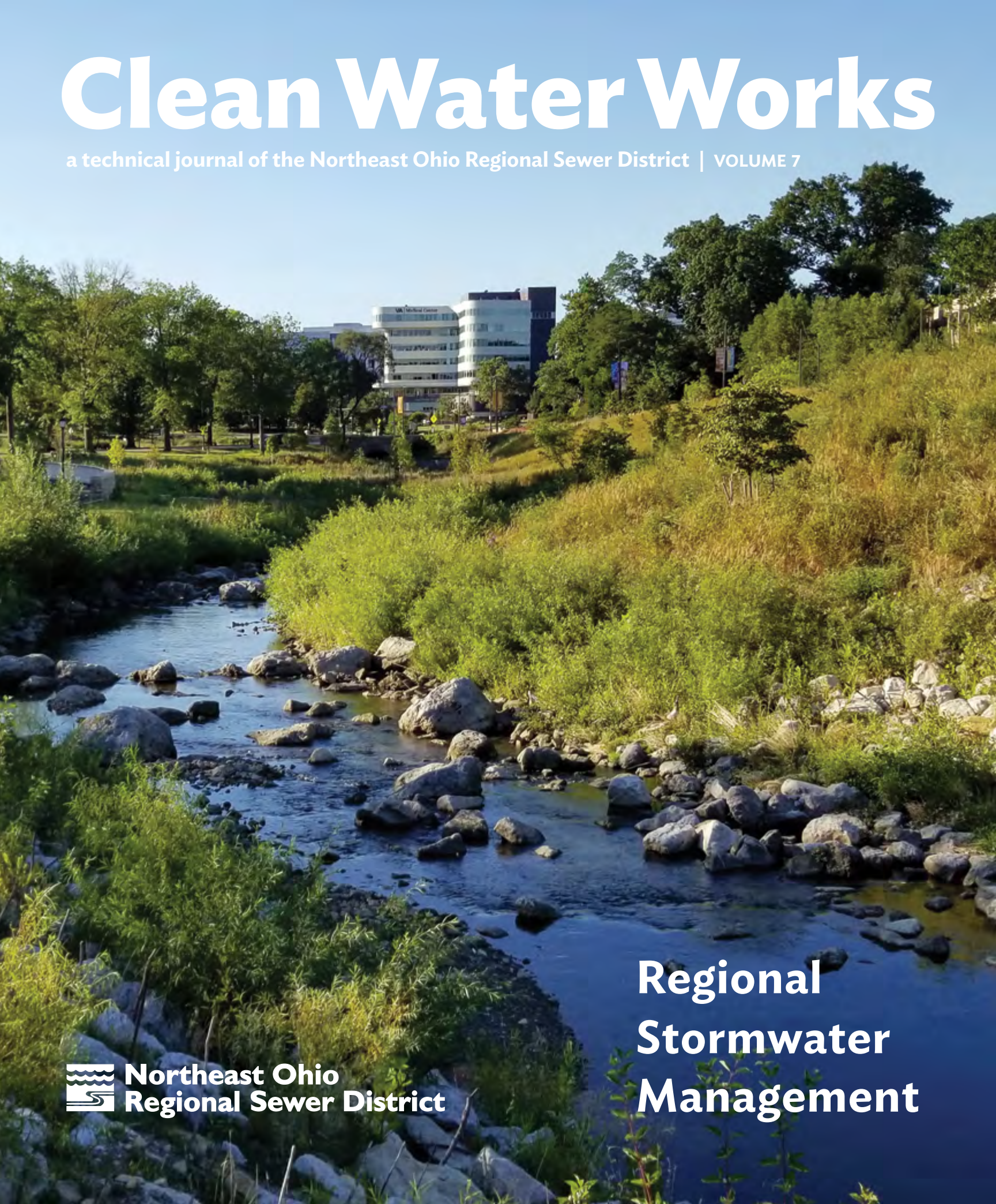
Clean Water Works

a technical journal of the Northeast Ohio Regional Sewer District | VOLUME 7



Regional Stormwater Management

Northeast Ohio Regional Sewer District

From the Director of Watershed Programs

ERIC MULL

Dear Reader,

It's a big problem when people worry about flooding every time it rains, and those worries have never been greater than now.

In Northeast Ohio, we are seeing more rain and an increase in major flooding events and related chronic issues like erosion. As we near year's end, we are about 14" above our normal local annual rainfall, with two of the top 10 highest-ever Cuyahoga River stages, as recorded by the U.S. Geological Survey. Also in 2020, Big Creek experienced four of its top 10 ever-recorded peak stages.

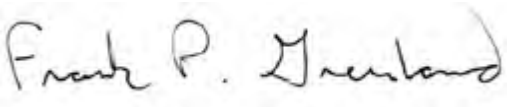
Stormwater problems directly impact our communities and economy. Having a program in place to start to turn things around and reverse those harmful trends is great for the region. As with the wastewater services that the Sewer District delivers, regional stormwater management is an essential business function, in terms of maintaining and protecting major infrastructure and mitigating flooding, erosion, and water-quality issues along area waterways.

We're out there every time it rains, trying to better understand stormwater problems, listening to community concerns, and making corrective actions.

Our stormwater program really shines in terms of what it does for the residents and our region on a day-to-day basis. The coordination and good will between the Sewer District and its member communities has been terrific as we've begun implementing much-needed projects. We're out there every time it rains, trying to better understand stormwater problems, listening to community concerns, and making corrective actions.

In this edition of *Clean Water Works,* numerous Sewer District teams share their thoughts on the work and coordination that drive the Regional Stormwater Management Program. To be clear: the success of the program is the people running it. They have the passion and the skillsets, and we are fortunate to have this exceptional staff.

I hope you enjoy reading about our stormwater program!



Frank Greenland has worked for the Sewer District since 1988. Formerly a Planning Engineer, Project Engineer, Planning Manager, Deputy Director of Engineering & Construction, and Director of Capital Programs, he is now Director of Watershed Programs. Mr. Greenland studied Environmental Engineering Technology at the University of Dayton and holds a master's degree in Civil Engineering from Cleveland State University.

Regular inspections and debris removal ensure that culverts provide good conveyance of stream flow.

