By Ted C. Fishman

The old stark skyline is gone. It's Chicago, April 2068. Gardens grow on the sides of skyscrapers that house the city's 20 million residents, many of them refugees from coastal regions consumed by the sea. The vertical gardens absorb rainwater, which is then used to irrigate flowers and vegetables—and to flush toilets. Across from Lincoln Park Zoo, on the balconies of the 90-story Ken Griffin Tower, the world's largest single-family residence, are 2,400 trees, 30,000 native plants, and 100 bird species, including hens for eggs.

The city's greenest neighborhood, North Lawndale, is also its trendiest. Old-timers in that West Side neighborhood can still remember the crime-ridden days before the city installed the first parks engineered to stop flooding. Now every block features fountains animated by rainwater, which then feed small streams and irrigate fruit trees and greenhouses. Amazon Market ships prized Chicago-grown apples and pears to affluent foodies all over the country. "Resilient parks" like these fill nearly every ward in the city, creating a vast chain of green space that doubles as an infinitely capacious reservoir.

Despite the intense rain and snow that global warming inflicts on northeastern Illinois, the floods that once plagued Chicago have ended. Thousands of square miles of highways, roads, and parking lots are paved with materials that let water pass through. Tiny solar panels in the roadways ensure that the surface temperature never drops below 33 degrees. That helped the region abandon salt for melting ice, a necessity given the amount of local land and groundwater that was ruinously salinated.

In the early part of the century, the asphalt-choked city was a sweltering "heat island." On hot summer nights, neighborhoods away from the lake—starved for trees and grass back then—could be 20 degrees warmer than less developed towns to the west. Now the permeable surfaces actually cool Chicago—enough to almost counteract the rise in temperatures from climate change.

Abundant freshwater has been key to the area's growth. When Amazon brought its second headquarters to Chicago in 2022, the city's relatively stable climate and access to the lake was a clincher. Most of the 50,000 employees are gone now, replaced with robots and drones. But Amazon still needs the city's water: It cools the company's fusion energy generators. Chicago's aquatic resources have spurred other innovation, too. When a 100-acre indoor almond orchard opened last year inside the Old Main Post Office, dark since the last century, former Californians who remembered when nut trees could grow in their state formed a drum circle and lifted glasses of Fox Valley Pinot, made from grapes transplanted from drought-desiccated Napa.

Chicago finally got its third Major League Baseball team, too—the Marlins, which relocated after the Atlantic finally overtook Miami. Opening day at Portillo's Field, against the St. Louis Carp, is a sellout. Before throwing out the first pitch, Mayor Bezos Kennedy spots St. Louis's bulbous mascot leaping around. She turns to her husband and says, "I'm so glad we re-reversed the river."

Can Chicago really become a better, maybe even a far better, place while much of the world suffers the intensifying storms and droughts resulting from climate change? A growing consensus suggests the answer may be a cautious yes. For one, there's Amir Jina, an economist at the University of Chicago who studies how global warming affects regional economies. In the simulations he ran, as temperatures rise, rainfall intensifies, and seas surge, Chicago fares better than many big U.S. cities because of its relative insulation from the worst ravages of heat, hurricanes, and loss of agriculture.

Karen Weigert, a fellow at the Chicago Council on Global Affairs and formerly the city's first chief sustainability officer, is banking on this bright vision of Chicago's future. In an op-ed in the *Chicago Tribune*, she touted it hard in lobbying Amazon to build its new headquarters here. "[Bezos] has to manage his downside," she tells me. "If you think about climate as a risk factor, this is a thriving city that will be better than a lot of other places when it comes to climate change."

Thirteen million Americans live in areas considered at high risk of coastal flooding. Many millions more face imminent water shortages. Most of the Southwest, for instance, may be facing a deadly megadrought worse than anything seen during the last 2,000 years. Scientists, including a group at NASA, think that's a near certainty sometime not long after 2050 if carbon emissions continue along their current trajectory. Wildfires will become more frequent across the West Coast, threatening even the historically soggy Pacific Northwest. The list of apocalyptic scenarios goes on and on.

"We're going to be like the Saudi Arabia of freshwater. This is one of the best places in the world to live out global warming."

