### Agenda

4:30 p.m. Welcome, Introductions and Background Information

4:35 p.m. Presentations:

- Proposed Minimum Flow for the Rainbow River System
- Evaluation of Hydrologic Changes to the Rainbow River System

5:25 p.m. Public Comment Period

Please note: Anyone wanting to ask questions or provide comments will need to fill out a blue card. Blue cards are available in the lobby and should be turned into Melissa Gulvin. There is a limit of three minutes per speaker.



# Proposed Minimum Flow for the Rainbow River System



Melissa Gulvin Government Affairs



### Agenda

1. Welcome, Introductions and Background Information Melissa Gulvin, Government Affairs Program Manager

2. Proposed Minimum Flow for the Rainbow River System Kym Rouse Holzwart, Senior Environmental Scientist

3. Evaluation of Hydrologic Changes to the Rainbow River System Ron Basso, P.G., Chief Hydrogeologist

4. Public Comment Period, Facilitated by Melissa Gulvin, Government Affairs Program Manager

Please note: Anyone wanting to ask questions or provide comments will need to fill out a blue card. Blue cards are available in the lobby and should be turned into Melissa. There is a limit of three minutes per speaker.



### Timeline

Time Frame	Activities
2005 – Ongoing	Data collection and analyses
September – November 2016	Peer review panel meets and provides evaluation of the peer review draft report
November 2016 – February 2017	District Governing Board shown the peer review feedback and staff's response; Staff prepared the draft report and posted online
Feb. 23, 2017	Public meeting to seek public input
March 28, 2017	Presentation to Governing Board and request for adoption of the proposed minimum flow
April – June 2017	Rule-making process
July 1,2017	MFL must be adopted as required by SB552 passed by the State legislature in 2016



Southwest Florida Water Management District

Data

Collection

District Tools Used to Protect Springs Conservation

Community Partnerships

Water

Reuse

Permitting

Wetland Restoration

Funding

Revegetation

Conservation Programs Protecting & Restoring Natural Systems

Education

Regional Water Supply Planning

Land Acquisition Minimum Flows & Levels

Living Shorelines

> Southwest Florida Water Management District

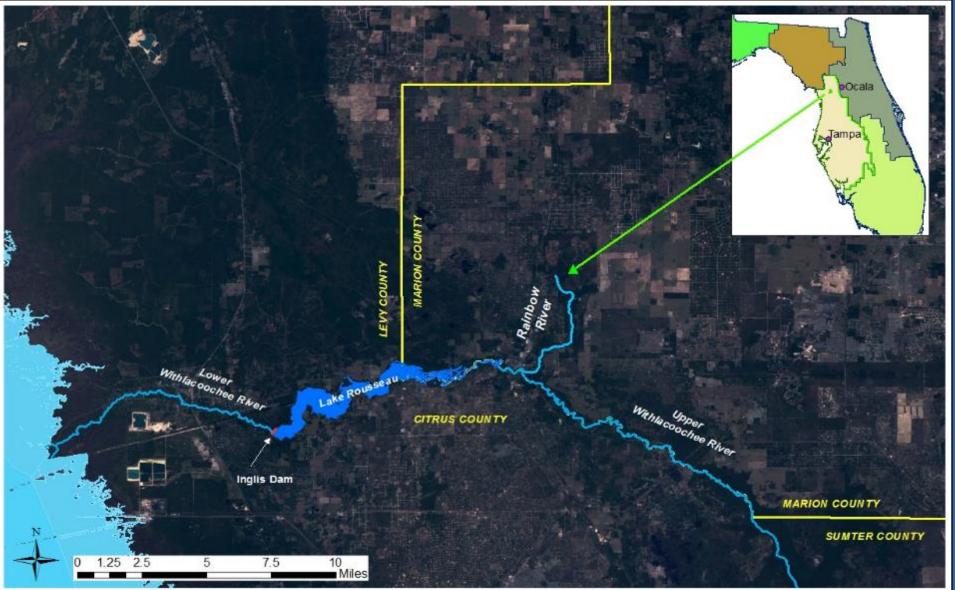
### Proposed Minimum Flow for the Rainbow River System

Dunnellon City Hall Dunnellon, Florida February 23, 2017

Kym Rouse Holzwart Senior Environmental Scientist Southwest Florida Water Management District



### **Location of Rainbow River System**





### Why Establish a Minimum Flow?

- Required by state law for priority springs, streams, and rivers [Section 373.042(1), F.S.]
- Per SB552, Minimum flow for Rainbow River System must be adopted by July 1





## What is a Minimum Flow?

- Limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area
- Established to protect flowing systems from damage caused by ground and surface water withdrawals
- Protects from significant harm







## What is a Minimum Flow?

- Must be developed using the best information available
- Tool used by the District to:
  - Protect water bodies
  - Review requests for withdrawals of ground and surface water
  - Plan for future water needs







### **Environmental Values Protected When Developing Minimum Flows**

- Recreation in and on the water
- Fish and wildlife habitats and the passage of fish
- Estuarine resources
- Transfer of detrital material
- Maintenance of freshwater storage and supply
- Aesthetic and scenic attributes
- Filtration and absorption of nutrients and other pollutants
- Sediment loads
- Water quality
- Navigation







### **Minimum Flows Criteria**

**Percent of Flow** – Percentage that flow can be reduced without reducing the availability of habitats or resources by more than 15% or that protects 85% of available habitats or resources





