BUILDINGENERGY NYC

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AIA Provider: Northeast Sustainable Energy Association

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Water: Lifeblood of Our Infrastructure

Course Number

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Course Description

Safe drinking water quality and effective wastewater treatment are essential to urban infrastructure but upgrading and maintaining systems is a costly challenge. This module will review the improvements in water and wastewater infrastructure over the last 25-30 years, challenges for the future, the costs of these programs and methods of managing water/sewer costs in multifamily housing.

Learning Objectives

At the end of the this course, participants will be able to better understand:

1. The function and scope of the water supply and wastewater treatment systems.

2. The cost of water

3. The use of water in apartment buildings and the sources of loss

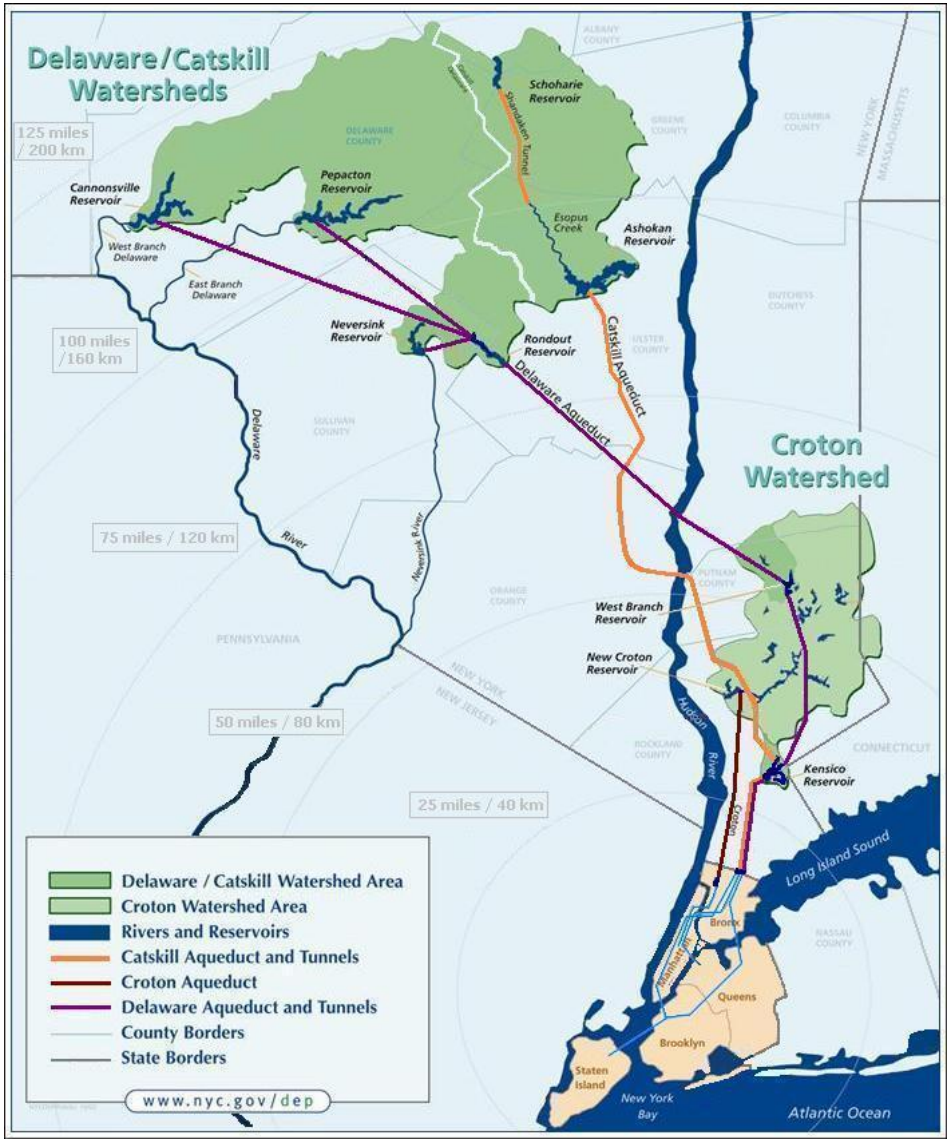
4. Solutions and methods for advanced water management

