

# Planning for Our Future: Effects of Climate Change on CSOs



Jersey Water Works  
CSO LTCP Implementation Committee

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## Introduction & Purpose

The Jersey Water Works (JWW) Combined Sewer Overflow (CSO) Committee recognizes that CSO permittees, communities, and stakeholders know that climate change can harm our sewer infrastructure but may struggle with how to plan for it. Major weather events like Hurricane Henri and Tropical Storm Ida have raised awareness that many parts of our current sewer infrastructure cannot handle increasingly severe storms. New Jersey's CSO communities have recently completed CSO Long Term Control Plans (LTCPs) to meet environmental regulations, but the question remains: are these plans adequate to confront climate change impacts? This report looks at the need to look at climate change's impact on planning for CSO communities.

## About Jersey Water Works

Jersey Water Works is a collaborative effort of many diverse organizations and individuals who embrace the common purpose of transforming New Jersey's inadequate water infrastructure by investing in sustainable, cost-effective solutions that provide communities with clean water and waterways; healthier, safer neighborhoods; local jobs; flood and climate resilience; and economic growth.

The goal of the Jersey Water Works Combined Sewer Overflow Committee is for municipalities and utilities to adopt innovative CSO Long Term Control Plans with cost-effective solutions that meet or exceed permit requirements and provide multiple community benefits.

Jersey Water Works welcomes all interested individuals and organizations that commit to supporting and advancing the shared purpose and goals. Members are invited to join any of the collaborative's four committees. To become a member and join one or more of the committees, [please sign up here](#).

## Authors

The Jersey Water Works Combined Sewer Overflow Committee includes a subcommittee focused on implementation of the CSO Long Term Control Plans, which spearheaded this project. The LTCP Implementation subcommittee includes Vin Rubino (lead author), Mo Kinberg (subcommittee lead), Andy Kricun & Drew Curtis (CSO Committee co-chairs), Kimberley Irby (backbone staff), Bill Schultz, Dan Van Abs, Michele Langa, Mohammed Ali, Molly Riley, Nicole Miller, Richard Loeffler, and Rosana DaSilva.

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## Effects of climate change on CSOs

Scientists and engineers widely agree that there are three important effects of climate change on our existing CSO infrastructure:

- Total precipitation is increasing, and a higher percentage of that precipitation occurs in heavy storms, resulting in more runoff to be handled by sewer systems.
- Sea-level rise has been occurring since the early 1900s in New Jersey at a rate faster than the world average and is accelerating. The 2020 NJ Scientific Report on Climate Change indicates that NJ has a 50% chance of experiencing sea level rise by more than 1.4 feet by 2050 and 3.3 feet by 2100.
- With more severe storms comes a greater possibility of power outages. Many combined sewer systems rely on grid electric power to capture and treat stormwater.

The LTCPs did not provide much guidance on how CSO utilities expect to handle climate change. The most important impact facing the public is the increased potential for surface flooding and sewer backups. Since both sea level rise and storm severity/frequency are getting worse, there is also a continuing need to adjust sewer systems to handle higher flows and increased sea level rise.

But New Jersey is not alone on this issue:

- An analysis by USA TODAY shows that 97% of cities with combined sewer systems have experienced an uptick in both annual precipitation and extreme rainfall over the past 30 years.
- The U.S. Environmental Protection Agency (EPA), which regulates combined sewer systems, tracks only the number of discharges and not the amount of sewage released. No national data exists showing total discharges. The last time the EPA estimated total spillage was nearly two decades ago. At the time, its numbers showed an average of 2.3 billion gallons of sewage-laden water entering the environment per day.
- Despite the EPA's own study that predicted more overflows on a warmer planet, the agency allows cities to use outdated rainfall data that may not apply when planning upgrades. In the worst scenarios, that means some cities could see no improvements in sewage overflows even after paying for expensive upgrades to control them.
- The cost of upgrading these systems often falls to those least able to afford it. Families in communities with combined sewer systems have disproportionately lower incomes and higher poverty rates than national averages.

## What can we do about it?

Past planning efforts have not been comprehensive. Effective plans should be flexible and adaptive to handle uncertain change and accommodate at least the most likely changes in the planning period. There are many methods for mitigation and/or adaptation to climate change. Generally, these fit into three categories:

- Adapting to increased high-tide levels at sewer discharge points
- Managing or mitigating increased flows in the sewers, both total flow and peak rates
- Providing resilient infrastructure

Providing tide gates, dams, weirs, and valves at sewer discharges to water bodies can mitigate backflow into the sewer and provide some relief from the impact of increasing water levels. In some cases, pumping systems will be needed to make sewers functional. Raising some sewer outfalls might be feasible, while sewer separation can limit backup of combined sewage.

There are established and effective means for reducing sewer flows. Adding green infrastructure or removing impervious surfaces reduces flow to sewers and provides other community benefits. Detention and retention of stormwater flows can be added to existing systems and be included in future development. Separation of stormwater and sanitary flows alleviates sewer capacity issues and can also reduce pollutant loads during CSO events. In some cases, providing newer, larger sewers can help alleviate pressure on the sewer system and reduce the frequency of CSO events.

