

Reclaimed Water Use The Florida Experience

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Schlumberger Water Services (SWS):

- Integrated Water Resource Management & Wellfields.
- Aquifer Storage and Recovery (ASR).
- Excess Wastewater Injection Disposal.
- Water in Oil & Gas.
- ME Offices in Abu Dhabi, Dubai, Doha, Riyadh, and Cairo.



Acknowledgements:

- Bob Maliva, Schlumberger Water Services.
- Richard Nevilus, Water Reuse Coordinator, SFWMD.
- Tom Mattausch, Water Department Director, Collier County Public Utilities.
- Florida Department of Environmental Protection.

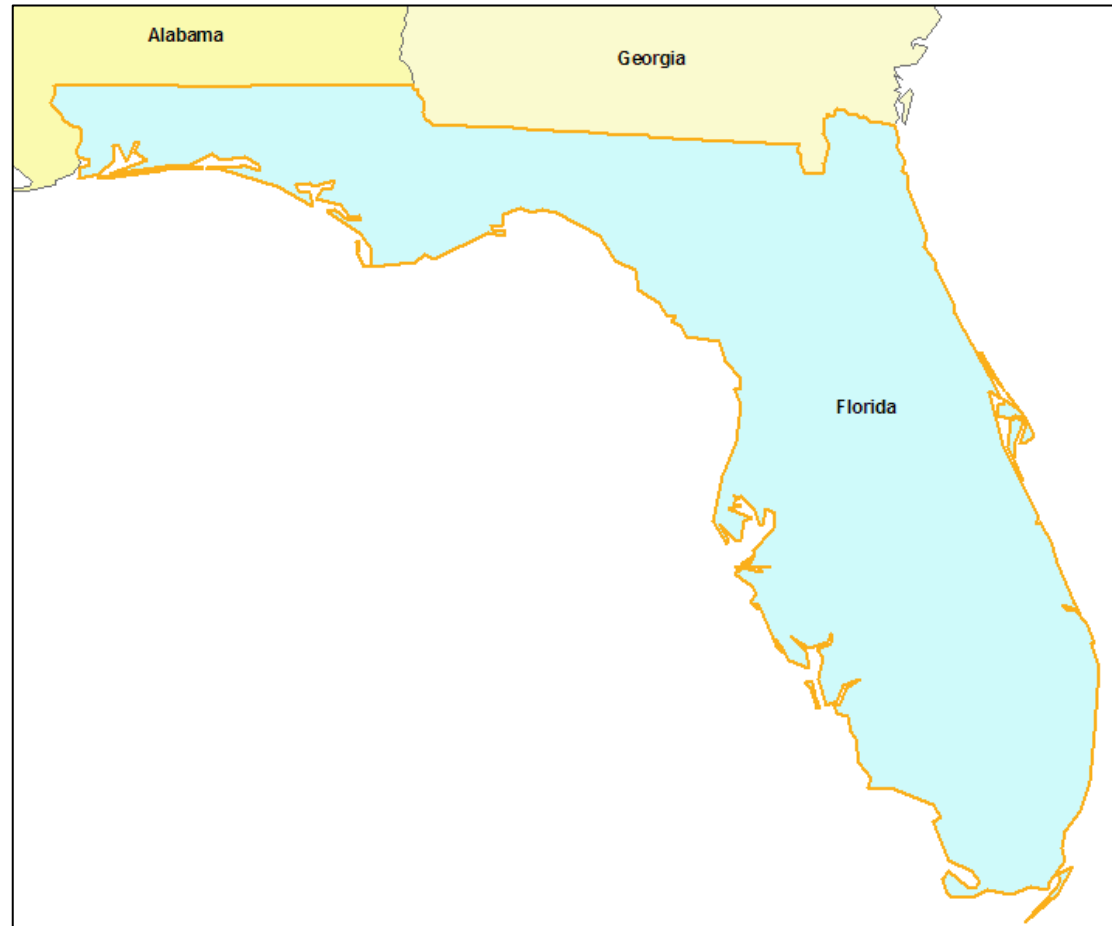






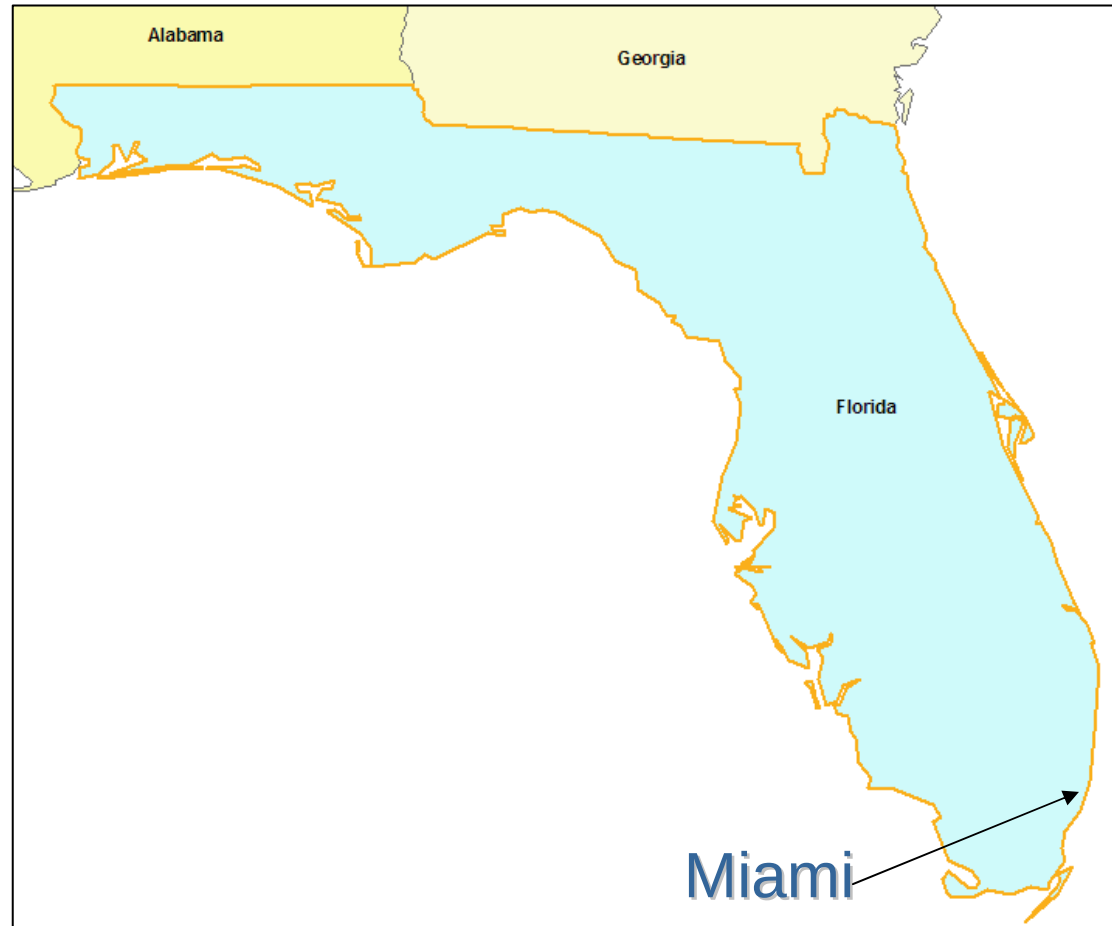
Florida:

- 4th Largest state by population.
- 18M People.



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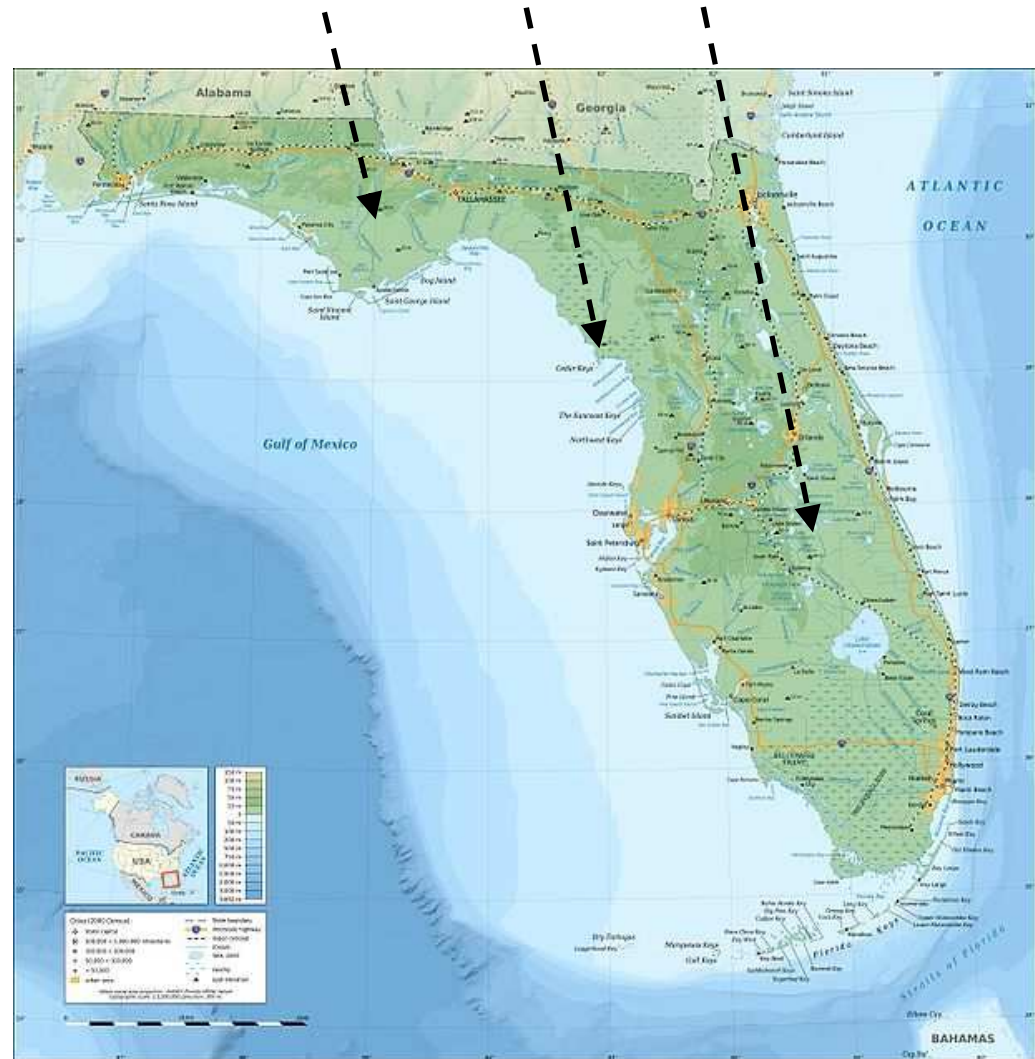
Florida:

- Vacation & retirement destination.



