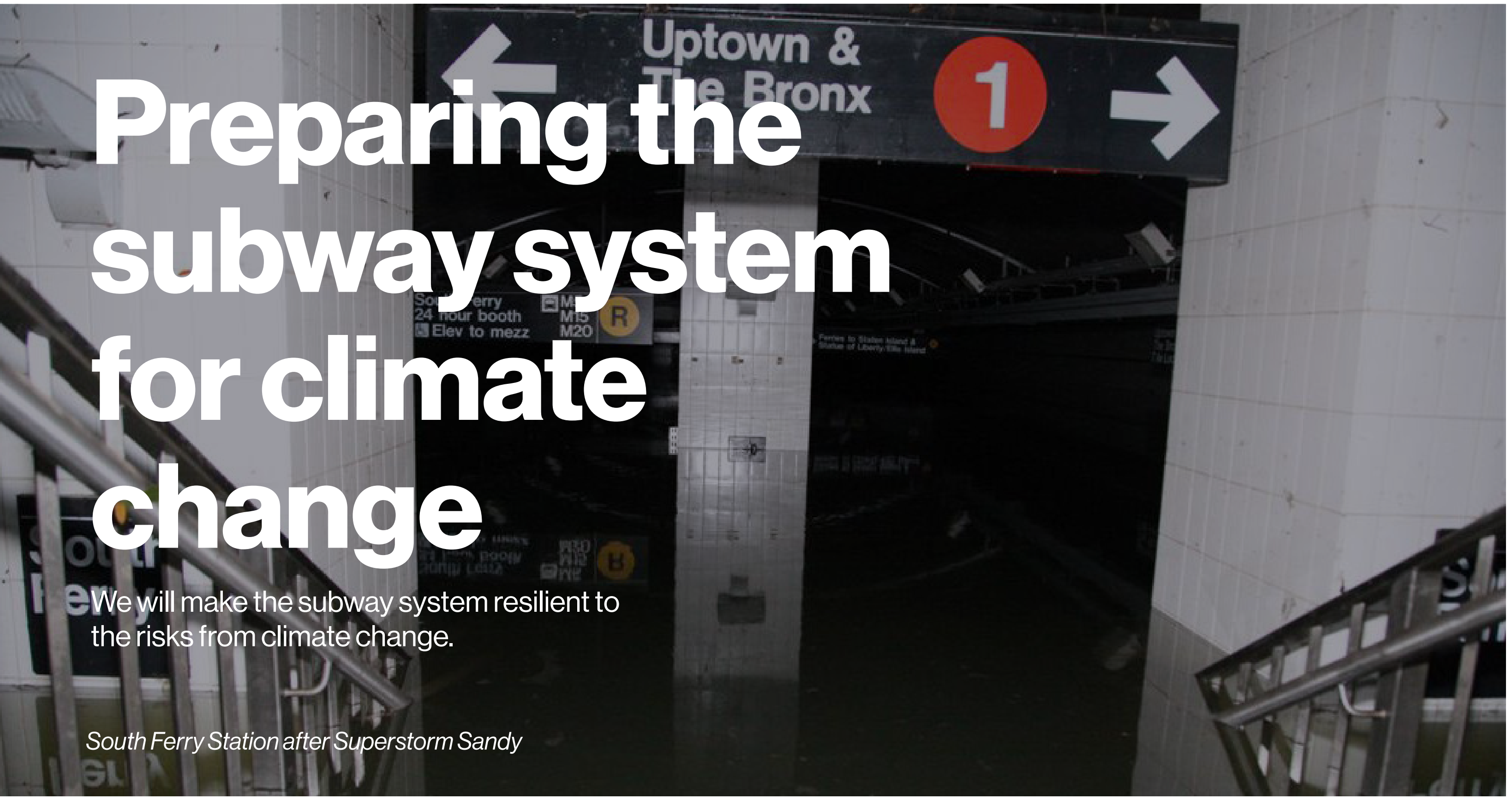
Subway Resilience Case Study

Preparing the subway system for climate change

We will make the subway system resilient to the risks from climate change.



South Ferry Station after Superstorm Sandy

Extreme weather poses significant subway system risks

On the evening of Oct. 29, 2012, Superstorm Sandy made landfall and soon began battering New York City with winds of 80 miles per hour and a storm surge over 14 feet. The following morning, about 17% of New York City was flooded. Our subway system was not spared. South Ferry Station, which carries more than 30,000 riders on an average weekday, was flooded nearly up to the ceiling. When the waters receded, the station was completely destroyed. Similar stories were repeated across the city.

