



# **Turkey Point Units 6 & 7 Underground Injection Control**

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**The information provided in the following  
presentation is of a preliminary nature  
and is considered DRAFT**

## Agenda

### **Provide the NRC with an overview of the use and success of Underground Injection Control (UIC) in Florida**

- General UIC Information
- Florida UIC Permitting Process
- UIC Design, Construction and Testing
- Fluid Migration Detection

# Turkey Point Units 6 & 7 – Underground Injection Control

## History of Underground Injection in Florida

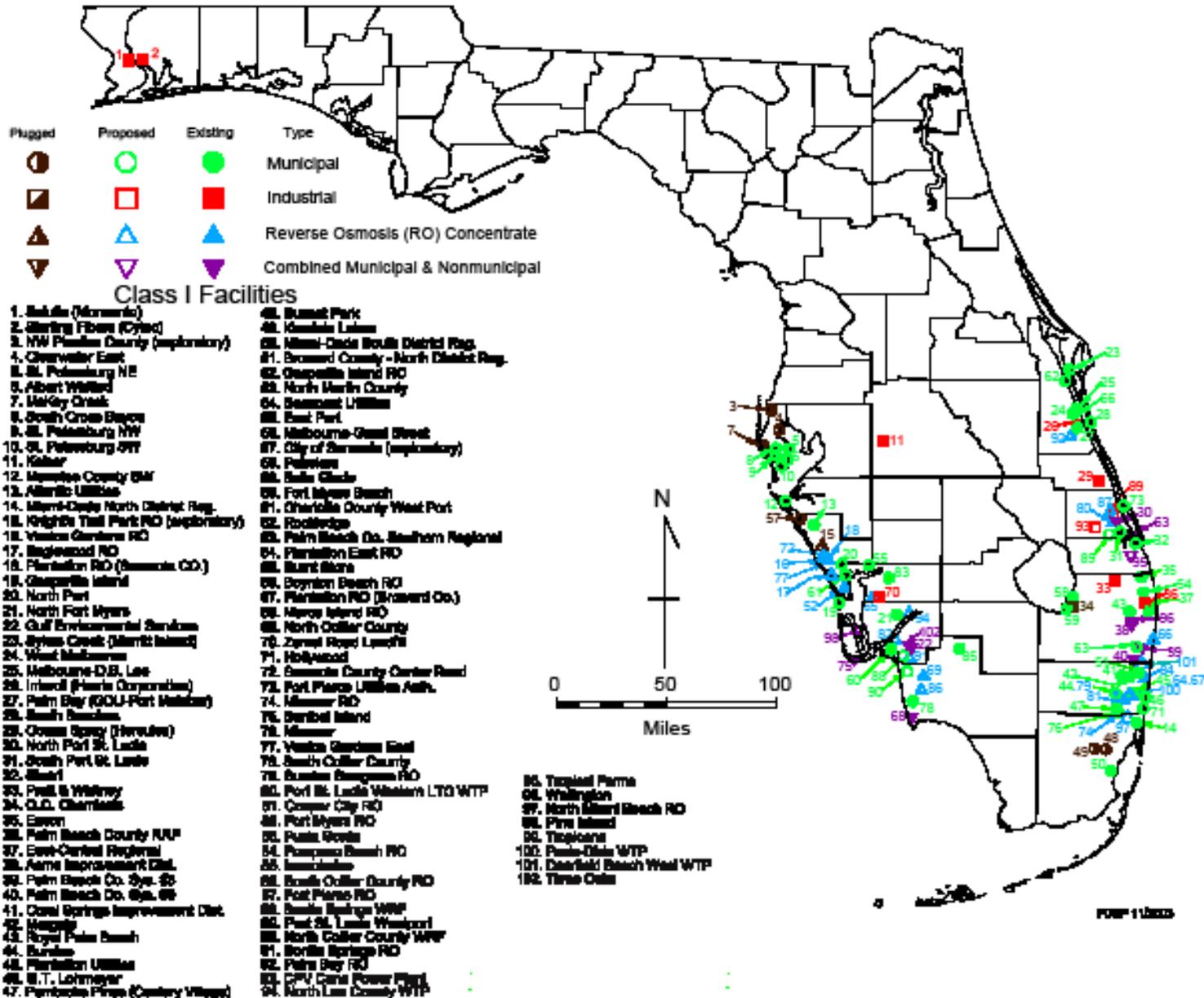
- **1943 – First injection into the Floridan Aquifer took place**
  - Oil Field Brine
- **1959 – First injection of municipal effluent into the Upper Floridan Aquifer**
- **1966 – First injection of non-oil field related industrial wastewater into the Lower Floridan Aquifer (Boulder Zone)**
- **1970s – Injection into Upper Floridan ceases and is replaced by injection into the Boulder Zone**
- **1983 - Florida is granted primacy of the State's UIC Program**
- **Today there are approximately 127 active Class I injection wells in Florida**