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Florida:

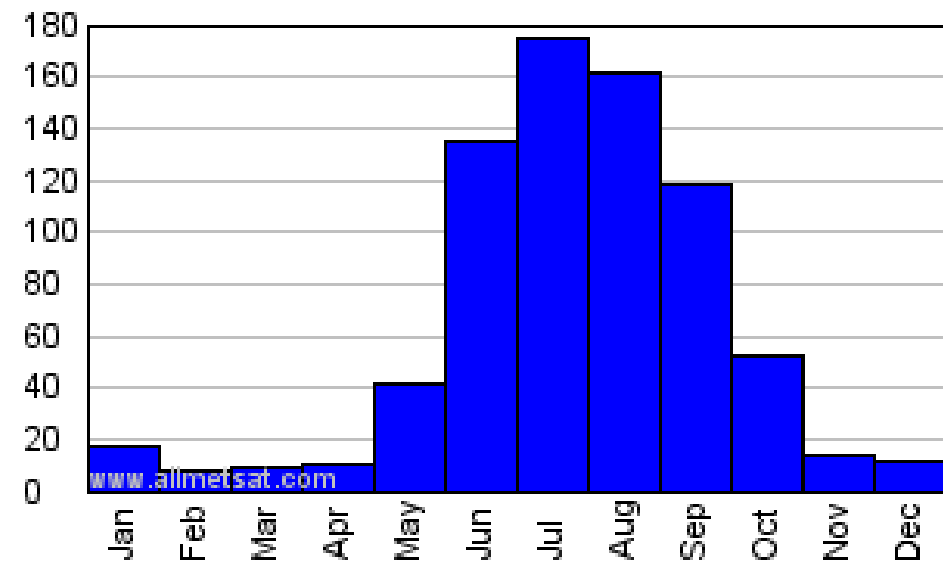
- Subtropical climate.
- Pleasant winters and hot humid summers.
- Beaches, orange groves, golf courses, and swamp.



Florida – Why reclaimed water use?

- Wet summers.
- Dry winters.

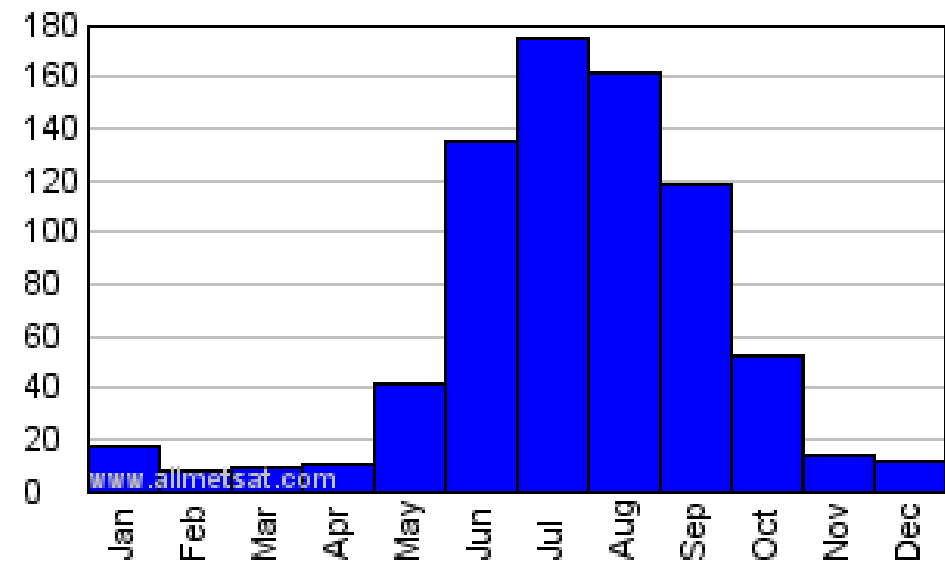
Rainfall



Florida – Why reclaimed water use?

- Wet summers.
- Dry winters.

Rainfall



Most rainfall in summer.

Florida – Water Use:

- Landscape irrigation.



Florida – Water Use:

- Landscape



Florida – Water Use:

- Landscape



Florida – Water Use:

- Landscape



Florida – Water Use:

- Landscape



Florida – Water Use:

- Golf course irrigation.



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Florida – Water Use:

- Orange groves.



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Florida – Water Use:

- Vegetable crops.



Florida – Water Use:

- Vegetable crops.



Florida – Water Use:

- Vegetable crops.



Florida – Water Use:

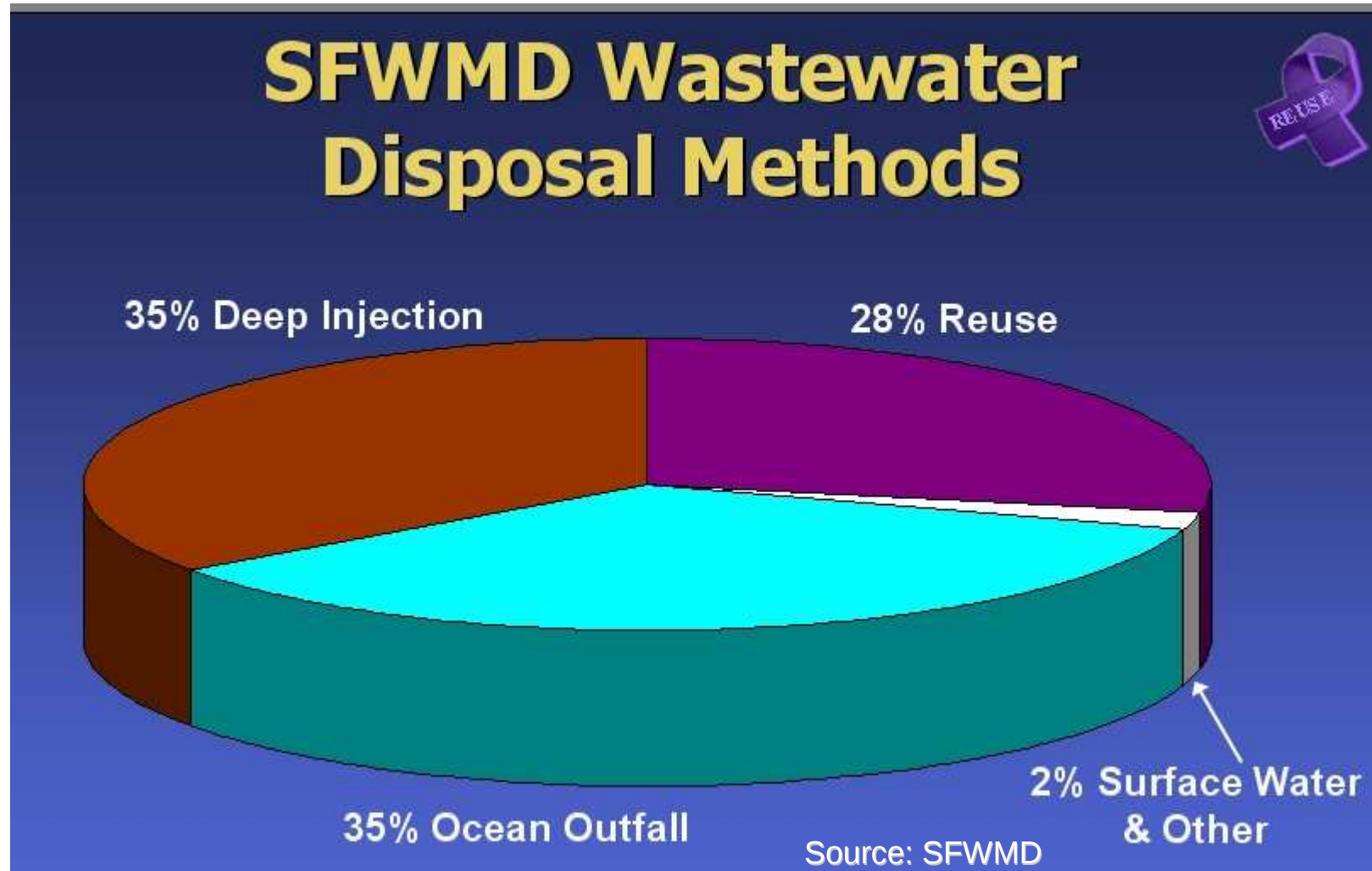
- Vegetable crops.



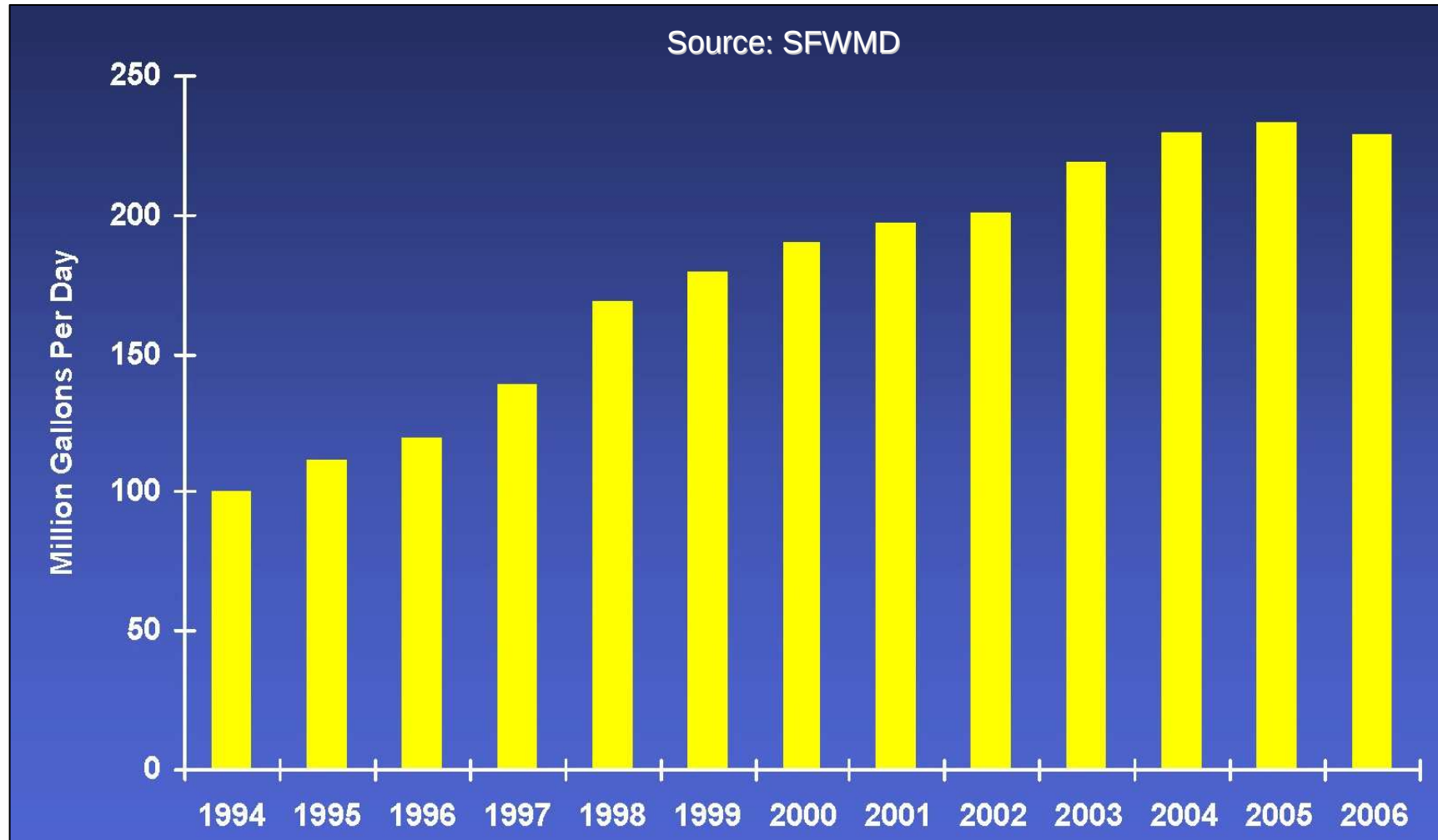
Florida – Reclaimed Water Use:



