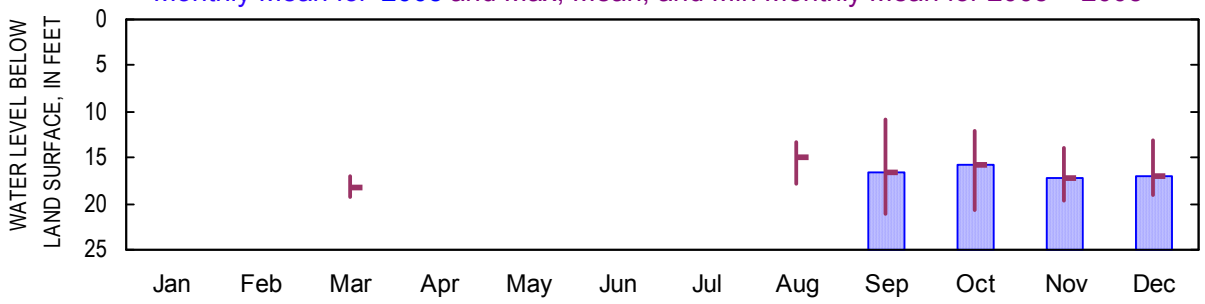
**311456081210504** **Site Name: 35H077**

Latitude: 31° 14' 56" Longitude: 081° 21' 05" GLYNN Period of Record: 2005 – 2005
Well Depth: 537 feet Datum: 20 feet NAVD88 Well Diameter: 6 inches

Daily Mean Water Level



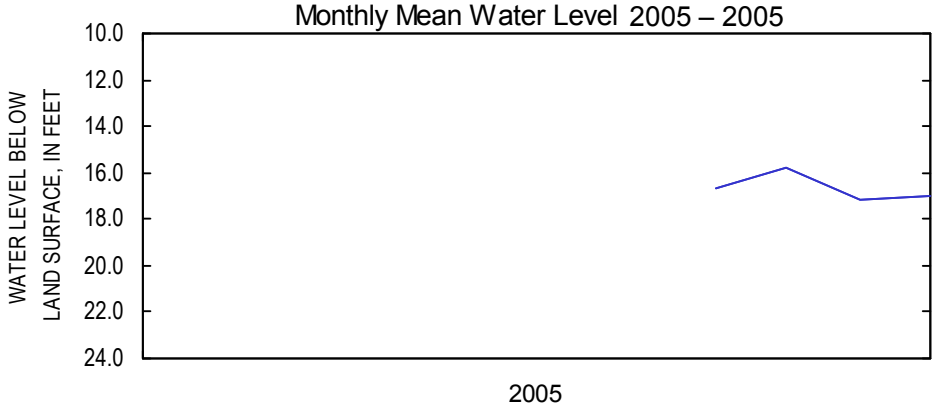

Monthly Mean for 2005 and Max, Mean, and Min Monthly Mean for 2005 – 2005




Monthly Water Level Statistics

| | | | | | | |
|---|---|---|---|---|---|---|
| 2005 | | | | | | |
| Mean | | | 16.66 | 15.76 | 17.14 | 16.96 |
| Max | | | 21.17 | 20.63 | 19.75 | 19.14 |
| Min | | | 10.83 | 12.18 | 13.96 | 13.12 |
| 2005 – 2005 | | | | | | |
| Mean | 18.30 | 14.94 | 16.66 | 15.76 | 17.14 | 16.96 |
| Max | 19.21 | 17.92 | 21.17 | 20.63 | 19.75 | 19.14 |
| Min | 16.99 | 13.39 | 10.83 | 12.18 | 13.96 | 13.12 |

Monthly Mean Water Level 2005 – 2005

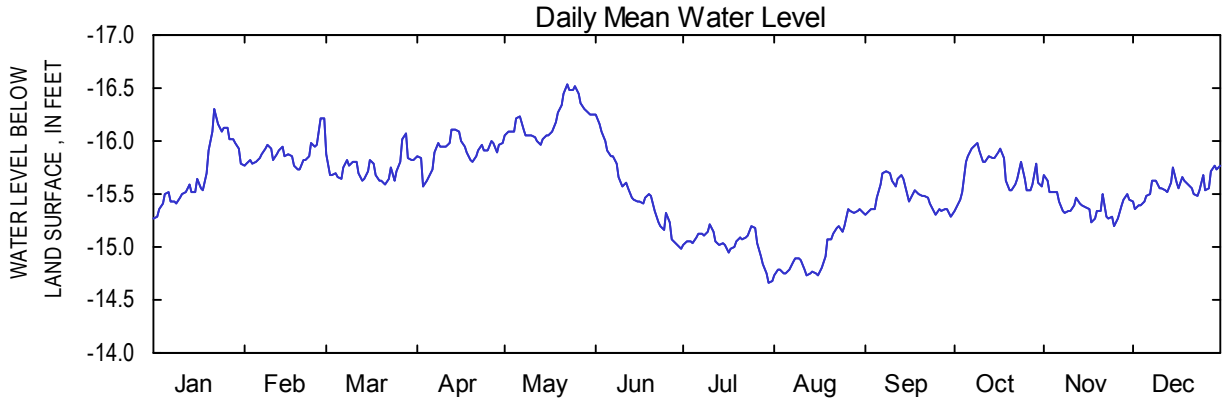


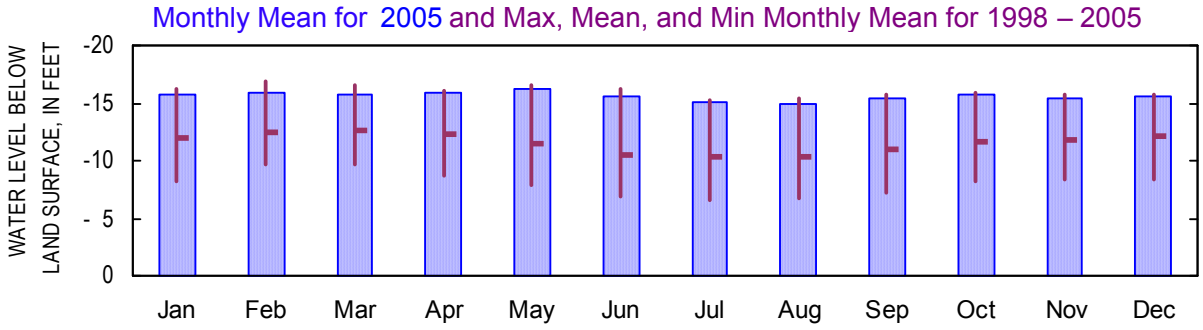

Negative value indicates water level above land surface

**Brunswick aquifer system**
**2005 Calendar Year**

**310629081323301** **Site Name: 33G028**

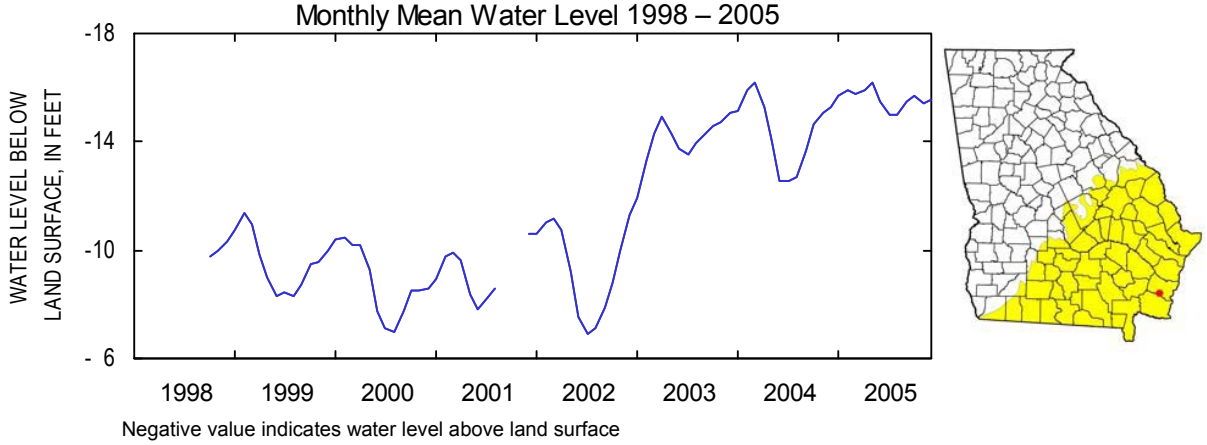
Latitude: 31° 06' 29" Longitude: 081° 32' 33" GLYNN Period of Record: 1998 – 2005
Well Depth: 475 feet Datum: 10 feet NGVD29 Well Diameter: 6 inches




Monthly Water-Level Statistics

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2005 | | | | | | | | | | | | |
| Mean | -15.70 | -15.88 | -15.75 | -15.90 | -16.21 | -15.52 | -15.03 | -14.98 | -15.48 | -15.71 | -15.39 | -15.57 |
| Max | -15.27 | -15.72 | -15.59 | -15.57 | -15.96 | -14.99 | -14.66 | -14.73 | -15.29 | -15.35 | -15.20 | -15.36 |
| Min | -16.30 | -16.22 | -16.07 | -16.11 | -16.54 | -16.25 | -15.22 | -15.36 | -15.72 | -15.97 | -15.68 | -15.77 |
| 1998 – 2005 | | | | | | | | | | | | |
| Mean | -11.91 | -12.54 | -12.64 | -12.35 | -11.48 | -10.45 | -10.26 | -10.37 | -11.05 | -11.65 | -11.74 | -12.09 |
| Max | -8.27 | -9.66 | -9.64 | -8.64 | -7.85 | -6.89 | -6.59 | -6.79 | -7.29 | -8.18 | -8.30 | -8.35 |
| Min | -16.30 | -16.84 | -16.50 | -16.11 | -16.54 | -16.25 | -15.22 | -15.36 | -15.72 | -15.97 | -15.68 | -15.77 |

