Desalination as an Alternative Water Supply in Florida

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History of Desalination in Florida

What	Where	When
Seawater evaporation distillation still 7,000 gpd Founded buried in rubble, partially restored in the 1990's	Fort Zachary Taylor, Key West	1862
Three-effect seawater distillation plant, 60,000 gpd. Replaced earlier plant.	Dry Tortugas	1880
Invention of seawater RO (cellulose acetate).	University of Florida	1960
Municipal desalter	City of Key West	1940s
Rotunda brackish-water RO	Rotunda (Charlotte Co.)	1966
IWA ED plant	Sanibel Island	1973
Large RO (brackish-water)	Cape Coral	1976

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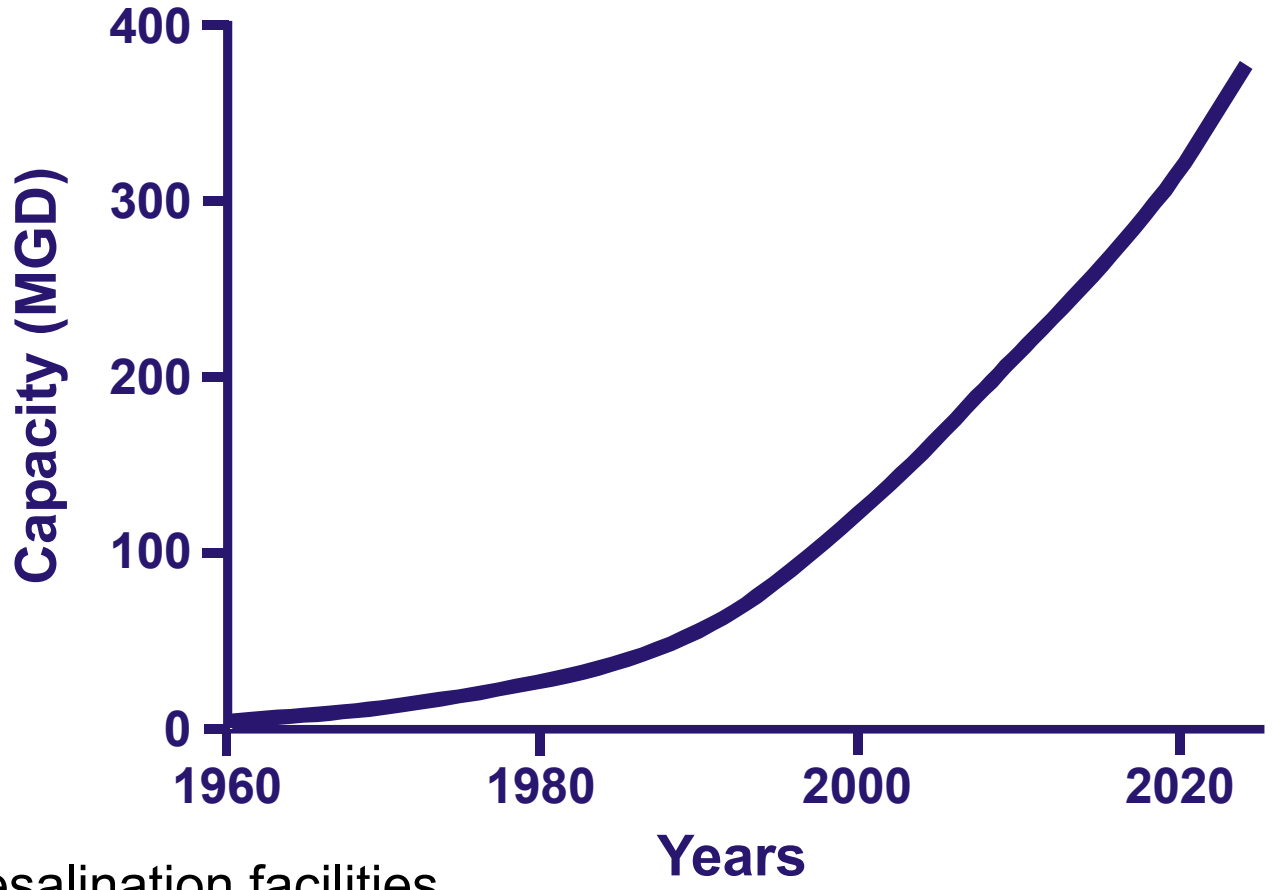
FDEP Regulatory District	*RO Plants*	*Population Served*	*Design Capacity (MGD)*
Northwest	2	< 1000	< 1 MGD
Northeast	15	~ 240,000	~ 23 MGD
Central	21	~730,000	~ 42 MGD
Southeast	42	~1,985,000	~ 280 MGD
South	31	~ 864,000	~ 81 MGD
Southwest	29	~ 459,000	~ 89 MGD
Totals	**140**	**~ 4,279,000**	**~ 515 MGD**