South Florida – Reclaimed Water Use:

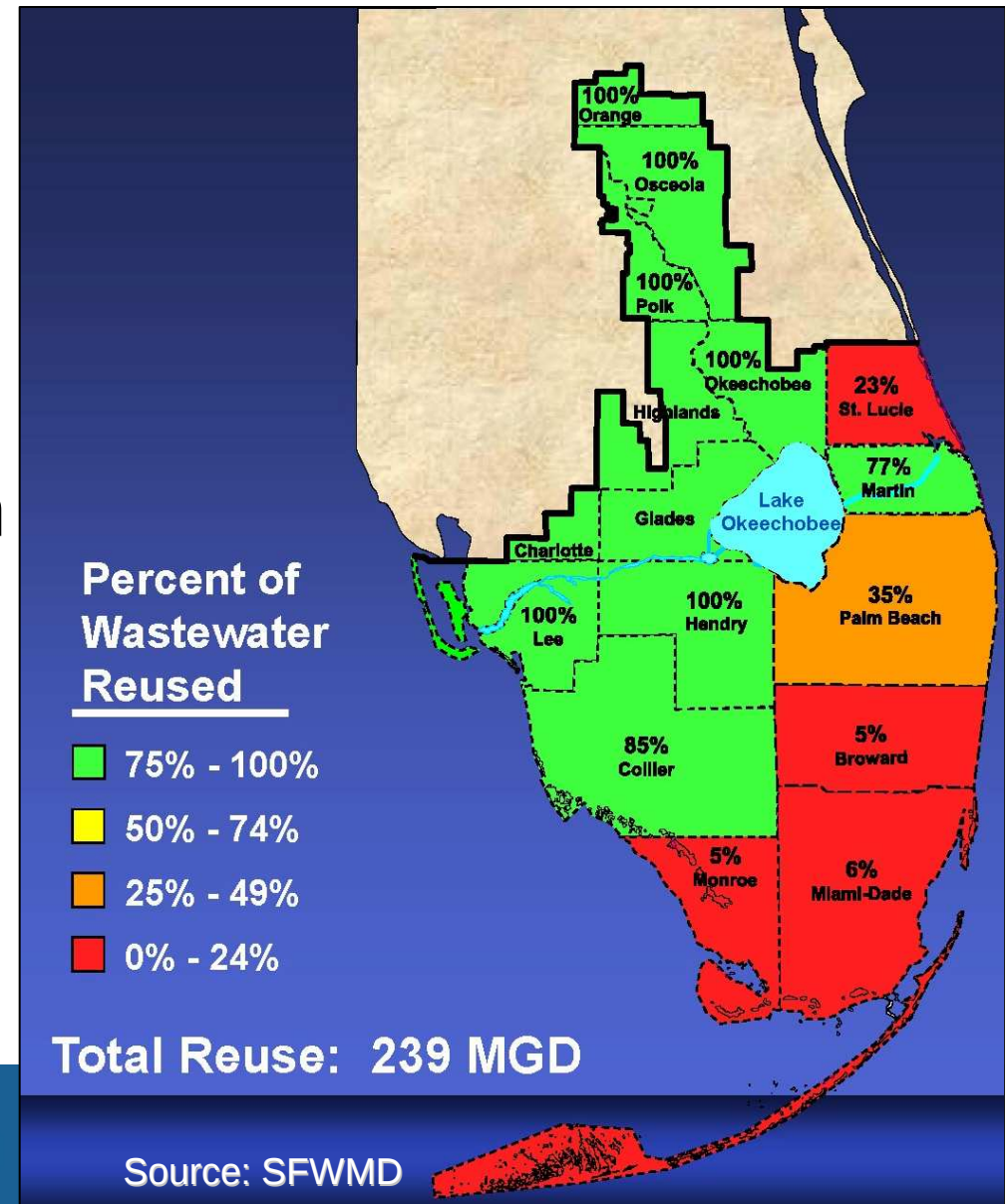


South Florida – Reclaimed Water Use:



South Florida – Reclaimed Water Use:

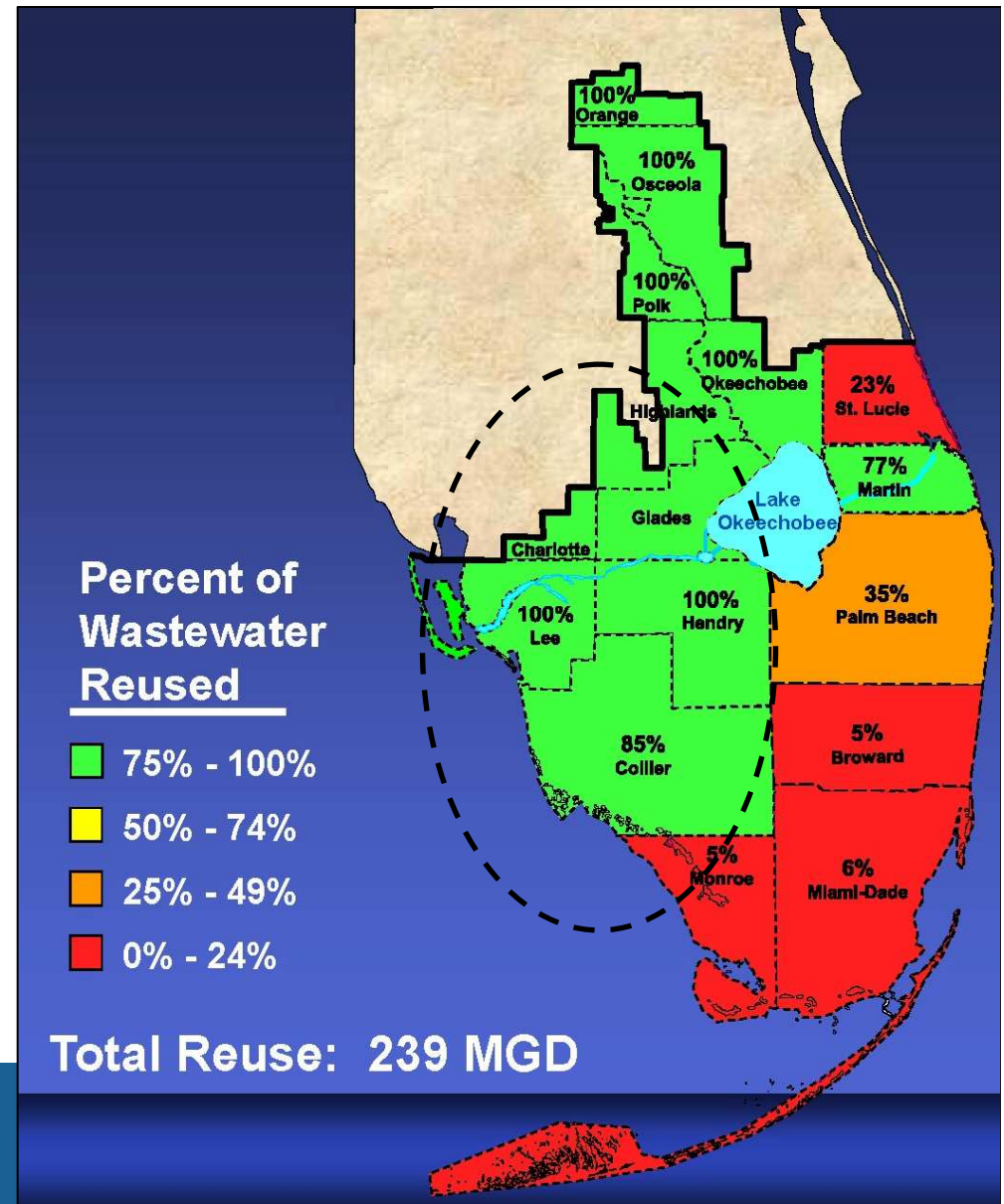
- Amount of reclaimed use varies by area, due to varying water supply from aquifers.
- Most wastewater reused in SW and Central Florida.
- Less reuse in SE (Miami) due to Biscayne Aquifer.



South Florida – Reclaimed Water Use:

SW Florida Reuse:

- All used for landscape and golf course.
- Agricultural uses too far from populations centers.
- All reclaimed water needed for irrigating grass.

