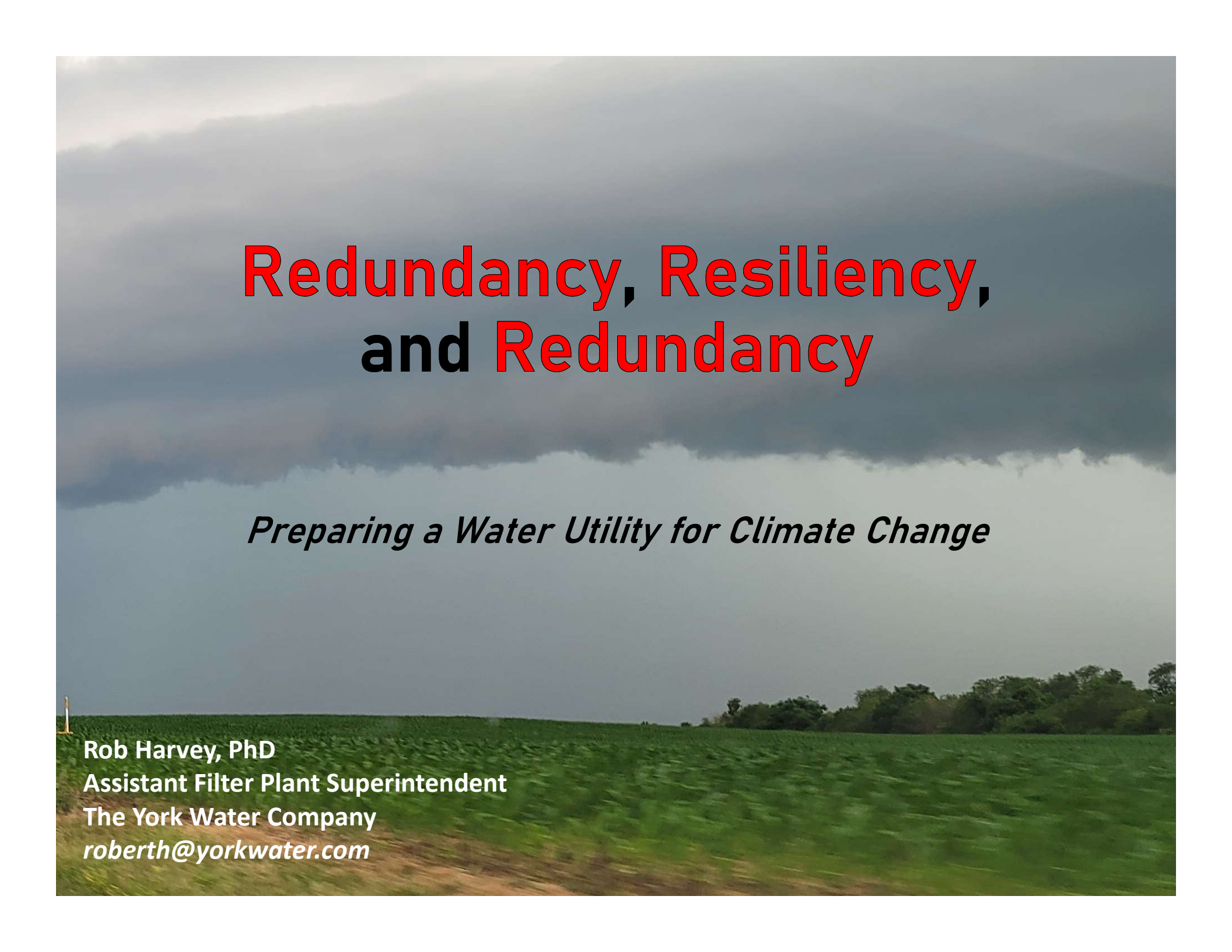


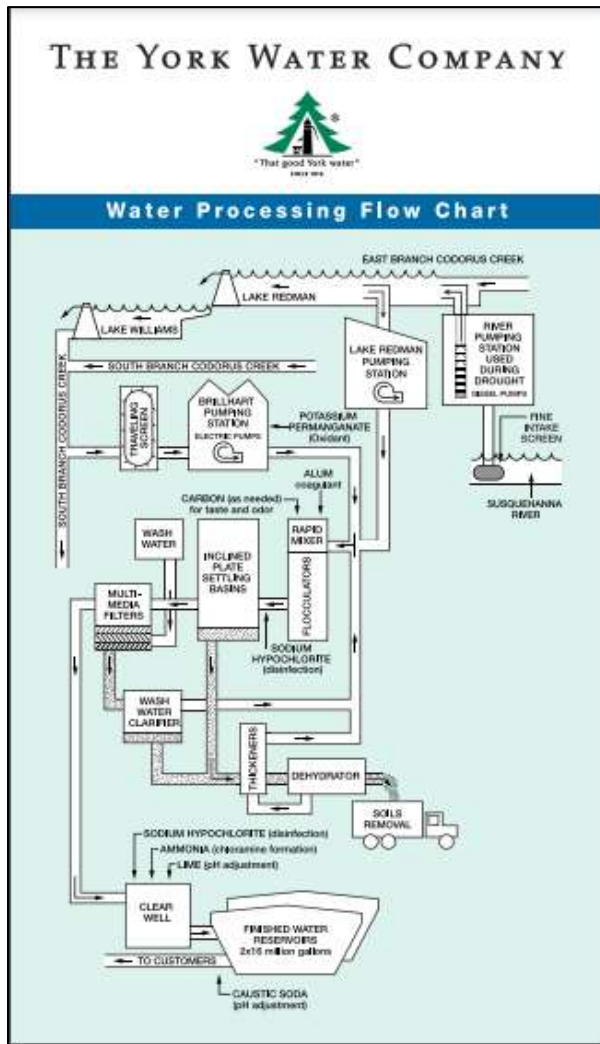


Redundancy, Resiliency, and Redundancy

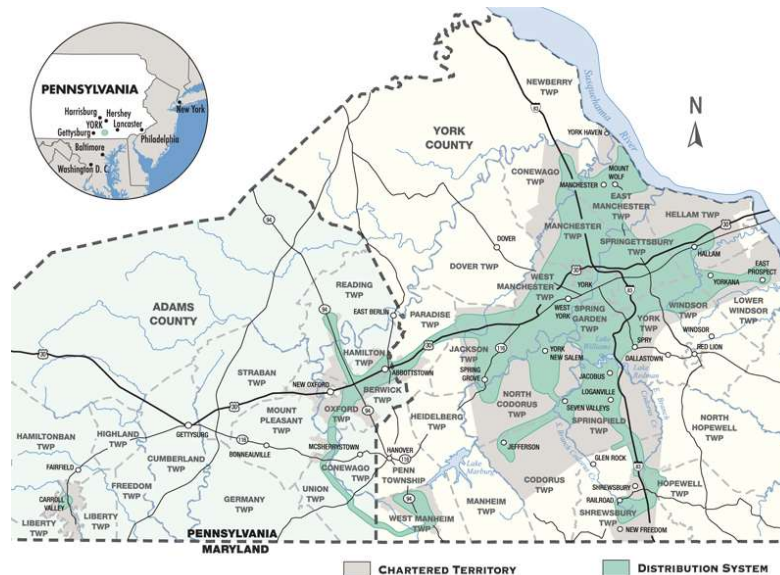
Preparing a Water Utility for Climate Change

Rob Harvey, PhD
Assistant Filter Plant Superintendent
The York Water Company
roberth@yorkwater.com

A brief bit about us...