# Turkey Point Units 6 & 7 – Underground Injection Control

## Class I Wells

- **Class I - industrial and municipal disposal wells which inject fluids beneath the lowermost unit containing an underground source of drinking water (USDW)**
  - Class I Municipal – disposes of treated domestic wastewater
  - Class I Industrial – disposes of non-hazardous industrial wastewater
- **Most dispose of treated municipal effluent**
- **Many dispose of reverse osmosis (RO) concentrate or a combination of treated wastewater and RO concentrate**
- **Power Plant industrial wastewater – primarily cooling tower blowdown**

# CLASS I INJECTION FACILITIES

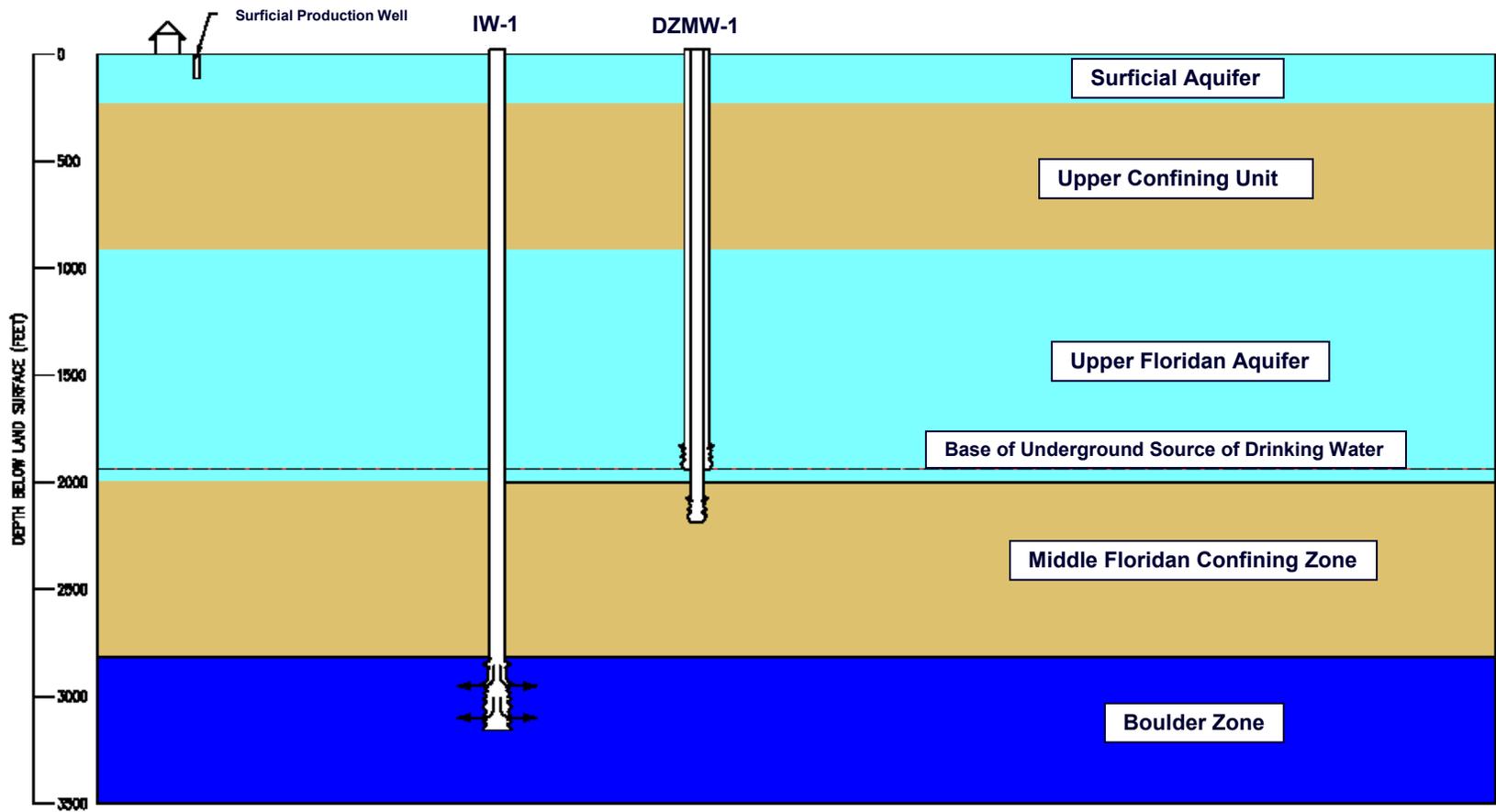


# Turkey Point Units 6 & 7 – Underground Injection Control

## Class I Injection Technology

- **Inject into the Boulder Zone in the Lower Floridan Aquifer**
- **Thick confining beds separate the Boulder Zone from the Underground Source of Drinking Water (USDW)**
  - USDW = an aquifer or its portion that contains water with a total dissolved solids concentration of less than 10,000 mg/L.
- **Confinement is low permeability limestone and dolomite**
  - Typically 800 – 1,000 feet thick
  - Vertical hydraulic conductivity typically  $10^{-4}$  to  $10^{-9}$  cm/sec

TYPICAL INJECTION WELL SYSTEM



NOT TO SCALE

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## Florida's UIC Permitting Process

- **The Florida Department of Environmental Protection (FDEP) administers the UIC Program in Florida**
- **Chapter 62-528, Florida Administrative Code**
- **Technical Advisory Committee (TAC)**
  - District and Tallahassee FDEP offices, USGS, Water Management District, local Health Department, and USEPA

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## Florida's UIC Permitting Process – cont.

- **Exploratory Well Construction Permit**
  - Well construction to evaluate site geology and hydrogeology
- **Class I Construction Permit**
  - Conversion of exploratory well to a Class I injection well
  - Short-Term injection test
  - Operational testing – 6 to 24 months of test operation with increased monitoring requirements
- **Operating Permit**
  - Allows operation of the Class I injection well system
  - Must be renewed every 5 years