It was a painful lesson. Climate change is here, and we must be prepared.

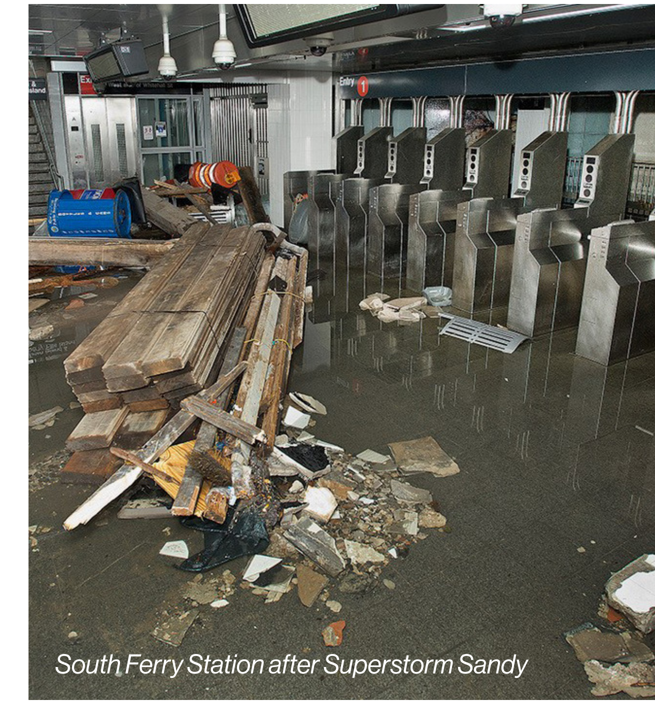
We've responded to protect the system

In the years since Sandy, the MTA has invested $7.6 billion in repairs and new coastal flood protections across all of our systems, including over $340 million in repairs and coastal storm surge protections alone at South Ferry. These coastal storm protections, like marine doors and vent closure devices, are designed to protect the subway system and reduce the risk of catastrophic flooding from storm surge, which will be exacerbated in the coming years by sea level rise.

More must be done

When our subway system was built in 1904, it was not designed to withstand the extreme weather events we experience today. As a result, we have widespread vulnerabilities to a growing range of climate threats, including torrential rainfall and prolonged heat. And these risks are only growing. By the 2050s, climate change projections indicate that New York City will experience more than twice the current number of torrential rainfall events and triple the current number of extreme heat days over 90 degrees.

That's why we must act now to protect against the threats we know are coming. We have developed plans to address the extreme weather events our city will face in the years ahead.



South Ferry Station after Superstorm Sandy

Working to withstand stormwater floods from torrential rainfall

A total of 418 of New York City's 665 miles of subway track are underground. When stormwater from average rainstorms (that produce less than 1.75 inches of rain per hour) enters the underground subway system through openings like street vents and stairways, it travels through a complex underground hydraulic system. This system of drains, drain lines, and pumps connects to the city's sewer system to drain the stormwater and keep the system dry.

However, during torrential rainfalls, stormwater can collect on the street and inundate our underground system, flood stations and track, and damage critical infrastructure like communication and electrical equipment. For example, in August 2007, when roughly 3.5 inches of rain fell in parts of Brooklyn and Queens over a two-hour period, it caused a shutdown of subway service.

More recently, in September 2021, Hurricane Ida brought a record 3.15 inches of rainfall in one hour and a total of 6-8 inches of rainfall in some locations across New York City, causing critical damage and service suspension across the system.

In response, we installed new mitigation measures, like raised stairway landings, raised vents, and flash flood mechanical closure devices, across stations that are vulnerable to torrential rainfall flooding.

Over the next 20 years, we will continue investing in these "passive" protection measures, which do not require special deployment but begin working as soon as rainfall begins. We will also invest in increasing pumping capacity and sump pit detention capacity across the system to reduce the amount of stormwater draining to the city's overwhelmed sewer system.

