Geochemistry of the Upper Floridan Aquifer and Avon Park Permeable Zone Within the South Florida Water Management District

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ACRONYMS AND ABBREVIATIONS

AGR	Agricultural Irrigation
APPZ	Avon Park Permeable Zone
ASR	aquifer storage and recovery
AWS	alternative water supply
CFWI	Central Florida Water Initiative
FAS	Floridan aquifer system
FDEP	Florida Department of Environmental Protection
ft	foot
ft^2/day	square feet per day
LEC	Lower East Coast
LFA	Lower Floridan aquifer
LKB	Lower Kissimmee Basin
LWC	Lower West Coast
mg/L	milligrams per liter
mgd	million gallons per day
NGVD29	National Geodetic Vertical Datum of 1929
PWS	Public Water Supply
RFGW	Regional Floridan Groundwater (monitoring network)
SFWMD	South Florida Water Management District
TDS	total dissolved solids
UEC	Upper East Coast
UFA	Upper Floridan aquifer
UKB	Upper Kissimmee Basin
USACE	United States Army Corps of Engineers

INTRODUCTION

The Regional Floridan Groundwater (RFGW) monitoring network was developed to evaluate current and future water quality and water level trends in the Floridan aquifer system (FAS) within the South Florida Water Management District (SFWMD). The RFGW network comprises 124 monitor wells completed in aquifers and confining units within the FAS. This report covers the stations sampled in the Upper Floridan aquifer (UFA) and Avon Park Permeable Zone (APPZ). Data from the RFGW network are used to evaluate long-term trends and current conditions, detect short-term temporal trends, and support development of FAS groundwater models within the SFWMD. Water supply planners use groundwater data and models to determine the long-term viability of the FAS as a water source and to monitor the effects of increasing use.

The RFGW network contains 50 monitor wells completed in the UFA and 22 monitor wells completed in the APPZ. Of these, 29 UFA wells and 12 APPZ wells have been sampled at least 5 times to establish background aquifer conditions. This subset of wells is referred to as the baseline, and their corresponding water quality analyses are presented in the results section of this report. **Figures 1** and **2** show the locations of RFGW wells completed in the UFA and APPZ, respectively. The status of the wells is characterized as: baseline (five of more sampling events), non-baseline (less than five sampling events), or retired (wells that are no longer being sampled in the network).

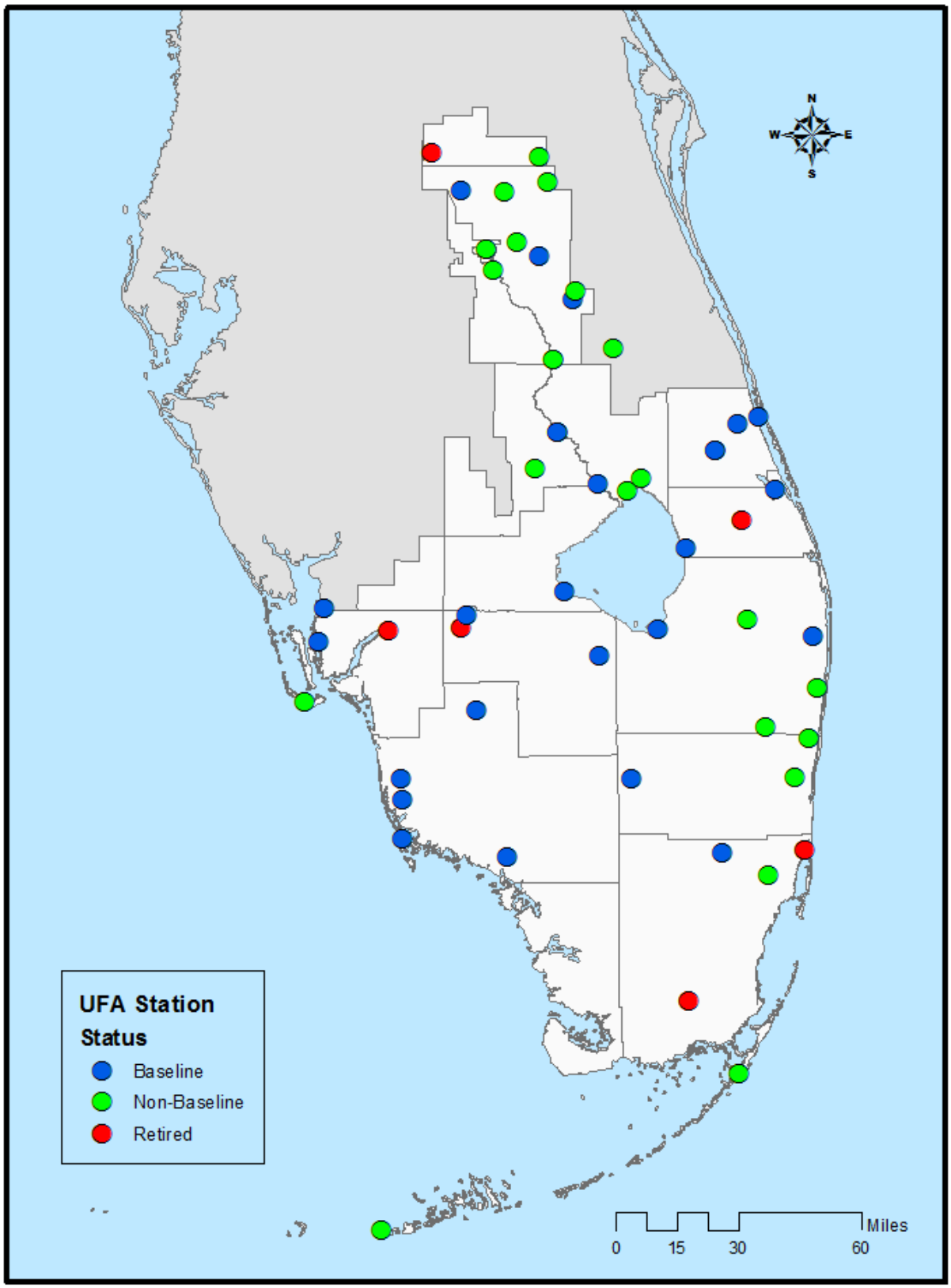


Figure 1. Location and status of RFGW monitoring stations completed in the UFA.

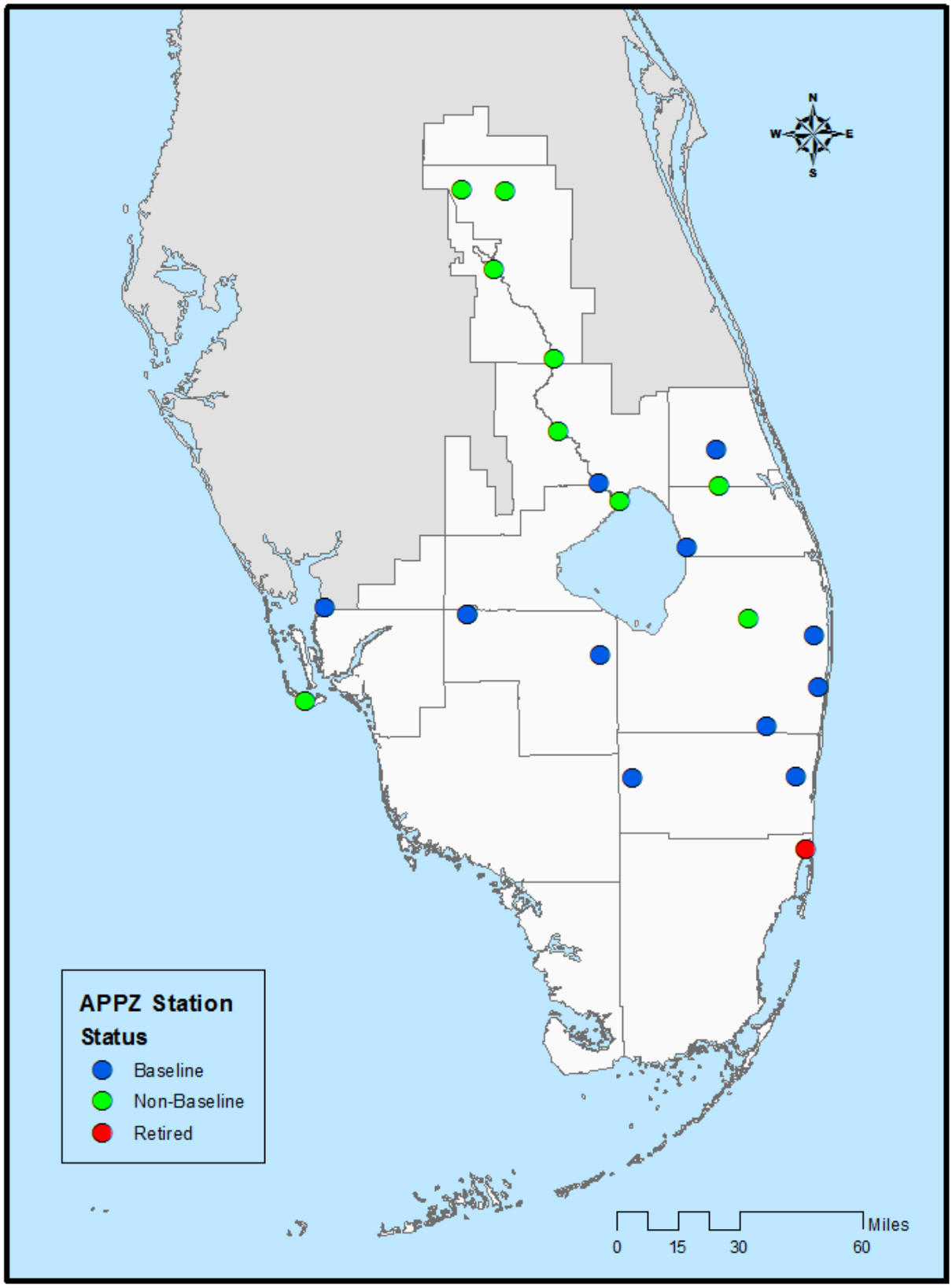


Figure 2. Location and status of RFGW monitoring stations completed in the APPZ.

Regional Geology and Hydrogeology

The FAS is a sequence of interbedded carbonate rocks, ranging in thickness from 2,700 to 3,400 feet (ft) in the SFWMD. The FAS is separated from the shallower surficial aquifer system by the Intermediate Confining Unit. This report utilizes the hydrogeologic units defined by Reese and Richardson (2008), a comprehensive study specific to central and southern Florida that includes lithological and geophysical data from several RFGW monitor wells. Reese and Richardson (2008) separated the FAS into four main sections: the UFA, Middle Confining Unit, APPZ, and Lower Floridan aquifer (LFA). **Figure 3** shows a generalized cross-section of the geologic and hydrogeologic units of the FAS.

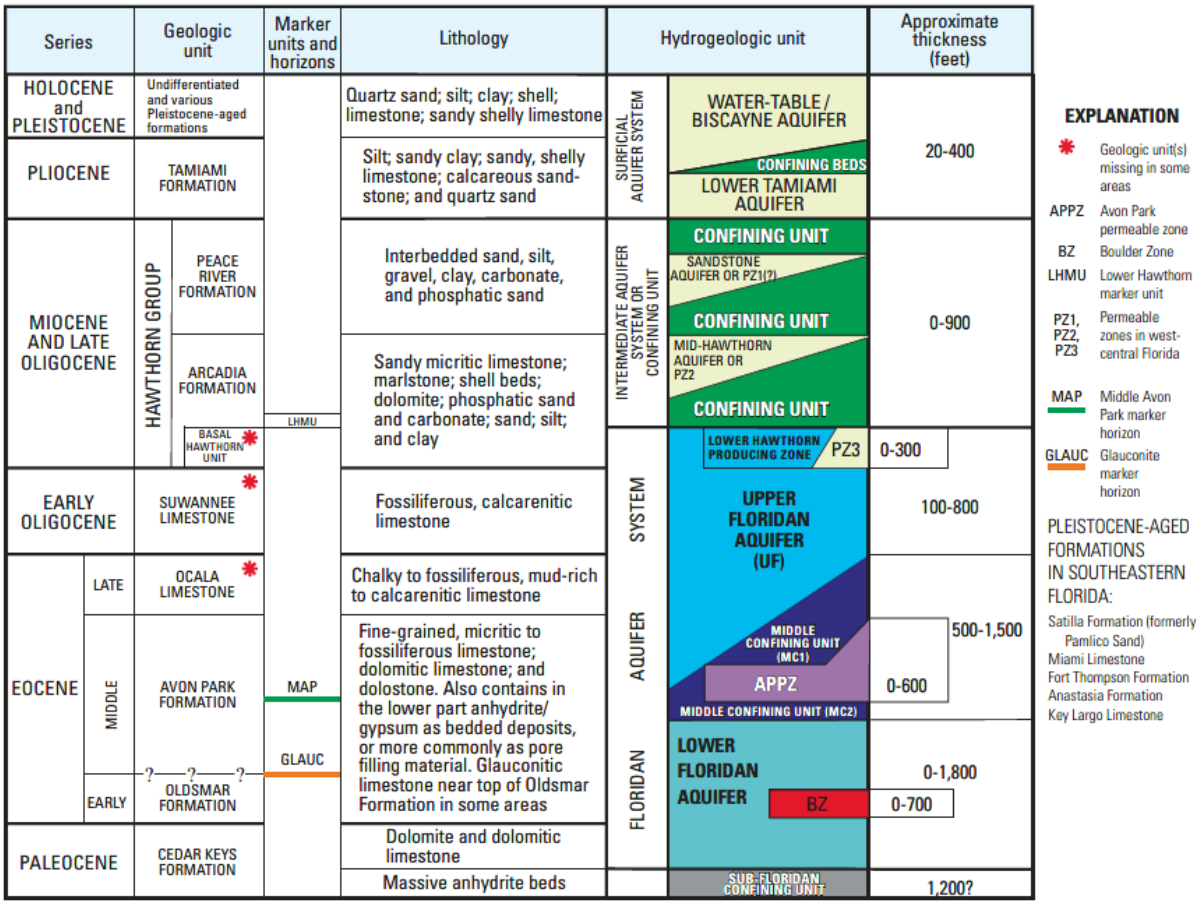


Figure 3. Generalized cross-section of the FAS in central and southern Florida (From: Reese and Richardson, 2008).

Present throughout the SFWMD, the UFA is recharged in Polk County where confining beds are thin or breached by sinkholes. The top of the UFA ranges from near land surface in portions of central Florida to depths of approximately -1,100 ft National Geodetic Vertical Datum of 1929 (NGVD29) in Miami-Dade County. Thickness ranges from less than 100 ft in central Florida to more than 700 ft in southwestern Florida (**Figure 4**). The UFA is most transmissive in west-central Florida and is greater than 100,000 feet squared per day (ft^2/day) in northwestern Polk County. Running through the center of the Florida peninsula is an area of low transmissivity (less than 10,000 ft^2/day) extending from southeastern Polk County to northwestern Miami-Dade County (Reese and Richardson, 2008).

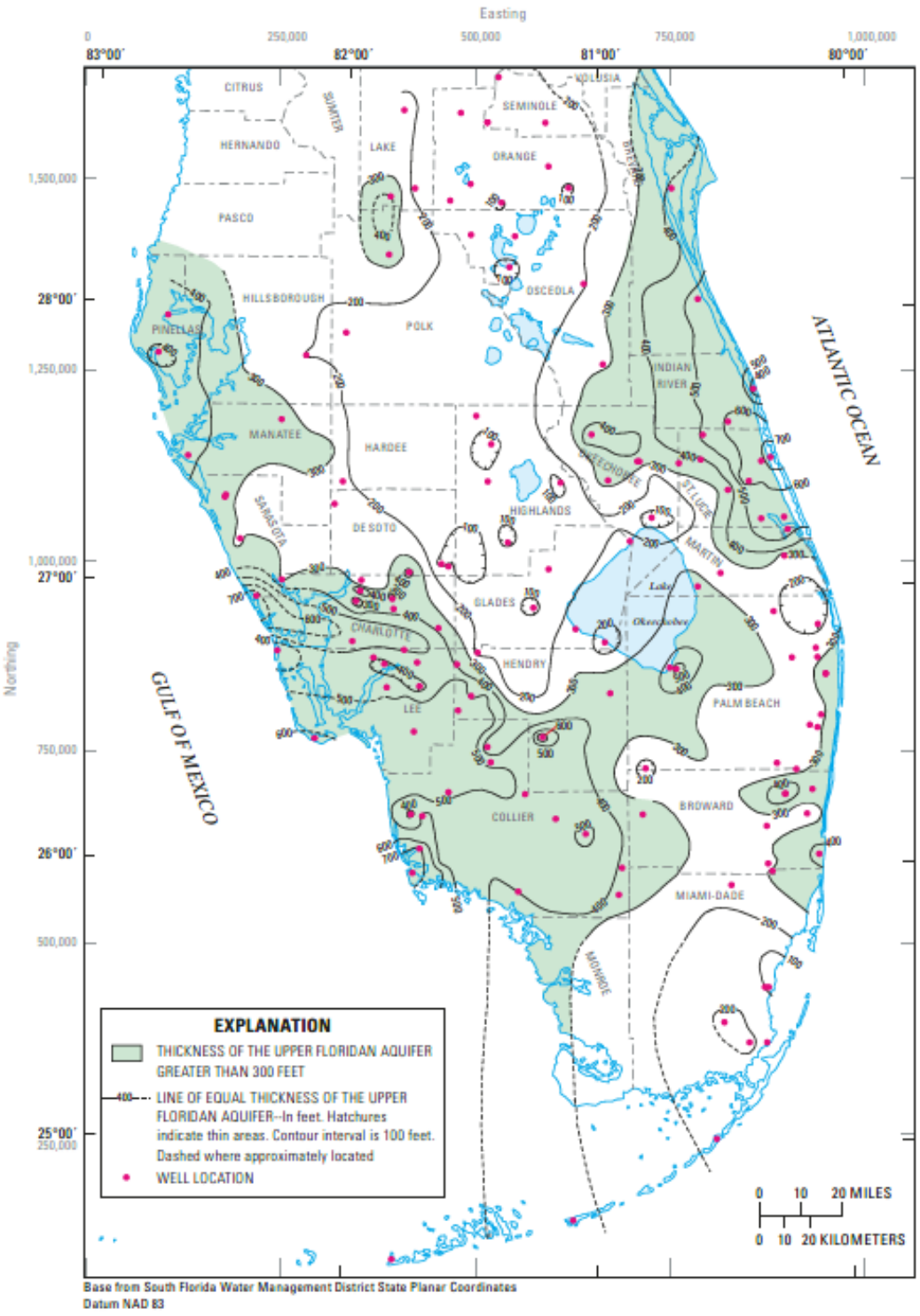


Figure 4. Isopach map of the UFA (From: Reese and Richardson, 2008).

The APPZ is present throughout the SFWMD except for southern Collier County and most of Monroe County. The APPZ is thickest in west-central Florida (approximately 500 ft) and thins out to approximately 200 ft thick in portions of St. Lucie, Martin, and Palm Beach counties (**Figure 5**). Where present, the APPZ is approximately 100 ft thick. It is wholly contained within the Avon Park Formation, generally in the upper and middle sections. The top of the APPZ ranges from approximately -200 ft NGVD29 in Orange County

to -1,800 ft NGVD29 in Lee County. In Miami-Dade County, the top of the APPZ is at -1,500 to -1,700 ft NGVD29. Permeability is largely driven by fracturing in the APPZ, and transmissivity can vary from less than 100,000 ft^2/day in southern Florida to 1.6 million ft^2/day in west-central Florida (Reese and Richardson, 2007).

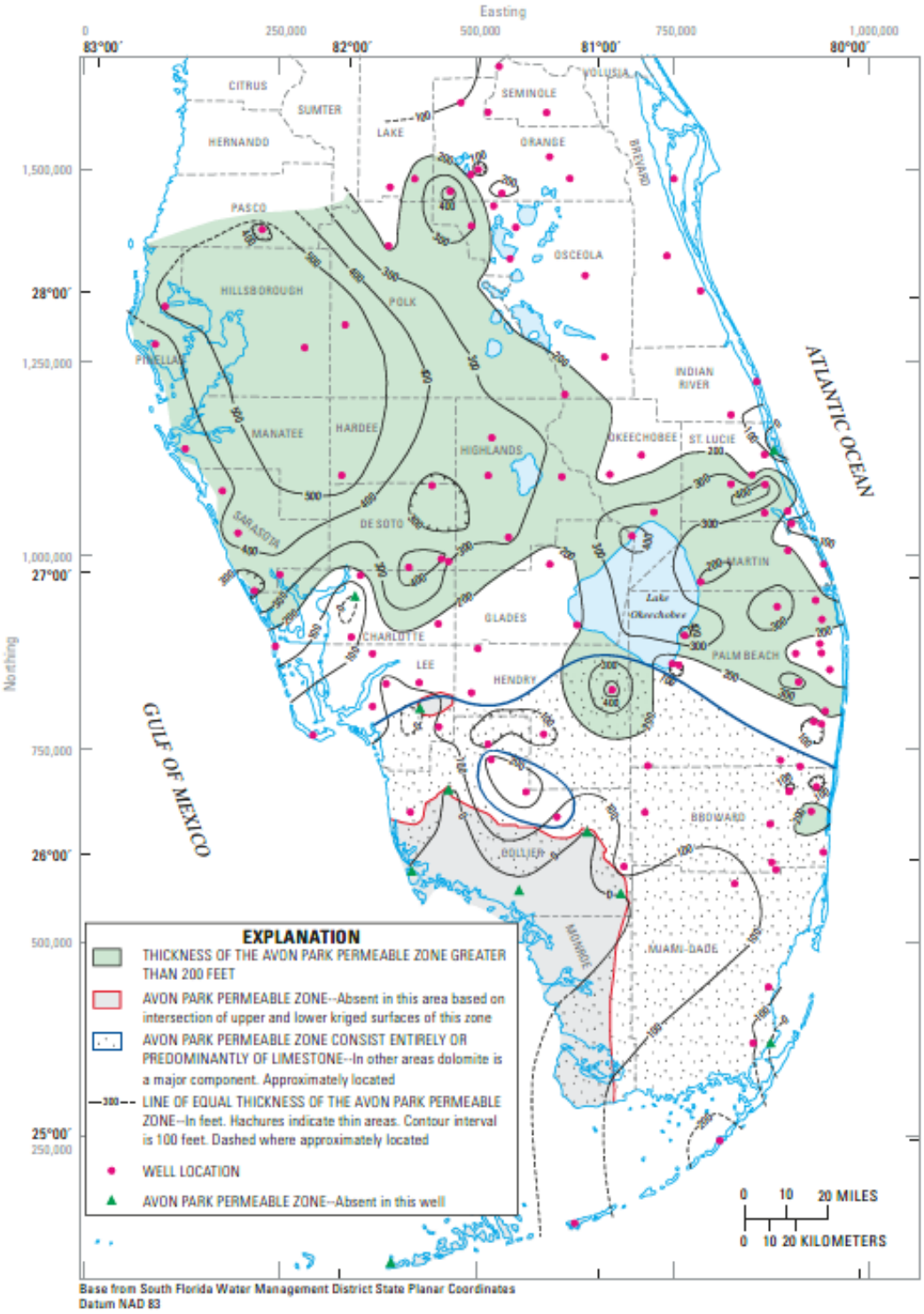


Figure 5. Isopach map of the APPZ (From: Reese and Richardson, 2008).

SFWMD Water Supply Planning Regions

To plan for future water needs, the SFWMD is divided into five water supply planning regions (**Figure 6**): Upper Kissimmee Basin (UKB, which is incorporated into the Central Florida Water Initiative [CFWI] planning area), Lower Kissimmee Basin (LKB), Upper East Coast (UEC), Lower East Coast (LEC), and Lower West Coast (LWC). Updated plans for each region are completed every 5 years, as required by Chapters 373, 403, and 187, Florida Statutes.

Due to increasing water demands within the SFWMD, alternative water supply (AWS) sources will be required to meet future needs. Because the UFA and APPZ are brackish in southern Florida, they are considered AWS sources. In central Florida, the UFA and APPZ generally contain fresh water and are important traditional water supply sources. However, the FAS is under stress in central Florida due to increasing demand for water and potential over-allocation of water resources for urban, agricultural, and environmental needs. Water quality data collected from RFGW monitor wells can help water managers and planners determine the viability and sustainability of the UFA and APPZ as resources in each of the water supply planning regions. The distribution of UFA and APPZ wells within the SFWMD's planning regions is summarized in **Table 1**.

Table 1. Distribution of UFA and APPZ wells in the RFGW monitoring network within the SFWMD.

Planning Region	Number of UFA Wells	Number of APPZ Wells	**Total**
CFWI (UKB only)	15	5	**20**
LKB	6	3	**9**
UEC	7	3	**10**
LEC	12	6	**18**
LWC	10	5	**15**
Total	**50**	**22**	**72**

APPZ = Avon Park Permeable Zone; CFWI = Central Florida Water Initiative; LEC = Lower East Coast; LKB = Lower Kissimmee Basin; LWC = Lower West Coast; RFGW = Regional Floridan Groundwater; SFWMD = South Florida Water Management District; UEC = Upper East Coast; UFA = Upper Floridan aquifer; UKB = Upper Kissimmee Basin.

Central Florida Water Initiative and Upper Kissimmee Basin

The CFWI is a collaborative planning effort addressing water supply issues in central Florida. The partnership includes the SFWMD, Southwest Florida Water Management District, St. Johns River Water Management District, Florida Department of Environmental Protection (FDEP), Florida Department of Agriculture and Consumer Services, and local stakeholders. Within the multijurisdictional CFWI footprint, the UKB encompasses parts of Polk, Osceola, and Orange counties within the SFWMD's boundaries. The most recent CFWI water supply plan update was approved in December 2015, and it concluded that "…traditional groundwater resources alone cannot meet projected future demands or current permit allocations without resulting in unacceptable impacts to water resources and related natural systems" (CFWI, 2015a). More information about the CFWI is provided at https://cfwiwater.com/.

Public Water Supply (PWS) is the largest water user in the CFWI planning area, followed by Agricultural Irrigation (AGR). The regional population is projected to increase 49 percent between 2010 and 2035, resulting in greater water supply demand. The water supply plan concluded current water supply sources cannot meet future demands and estimated a deficit of 250 million gallons per day (mgd) by 2035. Increased groundwater withdrawals can affect water quality and water levels within the aquifers. As of 2015, six wellfields within the CFWI area were at risk of water quality degradation. However, the risk is being managed through wellfield operation modifications (CFWI, 2015a).

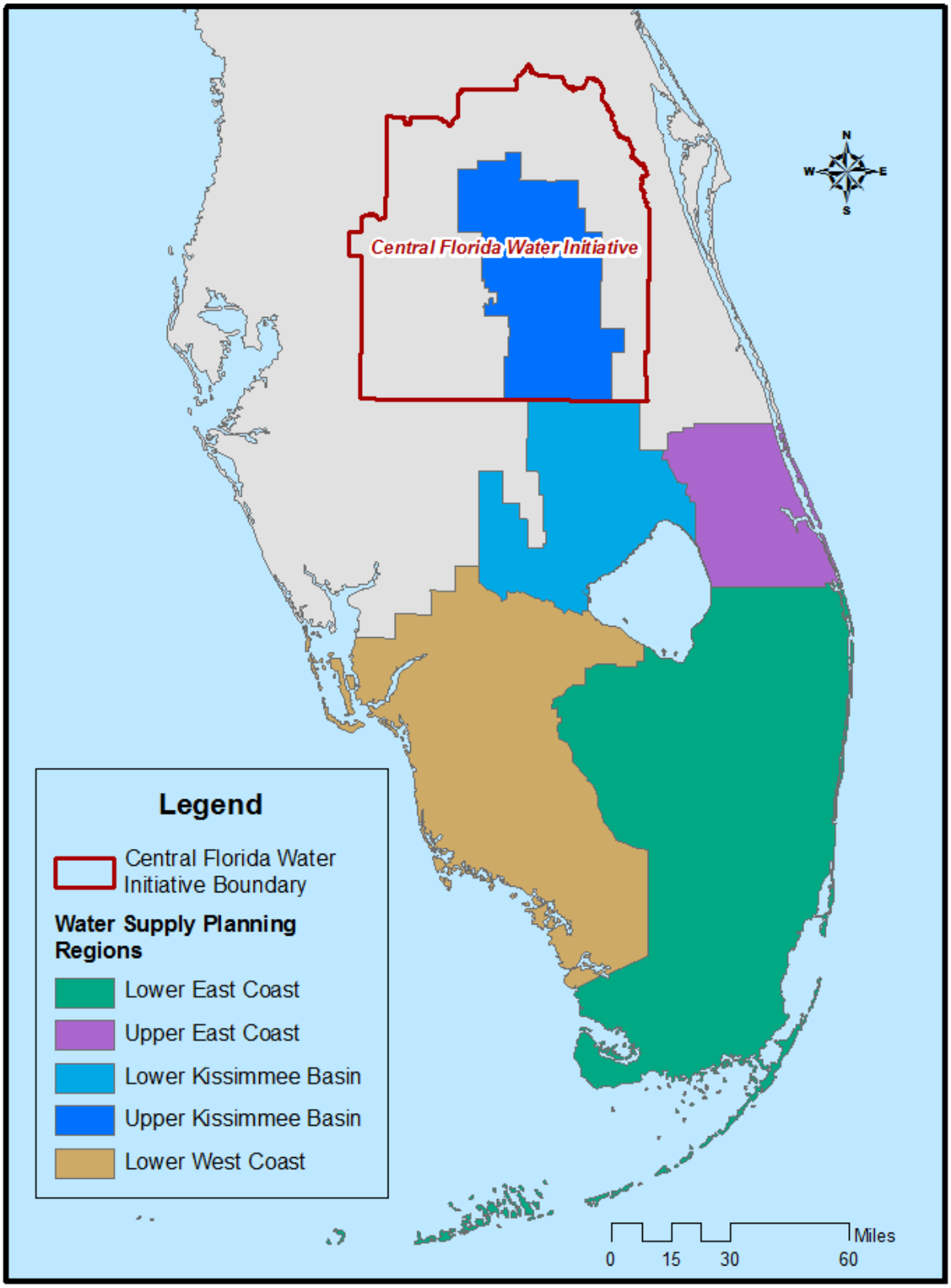


Figure 6. Map of water supply planning regions within the SFWMD. (Note: While the UKB still is considered a general planning region for the SFWMD, it no longer is evaluated separately from the CFWI.)

Figure 7 shows the predicted regional change in water level elevation in the UFA from 2005 to 2035 based on projected water demands. Most of the CFWI area within the SFWMD (i.e., the UKB) is expected to experience a decline in groundwater levels of 1 to 10 ft. Changes in water level can lead to water quality degradation, upconing of saline water, lowered lake stages, and wetlands impacts. The CFWI (2015b) water supply plan recommended continued groundwater level and quality monitoring as the UFA likely will remain a primary source of drinking water to meet future demands.

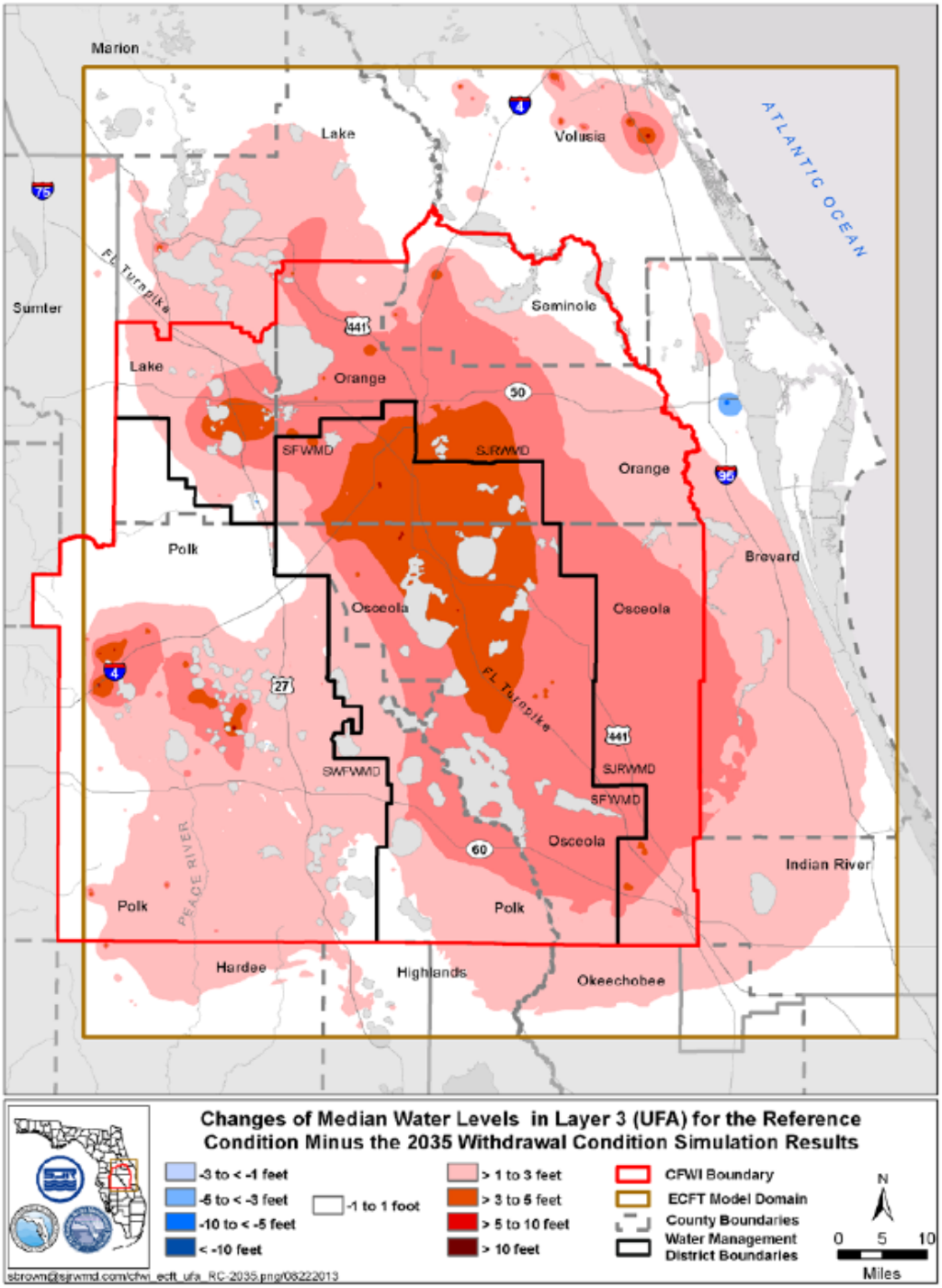


Figure 7. Change in UFA water levels from 2005 to 2035 based on projected withdrawals (From: CFWI, 2015b).

Lower Kissimmee Basin

The most recent water supply plan update for the LKB was published in 2014 (SFWMD, 2014); the next plan update will be published in 2019. The LKB planning area encompasses portions of Okeechobee, Highlands, and Glades counties as well as the Seminole Tribe of Florida Brighton Reservation. The region includes several notable natural areas such as the Kissimmee River and Lake Istokpoga as well as large swaths of agricultural land. AGR is the largest water use category in the LKB. In 2010, AGR accounted for approximately 85 percent (162.5 mgd) of the region's total water demand. Due to the expected increase in population of 23 percent, AGR demand is projected to increase 185 mgd (83 percent of total water demand). Industrial, commercial, and institutional users make up approximately 10 percent of water demand in the LKB, and no large changes are anticipated through 2035 for this use category. PWS is a small component of overall demand in the LKB. With recent increases in withdrawals from the UFA and APPZ, water quality may decline due to upconing of saline water and cross-contamination between aquifers. The APPZ has a higher concentration of total dissolved solids (TDS) than the UFA in many areas of the LKB and is unsuitable for AGR use in the region. Due to concerns regarding the sustainability of the FAS in the LKB, continued water level and quality monitoring is needed.

Upper East Coast

The most recent water supply plan update for the UEC was published in 2016 (SFWMD, 2016); the next plan update will be published in 2021. The UEC planning area encompasses St. Lucie and Martin counties and an eastern portion of Okeechobee County. Six state parks, a National Wildlife Refuge, and parts of the Loxahatchee and St. Lucie rivers are within the UEC boundaries. The planning horizon in the latest UEC plan update is 2040, and the demand for water is projected to increase substantially. The FAS provides 60 percent of PWS in the region, and this is expected to increase an additional 38 percent by 2040. AGR and PWS combined will increase from approximately 24 mgd in 2013 to more than 40 mgd by 2040. The East Coast Floridan Model, a groundwater model created by the SFWMD, was used to identify areas where water quality degradation may occur as a result of increased groundwater withdrawals over the planning horizon. The TDS concentration is expected to increase up to an additional 250 milligrams per liter (mg/L) in most PWS wellfields within the UEC between 2013 and 2040 (**Figure 8**). In northeastern St. Lucie County and neighboring Indian River County (beyond the SFWMD boundary but within the model boundary), the TDS concentration in the UFA is projected to increase up to an additional 1,000 mg/L by 2040. Modeling results predict a 10 to 25 percent increase (up to 3,000 mg/L in coastal areas) in the TDS concentration within the APPZ in the UEC planning area by 2040 (**Figure 9**). In central and northeastern Martin and northwestern St. Lucie counties, TDS concentration increases of 500 to 2,000 mg/L are expected in the APPZ. The TDS concentration may increase up to an additional 1,500 mg/L in the portion of Okeechobee County within the UEC planning area.

In addition to ongoing monitoring, the 2016 UEC plan update suggests identifying wells critical for long-term monitoring and funding their maintenance and replacement as needed. One key plan objective is understanding the relationship between water levels, water quality, and water use in the UEC planning area. The UFA and APPZ provide a substantial portion of the water needed to meet projected demands in the region. Declining water quality in the APPZ is anticipated through 2040 at some PWS wellfields in the UEC (SFWMD, 2016).

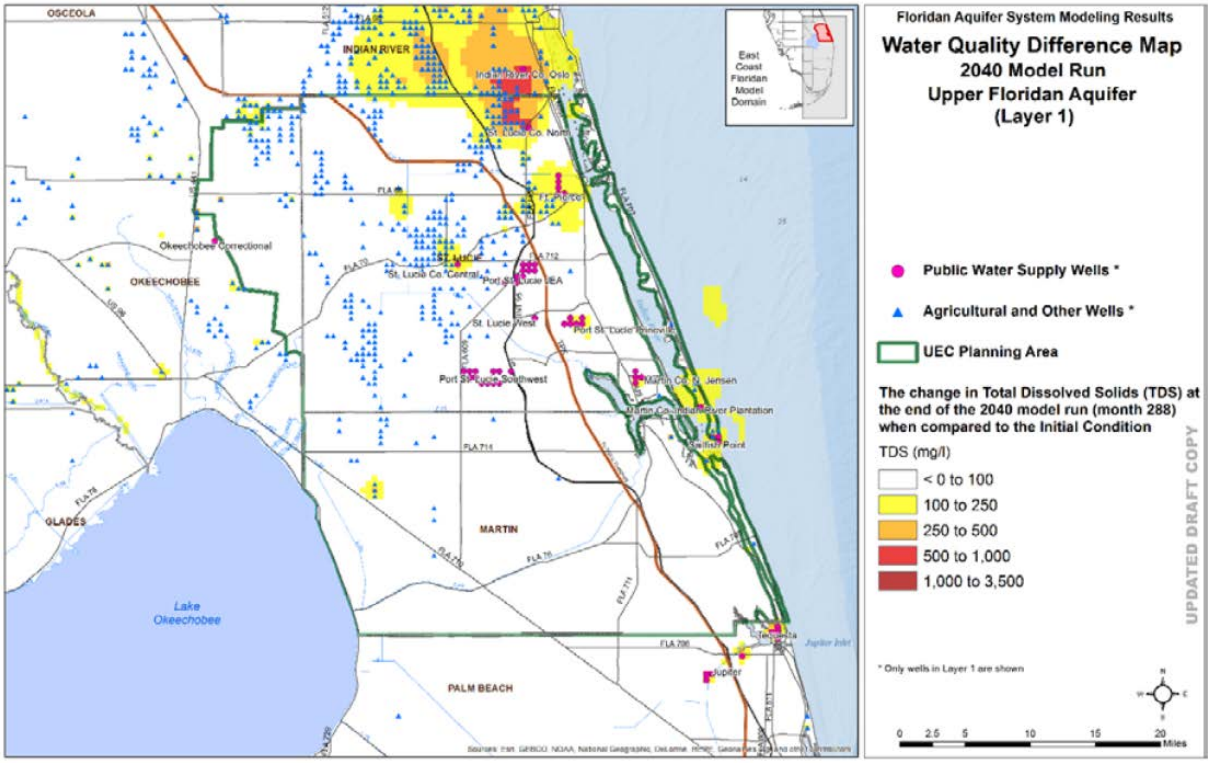


Figure 8. Water quality difference map of the UFA, showing modeled changes in TDS concentrations (From: SFWMD, 2016).

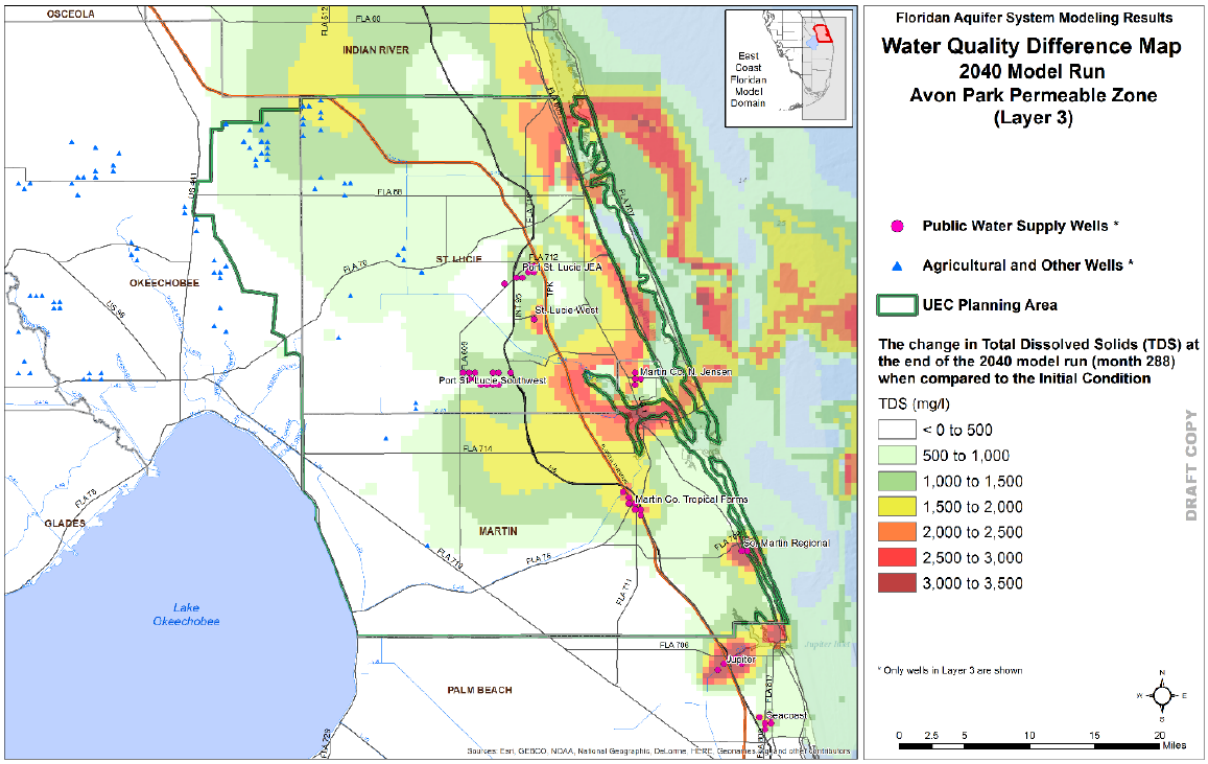


Figure 9. Water quality difference map of the APPZ, showing modeled changes in TDS concentrations (From: SFWMD, 2016).

Lower East Coast

At the time of writing this report, the most recent LEC water supply plan update was published in 2013 (SFWMD, 2013). The plan is being updated and will be published in late 2018. The LEC planning area encompasses Palm Beach, Broward, and Miami-Dade counties as well as portions of Monroe, Collier, and Hendry counties. This planning area contains the Loxahatchee River, Lake Okeechobee, Lake Worth Lagoon, Everglades National Park, and Biscayne Bay. Population projections are lower than previously estimated, partly due to the economic downturn, resulting in lower water demands than previously projected. The UFA is an AWS source in the LEC planning area and supplies 3 percent of the PWS demand; however, reliance on AWS sources is anticipated to increase as the population grows. The 2013 plan update called for increased understanding of the FAS through continued long-term water quality and water level data collection and analyses.

Lower West Coast

The most recent LWC water supply plan update was published in 2017 (SFWMD, 2017). This planning region encompasses Lee County and portions of Collier, Charlotte, Glades, Hendry, and Monroe counties. The LWC planning area includes important natural areas, including the Big Cypress National Preserve, Caloosahatchee River, and Picayune Strand. The FAS is considered an AWS source throughout the planning region and PWS is the largest water use category. The UFA provided approximately 45 percent of the PWS demand in 2014. Utilities have proposed an additional 51.5 mgd of brackish water development, including wellfield expansions, by 2040. However, almost all the utilities that withdraw from the UFA have seen degradation in water quality. The plan suggests identifying locations considered critical to long-term monitoring for modeling and continuity of data sets.

Geochemical Overview

As rainfall enters the ground and flows through soil, sediment, and rock, its chemistry evolves, and TDS concentrations increase, primarily through dissolution. Changes in groundwater chemistry are affected by residence time, travel distance, and host rock characteristics (e.g., texture, porosity, purity of minerals, degree of fissuring). In addition, changes in major ion composition can be affected by mixing with other water types (Hem, 1985). In South Florida, this is particularly important along the coast and in areas where upconing of saline water is observed.

Major anions of the FAS include sulfate (SO_4^{2-}) and chloride (Cl^-). Alkalinity is used in this study to calculate the equivalent value of bicarbonate (HCO_3^-). Alkalinity comes from carbon dioxide (CO_2) in the atmosphere and from the dissolution of carbonate minerals (Hem, 1985). Bicarbonate typically dominates in recharge areas in the FAS. In groundwater, the sulfate ion may be derived from anhydrite, gypsum, or pyrite (Freeze and Cherry, 1979). In younger recharge waters, the sulfate ion also may be a result of anthropogenic activities. The chloride ion is sourced from seawater. Higher concentrations typically are found in deeper zones of aquifers from saline connate water as a result of widespread saltwater intrusion during the Plio-Pleistocene high stands (Upchurch, 1992).

Major cations of the FAS included in this study are calcium (Ca^{2+}), sodium (Na^+), magnesium (Mg^{2+}), and potassium (K^+). The calcium ion is a result of dissolution of calcite, dolomite, anhydrite, and gypsum. Similar to chloride, the sodium cation comes from seawater and connate waters from prior marine transgressions (Upchurch, 1992). Magnesium comes from seawater transition zones, dolomite dissolution, and magnesium-rich clays. Potassium is present in low concentrations compared to the other major ions and comes from saline water and the weathering of potassium feldspars and clays (Hem, 1985).

Several reports and publications exist on the geochemistry of the UFA within the SFWMD (e.g., Sprinkle, 1989; Katz, 1991; Upchurch, 1992; Lukasiewicz and Switanek, 1995; Berndt et al., 2014; United States Army Corps of Engineers [USACE], 2015). Most reports do not include the entire SFWMD area or differentiate between the aquifers within the FAS. The USACE (2015) report was part of a regional aquifer storage and recovery (ASR) study, using a subset of the water quality data (2004 through 2013) for the UFA and APPZ and incorporating neighboring water management district monitoring stations. This study focuses on the changes in water quality that occurred over the period of record (1979 through 2017) for the UFA and APPZ within the SFWMD. In the FAS, water quality may vary in response to changes in pumping, upconing of more saline water, saltwater intrusion, or regional drawdown (Hem, 1985). Monitoring programs such as the RFGW network are necessary to track the effectiveness of water management practices. Data from monitor wells can pinpoint local areas of concern where further investigation may be needed to evaluate the cause(s) of water quality changes. Furthermore, the SFWMD and others can use monitor well data to identify issues of concern and potentially address problems before they occur.

METHODS

Water Quality Sampling

This investigation analyzed water quality data collected by the SFWMD and FDEP between 1979 and 2017. Both agencies maintain FAS monitoring programs and collaborate to avoid duplication of effort and expense. Most groundwater samples were collected using FDEP Standard Operating Procedure 001/01, Section FS2200; a few large-diameter wells were purged for less than three well volumes due to time constraints. All wells were purged and sampled after field parameter stabilization. Samples were preserved in acid, as appropriate, chilled, and taken to their respective agency's laboratory for processing. Samples were analyzed in a certified laboratory for major ion composition and alkalinity (**Table 2**). Alkalinity was measured as calcium carbonate then converted to bicarbonate. FDEP results were uploaded to the SFWMD's DBHYDRO database.

Table 2. List of water quality parameters.

Cations (mg/L)	Anions (mg/L)	Field Parameters
Sodium (Na^+)	Chloride (Cl^-)	pH
Potassium (K^+)	Sulfate (SO_4^{2-})	Temperature (°C)
Calcium (Ca^{2+})	Bicarbonate (HCO_3^-)*	Specific Conductance (µS/cm)
Magnesium (Mg^{2+})		Total Dissolved Solids (mg/L)

µS/cm = microsiemens per centimeter; mg/L = milligrams per liter.
* Derived from alkalinity.

Staff and budgetary constraints do not permit annual sampling of the entire RFGW monitoring network. Therefore, each year, RFGW sampling is performed at wells within the region that a water supply plan is being updated. Not all parameters were sampled at each well during each round of sampling. During recent sampling events, field parameters were collected at some locations where major ions were not sampled because the relevant ionic parameters have been reasonably stable, and it was deemed cost-effective to track only field parameters in these instances.

The ionic data were imported into AquaChem (Schlumberger Water Services, 2014) for analysis and generation of stiff and Piper plots. While Hem (1970) recommended a charge balance error of 2 percent or less, this only applies to samples with a TDS concentration between 250 and 1,000 mg/L, and most water quality data for this investigation have TDS concentrations above this range. Therefore, any sample with an error of more than 5 percent was excluded from the results. Large charge balance errors may result from multiple causes: laboratory errors, missing data from one of the major ions, or from preserving unfiltered

samples with acid, which can dissolve particulate matter and change the ion concentrations (Fritz, 1994). Data that the respective laboratories flagged during processing and all samples with a pH greater than 8.5 were excluded from the data set. Ratios of specific conductance and the sum of cations and anions were plotted as additional data quality checks, along with sodium to chloride ratios, which resulted in the removal of seven additional sampling events. Piper plots were generated for all stations, and stiff plots were generated for stations where changes in groundwater type were seen within the period of record. Summary statistics and the coefficient of variance were calculated for each ion and field parameter.

Hydrochemical Facies

To visually display the hydrochemical facies of the samples, major cations and anions were plotted on trilinear diagrams called Piper plots. Frazee (1982) developed hydrochemical facies specific to the southeastern region of the United States by mapping hundreds of water samples onto Piper plots. However, the divisions between the facies on the Piper plots are not definitive. Several samples plotted on lines dividing the hydrochemical facies, and it was difficult to determine the facies to which a sample belonged. For this reason, the hydrochemical facies laid out by Back (1960, 1961) were used to exactly classify water types. Back's hydrochemical facies are defined through numerical divisions based on the percentage of anion and cation constituents. These are based on approximately 3,000 chemical analyses of groundwater samples from the Atlantic coastal plain and their associated lithology. The grouping of results reflects the chemical constituents of the groundwater, host rock, and flowpath framework (Back, 1961). **Table 3** shows the cation and anion percentage ranges and classification of water types given to the facies, and **Figure 10** shows where these divisions fall on a Piper plot. These hydrochemical facies provide a fingerprint of a water sample's history.

Table 3. Classification of hydrochemical facies (Modified from: Back, 1961).

Hydrochemical Facies	Percentage of constituents (equivalents per million)			
	Ca + Mg	Na + K	$HCO_3 + CO_3$	$Cl + SO_4$
Cation Facies				
Calcium-magnesium	90 – 100	0 < 10	-	-
Calcium-sodium	50 – 90	10 < 50	-	-
Sodium-calcium	10 – 50	50 < 90	-	-
Sodium-potassium	0 – 10	90 – 100	-	-
Anion Facies				
Bicarbonate	-	-	90 – 100	0 < 10
Bicarbonate-chloride-sulfate	-	-	50 – 90	10 < 50
Chloride-sulfate-bicarbonate	-	-	10 – 50	50 < 90
Chloride-sulfate	-	-	0 – 10	90 – 100

Ca = calcium; Cl = chloride; CO_3 = carbonate; HCO_3 = bicarbonate; K = potassium; Mg = magnesium; Na = sodium; SO_4 = sulfate.

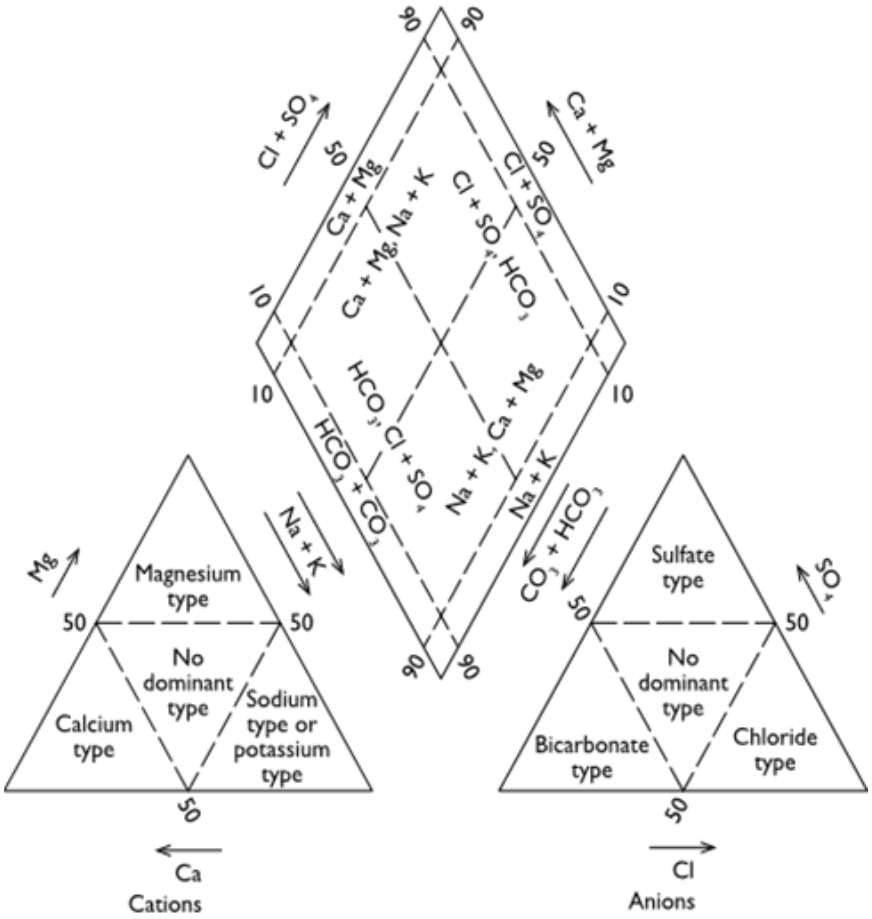


Figure 10. Classification of water types (From: Back, 1960).

Geographic Information System

Data from DBHYDRO used for this investigation are stored in a file geodatabase (**Appendix A**) for future use and to build on as more samples are collected and analyzed. A large database for the RFGW project allows for specific data to be selected and easily displayed based on criteria such as aquifer or water supply planning region.

WATER QUALITY RESULTS

This section includes the results for the baseline stations (those with five or more sampling events). The baseline well data sets allow temporal trends to be identified, if they occur. **Tables 4** and **5** show the UFA and APPZ baseline stations, water types, range of years sampled, and number of sampling events. **Appendix B** provides the analytical results by station in the UFA, including summary statistics (e.g., coefficient of variance as a percent) and associated plots. **Appendix C** presents results for each APPZ baseline station with summary statistics and associated plots. Maps of all major ions and physical parameters are presented in **Appendix D**. **Tables 6** and **7** present descriptive statistics for all water quality data for the UFA and APPZ, respectively.

Table 4. Summary of water types, date ranges, and number of sampling events for RFGW baseline stations completed in the UFA.

Station	Water Type	Date Range	Number of Sampling Events
BICY-MZ2	Na-Cl	2004 – 2015	15
BRY-MW	Na-Mg-Cl	2006 – 2016	7
BSU-MZU	Na-Mg-Cl	1999 – 2016	13
DF-4	Na-Cl	2004 – 2017	17
ENP-100	Na-Cl	2004 – 2009	13
FPL-MW	Na-Mg-Cl	2006 – 2009	8
FPU-MZU	Na-Mg-Cl	2000 – 2008	10
G-2618	Na-Mg-Cl-SO_4	2005 – 2016	16
GLF-6*	Na-Cl	2001 – 2014	5
HIF-42U	Na-Mg-Ca-Cl-SO_4	2008 – 2017	5
I75-MZ2	Na-Cl	1995 – 2016	16
IWSD-MZ2	Na-Mg-Cl-SO_4	2004 – 2016	14
L2-PW2	Na-Mg-Cl-SO_4	1999 – 2016	16
L-6436	Na-Cl	2005 – 2016	7
LAB-MZ1	Na-Mg-Cl-SO_4	1997 – 2016	15
MF-37U	Na-Mg-Cl-SO_4	2007 – 2011	6
MIU-MZ1	Na-Cl	2004 – 2015	12
OKF-42	Mg-Na-Ca-HCO_3-SO_4	1984 – 2006	21
OSF-100	Ca-Mg-HCO_3-SO_4	2005 – 2012	9
OSF-3	Ca-Na-HCO_3-Cl	1979 – 2006	6
OSF-66	Ca-Mg-HCO_3	2004 – 2006	10
PBF-3	Na-Cl	1996 – 2017	21
PBF-7U	Na-Cl	2000 – 2016	16
SCC-MZU	Na-Cl	1999 – 2009	15
SLF-21	Na-Mg-Cl-HCO_3-SO_4	1985 – 2014	9
SLF-75	Na-Mg-Cl	2004 – 2011	16
SLF-76	Na-Mg-Cl	2004 – 2016	16
STU-MZU	Na-Cl	1999 – 2008	9
WASANMZ1	Na-Cl	2004 – 2005	5

Ca = calcium; Cl = chloride; HCO_3 = bicarbonate; Mg = magnesium; Na = sodium; SO_4 = sulfate; UFA = Upper Floridan aquifer.

* GLF-6 has a long open hole interval from 855 to 1,560 ft below land surface. The total depth of the open borehole is 1,745 ft below land surface, but a temporary packer was installed at the intermediate depth. The well is open to the UFA and lower flow zones. Due to paucity of data in this area, the results are used to approximate water quality conditions in the UFA at this location.

Table 5. Summary of water types, date ranges, and number of sampling events for RFGW baseline stations completed in the APPZ.

Station	Water Type	Date Range	Number of Sampling Events
BF-4M	Na-Cl	2007 – 2014	8
BOYRO_EPXL	Na-Cl	2007 – 2017	7
BSU-MZL	Na-Cl	1999 – 2016	16
G-2617	Na-Mg-Cl-SO_4	1994 – 2016	18
HIF-42L	Na-Cl	2008 – 2017	5
L2-PW1	Na-Mg-Cl-SO_4	2005 – 2011	13
LAB-MZ3	Na-Cl	2004 – 2016	10
MF-37L	Na-Cl	2007 – 2015	6
PBF-11	Na-Mg-Cl	2003 – 2009	15
PBF-4	Na-Cl	1997 – 2010	16
SLF-74	Na-Mg-Cl	2005 – 2016	13
WASANMZ2	Na-Cl	2005 – 2006	8

APPZ = Avon Park Permeable Zone; Cl = chloride; Mg = magnesium; Na = sodium; SO_4 = sulfate.

Table 6. Descriptive statistics of water quality results for all RFGW monitor stations completed in the UFA.

	HCO_3	Alkalinity	SO_4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp.
Mean	158	130	412	2,021	149	127	40	1,100	6,846	4,237	7.69	26.52
Median	161	132	350	1,154	107	110	20	590	4,619	2,663	7.70	26.40
Minimum	16	13	0	4	5	22	0	3	185	120	6.40	20.46
25^{th}	116	95	174	600	69	67	14	336	2,717	1,550	7.47	24.60
75^{th}	194	159	504	2,367	162	147	49	1,340	8,232	4,778	7.93	28.55
Maximum	407	334	2,674	19,426	1,234	640	401	9,913	53,133	34,680	8.50	33.81
# of Samples	404	404	404	404	404	404	404	404	404	371	404	403

Ca = calcium; Cl = chloride; HCO_3 = bicarbonate; K = potassium; Mg = magnesium; Na = sodium; SC = specific conductance; SO_4 = sulfate; TDS = total dissolved solids.
Note: Major ion data (including alkalinity and TDS) are presented in milligrams per liter; specific conductance is in microsiemens per centimeter; and temperature is in degrees Celsius.

Table 7. Descriptive statistics of water quality results for all RFGW monitor stations completed in the APPZ.

	HCO_3	Alkalinity	SO_4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp.
Mean	145	119	808	4,577	304	228	88	2,471	13,700	8,230	7.66	26.79
Median	151	124	404	1,932	140	136	26	916	6,936	3,291	7.60	26.10
Minimum	74	61	18	4	8	24	1	4	204	118	6.90	18.44
25^{th}	116	96	341	1,079	106	93	21	625	4,345	2,503	7.40	23.80
75^{th}	165	135	539	2,385	187	241	48	1,323	8,313	5,000	7.88	30.46
Maximum	256	210	4,600	20,131	1,241	740	540	11,330	52,730	36,888	8.50	33.60
# of Samples	159	159	159	159	159	159	159	159	158	154	159	159

Ca = calcium; Cl = chloride; HCO_3 = bicarbonate; K = potassium; Mg = magnesium; Na = sodium; SC = specific conductance; SO_4 = sulfate; TDS = total dissolved solids.
Note: Major ion data (including alkalinity and TDS) are presented in milligrams per liter; specific conductance is in microsiemens per centimeter; and temperature is in degrees Celsius.

