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SUMMARY OF GROUNDWATER QUALITY IN THE ST. JOHNS RIVER WATER MANAGEMENT DISTRICT

1990–94

by

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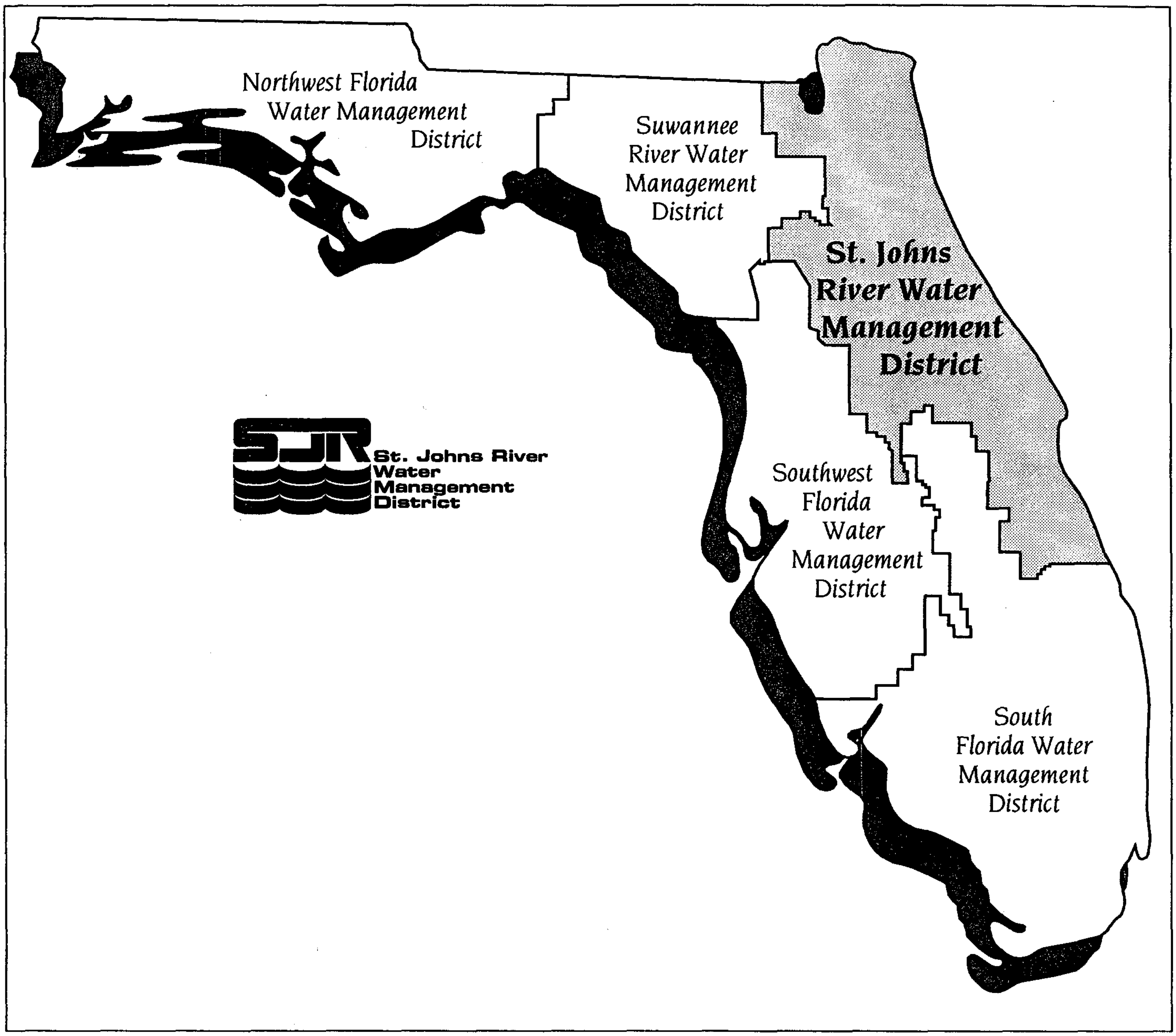

The **St. Johns River Water Management District** (SJRWMD) was created by the Florida Legislature in 1972 to be one of five water management districts in Florida. It includes all or part of 19 counties in northeast Florida. The mission of SJRWMD is to manage water resources to ensure their continued availability while maximizing environmental and economic benefits. It accomplishes its mission through regulation; applied research; assistance to federal, state, and local governments; operation and maintenance of water control works; and land acquisition and management.

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EXECUTIVE SUMMARY

Accurate and reliable water quality data are required to characterize groundwater chemistry for use in groundwater resource management. This report summarizes the groundwater quality of the Floridan, intermediate, and surficial aquifer systems in the St. Johns River Water Management District. Data were collected from 1990 through 1994.

The groundwater quality conditions in an aquifer are a result of natural systems and human-influenced conditions. Natural systems affect water quality in an aquifer by means of recharge to and discharge from the aquifer, the dissolution of minerals, flow paths, residence times, and the mixing of fresh groundwater with residual formation water or intruded seawater. Human-influenced conditions include aquifer degradation based on activities at land surface and upconing of water with high dissolved solids composition from deep zones due to groundwater withdrawals. Another human-influenced condition is the introduction of irrigation water from deep aquifers to surface systems; excess irrigation water from the deep aquifer may infiltrate down to near-surface systems.

The water quality variables discussed are those that constitute a major part of the total dissolved solids (TDS) content of water. The major cations include calcium, magnesium, sodium, and potassium. The major anions include chloride, sulfate, and carbonate alkalinity. Iron is an important minor cation; phosphate, nitrate and nitrite, and fluoride are important minor anions. Data on temperature, pH, specific conductance, TDS, and hardness also are presented.

FLORIDAN AQUIFER SYSTEM

The chemical composition of water in the Floridan aquifer system in recharge areas is characteristically low in concentrations of calcium, magnesium, chloride, sulfate, TDS, carbonates, and other constituents. In these recharge areas, such as the upland ridges and where the limestones of the Floridan aquifer system are at or near land surface, residence times for water in the Floridan aquifer system are relatively short. The water has not reached equilibrium conditions with aquifer materials. Water quality conditions typically reflect water quality in the surficial aquifer system, climatic conditions, soil types, and human activities.

As water in the Floridan aquifer system moves along flow paths from recharge to discharge areas, the increasing residence times allow more opportunity for the chemical composition of the water to be altered and for chemical reactions between the water and aquifer materials to reach equilibrium. The water in the Floridan aquifer system in and near discharge areas is composed mainly of calcium, magnesium, chloride, and sulfate. Typically high TDS concentrations, hardness values, and pH also occur in these areas. Where water in the Floridan aquifer system travels along deep flow paths, it comes in contact with gypsum in the aquifer system. Sulfate concentrations are notably high in discharge areas, such as in southern Duval and northern St. Johns counties, because of the gypsum dissolution.

The mixing of fresh water in the Floridan aquifer system with residual formation water still present in the aquifer results in water composed mainly of calcium, magnesium, sodium, chloride, and sulfate. This type of water occurs in the Floridan aquifer system in St. Johns County south of St. Augustine, in northern and central parts of Flagler County, and in eastern parts of Brevard County. In these areas, the highly mineralized residual formation waters of the Floridan aquifer system have not been replaced by fresh recharge waters. In addition, lower artesian pressures in the Floridan aquifer system due to water withdrawals result in the upward movement of highly mineralized formation water in the tri-county agricultural area of St. Johns, Flagler, and Putnam counties. A transition zone between the residual formation water and fresh groundwater occurs on the borders of these mixing areas.

The mixing of fresh water in the Floridan aquifer system with upwelling residual seawater along parts of the St. Johns River also results in water composed mainly of calcium, magnesium, sodium, chloride, and sulfate. This upwelling of highly mineralized water into the upper parts of the Floridan aquifer system occurs in discharge areas along the St. Johns River in parts of Brevard, Seminole, Orange, Lake, and Volusia counties. A transition zone between the upwelling residual seawater in discharge areas and fresh groundwater in recharge areas occurs to the east and west of the St. Johns River.

The mixing of fresh water in the Floridan aquifer system with laterally intruded seawater from the Atlantic Ocean occurs near Daytona Beach Shores (south of Daytona Beach in Volusia County). This mixing results in water composed mainly of sodium, chloride, calcium, magnesium, and sulfate. High concentrations of TDS and calcium carbonate (i.e., hardness) also occur in this area. A transition zone between the intruded seawater and fresh groundwater or residual formation water also occurs in other areas along the coast.

Intermediate Aquifer System

The wide range in concentrations of calcium, magnesium, sodium, potassium, chloride, sulfate, and TDS in the intermediate aquifer system reflects the diverse sediments that comprise the aquifer materials with which the water comes into contact. High concentrations of these constituents indicate that water has been in contact with carbonates and clays over long periods of time. Areas along the coast with high concentrations of calcium, magnesium, sodium, chloride, sulfate, and TDS are characteristic of lateral intrusion of seawater in Brevard, Duval, Flagler, and Nassau counties. High concentrations of these variables along parts of the St. Johns River are due to the upwelling of highly mineralized water from the underlying Floridan aquifer system.

The chemical composition of water in the intermediate aquifer system reflects recharge from the overlying surficial aquifer system or the underlying Floridan aquifer system, aquifer mineralogy and lithology, residence time, and proximity to coastal areas. The flow paths of water through the intermediate aquifer system can be complex, and residence times can vary. Long residence times are characteristic of areas where the Hawthorn Group sediments are relatively thick and comprised mostly of clay and fine-grained materials. Where the Hawthorn Group is breached by sinkholes and fractures, residence times may be short.

Surficial Aquifer System

Water from the surficial aquifer system is generally soft, contains fewer dissolved minerals, has a low pH, and has more iron than water from the deeper artesian aquifers. Chloride concentrations are low, except in those areas where the surficial aquifer system has been intruded by seawater from the coast or in those areas where water has moved from deep aquifers due to upward leakage.

The chemical composition of water in the surficial aquifer system reflects the quality of recharge water, aquifer mineralogy and lithology, residence time, proximity to coastal areas, and human influences. Although precipitation provides most of the recharge to the surficial aquifer system, some recharge occurs due to leakage from underlying aquifers and from infiltration of excess irrigation water. The relatively short flow paths and residence times typical of the surficial aquifer system result in water having less contact with aquifer minerals and less opportunity for the chemical composition to be altered. Where the surficial aquifer system is composed mostly of quartz sand, concentrations of TDS and other constituents are low. Where the aquifer is composed of clay, shell, or organic materials, TDS concentrations are higher.

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INTRODUCTION

The use of groundwater resources depends on the water quality acceptable for an intended use. Accurate and reliable water quality data are needed to characterize aquifer chemistry because of the increasing concern about the quality of water in Florida's aquifer systems.

The purpose of this report is to summarize the groundwater quality of the Floridan, intermediate, and surficial aquifer systems in the St. Johns River Water Management District (SJRWMD). This data summary is based primarily on data collected by SJRWMD as part of the Groundwater Quality Monitoring Program (GWQMP) of the Florida Department of Environmental Protection (DEP). Additional data collected from the water quality sampling of wells in the District Observation Well Network (DOWN) operated by SJRWMD also are included in this report.

The GWQMP was established as a result of the Water Quality Assurance Act (passed by the Florida Legislature in 1983) to protect the state's water resources and to address concerns about water quality in Florida's aquifer systems. The primary goals of the GWQMP are

- To develop and maintain a well network in order to establish baseline conditions and to provide a continuing assessment of groundwater quality in the state's major aquifer systems
- To detect changes in water quality resulting from changing land use activities
- To provide this information to government agencies and the public

The GWQMP is managed by DEP in cooperation with the state's five water management districts, the U.S. Geological Survey, and other interested agencies.

The primary objectives of the DOWN program are

- To evaluate water level and water quality conditions in the groundwater systems
- To evaluate the effectiveness of the groundwater regulatory process
- To provide information for use in groundwater resource investigations

This report includes data for groundwater samples collected from wells during the period 1990 to 1994. Most of the wells in this report are intended to characterize regional baseline or background water quality conditions and are usually located in areas unaffected by man's activities. The water quality samples were analyzed for selected major and minor cations and anions and total dissolved solids. Measurements of physical descriptors of groundwater are included. The water quality data are summarized using descriptive statistics for each parameter by aquifer system. Information about the source and significance of the chemical constituents found in groundwater and a comparison of the data to current water quality state standards are presented. Graphical representations of the data and maps of the distribution of selected parameters also are presented.

HYDROGEOLOGY

The principal hydrogeologic units in SJRWMD are the Floridan aquifer system, the intermediate aquifer system and upper confining unit, and the surficial aquifer system (Table 1). The occurrence, thickness, and characteristics of the aquifer systems are directly related to the depositional and structural features in a given area.

Table 1. Hydrogeologic units in the St. Johns River Water Management District

Hydrogeologic Unit	Series or Epoch	Formation	Lithology
Surficial aquifer system	Holocene to Pliocene	Undifferentiated surficial deposits	Discontinuous sand, clay, and shell beds, with limestone locally
Intermediate aquifer system and upper confining unit	Miocene	Hawthorn Group	Interbedded sand, silt, clay, shell, phosphate, and limestone
Floridan aquifer system	Eocene	Ocala Limestone Avon Park Formation Oldsmar Formation	Alternating beds of limestone and dolomite

Modified from Southeastern Geological Society 1986

The Floridan aquifer system is the primary source of water for public supply in SJRWMD. In the northern and central parts of SJRWMD (Figure 1), water from the aquifer generally meets drinking water standards, while in the southern parts of SJRWMD, water from the Floridan aquifer system is highly mineralized and, therefore, is treated by reverse osmosis for public supply use. The Floridan aquifer system is also an important water source for agricultural, industrial/commercial, recreational, and domestic self-supply uses throughout SJRWMD.

The surficial and intermediate aquifer systems are the primary sources of groundwater in local areas where the Floridan aquifer system contains nonpotable water or is too deep for affordable use. The surficial and intermediate aquifer systems are a source of public water supply in St. Johns, Flagler, southern Brevard, and Indian River

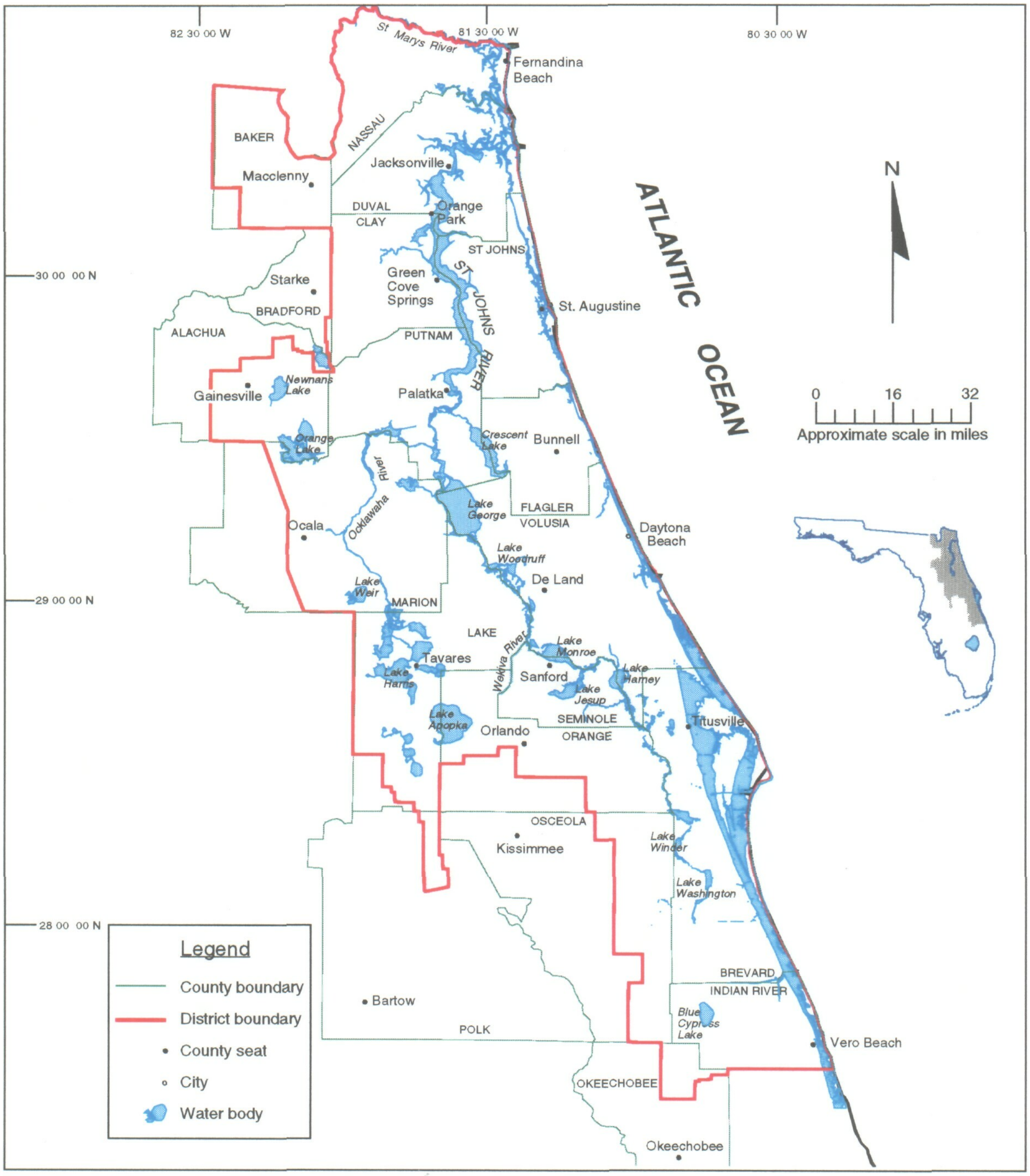

Figure 1. The St. Johns River Water Management District

counties. These aquifer systems also are used for domestic self-supply along the coast and locally in inland areas.

Floridan Aquifer System

The Floridan aquifer system is composed predominantly of limestones and dolomites (Figure 1). Formations comprising the Floridan aquifer system in SJRWMD include the late Eocene-age Ocala Limestone, the middle Eocene-age Avon Park Formation, and the early Eocene-age Oldsmar Formation. The top of the Floridan aquifer system coincides with the top of the vertically persistent, permeable carbonates (Southeastern Geological Society 1986). The base of the system is at the top of the low permeability limestones of the Paleocene-age Cedar Keys Formation, also known as the sub-Floridan confining unit.

The Floridan aquifer system is divided into three units: the Upper Floridan aquifer, the middle confining unit, and the Lower Floridan aquifer. Most supply wells pump water from the Upper Floridan aquifer because it is so productive and because, in most areas of SJRWMD, the Lower Floridan aquifer contains highly mineralized, nonpotable water. The Lower Floridan aquifer, however, is used for public supply in Duval, Orange, Seminole, and Lake counties where the water is potable. The majority of the water quality data for the Floridan aquifer system presented in this report are from wells that penetrate the Upper Floridan aquifer.

The quality of water in the Floridan aquifer system is directly influenced by recharge to and discharge from the aquifer system. Recharge to the Floridan aquifer system occurs from the downward leakage of water from the overlying surficial and intermediate aquifer systems or from direct infiltration of rainfall where the limestones of the Floridan aquifer system are at or near land surface.

Areas in SJRWMD with the highest recharge rates to the Floridan aquifer system occur in the Crescent City-De Land Ridge in Putnam and Volusia counties; the Casselberry, Oveido, Geneva, and Chuluota Hills in Seminole County; the Mount Dora Ridge, Lake Wales Ridge, Apopka Hills, and Orlando Hills in Orange and Lake counties; the Interlachen Hills and Trail Ridge in Putnam and Clay counties; the Ocala Scrub in eastern Marion County; and those areas in central and western Alachua and Marion counties where the limestones of the

Floridan aquifer system are at or near land surface (Figure 2). A description of these physiographic divisions can be found in Brooks (1981). In general, discharge from the Floridan aquifer system occurs in areas along the St. Johns, Wekiva, and Ocklawaha river systems; in most of Brevard and Indian River counties; in low-lying parts of northeastern SJRWMD; and along the Atlantic coast.

INTERMEDIATE AQUIFER SYSTEM

The intermediate aquifer system is composed of water-bearing zones of sand, shell, and limestones (Table 1). The water-bearing zones lie within or between less permeable units of clayey sand to clay of the upper confining unit overlying the Floridan aquifer system. On the Ocala Uplift in the central part of the Florida peninsula and over much of the Sanford High, these sediments are relatively thin or are absent where removed by erosion. The unit thickens toward the northern and southern parts of SJRWMD, where permeable sand, shell, and limestone beds comprising the intermediate aquifer system become more developed.

Recharge to the intermediate aquifer system is by downward movement of water from the overlying surficial aquifer system and by upward leakage from the Floridan aquifer system.

The clays of the upper confining unit retard the movement of water between the surficial and Floridan aquifer systems. The top of the upper confining unit coincides with the top of the laterally extensive and vertically persistent sediments of lower permeability, as compared to those sediments that comprise the surficial aquifer system (Southeastern Geological Society 1986). In most of SJRWMD, the top of the upper confining unit generally correlates to the top of the Miocene-age Hawthorn Group, but may also include post-Miocene deposits in some areas. The base of the unit is the top of the carbonates that comprise the Floridan aquifer system.

SURFICIAL AQUIFER SYSTEM

The surficial aquifer system consists of Pliocene- to Holocene-age sands, clays, shells, and, in some areas, limestones (Table 1). The surficial aquifer system includes sediments from land surface downward to the top of the upper confining unit or intermediate

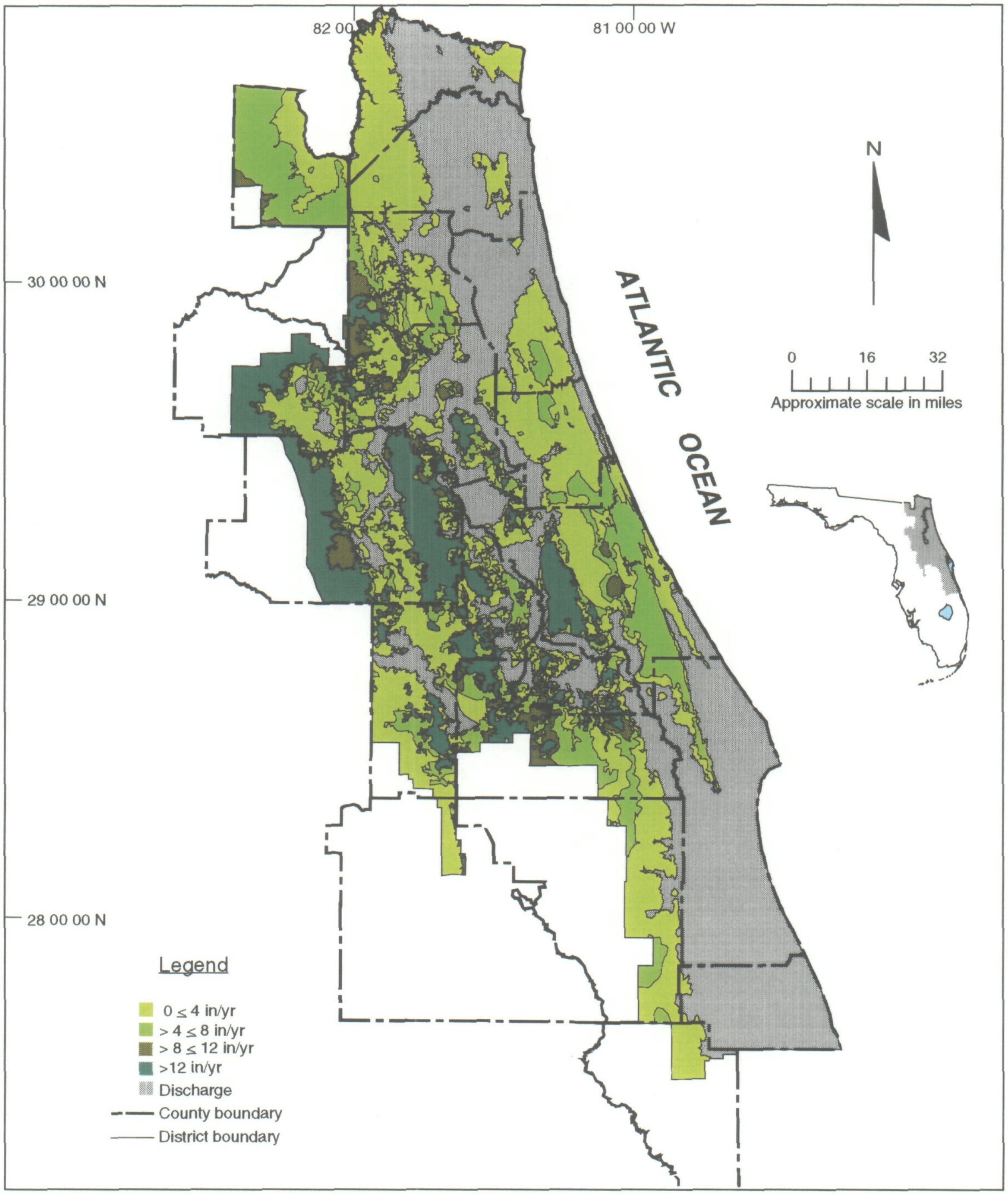

Figure 2. Recharge areas of the Floridan aquifer system in the St. Johns River Water Management District (Boniol et al. 1993)

aquifer system. Where the upper confining unit is absent, the surficial aquifer system includes sediments from land surface downward to the top of the limestones of the Floridan aquifer system.

Water in the surficial aquifer system is generally unconfined, but may be confined by beds of low permeability in some areas. Precipitation provides most of the recharge to the surficial aquifer system. Some recharge occurs from upward leakage from underlying aquifers; minor amounts of recharge occur from infiltration of excess irrigation water.

SOURCES OF DATA AND METHODS

Water samples collected and analyzed as part of the GWQMP and the DOWN program were used to compile this summary of water quality data. These well networks are generally designed to monitor groundwater quality in an area that represents the regional water quality conditions for that aquifer system.

Analyses of water from 398 wells sampled from January 1990 through December 1994 are included in this summary report. The analyses include water quality data from 224 wells penetrating the Floridan aquifer system, 64 wells penetrating the intermediate aquifer system, and 110 wells penetrating the surficial aquifer system (Figure 3; Appendix A). Each well is identified by a unique alphanumeric name consisting of the county abbreviation and number for the well. Appendix B details the well location and aquifer penetrated, as well as the casing depth, diameter, material, and total depth of the well.

Water quality data for 1990 through 1994 were collected by SJRWMD and analyzed by several agencies. SJRWMD hydrologic technicians collected the groundwater samples and measured the field parameters. The analysis of the GWQMP water samples was performed by the U.S. Geological Survey laboratory in Ocala and the DEP laboratory in Tallahassee. The analysis of the DOWN water samples was performed by the SJRWMD laboratory in Palatka. Data management and review were performed by SJRWMD staff and GWQMP staff at DEP.

Only data passing all quality assurance checks were used in this report. The quality assurance procedures used by DEP and SJRWMD are rigorous and comprehensive. These detailed procedures and the methods used for the collection and analysis of the groundwater samples are specified in the GWQMP and SJRWMD quality assurance project plans approved by the DEP Quality Assurance section.

Descriptive statistics are presented to characterize the 5 years of water chemistry results from the Floridan, intermediate, and surficial aquifer systems. The descriptive statistics for each parameter by aquifer include the number of wells sampled, the number of samples analyzed, the mean, the standard deviation, and the minimum, 25th percentile, median, 75th percentile, and maximum values. The mean is the arithmetic average of the data set. The median is the 50th percentile and is a better estimate of the central tendency of the data set than the mean. The standard deviation is a measure of the dispersion about the mean.

The distribution of the concentrations for each parameter by aquifer is presented in a boxplot graphical summary. A boxplot displays the 25th, 50th (median), and 75th percentiles and the mean of a data set, as well as the data less than the 10th percentile and the data greater than the 90th percentile (Figure 4).

The number of well samples above state standards for that parameter, if applicable, also are presented. DEP (1994) lists the current primary and secondary groundwater standards for regulated parameters and the guidance concentrations for nonregulated parameters. The primary standards, which specify the maximum permissible level of a contaminant in water at the tap, are health related and are legally enforceable. The secondary standards address contaminants in drinking water that affect the aesthetic qualities or properties of water and also are enforceable.

The areal distribution of the concentrations of selected parameters for the Floridan aquifer system is displayed in classed post maps. A classed post map shows concentration values for a parameter based on data ranges represented by selected symbol colors. The range and distribution of concentration values of these parameters for the intermediate and surficial aquifer systems did not justify producing maps for these aquifers.

If multiple water samples were analyzed for a given well, the mean value was computed and used for statistical, graphical, and mapping purposes. Where data for a parameter were less than the analytical detection limit, the detection limit was used.

The water samples collected for the analysis of the cations and anions were filtered through a 0.45-micrometer membrane filter in the field. The resultant "dissolved" analysis is more representative of aquifer water quality as compared to a total (unfiltered) water analysis, which is representative of the aquifer and well conditions, such as residual construction materials and casing corrosion.

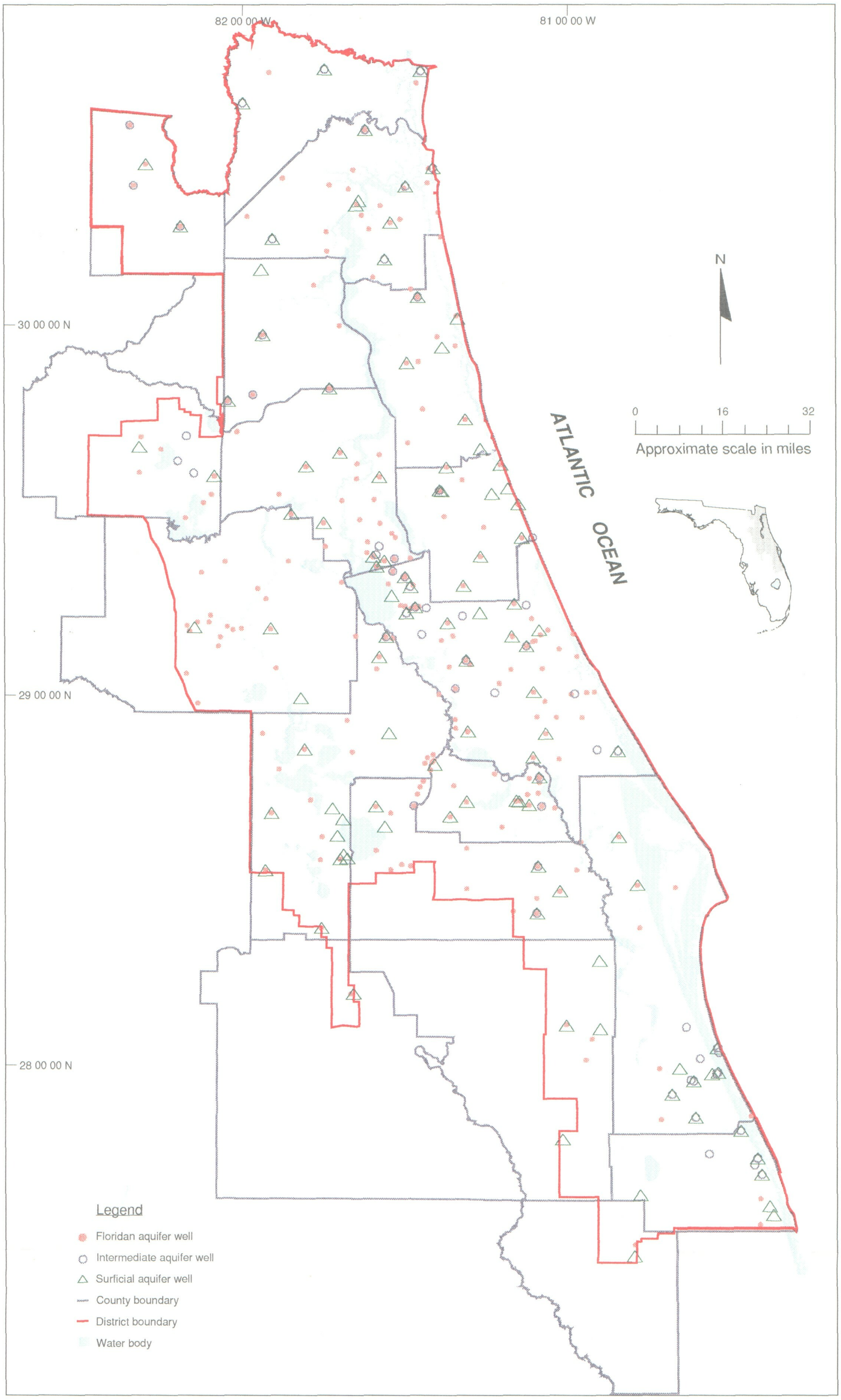

Figure 3. Well locations by aquifer system

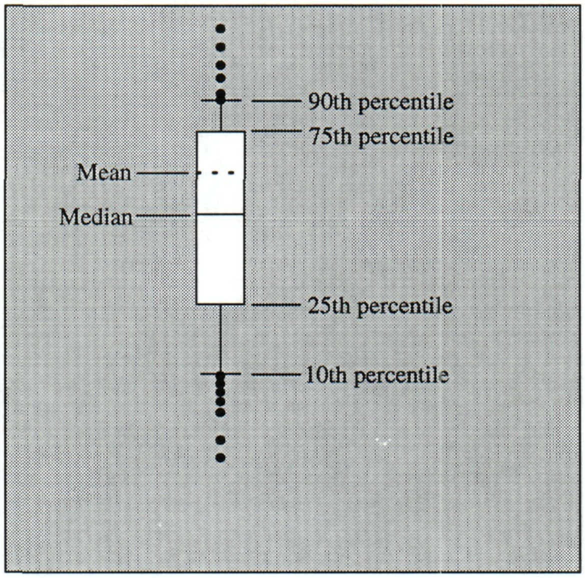

Figure 4. Explanation of boxplots used to display graphical summary of water quality data

QUALITY OF WATER

The water quality of an aquifer is characterized by the chemical constituents and the physical properties of the water. The chemical composition and physical properties of a groundwater sample represent the net effect of all the previous chemical processes that have dissolved, altered, or precipitated the chemical constituents. The primary factors that influence these chemical processes and that determine the chemical and physical characteristics of groundwater in the Floridan, intermediate, and surficial aquifer systems are listed below.

- Climatic conditions and precipitation chemistry
- Land surface features and soil types in the recharge area
- Lithology and mineralogy of the aquifer materials
- Aquifer system structure and porosity
- Recharge, discharge, and leakage relations among aquifers
- Precipitation and dissolution of minerals
- Flow paths and residence time
- Mixed waters of different chemical composition
- Aquifer biochemistry
- Cultural effects resulting from man's activities

Hem (1985) and Maddox et al. (1992) contain more detailed discussions of these factors.

