

# Water Use and the Shale Gas Industry

Jeremy Hoffman  
Compliance Specialist-Field Operations  
Susquehanna River Basin Commission  
Telephone: (717) 238-0423  
E-mail: [Jmhoffman@srbc.net](mailto:Jmhoffman@srbc.net)



# GOALS

## Explain

Who the SRBC is and What We Do

## Present

Factual Information and Data on Face Value

## Educate

NOT Persuade

# Presentation

- Overview of SRBC
- Review Process
- Approvals
- Record Keeping and Reporting
- Compliance Activities
- Question and Answer

# Susquehanna River Basin



# Susquehanna River Basin

## The Basin:

- 27,510-square-mile watershed
- Comprises 43 percent of the Chesapeake Bay's drainage area
- 4.2 million population
- 69 percent forested
- 49,000+ miles of waterways



## The Susquehanna River:

- 444 miles, largest tributary to the Chesapeake Bay
- Supplies 18 million gallons a minute to the Bay
- Provides 50% of fresh water flows to the Chesapeake Bay

# SRBC Charge

Ensure that a water use (consumptive or withdrawal) will not cause significant adverse impacts to other users in the basin.

Adverse impacts: Lowering of groundwater or stream flow levels; rendering competing supplies unreliable; that may be injurious to any existing or potential water use; affecting fish, wildlife or other living resources or their habitat; causing permanent loss of aquifer storage capacity; or affecting low flow of perennial or intermittent streams.

# What Does SRBC Regulate?

Water QUANTITY vs. Water QUALITY

## Regulatory Thresholds

- Surface Water Withdrawals (100,000 gpd)
- Groundwater Withdrawals (100,000 gpd)
- Consumptive Use (20,000 gpd)
- For Natural Gas Industry (From Gallon One)



# Marcellus Shale within Susquehanna River Basin

72% of Basin  
(20,000 Sq. Miles)  
Underlain  
by Marcellus Shale





# Where Does the Gas Industry Get Their Water?

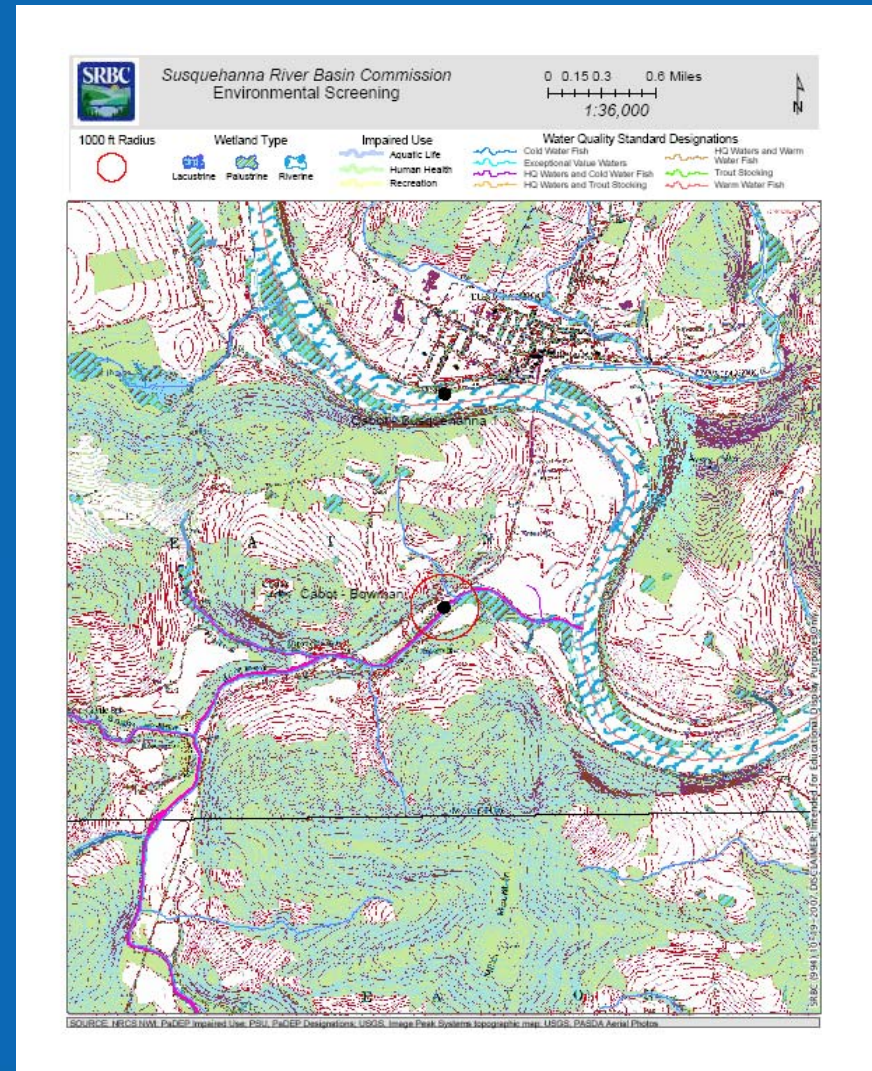
- Surface Water Withdrawals (~60%)
- Public Water Systems (~35%)
- Groundwater Withdrawals (~>5%)