David Archer, geophysical science professor at the University of Chicago
So yeah, when you look at it that way, we do have a lot going for us. At play these days in Chicago is a certain amount of what psychologists call situational optimism, an expectation of a future that's good relative to what else is around. The world might be a garbage fire in 50 years, but we'll be floating merrily on Lake Michigan in a flame-resistant dinghy. It's going to get hotter here—two to seven degrees by century's end, under the most optimistic projections. But that's nowhere near as bad as the big cities in Texas, Florida, and Southern California that by 2050 are projected to wither under 105-degree days for about a third of the year. And, of course, we're not on a coast being chipped away by perilously rising seawater. We also aren't at risk of rising sea levels pushing salt into the groundwater.

Indeed, the Great Lakes could be considered our greatest insurance against climate change. They contain 95 percent of North America's supply of freshwater—and are protected by the Great Lakes Water Compact, which prohibits cities and towns outside the Great Lakes basin from tapping them. While aquifers elsewhere run dry, Chicago should stay flush for hundreds of years to come.

"We're going to be like the Saudi Arabia of freshwater," says David Archer, a professor of geophysical science at the University of Chicago. "This is one of the best places in the world to live out global warming."

There's just one problem: Water, which should be our salvation, could also do us in.

Coming Soon: The Eco-Friendly Park

In June, as part of a pilot program, the city is opening eight parks on the West Side, including the one depicted below in North Lawndale, that are engineered to reduce flooding and boost the environment. Eventually, such parks could be added citywide. Here's how they work.

1. Permeable pavement—grids of granite pavers that allow water to pass through the gaps—cover the pathways. A layer of gravel underneath it slows rainwater so it doesn't overwhelm sewers during storms.

2. Prairie plantings that mimic a wild environment, such as prairie dropseed, American gold rush black-eyed Susans, and white wild indigo, reduce runoff by absorbing water through their roots, which extend as much as 30 times deeper than the roots of grass. They also help remove heavy metals like lead from the water before it enters the sewer.

3. Water vapor released by the leaves of trees helps keep the lot cool. (Shade helps, too.) If the city builds enough of these parks—in the hundreds—they could help reduce the heat island effect of all the asphalt and pavement in the city, bringing down the overall temperature.

RENDERING: COURTESY OF AECOM

The first drops of the impending deluge have already fallen. Every one-degree rise in temperature increases the atmosphere's capacity to hold water vapor by almost 4 percent. As a result, rain and snow come down with more force. Historically, there's been a 4 percent chance of a storm occurring in any given year in Chicago that drops 5.88 inches of rain in 48 hours—a so-called 25-year storm. In the last decade alone, we have had one 25-year storm, plus a 50-year storm *and*, in 2011, a 100-year storm. In the best-case scenario, where carbon emissions stay relatively under control, we're looking at a 25 percent increase in the number of days with extreme rainfall by the end of the century. The worst-case scenario sees a surge of 60 percent. Precipitation overall may increase by as much as 30 percent.

In other words, for us it could be death by a thousand raindrops. That's because of an inherent shortcoming with our infrastructure: "The current system is built to handle the rainfall patterns that existed from the 1930s through the 1980s," says Nora Beck, who oversees water issues for the Chicago Metropolitan Agency for Planning. "We're already seeing a change in the patterns since then." What about colossal new containment projects like the Deep Tunnel? Phase one of the $2.8 billion bedrock cavern opened in 2006 expressly to manage water from big storms, but a storm last October already overwhelmed it. The $1 billion McCook Reservoir, an abandoned quarry that can hold 3.5 billion gallons and will increase its capacity by 6.5 billion by 2029, was supposed to dramatically slash the number of flooding events. It, too, reached capacity recently after heavy rains combined with a large melting of snow in February, just two months after the reservoir opened. The projects will certainly help ease flooding. But with the number of storms on the rise, even these mega-reservoirs aren't enough.

The Deep Tunnel, the first phase of which opened in 2006, will eventually handle 17.5 billion gallons of water—not nearly enough for the coming deluge. Photos: Ernie Cox Jr./*Chicago Tribune*

Our limited ability to manage frequent and intense storms is threatening our prime asset: the lake. At the turn of the 20th century, we thought we'd largely solved the problem by reversing the river so that instead of contaminating our drinking water, excrement-laced storm runoff

flowed to the mighty Mississippi. This created a circumstance that Dan Egan, author of *The Life and Death of the Great Lakes*, characterized as “a continental-sized commode, turning Lake Michigan into the world’s largest toilet tank, and the Gulf of Mexico into its toilet bowl.”

In strong storms, though, the reversal of the river falls apart, and wastewater again flows into Lake Michigan. Last October, after the region received four inches of rain in 24 hours, the Metropolitan Water Reclamation District opened locks in both Wilmette and the Near North Side. It was just the latest of more than 30 such incidents in as many years. Together they have poured a total of 46 billion gallons of filth into the lake. This scenario repeats itself when we get as little as two-thirds of an inch of rain over a short period of time, a threshold we can expect to reach even more regularly in the future.

