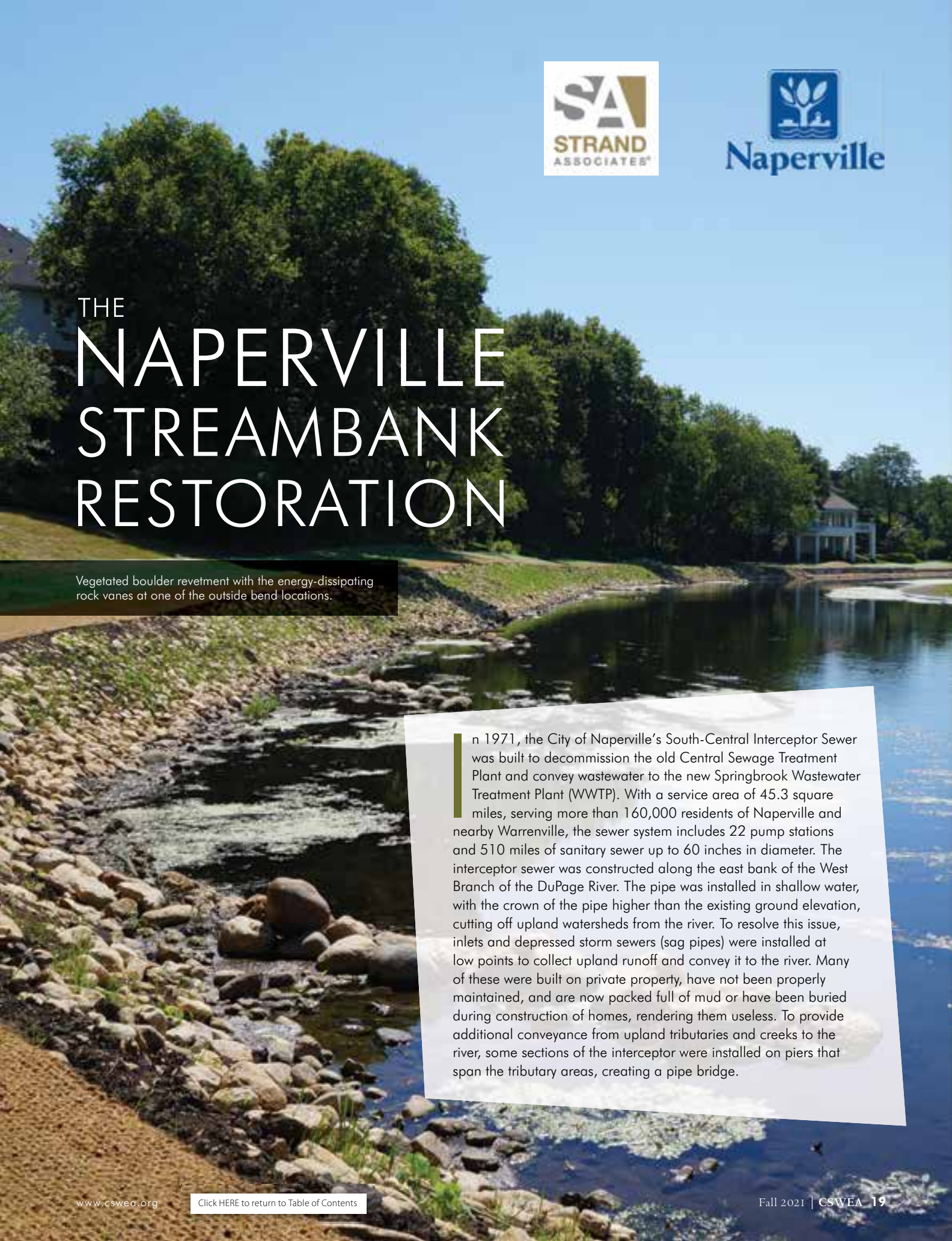
THE NAPERVILLE STREAMBANK RESTORATION



Vegetated boulder revetment with the energy-dissipating rock vanes at one of the outside bend locations.

In 1971, the City of Naperville's South-Central Interceptor Sewer was built to decommission the old Central Sewage Treatment Plant and convey wastewater to the new Springbrook Wastewater Treatment Plant (WWTP). With a service area of 45.3 square miles, serving more than 160,000 residents of Naperville and nearby Warrenville, the sewer system includes 22 pump stations and 510 miles of sanitary sewer up to 60 inches in diameter. The interceptor sewer was constructed along the east bank of the West Branch of the DuPage River. The pipe was installed in shallow water, with the crown of the pipe higher than the existing ground elevation, cutting off upland watersheds from the river. To resolve this issue, inlets and depressed storm sewers (sag pipes) were installed at low points to collect upland runoff and convey it to the river. Many of these were built on private property, have not been properly maintained, and are now packed full of mud or have been buried during construction of homes, rendering them useless. To provide additional conveyance from upland tributaries and creeks to the river, some sections of the interceptor were installed on piers that span the tributary areas, creating a pipe bridge.