Contents

Regional Stormwater Management Program

In addition to its wastewater treatment services, the Northeast Ohio Regional Sewer District is responsible for maintaining and repairing a stream system that is hundreds of miles long, and addressing serious flooding, erosion, and water-quality issues.

Cover story page 4

Data pages

Our Mission
is to provide progressive management of sewage and stormwater through fiscal responsibility, innovation, and community partnerships.

Our Vision
is to be the environmental leader in enhancing quality of life in the region and protecting its water resources.

This annual magazine gives subject-matter experts the opportunity to explain in greater detail our work and that of our partner agencies.

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ON THE COVER: The Doan Brook Streambank Stabilization Project at the Cleveland Museum of Art realigned a section of stream away from an eroding embankment and improved stream function. Photo by Kristen Buccier.

Rainy day woes

Hard surfaces can overload streams and systems

In addition to its wastewater treatment duties, the Northeast Ohio Regional Sewer District manages 476 miles of streams and rivers.

Prior to the Sewer District obtaining jurisdiction of these regional streams, they were managed locally by individual municipalities. This was problematic because each city typically worked on its own to solve the stormwater issues within its border, which frequently pushed the problem downstream into a different city. A regional approach was needed.

Aging infrastructure, an ever-expanding area of roadways, parking lots, and other hard surfaces, and more frequent and intense rain events due to climate change all contribute to flooding, erosion, and water-quality problems.

Across our region, pavement has replaced the natural green spaces that once slowed the pace of stormwater runoff from rain and melted snow and ice. Roads, parking lots, driveways, and sidewalks can't absorb water, so it moves quickly over these surfaces into nearby streams or sewers.

As stormwater flows over the ground, it also picks up debris, chemicals, and pollutants that can contaminate our drinking and recreational water supply. Unlike residential wastewater from toilets, showers, and sinks that is filtered through a wastewater treatment facility, anything that enters a storm sewer system or a roadside ditch can discharge directly into local streams and eventually Lake Erie. This leads to serious water-quality problems.

An established regional organization, the Sewer District has joined more than 1,000 communities, including Columbus, Cincinnati, and Toledo, that have created user fees to solve these stormwater problems.

Through its Regional Stormwater Management Program (RSMP), the Sewer District takes a holistic approach, managing multiple watersheds and working with municipalities and private property owners to address stormwater issues without pushing problems downstream.

"Thanks to our master-planning efforts, the Sewer District has a detailed roadmap of why problems occur and how to prioritize projects, so we can better structure our approach going forward," said Director of Watershed Programs Frank Greenland. "Through the work of our stormwater staff, the amount of contact we have with residents and community officials has been terrific."

Resiliency is a key term, and it applies to both the waste-

Flooding on Sheldon Road between Brookpark and Middleburg Heights

water and stormwater sides of the Sewer District's work. By building resiliency into the regional system to handle larger, more frequent rain events, the District has an opportunity to restore some urban streams by adding floodplain, arresting erosion, and improving water quality.

Fewer flooding incidents, healthier waterways, and a better quality of life for Greater Cleveland are the goals of the Sewer District's Regional Stormwater Management Program.

Streambank erosion on Mill Creek creeps towards Warner Road in Garfield Heights.

A barricade of used appliances forestalls erosion along Stickney Creek.

Erosion threatens a restaurant in Brecksville.

Debris pileup in Big Creek

Best laid plans

Looking at the big picture

Since stormwater problems cross community borders and boundaries, it's critical to get a big picture understanding of those issues.

Project Manager Michael Blair explains *master planning* as a health check on the regional stream system (RSS). "Master planning helps us get an overall understanding of the current state of the watersheds in our service area, the problems in those watersheds, and what measures we can take to stabilize or improve conditions with respect to flooding, erosion, and water quality."

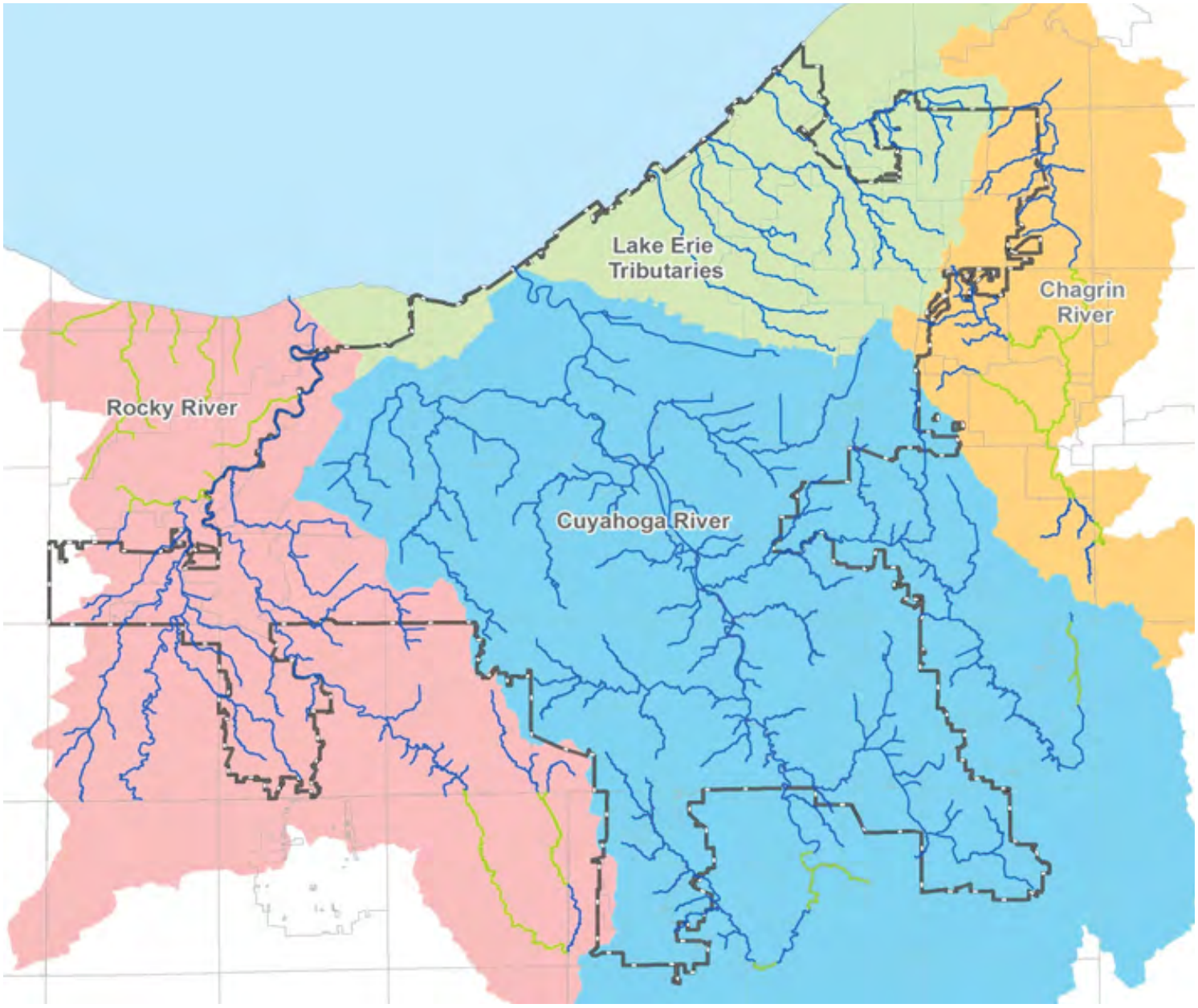
These are multi-year efforts to collect comprehensive data, including known problem areas, watershed hydrology, hydraulic info on culverts and bridges, and structural problems along the RSS. "We feed all of that into a modeling program and then run different storm events through the program to understand flooding issues," said Watershed Technical Support Manager Dave Ritter.