Extreme rainfall doesn’t just threaten the environment. It threatens our property values and the very viability of our neighborhoods. After all, the lake isn’t the only place poop flows when it storms. Chicago is among the flattest big cities in the world, so gravity doesn’t help funnel water away, explains David St. Pierre, the executive director of the MWRD. It’s built on a paved-over swamp where manmade surfaces like roads, parking lots, and roofs defy good drainage, so when the rains come, they often have nowhere to go but our basements. Many of us are already all too familiar with the ocean of ick that bubbles up during downpours. “People say that in Chicago, basements are the big hidden reservoir,” Beck says.

The Center for Neighborhood Technology examined five years’ worth of insurance data for Cook County. From 2006 through 2011, there were 181,000 flood claims amounting to $773 million. Seven in 10 flood victims here were hit three or more times during that period, according to the CNT, with the average claim totaling $4,300. (It’s a far from perfect indicator: The vast majority of flood victims have no insurance.) Among the hardest-hit places were poor areas like Lawndale, Roseland, and the town of Midlothian.

“People say that in Chicago, basements are the big hidden reservoir.”

Nora Beck, senior planner at the Chicago Metropolitan Agency for Planning

The waterlogged version of Chicago’s future has already arrived in Chatham. The South Side neighborhood, home to around 30,000, has long been an enclave of middle-class black families. Cheryl Watson, who lives in a bungalow her father bought decades ago, calls Chatham “Exhibit A for flooding.” Water regularly ran through the streets even before 2013—the year many consider a tipping point, after which Chicago started to see more frequent and more brutal rains. Sometimes the mucky mix of storm water and human waste makes it past Watson’s basement stairs and onto the first floor. In some houses, the structural damage and mold are so severe that residents exile themselves to their second floors and then their attics. “There was a lot of heartbreak,” Watson says.

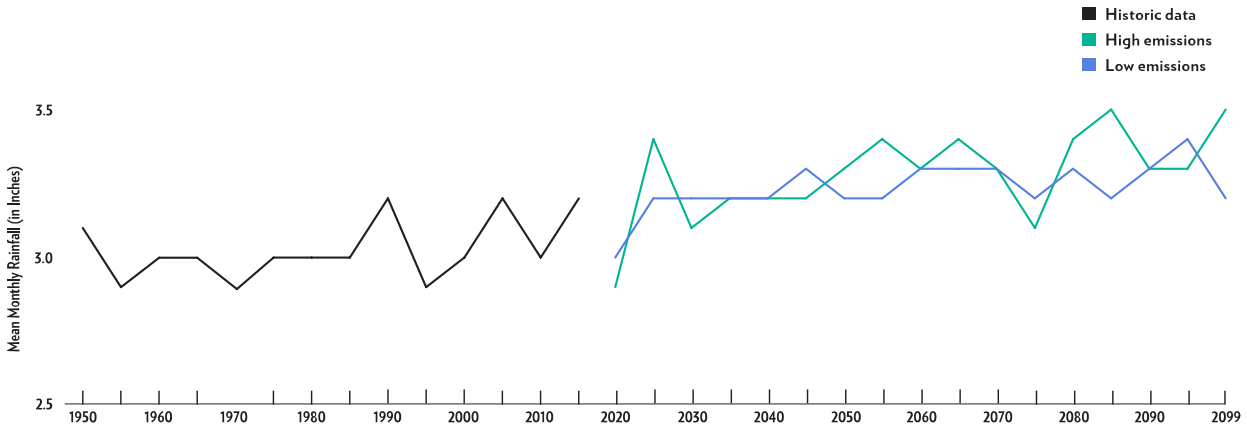
The effect on Chatham has been devastating. Houses are getting so wrecked that middle-class families are moving away. Long-established businesses that catered to the community have left, too, and new ones that come in frequently turn over, Watson says. Flooding cannot be entirely to blame, but wet basements alone tend to cut property values between 10 and 25

percent. If climate change triples the number of precipitation events that cause flooding, the city will need a mini-Marshall plan to overcome the billions lost in degraded home values and blighted neighborhood economies.

To manage the coming waters, the city and region need to somehow retrofit the landscape, but not with a few breathtakingly large caverns like the Deep Tunnel or the McCook Reservoir. The solution lies, instead, in millions of minuscule cracks.