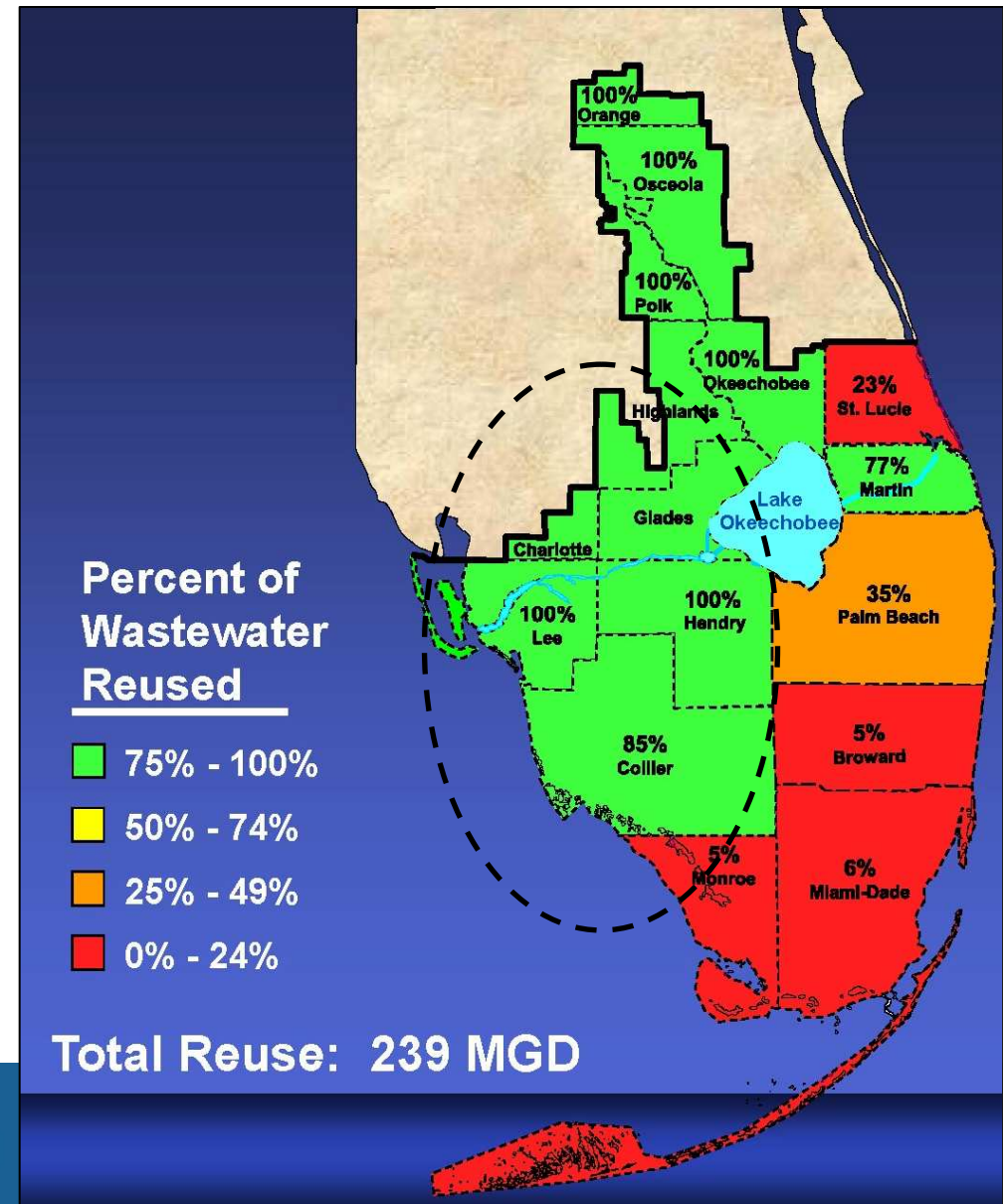


South Florida – Reclaimed Water Use:

SW Florida Reuse:



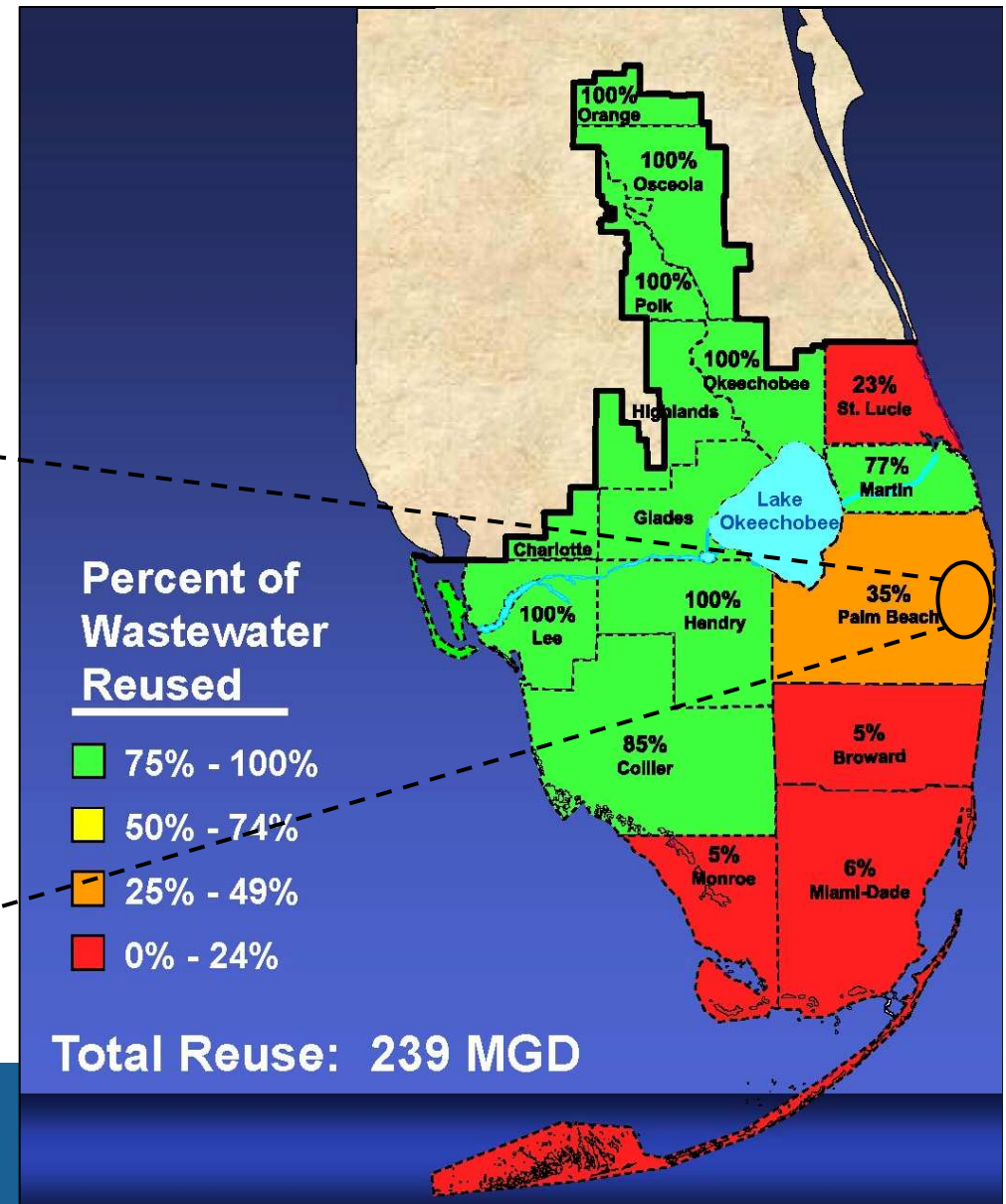
Reclaimed water sign in Collier County.



South Florida – Reclaimed Water Use:

SE Florida Reuse:

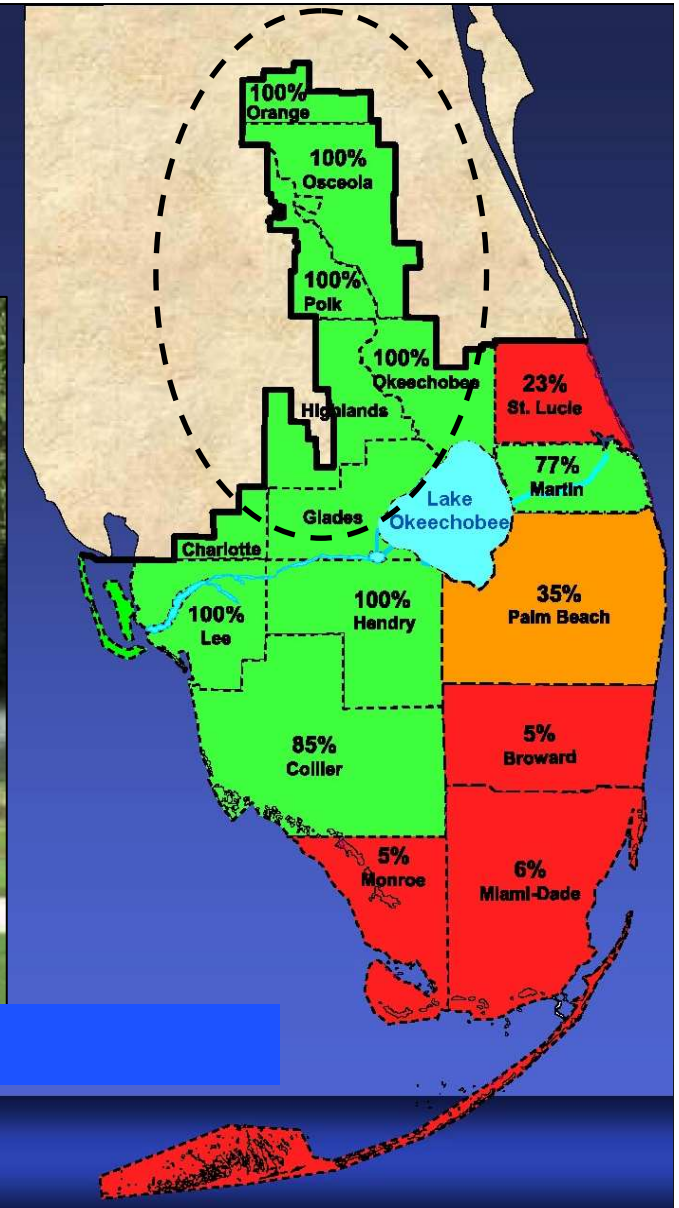
- Wetlands restoration project.



South Florida – Reclaimed Water Use:

Central Florida Reuse:

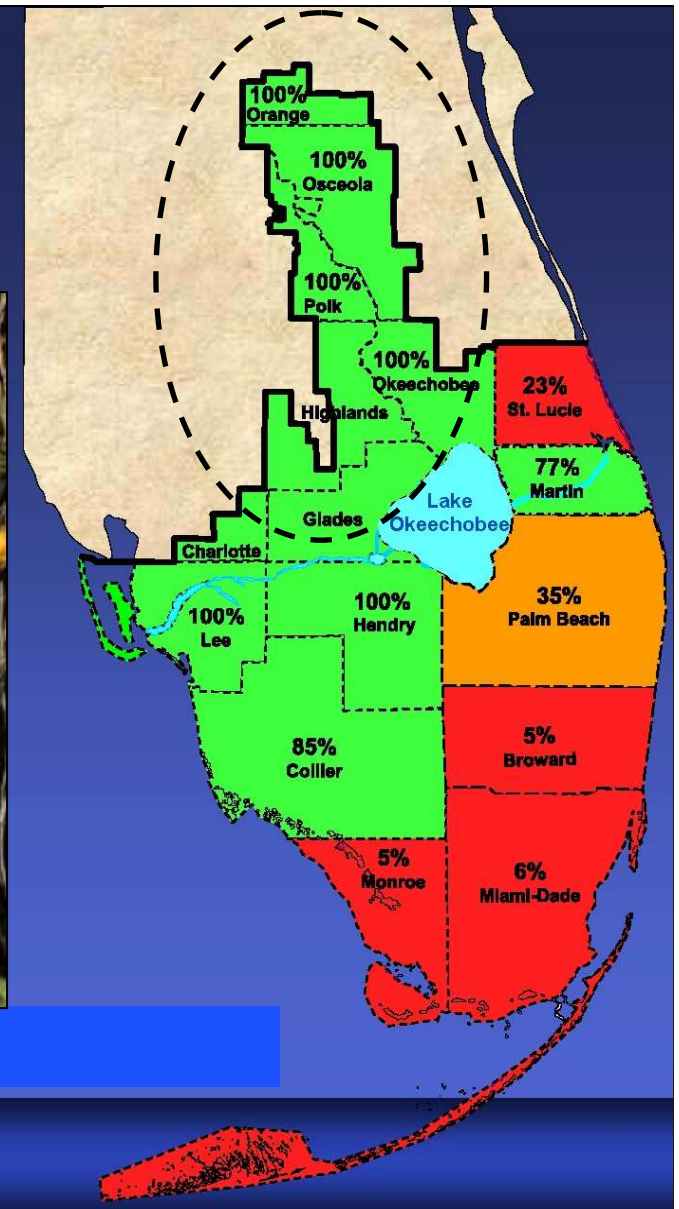
- Golf course.