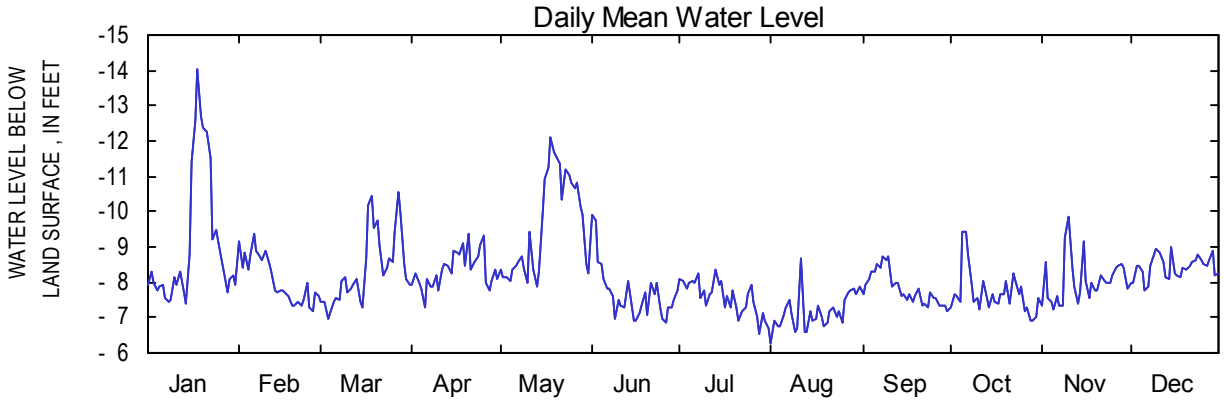


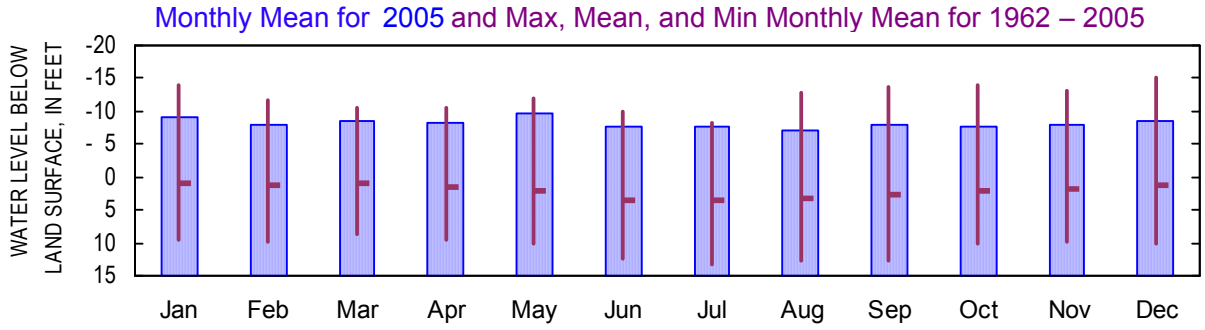

Negative value indicates water level above land surface

## Upper Floridan aquifer
## 2005 Calendar Year

**311007081301701** **Site Name: 33H127**

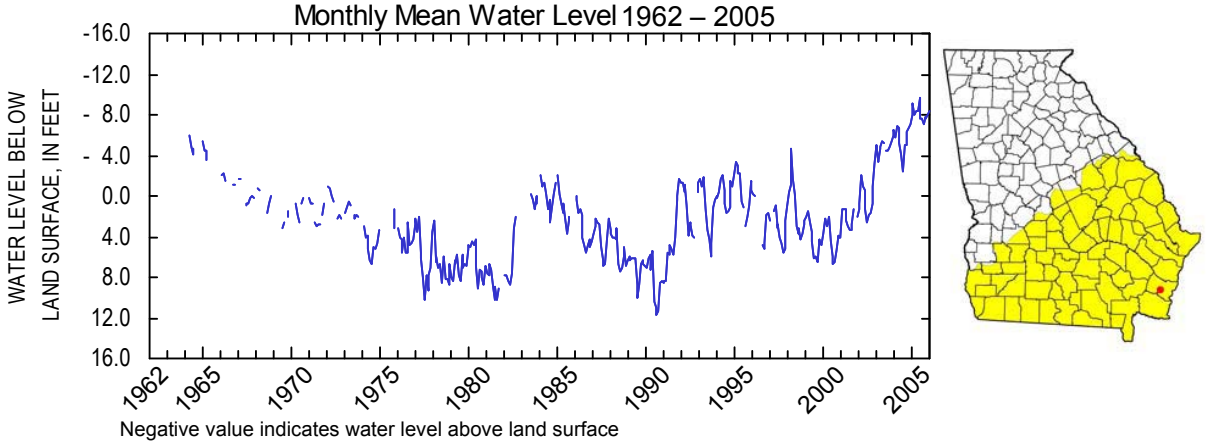
Latitude: 31° 10' 06" Longitude: 081° 30' 16" GLYNN Period of Record: 1962 – 2005
Well Depth: 952 feet Datum: 6.15 feet NGVD29 Well Diameter: 7.00 inches




### Monthly Water Level Statistics

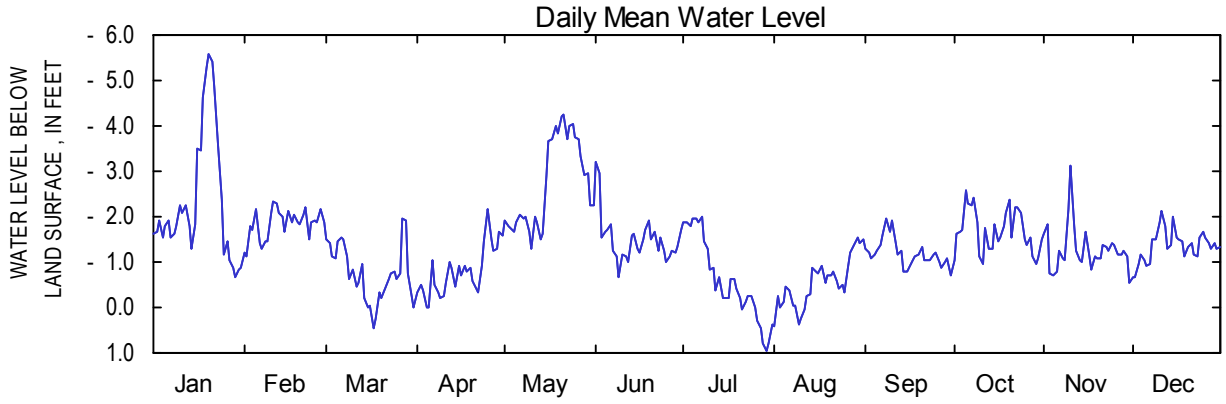
| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2005 | | | | | | | | | | | | |
| Mean | -9.10 | -8.07 | -8.38 | -8.34 | -9.60 | -7.69 | -7.57 | -7.15 | -7.81 | -7.70 | -8.04 | -8.42 |
| Max | -7.41 | -7.18 | -6.96 | -7.27 | -7.88 | -6.83 | -6.56 | -6.29 | -7.17 | -6.89 | -7.23 | -7.77 |
| Min | -14.02 | -9.36 | -10.53 | -9.36 | -12.11 | -9.93 | -8.36 | -8.66 | -8.73 | -9.43 | -9.84 | -9.02 |
| 1962 – 2005 | | | | | | | | | | | | |
| Mean | 0.99 | 1.13 | 0.99 | 1.41 | 2.08 | 3.57 | 3.64 | 3.21 | 2.77 | 2.12 | 1.75 | 1.25 |
| Max | 9.58 | 9.88 | 8.78 | 9.46 | 10.00 | 12.38 | 13.22 | 12.74 | 12.64 | 10.10 | 9.80 | 10.03 |
| Min | -14.02 | -11.80 | -10.53 | -10.50 | -12.11 | -9.93 | -8.36 | -12.70 | -13.60 | -14.00 | -13.00 | -15.00 |

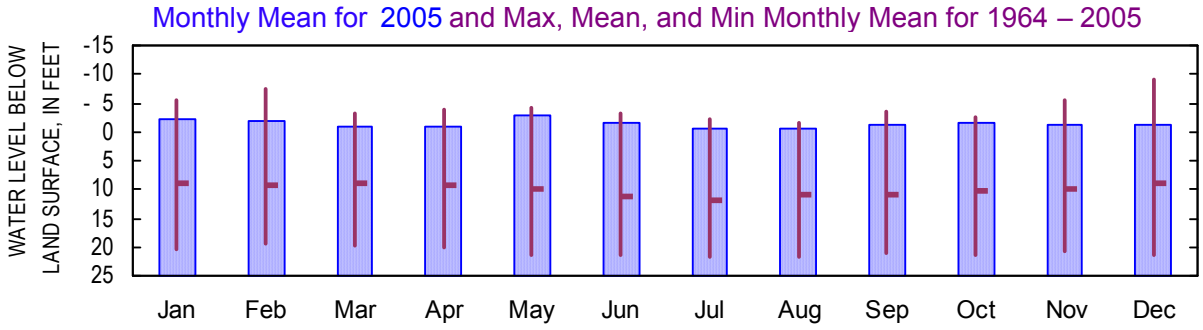


# Upper Floridan aquifer
## 2005 Calendar Year

**311007081301702** **Site Name: 33H133**

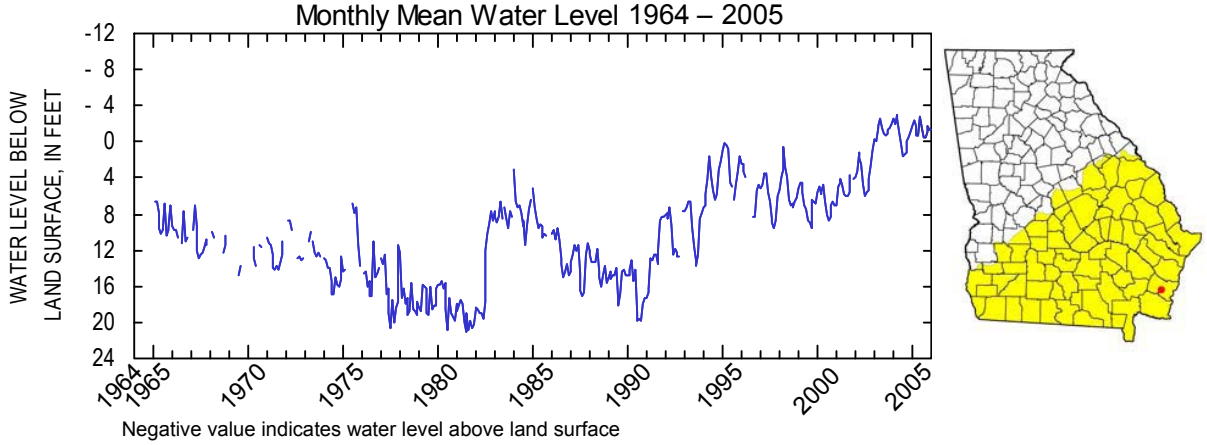
Latitude: 31° 10' 06" Longitude: 081° 30' 16" GLYNN Period of Record: 1964 – 2005
Well Depth: 790 feet Datum: 6.71 feet NGVD29 Well Diameter: 4.00 inches




### Monthly Water-Level Statistics

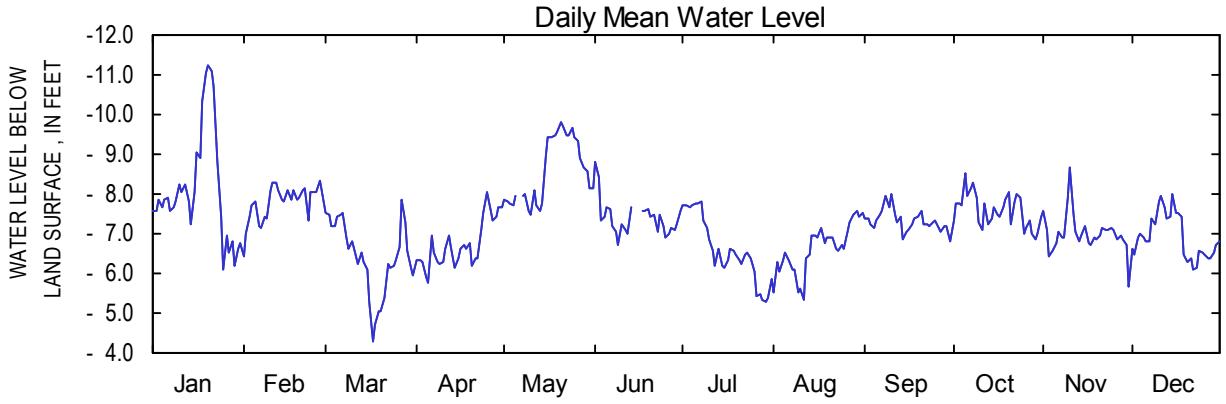
| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2005 | | | | | | | | | | | | |
| Mean | -2.34 | -1.83 | -0.75 | -0.80 | -2.72 | -1.50 | -0.59 | -0.54 | -1.19 | -1.68 | -1.28 | -1.35 |
| Max | -0.66 | -1.12 | 0.45 | 0.01 | -1.29 | -0.68 | 0.96 | 0.42 | -0.69 | -0.97 | -0.53 | -0.65 |
| Min | -5.57 | -2.34 | -1.94 | -2.17 | -4.25 | -3.21 | -1.98 | -1.54 | -1.95 | -2.57 | -3.11 | -2.10 |
| 1964 – 2005 | | | | | | | | | | | | |
| Mean | 9.01 | 9.19 | 8.78 | 9.27 | 9.97 | 11.34 | 11.74 | 10.91 | 10.85 | 10.24 | 9.92 | 8.82 |
| Max | 20.37 | 19.40 | 19.79 | 20.20 | 21.25 | 21.50 | 21.87 | 21.63 | 20.97 | 21.28 | 20.71 | 21.30 |
| Min | -5.57 | -7.45 | -3.25 | -3.96 | -4.25 | -3.21 | -2.10 | -1.56 | -3.44 | -2.57 | -5.61 | -9.07 |