DATA ANALYSES

This section examines the results from six UFA and six APPZ baseline stations with observed changes in water quality. The construction type of each station, well completion reports, technical publications, and historical water quality sampling records were compiled to investigate these changes. All major ion concentrations are presented in this section; however, the chloride ion is of primary interest from the perspective of water supply regulation and management. The SFWMD issues water use permits and considers existing use as well as environmental factors. Water use permit applicants are required to develop saltwater intrusion and water quality monitoring programs. Upon implementation, chloride concentrations are reported to the SFWMD monthly or quarterly (SFWMD, 2015).

Water Quality Changes in UFA Stations

BICY-MZ2

Station BICY-MZ2 is part of a quad-zone monitor well in Collier County within the LWC Planning Area. Chloride concentrations at this station have varied from a maximum of 3,000 mg/L in September 2005 to a minimum of 2,501 mg/L in May 2010 (**Figure 11**). Chloride concentrations have increased slightly since 2010; however, the most recent results were within this station's historical range.

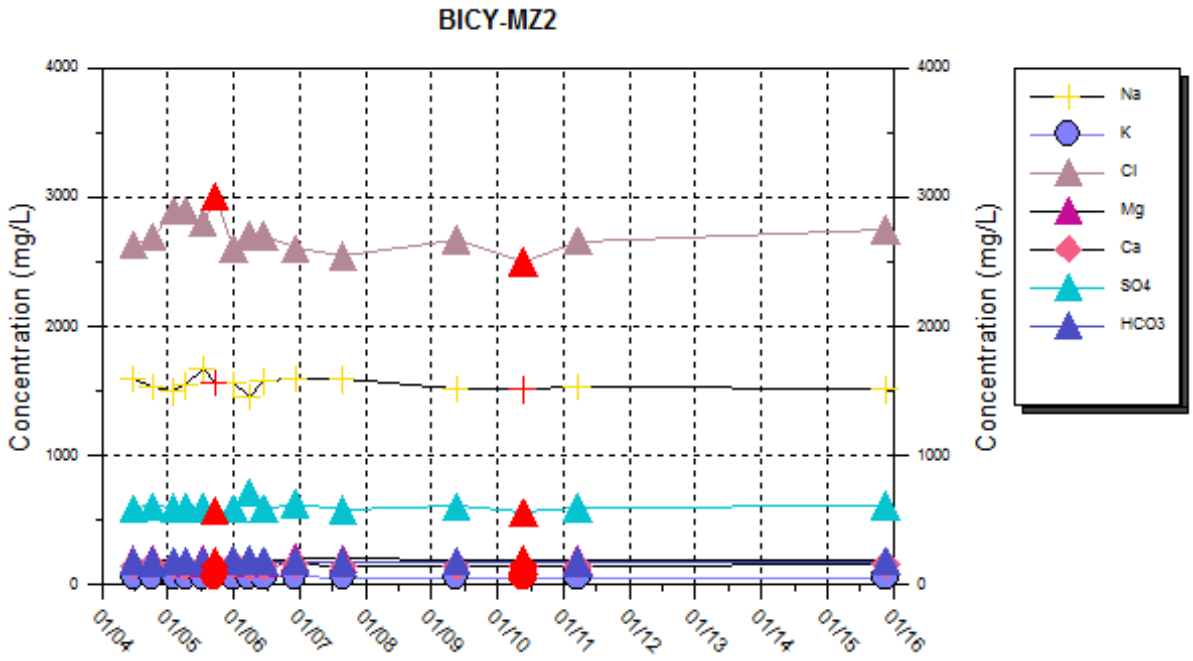


Figure 11. Major ion concentrations at station BICY-MZ2 over the period of record. (Note: The sampling events with the minimum and maximum concentrations for chloride are marked in red.)

BSU-MZU

Station BSU-MZU is the upper monitoring zone of a dual-zone monitor well for a Burnt Store Utilities Class 1 injection well in Charlotte County, within the northwest coastal area of the LWC Planning Area. The injection well disposes of reverse osmosis concentrate into the Boulder Zone, which should not affect water quality in the monitor well. Overall, the hydrochemical facies water type does not vary, but individual anions change (**Figure 12**). Although no samples were collected from 2000 to 2003 or from 2010 to 2015, chlorides have increased from 661 mg/L in 1999 to 807 mg/L in 2016, along with slight increases in sodium, TDS, and specific conductance. However, the most recent results were within this station's historical range.

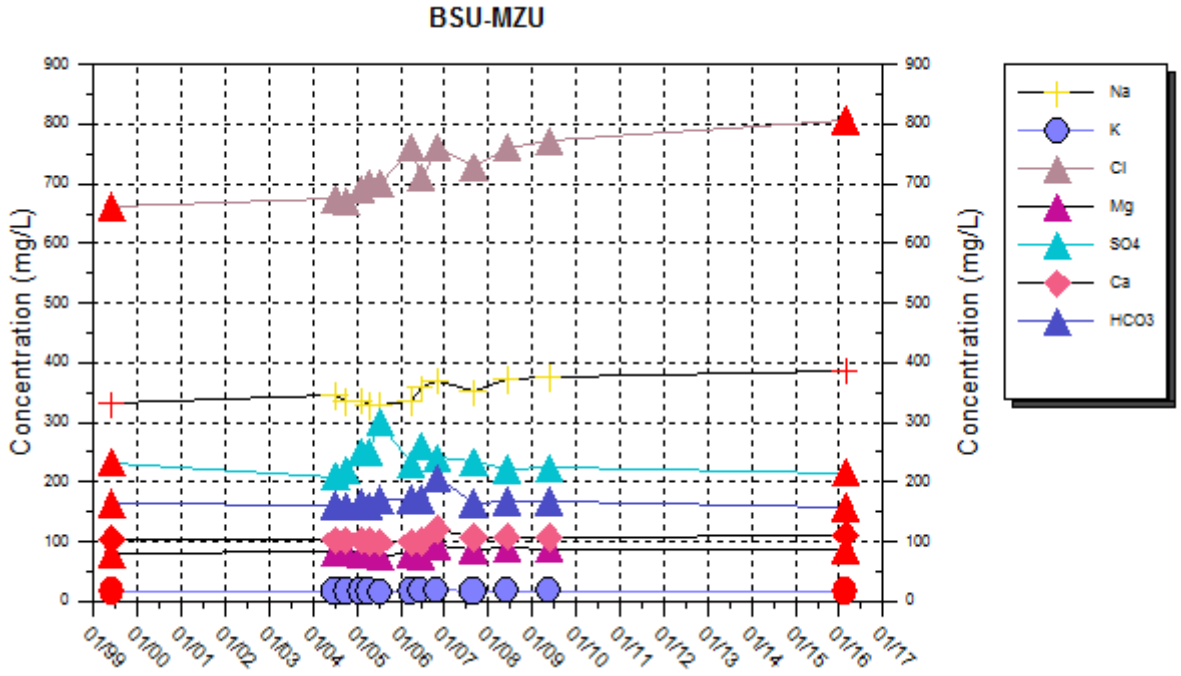


Figure 12. Major ion concentrations at station BSU-MZU over the period of record. (Note: The sampling events with the minimum and maximum concentrations for chloride are marked in red.)

IWSD-MZ2

Station IWSD-MZ2 is the UFA zone of a tri-zone monitor well in Immokalee, Collier County, within the LWC Planning Area. Most ion concentrations at this station have remained stable over time; however, chlorides increased from 1,082 mg/L in 2010 to 1,195 mg/L in 2016 (**Figure 13**). The most recent results were within this station's historical range.

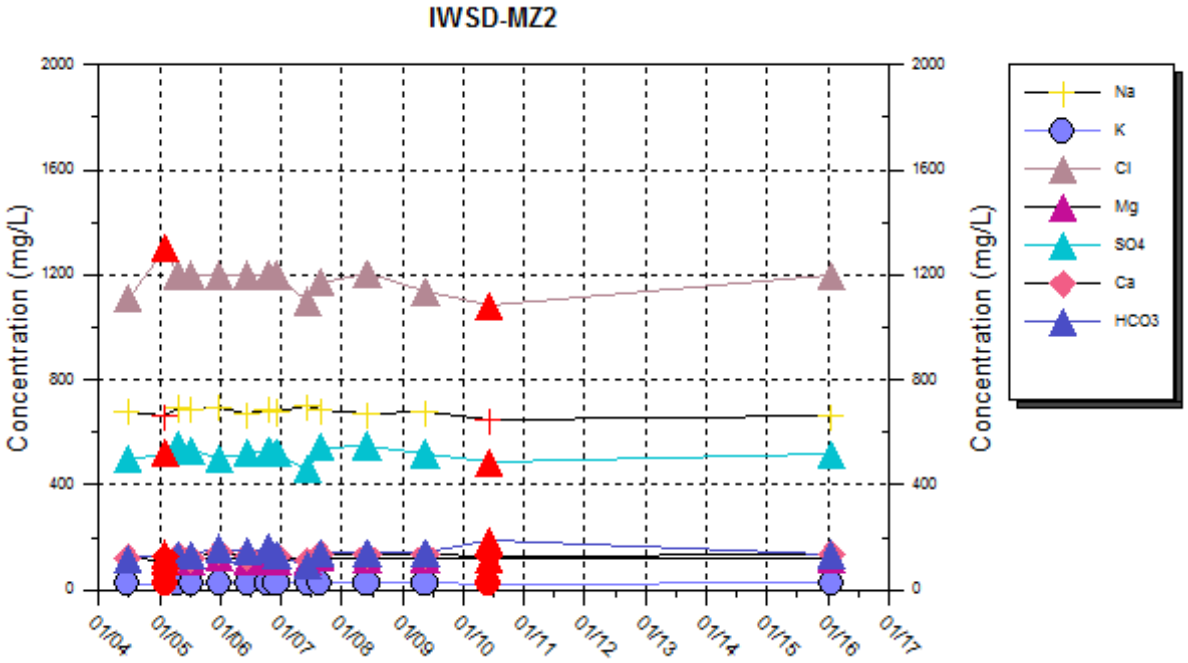


Figure 13. Major ion concentrations at station IWSD-MZ2 over the period of record. (Note: The sampling events with the minimum and maximum concentrations for chloride are marked in red.)

L-6436

Station L-6436 is a single-zone UFA monitor well in Cape Coral, Lee County, within the LWC Planning Area. Chloride concentrations at this station decreased from 15,000 mg/L in January 2007 to 13,000 mg/L in March 2007, but increased to 14,980 mg/L by 2016 (**Figure 14**). However, with almost a decade between the two most recent sampling events and limited historical field and laboratory documentation available, there is some uncertainty in the interpretation of these results.

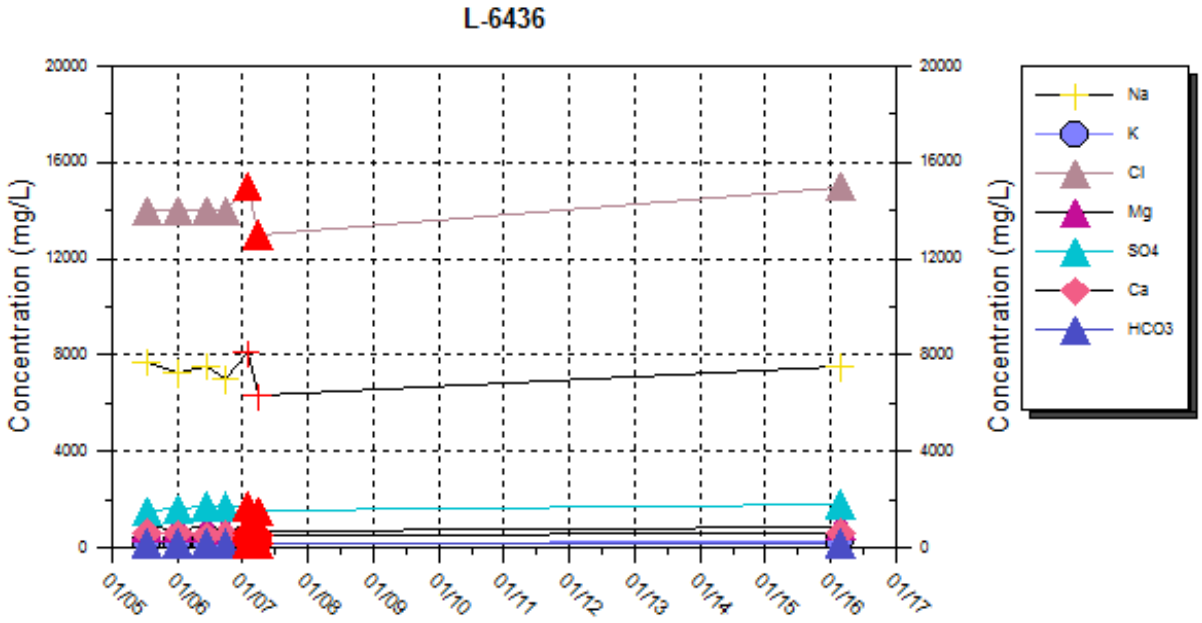


Figure 14. Major ion concentrations at station L-6436 over the period of record. (Note: The sampling events with the minimum and maximum concentrations for chloride are marked in red.)

LAB-MZ1

Station LAB-MZ1 is the UFA zone of a tri-zone monitor well near the Caloosahatchee River in Hendry County, within the LWC Planning Area. Water quality at this station has changed over time but not linearly. From December 1997 to October 2006, concentrations were stable. A leak in the lowest monitoring zone (LAB-MZ3) resulted in well repair and wellhead replacement from December 2006 through January 2007 (AECOM Water, 2008). The sample taken at the end of January 2007 showed a spike in chloride and sodium concentrations (**Figure 15**). In the following three samples (2007, 2008, and 2009), these concentrations decreased. The most recent sample from 2016 is within the range of the pre-repair data. The wide spread of data points in the Piper plot is most likely caused by the addition of salt used to suppress the artesian flow so the wellhead could be replaced. Water quality may have returned to background conditions; however, there was a large gap in time between the two most recent sampling events, which causes some uncertainty in this interpretation.

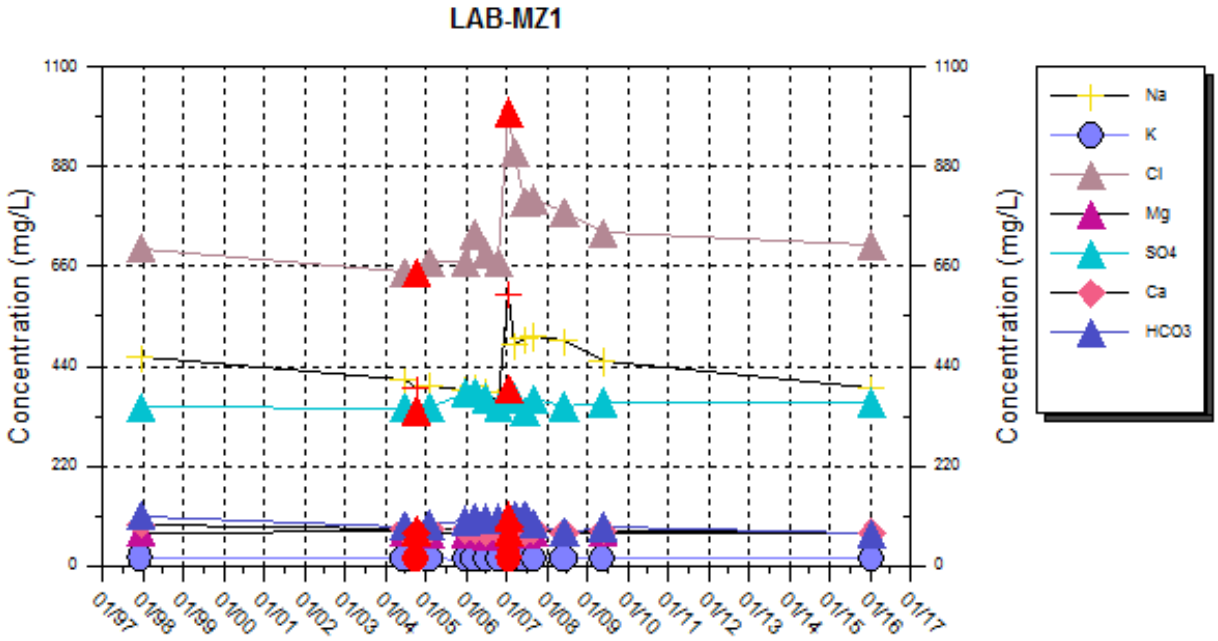


Figure 15. Major ion concentrations at station LAB-MZ1 over the period of record. (Note: The sampling events with the minimum and maximum concentrations for chloride are marked in red.)

MIU-MZ1

Station MIU-MZ1 is the upper monitoring zone of a deep injection well on Marco Island in the LWC Planning Area. There is a data gap from May 2009 to December 2015, during which time the chloride concentrations increased from 14,949 to 16,058 mg/L (**Figure 16**). During 2006 and 2007, chloride concentrations ranged between 15,000 and 17,000 mg/L. Although chloride concentrations increased slightly during this time period, the most recent results were within this station's historical range.

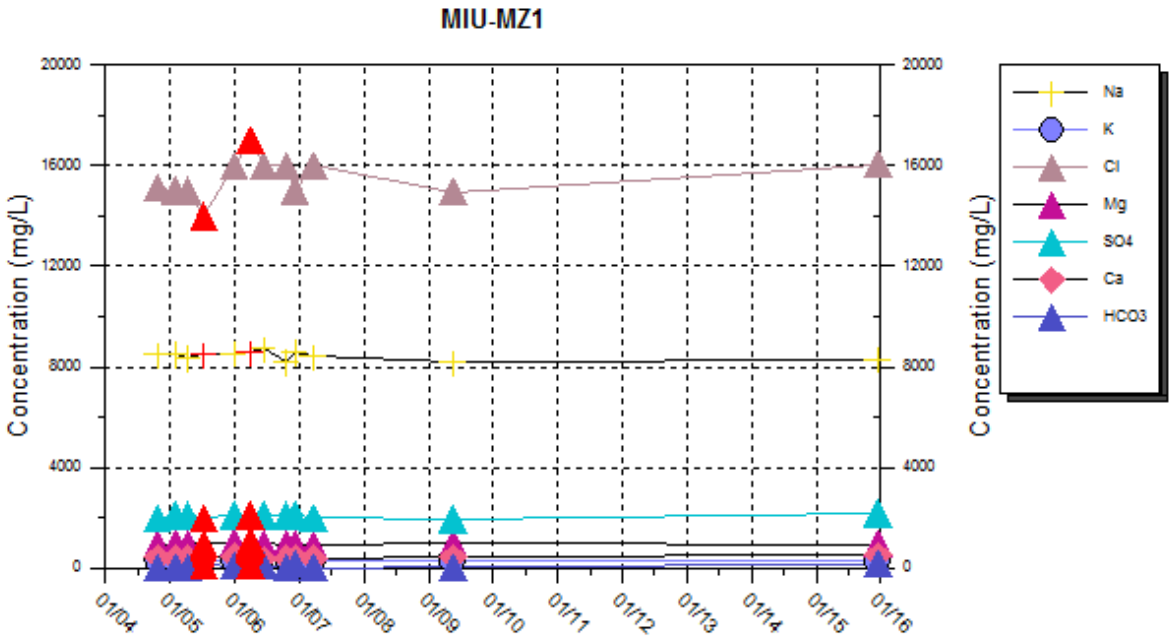


Figure 16. Major ion concentrations at station MIU-MZ1 over the period of record. (Note: The sampling events with the minimum and maximum concentrations for chloride are marked in red.)

Water Quality Changes in APPZ Stations

BSU-MZL

Station BSU-MZL is the lower monitoring zone associated with a deep injection well and is co-located with BSU-MZU in Charlotte County within the LWC Planning Area. Chloride concentrations at this station have ranged from 18,048 to 20,131 mg/L, and the most recent sample had a concentration of 18,546 mg/L (**Figure 17**). Due to data gaps from June 1999 to July 2004 and from May 2009 to February 2016 and to the fluctuating ionic concentrations between those time periods, interpretation of the data is difficult. However, there is a slight increase in chloride concentrations from 2009 to 2016, and the most recent results are within this station's historical range. Wellhead repairs occurred in 2002 and 2014, but whether these events impacted water quality is unknown as samples were not collected during those years.

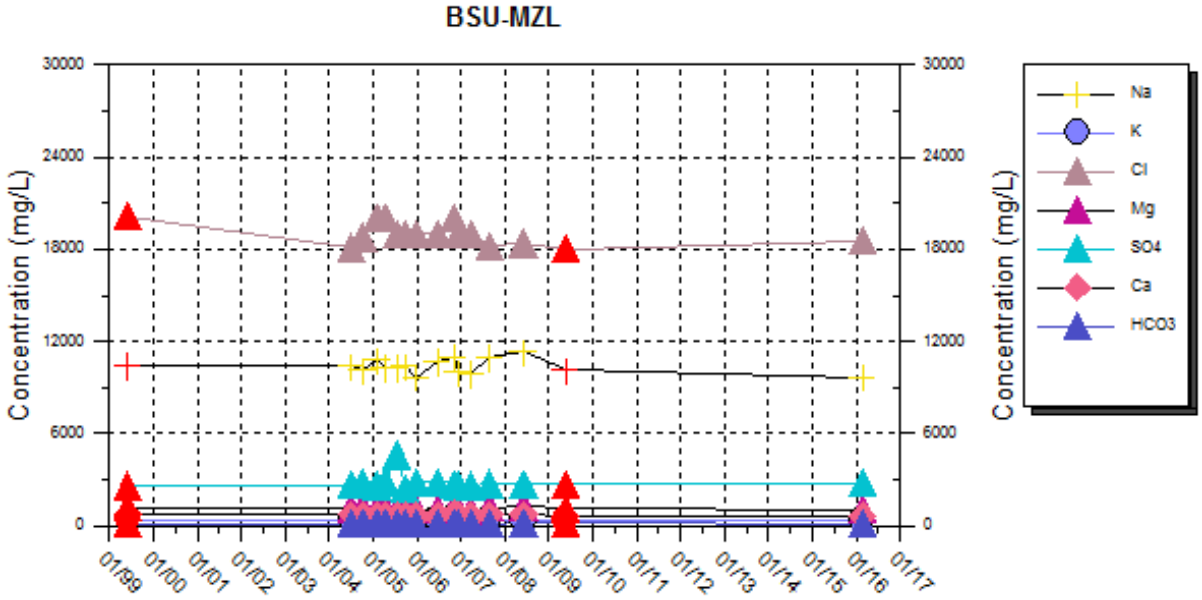


Figure 17. Major ion concentrations at station BSU-MZL over the period of record. (Note: The sampling events with the minimum and maximum concentrations for chloride are marked in red.)

G-2617

Station G-2617 is part of a five-zone monitor well located along Alligator Alley (I-75) in Broward County, within the LEC Planning Area. The chloride concentrations ranged from a maximum of 1,109 mg/L in February 1996 to a minimum of 964 mg/L in September 2008 (**Figure 18**). There has been a slight decline in chloride concentrations since 2011; however, the most recent results are within this station's historical range.

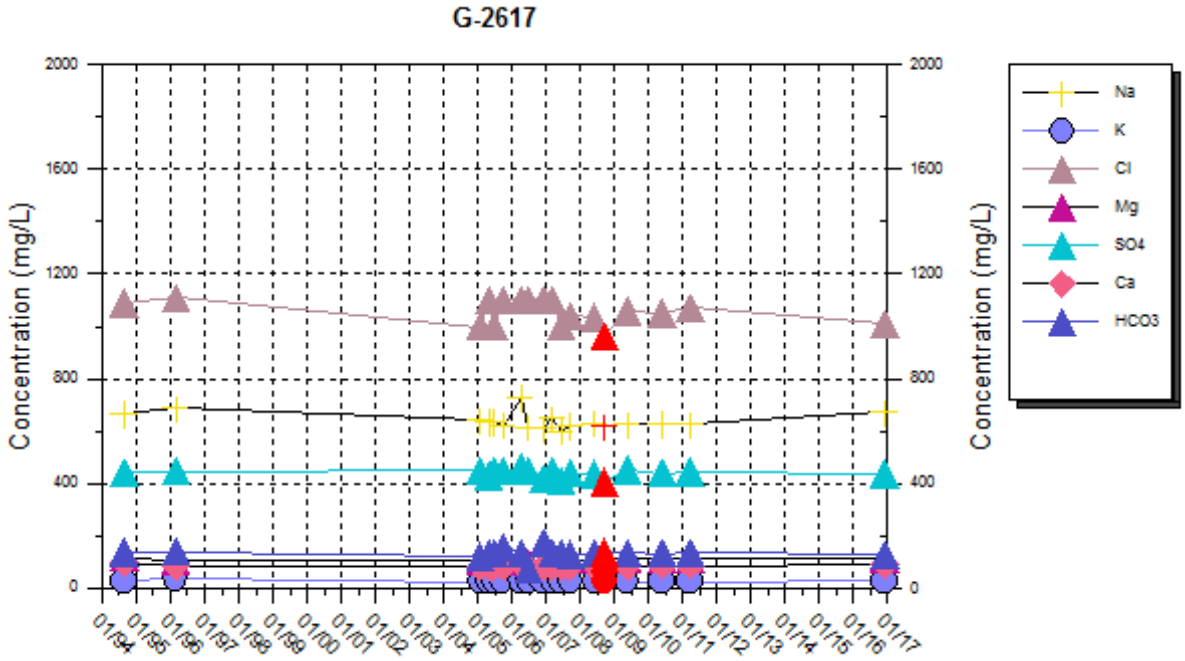


Figure 18. Major ion concentrations at station G-2617 over the period of record. (Note: The sampling events with the minimum and maximum concentrations for chloride are marked in red.)

LAB-MZ3

LAB-MZ3 is part of a tri-zone monitor well in Hendry County, within the LWC Planning Area. Chloride concentrations appear to fluctuate in the earlier part of the period of record, but with a large data gap between 2007 and 2016, it is unknown if this has been an ongoing pattern (**Figure 19**). The minimum chloride concentration (8,760 mg/L) was recorded in October 2004, and the maximum chloride concentration (9,800 mg/L) was recorded in April 2005 and in January 2007. Recent data are insufficient to determine if there are any trends in ionic concentrations. The wellhead was replaced in January 2007 after developing a leak. Incomplete purging of the salt used to suppress artesian flow could have caused higher chloride concentrations in the 2007 sample. This spike also was observed in LAB-MZ1 (AECOM Water, 2008). AECOM Water (2008) reviewed TDS concentrations and found no apparent trends in water levels or water quality.

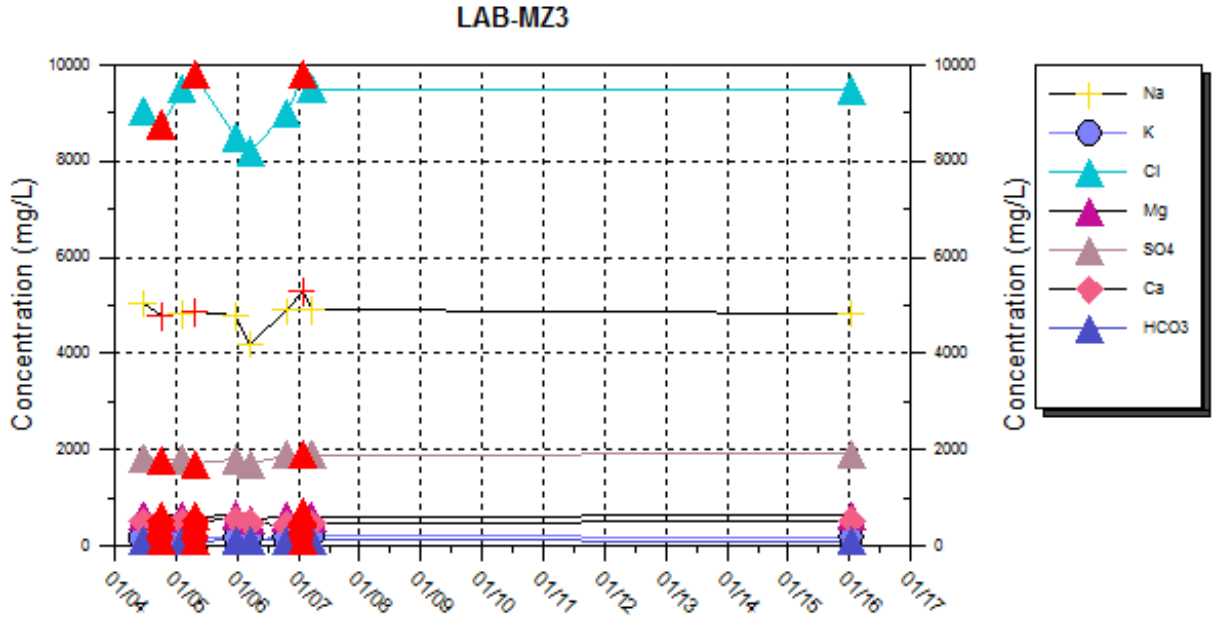


Figure 19. Major ion concentrations at station LAB-MZ3 over the period of record. (Note: The sampling events with the minimum and maximum concentrations for chloride are marked in red.)

L2-PW1

L2-PW1 is a single-zone monitor well in Hendry County, within the LWC Planning Area. Chloride concentrations at this station ranged from a maximum of 990 mg/L in April 2005 to a minimum of 526 mg/L in May 2010 (**Figure 20**). However, the well was not sufficiently purged during the 2010 sampling event, which may have caused the lower chloride concentrations. Although no record of the 2009 sampling event was available, the same situation could have occurred then as in 2010. If the 2009 and 2010 data points are removed, chloride concentrations appear to show a slight increasing trend from 2008 to 2011, although lower than pre-2008 concentrations. The most recent results are within this station's historical range.

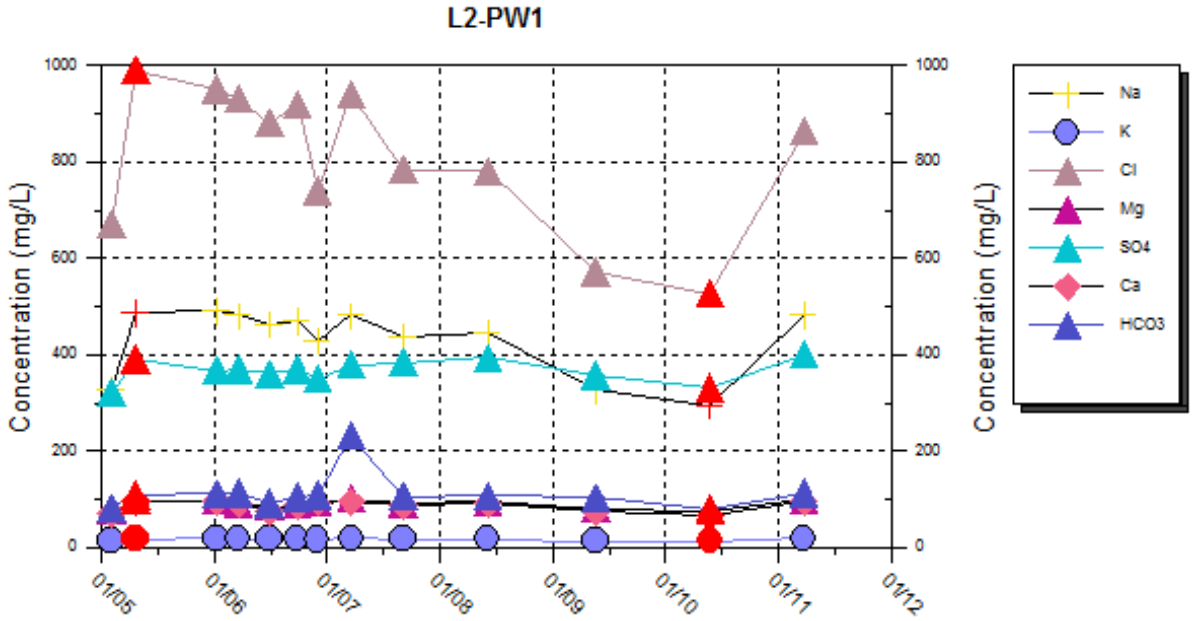


Figure 20. Major ion concentrations at station L2-PW1 over the period of record. (Note: The sampling events with the minimum and maximum concentrations for chloride are marked in red.)

PBF-4

Station PBF-4 is part of a tri-zone monitor well in Palm Beach County within the LEC Planning Area. The wellhead was repaired in 2002 and again in 2010. Chloride concentrations at this station have ranged from a maximum of 2,440 mg/L in January 2006 to a minimum of 1,816 mg/L in May 2009 (**Figure 21**). The most recent sampling event was in 2010, at which time the chloride concentration was 1,940 mg/L. There is a large gap in sampling events and available data from the time of well construction in 1997 until 2004. In addition, historical laboratory documentation for most of the sampling events and information on the 2010 wellhead repair was unavailable. This may explain the decreasing trend in chloride concentrations between 2006 and 2009, which was followed by an increase in 2011. A more robust data set with proper backup documentation is needed before trends can be determined with certainty.

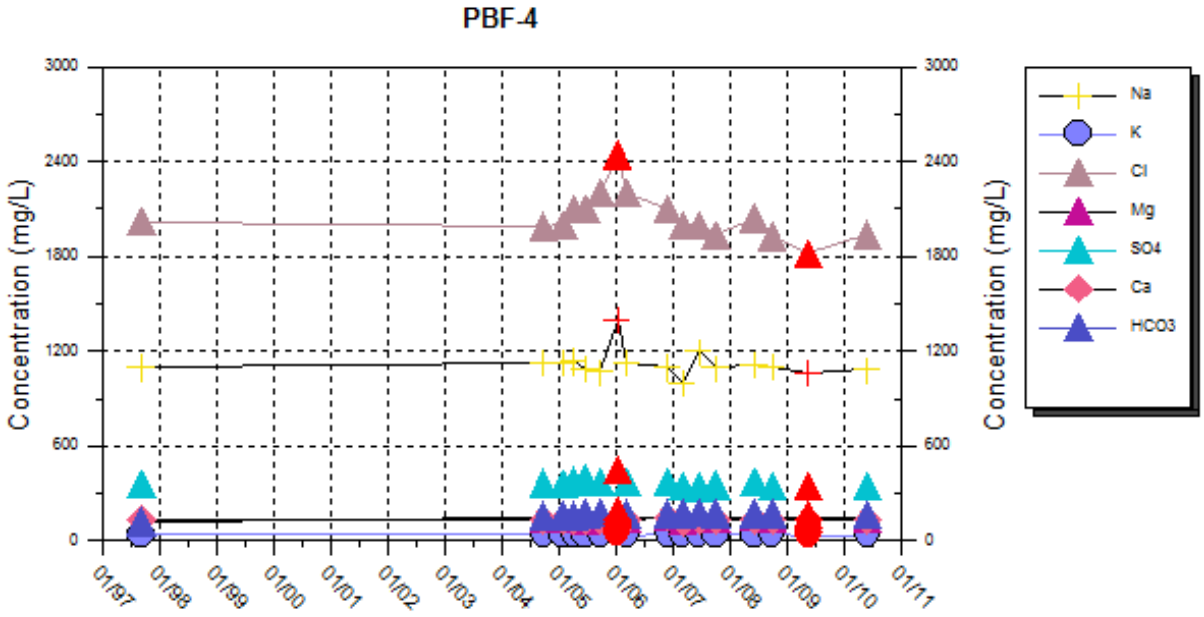


Figure 21. Major ion concentrations at station PBF-4 over the period of record. (Note: The sampling events with the minimum and maximum concentrations for chloride are marked in red.)

WASANMZ2

Station WASANMZ2 is used to monitor an associated deep injection well in Miami-Dade County, within the LEC Planning Area. Water quality data available for this well only covers a 2-year period from January 2005 to December 2006 (**Figure 22**). During this time, chloride concentrations ranged from 12,000 to 13,400 mg/L, with no discernible trend. Because these data are more than a decade old, more current data are needed to determine any type of trend.

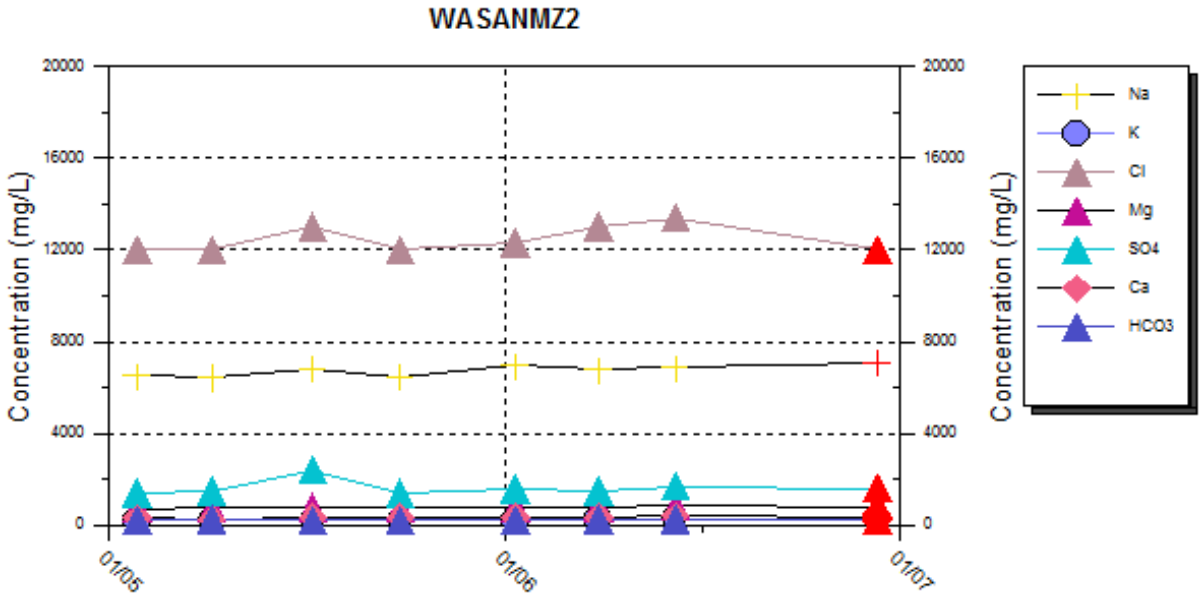


Figure 22. Major ion concentrations at station WASANMZ2 over the period of record. (Note: The sampling events with the minimum and maximum concentrations for chloride are marked in red.)

DISCUSSION

Upper Floridan Aquifer

Of the 50 UFA monitor wells in the RFGW network, 29 are baseline stations (**Figure 1**). Approximately two-thirds of the wells have been chemically stable over the period of record, five wells show probable increasing chloride concentration trends (BICY-MZ2, BSU-MZU, IWSD-MZ2, L-6436, and MIU-MZ1), and one well has anomalies in the data likely related to wellhead repair activities (LAB-MZ1). Given the paucity of data for approximately half of the UFA wells, spatial changes in water quality cannot be determined over much of the study area. The temporal spread of data is also of concern as sampling events at each station have been irregular through the period of record.

For the five UFA stations with probable increasing trends in chloride concentrations, interpretations were made with uncertainty due to the infrequency of sampling and the large data gaps over the period of record. Greater certainty would have required more consistent sampling events during the long spans of time between the last two events for each station or more current information for several wells that have not been sampled in more than 8 years.

There currently is only one baseline station in Miami-Dade County. Use of the FAS for ASR and as an AWS source is increasing. Monitoring stations should be identified to replace the retired monitor wells (ENP-100 and WASANMZ1), and more sites should be added to ensure sufficient spatial coverage given increasing use. Broward County also only has one UFA baseline station. There are three baseline UFA stations in the UKB planning area portion of the CFWI, and one in the LKB planning area. Overall, UFA sampling frequency needs to increase throughout the SFWMD to create a more robust data set and effectively characterize temporal trends in water quality. Use of the UFA is projected to increase in all planning areas over their respective planning horizons, which may degrade water quality.

Avon Park Permeable Zone

Twenty-two RFGW monitor wells are finished in the APPZ. Of these, 12 wells are baseline stations (**Figure 2**). Like the UFA, the spatial and temporal data gaps make it impossible to determine if background water quality has changed over time for much of the aquifer footprint. Six of the APPZ baseline stations show changes in water quality. Two stations have probable decreases in chloride concentrations between the two most recent sampling events (G-2617 and WASANMZ2). However, the latter was last sampled more than 10 years ago and a suitable replacement for this station is needed. Station BSU-MZL appears to have an increasing trend in chloride concentrations between the two most recent sampling events (2009 and 2016). The water quality results from the remaining three stations fluctuate over their periods of record. Fluctuations in the chloride concentrations over the period of record and lack of more recent samples make it difficult to determine trends with any degree of certainty. Increased sampling frequency, replacement of retired stations, and optimized spatial coverage are needed to meet the objectives of the RFGW monitoring network. Site summaries for the RFGW monitor stations finished in the UFA and APPZ are provided in **Appendix E**.

Comparison with USACE Results

As part of a Comprehensive Everglades Restoration Plan ASR regional study, the USACE (2015) characterized groundwater quality for the UFA and APPZ. The data set included wells within and outside of the SFWMD's jurisdiction, and the data ranged from 2004 through 2013. **Table 8** compares results from this report and the USACE (2015) report. Overall, concentrations are in reasonable agreement. The difference in sulfate maximums in both aquifers likely is due to anhydrite and gypsum affecting water quality and the USACE's inclusion of several stations in central Florida beyond the SFWMD's borders.

Table 8. Comparison of results from this study with results from the USACE (2015) report.

UFA

Means

Consitituent	SFWMD	USACE*
Alkalinity	130	122
Sulfate	412	446
Chloride	2021	1480
Magnesium	149	114
Calcium	127	107
Potassium	40	31
Sodium	1110	832
Specific Cond	6846	4910
TDS	4237	3210
pH	7.69	7.73
Temperature	26.52	26.30

Minimums

Consitituent	SFWMD	USACE*
Alkalinity	13	16
Sulfate	0	8
Chloride	4	5
Magnesium	5	6
Calcium	22	25
Potassium	0	1
Sodium	3	4
Specific Cond	185	258
TDS	120	148
pH	6.40	7.06
Temperature	20.46	22.30

Maximums

Consitituent	SFWMD	USACE*
Alkalinity	334	190
Sulfate	2674	4500
Chloride	19426	15460
Magnesium	1234	961
Calcium	640	419
Potassium	401	309
Sodium	9913	8460
Specific Cond	53133	43540
TDS	34680	29350
pH	8.50	8.37
Temperature	33.81	32.00

Number of Samples

Consitituent	SFWMD	USACE*
Alkalinity	404	49
Sulfate	404	47
Chloride	404	49
Magnesium	404	49
Calcium	404	49
Potassium	404	49
Sodium	404	49
Specific Cond	404	47
TDS	371	47
pH	404	46
Temperature	403	46

APPZ

Means

Consitituent	SFWMD	USACE*
Alkalinity	119	113
Sulfate	808	662
Chloride	4577	3420
Magnesium	304	239
Calcium	228	197
Potassium	88	64
Sodium	2471	1855
Specific Cond	13700	10670
TDS	8230	6657
pH	7.66	7.64
Temperature	26.79	26.90

Minimums

Consitituent	SFWMD	USACE*
Alkalinity	61	71
Sulfate	18	57
Chloride	4	71
Magnesium	8	16
Calcium	24	37
Potassium	1	2
Sodium	4	40
Specific Cond	204	465
TDS	118	257
pH	6.90	7.10
Temperature	18.44	19.00

Maximums

Consitituent	SFWMD	USACE*
Alkalinity	210	195
Sulfate	4600	2798
Chloride	20131	18900
Magnesium	1241	1120
Calcium	740	671
Potassium	540	392
Sodium	11330	10450
Specific Cond	52730	51350
TDS	36888	34160
pH	8.50	8.25
Temperature	33.60	32.60

Number of Samples

Consitituent	SFWMD	USACE*
Alkalinity	159	18
Sulfate	159	18
Chloride	159	18
Magnesium	159	18
Calcium	159	18
Potassium	159	18
Sodium	159	18
Specific Cond	159	18
TDS	154	18
pH	159	18
Temperature	159	18

APPZ = Avon Park Permeable Zone; SFWMD = South Florida Water Management District; TDS = total dissolved solids; UFA = Upper Florida aquifer; USACE = United States Army Corps of Engineers.

RECOMMENDATIONS

As the population of South Florida grows, use of the FAS will increase to meet future water demand. To monitor the viability of this source over time, water quality sampling should be done with greater frequency and regularity. Several baseline stations exhibit stable ion concentrations, but some wells have shown changes in water quality over time, and the baseline stations represent only half of the available wells for the UFA and APPZ. With additional sampling of non-baseline stations, the RFGW monitoring network could provide a more comprehensive water quality data set to identify areas where ions concentrations are changing. Additionally, a consistent sampling schedule would provide a more accurate aquifer assessment and higher resolution of sample data, which would help track seasonal variations and identify sampling errors.

In an effort to characterize water quality trends in the UFA and APPZ, wells with five or more samples (baseline stations) were considered, regardless of the age of the data. Out of 50 RFGW monitor stations completed in the UFA, only 29 stations were classified as baseline. There are 22 RFGW stations completed in the APPZ, of which 12 were classified as baseline, with similar issues as the UFA wells. Collaboration with other agencies could help produce a more robust data set without substantially increasing cost. If the sampling protocols, including the suite of major ions and field parameters, of utility-owned monitor wells finished in the appropriate aquifer are the same, the additional data could be included in further studies.

Throughout the SFWMD, the UFA and APPZ are used for PWS, AGR, industrial use, and ASR. Water quality results provided by the RFGW monitoring network provide key measurements for effective management practices of these limited groundwater resources.

LITERATURE CITED

AECOM Water. 2008. Technical Review of Anomalous Water Level Trends Recorded for Monitor Zone 3 of the Floridan Aquifer Well Identified as LAB-TW. West Palm Beach, FL.

Back, W. 1960. Origin of hydrochemical facies of ground water in the Atlantic Coastal Plain. International Geological Congress, 21st Copenhagen. Part 1:87-95.

Back, W. 1961. Techniques for Mapping of Hydrochemical Facies, pp. 380-382. U.S. Geological Survey Professional Paper 424-D. U.S. Geological Survey, Washington, D.C.

Berndt, M.P., B.G. Katz, J.A. Kingsbury, and C.A. Crandall. 2014. The quality of our Nation's waters—Water quality in the Upper Floridan aquifer and overlying surficial aquifers, southeastern United States, 1993-2010. U.S. Geological Survey Circular 1355. 72 pp.

CFWI. 2014. East-Central Florida Transient (ECFT) Model Documentation in Support of the 2014 Draft CFWI Regional Water Supply Plan. Extracted January 2, 2018.

CFWI. 2015a. Central Florida Water Initiative Regional Water Supply Plan: Volume I – Planning Document.

CFWI. 2015b. Central Florida Water Initiative Regional Water Supply Plan: Volume IA – Appendices.

Frazee, Jr., J.M. 1982. Geochemical pattern analysis: method of describing the southeastern limestone regional aquifer system. Studies of hydrogeology of the Southeastern United States, Special Publications: Number 1, pp. 46-58. Georgia Southwestern College, Americus, GA.

Freeze, R.A. and J.A. Cherry. 1979. Groundwater. Prentice Hall, Englewoods Hills, NJ.

Fritz, S.J. 1994. A Survey of Charge-Balance Errors on Published Analyses of Potable Ground and Surface Waters. Groundwater 32:539-546.

Hem, J.D. 1970. Study and interpretation of the chemical characteristics of natural water. Third Edition. Water-Supply Paper 1473. U.S. Geological Survey, Alexandria, VA.

Katz, B.G. 1991. Hydrochemistry of the Upper Floridan Aquifer, Florida. Water-Resources Investigations Report 91-4196, U.S. Geological Survey, Tallahassee, FL. 43 pp.

Lukasiewicz, J. and M.P. Switanek. 1995. Water quality analysis and mapping of artesian water from the Floridan Aquifer System in Martin, St. Lucie, Okeechobee, and Indian River counties, Florida. South Florida Water Management District, West Palm Beach, FL.

Reese, R.S. and E. Richardson. 2008. Synthesis of the Hydrogeologic Framework of the Floridan Aquifer System and Delineation of a Major Avon Park Permeable Zone in Central and Southern Florida. U.S. Geological Survey, Reston, VA. 66 pp.

Schlumberger Water Services. 2014. AquaChem v. 2014.2. Kitchener, Ontario, Canada.

SFWMD. 2013. 2013 Lower East Coast Water Supply Plan Update. South Florida Water Management District, West Palm Beach, FL.

SFWMD. 2014. 2014 Lower Kissimmee Basin Water Supply Plan. South Florida Water Management District, West Palm Beach, FL.

SFWMD. 2015. Water Use Permitting Manual Volume III. South Florida Water Management District, West Palm Beach, FL.

SFWMD. 2016. 2016 Upper East Coast Water Supply Plan Update. South Florida Water Management District, West Palm Beach, FL.

SFWMD. 2017. 2017 Lower West Coast Water Supply Plan Update. South Florida Water Management District, West Palm Beach, FL.

Sprinkle, C.L. 1989. Geochemistry of the Floridan Aquifer System in Florida and in Parts of Georgia, South Carolina, and Alabama. U.S. Geological Survey Professional Paper 143-1, Washington D.C. 114 pp.

Upchurch, S.B. 1992. Quality of Water in Florida's Aquifer System. Florida Geological Survey Special Publication No. 34. Chapter 4:13-56.

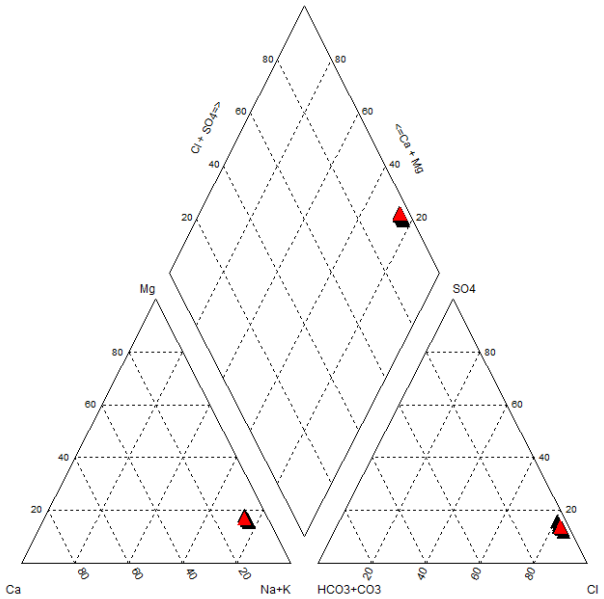
USACE. 2015. Central and Southern Florida Project Comprehensive Everglades Restoration Plan. Final Technical Report Aquifer Storage and Recovery Regional Study. USACE, Jacksonville, FL.

APPENDIX A: GEODATABASE

The Geodatabase Excel file is attached to this PDF.

APPENDIX B: UPPER FLORIDAN AQUIFER RESULTS

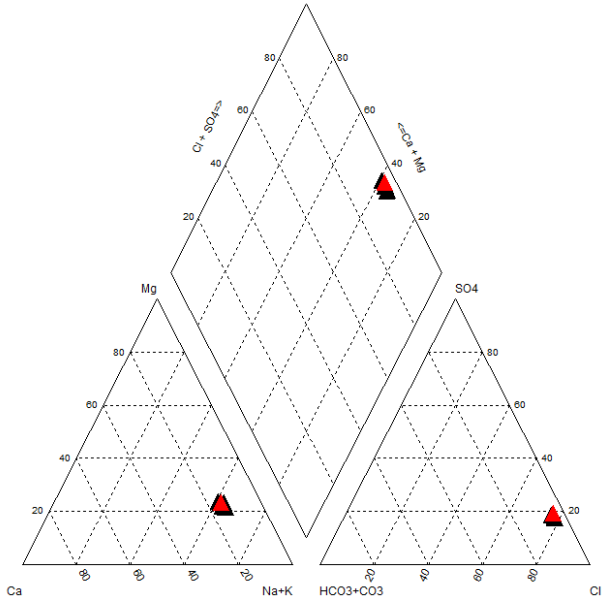
BICY-MZ2



BICY-MZ2	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	150	605	2709	190	152	60	1556	9404	5483	7.67	27.9
Std Dev	4	35	135	8	5	3	51	552	568	0.17	0.6
CV (%)	2.9	5.8	5.0	4.5	3.5	4.5	3.3	5.9	10.4	2.2	2.1
Minimum	144	560	2501	174	144	58	1460	7487	3900	7.39	26.7
25th	148	590	2615	186	147	58	1520	9349	5570	7.53	27.6
Median	150	600	2690	191	152	60	1550	9461	5700	7.67	27.9
75th	150	610	2800	193	155	61	1596	9777	5783	7.80	28.3
Maximum	160	720	3000	210	162	68	1680	9932	5900	7.90	28.9
# of samples	15	15	15	15	15	15	15	15	13	15	15.0

2004 - 2015

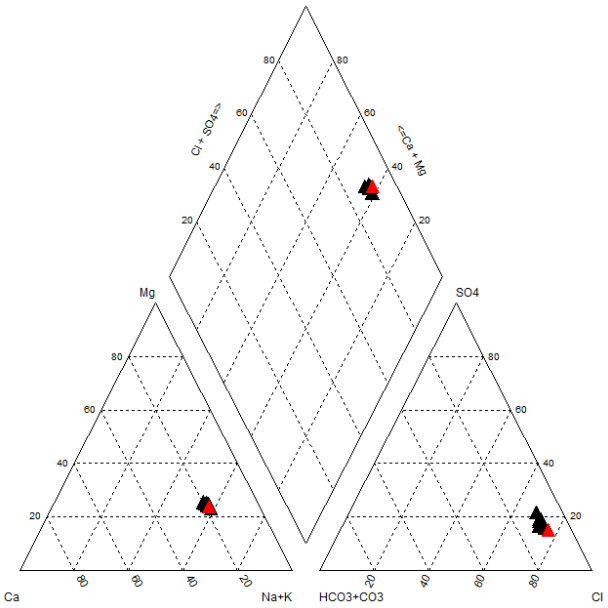
BRY-MW



BRY-MW	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	107	410	1300	126	135	27	648	4837	2740	7.44	28.9
Std Dev	7	19	0	9	7	1	32	131	86	0.17	1.8
CV (%)	7.0	4.7	0.0	7.5	4.9	5.2	4.9	2.7	3.1	2.3	6.2
Minimum	100	390	1300	114	125	25	610	4614	2640	7.14	25.0
25th	100	393	1300	120	129	26	629	4760	2700	7.35	29.3
Median	105	405	1300	125	139	27	639	4857	2700	7.50	29.6
75th	110	425	1300	130	140	27	660	4948	2775	7.54	29.9
Maximum	120	440	1300	143	140	29	709	4988	2900	7.67	30.1
# of samples	6	6	6	6	6	6	6	6	6	6	6

2006-2016

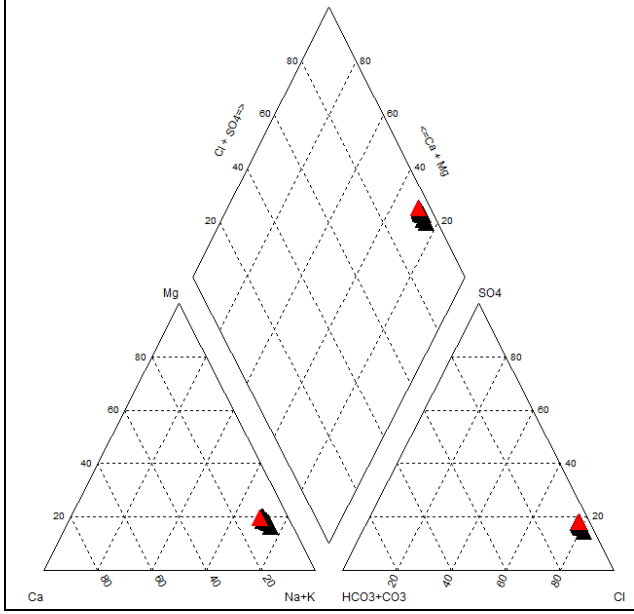
BSU-MZU



BSU-MZU	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	138	237	723	83	105	16	351	3033	1707	7.66	32.0
Std Dev	10	23	44	5	6	1	19	200	122	0.23	1.0
CV (%)	7.2	9.7	6.0	6.1	5.6	4.2	5.5	6.6	7.2	3.0	3.0
Minimum	129	209	662	77	98	15	329	2566	1530	6.91	29.5
25th	132	221	690	79	100	16	336	2923	1630	7.66	31.9
Median	136	232	710	82	103	16	346	3042	1700	7.70	32.2
75th	140	250	760	87	107	17	370	3182	1772	7.77	32.5
Maximum	170	300	807	94	120	18	387	3408	1958	7.90	33.8
# of samples	13	13	13	13	13	13	13	13	11	13	13

1999-2016

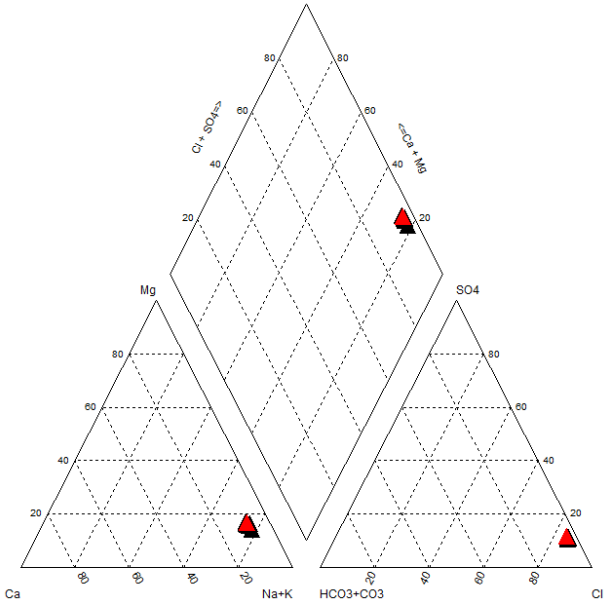
DF-4



DF-4	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	124	508	1708	140	114	36	989	6665	3693	7.83	22.3
Std Dev	6	29	91	8	8	2	42	1347	168	0.18	0.5
CV (%)	4.8	5.6	5.4	5.9	7.2	4.4	4.3	20.2	4.5	2.3	2.1
Minimum	116	424	1558	120	100	33	915	6072	3200	7.60	21.7
25th	120	504	1651	133	108	35	963	6279	3626	7.70	21.9
Median	122	510	1700	142	115	35	985	6303	3740	7.80	22.1
75th	130	522	1760	146	117	36	1010	6445	3817	7.94	22.7
Maximum	140	550	1900	158	129	40	1110	12030	3882	8.23	23.0
# of samples	17	17	17	17	17	17	17	17	15	17	17

2004-2017

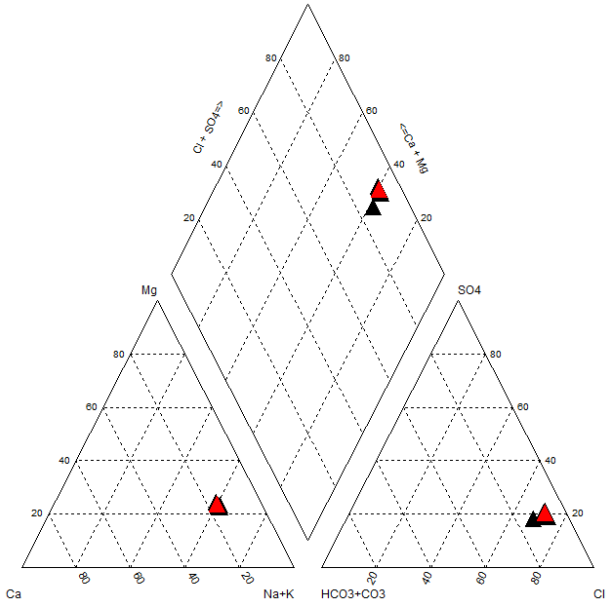
ENP-100



ENP-100	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	161	484	2748	177	152	57	1531	9415	5477	7.39	28.1
Std Dev	7	11	119	9	7	2	61	276	168	0.11	0.3
CV (%)	4.4	2.2	4.3	4.8	4.7	4.2	4.0	2.9	3.1	1.4	1.1
Minimum	150	469	2577	157	139	54	1464	9142	5100	7.15	27.3
25th	157	477	2637	170	149	57	1500	9253	5420	7.31	28.0
Median	160	486	2790	180	152	57	1514	9302	5461	7.40	28.1
75th	170	490	2800	183	157	58	1550	9550	5600	7.50	28.2
Maximum	170	510	3000	190	164	62	1700	10180	5713	7.50	28.6
# of samples	13	13	13	13	13	13	13	13	11	13	13