## **Defining Significant Harm**

#### Significant harm threshold:

- Defined as more than a 15% decrease in available habitat or resource
- Protects 85% of available habitat or resource
- Developed at suggestion of independent scientists
- Supported by 17 panels of independent scientists reviewing proposed minimum flows for other flowing systems
- Method used in minimum flows adopted for 3 other Outstanding Florida Waters
- Well supported in the literature

### Rainbow River System Minimum Flow Development: A Habitat-Based Approach





### Rainbow River System Minimum Flow Development

- Complex effort since 2005
- Conduct many studies
- Large amount of data collected
- Use best available information















### Methods Used to Develop Rainbow River System Minimum Flow

- Habitat in the water for fish, crustaceans, snails, and insects
- Sticks, logs, and roots in the water



















Southwest Florida Water Management District

### Methods Used to Develop Rainbow River System Minimum Flow

Inundated floodplain wetlands habitat











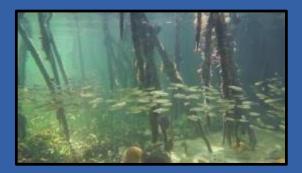






#### Instream habitat:

- 18 functional/taxonomic groups, 3 sites
- Habitat availability at two downstream sites not sensitive to reductions in flow
- At the most upstream site, largemouth bass fry habitat was the most sensitive to reductions in flow
- Flow reduction of 9% was significantly harmful to largemouth bass fry habitat







### Woody habitat:

- At all 11 sites, snags not sensitive to reductions in flow
- Roots at 3 sites sensitive to reductions in flow
- For these 3 sites, an average flow reduction of 9% was significantly harmful to root habitat









### Inundated floodplain wetlands habitat:

 An average flow reduction of 5% is significantly harmful to inundated wetlands habitat



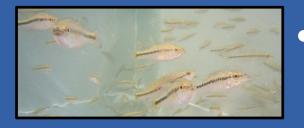


Water quality not a limiting environmental value:

- Increased nitrate not related to flow but strongly dependent on time
- Phosphorus, dissolved oxygen, chlorophyll, and water clarity have not changed over time
- With the exception of Blue Cove, river water residence times are short, limits phytoplankton (chlorophyll) accumulation
- Research ongoing to investigate effects of Blue Cove phytoplankton accumulation on the river
- Filamentous algae abundance may be related to flow and is being investigated



### Summary of Rainbow River System Minimum Flow Development Results



 9% allowable flow reduction protects instream habitat



 9% allowable flow reduction protects woody habitat

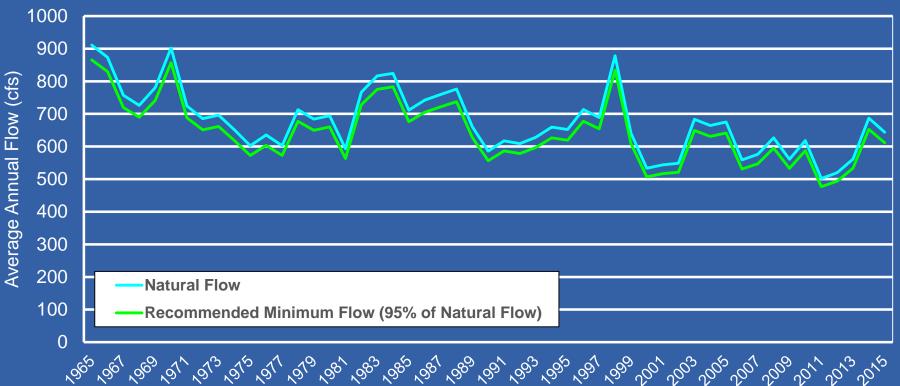


 5% allowable flow reduction protects inundated floodplain wetlands habitat



### **Proposed Minimum Flow**

- Protects 95% of natural flow or 5% allowable flow reduction due to withdrawals
- Based on habitat most sensitive to reductions in flow: inundated floodplain wetlands and on science
- Protects all environmental values evaluated





### **Results of Peer Review**

- Voluntary peer review of earlier draft report conducted in Sept.-Nov. 2016 under the Florida Sunshine Law
  - Draft report met the requirements of the law
  - Analyses were thorough, scientifically reasonable, and based on best available data
  - Overall assessment was supportive
- Current draft report and information incorporates comments/recommendations from panel and stakeholders

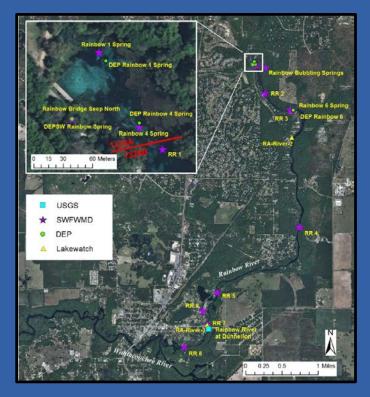






### **Minimum Flow Status Assessments**

- Recommend minimum flow re-evaluation in 10 years
- Conduct annual status assessments and 5-year assessments for regional planning
- Continue ongoing monitoring of water quality, flows, groundwater conditions, and rainfall
- Study factors affecting flows and effects of flow changes







#### An Evaluation of Hydrologic Changes to Rainbow Springs

By Ron Basso, P.G., Chief Hydrogeologist Southwest Florida Water Management District

