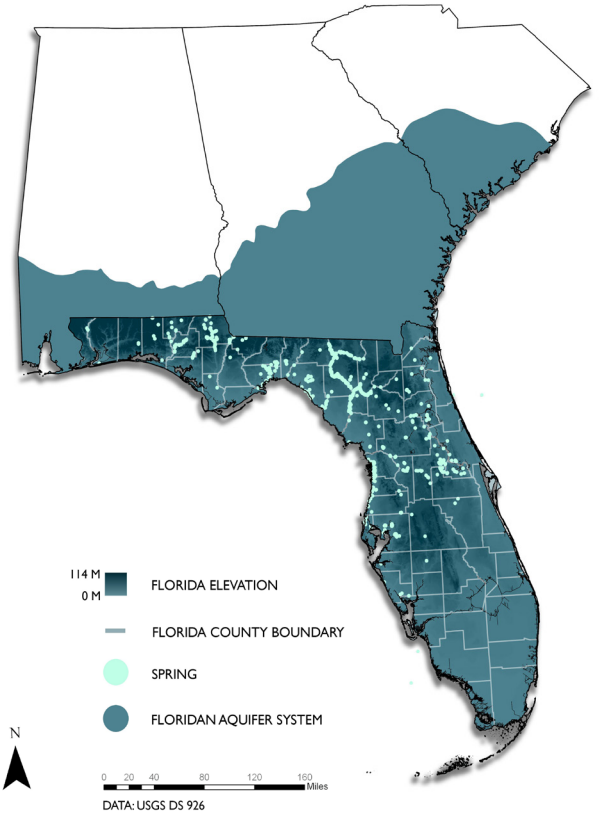
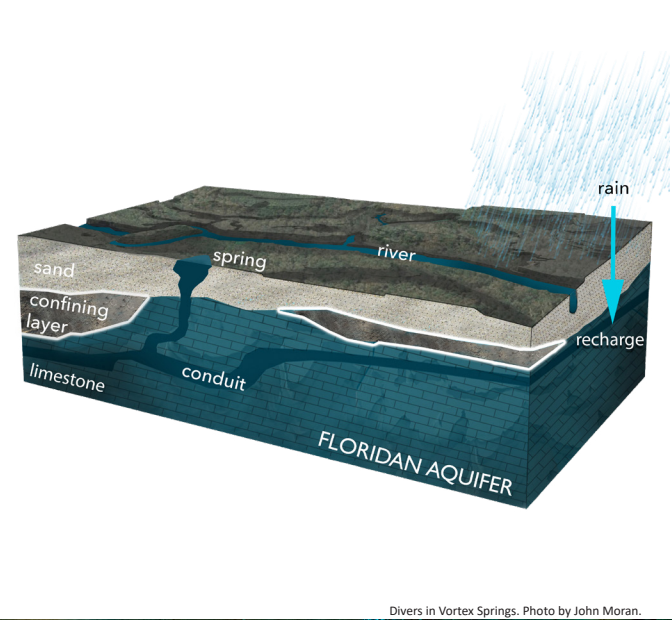

Florida Springs
POCKET
GUIDE

The Floridan Aquifer

Considered one of the most productive aquifers in the world, the Floridan Aquifer System covers all of Florida and portions of Alabama, South Carolina, and Georgia.





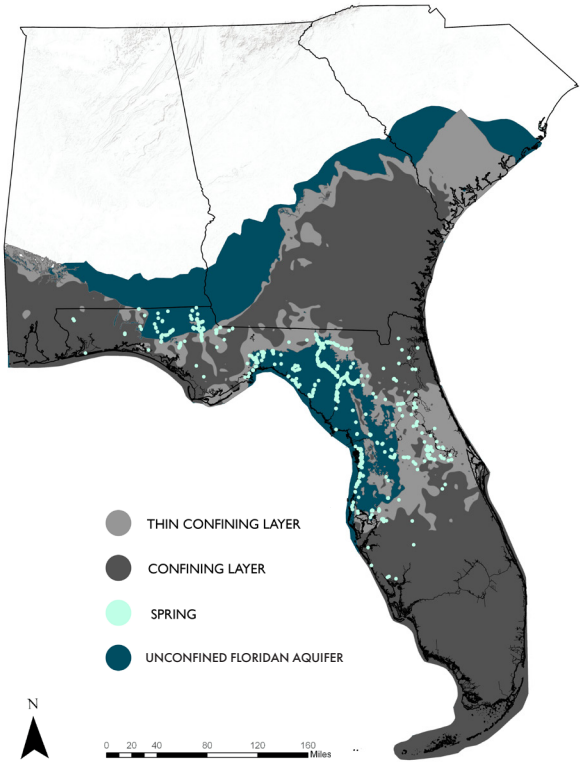
Karst Riverbank on the Suwannee River. Photo by Haley Moody.

Divers in Vortex Springs. Photo by John Moran.

Karst

Much of Florida's geology consists of limestone formations known as karst. Rainwater is naturally slightly acidic, dissolving Florida's soluble limestone as it percolates through the ground's surface, creating holes and fissures in the rock.

A karst landscape is characterized by the presence of sinkholes, springs, and conduits that create the ***Floridan Aquifer System.***



Aquifer Confinement

The Floridan Aquifer may be ***confined*** or ***unconfined***, depending on the presence or absence of a ***confining layer.*** A confining layer is a geological formation that limits **aquifer recharge.** In Florida, the confining layer is often a layer of fine sediment or clay.

In ***unconfined*** areas, rainwater enters the aquifer directly after percolating through well drained, sandy soils. This crucial process is known as ***aquifer recharge*** and is the primary method of replenishing groundwater.

An ***unconfined aquifer*** is great for recharge, but this is also where the aquifer is ***most vulnerable*** to contaminants entering our groundwater from human activities on the surface.

Little River Springs from above. Photo by John Moran.

Springs

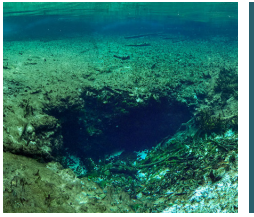
Springs are areas where pressure in the aquifer causes groundwater to flow from an opening in the land's surface. There are ***1,000+*** freshwater springs in Florida.

