



**NEW JERSEY
AMERICAN WATER**

Water User: A Water Utility Experience

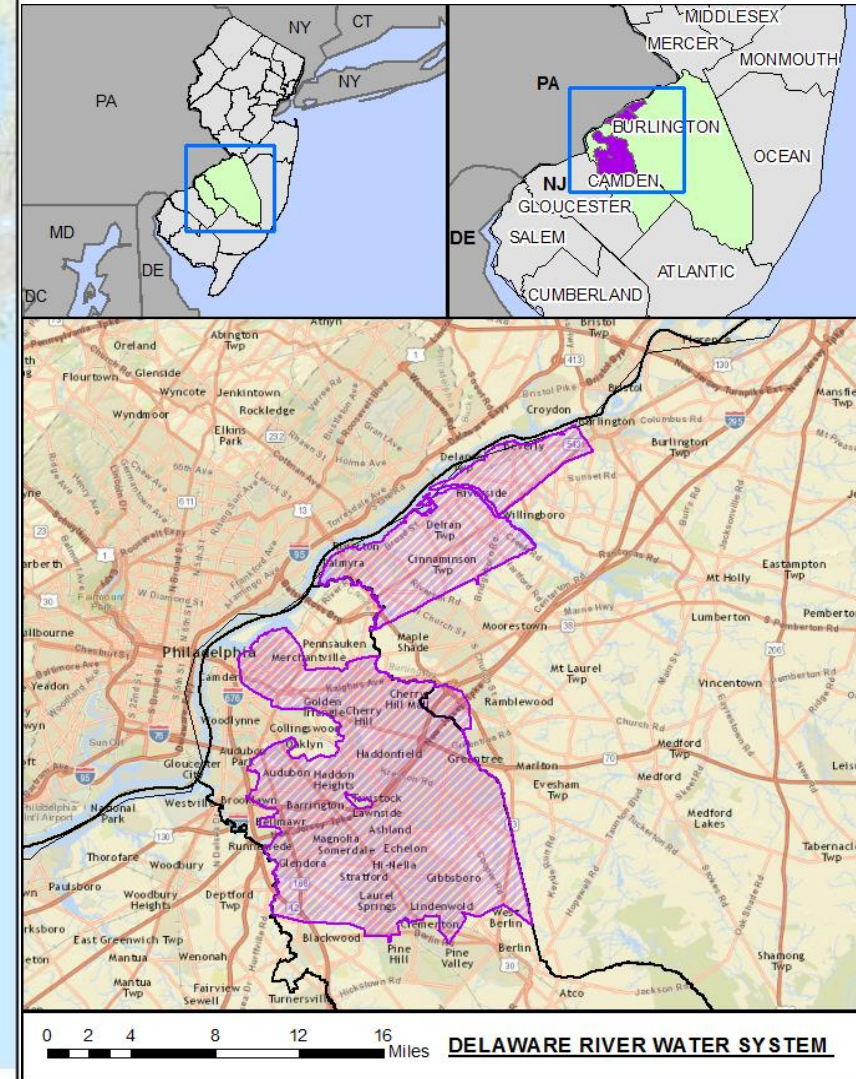
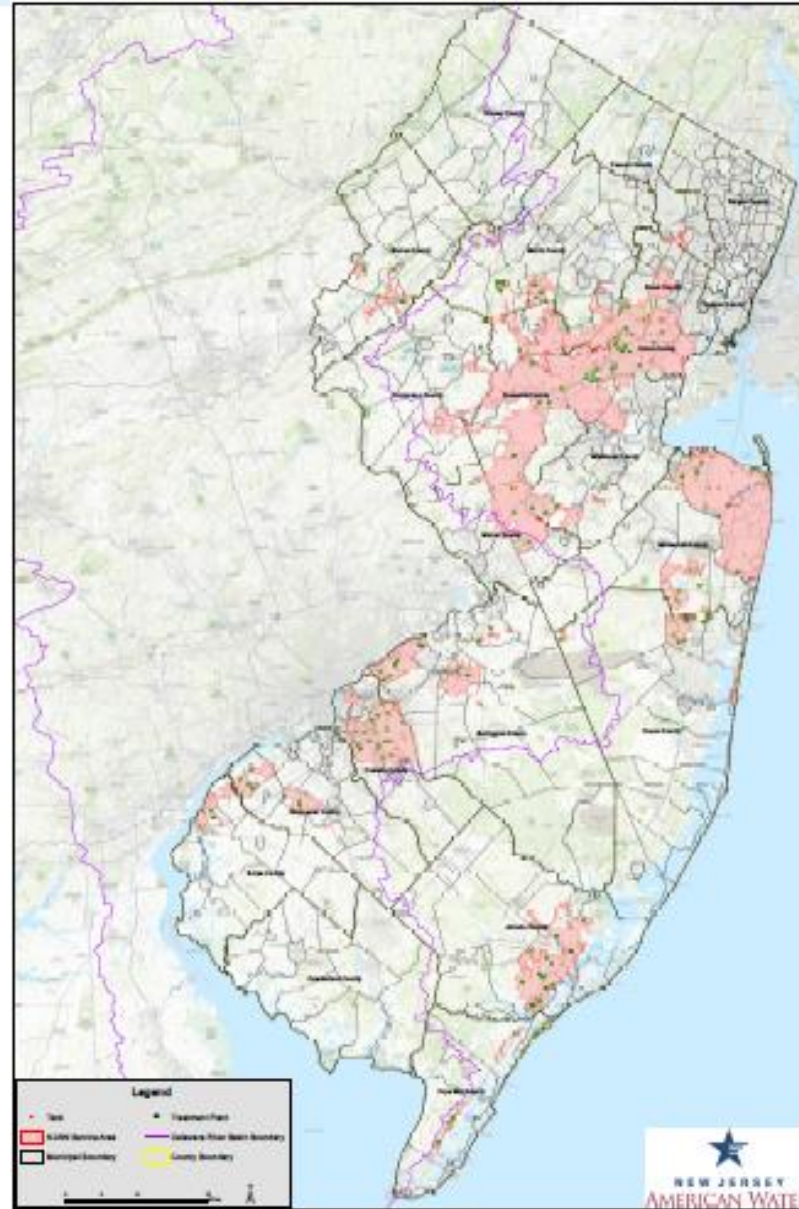
September 25th, 2018