February 23, 2017

**MFL Public Workshop** 





### What is a Spring?

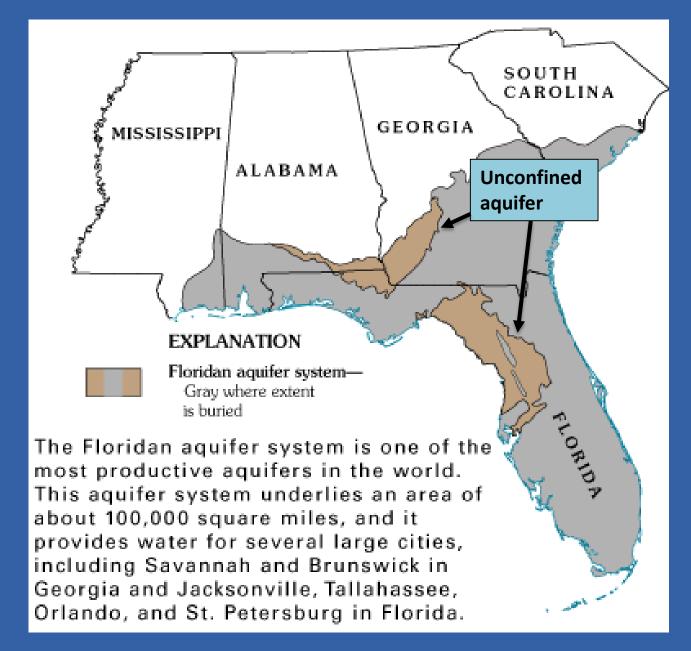
- A natural opening in the ground where water flows directly from the aquifer to the earth's surface
- Water exiting a spring is groundwater rainfall that has soaked into the ground
- Springs are a common feature of karst terrain



Spring vent where groundwater discharges from the aquifer

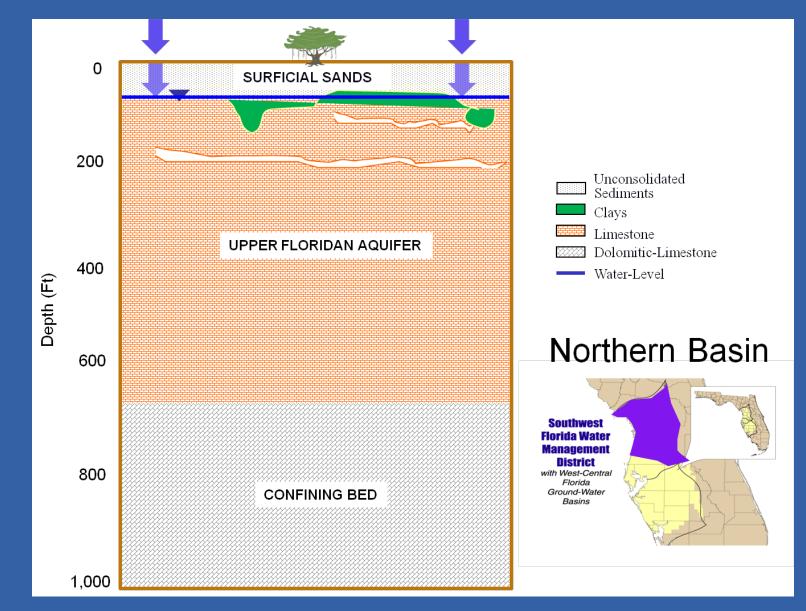


Location of the Floridan aquifer



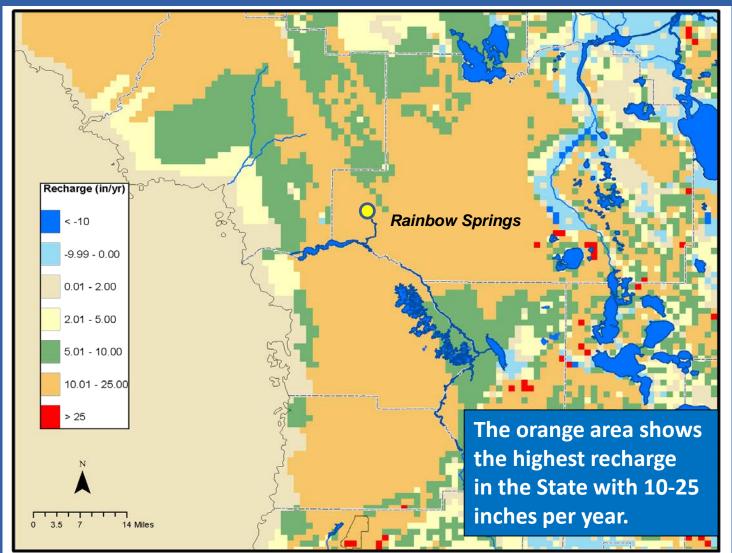


#### **Karst Geology**





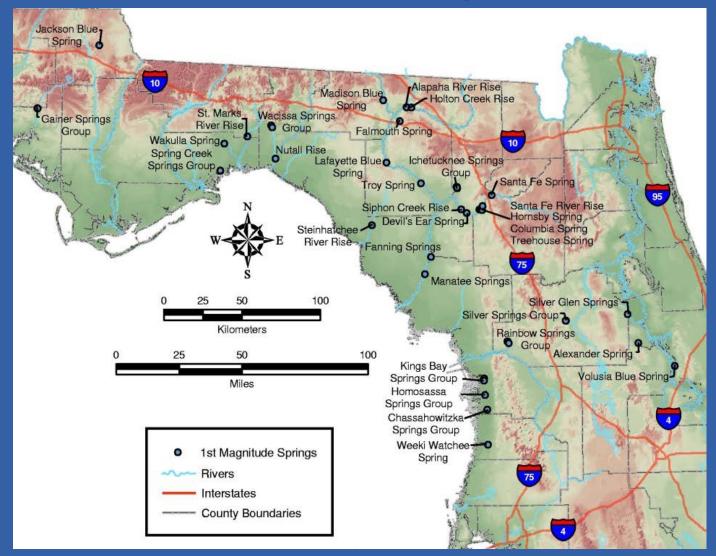
### Recharge to the Floridan aquifer based on Average Rainfall Conditions (USGS Mega Model)



