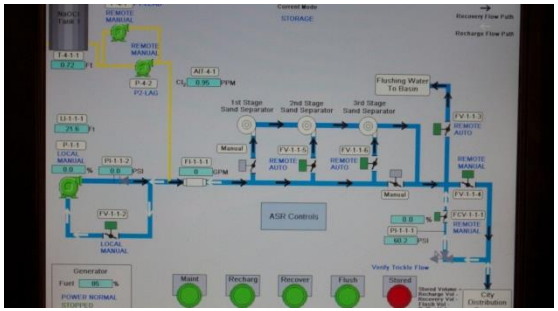


Aquifer Storage and Recovery (ASR)

ALTERNATIVE USE IN A WATER SYSTEM

Michael E. Richardson

Water Resources Manager, CFPUA

Cape Fear Public Utility Authority
Stewardship. Sustainability. Service.

Water Treatment Plant Service Areas

- Sweeney Water Treatment Plant (Surface Water)
  - Largest in System
  - Supplies 80% of Service Area
- Nano Filtration Plant (Groundwater)
  - Northern 17% of Service Area
- Groundwater (Well System)
  - 2 Small Systems Comprising 3% of Southern and Western Service Area
- Aquifer Storage and Recovery
  - Eastern Area Near Wrightsville Beach (Sweeney Service Area)

What is ASR?

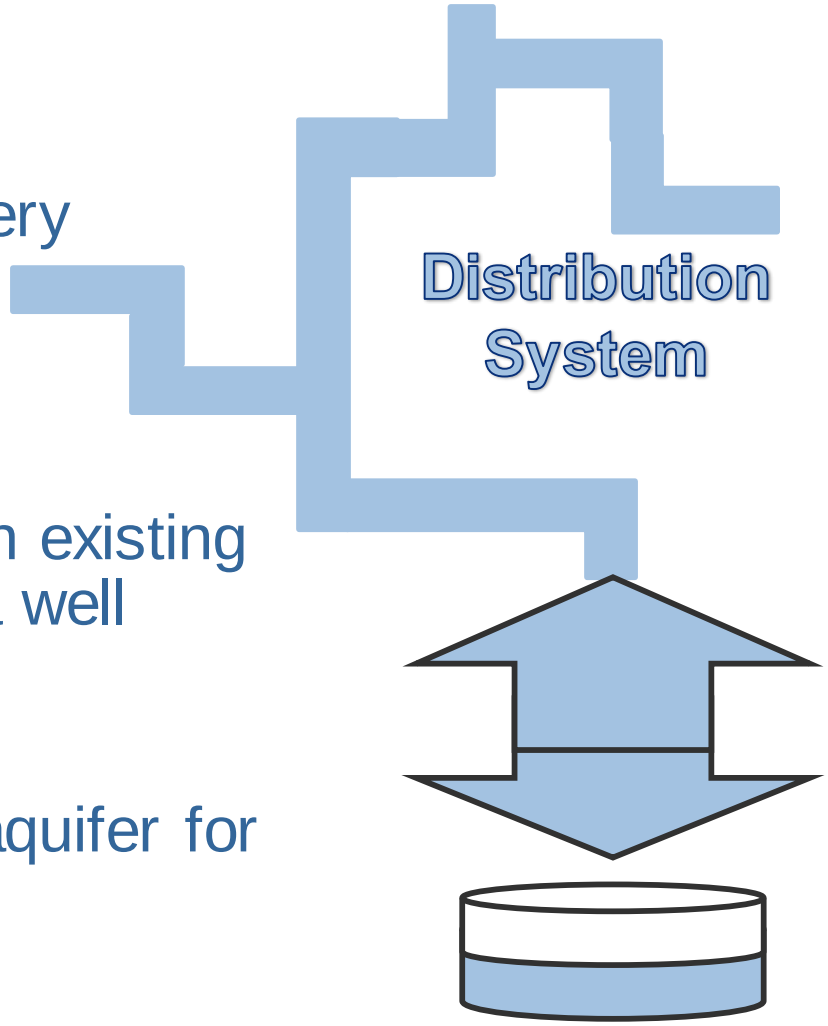
ASR- Aquifer Storage and Recovery

Three Step Process = 1 Cycle:

1. Treated water is placed into an existing groundwater aquifer through a well casing – **RECHARGE**

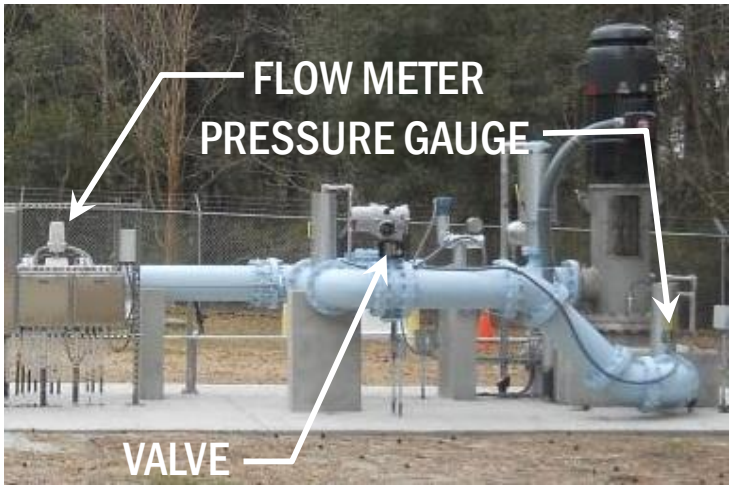
2. The water is **STORED** in the aquifer for future use

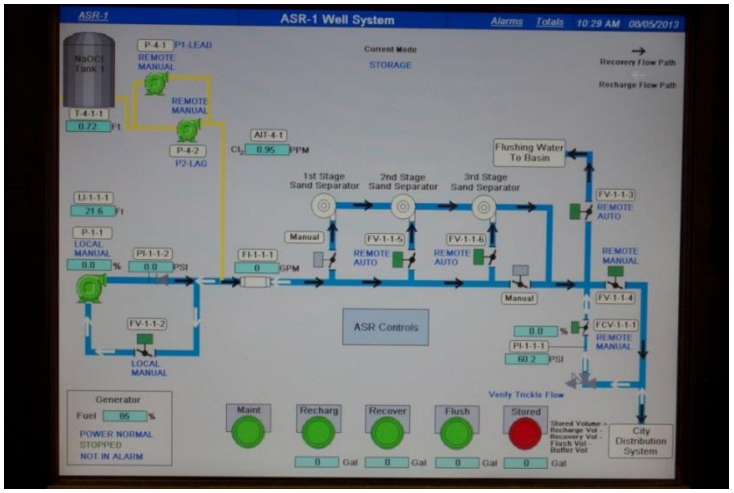
3. Water is **RECOVERED** through a well and pumped back into distribution system



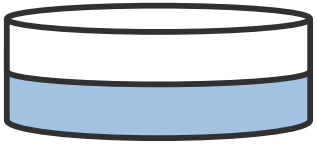
Process of Recharge

- Open valve to provide desired recharge rate
- Monitor flow and pressure
- End when desired volume has been achieved