The Sewer District's analysis of how to best address these issues starts with a goal of attaining a 100-year level of service for each problem area. If you're unfamiliar with that terminology, a 100-year flood has a 1% chance of occurring in any given year, from a statistical perspective. (But it could still happen three years in row, or even three times in a year.) The probability of that occurring depends on rainfall amount, intensity, distribution, and watershed conditions. To reach a 100-year level of service is to eliminate all flooding problems to roads and buildings up to a 100-year flood.

"We look at the buildings, roadways, and utilities that are threatened and try to look at alternatives to get to that 100-year level of service," said Blair. "That gets expensive very fast, so we also look for 'low hanging fruit,' where we can go from a two-year level of service to a five- or ten-year level of service and get more bang for our buck."

Flooding itself is not a bad thing. It's a natural stream function. "Some areas flood simply because they are in a floodplain," added Webb. "We'll allow and even protect flooding in forested areas that don't pose a risk to buildings or roads." Only when flooding impacts the built environment does it really cause problems.

Even before master planning began, the Sewer District's Stormwater Inspection & Maintenance (SWIM) group was out walking the streams, identifying erosion problems, and assigning criticality values to buildings, transportation assets, roads, bridges, and utilities based on their proximity to the



The Sewer District divided its master planning into four areas: Cuyahoga River South, Cuyahoga North, Rocky River, and Chagrin River/Lake Erie.

streams. "We'd give a higher score to a hospital than to a business or a residence, a higher score to a highway or major road than to a residential roadway or footpath," said Blair.

The Stormwater Master Plan field crew assigns each asset a condition score of 1 through 5, and uses a back-pack-mounted, spherical-imagery 3D camera to record views of all the open sections of the stream. "We can go back and visit those sections as needed, and that's available to our consultants and stakeholders as well," said Blair.

The criticality value and the condition score are multiplied together to get an overall Risk Evaluation Score, which helps define problem areas within the RSS.

A preferred alternative is developed for each problem and nominated to the Sewer District's construction plan. Projects are ranked based on their ability to reduce risk of

It's an ongoing effort to keep the models updated because things are constantly changing within the watershed.

A spherical-imagery camera view of the Rocky River.

flooding or erosion, among other benefits, and implementation of projects is driven by the cash that's available. (No loans are taken out to build stormwater projects.) "We have enough work identified to last us a very long time," said Ritter.

"A lot of culverted streams may not have been looked at since they were constructed," said Ritter. "Getting a condition score and understanding risk, liability, and the cost to repair culverted streams has been a large part of these master plans." It's an ongoing effort to keep the models updated because things are constantly changing within the watershed.

Echo Lane, on the border of Broadview Heights and North Royalton, was one project that came out of master planning. A councilman called the Sewer District to complain about extreme, chronic flooding in his area. The SWIM group looked at the drainage issue that was occurring between the two cities. Master planning confirmed the extent of the flooding through modeling.

The team compared several options for resolving the issue. "Echo Lane had been overlooked in terms of maintenance, as a lot of basins are," said Webb. "We wanted to maximize the basin's ability to hold back water, and remove some sections of the culvert, open up the stream, and add more sinuosity, or bends, to the stream."

After a project is advanced to the design stage, the team works on property acquisitions and easements needed to complete the project. "The design of the project is partially determined by what properties we can get," said Ritter. "If a property owner says 'no,' that can stop a design dead in the water, or we have to adjust the design to work around that."

"Almost everything we do is on private property," said Webb. "We did not have property acquisition in mind when master planning started, but quickly realized there was no way to do it without that, or we'd just be moving the problem. One of the commandments of master planning is, 'Thou shalt not move the problem downstream'."

"People's life circumstances can change," said Ritter. "If

Resident-provided photos of flooding from Chippewa Creek, where Broadview Heights meets North Royalton.

we encounter resistance on a project, we'll put that project on the back burner and come back to it when the owners are better prepared to move. You're dealing with people's lives and one of their largest investments, their home, and you have to be sensitive to that."

Stormwater solutions can be complex, expensive, and limited. "There has been a lot of development in natural floodplains that is very difficult to protect from flooding," said Ritter. Big Creek at Brookpark Road and at Jennings Road, as well as Valley View along the Cuyahoga, are some examples. "The Cuyahoga is a big river, and no detention basin you build will stop it from flooding. Getting people and businesses out of harm's way is the most cost-effective option to deal with some of those big problem areas."