Florida's springs are categorized by the average amount of water that they discharge on a daily basis. These categories are known as ***magnitudes.***

Florida has more first magnitude springs than any other state in the U.S.

1st MAGNITUDE
=
> 65
MILLION GALLONS/DAY

2nd MAGNITUDE
=
6.5 - 65
MILLION GALLONS/DAY



3rd MAGNITUDE
=
.65 - 6.5
MILLION GALLONS/DAY

4th MAGNITUDE
=
< .65
MILLION GALLONS/DAY

The Importance of the Aquifer and Springs

Clean groundwater is vital for the future of Florida. A healthy aquifer and springs means a healthy future for our state.

Gilchrist Blue Spring. Photo by John Moran.

The most recent USGS water report (2015) estimates that over **92%** of Florida's population rely on groundwater for their drinking water. That is just over **18 million people** that depend on a healthy aquifer.

According to an economic impact assessment for the Florida State Park System, in 2019 Florida State Parks with springs had over **4 million visitors**, with an economic impact of **$370 million**. Springs are an important part of tourism in Florida.

Countless Florida businesses, industries, and farms depend on a clean and plentiful groundwater supply.

Crop irrigation. Photo by John Moran.

Fertilizers, human wastewater, and livestock waste are the primary sources of nitrogen loading from activities at the land's surface. ***Nitrates*** from human activities may enter the Floridan Aquifer either directly through karst features like sinkholes, or after percolating through sandy soils into groundwater.

Increasing demand for groundwater reduces the quantity of water available to discharge from our springs and the source of water that Florida's population relies on for drinking.

Our Impact

Human activities at the land's surface affect the ***quality*** of water and groundwater withdrawals impact the ***quantity*** of water in our aquifer and springs.

Tools for Springs Protection

In 2016, the Florida Legislature identified 30 "Outstanding Florida Springs" as part of the Springs and Aquifer Protection Act.

Silver Springs from above. Photo by Brad Stith and John Moran.

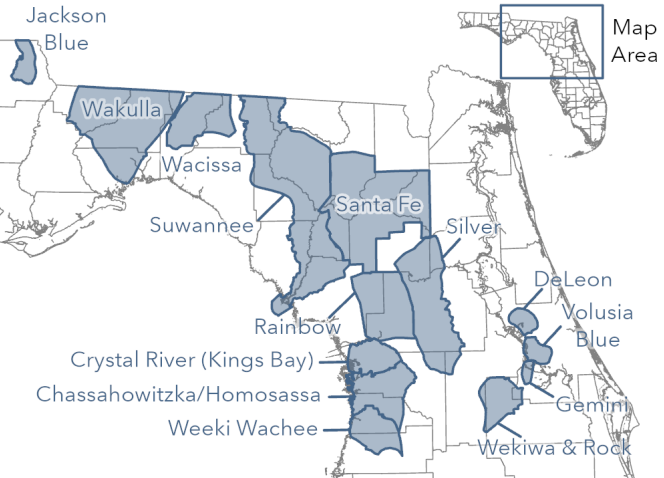
30 Outstanding Florida Springs

- Madison Blue Spring
- Volusia Blue Spring
- Homossassa Spring Group
- DeLeon Spring
- Rainbow Spring Group
- Falmouth Spring
- Jackson Blue Spring
- Silver Glen Springs
- Wekiwa Spring
- Silver Springs
- Gemini Springs
- Wakulla Spring
- Fanning Spring
- Troy Springs
- Wacissa Spring Group
- Crystal River (Including Kings Bay Springs)
- Lafayette Blue Spring
- Peacock Springs
- Devil's Ear Spring
- Ichetucknee Spring Group
- Poe Spring
- Weeki Wachee Spring Group
- Hornsby Spring
- Treehouse Spring
- Columbia Spring
- Manatee Spring
- Alexander Spring
- Gainer Spring Group
- Rock Springs
- Chassahowitzka Spring Group

WATER QUALITY

Basin Management Action Plans (BMAPs)

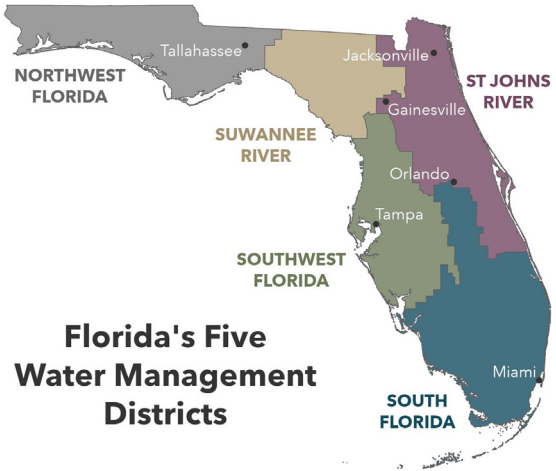
Required by the 2016 Springs and Aquifer Protection Act, FDEP established ***Basin Management Action Plans (BMAPs)*** to address water quality restoration for Florida's water bodies. These plans are focused on reducing ***nitrogen pollution*** that is impacting the water quality. Each BMAP must identify the sources of nitrogen pollution, establish a ***Total Maximum Daily Load (TMDL)*** for pollutants, as well as projects and strategies to improve water quality in the region. All 30 Outstanding Florida Springs have BMAPS and TMDLs. Florida's BMAP areas are shown below.



WATER QUANTITY

Minimum Flows and Levels (MFLs)

Florida is separated into 5 Water Management Districts, which by Florida law (section 373.042(1)) are responsible for establishing ***Minimum Flows and Levels (MFLs)*** necessary to protect Florida's water bodies. Water bodies that are below their minimum flow and level, or are projected to fall below their MFL within 20 years, must be issued a recovery or prevention strategy by their water management district. All 30 Outstanding Florida Springs have MFLs. Florida's five Water Management Districts are shown below.