**2018 Delaware River Watershed Forum
The Grand Hotel
Cape May, New Jersey**

**Vincent Monaco, PE
NJAW – Engineering**

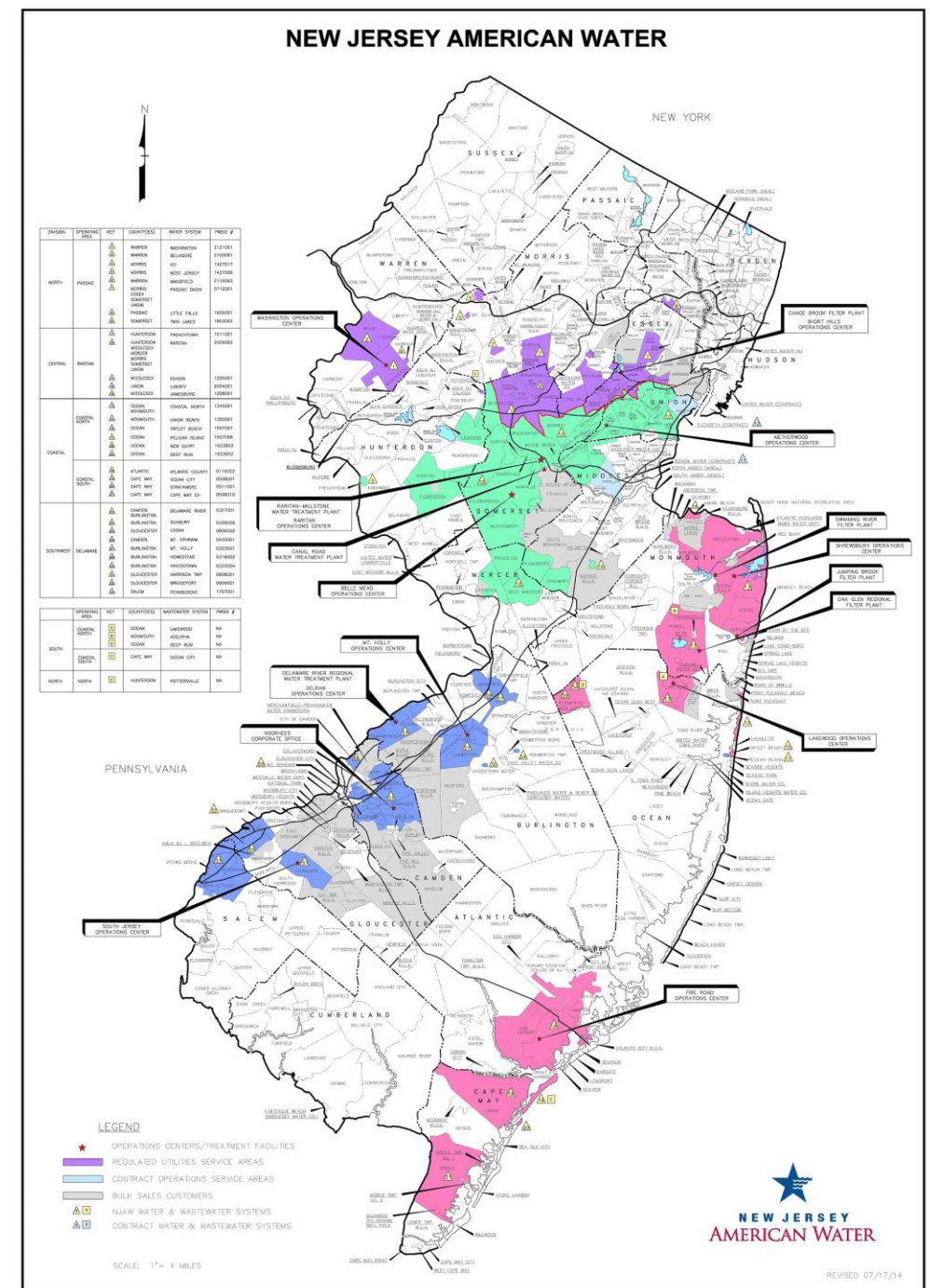
Presentation Overview

- **Assets in Use**
 - What are they
 - Where are they found
 - Impacting regulations
- **Challenges**
 - Capital
 - Operations
- **Water Use Trend**
 - NJAW Statewide
 - NJAW DRR
- **Other**
 - Operational
 - Project Development
- **Summary**



New Jersey American Water – Statewide

Customers	625,000
Population Served	2.7 Million
Municipalities Served	189
Employees	800+/-
Water & Sewer Mains	8,600 miles
Water Systems	35
Wastewater Systems	25
Surface Water Treatment Plants	7 (combined capacity of 350 MGD)
Reservoirs	5 (combined capacity of 6 billion gallons)
Wells	247 (combined capacity of 110 MGD)
Hydrants	45,000
Valves	170,000



Assets in Use – Within Delaware River Basin, NJ Side

- What are they
- Where are they found

Source of Supply

Surface – Delaware River – 40 MGD
 Delaware-Raritan Canal ^(a) – 100 MGD
 Groundwater Stations – 65 MGD ^(35 Sta.- 78 Wells)

Treatment – Three Regional Water Treatment Plants

Tri-County Regional WTP – 40 MGD
 Canal Road WTP ⁽¹⁾ – 80 MGD
 Raritan-Millstone WTP ⁽¹⁾ – 155 MGD

Booster Pump Stations – 16 MGD ^(10 stations)

Storage – 37 MG ^(51 tanks)

Distribution ⁽²⁾ – 1,848 miles ^(water mains)

NJAW - Delaware River Basin Distribution Assets					
	System	mains	hydrants	valves	services
1	Country Oaks	2	24	58	170
2	West Jersey	6	3	122	211
3	Washington	80	330	1,468	4,416
4	Delaware River Regional	1,333	5,743	20,070	100,865
5	Mount Holly	215	1,186	4,231	14,397
6	Homestead	12	77	247	1,152
7	Sunburry	4	17	57	347
8	Vincentown	3	32	98	230
9	Bridgeport	13	71	188	331
10	Harrison	64	432	1,147	3,098
11	Logan	48	237	757	2,157
12	Penns Grove	68	360	1,174	3,905
	Totals	1,848	8,512	29,617	131,279

^(a) DR Canal serves other systems within Raritan Basin, emergency source for NJAW

⁽¹⁾ CR & R-M WTPs supplied by Raritan R., but serve portions of Mercer Co. in Delaware R. Basin;

⁽²⁾ Distribution mains only those entirely within Delaware River Basin in NJ

Impacting Regulations – National and State

National

Surface Water Treatment – LT2 and DBP

- Microbial attenuation
- Disinfection by Products Control
- Balancing Acute vs. Chronic Contaminants

UCM3 Monitoring

- Detection of Emerging Contaminants
- 1,4-dioxane
- Per- and Polyfluoroalkyl Substances (PFAS)
- Metals

Others

Impacting regulations & statutes

Safe Drinking Water Act Rules;

Water Supply Management Act Rules;

Water Quality Accountability Act of Oct. 2017.

Other Concerns

“**Contaminants of emerging concern**” remains a moving target as new chemical compounds are continuously being produced and science continuously improves its understanding of current and past contaminants from detection sensitivity to health significance.

In past, we measured these contaminants in mg/L, than ug/L, and more recently in ng/L. The term “**emerging**” is relative, what was emerging as an important environmental concern a decade or two ago, might no longer be qualified as an **Emerging Contaminant**.

Aging Infrastructure

Resilience

Emerging Contaminants – What are they?

- **Per- and Polyfluoroalkyl Substances (PFAS)**

- A class of man-made chemical

- Chains of carbon (C) surrounded by fluorine (F) atoms
Water repellent (hydrophobic) and Stable C-F bond

- Some PFAS include oxygen, hydrogen, sulfur, and/or nitrogen atoms

- Sources:

- Used to make carpets, clothing, fabrics for furniture, paper packaging for food and other materials (e.g., cookware). Also used for firefighting at air- fields and in a number of industrial processes, including electronics manufacturing, dust suppression-chrome plating, oil & mining, and performance chemicals, e.g. hydraulic fluid, fuel additives, etc.

- Health Effects:

- Developmental effects to fetuses or to breastfed infants; cancer; liver, immune, thyroid and other effects

- Advisories/Regulations

EPA Health Advisory Level: 70 ng/L PFOA and PFOS combined

NJDEP Guidelines: 14 ng/L PFOA, 13 ng/L PFOS, and 13 ng/L PFNA

NJDEP MCLs: PFNA - 0.013 ug/L, and 1,2,3-TCP - 0.030 ug/L, September 4th 2018

New Jersey American is compliant with the new MCLs at all its active production facilities, including Birch Creek and Ranney stations where PFNA is present but effectively removed with GAC.