The high cost to fix some problems lead some communities to shop around for options. One problem area is Big Creek Parkway in Middleburg Heights. The existing creek is only three feet wide. One option, which would widen the floodplain to 75 feet, would cost $24 million. A second alternative cost $16 million, but residents didn't want to lose old growth trees that would need to be removed. "We came up with a third option, to create three detention basins that would provide some flood protection, at the much lower cost of $5 million," said Blair. "The residents thanked us for presenting all three options and were willing to accept the lower level of service in order to keep the trees. There was a willingness to work with each other."

"You have to take into account the limit to what people will sacrifice to achieve goals," said Ritter. Doan Brook, which runs through the east side of Cleveland, was long ago forced into culverts, and often experiences flooding. "The ideal solution would be to daylight Doan Brook, just open it up and create a floodplain. But University Circle, Cleveland's cultural center, is right there, so that's just not an option. We try to work around constraints and competing interests to find that balance."

"I'm very grateful for the program the Sewer District has put together," said Brian Higgins, Service Director for the City of Parma. "With their involvement, and the funds and resources they have available, we've done some big projects in Parma to retain stormwater so people don't have it in their basements."

"One thing that's frustrating for a person in my position is, even if you can manage the water in your city properly, you have no control when it leaves, or how it's entering your city from other places," said Higgins. "Master planning is helping communities complement each other's projects, and not push a problem onto someone else, or receive somebody's problem. The Sewer District has been fantastic. We couldn't work with a better group of professionals."

Mapping stormwater problems and solutions

An example of stormwater master plan data visualization, this map shows a problem area in Broadview Heights and North Royalton. Areas predicted to flood (in blue and purple), streams, and culverts, as well as building, transportation, and utility (BTU) assets (red and green dots) that may be impacted, provide clear data for the design and construction stage.

The map is accompanied by a Problem Statement describing specific flooding issues. Examples include:

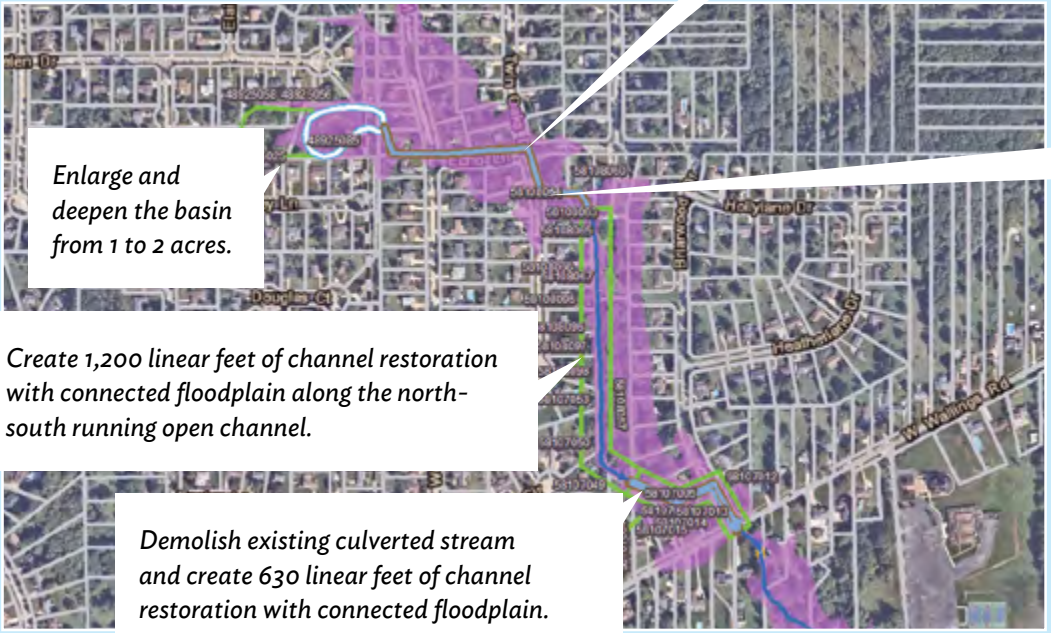
- *Three houses are predicted to flood at the foundation level in the 10-year design storm, with first-floor flooding starting in the 25-year design storm.*
- *One road is predicted to flood and be impassable starting in the 10-year design storm.*
- *Two roads are inundated but passable in the 10-year design storm, and become impassable (greater than 9" of water) starting in the 25-year design storm.*
- *One culverted stream has a visible void, stream connectivity issues, and ongoing sedimentation issues.*

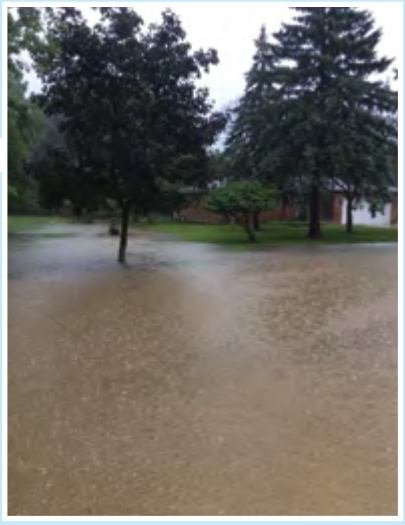
An open stream

A culverted stream

The three project elements are indicated on this second map. Each task required either partial or full land acquisition of private and city-owned parcels.

Kayaking along a flooded Echo Lane, Broadview Heights





Twin Oaks Drive, Broadview Heights

Project results are illustrated on this third map. They include:

- *Elimination of first-floor flooding in eight houses through the 100-year design storm.*
- *Reduced flooding for four roads: West Ridge Drive, Echo Lane, Wallings Road, and Briarwood Drive.*
- *Improved floodplain connectivity, stream function, and stream health.*

A bird's-eye view

GIS lays foundation for a stormwater program

Geographic Information Systems (GIS) has been a key building block of the Sewer District's Regional Stormwater Management Program (RSMP).

What is GIS? If you use Google Maps, you are using GIS, but it encompasses much more. GIS software can use data to create interactive models and visual displays of information. The Sewer District's Stormwater Inspection & Maintenance team uses GIS data-collection forms and maps for field inspections and maintenance activities. Water Quality & Industrial Surveillance tracks information on stream sampling, emergency responses, and aquatic wildlife using GIS. The software is also used for stormwater master planning and studies related to watershed issues, like flooding and erosion. These various information items can be plotted on, and accessed from, maps.