# Turkey Point Units 6 & 7 – Underground Injection Control

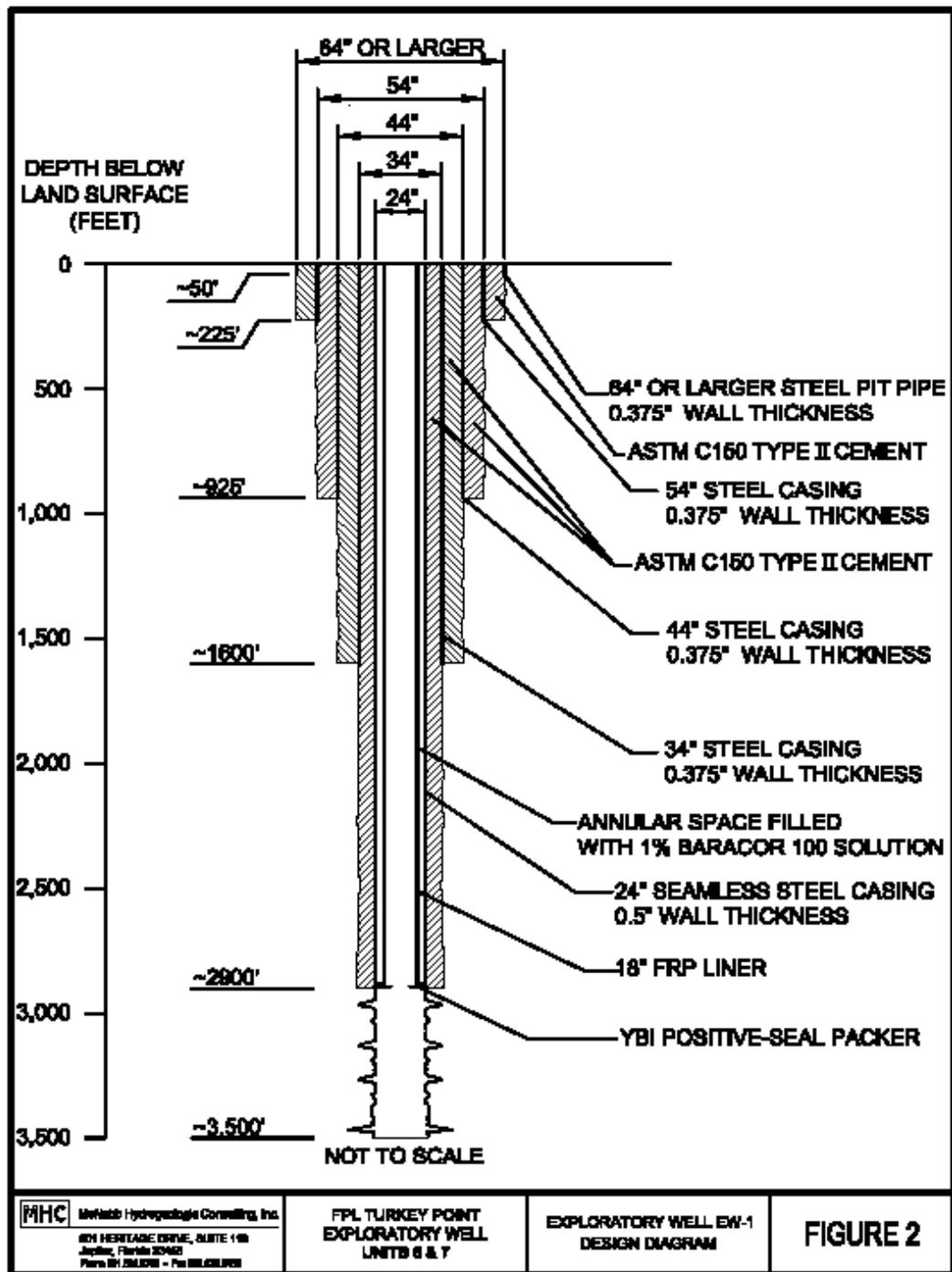
## Injection Well Design

- **Multiple concentric casings**
  - 54-, 44-, 34-, and 24-inch diameter steel fully cemented casings
  - 0.375-inch wall thickness except final casing is seamless 0.5-inch
  - 34-inch and 24-inch diameters casings set below base of USDW
- **Fiberglass Reinforced Pipe (FRP) injection tubing**
  - Protects final casing from corrosion
  - Packer at base of FRP isolates FRP-casing annulus
  - Annulus filled with corrosion inhibitor
- **10-inch overdrill on final casing to allow 5-inch cement thickness around casing**

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## Injection Well Mechanical Integrity Test

- **Mechanical integrity testing (MIT) is required every 5 years**
- **MIT consist of the following**
  - Video survey – visual inspection of injection tubing, packer and open hole interval
  - High-resolution temperature logging – leak detection
  - Annular pressure test – test for leaks in tubing, final casing and packer
  - Radioactive tracer survey – test the integrity of the cement seal at the base of the final casing
  - Interpretation of previous five years of monitoring and operating data
- **Results compiled in report and submitted to FDEP for review and approval**