Emerging Contaminants Overview

- **1,4-Dioxane**
 - **1,4-Dioxane** is a synthetic industrial chemical that is completely miscible in water (EPA 2006; ATSDR 2012)
 - is a heterocyclic organic compound, classified as an ether. It is a colorless liquid with a faint sweet odor. [Wikipedia](#)
 - **Sources:** Used as a solvent and as a stabilizer for chlorinated solvents. Also found as trace amounts in many cosmetics including shampoo, liquid soap, bubble bath, and hair relaxers.
 - **Health Effects:**
 - Carcinogenicity (EPA): B2–probable human carcinogen
 - 10^{-4} / 10^{-6} cancer risk: 35 $\mu\text{g/L}$ / 0.35 $\mu\text{g/L}$ [EPA IRIS]
 - Not federally regulated, but was included in UCMR 3
 - NJ Groundwater Standard: 0.4 $\mu\text{g/L}$
 - NJ Drinking Water Quality Institute (DWQI) evaluating for an MCL recommendation to NJDEP in 2018/2019

1,4-Dioxane

Chemical compound

1,4-Dioxane is a heterocyclic organic compound, classified as an ether. It is a colorless liquid with a faint sweet odor similar to that of diethyl ether. [Wikipedia](#)

Boiling point: 213.8°F (101°C)

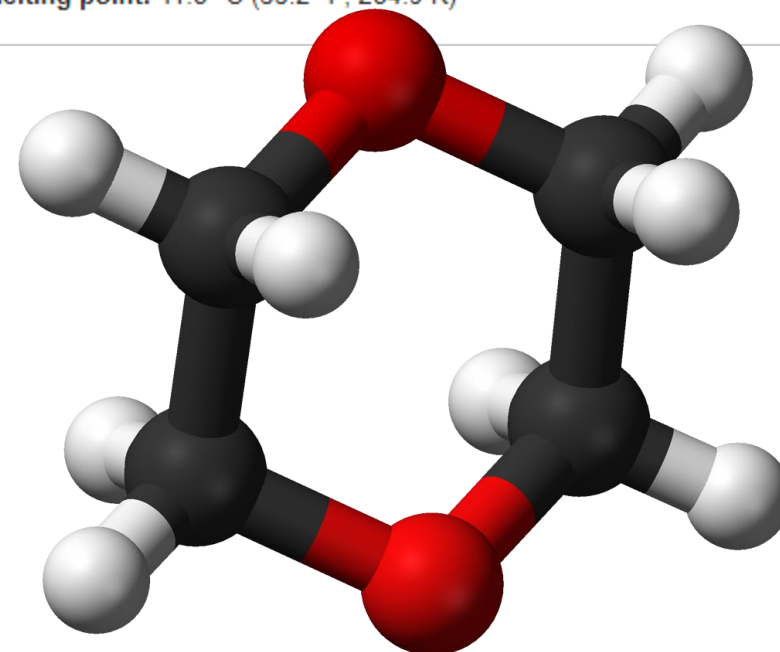
Density: 1.03 g/cm³

Formula: C₄H₈O₂

Molar mass: 88.11 g/mol

Solubility in water: [Miscible](#)

Melting point: 11.8 °C (53.2 °F; 284.9 K)



Case Histories - Occurrence

- Occurrence - NJ

- PFAS (PFOA, PFOS, & PFNA)
 - Found ~ 50% of water table (WT) aquifer wells
 - Found ~ 30% > 14 ng/L NJ Guidance
 - Detected ~ 90% of Surface Water (low level)
- 1,4-dioxane
 - Found ~ 24% of water table aquifer wells
 - Found ~ 16% > 0.4 ug/L NJ Guidance

- Occurrence – NJAW

- PFAS – Similar to State
 - SW > 5 ng/L in 85%, none > 14 ng/L at POE
 - GW > 5 ug/L in most WT aquifers
 - GW > 14 ug/L in 15% (16/110) all; or
37% (11/30) in Non-Coastal region

Perfluorooctanoic acid

Chemical compound

Perfluorooctanoic acid is a perfluorinated carboxylic acid produced and used worldwide as an industrial surfactant in chemical processes and as a material feedstock, and is known as an emerging health ... [Wikipedia](#)

Formula: C₈HF₁₅O₂

Molar mass: 414.07 g/mol

Density: 1.8 g/cm³

Boiling point: 372.2°F (189°C)

Melting point: 40 to 50 °C (104 to 122 °F; 313 to 323 K)

Solubility in other solvents: polar organic; solvents

Perfluorooctanesulfonic acid

Perfluorooctanesulfonic acid is an anthropogenic fluorosurfactant and global pollutant. PFOS was the key ingredient in Scotchgard, a fabric protector made by 3M, and numerous stain repellents. [Wikipedia](#)

Formula: C₈HF₁₇O₃S

Molar mass: 500.13 g/mol

Boiling point: 271.4°F (133°C)

R-phrases (outdated): R61, R20/22, R40, R48/25, R64, R51/53

EU classification (DSD) (outdated): Toxic (T); Dangerous for the environment (N)

Classification: Sulfonic acid

PubChem CID: 74483

Perfluorononanoic acid

Perfluorononanoic acid, or PFNA, is a synthetic perfluorinated carboxylic acid and fluorosurfactant that is also an environmental contaminant found in people and wildlife along with PFOS and PFOA. [Wikipedia](#)

Molar mass: 464.08 g/mol

Formula: C₉HF₁₇O₂

Boiling point: 424.4°F (218°C)

Solubility in water: 9.5 kg/m³

Solubility in other solvents: polar organic solvents

R-phrases (outdated): R22 R34 R52/53

Case Histories – Facilities

- **Treatment Options**

- PFAS: GAC or Resin Specific Ion Exchange
- 1,4-dioxane: Advanced Oxidation Process

- **NJAW Facilities – Currently Five**

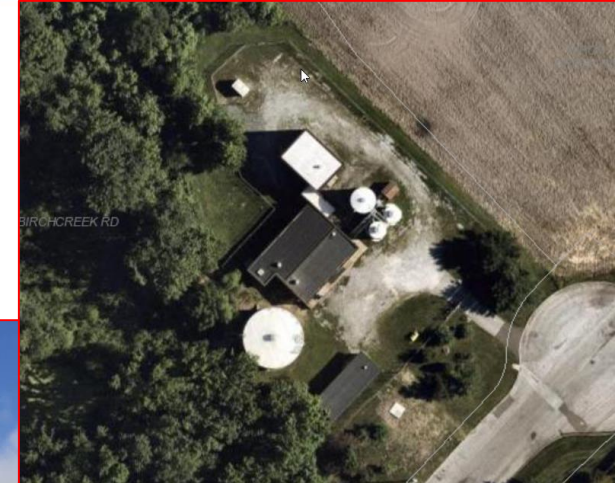
2 in Burlington County (existing GAC for VOC),
1 in each Gloucester, Salem, and Union County

Permanent

- Birch Creek Station – 1 MGD built in 2012
- Ranney Station – 2 MGD built in 2014
- Prior Existing (Highlands and Pomona)