- Investor owned utility serving over 200,000 customers in York, Adams, and Franklin counties
- One conventional treatment plant (rated 40 MGD, average 20 MGD)
- Four satellite well systems
- Founded 1816



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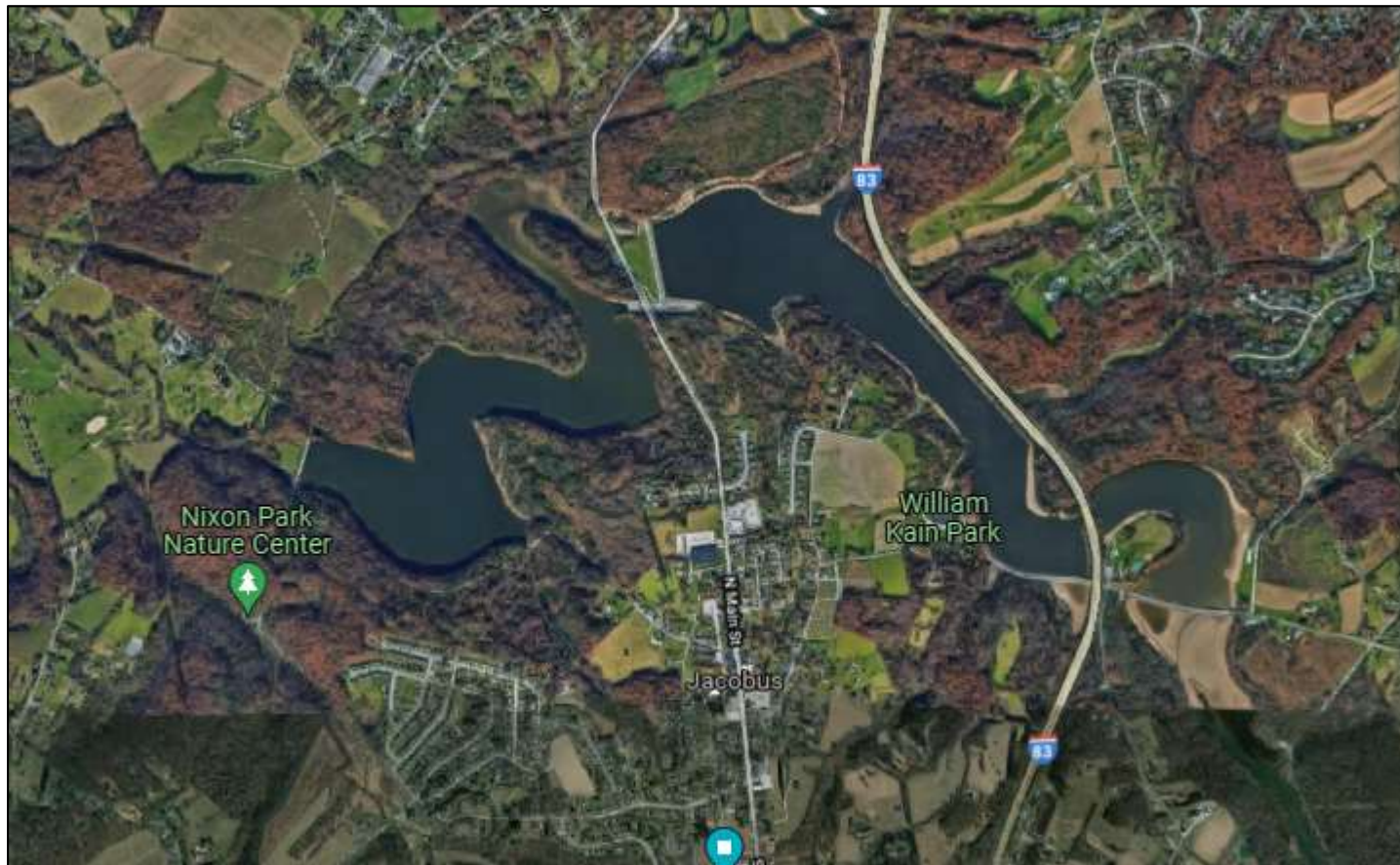
Water is supplied directly to the WTP by two pumping stations