# Review of Surface Water Applications

- Application Data Requirements
- Environmental Review
- Safe Yield Calculation
- Cumulative Impact Analysis - Upstream Uses
- Passby Flow Determination
- Cumulative Impact Analysis – Downstream Uses

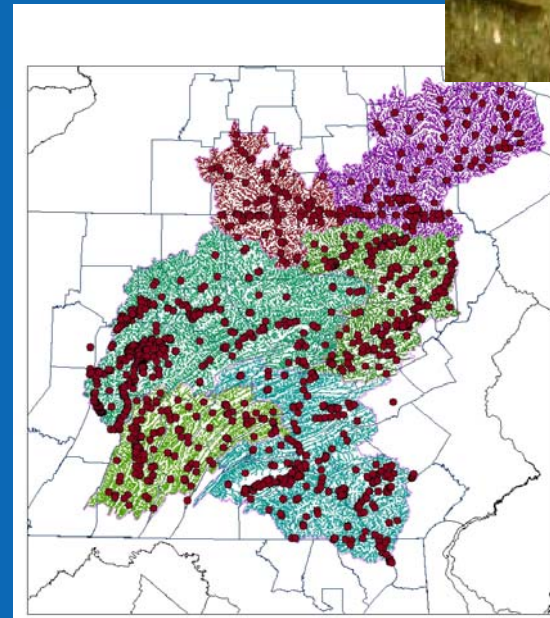
# Environmental Review

- Stream Classifications
  - Special Protection Areas
  - Wild Trout Fishery
- 303(d) List or PWL Status
  - Type of Impairment
  - TMDL Development



# Environmental Screening

- Adjacent Wetlands
- Wild/Scenic Rivers
- Natural Diversity Inventory Search
  - State Agencies (PFBC/PGC)
  - DCNR
  - USFWS
- Any Additional Water Quality Issues
  - Aquatic Nuisance Species





# Aquatic Resource Surveys

- When no data available
- When information obsolete
- For special protection streams (EV/HQ)
- For background data
- To correct protection level
- When passby needed