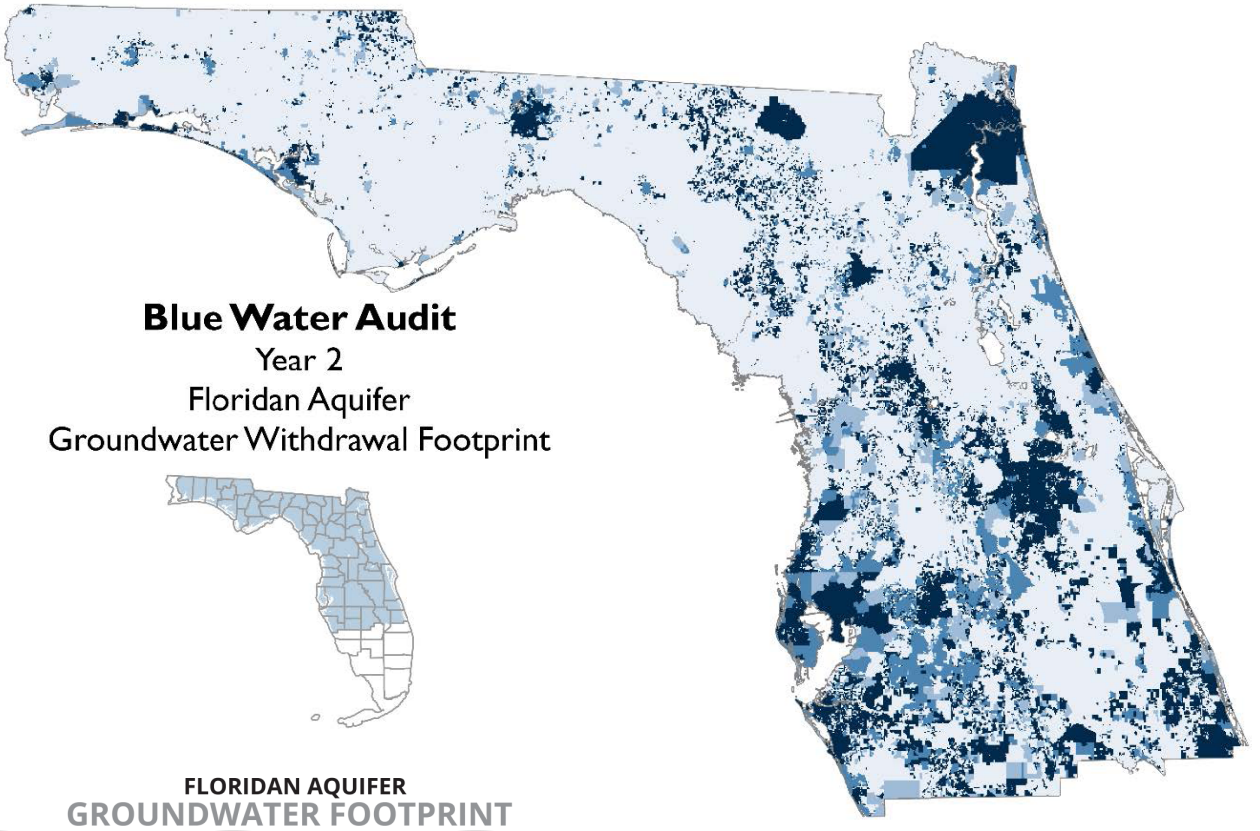


Blue Water Audit

The Howard T. Odum Florida Springs Institute created the Blue Water Audit to quantify the impact of human activities on the Floridan Aquifer, and to help others understand the problems.

Using existing data from a variety of sources, the **Blue Water Audit** estimates nitrogen loading and groundwater withdrawals for the Florida Springs Region. These estimates are used to assign Aquifer Footprints – a ***Floridan Aquifer Nitrogen Footprint*** (water quality) and a ***Floridan Aquifer Groundwater Footprint*** (water quantity).

The following pages will show visualizations of the Blue Water Audit's nitrogen and groundwater withdrawal footprints for the entire Florida Springs Region, as well as BWA profiles for four out of the five water management districts that serve the Florida Springs Region, with BMAP estimated nitrate sources for an Outstanding Florida Spring within each District.



Blue Water Audit

Year 2

Floridan Aquifer

Groundwater Withdrawal Footprint

FLORIDAN AQUIFER
GROUNDWATER FOOTPRINT

MINIMAL
Estimated to withdraw less than10,000 gallons per acre, per year from the Floridan Aquifer.

MODERATE
Estimated to withdraw 10,000 - 30,000 gallons per acre, per year from the Floridan Aquifer.