The composition of groundwater can be evaluated by examining its chemical analysis (Table 2). Major ion chemistry often is used as a general indicator of groundwater quality. The major constituents considered are those constituents commonly present in concentrations exceeding 1.0 milligrams per liter (mg/L). The dissolved cations (positively charged ions) and anions (negatively charged ions) discussed in this report are those that constitute a major part of the content of total dissolved solids. The major cations include calcium [Ca^{2+}], magnesium [Mg^{2+}], sodium [Na^{+}], and potassium [K^{+}]. Iron [Fe^{2+}] is an important minor cation, and is also discussed. The major anions include chloride [Cl^{-}], sulfate [SO_4^{2-}], and carbonate alkalinity [HCO_3^{-} + CO_3^{-}]. Phosphate [PO_4^{3-}], nitrate [NO_3^{-}], nitrite [NO_2^{-}], and fluoride [F^{-}] are important minor anions discussed. Data on temperature, pH,

Table 2. Statistical summary of the concentrations of chemical constituents and physical properties of water in the Floridan, intermediate, and surficial aquifer systems

Parameter	Number of Wells Sampled	Number of Analyses	Mean	Standard Deviation	Min	25th Percentile	Median	75th Percentile	Max	Composition of Seawater*
Floridan Aquifer System										
Temperature (°C)	217	1,419	23.5	1.3	20.9	22.6	23.3	24.1	28.8	NA
pH (standard units)	181	853	7.55	0.37	6.75	7.30	7.51	7.81	8.59	NA
Specific conductance (µmhos/cm)	217	1,399	1,322	3,005	76	328	567	990	34,200	NA
Calcium, dissolved (mg/L)	224	1,358	78.6	59.6	6.0	41.0	62.3	98.0	538.3	410
Magnesium, dissolved (mg/L)	224	1,355	29.7	63.0	1.0	7.0	12.4	31.0	749.6	1,350
Sodium, dissolved (mg/L)	224	1,358	148.2	574.8	0.9	6.4	14.4	80.0	7,308.8	15,500
Potassium, dissolved (mg/L)	224	1,358	5.4	18.3	0.1	1.0	1.8	3.6	239.5	390
Iron, dissolved (µg/L)[†]	78	747	375.6	120.4	4.0	19.5	35.6	176.6	6,823.3	NA
Chloride, dissolved (mg/L)	168	508	228.5	1,169.7	2.2	8.7	15.0	79.0	14,700.0	19,000
Sulfate, dissolved (mg/L)	168	508	82.4	187.0	0.2	2.9	10.7	89.3	1,730.0	2,700
Alkalinity, dissolved (mg/L as $CaCO_3$)	212	969	160	68	22	114	146	194	375	NA
Phosphate, dissolved (mg/L as P)	101	209	0.34	0.20	0.10	0.20	0.30	0.49	0.95	0.09
Nitrate and nitrite, dissolved (mg/L as N)	156	505	0.57	1.46	0.05	0.20	0.27	0.45	16.10	0.67
Fluoride, dissolved (mg/L)	201	1,102	0.34	0.25	0.10	0.15	0.22	0.50	1.00	1.3
Total dissolved solids (mg/L)	215	1,207	767	1,680	37	180	329	582	18,211	NA
Hardness, total (mg/L as $CaCO_3$)	160	339	304	419	23	135	221	305	4,466	NA
Intermediate Aquifer System										
Temperature (°C)	64	403	23.0	1.2	20.6	22.2	22.9	23.9	25.5	NA
pH (standard units)	59	386	7.39	0.44	6.13	7.11	7.33	7.68	8.69	NA
Specific conductance (µmhos/cm)	64	432	1,125	2,287	51	351	523	649	14,290	NA
Calcium, dissolved (mg/L)	63	280	77.1	53.2	9.1	45.8	66.3	102.0	381.4	410
Magnesium, dissolved (mg/L)	64	280	17.7	36.7	0.4	2.9	6.1	18.0	240.0	1,350
Sodium, dissolved (mg/L)	63	282	134.1	425.9	3.0	8.2	17.0	33.2	2,500.0	15,500
Potassium, dissolved (mg/L)	64	282	7.2	16.0	0.3	1.0	1.7	6.3	96.0	390
Iron, dissolved (µg/L)[†]	51	256	279.9	65.7	5.0	34.4	138.5	302.9	2,389.3	NA
Chloride, dissolved (mg/L)	53	178	219.2	788.7	5.1	7.6	14.8	36.5	4,600.0	19,000
Sulfate, dissolved (mg/L)	53	178	24.6	80.5	0.2	1.3	2.6	4.7	435.5	2,700
Alkalinity, dissolved (mg/L as $CaCO_3$)	58	256	195	80	33	133	206	265	420	NA
Phosphate, dissolved (mg/L as P)	32	81	0.21	0.29	0.01	0.05	0.08	0.31	1.48	0.09
Nitrate and nitrite, dissolved (mg/L as N)	54	192	0.27	0.81	0.01	0.02	0.04	0.16	5.80	0.67
Fluoride, dissolved (mg/L)	57	230	0.28	0.29	0.10	0.11	0.20	0.31	1.90	1.3
Total dissolved solids (mg/L)	60	211	656	1,326	59	200	303	385	8,218	NA
Hardness, total (mg/L as $CaCO_3$)	49	112	254	230	36	134	224	297	1,415	NA

Parameter	Number of Wells Sampled	Number of Analyses	Mean	Standard Deviation	Min	25th Percentile	Median	75th Percentile	Max	Composition of Seawater*
Surficial Aquifer System										
Temperature (°C)	110	685	23.1	1.4	20.3	22.2	22.9	23.7	26.9	NA
pH (standard units)	110	960	6.45	1.06	3.69	5.74	6.47	7.12	8.97	NA
Specific conductance (μmhos/cm)	109	675	471	589	43	152	321	575	4,238	NA
Calcium, dissolved (mg/L)	110	559	48.7	45.7	0.7	8.8	36.3	82.0	212.0	410
Magnesium, dissolved (mg/L)	110	558	5.6	10.9	0.4	1.3	2.4	6.1	88.0	1,350
Sodium, dissolved (mg/L)	110	559	35.5	93.2	1.8	6.6	11.0	28.0	690.0	15,500
Potassium, dissolved (mg/L)	110	559	4.8	18.0	0.3	0.9	1.3	3.1	183.5	390
Iron, dissolved (μg/L)†	97	538	1,110.5	217.8	6.5	99.5	364.0	1,000.0	14,028.0	NA
Chloride, dissolved (mg/L)	94	390	50.5	134.8	3.5	9.2	18.3	39.1	1,200.0	19,000
Sulfate, dissolved (mg/L)	94	389	16.3	31.7	0.2	2.3	5.0	13.8	200.0	2,700
Alkalinity, dissolved (mg/L as $CaCO_3$)	96	477	119	110	1	24	91	192	414	NA
Phosphate, dissolved (mg/L as P)	62	172	0.16	0.23	0.01	0.04	0.07	0.18	1.25	0.09
Nitrate and nitrite, dissolved (mg/L as N)	96	398	0.43	1.29	0.01	0.02	0.04	0.26	11.10	0.67
Fluoride, dissolved (mg/L)	97	454	0.16	0.14	0.04	0.10	0.10	0.16	0.80	1.3
Total dissolved solids (mg/L)	101	360	278	362	21	95	186	341	2,610	NA
Hardness, total (mg/L as $CaCO_3$)	88	229	131	140	4	27	80	213	750	NA

†Only wells constructed with polyvinyl chloride (PVC) casing were used in the statistical summary.

Note:
Min = minimum
Max = maximum
mg/L = milligrams per liter
μg/L = micrograms per liter
μmhos/cm = micromhos per centimeter
P = phosphorus
N = nitrogen
NA = not applicable

*Source: Hem 1985

specific conductance, total dissolved solids, and hardness also are presented.

The descriptive statistics for the concentrations of chemical constituents and physical properties of water are summarized for the Floridan, intermediate, and surficial aquifer systems (Table 2). Data for the concentrations and measurements of the selected parameters analyzed for each well included in this summary report also are compiled (Appendix C).

FIELD MEASUREMENTS

Field measurements include the following parameters: temperature, pH, and specific conductance.

Temperature

The temperature of groundwater is controlled by climatic conditions, recharge, chemical reactions in the aquifer system, heat from the earth's interior, and cultural activities (Maddox et al. 1992). Temperature measurements are recorded in the field. There are no guidance criteria for the temperature of groundwater.

Floridan Aquifer System. The median temperature of water in the Floridan aquifer system was 23.3°C, with a mean of 23.5°C (Table 3, Figure 5). The minimum temperature recorded from the 217 wells sampled was 20.9°C, and the maximum was 28.8°C. The temperature data for the Floridan aquifer system reflect well depths and flow paths. Cool water temperatures occur inland in recharge areas, and warm temperatures occur along the coast and in discharge areas from water that has traveled along deep flow paths. The high temperature values of 28.8°C for well D-0090, 28.7°C for well D-425T, and 28.6°C for well SJ0027 (Appendix C) are probably due to warm water that flows from deep zones through geologic structures.

Intermediate Aquifer System. The median temperature of water in the intermediate aquifer system was 22.9°C, with a mean of 23.0°C (Table 3, Figure 5). The minimum temperature recorded from the 64 wells sampled was 20.6°C, and the maximum was 25.5°C.

Table 3. Summary of temperature data by aquifer system (in °C)

Aquifer System	Number of Wells Sampled	Number of Analyses	Mean	Standard Deviation	Min	25th Percentile	Median	75th Percentile	Max
Floridan	217	1,419	23.5	1.3	20.9	22.6	23.3	24.1	28.8
Intermediate	64	403	23.0	1.2	20.6	22.2	22.9	23.9	25.5
Surficial	110	685	23.1	1.4	20.3	22.2	22.9	23.7	26.9

Note: Min = minimum
Max = maximum

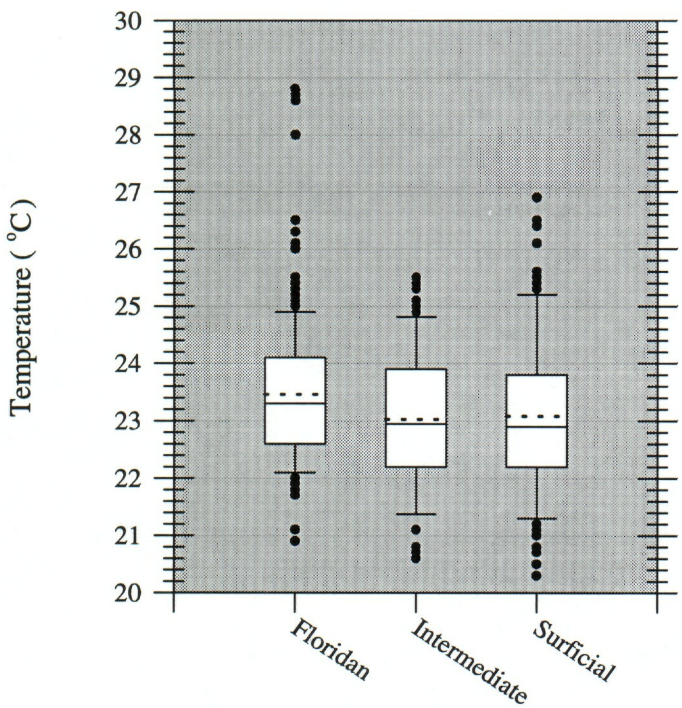

Figure 5. Boxplot of temperature data by aquifer system

Surficial Aquifer System. The median temperature of water in the surficial aquifer system was 22.9°C, with a mean of 23.1°C (Table 3, Figure 5). The minimum temperature recorded from the 110 wells sampled was 20.3°C, and the maximum was 26.9°C. The temperature data for the surficial aquifer system reflect variability due to climatic conditions at the time of sampling and recharge conditions.

pH

The pH of a water sample is an indicator of the status of equilibrium reactions between the water and the aquifer materials. The pH reflects the past history of chemical reactions that have taken place and the potential for future reactions.

The pH of a water sample is a measure of the activity of hydrogen ions and is expressed in logarithmic units, with pH representing the negative base-10 log of the hydrogen ion activity in moles per liter (Hem 1985). The pH of pure water at 25°C is 7.00, or neutral. Values less than 7.00 are acidic and values greater than 7.00 are basic, or alkaline. The hydrogen ion [H^+] is generally the cause of acidity, and bicarbonate [HCO_3^-] is generally the source of alkalinity. Water with a pH less than 6.5 is likely to be corrosive. Water with a pH greater than 8.5 also is likely to be corrosive and may result in turbidity from the precipitation of carbonate minerals. High pH values may be the result of drilling fluids remaining in the well after construction (Maddox et al. 1992).

Precipitation has a pH of about 5.5 (Maddox et al. 1992). As rainfall infiltrates into the ground, it reacts with carbon dioxide in the soil zone, resulting in low pH values typically measured in wells that penetrate the surficial aquifer system. As water moves downward and interacts with aquifer minerals, the water becomes less acidic and more alkaline, resulting in higher pH levels. For example, carbonate minerals such as calcite in the Floridan aquifer system are highly reactive, raising pH levels (Maddox et al. 1992). The guidance criterion for pH in groundwater is 6.5–8.5 standard units and is an enforceable secondary drinking water standard.

Floridan Aquifer System. The median pH of water in the Floridan aquifer system was 7.51, with a mean of 7.55 (Table 4, Figure 6). The minimum pH measured from the 181 wells sampled was 6.75, and the maximum was 8.59. The pH data for the Floridan aquifer system reflect the flow history of the water and its reactions with aquifer materials. Two pH measurements exceeded 8.5 (wells M-0024 and P-0450, Appendix C).

Intermediate Aquifer System. The median pH of water in the intermediate aquifer system was 7.33, with a mean of 7.39 (Table 4, Figure 6). The minimum pH measured from the 59 wells sampled was 6.13, and the maximum was 8.69. One pH measurement was lower than 6.5 (well A-0697, Appendix C) and one pH measurement exceeded 8.5 (well N-0201, Appendix C).

Surficial Aquifer System. The median pH of water in the surficial aquifer system was 6.47, with a mean of 6.45 (Table 4, Figure 6). The minimum pH measured from the 110 wells sampled was 3.69, and the maximum was 8.97. The pH data for the surficial aquifer system reflect the low pH of rainfall and reactions in the soil zone that lower the pH. As the shell content of the surficial aquifer system increases toward the coast, pH values are higher. Fifty-six pH measurements were below 6.5, and four pH measurements exceeded 8.5.

Specific Conductance

Specific conductance is a measure of the ability of water to conduct electric currents and is dependent on the concentrations and types of ions in the water and on temperature. Specific conductance has a strong positive correlation with total dissolved solids and chloride concentrations. There are no guidance criteria for the specific conductance of groundwater.

Floridan Aquifer System. The median specific conductance of water in the Floridan aquifer system was 567 micromhos per centimeter (µmhos/cm), with a mean of 1,322 µmhos/cm (Table 5, Figure 7). The minimum specific conductance for the 217 wells sampled was 76 µmhos/cm. The maximum specific conductance was 34,200 µmhos/cm, in well V-0200 (Appendix C). Specific conductance generally increases along the flow path with increased residence time.

Table 4. Summary of pH data by aquifer system (standard units)

Aquifer System	Number of Wells Sampled	Number of Analyses	Mean	Standard Deviation	Min	25th Percentile	Median	75th Percentile	Max
Floridan	181	853	7.55	0.37	6.75	7.30	7.51	7.81	8.59
Intermediate	59	386	7.39	0.44	6.13	7.11	7.33	7.68	8.69
Surficial	110	960	6.45	1.06	3.69	5.74	6.47	7.12	8.97

Note: Min = minimum
Max = maximum

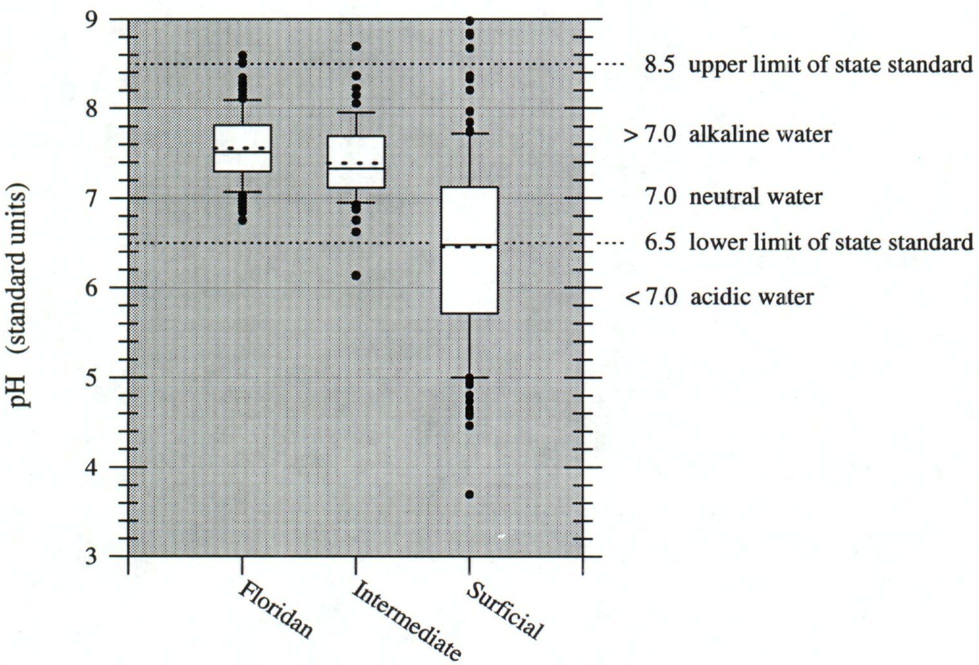

Figure 6. Boxplot of pH data by aquifer system

Table 5. Summary of specific conductance data by aquifer system (in micromhos per centimeter at 25°C)

Aquifer System	Number of Wells Sampled	Number of Analyses	Mean	Standard Deviation	Min	25th Percentile	Median	75th Percentile	Max
Floridan	217	1,399	1,322	3,005	76	328	567	990	34,200
Intermediate	64	432	1,125	2,287	51	351	523	649	14,290
Surficial	109	675	471	589	43	152	321	575	4,238

Note: Min = minimum
Max = maximum

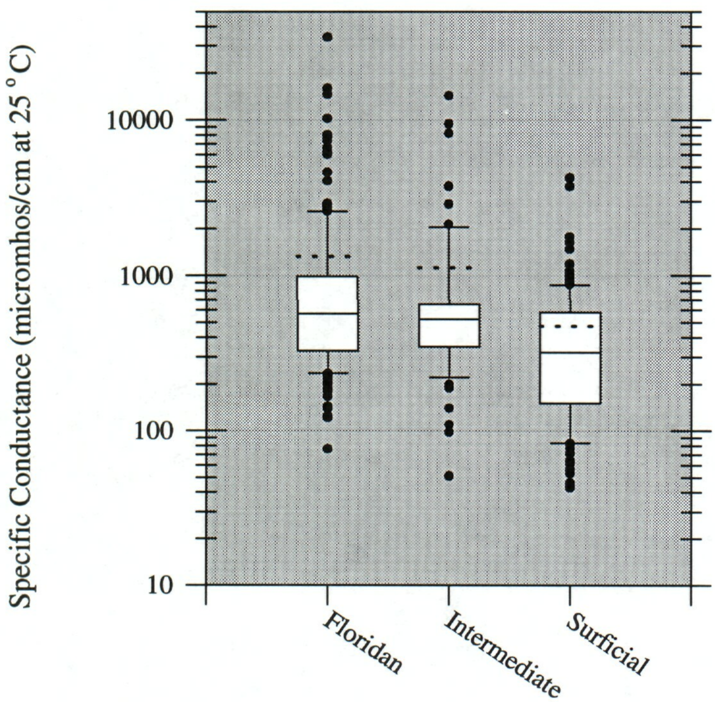

Figure 7. Boxplot of specific conductance data by aquifer system

Specific conductance values over 2,000 µmhos/cm are typical of areas where highly mineralized formation waters are at relatively shallow depths (e.g., well SJ0516, Appendixes B and C) or in wells in the coastal transition zone (e.g., well V-0508).

Intermediate Aquifer System. The median specific conductance of water in the intermediate aquifer system was 523 µmhos/cm, with a mean of 1,125 µmhos/cm (Table 5, Figure 7). The minimum specific conductance for the 64 wells sampled was 51 µmhos/cm. The maximum specific conductance was 14,290 µmhos/cm, in well D-0013 (Appendix C).

Surficial Aquifer System. The median specific conductance of water in the surficial aquifer system was 321 µmhos/cm, with a mean of 471 µmhos/cm (Table 5, Figure 7). The minimum specific conductance for the 109 wells sampled was 43 µmhos/cm, and the maximum was 4,238 µmhos/cm. The median and mean specific conductance of water in the surficial aquifer system are relatively low due to the low ion concentrations typical of water in the surficial aquifer system.

Cations

Major cations include calcium, magnesium, sodium, and potassium; minor cations include iron.

Calcium

The calcium ion is dissolved from most soils and rocks and especially from limestone, dolomite, and gypsum. Calcium is a dominant cation resulting from the chemical weathering of the mineral calcite (calcium carbonate [$CaCO_3$]) in limestone and the mineral dolomite ($CaMg[CO_3]$) in dolostone. The concentration of dissolved calcium in a groundwater sample is a result of contact of water with aquifer materials, residence time, and flow path. Highest concentrations of calcium occur in alkaline waters that are in equilibrium with aquifer materials (Maddox et al. 1992). There is no guidance concentration for calcium in groundwater.

Floridan Aquifer System. The median concentration of dissolved calcium in the Floridan aquifer system was 62.3 mg/L, with a mean of 78.6 mg/L (Table 6, Figure 8). The minimum concentration of calcium from the 224 wells sampled was 6.0 mg/L, and the maximum was 538.3 mg/L. Almost 80% of the wells had a calcium concentration less than 100.0 mg/L. Calcium concentrations are not as high as may be expected in discharge areas along the coast in southern Brevard County and Indian River County (Figures 9 and 2) because of the removal of calcium by mineral precipitation or ion exchange.

High calcium concentrations due to the mixing of fresh groundwater with formation water high in dissolved solids that have not been flushed from the aquifer occur in Flagler and St. Johns counties (e.g., wells F-0200, SJ0263, and SJ0516, Appendix C) (Figure 9). These high concentrations also reflect the increased mineralization of the water as it moves along flow paths from recharge to discharge areas.

High calcium concentrations in the Floridan aquifer system also occur along the St. Johns River in the central part of SJRWMD and along the lower Wekiva River (Figure 9) due to the upwelling of residual seawater (e.g., wells S-0025, S-0097, and V-0083, Appendix C). There is a transitional zone between fresh groundwater and residual seawater.

High calcium concentrations due to the lateral intrusion of seawater occur in well V-0200. Well V-0508 (which is near well V-0200) is located along the coast where fresh groundwater mixes with laterally intruded seawater.

Intermediate Aquifer System. The median concentration of dissolved calcium in the intermediate aquifer system was 66.3 mg/L, with a mean of 77.1 mg/L (Table 6, Figure 8). The minimum concentration of calcium from the 63 wells sampled was 9.1 mg/L, and the maximum was 381.4 mg/L. About 70% of the wells had a calcium concentration less than 100.0 mg/L. Calcium concentrations in the intermediate aquifer system are typically due to the dissolution of shell, marl, and limestone aquifer materials. High calcium concentrations were measured in wells BR1085, BR1145, and S-0041 (Appendix C). High calcium concentrations due to lateral intrusion of seawater were measured along the coast at wells D-0013 and F-0174.

Table 6. Summary of calcium data by aquifer system (dissolved; milligrams per liter)

Aquifer System	Number of Wells Sampled	Number of Analyses	Mean	Standard Deviation	Min	25th Percentile	Median	75th Percentile	Max
Floridan	224	1,358	78.6	59.6	6.0	41.0	62.3	98.0	538.3
Intermediate	63	280	77.1	53.2	9.1	45.8	66.3	102.0	381.4
Surficial	110	559	48.7	45.7	0.7	8.8	36.3	82.0	212.0

Note: Min = minimum
Max = maximum

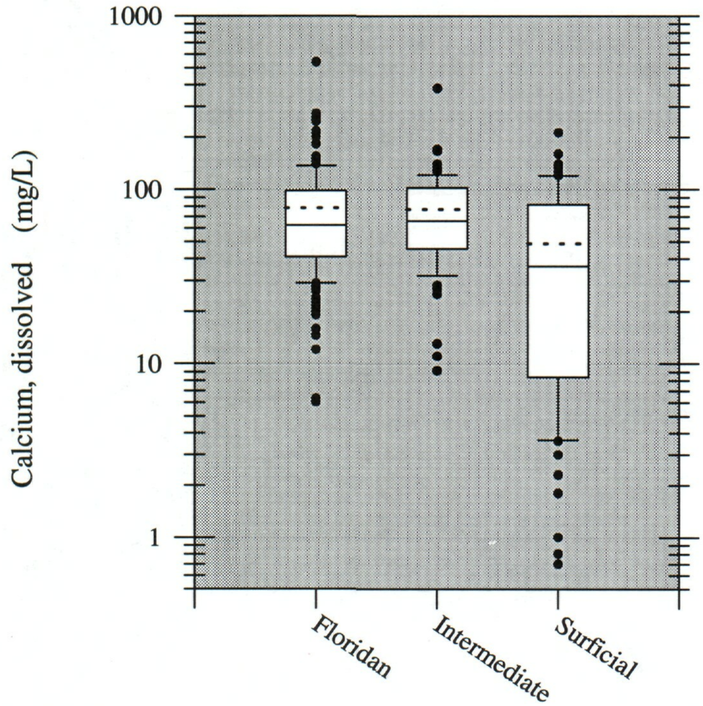

Figure 8. Boxplot of calcium data by aquifer system

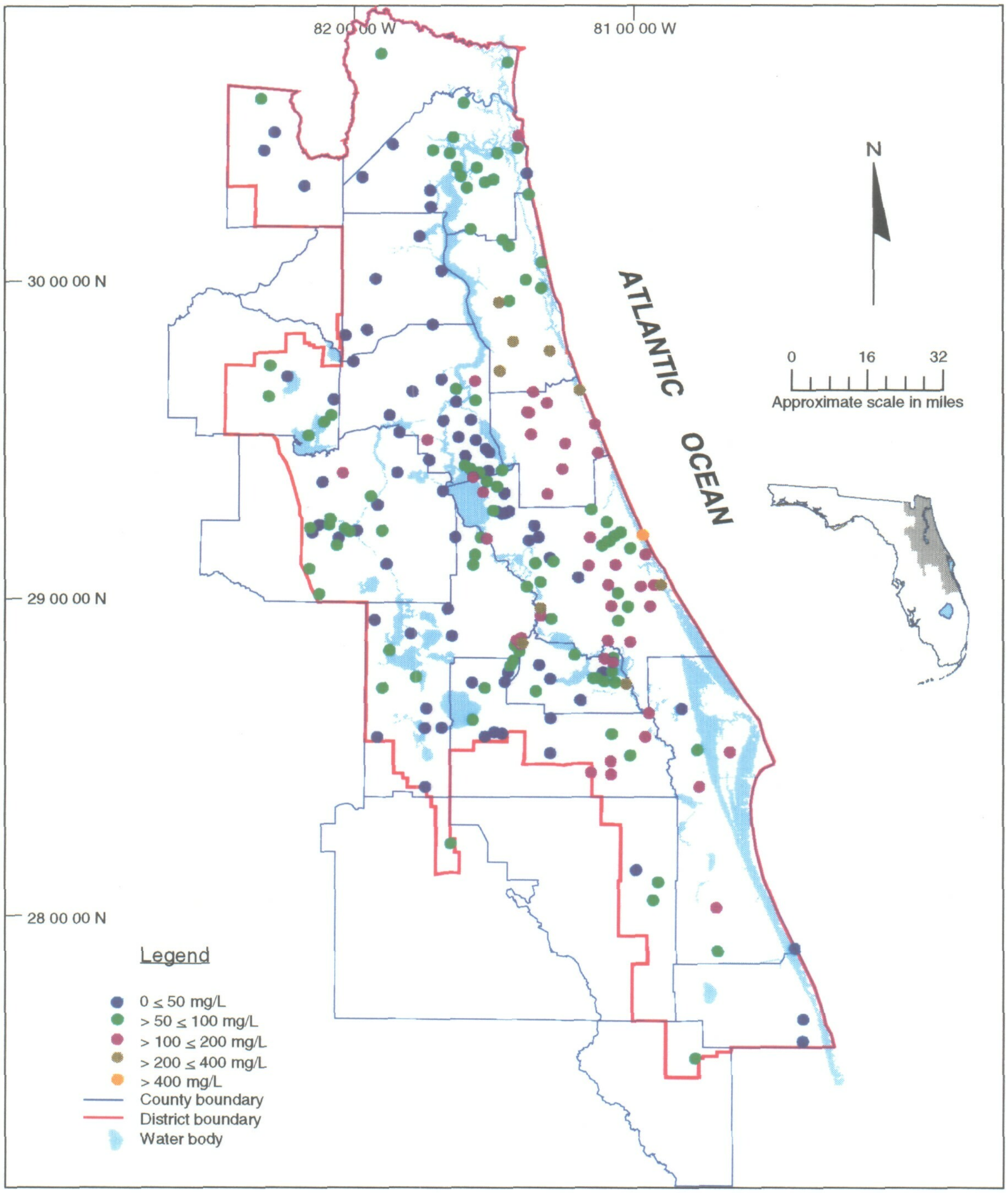

Figure 9. Areal distribution of calcium in the Floridan aquifer system

Surficial Aquifer System. The median concentration of dissolved calcium in the surficial aquifer system was 36.3 mg/L, with a mean of 48.7 mg/L (Table 6, Figure 8). The minimum concentration of calcium from the 110 wells sampled was 0.7 mg/L, and the maximum was 212.0 mg/L. About 80% of the wells had a calcium concentration less than 100.0 mg/L. Calcium concentrations increase toward the coast and the southern part of SJRWMD where the shell content of the surficial aquifer system increases (e.g., well IR0350). High calcium concentrations due to lateral intrusion of seawater were measured along the coast at wells F-0177, F-0226, and SJ0503 (Appendix C).

Magnesium

Magnesium, like calcium, is dissolved from most soils and rocks, especially limestone and dolomite. The occurrence of dissolved magnesium in aquifer systems in SJRWMD is a result of the dissolution of dolomite and ion exchange with clays. There is no guidance concentration for magnesium in groundwater.

Floridan Aquifer System. The median concentration of dissolved magnesium in the Floridan aquifer system was 12.4 mg/L, with a mean of 29.7 mg/L (Table 7, Figure 10). The minimum concentration of magnesium from the 224 wells sampled was 1.0 mg/L, and the maximum was 749.6 mg/L. Almost 90% of the wells had a magnesium concentration less than 50.0 mg/L. Magnesium concentrations increase along regional flow lines toward the coast and other discharge areas (Figure 11).

High magnesium concentrations due to the mixing of fresh groundwater with formation water high in dissolved solids that have not been flushed from the aquifer occur in Flagler and St. Johns counties (e.g., wells F-0200, F-0225, and SJ0516, Appendix C) (Figure 11). These high concentrations also reflect the increased mineralization of the water as it moves along flow paths from recharge to discharge areas.

High magnesium concentrations in the Floridan aquifer system also occur along the St. Johns River in the central part of SJRWMD and along the lower Wekiva River (Figure 11) due to the upwelling of residual seawater (e.g., wells S-0025, S-0097, and V-0083, Appendix C). There is a transitional zone between fresh groundwater and residual seawater.

Table 7. Summary of magnesium data by aquifer system (dissolved; milligrams per liter)

Aquifer System	Number of Wells Sampled	Number of Analyses	Mean	Standard Deviation	Min	25th Percentile	Median	75th Percentile	Max
Floridan	224	1,355	29.7	63.0	1.0	7.0	12.4	31.0	749.6
Intermediate	64	280	17.7	36.7	0.4	2.9	6.1	18.0	240.0
Surficial	110	558	5.6	10.9	0.4	1.3	2.4	6.1	88.0

Note: Min = minimum
Max = maximum

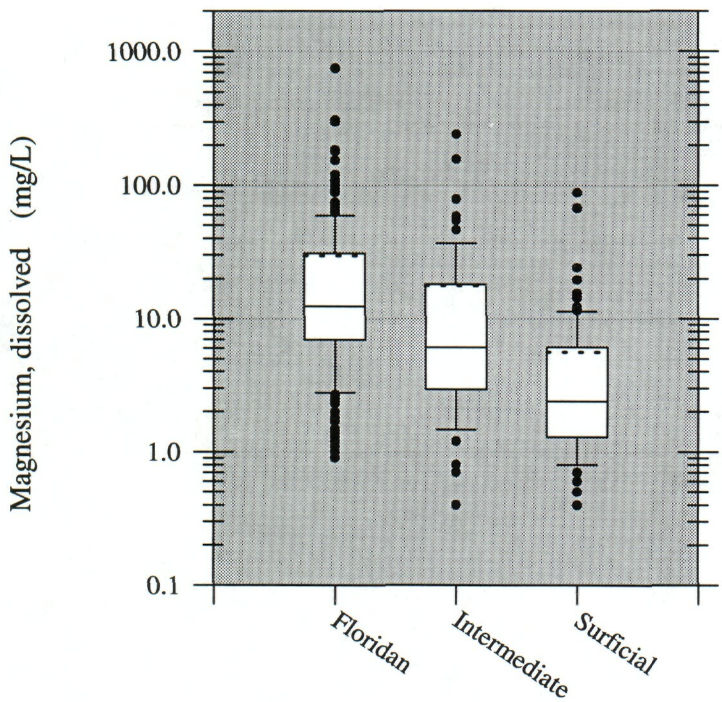

Figure 10. Boxplot of magnesium data by aquifer system

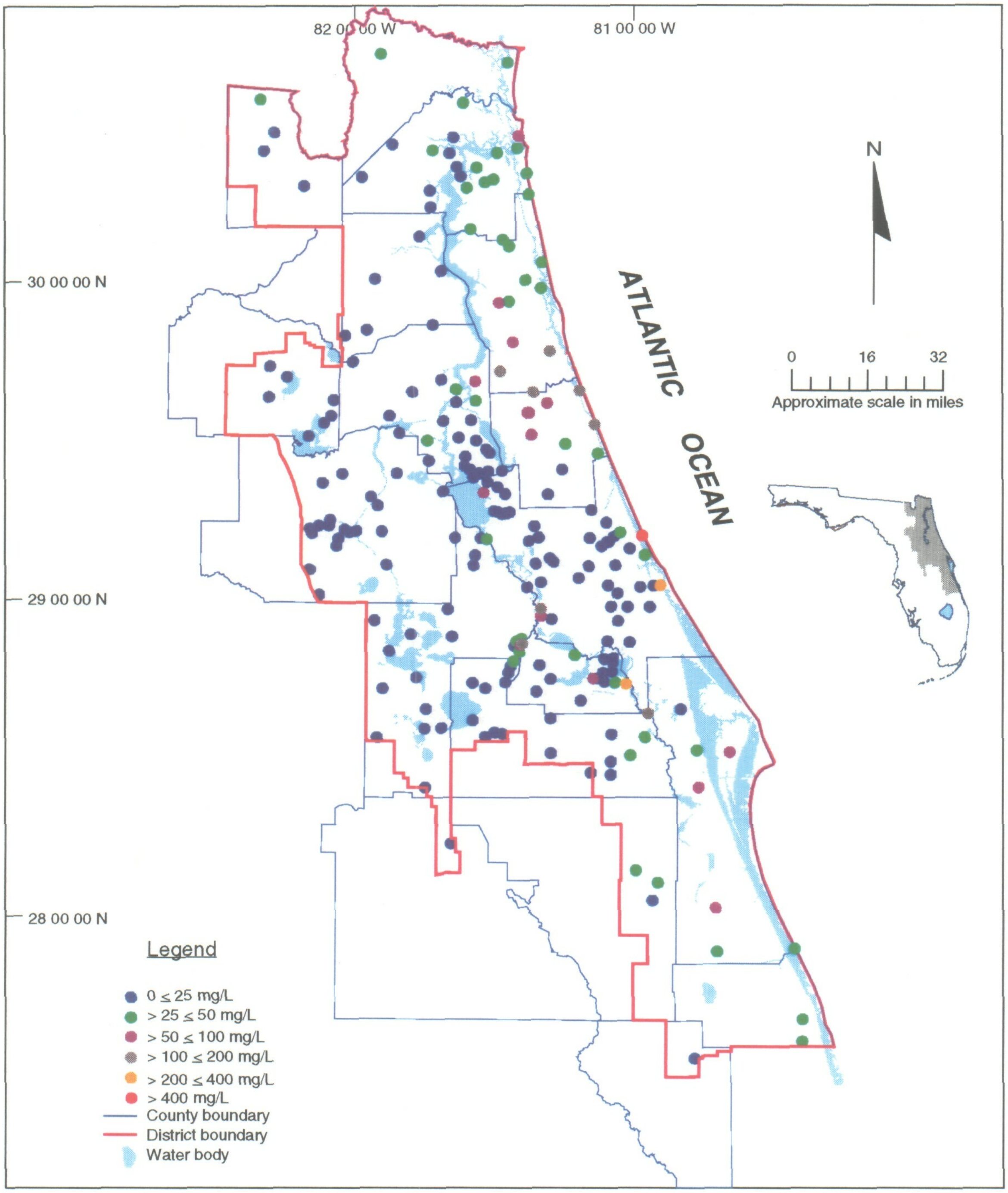

Figure 11. Areal distribution of magnesium in the Floridan aquifer system

High magnesium concentrations due to the lateral intrusion of seawater occur in and around well V-0200. Well V-0508 (which is near well V-0200) is located along the coast where fresh groundwater mixes with intruded seawater.