Storage Phase



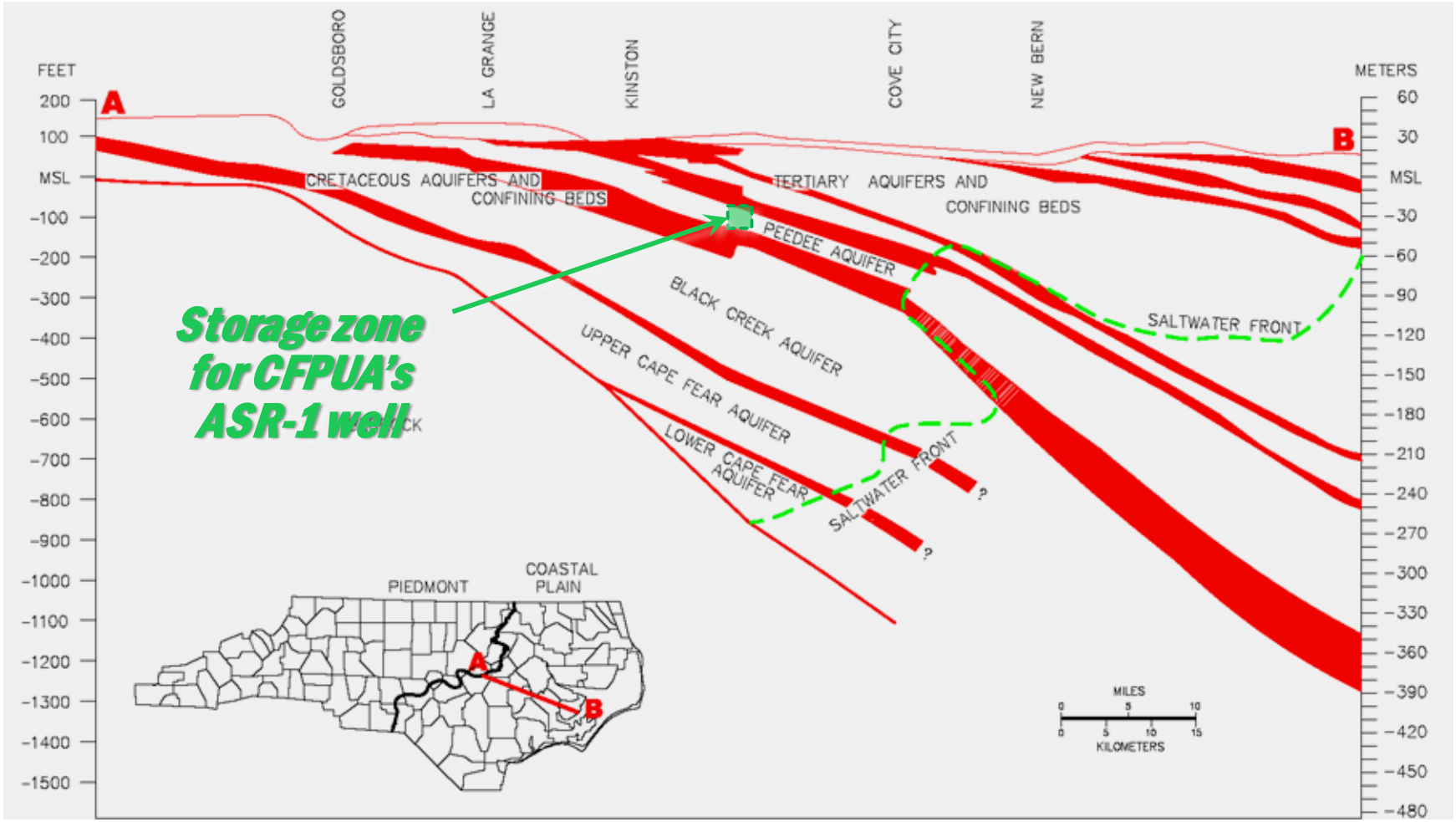
- Allow water to sit in aquifer

- Test for quality
- Recovery to begin when predetermined criteria are met
- Emergency recovery can begin anytime