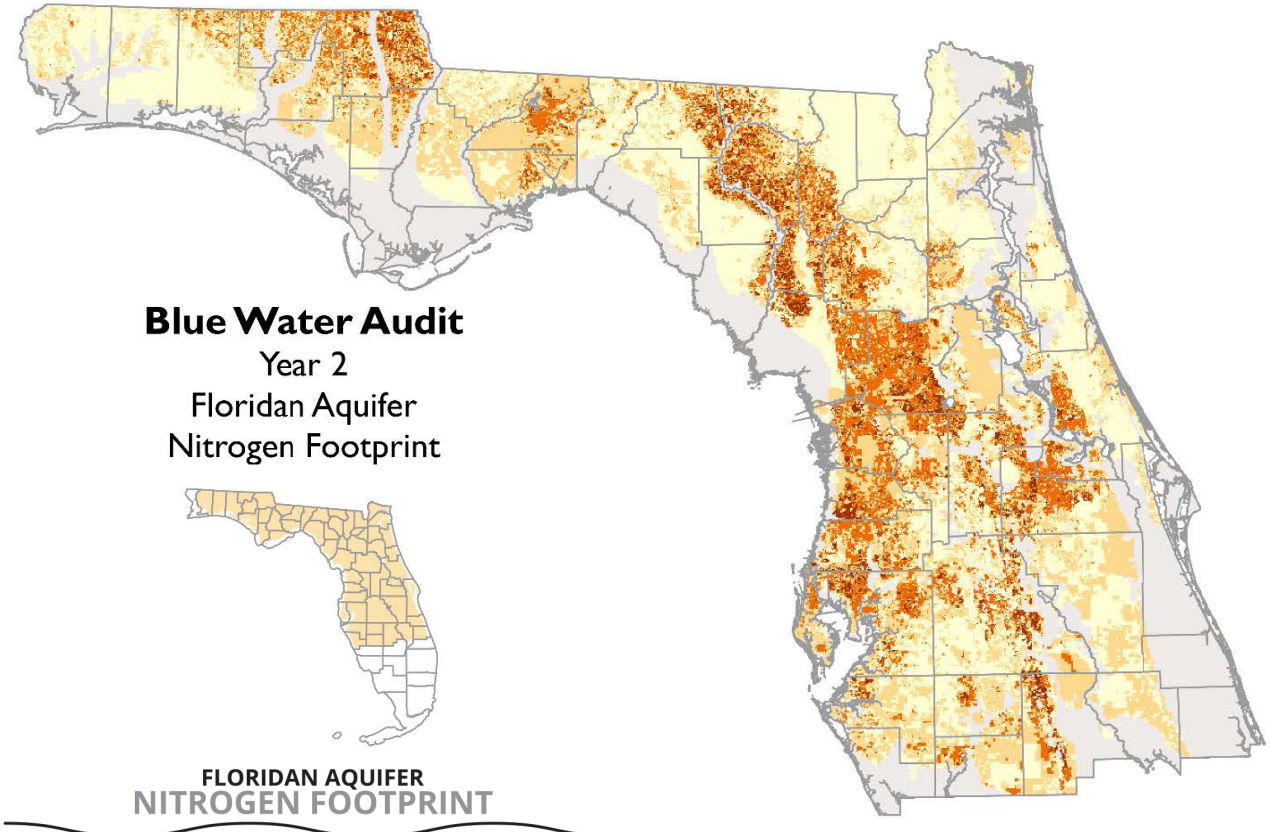
HIGH
Estimated to withdraw 30,000 - 60,000 gallons per acre, per year from the Floridan Aquifer.

SEVERE
Estimated to withdraw greater than 60,000 gallons per acre, per year from the Floridan Aquifer.

N

0 25 50 100 Miles

BLUE WATER AUDIT



Blue Water Audit

Year 2

Floridan Aquifer

Nitrogen Footprint

FLORIDAN AQUIFER
NITROGEN FOOTPRINT

ZERO
No nitrogen input into the Floridan Aquifer. Discharge area.

MINIMAL
Estimated input of less than .50 pounds of nitrogen per acre, per year into the Floridan Aquifer.

MODERATE
Estimated input .50 to 3.5 pounds of nitrogen per acre, per year into the Floridan Aquifer.

HIGH
Estimated input 3.5 to 15 pounds of nitrogen per acre, per year into the Floridan Aquifer.

SEVERE
Estimated input greater than 15 pounds of nitrogen per acre, per year into the Floridan Aquifer.

N

0 25 50 100 Miles

BLUE WATER AUDIT

Southwest Florida Water Management District

SWFWMD – Blue Water Audit

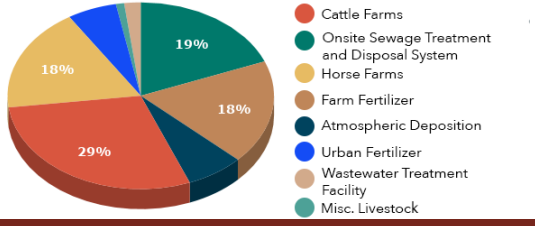
Floridan Aquifer Nitrogen Footprint

Counties: Citrus, DeSoto, Hardee, Hernando, Hillsborough, Manatee, Pasco, Pinellas, Sarasota, Sumter, and portions of Charlotte, Highlands, Lake, Levy, Marion, and Polk.

There are more than 200 springs within the SWFWMD, including 5 first magnitude, Outstanding Florida Springs groups. Collectively, these OFS spring groups discharge more than one billion gallons of groundwater per day.

Using Rainbow Springs as an example of a well-known Outstanding Florida Spring within a state park in this WMD, below is a graph of the sources of estimated nitrogen loading to groundwater for the Rainbow Springs BMAP area. **Cattle Farms, Onsite Sewage Treatment and Disposal Systems, Horse Farms, and Farm Fertilizers** are the biggest sources of nitrogen loading for the Rainbow Springs BMAP area.

SWFWMD - Rainbow Springs Group and Rainbow Springs Run BMAP Estimated Nitrogen Loading to Groundwater by Source



On the right is the Blue Water Audit Floridan Aquifer Nitrogen Footprint visualization for this District, with use categories indicated below.

FLORIDAN AQUIFER
NITROGEN FOOTPRINT

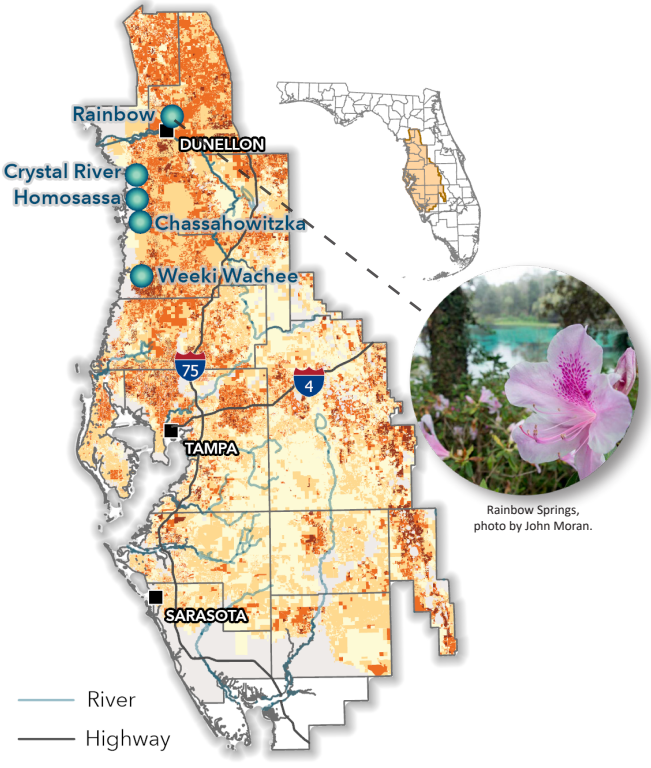
ZERO
No nitrogen input into the Floridan Aquifer. Discharge area.