2004-2009

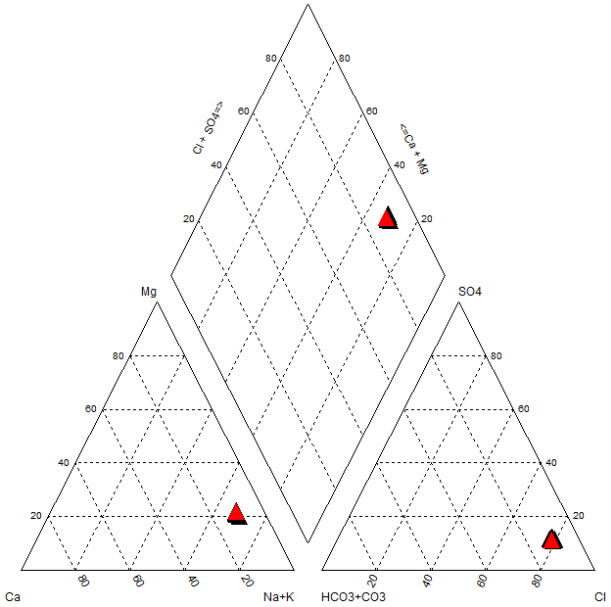
FPL-MW



FPL-MW	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	133	312	820	91	104	18	434	3588	2039	7.61	27.7
Std Dev	37	12	34	4	5	1	12	212	53	0.05	0.3
CV (%)	28.1	3.8	4.1	4.9	4.7	3.5	2.7	5.9	2.6	0.7	1.2
Minimum	75	290	770	86	98	17	410	3433	2000	7.50	27.2
25th	125	306	802	86	100	18	432	3482	2000	7.60	27.5
Median	129	315	815	92	104	18	439	3521	2001	7.60	27.8
75th	130	320	829	95	109	18	440	3578	2075	7.62	28.0
Maximum	220	328	890	97	110	19	449	4129	2140	7.68	28.2
# of samples	8	8	8	8	8	8	8	8	8	8	8

2006-2009

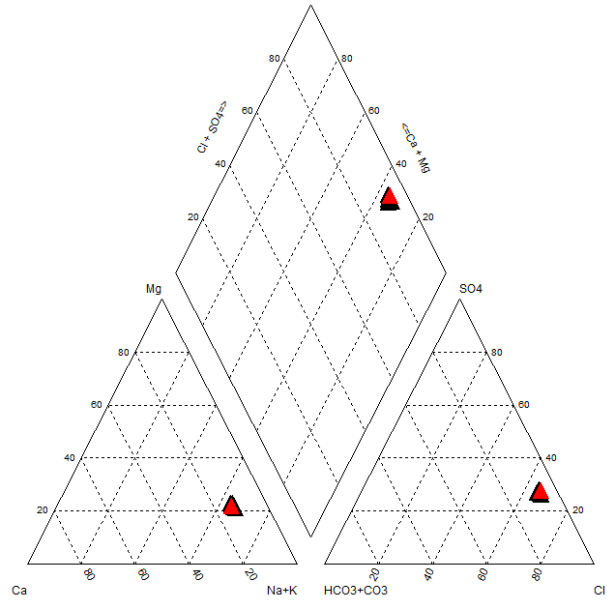
FPU-MZU



FPU-MZU	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	162	180	904	86	69	20	509	3572	2005	7.88	24.5
Std Dev	10	10	40	4	4	1	20	147	48	0.14	0.4
CV (%)	6.2	5.6	4.4	4.2	6.4	3.2	3.9	4.1	2.4	1.7	1.7
Minimum	147	163	842	78	63	19	483	3128	1930	7.68	23.6
25th	160	172	874	84	66	19	497	3580	1962	7.80	24.3
Median	160	180	900	85	70	20	500	3597	2000	7.89	24.5
75th	163	190	930	88	71	20	527	3624	2040	7.97	24.7
Maximum	180	190	990	92	78	21	550	3740	2080	8.14	25.3
# of samples	11	11	11	11	11	11	11	11	11	11	11

2000 - 2008

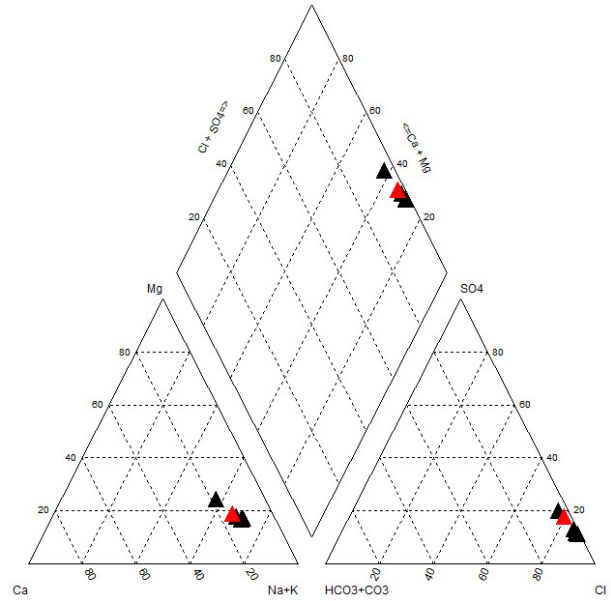
G-2618



G-2618	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	88	336	602	69	66	20	375	2747	1584	7.99	25.7
Std Dev	7	12	23	4	3	1	15	48	57	0.11	0.5
CV (%)	8.0	3.4	3.9	5.1	4.6	4.4	4.1	1.7	3.6	1.4	2.1
Minimum	79	310	557	63	61	19	353	2627	1450	7.69	24.8
25th	85	330	590	66	65	19	364	2728	1562	7.98	25.4
Median	86	340	610	70	66	20	373	2753	1600	8.00	25.9
75th	88	345	618	72	68	20	378	2786	1607	8.09	26.1
Maximum	110	350	641	77	72	22	416	2808	1664	8.10	26.6
# of samples	16	16	16	16	16	16	16	16	16	16	16

2004 - 2016

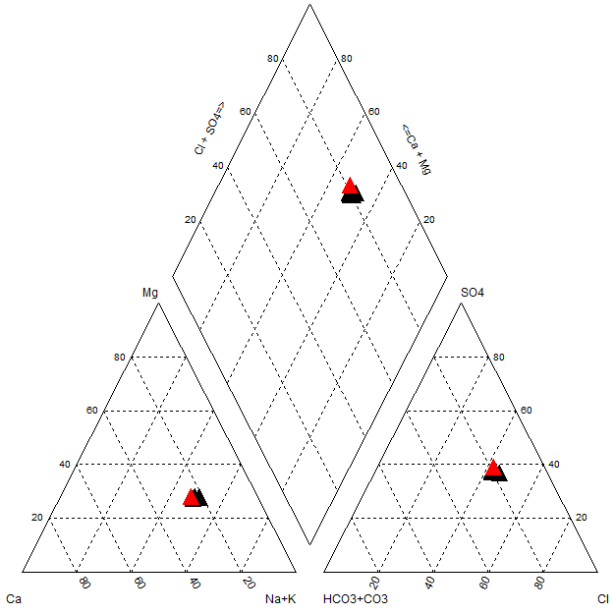
GLF-6



GLF-6	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	80	599	2694	192	237	39	1366	9510	5629	7.50	29.5
Std Dev	2	127	1208	68	76	16	638	3842	2288	0.22	1.6
CV (%)	2.3	21.2	44.8	35.1	31.9	42.2	46.7	40.4	40.6	2.9	5.3
Minimum	77	406	1151	120	147	14	525	4464	2625	7.31	27.2
25th	80	549	1843	139	178	32	933	6367	4166	7.33	28.0
Median	81	574	2423	171	218	36	1223	9495	5046	7.47	30.1
75th	81	647	3462	230	290	47	1774	12057	7022	7.50	30.8
Maximum	82	824	4711	313	359	67	2428	15165	9505	7.91	30.9
# of samples	6	6	6	6	6	6	6	5	6	5	6

2001 - 2014

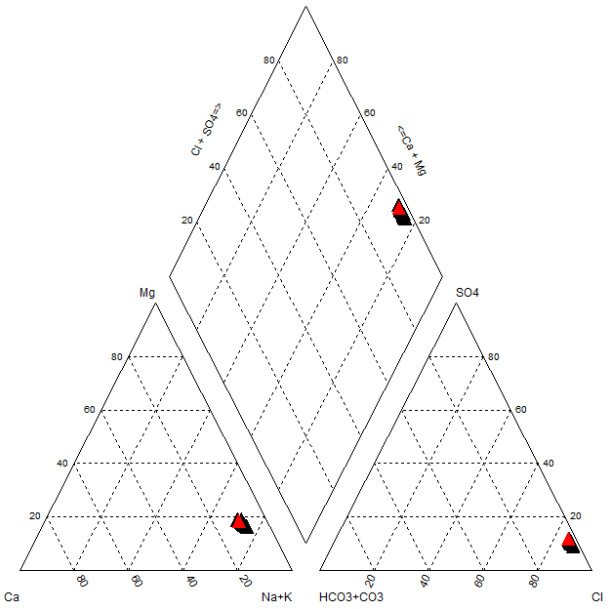
HIF-42U



HIF-42U	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	93	175	150	31	41	5	101	1067	651	7.98	28.1
Std Dev	4	6	11	1	1	0	7	44	33	0.16	1.2
CV (%)	3.8	3.3	7.2	4.7	1.6	5.3	7.1	4.1	5.1	2.0	4.2
Minimum	86	169	141	29	41	4	91	1000	609	7.70	26.2
25th	92	170	141	29	41	5	96	1044	630	8.00	27.5
Median	94	175	143	31	41	5	100	1064	654	8.00	28.4
75th	95	177	154	32	42	5	107	1100	656	8.00	28.9
Maximum	96	185	169	33	43	5	110	1126	708	8.20	29.6
# of samples	5	5	5	5	5	5	5	5	5	5	5

2008 - 2017

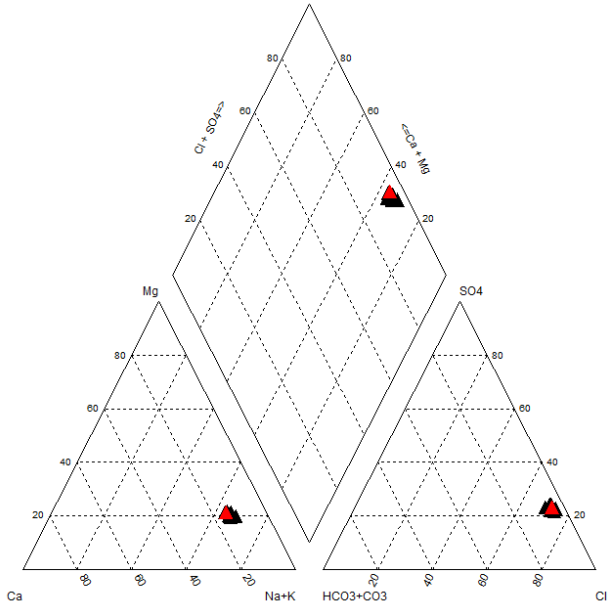
I75-MZ2



I75-MZ2	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	167	636	3826	270	237	69	2037	12630	7528	7.37	28.8
Std Dev	10	28	302	15	16	6	129	554	586	0.17	0.4
CV (%)	5.9	4.4	7.9	5.6	6.9	8.2	6.3	4.4	7.8	2.3	1.4
Minimum	156	580	3302	248	215	61	1820	11560	6690	7.02	28.1
25th	160	619	3651	259	223	63	1923	12242	7008	7.29	28.6
Median	162	640	3800	267	237	67	2085	12742	7655	7.40	28.8
75th	173	651	4007	281	246	73	2122	13021	7800	7.42	29.1
Maximum	190	680	4300	304	274	80	2220	13433	9000	7.68	29.7
# of samples	16	16	16	16	16	16	16	16	14	16	16

1995 - 2016

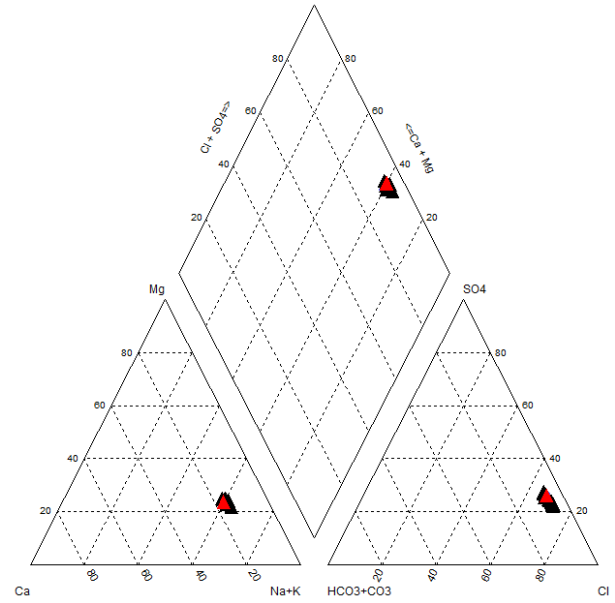
IWSD-MZ2



IWSD-MZ2	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	115	517	1179	116	130	25	678	4826	2892	7.97	29.1
Std Dev	17	24	54	6	9	1	15	113	57	0.15	0.5
CV (%)	14.7	4.6	4.6	4.8	6.6	3.4	2.2	2.3	2.0	1.9	1.8
Minimum	76	460	1082	110	110	24	647	4509	2800	7.68	28.3
25th	110	504	1145	110	126	25	668	4793	2850	7.83	28.7
Median	114	520	1200	115	130	25	681	4836	2900	8.00	29.1
75th	119	530	1200	119	134	26	690	4898	2900	8.07	29.3
Maximum	154	550	1300	126	147	27	700	4987	3000	8.30	30.0
# of samples	14	14	14	14	14	14	14	14	13	14	14

2004 - 2016

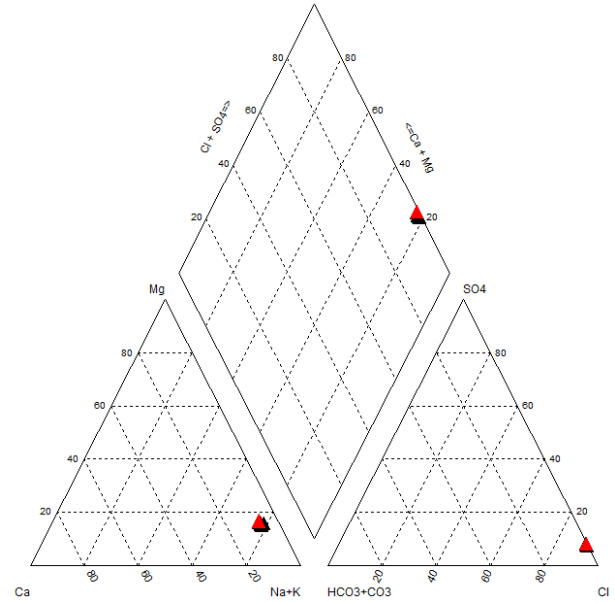
L2-PW2



L2-PW2	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	85	329	679	78	85	15	371	2948	1726	7.80	26.3
Std Dev	5	19	86	7	8	2	42	250	165	0.14	0.7
CV (%)	5.8	5.8	12.6	8.7	9.3	13.2	11.4	8.5	9.6	1.8	2.6
Minimum	71	280	564	71	77	13	307	2413	1451	7.47	24.8
25th	84	321	617	75	80	14	340	2804	1647	7.79	25.8
Median	85	330	646	77	83	15	357	2865	1700	7.81	26.2
75th	89	343	743	80	87	15	390	3070	1800	7.90	26.5
Maximum	93	351	832	95	110	22	470	3474	2048	8.00	28.0
# of samples	16	16	16	16	16	16	16	16	15	16	16

1999 - 2016

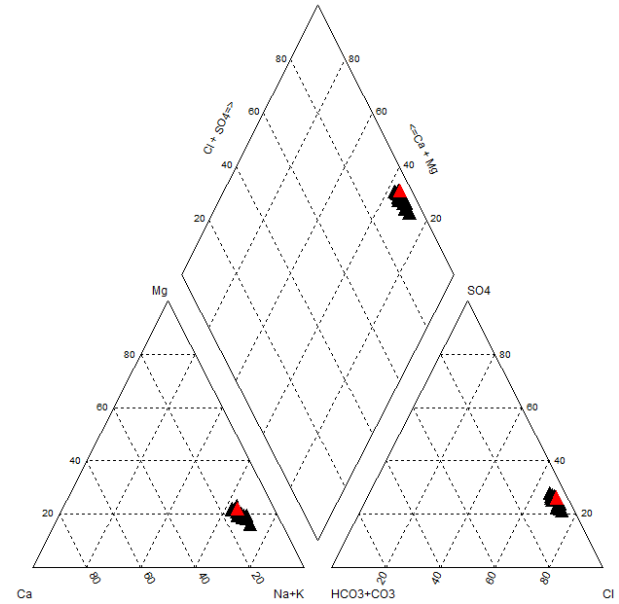
L-6436



L-6436	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	140	1642	14140	815	577	241	7350	38470	24587	7.08	28.7
Std Dev	8	104	635	55	50	37	534	1490	3786	0.08	2.4
CV (%)	5.4	6.4	4.5	6.7	8.7	15.3	7.3	3.9	15.4	1.2	8.4
Minimum	130	1500	13000	720	490	190	6300	35162	16300	6.98	25.4
25th	135	1550	14000	780	545	214	7130	38319	23950	7.02	26.3
Median	140	1700	14000	827	577	245	7532	38648	25909	7.06	30.3
75th	145	1700	14490	854	622	257	7630	39334	26500	7.15	30.7
Maximum	150	1797	15000	889	640	310	8100	40175	29000	7.20	31.4
# of samples	7	7	7	7	7	7	7	7	7	7	7

2005 - 2016

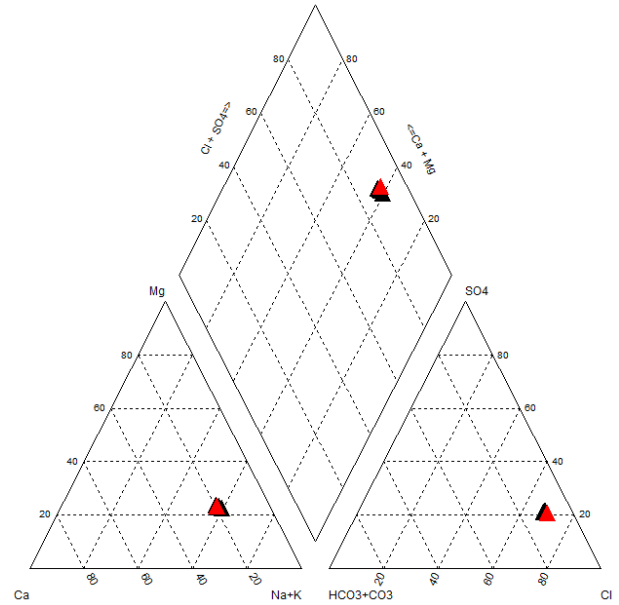
LAB-MZ1



LAB-MZ1	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	78	361	744	73	80	16	441	3275	1918	8.02	29.2
Std Dev	11	15	98	3	5	1	64	264	154	0.17	0.7
CV (%)	14.1	4.1	13.1	3.6	6.2	4.5	14.5	8.0	8.0	2.2	2.5
Minimum	58	340	646	67	73	14	360	3026	1756	7.73	28.1
25th	72	350	670	72	77	15	391	3054	1800	7.87	28.8
Median	82	360	708	73	80	16	409	3128	1800	8.06	29.1
75th	88	370	790	75	82	16	491	3455	2077	8.15	29.4
Maximum	90	390	1000	77	92	17	600	3880	2200	8.30	31.2
# of samples	15	15	15	15	15	15	15	15	12	15	15

1997 - 2016

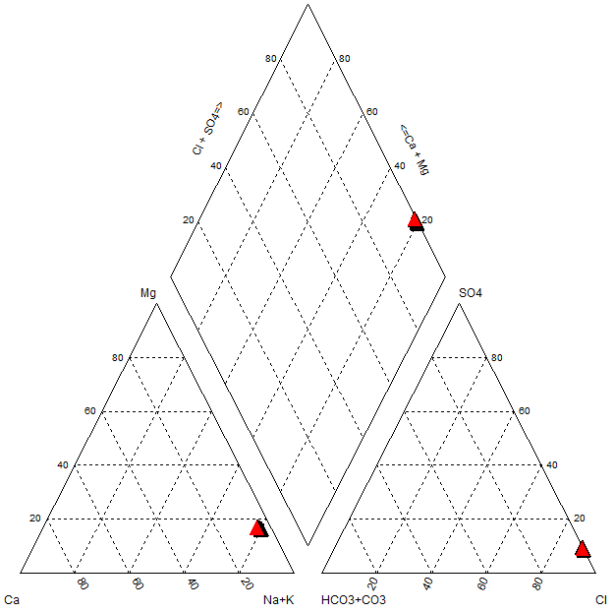
MF-37U



MF-37U	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	124	251	599	69	95	10	324	2637	1571	7.53	28.5
Std Dev	2	8	24	2	2	0	12	118	58	0.11	0.6
CV (%)	1.5	3.3	3.9	2.3	2.1	2.4	3.6	4.5	3.7	1.5	2.0
Minimum	121	238	563	68	92	9	305	2394	1490	7.40	27.8
25th	122	246	583	68	94	10	316	2644	1516	7.43	28.0
Median	124	254	601	69	95	10	325	2661	1587	7.55	28.3
75th	125	257	618	70	97	10	333	2684	1614	7.60	28.8
Maximum	126	262	631	73	97	10	338	2778	1644	7.70	29.4
# of samples	6	6	6	6	6	6	6	6	6	6	6

2007 - 2011

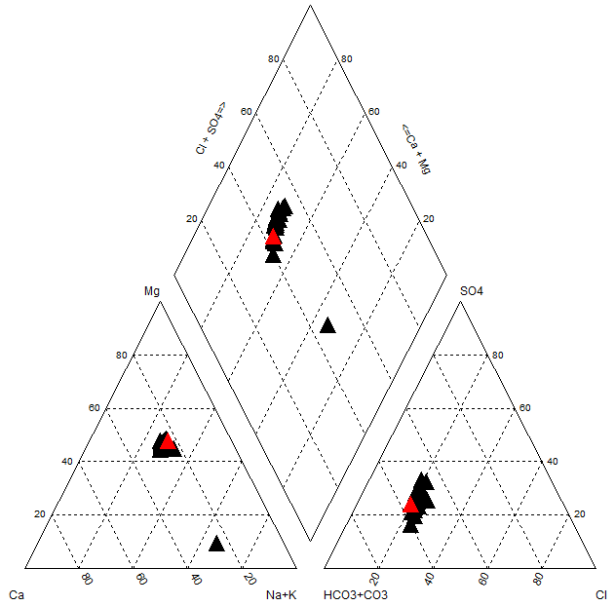
MIU-MZ1



MIU-MZ1	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	65	2065	15509	961	425	307	8448	43142	29297	7.97	28.5
Std Dev	39	68	765	29	43	31	156	1750	1344	0.35	1.7
CV (%)	60.9	3.3	4.9	3.0	10.2	10.1	1.8	4.1	4.6	4.5	6.1
Minimum	13	1933	14000	890	358	272	8176	38723	27000	7.40	25.7
25th	34	2000	15000	955	397	290	8347	42713	28357	7.63	28.0
Median	52	2100	15550	961	422	293	8490	43270	29000	8.05	28.5
75th	93	2100	16000	970	471	318	8555	43559	30000	8.22	29.3
Maximum	134	2176	17000	1020	495	380	8710	46920	31700	8.50	32.8
# of samples	12	12	12	12	12	12	12	12	11	12	12

1996 - 2015

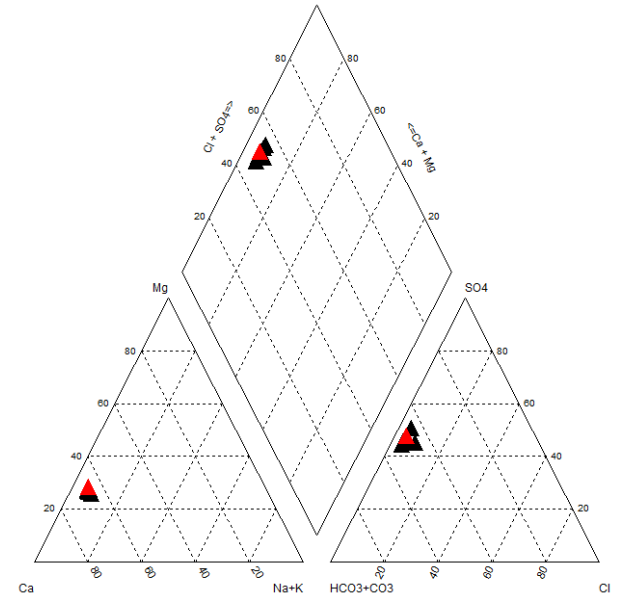
OKF-42



OKF-42	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	189	89	56	37	34	5	44	734	411	7.44	25.6
Std Dev	7	16	4	7	3	1	13	150	23	0.28	0.7
CV (%)	3.5	18.6	7.5	19.0	7.9	19.1	30.3	20.5	5.7	3.8	2.7
Minimum	171	53	50	8	29	1	38	624	365	6.40	24.3
25th	186	81	52	38	32	5	40	682	403	7.38	25.0
Median	190	92	55	39	34	5	41	719	410	7.50	25.6
75th	192	98	57	40	36	5	43	731	432	7.60	26.2
Maximum	201	120	69	42	40	7	102	1369	445	7.80	26.7
# of samples	20	20	20	20	20	20	20	20	16	20	19

1984 - 2006

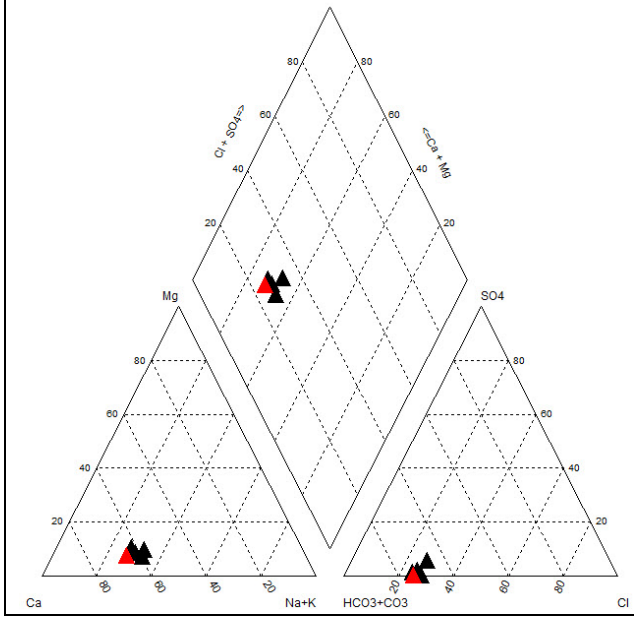
OSF-100



OSF-100	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	70	66	5	10	39	2	4	301	184	8.12	23.4
Std Dev	3	3	1	0	1	0	1	8	11	0.29	0.7
CV (%)	4.5	5.0	26.2	4.9	3.4	18.9	21.6	2.5	6.2	3.5	3.1
Minimum	62	56	4	9	36	1	3	288	170	7.21	21.7
25th	69	65	4	9	38	2	3	296	175	8.03	23.2
Median	70	66	5	10	39	2	3	300	180	8.20	23.7
75th	72	67	5	10	40	2	4	307	190	8.27	23.9
Maximum	77	70	9	10	41	3	6	314	210	8.50	24.8
# of samples	15	15	15	15	15	15	15	15	13	15	15

2004 - 2012

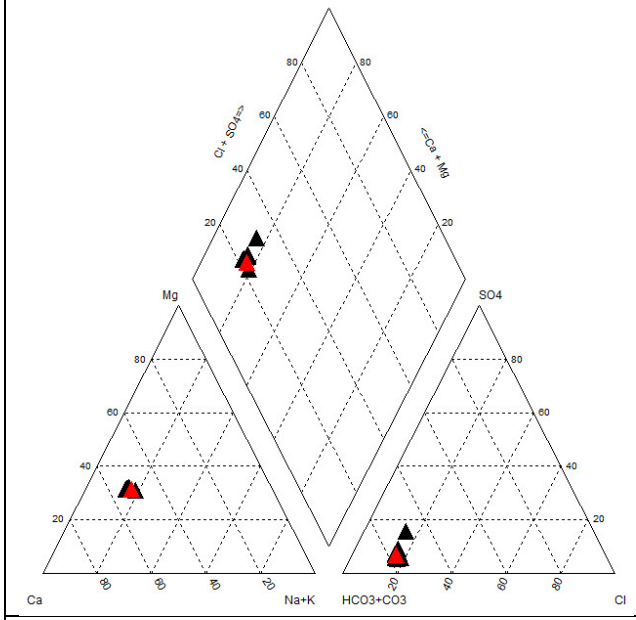
OSF-3



OSF-3	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	204	5	53	6	68	2	36	543	314	7.68	24.2
Std Dev	9	5	3	1	5	0	3	36	14	0.13	0.7
CV (%)	4.6	105.8	5.2	15.0	6.9	29.2	7.2	6.6	4.4	1.7	2.8
Minimum	186	0	48	5	59	1	34	465	297	7.50	23.0
25th	203	1	51	5	67	1	35	546	309	7.55	23.9
Median	205	3	54	5	69	1	36	558	311	7.75	24.1
75th	209	5	55	6	71	2	37	563	313	7.80	24.6
Maximum	217	15	56	7	74	3	42	570	342	7.80	25.2
# of samples	6	6	6	6	6	6	6	6	6	6	6

1979 - 2006

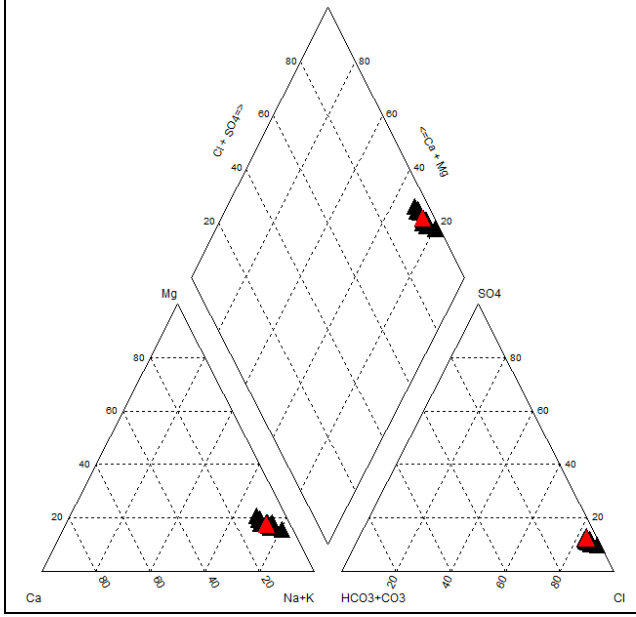
OSF-66



OSF-66	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	94	9	15	10	26	1	9	256	154	7.80	24.0
Std Dev	2	4	1	0	1	0	1	8	11	0.15	0.7
CV (%)	2.3	42.5	4.8	3.3	2.5	26.8	10.0	2.9	6.9	1.9	2.7
Minimum	91	6	14	9	25	0	8	244	140	7.50	22.7
25th	93	7	14	9	26	1	8	251	150	7.69	24.1
Median	94	8	15	10	26	1	8	256	150	7.83	24.2
75th	95	9	15	10	27	1	9	262	153	7.88	24.5
Maximum	100	20	16	10	27	1	11	269	180	8.00	24.7
# of samples	10	10	10	10	10	10	10	10	9	10	10

2004 - 2006

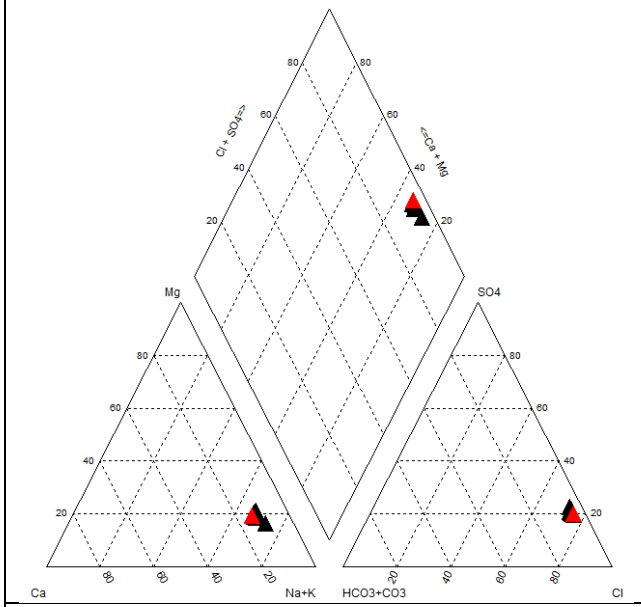
PBF-3



PBF-3	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	146	418	2269	162	124	46	1255	9484	5722	7.65	22.7
Std Dev	24	42	171	12	18	4	125	7874	5509	0.29	0.7
CV (%)	16.2	10.1	7.6	7.1	14.8	7.7	10.0	83.0	96.3	3.8	3.2
Minimum	53	324	1810	131	58	35	940	6110	3430	7.22	21.6
25th	144	377	2150	157	120	45	1199	7315	4240	7.44	22.3
Median	150	437	2294	162	125	46	1300	8173	4682	7.66	22.5
75th	156	450	2400	170	133	48	1330	8268	4800	7.80	23.0
Maximum	180	470	2500	183	157	52	1410	46290	30900	8.30	24.5
# of samples	23	23	23	23	23	23	23	23	22	23	23

1996 - 2017

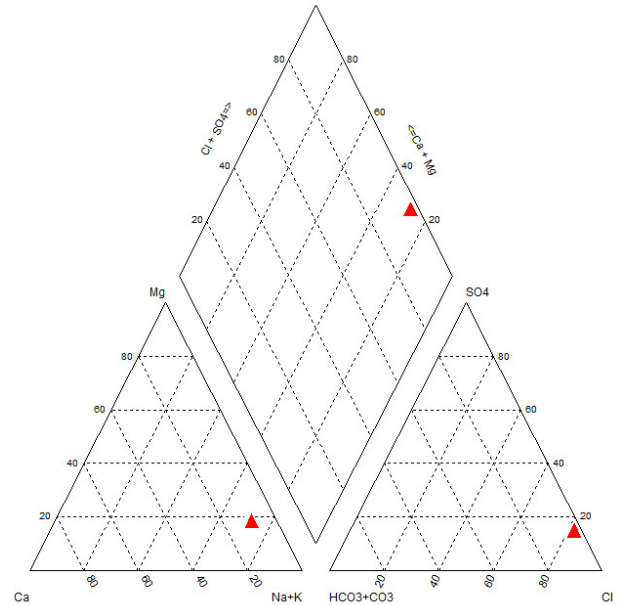
PBF-7U



PBF-7U	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	112	463	1240	111	119	24	716	5085	2818	7.96	26.2
Std Dev	6	21	70	6	10	1	35	995	118	0.25	0.6
CV (%)	5.1	4.5	5.6	5.6	8.5	4.9	5.0	19.6	4.2	3.1	2.1
Minimum	102	420	1100	98	100	21	640	4321	2460	7.52	24.6
25th	110	452	1200	109	111	23	699	4797	2783	7.80	26.0
Median	110	461	1212	111	120	24	705	4881	2820	7.97	26.1
75th	118	470	1300	115	124	24	730	4949	2900	8.16	26.3
Maximum	120	500	1400	120	141	26	818	9131	2976	8.40	27.6
# of samples	18	18	18	18	18	18	18	18	16	18	18

2000 - 2016

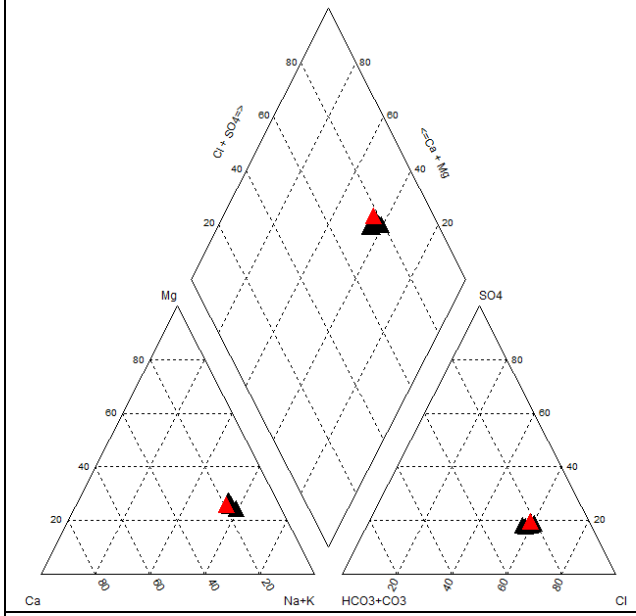
SCC-MZU



SCC-MZU	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	163	677	2764	211	199	57	1579	9735	5991	7.74	28.1
Std Dev	19	31	187	11	13	2	53	445	139	0.26	1.4
CV (%)	11.4	4.6	6.8	5.0	6.4	4.2	3.4	4.6	2.3	3.4	4.9
Minimum	111	618	2454	199	175	54	1492	8404	5800	7.43	25.8
25th	160	667	2650	204	193	55	1540	9630	5878	7.51	27.6
Median	170	680	2742	210	198	58	1600	9739	6000	7.70	28.3
75th	175	688	2879	215	206	59	1610	9839	6100	7.95	28.7
Maximum	180	740	3200	239	224	61	1700	10675	6210	8.30	30.6
# of samples	15	15	15	15	15	15	15	15	15	15	15

1999 - 2009

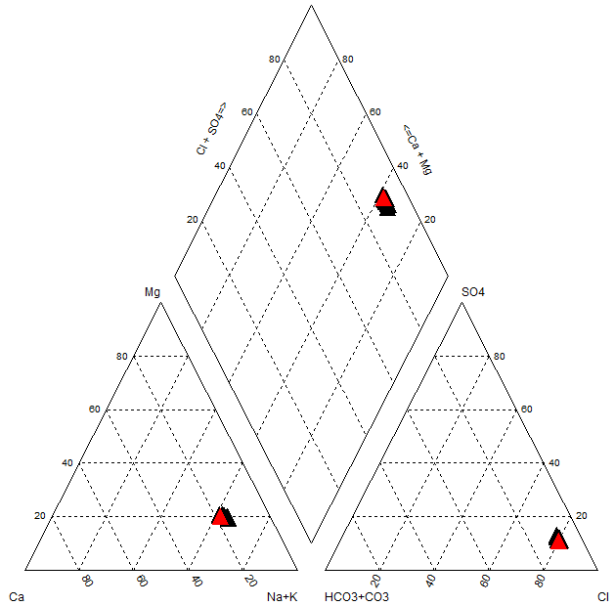
SLF-21



SLF-21	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	168	135	314	47	53	14	183	1473	889	7.36	25.5
Std Dev	11	6	15	2	1	12	8	60	22	0.11	0.3
CV (%)	6.3	4.8	4.8	3.8	2.0	82.8	4.5	4.1	2.5	1.5	1.1
Minimum	160	127	290	44	51	9	171	1383	842	7.20	25.3
25th	162	130	309	46	53	10	179	1442	877	7.30	25.4
Median	163	133	313	47	53	10	182	1469	890	7.30	25.5
75th	166	135	315	48	54	10	186	1505	905	7.40	25.6
Maximum	196	148	351	49	55	49	203	1603	918	7.60	26.3
# of samples	10	10	10	10	10	10	10	10	10	10	10

1985 - 2014

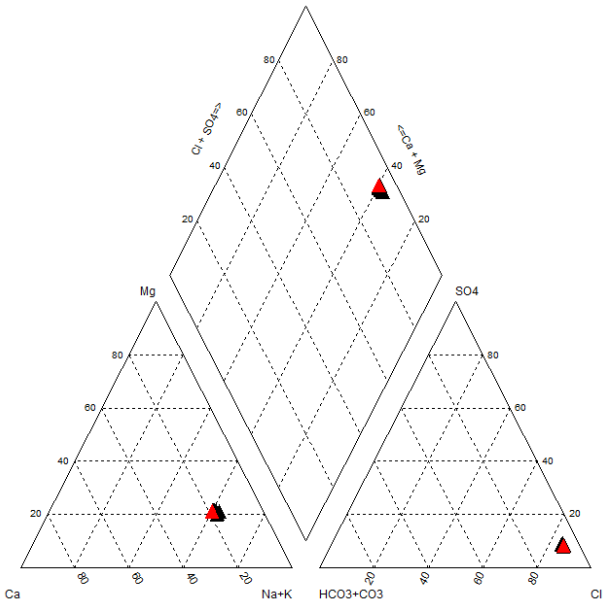
SLF-75



SLF-75	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	143	185	930	80	111	15	460	3622	1998	7.41	28.0
Std Dev	5	14	41	3	7	1	11	77	100	0.15	0.8
CV (%)	3.3	7.6	4.4	4.2	6.2	6.0	2.4	2.1	5.0	2.0	2.9
Minimum	134	157	851	72	96	14	442	3506	1800	7.20	27.2
25th	140	176	910	78	109	14	450	3570	1935	7.30	27.6
Median	140	184	930	80	111	15	461	3605	1998	7.35	27.7
75th	148	190	960	83	115	15	466	3669	2100	7.50	28.2
Maximum	150	210	1000	86	121	17	489	3793	2118	7.70	30.4
# of samples	17	17	17	17	17	17	17	17	15	17	17

2004 - 2016

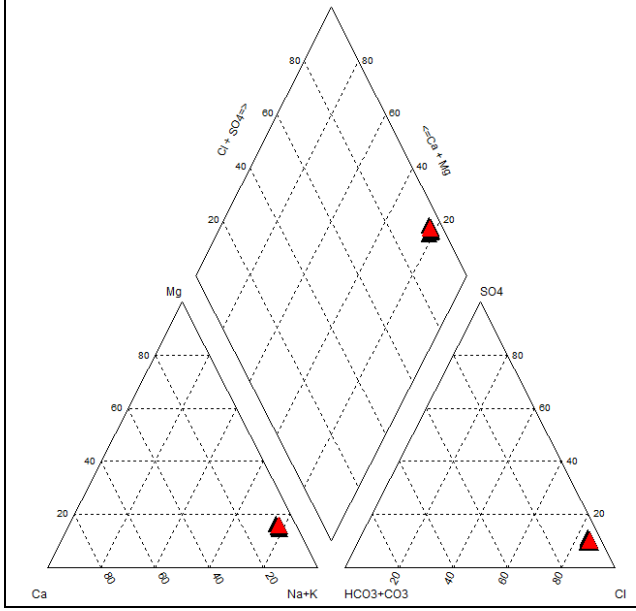
SLF-76



SLF-76	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	136	175	1304	111	155	16	594	4724	2754	7.31	28.8
Std Dev	6	12	63	5	7	1	18	100	113	0.15	1.5
CV (%)	4.4	6.7	4.8	4.5	4.5	4.6	3.1	2.1	4.1	2.1	5.4
Minimum	122	156	1172	100	140	14	565	4505	2532	7.00	24.4
25th	133	168	1270	109	150	15	584	4682	2702	7.20	29.0
Median	137	174	1300	112	157	16	590	4750	2788	7.36	29.4
75th	140	180	1313	114	160	16	605	4793	2800	7.40	29.5
Maximum	150	200	1400	120	168	17	640	4897	2942	7.60	30.0
# of samples	17	17	17	17	17	17	17	17	14	17	17

2004 - 2016

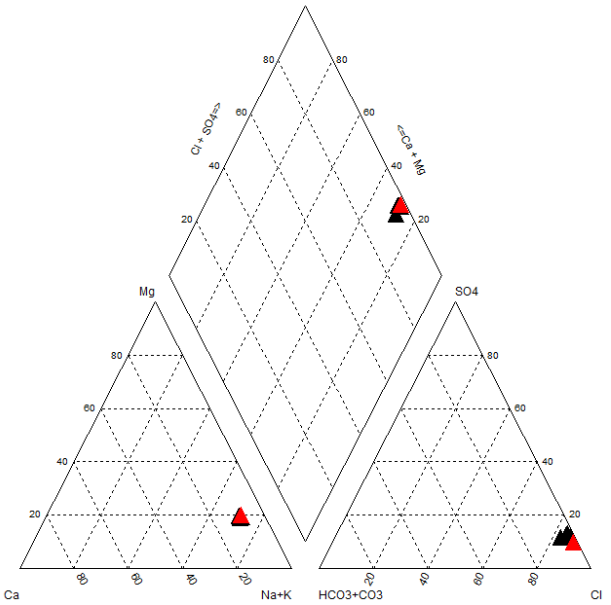
STU-MZU



STU-MZU	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	177	372	2318	145	102	53	1355	7728	4703	7.82	24.4
Std Dev	21	14	74	8	5	3	77	801	173	0.20	0.4
CV (%)	11.8	3.9	3.2	5.2	5.0	5.9	5.6	10.4	3.7	2.5	1.8
Minimum	160	350	2200	130	96	50	1200	5706	4410	7.65	23.3
25th	168	361	2300	140	100	51	1311	8011	4600	7.70	24.3
Median	170	370	2309	146	100	51	1356	8095	4700	7.70	24.6
75th	171	380	2376	150	107	56	1400	8131	4800	7.86	24.7
Maximum	234	400	2405	158	110	59	1487	8310	5039	8.30	24.9
# of samples	9	9	9	9	9	9	9	9	9	9	9

1999 - 2008

WASANMZ1

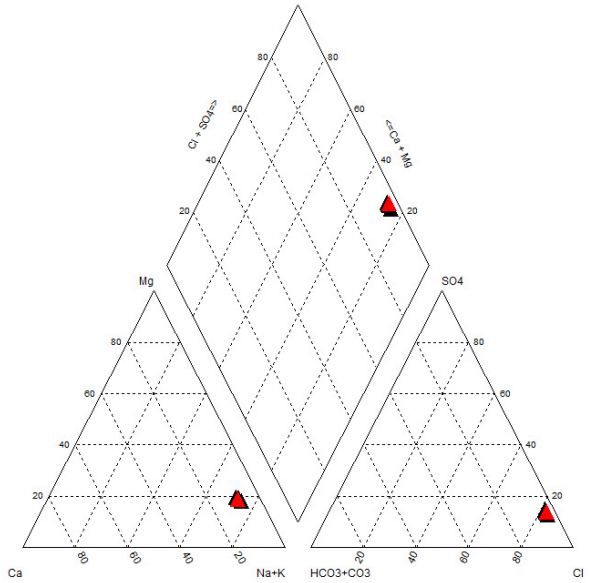


WASANMZ1	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	85	347	1860	142	108	31	968	6312	3453	8.31	24.4
Std Dev	44	40	49	4	9	1	31	197	61	0.08	3.1
CV (%)	51.3	11.6	2.6	2.6	8.6	2.7	3.2	3.1	1.8	1.0	12.8
Minimum	51	280	1800	138	97	29	927	6059	3350	8.23	20.5
25th	56	330	1800	140	99	30	953	6169	3433	8.23	22.2
Median	70	360	1900	142	107	31	954	6301	3480	8.29	23.1
75th	78	366	1900	143	118	31	997	6400	3500	8.39	27.3
Maximum	170	400	1900	149	119	32	1010	6630	3500	8.42	28.7
# of samples	5	5	5	5	5	5	5	5	4	5	5

2004 - 2005

APPENDIX C: AVON PARK PERMEABLE ZONE RESULTS

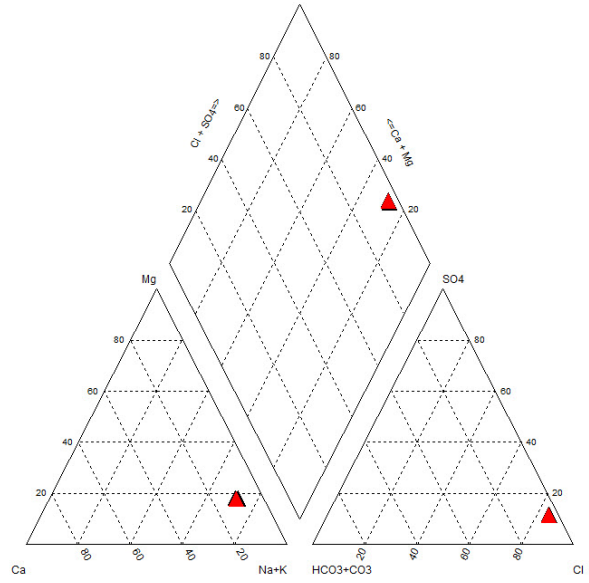
BF-4M



BF-4M	HCO3	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	162	133	517	2269	182	131	46	1295	8130	4990	7.88	22.6
Std Dev	4	3	18	88	6	5	2	23	145	127	0.11	1.0
CV (%)	2.4	2.4	3.5	3.9	3.1	4.1	3.5	1.8	1.8	2.5	1.4	4.4
Minimum	157	129	494	2158	170	120	44	1252	7842	4776	7.70	21.6
25th	160	132	505	2201	180	129	44	1284	8049	4932	7.80	21.8
Median	161	132	508	2245	184	131	45	1299	8193	4990	7.85	22.3
75th	163	134	539	2358	187	133	47	1302	8214	5060	8.00	23.1
Maximum	171	140	540	2400	188	139	48	1336	8308	5199	8.00	24.7
# of samples	8	8	8	8	8	8	8	8	8	8	8	8

2007 - 2014

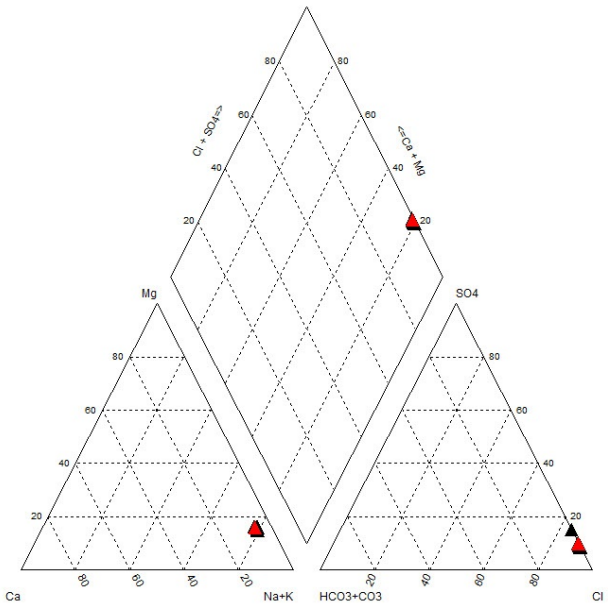
BOYRO_EPXL



BOYRO_EPXL	HCO3	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	169	139	421	2288	170	157	42	1273	8242	4791	7.43	25.6
Std Dev	3	2	11	38	5	8	2	30	141	199	0.07	0.1
CV (%)	1.6	1.6	2.6	1.7	2.9	5.3	4.5	2.4	1.7	4.1	0.9	0.5
Minimum	165	135	404	2209	164	148	40	1230	8006	4519	7.30	25.4
25th	168	138	415	2274	166	151	41	1246	8164	4682	7.40	25.5
Median	171	140	417	2295	171	153	42	1280	8279	4770	7.40	25.5
75th	171	140	431	2315	174	160	43	1298	8302	4844	7.50	25.7
Maximum	172	141	436	2332	178	173	46	1310	8481	5194	7.50	25.8
# of samples	7	7	7	7	7	7	7	7	7	7	7	7

2007 - 2017

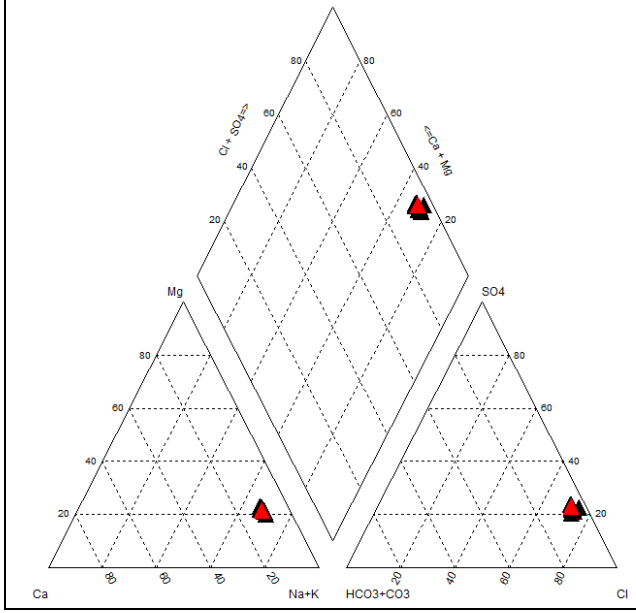
BSU-MZL



BSU-MZL	HCO3	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	143	118	2797	19013	1115	674	388	10377	51137	33617	7.48	32.6
Std Dev	8	6	476	674	57	36	53	465	994	1809	0.12	0.5
CV (%)	5.4	5.4	17.0	3.5	5.2	5.4	13.6	4.5	1.9	5.4	1.5	1.5
Minimum	132	108	2400	18048	1000	582	345	9662	49007	30790	7.19	31.8
25th	138	113	2600	18508	1078	654	357	10075	50892	32250	7.40	32.1
Median	144	119	2697	19000	1102	677	373	10350	51204	33750	7.48	32.8
75th	146	120	2766	19250	1147	690	385	10725	51746	34949	7.55	33.0
Maximum	158	130	4600	20131	1241	740	540	11330	52730	36888	7.70	33.1
# of samples	16	16	16	16	16	16	16	16	16	14	16	16

1999 - 2016

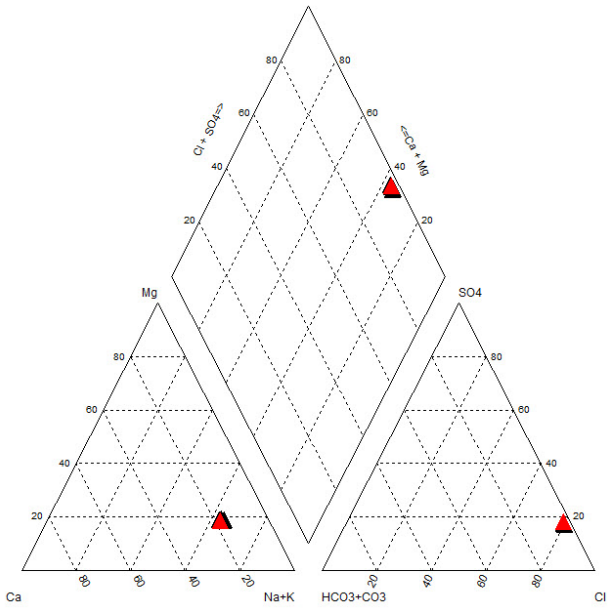
G-2617



G-2617	HCO3	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	134	110	440	1057	110	84	27	640	4366	2570	7.79	25.9
Std Dev	18	14	14	45	6	5	3	30	83	85	0.16	0.6
CV (%)	13.2	13.2	3.3	4.3	5.3	5.7	11.3	4.7	1.9	3.3	2.1	2.2
Minimum	76	62	405	964	96	76	25	600	4176	2410	7.23	24.9
25th	133	109	437	1015	107	81	26	622	4330	2500	7.78	25.7
Median	134	110	443	1064	110	83	26	629	4372	2572	7.80	25.9
75th	137	113	450	1100	113	86	28	648	4407	2630	7.90	26.1
Maximum	171	140	460	1109	120	96	39	727	4504	2700	8.00	27.4
# of samples	18	18	18	18	18	18	18	18	18	18	18	18

1994 - 2016

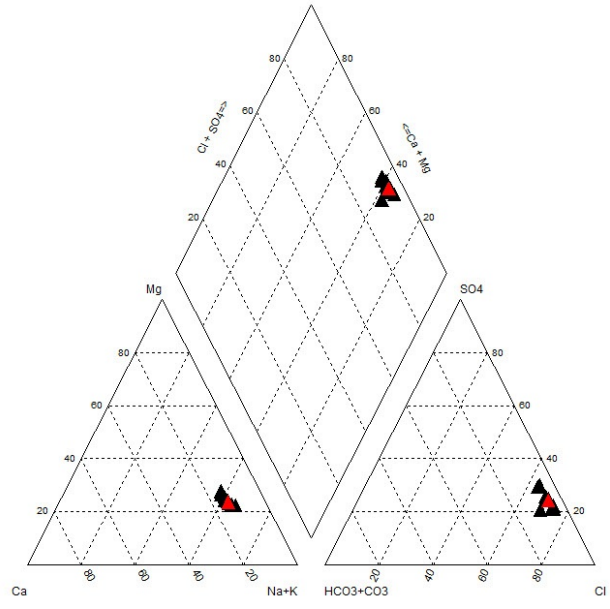
HIF-42L



HIF-42L	HCO3	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	96	79	506	1701	134	203	21	847	6405	3852	7.66	29.1
Std Dev	4	3	24	38	6	5	0	31	177	198	0.19	0.6
CV (%)	3.7	3.7	4.6	2.2	4.1	2.3	2.3	3.7	2.8	5.2	2.4	2.2
Minimum	91	75	468	1641	128	197	21	810	6201	3473	7.40	28.4
25th	93	76	500	1690	130	200	21	814	6290	3850	7.50	28.6
Median	95	78	503	1704	132	203	21	852	6329	3931	7.70	29.1
75th	100	82	522	1714	140	208	22	872	6506	3970	7.80	29.3
Maximum	100	82	538	1758	142	209	22	888	6699	4034	7.90	30.2
# of samples	5	5	5	5	5	5	5	5	5	5	5	5

2008 - 2017

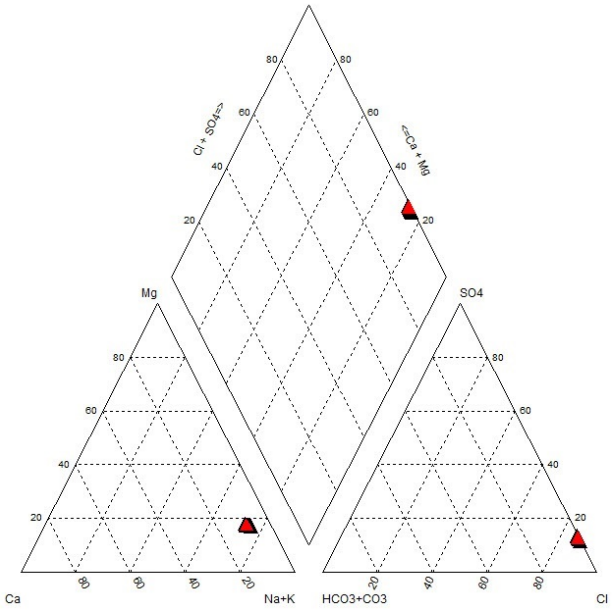
L2-PW1



L2-PW1	HCO3	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	112	92	367	811	90	86	17	433	3358	1979	8.00	26.4
Std Dev	36	30	23	143	8	10	2	66	480	243	0.26	1.0
CV (%)	32.1	32.1	6.2	17.7	8.8	12.2	13.4	15.3	14.3	12.3	3.3	3.9
Minimum	80	66	320	526	76	66	13	295	2436	1472	7.51	24.4
25th	102	84	357	740	85	75	16	430	3032	1900	7.90	26.0
Median	107	88	370	863	91	90	17	463	3409	2009	8.00	26.3
75th	111	91	383	930	97	95	18	482	3690	2200	8.10	27.1
Maximum	232	190	401	990	101	96	19	491	3990	2300	8.50	28.4
# of samples	13	13	13	13	13	13	13	13	13	13	13	13

2005 - 2011

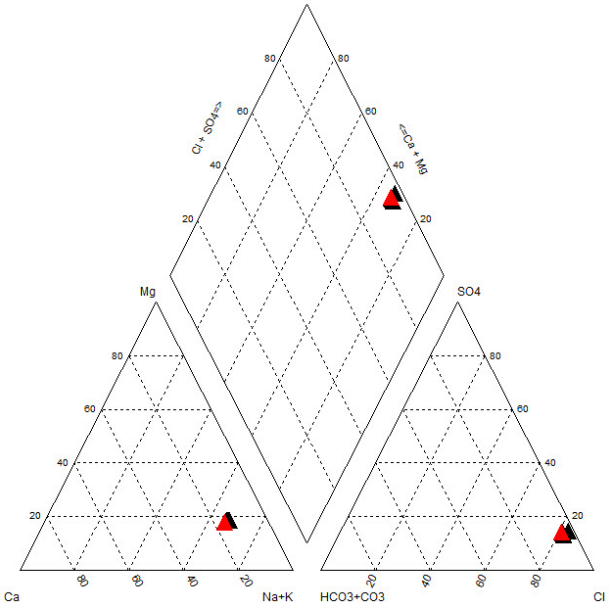
LAB-MZ3



LAB-MZ3	HCO3	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	107	88	1822	9158	616	491	169	4847	27605	16896	7.37	31.9
Std Dev	6	5	77	521	33	33	22	261	1549	967	0.13	0.9
CV (%)	5.4	5.4	4.2	5.7	5.4	6.7	13.2	5.4	5.6	5.7	1.8	3.0
Minimum	96	79	1700	8200	540	430	140	4200	23899	15000	7.19	30.3
25th	104	85	1785	8820	604	471	156	4800	27330	16525	7.27	31.3
Median	107	88	1815	9259	617	499	164	4856	27838	16900	7.38	31.9
75th	112	92	1900	9500	628	509	169	4908	28403	17750	7.47	32.6
Maximum	116	95	1912	9800	680	547	220	5300	29800	18000	7.60	33.6
# of samples	10	10	10	10	10	10	10	10	10	8	10	10

2004 - 2016

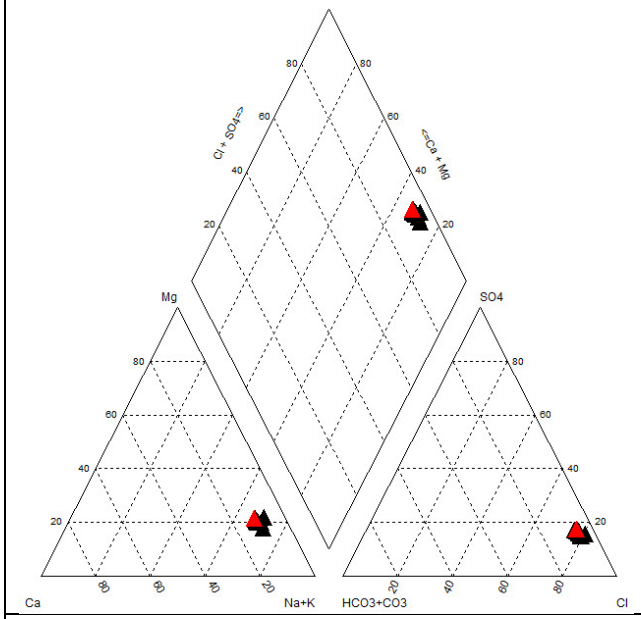
MF-37L



MF-37L	HCO3	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	140	115	360	1576	121	163	23	818	5703	3369	7.43	28.4
Std Dev	30	24	15	36	5	15	1	35	322	198	0.11	0.7
CV (%)	21.1	21.1	4.2	2.3	4.3	9.0	4.5	4.3	5.6	5.9	1.5	2.6
Minimum	74	61	340	1516	110	140	22	750	5193	3060	7.30	27.2
25th	150	123	345	1550	121	158	23	808	5511	3253	7.33	28.0
Median	152	125	363	1591	124	161	23	825	5690	3347	7.45	28.4
75th	154	126	370	1598	124	165	23	834	5962	3557	7.50	28.8
Maximum	158	130	380	1619	125	190	25	865	6141	3611	7.60	29.5
# of samples	6	6	6	6	6	6	6	6	6	6	6	6

2007 - 2015

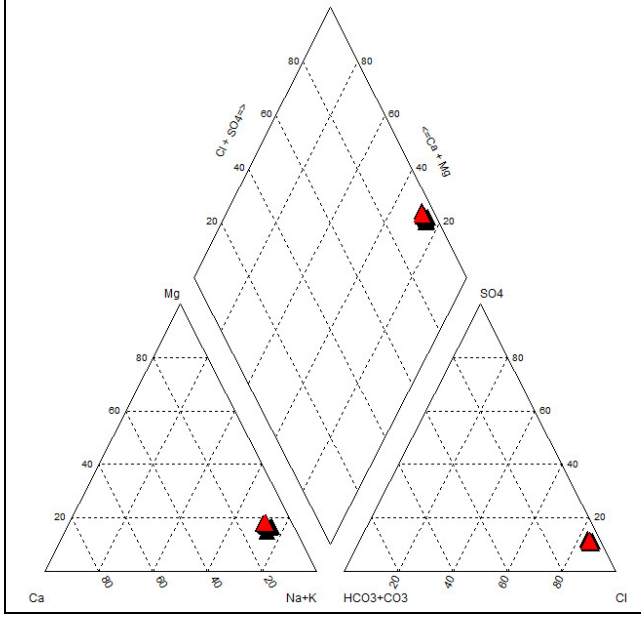
PBF-11



PBF-11	HCO3	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	155	127	335	1180	106	92	23	663	4404	2574	7.88	23.5
Std Dev	17	14	21	84	4	8	1	32	171	236	0.27	0.6
CV (%)	11.2	11.2	6.1	7.1	3.4	9.1	5.1	4.8	3.9	9.2	3.5	2.7
Minimum	93	76	290	1027	97	64	20	611	3962	2300	7.58	22.8
25th	155	127	325	1120	105	91	23	642	4352	2358	7.68	23.0
Median	158	130	338	1200	108	95	23	665	4408	2595	7.80	23.3
75th	158	130	350	1220	110	97	24	684	4501	2653	8.00	23.9
Maximum	171	140	380	1300	110	100	25	723	4672	3200	8.50	24.9
# of samples	15	15	15	15	15	15	15	15	14	14	15	15

2003 - 2009

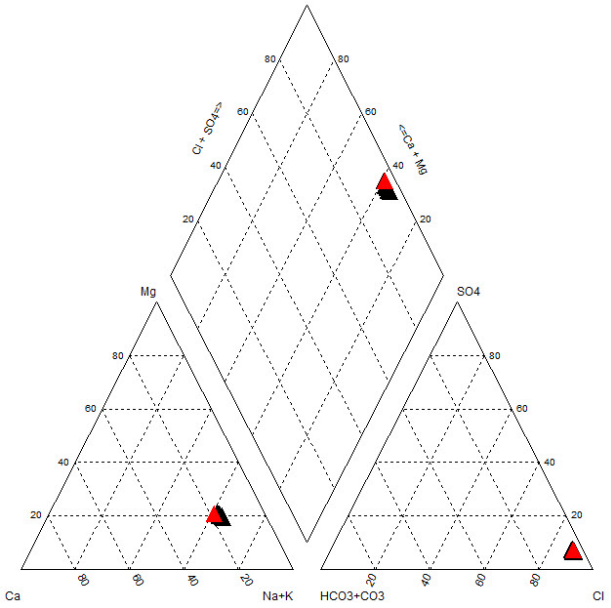
PBF-4



PBF-4	HCO3	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	168	138	367	2050	143	133	38	1123	7100	4099	7.55	22.5
Std Dev	15	12	24	140	11	6	3	83	280	226	0.19	0.8
CV (%)	8.8	8.8	6.7	6.8	7.4	4.7	8.4	7.4	3.9	5.5	2.5	3.5
Minimum	123	101	340	1816	120	120	35	1000	6731	3800	7.30	21.6
25th	165	136	350	1978	140	131	37	1089	6970	3974	7.41	22.1
Median	171	140	364	2011	144	133	38	1103	7060	4038	7.51	22.4
75th	173	142	372	2100	147	135	39	1130	7159	4156	7.60	22.6
Maximum	195	160	446	2440	170	150	49	1400	8015	4800	8.12	25.1
# of samples	16	16	16	16	16	16	16	16	16	16	16	16

1997 - 2010

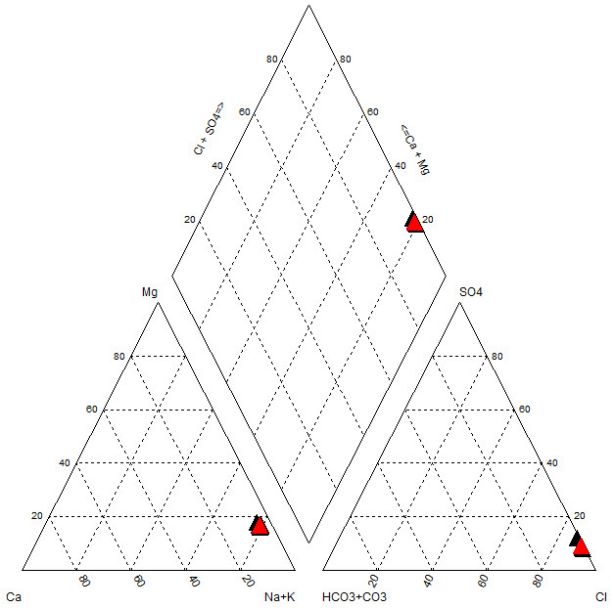
SLF-74



SLF-74	HCO3	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	163	134	216	2134	164	228	21	941	7190	4330	7.29	30.5
Std Dev	7	6	12	83	8	12	1	37	151	321	0.13	0.3
CV (%)	4.2	4.2	5.8	3.9	4.8	5.1	5.8	4.0	2.1	7.4	1.8	0.8
Minimum	151	124	194	1976	150	210	18	882	6969	3805	6.90	29.8
25th	158	130	209	2100	159	219	20	920	7064	4014	7.20	30.4
Median	160	131	220	2126	167	230	21	931	7193	4300	7.33	30.5
75th	171	140	220	2200	169	234	21	947	7263	4512	7.40	30.7
Maximum	171	140	240	2300	181	249	23	1024	7565	5000	7.40	30.8
# of samples	13	13	13	13	13	13	13	13	13	13	13	13

2005 - 2016

WASANMZ2



WASANMZ2	HCO3	ALKA	SO4	Cl	Mg	Ca	K	Na	SC	TDS	pH	Temp
Mean	238	195	1634	12463	773	351	232	6750	34835	22225	7.64	19.2
Std Dev	15	12	304	541	40	34	28	226	1150	1644	0.27	0.6
CV (%)	6.3	6.3	18.6	4.3	5.2	9.8	12.0	3.3	3.3	7.4	3.5	3.3
Minimum	219	180	1400	12000	715	288	213	6440	32669	19900	7.41	18.4
25th	229	188	1475	12000	749	330	214	6513	34102	20750	7.45	18.8
Median	232	190	1540	12150	769	361	220	6810	35058	22500	7.58	18.9
75th	256	210	1623	13000	787	371	237	6888	35687	23925	7.65	19.4
Maximum	256	210	2400	13400	847	405	300	7100	36196	24000	8.29	20.5
# of samples	8	8	8	8	8	8	8	8	8	8	8	8

2005 - 2006

APPENDIX D: AQUIFER DATA MAPS

UPPER FLORIDAN AQUIFER

Water quality variations throughout the Upper Floridan aquifer (UFA) in southern Florida are driven by a number of factors including distance from recharge area, degree of confinement, mixing with coastal water or upconing water, and equilibrium with host rock. The general trend in total dissolved solids, chloride, magnesium, potassium, and sulfate concentrations as well as specific conductance is lower concentrations in recharge areas with increasing values as groundwater travels toward coastal areas. Calcium concentrations generally lower are in central and southeastern Florida, and coastal areas in the south and southwestern zones of the peninsula have increased concentrations. Alkalinity shows more variability, but overall, lower concentrations are found in the central and inland areas of Florida, with higher levels in the coastal regions. Temperature trends show warmer groundwater in the southwestern region. Lastly, pH is neutral to alkaline, ranging between 7.04 and 8.31. **Table D-1** lists the sampling history, status, and ownership of the UFA monitoring stations. **Figures D-1** through **D-11** show the concentrations of the major ions and physical parameters based on results from baseline, non-baseline, and retired stations.