Critical infrastructure needs to remain operational during storms and—if damaged or overwhelmed—must recover quickly to service. Resilience has been added to sewer infrastructure in the last decade and must be made part of the LTCPs. This includes the use of alternative power sources, such as renewable energy, that do not add to the climate change problem.

Impacts of climate change may not always be predictable and will likely change over time. Thus, infrastructure needs to be flexible; for example, weirs on sewers should be adjustable, and pump capacities might need to be increased over the next 20-30 years. These climate change impacts need to be considered in the modeling, design, and implementation of LTCP projects. The processes must also consider the selection of the typical year used in rainfall projections in order to focus on more applicable current conditions or to use a synthetic rainfall year using climate change modeling. Implementation plans should also prioritize the implementation of selected CSO projects, providing a phased program to meet changing needs.

## What others are doing: Case Studies

Agencies across the US are beginning to incorporate various levels of climate change planning:

### **Great Lakes Water Authority (GLWA):**

Rising water levels are not limited to our oceans; the GLWA in Detroit has been dealing with rising Great Lakes/Detroit River levels for a while. They are evaluating rising river levels on their sewage conveyance and treatment systems. River inflow to the conveyance system is controlled using fixed dams at some outfalls, with backwater gates at the remaining outfalls. GLWA continues to monitor the Detroit River levels and raise the dam elevations by adding flashboards to alleviate river inflow back to the sewer system

### **Passaic Valley Sewer Commission (PVSC):**

After Superstorm Sandy flooded the PVSC treatment facility in Newark, it took days to recover even basic service. PVSC decided to provide more resilience against a similar occurrence by building a floodwall around the facility, along with a new stormwater pumping facility and standby power. However, the standby power that they are calling for involves a natural gas power plant, which would be the third plant of its kind in the Ironbound neighborhood in Newark. Standby power should be generated by renewable, clean energy.

### **New York City Department of Environmental Protection (NYCDEP):**

In 2010, based on recommendations from the NYCDEP, local advocates, and City Council, New York City developed a 20-year Green Infrastructure Plan. The plan aims to use green infrastructure to manage the first inch of runoff from 10% of impervious cover within the CSO sewer shed. This effort will capture a projected 1.5 billion gallons of stormwater per year. Combined with various gray infrastructure projects, it will help meet regulatory obligations for a lower cost than the original gray-only approach. NYCDEP also developed a Resiliency plan for its wastewater infrastructure based on climate change impacts that is being implemented system-wide now.

### **Hampton Roads, VA – various agencies:**

The impacts of climate change have been the focus of planning level actions in the Hampton Roads area. In 2011, the Hampton Roads Planning District released a report on the Climate Change Adaptation project. The report examined predicted sea level rise in Hampton Roads, expected flooding vulnerability, and some adaptation options. One municipality in Hampton Roads, Norfolk, passed changes to its flood and coastal zone ordinance following increases in severe coastal flooding and in anticipation of potential sea level rise. The ordinance requires that new structures in coastal flood zones must be built at least 3 feet above the 100-year floodplain.

## What to do in NJ?

Planning periods incorporated in the current LTCPs extend out over 40-50 years. The LTCPs are being finalized through a series of public comments and comments by the New Jersey Department of Environmental Protection (NJDEP) as part of the CSO permitting process. When permits are renewed (projected completion in 2022), these plans will be implemented through the respective CSO permits and renewed every five years.

These renewals provide an opportunity to make the issue of climate change part of public dialogue. Public input will be sought during the permit renewals. This presents the opportunity for CSO Permit holders to evaluate their climate assumptions to meet current climate science. For example, the frequency and severity of intense storms needs to be considered as well as sea level rise.

The public dialogue and CSO permits can encourage permit holders to continually revisit the impact of climate change over time, possibly on an annual basis. Regulatory and funding issues can also affect implementation of projects in the respective LTCPs. These changes can be addressed via the permits.

Some specific actions that JWW is recommending as the CSO permits are reviewed:

- Adopt an official state sea level rise standard to guide planning for combined sewer overflow plans and projects.
  - Revise the official design storm standard to account for increased inland flooding and combined sewage generation, ensuring appropriate stormwater and floodplain planning and management for CSO plans and projects. The design storm should incorporate climate change modeling.
- Adopt a model year for project design to account for the future impacts of climate change.
- Require CSO permit holders to use NJDEP's 1) adopted statewide sea-level rise standard, 2) revised official design storm standard, and 3) model year for designing, planning, and evaluation of CSO projects.
- Require utility permit holders to incorporate energy efficiencies and projects that will achieve zero carbon emissions from their treatment facilities. Failure to use clean and renewable energy sources will just further exacerbate the effects of climate change.
  - Significant capital improvements will be required. Stakeholders should advocate for more federal and state funding for such improvements
  - Given the increased wet weather flow, we recommend stricter adherence to, and enforcement of, EPA's nine minimum controls, such as keeping sewers cleaned on a regular basis, as well as keeping regulators and tide gates functioning properly.