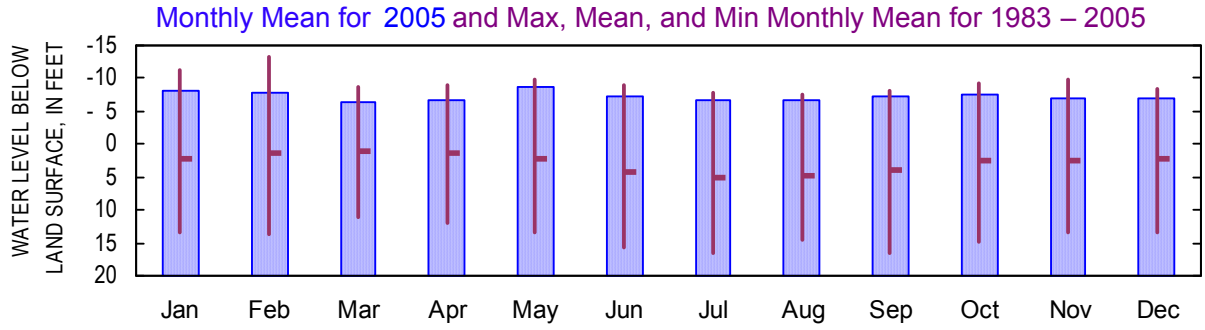


## Upper Floridan aquifer
## 2005 Calendar Year

**310925081312202** **Site Name: 33H207**

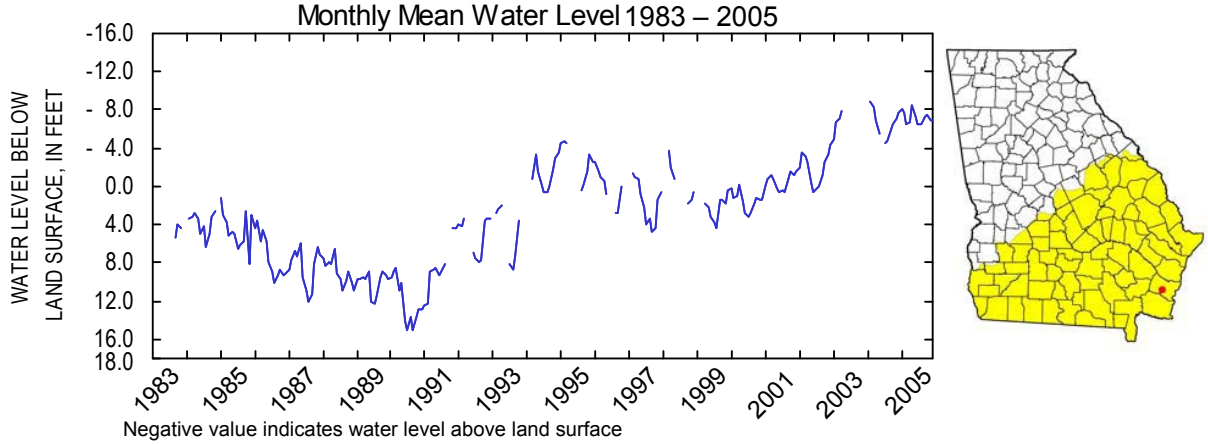
Latitude: 31° 09' 25" Longitude: 081° 31' 22" GLYNN Period of Record: 1983 – 2005
Well Depth: 720 feet Datum: 7.00 feet NGVD29 Well Diameter: 4.00 inches




### Monthly Water Level Statistics

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2005 | | | | | | | | | | | | |
| Mean | -8.12 | -7.77 | -6.41 | -6.72 | -8.58 | -7.40 | -6.58 | -6.61 | -7.32 | -7.58 | -7.00 | -6.93 |
| Max | -6.11 | -6.45 | -4.30 | -5.77 | -7.48 | -6.74 | -5.26 | -5.32 | -6.81 | -6.86 | -5.66 | -6.09 |
| Min | -11.26 | -8.33 | -7.84 | -8.03 | -9.79 | -8.83 | -7.80 | -7.55 | -7.99 | -8.52 | -8.65 | -7.98 |
| 1983 – 2005 | | | | | | | | | | | | |
| Mean | 2.12 | 1.43 | 1.13 | 1.38 | 2.09 | 4.34 | 5.00 | 4.89 | 4.03 | 2.56 | 2.48 | 2.10 |
| Max | 13.30 | 13.78 | 11.14 | 11.90 | 13.27 | 15.68 | 16.42 | 14.67 | 16.57 | 14.79 | 13.49 | 13.47 |
| Min | -11.26 | -13.19 | -8.81 | -8.95 | -9.79 | -8.83 | -7.80 | -7.55 | -7.99 | -9.22 | -9.86 | -8.34 |



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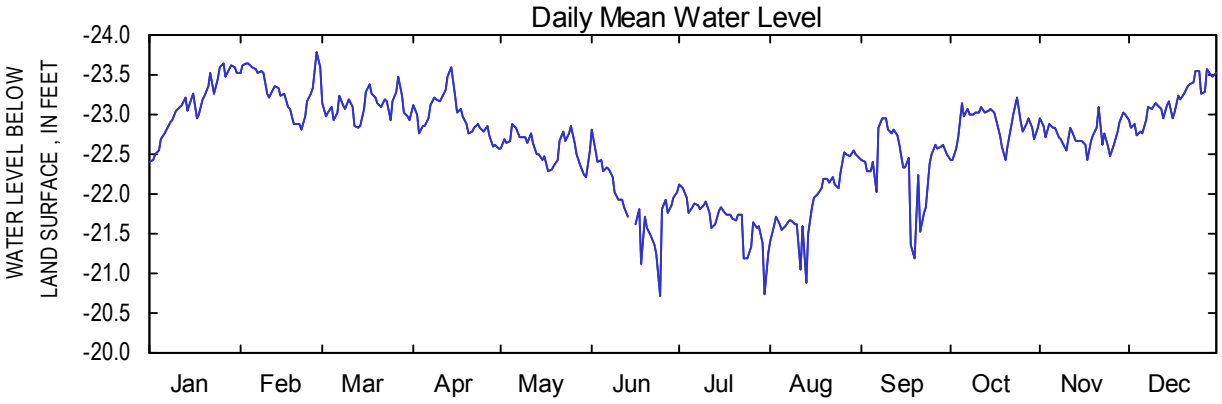
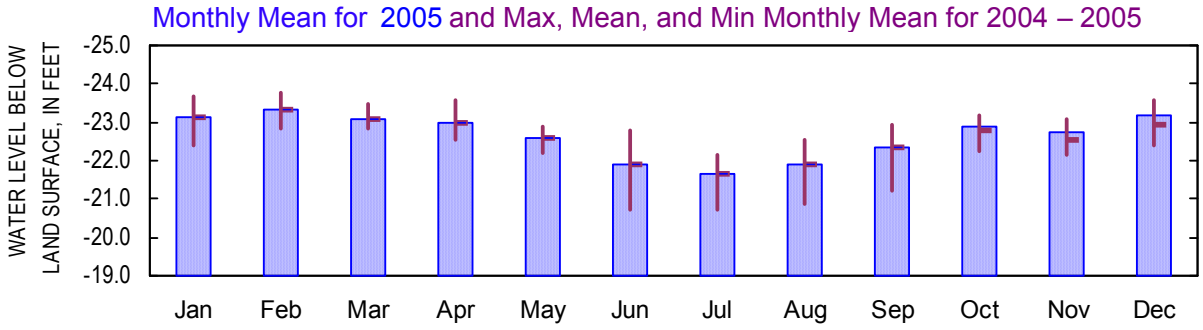
# Upper Floridan aquifer
## 2005 Calendar Year

**310418081244701** **Site Name: 34G033**

Latitude: 31°04'23" Longitude: 081°24'51" GLYNN Period of Record: 2004 – 2005

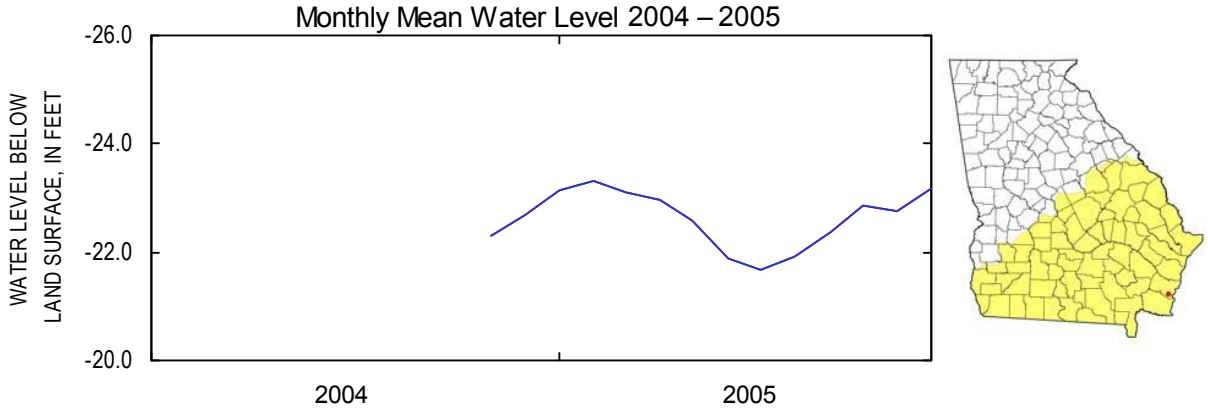
Well Depth: 751 feet Datum: 13.00 feet NGVD29 Well Diameter: 8.00 inches