Water, Logged

Cook County is expected to get more frequent and more intense storms in the coming decades, putting Chicago at increased risk of flooding. Here, a look at rainfall projections under two scenarios, depending on future carbon-emission levels.



SOURCE: U.S. Geological Survey

On a conference table in the Willis Tower office of the Chicago Metropolitan Agency for Planning sits a mountain of reports on the region's physical and social future. Beck, whose job is to assess water needs and infrastructure plans, jumps from one minutely detailed map to another. They trace the path of virtually every drop of water in northeastern Illinois. Areas in and around downtown Chicago are 70 to 80 percent covered by impervious roads and structures, as are most commercial areas of the suburbs—a vast concrete and asphalt crust meant to keep the swampy earth firmly at bay.

Many city planners believe reducing flooding will require cracking that crust and making it permeable, or rather replacing it with surfaces designed to allow water through to absorb directly into the soil. Implementing that kind of infrastructure, Beck says, isn't as overwhelming as it sounds: "Every time there's reinvestment in a project, there's an opportunity to improve the water management." One place to start: our roadways. Most often composed of concrete or stone grids—like a tile floor minus the grout—permeable pavement sits atop layers of gravel and earth, which slow the flow of water and naturally filter contaminants. There are thousands upon thousands of streets to tackle, yes, but they get resurfaced regularly anyway. (It's unclear whether permeable pavement can handle the load of a major highway, but even redoing the shoulders would be enough to manage all the water that hits the roadway.)

Of course, roads aren't the only rock-solid surface ripe for transformation. In Chicago, 15 paved schoolyards have already been or soon will be converted to landscapes that absorb and collect rainwater and also give schoolchildren green space. Now the yards collectively hold 2.5 million gallons of storm water in rain barrels and in two-foot-deep layers of gravel buried beneath permeable turf. Getting the yards rebuilt took multiple organizations working together with shared funding, including the MWRD, the Chicago Department of Water Management, Chicago Public Schools, and Openlands, a nonprofit dedicated to urban green space. Making over the region won't be cheap. Permeable surfaces cost two to three times as much as

traditional asphalt and concrete. Over time, however, the savings created by smarter infrastructure—fewer big pipes needed underground, less demand on treatment plants—can make up for the initial expense.

Mayor Richard M. Daley took the first big stab at converting Chicago's impervious surfaces in 2000 with his green roof initiative, which added greenery and other features to the tops of municipal buildings, including City Hall. Businesses and homeowners were offered incentives, too. The program continues under Mayor Rahm Emanuel and, according to the city, now covers 500 roofs and has the capacity to manage 70 million gallons of rainwater. (Keep in mind, though, that one inch of rain means 4 billion gallons dumped on the city.)

Green infrastructure has an influential champion in Emanuel. The issue doesn't get the play of crime, schools, or property taxes, but building the city's future around water has arguably been his core issue since he first took public office in 2003 as a U.S. congressman from the 5th District, representing much of the North Side. Through the years, he's been a vocal advocate for the region's water. "[One of my] first bills [as a congressman] was the Great Lakes Restoration Financing Act," he boasts when he calls me, fittingly, during a break at a conference in Denver on water infrastructure. That bill, which would have delivered $4 billion to fund preservation initiatives, failed—a major setback for the region in the eyes of environmentalists. Recently, Emanuel has been part of the ongoing fight to preserve $300 million in annual funding for strengthening freshwater infrastructure in the Great Lakes; President Donald Trump has threatened repeatedly to slash funding to as little as $10 million. Emanuel also pushed for a near-complete overhaul of the city's 900 miles of water mains, which were breaking 3,500 times a year, wasting an estimated one-eighth of the city's drinking water annually.

"If I went into the City Council and advocated for a water project by saying it was about climate, I'd get nowhere. But part of politics is building political and public support for projects for the next two to three years that are really about the next 25 to 30 years."

Mayor Rahm Emanuel

As imperative as such changes are, they're hardly immune to political spin. "If I went into the City Council and advocated for a water project by saying it was about climate, I'd get nowhere," the mayor says. "They'd laugh at me. But part of politics is building political and public support for projects for the next two to three years that are really about the next 25 to 30 years."