South Florida – Reclaimed Water Use:

Central Florida Reuse:

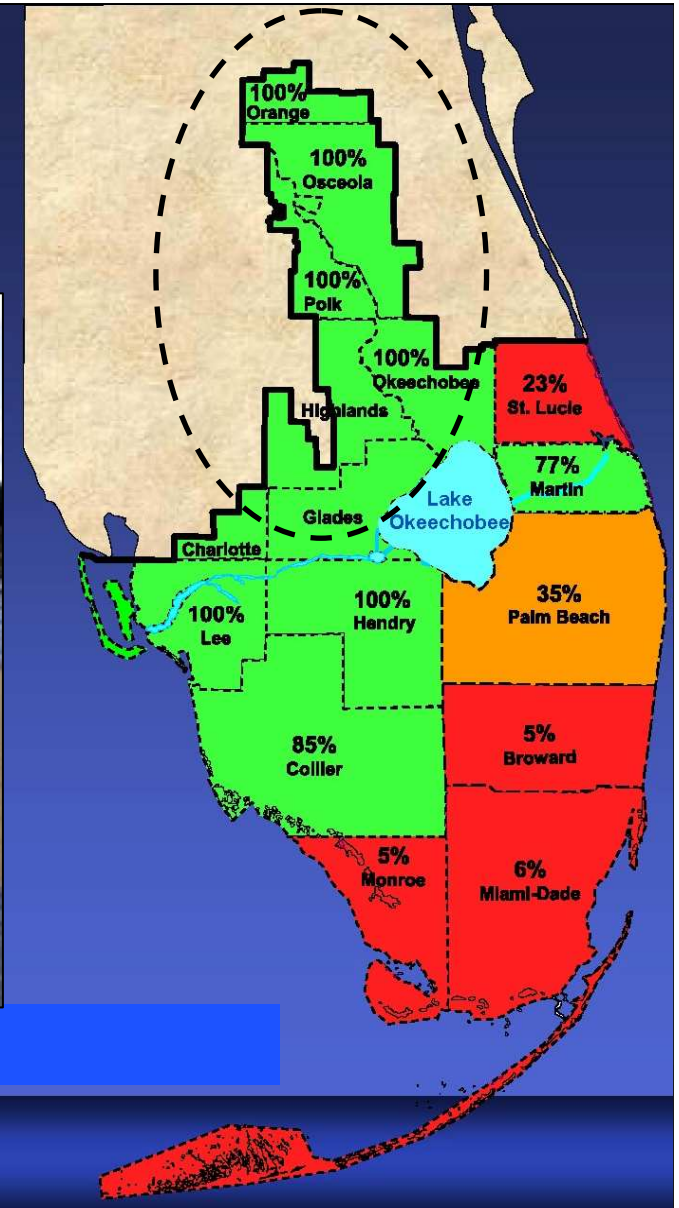
- Orange groves.



South Florida – Reclaimed Water Use:

Central Florida Reuse:

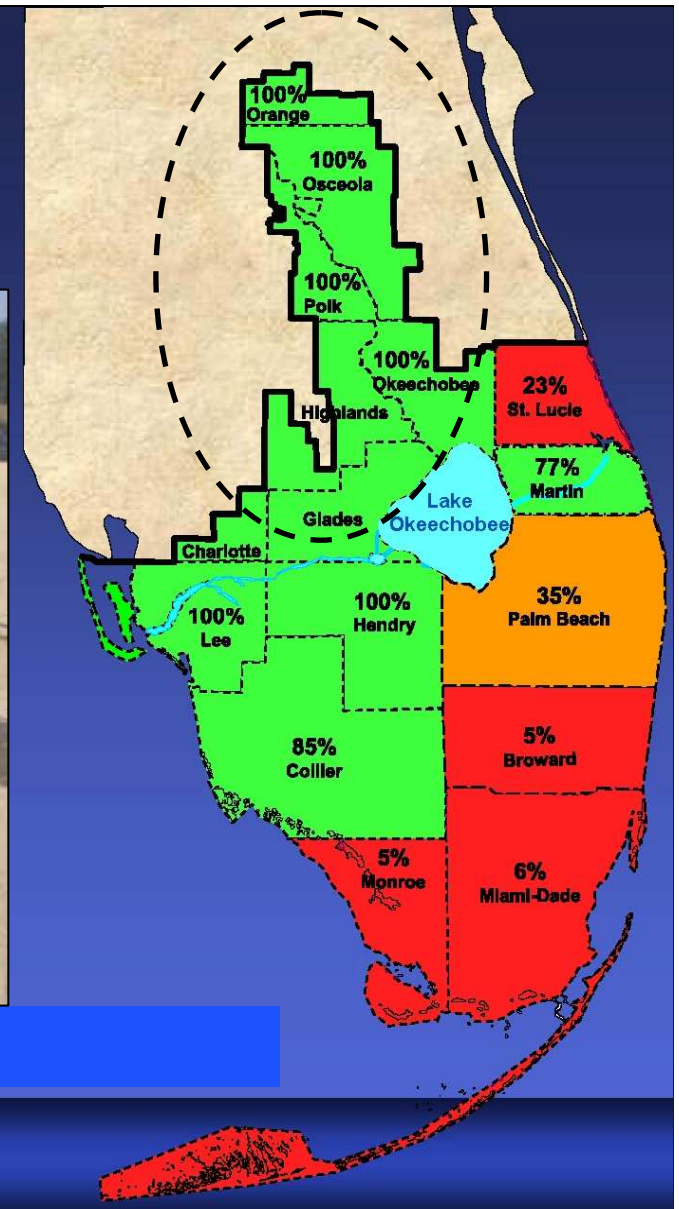
- Groundwater recharge.



South Florida – Reclaimed Water Use:

Central Florida Reuse:

- Groundwater recharge.



Florida – Reclaimed Water Use:

West Florida Reuse:

- Landscape and Golf.
- Orange groves.
- 7 Power Plants use reclaimed water for cooling.



Florida – Reclaimed Water Use:

Reclaimed Water:

- Lavender pipes.



Florida – Reclaimed Water Use:

Florida Monitoring Requirements – Treatment Plant Monitoring

Minimum Schedule for Sampling and Testing of Domestic Wastewater Treatment Plant Monitoring Parameters

	Permitted Capacity						
Parameters	2,000 gpd up to, but not including 5,000 gpd	5,000 gpd up to, but not including, 50,000 gpd	50,000 gpd up to, but not including 500,000 gpd	0.5 mgd up to, but not including 1 mgd	1 mgd up to, but not including, 5 mgd	5 mgd up to, but not including, 15 mgd	15 mgd and above
Flow, pH ¹ Chlorine Residual ²	daily 5/wk	daily 5/wk	daily 5/wk	daily 5/wk	continuous	continuous	continuous
Dissolved Oxygen	daily 5/wk	daily 5/wk	daily 5/wk	daily 5/wk	daily 7/wk	daily 7/wk	daily 7/wk
Suspended Solids ⁴ CBOD ₅ , Nutrients	monthly	monthly	every two weeks ³	weekly	weekly	daily 5/wk	daily 7/wk
Chlorine Residual ⁵	monthly	monthly	every two weeks ³	weekly	daily 7/wk	daily 7/wk	daily 7/wk
Fecal Coliform ⁴	monthly	monthly	every two weeks ³	weekly	weekly	daily 5/wk	daily 7/wk

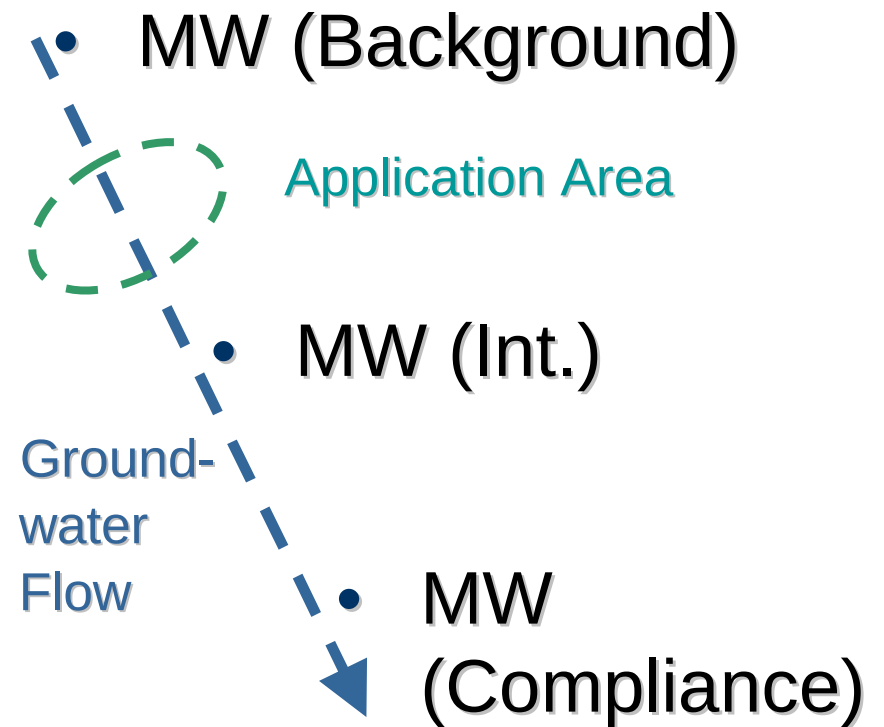


Florida – Reclaimed Water Use:

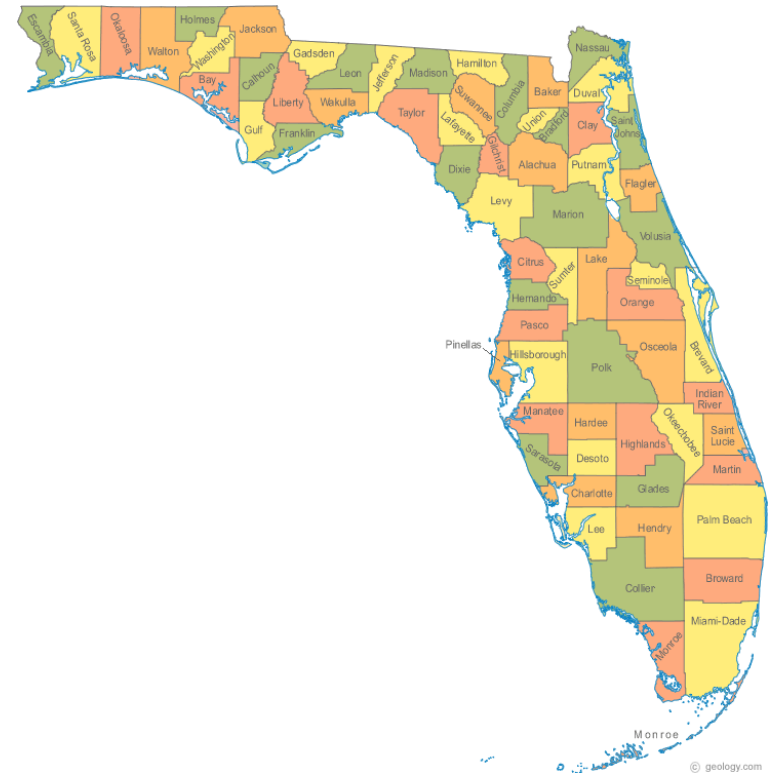
Florida Monitoring Requirements – Groundwater