Safe Water Yield of  
Watershed  
is “Approximated”  
by  $Q_{7-10}$  Statistic

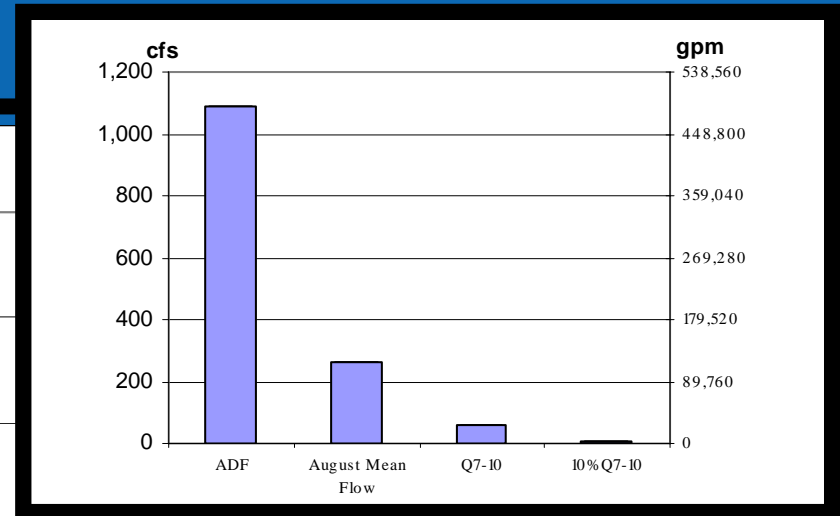
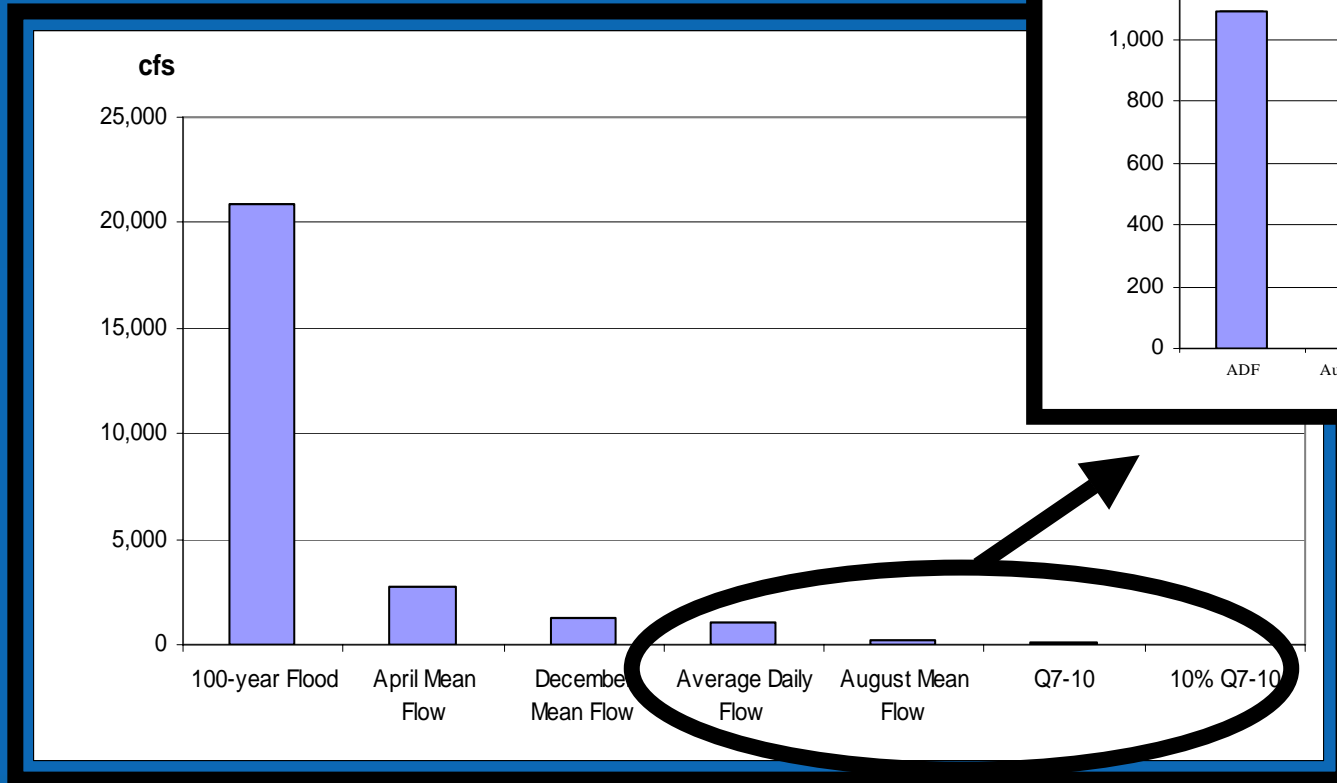