Monica Day is the District's GIS Services Manager. Her love for GIS began at Cleveland State University, in an Intro to GIS course. "I wanted to be a city planner," she said. "Once I started diving into the data and analytical capabilities of GIS, it was something I was drawn to." Working on a project for the City of Cleveland to improve water service delivery, Day used GIS to digitally map water mains for hydraulic models, to visualize the capacity within the system, flow of water through pipes, and peak demand. After graduation, she worked as a consultant before joining the Sewer District's Engineering department in 2005.

Day joined the Sewer District at the early stage of its use of GIS, which played a key role in developing a system to fund its stormwater management goals. "To protect regional streams and prevent flooding, erosion, and debris issues, those foundational elements were there from the beginning," said Day. "We knew we wanted to do those things, but what residents could afford would determine how much construction and maintenance we could do each year."

Consultants were key to designing the initial roadmap for how the Sewer District could implement a regional stormwater program. During visits to cities across the country, the consultants noted how each city charged customers. They reported a wide range of monthly stormwater fees, even up to $40 a month in Portland, Oregon.

"Then we dove into the details," said Day. Her team had to determine how many properties and customers were within the Sewer District's service area: 425,000 parcels related to over 330,000 accounts. They chose a rate structure based

The GIS team hand drew all 425,000 parcels for accuracy, and new satellite imagery is obtained twice a year.

on the square footage of impervious surface on a customer's property, measured in *equivalent residential units,* or "ERUs." With the help of satellite imagery, an algorithm was created to ascertain the average size of housing in the service area. Using those property characteristics and information from the consultants, a three-tier rate structure was created, with an average residential stormwater fee of $5.15 per month. Through that fee, the RSMP generates approximately $44 million in revenue annually.

Day's team originally relied on automated software to draw the impervious area on each property, but decided to go back and hand draw all 425,000 parcels for accuracy. New satellite imagery is obtained twice a year, in addition to an annual manual review of changes in impervious surface. "We've tried different software techniques, but it just doesn't get us the same results as having someone actually look through it every year," said Day.

Day's group works closely with the District's Finance department to determine who gets billed and for how many ERUs. "The GIS folks were easily the driver, establishing all of the billing factors for the parcels in the service area," said former Billing Services & Systems Manager Mike McGing, who worked with the Cleveland Division of Water and the District's other billing agents to ensure accuracy of the billing system. (McGing retired in 2020.)

Finance translates the GIS data into what ultimately appears on a customer's bill. "There is constant interaction between GIS, Finance, and the billing agents to keep all of the parties synced," said McGing. Edits to the parcel information are managed by GIS, and then reviewed by Finance to ensure that a customer hasn't moved into a different ERU tier.

"There are so many factors and considerations that need to be made to get that final, correct line item on a bill. We did a lot of testing, and in the end, it went very smoothly. Everyone at the District did a tremendous job to start up a new utility and have success at billing from day one, and there's no way it would have worked if GIS, Billing, and Watersheds

There are so many factors and considerations that need to be made to get that final, correct line item on a bill.

tried to work independently. You have to work together."

The Stormwater Fee Finder, another GIS-based application, provides information for all properties in the stormwater service area and is updated daily so customers can understand the calculations behind their stormwater fee.

The Sewer District's Customer Service department plays another critical role in the program, and if they are unable to answer a ratepayer's questions, one of the District's Watershed Team Leaders provides assistance. Due to their in-depth knowledge of the benefits of the stormwater program and how the fee is calculated, Team Leaders are an excellent resource, and GIS staff are ready to assist with maps and property-analysis reports.

"GIS helps us to analyze and solve problems through the use of technology, and I find that really rewarding," added Day.

How fees are calculated:

A stormwater utility is based on the premise that the urban drainage system is a public system, similar to water or sanitary systems. When a demand is placed on these systems, the user pays.

Parking lots, rooftops, and driveways can't absorb water, so it moves quickly over these surfaces into nearby streams or sewers. A greater flow of water—i.e. a greater demand—is placed on the urban drainage system. So, the more paved (or "impervious") surfaces there are on one's property, the greater the user fee.

For residential properties of four units or fewer, the user fee is based on an Equivalent Residential Unit (ERU) equal to 3,000 sq. ft. of impervious surface (such as roof and driveway). The rate for one ERU is $5.15 per month.

Residences are placed in one of three categories:

- Tier 1 — less than 2,000 sq. ft.
- Tier 2 — 2,000 to 4,000 sq. ft.
- Tier 3 — more than 4,000 sq. ft.

In 2020, a Tier 1 house pays $3.09 per month, a Tier 2 house pays $5.15 per month, and a Tier 3 house pays $9.27 per month.

The Sewer District offers financial incentives for managing stormwater at the source, which reduces the regional costs of stormwater problems and encourages environmental stewardship. Visit **neorsd.org/fee-credit** for details.

Roof + driveway
= 3,000 sq. ft. impervious surface
= 1 ERU

Experience a clean water festival like never before

Clean Water Fest

The Sewer District's annual open house went virtual in 2020!

Our celebration of all things water is online for the first time ever, broadcasts filled with education, exploration, and entertainment from the creative team at the Northeast Ohio Regional Sewer District.

Featuring spotlight videos and live Q&A with 20 different clean-water experts. Check out the broadcasts, live replays, special video features, and more!

cleanwaterfest.com

The art of listening

Watershed Team Leaders connect with residents

Flooded basements, submerged streets, eroding streambanks: these issues are all too real for many Northeast Ohio residents. The Sewer District's dedicated team of Watershed Team Leaders work with ratepayers and communities that experience these issues.

Over the past few years, our region has seen an increase in short, yet intense, periods of rain. "When many of our communities were developed, there were not stormwater practices in place other than just piping it out to the lake," said Watershed Programs Manager Keith McClintock. "Unfortunately, we are now seeing the impacts of that. The system cannot handle these quick downpours and we get some pretty significant flooding in certain communities."

