



FPL Experience with Alternative Water Sources

**28th Annual Florida Chamber of Commerce
Environmental Permitting Summer School**

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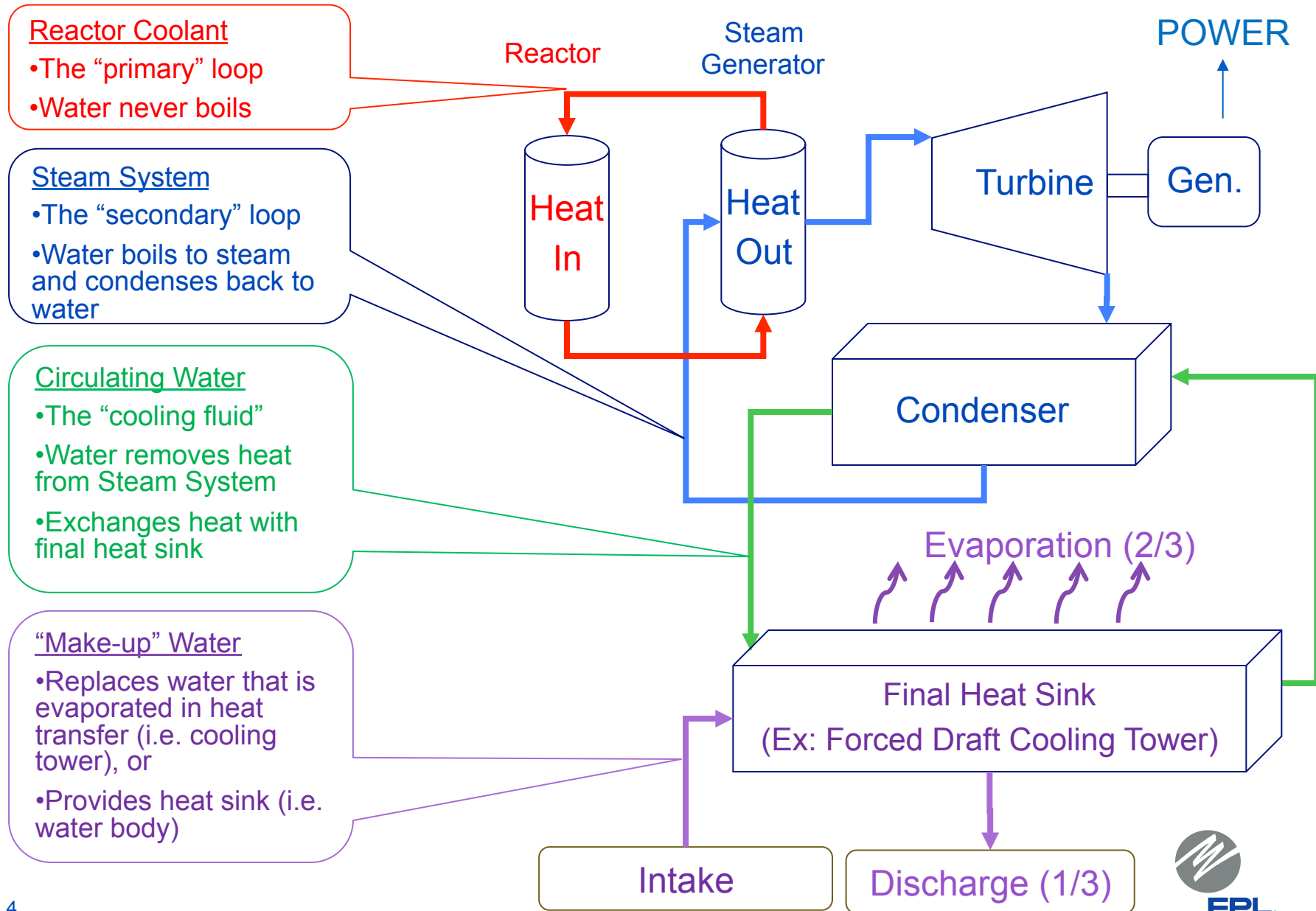
Discussion Topics

