Groundwater Levels

Upper Floridan Aquifer

City of Brunswick Area

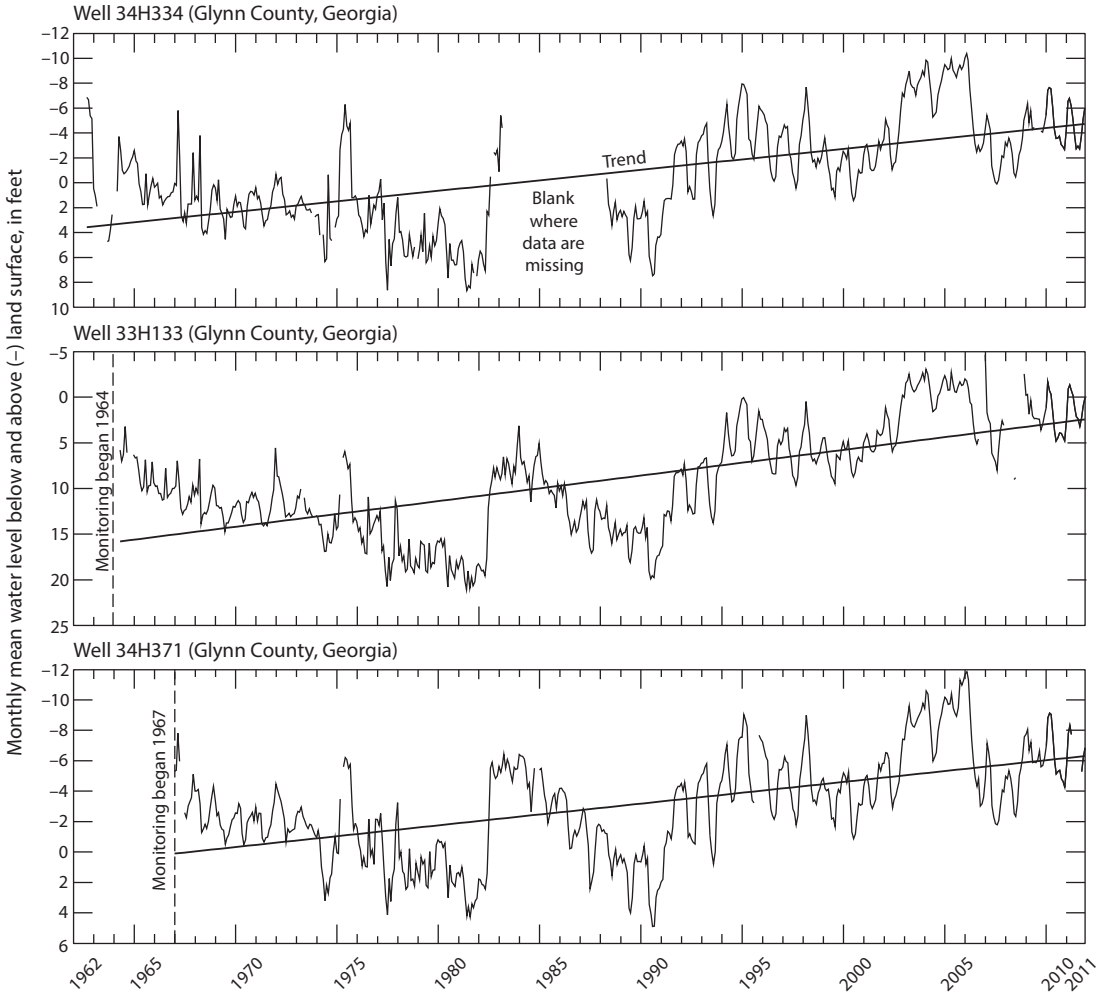
Water levels in 10 wells were used to define groundwater conditions in the Upper Floridan aquifer near the city of Brunswick in the central coastal area of Georgia during 2010–2011 (maps and table, facing page). In this area, water in the Upper Floridan aquifer is confined, and groundwater flow paths are influenced primarily by pumping for industrial and public supply (Cherry and others, 2011).

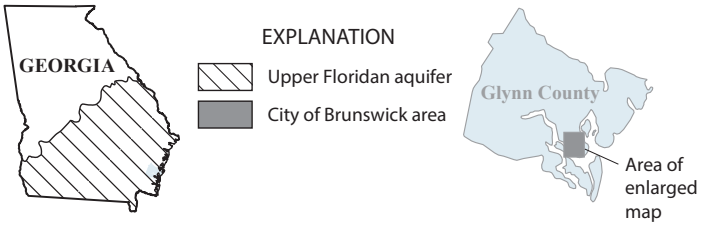
During the period of record, water levels in all of the wells had rising trends with rates of change that ranged from 0.06 to 6.81 feet per year (ft/yr). Hydrographs for three wells in the Upper Floridan aquifer in the Brunswick area (below) illustrate monthly mean water levels for the period of record. During 2010–2011, water levels in six wells declined at rates ranging from 0.24 to 1.58 ft/yr and rose in four wells at rates ranging from 0.11 to 16.94 ft/yr. The largest rise during 2010–2011 was at well 33H325 located in an area of industrial pumping. Although well 33H324 is located adjacent to well 33H325, it showed a rise of only 1.24 ft during the same period. The two wells are completed in different water-bearing zones of the Upper Floridan aquifer—the deeper zone in well 33H325 provides water to a nearby industrial user and therefore shows a greater response to changes in pumping at the industrial site (John S. Clarke, U.S. Geological Survey, written commun., August 17, 2012).