Range of Challenges

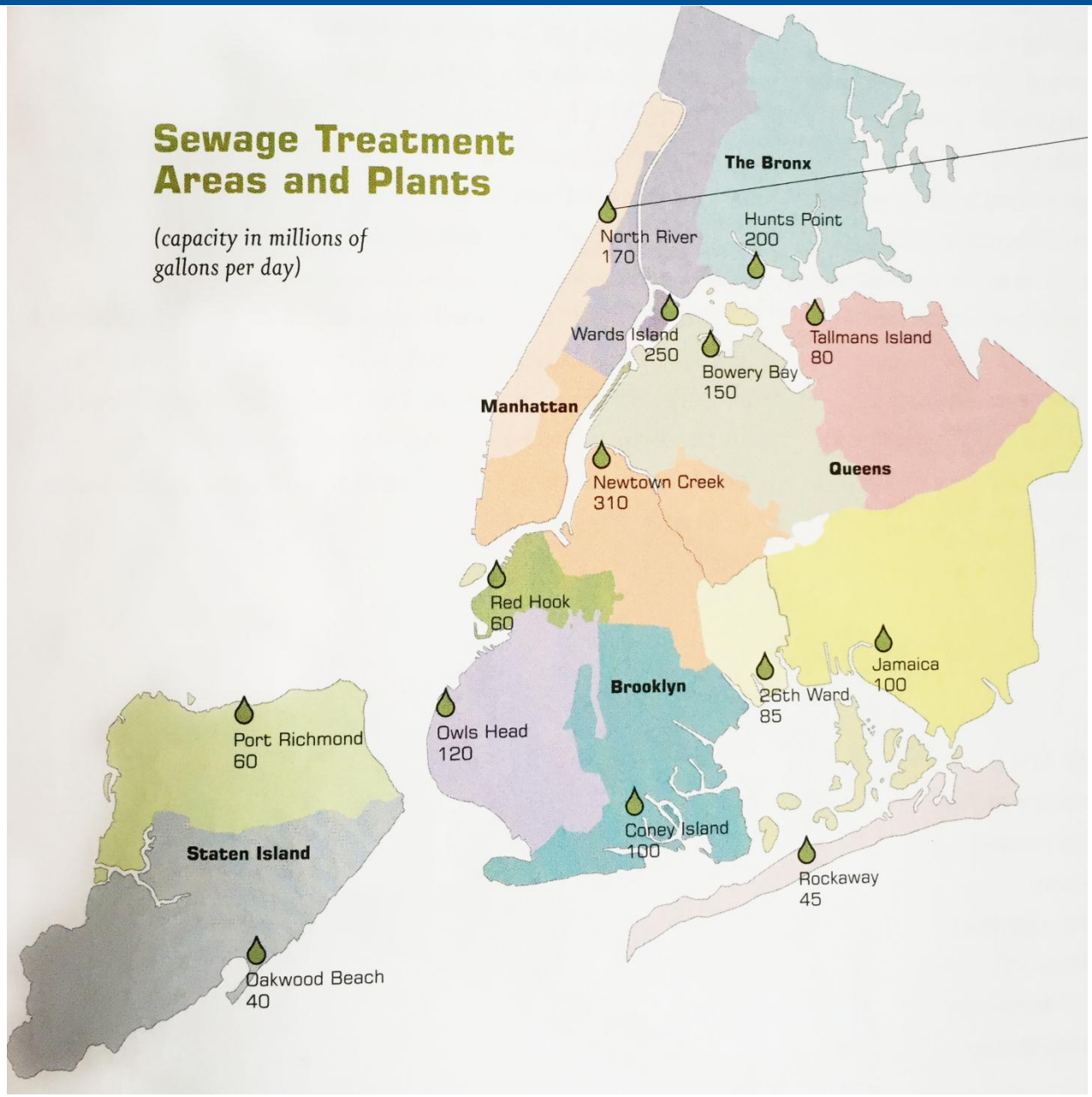
The Water/Wastewater System

Water Supply for New York City

- 2,000 square mile watershed
- Serves 9 million people (50% of New York State)
- 580 billion gallon capacity
- ~ 1.1 billion gallons/day, including upstate communities



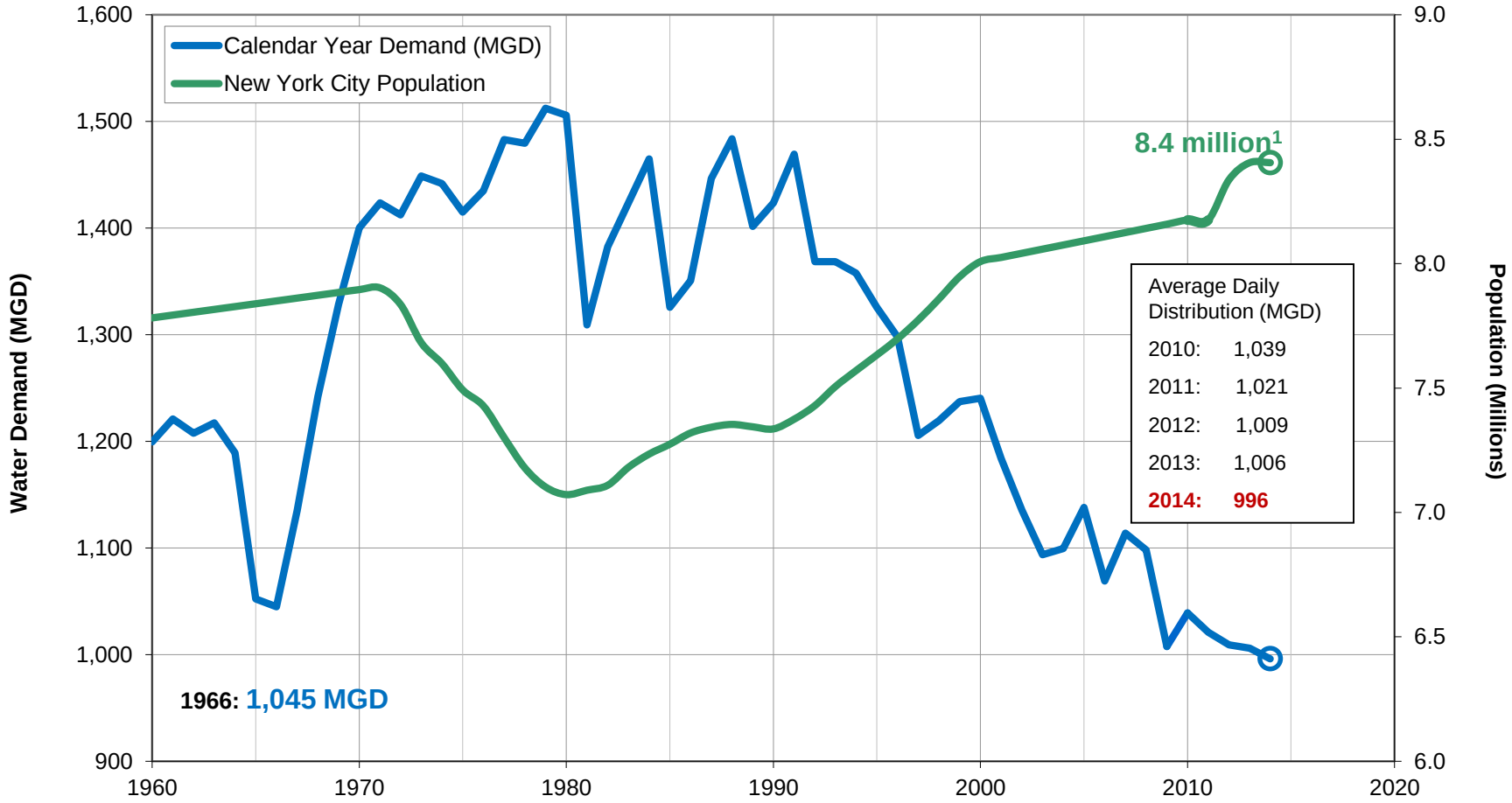
Wastewater Treatment Plants



Source: Anatomy of a City by Kate Ascher

Water Demand Reductions

- Distribution has declined more than 30% since the early 1990s – despite increasing population
- Since 2009, water usage has been below the record drought in the 1960s



[1] Official 2013 New York City Department of City Planning Estimate.