MINIMAL
Estimated input of less than .50 pounds of nitrogen per acre, per year into the Floridan Aquifer.

MODERATE
Estimated input .50 to 3.5 pounds of nitrogen per acre, per year into the Floridan Aquifer.

HIGH
Estimated input 3.5 to 15 pounds of nitrogen per acre, per year into the Floridan Aquifer.

SEVERE
Estimated input greater than 15 pounds of nitrogen per acre, per year into the Floridan Aquifer.



Rainbow Springs, photo by John Moran.

BLUE WATER AUDIT

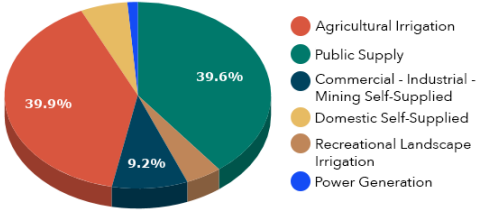
Southwest Florida Water Management District

SWFWMD – Blue Water Audit

Floridan Aquifer Groundwater Withdrawal Footprint

According to USGS data for 2015, an estimated **773.08 million gallons per day** of fresh groundwater were withdrawn within the SWFWMD in 2015. Below you can find the breakdown of source-specific estimated water withdrawals, indicating that **Public Supply** was the largest, **Agricultural Irrigation** the second largest, and **Commercial - Industrial - Mining Self-Supplied** wells the third largest fresh groundwater consumer within this WMD.

SWFMD - Fresh Groundwater Withdrawals (2015)



On the right is the Blue Water Audit Groundwater Withdrawal Footprint visualization for this WMD, with use categories indicated below.

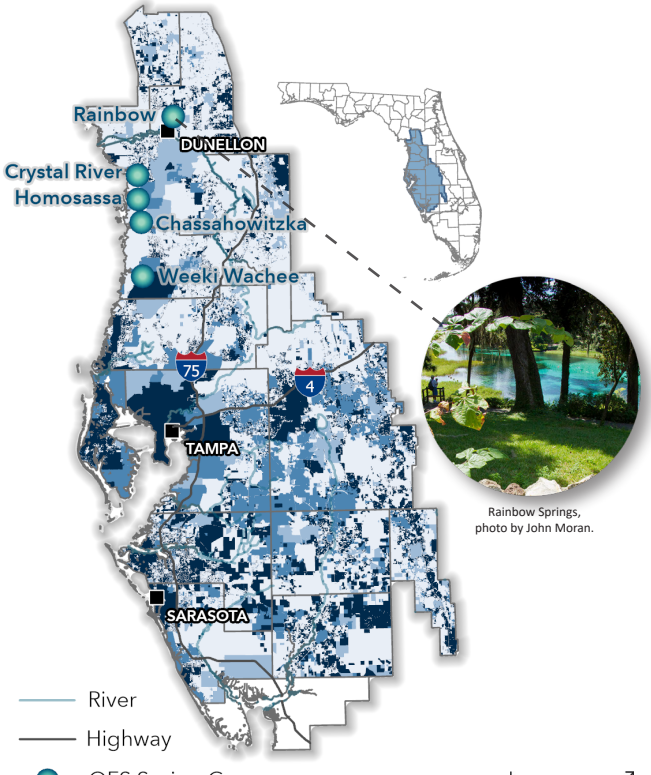
FLORIDAN AQUIFER GROUNDWATER FOOTPRINT

MINIMAL
Estimated to withdraw less than10,000 gallons per acre, per year from the Floridan Aquifer.

MODERATE
Estimated to withdraw 10,000 - 30,000 gallons per acre, per year from the Floridan Aquifer.

HIGH
Estimated to withdraw 30,000 - 60,000 gallons per acre, per year from the Floridan Aquifer.

SEVERE
Estimated to withdraw greater than 60,000 gallons per acre, per year from the Floridan Aquifer.



Rainbow Springs, photo by John Moran.

BLUE WATER AUDIT

Suwannee River Water Management District

SRWMD – Blue Water Audit

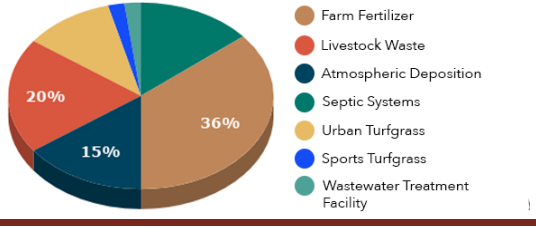
Floridan Aquifer Nitrogen Footprint

Counties: Columbia, Dixie, Gilchrist, Hamilton, Lafayette, Madison, Suwannee, Taylor, Union and portions of Alachua, Baker, Bradford, Jefferson, and Levy.

There are more than 300 documented springs in the SRWMD. Of Florida's 33 first-magnitude springs, 21 are within the SRWMD. This district's territory includes over 7,640 square miles, with an estimated population of 340,000 people.

Using Ichetucknee as an example of a well-known Outstanding Florida Spring within a state park in this WMD, below is a graph of the sources of estimated nitrogen loading to groundwater for the Ichetucknee Springshed within the Santa Fe BMAP area. **Farm Fertilizer, Livestock Waste, and Atmospheric Deposition** are the biggest sources of nitrogen loading for the Ichetucknee springshed within the Santa Fe BMAP area.