In addition to continuous water-level monitoring, synoptic water-level measurements are made periodically in wells in the Brunswick area. Water-level measurements from 39 wells during August 2010 and 43 wells during August 2011 were used to construct potentiometric-surface maps of the Upper Floridan aquifer. The maps on the facing page show that groundwater generally flows from the south, where water-level altitudes are greater than 15 ft, toward industrial pumping centers in northern Brunswick, where water-level altitude is less than 0 ft.

Reference

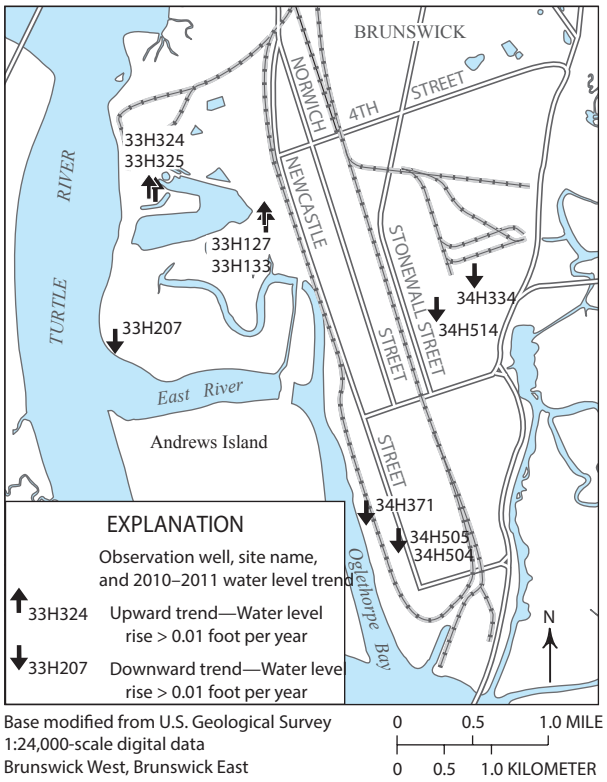
Cherry, G.S., Peck, M.F., Painter, J.A., and Stayton, W.L., 2011, Groundwater conditions in the Brunswick–Glynn County area, Georgia, 2009: U.S. Geological Survey Scientific Investigations Report 2011–5087, 58 p.; available online at *http://pubs.usgs.gov/sir/2011/5087/*.





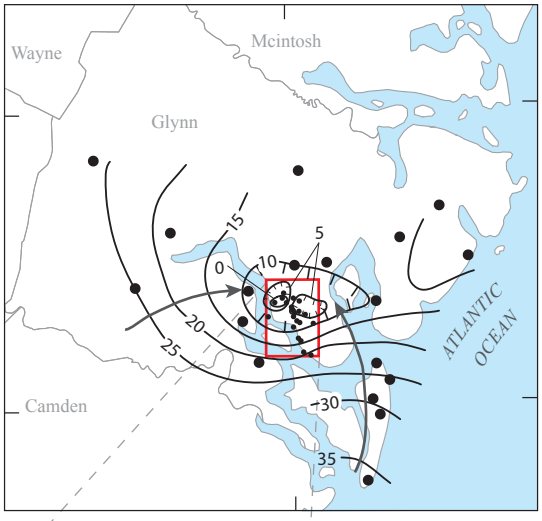
Site name	County	Year monitoring began	Water-level trend, in feet, per year[1]	
			Period of record	From 2010 to 2011
33H127	Glynn	1962	0.06	0.22
33H133	Glynn	1964	0.28	0.11
34H504	Glynn	2007	0.53	–1.16
34H505	Glynn	2007	0.27	–1.58
34H514	Glynn	2007	0.55	–0.98
33H207	Glynn	1983	0.43	–0.24
33H324	Glynn	2007	1.41	1.04
33H325	Glynn	2007	6.81	16.94
34H334	Glynn	1988	0.17	–1.02
34H371	Glynn	1967	0.14	–0.75

[1]See appendix for summary statistics.