Why Has Consumption Decreased

- Metering
- Improvements in distribution system leak detection
  - Most of the city is surveyed every nine months
- Replacement of 1.3 million toilets through DEP program (1994-1997)
- NYCHA toilet replacements (1994-2003)
- Locking hydrant caps
- Code changes (toilets, showerheads, clothes washers, water-cooled equipment)
- Increased prices/rates
- Increased education and visibility

Wastewater System Improvements

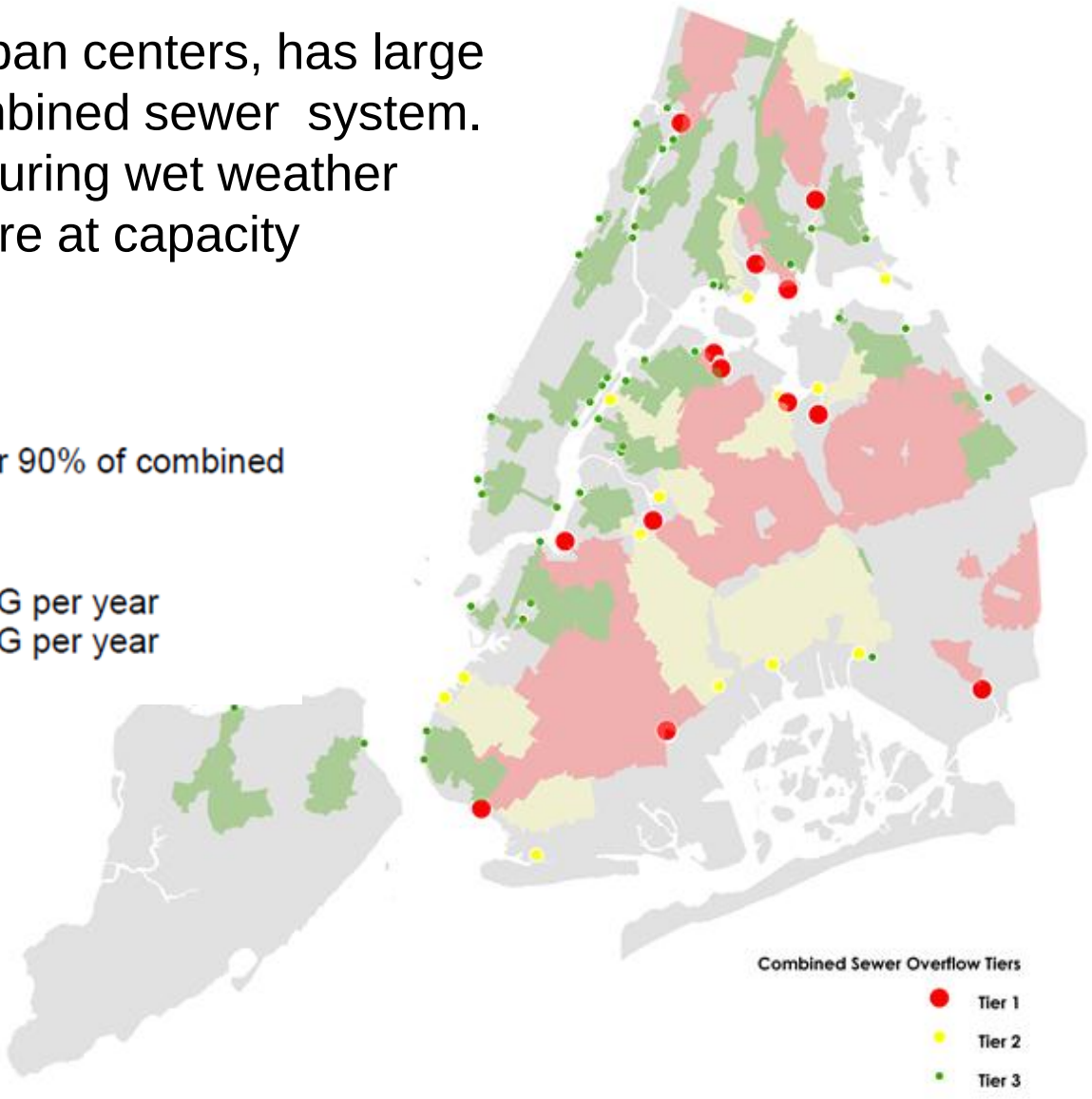
- All Wastewater Treatment Plants (WTP) have been operating at least 25% below their permitted capacities since the mid-1990's and are operating at a minimum of secondary treatment
- New York no longer dumps sewage sludge into the ocean (as of 1992)
- WTP that discharge into Long Island Sound and/or the East River are now equipped with nitrogen removal technology to decrease eutrophication
- Combined Sewer Overflow capture has improved from 18% (1980's) to 72% (2015) and is expected to reach 82% (2018) at a cost of $2.1 Billion (2002-2018)
- CSO content is now composed of 12% sanitary sewage compared to 30% in the 1980's

Combined Sewers

- NYC, like other older urban centers, has large areas serviced by a combined sewer system.
- This system overflows during wet weather when treatment plants are at capacity

Tier 1 through Tier 3 outfalls account for 90% of combined sewer overflows.

Tier 1: >500 MG per year
Tier 2: >250 MG per year and <500 MG per year
Tier 3: >50.7 MG per year and <250 MG per year