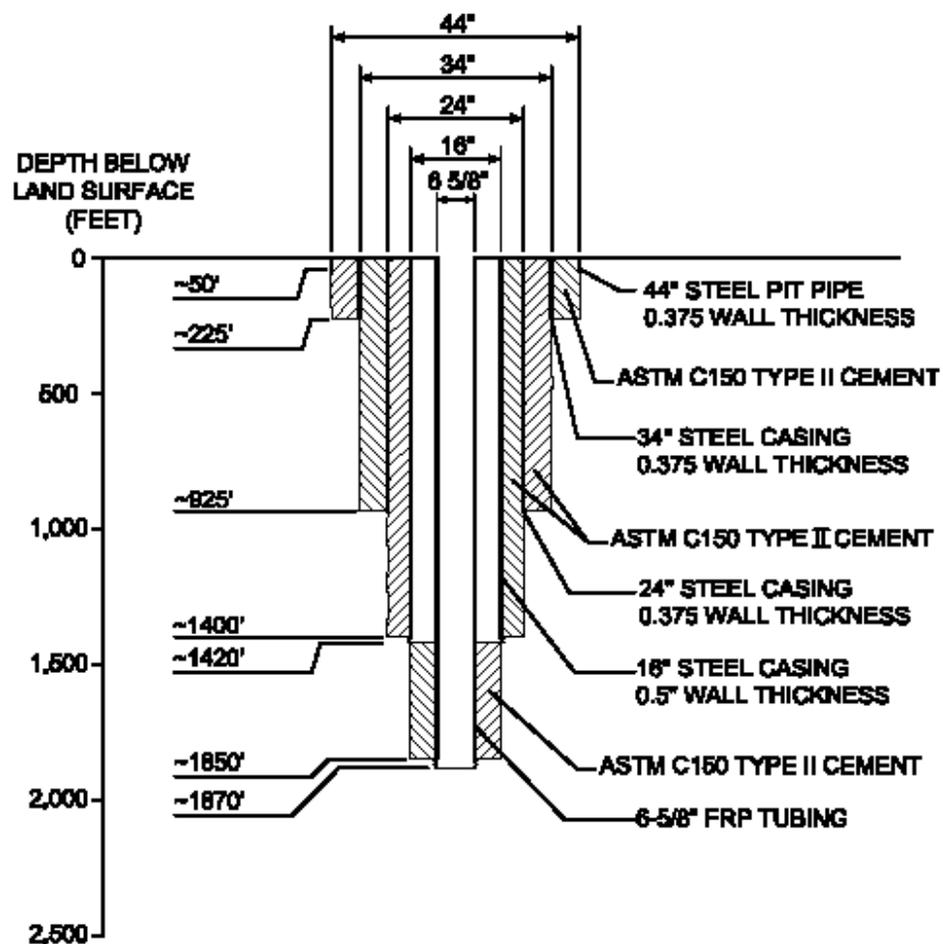


# Turkey Point Units 6 & 7 – Underground Injection Control

## Monitor Well Design

- **Multiple concentric casings**
  - 34-, 24-, 16-, and 6.625-inch diameter casings
  - 16-inch diameter casing is 0.5-inch wall thickness steel, 34- and 24-inch diameter casings are 0.375-inch wall thickness steel
  - 6.625-inch diameter casing is FRP to provide corrosion protection
- **Monitors two separate zones**
  - Upper zone monitors just above or at the base of the USDW
  - Lower zone monitors below base of the USDW and just above the primary confining unit – typically a few hundred feet below the base of the USDW to provide early warning system

## DUAL-ZONE MONITOR WELL



NOT TO SCALE

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FPL TURKEY POINT  
EXPLORATORY WELL  
UNITS 6 & 7

DUAL ZONE MONITOR WELL  
DZMW-1  
DESIGN DIAGRAM

FIGURE 3



# Turkey Point Units 6 & 7 – Underground Injection Control

## Injection Well Drilling Rig



# Turkey Point Units 6 & 7 – Underground Injection Control

## 12.25-Inch Diameter Pilot Hole Bit



# Turkey Point Units 6 & 7 – Underground Injection Control

## 58-Inch Diameter Reaming Bit



# Turkey Point Units 6 & 7 – Underground Injection Control Casing Installation



## Turkey Point Units 6 & 7 – Underground Injection Control FRP Injection Tubing Installation



# Turkey Point Units 6 & 7 – Underground Injection Control Class I Injection Wellhead



# Turkey Point Units 6 & 7 – Underground Injection Control Class I Injection Wellhead



# Turkey Point Units 6 & 7 – Underground Injection Control

## Confinement Characterization

- **Geophysical logs**
- **Rock Cores**
  - Laboratory Analysis of core samples
- **Straddle Packer Testing**
  - Hydraulic and water quality data

# Turkey Point Units 6 & 7 – Underground Injection Control

## Vertical Fluid Migration Detection

- **Monitor well is located less than 150 feet from injection well**
- **Monitor well sample collection**
  - Weekly during operational testing
  - Monthly thereafter
  - Total dissolved solids, conductivity, chloride, phosphorus, sulfate, sodium, calcium, magnesium, potassium, carbonate, bicarbonate, temperature, pH, gross alpha, radium-226, radium-228
- **Monitor well water level monitoring**
- **Changes in monitor zone water quality and level can indicate vertical migration**



## **Closing Questions & Comments**