SRWMD - Santa Fe BMAP: Ichetucknee Springshed
Estimated Nitrogen Loading to Groundwater by Source

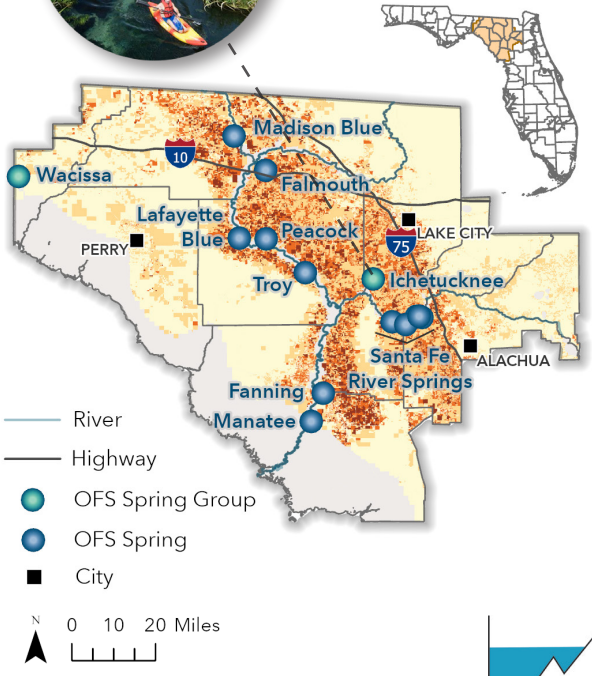


On the right is the Blue Water Audit Floridan Aquifer Nitrogen Footprint visualization for this District, with use categories indicated below.

FLORIDAN AQUIFER
NITROGEN FOOTPRINT

ZERO	MINIMAL	MODERATE	HIGH	SEVERE
No nitrogen input into the Floridan Aquifer. Discharge area.	Estimated input of less than .50 pounds of nitrogen per acre, per year into the Floridan Aquifer.	Estimated input .50 to 3.5 pounds of nitrogen per acre, per year into the Floridan Aquifer.	Estimated input 3.5 to 15 pounds of nitrogen per acre, per year into the Floridan Aquifer.	Estimated input greater than 15 pounds of nitrogen per acre, per year into the Floridan Aquifer.

Ichetucknee Spring Run, photo by John Moran.



BLUE WATER AUDIT

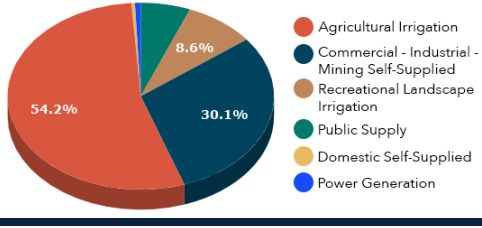
Suwannee River Water Management District

SRWMD – Blue Water Audit

Floridan Aquifer Groundwater Withdrawal Footprint

According to USGS data for 2015, an estimated **222.54 million gallons per day** of fresh groundwater were withdrawn within the SRWMD in 2015. Below you can find the breakdown of source-specific estimated water withdrawals, indicating that **Agricultural Irrigation** was the largest, **Commercial-Industrial-Mining Self-Supplied** wells the second largest, and **Domestic Self-Supplied** wells the third largest fresh groundwater consumer within this WMD.

SRWMD - Fresh Groundwater Withdrawals (2015)



On the right is the Blue Water Audit Groundwater Withdrawal Footprint visualization for this WMD, with use categories indicated below.

FLORIDAN AQUIFER
GROUNDWATER FOOTPRINT

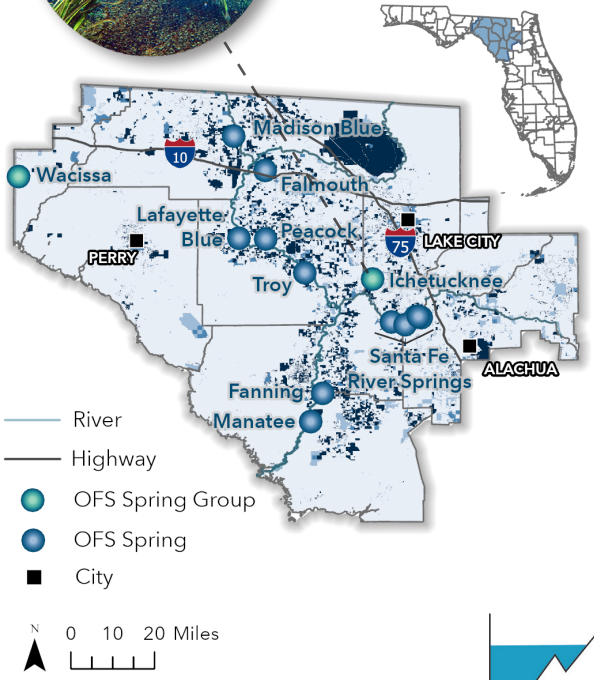
MINIMAL
Estimated to withdraw less than10,000 gallons per acre, per year from the Floridan Aquifer.

MODERATE
Estimated to withdraw 10,000 - 30,000 gallons per acre, per year from the Floridan Aquifer.

HIGH
Estimated to withdraw 30,000 - 60,000 gallons per acre, per year from the Floridan Aquifer.

SEVERE
Estimated to withdraw greater than 60,000 gallons per acre, per year from the Floridan Aquifer.

Ichetucknee Spring Run, photo by John Moran.



BLUE WATER AUDIT

St. Johns River Water Management District

SJRWMD – Blue Water Audit

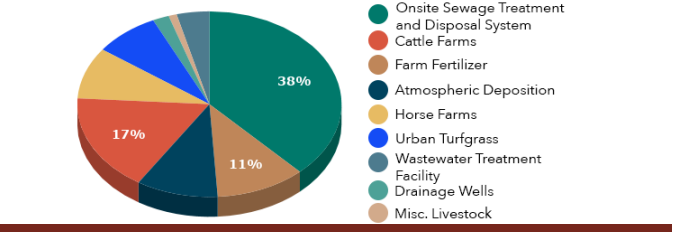
Floridan Aquifer Nitrogen Footprint

Counties: Brevard, Clay, Duval, Flagler, Indian River, Nassau, Seminole, St. Johns, Volusia, and portions of Alachua, Baker, Bradford, Lake, Marion, Okeechobee, Orange, Osceola, and Putnam.