### Submerged Caverns

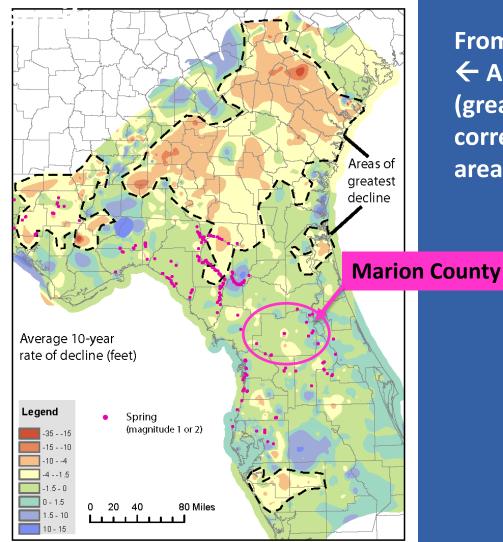


### The largest springs in Florida are located in the unconfined UFA aquifer

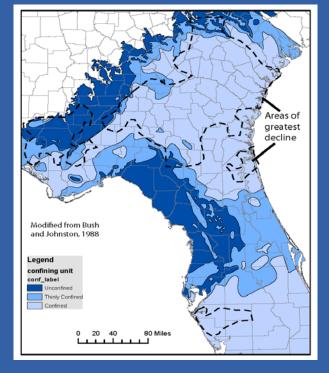




# USGS study found greatest declines in aquifer water levels in areas with well-confined Upper Floridan



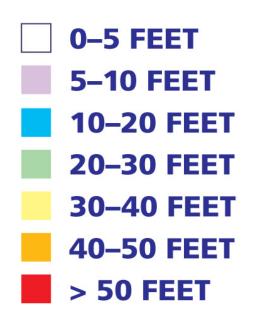
From 1970 to 2010  $\leftarrow$  Areas in reds, oranges and yellow (greatest decline in aquifer water level) corresponding to the light blue confined areas below  $\checkmark$ 



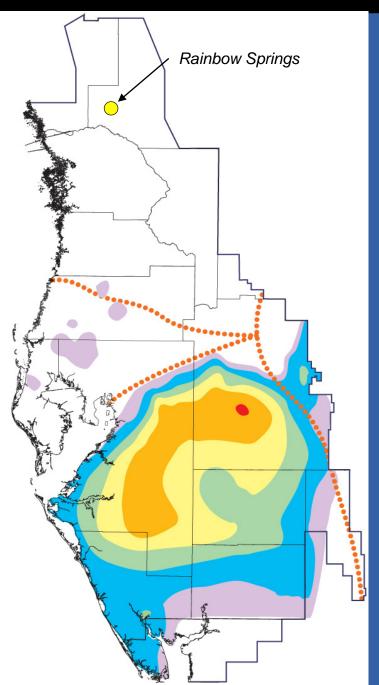


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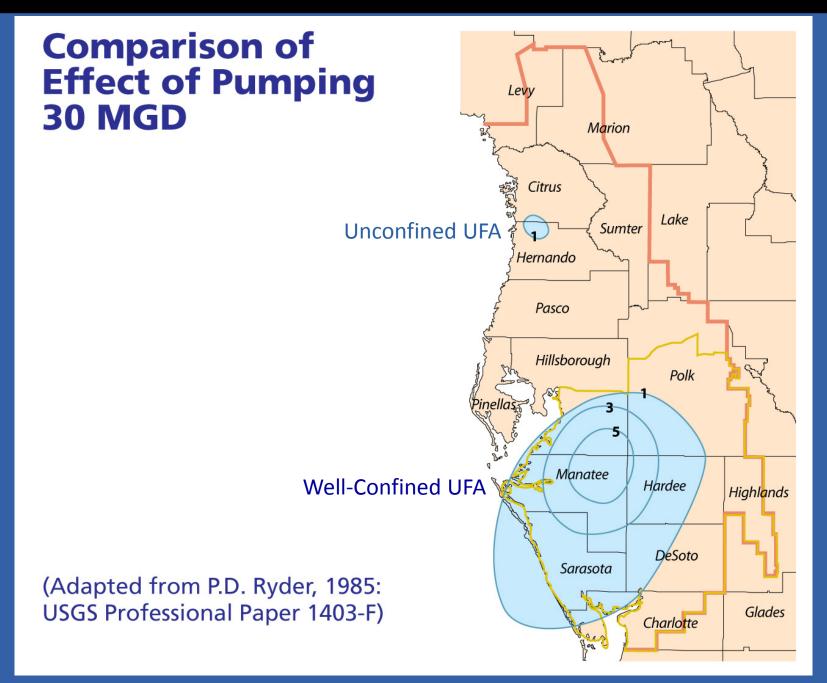
#### Water Level Decline in the Upper Floridan Aquifer since the early 1930s