Monthly Water-Level Statistics

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2005 | | | | | | | | | | | | |
| Mean | –23.13 | -23.32 | -23.11 | -22.98 | -22.58 | -21.88 | -21.66 | -21.91 | -22.37 | -22.87 | -22.75 | -23.17 |
| Max | –22.40 | -22.81 | -22.83 | -22.56 | -22.21 | -20.72 | -20.74 | -20.89 | -21.19 | -22.42 | -22.44 | -22.73 |
| Min | –23.65 | -23.79 | -23.48 | -23.59 | -22.88 | -22.80 | -22.13 | -22.54 | -22.95 | -23.20 | -23.09 | -23.58 |
| 2004 – 2005 | | | | | | | | | | | | |
| Mean | -23.13 | -23.32 | -23.11 | -22.98 | -22.58 | -21.88 | -21.66 | -21.91 | -22.37 | -22.81 | -22.53 | -22.92 |
| Max | -22.40 | -22.81 | -22.83 | -22.56 | -22.21 | -20.72 | -20.74 | -20.89 | -21.19 | -22.24 | -22.13 | -22.39 |
| Min | -23.65 | -23.79 | -23.48 | -23.59 | -22.88 | -22.80 | -22.13 | -22.54 | -22.95 | -23.20 | -23.09 | -23.58 |




Negative value indicates water level above land surface

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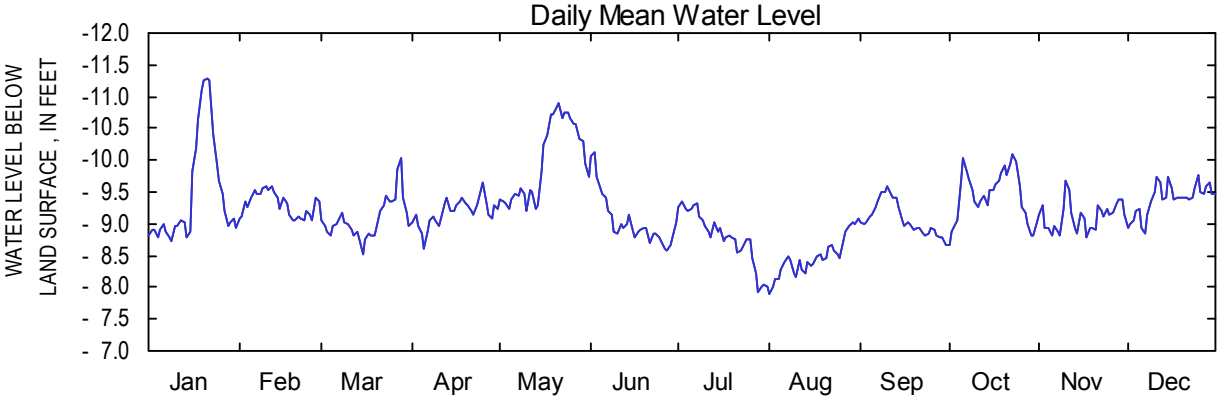
## Upper Floridan aquifer
## 2005 Calendar Year

**310938081285301** **Site Name: 34H334**

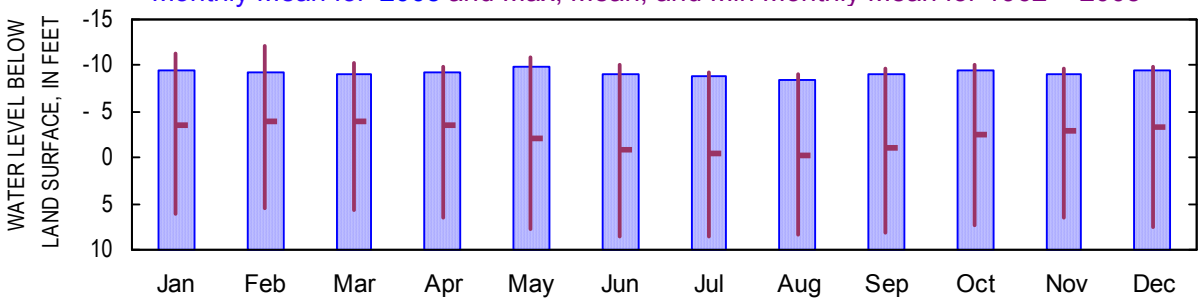
Latitude: 31° 09' 38" Longitude: 081° 28' 53" GLYNN Period of Record: 1962 – 2005

Well Depth: 980 feet Datum: 8.33 feet NGVD29 Well Diameter: 4.00 inches

Daily Mean Water Level



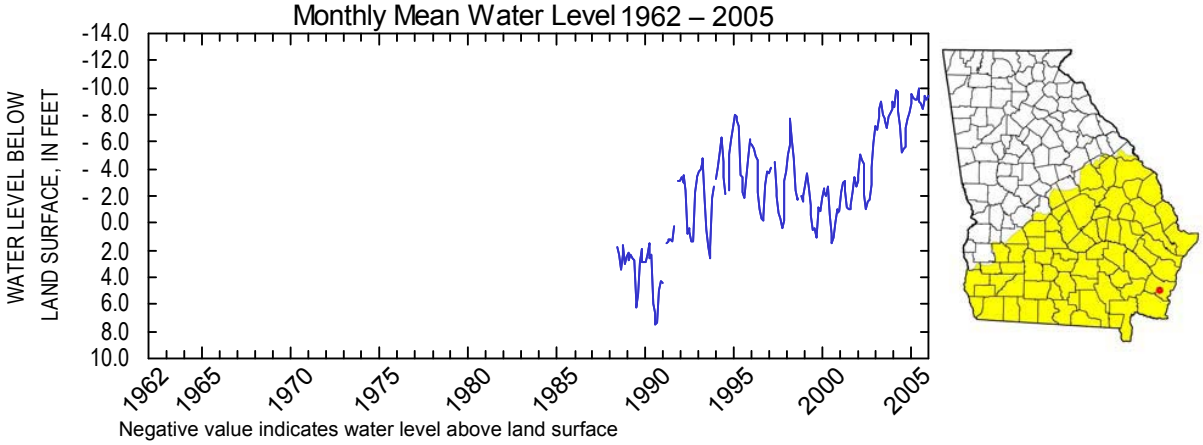

Monthly Mean for 2005 and Max, Mean, and Min Monthly Mean for 1962 – 2005




Monthly Water Level Statistics

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2005 | | | | | | | | | | | | |
| Mean | -9.47 | -9.30 | -9.08 | -9.18 | -9.98 | -9.04 | -8.78 | -8.47 | -9.07 | -9.44 | -9.11 | -9.39 |
| Max | -8.73 | -9.05 | -8.52 | -8.62 | -9.22 | -8.57 | -7.93 | -7.90 | -8.66 | -8.67 | -8.79 | -8.84 |
| Min | -11.28 | -9.60 | -10.02 | -9.64 | -10.90 | -10.13 | -9.34 | -9.08 | -9.58 | -10.10 | -9.68 | -9.77 |
| 1962 – 2005 | | | | | | | | | | | | |
| Mean | -3.49 | -3.93 | -3.91 | -3.59 | -2.10 | -0.82 | -0.38 | -0.19 | -1.10 | -2.50 | -2.85 | -3.28 |
| Max | 6.17 | 5.50 | 5.74 | 6.58 | 7.70 | 8.65 | 8.62 | 8.44 | 8.19 | 7.25 | 6.59 | 7.51 |
| Min | -11.28 | -12.10 | -10.27 | -9.92 | -10.90 | -10.13 | -9.34 | -9.08 | -9.58 | -10.10 | -9.68 | -9.81 |

Monthly Mean Water Level 1962 – 2005

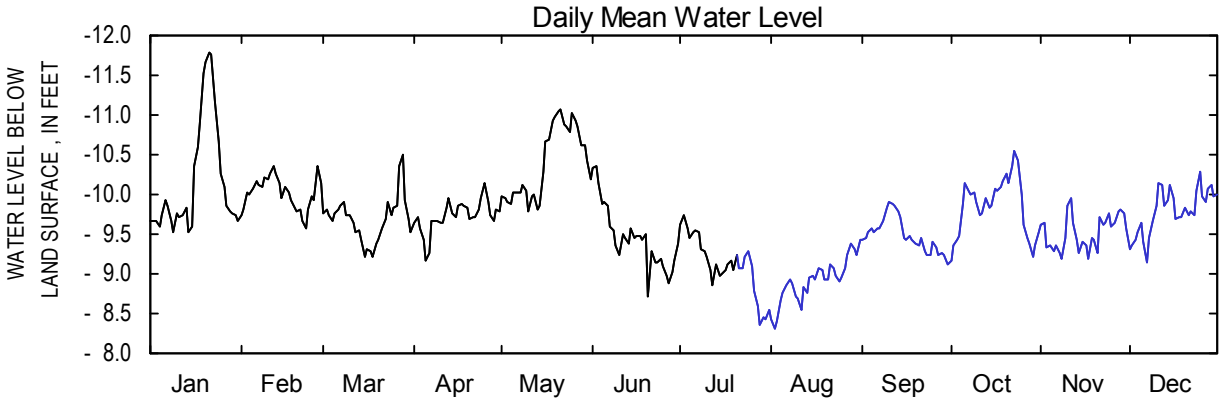


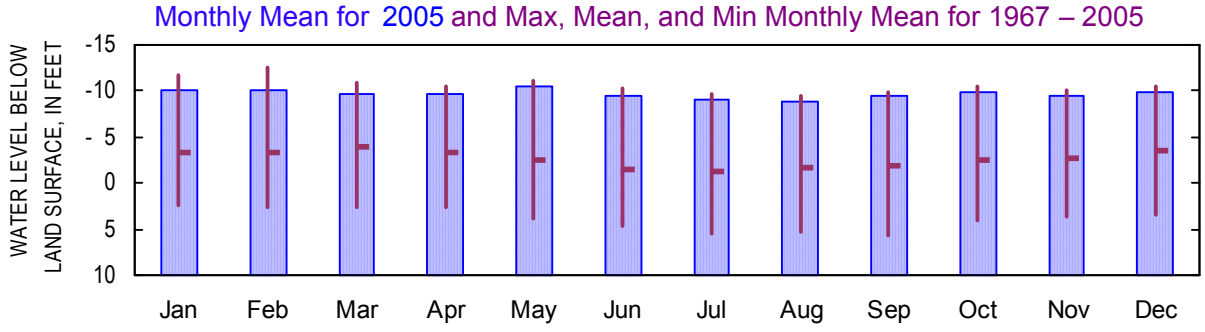

Negative value indicates water level above land surface

**Upper Floridan aquifer**
**2005 Calendar Year**

**310818081293701** **Site Name: 34H371**

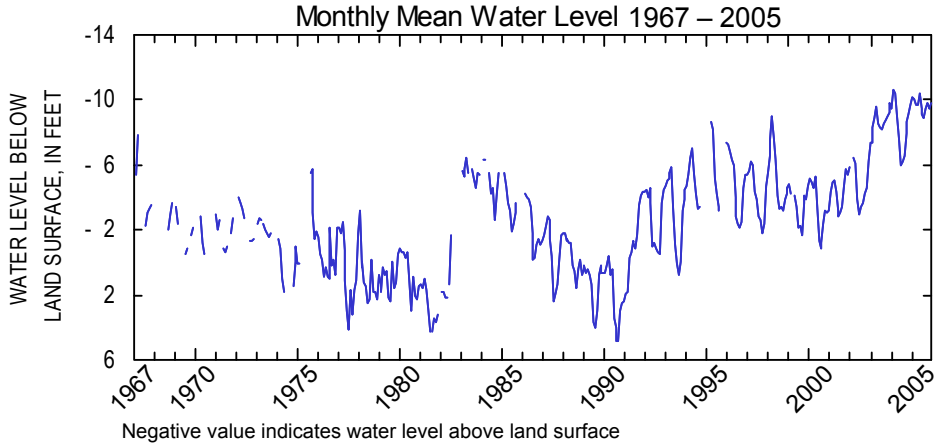
Latitude: 31° 08 '18" Longitude: 081° 29 '36" GLYNN Period of Record: 1967 – 2005
Well Depth: 700 feet Datum: 9.49 feet NGVD29 Well Diameter: 2.00 inches