Table 3-6. Characterization of Desalination Plants in Florida (FDEP, 2009)

Brackish Water Desalination
Florida Capacities



- >140 desalination facilities
- >100 Brackish water facilities
- +/-515 MGD capacity

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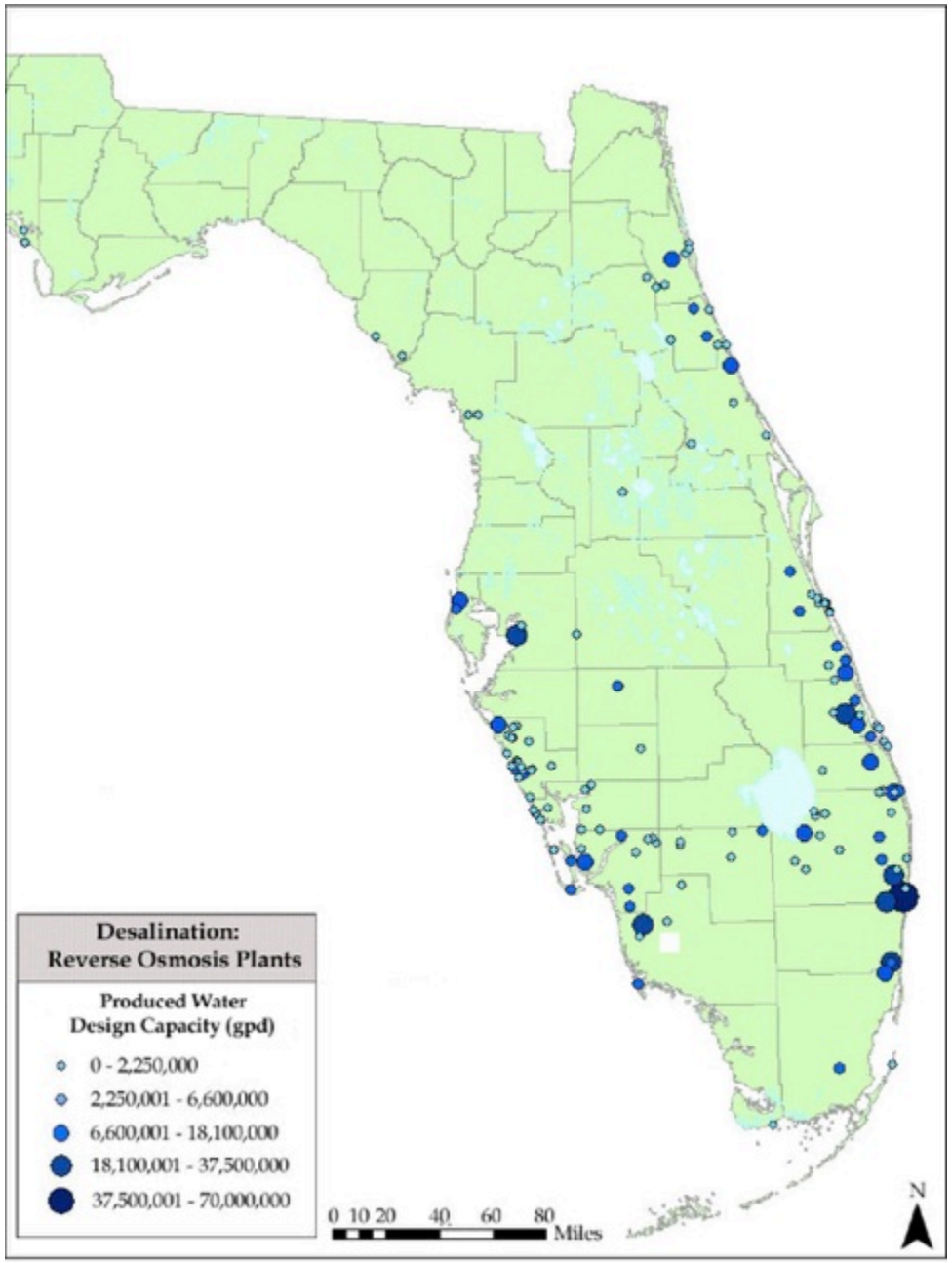