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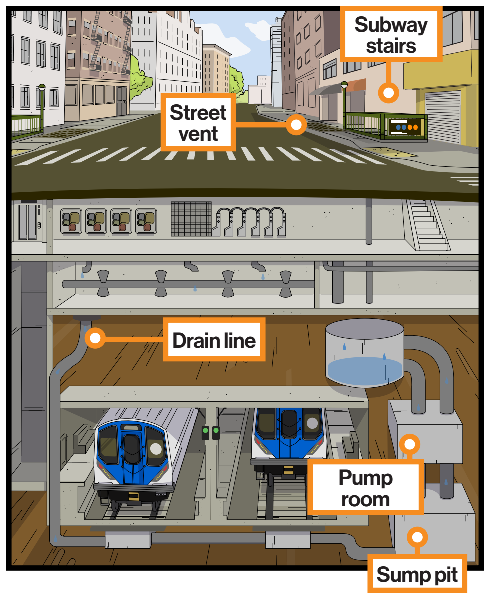
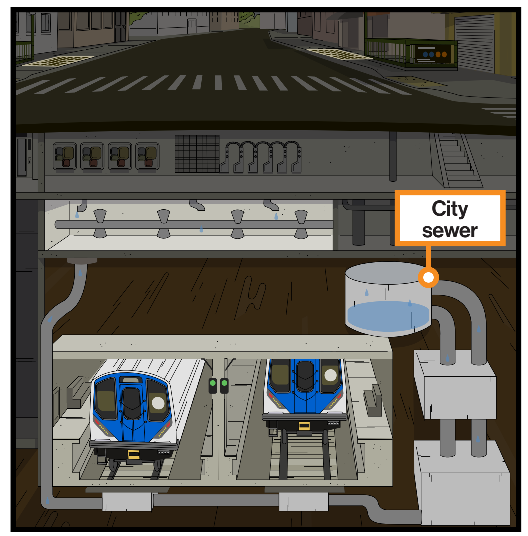
How stormwater from torrential rainfall can flood the subway

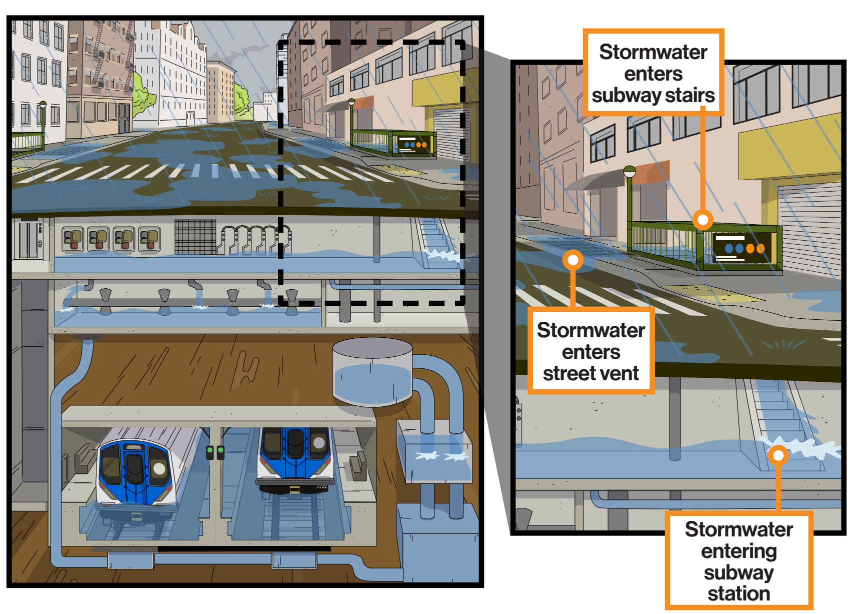
1. A complex system of underground drains, drain lines, pumps and sumps keeps the subway system dry during normal conditions.