Intermediate Aquifer System. The median concentration of dissolved magnesium in the intermediate aquifer system was 6.1 mg/L, with a mean of 17.7 mg/L (Table 7, Figure 10). The minimum concentration of magnesium from the 64 wells sampled was 0.4 mg/L, and the maximum was 240.0 mg/L. About 90% of the wells had a magnesium concentration less than 50.0 mg/L. Magnesium in the water of the intermediate aquifer system is typically the result of the dissolution of dolomite aquifer materials and ion exchange with clays. High magnesium concentrations in wells BR0903, D-0013, and F-0174 (Appendix C) are due to the lateral intrusion of seawater.

Surficial Aquifer System. The median concentration of dissolved magnesium in the surficial aquifer system was 2.4 mg/L, with a mean of 5.6 mg/L (Table 7, Figure 10). The minimum concentration of magnesium from the 110 wells sampled was 0.4 mg/L, and the maximum was 88.0 mg/L. The maximum concentration, from well F-0226 (Appendix C), is due to the lateral intrusion of seawater. Almost 100% of the wells had a magnesium concentration less than 50.0 mg/L. As expected from the sediments that comprise the surficial aquifer system, most wells had magnesium concentrations below 10.0 mg/L.

Sodium

The primary sources of sodium in Florida's aquifer systems are the mixing of fresh groundwater with seawater along the coast and in coastal transition zones, the upconing of seawater from deeper zones, the weathering of sodium-rich minerals such as clays or feldspars, and marine aerosols (Maddox et al. 1992). Sodium is regulated as a primary drinking water standard, with a state standard of 160.0 mg/L for sodium in groundwater.

Floridan Aquifer System. The median concentration of dissolved sodium in the Floridan aquifer system was 14.4 mg/L, with a mean of 148.2 mg/L (Table 8, Figure 12). The minimum concentration of sodium from the 224 wells sampled was 0.9 mg/L, and the maximum was 7,308.8 mg/L, with 84% of the wells having a sodium concentration less than 160.0 mg/L. Thirty-five wells had sodium concentrations exceeding the state standard of 160.0 mg/L.

High sodium concentrations due to the mixing of fresh groundwater with formation water high in dissolved solids that have not been flushed from the aquifer occur in Flagler and St. Johns counties (e.g., wells F-0200, SJ0263, and SJ0516, Appendix C) (Figure 13). These high concentrations also reflect the increased mineralization of the water as it moves along flow paths from recharge to discharge areas.

High sodium concentrations in the Floridan aquifer system also occur along the St. Johns River in the central part of SJRWMD and along the lower Wekiva River (Figure 13) due to the upwelling of residual seawater (e.g., wells BR0202, BR0660, S-0025, S-0097, and V-0083, Appendix C). There is a transitional zone between fresh groundwater and residual seawater.

High sodium concentrations due to the lateral intrusion of seawater occur in and around well V-0200. Well V-0508 (which is near well V-0200) is located along the coast where fresh groundwater mixes with seawater.

Intermediate Aquifer System. The median concentration of dissolved sodium in the intermediate aquifer system was 17.0 mg/L, with a mean of 134.1 mg/L (Table 8, Figure 12). The minimum concentration of sodium from the 63 wells sampled was 3.0 mg/L, and the maximum was 2,500.0 mg/L, with 87% of the wells having a sodium concentration less than 160.0 mg/L. Eight wells had sodium concentrations exceeding the state standard of 160.0 mg/L. High sodium concentrations occur from seawater intrusion along the coast (e.g., wells BR0903, D-0013, F-0174, and N-0019, Appendix C). High sodium concentrations due to the upwelling of water from deeper aquifers occur along the St. Johns River in Seminole County (wells S-0041 and S-0780).

Table 8. Summary of sodium data by aquifer system (dissolved; milligrams per liter)

Aquifer System	Number of Wells Sampled	Number of Analyses	Mean	Standard Deviation	Min	25th Percentile	Median	75th Percentile	Max
Floridan	224	1,358	148.2	574.8	0.9	6.4	14.4	80.0	7,308.8
Intermediate	63	282	134.1	425.9	3.0	8.2	17.0	33.2	2,500.0
Surficial	110	559	35.5	93.2	1.8	6.6	11.0	28.0	690.0

Note: Min = minimum
Max = maximum

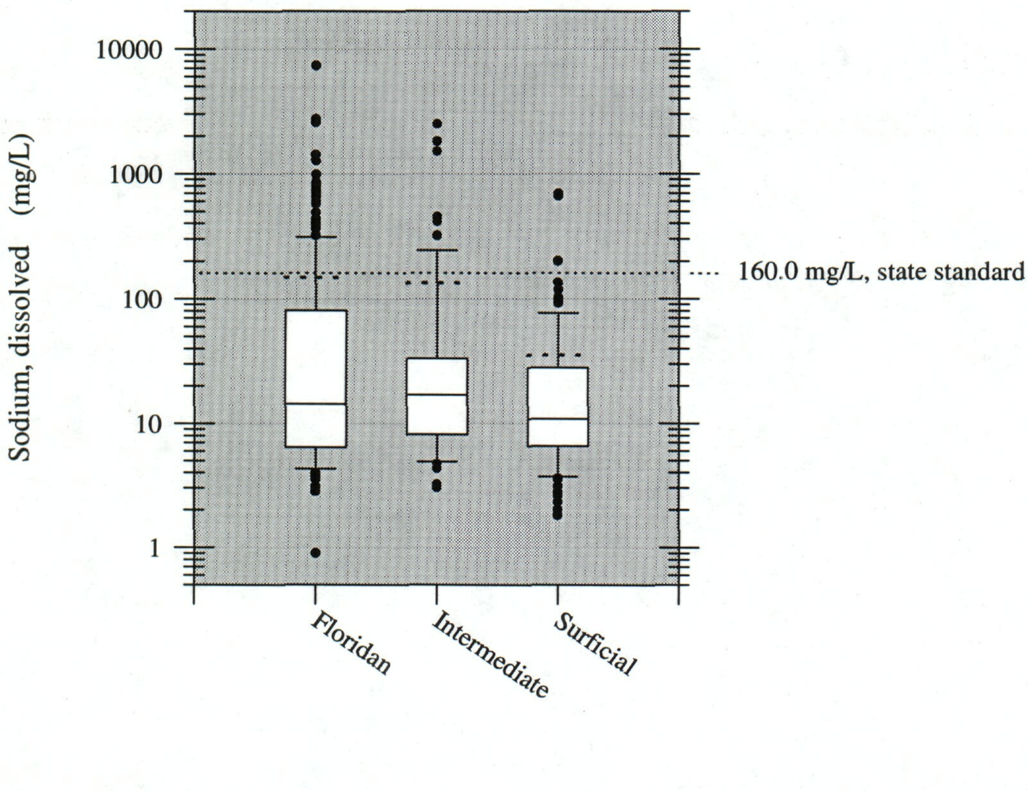

Figure 12. Boxplot of sodium data by aquifer system

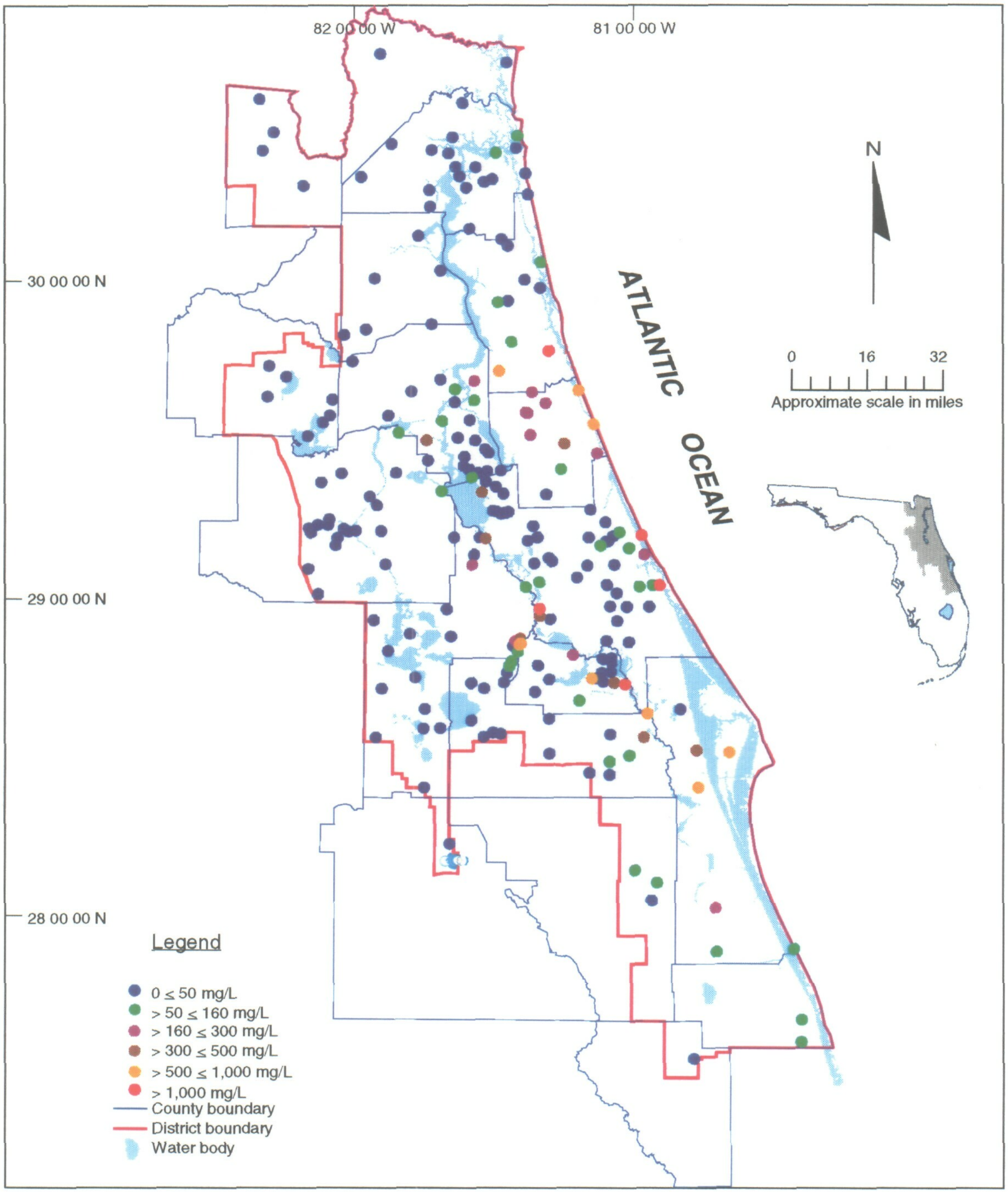

Figure 13. Areal distribution of sodium in the Floridan aquifer system

Surficial Aquifer System. The median concentration of dissolved sodium in the surficial aquifer system was 11.0 mg/L, with a mean of 35.5 mg/L (Table 8, Figure 12). The minimum concentration of sodium from the 110 wells sampled was 1.8 mg/L, and the maximum was 690.0 mg/L, with 97% of the wells having a sodium concentration less than 160.0 mg/L. Three wells had sodium concentrations exceeding the state standard of 160.0 mg/L. High sodium concentrations from seawater intrusion occurred in wells F-0226 and N-0018 (Appendix C).

Potassium

The principal sources of the potassium ion are the mixing of groundwater with seawater along the coast and in coastal transition zones and with residual seawater (Maddox et al. 1992). Maximum potassium concentrations in wells located in inland parts of SJRWMD may be the result of residual drilling fluids. There is no guidance concentration for potassium in groundwater.

Floridan Aquifer System. The median concentration of dissolved potassium in the Floridan aquifer system was 1.8 mg/L, with a mean of 5.4 mg/L (Table 9, Figure 14). The minimum concentration of potassium from the 224 wells sampled was 0.1 mg/L, and the maximum was 239.5 mg/L. Almost 100% of the wells had a potassium concentration less than 25.0 mg/L. The maximum concentration, from well V-0200 (Appendix C), is due to the lateral intrusion of seawater (Figure 15).

Intermediate Aquifer System. The median concentration of dissolved potassium in the intermediate aquifer system was 1.7 mg/L, with a mean of 7.2 mg/L (Table 9, Figure 14). The minimum concentration of potassium from the 64 wells sampled was 0.3 mg/L, and the maximum was 96.0 mg/L. The maximum concentration, from well D-0013 (Appendix C), is due to the lateral intrusion of seawater along the coast. Almost 90% of the wells had a potassium concentration less than 25.0 mg/L.

Table 9. Summary of potassium data by aquifer system (dissolved; milligrams per liter)

Aquifer System	Number of Wells Sampled	Number of Analyses	Mean	Standard Deviation	Min	25th Percentile	Median	75th Percentile	Max
Floridan	224	1,358	5.4	18.3	0.1	1.0	1.8	3.6	239.5
Intermediate	64	282	7.2	16.0	0.3	1.0	1.7	6.3	96.0
Surficial	110	559	4.8	18.0	0.3	0.9	1.3	3.1	183.5

Note: Min = minimum
Max = maximum

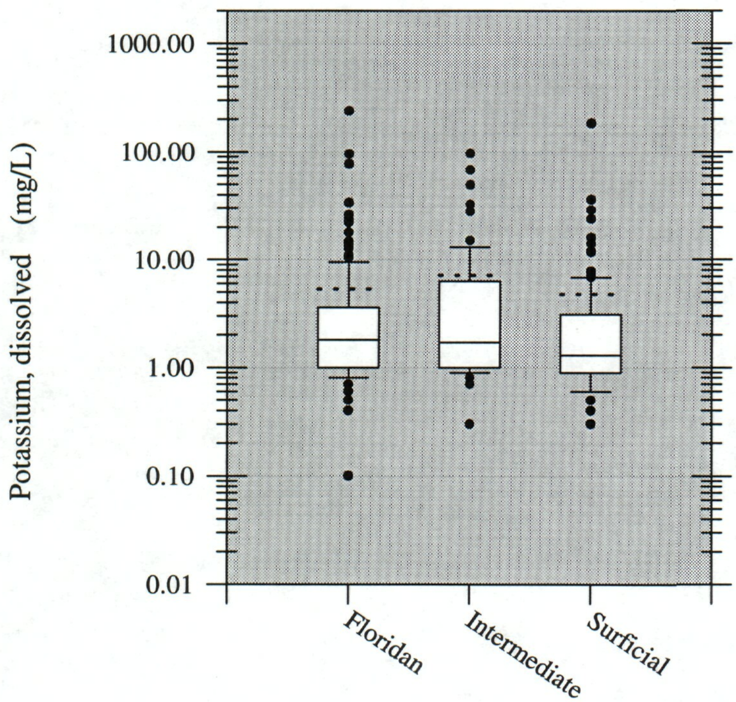

Figure 14. Boxplot of potassium data by aquifer system

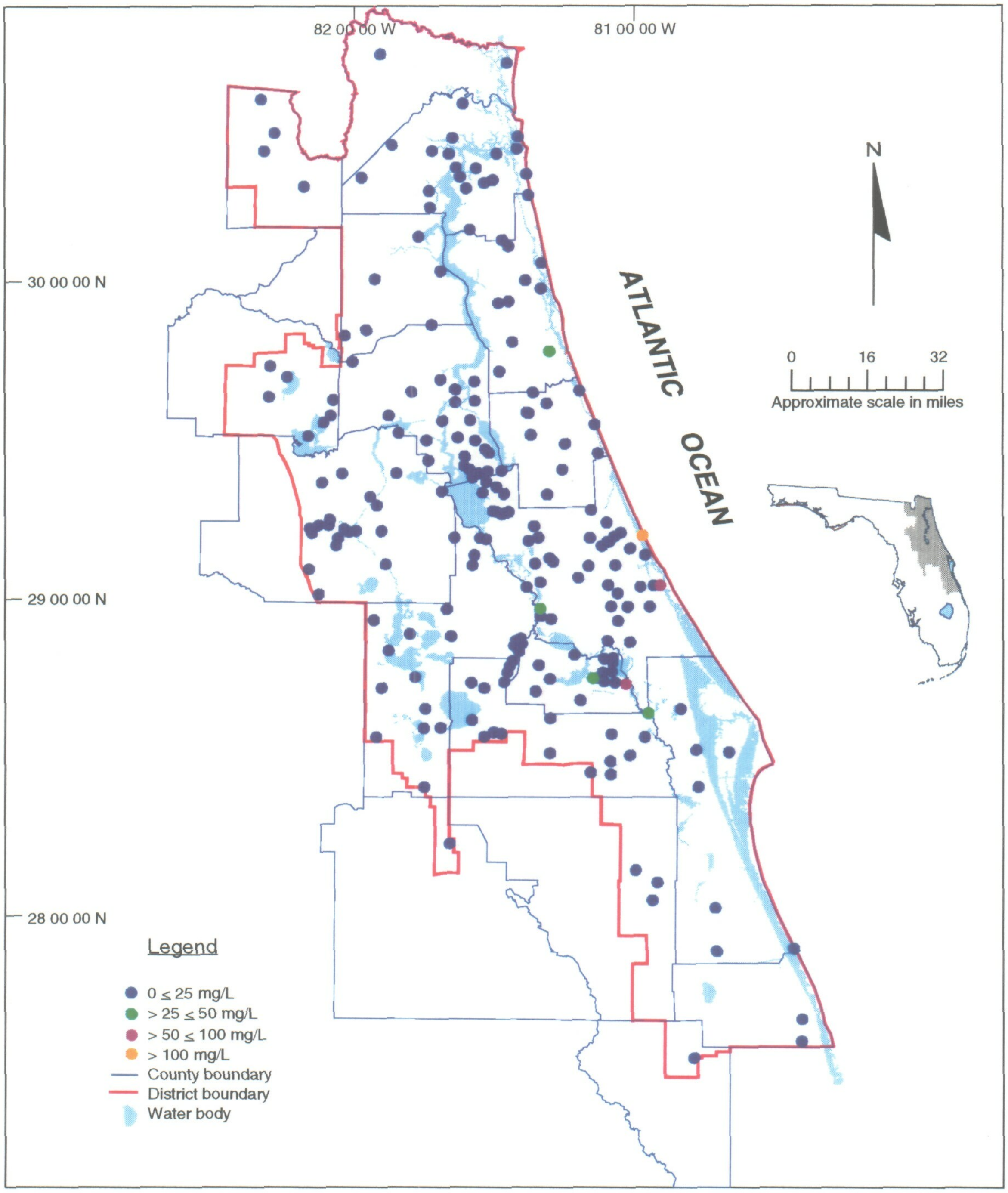

Figure 15. Areal distribution of potassium in the Floridan aquifer system

Surficial Aquifer System. The median concentration of dissolved potassium in the surficial aquifer system was 1.3 mg/L, with a mean of 4.8 mg/L (Table 9, Figure 14). The minimum concentration of potassium from the 110 wells sampled was 0.3 mg/L, and the maximum was 183.5 mg/L. Almost 100% of the wells had a potassium concentration less than 25.0 mg/L. The maximum concentration, from well PO0002 (Appendix C), probably indicates residual drilling fluid in the well.

Iron

The sources of iron in groundwater are the oxidation of pyrite, the oxidation of humic materials, and the dissolution of iron oxide and silicate minerals. The distribution and concentration of iron depends on the pH and on oxidation-reduction reactions. The red, brown, or yellow stain or scale commonly found on plumbing fixtures in areas of iron-rich waters is ferric hydroxide. Ferric hydroxide results from the oxidation of [Fe^{2+}] to [Fe^{3+}] and can form when basic, oxidizing water is heated in hot water heaters or is aerated in well pumps, sinks, or toilets. Colloidal ferric hydroxide and the bacteria associated with the colloidal mass clog well screens and aquifer pore openings (Maddox et al. 1992). Wells with high iron concentrations also tend to have highly turbid water and undesirable color characteristics.

Iron is regulated as a secondary drinking water standard, with a state standard for iron in groundwater of 300.0 micrograms per liter (µg/L). Only data from wells constructed with polyvinyl chloride (PVC) casing material were used in summarizing the iron concentrations in groundwater, because well casing materials containing iron could influence the iron levels in the water.

Floridan Aquifer System. The median concentration of dissolved iron in the Floridan aquifer system was 35.6 µg/L, with a mean of 375.6 µg/L (Table 10, Figure 16). The minimum concentration of iron from the 78 wells sampled was 4.0 µg/L, and the maximum was 6,823.3 µg/L, with 79% of the wells having an iron concentration less than 300.0 µg/L. Sixteen wells had iron concentrations exceeding the state standard of 300.0 µg/L. Iron in the Floridan aquifer system is generally the result of water movement into the Floridan from overlying aquifers.

Table 10. Summary of iron data by aquifer system (dissolved; micrograms per liter)

Aquifer System	Number of Wells Sampled	Number of Analyses	Mean	Standard Deviation	Min	25th Percentile	Median	75th Percentile	Max
Floridan	78	747	375.6	120.4	4.0	19.5	35.6	176.6	6,823.3
Intermediate	51	256	279.9	65.7	5.0	34.4	138.5	302.9	2,389.3
Surficial	97	538	1,110.5	217.8	6.5	99.5	364.0	1,000.0	14,028.0

*Only wells constructed with polyvinyl chloride (PVC) casing were used in the summary.

Note: Min = minimum
Max = maximum

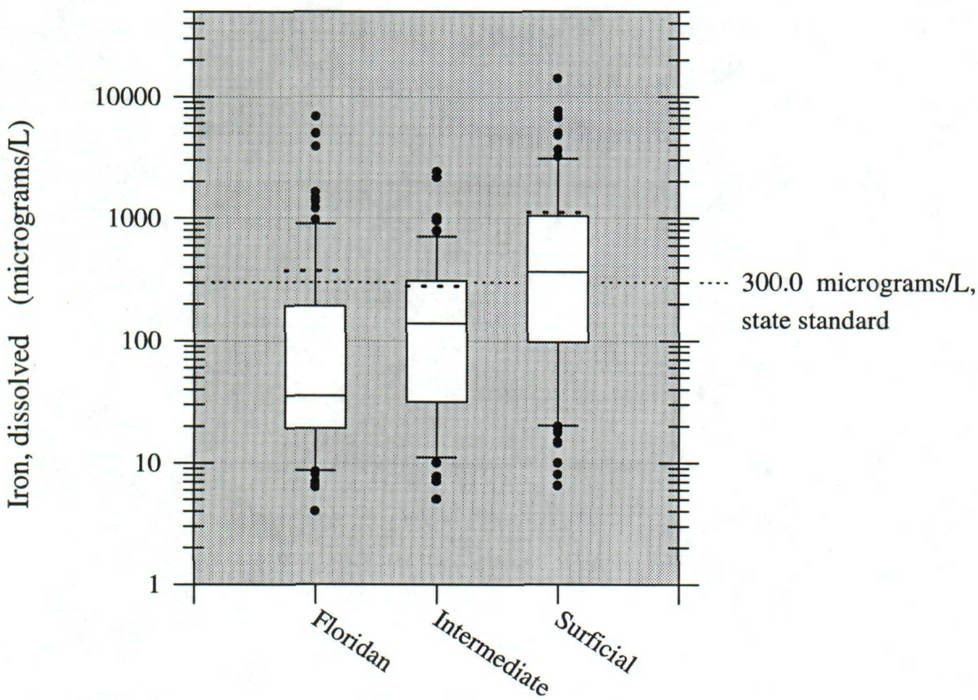

Figure 16. Boxplot of iron data by aquifer system

Intermediate Aquifer System. The median concentration of dissolved iron in the intermediate aquifer system was 138.5 μg/L, with a mean of 279.9 μg/L (Table 10, Figure 16). The minimum concentration of iron from the 51 wells sampled was 5.0 μg/L, and the maximum was 2,389.3 μg/L, with 75% of the wells having an iron concentration less than 300.0 μg/L. Thirteen wells had iron concentrations exceeding the state standard of 300.0 μg/L. Iron in the intermediate aquifer system is a result of the weathering of clays, pyrite, and related iron minerals in the Hawthorn Group.

Surficial Aquifer System. The median concentration of dissolved iron in the surficial aquifer system was 364.0 μg/L, with a mean of 1,110.5 μg/L (Table 10, Figure 16). The minimum concentration of iron from the 97 wells sampled was 6.5 μg/L, and the maximum was 14,028.0 μg/L, with 45% of the wells having an iron concentration less than 300.0 μg/L. Fifty-three wells had iron concentrations exceeding the state standard of 300.0 μg/L. Iron concentrations are relatively high in the surficial aquifer system due to the presence of humic substances and iron minerals.

ANIONS

The major anions include chloride, sulfate, and alkalinity. Minor anions include phosphate, nitrate and nitrite, and fluoride.

Chloride

The sources of chloride in Florida's aquifer systems are recent seawater that has intruded into freshwater zones, residual seawater in an aquifer, and marine aerosols. Chloride is a very soluble ion that does not readily enter into mineral reactions under the conditions found in Florida's aquifer systems. The occurrence of chloride is useful for identifying laterally intruded seawater and the mixing of fresh groundwater with residual seawater (Maddox et al. 1992). There is a strong positive correlation between chloride and sodium concentrations in groundwater.

Chloride is regulated as a secondary drinking water standard, with a state standard for chloride in groundwater of 250.0 mg/L. Chloride concentrations over 250.0 mg/L are associated with bad taste and corrosion.

Floridan Aquifer System. The median concentration of dissolved chloride in the Floridan aquifer system was 15.0 mg/L, with a mean of 228.5 mg/L (Table 11, Figure 17). The minimum concentration of chloride from the 168 wells sampled was 2.2 mg/L, and the maximum was 14,700.0 mg/L, with 85% of the wells having a chloride concentration less than 250.0 mg/L. Twenty-five wells had chloride concentrations exceeding the state standard of 250.0 mg/L. Chloride concentrations are relatively low in Floridan aquifer system wells located in inland recharge areas (Figures 18 and 2). Chloride concentrations generally increase along flow paths and with increased well depth.

High chloride concentrations due to the mixing of fresh groundwater with residual formation water high in dissolved solids occur in parts of Brevard, Flagler, Seminole, and St. Johns counties (e.g., wells BR0202, F-0200, S-0038, and SJ0516, Appendix C). The relatively high chloride concentrations in some wells in Duval County (e.g., wells D-0360 and D-0450) may be due to the upward movement of water that flows from deep zones through geologic structures. High chloride concentrations due to the lateral intrusion of seawater occur in well V-0200 (Appendix C).

Intermediate Aquifer System. The median concentration of dissolved chloride in the intermediate aquifer system was 14.8 mg/L, with a mean of 219.2 mg/L (Table 11, Figure 17). The minimum concentration of chloride from the 53 wells sampled was 5.1 mg/L, and the maximum was 4,600.0 mg/L, with 91% of the wells having a chloride concentration less than 250.0 mg/L. Five wells had chloride concentrations exceeding the state standard of 250.0 mg/L. High chloride concentrations occur in Duval and Flagler counties due to lateral intrusion of seawater (wells D-0013 and F-0174, Appendix C). High chloride concentrations also occur in Seminole County due to upwelling of water from deeper aquifers (wells S-0041 and S-0780).

Table 11. Summary of chloride data by aquifer system (dissolved; milligrams per liter)

Aquifer System	Number of Wells Sampled	Number of Analyses	Mean	Standard Deviation	Min	25th Percentile	Median	75th Percentile	Max
Floridan	168	508	228.5	1,169.7	2.2	8.7	15.0	79.0	14,700.0
Intermediate	53	178	219.2	788.7	5.1	7.6	14.8	36.5	4,600.0
Surficial	94	390	50.5	134.8	3.5	9.2	18.3	39.1	1,200.0

Note: Min = minimum
Max = maximum

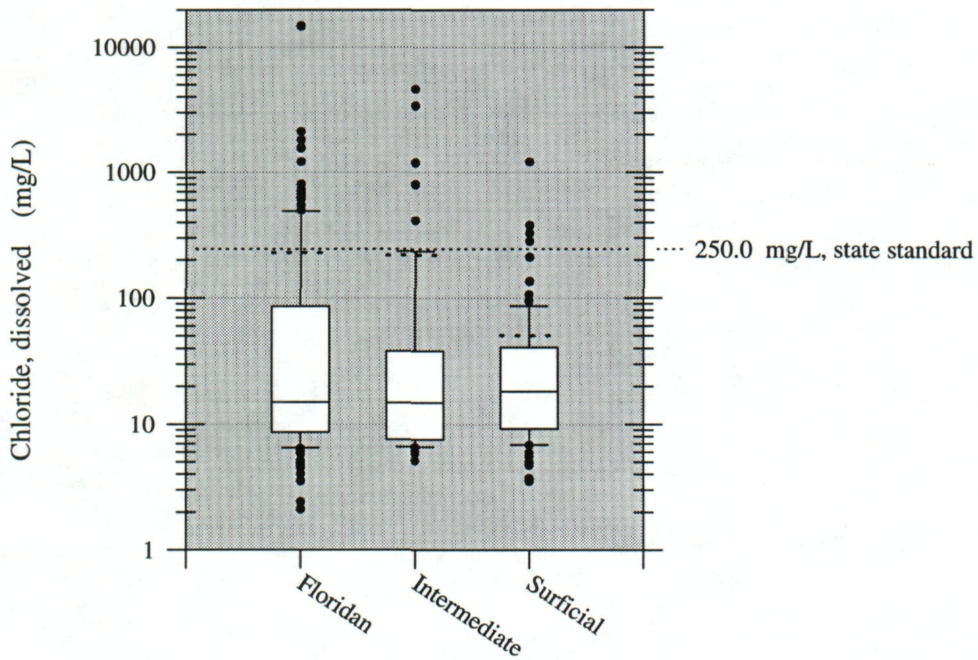

Figure 17. Boxplot of chloride data by aquifer system

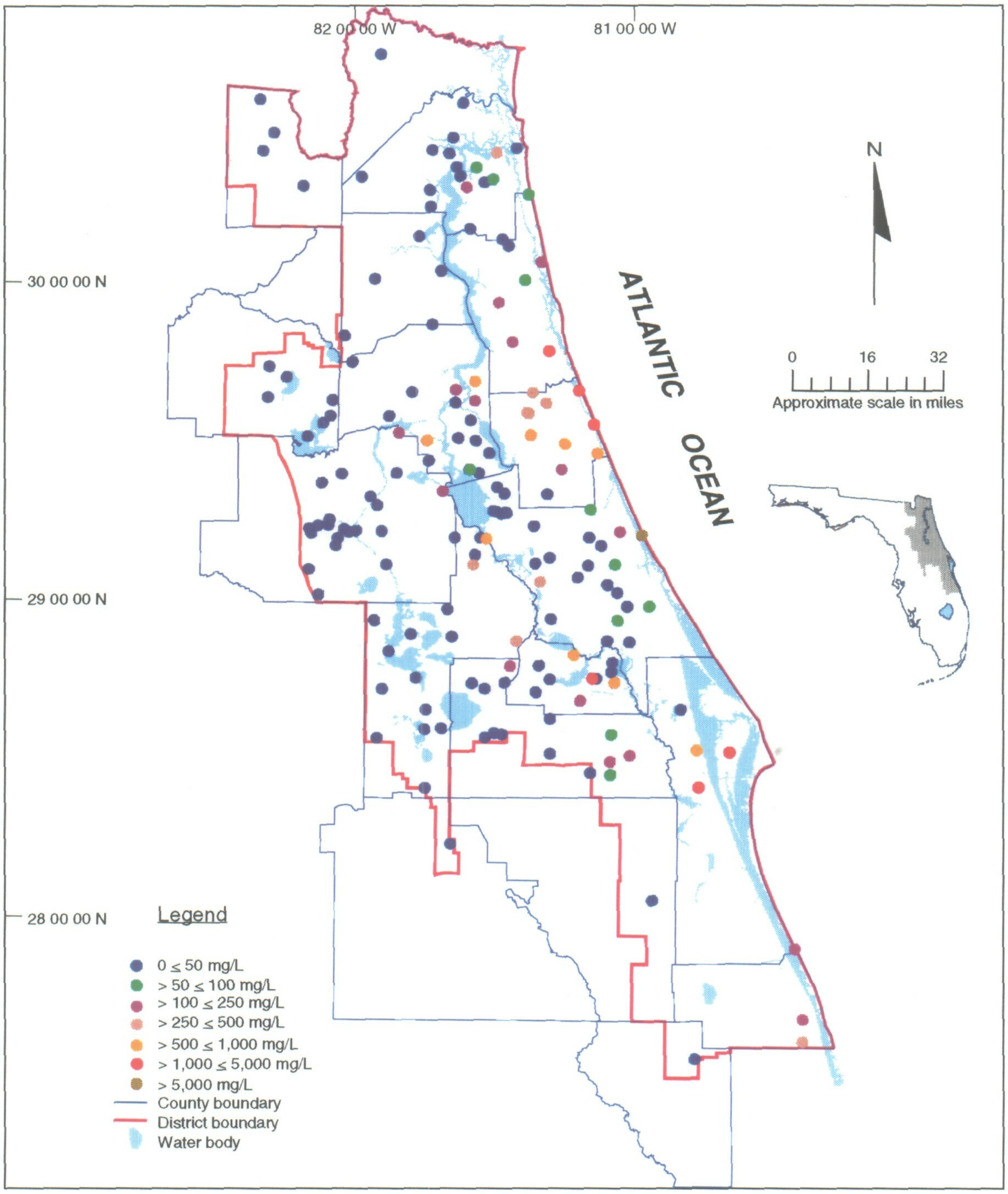

Figure 18. Areal distribution of chloride in the Floridan aquifer system

Surficial Aquifer System. The median concentration of dissolved chloride in the surficial aquifer system was 18.3 mg/L, with a mean of 50.5 mg/L (Table 11, Figure 17). The minimum concentration of chloride from the 94 wells sampled was 3.5 mg/L, and the maximum was 1,200.0 mg/L, with 96% of the wells having a chloride concentration less than 250.0 mg/L. Four wells had chloride concentrations exceeding the state standard of 250.0 mg/L. Typically, concentrations of chloride in the surficial aquifer system reflect the low concentrations of chlorides in precipitation. High chloride concentrations due to lateral intrusion of seawater occur in Flagler County (well F-0226, Appendix C). High chloride concentrations also occur in a transitional zone in Indian River County (well IR0350).

Sulfate

Sources of sulfate in groundwater are the dissolution of gypsum and anhydrite, the weathering of pyrite and iron sulfides, residual formation water, the lateral intrusion of seawater, precipitation (which contains sulfur oxides), and marine aerosols. The occurrence of sulfate depends upon the reduction-oxidation potential of the water. Sulfate reduction produces hydrogen sulfide, which is the cause of the rotten-egg odor in some wells. Sulfides may be oxidized to sulfates (Maddox et al. 1992).

Sulfate is regulated as a secondary drinking water standard, with a state standard for sulfate in groundwater of 250.0 mg/L. Waters with high sulfate concentrations can have a laxative effect on humans and are associated with an adverse taste. Sulfate-rich water also can be corrosive and harmful to plants and aquatic organisms.

Floridan Aquifer System. The median concentration of dissolved sulfate in the Floridan aquifer system was 10.7 mg/L, with a mean of 82.4 mg/L (Table 12, Figure 19). The minimum concentration of sulfate from the 168 wells sampled was 0.2 mg/L, and the maximum was 1,730.0 mg/L, with 93% of the wells having a sulfate concentration less than 250.0 mg/L. Twelve wells had sulfate concentrations exceeding the state standard of 250.0 mg/L.