There are 148 known springs and 1,400 lakes in the SJRWMD. This WMD covers 12,283 square miles. The main water body is the longest river entirely contained in the state of Florida, the St. Johns River.

Using Silver Springs as an example of a well-known Outstanding Florida Spring within a state park in this WMD, below is a graph of the sources of estimated nitrogen loading to groundwater for the Silver Springs BMAP area. **Onsite Sewage Treatment and Disposal Systems, Cattle Farms, and Farm Fertilizer** are the biggest sources of nitrogen loading for the Silver Springs BMAP area.

SJRWMD - Silver Springs, Silver Springs Group, and Upper Silver River BMAP Estimated Nitrogen Loading to Groundwater by Source



On the right is the Blue Water Audit Floridan Aquifer Nitrogen Footprint visualization for this District, with use categories indicated below.

FLORIDAN AQUIFER

NITROGEN FOOTPRINT

ZERO
No nitrogen input into the Floridan Aquifer. Discharge area.

MINIMAL
Estimated input of less than .50 pounds of nitrogen per acre, per year into the Floridan Aquifer.

MODERATE
Estimated input .50 to 3.5 pounds of nitrogen per acre, per year into the Floridan Aquifer.

HIGH
Estimated input 3.5 to 15 pounds of nitrogen per acre, per year into the Floridan Aquifer.

SEVERE
Estimated input greater than 15 pounds of nitrogen per acre, per year into the Floridan Aquifer.

Silver Springs, photo by John Moran.

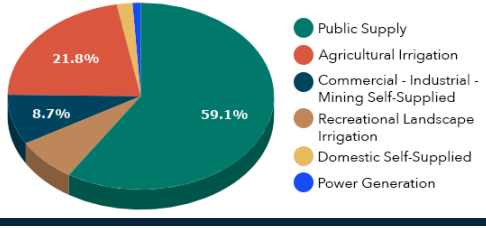
St. Johns River Water Management District

SJRWMD – Blue Water Audit

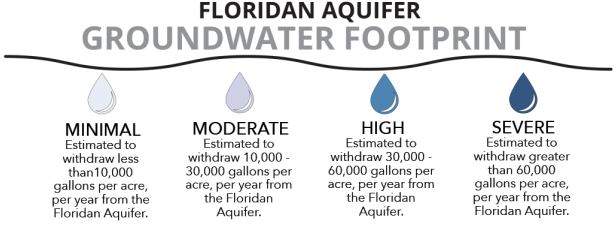
Floridan Aquifer Groundwater Withdrawal Footprint

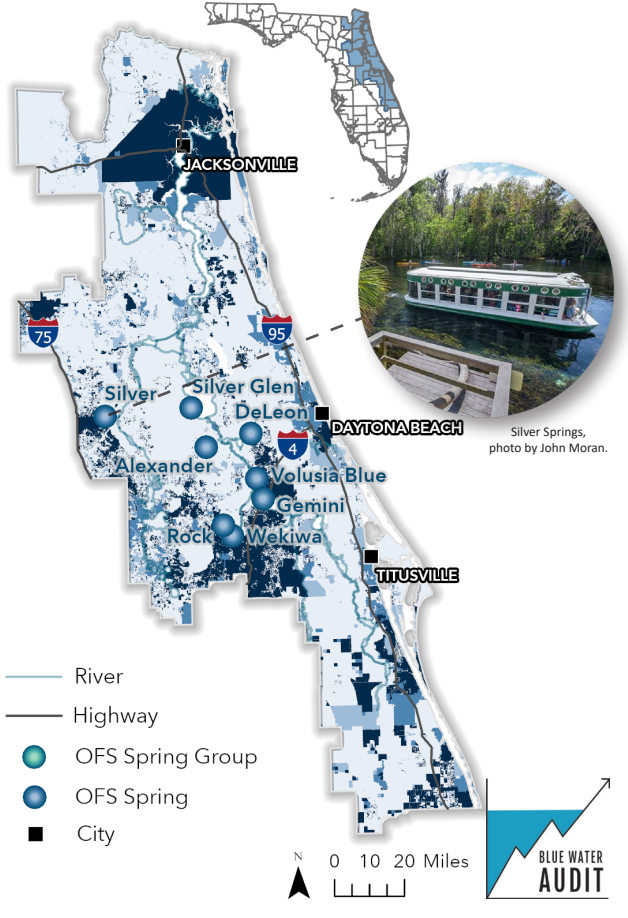
According to USGS data for 2015, an estimated **867.73 million gallons per day** of fresh groundwater were withdrawn within the SJRWMD in 2015. Below you can find the breakdown of source-specific estimated water withdrawals, indicating that **Public Supply** was the largest, **Agricultural Irrigation** the second largest, and **Commercial - Industrial - Mining Self-Supplied** wells the third largest fresh groundwater consumer for this WMD.

SJRWMD - Fresh Groundwater Withdrawals (2015)



On the right is the Blue Water Audit Groundwater Withdrawal Footprint visualization for this WMD, with use categories indicated below.





Silver Springs, photo by John Moran.

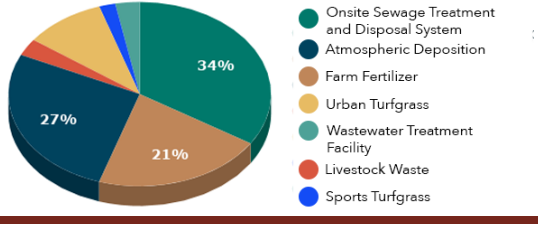
Northwest Florida Water Management District

Counties: Bay, Calhoun, Escambia, Franklin, Gadsden, Gulf, Holmes, Jackson, Jefferson (western half), Leon, Liberty, Okaloosa, Santa Rosa, Wakulla, Walton, and Washington.

There are more than 250 documented springs in the NWFWMD. This district covers 11,305 square miles and serves an estimated population of 1.37 million residents. Within this district lie serval major hydrologic basins, including Apalachicola River and Bay, Pensacola Bay System, and St. Marks River Basin (includes the Wakulla River).