Monthly Water-Level Statistics

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2005 | | | | | | | | | | | | |
| Mean | -10.16 | -10.01 | -9.69 | -9.72 | -10.39 | -9.45 | -9.11 | -8.91 | -9.49 | -9.85 | -9.52 | -9.79 |
| Max | -9.51 | -9.57 | -9.20 | -9.17 | -9.78 | -8.72 | -8.37 | -8.32 | -9.13 | -9.17 | -9.19 | -9.14 |
| Min | -11.79 | -10.35 | -10.50 | -10.15 | -11.06 | -10.36 | -9.73 | -9.42 | -9.90 | -10.54 | -9.96 | -10.29 |
| 1967 – 2005 | | | | | | | | | | | | |
| Mean | -3.32 | -3.39 | -3.89 | -3.41 | -2.59 | -1.50 | -1.27 | -1.63 | -1.89 | -2.53 | -2.75 | -3.45 |
| Max | 2.47 | 2.58 | 2.54 | 2.71 | 3.90 | 4.64 | 5.40 | 5.36 | 5.64 | 4.09 | 3.62 | 3.49 |
| Min | -11.79 | -12.49 | -10.86 | -10.49 | -11.06 | -10.36 | -9.73 | -9.42 | -9.90 | -10.54 | -10.09 | -10.44 |




Negative value indicates water level above land surface

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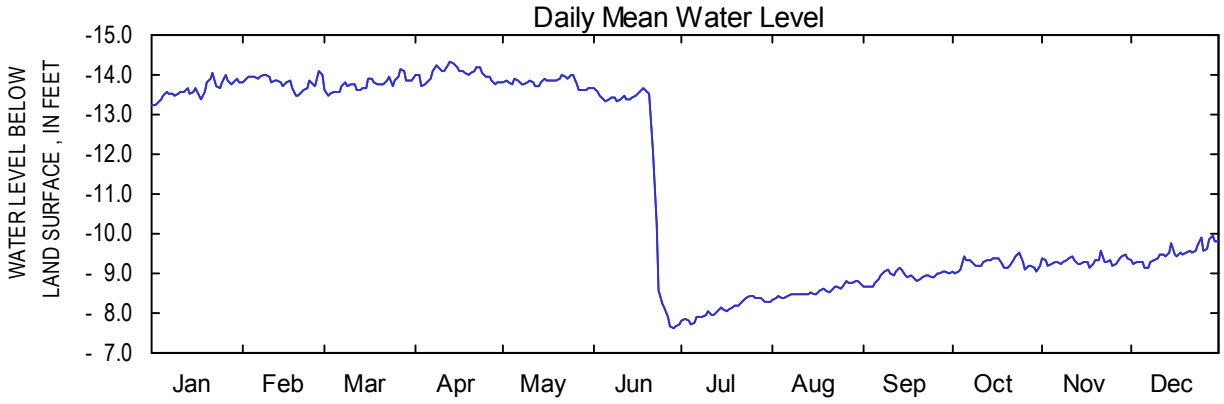
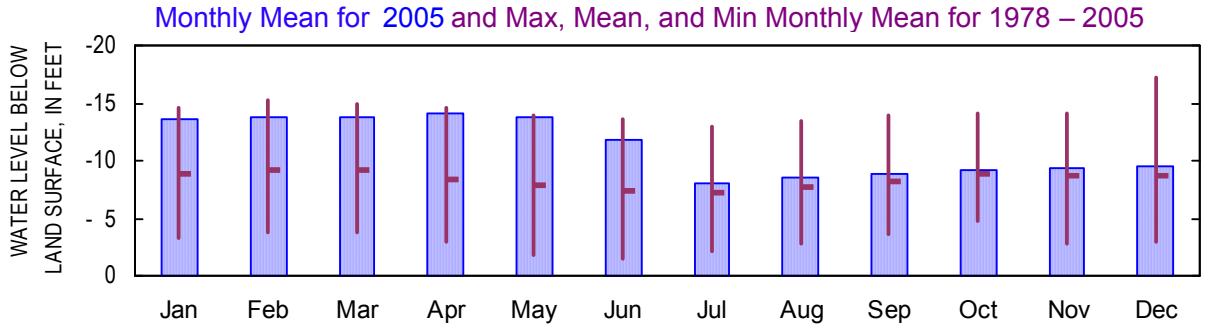
## Lower Floridan aquifer
## 2005 Calendar Year

**310810081323501** **Site Name: 33H188**

Latitude: 31° 08' 09" Longitude: 081° 32' 35" GLYNN Period of Record: 1978 – 2005

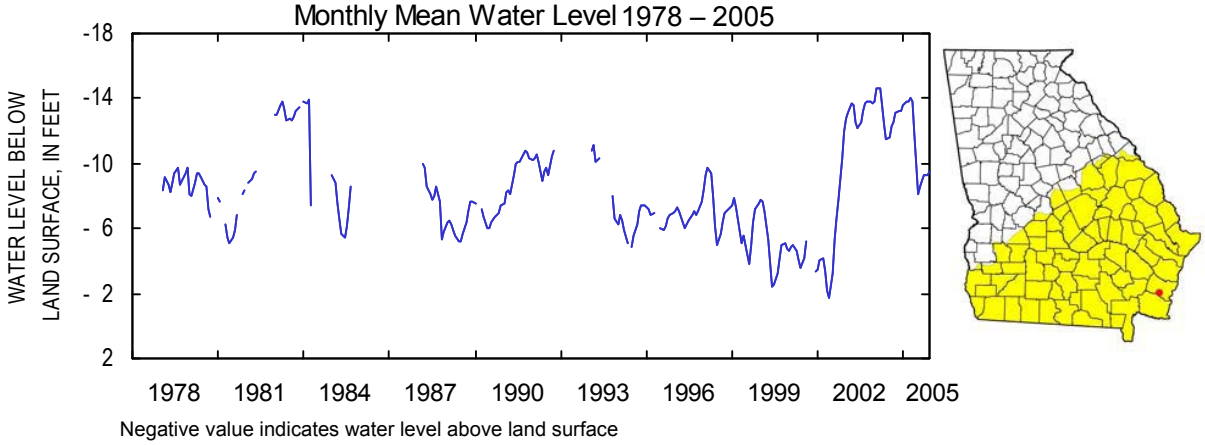
Well Depth: 2,720 feet Datum: 9.37 NGVD29 Well Diameter: 10.00 inches




### Monthly Water-Level Statistics

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2005 | | | | | | | | | | | | |
| Mean | -13.62 | -13.82 | -13.76 | -14.03 | -13.82 | -11.84 | -8.11 | -8.55 | -8.92 | -9.23 | -9.32 | -9.51 |
| Max | -13.23 | -13.49 | -13.46 | -13.73 | -13.63 | -7.63 | -7.71 | -8.33 | -8.66 | -9.00 | -9.15 | -9.14 |
| Min | -14.03 | -14.07 | -14.12 | -14.35 | -14.00 | -13.66 | -8.44 | -8.79 | -9.14 | -9.54 | -9.58 | -9.93 |
| 1978 – 2005 | | | | | | | | | | | | |
| Mean | -8.84 | -9.12 | -9.18 | -8.38 | -7.88 | -7.41 | -7.25 | -7.72 | -8.21 | -8.79 | -8.61 | -8.74 |
| Max | -3.30 | -3.73 | -3.74 | -2.99 | -1.74 | -1.46 | -2.12 | -2.73 | -3.61 | -4.75 | -2.80 | -2.92 |
| Min | -14.57 | -15.18 | -14.93 | -14.64 | -14.00 | -13.66 | -13.00 | -13.49 | -13.94 | -14.11 | -14.03 | -17.20 |




Negative value indicates water level above land surface

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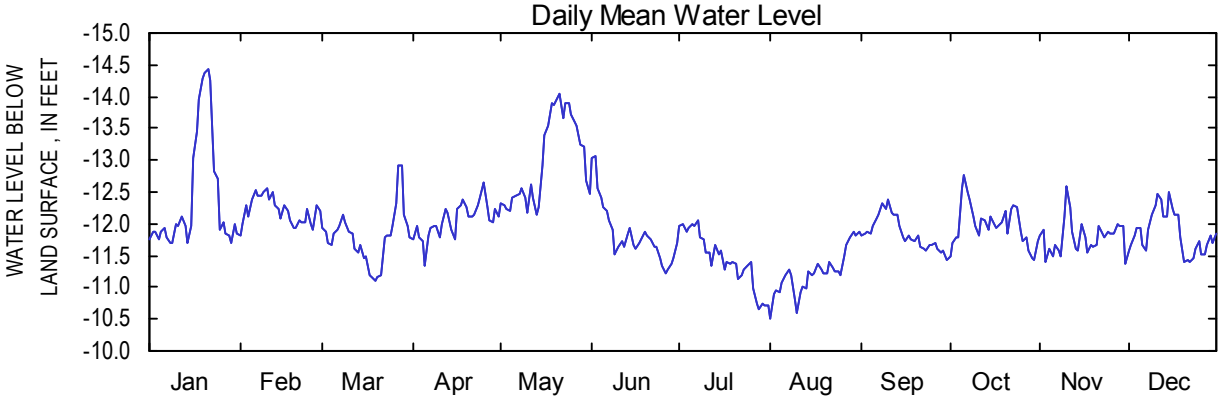
# Lower Floridan aquifer
## 2005 Calendar Year

**310925081312201** **Site Name: 33H206**

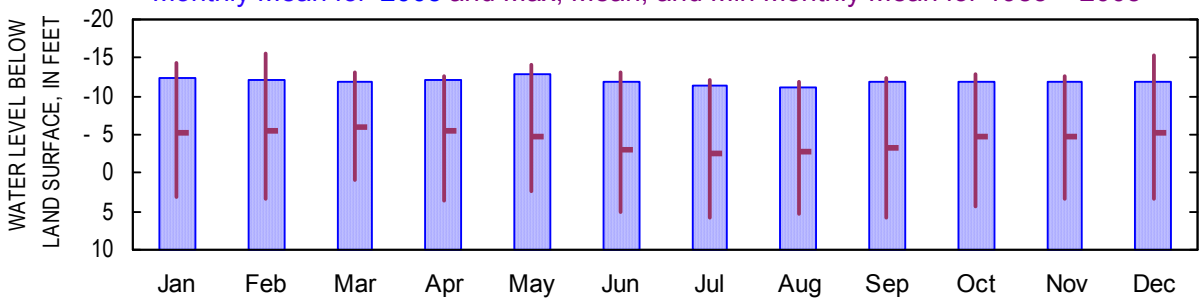
Latitude: 31° 09' 25" Longitude: 081° 31' 22" GLYNN Period of Record: 1983 – 2005