McClintock, who studied geology with a focus in hydrology, started his career protecting streams and rivers from sediment and erosion issues originating from construction sites. He worked at the Geauga Soil & Water Conservation District, Geauga Park District, and Western Reserve Land Conservancy, doing site inspections and stream restoration projects, and ensuring that new parks were hydrologically friendly. When a position opened at the Sewer District, he enthusiastically applied. "I work with a great group of people," he said.

Watershed Team Leaders have a variety of roles and responsibilities that are heavily dependent on the weather. When it's pleasant out, team leaders are in the community informing residents about the programs that the Sewer District offers, including cost-saving stormwater credits. Other dry-weather projects include reviewing stormwater master plan reports and hosting public presentations in communities where the Sewer District has projects.

But when it rains, it pours—literally! The increased frequency of intense rain that dumps inches of rain within a short period of time is a stressor on our aging infrastructure and urbanized watershed. "We spend the majority of our time being reactive, especially when it rains," said McClintock. His team answers hundreds of calls from residents who have water in their basements and backyards. Team leaders assess where the water is coming from and carefully examine District stormwater master plan recommendations. They are in constant communication with mayors, service directors, and community engineers to assist with managing the flooding.

"Of course, we'd like to see the flooding addressed today," said McClintock. But solving regional stormwater issues is a multi-year process. "As a Watershed Team Leader, you're out

Property owners arrive at inventive yet temporary solutions to erosion problems.

visiting with these landowners and seeing the distress in their faces. Their basements are continually flooded, often there's sewage in their basements, their property is losing value, and you can see that it's wearing on them." Seeing customers suffer can weigh on a team leader, but the reward comes once projects are implemented. "It's gratifying when that flooding is reduced, and houses are no longer inundated due to our projects," said McClintock.

Relationships are key to solving problems and getting projects done. "With residents, you have to listen, be honest, and be patient," said Team Leader Donna Friedman. "Each person and every situation is different, and remembering those differences helps build a relationship."

Many local stormwater problem areas fall outside of the responsibility of the Sewer District. If team leaders determine that a stormwater issue is regional, they can go back to the stormwater master plan and see if the location has been identified as a problem area. Stormwater projects are ranked annually, through a scoring system *(see pages 8-9)*. High-priority sites move into design and construction, but an annual stormwater construction plan budget of about $20 million only goes so far.

Further assistance is provided through the District's Community Cost-Share Program, which helps fund community-specific stormwater management projects. Twenty-five percent of the revenue from stormwater fees collected from each community is made available to that community through a grant-application and reimbursement process.

The Sewer District also has programs that complement its stormwater projects with sewer rehabilitation and replacement. The Member Community Infrastructure Program helps fund community sewer infrastructure repairs that alleviate basement flooding. A grants program is also available to member communities, government entities, non-profits, and businesses that partner on Green Infrastructure projects in the Sewer District's combined-sewer area. (Both of these programs are funded by District wastewater revenues.)

"You're out visiting with these landowners and seeing the distress in their faces. It's gratifying when that flooding is reduced."

Erosion threatened houses along Beecher's Brook in Mayfield Village, Ohio.

In addition, homeowners can receive a credit on their stormwater fee by reducing stormwater on their property through control measures like rain barrels and rain gardens.

"Communities are really seeing the utility of our stormwater program," said McClintock. "It's nice for them to have someone to call for assistance. Now that the program has developed and we're doing projects and maintaining the system, they're seeing the benefits." He gives as an example a detention basin on Chevrolet Boulevard in Parma, an area that regularly flooded, even in small rain events. "Ever since we did work there, that community has not reported flooding."

"The Sewer District's stormwater program is unique to our region," said McClintock. "Not many other parts of Ohio or the nation provide this kind of funding to help solve these problems that all communities are facing."

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The stream was moved away from the steep eroding banks, and given plenty of floodplain.

Beecher's Brook, one year after the stream stabilization project

Free flowing

The SWIM team makes sure things keep moving

One aspect of the Regional Stormwater Management Program (RSMP) is making sure streams are flowing functionally.

The Sewer District's Stormwater Inspection & Maintenance team (SWIM) helps make this happen. This team of 15 serves in a variety of roles: inspecting and maintaining the stormwater system, collecting and analyzing data, and finding areas prone to flooding. However, SWIM wasn't always so robust!

"In 2013, SWIM was just two people and an easel with a flipchart," said Manager Mark Link. He and co-worker George Remias were tasked with coming up with ways to inspect all of the Sewer District's stormwater assets. Data collection programs were not what they are today, and Mark and George used paper forms generated from Microsoft Excel, a far cry from today's electronic field-data collection on tablets and phones.

Link's career has always in one way or the other been involved with water, whether it be in aquatics, fisheries, or stormwater. He started at the Sewer District in 1997 working on stormwater projects, although the RSMP wasn't even a pipe dream at the time.

George Remias has been with the District since 2013, but has spent 23 years working in stormwater. As Manager of Stormwater Strategic Support, he maintains hydrologic and hydraulic models created through the District's stormwater master plans. These models can help predict when an area may flood, so it is essential to keep them current.

Electronic stream monitors—over 100 of them installed throughout the District's service area—measure water levels and velocity, and help Remias understand how streams react when it rains and what types of projects are needed.

Remias directs the SWIM team to problem areas during and after storms, so they can compare the models to field observations. "George developed tables that show where a certain amount of rain comes down," said Link. "The tables will say, for example, 'It looks like these ten houses and four roads are going to flood'." Collecting data from real events allow SWIM to verify problems and their causes, and focus Sewer District resources on the biggest, most frequent issues.

Assessing the condition of a 476-mile-long stream system—and its 1,200 crossings, 100 basins, and 200 culverted streams—was a massive undertaking. "By now, over 90 percent of those assets have been inspected, and SWIM has a

Stormwater Inspector Christina Silea and SWIM co-workers encounter a culvert blocked by debris.

solid handle on the problem areas," said Link. Inspectors are experts not only in reviewing streams but are trained to look at factors that may affect the whole stream system. With only four trained inspectors for 4,000 regional stormwater assets, prioritization is key.