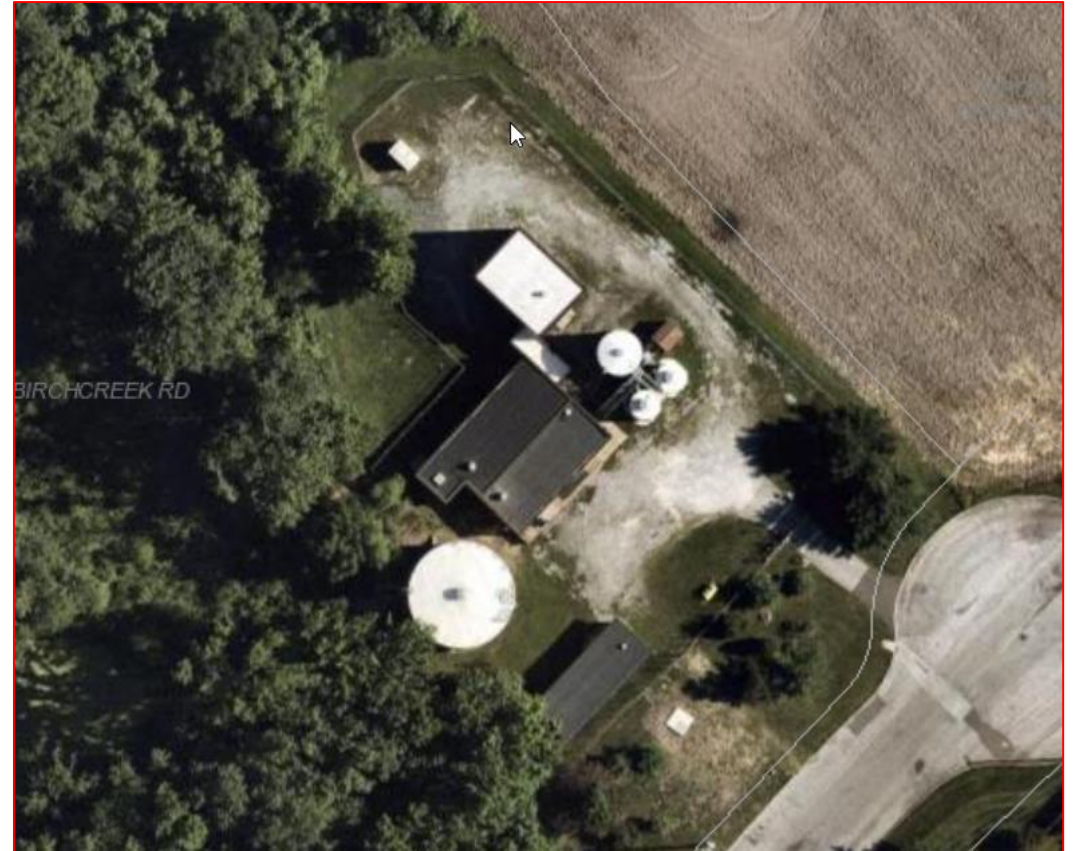
Temporary

- Hummocks Station – 1.7 MGD (orig. 5 MGD)
 - Full Scale Demonstration in phases
 - Mid 2016 GAC
 - End 2017 AOP (UV+H₂O₂)



Birch Creek – Swedesboro NJ

- **Birch Creek PFAS discovered**
 - PFNA ~60 ng/L (ppt)
 - PFOA ~40 ng/L
 - PFOS ~10 ng/L
 - 1,4-Dioxane: < 0.4 ug/L (ppb)
- **PFAS Treatment – 1 MGD**
 - Early 2012 using GAC (f-400)
 - Project cost \$ 1.6 million
 - Operations cost \$ 0.09 million annually



Ranney Station – Carneys Point NJ

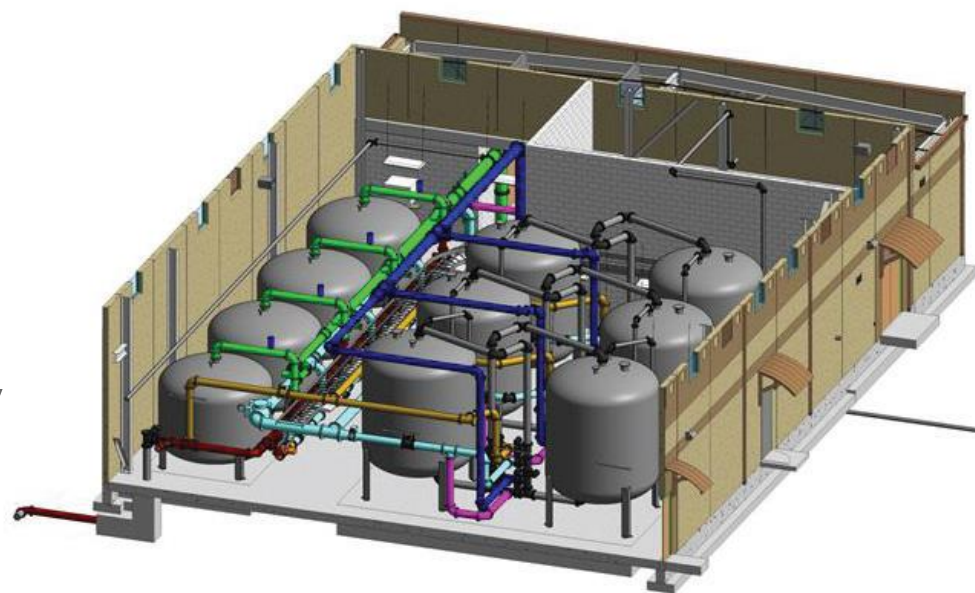
- **Layton - Ranney wellfields PFAS discovered**

- PFNA ~9 (ppt)
- PFOA ~120 ng/L
- PFOS ~7 ng/L
- 1,4-Dioxane: < 0.4 ug/L (ppb)

- **PFAS Treatment – 2.2 MGD**

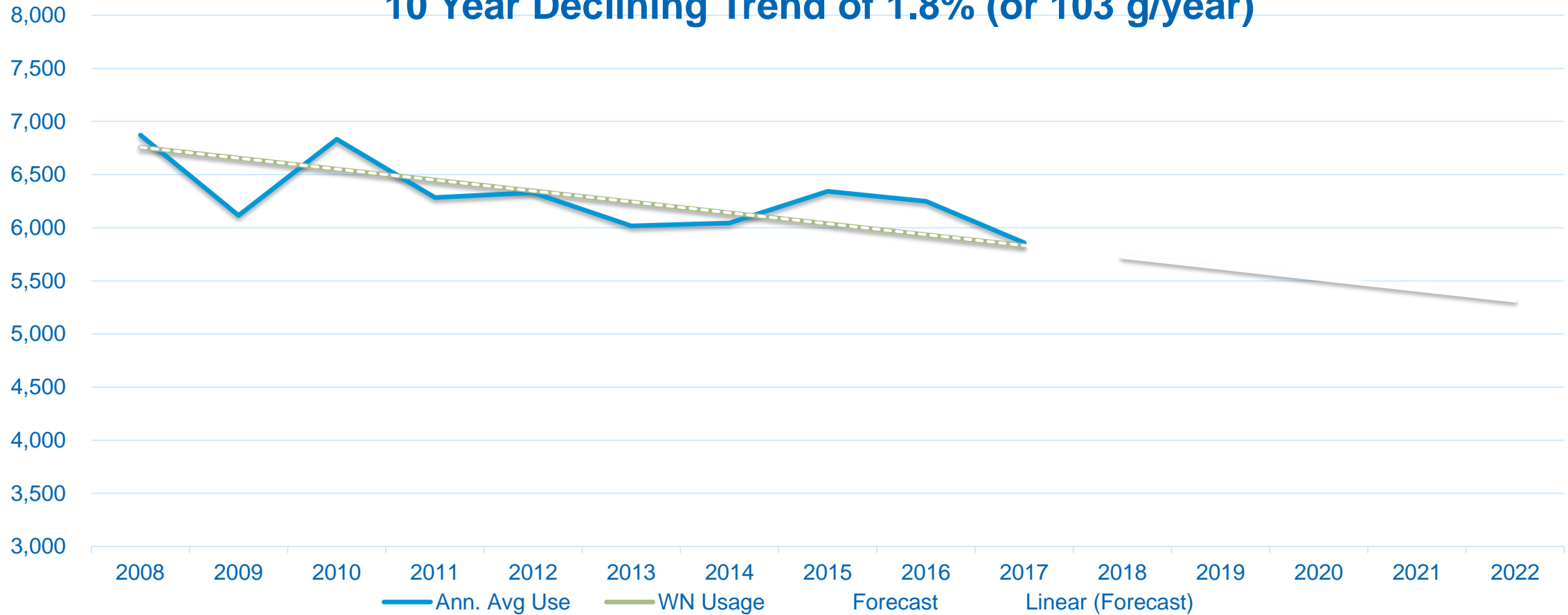
- Summer 2014 using GAC (f-400)
- Project cost \$ 14.3 million
- Operations cost \$ 0.3¹ million annually