- **Water and Electric Generation - Background**
- **Water Resource Options**
 - Marine water
 - Cooling Ponds
 - Deep aquifer wells
 - Reclaimed Water
- **Case Study - Turkey Point 6 & 7**
 - Resource Options
 - Selection Process
 - Certified Design
 - Reclaimed Water
 - Radial Collector Wells

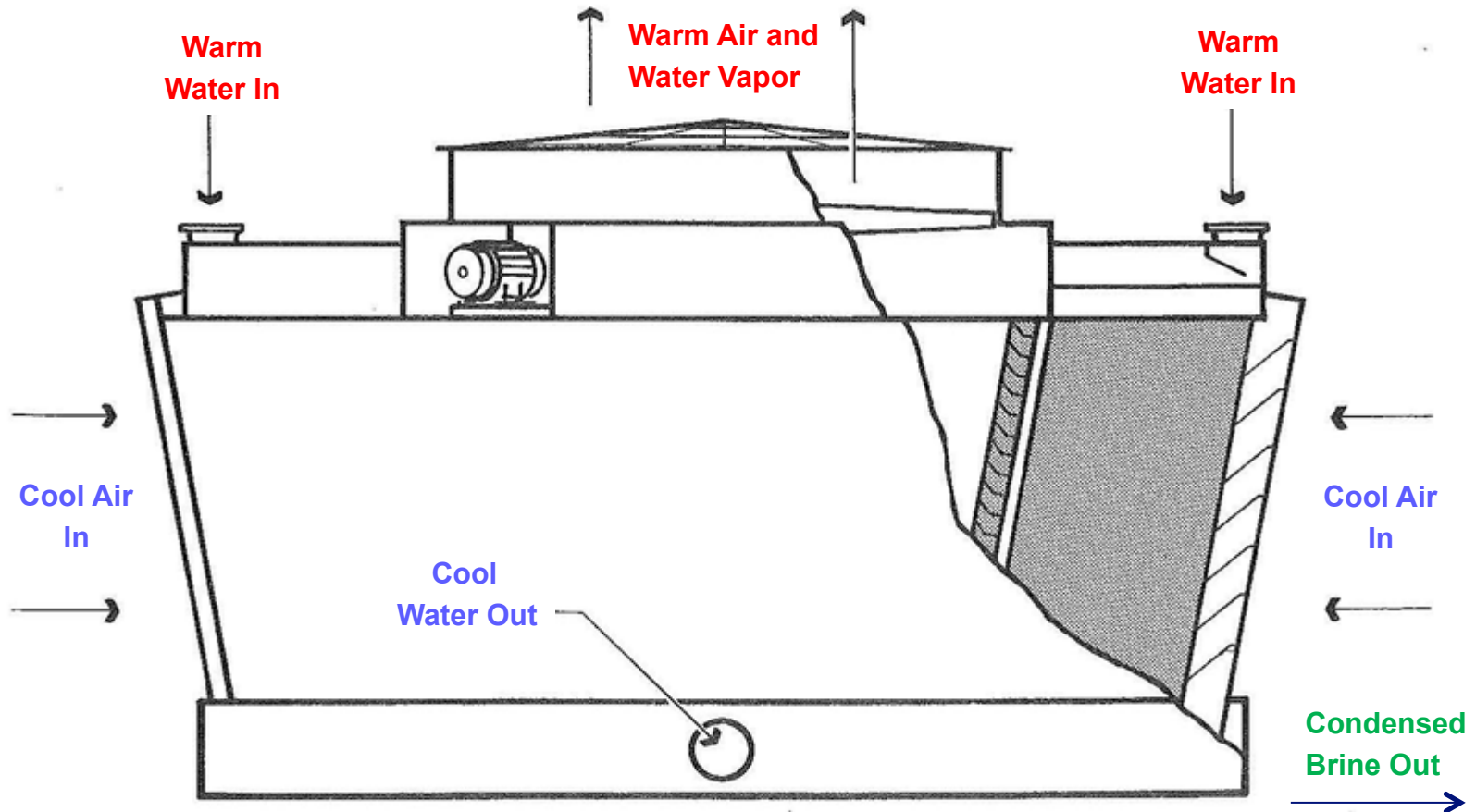


Water and Electric Generation

Water is a necessary part of the power generation process



Forced draft cooling towers are the most efficient technology for providing cooling while minimizing water use