Well Depth: 1,100 feet Datum: 7.00 feet NGVD29 Well Diameter: 10.00 inches

Daily Mean Water Level



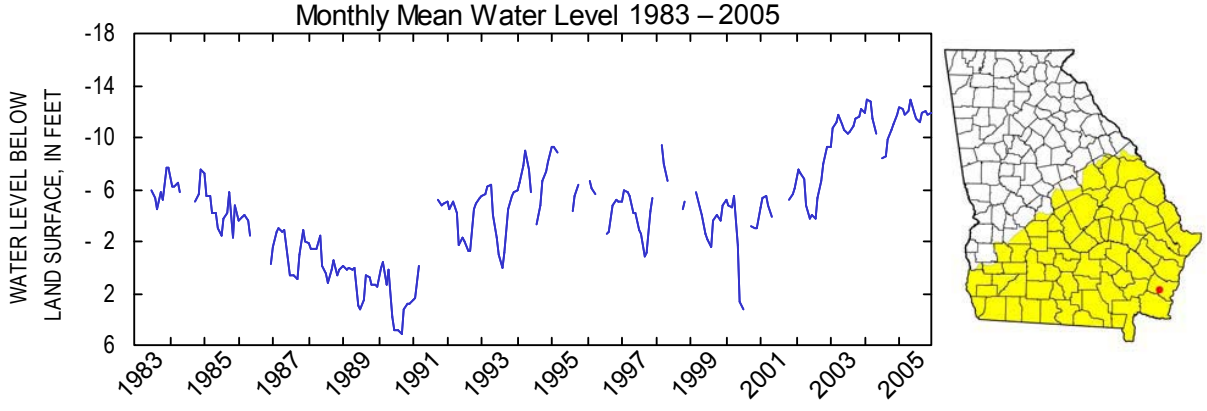

Monthly Mean for 2005 and Max, Mean, and Min Monthly Mean for 1983 – 2005




Monthly Water-Level Statistics

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2005 | | | | | | | | | | | | |
| Mean | -12.40 | -12.20 | -11.80 | -12.05 | -12.98 | -11.84 | -11.43 | -11.22 | -11.85 | -11.98 | -11.79 | -11.85 |
| Max | -11.69 | -11.82 | -11.10 | -11.33 | -12.13 | -11.21 | -10.65 | -10.52 | -11.43 | -11.44 | -11.38 | -11.40 |
| Min | -14.42 | -12.56 | -12.91 | -12.66 | -14.06 | -13.07 | -12.06 | -11.89 | -12.37 | -12.77 | -12.59 | -12.49 |
| 1983 – 2005 | | | | | | | | | | | | |
| Mean | -5.30 | -5.57 | -5.87 | -5.55 | -4.78 | -3.07 | -2.44 | -2.79 | -3.39 | -4.65 | -4.87 | -5.28 |
| Max | 3.17 | 3.37 | 0.99 | 3.68 | 2.30 | 5.04 | 5.93 | 5.36 | 5.89 | 4.27 | 3.31 | 3.27 |
| Min | -14.42 | -15.45 | -13.17 | -12.66 | -14.06 | -13.07 | -12.06 | -11.89 | -12.37 | -12.80 | -12.59 | -15.23 |

Monthly Mean Water Level 1983 – 2005



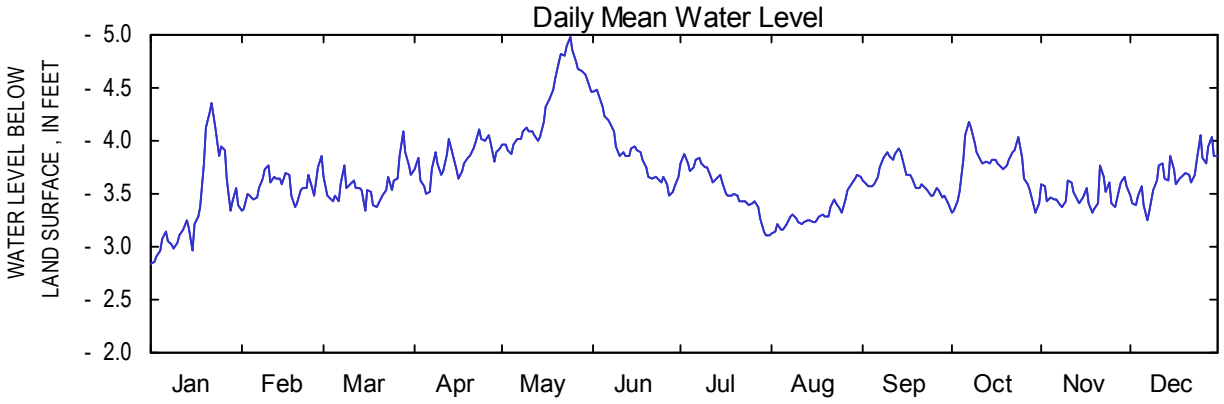


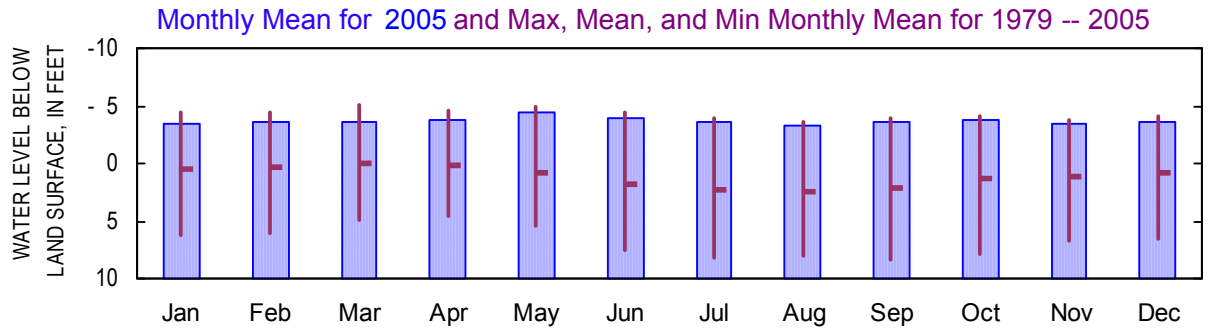

Negative value indicates water level above land surface

**Lower Floridan aquifer**
**2005 Calendar Year**

**311633081324001** **Site Name: 33J044**

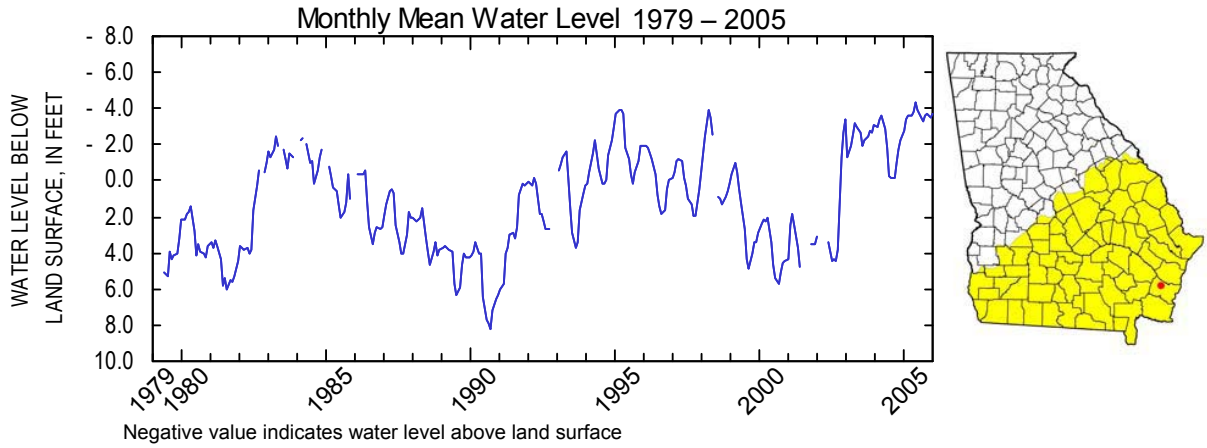
Latitude: 31° 16' 33" Longitude: 081° 32' 40" GLYNN Period of Record: 1979 – 2005
Well Depth: 1,910 feet Datum: 20 feet NGVD29 Well Diameter: 9.00 inches




Monthly Water Level Statistics

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2005 | | | | | | | | | | | | |
| Mean | -3.39 | -3.57 | -3.58 | -3.82 | -4.36 | -3.89 | -3.55 | -3.33 | -3.65 | -3.74 | -3.50 | -3.67 |
| Max | -2.84 | -3.34 | -3.35 | -3.51 | -3.87 | -3.48 | -3.10 | -3.12 | -3.41 | -3.32 | -3.32 | -3.25 |
| Min | -4.36 | -3.86 | -4.09 | -4.10 | -4.99 | -4.49 | -3.88 | -3.67 | -3.93 | -4.18 | -3.76 | -4.06 |
| 1979 – 2005 | | | | | | | | | | | | |
| Mean | 0.48 | 0.29 | 0.03 | 0.12 | 0.77 | 1.84 | 2.30 | 2.52 | 2.12 | 1.34 | 1.10 | 0.77 |
| Max | 6.31 | 6.14 | 4.87 | 4.63 | 5.39 | 7.52 | 8.23 | 8.09 | 8.44 | 7.82 | 6.79 | 6.53 |
| Min | -4.36 | -4.41 | -5.09 | -4.56 | -4.99 | -4.49 | -3.88 | -3.67 | -3.93 | -4.18 | -3.76 | -4.06 |



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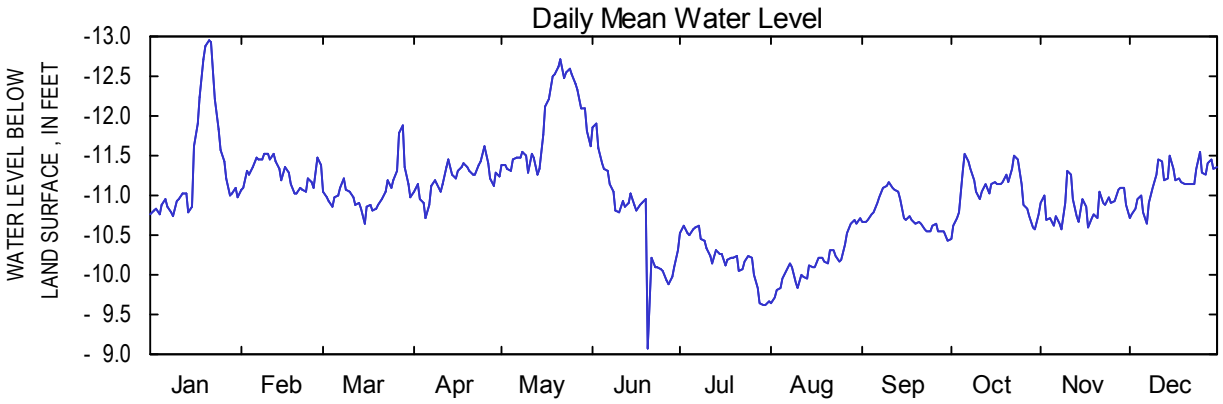
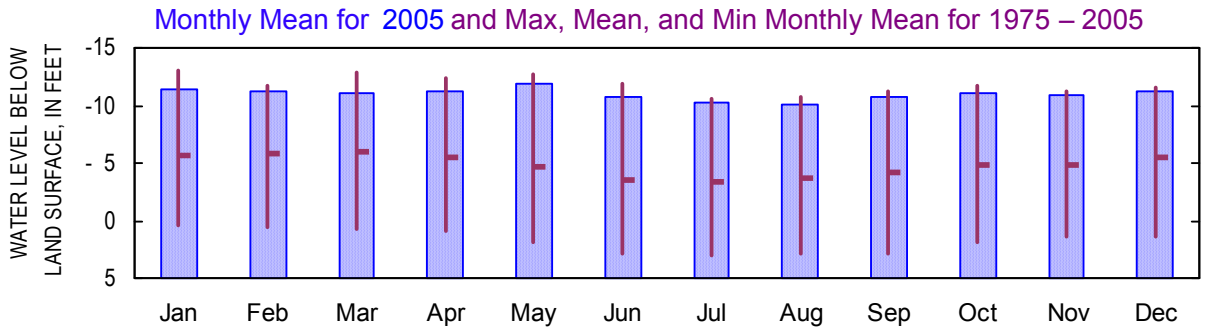
# Lower Floridan aquifer
## 2005 Calendar Year