¹ Includes ~\$0.1 for potassium hydroxide



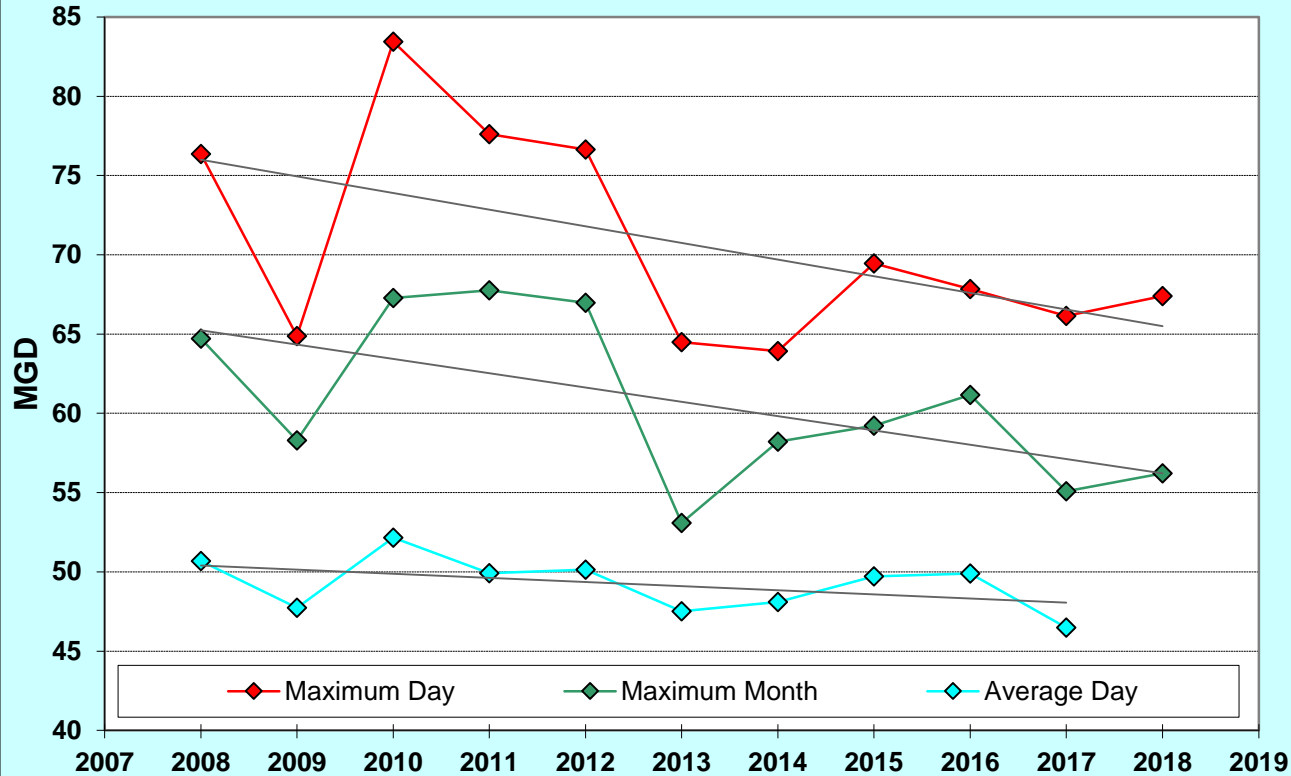
NJAW Residential Water Usage – 10 Year Trend/Forecast

NJ Weather Normalize Residential Annual Usage Per Customer – 10 Year Declining Trend of 1.8% (or 103 g/year)



NJAW Delaware Regional Delivery – 10 Year Trend

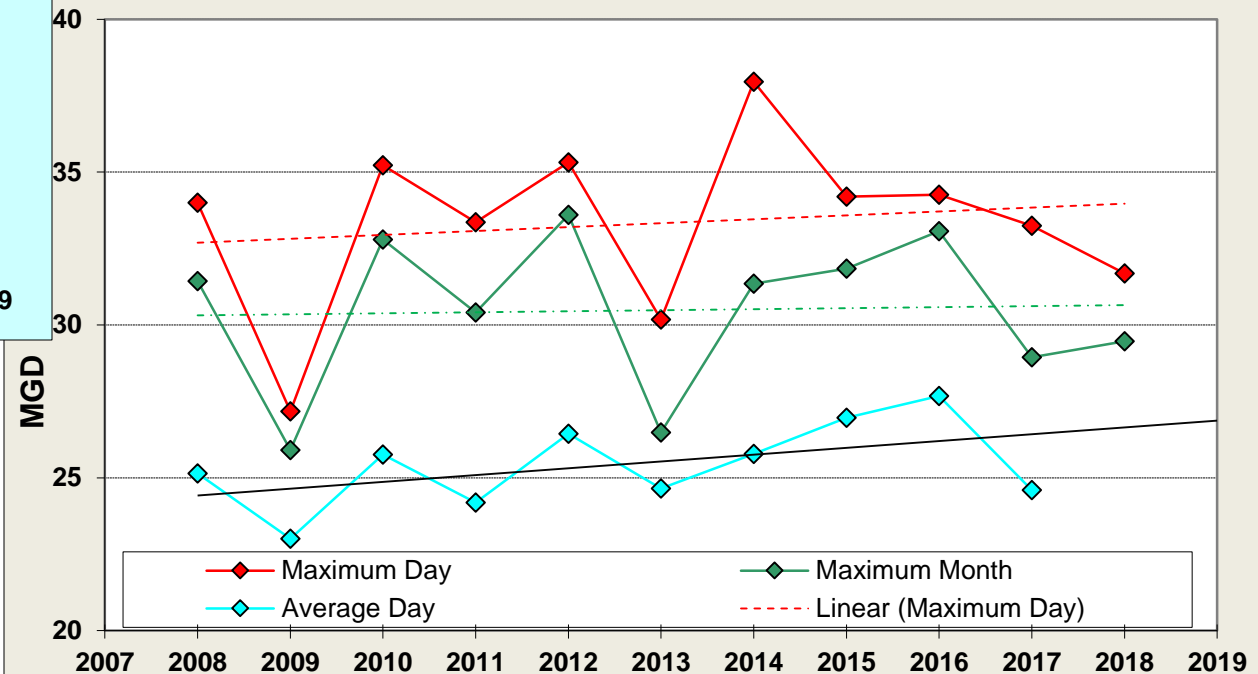
Delaware River System - PWSID 0327001
Consolidated System Delivery



