

DOE Marcellus Research

Richard Hammack

SRBC Water Quality Advisory Committee Meeting

October 13, 2010

Extramural Program

Water Management

1. Comprehensive Lifecycle Planning and Management System for Addressing Water Issues Associated With Shale Gas Development in New York, Pennsylvania and West Virginia-*Arthur Langhus Layne LLC*

2. Integration of Water Resource Models with Fayetteville Shale Decision and Support Systems-*University of Arkansas*



Extramural Program

Frac Flowback and Produced Water Treatment

1. Cost Effective Recovery of Low-TDS Frac Flowback Water for Re-Use-
GE Global Research

2. Pilot Testing: Pretreatment Options to Allow Re-Use of Frac Flowback and Produced Brine for Gas Shale Resource Development-
Texas A&M University

3. An Integrated Water Treatment Technology Solution for Sustainable Water Resource Management in the Marcellus Shale-
Altela, Inc.

4. Sustainable Management of Flowback Water during Hydraulic Fracturing of Marcellus Shale for Natural Gas Production-
University of Pittsburgh

5. Zero Discharge Water Management for Horizontal Shale Gas Well Development-
West Virginia University

6. Produced Water Treatment Catalog and Decision Tool-
Arthur Langhus Layne LLC

Extramural Program

Water Management

- **Barnett and Appalachian Shale Water Management and Reuse Technologies** - *Gas Technology Institute*

Treatment

- **Pretreatment Processing for Salt By-Product Recovery**- *GE Global Research*
- **An Integrated Framework for the Treatment and Management of Produced Water** - *Colorado School of Mines*

Intramural

Characterization of Marcellus Flowback/Produced Waters

1. Inorganics

2. Organic Components

- Endocrine Disrupters

3. Isotopic Characterization

- Pitt (Stewart)
- WVU (Sharma) – “Stray Gas”