- Brillhart Pumping Station
- Original (late 1800s) and primary pumping source
- Situated along the South Branch of the Codorus Creek
- Total output: ~44 MGD



- Lake Redman Pumping Station
- New (2018) and secondary pumping source
- Situated on Lake Redman (East Branch of the Codorus)
- Total output: ~36 MGD

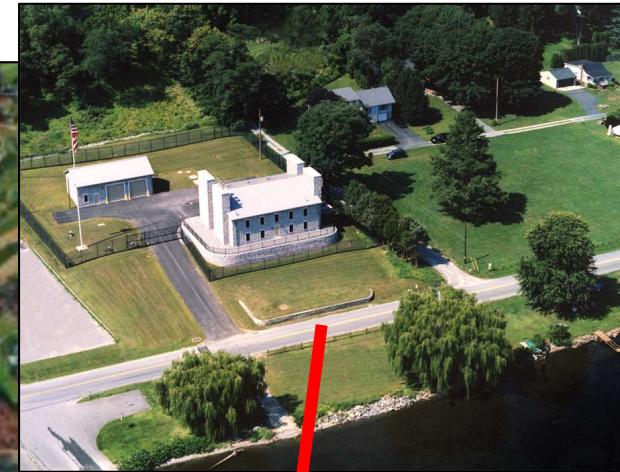
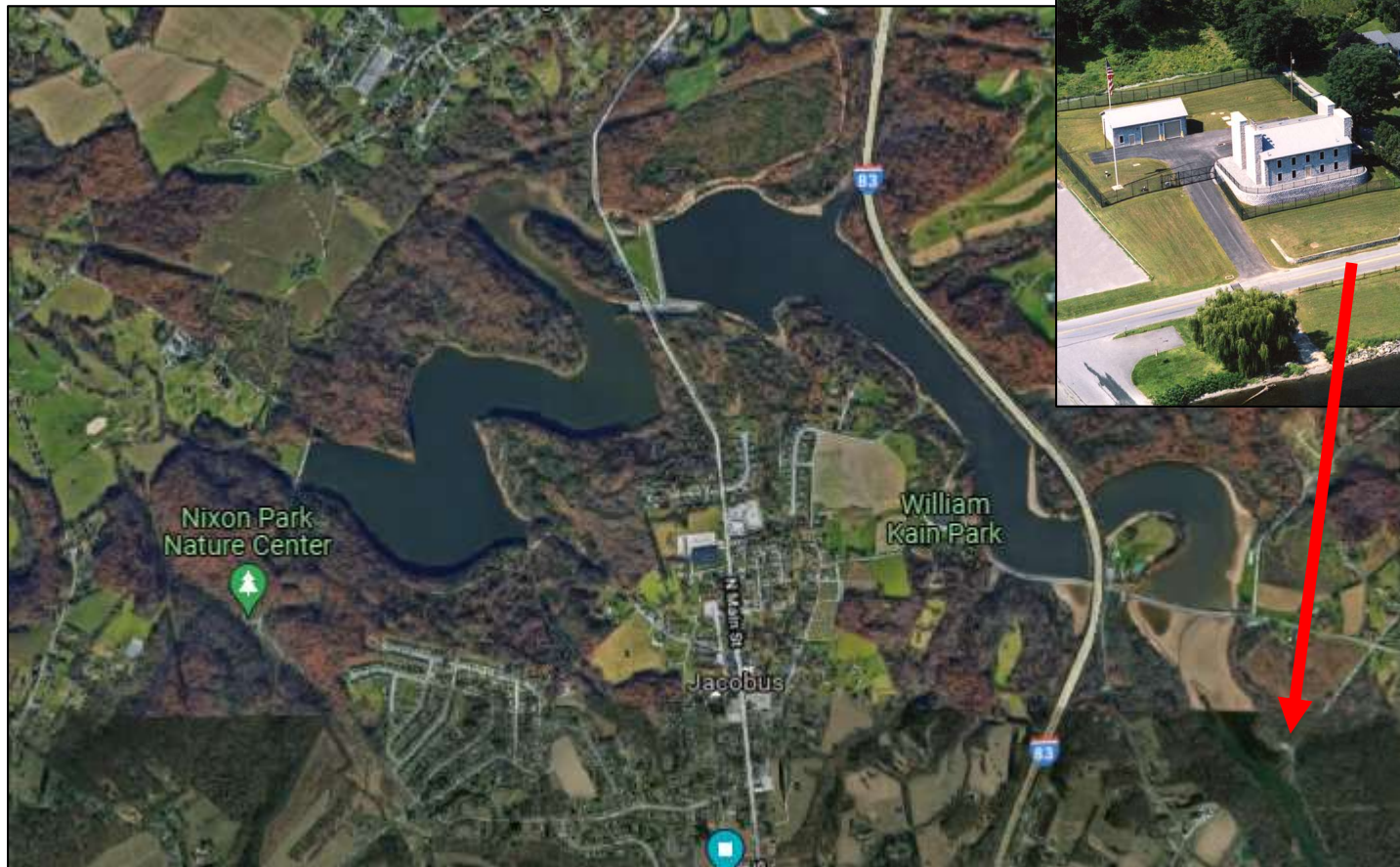
We also own/manage two drinking water reservoirs, storing collectively over 1 billion gallons of water



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As needed we can pump water from the
Susquehanna River to Lake Redman



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Why have we invested extensive capital resources into maintaining these “extra” pumping stations?