Future Challenges

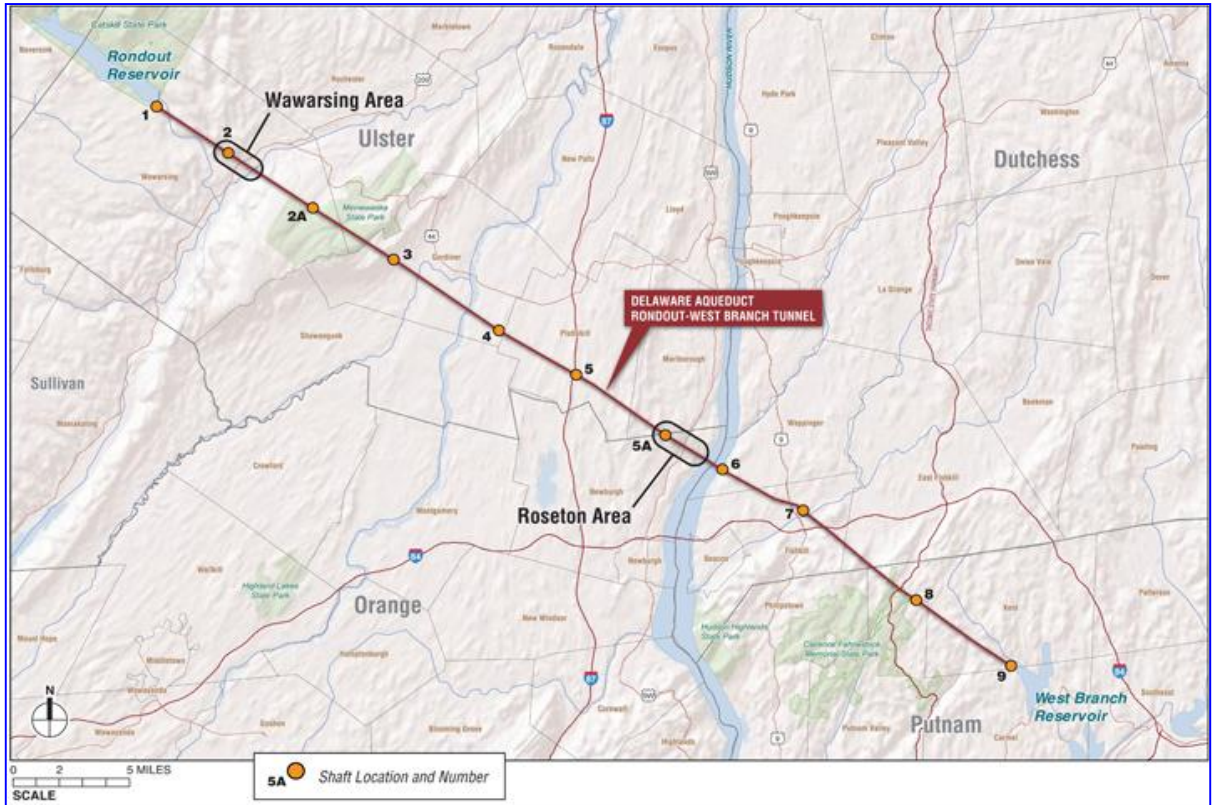
Long-term Control Plans for CSOs

- Under an administrative consent order with the New York State Department of Environmental Conservation (DEC), DEP is required to submit long-term control plans (LTCPs) for combined sewer overflows (CSOs)
- DEP is developing Control Plans for ten waterbodies, as well as a citywide plan for the East River and open waters
- $1.3 billion is set aside in the capital budget to fund the LTCPs

CSO Waterbodies	
Alley Creek	Gowanus Canal
Westchester Creek	Jamaica Tributaries & Bay
Hutchinson River	Coney Island Creek
Flushing Creek	Flushing Bay
Bronx River	Newtown Creek
Citywide (East River and open waters)	

Delaware Aqueduct Repair

- Delaware Aqueduct has significant leakage in the Roundout-West Branch Tunnel (RWBT) section
- RWBT needs to be fixed to ensure future stability and supply
- During RWBT shutdown to repair the tunnel, NYC will need water from other sources
- Water supply needs are based on planned hydrology and shutdown duration



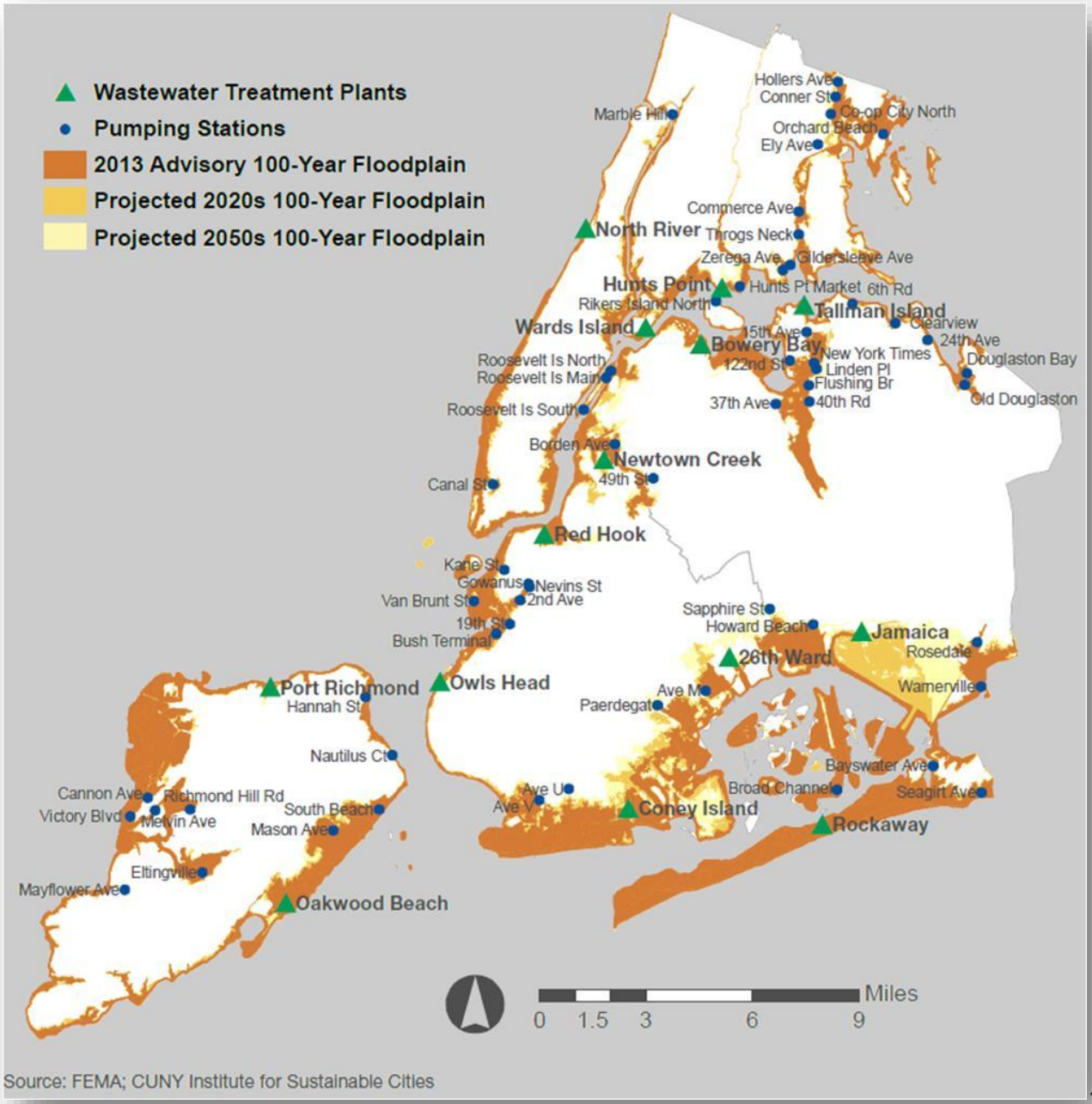
Water Demand Management

- Reduce water demand by 5% by 2021
- Toilet replacement program; estimated to save 10 million gallons of water per day
  - Replace toilets with low-flow models that use 1.28 gallons or less per flush
  - Toilet vouchers worth $125 per fixture are available for properties enrolled in the Multi-Family Conservation Program; 260 vouchers for a total of 1,300 toilets requested to date
- Municipal Water Efficiency Program
  - Install activation buttons on spray showers in 400 playgrounds; estimated to save 1.5 million gallons of water a day; 150 spray showers upgraded to date
  - Replace bathroom fixtures in 500 city schools that will save 4 million gallons of water a day; 82 schools have been completed