Figure 1-4. Desalination Facilities in Florida (FDEP, 2009)

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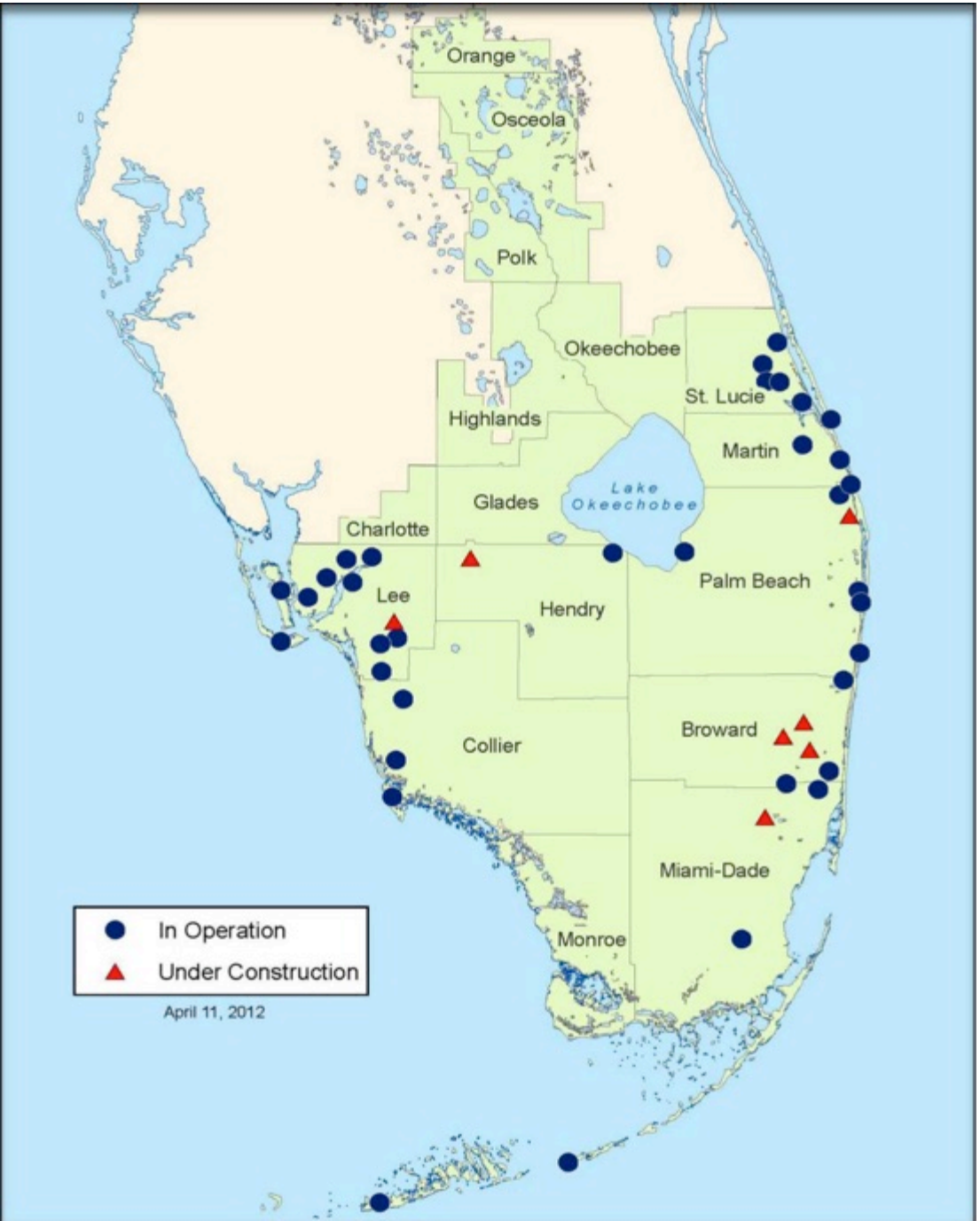