4. Microbial Ecology of Flowback/PW pits

- Genome Classification
- Microbiological Transformations during On-Site Storage

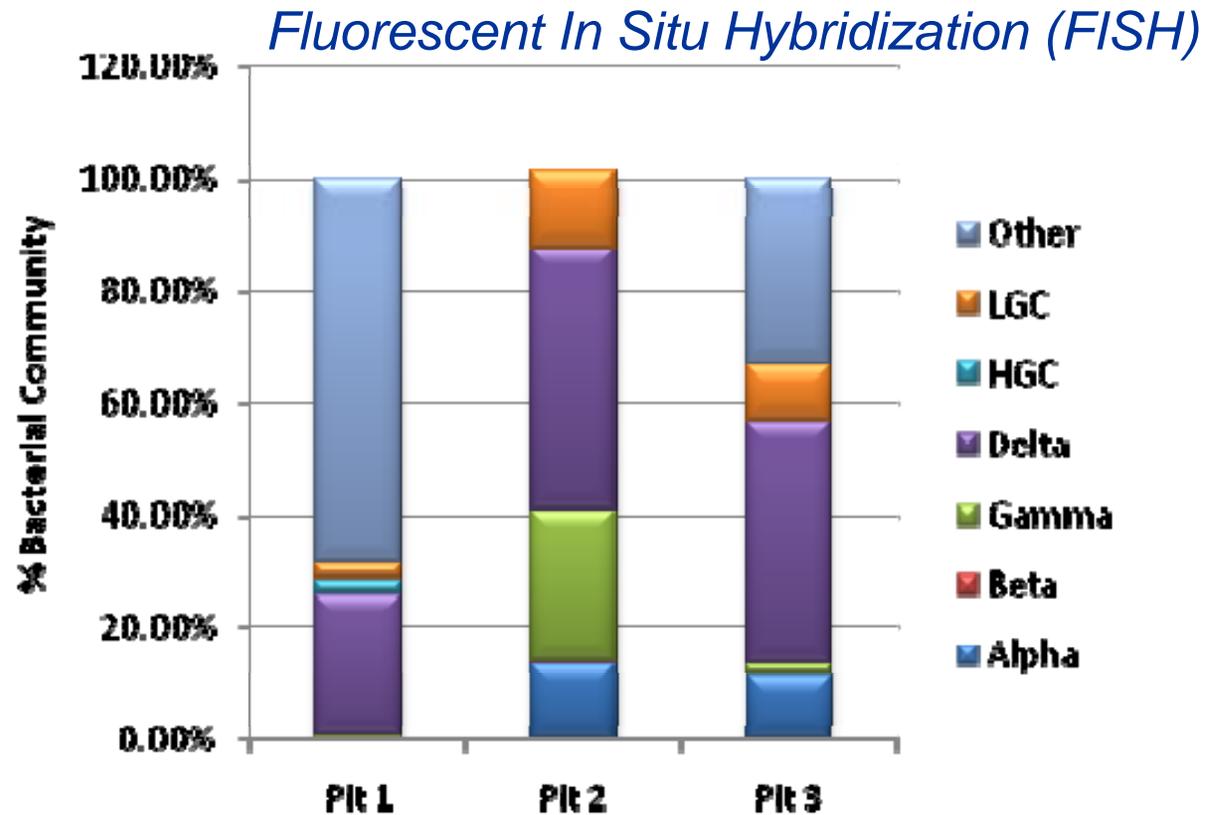


LC-Q-

Microbiology of Pits

Sample	Cell Count (cells/mL)
Pit1	9.4×10^7
Pit2	4.6×10^7
Pit3	3.3×10^7

Sample	SRB385
Pit 1	34.31%
Pit 2	13.45%
Pit 3	28.92%



Intramural

Simulated Weathering of Drill Cuttings

1. Inorganics including REE

2. NORM (Gregory)

3. Isotopic Characterization of Source Rock

- Pitt (Stewart)
- WVU (Sharma)



Multi-Collector ICP MS

Intramural

Monitoring of Air Emissions

1. Mobile Air Monitoring Laboratory

- Allegheny National Forest
- Washington County, PA (Range Resources)



Intramural

Ecological Impacts of Access Roads and Drill Pads

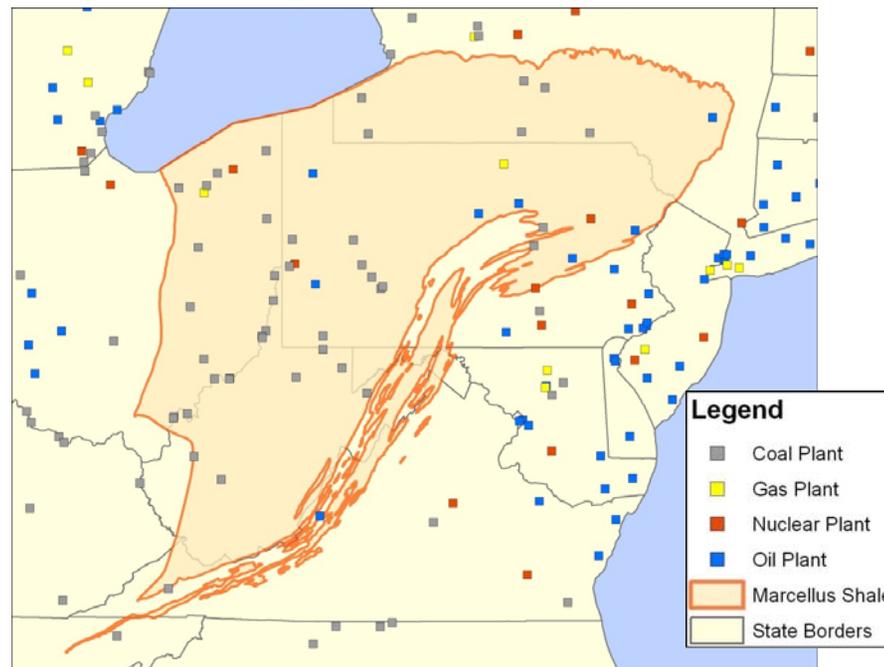
1. Better Road Design Criteria (*PSU-Dirt and Gravel Roads Program*)
2. Impact on Sensitive Bird Species (*WVU*)
3. Impact on Streams and Aquatic Life (*Clarion University-macroinvertebrate surveys; USGS- stream sedimentation*)