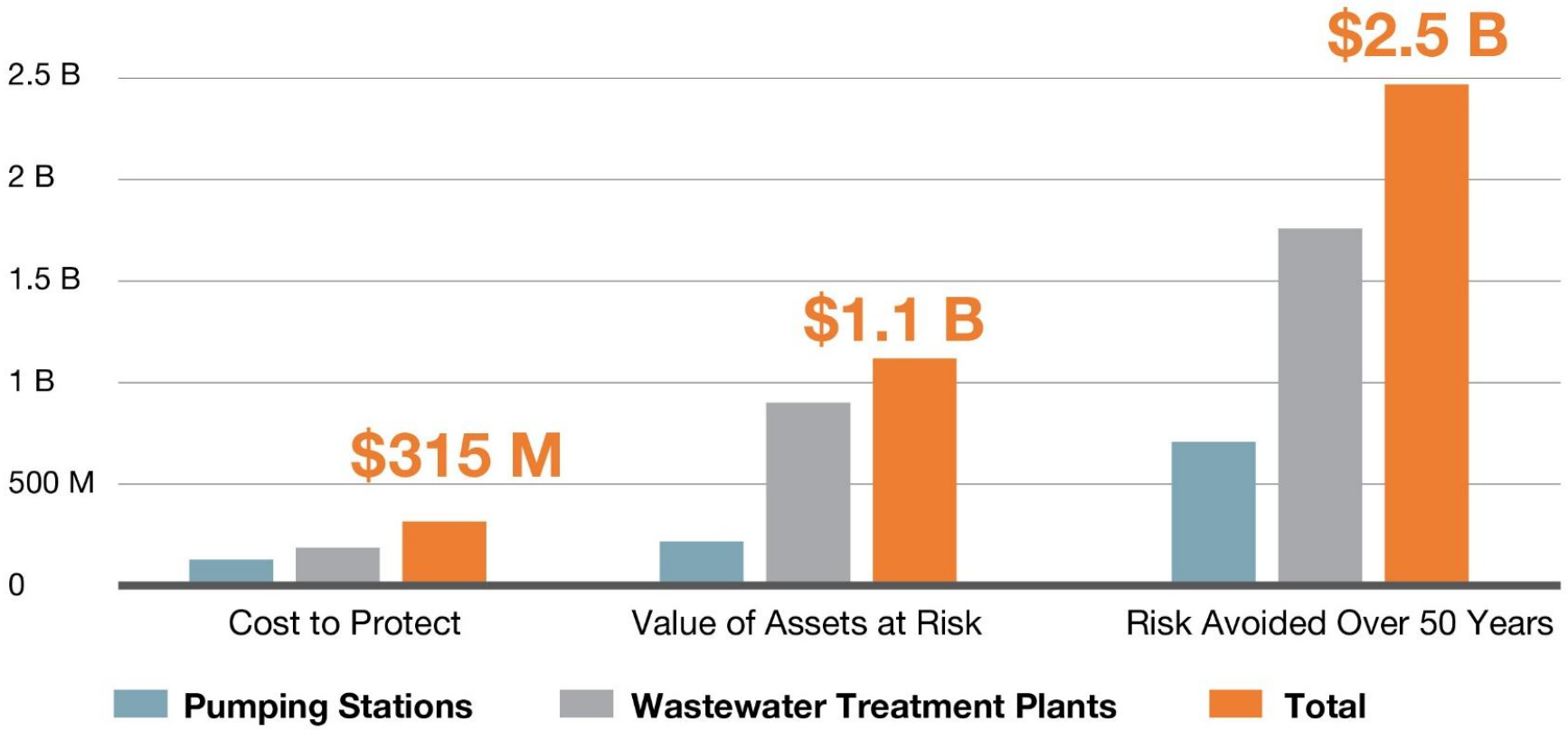
Resiliency in the Face of Climate Change

Based on 100-year floodplain plus 30 inches of Sea Level Rise (SLR):

- All 14 treatment plants and 60% of pumping stations are at risk.
- Over $1.1 billion of assets are at risk if no protective measures are implemented



Cost to Protect Wastewater Facilities

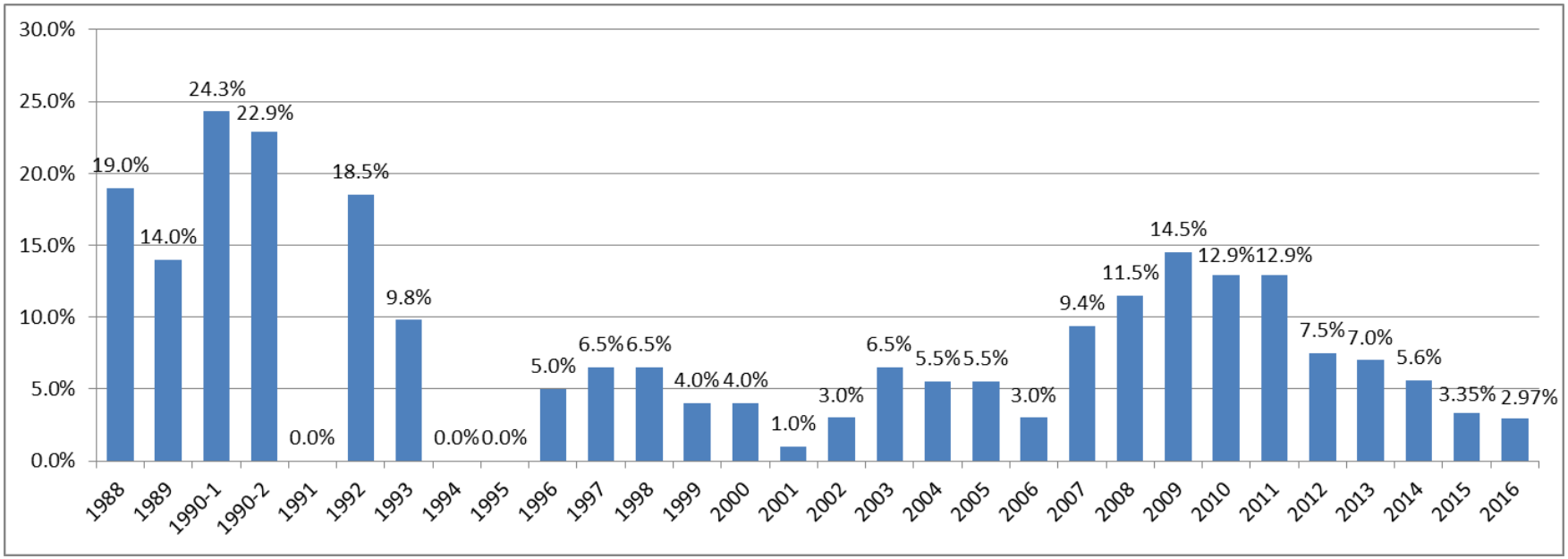


Investing **$315 Million** in strategic fortification can safeguard **$1.1 Billion** of vital infrastructure and save the city **$2.5 Billion** in emergency response costs over the next 50 years.