Generalized delineation of major groundwater basins

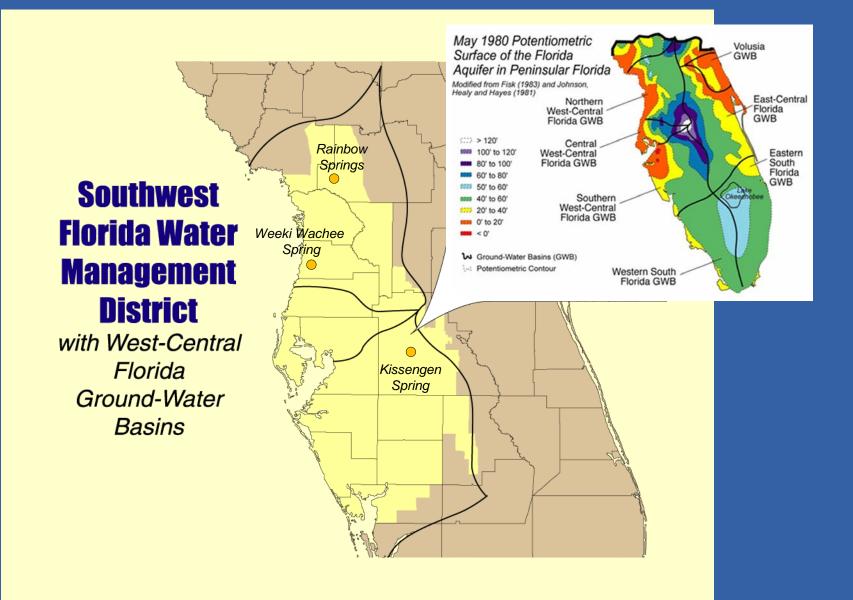




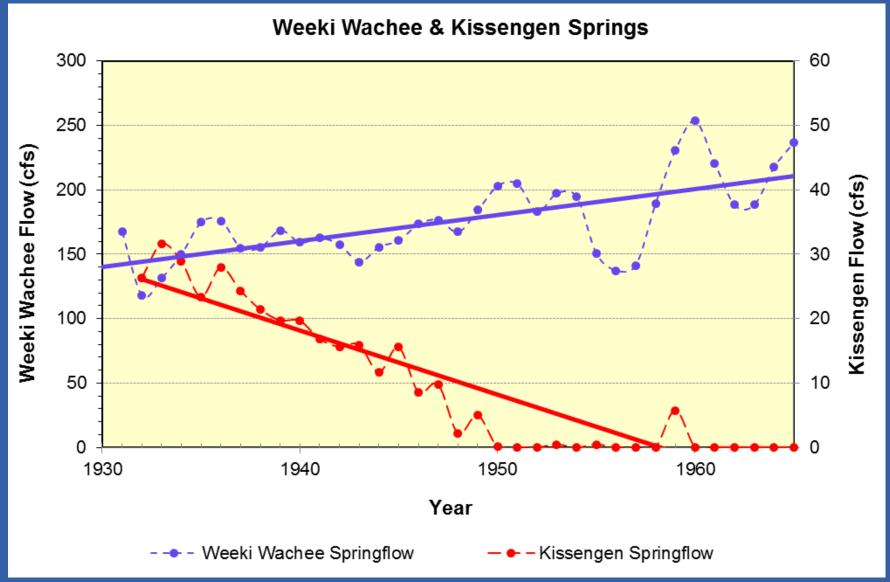




#### Southwest Florida Water Management District

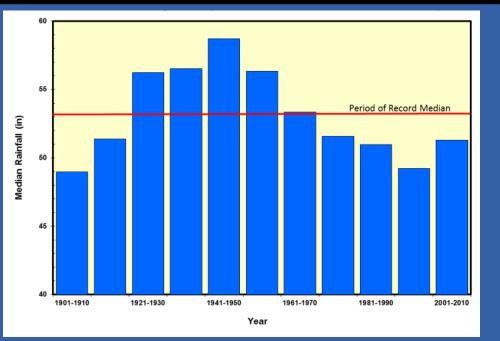






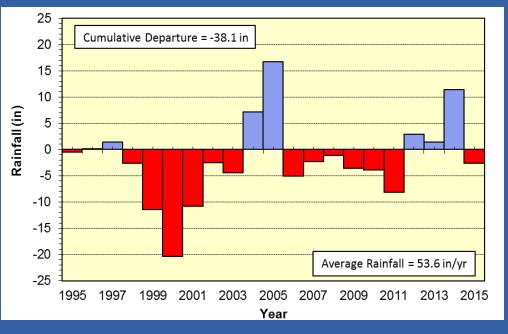
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#### Southwest Florida Water Management District



### Long-term rainfall trends

#### Annual departure in rainfall based on radar rainfall in springshed





# Simple Water Budget

Recharge = Rainfall - Evapotranspiration (ET) - Runoff In internally drained areas: Recharge = Rainfall - ET

Rainfall = 53 inches ET = 37 inches Recharge = 16 inches Rainfall = 47.7 inches ET = 35.7 inches Recharge = 12 inches

#### Net Result

10% decrease in rainfall (53 to 47.7 in) 25% decrease in recharge (16 to 12 in)