**310818081294201** **Site Name: 34H391**

Latitude: 31° 08 '18" Longitude: 081° 29 '42" GLYNN Period of Record: 1975 – 2005

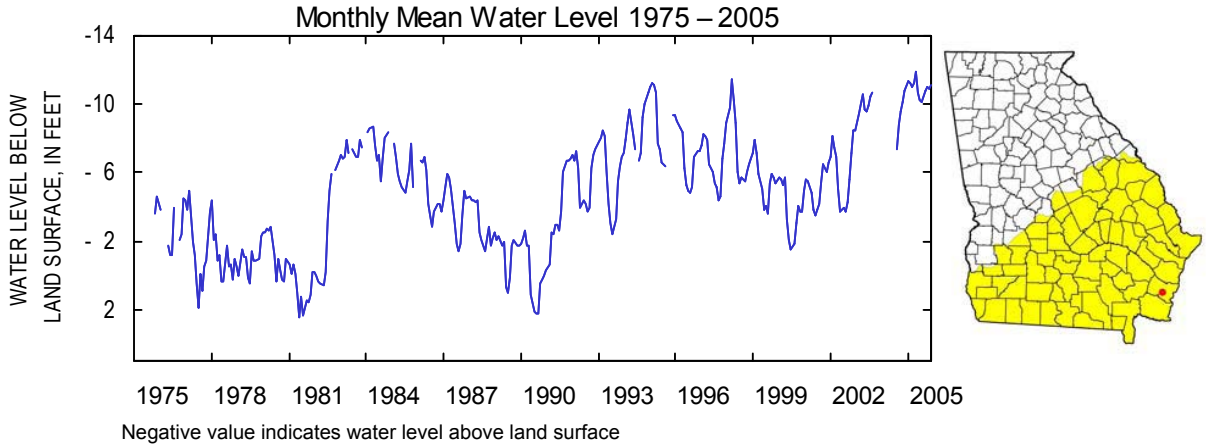
Well Depth: 1,158 feet Datum: 7.13 feet NGVD29 Well Diameter: 4.00 inches




### Monthly Water-Level Statistics

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2005 | | | | | | | | | | | | |
| Mean | -11.37 | -11.28 | -11.05 | -11.22 | -11.89 | -10.70 | -10.21 | -10.15 | -10.76 | -11.05 | -10.87 | -11.17 |
| Max | -10.73 | -11.03 | -10.65 | -10.71 | -11.25 | -9.08 | -9.62 | -9.65 | -10.43 | -10.46 | -10.58 | -10.65 |
| Min | -12.96 | -11.52 | -11.89 | -11.62 | -12.71 | -11.91 | -10.62 | -10.71 | -11.16 | -11.52 | -11.31 | -11.54 |
| 1975 – 2005 | | | | | | | | | | | | |
| Mean | -5.64 | -5.75 | -5.93 | -5.53 | -4.67 | -3.57 | -3.36 | -3.77 | -4.23 | -4.89 | -4.88 | -5.52 |
| Max | 0.33 | 0.55 | 0.72 | 0.86 | 1.93 | 2.83 | 2.96 | 2.83 | 2.90 | 1.96 | 1.44 | 1.45 |
| Min | -12.96 | -11.71 | -12.85 | -12.34 | -12.71 | -11.91 | -10.64 | -10.79 | -11.26 | -11.65 | -11.31 | -11.54 |



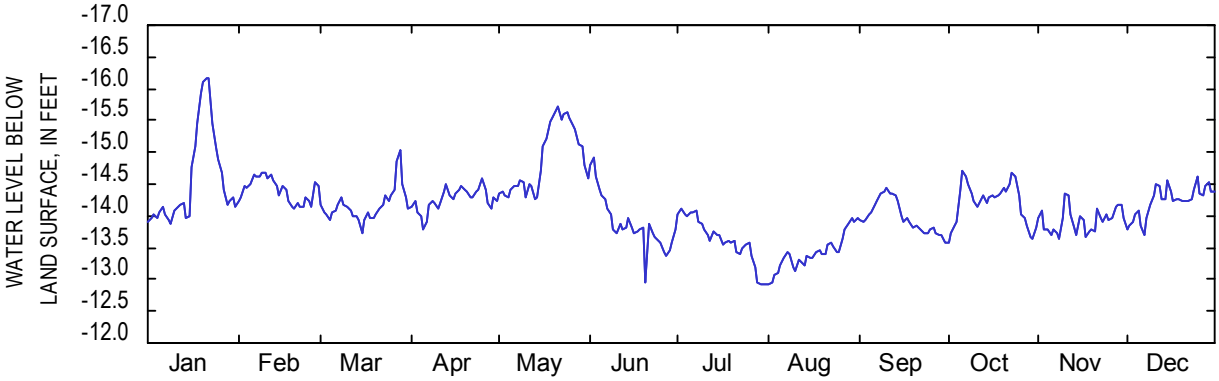

Negative value indicates water level above land surface

**Lower Floridan aquifer**
**2005 Calendar Year**

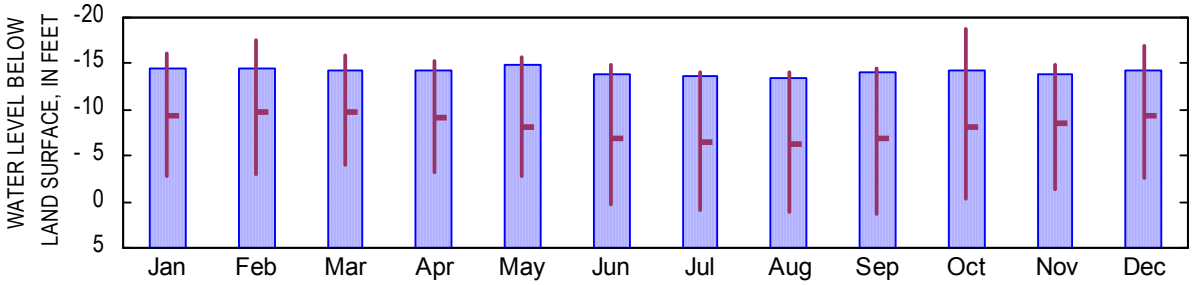
**310901081284401** **Site Name: 34H436**

Latitude: 31° 09' 01" Longitude: 081° 28' 44" GLYNN Period of Record: 1983 – 2005
Well Depth: 1,103 feet Datum: 6.62 feet NGVD29 Well Diameter: 4.00 inches

Daily Mean Water Level



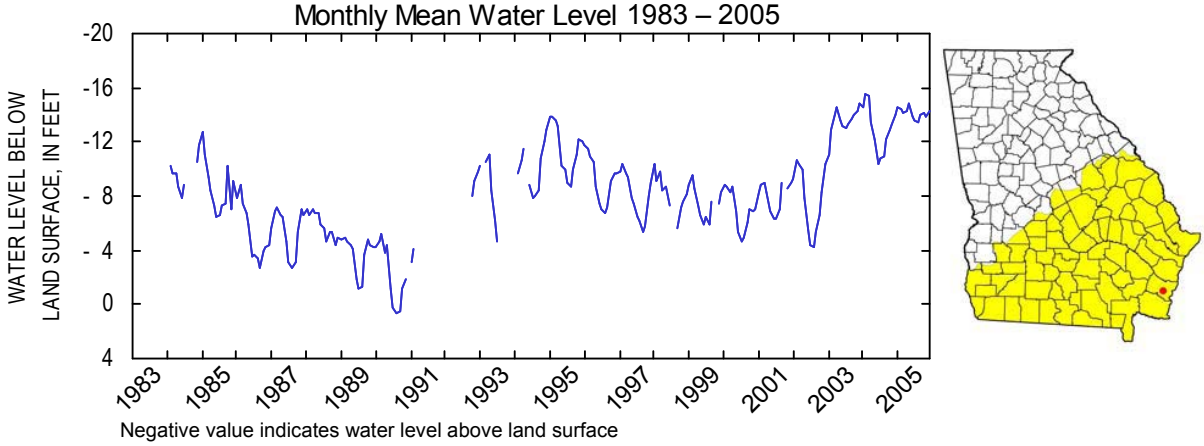

Monthly Mean for 2005 and Max, Mean, and Min Monthly Mean for 1983 – 2005




Monthly Water-Level Statistics

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2005 | | | | | | | | | | | | |
| Mean | -14.56 | -14.40 | -14.16 | -14.26 | -14.89 | -13.88 | -13.61 | -13.42 | -13.98 | -14.20 | -13.93 | -14.23 |
| Max | -13.87 | -14.13 | -13.74 | -13.77 | -14.25 | -12.95 | -12.92 | -12.91 | -13.58 | -13.58 | -13.65 | -13.71 |
| Min | -16.16 | -14.68 | -15.02 | -14.60 | -15.71 | -14.90 | -14.12 | -13.97 | -14.43 | -14.71 | -14.35 | -14.63 |
| 1983 – 2005 | | | | | | | | | | | | |
| Mean | -9.37 | -9.66 | -9.66 | -9.15 | -8.12 | -6.86 | -6.44 | -6.26 | -6.87 | -8.15 | -8.55 | -9.30 |
| Max | -2.70 | -2.90 | -4.10 | -3.10 | -2.70 | 0.30 | 0.90 | 1.10 | 1.30 | -0.40 | -1.30 | -2.50 |
| Min | -16.16 | -17.48 | -15.97 | -15.28 | -15.71 | -14.90 | -14.12 | -13.97 | -14.43 | -18.79 | -14.95 | -17.00 |