Table D-1. UFA monitoring station sampling history, status, and ownership.

Station	Status	First Sample Date	Last Sample Date	Sampling Events	Baseline	Owner
BF-4S	Active	2010	2017	3	No	SFWMD
BF-6	Active	2016	2016	1	No	Deerfield Beach
BICY-MZ2	Active	2004	2015	17	Yes	SFWMD
BOYRO_EPXU	Active	2007	2010	4	No	Boynton Beach East Plant
BRY-MW	Retired	2006	2016	7	Yes	Berry Groves
BSU-MZU	Active	1999	2016	13	Yes	Burnt Store Road Utilities
D-4	Active	2004	2017	17	Yes	SFWMD
ENP-100	Retired	2004	2009	13	Yes	Everglades National Park
FPL-MW	Retired	2006	2009	8	Yes	Florida Power & Light
FPU-MZU	Active	2000	2008	10	Yes	Fort Pierce Utilities
G-2618	Active	2004	2016	18	Yes	USGS
G-3061	Active	2014	2017	2	No	USGS
GLF-6*	Active	2001	2014	5	Yes	SFWMD
HIF-40	Active	2014	2014	1	No	SFWMD
HIF-42U	Active	2008	2017	5	Yes	SFWMD
I75-MZ2	Active	1995	2016	16	Yes	SFWMD
IWA-MZU	Active	2000	2016	3	No	Island Water Authority
IWSD-MZ2	Active	2004	2016	15	Yes	Immokalee Water & Sewer District
KW-MZL	Active	2000	2000	1	No	Key West WWTF
L2-PW2	Active	1999	2016	16	Yes	SFWMD
L-6436	Active	2005	2016	7	Yes	SFWMD
LAB-MZ1	Active	1997	2016	15	Yes	SFWMD
MF-37U	Active	2007	2011	6	Yes	USACE
MF-52	Retired	2005	2005	1	No	SFWMD
MF-52RU	In Progress	0	0	0	No	SFWMD
MIU-MZ1	Active	1996	2015	13	Yes	Marco Island Utilities
MOSS_PK	Active	2005	2005	1	No	SFWMD
OKF-101	Retired	2005	2005	1	No	Okeechobee Utility Authority
OKF-105U	Active	2013	2015	2	No	SFWMD
OKF-106	Active	2014	2014	1	No	SFWMD
OKF-42	Active	1984	2006	21	Yes	SFWMD

Station	Status	First Sample Date	Last Sample Date	Sampling Events	Baseline	Owner
ORF-29	Retired	2005	2007	3	No	SFWMD
OSF-100	Active	2005	2012	9	Yes	SFWMD
OSF-110	Active	0	0	0	No	SFWMD
OSF-104U	Active	2009	2014	3	No	SFWMD
OSF-22	Active	1985	1985	1	No	USGS
OSF-3	Active	1979	2006	6	Yes	SFWMD
OSF-53	In Progress	0	0	0	No	SFWMD
OSF-60*	Active	1993	2007	4	No	SFWMD
OSF-62	Active	2005	2006	2	No	SFWMD
OSF-64	Active	2005	2007	3	No	SFWMD
OSF-66	Active	2004	2006	10	Yes	SFWMD
OSF-70R	Active	2011	2012	2	No	SFWMD
PBF-10R	Active	2009	2009	1	No	SFWMD
PBF-15U	Active	2011	2014	2	No	SFWMD
PBF-3	Active	1996	2017	21	Yes	SFWMD
PBF-7U	Active	2000	2016	18	Yes	SFWMD
POF-20R	Active	2006	2016	3	No	SFWMD
POF-22	Active	2007	2007	1	No	SFWMD
POF-27U	Active	2015	2015	1	No	SFWMD
SCC-MZU	Active	1999	2009	15	Yes	South County Regional WWTF
SLF-21	Active	1985	2014	9	Yes	Fort Pierce Ag. Experiment Station
SLF-75	Active	2004	2011	16	Yes	SFWMD
SLF-76	Active	2004	2016	16	Yes	SFWMD
STU-MZU	Active	1999	2008	10	Yes	Stuart WWTP
W-7362	Active	2016	2016	1	No	John Pennekamp Coral Reef State Park
WASANMZ1	Retired	2004	2006	6	Yes	Miami-Dade Water & Sewer Department

SFWMD = South Florida Water Management District; USACE = United States Army Corps of Engineers; USGS = United States Geological Survey; WWTF = wastewater treatment facilities.

* GLF-6 and OSF-60 are finished in the Floridan aquifer system. They are included with the Upper Floridan aquifer.

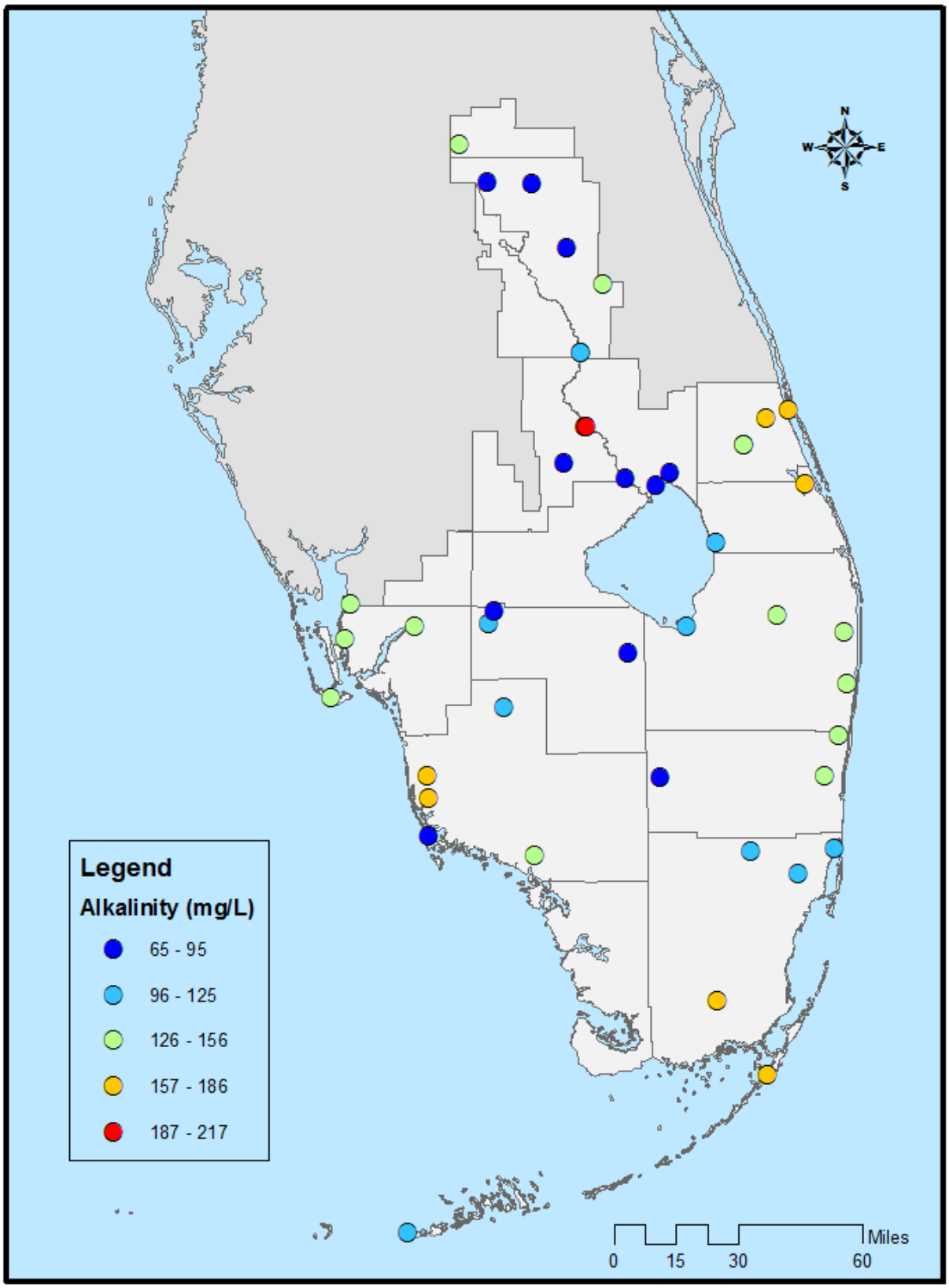


Figure D-1. Map of alkalinity concentration (mg/L) in the UFA.

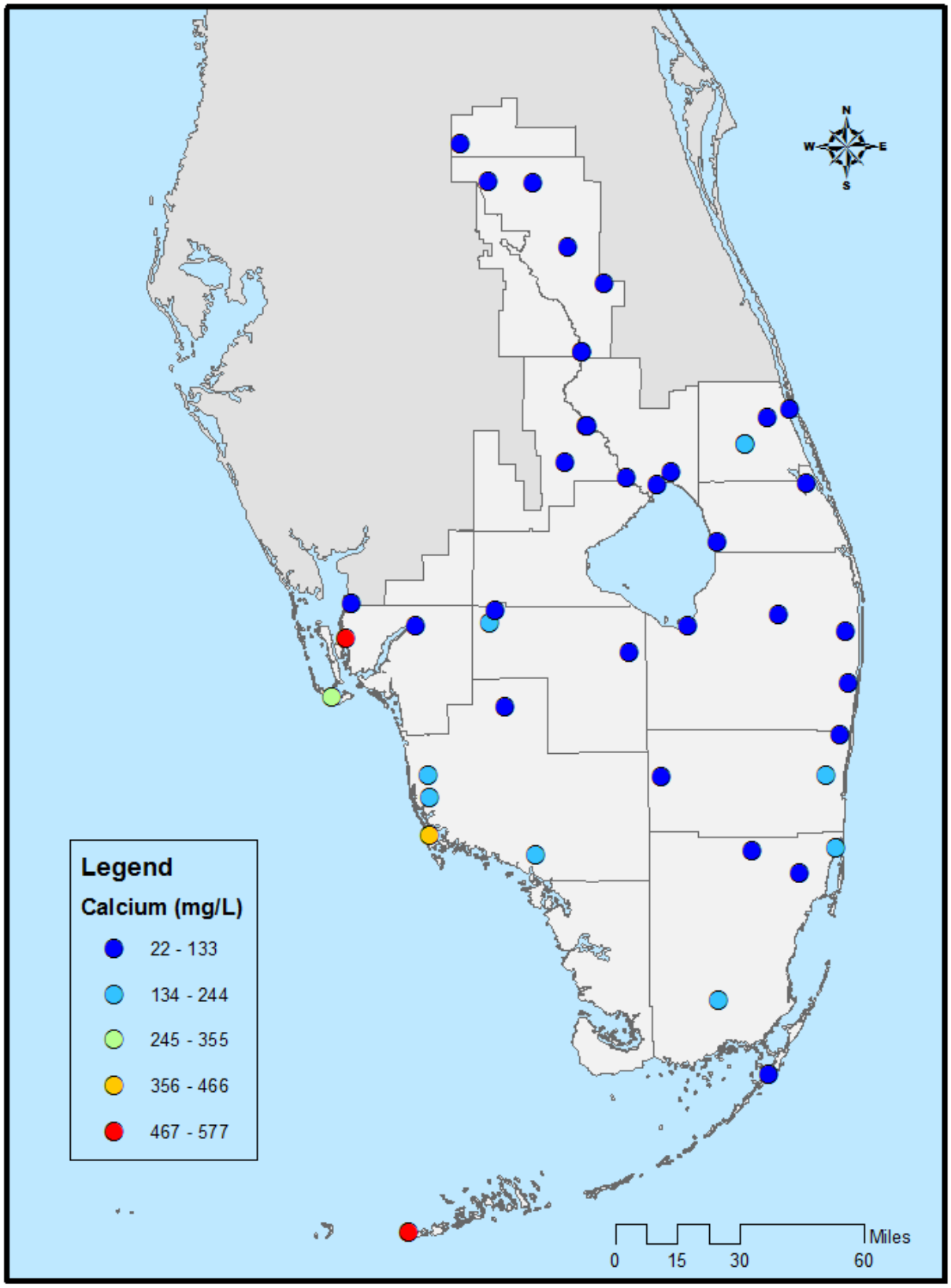


Figure D-2. Map of calcium concentration (mg/L) in the UFA.

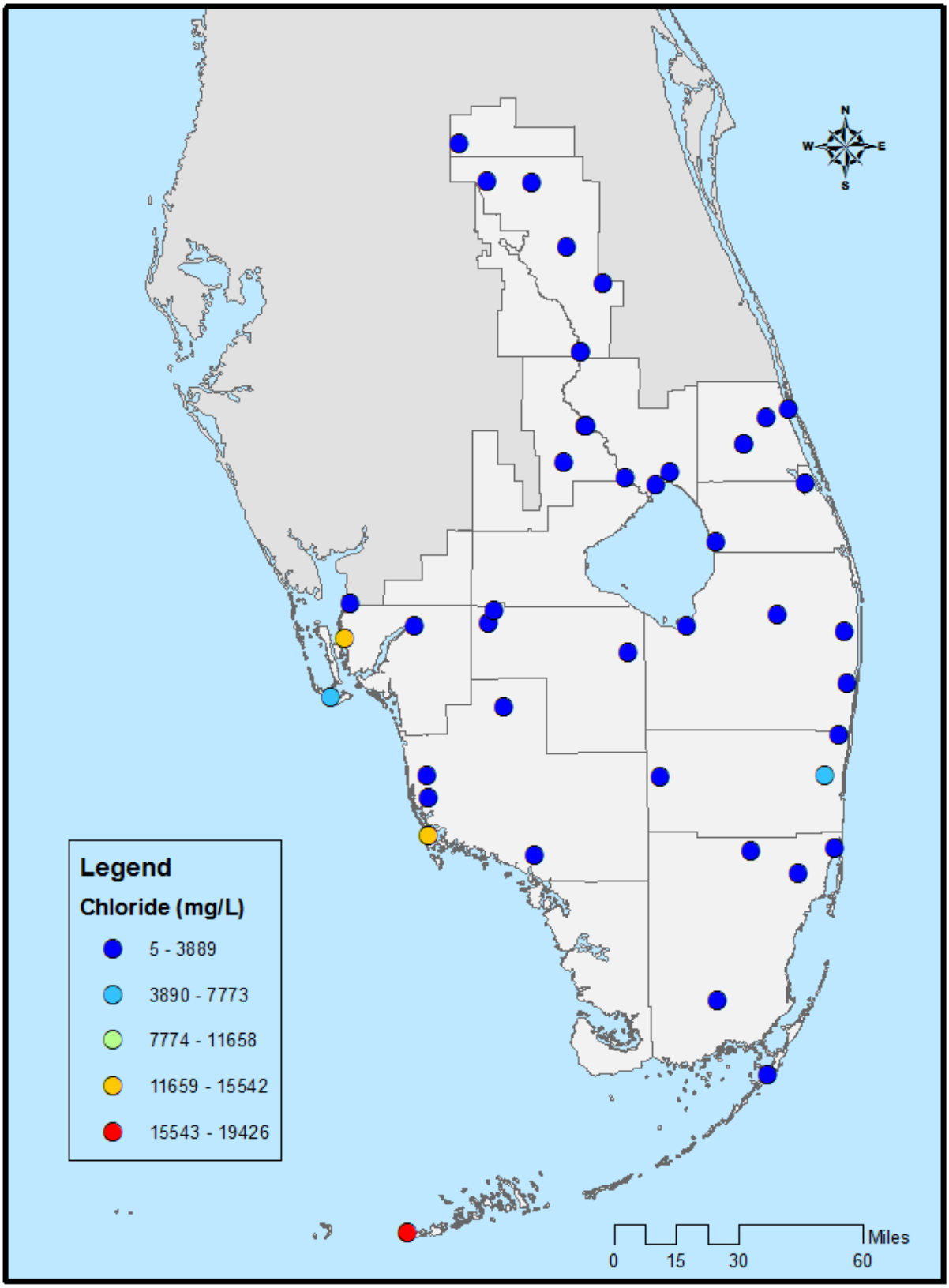


Figure D-3. Map of chloride concentration (mg/L) in the UFA.

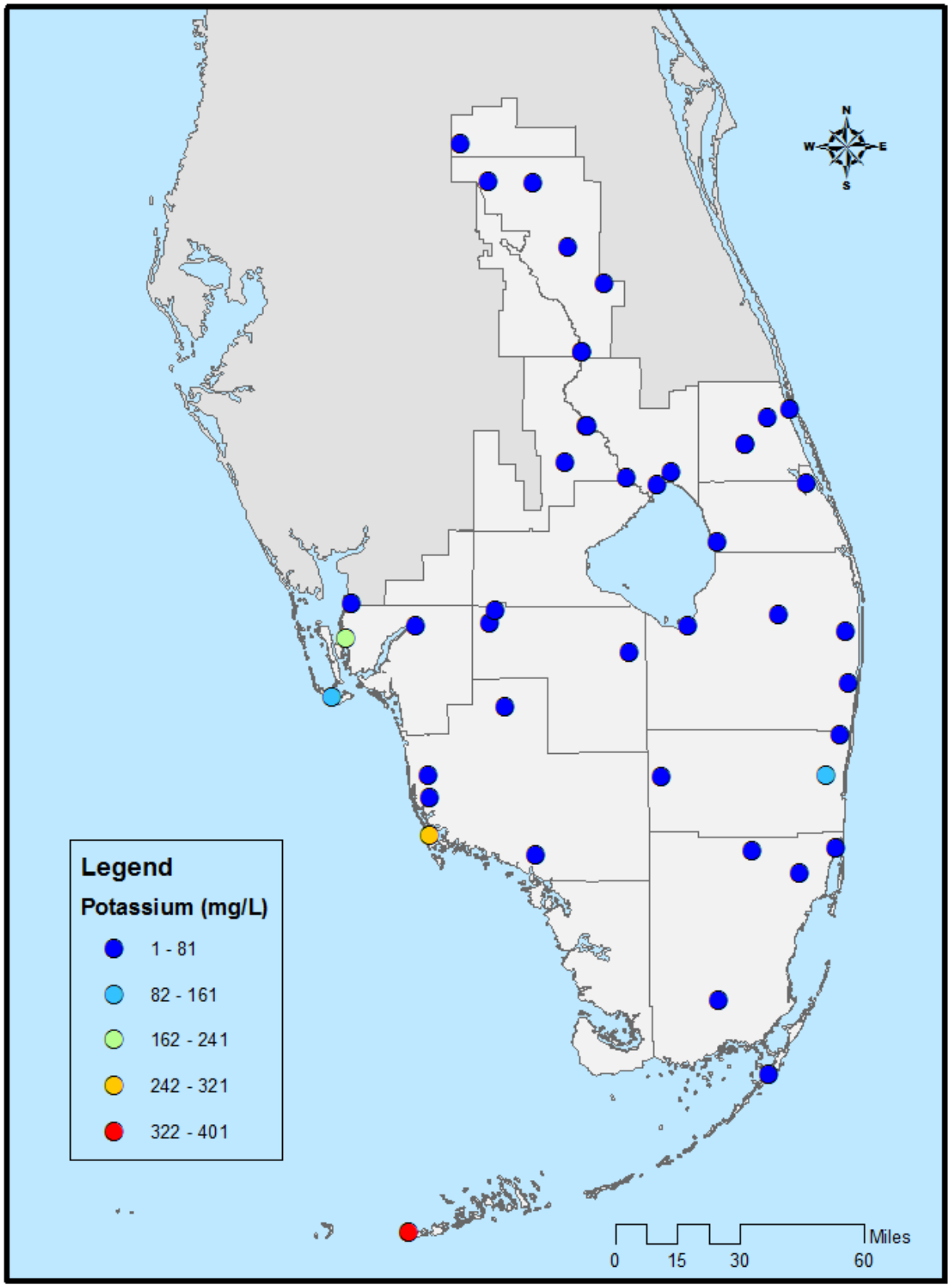


Figure D-4. Map of potassium concentration (mg/L) in the UFA.

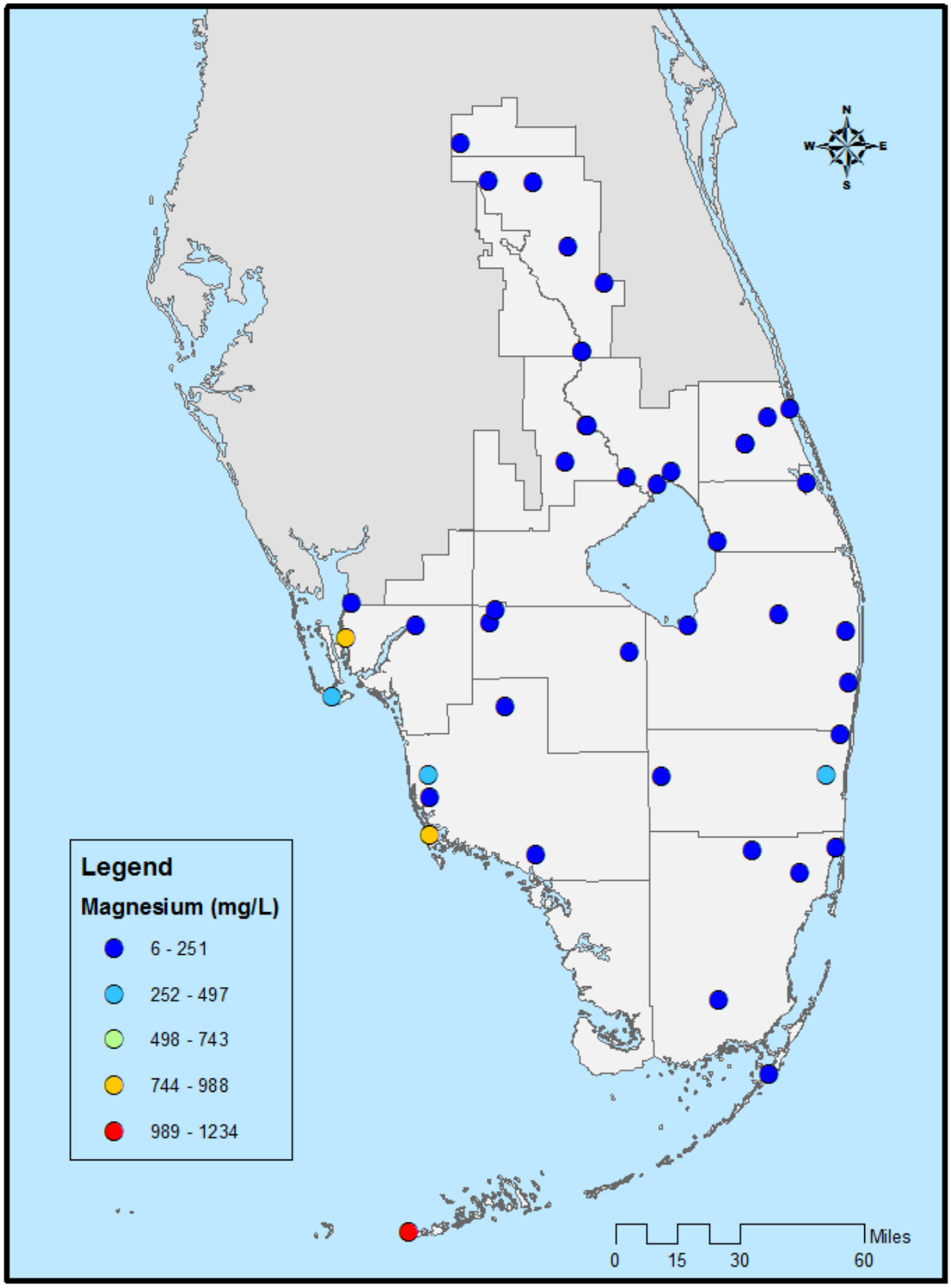


Figure D-5. Map of magnesium concentration (mg/L) in the UFA.

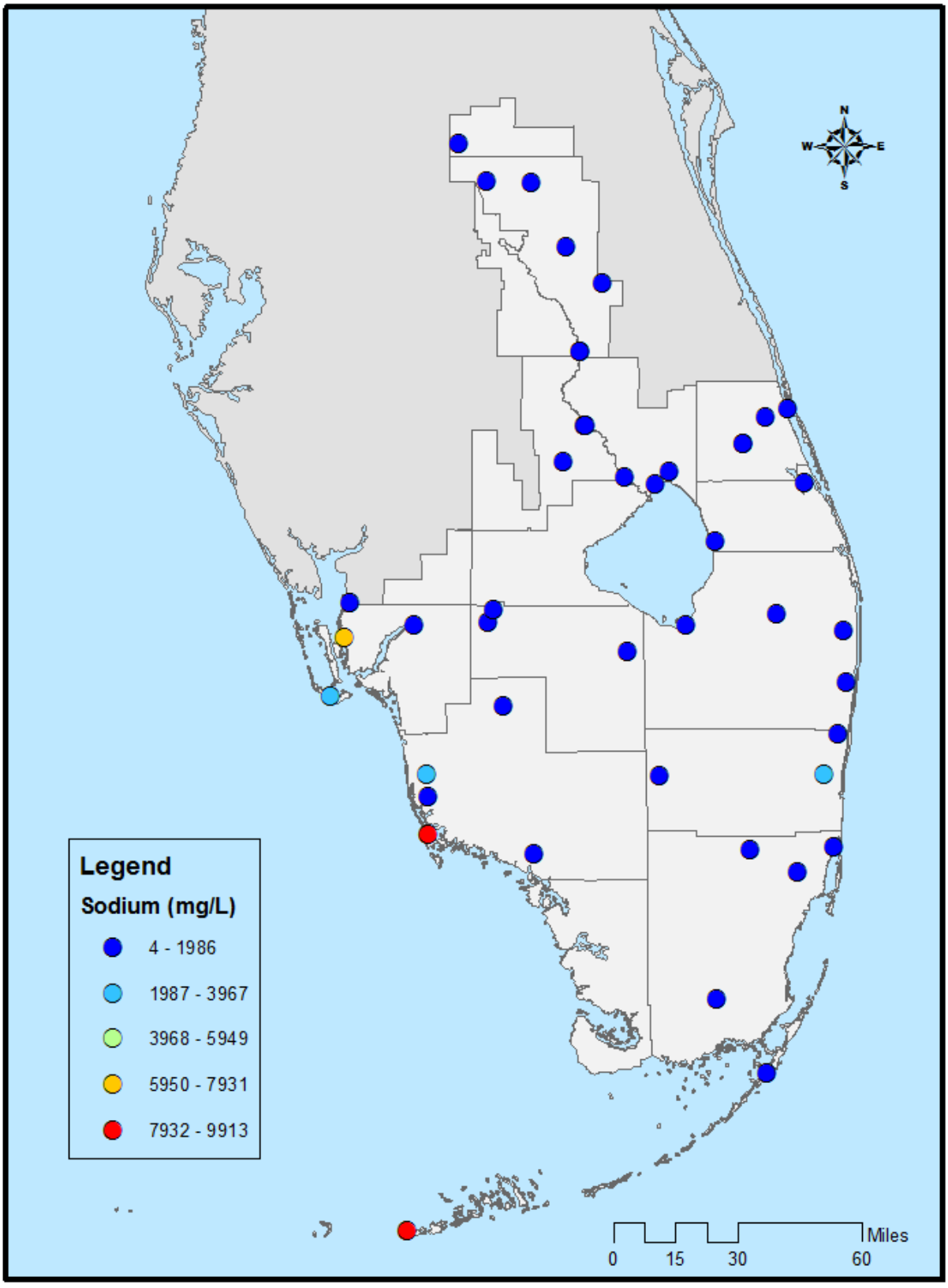


Figure D-6. Map of sodium concentration (mg/L) in the UFA.

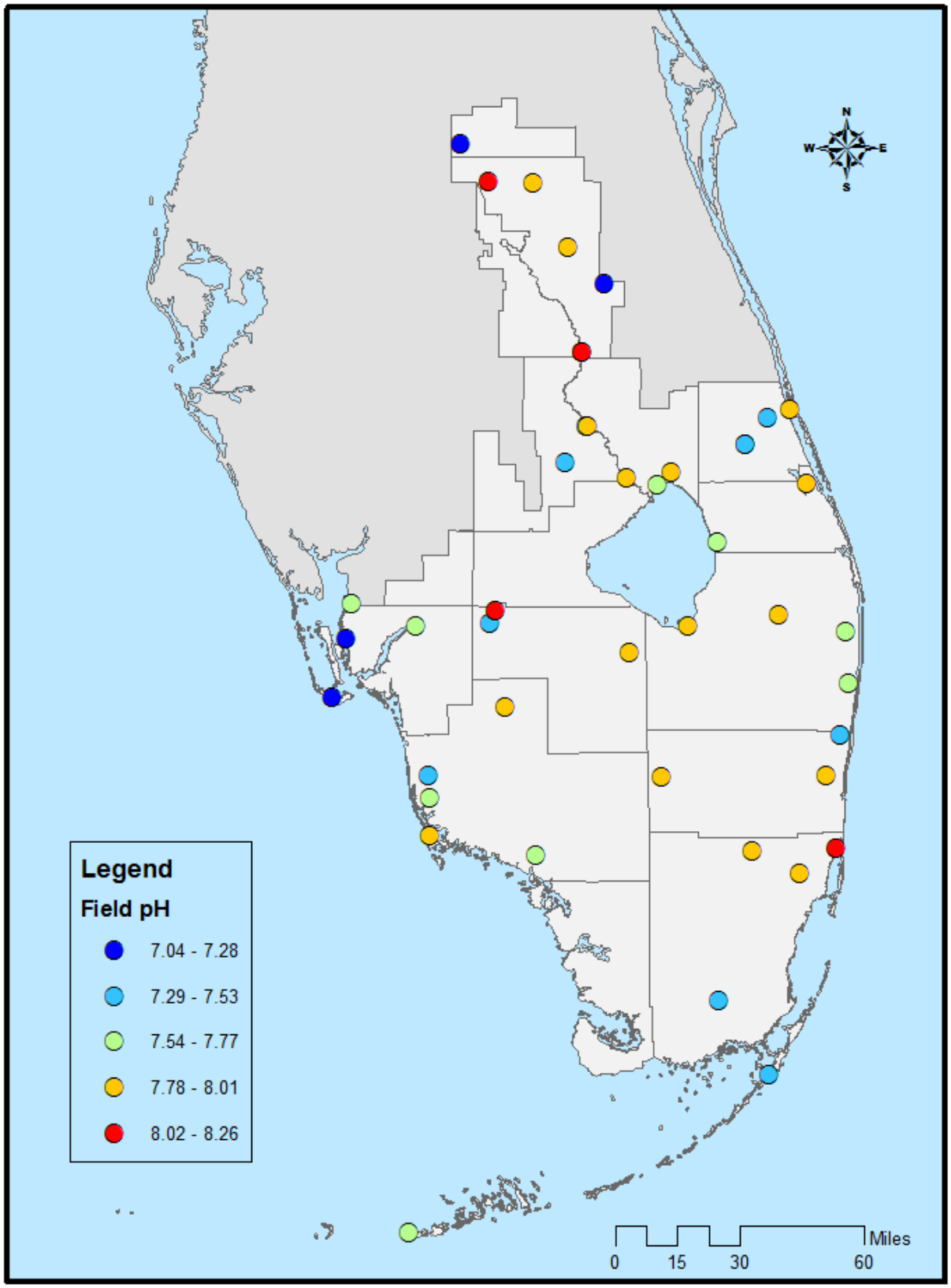


Figure D-7. Map of field pH in the UFA.

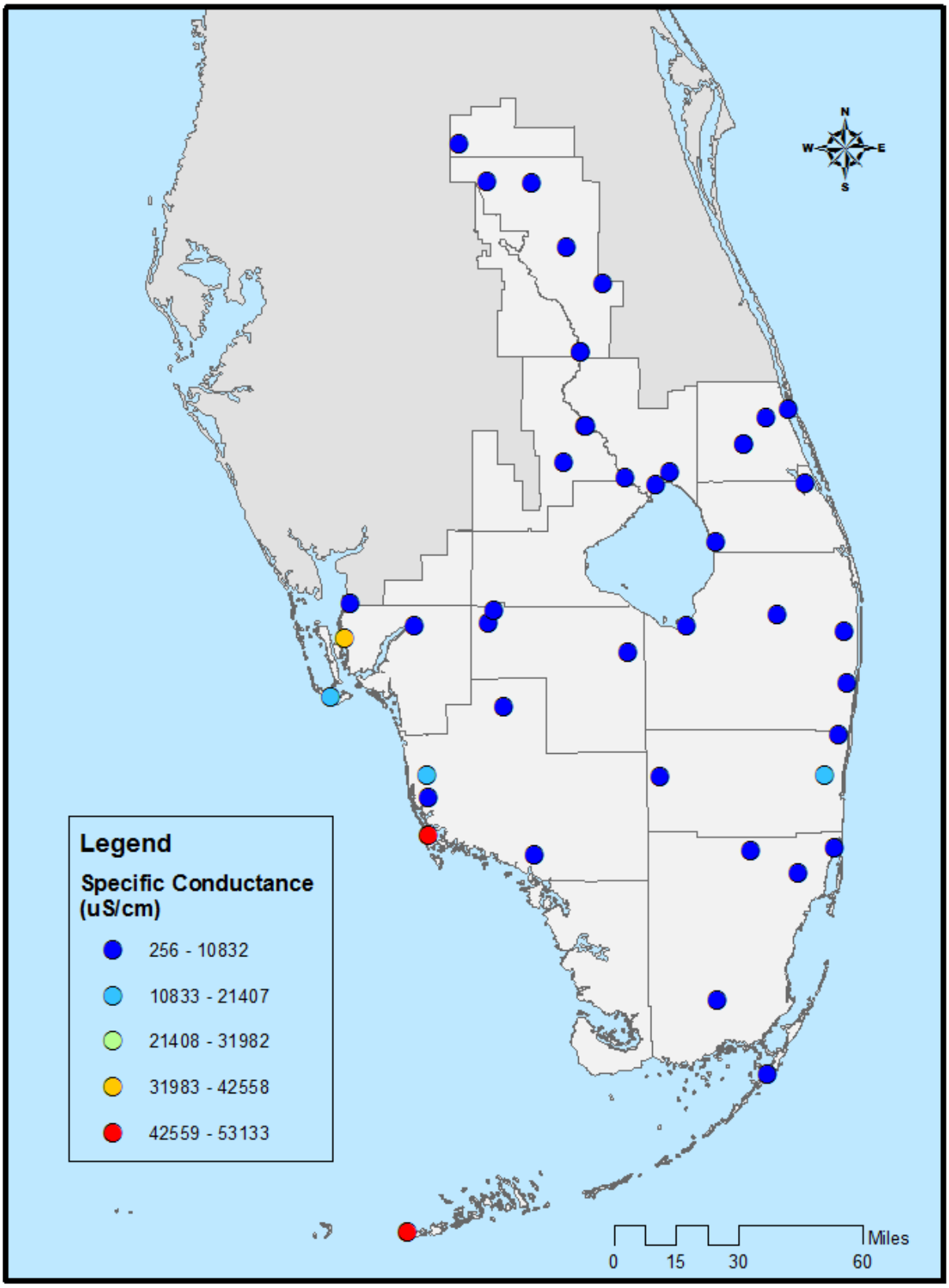


Figure D-8. Map of specific conductance (µS/cm) in the UFA.

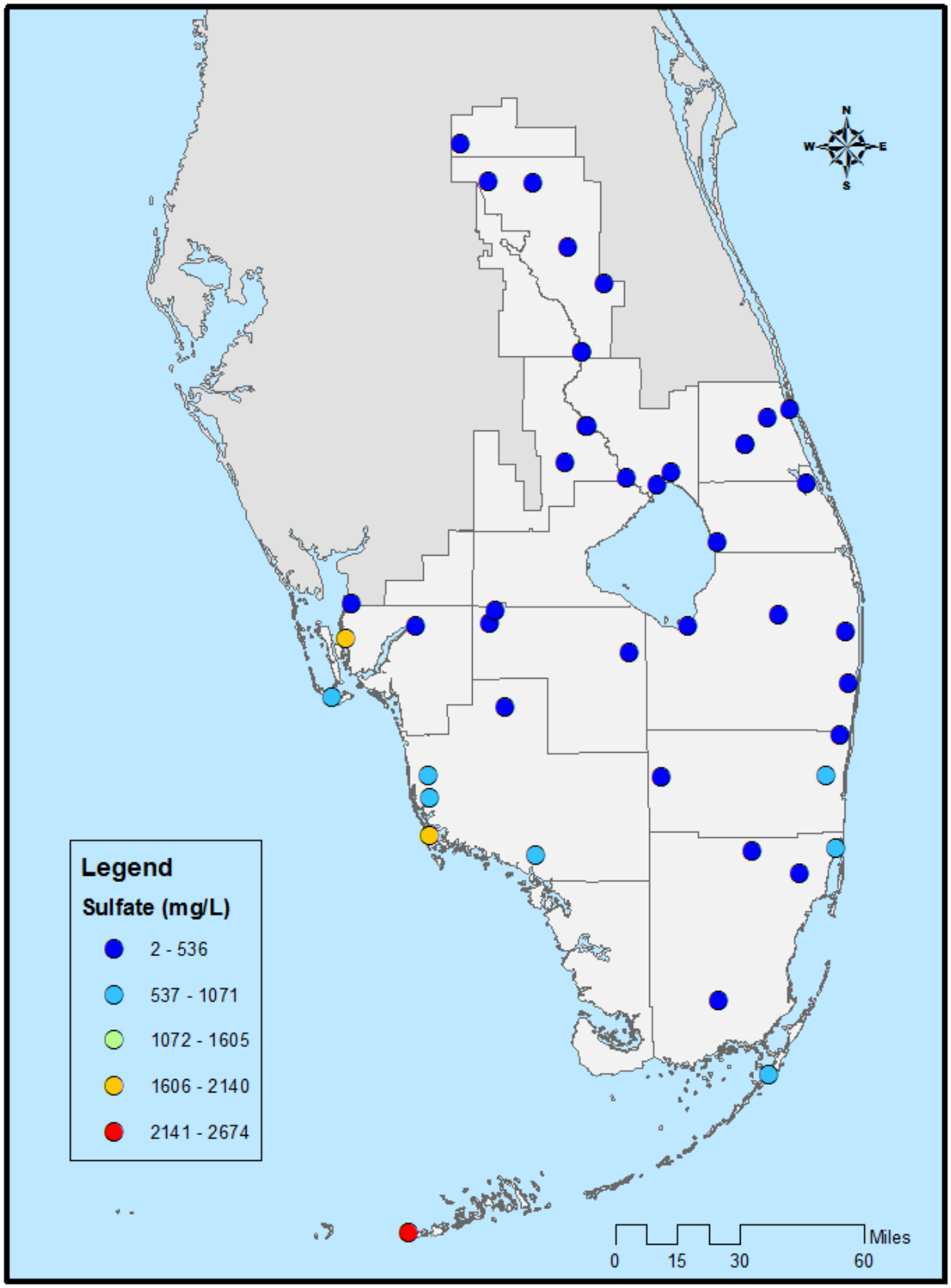


Figure D-9. Map of sulfate concentration (mg/L) in the UFA.

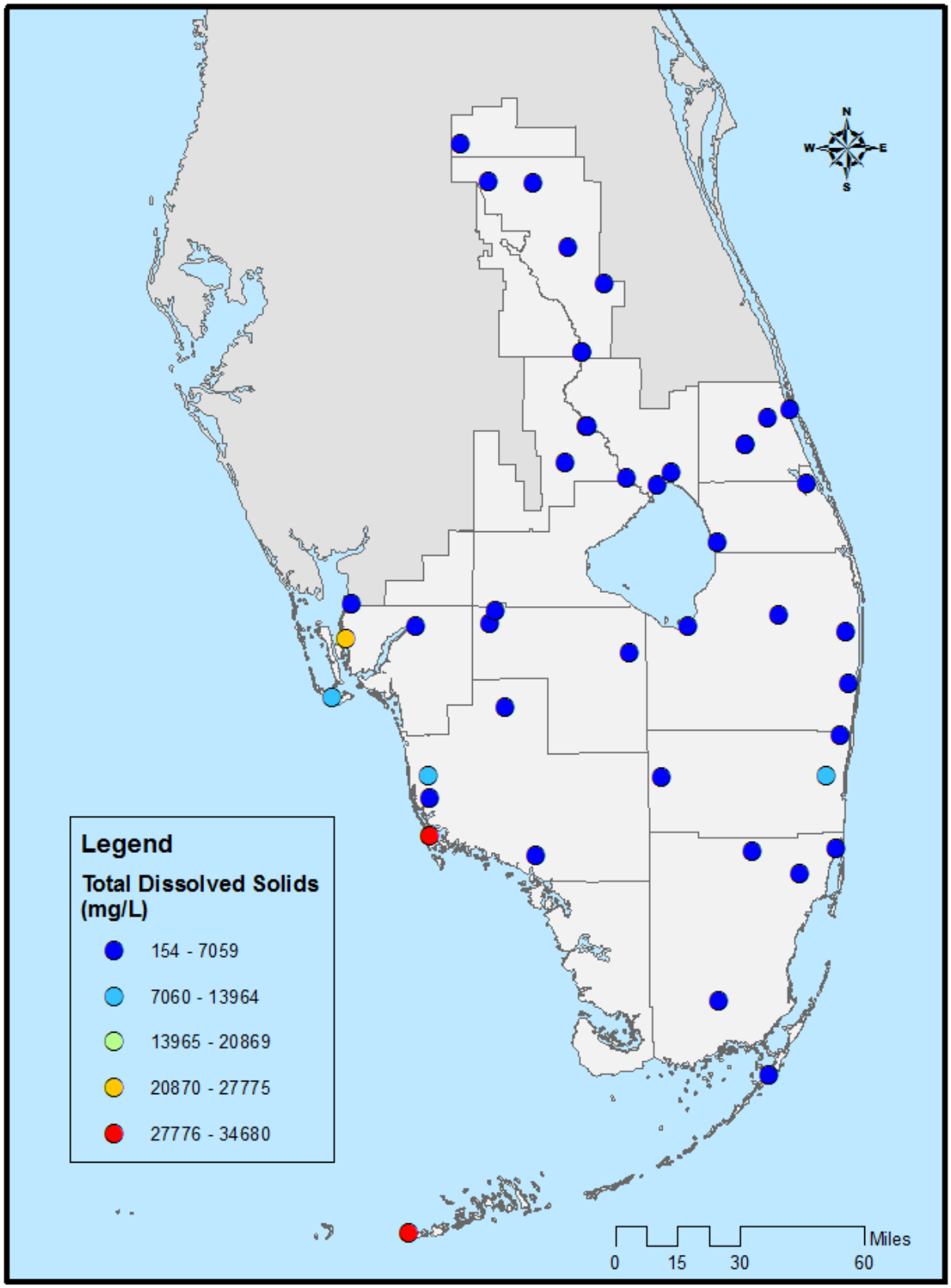


Figure D-10. Map of total dissolved solids concentration (mg/L) in the UFA.

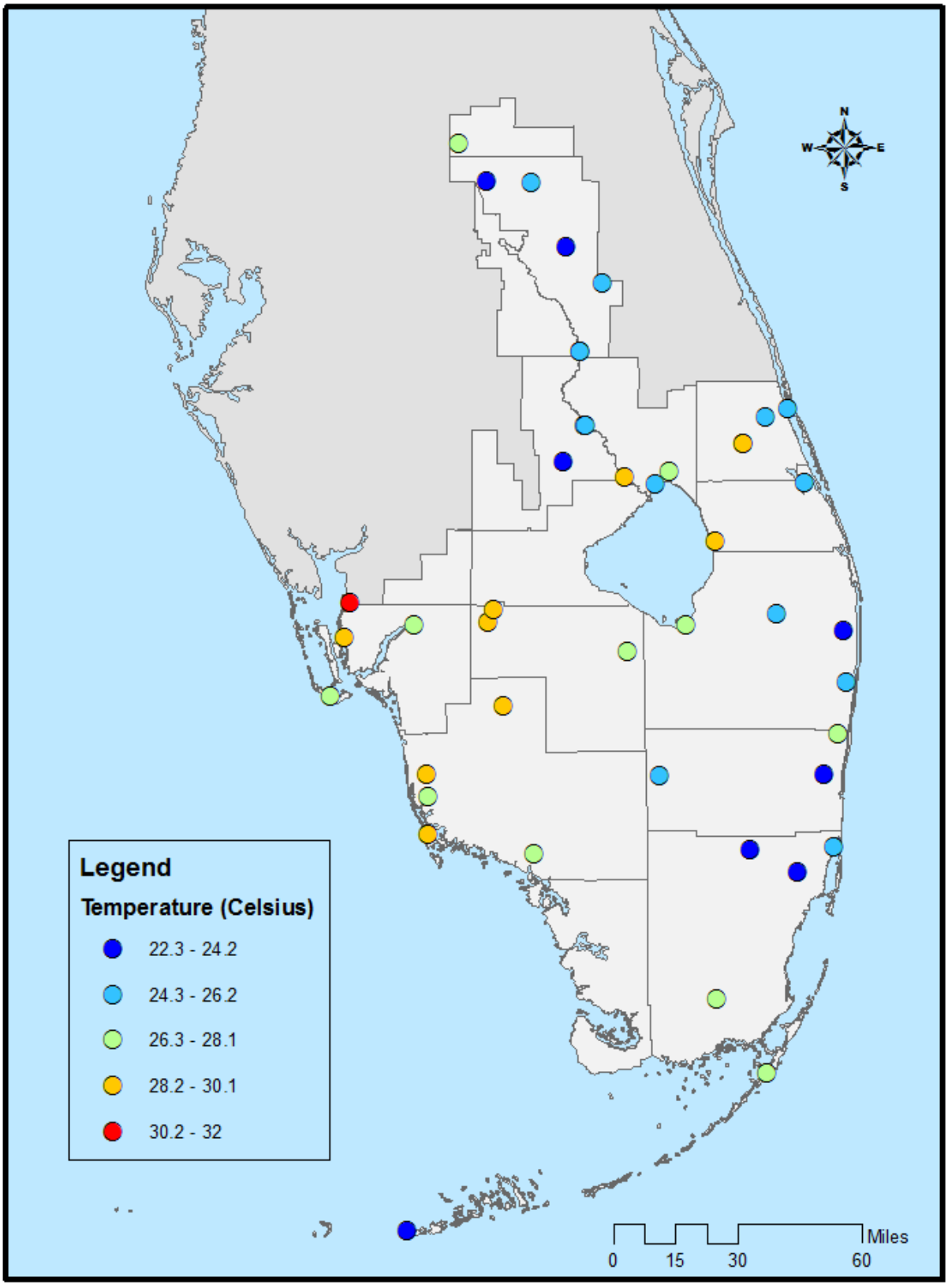


Figure D-11. Map of temperate (°C) in the UFA.

AVON PARK PERMEABLE ZONE

Like the Upper Floridan aquifer, the groundwater quality of the Avon Park Permeable Zone varies spatially in southern Florida. Total dissolved solids, chloride, magnesium, potassium and sulfate concentrations as well as specific conductance are lower in central and southern Florida, with the higher concentrations located in the southwestern region. Calcium concentrations generally are lower in central and southern areas, with higher concentrations in the southwestern region. Alkalinity shows more variability, with lower concentrations in central and southern areas and higher values towards the coast. Temperatures are relatively cooler in northern and southern portions of the peninsula, with warmer values in central and southwestern areas. The pH ranges from 7.13 to 8.2, with coastal areas being more neutral and inland areas more alkaline. **Table D-2** lists the sampling history, status, and ownership of the APPZ monitoring stations. **Figures D-12** through **D-22** show the concentrations of the major ions and physical parameters based on results from baseline, non-baseline, and retired stations.

Table D-2. APPZ monitoring station sampling history, status, and ownership.

Station	Status	First Sample Date	Last Sample Date	Sampling Events	Baseline	Owner
BF-4M	Active	2007	2014	8	Yes	SFWMD
BOYRO_EPXL	Active	2007	2017	7	Yes	Boynton Beach East Plant
BSU-MZL	Active	1999	2016	16	Yes	Burnt Store Road
G-2617	Active	1994	2016	21	Yes	USGS
HIF-42L	Active	2008	2017	5	Yes	SFWMD
IWA-MZL	Active	2000	2016	3	No	Island Water Authority
L2-PW1	Active	2005	2011	13	Yes	SFWMD
LAB-MZ3	Active	2004	2016	10	Yes	SFWMD
LAB-PW2	Active	2015	2015	1	No	SFWMD
MF-37L	Active	2007	2015	6	Yes	SFWMD
MF-40L	Active	2009	2014	3	No	SFWMD
MF-52RL	Onboarding	0	0	0	No	SFWMD
OKF-100L	Active	2004	2008	3	No	SFWMD
OKF-105M	Active	2009	2015	4	No	SFWMD
OSF-104M	Active	2007	2014	2	No	SFWMD
OSF-112*	Onboarding	0	0	0	No	SFWMD
OSF-82U	Active	2012	2012	1	No	SFWMD
OSF-99	Active	2006	2015	3	No	SFWMD
PBF-11	Active	2003	2009	15	Yes	SFWMD
PBF-15M	Active	2008	2010	2	No	SFWMD
PBF-4	Active	1997	2010	16	Yes	SFWMD
POF-27L	Active	2011	2013	2	No	SFWMD
SLF-74	Active	2005	2016	13	Yes	SFWMD
WASANMZ2	Retired	2005	2006	8	Yes	Miami-Dade Water & Sewer Department

SFWMD = South Florida Water Management District; USGS = United States Geological Survey.

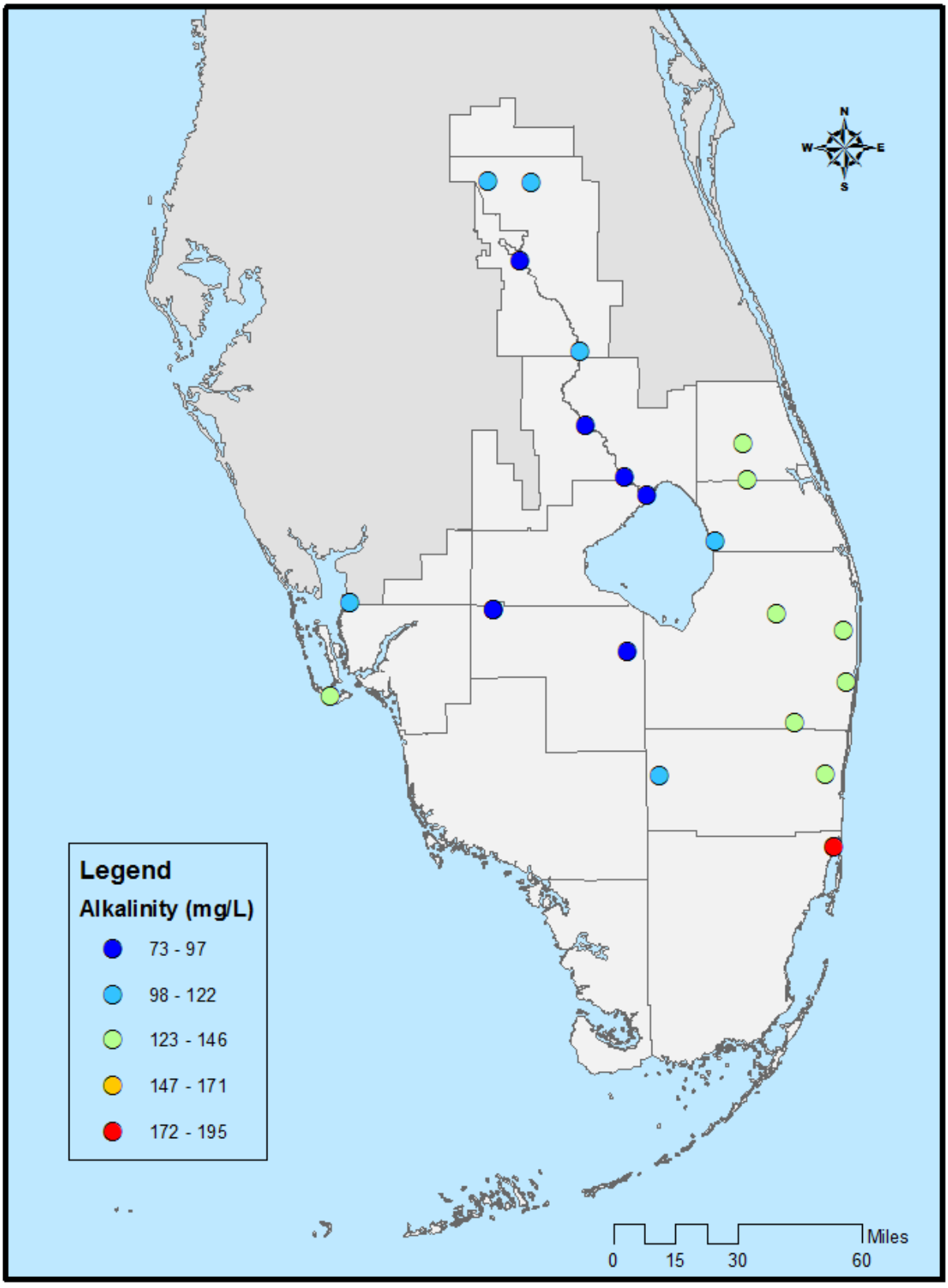


Figure D-12. Map of alkalinity concentration (mg/L) in the APPZ.