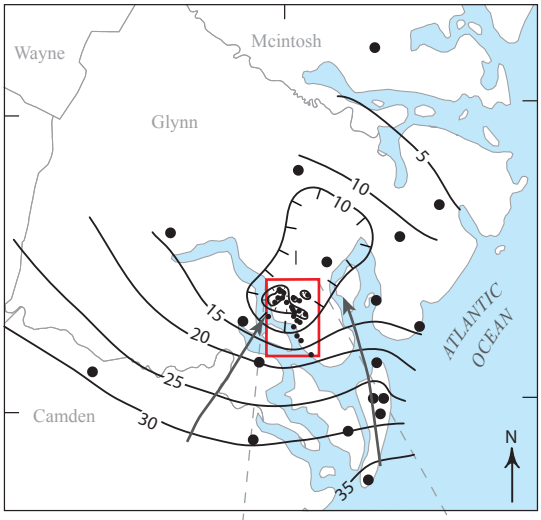


Base modified from U.S. Geological Survey 1:24,000-scale digital data Brunswick West, Brunswick East

August 2010

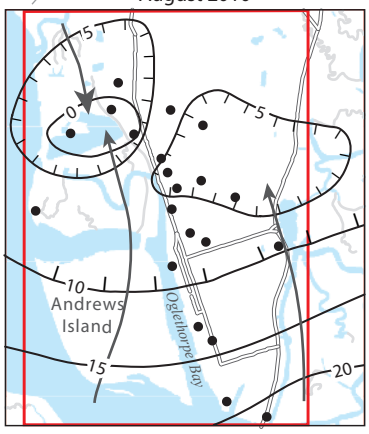


August 2011



0 5 10 MILES
0 5 10 KILOMETERS

August 2010



EXPLANATION

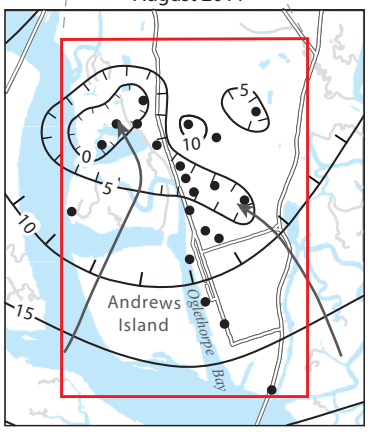
—15— Potentiometric contour—Shows altitude at which water level would have stood in tightly cased wells in the Upper Floridan aquifer. Contour interval 5 feet. Hachures indicate depression. Datum is North American Vertical Datum of 1988

General direction of groundwater flow

Observation well

0 1 2 MILES
0 1 2 KILOMETERS

August 2011



Groundwater Quality in the Upper and Lower Floridan Aquifers

City of Brunswick Area

Chloride concentrations have been monitored in the Brunswick area since the late 1950s when saltwater was first detected in wells completed in the Upper Floridan aquifer at the southern part of the area (Wait, 1965; Cherry and others, 2011). By the 1960s, a plume of saltwater had migrated northward toward two major industrial pumping centers. Since 1965, chloride concentrations have increased markedly in wells completed in the Upper Floridan aquifer in the northern Brunswick area. During 2010 and 2011, the chloride concentration was above the 250 milligrams per liter (mg/L) State and Federal secondary drinking-water standards (Georgia Environmental Protection Division, 1997; U.S. Environmental Protection Agency, 2000) in a 2-square-mile area and exceeded 2,250 mg/L in part of the area. More information on monitoring groundwater quality in the Brunswick area is available at *http://ga.water.usgs.gov/projects/brunswick/*.

Dissolved chloride concentrations in the upper water-bearing zone of the Upper Floridan aquifer at Brunswick were mapped for August 2010 using data from 28 wells, and for August 2011 using data from 26 wells (facing page). The 2010 and 2011 maps are similar to previously published maps for 2008 and 2009 (Peck and others, 2011) and show that areas of highest chloride concentrations are near the two industrial pumping centers in the northern part of the city and the original area of contamination in the southern part of the city.

Changes in chloride concentration during 1960–2011 are illustrated on graphs from selected wells in the southern and northern Brunswick areas, and on a map showing changes during 2010–2011. Chloride concentrations within the plume area decreased in 21 of 29 wells sampled during 2010–2011. The greatest decrease in concentration was 200 mg/L at well 34H401 in the north-central part of the plume. Chloride concentrations in seven wells increased from 0.3 to 50 mg/L during 2010–2011; the largest increase occurred in well 34H424 in the northern part of the plume, and concentrations remained the same in one well. These changes probably reflect shifts in local pumping patterns.