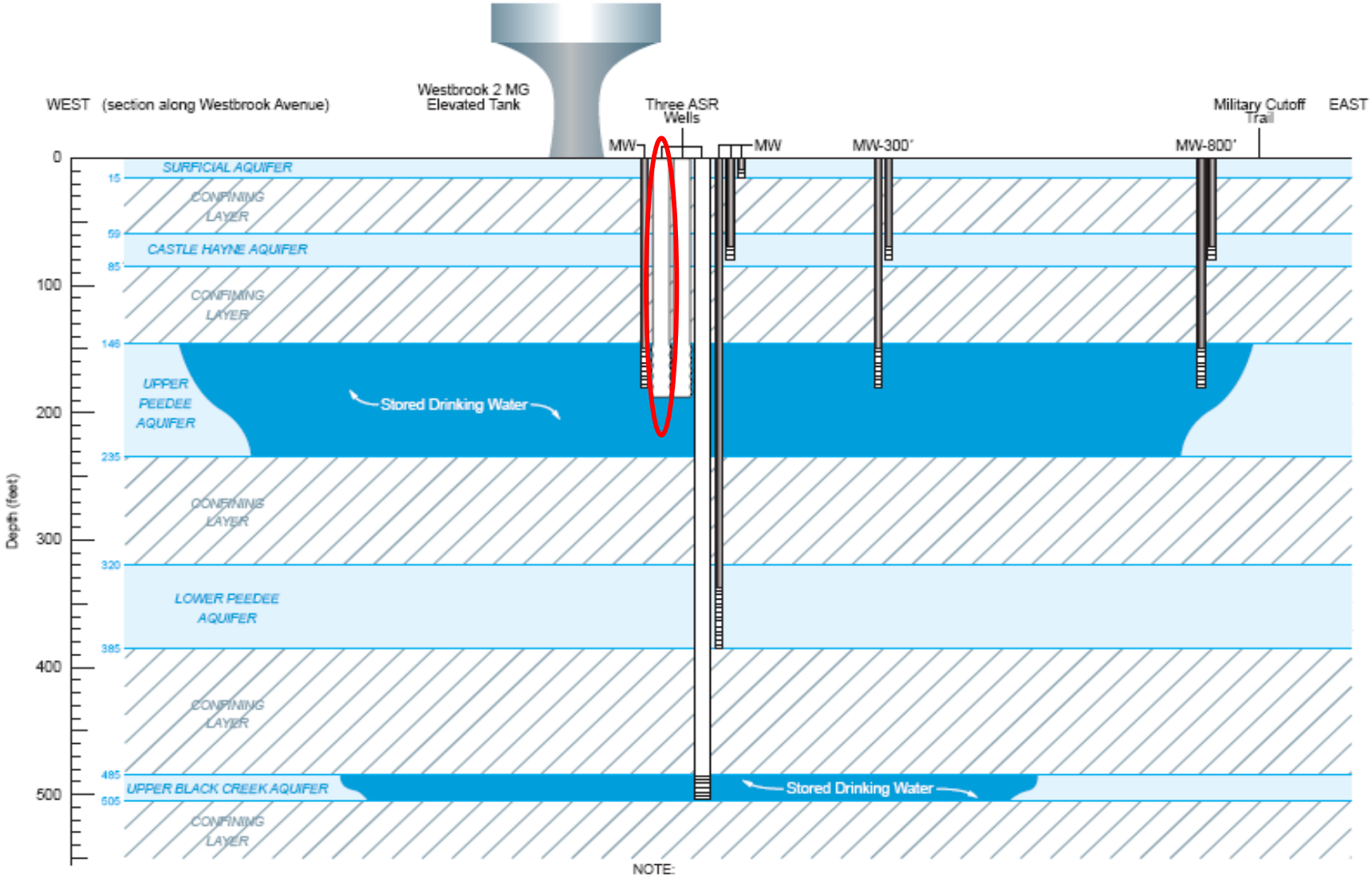
Recovery Phase

Getting Started with an ASR

Cross Section of NC Aquifers



(modified from Winner and Coble, 1996)