Using Wakulla Springs as an example of a well-known Outstanding Florida Spring within a state park in this WMD, below is a graph of the sources of estimated nitrogen loading to groundwater for the Wakulla Springs BMAP area. **Onsite Sewage Treatment and Disposal Systems, Atmospheric Deposition, and Farm Fertilizer** are the biggest sources of nitrogen loading for the Wakulla BMAP area.

NWFWMD - Upper Wakulla River and Wakulla Springs BMAP
Estimated Nitrogen Loading to Groundwater by Source



On the right is the Blue Water Audit Floridan Aquifer Nitrogen Footprint visualization for this District, with use categories indicated below.

FLORIDAN AQUIFER
NITROGEN FOOTPRINT

ZERO
No nitrogen input into the Floridan Aquifer. Discharge area.

MINIMAL
Estimated input of less than .50 pounds of nitrogen per acre, per year into the Floridan Aquifer.

MODERATE
Estimated input .50 to 3.5 pounds of nitrogen per acre, per year into the Floridan Aquifer.

HIGH
Estimated input 3.5 to 15 pounds of nitrogen per acre, per year into the Floridan Aquifer.

SEVERE
Estimated input greater than 15 pounds of nitrogen per acre, per year into the Floridan Aquifer.

NWFWMD – Blue Water Audit

Floridan Aquifer Nitrogen Footprint

Wakulla Springs, photo by John Moran.

BLUE WATER AUDIT

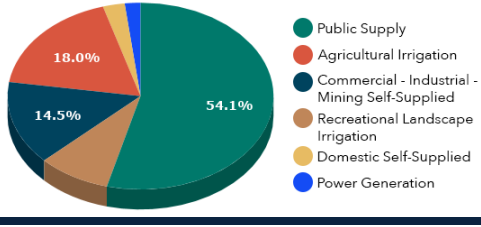
Northwest Florida Water Management District

NWFWMD – Blue Water Audit

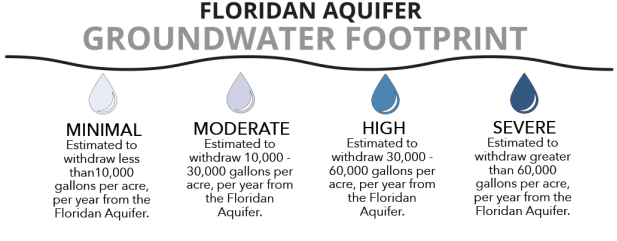
Floridan Aquifer Groundwater Withdrawal Footprint

According to USGS data for 2015, an estimated **241.46 million gallons per day** of fresh groundwater were withdrawn within the NWFWMD in 2015. Below you can find the breakdown of source-specific estimated water withdrawals, indicating that **Public Supply** was the largest groundwater consumer, **Agricultural Irrigation** the second largest, and **Commercial - Industrial-Mining Self-Supplied** wells the third largest fresh groundwater consumer within this WMD.

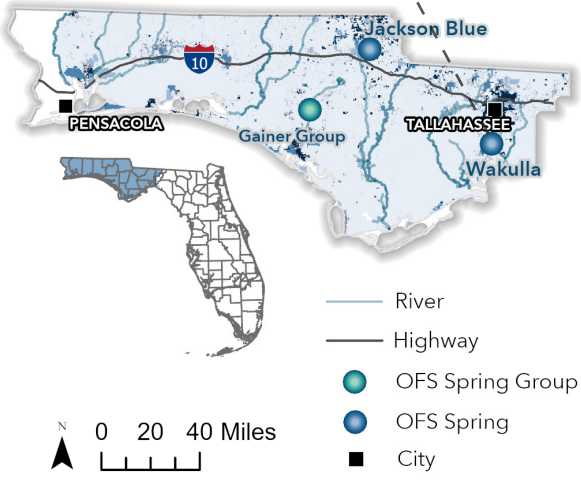
NWFWMD - Fresh Groundwater Withdrawals



On the right is the Blue Water Audit Groundwater Withdrawal Footprint visualization for this WMD, with use categories indicated below.



Wakulla Springs, photo by John Moran.



BLUE WATER AUDIT

Save Our Springs

This Florida Springs Pocket Guide was created to help people better understand Florida's aquifer and springs, the challenges they face, and the tools available for their protection.

Ruth B. Kirby Gilchrist Blue Springs, 2017. Photo by John Moran.

Florida's **1,000+ springs** are an integral part of Florida's environment and economy. Florida springs provide a window into the health of Florida's groundwater, the source of drinking water for more than 90% of Florida residents and tourists. This Pocket Guide provides basic information about our springs and the modern challenges they face: ***groundwater withdrawals*** and ***nitrogen loading***.

Basin Management Action Plans (BMAPs) with ***Total Maximum Daily Loads*** (TMDLs) are the current tools available to address excessive nutrient loading of our Outstanding Florida Springs. At this time, ***Minimum Flows and Levels*** (MFLs) are the tools for addressing excessive groundwater withdrawals.

By understanding the basics of springs science and protection in Florida, together we can do more to ***Save Our Springs.***

ACRONYMS AND ABBREVIATIONS

BMAP	Basin Management Action Plan
BWA	Blue Water Audit
DEP	Florida Department of Environmental Protection
FSI	Florida Springs Institute
MFL	Minimum Flow and Level
N	Nitrogen
NSILT	Nitrogen Source Inventory Loading Tool
NWFWMD	Northwest Florida Water Management District
OFS	Outstanding Florida Spring
OSTDS	Onsite Sewage Treatment and Disposal System
SJRWMD	St. Johns River Water Management District
SRWMD	Suwannee River Water Management District
SWFWMD	Southwest Florida Water Management District
TMDL	Total Maximum Daily Load
USGS	U.S. Geological Survey
WMD	Water Management District
WWTF	Wastewater Treatment Facility

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The Howard T. Odum Florida Springs Institute is a 501(c)(3) non-profit organization, working to protect Florida springs through sound science and education. More information about our organization can be found on our website: www.floridaspringsinstitute.org

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