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To ensure a safe and steady supply of drinking water!

Okay – but what are the various factors that could disrupt this goal?



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Our past preparations for the improbable are now paying dividends for the probable

So what are some possible impacts?

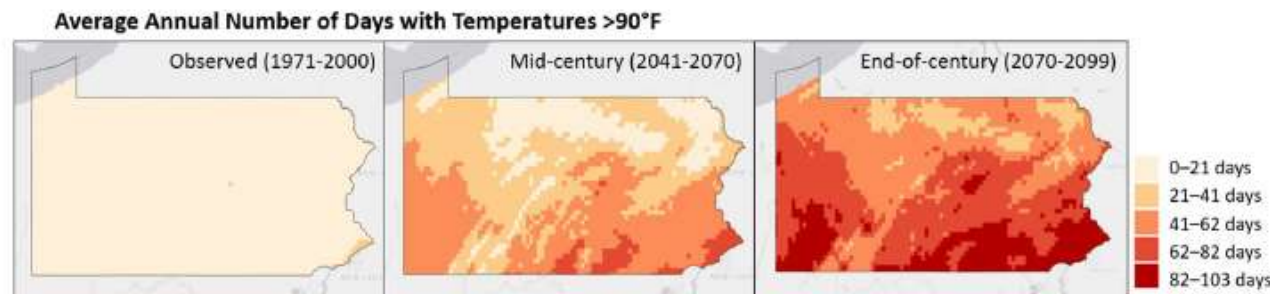


Figure 1. Observed and projected annual days with temperatures above 90°F

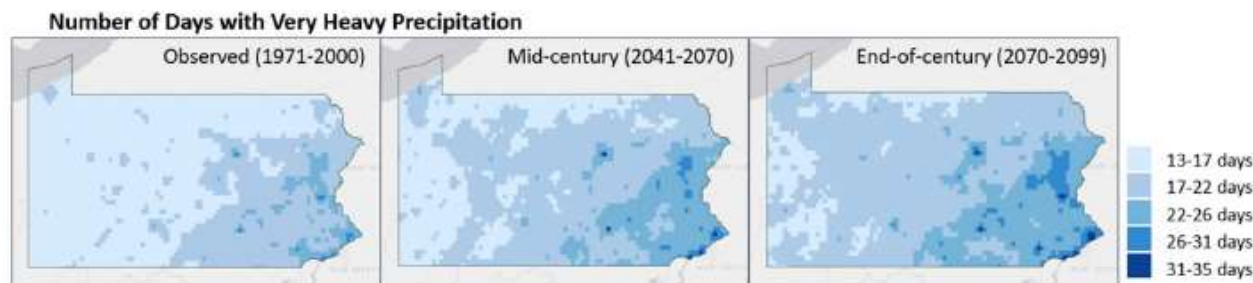


Figure 2. Observed and projected annual days with “very heavy” precipitation

Two important impacts we are concerned about are the increase in hot days and increase in extreme rainfall events

DEP's top 3 impacts all directly impact our operations

Heavy precipitation increases our treatment costs and can damage/destroy our infrastructure (increase in electrical outages as well)

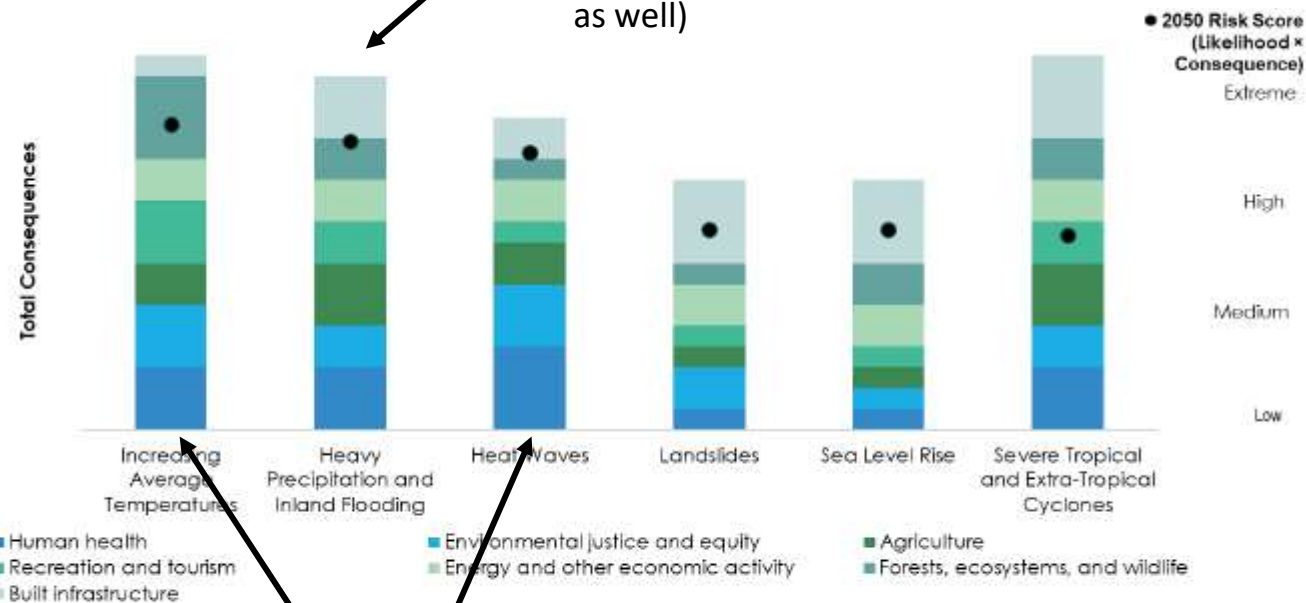
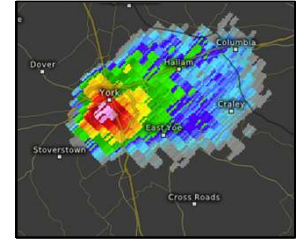
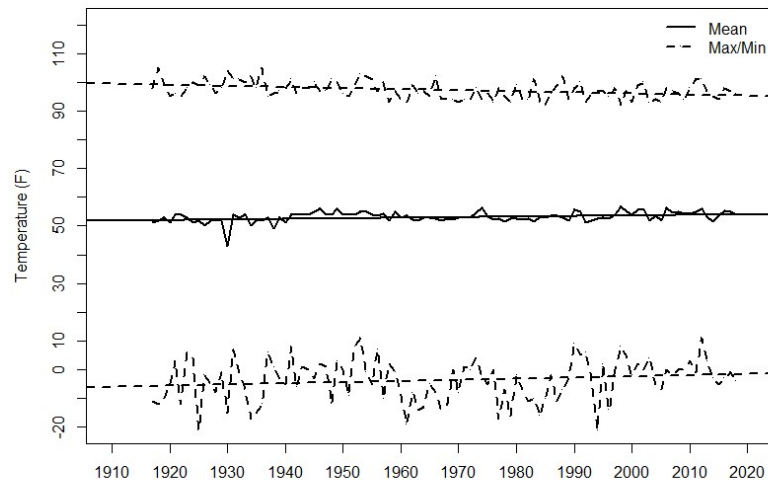