Table 12. Summary of sulfate data by aquifer system (dissolved; milligrams per liter)

Aquifer System	Number of Wells Sampled	Number of Analyses	Mean	Standard Deviation	Min	25th Percentile	Median	75th Percentile	Max
Floridan	168	508	82.4	187.0	0.2	2.9	10.7	89.3	1,730.0
Intermediate	53	178	24.6	80.5	0.2	1.3	2.6	4.7	435.5
Surficial	94	389	16.3	31.7	0.2	2.3	5.0	13.8	200.0

Note: Min = minimum
Max = maximum

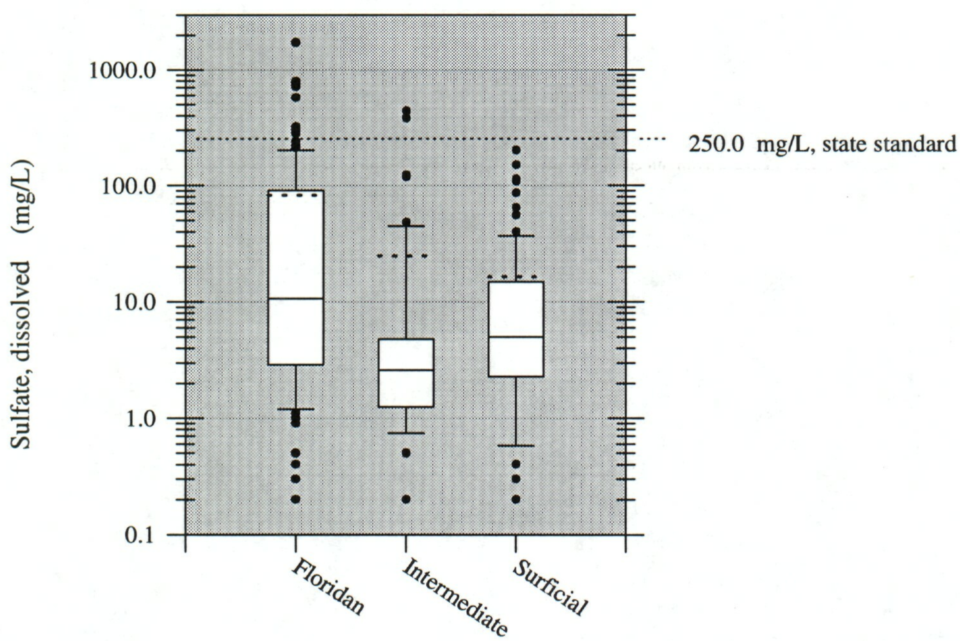

Figure 19. Boxplot of sulfate data by aquifer system

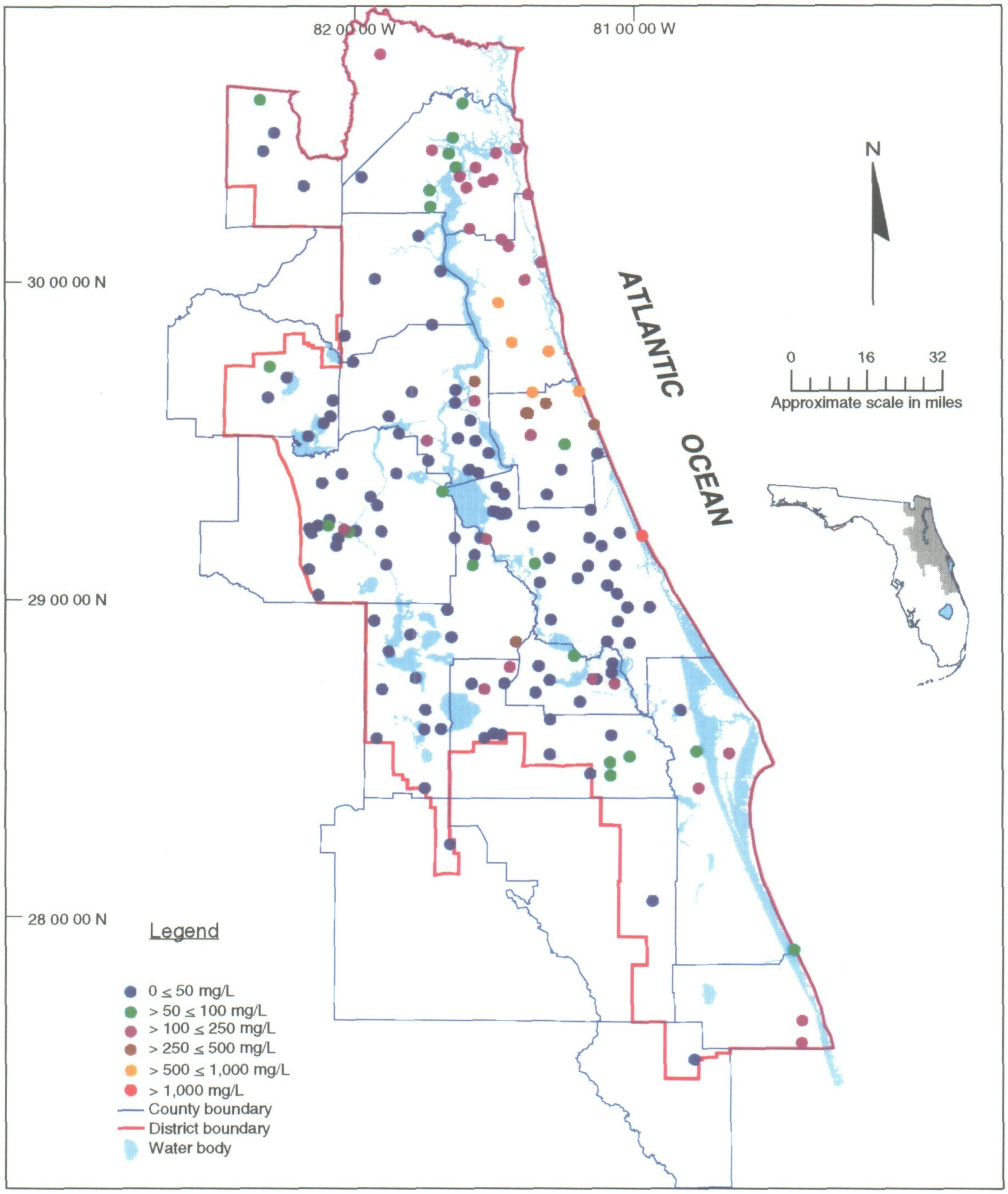

Figure 20. Areal distribution of sulfate in the Floridan aquifer system

Sulfate concentrations in the Floridan aquifer system increase with depth and toward the coast (Figure 20). Where water in the Floridan aquifer system travels along deep flow paths, it comes in contact with gypsum in the aquifer system. High sulfate concentrations in wells in Duval, Flagler, and St. Johns counties reflect gypsum and anhydrite dissolution (e.g., wells D-0296, F-0200, SJ0027, SJ0317, and SJ0516, Appendix C).

A high sulfate concentration due to the lateral intrusion of seawater occurs in well V-0200 (Appendix C).

Intermediate Aquifer System. The median concentration of dissolved sulfate in the intermediate aquifer system was 2.6 mg/L, with a mean of 24.6 mg/L (Table 12, Figure 19). The minimum concentration of sulfate from the 53 wells sampled was 0.2 mg/L, and the maximum was 435.5 mg/L, with 96% of the wells having a sulfate concentration less than 250.0 mg/L. Two wells had sulfate concentrations exceeding the state standard of 250.0 mg/L. The highest concentration was measured at well S-0041 (Appendix C) and is from the upwelling of water from deeper aquifers. The high sulfate concentration at well D-0013 is due to the lateral intrusion of seawater.

Surficial Aquifer System. The median concentration of dissolved sulfate in the surficial aquifer system was 5.0 mg/L, with a mean of 16.3 mg/L (Table 12, Figure 19). The minimum concentration of sulfate from the 94 wells sampled was 0.2 mg/L, and the maximum was 200.0 mg/L. All surficial wells sampled had sulfate concentrations below the state standard of 250.0 mg/L.

Alkalinity

Alkalinity is an indicator of the ability of water to react with and to neutralize acids. Alkalinity is produced by the reaction of carbon dioxide and water in the atmosphere or the soil zone, the dissolution of calcite and dolomite, and the oxidation of organic materials by microorganisms. Bicarbonate is the dominant anion in natural waters and is the dominant constituent of alkalinity (Maddox et al. 1992). As summarized in this report, alkalinity (as $CaCO_3$) includes bicarbonate [HCO_3^-], carbonate [CO_3^{2-}], and other anions that can be neutralized by a strong acid. There is no guidance concentration for alkalinity in groundwater.

Floridan Aquifer System. The median concentration of dissolved alkalinity (as $CaCO_3$) in the Floridan aquifer system was 146 mg/L, with a mean of 160 mg/L (Table 13, Figure 21). The minimum concentration of alkalinity from the 212 wells sampled was 22 mg/L, and the maximum was 375 mg/L. Alkalinity of the Floridan aquifer system is high due to the limestone and dolostone that comprise the aquifer. Waters that have traveled from recharge areas to discharge areas have high alkalinities because the waters have had more time to react with the aquifer materials (Figure 22).

Intermediate Aquifer System. The median concentration of dissolved alkalinity (as $CaCO_3$) in the intermediate aquifer system was 206 mg/L, with a mean of 195 mg/L (Table 13, Figure 21). The minimum concentration of alkalinity from the 58 wells sampled was 33 mg/L, and the maximum was 420 mg/L. High alkalinities in the intermediate aquifer system are due to the carbonate materials in the Hawthorn Group.

Surficial Aquifer System. The median concentration of dissolved alkalinity (as $CaCO_3$) in the surficial aquifer system was 91 mg/L, with a mean of 119 mg/L (Table 13, Figure 21). The minimum concentration of alkalinity from the 96 wells sampled was 1 mg/L, and the maximum was 414 mg/L. The alkalinity of the surficial aquifer system is low due to the absence of carbonate materials. Alkalinity increases toward the coast as the shell content of the aquifer increases.

Phosphate

Sources of phosphate (measured as orthophosphate) in groundwater are the dissolution of phosphate-rich sediments, organic sediments and plant materials, agricultural fertilizers, human waste effluent (such as from septic tank systems), and industrial effluent (Maddox et al. 1992). There is no guidance concentration for phosphate in groundwater.

Floridan Aquifer System. The median concentration of dissolved phosphate in the Floridan aquifer system was 0.30 mg/L, with a mean of 0.34 mg/L (Table 14, Figure 23). The minimum concentration of phosphate from the 101 wells sampled was 0.10 mg/L, and the maximum was 0.95 mg/L.

Table 13. Summary of alkalinity data by aquifer system (dissolved; milligrams per liter as $CaCO_3$)

Aquifer System	Number of Wells Sampled	Number of Analyses	Mean	Standard Deviation	Min	25th Percentile	Median	75th Percentile	Max
Floridan	212	969	160	68	22	114	146	194	375
Intermediate	58	256	195	80	33	133	206	265	420
Surficial	96	477	119	110	1	24	91	192	414

Note: $CaCO_3$ = calcium carbonate
Min = minimum
Max = maximum

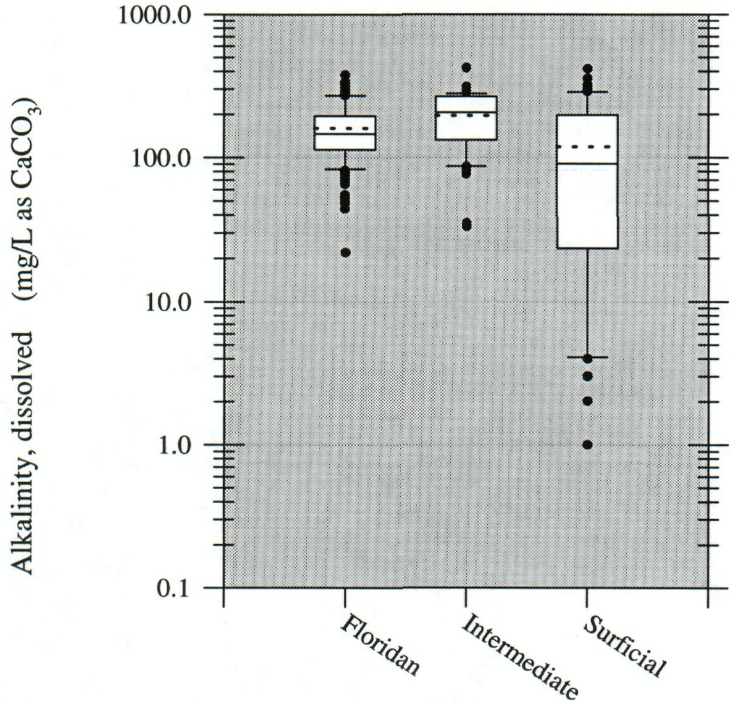

Figure 21. Boxplot of alkalinity data (as calcium carbonate) by aquifer system

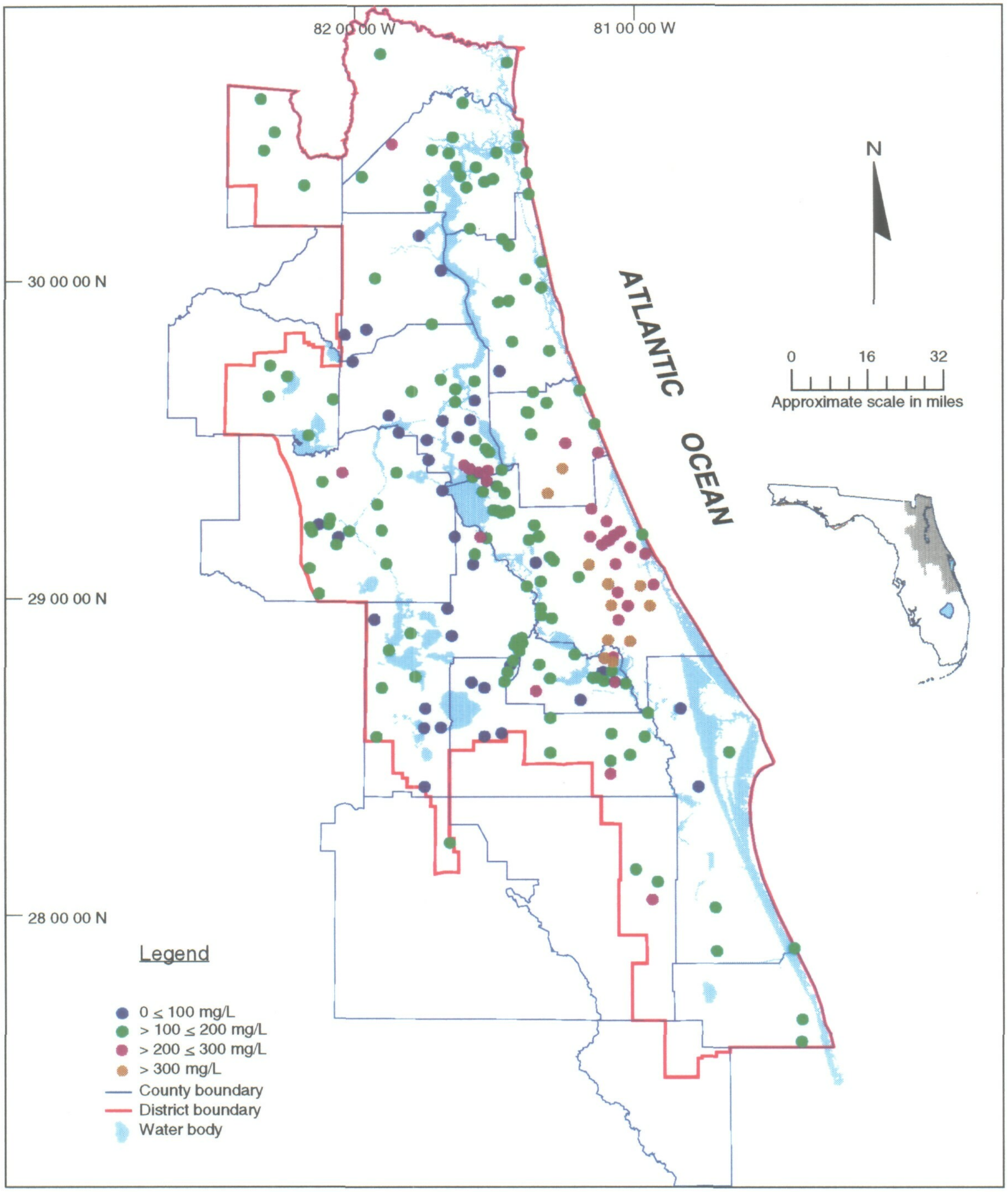

Figure 22. Areal distribution of alkalinity in the Floridan aquifer system

Table 14. Summary of phosphate data by aquifer system (dissolved; milligrams per liter)

Aquifer System	Number of Wells Sampled	Number of Analyses	Mean	Standard Deviation	Min	25th Percentile	Median	75th Percentile	Max
Floridan	101	209	0.34	0.20	0.10	0.20	0.30	0.49	0.95
Intermediate	32	81	0.21	0.29	0.01	0.05	0.08	0.31	1.48
Surficial	62	172	0.16	0.23	0.01	0.04	0.07	0.18	1.25

Note: Min = minimum
Max = maximum

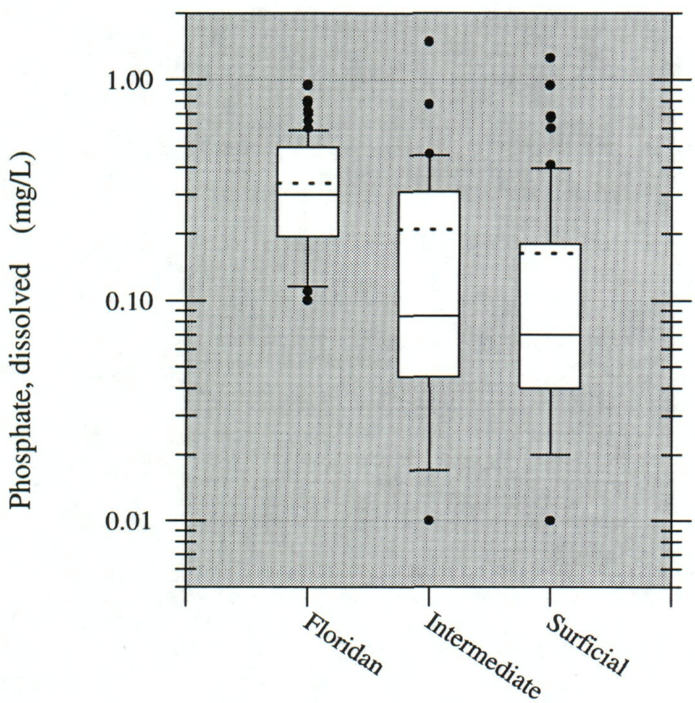

Figure 23. Boxplot of phosphate data by aquifer system

Intermediate Aquifer System. The median concentration of dissolved phosphate in the intermediate aquifer system was 0.08 mg/L, with a mean of 0.21 mg/L (Table 14, Figure 23). The minimum concentration of phosphate from the 32 wells sampled was 0.01 mg/L. The maximum concentration of phosphate was 1.48 mg/L, at well A-0697 (Appendix C).

Surficial Aquifer System. The median concentration of dissolved phosphate in the surficial aquifer system was 0.07 mg/L, with a mean of 0.16 mg/L (Table 14, Figure 23). The minimum concentration of phosphate from the 62 wells sampled was 0.01 mg/L. The maximum concentration of phosphate was 1.25 mg/L, at well M-0211 (Appendix C).

Nitrate and Nitrite

Nitrogen compounds occur in groundwater as a result of specific land uses, the leaching of organic soils, and precipitation. Sources of nitrogen include agricultural fertilizers, animal wastes, and human wastes. Nitrogen is transformed between organic nitrogen (as total Kjeldahl nitrogen), ammonium [NH_4^+], nitrite [NO_2^-], nitrate [NO_3^-], and other nitrogen compounds, depending on oxidation-reduction conditions, microbial activity, and plant utilization. Once nitrogen compounds leave near-surface environments where these compounds are used, converted, and/or removed, the compounds can persist and move long distances in aquifers (Maddox et al. 1992).

Nitrate and nitrite (NO_X) is regulated as a primary drinking water standard, with a state standard for total NO_X in groundwater of 10.00 mg/L. Although NO_X (as nitrogen) is the parameter typically reported and used in this report, nitrite is readily converted to nitrate in oxidizing conditions. There is a health advisory for nitrate at 1.00 mg/L.

Floridan Aquifer System. The median concentration of dissolved NO_X in the Floridan aquifer system was 0.27 mg/L, with a mean of 0.57 mg/L (Table 15, Figure 24). The minimum concentration of NO_X from the 156 wells sampled was 0.05 mg/L. The maximum concentration of NO_X was 16.10 mg/L, in well V-0156 (Appendix C), which is located in a fern agricultural area.

Table 15. Summary of nitrate and nitrite data by aquifer system (dissolved; milligrams per liter)

Aquifer System	Number of Wells Sampled	Number of Analyses	Mean	Standard Deviation	Min	25th Percentile	Median	75th Percentile	Max
Floridan	156	505	0.57	1.46	0.05	0.20	0.27	0.45	16.10
Intermediate	54	192	0.27	0.81	0.01	0.02	0.04	0.16	5.80
Surficial	96	398	0.43	1.29	0.01	0.02	0.04	0.26	11.10

Note: Min = minimum
Max = maximum

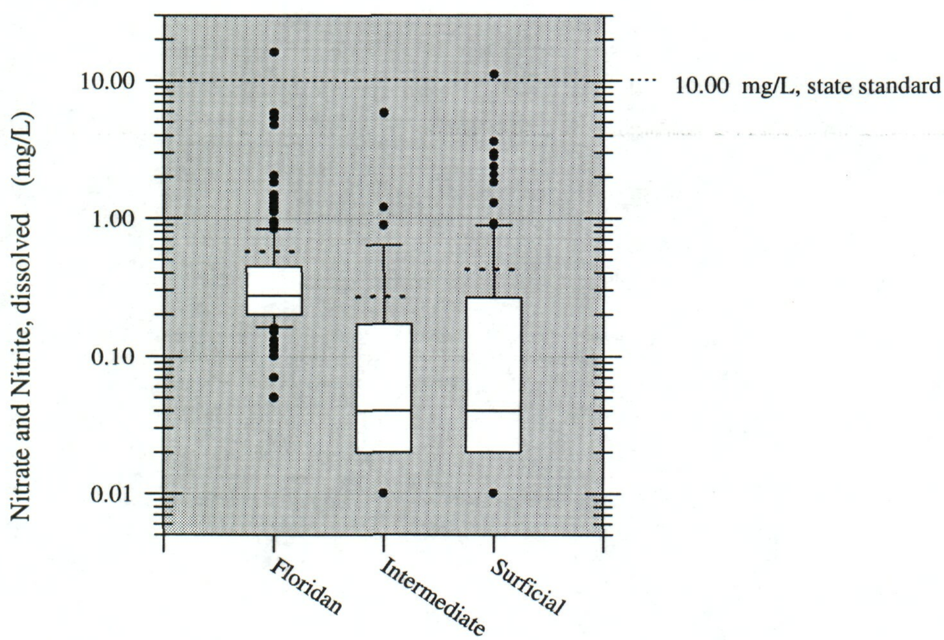

Figure 24. Boxplot of nitrate and nitrite data by aquifer system

Although only one well in the Floridan aquifer system had an NO_x concentration above 10.00 mg/L, the low nitrate levels in the sampled wells do not mean that there are no nitrate contamination problems in the Floridan aquifer system in SJRWMD. Nitrate contamination problems, some of which have been documented, are localized problems.

Intermediate Aquifer System. The median concentration of dissolved NO_x in the intermediate aquifer system was 0.04 mg/L, with a mean of 0.27 mg/L (Table 15, Figure 24). The minimum concentration of NO_x from the 54 wells sampled was 0.01 mg/L. The maximum concentration of NO_x was 5.80 mg/L, in well V-0114 (Appendix C). No intermediate aquifer system wells exceeded the state standard of 10.00 mg/L.

Surficial Aquifer System. The median concentration of dissolved NO_x in the surficial aquifer system was 0.04 mg/L, with a mean of 0.43 mg/L (Table 15, Figure 24). The minimum concentration of NO_x from the 96 wells sampled was 0.01 mg/L. The maximum concentration of NO_x was 11.10 mg/L, in well PO0002 (Appendix C), which is located in a cow pasture.

Although only one well in the surficial aquifer had an NO_x concentration above 10.00 mg/L, the low nitrate levels in the sampled wells do not mean that there are no nitrate contamination problems in the surficial aquifer system in SJRWMD. Nitrate contamination problems, some of which have been documented, are localized problems.

Fluoride

Fluoride in Florida's aquifer systems is derived from the weathering of carbonate-fluorapatite in the Hawthorn Group or from the mixing of seawater with groundwater (Maddox et al. 1992). The primary drinking water standard for fluoride, which addresses toxicity, is 4.00 mg/L. The secondary drinking water standard is 2.00 mg/L, which addresses fluorosis, or the darkening and mottling of teeth. In amounts less than 1.00 mg/L, fluoride is considered beneficial for preventing cavities.

Floridan Aquifer System. The median concentration of dissolved fluoride in the Floridan aquifer system was 0.22 mg/L, with a mean of 0.34 mg/L (Table 16, Figure 25). The minimum concentration of fluoride from the 201 wells sampled was 0.10 mg/L, and the maximum was 1.00 mg/L. No wells penetrating the Floridan aquifer system exceeded the state standards.

Intermediate Aquifer System. The median concentration of dissolved fluoride in the intermediate aquifer system was 0.20 mg/L, with a mean of 0.28 mg/L (Table 16, Figure 25). The minimum concentration of fluoride from the 57 wells sampled was 0.10 mg/L, and the maximum was 1.90 mg/L. No wells penetrating the intermediate aquifer system exceeded the state standards.

Surficial Aquifer System. The median concentration of dissolved fluoride in the surficial aquifer system was 0.10 mg/L, with a mean of 0.16 mg/L (Table 16, Figure 25). The minimum concentration of fluoride from the 97 wells sampled was 0.04 mg/L, and the maximum was 0.80 mg/L. No wells penetrating the surficial aquifer system exceeded the state standards.

CHEMICALLY RELATED PARAMETERS

The chemically related parameters include total dissolved solids (TDS) and hardness. These "kinds of data...are included in many water analyses but are not readily definable in terms of single, specific, chemical components. They may be properties resulting from the combined effects of several constituents, or they may be general evaluations of water quality that have been developed as empirical indices for certain purposes" (Hem 1985).

Total Dissolved Solids

Dissolved solids in groundwater are the result of mineral dissolution. TDS is a general measure of the total mass of ions dissolved in water and is usually determined from the weight of the dry residue remaining after evaporation of the volatile portion of an aliquot of the sample (Maddox et al. 1992). TDS concentrations are higher for water from an aquifer comprised of reactive materials, such as limestone, than from an aquifer composed of quartz sand materials, which are

Table 16. Summary of fluoride data by aquifer system (dissolved; milligrams per liter)

Aquifer System	Number of Wells Sampled	Number of Analyses	Mean	Standard Deviation	Min	25th Percentile	Median	75th Percentile	Max
Floridan	201	1,102	0.34	0.25	0.10	0.15	0.22	0.50	1.00
Intermediate	57	230	0.28	0.29	0.10	0.11	0.20	0.31	1.90
Surficial	97	454	0.16	0.14	0.04	0.10	0.10	0.16	0.80

Note: Min = minimum
Max = maximum

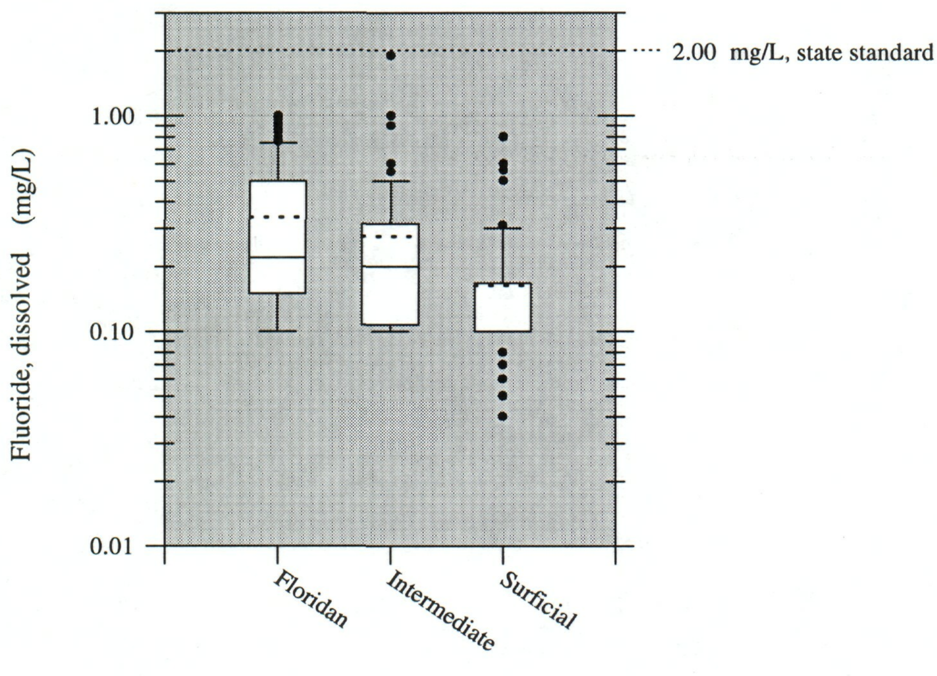

Figure 25. Boxplot of fluoride data by aquifer system

relatively inert. Water with low concentrations of TDS is common to recharge areas. Water that has recently entered an aquifer has had less time to dissolve minerals than has water that has traveled for some greater distance through the aquifer.

TDS is regulated as a secondary drinking water standard, with a state standard for TDS in groundwater of 500.0 mg/L. Water with a high TDS concentration may have an unpleasant taste, may contribute to the development of kidney stones, and may result in scale or precipitates in hot water heaters.

Floridan Aquifer System. The median concentration of TDS in the Floridan aquifer system was 329 mg/L, with a mean of 767 mg/L (Table 17, Figure 26). The minimum concentration of TDS from the 215 wells sampled was 37 mg/L, and the maximum was 18,211 mg/L, with 69% of the wells having a TDS concentration less than 500.0 mg/L. Sixty-seven wells had TDS concentrations exceeding the state standard of 500.0 mg/L. TDS generally increases along flow paths with increased residence time. The highest concentrations are measured in deep wells, wells located in or near discharge areas, or wells in the coastal transition zone (Figures 27 and 2).

High TDS concentrations due to the mixing of fresh groundwater with residual formation water high in dissolved solids that have not been flushed from the aquifer occur in Brevard, Flagler, and St. Johns counties (e.g., wells BR0202, F-0200, and SJ0516, Appendix C). These high concentrations also reflect the increased mineralization of the water as it moves along flow paths from recharge to discharge areas.

High TDS concentrations in the Floridan aquifer system also occur along the St. Johns River in the central part of SJRWMD and along the lower Wekiva River (Figure 27) due to the upwelling of residual seawater (e.g., wells BR0660, S-0025, S-0097, and V-0083, Appendix C). There is a transitional zone between fresh groundwater and residual seawater.

High TDS concentrations due to the lateral intrusion of seawater occur in and around well V-0200 (Appendix C). Well V-0508 (which is near well V-0200) is located along the coast where fresh groundwater mixes with intruded seawater.

Table 17. Summary of total dissolved solids data by aquifer system (milligrams per liter)

Aquifer System	Number of Wells Sampled	Number of Analyses	Mean	Standard Deviation	Min	25th Percentile	Median	75th Percentile	Max
Floridan	215	1,207	767	1,680	37	180	329	582	18,211
Intermediate	60	211	656	1,326	59	200	303	385	8,218
Surficial	101	360	278	362	21	95	186	341	2,610

Note: Min = minimum
Max = maximum

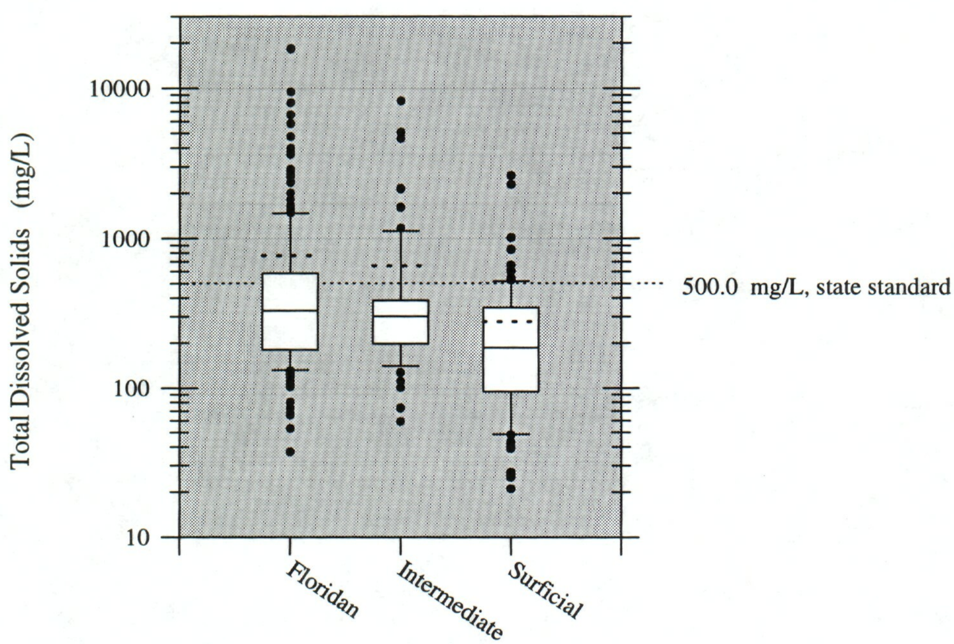

Figure 26. Boxplot of total dissolved solids data by aquifer system

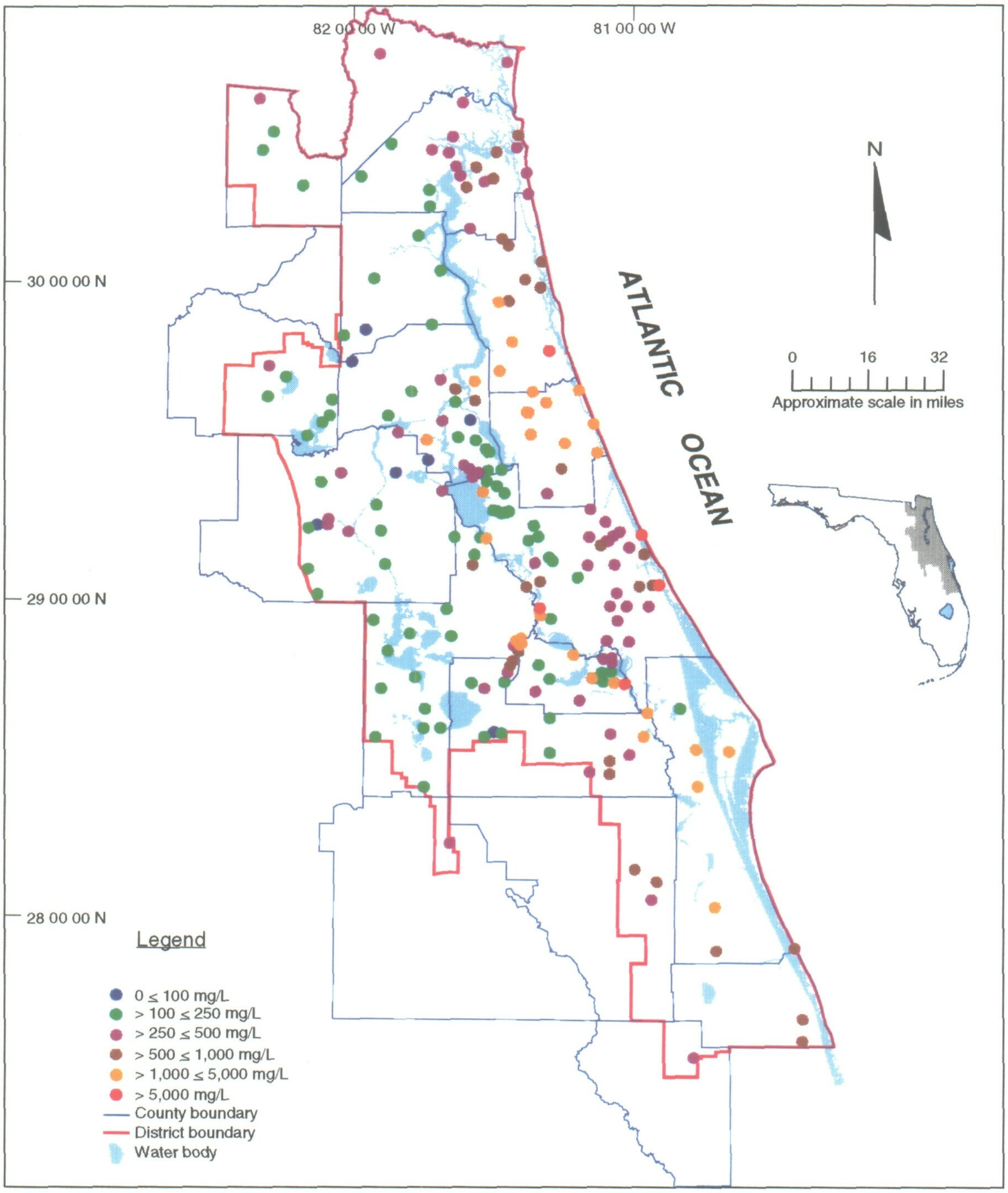

Figure 27. Areal distribution of total dissolved solids in the Floridan aquifer system

Intermediate Aquifer System. The median concentration of TDS in the intermediate aquifer system was 303 mg/L, with a mean of 656 mg/L (Table 17, Figure 26). The minimum concentration of TDS from the 60 wells sampled was 59 mg/L, and the maximum was 8,218 mg/L, with 83% of the wells having a TDS concentration less than 500.0 mg/L. Ten wells had TDS concentrations exceeding the state standard of 500.0 mg/L. High concentrations of TDS are due to seawater intrusion (e.g., wells BR0903, D-0013, and F-0174, Appendix C).