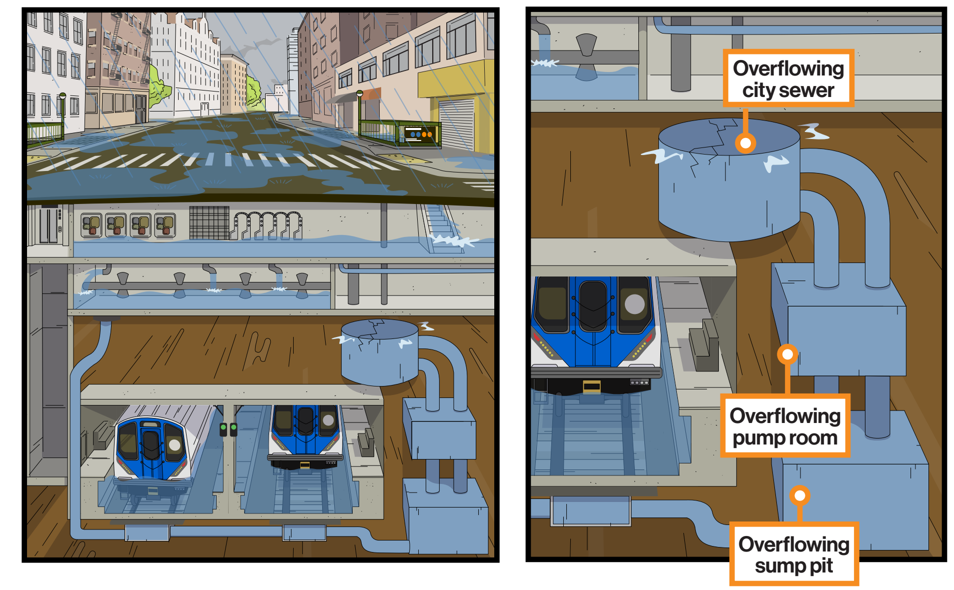
2. The subway drainage system connects to the New York City storm sewer system that takes the water to the local wastewater treatment plant.



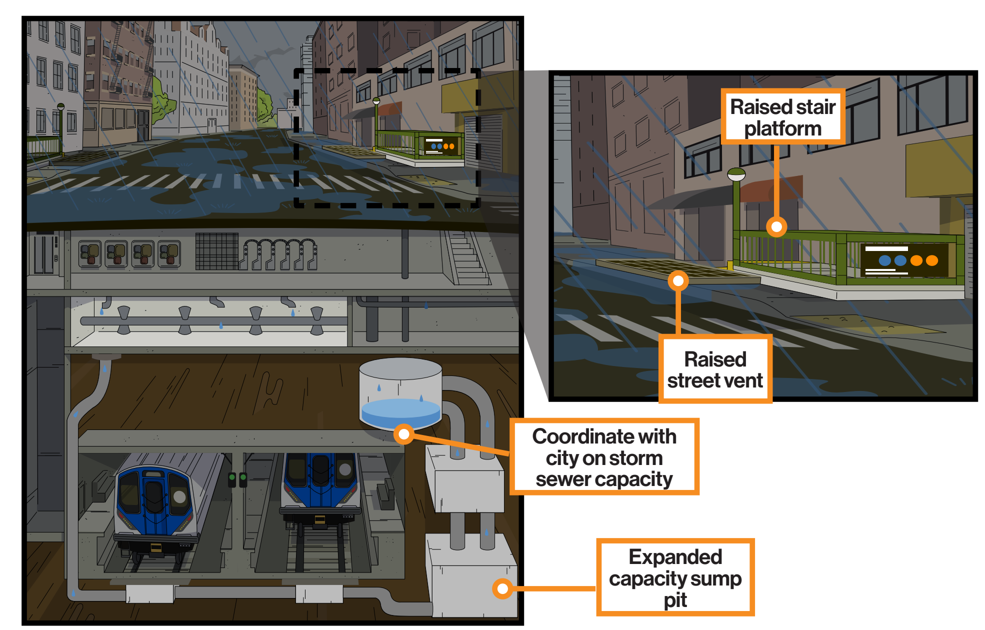
3. When sewers are overwhelmed, torrential rainfall events cause water to collect on the street. This stormwater can enter the subway from the street through openings like sidewalk vents and stairs.



4. In addition to entering the subway from the street, stormwater can also back up within the subway when sewers are overwhelmed.



5. Over the next 20 years, we will adapt the subway to more torrential rainfall events by installing more flood mitigation measures at the street-level and improving the subway drainage system where possible. We will also coordinate with the city to reduce the impacts of overwhelmed storm sewers.