Minimum Ground Water Monitoring Schedule

Parameter	Sampling Frequency	
	Reuse and Land Application Systems	Class I and Class V Injection Wells
Water Level	Quarterly	Monthly
Nitrate	Quarterly	Monthly
Total Dissolved Solids	Quarterly	Monthly
Arsenic	Quarterly	
Cadmium	Quarterly	
Chloride	Quarterly	
Chromium	Quarterly	
Lead	Quarterly	
Fecal Coliform	Quarterly	
pH	Quarterly	
Sulfate	Quarterly	
Total Kjeldahl Nitrogen		Monthly
Total Phosphorus		Monthly



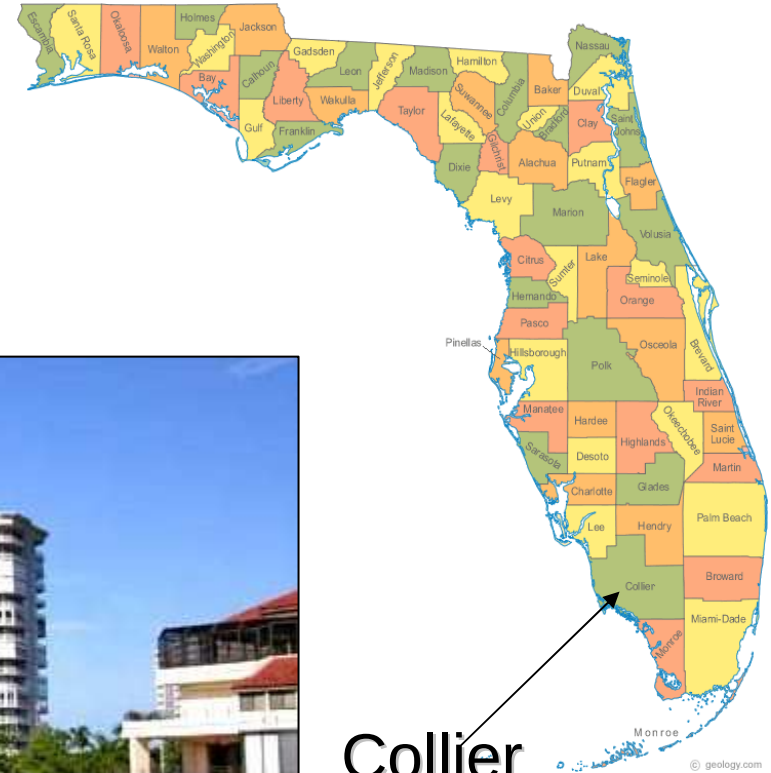
Florida – Case Studies



Florida – Case Studies:

Collier County:

- Home of affluent Naples, Florida.



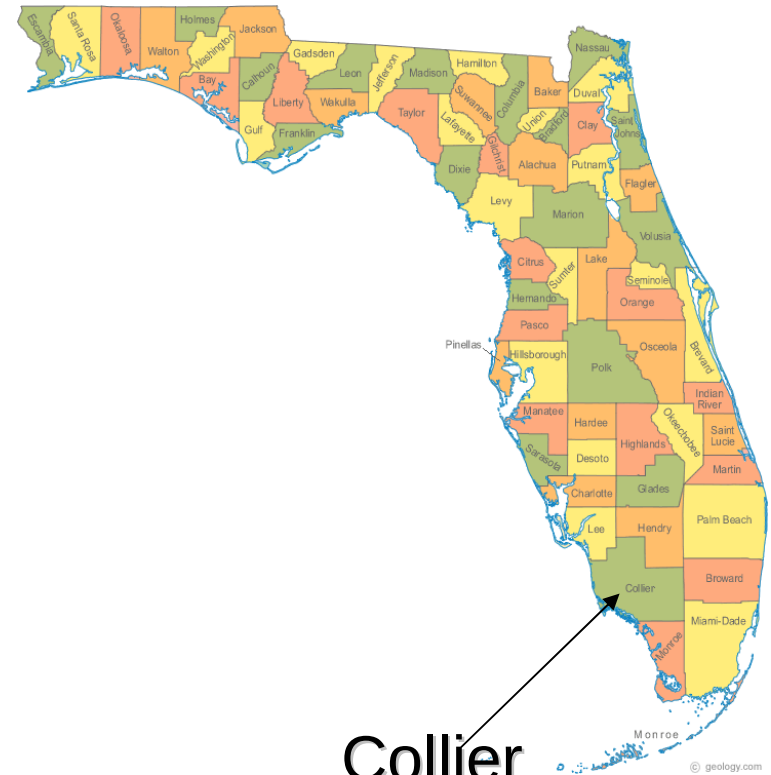
Collier
County



Florida – Case Studies:

Collier County:

- 95% of wastewater reused.
- Reclaimed water mixed with some groundwater and delivered as “irrigation quality (IQ) water”.
- At \$7M/MG, estimated savings of \$98M in potable water infrastructure offset.



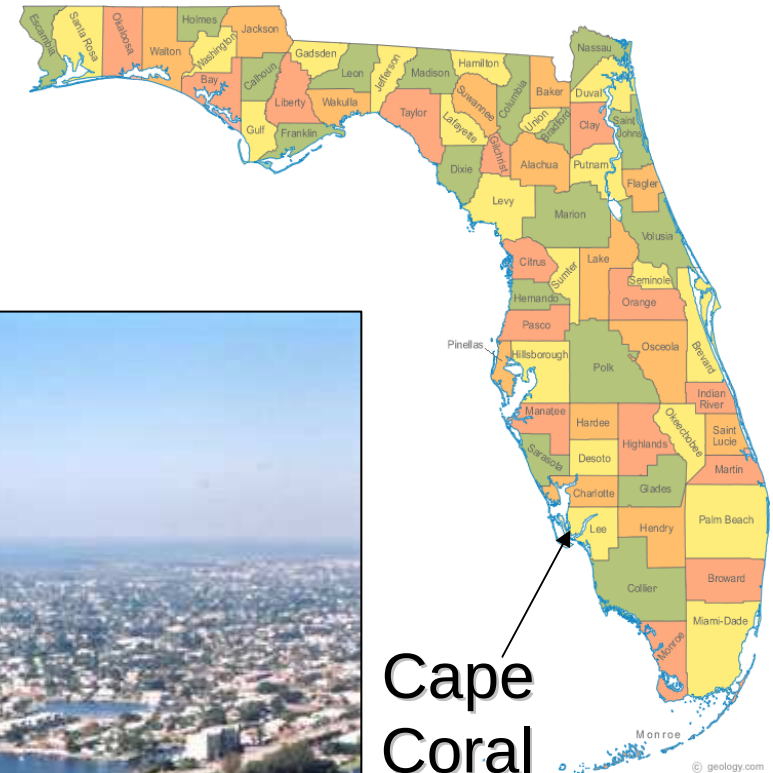
Collier
Count
y



Florida – Case Studies:

Cape Coral:

- More canals than Venice, Italy.



Cape
Coral



Florida – Case Studies:

Cape Coral:

- Second largest city in FL by area.
- All houses served with dual water system – potable and IQ.
- IQ = reclaimed water.



Florida – Case Studies:

Cape Coral:

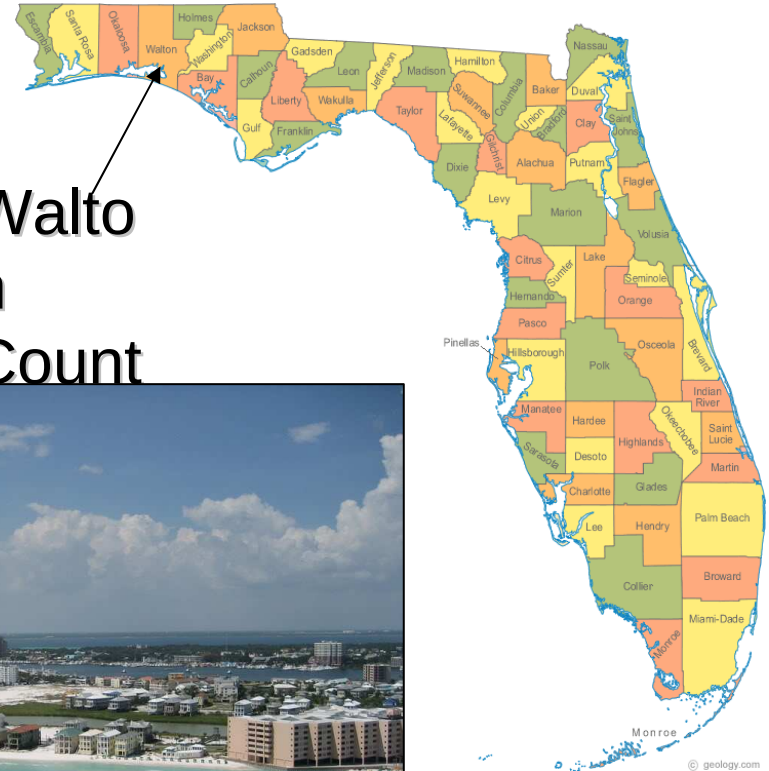
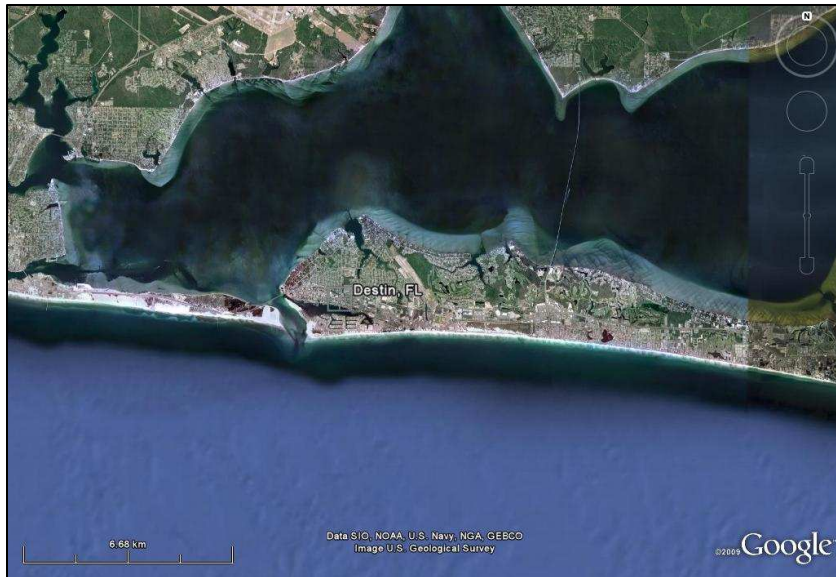
- New service installations paid for by assessment fees to homeowners.
- Originally free, now metered monthly fee.