Surficial Aquifer System. The median concentration of TDS in the surficial aquifer system was 186 mg/L, with a mean of 278 mg/L (Table 17, Figure 26). The minimum concentration of TDS from the 101 wells sampled was 21 mg/L, and the maximum was 2,610 mg/L, with 89% of the wells having a TDS concentration less than 500.0 mg/L. Eleven wells had TDS concentrations exceeding the state standard of 500.0 mg/L. The highest concentrations of TDS are due to seawater intrusion or are located in the transition zone between fresh groundwater and seawater (e.g., well F-0226, Appendix C).

Hardness

Hardness is caused by the presence of calcium and/or magnesium ions in water and is expressed as an equivalent quantity of $CaCO_3$. Calcium and magnesium can interfere with the activity of soaps and detergents, and hard water can precipitate mineral residues in hot water heaters, boilers, and humidifiers. Evaporation of hard water causes scale on plumbing fixtures, on dishes, and in swimming pools. There is no guidance concentration for the hardness of groundwater. The range of hardness for water has been classified as soft (0–60 mg/L), moderately hard (61–120 mg/L), hard (121–180 mg/L), and very hard (greater than 180 mg/L) (Hem 1985).

Floridan Aquifer System. The median total hardness of water in the Floridan aquifer system was 221 mg/L, with a mean of 304 mg/L (Table 18, Figure 28). The minimum hardness from the 160 wells sampled was 23 mg/L. The maximum hardness was 4,466 mg/L, in well V-0200 (Appendix C). Almost 80% of the wells had hard or very hard water. Water in the Floridan aquifer system is characteristically hard due to the limestones and dolomites that comprise the aquifer (Figure 29).

Table 18. Summary of hardness data by aquifer system (in milligrams per liter as $CaCO_3$)

Aquifer System	Number of Wells Sampled	Number of Analyses	Mean	Standard Deviation	Min	25th Percentile	Median	75th Percentile	Max
Floridan	160	339	304	419	23	135	221	305	4,466
Intermediate	49	112	254	230	36	134	224	297	1,415
Surficial	88	229	131	140	4	27	80	213	750

Note: $CaCO_3$ = calcium carbonate
Min = minimum
Max = maximum

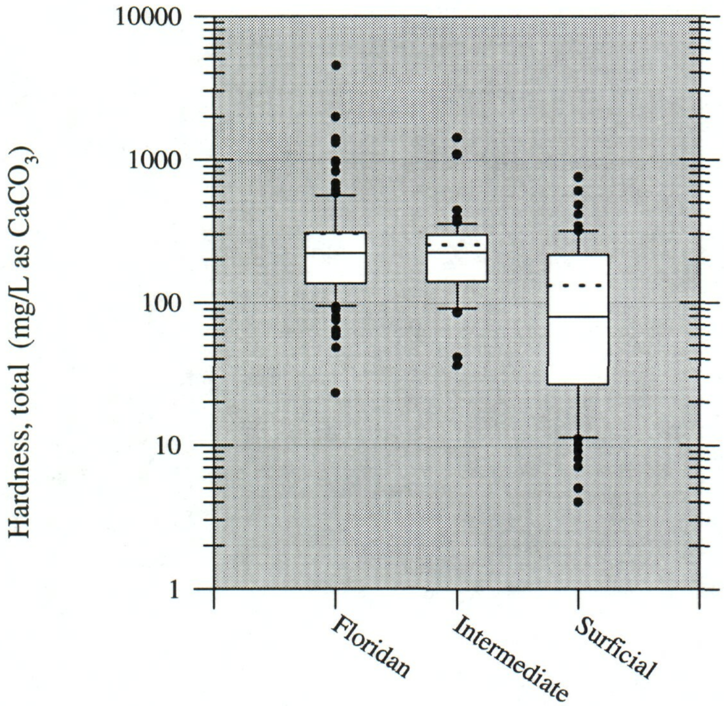

Figure 28. Boxplot of hardness data (as calcium carbonate) by aquifer system

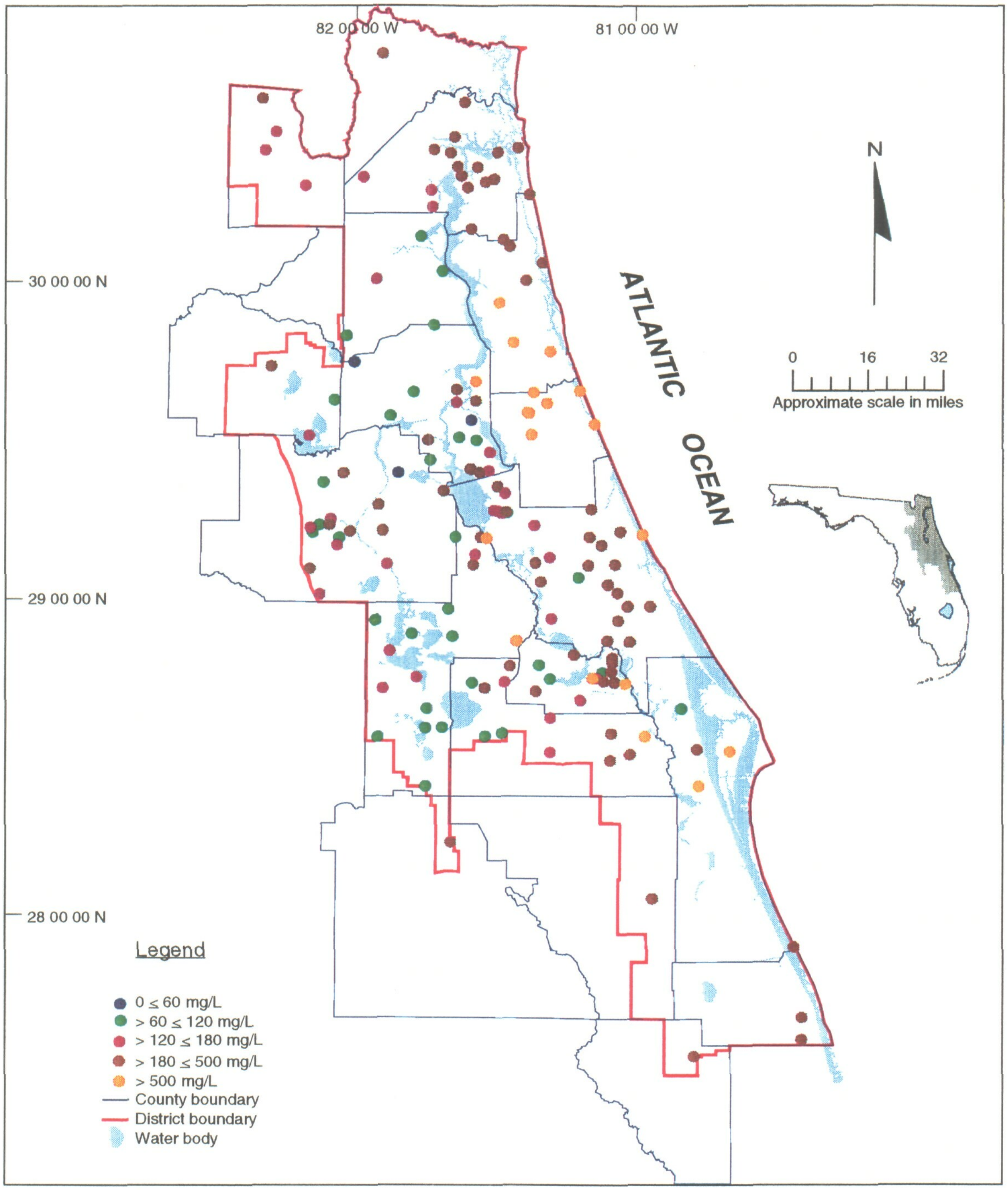

Figure 29. Areal distribution of hardness in the Floridan aquifer system

Intermediate Aquifer System. The median total hardness of water in the intermediate aquifer system was 224 mg/L, with a mean of 254 mg/L (Table 18, Figure 28). The minimum hardness from the 49 wells sampled was 36 mg/L. The maximum hardness was 1,415 mg/L, in well D-0013 (Appendix C). About 80% of the wells had hard or very hard water.

Surficial Aquifer System. The median total hardness of water in the surficial aquifer system was 80 mg/L, with a mean of 131 mg/L (Table 18, Figure 28). The minimum hardness from the 88 wells sampled was 4 mg/L. The maximum hardness was 750 mg/L, in well F-0226 (Appendix C). About 40% of the wells had hard or very hard water.

DATA SUMMARY

The data summarized in this report represent an evaluation of groundwater quality conditions in the Floridan, intermediate, and surficial aquifer systems in SJRWMD from wells sampled in 1990 through 1994. The data were compiled from well networks that are generally designed to monitor water quality in an area that is representative of the regional water quality conditions in an aquifer system. Although well coverage does not provide sufficient data for site-specific assessments in SJRWMD for each aquifer, the data are useful for characterizing regional groundwater quality conditions. The data could be used as a baseline against which future water quality conditions can be compared. The data also can be used to check on whether the water quality of an aquifer in an area is suitable for the intended use.

The data for the concentrations of selected water quality constituents are summarized for the Floridan, intermediate, and surficial aquifer systems as boxplots (Figure 30). For all cations and anions, except alkalinity in the intermediate aquifer system, the mean concentration exceeded the median concentration (Table 2), suggesting that high concentrations were influencing the mean and that the median concentration is a better estimate of water quality.

The regional conditions of the water in an aquifer are a result of natural systems and human-influenced conditions. Natural systems affect water quality in an aquifer by means of recharge to and discharge from the aquifer, the dissolution of minerals, flow paths, residence times, and the mixing of fresh groundwater with residual formation water or intruded seawater. Human-influenced conditions include aquifer degradation based on activities at land surface and the upconing of water with high dissolved solids composition from deep zones due to groundwater withdrawals. Another human-influenced condition is the introduction of irrigation water from deep aquifers to surface systems; excess irrigation water from the deep aquifer may infiltrate down to near-surface systems.

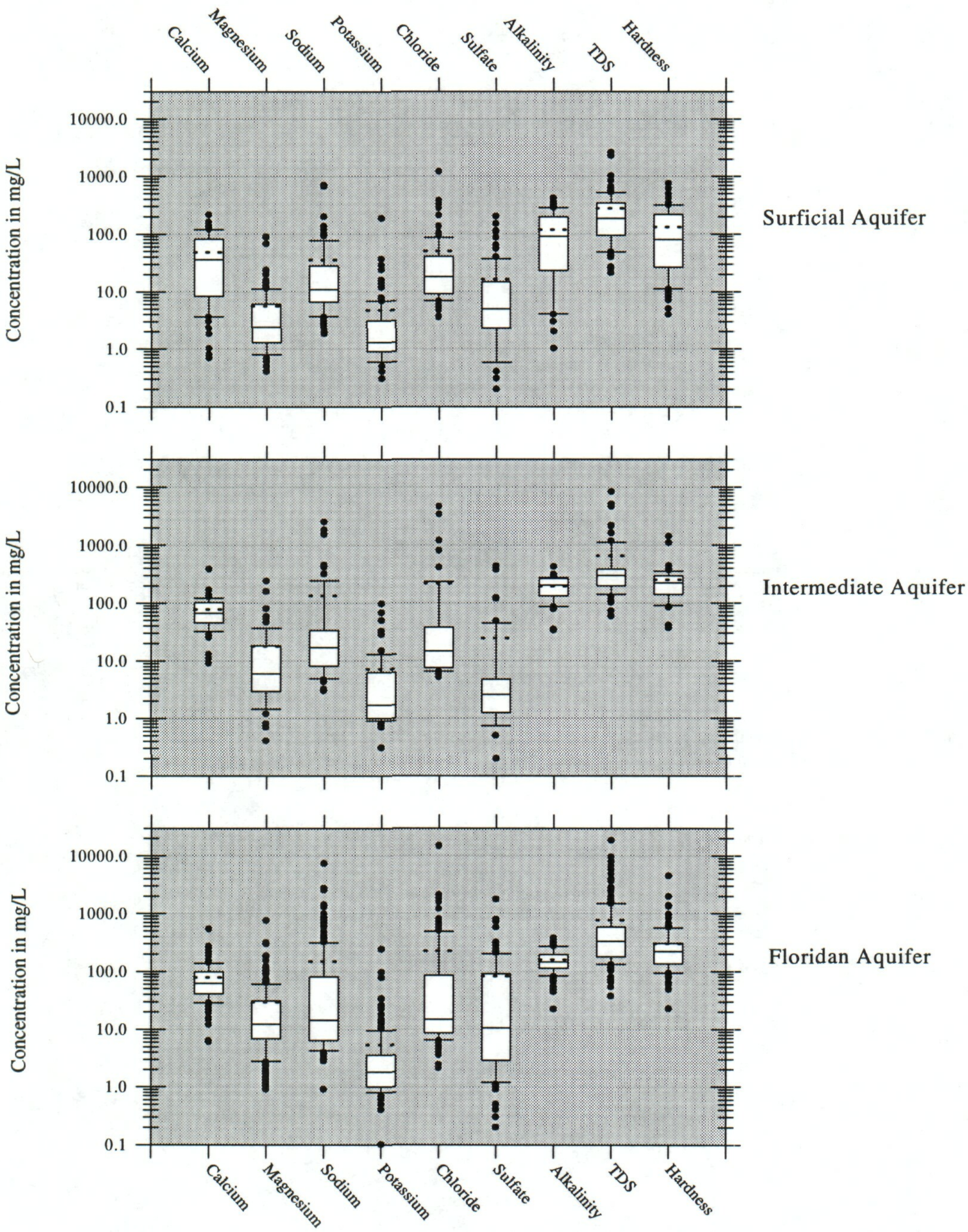

Figure 30. Boxplots of concentrations of major cations, major anions, and chemically related properties in the Floridan, intermediate, and surficial aquifer systems

FLORIDAN AQUIFER SYSTEM

The chemical composition of water in the Floridan aquifer system in recharge areas is characteristically low in concentrations of calcium, magnesium, chloride, sulfate, TDS, $CaCO_3$ (i.e., hardness), and other constituents (Figures 9, 11, 18, 20, 27, and 29, respectively). In these recharge areas (Figure 2), residence times for water in the Floridan aquifer system are relatively short. The water has not reached equilibrium conditions with aquifer materials. Water quality conditions typically reflect water quality in the surficial aquifer system, climatic conditions, soil types, and human activities.

As water in the Floridan aquifer system moves along flow paths from recharge to discharge areas, the increasing residence times allow more opportunity for the chemical composition of the water to be altered and for chemical reactions between the water and aquifer materials to reach equilibrium. The water in the Floridan aquifer system in and near discharge areas is composed mainly of calcium, magnesium, chloride, and sulfate (Figures 9, 11, 18, and 20, respectively). Typically high TDS concentrations, hardness values, and pH also occur in these areas (Figures 27 and 29, respectively). Where water in the Floridan aquifer system travels along deep flow paths, it comes in contact with gypsum in the aquifer system. Sulfate concentrations are notably high in discharge areas, such as in southern Duval and northern St. Johns counties (Figure 20), because of the gypsum dissolution. Hydraulic pressure conditions in discharge areas result in upward leakage of highly mineralized water into overlying formations or in direct upward movement of water through faults, fractures, or relict karst features in the aquifer formations.

The mixing of fresh water in the Floridan aquifer system with residual formation water still present in the aquifer results in water composed mainly of calcium, magnesium, sodium, chloride, and sulfate. This type of water occurs in the Floridan aquifer system in St. Johns County south of St. Augustine, in northern and central parts of Flagler County, and in eastern parts of Brevard Counties (Figures 1, 9, 11, 13, 18, and 20). In these areas, the highly mineralized residual formation waters of the Floridan aquifer system have not been replaced by fresh recharge waters. Lower artesian pressures in the Floridan aquifer system due to water withdrawals also result in the upward movement of highly mineralized formation water in the tri-county agricultural area of

St. Johns, Flagler, and Putnam counties (Figure 1). A transition zone between the residual formation water and fresh groundwater occurs on the borders of these mixing areas.

The mixing of fresh water in the Floridan aquifer system with upwelling residual seawater along parts of the St. Johns River also results in water composed mainly of calcium, magnesium, sodium, chloride, and sulfate. This upwelling of highly mineralized water into the upper parts of the Floridan aquifer system occurs in discharge areas along the St. Johns River in parts of Brevard, Seminole, Orange, Lake, and Volusia counties (Figures 1, 9, 11, 13, 18, and 20). A transition zone between the upwelling residual seawater in discharge areas and fresh groundwater in recharge areas occurs to the east and west of the St. Johns River.

The mixing of fresh water in the Floridan aquifer system with laterally intruded seawater from the Atlantic Ocean occurs near Daytona Beach Shores (south of Daytona Beach in Volusia County). This mixing results in water composed mainly of sodium, chloride, calcium, magnesium, and sulfate (Figures 1, 9, 11, 13, 18, 20). High concentrations of TDS and $CaCO_3$ (i.e., hardness) also occur in this area (Figures 27 and 29). A transition zone between the intruded seawater and fresh groundwater or residual formation water also occurs in other areas along the coast. As the water levels in the Floridan aquifer system decline due to changes in hydrologic conditions and increased water withdrawals, the depth to the interface between fresh groundwater and seawater decreases.

INTERMEDIATE AQUIFER SYSTEM

The wide range in concentrations of calcium, magnesium, sodium, potassium, chloride, sulfate, and TDS in the intermediate aquifer system reflects the diverse sediments that comprise the aquifer materials with which the water comes into contact (Figure 30). High concentrations of these constituents mean that water has been in contact with carbonates and clays over long periods of time. Areas along the coast with high concentrations of calcium, magnesium, sodium, chloride, sulfate, and TDS are characteristic of lateral intrusion of seawater in Brevard, Duval, Flagler, and Nassau counties. High concentrations of these variables along parts of the St. Johns River are due to the upwelling of highly mineralized water from the underlying Floridan aquifer system.

The chemical composition of water in the intermediate aquifer system reflects recharge from the overlying surficial aquifer system or the underlying Floridan aquifer system, aquifer mineralogy and lithology, residence time, and proximity to coastal areas. The flow paths of water through the intermediate aquifer system can be complex, and residence times can vary. Long residence times are characteristic of areas where the Hawthorn Group sediments are relatively thick and comprised mostly of clay and fine-grained materials. Where the Hawthorn Group is breached by sinkholes and fractures, residence times may be short.

SURFICIAL AQUIFER SYSTEM

Water from the surficial aquifer system is generally soft, contains fewer dissolved minerals, has a low pH, and has more iron than water from the deeper artesian aquifers. Chloride concentrations are low, except in those areas where the surficial aquifer system has been intruded by seawater from the coast or in those areas where water has moved from deep aquifers due to upward leakage.

The chemical composition of water in the surficial aquifer system reflects the quality of recharge water, aquifer mineralogy and lithology, residence time, proximity to coastal areas, and human influences. Although precipitation provides most of the recharge to the surficial aquifer system, some recharge occurs due to leakage from underlying aquifers and from infiltration of excess irrigation water. The relatively short flow paths and residence times typical of the surficial aquifer system result in water having less contact with aquifer minerals and less opportunity for the chemical composition to be altered. Where the surficial aquifer system is composed mostly of quartz sand, concentrations of TDS and other constituents are low. Where the aquifer is composed of clay, shell, or organic materials, TDS concentrations are high.

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Appendix A—Cross Reference of Identification Number to Well Station Name

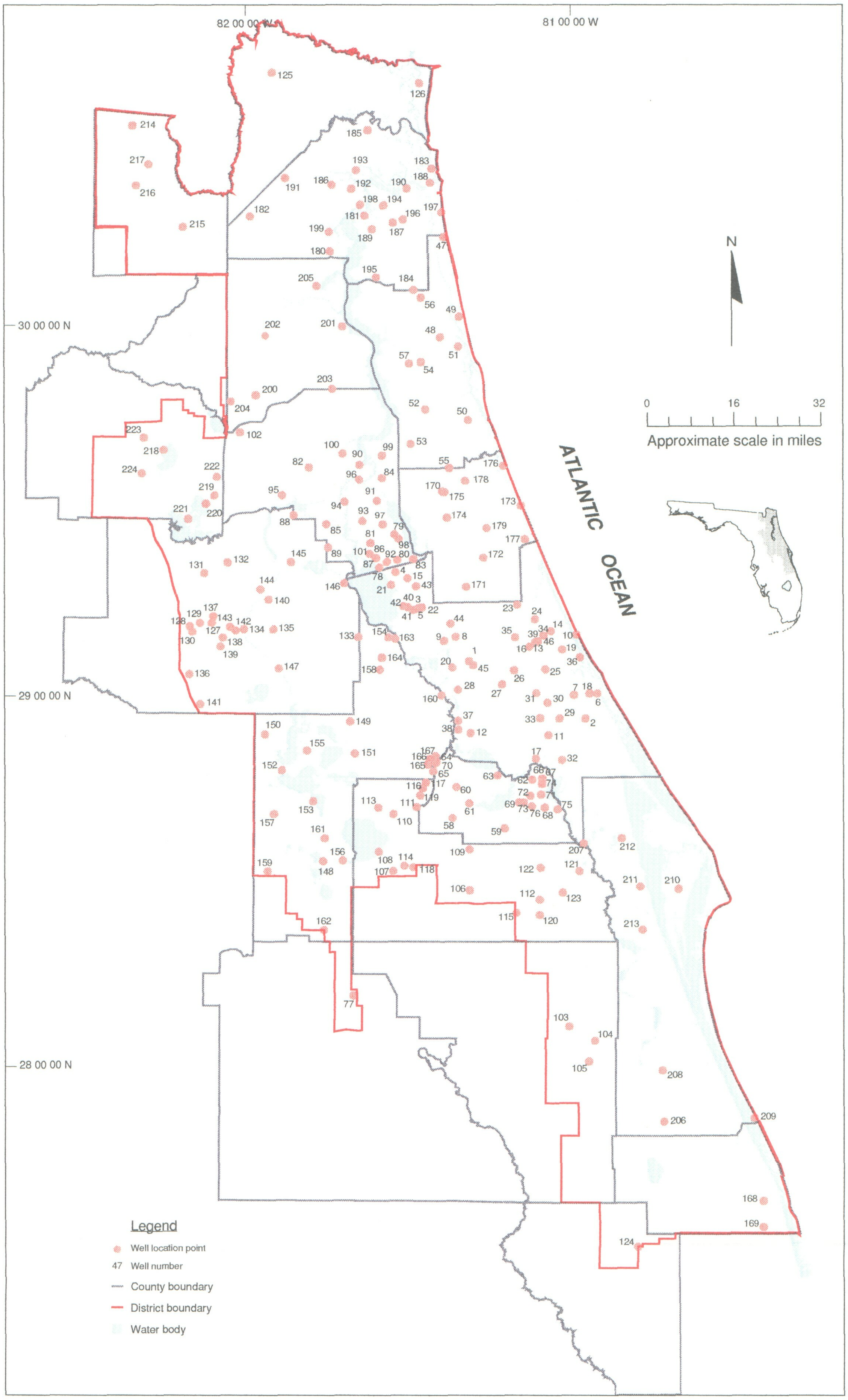

Figure A1. Location of wells monitoring the Floridan aquifer system (see Table A1)

Table A1. Wells in the Floridan aquifer system (see Figure A1)

Map Identification Number	Well Station Name	Map Identification Number	Well Station Name	Map Identification Number	Well Station Name
224	A-0018	180	D-4609	136	M-0041
223	A-0043	179	F-0087	135	M-0044
222	A-0071	178	F-0165	134	M-0048
221	A-0694	177	F-0176	133	M-0049
220	A-0695	176	F-0200	132	M-0052
219	A-0696	175	F-0204	131	M-0063
218	A-0699	174	F-0206	130	M-0208
217	BA0009	173	F-0225	129	M-0213
216	BA0018	172	F-0240	128	M-0243
215	BA0054	171	F-0251	127	M-0322
214	BA0057	170	F-0294	126	N-0128
213	BR0202	169	IR0312	125	N-0199
212	BR0585	168	IR0313	124	OK0001
211	BR0586	167	L-0032	123	OR0003
210	BR0608	166	L-0037	122	OR0007
209	BR0625	165	L-0038	121	OR0013
208	BR0645	164	L-0040	120	OR0025
207	BR0660	163	L-0045	119	OR0035
206	BR0925	162	L-0051	118	OR0047
205	C-0094	161	L-0053	117	OR0060
204	C-0120	160	L-0059	116	OR0068
203	C-0123	159	L-0062	115	OR0082
202	C-0128	158	L-0066	114	OR0101
201	C-0373	157	L-0095	113	OR0106
200	C-0380	156	L-0199	112	OR0265
199	D-0075	155	L-0290	111	OR0548
198	D-0090	154	L-0455	110	OR0554
197	D-0160	153	L-0591	109	OR0555
196	D-0224	152	L-0592	108	OR0558
195	D-0296	151	L-0593	107	OR0559
194	D-0313	150	L-0594	106	OR0560
193	D-0329	149	L-0595	105	OS0004
192	D-0336	148	L-0596	104	OS0017
191	D-0348	147	M-0013	103	OS0031
190	D-0360	146	M-0021	102	P-0001
189	D-0450	145	M-0024	101	P-0102
188	D-0464	144	M-0025	100	P-0123
187	D-0547	143	M-0026	99	P-0172
186	D-0592	142	M-0028	98	P-0242
185	D-0673	141	M-0031	97	P-0246
184	D-0909	140	M-0036	96	P-0270
183	D-0913	139	M-0037	95	P-0306
182	D-1342	138	M-0038	94	P-0395
181	D-425T	137	M-0039	93	P-0408

Table A1—*Continued*

Map Identification Number	Well Station Name	Map Identification Number	Well Station Name	Map Identification Number	Well Station Name
92	P-0410	61	S-0829	30	V-0111
91	P-0413	60	S-0972	29	V-0113
90	P-0418	59	S-0973	28	V-0115
89	P-0427	58	S-1014	27	V-0118
88	P-0450	57	SJ0027	26	V-0120
87	P-0468	56	SJ0029	25	V-0123
86	P-0469	55	SJ0115	24	V-0127
85	P-0472	54	SJ0119	23	V-0130
84	P-0474	53	SJ0263	22	V-0147
83	P-0495	52	SJ0317	21	V-0155
82	P-0510	51	SJ0412	20	V-0156
81	P-0691	50	SJ0516	19	V-0162
80	P-0696	49	SJ0548	18	V-0164
79	P-0719	48	SJ0753	17	V-0165
78	P-0736	47	SJ0754	16	V-0183
77	PO0001	46	V-0008	15	V-0184
76	S-0001	45	V-0028	14	V-0187
75	S-0025	44	V-0062	13	V-0188
74	S-0026	43	V-0064	12	V-0196
73	S-0028	42	V-0065	11	V-0198
72	S-0033	41	V-0066	10	V-0200
71	S-0034	40	V-0068	9	V-0213
70	S-0037	39	V-0080	8	V-0215
69	S-0038	38	V-0082	7	V-0381
68	S-0042	37	V-0083	6	V-0508
67	S-0086	36	V-0085	5	V-0531
66	S-0087	35	V-0086	4	V-0567
65	S-0091	34	V-0099	3	V-0569
64	S-0097	33	V-0101	2	V-0614
63	S-0257	32	V-0103	1	V-0742
62	S-0305	31	V-0106		

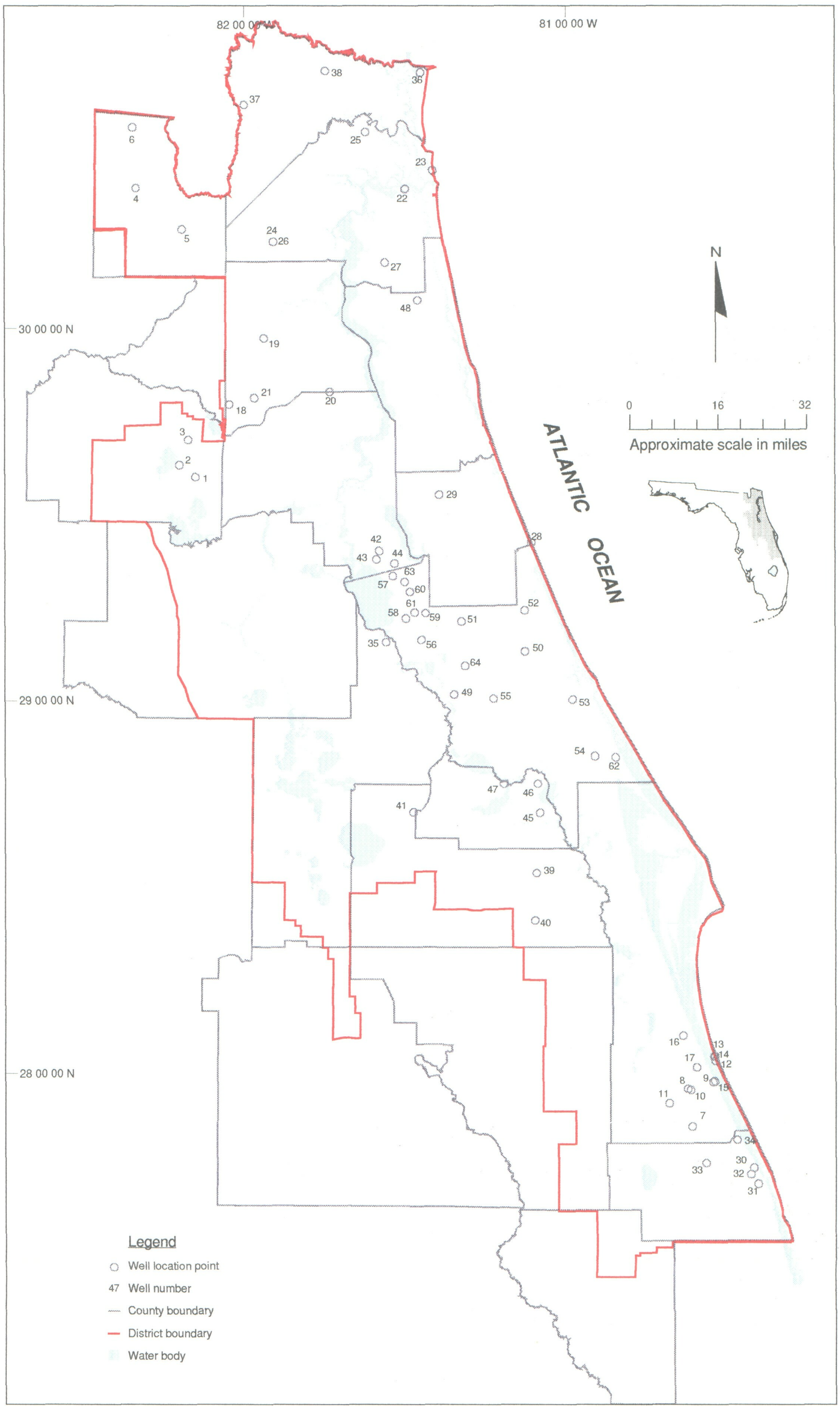

Figure A2. Location of wells monitoring the intermediate aquifer system (see Table A2)

Table A2. Wells in the intermediate aquifer system (see Figure A2)

Map Identification Number	Well Station Name	Map Identification Number	Well Station Name
1	A-0697	33	IR0287
2	A-0698	34	IR0289
3	A-0700	35	L-0458
4	BA0020	36	N-0019
5	BA0055	37	N-0110
6	BA0058	38	N-0201
7	BR0634	39	OR0008
8	BR0753	40	OR0017
9	BR0784	41	OR0546
10	BR0790	42	P-0144
11	BR0796	43	P-0145
12	BR0799	44	P-0146
13	BR0885	45	S-0041
14	BR0903	46	S-0202
15	BR1029	47	S-0780
16	BR1085	48	SJ0030
17	BR1145	49	V-0114
18	C-0116	50	V-0192
19	C-0127	51	V-0501
20	C-0434	52	V-0502
21	C-0477	53	V-0503
22	D-0010	54	V-0504
23	D-0013	55	V-0505
24	D-0137	56	V-0506
25	D-1156	57	V-0522
26	D-4560	58	V-0526
27	D-4564	59	V-0536
28	F-0174	60	V-0542
29	F-0293	61	V-0557
30	IR0274	62	V-0559
31	IR0282	63	V-0566
32	IR0284	64	V-0743