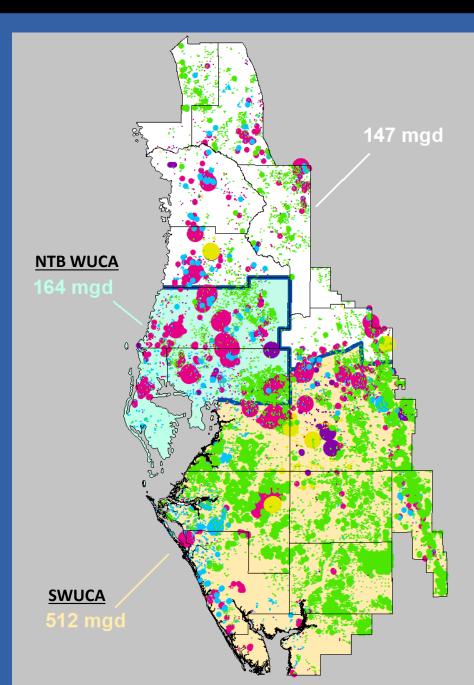
**Recharge in Springshed = Springflow** 

# 2011 Estimated & Metered Groundwater Withdrawals



#### Pumping (continuous scale)

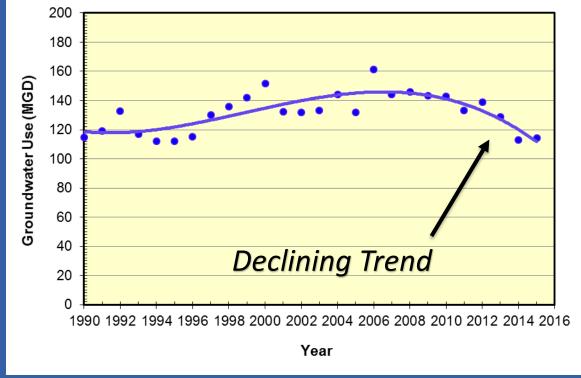
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10 mgd		_	_	_	_	_			_	_	_	_	 	1		_		/
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# **Groundwater Withdrawals in District's Northern Region**

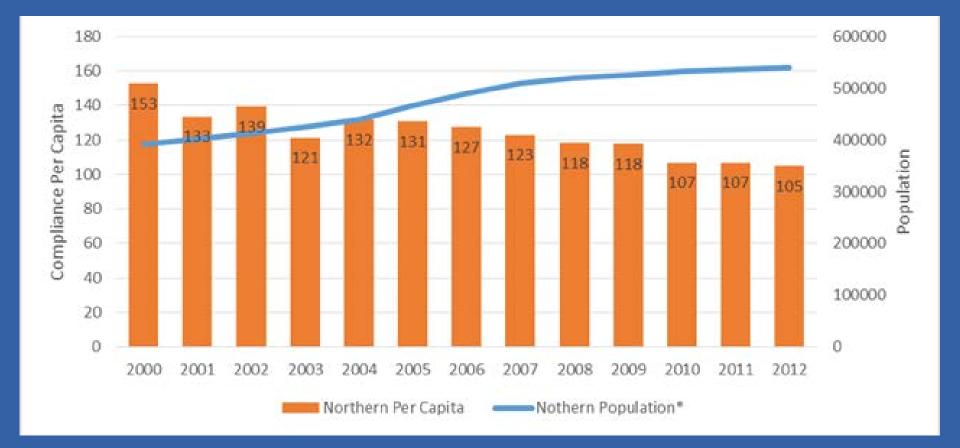




SWFWMD Northern Planning Area - Groundwater Use (1990-2015)

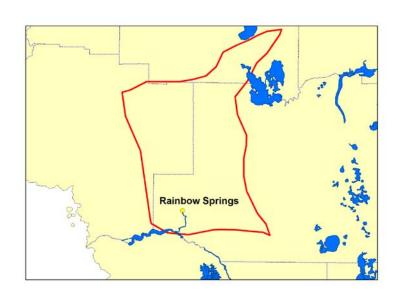


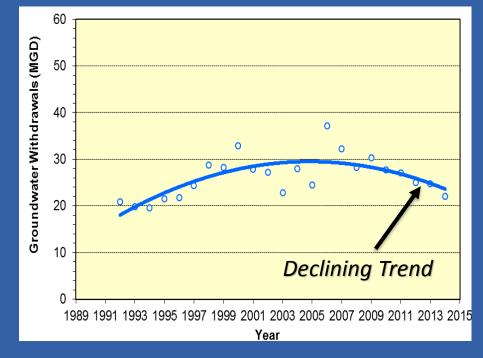
## **Northern Region Per Capita vs Population**





## **Rainbow Springshed Groundwater Withdrawals**

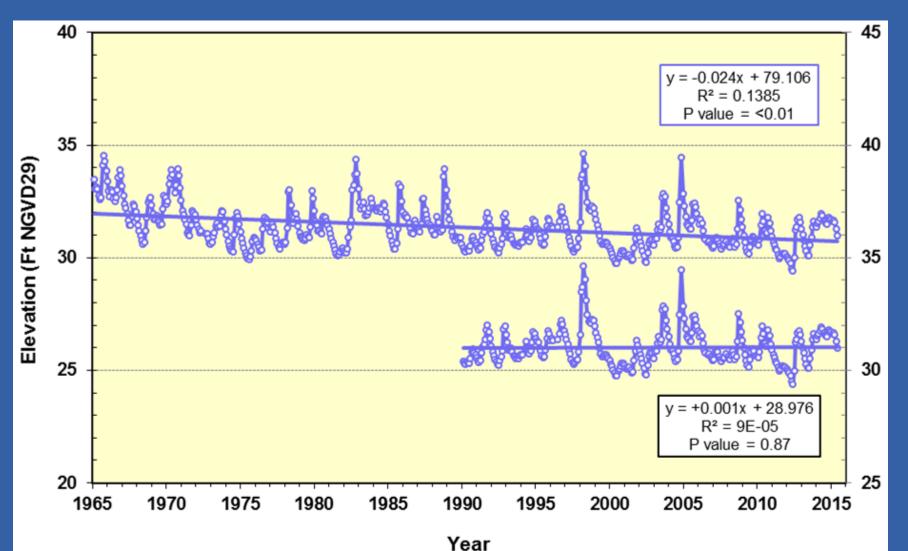




Springshed Pumping History (1992-2014)