Florida – Case Studies:

Walton County:

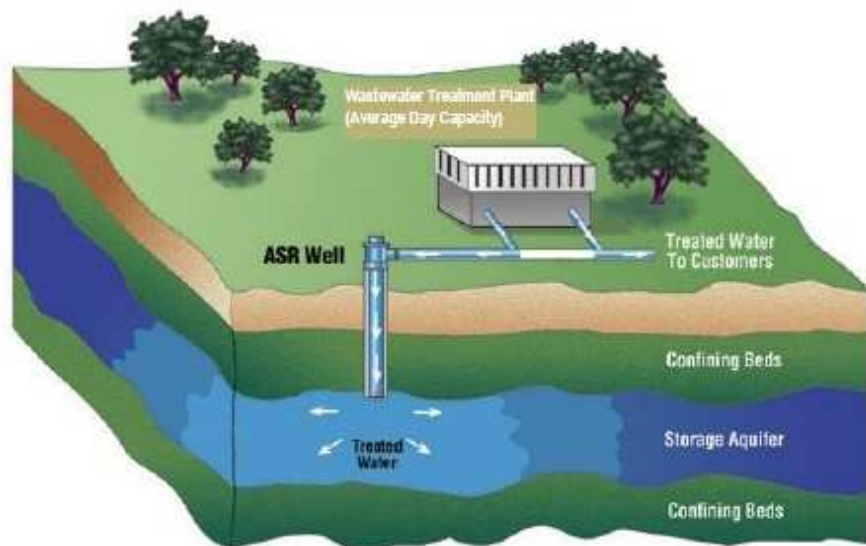
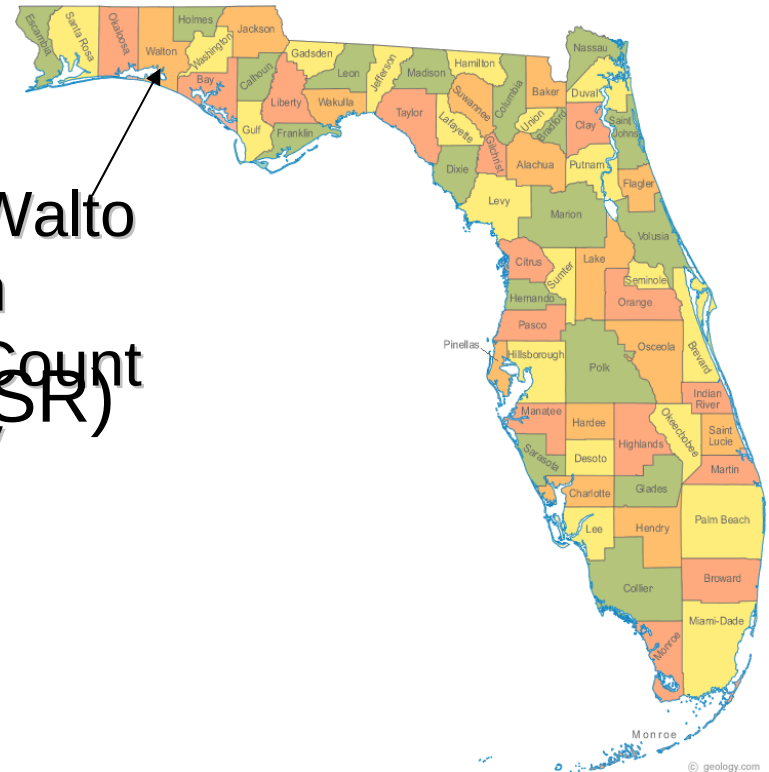
- Barrier island on emerald coast



Florida – Case Studies:

Walton County:

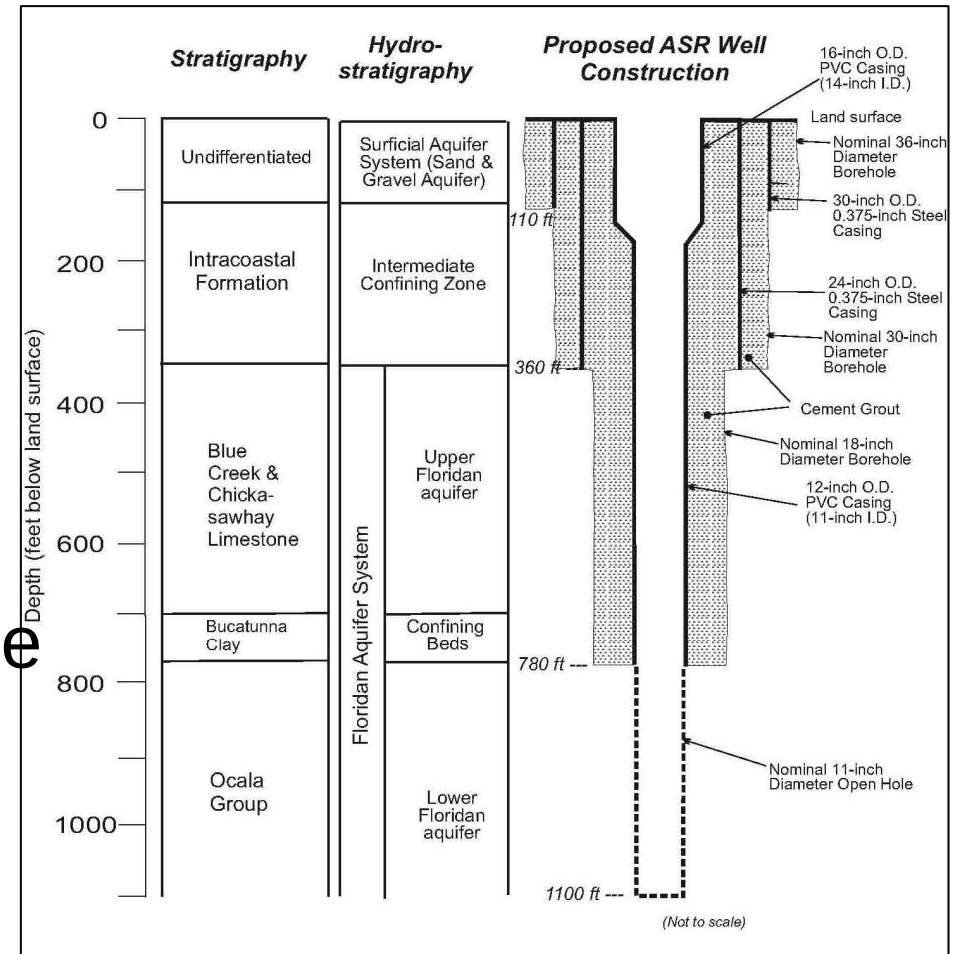
- Seasonal population – seasonal wastewater production.
- Aquifer storage and recovery (ASR) currently being developed to address demand/ supply

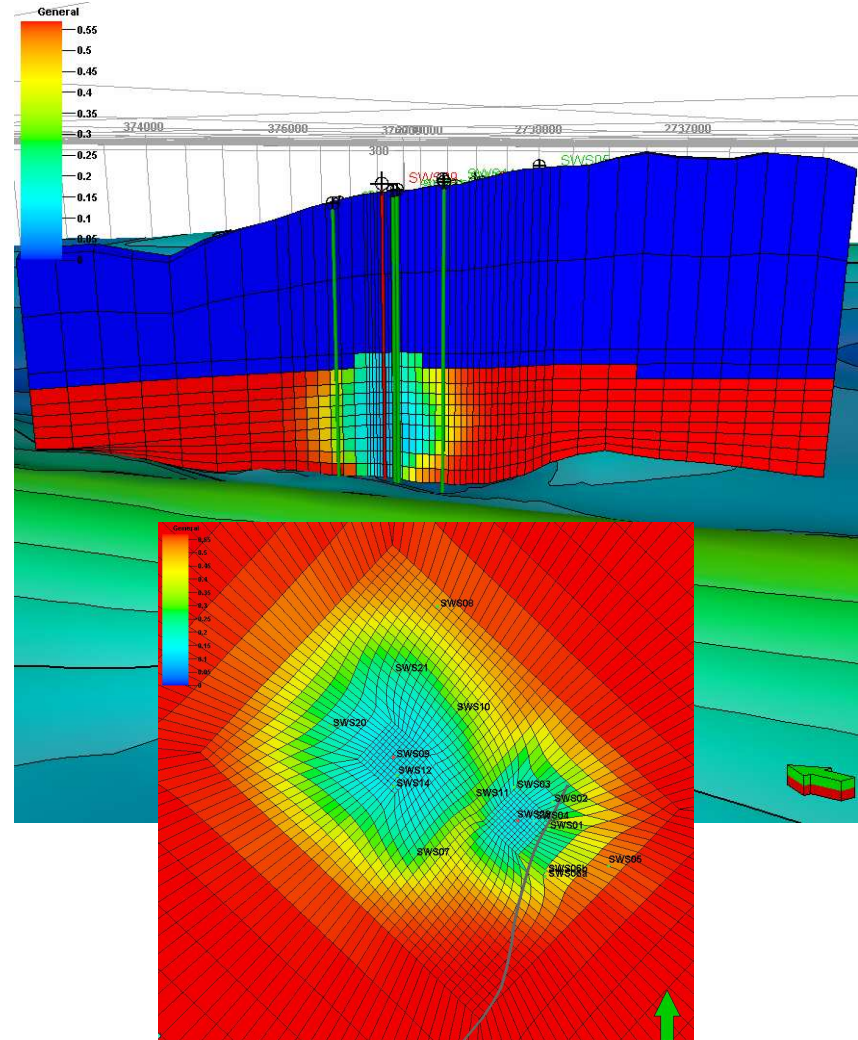


Florida – Case Studies:

Walton County:

- ASR provides storage at ~1/10 of the cost of ground storage.
- Successful storage zone depends on local subsurface conditions.
- Detailed hydrogeological assessment required.





Thoughts for the Middle East



Thoughts for the Middle

East:

- Florida has little industry – in the Middle East, industrial impacts to wastewater quality must be considered in reuse.



Thoughts for the Middle

East:

- Use of irrigation quality water for public areas can significantly enhance the quality of life.



Thoughts for the Middle

East:

- Use of irrigation quality water for public areas can significantly enhance the quality of life.



Thoughts for the Middle

East:

- Dual water systems can be implemented in new residential



Thoughts for the Middle

East:

- Reclaimed water can potentially be used in the oil and gas industry, as well as in other industries.