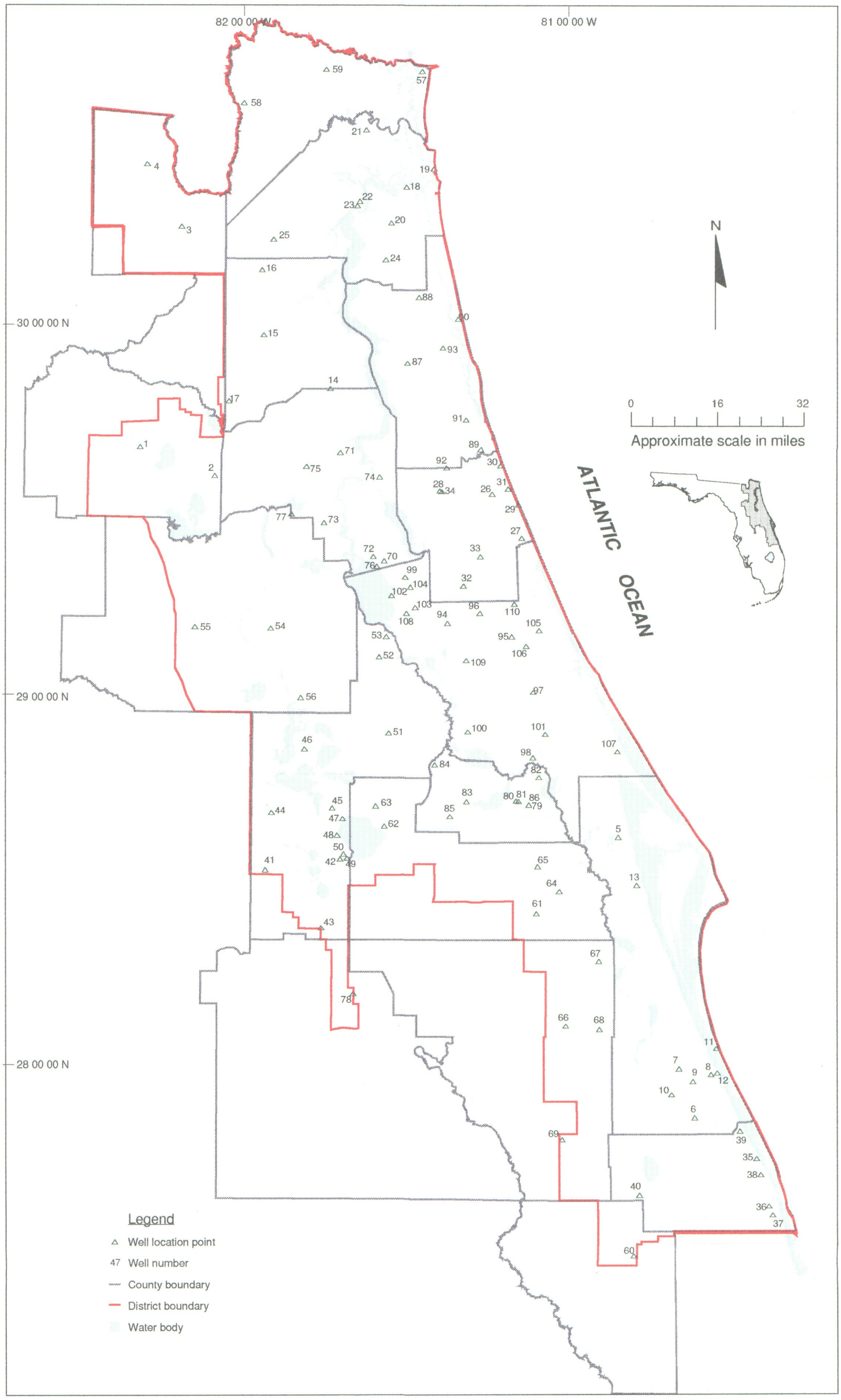

Figure A3. Location of wells monitoring the surficial aquifer system (see Table A3)

Table A3. Wells in the surficial aquifer system (see Figure A3)

Map Identification Number	Well Station Name	Map Identification Number	Well Station Name	Map Identification Number	Well Station Name
1	A-0074	38	IR0283	75	P-0511
2	A-0436	39	IR0290	76	P-0734
3	BA0056	40	IR0350	77	P-0738
4	BA0098	41	L-0041	78	PO0002
5	BR0584	42	L-0044	79	S-0002
6	BR0644	43	L-0050	80	S-0035
7	BR0757	44	L-0096	81	S-0045
8	BR0786	45	L-0286	82	S-0266
9	BR0788	46	L-0289	83	S-0828
10	BR0794	47	L-0301	84	S-0830
11	BR0883	48	L-0308	85	S-1015
12	BR1030	49	L-0320	86	S-1023
13	BR1118	50	L-0325	87	SJ0028
14	C-0125	51	L-0378	88	SJ0032
15	C-0126	52	L-0456	89	SJ0499
16	C-0435	53	L-0460	90	SJ0503
17	C-0452	54	M-0045	91	SJ0517
18	D-0009	55	M-0211	92	SJ0698
19	D-0011	56	M-0254	93	SJ0755
20	D-0545	57	N-0018	94	V-0063
21	D-1157	58	N-0109	95	V-0087
22	D-1166	59	N-0203	96	V-0088
23	D-1169	60	OK0055	97	V-0109
24	D-4578	61	OR0016	98	V-0167
25	D-4592	62	OR0089	99	V-0185
26	F-0164	63	OR0107	100	V-0197
27	F-0177	64	OR0248	101	V-0199
28	F-0205	65	OR0264	102	V-0523
29	F-0226	66	OS0024	103	V-0528
30	F-0234	67	OS0171	104	V-0541
31	F-0248	68	OS0179	105	V-0543
32	F-0252	69	OS0183	106	V-0546
33	F-0291	70	P-0147	107	V-0558
34	F-0295	71	P-0148	108	V-0578
35	IR0275	72	P-0470	109	V-0744
36	IR0277	72	P-0473	110	V-0761
37	IR0279	74	P-0475		

APPENDIX B—WELL CHARACTERISTICS

Table B1. Well characteristics

Well	County	Location	Latitude	Longitude	Aquifer System	Casing Depth (feet)	Well Depth (feet)	Diameter (inches)	Material
A-0018	Alachua	East of Highway 441	293623	821812	Floridan	37	52	4	Steel
A-0043	Alachua	Gainesville PS Well #2	294211	821757	Floridan	185	475	24	Steel
A-0071	Alachua	Hawthorne Tower	293555	820431	Floridan	95	113	4	PVC
A-0074	Alachua	Highway 24	294031	821818	Surficial	20	31	2	PVC
A-0436	Alachua	Hawthorne Tower	293556	820434	Surficial	32	52	4	PVC
A-0694	Alachua	Cross Creek	292905	820942	Floridan	63	80	4	Iron
A-0695	Alachua	Lochloosa Lake	293135	820630	Floridan	92	100	4	Iron
A-0696	Alachua	Lake Jeffords	293255	820500	Floridan	89	110	4	Iron
A-0697	Alachua	SR 20 west of Hawthorne	293621	820818	Intermediate	56	95	4	Iron
A-0698	Alachua	Windsor	293818	821114	Intermediate	58	100	4	Iron
A-0699	Alachua	Newnans Lake	294012	821418	Floridan	50	70	4	Galv iron
A-0700	Alachua	SR 26 west of Highway 301	294224	820940	Intermediate	95	120	4	Iron
BA0009	Baker	Taylor	302620	821735	Floridan	417	898	6	Iron
BA0018	Baker	Osceola National Forest	302251	821949	Floridan	320	338	4	Iron
BA0020	Baker	Osceola National Forest	302251	821949	Intermediate	117	122	4	PVC
BA0054	Baker	Macclenny Tower	301618	821109	Floridan	370	700	4	PVC
BA0055	Baker	Macclenny Tower	301618	821109	Intermediate	80	99	4	PVC
BA0056	Baker	Macclenny Tower	301618	821109	Surficial	40	60	4	PVC
BA0057	Baker	Eddy Tower	303235	822035	Floridan	360	700	4	PVC
BA0058	Baker	Eddy Tower	303235	822035	Intermediate	40	50	4	PVC
BA0098	Baker	Taylor	302620	821735	Surficial	23	33	4	PVC
BR0202	Brevard	Cocoa	282245	804716	Floridan	114	129	4	Iron
BR0584	Brevard	Titusville Astronaut High School	283732	805059	Surficial	32	40	2	PVC
BR0585	Brevard	Titusville Astronaut High School	283734	805059	Floridan	107	195	4	PVC
BR0586	Brevard	Tico Airport	282945	804739	Floridan	93	135	4	PVC
BR0608	Brevard	NASA near Gate #2	282921	804047	Floridan	75	320	4	PVC
BR0625	Brevard	Sebastian State Park	275210	802722	Floridan	299	454	4	PVC
BR0634	Brevard	Fellsmere	275158	803721	Intermediate	80	130	4	PVC
BR0644	Brevard	Fellsmere	275158	803721	Surficial	20	30	2	PVC
BR0645	Brevard	Platt	275955	804346	Floridan	125	447	4	Iron
BR0660	Brevard	Seminole Ranch	283644	805749	Floridan	105	280	4	Iron
BR0753	Brevard	Columbia Elementary School	275800	803809	Intermediate	80	97	4	PVC
BR0757	Brevard	Malabar Road	275954	804009	Surficial	5	15	4	PVC
BR0784	Brevard	Rocky Point	275913	803317	Intermediate	72	76	4	PVC
BR0786	Brevard	Rocky Point	275913	803317	Surficial	10	15	4	PVC
BR0788	Brevard	Paragon Street	275749	803739	Surficial	9	15	4	PVC
BR0790	Brevard	Paragon Street	275749	803739	Intermediate	57	87	4	PVC

Table B1—*Continued*

Well	County	Location	Latitude	Longitude	Aquifer System	Casing Depth (feet)	Well Depth (feet)	Diameter (inches)	Material
BR0794	Brevard	Laika Street	275542	804131	Surficial	6	11	4	PVC
BR0796	Brevard	Laika Street	275542	804131	Intermediate	85	95	4	PVC
BR0799	Brevard	South Beach	280229	803309	Intermediate	75	85	4	PVC
BR0883	Brevard	Gemini Elementary School	280311	803323	Surficial	16	21	4	PVC
BR0885	Brevard	Gemini Elementary School	280311	803323	Intermediate	76	82	4	PVC
BR0903	Brevard	Flutie Park	280314	803313	Intermediate	76	86	4	PVC
BR0925	Brevard	St. Johns Marsh SW of Palm Bay	275140	804330	Floridan	100	282	3	PVC
BR1029	Brevard	Turkey Creek	275905	803335	Intermediate	83	93	4	PVC
BR1030	Brevard	Turkey Creek	275859	803424	Surficial	20	30	4	PVC
BR1085	Brevard	Melbourne Airport	280634	803858	Intermediate	60	120	6	PVC
BR1118	Brevard	Tico Airport	282945	804739	Surficial		22	2	PVC
BR1145	Brevard	General Development Utilities	280129	803630	Intermediate	70	89	10	Steel
C-0094	Clay	Near Middleburg, SJRCC campus	300656	814634	Floridan	391	1,197	8	Steel
C-0116	Clay	Brooklyn Lake	294807	820209	Intermediate	78	136	2	Galv iron
C-0120	Clay	Brooklyn Lake	294808	820209	Floridan	192	227	6	Galv iron
C-0123	Clay	Sungarden Tower	295016	814335	Floridan	348	457	4	PVC
C-0125	Clay	Sungarden Tower	295016	814335	Surficial	20	40	2	PVC
C-0126	Clay	Penney Farms Tower	295851	815553	Surficial	20	40	2	PVC
C-0127	Clay	Penney Farms Tower	295851	815553	Intermediate	110	136	4	PVC
C-0128	Clay	Penney Farms Tower	295851	815552	Floridan	366	405	4	PVC
C-0373	Clay	Green Cove PS, Harbour Road	300024	814150	Floridan	400	1,100	18	Steel
C-0380	Clay	Gold Head Branch	294912	815733	Floridan			4	
C-0434	Clay	Sungarden Tower	295016	814335	Intermediate	116	126	4	PVC
C-0435	Clay	Black Creek	300925	815617	Surficial	61	71	4	PVC
C-0452	Clay	Brooklyn Lake	294807	820209	Surficial	60	70	2	PVC
C-0477	Clay	Gold Head Branch	294912	815733	Intermediate	95	105	2	
D-0009	Duval	Fort Caroline State Park	302301	812950	Surficial	24	34	4	PVC
D-0010	Duval	Fort Caroline State Park	302301	812950	Intermediate	190	204	4	PVC
D-0011	Duval	Little Talbot State Park	302600	812445	Surficial	16	24	2	PVC
D-0013	Duval	Little Talbot State Park	302600	812443	Intermediate	80	88	2	PVC
D-0075	Duval	Confederate Point	301537	814419	Floridan	488	1,302	12	Steel
D-0090	Duval	Jacksonville PS Well #106	302003	813840	Floridan	510	1,297	12	Steel
D-0137	Duval	Cecil Field	301422	815412	Intermediate	82	101	2	Galv iron
D-0160	Duval	Neptune Beach	301852	812342	Floridan	338	550	8	Iron
D-0224	Duval	Jacksonville PS, Sandalwood High	301743	813047	Floridan	423	1,179	12	Steel
D-0296	Duval	Hood Landing	300820	813540	Floridan		487	3	Steel
D-0313	Duval	Jacksonville PS, Alderman Park	301957	813423	Floridan	576	1,150	8	Steel
D-0329	Duval	Jacksonville PS, Highlands	302538	813925	Floridan	545	1,209	20	Steel

Table B1—*Continued*

Well	County	Location	Latitude	Longitude	Aquifer System	Casing Depth (feet)	Well Depth (feet)	Diameter (inches)	Material
D-0336	Duval	Jacksonville PS, Kenmore Street	302236	814015	Floridan	520	1,303		Steel
D-0348	Duval	Garden Street	302416	815226	Floridan	416	708	6	Iron
D-0360	Duval	Hidden Hills Golf Course	302243	813004	Floridan	462	665	5	Steel
D-0450	Duval	Santa Monica	301608	813628	Floridan	502	1,304	12	Steel
D-0464	Duval	Jacksonville PS, Julia Street	302339	812547	Floridan	427	1,000	10	Steel
D-0545	Duval	Southside Tower	301710	813236	Surficial	40	60	2	PVC
D-0547	Duval	Southside Tower	301710	813236	Floridan	490	740	4	PVC
D-0592	Duval	Lincoln Estates	302272	814350	Floridan	528	1,326	10	Steel
D-0673	Duval	Tisonia Tower	303209	813718	Floridan	450	857	4	PVC
D-0909	Duval	Dee Dot Ranch	300622	812847	Floridan		500	4	Steel
D-0913	Duval	Fort George Island	302557	812531	Floridan	432	556	4	
D-1156	Duval	Tisonia Tower	303209	813717	Intermediate	240	260	4	PVC
D-1157	Duval	Tisonia Tower	303209	813717	Surficial	40	60	4	PVC
D-1166	Duval	Gilbert School	302037	813825	Surficial	49	54	4	PVC
D-1169	Duval	Oakland Playground	301954	813853	Surficial	14	24	4	PVC
D-1342	Duval	Baldwin PS, Totman Water Works	301802	815850	Floridan	456	764	10	Steel
D-425T	Duval	Linden Avenue, Top Zone	301817	813749	Floridan	752	1,895	8	Iron
D-4560	Duval	Cecil Field, Normandy Boulevard	301422	815412	Intermediate	205	210	2	PVC
D-4564	Duval	US 1 and I-95	301111	813334	Intermediate	42	83	2	Galv iron
D-4578	Duval	US 1 and I-95	301111	813334	Surficial	38	46	2	Galv iron
D-4592	Duval	Cecil Field, Normandy Boulevard	301422	815412	Surficial	26	36	4	PVC
D-4609	Duval	Ortega Utilities PS, Duclay	301229	814408	Floridan	471	950	12	Steel
F-0087	Flagler	Bunnell	292750	811520	Floridan	110	417	6	Iron
F-0164	Flagler	Palm Coast	293313	811352	Surficial	78	94	6	Iron
F-0165	Flagler	Palm Coast	293529	811917	Floridan	127	140	4	
F-0174	Flagler	Flagler Beach State Park	292604	810624	Intermediate	110	118	2	PVC
F-0176	Flagler	Bulow Ruins	292603	810825	Floridan	91	120	4	PVC
F-0177	Flagler	Bulow Ruins	292603	810827	Surficial	24	43	4	PVC
F-0200	Flagler	Washington Oaks State Park	293753	811219	Floridan	143	148	4	PVC
F-0204	Flagler	Dinner Island	293337	812305	Floridan	86	113	4	PVC
F-0205	Flagler	Dinner Island	293337	812303	Surficial	16	24	2	PVC
F-0206	Flagler	Near Dinner Island	292930	812234	Floridan	146	203	4	PVC
F-0225	Flagler	Beverly Beach	293130	810908	Floridan	80	140	4	PVC
F-0226	Flagler	Beverly Beach	293128	810905	Surficial	14	24	4	PVC
F-0234	Flagler	Washington Oaks State Park	293754	811219	Surficial	10	14	2	PVC
F-0240	Flagler	Near Codys Corner	292302	811559	Floridan	92	155	4	Steel
F-0248	Flagler	A1A South Bonterra	293403	811057	Surficial		30	2	PVC
F-0251	Flagler	Relay Tower	291818	811904	Floridan	78	147	4	PVC

Table B1—*Continued*

Well	County	Location	Latitude	Longitude	Aquifer System	Casing Depth (feet)	Well Depth (feet)	Diameter (inches)	Material
F-0252	Flagler	Relay Tower	291818	811904	Surficial	10	21	2	PVC
F-0291	Flagler	Near Codys Corner	292302	811559	Surficial	5	15	4	PVC
F-0293	Flagler	Dinner Island	293344	812324	Intermediate	48	58	4	PVC
F-0294	Flagler	Dinner Island	293345	812328	Floridan	95	124	4	PVC
F-0295	Flagler	Dinner Island	293344	812324	Surficial	13	23	4	PVC
IR0274	Indian River	Wabasso School	274517	802618	Intermediate	83	133	4	PVC
IR0275	Indian River	Wabasso School	274517	802618	Surficial	39	49	2	PVC
IR0277	Indian River	Vero Beach Elementary School	273732	802410	Surficial	45	55	2	PVC
IR0279	Indian River	South Canal TS, Vero Beach	273607	802328	Surficial	43	53	2	PVC
IR0282	Indian River	Winter Beach Transfer Station	274240	802532	Intermediate	95	144	4	Iron
IR0283	Indian River	Winter Beach Transfer Station	274240	802532	Surficial	43	53	2	PVC
IR0284	Indian River	Wabasso Transfer Station	274414	802650	Intermediate	84	128	4	PVC
IR0287	Indian River	Fellsmere Transfer Station	274603	803457	Intermediate	105	140	4	Iron
IR0289	Indian River	Roseland Transfer Station	274948	802916	Intermediate	105	134	4	PVC
IR0290	Indian River	Roseland Transfer Station	274948	802916	Surficial	25	35	2	PVC
IR0312	Indian River	Oslo Road (43rd Ave), Vero Beach	273435	802551	Floridan	120	568	6	Iron
IR0313	Indian River	North Vero Field, Dodgertown	273846	802547	Floridan	163	511	2	Iron
IR0350	Indian River	Near Yeehaw Junction	273923	804718	Surficial	13	19	6	Iron
L-0032	Lake	Blackwater Creek	285057	812432	Floridan	96	120	4	Iron
L-0037	Lake	Seminole State Forest	285028	812533	Floridan	102	363	4	Iron
L-0038	Lake	Blackwater Creek	284933	812558	Floridan	78	92	4	Iron
L-0040	Lake	Near Alexander Springs	290647	813421	Floridan	140	171	4	Iron
L-0041	Lake	Mascotte	283204	815449	Surficial	16	30	6	Iron
L-0044	Lake	Waits Junction	283355	814117	Surficial	10	28	4	PVC
L-0045	Lake	Astor	290950	813155	Floridan	204	254	6	Iron
L-0050	Lake	Sand Mine, Horsehead Pond	282241	814439	Surficial	25	35	2	PVC
L-0051	Lake	Sand Mine, Horsehead Pond	282241	814439	Floridan	85	115	4	PVC
L-0053	Lake	Lake Louisa State Park	283732	814434	Floridan	70	85	4	PVC
L-0059	Lake	Crows Bluff	290043	812328	Floridan	153	170	3	Iron
L-0062	Lake	Mascotte	283206	815448	Floridan	63	160	6	Iron
L-0066	Lake	Alexander Springs	290451	813444	Floridan	74	102	4	PVC
L-0095	Lake	Groveland Tower	284122	815344	Floridan	150	365	4	PVC
L-0096	Lake	Groveland Tower	284122	815344	Surficial	110	130	4	PVC
L-0199	Lake	Waits Junction	283355	814117	Floridan	110	146	4	PVC
L-0286	Lake	Ranch Road 33	284209	814244	Surficial	28	33	4	PVC
L-0289	Lake	Leesburg Tower	285144	814750	Surficial	40	50	4	PVC
L-0290	Lake	Leesburg Tower	285144	814750	Floridan	190	400	4	PVC
L-0301	Lake	Apopka-Beauclair Canal	284024	814053	Surficial	20	22	2	PVC

Table B1—*Continued*

Well	County	Location	Latitude	Longitude	Aquifer System	Casing Depth (feet)	Well Depth (feet)	Diameter (inches)	Material
L-0308	Lake	SR 455 SW of Lake Apopka	283744	814150	Surficial	10	15	2	PVC
L-0320	Lake	SR 455 SW of Lake Apopka	283403	814000	Surficial	30	35	2	PVC
L-0325	Lake	SR 455 SW of Lake Apopka	283443	814040	Surficial	20	25	2	PVC
L-0378	Lake	Lake Norris	285425	813234	Surficial	28	33	2	PVC
L-0455	Lake	Astor, VFW	291001	813309	Floridan	100	150	6	PVC
L-0456	Lake	Near Alexander Springs	290647	813421	Surficial	22	32	4	PVC
L-0458	Lake	Astor, VFW	291002	813306	Intermediate	90	100	6	PVC
L-0460	Lake	Astor, VFW	291002	813306	Surficial	20	30	6	PVC
L-0591	Lake	Howey-In-The-Hills PS #3	284330	814642	Floridan	162	350	14	Steel
L-0592	Lake	Leesburg PS #6, Canal Street	284830	815224	Floridan	58	390	12	Steel
L-0593	Lake	Eustis PS, Easterly	285118	813910	Floridan	274	750	16	Steel
L-0594	Lake	Lady Lake PS	285419	815528	Floridan	160	180	10	Steel
L-0595	Lake	Umatilla PS, Blanding Well #2	285628	814005	Floridan	137	450	12	Steel
L-0596	Lake	Clermont PS, Grand Highway	283349	814450	Floridan	605	918	12	Steel
M-0013	Marion	Moss Bluff	290455	815304	Floridan	80	225	8	Iron
M-0021	Marion	Near Salt Springs, Salt Run	291849	814114	Floridan	268	277	4	Steel
M-0024	Marion	Highway 316 near Eureka	292212	815057	Floridan	53	90	6	Iron
M-0025	Marion	Gores Landing	291744	815626	Floridan	258	280	6	Iron
M-0026	Marion	Silver Springs	291134	820156	Floridan	174	192	6	Iron
M-0028	Marion	Highway 314	291102	820054	Floridan	124	153	6	Iron
M-0031	Marion	Pedro	285907	820714	Floridan	45	66	6	Iron
M-0036	Marion	Fore Lake, SR 314	291607	815500	Floridan	85	165	4	Iron
M-0037	Marion	SR 464 west of SR 3	290826	820335	Floridan	51	72	4	Iron
M-0038	Marion	SR 35	290951	820313	Floridan	60	86	4	Iron
M-0039	Marion	NE 35th Street	291321	820500	Floridan	20	40	4	Iron
M-0041	Marion	SR 475B	290356	820916	Floridan	29	80	4	Iron
M-0044	Marion	Redwater Lake	291113	815404	Floridan	46	199	4	PVC
M-0045	Marion	Redwater Lake	291117	815405	Surficial	2	10	2	PVC
M-0048	Marion	Sharpes Ferry	291115	815925	Floridan	135	135	6	
M-0049	Marion	Routes 19 and 40	291005	813837	Floridan	157	165	6	Iron
M-0052	Marion	Fort McCoy Tower	292204	820228	Floridan	60	160	4	PVC
M-0063	Marion	Sparr Replacement	292019	820642	Floridan	61	120	4	Iron
M-0208	Marion	SW 7th Street	291049	820847	Floridan	30	40	4	PVC
M-0211	Marion	NE 3rd Street	291123	820754	Surficial	20	30	4	PVC
M-0213	Marion	NE 16th Street	291214	820725	Floridan	20	30	4	PVC
M-0243	Marion	NW 7th Street	291140	820914	Floridan	25	35	4	PVC
M-0254	Marion	Sunnyhill Farms	290002	814835	Surficial	71	81	4	PVC
M-0322	Marion	Ocala PS, NE 36th Avenue	291216	820515	Floridan	85	265	24	Steel

Table B1—*Continued*

Well	County	Location	Latitude	Longitude	Aquifer System	Casing Depth (feet)	Well Depth (feet)	Diameter (inches)	Material
N-0018	Nassau	Fort Clinch State Park	304144	812702	Surficial	23	33	4	PVC
N-0019	Nassau	Fort Clinch State Park	304144	812702	Intermediate	68	78	4	PVC
N-0109	Nassau	Hilliard	303622	815952	Surficial	11	56	4	PVC
N-0110	Nassau	Hilliard	303622	815952	Intermediate	106	146	4	PVC
N-0128	Nassau	ITT Rayonier #1	303948	812752	Floridan	556	1,693	24	Steel
N-0199	Nassau	Hilliard PS	304120	815500	Floridan	447	821	10	Steel
N-0201	Nassau	Evergreen, CR 108	304155	814446	Intermediate	60	95	4	PVC
N-0203	Nassau	Evergreen, CR 108	304155	814446	Surficial	10	34	4	PVC
OK0001	Okeechobee	Fort Drum	273127	804814	Floridan	125	960	8	Steel
OK0055	Okeechobee	South Fort Drum	272932	804822	Surficial	19	22	6	Iron
OR0003	Orange	Cocoa H	282847	810138	Floridan	252	495	4	Iron
OR0007	Orange	Bithlo 1	283249	810534	Floridan	151	492	6	Iron
OR0008	Orange	Bithlo 2	283249	810532	Intermediate	65	75	6	Iron
OR0013	Orange	SR 50 east of Bithlo	283214	805834	Floridan			2	
OR0016	Orange	Cocoa M	282510	810545	Surficial	10	10	6	Iron
OR0017	Orange	Cocoa 1-T	282510	810545	Intermediate	85	200	12	Iron
OR0025	Orange	Cocoa 1	282510	810545	Floridan	316	710	20	Iron
OR0035	Orange	Wekiva Preserve	284429	812720	Floridan			3	PVC
OR0047	Orange	Orlovista	283252	812832	Floridan	328	350	6	Iron
OR0060	Orange	Rock Springs	284636	812618	Floridan	75	120	2	Galv iron
OR0068	Orange	Wekiva Preserve	284541	812652	Floridan	90	95	2	Galv iron
OR0082	Orange	Cocoa D	282531	810957	Floridan	226	300	4	Iron
OR0089	Orange	Hooper Farm Road	283914	813317	Surficial	7	17	4	PVC
OR0101	Orange	Near Highway 526	283307	813008	Floridan	118	450	24	
OR0106	Orange	Plymouth Tower	284230	813453	Floridan	100	395	4	PVC
OR0107	Orange	Plymouth Tower	284230	813453	Surficial	20	40	2	PVC
OR0248	Orange	Cocoa K near Bithlo	282847	810137	Surficial	8	8	6	Iron
OR0264	Orange	Bithlo 3	283249	810532	Surficial	12	15	6	Iron
OR0265	Orange	Cocoa F, near Bithlo	282739	810545	Floridan	200	375	6	Iron
OR0546	Orange	Wekiwa Springs State Park	284238	812758	Intermediate	50	60	6	PVC
OR0548	Orange	Wekiwa Springs State Park	284238	812758	Floridan	100	155	6	PVC
OR0554	Orange	Apopka PS Well #4, Grossenbach	284128	813209	Floridan	660	1,400	20	Steel
OR0555	Orange	Winter Park PS Well #8	283547	811824	Floridan	202	700	24	Steel
OR0558	Orange	SE of Lake Apopka	283524	813447	Floridan	17	121	6	
OR0559	Orange	Ocoee PS, South Water Plant	283216	813209	Floridan	800	1,450	24	Steel
OR0560	Orange	Orlando PS, Mccoy Elementary	282911	811824	Floridan	1100	1,400	10	Steel
OS0004	Osceola	Bull Creek WMA	280122	805658	Floridan	202	329	4	PVC
OS0017	Osceola	Bull Creek Loop Road NE	280445	805551	Floridan	210	380	4	PVC

Table B1—*Continued*

Well	County	Location	Latitude	Longitude	Aquifer System	Casing Depth (feet)	Well Depth (feet)	Diameter (inches)	Material
OS0024	Osceola	Bull Creek	280655	810029	Surficial	40	50	4	PVC
OS0031	Osceola	Bull Creek	280704	810027	Floridan	360	460	6	PVC
OS0171	Osceola	Deseret, SR 520	281722	805430	Surficial	13	19	6	Iron
OS0179	Osceola	US 192, Deer Park	280619	805426	Surficial	13	18	6	Iron
OS0183	Osceola	Peavine Road, south of Kenensville	274828	810109	Surficial	19	27	6	Iron
P-0001	Putnam	Swan Lake Drainage	294309	820025	Floridan	90	170	10	Iron
P-0102	Putnam	Near Georgetown	292337	813639	Floridan	48	53	2	
P-0123	Putnam	SJRWMD, Headquarters	293951	814139	Floridan	178	394	6	PVC
P-0144	Putnam	Fill Road	292440	813426	Intermediate	66	76	4	PVC
P-0145	Putnam	Near Paradise Lakes	292318	813457	Intermediate	75	85	4	PVC
P-0146	Putnam	Near Silver Pond	292239	813137	Intermediate	45	55	4	PVC
P-0147	Putnam	Jumping Gully Road	292218	813331	Surficial	45	55	4	PVC
P-0148	Putnam	SJRWMD, Headquarters	293951	814139	Surficial	17	27	4	PVC
P-0172	Putnam	Orange Mills	293933	813428	Floridan	112	543	6	Iron
P-0242	Putnam	Gautier, Lake Stella	292606	813124	Floridan	105	135	4	Iron
P-0246	Putnam	Thunderbird Airport	292824	813415	Floridan	104	144	4	Steel
P-0270	Putnam	Fruitland Handy Way	293537	813835	Floridan	91	124	6	Iron
P-0306	Putnam	Near Kenwood	293300	815239	Floridan	105	189	8	Iron
P-0395	Putnam	Hamilton	293203	814115	Floridan	320	320	6	Iron
P-0408	Putnam	Fruitland	292856	813757	Floridan	127	148	4	PVC
P-0410	Putnam	Jumping Gulley Road	292218	813331	Floridan	81	156	4	PVC
P-0413	Putnam	Near Lake Broward	293214	813522	Floridan	89	182	4	PVC
P-0418	Putnam	Ravine State Gardens	293801	813832	Floridan	86	405	3	
P-0427	Putnam	Highway 19 near Frontier	292437	814413	Floridan	95	148	4	PVC
P-0450	Putnam	Forest Road 77 and 77-G	292948	815030	Floridan	215	241	4	Steel
P-0468	Putnam	Paradise Lakes West	292257	813533	Floridan	92	174	4	PVC
P-0469	Putnam	Paradise Lakes	292256	813526	Floridan	105	190	4	PVC
P-0470	Putnam	Paradise Lakes	292258	813532	Surficial	50	55	3	PVC
P-0472	Putnam	Johnson Field, Forest Road 77	292824	814433	Floridan	96	144	4	Iron
P-0473	Putnam	Johnson Field	292824	814433	Surficial	37	45	6	PVC
P-0474	Putnam	San Mateo Tower	293554	813426	Floridan	130	226	4	PVC
P-0475	Putnam	San Mateo Tower	293554	813426	Surficial	65	85	2	PVC
P-0495	Putnam	Clifton Road	292246	812843	Floridan	132	246	6	Iron
P-0510	Putnam	Hollister Work Center	293733	814748	Floridan	175	300	4	PVC
P-0511	Putnam	Hollister Work Center	293733	814748	Surficial	40	62	2	PVC
P-0691	Putnam	Near Fruitland	292522	813630	Floridan	62	100	4	
P-0696	Putnam	Silver Pond Road	292239	813137	Floridan	80	400	6	PVC
P-0719	Putnam	Near Crescent City	292646	813205	Floridan	94	472	8	

Table B1—*Continued*

Well	County	Location	Latitude	Longitude	Aquifer System	Casing Depth (feet)	Well Depth (feet)	Diameter (inches)	Material
P-0734	Putnam	Middle Road	292124	813452	Surficial	10	20	10	PVC
P-0736	Putnam	Middle Road	292124	813452	Floridan	70	100	6	PVC
P-0738	Putnam	Forest Road 77 and 77-G	292948	815030	Surficial	92	102	4	PVC
PO0001	Polk	Thornhill Ranch	281203	813916	Floridan	108	151	4	PVC
PO0002	Polk	Thornhill Ranch	281202	813847	Surficial	10	15	3	PVC
S-0001	Seminole	Geneva	284247	810708	Floridan	92	170	4	PVC
S-0002	Seminole	Geneva	284247	810708	Surficial	45	50	2	PVC
S-0025	Seminole	Kilbee #3	284217	810230	Floridan	58	154	4	PVC
S-0026	Seminole	Kay Road	284625	810519	Floridan	83	200	4	PVC
S-0028	Seminole	Cockran Forest East	284325	810840	Floridan	90	205	4	PVC
S-0033	Seminole	Avenue C Upper Zone	284428	810726	Floridan	117	353	6	Steel
S-0034	Seminole	Winona Drive	284440	810529	Floridan	48	200	6	PVC
S-0035	Seminole	Cockran Forest West	284325	810927	Surficial	31	35	2	PVC
S-0037	Seminole	SR 46 and Fernandez	284945	812442	Floridan		41	2	Iron
S-0038	Seminole	Cockran Forest West	284324	810928	Floridan	55	165	4	PVC
S-0041	Seminole	Kilbee #1	284233	810452	Intermediate	77	100	4	PVC
S-0042	Seminole	Kilbee #2	284235	810449	Floridan	107	133	4	PVC
S-0045	Seminole	Cockran Forest	284320	810900	Surficial	27	37	2	PVC
S-0086	Seminole	Osceola Landfill	284715	810518	Floridan	70	225	6	PVC
S-0087	Seminole	Osceola Landfill	284716	810518	Floridan	76	350	4	PVC
S-0091	Seminole	Seckinger	284829	812459	Floridan	75	160	2	Iron
S-0097	Seminole	Wekiva River Haven	285001	812423	Floridan	110	120	4	Iron
S-0202	Seminole	Osceola Landfill	284715	810518	Intermediate	55	60	4	PVC
S-0257	Seminole	Near Sanford	284749	811323	Floridan		206	6	Iron
S-0266	Seminole	Seminole County Landfill	284715	810518	Surficial	9	14	4	PVC
S-0305	Seminole	Thrasher	284706	810708	Floridan	99	178	6	Iron
S-0780	Seminole	SR 46	284712	811131	Intermediate	30	40	4	PVC
S-0828	Seminole	Environmental Center, Osprey Trail	284317	811826	Surficial	54	64	4	PVC
S-0829	Seminole	Environmental Center, Osprey Trail	284315	811827	Floridan	85	180	2	Galv iron
S-0830	Seminole	Lower Wekiva River State Reserve	284919	812413	Surficial	20	30	4	PVC
S-0972	Seminole	Lake Mary PS Well #2, Rinehart	284553	812048	Floridan	162	500	16	Iron
S-0973	Seminole	Oviedo PS Well #204	283911	811205	Floridan	160	300	12	Steel
S-1014	Seminole	Charlotte Street	284052	812126	Floridan	142	300	6	PVC
S-1015	Seminole	Charlotte Street	284052	812126	Surficial	40	50	6	PVC
S-1023	Seminole	Geneva , CR 426	284247	810708	Surficial	20	30	4	PVC
SJ0027	St. Johns	Bakersville Tower	295427	812931	Floridan	225	464	4	PVC
SJ0028	St. Johns	Bakersville Tower	295427	812931	Surficial	40	60	2	PVC
SJ0029	St. Johns	Durbin Tower	300507	812726	Floridan	350	603	4	PVC