Cooling technology and make up water quality determine how much water is needed for cooling



Water Resource Options

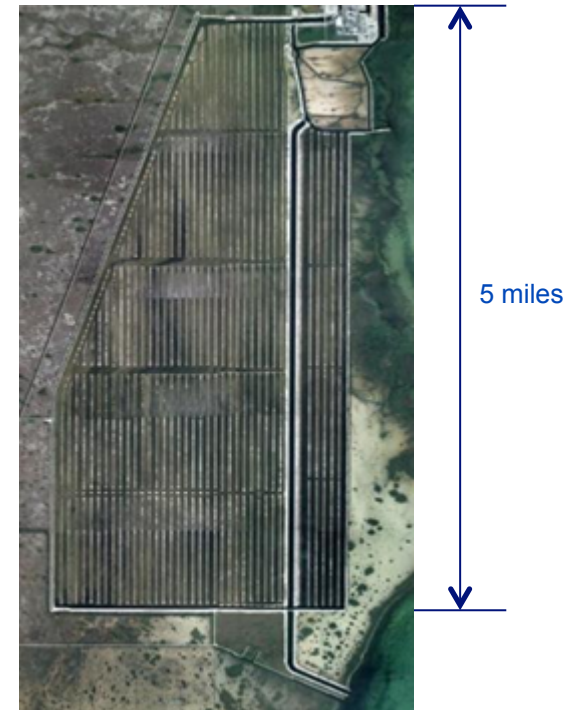
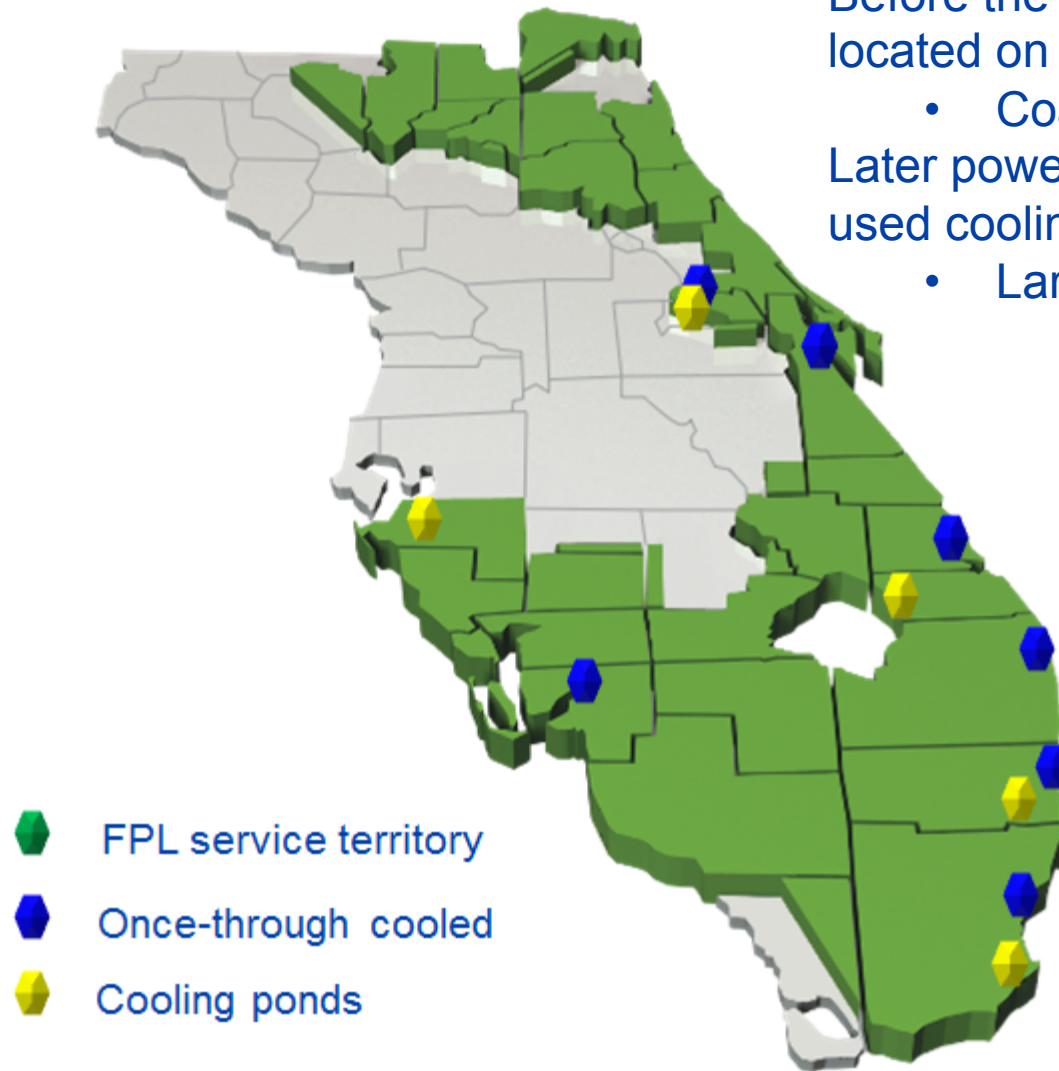
Generation sites historically relied on large water bodies; during the 1970's CWA began to significantly influence water sources