Facilities Using Brackish Groundwater and Seawater in South Florida

Number of Facilities:

- Operating 35
- Under construction 7

Total Capacity (MGD):

- Operating 245
- Under Construction 36.5

Major Brackish-Water RO Plants in Florida

Facility	Design Capacity (MGD)
Cape Coral (SW and N Plants)	30.0
Collier SCRWTP	20.0
Collier NCRWTP	8.0
Lee County (North)	10.0
Fort Myers	12.0
Marco Island	6.0
Bonita Springs Utilities	6.5
Sarasota	4.5
Venice	4.0
City of Clearwater WTP 2	6.25
City of Punta Gorda	4.0

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Major Brackish-Water RO Plants in Florida (cont.)

Facility	Design Capacity (MGD)
Plantation	6.0
City of Hialeah	10.0
FKAA Robert Dean	6.0
City of Hollywood	4.0
North Miami Beach	6.0
Lake Region WTP (Palm Beach Co.)	10.0
Martin County Tropical Farms	8.0
South Miami Heights	20.0

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Desalination Costs

Type	Cost (1970) (Per 1000 gal.)	Cost (Per 1000 gal.)*
Seawater (RO)	$8 - $12	$3.50 - $8.00 ($1/m^3 - $3.78)
Brackish Water	$2 - $4	$0.98 - $2.04

*Ghaffour et al. (2013)

Costs function of:

- System size (economies of scale)
- Raw water source
- Energy costs
- System specific issues (location, design, construction costs)
- Existing infrastructure

Energy requirements
BWRO: 1.5 to 2.5 KWh/1000 gallons
SWRO: 10 to 15 KWh/1000 gallons

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Regulatory issues

Water use

- Recognized alternative water supply – implementation encourages as a means to reduce reliance on fresh groundwater resources
- Inability to permit additional fresh groundwater use has been a driver for implementation of desalination.
- Brackish groundwater resources are not unlimited.

  - Change in long-term water quality.

  - Competing uses of brackish aquifers (ASR).

Concentrate Disposal

- Economic concentrate disposal can be key economic feasibility issues.
- Large plants – south and southwest part of state – deep well injection. Expensive, but economy of scale.
- Surface water discharges – likely not permittable.
- Small systems – wastewater blending, land supplication, zero-liquid discharge.

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Concentrate Disposal in Florida