Figure 3. Total consequences by hazard (sorted highest to lowest overall risk)

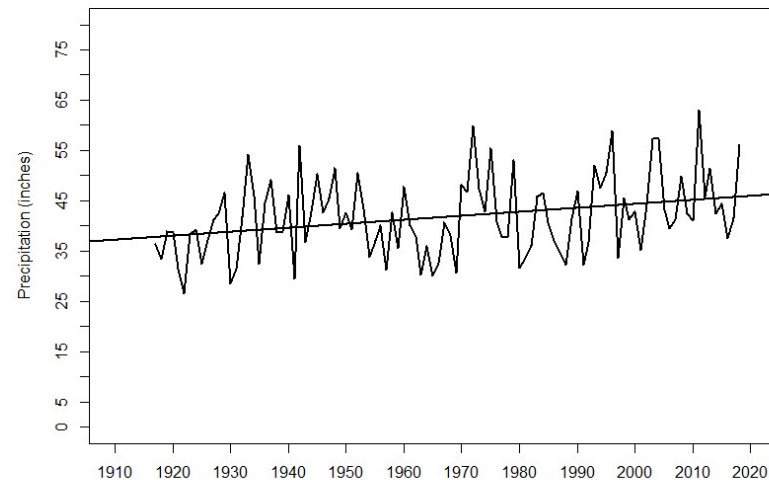
Overall increase in temperatures and heatwaves will drive up demand and consumption, and amplify any drought conditions present

Of note – these impacts can be seen in our weather records back to ~1911

Max, Min, and Average Temperature in York PA



Total Rainfall in York PA



Three of our main concerns:

Too little water



Too much water



Power outages/severe weather



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With two centuries of operation, we have had our fair share of droughts

- The best way to counter a drought?



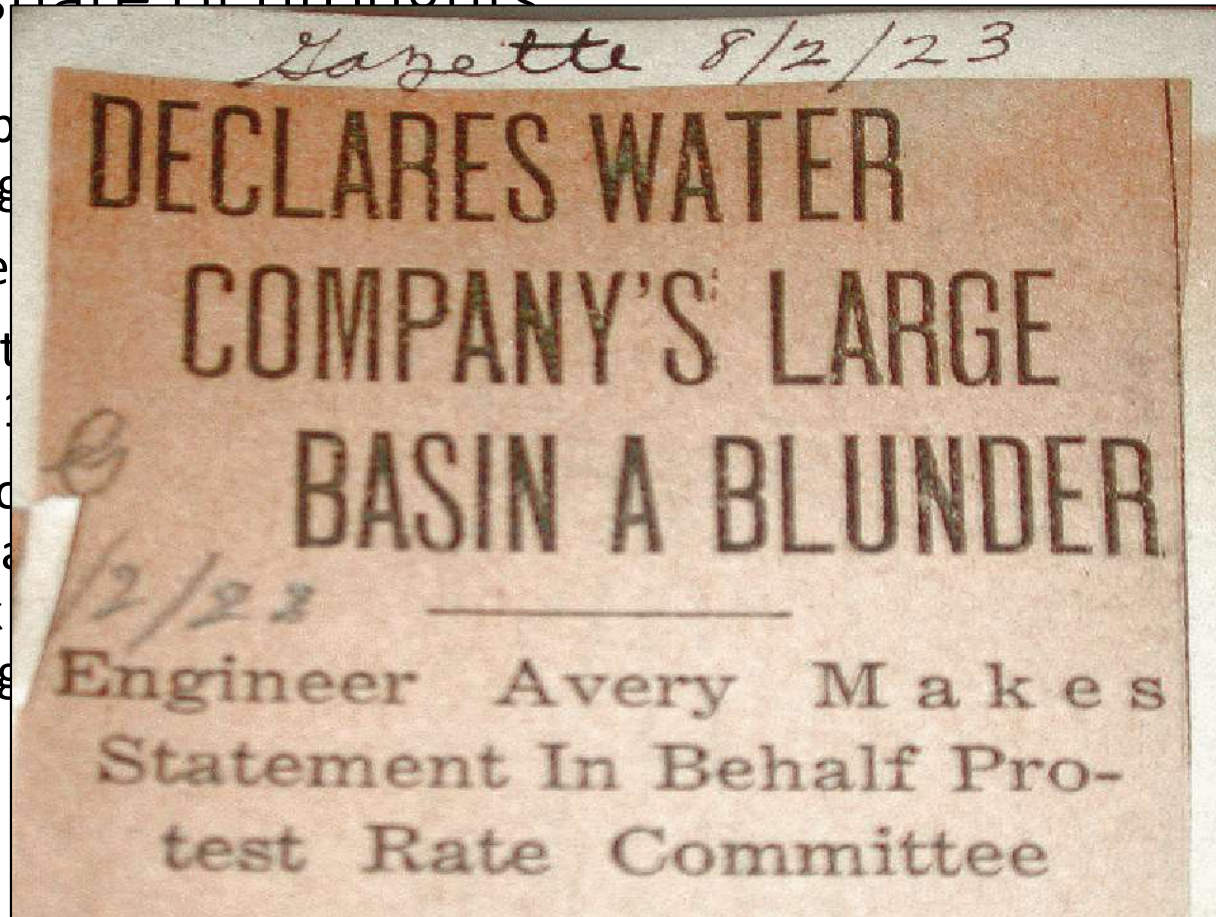
With two centuries of operation, we have had our fair share of droughts