Monthly Mean Water Level 1983 – 2005




Negative value indicates water level above land surface

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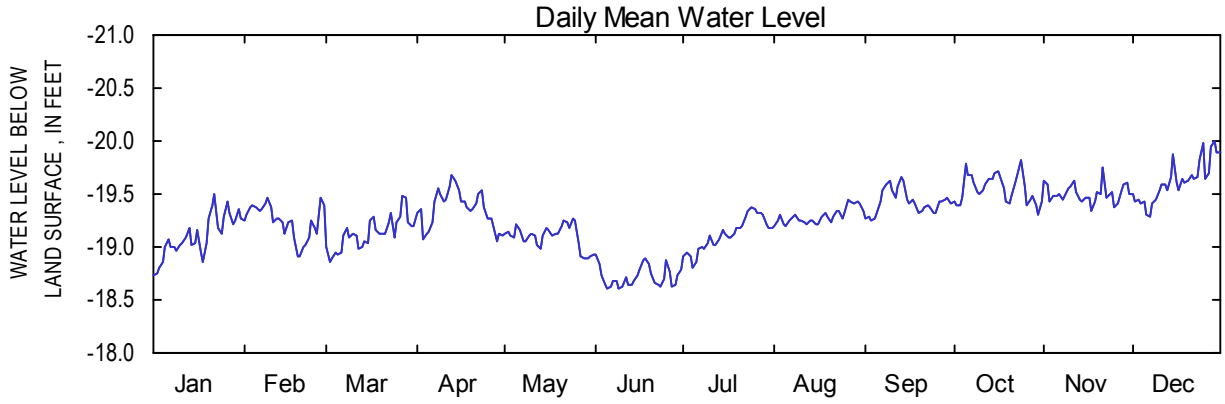
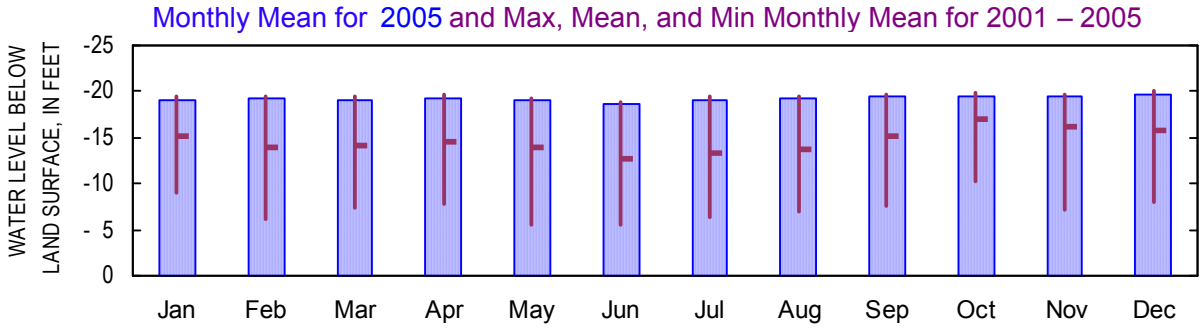
## Lower Floridan aquifer
## 2005 Calendar Year

**310835081294501** **Site Name: 34H495**

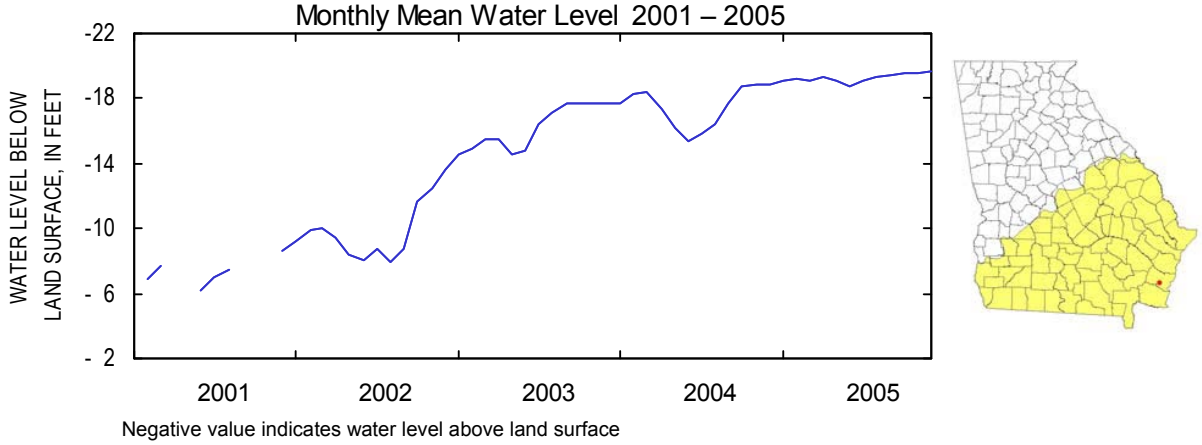
Latitude: 31° 08 ' 35" Longitude: 081° 29' 45" GLYNN Period of Record: 2001 − 2005
Well Depth: 2,720 feet Datum: 10 feet NGVD29 Well Diameter: 8 inches




### Monthly Water-Level Statistics

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2005 | | | | | | | | | | | | |
| Mean | -19.10 | -19.24 | -19.13 | -19.36 | -19.10 | -18.72 | -19.12 | -19.29 | -19.42 | -19.55 | -19.50 | -19.62 |
| Max | -18.74 | -18.90 | -18.85 | -19.06 | -18.89 | -18.61 | -18.81 | -19.20 | -19.25 | -19.31 | -19.33 | -19.28 |
| Min | -19.50 | -19.47 | -19.47 | -19.69 | -19.27 | -18.93 | -19.38 | -19.45 | -19.66 | -19.82 | -19.76 | -20.00 |
| 2001 − 2005 | | | | | | | | | | | | |
| Mean | -15.14 | -13.96 | -14.15 | -14.54 | -13.98 | -12.62 | -13.42 | -13.65 | -15.21 | -16.93 | -16.10 | -15.68 |
| Max | -8.92 | -6.16 | -7.42 | -7.74 | -5.44 | -5.61 | -6.26 | -6.87 | -7.54 | -10.33 | -7.26 | -8.08 |
| Min | -19.50 | -19.47 | -19.47 | -19.69 | -19.27 | -18.93 | -19.38 | -19.45 | -19.66 | -19.82 | -19.76 | -20.00 |




Negative value indicates water level above land surface

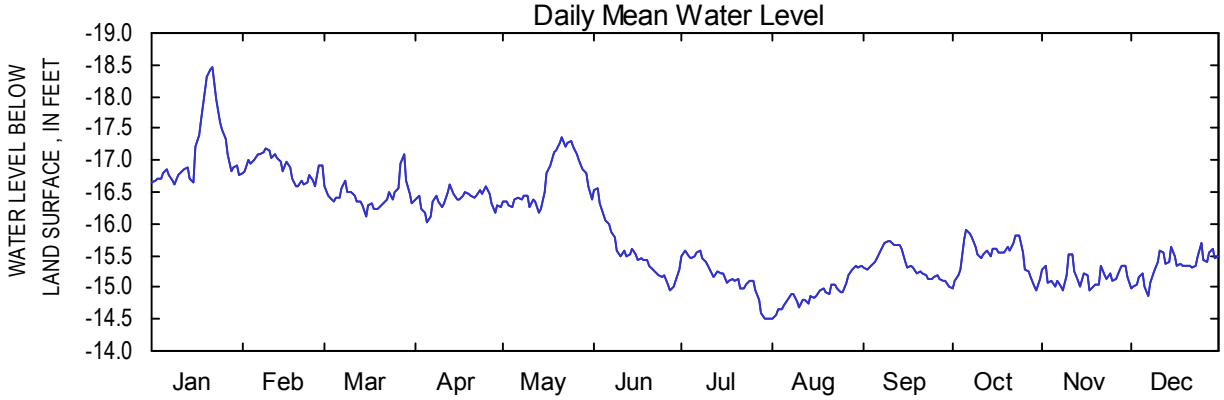
USGS science for a changing world

## Lower Floridan aquifer
## 2005 Calendar Year

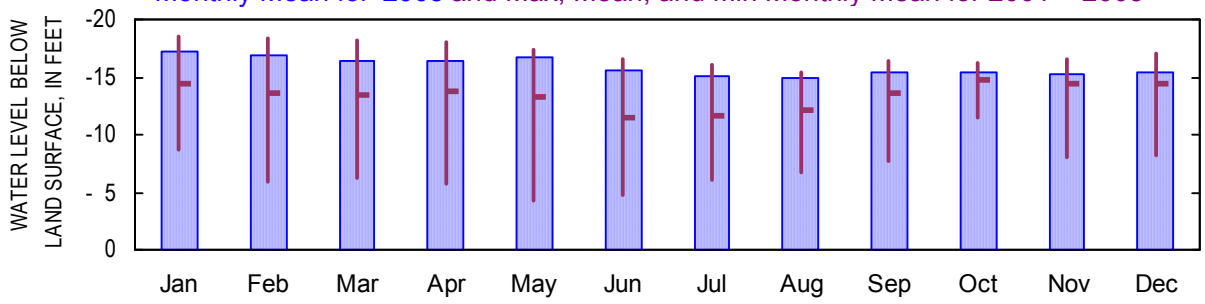
**310835081294502** **Site Name: 34H500**

Latitude: 31° 08' 35" Longitude: 081° 29' 45" GLYNN Period of Record: 2001 – 2005
Well Depth: 1,400 feet Datum: 10 feet NGVD29 Well Diameter: 8.0 inches

Daily Mean Water Level



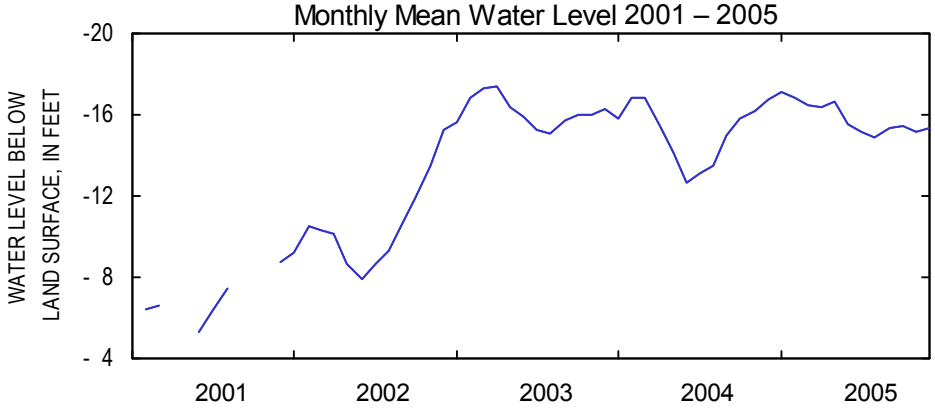

Monthly Mean for 2005 and Max, Mean, and Min Monthly Mean for 2001 – 2005




Monthly Water-Level Statistics

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2005 | | | | | | | | | | | | |
| Mean | -17.15 | -16.88 | -16.45 | -16.38 | -16.70 | -15.56 | -15.14 | -14.91 | -15.36 | -15.48 | -15.17 | -15.34 |
| Max | -16.62 | -16.58 | -16.11 | -16.03 | -16.18 | -14.96 | -14.49 | -14.50 | -15.01 | -14.97 | -14.94 | -14.88 |
| Min | -18.48 | -17.18 | -17.10 | -16.62 | -17.35 | -16.57 | -15.57 | -15.35 | -15.72 | -15.91 | -15.52 | -15.69 |
| 2001 – 2005 | | | | | | | | | | | | |
| Mean | -14.45 | -13.53 | -13.50 | -13.73 | -13.34 | -11.45 | -11.69 | -12.05 | -13.64 | -14.78 | -14.43 | -14.48 |
| Max | -8.73 | -5.93 | -6.20 | -5.75 | -4.33 | -4.71 | -6.02 | -6.72 | -7.68 | -11.41 | -8.07 | -8.27 |
| Min | -18.48 | -18.37 | -18.26 | -17.95 | -17.35 | -16.57 | -16.08 | -15.35 | -16.45 | -16.23 | -16.52 | -16.99 |

Monthly Mean Water Level 2001 – 2005




Negative value indicates water level above land surface

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Prepared by USGS Georgia Water Science Center
Edited by Patricia L. Nobles
Graphics by Bonnie J. Turcott
For more information concerning the research in this report, contact
USGS Georgia Water Science Center, Atlanta,
telephone: 770-903-9100