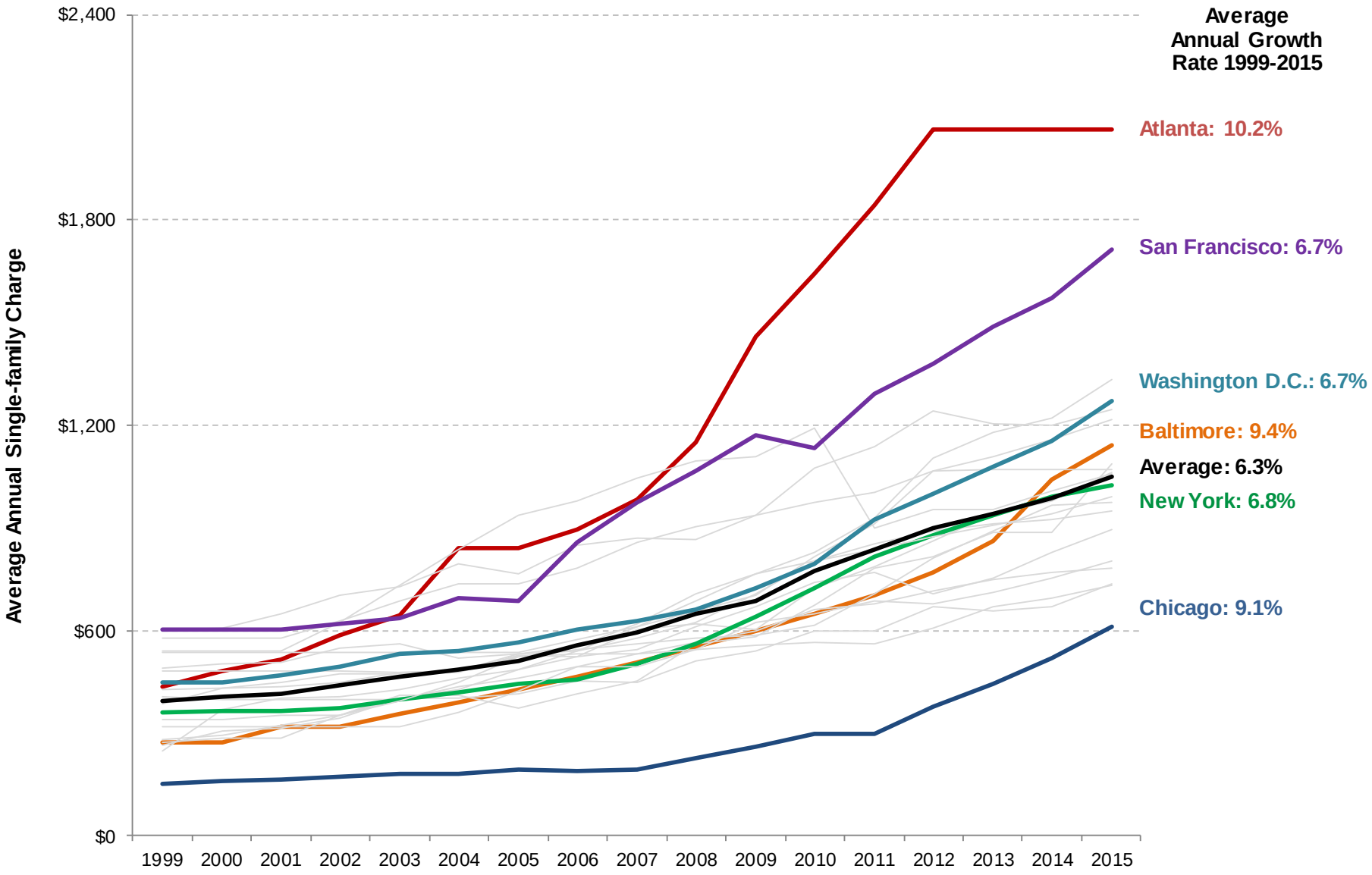
All estimates are based on AACE Level 5 Cost Estimate guidelines as noted in the NYCDEP BEDC Cost Estimating Manual

Cost of Maintaining the System

History of Water/Sewer Rate Increases



Rate Trends in Major Cities



All estimates based on consumption of 80,000 gallons per year

Average Annual Costs: FY16 Rates

• Single-Family Home (219 gpd)	$1,055.39
• Multifamily Apartment (142 gpd)	$ 686
• MCP Apartment Fixed Charge	$1,004.82
• MCP is equivalent to 209 gpd	
• Minimum Charge (96-97 gpd)	$465

Building Consumption in Context

What Should We Be Using (More or Less)?

- Without high-efficiency fixtures:
  - About 70 – 75 gallons per person per day
- With high-efficiency fixtures:
  - About 60 gallons per person per day or less
- Unless the building averages four or more people per apartment, why would it be on the MCP rate?
- If you're using over 100 gallons per person per day, what's going on?

Pollard/Bluestone Case Study

- 49-unit building: 198 gallons per unit per day in 2014
- Upgrade:
  - 1.6 gpf toilets replaced with 0.8 gpf
  - 2.5 gpm showerheads replaced with 1.5 gpm with thermal shutoff valve
  - New shower diverter valves
  - 0.5 gpm – 1.5 gpm bathroom aerator, 1.5 gpm kitchen swivel aerator
- Consumption is down to 89.4 gallons per unit per day (55% reduction)
- Water cost fell from $950 per apartment per year to $431 and gas use is down by at least 20%
- Nine-month payback

Some Basic Concepts

- No metric has a better correlation than population density
- Toilet leaks are the single worst source of waste in most buildings
- Domestic hot water use/loss incurs both an energy and a water penalty
- In pumped buildings water use also incurs an electrical penalty
- WaterSense toilets provide savings and improve performance
- Monitor steam condensate losses in a building with a large boiler