Table B1—*Continued*

Well	County	Location	Latitude	Longitude	Aquifer System	Casing Depth (feet)	Well Depth (feet)	Diameter (inches)	Material
SJ0030	St. Johns	Durbin Tower	300507	812727	Intermediate	100	120	4	PVC
SJ0032	St. Johns	Durbin Tower	300507	812727	Surficial	40	60	2	PVC
SJ0115	St. Johns	Old Brick Road	293732	812210	Floridan	142	609	6	Iron
SJ0119	St. Johns	Near Bakersville, C.H. Arnold	295442	812722	Floridan	131	188	4	
SJ0263	St. Johns	Dick Reid Farm	294128	812913	Floridan	117	320	6	Iron
SJ0317	St. Johns	Sykes Farm	294701	812633	Floridan	99	290	6	Iron
SJ0412	St. Johns	St. Augustine Airport	295713	812034	Floridan	190	350	4	Iron
SJ0499	St. Johns	Faver Dykes State Park	294031	811558	Surficial	24	44	4	PVC
SJ0503	St. Johns	Guana Park WMA	300137	812012	Surficial	50	58	2	PVC
SJ0516	St. Johns	Dupont Center Tower	294519	811844	Floridan	95	205	4	PVC
SJ0517	St. Johns	Dupont Center Tower	294519	811845	Surficial	35	45	2	PVC
SJ0548	St. Johns	Guana Park WMA	300203	812027	Floridan	316	433	4	Iron
SJ0698	St. Johns	Old Brick Road	293729	812212	Surficial	65	75	4	PVC
SJ0753	St. Johns	St. Augustine PS Well #9	295844	812353	Floridan	256	325	12	Steel
SJ0754	St. Johns	Ponte Vedra WTP	301453	812315	Floridan	385	857	16	Steel
SJ0755	St. Johns	St. Augustine PS Well #1	295657	812300	Surficial	55	95	10	Steel
V-0008	Volusia	Near Daytona	290926	810602	Floridan	480	496	2	Iron
V-0028	Volusia	Near De Land SR 11	290536	811749	Floridan	245	259	4	Iron
V-0062	Volusia	SR 40 east of Barberville	291218	812154	Floridan	131	200	4	Iron
V-0063	Volusia	SR 40 east of Barberville	291216	812156	Surficial	10	25	2	PVC
V-0064	Volusia	Cowarts Road	291823	812808	Floridan	113	158	4	Iron
V-0065	Volusia	Truck Road #3	291508	813028	Floridan	97	180	4	PVC
V-0066	Volusia	Pierson	291433	812842	Floridan	246	367	4	Iron
V-0068	Volusia	West of Pierson	291459	812939	Floridan	63	125	4	Iron
V-0080	Volusia	Near Daytona	290920	810630	Floridan	102	235	6	Iron
V-0082	Volusia	Blue Springs	285512	812028	Floridan	106	200	4	Iron
V-0083	Volusia	Blue Springs	285638	812031	Floridan	84	432	6	Iron
V-0085	Volusia	Harbor Oaks	290651	805828	Floridan	104	146	4	Iron
V-0086	Volusia	Tiger Bay 4A	291006	811010	Floridan	122	222	4	Steel
V-0087	Volusia	Tiger Bay	291007	811016	Surficial	18	20	4	PVC
V-0088	Volusia	Union Camp	291353	811604	Surficial	18	20	2	PVC
V-0099	Volusia	I-95 Daytona	291023	810501	Floridan	152	498	6	Iron
V-0101	Volusia	Alamana	285705	810540	Floridan	113	121	6	
V-0103	Volusia	Maytown Cow Creek	285016	810141	Floridan	102	107	4	PVC
V-0106	Volusia	West Samsula	290107	810620	Floridan	105	111	4	Iron
V-0109	Volusia	West Samsula	290107	810620	Surficial	21	21	4	Iron
V-0111	Volusia	South Samsula	285934	810418	Floridan	58	105	4	Iron
V-0113	Volusia	Lake Ashby	285700	810210	Floridan	90	261	3	Iron

Table B1—*Continued*

Well	County	Location	Latitude	Longitude	Aquifer System	Casing Depth (feet)	Well Depth (feet)	Diameter (inches)	Material
V-0114	Volusia	SR 44 west of De Land	290138	812032	Intermediate	50	64	3	Iron
V-0115	Volusia	SR 44 west of De Land	290138	812032	Floridan	252	350	4	Iron
V-0118	Volusia	Five miles east of De Land	290230	811234	Floridan	72	241	3	Iron
V-0120	Volusia	I-4 east of De Land	290447	811023	Floridan	92	241	3	Steel
V-0123	Volusia	West Allandale, Guava Road	290456	810444	Floridan	90	261	3	Iron
V-0127	Volusia	11th Street	291302	810638	Floridan	84	240	3	Iron
V-0130	Volusia	SR 40 West Ormond Beach	291523	810950	Floridan	82	242	3	Iron
V-0147	Volusia	Franklin Street	291457	812709	Floridan	128	140	4	PVC
V-0155	Volusia	Pine Island	291835	813242	Floridan	120	155	6	Iron
V-0156	Volusia	Glenwood	290512	812136	Floridan	65	195	4	PVC
V-0162	Volusia	Port Orange	290806	810139	Floridan	105	224	3	Iron
V-0164	Volusia	New Smyrna, Jungle Road	290102	805642	Floridan		220	4	Iron
V-0165	Volusia	Took Farm	285031	810623	Floridan	58	255	4	PVC
V-0167	Volusia	Took Farm	285031	810623	Surficial	20	40	2	PVC
V-0183	Volusia	Tomoka Tower	290834	810738	Floridan	445	545	4	PVC
V-0184	Volusia	Seville Tower	291941	812943	Floridan	75	100	4	PVC
V-0185	Volusia	Seville Tower	291941	812942	Surficial	30	45	2	PVC
V-0187	Volusia	Daytona Beach Airport	291107	810342	Floridan	97	817	8	PVC
V-0188	Volusia	Tomoka Tower	290834	810737	Floridan	92	150	4	PVC
V-0192	Volusia	Tomoka Tower	290834	810738	Intermediate	60	80	2	PVC
V-0196	Volusia	Orange City Tower	285440	811814	Floridan	88	234	4	PVC
V-0197	Volusia	Orange City Tower	285442	811814	Surficial	20	30	2	PVC
V-0198	Volusia	Lake Ashby Tower	285419	810410	Floridan	88	122	4	PVC
V-0199	Volusia	Lake Ashby Tower	285419	810410	Surficial	86	86	2	PVC
V-0200	Volusia	Daytona Beach Shores	291031	805904	Floridan	98	160	4	PVC
V-0213	Volusia	SE Deep Creek	290930	812302	Floridan	143	145	2	Steel
V-0215	Volusia	Blackwelder	291009	812058	Floridan	191	450	10	Iron
V-0381	Volusia	SR 44 and I-95	290047	805931	Floridan	107	130	4	Iron
V-0501	Volusia	SR 40 and SR 11	291323	811912	Intermediate	60	70	4	PVC
V-0502	Volusia	Tymber Creek	291510	810740	Intermediate	75	85	4	PVC
V-0503	Volusia	SR 44	290048	805852	Intermediate	90	100	4	PVC
V-0504	Volusia	Oak Hill, Maytown Road	285140	805450	Intermediate	85	95	4	PVC
V-0505	Volusia	Volusia County Agricultural Center	290100	811322	Intermediate	72	82	4	PVC
V-0506	Volusia	Eldridge	291025	812636	Intermediate	80	90	4	PVC
V-0508	Volusia	US 1 and Smith Street	290103	805519	Floridan	170	210	3	PVC
V-0522	Volusia	Near Nine Mile Point	292038	813153	Intermediate	61	71	4	PVC
V-0523	Volusia	B.E. Road off Nine Mile Point Road	291640	813209	Surficial	17	27	4	PVC
V-0526	Volusia	Shell Harbor Road	291351	812925	Intermediate	50	60	4	PVC

Table B1—*Continued*

Well	County	Location	Latitude	Longitude	Aquifer System	Casing Depth (feet)	Well Depth (feet)	Diameter (inches)	Material
V-0528	Volusia	Pierson Airport	291448	812749	Surficial	13	23	4	PVC
V-0531	Volusia	Pierson Airport	291449	812748	Floridan	130	210	6	PVC
V-0536	Volusia	Kalota	291441	812548	Intermediate	49	59	2	PVC
V-0541	Volusia	Nolan Road	291806	812843	Surficial	20	30	2	PVC
V-0542	Volusia	Nolan Road	291806	812843	Intermediate	51	61	2	PVC
V-0543	Volusia	Daytona	291107	810517	Surficial	7	17	4	PVC
V-0546	Volusia	Tomoka Tower	290834	810738	Surficial	37	57	4	PVC
V-0557	Volusia	Pierson Airport	291448	812749	Intermediate	88	98	6	PVC
V-0558	Volusia	Oak Hill	285129	805105	Surficial	20	30	6	PVC
V-0559	Volusia	Oak Hill	285129	805105	Intermediate	50	60	6	PVC
V-0566	Volusia	Seville Tower	291941	812943	Intermediate	42	52	6	PVC
V-0567	Volusia	Silver Pond Road	292038	813153	Floridan	86	120	6	PVC
V-0569	Volusia	Pierson PS, Pierson High School	291445	812740	Floridan	150	200	10	Steel
V-0578	Volusia	Shell Harbor Road	291351	812925	Surficial	20	30	6	PVC
V-0614	Volusia	Edgewater PS Well #6	285700	805730	Floridan	103	250	10	Steel
V-0742	Volusia	Bob Lee Airport	290615	811833	Floridan	140	460	6	PVC
V-0743	Volusia	Bob Lee Airport	290614	811833	Intermediate	62	72	6	PVC
V-0744	Volusia	Bob Lee Airport	290614	811833	Surficial	26	36	6	PVC
V-0761	Volusia	SR 40 west of Ormond Beach	291523	810950	Surficial	8	18	4	PVC

Blank cells indicate data not known.

Note:
PS = public supply
PVC = polyvinyl chloride
SR = state road
Galv = galvanized
SJRCC = St. Johns River Community College
TS = transfer station
VFW = Veterans of Foreign Wars
CR = county road
WMA = wildlife management area
SJRWMD = St. Johns River Water Management District
WTP = wastewater treatment plant

Table C1. Concentrations and measurements of selected parameters

Well	Aquifer System	Temp (°C)	pH	SC (µmhos/cm)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Fe (µg/L)	Cl (mg/L)	S (mg/L)	Alk (mg/L)	P (mg/L)	NO_x (mg/L)	F (mg/L)	TDS (mg/L)	Hard (mg/L)
A-0018	Floridan	22.9	7.34	299	62.0	1.4	3.0	0.4	2,100.0	3.5	2.6	142	0.22	0.05	0.36	166	
A-0043	Floridan	24.1	7.57	487	52.0	20.0	9.8	1.5	10.0	11.0	55.0	175		0.20	0.40	283	213
A-0071	Floridan	22.6	7.82	233	33.3	6.0	3.7	0.6	13.7	7.4	2.7	107	0.41	0.31	0.24	136	107
A-0074	Surficial	23.8	5.01	108	5.4	2.4	8.2	0.7	1,223.6	13.3	14.8	15	0.05	0.03	0.13	69	22
A-0436	Surficial	22.6	6.22	115	12.5	1.8	7.5	0.7	252.9	8.7	1.2	34	0.68	0.77	0.56	96	33
A-0694	Floridan	22.7	7.20	381	57.2	8.8	10.7	1.1	318.8	13.1	5.7	171	0.23	0.07	0.30	227	177
A-0695	Floridan	22.0	7.44	354	55.3	9.8	5.4	0.8	54.0	7.0	5.0			0.05	0.25	180	
A-0696	Floridan	22.6	7.37	346	54.5	9.5	5.3	0.8	33.0	7.5	5.0			0.05	0.26	170	
A-0697	Intermediate	22.9	6.13	98	11.0	3.3	3.1	0.7	22.9	5.1	1.5	33	1.48	0.47	1.00	100	41
A-0698	Intermediate	21.8	7.34	346	45.5	14.6	4.7	0.3	18.0	7.5	5.0		0.09	0.05	0.36		
A-0699	Floridan	20.9	7.29	396	43.0	19.0	9.1	0.1	100.0	12.5	2.5	200		0.05	0.30	235	
A-0700	Intermediate	22.0	7.32	433	43.9	23.4	9.5	1.0	277.0	16.0	5.5		0.08	0.05	0.33		
BA0009	Floridan	23.1	7.36	386	42.0	17.0	11.0	1.6	190.0	11.0	22.0	162		0.30	0.60	227	175
BA0018	Floridan	21.9	7.76	383	41.0	18.0	11.0	1.5	10.0	10.0	15.0	173		0.20	0.60	229	177
BA0020	Intermediate	20.6	7.30	530	56.0	27.0	13.0	2.0	790.0	7.5	0.2	279		0.02	0.50	295	251
BA0054	Floridan	22.2	7.65	323	34.2	14.8	8.3	3.5	27.2	9.0	1.4	160	0.34	0.45	0.46	184	153
BA0055	Intermediate	21.1	7.59	295	28.2	12.9	8.5	2.6	173.8	11.8	1.5	132	0.38	0.17	0.23	175	133
BA0056	Surficial	22.0	8.81	252	38.4	0.7	14.5	6.4	36.2	15.2	2.3	121	0.04	0.06	0.19	137	60
BA0057	Floridan	23.5	7.63	599	66.0	28.0	16.0	2.6	20.0	27.0	100.0	158		0.20	0.80	365	281
BA0058	Intermediate	21.4	6.92	311	35.0	18.0	3.2	1.0	340.0	6.5	1.4	155		0.02	0.10	166	162
BA0098	Surficial	22.2	5.82	136	11.0	2.1	9.3	1.4	20.0	21.0	0.4	23		1.30	0.10	73	36
BR0202	Floridan	24.7	7.51	7,282	125.9	90.3	792.9	17.8	374.3	1,560.0	240.0	65	0.72	0.35	0.29	2,873	824
BR0584	Surficial	24.5	7.70	224	43.2	0.5	1.8	0.5	364.0	5.0	4.4	104	0.16	0.10	0.13	145	109
BR0585	Floridan	24.1	8.02	203	27.7	2.3	8.7	0.8	26.7	16.3	4.7	75	0.31	0.29	0.34	119	79
BR0586	Floridan	23.0	7.24	2,550	76.5	34.8	394.5	7.6	4.0	606.5	72.5		0.27	0.35	0.10	1,161	335
BR0608	Floridan	24.6	7.36	6,612	155.2	93.1	701.8	14.8	36.0	1,545.0	155.0	118	0.20	0.35	0.44	2,781	819
BR0625	Floridan	24.0	7.65	1,910	47.5	36.6	81.4	4.9	35.7	180.0	87.5	148	0.52	0.15	0.77	536	295
BR0634	Intermediate	23.1	7.03	468	102.0	6.0	27.4	1.7	15.0	55.5	4.5		0.08	0.06	0.22	298	275
BR0644	Surficial	23.0	7.17	508	111.0	6.1	30.4	1.5	14.5	53.5	5.4		0.09	0.06	0.21	363	300
BR0645	Floridan	24.5		2,169	102.3	56.0	230.5	6.2	213.2			117			0.40	1,188	
BR0660	Floridan	24.1		7,732	184.3	105.7	835.6	26.2	975.9			152			0.28	4,750	
BR0753	Intermediate	24.4	7.41	702	83.8	5.7	28.6	1.5	56.3	118.0	5.0	180	0.08	0.02	0.13	370	
BR0757	Surficial	21.5	6.45	1,003	136.0	9.6	51.3	2.7	432.0	135.0	55.9		0.05	0.05	0.14	600	
BR0784	Intermediate	25.0	7.34	915	75.3	18.4	53.3	7.7	185.7			266				446	
BR0786	Surficial	26.4	6.25	321	25.3	2.7	25.0	0.8	237.7			62				219	
BR0788	Surficial	24.5	5.57	146	10.0	1.0	9.7	3.2	383.0			24				124	
BR0790	Intermediate	24.9	7.30	919	90.0	2.0	11.7	0.9	153.7			275				301	

Table C1—*Continued*

Well	Aquifer System	Temp (°C)	pH	SC (µmhos/cm)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Fe (µg/L)	Cl (mg/L)	S (mg/L)	Alk (mg/L)	P (mg/L)	NO_x (mg/L)	F (mg/L)	TDS (mg/L)	Hard (mg/L)
BR0794	Surficial	25.0	8.97	391	40.0	1.8	38.3	1.0	207.3			57				341	
BR0796	Intermediate	24.5		1,326	65.0	4.2	75.7	7.7	50.0			77				532	
BR0799	Intermediate	25.1	7.70	2,036	64.8	58.5	225.5	15.0	268.8			139				1,063	
BR0883	Surficial	25.6	7.38	1,181	117.0	14.2	96.5	3.0	176.0			213				605	
BR0885	Intermediate	25.5	7.72	1,905	96.3	54.1	196.3	6.3	84.3			128				817	
BR0903	Intermediate	24.8	7.73	8,177	66.3	156.3	1,806.7	67.8	76.0			204				4,612	
BR0925	Floridan	23.5	7.56	1,007	54.0	33.6	80.0	4.7	50.0			139			0.80	526	
BR1029	Intermediate	25.3	6.87	595	70.7	5.5	33.0	1.1	364.3			240				349	
BR1030	Surficial	25.5	6.86	780	53.0	15.5	99.3	2.4	663.3			284				478	
BR1085	Intermediate	23.2	6.75	795	132.5	4.6	24.5	1.3	138.5	94.0	2.6		0.35	0.04	0.15	356	345
BR1118	Surficial	22.5	4.46		0.8	2.4	8.9	0.7	360.0	14.6	9.3	2	0.02	0.02	0.10	205	11
BR1145	Intermediate	23.4	7.28	1,170	140.0	9.2	79.0	2.2	420.0	190.0	44.0			0.02	0.20	638	389
C-0094	Floridan	26.3	8.19	206	19.0	11.0	3.7	1.8	10.0	4.9	17.0	78		0.20	0.30	119	93
C-0116	Intermediate	23.1	6.62	109	9.1	3.5	4.3	0.8	95.0	7.1	1.0	35	0.77	1.20	0.28	59	36
C-0120	Floridan	22.5	7.90	179	15.8	5.3	3.0	1.0	373.6	7.3	0.4	80	0.42	0.44	0.12	130	75
C-0123	Floridan	22.5	8.14	236	26.0	12.0	5.3	1.5	20.0	6.9	3.9	114		0.20	0.20	136	120
C-0125	Surficial	22.6	4.57	77	3.6	1.1	6.4	1.3	1,000.0	9.5	8.1	7		0.02	0.10	43	14
C-0126	Surficial	22.9	6.21	92	16.4	0.4	2.3	0.7	177.6	5.5	3.0	37	0.17	0.08	0.10	81	36
C-0127	Intermediate	23.0	7.12	420	52.5	19.1	5.0	1.6	317.4	9.6	0.9	211	0.45	0.04	0.38	238	214
C-0128	Floridan	22.2	7.75	290	33.1	12.2	7.3	1.7	38.0	9.0	4.4	136	0.30	0.31	0.20	163	135
C-0373	Floridan	26.1	8.29	215	20.0	10.0	3.5	1.6	80.0	4.9	18.0	81		0.20	0.20	120	92
C-0380	Floridan	22.4	7.31	121	12.0	4.8	3.0	1.0	50.0			48			0.15	66	
C-0434	Intermediate	22.2	7.02	325	59.0	1.6	7.3	2.6	140.0	7.5	1.1	161		0.02	0.30	196	150
C-0435	Surficial	20.7	6.77	575	110.0	2.9	9.2	6.1	570.0	8.2	1.2	297		0.02	0.10	334	278
C-0452	Surficial	22.9	5.34	89	5.4	4.5	7.4	1.0	63.3	10.0	0.6	3	0.02	3.61	0.08	39	9
C-0477	Intermediate	22.8	8.14	140	13.0	6.4	3.0	1.0	50.0			86			0.11	73	
D-0009	Surficial	21.0	7.03	322	52.0	1.9	9.8	1.0	2,000.0	22.0	1.5	125		0.05	0.10	174	138
D-0010	Intermediate	20.8	8.14	224	33.0	3.4	8.1	0.9	10.0	13.0	1.3	94		0.04	0.10	126	97
D-0011	Surficial	24.1	8.32	385	41.0	10.0	15.0	3.1	90.0	33.0	8.9	128		0.02	0.60	210	144
D-0013	Intermediate	23.2	7.80	14,290	170.0	240.0	2,500.0	96.0	5.0	4,600.0	380.0	207		0.02	0.30	8,218	1,415
D-0075	Floridan	25.0	8.00	372	40.0	16.0	7.1	1.8		7.5	65.0	109			0.40	235	170
D-0090	Floridan	28.8	7.45	521	55.0	21.0	13.0	1.8	5.0	17.0	82.0	155		0.20	0.60	311	226
D-0137	Intermediate	20.7	7.03	485	71.0	13.0	11.0	2.5	1,300.0	13.0	0.2	238		0.03	0.20	290	230
D-0160	Floridan				35.0	44.8	13.0	2.4				112			0.86	436	
D-0224	Floridan	25.0	7.80	700	76.0	31.0	25.0	2.3		59.0	150.0	140			0.70	511	320
D-0296	Floridan	22.0	8.20	658	60.0	40.0	16.0	3.1		18.0	220.0	118			0.70	487	320
D-0313	Floridan	28.0	7.60	843	76.0	30.0	37.0	1.9		100.0	120.0	146			0.60	537	320
D-0329	Floridan	26.0	7.50	510	57.0	24.0	15.0	1.8		17.0	78.0	160			0.60	339	240

Table C1—*Continued*

Well	Aquifer System	Temp (°C)	pH	SC (μmhos/cm)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Fe (μg/L)	Cl (mg/L)	S (mg/L)	Alk (mg/L)	P (mg/L)	NO_x (mg/L)	F (mg/L)	TDS (mg/L)	Hard (mg/L)
D-0336	Floridan	26.5	7.90	490	55.0	21.0	12.0	1.5		14.0	82.0	147			0.60	309	230
D-0348	Floridan				48.0	14.6	6.0	0.9				225			0.29	241	
D-0360	Floridan	26.5	7.80	1,410	98.0	42.0	100.0	2.5		270.0	140.0	145			0.60	829	420
D-0450	Floridan	25.5	8.00	930	90.0	37.0	32.0	2.5		110.0	170.0	141			0.70	581	380
D-0464	Floridan	23.0	7.50	568	61.0	28.0	11.0	1.7		15.0	140.0	134			0.70	380	270
D-0545	Surficial	22.5	6.30	176	24.0	1.1	6.7	0.6	710.0	8.8	8.8	61		0.02	0.10	96	65
D-0547	Floridan	23.6	7.79	651	73.0	32.0	14.0	3.3	13.0	15.0	170.0	142		0.20	0.80	420	318
D-0592	Floridan	24.5	7.90	615	73.0	26.0	10.0	1.7		12.0	170.0	132			0.60	412	290
D-0673	Floridan	23.6	7.50	566	52.2	29.5	14.7	2.0	25.0	27.2	94.6	160	0.30	0.27	0.76	384	249
D-0909	Floridan	23.0	7.40	765	87.0	35.0	15.0	2.6		20.0	240.0	133			0.90	560	370
D-0913	Floridan				101.0	51.8	124.0	3.2				150			0.61	831	
D-1156	Intermediate	21.6	7.47	374	51.1	9.8	7.7	1.3	28.8	14.8	0.9	172	0.07	0.89	0.11	212	166
D-1157	Surficial	22.1	6.21	143	23.9	1.1	5.4	0.9	320.4	11.8	1.9	62	0.34	0.17	0.10	100	35
D-1166	Surficial	24.4	7.12	567	71.1	14.4	21.0	2.0	1,990.0	33.5	20.0	212	0.19	0.02	0.15	318	230
D-1169	Surficial	22.6	6.13	273	27.4	7.6	8.4	3.6	99.5	12.0	55.0	47	0.14	0.02	0.10	150	92
D-1342	Floridan	24.4	7.76	328	32.0	13.0	9.2	1.7	20.0	10.0	25.0	125		0.20	0.40	187	135
D-425T	Floridan	28.7	7.59	573	70.0	25.0	11.0	2.3	10.0	14.0	140.0	138		0.20	0.70	372	282
D-4560	Intermediate	21.8	7.77	402	34.0	18.0	20.0	2.4	20.0	22.0	0.2	174		0.04	1.90	243	159
D-4564	Intermediate	20.7	7.31	510	92.0	2.9	10.0	1.3	10.0	10.0	0.5	259		0.02	0.10	286	242
D-4578	Surficial	21.1	7.08	524	97.0	2.8	9.4	1.1	10.0	11.0	0.2	268		0.02	0.10	295	254
D-4592	Surficial	22.2	5.42	61	2.3	0.6	7.8	1.7	1,200.0	7.4	2.9	12		0.03	0.10	40	8
D-4609	Floridan	24.9	7.87	351	34.0	16.0	7.0	2.0	6.0	7.2	53.0	109		0.20	0.50	204	154
F-0087	Floridan	23.7	7.01	2,400	147.0	47.6	310.0	7.0	3,680.0	712.0	51.0	201	0.17	0.50		1,600	
F-0164	Surficial	23.0	7.32	860	120.0	4.6	52.0	1.6	600.0	94.0	0.6	291		0.02	0.30	477	320
F-0165	Floridan	22.3	7.46	2,220	130.0	88.0	190.0	9.3	280.0	460.0	320.0	162		0.20	0.70	1,320	680
F-0174	Intermediate	23.7	7.15	3,745	166.1	78.6	452.4	8.4	92.4	1,180.0	122.0	217	0.04	0.01	0.39	2,131	
F-0176	Floridan	21.8	7.17	2,388	136.8	48.2	248.6	5.3	100.3	657.0	31.0	233	0.14	0.50	0.29	1,333	
F-0177	Surficial	21.7	7.01	924	134.7	7.2	49.3	1.6	480.5	95.0	6.0	319	0.25	0.50	0.19	607	
F-0200	Floridan	23.3	7.33	6,227	244.6	153.7	852.0	23.6	466.7	1,800.0	710.0	134		0.20	0.84	3,612	1,300
F-0204	Floridan	22.3	7.38	2,037	154.8	59.3	188.2	5.9	45.2	430.0	300.0	184	0.20	0.35	0.28	1,209	670
F-0205	Surficial	22.7	5.15	186	11.9	1.3	13.5	0.9	1,353.1	29.0	25.0	15	0.03	0.04	0.07	135	50
F-0206	Floridan	23.6	6.95	2,600	140.0	65.0	270.0	9.1	20.0	620.0	140.0	178	0.40	0.12	0.50	1,370	610
F-0225	Floridan	23.0	7.30	4,605	200.0	110.0	570.0	14.0	10.0	1,200.0	280.0	200		0.20	0.40	2,550	950
F-0226	Surficial	23.6	7.08	3,740	160.0	88.0	690.0	36.0	110.0	1,200.0	200.0	414		0.02	0.30	2,610	750
F-0234	Surficial	22.7	6.07	399	37.0	6.0	26.0	3.7	7,000.0	58.0	1.5	90		0.02	0.10	203	120
F-0240	Floridan	22.6	6.84	838	132.0	12.3	52.0	2.4	226.0	104.0	6.0	323	0.17	0.50		515	
F-0248	Surficial	21.8	7.64	409	62.0	2.2	18.0	0.9	50.0	31.0	6.3	154		0.02	0.10	220	160
F-0251	Floridan	22.9	7.01	788	132.8	10.0	25.4	1.6	28.6	40.1	1.1	375	0.31	0.25	0.18	478	

Table C1—*Continued*

Well	Aquifer System	Temp (°C)	pH	SC (µmhos/cm)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Fe (µg/L)	Cl (mg/L)	S (mg/L)	Alk (mg/L)	P (mg/L)	NO_x (mg/L)	F (mg/L)	TDS (mg/L)	Hard (mg/L)
P-0734	Surficial	21.6	7.39	650	51.9	9.8	53.9	1.8	578.0			212				390	
P-0736	Floridan	21.9		845	114.0	17.3	82.5	9.4	1,637.0			182			0.26	471	
P-0738	Surficial	23.8	7.73	548	18.0	3.0	93.0	5.3	10.0	42.0	40.0	160		0.15	0.60	305	58
PO0001	Floridan	24.1	7.18	406	74.5	3.4	6.9	3.0	1,465.0	8.6	1.1	184	0.22	1.83	0.10	252	192
PO0002	Surficial	24.0	6.07	969	31.0	12.2	34.0	183.5	120.0	85.5	108.5	144	0.67	11.10	0.10	843	139
S-0001	Floridan	23.5		365	66.6	2.7	6.3	0.8	128.9			178			0.68	206	183
S-0002	Surficial	22.8	7.75	322	62.0	1.5	7.0	1.3	687.0			186			0.16		161
S-0025	Floridan	23.0		15,962	273.2	299.5	2,726.7	94.8	192.5			166			0.16	9,404	1,970
S-0026	Floridan	23.3	6.99	656	102.6	13.3	15.8	1.1	729.6	27.0	3.1	306	0.70	1.50	0.15	364	303
S-0028	Floridan	22.6	7.85	480	52.4	6.5	32.5	1.8	663.1	38.0	6.2	136	0.80	0.36	0.67	247	155
S-0033	Floridan	24.1	7.98	235	33.7	1.4	6.0	0.8	51.0			90			0.87	122	88
S-0034	Floridan	22.3	7.16	417	74.0	1.7	7.0	0.8	1,361.3	10.3	1.2	184	0.10	0.81	0.58	218	191
S-0035	Surficial	23.4	7.67	4,238	82.0	67.2	663.3	24.0	267.3			114			0.10	2,274	481
S-0037	Floridan	23.0		4,062	181.1	74.5	604.3	14.5	43.6			137			0.21	2,650	
S-0038	Floridan	22.6	7.59	4,059	85.0	71.5	656.2	33.3	22.7	1,197.4	160.0	121	0.38	0.26	0.16	2,357	508
S-0041	Intermediate	24.3	8.36	9,385	381.4	29.5	1,504.0	49.2	51.2	3,385.0	435.5	138	0.01	0.04	0.19	5,052	1,085
S-0042	Floridan	23.3	7.47	2,731	59.8	50.0	433.4	22.0	60.6	634.5	126.0	241	0.14	0.15	0.15	1,478	351
S-0045	Surficial	22.9	7.12	370	68.1	1.2	9.1	0.9	4,850.5	15.7	4.0	178	0.18	0.05	0.11	240	166
S-0086	Floridan	22.8		553	94.8	2.5	13.5	1.2	4,965.6			249			0.11	329	275
S-0087	Floridan	22.0	6.92	557	92.7	1.7	9.7	0.7	6,823.3			287			0.12	304	229
S-0091	Floridan	24.1		1,338	92.4	28.2	130.2	4.1	488.9			131			0.44	774	
S-0097	Floridan	23.3		6,017	252.8	107.2	982.9	22.7	50.7			143			0.24	3,978	
S-0202	Intermediate	24.1	7.35	355	62.3	1.2	5.9	0.9	2,389.3			173			0.12	201	143
S-0257	Floridan	24.3	7.99	2,100	71.5	29.7	279.0	10.7	120.0	544.5	70.0	117	0.01	0.21	0.20	1,138	309
S-0266	Surficial	25.4	6.55	407	68.2	1.6	9.3	0.9	562.1			148			0.04	294	
S-0305	Floridan	23.7		650	108.7	9.7	17.0	1.8	297.3			308				370	
S-0780	Intermediate	22.9	7.63	2,870	106.5	35.6	413.5	9.0	17.9	791.5	118.0	125	0.03	0.10	0.10	1,606	441
S-0828	Surficial	22.4	7.84	253	33.0	8.1	6.8	0.9	40.0	9.6	2.3	110		0.28	0.20	139	116
S-0829	Floridan	22.7	7.88	263	33.0	8.3	7.9	0.9	4.0	12.0	2.8	110		0.30	0.20	144	117
S-0830	Surficial	23.8	5.89	46	4.2	0.4	1.8	0.3	30.0	3.7	7.2	5		0.02	0.10	26	12
S-0972	Floridan	23.3	7.73	260	38.0	4.2	4.4	0.7	15.0	8.2	5.1	110		0.30	0.10	138	112
S-0973	Floridan	24.3	7.91	778	46.0	11.0	81.0	3.2	3.0	158.0	24.0	100		0.20	0.20	399	161
S-1014	Floridan	23.2	7.54	486	72.3	13.3	8.0	3.2	203.0	13.0	2.9	237		0.42	0.20	282	233
S-1015	Surficial	22.4	5.53	242	11.8	2.2	26.1	1.3	5,000.0	24.0	7.5	50		0.02	0.10	181	56
S-1023	Surficial	23.0	6.52	334	57.6	2.1	6.6	2.8	83.2			120			0.11	186	
SJ0027	Floridan	28.6	7.35	1,918	216.5	90.7	69.0	4.0	39.0	180.0	740.0	126		0.20	0.98	1,456	970
SJ0028	Surficial	22.4	7.29	534	74.0	8.0	27.0	3.9	440.0	25.0	4.0	239		0.02	0.30	325	220
SJ0029	Floridan	24.9	7.49	751	76.4	38.2	16.8	3.4	21.1	23.3	221.0	136	0.27	0.27	0.99	539	348

Table C1—*Continued*

Well	Aquifer System	Temp (°C)	pH	SC (µmhos/cm)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Fe (µg/L)	Cl (mg/L)	S (mg/L)	Alk (mg/L)	P (mg/L)	NO_x (mg/L)	F (mg/L)	TDS (mg/L)	Hard (mg/L)
SJ0030	Intermediate	22.1	7.04	596	111.7	3.0	13.1	1.0	58.1	23.4	1.4	294	0.37	0.14	0.11	375	297
SJ0032	Surficial	22.5	5.68	227	24.1	2.9	12.9	1.4	365.7	19.9	20.1	58	0.10	0.10	0.11	173	49
SJ0115	Floridan	23.9	7.33	2,600	200.0	120.0	180.0	11.0	380.0	480.0	570.0	134		0.20	0.80	1,660	970
SJ0119	Floridan	22.1	7.58	1,227	75.4	45.8	29.6	4.1	79.9			127			0.63	584	
SJ0263	Floridan	34.3	7.65	6,244	252.9	182.9	734.8	12.6	757.5			89			0.44	3,791	
SJ0317	Floridan	22.8	7.56	2,110	210.0	100.0	110.0	9.2	50.0	220.0	790.0	114		0.20	0.50	1,540	940
SJ0412	Floridan	23.0		1,049	85.4	48.8	48.8	4.4	46.7			147			0.97	682	
SJ0499	Surficial	21.1	6.72	310	46.0	1.9	12.0	0.9	980.0	20.0	5.0	121		0.02	0.10	164	123
SJ0503	Surficial	20.5	6.83	804	130.0	3.4	32.0	1.6	6,900.0	46.0	0.2	353		0.05	0.10	445	342
SJ0516	Floridan	24.2	7.33	8,014	257.2	183.8	1,270.1	33.9	59.3	2,100.0	770.0	132		0.20	0.90	6,607	1,381
SJ0517	Surficial	22.2	6.90	1,073	116.5	4.2	33.8	1.0	245.5	56.0	0.2	305		0.02	0.24	433	320
SJ0548	Floridan	23.8	7.37	969	73.0	33.0	64.0	3.6	10.0	120.0	170.0	148		0.20	1.00	583	321
SJ0698	Surficial	21.9	8.67	799	100.0	4.8	91.0	12.0	220.0	16.0	24.0	414		0.02	0.20	525	270
SJ0753	Floridan	24.8	7.63	863	71.0	37.0	35.0	3.8	5.0	52.0	210.0	140		0.20	1.00	527	334
SJ0754	Floridan	24.5	7.27	767	67.0	34.0	33.0	2.2	5.0	72.0	140.0	144		0.20	0.90	465	310
SJ0755	Surficial	24.3	7.31	522	91.0	1.4	13.0	0.8	1,000.0	18.0	1.5	250		0.02	0.10	289	234
V-0008	Floridan	23.2		764	99.0	12.7	48.0	1.8	106.8			269			0.20	478	
V-0028	Floridan	21.8		380	62.5	9.0	6.5	1.1	1,092.5			200				223	
V-0062	Floridan	22.9	7.66	373	43.5	8.6	11.3	1.6	193.3	20.0	1.8	153	0.42	0.27	0.15	203	154
V-0063	Surficial	22.0	5.60	126	14.6	1.4	6.1	1.2	1,484.0	13.5	3.9	39	0.01	0.01	0.10	95	49
V-0064	Floridan	23.3	7.41	320	46.3	6.6	7.9	1.1	23.3	12.3	7.6	138	0.15	0.43	0.20	181	141
V-0065	Floridan	22.5	7.47	346	50.6	8.3	6.6	1.9	27.2	11.7	8.3	154	0.11	0.20	0.10	194	158
V-0066	Floridan	23.1	7.51	347	43.9	13.3	6.0	0.9	55.6	10.3	2.2	166	0.37	0.35	0.29	194	164
V-0068	Floridan	22.8	7.51	345	49.0	9.9	5.9	0.9	30.0	9.0	2.1	161	0.94	0.50	0.20	174	160
V-0080	Floridan	23.2		673	99.5	10.2	38.8	1.4	461.2			276			0.20	437	
V-0082	Floridan	22.4		2,751	148.8	62.4	486.9	10.5	360.1			155			0.14	2,003	
V-0083	Floridan	24.2		10,193	265.3	178.8	1,417.2	25.7	350.1			131			0.12	5,796	
V-0085	Floridan	22.8		2,016	106.5	39.4	232.3	6.9	283.8			254				856	
V-0086	Floridan	21.9	6.91	633	111.8	2.8	14.0	1.8	2,978.0	20.5	3.2	297	0.26	0.35	0.10	355	260
V-0087	Surficial	22.3	3.69	118	1.0	0.8	7.7	0.6	393.5	14.5	8.1	2	0.27	0.65	0.10	84	7
V-0088	Surficial	21.8	4.80	497	1.0	7.4	102.0	1.0	1,500.0	210.0	5.0	6	0.01	0.01		310	
V-0099	Floridan	23.4		707	95.6	12.1	32.5	1.4	330.6			273			0.20	397	
V-0101	Floridan	22.6	7.13	670	112.7	4.5	15.3	1.5	2,027.7			322				348	
V-0103	Floridan	22.1	6.97	780	133.0	7.0	30.5	0.8	396.0	48.0	2.3	337	0.21	0.53	0.10	430	347
V-0106	Floridan	22.3	7.11	655	115.0	2.4	13.5	1.5	830.0	20.5	0.2	310		0.25	0.20		302
V-0109	Surficial	23.4	7.35	251	26.0	2.6	11.0	1.0	21,500.0	23.0	5.0	24	0.01	0.01			
V-0111	Floridan	22.6	7.01	546	92.5	1.5	8.5	1.0	540.0	13.5	2.6	258	0.55	0.25	0.20	297	296
V-0113	Floridan	22.2	7.12	502	91.5	4.5	10.0	0.9	682.5	14.5	2.6	233	0.32	0.35	0.10	299	242