# What is $Q_{7-10}$ ?

It's a “Drought flow”  
Condition

Lowest average flow experienced during a consecutive 7-day period that is estimated to recur on average only once every 10 years

# Low Flow Statistics of Perennial or Intermittent Streams



# Cumulative Impact Analysis

Pre-Existing “Upstream Uses”

“Cumulative Water Demand” Equals

Net Upstream Water Uses Plus

Proposed Withdrawal Rate

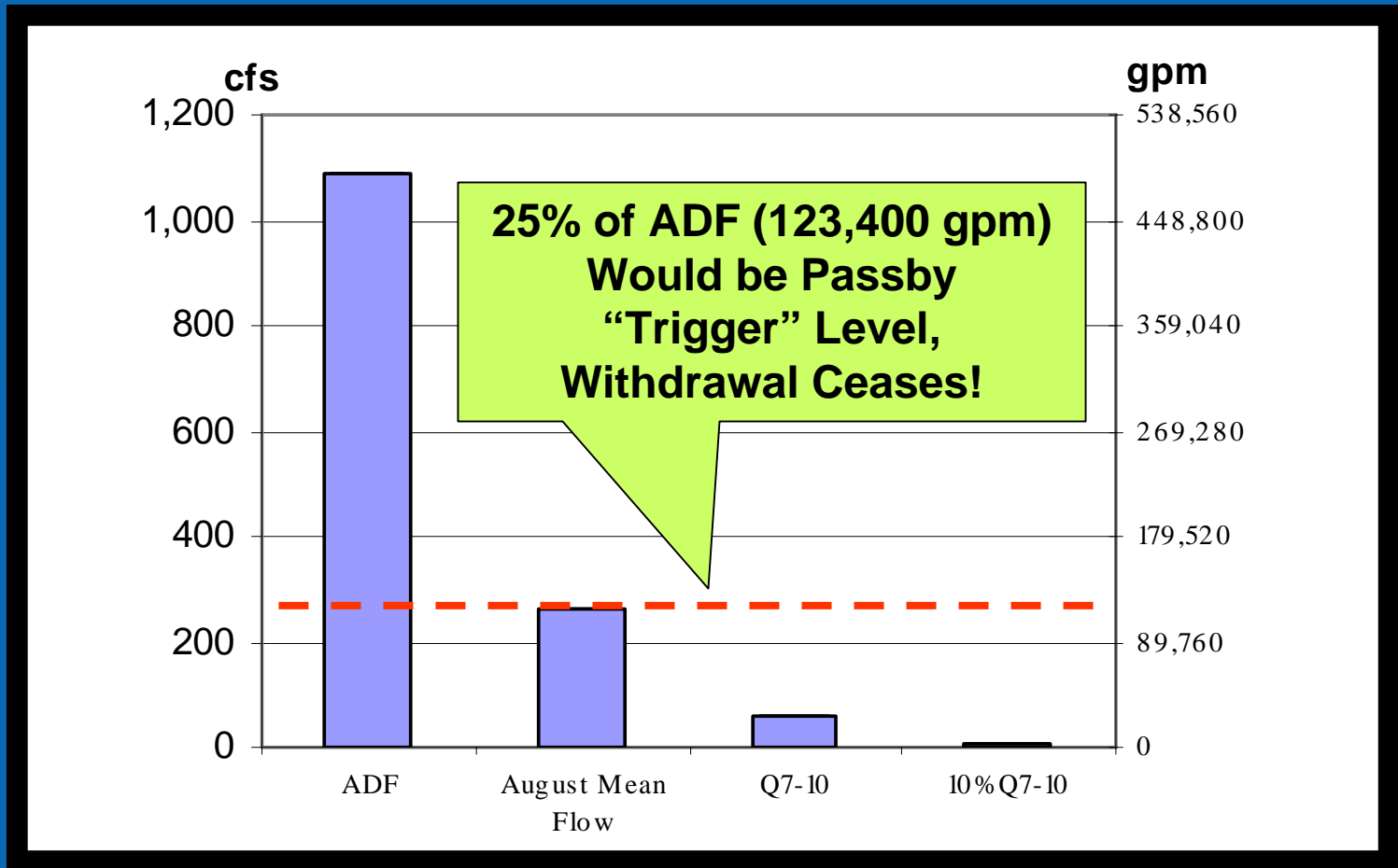
# Passby Flow Determination

Compare Cumulative Water Demand to Safe Yield

If Cumulative Water Demand is:

- $\leq 10\% Q_{7-10}$  (de minimis Standard), Passby Flow Not Required
- $> 10\%$  of  $Q_{7-10}$ , Passby Flow Required
  - Determine Passby Flow Condition (SRBC Policy No. 2003-01)
  - **Or**, Reduce Proposed Withdrawal Rate to  $\leq 10\% Q_{7-10}$

# Example of Low Flow Statistics for Rivers and Streams



# Passby Flow

## (Compliance)

### Establish Passby Trigger Mechanism

- Use Reference Gage Selection Criteria to:
  - Identify Trigger Gage with Real-Time Flow Data
  - Calculate Trigger Flows (Q7-10 and % ADF Passby)
- Monitor Trigger Gage Flow Periodically, Especially in Dry Periods
  - Gage Notification System



# Withdrawal Approvals

- Approval limits
  - Peak Day Withdrawal, Rate of Withdrawal, 30- Day Average Withdrawal, Minimum Stream (Passby) Flow
- Accounted for Daily-
  - Reported Quarterly

# Record Keeping and Reporting

- **Daily Recording**
  - Withdrawals, Consumptive Use, Passby, Water Purchases, All Waters Arriving and Leaving Pad Sites, Origin/Destination
- **Quarterly Reporting**
  - Daily Withdrawals, Consumptive Use, Passby
- **Event Reporting – Each Hydrofracture**
  - Water Purchases, All Waters Arriving and Leaving Pad Sites, Origin/Destination