### Rainbow well near Dunnellon Water level trend from 1965-2015 and 1990-2015



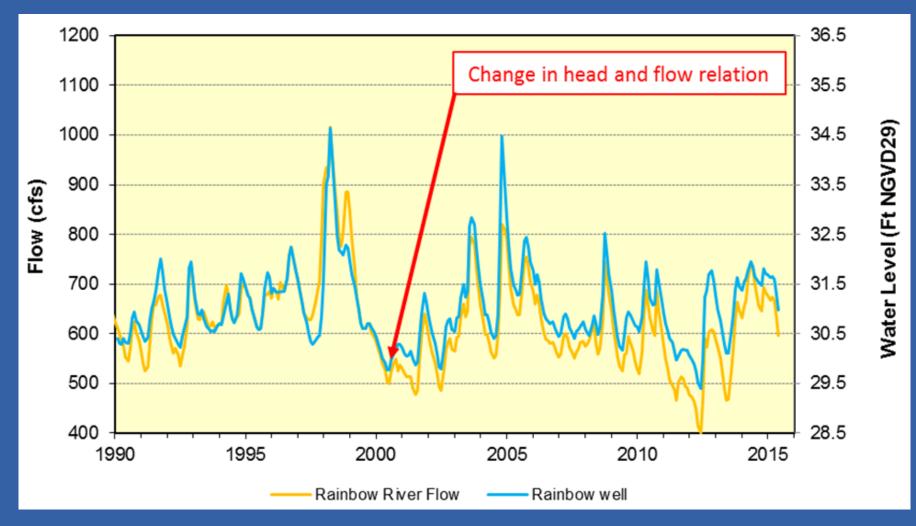


## Water Level Change from 16 monitor wells (1990-2010)



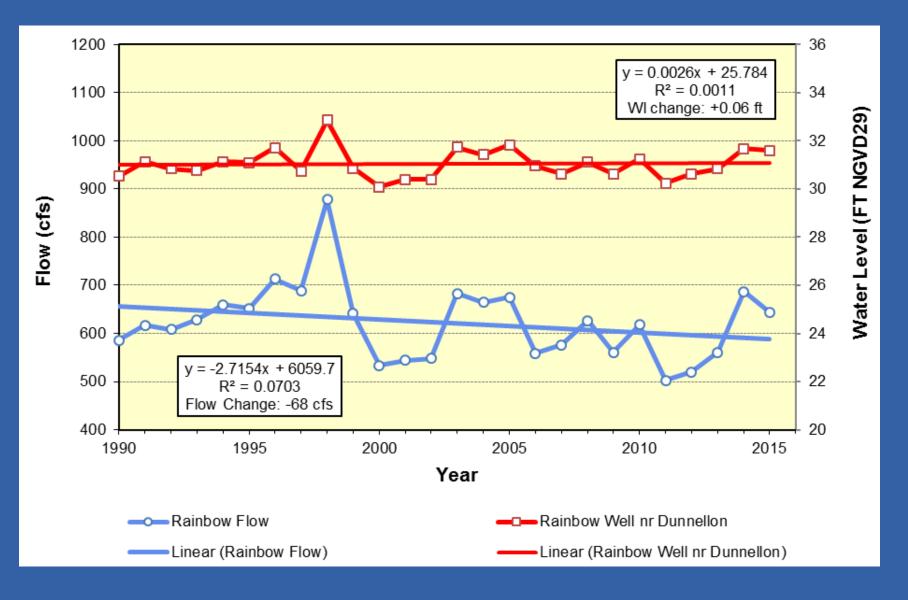


# Rainbow Springs Flow versus UFA water Level at Rainbow well near Dunnellon





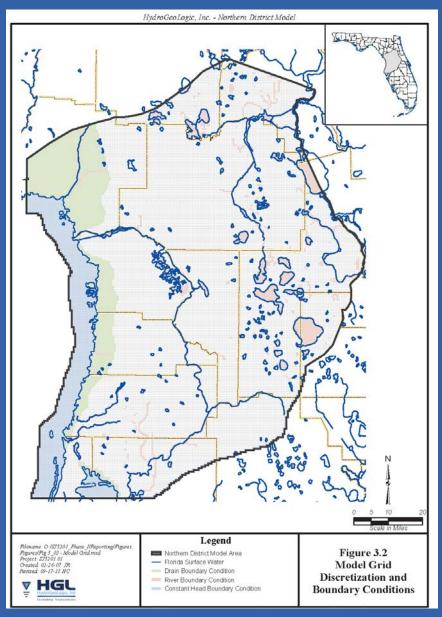
# Rainbow Spring Flow and UFA Water Level (1990-2015)





#### Southwest Florida Water Management District

#### Northern District Model (Version 5.0)



Layer 1 - Surficial Aquifer

Layer 2 - Intermediate Confining Unit (Hawthorn)

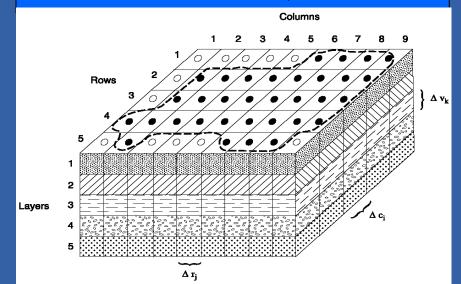
Layer 3 – Upper Floridan Aquifer (Suwanee)