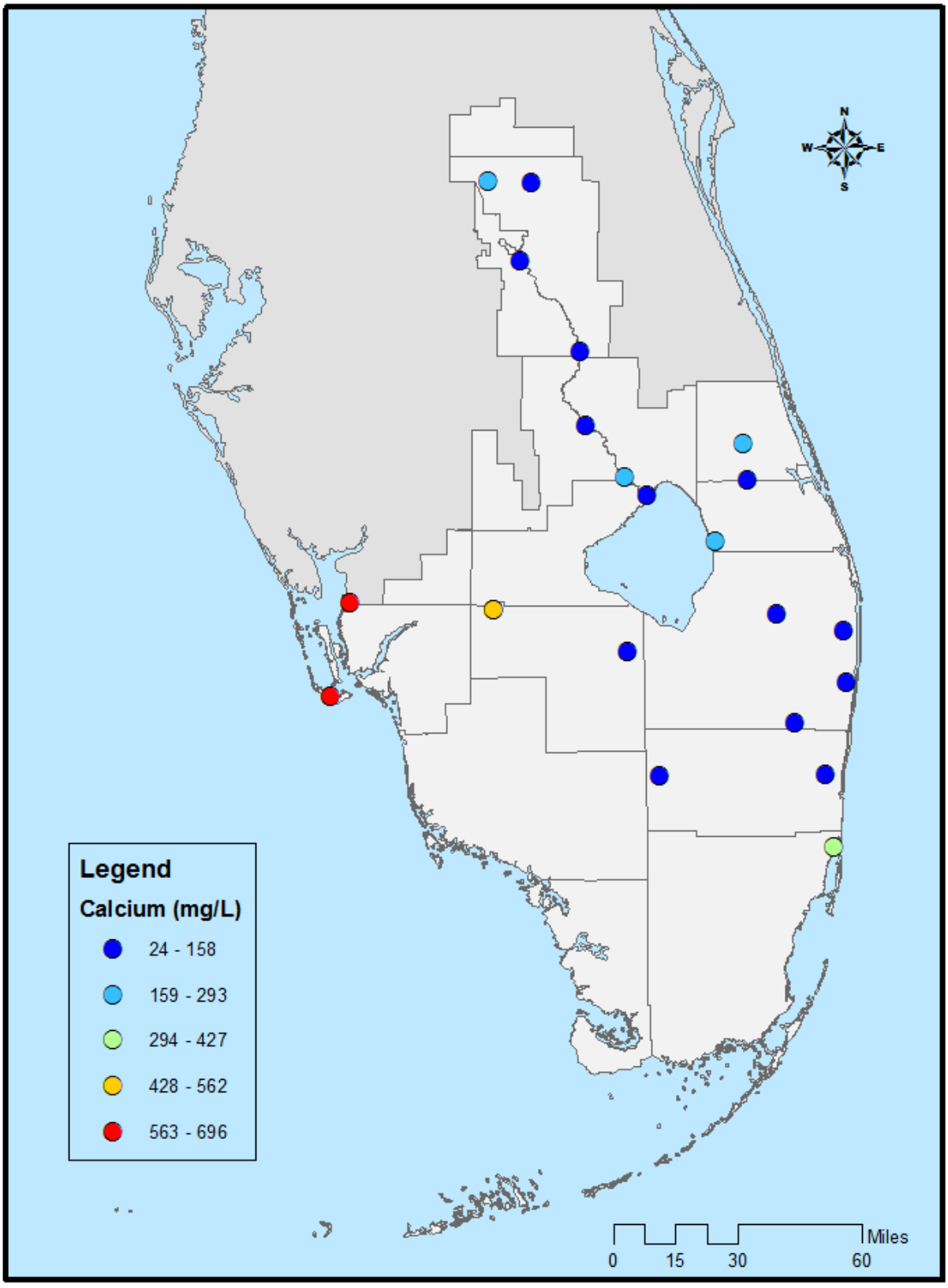


Figure D-13. Map of calcium concentration (mg/L) in the APPZ.

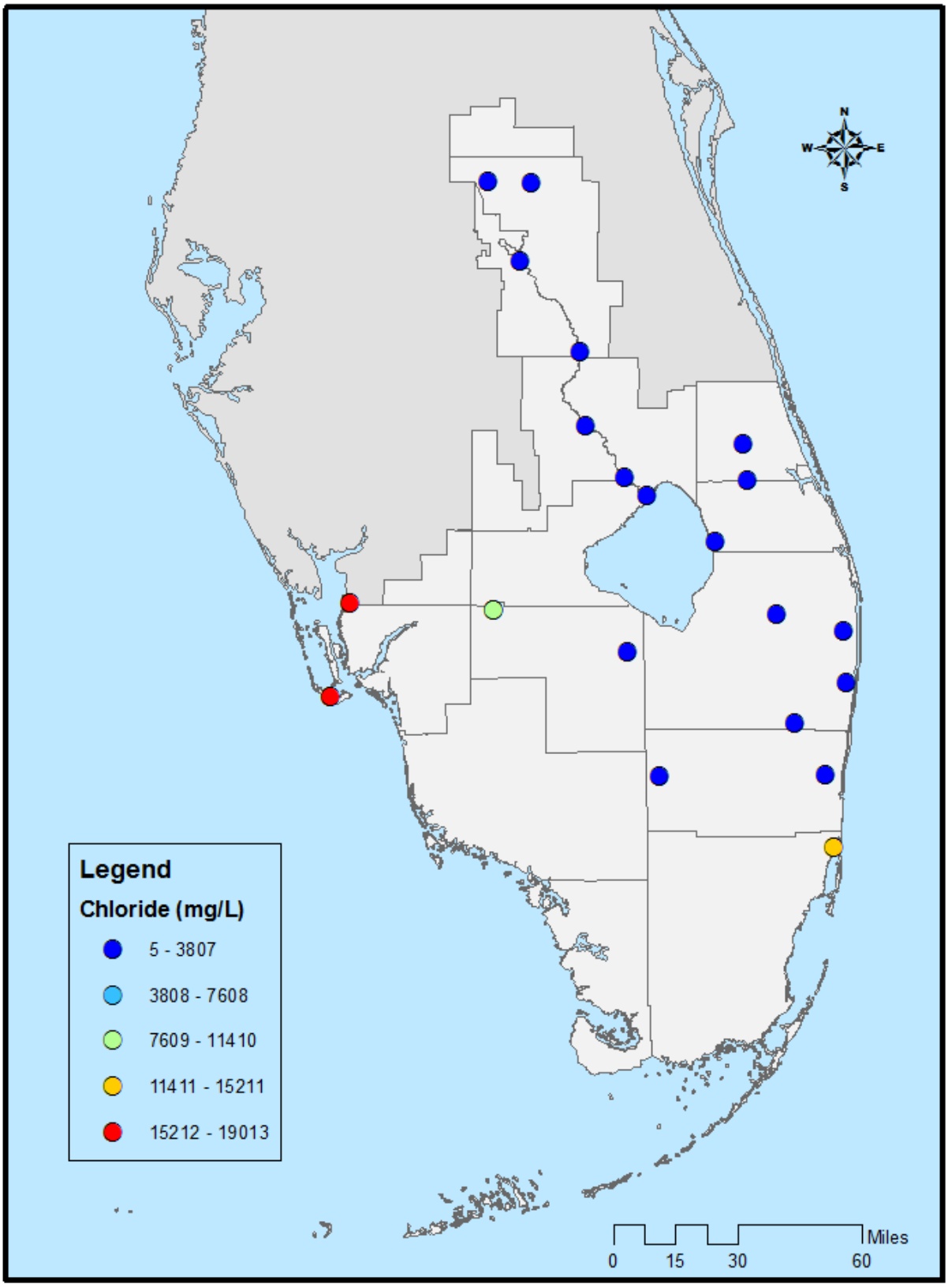


Figure D-14. Map of chloride concentration (mg/L) in the APPZ.

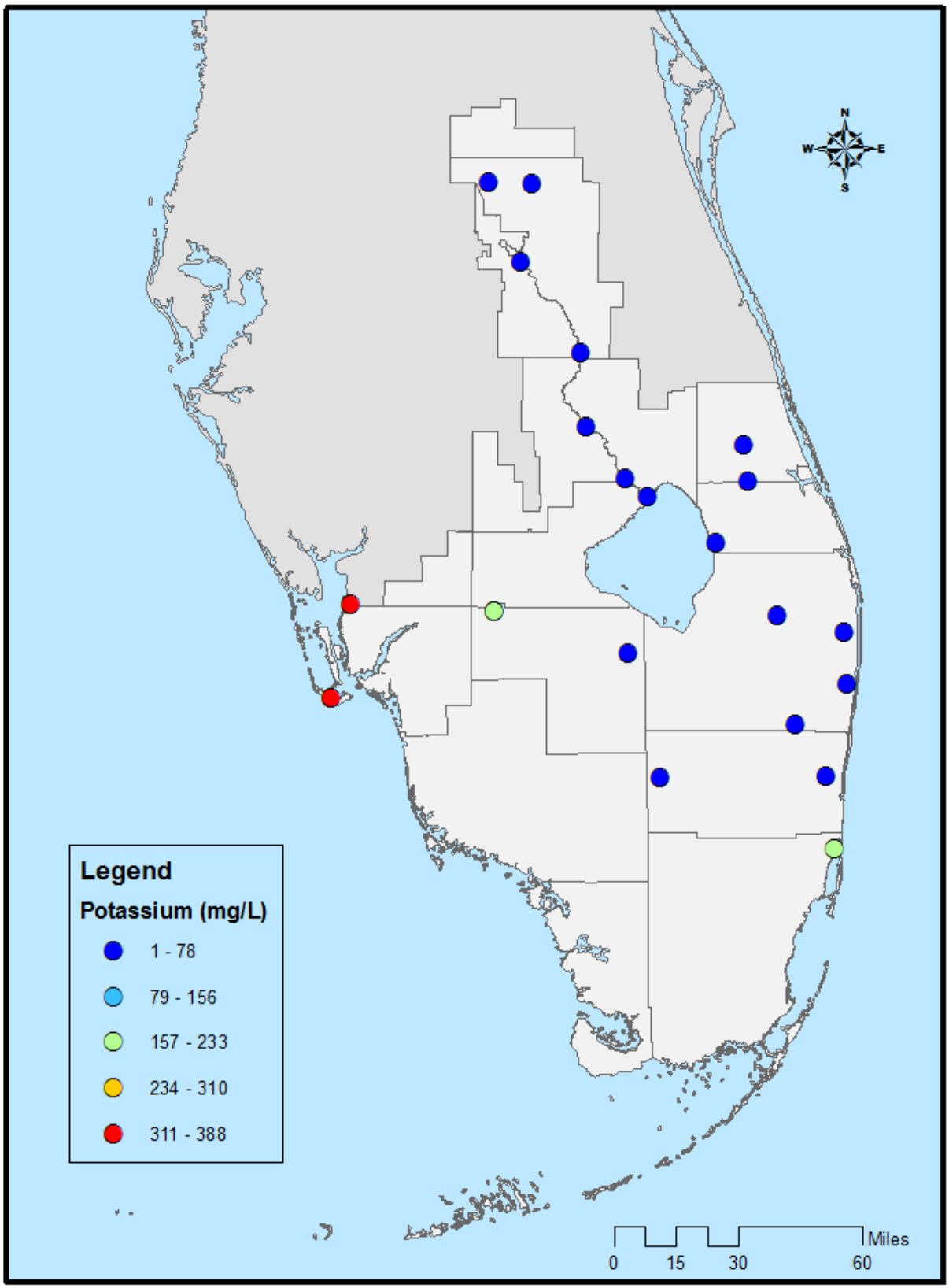


Figure D-15. Map of potassium concentration (mg/L) in the APPZ.

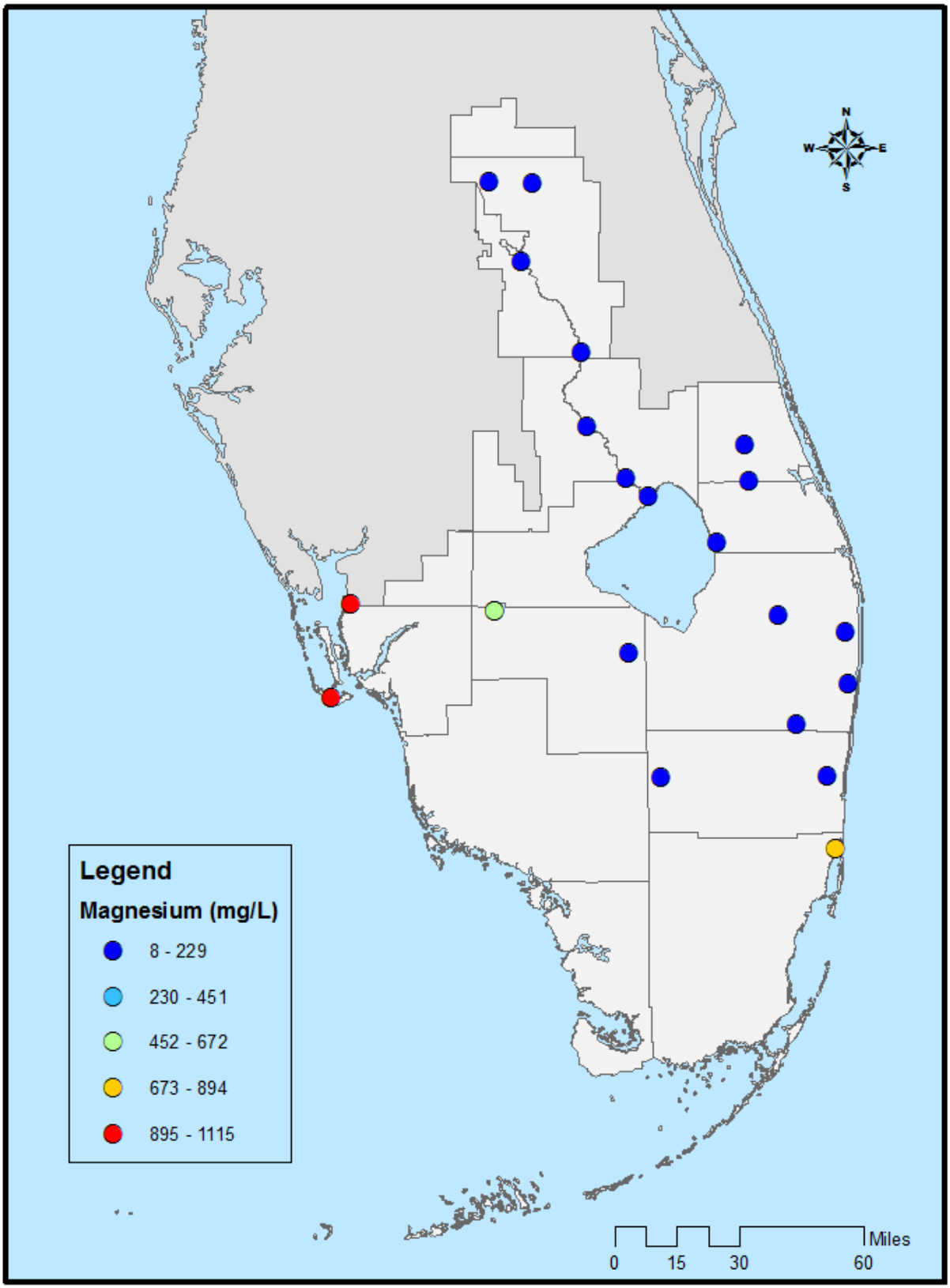


Figure D-16. Map of magnesium concentration (mg/L) in the APPZ.

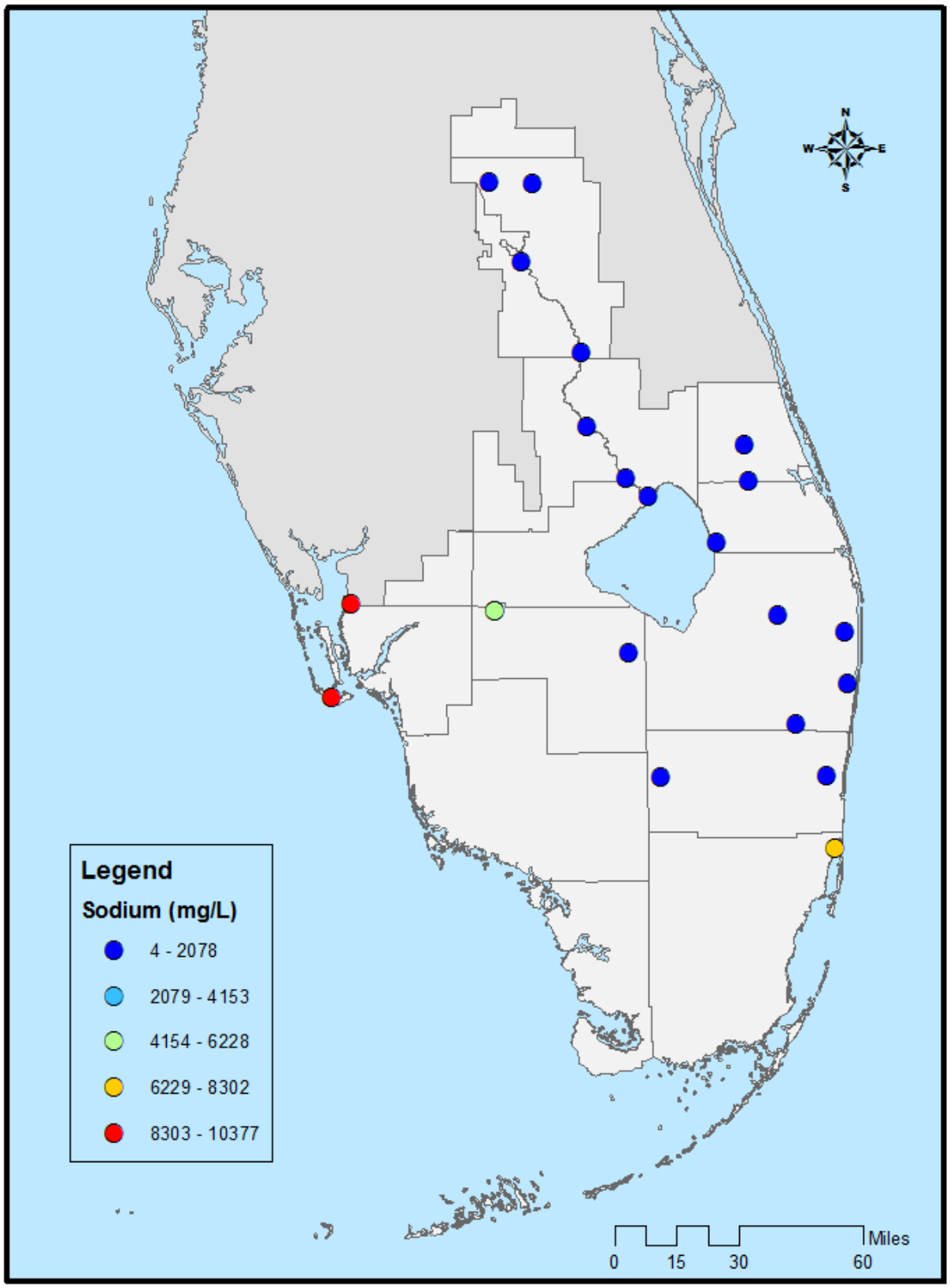


Figure D-17. Map of sodium concentration (mg/L) in the APPZ.

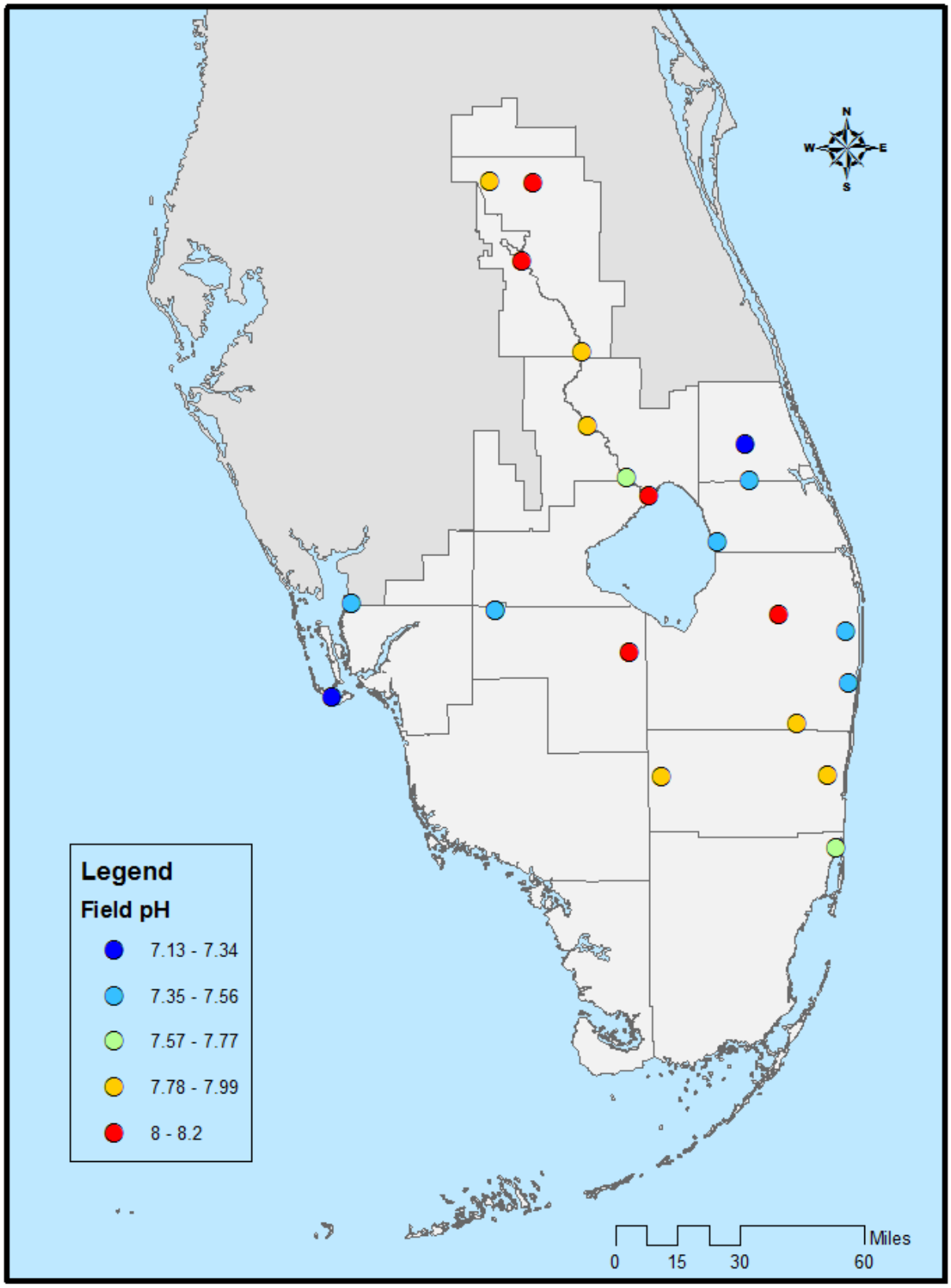


Figure D-18. Map of field pH in the APPZ.

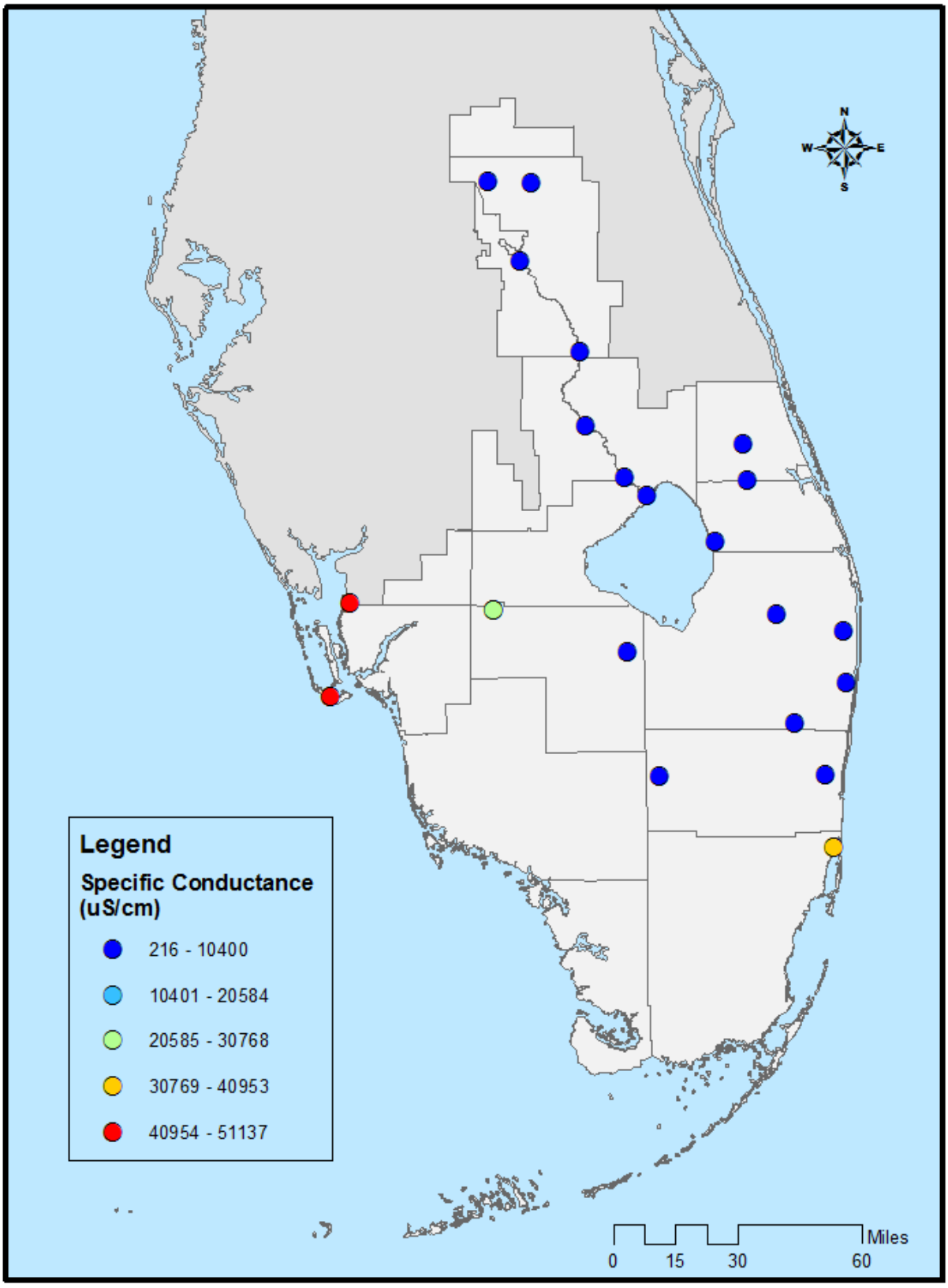


Figure D-19. Map of specific conductance (µS/cm) in the APPZ.

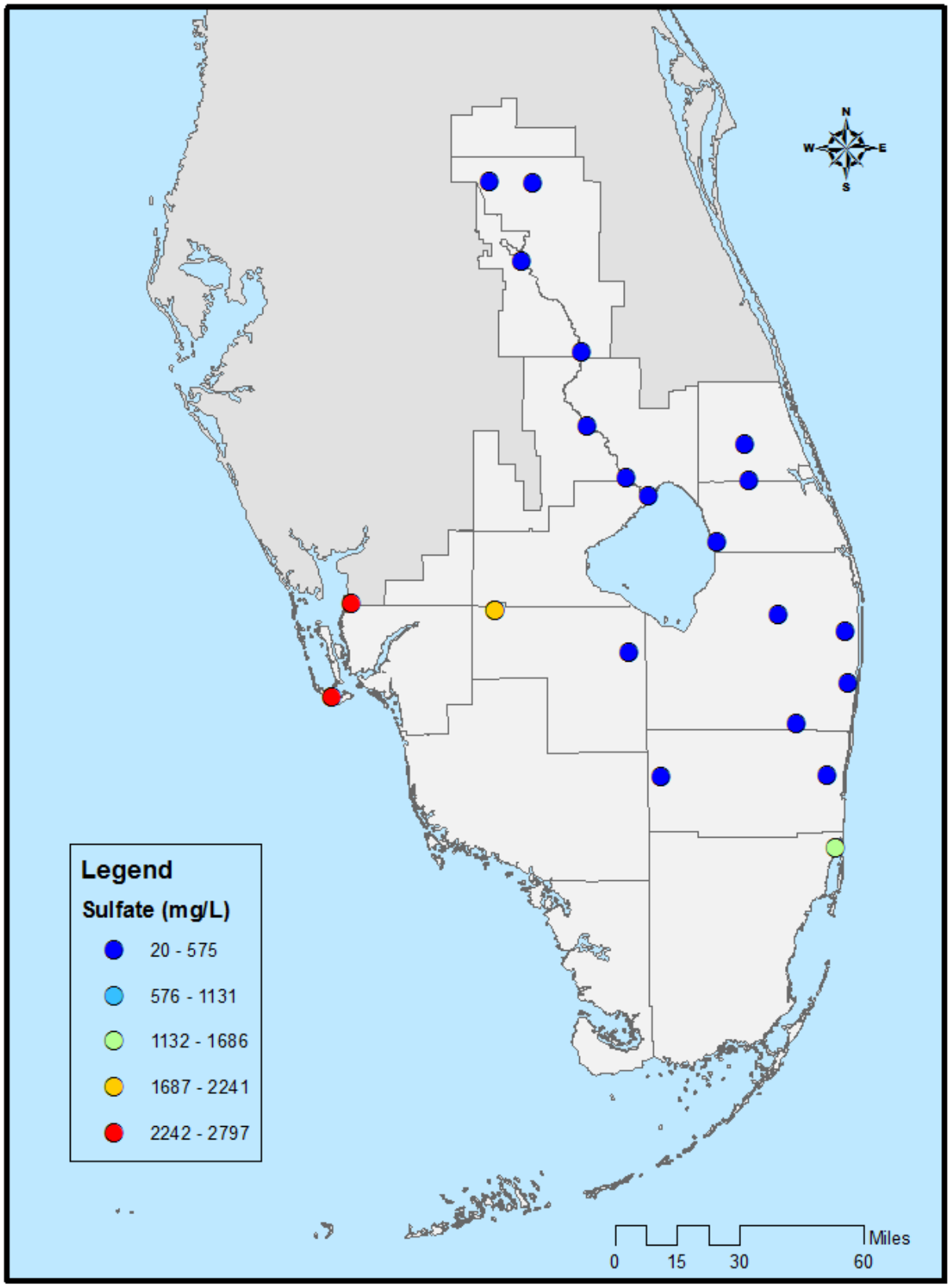


Figure D-20. Map of sulfate concentration (mg/L) in the APPZ.

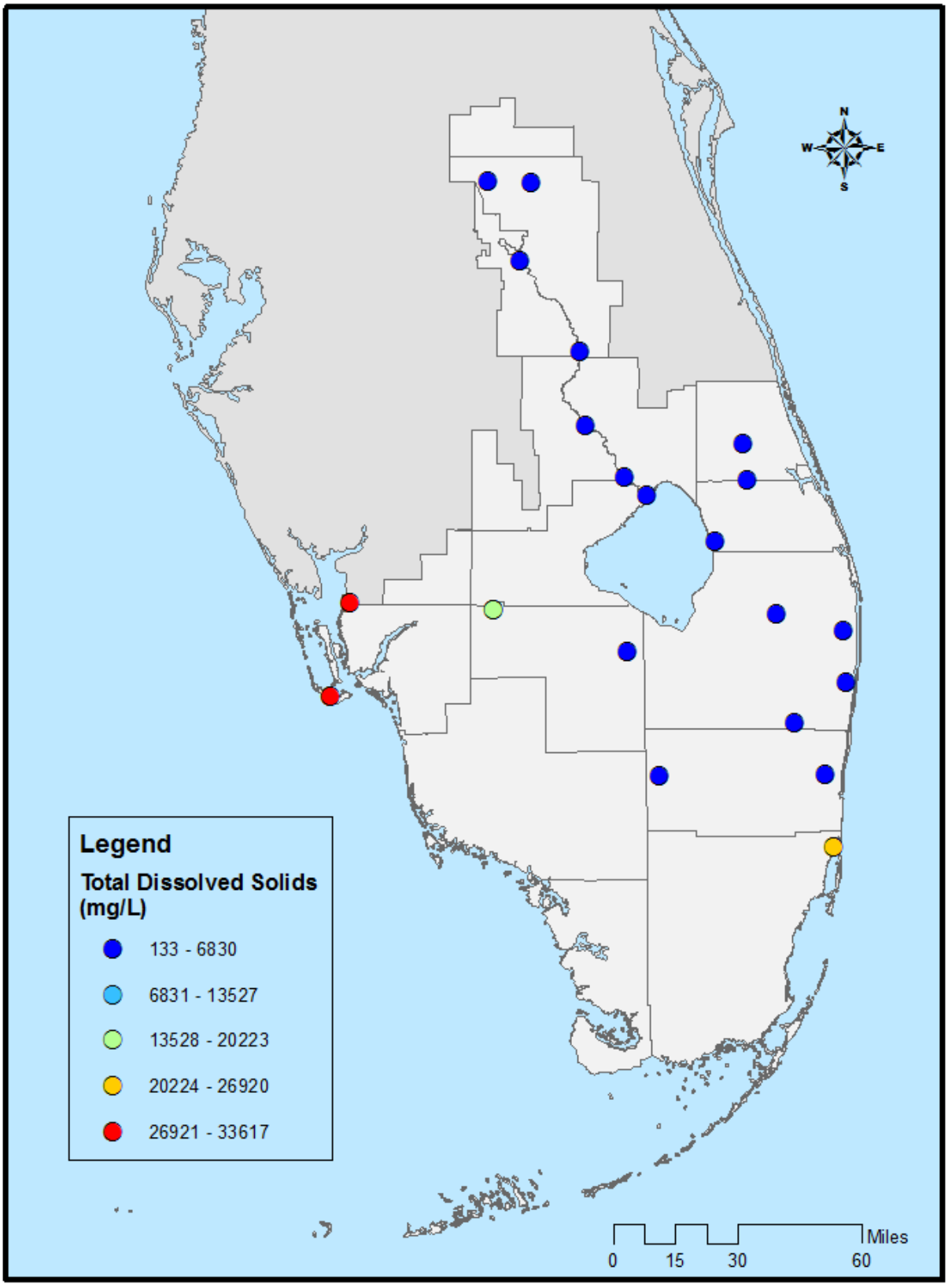


Figure D-21. Map of total dissolved solids concentration (mg/L) in the APPZ.

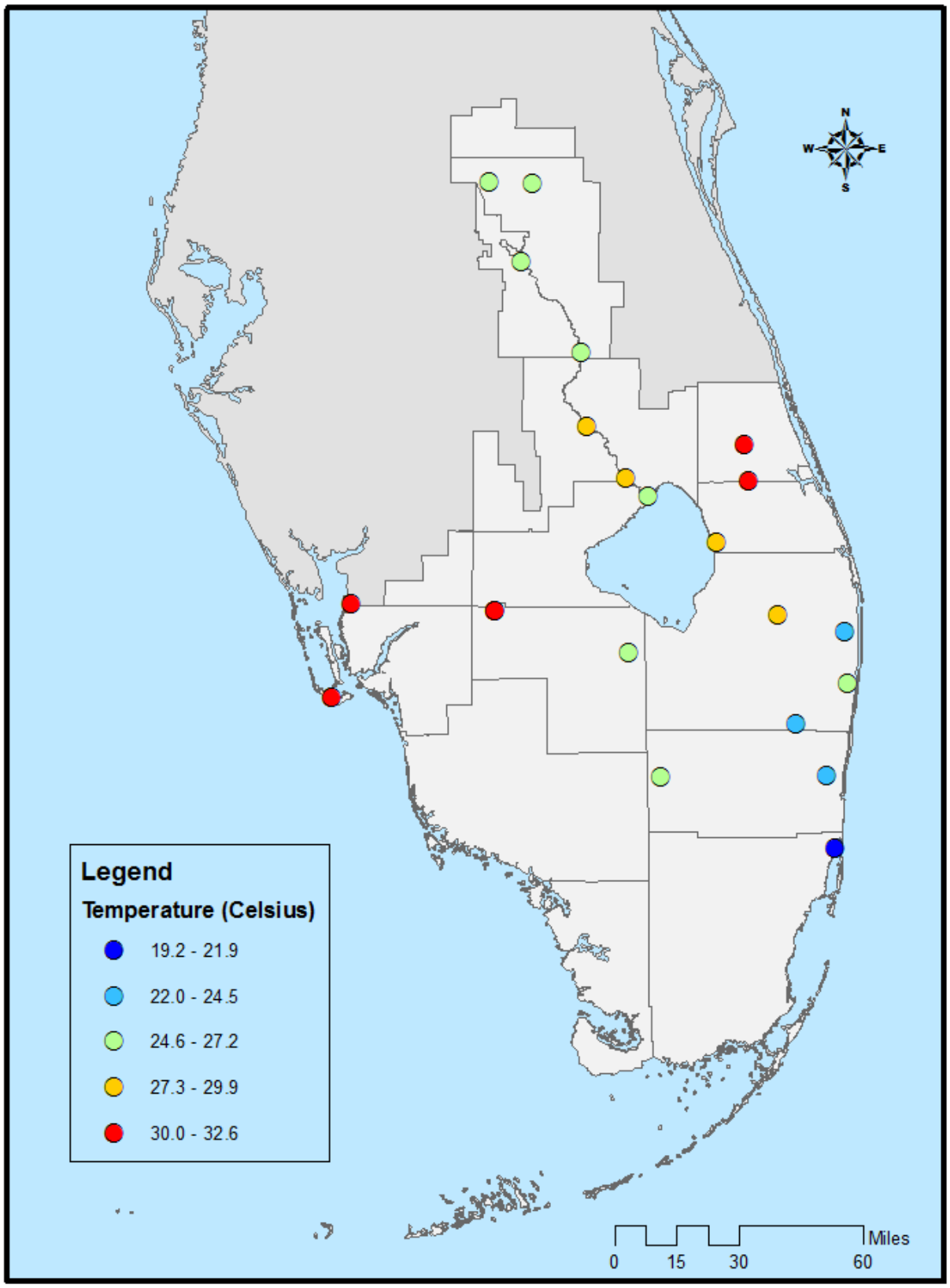


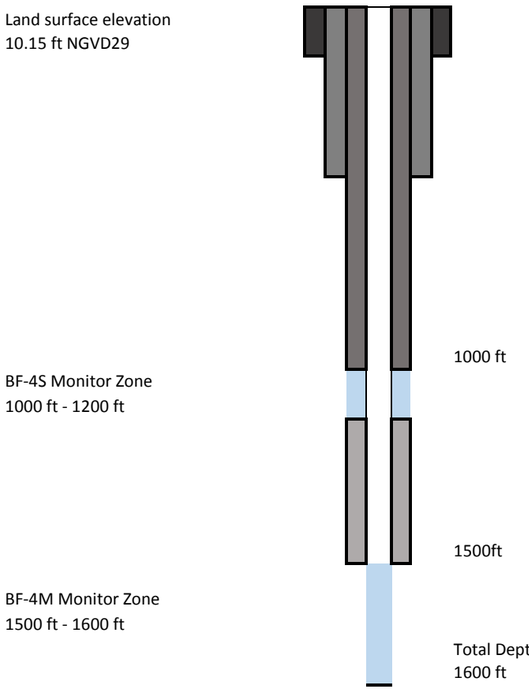
Figure D-22. Map of temperature (°C) in the APPZ.

APPENDIX E: SITE SUMMARIES

Site Name	**BF-4**
Station Names	BF-4M, BF-4S
Aquifers	APPZ and UFA
FDEP Identifier	Unknown
Date of this summary	7/23/2017

Lat / Long: 261024.195, 801047.271
County: Broward
Wellhead Repair Date: 2002 (Replaced), July 2014

Not to scale



Date of Photo: 2007

Survey data:	Survey Addendum 9/24/14 NGVD offset 1.575 ft
Reference elevations:	BF-4S (GW1) 11.642 ft NAVD 88, BF-4M(GW2) 11.412 ft NAVD 88
Data Adjustments:	
Access Agreement:	Within C-14 right of way; "S-Key" needed for access

References

SFWMD, 2003. Floridan Aquifer Test Well Program. C-13 Canal, Oakland Park, Florida.Tech Pub WS-16
SFWMD Survey: 01/23/14

BF-4S Monitor Zone

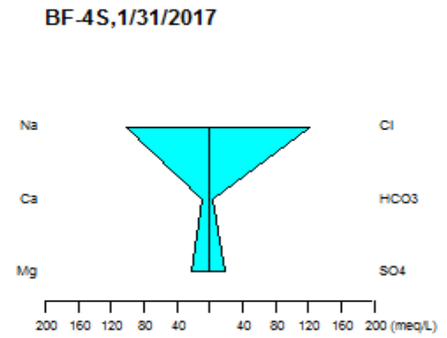
Casing Material:	Steel
Diameter:	6-inch
Data Range:	2010-2017
Sampling Events Analyzed:	3
Water Type:	Na-Cl

Field Parameter Averages BF-4S Monitor Zone

Field pH:	7.87
Specific Condutance (uS/cm)	14103
Temperature (Celcius)	22.33
TDS (mg/L)	8669
Water Level (ft NGVD 29)	43.74
Well Volume (gallons)	1567

BF-4S Monitor Zone Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	83	86
Sodium (Na)	2350	2428
Calcium (Ca)	183	199
Magnesium (Mg)	267	286
Chloride (Cl)	4116	4320
Bicarbonate (HCO3)	161	169
Sulfate (SO4)	904	943



BF-4M Monitor Zone

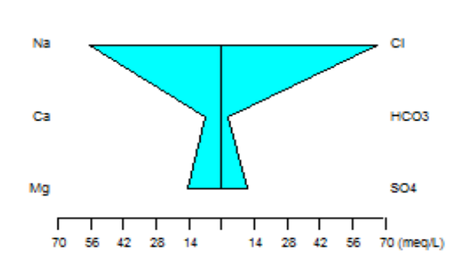
Casing Material:	Steel
Diameter:	2-inch
Data Range:	2007-2014
Sampling Events Analyzed:	8
Water Type:	Na-Cl

Field Parameter Averages BF-4M Monitor Zone

Field pH:	7.86
Specific Condutance (uS/cm)	8030
Temperature (Celcius)	22.65
TDS (mg/L)	4970
Water Level (ft NGVD 29)	47.16
Well Volume (gallons)	392

BF-4M Monitor Zone Ionic Ranges

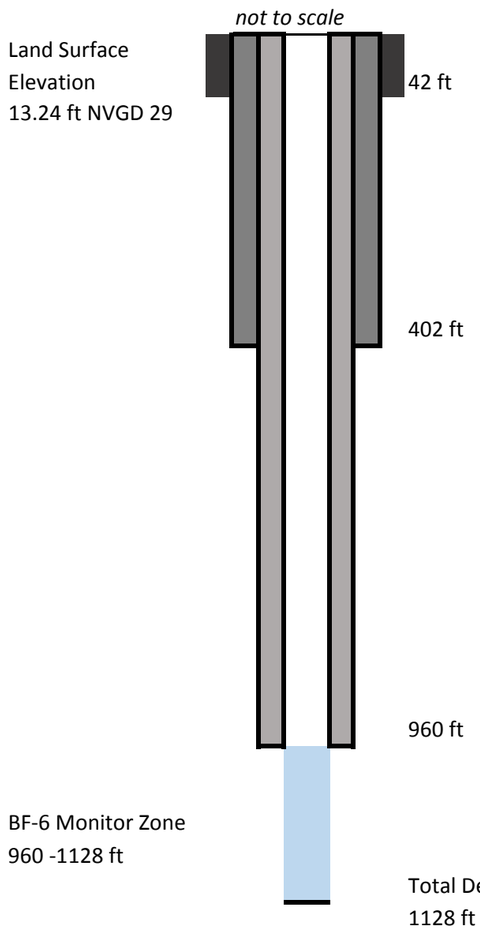
Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	44	48
Sodium (Na)	1252	1336
Calcium (Ca)	120	139
Magnesium (Mg)	170	188
Chloride (Cl)	2158	2400
Bicarbonate (HCO3)	157	171
Sulfate (SO4)	494	540



Site Name	**BF-6**
Station Names	BF-6
Aquifers	UFA
FDEP Identifier	Unknown
Date of Summary	8/4/2017

Lat / Long:	261852/800726.16
County:	BROWARD
Wellhead Repair Date:	2006, April 2014

not to scale



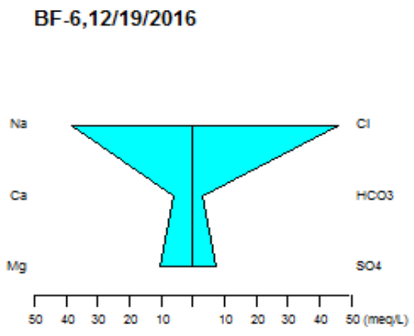
Date of Photo: 2016

BF-6 Monitor Zone	
Casing Material:	PVC
Diameter:	12-inch
Data Range:	12/19/2016
Sampling Events Analyzed:	1
Water Type:	Na-Cl

Field Parameter Averages BF-6 Monitor Zone	
Field pH:	7.5
Specific Condutance (uS/cm)	5856
Temperature (Celcius)	27.9
TDS (mg/L)	3369
Water Level (ft NGVD 29)	43.5
Well Volume (gallons)	1657

BF-6 Monitor Zone Ionic Ranges

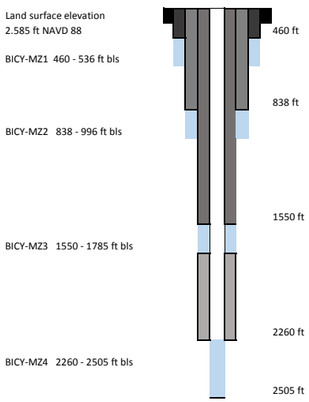
Parameter	Concentration (mg/L)
Potassium (K)	32
Sodium (Na)	878
Calcium (Ca)	123
Magnesium (Mg)	126
Chloride (Cl)	1625
Bicarbonate (HCO_3)	172
Sulfate (SO_4)	354



Survey data: 2/17/2016 NGVD offset 1.57
Reference elevations 16.45 ft NAVD 88
Access Agreement: Owned by City of Deerfield Beach; New Access Agreement Needed

References
CDM, 1993. City of Deerfield Beach Floridan Aquifer Test/Production Well and Monitor Well Completion Report.
SFWMD Survey date: 2/17/2016

Site Name	**BICY**	Lat / Long:	255337.612, 811833.75
Station Names	BICY-MZ1, BICY-MZ2, BICY-MZ3 and BICY-MZ4	County:	Collier
Aquifers	IAS, UFA, MCU, LFA	Wellhead Repair Date:	2009, June 2015
FDEP Identifier	Unknown		
Date of this summ	7/11/2017		



Construction diagram is not to scale

Date of Photo - 2015

Survey data: 3/3/2016
Reference elevatio 5.205 (BICY-MZ1), 7.205 (BICY-MZ2), 7.315 (BICY-MZ3), 7.20 (BICY-MZ4) in ft NAVD88
conversion to NGVD 29 add 1.38 ft
Data Adjustments: BICY-MZ4 water level correction 10/18/2016 see DBhydro multimedia
Access Agreement National Park Service - Big Cypress 12/4/2014, Co-op agreement

References
SFWMD Survey 3/3/2016
Bennett, Michael, 2004.
Hydrogeologic Investigation of the Floridan Aquifer System
Big Cypress Preserve, Collier County, Florida
SFWMD Technical Publication WS-18

BICY-MZ1

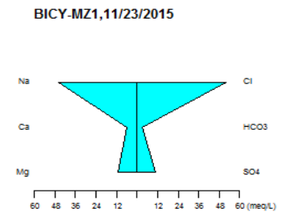
Casing Material:	Steel
Diameter:	24-inch
Data Range:	2007 - 2015
Sampling Events Analyzed:	5
Water Type:	Na-Cl

Field Parameter Averages BICY-MZ1

Field pH:	7.84
Specific Condutance (uS/cm)	6754
Temperature (Celcius)	26.86
TDS (mg/L)	4018
Water Level (ft NGVD 29)	38.63

BICY-MZ1 Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	41	44
Sodium (Na)	1025	1120
Calcium (Ca)	104	117
Magnesium (Mg)	134	142
Chloride (Cl)	1685	1853
Bicarbonate (HCO3)	176	190
Sulfate (SO4)	483	525



BICY-MZ2

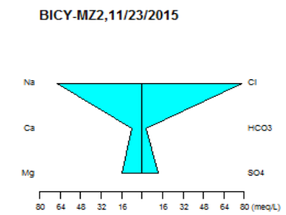
Casing Material:	Steel
Diameter:	18-inch
Data Range:	2004 - 2015
Sampling Events Analyzed:	17
Water Type:	Na-Cl

Field Parameter Averages BICY-MZ2

Field pH:	7.67
Specific Condutance (uS/cm)	9250
Temperature (Celcius)	27.82
TDS (mg/L)	5421
Water Level (ft NGVD 29)	38.47

BICY-MZ2 Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	43	68
Sodium (Na)	110	1680
Calcium (Ca)	56	162
Magnesium (Mg)	130	210
Chloride (Cl)	1700	2900
Bicarbonate (HCO3)	56	195
Sulfate (SO4)	423	720



BICY-MZ3

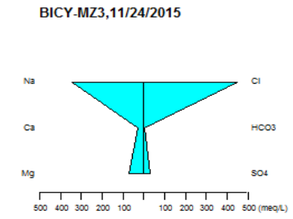
Casing Material:	Steel
Diameter:	12-inch
Data Range:	2004 - 2015
Sampling Events Analyzed:	13
Water Type:	Na-Cl

Field Parameter Averages BICY-MZ3

Field pH:	7.54
Specific Condutance (uS/cm)	43606
Temperature (Celcius)	27.65
TDS (mg/L)	28021
Water Level (ft NGVD 29)	20.77

BICY-MZ3 Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	238	470
Sodium (Na)	7968	11000
Calcium (Ca)	488	800
Magnesium (Mg)	817	1200
Chloride (Cl)	14515	20000
Bicarbonate (HCO3)	39	207
Sulfate (SO4)	1196	2600



BICY-MZ4

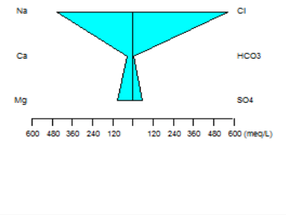
Casing Material:	Fiberglass
Diameter:	2-inch
Data Range:	2004 - 2015
Sampling Events Analyzed:	16
Water Type:	Na-Cl

Field Parameter Averages BICY-MZ4

Field pH:	6.96
Specific Condutance (uS/cm)	51937
Temperature (Celcius)	27.48
TDS (mg/L)	35479
Water Level (ft NGVD 29)	10.26

BICY-MZ4 Ionic Ranges

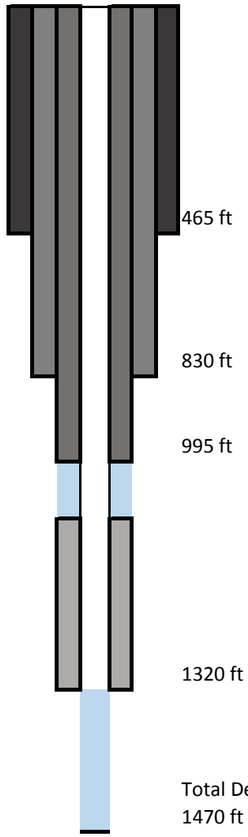
Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	310	540
Sodium (Na)	830	11830
Calcium (Ca)	610	830
Magnesium (Mg)	890	1235
Chloride (Cl)	16000	21000
Bicarbonate (HCO3)	139	238
Sulfate (SO4)	1500	4500



Site Name	**BOYRO_EPX**
Station Names	BOYRO_EPXU and BOYRO_EPXL
Aquifers	UFA and APPZ
FDEP Identifier	Unknown
Date of this summary	9/26/2017

Lat / Long: 26.49384697 / -80.09177722
County: Palm Beach
Wellhead Repair Date: Unknown

not to scale



BOYRO_EPXU
995 - 1164 ft

BOYRO_EPXL
1320 - 1470 ft

Date of photo: 2/27/2007

Survey data:	27-Feb-07
Reference elevations:	BOYRO_EPXU 18.39 ft NGVD 29, BOYRO_EPXL 19.88 ft NGVD 29 NAVD 88 offset 1.55 ft
Access Agreement:	Owner - City of Boynton Beach
References	CH2MHill, 2008. Report on the Construction and Testing of the East Plant Expansion Monitor Wells. City of Boynton Beach, Volume 1. Survey documents, 2007.