- The best way to counter a drought?
- Water storage!
- Constructed Lake Williams in 1912
- Obviously the press was very appreciative of the work we did to prevent drought issues, right?

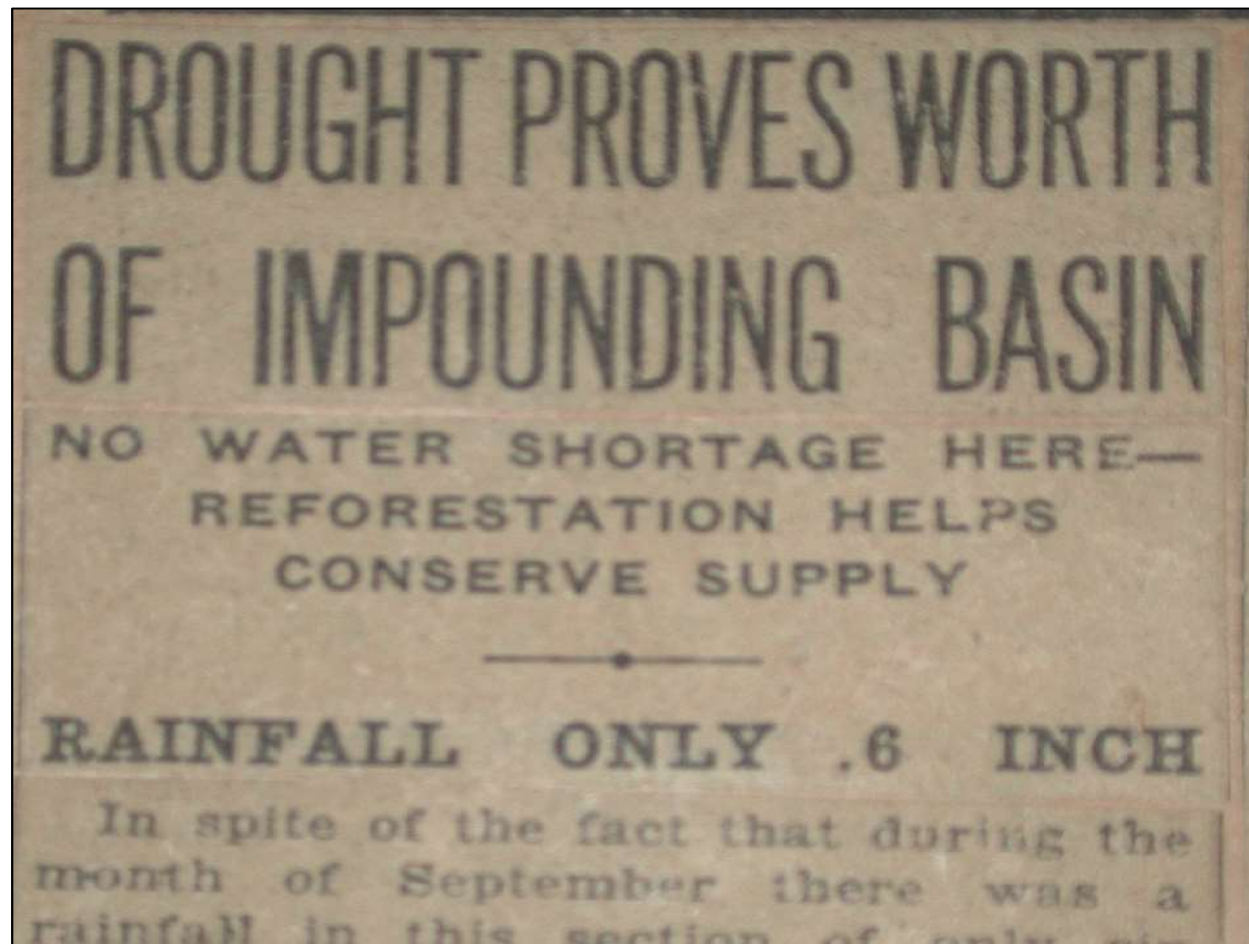


With two centuries of operation, we have had our fair share of droughts

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One year later we got the last laugh...