References

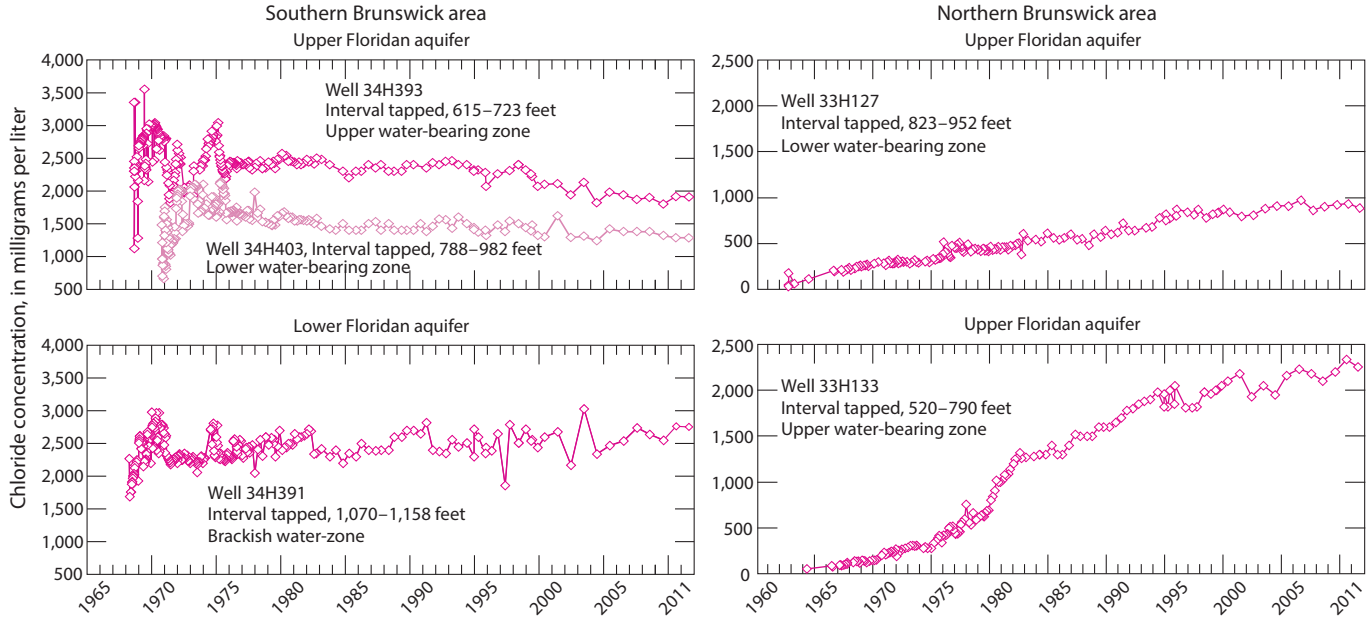
Cherry, G.S., Peck, M.F., Painter, J.A., and Stayton, W.L., 2011, Groundwater conditions in the Brunswick–Glynn County area, Georgia, 2009: U.S. Geological Survey Scientific Investigations Report 2011–5087, 58 p.; available online at *http://pubs.usgs.gov/sir/2011/5087/*.

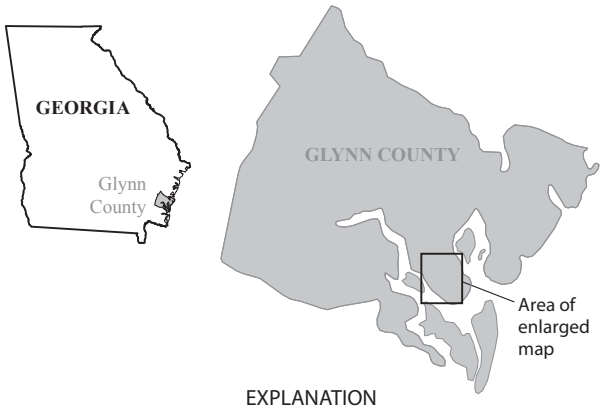
Georgia Environmental Protection Division, 1997, Secondary maximum contaminant levels for drinking water: Environmental Rule 391-3-5-19, revised October 1997: Official Code of Georgia Annotated Statutes, Statute 12-5-170 (Georgia Safe Drinking Water Act), variously paginated.

Peck, M.F., Leeth, D.C., and Painter, J.A., 2011, Groundwater conditions and studies in Georgia, 2008–2009: U.S. Geological Survey Scientific Investigations Report 2011–5048, 83 p.; available online at *http://pubs.usgs.gov/sir/2011/5048/*.

U.S. Environmental Protection Agency, 2000, Maximum contaminant levels (Part 143, National Secondary Drinking Water Regulations): U.S. Code of Federal Regulations, Title 40, Parts 100–149, rev. July 1, 2000, p. 612–614.

Wait, R.L., 1965, Geology and occurrence of fresh and brackish ground water in Glynn County, Georgia: U.S. Geological Survey Water-Supply Paper 1613–E , 94 p.





EXPLANATION

MAPS BELOW

Chloride concentration in water from upper water-bearing zone of Upper Floridan aquifer—In milligrams per liter