Trend of Regional Water System

- Overall – Downward
- Mixed results on type
- Surface vs. Groundwater

DRRWTP / SW - Regional Supply Pipeline

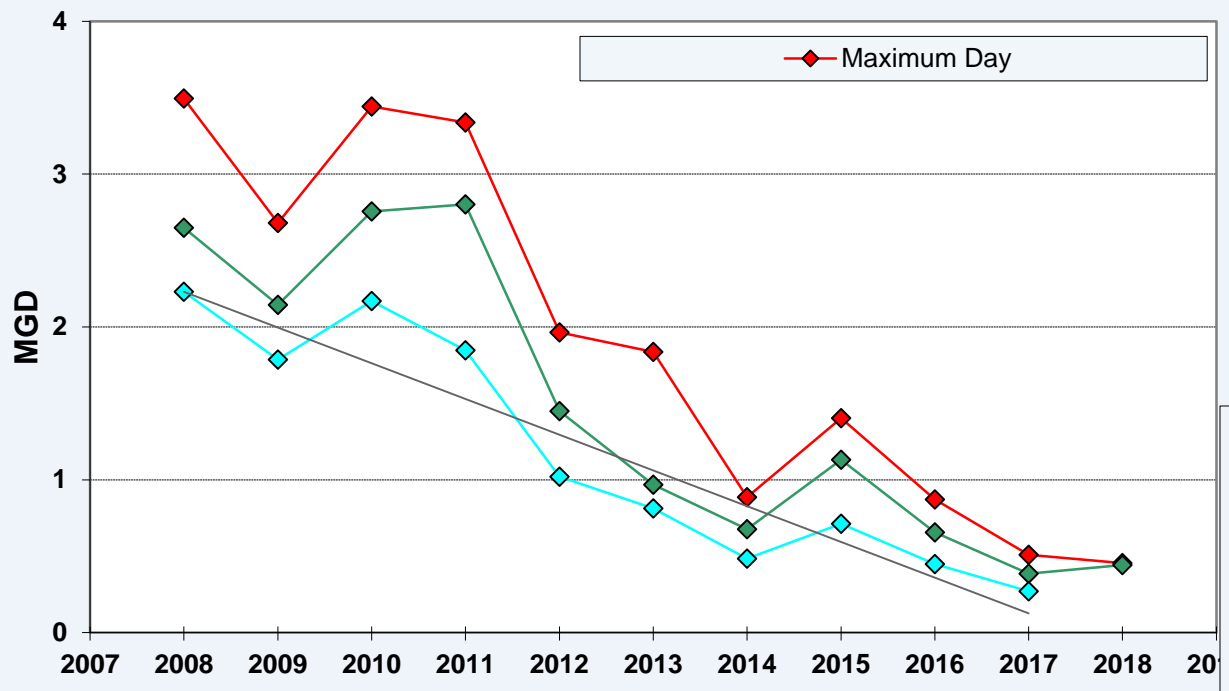


Surface Water

- Upward Trend (~ 1%/yr)
- Due to WQ issues with GW
- Due to PRM Critical Area 2

NJAW Delaware Regional Groundwater Delivery – 10 Year Trend

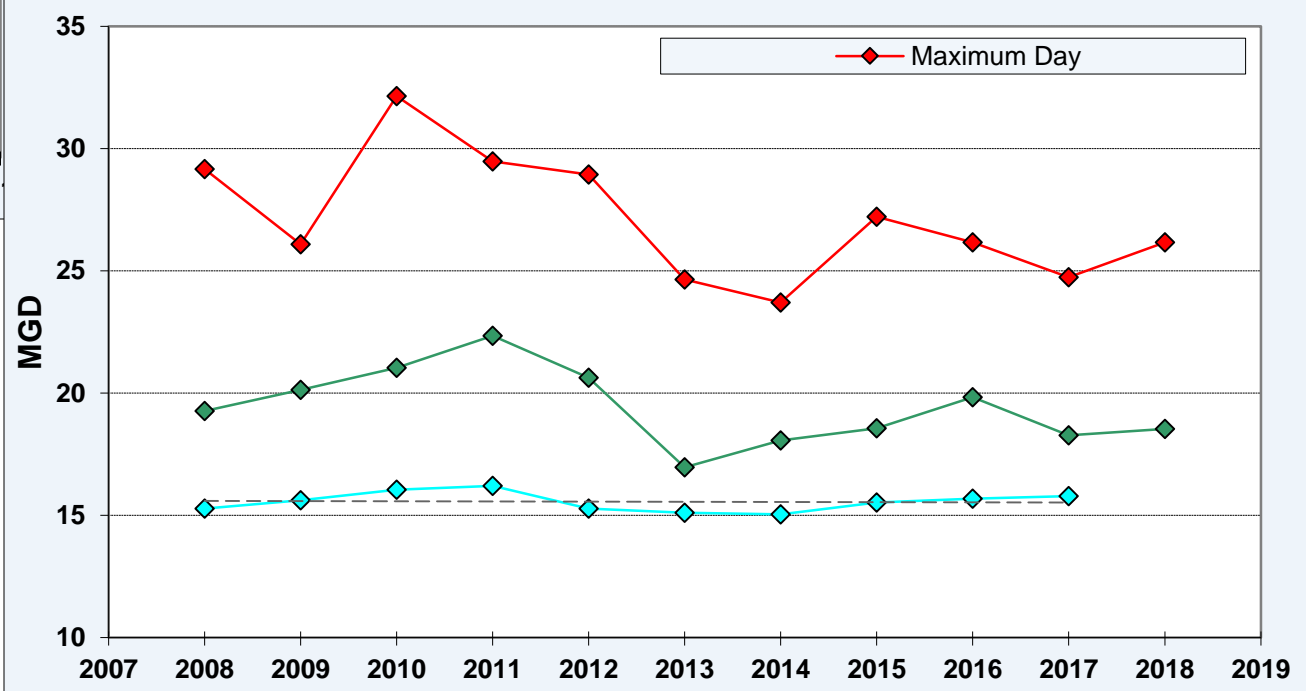
Northern Burlington County Groundwater



Burlington County Groundwater

- WQ Primary Driver
Radionuclides
Emergent Contaminants
- GW Yield Secondary

Suburban Camden County Groundwater

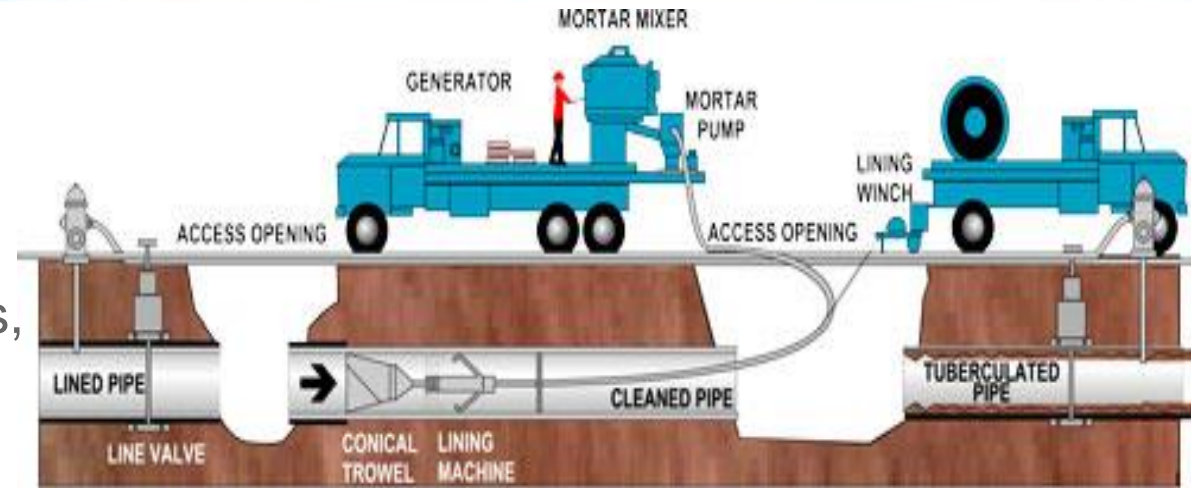


Camden County Groundwater

- WQ Relatively Stable
- Mostly Confined & Protected
- Yield Relatively Stable

Asset Management - Aging Infrastructure

- **Vertical assets vs. Horizontal assets**