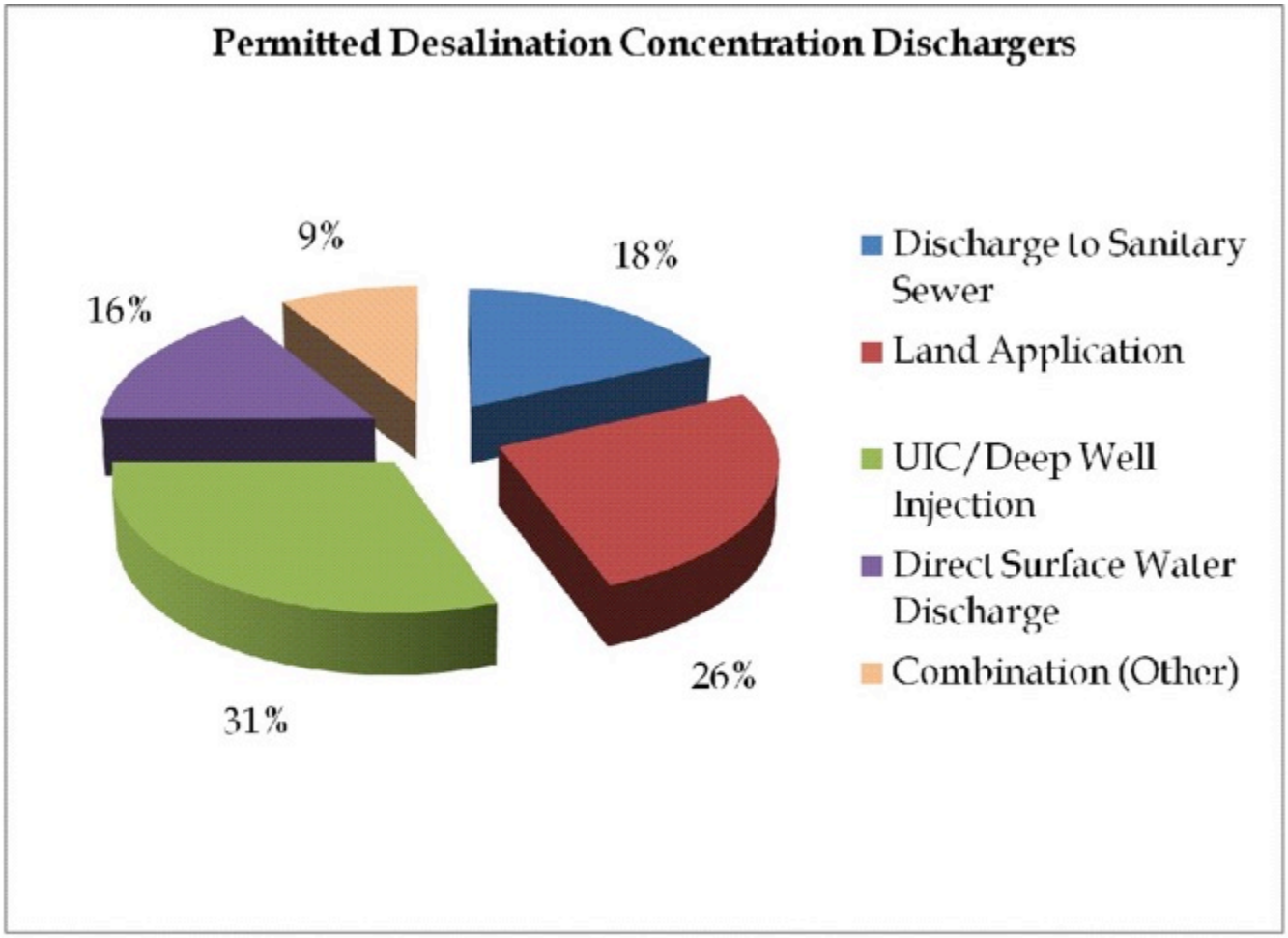

Figure 4-4. Desalination Concentrate Management Methods in Florida (FDEP, 2008a)

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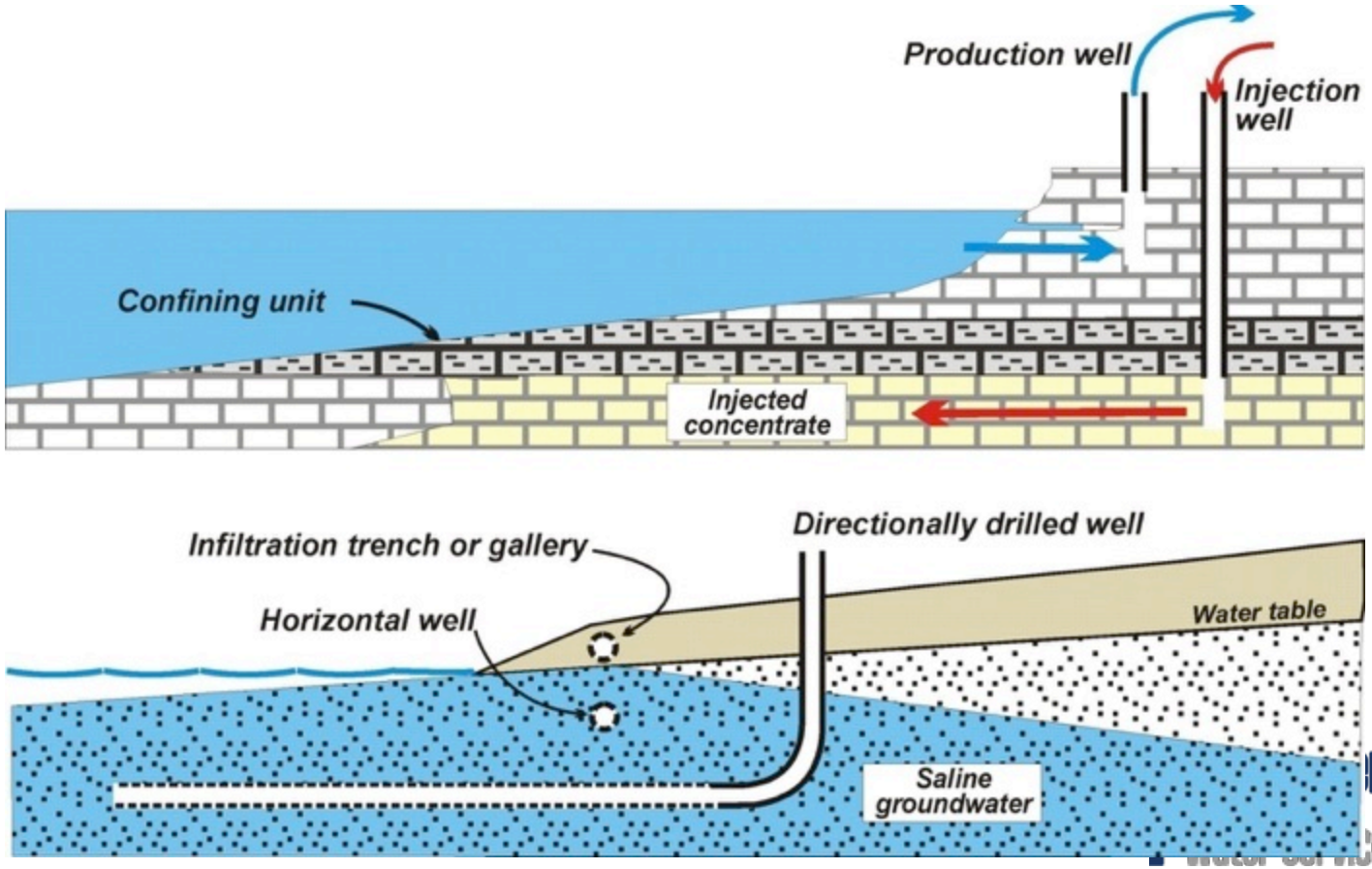
Concentrate Disposal