Before the 1970's Florida plants were located on natural water bodies

- Coastal, lakes, rivers

Later power plants (1970's and 1980's) used cooling ponds or cooling canals

- Large land requirements



Turkey Point cooling canal system

St. Lucie Nuclear Units 1 and 2



Example of once-through cooling using intake and discharge pipes that go out into the Atlantic

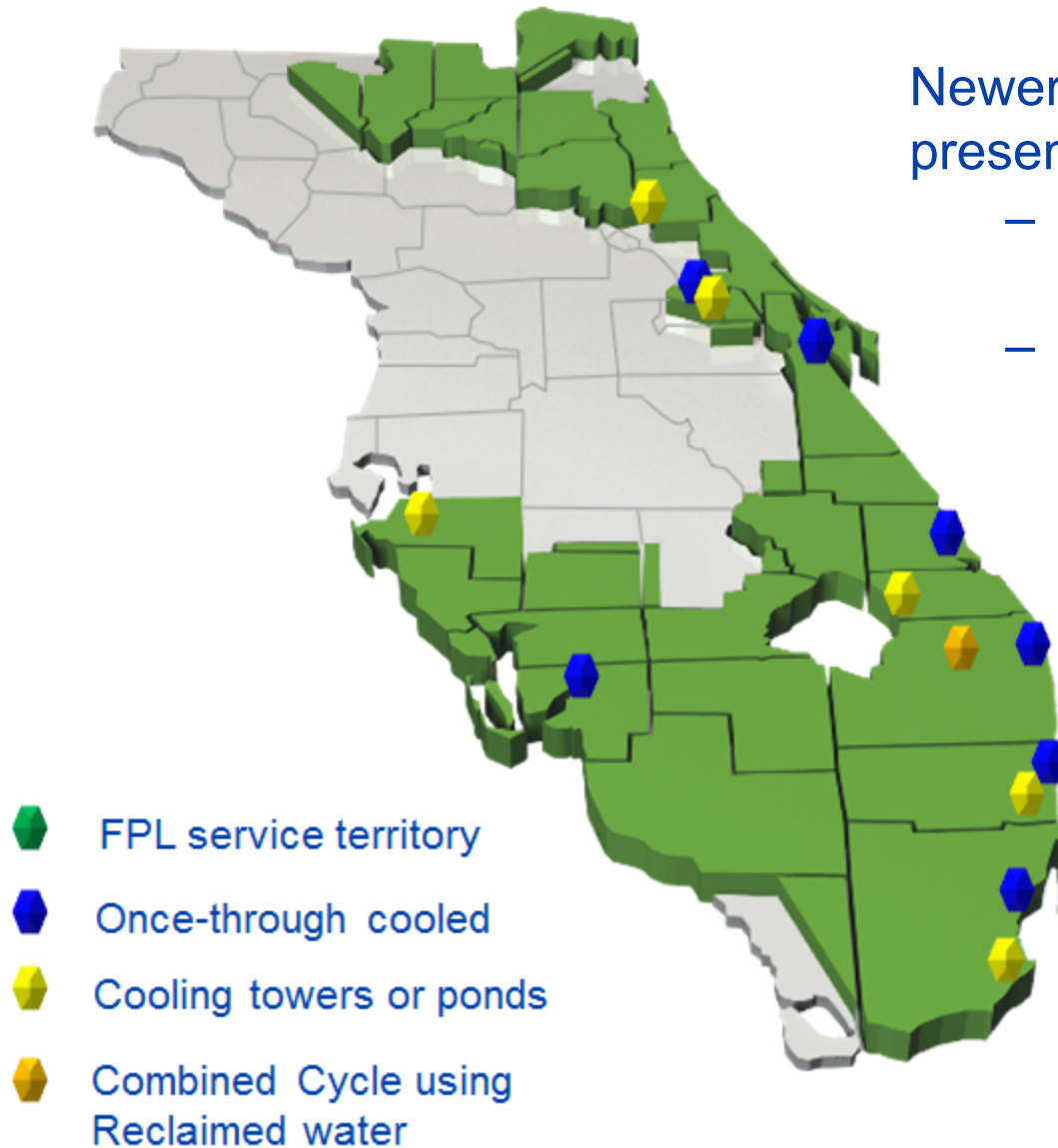
Power generation and cooling water technological advances provide more flexibility in location of power generation and reduce water use

Next Generation Solar at FPL's Martin Plant



Three different generating technologies using a cooling pond as a water source and forced draft cooling towers as the cooling technology

Current generation and cooling technologies require less water, allowing for more potential site locations



Newer power plants (1990's to present)

- Combined Cycle requires less water
- Forced draft cooling towers further reduce requirements



Water Policy in Florida Today

- **State water policy requires a proposed water use to be a “Reasonable-Beneficial Use”**
- **Strong competition exists for available surface and groundwater sources**
- **By regulation, the lowest quality water for the intended use must be used**
- **The State’s water management districts have specifically directed local governments to increase wastewater reuse**
- **It is stated public policy that use of water only once is not in the public interest**



Case Study: Turkey Point 6 & 7

Case History: State Certification was granted for two new nuclear plants in May 2014

Turkey Point Units 6 & 7

- **2,200 MW two unit facility using Westinghouse AP1000**
- **Environmental benefits include:**
 - Avoids 267 million tons of CO₂
 - FPL system produces ~40 million tons per year
 - Avoids consumption of over \$60 billion in natural gas
 - Use 60 million gallons per day of reclaimed water
 - Marine water via Radial Collector wells will provide backup



Specifically designed to be integrated into the South Florida environment

Water is all around us, but just try to use some!



1. Marine
2. Ground Water
3. Reclaimed
4. Surface Canals
5. Onsite Canals

Water is all around us, but just try to go use some!