Table C1—*Continued*

Well	Aquifer System	Temp (°C)	pH	SC (μmhos/cm)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Fe (μg/L)	Cl (mg/L)	S (mg/L)	Alk (mg/L)	P (mg/L)	NO_x (mg/L)	F (mg/L)	TDS (mg/L)	Hard (mg/L)
V-0114	Intermediate	22.8	7.71	353	49.5	6.1	10.5	1.1	6.5	20.0	5.4	110	0.05	5.80	0.10	179	175
V-0115	Floridan	23.1	7.59	1,243	68.5	20.3	135.0	5.3	252.7	275.5	44.0	147	0.36	0.32	0.10	656	267
V-0118	Floridan	22.7	7.92	286	37.4	6.1	8.4	0.9	104.0	12.5	2.2	122	0.21	0.26	0.40	148	116
V-0120	Floridan	21.7	7.01	695	116.0	7.1	26.5	1.2	1,275.0	37.0	2.6	308	0.35	0.18	0.20	414	310
V-0123	Floridan	22.6	7.10	731	101.7	8.8	38.9	1.7	2,644.0	71.0	2.1	277	0.26	0.41	0.10	399	284
V-0127	Floridan	23.0		562	87.0	12.8	20.0	1.7	611.0			266				340	
V-0130	Floridan	23.1	6.96	693	98.5	9.9	29.5	1.9	1,365.0	55.0	0.2	289		0.30	0.10	413	266
V-0147	Floridan	23.0		256	31.6	5.9	5.4	0.7	35.3			110			0.22	135	
V-0155	Floridan	23.6		2,282	107.3	52.9	392.7	9.1	136.3			195				1,203	
V-0156	Floridan	22.6	7.81	1,260	70.3	5.1	10.7	5.4	31.3	31.5	61.5	72	0.12	16.10	0.74	356	212
V-0162	Floridan	22.8		850	92.0	12.1	72.3	3.4	218.7			257				485	
V-0164	Floridan	23.3		1,405	101.2	24.7	140.0	4.8	108.2			286				785	
V-0165	Floridan	22.9	7.01	694	130.8	4.6	16.0	1.2	622.0	28.0	3.1	329	0.12	1.12	0.10	402	341
V-0167	Surficial	23.3	6.99	748	119.0	2.4	36.0	0.8	6,665.0	75.0	11.0	232	0.05	0.54	0.20	430	279
V-0183	Floridan	23.9	7.36	977	100.2	18.7	61.9	2.1	57.3			225			0.22	600	
V-0184	Floridan	21.1	7.25	417	70.7	2.0	10.0	0.9	59.2	17.1	2.0	183	0.38	0.30	0.13	232	187
V-0185	Surficial	21.3	8.36	430	71.0	1.4	11.4	1.3	131.9	18.8	35.8	153	0.10	0.05	0.24	233	209
V-0187	Floridan	23.9	7.48	897	69.8	26.0	70.2	4.1	33.0	134.0	12.0	215	0.50	0.31	0.38	485	285
V-0188	Floridan	22.5	7.29	614	94.5	7.6	18.6	1.1	35.4	32.4	3.1	271	0.34	0.24	0.21	285	279
V-0192	Intermediate	22.4	7.05	563	108.4	1.7	9.6	1.0	357.0	15.7	1.1	276	0.46	0.05	0.15	320	279
V-0196	Floridan	23.2	7.57	333	52.9	4.5	17.2	1.3	46.1	8.7	6.3	146	0.45	0.34	0.13	229	148
V-0197	Surficial	23.7	4.73	63	1.0	2.6	2.8	1.8	18.6	7.6	9.5	2	0.04	0.44	0.11	42	13
V-0198	Floridan	22.7	7.14	648	98.5	4.9	32.5	2.1	3,880.0	55.5	9.2	240	0.17	0.32	0.10	374	271
V-0199	Surficial	22.7	7.24	631	91.0	3.9	37.0	1.8	3,630.0	54.0	5.0	226	0.13	0.04		369	
V-0200	Floridan	24.4	7.20	34,200	538.3	749.6	7,308.8	239.5	25.0	14,700.0	1,730.0	131	0.37	0.84	0.24	18,211	4,466
V-0213	Floridan	22.1		284	41.0	7.8	10.0	1.4	87.5			126				166	
V-0215	Floridan	22.7		279	36.3	11.2	6.0	2.5	82.7			106				140	
V-0381	Floridan	23.2	6.99	1,632	144.0	21.9	136.3	2.7	137.3			307				917	
V-0501	Intermediate	23.9		258	43.0	0.7	6.9	2.4	20.0	7.9	0.8	82	0.05	0.02	0.10	127	110
V-0502	Intermediate	22.6	7.17	643	102.0	5.7	22.0	2.2	582.0	34.0	3.1	268		0.01	0.10	328	300
V-0503	Intermediate	23.6	7.19	460	114.0	2.8	13.5	0.9	261.0	20.0	1.8	228	0.19	0.57	0.10	296	302
V-0504	Intermediate	22.2	7.33	588	120.0	2.7	18.5	0.8	201.5	27.0	2.2	266	0.01	0.06	0.10	358	364
V-0505	Intermediate	22.7	7.40	516	102.0	1.7	8.7	1.1	288.5	12.0	2.8	237	0.30	0.17	0.20	302	267
V-0506	Intermediate	22.6	7.72	296	44.0	3.1	8.4	1.6	13.0	7.7	3.4	102	0.05	0.02	0.10	154	124
V-0508	Floridan	24.5		14,628	249.0	307.0	2,570.0	76.9	50.0						0.35	7,970	
V-0522	Intermediate	22.8		51		0.4	6.9	0.7	655.0	7.2	3.7			0.09	0.10		
V-0523	Surficial	22.7	6.06	228	10.4	9.4	23.0	1.7	1,160.0	24.0	4.0	70	0.05	0.02	0.10	147	64
V-0526	Intermediate	21.7		330	46.0	7.9	5.6	1.0	40.0	7.6	0.2	157		0.02	0.10		148

Table C1—*Continued*

Well	Aquifer System	Temp (°C)	pH	SC (µmhos/cm)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Fe (µg/L)	Cl (mg/L)	S (mg/L)	Alk (mg/L)	P (mg/L)	NO_x (mg/L)	F (mg/L)	TDS (mg/L)	Hard (mg/L)
V-0528	Surficial	23.4	4.95	190	6.7	2.9	10.9	5.2	875.3	18.5	30.5	8	0.04	0.02	0.05	103	29
V-0531	Floridan	23.3	7.98	281	42.2	6.3	7.2	3.8	24.3	10.2	6.3	113	0.58	0.43	0.13	148	221
V-0536	Intermediate	22.8	8.05	189	41.3	1.2	4.9	1.0	7.7	7.0	8.0	105		0.27	0.13	160	108
V-0541	Surficial	22.5	5.24	90	5.4	1.4	2.6	6.8	15.0	7.9	17.0	5		0.72	0.10	48	19
V-0542	Intermediate	22.8	7.65	286	46.0	1.2	8.4	1.0	27.0	7.4	25.5	104		0.24	0.20	192	120
V-0543	Surficial	26.5	6.23	781	102.0	9.9	26.0	1.0	4,767.0			179	0.06	0.04	0.11	542	
V-0546	Surficial	23.6	6.85	523	95.0	1.3	8.0	1.0	645.0			272	0.41	0.01	0.15	352	
V-0557	Intermediate	22.8		461	53.3	1.5	12.3	7.2	201.6	6.6	1.4	81	0.06	0.05	0.31	168	86
V-0558	Surficial	24.0	7.11	321	52.0	1.0	12.2	1.2	621.5	23.5	9.9	102		0.01	0.10	186	133
V-0559	Intermediate	23.0	7.17	626	98.5	5.9	29.3	1.4	240.8	76.0	3.7	237	0.20	0.03	0.18	370	273
V-0566	Intermediate	21.8	7.11	538	72.0	6.7	40.0	6.5	50.0			268	0.29	0.04	0.46	384	
V-0567	Floridan	22.5	7.47	365	56.0	12.5	8.0	1.6	74.0			206				209	
V-0569	Floridan	24.1	8.07	250	36.0	5.6	4.7	0.7	17.0	8.0	1.8	110		0.17	0.10	134	113
V-0578	Surficial	21.2	6.09	331	37.0	1.3	32.0	1.7	320.0	26.0	23.0	99		0.02	0.10	190	98
V-0614	Floridan	22.1	7.24	771	120.0	11.0	35.0	1.4	41.0	56.0	0.5	330		0.18	0.20	440	336
V-0742	Floridan	22.8	7.60	302	40.0	7.9	8.1	2.1	231.7	13.0	3.7	133		0.20	0.20	162	121
V-0743	Intermediate	23.5	7.37	299	46.0	2.8	14.0	2.7	76.0	6.1	3.6	140		0.02	0.10	171	127
V-0744	Surficial	23.6	5.21	168	1.8	1.0	3.5	0.3	429.7	7.3	1.7	4		0.02	0.10	27	10
V-0761	Surficial	22.1	5.86	198	21.0	1.7	12.0	1.1	7,600.0	15.0	2.5	63		0.02	0.10		60

Blank cells indicate no data are available.

Note: Temp = temperature
Ca = calcium
Mg = magnesium
Na = sodium
K = potassium
Fe = iron
Cl = chloride
S = sulfate
Alk = alkalinity
P = phosphate
NO_x = nitrate and nitrite
F = fluoride
TDS = total dissolved solids
SC = specific conductance
Hard = hardness

mg/L = milligrams per liter
µg/L = micrograms per liter
µmhos/cm = micromhos per centimeter

Table C1—*Continued*

Well	Aquifer System	Temp (°C)	pH	SC (µmhos/cm)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Fe (µg/L)	Cl (mg/L)	S (mg/L)	Alk (mg/L)	P (mg/L)	NO_x (mg/L)	F (mg/L)	TDS (mg/L)	Hard (mg/L)
F-0252	Surficial	23.0	6.74	811	125.5	4.2	27.9	1.1	14,028.0	68.8	1.6	314	0.10	0.07	0.10	512	
F-0291	Surficial	22.7	6.87	647	90.0	5.4	28.0	2.3	3,200.0	35.0	0.2	270		0.03	0.80	339	248
F-0293	Intermediate	22.1	6.99	790	128.1	7.2	27.8	1.7	2,151.4	50.0	1.8	309		0.02	0.13	478	329
F-0294	Floridan	21.7	7.44	2,241	151.1	73.5	204.1	6.9	47.4	495.0	320.0	179		0.20	0.34	1,362	624
F-0295	Surficial	22.0	6.79	710	119.4	3.2	23.8	0.9	1,661.3	50.0	0.2	285		0.02	0.11	439	313
IR0274	Intermediate	23.2	7.29	536	66.7	13.0	22.4	5.6	346.9	27.6	1.0	244	0.03	0.03	0.41	321	224
IR0275	Surficial	23.4	7.25	677	84.4	2.1	62.3	0.9	18.9	64.7	19.6	238	0.19	0.12	0.11	409	229
IR0277	Surficial	25.3	6.75	878	140.0	7.3	46.9	0.9	1,190.0	77.0	150.0		0.39	0.10	0.20	495	
IR0279	Surficial	25.5	6.96	723	127.0	4.4	29.4	1.0	712.0	54.0	3.6	278	0.29	0.68	0.20	392	318
IR0282	Intermediate	25.4	7.09	633	109.0	5.4	27.6	2.6	1,240.0	33.0	3.1	268	0.10	0.02	0.20	314	297
IR0283	Surficial	26.9	5.59	441	34.6	6.9	18.2	28.9	216.0	31.5	8.1	142	0.02	0.69	0.10	250	122
IR0284	Intermediate	23.9	7.33	629	68.9	18.2	39.2	6.3	949.0	34.7	2.2	267	0.02	0.29	0.55	394	242
IR0287	Intermediate	24.2	7.53	606	44.7	20.7	51.5	12.2	359.0	36.5	2.6	243	0.01	0.61	0.90	347	192
IR0289	Intermediate	24.7	7.29	666	72.2	20.3	37.0	12.8	278.0	42.5	4.7	264	0.04	0.89	0.50	388	236
IR0290	Surficial	25.2	5.12	125	7.0	2.1	10.8	1.9	145.5	18.5	3.3	25	0.01	0.88	0.10	49	36
IR0312	Floridan	25.0	7.62	1,260	32.5	40.7	150.6	13.3	51.2	283.5	115.0	145	0.49	0.15	0.93	670	325
IR0313	Floridan	24.9	7.67	1,714	32.0	37.7	107.7	10.4	189.2	187.0	102.0	149	0.43	0.15	1.00	550	277
IR0350	Surficial	22.1	6.72	1,760	212.0	5.5	135.0	1.4	6,265.0	375.0	113.0		0.08	0.06	0.15	1,007	599
L-0032	Floridan	22.1		2,902	129.6	49.3	407.6	10.8	148.6			164			0.22	1,813	
L-0037	Floridan	22.9	7.43	1,982	130.2	37.2	226.6	8.1	317.1	454.0	279.5	194	0.41	0.55	0.19	1,220	543
L-0038	Floridan	22.3		550	71.8	9.2	31.8	1.7	894.8			170			0.26	349	
L-0040	Floridan	22.0	7.40	329	51.5	8.2	4.6	0.6	650.0	7.8	0.3	159	0.13	0.25	0.10	176	164
L-0041	Surficial	23.6	5.41	56	3.7	0.7	2.0	0.6	3,710.0	3.5	2.3	14	0.02	0.37	0.10	52	11
L-0044	Surficial	25.2	6.94	406	35.5	7.5	6.1	7.6	33.0	4.7	36.5	72	0.07	2.80	0.10	195	79
L-0045	Floridan	23.4	7.40	2,850	120.0	48.0	360.0	6.5	220.0	700.0	110.0	196	0.20	0.20	0.20	1,480	510
L-0050	Surficial	23.3	4.99	84	4.8	1.4	4.9	1.7	19.5	11.9	11.0	3	0.01	0.13	0.10	53	17
L-0051	Floridan	23.8	7.87	199	34.5	0.9	3.1	2.4	7.0	7.5	5.3	77	0.60	0.28	0.10	136	89
L-0053	Floridan	23.2	8.14	253	23.5	12.6	4.8	0.7	7.0	18.5	2.2	67	0.50	5.35	0.20	152	107
L-0059	Floridan	23.1	7.57	992	61.8	20.3	102.4	3.7	38.4			163			0.64	557	
L-0062	Floridan	24.0	6.75	264	47.5	1.1	5.2	0.7	2,060.0	9.5	1.2	105	0.95	0.80	0.30	165	111
L-0066	Floridan	23.1	7.78	1,369	56.5	23.0	170.0	3.8	7.0	325.0	79.0	83	0.30	0.65	0.10	715	235
L-0095	Floridan	23.9	7.34	377	66.9	2.4	5.6	1.0	493.2	13.0	2.9	168	0.41	0.34	0.12	217	180
L-0096	Surficial	24.3	8.20	249	42.1	1.9	5.3	1.0	27.2	15.8	9.8	85	0.06	2.37	0.13	180	
L-0199	Floridan	24.7	8.50	223	27.5	6.8	5.2	0.8	11.5	12.0	6.3	49	0.13	5.86	0.10	139	93
L-0286	Surficial	23.7	7.36	350	58.6	5.8	5.2	1.4	21.5	6.9	4.1	170	0.06	0.07	0.14	210	168
L-0289	Surficial	24.1	6.91	64	5.7	1.3	3.6	0.6	6.5	4.7	4.2	15	0.06	0.92	0.10	52	19
L-0290	Floridan	24.2	8.10	251	34.0	7.0	4.9	1.9	6.5	7.6	7.5	107	0.55	0.20	0.10	150	109
L-0301	Surficial	23.0	7.12	600	84.0	19.6	10.4	6.9	728.9								

Table C1—*Continued*

Well	Aquifer System	Temp (°C)	pH	SC (µmhos/cm)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Fe (µg/L)	Cl (mg/L)	S (mg/L)	Alk (mg/L)	P (mg/L)	NO_x (mg/L)	F (mg/L)	TDS (mg/L)	Hard (mg/L)
L-0308	Surficial	22.9	6.47	71	3.0	1.4	1.8	5.9	55.6				0.05				
L-0320	Surficial	24.9	6.39	213	23.3	11.8	4.4	7.8	56.3				0.03				
L-0325	Surficial	23.6	7.22	447	52.9	15.5	13.9	5.1	57.1				0.02				
L-0378	Surficial	25.4	6.56	152	10.5	5.0	4.2	3.5	157.0	6.8	26.5	30	0.04	0.03	0.10	96	45
L-0455	Floridan	22.4	7.25	418	68.1	6.9	5.6	1.6	475.2	9.5	0.2	206		0.20	0.63	212	202
L-0456	Surficial	22.1	5.71	102	6.7	1.0	7.6	4.0	360.0	12.1	4.7	20		0.02	0.10	53	21
L-0458	Intermediate	23.2	7.26	565	81.5	6.2	23.0	2.3	50.0			289			0.21	417	
L-0460	Surficial	23.5	5.21	83	5.1	1.5	5.2	0.5	1,474.4	11.1	3.2	15		0.02	0.06	52	18
L-0591	Floridan	23.9	7.52	366	52.0	8.8	6.7	0.8	17.0	12.0	6.3	160		0.95	0.20	196	166
L-0592	Floridan	23.4	7.65	353	52.0	9.0	6.2	1.0	25.0	9.8	2.1	170		0.50	0.10	194	167
L-0593	Floridan	24.2	8.09	254	27.0	8.3	6.4	2.8	4.0	11.5	19.5	84		0.73	0.10	135	101
L-0594	Floridan	23.6	8.06	200	31.0	5.1	3.6	0.4	10.0	5.9	3.4	85		1.20	0.10	112	99
L-0595	Floridan	23.5	8.11	244	27.5	7.3	6.5	1.4	7.5	12.0	6.3	95		0.20	0.20	131	99
L-0596	Floridan	24.6	7.98	218	24.0	9.8	3.9	0.5	45.0	6.3	2.5	99		0.20	0.10	118	100
M-0013	Floridan	22.4	7.63	307	41.5	9.8	5.5	1.9	66.5	8.0	2.7	141	0.40	0.20	0.20	181	143
M-0021	Floridan	22.3	8.26	904	44.0	18.0	98.5	3.5	20.0	182.0	85.0	69	0.10	0.45	0.10	480	182
M-0024	Floridan	22.4	8.51	122	14.5	2.8	3.7	0.4	9.0	6.4	11.0	193	0.20	0.13	0.10	65	48
M-0025	Floridan	22.6	7.08	716	89.0	15.0	27.0	1.0	230.0	37.0	24.0		0.50	0.50	0.28		
M-0026	Floridan	24.0	7.45	692	94.0	20.0	11.0	1.0	210.0	16.0	180.0		0.50	0.28	0.20		
M-0028	Floridan	23.4	7.55	459	60.5	13.5	7.8	1.1	3,585.0	9.9	85.5	140	0.50	0.24	0.20	294	221
M-0031	Floridan	23.7	7.47	315	55.0	4.2	3.0	0.6	28.0	5.8	12.5	137	0.20	0.82	0.10	174	155
M-0036	Floridan	21.9	7.44	374	45.0	15.0	6.6	1.7	48.5	13.5	3.5	180	0.50	0.18	0.23	231	186
M-0037	Floridan	24.8	7.34	357	55.5	6.5	4.4	1.3	30.5	6.1	32.0	130	0.50	1.30	0.15		170
M-0038	Floridan	25.0	7.72	227	33.0	4.6	3.6	0.8	29.0	4.7	22.5	87	0.50	0.91	0.15		115
M-0039	Floridan	24.5	7.13	352	61.0	1.8	3.5	0.9	50,025.0	4.5	12.0	150	0.14	0.38	0.31	288	165
M-0041	Floridan	24.3	7.20	427	72.0	8.6	4.0	0.5	24.0	6.8	35.0	167	0.30	0.94	0.10	239	218
M-0044	Floridan	21.7	7.25	391	53.8	14.2	5.2	1.1	510.5	7.5	1.0	194	0.27	0.28	0.37	235	194
M-0045	Surficial	21.7	4.59	53	0.7	0.4	3.1	4.8	262.4	5.5	5.6	2	0.09	0.04	0.19	93	4
M-0048	Floridan	24.8	7.44	355	40.0	10.0	6.5	1.0	50.0	8.4	12.0		0.50	0.13	0.20		
M-0049	Floridan	22.7	8.11	241	23.0	7.7	11.5	0.9	69.5	20.5	6.7	79	0.10	0.35	0.10	126	89
M-0052	Floridan	21.8	6.97	567	110.0	2.4	9.0	0.4	9.0	15.5	4.6	271	0.20	0.47	0.35	321	283
M-0063	Floridan	23.7	7.62	273	42.0	1.5	7.1	2.6	8.5	10.7	1.0	105	0.10	4.75	0.10	149	109
M-0208	Floridan	23.8	7.54	276	49.0	1.4	3.8	2.7	8.5	4.0	3.3	120	0.50	1.23	0.10		115
M-0211	Surficial	23.9	5.59	304	21.7	6.0	23.9	0.6	8.0	40.5	35.5	34	1.25	0.89	0.24	165	80
M-0213	Floridan	23.3	7.10	166	28.9	1.3	2.8	0.9	8.0	2.4	3.5	55	0.52	0.56	0.40	73	64
M-0243	Floridan	22.2	7.24	299	59.2	1.2	0.9	1.3	10.0	2.1	5.7	160	0.16	0.51	0.22	175	165
M-0254	Surficial	23.7	8.84	496	4.9	1.2	93.0	2.9	30.0	7.3	64.0	161	0.17	0.34	0.50	281	17
M-0322	Floridan	24.0	7.27	537	84.5	11.0	7.9	0.9	13.5	12.0	81.0	170		1.40	0.20	312	257

Table C1—*Continued*

Well	Aquifer System	Temp (°C)	pH	SC (µmhos/cm)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Fe (µg/L)	Cl (mg/L)	S (mg/L)	Alk (mg/L)	P (mg/L)	NO_x (mg/L)	F (mg/L)	TDS (mg/L)	Hard (mg/L)
N-0018	Surficial	20.8	7.58	1,625	88.0	24.0	200.0	16.0	1,600.0	280.0	0.2	355		0.02	0.80		319
N-0019	Intermediate	20.6	7.45	2,130	33.0	46.0	320.0	28.0	10.0	410.0	26.0	420		0.04	0.30	1,173	272
N-0109	Surficial	26.1	4.92	43	0.7	0.7	3.7	0.9	480.0	7.4	1.2	2		0.02	0.10	25	5
N-0110	Intermediate	24.5	7.78	496	61.0	20.0	17.0	4.3	7.0	14.0	2.0	250		0.02	0.60	298	236
N-0128	Floridan	23.9	7.07	734	66.0	35.2	24.0	2.5	50.0			156			0.59	483	
N-0199	Floridan	25.1	7.58	633	62.0	30.0	19.0	1.6	5.0	28.0	120.0	159		0.20	0.60	392	279
N-0201	Intermediate	23.0	8.69	199	25.0	5.1	4.9	1.2	12.0	5.8	2.2	89		0.02	0.20	111	84
N-0203	Surficial	23.4	6.16	114	8.4	1.5	8.5	1.1	2,400.0	8.9	3.7	31		0.02	0.10	68	27
OK0001	Floridan	24.3	7.50	637	87.5	7.0	39.9	1.8	507.5	48.0	2.9		0.41	0.15	0.38	309	245
OK0055	Surficial	23.0	6.16	252	40.9	0.8	7.4	0.4	5,095.0	14.5	4.3		0.05	0.06	0.15	97	93
OR0003	Floridan	23.7	7.45	841	63.4	30.7	54.0	2.3	181.8	103.0	68.0	187	0.18	0.35	0.60	469	304
OR0007	Floridan	24.3	7.72	588	52.6	14.2	37.0	1.8	92.7	69.0	38.5	158	0.30	0.65	0.10	323	223
OR0008	Intermediate	23.7	7.07	586	117.5	2.5	8.5	0.9	989.0	8.9	3.1	276	0.32	0.49	0.10	375	313
OR0013	Floridan				139.0	47.7	318.0	10.6	501.0			192				1,450	578
OR0016	Surficial	21.3	6.09	776	82.0	11.0	42.0	14.0	3,800.0	106.0	86.0			0.80	0.10	413	250
OR0017	Intermediate	23.2	6.90	640	118.0	4.2	17.1	1.0	1,735.0	16.5	2.6	310		0.04	0.15	360	304
OR0025	Floridan	24.5	7.30	772	110.0	11.0	42.0	1.8	70.0	68.0	74.0	264			0.20	536	
OR0035	Floridan	22.4	7.82	393	39.5	11.1	25.1	1.3	35.3			102			0.28	293	
OR0047	Floridan	24.9	8.06	185	22.0	7.1	3.9	0.8	64.0	6.8	5.1	71	0.16	0.78	0.10	124	90
OR0060	Floridan	24.6		956	83.9	26.0	107.0	3.3	42.4			103			0.29	653	
OR0068	Floridan	23.3	7.77	1,216	73.1	25.3	120.0	3.4	103.3	245.0	146.0	98	0.16	0.25	0.31	660	283
OR0082	Floridan	23.5	7.03	620	121.0	3.8	20.9	0.9	387.0	12.0	5.0		0.44	0.50	0.20	304	
OR0089	Surficial	24.5	6.18	313	38.7	8.6	5.8	11.7	112.5	6.9	19.7	110	0.36	2.99	0.31	187	151
OR0101	Floridan	22.9		125	6.0	4.6	4.0	4.9	50.0	9.0	25.0		0.24	2.04	0.50	68	
OR0106	Floridan	23.4	8.21	236	28.0	6.2	5.0	1.2	27.0	8.1	8.8	92		0.20	0.20	128	96
OR0107	Surficial	23.6	4.65	154	6.3	4.6	6.6	4.8	281.0	11.2	31.5	2	0.60	2.07	0.10	160	34
OR0248	Surficial	20.5	6.04	316	16.5	4.4	11.0	0.7	28,150.0	34.0	6.2	91	0.03	0.27	0.10	144	51
OR0264	Surficial	22.8	6.39	247	37.0	1.1	6.2	0.6	9,030.0	12.5	3.9	91	0.08	1.83	0.10	127	94
OR0265	Floridan	24.1	7.57	1,177	103.0	22.8	94.7	3.6	194.4	137.0	86.0	200	0.78	0.35	0.41	818	395
OR0546	Intermediate	24.4	8.22	388	27.0	7.7	22.5	32.6	116.0	8.1	48.0	136		0.88	0.30	233	85
OR0548	Floridan	24.1	8.12	306	39.7	10.7	5.9	1.8	237.0	9.5	13.0	198		0.10	0.10	173	135
OR0554	Floridan	25.5	7.90	485	65.0	16.0	4.9	1.0	16.0	8.0	120.0	100		0.20	0.20	292	229
OR0555	Floridan	25.2	7.94	272	37.0	8.1	6.5	0.9	4.0	9.5	5.9	120		0.60	0.20	151	126
OR0558	Floridan	25.1		551	59.6	12.2	36.9	2.9	64.3				0.72				
OR0559	Floridan	25.1	8.03	226	30.0	7.2	4.3	0.7	5.0	6.8	2.9	100		0.11	0.10	124	105
OR0560	Floridan	25.4	8.00	303	41.0	8.7	7.6	1.0	9.0	9.6	10.0	130		0.20	0.20	169	140
OS0004	Floridan	23.3	7.31	638	88.7	14.8	29.2	1.3	22.8	43.4	10.4	266	0.65	0.26	0.91	428	280
OS0017	Floridan	24.0		1,222	59.1	31.2	129.5	3.7	19.3			128			0.68	637	

Table C1—*Continued*

Well	Aquifer System	Temp (°C)	pH	SC (µmhos/cm)	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	Fe (µg/L)	Cl (mg/L)	S (mg/L)	Alk (mg/L)	P (mg/L)	NO_x (mg/L)	F (mg/L)	TDS (mg/L)	Hard (mg/L)
OS0024	Surficial	23.6	6.79	584	121.5	1.2	8.1	1.1	242.5	9.2	2.6		0.07	0.04	0.15	21	305
OS0031	Floridan	24.6		1,156	41.7	33.2	120.7	5.6	44.7			138				592	
OS0171	Surficial	20.3	6.48	1,473	124.5	11.6	118.0	1.9	41,300.0	325.0	4.8		0.04	0.04	0.15	662	413
OS0179	Surficial	23.2	5.87	176	4.4	0.8	6.3	0.8	32,400.0	13.5	3.8		0.07	0.04	0.15	48	12
OS0183	Surficial	22.9	6.25	283	4.1	1.6	18.1	3.6	38,900.0	45.5	6.6		0.02	0.04	0.15	94	18
P-0001	Floridan	23.4		76	6.3	1.8	3.8	0.8	200.0	8.1	0.5	22		0.30	0.20	37	23
P-0102	Floridan	20.9	7.17	543	70.0	12.2	8.0	1.2	674.0			228			0.14	277	
P-0123	Floridan	23.6		503	33.0	16.5	28.5	1.7	50.0			116			0.22	260	
P-0144	Intermediate	22.5	7.80	410	58.0	5.8	18.0	5.8	320.0	12.0	1.0	197	0.13	0.11	0.17	229	170
P-0145	Intermediate	22.5	7.33	569	61.3	11.0	33.3	8.2	186.7	58.7	1.3	193	0.09	0.03	0.20	303	198
P-0146	Intermediate	22.5	7.18	426	80.0	0.8	7.2	1.4	1,000.0	6.6	3.2	210		0.06	0.35	257	204
P-0147	Surficial	22.4	7.21	500	67.3	10.7	16.3	2.9	480.0	28.0	1.7	209	0.04	0.02	0.30	267	211
P-0148	Surficial	23.7	4.60	44	0.8	0.5	4.7	0.6	790.0	7.5	0.2	1		0.02	0.10		4
P-0172	Floridan	22.4	7.54	2,580	120.0	68.0	280.0	7.3	30.0	610.0	280.0	101		0.20	0.30	1,460	600
P-0242	Floridan	22.6	7.41	341	47.0	4.5	12.5	2.0	58.5	18.5	11.4	126	0.23	0.20	0.20	181	138
P-0246	Floridan	23.6	7.58	243	39.0	4.1	5.2	0.8	160.0	6.7	0.2	113	0.10	0.20	0.10	132	110
P-0270	Floridan	22.9	7.49	319	45.5	7.9	6.2	0.9	148.5	8.2	0.2	148	0.20	0.20	0.17	181	150
P-0306	Floridan	22.8	7.47	199	24.0	7.1	3.1	0.8	60.0	4.9	1.3	90	0.10	0.20	0.10	105	89
P-0395	Floridan	22.8	7.75	751	46.0	19.0	64.5	1.8	92.5			97				396	
P-0408	Floridan	23.9	8.34	188	19.0	6.5	8.1	0.9	10.0	5.1	3.8	79	0.10	0.20	0.70	101	75
P-0410	Floridan	22.5	7.24	526	75.3	12.0	15.7	1.6	6.3	27.7	0.9	230	0.20	0.23	0.20	284	239
P-0413	Floridan	25.3	8.09	139	21.0	1.3	4.5	0.7	10.0	6.1	5.3	53	0.20	0.30	0.10	80	58
P-0418	Floridan	23.7	7.60	990	62.0	28.0	81.0	2.5	10.0	200.0	48.0	121		0.20	0.20	509	270
P-0427	Floridan	23.0	8.21	144	23.5	1.0	3.8	0.8	12.0	4.8	7.8	52	0.21	0.35	0.10	53	62
P-0450	Floridan	22.5	8.59	722	29.0	13.5	88.0	1.0	43.0	177.0	36.0	44	0.70	0.26		290	
P-0468	Floridan	22.1	7.07	633	96.0	15.0	16.0	1.2	1,200.0	33.0	0.2	282		0.40	0.20	347	300
P-0469	Floridan	22.9	6.88	677	85.0	17.5	25.5	1.2	970.0	59.0	0.3	270		0.30	0.20	393	285
P-0470	Surficial	22.5	5.05	138	7.1	1.9	10.3	1.3	2,500.0	29.7	0.3	7	0.27	0.04	0.10	86	26
P-0472	Floridan	22.3	7.69	2,885	110.0	49.5	375.0	6.2	32.0	796.0	160.0	79	0.10	0.80	0.20	1,553	475
P-0473	Surficial	21.2	5.90	219	26.5	2.3	11.5	0.6	835.0	21.0	1.3	68	0.94	0.02	0.20	129	76
P-0474	Floridan	23.0	8.02	996	73.2	27.9	64.0	2.5	13.3	181.5	109.7	83	0.37	0.43	0.34	633	301
P-0475	Surficial	22.2	7.96	205	34.9	1.2	4.7	0.7	17.6	7.7	8.0	84	0.14	0.26	0.11	127	91
P-0495	Floridan	22.7		400	56.0	9.4	7.5	1.2	248.0			195				225	
P-0510	Floridan	22.0	8.12	261	36.0	8.2	4.6	1.0	10.0	6.7	1.8	123		0.20	0.10	145	120
P-0511	Surficial	21.8	6.13	115	16.0	0.5	3.7	0.5	290.0	5.9	2.1	38		0.02	0.10	62	44
P-0691	Floridan				32.0	2.9	6.0	1.2	132.0								
P-0696	Floridan				49.3	4.4	5.3	1.0	50.0			248				178	151
P-0719	Floridan				39.0	5.8	9.0	0.9	50.0			120				161	