Layer 4 – Upper Floridan Aquifer (Ocala)

Layer 5 – Upper Floridan Aquifer (Upper Avon Park)

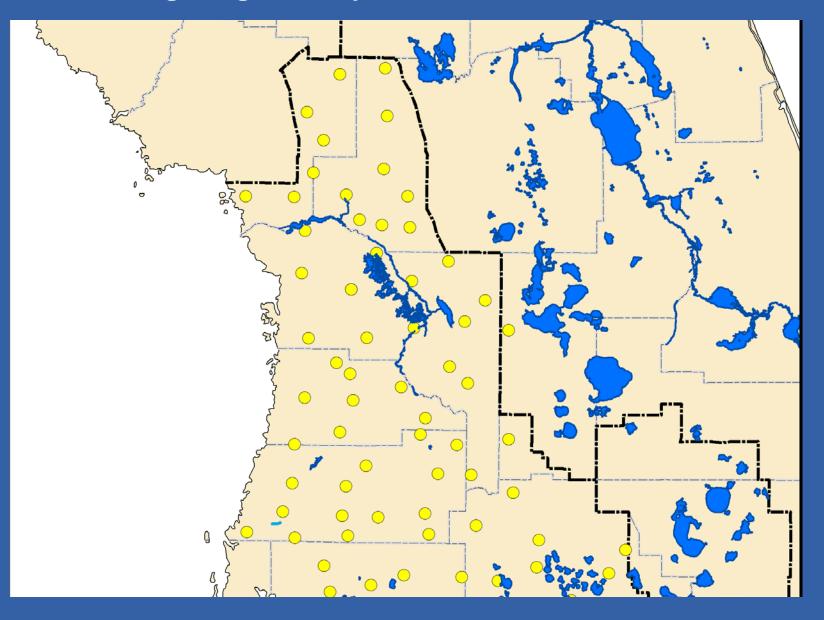
Layer 6 - Middle Confining Unit

#### Layer 7 – Lower Floridan Aquifer (Lower Avon Park/Oldsmar)

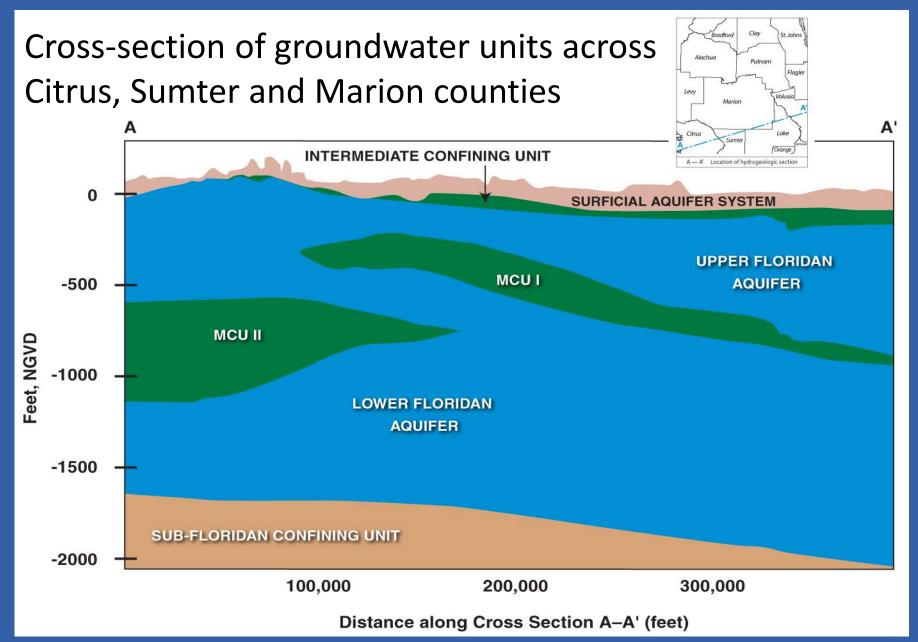




#### Sites where geologic and hydraulic data was used for the NDM5









## Rainbow Spring Flow Change from Groundwater Withdrawals

Year	Model GW Withdrawals (mgd)	Non- pumping flow (cfs)	Pumping Flow (cfs)	Difference (cfs)	Difference (percent)
2010	479.1	659.58	651.37	8.21	-1.2
2014	403.9	659.58	653.51	6.07	-0.9
2035	635.1	659.58	643.94	16.18	-2.5
2035 with Conservation & Reuse	576.6	659.58	646.13	13.45	-2.0

Note: Groundwater withdrawal impact based on Northern District Model Version 5

Dr. Stewart indicated in his most recent peer review that the "NDM, Version 5.0, is the best numerical groundwater flow model currently available for assessing the effects of withdrawals in the central (Florida) springs region."

# Summary

- Rainfall deficits have contributed to most of the lower springflow since the 1960s
- Geology and relatively low groundwater use have led to small flow changes of one to two percent compared to flow changes caused by below average rainfall and other factors
- Springflow is lower post-2000 but not due to groundwater withdrawals
- Current groundwater use is lowest since the mid-1990s due to water conservation and slower population growth
- No recovery or additional prevention strategy is needed at this time based on current springflow decline of 1 to 2 percent due to withdrawals. This is projected to increase to 2.5 percent in 2035.

# **Questions and Comments**

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Webpage:

WaterMatters.org/Rainbow

Recommended Minimum Flow for the Rainbow River System DRAFT



February 2017



Kym Rouse Holzwart, Yonas Ghile, Ron Basso, Doug Leeper, Sean King Southwest Florida Water Management District Brooksville, Florida

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