Water Sources

Source Type	Intake Method	Additional Requirements	Volume (MGD) ¹
Marine	Offshore Intakes Canal Intakes Subsurface Intakes	Tunneling Fish screens Radial Collector Wells	125
Ground water	Biscayne Upper/Lower Floridan Boulder Zone	Well system Well system Well system	60 ~90 125
Reclaimed	Buried pipeline	On-site treatment	60
Surface water canals	Pumping system	On-site treatment	60-80
Surface water - onsite	Cooling Canal System	Expand system to provide capacity	>125

1) Values estimated, vary with TDS content

Multiple screening studies result in a relative evaluation of the various sources and conveyance methods

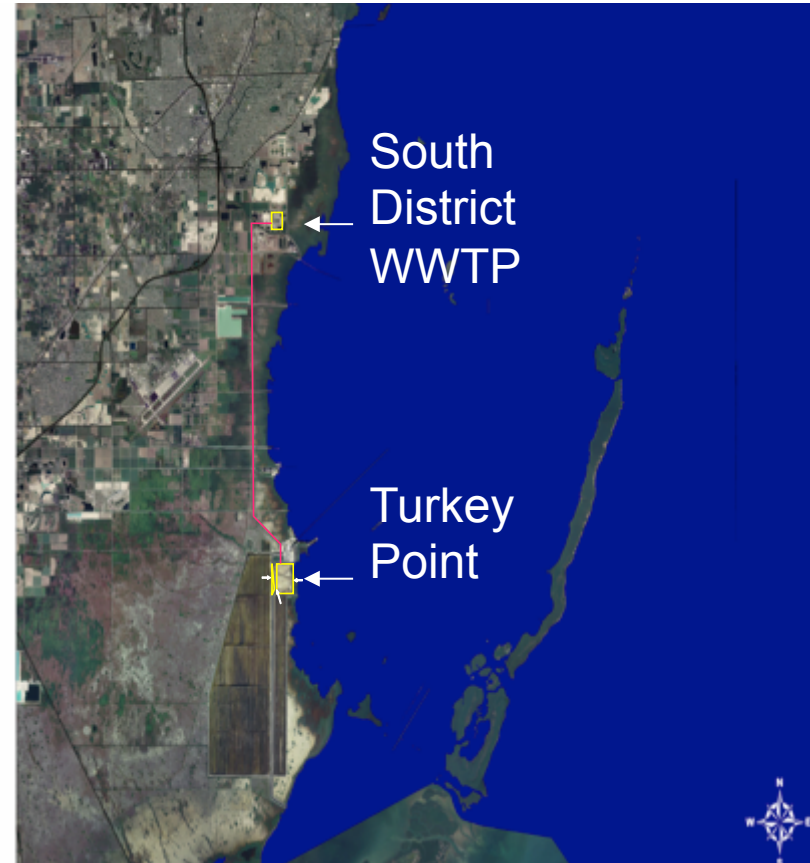
Resource Ranking

- **Technical Factors**
 - Volume, reliability, quality, permissibility, navigation, security
- **Environmental Factors**
 - Construction impacts, operational impacts, CERP consistency, permissibility
- **Reclaimed emerged highly ranked, but with a reliability concern**
 - Municipal Water entity is a non-recourse supplier
 - Answer: Identify a backup source to balance reliability concern
 - Current Example: West County Energy Center
 - Use of 21 MGD reclaimed water from Palm Beach County
 - Retains original Floridan well system as a restricted backup

Project will use 59 MGD of reclaimed water as its primary source of cooling water

Reclaimed Water

- A cost-effective beneficial use of reclaimed municipal wastewater
- Does not use water targeted for Everglades restoration
- County will own/operate a 9 mile reclaimed water pipeline from South District Plant



Reclaimed water used by Turkey Point 6 & 7 will not compete with reclaimed water reserved for Everglades restoration

Proposed project includes a 44 acre Reclaimed Water Treatment Facility to remove nutrient and mineral content prior to use