<250
750
1,250
1,750
2,250
>2,620

Data point

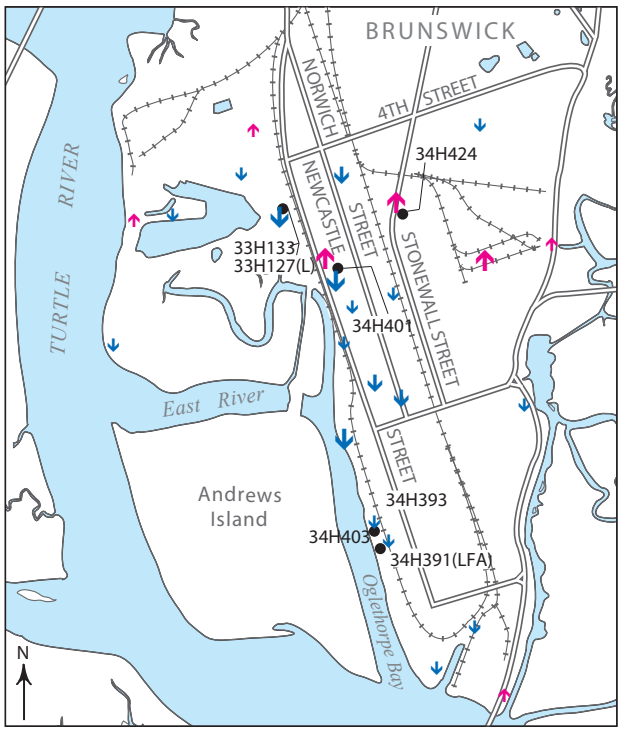
MAP AT RIGHT

Change in chloride concentration in water from upper water-bearing zone of Upper Floridan aquifer from 2010 to 2011, in milligrams per liter

Decrease	Increase
–200.00 to –50.00	0.01 to 10.00
–49.99 to –25.00	25.01 to 50.00
–24.99 to 0	

34H391 Well and site name—L, lower water-bearing zone of Upper Floridan aquifer; LFA, Lower Floridan aquifer

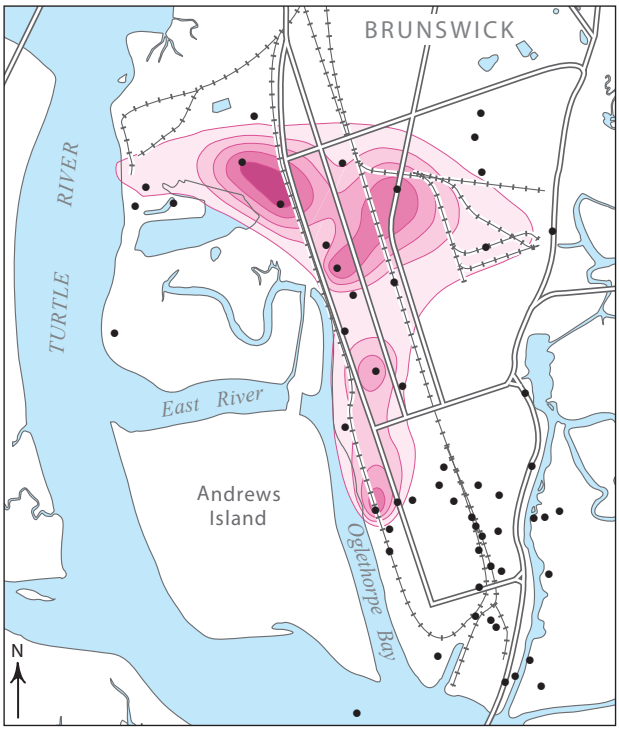
Change in chloride concentration August 2010–August 2011



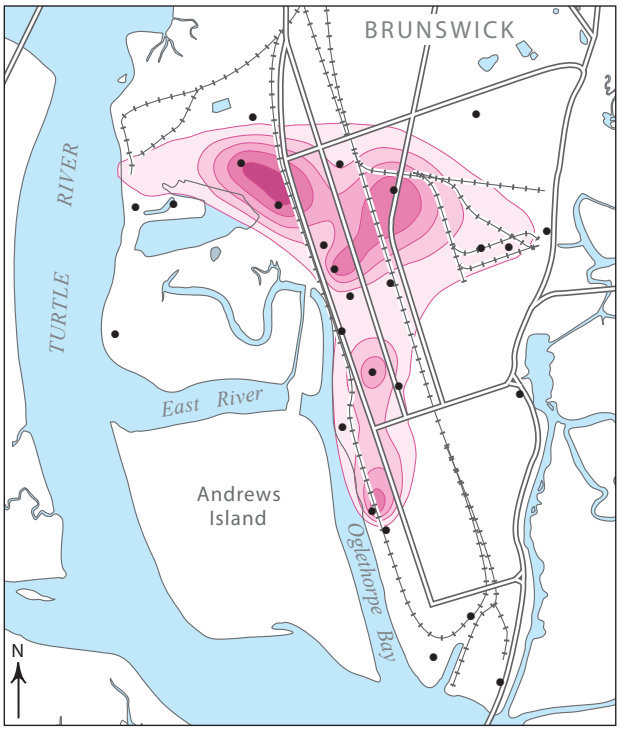
Base modified from U.S. Geological Survey 1:24,000-scale digital data Brunswick West, Brunswick East