- **Vertical Assets**
 - Wells, Water treatment plants, reservoirs/tanks, pump stations
 - Visible, generally maintained, and inspected
- **Horizontal**
 - Transmission and distribution mains, Valves, Service Lines, etc.
 - Buried, not visible, poorly maintained, seldom inspected
 - Out of site, out of mind? Not so.
 - Knowing what they are, exact locations, ongoing maintenance and performance evaluation is fundamental and critical



BEFORE



AFTER

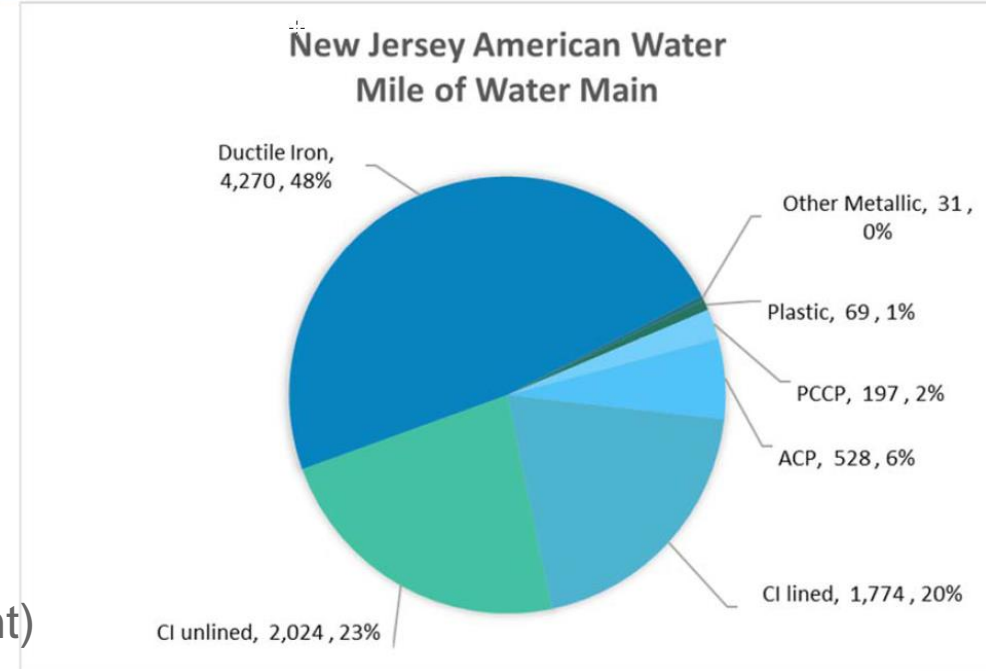
NJAW – Renewal of Aging Infrastructure

- **Transmission Mains**

- Large Diameter pipes (170 miles)
- High consequences on failure
- Condition Assessment critical
- Proactive repair, rehab, or replacement

- **Distribution**

- Mains (8,900 miles)
 - 1/4th Unlined Cast Iron (priority for rehab or replacement)