Aquifer Storage Recovery Program, Westbrook Site

All ASR Wells and Monitor Wells
November 2007

ASR SYSTEMS

Getting Started with an ASR

Cycle Testing

- Smaller scale recharge/storage/recovery volume
- Testing for Permitting Agencies
  - Dictated by Injection Permit
  - Almost all treated water and groundwater constituents to be tested

Getting Started with an ASR

Water Quality Monitoring

- Baseline for Groundwater from Monitoring Well
- Water quality testing (Treated Water)

Getting Started with an ASR

Cycle Testing

- Recovery testing
  - Test “Tap” Water to Determine Where Influence Area Boundaries Are
  - Tracer

CFPUA's ASR

- Concept/Design/Permitting – 2004 – November 2011
- Construction – 2012
- Cycle Testing
  - Cycle 1 – 2013
  - Cycle 2 – 2016
  - Well rehab for sand issues - 2015
  - Full Operation – 2016

- **GOAL – Water Quality and Emergency Supply**

CFPUA – Cycle Testing

- Cycle 1
  - Recharge - From March to May 2013 – 26 Million Gallons
  - Storage – From May to September 2013
  - Recovery – October 2013

- Findings
  - Reduced THM's from 80 PPM to 10 PPM (95 Days of Storage)
  - Area of Influence Different than expected *Fluoride Tracer
  - Higher volume of sand recovered
  - Allows Sweeney to operate more efficiently at lower demand times

CFPUA – Cycle Testing

- Cycle 2
  - Recharge – Began March 2014
  - Sand issues – screen well Nov 2015
  - Storage – TBD
  - Recovery – TBD

- Findings (so far)
  - Start-up smoother
  - Operator familiarity

How Can This Help Operation of a Water System?

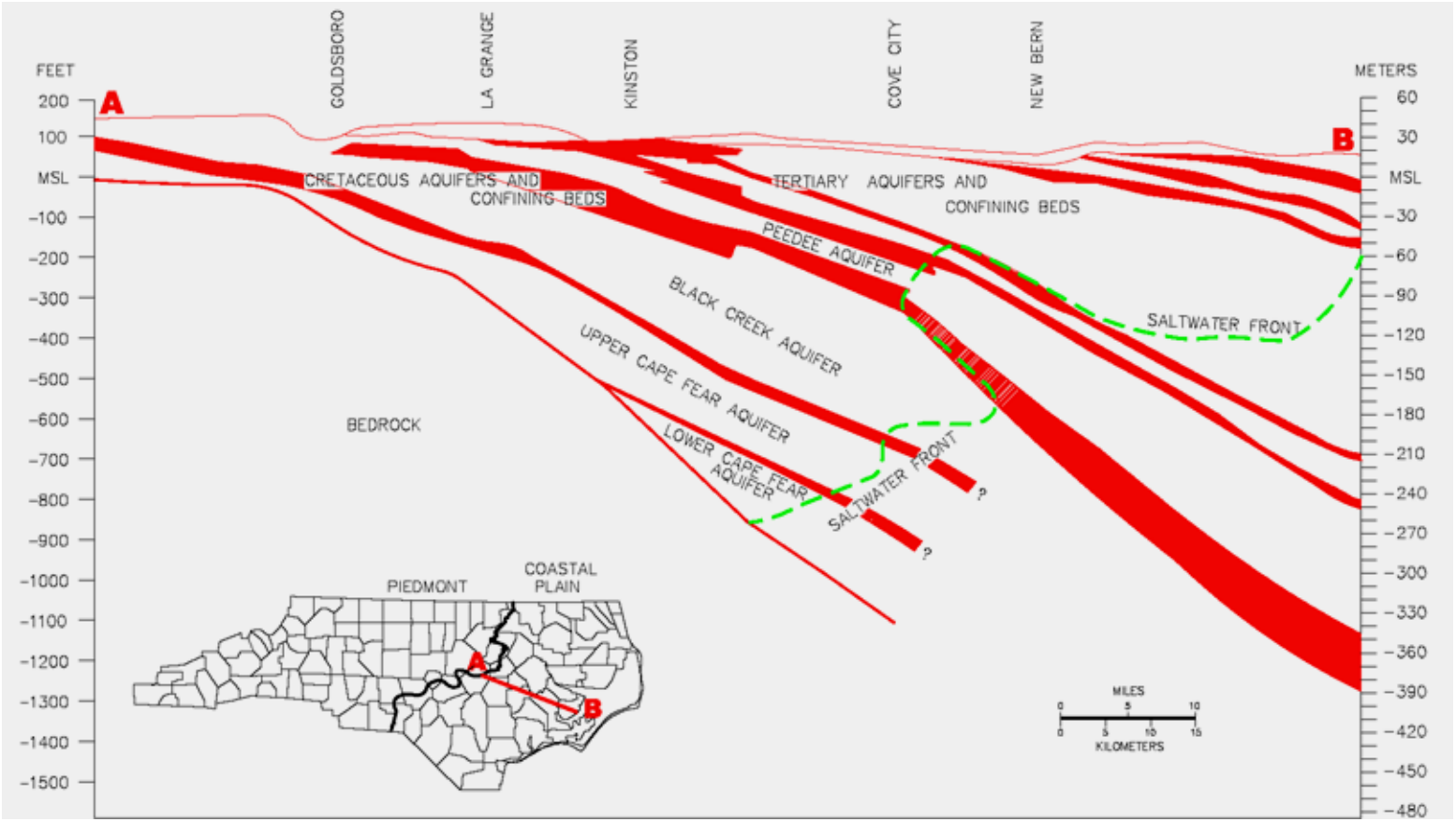
- Cost Effective Seasonal Storage of Finished Water
  - No physical tank to maintain
  - Fluoride remains in stored water
  - May allow the Water Treatment Plant to operate more efficiently during lower demand periods
  - Can Leave it “Empty”
- Assist with Peak Demands
  - Dependable/Efficient Volume for Peak Usage Periods
- Enhanced Water Quality
  - THM attenuation
  - Same quality as plant output