0 0.5 1 MILE
0 0.5 1 KILOMETER

Chloride concentration, August 2010



Chloride concentration, August 2011



Groundwater Quality in the Upper and Lower Floridan Aquifers

Real-Time Specific Conductance Monitoring in Brunswick Area

Beginning in 2007, a network of wells with real-time satellite telemetry was established at Brunswick to monitor changes in specific conductance in the upper and lower water-bearing zones of the Upper Floridan aquifer (specific conductance is a surrogate for changes in chloride concentration). Four of the five wells are located immediately outside of the chloride plume, and one is located inside the plume area (see map, facing page). Of these five wells currently monitored in real time, four are monitored for daily specific conductance and hourly water levels, and one is monitored for specific conductance only. Specific conductance is monitored in wells 33H325, 34H505, and 34H514 by pumping once a day from rigid, small-diameter tubing installed at predetermined depths (see table, below) in the water-bearing zone of interest (Walls and others, 2009). In supply wells 34H134 and 34H552, specific conductance is recorded directly in the well-discharge pipe as the well is pumped every 15 minutes. Data are transmitted every 1 to 4 hours, based on equipment, and can be viewed on the Web at *http://water.usgs.gov/ga/nwis/current/?type=gw/*.

Ranges of chloride concentrations in the five wells monitored for specific conductance were estimated based on a correlation of specific conductance to chloride concentration (Cherry and others, 2011; see table, below). Specific conductance monitoring indicates estimated chloride concentration in the upper water-bearing zone in well 34H552 was at or below the 250 mg/L secondary drinking water standard and in well 34H514 ranged above the standard (Georgia Environmental Protection Division, 1997; U.S. Environmental Protection Agency, 2000). The estimated chloride concentration in lower water-bearing zone wells 34H505 and 33H325 exceeded the secondary drinking water standard during 2010–2011. In well 34H134, completed in the upper and lower water-bearing zones, the estimated chloride concentration was below the secondary drinking water standard during 2010–2011.

References

Cherry, G.S., Peck, M.F., Painter, J.A., and Stayton, W.L., 2011, Groundwater condition in the Brunswick–Glynn County area, Georgia, 2009: U.S. Geological Survey Scientific Investigations Report 2011–5087, 58 p.; available online at *http://pubs.usgs.gov/sir/2011/5087/*.

Georgia Environmental Protection Division, 1997, Secondary maximum contaminant levels for drinking water: Environmental Rule 391-3-5-19, revised October 1997: Official Code of Georgia Annotated Statutes, Statute 12-5-170 (Georgia Safe Drinking Water Act), variously paginated.

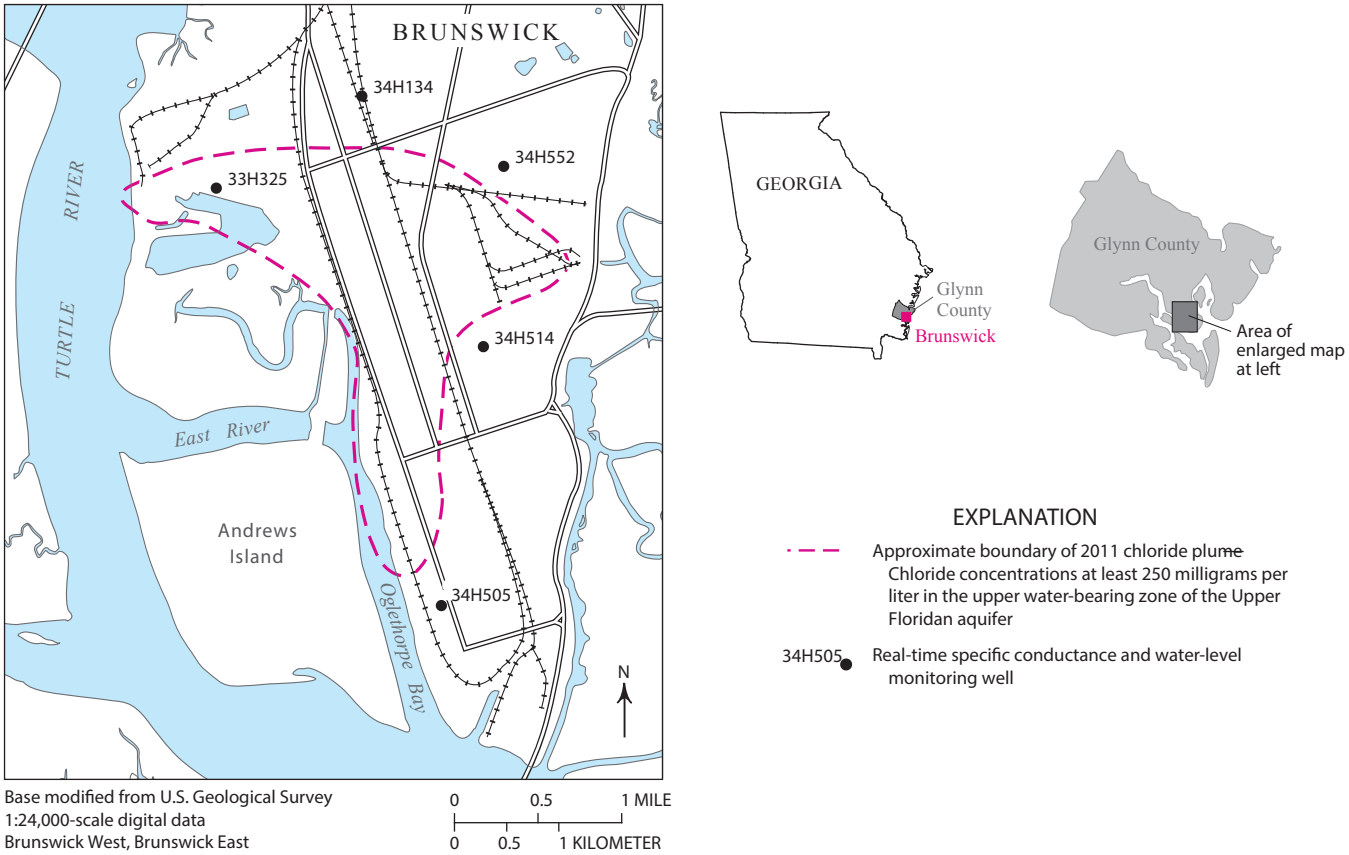
U.S. Environmental Protection Agency, 2000, Maximum contaminant levels (Part 143, National Secondary Drinking Water Regulations): U.S. Code of Federal Regulations, Title 40, Parts 100–149, rev. July 1, 2000, p. 612–614.