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We further developed our water storage in 1955 and 1967



1955 – installation of bascule gates at Lake Williams to increase the lake level by 4 feet



1967 – creation of Lake Redman (ironically during the drought of 1967)

And now in 2022 we will be further developing our water storage

Lake Williams Dam Redesign/Construction

Increased resiliency

- Fully armored
- Withstand 40" of rain in 72 hours
- Spillway excavated to bedrock

Increase capacity

- Addition of 60 MG of capacity



From the late 60s through 2005 our strategy was to first drain Lake Williams, with Redman as backup



Lake Redman was first “used” in 1997, then 1999, and 2001

The capital investment of Lake Redman did not “pay off” for 30 years

But when you need it...you *need* it

Redundant lakes create a resilient system!!

In 2005 our Susquehanna River Pumping Station was completed

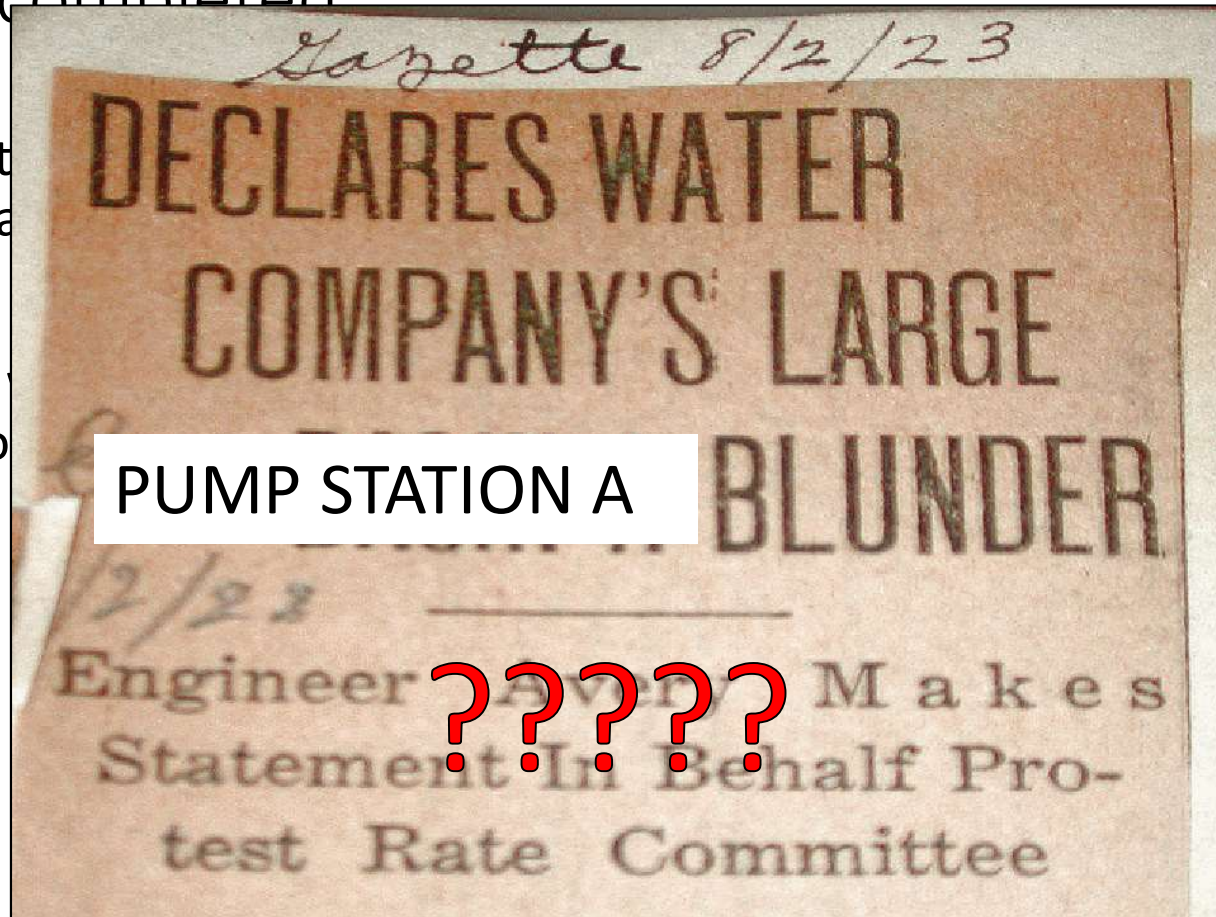
- When needed, can supply ~10 MGD to the headwater of Lake Redman to supplement flow
- So far we have not seen a “pay off” for this capital investment



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- When MGD to Redman

- So far off" for



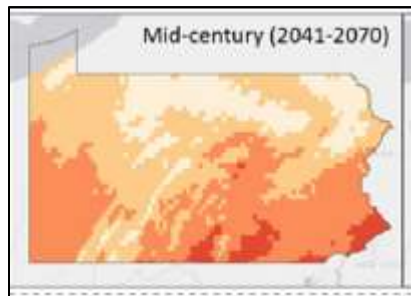
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- So...2035?



We reacted proactively— setting us up for future situations

- Difference between a mindset of:
 - “Wow that was a pretty bad drought, if we made it through that we can make it through anything”
 - “Wow that was a pretty bad drought, we made it through without issue...but what if we didn’t”
- By working to prepare for the next event, and taking previous events as warning, we created a resilient and redundant water system
- We will need to carry this attitude of “staying ahead of the next event” through climate related impacts



We have discussed too little water – but what about too much water?

- Pumping stations right along creeks are great! But sometimes...





Sometimes
you can have
some issues
with
flooding....