How Can This Help Operation of a Water System?

- Emergency Supply
  - Can enhance supply to neighboring systems with issues
  - Enough volume to supply short term during storms
  - Could use during line breaks

How Can This Help Operation of a Water System?

- Could slow/reverse salt water intrusion into aquifer



modified from Winner and Coble, 1996)

Where to install your ASR

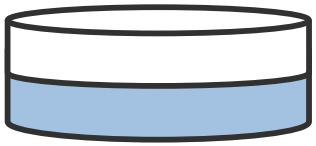
- Locate near larger/artery type mains to reduce infrastructure improvements where possible
- Locate at point in system with highest water age to allow for blending to improve quality
- Consider Topography

Operational Resources/Activities

- Recharge
  - Daily Site Visit to Observe System
  - Weekly/Bi-weekly Water Quality Testing

Operational Resources/Activities

- Storage



  - Daily Site Visit
  - Bi-Weekly Testing for THM's

Operational Resources/Activities

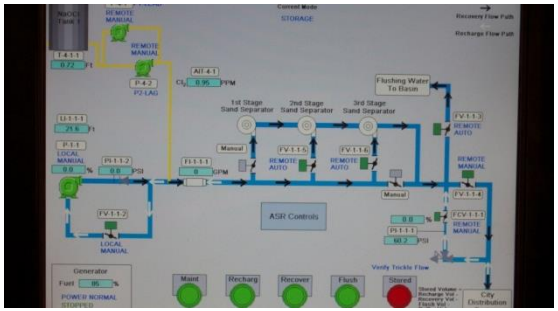
- Recovery

  - Daily Site Visit to Observe System
    - Chemical Feed
    - Pump Rate
    - Sand Separators

  - Weekly and Bi-weekly Water Quality Testing

  - Monthly Reporting

Questions?



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