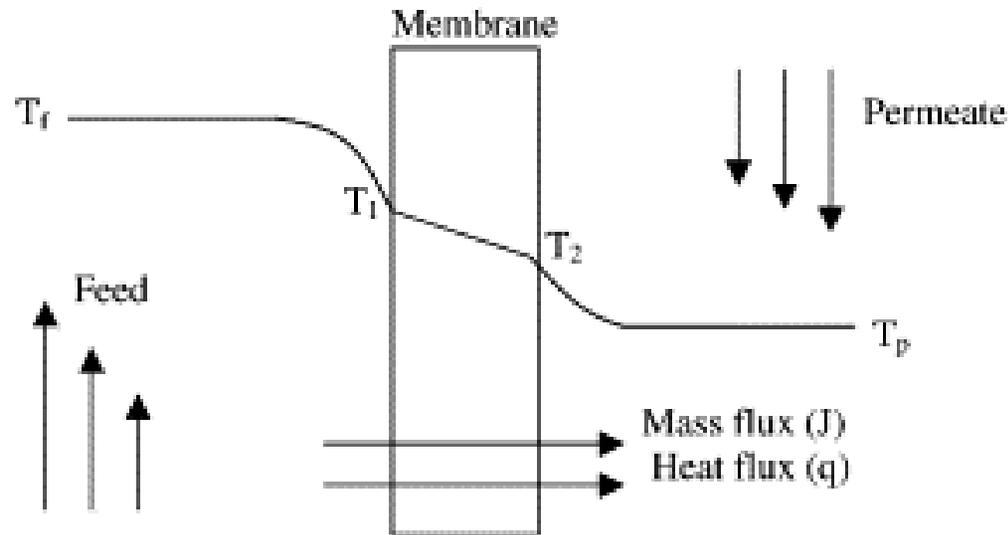
Intramural

Marcellus Produced/Flowback Water Treatment

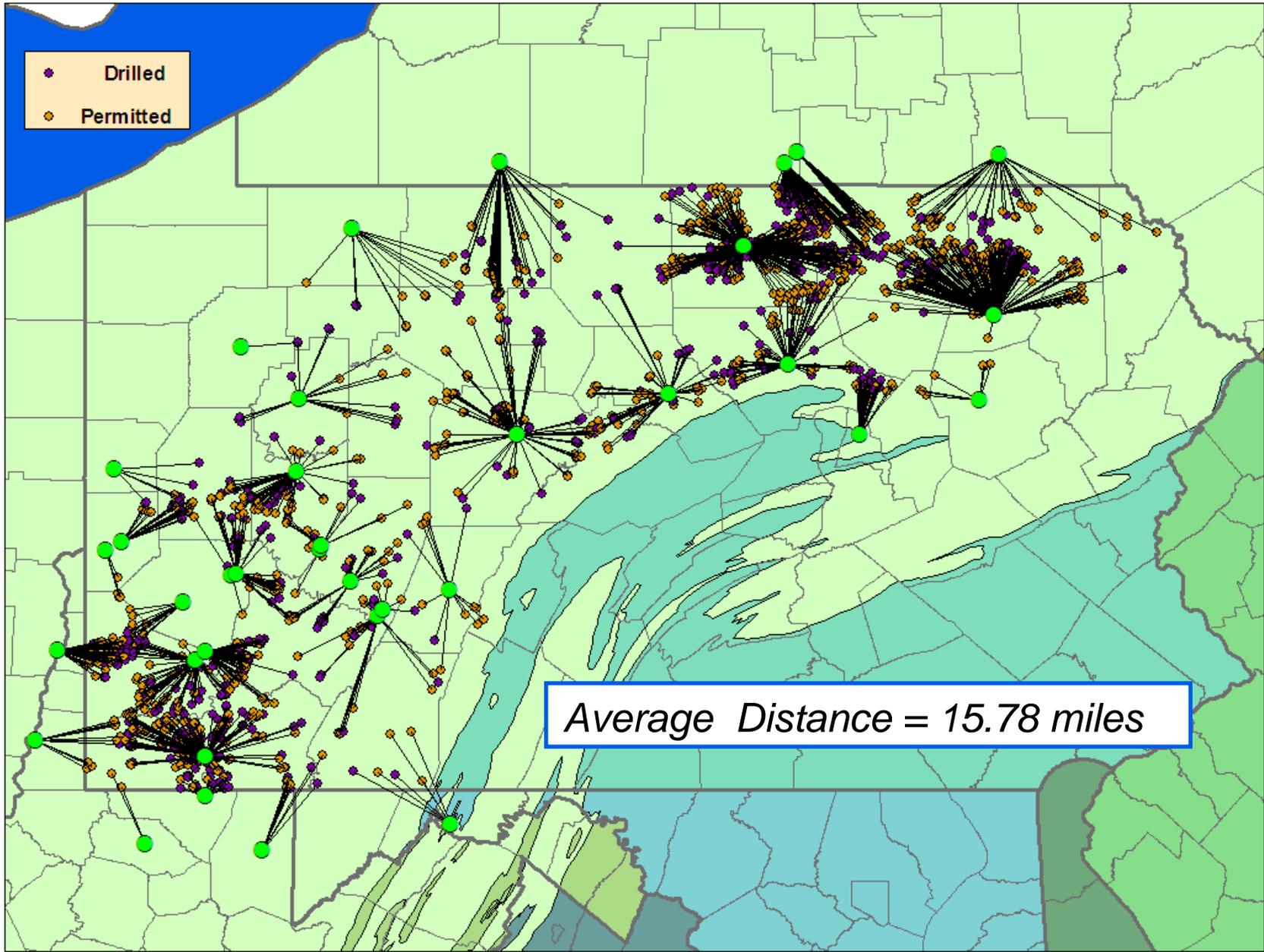
1. Microbial Fuel Cells/Capacitive Deionization (WVU)
2. Forward Osmosis w/ Novel Draw Solution (WVU)
3. Membrane Distillation (Sandia National Lab)