# Project Signage Required



Pad Sites



Withdrawal Sites

# Metering



- Visible at all times
- Totalizing
- Withdrawal Rate
- Accurate to +/- 5%

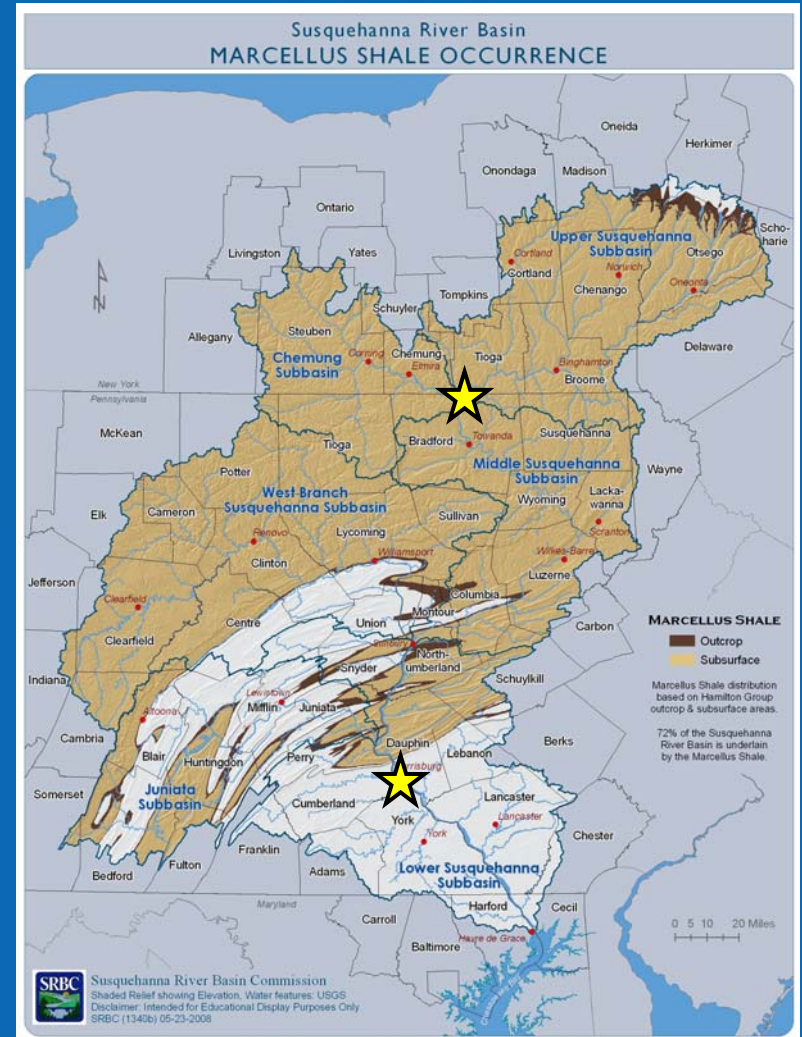
# Withdrawal Requirements

- Semi-Permanent
- Intake
  - Impingement / Entrainment Standards
- Piping
  - Dedicated - Backflow Prevention
- Tamper Resistant Flow Control



# Commission Offices

Compliance Field  
Office Centrally  
Located in  
Marcellus Shale  
Region





# Inspections

## ARE UNANNOUNCED

- Location Based  
County, Township, Watershed, Etc.
- Approval Based  
Withdrawal, Consumptive Use, Company
- Complaint / Concern based

Occur at any time day, night, weekends and  
holidays.

# Compliance Activity\*

- Over 125,000 Road Miles
- ~ 4,000+ Individual Inspections
  - ~ 1,200+ Withdrawal Site Inspections
  - ~ 2,700+ Pad Sites Inspections
- 250+ Individual Compliance Meetings
- 150+ Complaint Responses

\* Since May 2010

# Passby Notification System

- Daily Automatic Query of USGS Gages
- Identifies Lowest Measured Flow  
(24 Hour Period)
- Compares to Passby Limits
- Daily Report to Commission Staff (7:00am email)
- Additional Capabilities Under Development

But How Much Water are  
they Really Using to Fracture  
the Wells and is there Enough  
Water to go Around?

# Post Hydrofracture Reporting

## Three Parts

1. Water Brought On Site by Source
  - Fresh, Waste, Flowback
2. Water Injected/Water Recovered
  - 30-day recovery period
3. Water Left Site by Destination
  - Pad Transfer or Disposal