- **Class V Injection wells**
  - Inject in a saline zone above lowest USDW.
  - FDEP policy had been to not permit although allowed under rules.



Brackish Groundwater RO in Florida

- **National (global) leader in terms of install capacity.**
- Very well established technology in South Florida, where conditions are ideal: ample raw water source and injection zone.
- Very competitive market. BWRO is entering realm of commodity engineering – cost rather than technology driven.
- One technical problem area for some systems is increases in salinity that are more rapid the predicted.
  Example: Lake Regional Water Treatment Plant – Belle Glade.
  - Unexpected rapid salinity changes – minimal hydrogeological testing program; none in main wellfield area.
- Continued implementation driven by population growth.

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Seawater Desalination in Florida

- **One large facility (Tampa Bay); some small systems.**
- Technically viable and can provide unlimited supply of freshwater.
- Limitation: **Cost**. Energy intensive (50% of costs); carbon footprint.
- Environmental – open intakes cause impingement and entrainment of marine organisms – can be avoided with subsurface intakes.
- Will be option of last resort.

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Florida Desalination Issues
Tampa Bay SW Desalination Facility

- Location: Apollo Beach, Hillsborough County
- Co-located at Tampa Bay Electric Big Bend Power Plant

- Design capacity: 25 Mgd
- Fully operational: 2008

- Total cost: $158 million ($85 from SWFWD)

- Water cost: $3.00 to $3.50/1,000 gal.

- Uses existing power plant intake and outfall
- Largest operational SW desalination plant in the United States.
- Current status: standby

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Florida Desalination Issues
Coquina Coast, Northeast Florida

- Initial plans
  - 10-15 MGD by 2020
  - 25-50 MGD by 2050

- Estimated water costs: $6.27 to $7.74 per 1,000 gallons (10-15 Mgd)
- Future water costs: $4.27 per 1,000 gallons

- Partners pulled out of project
- Demand growth has not occurred
- Project “on the shelf”

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Public-Private Partnerships

- SB/HB-84: New (2013) law signed by Gov. Scott facilitates public-private partnerships for utility projects including:

  - Design-build
  - Design-build-operate
  - Design-build-finance-operate

  Could attract more interest in Florida desalination market by international private firms.

- Clarification of state support for these types of projects and removes some obstacles.
- South Miami Heights (DBO/DBOF)

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Conclusions

- **Florida is not running out of water!**
- **Florida is running out of cheap freshwater!**

- Brackish water desalination will continued to be implemented as a cost effective alternative water supply.
  - plants need to be designed to accommodate changes in water quality over time.

- Seawater desalination – expensive option of last resort.

- Demand – drop of rate of population growth reduced current needs. Many utilities have considered excess in WTP capacity.

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