BOYRO_EPXU Monitor Zone

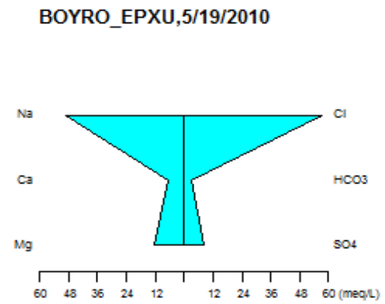
Casing Material:	Steel
Diameter:	10-inch
Data Range:	2007 - 2010
Sampling Events Analyzed:	4
Water Type:	Na-Cl

Field Parameter Averages BOYRO_EPXU

Field pH:	7.75
Specific Condutance (uS/cm)	7452
Temperature (Celcius)	25.2
TDS (mg/L)	4276
Water Level (ft NGVD 29)	46.52
Well Volume (gallons)	4307

BOYRO_EPXU Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	37	40
Sodium (Na)	1100	1185
Calcium (Ca)	100	138
Magnesium (Mg)	140	154
Chloride (Cl)	1948	2200
Bicarbonate (HCO3)	94	183
Sulfate (SO4)	331	378



BOYRO_EPXL Monitor Zone

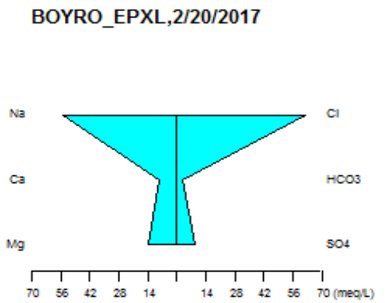
Casing Material:	PVC
Diameter:	3-inch
Data Range:	2007 - 2017
Sampling Events Analyzed:	7
Water Type:	Na-Cl

Field Parameter Averages BOYRO_EPXL

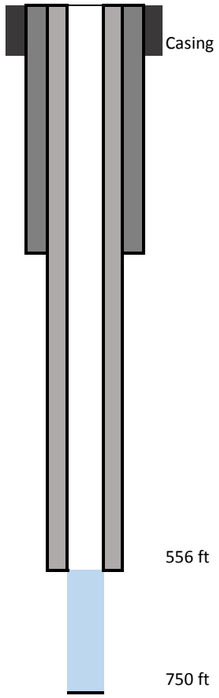
Field pH:	7.43
Specific Condutance (uS/cm)	8242
Temperature (Celcius)	25.57
TDS (mg/L)	4791
Water Level (ft NGVD 29)	48.11
Well Volume (gallons)	1076

BOYRO_EPXL Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	40	46
Sodium (Na)	1230	1310
Calcium (Ca)	148	173
Magnesium (Mg)	164	178
Chloride (Cl)	2209	2332
Bicarbonate (HCO3)	165	172
Sulfate (SO4)	404	436



Site Name	**BRYMW**	Lat / Long:	264230, 812948
Station Names	BRY-MW	County:	Hendry
Aquifers	UFA	Wellhead Repair Date:	Well abandoned 2016
FDEP Identifier	Unknown		
Date of this summary			
7/11/2017			



BRY-MW was abandoned in 2016

Survey data:	Could not locate
Data Adjustments:	Unknown
References	DBhydro

Monitor Zone

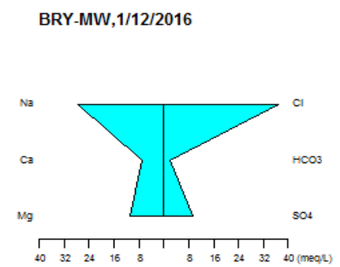
Casing Material:	Unknown
Diameter:	Unknown
Data Range:	2006 - 2016
Sampling Events Analyzed:	6
Water Type:	Na-Mg-Cl

Field Parameter Averages Monitor Zone

Field pH:	7.44
Specific Condutance (uS/cm)	4837
Temperature (Celcius)	28.93
TDS (mg/L)	2740
Water Level (ft NGVD 29)	51.78

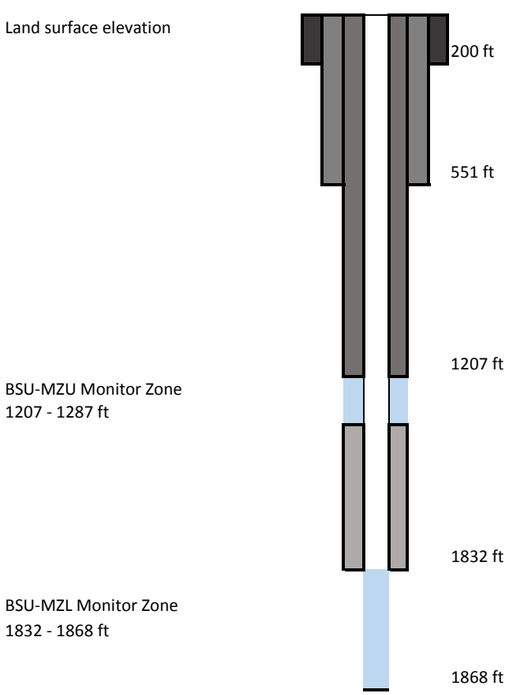
Monitor Zone Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	25	29
Sodium (Na)	610	709
Calcium (Ca)	125	140
Magnesium (Mg)	114	143
Chloride (Cl)	1300	1300
Bicarbonate (HCO3)	122	146
Sulfate (SO4)	390	440



Site Name	**BRNTMW**
Station Names	BSU-MZU and BSU-MZL
Aquifers	UFA and APPZ
FDEP Identifier	Unknown
Date of this summary	7/11/2017

Lat / Long:	264620.877, 820208.737
County:	Charlotte
Wellhead Repair Date:	2007



Date of photo: 2013

Survey data:	NAVD 88 offset 1.14 ft
Reference elevations:	BSU-MZU 15.729 ft NGVD 29, BSU-MZL 16.994 ft NGVD 29
Access Agreement:	Unknown. Owner is Burnt Store Water Treatment Plant

References

ViroGroup, Inc., 1995.
Completion Report for Burnt Store Utilities Class 1 Injection Well System
Punta Gorda, Chatlotte County, Florida
SCADA photos
2006 Survey documents (for offset only)

BSU-MZU Monitor Zone

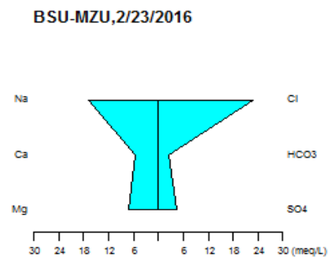
Casing Material:	Steel
Diameter:	9 5/8 inch
Data Range:	1999 - 2016
Sampling Events Analyzed:	13
Water Type:	Na-Mg-Cl

Field Parameter Averages BSU-MZU

Field pH:	7.66
Specific Condutance (uS/cm)	3033
Temperature (Celcius)	32.00
TDS (mg/L)	1707
Water Level (ft NGVD 29)	41.42

BSU-MZU Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	15	18
Sodium (Na)	329	387
Calcium (Ca)	98	120
Magnesium (Mg)	77	94
Chloride (Cl)	661	807
Bicarbonate (HCO3)	157	207
Sulfate (SO4)	209	300



BSU-MZL Monitor Zone

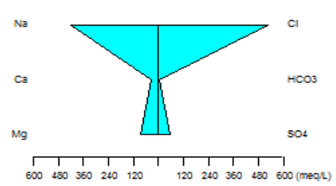
Casing Material:	Steel
Diameter:	4.5 inch
Data Range:	1999 - 2016
Sampling Events Analyzed:	16
Water Type:	Na-Cl

Field Parameter Averages BSU-MZL

Field pH:	7.49
Specific Condutance (uS/cm)	51136
Temperature (Celcius)	32.57
TDS (mg/L)	33617
Water Level (ft NGVD 29)	12.52

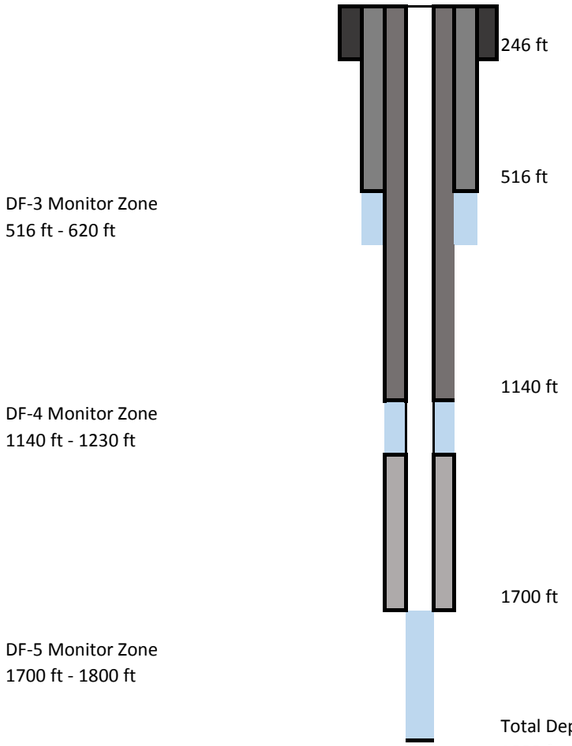
BSU-MZL Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	345	540
Sodium (Na)	9662	11330
Calcium (Ca)	582	740
Magnesium (Mg)	1000	1241
Chloride (Cl)	18048	20131
Bicarbonate (HCO3)	132	158
Sulfate (SO4)	2400	4600



Site Name	**KRM-TZMW/KRMGW**
Station Names	DF-3, DF-4, DF-5
Aquifers	ICU, UFA and APPZ
FDEP Identifier	Unknown
Date of this summary	8/4/2016

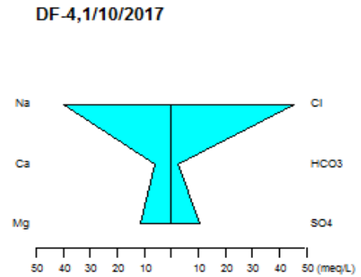
Lat / Long:	255435.831,802806.935
County:	Miami-Dade
Wellhead Repair Date:	6/14/2012



Date of Photo: 2012

DF-4 Monitor Zone

Casing Material:	Steel
Diameter:	6-inch
Data Range:	2005 - 2017
Sampling Events Analyzed:	14
Water Type:	Na-Cl



Field Parameter Averages DF-4

Field pH:	7.83
Specific Condutance (uS/cm)	6665
Temperature (Celcius)	22.28
TDS (mg/L)	3693
Water Level (ft NGVD 29)	49.29
Well Volume (gallons)	1606

DF-4 Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	33	40
Sodium (Na)	915	1110
Calcium (Ca)	100	129
Magnesium (Mg)	120	158
Chloride (Cl)	1558	1900
Bicarbonate (HCO_3)	141	171
Sulfate (SO_4)	424	550

Survey data:	Survey Addendum 8/21/2014 and NGVD offset 1.529
Reference elevations:	GW1 (DF-4)-14.272ft NGVD 29, GW2 (DF-5)- 13.342ft NGVD 29
Note:	DF-3 (ICU) Only packer test water quailty data - 3/21/1994
	DF-5 (APPZ) the pH was too high
Access Agreement:	Within L-30 right of way

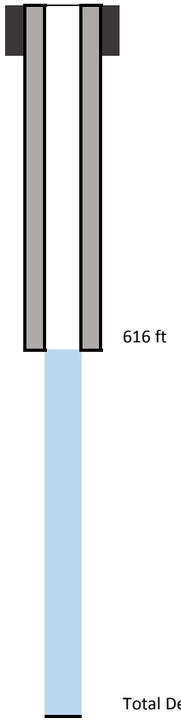
References

SFWMD, 2003. FAS Test Well program L-30N Canal , Miami-Dade, Florida
Technical Publication WS-17
SFWMD Survey date: 5/7/1997

Site Name	**ENP-100**
Station Names	ENP-100
Aquifers	UFA
FDEP Identifier	Unknown
Date of this summary	9/26/2017

Lat / Long:	252257.096/803610.71
County:	Miami-Dade
Wellhead Repair Date:	N/A

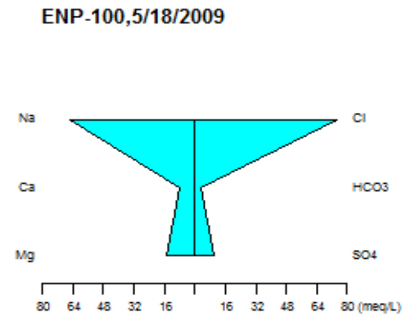
Land Surface Elevation
4.5 ft NGVD 29



Date of Photo (2005)

ENP-100 Monitor Zone

Casing Material:	Steel
Diameter:	8-inch
Data Range:	2004 - 2009
Sampling Events Analyzed:	13
Water Type:	Na-Cl



Field Parameter Averages ENP-100

Field pH:	7.39
Specific Condutance (uS/cm)	9415
Temperature (Celcius)	28.07
TDS (mg/L)	5477
Water Level (ft NGVD 29)	41.42
Well Volume (gallons)	3480

ENP-100 Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	54	62
Sodium (Na)	1464	1700
Calcium (Ca)	139	164
Magnesium (Mg)	157	190
Chloride (Cl)	2577	3000
Bicarbonate (HCO3)	183	207
Sulfate (SO4)	469	510

Survey data:	05/04/2005 NGVD offset 1.989 ft
Reference elevations:	7.544ft NGVD29
Data Adjustments:	
Access Agreement:	'Permit expired June 2016; well plugged and abandoned by ENP' Owned by: ENP/USA

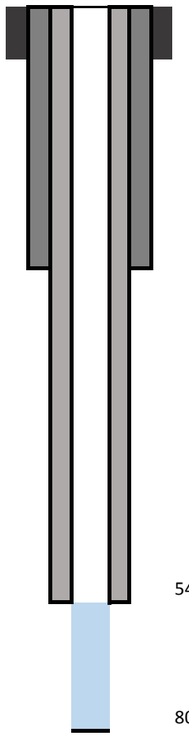
References

SFWMD Survey date 05/04/2005
USGS Open File Report , 1965. Effects of mineralized artesian water on the fresh-water biota of Taylor Slough Everglades National Park, Florida
SFWMD Geophysical Logs 10/24/1996

Site Name	**FPLMW**
Station Names	FPL-MW
Aquifers	UFA
FDEP Identifier	Unknown
Date of summary	7/11/2017

Lat / Long:	264124.243, 814655.134
County:	Lee
Wellhead Repair Date:	Well now used by FPL for water supply
	Redone - unknown date

not to scale

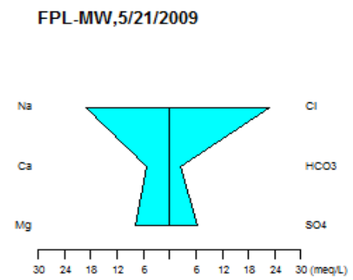


Date of Photo - 2006

Survey data:	6/27/2005
Access Agreement:	FPL - 8/30/2013
References	Surveyor's report

Monitor Zone

Casing Material:	Unknown
Diameter:	Unknown
Data Range:	2006 - 2009
Sampling Events Analyzed:	8
Water Type:	Na-Mg-Cl



Field Parameter Averages Monitor Zone

Field pH:	7.58
Specific Condutance (uS/cm)	3589
Temperature (Celcius)	27.78
TDS (mg/L)	2038
Water Level (ft NGVD 29)	43.46

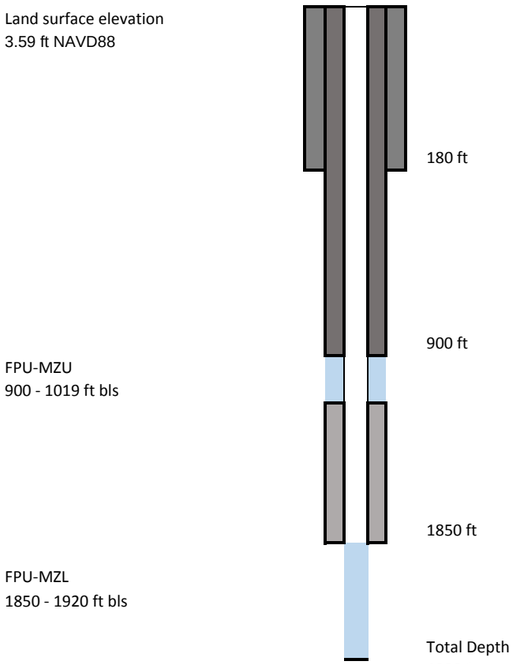
Monitor Zone Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	17	19
Sodium (Na)	410	449
Calcium (Ca)	98	110
Magnesium (Mg)	86	97
Chloride (Cl)	800	890
Bicarbonate (HCO3)	152	268
Sulfate (SO4)	290	328

Site Name	**FTPUTL, FPU-MW**
Station Names	FPU-MZL, FPU-MZU
Aquifers	Upper Floridan and Lower Floridan
FDEP Identifier	Unknown
Date of this summary	6/20/2017

Lat / Long:	272721.482 / 801854.543
County:	St. Lucie
Wellhead Repair Date:	2005

not to scale



11/8/2006

Survey data:	1/10/2005 NGVD 29 offset + 1.5
Reference elevations:	NAVD 88: 8.509 FPU-MZL, 10.404 FPU-MZU
Access Agreement:	Fort Pierce Utilities Authority 2009
References	SFWMD Surery 1/10/2005

FPU-MZU Monitor Zone

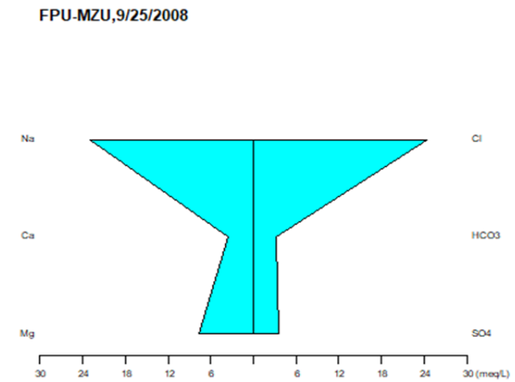
Casing Material:	Steel
Diameter:	16 inches
Data Range:	2000-2008
Sampling Events Analyzed:	11
Water Type:	Na-Mg-Cl

Field Parameter Averages FPU-MZU

Field pH:	7.89
Specific Condutance (uS/cm)	3569
Temperature (Celcius)	24.5
TDS (mg/L)	1999
Water Level (ft NGVD 29)	35.78

FPU-MZU Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	19	22
Sodium (Na)	483	550
Calcium (Ca)	63	78
Magnesium (Mg)	78	90
Chloride (Cl)	842	990
Bicarbonate (HCO3)	179	219
Sulfate (SO4)	163	190



FPU-MZL Monitor Zone

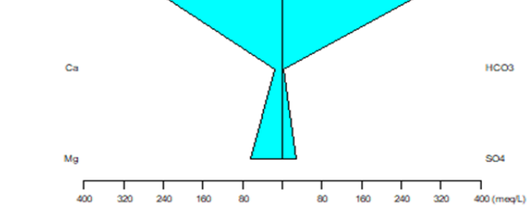
Casing Material:	Steel
Diameter:	6 inches
Data Range:	2000-2008
Sampling Events Analyzed:	10
Water Type:	Na-Cl

Field Parameter Averages FPU-MZL

Field pH:	7.8
Specific Condutance (uS/cm)	38091
Temperature (Celcius)	24.7
TDS (mg/L)	23491
Water Level (ft NGVD 29)	29.40

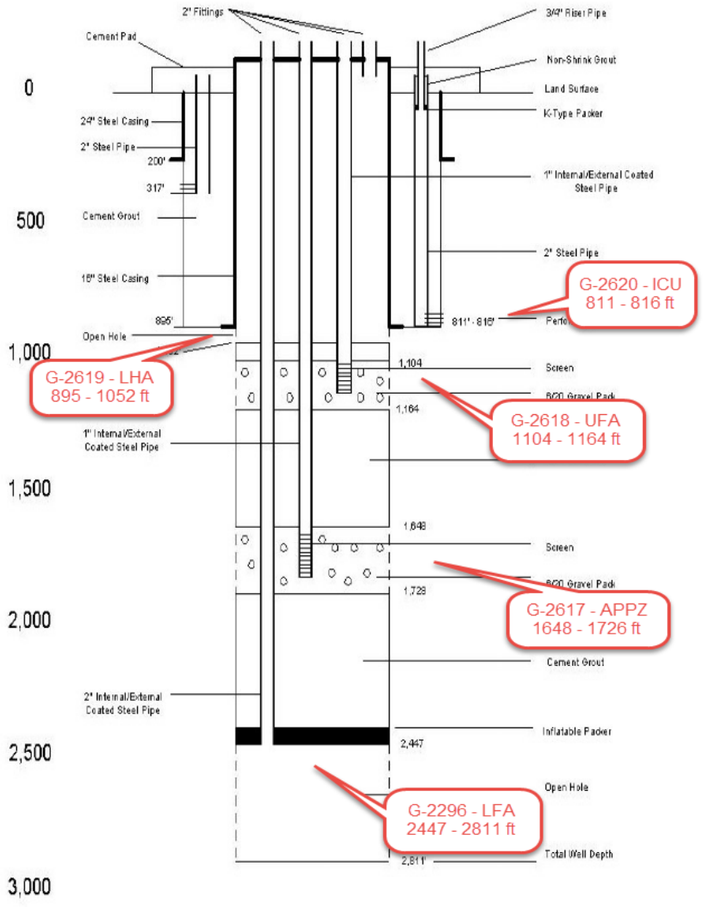
FPU-MZL Ionic Ranges

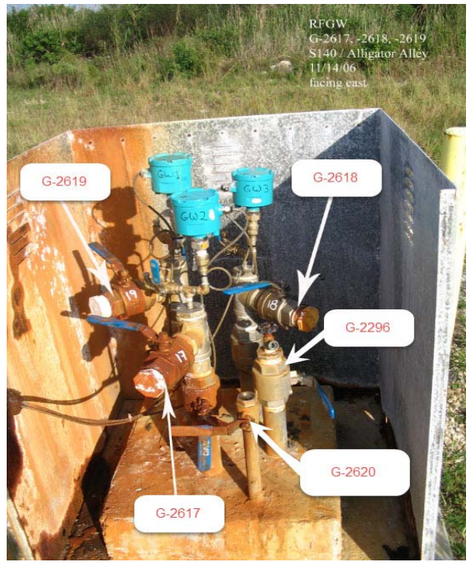
Sodium (Na)	6300	7621
Calcium (Ca)	258	330
Magnesium (Mg)	730	891
Chloride (Cl)	11825	15000
Bicarbonate (HCO3)	183	207
Sulfate (SO4)	1300	1700



Site Name	**ALLY-TW**	Lat / Long:	261017.046/804919.375
Station Names	G-2620, G-2619, G-2618, G-2617, G-2296	County:	Broward
Aquifers	ICU, LHA, UFA, APPZ, LFA	Wellhead Repair Date:	10/11/2000
FDEP Identifier	Unknown		
Date of this summary	9/25/2017		

Figure 3. Modified Alligator Alley Well Schematic





Date of Photo (2006)

This is a five zone monitor well.
Water quality summaries are provided for the G-2617 (APPZ) and G-2618 (UFA).
G-2619 had purging issues possibly impacting the quality of data.
G-2296 (LFA) did not have sufficient data for this analysis.

Survey data:	Survey Addendum May 2017, NGVD offset 1.453ft
Reference elevations:	Land surface elevation 15.4 ft NGVD G-2619 (GW1)-17.43ft NAVD88, G-2618 (GW2)-17.22ft NAVD88, G-2617 (GW3)-17.24ft NAVD88
References	SFWMD Technical memorandum, Alligator Alley, Wellhead Repair, October 2000. SFWMD Survey date 5/4/2017

Monitor Zone G-2618 (UFA)

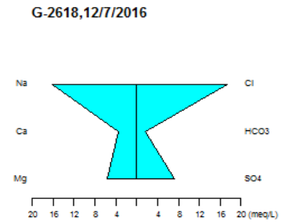
Casing Material:	Steel
Diameter:	1-inch
Data Range:	2004 - 2016
Sampling Events Analyzed:	19
Water Type:	Na-Mg-Cl-SO4

Field Parameter Averages G-2618

Field pH:	7.96
Specific Condutance (uS/cm)	3625
Temperature (Celcius)	25.65
TDS (mg/L)	1594
Water Level (ft NGVD 29)	59.11
Well Volume (gallons)	47

G-2618 Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	19	26
Sodium (Na)	353	639
Calcium (Ca)	61	84
Magnesium (Mg)	63	110
Chloride (Cl)	557	1100
Bicarbonate (HCO3)	73	127
Sulfate (SO4)	316	450



Monitor Zone G-2617 (APPZ)

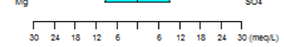
Casing Material:	Steel
Diameter:	1-inch
Data Range:	1994 - 2016
Sampling Events Analyzed:	21
Water Type:	Na-Mg-Cl-SO4

Field Parameter Averages G-2617

Field pH:	7.81
Specific Condutance (uS/cm)	4307
Temperature (Celcius)	25.87
TDS (mg/L)	2560
Water Level (ft NGVD 29)	59.86
Well Volume (gallons)	70

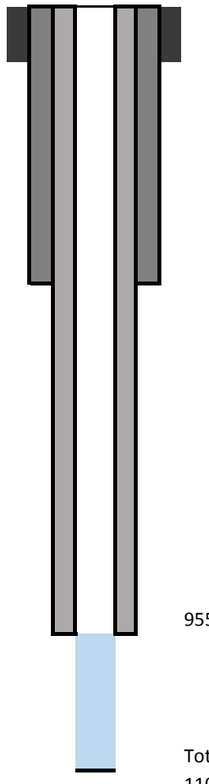
Monitor Zone G-2617 Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	20	27
Sodium (Na)	378	727
Calcium (Ca)	66	96
Magnesium (Mg)	69	120
Chloride (Cl)	573	1109
Bicarbonate (HCO3)	76	171
Sulfate (SO4)	327	460



Site Name	**HIAFAS**	Lat / Long:	254942.534,801715.984
Station Names	G-3061	County:	Miami-Dade
Aquifers	UFA	Wellhead Repair Date:	Unknown
FDEP Identifier	Unknown		
Date of summary	8/6/217		

Land Surface Elevation
8.4ft NGVD29



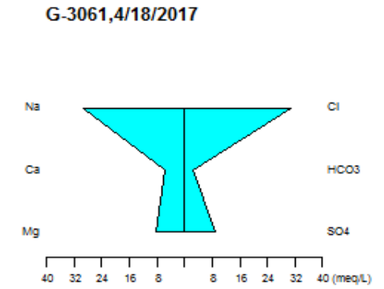
955ft

Monitor Zone
955-1105ft

Total Depth
1105ft

Date of Photo (2017)

Monitor Zone	
Casing Material:	Steel
Diameter:	14-inch
Data Range:	2014-2017
Sampling Events Analyzed:	2
Water Type:	Na-Cl-SO4



Field Parameter Averages Monitor Zone

Field pH:	8
Specific Condutance (uS/cm)	5585
Temperature (Celcius)	23.25
TDS (mg/L)	2717
Water Level (ft NGVD 29)	44.63

Monitor Zone Ionic Ranges

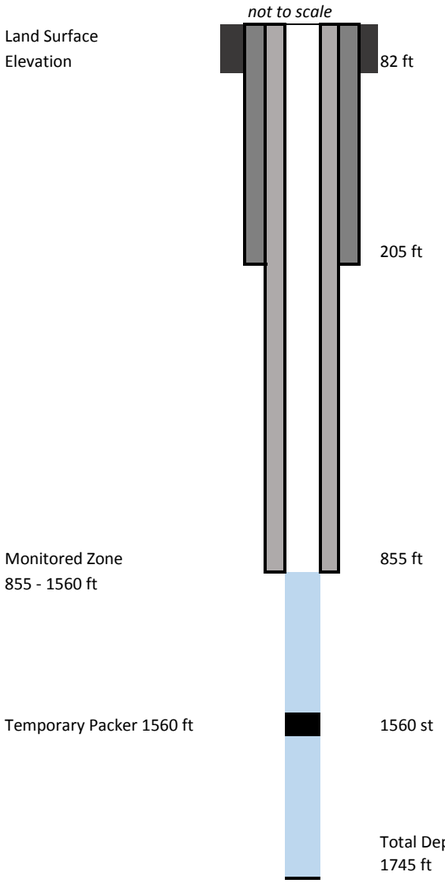
Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	26	27.3
Sodium (Na)	647.6	670.2
Calcium (Ca)	94.6	112.1
Magnesium (Mg)	102	102
Chloride (Cl)	1094	1158
Bicarbonate (HCO3)	143.8674	159.7171
Sulfate (SO4)	435	449

Survey data: Survey Addendum 6/21/2017 and NGVD offset 1.552ft
Reference elevati G-3061(GW1)-10.61ft NAVD88
Access Agreemen Owned by Miami-Dade County - Hialieah ASR; 2002 with automatic five 5-year extensions

References SFWMD Survey date 6/15/2017

Site Name **GLF6**
Station Names GLF-6
Aquifers FAS
FDEP Identifier Unknown
Date of this summ 7/11/2017

Lat / Long: 265018.722, 810507.402
County: Glades
Wellhead Repair Date: 2006 , December 2015



Date of photo - 2016

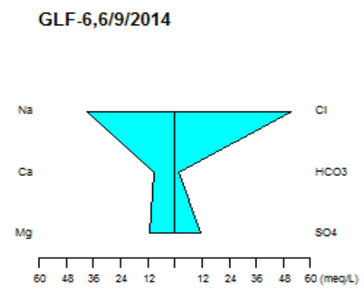
Monitor Zone	
Casing Material:	Steel
Diameter:	12.35 inch
Data Range:	2001 - 2014
Sampling Events Analyzed:	5
Water Type:	Na-Cl

Field Parameter Averages Monitor Zone

Field pH:	7.5
Specific Condutance (uS/cm)	9510
Temperature (Celcius)	29.84
TDS (mg/L)	5927
Water Level (ft NGVD 29)	53.96

Monitor Zone Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	14	67
Sodium (Na)	525	2428
Calcium (Ca)	147	359
Magnesium (Mg)	120	313
Chloride (Cl)	1151	4711
Bicarbonate (HCO_3)	97	100
Sulfate (SO_4)	406	824



Survey data: 5/3/2016
Reference elevations: 18.13 ft NAVD 88
Data Adjustments: NGVD 29 offset add 1.32 ft
Access Agreement: Unknown
References Bennett, M.W., Rectenwald, E.E., and Shaw, J.E., 2016
Hydrogeologic investigation of the Floridan Aquifer System Moore Haven Site
Glades County, Florida. SFWMD Technical Publication WS-39

SFWMD suvey 5/3/2016

Site Name	**HIF40**
Station Names	HIF-40
Aquifers	Upper Floridan
FDEP Identifier	Unknown
Date of this summary	6/28/2017

Lat / Long:	271617.813 / 811207.99
County:	Highlands
Wellhead Repair Date:	12/1/2011

not to scale

Land Surface Elevation
36.05 ft NGVD 29

540 ft

Monitor Zone
540-600 ft bls

Total Depth
600 ft

6/10/2014

Survey data:	6/25/12 NGVD 29 offset + 1.198
Reference elevations:	34.691 ft NAVD 88
References	Survey report, 2012

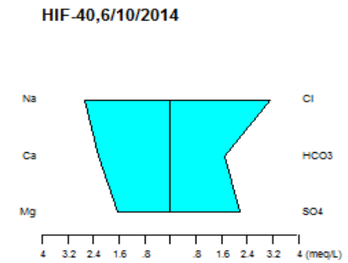
Monitor Zone	
Casing Material:	Steel
Diameter:	4 inches
Data Range:	2014
Sampling Events Analyzed:	1
Water Type:	Na-Ca-Mg-Cl-SO4-HCO3

Field Parameter Averages Monitor Zone

Field pH:	7.4
Specific Condutance (uS/cm)	823
Temperature (Celcius)	24
TDS (mg/L)	358
Water Level (ft NGVD 29)	46.68

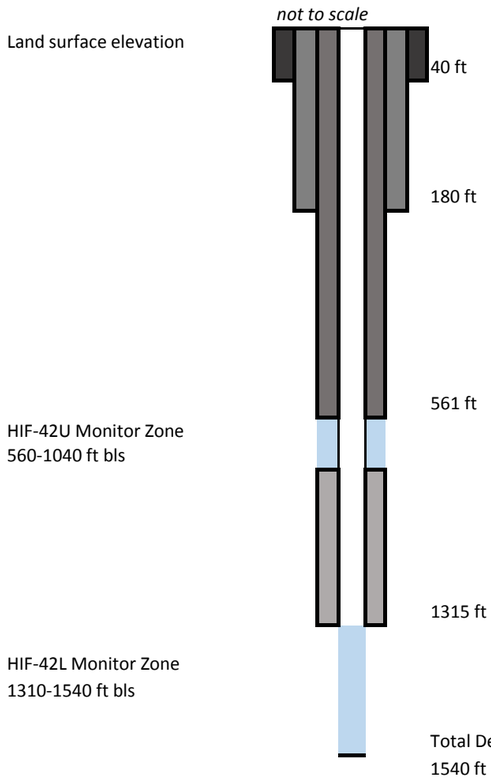
Monitor Zone Ionic concentrations

Parameter	Concentration (mg/L)
Potassium (K)	3.4
Sodium (Na)	61.7
Calcium (Ca)	45
Magnesium (Mg)	20.1
Chloride (Cl)	111
Bicarbonate (HCO3)	103.6
Sulfate (SO4)	105



Site Name	**HIF42W**
Station Names	HIF-42U, HIF-42L
Aquifers	Upper Floridan, Avon Park Permeable Zone
FDEP Identifier	Unknown
Date of this summary	6/28/2017

Lat / Long:	271311.155 / 805721.978
County:	Okeechobee
Wellhead Repair Date:	12/1/2014



12/31/2013

Survey data:	2008
Reference elevations:	25.75 ft NGVD 29, 24.55 ft NAVD 88
References	Surveyor's report, 2008
	CH2M Hill, 2008. Well construction and testing report. Paradise Run Aquifer Storage and Recovery Test-Monitor well HIF-42, 74p.

HIF-42U

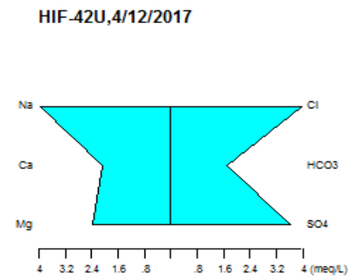
Casing Material:	Steel
Diameter:	24-inch
Data Range:	2008 - 2017
Sampling Events Analyzed:	5
Water Type	Na-Mg-Ca-Cl-SO4

Field Parameter Averages HIF-42U

Field pH:	7.98
Specific Condutance (uS/cm)	1056.67
Temperature (Celcius)	28.12
TDS (mg/L)	631.00
Water Level (ft NGVD 29)	46.99

HIF-42U Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	4	5
Sodium (Na)	91	110
Calcium (Ca)	41	43
Magnesium (Mg)	29	33
Chloride (Cl)	141	169
Bicarbonate (HCO3)	105	117
Sulfate (SO4)	169	185



HIF-42L

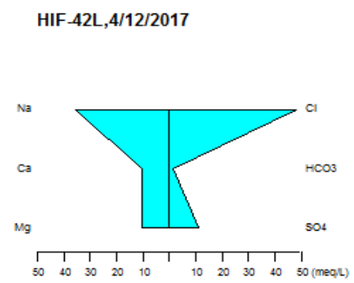
Casing Material:	Steel
Diameter:	14-inch
Data Range:	2008 - 2017
Sampling Events Analyzed:	5
Water Type	Na-Cl

Field Parameter Averages HIF-42L

Field pH:	7.66
Specific Condutance (uS/cm)	6298
Temperature (Celcius)	29.12
TDS (mg/L)	3693.5
Water Level (ft NGVD 29)	43.69

HIF-42L Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	21	22.4
Sodium (Na)	809.7	887.8
Calcium (Ca)	196.6	209.1
Magnesium (Mg)	128	142
Chloride (Cl)	1641	1758
Bicarbonate (HCO3)	91.4	100
Sulfate (SO4)	468	538



Site Name	**I75MZ**	Lat / Long:	261013.048 / 814350.032
Station Names	I75-MZ1, I75-MZ2 and I75-MZ3	County:	Collier
Aquifers	Lower Hawthorn, Upper Floridan and Lower Floridan	Wellhead Repair:	Sandblasting
FDEP Identifier	Unknown		
Date of this summary	5/30/2017		

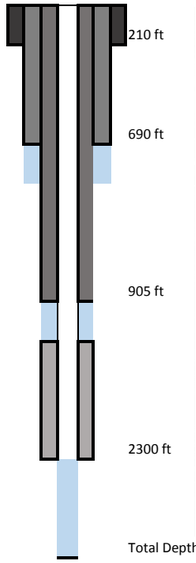


Photo dated 2006

Survey data:	3/30/2016 NGVD29 offset +1.29
Reference elevations:	13.335 ft NAVD88, 13.555 ft NAVD88 and 13.265 ft NAVD88
Access Agreement:	Perpetual Easement - FDOT 1/6/2017

References

Bennett, M.W., 2001. Hydrogeological Investigation of the Floridan Aquifer System at the I75 Canal Site, Collier County, Florida. Technical Publication WS-7. SFWMD, West Palm Beach, 60p.

SFWMD Survey 3/30/2016

I75-MZ1

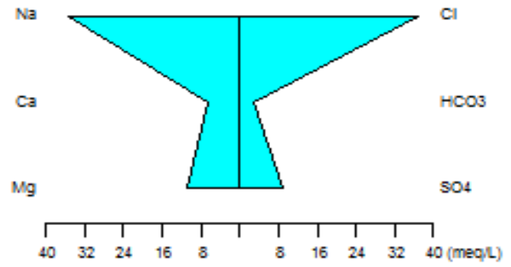
Casing Material:	Fiberglass
Diameter:	2 inches
Data Range:	1995 - 2016
Sampling Events Analyzed:	19
Water Type	Na-Cl

Field Parameter Averages I75-MZ1

Field pH:	7.94
Specific Condutance (uS/cm)	5590
TDS (mg/L)	3233
Water Level (ft NGVD 29)	33.98

I75-MZ1 Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	31	43
Sodium (Na)	749	1060
Calcium (Ca)	97	238
Magnesium (Mg)	4	157
Chloride (Cl)	1306	1848
Bicarbonate (HCO3)	38	256
Sulfate (SO4)	206	563



I75-MZ2

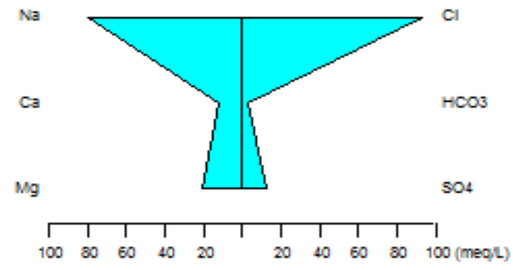
Casing Material:	Stainless Steel
Diameter:	12 inches
Data Range:	1995 - 2016
Sampling Events Analyzed:	20
Water Type	Na-Cl

Field Parameter Averages I75-MZ2

Field pH:	7.84
Specific Condutance (uS/cm)	12473
TDS (mg/L)	7460
Water Level (ft NGVD 29)	32.91

I75-MZ2 Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	55	80
Sodium (Na)	1661	2220
Calcium (Ca)	137	274
Magnesium (Mg)	222	304
Chloride (Cl)	3005	4300
Bicarbonate (HCO3)	18	231
Sulfate (SO4)	380	433



I75-MZ3

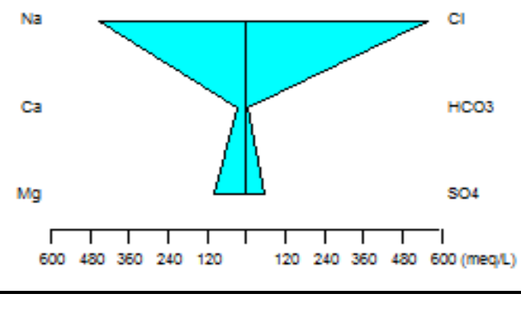
Casing Material:	Fiberglass
Diameter:	2 3/8 inches
Data Range:	2004 - 2016
Sampling Events Analyzed:	17
Water Type	Na-Cl

Field Parameter Averages I75-MZ3

Field pH:	7.39
Specific Condutance (uS/cm)	53041
TDS (mg/L)	35087
Water Level (ft NGVD 29)	9.18

I75-MZ3 Ionic Ranges

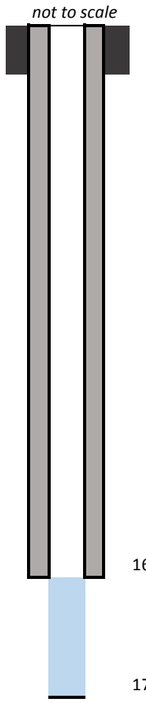
Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	363	520
Sodium (Na)	10390	11880
Calcium (Ca)	414	560
Magnesium (Mg)	1150	1367
Chloride (Cl)	18400	20165
Bicarbonate (HCO3)	95	146
Sulfate (SO4)	2320	4600



Site Name	**IWAMZL**
Station Names	IWA-MZL
Aquifers	APPZ
FDEP Identifier	Unknown
Date of summary	7/12/2017

Lat / Long:	262632.006, 820635.35
County:	Lee
Wellhead Repair Date:	Unknown

not to scale



Date of photo: 2003

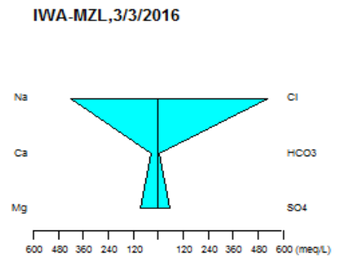
Survey data:	3/27/2000
Reference elevation:	9.90 ft NGVD 29
References	Survey in DBhydro, 2000.

IWA-MZL Monitor Zone	
Casing Material:	Steel
Diameter:	6.62 inch
Data Range:	2000 - 2016
Sampling Events Analyzed:	3
Water Type	Na-Cl

Field Parameter Averages IWA-MZL	
Field pH:	7.13
Specific Condutance (uS/cm)	48873
Temperature (Celcius)	30.74
TDS (mg/L)	33447
Water Level (ft NGVD 29)	8.12

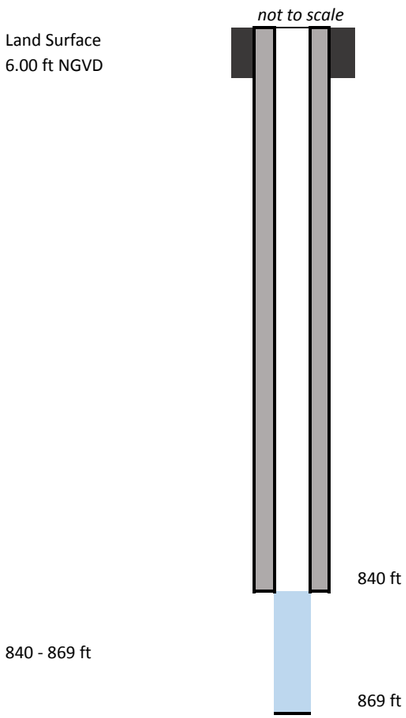
IWA-MZL Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	346	361
Sodium (Na)	9681	10150
Calcium (Ca)	664	723
Magnesium (Mg)	1064	1086
Chloride (Cl)	18254	18561
Bicarbonate (HCO3)	151	160
Sulfate (SO4)	2493	2663



Site Name **IWAMZU**
Station Name IWA-MZU
Aquifer UFA
FDEP Identifier Unknown
Date of this sumn 7/12/2017

Lat / Long: 262631.988, 820637.568
County: Lee
Wellhead Repair Date: Unknown



Date of photo: 2003

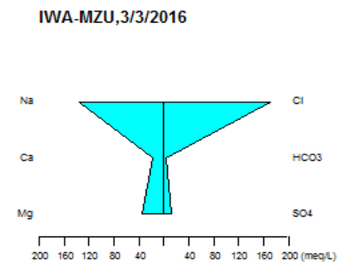
IWA-MZU Monitor Zone	
Casing Material:	PVC
Diameter:	4 inch
Data Range:	2000 - 2016
Sampling Events Analyzed:	3
Water Type:	Na-Cl

Field Parameter Averages IWA-MZU

Field pH:	7.04
Specific Condutance (uS/cm)	18352
Temperature (Celcius)	27.53
TDS (mg/L)	12073
Water Level (ft NGVD 29)	17.68

IWA-MZU Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	98	106
Sodium (Na)	3104	3152
Calcium (Ca)	303	354
Magnesium (Mg)	415	433
Chloride (Cl)	6068	6468
Bicarbonate (HCO3)	185	190
Sulfate (SO4)	605	654

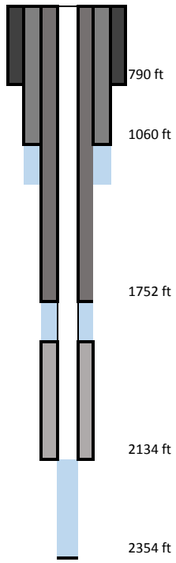


Survey data: 3/27/2007
Reference elevation: 7.04 ft NGVD 29
Access Agreemen Island Water Authority - Right of Access Agreement, 6/10/2001

References SCADA form

Site Name	**IWSD**	Lat / Long:	262449.5, 812552.9
Station Names	IWSD-MZ2, IWSD-MZ3, IWSD-MZ4	County:	Collier
Aquifers	UFA, MCU and LFA	Wellhead Repair Date:	Yes - Modification
FDEP Identifier	Unknown		Date unknown
Date of this summary	7/12/2017		

Land Surface elevation
31.76 ft NGVD 29



IWSD-MZ2
1060 - 1140 ft bls

IWSD-MZ3
1752 - 1880 ft bls

IWSD-MZ4
2134 - 2354 ft bls

Survey data: 5/9/2008 Date of photo: 2006
Reference elevations: MZ2 (34.194 ft), MZ3 (34.864 ft) NGVD 29 to convert to NAVD 88: -1.31 ft
References

Bennett, M.W., 2002.
Hydrogeologic investigation of the Floridan Aquifer System
Immokalee Water & Sewer District Wastewater Treatment Plant
Collier County, Florida. Technical Publication WS-14

SFWMD Survey 2008

IWSD-MZ2

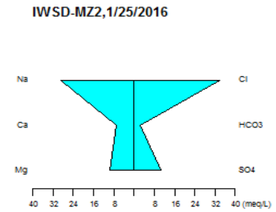
Casing Material:	Steel
Diameter:	12 inch
Data Range:	2004 - 2016
Sampling Events Analyzed:	15
Water Type	Na-Mg-Cl-SO4

Field Parameter Averages IWSD-MZ2

Field pH:	7.92
Specific Condutance (uS/cm)	5101
Temperature (Celcius)	29.06
TDS (mg/L)	2892
Water Level (ft NGVD 29)	55.46

IWSD-MZ2 Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	24	45
Sodium (Na)	647	1260
Calcium (Ca)	110	203
Magnesium (Mg)	110	218
Chloride (Cl)	1082	2280
Bicarbonate (HCO3)	84	188
Sulfate (SO4)	460	816



IWSD-MZ3

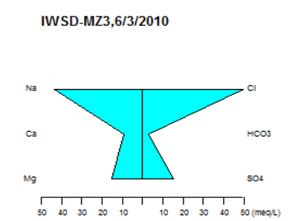
Casing Material:	Steel
Diameter:	7.63 inch
Data Range:	2004 - 2010
Sampling Events Analyzed:	14
Water Type	Na-Mg-Cl-SO4

Field Parameter Averages IWSD-MZ3

Field pH:	8.2
Specific Condutance (uS/cm)	7250
Temperature (Celcius)	28.34
TDS (mg/L)	4500
Water Level (ft NGVD 29)	54.89

IWSD-MZ3 Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	35	43
Sodium (Na)	997	1180
Calcium (Ca)	130	190
Magnesium (Mg)	150	203
Chloride (Cl)	1700	2000
Bicarbonate (HCO3)	16	172
Sulfate (SO4)	540	880



IWSD-MZ4

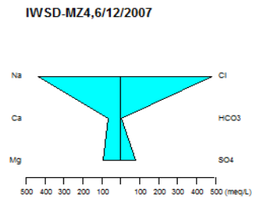
Casing Material:	Fiberglass
Diameter:	2.38 inch
Data Range:	2000 - 2007
Sampling Events Analyzed:	3
Water Type	Na-Cl

Field Parameter Averages IWSD-MZ4

Field pH:	7.12
Specific Condutance (uS/cm)	51248
Temperature (Celcius)	28.29
TDS (mg/L)	34300
Water Level (ft NGVD 29)	no data

IWSD-MZ4 Ionic Ranges

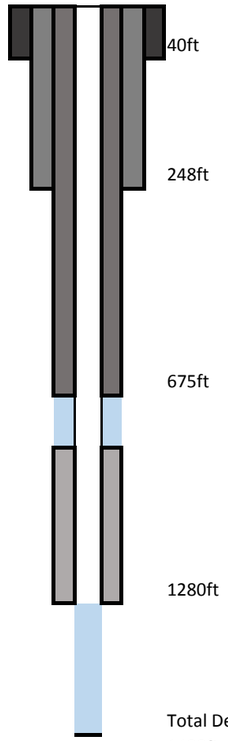
Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	355	480
Sodium (Na)	9700	10000
Calcium (Ca)	1300	1360
Magnesium (Mg)	1100	1100
Chloride (Cl)	17000	18100
Bicarbonate (HCO3)	99	146
Sulfate (SO4)	3900	4510



Site Name	**KEYWST/KWDZMW-1**
Station Names	KW-MZL, KW-MZU
Aquifers	UFA, IAS
FDEP Identifier	Unknown
Date of this summary	8/8/2017

Lat / Long:	243406.603/814746.725
County:	Monroe
Wellhead Repair Date:	Unknown

Land surface elevation
7.65ft NGVD29



KW-MZU Monitor Zone
675-725ft

KW-MZL Monitor Zone
1280-1320ft

Date of Photo (2017)

Upper Monitor Zone KW-MZU

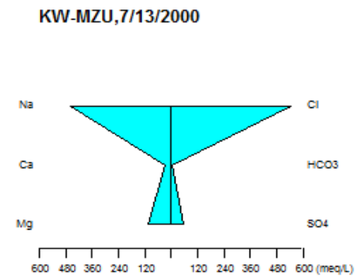
Casing Material:	Steel
Diameter:	16-inch
Data Range:	2000
Sampling Events Analyzed:	1
Water Type	Na-Cl

Field Parameter Averages KW-MZU

Field pH:	7.73
Specific Condutance (uS/cm)	53870
Temperature (Celcius)	25.06
TDS (mg/L)	34540
Water Level (ft NGVD 29)	2.66

KW-MZU Ionic Ranges

Parameter	Concentration (mg/L)
Potassium (K)	390
Sodium (Na)	10581
Calcium (Ca)	598
Magnesium (Mg)	1248
Chloride (Cl)	19246
Bicarbonate (HCO3)	137
Sulfate (SO4)	2703



Lower Monitor Zone KW-MZL

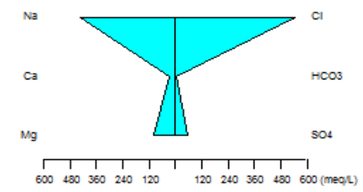
Casing Material:	Fiberglass
Diameter:	6.62-inch
Data Range:	2000
Sampling Events Analyzed:	1
Water Type	Na-Cl

Field Parameter Averages KW-MZL

Field pH:	7.73
Specific Condutance (uS/cm)	53133
Temperature (Celcius)	23.64
TDS (mg/L)	34680
Water Level (ft NGVD 29)	6.38

KW-MZL Ionic Ranges

Parameter	Concentration (mg/L)
Potassium (K)	401
Sodium (Na)	9913
Calcium (Ca)	537
Magnesium (Mg)	1234
Chloride (Cl)	19426
Bicarbonate (HCO3)	140
Sulfate (SO4)	2674

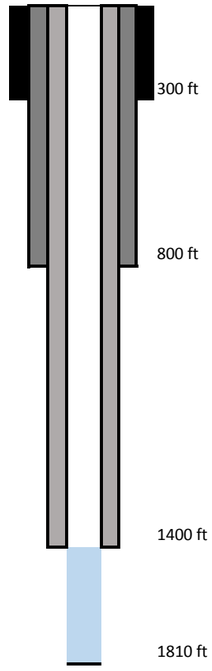


Survey data:	Survey Addendum and 6/21/2017 NGVD offset 1.345ft
Reference elevations:	KW-MZU(GW1)-7.9ft NAVD88, KW-MZL(GW2)-9.07 NAVD88
Access Agreement:	Owned by City of Key West Waste Water Treatment Plant -Active Agreement-2001 w/automatic 5-year extension
References	SFWMD Survey date 6/15/2017

Site Name	**L2GW**
Station Names	L2-PW1
Aquifers	APPZ
FDEP Identifier	unknown
Date of this summ	7/12/2017

Lat / Long:	263627.433, 805657.397
County:	Hendry
Wellhead Repair Date:	2014

Land Surface Elevation
16.5 ft NAVD 88



Date of photo: 2016

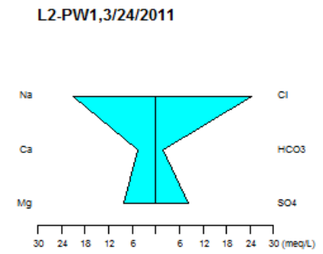
Monitor Zone	
Casing Material:	Steel
Diameter:	8 inch
Data Range:	2005 - 2011
Sampling Events Analyzed:	13
Water Type:	Na-Mg-Cl-SO4

Field Parameter Averages

Field pH:	8.01
Specific Condutance (uS/cm)	3313
Temperature (Celcius)	26.42
TDS (mg/L)	2238
Water Level (ft NGVD 29)	58.62

Monitor Zone

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	13	57
Sodium (Na)	295	1500
Calcium (Ca)	66	150
Magnesium (Mg)	72	180
Chloride (Cl)	526	2300
Bicarbonate (HCO_3)	80	232
Sulfate (SO_4)	320	790

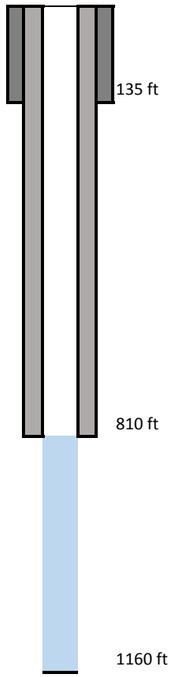


Survey data: 6/13/2017
Reference elevation: 22.05 ft NAVD 88 to convert to NGVD 29 add 1.378
References SFWMD survey 6/13/2017
Bennett, M. W., 2001.
Hydrogeologic investigation of Flordan Aquifer System at
L2 canal site, Hendry County, Florida
Technical Publication WS-3

Site Name	**L2GW**
Station Names	L2-PW2
Aquifers	UFA
FDEP Identifier	Unknown
Date of this sumn	7/12/2017

Lat / Long:	263628.811, 805657.738
County:	Hendry
Wellhead Repair Date:	2014

Land Surface Elevation
16.15 ft NAVD 88



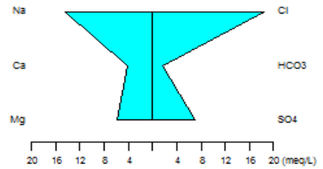
810 - 1160 ft bls

Date of photo: 2016

Monitor Zone	
Casing Material:	Steel
Diameter:	12 inch
Data Range:	1999 - 2016
Sampling Events Analyzed:	16
Water Type:	Na-Mg-Cl-SO4

Field Parameter Averages	
Field pH:	7.87
Specific Condutance (uS/cm)	2931
Temperature (Celcius)	26.16
TDS (mg/L)	1726
Water Level (ft NGVD 29)	57.97

L2-PW2,2/9/2016



Monitor Zone

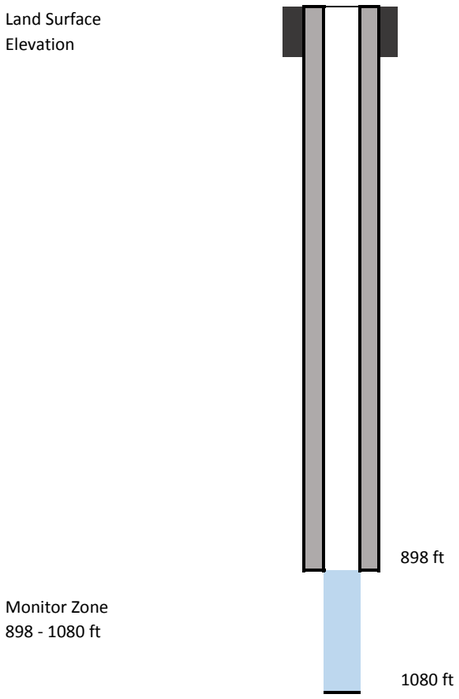
Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	13	22
Sodium (Na)	307	470
Calcium (Ca)	48	110
Magnesium (Mg)	71	95
Chloride (Cl)	564	832
Bicarbonate (HCO_3)	47	113
Sulfate (SO_4)	278	351

Survey data: 6/13/2017
Reference elevation: 20.56 ft NAVD 88 to convert to NGVD 29 add 1.378

References SFWMD survey 6/13/2017
Bennett, M. W., 2001.
Hydrogeologic investigation of Flordan Aquifer System at
L2 canal site, Hendry County, Florida
Technical Publication WS-3

Site Name	**LMMW**
Station Names	L-6436
Aquifers	UFA
FDEP Identifier	Unknown
Date of this summary	7/12/2017

Lat / Long:	263907.248, 820320.326
County:	Lee
Wellhead Repair Date:	Unknown



Date of Photo: 2006

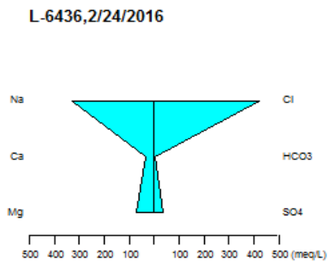
Monitor Zone	
Casing Material:	Unknown
Diameter:	5 inch
Data Range:	2005 - 2016
Sampling Events Analyzed:	7
Water Type:	Na-Cl

Field Parameter Averages Monitor Zone

Field pH:	7.08
Specific Condutance (uS/cm)	38470
Temperature (Celcius)	28.71
TDS (mg/L)	24587
Water Level (ft NGVD 29)	31.68

Monitor Zone Ionic Ranges

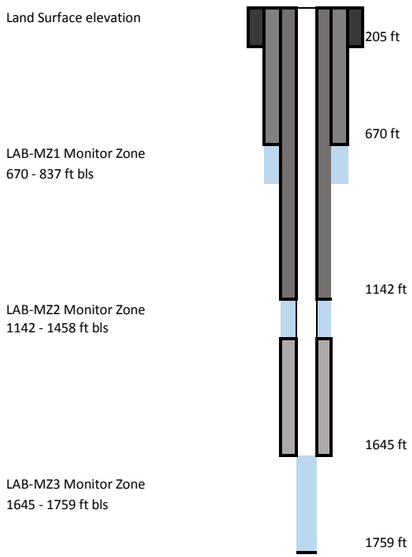
Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	190	310
Sodium (Na)	630	8100
Calcium (Ca)	490	640
Magnesium (Mg)	720	889
Chloride (Cl)	13000	15000
Bicarbonate (HCO3)	158	183
Sulfate (SO4)	1500	1797



Survey data: 4/10/2010
Reference elevation: 8.976 ft NAVD 88
Data Adjustments: Coversion for NGVD 29 +1.188
References SFWMD Survey, 2010

Site Name	**LABTW**
Station Names	LAB-MZ1, LAB-MZ2 and LAB-MZ3
Aquifers	UFA, MCU and APPZ
FDEP Identifier	Unknown
Date of this summary	7/12/2017

Lat / Long:	264511.442, 812817.716
County:	Hendry
Wellhead Repair Date:	Unknown



Date of Photo: 2006

Survey data:	6/10/2009
Reference elevations:	MZ1 - 19.385 ft NAVD 88, MZ2 - 19.805 ft NAVD 88 and 19.765 ft NAVD 88, to convert to NGVD 29 +1.358 ft
References	Bennett, M.W., 2003
	Hydrogeologic investigation of the Floridan Aquifer System
	LaBelle, Hendry County, Florida. Technical Publication WS-15
	Note: Anolomous water level data report prepared by AECOM in 2008 - in DBhydro

LAB-MZ1

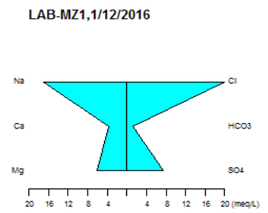
Casing Material:	Steel
Diameter:	24 inch
Data Range:	1997 - 2016
Sampling Events Analyzed:	15
Water Type:	Na-Mg-Cl-SO4

Field Parameter Averages LAB-MZ1

Field pH:	8.02
Specific Condutance (uS/cm)	3275
Temperature (Celcius)	29.2
TDS (mg/L)	1918
Water Level (ft NGVD 29)	52.26

Ionic Ranges LAB-MZ1

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	14	17
Sodium (Na)	360	600
Calcium (Ca)	73	92
Magnesium (Mg)	67	77
Chloride (Cl)	646	1000
Bicarbonate (HCO3)	71	110
Sulfate (SO4)	340	390



LAB-MZ2

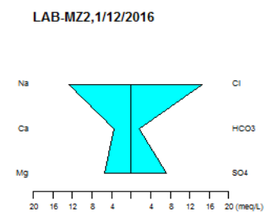
Casing Material:	Steel
Diameter:	12 inch
Data Range:	1997 - 2016
Sampling Events Analyzed:	17
Water Type:	Na-Mg-Cl-SO4

Field Parameter Averages LAB-MZ2

Field pH:	8.03
Specific Condutance (uS/cm)	2473
Temperature (Celcius)	29.73
TDS (mg/L)	1458
Water Level (ft NGVD 29)	52.61

Ionic Ranges LAB-MZ2

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	13	18
Sodium (Na)	267	390
Calcium (Ca)	49	81
Magnesium (Mg)	56	72
Chloride (Cl)	440	610
Bicarbonate (HCO3)	98	171
Sulfate (SO4)	310	360



LAB-MZ3

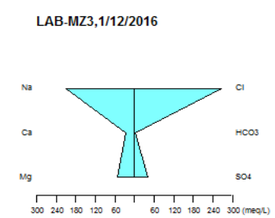
Casing Material:	Fiberglass
Diameter:	7 inch
Data Range:	2004 - 2016
Sampling Events Analyzed:	10
Water Type:	Na-Cl

Field Parameter Averages LAB-MZ3

Field pH:	7.37
Specific Condutance (uS/cm)	27605
Temperature (Celcius)	31.95
TDS (mg/L)	16896
Water Level (ft NGVD 29)	39.2

Ionic Ranges LAB-MZ3

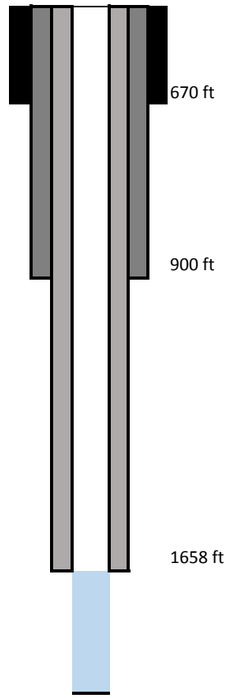
Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	140	220
Sodium (Na)	4200	5300
Calcium (Ca)	430	547
Magnesium (Mg)	540	680
Chloride (Cl)	8200	9800
Bicarbonate (HCO3)	96	116
Sulfate (SO4)	1700	1912



Site Name	**LABPW2**
Station Names	LAB-PW2
Aquifers	APPZ
FDEP Identifier	Unknown
Date of this summary	7/12/2017

Lat / Long:	264509.357, 812816.108
County:	Hendry
Wellhead Repair Date:	Modification 2006

Land Surface Elevation



1658 - 1758 ft bls

Date of photo: 2016

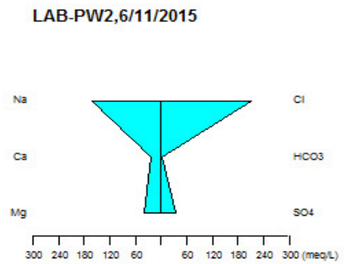
Monitor Zone	
Casing Material:	Steel
Diameter:	6 inch
Data Range:	2015
Sampling Events Analyzed:	1
Water Type:	Na-Cl

Field Parameter Averages

Field pH:	7.4
Specific Condutance (uS/cm)	22371
Temperature (Celcius)	31.6
TDS (mg/L)	14317
Water Level (ft NGVD 29)	37.99

Monitor Zone

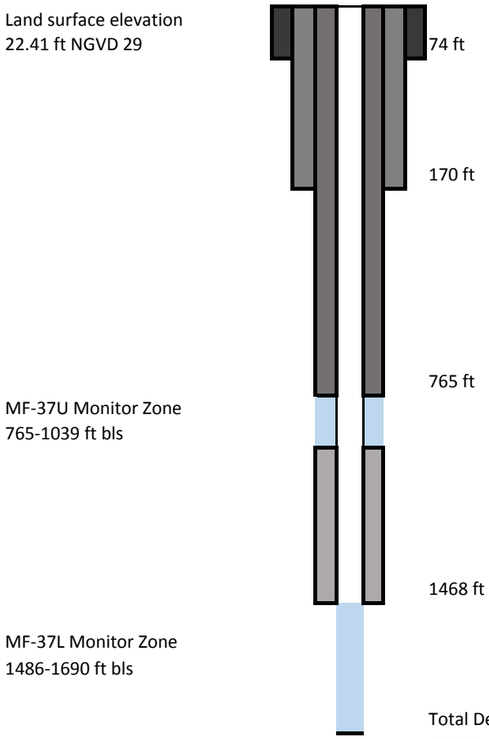
Parameter	Concentration (mg/L)
Potassium (K)	123
Sodium (Na)	3741
Calcium (Ca)	480
Magnesium (Mg)	495
Chloride (Cl)	7508
Bicarbonate (HCO3)	117
Sulfate (SO4)	1578



Survey data: 6/10/2009
Reference elevation: Post modification 19.04 ft NGVD 29 (previously 18.65 ft NGVD 29)
Data Adjustments: Datum offset 1.358 ft
References
Bennett, M.W., 2003
Hydrogeologic investigation of the Floridan Aquifer System
LaBelle, Hendry County, Florida. Technical Publication WS-15
CH2M Hill - modification as built diagram (DBhydro)
SFWMD Survey, 2009

Site Name	**MF37**
Station Names	MF-37L, MF-37U
Aquifers	Upper Floridan, Avon Park Permeable Zone
FDEP Identifier	Unknown
Date of this summary	6/28/2017

Lat / Long:	265928.87 / 803616.48
County:	Martin
Wellhead Repair Date:	Initial contruction left the well open from 750 -1740 ft bls. 2007: well was retrofitted to dual-zone contruction. 2012: Sandblast and paint, replace valve(s) with stainless steel

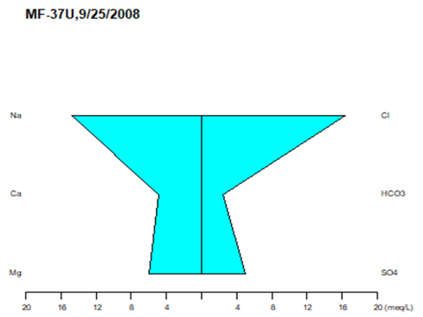


2017

Survey data:	6/26/08 NGVD29 offset +0.96
Reference elevations:	NAVD88: MF-37L measuring point 27.03, sensor 27.01, MF-37U measuring point 25.36, sensor 25.37
References	SFWMD Survey 6/26/08
	MACTEC Engineering and Consulting, 2007. MF-37 Dual Zone Monitoring Well Conversion at Site 3 Port Mayaca Lake Okeechobee ASR Pilot Project, USACE Contract. 400p.