## If you want to learn more:

- EPA has done a high-level screening analysis of climate change impacts on CSOs in the New England and Great Lakes Regions in “A Screening Assessment of the Potential Impacts of Climate Change on Combined Sewer Overflow Mitigation in the Great Lakes and New England Regions”:  
[https://www.epa.gov/sites/default/files/2015-10/documents/cso\\_climate\\_final.pdf](https://www.epa.gov/sites/default/files/2015-10/documents/cso_climate_final.pdf)
- NJDEP provides guidance in “Local Planning for Climate Change Toolkit”:  
<https://www.nj.gov/dep/climatechange/>
- The U.S. Climate Resilience Toolkit is a website with information to build climate resilience. The Toolkit offers information from across the federal government: <https://toolkit.climate.gov/topics/built-environment/water-and-wastewater>
- Purdue University - Agriculture published a flyer, “Climate Change How will you manage stormwater runoff?”: <https://www.extension.purdue.edu/extmedia/fnr/fnr-426-w.pdf>
- New Jersey’s overall plan for climate change resiliency is presented in “State of NJ Climate Change Resiliency Strategy”: <https://www.nj.gov/dep/climatechange/docs/nj-climate-resilience-strategy-2021.pdf>
- The most recent projections for climate change impacts are provided in “IPCC 6th Assessment Report (AR6)”: <https://podaac.jpl.nasa.gov/announcements/2021-08-09-Sea-level-projections-from-the-IPCC-6th-Assessment-Report>
- NJDEP’s first scientific report on climate change summarizes the current state of knowledge regarding the effects of climate change on New Jersey’s environment in “2020 New Jersey Scientific Report on Climate Change” (<https://nj.gov/dep/climatechange/data.html>)
- The regulatory reform effort to help reduce greenhouse gas while making our natural and built environments more resilient is called NJ PACT (NJ Protecting Against Climate Threats):  
<https://nj.gov/dep/njpact/>
- In an article titled “Climate change brings a perfect storm of raw sewage and rainfall in cities that can least afford it”, USA TODAY spent a year investigating how climate change is affecting numerous communities: <https://news.yahoo.com/climate-change-brings-perfect-storm-033913136.html>

## If you want to learn more:

- A November 24, 2021 article in NJ Spotlight News cites two recent reports from Cornell University on climate change impacts on NJ: ([https://www.njspotlightnews.org/2021/11/climate-change-nj-increased-rainfall-precipitation-extreme-storms-flooding-tropical-storms-new-reports-northeast-regional-climate-center/?fbclid=IwAR3BUI25S\\_Fo6p2na-8jv\\_yB70gg19eHbJhhgpGL5s\\_Q4QeU17uwBGkxJiY](https://www.njspotlightnews.org/2021/11/climate-change-nj-increased-rainfall-precipitation-extreme-storms-flooding-tropical-storms-new-reports-northeast-regional-climate-center/?fbclid=IwAR3BUI25S_Fo6p2na-8jv_yB70gg19eHbJhhgpGL5s_Q4QeU17uwBGkxJiY)) The first study, “[Changes in Hourly and Daily Extreme Rainfall Amounts in NJ since the Publication of NOAA Atlas 14 Volume](#),” concluded that across New Jersey, extreme precipitation amounts are up 2.5% from a 1999 baseline. In some places, that increase reaches up to 10%. The second study, “[Projected Changes in Extreme Rainfall in New Jersey based on an Ensemble of Downscaled Climate Model Projections](#),” projects that extreme precipitation in New Jersey is likely to increase another 20% by 2100.
- Report to be published in January 2022, but the first webinar talks specifically on the issues of sea level rise projections to NJ (sources EPA, USGS, USACE): <https://www.hudsonriver.org/article/assessing-combined-sewer-systems-vulnerability-to-sea-level-rise>
- Alliance for National and Community Resilience (ANCR) released the third of its Community Resilience Benchmarks—the water benchmark, which addresses resilience of drinking water, wastewater and stormwater systems. <https://www.resilientalliance.org/ancr-releases-new-community-benchmark-on-water-infrastructure-resilience/>
- Planning efforts in the Hampton Roads, VA area are addressing climate change. An initial planning effort is noted in the report: [https://www.hrpdcva.gov/uploads/docs/HRPDC\\_ClimateChange2010\\_FINAL.pdf](https://www.hrpdcva.gov/uploads/docs/HRPDC_ClimateChange2010_FINAL.pdf); municipal level efforts to guide new infrastructure in Norfolk, VA are noted in: <https://kresge.org/sites/default/files/library/climate-adaptation-the-state-of-practice-in-us-communities-full-report.pdf>; the value of integrated efforts among municipal, county, state and federal entities is studied in: [https://digitalcommons.odu.edu/hripp\\_reports/2](https://digitalcommons.odu.edu/hripp_reports/2)