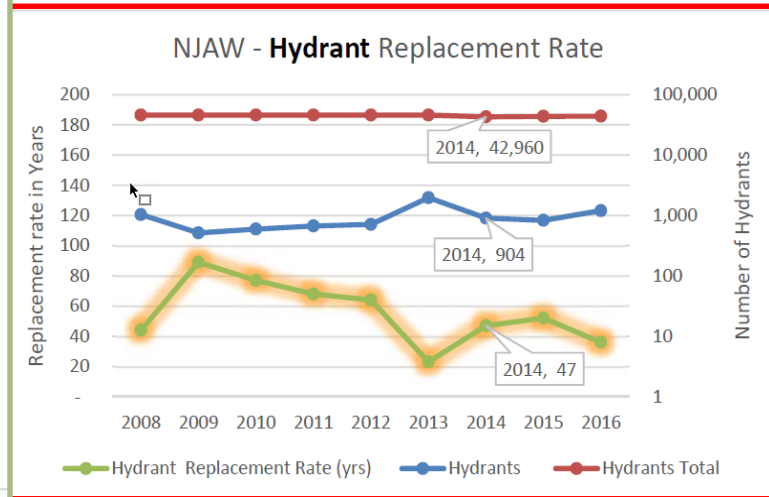
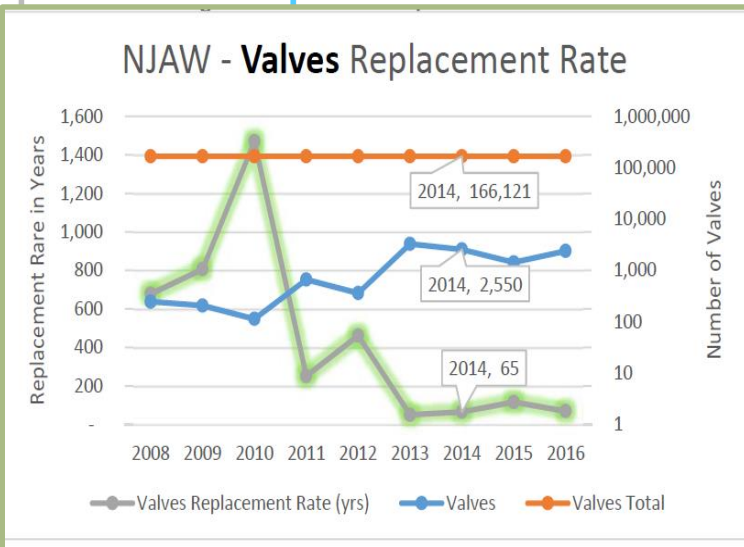
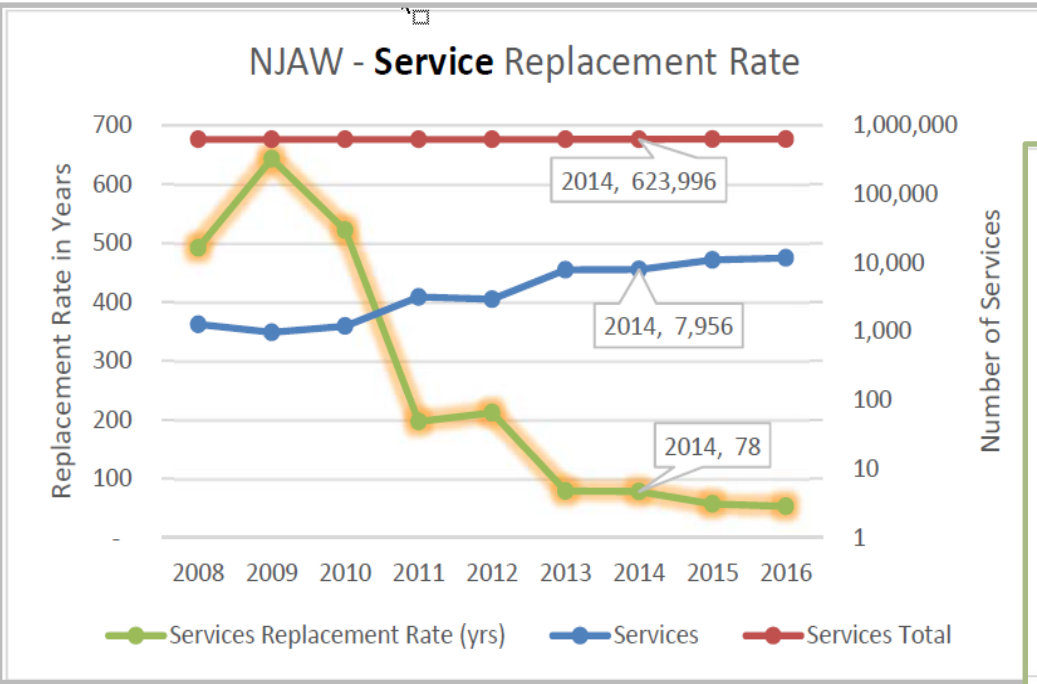
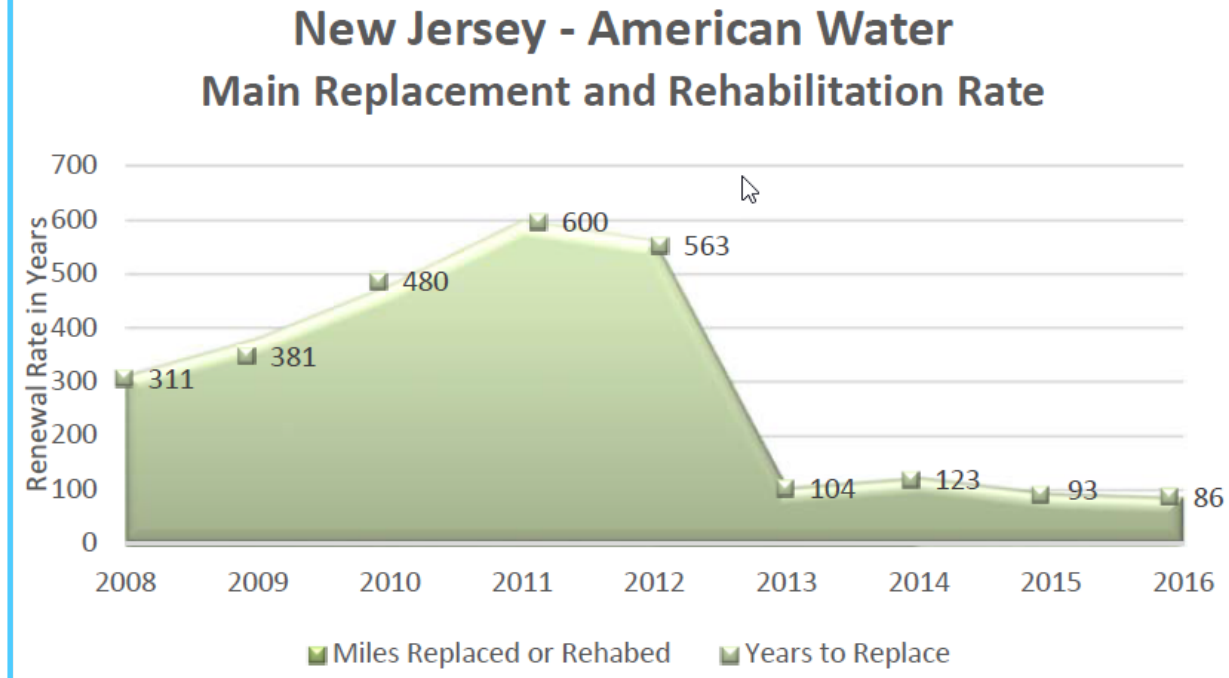
Operating Area	Unknown	1900-1910	1910-1920	1920-1930	1930-1940	1940-1950	1950-1960	1960-1970	1970-1980	1980-1990	1990-2000	2000-2010	2010-2017*	Total
Central District	210	90	-	180	310	70	220	370	320	490	430	340	140	3,170
Coastal District	-	30	40	210	140	80	380	330	220	330	350	310	190	2,610
North District	20	60	20	100	60	90	220	160	70	150	230	120	50	1,350
Southwest District	40	50	10	50	50	40	240	340	180	200	240	200	130	1,770
Total	270	230	70	540	560	280	1,060	1,200	790	1,170	1,250	970	510	8,900

Source: NJAW GIS (05/2017)

Rounded to nearest 10 miles

NJAW – Renewal Rate

- **Distribution**
 - Mains (8,900 miles) ~ 1% (or 100 miles)
 - Service Lines (624,000) ~1.5% (or 9,000)
 - Valves (170,000) ~ 1.5% (or 2,500)
 - Hydrants (47,000) ~2% (or 900)
- **Annual Renewal Budget - ~\$150 million**
 - ~50% of total Capital Budget



NJAW – Operational PFAS Mitigation

- **Extensive Monitoring of all Surface and Ground Water Sources**
 - 7 Surface Water WTP – Ongoing influent and effluent monitoring
 - 100s Wells Screened for PFAS – at low MRL (5 ng/L)
 - Monitoring until reliably and consistently below NJ-Guidance (14 ng/L & 13 ng/L)
 - Ongoing monitoring of any POE > 14 ng/L
- **Evaluate source Water Quality –**
 - GW: > 14 ng/L Remove from Service when Practical or “last on first off”
 - SW: Assess individual stream WQ (if more than one stream)
 - Modify diversion practices, if applicable
 - Employ PAC where appropriate
 - To date, No POE > NJ - Guidance levels

NJAW – Summary Capital Mitigation Projects

- **Three Ground Water stations fitted with GAC for PFAS removal**
 - Birch Creek 1.0 MGD \$ 1.6 million
 - Ranney 2.2 MGD \$ 14.3 million
 - Hummocks 1.7 MGD \$ 3.7 million (includes mobile AOP w/ UV-H₂O₂)
 - Hummocks (future) 5.2 MGD \$ 20.0 million (includes AOP and GAC)
- **Eight other GW stations evaluates for PFAS Removal**
 - Cumulative Capacity - 20 MGD
 - Capital Project Cost
 - Range (0.1 – 4.8 MGD) - \$ 2.2 to \$ 14.1 million
 - Unit Cost (\$/MG capacity \$ 3.4 million / MGD capacity
 - Annual Operational Expenses
 - GAC exchange - \$ 0.1 million / MGD capacity
 - Other Cost (Lab, power, labor) \$ 0.05 million / MGD capacity
- **2018-2020 DSIC Foundational Filing**
 - NJAW Statewide - 1.664 million Linear Feet (316 miles)
 - NJAW Delaware Basin - 0.377 million Linear Feet (71 miles)

Summary – Why All of this

- Resilience
- Sustainability
- Public Trust



Raritan-Millstone Water Treatment Plant Flood Protection Project

Cost: \$37 million – Completed Sep. 2018

Protecting the largest NJAW production asset (155 MGD) located on 127 acres at the Confluence of Raritan River, Millstone River, and Delaware Raritan Canal

Questions?

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