MF-37U Monitor Zone

Casing Material:	Steel
Diameter:	12 inches
Data Range:	2007-2011
Sampling Events Analyzed:	6
Water Type:	Na-Mg-Cl-SO4



Field Parameter Averages MF-37U

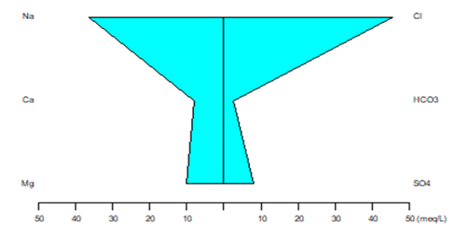
Field pH:	7.53
Specific Condutance (uS/cm)	2637
Temperature (Celcius)	28.45
TDS (mg/L)	1571
Water Level (ft NGVD 29)	52.61

MF-37U Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	9	10
Sodium (Na)	305	338
Calcium (Ca)	92	97
Magnesium (Mg)	68	73
Chloride (Cl)	563	631
Bicarbonate (HCO_3)	148	154
Sulfate (SO_4)	238	262

MF-37L Monitor Zone

Casing Material:	Steel
Diameter:	4 inches
Data Range:	2007 - 2011
Sampling Events Analyzed:	6
Water Type:	Na-Cl



Field Parameter Averages MF-37L

Field pH:	7.43
Specific Condutance (uS/cm)	5703
Temperature (Celcius)	28.37
TDS (mg/L)	3369.00
Water Level (ft NGVD 29)	51.35

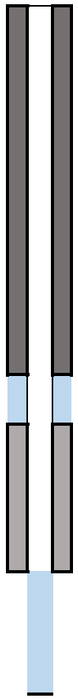
MF-37L Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	22	25
Sodium (Na)	750	865
Calcium (Ca)	140	190
Magnesium (Mg)	110	125
Chloride (Cl)	1516	1619
Bicarbonate (HCO_3)	74	159
Sulfate (SO_4)	340	380

Site Name	**MFH40**
Station Names	MF-40U, MF-40L
Aquifers	Upper Floridan, APPZ
FDEP Identifier	Unknown
Date of this summary	6/26/2017

Lat / Long:	271221.4 / 802832.5
County:	Martin
Wellhead Repair Date:	7/09 Wellhead redone in Stainless Steel

Land surface elevation



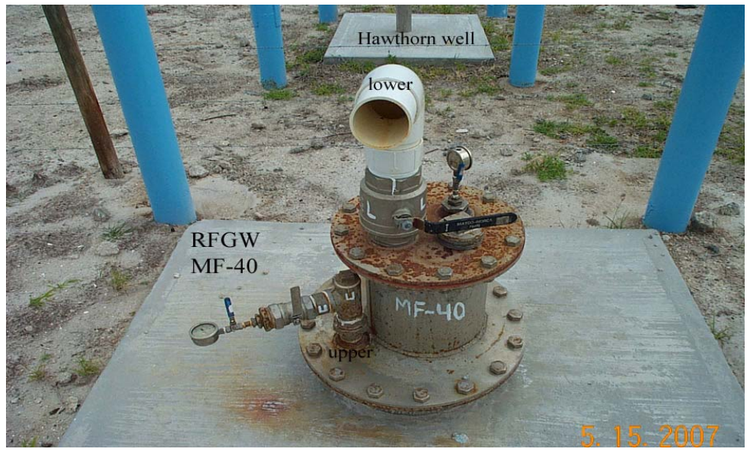
790 ft

MF-40U Monitor Zone
790 - 970 ft bls

1100 ft

MF-40L Monitor Zone
1100-1200 ft bls

Total Depth
1240 ft



5/15/2007

Survey data:	NGVD 29 offset + 2.98
Reference elevations:	MF-40U 34.72 ft NGVD29, MF-40L 35.62 ft NGVD29
References	Date of Survey 3/6/06

MF-40U Monitor Zone

Casing Material:	Steel
Diameter:	18 inches
Data Range:	
Sampling Events Analyzed:	0
Water Type:	

MF-40L Monitor Zone

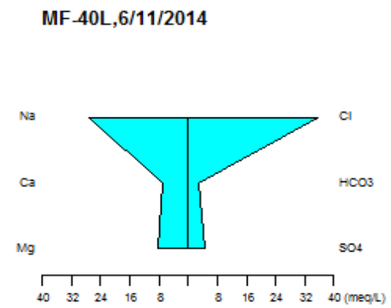
Casing Material:	Steel
Diameter:	12 inches
Data Range:	2009-2014
Sampling Events Analyzed:	3
Water Type:	Na-Cl

Field Parameter Averages MF-40L

Field pH:	7.47
Specific Condutance (uS/cm)	4153
Temperature (Celcius)	31.97
TDS (mg/L)	2585
Water Level (ft NGVD 29)	49.03

MF-40L Ionic Ranges

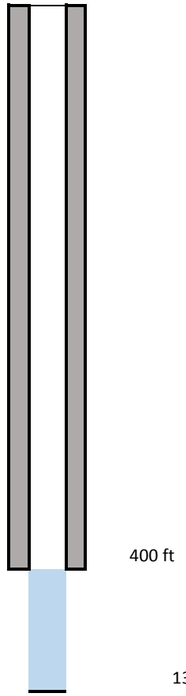
Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	18	19
Sodium (Na)	587	622
Calcium (Ca)	55	140
Magnesium (Mg)	82	100
Chloride (Cl)	1115	1257
Bicarbonate (HCO3)	35	166
Sulfate (SO4)	78	211



Site Name	**MF52**	Lat / Long:	270506.479 / 802308.198
Station Names	MF-52	County:	Martin
Aquifers	Upper Floridan Aquifer	Wellhead Repair Date:	2007 Redone in Stainless Steel
FDEP Identifier	Unknown		
Date of this summary	6/26/2017		

not to scale

Land Surface
Elevation
29.6 ft NAVD88



400 ft

Monitor Zone
400-1320 ft bls

1320

2011

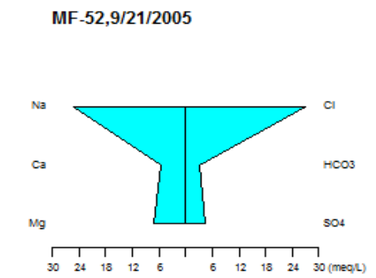
Monitor Zone	
Casing Material:	Unknown
Diameter:	10 inches
Data Range:	2005
Sampling Events Analyzed:	1
Water Type:	Na-Cl

Field Parameter Averages Monitor Zone

Field pH:	7.26
Specific Condutance (uS/cm)	3930.00
Temperature (Celcius)	28.61
TDS (mg/L)	2200
Water Level (ft NGVD 29)	51.00

Monitor Zone Ionic Ranges

Parameter	Concentration (mg/L)
Potassium (K)	19
Sodium (Na)	582
Calcium (Ca)	110
Magnesium (Mg)	89
Chloride (Cl)	960
Bicarbonate (HCO3)	195
Sulfate (SO4)	160

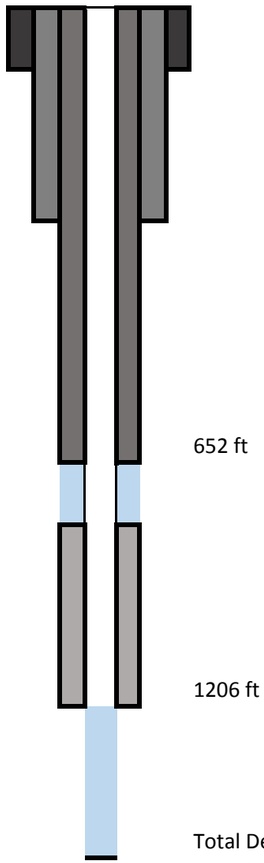


Survey data: 1/7/08 NGVD29 offset + 1.424
Reference elevations: Upper Measuring Point (MP1) 22.558 ft NGVD29, Lower Measuring Point (MP2) 31.735 ft NGVD29
References SFWMD Survey 1/7/08

Site Name	**MF52R**
Station Names	MF-52RU and MF-52RL
Aquifers	Upper Floridan, Avon Park Permeable Zone
FDEP Identifier	Unknown
Date of this summary	1/4/2018

Lat / Long:	270518.73 / 802305.22
County:	Martin
Wellhead Repair Date:	None

Land surface elevation
22.68 ft NAVD 88



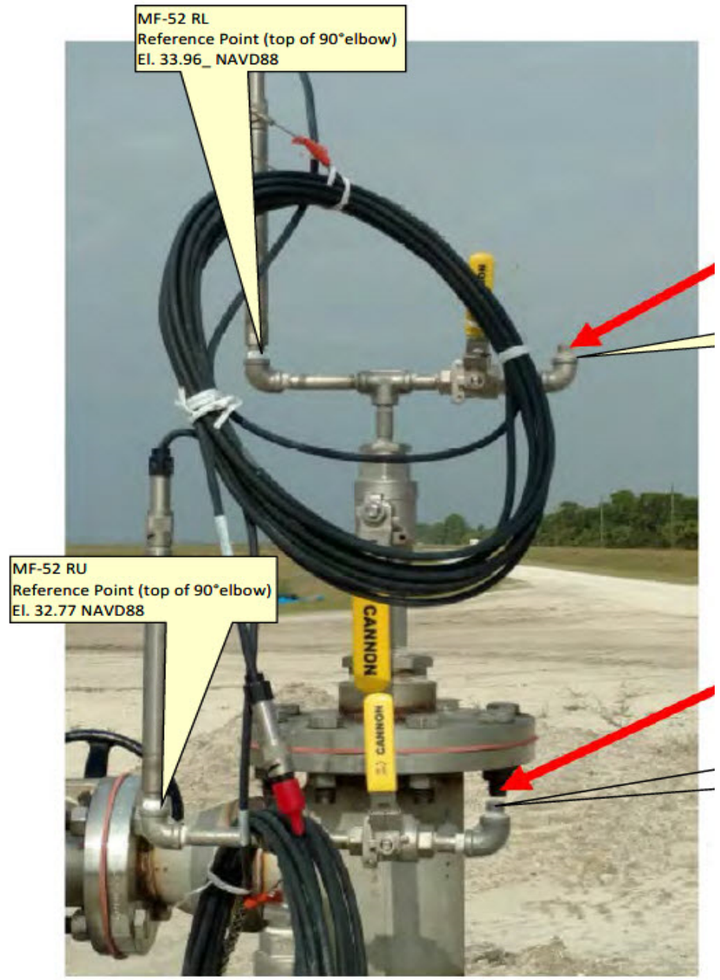
652 ft

MF-37U Monitor Zone
652 - 802 ft bls

1206 ft

MF-37L Monitor Zone
1206 - 1450 ft bls

Total Depth
1450 ft



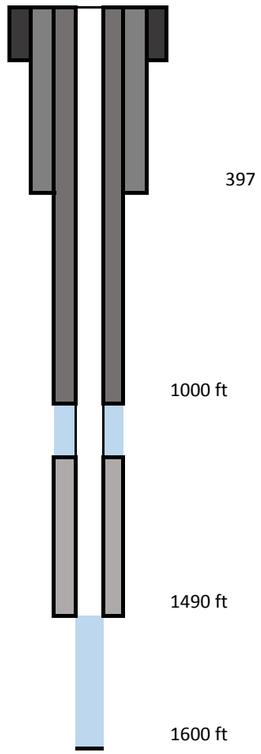
Date of photo: 2017

Survey data:	6/14/17 NGVD29 offset +1.42
Reference elevations:	NAVD88: MF-52RU measuring point 32.77 and MF-52RL measuring point 33.96
References	Betsy Lindsay, Inc Survey 6/14/2017
	KLJ Letter of Transmittal 6/28/2017 Monitor Well As Built Drawings
Note	Newly constructed well
	Water quality data is not available at time of publishing.

Site Name	**MIUGW**
Station Names	MIU-MZ1 and MIU-MZ2
Aquifers	UFA and MCU
FDEP Identifier	Unknown
Date of this summary	7/12/2017

Lat / Long:	255733, 814324
County:	Collier
Wellhead Repair Date:	2011, 2015

Land surface elevation
4.6 ft NAVD 88



MIU-MZ1 Monitor Zone
1000 - 1089 ft bls

MIU-MZ2 Monitor Zone
1490 - 1600 ft bls

Date of Photo: 2006

Survey data:	3/28/2017
Reference elevations:	MIU-GW1 8.88 ft NAVD 88, (offset 1.31 ft for NGVD)
References	Missimer & Associated, Inc., 1992.
	Marco Island Injection Well No. 1 Well Completion Report Volume 1
	SFWMD Survey, 2017

MIU-MZ1

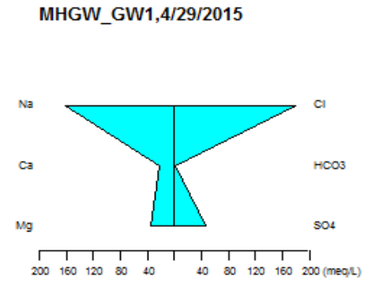
Casing Material:	Steel
Diameter:	16 inch
Data Range:	1996 - 2015
Sampling Events Analyzed:	13
Water Type:	Na-Cl

MIU-MZ1 Field Parameter Averages

Field pH:	7.89
Specific Condutance (uS/cm)	43433
Temperature (Celcius)	28.7
TDS (mg/L)	29622
Water Level (ft NGVD 29)	41.64

MIU-MZ1 Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	272	514
Sodium (Na)	8179	10534
Calcium (Ca)	358	571
Magnesium (Mg)	890	1061
Chloride (Cl)	14000	18021
Bicarbonate (HCO3)	16	163
Sulfate (SO4)	1933	2475



MIU-MZ2

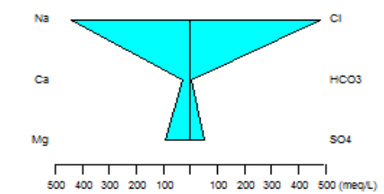
Casing Material:	Fiberglass
Diameter:	6 5/8 inch
Data Range:	1996 - 2015
Sampling Events Analyzed:	13
Water Type:	Na-Cl

MIU-MZ2 Field Parameter Averages

Field pH:	7.22
Specific Condutance (uS/cm)	51669
Temperature (Celcius)	30.08
TDS (mg/L)	34796
Water Level (ft NGVD 29)	13.85

MIU-MZ2 Ionic Ranges

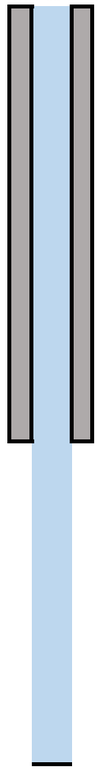
Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	333	520
Sodium (Na)	8412	11410
Calcium (Ca)	461	670
Magnesium (Mg)	907	1209
Chloride (Cl)	16000	20000
Bicarbonate (HCO3)	134	158
Sulfate (SO4)	2034	2700



Site Name	**MOSSPK**
Station Names	MOSSPK_D
Aquifers	UFA
FDEP Identifier	Unknown
Date of this sumn	10/23/2017

Lat / Long:	282242.02 / 811127.225
County:	Orange
Wellhead Repair Date:	Unknown

not to scale



Land Surface Elevation

240 ft

MOSSPK_D Monitor Zone

302 ft

Date of Photo: 2007

Survey data:	9/25/2007
	Reference elevation 72.29 ft NGVD 29
	To convert to NAVD 88 add 1.04 ft
References	SFWMD survey 9/25/2007

MOSSPK_D Monitor Zone

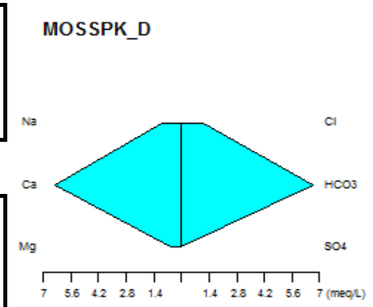
Casing Material:	Steel
Diameter:	4-inch
Data Range:	2005
Sampling Events Analyzed:	1
Water Type:	Ca-HCO3

Field Parameters MOSSPK_D

Field pH:	6.58
Specific Condutance (uS/cm)	773
Temperature (Celcius)	24.4
TDS (mg/L)	480
Water Level (ft NGVD 29)	41.01

MOSSPK_D Ionic Concentrations

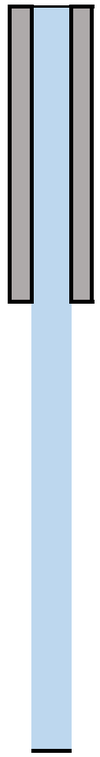
Parameter	Concentration (mg/L)
Potassium (K)	1
Sodium (Na)	24
Calcium (Ca)	129
Magnesium (Mg)	7
Chloride (Cl)	39
Bicarbonate (HCO_3)	407
Sulfate (SO_4)	0



Site Name	**S65CGW**	Lat / Long:	272402.96 / 810655.94
Station Names	OKF-42	County:	Okeechobee
Aquifers	Upper Floridan	Wellhead Repair Date:	Well abandoned 2017
FDEP Identifier	unknown		
Date of this summ	6/28/2017		

not to scale

Land Surface Elevation



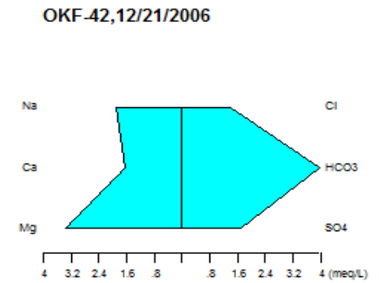
370 ft

Monitor Zone
370-1152 ft bls

Total Depth
1152 ft

11/9/2006

OKF-42 Monitor Zone	
Casing Material:	PVC
Diameter:	6-inch
Data Range:	1984-2006
Sampling Events Analyzed:	20
Water Type:	Mg-Na-Ca-HCO3-SO4



Field Parameter Averages OKF-42

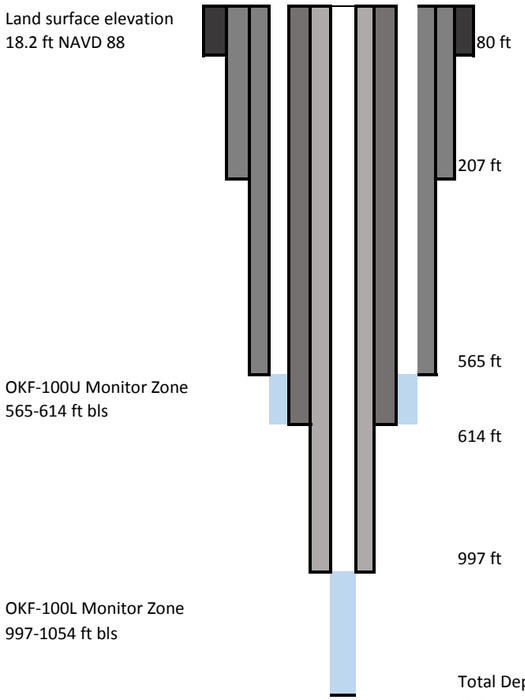
Field pH:	7.44
Specific Condutance (uS/cm)	760
Temperature (Celcius)	25.56
TDS (mg/L)	371
Water Level (ft NGVD 29)	45.62

OKF-42 Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	1	6
Sodium (Na)	38	102
Calcium (Ca)	29	40
Magnesium (Mg)	8	42
Chloride (Cl)	50	69
Bicarbonate (HCO_3)	208	276
Sulfate (SO_4)	53	120

Reference USACE, 2017. Kissimmee River Restoration Project. Report of the Plug and Abandonment of Artesian Well OKF-42 and Surficial Aqiofer Well. Okeechobee and Highlands Counties. 79p.

Site Name	**OKF100** (Floridan Aquifer System)	Lat / Long:	270917.348 / 805216.254
Station Names	OKF-100U, OKF-100L	County:	Okeechobee
Aquifers	Upper Florida, Avon Park Permeable Zone	Wellhead Repair Date:	Originally an open well from 565-1350 ft. Was retrofitted in 2006 to be a dual zone well.
FDEP Identifier	Unknown		
Date of this summary	6/28/2017		

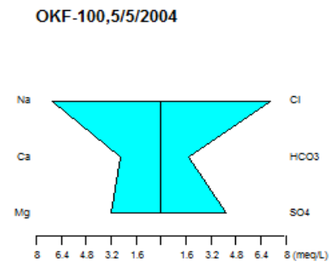


5/15/2007

Survey data: 2/15/2016
Reference elevations: OKF-100U 21.09 ft NAVD 88 and OKF-100L 22.64 ft NAVD 88
Data Adjustments: To convert to NGVD 29 add 1.27 ft
References SFWMD Survey Report, 2016
USACE, 2006. Lake Okeechobee ASR Regional Project Site Characterization Report
Conversion of Well OKF-100 from a Single-Zone Test Well to a Dual-Zone Monitoring Well Site 2 (Kissimmee River Site), Okeechobee County, Florida. 283p.

OKF-100 Monitor Zone - before modification	
Casing Material:	Steel
Diameter:	12 inches
Data Range:	2004
Sampling Events Analyzed:	1
Water Type:	Na-Mg-Ca-Cl-SO4

OKF-100U results are not representative of native water. Impacted by Kissimmee River ASR.



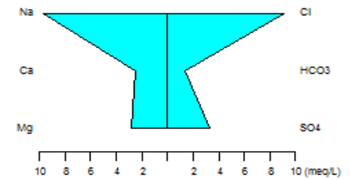
Field Parameters OKF-100 - before modification

Field pH:	7.78
Specific Condutance (uS/cm)	1387
Temperature (Celcius)	25.29
TDS (mg/L)	809
Water Level (ft NGVD 29)	47.86

OKF-100 Ionic Ranges - before modification

Parameter	Concentration (mg/L)
Potassium (K)	9
Sodium (Na)	160
Calcium (Ca)	53
Magnesium (Mg)	39
Chloride (Cl)	250
Bicarbonate (HCO3)	111
Sulfate (SO4)	200

OKF-100L Monitor Zone	
Casing Material:	Steel
Diameter:	4 inches
Data Range:	2007-2008
Sampling Events Analyzed:	3
Water Type:	Na-Cl-SO4



Field Parameter Averages OKF-100L

Field pH:	8.13
Specific Condutance (uS/cm)	1501
Temperature (Celcius)	26.7
TDS (mg/L)	883
Water Level (ft NGVD 29)	47.66

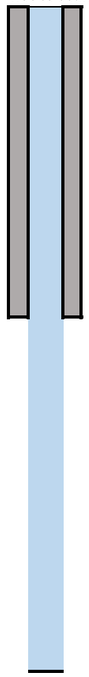
OKF-100L Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	5	7
Sodium (Na)	150	222
Calcium (Ca)	49	51
Magnesium (Mg)	35	36
Chloride (Cl)	245	323
Bicarbonate (HCO3)	84	106
Sulfate (SO4)	160	173

Site Name	**OKEEUA**
Station Names	OKF-101
Aquifers	Upper Floridan
FDEP Identifier	Unknown
Date of this summary	10/24/2017

Lat / Long:	271152.176 / 805022.577
County:	Okeechobee
Wellhead Repair Date:	10/1/2011

not to scale



Land Surface Elevation -2 ft

372 ft

Monitor Zone
372-800 ft bls

Total Depth
800 ft

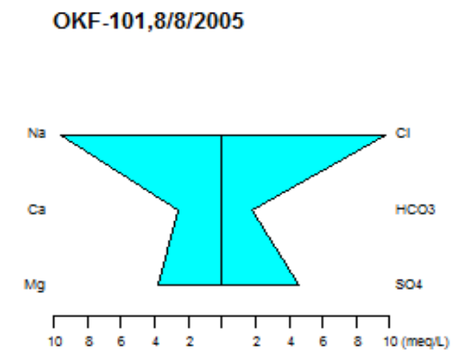
OKF-101 Monitor Zone	
Casing Material:	Steel
Diameter:	6-inch
Data Range:	2005
Sampling Events Analyzed:	1
Water Type:	Na-Mg-Cl-SO4

Field Parameters OKF-101

Field pH:	7.73
Specific Condutance (uS/cm)	1765
Temperature (Celcius)	24.8
TDS (mg/L)	1040
Water Level (ft NGVD 29)	46.96

OKF-101 Ionic Concentrations

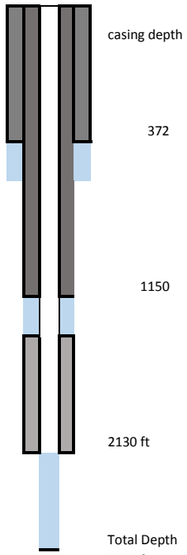
Parameter	Concentration (mg/L)
Potassium (K)	10
Sodium (Na)	221
Calcium (Ca)	52
Magnesium (Mg)	47
Chloride (Cl)	345
Bicarbonate (HCO_3)	112
Sulfate (SO_4)	220



Survey data: 1/25/05 NGVD 29 offset + 1.28
Reference elevations: 17.262 NAVD 88
References SFWMD survey

2005

Site Name	**OKF105**	Lat / Long:	272407.3 / 810651.1
Station Names	OKF-105L, OKF-105M, OKF-105U	County:	Okeechobee
Aquifers	Upper Floridan, Avon-Park Permeable Zone, Lower Floridan Confining Unit	Wellhead Repair Date:	Noember 2013
FDEP Identifier	Unknown		
Date of this summary	6/28/2017		



6/17/2015

Survey data:	6/10/2014
Reference elevations:	OKF-105U 41.063 ft NAVD 88, OFK-105M 43.143 ft NAVD 88 and OKF-105L 44.113 ft NAVD 88
Data Adjustments:	To convert to NGVD 29 add 1.175
References	SFWMD, 2011. Hydrogeologicl Investigation of the Floridan Aquifer System at S-65C Site (Well OKF-105) Okeechobee County, Florida, Technical Publication WS-32. 288p. SFWMD survey, June 2014

Note: During construction a packer test #3 was done in the LFA-FZ1 zone. The field parameter and ionic concentrations are below. Water type was Na-Cl

Field Parameter Concentrations OKF-105	
Field pH:	6.38
Specific Condutance (uS/	10931
Temperature (Celcius)	29.99
TDS (mg/L)	6681

OKF-105 Ionic Ranges	
Parameter	Concentration (mg/L)
Potassium (K)	56
Sodium (Na)	1681
Calcium (Ca)	239
Magnesium (Mg)	240
Chloride (Cl)	3193
Bicarbonate (HCO3)	109
Sulfate (SO4)	722

OKF-105U Monitor Zone

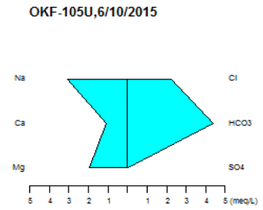
Casing Material:	Steel
Diameter:	18 inches
Data Range:	2013-2015
Sampling Events Analyzed:	2
Water Type:	Na-Mg-HCO3-Cl

Field Parameter Averages OKF-105U

Field pH:	7.85
Specific Condutance (uS/cm)	812.00
Temperature (Celcius)	24.35
TDS (mg/L)	384
Water Level (ft NGVD 29)	45.67

OKF-105U Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	7.6	7.8
Sodium (Na)	70.9	116.3
Calcium (Ca)	21.5	22.3
Magnesium (Mg)	23.5	23.7
Chloride (Cl)	79.2	153
Bicarbonate (HCO3)	262	268
Sulfate (SO4)	1.2	2



OKF-105M Monitor Zone

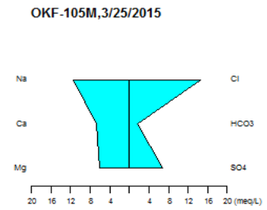
Casing Material:	Steel
Diameter:	12 inches
Data Range:	2009-2015
Sampling Events Analyzed:	4
Water Type:	Na-Ca-Mg-Cl-SO4

Field Parameter Averages OKF-105M

Field pH:	7.83
Specific Condutance (uS/cm)	2517
Temperature (Celcius)	28.5
TDS (mg/L)	1499.00
Water Level (ft NGVD 29)	45.39

OKF-105M Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	6.7	7
Sodium (Na)	258	261
Calcium (Ca)	128	137
Magnesium (Mg)	71	75
Chloride (Cl)	495	536
Bicarbonate (HCO3)	94	95
Sulfate (SO4)	325	359



OKF-105L Monitor Zone

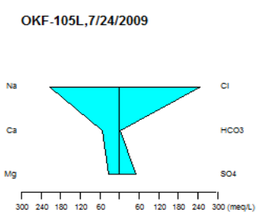
Casing Material:	Fiberglass
Diameter:	5 inches
Data Range:	2009
Sampling Events Analyzed:	1
Water Type:	Na-Cl

Field Parameter Averages OKF-105L

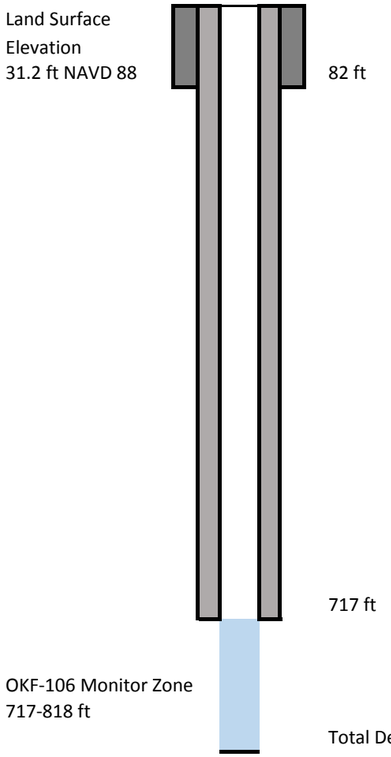
Field pH:	6.6
Specific Condutance (uS/cm)	27668
Temperature (Celcius)	31.2
TDS (mg/L)	18836
Water Level (ft NGVD 29)	51.06

OKF-105L Ionic Concentrations

Parameter	Concentration (mg/L)
Potassium (K)	180
Sodium (Na)	4890
Calcium (Ca)	1067
Magnesium (Mg)	419
Chloride (Cl)	8783
Bicarbonate (HCO3)	51
Sulfate (SO4)	2358



Site Name	**L63NCW**	Lat / Long:	271416.376 / 804708.028
Station Names	OKF-106	County:	Okeechobee
Aquifers	Upper Floridan	Wellhead Repair Date:	None
FDEP Identifier	Unknown		
Date of this summ	6/28/2017		

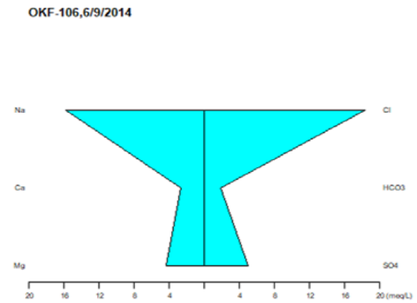


5/27/2014

Survey data:	4/17/2017
Reference elevations:	36.75 ft NAVD 88
Data Adjustments:	To convert to NGVD 29 add 1.253 ft
References	SFWMD Survey, 2017
	SFWMD, 2008. Construction and Testing of an Upper Floridan Aquifer Mointor Well L-63N Canal ASR Site, Okeechobee, Florida. Technical Publication WS-27. 534p.

OKF-106 Monitor Zone

Casing Material:	PVC
Diameter:	10 inches
Data Range:	2014
Sampling Events Analyzed:	1
Water Type:	Na-Cl-SO4



Field Parameter Concentrations OKF-106

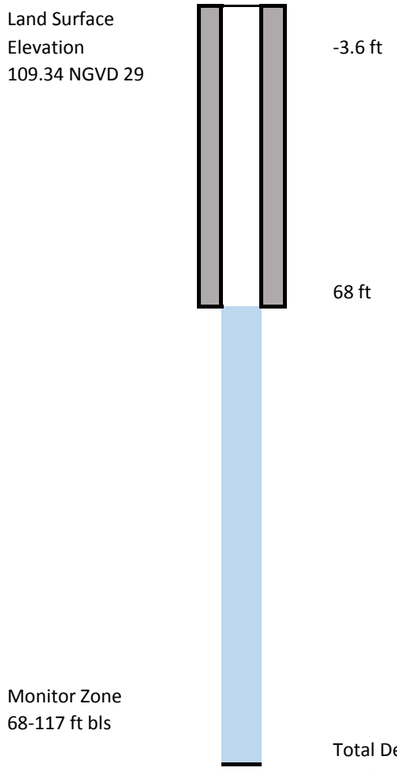
Field pH:	7.8
Specific Condutance (uS/cm)	2612
Temperature (Celcius)	26.5
TDS (mg/L)	1590
Water Level (ft NGVD 29)	45.06

OKF-106 Ionic Concentrations

Parameter	Concentration (mg/L)
Potassium (K)	13.9
Sodium (Na)	363.7
Calcium (Ca)	53
Magnesium (Mg)	53.1
Chloride (Cl)	650
Bicarbonate (HCO_3)	112.2
Sulfate (SO_4)	239

Site Name	**SW15**
Station Names	ORF-29
Aquifers	Upper Floridan
FDEP Identifier	Unknown
Date of this sumn	6/29/2017

Lat / Long:	282332.017 / 813707.251
County:	Orange
Wellhead Repair Date:	Unknown



Date of photo: 2007

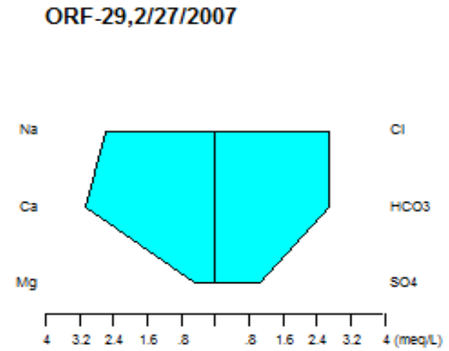
Survey data:	2007
Reference elevations:	111.40 ft NAVD 88
Data Adjustments:	To convert to NGVD 29 add 0.94 ft
References	SFWMD survey 2007

Monitor Zone

Casing Material:	PVC
Diameter:	4-inch
Data Range:	2005-2007
Sampling Events Analyzed:	3
Water Type:	Ca-Na-Cl-HCO3

Field Parameter Averages Monitor Zone

Field pH:	7.25
Specific Condutance (uS/cm)	678
Temperature (Celcius)	26.73
TDS (mg/L)	335
Water Level (ft NGVD 29)	101.34

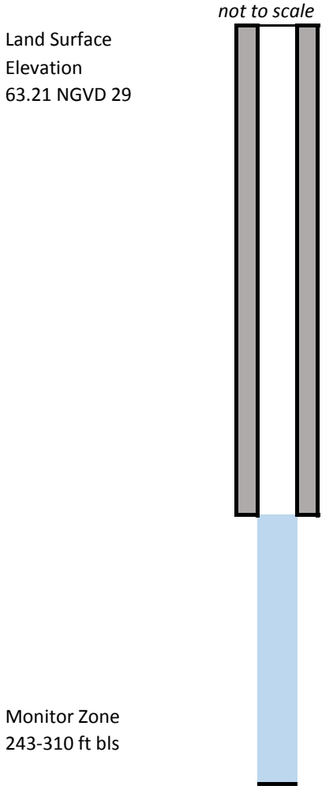


Monitor Zone Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	7.2	7.85
Sodium (Na)	55.6	59.4
Calcium (Ca)	61.5	62.5
Magnesium (Mg)	5.56	5.84
Chloride (Cl)	92.1	95.1
Bicarbonate (HCO3)	156.1	163.4
Sulfate (SO4)	49.2	50.7

Site Name	**LMARIN**	Lat / Long:	275222.972 / 810307.816
Station Names	OSF-3	County:	Osceola
Aquifers	Upper Floridan Aquifer	Wellhead Repair Date:	Unknown
FDEP Identifier	Unknown		
Date of this summary	6/29/17		

not to scale



3/11/2006

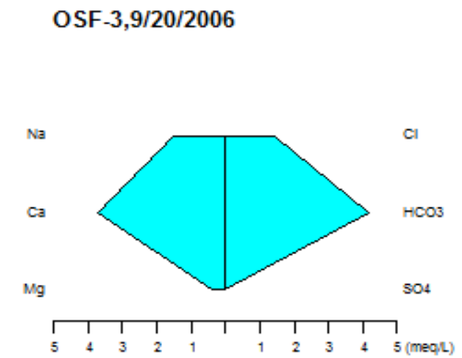
(OSS-77 is the small well on the left).

Monitor Zone

Casing Material:	Steel
Diameter:	4 inches
Data Range:	1979-2006
Sampling Events Analyzed:	6
Water Type:	Ca-Na-HCO3-Cl

Field Parameter Averages Monitor Zone

Field pH:	7.68
Specific Condutance (uS/cm)	543
Temperature (Celcius)	24.17
TDS (mg/L)	314
Water Level (ft NGVD 29)	53.87



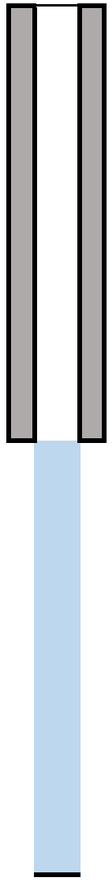
Monitor Zone Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	1	3
Sodium (Na)	34	42
Calcium (Ca)	59	74
Magnesium (Mg)	5	7
Chloride (Cl)	47	56
Bicarbonate (HCO_3)	227	264
Sulfate (SO_4)	1	15

Survey data:	2/21/05	NGVD 29 offset + 1.216
Reference elevations:	from survey - one for each station	
Borehole Well Volume:	202 gallons	
References	SFWMD survey 2005	

Site Name	**8171090**	Lat / Long:	281715.032 / 810929.223
Station Names	OSF-22	County:	Osceola
Aquifers	Upper Floridan	Wellhead Repair Date:	Unknown
FDEP Identifier	Unknown	No photo available	
Date of this summ	6/29/2017		

Land Surface Elevation
64.78 NGVD 29



-1 ft

394 ft

Monitor Zone
394-750 ft bls

Total Depth
750 ft

Monitor Zone

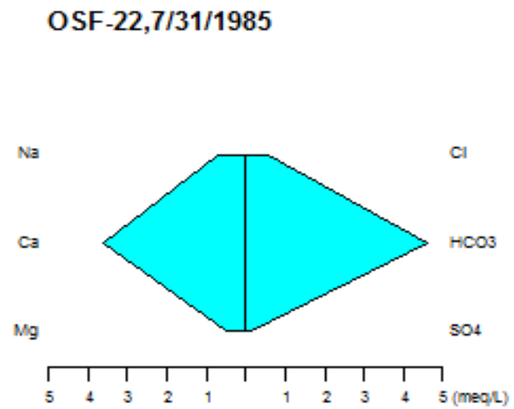
Casing Material:	Steel
Diameter:	8 inches
Data Range:	1985
Sampling Events Analyzed:	1
Water Type:	Ca-HCO3

Field Parameter Averages Monitor Zone

Field pH:	7.6
Specific Condutance (uS/cm)	467
Temperature (Celcius)	23
TDS (mg/L)	294
Water Level (ft NGVD 29)	42.51

Monitor Zone Ionic Ranges

Parameter	Concentration (mg/L)
Potassium (K)	1
Sodium (Na)	17
Calcium (Ca)	72
Magnesium (Mg)	6
Chloride (Cl)	21
Bicarbonate (HCO_3)	280
Sulfate (SO_4)	6



Reference FGS, 1969. Well construction information form

Site Name	**S65GW**
Station Names	OSF-53
Aquifers	Floridan Aquifer System
FDEP Identifier	Unknown
Date of summary	11/7/2017

Lat / Long:	280823.692/812104.238
County:	Osceola
Wellhead Repair Date:	Being modified 2017

not to scale

Land Surface Elevation

160 ft

Monitor Zone
160-963 ft bls

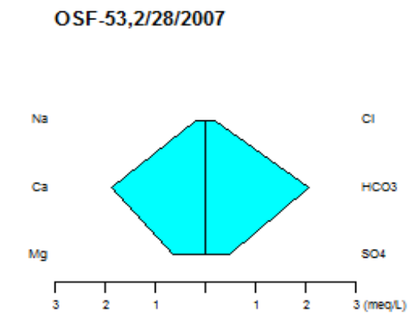
Total Depth
963 ft

Date of photo: August 2017. OSF-53 is on the left

Monitor Zone	
Casing Material:	PVC
Diameter:	6-inch
Data Range:	1982 - 2007
Sampling Events Analyzed:	7
Water Type:	Ca-Mg-HCO3

Field Parameter Averages Monitor Zone

Field pH:	7.71
Specific Condutance (uS/cm)	236
Temperature (Celcius)	25.53
TDS (mg/L)	175
Water Level (ft NGVD 29)	50.80



Monitor Zone Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	0.7	0.9
Sodium (Na)	4	6
Calcium (Ca)	35	39
Magnesium (Mg)	6	9
Chloride (Cl)	6	11
Bicarbonate (HCO3)	105	126
Sulfate (SO4)	9	25

Survey data:	December 2007
Reference elevations:	60.365 ft NAVD 88
Data Adjustments:	61.408 ft NGVD 29
References	Survey documents December 2007
Borehole Volume:	Well being modified 2017

Site Name	**TPKDOT**
Station Names	OSF-60
Aquifers	Floridan Aquifer System
FDEP Identifier	Unknown
Date of this summary	6/29/2017

Lat / Long:	274148.241 / 805346.179
County:	Osceola
Wellhead Repair Date:	Unknown

not to scale

Land Surface Elevation
63.28 NGVD 29

328 ft

Monitor Zone
328-590 ft bls

Total Depth
590 ft

Date of photo: 11/20/2007

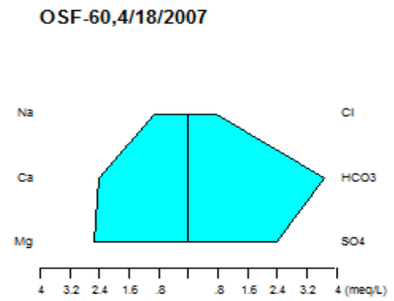
Survey data:	2/21/05 NGVD 29 offset + 1.246
Reference elevations:	62.193 NAVD 88
References	SFWMD survey 2005
Borehole volume:	1541 gallons

Monitor Zone

Casing Material:	PVC or Plastic
Diameter:	8 inches
Data Range:	1993-2007
Sampling Events Analyzed:	4
Water Type:	Mg-Ca-HCO3-SO4

Field Parameter Averages Monitor Zone

Field pH:	7.35
Specific Condutance (uS/cm)	616
Temperature (Celcius)	24.8
TDS (mg/L)	429
Water Level (ft NGVD 29)	43.17



Monitor Zone Ionic Ranges

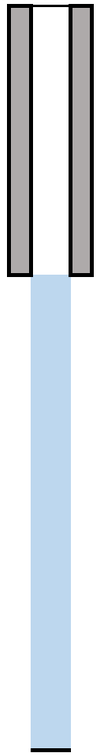
Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	1.7	2.5
Sodium (Na)	19.8	22.1
Calcium (Ca)	42	49
Magnesium (Mg)	30.4	31.4
Chloride (Cl)	26	29
Bicarbonate (HCO_3)	224	259
Sulfate (SO_4)	16	118

Site Name	**OSF62**
Station Names	OSF-62
Aquifers	Upper Floridan
FDEP Identifier	Unknown
Date of this summary	6/29/2017

Lat / Long:	275403.58 / 810240.81
County:	Osceola
Wellhead Repair Date:	Unknown

not to scale

Land Surface Elevation
70.62 NGVD 29



260 ft

Monitor Zone
260-630 ft bls

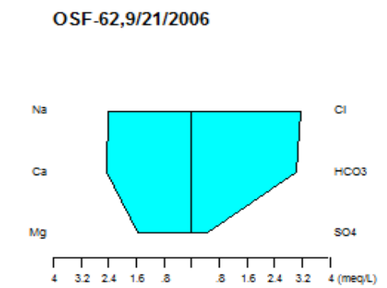
Total Depth
630 ft

Date of photo: 3/19/2003

Survey data:	August 15, 2006
Reference elevations:	71.83 ft NGVD 29
Data Adjustments:	subtract 1.198 to convert to NAVD 88
Access Agreement:	FDOT 10/25/2017
References	SFWMD survey August 2006
Borehole Volume:	1645 gallons

Monitor Zone

Casing Material:	PVC
Diameter:	8-inch
Data Range:	2005 - 2006
Sampling Events Analyzed:	2
Water Type:	Ca-Na-Mg-Cl-HCO3



Field Parameter Averages Monitor Zone

Field pH:	7.21
Specific Condutance (uS/cm)	707
Temperature (Celcius)	25.8
TDS (mg/L)	408
Water Level (ft NGVD 29)	43.21

Monitor Zone Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	2.08	2.2
Sodium (Na)	55.3	59.3
Calcium (Ca)	49.5	49.9
Magnesium (Mg)	19	20.1
Chloride (Cl)	112	112
Bicarbonate (HCO3)	185	186
Sulfate (SO4)	16	23

Site Name	**OSF64**
Station Names	OSF-64
Aquifers	Upper Floridan
FDEP Identifier	Unknown
Date of this summary	11/7/2017

Lat / Long:	280420.648/811646.612
County:	Osceola
Wellhead Repair Date:	Unknown

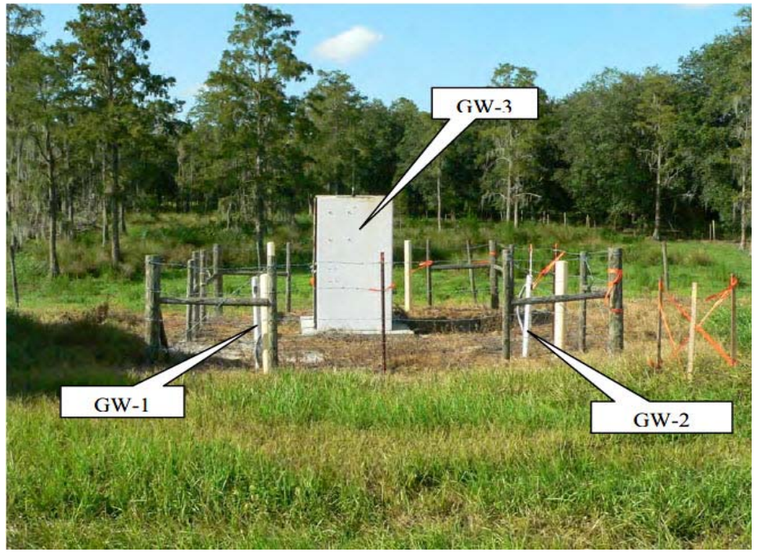
not to scale

Land Surface Elevation

310 ft

Monitor Zone
310-610 ft bls

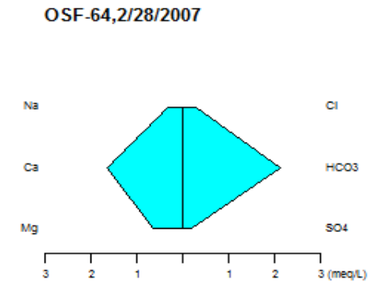
Total Depth
610 ft



OSF-64 is in the center (labelled as GW-3) - photo August 2006

Monitor Zone

Casing Material:	Unknown
Diameter:	8-inch
Data Range:	2005 - 2007
Sampling Events Analyzed:	3
Water Type:	Ca-Mg-HCO3



Field Parameter Averages Monitor Zone

Field pH:	7.73
Specific Condutance (uS/cm)	257
Temperature (Celcius)	25.07
TDS (mg/L)	149
Water Level (ft NGVD 29)	50.31

Monitor Zone Ionic Ranges

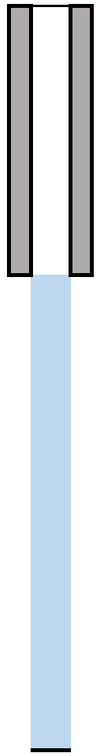
Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	0.95	1.02
Sodium (Na)	6.99	7.43
Calcium (Ca)	32.2	33.3
Magnesium (Mg)	7.75	8.09
Chloride (Cl)	10.2	10.9
Bicarbonate (HCO3)	123	129
Sulfate (SO4)	9.34	9.6

Survey data:	June 25, 2015
Reference elevations:	61.89 ft NAVD 88 - to convert to NGVD 29 add 1.14 ft
Data Adjustments:	Data was adjused from 2001 - 2004 from old NGVD 29 reference point 63.60 ft
References	SFWMD survey June 2015
Borehole Volume:	1593 gallons

Site Name	**OSF66**
Station Names	OSF-66
Aquifers	Upper Floridan
FDEP Identifier	Unknown
Date of this summary	11/7/2017

Lat / Long:	280138.066 / 8111123.124
County:	Osceola
Wellhead Repair Date:	Unknown

not to scale



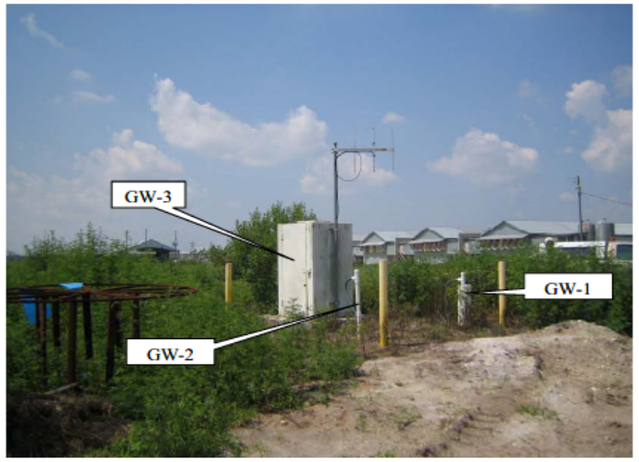
Land Surface Elevation
76.65 ft NAVD 88

260 ft

Monitor Zone
260-670 ft bls

Total Depth
670 ft

OSF-66



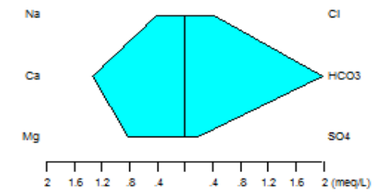
OSF-66 is labelled as GW-3

Survey data:	7/6/2015
Reference elevations:	79.57 ft NAVD 88
Data Adjustments:	add 1.19 ft for NGVD 29
Access Agreement:	FDOT October 2017
References	SFWMD 2015 survey
Borehole Volume:	1671 gallons

Monitor Zone

Casing Material:	PVC
Diameter:	8-inch
Data Range:	2004 - 2006
Sampling Events Analyzed:	10
Water Type:	Ca-Mg-HCO3

OSF-66,12/3/2006



Field Parameter Averages Monitor Zone

Field pH:	7.8
Specific Condutance (uS/cm)	256
Temperature (Celcius)	24.05
TDS (mg/L)	154
Water Level (ft NGVD 29)	47.57

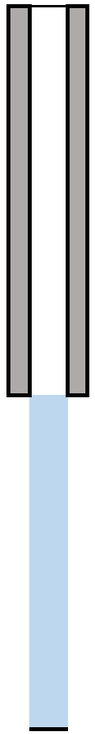
Monitor Zone Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	0.48	1.3
Sodium (Na)	7.79	10.8
Calcium (Ca)	25	27.2
Magnesium (Mg)	9.26	10.1
Chloride (Cl)	13.5	16
Bicarbonate (HCO3)	111	122
Sulfate (SO4)	6.2	20

Site Name	**OSF70**
Station Names	OSF-70R
Aquifers	Upper Floridan
FDEP Identifier	Unknow
Date of this summary	6/29/2017

Lat / Long:	281508.51 / 811941.51
County:	Osceola
Wellhead Repair Date:	OSF-70 was backfilled in 2008 from 470 ft bls to 246 ft bls. Now OSF-70R.

Land Surface
Elevation
62 NGVD 29



130 ft

Monitor Zone
130-246 ft bls

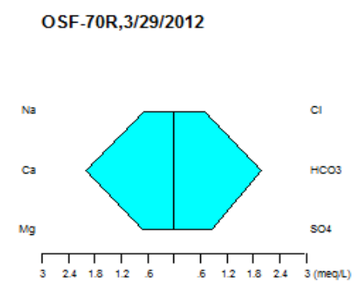
Total Depth
246 ft

Date of photo: 11/20/2007

Survey data:	4/8/2015
Reference elevations:	63.791 ft NAVD 88
Data Adjustments:	add 0.97 ft to convert to NGVD 29
References	SFWMD survey 2015
	SFWMD, 2011. Upper Floridan Aquifer testing project St. Cloud and River Ranch, Sites Osceloa and Polk Counties, Florida. Technical Publication WS-29. 70p
Borehole Volume:	642 gallons

Monitor Zone

Casing Material:	PVC or Plastic
Diameter:	8 inches
Data Range:	2011 - 2012
Sampling Events Analyzed:	2
Water Type:	Ca-Mg-HCO3-SO4-Cl



Field Parameter Averages Monitor Zone

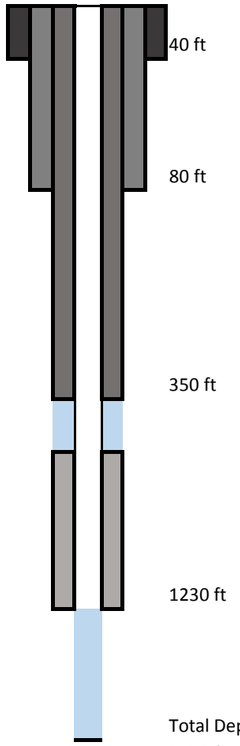
Field pH:	7.9
Specific Condutance (uS/cm)	383
Temperature (Celcius)	24.65
TDS (mg/L)	239
Water Level (ft NGVD 29)	45.09

Monitor Zone Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	1.3	2.7
Sodium (Na)	15.6	26.5
Calcium (Ca)	38.2	40.5
Magnesium (Mg)	8.9	9
Chloride (Cl)	25.3	42.1
Bicarbonate (HCO3)	99	122
Sulfate (SO4)	41.2	41.9

Site Name	**OSF70**	Lat / Long:	281508 / 811943
Station Names	OSF-82L, OSF-82U	County:	Osceola
Aquifers	Avon Park Permeable Zone, Lower Floridan	Wellhead Repair Date:	Unknown
FDEP Identifier	Unknown		
Date of this summary	6/29/2017		

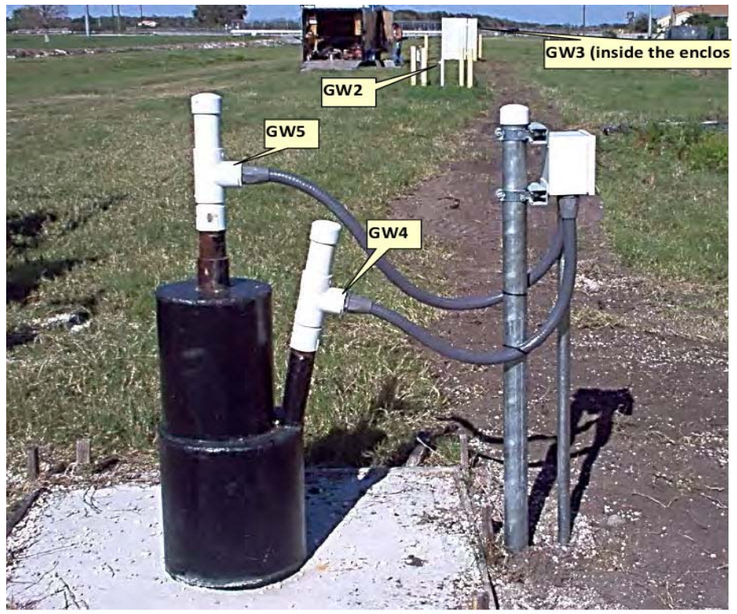
Land surface elevation



OSF-82U Monitor Zone
350-583 ft

OSF-82L Monitor Zone
1230-1503 ft

Total Depth
1503 ft



OSF-82U is labelled GW4
OSF-82L is labelled GW5

Survey data:	4/8/2015
Reference elevations:	OSF-82U 65.186 ft NAVD 88 and OSF-82L 65.451 ft NAVD 88
Data Adjustments:	to convert to NGVD 29 add 0.97 ft
References	SFWD survey April 2015
Borehole Volumes:	OSF-82U is 2645 gallons
	OSF-82L is 3924 gallons

OSF-82U Monitor Zone

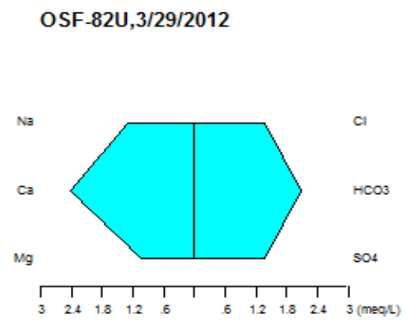
Casing Material:	Steel
Diameter:	14-inch
Data Range:	2012
Sampling Events Analyzed:	1
Water Type:	Ca-Na-Mg-HCO3-SO4-Cl

Field Parameters OSF-82U

Field pH:	8.2
Specific Condutance (uS/cm)	509
Temperature (Celcius)	25.6
TDS (mg/L)	312
Water Level (ft NGVD 29)	45.37

OSF-82U Ionic Concentrations

Parameter	Concentration (mg/L)
Potassium (K)	2
Sodium (Na)	30.1
Calcium (Ca)	48.8
Magnesium (Mg)	12.6
Chloride (Cl)	48.6
Bicarbonate (HCO3)	128
Sulfate (SO4)	65.9



OSF-82L Monitor Zone

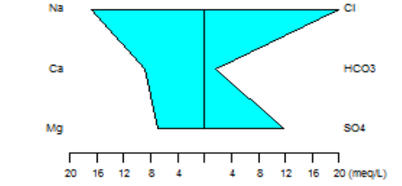
Casing Material:	Steel
Diameter:	8-inch
Data Range:	2007-2012
Sampling Events Analyzed:	3
Water Type:	Na-Ca-Mg-Cl-SO4

Field Parameter Averages OSF-82L

Field pH:	7.8
Specific Condutance (uS/cm)	3368
Temperature (Celcius)	24.8
TDS (mg/L)	2086
Water Level (ft NGVD 29)	48.27

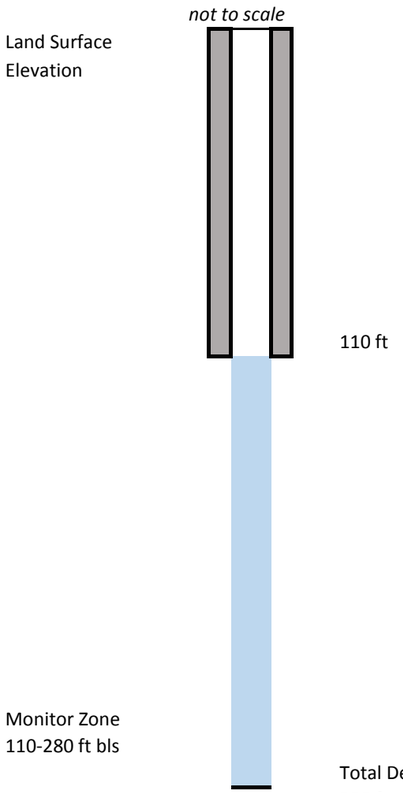
OSF-82L Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	13.5	14
Sodium (Na)	378	387
Calcium (Ca)	179	183
Magnesium (Mg)	83	85
Chloride (Cl)	705	712
Bicarbonate (HCO3)	94	104
Sulfate (SO4)	561	574



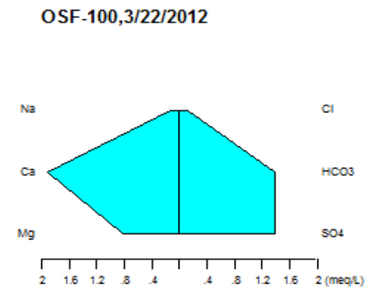
Site Name	**INRCTY**
Station Names	OSF-100
Aquifers	Upper Floridan Aquifer
FDEP Identifier	Unknown
Date ofsummary	6/29/2017

Lat / Long:	281521.4 / 813014.8
County:	Osceola
Wellhead Repair Date:	Unknown



Date of photo: 11/8/2006

Monitor Zone	
Casing Material:	Steel
Diameter:	4 inches
Data Range:	2004 - 2012
Sampling Events Analyzed:	15
Water Type:	Ca-Mg-HCO3-SO4



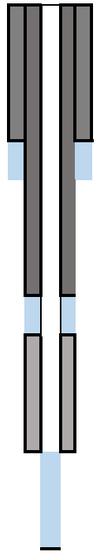
Field Parameter Averages Monitor Zone	
Field pH:	8.12
Specific Condutance (uS/cm)	301
Temperature (Celcius)	23.42
TDS (mg/L)	184
Water Level (ft NGVD 29)	no data

Monitor Zone Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	1.44	2.61
Sodium (Na)	3.2	6.45
Calcium (Ca)	36	41
Magnesium (Mg)	8.9	10.3
Chloride (Cl)	4.2	9.4
Bicarbonate (HCO3)	76	94
Sulfate (SO4)	56	70

Survey data:	December 2007
Reference elevations:	71.98 ft NGVD 29 and 71.02 ft NAVD 88
Data Adjustments:	Conversion is 0.96 ft
References	SFWMD survey 2007

Site Name	**S65AMW**	Lat / Long:	273934.744 / 810757.825
Station Names	OSF-104U, OSF-104M, OSF-104L	County:	Osceola
Aquifers	Upper Floridan, Avon Park Permeable Zone, Lower Floridan	Wellhead Repair Date:	Unknown
FDEP Identifier	Unknown		
Date of this summary	6/29/2017		



Date of photo: 5/15/2007

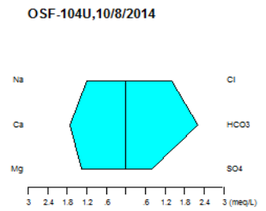
Survey data:	September 4, 2008
Reference elevations:	OSF-104U (GW5) 57.23 ft NGVD 29 , OSF-104M (GW6) 57.46 ft NGVD 29 and OSF-104L (GW7) 57.37 ft NGVD 29
Data adjustment:	subtract 1.18 ft to convert to NAVD 88
Borehole Volumes:	OSF-104U 4039 gallons
	OSF-104M 6005 gallons
	OSF-104L 1501 gallons
References	AECOM, 2008. Hydrogeologic Investigation of the Floridan Aquifer System S-65A Site Osceola County Florida (OSF-104 & OSF-105). 52p
	SFWMD survey 2008

OSF-104U Monitor Zone

Casing Material:	Steel
Diameter:	18-inch
Data Range:	2009-2014
Sampling Events Analyzed:	3
Water Type:	Ca-Mg-Na-HCO3-Cl

Field Parameter Averages OSF-104U

Field pH:	8.2
Specific Condutance (uS/cm)	457
Temperature (Celcius)	24.43
TDS (mg/L)	256
Water Level (ft NGVD 29)	45.16



OSF-104U Ionic Ranges

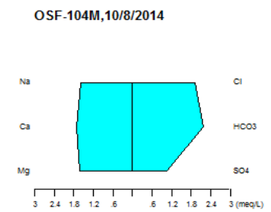
Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	1.7	2
Sodium (Na)	27.3	28.7
Calcium (Ca)	33.6	34.2
Magnesium (Mg)	16.6	17.5
Chloride (Cl)	49.9	52.8
Bicarbonate (HCO3)	132	137
Sulfate (SO4)	34.5	39.1

OSF-104M Monitor Zone

Casing Material:	Steel
Diameter:	12-inch
Data Range:	2007-2014
Sampling Events Analyzed:	2
Water Type:	Ca-Mg-Na-HCO3-Cl-SO4

Field Parameter Averages OSF-104M

Field pH:	7.85
Specific Condutance (uS/cm)	618
Temperature (Celcius)	25
TDS (mg/L)	333
Water Level (ft NGVD 29)	45.09



OSF-104M Ionic Ranges

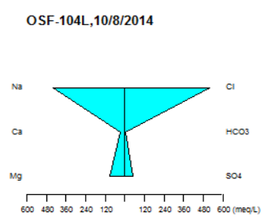
Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	2.2	2.2
Sodium (Na)	36.4	38.4
Calcium (Ca)	34.6	37.3
Magnesium (Mg)	19.6	19.6
Chloride (Cl)	67.6	71.6
Bicarbonate (HCO3)	132	133
Sulfate (SO4)	50.7	56.6

OSF-104L Monitor Zone

Casing Material:	Steel
Diameter:	4 inches
Data Range:	2006-2014
Sampling Events Analyzed:	5
Water Type:	Na-Cl

Field Parameter Averages OSF-104L

Field pH:	7.44
Specific Condutance (uS/cm)	48675
Temperature (Celcius)	28.02
TDS (mg/L)	32686
Water Level (ft NGVD 29)	7.57