Turkey Point 6 & 7 Project Site

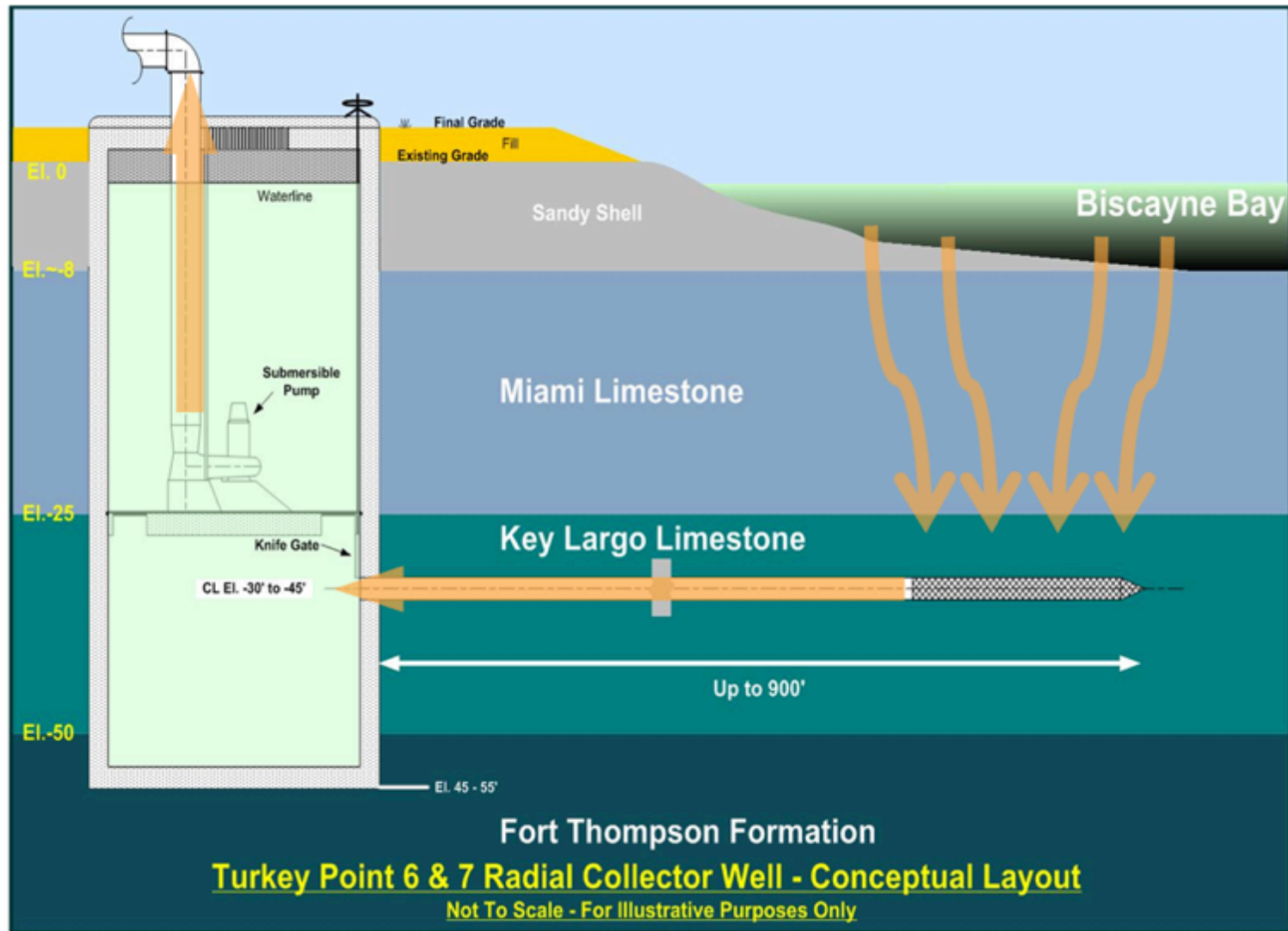


Conceptual Radial Collector Well (RCW) Design

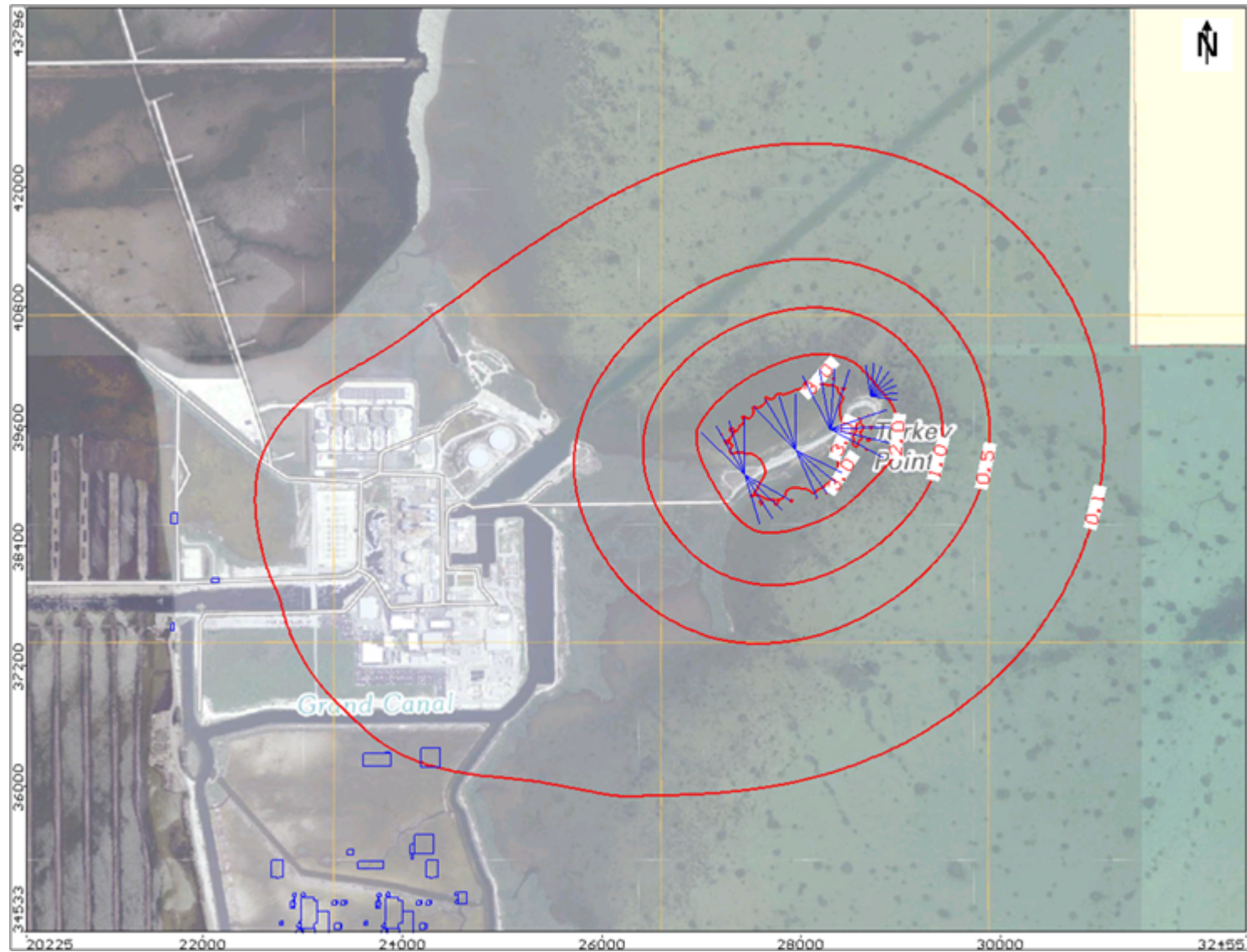


- 4 onshore caissons each 1/3 capacity (one back-up)
- Caisson construction in upland areas
- Laterals approximately 25 to 40 ft below the substrate
- Laterals constructed from within caisson – no dredge and fill activities in Biscayne Bay

Pumping Activities At Equilibrium



RCW Drawdown (ft) within the Pumped Layer





Questions?