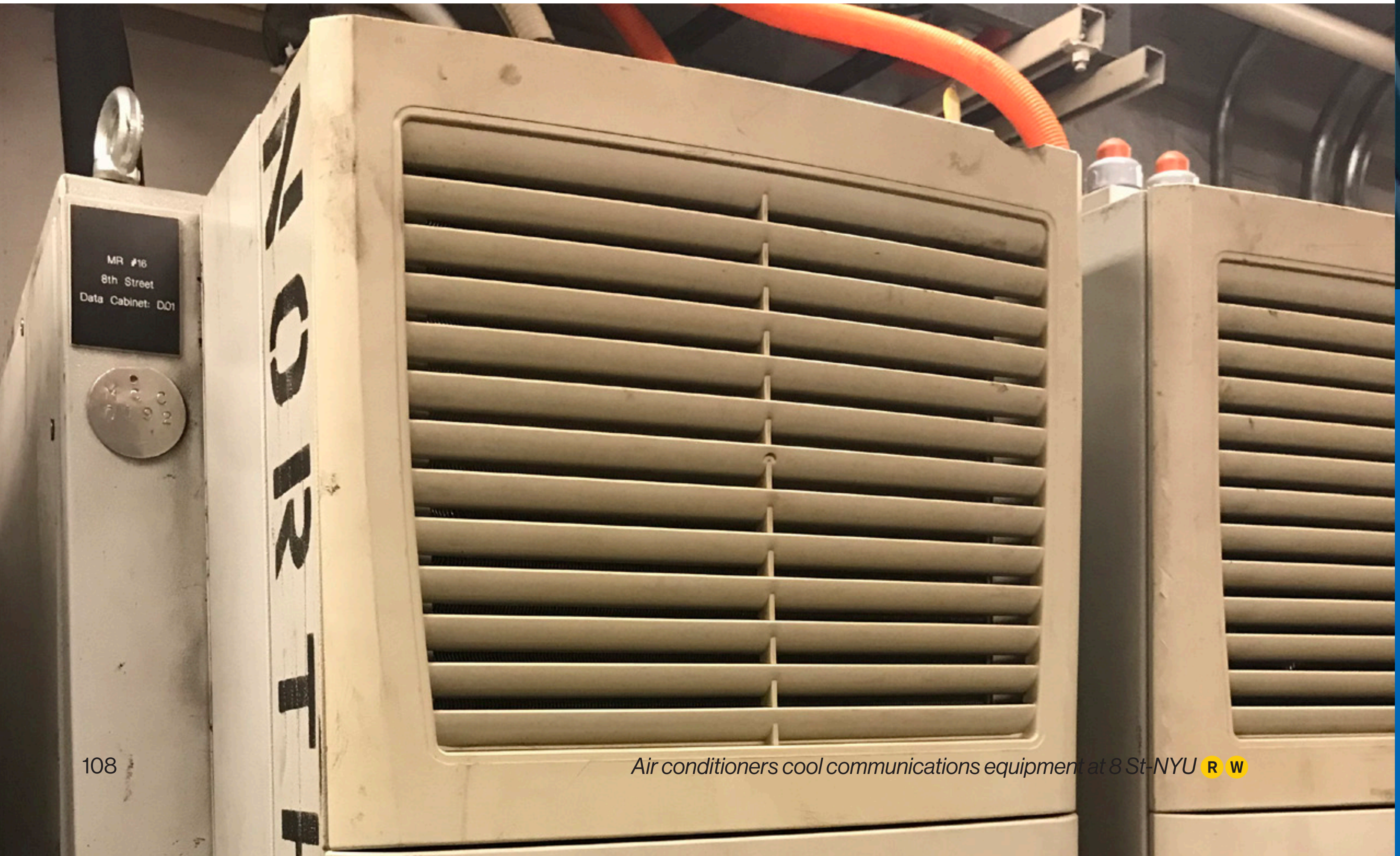
Subway Resilience Case Study

Preparing for more extreme and prolonged heat waves

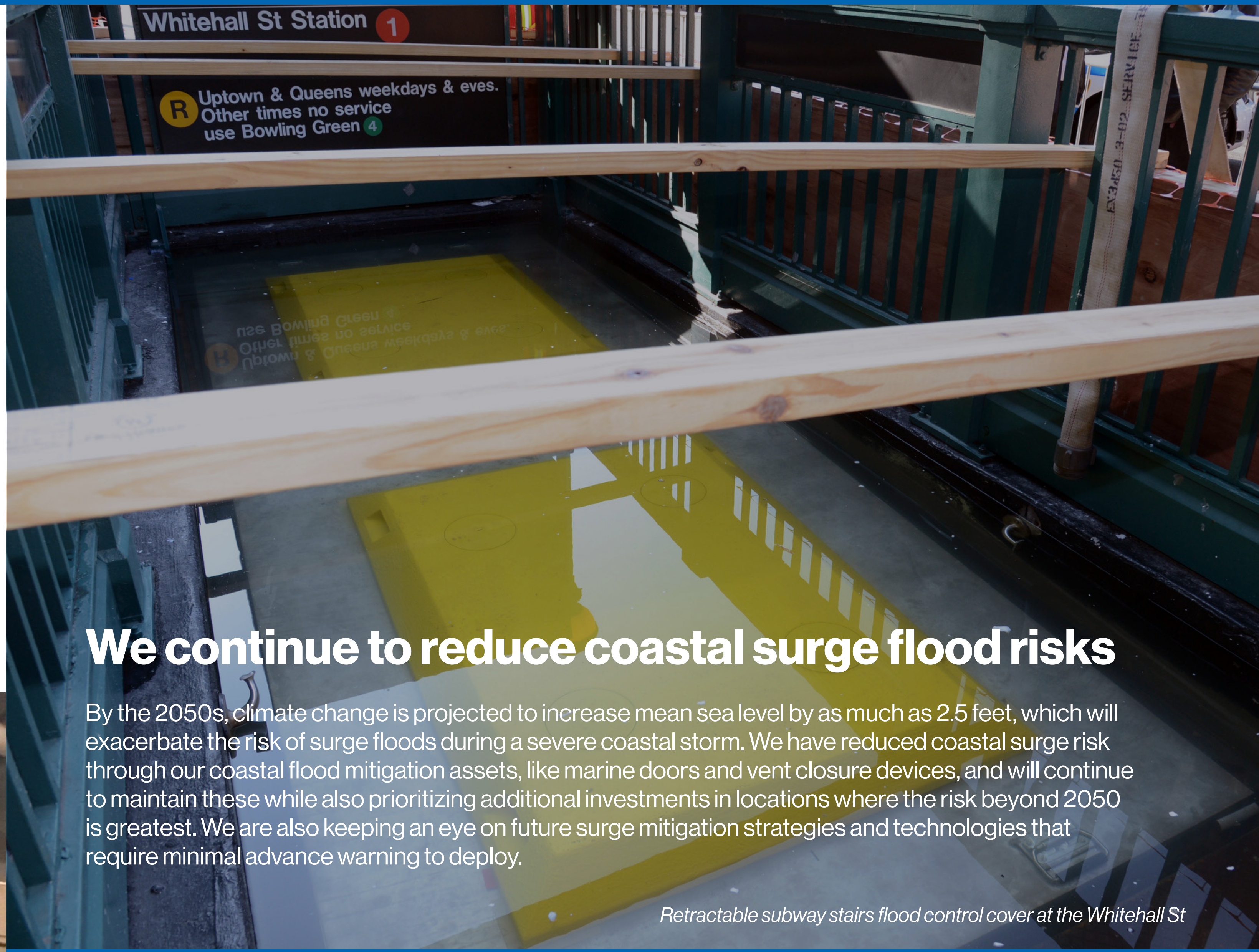
Extreme and prolonged heat days above 90 degrees are projected to increase from 17 days per year to more than 65 days per year by the 2050s. This kind of heat can cause exposed, outdoor tracks to expand, buckle, and kink, posing a derailment risk. Subway signals and switches can also expand and malfunction, disrupting service; and communication and fare control equipment can degrade and impact closed-circuit television (CCTV) and voice and data communications with customers.

To account for the prolonged heat waves that will occur over the next 20 years, future design of projects will consider heat-related impacts. We will also collect real-time temperature data in stations and assets within stations, like communications and electrical rooms, to prioritize investments in cooling and air circulation technologies.

Technician collects temperature data on subway car while testing HVAC systems



Air conditioners cool communications equipment at 8 St-NYU R W



We continue to reduce coastal surge flood risks

By the 2050s, climate change is projected to increase mean sea level by as much as 2.5 feet, which will exacerbate the risk of surge floods during a severe coastal storm. We have reduced coastal surge risk through our coastal flood mitigation assets, like marine doors and vent closure devices, and will continue to maintain these while also prioritizing additional investments in locations where the risk beyond 2050 is greatest. We are also keeping an eye on future surge mitigation strategies and technologies that require minimal advance warning to deploy.

Retractable subway stairs flood control cover at the Whitehall St

We must rise to the climate change challenge

With the investments of the past 15 years, the New York City subway system is undoubtedly more resilient to climate risks than it was before. But climate change will continue to expose the system to new and growing risks. That's why we are taking a proactive approach to anticipate and prepare for future threats by continuously assessing climate risk and making the capital investments needed to protect the system from extreme weather for the next generation.