Remias said that this asset management approach to stormwater management is unique, compared to other programs across the country. Typically, "assets" refers to sewer pipes and treatment plants, but the term also applies to streams, buildings, and utilities. The Sewer District does not own the majority of these assets—and often the owners are not aware of what they own! "Regardless of who owns it, our interest is making sure we can reduce flooding, so the infrastructure is sound and operating properly," said Remias.

Routine maintenance such as sediment and debris removal is a key component of the RSMP. Blockages are identified by inspectors or called in from a resident. A report is made, contractors provide quotes, and the blockage is removed. Repair projects are identified in a similar manner, with SWIM working with the Sewer District's Stormwater Design & Construction team to determine the best solution.

Before the existence of the RSMP, there weren't many organizations cleaning streams because of the cost. Even finding contractors who knew how to do the work was an initial challenge, so the District had to develop its own methods and work with its contractors to find the best solutions.

With the RSMP being a fairly young program, much of SWIM's work has been making sure natural flow area is available and keeping culverts free of debris. "Just keeping the system operating as designed relieves a lot of problems that existed in the past," Remias said.

Now that the Sewer District can forecast problems through modeling, track actual flow with stream monitors, and deploy field crews for regular inspections of the stream system, many legacy problems can be addressed. Continued investment in monitoring, combined with routine field inspection and maintenance, will ensure the sustainability of Northeast Ohio streams for generations to come.

Assessing the condition of a 476-mile stream system, 1,200 crossings, 100 basins, and 200 culverted streams is a massive undertaking.

Built to last

Designing and constructing nature-based solutions

When residents, mayors, or other community members report erosion or flooding, the Sewer District's Stormwater Inspection & Maintenance (SWIM) team goes into the field to evaluate if the problem should be addressed by the Design & Construction team. SWIM regularly inspects the regional stormwater network and may come across unreported issues, like erosion that threatens a roadway, or an exposed sanitary sewer near a stream.

Problems can also be identified directly from models that are developed through the stormwater master plans. Unfortunately, some areas flood so frequently that residents give up on reporting it, and it is through the models that the Sewer District discovers the problem and reaches out to the residents to confirm that flooding is still occurring.

Unlike Project Clean Lake, the Sewer District's 25-year federally-mandated consent decree to reduce combined sewer overflows, the RSMP doesn't have compliance goals that the District is required to meet. "One challenge is that we are a cash-based program, so we need to be careful and selective about how we spend the money," said Manager of Stormwater Design Kim Colich. "We have to be strategic in how we choose projects, and some funds need to be reserved for emergency repairs and major storms."

Colich studied Civil & Environmental Engineering at the University of Michigan and holds a master's degree from Cleveland State University. She joined the Sewer District in 2012 as a project manager, overseeing parts of the Stormwater Master Plan. "In all of my different roles at the District, it was always with the hope to be intimately involved with water quality and improving our waterways," said Colich.

Colich's four project managers oversee engineering contracts for the design and construction of stormwater projects. These are prioritized through an extensive scoring system that factors in project benefits, difficulty, and whether or not other groups can assist with land acquisition, funding, or design. Subjective variables are also in play, since some areas endure extensive flooding that the Sewer District could spend a decade fixing, but projects need to be balanced and fair to all member communities.

Once a project gets the green light, it moves into the design phase. Designing stormwater solutions can be a long process depending on what easements, land acquisitions, and permits are required.

A failing concrete drop structure threatened a nearby road and railway. The Big Creek Stabilization Project included a rock cascade on top of the existing spillway. Now, Big Creek's flows are more natural, allowing fish to navigate the area that had previously been cut off by the spillway.

In most cases, properties sought out by the Sewer District have been threatened by flooding or erosion for years, so their acquisition can be a way out for property owners. "All of our property interests, whether it's an easement or an acquisition of a house that has flooded or is threatened by severe erosion, are voluntary," explained Stormwater Programs Manager Janet Popielski. "We can try to negotiate as much as possible, but sometimes we just have to walk away. We have gotten most people around to working with us, because they see the value of the work that we are doing."

Residents may be reluctant to agree to easements on their property if they feel that they are not directly impacted by problems the District is trying to solve, or think they may have trouble later if they try to sell the property. "That is where we work hand-in-hand with our Watershed Team Leaders, to build those relationships, explain to the residents what we're doing, and really take time to listen to their concerns," said Popielski. "Team leaders really help with that one-on-one communication, listening and working with the property owners to find out what is important to them."

Popielski grew up in Parma and recalls spending much of her time playing in West Creek when there was an active landfill right next to it. "I had always been around creeks and understood the value of watersheds," she said. "I got involved with the grassroots West Creek Conservancy and became interested in that type of work." She became a civil engineer and held positions with the Cuyahoga Valley National Park and Cleveland Metroparks.

"I observed the impact that stormwater and major storms had on people, and became interested in how that was affecting their lives and communities, and how we were going to deal with that." Now in her role as Stormwater Programs Manager, she oversees the whole cycle of a project, "how we identify the problem and determine how to fix it, and the construction and maintenance pieces, too."

Some areas flood so frequently that residents give up on reporting it. Through its models, the Sewer District can discover the problem and reach out to residents.

The Stickney Creek Stream Restoration & Utility Repair Project in Brooklyn, Ohio expanded the floodplain available to the stream.

No two projects are alike, and there isn't a one-size-fits-all solution, even for similar problems. In Brooklyn, Ohio, a section of Stickney Creek had eroded, exposing a sanitary sewer line running parallel with the creek. ("For some reason, they like to run sewers next to streams, probably because it's nice and flat," said Popielski.) To fix this, the creek was redirected away from the sewer, and the floodplain was expanded to accommodate rising stream levels in heavy rains.

A similar issue was discovered in North Royalton within a small tributary of the Rocky River. The site was more constrained than Stickney, so stream realignment was not an option. Instead, the design team chose to install riffles, rock structures that help absorb energy, decrease erosion, and improve habitat for macroinvertebrates and fish. Building riffles into the shallow parts of the stream allows pools to form, building up sediment to fortify the sewer pipe, which was further protected by being encased in concrete.

A major consideration when designing stormwater projects is ensuring that the solution doesn't simply move the problem downstream. Increasing the volume of water that passes through an area can push that flooding problem elsewhere. Likewise, hardening a streambank to prevent erosion can intensify water velocity, thereby moving the erosion to an area downstream.