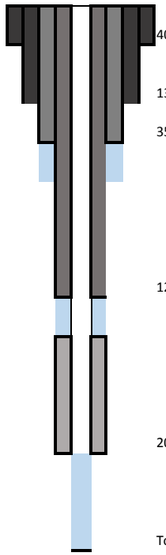


OSF-104L Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	244	427
Sodium (Na)	6560	10890
Calcium (Ca)	404	598
Magnesium (Mg)	686	1245
Chloride (Cl)	12200	19253
Bicarbonate (HCO3)	57	140
Sulfate (SO4)	1610	2725

Site Name	**INRCTY**	Lat / Long:	281521.364/813013.655
Station Names	IC-TW, OSF-97, OSF-98, OSF-99	County:	Osceola
Aquifers	Avon Park Permeable Zone, Lower Floridan (FZ1, FZ2)	Wellhead Repair Date:	Unknown
FDEP Identifier	Unknown		
Date of this summary	6/29/2017		

Land Surface elevation
68.2 NGVD 29



40 ft

134 ft

354 ft

OSF-99 Monitor Zone
354-675 ft bls

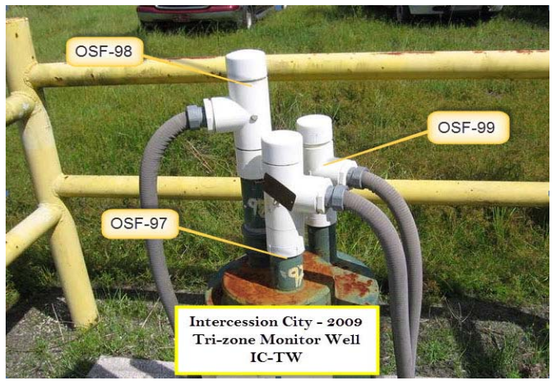
1220 ft

OSF-98 Monitor Zone
1220-1501 ft bls

2000 ft

OSF-97 Monitor Zone
2000-2096 ft bls

Total Depth
2096 ft



Date of photo: 2009

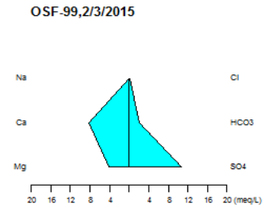
Survey data:	December 2007
Reference elevations:	OSF-97 (GW5) 71.02 ft NAVD 88, OSF-98 (GW4) 72.57 ft NAVD 88 and OSF-99 (GW3) 71.02 ft NAVD 88
Data Adjustments:	add 0.96 ft to convert to NGVD 29
References	SFWMD, 2003. Hydrogeologic Investigation of the Floridan Aquifer System, Intercession City, Osceola County, Florida. Technical Publication WS-23. 102p
	SFWMD survey 2007
Borehole Volumes:	OSF-97 1017 gallons
	OSF-98 3781 gallons
	OSF-99 3114 gallons

OSF-99 Monitor Zone

Casing Material:	Steel
Diameter:	14-inch
Data Range:	2006-2015
Sampling Events Analyzed:	3
Water Type:	Ca-Mg-SO4

Field Parameter Averages OSF-99

Field pH:	7.83
Specific Condutance (uS/cm)	1125
Temperature (Celcius)	25.4
TDS (mg/L)	912
Water Level (ft NGVD 29)	61.85



OSF-99 Zone Ionic Ranges

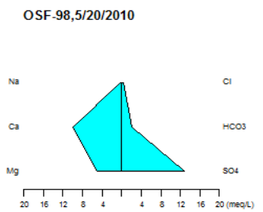
Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	1.5	1.67
Sodium (Na)	3.8	4.01
Calcium (Ca)	160	169
Magnesium (Mg)	50	54
Chloride (Cl)	4.4	5.9
Bicarbonate (HCO3)	116	121
Sulfate (SO4)	512	524

OSF-98 Monitor Zone

Casing Material:	Steel
Diameter:	8-inch
Data Range:	2006-2010
Sampling Events Analyzed:	4
Water Type:	Ca-Mg-SO4

Field Parameter Averages OSF-98

Field pH:	7.83
Specific Condutance (uS/cm)	1164.00
Temperature (Celcius)	25.33
TDS (mg/L)	945.00
Water Level (ft NGVD 29)	51.25



OSF-98 Ionic Ranges

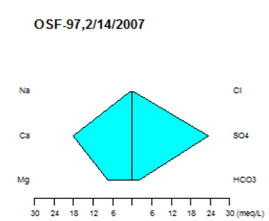
Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	1.6	2.65
Sodium (Na)	4	8
Calcium (Ca)	148	198
Magnesium (Mg)	55	61
Chloride (Cl)	5.6	9.4
Bicarbonate (HCO3)	78	124.4
Sulfate (SO4)	512	613

OSF-97 Monitor Zone

Casing Material:	Steel
Diameter:	3-inch
Data Range:	2006-2007
Sampling Events Analyzed:	4
Water Type:	Ca-Mg-SO4

Field Parameter Averages Lower Monitor Zone

Field pH:	7.48
Specific Condutance (uS/cm)	2037
Temperature (Celcius)	25.86
TDS (mg/L)	1808.00
Water Level (ft NGVD 29)	50.09

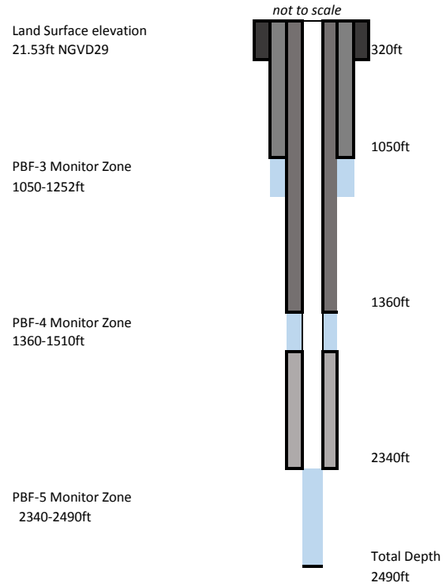


Lower Monitor Zone Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	1.96	2.23
Sodium (Na)	12.8	13.6
Calcium (Ca)	358	367
Magnesium (Mg)	86	93
Chloride (Cl)	19	19.1
Bicarbonate (HCO3)	140	158
Sulfate (SO4)	1090	1200

Site Name	**LYTAL-TW**
Station Names	PBF-3, PBF-4, PBF-5
Aquifers	UFA, APPZ, LFA
FDEP Identifier	Unknown
Date of this summary	8/8/2017

Lat / Long:	264034.82/800612.63
County:	Palm Beach
Wellhead Repair Date:	2002, 2010

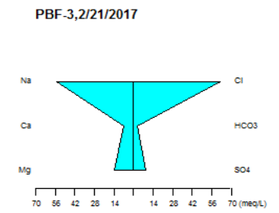


Date of Photo (2006)

Survey data:	9/19/2017
Reference elevations:	PBF-3 23.86 ft NAVD 88, PBF-4 24.20 ft NAVD 88 and PBF-5 22.11 ft NAVD 88
Data Adjustments:	NGVD 29 adjustment add 1.522
Access Agreement:	Owned by Palm Beach County; effective November 2013 and expires January 2019
References	Lukasiewicz, et al, 2001. Final Report: Florian Aquifer System Test Well Program at Lake Lytal Park, West Palm Beach, Florida. Technical Publication WS-5, SFWMD, 152p
	SFWMD Survey Septmeber 2017

Upper Monitor Zone PBF-3

Casing Material:	Steel
Diameter:	12-inch
Data Range:	1996-2017
Sampling Events Analyzed:	23
Water Type:	Na-Cl



Field Parameter Averages PBF-3

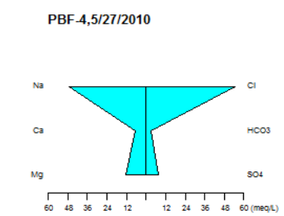
Field pH:	7.37
Specific Condutance (uS/cm)	4842
Temperature (Celcius)	23.53
TDS (mg/L)	2668
Water Level (ft NGVD 29)	9.05

PBF-3 Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	35	52
Sodium (Na)	940	1410
Calcium (Ca)	58	157
Magnesium (Mg)	131	183
Chloride (Cl)	1810	2500
Bicarbonate (HCO3)	43	220
Sulfate (SO4)	253	470

Middle Monitor Zone PBF-4

Casing Material:	Steel
Diameter:	7-inch
Data Range:	1996-2010
Sampling Events Analyzed:	16
Water Type:	Na-Cl



Field Parameter Averages PBF-4

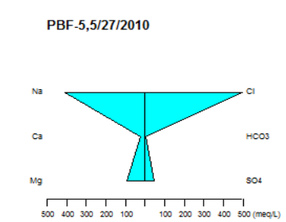
Field pH:	7.55
Specific Condutance (uS/cm)	7100
Temperature (Celcius)	22.48
TDS (mg/L)	4099
Water Level (ft NGVD 29)	8.95

PBF-4 Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	35	56
Sodium (Na)	1000	1400
Calcium (Ca)	120	150
Magnesium (Mg)	107	170
Chloride (Cl)	1816	2440
Bicarbonate (HCO3)	123	266
Sulfate (SO4)	340	446

Lower Monitor Zone PBF-5

Casing Material:	Steel
Diameter:	2-inch
Data Range:	1996-2010
Sampling Events Analyzed:	17
Water Type:	Na-Cl



Field Parameter Averages PBF-5

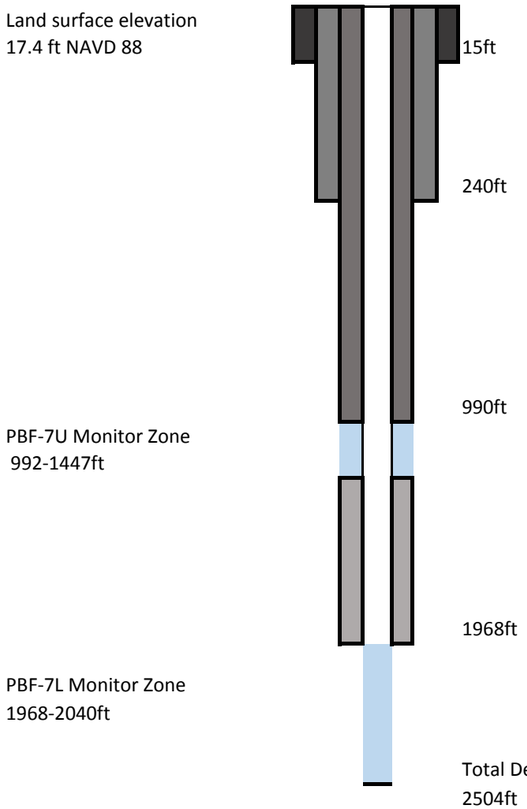
Field pH:	7.25
Specific Condutance (uS/cm)	47904
Temperature (Celcius)	22.95
TDS (mg/L)	31735
Water Level (ft NGVD 29)	7.13

PBF-5 Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	305	430
Sodium (Na)	9040	10560
Calcium (Ca)	400	560
Magnesium (Mg)	970	1236
Chloride (Cl)	15600	19000
Bicarbonate (HCO3)	146	171
Sulfate (SO4)	1900	2680

Site Name	**PBF-7**
Station Names	PBF-7L, PBF-7U
Aquifers	UFA, FAS
FDEP Identifier	Unknown
Date of this summary	8/10/2017

Lat / Long: 264159.367/804257.405
County: Palm Beach
Wellhead Repair Date: 2004



Date of Photo - 2004 (PBF-7U is on the left and PBF-7L is on the right)

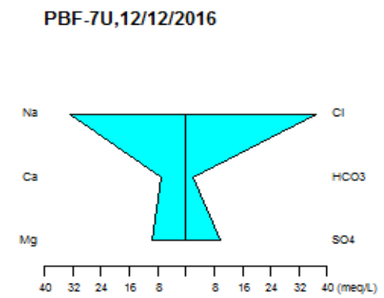
Survey data:	Addendum Added 2/29/2016 and NGVD offset 1.40ft
Reference elevations:	PBF-7U(GW1)-21.46ft NAVD88, PBF-7L(GW2)-21.97ft NAVD88
Data Adjustments:	to convert to NGVD 29 add 1.404 ft
Access Agreement:	Within LD-2 right of way
References	SFWMD, 2001. Floridan Aquifer System Test Well Program. City of South Bay, Florida Technical Publication WS-2. 90p.
	SFWMD Survey date 2/1/2016
Borehole Volumes:	PBF-7U
	PBF-7L

Upper Monitor Zone PBF-7U

Casing Material:	Steel
Diameter:	12-inch
Data Range:	2000-2016
Sampling Events Analyzed:	18
Water Type:	Na-Cl

Field Parameter Averages PBF-7U

Field pH:	7.96
Specific Condutance (uS/cm)	5085
Temperature (Celcius)	26.18
TDS (mg/L)	2818
Water Level (ft NGVD 29)	13.86



PBF-7U Ionic Ranges

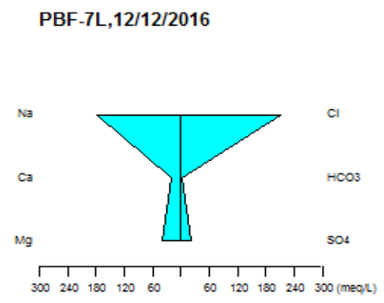
Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	21.4	26.2
Sodium (Na)	640	818
Calcium (Ca)	100	141
Magnesium (Mg)	98	120
Chloride (Cl)	1100	1400
Bicarbonate (HCO_3)	125	146
Sulfate (SO_4)	420	500

Lower Monitor Zone PBF-7L

Casing Material:	Fiberglass
Diameter:	7-inch
Data Range:	2000-2016
Sampling Events Analyzed:	19
Water Type:	Na-Cl

Field Parameter Averages PBF-7L

Field pH:	7.67
Specific Condutance (uS/cm)	23662
Temperature (Celcius)	26.32
TDS (mg/L)	13925
Water Level (ft NGVD 29)	7.66

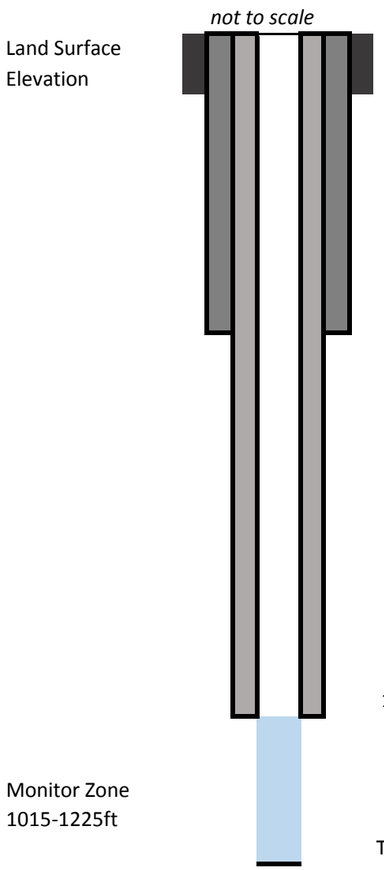


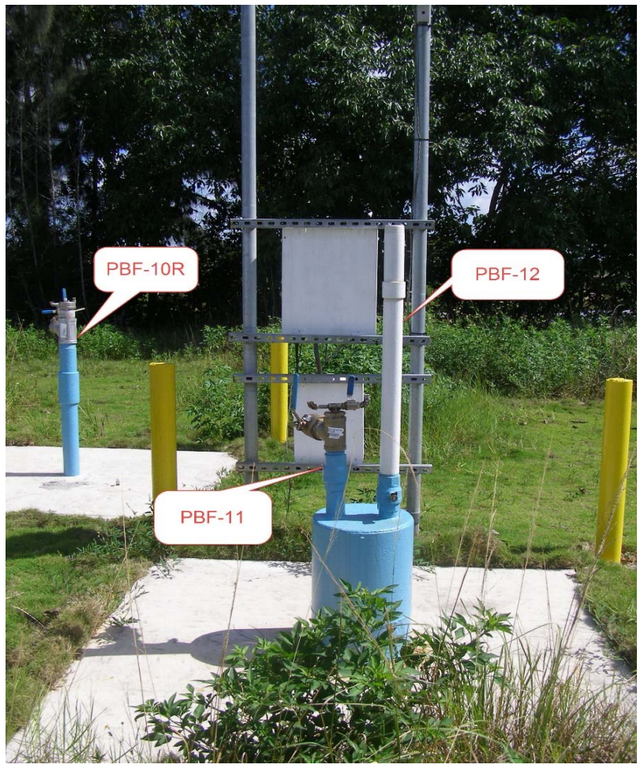
PBF-7L Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	115	141
Sodium (Na)	3730	4212
Calcium (Ca)	320	424
Magnesium (Mg)	400	493
Chloride (Cl)	6800	8000
Bicarbonate (HCO_3)	20	146
Sulfate (SO_4)	911	1300

Site Name	**WHILL**
Station Names	PBF-10R
Aquifers	Upper Floridan Aquifer
FDEP Identifier	Unknown
Date of summary	8/10/2017

Lat / Long:	262120.286/801745.837
County:	Palm Beach
Wellhead Repair Date:	Unknown





Date of Photo 8/13/2014

Survey	Reference elevation 17.361 ft NGVD 29
References	SFWMD, 2008. Hydrogeologic Investigation of the Floridan Aquifer System West Hillsboro Basin, Palm Beach County, Florida. Technical Publications WS-8. 130p
Borehole Volume	450 gallons

Monitor Zone

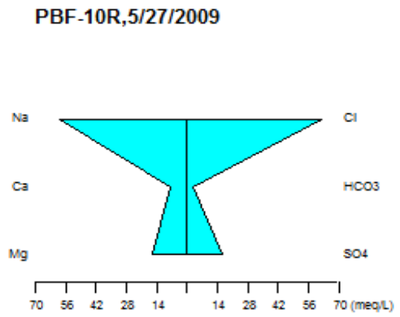
Casing Material:	Fiberglass
Diameter:	3-inch
Data Range:	2009
Sampling Events Analyzed:	1
Water Type:	Na-Cl

Field Parameter Averages Monitor Zone

Field pH:	7.5
Specific Condutance (uS/cm)	8561
Temperature (Celcius)	24.5
TDS (mg/L)	4859
Water Level (ft NGVD 29)	51.81

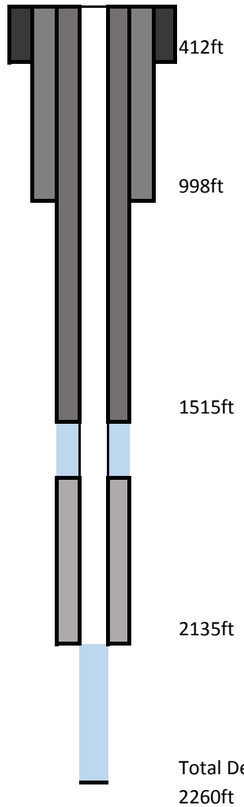
Monitor Zone Ionic Concentrations

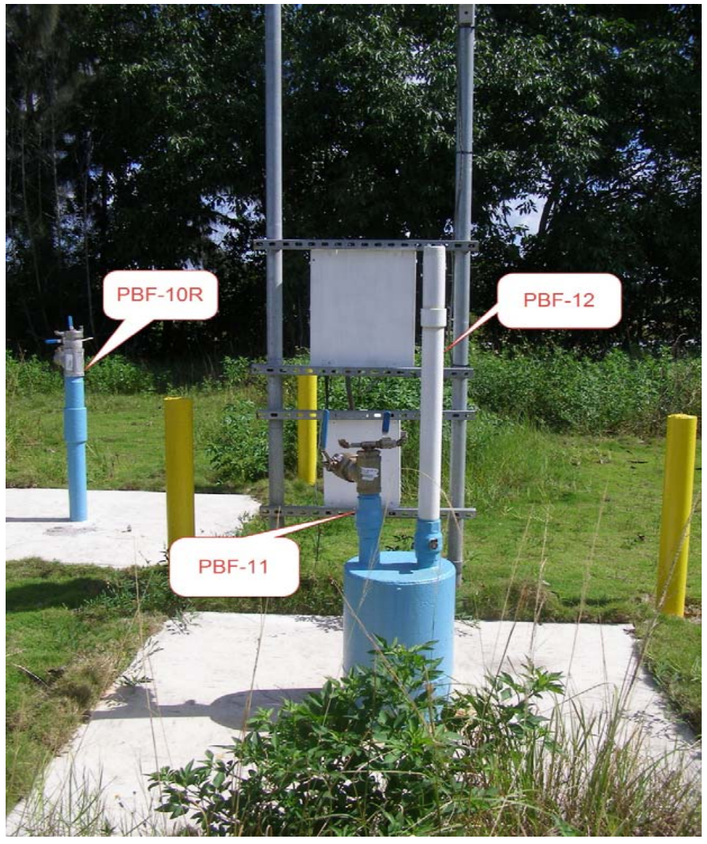
Parameter	Concentration (mg/L)
Potassium (K)	52
Sodium (Na)	1361
Calcium (Ca)	158
Magnesium (Mg)	191
Chloride (Cl)	2194
Bicarbonate (HCO3)	157
Sulfate (SO4)	779



Site Name	**HASR-DZMW**
Station Names	PBF-11, PBF-12
Aquifers	APPZ, LFA
FDEP Identifier	Unknown
Date of this summary	8/10/2017

Lat / Long:	262120.286/801745.837
County:	Palm Beach
Wellhead Repair Date:	July 2014





Date of photo: 2014

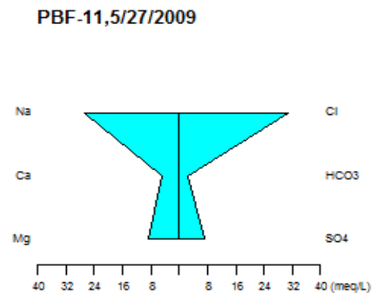
Reference elevations:	PBF-11(GW2) and PBF-12(GW3)
Access Agreement:	Hillsboro ASR; Within Hillsboro Canal right of way
References	SFWMD, 2001. Hydrogeologic Investigation of the Floridan Aquifer System Western Hillsboro Basin Palm Beach County, Florida. Technical Publication WS-8. 130p.
Borehole Volumes	PBF-11 9428 gallons PBF 12 1271 gallons

PBF-11 Monitor Zone

Casing Material:	Steel
Diameter:	12-inch
Data Range:	2003-2009
Sampling Events Analyzed:	15
Water Type:	Na-Mg-Cl

Field Parameter Averages PBF-11

Field pH:	7.88
Specific Condutance (uS/cm)	4404
Temperature (Celcius)	23.5
TDS (mg/L)	2574
Water Level (ft NGVD 29)	53.16



PBF-11 Ionic Ranges

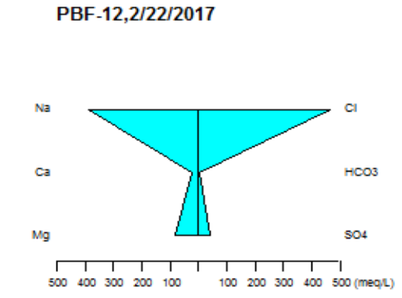
Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	20.3	25
Sodium (Na)	610.5	723
Calcium (Ca)	64	100
Magnesium (Mg)	97	110
Chloride (Cl)	1027	1300
Bicarbonate (HCO_3)	93	171
Sulfate (SO_4)	290	380

PBF-12 Monitor Zone

Casing Material:	Fiberglass
Diameter:	2.37
Data Range:	1999-2017
Sampling Events Analyzed:	18
Water Type:	Na-Cl

Field Parameter Averages PBF-12

Field pH:	7.32
Specific Condutance (uS/cm)	44637
Temperature (Celcius)	24.77
TDS (mg/L)	28094
Water Level (ft NGVD 29)	15.04

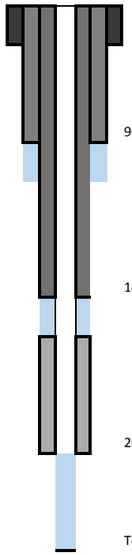


PBF-12 Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	271	380
Sodium (Na)	7908	9900
Calcium (Ca)	440	667
Magnesium (Mg)	853	1110
Chloride (Cl)	14700	18000
Bicarbonate (HCO_3)	117	171
Sulfate (SO_4)	1570	6500

Site Name	**PBF15**
Station Names	PBF-15U, PBF-15M, PBF-15L
Aquifers	UFA, APPZ, LFA (FZ1)
FDEP Identifier	Unknown
Date of this summary	8/10/2017
Lat / Long:	264416.078/802148.682
County:	Palm Beach
Wellhead Repair Date:	Unknown

Land Surface elevation
24.19ft NGVD29



908ft

PBF-15U Monitor Zone
908-1144ft

1400ft

PBF-15M Monitor Zone
1400-1583ft

2010ft

PBF-15L Monitor Zone
2010-2100ft

Total Depth
2300ft

Date of Photo: 2007

Survey data:	Addendum Added 2/29/2016 and NGVD offset 1.46ft
Reference elevations:	PBF-15U(GW1)-25.88ft NAVD88, PBF-15M(GW2)-26.51ft NAVD88, PBF-15L(GW3)-29.42ft NAVD88
Access Agreement:	Within L-8 right of way
References	SFWMD, 2008. Hydrogeologic Investigation of the Floridan Aquifer System L-8 (PBF-15), Palm Beach County Florida. Techinical Publication WS-25. 136p.
	SFWMD Survey date 2/25/2016
Borehole Volumes:	PBF-15U 5227 gallons
	PBF-15M 8266 gallons
	PBF-15L 1841 gallons

Upper Monitor Zone PBF-15U

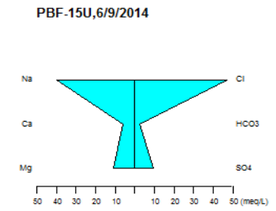
Casing Material:	Steel
Diameter:	18-inch
Data Range:	2011-2014
Sampling Events Analyzed:	2
Water Type:	Na-Cl

Field Parameter Averages PBF-15U

Field pH:	7.85
Specific Condutance (uS/cm)	5704
Temperature (Celcius)	24.45
TDS (mg/L)	3447
Water Level (ft NGVD 29)	11.1

PBF-15U Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	34	37
Sodium (Na)	849	919
Calcium (Ca)	108	124
Magnesium (Mg)	122	131
Chloride (Cl)	1459	1659
Bicarbonate (HCO3)	156	158
Sulfate (SO4)	406	466



Middle Monitor Zone PBF-15M

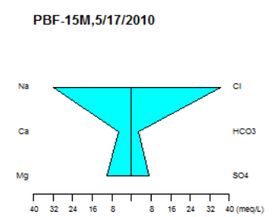
Casing Material:	Steel
Diameter:	12-inch
Data Range:	2008-2010
Sampling Events Analyzed:	2
Water Type:	Na-Mg-Cl

Field Parameter Averages PBF-15M

Field pH:	8.1
Specific Condutance (uS/cm)	5087
Temperature (Celcius)	28.1
TDS (mg/L)	2945
Water Level (ft NGVD 29)	11.3

PBF-15M Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	27.9	28.3
Sodium (Na)	734	749
Calcium (Ca)	92	105
Magnesium (Mg)	121	123
Chloride (Cl)	1284	1351
Bicarbonate (HCO3)	155	173
Sulfate (SO4)	340	341



Lower Monitor Zone PBF-15L

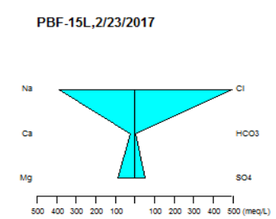
Casing Material:	Fiberglass
Diameter:	4-inch
Data Range:	2008-2017
Sampling Events Analyzed:	6
Water Type:	Na-Cl

Field Parameter Averages PBF-15L

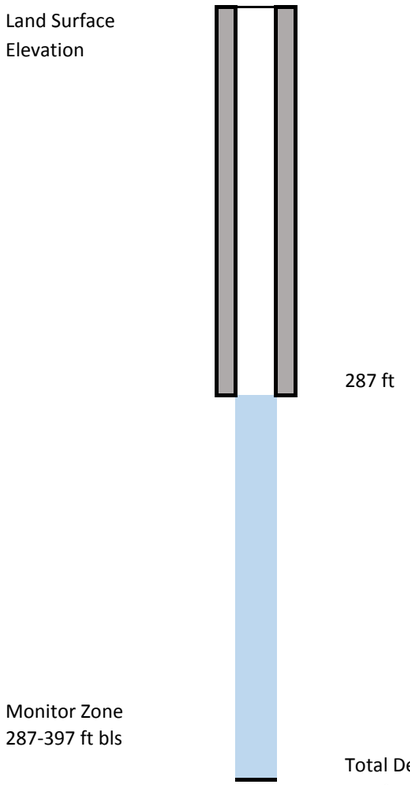
Field pH:	7.23
Specific Condutance (uS/cm)	47917
Temperature (Celcius)	28.58
TDS (mg/L)	33457
Water Level (ft NGVD 29)	6.17

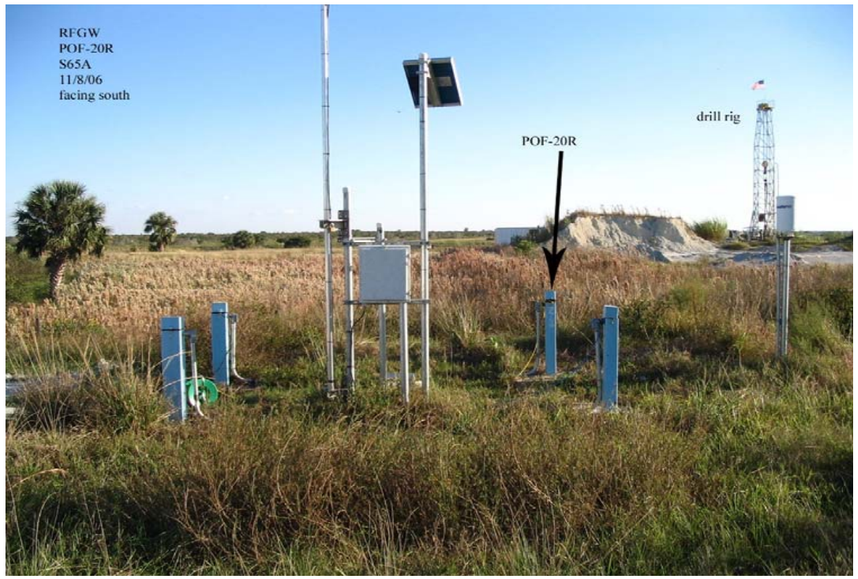
PBF-15L Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	341	376
Sodium (Na)	8959	10140
Calcium (Ca)	424	529
Magnesium (Mg)	1072	1203
Chloride (Cl)	16996	18908
Bicarbonate (HCO3)	132	143
Sulfate (SO4)	2248	2478



Site Name	**S65AMW**	Lat / Long:	273933.765 / 810758.547
Station Names	POF-20R	County:	Polk
Aquifers	Upper Floridan Aquifer	Wellhead Repair Date:	Unknown
FDEP Identifier	Unknown		
Date of summary	6/29/2017		

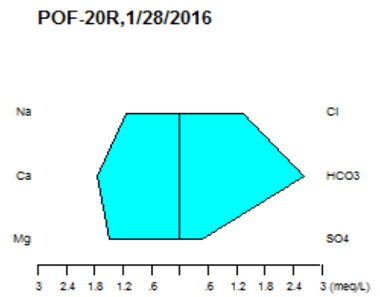




Date of photo: 11/8/2006

Monitor Zone

Casing Material:	PVC or Plastic
Diameter:	2-inch
Data Range:	2006-2016
Sampling Events Analyzed:	3
Water Type:	Ca-Mg-Na-HCO3-Cl



Field Parameter Averages Monitor Zone

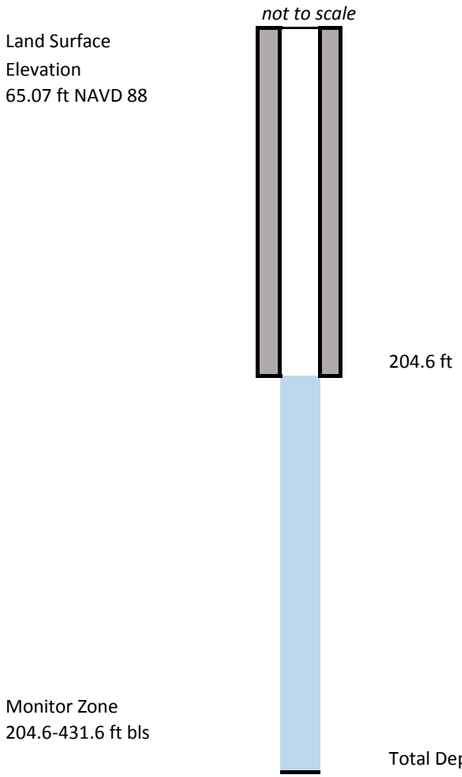
Field pH:	7.68
Specific Condutance (uS/cm)	455
Temperature (Celcius)	25.52
TDS (mg/L)	257
Water Level (ft NGVD 29)	45.03

Monitor Zone Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	1.55	2.42
Sodium (Na)	23	26
Calcium (Ca)	30	35
Magnesium (Mg)	16	18
Chloride (Cl)	43	47
Bicarbonate (HCO_3)	160	183
Sulfate (SO_4)	9	23

Survey data:	11/1/2007
Reference elevation	55.22 ft NAVD 88
Data Adjustment	add 1.2 ft to convert to NGVD 29
References	SFWMD survey 11/7/2007
Borehole volume	65 gallons

Site Name	**WRWX**	Lat / Long:	280255.77 / 812400.35
Station Names	POF-22, FMW1	County:	Polk
Aquifer	Upper Floridan Aquifer	Wellhead Repair Date:	Unknown
FDEP Identifier	Unknown		
Date of this summary	6/29/2017		



Date of photo: 7/15/2015

Survey data:	7/15/2015
Reference elevations:	68.32 ft NAVD 88
Data Adjustments:	NGVD 29 offset + 1.12
References	SFWMD, 2015. Aquifer Performance Testing The Nature Conservancy Disney Wilderness Preserve Site Polk County, Florida. Technical Publication WS-36. 60p.
	SFWMD survey 2015
Borehole volume	38 gallons

Monitor Zone

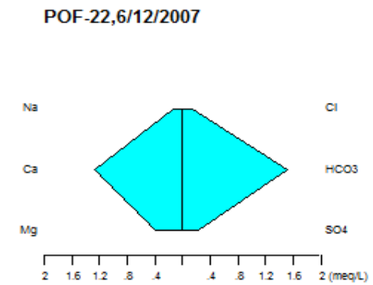
Casing Material:	PVC
Diameter:	4-inch
Data Range:	2007
Sampling Events Analyzed:	1
Water Type:	Ca-Mg-HCO3

Field Parameters Monitor Zone

Field pH:	8.2
Specific Condutance (uS/cm)	187
Temperature (Celcius)	22.8
TDS (mg/L)	120
Water Level (ft NGVD 29)	60

Monitor Zone Ionic Concentration

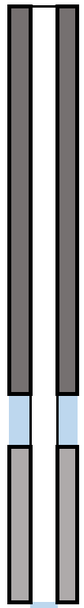
Parameter	Concentration (mg/L)
Potassium (K)	0.6
Sodium (Na)	3.2
Calcium (Ca)	25.4
Magnesium (Mg)	4.9
Chloride (Cl)	4.8
Bicarbonate (HCO3)	92
Sulfate (SO4)	11.4



Site Name	**LFAKBB**
Station Names	POF27U, POF-27L
Aquifers	Upper Florida, Avon Park Permeable Zone
FDEP Identifier	Unknown
Date of this summary	6/29/2017

Lat / Long:	275836.728 / 812221.215
County:	Polk
Wellhead Repair Date:	Unknown

Land surface elevation
62.54 NGVD 29



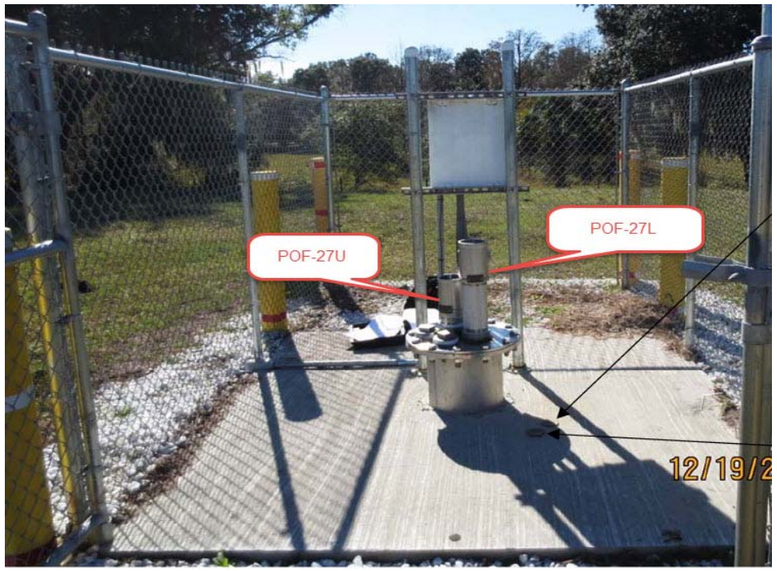
275 ft

POF-27U Monitor Zone
275-529 ft bls

750 ft

Lower Monitor Zone
750-1105 ft bls

Total Depth
1105 ft



Date of Photo 12/19/2013

Survey data:	August 2012
Reference elevations:	POF-27U (GW1) 63.81 ft NAVD 88 and POF-27L (GW2) 64.48 ft NAVD 88
Data Adjustments:	add 1.204 ft to convert ot NGVD 29
References	SFWMD survey 8/15/2012
Borehole Volumes	POF-27U - 2914 gallons
	POF-27L - 2028 gallons

POF-27U Monitor Zone

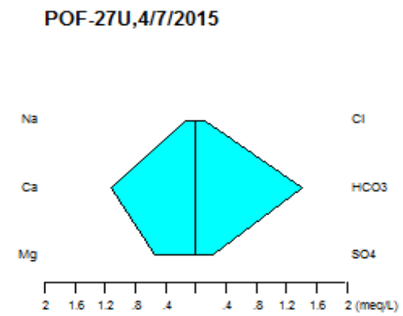
Casing Material:	Steel
Diameter:	14-inch
Data Range:	2015
Sampling Events Analyzed:	1
Water Type:	Ca-Mg-HCO3

Field Parameters POF-27U

Field pH:	7.8
Specific Condutance (uS/cm)	185
Temperature (Celcius)	24.1
TDS (mg/L)	140
Water Level (ft NGVD 29)	59.34

POF-27U Ionic Concentrations

Parameter	Concentration (mg/L)
Potassium (K)	0.6
Sodium (Na)	3.3
Calcium (Ca)	22.3
Magnesium (Mg)	6.5
Chloride (Cl)	4.5
Bicarbonate (HCO3)	87
Sulfate (SO4)	10.7



POF-27L Monitor Zone

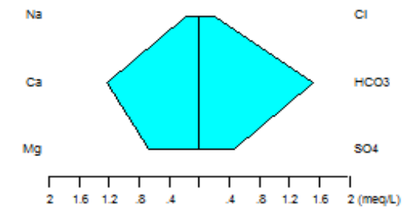
Casing Material:	Steel
Diameter:	6-inch
Data Range:	2011 - 2013
Sampling Events Analyzed:	2
Water Type:	Ca-Mg-HCO3-SO4

Field Parameter Averages POF-27L

Field pH:	8.15
Specific Condutance (uS/cm)	216
Temperature (Celcius)	25.05
TDS (mg/L)	133
Water Level (ft NGVD 29)	58.47

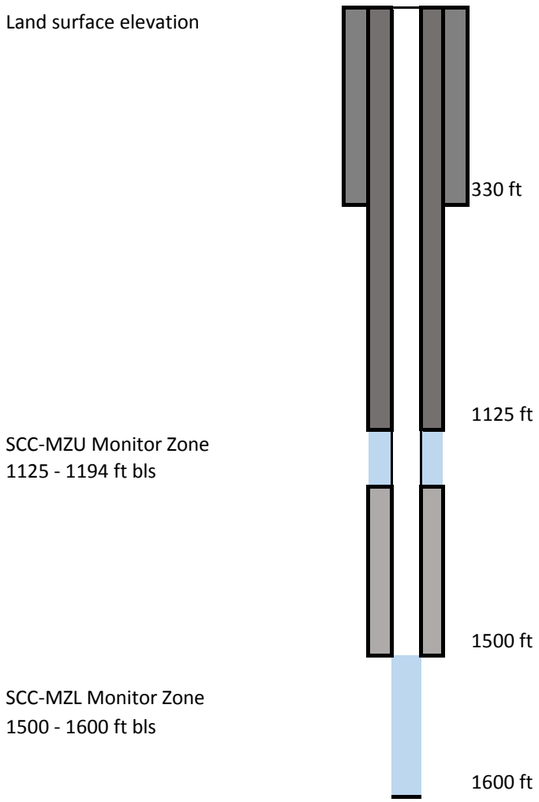
POF-27L Ionic Ranges

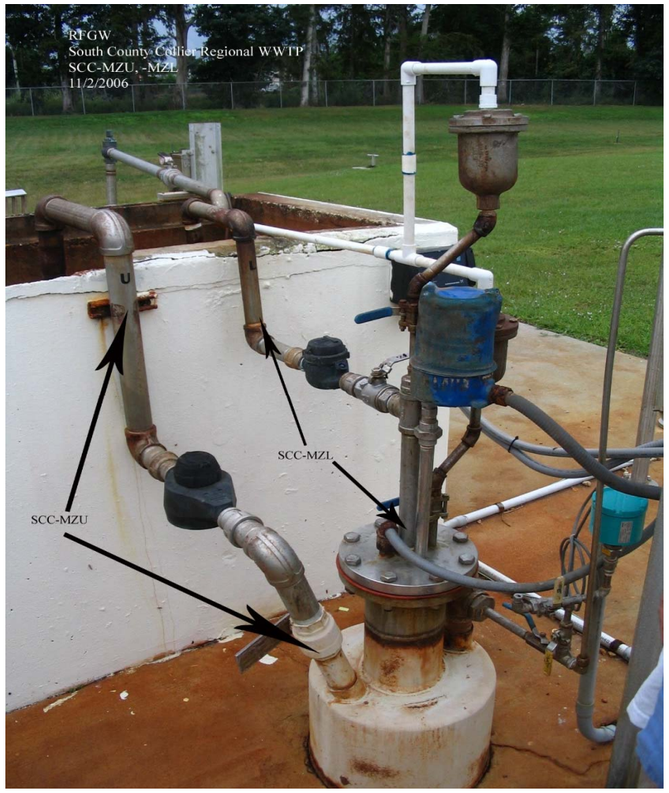
Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	0.6	0.7
Sodium (Na)	3.9	4.1
Calcium (Ca)	23.7	24.8
Magnesium (Mg)	8.2	8.3
Chloride (Cl)	6.6	7.6
Bicarbonate (HCO3)	85	93
Sulfate (SO4)	18	22



Site Name	**SCWRF**
Station Names	SCC-MZU and SCC-MZL
Aquifers	UFA and MCU
FDEP Identifier	Unknown
Date of this summary	7/12/2017

Lat / Long:	260543.927, 814323.935
County:	Collier
Wellhead Repair Date:	Unknown

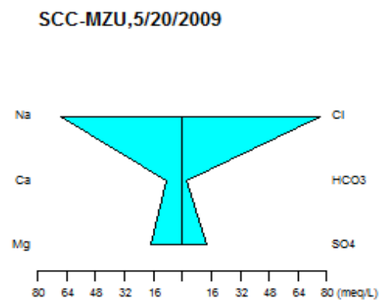




Date of Photo: 2006

SCC-MZU

Casing Material:	Steel
Diameter:	16 inch
Data Range:	1999 - 2009
Sampling Events Analyzed:	15
Water Type:	Na-Cl



Field Parameter Averages SCC-MZU

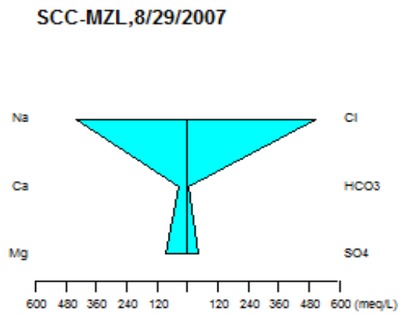
Field pH:	7.74
Specific Condutance (uS/cm)	9735
Temperature (Celcius)	28.1
TDS (mg/L)	5991
Water Level (ft NGVD 29)	35.04

SCC-MZU Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	54	61
Sodium (Na)	1492	1700
Calcium (Ca)	175	224
Magnesium (Mg)	199	239
Chloride (Cl)	2454	3200
Bicarbonate (HCO3)	135	219
Sulfate (SO4)	618	740

SCC-MZL

Casing Material:	Steel
Diameter:	6.63 inch
Data Range:	2005 - 2007
Sampling Events Analyzed:	7
Water Type:	Na-Cl



Field Parameter Averages SCC-MZL

Field pH:	7.58
Specific Condutance (uS/cm)	48773
Temperature (Celcius)	28.87
TDS (mg/L)	31112
Water Level (ft NGVD 29)	no data

SCC-MZL Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	270	400
Sodium (Na)	950	10160
Calcium (Ca)	472	730
Magnesium (Mg)	960	1200
Chloride (Cl)	17000	19000
Bicarbonate (HCO3)	79	195
Sulfate (SO4)	1900	2100

Survey data: January 25, 2005

References

Metcalf & Eddy, Hazen Sawyer, 2003.
Engineering well completion report. South Collier County
8-mgd R.O. Expansion Concentrate Disposal System

Site Name	**SLF21**
Station Names	SLF-21
Aquifers	Upper Floridan
FDEP Identifier	Unknown
Date of this summary	6/26/2017

Lat / Long:	272541.850 / 802407.439
County:	St. Lucie
Wellhead Repair Date:	Unknown

not to scale

Land Surface
Elevation
18.0 ft NAVD88

156 ft

Monitor Zone
156-707 ft bls

Total Depth
707 ft

6/11/2014

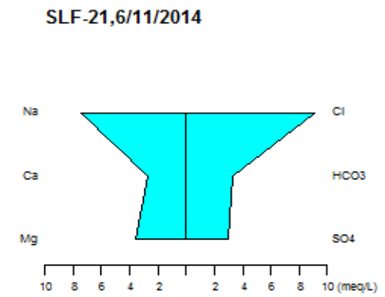
Survey data:	5/4/2017
Reference elevations:	21.09 ft NAVD88
Data Adjustments:	NGVD29 Offset +1.486
References	SFWMD Survey 5/4/2017
Borehole Volume	353 gallons

Monitor Zone

Casing Material:	PVC
Diameter:	3.5-inch
Data Range:	1985 - 2014
Sampling Events Analyzed:	10
Water Type:	Na-Mg-Cl-HCO3-SO4

Field Parameter Averages Monitor Zone

Field pH:	7.36
Specific Condutance (uS/cm)	1473
Temperature (Celcius)	25.54
TDS (mg/L)	889
Water Level (ft NGVD 29)	35.20



Monitor Zone Ionic Ranges

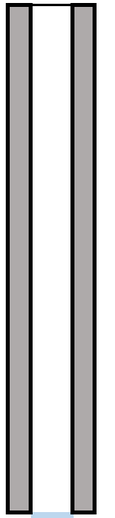
Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	9	11
Sodium (Na)	171	203
Calcium (Ca)	51	55
Magnesium (Mg)	44	49
Chloride (Cl)	303	351
Bicarbonate (HCO_3)	196	239
Sulfate (SO_4)	127	148

Site Name	**C24FAS**
Station Names	SLF-74
Aquifers	APPZ
FDEP Identifier	Unknown
Date of this summary	6/26/2017

Lat / Long:	272015.957 / 802922.827
County:	St. Lucie
Wellhead Repair Date:	12/01 Well head and slab repaired. 11/11 redone in stainless steel.

not to scale

Land Surface Elevation
28.3 ft NGVD29



1068 ft

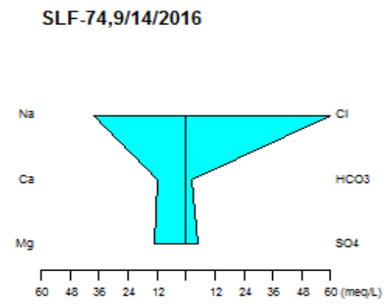
Monitor Zone
1068-1450 ft

Total Depth
1450 ft

Survey data:	11/14/2016
Reference elevations:	29.93 ft NAVD88
Data Adjustments:	NGVD29 offset +1.46
References	SFWMD Survey 11/14/16
Borehole Volume	3786 gallons

Monitor Zone

Casing Material:	Steel
Diameter:	8 inches
Data Range:	2005-2016
Sampling Events Analyzed:	13
Water Type:	Na-Mg-Cl



Field Parameter Averages Monitor Zone

Field pH:	7.29
Specific Condutance (uS/cm)	7190
Temperature (Celcius)	30.48
TDS (mg/L)	4330
Water Level (ft NGVD 29)	40.73

Monitor Zone Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	18.4	22.8
Sodium (Na)	881.9	1024
Calcium (Ca)	210	249
Magnesium (Mg)	150	181
Chloride (Cl)	1976	2300
Bicarbonate (HCO3)	151	171
Sulfate (SO4)	194	240

Site Name	**C24FAS**
Station Names	SLF-75
Aquifers	Upper Floridan
FDEP Identifier	Unknown
Date of this summary	6/28/2017

Lat / Long:	272015.9 / 802923
County:	St. Lucie
Wellhead Repair Date:	

12/01 well head repaired. Diversified Drillers replaced the well head 1/03. 11/11 Redone with stainless. 10/16 Well head replaced.

not to scale

Land Surface Elevation
27.9 ft NGVD29

480 ft

Monitor Zone
480-700 ft

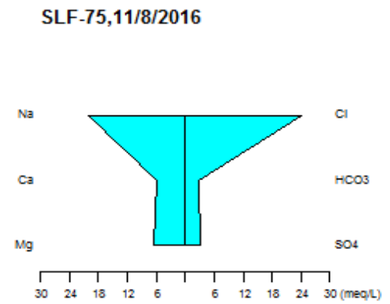
Total Depth
700 ft

Date of photo 2016

Survey data:	11/14/2016
Reference elevations:	29.5 ft NAVD88
Data Adjustments:	NGVD Offset +1.46
References	SFWMD Survey 11/14/16
Borehole Volume	1828 gallons

Monitor Zone

Casing Material:	PVC
Diameter:	4
Data Range:	2004-2011
Sampling Events Analyzed:	17
Water Type:	Na-Mg-Cl



Field Parameter Averages Monitor Zone

Field pH:	7.41
Specific Condutance (uS/cm)	3622
Temperature (Celcius)	28.03
TDS (mg/L)	1998
Water Level (ft NGVD 29)	41.34

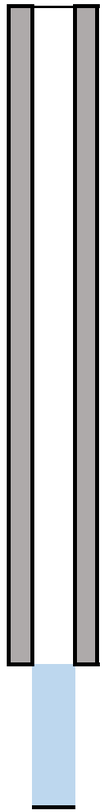
Monitor Zone Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	13.5	16.8
Sodium (Na)	442	489
Calcium (Ca)	96	121
Magnesium (Mg)	72	86
Chloride (Cl)	851	1000
Bicarbonate (HCO_3)	163	183
Sulfate (SO_4)	157	210

Site Name	**C24FAS**
Station Names	SLF-76
Aquifers	Upper Floridan
FDEP Identifier	Unknown
Date of this summary	6/28/2017

Lat / Long:	272015.957 / 802922.827
County:	St. Lucie
Wellhead Repair Date:	Well head repaired 12/01. 1/17 well still leaking below ground, 11/27/02 Well head repairs completed. 11/11 Wellhead redone and painted. 10/16 Wellhead replaced.

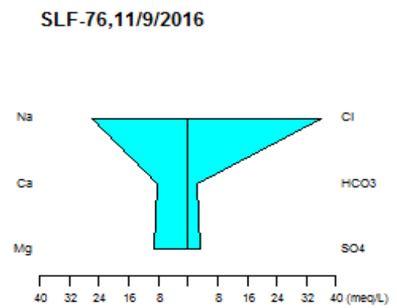
not to scale



Survey data:	11/9/2016
Reference elevations:	29.58 ft NAVD88
Data Adjustments:	NGVD29 offset + 1.46
References	SFWMD Survey 11/9/2016
Borehole Volume:	2245 gallons

Monitor Zone

Casing Material:	PVC
Diameter:	4 inches
Data Range:	2004-2016
Sampling Events Analyzed:	16
Water Type:	Na-Mg-Cl



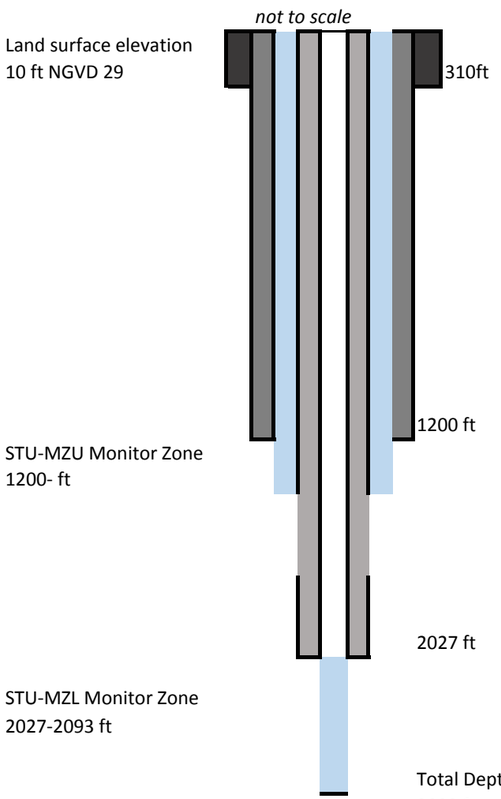
Field Parameter Averages Monitor Zone

Field pH:	7.31
Specific Condutance (uS/cm)	4724
Temperature (Celcius)	28.8
TDS (mg/L)	2754
Water Level (ft NGVD 29)	41.50

Monitor Zone Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	14.3	17
Sodium (Na)	565.2	640
Calcium (Ca)	140	168.4
Magnesium (Mg)	100	120
Chloride (Cl)	1224	1400
Bicarbonate (HCO_3)	148.7	180.9
Sulfate (SO_4)	158	200

Site Name	**M-1034**	Lat / Long:	271145.4 / 801459.2
Station Names	STU-MZU and STU-MZL	County:	Martin
Aquifers	UFA, LFA-FZ1	Wellhead Repair Date:	1992
FDEP Identifier	Unknown		
Date of this summary	6/28/2016		



11/8/2006

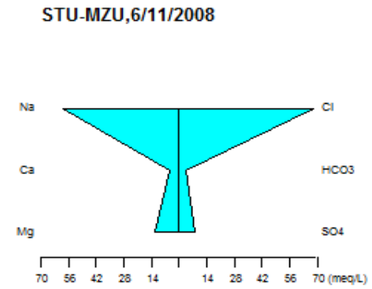
Survey data:	1/4/2005 NGVD29 Offset +1.462
Reference elevations:	12.253 ft NAVD88
References	Fact Sheet City of Stuart, Permit Numbers 0043090-128UO, WACS Facility ID #68887, FDEP July 2013
	SFWMD Survey 1/4/2005

STU-MZU Monitor Zone

Casing Material:	Steel
Diameter:	16-inch
Data Range:	1999-2008
Sampling Events Analyzed:	10
Water Type:	Na-Cl

Field Parameter Averages STU-MZU

Field pH:	7.74
Specific Condutance (uS/cm)	6964
Temperature (Celcius)	24.57
TDS (mg/L)	5433
Water Level (ft NGVD 29)	none



STU-MZU Ionic Ranges

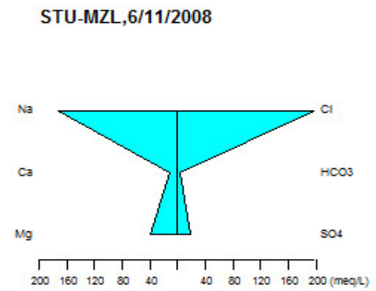
Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	50	130
Sodium (Na)	1200	3400
Calcium (Ca)	48.6	200
Magnesium (Mg)	130	390
Chloride (Cl)	2200	6100
Bicarbonate (HCO_3)	76	285
Sulfate (SO_4)	44	400

STU-MZL Monitor Zone

Casing Material:	Steel
Diameter:	8.625-inch
Data Range:	1999-2008
Sampling Events Analyzed:	13
Water Type:	Na-Cl

Field Parameter Averages STU-MZL

Field pH:	7.86
Specific Condutance (uS/cm)	24291
Temperature (Celcius)	24.36
TDS (mg/L)	14422
Water Level (ft NGVD 29)	not available



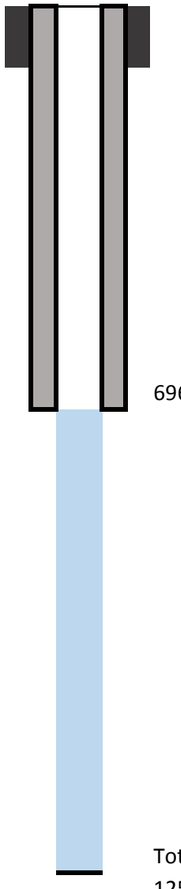
STU-MZL Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	51	400
Sodium (Na)	1300	9700
Calcium (Ca)	100	380
Magnesium (Mg)	130	1100
Chloride (Cl)	2500	18025
Bicarbonate (HCO_3)	173	232
Sulfate (SO_4)	370	1354

Site Name	**W-7362**
Station Names	W-7362
Aquifers	UFA
FDEP Identifier	Unknown
Date of this summ	8/10/2016

Lat / Long:	250726.45/802430.2
County:	Monroe
Wellhead Repair Date:	Unknown

Land Surface
Elevation
2ft NGVD29



696 ft

Monitor Zone
696 -1259 ft

Total Depth
1259 ft

Monitor Zone

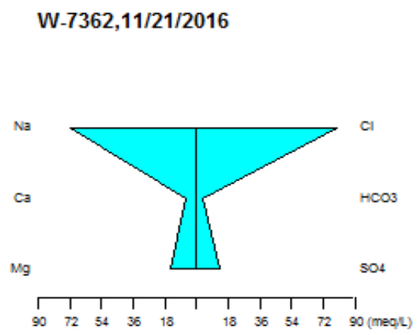
Casing Material:	Unknown
Diameter:	6-inch
Data Range:	2016
Sampling Events Analyzed:	1
Water Type:	Na-Cl

Field Parameter Averages Monitor Zone

Field pH:	7.4
Specific Condutance (uS/cm)	9697
Temperature (Celcius)	26.8
TDS (mg/L)	5529
Water Level (ft NGVD 29)	no data

Monitor Zone Ionic Concentration

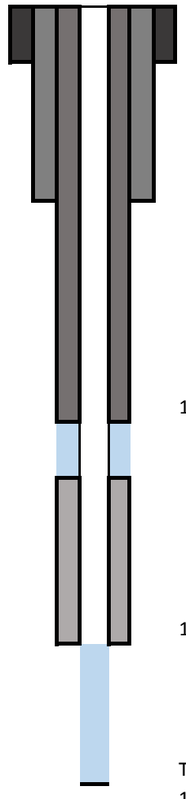
Parameter	Concentration (mg/L)
Potassium (K)	72
Sodium (Na)	1644
Calcium (Ca)	131
Magnesium (Mg)	176
Chloride (Cl)	2846
Bicarbonate (HCO_3)	221
Sulfate (SO_4)	650



Site Name	**WASAN**
Station Names	WASANMZ1, WASANMZ2
Aquifers	UFA, APPZ
FDEP Identifier	Unknown
Date of this summary	8/10/2017

Lat / Long:	255505.037/800849.465
County:	Miami-Dade
Wellhead Repair Date:	Unknown

Land surface elevation



1050ft

Upper Monitor Zone
1050-1150ft

1410ft

Lower Monitor Zone
1410-1510ft

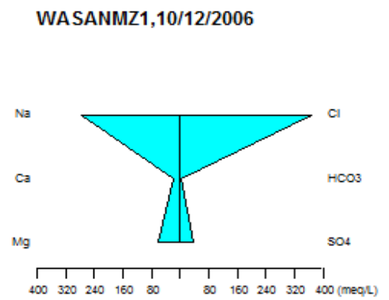
Total Depth
1560ft

Date of photo unknown

Survey data:	9/15/2004
Note	No longer used for monitoring

Upper Monitor Zone WASANMZ1

Casing Material:	Unknown
Diameter:	12-inch
Data Range:	2004-2006
Sampling Events Analyzed:	6
Water Type:	Na-Cl



Field Parameter Averages WASANMZ1

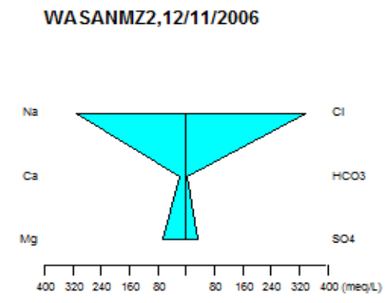
Field pH:	8.25
Specific Condutance (uS/cm)	6364
Temperature (Celcius)	24.33
TDS (mg/L)	3453
Water Level (ft NGVD 29)	

WASANMZ1 Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	29	270
Sodium (Na)	927	6390
Calcium (Ca)	97	350
Magnesium (Mg)	138	760
Chloride (Cl)	1800	13000
Bicarbonate (HCO_3)	62	244
Sulfate (SO_4)	280	1700

Lower Monitor Zone WASANMZ2

Casing Material:	Unknown
Diameter:	7-inch
Data Range:	2005-2006
Sampling Events Analyzed:	8
Water Type:	Na-Cl



Field Parameter Averages WASANMZ2

Field pH:	7.64
Specific Condutance (uS/cm)	34835
Temperature (Celcius)	19.18
TDS (mg/L)	22225
Water Level (ft NGVD 29)	

WASANMZ2 Ionic Ranges

Parameter	Min (mg/L)	Max (mg/L)
Potassium (K)	213	300
Sodium (Na)	6440	7100
Calcium (Ca)	288	405
Magnesium (Mg)	715	847
Chloride (Cl)	12000	13400
Bicarbonate (HCO_3)	219	256
Sulfate (SO_4)	1400	2400