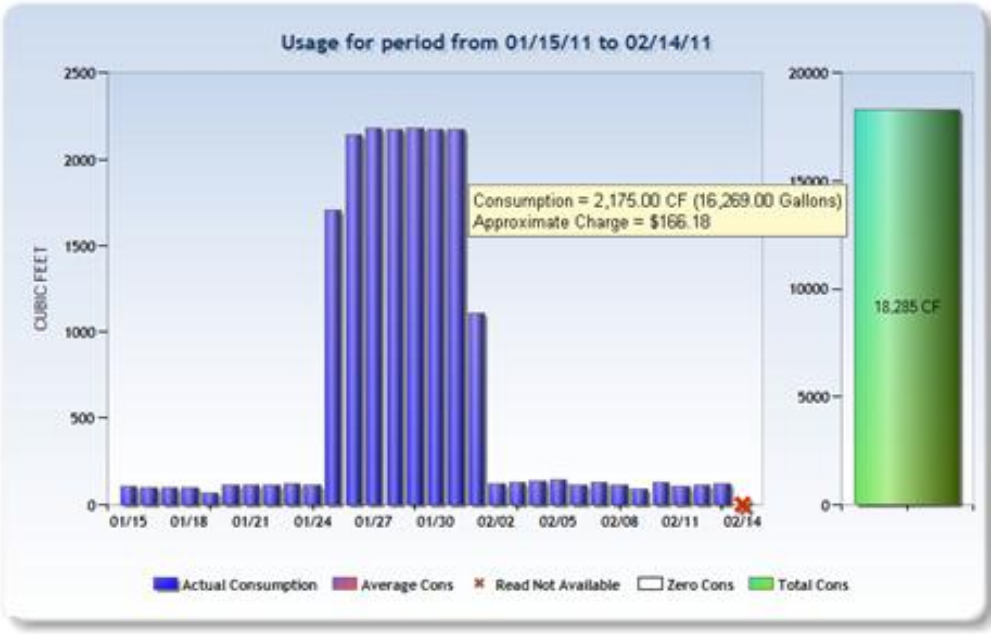
Checklist

- Register to see your water use online at My DEP Account
- Replace ballcock refill valves with “fluidmaster” types
- Have a Plan for Toilet Leaks: Perform dye tablet tests each year and replace flappers every five years or take equivalent action to defend against toilet leaks
- Install replacement flappers appropriate for 1.6 gpf toilets
- Replace toilets that have a nominal flush volume over 1.6 gpf with WaterSense fixtures
  - 1.28 gpf or less
  - Improved flush performance
- Large steam boiler? Install meter on makeup water line

Tools

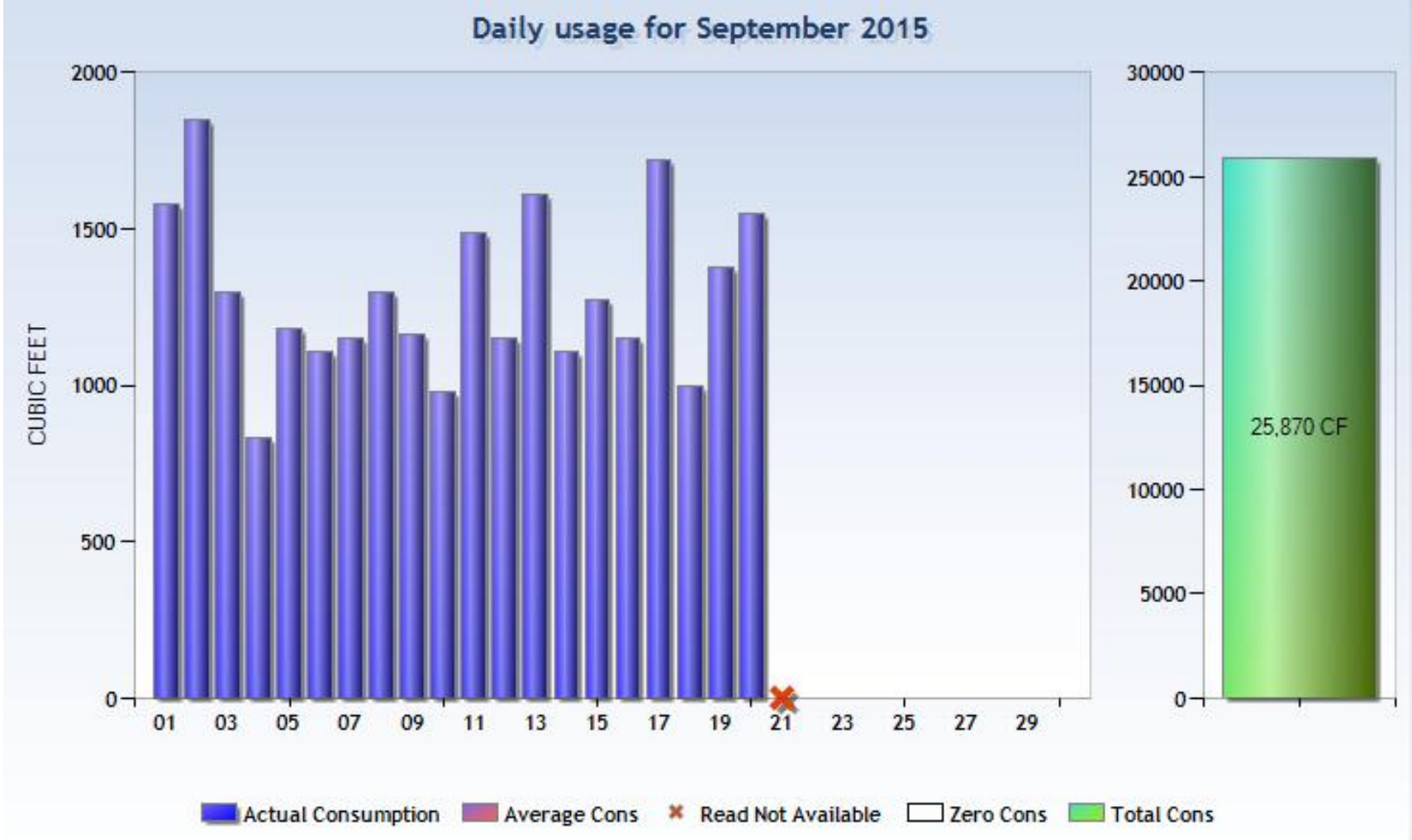
Leak Notification

- Customers who sign up for leak notification on **My DEP Account** will receive an email alert when their property uses water at a rate significantly above their normal consumption pattern
- Managers of large buildings can change the alert settings
- There are 238,795 accounts enrolled and 92,279 alerts have been sent out
- DEP's leak notification program has saved customers about $77 million since its inception in 2011