# Actual Hydrofracture Water Use For Marcellus Gas Wells

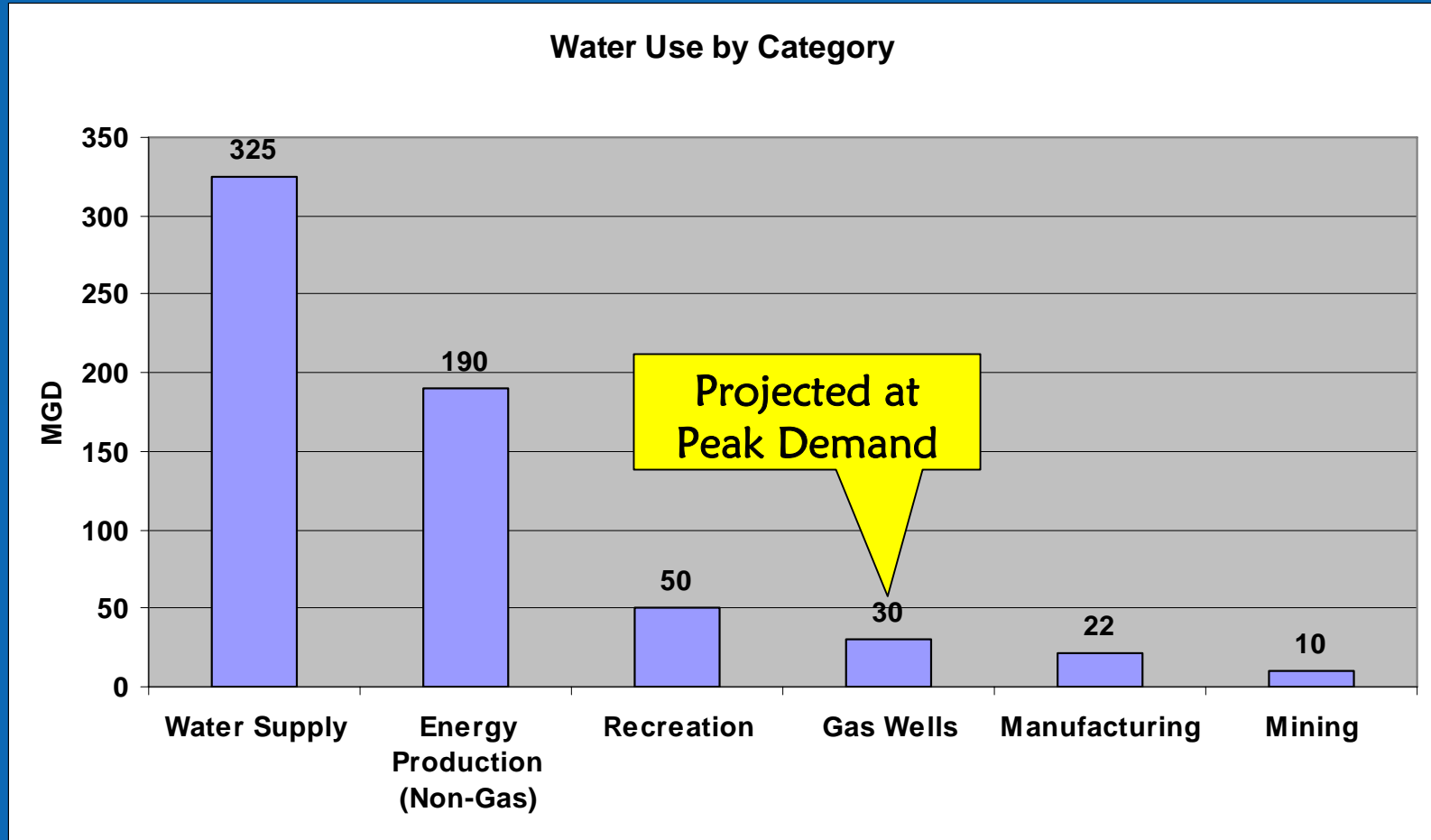
Data Period 6/1/08 – 6/1/11 (1095 days) /  
724 Wells Fractured

- Total Volume of Freshwater Delivered – 2,135.8 mgal
  - 32% - 693.5 mgal from Public Water Supplies
  - 65% - 1049.8 mgal from Withdrawals
- Average Volume of Water Injected per Well – ~4.3 mgal
  - 90% - 3.8 mgal Freshwater
  - 10% - 0.4 mgal Recycled Flowback
- Average Volume of Flowback (first 30-days)
  - 8% of Injected Volume - ~336,000gal/per well

mgal = million gallons



# Projected Average Daily Consumptive Use in Susquehanna River Basin



The Projected Average Peak  
Consumptive Water Use Demand  
from Shale Gas Operations at Full  
“Build-Out” ~ (+/- 30 MGD)  
Which is Equal to the Daily  
Consumptive Water Use from One  
Nuclear Power Plant

# Summary of SRBC “Conclusions”

- Science-based decision making,
- Cumulative impacts critical,
- Timing and location of withdrawals important,
- Passby’s are used to minimize impacts during low flow periods,
- The move from exploration to production may necessitate yet more regulatory changes,
- Gas industry water use can be accommodated.

# Questions???

*40<sup>th</sup> Anniversary*

**SRBC**

*1971-2011*

New York, Pennsylvania, Maryland, United States