Walls, C.B., Cressler, A.M., and Stayton, W.L., 2009, Real-time water-level and specific conductance monitoring of saltwater contamination in the Upper Floridan aquifer, Brunswick, Georgia, *in* Rasmussen, Todd, Carroll, D.G., and Georgakakos, Aris, eds., Proceedings of the 2009 Georgia Water Resources Conference, held April 27–29, 2009, at the University of Georgia, Athens, Institute of Ecology, The University of Georgia, accessed July 2, 2009, at *http://www.gwri.gatech.edu/node/3851*.

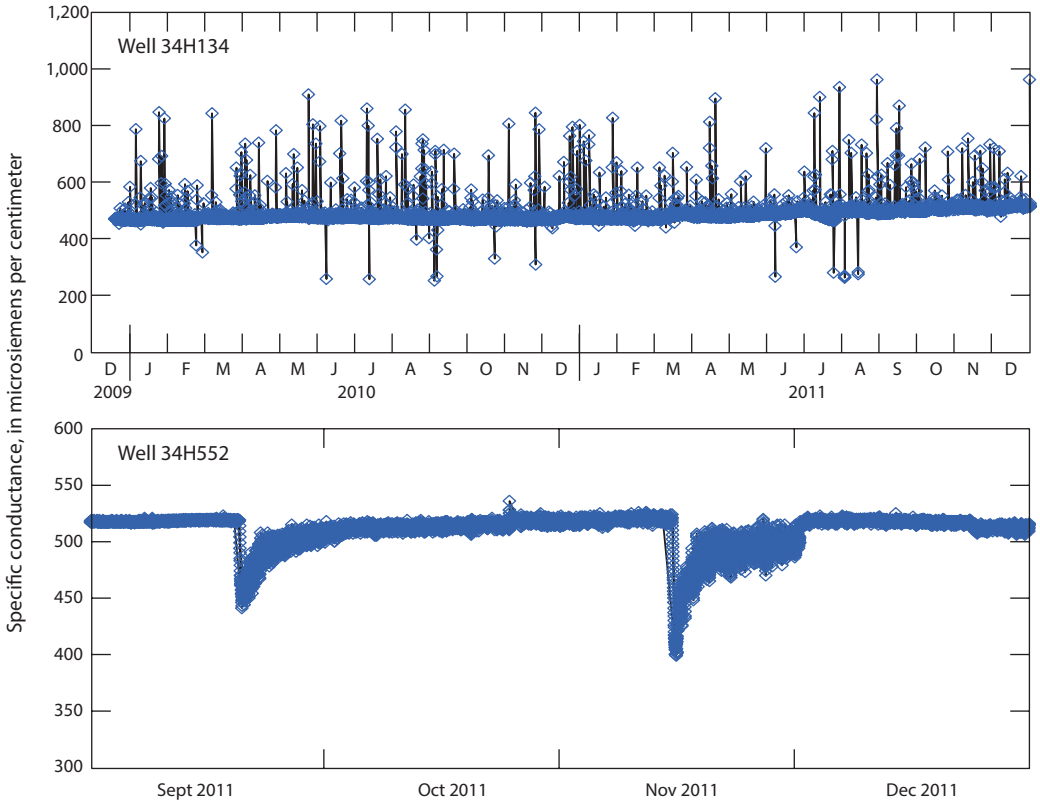
Period of Record Specific Conductance, Upper Floridan aquifer