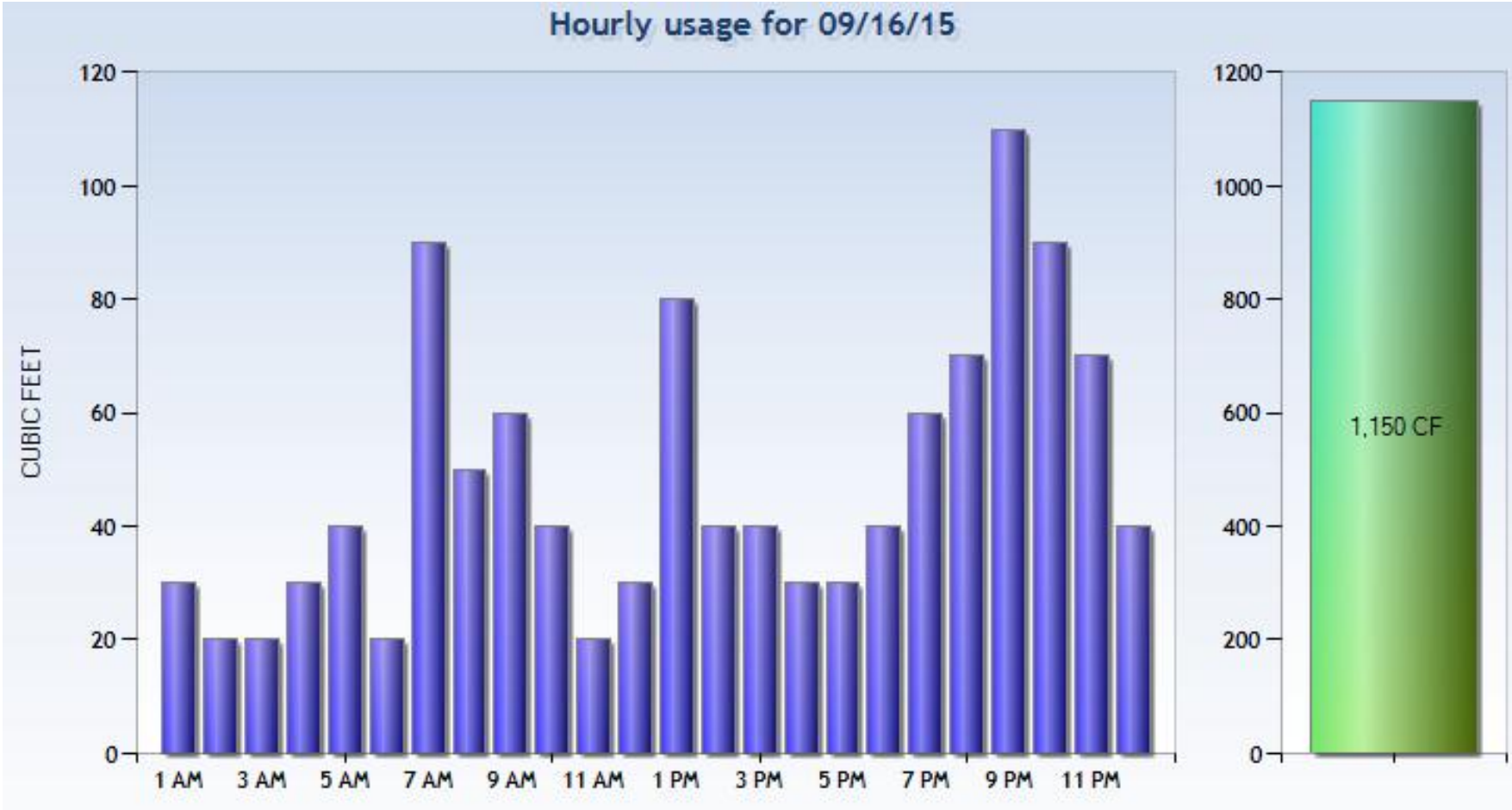
A Second Case Study

- 40 apartments, 15 – 17 HCF per day (building total)
- 250 – 300 gallons per apartment per day
- $1,350 per apartment per year



Base Leakage of 2.5 gpm = 4.8 HCF/day

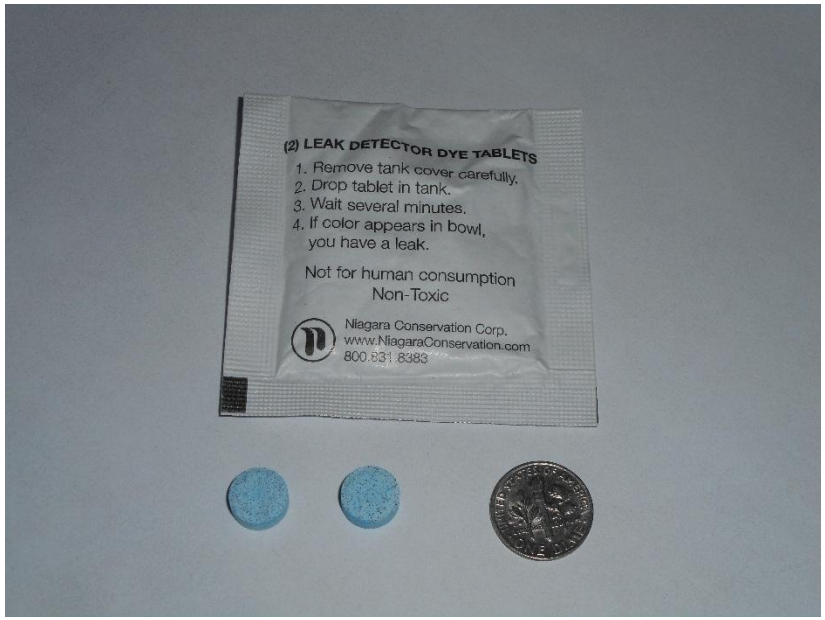
- 2.5 gpm is one toilet refill valve running open; = $450/apartment/year



What is it worth to insure this does not happen to you?

Toilet Leak Solutions

Dye Tablet Tests



- Simple, manual
- Food coloring in toilet tank
- If color appears in bowl, toilet is leaking
- The faster the color appears, the worse the leak
- Results: Instantaneous to 30 minutes
- Requires access to the apartment and toilet

Leak Detection Refill Valves

Leak Detection Refill Valves

- Limits toilet leak to one tank (1-2 gallons) per normal use
- Refill valve designed to only refill the tank when toilet is flushed
- Allows leaking toilet to empty tank and does not refill until toilet is flushed
- Resident must flush once to refill tank and second time to flush toilet
- Inconvenience encourages resident to contact Building Maintenance (?)
- Two major manufacturers
- Both are available with long-life replacement flappers

Auto Shutoff Valve

- Connects to water supply to tank
- Also may incorporate a sensor inside the tank
- Shuts water supply and may sound an alarm if flow exceeds set point
- Requires manual corrective action or reset button
- Several manufacturers

Wireless Flow Sensors

- Clamp-on plug-n-play wireless sensors
- Alerts and information to the cloud
- NYCHA and DEP planning a demonstration project

Networked Wireless Point-of-Use Meters

- Small in-line submeters can also be used for toilet or other leak detection
- Local communications using Zigbee Pro protocol
- Offsite communications are required using internet access
- DEP and NYCHA are planning a demonstration project

The Bottom Line

- There is no shortage of water-efficient technologies
- There is no shortage of monitoring technologies
- Will Owners/Managers recognize that this is a cost that can, beyond population density, be managed?
- Are you ready to be strong?

Thank You!


THE CATSKILLS
CROTON DAM
WATER IS THE LIFE OF NYC
CONSERVE AND PROTECT IT
THE Sandhogs
DEP

This concludes The American Institute of Architects
Continuing Education Systems Course

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