Having the right permits is crucial, too. "For every project, we review any regulations that might apply to it and determine what we need to do to be in compliance, to ensure our work can proceed," said Regulatory Compliance Manager Robin Halperin. Even maintenance activities like removing debris from a stream are looked at with a careful eye to make sure they do not require special permits.

Halperin's consultants assess any ecological or histrical resources, endangered species, habitats, or wetlands that might be impacted by that design. That way, she can help

During heavy rain, the creek overflows onto its floodplain, instead of flooding a nearby road.

The creek returns to its normal level and serpentine alignment.

steer the designers away from options that unnecessarily impact those resources and require additional permits. "The repair of a century-old dam at Green Lake in Shaker Lakes was challenging, due to the significant historic resources associated with it," Halperin said. "We try to advise our design team, keeping in mind things that can trigger a longer review and approval process and delay a project."

Communication and outreach are key to the design and construction process as well. The Sewer District is constantly in contact with public works officials, council members, mayors, and community members. For smaller projects, there is coordination with the property owners who are impacted. For larger projects, public meetings are held.

Recent RSMP successes include the Pepper Luce Creek on Shaker Boulevard and Beecher's Brook on SOM Center Road. Both sites had experienced erosion for years. At Pepper Luce, homeowners had placed bags of concrete into the stream in an attempt to keep their house from falling into the creek. "We were able to purchase the house and tear it down so that the stream had the space it needed to function," said Popielski. One year later, both projects look beautiful. "With that floodplain connectivity, they function really well, and the erosion is just not a problem anymore," said Colich. "That's really exciting to see."

The annual RSMP budget for design, construction, and land acquisitions is about $20 million. Several legacy and emergency issues that had straightforward solutions were addressed early on, and with master plans now nearly complete, more of that budget can go towards construction projects, and complex and extensive problems can be prioritized to build a more resilient stream system.

"Everyone is here because they are passionate about stormwater and water quality," said Colich. "It's really exciting to be part of a group like that."

Stickney Creek four months after completion of the Stream Restoration & Utility Repair Project

Resources

Technical assistance is available to residents from Sewer District staff (see page 20) and our partner organizations:

Big Creek Connects
Works to conserve, enhance, and bring recognition to the natural and historic resources of the Big Creek Watershed and develop a recreational trail network that connects these resources to each other and the community.
friendsofbigcreek.org

Bluestone Heights
Assesses current ecological assets, focusing upon the function of forests, streams, and wetlands. We serve the planning community with hard data on ecosystem value.
bluestoneheights.org

Central Lake Erie Basin Collaborative
A network of organizations and initiatives that work collaboratively to protect and restore natural areas and promote stormwater solutions for healthy streams and Lake Erie.
centrallakeerie.org

Chagrin River Watershed Partners
Works with member communities, partners, and landowners to develop strategies for solving flooding, erosion, and water quality problems.
crwp.org

Cuyahoga Soil & Water Conservation District
Responsible for protecting the natural resources within the county, providing local leadership, education, and technical assistance.
cuyahogaswcd.org

Doan Brook Watershed Partnership
Through collaboration and sharing of resources, develops and implements a watershed management plan for the preservation and improvement of Doan Brook.
doanbrookpartnership.org

Euclid Creek Watershed Program
Works to protect and restore the health of this urban watershed in Northeast Ohio.
www.cuyahogaswcd.org/euclid-creek

Mill Creek Watershed Partnership
Citizens, businesses, agencies, and government organizations working together for the improvement of the Mill Creek watershed.
millcreekpartnership.org

Rocky River Watershed Council
Works to protect, restore, and perpetuate a healthy watershed through public education, watershed planning, communication, and cooperation among stakeholders.
myrockyriver.org

Summit Soil & Water Conservation District
Provides local leadership and technical assistance for programs to conserve soil, improve water quality, and enhance the natural resources of Summit County.
sswcd.summitoh.net

Tinker's Creek Watershed Partners
Works to protect and restore water quality and habitats of the Tinker's Creek watershed through community partnerships, promoting low-impact and conservation development practices that balance environmental integrity with human development.
tinkerscreek.org

West Creek Conservancy
Seeks to conserve open space and create outdoor recreation opportunities in the West Creek watershed in Parma, Seven Hills, Brooklyn Heights, and Independence.
westcreek.org

Q&A

An interview with Brooklyn Acres president Rob Slattery

What's your involvement in this neighborhood?

I'm the board president for Brooklyn Acres Mutual Homes, a 600-unit housing cooperative located in both the City of Brooklyn and City of Cleveland.

What's the project the Sewer District did at Brooklyn Acres?

This was actually two projects: the relocation and redirecting of the water on Stickney Creek, and also replacing a sanitary sewer line.

What were some of the issues there?

There was a lot of flooding. It would overflow onto Ridge Road, which caused a hazard. There were also flooded basements and things like that.

How often did this occur?

Anytime we got a big rain, which seemed to be more and more common. It caused a lot of damage to some properties.

How did the Sewer District get involved?

The Sewer District contacted us. They were unbelievably easy to work with. We met multiple times to go over this project so that we understood and could pass the information on to our community members. That really helped. When you have a project like this, you normally have a lot of complaints. We avoided that because we had all this information beforehand.

How long did the project take?

Roughly 14 months. Well over a year went into the planning of it and preparing. It seemed like the planning part took longer than the actual physical replacement of the sewer line and relocation of the creek.

Have you noticed any changes since the project's completion?

We've had several very heavy rains, to the point where in years' past it would have flooded the roads and caused property damage. It hasn't flooded.

Why not?

As it was designed and explained to us, the rerouting of the creek, to serpentine and slow the water down and allow it to raise up on the banks, alleviated the flooding. We had a rain in May that was unbelievably heavy. I came down and the water had risen to a flooding level, but it did not flood. It did not reach the road, and there were no flooding hazards or damage. Within hours it dissipated to a normal level.

That must've been a nice surprise.

It was really amazing to see that it worked how it was designed. On paper it was hard to understand, but seeing it out here firsthand, I was like, "Okay, now I get it." The design worked as the Sewer District said it would.


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