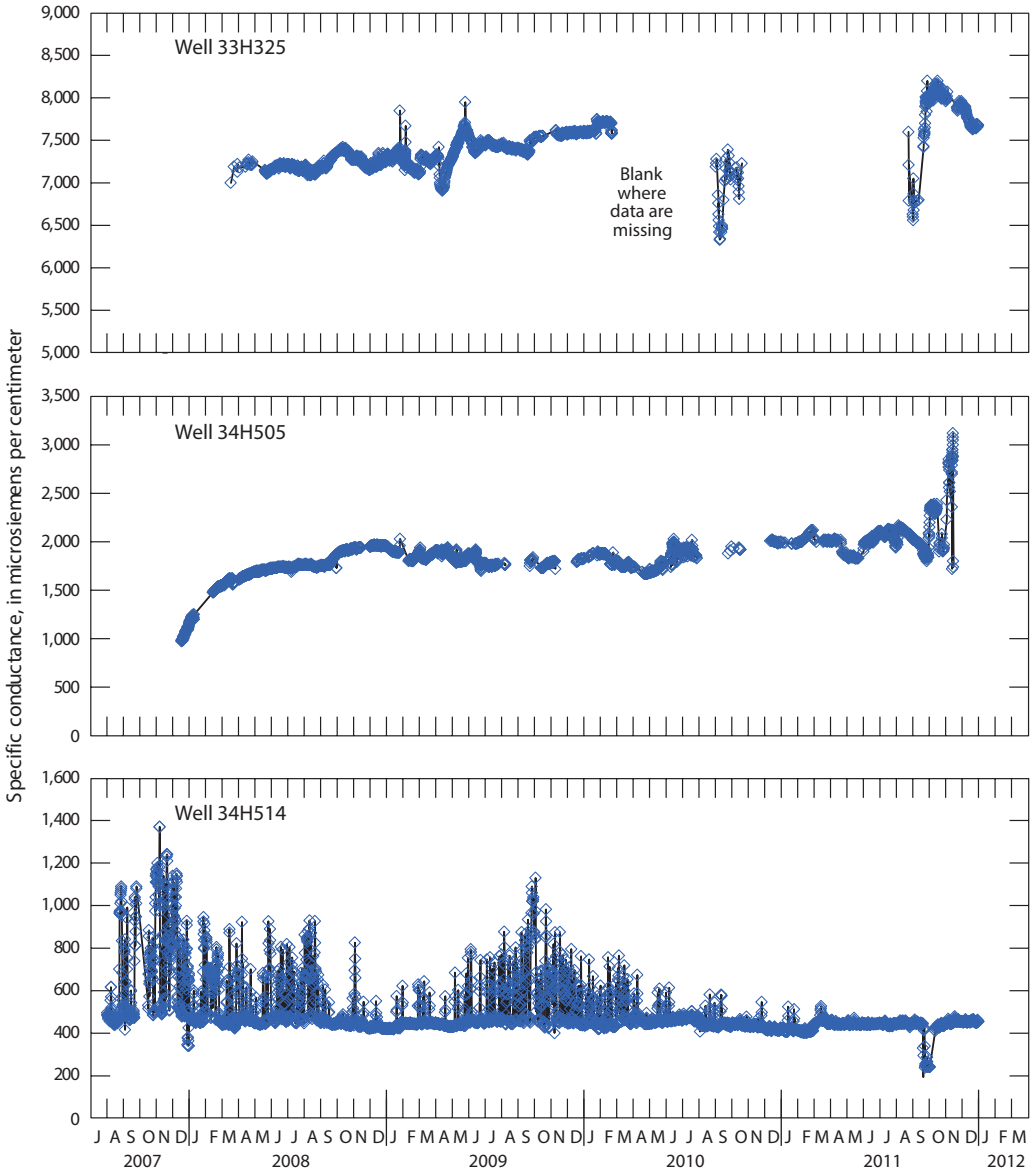
[µS/cm, microsiemens per centimeter at 25degrees Celsius; mg/L, milligram per liter; >, greater than; LWBZ, lower water-bearing zone; UWBZ, upper water-bearing zone; ULWBZ, upper and lower water-bearing zones; estimates based on correlation between specific conductance and chloride concentration reported by Cherry and others, 2011]

Site name	Water-bearing zone	Sampling interval (feet)	Specific conductance (µS/cm)	Estimated chloride concentration (mg/L)
34H514	UWBZ	605	194–1,370	>1–283
34H134	ULWBZ	518–942	251–962	>1–167
33H325	LWBZ	900	6,330–8,200	1,686–2,214
34H505	LWBZ	960	973–3,120	171–778
34H552	UWBZ	565–750	399–536	8–47



Location of real-time specific conductance monitoring network and estimated chloride concentration in the upper and lower water-bearing zone of the Upper Floridan aquifer in the Brunswick–Glynn County area, Georgia.




Specific conductance, in microsiemens per centimeter
Well 33H325
Blank where data are missing
Well 34H505
Well 34H514
9,000
8,500
8,000
7,500
7,000
6,500
6,000
5,500
5,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1,600
1,400
1,200
1,000
800
600
400
200
0
J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M
2007
2008
2009
2010
2011
2012