The populations of both the City of Naperville and DuPage County have grown rapidly since the 1970s, with 87% of the residential housing in Naperville built after 1970. Because of the urbanized nature of the watershed, runoff volumes and water levels rise and fall quickly in response to rainfall, leading to erosion where surface flows pass over, and in some cases under, the interceptor and along the riverbank. Continued riverbank erosion has cut away more of the riverbank and adjacent land, causing the interceptor sewer to become exposed in some locations. These continuing hydromodifications threaten the interceptor and create operating problems for the City.

In 2015, the City hired Strand Associates, Inc.® (Strand) to study the relationship between the river and a 7,000-foot segment of the sewer to identify a way to stabilize and protect this valuable piece of public infrastructure. The project began with a comprehensive river corridor evaluation to identify, GPS locate, document, rate, and prioritize hydromodification issues related to the interceptor as well as the general health of the river. The severity of riverbank erosion was ranked on a scale of two (slight) to five (very severe). Segments of the river that scored a three or higher, and the adjacent segments regardless of score, would be restored. Strand developed final engineering drawings and specifications for several stabilization techniques addressing different types of riverbank erosion and five different locations where upstream tributaries drain over the top or under the interceptor in route to the river. The evaluation also included a Property Ownership Investigation, which identified land ownership along the river. A 20-foot sanitary sewer easement runs through land adjacent to the river belonging to Naperville Park District, Forest Preserve District of DuPage County, and the City, as well as private owners.

In areas with the most severe erosion, vegetated boulder revetment was installed consisting of large stone boulders used to stabilize the bank. Between the boulders, topsoil was returned, and native plantings were incorporated to encourage vegetation growth. At locations along the river with outside bends, rock vanes into the river were installed to create an eddy, forcing velocity away from the banks and back into the river, reducing scouring of the riverbank.

Exposed interceptor sewer pipe.

After construction of the ledge stone wall, residents were already enjoying their new backyard by placing chairs at the bank.

Many of the backyard locations featured turf grass where the shallow rooted system was not able to hold onto the soils and stabilize the riverbank from erosion, resulting in an average backyard loss of 12 feet, with some locations experiencing loss of up to 25 feet. Ledge stone walls were installed, enabling up to 4 feet of backyard to be restored. These walls consisted of large, heavy cut stone used to provide vertical stability while maintaining a natural aesthetic.

Field evaluation also identified where the sewer interceptor was exposed because of the loss of soil cover over the pipe caused by upland runoff and riverbank erosion. Some of the most significant exposure was at pipe dam locations, where upland inlets and sag

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One of the pipe dam locations completed during construction in 2020.

A tree repurposed as fish habitat.

pipes were no longer in use, completely plugged up, or buried. Consequently, upland flow had no choice but to flow over the pipe, scouring away the earth until the pipe was acting as a dam.

One option to remedy this problem was to excavate underneath the pipe to create a pipe bridge, but the pipes were so close to the same elevation as normal river water levels that this would essentially just bring the river up into the upland area. It was decided to leave the pipes where they were and stabilize them in place by creating a pipe cradle that would allow the runoff to continue to flow over the pipe while maintaining current flow conditions and not backing up the flow upstream or impacting the wetland area created by the pipe dam.

Some of the pipe bridges had been incorporated into nearby trails as a way of crossing the tributaries, so they were left in place. However, there were still some upstream flow concerns that needed to be addressed. The pipe restricted the flow and velocity of the runoff underneath it, causing a buildup of debris upstream which put pressure on the pipe. The 10-year flood event would flow over the top of the pipe, increasing the velocity of flow and creating a significant amount of force on the pipe. To address the high flow velocities and scour energy underneath the interceptor sewer, it was decided to use a wire-connected articulated concrete block to provide protection against scour. The run in and run out sections in the side walls were stabilized with large diameter riprap and tied into the vegetated boulder revetment. To protect the pipe from upland debris, vertical concrete piles were installed to protect the pipe while allowing the flow under the pipe to continue to the river.

Along the riverbank, trees were removed because vegetation was not able to grow underneath the tree canopy, causing further erosion along the riverbank. Some trees were repurposed as fish habitat.

A previously performed detailed Wetland and Existing Vegetation Study was reviewed. Field delineation was performed and became a critical aspect in permitting, especially with DuPage County. Final permitting included requirements for native planting restoration, wetland restoration, and permanent wetland mitigation fees. A five-year monitoring period was set up to allow the City to evaluate and improve the wetland to earn some of the wetland mitigation credit back.

Construction was separated into stages to limit the area of disturbance along the corridor. Stage 1 began in July 2020 and was completed in September 2021. Stage 2, which encompasses the north end of the project corridor, will begin in 2022. The project was imperative to public safety since its purpose was to protect a major piece of City infrastructure. The City approved additional areas of riverbank erosion as a good-faith effort to the various property owners along the river corridor, especially to those who had lost nearly 15 feet of their backyards to the river. Since construction, a resurgence in wildlife has been enjoyed by area residents, including great blue herons, egrets, orioles, red winged black birds, deer, and muskrats, among others. CS