Brillhart has been outfitted in a way that electrical motors, and other sensitive material are out of the floodplain/can be moved quickly

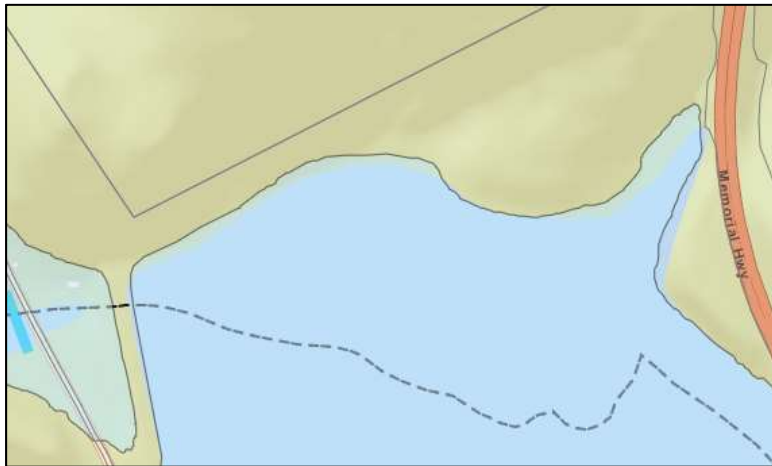


- This allows us to resume operations ASAP when flood waters recede



Just about all of BPS is in some type of floodplain though...

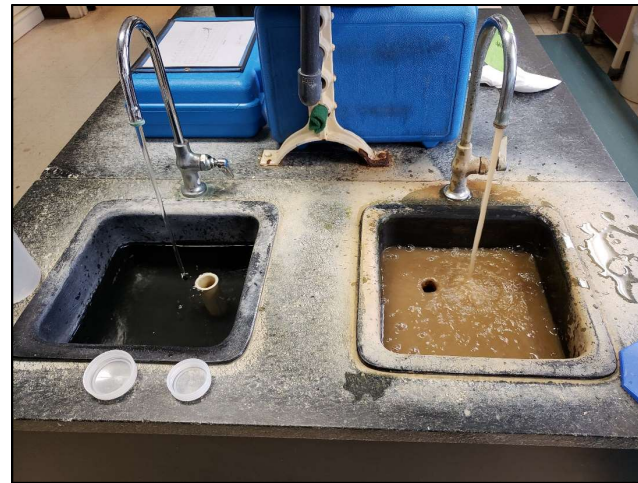
Construction was finished in 2018 on our second raw water pumping station



- Located on Lake Redman
- Outside of the 100 year floodplain
- Serves as a back-up pumping station
 - Flooding at BPS
 - Fire/other event at BPS
 - Contamination event near BPS
- Provides us with a *redundant* pumping station that is at less risk of flooding

With flooding comes high turbidity

- High turbidity events = high risk
- Rapidly changing and deteriorating conditions
- ↑extreme rainfall events =
↑turbidity = ↓water quality
- We need to invest in the latest technology to stay ahead of issues



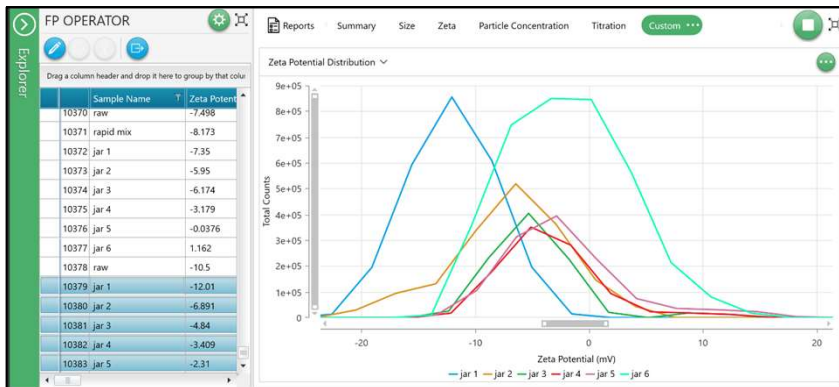
Technology #1: Inclined Plate Settlers

- Utilizes a series of angled plates to vastly increase the amount of water that can be settled
- Helps reduce issues from high turbidity events
- Also increases redundancy in treatment



Technology #2: Zetasizer/Zeta Potential

- Fast, accurate coagulant dose determination
- Objective measurement with little to no user influence on result
- Increased dosing confidence



With heavy rainfall comes electrical outages

- Generators!
 - Allow for redundant power source
- Automatic transfer switches
 - Near instant transfer to generator
 - Fast back in service time
 - No in person visit needed



And the generator is here!

Imagine you are here

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Redundant power supplies (generators) create a resilient system

- Can also rely on our finished water storage to bridge any gaps due to power outages
- Also have a supply of portable generators/PAWARN to assist if a generator fails at a location
- Multiple tanks in a pressure zone means that even without a pumphouse, people can still get water

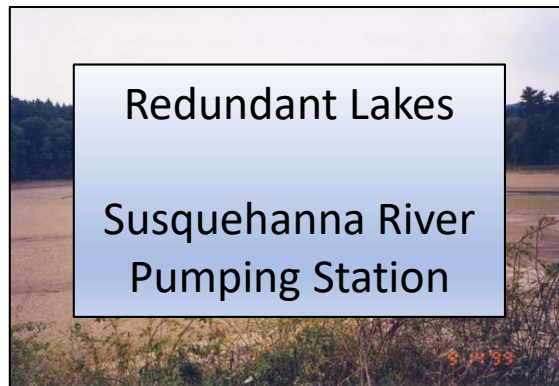


By evaluating our system for “weak links” we are able to plan strategic projects to increase redundancy and resiliency



To Recap....

Too little water



Too much water



Power outages/severe weather



Questions?