Thoughts for the Middle

East:

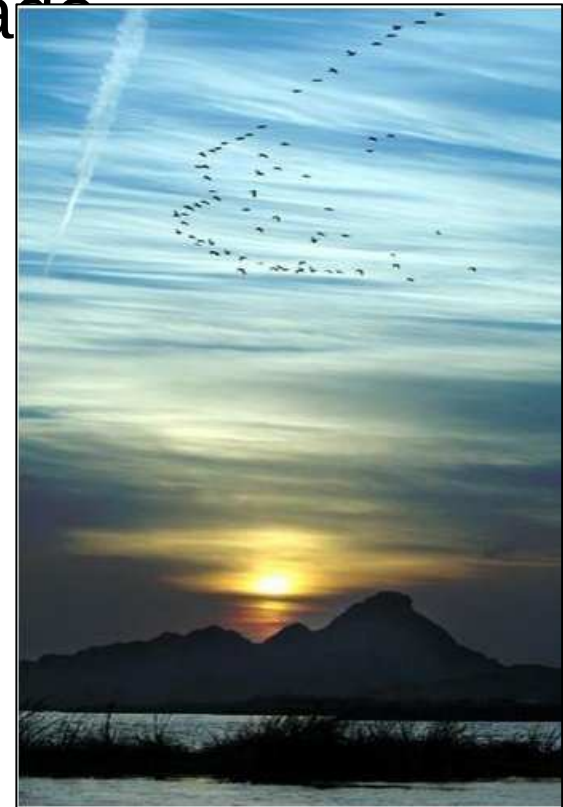
- Date farms present a large opportunity for reclaimed water use.



Thoughts for the Middle

East:

- Large volumes of treated wastewater are currently lost through evaporation and seepage



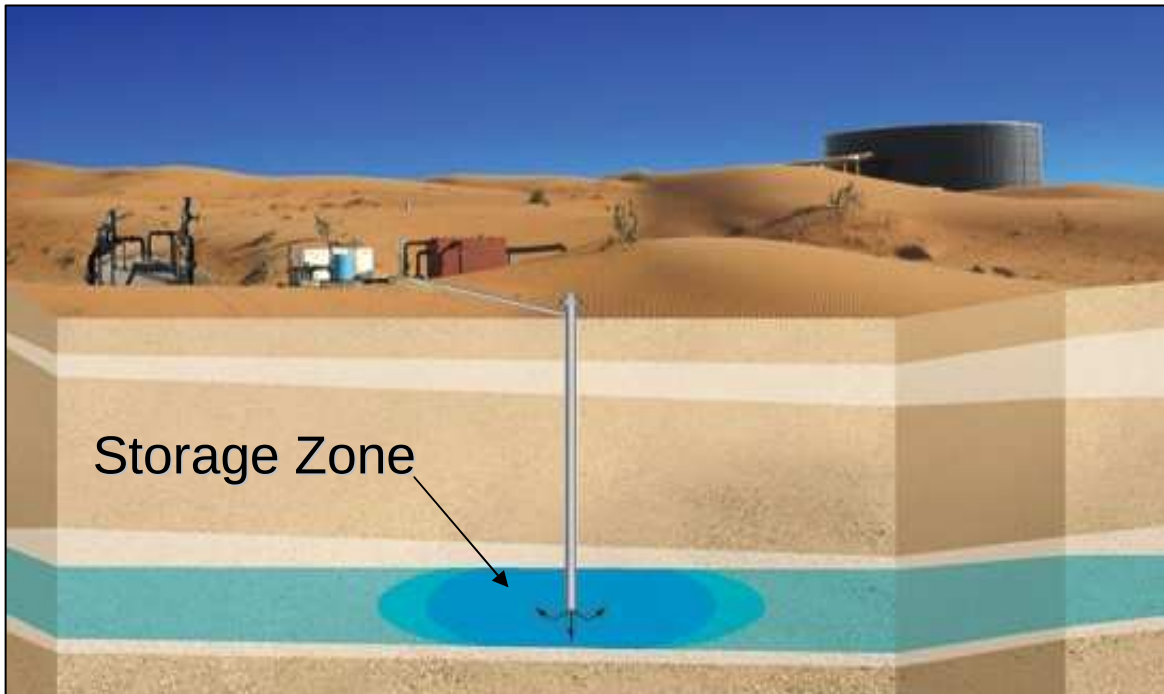
Source: google earth



Thoughts for the Middle

East:

- Aquifer storage and recovery (ASR) can be an important component of a reclaimed water supply



Reclaimed Water Agricultural Use Concerns in the Middle East

Frank P. Winslow
Senior Hydrogeologist

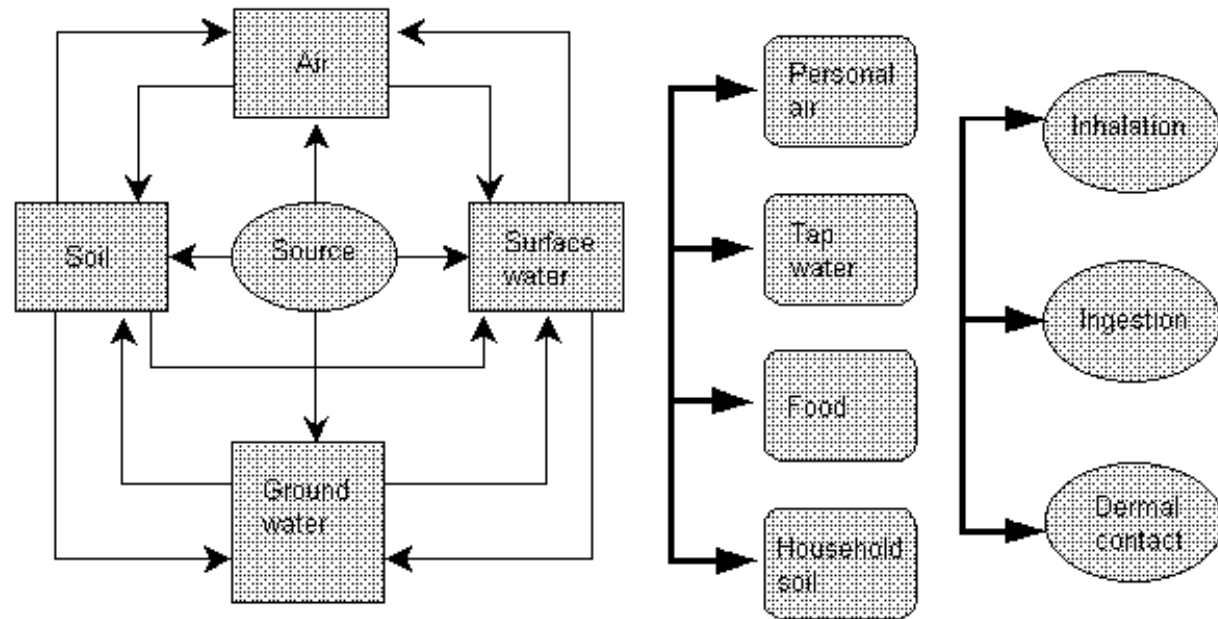
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Riyadh, Saudi Arabia



Reclaimed Water – Use Concerns

Exposure Mechanisms:

- Inhalation.
- Dermal.
- Ingestion.



Source: Inchem.org

Reclaimed Water – Use Concerns

Exposure Mechanisms:

- Inhalation.
 - Spray Irrigation.
 - Exposure only in close proximity
 - Concern primarily bacterial.
 - High-level disinfection eliminates concern.



Reclaimed Water – Use Concerns

Exposure Mechanisms:

- Dermal.
 - Spray Irrigation on grass turf.
 - Exposure concern typically in parks.
 - Concern primarily bacterial.
 - High-level disinfection eliminates concern.



Reclaimed Water – Use Concerns

Exposure Mechanisms:

- Ingestion.
 - Ingestion includes eating of crops, and consumption of shallow groundwater that is recharged.
 - Crop type dependent (root, leaf, fruit).
 - Irrigation method dependent (spray, drip).



Reclaimed Water – Use Concerns

Exposure Mechanisms:

- Ingestion.
 - Concerns include bacterial, heavy metals, pharmaceuticals, etc.
 - High-level disinfection eliminates most, but not all, concerns.



Reclaimed Water – Use Concerns

Agricultural Uses:

- Spray irrigation not recommended for crops with direct exposure (leaves or fruits with ingestible skins).
- Drip irrigation generally safer – no direct contact except with roots, and soils provide natural buffering and attenuation.



Reclaimed Water – Use Concerns

Agricultural Uses:

- Uptake of constituents depends on crop type.
- For heavy metals:

Roots >> Stems >> Leafs & Fruits

- Therefore drip irrigation for leaf and fruit consumption generally safest alternative.

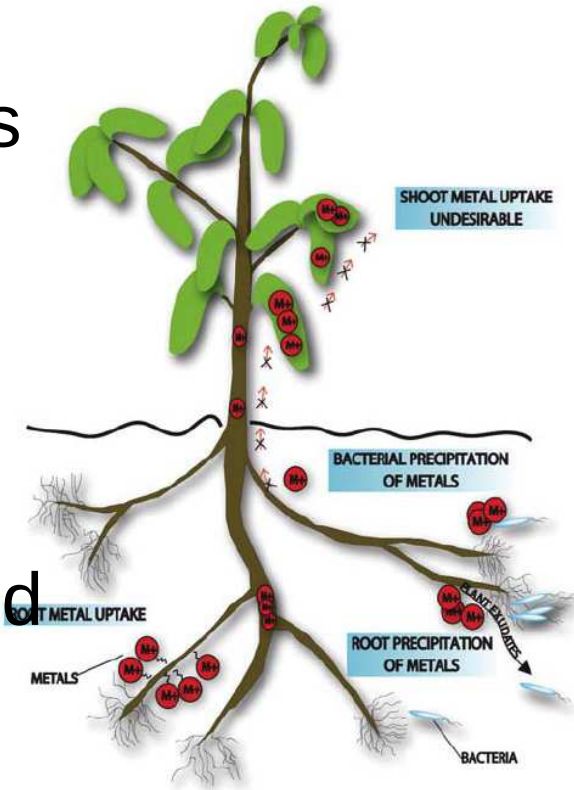


Figure 1. Schematic showing phytostabilization mechanisms including precipitation of metals by bacterial and root surfaces, precipitation of metals by bacterial and root exudates, bacterial uptake and sequestration of metals, and root uptake of metals. In phytostabilization, accumulation of metals in plant shoot tissues is undesirable.

Source: NIH.gov



Reclaimed Water – Use Concerns

Agricultural Uses:

- Multiple layers of protection principal provides redundancy in human health protection:
 - Advanced wastewater treatment
 - Application location (drip)
 - Soil natural attenuation mechanisms



Reclaimed Water – Use Concerns

Agricultural Uses:

- Date farms irrigated via drip irrigation.
- Good separation between application point and crop.
- Good use of resource (minimized evaporative loss).
- Crop appropriate for region.



Reclaimed Water – Use Concerns

Agricultural Uses:

- Date farms irrigated via drip irrigation.
- Ideal agricultural use?
- Any public perception concerns?



Reclaimed Water – Use Concerns

Alternatives – Irrigation Quality (IQ) Water Supply:

- Reclaimed water blended with other sources.
- Aquifer storage and recovery.
 - Provides storage to offset imbalance between supply and demand.
 - Can result in natural “polishing” enhancing water quality.



Questions?