It makes sense for Emanuel to focus so sharply on water. Being smarter about the way we push it around has benefits that go far beyond staving off floods. Because permeable pavement lets water through to the ground, roads freeze much less frequently. Good riddance to road salt and the damage it causes to soil, vegetation, and animals. Permeable surfaces also can fundamentally change the way water is cleaned. "When you put water in the soil, treatment occurs," says Pete Weiss, a professor of engineering at Valparaiso University who

studies permeable pavement. “Contaminants are absorbed by the soil. Biological activity degrades the organics [such as human waste], and the metal particles in storm water can be absorbed. … Over years or decades, water can get back into the lake and also recharge area aquifers.”

In areas of northeastern Illinois that draw their water from aquifers—some of which have been depleted to half their natural volume—there would be less pressure to eventually tap into the lake and risk pushing the state over its legal allotment, something that’s already happened several times since the the cap was imposed in 1967. (We’re now back in compliance, drawing 76 percent of our share in 2013, the most recent data available. Our 40-year average, however, is 97 percent.)

In short, green infrastructure would allow water that falls here to stay in the Great Lakes system rather than get shunted off to the Mississippi basin as wastewater. It would also ease the burden on our treatment plants. Not only do those facilities tackle the 1.4 billion gallons we send down the drain on a typical day, they also process runoff from rain before dumping it into the river. While the treated water is technically clean, MWRD says it is still not “intended for drinking.” (Make of that phrasing what you will. The dead zone in the Gulf of Mexico is largely a result of the nitrogen and phosphorous in spent water from the metro area.) If the region’s soil provided an assist—doing some of the heavy work of filtering rainwater—we’d finally be able to restore the Chicago River’s natural lakeward flow by closing off the Chicago Sanitary and Ship Canal that tugs it west. (It would also improve the ecosystem by closing the point of entry for invasive species like Asian carp.)

In her 2011 book *Reverse Effect*, the architect Jeanne Gang advocates for doing just that. “Rather than seeking to control nature with technology,” Gang writes, “we will discover instead that … nature becomes technology.”

On a sunny but bitterly cold February day, Michael Berkshire, green projects administrator with the city’s Department of Planning and Development, and I ride the Pink Line to the Central Park station to get a glimpse of the potential Eden that people dream of for Chicago. He’s come to look over five of the small landscapes taking shape in flood-prone North Lawndale’s new “resilient corridors.” In the near term, the city will build 10 such parks on the West Side. The city is using $7.6 million in disaster relief funds it received from the Department of Housing and Urban Development after April 2013 storms to convert vacant lots—the city owns many in North Lawndale—into landscaped areas that can diffuse storm waters that would otherwise rush down local streets and into residents’ homes.

The first stop is a triangular lot behind the station. It’s covered with three feet of fresh gravel, which will ultimately be crowned with granite paving stones separated by pebbles rather than grout. In some cases, the permeable surface is designed to allow stormwater to descend into the earth. In others, the gravel will slow down the flow into sewers, preventing them from exceeding their capacity and pushing water into homes during storms. Small manmade streams running through some lots will help direct drainage and also attract residents. Healthy

street life, the thinking goes, makes the neighborhood safer and livelier. Berkshire points to an adjacent alley that will divert water to a storage area beneath the lot. Some of the parks will include beds for growing flowers, fruits, and vegetables.

As Berkshire walks the lot, a couple of women pass by and ask what he's up to. He describes the project and adds that the space may be used as an outdoor classroom for schoolchildren.

"We need help with the flooding *and* with the kids," says one of the women, smiling.

They move on, and Berkshire explains that the city is working with community groups to maintain the lots. (The porous surfaces require frequent cleaning.) He pulls out design renderings of the parks. The gardens are abloom with trees and flowers. The granite pavers, in grays and white, will reflect heat in the summer. The streams will be lined with natural stones. The drawings don't show the half-million gallons of water each year that the parks will safely funnel back into the earth.

Berkshire, who has worked on sustainability projects for the city for 15 years, is energized by what he sees. This part of North Lawndale, which until now was one of the neighborhoods most lacking in green space, is blazing hot in the summer. The resilient corridors, it's hoped, can create cooler microclimates. Berkshire envisions businesses springing up around the parks, too. "This is an attempt to address a lot of problems," Berkshire says: health, community cohesion, jobs, crime. And of course the deleterious cycle of flooding that keeps property values down and discourages investment. If these pilot parks, which will open in June, are a success, Berkshire says, his department will seek funds to build dozens, even hundreds, more —a green archipelago extending across the city.

Just as the creation of the Chicago Riverwalk refashioned a formerly forbidding stretch of commercial waterfront downtown, the resilient corridor model could have a similarly enlivening effect on the city's landlocked areas. A Chicago that thrives even in the era of climate change comes into view.