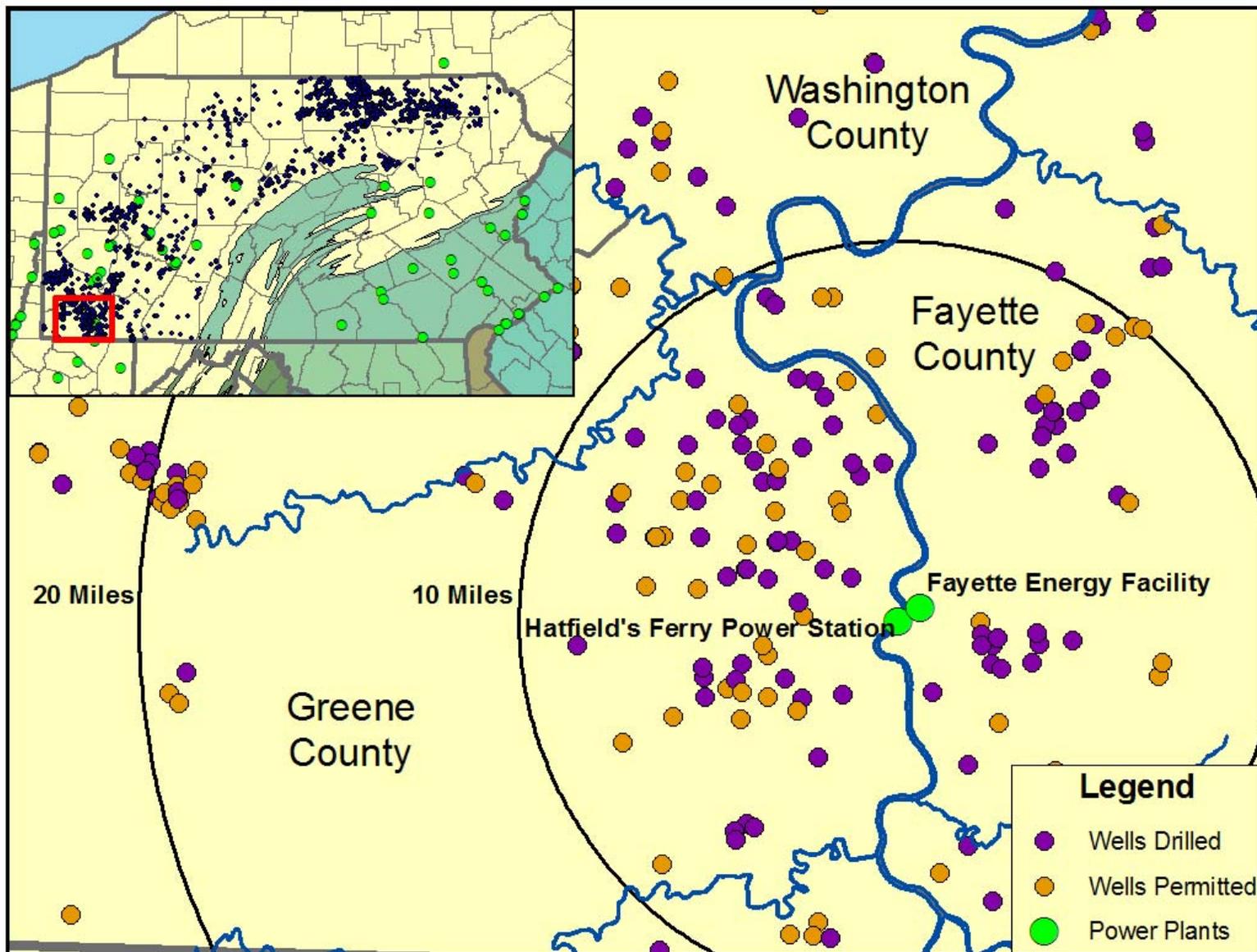


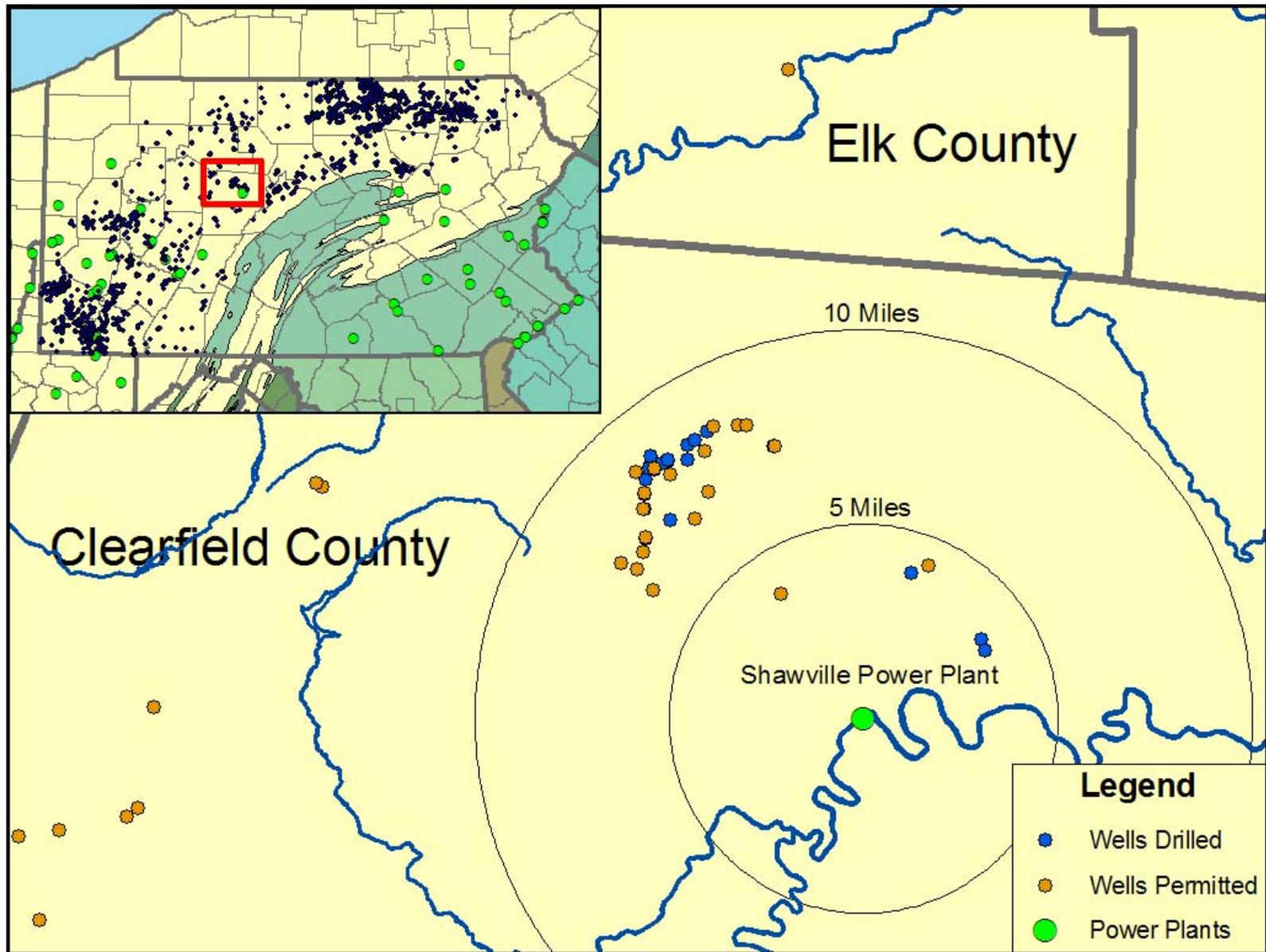
Membrane Distillation



- *Treats high-TDS water*
- *Uses low-grade heat*
- *Hydrophobic membrane*







Baseline Monitoring Sites

